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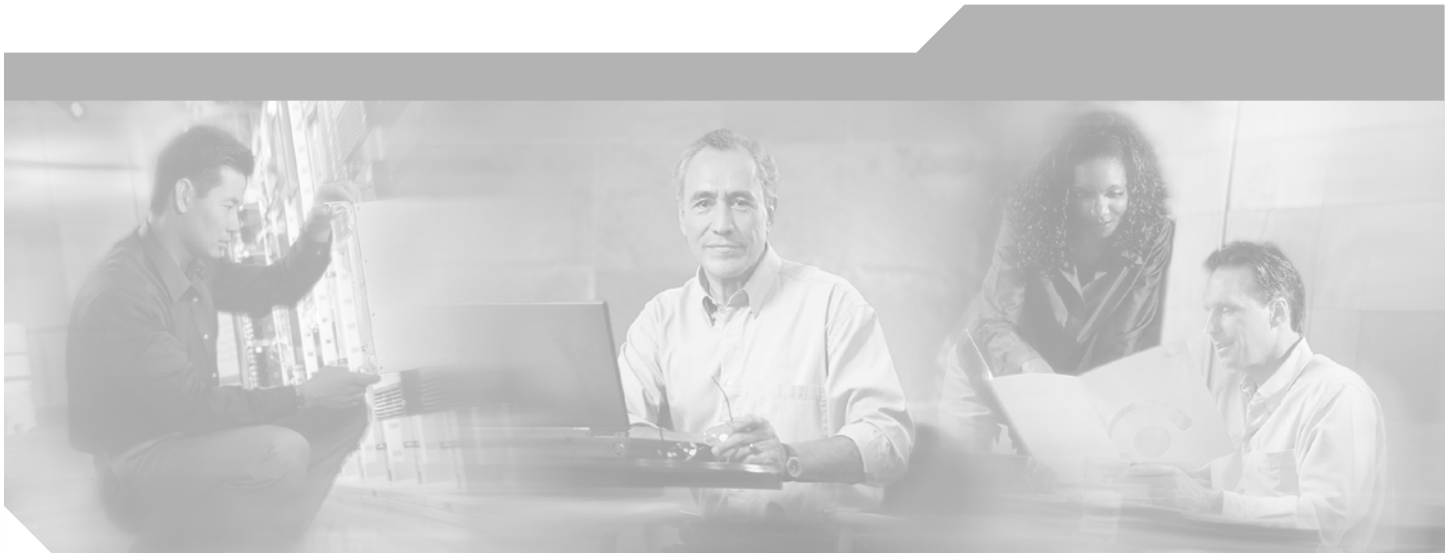

Cisco MDS 9500 Series Hardware Installation Guide

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Cisco MDS 9500 Series Hardware Installation Guide

CONTENTS

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New and Changed Information

This *Cisco MDS 9500 Series Hardware Installation Guide*applies to all the Cisco MDS SAN-OS releases.

Table 1 lists the new and changed features available with each supported Cisco MDS SAN-OS release for the Cisco MDS 9500 Series, with the latest release first.

Table 1 Documented Features for the Cisco MDS 9500 Series Hardware Installation Guide

Feature	Description	Changed in Release	Where Documented
Cisco MDS 9513 Multilayer Director	Added Cisco MDS 9513 Multilayer Director. The chassis consists of 13 horizontal slots, where slots 1 to 6 and slots 9 to 13 are reserved for switching, services, and IPS modules, and slots 7 and 8 are for supervisor-2 modules only.	3.0(1)	The "Chassis" section on page 1-2 and the "Installing the Cisco MDS 9513 Director in a Rack" section on page 2-7.
Supervisor-2 module	Added Supervisor-2 module. Supervisor-2 modules can be used in the Cisco MDS 9509 and 9506 Director in slots 5 and 6. Dual Supervisor-2 modules must be used in slots 7 and 8 of the Cisco MDS 9513 Director.	3.0(1)	The "Supervisor-2 Modules" section on page 1-13.
48-port 4-Gbps Fibre Channel switching module	Added 48-port 4-Gbps Fibre Channel switching module. The switching module offers 48 autosensing 1-, 2-, and 4-Gbps Fibre Channel ports and can be used in any of the Cisco MDS 9500 Series chassis and in the Cisco MDS 9216i and 9216A Switches.	3.0(1)	The "48-port 4-Gbps Fibre Channel Switching Module" section on page 1-27 and Appendix B, "Technical Specifications".
24-port 4-Gbps Fibre Channel switching module	Added 24-port 4-Gbps Fibre Channel switching module. The switching module offers 24 autosensing 1-, 2-, and 4-Gbps Fibre Channel ports and can be used in any of the Cisco MDS 9500 Series chassis and in the Cisco MDS 9216i and 9216A Switches.	3.0(1)	The "24-port 4-Gbps Fibre Channel Switching Module" section on page 1-28 and Appendix B, "Technical Specifications".

Table 1 Documented Features for the Cisco MDS 9500 Series Hardware Installation Guide

Feature	Description	Changed in Release	Where Documented
12-port 4-Gbps Fibre Channel switching modulee	Added 12-port 4-Gbps Fibre Channel switching module. The switching module can be used in any of the Cisco MDS 9500 Series chassis and in the Cisco MDS 9216i and 9216A Switches.	3.0(1)	The "12-port 4-Gbps Fibre Channel Switching Module" section on page 1-29 and Appendix B, "Technical Specifications".
4-port 10-Gbps Fibre Channel switching module	Added 4-port 10-Gbps Fibre Channel switching module. The switching module offers four dedicated bandwidth Fibre Channel ports running at 10 Gbps with no oversubscription.	3.0(1)	The "4-port 10-Gbps Fibre Channel Switching Module" section on page 1-30 and Appendix B, "Technical Specifications".
Crossbar modules	Added crossbar modules. The Cisco MDS 9513 Director supports two crossbar modules located at the rear of the chassis. Each supervisor-2 module has an associated crossbar module.	3.0(1)	The "Crossbar Modules" section on page 1-22 and "Removing and Installing a Crossbar Module" section on page 2-47.
X2 transceiver	Added the X2 transceiver information. The X2 transceiver is a small form-factor pluggable optimized for 10-Gbps applications.	3.0(1)	The "X2 Transceivers" section on page 1-45 and the "X2 Transceiver Specifications" section on page 15.
Fibre Channel SFP transceiver	Added 4-Gbps Fibre Channel SFP trans-ceiver..	3.0(1)	The "Fibre Channel SFP Transceivers" section on page 1-45 and the "SFP Transceiver Specifications" section on page B-16.
3000W Power Supply for the Cisco MDS 9509 Director	Added 3000W Power Supply for the Cisco MDS 9509 Director.	3.0(1)	The "Cisco MDS 9509 Power Supplies" section on page 1-8, "Installing an AC Power Supply in the Cisco MDS 9509 Director" section on page 2-57, and the "Specifications for the Cisco MDS 9509 Power Supplies" section on page B-8
Gigabit Ethernet SFP transceiver	Added Gigabit Ethernet SFP trans-ceiver.	Not release specific	The "Supported Transceivers" section on page 1-45 and the "SFP Transceiver Specifications" section on page B-16.
32-port Fibre Channel Storage Services Module (SSM)	Added 32-port Fibre Channel Storage Services Module (SSM).	2.0(2b)	The "32-Port Fibre Channel Storage Services Module" section on page 1-39.

Table 1 Documented Features for the Cisco MDS 9500 Series Hardware Installation Guide

Feature	Description	Changed in Release	Where Documented
14/2-port Multiprotocol Services (MPS-14/2) module	Provided FCIP, iSCSI, and Fibre Channel capability in a multiprotocol module.	2.0(1b)	The "14/2-Port Multiprotocol Services Module" section on page 1-33.
Clock module installation	Added installation procedure for clock modules.	Not release specific	The "Removing and Installing Clock Modules" section on page 2-76.
9500 Shelf Kit	Added optional shelf bracket kit for the Cisco MDS 9509 Director.	Not release specific	The "Cisco MDS 9500 Shelf Bracket" section on page A-11.
4-port IP Storage Services (IPS-4) module	Provided FCIP services and iSCSI services capability in a 4-port Gigabit Ethernet module.	1.3(4a)	The "IP Storage Services Modules" section on page 1-35.
Jumper power cord	Added jumper power cord available for use in a cabinet.	Not release specific	The "Jumper Power Cord" section on page C-12.
Installation	Modified Cisco MDS 9509 installation options.	Not release specific	The "Installation Options" section on page 2-2.
Power supplies	Added information on Cisco MDS 9509 power supplies.	Not release specific	The "Installing the Cisco MDS 9509 Director in a Rack" section on page 2-11.
Installation of SFP transceivers	Added instructions for installation and removal of SFP transceivers and cables.	Not release specific	The "Removing, Installing, and Verifying Supervisor, Switching, and Services Modules" section on page 2-38.
Additional UK power cable	Added United Kingdom power cable BS89/13, BS 1363/A, for use with 1900-W power supply.	Not release specific	The "Power Cords" section on page C-8.
Caching Services Module (CSM)	Added virtualization services for reallocating physical resources as virtual resources.	1.3(1)	The "32-Port 2-Gbps Fibre Channel Switching Module" section on page 1-30.
Telco and EIA Shelf Bracket Kit	Allowed single-user installation and installation in a telco rack.	Not release specific	The "Cisco MDS 9000 Family Telco and EIA Shelf Bracket" section on page A-4.
Advanced Services Module (ASM)	Added support for up to 32 Fibre Channel ports, provided distributed intelligent storage services, and enabled virtualization.	1.2(2a)	The "32-Port Fibre Channel Advanced Services Module" section on page 1-37.
Console port to modem Connection	Added support for connecting the console port on the Cisco MDS 9500 Series to a modem.	1.2(2a)	The "Connecting to the Console Port" section on page 3-2.

Table 1 Documented Features for the Cisco MDS 9500 Series Hardware Installation Guide

Feature	Description	Changed in Release	Where Documented
COM1 port to modem Connection	Added support for connecting the COM1 port on the Cisco MDS 9500 Series to a modem.	1.2(1a)	The "Connecting to the COM1 Port" section on page 3-4.
Gigabit Ethernet and CWDM SFP transceivers	Added support for Gigabit Ethernet/Fibre Channel SFP transceivers and CWDM SFP transceivers.	1.1(1a)	The "Supported Transceivers" section on page 1-45.
8-port IP Storage Services (IPS-8) module	Provided FCIP services and iSCSI services capability in an 8-port Gigabit Ethernet module.	1.1(1a)	The "IP Storage Services Modules" section on page 1-35.
Cisco MDS 9506 Director	Added the Cisco MDS 9506 Director, a multilayer Fibre Channel switch that supports up to six modules.	1.1(1a)	This guide.
16-port Fibre Channel module	Added 16-port Fibre Channel hot-swappable switching module for use with the Cisco MDS 9500 Series.	1.0(2a)	The "Switching Modules" section on page 1-27.
32-port Fibre Channel module	Added 32-port Fibre Channel hot-swappable switching module for use with the Cisco MDS 9500 Series.	1.0(2a)	The "Switching Modules" section on page 1-27.
Cisco MDS 9509 Switch	Added the Cisco MDS 9509 Director, a multilayer Fibre Channel switch that supports up to nine modules.	1.0(2a)	This guide.

Preface

This preface describes the audience, organization, and conventions of the *Cisco MDS 9500 Series Hardware Installation Guide*. It also provides information on how to obtain related documentation.

Audience

To use this installation guide, you must be familiar with electronic circuitry and wiring practices and preferably be an electronic or electromechanical technician.

Organization

This guide is organized as follows:

Chapter	Title	Description
Chapter 1	Product Overview	Provides an overview of the Cisco MDS 9500 Series and its components.
Chapter 2	Installing the Cisco MDS 9500 Series	Describes how to install the Cisco MDS 9500 Series, including installing the chassis, modules, CompactFlash card, power supplies, and fan assembly.
Chapter 3	Connecting the Cisco MDS 9500 Series	Describes how to connect the Cisco MDS 9500 Series, including the modules.
Appendix A	Cabinet and Rack Installation	Provides guidelines for selecting an enclosed cabinet, and the procedure for installing a switch using the optional Telco and EIA Shelf Bracket Kit.
Appendix B	Technical Specifications	Lists the Cisco MDS 9500 Series switch specifications, and includes safety information, site requirements, and power connections.
Appendix C	Cable and Port Specifications	Lists cable and port specifications for the Cisco MDS 9500 Series switch.
Appendix D	Site Planning and Maintenance Records	Provides a site-planning checklist and sample maintenance and network records.

Conventions

This document uses the following conventions for notes, cautions, and safety warnings.

Notes and Cautions contain important information that you should be aware of.

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

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

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

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.**

Related Documentation

The documentation set for the Cisco MDS 9000 Family includes the following documents. To find a document online, use the Cisco MDS SAN-OS Documentation Locator at:
http://www.cisco.com/en/US/products/ps5989/products_documentation_roadmap09186a00804500c1.html.
For information on IBM TotalStorage SAN Volume Controller Storage Software for the Cisco MDS 9000 Family, refer to the IBM TotalStorage Support website:
http://www.ibm.com/storage/support/2062-2300/

Release Notes

- *Cisco MDS 9000 Family Release Notes for Cisco MDS SAN-OS Releases*
- *Cisco MDS 9000 Family Release Notes for Storage Services Interface Images*
- *Cisco MDS 9000 Family Release Notes for Cisco MDS SVC Releases*
- *Cisco MDS 9000 Family Release Notes for Cisco MDS 9000 EPLD Images*

Compatibility Information

- *Cisco MDS 9000 SAN-OS Hardware and Software Compatibility Information*
- *Cisco MDS 9000 Family Interoperability Support Matrix*
- *Cisco MDS SAN-OS Release Compatibility Matrix for IBM SAN Volume Controller Software for Cisco MDS 9000*
- *Cisco MDS SAN-OS Release Compatibility Matrix for Storage Service Interface Images*

Regulatory Compliance and Safety Information

- *Regulatory Compliance and Safety Information for the Cisco MDS 9000 Family*

Hardware Installation

- *Cisco MDS 9500 Series Hardware Installation Guide*
- *Cisco MDS 9200 Series Hardware Installation Guide*
- *Cisco MDS 9216 Switch Hardware Installation Guide*
- *Cisco MDS 9100 Series Hardware Installation Guide*
- *Cisco MDS 9020 Fabric Switch Hardware Installation Guide*

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Cisco Fabric Manager

- *Cisco MDS 9000 Family Fabric Manager Quick Configuration Guide*
- *Cisco MDS 9000 Family Fabric Manager Configuration Guide*
- *Cisco MDS 9000 Fabric Manager Online Help*
- *Cisco MDS 9000 Fabric Manager Web Services Online Help*

Command-Line Interface

- *Cisco MDS 9000 Family Software Upgrade and Downgrade Guide*
- *Cisco MDS 9000 Family CLI Quick Configuration Guide*
- *Cisco MDS 9000 Family CLI Configuration Guide*
- *Cisco MDS 9000 Family Command Reference*
- *Cisco MDS 9000 Family Quick Command Reference*
- *Cisco MDS 9020 Fabric Switch Configuration Guide and Command Reference*
- *Cisco MDS 9000 Family SAN Volume Controller Configuration Guide*

Troubleshooting and Reference

- *Cisco MDS 9000 Family Troubleshooting Guide*
- *Cisco MDS 9000 Family MIB Quick Reference*
- *Cisco MDS 9020 Fabric Switch MIB Quick Reference*
- *Cisco MDS 9000 Family SMI-S Programming Reference*
- *Cisco MDS 9000 Family System Messages Reference*
- *Cisco MDS 9020 Fabric Switch System Messages Reference*

Installation and Configuration Note

- *Cisco MDS 9000 Family SSM Configuration Note*
- *Cisco MDS 9000 Family Port Analyzer Adapter Installation and Configuration Note*

Obtaining Documentation

Cisco documentation and additional literature are available on Cisco.com. Cisco also provides several ways to obtain technical assistance and other technical resources. These sections explain how to obtain technical information from Cisco Systems.

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You can access international Cisco websites at this URL:

http://www.cisco.com/public/countries_languages.shtml

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Cisco Product Security Overview

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http://www.cisco.com/en/US/products/products_security_vulnerability_policy.html

From this site, you will find information about how to:

- Report security vulnerabilities in Cisco products.
- Obtain assistance with security incidents that involve Cisco products.
- Register to receive security information from Cisco.

A current list of security advisories, security notices, and security responses for Cisco products is available at this URL:

http://www.cisco.com/go/psirt

To see security advisories, security notices, and security responses as they are updated in real time, you can subscribe to the Product Security Incident Response Team Really Simple Syndication (PSIRT RSS) feed. Information about how to subscribe to the PSIRT RSS feed is found at this URL:

http://www.cisco.com/en/US/products/products_psirt_rss_feed.html

Reporting Security Problems in Cisco Products

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- For Emergencies only—security-alert@cisco.com

  An emergency is either a condition in which a system is under active attack or a condition for which a severe and urgent security vulnerability should be reported. All other conditions are considered nonemergencies.
- For Nonemergencies—psirt@cisco.com

In an emergency, you can also reach PSIRT by telephone:

- 1 877 228-7302
- 1 408 525-6532

Tip We encourage you to use Pretty Good Privacy (PGP) or a compatible product (for example, GnuPG) to encrypt any sensitive information that you send to Cisco. PSIRT can work with information that has been encrypted with PGP versions 2.*x* through 9.*x*.

Never use a revoked or an expired encryption key. The correct public key to use in your correspondence with PSIRT is the one linked in the Contact Summary section of the Security Vulnerability Policy page at this URL:

http://www.cisco.com/en/US/products/products_security_vulnerability_policy.html

The link on this page has the current PGP key ID in use.

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Access to all tools on the Cisco Technical Support & Documentation website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register at this URL:

http://tools.cisco.com/RPF/register/register.do

Note Use the Cisco Product Identification (CPI) tool to locate your product serial number before submitting a web or phone request for service. You can access the CPI tool from the Cisco Technical Support & Documentation website by clicking the **Tools & Resources** link under Documentation & Tools. Choose **Cisco Product Identification Tool** from the Alphabetical Index drop-down list, or click the **Cisco Product Identification Tool** link under Alerts & RMAs. The CPI tool offers three search options: by product ID or model name; by tree view; or for certain products, by copying and pasting **show** command output. Search results show an illustration of your product with the serial number label location highlighted. Locate the serial number label on your product and record the information before placing a service call.

Submitting a Service Request

Using the online TAC Service Request Tool is the fastest way to open S3 and S4 service requests. (S3 and S4 service requests are those in which your network is minimally impaired or for which you require product information.) After you describe your situation, the TAC Service Request Tool provides recommended solutions. If your issue is not resolved using the recommended resources, your service request is assigned to a Cisco engineer. The TAC Service Request Tool is located at this URL:

http://www.cisco.com/techsupport/servicerequest

For S1 or S2 service requests, or if you do not have Internet access, contact the Cisco TAC by telephone. (S1 or S2 service requests are those in which your production network is down or severely degraded.) Cisco engineers are assigned immediately to S1 and S2 service requests to help keep your business operations running smoothly.

To open a service request by telephone, use one of the following numbers:

Asia-Pacific: +61 2 8446 7411 (Australia: 1 800 805 227)
EMEA: +32 2 704 55 55
USA: 1 800 553-2447

For a complete list of Cisco TAC contacts, go to this URL:

http://www.cisco.com/techsupport/contacts

Definitions of Service Request Severity

To ensure that all service requests are reported in a standard format, Cisco has established severity definitions.

Severity 1 (S1)—An existing network is down, or there is a critical impact to your business operations. You and Cisco will commit all necessary resources around the clock to resolve the situation.

Severity 2 (S2)—Operation of an existing network is severely degraded, or significant aspects of your business operations are negatively affected by inadequate performance of Cisco products. You and Cisco will commit full-time resources during normal business hours to resolve the situation.

Severity 3 (S3)—Operational performance of the network is impaired, while most business operations remain functional. You and Cisco will commit resources during normal business hours to restore service to satisfactory levels.

Severity 4 (S4)—You require information or assistance with Cisco product capabilities, installation, or configuration. There is little or no effect on your business operations.

Obtaining Additional Publications and Information

Information about Cisco products, technologies, and network solutions is available from various online and printed sources.

- The *Cisco Product Quick Reference Guide* is a handy, compact reference tool that includes brief product overviews, key features, sample part numbers, and abbreviated technical specifications for many Cisco products that are sold through channel partners. It is updated twice a year and includes the latest Cisco offerings. To order and find out more about the Cisco Product Quick Reference Guide, go to this URL:

  http://www.cisco.com/go/guide

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- *Cisco Press* publishes a wide range of general networking, training and certification titles. Both new and experienced users will benefit from these publications. For current Cisco Press titles and other information, go to Cisco Press at this URL:

  http://www.ciscopress.com

- *Packet* magazine is the Cisco Systems technical user magazine for maximizing Internet and networking investments. Each quarter, Packet delivers coverage of the latest industry trends, technology breakthroughs, and Cisco products and solutions, as well as network deployment and troubleshooting tips, configuration examples, customer case studies, certification and training information, and links to scores of in-depth online resources. You can access Packet magazine at this URL:

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- *iQ Magazine* is the quarterly publication from Cisco Systems designed to help growing companies learn how they can use technology to increase revenue, streamline their business, and expand services. The publication identifies the challenges facing these companies and the technologies to help solve them, using real-world case studies and business strategies to help readers make sound technology investment decisions. You can access iQ Magazine at this URL:

  http://www.cisco.com/go/iqmagazine

  or view the digital edition at this URL:

  http://ciscoiq.texterity.com/ciscoiq/sample/

- *Internet Protocol Journal* is a quarterly journal published by Cisco Systems for engineering professionals involved in designing, developing, and operating public and private internets and intranets. You can access the Internet Protocol Journal at this URL:

  http://www.cisco.com/ipj

- Networking products offered by Cisco Systems, as well as customer support services, can be obtained at this URL:

  http://www.cisco.com/en/US/products/index.html

- Networking Professionals Connection is an interactive website for networking professionals to share questions, suggestions, and information about networking products and technologies with Cisco experts and other networking professionals. Join a discussion at this URL:

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CHAPTER 1

Product Overview

The Cisco MDS 9500 Multilayer Director elevates the standard for director-class switches. Providing industry-leading availability, scalability, security, and management, the Cisco MDS 9500 Series allows deployment of high-performance SANs with lowest total cost of ownership. Layering a rich set of intelligent features onto a high-performance, protocol-agnostic switch fabric, the Cisco MDS 9500 Series of Multilayer Directors addresses the stringent requirements of large data-center storage environments: uncompromisingly high availability, security, scalability, ease of management, and transparent integration of new technologies.

The Cisco MDS 9500 Series includes the Cisco MDS 9513 Director, the Cisco MDS 9509 Director, and the Cisco MDS 9506 Director, which all provide the following high availability features:

- Redundant Supervisor-2 modules with associated external crossbar modules for the Cisco MDS 9513 Director.
- Redundant Supervisor-2 modules with associated integrated crossbar modules for the Cisco MDS 9509 and 9506 Directors.
- Redundant Supervisor-1 modules with dual switching fabrics for the Cisco MDS 9509 and 9506 Directors.
- Optional hot-swappable switching or services modules.
- Switching module port interfaces that support field-replaceable, hot-swappable, form-factor pluggable X2 transceivers.
- Switching module port interfaces that support field-replaceable, hot-swappable, small form-factor pluggable (SFP) transceivers.
- Redundant and hot-swappable power supplies and fan modules.
- Power and cooling management and environmental monitoring.
- Nondisruptive code load and activation.
- Redundant and self-monitoring system clocks.

For more information about high availability features, redundant supervisor operation, and how to configure the Cisco MDS 9500 Series, refer to the *Cisco MDS 9000 Family CLI Configuration Guide* and the *Cisco MDS 9000 Family Fabric Manager Configuration Guide*.

The Cisco MDS 9500 Series supports the following hot-swappable, field-replaceable modules:

- 48-port 4-Gbps Fibre Channel switching module (DS-X9148)
- 24-port 4-Gbps Fibre Channel switching module (DS-X9124)
- 12-port 4-Gbps Fibre Channel switching module (DS-X9112)
- 4-port 10-Gbps Fibre Channel switching module (DS-X9704)
- 32-port 2-Gbps Fibre Channel switching module (DS-X9032)
- 16-port 2-Gbps Fibre Channel switching module (DS-X9016)
- 14/2-port Multiprotocol Services (MPS-14/2) module (DS-X9302-14K9)
- 8-port IP Storage Services (IPS-8) module (DS-X9308-SMIP)
- 4-port IP Storage Services (IPS-4) module (DS-X9304-SMIP)
- Storage Services Module (SSM) (DS-X9032-SSM)
- Advanced Services Module (ASM) (DS-X9032-SMV)
- Caching Services Module (CSM) (DS-X9560-SMC)

This chapter includes the following sections:

Chassis

This section describes the different chassis offerings in the Cisco MDS 9500 Series:

Cisco MDS 9513 Director

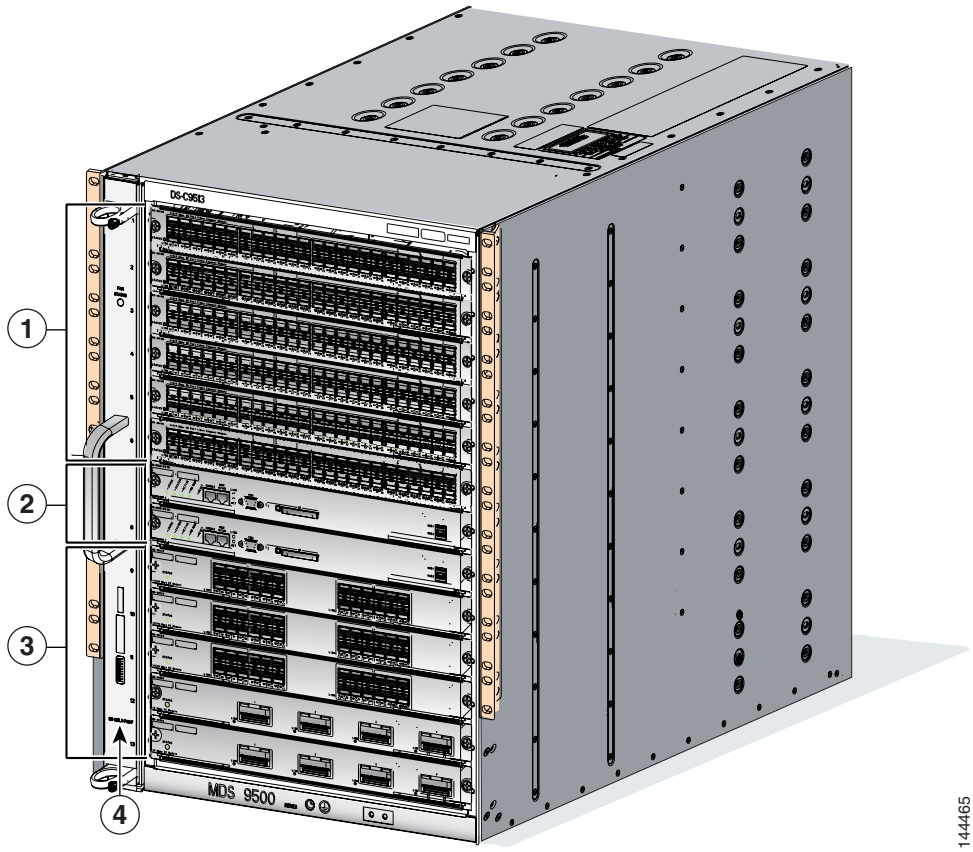
The Cisco MDS 9513 Director is a 13-slot Fibre Channel switch. The front panel consists of 13 horizontal slots, where slots 1 to 6 and slots 9 to 13 are reserved for switching and services modules only, and slots 7 and 8 are for Supervisor-2 modules only. A variable speed fan tray, with 15 individual fans, is located on the front left panel of the chassis.

The Cisco MDS 9513 Director uses a midplane. Modules exist on both sides of the plane. (See Figure 1-1.) The Cisco MDS 9513 Director supports the following:

- Two Supervisor-2 modules that reside in slots 7 and 8.
- Switching and storage services modules. (See the "Port Index Availability" section on page 1-23 for possible configurations.)
- One hot-swappable front panel fan tray with redundant individual fans.
- Two power supplies located at the rear of the chassis. The power supplies are redundant by default and can be configured to be combined if desired.
- Two crossbar modules located at the rear of the chassis.
- One hot-swappable fan module for the crossbar modules located at the rear of the chassis.
- Two hot-swappable clock modules located at the rear of the chassis.

Note The Cisco MDS 9513 Director does not support the Advanced Services Module (ASM) or the Caching Services Module (CSM).

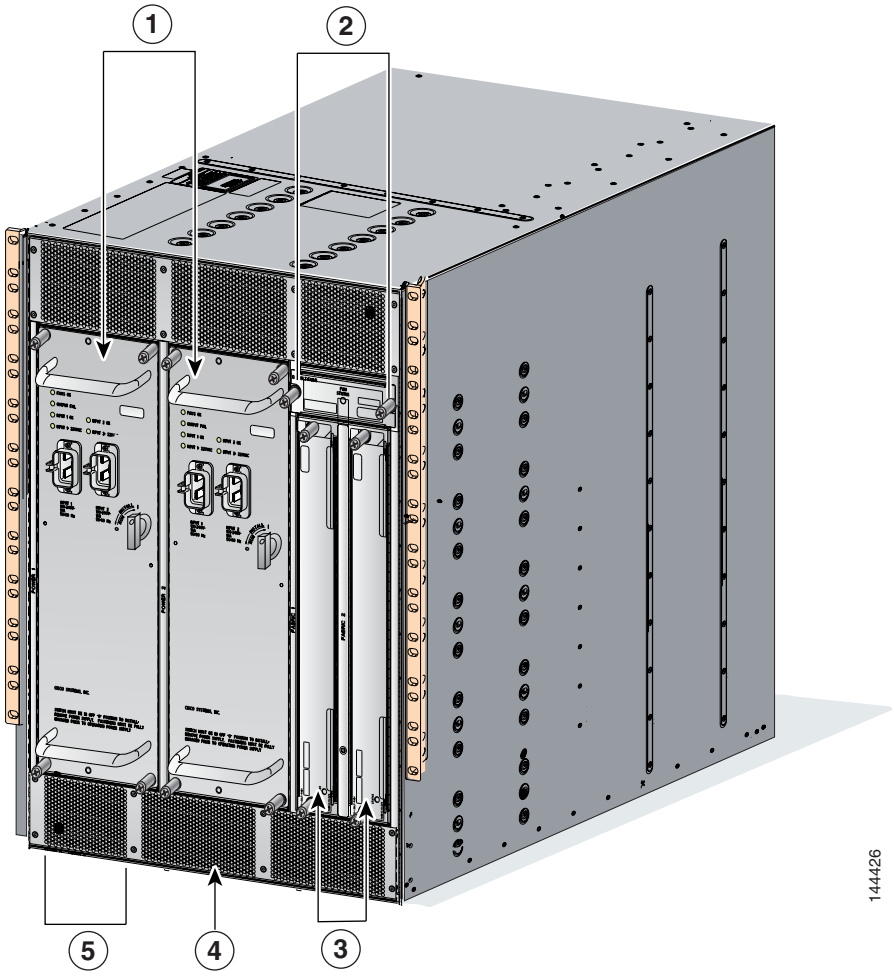
Figure 1-1 Cisco MDS 9513 Chassis Front Panel View



1	Switching or services modules in slots 1–6	3	Switching or services modules in slots 9–13
2	Supervisor-2 modules in slots 7 and 8	4	Fan tray

The rear of the chassis supports two vertical, redundant power supplies, two clock modules, two vertical, redundant, external crossbar modules, and a variable speed fan tray with two individual fans located above the crossbar modules. (See Figure 1-2.)

Figure 1-2 Rear Panel 9513 Chassis



1	Power supplies	**4**	Clock module[1]
2	crossbar module fans	**5**	Air vent panels
3	crossbar modules		

1. Clock modules are located inside the air vent panel. You must remove the air vent panel to access the clock modules.

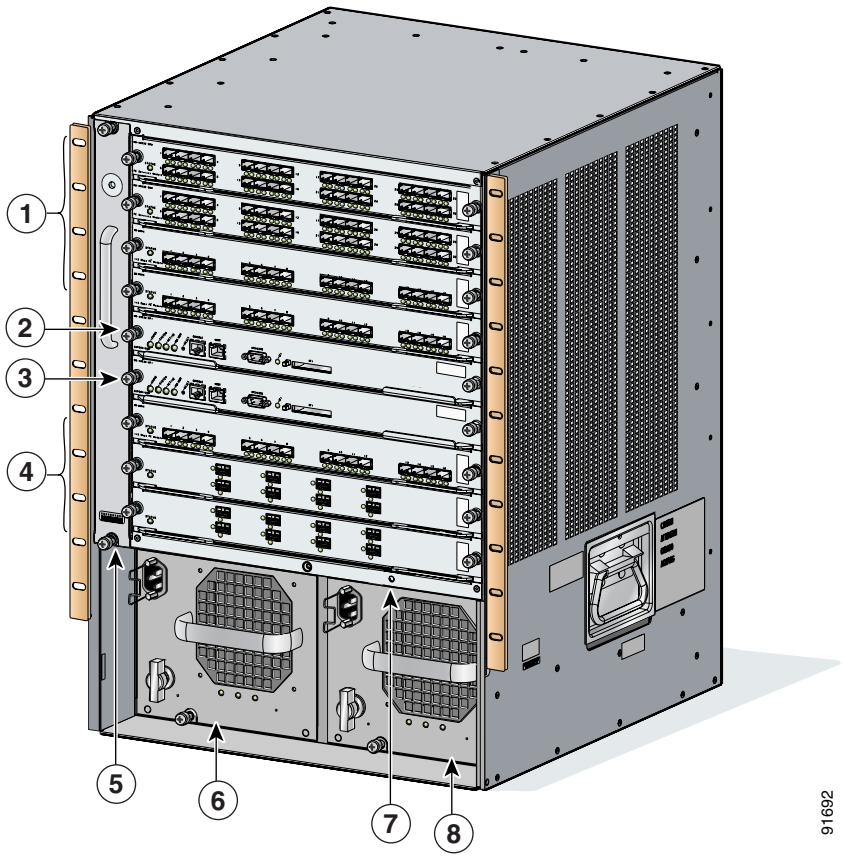
Cisco MDS 9509 Director

The Cisco MDS 9509 Director has a 9-slot chassis as shown in Figure 1-3, and it supports the following:

- Redundant Supervisor-2 modules with associated internal crossbar modules.
- Up to two Supervisor-1 modules that provide a switching fabric, plus a console port, COM1 port, and a MGMT 10/100 Ethernet port on each module. Slots 5 and 6 are reserved for the supervisor modules.

- Seven slots for optional modules that can include up to seven switching modules or six IPS modules.
- Two power supplies located in the front of the chassis. The power supplies are redundant by default and can be configured to be combined if desired.
- One hot-swappable fan module with redundant fans.

Figure 1-3 Cisco MDS 9509 Chassis



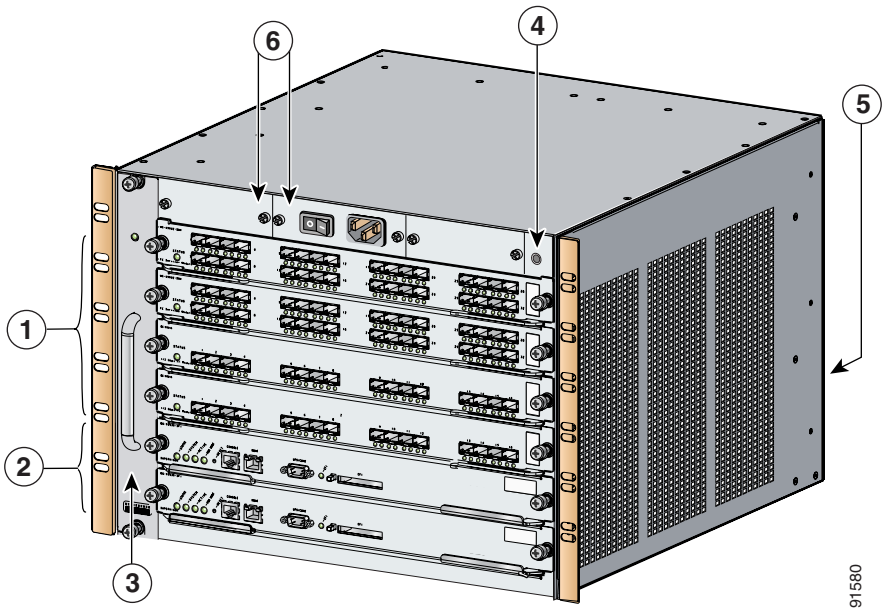
1	Switching or services modules in slots 1–4	**5**	Fan module
2	Supervisor module in slot 5	**6**	Power supply 1
3	Redundant supervisor module in slot 6	**7**	ESD socket
4	Switching or services modules in slots 7–9	**8**	Power supply 2 (redundant)

Cisco MDS 9506 Director

The Cisco MDS 9506 Director has a 6-slot chassis as shown in Figure 1-4, and it supports the following:

- Up to two Supervisor-1 modules that provide a switching fabric, with a console port, COM1 port, and a MGMT 10/100 Ethernet port on each module. Slots 5 and 6 are reserved for the supervisor modules.
- Four slots for optional modules that can include up to four switching modules or three IPS modules.
- Two power supplies located in the back of the chassis. The power supplies are redundant by default and can be configured to be combined if desired.
- Two power entry modules (PEMs) in the front of the chassis for easy access to power supply connectors and switches.
- One hot-swappable fan module with redundant fans.

Figure 1-4 Cisco MDS 9506 Chassis



1	Switching or services modules in slots 1–4	4	ESD Socket
2	Supervisor modules in slots 5 and 6	5	Power supplies (in back)
3	Fan module	6	Location of power entry modules (PEMs) - one PEM shown and one filler panel shown.

Backplane and Clock Modules

The Cisco MDS 9500 Series clock modules are accessible from the back of the chassis and are field-replaceable. In the unlikely event of a clock module failure, the Cisco MDS 9500 Series generates an error message and a switchover from one clock module to the other, causing the system to reset automatically. We recommend that the failed clock module be replaced during a maintenance window.

Power Supplies

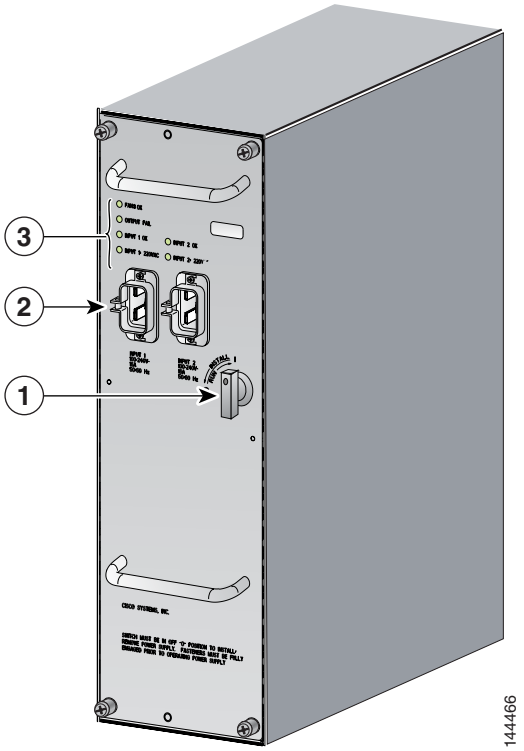
The Cisco MDS 9500 Series supports dual hot-swappable power supplies, each of which is capable of supplying sufficient power to the entire chassis should one power supply fail. The power supplies monitor their output voltage and provide status to the supervisor modules. To prevent the unexpected shutdown of an optional module, the power management software only allows a module to power up if adequate power is available.

The power supplies can be configured to be redundant or combined. By default, they are configured as redundant, so that if one fails, the remaining power supply can still power the entire system. For information about how to configure the power supplies, refer to the *Cisco MDS 9000 CLI Family Configuration Guide*.

Cisco MDS 9513 Power Supplies

The Cisco MDS 9513 Director supports the 6000-W AC power supply (AC input). (See Figure 1-5.)

Figure 1-5 Cisco MDS 9513 Power Supply



1	Power supply switch	**3**	Power Supply LEDs
2	AC power connection		

Table 1-1 describes the LEDs for the Cisco MDS 9513 Director power supplies.

Table 1-1 LEDs for the Cisco MDS 9513 Director Power Supplies

LED	Status	Description
Input 1 OK	Green	AC input at greater than 85 V is good and power supply is functioning normally if two single 110 V or one single 220 V are connected.
	Off	Power supply is turned off or power is not connected.
Input 2 OK	Green	AC input at greater than 85 V is good and power supply is functioning normally if two single 110 V or one single 220 V are connected.
	Off	Power supply is turned off or power is not connected.
INPUT 1 = 220VAC	Green	AC input is good at greater than 168 V and power supply should function normally.
	Off	AC input is 163 V or less or power is not connected.
INPUT 2 = 220VAC	Green	AC input is good at greater than 168 V and power supply should function normally.
	Off	AC input is 163 V or less or power is not connected.
FAN OK	Green	Power supply fans are operating properly.
	Off	Fan is not operating or power supply is off.
OUTPUT FAIL	Red	Power supply is not in a stable state. If this indication continues after initial power on, check that all connections are secure, including the system fan tray.
	Off	Normal operation or power supply is turned off.

Cisco MDS 9509 Power Supplies

The Cisco MDS 9509 Director supports the following types of power supplies:

- 4000-W AC power supply (AC input and DC output)

  The 4000-W AC power supply has a permanently attached power cable, and it requires 220-VAC input. (See Figure 1-6.)

- 3000-W AC power supply (AC input)

  The 3000-W AC power supply requires 220 VAC to deliver 3000 W of power. If powered with 110 VAC, it delivers only 1400 W. (See Figure 1-7.)

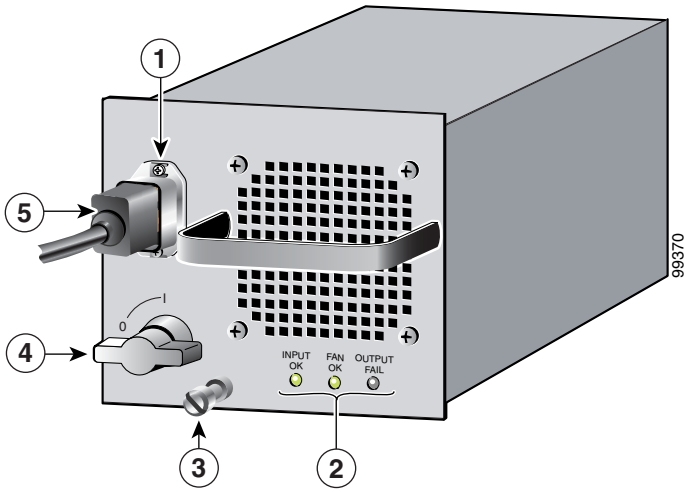
- 2500-W AC power supply (AC input and DC output)

  The 2500-W AC power supply requires 220 VAC to deliver 2500 W of power. If powered with 110 VAC, it delivers only 1300 W. (See Figure 1-8.)

- 2500-W DC power supply (DC input and DC output)

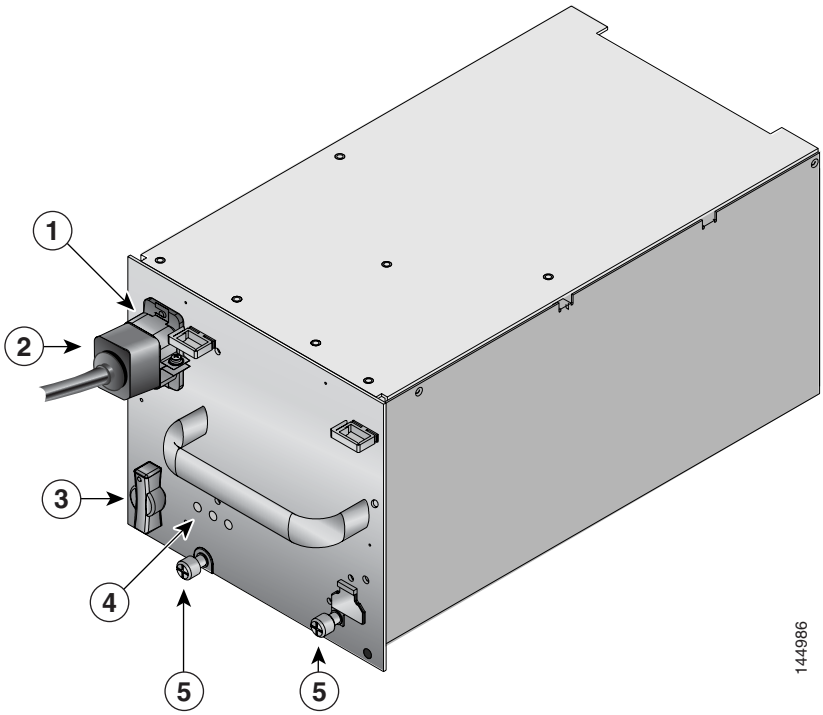
  The 2500-W DC power supply requires positive, negative, and ground wires. (See Figure 1-9.

Figure 1-6 4000-W AC Power Supply for the Cisco MDS 9509 Director



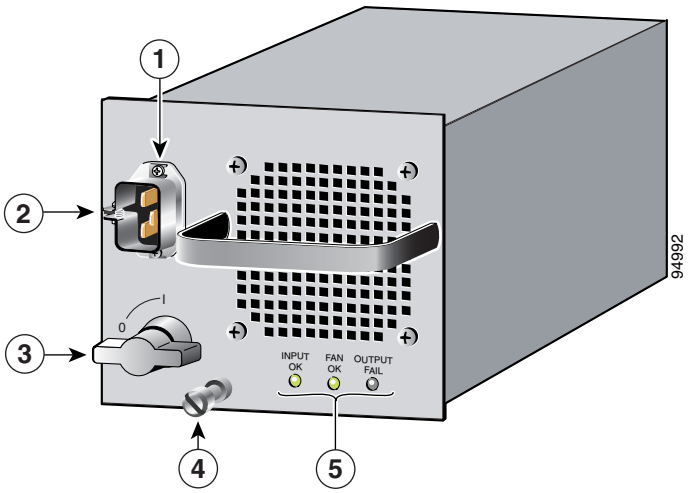
1	AC power connection	**4**	Power supply switch
2	Power supply LEDs	**5**	Permanent power cable
3	Captive screws		

Figure 1-7 3000-W AC Power Supply for the Cisco MDS 9509 Director



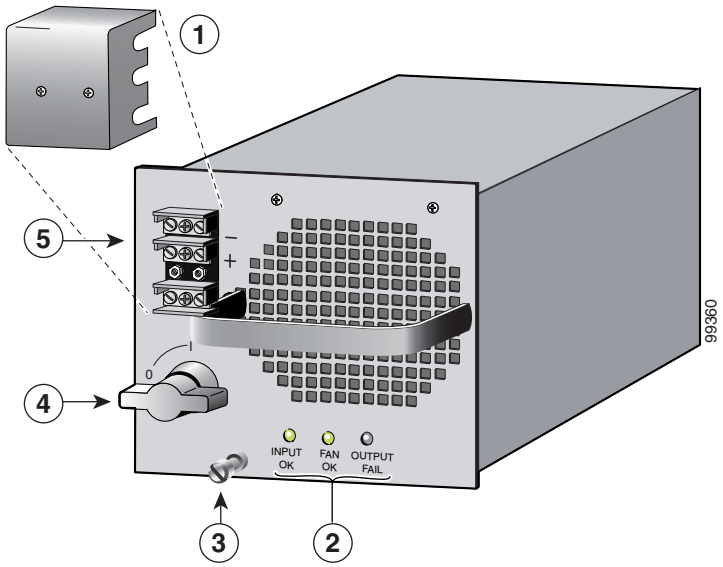
1	AC power connection	**4**	Power supply LEDs
2	Power cable	**5**	Captive screws
3	Power supply switch		

Figure 1-8 2500-W AC Power Supply for the Cisco MDS 9509 Director



1	AC power connection	**4**	Captive screws
2	Cable retention device	**5**	Power supply LEDs
3	Power supply switch		

Figure 1-9 2500-W DC Power Supply for the Cisco MDS 9509 Director



1	Terminal block cover	**4**	Power supply switch
2	Power supply LEDs	**5**	Terminal block
3	Captive screw		

Cisco MDS 9506 Power Supplies

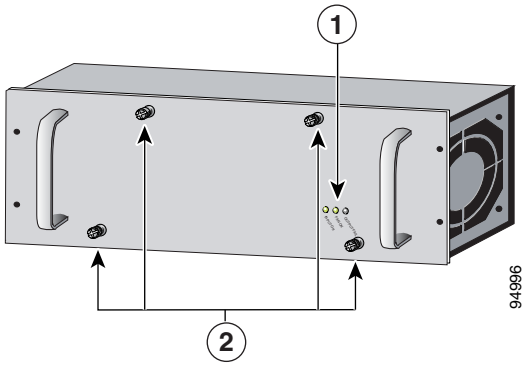
The Cisco MDS 9506 Director supports the following types of power supplies:

- 1900-W AC power supply (AC input and DC output)
- 1900-W DC power supply (DC input and DC output)

Power is supplied to the Cisco MDS 9506 power supplies though PEMs in the front of the chassis. The AC power requires an AC PEM, and the DC power requires a DC PEM.

The 1900-W AC and DC power supplies are similar in appearance (see Figure 1-10), except for the label that indicates whether the power supply is AC or DC.

Figure 1-10 Cisco MDS 9506 Power Supply (1900-W AC or DC)



1	Power supply LEDs	**2**	Captive screws

Table 1-2 describes the power supply LEDs for the Cisco MDS 9509 and 9506 Directors.

Table 1-2 Power Supply LEDs for the Cisco MDS 9509 and 9506 Directors

LED	Status	Description
Input OK	Green	AC input is good and power supply is functioning normally.
	Off	Power supply is turned off or is not seated properly in the chassis.
Fan OK	Green	Power supply fans are operating properly.
	Off	Fan is not operating or power supply is off.
Output Fail	Red	Power supply is not in a stable state. If this indication continues after initial power on, check that all connections are secure, including the system fan tray.
	Off	Normal operation or power supply is turned off.

Fan Modules

The Cisco MDS 9513 Director has a front panel fan tray with 15 fans with of an abrupt stop-to-fan rotation safety feature once power is disconnected or the fan tray is removed from the midplane. The Cisco MDS 9509 Director has a front panel fan module with nine fans and the Cisco MDS 9506 Director has a front panel fan module with six fans.

Sensors on the supervisor module monitor the internal air temperature. If the air temperature exceeds a preset lower-level threshold, the environmental monitor displays warning messages. If the air temperatures exceeds a preset higher-level threshold, the switch will shut down.

If one or more fans within the module fail, the Fan Status LED turns red and the module must be replaced. If the higher-level temperature threshold is not exceeded, the switch continues to run for five minutes after the fan module is removed. This allows you to swap out a fan module without having to bring the system down. To replace a fan module, see the "Removing and Installing Fan Modules" section on page 2-68.

The fan module has one status LED that indicates the following conditions:

- Green—Fan module is operating normally.
- Red—One or more fans failed. Fan module should be replaced.
- Off—Fan module is not properly seated in the chassis or power supply has failed.

Caution The Cisco MDS 9000 Family switches have internal temperature sensors that are capable of shutting down the system if the temperature at different points within the chassis exceed certain safety thresholds. To be effective, the temperature sensors require the presence of airflow; therefore, in the event a fan module is removed from the chassis, the Cisco MDS 9000 Family switches will be shut down after five minutes to prevent potentially undetectable overheating. However, the switches will shut down sooner if the higher-level temperature threshold is exceeded.

The Cisco MDS 9513 Director also has crossbar module fan trays located at the back of the chassis. There is one fan per crossbar module. To replace these fan modules, see the "Removing and Installing Fan Modules" section on page 2-68.

Supervisor Modules

The Cisco MDS 9500 Series supports two types of supervisor modules: Supervisor-1 and Supervisor-2 modules. Both supervisor modules provide the control and management functions for the Cisco MDS 9500 Series. The Cisco MDS 9500 Series supports two supervisor modules for redundancy. In the event of an internal component failure, the standby supervisor module takes over if installed. This section discusses the following modules:

- Supervisor-2 Modules, page 1-13 (DS-X9530-SF2-K9)
- Supervisor-1 Modules, page 1-18 (DS-X9530-SF1-K9)

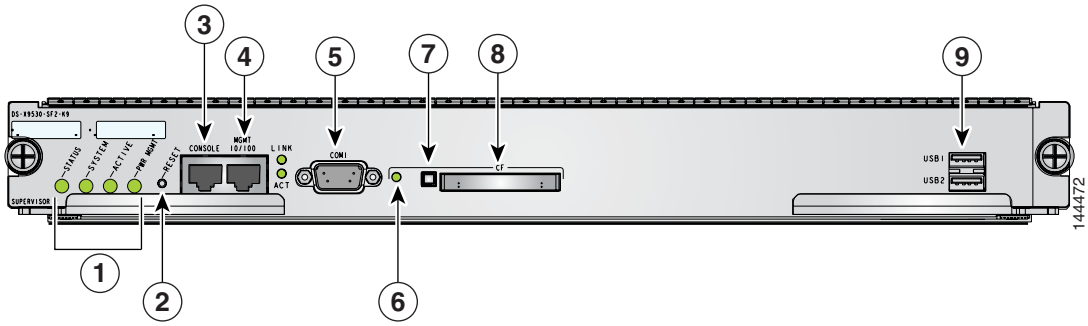
Note The internal bootflash installed on the modules are not field-replaceable units. Do not remove or replace internal bootflash on the modules. Modifying the factory installed bootflash is not supported.

Supervisor-2 Modules

The Cisco MDS 9500 Series offers redundant, hot-swappable, Supervisor-2 modules. (See Figure 1-11.) Supervisor-2 modules can be used in the Cisco MDS 9509 and 9506 Directors in slots 5 and 6. Supervisor-2 modules must be used in slots 7 and 8 of the Cisco MDS 9513 Director.

Supervisor-2 modules provide an integrated crossbar switching fabric to connect all the switching modules when used in a Cisco MDS 9509 or 9506 Director. Single fabric configurations provide 720-Gbps full duplex speed with 80-Gbps full duplex bandwidth per switching module. Dual fabric configurations provide 1.4-Tbps speed with 160-Gbps full duplex bandwidth per switching module. This integrated crossbar switching fabric is disabled when a Supervisor-2 module is installed in a Cisco MDS 9513 Director. The Cisco MDS 9513 Director supports two external crossbar modules located at the rear of the chassis that handle this function. (See the "Crossbar Modules" section on page 1-22 for more information.)

Figure 1-11 Cisco MDS 9500 Series Supervisor-2 Module



1	Status, System, Active, and Pwr Mgmt LEDs[1]	**6**	CompactFlash LED
2	Reset button	**7**	CompactFlash eject button
3	Console port	**8**	CompactFlash slot
4	MGMT 10/100/1000 Ethernet port (with integrated Link and Activity LEDs)	**9**	USB ports
5	COM1 serial port		

1. See Table 1-3 on page 1-17 for status LED descriptions.

The main functions and components of the Supervisor-2 modules are as follows:

- Control and Management
- Processor
- Port Interfaces
- LEDs on the Supervisor-2 Module

Control and Management

The Supervisor-2 modules provide the following control and management features:

- A redundant central arbiter that provides traffic control and access fairness.
- A nondisruptive restart of a single failing process on the same supervisor.

  A kernel service running on the Supervisor-2 module keeps track of the high availability policy of each process and issues a restart when a process fails. The type of restart issued is based on the process's capability:

  - Warm or stateful (state is preserved)
  - Cold or stateless (state is not preserved)

  If the kernel service cannot perform a warm restart of the process, it issues a cold restart.
- A nondisruptive switchover from the active Supervisor-2 to a redundant standby without loss of traffic.

If the Supervisor-2 module has to be restarted, then the secondary Supervisor-2 (which is continuously monitoring the primary) takes over. Once a switchover has occurred and the failed Supervisor-2 has been replaced or restarted, operation does not switch back to the original primary Supervisor-2, unless it is forced to switch back or another failure occurs.

Processor

The Supervisor-2 module has a processor running at 1.4 GHz. It contains a PowerPC class processor and offers the following memory specifications:

Memory	Bytes
DRAM	1 GB
1 internal CompactFlash card[1]	512 MB
1 external CompactFlash slot[2]	NA[3]

1. The card stores software images.
2. The slot is for optional cards to store additional images, and for configuration, debugging, and syslog information.
3. NA = not applicable.

Port Interfaces

The Supervisor-2 module provides the following port interfaces:

- RS-232 (EIA/TIA-232) console port with an RJ-45 connection that you can use to:
  - Configure the Cisco MDS 9500 Series from the CLI
  - Monitor network statistics and errors
  - Configure SNMP agent parameters
- RS-232 COM1 port with a DB-9 connector, which can be attached to a modem.
- Front panel triple speed (10/100/1000) management port with CTS function. This port is used as an out-of-band management port. There are two LEDs associated with it. The Link LED on the left side tells the link status and the Activity LED on the right side blinks when there is traffic going through this port.
- Two USB ports provide a simple interface allowing you to connect to different devices supported by Cisco MDS SAN-OS. On the double decker connector, USB port 1 is on the lower position and port 2 is on the upper position.

Note The USB ports are not supported for the Cisco MDS SAN-OS software.

- Supervisor CPU subsystem based on Motorola PowerPC 7447
- Reset button that resets the Supervisor-2 without cycling the power.
- External CompactFlash slot provides a convenient way to boot different images, back up the image, or store running-configuration data. There is one LED that blinks when accessing this CompactFlash.
- CompactFlash slot for an optional CompactFlash card. The optional card can be used for storing additional software images and configuration, debugging, and syslog information.

Caution Only use CompactFlash devices that are certified for use with Cisco MDS 9000 switches and are formatted using Cisco MDS 9000 switches. Using CompactFlash devices that are uncertified or are formatted using other platforms may result in errors.

LEDs on the Supervisor-2 Module

The front panel on the supervisor module has the following LEDs:

- Status LED
- System LED
- Active LED
- Power Management LED
- MGMT 10/100/1000 Ethernet port LEDs (at right of the port):
  - Link LED (on top)
  - Activity LED (on bottom)
- CompactFlash LED for external CompactFlash card

The front panel on the Supervisor-2 module also includes a reset button (see Figure 1-12).

The LEDs on the Supervisor-2 module indicate the status of the Supervisor-2 module, power supplies, and fan module. Table 1-3 provides more information about these LEDs.

Figure 1-12 Supervisor-2 Modile LEDs

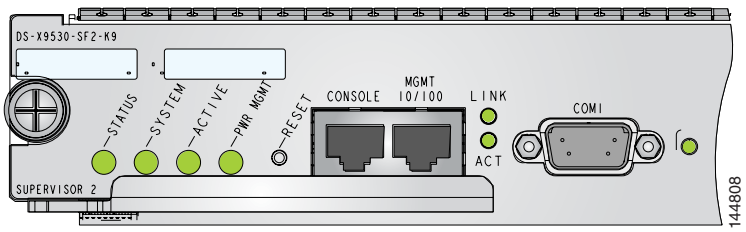


Table 1-3 LEDs for the Cisco MDS 9500 Series Supervisor-2 Modules

LED	Status	Description
Status	Green	All diagnostics pass. The module is operational (normal initialization sequence).
	Orange	One of the following occurs: • The module is booting or running diagnostics (normal initialization sequence). • An over temperature condition occurred (a minor threshold was exceeded during environmental monitoring).
	Red	One of the following occurred: • The diagnostic test failed. The module is not operational because a fault occurred during the initialization sequence. • An over temperature condition occurred (a major threshold was exceeded during environmental monitoring).
System	Green	All chassis environmental monitors are reporting OK.
	Orange	One of the following occurred: • The power supply failed or the power supply fan failed. • Incompatible power supplies are installed. • The redundant clock failed.
	Red	The temperature of the supervisor module exceeded the major threshold.
Active	Green	The Supervisor-2 module is operational and active.
	Orange	The Supervisor-2 module is in standby mode.
Pwr Mgmt	Green	Sufficient power is available for all modules.
	Orange	Sufficient power is not available for all modules.
MGMT 10/100/1000 Ethernet Link LED	Green	Link is up.
	Off	No link.
MGMT 10/100 Ethernet Activity LED	Green	Traffic is flowing through port.
	Off	No link or no traffic.
CompactFlash	Green	The external CompactFlash card is being accessed.
	Off	No activity.

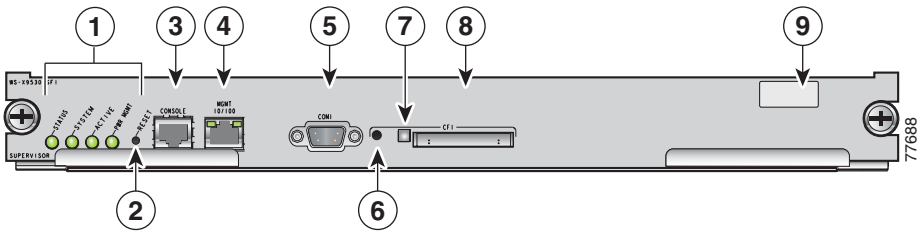
Supervisor-1 Modules

The Cisco MDS 9509 and 9506 Directors support up to two Supervisor-1 or Supervisor-2 modules that can be installed in slots 5 and 6 only. The main functions and components of the Supervisor-1 modules are as follows:

Note Supervisor-1 is not supported on the Cisco MDS 9513 Director.

Figure 1-13 shows a Cisco MDS 9500 Series Supervisor-1 module.

Figure 1-13 Cisco MDS 9500 Series Supervisor-1 Module



1	Status, System, Active, and Pwr Mgmt LEDs[1]	**6**	CompactFlash LED
2	Reset button	**7**	CompactFlash eject button
3	Console port	**8**	CompactFlash slot
4	MGMT 10/100 Ethernet port (with integrated Link and Activity LEDs)	**9**	Asset tag
5	COM1 serial port		

1. See Table 1-4 on page 1-21 for status LED descriptions.

Control and Management

The supervisor modules provide the following control and management features:

- A redundant central arbiter that provides traffic control and access fairness.
- A nondisruptive restart of a single failing process on the same supervisor.

  A kernel service running on the supervisor module keeps track of the high availability policy of each process and issues a restart when a process fails. The type of restart issued is based on the process's capability:

  - Warm or stateful (state is preserved)
  - Cold or stateless (state is not preserved)

If the kernel service cannot perform a warm restart of the process, it issues a cold restart.

- A nondisruptive switchover from the active supervisor to a redundant standby without loss of traffic.

  If the supervisor module has to be restarted, then the secondary supervisor (which is continuously monitoring the primary) takes over. Once a switchover has occurred and the failed supervisor has been replaced or restarted, operation does not switch back to the original primary supervisor, unless it is forced to switch back or another failure occurs.

Crossbar Switching Fabric

The Cisco MDS 9500 Series supervisor modules provide an integrated crossbar switching fabric to connect all the switching modules. Single fabric configurations provide 720-Gbps full duplex speed with 80-Gbps full duplex bandwidth per switching module. Dual fabric configurations provide 2.4-Tbps speed with 160-Gbps full duplex bandwidth per switching module.

The Cisco MDS 9500 Series supports redundant supervisor modules. Upon power up with slots 5 and 6 active, the supervisors negotiate to determine which one is active and which is the standby supervisor.

Each supervisor exchanges its own status and updates the signal quality error (SQE) status periodically. If the active supervisor becomes disabled, the standby supervisor switches over to become the active supervisor.

Dual supervisor modules provide dual crossbar switching fabrics for redundancy.

Processor

The Supervisor-1 module contains a Pentium III class processor. It has the following memory specifications:

Memory	Bytes
DRAM	1 GB
1 internal CompactFlash card[1]	512 MB
1 external CompactFlash slot[2]	NA[3]

1. The card stores software images.
2. The slot is for optional cards to store additional images, and for configuration, debugging, and syslog information.
3. NA = not applicable.

Port Interfaces

The Supervisor-1 module provides the following port interfaces:

- RS-232 (EIA/TIA-232) console port with an RJ-45 connection that you can use to:
  - Configure the Cisco MDS 9500 Series from the CLI
  - Monitor network statistics and errors
  - Configure SNMP agent parameters
- MGMT 10/100 Ethernet port with an RJ-45 connection that provides network management capabilities.
- RS-232 COM1 port with a DB-9 connector, which can be attached to a modem.

- CompactFlash slot for an optional CompactFlash card. The optional card can be used for storing additional software images and configuration, debugging, and syslog information.

Caution Only use CompactFlash devices that are certified for use with Cisco MDS switches and are formatted using Cisco MDS switches. Using CompactFlash devices that are uncertified or are formatted using other platforms may result in errors.

LEDs on the Supervisor-1 Module

The front panel on the Supervisor-1 module has the following LEDs:

- Status LED
- System LED
- Active LED
- Power Management LED
- MGMT 10/100 Ethernet port LEDs (at top of port):
  - Link LED (on left)
  - Activity LED (on right)
- CompactFlash LED for external CompactFlash card

The front panel on the supervisor module also includes a reset button (see Figure 1-14).

The LEDs on the Supervisor-1 module indicate the status of the Supervisor-1 module, power supplies, and fan module. Table 1-4 provides more information about these LEDs.

Figure 1-14 Supervisor-1 Module LEDs

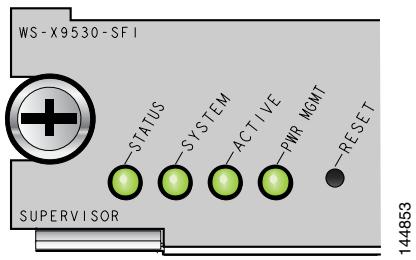


Table 1-4 LEDs for the Cisco MDS 9500 Series Supervisor Modules

LED	Status	Description
Status	Green	All diagnostics pass. The module is operational (normal initialization sequence).
	Orange	One of the following occurs: • The module is booting or running diagnostics (normal initialization sequence). • An over temperature condition occurred (a minor threshold was exceeded during environmental monitoring).
	Red	One of the following occurrs: • The diagnostic test failed. The module is not operational because a fault occurred during the initialization sequence. • An over temperature condition occurred (a major threshold was exceeded during environmental monitoring).
System[1]	Green	All chassis environmental monitors are reporting OK.
	Orange	One of the following occurrs: • The power supply failed or the power supply fan failed. • Incompatible power supplies are installed. • The redundant clock failed.
	Red	The temperature of the supervisor module exceeded the major threshold.
Active	Green	The supervisor module is operational and active.
	Orange	The supervisor module is in standby mode.
Pwr Mgmt[1]	Green	Sufficient power is available for all modules.
	Orange	Sufficient power is not available for all modules.
MGMT 10/100 Ethernet Link LED	Green	Link is up.
	Off	No link.
MGMT 10/100 Ethernet Activity LED	Green	Traffic is flowing through port.
	Off	No link or no traffic.
CompactFlash	Green	The external CompactFlash card is being accessed.
	Off	No activity.

1. The System and Pwr Mgmt LEDs on a redundant supervisor module are synchronized to the active supervisor module.

Crossbar Modules

The Cisco MDS 9513 Director supports two external crossbar modules located at the rear of the chassis. Each Supervisor-2 module has an associated external crossbar module. The Supervisor-2 module in slot 7 is associated with crossbar module 1 and Supervisor-2 in slot 8 is associated with crossbar module 2. Redundant crossbar modules act in an active-active method, where each switching module forwards traffic across both crossbar fabrics based on the intended destination. Therefore the traffic load is shared across both crossbar modules. Each crossbar fabric channel connects to a fabric interface ASIC on the switching modules through serial links on the midplane. Each Supervisor-2 processor also has a 20-Gbps (40-Gbps FDX) link to each crossbar fabric for participating in management and control protocols and for in-band diagnostics.

Cisco MDS 9000 Series Module Compatibility

Table 1-5 lists the hardware modules available and the chassis compatibility associated with them.

Table 1-5 MDS 9000 Modules and Platform Compatibility Matrix

Module	9513	9509	9506	9216A	9216i	9216
Supervisor-2 module	X	X	X			
Supervisor -1 module		X	X			
48-port 4-Gbps Fibre Channel switching module	X	X	X	X	X	
24-port 4-Gbps Fibre Channel switching module	X	X	X	X	X	
12-port 4-Gbps Fibre Channel switching module	X	X	X	X	X	
4-port 10-Gbps Fibre Channel switching module	X	X	X	X	X	
32-port 1-Gbps/2-Gbps Fibre Channel module	X	X	X	X	X	X
16-port 1-Gbps/2-Gbps Fibre Channel module	X	X	X	X	X	X
8-port Gigabit Ethernet IP Storage Services module.	X	X	X	X	X	X
4-port Gigabit Ethernet IP Storage Services module.	X	X	X	X	X	X
32-port 1-Gbps/2-Gbps Fibre Channel Storage Services Module (SSM).	X	X	X	X	X	X
32-port Fibre Channel Advanced Services Module (ASM).		X	X	X	X	X
Caching Services Module (CSM).		X	X	X	X	X
14-port Fibre Channel/2-port Gigabit Ethernet Multiprotocol Services (MPS-14/2) module.	X	X	X	X	X	X

Port Index Availability

The Cisco MDS 9500 Multilayer Directors are designed to operate with any combination of Cisco MDS 9000 modules. However, you should be aware of the maximum port availability your chassis can support. A port index is an internally assigned number that Cisco SAN-OS uses to switch data packets within the director or fabric switch. When the maximum number of port indexes is reached in a chassis, any modules remaining or added to the chassis will not boot up. The number of physical ports on a Fibre Channel module is equal to its number of port indexes. However, for Gigabit Ethernet modules (IPS-8, IPS-4, and MPS-14/2), one physical port is equal to four port indexes (one port index for iSCSI and three port indexes for FC IP tunnels). Table 1-6 lists the physical ports and port indexes (virtual ports) available per Cisco MDS 9000 module.

Table 1-6 Port Index Allocation

Module	Physical Ports	Port Indexes Allocated
48-port 4-Gbps Fibre Channel switching module	48	48
24-port 4-Gbps Fibre Channel switching module	24	24
12-port 4-Gbps Fibre Channel switching module	12	12
4-port 10-Gbps Fibre Channel switching module	4	4
16-port 2-Gbps Fibre Channel module	16	16[1]
32-port 2-Gbps Fibre Channel module	32	32[1]
8-port Gigabit Ethernet IP Storage Services module.	8	32[1]
4-port Gigabit Ethernet IP Storage Services module.	4	32 (with Supervisor-1) 16 (with Supervisor-2)
32-port 2-Gbps Fibre Channel Storage Services Module (SSM).	32	32[1]
14-port Fibre Channel/2-port Gigabit Ethernet Multiprotocol Services (MPS-14/2) module.	16[2]	32 (with Supervisor-1) 22 (with Supervisor-2)

1. All Generation 1 modules reserve port indexes on fixed boundaries with Supervisor-1. See Table 1-7.
2. 14 Fibre Channel ports and two Gigabit Ethernet ports.

Using any combination of modules that include a Generation 1 module or a Supervisor-1 module limits the port index availability to 252 on all Cisco MDS 9500 Series directors. Generation 1 modules also require contiguous port indexes where the system assigns a block of port index numbers contiguously starting from the first port index reserved for the slot that the module is inserted in (See Table 1-7). This means that while there may be enough port indexes available for a Generation 1 module, the module may not boot up because the available port indexes are not in a contiguous range or the contiguous block does not start at the first port index for a given slot.

Example 1-1shows a case with a Supervisor-1 module, where a 48-port Generation 2 module borrowed port indexes from the first slot. Slot 1 still has 16 port indexes available, but the full 32 indexes are no longer available (28-31 are used by the module in slot 4). This means that no Generation 1 module except a 16-port Fibre Channel switching module can be inserted into slot 1 because some of the port indexes for the slot are already in use.

Example 1-1 Borrowing Port Indexes from Another Slot

```
switch#show port index-allocation
Module index distribution:
-------------------------------------------------+
Slot    | Allowed |      Alloted indices info       |
        |  range* | Total |          Index values   |
--------|---------|-------|-------------------------|
1       |   0-  31|   -   |   -                     |
2       |  32-  63|   32  |   32-63                 |
3       |  64-  95|   48  |   64-95,224-239         |
4       |  96- 127|   48  |  96-127, 240-252, 28-31 |
7       | 128- 159|   32  |   128-159               |
8       | 160- 191|   32  | 160-191                 |
9       | 192- 223|   32  | 192-223                 |
SU      | 253-255 |   3   |  253-255                |
*Allowed range applicable only for Generation-1 modules
```

Using any combination of modules that include a Generation 1 module and a Supervisor-2 module limits the port index availability to 252 on all Cisco MDS 9500 Series directors. The Generation 1 modules canuse any contiguous block of port indexes that start on the first port index reserved for any slot in the range 0-252. (See Table 1-7.)

Using any combination of only Generation 2 with a Supervisor-2 module allows a maximum of 528 (with an architectural limit of 1020) port indexes on all Cisco MDS 9500 Series directors. Generation 2 modules do not need contiguous port indexes. Generation 2 modules use the available indexes in the slot that it is installed and then borrow available indexes from the supervisors. If the module requires more indexes, it starts borrowing available indexes from slot 1 of the chassis until it has the number of port indexes necessary.

Note Use the **purge module** CLI command to free up reserved port indexes after you remove a module.

Table 1-7 Port Index Requirements

Supervisor	Module	Port Index Requirements
Supervisor-1	Generation 1	Indexes must be: • Contiguous • In the range assigned to the given slot • Start with the lowest value assigned to that slot Maximum 252 assignable port indexes available,
	Generation 2	Indexes can be any available number in the range 0-252.
Supervisor-2	Generation 1	Indexes must be contiguous, but can be any available contiguous block in the range 0-252.
	Generation 2	Indexes can be any available number in the range 0-1020 if all modules are Generation 2 modules. Otherwise, indexes can be any available number in the range 0-252.

Table 1-8 shows a valid sample configuration for maximum capacity within the port index limits. The table lists a mixture of Generation 1 and Generation 2 modules on a Cisco MDS 9509 Director.

Table 1-8 Sample Chassis Configuration on a Cisco MDS 9509 Director (Valid)

Slot No.	Modules in Cisco MDS 9509 Director	Generation	Physical Ports	Port Indexes
1	12-port 4-Gbps Fibre Channel switching module	1	12	12
2	48-port 4-Gbps Fibre Channel switching module	2	48	48
3	48-port 4-Gbps Fibre Channel switching module	2	48	48
4	48-port 4-Gbps Fibre Channel switching module	2	48	48
5	Supervisor-1	1		
6	Supervisor-1	1		
7	48-port 4-Gbps Fibre Channel switching module	2	48	48
8	48-port 4-Gbps Fibre Channel switching module	2	48	48
9	(empty)			
	Totals		**252**	**252**

Table 1-9 shows a sample configuration that exceeds the port index limit. The table lists a mixture of Generation 1 storage IPS modules and Generation 2 modules on a Cisco MDS 9509 Director. In this example, one of the modules installed will not boot up because the number of port indexes needed has been exceeded.

Table 1-9 Maximum Chassis Configuration on a Cisco MDS 9509 Director (Exceeded)

Slot No.	Modules in Cisco MDS 9509 Director	Generation	Physical Ports	Port Indexes
1	14-port Fibre Channel/2-port Gigabit Ethernet Multiprotocol Services (MPS-14/2) module.	1	14	22
2	8-port Gigabit Ethernet IP Storage Services module	1	8	32
3	4-port Gigabit Ethernet IP Storage Services module	1	4	16
4	48-port 4-Gbps Fibre Channel switching module	2	48	48
5	Supervisor-1	1		
6	Supervisor-1	1		
7	48-port 4-Gbps Fibre Channel switching module	2	48	48
8	48-port 4-Gbps Fibre Channel switching module	2	48	48
9	48-port 4-Gbps Fibre Channel switching module	2	48	48
	Totals		**218**	**262**

Using any combination of modules that include a Generation 1 module and a Supervisor-2 module limits the port index availability to 252 on all Cisco MDS 9500 Series Directors. But the Generation 1 modules can use any contiguous block of port indexes in the range 0 - 252 (See Table 1-7).

Using any combination of only Generation 2 with a Supervisor-2 module allows a maximum of 528 (with an architectural limit of 1020) port indexes on all Cisco MDS 9500 Series Directors. Generation 2 modules do not need contiguous port indexes. Generation 2 modules will use the available ports in the slot that it is installed and then borrow available ports from the supervisors, and then restart at slot 1 of the chassis until it has the number of port indexes necessary.

Table 1-10 shows a valid sample configuration for maximum capacity within the port index limits. The table only lists Generation 2 modules in a Cisco MDS 9513 Director.

Table 1-10 Maximum Chassis Configuration on a Cisco MDS 9513 Director (Valid)

Slot No.	Modules in Cisco MDS 9513 Director	Generation	Physical Ports	Port Indexes
1	48-port 4-Gbps Fibre Channel switching module	2	48	48
2	48-port 4-Gbps Fibre Channel switching module	2	48	48
3	48-port 4-Gbps Fibre Channel switching module	2	48	48
4	48-port 4-Gbps Fibre Channel switching module	2	48	48
5	48-port 4-Gbps Fibre Channel switching module	2	48	48
6	48-port 4-Gbps Fibre Channel switching module	2	48	48
7	Supervisor-2	2		
8	Supervisor-2	2		
9	48-port 4-Gbps Fibre Channel switching module	2	48	48
10	48-port 4-Gbps Fibre Channel switching module	2	48	48
11	48-port 4-Gbps Fibre Channel switching module	2	48	48
12	48-port 4-Gbps Fibre Channel switching module	2	48	48

Table 1-10 Maximum Chassis Configuration on a Cisco MDS 9513 Director (Valid) (continued)

Slot No.	Modules in Cisco MDS 9513 Director	Generation	Physical Ports	Port Indexes
13	48-port 4-Gbps Fibre Channel switching module	2	48	48
	Totals		**528**	**528**

Switching Modules

The Cisco MDS 9500 Series supports the following hot-swappable Fibre Channel switching modules:

- Generation 2 Modules
  - 48-port 4-Gbps Fibre Channel Switching Module
  - 24-port 4-Gbps Fibre Channel Switching Module
  - 12-port 4-Gbps Fibre Channel Switching Module
  - 4-port 10-Gbps Fibre Channel Switching Module
- Generation 1 Modules
  - 32-Port 2-Gbps Fibre Channel Switching Module
  - 16-Port 2-Gbps Fibre Channel Switching Module

The Cisco MDS 9500 Series supports up to eleven hot-swappable switching modules. By combining different switching modules in a single, modular chassis, you can design cost and performance optimized storage networks in a wide range of application environments.

The Fibre Channel switching modules provide system-wide power management and autonegotiation, which allows ports to negotiate for speed at the other end of the link. Each module has temperature sensors and an EEPROM that stores serial number and model number information.

The Fibre Channel port interfaces support hot-swappable Fibre Channel SFP transceivers, which can be short wavelength (SWL) or long wavelength (LWL). The port interfaces also support coarse wavelength-division multiplexing (CWDM) SFP transceivers, which can be used for extended long wavelength (ELWL) transmission or for coarse wavelength-division multiplexing (CWDM). See the "Supported Transceivers" section on page 1-46.

Note The internal bootflash installed on the modules are not field replaceable units. Do not remove or replace internal bootflash on the modules. Modifying the factory installed bootflash is not supported.

Refer to the *Cisco MDS 9000 Family CLI Configuration Guide* or the *Cisco MDS 9000 Family Fabric Manager Configuration Guide* for configuration details about the modules.

48-port 4-Gbps Fibre Channel Switching Module

The 48-port 4-Gbps Fibre Channel switching module offers 48 autosensing 1-, 2-, and 4-Gbps Fibre Channel ports and can be used in any of the Cisco MDS 9500 Series chassis and in the Cisco MDS 9216i and 9216A Switches. The 48-port switching module can be configured in one of two operational modes: shared bandwidth mode (default) and dedicated bandwidth mode.

Figure 1-15 shows a 48-port 4-Gbps Fibre Channel switching module. The front panel connectors are standard modular SFP and the speed detection is autosensing.

Figure 1-15 48-Port 4-Gbps Fibre Channel Switching Module

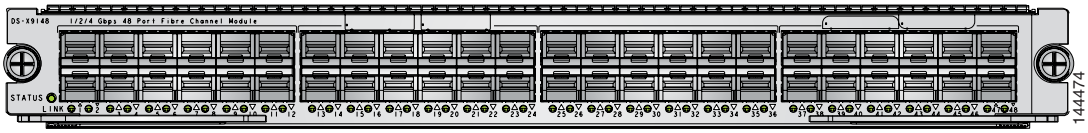
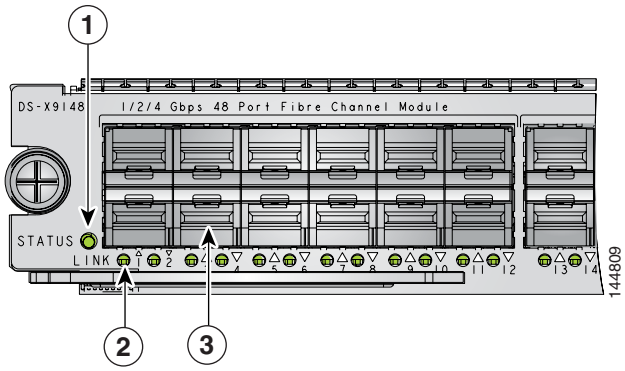


Figure 1-16 shows the port numbering and LEDs on the 48-port 4-Gbps Fibre Channel switching module.

Figure 1-16 48-Port 4-Gbps Fibre Channel Switching Module LEDs



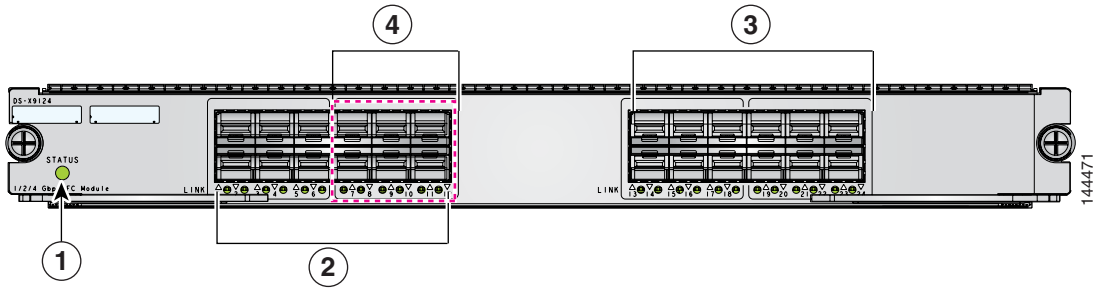
1	Status LED	**3**	Fibre Channel ports
2	Link LEDs		

24-port 4-Gbps Fibre Channel Switching Module

The 24-port 4-Gbps Fibre Channel switching module offers 24 autosensing 1-, 2-, and 4-Gbps Fibre Channel ports and can be used in any of the Cisco MDS 9500 Series chassis and in the Cisco MDS 9216i and 9216A Switches. The 24-port switching module can be configured in one of two operational modes: shared bandwidth mode (default) and dedicated bandwidth mode.

Figure 1-17 shows a 24-port 4-Gbps Fibre Channel switching module. The front panel connectors are standard modular SFP and the speed detection is autosensing.

Figure 1-17 24-Port 4-Gbps Fibre Channel Switching Module



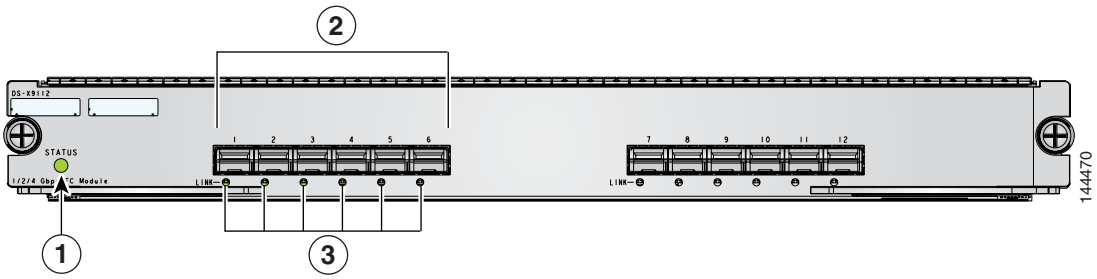
1	Status LED	3	Fibre Channel ports
2	Link LEDs	4	Port group

12-port 4-Gbps Fibre Channel Switching Module

The 12-port 4-Gbps Fibre Channel switching module can be used in any of the Cisco MDS 9500 Series chassis and in the Cisco MDS 9216i and 9216A Switches. The 12-port 4-Gbps switching module is a full rate mode module providing 12 SPF-based Fibre Channel interfaces. Each interface is capable of supporting full line rate operation at 4-Gbps interface speed. The module delivers a sustained data rate of up to 4 Gbps in each direction, on all ports simultaneously, and up to 96 Gbps of continuous, aggregate bandwidth when attached to high performance servers and storage subsystems.

Figure 1-18 shows a 12-port 4-Gbps Fibre Channel switching module. The front panel connectors are standard modular SFP and the speed detection is autosensing.

Figure 1-18 12-Port 4-Gbps Fibre Channel Switching Module



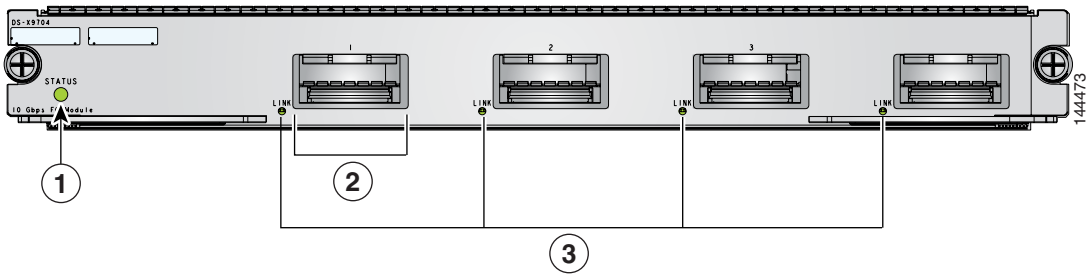
1	Status LED	3	Link LEDs
2	Fibre Channel ports		

4-port 10-Gbps Fibre Channel Switching Module

The 4-port 10-Gbps Fibre Channel switching module offers four dedicated bandwidth Fibre Channel ports running at 10 Gbps with no oversubscription. This module can be used in any of the Cisco MDS 9500 Series chassis and in the Cisco MDS 9216i and 9216A Switches. The module delivers a sustained data rate of up to 10 Gbps in each direction, on all ports simultaneously, and up to 80 Gbps of continuous, aggregate bandwidth.

Figure 1-19 shows a 4-port 10-Gbps switching module. The front panel connectors are standard modular X2 interfaces and the speed is fixed at 10 Gbps.

Figure 1-19 4-Port 10-Gbps Fibre Channel Switching Module



1	Status LED	**3**	Link LED
2	X2 port interfaces		

LEDs on the Generation 2 Switching Modules

Table 1-12 describes the LEDs for the 48-port, 24-port, and 12-port 4-Gbps Fibre Channel Switching Modules and the 4-port 10-Gbps Fibre Channel Switching Module.

Table 1-11 LEDs for the Cisco MDS 9000 Family Generation 2 Fibre Channel Switching Modules

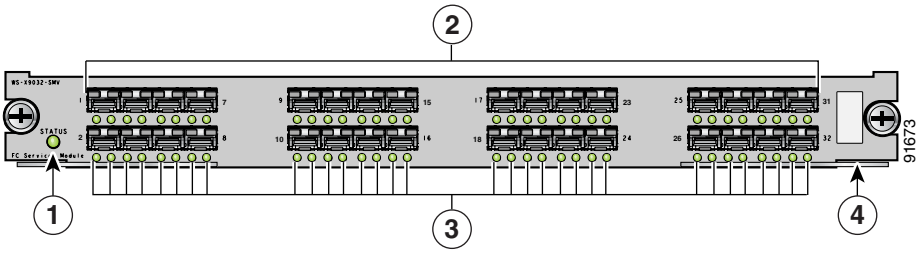
LED	Status	Description
Status	Green	All diagnostics pass. The module is operational (normal initialization sequence).
	Orange	One of the following occurs or occurred: • The module is booting or running diagnostics (normal initialization sequence). • The inlet air temperature of the system has exceeded the maximum system operating temperature limit (a minor environmental warning). To ensure maximum product life, you should immediately correct the environmental temperature and restore the system to normal operation.
	Red	One of the following occurs or occurred: • The diagnostic test failed. The module is not operational because a fault occurred during the initialization sequence. • The inlet air temperature of the system has exceeded the safe operating temperature limits of the card (a major environmental warning). The card has been shut down to prevent permanent damage.
Link	Solid green	Link is up.
	Intermittent flashing green	Link is up (traffic on port).
	Solid yellow	Link is disabled by software.
	Flashing yellow	A fault condition exists.
	Off	No link.

32-Port 2-Gbps Fibre Channel Switching Module

The 32-port 2-Gbps Fibre Channel switching module can be used to allocate bandwidth optimally. The module is organized into eight four-port groups. Only the first port in each four-port group can be an ISL. If the first port is an ISL, the other three ports in the group are disabled. The four ports within a port group share a single internal channel resulting in a subscription ratio of approximately 3.2 to 1. The 32-port 2-Gbps switching module provides more ports at a lower price per port. Figure 1-20 shows a 32-port switching module.

Tip For a full 2-Gbps bandwidth between two hosts, connect one host to the first port group and the second host to the second port group.

Figure 1-20 Cisco MDS 9000 Family 32-Port 2-Gbps Switching Module

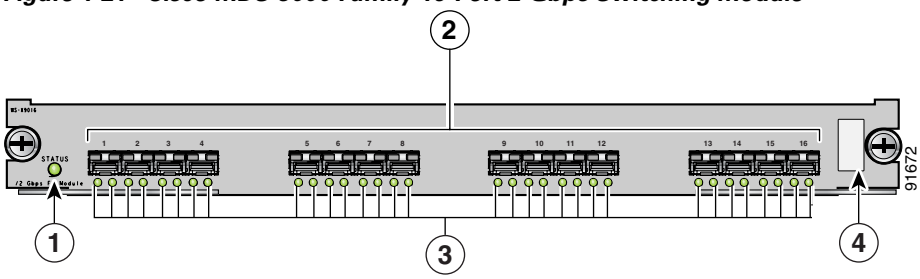


1	Status LED	3	Link LEDs (under ports, on left) and Speed LEDs (under ports, on right)
2	1-Gbps/2-Gbps Fibre Channel port group	4	Asset tag

16-Port 2-Gbps Fibre Channel Switching Module

The 16-port 2-Gbps switching module supports a sustained data rate of up to 2-Gbps in each direction, on all ports simultaneously. The autosensing 2-Gbps ports of the 16-port Fibre Channel switching module deliver up to 64-Gbps of continuous, aggregate bandwidth when attached to high performance servers and storage subsystems. Figure 1-21 shows a 16-port 2-Gbps switching module.

Figure 1-21 Cisco MDS 9000 Family 16-Port 2-Gbps Switching Module



1	Status LED	3	Link LEDs (under ports, on left) and Speed LEDs (under ports, on right)
2	1-Gbps/2-Gbps Fibre Channel ports	4	Asset tag

Switching Module Features

Each switching module draws its power from the 42V supplied on the backplane with local DC/DC power converters and regulators.

The control processor on the switching module provides power-on, offline, and online diagnostics. The control processor can be used to configure devices on the switching module and to gather statistical data from each port.

The control processor can determine which slot it is plugged into, and it can monitor its DC/DC power source and temperature. The control processor signals the supervisor module and displays an alarm on its front panel when a problem is detected.

The front panel on the switching module provides basic status information, such as power-on, self-test running, self-test passed, alarm, and ready.

The binary image for the switching module is downloaded from the supervisor module. Prior to the image download, the control processor on the switching module runs from code stored on its local CompactFlash card.

Note Routine software downloads are not required.

The supervisor module can force a reset on the switching module and controls whether power is applied to the switching module.

If a single component or a set of components on the switching module fails, this does not disable other switching modules if that is the only failure in the system.

Each switching module has a hardware watchdog timer for detecting most component failures. This watchdog resets the card if is not serviced periodically.

LEDs on the Generation 1 Switching Module

Table 1-12 describes the LEDs for the 16-port and 32-port switching modules.

Table 1-12 LEDs for the Cisco MDS 9000 Family Generation 1 Fibre Channel Switching Modules

LED	Status	Description
Status	Green	All diagnostics pass. The module is operational (normal initialization sequence).
	Orange	One of the following occurs or occurred: • The module is booting or running diagnostics (normal initialization sequence). • The inlet air temperature of the system has exceeded the maximum system operating temperature limit (a minor environmental warning). To ensure maximum product life, you should immediately correct the environmental temperature and restore the system to normal operation.
	Red	One of the following occurs or occurred: • The diagnostic test failed. The module is not operational because a fault occurred during the initialization sequence. • The inlet air temperature of the system has exceeded the safe operating temperature limits of the card (a major environmental warning). The card has been shut down to prevent permanent damage.
Speed	On	2-Gbps mode.
	Off	1-Gbps mode.
	Steady flashing green	Link is up (beacon used to identify port).[1]
Link	Solid green	Link is up.
	Intermittent flashing green	Link is up (traffic on port).
	Solid yellow	Link is disabled by software.
	Flashing yellow	A fault condition exists.
	Off	No link.

1. The flashing green light turns on automatically when an external loopback is detected that causes the interfaces to be isolated. The flashing green light overrides the beacon mode configuration. The state of the LED is restored to reflect the beacon mode configuration after the external loopback is removed.

The Fibre Channel switching modules provide autoconfiguring Fibre Channel ports that support Fibre Channel speeds of 1.0625 Gbps and 2.125 Gbps. For more information about supported port types, refer to the *Cisco MDS 9000 Family CLI Configuration Guide*.

Services Modules

The Cisco MDS 9500 Series supports the following hot-swappable Generation 1 services modules:

- 14/2-Port Multiprotocol Services Module
- IP Storage Services Modules
- 32-Port Fibre Channel Advanced Services Module
- 32-Port Fibre Channel Storage Services Module
- Caching Services Module

Note The internal bootflash installed on the modules are not field-replaceable units. Do not remove or replace internal bootflash on the modules. Modifying the factory installed bootflash is not supported.

14/2-Port Multiprotocol Services Module

The 14/2-port Multiprotocol Services (MPS-14/2) module provides 14 2-Gbps Fibre Channel autosensing ports and two 1-Gigabit Ethernet ports for iSCSI and FCIP over Gigabit Ethernet. The MPS-14/2 module supports the intelligent features available on other modules, including VSANs, security, and traffic management.

The 14 2-Gbps autosensing Fibre Channel ports (labeled 1 through 14) are best used for applications requiring high bandwidth; for example, Inter-Switch Link (ISL) connections between switches and high-performance host or storage controllers. Each Fibre Channel port supports a sustained data rate of up to 2 Gbps in each direction.

The Cisco 9513 supports up to seven MPS-14/2 modules. The Cisco MDS 9509 supports up to seven MPS-14/2 modules. The Cisco MDS 9506 supports up to four MPS-14/2 modules. The two Gigabit Ethernet ports (labeled 1 and 2) provide 1-Gbps throughput for IP services, including iSCSI and FCIP over Gigabit Ethernet. The MPS-14/2 also supports hardware-based encryption and compression for these Gigabit Ethernet ports. This hardware-based encryption handles the computationally intensive IPsec feature for IP services.

The MPS-14/2 modules support FCIP compression to maximize the effective WAN bandwidth of SAN extension solutions. It achieves up to a 30 to 1 compression ratio, with typical ratios of 2 to 1 over a wide variety of data sources. With the addition of hardware-based compression, the MPS-14/2 module is able to provide optimal levels of compressed throughput for implementations across low to high-bandwidth links.

The Gigabit Ethernet ports on the MPS-14/2 module support the iSCSI protocol, the FCIP protocol, or both protocols simultaneously. For information about configuring the ports, refer to the *Cisco MDS 9000 Family CLI Configuration Guide* or the *Cisco MDS Family Fabric Manager Configuration Guide*.

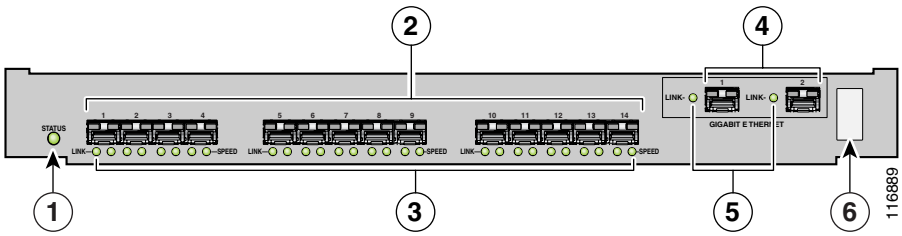
The Fibre Channel port interfaces support hot-swappable Fibre Channel SFP transceivers, which can be short wavelength (SWL) for connectivity up to 1640 feet (500 meters), or long wavelength (LWL) for connectivity up to 6.2 miles (10 km). All Fibre Channel interfaces are autosensing 1-Gbps or 2-Gbps

compatible. The Fibre Channel interfaces also support coarse wavelength-division multiplexing (CWDM) SFP transceivers, which can be used for extended long wavelength (ELWL) transmission or for CWDM. See "Supported Transceivers" section on page 1-46.

Note Cisco MDS 9500 Series switches running Cisco MDS SAN-OS Release 2.0(1b) or later support the MPS-14/2 module.

Figure 1-22 shows an MPS-14/2 module.

Figure 1-22 MPS-14/2 Module



1	Status LED	**4**	Gigabit Ethernet ports
2	1-Gbps/2-Gbps Fibre Channel ports	**5**	Link LEDs
3	Link LEDs (under ports, on left) and Speed LEDs (under the ports, on the right)	**6**	Asset tag

LEDs on the MPS-14/2 Module

Table 1-13 describes the LEDs for the MPS-14/2 modules.

Table 1-13 LEDs for the Cisco MDS 9000 Family MPS-14/2 Modules

LED	Status	Description
Status	Green	All diagnostics pass. The module is operational (normal initialization sequence).
	Orange	One of the following occurs or occurred: • The module is booting or running diagnostics (normal initialization sequence). • The inlet air temperature of the system exceeded the maximum system operating temperature limit (a minor environmental warning). To ensure maximum product life, you should immediately correct the environmental temperature and restore the system to normal operation.
	Red	One of the following occurred: • The diagnostic test failed. The module is not operational because a fault occurred during the initialization sequence. • The inlet air temperature of the system exceeded the safe operating temperature limits of the card (a major environmental warning). The card shut down to prevent permanent damage.
Speed	On	2-Gbps mode.
	Off	1-Gbps mode.

Table 1-13 LEDs for the Cisco MDS 9000 Family MPS-14/2 Modules (continued)

LED	Status	Description
Link	Solid green	Link is up.
	Flashing green	Link is up (beacon used to identify port).
	Solid yellow	Link is disabled by software.
	Flashing yellow	A fault condition exists.
	Off	No link.

IP Storage Services Modules

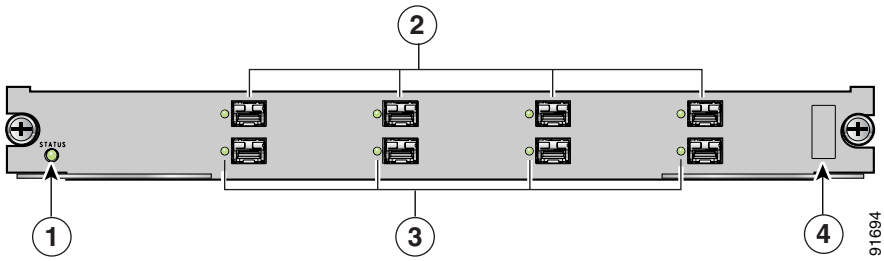
The 4-port and 8-port IP Storage services (IPS-4 and IPS-8) modules provide four or eight 1-Gigabit Ethernet ports for iSCSI as well as FCIP over Gigabit Ethernet, and they support the intelligent features available on other modules, including VSANs, security, and traffic management.

The IPS module ports can be configured to support the iSCSI protocol, the FCIP protocol, or both protocols simultaneously. For information about configuring the ports, refer to the *Cisco MDS 9000 Family CLI Configuration Guide* or the *Cisco MDS Family Fabric Manager Configuration Guide*.

The Fibre Channel port interfaces support hot-swappable Gigabit Ethernet SFP transceivers, which can be short wavelength (SWL) for connectivity up to 1640 feet (500 meters), or long wavelength (LWL) for connectivity up to 6.2 miles (10 km). The port interfaces also support coarse wavelength-division multiplexing (CWDM) SFP transceivers, which can be used for extended long wavelength (ELWL) transmission or for CWDM. See the "Supported Transceivers" section on page 1-46.

Figure 1-23 shows an IPS-8 module.

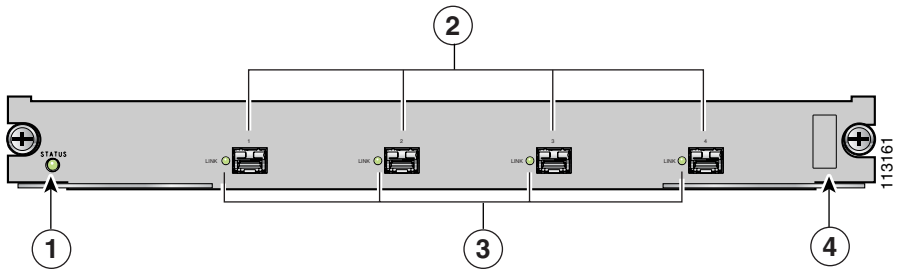
Figure 1-23 Cisco MDS 9000 Family IPS-8 Module



1	Status LED	3	Link LEDs
2	Gigabit Ethernet ports	4	Asset tag

Figure 1-24 shows the IPS-4 module.

Figure 1-24 Cisco MDS 9000 Family IPS-4 Module



1	Status LED	**3**	Link LEDs
2	Gigabit Ethernet ports	**4**	Asset tag

LEDs on IP Storage Services Modules

Table 1-14 describes the LEDs for the IPS modules.

Table 1-14 LEDs for the Cisco MDS 9000 Family IPS Module

LED	Status	Description
Status	Green	All diagnostics pass. The module is operational (normal initialization sequence).
	Orange	One of the following occurs or occurred: • The module is booting or running diagnostics (normal initialization sequence). • The inlet air temperature of the system exceeded the maximum system operating temperature limit (a minor environmental warning). To ensure maximum product life, you should immediately correct the environmental temperature and restore the system to normal operation.
	Red	One of the following occurred: • The diagnostic test failed. The module is not operational because a fault occurred during the initialization sequence. • The inlet air temperature of the system exceeded the safe operating temperature limits of the card (a major environmental warning). The card shut down to prevent permanent damage.
Link	Solid green	Link is up.
	Flashing green	Link is up (beacon used to identify port).
	Solid yellow	Link is disabled by software.
	Flashing yellow	A fault condition exists.
	Off	No link.

32-Port Fibre Channel Advanced Services Module

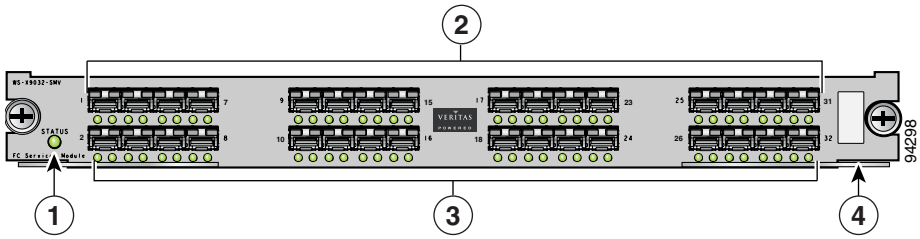
The Cisco MDS 9000 Family 32-port Fibre Channel Advanced Services Module (ASM) enables pooling of heterogeneous storage for increased storage utilization, simplified storage management, and reduced total cost of storage ownership. The ASM incorporates all the capabilities of the Cisco MDS 9000 DS-X9032 Fibre Channel switching module and also provides scalable, in-band storage virtualization services. The module makes it possible to allocate bandwidth optimally.

The Fibre Channel port interfaces support hot-swappable Fibre Channel SFP transceivers, which can be short wavelength (SWL) for connectivity up to 500 meters (1640 feet), or long wavelength (LWL) for connectivity up to 10 km (6.2 miles). All interfaces are autosensing 1-Gbps or 2-Gbps compatible. The port interfaces also support coarse wavelength-division multiplexing (CWDM) SFP transceivers, which can be used for extended long wavelength (ELWL) transmission or for CWDM. See the "Supported Transceivers" section on page 1-46.

Note Cisco MDS 9509 and 9506 Directors running Cisco MDS SAN-OS Release 1.2(2a) to Release 2.1(x) support the Fibre Channel ASM module. The Cisco MDS 9513 Director does not support the ASM module.

Figure 1-25 shows the Fibre Channel ASM.

Figure 1-25 Fibre Channel ASM



1	Status LED	**3**	Link and Speed LEDs
2	1-Gbps/2-Gbps Fibre Channel port group	**4**	Asset tag

Each module draws power from the 42 V supplied on the backplane with local DC/DC power converters and regulators.

The control processor on the module provides power-on, offline, and online diagnostics. The control processor can be used to configure devices on the switching module and to gather statistical data from each port.

The control processor monitors the DC/DC power source and temperature. The control processor signals the supervisor module and displays an alarm on its front panel when a problem is detected.

The front panel on the services module provides basic status information, such as power-on, self-test running, self-test passed, alarm, and ready.

The binary image for the services module is downloaded from the supervisor module. Prior to the image download, the control processor on the switching module runs from code stored on its local CompactFlash card.The image for an ASM can be specified using the ASM-SFN boot variable. For details on how to specify the ASM-SFN boot variable, refer to the *Cisco MDS 9000 Family CLI Configuration Guide.*

Note Software downloads are only necessary when a revision of the code is needed.

The supervisor module can force a reset on the services module and controls whether power is applied to the switching module.

If a single component or a set of components on the switching module fails, this failure does not disable another switching module if that is the only failure in the system.

Each ASM has a hardware watchdog timer to detect most component failures. The watchdog timer resets the card if it is not serviced periodically.

LEDs on the Fibre Channel ASMs

Table 1-15 describes the LEDs for the ASM.

Table 1-15 LEDs for the Cisco MDS 9000 Family Fibre Channel ASMs

LED	Status	Description
Status	Green	All diagnostics pass and the module is operational (normal initialization sequence).
	Orange	One of the following occurs or occurred: • The module is booting or running diagnostics (normal initialization sequence). • The inlet air temperature of the system exceeded the maximum system operating temperature limit (a minor environmental warning). To ensure maximum product life, you should immediately correct the environmental temperature and restore the system to normal operation.
	Red	One of the following occurred: • The diagnostic test failed. The module is not operational because a fault occurred during the initialization sequence. • The inlet air temperature of the system exceeded the safe operating temperature limits of the card (a major environmental warning). The card shut down to prevent permanent damage.
Speed	On	2-Gbps mode.
	Off	1-Gbps mode.
Link	Solid green	Link is up.
	Steady flashing green	Link is up (beacon used to identify port).
	Intermittent flashing green	Link is up (traffic on port).
	Solid yellow	Link is disabled by software.
	Flashing yellow	A fault condition exists.
	Off	No link.

32-Port Fibre Channel Storage Services Module

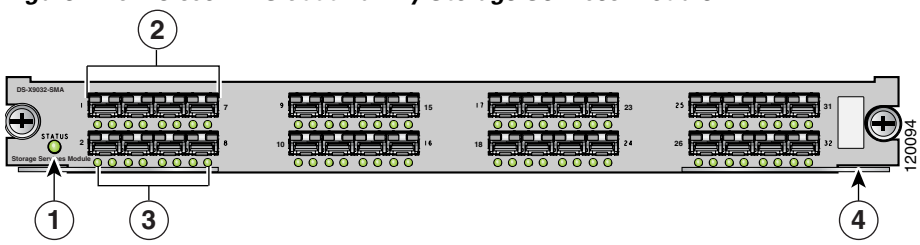
The 32-port Fibre Channel Storage Services Module (SSM) for the Cisco MDS 9000 Family supports up to 32 Fibre Channel ports, provides distributed intelligent storage services, and supports future storage services.

Note Cisco MDS 9500 Series switches running Cisco MDS SAN-OS Release 2.0(2b) or later support the SSM module.

The Fibre Channel ports support hot-swappable Fibre Channel SFP transceivers, which can be short wavelength (SWL) for connectivity up to 1640 ft (500 m), or long wavelength (LWL) for connectivity up to 6.2 miles (10 km). All interfaces are autosensing 1-Gbps/2-Gbps compatible. The ports also support coarse wavelength-division multiplexing (CWDM) SFP transceivers, which can be used for extended long wavelength (EWL) transmission or for CWDM. For more information about SFP transceivers, see the "Supported Transceivers" section on page 1-46.

Figure 1-26 shows the SSM.

Figure 1-26 Cisco MDS 9000 Family Storage Services Module



1	Status LED	3	Link and speed LEDs
2	1-Gbps/2-Gbps Fibre Channel port group	4	Asset tag

Each module draws power from the 42 V supplied on the backplane with local DC/DC power converters and regulators.

The control processor on the module provides power-on, offline, and online diagnostics. The control processor can be used to configure devices on the switching module and to gather statistical data from each port.

The control processor monitors the DC/DC power source and temperature. The control processor signals the SSM and displays an alarm on its front panel when it detects a problem.

The front panel of the SSM provides basic status information, such as power-on, self-test running, self-test passed, alarm, and ready.

The binary image for the SSM is downloaded from the supervisor module. Prior to the image download, the control processor on the services module runs from code stored on its local CompactFlash card. The image for an SSM can be specified using the SSI boot variable. For details on how to specify the SSI boot variable, refer to the *Cisco MDS 9000 Family CLI Configuration Guide.*

Note Software downloads are only necessary when a revision of the code is needed.

The SSM can force a reset and control whether or not power is applied to the switching module.

If a single component or a set of components on the switching module fails, this failure will not disable another switching module if that is the only failure in the system.

For the detection of most component failures, each switching module has a hardware watchdog timer that resets the card if is not serviced periodically.

LEDs on the Storage Services Modules

Table 1-16 describes the LEDs for the Storage Services Module.

Table 1-16 LEDs for the Cisco MDS 9000 Family Storage Services Modules

LED	Status	Description
Status	Green	All diagnostics pass. The module is operational (normal initialization sequence).
	Orange	One of the following occurs or occurred: • The module is booting or running diagnostics (normal initialization sequence). • The inlet air temperature of the system exceeded the maximum system operating temperature limit (a minor environmental warning). To assure maximum product life, you should immediately correct the environmental temperature and restore the system to normal operation.
	Red	One of the following occurred: • The diagnostic test failed. The module is not operational because a fault occurred during the initialization sequence. • The inlet air temperature of the system exceeded the safe operating temperature limits of the card (a major environmental warning). The card shut down to prevent permanent damage.
Speed	On	2-Gbps mode.
	Off	1-Gbps mode.
Link	Solid green	Link is healthy.
	Steady flashing green	Link is healthy and beacon is enabled.
	Intermittent flashing green	Link is up and traffic is flowing through port.
	Solid yellow	Link is disabled by software.
	Flashing yellow	A fault condition exists.
	Off	No link.

Caching Services Module

The Caching Services Module (CSM) provides virtualization services that allow the Cisco MDS 9000 Family switches to reallocate physical resources as virtual resources for increased efficiency. The CSM receives and sends data through the switch backplane. It has two disk drives, two internal batteries for backup in case of power failure, and no external ports.

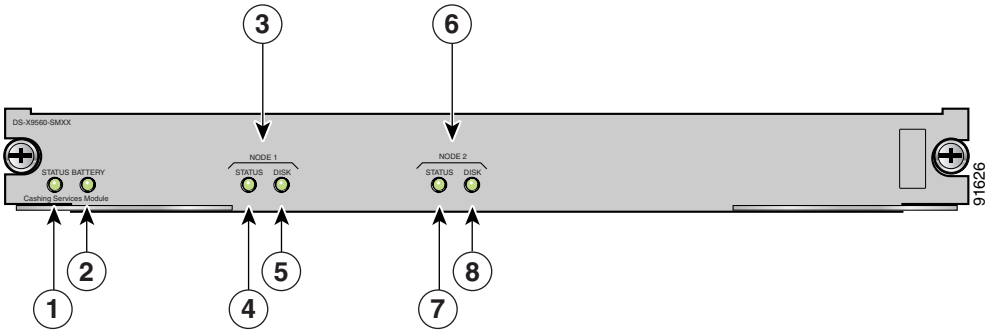
CSMs must be implemented in pairs in the fabric to provide redundancy and backup. Only two or more CSMs in a fabric are supported. However, the CSMs do not have to be installed in the same switch.

The CSM may shut down because of the software, an external power failure, or the module separated from the backplane while it still had power. The CSM automatically backs up the data in memory to the disk drives and then shuts down. The CSM batteries provide adequate power to back up data without external power.

Note The Cisco MDS 9513 does not support the CSM.

Figure 1-27 shows the CSM.

Figure 1-27 CSM

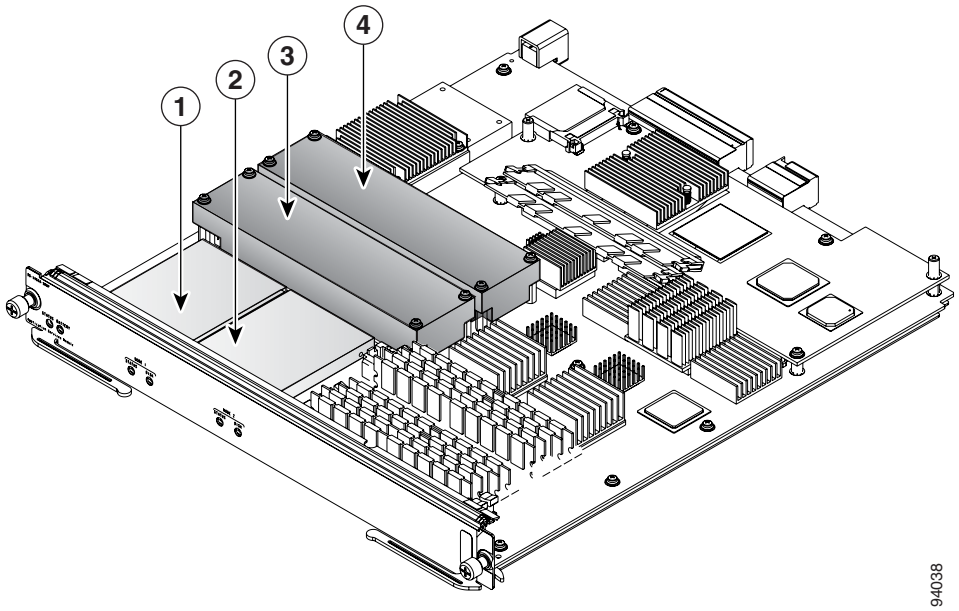


1	Status LED	**5**	Disk 1 Status LED
2	Battery LED	**6**	Node 2 LEDs
3	Node 1 LEDs	**7**	Node 2 Status LED
4	Node 1 Status LED	**8**	Disk 2 Status LED

Figure 1-28 shows the location of the disk drives and batteries on the CSM.

Caution The batteries are shipped fully charged and should be handled with caution accordingly.

Figure 1-28 CSM, Internal View



1	Disk drive 2	**3**	Battery 2
2	Disk drive 1	**4**	Battery 1

See the "Installing a Switching or Services Module, Including Caching Services Modules" section on page 2-45 for information about installing the CSM and maintaining the CSM batteries.

LEDs on the Caching Services Module

Table 1-17 describes the LEDs for the CSM.

Table 1-17 LEDs for the Cisco MDS 9000 Family CSM

LED	Status	Description
Status	Green	All diagnostics pass, and the module is operational (normal initialization sequence).
	Orange	One of the following occurs or occurred: • The module is booting or running diagnostics (normal initialization sequence). • The inlet air temperature of the system exceeded the maximum system operating temperature limit (a minor environmental warning). To ensure maximum product life, you should immediately correct the environmental temperature and restore the system to normal operation.
	Red	One of the following occurred: • The diagnostic test failed. The module is not operational because a fault occurred during the initialization sequence. • The inlet air temperature of the system exceeded the safe operating temperature limits of the card (a major environmental warning). The card shut down to prevent permanent damage.
Node	Green	Node is fully operational.
	Flashing green	Node is not yet part of a cluster.
	Orange	The module is booting or node is administratively down.
	Flashing orange	Node is in service mode.
	Red	Node failure.
	Off	Node does not have power.
Battery	Green	Battery has sufficient charge to dump cache.
	Flashing green	Battery is charging and has sufficient charge to dump cache. Battery conditioning in progress.
	Flashing orange	Battery is charging but has insufficient charge to dump cache.
	Red	Battery failure or battery is charged to the extent possible but insufficient to dump cache; replace CSM.
	Off	Battery does not have power and is not charged.
Disk	Solid green	Disk is operational.
	Flashing orange	Dumping cache to disk.
	Flashing green	Restoring cache from disk.
	Red	Disk failure.
	Off	Disk does not have power.

Supported Transceivers

The following types of transceivers are available from Cisco and are supported on the Cisco MDS 9500 Series:

- X2 transceivers
- Fibre Channel SFP transceivers, in either short wavelength (SWL) or long wavelength (LWL)
- Combination Fibre Channel/Gigabit Ethernet SFP transceivers, in either SWL or LWL
- Combination Fibre Channel/Gigabit Ethernet CWDM SFP transceivers, which can be used for extended long wavelength (ELWL) transmission or for CWDM
- Gigabit Ethernet SFP transceiver, 1-Gbps copper

Note Switches running Cisco MDS SAN-OS Release 1.1(1a) or later support combination Fibre Channel/Gigabit Ethernet SFP transceivers.

The transceivers are field-replaceable and hot-swappable. You can use any combination of SFP transceivers that are supported by the switch. The only restrictions are that SWL transceivers must be paired with SWL transceivers, and LWL transceivers with LWL transceivers, and the cable must not exceed the stipulated cable length for reliable communications.

For more information about the X2 transceiver, see the "X2 Transceiver Specifications" section on page B-15.

For more information about a specific Cisco SFP transceiver, see the "SFP Transceiver Specifications" section on page B-17. SFP transceivers can be ordered separately or with the Cisco MDS 9500 Series.

Note Use only Cisco transceivers in the Cisco MDS 9500 Series. Each Cisco transceiver is encoded with model information that enables the switch to verify that the transceiver meets the requirements for the switch.

X2 Transceivers

The X2 transceiver is a small form-factor optimized for 10-Gbps applications and uses an SC connector. The X2 transceiver is initially focused on optical links to 6.2 miles (10 km) and is ideally suited for Ethernet, Fibre Channel and telecom switches and standard PCI (peripheral component interconnect) based server and storage connections. The X2 provides robust thermal performance and electromagnetic shielding.

For detailed X2 transceiver specifications, see the "X2 Transceiver Specifications" section on page B-15.

Fibre Channel SFP Transceivers

Cisco Fibre Channel SFP transceivers are available in SWL or LWL versions. Both of these versions are 1-Gbps/2-Gbps/4-Gbps capable.

Cisco Fibre Channel SFP transceivers have LC connectors and comply with 1-Gbps/2-Gbps Fibre Channel standards as defined in FC-PI 10.0 2.

For detailed Fibre Channel SFP transceiver specifications, see the "SFP Transceiver Specifications" section on page B-17.

Combination Fibre Channel/Gigabit Ethernet SFP Transceivers

The combination Fibre Channel/Gigabit Ethernet SFP transceivers from Cisco Systems are available in SWL or LWL versions. Both of these versions are 1-Gbps/2-Gbps capable.

The combination SFP transceivers from Cisco Systems have LC connectors and comply with 1-Gbps/2-Gbps Fibre Channel as defined in FC-PI 10.0 2 and Gigabit Ethernet as defined in IEEE 802.3z.

For detailed Fibre Channel/Gigabit Ethernet SFP transceiver specifications, see the "SFP Transceiver Specifications" section on page B-17.

CWDM Combination Fibre Channel/Gigabit Ethernet SFP Transceivers

All Fibre Channel and Gigabit Ethernet ports in the Cisco MDS 9500 Series support CWDM SFP transceivers.

The Cisco CWDM SFP transceivers have LC connectors and support both Gigabit Ethernet and Fibre Channel (1-Gbps/2-Gbps). They match the wavelength plan of Cisco CWDM GBICs and Cisco CWDM optical add/drop multiplexers (OADMs).

CWDM SFP transceivers can be used in two ways:

- CWDM transmission can send and receive up to eight laser wavelengths carrying different signals simultaneously on the same optical fiber using an OADM.
- ELWL signals can transmit over longer distances than LWL SFP transceivers.

There are eight different "colors" of CWDM SFP transceivers, one for each fixed wavelength. The fiber optic cables from the CWDM SFP transceivers must be connected to an OADM. The OADM combines the wavelengths of the different outgoing signals into one composite send signal. The OADM also separates the received transmissions into the different wavelengths and sends them to the corresponding CWDM SFP transceiver.

For detailed CWDM SFP transceiver specifications, see the "SFP Transceiver Specifications" section on page B-17.

Gigabit Ethernet SFP Transceivers

The 4-port and 8-port IP Storage services (IPS-4 and IPS-8) modules provide four or eight 1-Gigabit Ethernet ports that support Gigabit Ethernet SFP transceivers. The Gigabit Ethernet SFP transceivers have RJ-45 connectors and support Gigabit Ethernet (1-Gbps).

For detailed Gigabit Ethernet SFP transceiver specifications, see the "SFP Transceiver Specifications" section on page B-17.

CHAPTER 2

Installing the Cisco MDS 9500 Series

This chapter describes how to install the Cisco MDS 9500 Series chassis and its components, and includes the following information:

Note Before you install, operate, or service the system, read the *Regulatory Compliance and Safety Information for the Cisco MDS 9000 Family* for important safety information.

Warning

IMPORTANT SAFETY INSTRUCTIONS

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

SAVE THESE INSTRUCTIONS

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

Warning **Only trained and qualified personnel should be allowed to install, replace, or service this equipment.** Statement 1030

Warning **A readily accessible two-poled disconnect device must be incorporated in the fixed wiring.** Statement 1022

Pre-Installation

This section provides the following topics:

Installation Options

The Cisco MDS 9513 Director can be installed using the following methods:

- In an open four-post EIA rack, using:
  - The rack-mount kit shipped with the switch

The Cisco MDS 9509 Director can be installed using the following methods:

- In an open EIA rack, using:
  - The rack-mount kit shipped with the switch
  - The Telco and EIA Shelf Bracket Kit (optional and purchased separately) in addition to the rack-mount kit shipped with the switch
- In a perforated or solid-walled EIA cabinet, using:
  - The rack-mount kit shipped with the switch
  - The Telco and EIA Shelf Bracket Kit (optional and purchased separately) in addition to the rack-mount kit shipped with the switch
- In a two-post telco rack using the rack-mount kit shipped with the switch
- In a four-post non-threaded cabinet or rack using the optional 9500 Shelf Bracket Kit

The Cisco MDS 9506 Director can be installed using the following methods:

- In an open EIA rack, using:
  - The rack-mount kit shipped with the switch
  - The Telco and EIA Shelf Bracket Kit (optional and purchased separately) in addition to the rack-mount kit shipped with the switch
- In a perforated or solid-walled EIA cabinet, using:
  - The rack-mount kit shipped with the switch

  - The Telco and EIA Shelf Bracket Kit (optional and purchased separately) in addition to the rack-mount kit shipped with the switch
- In a two-post telco rack, using:
  - The rack-mount kit shipped with the switch
  - The Telco and EIA Shelf Bracket Kit (optional and purchased separately) in addition to the front brackets shipped with the switch

For instructions on installing the switch using the rack-mount kit shipped with the switch, see the"Installing the Chassis in a Cabinet or Rack" section on page 2-6.

For instructions on installing the switch using the optional Telco and EIA Shelf Bracket Kit (purchased separately), see the "Cisco MDS 9000 Family Telco and EIA Shelf Bracket" section on page A-4.

Note The Telco and EIA Shelf Bracket Kit is optional and is not provided with the switch. To order the kit, contact your switch provider.

Note The Telco and EIA Shelf Bracket Kit is not intended for use with a Cisco MDS 9513 Director or Cisco MDS 9509 Director in a two-post telco rack.

Installation Guidelines

Follow these guidelines when installing the Cisco MDS 9500 Series:

- Plan your site configuration and prepare the site before installing the chassis. We recommend that you use the site planning tasks listed in Appendix D, "Site Planning and Maintenance Records."
- Ensure there is adequate space around the switch to allow for servicing the switch and for adequate airflow (airflow requirements are listed in Appendix B, "Technical Specifications").
- Ensure the air-conditioning meets the heat dissipation requirements listed in Appendix B, "Technical Specifications".
- Ensure the cabinet or rack meets the requirements listed in Appendix A, "Cabinet and Rack Requirements."

Note Jumper power cords are available for use in a cabinet. For more information, see the "Jumper Power Cord" section on page C-12.

- Ensure the chassis is adequately grounded. Grounding the chassis is recommended in all cases, and is it is mandatory for Cisco MDS 9506 Directors that have a DC power supply installed. If the switch is not mounted in a grounded rack or cabinet, we recommend connecting both the system ground on the chassis and the power supply ground to an earth ground, regardless of whether the power supplies are AC or DC.
- Ensure the site power meets the power requirements listed in Appendix B, "Technical Specifications." If available, you can use an uninterruptible power supply (UPS) to protect against power failures.

Caution Avoid UPS types that use ferroresonant technology. These UPS types can become unstable with systems such as the Cisco MDS 9000 Family, which can have substantial current draw fluctuations because of fluctuating data traffic patterns.

- Ensure circuits are sized according to local and national codes. For North America:
  - The 1900-W AC power supplies require a 20-A circuit.
  - The 1900-W DC power supplies require a 70-A circuit.
  - The 2500-W AC power supplies require a 20-A circuit.
  - The 2500-W DC power supplies require a 100-A circuit.
  - The 4000-W AC power supplies require a 30-A circuit.
  - The 6000-W AC power supplies require two 220 V inputs at 20-A circuit.

  If you are using 200/240 VAC power sources in North America, the circuits must be protected by two-pole circuit breakers.

Caution To prevent loss of input power, ensure the total maximum loads on the circuits supplying power are within the current ratings of the wiring and breakers.

- Record your installation and configuration information as you work. See Appendix D, "Site Planning and Maintenance Records."
- Use the following screw torques when installing the switch:
  - Captive screws: 4 in-lb
  - M3 screws: 4 in-lb
  - M4 screws: 12in-lb
  - M6 screws: 20in-lb
  - 10-32 screws: 20in-lb
  - 12-24 screws: 30in-lb

Required Equipment

Gather the following items before beginning the installation:

- Number 1 and number 2 Phillips screwdrivers with torque capability.
- 3/16-inch flat-blade screwdriver.
- Tape measure and level.
- ESD wrist strap or other grounding device.
- Antistatic mat or antistatic foam.
- In addition to the grounding items provided in the accessory kit, you need the following items:
  - Grounding cable (6 AWG recommended), sized according to local and national installation requirements; the required length depends on the proximity of the Cisco MDS 9500 to proper grounding facilities.

  - Crimping tool large enough to accommodate girth of lug.
  - Wire-stripping tool.
- For DC power supplies in a Cisco MDS 9506 Director, you need two 10-32 ring lugs for each DC power supply.
- For the Cisco MDS 9513 Director, you need a mechanical lift to handle the weight of the chassis.

Unpacking and Inspecting the Switch

Warning **Two people are required to lift the 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 prevent damage to the chassis and components, never attempt to lift the chassis with the handles on the power supplies or on the interface processors, or by the plastic panels on the front of the chassis. These handles were not designed to support the weight of the chassis.** Statement 5

Caution Use a mechanical lift to lift the MDS 9513 chassis. The Cisco MDS 9513 Director can weigh up to 375 lb (170 kg) when fully loaded, depending on what modules populate the chassis.

Caution We recommend that a third person assist whenever the chassis is being moved or lifted. The Cisco MDS 9509 Director weighs approximately 170 lb (77 kg) when fully loaded, and the Cisco MDS 9506 Director weighs approximately 125 lb (57 kg) when fully loaded with all modules and power supplies.

Caution When handling switch components, wear an ESD strap and handle modules by the carrier edges only. An ESD socket is provided on the chassis. For the ESD socket to be effective, the chassis must be grounded either through the power cable, the chassis ground, or metal-to-metal contact with a grounded rack.

Tip Keep the shipping container for use when moving or shipping the chassis in the future. The shipping carton can be flattened and stored with the pallet.

Note If you purchased this product through a Cisco reseller, contact the reseller directly for technical support. If you purchased this product directly from Cisco Systems, contact Cisco Technical Support at this URL: http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml.

Note The switch is thoroughly inspected before shipment. If any damage occurred during transportation or any items are missing, contact your customer service representative immediately.

To inspect the shipment, follow these steps:

Step 1 Compare the shipment to the equipment list provided by your customer service representative and verify you received all items, including the following:

- Print documentation and CD-ROMs
- Grounding lug kit
- Rack-mount kit
- ESD wrist strap
- Cables and connectors
- Any optional items ordered

Step 2 Check for damage and report any discrepancies or damage to your customer service representative. Have the following information ready:

- Invoice number of shipper (see packing slip)
- Model and serial number of the damaged unit
- Description of damage
- Effect of damage on the installation

Installing the Chassis in a Cabinet or Rack

This section describes how to install the Cisco MDS 9500 Series in a cabinet or rack that meets the requirements described in this document, using the rack-mount kit provided with the switch. A separate procedure is provided for each type of director:

- Installing the Cisco MDS 9513 Director in a Rack, page 2-7
- Installing the Cisco MDS 9509 Director in a Rack, page 2-11
- Installing the Cisco MDS 9506 Director in a Rack, page 2-15

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

Note You can remove the modules and other field-replaceable components to make moving and positioning the chassis easier and safer. See the "Removing, Installing, and Verifying Supervisor, Switching, and Services Modules" section on page 2-38 for instructions specific to the component.

Installing the Cisco MDS 9513 Director in a Rack

The 6000-W AC power supplies for the Cisco MDS 9513 Director are designed to provide an output power for the modules and fans. Each power supply has two AC power connections and will provide power as follows:

- One AC power connection @110 VAC = No output
- Two AC power connection @110 VAC = 2900-W output
- One AC power connection @ 220 VAC = 2900-W output
- Two AC power connection @ 220 VAC = 6000-W output

Note Power output does not include the power used by the individual modules used in the chassis.

Installation of the Cisco MDS 9513 Director in a rack requires a mechanical lift to place the chassis in the rack. Make sure you have access to the lift during the installation process.

Table 2-1 lists the items provided in the Cisco MDS 9513 rack-mount kit.

Note The rack-mount kit for the Cisco MDS 9513 Director includes rack-mount support brackets, which are required for the duration of the installation and are not removable.

Table 2-1 Contents for the Rack Mount Support Bracket Kit

Quantity	Part Description
2	Rack mount support bracket
2	Rack mount support bar
20	12-24 x 3/4-in. Phillips screws
20	10-32 x 3/4-in. Phillips screws

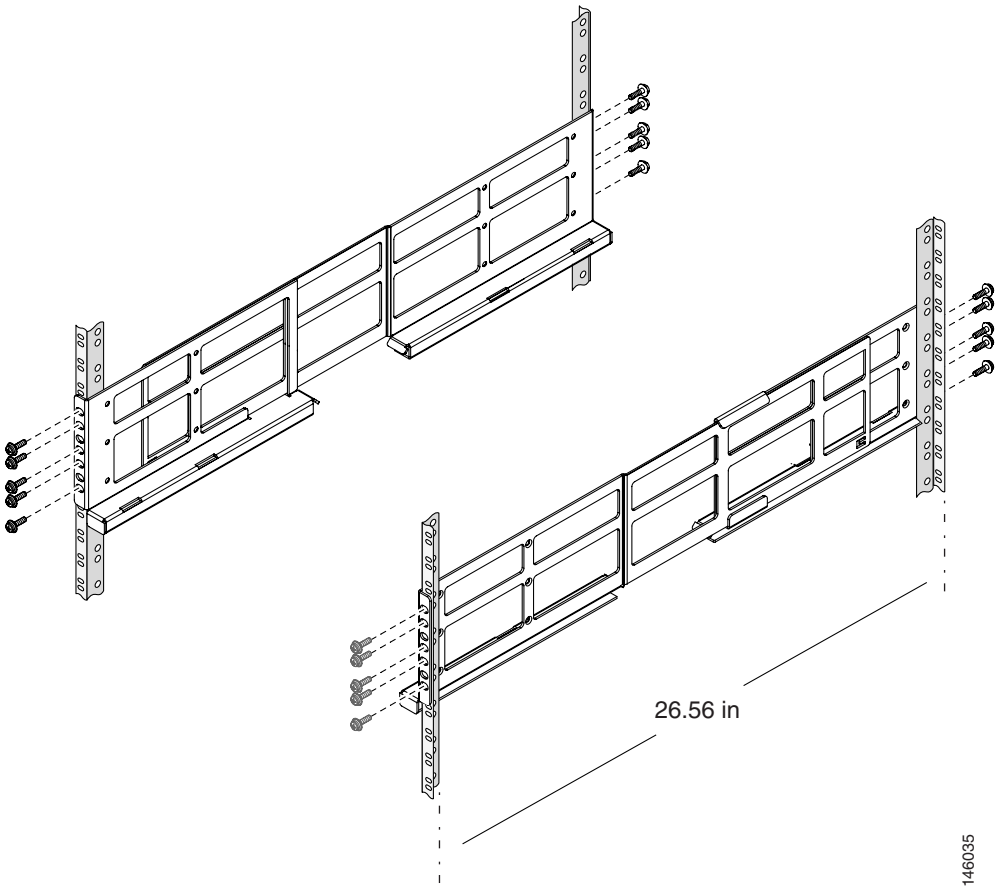
To install the Cisco MDS 9513 chassis in a rack using the rack-mount kit provided with the switch, follow these steps:

Step 1 Adjust the cabinet vertical rack mount rails to 26.56 ± 0.15 in. (67.46 cm). This step must be done prior to installing the support rack-mount brackets.

Step 2 Position one of the support rack-mount brackets in the rack and adjust it to the depth of the cabinet rack. Repeat this step for the other side. Use the screws to secure the brackets but do not tighten them yet.

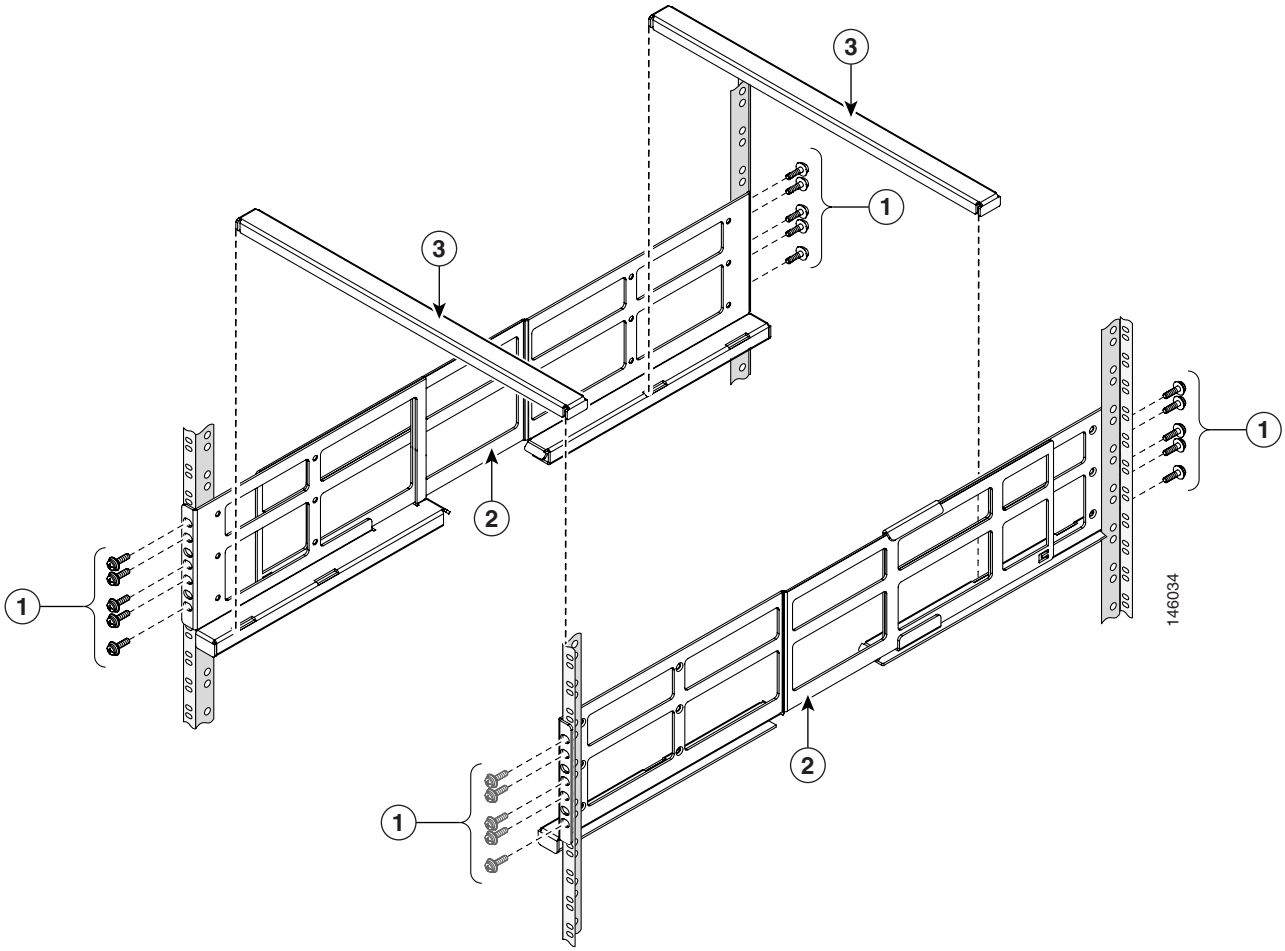
Note If you are using the cable management bracket shipped with the switch, do not install the top four screws into the front right of the bracket. However, you must install the bottom screw. (See Figure 2-1.) The top four screws will be used to install the cable management bracket to the rail.

Figure 2-1 Positioning the Rack-Mount Support Brackets



Step 3 Install one rack mount support bar into the slots located on the rack-mount support brackets. Repeat this for the other support bar.

Figure 2-2 Positioning the Support Bars

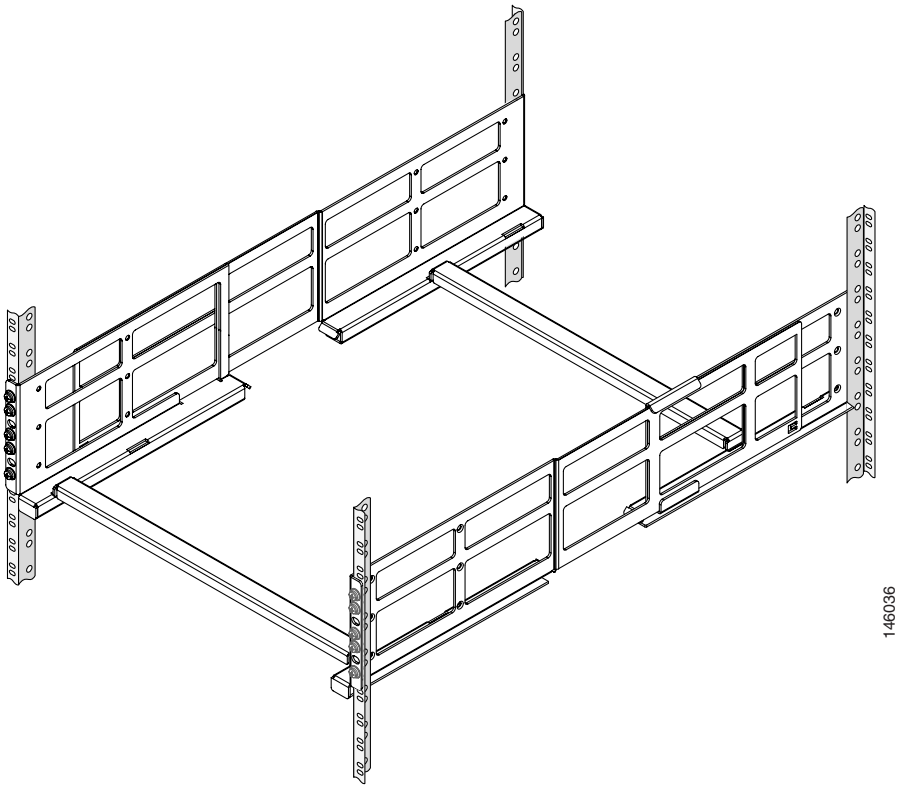


1	Screws	**3**	Rack-mount support bar
2	Rack mount support bracket		

Step 4 Once the support bars are installed, secure the rack-mount support brackets to the rack using the screws provided.

Note If you are using the cable management bracket shipped with the switch, do not install the top four screws to the front right side of the bracket. These will be installed after placing the cable management bracket along that side. The bottom screw should be installed to support the front of the rack-mount support bracket.

Figure 2-3 Securing the Rack-Mount Support Brackets



Step 5 Position a person at each side of the chassis and one at the mechanical lift. Place the chassis on the lift by lifting on the top front of rear of the chassis.

Step 6 Using the mechanical lift, lift the chassis up onto the rack-mount support brackets.

Step 7 Place the rear of the chassis on the rack-mount support brackets between the front mounting rails.

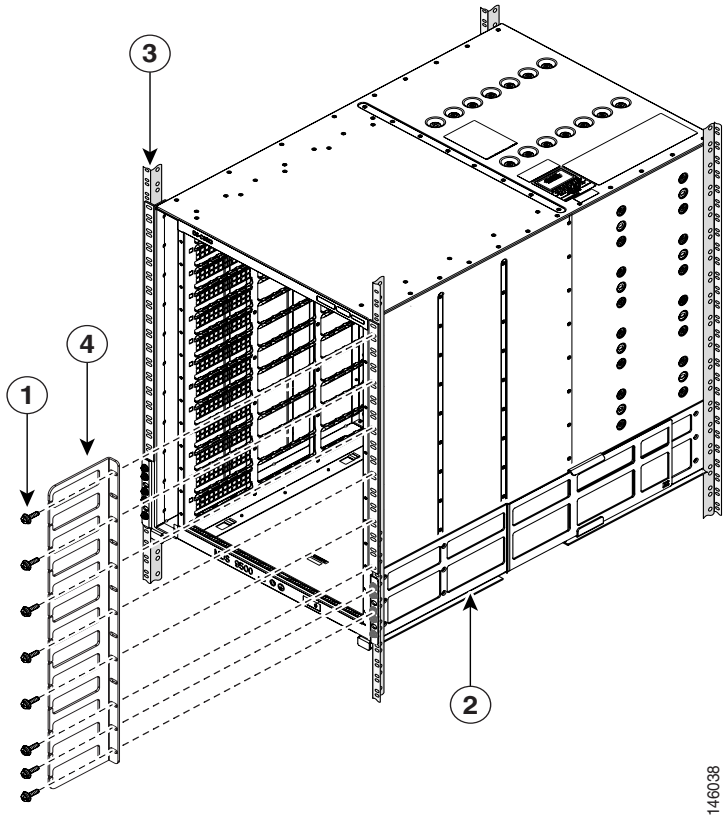
Step 8 Manually slide the chassis into the rack until it rests on the crossbar and the side rack-mount brackets.

Step 9 If you are installing the optional cable management brackets, place the cable management brackets in front of the right rack-mount brackets. Align the holes in the cable management brackets with the holes in the front rack-mount brackets on the right and mounting rails, and then insert the screws.

Step 10 Align the holes in the front rack-mount bracket with the holes in the mounting rails and insert the 12-24 x 3/4-inch or 10-32 x 3/4-inch screws, using six screws per side. (See Figure 2-4.)

Note Use a minimum of six screws to ensure the switch is adequately supported.

Figure 2-4 Installing the Cable Management Brackets on the MDS 9513 Chassis



1	Screws, 12-24 or 10-32	**3**	Mounting rail
2	Support bracket	**4**	Cable guide

Installing the Cisco MDS 9509 Director in a Rack

Caution If connecting a Cisco MDS 9509 Director to a 110-VAC power system, ensure sufficient power is provided to meet the chassis power requirements for the number of modules installed.

When connected to 220 VAC, the 2500-W AC power supplies (DS-CAC-2500W) for the Cisco MDS 9509 Director are designed to provide an output power of 2331 W to power the modules and fans. When connected to a 110 VAC power system, the power supply provides approximately 1150 W. In this case, and if the power supplies are used in redundant rather than combined mode, they might not provide adequate power, depending on the number of modules loaded in the chassis.

If a 110-VAC input is chosen, a 110-VAC power cord (CAB-7513AC=) must be ordered separately.

Table 2-2 lists the items provided in the Cisco MDS 9509 rack-mount kit.

Note The rack-mount kit for the Cisco MDS 9509 Director includes side rack-mount brackets, which are required for the duration of the installation only and can be removed once the front rack-mount brackets are securely fastened to the rack-mounting rails.

Note The Cisco MDS 9500 Shelf Bracket Kit may be purchased as an optional shelf bracket kit for the Cisco MDS 9509 Director. See "Cisco MDS 9500 Shelf Bracket" section on page A-11.

Table 2-2 Contents of Cisco MDS 9509 Rack-Mount Kit

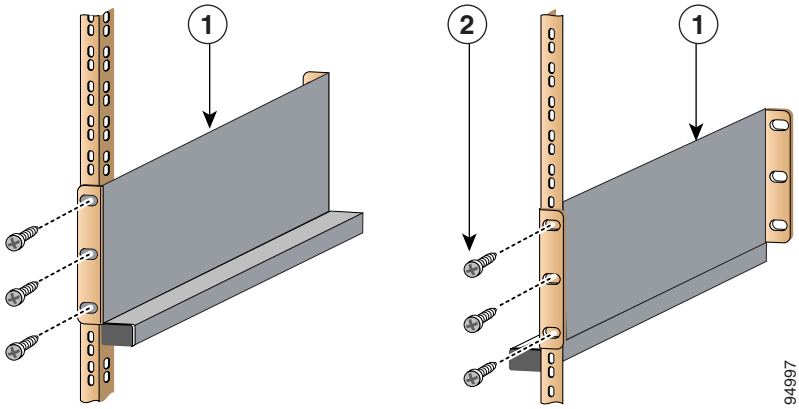
Quantity	Part Description
3 RU shelf bracket kit	
6	12-24 x 3/4-inch Phillips binder-head screws
6	10-32 x 3/4-inch Phillips binder-head screws
2	M3 x 8-mm Phillips pan-head screws
2	Side rack-mount brackets
1	Crossbar bracket
Cable management bracket kit	
2	Cable management brackets
18	12-24 x 3/4-inch Phillips binder-head screws
18	10-32 x 3/4-inch Phillips binder-head screws

To install the Cisco MDS 9509 chassis in a rack using the rack-mount kit provided with the switch, follow these steps:

Step 1 Position one of the side rack-mount brackets in the rack as shown in Figure 2-5. Secure the side rack-mount bracket to the rack using three of the 12-24 x 3/4-inch or 10-32 x 3/4-inch screws, depending on the type of holes in the mounting rails.

Step 2 Repeat for the second side rack-mount bracket, ensuring that the side rack-mount brackets are at the same height.

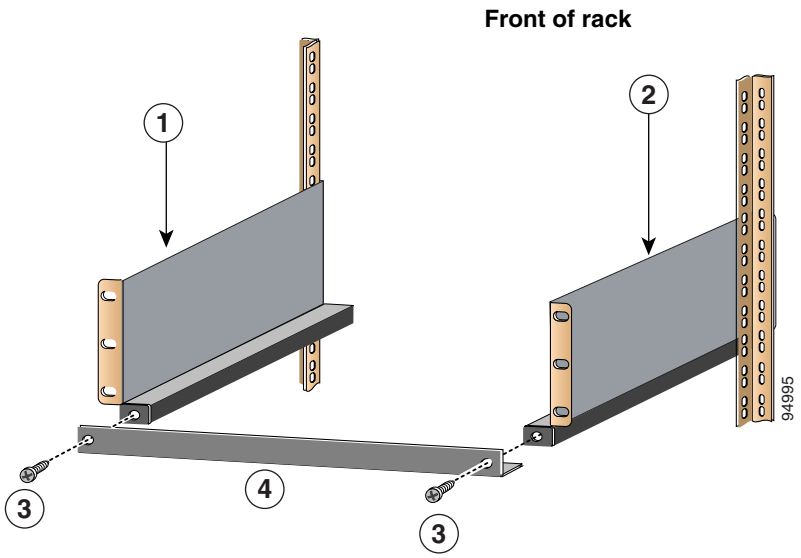
Figure 2-5 Installing the Side Rack-Mount Brackets for the Cisco MDS 9509 Chassis



1	Side rack-mount bracket	2	Screws, 12-24 or 10-32

Step 3 Attach the crossbar to the back of the side rack-mount brackets using one M3 x 8-mm screw per side as shown in Figure 2-6.

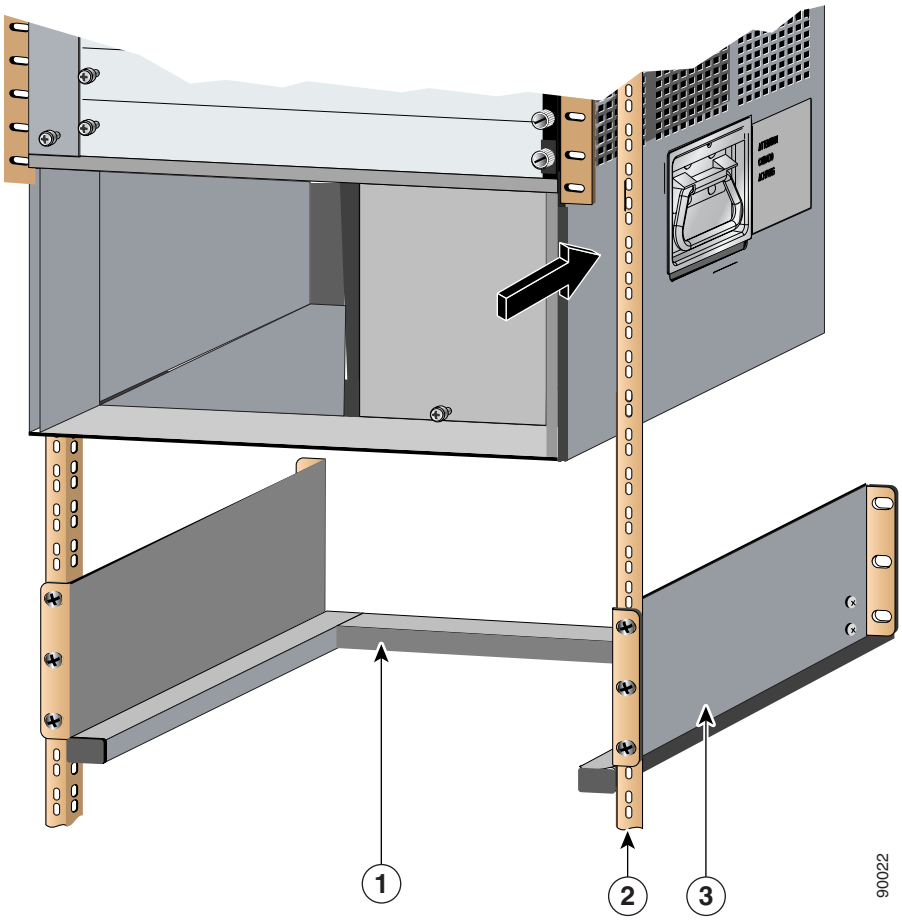
Figure 2-6 Attaching the Crossbar to the Side Rack-Mount Brackets (Rear View)



1	Side rack-mount bracket	3	Screws, M3
2	Side rack-mount bracket	4	Crossbar

Step 4 Position a person 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, avoiding sudden twists or moves to prevent injury. Place the rear of the chassis on the side rack-mount brackets between the front mounting rails, and slide it until it rests on the crossbar and the side rack-mount brackets (see Figure 2-7).

Figure 2-7 Installing the Cisco MDS 9509 Chassis in the Rack



1	Crossbar	**3**	Side rack-mount bracket
2	Mounting rail		

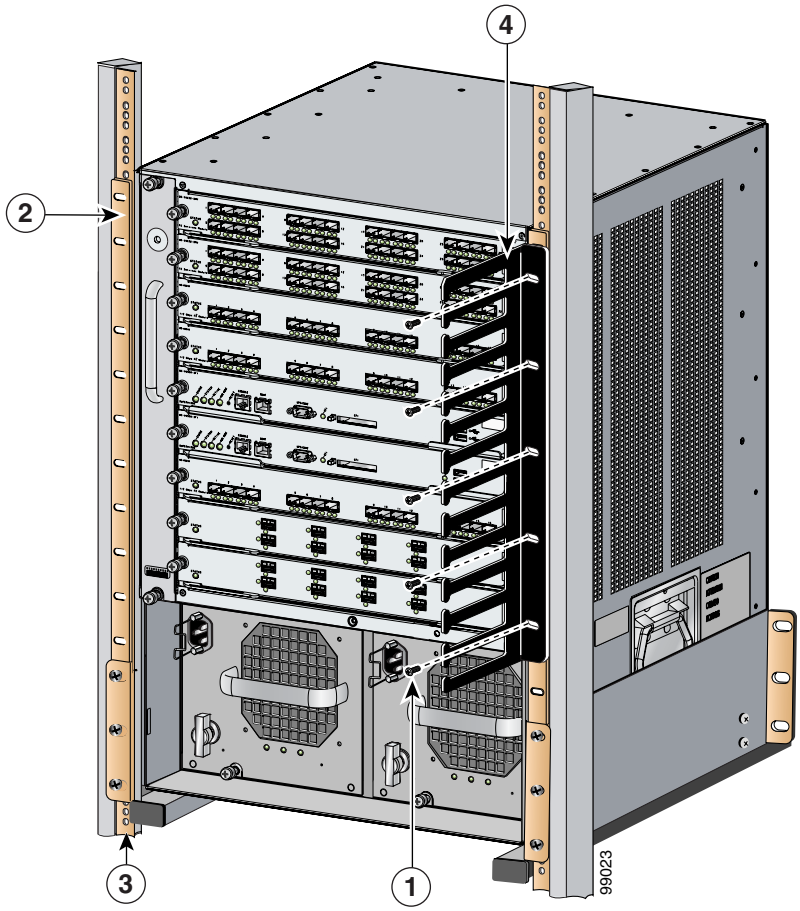
Step 5 If you are installing the optional cable management bracket, place the cable management bracket in front of the front right rack-mount brackets. Align the holes in the cable management brackets with the holes in the front rack-mount brackets and mounting rails, and then insert the screws.

Note Because the fan tray is on the left side of the chassis, we recommend using only the right side for cable management. This allows easy removal of the fan tray if you need to replace a fan.

Step 6 Align the holes in the front rack-mount bracket with the holes in the mounting rails and insert the 12-24 x 3/4-inch or 10-32 x 3/4-inch screws (see Figure 2-8), using six screws per side.

Note Use a minimum of six screws per side to ensure the switch is adequately supported.

Figure 2-8 Installing the Cable Management Bracket on the MDS 9509 Chassis



1	Screws, 12-24 or 10-32	**3**	Mounting rail
2	Front rack-mount bracket (behind cable guide)	**4**	Cable guide

Installing the Cisco MDS 9506 Director in a Rack

Table 2-3 lists the items provided in the Cisco MDS 9506 rack-mount kit. The kit contains extra M4 screws in case the front rack-mount brackets were removed from the switch and must be reinstalled.

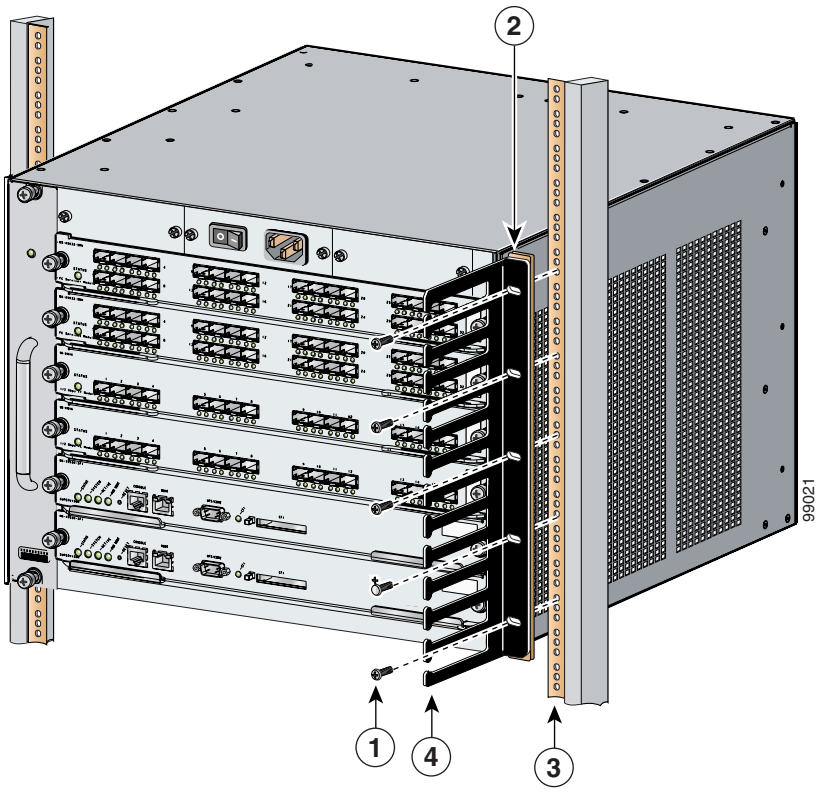
Note The rack-mount kit for the Cisco MDS 9506 Director does not include side rack mount brackets, because they are not required to install the Cisco MDS 9506 Director.

Table 2-3 Contents of Cisco MDS 9506 Rack-Mount Kit

Quantity	Part Description
14	12-24 x 3/4-in. Phillips binder-head screws
14	10-32 x 3/4-in. Phillips binder-head screws
14	M4 x 6-mm Phillips pan-head screws
2	Cable management brackets

Figure 2-9 shows the installation of a Cisco MDS 9506 director into a rack, using the cable management bracket.

Figure 2-9 Installing the Cisco MDS 9506 Chassis in the Rack



1	Screws, 12-24 or 10-32	**3**	Mounting rail
2	Front rack-mount bracket (behind cable guide)	**4**	Cable management bracket

To install the Cisco MDS 9506 chassis in the rack using the rack-mount kit, follow these steps:

Step 1 Place all the parts and screwdrivers near the rack for easy access while attaching the switch to the rack.

Note The front rack-mount brackets are shipped installed on the switch. If they have been uninstalled, reinstall them on the switch using the M4 x 6-mm screws.

Step 2 Position a person at each side of the chassis. Grasp the bottom of the chassis and slowly lift the chassis in unison, avoiding sudden twists or moves to prevent injury. Insert the rear of the chassis between the front mounting rails (see Figure 2-9), supporting the switch inside the rack until the next step is complete.

Step 3 If you are installing the optional cable management bracket, align the holes in the cable management bracket with the holes in the front, right rack-mount brackets and the mounting rail. Ensure that the chassis is level, and pass the screws through the cable management brackets and front rack-mount bracket and into the mounting rail.

Note Because the fan tray is on the left side of the chassis, we recommend using only the right side for cable management. This allows easy removal of the fan tray if you need to replace a fan.

Step 4 Align the holes in the front rack-mount bracket with the holes in the mounting rail, and ensure that the chassis is level. Insert the 12-24 x 3/4-inch or 10-32 x 3/4-inch screws (depending on the type of holes in the mounting rails) through the holes in the front rack-mount bracket and into the holes in the mounting rails, using four screws per side.

Caution Use a minimum of four screws per side to ensure the switch is adequately supported by the front rack-mount brackets.

System Grounding

This section describes the need for system grounding and explains how to prevent damage from electrostatic discharge.

Proper Grounding Practices

Grounding is one of the most important parts of equipment installation. Proper grounding practices ensure that the buildings and the installed equipment within them have low-impedance connections and low-voltage differentials between chassis. When you properly ground systems during installation, you reduce or prevent shock hazards, equipment damage due to transients, and data corruption. Table 2-4 lists some general grounding practice guidelines.

Table 2-4 Grounding Best Practices

Environment	Electromagnetic Noise Severity Level	Grounding Recommendations
Commercial building is subjected to direct lightning strikes. For example, some places in the United States, such as Florida, are subject to more lightning strikes than other areas.	High	All lightning protection devices must be installed in strict accordance with manufacturer recommendations. Conductors carrying lightning current should be spaced away from power and data lines in accordance with applicable recommendations and codes. Best grounding practices must be closely followed.
Commercial building is located in an area where lightning storms frequently occur but is not subject to direct lightning strikes.	High	Best grounding practices must be closely followed.
Commercial building contains a mix of information technology equipment and industrial equipment, such as welding.	Medium to high	Best grounding practices must be closely followed.
Existing commercial building is not subject to natural environmental noise or man-made industrial noise. This building contains a standard office environment. This installation has a history of malfunction due to electromagnetic noise.	Medium	Best grounding practices must be closely followed. Determine source and cause of noise if possible, and mitigate as closely as possible at the noise source or reduce coupling from the noise source to the victim equipment.
New commercial building is not subject to natural environmental noise or man-made industrial noise. This building contains a standard office environment.	Low	Best grounding practices should be followed as closely as possible. Electromagnetic noise problems are not anticipated, but installing a best practice grounding system in a new building is often the least expensive route and the best way to plan for the future.
Existing commercial building is not subject to natural environmental noise or man-made industrial noise. This building contains a standard office environment.	Low	Best grounding practices should be followed as much as possible. Electromagnetic noise problems are not anticipated, but installing a best practice grounding system is always recommended.

Note In all situations, grounding practices must comply with local National Electric Code (NEC) requirements or local laws and regulations.

Note Always ensure that all of the modules are completely installed and that the captive installation screws are fully tightened. In addition, ensure that all I/O cables and power cords are properly seated. These practices are normal installation practices and must be followed in all installations.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) damage, which can occur when modules or other FRUs are improperly handled, results in intermittent or complete failures. Modules consist of printed circuit boards that are fixed in metal carriers. Electromagnetic interference (EMI) shielding and connectors are integral components of the carrier. Although the metal carrier helps to protect the board from ESD, always use an ESD grounding strap when handling modules.

Follow these guidelines for preventing ESD damage:

- Always use an ESD wrist strap and ensure that it makes maximum contact with bare skin. ESD grounding straps are available with banana plugs, metal spring clips, or alligator clips. All MDS 9500 series chassis are equipped with a banana plug connector (identified by the ground symbol next to the connector) somewhere on the front panel. We recommend that you use a personal ESD grounding strap equipped with a banana plug.
- If you choose to use the disposable ESD wrist strap supplied with most FRUs or an ESD wrist strap equipped with an alligator clip, you must attach the system ground lug to the chassis in order to provide a proper grounding point for the ESD wrist strap.

Note This system ground is also referred to as the network equipment building system (NEBS) ground.

- If your chassis does not have the system ground attached, you must install the system ground lug. See "Establishing the System Ground" section on page 2-22 for installation instructions nd location of the chassis system ground pads.

Note You do not need to attach a supplemental system ground wire to the system ground lug; the lug provides a direct path to the bare metal of the chassis.

After you install the system ground lug, follow these steps to correctly attach the ESD wrist strap:

Step 1 Attach the ESD wrist strap to bare skin as follows:

a. If you are using the ESD wrist strap supplied with the FRUs, open the wrist strap package and unwrap the ESD wrist strap. Place the black conductive loop over your wrist and tighten the strap so that it makes good contact with your bare skin.

b. If you are using an ESD wrist strap equipped with an alligator clip, open the package and remove the ESD wrist strap. Locate the end of the wrist strap that attaches to your body and secure it to your bare skin.

Step 2 Grasp the spring or alligator clip on the ESD wrist strap and momentarily touch the clip to a bare metal spot (unpainted surface) on the rack. We recommend that you touch the clip to an unpainted rack rail so that any built-up static charge is then safely dissipated to the entire rack.

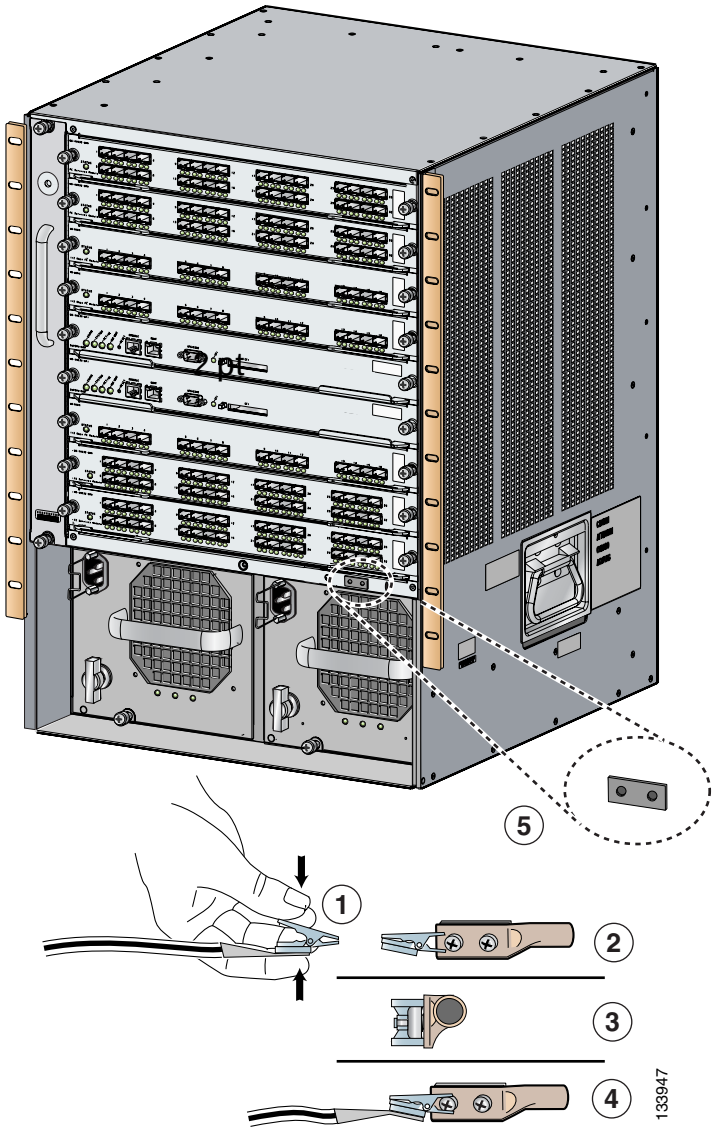
Step 3 Attach either the spring clip or the alligator clip to the ground lug screw as follows (See Figure 2-10.):

a. If you are using the ESD wrist strap that is supplied with the FRUs, squeeze the spring clip jaws open, position the spring clip to one side of the system ground lug screw head, and slide the spring clip over the lug screw head so that the spring clip jaws close behind the lug screw head.

Note The spring clip jaws do not open wide enough to fit directly over the head of the lug screw or the lug barrel.

b. If you are using an ESD wrist strap that is equipped with an alligator clip, attach the alligator clip directly over the head of the system ground lug screw or to the system ground lug barrel.

Figure 2-10 Attaching the ESD Wrist Strap to the System Ground Lug Screw



1	ESD ground strap	**4**	Clip installed (behind screw)
2	Clip and grounding lug	**5**	System ground connector
3	Side view of grounding lug (clip slid behind screw)		

c. In addition, follow these guidelines when handling modules:

- Handle carriers by available handles or edges only; avoid touching the printed circuit boards or connectors.
- Place a removed component board-side-up on an antistatic surface or in a static shielding container. If you plan to return the component to the factory, immediately place it in a static shielding container.

– Never attempt to remove the printed circuit board from the metal carrier.

Caution For safety, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 megohm (Mohm).

Establishing the System Ground

This section describes how to connect a system ground to the MDS 9500 series switches.

Note This system ground is also referred to as the network equipment building system (NEBS) ground.

You must use the system (NEBS) ground on both AC- and DC-powered systems if you are installing this equipment in a U.S. or European Central Office.

The system (NEBS) ground provides additional grounding for EMI shielding requirements and grounding for the low voltage supplies (DC-DC converters) on the modules and is intended to satisfy the Telcordia Technologies NEBS requirements for supplemental bonding and grounding connections. You must observe the following system grounding guidelines for your chassis:

- You must install the system (NEBS) ground connection with any other rack or system power ground connections that you make. The system ground connection is required if this equipment is installed in a U.S. or European Central Office.
- You must connect both the system (NEBS) ground connection and the power supply ground connection to an earth ground. The system (NEBS) ground connection is required if this equipment is installed in a U.S. or European Central Office.
- For MDS 9500 series chassis that are equipped with DC-input power supplies, you must install the system (NEBS) ground before you attach the source DC power cables to the DC PEM. If the chassis is powered up, you must power down the chassis before attaching the system (NEBS) ground. If you are installing the system (NEBS) ground on models of the MDS 9500 series chassis that are equipped with either AC-input or DC-input power supplies, you do not need to power down the chassis.

Note The system (NEBS) ground serves as the primary safety ground for the MDS 9500 series chassis that are equipped with DC-input PEMs. The DC-input power supplies for these chassis do not have a separate ground.

Required Tools and Equipment

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

- Grounding lug—A two holes standard barrel lug. Supports up to 6 AWG wire. Supplied as part of accessory kit.
- Grounding screws—Two M4 x 8mm (metric) pan-head screws. Supplied as part of the accessory kit.

- Grounding wire—Not supplied as part of accessory kit. The grounding wire should be sized according to local and national installation requirements. Depending on the power supply and system, a 12 AWG to 6 AWG copper conductor is required for U.S. installations. Commercially available 6 AWG wire is recommended. The length of the grounding wire depends on the proximity of the switch to proper grounding facilities.
- No. 1 Phillips screwdriver.
- Crimping tool to crimp the grounding wire to the grounding lug.
- Wire-stripping tool to remove the insulation from the grounding wire.

Grounding the Chassis

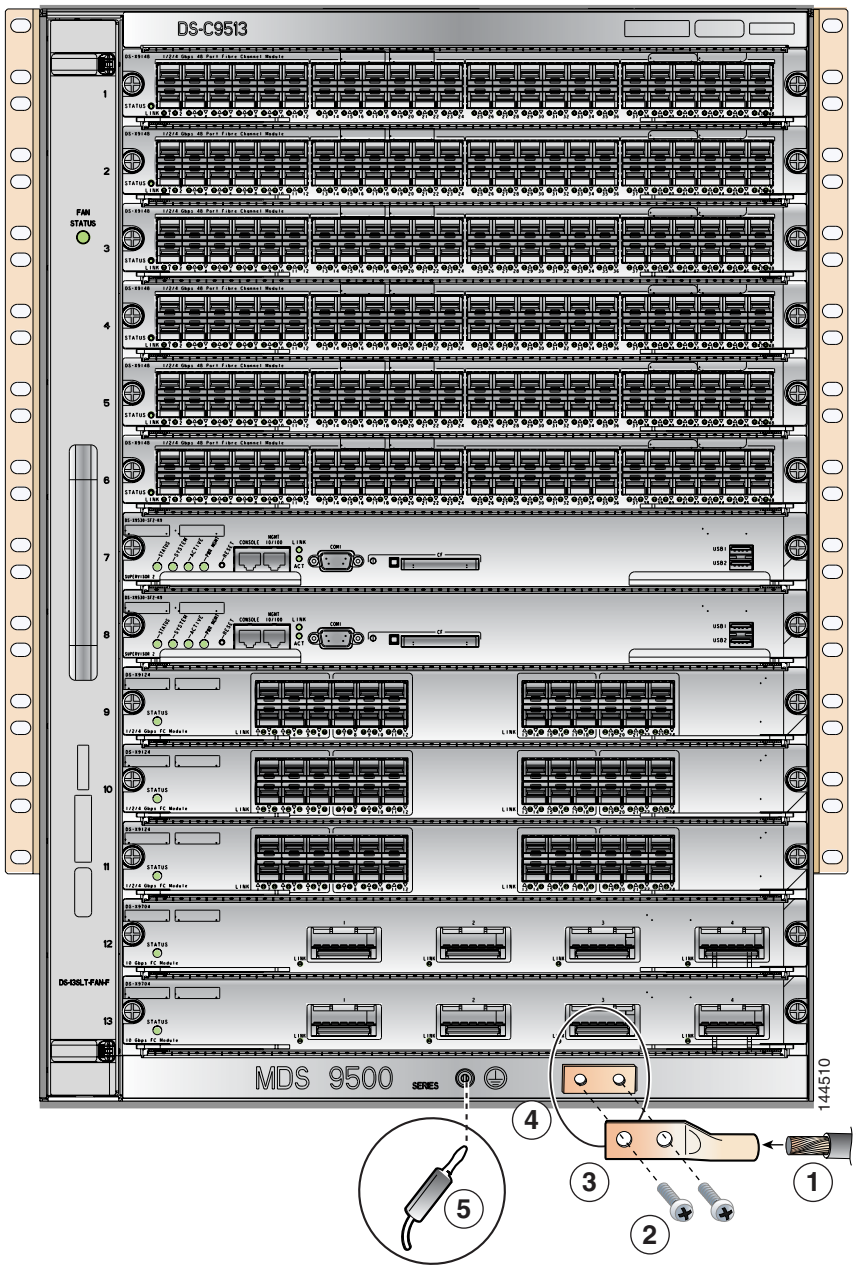
This section describes how to connect the Cisco MDS 9500 Series to earth ground.

You must complete this procedure before connecting system power or powering up your shelf.

Warning **When installing or replacing the unit, the ground connection must always be made first and disconnected last.** Statement 1046

Figure 2-11shows the system ground location on the front panel of the Cisco MDS 9513 chassis.

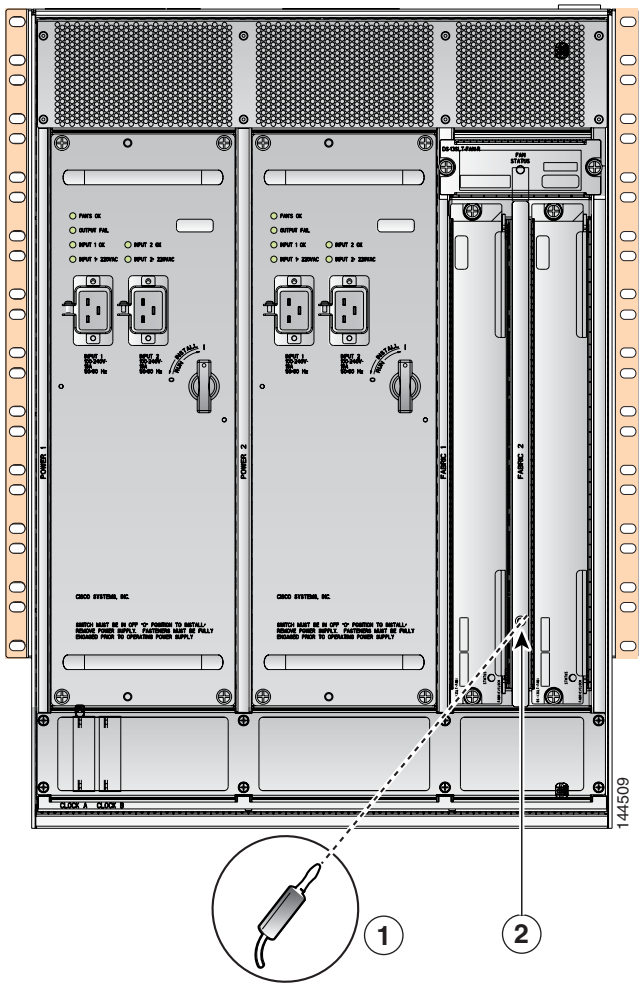
Figure 2-11 System Ground Location on the Cisco MDS 9513 Chassis (Front)



1	Grounding cable	**4**	Close-up of grounding pad on switch
2	Screws, M4, with square cone washers	**5**	ESD plug
3	NRTL listed grounding lug		

Figure 2-12 shows the ESD ground location on the rear panel of the Cisco MDS 9513 chassis.

Figure 2-12 ESD Ground Location on the Cisco MDS 9513 Chassis (Rear)

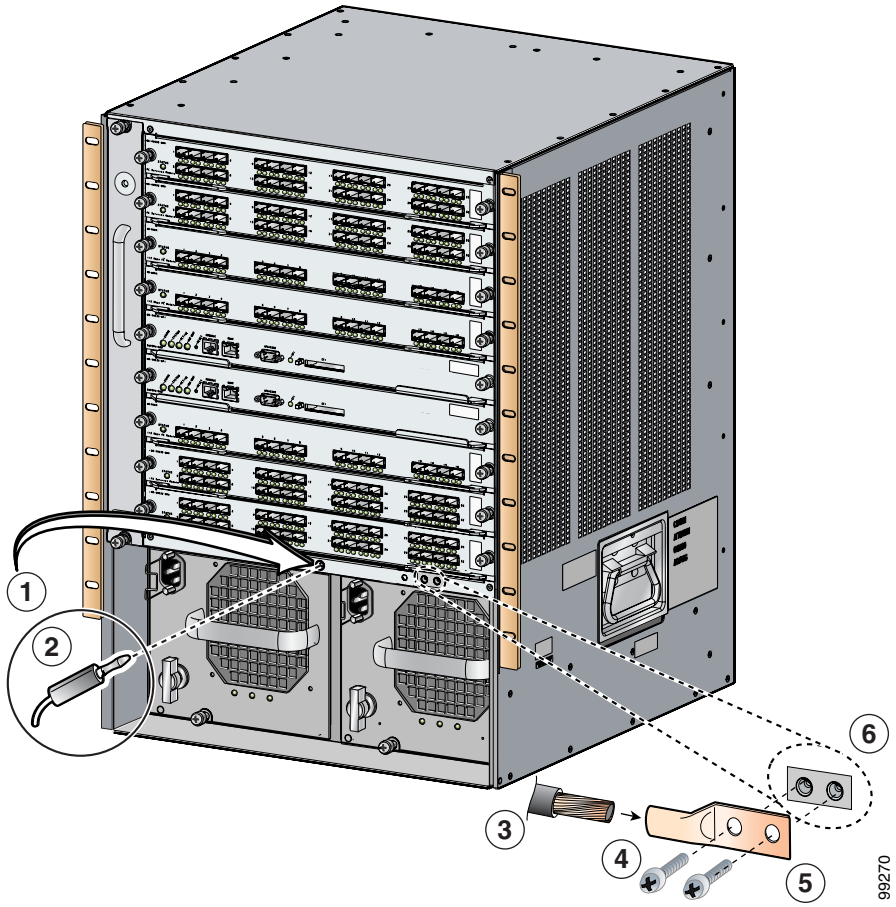


1	ESD plug	2	ESD socket

Caution All power supplies must be grounded. The receptacles of the AC power cables used to provide power to the chassis must be the grounding type, and the grounding conductors should connect to protective earth ground at the service equipment. For a Cisco MDS 9509 Director with a DC power supply, a grounding cable must be connected to the terminal block. For a Cisco MDS 9506 Director with a DC power supply, the chassis ground is required.

Figure 2-13 shows the system ground location on the Cisco MDS 9509 chassis.

Figure 2-13 System Ground Location on the Cisco MDS 9509 Chassis

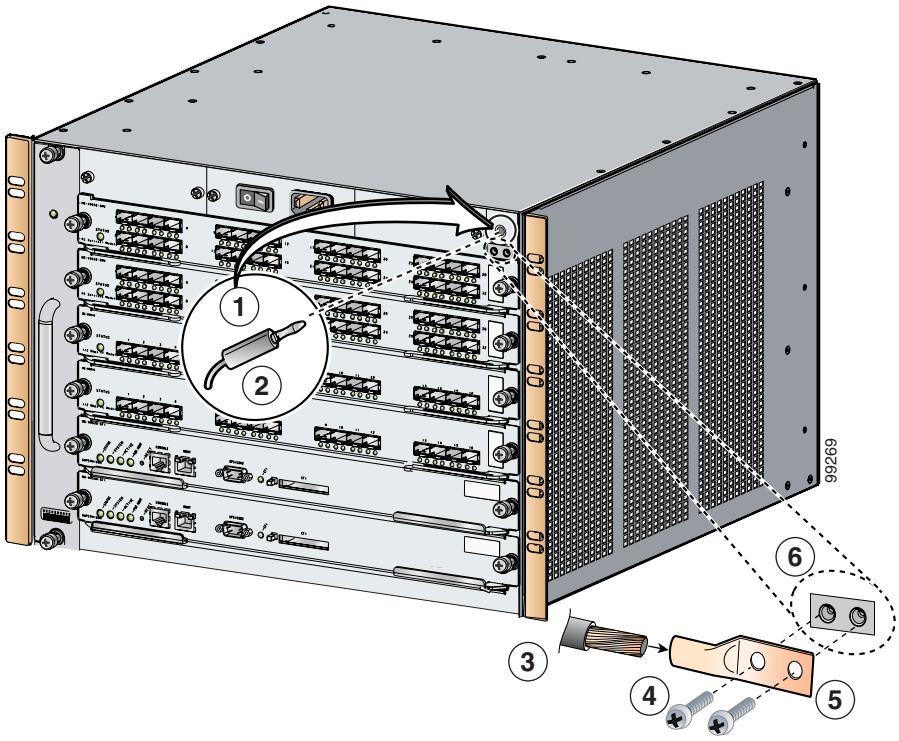


1	ESD socket (on switch)	**4**	Screws, M4, with square cone washers
2	ESD plug	**5**	NRTL listed grounding lug
3	Grounding cable	**6**	Close-up of grounding pad on switch

Caution Grounding the chassis is required for Cisco MDS 9506 Directors that have DC power supplies, and we recommend it for all other chassis types, even if the rack is already grounded. A grounding pad with two threaded M4 holes is provided on the chassis for attaching a grounding lug. The ground lug must be NRTL listed. In addition, the copper conductor (wires) must be used and the copper conductor must comply with NEC code for ampacity.

Figure 2-14 shows the system ground location on the Cisco MDS 9506 chassis.

Figure 2-14 System Ground Location on the Cisco MDS 9506 Chassis



1	ESD socket (on switch)	**4**	Screws, M4, with square cone washers
2	ESD plug	**5**	NRTL listed grounding lug
3	Grounding cable	**6**	Close-up of grounding pad on switch

To attach the grounding lug and cable to the chassis, follow these steps:

Step 1 Locate the ESD socket on your chassis and attach the ESD plug.

Step 2 Use a wire-stripping tool to remove approximately 0.75 inches (19 mm) of the covering from the end of the grounding cable.

Step 3 Insert the stripped end of the grounding cable into the grounding lug.

Step 4 Use the crimping tool to secure the grounding cable in the grounding lug.

Step 5 Remove the adhesive label from the grounding pad on the chassis.

Step 6 Place the grounding lug against the grounding pad so that there is solid metal-to-metal contact, and insert the two M4 screws with washers through the holes in the grounding lug and into the grounding pad. Ensure that the lug and cable do not interfere with other equipment.

Step 7 Prepare the other end of the grounding cable and connect it to an appropriate grounding point in your site to ensure adequate earth ground.

Starting Up the Switch

This section provides the following information:

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

Caution During this procedure, wear grounding wrist straps to avoid ESD damage to the switch.

Note The 2500-W (DS-CAC-2500W) power supplies provide power according to the input voltage. If they are in redundant rather than combined mode at 110 VAC, they may be unable to provide adequate power to all modules present in the system. See Appendix B, "Technical Specifications.".

Connecting the Power Supplies

The Cisco MDS 9513 Director uses a 6000-W power supply. The 6000-W AC power supplies for the Cisco MDS 9513 Director are designed to provide an output power for the modules and fans. Each power supply has two AC power connections and will provide power as follows:

- One AC power connection @110 VAC = No output
- Two AC power connection @110 VAC = 2900-W output
- One AC power connection @ 220 VAC = 2900-W output
- Two AC power connection @ 220 VAC = 6000-W output

Note Power output does not include the power used by the individual modules used in the chassis.

The Cisco MDS 9509 Director and Cisco MDS 9506 Director support both AC and DC power supplies.

The Cisco MDS 9506 Director uses power entry modules (PEMs) to provide power to its power supplies, whether they are AC or DC (there is no power connector on the power supplies). The left PEM (as viewed from the front of the switch) provides power to the upper power supply in the back of the Cisco MDS 9506 Director, and the right PEM provides power to the lower power supply.

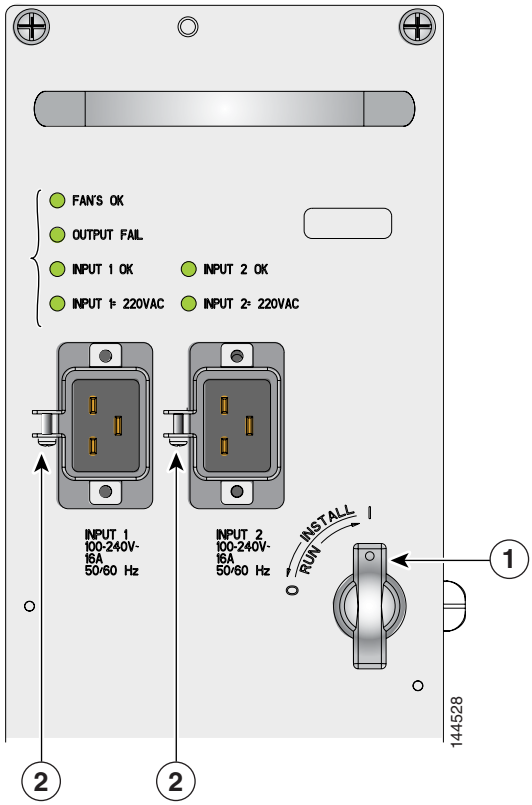
This section provides the following topics:

Providing Power to an AC Power Supply for the Cisco MDS 9513 Director

To provide power to an AC power supply in a Cisco MDS 9513 Director, follow these steps:

Step 1 Plug the power cable into the power supply, and tighten the screw on the cable retention device to ensure the cable cannot be pulled out. Each power supply has two AC power connections. (See Figure 2-15.)

Figure 2-15 Cable Retention on the Power Supply



1	Power switch	2	Cable retention

Step 2 Connect the other end of the power cable to an AC power source.

Step 3 Turn the power switch to the on (|) position on the power supply.

Step 4 Verify power supply operation by checking that the power supply LEDs are in the following states:

- INPUT OK LEDs are green.
- FAN OK LEDs are green.
- OUTPUT FAIL LED is off.

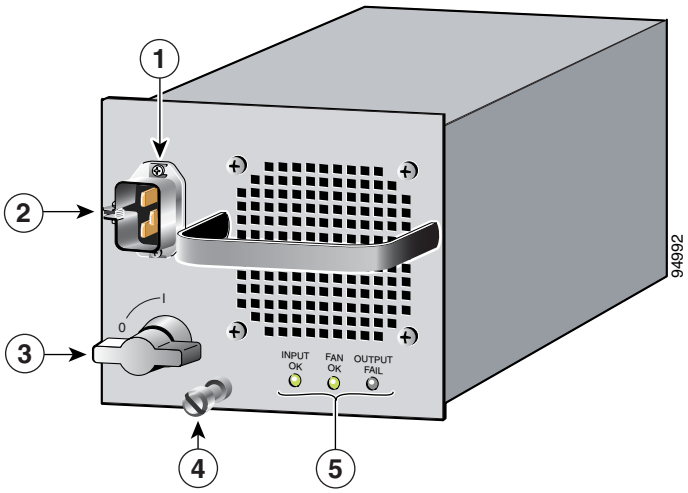
See Table 1-1 on page 1-8 for power supply LED details.

Providing Power to an AC Power Supply for the Cisco MDS 9509 and Cisco MDS 9506 Directors

The basic procedure for providing power to an AC power supply is the same for both a Cisco MDS 9509 Director and a Cisco MDS 9506 Director.

Figure 2-16 shows a 2500-W AC power supply for the Cisco MDS 9509 Director.

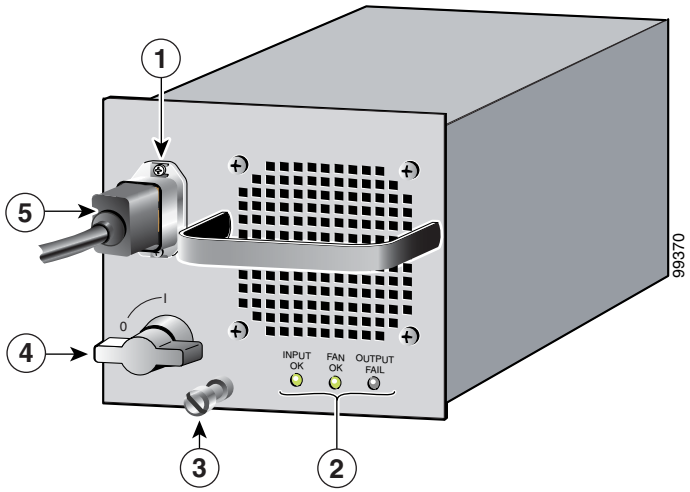
Figure 2-16 2500-W AC Power Supply for the Cisco MDS 9509 Director



1	AC power connection	**4**	Captive screws
2	Power cable retainer	**5**	Power supply LEDs
3	Power supply switch		

Figure 2-17 shows a 4000-W AC power supply for the Cisco MDS 9509 Director.

Figure 2-17 4000-W AC Power Supply for the Cisco MDS 9509 Director

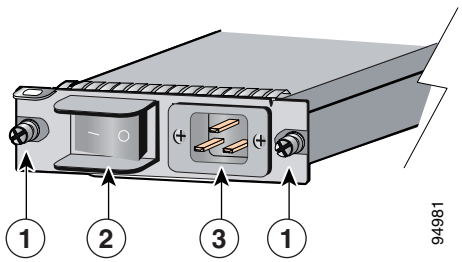


1	AC power connection	**4**	Power supply switch
2	Power supply LEDs	**5**	Permanent power cable
3	Captive screws		

Caution The following applies to AC power supplies on the Cisco MDS 9506 only:
The DS-C9506 equipment is suitable for use on TN power systems and the IT-power system connection of Norway (max 230-V phase-phase). If connected to a 230- or 400-V IT power system, beware of high leakage current. Earth connection is essential before connecting power supply.

Figure 2-18 shows an AC PEM for a Cisco MDS 9506 Director.

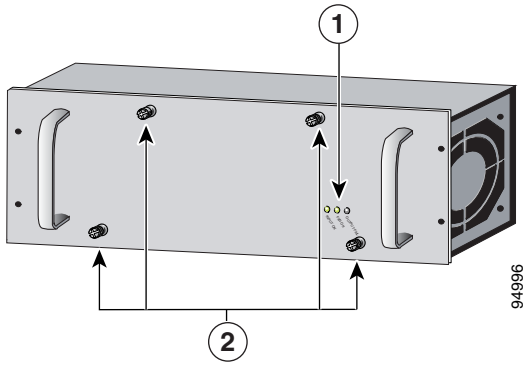
Figure 2-18 AC PEM for Cisco MDS 9506 Director



1	Captive screws	**3**	AC power connection
2	PEM switch		

Figure 2-19 shows a power supply for a Cisco MDS 9506 Director. The power supply has no power connector. The power connector is provided on the PEM. The AC and DC power supplies are similar in appearance except for the label, which indicates whether it is AC or DC.

Figure 2-19 Power Supply for Cisco MDS 9506 Director



1	Power supply LEDs	2	Captive screws

To provide power to an AC power supply in a Cisco MDS 9509 Director or a Cisco MDS 9506 Director, follow these steps:

Step 1 Plug the power cable into the switch as follows:

- For the Cisco MDS 9509 Director, plug the power cable into the power supply and tighten the screw on the power cable retainer to ensure the cable cannot be pulled out.

Note The 4000-W AC power supply for the Cisco MDS 9509 Director has a permanent power cable attached.

- For the Cisco MDS 9506 Director, plug the power cable into the AC PEM on the front of the chassis.

Step 2 Connect the other end of the power cable to a power source.

Note Depending on the outlet receptacle on your power distribution unit, you may need the optional jumper power cord to connect the Cisco MDS 9500 Series director to your outlet receptacle. See the "Jumper Power Cord" section on page C-12.

Providing Power to a DC Power Supply in the Cisco MDS 9509 Director

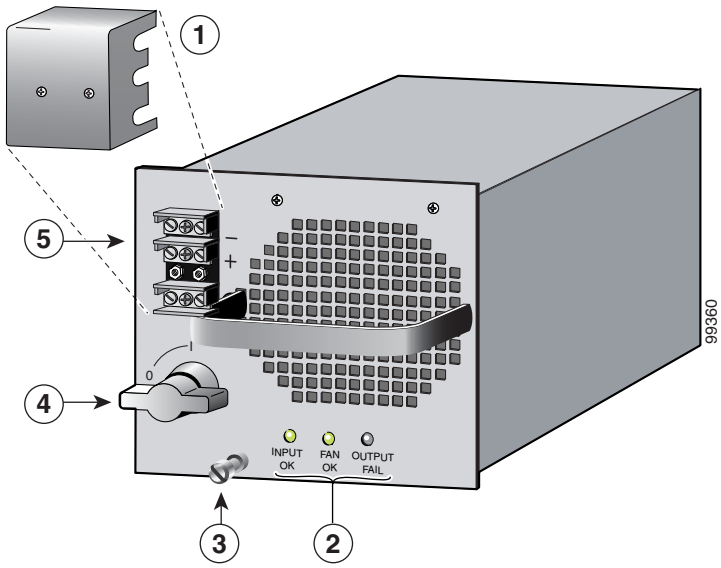
Warning **Before performing any of the following procedures, ensure that power is removed from the DC circuit.** Statement 1003

Warning **When installing or replacing the unit, the ground connection must always be made first and disconnected last.** Statement 1046

See the "System Grounding" section on page 2-17.

Figure 2-20 shows the 2500-W DC power supply.

Figure 2-20 2500-W DC Power Supply for the Cisco MDS 9509 Director



1	Terminal block cover	**4**	Power supply switch
2	Power supply LEDs	**5**	Terminal block
3	Captive screw		

Note Use 90-degree C fine-stranded copper conductors for North American installations.

To provide power to a DC power supply in a Cisco MDS 9509 Director, follow these steps:

Step 1 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 then tape the switch handle of the circuit breaker in the off position.

Step 2 Ensure that the system (earth) ground connection is made. See the "System Grounding" section on page 2-17.

Step 3 Turn the power switch on the power supply to off (0).

Step 4 Remove the two screws securing the terminal block cover and pull the cover off the terminal block.

Step 5 Connect the DC power cables to the terminal block as follows:

a. Identify the ground, negative, and positive DC cables and verify that all are copper and sized per local and national installation requirements.

b. Strip the cable ends to allow for metal-to-metal contact.

c. Loosen the screws in the terminal block and connect the DC power cables to the terminal block in the following order:

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

Caution The DC return connection (Negative (-)) to this system is to remain isolated from the system frame and chassis (DC-I). Loosen the captive screw on the power supply.

Warning **When installing or replacing the unit, the ground connection must always be made first and disconnected last.** Statement 1046

d. Secure the cables in place by tightening the terminal block screws.

e. Replace the terminal block cover and tighten the two screws attaching it to the chassis.

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

Step 6 If a second DC power supply is installed, repeat the procedure for the other power supply, using a separate power source to provide redundancy in case of a line failure and ensuring the related circuit is off.

Caution Leave the power to the DC circuit off until you are ready to provide power to the switch.

Step 7 If there are no other DC power cables to connect and you are ready to power the switch on, restore power to the DC circuit by removing the tape from the circuit breaker handle and flipping the handle to on.

Providing Power to a DC Power Supply in the Cisco MDS 9506 Director

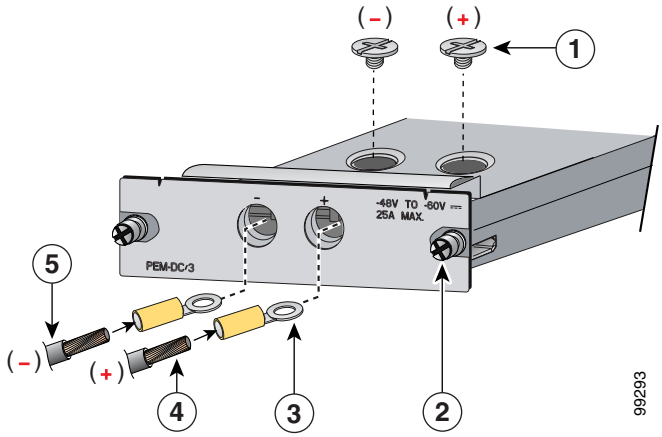
Warning **Before performing any of the following procedures, ensure that power is removed from the DC circuit.** Statement 1003

Warning **When installing or replacing the unit, the ground connection must always be made first and disconnected last.** Statement 1046

See the "System Grounding" section on page 2-17.

Figure 2-21 shows the location of the terminal block screws and how to insert the lugs through the holes in the front of the PEM to connect them to the screws.

Figure 2-21 DC PEM for a Cisco MDS 9506 Director



1	Terminal block screws (+ and -)	**4**	Exposed portion of positive cable
2	Captive screw	**5**	Insulated portion of negative cable
3	Ring lug		

Note Use 90-degree C fine-stranded copper conductors for North American installations.

To provide power to a DC power supply in a Cisco MDS 9506 Director, follow these steps:

Step 1 Ensure that all power to the DC circuit is off by locating 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.

Step 2 Ensure that the system (earth) ground connection is made. See the "System Grounding" section on page 2-17.

Step 3 Loosen the captive screws on the DC PEM and pull the PEM partially out of the chassis to provide access to the PEM terminal block screws.

Step 4 Connect the positive and negative DC cables to the DC PEM using a 10-32 ring lug for each cable, as follows:

a. Identify the positive and negative DC cables and ensure that both are copper and sized per local and national installation requirements.

b. Strip the cable ends to allow for metal-to-metal contact. Insert each cable into a separate ring lug, and crimp the lugs around the cables.

c. Insert each cable and lug into the appropriate hole in the front of the PEM and fasten the lugs to the appropriate terminal block screws in the following order:
   - Negative (-)
   - Positive (+)

d. Secure the cables in place by tightening the terminal block screws.

Step 5 Ensure that all cable connections are secure before sliding the PEM back into the chassis, and then tighten the captive screws.

Caution The DC return connection (Negative (-)) to this system is to remain isolated from the system frame and chassis (DC-I). Loosen the captive screw on the power supply.

Warning **When installing or replacing the unit, the ground connection must always be made first and disconnected last.** Statement 1046

Step 6 If a second DC power supply is installed, repeat the procedure for the other DC PEM, using a separate power source to provide redundancy in case of a line failure, and ensuring the related circuit is off.

Caution Leave the power to the DC circuits off until you are ready to provide power to the switch.

Step 7 If there are no other DC power cables to connect and you are ready to power the switch on, restore power to the DC circuit by removing the tape from the circuit breaker handle and flipping the handle to on.

Powering Up the Switch and Verifying Component Installation

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

Note Do not connect the MGMT 10/100 Ethernet port to the LAN until the initial switch configuration has been performed. For instructions on configuring the switch, refer to the *Cisco MDS 9000 Family CLI Configuration Guide* or the *Cisco MDS 9000 Family Fabric Manager Configuration Guide*.

For instructions on connecting to the console port, see the "Connecting to the Console Port" section on page 3-2).

To power up the switch and verify hardware operation, follow these steps:

Step 1 Verify that the faceplates of all modules are flush with the front of the chassis, and the ejector levers are fully closed and approximately parallel to the faceplate of the module.

Step 2 Verify that any empty module slots have filler panels installed.

Step 3 Verify that both power supplies and the fan module are installed.

Step 4 If any optional CompactFlash cards are installed, verify that the ejector button is popped out.

Step 5 Check the captive screws of the power supplies, fan module, and all supervisor, switching, or services modules, and tighten any loose captive screws.

Step 6 Ensure that the switch is adequately grounded as described in the "System Grounding" section on page 2-17, and that the power cables are connected to outlets that have the required AC or DC power voltages. See Appendix B, "Technical Specifications," for the required voltages.

Step 7 Power on the switch by turning the power switches on the power supplies or PEMs to the on (|) position or restoring power to the DC circuit, as required. The switch boots automatically.

Step 8 Listen for the fans; they should begin operating as soon as the switch is powered on.

Caution Do not operate the switch without a functioning fan module except during the brief fan module replacement procedure. The Cisco MDS 9000 Family switches can operate for only a few minutes without a functioning fan module before they begin to overheat.

Step 9 After the switch has finished booting, verify that the LED behavior is as follows:

- Fan module: Status LED is green.
- Power supplies:
  - Input OK LED is green.
  - Fan OK LED is green.
  - Output Fail LED is off.
- Supervisor, switching, or services modules:
  - The System LED on the supervisor module is green, indicating that all chassis environmental monitors are reporting that the system is operational. If this LED is orange or red, then one or more environmental monitor is reporting a problem.
  - The Status LED on the switching or services modules flashes orange once, remains orange during diagnostic boot tests, then turns green when the module is operational (online). If the system software cannot start up, this LED remains orange or turns red.

Note The LEDs for the Fibre Channel ports remain orange until the ports are enabled, and the LED for the MGMT 10/100 Ethernet port remains off until the port is connected.

If any LEDs other than the Fibre Channel port LEDs remain orange or red after the initial boot processes are complete, see Appendix B, "Technical Specifications."

Step 10 If a component is not operating correctly, try removing and reinstalling it. If it still does not operate correctly, contact your customer service representative for a replacement.

Note If you purchased this product through a Cisco reseller, contact the reseller directly for technical support. If you purchased this product directly from Cisco Systems, contact Cisco Technical Support at this URL: http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml.

Step 11 Verify that the system software has booted and the switch has initialized without error messages. If any problems occur, refer to the *Cisco MDS 9000 Family Troubleshooting Guide* or the *Cisco MDS 9000 Family System Messages Reference*. If you cannot resolve an issue, contact your customer service representative.

Step 12 Complete the worksheets provided in Appendix D, "Site Planning and Maintenance Records," for future reference.

Note A setup utility automatically launches the first time you access the switch and guides you through the basic configuration. For instructions about how to configure the switch and check module connectivity, refer to the *Cisco MDS 9000 Family CLI Configuration Guide* or the *Cisco MDS 9000 Family Fabric Manager Configuration Guide*.

Removing, Installing, and Verifying Supervisor, Switching, and Services Modules

This section provides the following information:

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

Warning **Use of controls, adjustments, or performing procedures other than those specified may result in hazardous radiation exposure.** Statement 1057

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

Caution To prevent ESD damage, wear grounding wrist straps during these procedures and handle modules by the carrier edges only.

Note Install the Cisco MDS 9500 Series chassis in the rack before installing modules. See the "Installing the Chassis in a Cabinet or Rack" section on page 2-6.

Note In systems with redundant supervisor modules, you can replace the faulty supervisor while the system is operating, provided one supervisor is always operating.

Removing Supervisor Modules

To remove a Supervisor-1 or Supervisor-2 module from the chassis, follow these steps:

Step 1 Gracefully shut down the crossbar switching fabric functionality in the supervisor module of the Cisco MDS 9509 and 9506 Directors by entering the **out-of-service module** *slot* command (where *slot* refers to the slot number for the Supervisor-1 or Supervisor-2 module where the integrated crossbar is located).

Step 2 If the switch has only one supervisor module, upload the current configuration to a server. For information about the correct command to use, refer to the *Cisco MDS 9000 Family CLI Configuration Guide*.

Step 3 If the switch has two supervisor modules and the supervisor you are removing is currently active, then fail over to the standby supervisor. Refer to the *Cisco MDS 9000 Family CLI Configuration Guide* for information on how to fail over a supervisor module.

Note Step 4 applies only to the Supervisor-1 module, not the Supervisor-2 module.

Step 4 If the switch has two supervisor modules and is running Cisco MDS SAN-OS Release 1.2(2a) or earlier, turn off the automatic synchronization feature. This prevents the switch from attempting to fail over to a nonexistent standby supervisor module. Refer to the *Cisco MDS 9000 Family CLI Configuration Guide* for information on how to turn off the **auto-sync** option.

Step 5 Disconnect any network interface cables attached to the module.

Step 6 Loosen the two captive screws on the module being removed.

Step 7 Remove the module from the chassis as follows:

a. Place your thumbs on the left and right ejector levers and simultaneously rotate the levers outward to unseat the module from the backplane connector.

b. Grasp the front edge of the module and slide the module partially out of the slot. Place your other hand under the module to support the weight of the module. Do not touch the module circuitry.

Step 8 Place the module on an antistatic mat or antistatic foam, or immediately reinstall it in another slot.

Step 9 If the slot will remain empty, install a filler panel to keep dust out of the chassis and to maintain proper airflow through the chassis.

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

Installing Supervisor Modules

In a Cisco MDS 9513 Director, slots 7 and 8 are reserved for the Supervisor-2 modules. For the Cisco MDS 9509 and 9506 Directors, slot 5 is reserved for the Supervisor-1 module. Slot 6 is reserved for an additional redundant supervisor module in case the supervisor module in slot 5 fails. See Figure 1-3 on page 1-5 and Figure 1-4 on page 1-6 for slot locations.

Step 1 Before installing any modules in the chassis, we recommend installing the chassis in the rack. See the "Installing the Chassis in a Cabinet or Rack" section on page 2-6.

Step 2 Verify that there is enough clearance to accommodate any cables or interface equipment that you want to connect to the module.

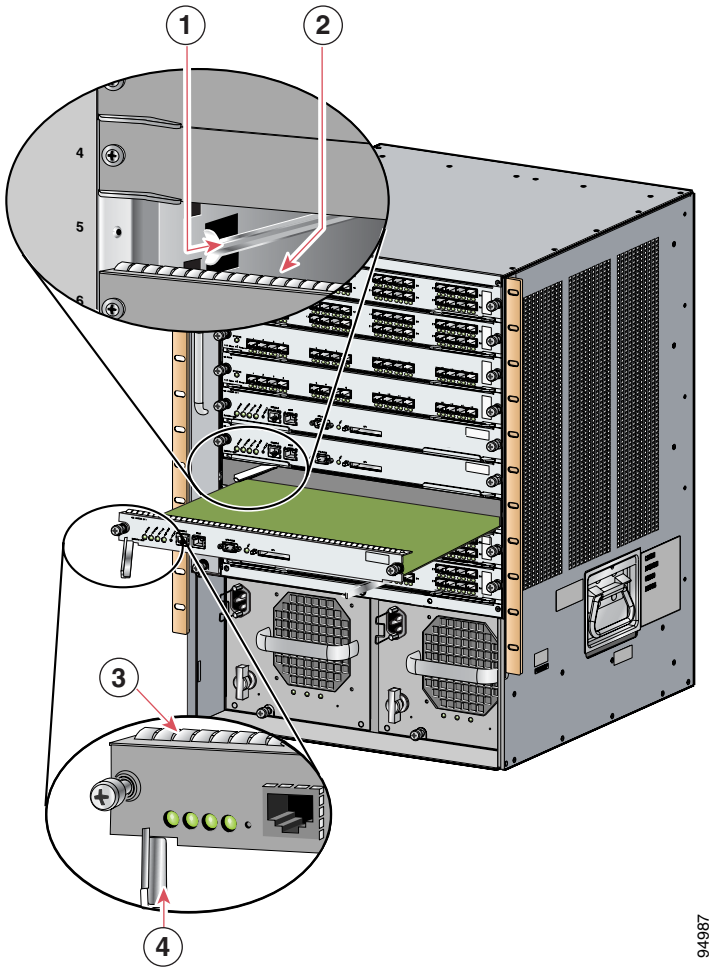
Step 3 Verify that the captive screws are tightened to 8 in-lb on all modules already installed in the chassis. This ensures that the EMI gaskets are fully compressed and maximizes the opening space for the module being installed.

Step 4 If a filler panel is installed, remove the two Phillips pan-head screws from the filler panel and remove the panel. To remove a currently installed module, see the "Removing Other Switching and Services Modules" section on page 2-45.

Step 5 Open fully both ejector levers on the new or replacement module (see Figure 2-22).

Step 6 Position the module in the chassis as follows:

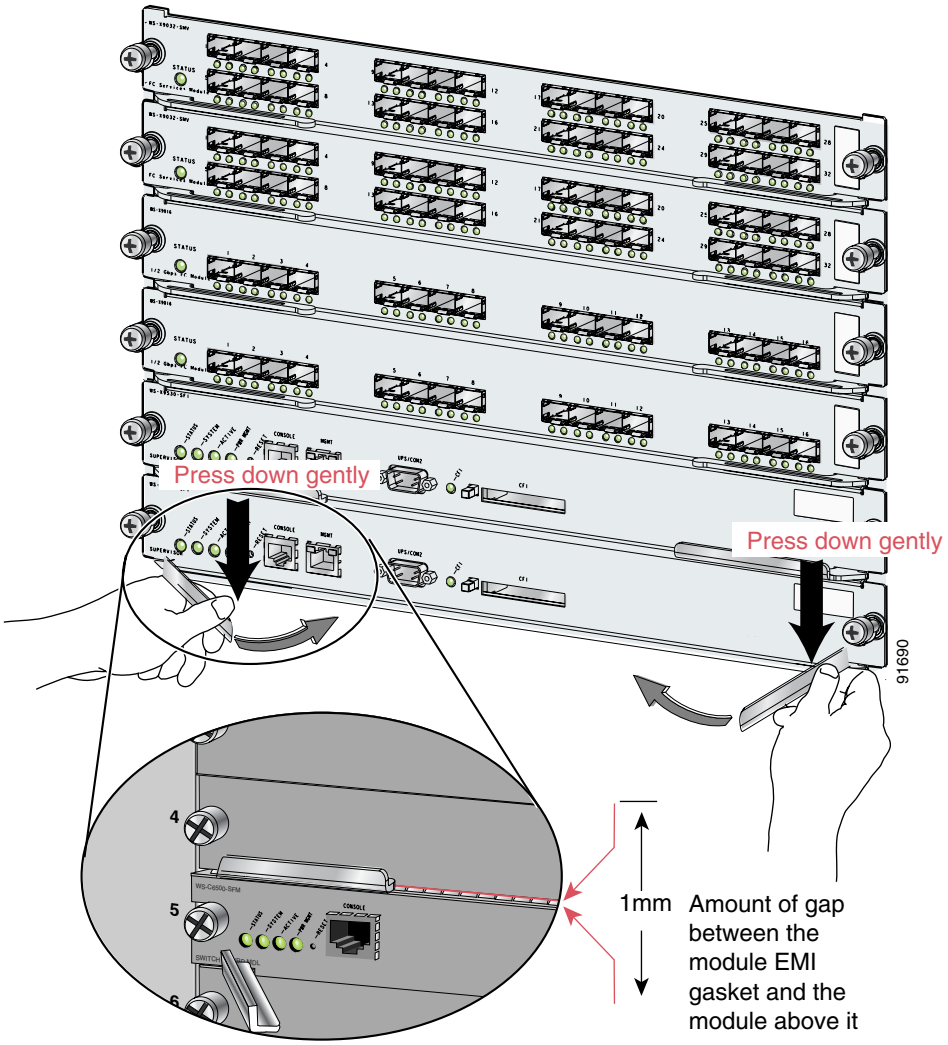
Figure 2-22 Positioning a Module in the Chassis



1	Slot guides	**3**	EMI Gasket
2	EMI Gasket	**4**	Ejector level (fully extended)

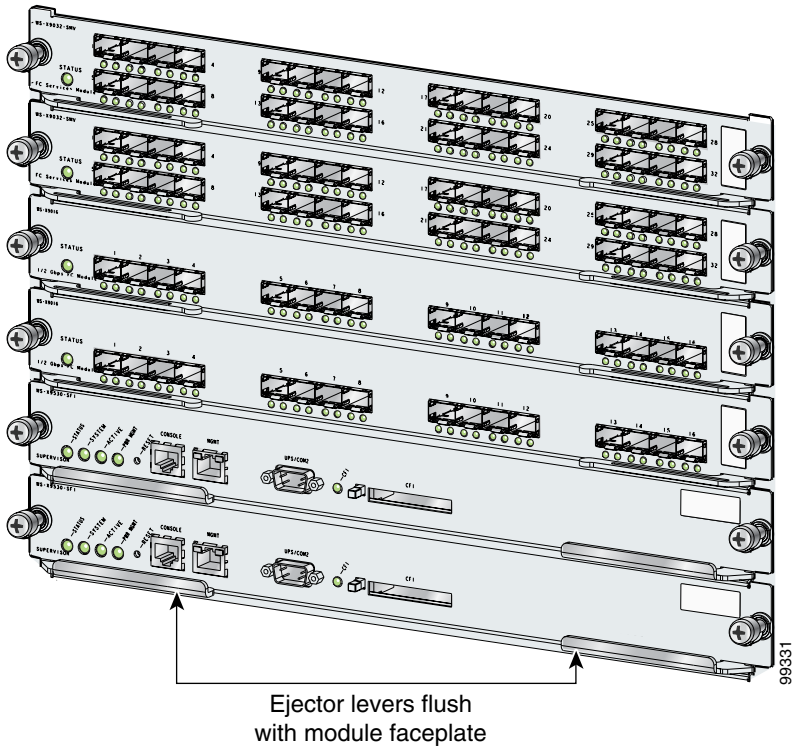
a. Slide the module carefully into the slot until the EMI gasket along the top edge of the module contacts the module in the slot above it and both ejector levers close to approximately 45 degrees with respect to the front of the module (see Figure 2-23).

Figure 2-23 Clearing the EMI Gasket



b. Grasp the two ejector levers using the thumb and forefinger of each hand, and press down to create a small 0.040-inch (1-mm) gap between the module's EMI gasket and the module above it (see Figure 2-24).

Figure 2-24 Closing the Ejector Levers



Caution Do not press down too forcefully on the levers because they can bend.

c. While pressing down, simultaneously close the left and right ejector levers to fully seat the supervisor module or switching module in the backplane connector. The ejector levers are fully closed when they are flush with the front of the module.

Note Ensure the ejector levers are fully closed before tightening the captive screws. Failure to fully seat the module in the backplane connector can result in error messages.

d. Tighten the two captive screws on the supervisor module or switching module to 8 in-lb.

Step 7 If you replaced the standby supervisor module in a switch that has two supervisors and is running Cisco MDS SAN-OS Release 1.2(2a) or earlier, enable the automatic synchronization feature, which is disabled by default. Refer to the *Cisco MDS 9000 Family CLI Configuration Guide* for information about the **auto-sync** option.

Step 8 If you replaced the supervisor in a switch that does not have a second supervisor or is running Cisco MDS SAN-OS Release 1.3(1) or later, download the configuration from the server to the nonvolatile memory of the supervisor. For more information, refer to the *Cisco MDS 9000 Family CLI Configuration Guide*.

Removing a Caching Services Module

Note A minimum of two CSMs in each fabric are required for redundancy and data backup.

Warning **Do not touch or bridge the metal contacts on the battery. Unintentional discharge of the batteries can cause serious burns.** Statement 341

Warning **Ultimate disposal of this product should be handled according to all national laws and regulations.** Statement 1040

Caution Wait for all LEDs to turn off before removing the module from the chassis. If the LEDs are on, the module still has power.

To remove a CSM module from the chassis, follow these steps:

Step 1 Power off the module from the CLI. For information about the correct command to use, refer to the *Cisco MDS 9000 Family CLI Configuration Guide.*

Step 2 Ensure the backup process has completed by verifying that all LEDs on the module have turned off. This requires up to 10 minutes.

Step 3 Loosen the two captive screws on the module.

Step 4 Remove the module from the chassis as follows:

a. Place your thumbs on the left and right ejector levers (shown in Figure 2-22 on page 2-41) and simultaneously rotate the levers outward to unseat the module from the backplane connector.

b. Grasp the front edge of the module and slide the module partially out of the slot. Place your other hand under the module to support the weight of the module. Do not touch the module circuitry.

Step 5 Place the module on an antistatic mat or antistatic foam if not immediately reinstalling it in another slot.

Step 6 If the slot will remain empty, install a filler panel to keep dust out of the chassis and maintain consistent airflow.

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

Removing Other Switching and Services Modules

To remove a switching or services module from the chassis, follow these steps:

Step 1 Disconnect any network interface cables attached to the module.

Step 2 Loosen the two captive screws on the module being removed.

Step 3 Remove the module from the chassis as follows:

a. Place your thumbs on the left and right ejector levers and simultaneously rotate the levers outward to unseat the module from the backplane connector.

b. Grasp the front edge of the module and slide the module partially out of the slot. Place your other hand under the module to support the weight of the module. Do not touch the module circuitry.

Step 4 Place the module on an antistatic mat or antistatic foam, or immediately reinstall it in another slot.

Step 5 If the slot will remain empty, install a filler panel to keep dust out of the chassis and to maintain proper airflow through the chassis.

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

Installing a Switching or Services Module, Including Caching Services Modules

The following warning applies only to the Caching Services Module:

Warning **Do not touch or bridge the metal contacts on the battery. Unintentional discharge of the batteries can cause serious burns.** Statement 341

To install a switching or services module in the chassis, follow these steps:

Step 1 Before installing any modules in the chassis, we recommend installing the chassis in the rack. See the "Installing the Chassis in a Cabinet or Rack" section on page 2-6.

Step 2 Before installing any switching modules, install at least one supervisor module.

Step 3 Choose a slot for the module and verify that there is enough clearance to accommodate any cables or interface equipment that you want to connect to the module. If possible, place modules between empty slots that contain filler panels.

Step 4 Verify that the captive screws are tightened to 8 in-lb on all modules already installed in the chassis. This ensures that the EMI gaskets are fully compressed and maximizes the opening space for the module being installed.

Step 5 If a filler panel is installed, remove the two Phillips pan-head screws from the filler panel and remove the panel. To remove a currently installed module, see the "Removing Other Switching and Services Modules" section on page 2-45.

Step 6 Open fully both ejector levers on the new or replacement module (see Figure 2-22).

Step 7 Position the module in the chassis as follows:

a. Position the module in the slot. Ensure that you align the sides of the module carrier with the slot guides on each side of the slot.

b. Slide the module carefully into the slot until the EMI gasket along the top edge of the module contacts the module in the slot above it and both ejector levers close to approximately 45 degrees with respect to the front of the module (see Figure 2-23).

c. Grasp the two ejector levers using the thumb and forefinger of each hand, and press down to create a small 0.040-inch (1-mm) gap between the module's EMI gasket and the module above it (see Figure 2-24).

Caution Do not press down too forcefully on the levers because they can bend.

d. While pressing down, simultaneously close the left and right ejector levers to fully seat the supervisor module or switching module in the backplane connector. The ejector levers are fully closed when they are flush with the front of the module.

Note Ensure the ejector levers are fully closed before tightening the captive screws. Failure to fully seat the module in the backplane connector can result in error messages.

e. Tighten the two captive screws on the supervisor module or switching module to 8 in-lb.

Step 8 If you replaced the standby supervisor module in a switch that has two supervisors and is running Cisco MDS SAN-OS Release 1.2(2a) or earlier, enable the automatic synchronization feature, which is disabled by default. Refer to the *Cisco MDS 9000 Family CLI Configuration Guide* for information about the **auto-sync** option.

Step 9 If you replaced the supervisor in a switch that does not have a second supervisor or is running Cisco MDS SAN-OS Release 1.3(1) or later, download the configuration from the server to the nonvolatile memory of the supervisor. For more information, refer to the *Cisco MDS 9000 Family CLI Configuration Guide*.

Verifying Installation of Supervisor, Switching, and Services Modules

To verify the module installation, follow these steps:

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

Step 2 Check the captive screws of each module, the power supply, and the fan module. Tighten any loose captive screws to 8 in-lb.

Step 3 Verify that any empty module slots have filler panels installed and that the screws holding the panels in place are tight.

Step 4 Turn on the power supply switches to power up the system and check the LEDs on the modules.

Note For information about how to check connectivity of modules, refer to the *Cisco MDS 9000 Family CLI Configuration Guide*.

Removing and Installing a Crossbar Module

To remove a crossbar module from the Cisco MDS 9513 Director without compromising the integrity and availability of SANs when Generation 1 and Generation 2 modules are combined in the chassis, follow these steps:

Step 1 Gracefully shut down the crossbar module by entering the **out-of-service xbar** *slot* command (where *slot* refers to the external crossbar module slot number).

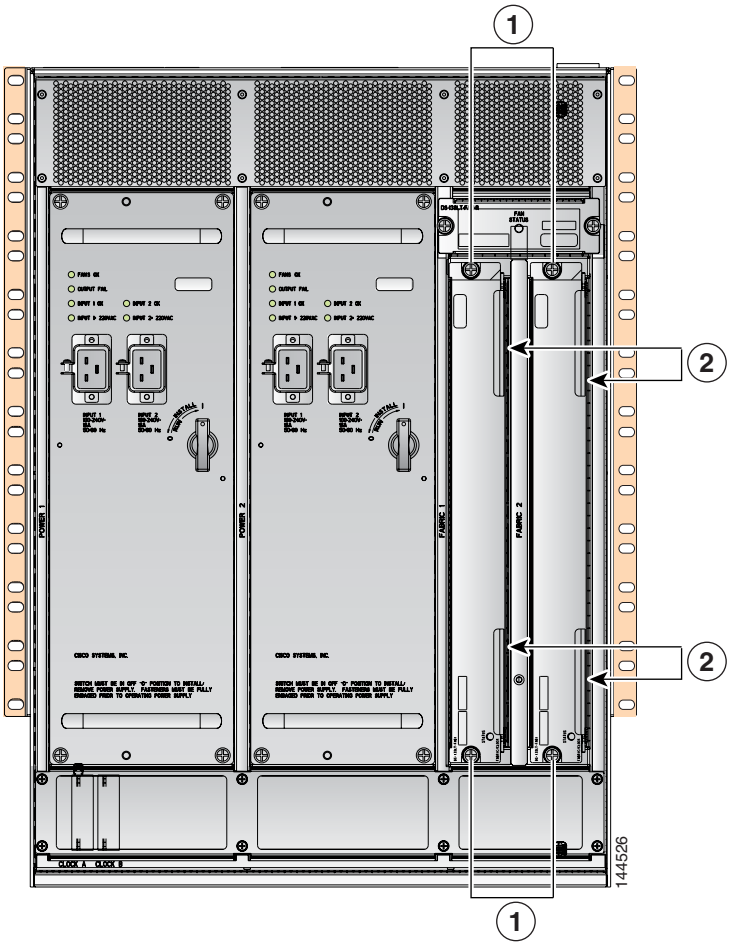
Step 2 Loosen the two captive screws on the module being removed.

Step 3 Remove the module from the chassis as follows:

a. Place your thumbs on the top and bottom ejector levers and simultaneously rotate the levers outward to unseat the module from the midplane connector. (See Figure 2-25.)

b. Grasp the front edge of the module and slide the module partially out of the slot. Do not touch the module circuitry.

Figure 2-25 Captive Screws and Ejector Levers on the Crossbar Module



1	Captive screws	**2**	Ejector levers

Step 4 Place the module on an antistatic mat or antistatic foam, or immediately reinstall it in another slot.

Step 5 If the slot will remain empty, install a filler panel to keep dust out of the chassis and to maintain proper airflow through the chassis.

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

To install a crossbar module in the Cisco MDS 9513 Director, follow these steps:

Step 1 Before installing any modules, install at least one Supervisor-2 module.

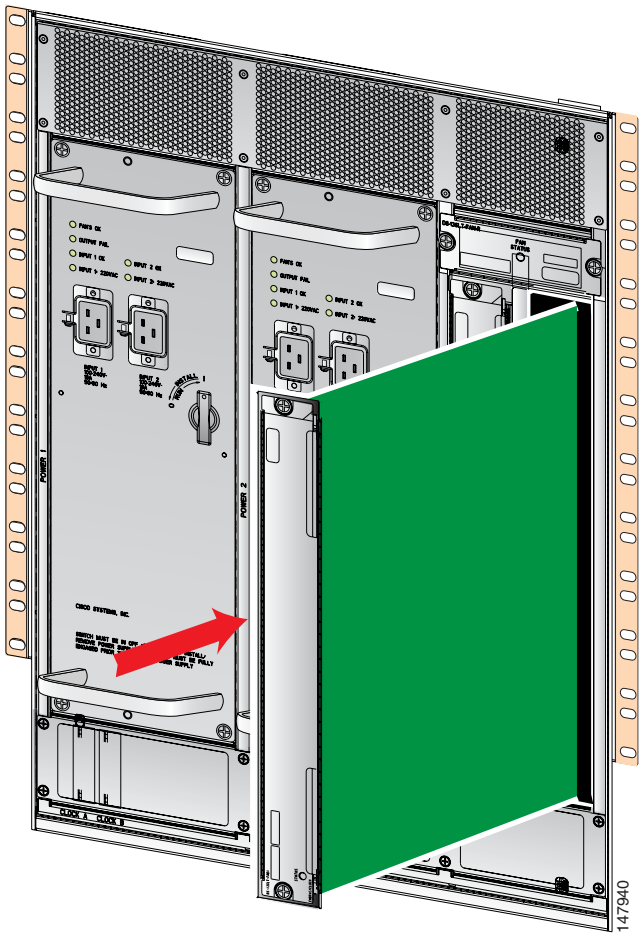
Step 2 Open fully both ejector levers on the new or replacement module.

Step 3 Position the module in the chassis as follows:

a. Position the module in the slot. Ensure that you align the sides of the module carrier with the slot guides on each side of the slot.

b. Slide the module carefully into the slot until the EMI gasket along the top edge of the module contacts the module in the slot above it and both ejector levers close to approximately 45 degrees with respect to the front of the module (see Figure 2-26).

Figure 2-26 Installing the Crossbar Module



c. Grasp the two ejector levers using the thumb and forefinger of each hand, and press down to create a small 0.040-inch (1-mm) gap between the module's EMI gasket and the module above it.

Caution Do not press down too forcefully on the levers because they can bend.

d. While pressing down, simultaneously close the top and bottom ejector levers to fully seat the module in the midplane connector. The ejector levers are fully closed when they are flush with the front of the module.

Note Ensure the ejector levers are fully closed before tightening the captive screws. Failure to fully seat the module in the backplane connector can result in error messages.

e. Tighten the two captive screws on the module to 8 in-lb.

Maintaining a Caching Services Module

Caution Maintenance should only be performed by qualified service personnel.

Note A minimum of two CSMs in each fabric are required for redundancy and data backup.

This section provides the following information:

Maintaining the Batteries on the Caching Services Module

The CSM batteries last approximately three years. The following message displays in the system log when a battery fails:

```
Dec 5 17:14:36 sw-90.21 %SVC_BATTERY-SLOT8-4-BATTERY_CAPACITY_LOW:
Battery capacity is below the required threshold.
```

If you see this message, contact your support provider for assistance. If a battery fails, the CSM must be replaced. The other CSMs in the fabric contain the same data, and they continue providing caching services during the replacement period.

Caution The CSM batteries are shipped fully charged and should be handled accordingly.

Warning **Do not touch or bridge the metal contacts on the battery. Unintentional discharge of the batteries can cause serious burns.** Statement 341

Warning **Ultimate disposal of this product should be handled according to all national laws and regulations.** Statement 1040

The batteries are automatically charged on a periodic basis with an SMBus compliant Level III smart charger located on the CSM. The smart charger measures the charge and recharges the battery to full if it is less than 90% of capacity.

The batteries are also automatically reconditioned on a periodic basis, one battery at a time. During reconditioning all power is drained from the battery and the battery is completely recharged, requiring approximately 6 hours. The “battery status” LED flashes green during the reconditioning.

Maintaining the Disk Drives on the Caching Services Module

You see a message in the system log when a disk drive requires replacement. If you see this message, contact your support provider for assistance.

If a disk drive fails, the CSM must be replaced. The other CSM(s) in the fabric contain the same data, and they continue providing caching services during the replacement period.

Removing and Installing a Power Supply or PEM

This section provides the following information:

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

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.** Statement 166

Warning **Power supply captive installation screws must be tight to ensure protective grounding continuity.** Statement 289

Caution Use both hands to install and remove power supplies. Each DC power supply for the Cisco MDS 9500 Series weighs between 22 lb (9.9 kg) and 28 lb (12.6 kg).

Note You can replace the faulty power supply while the system is operating if the other power supply is functioning.

Removing and Installing the Power Supplies on the Cisco MDS 9513 Director

The Cisco MDS 9513 power supplies are located at the rear of the chassis. The physical position of the chassis in a rack will determine how you handle the power supply when removing or installing.

Removing an AC Power Supply from the Cisco MDS 9513 Director

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.** Statement 166

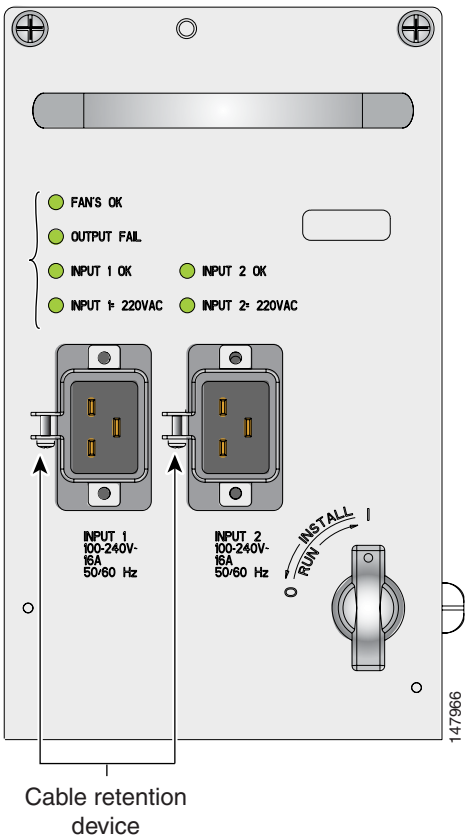
To remove an AC power supply from the Cisco MDS 9513 Director, follow these steps:

Step 1 Turn the power switch on the power supply to the off (0) position. There is an internal lock mechanism that prevents you from removing the power supply if it is not set to the off position.

Step 2 Disconnect the power cable(s) from the power source.

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

Figure 2-27 Cable Retention Device on the 6000W Power Supply



Step 4 Loosen all four 6-32 panel fasteners at the corners of the power supply.

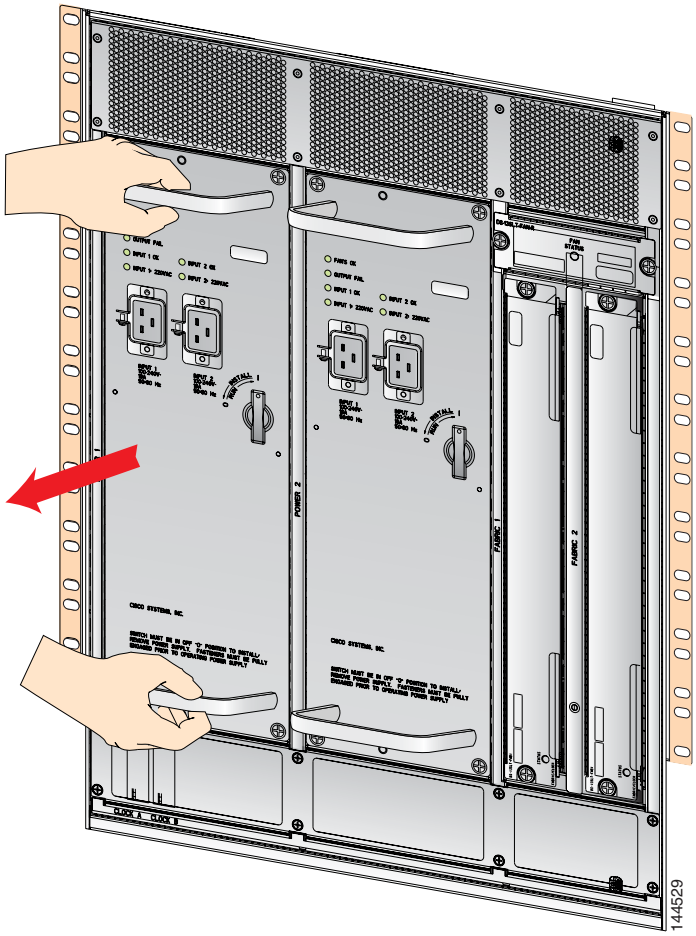
Caution Use both hands to install and remove power supplies. Each power supply weighs 34.2 lbs (15.5 kg).

Step 5 Grasp the power supply handles and slide the power supply partially out of the chassis, about four to five inches. (See Figure 2-28.)

Step 6 If the power supply is at your waist or chest level, place your other hand underneath the power supply and slide the power supply completely out of the chassis. Use the two front handles if you are comfortable doing so.

Note There is a handle at the top rear of the power supply you can also use to lift the power supply out of the chassis.

Figure 2-28 Handling a Power Supply for the Cisco MDS 9513 Director



Step 7 If the power supply is above your waist or chest height, use the lower front handle on the face plate and the other hand underneath the power supply. Assure adequate support with both hands on the unit at the designated support points, and slowly pull the power supply out of the chassis such that the weight of the unit will be fully supported once it is out.

Caution To avoid damage to the panel fasteners, do not place the power supply down on the perforated ends. Place the the power supply down on the flat sheet metal sides or on the two brackets found on the rear of the supply.

Step 8 Install a power supply filler panel over the opening and tighten the captive screws to 8 in-lb if the power supply bay is to remain empty

Installing an AC Power Supply in the Cisco MDS 9513 Director

Caution Use both hands to install and remove power supplies. Each Cisco MDS 9513 AC power supply weighs up to 34.2 lb (15.5 kg).

Caution To avoid damage to the panel fasteners, do not place the power supply down on the perforated ends. Place the the power supply down on the flat sheet metal sides or on the two brackets found on the rear of the supply.

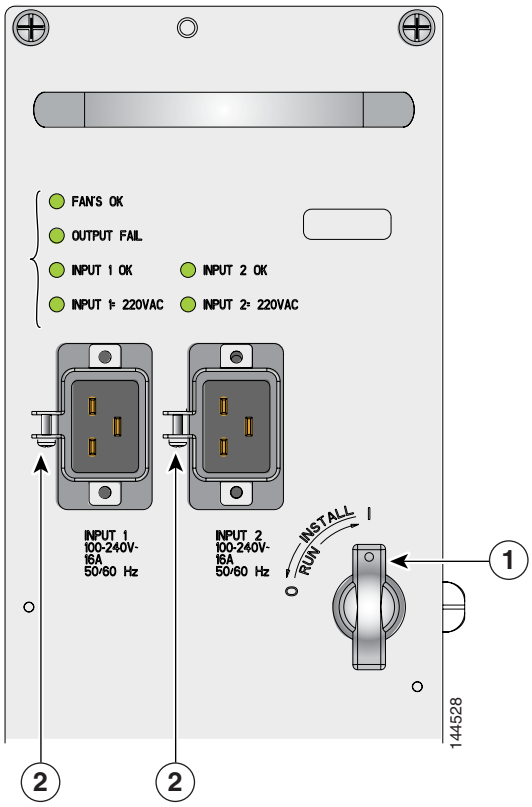
To install an AC power supply in the Cisco MDS 9513 Director, follow these steps:

Step 1 Ensure that the system (earth) ground connection has been made. See the "System Grounding" section on page 2-17.

Step 2 If a filler panel is installed, remove the filler panel from the power supply bay by loosening the captive screw.

Step 3 Ensure that the power switch is in the off (0) position on the power supply you are installing. (See Figure 2-29.)

Figure 2-29 AC Power Supply for the Cisco MDS 9513 Director



1	Power supply switch	**2**	Power cable retainer

Step 4 Grasp the power supply handles, one with each hand. Orient the power supply and align it with the bay.

Note There is a handle at the top rear of the power supply you can also use to tilt the power supply into the bay.

Step 5 Slide the power supply into the power supply bay. Ensure that the power supply is fully seated in the bay.

Step 6 Secure all four 6-32 panel fasteners and tighten to 8 in-lbs

Step 7 Plug the power cable into the power supply, and tighten the screw on the cable retention device to ensure the cable cannot be pulled out.

Step 8 Connect the other end of the power cable to an AC power source.

Step 9 Turn the power switch to the on (|) position on the power supply.

Step 10 Verify power supply operation by checking that the power supply LEDs are in the following states:

- INPUT OK LEDs are green.
- FANs OK LED is green.
- OUTPUT FAIL LED is off.

See Table 1-1 on page 1-8 for power supply LED details.

Removing an AC Power Supply from the Cisco MDS 9509 Director

The procedure for removing an AC power supply from the Cisco MDS 9509 Director is the same for the 4000-W, 3000-W, and 2500-W power supplies, except the power cable for the 4000-W power supply is hard wired to the 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.** Statement 166

To remove an AC power supply from the Cisco MDS 9509 Director, follow these steps:

Step 1 Turn the power switch on the power supply to the off (0) position. Turning the power switch off also unlocks the power supply from the chassis.

Step 2 Disconnect the power cable from the power source.

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

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

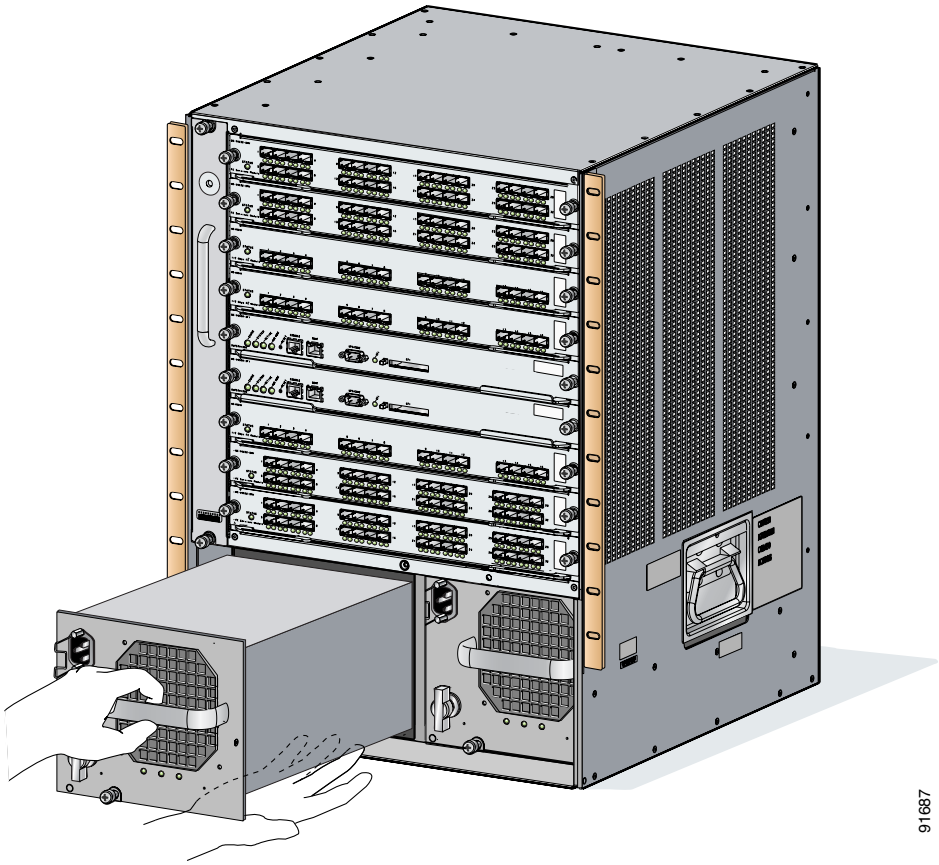
Step 4 Loosen the captive screw.

Caution Use both hands to install and remove power supplies. Each Cisco MDS 9500 Series AC power supply weighs between 22 lb (9.9 kg) and 28 lb (12.6 kg).

Step 5 Grasp the power supply handle with one hand, and slide the power supply partially out of the chassis. Place your other hand underneath the power supply, as shown in Figure 2-30, and slide the power supply completely out of the chassis.

Step 6 If the power supply bay is to remain empty, install a power supply filler panel over the opening, and tighten the captive screw to 8 in-lb

Figure 2-30 Handling a Power Supply for the Cisco MDS 9509 Director



Installing an AC Power Supply in the Cisco MDS 9509 Director

The procedure for installing an AC power supply in the Cisco MDS 9509 Director is the same for the 4000-W, 3000-W, and 2500-W power supplies, except the power cable for the 4000-W power supply is hard wired to the power supply.

Caution Use both hands to install and remove power supplies. Each Cisco MDS 9509 AC power supply weighs up to 28 lb (12.6 kg). The 4000-W and 2500-W power supplies weigh up to 28 lb (12.6 kg). The 3000-W power supply weighs up to 24 lb (11 kg)

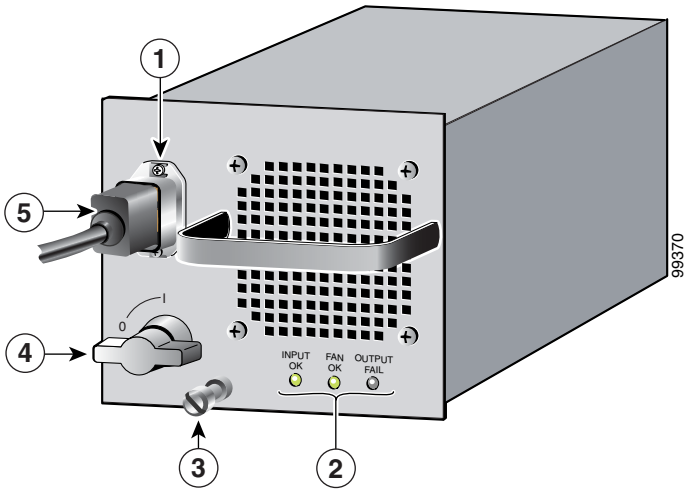
To install an AC power supply in the Cisco MDS 9509 Director, follow these steps:

Step 1 Ensure that the system (earth) ground connection has been made. See the "System Grounding" section on page 2-17.

Step 2 If a filler panel is installed, remove the filler panel from the power supply bay by loosening the captive screw.

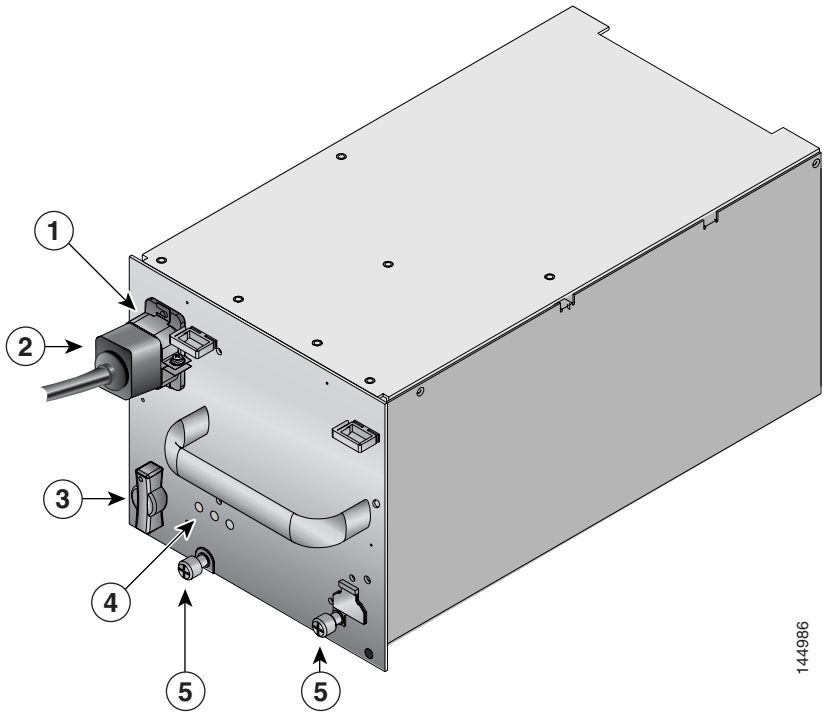
Step 3 Ensure that the power switch is in the off (0) position on the power supply you are installing. See Figure 2-33 and Figure 2-31 for the location of the switch.

Figure 2-31 4000-W AC Power Supply for the Cisco MDS 9509 Director



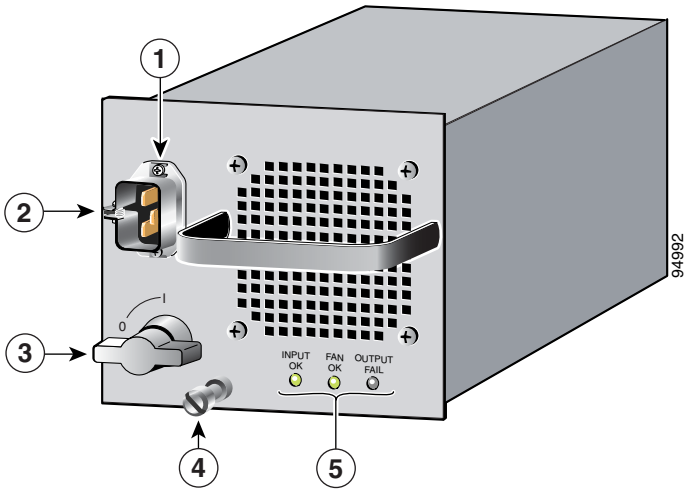
1	AC power connection	**4**	Power supply switch
2	Power supply LEDs	**5**	Permanent power cable
3	Captive screw		

Figure 2-32 3000-W AC Power Supply for the Cisco MDS 9509 Director



1	AC power connection	**4**	Power supply LEDs
2	Power cable	**5**	Captive screws
3	Power supply switch		

Figure 2-33 2500-W AC Power Supply for the Cisco MDS 9509 Director



1	AC power connection	**4**	Captive screw
2	Power cable retainer	**5**	Power supply LEDs
3	Power supply switch		

Step 4 Grasp the power supply handle with one hand, place your other hand underneath the power supply, and slide the power supply into the power supply bay. Ensure that the power supply is fully seated in the bay.

Step 5 Tighten the power supply captive screw to 8 in-lb

Step 6 Plug the power cable into the power supply, and tighten the screw on the cable retention device to ensure the cable cannot be pulled out.

Note The AC power cable for the 4000-W power supply is hard wired to the power supply.

Step 7 Connect the other end of the power cable to an AC power source.

Step 8 Turn the power switch to the on (|) position on the power supply. Turning the power switch on also locks the power supply in the bay.

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

- INPUT OK LED is green.
- FAN OK LED is green.
- OUTPUT FAIL LED is off.

If the LEDs indicate a power problem, see the "Identifying Startup Problems" section on page B-2 for troubleshooting information.

Removing a DC Power Supply from the Cisco MDS 9509 Director

The DC power supply for the Cisco MDS 9509 Director is 2500-W.

Note The DC return connection to this system is to remain isolated from the system frame and chassis (DC-I).

Warning **Before performing any of the following procedures, ensure that power is removed from the DC circuit.** Statement 1003

To remove a DC power supply from the Cisco MDS 9509 Director, follow these steps:

Step 1 Ensure that all power is off by locating 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.

Step 2 Remove the two screws securing the terminal block cover and slide the cover off the terminal block (see Figure 2-34).

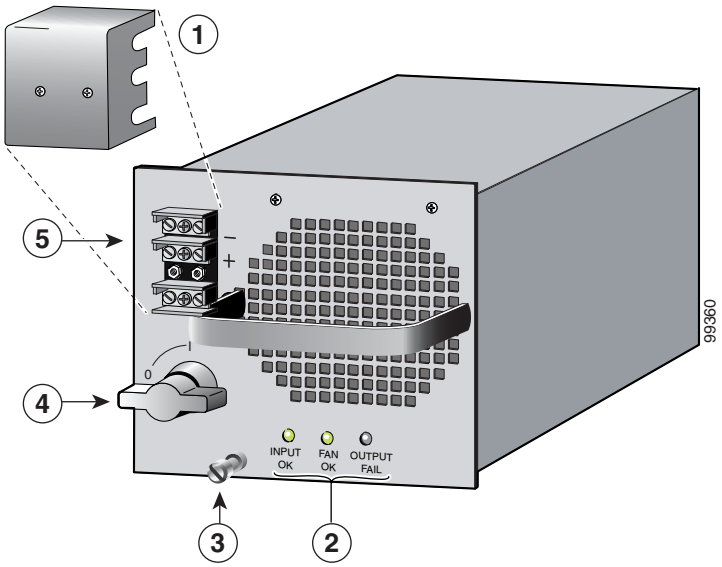
Step 3 Disconnect the DC cables from the terminal block in the following order:

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

Caution The DC return connection (Negative (-)) to this system is to remain isolated from the system frame and chassis (DC-I). Loosen the captive screw on the power supply.

Warning **When installing or replacing the unit, the ground connection must always be made first and disconnected last.** Statement 1046

Figure 2-34 Front Panel for the DC Power Supply of the Cisco MDS 9509 Director



1	Terminal block cover	**4**	Power supply switch
2	Power supply LEDs	**5**	Terminal block
3	Captive screw		

Caution Use both hands to install and remove power supplies. Each Cisco MDS 9500 Series DC power supply weighs between 22 lb (9.9 kg) and 28 lb (12.6 kg).

Step 4 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 y, and slide the power supply completely out of the chassis.

Step 5 If the power supply bay is to remain empty, install a power supply filler panel over the opening, and tighten the captive screw to 8 in-lb.

Installing a DC Power Supply in the Cisco MDS 9509 Director

The DC power supply for the Cisco MDS 9509 Director is 2500 W.

Note The DC return connection to this system is to remain isolated from the system frame and chassis (DC-I).

To install a DC power supply in the Cisco MDS 9509 Director, follow these steps:

Step 1 Ensure that all power is off by locating 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.

Step 2 Ensure that the system (earth) ground connection has been made. See the "System Grounding" section on page 2-17.

Step 3 Grasp the power supply handle with one hand, place your other hand underneath the power supply, and slide the power supply into the power supply bay, ensuring that it is fully seated in the bay.

Step 4 Tighten the captive screw on the power supply to 8 in-lb.

Step 5 Remove the two screws securing the terminal block cover and slide the cover off of the terminal block.

Note Use 90°C copper conductors for North American installations.

Step 6 Loosen the screws inside the terminal block and attach the DC cables to the screws. The wire must be copper, and sized per local and national installation requirements.

Step 7 Connect the DC cables to the terminal block in the following order:

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

Warning **When installing or replacing the unit, the ground connection must always be made first and disconnected last.** Statement 1046

Caution The DC return connection (Negative (-)) to this system is to remain isolated from the system frame and chassis (DC-I).

Step 8 Reinstall the terminal block cover after ensuring that all cable connections are secure and tighten the screws holding the terminal block to the power supply.

Caution Reinstall the terminal block cover to prevent a short circuit or shock hazard.

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

Step 9 Remove the tape from the circuit breaker switch handle and provide power by moving the handle to the on (|) position.Turning the power switch on also locks the power supply in the chassis.

Step 10 Verify power supply operation by checking that the power supply LEDs are in the following states:

- INPUT OK LED is green.
- FAN OK LED is green.
- Output fail LED is off.

If the LEDs indicate a power problem, see the"Identifying Startup Problems" section on page B-2.

Removing and Installing the PEMs on the Cisco MDS 9506 Director

Note For instructions on connecting the cables to the PEMs, see the "Connecting the Power Supplies" section on page 2-28.

The Cisco MDS 9506 Director uses PEMs to provide an input power connection on the front of the chassis. In addition, the PEM provides current protection, surge and EMI suppression, and filtering functions. An AC PEM is required for each AC power supply, and a DC PEM for each DC power supply.

The PEM that is on the left when viewed from the front of the switch (PEM 1) connects the site power source to power supply 1 (upper power supply); the PEM on the right (PEM 2) connects the site power source to power supply 2 (lower power supply).

Note You need a flat-blade or number 2 Phillips-head screwdriver to perform these procedures.

Removing an AC PEM

To remove an AC PEM from a Cisco MDS 9506 chassis, follow these steps:

Step 1 Remove power from the PEM by pressing the power switch to off (0).

Step 2 Loosen the captive screws and pull the PEM of the chassis, supporting the PEM from underneath.

Step 3 If the PEM bay is to remain empty, install a filler panel over the opening and tighten the captive screws to 8 in-lb.

Removing a DC PEM

Warning **Before performing any of the following procedures, ensure that power is removed from the DC circuit.** Statement 1003

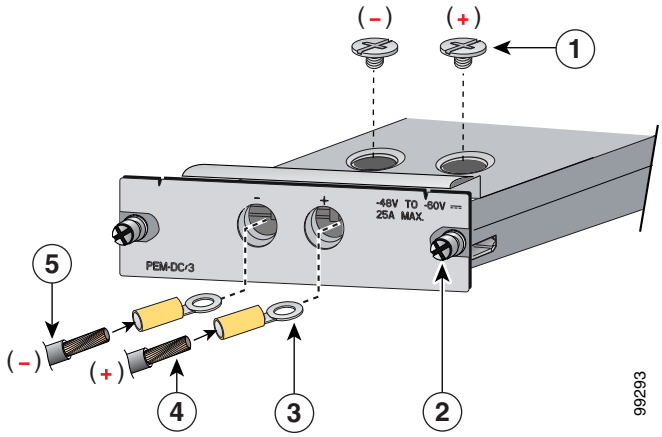
To remove a DC PEM from a Cisco MDS 9506 chassis, follow these steps:

Step 1 Ensure that all power is off by locating 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.

Step 2 Loosen the captive screws and pull the DC PEM from the chassis, holding it by the edges.

Step 3 Remove the cables from the DC PEM by removing the terminal block screws, and then removing the ring lugs from the screws. See Figure 2-35 for the location of the terminal block screws.

Figure 2-35 Connecting or Disconnecting the DC PEM



1	PEM terminal block screws (+ and -)	**4**	Stripped portion of positive cable
2	Captive screw	**5**	Insulated portion of negative cable
3	Ring lug		

Step 4 If the PEM bay is to remain empty, install a PEM filler panel over the opening and tighten the captive screws to 8 in-lb.

Installing an AC PEM

To install an AC PEM in a Cisco MDS 9506 chassis, follow these steps:

Step 1 Ensure that the system (earth) ground connection has been made. See the "System Grounding" section on page 2-17.

Step 2 If a filler panel is installed, remove it from the PEM bay by loosening the captive screws and pulling it from the chassis.

Step 3 Slide the PEM into the PEM bay, ensuring that the PEM is fully seated in the bay.

Step 4 Tighten the PEM captive screws to 8 in-lb.

Step 5 Provide power to the PEM as described in the "Providing Power to an AC Power Supply for the Cisco MDS 9509 and Cisco MDS 9506 Directors" section on page 2-30.

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

Step 6 Verify PEM and power supply operation by checking the power supply LED states in the back of the chassis:

- INPUT OK LED is green.
- FAN OK LED is green.
- OUTPUT FAIL LED is off.

If the LEDs indicate a power problem, see the "Identifying Startup Problems" section on page B-2.

Installing a DC PEM

To install a DC PEM in a Cisco MDS 9506 chassis, follow these steps:

Step 1 Ensure that the system (earth) ground connection has been made. See the "System Grounding" section on page 2-17.

Step 2 If a filler panel is installed, remove it from the PEM bay by loosening the captive screws and pulling it from the chassis.

Step 3 Attach the DC power cables to the PEM as described in "Providing Power to a DC Power Supply in the Cisco MDS 9506 Director" section on page 2-34.

Step 4 Slide the PEM into the PEM bay, ensuring that the PEM is fully seated in the bay.

Step 5 Tighten the PEM captive screws to 8 in-lb.

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

Step 6 Verify PEM and power supply operation by checking the power supply LED states in the back of the chassis:

- INPUT OK LED is green.
- FAN OK LED is green.
- OUTPUT FAIL LED is off.

If the LEDs indicate a power problem, see the "Identifying Startup Problems" section on page B-2.

Removing an AC or DC Power Supply from the Cisco MDS 9506 Director

The procedure for removing a Cisco MDS 9506 power supply is the same for AC and DC power supplies.

To remove an AC or DC power supply from the Cisco MDS 9506 Director, follow these steps:

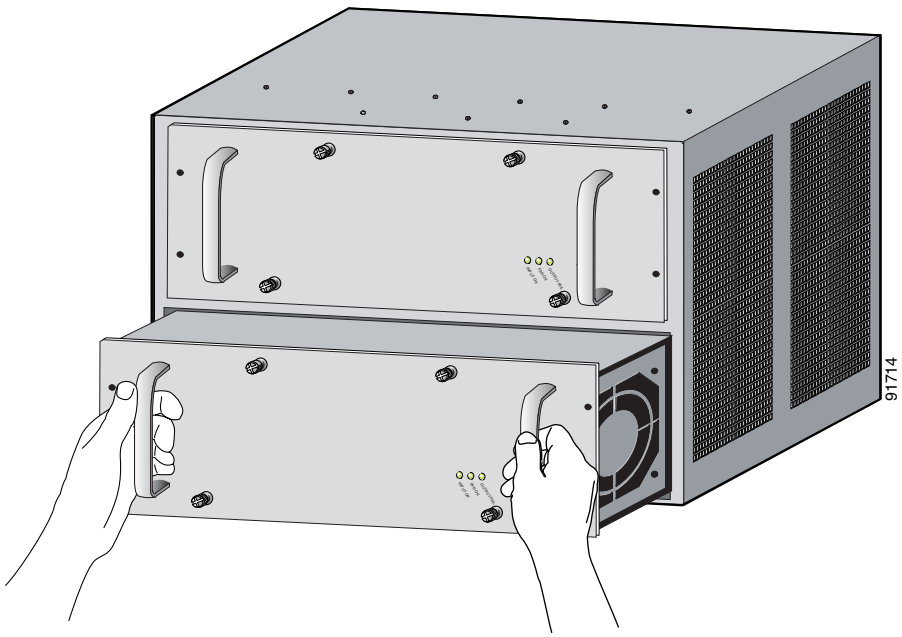
Step 1 Remove power from the PEM that corresponds to the power supply as follows:

- If the PEM is AC, press the power switch to off (0).
- If the PEM is DC, follow the instructions in the "Removing a DC PEM" section on page 2-64.

Step 2 Loosen the captive screws on the power supply.

Step 3 Grasp both power supply handles as shown in Figure 2-36 and slide the power supply completely out of the chassis.

Figure 2-36 Handling a Power Supply for the Cisco MDS 9506 Director



Step 4 If the power supply bay is to remain empty, install a filler panel over the opening and tighten the captive screws to 8 in-lb.

Installing an AC or DC Power Supply in the Cisco MDS 9506 Director

The procedure for installing a Cisco MDS 9506 power supply is the same for AC and DC power supplies.

To install an AC or DC power supply in the Cisco MDS 9506 Director, follow these steps:

Step 1 Ensure that the system (earth) ground connection has been made. See the "System Grounding" section on page 2-17.

Step 2 If a filler panel is installed, remove it from the power supply bay by loosening the captive screws and pulling the filler panel out of the bay.

Step 3 Grasp both power supply handles and slide the power supply into the power supply bay, ensuring that the power supply is fully seated in the bay.

Step 4 Tighten the captive screws on the power supply to 8 in-lb.

Step 5 Provide power to the PEM as described in the "Connecting the Power Supplies" section on page 2-28.

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

Step 6 Verify power supply operation by checking that the power supply LEDs are in the following states:

- INPUT OK LED is green.
- FAN OK LED is green.
- OUTPUT FAIL LED is off.

If the LEDs indicate a power problem, see the"Identifying Startup Problems" section on page B-2.

Removing and Installing Fan Modules

The fan module is designed to be removed and replaced while the system is operating without presenting an electrical hazard or damage to the system, provided the replacement is performed promptly.

The Cisco MDS 9513 fan module has 15 fans with an abrupt stop-to-fan rotation safety feature once power is disconnected or the fan tray is removed from the midplane. The Cisco MDS 9506 fan module has six fans and the Cisco MDS 9509 fan module has nine fans. The removal procedures differ slightly while the installation procedures are the same for all types of fan modules.

You need a flat-blade or number 2 Phillips screwdriver to perform these procedures.

Note Because the fan modules are located on the left side of the Cisco MDS 9500 Series, we recommend guiding the cables for the system out of the right side of the chassis.

Caution The Cisco MDS 9000 Family switches have internal temperature sensors that are capable of shutting down the system if the temperature at different points within the chassis exceed certain safety thresholds. To be effective, the temperature sensors require the presence of airflow; therefore, in the event a fan module is removed from the chassis, the Cisco MDS 9000 Family switches will be shut down after five minutes to prevent potentially undetectable overheating. However, the switches will be shut down sooner if the higher-level temperature threshold is exceeded.

This section includes the following topics:

Removing a Front Fan Module on the Cisco MDS 9513 Director

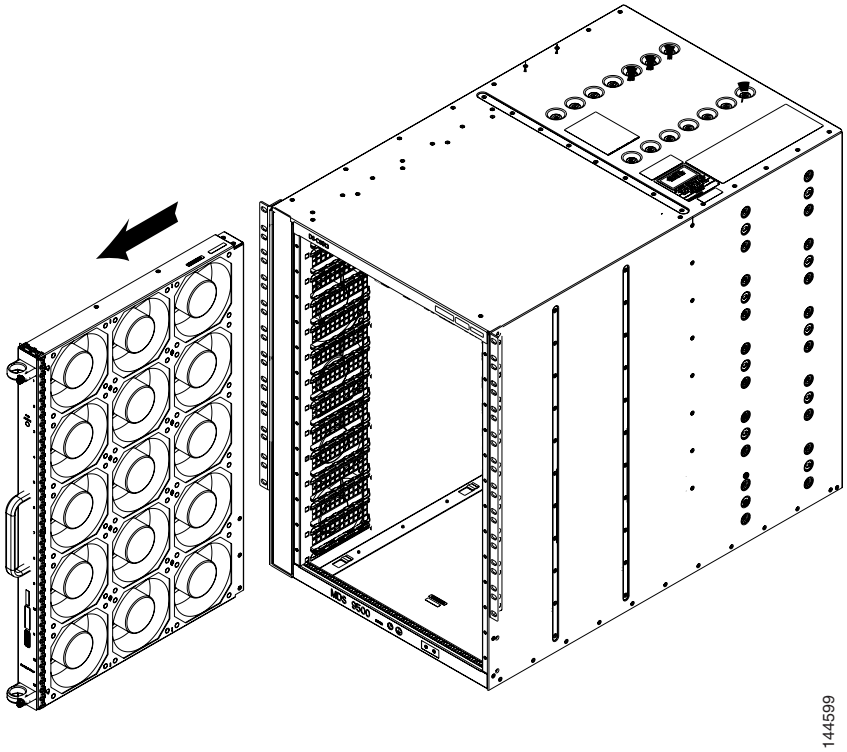
To remove the fan module from the Cisco MDS 9513 director, follow these steps:

Step 1 Push the button on the top fan module latch to release the fan module from the midplane. Repeat this on the bottom fan module latch.

Step 2 Grasp the fan module with both hands and pull it outward; rock it gently, if necessary, to unseat the power connector from the backplane.

Step 3 Pull the fan module clear of the chassis. (See Figure 2-36.)

Figure 2-37 Removing the Fan Module for the Cisco MDS 9513 Director



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.** Statement 258

Installing a Front Fan Module on the Cisco MDS 9513 Director

To install a front fan module on the Cisco MDS 9513 Director, follow these steps:

Step 1 Hold the fan module so that the Fan Status LED is at the top. (See Figure 2-39).

Step 2 Place the fan module into the front chassis cavity so it rests on the chassis, lift the fan module up slightly to align the top and bottom chassis guides, then push the fan module into the chassis until it seats in the backplane and the captive screws make contact with the chassis. The fan module will just snap in.

Step 3 If the switch is powered on, listen for the fans; you should immediately hear them operating. If you do not hear them, ensure that the fan module is inserted completely in the chassis and the outside surface of the fan module is flush with the outside surface of the chassis.

Step 4 Verify that the Fan Status LED is green. If the LED is not green, one or more fans are faulty. If this happens, contact your customer service representative for a replacement part.

Note If you purchased this product through a Cisco reseller, contact the reseller directly for technical support. If you purchased this product directly from Cisco Systems, contact Cisco Technical Support at this URL: http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml.

Removing the Crossbar Module Fan Tray

The crossbar module fan tray is designed to be removed and replaced while the system is operating without presenting an electrical hazard or damage to the system, provided the replacement is performed promptly. The crossbar module fan tray is used only in the Cisco MDS 9513 Director. It is installed at the rear of the chassis and plugs into the back side of the midplane just above the crossbar modules.

To remove a crossbar module fan tray, follow these steps:

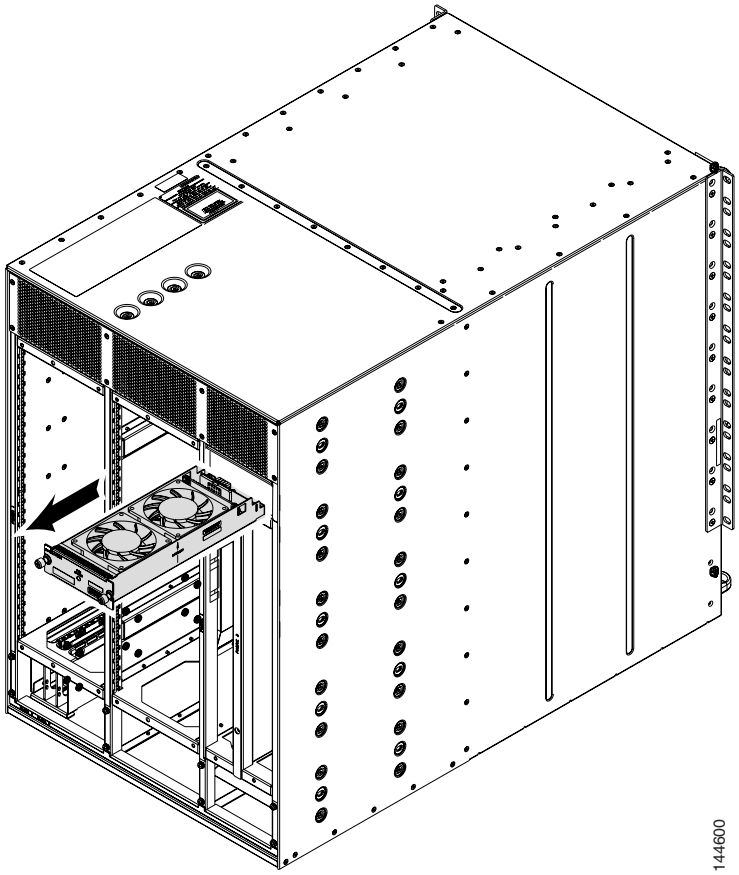
Step 1 Loosen the two captive screws on the fan tray.

Step 2 Hold the two captive screws and pull the fan tray out of the chassis using both hands.

Step 3 Take one hand and hold the face of the fan tray while supporting it with the other hand.

Step 4 Pull the fan module clear of the chassis. (See Figure 2-37.)

Figure 2-38 Removing a Crossbar Module Fan Tray



Installing the Crossbar Module Fan Tray

To install a crossbar module fan tray, follow these steps:

Step 1 Remove the crossbar module fan tray from the bag if necessary.

Step 2 Orient the crossbar module fan tray in the chassis as follows:

a. Position the module in the slot. (See Figure 2-38.)

b. Slide the module carefully into the slot until the the fan tray is fully inserted into the chassis.

c. Tighten the two captive screws on the crossbar module fan tray to 8 in-lb screws.

Removing a Front Fan Module on the Cisco MDS 9509 Director

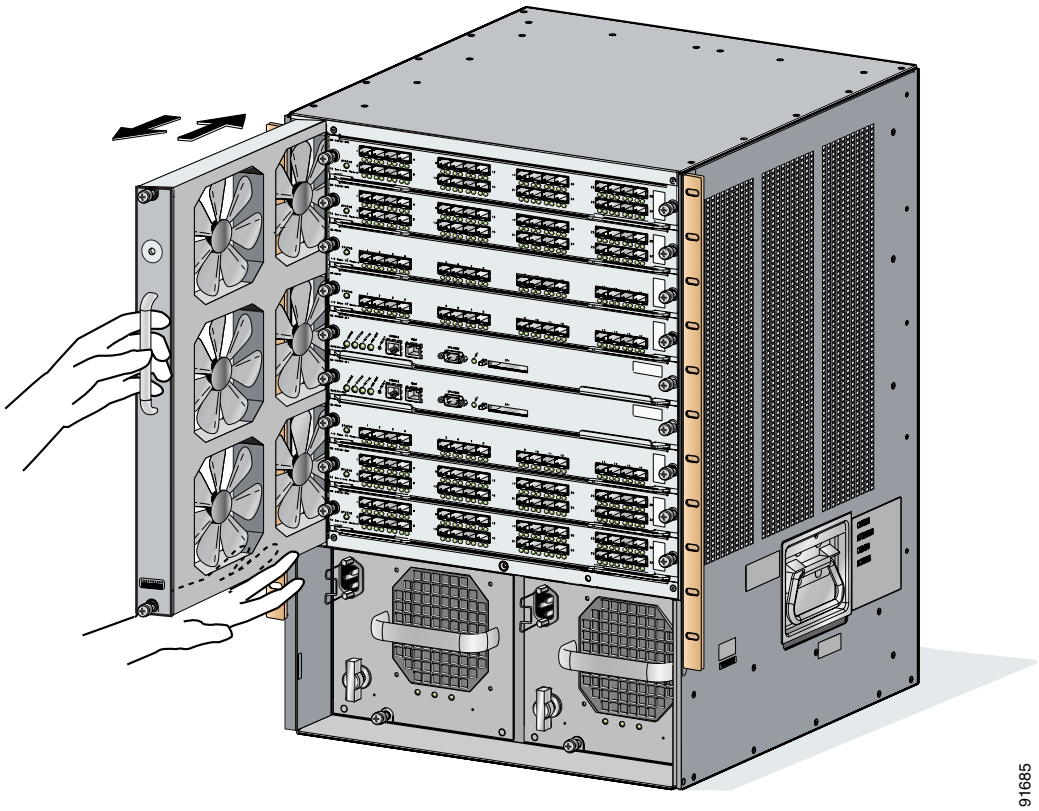
To remove a fan module from the Cisco MDS 9509 or 9506 switch, follow these steps:

Step 1 Loosen the two captive screws on the fan module (see Figure 2-39) by turning them counterclockwise, using a flat-blade or number 2 Phillips screwdriver if required.

Step 2 Grasp the fan module with both hands and pull it outward; rock it gently, if necessary, to unseat the power connector from the backplane.

Step 3 Pull the fan module clear of the chassis.

Figure 2-39 Handling the Fan Module for the Cisco MDS 9509 Director



Installing a Front Fan Module on the Cisco MDS 9509 Director

To install a front fan module on the Cisco MDS 9509 Director, follow these steps:

Step 1 Hold the fan module so that the Fan Status LED is at the top (see Figure 2-39).

Step 2 Place the fan module into the front chassis cavity so it rests on the chassis, lift the fan module up slightly to align the top and bottom chassis guides, then push the fan module into the chassis until it seats in the backplane and the captive screws make contact with the chassis.

Step 3 Tighten the captive screws to 8 in-lb.

Step 4 If the switch is powered on, listen for the fans; you should immediately hear them operating. If you do not hear them, ensure that the fan module is inserted completely in the chassis and the outside surface of the fan module is flush with the outside surface of the chassis.

Step 5 Verify that the Fan Status LED is green. If the LED is not green, one or more fans are faulty. If this happens, contact your customer service representative for a replacement part.

Note If you purchased this product through a Cisco reseller, contact the reseller directly for technical support. If you purchased this product directly from Cisco Systems, contact Cisco Technical Support at this URL: http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml.

Removing a Front Fan Module on the Cisco MDS 9506 Director

To remove a fan module from the Cisco MDS 9506 Director, follow these steps:

Step 1 Loosen the two captive screws on the fan module (see Figure 2-39) by turning them counterclockwise, using a flat-blade or number 2 Phillips screwdriver if required.

Step 2 Grasp the fan module with both hands and pull it outward; rock it gently, if necessary, to unseat the power connector from the backplane.

Step 3 Pull the fan module clear of the chassis.

Installing a Front Fan Module on the Cisco MDS 9506 Director

To install a front fan module on the Cisco MDS 9506 Director, follow these steps:

Step 1 Hold the fan module so that the Fan Status LED is at the top.

Step 2 Place the fan module into the front chassis cavity so it rests on the chassis, lift the fan module up slightly to align the top and bottom chassis guides, then push the fan module into the chassis until it seats in the backplane and the captive screws make contact with the chassis.

Step 3 Tighten the captive screws to 8 in-lb.

Step 4 If the switch is powered on, listen for the fans; you should immediately hear them operating. If you do not hear them, ensure that the fan module is inserted completely in the chassis and the outside surface of the fan module is flush with the outside surface of the chassis.

Step 5 Verify that the Fan Status LED is green. If the LED is not green, one or more fans are faulty. If this happens, contact your customer service representative for a replacement part.

Note If you purchased this product through a Cisco reseller, contact the reseller directly for technical support. If you purchased this product directly from Cisco Systems, contact Cisco Technical Support at this URL: http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml.

Removing and Installing CompactFlash Cards

The supervisor module has one slot for an optional CompactFlash card. You can use this slot to install additional Flash memory for storing and running software images and configuration files, or to serve as an I/O device.

Caution Only use CompactFlash devices that are certified for use with Cisco MDS switches and are formatted using Cisco MDS switches. Using CompactFlash devices that are uncertified or are formatted using other platforms may result in errors. For information on formatting the external CompactFlash, refer to the *Cisco MDS 9000 Family CLI Configuration Guide* or the *Cisco MDS 9000 Family Fabric Manager Configuration Guide*.

You can install and remove the CompactFlash card with the switch powered on.

Caution Do not remove the CompactFlash card while the access LED light is on or the file may be corrupted.

This section describes how to install and remove a CompactFlash card. For additional information about the CompactFlash card, refer to the *Cisco MDS 9000 Family CLI Configuration Guide* or the *Cisco MDS 9000 Family Fabric Manager Configuration Guide*.

Removing a CompactFlash Card

To remove a CompactFlash card, follow these steps:

Step 1 Verify that no operations are in progress by verifying that the LED is off.

Step 2 Press the ejector button until the card is free of the connector at the back.

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

Installing a CompactFlash Card

To install a CompactFlash card, follow these steps:

Step 1 Position the CompactFlash card with the connector end of the card toward the slot. The connector end of the card is on the opposite side of the write-protection switch.

Step 2 Insert the card into the slot until the card is firmly seated in the connector at the back of the slot and the ejector button pops out toward you.

Caution The card does not insert all the way inside the slot; a portion of the card remains outside the slot. Do not attempt to force the card past this point or you could damage the connector pins.

Removing and Installing Clock Modules

The Cisco MDS 9500 Series includes one or more clock modules that are accessible from the back of the chassis. In the unlikely event of a clock module failure, we recommend that the failed clock module be replaced during a maintenance window. The Cisco MDS 9513 and 9509 Directors have two field-replacable clock modules. The Cisco MDS 9506 Director has one field-replacable clock module. A separate procedure is provided for each type of director:

- Removing a Clock Module from the Cisco MDS 9513 Director, page 2-76
- Installing a Clock Module into the Cisco MDS 9513 Director, page 2-79
- Removing a Clock Module from the Cisco MDS 9509 Director, page 2-80
- Installing a Clock Module into the Cisco MDS 9509 Director, page 2-83
- Removing a Clock Module from the Cisco MDS 9506 Director, page 2-83
- Installing a Clock Module into the Cisco MDS 9506 Director, page 2-86

Removing a Clock Module from the Cisco MDS 9513 Director

Before installing the clock module, check the contents of your kit. Table 2-5 lists the contents of the clock module replacement kit, part number DS-C9513-CL.

Table 2-5 Contents of Cisco MDS 9513 Clock Module Replacement Kits

Quantity	Part Description
1	Cisco MDS 9513 clock module
1	Disposable ESD wrist strap

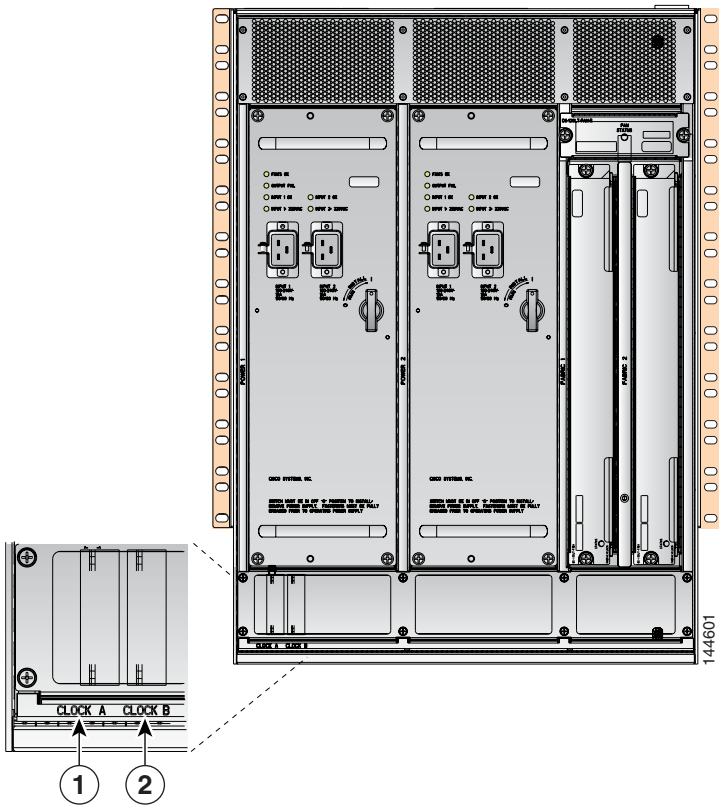
These tools are required to remove or install a clock module:

- Number 2 Phillips screwdriver

- Your own ESD-prevention equipment or the disposable grounding wrist strap included with all upgrade kits, field-replaceable units (FRUs), and spares

Clock modules are connected to the rear of the Cisco MDS 9513 Director and are not visible as they are located on the inside of the cover panel. Figure 2-40 shows the clock modules in a rear view of the Cisco MDS 9513 Director with the back panel removed. We recommend that the failed clock module be replaced during a maintenance window.

Figure 2-40 Clock Module Location on the Cisco MDS 9513 Director (Rear View)



1	Clock A (CLK A)	**2**	Clock B (CLK B)

Caution Always use an ESD wrist strap when handling modules or coming into contact with internal components.

To remove the clock module, follow these steps:

Step 1 Note which clock module you are removing. Use the **show environment clock** command to verify which is active and standby.

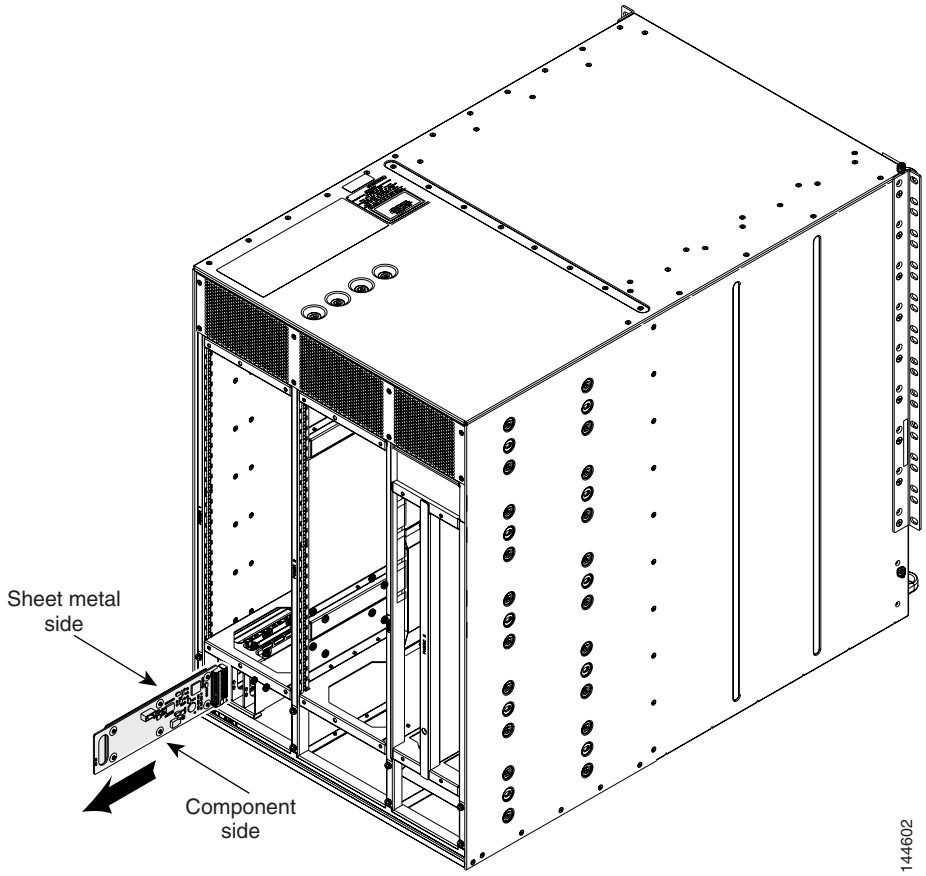
Step 2 Use a Phillips screwdriver to remove the eight back panel screws from the rear of the Cisco MDS 9513 Director chassis.

Note Note the position and orientation of the clock module before you remove it from the director chassis because you must install the new clock module in the same position.

Step 3 Verify the LEDs on the clock modules.

Step 4 Gently disconnect and remove the module, placing it on an antistatic mat or foam. (See Figure 2-41.)

Figure 2-41 Clock Module Replacement on the Cisco MDS 9513 Director (Rear View)



Step 5 Repeat Step 3 and Step 4 to remove any additional clock modules.

Installing a Clock Module into the Cisco MDS 9513 Director

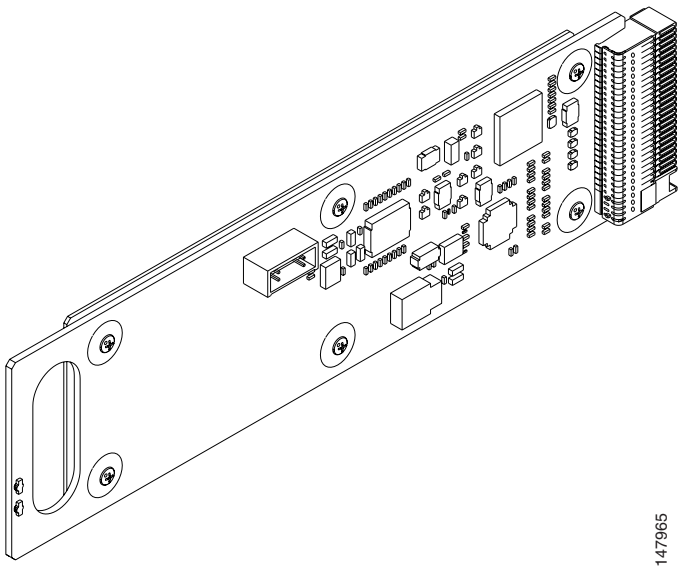
Caution Always use an ESD wrist strap when handling modules or coming into contact with internal components.

To install the clock module, follow these steps:

Step 1 Remove the new clock module from the antistatic bag.

Step 2 Hold the module with the backplane connectors away from you and the circuit board facing the right.

Figure 2-42 Clock Module for the Cisco MDS 9513 Director



Step 3 Carefully press the module onto the two matching connectors on the backplane.

Note You must install the new clock module in the same position that you removed it.

Step 4 Repeat Step 1 through Step 4 to install any additional clock modules.

Step 5 Replace the back panel safety cover using the eight screws.

Step 6 Provide power to the power supplies as described in the "Connecting the Power Supplies" section on page 2-28.

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

Step 7 Verify power supply operation by checking that the power supply LEDs are in the following states:

- INPUT OK LED is green.
- FAN OK LED is green.
- OUTPUT FAIL LED is off.

Step 8 If the LEDs indicate a power problem, see the"Identifying Startup Problems" section on page B-2.

Removing a Clock Module from the Cisco MDS 9509 Director

Before installing the clock module, check the contents of your kit. Table 2-6 lists the contents of the clock module replacement kit, part number DS-C9509-CL=.

Table 2-6 Contents of Cisco MDS 9509 Clock Module Replacement Kits

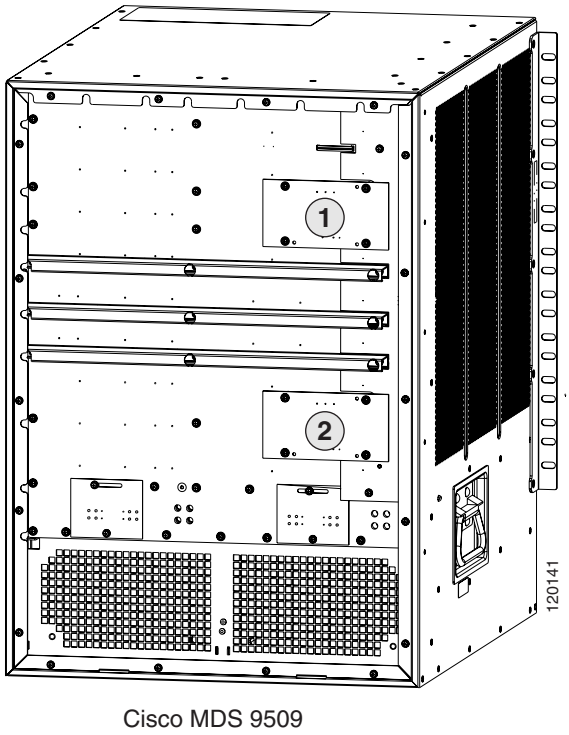
Quantity	Part Description
1	Cisco MDS 9509 clock module
12	M3 x 6-mm Phillips pan-head screws
1	Disposable ESD wrist strap

These tools are required to remove or install a clock module:

- Number 1 Phillips screwdriver
- Your own ESD-prevention equipment or the disposable grounding wrist strap included with all upgrade kits, field-replaceable units (FRUs), and spares

Clock modules are connected to the rear of the Cisco MDS 9509 Director using two connectors. Figure 2-43 shows the clock modules in a rear view of the Cisco MDS 9509 Director with the back panel removed.

Figure 2-43 Clock Module Location on the Cisco MDS 9509 Director (Rear View)



1	Clock A (CLK A)	**2**	Clock B (CLK B)

Caution Always use an ESD wrist strap when handling modules or coming into contact with internal components.

To remove the clock module, follow these steps:

Step 1 Remove power from both power supplies as follows:

- If the power supply is AC, press the power switch to off (0) and remove the power cable.
- If the power supply is DC, follow the instructions in the "Providing Power to a DC Power Supply in the Cisco MDS 9509 Director" section on page 2-33.

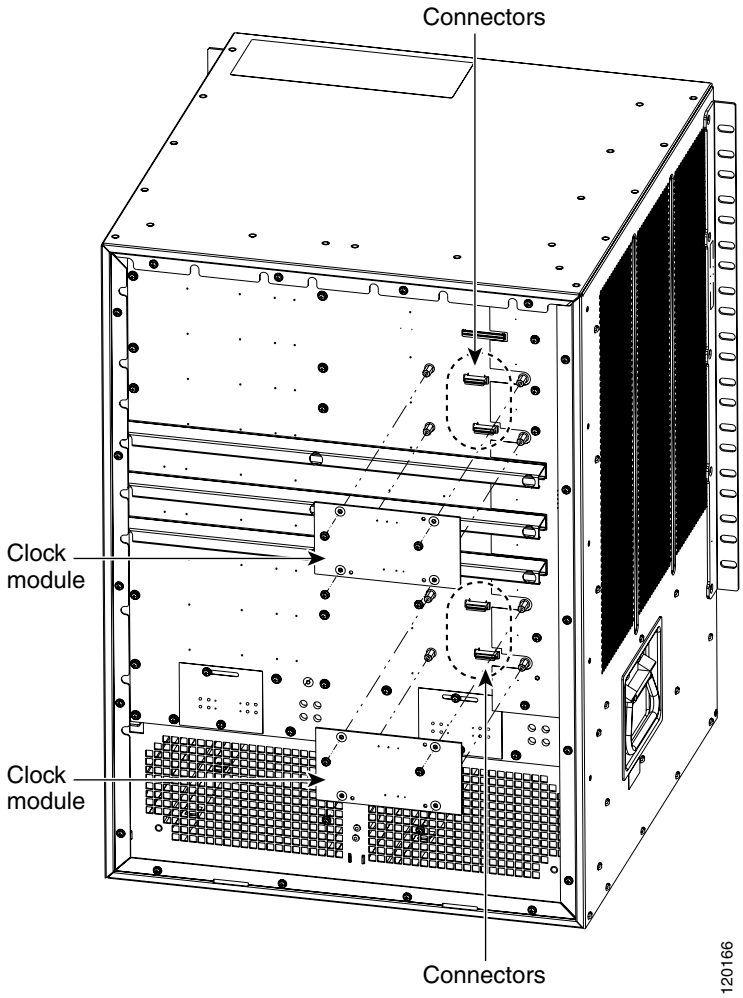
Caution Before working on a system that has an on/off switch, turn OFF the power and unplug the power cord.

Step 2 Use a Phillips screwdriver to remove the 18 back panel screws from the rear of the Cisco MDS 9509 Director chassis.

Note Note the position of the clock module before you remove it from the director chassis because you must install the new clock module in the same position.

Step 3 Remove the four screws that secure the clock module to the backplane (see Figure 2-44).

Figure 2-44 Clock Module Replacement on the Cisco MDS 9509 Director (Rear View)



Step 4 Gently disconnect and remove the module, placing it on an antistatic mat or foam.

Step 5 Repeat Step 3 and Step 4 to remove any additional clock modules.

Installing a Clock Module into the Cisco MDS 9509 Director

Caution Always use an ESD wrist strap when handling modules or coming into contact with internal components.

To install the clock module, follow these steps:

Step 1 Remove the new clock module from the antistatic bag.

Step 2 Hold the module with the connectors away from you.

Step 3 Carefully press the module onto the two matching connectors on the backplane.

Note You must install the new clock module in the same position that you removed it.

Step 4 Replace the four screws to secure the clock module onto the backplane.

Step 5 Repeat Step 1 through Step 4 to install any additional clock modules.

Step 6 Replace the back panel safety cover using the 18 screws.

Step 7 Provide power to the power supplies as described in the "Connecting the Power Supplies" section on page 2-28.

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

Step 8 Verify power supply operation by checking that the power supply LEDs are in the following states:

- INPUT OK LED is green.
- FAN OK LED is green.
- OUTPUT FAIL LED is off.

Step 9 If the LEDs indicate a power problem, see the"Identifying Startup Problems" section on page B-2

Removing a Clock Module from the Cisco MDS 9506 Director

Before replacing the clock module, check the contents of your kit. Table 2-7 lists the contents of the clock module replacement kit, part number DS-C9506-CL=.

Table 2-7 Contents of Cisco MDS 9506 Clock Module Replacement Kit

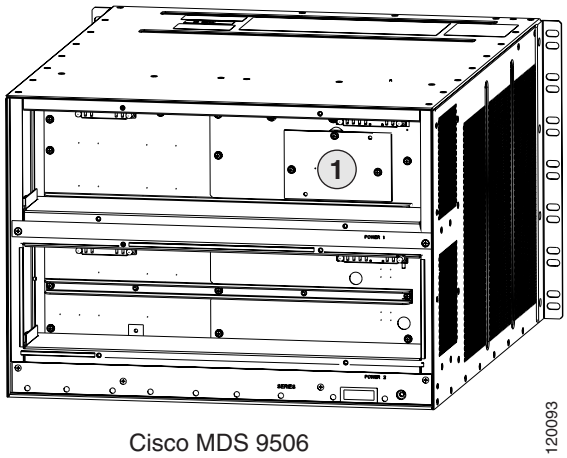
Quantity	Part Description
1	Cisco MDS 9506 clock module
12	M3 x 6-mm Phillips pan-head screws
1	Disposable ESD wrist strap

These tools are required to remove and install a clock module:

- Number 1 Phillips screwdriver
- Your own ESD-prevention equipment or the disposable grounding wrist strap included with the clock module replacement kit

The clock module is located behind the top power supply in the rear of the Cisco MDS 9506 Director. Figure 2-45 shows the rear view of the Cisco MDS 9506 Director with both power supplies removed.

Figure 2-45 Clock Module Location on the Cisco MDS 9506 Director (Rear View)



1	Clock module

Caution Always use an ESD wrist strap when handling modules or coming into contact with internal components.

To remove the clock module, follow these steps:

Step 1 Remove power from both PEMs, accessed from the front of the chassis as follows:

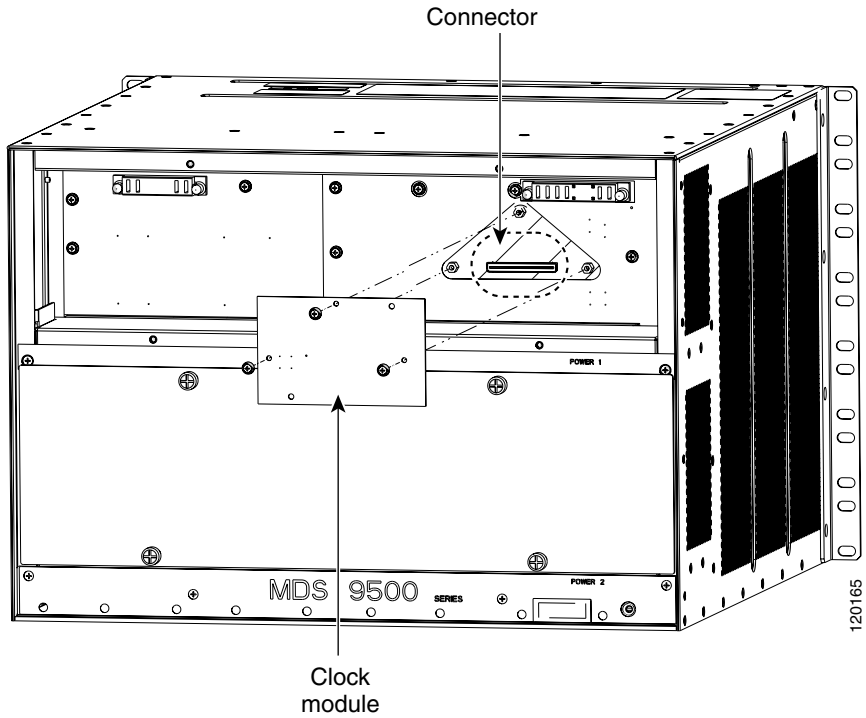
- If the PEM is AC, press the power switch to off (0). Remove the power cord from the PEM.
- If the PEM is DC, follow the instructions in the "Removing a DC PEM" section on page 2-64.

Step 2 Loosen the four captive screws on the top power supply.

Step 3 Grasp both power supply handles and slide the top power supply completely out of the chassis.

Step 4 Remove the three screws that secure the clock module to the backplane (see Figure 2-46).

Figure 2-46 Clock Module Replacement on the Cisco MDS 9506 Director (Rear View)



Step 5 The clock module has one connector to the backplane. Gently disconnect and remove the clock module, placing it on an antistatic mat or foam.

Note Note the position of the clock module before you remove it from the director chassis because you must install the new clock module in the same position.

Installing a Clock Module into the Cisco MDS 9506 Director

Caution Always use an ESD wrist strap when handling modules or coming into contact with internal components.

To install the clock module, follow these steps:

Step 1 Remove the new clock module from the antistatic bag.

Step 2 Hold the module with the connector away from you and carefully press the module onto the backplane connector.

Note You must install the new clock module in the same position that you removed it.

Step 3 Replace the three securing screws on the clock module.

Step 4 Grasp both power supply handles and slide the power supply into the power supply bay, ensuring that the power supply is fully seated in the bay.

Step 5 Tighten the captive screws on the power supply to 8 in-lb.

Step 6 Provide power to the PEMs as described in the "Connecting the Power Supplies" section on page 2-28.

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

Step 7 Verify power supply operation by checking that the power supply LEDs are in the following states:

- INPUT OK LED is green.
- FAN OK LED is green.
- OUTPUT FAIL LED is off.

If the LEDs indicate a power problem, see the "Identifying Startup Problems" section on page B-2.

CHAPTER 3

Connecting the Cisco MDS 9500 Series

The Cisco MDS 9500 Series provides the following types of ports:

- Console port (supervisor modules): An RS-232 port that you can use to create a local management connection.
- COM1 port (supervisor modules): An RS-232 port that you can use to connect to an external serial communication device such as a modem.
- MGMT 10/100/1000 Ethernet port (Supervisor-2 module): An Ethernet port that you can use to access and manage the switch by IP address, such as through Fabric Manager.
- MGMT 10/100 Ethernet port (Supervisor-1 module): An Ethernet port that you can use to access and manage the switch by IP address, such as through Fabric Manager.
- Fibre Channel ports (switching modules): Fibre Channel ports that you can use to connect to the SAN or for in-band management.
- Gigabit Ethernet ports (IP services modules): Gigabit Ethernet ports that you can use for iSCSI and/or FCIP.
- Two USB ports (Supervisor-2 module): A simple interface that allows you to connect to different devices supported by Cisco MDS SAN-OS. On the double decker connector, USB port 1 is on the lower position and port 2 is on the upper position.

Note The USB ports are not functional on Cisco MDS SAN-OS Release 3.0(1) or earlier.

- CPU subsystem based on Motorola PowerPC 7447

This chapter includes the following sections:

Caution When running power and data cables in overhead or sub-floor cable trays, we strongly recommend that power cables and other potential noise sources be located as far away as is practical from network cabling that terminates on Cisco equipment. In situations where long parallel cable runs cannot be separated by at least 3.3 ft (1 m), we recommend shielding any potential noise sources by housing them in a grounded metallic conduit.

Note The Cisco MDS 9506 Director and Cisco MDS 9509 Director use the Supervisor-1 module and therefore require the same port connecting procedures.

Preparing for Network Connections

When preparing your site for network connections to the Cisco MDS 9500 Series, consider the following for each type of interface, and gather all the required equipment before connecting the ports:

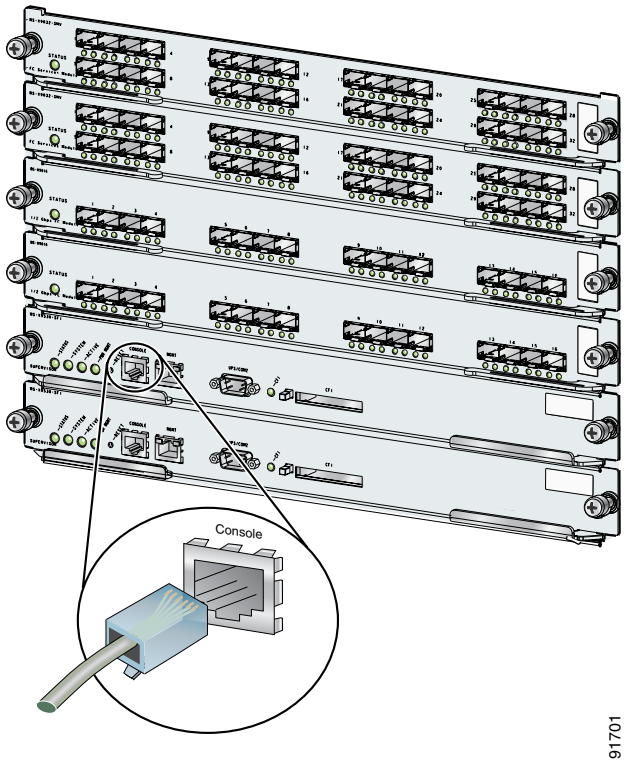
- Cabling required for each interface type
- Distance limitations for each signal type
- Additional interface equipment required

Connecting to the Console Port

The console port, labeled “Console,” is an RS-232 port with an RJ-45 interface (see Figure 3-1). It is an asynchronous (async) serial port; any device connected to this port must be capable of asynchronous transmission.

We recommend using this port to create a local management connection to set the IP address and other initial configuration settings before connecting the switch to the network for the first time.

Figure 3-1 Connecting to the Console Port on the Supervisor Module for the Cisco MDS 9500 Series



Note Connecting the console port to a modem is supported for switches running Cisco MDS SAN-OS Release 1.2(2a) or later.

Caution The console port can be used to connect to a modem, but we recommend using the COM1 port for this purpose. If you decide to connect the console port to a modem, do not connect it while the switch is booting; connect either before powering the switch on or after the switch has completed the boot process.

You can use the console port to perform the following functions:

- Configure the Cisco MDS 9500 from the CLI.
- Monitor network statistics and errors.
- Configure SNMP agent parameters.
- Download software updates.

Note To connect the console port to a computer terminal, the computer must support VT100 terminal emulation. The terminal emulation software—frequently an application such as HyperTerminal or Procomm Plus—makes communication between the switch and computer possible during setup and configuration.

To connect the console port to a computer terminal, follow these steps:

Step 1 Configure the terminal emulator program to match the following default port characteristics: 9600 baud, 8 data bits, 1 stop bit, no parity.

Step 2 Connect the supplied RJ-45 to DB-9 female adapter or RJ-45 to DP-25 female adapter (depending on your computer) to the computer serial port. We recommend using the adapter and cable provided with the switch.

Step 3 Connect the console cable (a rollover RJ-45 to RJ-45 cable) to the console port and to the RJ-45 to DB-9 adapter or the RJ-45 to DP-25 adapter (depending on your computer) at the computer serial port.

Note For configuration instructions, refer to the *Cisco MDS 9000 Family CLI Configuration Guide* or the *Cisco MDS 9000 Family Fabric Manager Configuration Guide*.

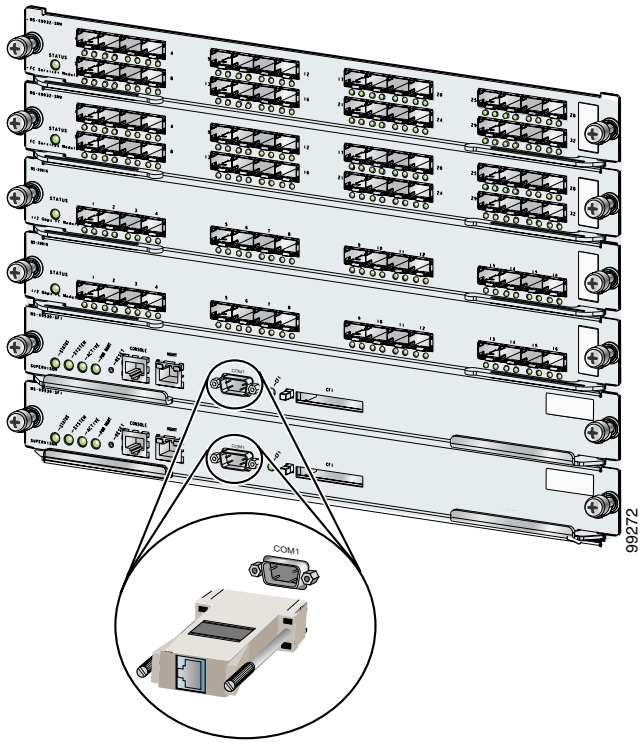
Connecting to the COM1 Port

Note The COM1 port is not supported for connection to a console.

The COM1 port (labeled “COM1”) is an RS-232 port with a DB-9 interface (see Figure 3-2). You can use it to connect to an external serial communication device such as a modem. For information about how to turn off hardware flow control, refer to the *Cisco MDS 9000 Family CLI Configuration Guide*.

Note Switches running Cisco MDS SAN-OS Release 1.2(1a) or later support the connection of a COM1 port to a modem.

Figure 3-2 Connecting to the COM1 Port on the Supervisor Module for the Cisco MDS 9500 Series



To connect the COM1 port to a modem, follow these steps:

Step 1 Connect the modem to the COM1 port using the adapters and cables provided with the accessory kit, as follows: connect the DB-9 serial adapter to the COM1 port, connect the RJ-45 to DB-25 modem adapter to the modem, and then connect the adapters using the RJ-45 to RJ-45 rollover cable (or equivalent crossover cable).

Step 2 If the default settings for the COM1 are modified, refer to the *Cisco MDS 9000 Family CLI Configuration Guide* containing information regarding verifying and resetting the default settings.

The default COM1 settings are as follows:

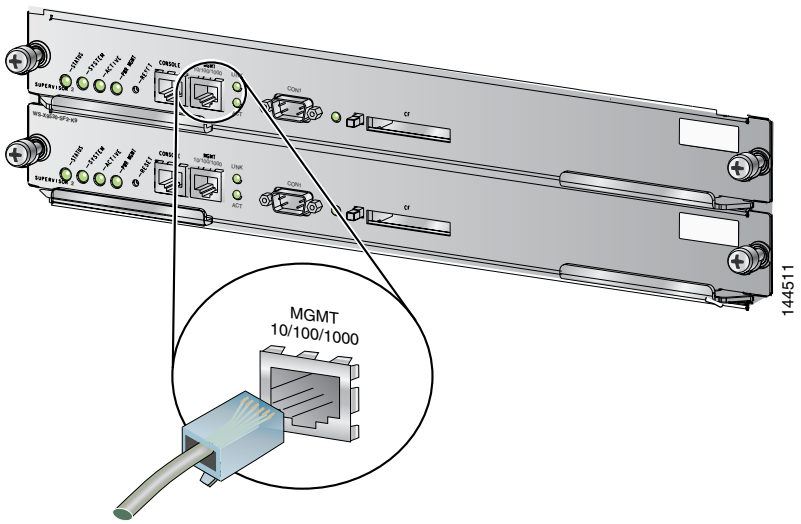
```
line Aux:
Speed: 9600 bauds
Databits: 8 bits per byte
Stopbits: 1 bit(s)
Parity: none
Modem In: Enable
Modem Init-String -
default : ATE0Q1&D2&C1S0=1\015
Statistics: tx:17 rx:0 Register Bits:RTS|DTR
```

Connecting to the MGMT 10/100/1000 Ethernet Port

Caution To prevent an IP address conflict, do not connect the MGMT 10/100/1000 Ethernet port to the network until the initial configuration is complete. Refer to the *Cisco MDS 9000 Family CLI Configuration Guide*.

The Supervisor-2 module supports an autosensing MGMT 10/100/1000 Ethernet port (labeled "MGMT 10/100/1000") and has an RJ-45 interface. (See Figure 3-3.) You can use this port to access and manage the switch by IP address, such as through Cisco Fabric Manager.

Figure 3-3 Connecting to the MGMT 10/100/1000 Ethernet Port on the Supervisor-2 Module for the Cisco MDS 9500 Series



To connect the MGMT 10/100/1000 Ethernet port to an external hub, switch, or router, follow these steps:

Step 1 Connect the appropriate modular cable to the MGMT 10/100/1000 Ethernet port:

- Use a modular, RJ-45, straight-through UTP cable to connect the MGMT 10/100/1000 Ethernet port to an Ethernet switch port or hub.
- Use a cross-over cable to connect to a router interface.

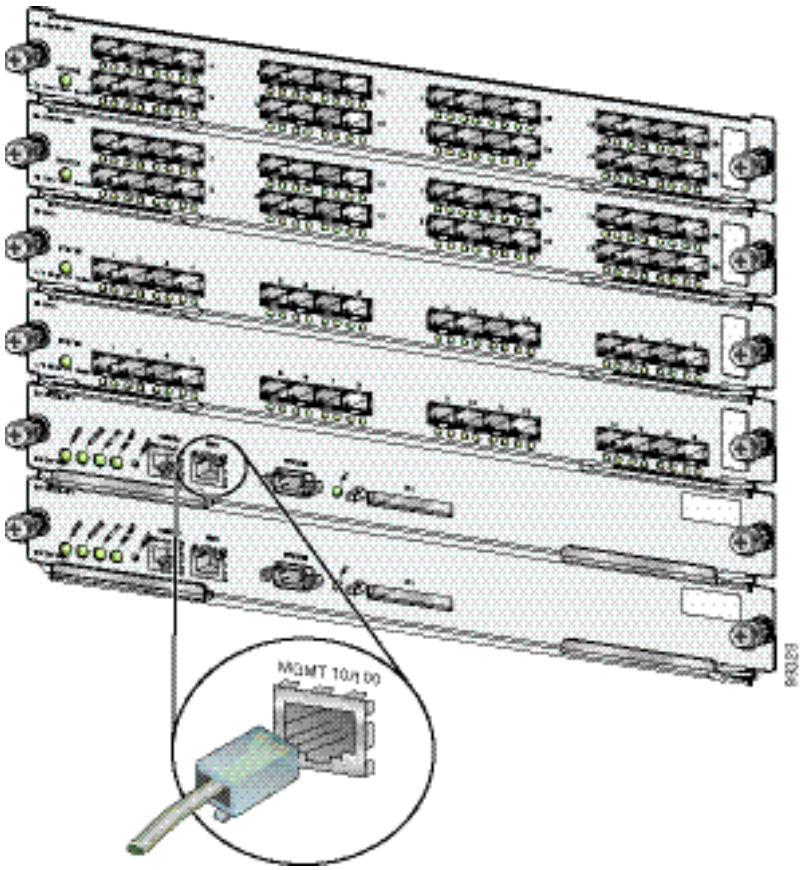
Step 2 Connect the other end of the cable to the device.

Connecting to the MGMT 10/100 Ethernet Port

Caution To prevent an IP address conflict, do not connect the MGMT 10/100 Ethernet port to the network until the initial configuration is complete. Refer to the *Cisco MDS 9000 Family CLI Configuration Guide*.

The Supervisor-1 module supports an autosensing MGMT 10/100 Ethernet port (labeled "MGMT 10/100") and has an RJ-45 interface. (See Figure 3-4.) You can use this port to access and manage the switch by IP address, such as through Cisco Fabric Manager.

Figure 3-4 Connecting to the MGMT 10/100 Ethernet Port on the Supervisor-1 Module for the Cisco MDS 9500 Series



To connect the MGMT 10/100 Ethernet port to an external hub, switch, or router, follow these steps:

Step 1 Connect the appropriate modular cable to the MGMT 10/100 Ethernet port:

- Use a modular, RJ-45, straight-through UTP cable to connect the MGMT 10/100 Ethernet port to an Ethernet switch port or hub.
- Use a cross-over cable to connect to a router interface.

Step 2 Connect the other end of the cable to the device.

Connecting to a Fibre Channel Port

The Fibre Channel ports on the switching modules are compatible with LC-type fiber-optic SFP transceivers and cables. You can use these ports to connect to the SAN or for in-band management. For information about configuring the switch for in-band management, refer to the *Cisco MDS 9000 Family CLI Configuration Guide*.

The Cisco MDS 9000 Family supports both Fibre Channel and Gigabit Ethernet protocols for SFP transceivers. Each transceiver must match the transceiver on the other end of the cable, and the cable must not exceed the stipulated cable length for reliable communication. Refer to the *Cisco MDS 9000 Family Release Notes for Cisco MDS SAN-OS* for your software release to get the list of supported SFP transceivers.

Warning **Class 1 laser product.** Statement 1008

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

Caution Wear an ESD wrist strap connected to the chassis when handling transceivers. Keep optical connectors covered when not in use, and do not touch connector ends. The fiber-optic connectors must be free of dust, oil, and other contaminants.

This section provides the following topics:

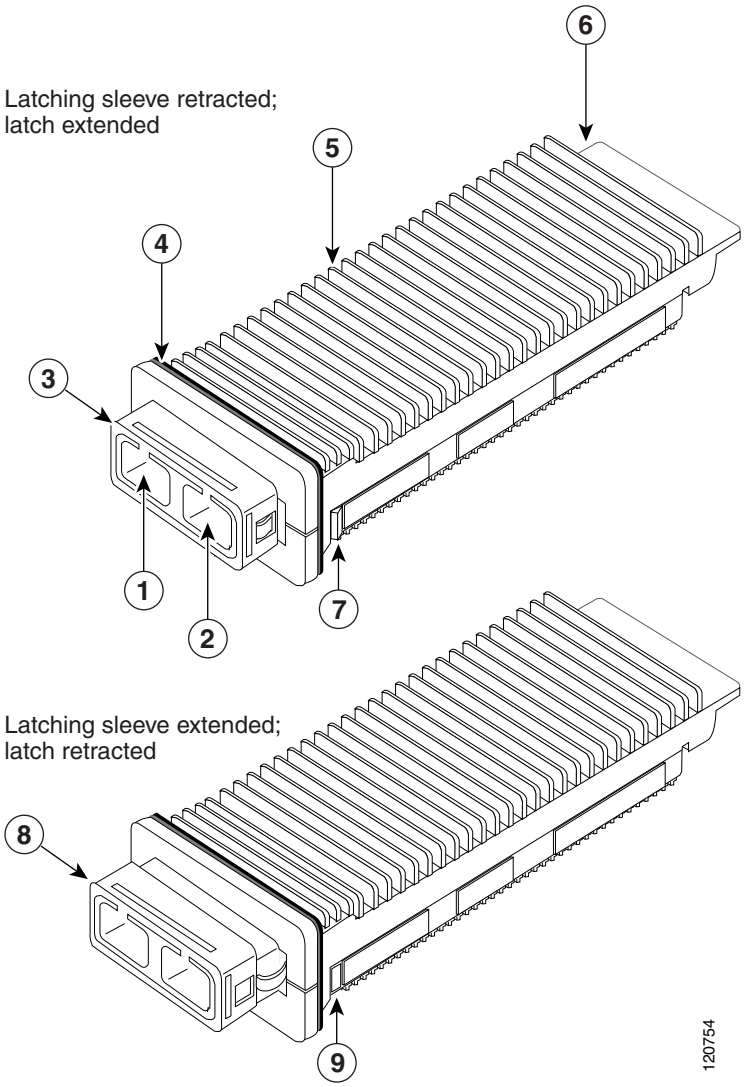
Removing and Installing X2 Transceivers

Caution Excessively removing and installing X2 transceivers can shorten its useful life. Do not remove and insert X2 transceivers more often than is absolutely necessary. We recommend disconnecting cables before installing or removing SFP transceivers to prevent damage to the cable or transceiver.

Note Use only Cisco X2 transceivers listed in Table B-16 on page B-15 on the Cisco MDS 9500 Series. Each X2 transceiver is encoded with model information that enables the switch to verify that the X2 transceiver meets the requirements for the switch. For instructions specific to the transceiver type, see the "X2 Transceiver Specifications" section on page B-15.

The Cisco MDS 9000 Family supports X2 transceivers with SC connectors. (See Figure 3-5.)

Figure 3-5 Cisco MDS 9000 Family X2 Transceivers



1	Transmit optical bore	**6**	Module connector
2	Receive optical bore	**7**	Latch (extended)
3	Latching sleeve (retracted)	**8**	Latching sleeve (extended)
4	EMI gasket	**9**	Latch (retracted)
5	Transceiver heat sink		

Removing an X2 Transceiver

To remove an X2 transceiver, follow these steps:

Step 1 Attach an ESD-preventive wrist strap and follow its instructions for use.

Step 2 If a cable is installed in the transceiver:

a. Record the cable and port connections for later reference.

b. Press the release latch on the cable, grasp the connector near the connection point, and gently pull the connector from the transceiver.

c. Insert a dust plug into the cable end of the transceiver.

Caution If the transceiver does not remove easily in the next step, push the transceiver all the way back in and then ensure that the latch is in the correct position before continuing.

Step 3 Remove the transceiver from the port.

Step 4 Insert a dust cover into the port end of the transceiver and place the transceiver on an antistatic mat or into a static shielding bag if you plan to return it to the factory.

Installing an X2 Transceiver

To install an X2 transceiver, follow these steps:

Step 1 Attach an ESD-preventive wrist strap and follow its instructions for use.

Caution If the transceiver does not install easily, ensure it is correctly oriented before continuing.

Step 2 Remove the dust cover from the port end of the transceiver.

Step 3 Insert the transceiver into the port. Make sure the transceiver is fully seated.

Note If you cannot install the cable into the transceiver, insert or leave the dust plug in the cable end of the transceiver.

Removing and Installing SFP Transceivers

Caution Removing and installing an SFP transceiver can shorten its useful life. Do not remove and insert SFP transceivers more often than is absolutely necessary. We recommend disconnecting cables before installing or removing SFP transceivers to prevent damage to the cable or transceiver.

Note Use only Cisco SFP transceivers on the Cisco MDS 9500 Series. Each Cisco SFP transceiver is encoded with model information that enables the switch to verify that the SFP transceiver meets the requirements for the switch. For instructions specific to the transceiver type, see the "SFP Transceiver Specifications" section on page B-16.

The Cisco MDS 9000 Family supports SFP transceivers with the following two types of latching devices:

- Mylar tab latch (Figure 3-6)
- Bale-clasp latch (Figure 3-7)

Figure 3-6 SFP Transceiver with Mylar Tab Latch

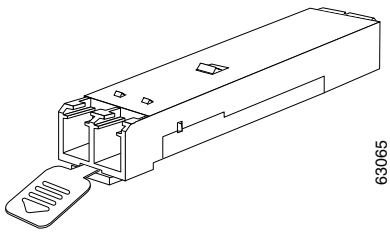
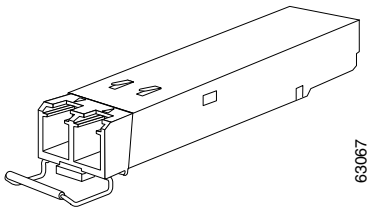


Figure 3-7 SFP Transceiver with Bale-Clasp Latch



Removing an SFP Transceiver

To remove an SFP transceiver, follow these steps:

Step 1 Attach an ESD-preventive wrist strap and follow its instructions for use.

Step 2 If a cable is installed in the transceiver:

a. Record the cable and port connections for later reference.

b. Press the release latch on the cable, grasp the connector near the connection point, and gently pull the connector from the transceiver.

c. Insert a dust plug into the cable end of the transceiver.

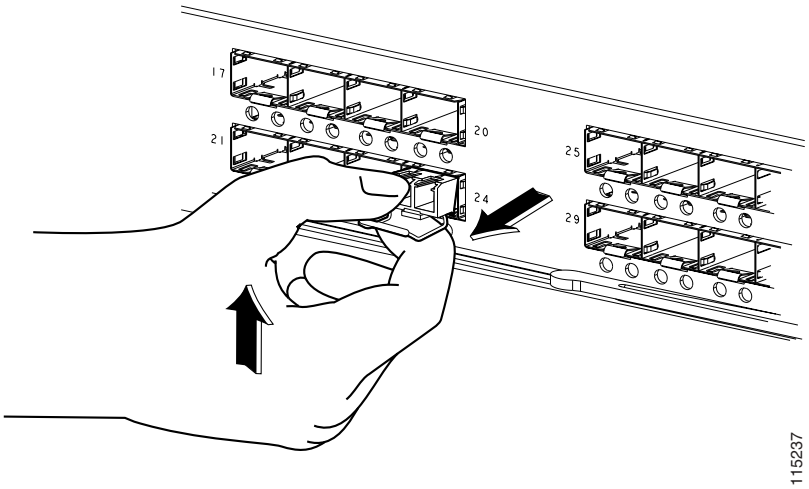
Caution If the transceiver does not remove easily in the next step, push the transceiver all the way back in and then ensure that the latch is in the correct position before continuing.

Step 3 Remove the transceiver from the port:

- If the transceiver has a Mylar tab latch, gently pull the tab straight out (do not twist), and then pull the transceiver out of the port.
- If the transceiver has a bale clasp latch, open the clasp by pressing it downwards, and then pull the transceiver out of the port.

Note If you have difficulty removing a bale clasp SFP transceiver, you should reseat the SFP by returning the bale clasp in the up position. Then press the SFP inward and upward into the cage. Next, lower the bale clasp and pull the SFP straight out with a slight upward lifting force (see Figure 3-8). Be careful not to damage the port cage during this process.

Figure 3-8 Alternate Removal Method for Bale Clasp SFP Transceivers



Step 4 Insert a dust cover into the port end of the transceiver and place the transceiver on an antistatic mat or into a static shielding bag if you plan to return it to the factory.

Step 5 If another transceiver is not being installed, protect the optical cage by inserting a clean cover.

Installing an SFP Transceiver

To install an SFP transceiver, follow these steps:

Step 1 Attach an ESD-preventive wrist strap and follow its instructions for use.

Step 2 Remove the dust cover from the port cage.

Step 3 Remove the dust cover from the port end of the transceiver.

Step 4 Insert the transceiver into the port:

- If the transceiver has a Mylar tab, orient the transceiver with the tab on the bottom, and then gently insert the transceiver into the port until it clicks into place.
- If the transceiver has a bale clasp, orient the transceiver with the clasp on the bottom, close the clasp by pushing it up over the transceiver, and then gently insert the transceiver into the port until it clicks into place.

Caution If the transceiver does not install easily, ensure it is correctly oriented and the tab or clasp are in the correct position before continuing.

Note If you cannot install the cable into the transceiver, insert or leave the dust plug in the cable end of the transceiver.

Removing and Installing Cables into SFP Transceivers

Caution To prevent damage to the fiber optic cables, do not place more tension on them than the rated limit and do not bend to a radius of less than 1 inch if there is no tension in the cable, or 2 inches if there is tension in the cable.

Removing a Cable from an SFP Transceiver

Caution When pulling a cable from a transceiver, grip the body of the connector. Do not pull on the jacket sleeve, because this can compromise the fiber-optic termination in the connector.

Caution If the cable does not remove easily, ensure that any latch present on the cable has been released before continuing.

To remove the cable, follow these steps:

Step 1 Attach an ESD-preventive wrist strap and follow its instructions for use.

Step 2 Press the release latch on the cable, grasp the connector near the connection point, and gently pull the connector from the transceiver.

Step 3 Insert a dust plug into the cable end of the transceiver.

Step 4 Insert a dust plug onto the end of the cable.

Installing a Cable into an SFP Transceiver

Caution To prevent possible damage to the cable or transceiver, install the transceiver in the port before installing the cable in the transceiver.

To install a cable into a transceiver, follow these steps:

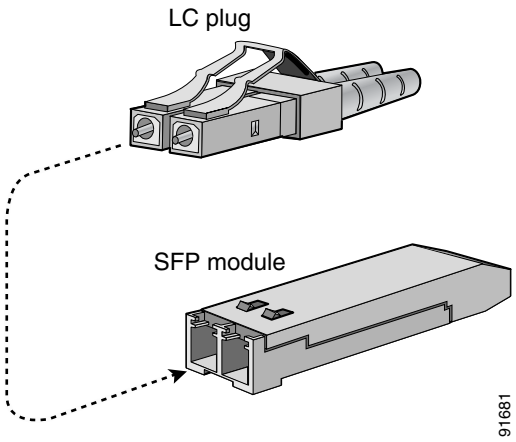
Step 1 Attach an ESD-preventive wrist strap and follow its instructions for use.

Step 2 Remove the dust cover from the connector on the cable.

Step 3 Remove the dust cover from the cable end of the transceiver.

Step 4 Align the cable connector with the transceiver and insert the connector into the transceiver until it clicks into place (see Figure 3-9).

Figure 3-9 Connecting the LC-Type Cable to a Fibre Channel Port



Caution If the cable does not install easily, ensure it is correctly oriented before continuing.

For instructions on verifying connectivity, refer to the *Cisco MDS 9000 Family CLI Configuration Guide* or the *Cisco MDS 9000 Family Fabric Manager Configuration Guide*.

Maintaining SFP Transceivers and Fiber Optic Cables

SFP transceivers and fiber optic cables must be kept clean and dust-free to maintain high signal accuracy and prevent damage to the connectors. Attenuation (Loss Of Light) is increased by contamination and should be below 0.35 dB.

Consider the following maintenance guidelines:

- SFP transceivers are static sensitive. To prevent ESD damage, wear an ESD-preventive wrist strap that is connected to the chassis.
- Do not remove and insert a transceiver more often than is necessary. Repeated removals and insertions can shorten its useful life.
- Keep all optical connections covered when not in use. If they become dusty, clean before using to prevent dust from scratching the fiber optic cable ends.
- Do not touch ends of connectors to prevent fingerprints and other contamination.
- Clean regularly; the required frequency of cleaning depends upon the environment. In addition, clean connectors if they are exposed to dust or accidentally touched. Both wet and dry cleaning techniques can be effective; refer to your site's fiber optic connection cleaning procedure.
- Inspect routinely for dust and damage. If damage is suspected, clean and then inspect fiber ends under a microscope to determine if damage has occurred.

APPENDIX A

Cabinet and Rack Installation

This appendix includes the following sections:

Cabinet and Rack Requirements

This section provides the Cisco MDS 9000 Family requirements for the following types of cabinets and racks, assuming an external ambient air temperature range of 32 to 104°F (0 to 40°C):

- Standard perforated cabinets
- Solid-walled cabinets with a roof fan tray (bottom to top cooling)
- Standard open racks
- Telco racks

Note If you are selecting an enclosed cabinet, we recommend one of the thermally validated types: standard perforated or solid-walled with a fan tray.

General Requirements for Cabinets and Racks

The cabinet or rack must be one of the following types:

- Standard 19-inch four-post EIA cabinet or rack, with mounting rails that conform to English universal hole spacing per section 1 of ANSI/EIA-310-D-1992. See the "Requirements Specific to Perforated Cabinets" section on page A-2 and the "Requirements Specific to Solid-Walled Cabinets" section on page A-3.
- Standard two-post telco rack, with mounting rails that conform to English universal hole spacing per section 1 of ANSI/EIA-310-D-1992. See the "Requirements Specific to Telco Racks" section on page A-4.

The cabinet or rack must also meet the following requirements:

- The minimum vertical rack space per chassis:
  - Cisco MDS 9513 chassis: 24.5 inches (62.2 cm) or 14 RU, height with required rack mount support is 15 RU.
  - Cisco MDS 9509 chassis: 24.5 inches (62.2 cm) or 14 RU
  - Cisco MDS 9506 chassis: 12.25 inches (31.1 cm) or 7 RU (rack unit)
- The width between the rack mounting rails must be at least 17.75 inches (45.1 cm). For four-post EIA racks, this is the distance between the two front rails and rear rails.
- The minimum spacing for four-post EIA cabinets (perforated or solid-walled):
  - To ensure the minimum bend radius for fiber optic cables, the front mounting rails of the cabinet should be offset from the front door by a minimum of 3 inches (7.6 cm), and a minimum of 5 inches (12.7 cm) if cable management brackets are installed on the front of the chassis.
  - A minimum of 2.5 inches (6.4 cm) of clear space between the side edge of the chassis and the side wall of the cabinet. No sizeable flow obstructions should be immediately in the way of the chassis air intake or exhaust vents.

Note Optional jumper power cords are available for use in a cabinet. See the "Jumper Power Cord" section on page C-12.

Requirements Specific to Perforated Cabinets

A perforated cabinet is defined here as a cabinet with perforated front and rear doors and solid side walls. In addition to the requirements listed in the "General Requirements for Cabinets and Racks" section on page A-1, perforated cabinets must meet the following requirements:

- The front and rear doors must have at least a 60 percent open area perforation pattern, with at least 15 square inches of open area per rack unit of door height.
- We recommend that the roof should be perforated with at least a 20 percent open area.
- We recommend an open or perforated cabinet floor to enhance cooling.

A perforated cabinet that conforms to these requirements is available from Rittal Corporation:

Rittal Corporation

One Rittal Place

Springfield, OH 45504

Contact: (800) 477–4220

Cabinet P/N: Rittal 9969427

Cabinet description: PS-DK/OEM Cabinet Assembly, 78.7 in. (1998 mm) x 23.6 in. (600 mm) x 39.4 in. (1000 mm) (H x W x D) (42RU)

Note Do not use the perforated cabinet from Rittal Corporation with the Cisco MDS 9513 Director.

Requirements Specific to Solid-Walled Cabinets

A solid-walled cabinet is defined here as a cabinet with solid (non-perforated) front and rear doors and solid side walls. In addition to the requirements listed in the "General Requirements for Cabinets and Racks" section on page A-1, solid-walled cabinets must meet the following requirements:

- A roof mounted fan tray and an air cooling scheme in which the fan tray pulls air in at the bottom of the cabinet and exhausts it out the top, with a minimum of 500 cfm of airflow exiting the cabinet roof through the fan tray.
- Non-perforated (solid and sealed) front and back doors and side panels so that air travels predictably from bottom to top.
- A recommended cabinet depth of 36 to 42 inches (91.4 to 106.7 cm) to allow the doors to close and adequate airflow.
- A minimum of 150 square inches (968 sq. cm) of open area at the floor air intake of the cabinet.
- The lowest piece of equipment should be installed a minimum of 1.75 inches (4.4 cm) above the floor openings to prevent blocking the floor intake.

Requirements Specific to Standard Open Racks

In addition to the requirements listed in the "General Requirements for Cabinets and Racks" section on page A-1, if mounting the chassis in an open rack (no side panels or doors), ensure the rack meets the following requirements:

- The minimum width between two front mounting rails must be 17.75 inches (45.1 cm).
- The minimum vertical rack space per chassis:
  - Cisco MDS 9513 chassis: 24.5 inches (62.2 cm) or 14 RU.
  - Cisco MDS 9509 chassis: 24.5 inches (62.2 cm) or 14 RU.
  - Cisco MDS 9506 chassis: 12.25 inches (31.1 cm) or 7 RU.

Note The rack-mount support brackets provided with the Cisco MDS 9513 Director require an additional height of 0.75 inches (1.9 cm). They are required during the installation of the Cisco MDS 9513 Director and cannot be removed.

Note The side rail mount brackets provided with the Cisco MDS 9509 Director require an additional height of 0.75 inches (1.9 cm). They are required during the installation of the Cisco MDS 9509 Director only, and can be removed or left installed once the front rack-mount brackets are securely fastened to the rack-mounting rails.

Note The Cisco MDS 9506 Director does not require shelf brackets.

- The horizontal distance between the chassis and any adjacent chassis should be 6 inches (15.2 cm), and the distance between the chassis air vents and any walls should be 2.5 inches (6.4 cm).

Requirements Specific to Telco Racks

In addition to the requirements listed in the "General Requirements for Cabinets and Racks" section on page A-1, telco racks must meet the following requirements:

- The minimum width between the two rack-mounting rails must be at least 17.75 inches (45.1 cm).
- The distance between the chassis air vents and any walls should be 2.5 inches (6.4 cm).

Note Telco racks are not for intended use with the Cisco MDS 9513 Director.

Cisco MDS 9000 Family Telco and EIA Shelf Bracket

The optional Telco and EIA Shelf Bracket Kit (DS-SHELF) can temporarily or permanently support the Cisco MDS 9500 Series during installation. Once the front rack-mount brackets are securely attached to the rack-mounting rails, the shelf bracket can be removed. This kit supports the following configurations:

- A Cisco MDS 9506 Director in a two-post Telco rack
- A Cisco MDS 9506 Director in a four-post EIA rack

Note This kit is not intended for use with a Cisco MDS 9509 Director in a two-post Telco rack nor with a Cisco MDS 9513 Director in any rack.

This section describes the procedure for installing a Cisco MDS 9000 Family switch in a rack or cabinet using the optional Telco and EIA Shelf Bracket Kit. It includes the following information:

Note This optional kit is not provided with the switch; to order the kit, contact your switch supplier.

Rack-Mounting Guidelines

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

Caution If installing this kit in an EIA rack, attach the switch to all four rack-mounting rails; the EIA rails may not be thick enough to prevent flexing of the shelf brackets if only two rails are used.

Before rack-mounting the chassis, ensure that the cabinet or rack meets the following requirements:

- The specifications listed in the "Cabinet and Rack Requirements" section on page A-1.
- The depth of the rack between the front and rear mounting rails is at least 18 in.(45.7 cm) but less than or equal to 30 in. (76.2 cm). This is specific to four-post EIA cabinets or racks.
- The airflow and cooling are adequate and there is sufficient clearance around the air vents on the switch, as described in Appendix B, "Technical Specifications." This is particularly important to verify if you are installing the switch in an enclosed cabinet.
- The rack has sufficient vertical clearance for the chassis plus 2 RU for the shelf brackets, and any desired clearance for the installation process.
- The rack meets the minimum rack load ratings per rack unit listed in the following table:

Rack Type	MDS 9513	MDS 9509	MDS 9506	MDS 9216i MDS 9216A	MDS 9100
EIA (4-Post)	45 lb (20.41 kg)	45 lb (20.41 kg)	30 lb (13.61 kg)	15 lb (6.8 kg)	7.5 lb (3.4 kg)
Telco (2-Post)	Do not use.	Do not use.	60 lb	30 lb	15 lb

Before Installing the Rack-Mount Support Brackets

Before installing the rack-mount support brackets for the Cisco MDS 9513 Director, check the contents of your kit. Table A-1 lists the contents of the optional shelf bracket kit.

Table A-1 Contents of Shelf Bracket Kit

Quantity	Part Description
2	Support rack mount bracket
2	Rack mount support brace
20	12-24 x 3/4-in. Phillips screws
20	10-32 x 3/4-in. Phillips screws

Before Installing the Shelf Brackets

Before installing the shelf brackets, check the contents of your kit. Table A-2 lists the contents of the optional shelf bracket kit.

Table A-2 Contents of Shelf Bracket Kit

Quantity	Part Description
2	Slider brackets
2	Shelf brackets
1	Crossbar
2	10-32 x 3/8-in. Phillips pan-head screws
16	12-24 x 3/4-in. Phillips screws
16	10-24 x 3/4-in. Phillips screws

Required Equipment

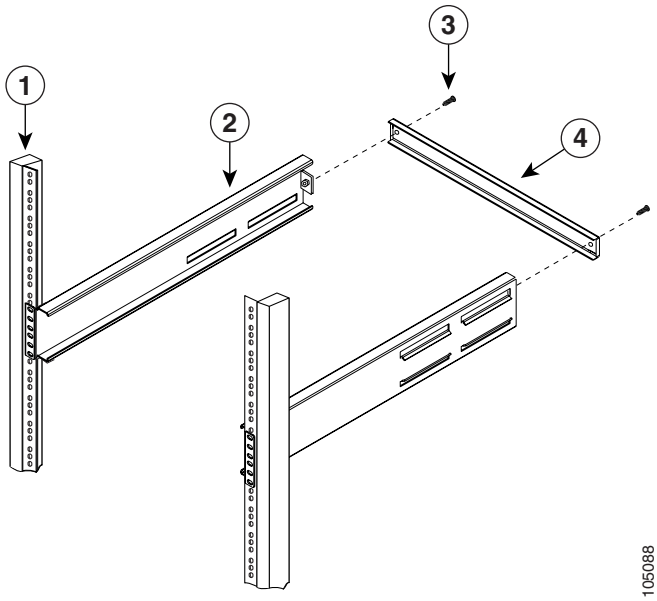
You need the following equipment for this installation:

- Number 2 Phillips screwdriver
- Tape measure and level (to ensure shelf brackets are level)

Installing the Shelf Bracket Kit into a Two-Post Telco Rack

Figure A-1 shows the installation of the shelf bracket kit into a two-post telco rack.

Figure A-1 Installing the Shelf Bracket Kit into a Telco Rack



1	Rack-mounting rail (2x)	**3**	10-32 screws (2x)
2	Shelf bracket (2x)	**4**	Crossbar

To install the shelf brackets in a telco rack, follow these steps:

Step 1 Position a shelf bracket inside a rack-mounting rail as shown in Figure A-1. Align the screw holes at the front of the shelf bracket with the holes in the rack-mounting rail. Then attach the shelf bracket to the rack-mounting rail using a minimum of four 12-24 or 10-24 screws.

Note The bottom hole of the shelf bracket should align with the bottom hole of a rack unit on the rack-mounting rail (the hole immediately above the 1/2-in. spacing).

Step 2 Repeat with the other shelf bracket.

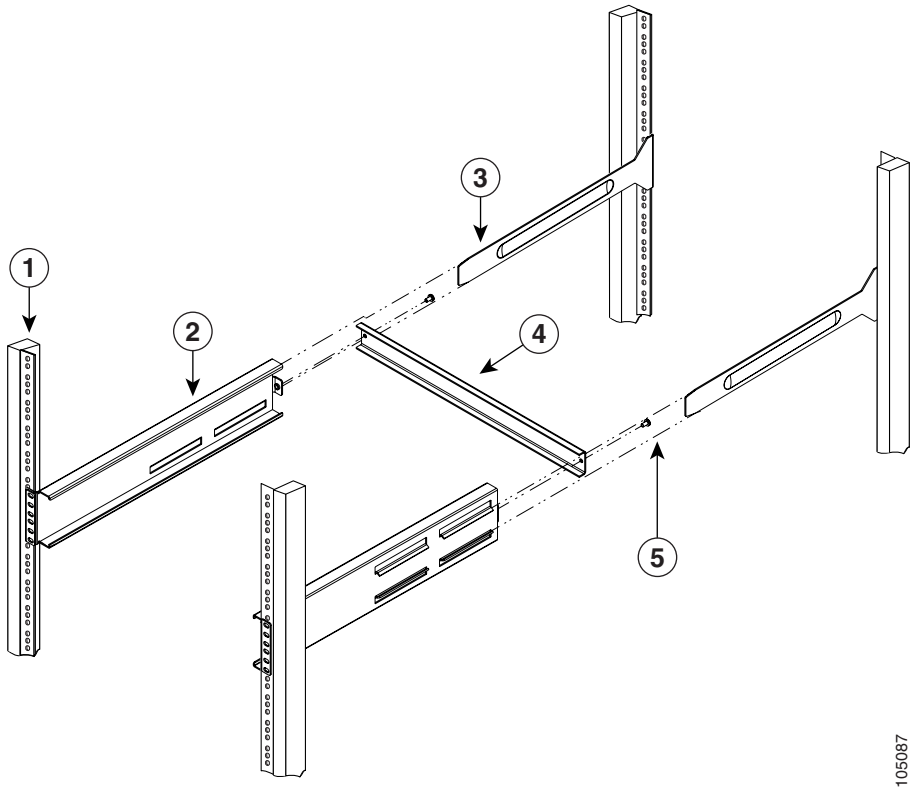
Step 3 Verify that the shelf brackets are at the same height (using the level or tape measure as desired).

Step 4 Attach the crossbar to the rear of the shelf brackets as shown in Figure A-1, using the 10-32 screws.

Installing the Shelf Bracket Kit into a Four-Post EIA Rack

Figure A-2 shows the installation of the shelf bracket kit into a four-post EIA rack.

Figure A-2 Installing the Shelf Bracket Kit into an EIA Rack



1	Rack-mounting rail (4x)	**4**	Crossbar
2	Shelf bracket (2x)	**5**	10-32 screws (2x)
3	Slider rail (2)		

To install the shelf brackets in an EIA rack, follow these steps:

Step 1 Position a shelf bracket inside the rack-mounting rails as shown in Figure A-2. Align the screw holes at the front of the shelf bracket with the holes in the front rack-mounting rail. Then attach the shelf bracket to the front rack-mounting rail using a minimum of four 12-24 or 10-24 screws.

Note The bottom hole of the shelf bracket should align with the bottom hole of a rack unit on the rack-mounting rail (the hole immediately above the 1/2-in. spacing).

Step 2 Repeat with the other shelf bracket.

Step 3 Verify that the shelf brackets are at the same height (using the level or tape measure as desired).

Step 4 Attach the crossbar to the shelf brackets as shown in Figure A-2, using the 10-32 screws.

Step 5 Insert the slider rails into the shelf brackets as shown in Figure A-2. Then attach them to the rear rack-mounting rails using a minimum of four 12-24 or 10-24 screws.

Installing the Switch on the Rack-Mount Support Brackets

This section provides general instructions for installing the switch on top of the rack-mount support brackets. For detailed installation instructions, see the "Installing the Chassis in a Cabinet or Rack" section on page 2-6.

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

Warning **Only trained and qualified personnel should be allowed to install, replace, or service this equipment.** Statement 1030

Note Before you install, operate, or service the system, refer to the *Regulatory Compliance and Safety Information for the Cisco 9000 Family* for important safety information.

To install the switch on top of the rack-mount support brackets, follow these steps:

Step 1 Verify that the rack-mount support brackets are level and securely attached to the rack-mounting rails, the support rack mount support brace is securely attached to the brackets, and the rack is stabilized.

Step 2 Slide a mechanical lift under the switch and lift the switch up onto the rack-mount support brackets, ensuring it is squarely positioned.

Step 3 Attach the switch to the rack-mounting rails. See the "Installing the Chassis in a Cabinet or Rack" section on page 2-6.

Caution We recommend grounding the chassis, even if the rack is already grounded. There is a grounding pad with two threaded M4 holes on the chassis for attaching a grounding lug.

Installing the Switch on the Shelf Brackets

This section provides general instructions for installing the switch on top of the shelf brackets. For detailed installation instructions, see the "Installing the Chassis in a Cabinet or Rack" section on page 2-6.

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

Warning **Only trained and qualified personnel should be allowed to install, replace, or service this equipment.** Statement 1030

Note Before you install, operate, or service the system, refer to the *Regulatory Compliance and Safety Information for the Cisco 9000 Family* for important safety information.

To install the switch on top of the shelf brackets, follow these steps:

Step 1 Verify that the shelf brackets are level and securely attached to the rack-mounting rails, the crossbar is securely attached to the shelf brackets, and the rack is stabilized.

Step 2 Slide the switch onto the shelf brackets, ensuring it is squarely positioned.

Step 3 Attach the switch to the rack-mounting rails. See the "Installing the Chassis in a Cabinet or Rack" section on page 2-6.

Caution We recommend grounding the chassis, even if the rack is already grounded. There is a grounding pad with two threaded M4 holes on the chassis for attaching a grounding lug.

Removing the Shelf Bracket Kit (Optional)

The shelf bracket kit can be removed once the Cisco MDS 9500 Series has been installed in a two-post telco or four-post EIA rack, and the front rack-mount brackets are securely attached to the rack-mounting rails. For additional support in an EIA rack, ensure the C brackets on the Cisco MDS 9500 Series are attached to the rear rack-mounting rails.

To remove the shelf bracket kit, follow these steps:

Step 1 Remove the screws fastening the slider brackets to the rear rack-mounting rails. Then slide the slider brackets out of the shelf brackets.

Step 2 Remove the screws fastening the crossbar to the shelf brackets and remove the crossbar.

Step 3 Remove the screws fastening the shelf brackets to the front rack-mounting rails. Then remove the shelf brackets from the rack.

Note This does not apply to the Cisco MDS 9513 Director.

Cisco MDS 9500 Shelf Bracket

Note This kit is optional and is not provided with the switch. To order the kit, contact your switch supplier.

The optional Cisco MDS 9500 Shelf Bracket Kit (DS-SHELF-9500) can be used to support the Cisco MDS 9509 Director in a non-threaded cabinet or rack with an 18-inch (45.7 cm) front to rear fixed rail spacing This shelf bracket kit can be used as a permanent support when installing a Cisco MDS 9509 Director in a cabinet or rack that meets the requirements listed in the "Cabinet and Rack Requirements" section on page A-1.

Note Do not use this shelf bracket with the Cisco MDS 9513 Director.

Note Do not use this shelf bracket with the Cisco MDS 9506 Director.

Note This kit is not intended for use with a Cisco MDS 9509 Director in a two-post telco rack. This kit is also not intended for use with any other product in the Cisco MDS 9000 Family.

This section describes the procedure for installing a Cisco MDS 9509 Director in a non-threaded rack or cabinet using the optional Cisco MDS 9500 Shelf Bracket Kit. It includes the following information:

Rack-Mounting Guidelines

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

Before rack mounting the chassis, ensure that the cabinet or rack meets the following requirements:

- The specifications listed in the "Cabinet and Rack Requirements" section on page A-1.
- The depth of the rack between the front and rear mounting rails is fixed at 18 inches (45.7 cm).
- The depth of the rack between the front and rear mounting rails is fixed at 26.67 inches (67.7 cm) for a Cisco MDS 9513 Director.
- The cabinet or rack mounting rails are non-threaded.
- The airflow and cooling are adequate and there is sufficient clearance around the air vents on the Cisco MDS 9509 Director, as described in Appendix B, "Technical Specifications." This is particularly important to verify if you are installing the switch in an enclosed cabinet.
- The rack has sufficient vertical clearance for the chassis and any desired clearance for the installation process. The Cisco MDS 9500 Shelf Bracket Kit does not consume any RU when installed.
- The rack meets the minimum rack load ratings of 45 lb (20.41 kg) per rack unit (RU) for the Cisco MDS 9509 Director.

Before Installing the Shelf Brackets

Before installing the shelf brackets, check the contents of your kit.Table A-3 lists the contents of the optional shelf bracket kit.

Table A-3 Contents of Cisco MDS 9500 Shelf Bracket Kit

Quantity	Part Description
2	Shelf brackets
16	1/4-20 x 3/4 in. Phillips pan-head screws with lock washers
12	10-32 x 1/3 in. Phillips pan-head screws with lock washers
12	10-32 clip nuts

Required Equipment

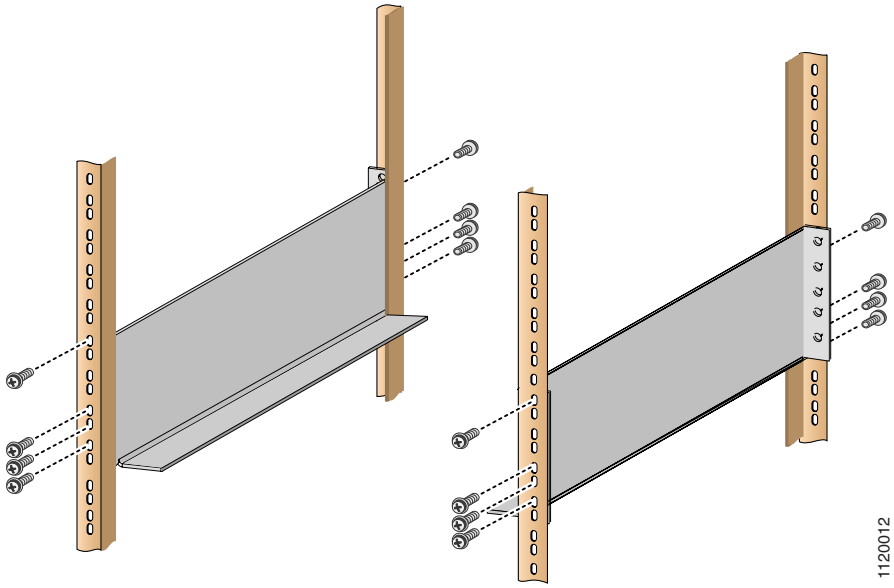
You need the following equipment for this installation:

- Number 2 Phillips screwdriver
- Tape measure and level (to ensure shelf brackets are level)

Installing the Cisco MDS 9500 Shelf Bracket Kit into a Cabinet or Rack

Figure A-3 shows the installation of the Cisco MDS 9500 Shelf Bracket Kit into a four-post rack.

Figure A-3 Installing the Shelf Bracket Kit into a Rack



To install the shelf brackets in a cabinet or rack, follow these steps:

Step 1 Position a shelf bracket inside the rack-mounting rails as shown in Figure A-3. Align the screw holes at the front of the shelf bracket with the holes in the front rack-mounting rail, and then attach the shelf bracket to the front rack-mounting rail using a minimum of four 1/4-20 screws.

Note The bottom hole of the shelf bracket should align with the bottom hole of a rack unit on the rack-mounting rail (the hole immediately above the 1/2-inch spacing).

Step 2 Align the screw holes at the back of the shelf bracket with the holes in the back rack-mounting rail, and then attach the shelf bracket to the back rack-mounting rail using a minimum of four 1/4-20 screws.

Step 3 Repeat Step 1 and Step 2 with the other shelf bracket.

Step 4 Verify that the shelf brackets are at the same height (using the level or tape measure as desired).

Installing the Switch on the Shelf Brackets

This section provides general instructions for installing the Cisco MDS 9509 Director on top of the shelf brackets. For detailed installation instructions, see "Installing the Chassis in a Cabinet or Rack" section on page 2-6.

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

Warning **Only trained and qualified personnel should be allowed to install, replace, or service this equipment.** Statement 1030

Note Before you install, operate, or service the system, refer to the *Regulatory Compliance and Safety Information for the Cisco 9000 Family* for important safety information.

To install the Cisco MDS 9509 Director on top of the shelf brackets, follow these steps:

Step 1 Verify that the shelf brackets are level and securely attached to the rack-mounting rails, and the rack is stabilized.

Step 2 Slide the Cisco MDS 9509 Director onto the shelf brackets, ensuring it is squarely positioned.

Step 3 Attach the Cisco MDS 9509 Director to the rack-mounting rails. Slide the clip nuts over the holes on the non-threaded rails on the cabinet or rack. These clip nuts provide the threading for the screws that will secure the chassis to the cabinet or rack. Use the 10-32 x 1/2 inch screws provided in this shelf bracket kit to secure the chassis to the cabinet or rack. See "Installing the Chassis in a Cabinet or Rack" section on page 2-6.

Caution We recommend grounding the chassis, even if the rack is already grounded. There is a grounding pad with two threaded M4 holes on the chassis for attaching a grounding lug.

APPENDIX B

Technical Specifications

This appendix includes the following sections:

Note Specifications for cables and connectors are provided in Appendix C, "Cable and Port Specifications."

Switch Specifications

The Cisco MDS 9500 Series supports hot-swappable fan modules that provide 85 cfm (cubic feet per minute) of airflow per slot with 410 W of power dissipation per slot.

Table B-1 lists the environmental specifications for the Cisco MDS 9500 Series.

Table B-1 Environmental Specifications for the Cisco MDS 9500 Series

Description	Specification
Temperature, certified for operation	32 to 104°F (0 to 40°C)
Temperature, designed and tested for operation	32 to 130°F (0 to 55°C)
Temperature, ambient nonoperating and storage	-40 to 158°F (-40 to 70°C)
Humidity (RH), ambient (noncondensing) operating	10 to 90%
Humidity (RH), ambient (noncondensing) nonoperating and storage	5 to 95%
Altitude, certified for operation	0 to 6500 ft (0 to 2000 m)
Altitude, designed and tested for operation	-200 to 10000 ft (-60 to 3000 m)
Noise levels	70 dB

Table B-2 lists the physical specifications for the Cisco MDS 9513 Director.

Table B-2 Physical Specifications for the Cisco MDS 9513 Director

Description	Specification
Dimensions (HxWxD)	24.5 x 17.5 x 28 in. (62.2 x 44.5 x 71.1 cm) Chassis requires 14 RU[1], 15 RU with a rack-mount kit. Chassis depth including cable guide is 33 in. (83.8 cm).
Weight	Chassis only: 101 lb (45.36 kg) Fully loaded chassis[2]: 375 lb (170.10 kg) System fan tray: 18 lbs (8.2 kg) Crossbar module fan tray: 2.25 lbs (1.02 kg)
Power supply	6000-W, AC input 33 lb (15 kg)
Airflow	275 to 325 lfm[3] through system fan module, or 90 cfm[4] per supervisor, switching, or services module. Total of 1150 cfm if all slots are filled. Spacing requirements: • If installed in an open rack (no side panels), the horizontal distance required between the chassis and any devices that exhaust air towards the chassis is a minimum of 12 in. (304 cm), and the distance required between the chassis air vents and any walls is a minimum of 6 in. (15.2 cm).

1. RU = rack unit; 1 RU = 1.75 in. (4.45 cm).
2. Depending on what modules are installed in the chassis.
3. lfm = linear feet per minute.
4. cfm = cubic feet per minute.

Table B-3 lists the physical specifications for the Cisco MDS 9509 Director.

Table B-3 Physical Specifications for the Cisco MDS 9509 Director

Description	Specification
Dimensions (HxWxD)	24.5 x 17.25 x 18.8 in. (62.2 x 43.8 x 47.8 cm) Chassis requires 14 RU[1] plus space for shelf brackets. Chassis depth including cable guide is 21.64 in. (55.0 cm).
Weight	Chassis only: 55 lb (24.9 kg) Chassis configured with two supervisor modules, and 2500-W power supplies: 120 lb (54.4 kg) Chassis configured with two supervisor modules, and 4000-W power supplies: 140 lb (63.5 kg) System fan tray: 10.5 lb (5.0 kg).

Table B-3 Physical Specifications for the Cisco MDS 9509 Director (continued)

Description	Specification
Power supply	4000-W, AC input 3000-W, AC input 2500-W, AC input 2500-W, DC input
Airflow	300 lfm[2] through system fan module, or 80 cfm[3] per supervisor, switching, or services module. Total of 720 cfm if all slots are filled. Spacing requirements: • If installed in a cabinet, a minimum clearance of 2.5 in. (6.4 cm) is required between the chassis air vents and the cabinet walls. • If installed in an open rack (no side panels), the horizontal distance required between the chassis and any devices that exhaust air towards the chassis is a minimum of 6 in. (15.2 cm), and the distance required between the chassis air vents and any walls is a minimum of 2.5 in. (6.4 cm).

1. RU = rack unit; 1 RU = 1.75 in. (4.45 cm)
2. lfm = linear feet per minute
3. cfm = cubic feet per minute

Table B-4 lists the physical specifications for the Cisco MDS 9506 Director.

Table B-4 Physical Specifications for the Cisco MDS 9506 Director

Description	Specification
Dimensions (HxWxD)	12.25 x 17.37 x 21.75 in. (31.1 x 44.1 x 55.2 cm). Chassis requires 7 RU[1]. Chassis depth including cable guides is 26.75 inches (67.9 cm).
Weight	Chassis only: 46 lb (20.9 kg). Chassis configured with two supervisor modules, fan module, and two power supplies: 86 lb (39 kg). System fan tray: 7.70 lbs (3.49 kg) 1900W AC power supply: 11 lbs (4.99 kg)

Table B-4 Physical Specifications for the Cisco MDS 9506 Director (continued)

Description	Specification
Power supply	1900-W, AC input 1900-W, DC input
Airflow	300 lfm[2] through system fan module, or 80 cfm[3] per supervisor, switching, or services module (total of 480 cfm if all slots are filled). Spacing requirements: • If installed in a cabinet, a minimum of 2.5 in. (6.4 cm) is required between the chassis air vents and the cabinet walls. • If installed in an open rack (no side panels), the horizontal distance required between the chassis and any devices that exhaust air towards the chassis is a minimum of 6 in. (15.2 cm), and the distance required between the chassis air vents and any walls is a minimum of 2.5 in. (6.4 cm).

1. RU = rack unit; 1 RU = 1.75 in. (4.45 cm)
2. lfm = linear feet per minute
3. cfm = cubic feet per minute

Module Specifications

Table B-5 lists the specifications for the Cisco MDS 9500 Series supervisor modules, services modules, and switching modules.

Table B-5 Cisco MDS 9500 Series Module Specifications

Description	Specification
Environmental Requirements	
Temperature, certified for operation	32 to 104°F (0 to 40°C)
Temperature, designed and tested for operation	32 to 130°F (0 to 55°C)
Temperature, ambient nonoperating and storage	-40 to 167°F (-40 to 75°C)
Humidity (RH), ambient (noncondensing) operating	10 to 90%
Altitude, certified for operation	0 to 6500 ft (0 to 2000 m)
Altitude, designed and tested for operation	-200 to 10000 ft (-60 to 3000 m)
Physical Characteristics	

Table B-5 Cisco MDS 9500 Series Module Specifications (continued)

Description	Specification
Dimensions	1.75 x15.5 x16.5 in. (4.4 x 39.4 x 41.9 cm) **Note** These are the maximum dimensions of the faceplate and board, and include the connectors on the board.
Weight	8 to 11.5 lb (1.4 to 5.2 kg)

Weight of Modules

Table B-6 lists the weight for each module in the Cisco MDS 9000 Family.

Table B-6 Weight of Modules in the Cisco MDS 9000 Family

Module	Weight
Crossbar switching module	6 lb (2.7 kg)
48-port 4-Gbps switching module	11.0 lb (4.99 kg)
24-port 4-Gbps switching module	7.75 lb (3.52 kg)
12-port 4-Gbps switching module	7.5 lb (3.40 kg)
4-Port 10-Gbps switching module	8.5 lb (3.86 kg)
32-port FC switching module	9 lb (4.1 kg)
16-port FC switching module	9 lb (4.1 kg)
SSM	11 lb (5 kg)
ASM	11 lb (5 kg)
CSM	11.5 lb (5.2 kg)
IPS-8	10 lb (4.5 kg)
IPS-4	9 lb (4.1 kg)
MPS-14/2	10 lb (4.5 kg)
Supervisor-2 for MDS 9500 Series	7.25 lb (kg)
Supervisor-1 for MDS 9500 Series	9 lb (4.1 kg)
Supervisor for MDS 9200 Series	9 lb (4.1 kg)
Crossbar module fan tray	2.25 lb (1.13 kg)
Module blank panels	0.50 lb (0.25 kg)

Table B-7 lists the specifications for the batteries on the Cisco MDS 9000 Family caching services module.

Note The CSM does not support Cisco SAN-OS Release 3.0(1).

Table B-7 Caching Services Module Battery Specifications

Attribute	Value
Nominal voltage	9.6 V
Rated capacity	Typical discharge capacity at 0.2C rate: 2100 mAh
	Minimum discharge capacity at 0.2C rate: 2000 mAh
	Minimum discharge capacity at 5C rate: 1800 mAh (1 V/cell discharge cut-off)
Discharge	The battery is capable of continuous discharge from 41 to 140°F (5 to 60°C) at 5C-rate
Charge	From 32 to 59°F (0 to 15°C) at C/10 rate and from 59 to 104°F (15 to 40°C) at C/2 rate
Storage temperature	32 to 95°F (0 to +35°C)
Relative humidity range	From 5 to 90%

Power Specifications for the Cisco MDS 9513 Director

This section includes the following topics:

Specifications for the Cisco MDS 9513 Power Supplies

The 6000-W AC power supply provides power based upon the input voltage. Each power supply has two AC power connections and will provide power as follows:

- One AC power connection @110 VAC = No output
- Two AC power connection @110 VAC = 2900 W output
- One AC power connection @ 220 VAC = 2900 W output
- One AC power connection @110 VAC and one AC power connection @ 220 VAC = 2900 W output
- Two AC power connection @ 220 VAC = 6000 W output

If a 110 VAC input is chosen, a 110-VAC power cord (CAB-7513AC=) must be ordered separately.

Note Power output does not include the power used by the individual modules used in the chassis.

Table B-8 lists the specifications for the Cisco MDS 9513 power supplies.

Table B-8 Specifications for Cisco MDS 9513 Power Supplies

Description	Specification
6000-W AC Power Supply	
Type	Autoranging input with power factor corrector.

Table B-8 Specifications for Cisco MDS 9513 Power Supplies (continued)

Description	Specification
Voltage	100 to 240 VAC (±10%).
Current rating	16 A maximum at 100 to 120 VAC and 2900-W output. 16 A maximum at 200 to 240 VAC and 6000-W output.
Frequency	50 to 60 Hz (nominal) (±3 Hz for full range).
Output capacity	One AC power connection @110 VAC = No output Two AC power connection @110 VAC = 2900 W output One AC power connection @ 220 VAC = 2900 W output One AC power connection @110 VAC and one AC power connection @ 220 VAC = 2900 W output Two AC power connection @ 220 VAC = 6000 W output
Output voltage at 110/120	3.3 V at 10 A, 50 V at 57 A
Output voltage at 200/240	3.3 V at 10A, 50 V at 119 A

Component Power Requirements and Heat Dissipation for the Cisco MDS 9513 Director

Consider heat dissipation when sizing the air-conditioning requirements for an installation. The power and heat associated with a Cisco MDS 9513 Director varies based upon the following considerations:

- Power supply type
- Switching module type and number of switching modules installed
- Average switching traffic levels

Table B-9 lists the power requirements and heat dissipation for the components of the Cisco MDS 9513 Director.

Note Unless noted otherwise, the data listed in Table B-9 is based on worst-case conditions. Typical numbers are approximately 30 percent below the numbers listed here.

Table B-9 Requirements and Heat Dissipation for 6000-W AC Power Supplies

Module Type/ Product Number	SAN-OS Release	Power Required (watts)	Heat Dissipation (BTU/hr)	Input Current			
				90 VAC (amps)	120 VAC (amps)	180 VAC (amps)	240 VAC (amps)
Fan tray 1 (front panel), DS-13SLT-FAN-F	3.x	248	1059	3.44	2.58	1.72	1.29
Fan tray 2 (rear panel), DS-13SLT-FAN-R	3.x	70	299	0.97	0.73	0.49	0.36

Table B-9 Requirements and Heat Dissipation for 6000-W AC Power Supplies (continued)

Module Type/ Product Number	SAN-OS Release	Power Required (watts)	Heat Dissipation (BTU/hr)	Input Current			
				90 VAC (amps)	120 VAC (amps)	180 VAC (amps)	240 VAC (amps)
Cisco MDS 9513 chassis, DS-C9513, with front (DS-13SLT-FAN-F) and rear (DS-13SLT-FAN-R) fan trays	3.x	318	1358	4.41	3.31	2.21	1.65
Supervisor-2, DS-X9530-SF2-K9	3.x	126	538	1.75	1.31	0.88	0.66
48-port 4-Gbps switching module, DS-X9148	3.x	185	790	2.57	1.93	1.28	0.96
24-port 4-Gbps switching module, DS-X9124	3.x	147	628	2.04	1.53	1.02	0.77
12-port 4-Gbps switching module, DS-X9112	3.x	132	564	1.83	1.38	0.92	0.69
4-Port 10-Gbps switching module, DS-X9704	3.x	172	734	2.39	1.79	1.19	0.90
Crossbar module, DS-13SLT-FAB1	3.x	63	269	0.88	0.66	0.44	0.33

Power Specifications for the Cisco MDS 9509 Director

This section includes the following topics:

Specifications for the Cisco MDS 9509 Power Supplies

The 3000-W AC power supply provides power based upon the input voltage, as follows:

- Maximum of 1400 W at input of 100 to 120 VAC (1174 W available to modules and fans)
- Maximum of 3000 W at input of 200 to 240 VAC (2774 W available to modules and fans)

The 2500-W AC power supply provides power based upon the input voltage, as follows:

- Maximum of 1325 W at input of 100 to 120 VAC (1150 W available to modules and fans)
- Maximum of 2525 W at input of 200 to 240 VAC (2331 W available to modules and fans)

If a 110-VAC input is chosen, a 110-VAC power cord (CAB-7513AC=) must be ordered separately.

Table B-10 lists the specifications for the Cisco MDS 9509 power supplies.

Table B-10 Specifications for Cisco MDS 9509 Power Supplies

Description	Specification
2500-W AC Power Supply	
Type	Autoranging input with power factor corrector.
Voltage	100 to 240 VAC (±10%).
Current rating	16 A maximum at 100 to 120 VAC and 1300-W output. 16 A maximum at 200 to 240 VAC and 2500-W output. **Note** For current ratings of plugs, see Figure C-5 on page C-10.
Frequency	50 to 60 Hz (nominal) (±3 Hz for full range).
Output capacity	1325 W maximum (100 to 120 VAC). 2525 W maximum (200 to 240 VAC).
Output voltage at 110/120	3.3 V at 15 A; 5 V at 5 A; 12 V at 12 A; 42 V at 27.5 A.
Output voltage at 200/240	3.3 V at 1 5 A; 5 V at 5 A; 12 V at 12 A; 42 V at 55.5 A.
2500-W DC Power Supply	
Voltage	-48 VDC to -60 VDC continuous.
Current rating	70 A at -48 VDC; 55 A at -60 VDC; 80 A at -40.5 VDC.
Terminal block	Accommodates 2 to 14 AWG copper conductors. Use 90°C copper conductors for North American installations. **Note** Actual size of the wire required is determined by the installer or local electrician. Terminal block material is rated at 302°F (150°C).
Output capacity	2525 W maximum (-48 to -60 VDC).
Output voltage	3.3 V at 15 A; 5 V at 5 A; 12 V at 12 A; 42 V at 55.5 A.
3000-W AC Power Supply	
Type	Autoranging input with power factor corrector.
Voltage	100 to 240 VAC (±10%).
Current rating	17.6 A maximum at 100 to 120 VAC and 1400-W output. 17.6 A maximum at 200 to 240 VAC and 3000-W output. For current ratings of plugs, see Figure C-5 on page C-10
Frequency	50 to 60 Hz (nominal) (±3 Hz for full range).
Output capacity	1400 W maximum (100 to 120 VAC). 3000 W maximum (200 to 240 VAC).
Output voltage at 110/120	3.3 V at 15 A; 12 V at 12 A; 42 V at 27.9 A.
Output voltage at 200/240	3.3 V at 1 5 A; 12 V at 12 A; 42 V at 66 A.
4000-W AC Power Supply	
Type	High-line input with power factor corrector, 220 VAC, single-phase circuit.
Voltage	200 to 240 VAC (±10%).

Table B-10 Specifications for Cisco MDS 9509 Power Supplies (continued)

Description	Specification
Current rating	23 A **Note** For current ratings of plugs, see Figure C-8 on page C-11.
Frequency	50/60 Hz (nominal) (±3% for full range).
Output capacity	4000 W maximum.
Output voltage at 200/240	3.3 V at 15 A; 5 V at 5 A; 12 V at 12 A; 42 V at 91.2 A

Component Power Requirements and Heat Dissipation for the Cisco MDS 9509 Director

Consider heat dissipation when sizing the air-conditioning requirements for an installation. The power and heat associated with a Cisco MDS 9509 Director varies based upon the following considerations:

- Power supply type
- Switching module type and number of switching modules installed
- Average switching traffic levels

Table B-11 and Table B-12 list the power requirements and heat dissipation for the components of the Cisco MDS 9509 Director.

Note Unless noted otherwise, the data listed in Table B-11 and Table B-12 is based on worst-case conditions. Typical numbers are approximately 30 percent below the numbers listed here.

Table B-11 Requirements and Heat Dissipation for 2500- and 4000-W AC Power Supplies

Module Type/ Product Number	SAN-OS Release	Power Required (watts)	Heat Dissipation (BTU/hr)	Input Current			
				90 VAC (amps)	120 VAC (amps)	180 VAC (amps)	240 VAC (amps)
Cisco MDS 9509 chassis with fan module DS-C9509	3.x	210	897	2.92	2.19	1.46	1.09
	2.x and 1.x	216	920	3.00	2.25	1.50	1.13
Supervisor/fabric 1 DS-X9530-SF1	3.x	210	897	2.92	2.19	1.46	1.09
	2.x and 1.x	220	940	3.05	2.29	1.53	1.15
48-port 4-Gbps switching module, DS-X9148	3.x	185	790	2.57	1.93	1.28	0.96
	2.x and 1.x	—	—	—	—	—	—
24-port 4-Gbps switching module, DS-X9124	3.x	147	628	2.04	1.53	1.02	0.77
	2.x and 1.x	—	—	—	—	—	—
12-port 4-Gbps switching module, DS-X9112	3.x	132	564	1.83	1.38	0.92	0.69
	2.x and 1.x	—	—	—	—	—	—

Table B-11 Requirements and Heat Dissipation for 2500- and 4000-W AC Power Supplies (continued)

Module Type/ Product Number	SAN-OS Release	Power Required (watts)	Heat Dissipation (BTU/hr)	Input Current			
				90 VAC (amps)	120 VAC (amps)	180 VAC (amps)	240 VAC (amps)
4-Port 10-Gbps switching module, DS-X9704	3.x	172	734	2.39	1.79	1.19	0.90
	2.x and 1.x	—	—	—	—	—	—
32-port 1-Gbps/2-Gbps Fibre Channel module, DS-X9032	3.x	191	816	.2.65	1.99	1.33	0.99
	2.x and 1.x	200	855	2.78	2.08	1.39	1.04
16-port 1-Gbps/2-Gbps Fibre Channel module, DS-X9016	3.x	210	897	2.92	2.19	1.46	1.09
	2.x and 1.x	220	940	3.05	2.29	1.53	1.15
MPS-14/2 module DS-X9302-14K9	3.x	200	854	2.78	2.08	1.39	1.04
	2.x and 1.x	227	970	3.15	2.37	1.57	1.19
8-port IPS module DS-X9308-SMIP	3.x	200	854	2.78	2.08	1.39	1.04
	2.x and 1.x	220	940	3.05	2.29	1.53	1.15
4-port IPS module DS-X9304-SMIP	3.x	160	683	2.22	1.67	1.11	0.83
	2.x and 1.x	185	789	2.57	1.93	1.28	0.96
32-port SSM DS-X9032-SSM	3.x	281	1200	3.90	2.93	1.95	1.46
	2.x and 1.x	295	1260	4.10	3.07	2.05	1.54
32-port ASM DS-X9032-SMV	3.x	281	1200	3.90	2.93	1.95	1.46
	2.x and 1.x	295	1260	4.10	3.07	2.05	1.54
CSM DS-X9560-SMC	3.x	200	854	2.78	2.08	1.39	1.04
	2.x and 1.x	210	919	2.99	2.19	1.50	1.12

Table B-12 Power Requirements and Heat Dissipation for the 2500-W DC Power Supply

Module Type/ Product Number	SAN-OS Release	Power Required (watts)	Heat Dissipation (BTU/hr)	Input Current	
				48 VDC (amps)	60 VDC (amps)
Cisco MDS 9509 chassis with fan module DS-C9509	3.x	210	956	5.83	4.67
	2.x and 1.x	216	983	6.00	4.80
Supervisor/fabric 1 DS-X9530-SF1	3.x	210	956	5.83	4.67
	2.x and 1.x	220	1000	6.10	4.88
32-port 1-Gbps/2-Gbps Fibre Channel module DS-X9032	3.x	191	869	5.31	4.24
	2.x and 1.x	200	911	5.56	4.45
16-port 1-Gbps/2-Gbps Fibre Channel module DS-X9016	3.x	210	956	5.83	4.67
	2.x and 1.x	220	1000	6.10	4.88

Table B-12 Power Requirements and Heat Dissipation for the 2500-W DC Power Supply (continued)

Module Type/ Product Number	SAN-OS Release	Power Required (watts)	Heat Dissipation (BTU/hr)	Input Current	
				48 VDC (amps)	60 VDC (amps)
MPS-14/2 module DS-X9302-14K9	3.x	200	910	5.56	4.44
	2.x and 1.x	227	970	3.15	2.37
8-port IPS module DS-X9308-SMIP	3.x	200	910	5.56	4.44
	2.x and 1.x	220	1000	6.10	4.88
4-port IPS module DS-X9304-SMIP	3.x	160	728	4.44	3.56
	2.x and 1.x	185	841	5.14	4.11
32-port SSM DS-X9032-SSM	3.x	281	1279	7.81	6.24
	2.x and 1.x	295	1342	8.19	6.56
32-port ASM DS-X9032-SMV	3.x	281	1279	7.81	6.24
	2.x and 1.x	295	1342	8.19	6.56
CSM DS-X9560-SMC	3.x	200	910	5.56	4.44
	2.x and 1.x	210	956	5.83	4.67

Power Specifications for the Cisco MDS 9506 Director

This section includes the following topics:

Specifications for the Cisco MDS 9506 Power Supplies

Caution The following applies to AC power supplies on the Cisco MDS 9506 only:
The DS-C9506 equipment is suitable for use on TN power systems and the IT-power system connection of Norway (max 230 v phase-phase). If connected to a 230/400-V IT power system, beware of high leakage current. Earth connection is essential before connecting the supply.

The 1900-W AC power supply provides power based upon the input voltage:

- Maximum of 1050 W at input of 100 to 120 VAC
- Maximum of 1900 W at input of 200 to 240 VAC

A 110-VAC power cord (CAB-7513AC=) must be ordered separately.

Table B-13 lists the specifications for the Cisco MDS 9506 power supplies.

Table B-13 Specifications for Cisco MDS 9506 Power Supplies

Description	Specification
1900-W AC Power Supply	
Type	Autoranging input with power factor corrector.
Voltage	100 to 240 VAC (±10%).
Current rating	12 A maximum at 100 to 120 VAC and 1050-W output. 12 A maximum at 200 to 240 VAC and 1900-W output. **Note** For current ratings of plugs, see Figure C-5 on page C-10.
Frequency	50/60 Hz (nominal) (±3 Hz for full range).
Output capacity	1050 W maximum (at input of 100 to 120 VAC). 1900 W maximum (at input of 200 to 240 VAC).
Output voltage at 110/120	3.3 V at 2.5 A; 1.5 V at 15 A; 50 V at 20.4 A.
Output voltage at 200/240	3.3 V at 2.5 A; 1.5 V at 15 A; 50 V at 37.4 A.
1900-W DC Power Supply	
Voltage	-48 to -60 VDC continuous.
Current rating	50 A at -48 VDC, 40 A at -60 VDC, 60 A at -40.5 VDC.
Terminal block	Accommodates 2 to 14 AWG copper conductors. Use 90°C copper conductors for North American installations. **Note** Actual size of the wire required is determined by the installer or local electrician. Terminal block material is rated at 302°F (150°C).
Output capacity	1900 W maximum (at input of -48 to -60 VDC).
Output voltage	3.3 V at 2.5 A; 1.5 V at 15 A; 50 V at 37.4 A.

Component Power Requirements and Heat Dissipation for the Cisco MDS 9506 Director

Consider heat dissipation when sizing the air-conditioning requirements for an installation. The power and heat associated with a Cisco MDS 9506 Director varies based upon the following considerations:

- Power supply type
- Switching module type and number of switching modules installed
- Average switching traffic levels

Table B-14 and Table B-15 list the AC and DC power requirements and heat dissipation for the components of the Cisco MDS 9506 Director.

Note Unless noted otherwise, the information listed in Table B-14 and Table B-15 is based on worst-case conditions. Typical numbers are approximately 30 percent below the numbers listed here.

Table B-14 Power Requirements and Heat Dissipation for the 1900-W AC Power Supply

Module Type/ Product Number	SAN-OS Release	Power Required (watts)	Heat Dissipation (BTU/hr)	Input Current			
				90 VAC (amps)	120 VAC (amps)	180 VAC (amps)	240 VAC (amps)
Cisco MDS 9506 chassis with fan module DS-C9506	3.x	126	538	1.75	1.31	0.88	0.66
	2.x and 1.x	126	538	1.75	1.32	0.88	0.66
Supervisor/fabric 1 DS-X9530-SF1	3.x	210	897	2.92	2.19	1.46	1.09
	2.x and 1.x	220	940	3.05	2.29	1.53	1.15
48-port 4-Gbps switching module, DS-X9148	3.x	185	790	2.57	1.93	1.28	0.96
	2.x and 1.x	—	—	—	—	—	—
24-port 4-Gbps switching module, DS-X9124	3.x	147	628	2.04	1.53	1.02	0.77
	2.x and 1.x	—	—	—	—	—	—
12-port 4-Gbps switching module, DS-X9112	3.x	132	564	1.83	1.38	0.92	0.69
	2.x and 1.x	—	—	—	—	—	—
4-Port 10-Gbps switching module, DS-X9704	3.x	172	734	2.39	1.79	1.19	0.90
	2.x and 1.x	—	—	—	—	—	—
32-port 1-Gbps/2-Gbps Fibre Channel module DS-X9032	3.x	191	816	2.65	1.99	1.33	0.99
	2.x and 1.x	200	855	2.78	2.08	1.39	1.04
16-port 1-Gbps/2-Gbps Fibre Channel module DS-X9016	3.x	210	897	2.92	2.19	1.46	1.09
	2.x and 1.x	220	940	3.05	2.29	1.53	1.15
MPS-14/2 module DS-X9302-14K9	3.x	200	854	2.78	2.08	1.39	1.04
	2.x and 1.x	227	970	3.15	2.37	1.57	1.19
8-port IPS module DS-X9308-SMIP	3.x	200	854	2.78	2.08	1.39	1.04
	2.x and 1.x	220	940	3.05	2.29	1.53	1.15
4-port IPS module DS-X9304-SMIP	3.x	160	683	2.22	1.67	1.11	0.83
	2.x and 1.x	185	789	2.57	1.93	1.28	0.96
32-port SSM DS-X9032-SSM	3.x	281	1200	3.90	2.93	1.95	1.46
	2.x and 1.x	295	1260	4.10	3.07	2.05	1.54
32-port ASM DS-X9032-SMV	3.x	281	1200	3.90	2.93	1.95	1.46
	2.x and 1.x	295	1260	4.10	3.07	2.05	1.54

Table B-14 Power Requirements and Heat Dissipation for the 1900-W AC Power Supply (continued)

Module Type/ Product Number	SAN-OS Release	Power Required (watts)	Heat Dissipation (BTU/hr)	Input Current			
				90 VAC (amps)	120 VAC (amps)	180 VAC (amps)	240 VAC (amps)
CSM DS-X9560-SMC	3.x	200	854	2.78	2.08	1.39	1.04
	2.x and 1.x	210	907	2.95	2.22	1.48	1.11

Table B-15 Power Requirements and Heat Dissipation for the 1900-W DC Power Supply

Module Type/ Product Number	SAN-OS Release	Power Required (watts)	Heat Dissipation (BTU/hr)	Input Current	
				48 VDC (amps)	60 VDC (amps)
Cisco MDS 9506 chassis with fan module DS-C9506	3.x	126	573	3.50	2.80
	2.x and 1.x	126	573	3.50	2.80
Supervisor/fabric 1 DS-X9530-SF1	3.x	210	956	5.83	4.67
	2.x and 1.x	220	1000	6.10	4.88
32-port 1-Gbps/2-Gbps Fibre Channel module DS-X9032	3.x	191	869	5.31	4.24
	2.x and 1.x	200	911	5.56	4.45
16-port 1-Gbps/2-Gbps Fibre Channel module DS-X9016	3.x	210	956	5.83	4.67
	2.x and 1.x	220	1000	6.10	4.88
MPS-14/2 module DS-X9302-14K9	3.x	200	910	5.56	4.44
	2.x and 1.x	227	970	3.15	2.37
8-port IPS module DS-X9308-SMIP	3.x	200	910	5.56	4.44
	2.x and 1.x	220	1000	6.10	4.88
4-port IPS module DS-X9304-SMIP	3.x	160	728	4.44	3.56
	2.x and 1.x	185	841	5.14	4.11
32-port SSM DS-X9032-SSM	3.x	281	1279	7.81	6.24
	2.x and 1.x	295	1342	8.19	6.56
32-port ASM DS-X9032-SMV	3.x	281	1279	7.81	6.24
	2.x and 1.x	295	1342	8.19	6.56
CSM DS-X9560-SMC	3.x	200	910	5.56	4.44
	2.x and 1.x	210	955	5.83	4.66

X2 Transceiver Specifications

The Cisco MDS 9500 Series is compatible with X2 transceivers and cables that have SC connectors. Each transceiver must match the transceiver on the other end of the cable in terms of wavelength, and the cable must not exceed the stipulated cable length for reliable communications.

Use only Cisco X2 transceivers on the Cisco MDS 9500 Series. Each Cisco X2 transceiver is encoded with model information that enables the switch to verify that the SFP transceiver meets the requirements for the switch.

For information about safety, regulatory, and standards compliance, refer to the *Regulatory Compliance and Safety Information for the Cisco MDS 9000 Family*.

Table B-16 lists the 10-Gigabit/Ethernet X2 transceiver module available through Cisco.

Table B-16 10 Gigabit/Ethernet X2 Transceiver Modules

X2 Transceiver Module Product Number	Description
	Cisco 10GBASE-LR X2 transceiver module for SMF, dual SC connector

Table B-17 lists the port cabling specifications for the 10-Gigabit/Ethernet X2 transceiver modules. Table B-18 lists the X2 transceiver optical transmit and receive specifications.

Table B-17 X2 Transceiver Port Cabling Specifications

X2 Product Number	Wavelength (nm)	Cable Type	Core Size (microns)	Modal Bandwidth (MHz/km	Maximum Cabling Distance
DS-X2-FC10G-LR	1310	SMF	G.652 fiber	—	10 km (6.21 miles)

Table B-18 X2 Transceiver Optical Transmit and Receive Specifications

X2 Product Number	Transceiver Type	Transmit Power (dBm)	Receive Power (dBm)	Transmit and Receive Wavelength (nm)
DS-X2-FC10G-LR	1310-nm SMF	-8.2 (Min)	-14.4 (Min)	1260 to 1355

SFP Transceiver Specifications

The Cisco MDS 9500 Series is compatible with SFP transceivers and cables that have LC connectors. Each transceiver must match the transceiver on the other end of the cable in terms of wavelength, and the cable must not exceed the stipulated cable length for reliable communications.

Cisco SFP transceivers provide the uplink interfaces, laser transmit (TX) and laser receive (RX), and support 850 to 1610 nm nominal wavelengths, depending upon the transceiver.

Use only Cisco SFP transceivers on the Cisco MDS 9500 Series. Each Cisco SFP transceiver is encoded with model information that enables the switch to verify that the SFP transceiver meets the requirements for the switch. Refer to the *Cisco MDS 9000 Family Release Notes for Cisco MDS SAN-OS* for a list of specific supported SFP transceivers.

Note Generation 2 modules will not support 1-Gbps/2-Gbps SFPs. Generation 2 modules only support 4-Gbps SFPs.

This section provides the following information:

- Cisco Fibre Channel SFP Transceivers, page B-18
- Cisco Fibre Channel/Gigabit Ethernet Transceivers, page B-19
- Cisco CWDM SFP Transceivers, page B-21
- Cisco Gigabit Ethernet Transceivers, page B-23

For information about safety, regulatory, and standards compliance, refer to the *Regulatory Compliance and Safety Information for the Cisco MDS 9000 Family*.

Cisco Fibre Channel SFP Transceivers

Table B-19 lists the Fibre Channel SFP transceivers available through Cisco.

Table B-19 Cisco Fibre Channel SFP Transceivers

Transceiver Module Product Number	Description	Type
DS-SFP-FC4G-LW	4-Gbps Fibre Channel-LW, SFP, LC	Long wavelength, 6.2 miles (10 km)
DS-SFP-FC4G-MR	4-Gbps Fibre Channel-LW, SFP, LC	Long wavelength, 2.5 miles (4 km)
DS-SFP-FC4G-SW	4-Gbps Fibre Channel-SW, SFP, LC	Short wavelength
DS-SFP-FC-2G-SW	2-Gbps Fibre Channel SW SFP, LC	Short wavelength
DS-SFP-FC-2G-LW	2-Gbps Fibre Channel LW SFP, LC	Long wavelength

General Specifications for Cisco Fibre Channel SFP Transceivers

Table B-20 lists general specifications for Cisco Fibre Channel SFP transceivers at 4 Gbps.

Note The cable distances provided are for 2 Gbps and 4 Gbps.

Table B-20 General Specifications for Cisco Fibre Channel SFP Transceivers at 4 Gbps

Description	Short wavelength		Long wavelength
Connector type	LC		LC
Wavelength	850 nm		1310 nm
Fiber type	MMF		SMF
Core size	50 microns	62.5 microns	9/125 microns
Cable distance[1]	328.08 yd (300 m)	164.04 yd (150 m)	6.2 miles (10 km)
Transmit power	-9 to -2.5 dBm		-8.4 to -2 dBm

1. Approximate; actual distance may vary depending on fiber quality and other factors.

Table B-21 lists general specifications for Cisco Fibre Channel SFP transceivers at 2 Gbps.

Note The cable distances provided are for 2 Gbps.

Table B-21 General Specifications for Cisco Fibre Channel SFP Transceivers at 2 Gbps

Description	Short Wavelength		Long Wavelength
Connector type	LC		LC
Wavelength	850 nm		1310 nm
Fiber type	MMF		SMF
Core size	50 microns	62.5 microns	9/125 microns

Table B-21 General Specifications for Cisco Fibre Channel SFP Transceivers at 2 Gbps (continued)

Description	Short Wavelength		Long Wavelength
Cable distance[1]	328.08 yd (300 m)	164.04 yd (150 m)	6.2 miles (10 km)
Transmit power	-10 to -2.5 dBm		-11.7 to -2 dBm

1. Approximate; actual distance may vary depending on fiber quality and other factors.

Environmental and Electrical Specifications for Cisco Fibre Channel SFP Transceivers

Table B-22 provides the maximum environmental and electrical ratings for Cisco Fibre Channel SFP transceivers.

Table B-22 Maximum Environmental and Electrical Ratings for Cisco Fibre Channel SFP Transceivers

Parameter[1]	Symbol	Min.	Max.[2]	Unit	Notes
Storage temperature	T_S	-40	85	°C	1
Case temperature	T_C	0	70	°C	1, 2
Relative humidity	RH	5	95	%	1
Module supply voltage	V_{CC}T,R	3.1	3.5	V	1

1. Do not operate outside the recommended operating conditions. Device reliability may be affected and damage to the device may occur over an extended period of time
2. Absolute maximum ratings are those values beyond which damage to the device may occur if these limits are exceeded for other than a short period of time.

Cisco Fibre Channel/Gigabit Ethernet Transceivers

Table B-23 lists the combination Fibre Channel/Gigabit Ethernet SFP transceivers available through Cisco.

Table B-23 Cisco Fibre Channel/Gigabit Ethernet SFP Transceivers

Transceiver Module Product Number	Description	Type
DS-SFP-FCGE-SW	1-Gbps Ethernet and 1-Gbps/2-Gbps Fibre Channel-SW SFP, LC	Short wavelength
DS-SFP-FCGE-LW	1-Gbps Ethernet and 1-Gbps/2-Gbps Fibre Channel-LW SFP, LC	Long wavelength

General Specifications for Cisco Fibre Channel/Gigabit Ethernet SFP Transceivers

Table B-24 lists general specifications for Cisco combination Fibre Channel/Gigabit Ethernet SFP transceivers.

Note The cable distances provided are for 2 Gbps.

Table B-24 General Specifications for Cisco Fibre Channel/Gigabit Ethernet SFP Transceivers

Description	Short Wavelength		Long Wavelength
Connector type	LC		LC
Wavelength	850 nm		1310 nm
Fiber type	MMF		SMF
Core size	50 microns	62.5 microns	9/125 microns
Cable distance[1]	328.08 yd (300 m)	164.04 yd (150 m)	6.2 miles (10 km)
Transmit power	-1.5 to -9.5 dBm		-3 to -9.5 dBm

1. Approximate; actual distance may vary depending on fiber quality and other factors.

Environmental and Electrical Specifications for Cisco Fibre Channel/Gigabit Ethernet SFP Transceivers

Table B-25 provides the maximum environmental and electrical ratings for Cisco Fibre Channel/Gigabit Ethernet SFP transceivers.

Table B-25 Maximum Environmental and Electrical Ratings for Cisco Gigabit Ethernet/Fibre Channel SFP Transceivers

Parameter[1]	Symbol	Min.	Max.[2]	Unit	Notes
Storage temperature	T_S	-40	100	°C	1
Case temperature	T_C	0	85	°C	1, 2
Relative humidity	RH	5	95	%	1
Module supply voltage	V_{CC}T,R	3.1	3.5	V	1

1. Do not operate outside the recommended operating conditions. Device reliability may be affected and damage to the device may occur over an extended period of time.
2. Absolute maximum ratings are those values beyond which damage to the device may occur if these limits are exceeded for other than a short period of time.

Cisco CWDM SFP Transceivers

Table B-26 lists the CWDM SFP transceivers available through Cisco.

Table B-26 Cisco CWDM SFP Transceivers

Description	Color
Cisco CWDM SFP 1470 nm; Gigabit Ethernet and 1-Gbps/2-Gbps FC	Gray
Cisco CWDM SFP 1490 nm; Gigabit Ethernet and 1-Gbps/2-Gbps FC	Violet
Cisco CWDM SFP 1510 nm; Gigabit Ethernet and 1-Gbps/2-Gbps FC	Blue
Cisco CWDM SFP 1530 nm; Gigabit Ethernet and 1-Gbps/2-Gbps FC	Green
Cisco CWDM SFP 1550 nm; Gigabit Ethernet and 1-Gbps/2-Gbps FC	Yellow
Cisco CWDM SFP 1570 nm; Gigabit Ethernet and 1-Gbps/2-Gbps FC	Orange
Cisco CWDM SFP 1590 nm; Gigabit Ethernet and 1-Gbps/2-Gbps FC	Red
Cisco CWDM SFP 1610 nm; Gigabit Ethernet and 1-Gbps/2-Gbps FC	Brown

General Specifications for Cisco CWDM SFP Transceivers

Table B-27 lists general specifications for Cisco CWDM SFP transceivers.

Table B-27 General Specifications for Cisco CWDM SFP Transceivers

Description	Specification
Connector type	LC
Wavelength	1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610 nm
Fiber type	SMF

Table B-27 General Specifications for Cisco CWDM SFP Transceivers (continued)

Description	Specification
Core size	9/125 microns
Cable distance[1]	62 miles (100 km)
Transmit power	0 to 5 dBm
Receive sensitivity	-28 to -7 dBm

1. Approximate; actual distance may vary depending on fiber quality and other factors.

Environmental and Electrical Specifications for Cisco CWDM SFP Transceivers

Table B-28 provides the environmental specifications for CWDM SFP transceivers.

Table B-28 Environmental Specifications for Cisco CWDM SFP Transceivers

Description	Specification
Temperature, certified for opertion	32 to 104°F (0 and 40°C)
Temperature, designed and tested for operation	32 to 130°F (0 to 55°C)
Temperature, ambient nonoperating and storage	-40 to 185°F (-40 to 85°C)

Table B-29 provides the electrical specifications for CWDM SFP transceivers.

Table B-29 Electrical Specifications for Cisco CWDM SFP Transceivers

Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply current	I_s	—	220	300	mA
Surge current	I_{surge}	—		+30	mA
Input voltage	Vmax	3.1	3.3	3.6	V

Optical Specifications for Cisco CWDM SFP Transceivers

Table B-30 provides the optical specifications for CWDM SFP transceivers. CWDM SFP transceivers have an optical link budget of 28 decibels (db).

Note The parameters are specified over temperature and at end of life unless otherwise noted.

Note When shorter distances of single-mode fiber are used, it might be necessary to insert an in-line optical attenuator in the link to avoid overloading the receiver.

Table B-30 Optical Specifications for Cisco CWDM SFP Transceivers

Parameter	Symbol	Min.	Typical	Max.	Units	Notes
Transmitter central wavelength	λ_c	(x-4)	(x+1)	(x+7)	Nm	Available center wavelengths: 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610 nm
Wavelength temperature dependence			0.08	0.1	nm/° C	
Side-mode suppression ratio	SMSR	30			dB	
Transmitter optical output power	P_{out}	0.0		5.0	dBm	Average power coupled into single-mode fiber
Receiver optical input power (BER <10^{-12} with PRBS 2^{-7}–1)	P_{in}	-28.0		-7.0	dBm	@ 2.12 Gbps, 140°F (60°C) case temp.
Receiver optical input wavelength	λ_{in}	1450		1620	Nm	
Transmitter extinction ratio	OMI	9			dB	
Dispersion penalty at 60 km				2	dB	
Dispersion penalty at 100 km				2	db	@ 1.25 Gbps
				3	dB	@ 2.12 Gbps

Cisco Gigabit Ethernet Transceivers

Cisco Systems offers a 1-Gbps Gigabit Ethernet SFP transceiver used on the Cisco MDS 9000 IPS modules. Table B-31 lists the transceivers supported on the Cisco MDS 9500 Series.

Table B-31 Cisco Gigabit Ethernet SFP Transceivers

Transceiver Module Product Number	Description
DS-SFP-GE-T	1-Gbps Ethernet SFP

General Specifications for Cisco Gigabit Ethernet SFP Transceiver

Table B-32 lists general specifications for Cisco Gigabit Ethernet SFP transceiver.

Table B-32 General Specifications for Cisco Gigabit Ethernet SFP Transceivers

Description	Specification
Connector type	RJ-45

Table B-32 General Specifications for Cisco Gigabit Ethernet SFP Transceivers (continued)

Description	Specification
Fiber type	Copper
Cable distance[1]	Cu GE is 328.08 ft (100 m)

1. Category 5 cable

Environmental and Electrical Specifications for Cisco Gigabit Ethernet SFP Transceiver

Table B-33 provides the maximum environmental and electrical ratings for Cisco Gigabit Ethernet SFP transceiver.

Table B-33 Environmental and Electrical Ratings

Parameter[1]	Symbol	Min	Max[2]	Unit	Notes
Storage temperature	Ts	-40	85	°C	1
Case temperature	Tc	0	70	°C	1, 2
Relative humidity	RH		95	%	1
Module supply voltage	VccT,R	3.135 V	3.465 V	V	1

1. Do not operate outside the recommended operating conditions. Device reliability may be affected and damage to the device may occur over an extended period of time.
2. Absolute maximum ratings are those values beyond which damage to the device may occur if these limits are exceeded for other than a short period of time.

APPENDIX C

Cable and Port Specifications

This appendix includes the following sections:

Cables and Adapters Provided

The Cisco MDS 9500 Series accessory kit includes the following items:

- RJ-45 rollover cable
- DB-9F/RJ-45F PC—RJ-45 to DB-9 female DTE adapter (labeled “Terminal”)
- RJ-45/DSUB F/F adapter—RJ-45 to DB-25 female DTE adapter (labeled “Terminal”)
- RJ-45/DSUB R/P adapter—RJ-45 to DB-25 male DCE adapter (labeled “Modem”)

Note Additional cables and adapters can be ordered from your customer service representative.

Note If you purchased Cisco support through a Cisco reseller, contact the reseller directly. If you purchased support directly from Cisco Systems, contact Cisco Technical Support at this URL: http://www.cisco.com/warp/public/687/Directory/DirTAC.shtm

Console Port

The console port is an asynchronous RS-232 serial port with an RJ-45 connector. You can use the RJ-45 rollover cable and the RJ-45/DSUB F/F adapter or the DB-9F/RJ-45F PC terminal adapter to connect the console port to a computer running terminal emulation software.

Console Port Pinouts

Table C-1 lists the pinouts for the console port on the Cisco MDS 9500 Series.

Table C-1 Console Port Pinouts

Pin	Signal
1[1]	RTS
2	DTR
3	TxD
4	GND
5	GND
6	RxD
7	DSR
8	CTS

1. Pin 1 is connected internally to pin 8.

Connecting the Console Port to a Computer Using the DB-25 Adapter

You can use the RJ-45 rollover cable and RJ-45/DSUB F/F adapter (labeled “Terminal”) to connect the console port to a computer running terminal emulation software. Table C-2 lists the pinouts for the console port, the RJ-45 rollover cable, and the RJ-45/DSUB F/F adapter.

Table C-2 Port Mode Signaling and Pinouts with the DB-25 Adapter

Console Port	RJ-45 Rollover Cable		RJ4-5/DSUB F/F Terminal Adapter	Console Device
Signal	RJ-45 Pin	RJ-45 Pin	DB-25 Pin	Signal
RTS	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	4	RTS

Connecting the Console Port to a Computer Using the DB-9 Adapter

You can use the RJ-45 rollover cable and DB-9F/RJ-45F PC terminal (labeled "Terminal") to connect the console port to a computer running terminal emulation software. Table C-3 lists the pinouts for the console port, the RJ-45 rollover cable, and the DB-9F/RJ-45F PC terminal.

Table C-3 Port Mode Signaling and Pinouts with the DB-9 Adapter

Console Port	RJ-45 Rollover Cable		DB9F/RJ45F PC Terminal	Console Device
Signal	**RJ-45 Pin**	**RJ-45 Pin**	**DB-9 Pin**	**Signal**
RTS	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	7	RTS

COM1 Port

The COM1 port is a serial port with a DB-9 connector. The COM1 port can be connected to a modem using the cable and adapters provided in the accessory kit.

COM1 Port Pinouts

Table C-4 lists the pinouts for the COM1 port on the Cisco MDS 9500 Series.

Note Additional cables and adapters can be ordered from your customer service representative.

Table C-4 COM1 Port Pinouts

Pin	Signal
1	DCD
2	RxD
3	TxD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	RI

Connecting the COM1 Port to a Modem

You can use the DB-9F/RJ-45F PC terminal (labeled “Terminal”) to connect to the COM1 port, and the RJ-45/DSUB R/P adapter (labeled “Modem”) to connect to the modem. You can use the RJ-45 rollover cable to connect these adapters.

Table C-5 lists the pinouts for the COM1 port, the DB-9F/RJ-45F PC terminal, RJ-45 rollover cable, and the RJ-45/DSUB R/P adapter.

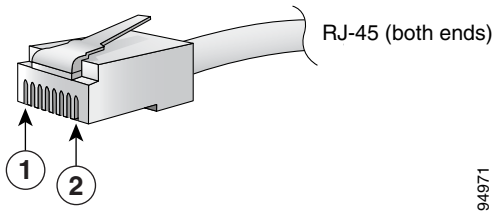
Table C-5 Port Mode Signaling and Pinouts for Modem with DB-25 Connection

COM1 Port	DB-9F/RJ45F PC terminal	RJ-45 Rollover Cable		RJ-45/DSUB R/P Adapter	Modem
Signal	DB-9 Pin	RJ-45 Pin	RJ-45 Pin	DB-25 Pin	Signal
CTS	8	8	1	5	CTS
DSR	6	7	2	8	DCD
RxD	2	6	3	3	RxD
GND	5	5	4	7	GND
GND	5	4	5	7	GND
TxD	3	3	6	2	TxD
DTR	4	2	7	20	DTR
RTS	7	1	8	4	RTS

MGMT 10/100/1000 Ethernet Port

The MGMT 10/100/1000 Ethernet port is an Ethernet port with an RJ-45 connector. You can use a modular, RJ-45, straight-through UTP cable to connect the management port to an external hub, switch, or router (see Figure C-3).

Figure C-1 RJ-45 Interface Cable Connector



1	Pin 1	2	Pin 8

Table C-6 lists the connector pinouts and signal names for a 10/100/1000BASE-T management port (MDI) cable.

Note The RJ-45 interface only uses pins 1, 2, 3, and 6.

Table C-6 10/100/1000BASE-T Management Port Cable Pinout (MDI)

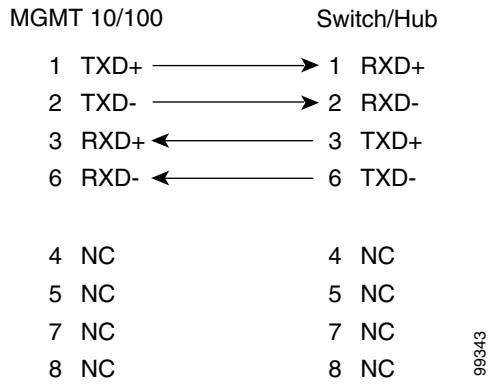
Pin	Signal
1	TD+
2	TD-

Table C-6 10/100/1000BASE-T Management Port Cable Pinout (MDI) (continued)

Pin	Signal
3	RD+
6	RD–
4	Not used
5	Not used
7	Not used
8	Not used

Figure C-2 shows a schematic of the 10/100/1000BASE-T cable required to connect the management port to a switch or hub (not provided with the switch).

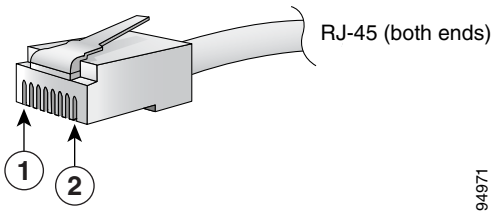
Figure C-2 Twisted-Pair 10/100/1000BASE-T Cable Schematic



MGMT 10/100 Ethernet Port

The MGMT 10/100 Ethernet port is an Ethernet port with an RJ-45 connector. You can use a modular, RJ-45, straight-through UTP cable to connect the management port to an external hub, switch, or router (see Figure C-3).

Figure C-3 RJ-45 Interface Cable Connector



1	Pin 1	**2**	Pin 8

Table C-8 lists the connector pinouts and signal names for a 10/100BASE-T management port (MDI) cable.

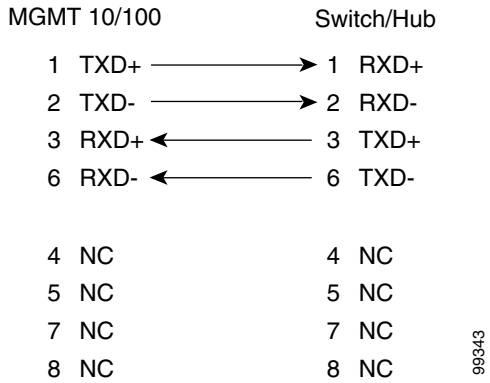
Note The RJ-45 interface only uses pins 1, 2, 3, and 6.

Table C-7 10/100BASE-T Management Port Cable Pinout (MDI)

Pin	Signal
1	TD+
2	TD-
3	RD+
6	RD–
4	Not used
5	Not used
7	Not used
8	Not used

Figure C-4 shows a schematic of the 10/100BASE-T cable required to connect the management port to a switch or hub (not provided with the switch).

Figure C-4 Twisted-Pair 10/100BASE-T Cable Schematic



Supported Power Cords and Plugs

Each power supply has a separate power cord. Standard power cords or jumper power cords are available for connection to a power distribution unit having IEC 60320 C19 outlet receptacles. The jumper power cords, for use in cabinets, are available as an optional alternative to the standard power cords.

Power Cords

The standard power cords have an IEC C19 connector on the end that plugs into the switch. The optional jumper power cords have an IEC C19 connector on the end that plugs into the switch, and an IEC C20 connector on the end that plugs into an IEC C19 outlet receptacle.

Note Only the regular power cords or jumper power cords provided with the switch are supported.

Table C-8 lists the power cords for the Cisco MDS 9500 Series switches and provides their lengths in feet and meters.

Table C-8 Power Cords for the MDS 9500 Series Switches

Description	Length	
	Feet	Meters
MDS 9513 and MDS 9509 - 3000W Power Supply		
Power Cord, 125VAC 20A NEMA 5-20 Plug, North America/Japan	14	4.27
Power Cord, 250VAC 16A US/Japan, Src Plug NEMA 6-20	13.16	4
Power Cord, 250VAC 16A US/Japan, Src Plug NEMA L6-20	13.58	4.14
Power Cord, 250VAC 16A Europe, Src Plug CEE 7/7	13.65	4
Power Cord, 250VAC 16A International, Src Plug IEC 309	13.58	4.14
Power Cord, 250VAC 16A Switzerland, Src Plug SEV 5934-2 Type 23	8	2.5
Power Cord, 250VAC 16A South Africa, Src Plug EL208, SABS 164-1	14	4.27
Power Cord, 250VAC 16A Israel, Src Plug SI16S3	14	4.27
Power Cord, 250VAC 16A China, Src Plug GB16C	14	4.27
Power Cord, 250VAC 16A Australia, Src Plug AU20S3	14.76	4.5
Cabinet Jumper Power Cord, 250VAC 16A, C20-C19 Connectors	9	2.74
MDS 9509 - 2500W Power Supply		
Power Cord, 250VAC 20A NEMA, 6-20 Plug, US	13.12	4
Power Cord, 250VAC 20A NEMA L6-20 Twist Lock Plug, US	13.58	4.14
Power Cord, 250VAC 16A CEE 7/7 Plug, EU	13.12	4
Power Cord, 250VAC 16A IEC 309 Plug, INTL	13.58	4.14
Power Cord, 250VAC 16A SEV 1011 Plug, SWITZ	8	2.44
Power Cord, 250VAC SABS 1661 Plug, South Africa	14	4.27
Power Cord, 250VAC 16A SI16S3 Plug, Israel	14	4.27
Cabinet Jumper Power Cord, 250VAC 16A, C20-C19 Connectors	9	2.74

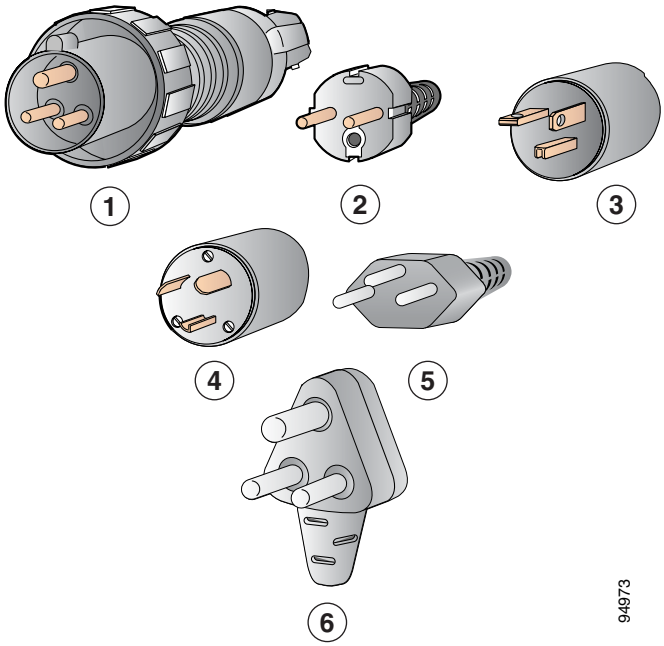
Table C-8 Power Cords for the MDS 9500 Series Switches

Description	Length	
	Feet	Meters
MDS 9506		
Power Cord, 250VAC 20A NEMA 6-20 Plug, US	13.94	4.25
Power Cord, 250VAC 20A NEMA L6-20 Twist Lock Plug, US	13.94	4.25
Power Cord, 250VAC 16A CEE 7/7 Plug, EU	13.94	4.25
Power Cord, 250VAC16A IEC 309 Plug, INTL	13.94	4.25
Power Cord, 250VAC SEV 1011 Plug, SWITZ	13.94	4.25
Power Cord, 250VAC SABS 1661 Plug, South Africa	13.94	4.25
Power Cord, 250VAC 16A SI16S3 Plug, Israel	13.94	4.25
Power Cord, 250VAC 13A BS1363 Plug (13A fuse), UK	13.94	4.25
Cabinet Jumper Power Cord, 250VAC 16A C20-C19 Connectors	9	2.74

Supported Plugs for 6000-W AC, 2500-W AC, and 1900-W AC Power Supplies

Figure C-5 shows the supported plugs for the 6000-W AC, 3000-W AC, 2500-W AC, and 1900-W AC power supplies.

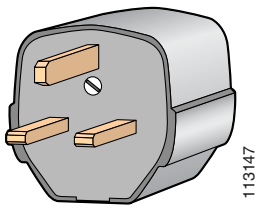
Figure C-5 6000-W AC, 3000-W AC, 2500-W AC, and 1900-W AC Power Supply Plugs



1	International (6000 W, 3000 W, 2500 W, and 1900 W) IEC 309 (20 A)	**4**	North America (locking) (6000 W, 3000 W, 2500 W, and 1900 W) NEMA L6-20 plug (2 0A)
2	Europe (6000 W, 3000 W, 2500 W, and 1900 W) CEE 7/7 (16 A)	**5**	Switzerland (6000 W, 3000 W, 2500 W, and 1900 W) 23 G SEV 1011 (16 A)
3	North America (non-locking) (6000 W, 3000 W, 2500 W, and 1900 W) NEMA 6-20 plug (20 A)	**6**	South Africa (6000 W, 3000 W, 2500 W, and 1900 W) EL 208, SABS 164-1 (16 A)

Figure C-6 shows an additional plug that is supported for the 1900-W AC power supply only.

Figure C-6 Additional Power Supply Plug Supported for 1900-W Only

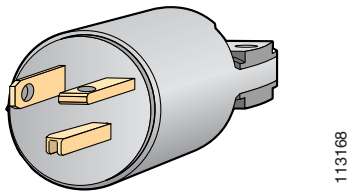


1	United Kingdom BS89/13, BS 1363/A (13 A; replaceable fuse)

Figure C-7 shows an additional plug that is supported for the 3000-W and 2500-W power supply, using 110 VAC.

Note Using the plug in Figure C-7 at 110 VAC results in 1300 W available to the system.

Figure C-7 Additional Power Supply Plug Supported for 3000-W and 2500-W 110 VAC Only

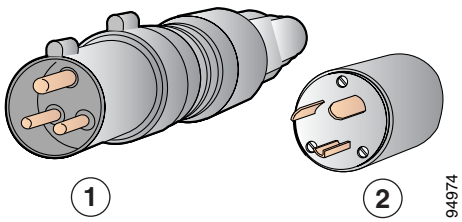


1	NEMA 5-20P North American power cord product ID: CAB-7513AC 110 VAC (20 A)

Supported Plugs for the 4000-W AC Power Supply

Figure C-8 shows the supported plugs for the 4000-W AC power supply. The power cable on the 4000 W power supply is non-detachable.

Figure C-8 4000-W Power Supply Plugs

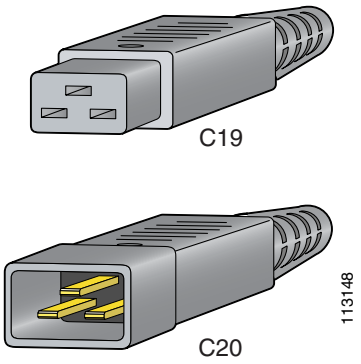


1	International (4000-W power supply) IEC 60309 (3 0A, 250 V)	2	North America (Locking) (4000-W power supply) NEMA L6-30 plug (30 A, 250 V)

Jumper Power Cord

Figure C-9 shows the C19 and C20 connectors on the optional jumper power cord for the Cisco MDS 9500 Series. The C19 connector plugs into the C20 inlet on the Cisco MDS 9500 Series power supply, while the C20 connector plugs into the C19 receptacle of a power distribution unit for a cabinet.

Figure C-9 End of C19 and C20 Connectors on Jumper Power Cord for Cisco MDS 9500 Series



1	C19 and C20 connectors on jumper power cord for Cisco 9500 Series Power cord product ID:CAB-C19-CBN 250 VAC 16 A, C20-C19 connectors

APPENDIX D

Site Planning and Maintenance Records

This appendix includes the following records to use when installing the Cisco MDS 9500 Series:

Note For information on how to query the switch for configuration information, refer to *Cisco MDS 9000 Family CLI Configuration Guide* or the *Cisco MDS 9000 Family Fabric Manager Configuration Guide*.

Contacting Customer Service

If you are unable to solve a startup problem after using the troubleshooting suggestions in this appendix, contact your 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. See the "Finding the Chassis Serial Number" section on page D-2.
- 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.

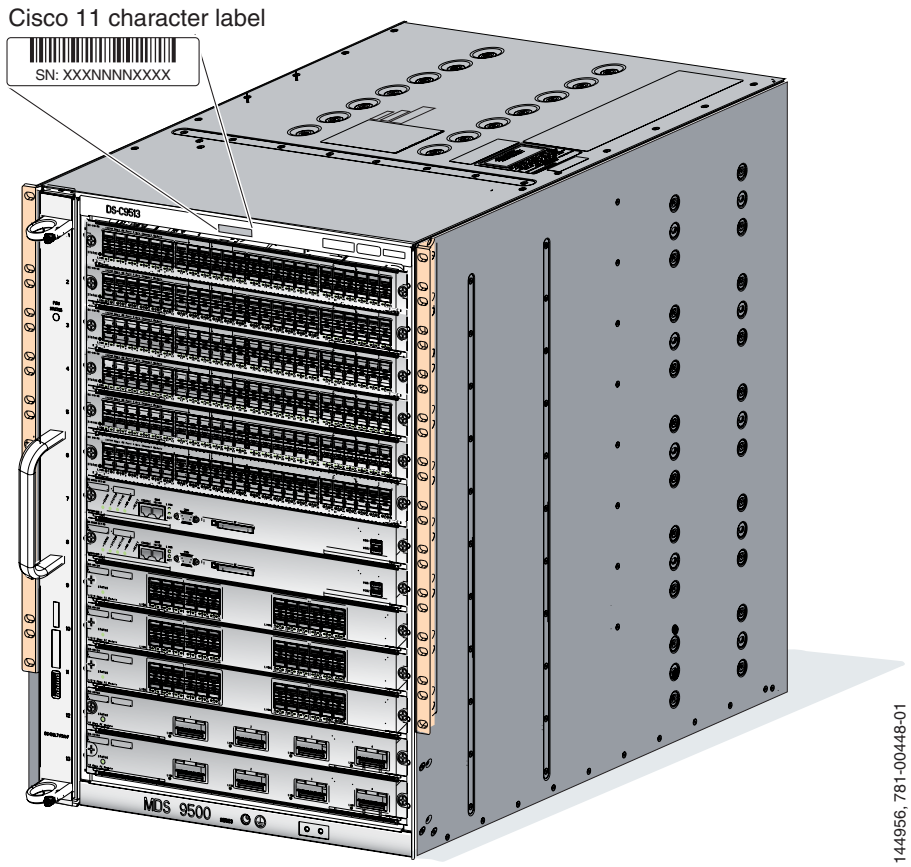
Note If you purchased Cisco support through a Cisco reseller, contact the reseller directly. If you purchased support directly from Cisco, contact Cisco Technical Support at this URL: http://www.cisco.com/warp/public/687/Directory/DirTAC.shtm

Finding the Chassis Serial Number

Tip If you have CLI access, run the **show sprom backplane 1** command to display the backplane contents, including the switch serial number.

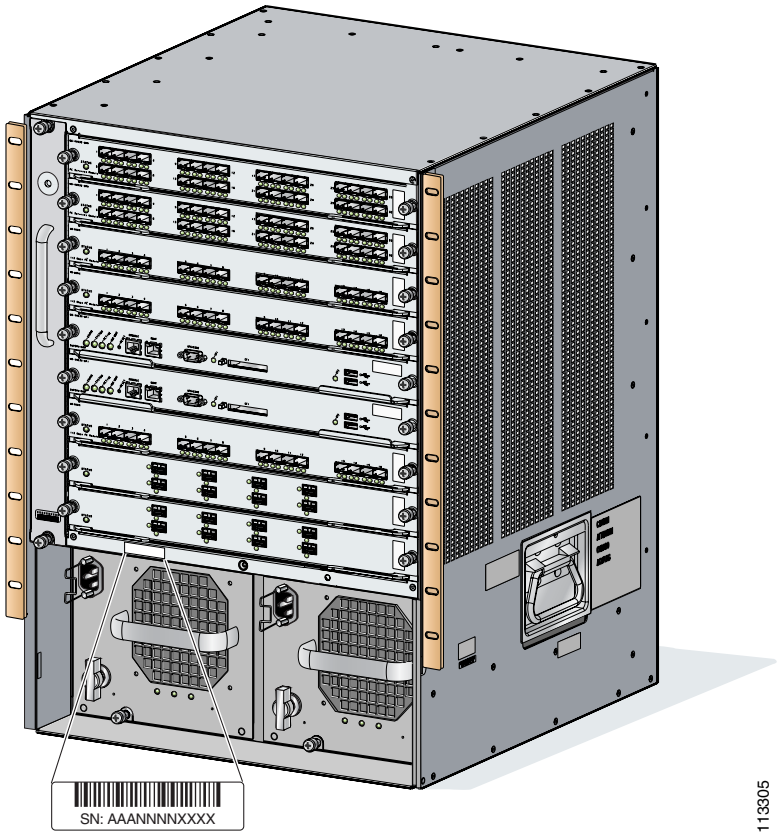
Figure D-1 shows the location of the serial number label on the Cisco MDS 9513 Director.

Figure D-1 Serial Number Location on Cisco MDS 9513 Director



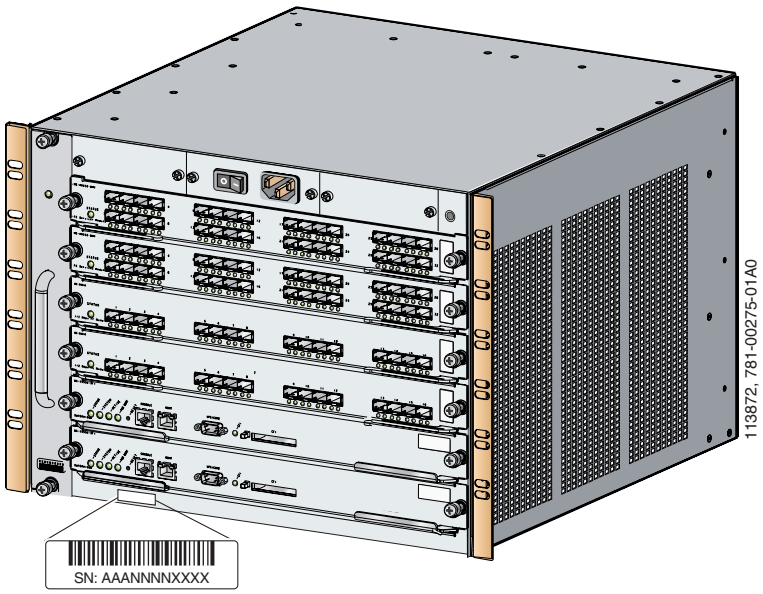
In later releases of the Cisco MDS 9509 Director, the chassis serial number label was moved, as shown in Figure D-2. Earlier releases may have the serial number label on the right side instead of the left.

Figure D-2 Serial Number Location on Cisco MDS 9509 Director



The Cisco MDS 9506 Director chassis serial number label is shown in Figure D-3.

Figure D-3 Serial Number Location on Cisco MDS 9506 Director



Site Preparation Checklist

Planning the location and layout of your equipment rack or wiring closet is essential for successful switch operation, ventilation, and accessibility. Table D-1 lists the site planning tasks that we recommend completing before installing the Cisco MDS 9500 Series.

Consider heat dissipation when sizing the air-conditioning requirements for an installation. See Table B-1 on page B-1 for the environmental requirements. See the"Power Specifications for the Cisco MDS 9513 Director" section on page B-6, the "Power Specifications for the Cisco MDS 9509 Director" section on page B-8, and the "Power Specifications for the Cisco MDS 9506 Director" section on page B-11 for power and heat ratings.

Table D-1 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 • Air flow			
3	Power evaluation: • Input power type • Power receptacles (20 A)[1] • Receptacle proximity to the equipment • Dedicated (separate) circuits for redundant power supplies • UPS[2] for power failures • DC systems: proper gauge wire and lugs			
4	Grounding evaluation: • Circuit breaker size • CO ground (AC- and DC-powered systems)			

Table D-1 Site Planning Checklist (continued)

Task No.	Planning Activity	Verified By	Time	Date
5	Cable and interface equipment evaluation: • Cable type • Connector type • Cable distance limitations • Interface equipment (transceivers)			
6	EMI[3] evaluation: • Distance limitations for signaling • Site wiring • RFI[4] levels			

1. Verify that each power supply installed in the chassis has a dedicated AC source or DC source circuit.
2. UPS = uninterruptible power supply
3. EMI = electromagnetic interference
4. RFI = radio frequency interference

Contact and Site Information

Use the following worksheet (Figure D-3) to record contact and site information.

Table D-2 Contact and Site Information

Contact person	
Contact phone	
Contact e-mail	
Building/site name	
Data center location	
Floor location	
Address (line 1)	
Address (line 2)	
City	
State	
Zip code	
Country	

Chassis and Module Information

Use the following worksheets (Table D-3 and Table D-4) to record information about the chassis and modules.

Contract number_____

Chassis serial number_____

Product number_____

Table D-3 Network-Related Information

Switch IP address	
Switch IP netmask	
Host name	
Domain name	
IP broadcast address	
Gateway/router address	
DNS address	
Modem telephone number	

Table D-4 Module Information

Slot	Module Type	Module Serial Number	Notes
1			
2			
3			
4			
5	Supervisor		

Table D-4 Module Information (continued)

Slot	Module Type	Module Serial Number	Notes
6	Supervisor		
7			
8			
9			

Note Slots 7, 8, and 9 are only available in the Cisco MDS 9509 Director.

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