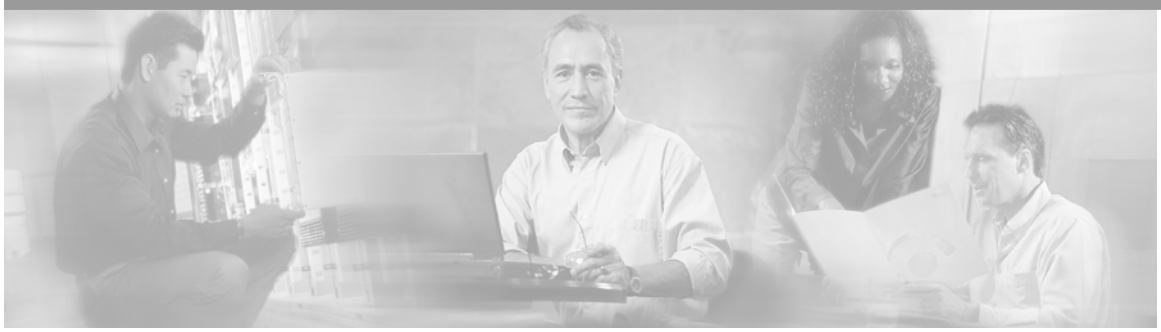

Cisco 7609 Internet Router Installation Guide

September 2004

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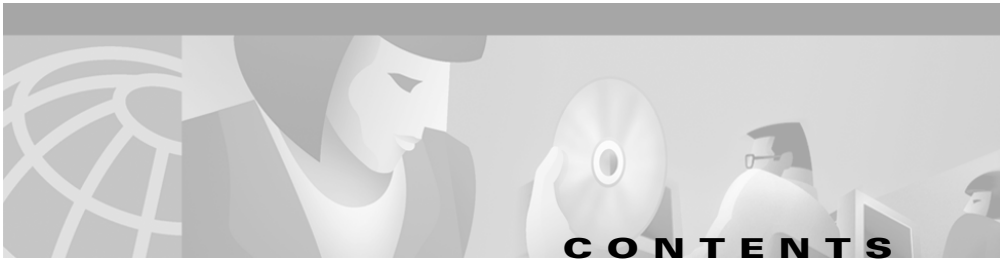
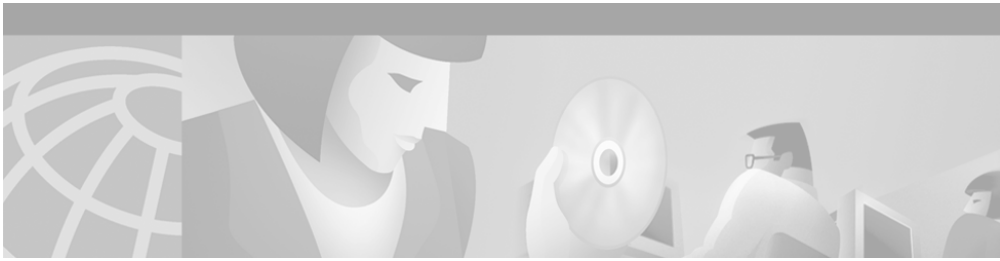
Cisco 7609 Internet Router Installation Guide



CONTENTS



Preface

Note This document describes the Cisco 7609 Internet Router (OSR-7609) and not the Cisco 7609 Internet Router (CISCO7609).

This preface describes who should read the *Cisco 7609 Internet Router Installation Guide*, how it is organized, and its document conventions.

Audience

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

Organization

This publication is organized as follows:

Chapter	Title	Description
Chapter 1	Product Overview	Describes and lists the hardware features and functionality of the Cisco 7609 Internet Router.
Chapter 2	Preparing for Installation	Describes how to prepare your site for the installation of the Cisco 7609 Internet Router.
Chapter 3	Installing the Cisco 7609 Internet Router	Describes how to install your Cisco 7609 Internet Router
Chapter 4	Troubleshooting	Provides troubleshooting guidelines for the initial hardware installation and suggests steps to help isolate and resolve problems
Chapter 5	Removal and Replacement Procedures	Provides procedures for removing and installing chassis components
Appendix A	Technical Specifications	Lists the Cisco 7609 Internet Router system specifications
Appendix B	Connector and Cable Specifications	Describes the connectors and cables used with the Cisco 7609 Internet Router
Appendix C	Repacking the Cisco 7609 Internet Router	Provides procedures to repack your Cisco 7609 Internet Router if you have to return it to the factory

Conventions

Notes use the following conventions:

Note Means *reader take note*. Notes contain helpful suggestions or references to material not covered in the publication.

Tips use the following conventions:

Tip Means *the following information will help you solve a problem*. The tips information might not be troubleshooting or even an action, but could be useful information, similar to a Timesaver.

Cautions use the following conventions:

Caution Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

Warnings use the following conventions:

Warning **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. To see translations of the warnings that appear in this publication, refer to the *Regulatory Compliance and Safety Information* document that accompanied this device.**

Waarschuwing **Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van standaard maatregelen om ongelukken te voorkomen. Voor vertalingen van de waarschuwingen die in deze publicatie verschijnen, kunt u het document *Regulatory Compliance and Safety Information* (Informatie over naleving van veiligheids- en andere voorschriften) raadplegen dat bij dit toestel is ingesloten.**

Varoitus **Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista. Tässä julkaisussa esiintyvien varoitusten käännökset löydät laitteen mukana olevasta *Regulatory Compliance and Safety Information* -kirjasesta (määräysten noudattaminen ja tietoa turvallisuudesta).**

Attention **Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions d'avertissements figurant dans cette publication, consultez le document *Regulatory Compliance and Safety Information* (Conformité aux règlements et consignes de sécurité) qui accompagne cet appareil.**

Warnung **Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewußt. Übersetzungen der in dieser Veröffentlichung enthaltenen Warnhinweise finden Sie im Dokument *Regulatory Compliance and Safety Information* (Informationen zu behördlichen Vorschriften und Sicherheit), das zusammen mit diesem Gerät geliefert wurde.**

Avvertenza **Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di lavorare su qualsiasi apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed essere al corrente delle pratiche standard per la prevenzione di incidenti. La traduzione delle avvertenze riportate in questa pubblicazione si trova nel documento *Regulatory Compliance and Safety Information* (Conformità alle norme e informazioni sulla sicurezza) che accompagna questo dispositivo.**

Advarsel **Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du vare oppmerksom på de faremomentene som elektriske kretser innebærer, samt gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker. Hvis du vil se oversettelser av de advarslene som finnes i denne publikasjonen, kan du se i dokumentet *Regulatory Compliance and Safety Information* (Overholdelse av forskrifter og sikkerhetsinformasjon) som ble levert med denne enheten.**

Aviso **Este símbolo de aviso indica perigo. Encontra-se numa situação que lhe poderá causar danos físicos. Antes de começar a trabalhar com qualquer equipamento, familiarize-se com os perigos relacionados com circuitos eléctricos, e com quaisquer práticas comuns que possam prevenir possíveis acidentes. Para ver as traduções dos avisos que constam desta publicação, consulte o documento *Regulatory Compliance and Safety Information* (Informação de Segurança e Disposições Reguladoras) que acompanha este dispositivo.**

¡Advertencia! **Este símbolo de aviso significa peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considerar los riesgos que entraña la corriente eléctrica y familiarizarse con los procedimientos estándar de prevención de accidentes. Para ver una traducción de las advertencias que aparecen en esta publicación, consultar el documento titulado *Regulatory Compliance and Safety Information* (Información sobre seguridad y conformidad con las disposiciones reglamentarias) que se acompaña con este dispositivo.**

Varning! **Denna varningssymbol signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanligt förfarande för att förebygga skador. Se förklaringar av de varningar som förkommer i denna publikation i dokumentet *Regulatory Compliance and Safety Information* (Efterrättelse av föreskrifter och säkerhetsinformation), vilket medföljer denna anordning.**

Related Documentation

For additional Cisco 7600 series Internet Router information, refer to these publications:

- *Regulatory Compliance and Safety Information for Cisco 7600 Series Internet Routers*
- *Cisco 7600 Series Internet Router Installation Guide*
- *Cisco 7600 Series Internet Router Module Installation Guide*
- *Cisco 7600 Series Internet Router Quick Software Configuration Guide*
- *Cisco 7600 Series Internet Router Software Configuration Guide*
- *Cisco 7600 Series Internet Router Command Reference*
- *Cisco 7600 Series Internet Router System Message Guide*
- *Cisco 7600 Series Internet Router IOS Software Configuration Guide*
- *Cisco 7600 Series Internet Router IOS Command Reference*
- *Cisco 7600 Series Internet Router IOS System Message Guide*
- For information about MIBs, refer to http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

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The following sections provide sources for obtaining documentation from Cisco Systems.

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You can access the most current Cisco documentation on the World Wide Web at the following sites:

- http://www.cisco.com
- http://www-china.cisco.com
- http://www-europe.cisco.com

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The Cisco TAC is available to all customers who need technical assistance with a Cisco product, technology, or solution. Two types of support are available through the Cisco TAC: the Cisco TAC Web Site and the Cisco TAC Escalation Center.

Inquiries to Cisco TAC are categorized according to the urgency of the issue:

- Priority level 4 (P4)—You need information or assistance concerning Cisco product capabilities, product installation, or basic product configuration.
- Priority level 3 (P3)—Your network performance is degraded. Network functionality is noticeably impaired, but most business operations continue.
- Priority level 2 (P2)—Your production network is severely degraded, affecting significant aspects of business operations. No workaround is available.
- Priority level 1 (P1)—Your production network is down, and a critical impact to business operations will occur if service is not restored quickly. No workaround is available.

Which Cisco TAC resource you choose is based on the priority of the problem and the conditions of service contracts, when applicable.

Cisco TAC Web Site

The Cisco TAC Web Site allows you to resolve P3 and P4 issues yourself, saving both cost and time. The site provides around-the-clock access to online tools, knowledge bases, and software. To access the Cisco TAC Web Site, go to the following URL:

http://www.cisco.com/tac

All customers, partners, and resellers who have a valid Cisco services contract have complete access to the technical support resources on the Cisco TAC Web Site. The Cisco TAC Web Site requires a Cisco.com login ID and password. If you have a valid service contract but do not have a login ID or password, go to the following URL to register:

http://www.cisco.com/register/

If you cannot resolve your technical issues by using the Cisco TAC Web Site, and you are a Cisco.com registered user, you can open a case online by using the TAC Case Open tool at the following URL:

http://www.cisco.com/tac/caseopen

If you have Internet access, it is recommended that you open P3 and P4 cases through the Cisco TAC Web Site.

Cisco TAC Escalation Center

The Cisco TAC Escalation Center addresses issues that are classified as priority level 1 or priority level 2; these classifications are assigned when severe network degradation significantly impacts business operations. When you contact the TAC Escalation Center with a P1 or P2 problem, a Cisco TAC engineer will automatically open a case.

To obtain a directory of toll-free Cisco TAC telephone numbers for your country, go to the following URL:

http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml

Before calling, please check with your network operations center to determine the level of Cisco support services to which your company is entitled; for example, SMARTnet, SMARTnet Onsite, or Network Supported Accounts (NSA). In addition, please have available your service agreement number and your product serial number.

Product Overview

Note This document describes the Cisco 7609 Internet Router (OSR-7609) and not the Cisco 7609 Internet Router (CISCO7609).

This chapter describes the Cisco 7609 Internet Router (OSR-7609) and contains these sections:

The Cisco 7609 Internet Router delivers optical WAN and MAN networking with a focus on line-rate delivery of high-touch IP services at the edge of service providers networks. Service providers can “service enable” their networks at optical speeds, enabling them to differentiate their service offerings for competitive advantage.

The Cisco 7609 Internet Router supports the following features:

- 30 Mpps forwarding processor and up to 512 MB DRAM for Internet routing
- Up to two distributed Parallel Express Forwarding (PXF) IP services processors on each Optical Services Module (OSM) for flexible IP service implementation
- High-touch, line-rate IP services at 6 Mpps per slot:
  - QoS
  - Hierarchical Traffic Shaping

  - Destination Sensitive Services (accounting, billing, and QoS)
- The ability to monitor service levels delivered to customers under service level agreements (SLAs)
- Wide range of WAN and MAN interfaces providing DS0 through OC-48 (using the FlexWAN module)
- Compatibility with the Catalyst 6000 family LAN interfaces offering 10 Mbps Ethernet to 1 Gbps

Warning # 1017

Warning **This unit is intended for installation in restricted access areas. A restricted access area can be accessed only through the use of a special tool, lock and key, or other means of security. Statement 1017**

Waarschuwing **Deze eenheid is bestemd voor installatie in plaatsen met beperkte toegang. Toegang tot een dergelijke plaats kan alleen verkregen worden door middel van een speciaal instrument, een slot en sleutel of een ander veiligheidsmiddel.**

Varoitus **Tämä laite on tarkoitettu asennettavaksi paikkaan, johon pääsy on rajoitettua. Tällaiseen paikkaan pääsee vain erikoistyökalua, lukkoon sopivaa avainta tai jotakin muuta turvalaitetta käyttämällä.**

Attention **Cet appareil est à installer dans des zones d'accès réservé. L'accès à une zone d'accès réservé n'est possible qu'en utilisant un outil spécial, un mécanisme de verrouillage et une clé, ou tout autre moyen de sécurité.**

Warnung **Diese Einheit ist zur Installation in Bereichen mit beschränktem Zutritt vorgesehen. Der Zutritt zu derartigen Bereichen ist nur mit einem Spezialwerkzeug, Schloss und Schlüssel oder einer sonstigen Sicherheitsvorkehrung möglich.**

Avvertenza **Questa unità è prevista per essere installata in un'area ad accesso limitato, vale a dire un'area accessibile solo mediante l'uso di un attrezzo speciale, come lucchetto e chiave, o altri dispositivi di sicurezza.**

Advarsel **Denne enheten er beregnet på installasjon i områder med begrenset tilgang. Et begrenset tilgangsområde kan bare nås ved hjelp av et spesielt verktøy, lås og nøkkel, eller andre sikkerhetsanordninger.**

Aviso **Esta unidade foi concebida para instalação em áreas de acesso restrito. Uma área de acesso restrito é uma área à qual apenas tem acesso o pessoal de serviço a utorizado, que possua uma ferramenta, chave e fechadura especial, ou qualquer outra forma de segurança.**

¡Advertencia! **Esta unidad ha sido diseñada para instalación en áreas de acceso restringido. Sólo puede obtenerse acceso a una de estas áreas mediante la utilización de una herramienta especial, cerradura con llave u otro medio de seguridad.**

Varning! **Denna enhet är avsedd för installation i områden med begränsat tillträde. Ett område med begränsat tillträde kan endast tillträdas med hjälp av specialverktyg, lås och nyckel eller annan säkerhetsanordning.**

Figyelem **A készülék korlátozottan hozzáférhető területre történő beszerelésre készült. A korlátozottan hozzáférhető területekhez csak speciális szerszám, zár és kulcs vagy más biztonsági berendezés segítségével lehet hozzáférni.**

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警告 安装在限制进出的场所。限制进出的场所指只能通过使用特殊工具、锁和钥匙或其它安全手段进出的场所。

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Cisco 7609 Internet Router

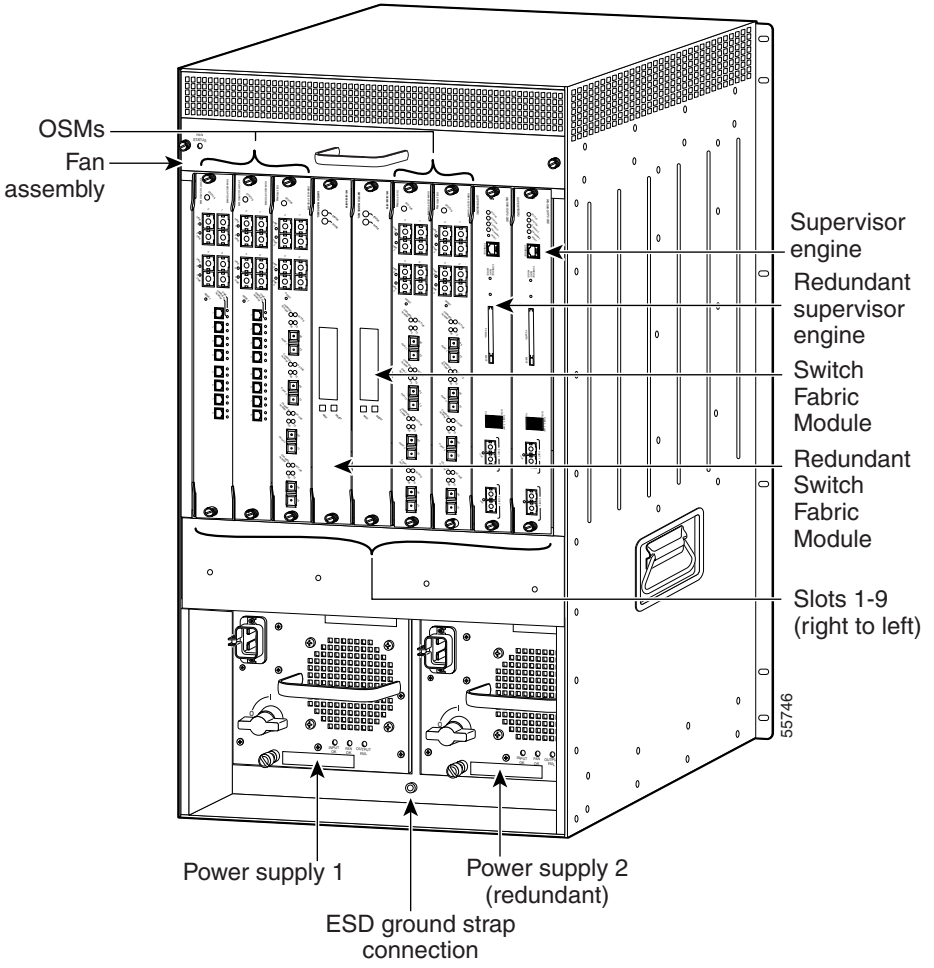
The Cisco 7609 Internet Router chassis has nine vertical slots that are numbered from right to left. (See Figure 1-1.)

Slot 1 is reserved for the supervisor engine, which provides switching, local and remote management, and multiple gigabit uplink interfaces.

Slot 2 can contain an additional redundant supervisor engine, which can act as a backup if the first supervisor engine fails. If a redundant supervisor engine is not required, slot 2 is available for an OSM or other supported Catalyst 6000 family modules.

For a detailed description of supervisor engine operation in a redundant configuration, refer to the *Cisco 7600 Series Internet Router Software Configuration Guide*.

Figure 1-1 Cisco 7609 Internet Router



The Cisco 7609 Internet Router supports the following:

- A Supervisor Engine 2 with MSFC2 and a PFC2, and an optional redundant Supervisor Engine 2 with MSFC2 and a PFC2. Each supervisor engine has two Gigabit interface uplinks.

Note The uplink ports are fully functional on the redundant supervisor engine in standby mode.

Note Both supervisor engines in a single chassis must be completely identical.

- Backplane bandwidth scalable up to 256 Gbps when using the Switch Fabric Module (WS-C6500-SFM)
- Up to eight additional OSMs or Catalyst 6000 family modules
- Hot-swappable fan assembly and modules
- Redundant AC-input or DC-input power supplies

System Features

This section describes the hardware features for the Cisco 7609 Internet Router. For software descriptions, refer to the *Cisco 7600 Series Internet Router Software Configuration Guide*. For module descriptions and installation procedures, refer to the *Cisco 7600 Series Internet Router Module Installation Guide*.

Bandwidth and Port Density

Table 1-1 lists the bandwidth and port densities of the Cisco 7609 Internet Router.

Table 1-1 Cisco 7609 Internet Router Bandwidth and Port Density

Architecture	Cisco 7609 Internet Router
Backplane Bandwidth	32 to 256 Gbps
Number of Gigabit Ethernet ports	130
Number of OC-3 POS ports	128
Number of OC-12 POS ports	32
Number of OC-12 ATM ports	4
Number of OC-48 POS ports	8
Number of channelized OC-12 ports	64
Number of channelized OC-48 ports	16
Number of FlexWAN modules	8

Redundancy

The Cisco 7609 Internet Router has these redundancy features:

- Ability to house two hot-swappable supervisor engines
- Ability to house two fully redundant, AC-input or DC-input, load-sharing power supplies

Note In certain configurations, the power supplies are not fully redundant.

- A hot-swappable fan assembly containing multiple fans
- Redundant backplane-mounted clock modules
- Redundant backplane-mounted voltage termination (VTT) modules

Component Hot Swapping

You can hot swap all modules (including the supervisor engine if you have a redundant supervisor engine) and fans. You can add, replace, or remove modules without interrupting the system power or causing other software or interfaces to shut down.

Note Although the FlexWAN module supports hot swapping, individual port adapters do not. To replace port adapters, you must first remove the FlexWAN module from the chassis and then install or replace port adapters as required.

Cisco 7600 Internet Router Components

This section describes the major hardware components for the Cisco 7609 Internet Router.

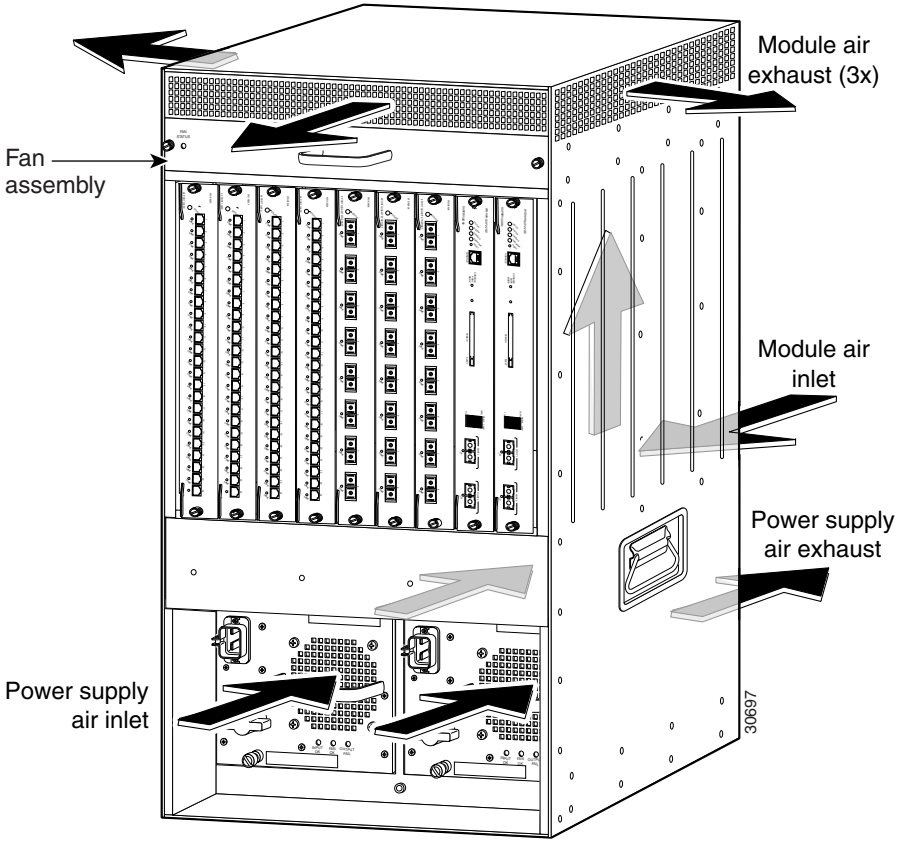
Fan Assembly

The system fan assembly provides cooling air for the supervisor engine and the switching modules. The fan assembly is located in the chassis. Figure 1-2 shows the direction of airflow into and out of the Cisco 7609 Internet Router. Sensors on the supervisor engine monitor the internal air temperatures. If the air temperature exceeds a preset threshold, the environmental monitor displays warning messages.

If an individual fan within the assembly fails, the FAN STATUS LED turns red. To replace a fan assembly, see the "Removing and Replacing the Fan Assembly" section on page 5-12.

Note Refer to the *Cisco 7600 Series Internet Router Software Configuration Guide* for information on environmental monitoring.

Figure 1-2 Cisco 7609 Internet Router Internal Airflow



Power Supplies

The Cisco 7609 Internet Router power supplies are available in two power ratings:

- 2500W—AC and DC input (WS-CAC-2500W and WS-CDC-2500W)
- 4000W—AC input only (WS-CAC-4000W-US1 or WS-CAC-4000W-INT)

All power supplies have the same form factor.

The Cisco 7609 Internet Router supports redundant AC-input and DC-input power supplies.

Each power supply has an individual power switch.

The AC-input power supply (see Figure 1-3) has a detachable power cord (except for the WS-CAC-4000W) that allows you to connect each power supply to the site power source. You can connect the DC-input power supply (see Figure 1-4) to the power source with heavy gauge wiring connected to a terminal block.

Note The power cord is not shown in Figure 1-3.

Both AC-input and DC-input power supplies support redundancy. When power is removed from one supply, the redundant power feature causes the second supply to produce full power.

Note If you run the 2500W power supply at the low range input (100 to 120VAC), it is not redundant in a fully populated Cisco 7609 Internet Router.

For complete power specifications, see Appendix A, "Technical Specifications."

Figure 1-3 AC-Input Power Supply

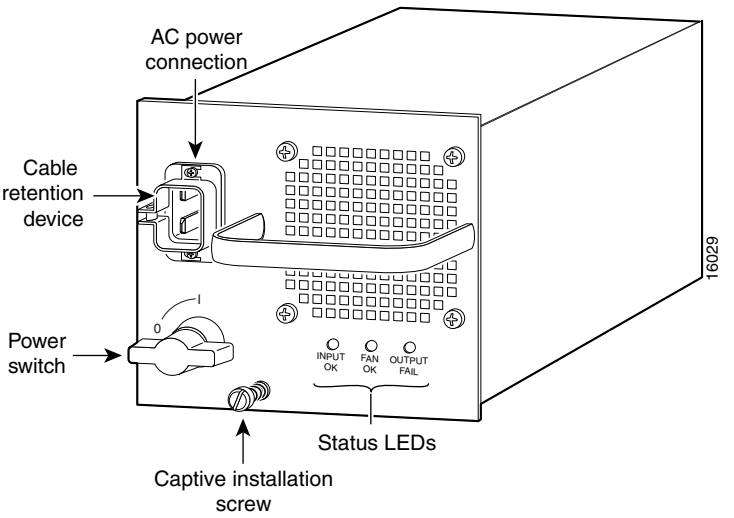
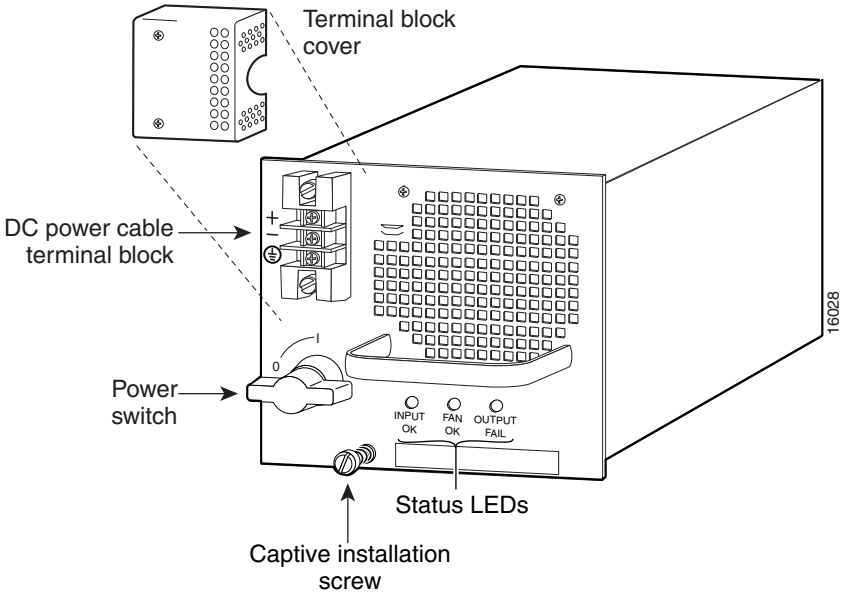


Figure 1-4 DC-Input Power Supply



Load Sharing

When you install and turn on two power supplies, each power supply concurrently provides approximately half of the required power to the system. If one power supply fails, the second power supply immediately assumes full power to maintain uninterrupted system operation. Installing the second power supply enables load sharing and fault tolerance automatically; no software configuration is required.

Note For proper load-sharing operation in a redundant power supply configuration, you must install two modules in the chassis. If you fail to install two modules, you might receive spurious OUTPUT FAIL indications on the power supply.

For information about the power management feature and individual module power consumption, refer to the *Cisco 7600 Series Internet Router Software Configuration Guide*.

Environmental Monitoring of the Power Supply

The environmental monitoring and reporting functions allow you to maintain normal system operation by resolving adverse environmental conditions prior to loss of operation.

The power supplies monitor their own internal temperature and voltages. In the event of excessive internal temperature, the power supply will shut down to prevent damage. When the power supply returns to a safe operating temperature, it will restart. In the event of an abnormal voltage on one or more outputs of the power supplies, the OUTPUT FAIL LED will light. Substantial overvoltage conditions can lead to a power supply shutdown.

The power supply front panel LEDs are described in Table 1-2.

For more information about the environmental monitoring feature, refer to the *Cisco 7600 Series Internet Router Software Configuration Guide*.

Table 1-2 Power Supply Front Panel LEDs

LED	Description
INPUT OK	AC-input power supplies: • Green when the input voltage is OK (85 VAC or greater) • Off when the input voltage falls below 70 VAC or if the power supply shuts down DC-input power supplies: • Green when the input voltage is OK (–40.5 VDC or greater) • Off when the input voltage falls below –33 VDC or if the power supply shuts down
FAN OK	Green when the power supply fan is operating properly
OUTPUT FAIL	Red when there is a problem with one or more of the DC-output voltages of the power supply

Power Supply Fan Assembly

The power supplies have a built-in fan; air enters the front of the fan (power-input end) and exits through the back. An air dam keeps the airflow separate from the rest of the chassis, which is cooled by the system fan assembly.

To replace a power supply, see the "Removing and Replacing the Power Supply" section on page 5-2.

CHAPTER 2

Preparing for Installation

Note This document describes the Cisco 7609 Internet Router (OSR-7609) and not the Cisco 7609 Internet Router (CISCO7609).

This chapter describes how to prepare your site for Cisco 7609 Internet Router (OSR-7609) installation and contains these sections:

For detailed information about module cabling requirements, see Appendix B, "Connector and Cable Specifications."

Safety

Warning **Before you install, operate, or service the system, read the *Site Preparation and Safety Guide*. This guide contains important safety information you should know before working with the system.**

Site Requirements

This section provides site power requirements for the Cisco 7609 Internet Router. You should verify the site power *prior* to installing the switch. Power requirements vary for each switch; ensure that you verify the site power for the type of switch you are installing.

For EMI recommendations, refer to the *Site Preparation and Safety Guide*.

Environmental Requirements

Insure adequate spacing between racks using the information in Table 2-1. Keep all of the vents clear of obstructions, including dust and foreign conductive material, and away from the exhaust ports of other equipment.

Table 2-1 Chassis Airfow Requirements

Chassis Model	Airflow Intake	Airflow Exhaust	Air Filter Option	Minimum Clearance (walls)	Minimum Horizontal Separation
OSR-7609 (Figure 1-2)	Front, rear	Front, rear, left side, right side	No	6 in (15 cm)	12 in (30.5)

Heat dissipation is an important consideration for sizing the air-conditioning requirements for an installation. The power and heat associated with a Cisco 7609 Internet Router varies based upon these considerations:

- Power supply type
- Module types and quantities
- Average traffic levels

Unless otherwise noted, the information in Table 2-2 and Table 2-3 assumes worst-case conditions (with GBICs and port adapters installed, if applicable). Typical numbers are approximately 30 percent below the numbers listed here. See Table 2-4 for a sample calculation of a switch configuration.

Table 2-2 AC Power Requirements and Heat Dissipation

Model Number/ Module Type	AC-Input Power (Watts)	DC-Output Power (Watts)	Heat Diss. (BTU/HR)	Input Current			
				90 VAC (Amps)	120 VAC (Amps)	180 VAC (Amps)	240 VAC (Amps)
Cisco 7609 Internet Router chassis (with fans)	155	75	530	1.71	1.29	0.86	0.65
WS-X6K-S2U-MSFC2	181.65	129	549	1.79	1.34	0.89	0.67
OSM-2OC12-POS-MM, -SI, -SL OC-12 POS, 2-port	176	141	602	1.96	1.47	0.98	0.74
OSM-4OC12-POS-MM, -SI, -SL OC-12 POS, 4-port	251	201	857	2.79	2.09	1.39	1.05
OSM-4OC12-POS-SI+ OC-12 POS, 4-port	239	191	816	2.65	1.99	1.33	1.00
OSM-4OC3-POS-SI OC-3 POS, 4-port	128	102	437	1.42	1.07	0.71	0.53
OSM-8OC3-POS-MM, -SI, -SL OC-3 POS, 8-port	187	150	640	2.08	1.56	1.04	0.78
OSM-16OC3-POS-MM, -SI, -SL OC-3 POS, 16-port	267	214	913	2.97	2.23	1.48	1.11
OSM-16OC3-POS-SI+ OC-3 POS, 16-port	252	202	861	2.80	2.10	1.40	1.05
OSM-2OC12-ATM-MM, -SI OC-12 ATM, 2-port	190	152	649	2.11	1.58	1.06	0.79
OSM-2OC12-ATM-MM+, -SI+ OC-12 ATM, 2-port	210	168	717	2.33	1.75	1.17	0.88
OSM-1OC48-POS-SS, -SI, -SL OC-48 POS, 1-port	223	179	762	2.48	1.86	1.24	0.93

Table 2-2 AC Power Requirements and Heat Dissipation (continued)

Model Number/ Module Type	AC-Input Power (Watts)	DC-Output Power (Watts)	Heat Diss. (BTU/HR)	Input Current			
				90 VAC (Amps)	120 VAC (Amps)	180 VAC (Amps)	240 VAC (Amps)
OSM-1OC48-POS-SS+, -SI+, -SL+ OC-48 POS, 1-port	205	164	699	2.28	1.71	1.14	0.85
OSM-12CT3/T1 Channelized T-3 to DS-0, 12-port	147	118	502	1.63	1.23	0.82	0.61
OSM-1CHOC12/T1-SI Channelized OC-12/STM-4 to DS-0, 1 port	147	118	502	1.63	1.23	0.82	0.61
OSM-1CHOC12/T3-SI Channelized OC-12, 1-port	231	185	789	2.57	1.93	1.28	0.96
OSM-1CHOC48/T3-SS Channelized OC-48, 1-port	197	158	672	2.19	1.64	1.09	0.82
OSM-2OC48/1DPT-SS, -SI, -SL OC-48 DPT[1]/POS, 2-ports	302	242	1031	3.35	2.52	1.68	1.26
OSM-4GE-WAN-GBIC[2] Gigabit Ethernet WAN Services Module, 4-port	188	151	644	2.09	1.57	1.05	0.79
WS-C6500-SFM Switch Fabric Module	146	117	500	1.63	1.22	0.81	0.61
WS-X6500-SFM2 Switch Fabric Module 2	162	130	554	1.80	1.35	0.90	0.68
WS-X6182-2PA FlexWAN module	125	100	427	1.39	1.04	0.69	0.52
WS-X6348-RJ-45 10/100BASE-TX, 48-port	125	100	428	1.39	1.05	0.70	0.52
WS-X6516-GBIC[2] 1000BASE-X (SX, LX/LH, ZX), 16-port	179	143	610	1.98	1.49	0.99	0.74

1. DPT = Dynamic Packet Transport
2. GBICs = Gigabit Interface Converters

Table 2-3 DC Power Requirements and Heat Dissipation

Module Number/Module Type	DC-Input Power (Watts)	Heat Diss. (BTU/HR)	Input Current	
			48 VDC (Amps)	60 VDC (Amps)
Cisco 7609 Internet Router chassis (with fans)	167	569	3.47	2.78
WS-X6K-S2U-MSFC2	173	590	3.6	2.88
OSM-2OC12-POS-MM, -SI, -SL OC-12 POS, 2-port	190	648	3.95	3.16
OSM-4OC12-POS-MM, -SI, -SL OC-12 POS, 4-port	270	921	5.62	4.50
OSM-4OC12-POS-SI+ OC-12 POS, 4-port	257	877	5.35	4.28
OSM-4OC3-POS-SI OC-3 POS, 4-port	138	4.70	2.87	2.30
OSM-8OC3-POS-MM, -SI, -SL OC-3 POS, 8-port	202	688	4.20	3.36
OSM-16OC3-POS-MM, -SI, -SL OC-3 POS, 16-port	287	981	5.99	4.79
OSM-16OC3-POS-SI+ OC-3 POS, 16-port	271	925	5.65	4.52
OSM-2OC12-ATM-MM, -SI OC-12 ATM, 2-port	204	698	4.26	3.41
OSM-2OC12-ATM-MM+, -SI+ OC-12 ATM, 2-port	226	771	4.70	3.76
OSM-1OC48-POS-SS, -SI, -SL OC-48 POS, 1-port	240	819	5.00	4.00

Table 2-3 DC Power Requirements and Heat Dissipation (continued)

Module Number/Module Type	DC-Input Power (Watts)	Heat Diss. (BTU/HR)	Input Current	
			48 VDC (Amps)	60 VDC (Amps)
OSM-1OC48-POS-SS+, -SI+, -SL+ OC-48 POS, 1-port	220	752	4.59	3.67
OSM-12CT3/T1 Channelized T-3 to DS-0, 12-port	158	540	3.29	2.63
OSM-1CHOC12/T1-SI Channelized OC-12/STM-4 to DS-0, 1 port	158	540	3.29	2.63
OSM-1CHOC12/T3-SI Channelized OC-12, 1-port	248	848	5.17	4.14
OSM-1CHOC48/T3-SS Channelized OC-48, 1-port	212	723	4.41	3.53
OSM-2OC48/1DPT-SS, -SI, -SL OC-48 DPT[1]/POS, 2-ports	325	1108	6.76	5.41
OSM-4GE-WAN-GBIC[2] Gigabit Ethernet WAN Services Module, 4-port	203	692	4.22	3.38
WS-C6500-SFM Switch Fabric Module	158	538	3.28	2.63
WS-X6500-SFM2 Switch Fabric Module 2	174	596	3.63	2.91
WS-X6182-2PA FlexWAN module	134	459	2.80	2.24
WS-X6348-RJ-45 10/100BASE-TX, 48-port	135	461	2.81	2.85
WS-X6516-GBIC[2] 1000BASE-X (SX, LX/LH, ZX), 16-port	192	655	4.00	3.20

1. DPT = Dynamic Packet Transport
2. GBICs = Gigabit Interface Converters

Table 2-4 provides a sample calculation of power and heat dissipation for the following switch configuration:

- Cisco 7609 Internet Router chassis (including AC-input power supplies)
- Two WS-X6K-S2U-MSFC2 supervisor engines
- One Switch Fabric Module
- Two 4-port OC-12 POS modules
- Two 8-port OC-3 POS modules

Table 2-4 Sample Calculation

Model Number/ Module Type	AC-Input Power (Watts)	DC-Output Power (Watts)	Heat Diss. (BTU/HR)	Input Current			
				90 VAC (Amps)	120 VAC (Amps)	180 VAC (Amps)	240 VAC (Amps)
Cisco 7609 Internet Router chassis (with fans)	124	50	422	1.37	1.03	0.69	0.52
WS-X6K-S2U-MSFC2	322	258	1098	3.58	2.68	1.78	1.34
WS-C6500-SFM Switch Fabric Module	146	117	500	1.63	1.22	0.81	0.61
OSM-4OC12-POS-MM 4-port OC-12 module	502	402	1714	5.58	4.18	2.78	2.10
OSM-8OC3-POS-MM 8-port OC-3 module	374	300	1280	4.16	3.12	2.08	1.56
Total	1468	1127	5014	16.32	12.23	8.14	6.13

Power Requirements

Follow these requirements when preparing your site for the switch installation:

- The redundant power option provides a second, identical power supply to ensure that power to the chassis continues uninterrupted if one power supply fails or input power on one line fails.
- In systems configured with the redundant power option, connect each of the two power supplies to a separate input power source. If you fail to do this, your system might be susceptible to total power failure due to a fault in the external wiring or a tripped circuit breaker.
- To prevent a loss of input power, be sure the total maximum load on each circuit supplying the power supplies is within the current ratings of the wiring and breakers.
- In some systems, you might use an uninterruptible power supply (UPS) to protect against power failures at your site. Avoid UPS types that use ferroresonant technology. These UPS types can become unstable with systems like the Cisco 7609 Internet Router, which can have substantial current draw fluctuations due to bursty data traffic patterns.

Use the information in Table 2-2 to estimate the power requirements and heat dissipation of a Cisco 7609 Internet Router based on a given configuration of the switch. Table 2-4 provides a sample calculation. Determining power requirements might be useful for planning the power distribution system needed to support the switch.

Power Connection Guidelines

This section provides the guidelines for connecting the Cisco 7609 Internet Router AC and DC power supplies to the site power source.

- AC-Powered Systems, page 2-9
- DC-Powered Systems, page 2-11

AC-Powered Systems

Basic guidelines include the following:

- Each chassis power supply should have its own dedicated branch circuit.
- For North America, the circuit breaker should be rated 20A for the 2500W power supply and 30A for the 4000W power supply. For everywhere else, the circuit breaker should be sized according to the power supply input rating and local or national code requirements.
- If you are using a 200/240 VAC power source in North America, the circuit must be protected by a dedicated two-pole circuit breaker.
- The source AC outlet must be within 6 feet (1.8 meters) of the system and should be easily accessible.
- The AC power receptacles used to plug in the chassis must be the grounding type. The grounding conductors that connect to the receptacles should connect to protective earth ground at the service equipment.

Two types of AC-input power supplies are available:

- 2500W—Figure 2-1 shows the different styles of 2500W AC-input power cord plugs that are available for North America or various international locales. Figure 2-1 also shows the appliance coupler that is attached to the other end of the 2500W power supply power cord. Table 2-5 lists the AC-input power cord options and Cisco product numbers.
- 4000W—Figure 2-2 shows the two different styles of AC-input power cord plugs that are available for North America and international locales. Unlike the other power supplies, the 4000W power supply power cord is hardwired to the power supply and cannot be removed.

Figure 2-1 AC Power Cord Plugs and Appliance Coupler for the 2500W Power Supply

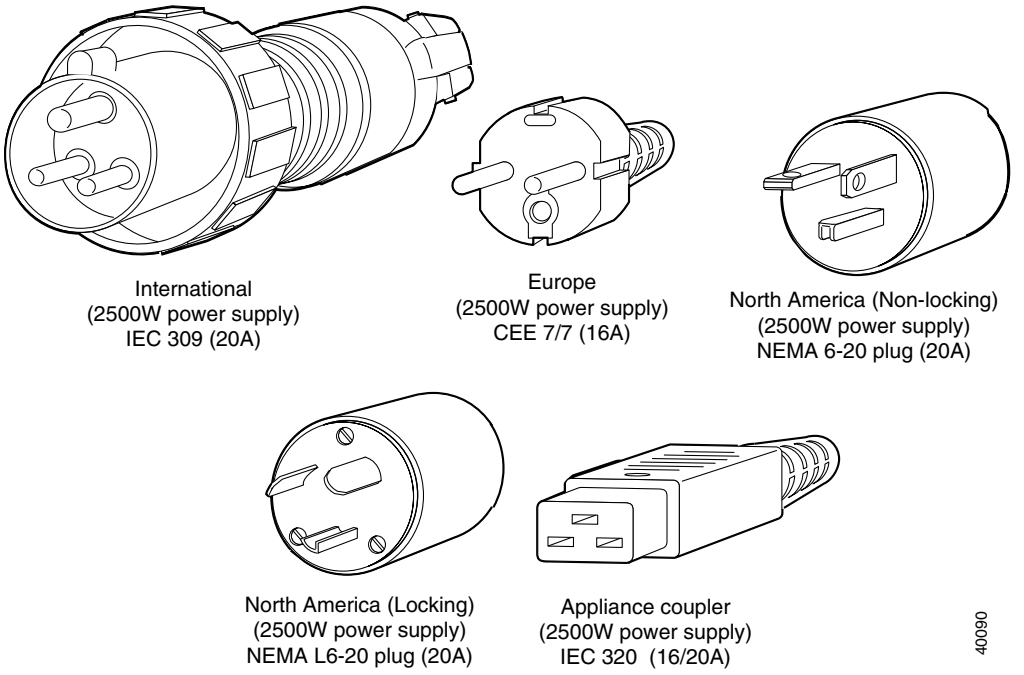


Figure 2-2 AC Power Cord Connectors for the 4000W Power Supply

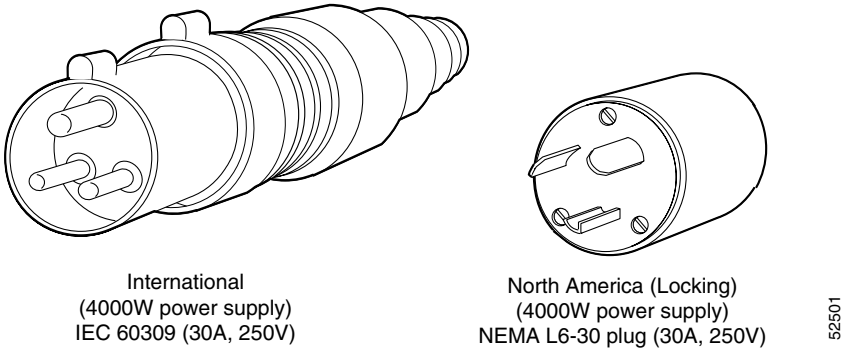


Table 2-5 AC-Input Power Cord Options

Locale	Description	Product Number
2500W Power Supply (WS-CAC-2500W=)		
North America (nonlocking)	12 AWG, 16A/250V	CAB-AC-2500W-US1=
North America (locking)	12 AWG, 16A/250V	CAB-AC-C6K-TWLK=
Europe	2.5 mm, 16A/250V	CAB-AC-2500W-EU=
International	2.5 mm, 16A/250V	CAB-AC-2500W-INT=

DC-Powered Systems

Basic guidelines include the following:

- Each chassis power supply should have its own dedicated input power source.
- The circuit must be protected by a dedicated two-pole circuit breaker. The circuit breaker should be sized according to the power supply input rating and local or national code requirements.
- The circuit breaker is considered the disconnect device and should be easily accessible.
- The power supply ground should connect to protective earth ground even though the system ground connection is provided.
- The DC return is to remain isolated from the system frame and chassis (DC-I).

Site Preparation Checklist

Table 2-6 lists the site planning activities that you should perform prior to installing the Cisco 7609 Internet Router. Completing each activity helps ensure a successful switch installation.

Table 2-6 Site Planning Checklist

Task No.	Planning Activity	Verified By	Time	Date
1	Space evaluation: Space and layout Floor covering Impact and vibration Lighting Maintenance access			
2	Environmental evaluation: Ambient temperature Humidity Altitude Atmospheric contamination Airflow			
3	Power evaluation: Input power type Power receptacles Receptacle proximity to the equipment Dedicated (separate) circuits for redundant Power supplies UPS for power failures DC systems: Proper gauge wire and lugs			
4	Grounding evaluation: Circuit breaker size CO ground (AC- and DC-powered systems)			
5	Cable and interface equipment evaluation: Cable type Connector type Cable distance limitations Interface equipment (transceivers)			
6	EMI evaluation: Distance limitations for signaling Site wiring RFI levels			

CHAPTER 3

Installing the Cisco 7609 Internet Router

Note This document describes the Cisco 7609 Internet Router (OSR-7609) and not the Cisco 7609 Internet Router (CISCO7609).

This chapter describes how to install a Cisco 7609 Internet Router (OSR-7609) in a rack. For first-time installations, perform the procedures in the following sections in the order listed:

Note If you are installing a free-standing (not rack-mounted) Cisco 7609 Internet Router, you must install the stabilizer kit, which is included in the accessories box.

Before starting the installation procedures in this chapter, see the "Site Preparation Checklist" section on page 2-11 to verify that all site planning activities were completed.

For information on installing modules, refer to the *Cisco 7600 Series Internet Router Module Installation Guide*.

Warning **Only trained and qualified personnel should be allowed to install, replace, or service this equipment.**

Unpacking the Cisco 7609 Internet Router

Tip Do not discard the shipping container when you unpack the Cisco 7609 Internet Router. Flatten the shipping cartons and store them with the pallet. You will need these containers if you need to move or ship the Cisco 7609 Internet Router in the future. Repacking instructions are provided in Appendix C, "Repacking the Cisco 7609 Internet Router."

Perform the following to check the contents of the shipping container:

- Check the contents of the accessories box against the Accessories Box Components Checklist and the packing slip. Verify that you received all listed equipment, which should include the following:
  - Cisco 7609 Internet Router hardware and software documentation, if ordered
  - Optional equipment that you ordered, such as network interface cables, transceivers, or special connectors
- Check the modules in each slot. Ensure that the configuration matches the packing list and that all the specified interfaces are included.

Installing the Rack-Mount Kit

This section describes how to install the rack-mount kit provided in the accessories box. The kit contains a shelf bracket and crossbar assembly that attaches directly to the rack and L brackets that attach to the chassis.

Open the rack-mount kit and use the checklist in Table 3-1 to verify that all parts are included.

Table 3-1 Rack-Mount Kit Checklist

Part Description	Received
L brackets	
M3 Phillips countersunk-head screws	
M4 Phillips countersunk-head screws	
12-24 x 3/4-inch Phillips binder-head screws	
10-32 x 3/4-inch Phillips binder-head screws	
Shelf brackets	
Crossbar bracket	
M3 Phillips pan-head screws	

Rack-Mounting Guidelines

Before rack-mounting the Cisco 7609 Internet Router, ensure that the equipment rack complies with the following guidelines:

- The width of the rack, measured between the two front mounting strips or rails, must be 17.75 inches (45.09 cm).
- The depth of the rack, measured between the front and rear mounting strips, must be at least 19.25 inches (48.9 cm) but not more than 32 inches (81.3 cm).
- The rack must have sufficient vertical clearance to insert the chassis. The chassis height for the Cisco 7609 Internet Router is 33.5 inches (85.1 cm) (20 RU).

Note Chassis height is measured in rack units (RU).

Caution If the rack is on wheels, ensure that the brakes are engaged or that the rack is otherwise stabilized.

This kit is not suitable for use with racks with obstructions (such as a power strip) that could impair access to field-replaceable units (FRUs).

Required Tools

These tools and equipment are required to install the rack-mount kit:

- Number 1 and number 2 Phillips-head screwdrivers
- 3/16-inch flat-blade screwdriver
- Tape measure and level

Installing the Shelf and Crossbar Brackets

To install the shelf and crossbar brackets, perform these steps:

Step 1 Position one of the two shelf brackets in the rack as shown in Figure 3-1.

Step 2 Secure the shelf bracket to the rack by using three 12-24 x 3/4-inch or 10-32 x 3/4-inch screws.

Step 3 Repeat Steps 1 and 2 for the second shelf bracket. Make sure that the second shelf bracket is level with the first bracket.

Step 4 Attach the crossbar bracket to the back of the shelf brackets using two M3 screws as shown in Figure 3-2.

Figure 3-1 Installing the Shelf Brackets

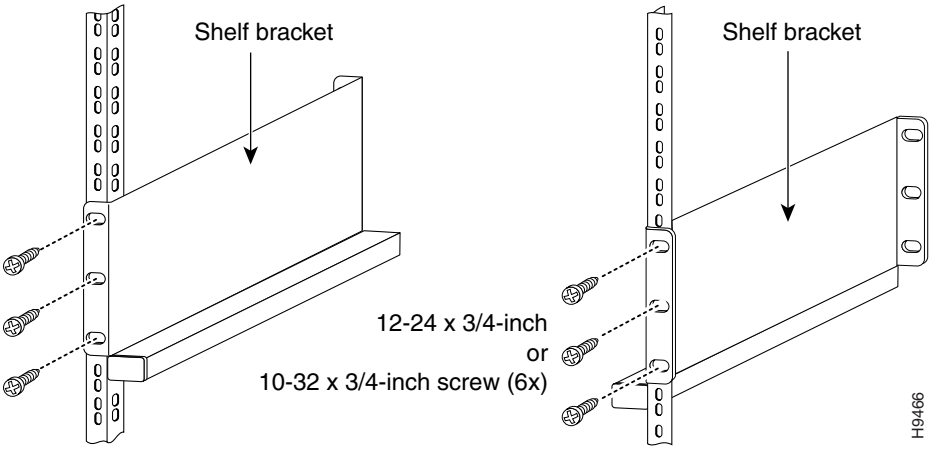
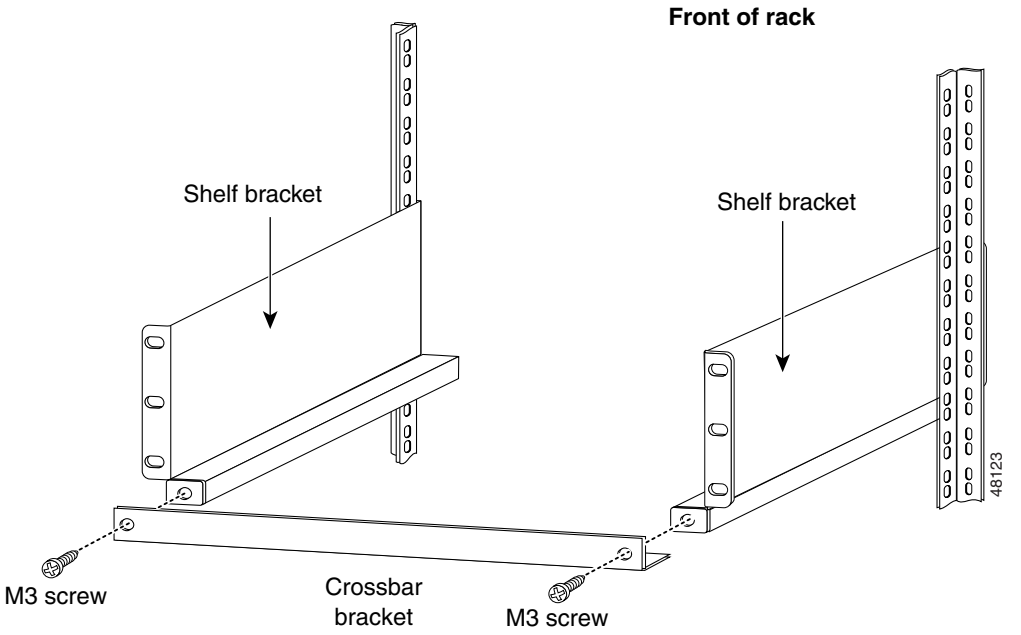


Figure 3-2 Attaching the Crossbar Bracket to the Shelf Brackets



Installing the L Brackets and Cable Guides

The Cisco 7609 Internet Router L bracket screw holes are stamped + and –. You can install the brackets either on the left or right side of the chassis; use the + holes on one side and the – holes on the other side. The L brackets are installed with eight M4 Phillips countersunk-head screws (four screws on each side).

The optional cable guide installs on the front of the chassis and is secured with four M3 screws.

Step 1 Position one of the L brackets against the Cisco 7609 chassis side and align the screw holes (use either the + or the – holes).

Step 2 Secure the L bracket to the Cisco 7609 chassis with the four M4 screws.

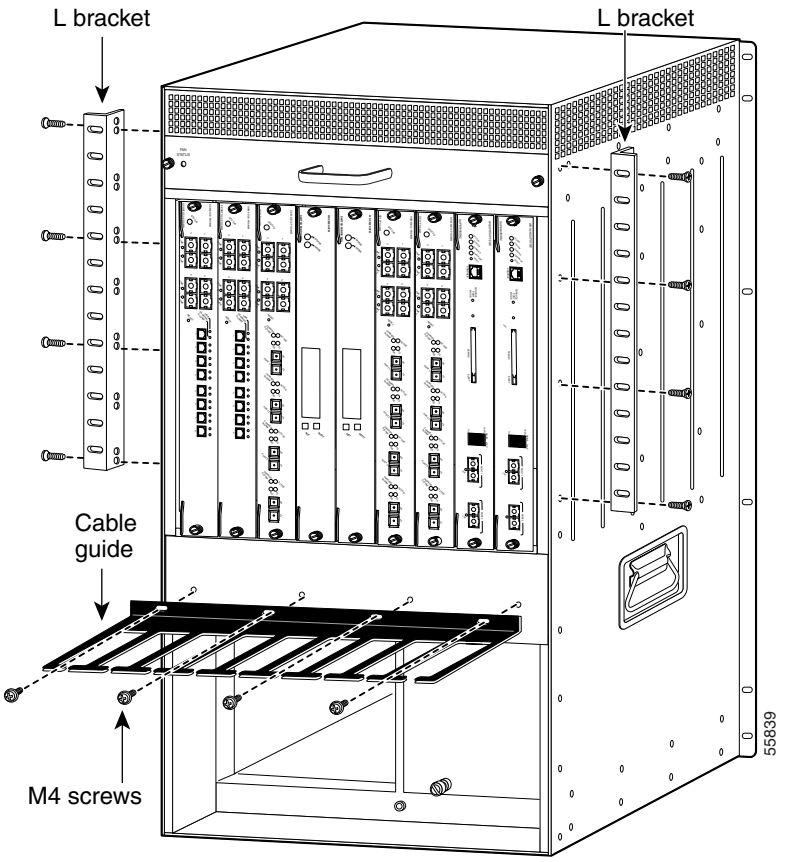
Step 3 Repeat Steps 1 and 2 for the other L bracket. If you used the + set of holes for the first L bracket, use the – set of holes for the second L bracket.

If you want to install the optional cable guide, perform these steps:

Step 1 Position the cable guide against the front of the chassis and align the four screw holes as shown in Figure 3-3.

Step 2 Secure the cable guide with four M4 screws.

Figure 3-3 Attaching L Brackets and Cable Guides



Installing the Cisco 7609 Chassis in the Rack

Note If you are not installing the Cisco 7609 Internet Router in the rack, you must install the stabilizer kit. See "Installing the Stabilizer Kit" section on page 3-10.

Caution Mount the chassis in the rack before installing the power supplies or line cards.

You are now ready to install the Cisco 7609 chassis in the rack.

Tip We recommend that you have a third person to assist in this procedure.

Warning **Two people are required to lift the empty chassis. Grasp the chassis underneath the lower edge and lift with both hands. To prevent injury, keep your back straight and lift with your legs, not your back.**

To install the Cisco 7609 chassis in the equipment rack, perform these steps:

Step 1 With a person standing at each side of the chassis, grasp the chassis handle with one hand and use the other hand near the back of the chassis for balance. Slowly lift the chassis in unison. Avoid sudden twists or moves to prevent injury.

Step 2 Position the chassis in the rack as follows. (See Figure 3-4.)

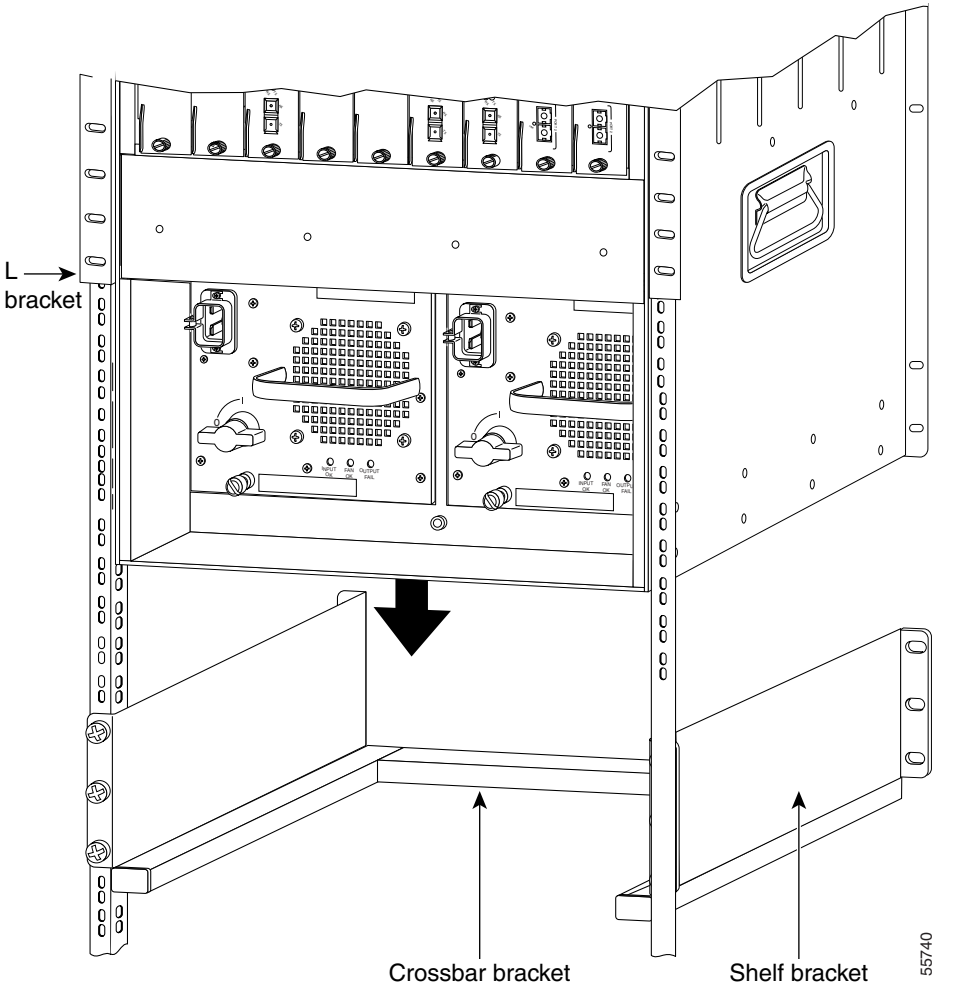
a. If the front of the chassis (front panel) is at the front of the rack, insert the rear of the chassis between the mounting posts.

b. If the rear of the chassis is at the front of the rack, insert the front of the chassis between the mounting posts.

Step 3 Rest the chassis on the shelf brackets and crossbar bracket.

Step 4 Align the mounting holes in the L bracket with the mounting holes in the equipment rack.

Figure 3-4 Installing the Cisco 7609 Chassis in the Rack



Step 5 Install the eight or ten (four or five per side) 12-24 x 3/4-inch or 10-32 x 3/4-inch screws through the holes in the L bracket and into the threaded holes in the equipment rack posts.

Step 6 Use a tape measure and level to verify that the chassis is installed straight and level.

Installing the Stabilizer Kit

Note The stabilizer kit is included only in the accessory kits for the Cisco 7609 Internet Router.

If you are not installing the Cisco 7609 Internet Router in a rack, you must install stabilizer brackets to the bottom of the chassis. The stabilizer brackets reduce the possibility that the freestanding chassis will tip over.

Open the stabilizer kit package and use the kit contents list in Table 3-2 to verify that all parts are included.

Table 3-2 Stabilizer Kit Contents

Quantity	Part Description	Received
16	M4 Phillips countersunk-head screws	
2	Stabilizer brackets	

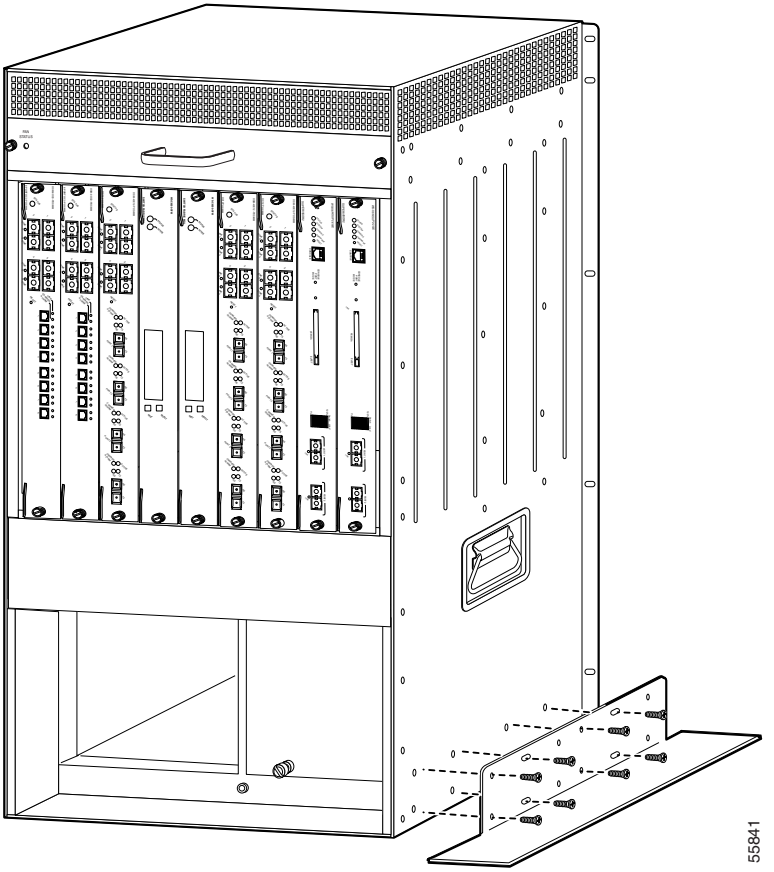
Note Have a second person available to perform this procedure.

To install the stabilizer brackets, perform these steps:

Step 1 Have one person tilt and hold the chassis to one side.

Step 2 With the chassis tilted, attach the stabilizer bracket to the side of the chassis with the eight M4 screws as shown in Figure 3-5.

Figure 3-5 Installing the Stabilizer Brackets



Step 3 Tilt the chassis to the other side.

Step 4 Attach the second stabilizer bracket to the other side of the chassis with eight M4 screws.

Step 5 Lower the chassis so that it rests on both stabilizer brackets.

System Ground Connection

This section describes how to connect a system (earth) ground to the Cisco 7609 Internet Router.

Note You must connect both the system ground connection and the power supply ground connection to an earth ground. The system ground connection is required if Foreign Exchange Station (FXS) modules are installed or if this equipment is installed in a US or European Central Office.

Two threaded M4 holes are provided on the chassis frame to attach the ground cable. (See Figure 3-6.)

Note If FXS modules are installed or if this equipment is installed in a US or European Central Office, you must use the system (earth) ground on both AC- and DC-powered systems.

Required Tools and Equipment

To connect the system ground, you need the following tools and materials:

Note Materials are not provided; contact any commercial cable vendor for the required parts.

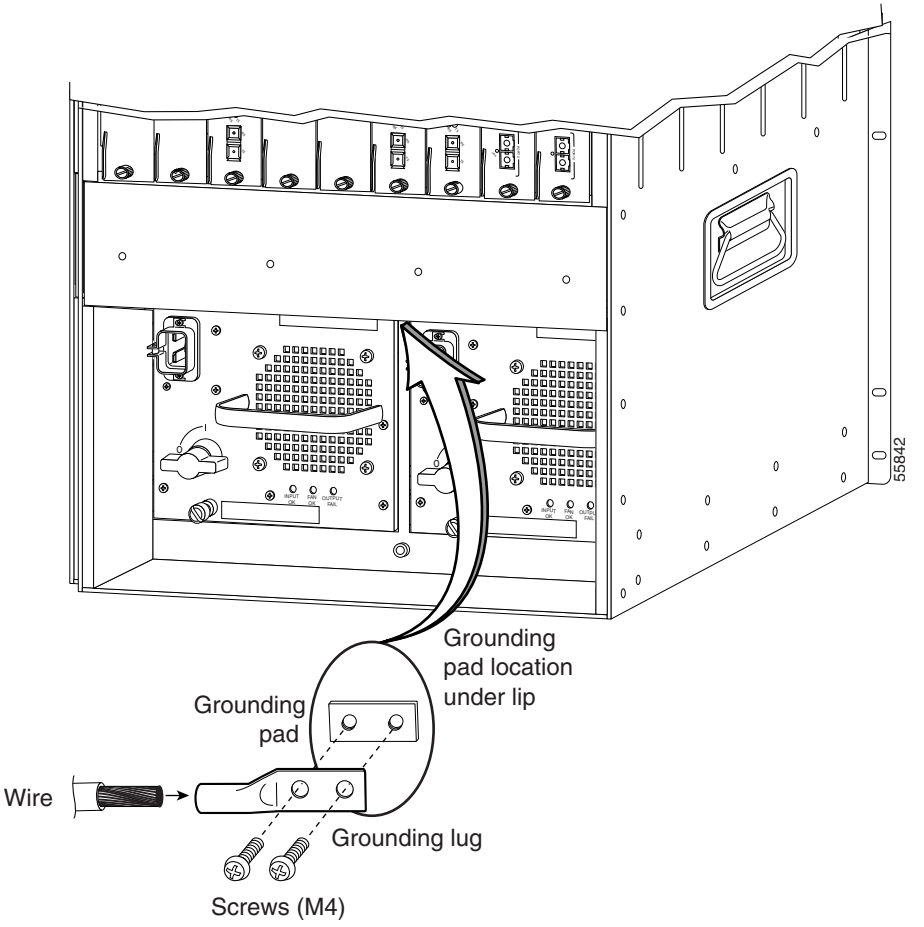
- Grounding lug

  The grounding lug must have two M4 screw holes and accept 6 AWG wire.
- Two M4 (metric) hex-head screws with locking washers
- One grounding wire

  The grounding wire should be sized according to local and national installation requirements. The length of the grounding wires depends on the proximity of the Cisco 7609 Internet Router to proper grounding facilities.
- Number 2 Phillips-head screwdriver
- Crimping tool

- Wire-stripping tool

Figure 3-6 System Ground Location



Connecting the System Ground

You must complete this procedure before connecting system power or turning on the Cisco 7609 Internet Router.

To attach the grounding lug and cable to the grounding pad, perform these steps:

Step 1 Use a wire-stripping tool to remove approximately 0.75 inch (19 mm) of the covering from the end of the grounding wire.

Step 2 Insert the stripped end of the grounding wire into the open end of the grounding lug.

Step 3 Use a crimping tool to secure the grounding wire in place in the grounding lug.

Step 4 Locate and remove the adhesive label from the system grounding pad on the Cisco 7609 chassis.

Step 5 Place the grounding wire lug against the grounding pad, making sure there is good metal-to-metal contact.

Step 6 Secure the grounding lug to the chassis with two M4 screws. Ensure that the grounding lug will not interfere with other Cisco 7609 hardware or rack equipment.

Step 7 Prepare the other end of the grounding wire and connect it to an appropriate grounding point in your site to ensure adequate earth ground for the Cisco 7609 Internet Router.

Installing the Power Supplies in the Cisco 7609 Chassis

The Cisco 7609 Internet Router power supply (AC or DC) is shipped separately from the chassis. Remove the power supply from its shipping packaging. Install and connect it to the site power by referring to the "Installing an AC-Input Power Supply" section on page 5-5 or the "Installing a DC-Input Power Supply" section on page 5-10.

Attaching the Interface Cables

This section provides general information on attaching interface cables to the supervisor engines and to the modules.

Depending on the modules you have installed in your chassis, you will have different styles of connectors to attach.

Note Refer to the *Cisco 7600 Series Internet Router Module Installation Guide* for additional module information.

Connecting the Supervisor Engine Console Port

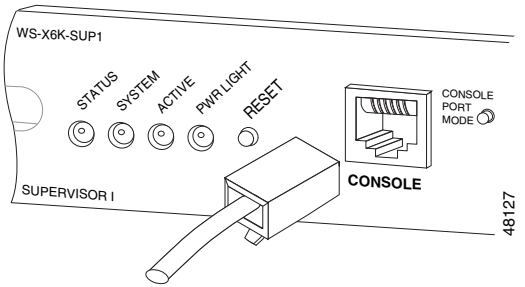
This section describes how to connect to the supervisor engine console port from a terminal or modem.

The console port on the supervisor engine allows you to perform the following functions:

- Configure the Cisco 7609 Internet Router from the CLI
- Monitor network statistics and errors
- Configure SNMP agent parameters
- Download software updates to the Cisco 7609 Internet Router or distribute software images residing in Flash memory to attached devices

The console port, located on the front panel of the supervisor engine, is shown in Figure 3-7.

Figure 3-7 Supervisor Engine Console Port Connector



Note The accessory kit that shipped with your Cisco 7609 Internet Router contains the necessary cable and adapters to connect a terminal or modem to the console port.

To connect a terminal to the console port using the cable and adapters provided, perform these steps:

Step 1 Place the console port mode switch in the *in* position (factory default).

Step 2 Connect to the port using the RJ-45-to-RJ-45 cable and RJ-45-to-DB-25 DTE adapter or RJ-45-to-DB-9 DTE adapter (labeled "Terminal").

Step 3 Position the cable in the cable guide (if installed). Make sure that there are no sharp bends in the cable.

Step 4 Check the terminal documentation to determine the baud rate. The baud rate of the terminal must match the default baud rate (9600 baud) of the console port. Set up the terminal as follows:

- 9600 baud
- 8 data bits
- No parity
- 2 stop bits

To connect a terminal using a Catalyst 5000 family Supervisor Engine III console cable, perform these steps:

Step 1 Place the console port mode switch in the *out* position.

Step 2 Connect to the port using the Supervisor Engine III cable and the appropriate adapter for the terminal connection.

Step 3 Position the cable in the cable guide (if installed). Make sure there are no sharp bends in the cable.

Step 4 Check the terminal documentation to determine the baud rate. The baud rate of the terminal must match the default baud rate (9600 baud) of the console port. Set up the terminal as follows:

- 9600 baud
- 8 data bits
- No parity
- 2 stop bits

To connect a modem to the console port, perform these steps:

Step 1 Place the console port mode switch in the *in* position.

Step 2 Connect to the port using the RJ-45-to-RJ-45 rollover cable and the RJ-45-to-DB-25 DCE adapter (labeled “Modem”).

Step 3 Position the cable in the cable guide (if installed). Make sure there are no sharp bends in the cable.

Connecting the Supervisor Engine Uplink Ports

This section describes how to connect to the supervisor engine uplink ports.

Warning **Because invisible laser radiation may be emitted from the aperture of the port when no cable is connected, avoid exposure to laser radiation and do not stare into open apertures.**

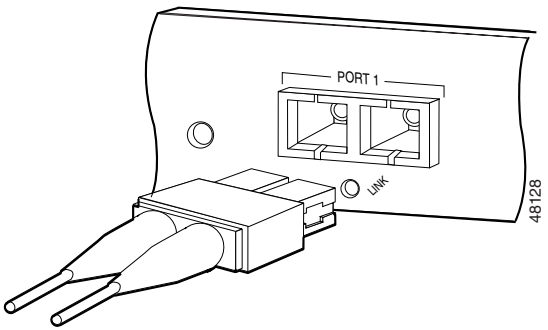
Note In a redundant configuration with two supervisor engines, the uplink ports on the redundant (standby) supervisor engine are active and can be used for normal traffic, like any other ports in the chassis.

To connect to the supervisor engine uplink ports, perform these steps:

Step 1 Remove the plugs from the Gigabit Interface Converter (GBIC) optical bores; store them for future use.

Step 2 Remove the plugs from the SC-type connector on the fiber-optic cable. Insert the connector into the GBIC. (See Figure 3-8.)

Figure 3-8 Connecting the Supervisor Engine Uplink Ports



Note When you plug the SC-type connector into the GBIC, make sure that both the transmit (Tx) and receive (Rx) fiber-optic cables are fully inserted into the SC-type connector.

Note If you are using the LX/LH GBIC with MMF, you need to install a patch cord between the GBIC and the MMF cable.

Connecting to the Interface Ports

Note For connector specifications, see Appendix B, "Connector and Cable Specifications."

The Optical Services Modules (OSMs) and supported Catalyst 6000 family modules have the following interface ports:

- OC-3 POS, OC-12 POS, OC-48 POS, and OC-12 ATM OSMs—SC-Type Fiber Optic (See Figure 3-9.)
- Channelized OC-12 and OC-48 OSMs—LC fiber-optic connectors (See Figure 3-10.)
- OC-48 POS OSM—MT-RJ fiber-optic connector (See Figure 3-11.)
- Catalyst 6000 family 48-port 10/100TX switching modules—RJ-45 (See Figure 3-12.)

Figure 3-9 SC-Type Fiber-Optic Connector

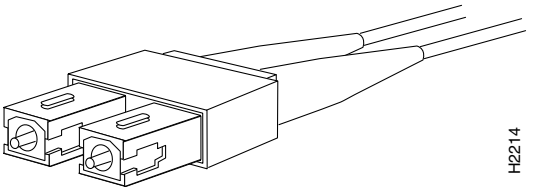


Figure 3-10 LC Fiber-Optic Connector

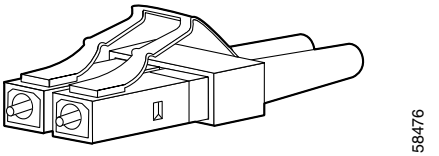


Figure 3-11 MT-RJ Fiber-Optic Connector

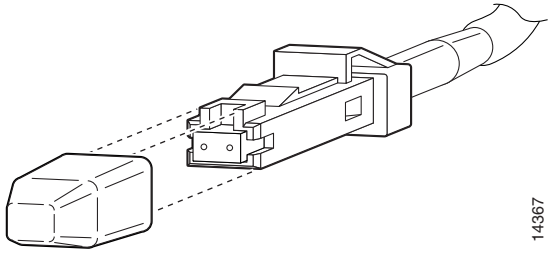
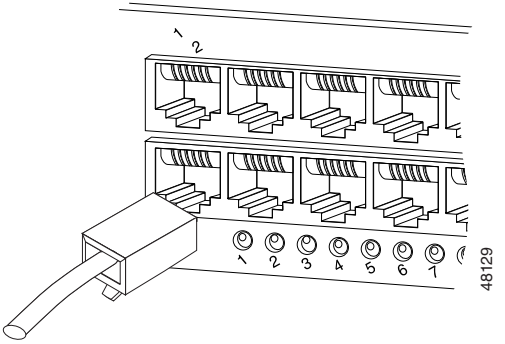


Figure 3-12 RJ-45 Connectors



Verifying Cisco 7609 Chassis Installation

After you finish connecting the modules, you need to verify that the modules, power supplies, and fan assembly are correctly and securely installed. To verify the Cisco 7609 chassis installation, perform these steps:

Step 1 Verify that the ejector levers of each module are fully closed (parallel to the faceplate) to ensure that the supervisor engine and all modules are fully seated in the backplane connectors.

Step 2 Check the captive installation screws of each module, the power supply, and the fan assembly. Tighten any loose captive installation screws.

Step 3 Verify that all empty module slots have blank faceplates (WS-X6K-SLOT-CVR) installed and that the screws holding the plates in place are tight.

Step 4 Turn on the power supply switches to power up the system.

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

CHAPTER 4

Troubleshooting

Note This document describes the Cisco 7609 Internet Router (OSR-7609) and not the Cisco 7609 Internet Router (CISCO7609).

This chapter describes how to troubleshoot the Cisco 7609 Internet Router (OSR-7609) hardware installation and contains these sections:

If your system has problems starting up, use the information in this chapter to help isolate the cause. Problems with the initial startup are often caused by a switching module that has become dislodged from the backplane or a power supply that has been disconnected from the power cord connector. Although temperature conditions above the maximum acceptable level rarely occur at initial startup, you may encounter these conditions during extended operation. Long-term monitoring functions also include independent reporting of DC-output voltage problems.

Note This chapter covers only the chassis component hardware aspects of troubleshooting. For module-specific information, refer to the *Cisco 7600 Series Internet Router Module Installation Guide*.

Getting Started

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

- Power supplies are supplying power to the system.
- The system fan assembly is operating.
- System software boots successfully.
- The supervisor engine and all switching modules are installed properly in their slots, and each was initialized without problems.

If each of these conditions is met and the hardware installation is complete, refer to the *Cisco 7600 Series Internet Router Software Configuration Guide*, the *Cisco 7600 Series Internet Router IOS Software Configuration Guide*, the *Cisco 7600 Series Internet Router Command Reference*, or the *Cisco 7600 Series Internet Router IOS Command Reference* publications to troubleshoot the software. However, if any of these conditions are not met, use the procedures in this chapter to isolate and, if possible, resolve the problem.

Problem Solving to the System Component Level

The key to success when troubleshooting the system is to isolate the problem to a specific system component. The first step is to compare what the system *is doing* to what it *should be doing*. Because a startup problem can usually be attributed to a single component, it is more efficient to isolate the problem to a subsystem rather than troubleshoot each separate component in the system.

The switch consists of the following subsystems:

- Power supply—Includes the power supplies and power supply fans.
- Fan assembly—The chassis fan assembly should operate whenever system power is on. You should see the FAN LED turn green and should be able to hear the fan assembly to determine whether or not it is operating. If the FAN

LED is red, this indicates that one or more fans in the fan assembly is not operating. You should immediately contact a customer service representative. (See the "Contacting Customer Service" section on page 4-7.) There are no installation adjustments that you can make if the fan assembly does not function properly at initial startup.

- Supervisor engine—The supervisor engine contains the system operating software, so check here if you have trouble with the system software. Status LEDs on the supervisor engine indicate whether or not the supervisor engine is able to initialize the switching module.

  If you have a redundant supervisor engine, refer to the *Cisco 7600 Series Internet Router Software Configuration Guide* or the *Cisco 7600 Series Internet Router IOS Software Configuration Guide* publications for descriptions of how the redundant supervisor engine comes online and how the software images are handled.

- Switching modules—Status LEDs on each switching module indicate if the module has been initialized by the supervisor engine. A switching module that is partially installed in the backplane can cause the system to halt.

Identifying Startup Problems

LEDs indicate all system states in the startup sequence. By checking the LEDs, you can determine when and where the system failed in the startup sequence.

Perform these steps to identify startup problems:

Step 1 Turn on the power supplies. You should immediately hear the system fan assembly begin to operate. If you do not, see the "Troubleshooting the Power Supply" section on page 4-5. If you determine that the power supplies are functioning normally and that the fan assembly is faulty, contact a customer service representative. If the system fan assembly does not function properly at initial startup, there are no installation adjustments that you can make. To replace the fan assembly, see the "Removing and Replacing the Fan Assembly" section on page 5-12.

Step 2 Check that the LEDs on the supervisor engine light as follows:

- The STATUS LED flashes orange once and stays orange during diagnostic boot tests. It turns green when the module is operational (online). If the system software is unable to start up, this LED stays orange.
- The SYSTEM LED turns green, indicating that all chassis environmental monitors are reporting that the system is OK. If one or more environmental monitor reports a problem, the SYSTEM LED is orange or red.
- The ACTIVE LED turns green, indicating that the supervisor engine is operational and active. If the supervisor engine is in standby mode, the ACTIVE LED is orange.
- Each LINK LED flashes orange once, stays orange during diagnostic boot tests, and turns green when the module is operational (online). If no signal is detected, the LINK LED turns off. The LINK LED blinks orange if the port is bad.

If any LEDs on the supervisor engine front panel are red or orange, see the "Troubleshooting Modules" section on page 4-6.

If you have a redundant supervisor engine, refer to the *Cisco 7600 Series Internet Router Software Configuration Guide* or the *Cisco 7600 Series Internet Router IOS Software Configuration Guide* publications for descriptions of how the redundant supervisor engine comes online and how the software images are handled.

For a complete description of the supervisor engine LEDs, refer to the *Cisco 7600 Series Internet Router Module Installation Guide.*

Step 3 Verify that the STATUS LEDs on the supervisor engine and on each switching module are green when the supervisor engine completes initialization. This LED indicates that the supervisor engine or switching modules are receiving power, have been recognized by the supervisor engine, and contain a valid Flash code version. This LED does not indicate the state of the individual interfaces on the switching modules. If a STATUS LED is red or orange, see the "Troubleshooting Modules" section on page 4-6.

Step 4 If the boot information and system banner are not displayed, refer to the *Cisco 7600 Series Internet Router Module Installation Guide* to verify that the terminal is set correctly and that it is connected properly to the supervisor engine console port.

Troubleshooting the Power Supply

Perform these steps when troubleshooting the power supply to isolate a power subsystem problem:

Step 1 Verify that the INPUT OK LED on the power supply is green.

- If the INPUT OK LED is green, the AC or DC source is good and the power supply is functional.
- If the INPUT OK LED is off, first ensure that the power supply is flush with the back of the chassis. Turn off the power switch, tighten the captive installation screw(s), and then turn on the power switch.
- If the INPUT OK LED remains off, there might be a problem with the AC or DC source, or the power cable.

  Turn off the power to the switch, connect the power cord to another power source if one is available, and turn on the power switch.
- If the INPUT OK LED is green, the problem is the first power source.
- If the INPUT OK LED fails to light after you connect the power supply to a new power source, replace the power cord, and turn on the switch.
- If the INPUT OK LED then goes on, return the first power cord for replacement.

If this unit has more than one power cord, repeat Step 1 for each power supply.

If the INPUT OK LED still fails to light when the switch is connected to a different power source with a new power cord, the power supply is probably faulty.

If a second power supply is available, install it in the second power supply bay and contact a customer service representative for further instructions.

Step 2 If you have a second (redundant) power supply, repeat Step 1 for this power supply.

If you are unable to resolve the problem or if you determine that either a power supply or backplane connector is faulty, see the "Contacting Customer Service" section on page 4-7.

Troubleshooting the Fan Assembly

Perform these steps when troubleshooting the fan assembly to isolate a fan assembly problem:

Step 1 Verify that the FAN LED on the fan assembly is green.

If it is not, see the "Problem Solving to the System Component Level" section on page 4-2 to determine whether the power subsystem is functioning properly.

Step 2 Verify that the FAN LED is red.

- If it is red, the fan assembly is not seated in the backplane or has malfunctioned.
- To ensure that the fan assembly is seated properly, loosen the captive installation screws, remove the fan assembly, and reinstall it.
- Tighten all captive installation screws, and then restart the system.
- If the FAN LED is still red, the system detects a fan assembly failure. Contact a customer service representative for instructions.

Troubleshooting Modules

Perform these steps when troubleshooting the modules to isolate a supervisor engine or module problem:

Step 1 Verify that all status LEDs are on.

Step 2 If any status LEDs on the supervisor engine or any modules are red or off, the module might have shifted out of its slot. Reseat the module until both ejector levers are at 90 degrees to the rear of the chassis. Tighten the captive installation screws at the left and right of the module front panel, and restart the system.

If the status LED on a switching module is orange, the module might be busy or disabled. Refer to the *Cisco 7600 Series Internet Router Software Configuration Guide,* the *Cisco 7600 Series Internet Router IOS Software Configuration Guide,* the *Cisco 7600 Series Internet Router Command Reference* or the *Cisco 7600 Series Internet Router IOS Command Reference* publications to configure or enable the interfaces. After the system reinitializes the interfaces, the status LED on the module should be green.

If you still experience trouble with the startup, see the "Contacting Customer Service" section on page 4-7.

Contacting Customer Service

If you are unable to solve a startup problem after using the troubleshooting suggestions in this chapter, contact a customer service representative for assistance and further instructions. Before you call, have the following information ready to help your service provider assist you as quickly as possible:

- Date you received the switch
- Chassis serial number (located on a label on the right of the rear panel of the chassis)
- Type of software and release number
- Maintenance agreement or warranty information
- Brief description of the problem
- Brief explanation of the steps you have already taken to isolate and resolve the problem

CHAPTER 5

Removal and Replacement Procedures

Note This document describes the Cisco 7609 Internet Router (OSR-7609) and not the Cisco 7609 Internet Router (CISCO7609).

This chapter describes how to perform the following removal and replacement procedures for Cisco 7609 Internet Router (OSR-7609) field-replaceable units (FRUs):

Warning **Before you install, operate, or service the system, read the *Site Preparation and Safety Guide*. This guide contains important safety information you should know before working with the system.**

Warning **Only trained and qualified personnel should be allowed to install, replace, or service this equipment.**

For instructions on installing and replacing modules, refer to the *Cisco 7600 Series Internet Router Module Installation Guide*.

Removing and Replacing the Power Supply

This section describes how to remove and install power supplies for the Cisco 7609 Internet Router.

Note In systems with redundant power supplies, you can replace the faulty supply while the system is operating.

Required Tools

A flat-blade or number 2 Phillips-head screwdriver is required to perform these procedures.

Removing an AC-Input Power Supply

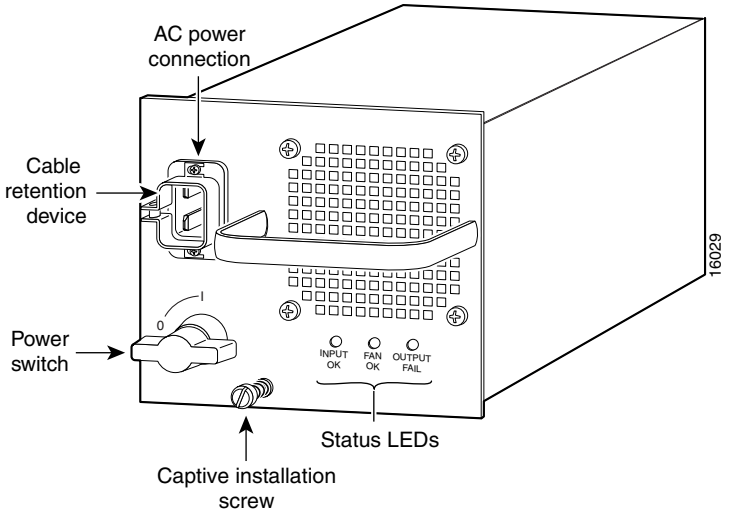
Warning **Voltage is present on the backplane when the system is operating. To reduce risk of an electric shock, keep hands and fingers out of the power supply bays and backplane areas.**

Follow these steps to remove an AC-input power supply:

Step 1 Turn the power switch to the Off (0) position on the power supply you are removing. (See Figure 5-1.) Turning the power switch to the Off (0) position also disengages a pawl that unlocks the power supply from the chassis.

Step 2 Disconnect the power cord from the power source.

Figure 5-1 AC-Input Power Supply Front Panel



Step 3 Loosen the screw on the cable retention device and disconnect the power cord from the power supply being removed.

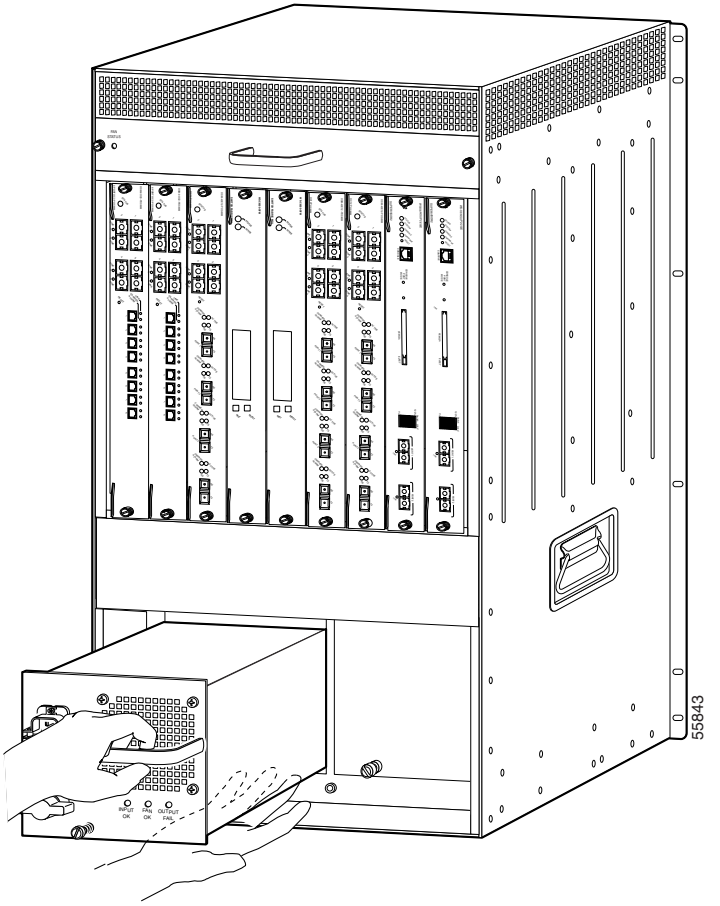
Note The AC power cord for the 4000W power supply is hard wired and cannot be removed from the supply.

Step 4 Loosen the captive installation screw. (See Figure 5-1.)

Caution Use both hands to install and remove power supplies. Each Cisco 7609 Internet Router AC-input power supply weighs between 22 pounds (9.9 kg) and 28 pounds (12.6 kg).

Step 5 Grasp the power supply handle with one hand and slide the power supply part of the way out of the chassis. Place your other hand underneath the power supply, as shown in Figure 5-2, and slide the power supply completely out of the chassis.

Figure 5-2 Handling an AC-Input Power Supply



Step 6 If the power supply bay is to remain empty, install a blank power supply filler plate (Cisco part number 700-03104-01) over the opening and secure it with the captive installation screw.

Installing an AC-Input Power Supply

Caution Use both hands to install and remove power supplies. Each Cisco 7609 Internet Router AC-input power supply weighs between 22 pounds (9.9 kg) and 28 pounds (12.6 kg).

Follow these steps to install an AC-input power supply:

Step 1 Ensure that the system (earth) ground connection has been made. For ground connection instructions, see the "System Ground Connection" section on page 3-12.

Step 2 If necessary, remove the blank power supply filler plate (Cisco part number 700-03104-01) from the chassis power supply bay opening by loosening the captive installation screw.

Step 3 Verify that the power switch is in the Off (0) position on the power supply you are installing. (See Figure 5-1.)

Step 4 Grasp the power supply handle with one hand. Place your other hand underneath the power supply, as shown in Figure 5-2. Slide the power supply into the power supply bay. Make sure that the power supply is fully seated in the bay.

Step 5 Tighten the power supply captive installation screw. (See Figure 5-1.)

Step 6 Plug the power cord into the power supply and tighten the screw on the cable retention device.

Note The AC power cord for the 4000W power supply is hard wired and cannot be removed from the supply.

Step 7 Connect the other end of the power cord to an AC-input power source.

Caution In a system with dual power supplies, connect each power supply to a separate input source. In case of a power source failure, the second source will most likely still be available.

Step 8 Turn the power switch to the On (|) position on the power supply. Switching the power switch to On also engages a pawl that locks the power supply in the bay.

Step 9 Verify power supply operation by checking that the power supply front panel LEDs are in the following states:

- INPUT OK LED is green
- FAN OK LED is green
- OUTPUT FAIL LED is not lit

If the LEDs indicate a power problem, see the "Identifying Startup Problems" section on page 4-3 for troubleshooting information.

Removing a DC-Input Power Supply

Warning **Before performing any of the following procedures, ensure that power is removed from the DC circuit. To ensure that all power is OFF, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the OFF position, and tape the switch handle of the circuit breaker in the OFF position.**

Warning **Voltage is present on the backplane when the system is operating. To reduce risk of an electric shock, keep hands and fingers out of the power supply bays and backplane areas.**

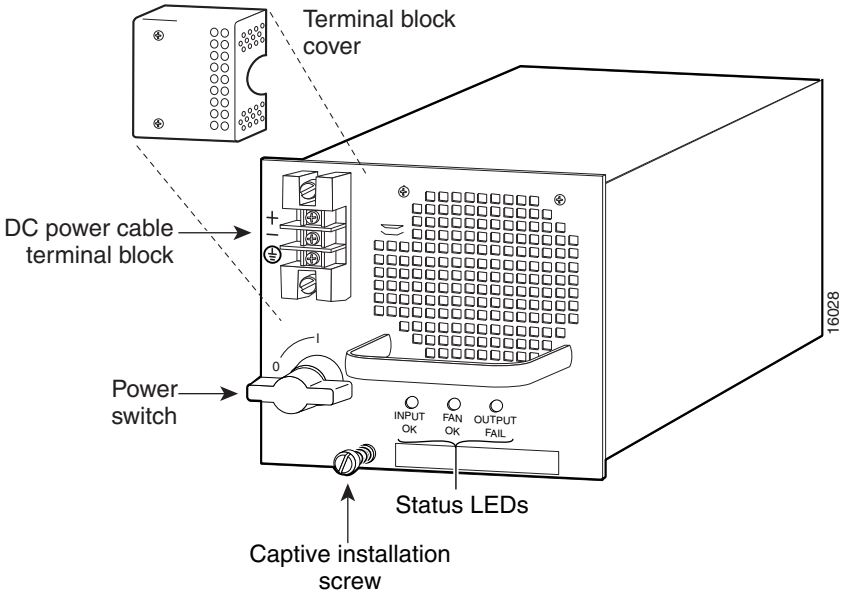
Follow these steps to remove a DC-input power supply:

Step 1 Verify that power is off to the DC circuit on the power supply you are removing.

Step 2 Turn the power switch to the Off (0) position on the power supply you are removing. (See Figure 5-3.) Turning the power switch off also disengages a pawl that unlocks the power supply from the chassis.

Step 3 Remove the two screws securing the terminal block cover, and slide the cover off the terminal block. (See Figure 5-3.)

Figure 5-3 DC-Input Power Supply Front Panels

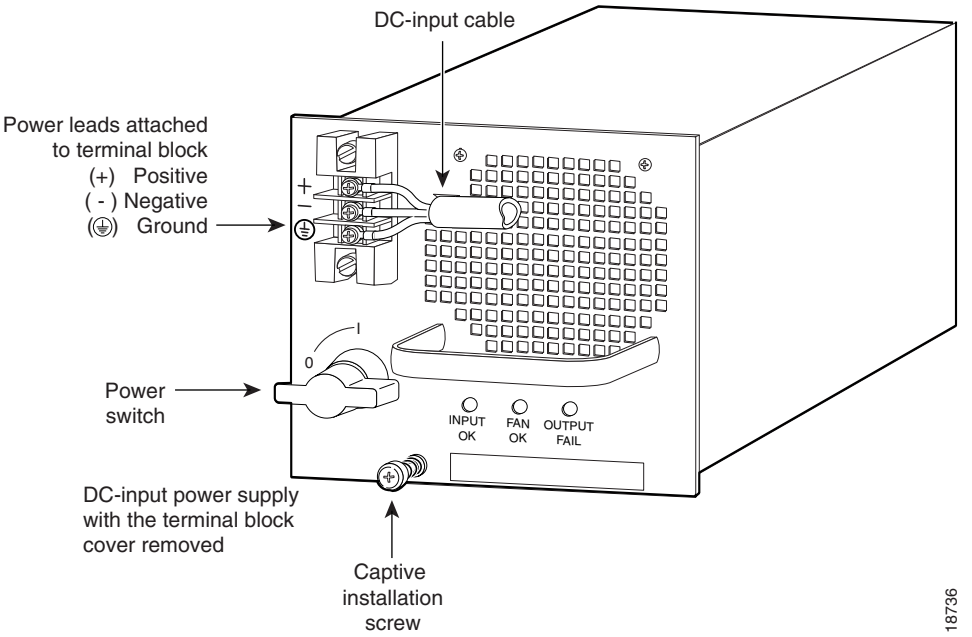


Step 4 Disconnect the DC-input wires from the terminal block (see Figure 5-4) in the following order:

- Positive (+)
- Negative (–)
- Ground

Warning **When installing the unit, the ground connection must always be made first and disconnected last.**

Figure 5-4 DC-Input Wire Connections on the Terminal Block

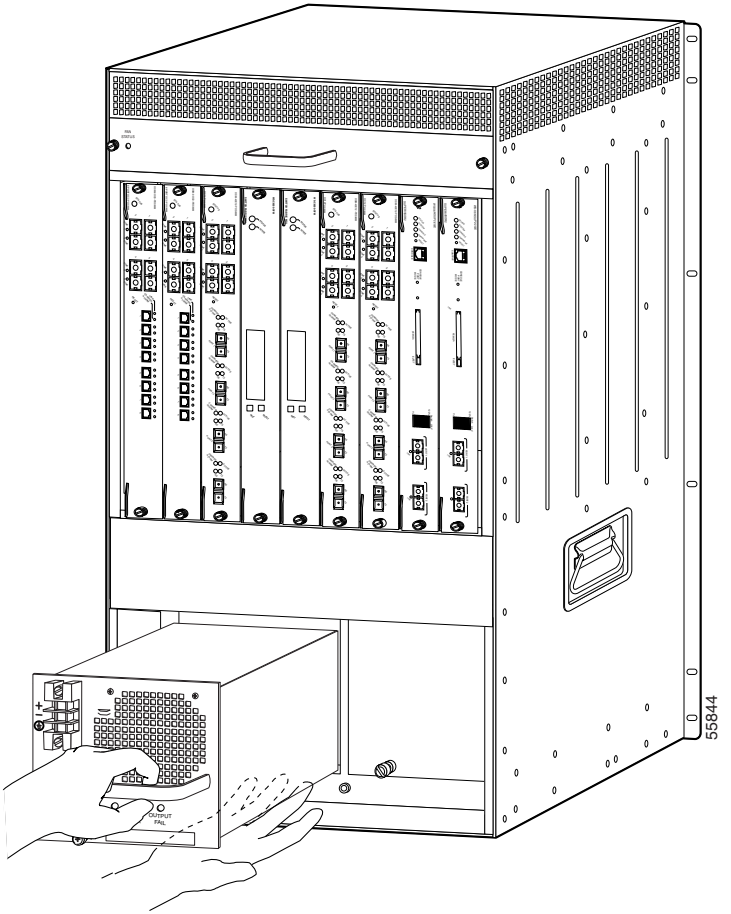


Step 5 Loosen the captive installation screw on the power supply. (See Figure 5-4.)

Caution Use both hands to install and remove power supplies. Each Cisco 7609 Internet Router DC-input power supply weighs between 22 pounds (9.9 kg) and 28 pounds (12.6 kg).

Step 6 Grasp the power supply handle with one hand and slide the power supply halfway out of the chassis. Place your other hand underneath the power supply, as shown in Figure 5-5, and slide the power supply completely out of the chassis. Set the power supply aside.

Figure 5-5 Handling a DC-Input Power Supply



Step 7 If the power supply bay is to remain empty, install a blank power supply filler plate (Cisco part number 700-03104-01) over the opening, and secure it with the captive installation screw.

Installing a DC-Input Power Supply

Warning **Before performing any of the following procedures, ensure that power is removed from the DC circuit. To ensure that all power is OFF, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the OFF position, and tape the switch handle of the circuit breaker in the OFF position.**

Note You must isolate the DC return connection from the system frame and chassis.

Follow these steps to install a DC-input power supply:

Step 1 Ensure that the system (earth) ground connection has been made. For ground connection installation instructions, see the "System Ground Connection" section on page 3-12.

Step 2 Verify that power is off to the DC circuit on the power supply you are installing.

Step 3 Verify that the power switch is in the Off (0) position on the power supply you are installing. (See Figure 5-3.)

Caution Use both hands to install and remove power supplies. Each Cisco 7609 Internet Router DC-input power supply weighs between 22 pounds (9.9 kg) and 28 pounds (12.6 kg).

Step 4 Grasp the power supply handle with one hand and place your other hand underneath the power supply. Slide the power supply into the power supply bay. Make sure that the power supply is fully seated in the bay. (See Figure 5-5.)

Step 5 Tighten the power supply captive installation screw. (See Figure 5-3.)

Step 6 Remove the two screws securing the terminal block cover and slide the cover off of the terminal block. (See Figure 5-3.)

Step 7 Attach the appropriate lugs to the DC-input wires. The maximum width of a lug is 0.300 inch (7.6 mm). The wire should be sized per local and national installation requirements. Use only copper wire.

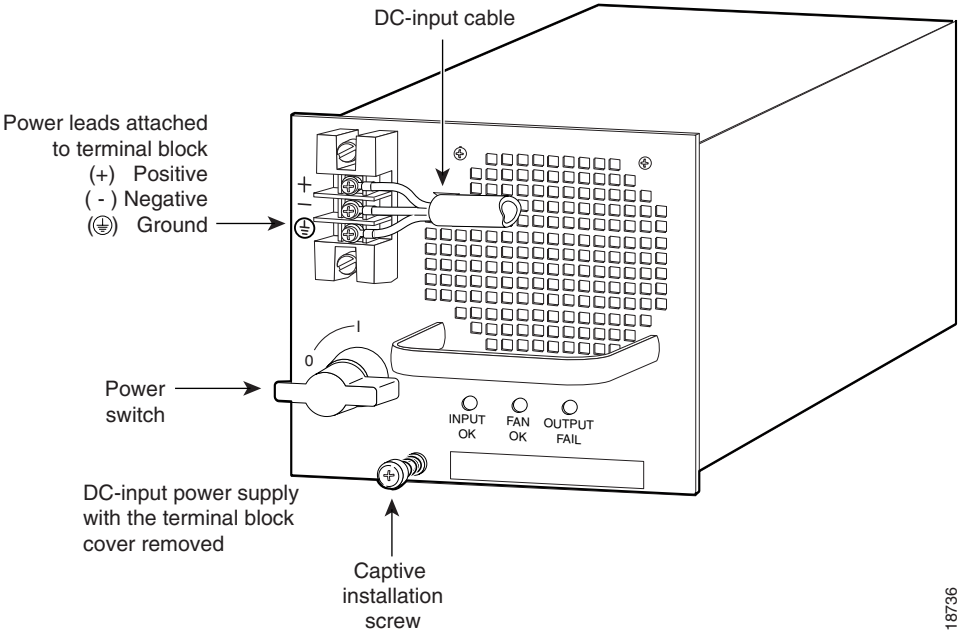
Note For 2500W power supplies, use 90-degree C copper conductors for North American installations.

Step 8 Connect the DC-input wires to the terminal block (see Figure 5-6) in the following order:

- Ground
- Negative (–)
- Positive (+)

Warning **When installing the unit, the ground connection must always be made first and disconnected last.**

Figure 5-6 DC-Input Power Supply Connectors



Step 9 After ensuring that all wire connections are secure, reinstall the terminal block cover.

Caution To prevent a short circuit or shock hazard after wiring the DC-input power supply, reinstall the terminal block cover.

Caution In a system with dual power supplies, connect each power supply to a separate input line. In case of a line failure, the second source will most likely still be available.

Step 10 Remove the tape from the circuit breaker switch handle and restore power by moving the circuit breaker switch handle to the On (|) position.

Step 11 Turn the power switch to the On (|) position on the power supply. Turning the power switch on also engages a pawl that locks the power supply in the chassis.

Step 12 Verify power supply operation by checking that the power supply front panel LEDs are in the following states:

- INPUT OK LED is green
- FAN OK LED is green
- OUTPUT FAIL LED is not lit

If the LEDs indicate a power problem, see the "Identifying Startup Problems" section on page 4-3.

Removing and Replacing the Fan Assembly

This section describes how to remove and replace fan assemblies for the Cisco 7609 Internet Router. A flat-blade or number 2 Phillips-head screwdriver is required to perform this procedure.

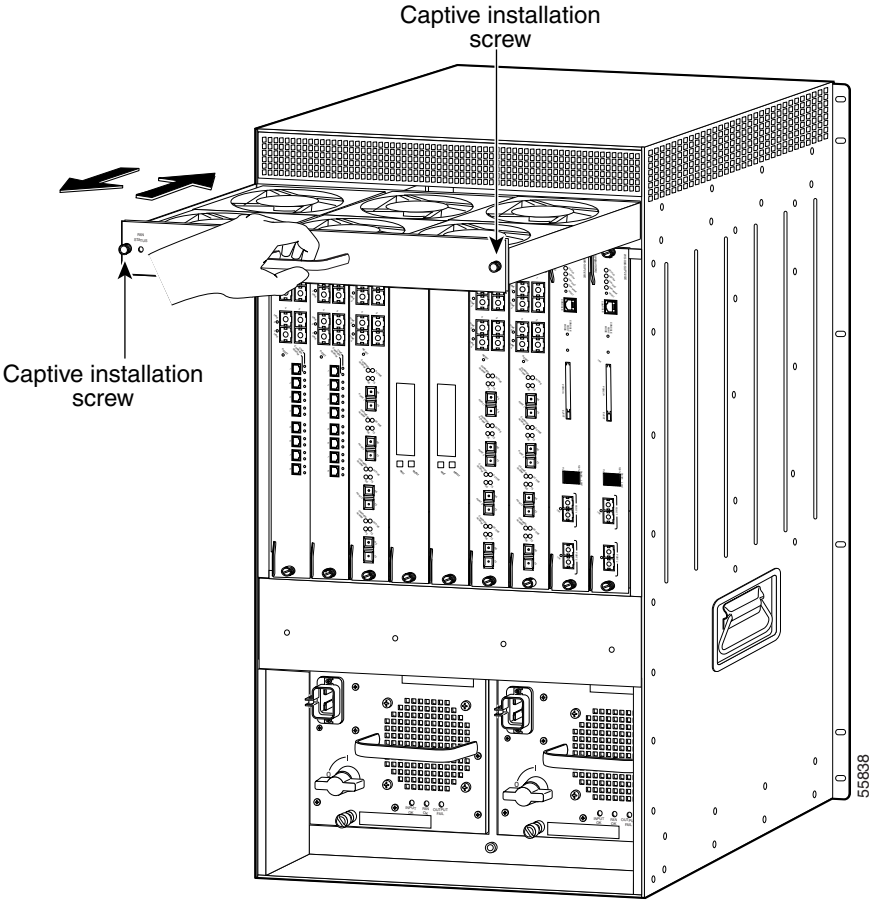
Removing the Fan Assembly

The fan assembly is designed to be removed and replaced while the system is operating without presenting an electrical hazard or damage to the system.

Perform these steps to remove the existing fan assembly:

Step 1 Locate the fan assembly located above the card cage. (See Figure 5-7.)

Figure 5-7 Fan Assembly



Step 2 Loosen the two captive installation screws by turning them counterclockwise.

Step 3 Grasp the fan assembly with both hands and pull it outward; rock it gently if necessary to unseat the power connector from the backplane.

Warning **When removing the fan tray, keep your hands and fingers away from the spinning fan blades. Let the fan blades completely stop before you remove the fan tray.**

Step 4 Pull the fan assembly clear of the chassis and place it in a safe place.

Installing the Fan Assembly

Perform these steps to install the new fan assembly:

Step 1 Hold the fan assembly with the fans facing down and the FAN STATUS LED on the left. (See Figure 5-7.)

Step 2 Place the fan assembly into the front chassis cavity so it rests on the chassis, and then lift the fan assembly up slightly, aligning the top and bottom chassis guides.

Step 3 Push the fan assembly into the chassis until the power connector seats in the backplane and the captive installation screws make contact with the chassis.

Step 4 Tighten the captive installation screws.

Checking the Installation

Perform these steps when checking the installation to verify that the new fan assembly is installed correctly:

Step 1 Listen for the fans; you should immediately hear them operating. If you do not hear them, ensure that the fan assembly is inserted completely in the chassis and the faceplate is flush with the switch back panel.

Step 2 Verify that the FAN STATUS LED is green. If the LED is red, one or more fans are faulty.

Step 3 If after several attempts the fans do not operate or you experience trouble with the installation (for instance, if the captive installation screws do not align with the chassis holes), contact a Cisco customer service representative for assistance.

Technical Specifications

Note This document describes the Cisco 7609 Internet Router (OSR-7609) and not the Cisco 7609 Internet Router (CISCO7609).

This appendix provides the technical specifications for the Cisco 7609 Internet Router (OSR-7609):

Refer to the *Cisco 7600 Series Internet Router Module Installation Guide* for module and interface port specifications.

Cisco 7609 Internet Router

The Cisco 7609 Internet Router (OSR-7609) specifications are provided in Table A-1.

Table A-1 Cisco 7609 Internet Router Specifications

Item	Specification
Environmental	
Temperature, ambient operating	32°F (0°C) to 104°F (40°C)
Temperature, ambient nonoperating and storage	–40°F (–40°C) to 158°F (70°C)
Humidity (RH), ambient (noncondensing) operating	10% to 90%
Humidity (RH), ambient (noncondensing) nonoperating and storage	5% to 95%
Altitude, operating	Sea level to 6500 feet (2000 m)
Physical Characteristics	
Dimensions (H x W x D)	33.5 x 17.25 x 18.1 inches (85.1 x 43.1 x 46 cm)
Weight	Chassis only: 55 lb (24.9 kg) Chassis fully configured with 1 supervisor engine, 8 modules, and 2 AC-input power supplies: 135 lb (61.2 kg)
Power Supply	2500W AC- or DC-input or 4000W AC-input power supply. An optional second power supply can be installed in the chassis.
Airflow	200 lfm[1] through system fan assembly

1. lfm = linear feet per minute

Cisco 7609 Internet Router Power Supplies

Table A-2 lists the specifications for the Cisco 7609 Internet Router power supplies.

Table A-2 Cisco 7609 Internet Router Power Supply Specifications

Item	Specification
2500W AC- and DC-input Power Supplies	
AC-input type	Autoranging input with power factor corrector.
AC-input voltage	100 to 120 VAC, 200 to 240 VAC (±10% for full range).
AC-input current	16A maximum at 200 VAC at 2500W output. 16A maximum at 100 VAC at 1300W output.
AC-input frequency	50/60 Hz (nominal) (±3% for full range).
Power supply output capacity	1300W maximum (100–120 VAC). 2500W maximum (200–240 VAC or –48 to –60 VDC).
System power dissipation	3520W (total input power) or 3.6 KVA (high-line operation).
DC-input voltage	–48 VDC to –60 VDC continuous.
DC-input current	80A
Power supply output (AC supply)	15A @ +3.3V, 5A @ +5V, 6A @ +12V, 27.5A @ +42V (100/120VAC).
	15A @ +3.3V, 5A @ +5V, 10A @ +12V, 55.5A @ +42V (200/240VAC).
Power supply output (DC supply)	15A @ +3.3V, 5A @ +5V, 10A @ +12V, 55.5A @ +42V.
DC input terminal block	Accepts 2–14 AWG copper conductors. Actual size of the wire needed is determined by the installer or local electrician. Terminal block material rated at 150°C.
Output holdup time	20 ms minimum (AC-input power supply).
	4 ms (DC-input power supply).

Table A-2 Cisco 7609 Internet Router Power Supply Specifications (continued)

Item	Specification
4000W AC-input Power Supply	
AC-input type	High-line input with power factor corrector, 30A single-phase circuit.
AC-input voltage	200 to 240 VAC (±10% for full range).
AC-input current	23A
Power supply output capacity	4000W maximum.
AC-input frequency	50/60 Hz (nominal) (±3% for full range).
KVA rating	5.4 kVA maximum.
Maximum output current	15A @ +3.3V, 5A @ +5V, 10A @ +12V, 91.20A @ +42V.
Output holdup time	20 ms minimum.

Regulatory Standards Compliance

The Cisco 7609 Internet Router complies with the regulatory standards listed in the *Regulatory Compliance and Safety Information for the Cisco 7600 Series Internet Routers* publication.

Connector and Cable Specifications

Note This document describes the Cisco 7609 Internet Router (OSR-7609) and not the Cisco 7609 Internet Router (CISCO7609).

This chapter describes the cables and connectors used with the Cisco 7609 Internet Router.

The chapter is divided into the following sections:

Warning **To reduce the risk of fire, use only No. 26 AWG or larger telecommunication line cord.**

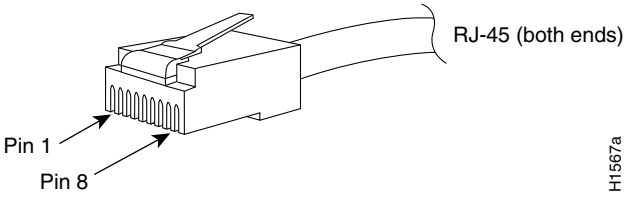
Connector Specifications

This section covers the types of connectors used with the Cisco 7609 Internet Router:

RJ-45

The RJ-45 connector (shown in Figure B-1) is used to connect a Category 3 or Category 5 foil twisted-pair or unshielded twisted-pair cable from the external network to the module interface connector.

Figure B-1 RJ-45 Interface Cable Connector

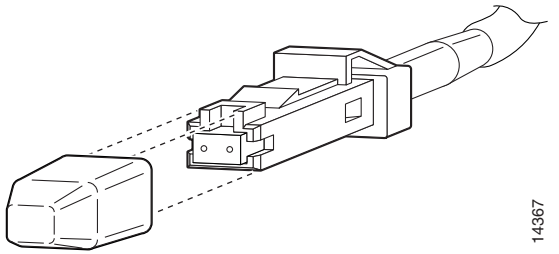


MT-RJ

Warning **Because invisible laser radiation may be emitted from the aperture of the port when no cable is connected, avoid exposure to laser radiation and do not stare into open apertures.**

The MT-RJ style connector, shown in Figure B-2, is used on fiber-optic modules to increase port density.

Figure B-2 MT-RJ Connector



When you are connecting MT-RJ cables to a module, make sure that 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.

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.

Always make sure that you insert the connector completely into the socket. This is especially important when you are making a connection between a module and a long distance (1.24 miles) (2 km) or a suspected highly attenuated network. If the link LED 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.

To clean the MT-RJ plug faceplate, perform these steps:

Step 1 Use a lint-free tissue soaked in 99 percent pure isopropyl alcohol to gently wipe the faceplate.

Step 2 Carefully wipe the faceplate with a dry lint-free tissue.

Step 3 Remove any residual dust from the faceplate with compressed air before installing the cable.

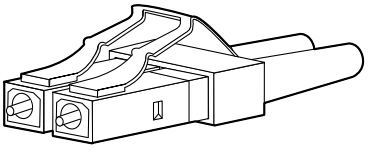
Note Make sure that dust caps are installed on all unused module connectors and unused network fiber-optic cable connectors.

LC

Warning **Because invisible laser radiation may be emitted from the aperture of the port when no cable is connected, avoid exposure to laser radiation and do not stare into open apertures.**

The LC fiber-optic connector, shown in Figure B-3, is used to connect the channelized OC-12 and OC-48 OSMs to optical networks using SMF.

Figure B-3 LC Fiber-Optic Connector

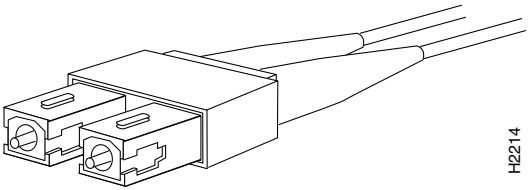


SC-Type

Warning **Because invisible laser radiation may be emitted from the aperture of the port when no cable is connected, avoid exposure to laser radiation and do not stare into open apertures.**

The SC-type fiber connector, shown in Figure B-4, is used to connect fiber-optic module ports with the external network.

Figure B-4 SC-Type Fiber-Optic Connector



Gigabit Interface Converters

Warning **Because invisible laser radiation may be emitted from the aperture of the port when no cable is connected, avoid exposure to laser radiation and do not stare into open apertures.**

A GBIC is a hot-swappable input/output device that plugs into a Gigabit Ethernet module, linking the module with the fiber-optic network. GBICs are available in two physical models and three optical models. The two physical models are shown in Figure B-5. The three optical models are listed in Table B-1.

Figure B-5 GBIC Physical Styles

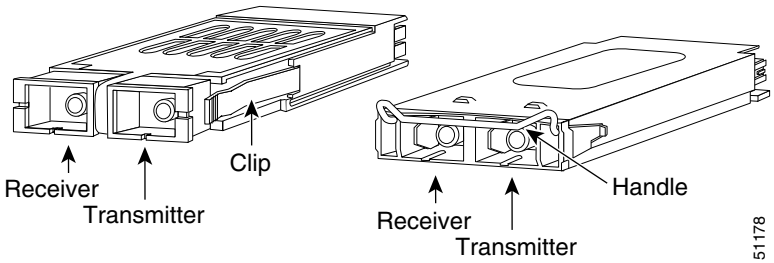


Table B-1 GBIC Optical Model List

GBIC	Product Number
Short wavelength (1000BASE-SX)	WS-G5484
Long wavelength/long haul (1000BASE-LX/LH)	WS-G5486
Extended distance (1000BASE-ZX)	WS-G5487

WS-G5484

The WS-G5484 GBIC (1000BASE-SX) operates on ordinary multimode fiber-optic link spans of up to 550 meters in length.

WS-G5486

The WS-G5486 GBIC (1000BASE-LX/LH) interfaces fully comply with the IEEE 802.3z 1000BASE-LX standard. However, their higher optical quality allows them to reach 10 km over single-mode fiber (SMF), versus the 5 km specified in the standard.

WS-G5487

The WS-G5487 GBIC (1000BASE-ZX) operates on ordinary single-mode fiber-optic link spans of up to 70 km in length. Link spans of up to 100 km are possible using premium single-mode fiber or dispersion-shifted single-mode fiber. (Premium single-mode fiber has a lower attenuation per unit length than ordinary single-mode fiber; dispersion-shifted single-mode fiber has both lower attenuation per unit length and less dispersion.)

The WS-G5487 GBIC must be coupled to single-mode fiber-optic cable, which is the type of cable typically used in long-haul telecommunications applications. The WS-G5487 GBIC will not operate correctly when coupled to multimode fiber, and it is not intended to be used in application environments (e.g., building backbones or horizontal cabling) where multimode fiber is frequently used.

The WS-G5487 GBIC is intended to be used as a physical medium dependent (PMD) component for Gigabit Ethernet interfaces, as found on various switch and router products. It will operate at a signaling rate of 1250 MBaud, transmitting and receiving 8B/10B encoded data.

When shorter distances of single-mode fiber are used, you might need to insert an in-line optical attenuator in the link to avoid overloading the receiver:

- Insert a 10-dB in-line optical attenuator between the fiber-optic cable plant and the receiving port on the WS-G5487 GBIC at each end of the link whenever the fiber-optic cable span is less than 25 km.
- Insert a 5-dB in-line optical attenuator between the fiber-optic cable plant and the receiving port on the WS-G5487 GBIC at each end of the link whenever the fiber-optic cable span is equal to or greater than 25 km and less than 50 km.

GBICs use an SC-type connector to link the module to the fiber-optic cable.

Cable Specifications

The Cisco 7609 Internet Router comes with an accessories box 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. The accessories box 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")

The cable and adapters are the same cable and adapters that ship with the Cisco 2500 series routers and other Cisco products.

Console Port Mode Switch

The supervisor engine front-panel console port mode switch allows you to connect a terminal or modem to the console port as follows:

Note Use a ballpoint pen tip or other small, pointed object to access the console port mode switch. The switch is shipped in the *in* position.

- Mode 1—Switch in the *in* position. Use this mode to connect a terminal to the console port using the RJ-45-to-RJ-45 rollover cable and DTE adapter (labeled "Terminal").

  You can also use this mode to connect a modem to the console port using the RJ-45-to-RJ-45 rollover cable and DCE adapter (labeled "Modem").

  See the "Console Port Mode 1 Signaling and Pinouts" section on page B-9.

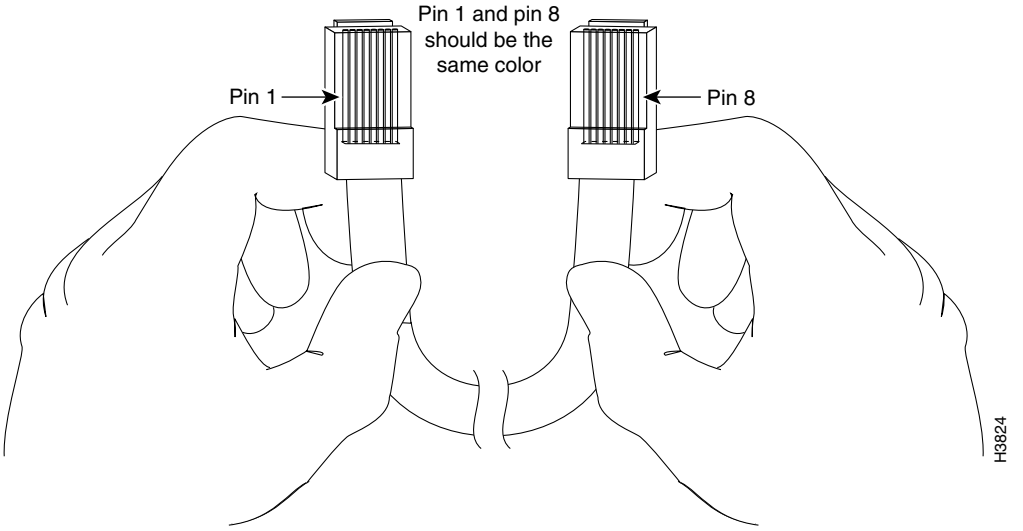
- Mode 2—Switch in the *out* position. Use this mode to connect a terminal to the console port using the Catalyst 5000 family Supervisor Engine III console cable and appropriate adapter for the terminal connection (cable and adapter are not provided).

  See the "Console Port Mode 2 Signaling and Pinouts" section on page B-12.

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-6.) If your cable was purchased from Cisco Systems, pin 1 will be white on one connector, and pin 8 will be white on the other. (A rollover cable reverses pins 1 and 8, 2 and 7, 3 and 6, and 4 and 5.)

Figure B-6 Identifying a Rollover Cable



Console Port Mode 1 Signaling and Pinouts

This section provides the signaling and pinouts for the console port in mode 1 (port mode switch in the *in* position).

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-2 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-2 Port Mode 1 Signaling and Pinouts (DB-9 Adapter)

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-3 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-3 Port Mode 1 Signaling and Pinouts (DB-25 Adapter)

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-4 lists the pinouts for the asynchronous serial auxiliary port, the RJ-45-to-RJ-45 rollover cable, and the RJ-45-to-DB-25 male DCE adapter.

Table B-4 Port Mode 1 Signaling and Pinouts (Modem Adapter)

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

Table B-4 Port Mode 1 Signaling and Pinouts (Modem Adapter) (continued)

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**
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

This section provides the signaling and pinouts for the console port in mode 2 (port mode switch in the *out* position). (See Table B-5 for the pinouts.)

Table B-5 Port Mode 2 Signaling and Pinouts (Port Mode Switch Out)

Console Port	Console Device
Pin (signal)	**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.

Mode-Conditioning Patch Cord

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

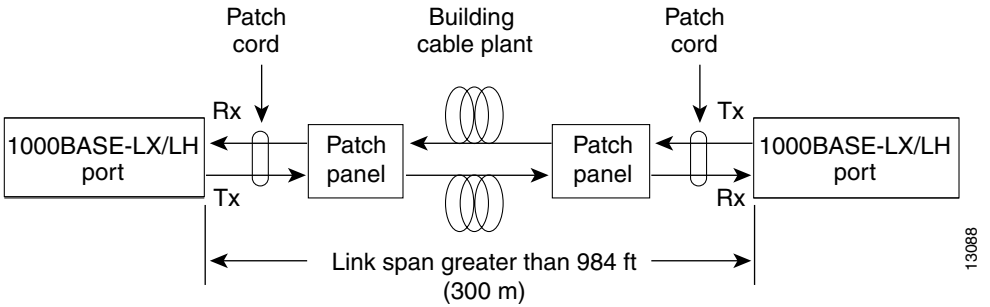
Note We do not recommend using the LX/LH GBIC and MMF without the patch cord for very short link distances of 33 to 328 feet (10 to 100 meters). The result could be an elevated bit error rate (BER).

The patch cord is required to comply with IEEE standards. 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 patch cord. At the output of the patch cord, the LX/LH GBIC complies with the IEEE 802.3z standard for 1000BASE-LX.

Patch Cord Configuration Example

Figure B-7 shows a typical patch cord configuration.

Figure B-7 Patch Cord Configuration

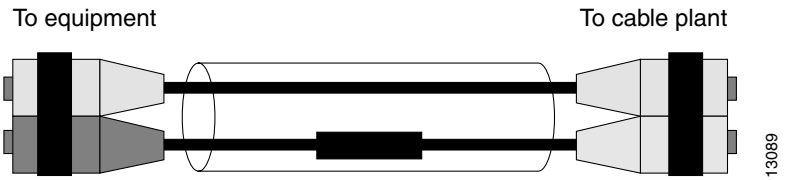


Patch Cord Installation

Warning **Because invisible laser radiation may be emitted from the aperture of the port when no cable is connected, avoid exposure to laser radiation and do not stare into open apertures.**

Plug the end of the patch cord labeled "To Equipment" into the GBIC. (See Figure B-8.) 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-type male connectors at each end.

Figure B-8 Patch Cord Installation



Differential Mode Delay

When an unconditioned laser source designed for operation on an SMF cable is directly coupled to an MMF cable, differential mode delay (DMD) might occur. DMD can degrade the modal bandwidth of the fiber-optic cable. This degradation causes a decrease in the link span (the distance between the transmitter and the receiver) that can be reliably supported.

The Gigabit Ethernet specification (IEEE 802.3z) outlines parameters for Ethernet communications at a gigabit-per-second rate. The specification offers a higher-speed version of Ethernet for backbone and server connectivity using existing deployed MMF cable by defining the use of laser-based optical components to propagate data over MMF cable.

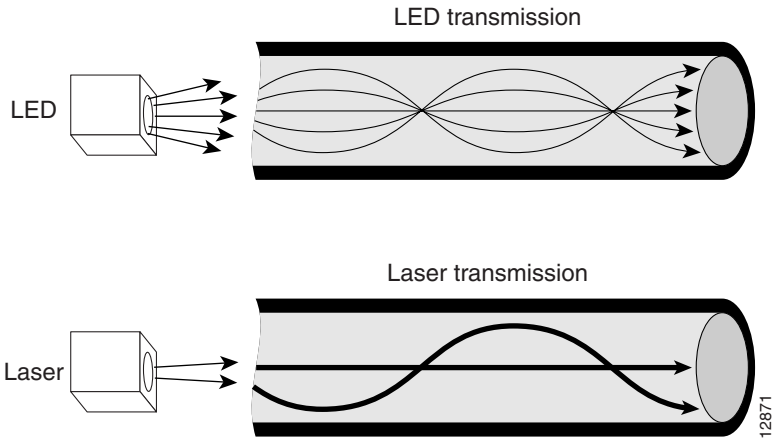
Lasers function at the baud rates and longer distances required for Gigabit Ethernet. The 802.3z Gigabit Ethernet Task Force has identified the DMD condition that occurs with particular combinations of lasers and MMF cable. The results create an additional element of jitter that can limit the reach of Gigabit Ethernet over MMF cable.

With DMD, a single laser light pulse excites a few modes equally within an MMF cable. These modes, or light pathways, then follow two or more different paths. These paths might have different lengths and transmission delays as the light travels through the cable. With DMD, a distinct pulse propagating down the cable no longer remains a distinct pulse or, in extreme cases, might become two independent pulses. Strings of pulses can interfere with each other making it difficult to recover data.

DMD does not occur in all deployed fibers; it occurs with certain combinations of worst-case fibers and worst-case transceivers. Gigabit Ethernet experiences this problem because of its very high baud rate and its long MMF cable lengths. SMF cable and copper cable are not affected by DMD.

MMF cable has been tested for use only with LED sources. LEDs can create an *overfilled launch condition* within the fiber-optic cable. The overfilled launch condition describes the way LED transmitters couple light into the fiber-optic cable in a broad spread of modes. Similar to a light bulb radiating light into a dark room, the generated light that shines in multiple directions can overfill the existing cable space and excite a large number of modes. (See Figure B-9.)

Figure B-9 LED Transmission Compared to Laser Transmission



Lasers launch light in a more concentrated fashion. A laser transmitter couples light into only a fraction of the existing modes or optical pathways present in the fiber-optic cable. (See Figure B-9.)

The solution is to condition the laser light launched from the source (transmitter) so that it spreads the light evenly across the diameter of the fiber-optic cable, making the launch look more like an LED source to the cable. The objective is to scramble the modes of light to distribute the power more equally in all modes and prevent the light from being concentrated in just a few modes.

An unconditioned launch, in the worst case, might concentrate all of its light in the center of the fiber-optic cable, exciting only two or more modes equally.

A significant variation in the amount of DMD is produced from one MMF cable to the next. No reasonable test can be performed to survey an installed cable plant to assess the effect of DMD. Therefore, you must use the mode-conditioning patch cords for all uplink modules using MMF when the link span exceeds 984 feet (300 meters). For link spans less than 300 meters, you can omit the patch cord (although there is no problem using it on short links).

For link spans less than 984 feet (300 meters), you can omit the patch cord. (We do not recommend using the LX/LH GBIC and MMF without a patch cord for very short link distances of 33 to 328 feet (10 to 100 meters.) The result could be an elevated bit error rate [BER]).

APPENDIX C

Repacking the Cisco 7609 Internet Router

Note This document describes the Cisco 7609 Internet Router (OSR-7609) and not the Cisco 7609 Internet Router (CISCO7609).

If you need to return or move the Cisco 7609 Internet Router (OSR-7609) chassis, follow these steps to repack the chassis using the original packaging material:

Step 1 Set the chassis in the bottom pallet. (See Figure C-1.)

Step 2 Place the packing bag over the chassis.

Step 3 Place the front-packing material and power supply packing material around the chassis.

Step 4 Place the power supplies in the spaces provided in the power supply packing material. (See Figure C-1.)

Step 5 Place the top-packing material over the top of the chassis and power supplies.

Step 6 Place the rack-mount kit and the accessories box on the top-packing material.

Note You must include the accessories box for the final packaging to fit properly.

Step 7 Place the outside carton over the entire package.

Step 8 Fold the outside carton down over the top and seal with packing tape.

Step 9 Wrap three packing straps tightly around the top and bottom of the package to hold the outside carton and the bottom pallet together. (See Figure C-2.)

Figure C-1 Packing Material

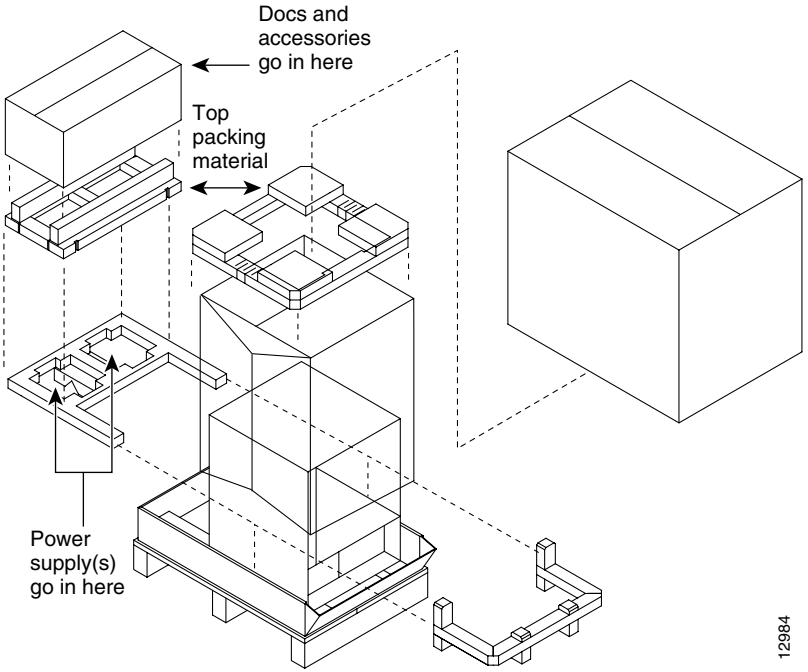
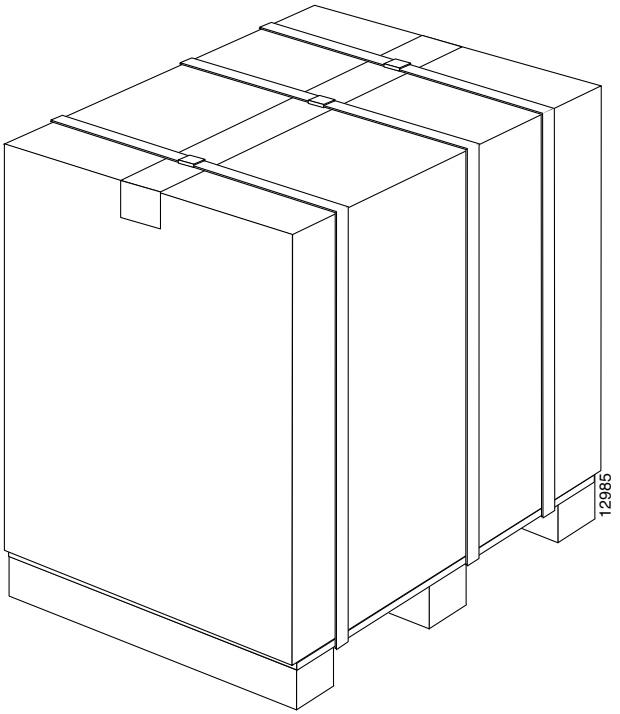
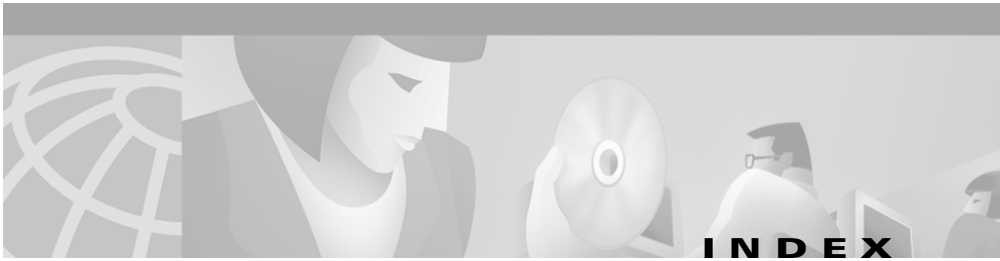


Figure C-2 Final Package



Note Do not use tape to hold the outside carton to the bottom pallet. Packing straps must be added to hold the entire package together and to add strength to the package.



Numerics

A

B

C

D

E

F

G

H

I

L

M

O

P

R

S

T

V

W