Cisco 7600 Series Router Supervisor Engine and Route Switch Processor Guide

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CONTENTS

Preface

This guide describes the route switch processors and supervisor engines supported by Cisco 7600 series routers. It also provides technical specifications for these modules and describes cable and connector specifications.

Caution Only trained and qualified service personnel (as defined in IEC 60950 and AS/NZS3260) should install, replace, or service the equipment described in this document.

Contents

This preface contains the following sections:

Document History

Table 1 lists the technical changes made to this document since it was first printed.

Table 1 Document History

Revision	Date	Change Summary
OL-10100-12	November 2012	Added support for Sup 2T on 7613-S and 7604 chassis.
OL-10100-11	March 2012	Added Supervisor Engine 2T information.
OL-10100-10	November 2010	Added scenario information when the system LED on the supervisor turns to orange from green.
OL-10100-09	October 2010	Added troubleshooting information in Chapter 4, "Troubleshooting Route Switch Processors and Supervisor Engines".

Table 1 Document History (continued)

Revision	Date	Change Summary
OL-10100-08	April 2010	Updated information about the line card firmware bundled with the IOS image.
OL-10100-08	April 2010	Added information about the following supported wavelenghths: • DWDM-SFP-xxxx 40x wavelengths on RSP720 • CWDM-SFP-xxxx on RSP720 GE • DWDM-SFP-xxxx on SUP32 and 67xx-SFP on c7600 (8x additional wavelengths)
OL-10100-07	February 2010	Added information about the following command: • show platform redundancy bias and platform redundancy bias • mls qos recirc untrust
OL-10100-06	November 2009	Added information about X2-DWDM and X2-10GB-LRM/ZR support on 7600 cards (RSP720-10GE and WS-X6708-10GE).
OL-10100-05	March 2009	Added information about increasing RSP720 and RSP720-10GE maximum switch processor (SP) memory to 2 GB.
OL-10100-04	January 2008	Added information about the Route Switch Processor 720 with 10-GE uplink ports, introduced in Cisco IOS Release 12.2SRC.
OL-10100-03	May 2007	Removed eFSU from the list of unsupported features for the Route Switch Processor 720. Beginning in Cisco IOS Release 12.2SRB1, eFSU and ISSU are supported on the RSP720, Sup720, and Sup32. Added a note that Cisco IOS Release 12.2SXF is the last release in which the Supervisor Engine 720 (with PFC3A) is supported.
OL-10100-02	February 2007	Added information about the Route Switch Processor 720 (a new supervisor engine) introduced in Cisco IOS Release 12.2SRB.
OL-10100-01	May 2006	Initial release of the document.

Document Organization

This document is organized as follows:

Chapter	Title	Description
Chapter 1	Cisco 7600 Product Overview	Provides an overview of Cisco 7600 series routers, and interface and port addresses.
Chapter 2	Route Switch Processors and Supervisor Engines	Describes the route switch processors (RSPs) and supervisor engines supported on Cisco 7600 series routers.
Chapter 3	Installing and Configuring Route Switch Processors and Supervisor Engines	Provides instructions for installing and removing RSPs and supervisor engines and connecting to the console and uplink ports.

Chapter	Title	Description
Appendix A	Technical Specifications	Lists the technical specifications for the RSP and supervisor engines.
Appendix B	Cable and Connector Specifications	Lists the cable and connector specifications for the RSPs and supervisor engines.

Document Conventions

This document uses the following conventions:

Convention	Description
boldface font	Commands, command options, and keywords are in **boldface**.
italic font	Command arguments for which you supply values are in *italics*.

Caution Means *reader be careful*. You are capable of doing something that might result in equipment damage or loss of data.

Note Means *reader take note*. Notes contain helpful suggestions or references to materials not contained in this document.

Warning Definition

Warning

IMPORTANT SAFETY INSTRUCTIONS

This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071

SAVE THESE INSTRUCTIONS

See *Regulatory Compliance and Safety Information for the Cisco 7600 Series Routers* for translations of warnings and information about the compliance and safety standards with which Cisco 7600 series routers conform.

Related Documentation

The following documents provide additional information about Cisco 7600 series routers:

- *Cisco 7600 Series Routers Documentation Roadmap*
- *Supported Hardware for Cisco 7600 Series Routers*
- *Regulatory Compliance and Safety Information for the Cisco 7600 Series Routers*
- *Cisco 7600 Series Router Installation Guide*
- *Cisco 7609 Router Installation Guide (OSR-7609)*
- *Cisco 7600 Series Router Module Installation Guide*
- *Cisco 7600 Series Router Cisco IOS Command Reference*
- *Cisco 7600 Series Router Cisco IOS System Message Guide*
- *Cisco 7600 Series Router Cisco IOS Software Configuration Guide*

Documentation for the Cisco 7600 series router is available online at the following URL:

http://www.cisco.com/en/US/products/hw/routers/ps368/tsd_products_support_series_home.html

For information about MIBs, refer to this URL:

http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

Obtaining Documentation, Obtaining Support, and Security Guidelines

For information on obtaining documentation, obtaining support, providing documentation feedback, security guidelines, and also recommended aliases and general Cisco documents, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html

Subscribe to the What's New in Cisco Product Documentation as a Really Simple Syndication (RSS) feed and set content to be delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS Version 2.0.

CHAPTER 1

Cisco 7600 Product Overview

This chapter provides an overview of the Cisco 7600 series routers and describes interface and port addresses on the routers. It contains the following sections:

Note This document does not contain instructions for installing the router. For instructions on how to install the router, see the *Cisco 7600 Series Router Installation Guide*.

Cisco 7600 Series Routers

The Cisco 7600 series routers consist of these routers:

- Cisco 7603 router (3 slots)
- Cisco 7604 router (4 slots)
- Cisco 7606 router (6 slots)
- Cisco 7609 router (9 vertical slots)
- Cisco 7613 router (13 slots)

Note In addition, Cisco IOS Release 12.2SRB and later releases introduced enhanced versions of the 3-slot, 6-slot, and 9-slot chassis (CISCO7603-S, CISCO7606-S, and CISCO7609-S). These enhanced chassis provide increased power and cooling capabilities and an enhanced switch fabric to support high-power processors and future line cards, which will provide 80-Gbps connections.

Cisco 7600 series routers provide optical wide area network (WAN) and metropolitan-area network (MAN) networking with a focus on line-rate delivery of high-touch IP services at the edge of service provider networks.

Supported Hardware

Cisco 7600 series routers support the following hardware:

- A supervisor engine (such as the Sup720, Sup 2T, Sup32, or Sup2) or Route Switch Processor (RSP720) with modular Gigabit Ethernet uplink ports. Each supervisor engine or RSP has two integrated daughter cards: a policy feature card (PFC) and a multilayer switch feature card (MSFC). See the "Overview" section on page 2-2 for details.

  Note You can install a redundant supervisor engine or RSP in the router to provide a backup in case the active module fails. Both supervisor engines or RSPs must be identical. If the system does not include a redundant supervisor engine or RSP, you can install another type of module (for example, FlexWAN, OSM, or SIP and SPA) in the slot that is reserved for the redundant processor card.

- Optical Services Modules (OSMs), FlexWAN and Enhanced FlexWAN modules, recommended Catalyst 6000 family modules, and SPA interface processors (SIPs) in any combination.
  - Two additional modules for the Cisco 7603 router
  - Three additional modules for the Cisco 7604 router
  - Five additional modules for the Cisco 7606 router
  - Eight additional modules for the Cisco 7609 router
  - Twelve additional modules for the Cisco 7613 router

  Note Specific combinations of supervisor engines or RSPs and modules may not be supported in your chassis. See the *Supported Hardware for Cisco 7600 Series Routers* guide for information about which combinations are not supported.

- Hot-swappable fan assembly
- Redundant AC-input or DC-input power supplies
- Redundant AC-input or DC-input power entry modules (PEMs) (Cisco 7603 and Cisco 7606 routers only)
- An optional Switch Fabric Module (WS-X6500-SFM2) that is available with the Supervisor Engine 2. For redundancy, you can install a redundant SFM2 module. The module that is installed first functions as the primary module.

Features

Table 1-1 lists some key features of the Cisco 7600 series routers.

Table 1-1 Cisco 7600 Series Routers Key Features

Feature	Description
Performance and configuration	For detailed information about the features supported on Cisco 7600 series routers, see the *Cisco 7600 Series Router Cisco IOS Software Configuration Guide* for the version of software being used on the router.
Supervisor engine or route switch processor	• Modular, upgradable feature modules for core switching logic • Modular Gigabit Ethernet ports that you can configure with Gigabit Interface Converter (GBIC), small form-factor pluggable (SFP), XENPAK, and X2 optics modules • Several combinations of multilayer switch feature cards (MSFCs) and policy feature cards (PFCs) supported (see Table 2-1): – MSFC5 and PFC4 or PFC4XL – MSFC4 and PFC3C or PFC3CXL (for the RSP720, see note below) – MSFC3 and PFC3B, PFC3BXL, or PFC3A (see note below) – MSFC2 and PFC or PFC2 • The MSFC contains the switch processor and route processor (SP/RP) for the router. • PCMCIA slot • Console port for terminal and modem access • There is no separate RP or SP for Sup 2T on the MSFC. It is a single processor board. **Note** Cisco IOS Release 15.0(1)SY1 introduces support for the Sup 2T. **Note** The Route Switch Processor 720 (RSP720) is the latest supervisor engine for the Cisco 7600 series routers. It is available in Cisco IOS Release 12.2SRB and later releases. **Note** Cisco IOS Release 12.2SRC introduces support for the RSP720-10GE (an RSP with 10 Gigabit Ethernet uplink ports). **Note** Cisco IOS Release 12.2SXF is the last release in which the PFC3A is supported. Later releases do not support this PFC.

Table 1-1 Cisco 7600 Series Routers Key Features (continued)

Feature	Description
Fault tolerance and redundancy	• Support for two hot-swappable (redundant) supervisor engines or route switch processors, including fast switchover to the redundant (standby) module • Support for two redundant AC- or DC-input, load-sharing power supplies • Support for two redundant AC- or DC-input PEMs (Cisco 7603 and Cisco 7606 routers only) • Power management for modules and power supplies • Environmental monitoring of critical system components • Hot-swappable fan assembly • Redundant clock modules • LACP 1-1 redundancy with fast switchover

Table 1-1 Cisco 7600 Series Routers Key Features (continued)

Feature	Description
Memory components	• Electrically erasable programmable read-only memory (EEPROM) on the supervisor engine or route switch processor stores module-specific information, such as the serial number, part number, controller type, hardware revision, configuration information, and other details unique to each module. • NVRAM for storing configuration information. • DRAM for default system software. For the RSP720-GE and the RSP720-10GE: – RP Memory: 1 to 4 GB DRAM (default is 1 GB for the 3C version and 2GB for the 3CXL version) – SP: 1 to 2 GB DRAM (default is 1 GB) – WS-SUP720 supports 512MB of DRAM for the route processor and 512 MB for the switch processor – WS-SUP720-3B supports 512MB of DRAM for the route processor and 512 MB for the switch processor, upgradeable to 1GB – WS-SUP720-3BXL supports 1GB DRAM for route the processor and 1GB DRAM for the switch processor **Note** To support installation of new software releases from 12.2(33)SRE onwards in SUP720, RSP720-GE, and RSP720-10GE, ensure that you increase the DRAMS to 1024MB for SP and RP. • Internal flash memory—To store the boot image. The defaults are: • The RSP720 SP/RP and the Sup32 SP contain a CompactFlash (CF) adapter that provides 512 MB of internal flash memory. • The Sup720 SP/RP, Sup32 RP, and Sup2 SP/RP contain 32-MB or 64-MB of internal flash memory. Cisco IOS Release 12.2(18)SXF and later releases support the CF adapter as an orderable option (Cisco part number CF-ADAPTER=) for these Sups. **Note** In the command-line-interface (CLI), you access internal flash memory as **bootdisk** (CF adapter) or **bootflash** (non-CF adatper). When you install a CF adapter on the Sup720, Sup32, or Sup2, **bootflash** becomes an alias to **bootdisk**. • External flash memory—To store and run software images and configuration files or to serve as an input/output (I/O) device. You can install 64-MB, 128-MB, 256-MB, 512-MB, or 1 GB flash memory cards, or 1-GB MicroDrive card, in slots on the supervisor engine or RSP front panel. For information on using flash memory, see Using Flash Memory Cards, page 3-12. The RSP720 and RSP720-10GE support 1G external compact flash from Cisco IOS Release 12.2(33)SRD1 release onwards. (Previously, 512MB was the maximum external compact flash. The Sup2 supports PCMCIA flash memory cards only. It does not support CompactFlash or MicroDrive cards. • Flash file system—Flash memory contains a file system. You can use a variety of commands to manage the file system (such as **cd**, **pwd**, **dir**, and **delete**). The file system includes the following devices: – Onboard bootflash/bootdisk – Flash memory slot

Table 1-1 Cisco 7600 Series Routers Key Features (continued)

Feature	Description
Component hot swapping	All components (including optional redundant modules and fans) support hot swapping, which allows you to add, replace, or remove components without interrupting the system power or causing other software or interfaces to shut down.
Management	• CLI through the console port or Telnet • Simple Network Management Protocol (SNMP)

Port Addresses

Each port (or interface) in the Cisco 7600 series router has several different types of addresses. The physical interface address is the actual physical location (slot and port) of the interface connector within the chassis. The system software uses the physical addresses to control activity within the router and to display status information. These physical slot and port addresses are not used by other devices in the network; they are specific to the individual router and its internal components and software. For more information, see the "Physical Interface Addresses" section on page 1-6.

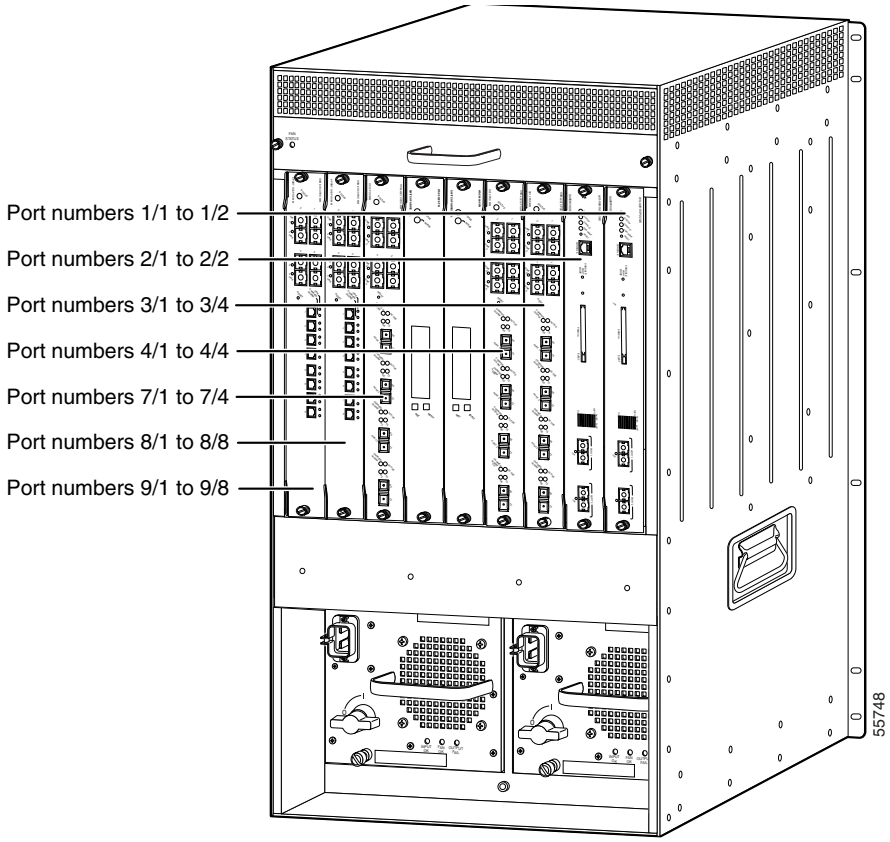
The Media Access Control (MAC) address is a standardized data link layer address that is required for every port or device that connects to a network. Other devices in the network use MAC addresses to locate specific ports in the network and to create and update routing tables and data structures. Routers use a unique method, described in the "MAC Addresses" section on page 1-7, to assign and control the MAC addresses of their interfaces.

Physical Interface Addresses

Physical port addresses specify the actual physical location of each port on every module in the router, as shown in Figure 1-1. The port address is a two-part number in the format *slot*/*port number* (for example, 1/1, 1/2, 2/1, 2/2, and so on):

- *Slot*—Identifies the slot in which the module is installed. Depending on the router layout, the slots are numbered from top to bottom or right to left starting with 1 (1/*n*, 2/*n*, and so on).
  - On horizontal-oriented chassis (such as the Cisco 7606 and Cisco 7613 routers), slots are numbered from top to bottom.
  - On vertical-oriented chassis (such as the Cisco 7609 router), slots are numbered from right to left.
- *Port number*—Identifies the physical port number on the module. Port numbers always begin at 1 (*n*/1, *n*/2, and so on).
  - On horizontal-oriented modules, ports are numbered from left to right.
  - On vertical-oriented modules, ports are numbered from top to bottom.

Figure 1-1 Cisco 7609 Router Port Address Examples



The supervisor engine and route switch processor have two or more uplink ports (numbered *n*/1, *n*/2, and so on). The Supervisor Engine 32 (WS-SUP32-GE-3B) has nine uplink ports, numbered *n*/1 to *n*/9.

In some cases, a single port supports two different types of connectors (for example, Port 2 on the Supervisor Engine 720 supports a Gigabit Ethernet SFP module or a 10/100/1000-Mbps RJ-45 connector). However, only one of the two options can be active at a time.

MAC Addresses

All network interface connections (ports) require a unique MAC address. The MAC address of an interface is stored in electrically erasable programmable read-only memory (EEPROM) on a component that resides directly on the interface circuitry. The router system code reads the EEPROM for each interface in the system, learns the MAC addresses, and then initializes appropriate hardware and data structures. Each VLAN in the spanning tree has one unique MAC address. This addressing scheme enables the router to identify the state (connected or not connected) of each interface. When you hot swap a module, the MAC address changes with the module.

Supervisor Engine 2T

The Supervisor Engine 2T (Sup 2T) is designed to deliver higher performance, better scalability, and enhanced hardware-enabled features. The Supervisor Engine 2T integrates a high-performance 2-Terabit crossbar switch fabric that enables 80 Gbps switching capacity per slot on 7609-S, 7613-S, and 7604 chassis. The forwarding engine on Supervisor Engine 2T is capable of delivering high-performance forwarding for Layer 2 and Layer 3 services. Supervisor Engine 2T delivers many new hardware-enabled innovations in the areas of security, quality of service (QoS), virtualization, and manageability. The feature set of Supervisor Engine 2T enhances applications such as traditional IP forwarding, Layer 2 and Layer 3 Multiprotocol.

Supported Hardware

The following 7600 chassis supports Supervisor Engine 2T:

- Cisco 7609-S routers effective with Cisco IOS Release 15.0(1)SY1
- Cisco 7613-S routers effective with Cisco IOS Release 15.1(1)SY
- Cisco 7604 routers effective with Cisco IOS Release 15.1(1)SY

Features

Supervisor Engine 2T delivers scalable performance, intelligence, and a broad set of features to address the needs of borderless networks, data centers, and service provider networks. Some of the primary features for Supervisor Engine 2T include:

- **Platform scalability:** Delivering up to 80 Gbps per slot of switching capacity on the 7609-S, 7613-S, and 7604 chassis; 2-Terabit aggregate bandwidth capacity. Providing 1Gbps/10Gbps and 40Gbps interface support for future customer bandwidth growth requirements.
- **Security:** Support for Cisco TrustSec, CTS, providing MacSec encryption and Role-Based ACL. Providing control plane policing to address denial of service attacks.
- **Virtualization:** Native support for VPLS, as well as enhancements such as VPN-aware NAT, VPN statistics, and VPN netflow as these are important features for the deployment of network virtualization.
- **Netflow application monitoring:** Supports enhanced application monitoring such as flexible and sampled Netflow for intelligent and scalable application monitoring.

Port Addresses

See Port Addresses, page 1-6 for the port address details.

CHAPTER 2

Route Switch Processors and Supervisor Engines

This chapter describes the route switch processors and supervisor engines supported on Cisco 7600 series routers and provides instructions for performing basic tasks on the modules. It contains the following sections:

Note The route switch processor is the newest version of supervisor engine. See Table 2-1 for a list of the route switch processor and supervisor engine configurations supported on Cisco 7600 series routers. Be sure to review the release notes for the software version running on your router for information about any restrictions and limitations that might apply.

Overview

The supervisor engine or route switch processor (RSP) is a module that is installed in one of the card slots in the router. The supervisor engine or RSP provides switching and local and remote management for the router and also contains the uplink ports for the router. Both types of modules (supervisor engine and RSP) perform the same functions in the router.

Cisco 7600 series routers support the following types of RSPs and supervisor engines:

- Route Switch Processor 720—Supported on all chassis (including enhanced) except the Cisco 7603 router and the Cisco OSR-7609. Available in Cisco IOS Release 12.2SRB and later releases.
- RSP720-10GE (with 10GE uplink ports)—Supported on the Cisco 7604 and 7609 routers and the Cisco 7603-S, 7606-S, and 7609-S routers (enhanced chassis). Available in Cisco IOS Release 12.2SRC and later releases.
- Supervisor Engine 720—Supported on all Cisco 7600 series routers.
- Supervisor Engine 32—Supported on all but the Cisco 7603 router.
- Supervisor Engine 2—Supported on all but the Cisco 7613 router. The Supervisor Engine 2 is no longer supported in Cisco IOS Release 12.2SRA and later releases.
- Supervisor Engine 2T —Supported on Cisco 7609-S routers (effective with Cisco IOS Release 15.0(1)SY1), Cisco 7613-S and 7604 routers (effective with Cisco IOS Release 15.1(1)SY.)

Although the router can operate with a single supervisor engine or RSP, you can also install a second redundant module (of the same type) in the chassis. Only one module is active at a time. The second module acts as a "standby," serving as a backup if the active module fails.

Note If the system does not include a redundant supervisor engine or RSP, you can install another type of module in the slot reserved for the redundant supervisor engine or RSP.

The supervisor engine or RSP contains the following integrated daughter cards that perform forwarding and routing and provide the protocols supported on the router. Several configurations of daughter cards are supported (as shown in Table 2-1).

- Policy Feature Card (PFC) is the forwarding plane and does the following:
  - Performs Layer 2 and Layer 3 forwarding.
  - Enforces access control list (ACL) functions.
  - Performs policing and marking for quality of service (QoS) traffic.
  - Collects Netflow statistics.

  Note A high-capacity (XL) PFC is also available. The XL version (PFC3BXL or PFC3CXL) provides more memory for more routing table and netflow cache capacity than a PFC. It allows routing and forwarding processes to be offloaded from the supervisor engine or RSP to the PFC, thus increasing the performance of the supervisor engine or RSP.

- Multilayer Switch Feature Card (MSFC) is the control plane and does the following:
  - Performs routing for the chassis. The MSFC contains the route processor (RP) and switch processor (SP) for the router.

– Runs Layer 2 and Layer 3 protocols, such as the Spanning Tree Protocol (STP) and others. For information about supported protocols, see the *Cisco 7600 Series Router Cisco IOS Software Configuration Guide* and the release notes for the software version running on the router.

Table 2-1 lists the RSP and supervisor engine configurations supported on Cisco 7600 series routers. Specific combinations of processors and modules may not be supported in your chassis. See the release notes for your software version for information about supported combinations.

Table 2-1 Route Switch Processor and Supervisor Engine Configurations

Product Number	Description
Route Switch Processor 720	
RSP720-3C-10GE	• Two 10 Gigabit Ethernet (10GE) uplink ports support 10-Gbps X2 modules • Three Gigabit Ethernet (1GE) uplink ports: two ports support 1-Gbps small form-factor pluggable (SFP) module; one port supports 10/100/1000-Mbps RJ-45 connector **Note** Use Category 5 Shielded Twisted Pair cable at the port that supports the10/100/1000-Mbps RJ-45 connector. • Integrated 720-Gbps switch fabric • PFC3C and MSFC4 with 512-MB bootdisk, 4-MB NVRAM, 4-MB ROMmon, and several DRAM options: – Route processor (RP): 1- to 4-GB DRAM (default 1 GB) – Switch processor (SP): 1- to 2-GB DRAM (default 1 GB) • One CompactFlash Type II slot (512 MB) on front panel and two internal CompactFlash (512 MB each for RP and SP; you can optionally increase external compact flash and each internal CompactFlash to 1 GB) • Requires larger power supplies and a high-speed fan tray • QoS port architecture, 10GE ports (Rx/Tx): **8q8t/1p7q8t** (CoS) • QoS port architecture, 1GE ports (Rx/Tx): **2q8t/1p3q8t**

Table 2-1 Route Switch Processor and Supervisor Engine Configurations (continued)

Product Number	Description
RSP720-3CXL-10GE	• Two 10GE) uplink ports support 10-Gbps X2 modules • Three 1GE)uplink ports: two ports support 1-Gbps small form-factor pluggable (SFP) module; one port supports 10/100/1000-Mbps RJ-45 connector **Note** Use Category 5 Shielded Twisted Pair cable at the port that supports the10/100/1000-Mbps RJ-45 connector. • Integrated 720-Gbps switch fabric • PFC3CXL (high-capacity) and MSFC4 with 512-MB bootdisk, 4-MB NVRAM, 4-MB ROMmon, and several DRAM options: – Route processor (RP): 1- to 4-GB DRAM (default 2 GB) – Switch processor (SP): 1- to 2-GB DRAM (default 1 GB) • One CompactFlash Type II slot (512 MB) on front panel and two internal CompactFlash (512 MB each for RP and SP; you can optionally increase external compact flash and each internal CompactFlash to 1 GB) • Requires larger power supplies and a high-speed fan tray • QoS port architecture, 10GE ports (Rx/Tx): **8q8t/1p7q8t** (CoS) • QoS port architecture, 1GE ports (Rx/Tx): **2q8t/1p3q8t**
Note See the "QoS on the RSP720-10GE" section on page 2-13 for more information about the QoS port architecture on the uplink ports.	
RSP720-3C-GE	• Two Gigabit Ethernet uplink ports: port 1 supports a 1-Gbps SFP module; port 2 is configurable with either a 1-Gbps SFP module or a 10/100/1000-Mbps RJ-45 connector • Integrated 720-Gbps switch fabric • PFC3C and MSFC4 with 512-MB bootdisk, 4-MB NVRAM, 4-MB ROMmon, and several DRAM options: – RP: 1- to 4-GB DRAM (default 1 GB) – SP: 1- to 2-GB DRAM (default 1 GB) • Two CompactFlash Type II slots on front panel (512 MB default with option to 1 GB) and two internal CompactFlash slots (one each for RP and SP, 512 MB default for each) • Requires larger power supplies and a high-speed fan tray • QoS port architecture (Rx/Tx): **1p1q4t/1p2q2t**

Table 2-1 Route Switch Processor and Supervisor Engine Configurations (continued)

Product Number	Description
RSP720-3CXL-GE	• Two Gigabit Ethernet uplink ports: port 1 supports a 1-Gbps SFP module; port 2 is configurable with either a 1-Gbps SFP module or a 10/100/1000-Mbps RJ-45 connector • Integrated 720-Gbps switch fabric • PFC3CXL (high-capacity) and MSFC4 with 512-MB bootdisk 4-MB NVRAM, 4-MB ROMmon, and several DRAM options: – Route processor (RP): 1- to 4-GB DRAM (default 2 GB) – Switch processor (SP): 1- to 2-GB DRAM (default 1GB) • Two CompactFlash Type II slots on front panel (512 MB default with option to 1 GB) and two internal CompactFlash slots (one each for RP and SP, 512 MB default for each) • Requires larger power supplies and a high-speed fan tray • QoS port architecture (Rx/Tx): **1p1q4t/1p2q2t**
Supervisor Engine 720	
WS-SUP720	• Two Gigabit Ethernet uplink ports: port 1 supports a 1-Gbps SFP module; port 2 is configurable with either a 1-Gbps SFP module or a 10/100/1000-Mbps RJ-45 connector • Integrated 720-Gbps switch fabric • PFC3A and MSFC3 with 2-MB NVRAM, 512-MB DRAM, and 64-MB bootflash (see note below) • Two CompactFlash Type II slots • Requires larger power supplies and a high-speed fan tray • QoS port architecture (Rx/Tx): **1p1q4t/1p2q2t** **Note** Cisco IOS Release 12.2SXF is the last release in which the Sup720 with PFC3A is supported.
WS-SUP720-3B	• Two Gigabit Ethernet uplink ports: port 1 supports a 1-Gbps SFP module; port 2 is configurable with either a 1-Gbps SFP module or a 10/100/1000-Mbps RJ-45 connector • Integrated 720-Gbps switch fabric • PFC3B and MSFC3 with 2-MB NVRAM, 512-MB DRAM, and 64-MB bootflash (see note below) • Two CompactFlash Type II slots • Requires larger power supplies and a high-speed fan tray • QoS port architecture (Rx/Tx): **1p1q4t/1p2q2t** **Note** To run Release SRE/15.0(1)S, SUP720 requires a minimum of 1 GB DRAM.

Table 2-1 Route Switch Processor and Supervisor Engine Configurations (continued)

Product Number	Description
WS-SUP720-3BXL	• Two Ethernet uplink ports: port 1 supports a 1-Gbps SFP module; port 2 is configurable with either a 1-Gbps SFP module or a 10/100/1000-Mbps RJ-45 connector • Integrated 720-Gbps switch fabric • PFC3BXL and MSFC3 with 2-MB NVRAM, 1-GB DRAM, and 64-MB bootflash; high-capacity PFC3BXL allows routing and forwarding processes to be offloaded from the supervisor engine to the PFC (see note below) • Two CompactFlash Type II slots • Requires larger power supplies and a high-speed fan tray • QoS port architecture (Rx/Tx): **1p1q4t/1p2q2t**
Note A CompactFlash (CF) adapter with 512-MB bootdisk is available for Sup720 modules in Release 12.2(18)SXF and later releases. Use the Cisco part number CF-ADAPTER= for ordering.	
Supervisor Engine 32	
WS-SUP32-GE-3B	• Nine Gigabit Ethernet uplink ports: eight SFP modules and one RJ-45 10/100/1000-Mbps connector • Integrated 32-Gbps switch fabric • PFC3B and MSFC2 daughter cards (see notes below) • QoS port architecture (Rx/Tx): **1p3q8t/1p3q8t**
WS-SUP32-10GE-3B	• Two 10-Gigabit Ethernet ports (XENPAKs) and one 10/100/1000-Mbps connector • Integrated 32-Gbps switch fabric • PFC3B and MSFC2 daughter cards (see notes below) • QoS port architecture (Rx/Tx): **1p3q8t/1p3q8t**
Note To run Release 12.2SRB, the Sup32 requires a minimum of 512-MB DRAM. **Note** A CF adapter with 512-MB bootdisk is available for Sup32 modules in Release 12.2(18)SXF and later releases. Use the Cisco part number CF-ADAPTER= for ordering.	
Supervisor Engine 2	
WS-X6K-S2-MSFC2	• Two dual-port 1000BASE-X GBIC uplinks, 16-MB bootflash, 128-MB DRAM on supervisor engine and 128 MB on MSFC2 • PFC2 and MSFC2 • Fabric enabled to support optional switch fabric module (SFM2) • QoS port architecture (Rx/Tx): **1p1q4t/1p2q2t**
WS-X6K-S2U-MSFC2	• Two dual-port 1000BASE-X GBIC uplinks, 32-MB bootflash, 256-MB DRAM on supervisor engine and 256 MB on MSFC2 • PFC2 and MSFC2 • Fabric enabled to support optional SFM2 • QoS port architecture (Rx/Tx): **1p1q4t/1p2q2t**

Table 2-1 Route Switch Processor and Supervisor Engine Configurations (continued)

Product Number	Description
WS-X6K-S2-PFC2	• Two dual-port 1000BASE-X GBIC uplinks • PFC2; fabric enabled, supports optional SFM2 • QoS port architecture (Rx/Tx): **1p1q4t/1p2q2t**
WS-X6500-SFM2	• (Optional) SFM2
Note The Sup2 is not supported in Cisco IOS Release 12.2SRA and later releases.	
Supervisor Engine 2T	• Five uplink ports on Sup 2T: two 10GE and three 1GE. The two 10GE ports use x2 as transceiver and the three 1GE ports use SFP. • Improved Switch fabric providing 80G/slot. Santa Monica fabric ASIC has 26 ports of 40 Gbps each, providing a total of 1040 Gbps • Sup 2T has MSFC5 and PFC4 (EARL8). – MSFC5 is a dual core 1.5Ghz CPU, Combined Route Processor/Switch Processor(RP/SP) – Single IOS image file – Supports USB Console port – Supports 2Gb DRAM – Supports 4Mb NVRAM – Supports CMP, which has its own DRAM/Bootdisk • One compact flash slot in the front panel. There are two types of flashes on SUP2T: – Internal flash (named bootdisk) – External flash (named disk0) **Note** These two types of flashs support 4Gb and 8Gb memory. • QOS settings when the uplink ports are in different mode: – 10G only COS-Q: RX: 8q4t; TX:1p7q4t – Mixed: COS-Q: RX: 2q4t; TX:1p3q4t – 1GE only : DSCP-Q : RX :8q4t, TX :1p7q4t

Route Switch Processor 720

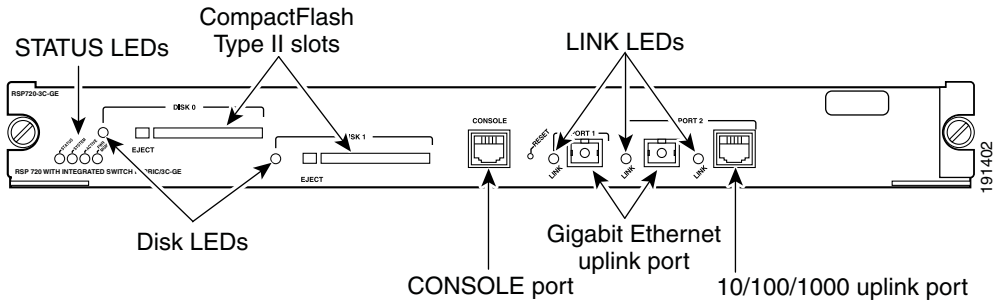
This section describes the Route Switch Processor 720 (RSP720). The Cisco 7600 RSP720 consists of a full-size board and two integrated daughter cards: the MSFC4 and a PFC3C or PFC3CXL. The RSP720 has an integrated switch fabric that interconnects all of the line cards in the Cisco 7600 router with point-to-point 20-Gbps full-duplex serial channels.

Note

- Cisco IOS Release 12.2SRB and later releases support the RSP720; earlier releases do not. The RSP720 is supported on all Cisco 7600 routers (including enhanced chassis) except the Cisco 7603 and the Cisco OSR-7609.
- Cisco IOS Release 12.2SRC and later releases support an RSP720 that has 10GE uplinks (RSP720-3C-10GE and RSP720-3CXL-10GE). See the "RSP720 with 10GE Uplink Ports" section on page 2-10 for more information.

Figure 2-1 shows the RSP720-3C-GE front panel, which is the same as the RSP720-3CXL-GE front panel. See Table 2-8 and Table 2-9 for information about the front-panel controls and LEDs.

Figure 2-1 Route Switch Processor 720 (RSP720-3C-GE) Front Panel



RSP720 Features

The RSP720 provides several new features and enhancements, which are summarized here. For details, see the *Cisco 7600 Series Router Cisco IOS Software Configuration Guide, Release 12.2SR*.

- 720 gigabits per second (Gbps) bandwidth (320 Gbps ingress and 320 Gbps egress)
- A faster CPU and additional memory to support larger configurations and more subscribers
- Performance and scalability improvements
- Quality of service (QoS) enhancements
- The RSP720-GE ships on the route processor (RP) with default 2-GB memory for the 3CXL version and 1-GB for the 3C version. The switch processor (SP) ships with a default 1-GB memory. Memory options are available to upgrade to 4-GB memory on the RP. From Cisco IOS Release 12.2(33)SRD1 onwards, a 2-GB memory upgrade option is supported on the SP.

Supported Chassis, Line Cards, and Modules

The RSP720 supports the following Cisco 7600 chassis, line cards and modules:

- Supported on all Cisco 7600 routers (including enhanced chassis) except the Cisco 7603 and the Cisco OSR-7609
- SPA interface processors (SIPs) and their shared port adapters (SPAs): 7600-SIP-600, 7600-SIP-400, and 7600-SIP-200
- Enhanced FlexWAN module (WS-X6582-2PA)
- Ethernet services modules: 2-port 10 GE line card (7600-ESM-2X10GE) and 20-port 1 GE line card (7600-ESM-20X1GE)
- Distributed Forwarding Cards: DFC3C, DFC3CXL, DFC3B, DFC3BXL
- LAN cards (which require CFC or DFC):
  - WS-X67xx
  - WS-X65xx
  - WS-X64xx
  - WS-X63xx
  - WS-X61xx

Unsupported Hardware and Features

The following hardware and features are not supported by the RSP720:

- Unsupported chassis: Cisco 7603, Cisco OSR-7609.
- Unsupported modules: Services modules, Optical Service Modules (OSMs), FlexWAN module.

RSP720 with 10GE Uplink Ports

Cisco IOS Release 12.2SRC introduces a new RSP720 with 10 Gigabit Ethernet (GE) uplink ports (RSP720-10GE). The Cisco 7600 RSP720-10GE consists of a full-size board and two integrated daughter cards: an MSFC4 and a PFC. The RSP720-10GE has an integrated switch fabric that interconnects all of the line cards in the router with point-to-point 20-Gbps full-duplex serial channels.

Two versions of the RSP720-10GE module are available:

- RSP720-3C-10GE
- RSP720-3CXL-10GE

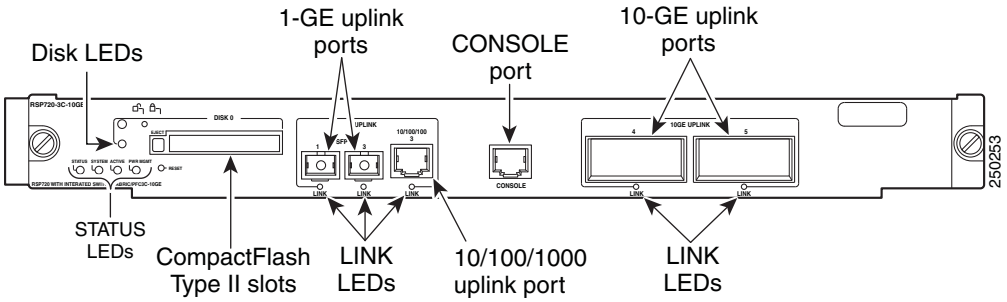
Because of physical differences between the RSP720 and RSP720-10GE (such as the CPU memory map and ASIC operation), there are several configuration guidelines and restrictions you should be aware of. See the "RSP720-10GE Usage Guidelines and Limitations" section on page 2-13 for details.

Following are the total power requirements for the RSP720-10GE:

- RSP720-3C-10GE = 355 watts (total power)
- RSP720-3CXL-10GE = 378 watts (total power)

Figure 2-2 shows the RSP720-3C-10GE front panel. The RSP720-3CXL-10GE front panel is similar. See Table 2-8 and Table 2-9 for information about the front-panel controls and LEDs.

Figure 2-2 RSP720-3C-10GE Front Panel



Note Use Category 5 Shielded Twisted Pair cable at the port that supports the10/100/1000-Mbps RJ-45 connector.

RSP720-10GE Features

The RSP720-10GE provides all of the features of the RSP720 and also provides the following benefits:

- The RSP720-10GE has two 10GE uplink ports and three 1GE uplink ports. You can use the 10GE ports as high-bandwidth uplinks and save chassis slots for high-density interfaces, such as a SIP/SPA. This is especially useful in smaller chassis and in redundant configurations. For the three 1GE uplink ports, two ports support 1-Gbps SFP modules and one port supports a 10/100/1000-Mbps RJ-45 connector.

Note Use CAT5 Shielded Twisted Pair cable at the port that supports the10/100/1000-Mbps RJ-45 connector.

- The RSP720-10GE supports the following line rates for uplink traffic and backplane forwarding:
  - 10 gigabits per second (Gbps) on both 10GE ports
  - 1 Gbps on all three 1GE ports
  - 16 Gbps backplane forwarding

  When all five uplink ports are operational, the total bandwidth for uplink traffic is 20 Gbps (20 GE).
- The RSP720-10GE provides flexible memory options like the RSP720. The RSP720-10GE ships on the route processor (RP) with a default 2-GB memory for the 3CXL version and 1-GB for the 3C version. The switch processor (SP) ships with a default 1-GB memory. Memory options are available to upgrade to 4-GB memory on the RP. From Cisco IOS Release 12.2(33)SRD1 onwards, a 2-GB memory upgrade option is supported on the SP.
- The RSP720-10GE supports Stateful Switchover (SSO) mode and the uplink ports are supported on the standby supervisor card beginning with Cisco IOS Release 12.2(33)SRE.

See the "RSP720-10GE Usage Guidelines and Limitations" section on page 2-13 for information about things to consider when you use the RSP720-10GE.

Supported Chassis, Line Cards, and Modules

The RSP720-10GE supports the following chassis and modules:

- Supported on the Cisco 7604 and 7609 chassis and the Cisco 7603-S, 7606-S, and 7609-S chassis

Note If you insert an RSP720-10GE into an unsupported chassis, the RSP720-10GE drops to ROMmon and only the console is accessible.

- SPA interface processors (SIPs) and their shared port adapters (SPAs): 7600-SIP-600, 7600-SIP-400, and 7600-SIP-200
- Enhanced FlexWAN module (WS-X6582-2PA)
- Ethernet services modules: 2-port 10 GE line card (7600-ESM-2X10GE) and 20-port 1 GE line card (7600-ESM-20X1GE)
- Distributed Forwarding Cards: DFC3C, DFC3CXL, DFC3B, DFC3BXL
- LAN cards (which require CFC or DFC):
  - WS-X67xx
  - WS-X65xx
  - WS-X64xx
  - WS-X63xx
  - WS-X61xx
- Uplink port transceiver modules: see Appendix B, "Cable and Connector Specifications"

Note The RSP720-10GE also supports two new 8-port 10GE line cards (WS-X6708-10G-3C and WS-X6708-10G-3CXL). The line cards, which provide 2-to-1 oversubscription, are available in Cisco IOS Release 12.2SRC and later.

Unsupported Chassis and Modules

The RSP720-10GE does not support the following chassis and modules:

- Unsupported chassis: Cisco 7603, 7606, and 7613 chassis
- Unsupported modules: Services modules, Optical Service Modules (OSMs), FlexWAN module

Unsupported Features

In Cisco IOS Release 12.2SRC, the RSP720-10GE does not support the following features, which are supported on the RSP720:

- High-availability features such as NonStop Forwarding with Stateful Switchover (NSF/SSO) and In-Service Software Upgrade (ISSU) are not supported. Only Route Processor Redundancy (RPR) mode is supported.

Note For SRD4 release, two new commands are introduced for high availability feature. The commands are **platform redundancy bias** and **show platform redundancy bias**.
For complete syntax and usage information for the commands, refer to the Cisco IOS High Availability Command Reference at this URL:
http://www.cisco.com/en/US/docs/ios/ha/command/reference/ha_book.html

- The uplinks on the standby RSP720-10GE are not active. This restriction exists because the uplink ports must perform lookups on the active RSP, which is not possible in RPR mode.
- Intelligent Service Gateway is not supported.
- Device authentication to prevent counterfeiting

- Keystore controller for key authentication
- Virtual switch functionality

RSP720-10GE Usage Guidelines and Limitations

Observe the following guidelines when using the RSP720-10GE:

- The RSP720-10GE runs the same Cisco IOS software images as the RSP720. The following software image feature sets are available for the RSP720-10GE: ipservices, ipservicesk9, advipservices, advipservicesk9, and adventerprisek9.
- Line card firmware is bundled with the IOS image and is not linked to any supervisor type.
- The RSP720-10GE uses new ROMMON software for both the SP and RP. Because the RSP720-10GE and RSP720 use a different IO memory map, the RSPs cannot share the same ROMMON software.
  - If you attempt to load RSP720 ROMMON software onto the RSP720-10GE, the RSP720-10GE does not power up and the ROMMON banner is not displayed.
  - If you load RSP720-10GE ROMMON software onto the RSP720, Cisco IOS software boots up but the software detects a mismatch and enters ROMMON mode.
- You can configure the RSP720-10GE to run QoS features on all uplink ports (10GE and 1GE) or on 10GE ports only. A new CLI command (**mls qos supervisor 10g-only**) is available to configure the module to run QoS features on 10GE ports only. QoS operates differently in each mode. See the "QoS on the RSP720-10GE" section on page 2-13 for more information.

QoS on the RSP720-10GE

The RSP720-10GE has both 10GE and 1GE uplink ports. You can configure the RSP720-10GE to run QoS features on all uplink ports (mixed mode) or on 10GE ports only. The number of queues available for QoS depends on which mode is used:

- In mixed mode (10GE and 1GE ports), the default, only four queues are available for QoS.

  The QoS port architecture for 1GE port is (Rx/Tx): **2q8t/1p3q8t**. The queue structure for 10GE ports in mixed mode is same as IGE ports : **2q8t/1p3q8t**.
- In 10GE only mode, eight queues are available for QoS. Use the **mls qos supervisor 10g-only** command to enable 10GE only mode.

  The QoS port architecture for 10GE only mode is (Rx/Tx): **8q8t/1p7q8t**.

Note For SRD4 release, a new command is introduced to prevent the QoS data getting reset during second pass lookup over internal vlans for the mvpn case.
For complete syntax and usage information for the command **mls qos recirc untrust**, refer to the Cisco QoS command reference at this URL:
http://www.cisco.com/en/US/docs/ios/qos/command/reference/qos_book.html

QoS Configuration Guidelines

As you configure QoS on the RSP720-10GE, consider the following:

- When you switch between mixed-mode QoS and 10GE only mode, any existing QoS configuration on the uplinks is lost. You must reconfigure QoS.

- While transitioning between modes, service will be temporarily lost on the uplinks.
- You can manually shut down all three 1GE ports before issuing the **mls qos supervisor 10g-only** command to switch to 10GE only mode. If you do not shut down the ports first, the **mls qos supervisor 10g-only** command shuts down the ports.
- When you switch from 10GE10GE only to mixed-mode QoS, you must issue the **no shutdown** command on each of the three 1GE ports to resume QoS service on those ports.
- In 10GE only mode, the 1GE ports are visible but they remain in an administratively down state.

Configuring 10GE Only QoS

Cisco IOS Release 12.2SRC introduces a new command to enable QoS features on 10GE uplink ports only. By default, the router runs in *mixed mode*, which means that QoS is enabled on both the 10GE uplink ports and the 1GE uplink ports.

mls qos supervisor 10g-only

no mls qos supervisor 10g-only

Note You can shut down all three 1GE uplink ports before entering the **mls qos supervisor 10g-only** command. If you do not shut down the ports first, the **mls qos supervisor 10g-only** command shuts down the ports.

Supervisor Engine 2T

The Supervisor Engine 2T is the newest addition to the family of supervisor engines. The Supervisor Engine 2T is designed to deliver higher performance, better scalability, and enhanced hardware-enabled features. Supervisor Engine 2T integrates a high-performance 2-Terabit crossbar switch fabric that enables 80 Gbps switching capacity per slot. The forwarding engine on Supervisor Engine 2T is capable of delivering high-performance forwarding for Layer 2 and Layer 3 services. Supervisor Engine 2T delivers many new hardware-enabled innovations in the areas of security, quality of service (QoS), virtualization, and manageability. The rich feature set of Supervisor Engine 2T enhances applications such as traditional IP forwarding, Layer 2 and Layer 3 Multiprotocol Label Switching (MPLS) VPNs, and VPLS.

This section describes the Supervisor Engine 2T (see Figure 2-7). Table 2-2 describes the controls and features on the front panel, and Table 2-3 describes the LEDs.

Figure 2-3 Supervisor Engine 2T Front Panel

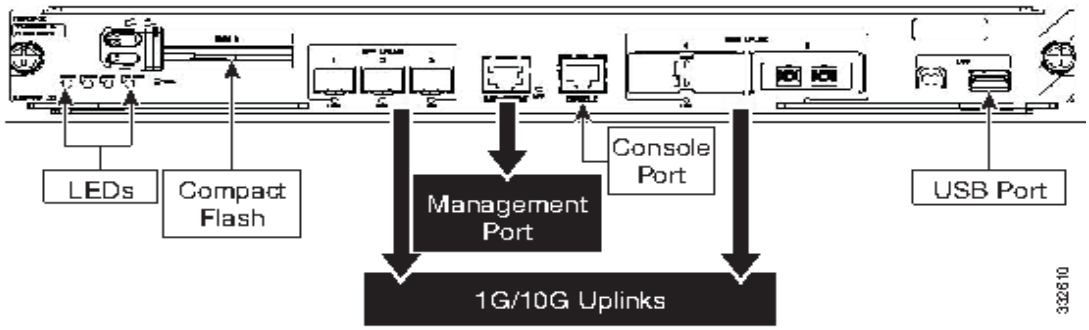


Table 2-2 Supervisor Engine 2T Front-Panel Controls

Component	Description
Status LEDs	Indicate the status of various functions on the module (see Table 2-9).
Reset Button	Restarts the router. Use a ballpoint pen tip or other small, pointed object to access the Reset button. Not all modules have a Reset button.
CompactFlash Disk Slots	One slots for flash memory cards. Do not remove the card from the slot while the disk LED is on. See the "Using Flash Memory Cards" section on page 3-12 for information about working with flash memory.
Console Port	Provides access to the router. The port is an EIA/TIA-232 asynchronous, serial connection with hardware flow control and an RJ-45 connector. See the "Connecting to the Console Port" section on page 3-9 for instructions on connecting to the console port.
Uplink Ports	Connects the router to other network devices. SUP-2T has two 10GE and three 1GE uplink ports. The two 10GE ports use X2 as transceiver, and the three 1GE ports use SFP. The uplink ports are configurable with SFP or X2 optics modules. See the "Connecting to the Uplink Ports" section on page 3-10 for more information.

Table 2-2 Supervisor Engine 2T Front-Panel Controls

Component	Description
USB Ports	Each USB port can function as a console port.
Management Ethernet Port	Directly connects to the network and copies IOS router image using the TFTP server. You can also use this port to network boot the system using the image on the TFTP server from rommon.

Table 2-11 lists the LED functions on the Supervisor Engine 2T.

Table 2-3 Supervisor Engine 2T LEDs

LED	Color	Description
STATUS	Green	All diagnostics pass; the module is operational (normal initialization sequence).
	Orange	The module is booting or running diagnostics (normal initialization sequence).
	Yellow	Minor hardware problems.
	Red	An overtemperature condition occurred. (A major threshold has been exceeded during environmental monitoring.)
ID	Blue	The beacon LED on the module level. The LED in enable state will flash (half second blue and half second off). By default, this LED is diabled. You can use **hw-module slot** *slot-no* **led beacon** command to configure the LED.
SYSTEM[1]	Green	All chassis environmental monitors are reporting OK.
	Orange	The module is powering up or a minor hardware fault has occurred.
	Red	Major hardware problem. The temperature of the supervisor engine has exceeded the major temperature threshold.
	Blinking Red	Continuous backplane stall.
ACTIVE	Green	The supervisor engine is operational and active.
	Orange	The supervisor engine is powering up or is in standby mode.
PWR MGMT[1]	Green	Sufficient power is available for all modules installed in the router.
	Orange	The supervisor engine is powering up or has minor hardware problems.
	Red	Major hardware problem.
DISK	Green	The disk is active. Do not remove the disk while the light is on or the file may get corrupted.
LINK	Green	The port is operational.
	Orange	The port is disabled.
	Flashing orange	The port is bad.
	Off	The supervisor engine is powering up or the port is enabled and there is no link.

1. The SYSTEM and PWR MGMT LEDs on a redundant supervisor engine are synchronized to the active module.

Primary Supervisor Engine 2T Components

Policy Feature Card 4

Supervisor Engine 2T features the integrated Policy Feature Card 4 (PFC4), which improves performance and scalability, and provides new and enhanced hardware features. The PFC4 is equipped with a high-performance ASIC complex that enables hardware acceleration for existing and new software features. The PFC4 supports Layer 2 and Layer 3 forwarding, QoS, Netflow and ACL and multicast packet replication and processes security policies such as access control lists (ACLs) operations all simultaneously enabled with no performance impact. The PFC4 supports all of these operations for both IPv4 and IPv6.

PFC4 also provides enhanced performance and scalability and supports many new innovations such as native VPLS, flexible NetFlow, egress NetFlow, Cisco TrustSec, distributed policers, control plane policing, and comprehensive IPv6 features.

Multilayer Switch Feature Card 5

Supervisor Engine 2T features the Multilayer Switch Feature Card 5 (MSFC5), providing high-performance, multilayer switching and routing intelligence. Equipped with a high-performance processor, the MSFC5 runs both Layer 2 protocols and Layer 3 protocols on the dual-core CPU complex. These include routing protocol support, Layer 2 protocols (for example, Spanning Tree Protocol and VLAN Trunking Protocol), and security services.

The MSFC5 builds the Cisco Express Forwarding information base (FIB) table in software and then downloads this table to the hardware application-specific-integrated circuits (ASICs) on the PFC4 and Distributed Forwarding Card 4 (DFC4), if present on a module, which make the forwarding decisions for IP unicast and multicast traffic.

Features and Benefits details

This section provides details of scalability and performance capabilities of Supervisor Engine 2T and functions supported.

Table 2-4 shows the scalability for Supervisor Engine 2T.

Table 2-4 Scalability

Name	VS-S2T-10G	VS-S2T-10G-XL
IPv4 routing	In hardware Up to 720 Mpps**	In hardware Up to 720 Mpps**
IPv6 routing	In hardware Up to 390 Mpps**	In hardware Up to 390 Mpps**
L2 bridging	In hardware Up to 720 Mpps**	In hardware Up to 720 Mpps**

Name	VS-S2T-10G	VS-S2T-10G-XL
MPLS	MPLS in hardware to enable use of Layer 3 VPNs and EoMPLS tunneling. Up to 8192 VRFs with a total of up to 256K[1] forwarding entries per system.	MPLS in hardware to enable use of Layer 3 VPNs and EoMPLS tunneling. Up to 8192 VRFs with a total of up to 1024K forwarding entries per system.
VLAN	4K	4K
Bridge domains	16k	16k
VPLS	In hardware (Up to 390 Mpps**)	In hardware (Up to 390 Mpps**)
GRE	In hardware (Up to 390 Mpps**)	In hardware (Up to 390 Mpps**)
NAT	Hardware assisted	Hardware assisted
MAC entries	128k	128k
Routes	256K(IPv4) 128K (IPv6)	1024K (IPv4) 512K (IPv6)
Netflow entries	512K	1024K
Multicast routes	128K (IPv4) 128K (IPv6)	128K (IPv4) 128K (IPv6)

1. 1K=1024.

Table 2-5 shows the QoS features and scalability for Supervisor Engine 2T.

Table 2-5 QoS Features and Scalability

Feature	VS-S2T-10G	VS-S2T-10G-XL
Layer-3 classification and marking access control entries (ACEs)	64K shared for QOS / Security	256K shared for QOS/Security
Aggregate traffic rate-limiting policers	16348	16348
Flow-based rate-limiting method; number of rates	Per source address, destination address, or full flow; 64 rates	Per source address, destination address, or full flow; 64 rates
Layer 2 rate limiters	20 ingress/6 egress	20 ingress/6 egress
MAC ACLs featuring per-port/per VLAN granularity	Yes	Yes
Distributed policers	Yes	Yes
Shared uFlow policers	Yes	Yes
Egress uFlow policers	Yes	Yes

Feature	VS-S2T-10G	VS-S2T-10G-XL
Packet or byte policers	Yes	Yes
Per port per VLAN	Yes	Yes

Table 2-6 shows security features and scalability for Supervisor Engine 2T.

Table 2-6 Security Features and Scalability

Feature	VS-S2T-10G	VS-S2T-10G-XL
Port security	Yes	Yes
IEEE 802.1x and 802.1x extensions	Yes	Yes
VLAN and router ACLs and port ACLs	Yes	Yes
1:1 mask ratio to ACE values	Yes	Yes
Security ACL entries	64K shared for QOS / Security	256K shared for QOS/Security
CPU rate limiters (DoS protection)	57	57
uRPF check (IPv4/IPv6)	Up to 16	Up to 16
Number of interfaces with unique ACL	16k	16k
RPF interfaces	16	16
Private VLANs	Yes	Yes
MAC ACLs on IP	Yes	Yes
Logical interfaces	128k	128k
EtherChannel hash	8 bits	8 bits
Cisco TrustSec support (including L2 encryption)	Yes	Yes
CPU HW rate limiters by PPS or BPS	Yes	Yes
CoPP for multicast	L2 and L3 support	L2 and L3 support
CoPP for exceptions (MTU, TTL)	Yes	Yes
CoPP exceptions Netflow support	Yes	Yes
ACL labels	16K	16K
Port ACL	8K	8K
ACL dry run	Yes	Yes
Hitless ACL changes	Yes	Yes

Table 2-7 shows the MPLS and virtualization features for Supervisor Engine 2T.

Table 2-7 MPLS and Virtualization Features

Feature	VS-S2T-10G	VS-S2T-10G-XL
Label imposition/disposition (MPLS-PE), swapping (MPLS-P)	Yes	Yes
Label Distribution Protocol (LDP)	Yes	Yes
MPLS VPN	Yes	Yes
VRF Lite	Yes	Yes
QoS mechanisms using experimental (EXP) bits	Yes	Yes
MPLS-RSVP-TE	Yes	Yes
MPLS differentiated services (diffserv)-aware traffic engineering (MPLS-DS-TE)	Yes	Yes
MPLS traceroute	Yes	Yes
EoMPLS	Yes	Yes
EoMPLS tunnels	16k	16k
Native VPLS in HW	Yes	Yes
Native L2 over multipoint GRE	Yes	Yes
VRF-aware operational contexts	Yes	Yes
VPN Netflow support	Yes	Yes
VPN aware NAT	Yes	Yes
VRF-lite scalability	VLAN reuse per sub-interface	VLAN reuse per sub-interface
Per VPN interface statistics	Yes	Yes

Supervisor Engine 720 and Supervisor Engine 32

The following figures (Figure 2-4, Figure 2-5, and Figure 2-6) show the front panel on the Supervisor Engine 720 (Sup720) and Supervisor Engine 32 (Sup32). The tables that follow describe the controls and LEDs on the RSP720, Sup720, and Sup32. For information on the Supervisor Engine 2 controls and LEDs, see the "Supervisor Engine 2" section on page 2-23.

Figure 2-4 Supervisor Engine 720 (WS-SUP720) Front Panel

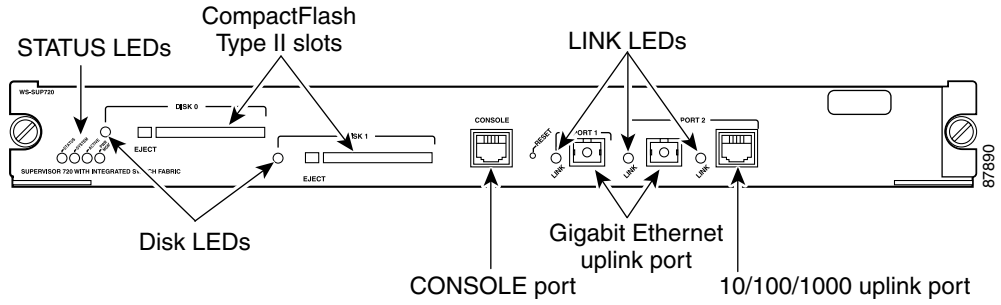


Figure 2-5 Supervisor Engine 32 (WS-SUP32-GE-3B) Front Panel

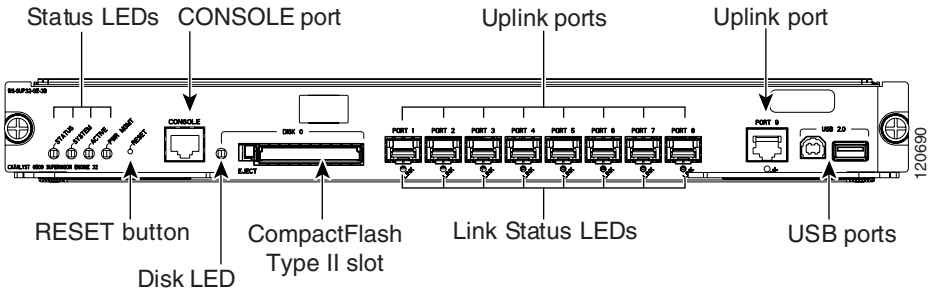
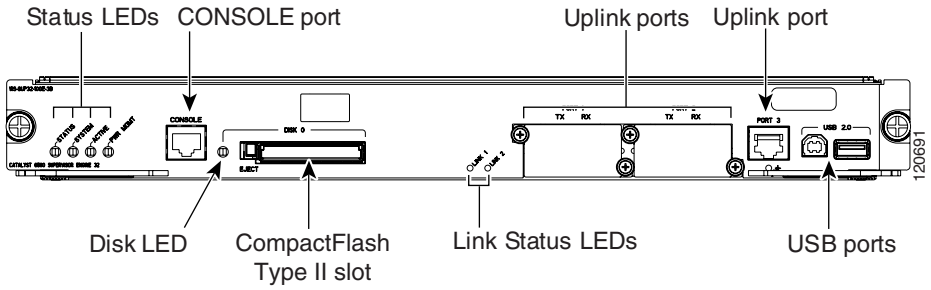


Figure 2-6 Supervisor Engine 32 (WS-SUP32-10GE-3B) Front Panel



Front-Panel Controls (RSP720, RSP720-10GE, Sup720, Sup32)

Table 2-8 describes the front-panel controls on the Route Switch Processor 720 and RSP720-10GE, the Supervisor Engine 720, and the Supervisor Engine 32.

Table 2-8 RSP720, RSP720-10GE, Sup720, and Sup32 Front-Panel Controls

Component	Description
Status LEDs	Indicate the status of various functions on the module (see Table 2-9).
Reset Button	Restarts the router. Use a ballpoint pen tip or other small, pointed object to access the Reset button. Not all modules have a Reset button.
CompactFlash Disk Slots	One or two slots for flash memory cards. Do not remove the card from the slot while the disk LED is on. See the "Using Flash Memory Cards" section on page 3-12 for information about working with flash memory.
Console Port	Provides access to the router. The port is an EIA/TIA-232 asynchronous, serial connection with hardware flow control and an RJ-45 connector. See the "Connecting to the Console Port" section on page 3-9 for instructions on connecting to the console port. On the RSP720, the console port allows you to access either the switch processor (SP) or the route processor (RP).
Uplink Ports	Used to connect the router to other network devices. The uplink ports are configurable with SFP, XENPAK, or X2 optics modules. See the "Connecting to the Uplink Ports" section on page 3-10 for more information.
USB Ports (Sup32 only)	Each USB port can function as a console port or security key.

Front-Panel LEDs (RSP720, RSP720-10GE, Sup720, Sup32)

LEDs on the front panel of the supervisor engine or route switch processor show the status of the processor and other components installed in the router. Table 2-9 lists the LED functions on the Route Switch Processor 720 and RSP720-10GE, the Supervisor Engine 720, and the Supervisor Engine 32. See Table 2-11 for a list of LED functions on the Supervisor Engine 2.

Table 2-9 RSP720, Sup720, and Sup32 LEDs

LED	Color	Description
STATUS	Green	All diagnostics pass; the module is operational (normal initialization sequence).
	Orange	The module is booting or running diagnostics (normal initialization sequence).
	Yellow	Minor hardware problems.
	Red	An overtemperature condition occurred. (A major threshold has been exceeded during environmental monitoring.)
SYSTEM[1]	Green	All chassis environmental monitors are reporting OK.
	Orange	The module is powering up or a minor hardware fault has occurred.
	Red	Major hardware problem. The temperature of the supervisor engine or RSP has exceeded the major temperature threshold.
	Blinking Red	Continuous backplane stall.

Table 2-9 RSP720, Sup720, and Sup32 LEDs (continued)

LED	Color	Description
ACTIVE	Green	The supervisor engine or RSP is operational and active.
	Orange	The supervisor engine or RSP is powering up or is in standby mode.
PWR MGMT[1]	Green	Sufficient power is available for all modules installed in the router.
	Orange	The supervisor engine or RSP is powering up or has minor hardware problems.
	Red	Major hardware problem.
DISK	Green	The disk is active. Do not remove the disk while the light is on or the file may be corrupted.
LINK	Green	The port is operational.
	Orange	The port is disabled.
	Flashing orange	The port is bad.
	Off	The supervisor engine or RSP is powering up or the port is enabled and there is no link.

1. The SYSTEM and PWR MGMT LEDs on a redundant supervisor engine or RSP are synchronized to the active module.

Supervisor Engine 2

This section describes the Supervisor Engine 2 (see Figure 2-7), which has slightly different controls and features than the Supervisor Engine 720 and Supervisor Engine 32. Table 2-10 describes the controls and features on the front panel and Table 2-11 describes the LEDs.

Note In Cisco IOS Release 12.2SR and later releases, the Supervisor Engine 2 is no longer supported on Cisco 7600 series routers.

Figure 2-7 Supervisor Engine 2 Front Panel

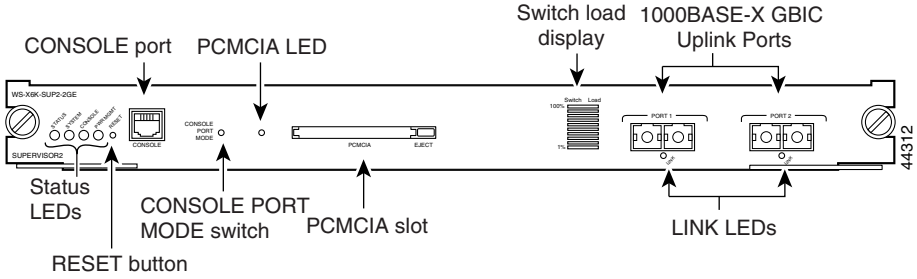


Table 2-10 Supervisor Engine 2 Front-Panel Controls

Component	Description
Status LEDs	Indicate the status of various functions on the module (see Table 2-11).
Reset Button	Restarts the router. Use a ballpoint pen tip or other small, pointed object to access the Reset button.
Console Port	Provides access to the router either locally (with a console terminal) or remotely (with a modem). The port is an EIA/TIA-232 asynchronous, serial connection with hardware flow control and an RJ-45 connector. See the "Connecting to the Console Port" section on page 3-9 for instructions on connecting to the console port.
Console Port Mode Switch	Enables you to connect a terminal to the console port using either the cable and adapters provided with the router (switch in the *in* position, factory default) or a Catalyst 5000 Supervisor Engine III console cable and adapter, not provided (switch in the *out* position).
PCMCIA Slot and LED	PCMCIA flash memory card slot. Do not remove the card from the slot while the disk LED is on. See the "Using Flash Memory Cards" section on page 3-12 for information about working with flash memory.
Switch Load Meter	A visual approximation of the current traffic load across the backplane.
Uplink Ports	Used to connect the router to another network device. Two dual-port Gigabit Ethernet uplink ports operate in full-duplex mode only. You can configure the ports with any combination of copper, short-wave (SX), long-wave/long-haul (LX/LH), extended-reach (ZX), and coarse wavelength division multiplexing (CWDM) 1000BASE-X Gigabit Interface Converters (GBICs). See the "Connecting to the Uplink Ports" section on page 3-10 for more information.

Table 2-11 lists the LED functions on the Supervisor Engine 2.

Table 2-11 Supervisor Engine 2 LEDs

LED	Color	Description
STATUS	Green	All diagnostics pass; the module is operational (normal initialization sequence).
	Orange	The module is booting or running diagnostics (normal initialization sequence). An overtemperature condition has occurred. (A minor threshold has been exceeded during environmental monitoring.)
	Red	Diagnostic test failed; the module is not operational. (The fault occurred during the initialization sequence.) An overtemperature condition has occurred. (A major threshold has been exceeded during environmental monitoring.)

Table 2-11 Supervisor Engine 2 LEDs (continued)

LED	Color	Description
SYSTEM[1]	Green	All chassis environmental monitors are reporting OK.
	Orange	The power supply or power supply fan failed. Incompatible power supplies are installed. The redundant clock failed. One VTT[2] module has failed or the VTT module temperature minor threshold has been exceeded.[3]
	Red	Two VTT modules failed or the VTT module temperature major threshold has been exceeded.[3] The temperature of the supervisor engine major threshold has been exceeded.
CONSOLE	Green	The supervisor engine is operational and active.
	Orange	The supervisor engine is in standby mode.
PWR MGMT[1]	Green	Sufficient power is available for all modules.
	Orange	Sufficient power is not available for all modules.
SWITCH LOAD	-	If the system is operational, the switch load meter indicates (as an approximate percentage) the current traffic load over the backplane.
PCMCIA	-	The PCMCIA LED is lit when no PCMCIA card is in the slot and goes off when you insert a card.
LINK	Green	The port is operational.
	Orange	The link has been disabled by software.
	Flashing orange	The link is bad and has been disabled due to a hardware failure.
	Off	No signal is detected.

1. The SYSTEM and PWR MGMT LED indications on a redundant supervisor engine are synchronized to the active engine.
2. VTT = voltage termination. The VTT module terminates signals on the system switching bus.
3. If no redundant supervisor engine is installed and there is a VTT module minor or major overtemperature condition, the system shuts down.

CHAPTER 3

Installing and Configuring Route Switch Processors and Supervisor Engines

This chapter describes how to install and configure a route switch processor or supervisor engine. It also provides instructions for connecting to the console and uplink ports on the module.

This chapter contains the following sections:

Preparing for Installation or Removal

Before you attempt to install a supervisor engine or route switch processor in the router, be sure to:

- Review the safety precautions and electrostatic discharge guidelines in the "Safety Precautions for Module Installation and Removal" section on page 3-2 and the "Preventing Electrostatic Discharge Damage" section on page 3-2.
- Make sure you have on hand the tools required for the installation. (See the "Tools Required for Module Installation" section on page 3-3.)
- Determine which chassis slot to install the module in. (See the "Determining Module Location" section on page 3-3.)
- Consider cabling for the console and uplink ports. (See Appendix B, "Cable and Connector Specifications.")

Safety Precautions for Module Installation and Removal

Be sure to observe the following warnings and safety precautions when you work on the router.

Warning **Hazardous voltage or energy is present on the backplane when the system is operating. Use caution when servicing.** Statement 1034

Warning **Hazardous network voltages are present in WAN ports regardless of whether power to the unit is OFF or ON. To avoid electric shock, use caution when working near WAN ports. When detaching cables, detach the end away from the unit first.** Statement 1026

Warning **Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

Warning **Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place.** Statement 1029

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. The supervisor engine or route switch processor consists of printed circuit boards that are fixed in metal carriers. Electromagnetic interference (EMI) shielding and connectors are integral components of the carrier. Although the metal carrier helps to protect the boards from ESD, use a preventive antistatic strap during handling.

To prevent ESD damage, follow these guidelines whenever you handle supervisor engine or RSP modules and router components:

- 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 components by their handles or edges only; do not touch 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 Periodically check the resistance value of the antistatic strap. The measurement should be within the range of 1 and 10 megohms (Mohms).

Tools Required for Module Installation

These tools are required to install modules in the Cisco 7600 series router:

- Flat-blade screwdriver
- Antistatic wrist strap or other grounding device
- Antistatic mat or antistatic foam

Determining Module Location

Determine which chassis slot to install the module in. Table 3-1 lists the chassis slots in which you can install a supervisor engine or route switch processor.

Table 3-1 Supervisor Engine and Route Switch Processor Slot Assignments

Module	Slot Assignments
Route Switch Processor 720 (RSP720-10GE)	• Slots 1 and 2 (3-slot enhanced [-S] chassis and 4-slot chassis) • Slots 5 and 6 (6-slot and 9-slot enhanced [-S] chassis and 9-slot chassis) • Not supported in the 3-slot, 6-slot, or 13-slot chassis
Route Switch Processor 720 (RSP720)	• Slots 1 and 2 (4-slot chassis) • Slots 5 and 6 (6-slot and 9-slot chassis, including enhanced [-S] chassis) • Slots 7 and 8 (13-slot chassis) • Not supported in the 3-slot chassis
Supervisor Engine 720 (Sup720)	• Slots 1 and 2 (3-slot and 4-slot chassis) • Slots 5 and 6 (6-slot and 9-slot chassis) • Slots 7 and 8 (13-slot chassis)
Supervisor Engine 2T	• Slots 5 and 6 (9 slot 7609-S chassis). • Slots 6 and 7 (13 slot 7613-S chassis). • Slots 1and 2 (4 slot 7604 chassis).

Table 3-1 Supervisor Engine and Route Switch Processor Slot Assignments (continued)

Module	Slot Assignments
Supervisor Engine 32	• Slots 1 and 2 (4-slot chassis) • Slots 5 and 6 (6-slot and 9-slot chassis) • Slots 7 and 8 (13-slot chassis) • Not supported in the 3-slot chassis
Supervisor Engine 2	• Slots 1 and 2 (all chassis) • Not supported in the 4-slot chassis

Installing a Supervisor Engine or Route Switch Processor

To install a supervisor engine or route switch processor module in the router, perform the following steps

Caution To prevent ESD damage, handle modules by the carrier edges only.

Step 1 Choose a slot for the module (see Table 3-1). Make sure that there is enough clearance to accommodate any equipment that will be connected to the ports on the module. If possible, place modules between empty slots that contain only blank module filler plates.

a. If a blank module filler plate is installed in the slot in which you plan to install the module, remove the plate by removing its two Phillips pan-head screws.

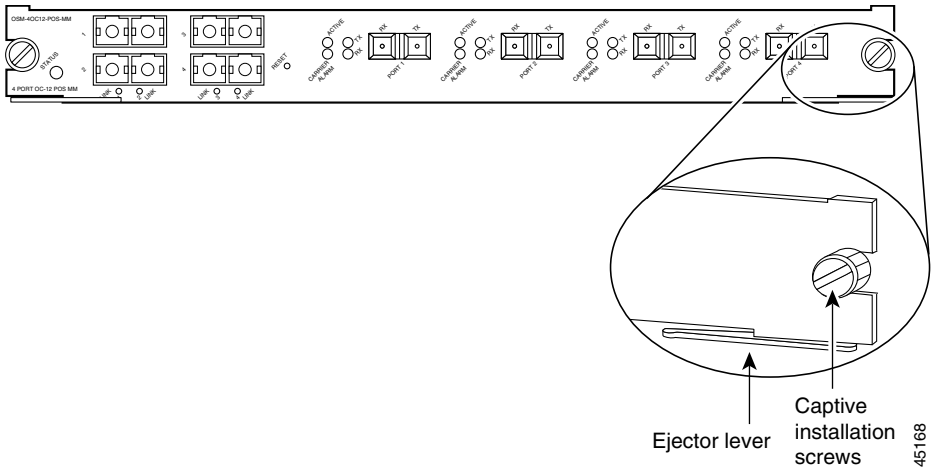
b. If another module is installed in the slot, remove the module by following the procedure in the "Removing a Supervisor Engine or Route Switch Processor" section on page 3-7.

Step 2 Verify that the captive installation screws are tightened on all of the modules installed in the chassis. This step ensures that the EMI gaskets on all modules are fully compressed in order to maximize the opening space for the new or replacement module.

Note If the captive installation screws are loose, the EMI gaskets on the installed modules will push adjacent modules toward the open slot, which reduces the opening size and makes it difficult to install the new module.

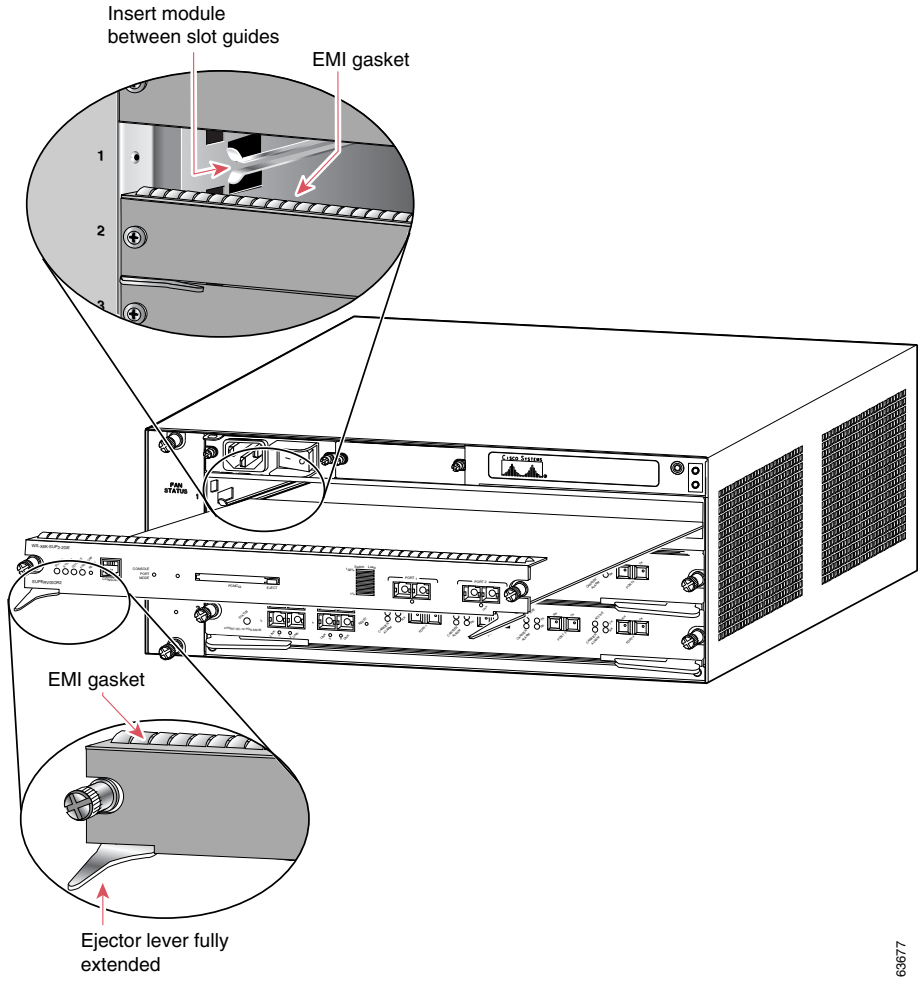
Step 3 Fully open both ejector levers on the new module. (See Figure 3-1.)

Figure 3-1 Ejector Levers and Captive Installation Screws



Step 4 Position the module in the slot. Make sure that you align the sides of the module with the guides on each side of the slot. (See Figure 3-2.)

Figure 3-2 Positioning the Module in the Slot

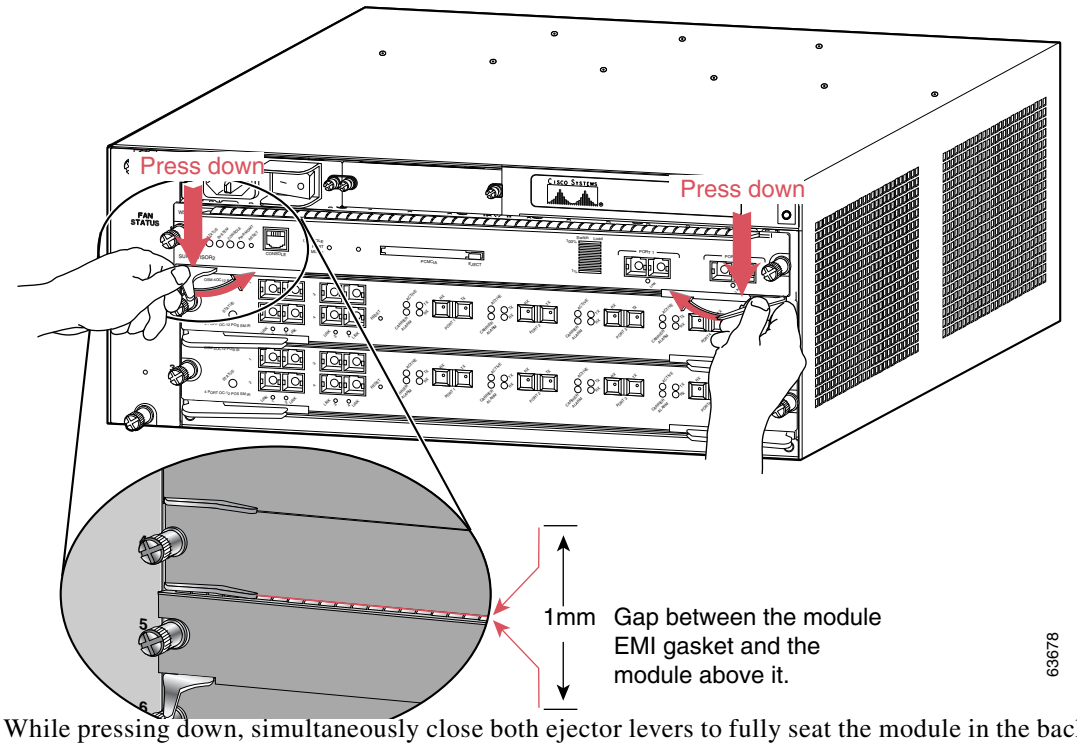


Step 5 Carefully slide the module into the slot until the EMI gasket on the module makes contact with the module in the adjacent slot and both ejector levers have closed to approximately 45 degrees with respect to the module faceplate. (See Figure 3-3.)

Step 6 Using the thumb and forefinger of each hand, grasp the two ejector levers and press down to create a small (0.040 inch [1 mm]) gap between the module EMI gasket and the adjacent module. (See Figure 3-3.)

Caution Do not press down too forcefully on the ejector levers. They will bend and be damaged.

Figure 3-3 Clearing the EMI Gasket



Step 7 While pressing down, simultaneously close both ejector levers to fully seat the module in the backplane connector. The ejector levers are fully closed when they are flush with the module faceplate.

Note Failure to fully seat the module in the backplane connector can result in error messages.

Step 8 Tighten the two captive installation screws on the module.

Note Make sure the ejector levers are fully closed before tightening the captive installation screws.

Note Blank module filler plates (Cisco part number 800-00292-01) should be installed in any empty chassis slots to keep dust out of the chassis and to maintain consistent airflow through the chassis.

Removing a Supervisor Engine or Route Switch Processor

Before you remove a supervisor engine or route switch processor (RSP) from the router, you should first save the current configuration using the **write** {*host file* | **network** | **terminal**} command. This step saves time when bringing the module back online. You can recover the configuration by downloading it from the server to the nonvolatile memory of the supervisor engine or RSP.

If the module is running Cisco IOS software, save the current running configuration by entering the **copy running-config startup-config** command.

Warning **Hazardous voltage or energy is present on the backplane when the system is operating. Use caution when servicing.** Statement 1034

Warning **Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

To remove a supervisor engine or RSP, perform these steps:

Step 1 Disconnect any cables attached to ports on the module.

Step 2 Verify that the captive installation screws on all of the modules in the chassis are tight. This step assures that the space created by the removed module is maintained.

Note If the captive installation screws are loose, the EMI gaskets on the installed modules will push the modules toward the open slot, which reduces the opening size and makes it difficult to remove the module.

Step 3 Loosen the two captive installation screws on the module you plan to remove from the chassis.

Step 4 Place your thumbs on the ejector levers (see Figure 3-1) and simultaneously rotate the ejector levers outward to unseat the module from the backplane connector.

Step 5 Grasp the front edge of the module and slide the module straight out of the slot. If the chassis has horizontal slots, place your hand under the module to support its weight as you slide it out from the slot. Do not touch the module circuitry.

Caution To prevent ESD damage, handle modules by the carrier edges only.

Step 6 Place the module on an antistatic mat or antistatic foam, or immediately reinstall the module in another slot.

Step 7 Install blank module filler plates (Cisco part number 800-00292-01) in any empty slots to keep dust out of the chassis and to maintain consistent airflow through the chassis.

Warning **Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place.** Statement 1029

Hot Swapping (OIR) Modules

Cisco 7600 series routers provide a feature that allows you to remove and replace a redundant supervisor engine or route switch processor (and other redundant cards) without powering down the router. This feature, called hot swapping or online insertion and removal (OIR), allows you to remove and replace a redundant module without disrupting router operation.

When two redundant modules are installed in the router, only one of the modules is active at a time. The other one runs in standby mode, ready to take over processing if the active module fails.

When you remove or insert a redundant module while the router is powered on and running, the router does the following:

1. Determines if there is sufficient power for the module.
2. Scans the backplane for configuration changes.
3. Initializes the newly inserted module. In addition, the system notes any removed modules and places those modules in the administratively shutdown state.
4. Places any previously configured interfaces on the module back to the state they were in when they were removed. Any newly inserted interfaces are put in the administratively shutdown state, as if they were present (but unconfigured) at boot time. If you insert the same type of module into a slot, its ports are configured and brought online up to the port count of the original module.

The router runs diagnostic tests on any new interfaces and the test results indicate the following:

- If the tests pass, the router is operating normally.
- If the new module is faulty, the router resumes normal operation but leaves the new interfaces disabled.
- If the diagnostic tests fail, the router stops operating, which usually indicates that the new module has a problem in the bus and should be removed.

Caution To avoid erroneous failure messages, note the current configuration of all interfaces before you remove or replace another module, and allow at least 15 seconds for the system to reinitialize after a module has been removed or replaced.

Removing and Replacing Memory

The multilayer switch feature card (MSFC4) on the RSP720 supports several configurable options for dynamic random-access memory (DRAM). The router uses this memory to store routing tables, protocols, and network accounting applications. The DRAM resides on four dual in-line memory modules (DIMMs), which you can remove and replace in order to upgrade the module with more memory or to replace failed memory.

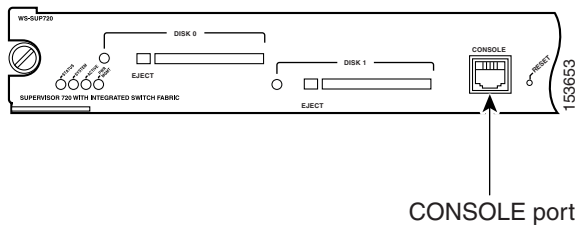
Note If you are replacing DRAM on an existing MSFC4, upload your current configuration file to a remote server before you remove the memory. Otherwise, you will have to re-enter all your current configuration information manually after you replace the memory.

Connecting to the Console Port

The console port allows you to access the router either locally (with a console terminal) or remotely (with a modem). The console port is located on the front panel of the route switch processor or supervisor engine (see Figure 3-4). This section provides information about how to connect to the console port on a route switch processor or supervisor engine.

You must connect to the router through the console port to configure the router for the first time. You can also connect to the console port to perform diagnostics and troubleshoot problems on the router. For console cabling specifications, see the "Console Port Cabling Specifications and Pinouts" section on page B-10.

Figure 3-4 Console Port Connector



Note The console port is an EIA/TIA-232 asynchronous, serial connection with hardware flow control and an RJ-45 connector.

Note The accessories kit that is shipped with your Cisco 7600 series router contains the necessary cable and adapters to connect a terminal or modem to the console port. See the "Console Port Signals and Pinouts" section on page B-11 for cable and adapter pinouts.

Connecting a Terminal

To connect a terminal to the console port, observe the following guidelines. For a Supervisor Engine 2 additional guidelines apply, as described below.

- Use the RJ-45-to-RJ-45 rollover cable and data terminal equipment (DTE) adapter (labeled "Terminal") provided with the router. Use the appropriate DTE adapter (RJ-45-to-DB-25 or RJ-45-to-DB-9).
- Set up the terminal as follows:
  - 9600 baud
  - 8 data bits
  - No parity
  - 2 stop bits
- Make sure that the baud rate of the terminal matches the default baud rate (9600 baud) of the console port. Check the terminal documentation to determine the baud rate.

Supervisor Engine 2

In addition to the above configuration requirements, note that with a Supervisor Engine 2 you can use two types of console cables to connect a terminal to the console port. To accommodate either type of cable, set the console port mode switch (to the right of the console port) as follows:

- To use the RJ-45-to-RJ-45 rollover cable and DTE adapter (labeled "Terminal") provided with the router, make sure that the console port mode switch is in the *in* position (factory default).
- To use a Catalyst 5000 Supervisor Engine III console cable and adapter (not provided), make sure that the console port mode switch is in the *out* position, and use the appropriate adapter for the terminal connection. See the "Console Port Mode 2 Signaling and Pinouts (Sup2 Only)" section on page B-13 for a list of console port pinouts when the switch is in the *out* position.

Note To access the console port mode switch, use a ballpoint pen tip or other small, pointed object.

Connecting a Modem

To connect a modem to the console port, observe the following guidelines:

- Use the RJ-45-to-RJ-45 rollover cable and the RJ-45-to-DB-25 data communications equipment (DCE) adapter (labeled "Modem") provided with the router.
- On a Supervisor Engine 2, make sure that the console port mode switch is in the *in* position (factory default).

Connecting to the Uplink Ports

The supervisor engine and route switch processor have uplink ports that you use to connect the router to other network devices. You can configure the ports with small form-factor pluggable (SFP), XENPAK, X2, or Gigabit Interface Converter (GBIC) optics modules.

Table 3-2 lists the different types of uplink ports on each module. SFP, XENPAK, and X2 optics modules have SC, LC, or MT-RJ connectors. GBIC modules (on the Supervisor Engine 2) have SC connectors.

Warning **Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

Caution Do not remove the plugs from the optical bores on the fiber-optic cable or the module port or until you are ready to connect the cable. The plugs protect the optical bores and cable from contamination.

Table 3-2 Route Switch Processor and Supervisor Engine Uplink Ports

Module	Uplink Ports
Route Switch Processor 720	Two 10/100/1000 BASE-T Gigabit Ethernet uplink ports: • Port 1 requires that a 1-Gbps SFP module be installed. • Port 2 supports either a 1-Gbps SFP module or a 10/100/1000-Mbps RJ-45 connector.
RSP720-10GE	Three Gigabit Ethernet uplink ports (1 gigabit per second [Gbps]): • Ports 1 and 2 require that a 1-Gbps SFP module be installed. • Port 3 supports either a 10/100/1000-Mbps RJ-45 connector. **Note** Use Category 5 Shielded Twisted Pair cable at port 3. Two 10 Gigabit Ethernet uplink ports (10 Gbps): • Ports 4 and 5 require that a 10-Gbps X2 optics module be installed.
Supervisor Engine 720	Two Gigabit Ethernet uplink ports: • Port 1 requires that a 1-Gbps SFP module be installed. • Port 2 supports either a 1-Gbps SFP module or a 10/100/1000-Mbps RJ-45 connector.
Supervisor Engine 2T	• Three 1 Gigabit Ethernet uplink ports (SFP) • Two 10 Gigabit Ethernet uplink ports (X2 optics)
Supervisor Engine 32	• The WS-SUP32-GE-3B provides one 10/100/1000-Mbps RJ-45 uplink port and eight Gigabit Ethernet uplink ports. The Gigabit Ethernet uplink ports require SFP modules to be installed into them. • The WS-SUP32-10GE-3B provides one 10/100/1000-Mbps uplink port and two 10-Gigabit Ethernet uplink ports. The Gigabit Ethernet uplink ports require XENPAK optics modules to be installed into them. The ports operate at 10 Gbps.
Supervisor Engine 2	• Two dual-port Gigabit Ethernet ports operate in full-duplex mode only. • You can configure the ports with any combination of copper, short-wave (SX), long-wave/long-haul (LX/LH), extended-reach (ZX), and coarse wavelength-division multiplexing (CWDM) 1000BASE-X GBICs.

To connect to the module uplink ports, follow these steps:

Step 1 If necessary, install an optics modules in the empty slots on the front panel.

Note The Sup720 and RSP720 provide two connectors for port 2; however, you can use only one of the connectors at a time. (Note that the RSP720-10GE provides only one port 2 connector.)

Step 2 Remove the plugs from the uplink ports and store them for future use.

Step 3 Remove the plugs from the connector on the fiber-optic cable.

Step 4 Insert the cable connector into the uplink port and make sure that both the transmit (Tx) and receive (Rx) fiber-optic cables are fully inserted into the connector.

Step 5 (Sup2 only) If you are using the LX/LH GBIC with multimode fiber (MMF), you need to install a patch cord between the GBIC and the MMF cable. For instructions, see the "Patch Cord" section on page B-19.

Note

- If two RSPs or supervisor engines are installed, the uplink ports on the redundant (standby) module are active and can be used for normal traffic like any other ports in the chassis.
- In Cisco IOS Release 12.2SRC, the uplink ports on a standby RSP720-10GE are not active and cannot be used for normal traffic.

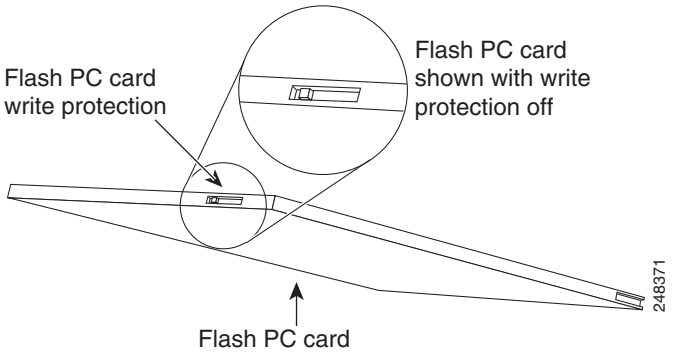
Using Flash Memory Cards

The front panel on the supervisor engine or route switch processor has one or two disk slots for flash memory cards. You can insert a Flash PC, CompactFlash, or MicroDrive memory card in the slot and use the card to store and run software images and configuration files or to serve as an I/O device. See Table 3-3 for memory options.

- The Route Switch Processor 720 with 10-GE uplink ports (RSP720-10GE) has a single disk slot (labeled DISK 0) that accepts CompactFlash cards.
- The Route Switch Processor 720 and Supervisor Engine 720 have two disk slots:
  - DISK 0 accepts a CompactFlash card only.
  - DISK 1 accepts either a CompactFlash card or a 1-GB MicroDrive.
- The Supervisor Engine 32 has a single slot (labeled DISK 0) that accepts CompactFlash cards and IBM MicroDrive cards.
- The Supervisor Engine 2 has a single slot (labeled PCMCIA) that accepts PCMCIA cards.
- The Supervisor Engine 2T has a single slot (labeled PCMCIA) that accepts PCMCIA cards.

Note You can insert and remove a flash memory card with the power on. Before you install a card, verify that the card is set with write protection off. The write-protection switch is located on the front edge of the card (when the printing is right side up and the edge connector end is away from you). (See Figure 3-5.)

Figure 3-5 Locating the Flash PC Card Write-Protection Switch



Note Not all flash memory cards have a write-protection switch.

Table 3-3 lists the Cisco product numbers of memory cards supported on Cisco 7600 supervisor engines and route switch processors.

Table 3-3 CompactFlash Memory Cards

Product Number	Description
RSP720 and RSP720-10GE Flash Memory Cards	
MEM-RSP720-CF256M	Cisco CompactFlash Memory Card, 256 MB
MEM-RSP720-CF512M	Cisco CompactFlash Memory Card, 512 MB
MEM-RSP720-CF1G	Cisco CompactFlash Memory Card, 1 GB
Sup720 and Sup32 Flash Memory Cards	
MEM-C6K-CPTFL64M	Cisco CompactFlash Memory Card, 64 MB
MEM-C6K-CPTFL128M	Cisco CompactFlash Memory Card, 128 MB
MEM-C6K-CPTFL256M	Cisco CompactFlash Memory Card, 256 MB
MEM-C6K-CPTFL512M	Cisco CompactFlash Memory Card, 512 MB
Sup2 Flash Memory Cards	
MEM-C6K-ATA-1-64M	Cisco ATA Type 1 Flash Memory Card, 64 MB
Sup2T Flash Memory Cards	
MEM-C6K-CPTFL1GB	Catalyst 6500 Compact Flash Memory 1GB
MEM-C6K-CPTFL2GB	Catalyst 6500 Compact Flash Memory 2GB

Installing a Flash Memory Card

To install a flash memory card, follow these steps:

Step 1 Hold the memory card with the connector end of the card toward the slot. The connector end of the card is opposite the end with the write-protection switch (if there is one), which is shown in Figure 3-5.

Step 2 Slide the card into the slot until the device completely seats in the connector at the back of the slot and the ejector button pops out toward you.

Caution Do not attempt to force the memory card fully into the slot or you could damage the connector pins. When correctly inserted, a portion of the device remains outside the slot.

Step 3 Format the memory card the first time that it is installed in the system.

Note Be sure to format the memory card with the type of supervisor engine or route switch processor that the card is being used with. A memory card formatted for one type of supervisor engine or route switch processor may not work with another type.

Removing a Flash Memory Card

Caution Do not remove a flash memory card while its LED light is on or the file may become corrupted.

To remove a flash memory card, follow these steps:

Step 1 Make sure that the Disk LED is off (no operations are in progress).

Step 2 Press the ejector button to disconnect the memory card from the connector at the back of the slot.

Step 3 Remove the memory card from the slot and place it in an antistatic bag.

Power Management and Environmental Monitoring

For detailed information on power management and environmental monitoring, see the *Cisco 7600 Series Router Cisco IOS Software Configuration Guide*.

Determining Software Feature Support

This section describes the Feature Navigator and Software Advisor tools. You can use these tools to determine which features are supported on the router and the minimum Cisco IOS software requirements for the hardware installed on your router.

Note You must have an account on Cisco.com to access the Feature Navigator or Software Advisor tool.

- To determine which software features are supported by your route switch processor or supervisor engine, use the Feature Navigator tool at the following URL:

  http://tools.cisco.com/ITDIT/CFN/jsp/index.jsp

- To check the minimum Cisco IOS software requirements for the hardware installed on your router, use the Software Advisor tool at the following URL:

  http://www.cisco.com/public/support/tac/tools.shtml

  This tool does not verify whether the line cards in a system are compatible, but it does provide the minimum Cisco IOS requirements for individual line cards, modules, or options.

Upgrading DIMMs on RSP720

This section describes how to upgrade the dynamic random-access memory (DRAM) dual inline memory modules (DIMMs) on the Route Switch Processor 720.

Before you order a DIMM, you have to decide whether you require a MINI- DIMM or SO-DIMM. Run the **show module** command to know which version you required for upgrade. If the version of the 7600-MSFC4 card is 4.0 and above, then you have to order SO-DIMM. If the version is below 4.0, then you have to order MINI-DIMM. Refer the sample output of the command below:

```
router#show module 1
Mod Ports Card Type                                              Model
Serial No.
--- ----- -------------------------------------------------------
----------------------------- ------------------------
 1    2  Route Switch Processor 720 (Active)    RSP720-3CXL-GE     SAL15077HPS

Mod MAC addresses                                Hw      Fw                   Sw
Status
--- ---------------------------------------------- ------- --------------
------------------------- -------
 1  c89c.1dfa.fb34 to c89c.1dfa.fb37   5.12  12.2(33r)SRE 12.2(33)SRD5 Ok

Mod  Sub-Module                                    Model                      Serial
Hw    Status
---- ---------------------------------------------- -------------------------
---------------------- ------- -------
 1  Policy Feature Card 3                    7600-PFC3CXL    SAL150673QR   1.1    Ok
 1  C7600 MSFC4 Daughterboard 7600-MSFC4     SAL1542T06C     4.0     Ok    ? ? ? <- <-

Mod  Online Diag Status
---- -------------------
 1  Pass
```

Order MINI- DIMM if your MEM PIDs are:

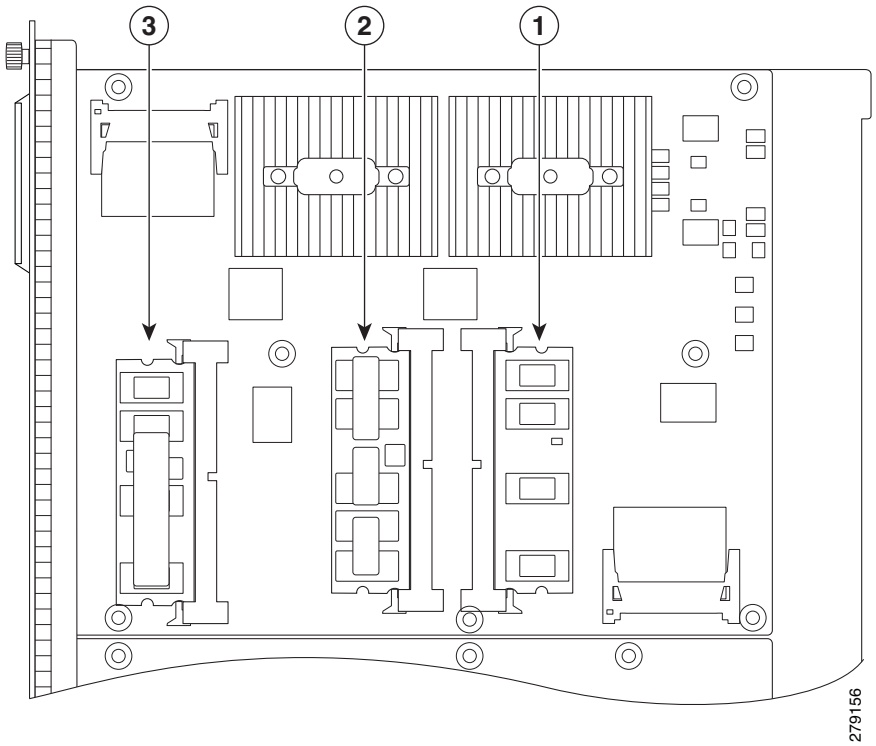
- MEM-RSP720-2G
- MEM-RSP720-4G
- MEM-RSP720-SP2G

Order SO-DIMM if your MEM PIDs are:

- MEM-A-RSP720-2G
- MEM-A-RSP720-4G
- MEM-A-RSP720-SP2G

7600 chassis supports RSP720-GE and RSP720-10GE. Figure 3-6 shows the location of the DIMMs. DIMMs are located on the CPU daughter card and you can see it on top of the Figure 3-6. SP has one DIMM slot and RP processor has two DIMM slots. Slot 1 and 2 are for the RP processor. Slot 3 is for the SP processor.

Figure 3-6 SP and RP DRAM DIMM Location on RSP



The following upgrades are possible on these cards:

RSP720-GE

RSP720-GE-3	2 GB on SP 2 GB or 4G on RP
RSP720-GE-3CXL	2 GB on SP 4 GB on RP

RSP720-10GE

RSP720-10GE-3C	2 GB on SP 2 GB or 4GB on RP
RSP720-10GE-3CXL	2 GB on SP 4 GB on RP

You have to remove the RSP from the chassis for DIMM upgrade. Save all your configurations before you remove the RSP.

Caution Always use an ESD wrist strap when handling the RSP or coming in contact with internal components.

Note If you are upgrading the RP, then slot 1 and slot 2 DIMMs should be of same vendor. If there is only one DIMM for RP, then install it in slot 1.

To upgrade SP DIMM to 2 GB, follow these steps:

Step 1 Remove the DIMM from slot 3.

Step 2 Install the new DIMM of 2 GB memory size in slot 3.

To upgrade RP DIMM to 2 GB, follow these steps:

Step 1 Remove the 1GB DIMM from slot 1.

Step 2 Install the new 2 GB DIMM in slot 1.

To upgrade RP DIMM to 4 GB, follow these steps:

Step 1 Remove the 1 GB DIMM from slot 1.

Step 2 Install the new 2 GB DIMM in slot 1.

Step 3 Remove the 1 GB DIMM from slot 2 (if present).

Step 4 Install another 2 GB DIMM in slot 2.

Configuring a Supervisor Engine or Route Switch Processor

See the *Cisco 7600 Series Router Cisco IOS Software Configuration Guide* for information about how to configure the supervisor engine or route switch processor for operation.

CHAPTER 4

Troubleshooting Route Switch Processors and Supervisor Engines

Getting Started

When the initial system boot is complete, verify the following:

- Power supplies are supplying adequate power to the system.
- The system fan assembly is operating normally.
- System software boots successfully.
- The supervisor engine and all switching modules are initialized and installed properly in their slots.

AC and DC Power Supply Information

AC power supply accepts a wide range of power inputs catering to different geographies. All AC power supplies relay a maximum output when connected to 230V input. For example, a 6000W AC power gives 6000W output when it is connected to 230V. When the AC power is connected to 110V, the power supply output is 3000W.

DC power supply draws power from more than one input. All the inputs of the supply is fed to receive the maximum rated power output. DC power supplies can work at lower capacity if all the inputs are not connected. For example, if a 6000W power supply takes 4 DC inputs, and if only 3 are connected, then output is 4500W, and if only 2 inputs are connected, the output is 3000W. However, if only one input is connected, 6000W Power supply output fails. The green LED indicates the DC power supply for all the power inputs. For more information on the various LED status, *Cisco 7600 Series Router Supervisor Engine and Route Switch Processor Guide* at http://www.cisco.com/en/US/docs/routers/7600/Hardware/Hardware_Guides/Supervisor_Engine_and_Route_Switch_Processor_Guide/SupE02_ps368_TSD_Products_Installation_Guide_Chapter.html#wp1135401 *and Cisco 7600 Series Cisco IOS Software Configuration Guide, 12.2SR at* http://www.cisco.com/en/US/docs/routers/7600/ios/12.2SR/configuration/guide/pwr_envr.html#wp1020518

Chassis and Supervisor Slot Installation

Table 4-1 lists the chassis and their slots where the supervisors can be installed.

Table 4-1 Chassis and Supervisor Slot Installation

Chassis	Designated Supervisor Slots
7603S	1, 2
7604	1, 2
7606	5, 6
7606S	5, 6
7609	5, 6
7609S	5, 6
7613	7, 8

RSP720-1GE Supported Hardware and Features

The RSP720 supports the following Cisco 7600 chassis, line cards and modules:

- Supported on all Cisco 7600 routers (including enhanced chassis) except the Cisco 7603. At present 7603 is discontinued and only 7603S is shipped.
- SPA interface processors (SIPs) and their shared port adapters (SPAs): 7600-SIP-600, 7600-SIP-400, and 7600-SIP-200.
- Enhanced FlexWAN module (WS-X6582-2PA).
- Ethernet services modules: 2-port 10 GE line card (7600-ESM-2X10GE) and 20-port 1 GE line card (7600-ESM-20X1GE).
- All boards in the ES+ line cards family.
- Distributed Forwarding Cards: DFC3C, DFC3CXL, DFC3B, DFC3BXL
- LAN cards.

RSP720-1GE Unsupported Hardware and Features

These hardware and features are not supported by the RSP720:

- Unsupported chassis: Cisco 7603.
- Unsupported modules: Optical Service Modules (OSMs), FlexWAN module.

RSP720-10GE Supported Chassis, Line Cards, and Modules

The RSP720-10GE supports the following chassis and modules:

- Cisco 7604 and 7609 chassis and the Cisco 7603-S, 7606-S, and 7609-S chassis.
- If you insert an RSP720-10GE into an unsupported chassis, the RSP720-10GE drops to ROMMON and only the console is accessible.
- SPA interface processors (SIPs) and their shared port adapters (SPAs): 7600-SIP-600, 7600-SIP-400, and 7600-SIP-200.
- Enhanced FlexWAN module (WS-X6582-2PA).
- Ethernet services modules: 2-port 10 GE line card (7600-ESM-2X10GE) and 20-port 1 GE line card (7600-ESM-20X1GE).
- All boards in the ES+ family of line cards.
- Distributed Forwarding Cards: DFC3C, DFC3CXL, DFC3B, DFC3BXL
- All LAN cards.

RSP720-10GE Unsupported Chassis, Modules and Features

The RSP720-10GE does not support the following chassis and modules:

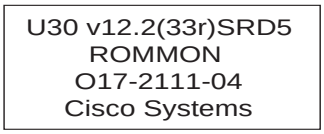
- Cisco 7603, 7606, and 7613 chassis.
- Services modules, Optical Service Modules (OSMs), FlexWAN module.
- RSP720-10GE does not support High Availability features in 12.2(33)SRC and 12.2(33)SRD.

Obtaining Technical Assistance

If you are unable to solve a problem on your own based on the solutions provided, consult a Cisco customer service representative for assistance. When you call, ensure that you have the following information:

- Chassis and module serial number.
- Card information: Use the **show module** and **show inventory** command to determine which cards are installed.
- Cisco IOS software release number: Use the **show version** command to determine this number.
- Brief description of the symptoms and steps to isolate and solve the problem.
- Maintenance agreement or warranty information.
- ROM images. (Use the **show version** exec command.)
- Programmable ROM labels. (This information is printed on the physical chip, and an example is shown in Figure 4-1.)

Figure 4-1 An Example of a Boot ROM Label—Boot ROM Version 12.2(33r)SRD5



- NVRAM configurations for client and adjacent routers.
- Debugging output from adjacent routers using the following privileged exec commands:
  - **debug ip packet**
  - **debug arp**
  - **debug ip udp**
  - **debug tftp**

Troubleshooting Supervisor Failures

Table 4-2 lists the solutions for supervisor issues.

Table 4-2 Troubleshooting Supervisor Failure

Problem	Solution
Supervisor fails to operate or power up	1. Ensure that the card is inserted firmly in the slot. 2. Ensure that you have place the gold edge of the PCB in the guide rails of the chassis. This prevents damage to the connector placed at the rear side the board. 3. Check whether the ejector levers are latched and that the captive screws are fastened properly. If you are uncertain, unlatch the levers, loosen the screws, and attempt to reset the supervisor again. 4. Examine the power supply to see whether the chassis, as a whole, is receiving power. 5. Use the status LED on the supervisor to verify the correct installation of the card. If the card is properly installed, the status LED turns green. **Note** If the system is running on reduced DC power supply, the system LED on a supervisor turns to orange from green. In this scenario, the system can run, however, not all the modules in the chassis may be supported.
Supervisor dual in-line memory module (DIMM) detection issue	1. Ensure that you have correctly installed DIMM in slot 1. 2. Ensure that you follow the standard ESD procedures while upgrading or replacing DIMMs.
RSP720 DIMM upgrade issues	1. Ensure that you remove the existing DIMM from slot 1. 2. Ensure that both the slot 1 and slot 2 DIMMs are from same vendor. 3. If you are upgrading the RP DIMMs to 2 Gigabytes by adding an extra Gigabyte DIMM in slot two, ensure that you insert the both the new 2 DIMMs in slot 1 and slot 2. 4. If you insert the DIMMs in both the slots for RP upgrade, and card does not initiate, then swap the DIMMs between the two slots and check again.

Troubleshooting Back-Plane Data Corruption During OIR of a RP

Table 4-3 lists the solutions for back-plane data corruption during Online Insertion and Removal of a route processor.

Table 4-3 Troubleshooting back-plane data corruption

Problem	Solution
Back-plane data corruption when cards are partially inserted	1. Ensure that the redundant supervisor is operational. 2. Ensure that the removed supervisor is reinserted into the chassis. **Note** Though the card does not make full contact with the back part of chassis, it makes enough contact to receive power from the chassis, 3. The new active supervisor changes its LED appearance and the first two LEDs turns red. 4. If the reinserted board is well inserted or removed from chassis, the active supervisor's LED backs to normal appearance. If not, after 60 seconds approximately the system starts resetting.

Troubleshooting Chassis Overheat Conditions

Table 4-4 lists the solutions for a overheated chassis.

Table 4-4 Troubleshooting Overheated Chassis

Problem	Solution
Overheating in a chassis	1. Move the cards to the center of the chassis. 2. Close and open the slots with face plates.

Troubleshooting Line Card Module

If a c7600 line card module experiences issues, follow these instructions.

Leave the card in its impaired state to allow the Cisco TAC and escalation teams to collect additional information before resetting the card. If you are unable to leave the card in the impaired state, the card may ultimately need to be reset, but some minimal data should be collected before reloading the card. Before reloading a line card, capture the following CLI data to a text file.

!

```
term mon
term len 0
show logging
show tech                                ! issue twice
remote command module <slot> show log
remote command module <slot> show tech  ! issue twice
!
```

Once you collect the data, follow any of these options to move the traffic from the line card module without disturbing the card's state.

1. Costing: increase ip ospf cost and/or isis metric all interfaces on the module and the respective neighbors
2. Passive: add passive-interface under the routing protocols for all interfaces on the module
3. Shutdown: perform a shutdown on all the interfaces on the module
4. Reset: soft reset the line card module
5. Power-cycle: power-cycle the line card module

If (1), (2) and (3), in that order, fail to restore connectivity, perform step (4) as follows. Ensure wait a minute or two for the card to boot completely.

```
!
7600#hw-module module 4 reset
Proceed with reload of module?[confirm]
% reset issued for module 4
7600#
*Feb 22 09:24:19.821: %C7600_PWR-SP-4-DISABLED: power to module in slot 4 set off (Reset)
*Feb 22 09:25:54.021: %DIAG-SP-6-BYPASS: Module 4: Diagnostics is bypassed
*Feb 22 09:25:56.513: %OIR-SP-6-INSCARD: Card inserted in slot 4, interfaces are now
online
```

If step (4) does not resolve the issue, perform step (5) by powering the card off completely. Wait about 10 seconds and then re-enable power to the card.

```
7600#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
7600(config)#no power enable module 4
*Feb 22 09:27:43.149: %C7600_PWR-SP-4-DISABLED: power to module in slot 4 set off (admin
request)
7600(config)#power enable module 4
*Feb 22 09:39:23.071: %DIAG-SP-6-BYPASS: Module 4: Diagnostics is bypassed
*Feb 22 09:39:25.622: %OIR-SP-6-INSCARD: Card inserted in slot 4, interfaces are now
online
```

Troubleshooting Interface Down Issues

Table 4-4 lists the solutions for a interface issues.

Table 4-5 Troubleshooting Interface Issues

Problem	Solution
Wrong or faulty cable	• Use a straight cable in place of a cross cable or vice versa [for example, ethernet]. • Use a single mode fiber in place of a multimode fiber or vice versa. • The Tx and Rx are reversed. The Tx of one end should connect to the Rx on the other side.
Clocking not synchronized	Though most interfaces work with internal clocking on both sides, it is advisable to use line clocking on one end. Execute the **clock source <INTERNAL|LINE>** command to configure the clocking. Execute the **hssi internal-clock** command to configure the internal clock on the HSSI interfaces.
Wrong transceiver or SFP connectors in use	If the SFP or transceivers are used, ensure that you use the correct SFP.
CRC mismatch at either end of the link	Check if the number of bits used for Cyclic Redundancy Check [CRC] on either end of the link are configured to be the same. CRC-16 and CRC-32 are the two options available.
Keepalive mismatch	Keepalives are link health polls that are periodically exchanged between routers over a link. A link is brought down if an end fails to respond to the keepalives for consecutive keepalive periods. If there is no response to the keepalives for three attempts, the link is UP momentarily as a recovery mechanism.
Mismatched timeslot configuration	For channelized interfaces, it is mandatory that the number of timeslots used for an interface on either end be the same i.e. if router A has used 10 timeslots for its interface, then router B should also use 10 timeslots. A mismatched timeslot configuration results in runts on either end and brings down the interface on either end.
Internal VLAN not allocated	Each interface/subinterface on the c7600 is allocated an internal VLAN by the SP. Sometimes the internal VLAN is not allocated or is lost or removed, the interface stays down and does not switch traffic after a router reload or an SSO switchover. To determine the internal/hidden VLAN allocated to an interface, use the **show platform vlans** command.

Traceback Decode Procedure

Tracebacks provide useful information to debug and fix problems. Tracebacks appear when a spurious memory access, alignment error, crash or memory corruption occurs.

This is a sample traceback message:

```
-Traceback 4018C538 4018A2A4 40338858 4034FDD0 403480B0 4017BC40
```

It is important to decode the traceback message while filing DDTS. To decode a traceback symbol, files of the corresponding image is required. A c7600 image has a set of symbol files like RP symbol file, SP symbol file and a symbol file for each line card.

In general the messages before the traceback reveal the source of the traceback. So after determining whether it is SP/RP/linecard traceback, the corresponding symbol file has to be chosen to decode it.

These are some commonly used symbol files:

```
[ciscouser@blr-cde-001:/auto/nonrel_122S_PI/122SR_GDB-nightly/2006-01-08/sym]$ls
cwpa-dw-m.rainier.symbols.gz
cwpa-dwdbg-m.rainier.symbols.gz
cwpa2-dw-m.rainier.symbols.gz
cwpa2-dwdbg-m.rainier.symbols.gz                          //Flexwan2 symbol file
cwtlc-dw-m.rainier.symbols.gz                             //OSM symbol file
cwtlc-dwdbg-m.rainier.symbols.gz
s3223-adventerprisek9_wan_dbg-mz.rainier.symbols.gz       //Sup32 SP symbol file
s3223_rp-adventerprisek9_wan_dbg-m.rainier.symbols.gz     //Sup32 RP symbol file
s72033-adventerprisek9_wan_dbg-mz.rainier.symbols.gz      //Sup720 SP symbol file
s72033_rp-adventerprisek9_wan_dbg-m.rainier.symbols.gz    //Sup720 RP symbol file
sip1-dwdbg-m.rainier.symbols.gz                           //SIP-200 symbol file
sip10g-dwdbg-m.rainier.symbols                            //SIP-600 symbol file
sip2-dwdbg-m.rainier.symbols.gz
```

[ciscouser@ blr-cde-001: ? /060108/sym]$ rsym sip10g-dwdbg-m.rainier.symbols

```
Reading sip10g-dwdbg-m.rainier_gdb_010806.symbols
sip10g-dwdbg-m.rainier_gdb_010806.symbols read in
Enter hex value: 4018C538 4018A2A4 40338858 4034FDD0 403480B0 4017BC40
0x4018C538:abort(0x4018c530)+0x8
0x4018A2A4:crashdump(0x4018a180)+0x124
0x40338858:sip10g_fatal_error(0x40338800)+0x58
0x4034FDD0:sip10g_external_error_interrupt_handler(0x4034fcb0)+0x120
0x403480B0:sb_imr_lev5(0x40348010)+0xa0
0x4017BC40:sip_lev5_intr(0x4017bb50)+0xf0
Enter hex value:
```

Troubleshooting Image Reload Issues

Table 4-5 describes the solutions for image reload issues.

Table 4-6 Troubleshooting Image Reload Issues

Problem	Solution

The following error message is displayed:
`76k-eigrp-4#reload netboot tftp://171.69.17.19/tftpboot/kapilk/nightly/Fri/s72033-jsv-mz`
`Copying tftp://171.69.17.19/tftpboot/kapilk/nightly/Fri/s72033-jsv-mz to sup-image:0`
`%Error opening sup-image:0 (Unknown error 0)`
	Ensure that you don't have a very large image loaded on the 7600 to begin with, which may cause resource problems. The solution is to load a default image first and then do reload netboot.

Troubleshooting Supervisor 2T

For more information on troubleshooting, see the following documents:

- *Troubleshooting Switch Port and Interface Problems* at the following URL:

  http://www.cisco.com/en/US/products/hw/switches/ps708/products_tech_note09186a008015bfd6.shtml

- *How to Determine the Type of Supervisor Module That Is Installed in Catalyst 6500/6000 Series Switches* at the following URL:

  http://www.cisco.com/en/US/products/hw/switches/ps700/products_tech_note09186a00801c0eb0.shtml

- *Catalyst Switch Cable, Connector, and AC Power Cord Guide* at the following URL:

  http://www.cisco.com/en/US/products/hw/switches/ps700/products_tech_note09186a00800a7af7.shtml

- *Troubleshooting Catalyst 6500/6000 Series Switches Running CatOS on the Supervisor Engine and Cisco IOS on the MSFC* at the following URL:

  http://www.cisco.com/en/US/products/hw/switches/ps700/products_tech_note09186a008015504b.shtml

- *Hardware Requirements for Catalyst 6000/Catalyst 6500 Redundancy* at the following URL:

  http://www.cisco.com/en/US/products/hw/switches/ps700/products_tech_note09186a00800a2cee.shtml

APPENDIX A

Technical Specifications

This appendix provides the technical specifications for the Cisco 7600 route switch processors and supervisor engines.

Module Specifications

Table A-1 lists the environmental and physical specifications for the Cisco 7600 route switch processors (RSPs) and supervisor engines.

Table A-1 Environmental and Physical Specifications

Item	Specification
Environmental	
Temperature, ambient operating	32 to 104°F (0 to 40°C)
Temperature, ambient nonoperating and storage	–40 to 167°F (–40 to 75°C)
Humidity (RH), ambient (noncondensing) operating	10% to 90%
Altitude operating	–197 to 6500 ft (–60 to 2000 m)
Physical Characteristics	
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm)
Weight	3 to 10 lb (1.4 to 4.5 kg)

Regulatory Standards Compliance

For information about the regulatory standards that Cisco 7600 series routers comply with, see *Regulatory Compliance and Safety Information for the Cisco 7600 Series Routers*.

APPENDIX B

Cable and Connector Specifications

This appendix lists the cable and connector specifications for the Cisco 7600 route switch processors (RSPs) and supervisor engines. It contains the following information:

Supported Dense Wave Division Multiplexing (DWDM) Wavelength Optics

Table B-1 lists the DWDM small form-factor pluggables (SFP) to RSP 720 and RSP 720-10GE:

Table B-1 Supported DWDM Wavelength Optics

Supervisor Engine or RSP	Transceiver Module Part Numbers
RSP720 and RSP720-10GE	DWDM-SFP-3346
	DWDM-SFP-3739
	DWDM-SFP-4134
	DWDM-SFP-4532
	DWDM-SFP-4931
	DWDM-SFP-5332
	DWDM-SFP-5736
	DWDM-SFP-6141
	DWDM-SFP-6061
	DWDM-SFP-5979
	DWDM-SFP-5898
	DWDM-SFP-5817
	DWDM-SFP-5655
	DWDM-SFP-5575
	DWDM-SFP-5494
	DWDM-SFP-5413
	DWDM-SFP-5252
	DWDM-SFP-5172
	DWDM-SFP-5092
	DWDM-SFP-5012
	DWDM-SFP-4851
	DWDM-SFP-4772
	DWDM-SFP-4692

Table B-1 Supported DWDM Wavelength Optics

Supervisor Engine or RSP	Transceiver Module Part Numbers
	DWDM-SFP-4612
	DWDM-SFP-4453
	DWDM-SFP-4373
	DWDM-SFP-4294
	DWDM-SFP-4214
	DWDM-SFP-4056
	DWDM-SFP-3977
	DWDM-SFP-3898
	DWDM-SFP-3819
	DWDM-SFP-3661
	DWDM-SFP-3582
	DWDM-SFP-3504
	DWDM-SFP-3425
	DWDM-SFP-3268
	DWDM-SFP-3190
	DWDM-SFP-3112
	DWDM-SFP-3033

Supported Coarse Wave Division Multiplexing (CWDM) Wavelength Optics

Table B-2 lists the CWDM small form-factor pluggables (SFP) to RSP 720 and RSP 720-10GE:

Table B-2 Supported CWDM Wavelength Optics

Supervisor Engine or RSP	Transceiver Module Part Numbers
RSP720 and RSP720-10GE	CWDM-SFP-1470
	CWDM-SFP-1490
	CWDM-SFP-1510
	CWDM-SFP-1530
	CWDM-SFP-1550
	CWDM-SFP-1570
	CWDM-SFP-1590
	CWDM-SFP-1610

Limiting Connection Distances

The length of your networks and the distances between connections depend on the type of signal, the signal speed, and the transmission media (the type of cabling used to transmit the signals). For example, fiber-optic cable has a greater channel capacity than twisted-pair cabling. The distance and rate limits in this appendix are the IEEE-recommended maximum speeds and distances for signaling. You can get good results with rates and distances greater than those described here, although you do so at your own risk. You need to be aware of the electrical problems that may arise and compensate for them.

Uplink Port Transceiver Modules

Transceiver modules that plug into the front panel of the supervisor engine or route switch processor provide the uplink ports for the router. Several types of transceiver modules are available: small form-factor pluggable (SFP) modules, X2 modules, XENPAK modules, and Gigabit Interface Converter (GBIC) modules.

Table B-3 lists the orderable part numbers for supported transceiver modules. In addition, the following tables provide information about the modules and their cabling specifications:

- Table B-4 and Table B-5 provide information about 1GE uplink ports.
- Table B-6 and Table B-7 provide information about 10GE uplink ports.
- Table B-8 provides information about 1GE GBIC modules.

Table B-3 Uplink Port Transceiver Modules

Supervisor Engine or RSP	Transceiver Module Part Numbers
RSP720 and RSP720-10GE	**10GE Uplink Ports (RSP720-10GE only):** X2-10GB-SR X2-10GB-LR X2-10GB-ER X2-10GB-LX4 X2-10GB-CX4 X2-10GB-LRM X2 10GB-ZR **1GE Uplink Ports:** GLC-SX-MM GLC-LH-SM GLC-ZX-SM GLC-T GLC-BX-D GLC-BX-U SFP-GE-S SFP-GE-L SFP-GE-T
Supervisor Engine 720	GLC-SX-MM GLC-LH-SM GLC-ZX-SM GLC-T

Table B-3 Uplink Port Transceiver Modules (continued)

Supervisor Engine or RSP	Transceiver Module Part Numbers
SUP 2T	**10GE Uplink Ports:** X2-10GB-SR X2-10GB-LR X2-10GB-ER X2-10GB-LX4 X2-10GB-CX4 X2-10GB-LRM X2 10GB-ZR **1GE Uplink Ports:** GLC-SX-MM GLC-LH-SM GLC-ZX-SM GLC-T GLC-BX-D GLC-BX-U SFP-GE-S SFP-GE-L SFP-GE-T
Supervisor Engine 32	**10GE Uplink Ports (WS-SUP32-10GE-3B only):** XENPAK-10GB-CX4 XENPAK-10GB-SR XENPAK-10GB-LX4 XENPAK-10GB-LR XENPAK-10GB-ER **1GE Uplink Ports (WS-SUP32-GE-3B):** GLC-SX-MM GLC-LH-SM GLC-ZX-SM GLC-T
Supervisor Engine 2	1000BASE-X GBIC modules, which are preinstalled

1GE Uplink Ports and Cabling Specifications

Table B-4 describes the 1GE SFP transceiver modules that are used for Cisco 7600 uplink ports. Table B-5 provides cabling specifications.

Note Use Category 5 Shielded Twisted Pair cable at the port that supports the10/100/1000-Mbps RJ-45 connector for the RSP720-10GE.

Table B-4 1GE SFP Transceiver Modules

Product ID	Description
Copper Modules	
GLC-SX-MM	1000BASE-SX SFP transceiver module for multimode fiber (MMF), 850-nm wavelength, LC connector
GLC-LH-SM	1000BASE-LX/LH SFP transceiver module for MMF and single-mode fiber (SMF), 1300-nm wavelength, LC connector
GLC-ZX-SM	1000BASE-ZX SFP transceiver module for SMF, 1550-nm wavelength, LC connector
GLC-T	1000BASE-T SFP transceiver module for Category 5, 5e, or 6 copper wire; 10/100/1000-Mbps RJ-45 connector
GLC-BX-D	1000BASE-BX10 SFP module for single-strand SMF, 1490-nm TX/1310-nm RX wavelength (downstream use in bidirectional single fiber applications), with Digital Optical Monitoring (DOM), LC connector
GLC-BX-U	1000BASE-BX10 SFP module for single-strand SMF, 1310-nm TX/1490-nm RX wavelength (upstream use in bidirectional single fiber applications), with DOM, LC connector
Fiber Modules	
SFP-GE-S	1000BASE-SX SFP transceiver module for MMF, 850-nm wavelength, extended operating temperature range and DOM support, LC connector
SFP-GE-L	1000BASE-LX/LH SFP transceiver module for MMF and SMF, 1300-nm wavelength, extended operating temperature range and DOM support, LC connector
SFP-GE-T	1000BASE-T SFP transceiver module for Category 5, 5e, or 6 copper wire, extended operating temperature range and DOM support (NEBS 3ESD); 10/100/1000-Mbps RJ-45 connector

Table B-5 lists the cabling specifications for the 1GE uplink ports, which are located on SFP transceiver modules that plug into the front panel.

Table B-5 1GE Cabling Specifications

SFP Module (Product ID)	Wavelength (nm)	Fiber Type (MHz km)	Core Size (micron)	Modal Bandwidth (MHz km)	Maximum Cable Distance
GLC-SX-MM SFP-GE-S	850	MMF [1]	62.5 62.5 50 50	160 200 400 500	722 ft (220 m) 902 ft (275 m) 1640 ft (500 m) 1804 ft (550 m)
GLC-LH-SM SFP-GE-L	1300	MMF [2]	62.5 50 50	500 400 500	1804 ft (550 m) 1804 ft (550 m) 1804 ft (550 m)
		SMF [3]	9/10	—	6.2 mi (10 km)

Table B-5 1GE Cabling Specifications (continued)

SFP Module (Product ID)	Wavelength (nm)	Fiber Type (MHz km)	Core Size (micron)	Modal Bandwidth (MHz km)	Maximum Cable Distance
GLC-ZX-SM	1550	SMF	9/10	—	43.5 mi (70 km)
		SMF [4]	8	—	62.1 mi (100 km)
GLC-T SFP-GE-T	—	Cat 5, 5e, or 6 copper wire	—	—	328 ft (100 m)
GLC-BX-D	1490-nm TX 1310-nm RX	SMF [3]	—	—	6.21 mi (10 km)
GLC-BX-U	1310-nm TX 1490-nm RX	SMF [3]	—	—	6.21 mi (10 km)

1. Multimode fiber (MMF) only.
2. A mode-conditioning patch cord is required when using the GLC-LH-SM module with 62.5-micron diameter MMF for link distances greater than 984 ft (300 m). In addition, we do not recommend using the GLC-LH-SM module and MMF without a patch cord for very short link distances (tens of meters) because it may result in an elevated bit error rate (BER).

   Install the patch cord between the module and the MMF cable on both the transmit and receive ends of the link.
3. ITU-T G.652 SMF as specified by the IEEE 802.3z standard.
4. Dispersion-shifted single-mode fiber-optic cable.

10GE Uplink Ports and Cabling Specifications

Table B-6 describes the X2 and XENPAK transceiver modules used for the 10GE uplink ports on the RSP720-10GE and WS-SUP32-10GE-3B. Table B-7 provides cabling specifications.

Table B-6 10GE X2 and XENPAK Transceiver Modules

Product ID	Description
X2-10GB-SR XENPAK-10GB-SR	10GBASE-SR X2 or XENPAK transceiver module for MMF, 850-nm wavelength, SC duplex connector
X2-10GB-LR XENPAK-10GB-LR	10GBASE-LR X2 or XENPAK transceiver module for SMF, 1310-nm wavelength, SC duplex connector
X2-10GB-ER XENPAK-10GB-ER	10GBASE-ER X2 or XENPAK transceiver module for SMF, 1550-nm wavelength, SC duplex connector
X2-10GB-LX4 XENPAK-10GB-LX4	10GBASE-LX4 X2 or XENPAK transceiver module for MMF, 1310-nm wavelength, SC duplex connector
X2-10GB-CX4 XENPAK-10GB-CX4	10GBASE-CX4 X2 or XENPAK transceiver module for CX4 copper cable, Infiniband 4X connector
X2-10GB-LRM	10GBASE-LRM X2 transceiver module for MMF, dual SC connector
X2-10GB-ZR	Cisco 10GBASE-ZR X2 transceiver module for SMF, dual SC connector

Table B-7 lists the cabling specifications for 10GE uplink ports, which are located on X2 or XENPAK transceiver modules that plug into the RSP720-10GE and WS-SUP32-10GE-3B front panel.

Note The 10GE uplink ports on the RSP720-10GE support X2 transceiver modules only.

Table B-7 10GE Cabling Specifications

X2 Device (Product ID)	Wavelength (nm)	Fiber Type (MHz km)	Core Size (micron)	Modal Bandwidth (MHz km)	Cable Distance [1]
X2-10GB-SR XENPAK-10GB-SR	850	MMF	62.5 62.5 50 50 50	160 200 400 500 2000	85.3 ft (26 m) 108.3 ft (33 m) 216.5 ft (66 m) 269.0 ft (82 m) 984.3 ft (300 m)
X2-10GB-LR XENPAK-10GB-LR	1310	SMF	ITU-T G.652	—	6.2 mi (10 km)
X2-10GB-ER [2] XENPAK-10GB-ER	1550	SMF	ITU-T G.652	—	24.9 mi (40 km) [3]
X2-10GB-LX4 XENPAK-10GB-LX4	1310	MMF	62.5 50 50	500 400 500	984.3 ft (300 m) 787.4 ft (240 m) 984.3 ft (300 m)
X2-10GB-CX4 XENPAK-10GB-CX4	—	CX4 (copper)	—	—	49.2 ft (15 m)
X2-10GB-LRM	1310	MMF	62.5 50.0 50.0	500 400 500	220 m (722 feet) 100 m (328 feet) 220 m (722 feet)
X2-10GB-ZR	1550	SMF	G.652 fiber	—	80 km (49.72 miles)[4]

1. Minimum cabling distance for -LR, -SR, -LX4, and -ER modules is 2 m, according to the IEEE 802.3ae standard.
2. Requires 5 dB 1550 nm fixed loss attenuator for < 20 km. Attenuator is available as a spare. The part number is WS-X6K-5DB-ATT=.
3. Links longer than 30 km are considered engineered links.
4. When shorter distances of SMF are used, an inline optical attenuator (10 dB) must be used to avoid overloading and damaging the receiver.

GBIC Module Cabling Specifications

Table B-8 provides cabling specifications for the 1000BASE-X interfaces on the Gigabit Interface Converter (GBIC) modules installed in the Supervisor Engine 2. All GBIC interfaces have SC connectors, and the minimum cable distance for all GBICs listed (MMF and SMF) is 6.5 feet (2 meters).

Table B-8 Gigabit Ethernet Maximum Transmission Distances

GBIC	Wavelength (nm)	Fiber Type (MHz km)	Core Size[1] (micron)	Modal Bandwidth (MHz km)	Cable Distance[2]
SX[3]	850	MMF	62 62 50 50	160 200 400 500	722 ft (220 m) 902 ft (275 m) 1640 ft (500 m) 1804 ft (550 m)
LX/LH	1300	MMF[4]	62 50 50	500 400 500	1804 ft (550 m) 1804 ft (550 m) 1804 ft (550 m)
		SMF (LX/LH)	9/10	–	6.2 mi (10 km)
ZX[5]	1550	SMF[6]	9/10 8	– –	43.5 mi (70 km)[7] 62.1 mi (100 km)

1. Core size refers to the core diameter. The cladding diameter is usually 25 microns.
2. Cable distances are based on fiber loss.
3. MMF only.
4. Patch cord required.
5. A maximum of 24 1000BASE-ZX GBICs is allowed for each system to comply with FCC Class A regulations.
6. Dispersion-shifted single-mode fiber-optic cable.
7. The minimum link distance for ZX GBICs is 6.2 miles (10 km) with an 8-dB attenuator installed at each end of the link. Without attenuators, the minimum link distance is 24.9 miles (40 km).

Console Port Cabling Specifications and Pinouts

The console port, which is located on the front panel of the supervisor engine or route switch processor, provides access to the Cisco 7600 router. The following sections provide information about the console port cabling specifications and the port's signals and pinouts.

Console Port Cabling Specifications

Table B-9 lists the maximum transmission distances for console port cables. See the "Console Port Signals and Pinouts" section on page B-11 for console port and cable pinout information.

The accessories kit that is shipped with your router contains the necessary cable and adapters to connect a terminal or modem to the front-panel console port.

Table B-9 EIA/TIA-232 Transmission Speed Versus Distance

Rate (bps)	Distance (feet)	Distance (meters)
2400	200	60
4800	100	30
9600	50	15

Table B-9 EIA/TIA-232 Transmission Speed Versus Distance (continued)

Rate (bps)	Distance (feet)	Distance (meters)
19,200	25	7.6
38,400	12	3.7
56,000	8.6	2.6

Console Port Signals and Pinouts

The Cisco 7600 series router is shipped with an accessories kit that contains the cable and adapters you need to connect a console (an ASCII terminal or PC running terminal emulation software) or modem to the console port on the front panel of the supervisor engine or route switch processor. For information about the signals and pinouts for the Supervisor Engine 2 console port in mode 2, see the "Console Port Mode 2 Signaling and Pinouts (Sup2 Only)" section on page B-13.

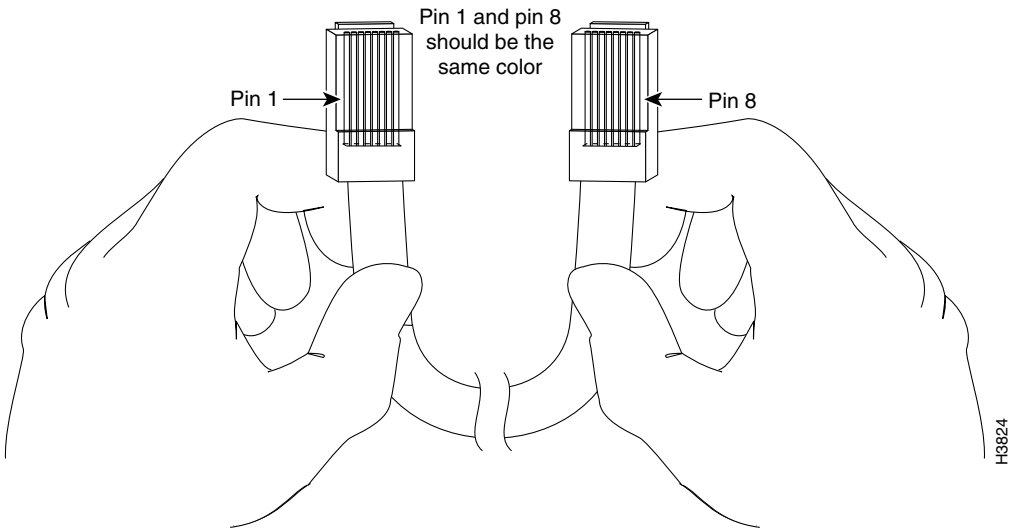
The accessories kit includes these items:

- RJ-45-to-RJ-45 rollover cable
- RJ-45-to-DB-9 female DTE adapter (labeled "Terminal")
- RJ-45-to-DB-25 female DTE adapter (labeled "Terminal")
- RJ-45-to-DB-25 male DCE adapter (labeled "Modem")

Identifying a Rollover Cable

You can identify a rollover cable by comparing the two ends of the cable. Holding the cables 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 wire connected to the pin on the outside of the right plug. (See Figure B-1.) If you purchased your cable from Cisco Systems, pin 1 is white on one connector, and pin 8 is white on the other (a rollover cable reverses pins 1 and 8, 2 and 7, 3 and 6, and 4 and 5).

Figure B-1 Identifying a Rollover Cable



DB-9 Adapter (for Connecting to a PC)

Use the RJ-45-to-RJ-45 rollover cable and RJ-45-to-DB-9 female DTE adapter (labeled "Terminal") to connect the console port to a PC running terminal emulation software. Table B-10 lists the pinouts for the asynchronous serial console port, the RJ-45-to-RJ-45 rollover cable, and the RJ-45-to-DB-9 female DTE adapter.

Table B-10 Console Port DB-9 Adapter Pinouts

Console Port	RJ-45-to-RJ-45 Rollover Cable		RJ-45-to-DB-9 Terminal Adapter	Console Device
Signal	**RJ-45 Pin**	**RJ-45 Pin**	**DB-9 Pin**	**Signal**
RTS	1[1]	8	8	CTS
DTR	2	7	6	DSR
TxD	3	6	2	RxD
GND	4	5	5	GND
GND	5	4	5	GND
RxD	6	3	3	TxD
DSR	7	2	4	DTR
CTS	8[1]	1	7	RTS

1. Pin 1 is connected internally to Pin 8.

DB-25 Adapter (for Connecting to a Terminal)

Use the RJ-45-to-RJ-45 rollover cable and RJ-45-to-DB-25 female DTE adapter (labeled "Terminal") to connect the console port to a terminal. Table B-11 lists the pinouts for the asynchronous serial console port, the RJ-45-to-RJ-45 rollover cable, and the RJ-45-to-DB-25 female DTE adapter.

Table B-11 Console Port DB-25 Adapter Pinouts

Console Port	RJ-45-to-RJ-45 Rollover Cable		RJ-45-to-DB-25 Terminal Adapter	Console Device
Signal	**RJ-45 Pin**	**RJ-45 Pin**	**DB-25 Pin**	**Signal**
RTS	1[1]	8	5	CTS
DTR	2	7	6	DSR
TxD	3	6	3	RxD
GND	4	5	7	GND
GND	5	4	7	GND
RxD	6	3	2	TxD
DSR	7	2	20	DTR
CTS	8[1]	1	4	RTS

1. Pin 1 is connected internally to Pin 8.

Modem Adapter

Use the RJ-45-to-RJ-45 rollover cable and RJ-45-to-DB-25 male DCE adapter (labeled "Modem") to connect the console port to a modem. Table B-12 lists the pinouts for the asynchronous serial console port, the RJ-45-to-RJ-45 rollover cable, and the RJ-45-to-DB-25 male DCE adapter.

Table B-12 Console Port Modem Adapter Pinouts

Console Port	RJ-45-to-RJ-45 Rollover Cable		RJ-45-to-DB-25 Modem Adapter	Modem
Signal	**RJ-45 Pin**	**RJ-45 Pin**	**DB-25 Pin**	**Signal**
RTS	1[1]	8	4	RTS
DTR	2	7	20	DTR
TxD	3	6	3	TxD
GND	4	5	7	GND
GND	5	4	7	GND
RxD	6	3	2	RxD
DSR	7	2	8	DCD
CTS	8[1]	1	5	CTS

1. Pin 1 is connected internally to Pin 8.

Console Port Mode 2 Signaling and Pinouts (Sup2 Only)

Table B-13 lists the pinouts for the Supervisor Engine 2 console port mode switch in mode 2 (switch in the *out* position). In this mode, you can connect a terminal to the supervisor engine using a Catalyst 5000 family Supervisor Engine III console cable and adapter (not provided). For instructions, see "Supervisor Engine 2" in the "Connecting a Terminal" section on page 3-9.

Table B-13 Console Port Pinouts (Supervisor Engine 2, Port Mode Switch Out)

Console Port	Console Device
Pin (Signal Name)	**Input/Output**
1 (RTS)[1]	Output
2 (DTR)	Output
3 (RxD)	Input
4 (GND)	GND
5 (GND)	GND
6 (TxD)	Output
7 (DSR)	Input
8 (CTS)[1]	Input

1. Pin 1 is connected internally to Pin 8.

RJ-45 Connector

The RJ-45 connector is used to connect a Category 3, Category 5, Category 5e, or Category 6 FTP from the external network to the module interface connector. (See Figure B-2.) Table B-14 lists the connector pinouts and signal names for a 10/100BASE-T crossover (MDI-X) cable. Figure B-3 shows a schematic of the 10/100BASE-T crossover cable. Table B-15 lists the connector pinouts and signal names for a 1000BASE-T crossover (MDI-X) cable. Figure B-4 shows a schematic of the 1000BASE-T crossover cable.

Caution Category 5e and Category 6 cables can store high levels of static electricity because of the dielectric properties of the materials used in their construction. Always ground the cables (especially in new cable runs) to a suitable and safe earth ground before connecting them to the module.

Caution To comply with Telcordia GR-1089 intrabuilding, lightning-immunity requirements, you must use foil-twisted pair (FTP) cable that is properly grounded at both ends.

Inline power for IP phones uses connector pins 1, 2, 3, and 6 in a Category 5, Category 5e, or Category 6 cable to transmit power (6.3 W) from the router. This method of supplying power is sometimes called *phantom power* because the IP phone power travels over the same pairs of wires used to transmit the Ethernet signals. The IP phone voltage is completely transparent to the Ethernet signals and does not interfere with their operation.

Figure B-2 RJ-45 Interface Cable Connector

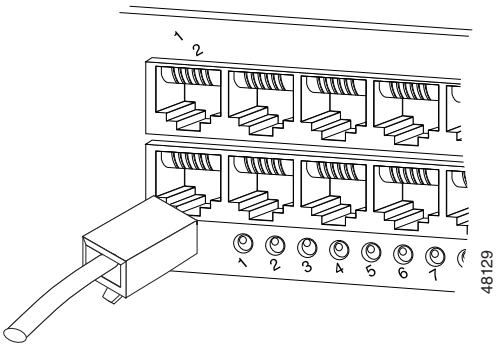


Table B-14 10/100BASE-T Crossover Cable Pinout (MDI-X)

Side 1 Pin (Signal)	Side 2 Pin (Signal)
1 (RD+)	3 (TD+)
2 (RD–)	6 (TD–)
3 (TD+)	1 (RD+)
6 (TD–)	2 (RD–)
4 (Not used)	4 (Not used)
5 (Not used)	5 (Not used)

Table B-14 10/100BASE-T Crossover Cable Pinout (MDI-X)

Side 1 Pin (Signal)	Side 2 Pin (Signal)
7 (Not used)	7 (Not used)
8 (Not used)	8 (Not used)

Figure B-3 Twisted-Pair Crossover 10/100BASE-T Cable Schematic

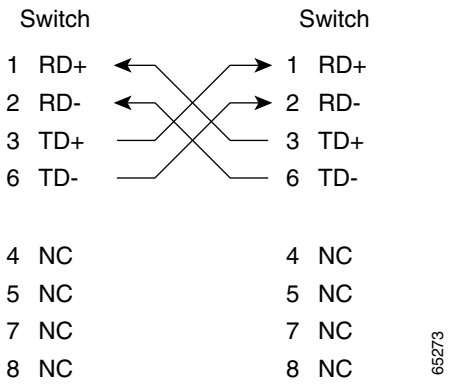
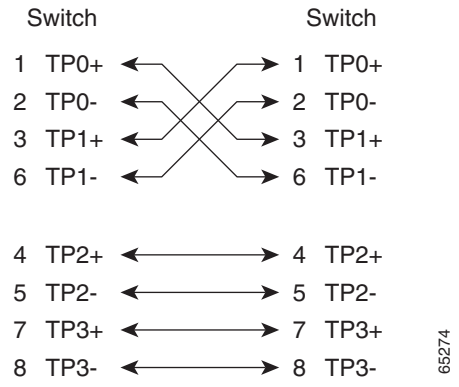


Table B-15 1000BASE-T Crossover Cable Pinout (MDI-X)

Side 1 Pin (Signal)	Side 2 Pin (Signal)
1 (TP0+)	3 (TP1+)
2 (TP0–)	6 (TP1–)
3 (TP1+)	1 (TP0+)
6 (TP1–)	2 (TP0–)
4 (TP2+)	7 (TP3+)
5 (TP2–)	8 (TP3–)
7 (TP3+)	4 (TP2+)
8 (TP3–)	5 (TP2–)

Figure B-4 Twisted-Pair Crossover 1000BASE-T Cable Schematic



Fiber-Optic Connectors

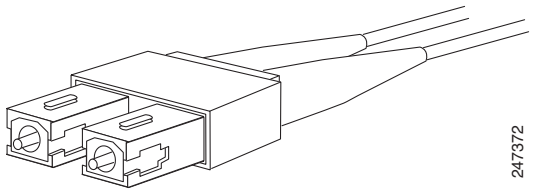
This section describes the SC, MT-RJ, and LC fiber-optic connectors and provides instructions for cleaning the fiber-optics connectors. It contains the following sections:

SC Connectors

Warning **Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

The SC single-mode fiber connector is used to connect fiber-optic module ports with the external network. (See Figure B-5.)

Figure B-5 SC Optical Connector



Always make sure that you insert the connector completely into the socket. This action is especially important when you are making a connection between a module and a long distance (1.24 miles [2 kilometers]) or a suspected highly attenuated network. If the LINK LED on the supervisor engine or route switch processor does not light, try removing the network cable plug and reinserting it firmly into the module socket. It is possible that enough dirt or skin oils have accumulated on the plug faceplate (around the optical-fiber openings) to generate significant attenuation, reducing the optical power levels below threshold levels so that a link cannot be made.

Caution Use extreme care when removing or installing connectors so that you do not damage the connector housing or scratch the end-face surface of the fiber. Always install protective covers on unused or disconnected components to prevent contamination. Always clean fiber connectors before installing them.

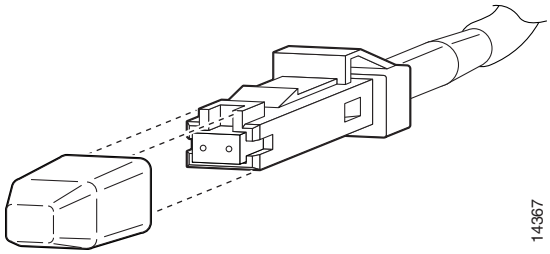
For fiber-optic connector cleaning instructions, see the "Cleaning the Fiber-Optic Connectors" section on page B-18.

MT-RJ Connectors

Warning **Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

The MT-RJ style connector is used on fiber-optic modules to increase port density. (See Figure B-6.)

Figure B-6 MT-RJ Optical Connector



When you are connecting MT-RJ cables to a module, make sure you firmly press the connector plug into the socket. The upper edge of the plug must snap into the upper front edge of the socket. You may or may not hear an audible click. Gently pull on the plug to confirm whether or not the plug is locked into the socket. To disconnect the plug from the socket, press down on the raised portion on top of the plug (releasing the latch). You should hear an audible click indicating that the latch has released. Carefully pull the plug out of the socket.

Make sure that you insert the connector completely into the socket. This action is especially important when you are making a connection between a module and a long distance (1.24 miles [2 kilometers]) or a suspected highly attenuated network. If the LINK LED on the supervisor engine or route switch processor does not light, try removing the network cable plug and reinserting it firmly into the module socket. It is possible that enough dirt or skin oils have accumulated on the plug faceplate (around the optical-fiber openings) to generate significant attenuation, reducing the optical power levels below threshold levels so that a link cannot be made.

Caution Use extreme care when removing or installing connectors so that you do not damage the connector housing or scratch the end-face surface of the fiber. Always install protective covers on unused or disconnected components to prevent contamination. Always clean fiber connectors before installing them.

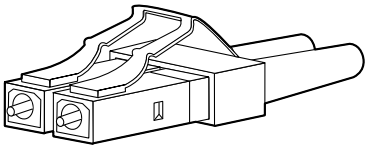
For fiber-optic connector cleaning instructions, see the "Cleaning the Fiber-Optic Connectors" section on page B-18.

When you disconnect the fiber-optic cable from the module, grip the body of the connector. Do not grip the connector jacket-sleeve. Gripping the sleeve can, over time, compromise the integrity of the fiber-optic cable termination in the MT-RJ connector.

LC Connectors

The small form-factor pluggable (SFP) tranceiver modules used on the Supervisor Engine 720, Route Switch Processor 720, and RSP720-10GE uplink ports use either MT-RJ connectors or LC connectors depending on the SFP module vendor. Figure B-7 shows an LC connector.

Figure B-7 LC Fiber-Optic Connector



Caution Use extreme care when removing or installing connectors so that you do not damage the connector housing or scratch the end-face surface of the fiber. Always install protective covers on unused or disconnected components to prevent contamination. Always clean fiber connectors before installing them.

For fiber-optic connector cleaning instructions, see the "Cleaning the Fiber-Optic Connectors" section on page B-18.

When you disconnect the fiber-optic cable from the module, grip the body of the connector. Do not grip the connector jacket-sleeve. Gripping the sleeve can, over time, compromise the integrity of the fiber-optic cable termination in the LC connector.

Cleaning the Fiber-Optic Connectors

Fiber-optic connectors are used to connect two fibers together. When these connectors are used in a communications system, proper connection is critical.

Fiber-optic connectors differ from electrical connectors or microwave connectors. In a fiber-optic system, light is transmitted through an extremely small fiber core. Because fiber cores are often 62.5 microns or less in diameter in multimode fiber (MMF) and 8.3 to 10 microns in single-mode fiber (SMF), dust particles and any contamination on the face of the fiber core can degrade the performance of the connector interface where the two cores meet. The connector must be precisely aligned, and the connector interface must be absolutely free of trapped contaminants.

Caution Use extreme care when removing or installing connectors so that you do not damage the connector housing or scratch the end-face surface of the fiber. Always install protective covers on unused or disconnected components to prevent contamination. Always clean fiber connectors before installing them.

To clean the fiber-optic connectors, use a CLETOP cassette cleaner (type A for SC connectors or type B for MT-RJ connectors) and follow the product instructions. If a CLETOP cassette cleaner is not available, follow these steps:

Step 1 Gently wipe the ferrules and end-face surfaces of the connector with an alcohol pad. Be sure that the pad makes full contact with the end-face surfaces. Wait five seconds for the surfaces to dry and repeat.

Step 2 Blow dry the connectors with canned, dry, oil-free, compressed air.

Step 3 Use a magnifying glass or inspection microscope to inspect the ferrule. If contaminants are visible, repeat the cleaning procedure.

The connectors used inside the system have been cleaned by the manufacturer and connected to the adapters in the proper manner. The operation of the system should be error-free if the customer provides clean connectors on the application side, follows the previous directions, and follows the listed guidelines:

- Clean the connectors using lens tissues before connecting to the adapters. Use pure alcohol to remove contamination.
- Do not clean the inside of the connector adapters.
- Do not use force or quick movements when connecting the fiber-optic connectors in the adapters.
- Cover the connector adapters to avoid contaminating the inside of the adapters while cleaning the chassis.
- Cover the connectors and adapters to prevent the inside of the adapters or the surface of the connectors from getting dirty when not using the connectors.

Note If the surface of the fiber-optic connector is not clean or does not have an even shine, repeat the process using a fresh surface of the alcohol pad.

LX/LH GBIC and MMF Cable Considerations

The following sections describe the things you should consider if you are using a Supervisor Engine 2 with a long wavelength/long haul (LX/LH) GBIC with 62.5-micron diameter MMF cable.

Patch Cord

When using the long wavelength/long haul (LX/LH) GBIC with 62.5-micron diameter MMF on links that span more than 984 feet (300 meters), a mode-conditioning patch cord is required. You must install the patch cord (Cisco product number CAB-GELX-625 or equivalent) between the GBIC and the MMF cable on both the transmit and receive ends of the link.

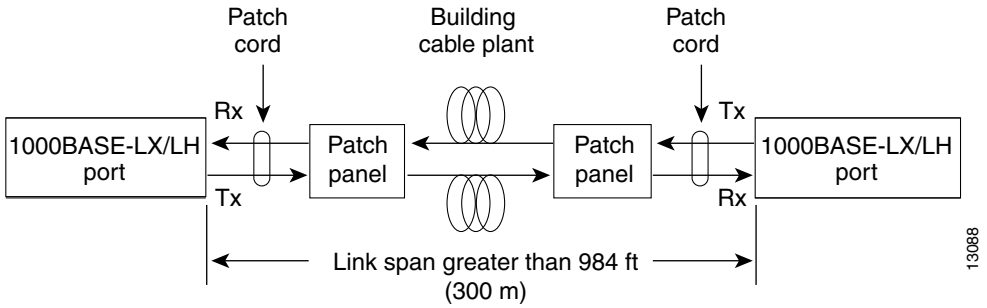
Note We also recommend using a patch cord between the LX/LH GBIC and MMF cable for very short link distances (10 to 100 meters). Without a patch cord, the link can have an elevated bit error rate (BER).

Note The 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 due to a problem in the center of some fiber-optic cable cores. The solution is to launch light from the laser at a precise offset from the center by using the mode-conditioning patch cord. At the output end of the patch cord, the LX/LH GBIC complies with the IEEE 802.3z standard for 1000BASE-LX.

Patch Cord Configuration Example

Figure B-8 shows a typical patch cord configuration.

Figure B-8 Patch Cord Configuration

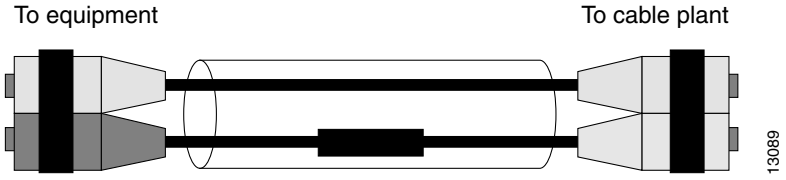


Patch Cord Installation

Warning **Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

Plug the end of the patch cord labeled “To Equipment” into the GBIC (see Figure B-9). Plug the end labeled “To Cable Plant” into the patch panel. The patch cord is 9.84 feet (3 meters) long and has duplex SC male connectors at each end.

Figure B-9 Patch Cord Installation



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