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Cisco MDS 9500 Series Hardware Installation Guide

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New and Changed Information

The *Cisco MDS 9500 Series Hardware Installation Guide* applies to Cisco MDS NX-OS Release 5.2 and earlier Cisco MDS SAN-OS releases.

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



Note

As of NX-OS Release 4.1(1b), SAN-OS has been changed to NX-OS. References to SAN-OS releases before 4.1(1b) still apply.

Table 1 Documented Features for the Cisco MDS 9500 Series

Feature	Description	Changed in Release	Where Documented
Cisco MDS 8-port 10-Gbps FCoE module	Added Cisco MDS 8-port 10Gbps FCoE module. Added information about the FCoE feature and the corresponding switches where the feature is implemented.	5.2	Product Overview chapter and “Technical Specifications” section on page 1-1.
Cisco MDS 48-Port 8-Gbps Advanced Fibre Channel Switching Module	The 48-port Advanced 8-Gbps Fibre Channel switching module provides 48 SFP/SFP+ based Fibre Channel external interfaces, allowing a maximum bandwidth up to 256-Gbps.	5.2	The “48-Port 8-Gbps Advanced Fibre Channel Switching Module” section on page 1-35 and the “Technical Specifications” section on page 1-1.
Cisco MDS 32-Port 8-Gbps Advanced Fibre Channel Switching Module	The 32-port Advanced 8-Gbps Fibre Channel switching module provides 32 SFP/SFP+ based Fibre Channel external interfaces, allowing a maximum bandwidth up to 256-Gbps.	5.2	The “32-Port 8-Gbps Advanced Fibre Channel Switching Module” section on page 1-35 and the “Technical Specifications” section on page 1-1.

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Table 1 Documented Features for the Cisco MDS 9500 Series (continued)

Feature	Description	Changed in Release	Where Documented
Crossbar modules	Added a new chapter “Migrating to Generation 4 8-Gbps Advanced Fibre Channel Switching Modules” and information about the DS-13SLT-FAB3 support and the switches compatible with the Fabric Module 3.	5.2	The “ Migrating to Generation 4 8-Gbps Advanced Fibre Channel Switching Modules ” section on page 1-1 and the “ Technical Specifications ” section on page 1-1.
Supervisor-2A module	Similar to the Supervisor-2 module, the Supervisor-2A module provides control and management functions for the Cisco MDS 9500 Series switches. The Cisco MDS 9500 Series switches support redundant, hot-swappable Supervisor-2A modules.	5.2	The “ Supervisor-2A Modules ” section on page 1-17 and the “ Technical Specifications ” section on page 1-1.
Cisco MDS 16-Port Storage Services Node (SSN-16)	Added Cisco MDS 16-Port Storage Services Node (SSN-16). The SSN-16 module has 16 1-Gigabit Ethernet ports.	4.2(1)	Product Overview chapter.
Cisco MDS 16-Port Storage Services Node (SSN-16) technical specifications	Added Cisco MDS 16-Port Storage Services Node (SSN-16) technical specifications.	4.2(1)	“ Technical Specifications ” section on page 1-1
48-port 8-Gbps Fibre Channel switching module	Added 48-port 8-Gbps Fibre Channel switching module. The switching module offers 48 autosensing 1-, 2-, 4- and 8-Gbps Fibre Channel ports and can be used in the Cisco MDS 9500 Series Switches.	4.1(1b)	The “ 48-Port 8-Gbps Fibre Channel Switching Module ” section on page 1-37 and the “ Technical Specifications ” section on page 1-1.
24-port 8-Gbps Fibre Channel switching module	Added 24-port 8-Gbps Fibre Channel switching module. The switching module offers 24 autosensing 1-, 2-, 4- and 8-Gbps Fibre Channel ports and can be used in the Cisco MDS 9500 Series Switches.	4.1(1b)	The “ 24-Port 8-Gbps Fibre Channel Switching Module ” section on page 1-38 and the “ Technical Specifications ” section on page 1-1.

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Table 1 Documented Features for the Cisco MDS 9500 Series (continued)

Feature	Description	Changed in Release	Where Documented
4/44-port 8-Gbps Host-Optimized Fibre Channel switching module	Added 4/44-port 8-Gbps Host-Optimized Fibre Channel switching module. The switching module offers 48 autosensing 1-, 2-, 4- and 8-Gbps Fibre Channel ports and can be used in any of the Cisco MDS 9500 Series chassis and in the Cisco MDS 9222i Switches.	4.1(1b)	The “4/44-Port 8-Gbps Host-Optimized Fibre Channel Switching Module” section on page 1-38 and the “Technical Specifications” section on page 1-1.
Migration to Generation 3 modules	Added the information associated with readying the MDS 9500 Series to support Generation 3 8-Gbps Fibre Channel switching modules.	4.1(1b)	“Migrating to Generation 3 8-Gbps Fibre Channel Switching Modules” section on page 1-1.
Crossbar modules	Added DS-13SLT-FAB2 support	4.1(1b)	“Technical Specifications” section on page 1-1.
SFP+ transceivers	Added the SFP+ transceivers information.	4.1(1b)	“Technical Specifications” section on page 1-1.
Cisco MDS Fibre Channel Bladeswitch overview	Description of the Cisco MDS Fibre Channel Bladeswitch for IBM BladeCenter.	3.3(1a)	Product Overview chapter.
18/4-port Multiservice (MSM-18/4) module	Added information on IPV6 support.	3.3(1a)	Product Overview chapter.
18/4-port Multiservice (MSM-18/4) module	Added information on SAN extension support.	3.3(1a)	The “18/4-Port Multiservice Module” section on page 48 .
18/4-port Multiservice (MSM-18/4) module	Added the Storage Media Encryption information.	3.2(1)	The “18/4-Port Multiservice Module” section on page 48.
18/4-port Multiservice (MSM-18/4) module	Added the new 18/4-port Multiservice (MSM-18/4) module.	3.2(1)	The “18/4-Port Multiservice Module” section on page 48 and the “Technical Specifications” section on page 1-1.
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 1-7.

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Table 1 Documented Features for the Cisco MDS 9500 Series (continued)

Feature	Description	Changed in Release	Where Documented
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 1-17.
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 1-39 and the “Technical Specifications” section on page 1-1.
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 1-39 and the “Technical Specifications” section on page 1-1.
12-port 4-Gbps Fibre Channel switching module	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 1-40 and the “Technical Specifications” section on page 1-1.
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 1-41 and “Technical Specifications” section on page 1-1.
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 1-25 and “Removing and Installing a Crossbar Module” section on page 1-47.
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 1-62 and the “Transceiver Specifications” section on page 20.
Fibre Channel SFP transceiver	Added 4-Gbps Fibre Channel SFP transceiver.	3.0(1)	The “Fibre Channel SFP Transceivers” section on page 1-63 and the “Transceiver Specifications” section on page 1-20.

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Table 1 Documented Features for the Cisco MDS 9500 Series (continued)

Feature	Description	Changed in Release	Where Documented
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 1-12, “Installing an AC Power Supply in the Cisco MDS 9509 Director” section on page 1-57, and the “Specifications for the Cisco MDS 9509 Power Supplies” section on page 1-10.
Gigabit Ethernet SFP transceiver	Added Gigabit Ethernet SFP transceiver.	Not release specific	The “Supported Transceivers” section on page 1-62 and the “Transceiver Specifications” section on page 1-20.
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 1-57.
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 1-51.
Clock module installation	Added installation procedure for clock modules.	Not release specific	The “Removing and Installing Clock Modules” section on page 1-76.
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 1-13.
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 1-53.
Jumper power cord	Added jumper power cord available for use in a cabinet.	Not release specific	The “Jumper Power Cord” section on page 1-11.
Installation	Modified Cisco MDS 9509 installation options.	Not release specific	The “Installation Options” section on page 1-2.
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 1-11.
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 1-38.

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Table 1 Documented Features for the Cisco MDS 9500 Series (continued)

Feature	Description	Changed in Release	Where Documented
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 1-7.
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 1-42.
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 1-6.
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 1-55.
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 1-2.
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 1-4.
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 1-62.
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 1-53.
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 1-32.
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 1-32.
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 1	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 1	Connecting the Cisco MDS 9500 Series	Describes how to connect the Cisco MDS 9500 Series, including the modules.
Appendix 1	Migrating to Generation 4 8-Gbps Advanced Fibre Channel Switching Modules	Describes the tasks associated with readying the MDS 9500 Series to support Generation 4 8-Gbps Advanced Fibre Channel switching modules.
Appendix 1	Migrating to Generation 3 8-Gbps Fibre Channel Switching Modules	Describes the tasks associated with readying the MDS 9500 Series to support Generation 3 8-Gbps Fibre Channel switching modules.

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Chapter	Title	Description
Appendix 1	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 1	Technical Specifications	Lists the Cisco MDS 9500 Series switch specifications, and includes safety information, site requirements, and power connections.
Appendix 1	Cable and Port Specifications	Lists cable and port specifications for the Cisco MDS 9500 Series switch.
Appendix 1	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 that are 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. 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

Waarschuwing

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

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Varoitus	Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista. Tässä julkaisussa esiintyvien varoitusten käännökset löydät laitteen mukana olevasta <i>Regulatory Compliance and Safety Information</i> -kirjasta (määräysten noudattaminen ja tietoa turvallisuudesta).
Attention	Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions d'avertissements figurant dans cette publication, consultez le document <i>Regulatory Compliance and Safety Information</i> (Conformité aux règlements et consignes de sécurité) qui accompagne cet appareil.
Warnung	Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewußt. Übersetzungen der in dieser Veröffentlichung enthaltenen Warnhinweise finden Sie im Dokument <i>Regulatory Compliance and Safety Information</i> (Informationen zu behördlichen Vorschriften und Sicherheit), das zusammen mit diesem Gerät geliefert wurde.
Avvertenza	Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di lavorare su qualsiasi apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed essere al corrente delle pratiche standard per la prevenzione di incidenti. La traduzione delle avvertenze riportate in questa pubblicazione si trova nel documento <i>Regulatory Compliance and Safety Information</i> (Conformità alle norme e informazioni sulla sicurezza) che accompagna questo dispositivo.
Advarsel	Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du være oppmerksom på de faremomentene som elektriske kretser innebærer, samt gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker. Hvis du vil se oversettelser av de advarslene som finnes i denne publikasjonen, kan du se i dokumentet <i>Regulatory Compliance and Safety Information</i> (Overholdelse av forskrifter og sikkerhetsinformasjon) som ble levert med denne enheten.

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

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

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

Related Documentation

The documentation set for the Cisco MDS 9000 Family includes the following documents. To find a document online, use the Cisco MDS NX-OS Documentation Locator at:

http://www.cisco.com/en/US/docs/storage/san_switches/mds9000/roadmaps/doclocator.htm

Release Notes

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

Regulatory Compliance and Safety Information

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

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Compatibility Information

- *Cisco Data Center Interoperability Support Matrix*
- *Cisco MDS 9000 NX-OS Hardware and Software Compatibility Information and Feature Lists*
- *Cisco MDS NX-OS Release Compatibility Matrix for Storage Service Interface Images*
- *Cisco MDS 9000 Family Switch-to-Switch Interoperability Configuration Guide*
- *Cisco MDS NX-OS Release Compatibility Matrix for IBM SAN Volume Controller Software for Cisco MDS 9000*
- *Cisco MDS SAN-OS Release Compatibility Matrix for VERITAS Storage Foundation for Networks Software*

Hardware Installation

- *Cisco MDS 9200 Series Hardware Installation Guide*
- *Cisco MDS 9100 Series Hardware Installation Guide*
- *Cisco MDS 9124 and Cisco MDS 9134 Multilayer Fabric Switch Quick Start Guide*

Software Installation and Upgrade

- *Cisco MDS 9000 NX-OS Release 4.1(x) and SAN-OS 3(x) Software Upgrade and Downgrade Guide*
- *Cisco MDS 9000 Family Storage Services Interface Image Install and Upgrade Guide*
- *Cisco MDS 9000 Family Storage Services Module Software Installation and Upgrade Guide*

Cisco NX-OS

- *Cisco MDS 9000 Family NX-OS Licensing Guide*
- *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide*
- *Cisco MDS 9000 Family NX-OS System Management Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Interfaces Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Fabric Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Quality of Service Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Security Configuration Guide*
- *Cisco MDS 9000 Family NX-OS IP Services Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Intelligent Storage Services Configuration Guide*
- *Cisco MDS 9000 Family NX-OS High Availability and Redundancy Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Inter-VSAN Routing Configuration Guide*

Cisco DCNM for SAN

- *Cisco DCNM Fundamentals Guide, Release 5.2*

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- *System Management Configuration Guide, Cisco DCNM for SAN, Release 5.2*
- *Interfaces Configuration Guide, Cisco DCNM for SAN, Release 5.2*
- *Fabric Configuration Guide, Cisco DCNM for SAN, Release 5.2*
- *Quality of Service Configuration Guide, Cisco DCNM for SAN, Release 5.2*
- *Security Configuration Guide, Cisco DCNM for SAN, Release 5.2*
- *IP Services Configuration Guide, Cisco DCNM for SAN, Release 5.2*
- *Intelligent Storage Services Configuration Guide, Cisco DCNM for SAN, Release 5.2*
- *High Availability and Redundancy Configuration Guide, Cisco DCNM for SAN, Release 5.2*
- *Inter-VSAN Routing Configuration Guide, Cisco DCNM for SAN, Release 5.2*
- *SMI-S and Web Services Programming Guide, Cisco DCNM for SAN, Release 5.2*

Command-Line Interface

- *Cisco MDS 9000 Family Command Reference*

Intelligent Storage Networking Services Configuration Guides

- *Cisco MDS 9000 I/O Acceleration Configuration Guide*
- *Cisco MDS 9000 Family SANTap Deployment Guide*
- *Cisco MDS 9000 Family Data Mobility Manager Configuration Guide*
- *Cisco MDS 9000 Family Storage Media Encryption Configuration Guide*
- *Cisco MDS 9000 Family Secure Erase Configuration Guide*
- *Cisco MDS 9000 Family Cookbook for Cisco MDS SAN-OS*

Troubleshooting and Reference

- *Cisco NX-OS System Messages Reference*
- *Cisco MDS 9000 Family NX-OS Troubleshooting Guide*
- *Cisco MDS 9000 Family NX-OS MIB Quick Reference*
- *Cisco MDS 9000 Family NX-OS SMI-S Programming Reference*
- *Cisco MDS 9000 Family DCNM for SAN Server Database Schema*



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 or Supervisor-2A modules with associated external crossbar modules for the Cisco MDS 9513 Director.
- Redundant Supervisor-2 or Supervisor-2A 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) and Enhanced 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, see the *Cisco MDS 9000 Family NX-OS High Availability and Redundancy Configuration Guide* and the *Cisco Fabric Manager High Availability and Redundancy Configuration Guide*.

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

- Cisco MDS 8-port 10-Gbps FCoE module (DS-X9708-K9)
- 48-port 8-Gbps Advanced Fibre Channel Switching Module (DS-X9248-256K9)
- 32-port 8-Gbps Advanced Fibre Channel Switching Module (DS-X9232-256K9)

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- Cisco MDS 16-port Storage Services module (DS-X9316-SSNK9)
- 48-port 8-Gbps Fibre Channel switching module (DS-X9248-96K9)
- 24-port 8-Gbps Fibre Channel switching module (DS-X9224-96K9)
- 4/44-port 8-Gbps Host-Optimized Fibre Channel switching module (DS-X9248-48K9)
- 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)
- 18/4-port Multiservice (MSM-18/4) module (DS-X9304-18K9)
- 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, page 1-2](#)
- [Backplane and Clock Modules, page 1-8](#)
- [Power Supplies, page 1-9](#)
- [Power Supplies, page 1-9](#)
- [Fan Modules, page 1-16](#)
- [Supervisor Modules, page 1-16](#)
- [Crossbar Modules, page 1-25](#)
- [Cisco MDS 9000 Series Module Compatibility, page 1-27](#)
- [Port Index Availability, page 1-28](#)
- [Switching Modules, page 1-32](#)
- [Services Modules, page 1-46](#)
- [Supported Transceivers, page 1-62](#)

Chassis

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

- [Cisco MDS 9513 Director, page 1-3](#)
- [Cisco MDS 9509 Director, page 1-6](#)
- [Cisco MDS 9506 Director, page 1-7](#)

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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 or Supervisor-2A modules that reside in slots 7 and 8.
- Switching and storage services modules. (See the [“Port Index Availability”](#) section on page 1-28 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.

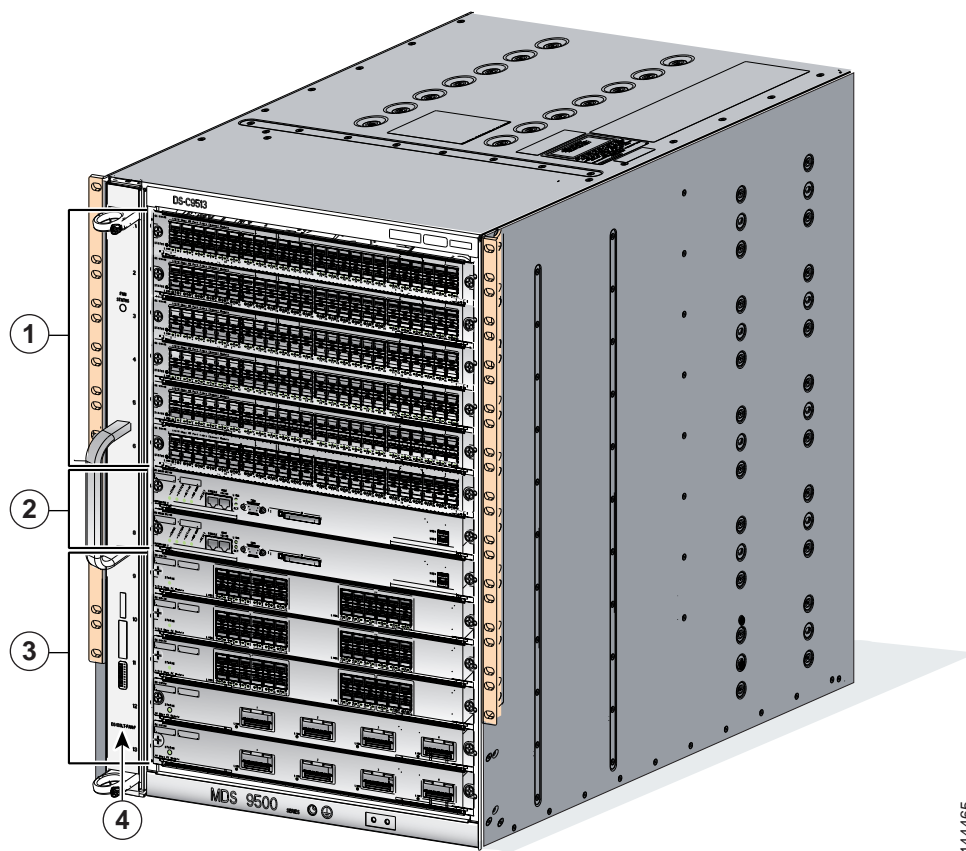


Note

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

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Figure 1-1 Cisco MDS 9513 Chassis Front Panel View



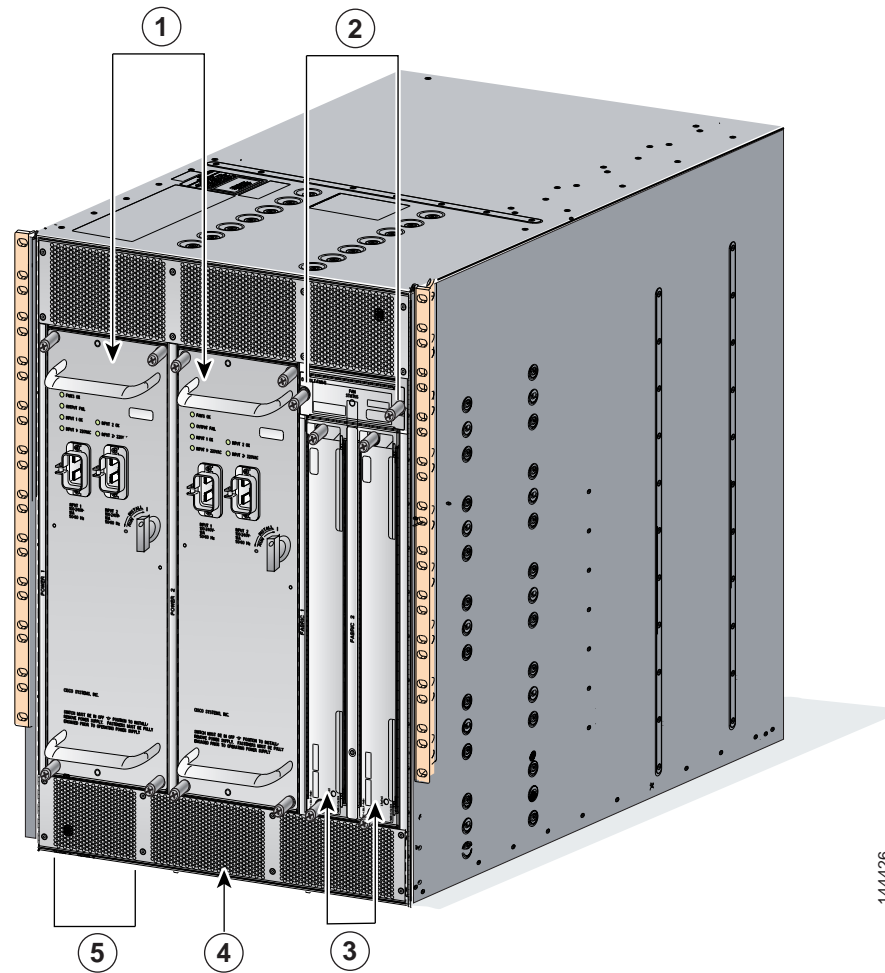
144465

1	Switching or services modules in slots 1–6	3	Switching or services modules in slots 9–13
2	Supervisor-2 or Supervisor-2A 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](#).)

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Figure 1-2 Rear Panel 9513 Chassis



144426

1	Power supplies	4	Air vent panels
2	crossbar module fans	5	Clock module ¹
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.

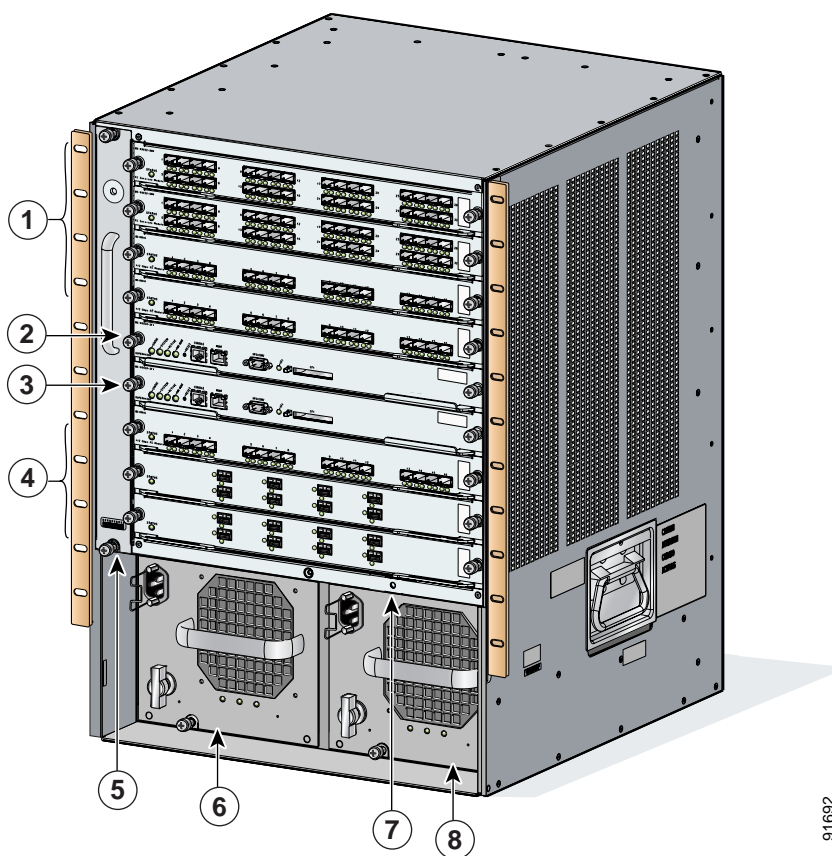
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Cisco MDS 9509 Director

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, Supervisor-2, or Supervisor-2A 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)

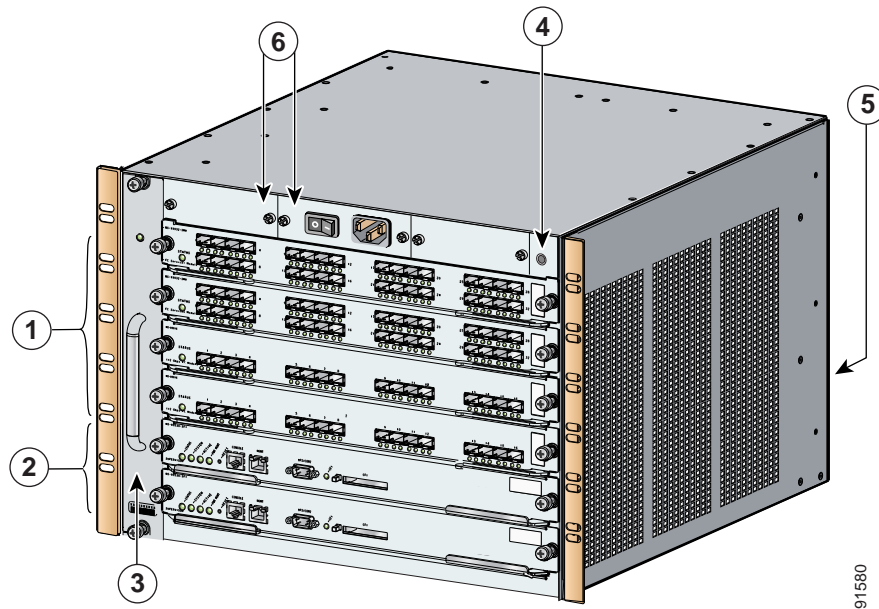
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Cisco MDS 9506 Director

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, Supervisor-2, or Supervisor-2A 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.

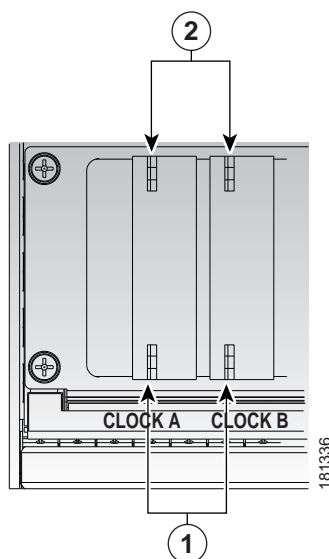
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Backplane and Clock Modules

The Cisco MDS 9500 Series includes one or more clock modules that are accessible from the back of the chassis. The Cisco MDS 9513 and 9509 Directors have two field-replaceable clock modules for redundancy and failover. The Cisco MDS 9506 Director has one field-replaceable clock module. 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. Cisco recommends that the failed clock module be replaced during a maintenance window. See the [“Removing and Installing Clock Modules”](#) section on page 1-76 for information on replacing clock modules.

There are two LEDs per clock module. [Figure 1-5](#) shows the upper and lower LEDs.

Figure 1-5 Clock Module LEDs



1	Lower LEDs	2	Upper LEDs
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Table 1-1 Clock LEDs for the Cisco MDS 9500 Series Directors

LED	Status	Description
Upper LED	Green	Clock module is active and in use.
	Off	Clock module is in standby mode.
Lower LED	Green	Power supply is on and working properly.
	Red	Power supply is not in a stable state. If this indication continues after initial power on, check that all connections are secure.
	Off	Normal operation or power supply is turned off.

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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.

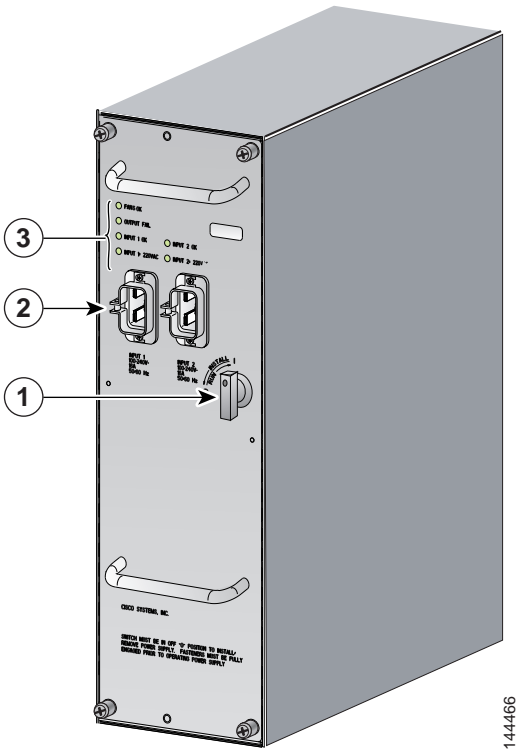
The power supplies can be configured to be redundant or combined. By default, they are configured as redundant, so that if one fails, the remaining power supply can still power the entire system. For information about how to configure the power supplies, see the *Cisco MDS 9000 Family NX-OS Fundamentals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

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Cisco MDS 9513 Power Supplies

The Cisco MDS 9513 Director supports the 6000-W AC power supply (AC input). (See [Figure 1-6](#).)

Figure 1-6 Cisco MDS 9513 Power Supply



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

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Table 1-2 describes the LEDs for the Cisco MDS 9513 Director power supplies.

Table 1-2 *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.

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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 1-7](#).)

- 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 1-8](#).)

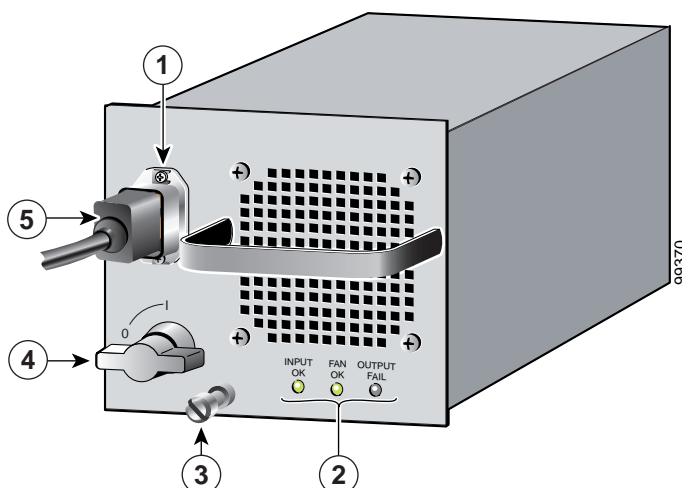
- 2500-W AC power supply (AC input and DC output)

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 1-9](#).)

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

The 2500-W DC power supply requires positive, negative, and ground wires. (See [Figure 1-10](#).)

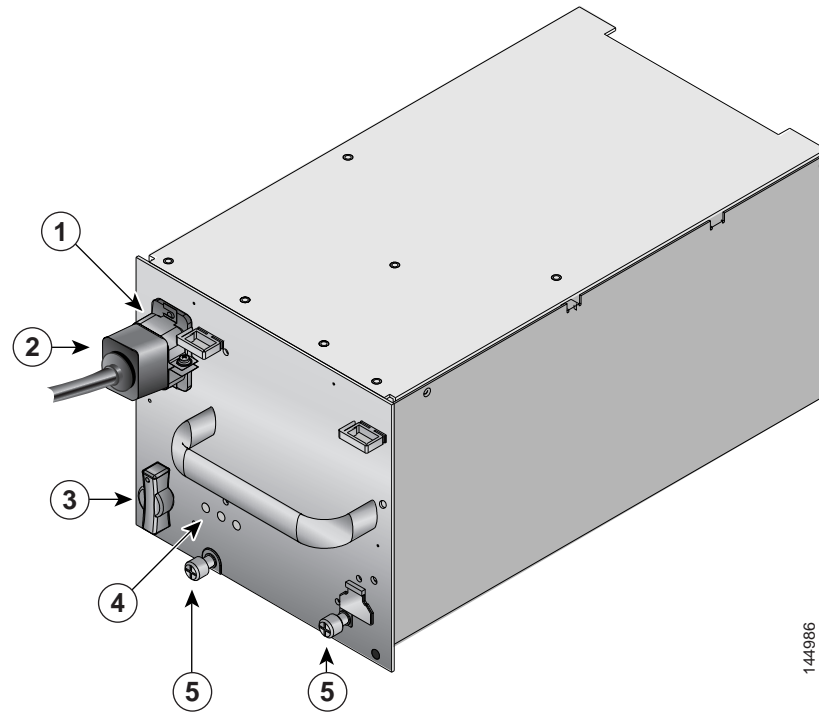
Figure 1-7 4000-W AC Power Supply for the Cisco MDS 9509 Director



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

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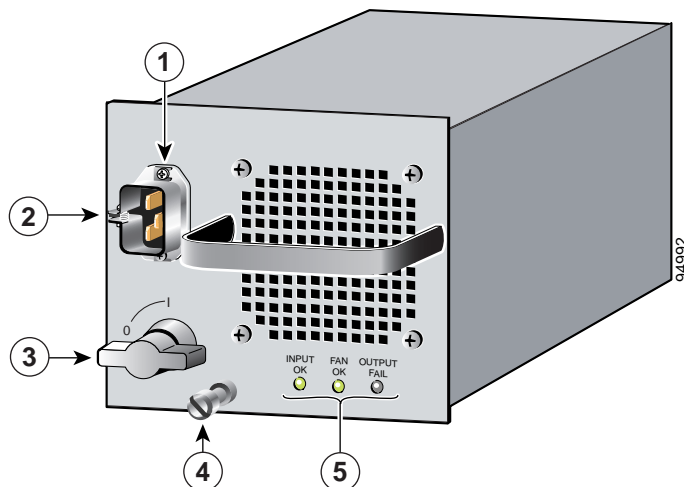
Figure 1-8 3000-W AC Power Supply for the Cisco MDS 9509 Director



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

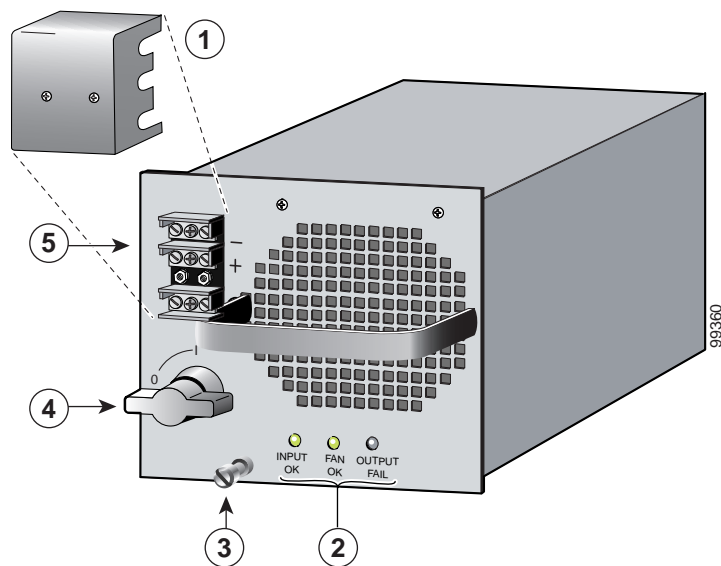
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Figure 1-9 2500-W AC Power Supply for the Cisco MDS 9509 Director



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

Figure 1-10 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		

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Cisco MDS 9506 Power Supplies

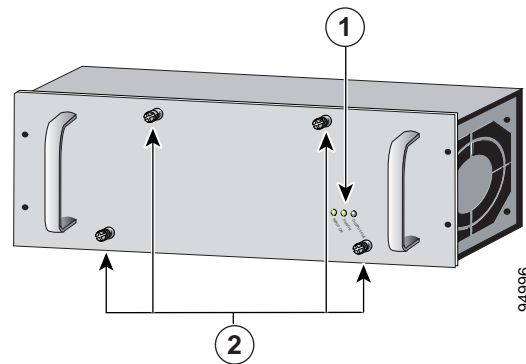
The Cisco MDS 9506 Director supports the following types of power supplies:

- 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 through 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 1-11](#)), except for the label that indicates whether the power supply is AC or DC.

Figure 1-11 Cisco MDS 9506 Power Supply (1900-W AC or DC)



1	Power supply LEDs	2	Captive screws
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[Table 1-3](#) describes the power supply LEDs for the Cisco MDS 9509 and 9506 Directors.

Table 1-3 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.

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Fan Modules

The Cisco MDS 9513 Director has a front panel fan tray with 15 fans with an abrupt stop-to-fan rotation safety feature after 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. For information on how to replace a fan module, see the [“Removing and Installing Fan Modules” section on page 1-68](#).

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. There is one LED that provides operational status. [Figure 1-2](#) shows the fan status LED on the Cisco MDS 9513 Director. To replace these fan modules, see the [“Removing and Installing Fan Modules” section on page 1-68](#).

Supervisor Modules

The Cisco MDS 9500 Series supports three types of supervisor modules: Supervisor-1, Supervisor-2, and Supervisor-2A modules. All of the supervisor modules provide the control and management functions for the Cisco MDS 9500 Series switches. The Cisco MDS 9500 Series supports these supervisor modules for redundancy. If installed, the standby supervisor module takes over if an internal component fails. This section discusses the following modules:

- [Supervisor-2A Modules, page 1-17](#) (DS-X9530-SF2A-K9)
- [Supervisor-2 Modules, page 1-17](#) (DS-X9530-SF2-K9)
- [Supervisor-1 Modules, page 1-21](#) (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.

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Supervisor-2A Modules

The Cisco MDS 9000 8-port 10-Gbps FCoE module is supported in Cisco MDS 9513, Cisco MDS 9509, and Cisco MDS 9506 director switches. The new upgraded Supervisor-2A module with 2-GB memory is shipped as the default in the MDS 9500 chassis.

Similar to the Supervisor-2 module, the Supervisor-2A module provides control and management functions for the Cisco MDS 9500 Series switches. The Cisco MDS 9500 Series switches support redundant, hot-swappable Supervisor-2A modules. Supervisor-2A modules in the Cisco MDS 9509 and 9506 Directors are used in slots 5 and 6. In the Cisco MDS 9513 Director, the Supervisor-2A modules must be used in slots 7 and 8.

You can install the Supervisor-2A module only if you are using the older version of the switch and if you need to upgrade from Supervisor-2 to Supervisor-2A. See the *Cisco MDS 9500 Series Supervisor-2A Module Tech Note* to learn more about the Supervisor-2A module.

See “[Removing Supervisor Modules, page 1-39](#)” and “[Installing Supervisor Modules, page 1-40](#)” to learn more about removing, and installing Supervisor-2A modules.

For more information about migrating to Supervisor-2A, see the following:

- “Migrating from Supervisor-1 Modules to Supervisor-2A Modules” section in the *Cisco MDS 9500 Series Supervisor-2A Module Tech Note*
- “Migrating from Supervisor-2 Modules to Supervisor-2A Modules” section in the *Cisco MDS 9500 Series Supervisor-2A Module Tech Note*



Note

There is no physical difference between the Supervisor-2 and Supervisor-2A modules. The Supervisor-2A module is functionally equivalent to the Supervisor-2 module, but has these distinguishing features:

- The Supervisor-2A module supports the deployment of Fibre Channel over Ethernet (FCoE) in the MDS 9500 Multilayer Director Chassis.
- The Supervisor-2A module has 2 GB of memory, twice as much as the Supervisor-2 module.

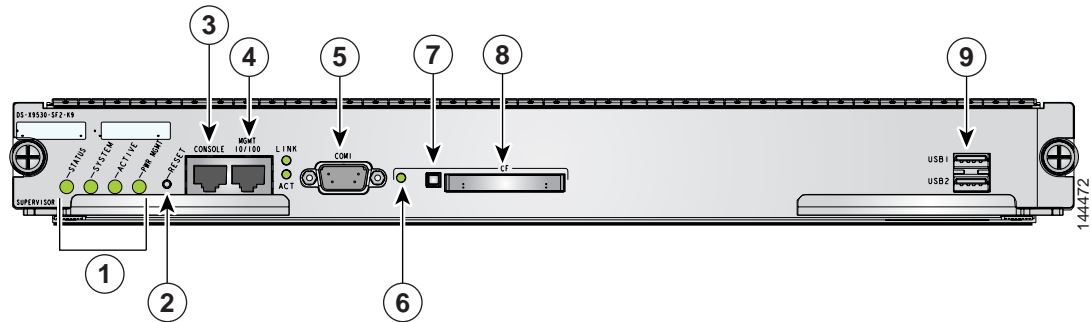
Supervisor-2 Modules

The Cisco MDS 9500 Series offers redundant, hot-swappable, Supervisor-2 modules. (See [Figure 1-12](#).) 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. (For more information, see the “[Crossbar Modules](#)” section on [page 1-25](#).)

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Figure 1-12 Cisco MDS 9500 Series Supervisor-2 Module



1	Status, System, Active, and Power Management 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 1-4 on page 1-20](#) 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 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)
- 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.

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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 indicates 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 NX-OS. On the double decker connector, USB port 1 is on the lower position and port 2 is on the upper position.
- Supervisor CPU subsystem based on Motorola PowerPC 7447.
- Reset button that resets the Supervisor-2 without cycling the power.
- External CompactFlash slot for an optional CompactFlash card provides a convenient way to boot different images, back up the image, or store running-configuration data. The optional card can be used for storing additional software images and configuration, debugging, and syslog information. There is one LED that blinks when accessing this CompactFlash.



Caution

Use only the 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.

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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 1-13](#)).

The LEDs on the Supervisor-2 module indicate the status of the Supervisor-2 module, power supplies, and fan module. [Table 1-4](#) provides more information about these LEDs.

Figure 1-13 Supervisor-2 Module LEDs

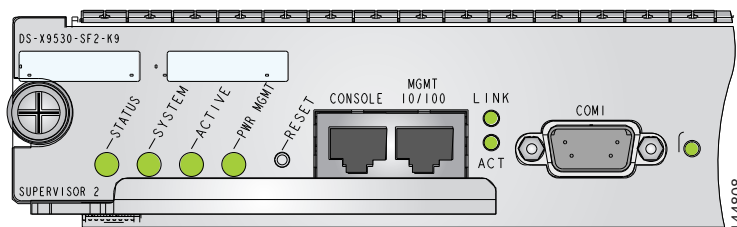


Table 1-4 LEDs for the Cisco MDS 9500 Series Supervisor-2 Modules

LED	Status	Description
Status	Green	All diagnostics pass. The module is operational (normal initialization sequence).
	Orange	One of the following occurs: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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).

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Table 1-4 *LEDs for the Cisco MDS 9500 Series Supervisor-2 Modules (continued)*

LED	Status	Description
System	Green	All chassis environmental monitors are reporting OK.
	Orange	One of the following occurred: <ul style="list-style-type: none"> 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.
Power Management	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:

- [Control and Management, page 1-22](#)
- [Crossbar Switching Fabric, page 1-22](#)
- [Processor, page 1-23](#)
- [Port Interfaces, page 1-23](#)
- [LEDs on the Supervisor-1 Module, page 1-23](#)



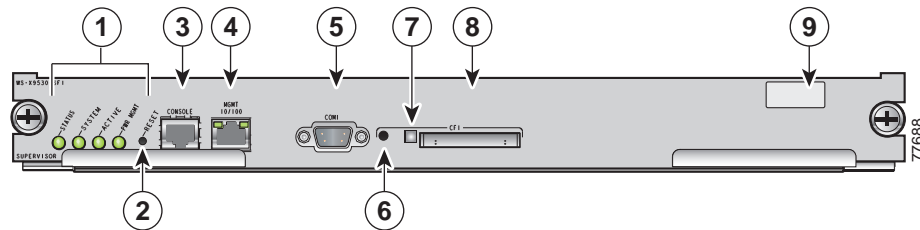
Note

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

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Figure 1-14 shows a Cisco MDS 9500 Series Supervisor-1 module.

Figure 1-14 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 1-5 on page 1-24](#) 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. Dual fabric configurations provide 2.1-Tbps system throughput with 192-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.

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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

Use only the 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

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- 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 1-15](#)).

The LEDs on the Supervisor-1 module indicate the status of the Supervisor-1 module, power supplies, and fan module. [Table 1-5](#) provides more information about these LEDs.

Figure 1-15 *Supervisor-1 Module LEDs*

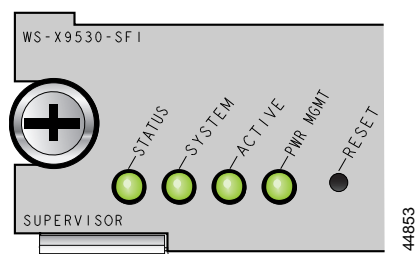


Table 1-5 *LEDs for the Cisco MDS 9500 Series Supervisor Modules*

LED	Status	Description
Status	Green	All diagnostics pass. The module is operational (normal initialization sequence).
	Orange	One of the following occurs: <ul style="list-style-type: none"> • 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 occurs: <ul style="list-style-type: none"> • 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 occurs: <ul style="list-style-type: none"> • 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.

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Table 1-5 LEDs for the Cisco MDS 9500 Series Supervisor Modules (continued)

LED	Status	Description
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 for redundancy. 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. 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.

The LEDs on the crossbar modules indicate the status of the crossbar modules. [Table 1-6](#) provides more information about these LEDs.

For information regarding migrating to Generation 4 modules, see the “[Migrating to Generation 4 8-Gbps Advanced Fibre Channel Switching Modules](#)” section on page 1-1.

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Figure 1-16 Crossbar Module LEDs

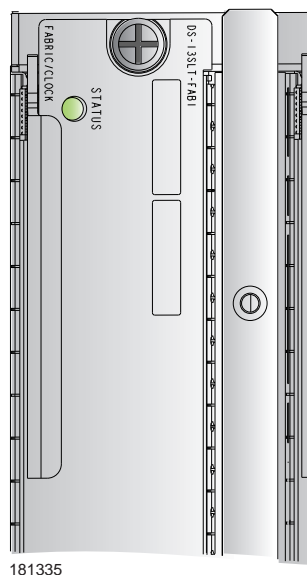


Table 1-6 LEDs for the Cisco MDS 9500 Crossbar Modules

LED	Status	Description
Status	Green	All diagnostics pass. The module is operational (normal initialization sequence).
	Orange	One of the following occurs: <ul style="list-style-type: none"> 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 occurs: <ul style="list-style-type: none"> 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).

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Cisco MDS 9000 Series Module Compatibility

Table 1-7 lists the hardware modules available and the chassis compatibility associated with them.

Table 1-7 MDS 9000 Modules and Platform Compatibility Matrix

Module	9513	9509	9506	9222i	9216A	9216i	9216
Supervisor-2A module	X	X	X				
Supervisor-2 module	X	X	X				
Supervisor-1 module		X	X				
8-port 10-Gbps FCoE Module	X	X	X				
48-port 8-Gbps Advanced Fibre Channel switching module	X	X	X				
32-port 8-Gbps Advanced Fibre Channel switching module	X	X	X				
Fabric Module 3	X						
16-port Storage Services module (SSN-16)	X	X	X	X			
48-port 8-Gbps Fibre Channel switching module	X	X	X				
24-port 8-Gbps Fibre Channel switching module	X	X	X				
4/44-port 8-Gbps Host-Optimized Fibre Channel switching module	X	X	X	X			
48-port 4-Gbps Fibre Channel switching module	X	X	X	X	X	X	
24-port 4-Gbps Fibre Channel switching module	X	X	X	X	X	X	
12-port 4-Gbps Fibre Channel switching module	X	X	X	X	X	X	
4-port 10-Gbps Fibre Channel switching module	X	X	X	X	X	X	
32-port 1-Gbps/2-Gbps Fibre Channel switching module	X	X	X		X	X	X
16-port 1-Gbps/2-Gbps Fibre Channel switching module	X	X	X		X	X	X
8-port Gigabit Ethernet IP Storage Services module	X	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	X
32-port Fibre Channel Advanced Services Module (ASM)		X	X		X	X	X
Caching Services Module (CSM)		X	X		X	X	X
18-port Fibre Channel and 4-port Gigabit Ethernet IP Services (MSM-18/4) module	X	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

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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 NX-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, MPS-14/2, MSM-18/4, and SSN-16), one physical port is equal to four port indexes (one port index for iSCSI and three port indexes for FC IP tunnels). [Table 1-8](#) lists the physical ports and port indexes (virtual ports) available per Cisco MDS 9000 module.

Table 1-8 *Port Index Allocation*

Module	Physical Ports	Port Indexes Allocated
Cisco MDS 8-port 10-Gbps FCoE module	8	8
48-port 8-Gbps Advanced Fibre Channel Switching Module	48	48
32-port 8-Gbps Advanced Fibre Channel Switching Module	32	32
16-port Storage Services module (SSN-16)	16	64
48-port 8-Gbps Fibre Channel switching module	48	48
24-port 8-Gbps Fibre Channel switching module	24	24
4/44-port 8-Gbps Host-Optimized Fibre Channel switching module	48	48
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 switching module	16	16 ¹
32-port 2-Gbps Fibre Channel switching 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-2/2A)
32-port 2-Gbps Fibre Channel Storage Services module (SSM)	32	32 ¹
18-port Fibre Channel and 4-port Gigabit Ethernet IP Multiservice module (MSM-18/4)	22 ²	34
14-port Fibre Channel/2-port Gigabit Ethernet Multiprotocol Services (MPS-14/2) module	16 ³	32 (with Supervisor-1) 22 (with Supervisor-2/2A)

1. All Generation 1 modules reserve port indexes on fixed boundaries with Supervisor-1. See [Table 1-9](#).

2. 18 Fibre Channel ports and four Gigabit Ethernet ports.

3. 14 Fibre Channel ports and two Gigabit Ethernet ports.

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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 1-9](#)). 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 1-1](#) shows a scenario 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 range*	Total	Alloted indices info 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 can use any contiguous block of port indexes that start on the first port index reserved for any slot in the range 0-252. (See [Table 1-9](#).)

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

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

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Table 1-9 *Port Index Requirements*


Supervisor	Module	Port Index Requirements
Supervisor-1	Generation 1	Indexes must be: <ul style="list-style-type: none"> • 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, Generation 3, and Generation 4	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. <div>  <p>Note The difference between Supervisor-2 and Supervisor-2A module is only in the amount of memory. All the other parameters remain the same.</p> </div>

Table 1-10 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 1-10 *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	2	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				
	Totals		252	252

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Table 1-11 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 1-11 Maximum Chassis Configuration on a Cisco MDS 9509 Director (Exceeded)

Slot No.	Modules in Cisco MDS 9509 Director	Generation	Physical Ports	Port Indexes
1	18-port Fibre Channel and 4-port Gigabit Ethernet IP Multiservice module (MSM-18/4)	2	22	34
2	14-port Fibre Channel/2-port Gigabit Ethernet Multiprotocol Services (MPS-14/2) module	1	16	22
3	8-port Gigabit Ethernet IP Storage Services module	1	8	32
4	4-port Gigabit Ethernet IP Storage Services module	1	4	16
5	48-port 4-Gbps Fibre Channel switching module	2	48	48
6	Supervisor-1	1		
7	Supervisor-1	1		
8	48-port 4-Gbps Fibre Channel switching module	2	48	48
9	48-port 4-Gbps Fibre Channel switching module	2	48	48
10	48-port 4-Gbps Fibre Channel switching module	2	48	48
	Totals		240	296

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 1-9).

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 1-12 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 1-12 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		

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Table 1-12 Maximum Chassis Configuration on a Cisco MDS 9513 Director (Valid) (continued)

Slot No.	Modules in Cisco MDS 9513 Director	Generation	Physical Ports	Port Indexes
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
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 switching modules:

- [8-Port 10-Gbps FCoE Module](#)
- Generation 4 modules
 - [48-Port 8-Gbps Advanced Fibre Channel Switching Module](#)
 - [32-Port 8-Gbps Advanced Fibre Channel Switching Module](#)
- Generation 3 modules
 - [48-Port 8-Gbps Fibre Channel Switching Module](#)
 - [24-Port 8-Gbps Fibre Channel Switching Module](#)
 - [4/44-Port 8-Gbps Host-Optimized Fibre Channel Switching Module](#)
- 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 and SFP+ transceivers, which can be short wavelength (SWL) or long wavelength (LWL). The port interfaces also support coarse wavelength-division multiplexing (CWDM) and dense wavelength-division multiplexing (DWDM) SFP transceivers, which can be used for extended long wavelength (ELWL) transmission or

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for coarse wavelength-division multiplexing (CWDM) and dense wavelength-division multiplexing (DWDM). See the “Supported Transceivers” section on page 1-62.

**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.

8-Port 10-Gbps FCoE Module

Fiber Channel over Ethernet (FCoE) is an encapsulation technique to carry Fibre Channel traffic natively over Ethernet without any additional layers such as TCP. FCoE runs on versions of Ethernet that have been improved to provide latency, quality of service, and guaranteed delivery, which avoids the need for discrete Fibre Channel fabric.

As part of Cisco’s I/O consolidation, the FCoE feature enables the expansion of the data center by allowing you to merge different technologies onto a unified technology without any disruption to your legacy infrastructure. The Cisco MDS 9000 8-Port 10-Gbps FCoE module bridges the gap between the traditional Fibre Channel SAN and the evolution to FCoE.

The Cisco MDS 9500 Series switches are updated with the 8-Port FCoE module with 8 SFP+ based 10-Gigabit Ethernet interfaces. The 8 ports are labeled 1 to 8 from left to right. The total nonredundant bandwidth available to the front panel ports is up to 80-Gbps per module in MDS 9500 Directors. If one of the fabric modules or the supervisor module fails, the aggregate bandwidth per slot is reduced by half. The available bandwidth is equally shared by all of the active ports in the 8-Port 10-Gbps FCoE module.

The Cisco MDS 9000 8-Port 10-Gbps FCoE module is supported in Cisco MDS 9513, Cisco MDS 9509, and Cisco MDS 9506 director switches. The new upgraded Supervisor-2A module with 2-GB memory is shipped as default in MDS 9500 chassis.

The 8-Port 10-Gbps FCoE module also allows FCoE interoperability features by supporting FCoE network traffic from Cisco Nexus 5000 and Cisco Nexus 7000 Series switches. The Cisco Nexus 7000 and the Cisco Nexus 5000 switches split the incoming traffic into FCoE and LAN data, and forward only the FCoE portion to the 8-Port 10-Gbps FCoE Module. The FCoE ports support both virtual F_Port (VF_Port) and virtual E_Port (VE_Port) configurations.

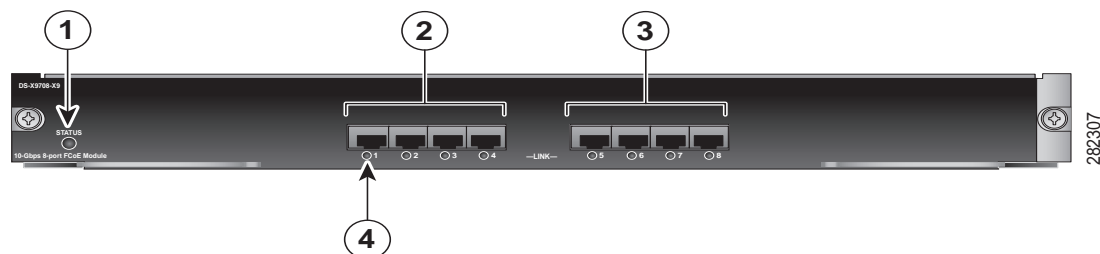
The 8-Port 10Gbps FCoE module adheres to the following standards:

- 802.1Qbb Priority Flow Control (PFC)
- 802.1Qaz Bandwidth Management (ETS)
- DCBX Data Center Bridging Exchange protocol (DCBX)

Figure 1-17 shows the 8-port 10-Gbps FCoE module.

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Figure 1-17 Cisco MDS 9000 8-Port 10-Gbps FCoE Module



1	Status LED	3	FCoE ports
2	FCoE ports	4	Link LEDs

LEDs on the 8-Port 10-Gbps FCoE Module

Table 1-13 describes the LEDs for the 8-port 10-Gbps FCoE module.

Table 1-13 LEDs for the Cisco MDS 9000 Family 8-Port 10-Gbps FCoE Modules

LED	Status	Description
Status	Green	All diagnostics pass. The module is operational (normal initialization sequence).
	Yellow	One of the following occurs or occurred: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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). Shut down the module to prevent permanent damage.
Link	Solid green	Link is up.
	Solid Yellow	Link is disabled by software.
	Flashing Yellow	A fault condition exists.
	Off	No link.

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Note

After you install the Cisco MDS 9000 8-port 10-Gbps Fibre Channel over Ethernet (FCoE) Module (DS-X9708-K9) and install Cisco MDS NX-OS Release 5.2(1), it takes approximately 60 to 90 seconds for the LED status light on the FCoE module to turn from amber to green.

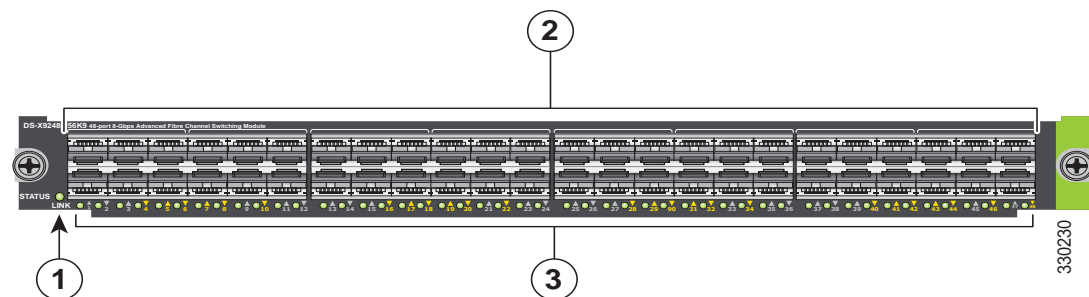
48-Port 8-Gbps Advanced Fibre Channel Switching Module

The 48-Port 8-Gbps Advanced Fibre Channel Switching Module provides high port density and is ideal for connection of high-performance virtualized servers. With Arbitrated Local Switching enabled, this module supports 48-ports of line-rate 8-Gbps and is perfect for deploying dense virtual machine clusters with locally mapped storage. For traffic switched across the backplane, this module supports 1.5:1 oversubscription at 8-Gbps Fibre Channel (FC) rate across all ports. For large-scale storage networking environments, the 48-port 8-Gbps Advanced Fibre Channel switching module delivers full-duplex aggregate backplane switching performance of 512 Gbps, making this module ideal for high-performance and virtualized servers. With Arbitrated Local Switching, the 48-port 8-Gbps Advanced module delivers full-duplex aggregate performance of 768 Gbps across locally switched ports on the module. Arbitrated Local Switching on the 48-port 8-Gbps Advanced Fibre Channel module is well suited for deployment of dense virtual machine clusters with locally mapped storage.

The thumb-screw tag color on the Lexan label is light green in color for the 48-port advanced 8-Gbps Fibre Channel module. The 10-Gbps capable ports are marked in yellow on the Lexan label as “10-Gbps FC Flexible Fibre Channel Ports”.

Figure 1-18 shows the 48-port 8-Gbps Advanced Fibre Channel switching module. The front panel connectors support standard modular SFP and SFP+ transceivers.

Figure 1-18 48-Port 8-Gbps Advanced Fibre Channel Switching Module



1	Status LED	3	Link LEDs
2	Fibre Channel ports		

32-Port 8-Gbps Advanced Fibre Channel Switching Module

The 32-Port 8-Gbps Advanced Fibre Channel Switching Module delivers line-rate performance across all ports and is ideal for high-end storage subsystems and for Inter-Switch Link (ISL) connectivity. For the most demanding storage networking environments, the 32-port 8-Gbps Advanced Fibre Channel switching module delivers uncompromising performance. The 32-port 8-Gbps Advanced switching module delivers full-duplex aggregate performance of 512 Gbps, making this module well suited for the high-performance 8-Gbps storage subsystems. The modules can support either 8-Gbps or 10-Gbps

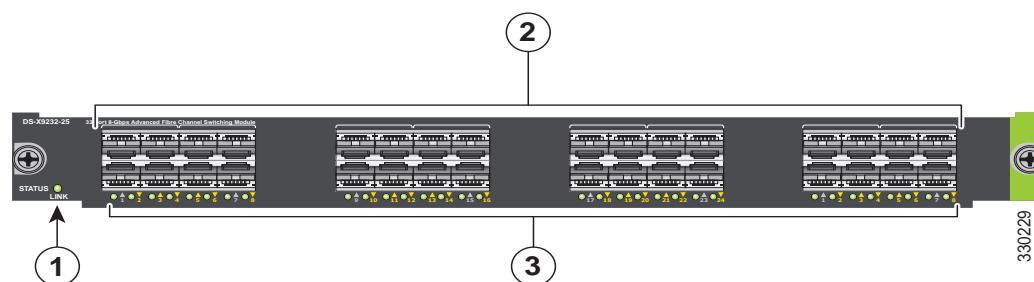
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and/or a combined (8- and 10-Gbps) Inter-Switch Link (ISL), and the ports are grouped in different orders depending upon the 8-Gbps and 10-Gbps modes. The 10-Gbps ports can be used for long-haul DWDM connections.

The thumb-screw tag color on the Lexan label is light green in color for the 32-port advanced 8-Gbps Fibre Channel module. The 10-Gbps capable ports are marked in yellow on the Lexan label as “10-Gbps FC Flexible Fibre Channel Ports”.

Figure 1-19 shows the 32-port 8-Gbps Advanced Fibre Channel switching module. The front panel connectors support standard modular SFP and SFP+ transceivers.

Figure 1-19 32-Port 8-Gbps Advanced Fibre Channel Switching Module



1	Status LED	3	Link LEDs
2	Fibre Channel ports		

Both the Cisco MDS 9000 48-Port 8-Gbps Advanced Fibre Channel switching module and the Cisco MDS 9000 32-Port 8-Gbps Advanced Fibre Channel switching module continue to support the advanced features that were supported with Cisco MDS 9000 Fibre Channel switching modules, including integrated hardware based VSANs, Inter-VSAN Routing (IVR), Intelligent Fabric Services, high performance FICON connectivity, and unparalleled high availability with Cisco PortChannels, dual supervisor and fabric modules, and In-Service Software Upgrade (ISSU).

In addition, both the modules are equipped with Cisco FlexSpeed technology, which enables ports on the Cisco MDS 9000 8-Gbps Advanced Fibre Channel Switching Modules to be configured as either 1/2/4/8-Gbps or 10-Gbps Fibre Channel interfaces. 10-Gbps interfaces enable reduced cabling for ISLs because they provide a 50 percent higher data rate than 8-Gbps interfaces. With integrated Cisco TrustSec encryption, the 10-Gbps links provide secure, high-performance native Fibre Channel SAN Extension. Both the modules support up to 24 10-Gbps Fibre Channel interfaces, which enables consolidation of 1/2/4/8-Gbps and 10-Gbps ports into the same Fibre Channel switching module, thereby conserving space on the Cisco MDS 9000 Family chassis.

LEDs on the Generation 4 Switching Modules

Table 1-14 describes the LEDs for the 48-port, and 32-port 8-Gbps advanced Fibre Channel switching modules.

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Table 1-14 LEDs for the Cisco MDS 9000 Family Generation 4 Advanced 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: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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.

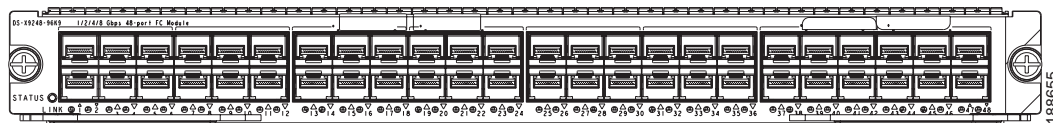
48-Port 8-Gbps Fibre Channel Switching Module

The 48-Port 8-Gbps Fibre Channel switching module offers 48 autosensing 1-, 2-, 4- and 8-Gbps Fibre Channel ports and can be used in the Cisco MDS 9500 Series Switches. The 48-port switching module can be configured in one of two operational modes: shared bandwidth mode (default) and dedicated bandwidth mode.

Figure 1-20 shows a 48-port 8-Gbps Fibre Channel switching module. The front panel connectors support standard modular SFP and SFP+ transceivers and the speed detection is autosensing.

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Figure 1-20 48-Port 8-Gbps Fibre Channel Switching Module

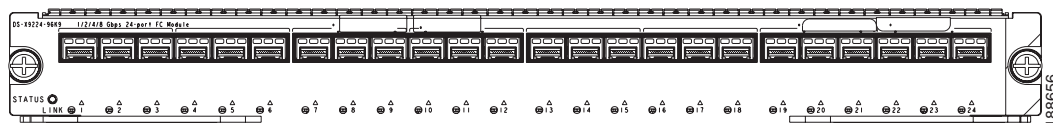


24-Port 8-Gbps Fibre Channel Switching Module

The 24-Port 8-Gbps Fibre Channel switching module offers 24 autosensing 1-, 2-, 4- and 8-Gbps Fibre Channel ports and can be used in the Cisco MDS 9500 Series Switches. The 24-port switching module can be configured in one of two operational modes: shared bandwidth mode (default) and dedicated bandwidth mode.

Figure 1-21 shows a 24-port 8-Gbps Fibre Channel switching module. The front panel connectors support standard modular SFP and SFP+ transceivers and the speed detection is autosensing.

Figure 1-21 24-Port 8-Gbps Fibre Channel Switching Module

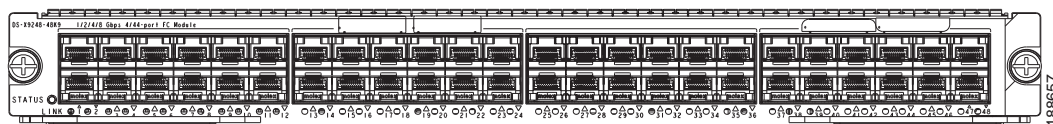


4/44-Port 8-Gbps Host-Optimized Fibre Channel Switching Module

The 4/44-port 8-Gbps Host-Optimized Fibre Channel switching module offers 48 autosensing 1-, 2-, 4- and 8-Gbps Fibre Channel ports and can be used in any of the Cisco MDS 9500 Series chassis and in the Cisco MDS 9222i Switches. The 48-port switching module can be configured in one of two operational modes: shared bandwidth mode (default) and dedicated bandwidth mode.

Figure 1-22 shows a 4/44-port 8-Gbps Host-Optimized Fibre Channel switching module. The front panel connectors support standard modular SFP and SFP+ transceivers and the speed detection is autosensing.

Figure 1-22 4/44-Port 8-Gbps Host-Optimized Fibre Channel Switching Module



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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 1-23 shows a 48-port 4-Gbps Fibre Channel switching module. The front panel connectors support standard modular SFP and the speed detection is autosensing.

Figure 1-23 48-Port 4-Gbps Fibre Channel Switching Module

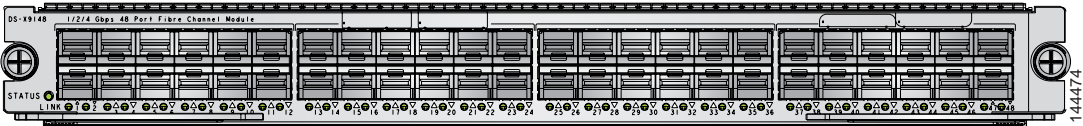
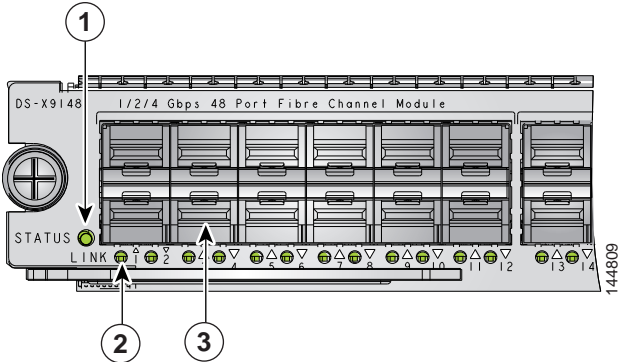


Figure 1-24 shows the port numbering and LEDs on the 48-port 4-Gbps Fibre Channel switching module.

Figure 1-24 48-Port 4-Gbps Fibre Channel Switching Module LEDs



1	Status LED	3	Fibre Channel ports
2	Link LEDs		

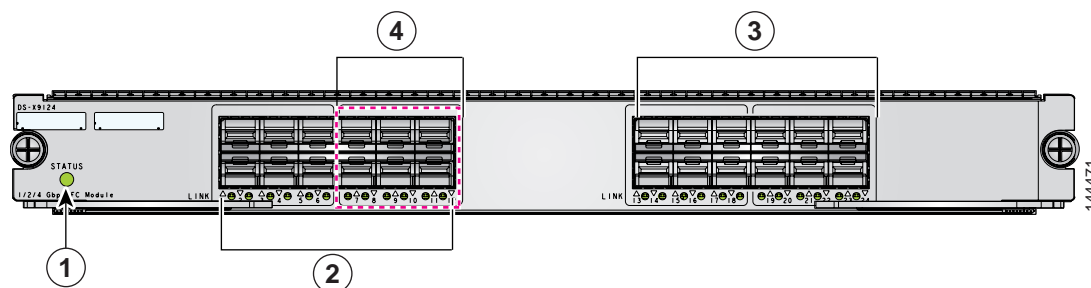
24-Port 4-Gbps Fibre Channel Switching Module

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 1-25 shows a 24-port 4-Gbps Fibre Channel switching module. The front panel connectors support standard modular SFP and the speed detection is autosensing.

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Figure 1-25 24-Port 4-Gbps Fibre Channel Switching Module



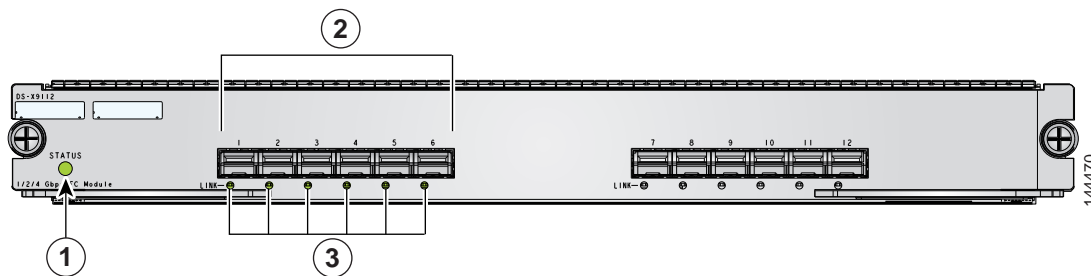
1	Status LED	3	Fibre Channel ports
2	Link LEDs	4	Port group

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 1-26 shows a 12-port 4-Gbps Fibre Channel switching module. The front panel connectors support standard modular SFP and the speed detection is autosensing.

Figure 1-26 12-Port 4-Gbps Fibre Channel Switching Module



1	Status LED	3	Link LEDs
2	Fibre Channel ports		

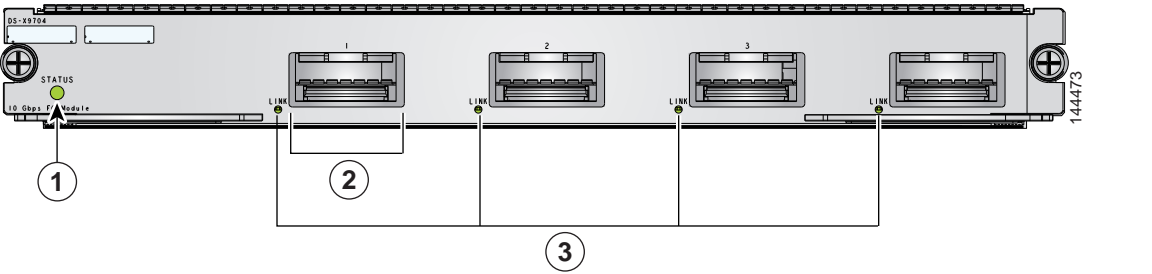
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4-Port 10-Gbps Fibre Channel Switching Module

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 1-27 shows a 4-port 10-Gbps switching module. The front panel connectors support standard modular X2 interfaces and the speed is fixed at 10 Gbps.

Figure 1-27 4-Port 10-Gbps Fibre Channel Switching Module



1	Status LED	3	Link LED
2	X2 port interfaces		

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LEDs on the Generation 2 Switching Modules

Table 1-15 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 1-15 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: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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 1-28 shows a 32-port switching module.

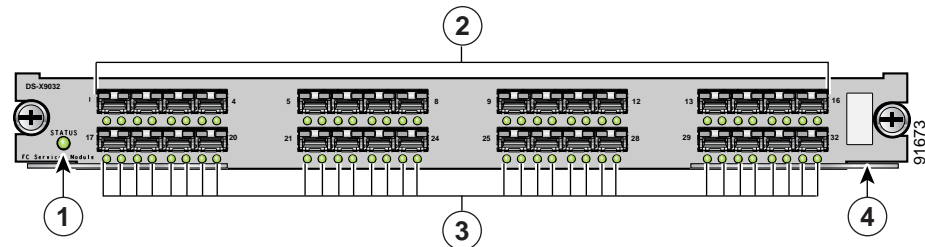
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Tip

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 1-28 Cisco MDS 9000 Family 32-Port 2-Gbps Switching Module

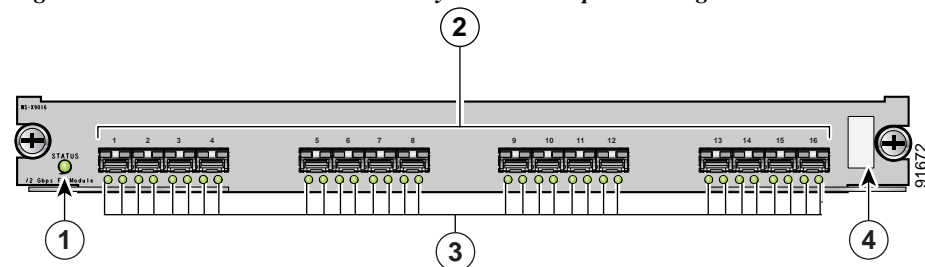


1	Status LED	3	Link LEDs (under ports, on left) and Speed LEDs (under ports, on right)
2	1-Gbps/2-Gbps Fibre Channel port group	4	Asset tag

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 1-29](#) shows a 16-port 2-Gbps switching module.

Figure 1-29 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

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Switching Module Features

Each switching module draws its power from the 42 V 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 for configuring 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 it is not serviced periodically.

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LEDs on the Generation 1 Switching Module

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

Table 1-16 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: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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, see the *Cisco MDS 9000 Family NX-OS Interfaces Configuration Guide*.

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Services Modules

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

- [16-Port Storage Services Module, page 1-46](#)
- [18/4-Port Multiservice Module, page 1-48](#)
- [14/2-Port Multiprotocol Services Module, page 1-51](#)
- [IP Storage Services Modules, page 1-53](#)
- [32-Port Fibre Channel Advanced Services Module, page 1-55](#)
- [32-Port Fibre Channel Storage Services Module, page 1-57](#)
- [Caching Services Module, page 1-59](#)

**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.

16-Port Storage Services Module

The Cisco MDS 9000 Family 16-port Storage Services module (SSN-16) provides 16-Gigabit Ethernet IP services ports. The SSN-16 module provides 16 1-Gigabit Ethernet ports, and supports features such as I/O Accelerator, Storage Media Encryption and Fiber Channel over IP.

The SSN-16 module acts as a service blade for the storage applications. The module provides 16-Gigabit front panel ports for IPS and for the management of the ISAPI applications. For ISAPI, up to four Gigabit Ethernet ports are used for management of the application.

The ports are arranged in such a way that all the odd numbered ports (1, 3, 5, and so on till 15) are arranged in a single horizontal line and the even numbered ports (2, 4, 6, and so on till 16) are arranged below it, in another single horizontal line. That is, port 1 would be placed on the top left, port 2 would be placed on the bottom left, port 3 would be placed next to port 1, port 4 would be placed next to port 2, and so on.

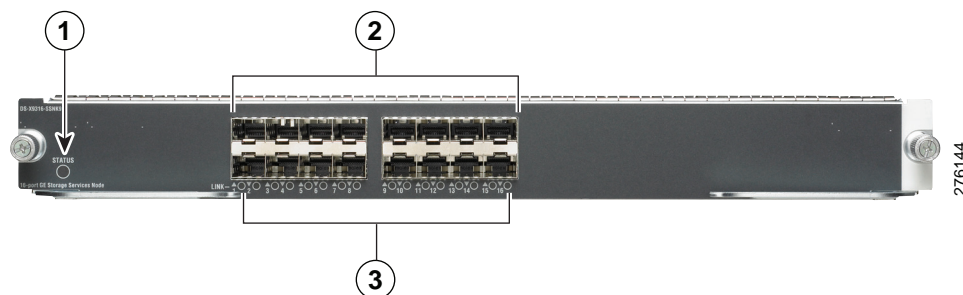
The SSN-16 module provides transparent services to any port in a fabric and does not require additional SAN reconfiguration and rewiring. The module does not require the host or target to be directly attached and provides high availability with multimodule clustering and balancing.

By running four separate, concurrent applications on the SSN-16 module, it can provide the following functions:

- Provides better disaster recovery and continuity solutions for mission-critical applications.
- Minimizes the number of devices required, which improves the reliability.
- Consolidates the management with a single module, which provides end-to-end visibility.
- Provides optimized performance.

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Figure 1-30



1	Status LED	3	Link LEDs
2	16-Gigabit Ethernet IP services ports		

The SSN-16 module provides the following features:

- FCIP for remote SAN extension
 - Simplifies data protection and business continuance strategies by enabling backup, remote replication, and other disaster-recovery services over WAN distances using open-standard FCIP tunneling.
 - Optimizes utilization of WAN resources for backup and replication by enabling hardware-based compression, hardware-based encryption, FCIP write acceleration, and FCIP tape read and write acceleration.
 - Preserves the Cisco MDS 9000 Family switch enhanced capabilities, including VSANs, advanced traffic management, and security, across remote connections.
- If you use engines for FCIP, then the mapping between the engines and the corresponding ports are:
 - Engine 1 - Ports 1 to 4
 - Engine 2 - Ports 5 to 8
 - Engine 3 - Ports 9 to 12
 - Engine 4 - Ports 13 to 16
- Integrated IP storage services in a high density form factor

The module supports 16-Gigabit Ethernet ports for FCIP. Individual ports can be configured with hot-swappable shortwave, longwave small form-factor pluggables (SFPs).

- Integrated hardware-based virtual SANs (VSANs) and Inter-VSAN Routing (IVR)

The module enables deployment of large-scale multisite and heterogeneous SAN topologies. Integration into port-level hardware allows any port within a system or fabric to be partitioned into any VSAN. Integrated hardware-based IVR provides line-rate routing between any ports within a system or fabric without the need for external routing appliances.

- Intelligent network services

The module uses VSAN technology for hardware-enforced, isolated environments within a single physical fabric, access control lists (ACLs) for hardware-based intelligent frame processing, and

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advanced traffic management features such as Fibre Channel congestion control and fabric-wide quality of service (QoS) to facilitate migration from SAN islands to enterprise-wide storage networks.

- Sophisticated diagnostics

The module provides intelligent diagnostics, protocol decoding, and network analysis tools as well as integrated Call Home capability for added reliability, faster problem resolution, and reduced service costs.

- Comprehensive network security framework

The module supports RADIUS and TACACS+, Fibre Channel Security Protocol (FC-SP), Secure File Transfer Protocol (SFTP), Secure Shell (SSH) Protocol, and Simple Network Management Protocol Version 3 (SNMPv3) implementing AES, VSANs, hardware-enforced zoning, ACLs, and per-VSAN role-based access control (RBAC). RBAC provides separate control over management functions and access on a per-VSAN basis, enabling separation of duties among administrators on the same physical switch. Gigabit Ethernet ports support IPsec authentication, data integrity, and hardware-assisted data encryption.

- IP version 6 (IPv6) support

The module supports IPv6 as mandated by the U.S. Department of Defense (DoD), Japan, and China. IPv6 support is provided for FCIP and management traffic routed in-band and out-of-band.

18/4-Port Multiservice Module

The Cisco MDS 9000 Family 18/4-port Multiservice (MSM-18/4) module provides 18 autosensing 1-, 2-, and 4-Gbps Fibre Channel ports and four Gigabit Ethernet IP services ports. The MSM-18/4 module provides multiprotocol capabilities such as Fibre Channel, Fibre Channel over IP (FCIP), Small Computer System Interface over IP (iSCSI), IBM Fiber Connectivity (FICON), and FICON Control Unit Port (CUP) management.

The MSM-18/4 module provides 18 4-Gbps Fibre Channel interfaces for high-performance SAN and mainframe connectivity and four Gigabit Ethernet ports for FCIP and iSCSI storage services. Individual ports can be configured with hot-swappable shortwave, longwave, extended-reach, coarse wavelength-division multiplexing (CWDM) or dense wavelength-division multiplexing (DWDM) Small Form-Factor Pluggables (SFPs) for connectivity up to 125 miles (200 km).

The MSM-18/4 module can minimize latency for disk and tape through FCIP write acceleration and FCIP tape write and read acceleration. The MSM-18/4 module provides up to 16 virtual Inter-Switch Link (ISL) connections on the four 1-Gigabit Ethernet ports through tunneling, and provides up to 4095 buffer-to-buffer credits that can be assigned to a single Fibre Channel port.

The MSM-18/4 supports hardware-based encryption and it is required to run the Storage Media Encryption (SME) which, is a part of the Cisco NX-OS. For more information on SME, see the *Cisco MDS 9000 Family Storage Media Encryption Configuration Guide*.

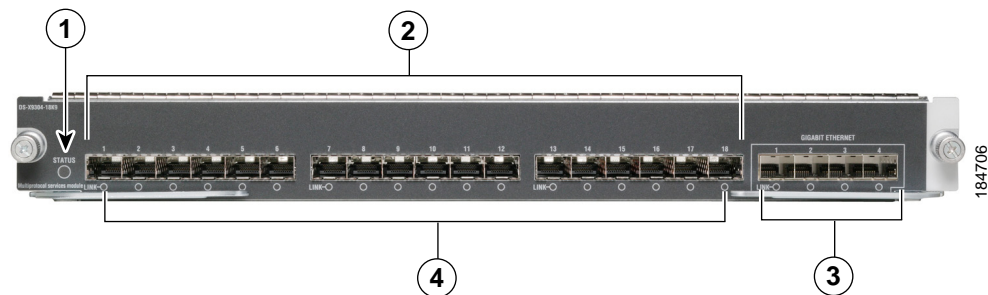
The MSM-18/4 supports SAN extension over IP and is compatible with current SAN extension products, such as MPS-14/2, 9216i, and IPS. The MSM-18/4 provides an integrated next generation 4-Gbps FC platform for SAN extension. The MSM-18/4 module supports Internet Protocol version 6 (IPv6) as mandated by the U.S. Department of Defense (DoD), Japan, and China. The IPv6 support is provided for FCIP, iSCSI, and management traffic routed in-band and out-of-band.

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The MSM-18/4 provides intelligent diagnostics, protocol decoding, and network analysis tools with the integrated Call Home capability.

Figure 1-31 shows the MSM-18/4 module.

Figure 1-31 18/4-Port Multiservice Module



1	Status LED	3	Gigabit Ethernet ports
2	1-Gbps/2-Gbps/4-Gbps Fibre Channel ports	4	Link LEDs

LEDs on the 18/4-Port Multiservice Module

Table 1-17 describes the LEDs for the 18/4-port Multiservice module.

Table 1-17 LEDs for the Cisco MDS 9000 Family 18/4-Port Multiservice Modules

LED	Status	Description
Status	Green	All diagnostics pass. The module is operational (normal initialization sequence).
	Orange	One of the following occurs or occurred: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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.

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Table 1-17 *LEDs for the Cisco MDS 9000 Family 18/4-Port Multiservice Modules (continued)*

LED	Status	Description
Link	Solid green	Link is up.
	Solid yellow	Link is disabled by software.
	Flashing yellow	A fault condition exists.
	Off	No link.

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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-bandwidth 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, see the *Cisco MDS 9000 Family NX-OS Interfaces 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 the [“Supported Transceivers” section on page 1-62](#).



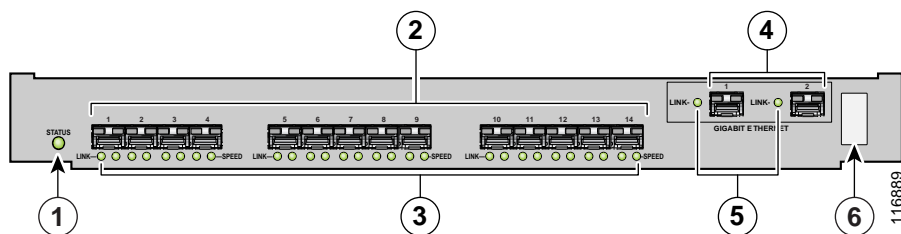
Note

Cisco MDS 9500 Series switches running Cisco MDS SAN-OS Release 2.x, 3.x, or NX-OS Release 4.1(1b) support the MPS-14/2 module.

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Figure 1-32 shows an MPS-14/2 module.

Figure 1-32 Cisco MDS 9000 Family 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 1-18 describes the LEDs for the MPS-14/2 modules.

Table 1-18 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: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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.

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Table 1-18 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

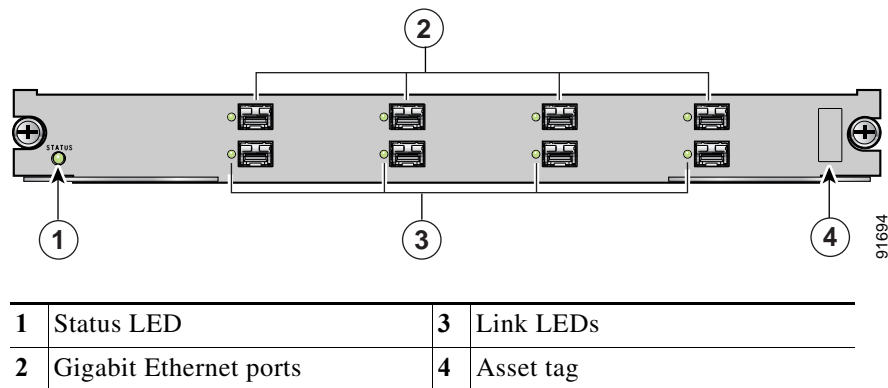
The 4-port and 8-port IP Storage services (IPS-4 and IPS-8) modules provide four or eight 1-Gigabit Ethernet ports for iSCSI as well as FCIP over Gigabit Ethernet, and they support the intelligent features available on other modules, including VSANs, security, and traffic management.

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, see the *Cisco MDS 9000 Family NX-OS Interfaces 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 1-62.

Figure 1-33 shows an IPS-8 services module.

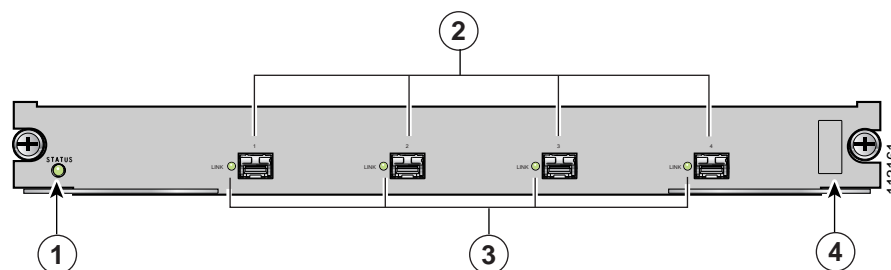
Figure 1-33 Cisco MDS 9000 Family IPS-8 Services Module



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Figure 1-34 shows the IPS-4 services module.

Figure 1-34 Cisco MDS 9000 Family IPS-4 Services Module



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

LEDs on IP Storage Services Modules

Table 1-19 describes the LEDs for the IPS services modules.

Table 1-19 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: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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.

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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 1-62.

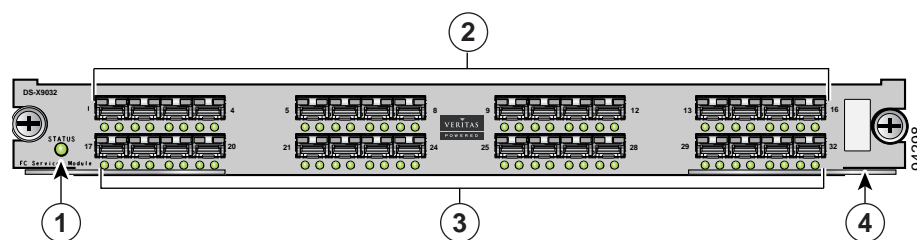


Note

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. The Cisco MDS 9513 Director does not support the ASM.

Figure 1-35 shows the Fibre Channel ASM.

Figure 1-35 *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, see the *Cisco MDS 9000 Family NX-OS High Availability and Redundancy Configuration Guide*.

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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 Advanced Services Modules

Table 1-20 describes the LEDs for the Advanced Services module.

Table 1-20 *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: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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.

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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.



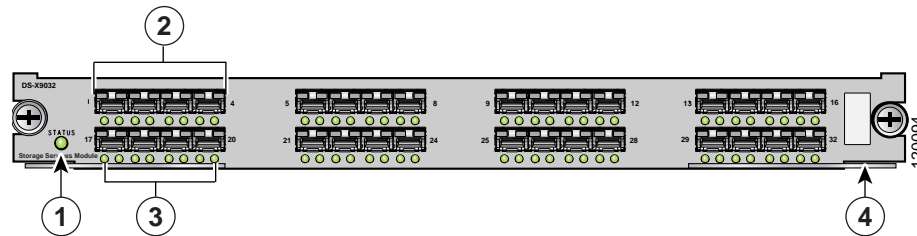
Note

Cisco MDS 9500 Series switches running Cisco MDS SAN-OS Release 2.x, 3.x, or NX-OS Release 4.1(1b) support the SSM.

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 1-62.

Figure 1-36 shows the SSM.

Figure 1-36 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, see the *Cisco MDS 9000 Family NX-OS Fundamentals 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.

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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 it is not serviced periodically.

LEDs on the Storage Services Modules

Table 1-21 describes the LEDs for the Storage Services Modules.

Table 1-21 *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: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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.

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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.

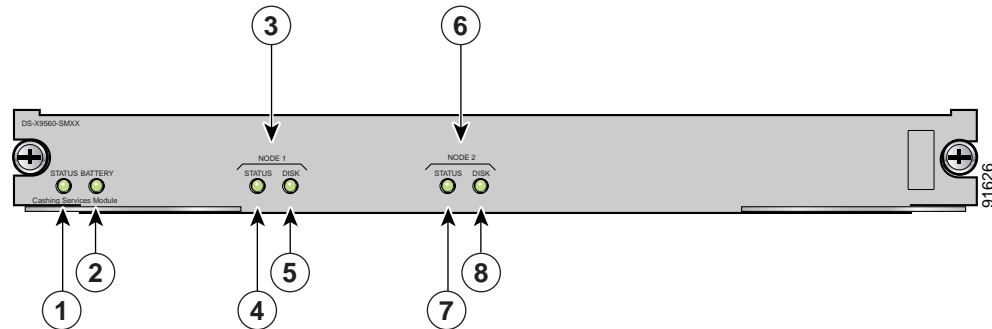


Note

The Cisco MDS 9513 does not support the CSM.

Figure 1-37 shows the CSM.

Figure 1-37 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 1-38 shows the location of the disk drives and batteries on the CSM.

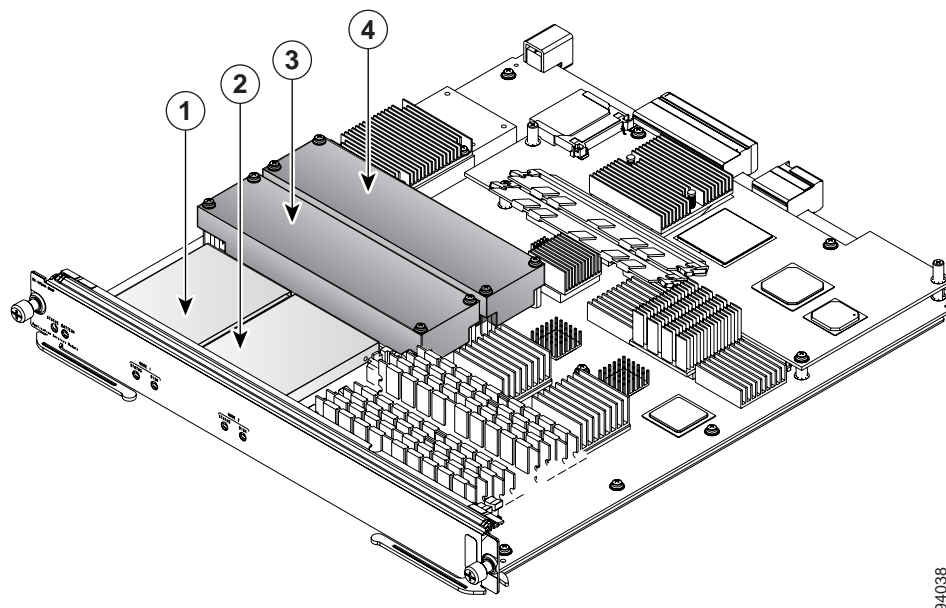


Caution

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

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Figure 1-38 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 1-45](#) for information about installing the CSM and maintaining the CSM batteries.

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LEDs on the Caching Services Module

Table 1-22 describes the LEDs for the CSM.

Table 1-22 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: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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.

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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 and SFP+ transceivers, in either SWL or 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 ELWL transmission or for CWDM
- Gigabit Ethernet SFP transceiver, 1-Gbps copper
- Fibre Channel DWDM SFP transceiver, which can be used for ELWL transmission or for DWDM

**Note**

Switches running Cisco MDS SAN-OS Release 1.x, 2.x, 3.x, or NX-OS Release 4.1(1b) 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 [“Transceiver Specifications” section on page 1-20](#).

For more information about a specific Cisco SFP transceiver, see the [“Transceiver Specifications” section on page 1-20](#). 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 transceiver optimized for 10-Gbps applications and uses an SC connector. The X2 transceiver 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 more information about X2 transceiver specifications, see the [“Transceiver Specifications” section on page 1-20](#).

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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 are available in SWL or LWL versions. Both of these versions are 2-Gbps/4-Gbps/8-Gbps capable.

Cisco Fibre Channel SFP transceivers have LC connectors and comply with 1-Gbps/2-Gbps/4-Gbps Fibre Channel standards as defined in FC-PH 10.0 2. Cisco Fibre Channel SFP+ transceivers have LC connectors and comply with 2-Gbps/4-Gbps/8-Gbps Fibre Channel standards as defined in FC-PH 4.

For more information about Fibre Channel SFP and SFP+ transceiver specifications, see the [“Transceiver Specifications” section on page 1-20](#).

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-PH 10.0 2 and Gigabit Ethernet as defined in IEEE 802.3z.

For more information about Fibre Channel/Gigabit Ethernet SFP transceiver specifications, see the [“Transceiver Specifications” section on page 1-20](#).

CWDM Combination Fibre Channel/Gigabit Ethernet SFP Transceivers

The Cisco CWDM SFP transceivers have LC connectors and support Gigabit Ethernet and 1-Gbps/2-Gbps Fibre Channel. They match the wavelength plan of Cisco CWDM GBICs and Cisco CWDM optical add/drop multiplexers (OADMs). Cisco 4-Gbps CWDM SFP transceivers are also available.

CWDM SFP transceivers are used in the following 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 more information about CWDM SFP transceiver specifications, see the [“Transceiver Specifications” section on page 1-20](#).

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).

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For more information about Gigabit Ethernet SFP transceiver specifications, see the [“Transceiver Specifications”](#) section on page 1-20.

DWDM Fibre Channel SFP Transceivers

The Cisco DWDM SFP transceivers have LC connectors and support 1-Gbps and 2-Gbps Fibre Channel. The DWDM SFP transceivers match the International Telecommunications Union (ITU) 100-GHz wavelength grid and the wavelength plan of Cisco 100-GHz ONS product family.

DWDM SFP transceivers are used in the following ways:

- DWDM transmission can send and receive up to 32 laser wavelengths carrying different signals simultaneously on the same optical fiber using an optical filter.
- ELWL signals can transmit over longer distances than LWL SFP transceivers.

For more information about Gigabit Ethernet SFP transceiver specifications, see the [“Transceiver Specifications”](#) section on page 1-20.



CHAPTER 1

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:

- [Preinstallation, page 1-2](#)
- [Installing the Chassis in a Cabinet or Rack, page 1-6](#)
- [System Grounding, page 1-17](#)
- [Grounding the Chassis, page 1-23](#)
- [Starting Up the Switch, page 1-28](#)
- [Removing, Installing, and Verifying Supervisor, Switching, and Services Modules, page 1-38](#)
- [Maintaining a Caching Services Module, page 1-50](#)
- [Removing and Installing a Power Supply or PEM, page 1-51](#)
- [Removing and Installing Fan Modules, page 1-68](#)
- [Removing and Installing CompactFlash Cards, page 1-75](#)
- [Removing and Installing Clock Modules, page 1-76](#)



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 indicates danger. You are in a situation that could cause physical 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

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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

Preinstallation

This section provides the following topics:

- [Installation Options, page 1-2](#)
- [Installation Guidelines, page 1-3](#)
- [Required Equipment, page 1-5](#)
- [Unpacking and Inspecting the Switch, page 1-5](#)

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



Note

The Cisco MDS 9509 Director cannot be installed in a two-post telco rack using the DS-SHELF, the Telco and EIA Shelf Bracket Kit.

- 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 nonthreaded 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

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- 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 1-6.

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 1-6.

**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. Cisco recommends that you use the site planning tasks listed in [Appendix 1, “Site Planning and Maintenance Records.”](#)
- Ensure that there is adequate space around the switch to allow for servicing the switch and for adequate airflow (airflow requirements are listed in [Appendix 1, “Technical Specifications”](#)).
- Ensure that the air-conditioning meets the heat dissipation requirements listed in [Appendix 1, “Technical Specifications.”](#)
- Ensure that the cabinet or rack meets the requirements listed in [Appendix 1, “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 1-11.

- Ensure that the chassis is adequately grounded. Grounding the chassis is recommended in all cases, and 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, Cisco recommends connecting 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.
-

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- Ensure that the site power meets the power requirements listed in [Appendix 1, “Technical Specifications.”](#) 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 that 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 that 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 1, “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: 12 in-lb
 - M6 screws: 20 in-lb
 - 10-32 screws: 20 in-lb
 - 12-24 screws: 30 in-lb

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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

Cisco recommends 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.

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**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/en/US/support/tsd_cisco_worldwide_contacts.html.

**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 ensure that you have 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. Keep 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 1-7](#)
- [Installing the Cisco MDS 9509 Director in a Rack, page 1-11](#)
- [Installing the Cisco MDS 9506 Director in a Rack, page 1-15](#)

**Caution**

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

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**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 1-38 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. Ensure that you have access to the lift during the installation process.

[Table 1-1](#) 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 1-1 *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:

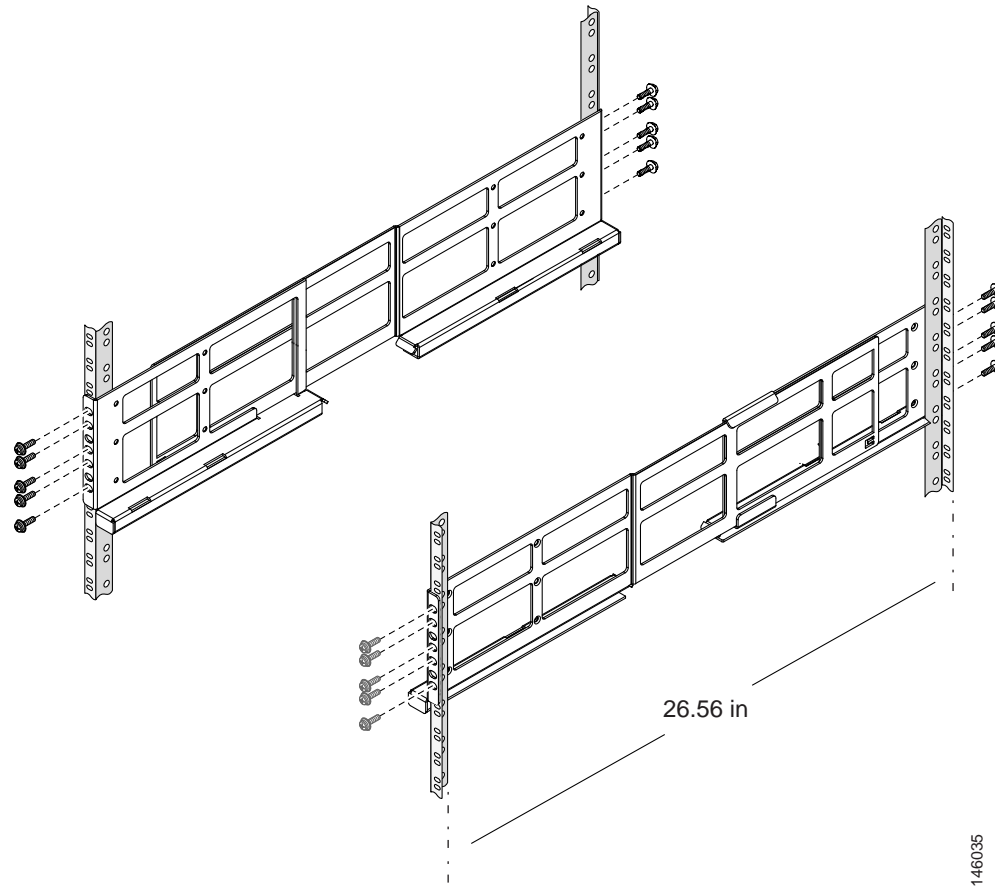
- Step 1** Adjust the distance between the front and rear cabinet vertical rack-mount rails to 26.56 ± 0.15 in. (67.46 cm). This step must be performed prior to installing the support rack-mount brackets.
- Step 2** Position one of the support rack-mount brackets in the rack and adjust it to the depth of the cabinet rack. Repeat this step for the other side. Use the screws to secure the brackets but do not tighten them yet.

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**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 1-1](#)). The top four screws will be used to install the cable management bracket to the rail.

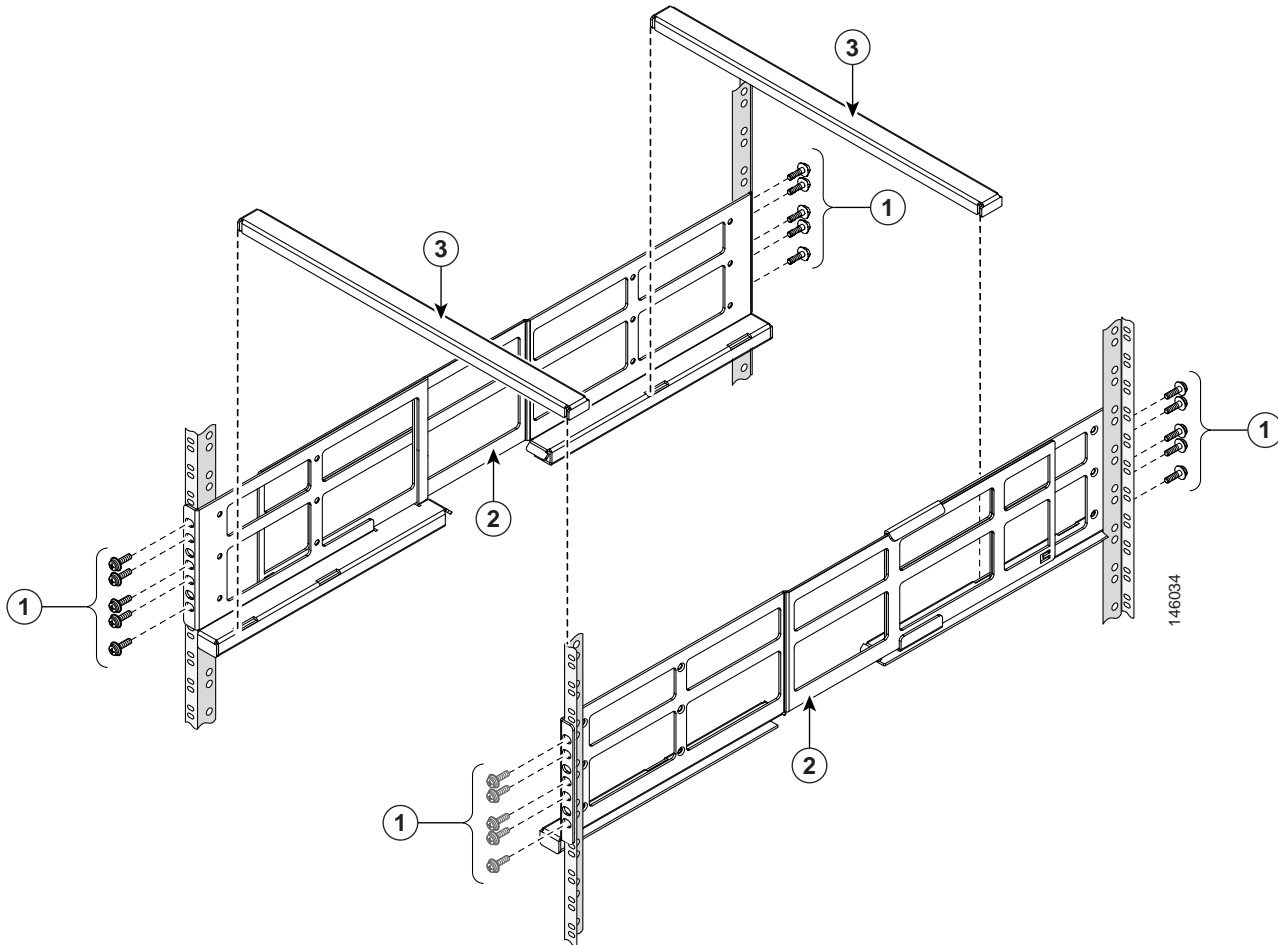
Figure 1-1 Positioning the Rack-Mount Support Brackets



- 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.

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Figure 1-2 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.

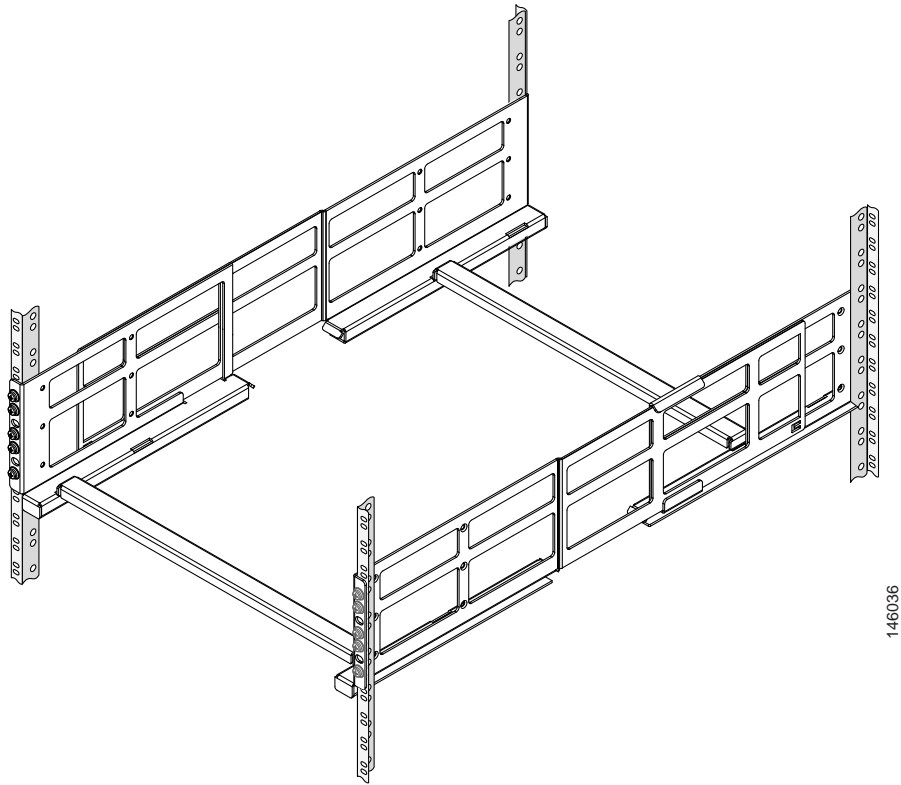


Note

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.

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Figure 1-3 *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 or 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 1-4](#).)

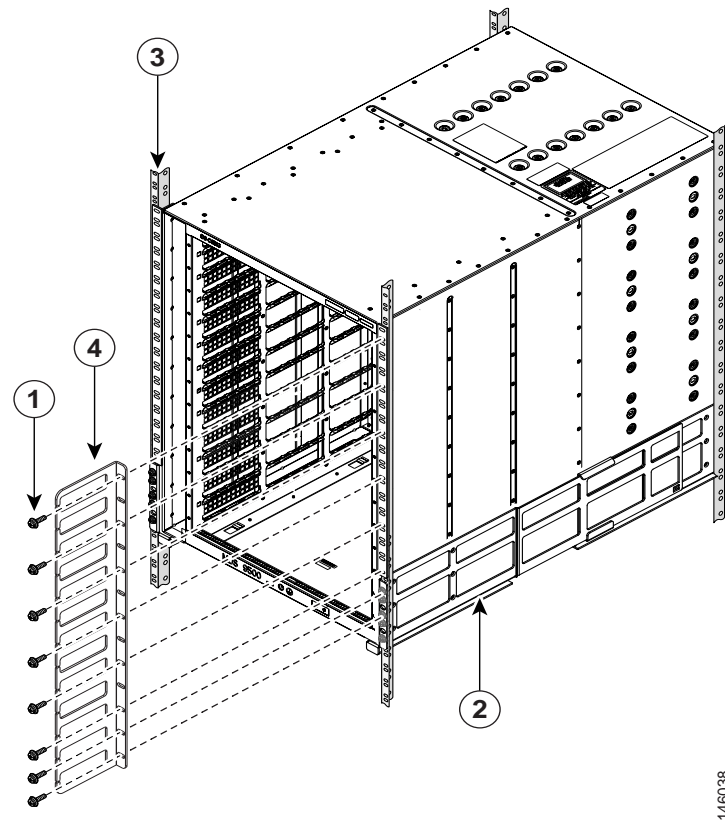


Note

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

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Figure 1-4 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

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Installing the Cisco MDS 9509 Director in a Rack



Caution

If connecting a Cisco MDS 9509 Director to a 110-VAC power system, ensure that 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 1-2 lists the items provided in the Cisco MDS 9509 rack-mount kit.

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**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 can be purchased as an optional shelf bracket kit for the Cisco MDS 9509 Director. See [“Cisco MDS 9500 Shelf Bracket” section on page 1-13](#).

Table 1-2 *Contents of Cisco MDS 9509 Rack-Mount Kit*

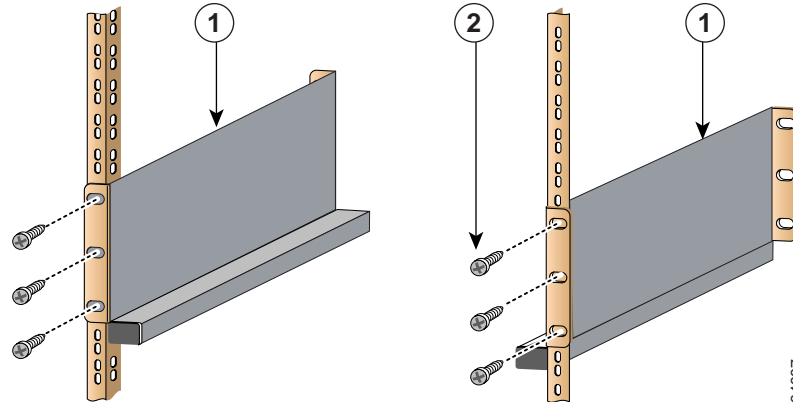
Quantity	Part Description
3 RU shelf bracket kit	
6	12-24 x 3/4-inch Phillips binder-head screws
6	10-32 x 3/4-inch Phillips binder-head screws
2	M3 x 8-mm Phillips pan-head screws
2	Side rack-mount brackets
1	Crossbar bracket
Cable management bracket kit	
2	Cable management brackets
18	12-24 x 3/4-inch 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 1-5](#). 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.

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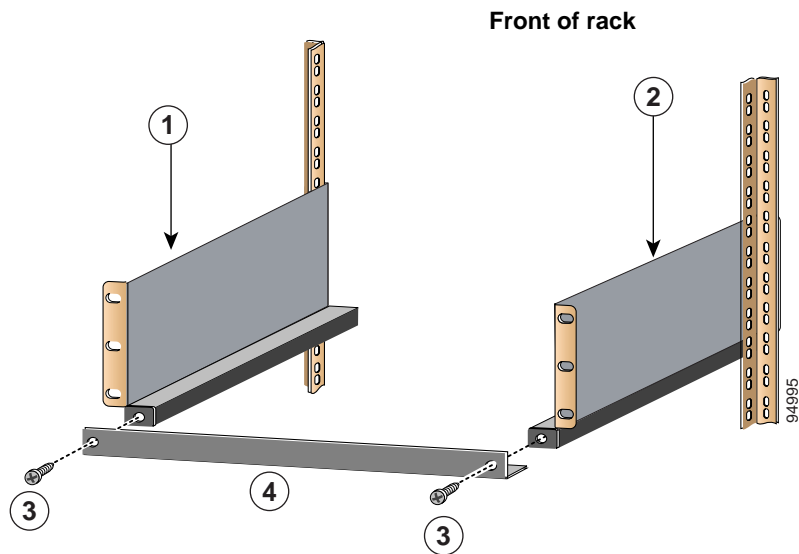
Figure 1-5 *Installing the Side Rack-Mount Brackets for the Cisco MDS 9509 Chassis*



1	Side rack-mount bracket	2	Screws, 12-24 or 10-32
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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 1-6](#).

Figure 1-6 *Attaching the Crossbar to the Side Rack-Mount Brackets (Rear View)*

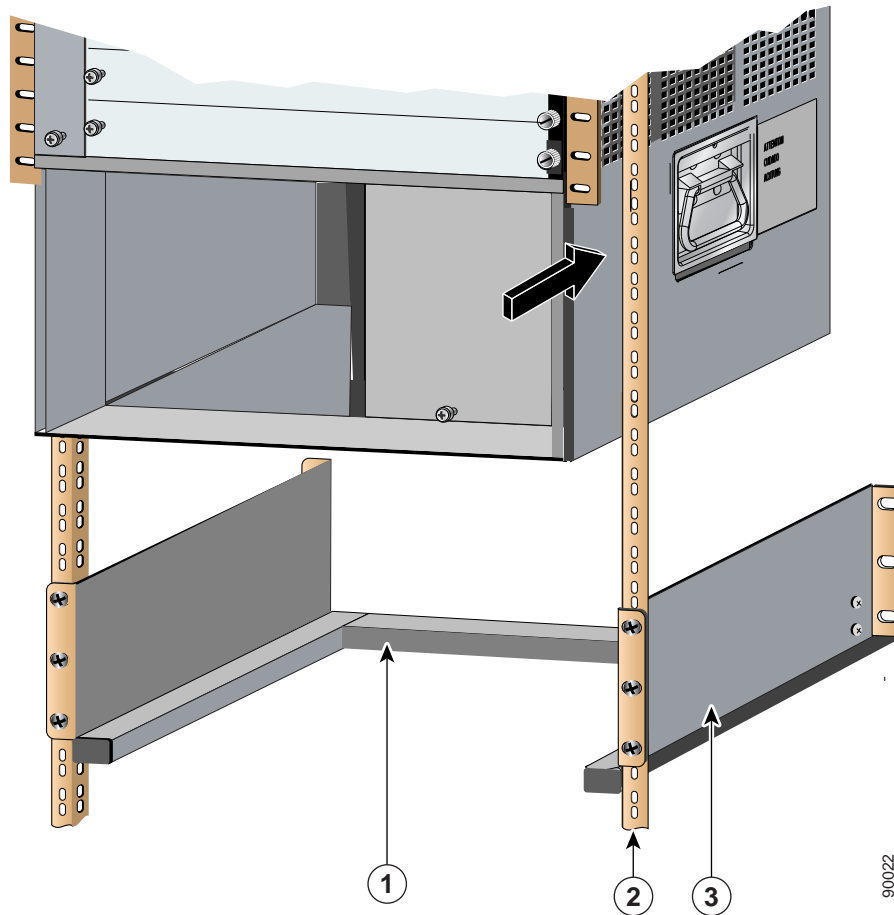


1	Side rack-mount bracket	3	Screws, M3
2	Side rack-mount bracket	4	Crossbar

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 1-7](#)).

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Figure 1-7 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, Cisco recommends using only the right side for cable management. Using the right side for cable management allows easy removal of the fan tray if you need to replace a fan.

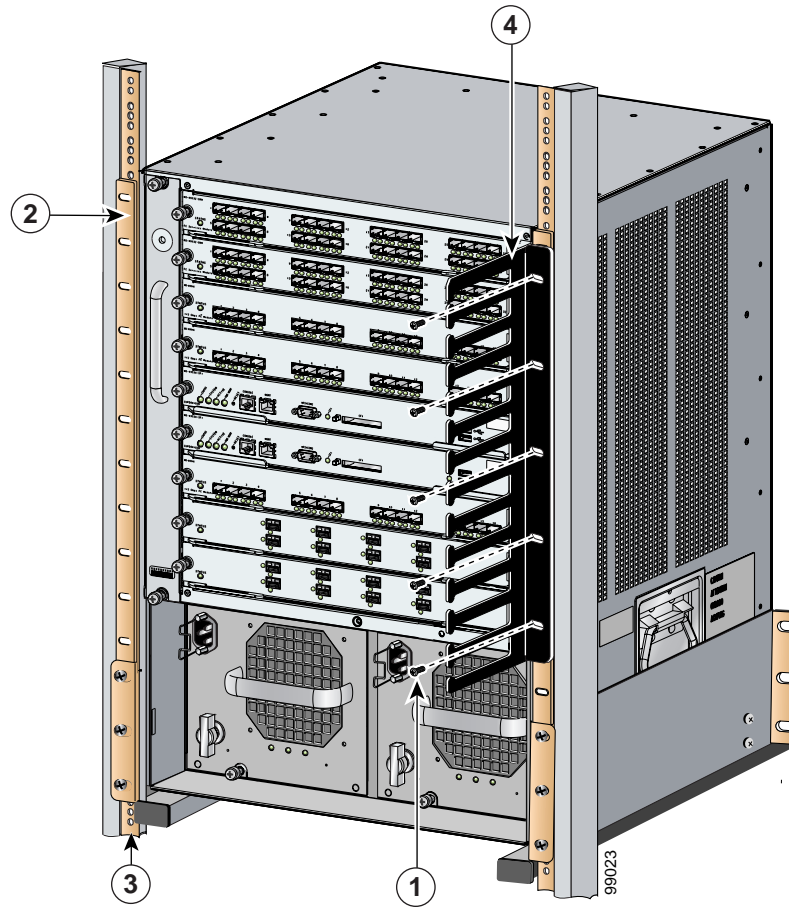
- Step 6** Align the holes in the front rack-mount bracket with the holes in the mounting rails and insert the 12-24 x 3/4-inch or 10-32 x 3/4-inch screws (see [Figure 1-8](#)), using six screws per side.



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

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Figure 1-8 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 1-3 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.

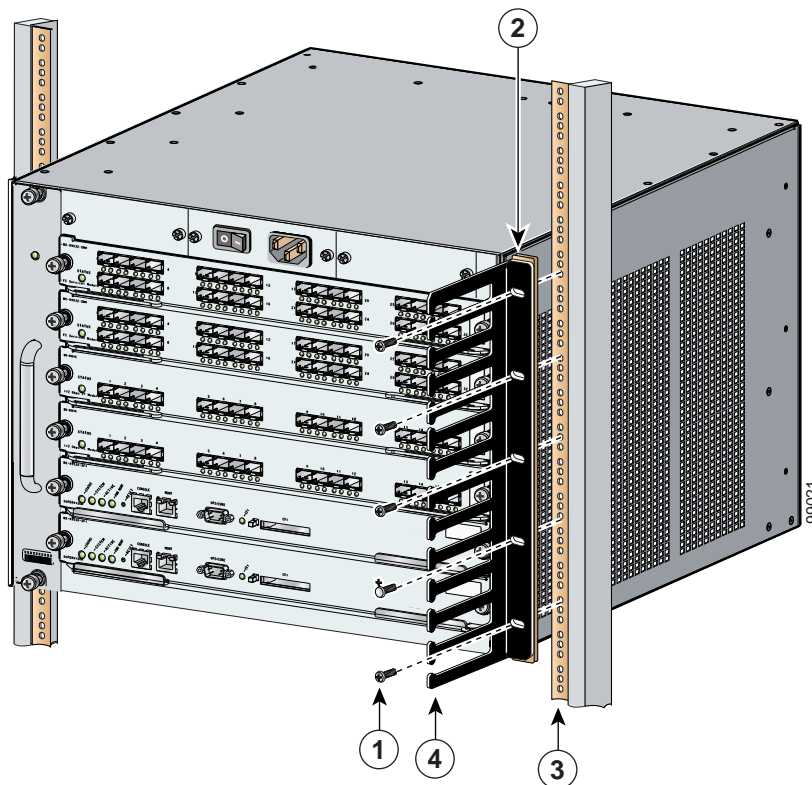
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Table 1-3 Contents of Cisco MDS 9506 Rack-Mount Kit

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 1-9 shows the installation of a Cisco MDS 9506 director into a rack, using the cable management bracket.

Figure 1-9 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

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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 1-9](#)), 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, Cisco recommends 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 that 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 1-4](#) lists grounding best practices.

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Table 1-4 **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. Appropriate 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	Appropriate grounding practices must be closely followed.
Commercial building contains a mix of information technology equipment and industrial equipment, such as welding.	Medium to high	Appropriate 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	Appropriate 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	Appropriate 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	Appropriate 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.

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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 protect the board from ESD. Always wear an ESD grounding strap when handling modules.

Follow these guidelines for preventing ESD damage:

- Always wear 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. Cisco recommends 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. For installation instructions and location of the chassis system ground pads, see [“Establishing the System Ground” section on page 1-22](#).



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.

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- 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. Cisco recommends 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 1-10](#)):
- 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.

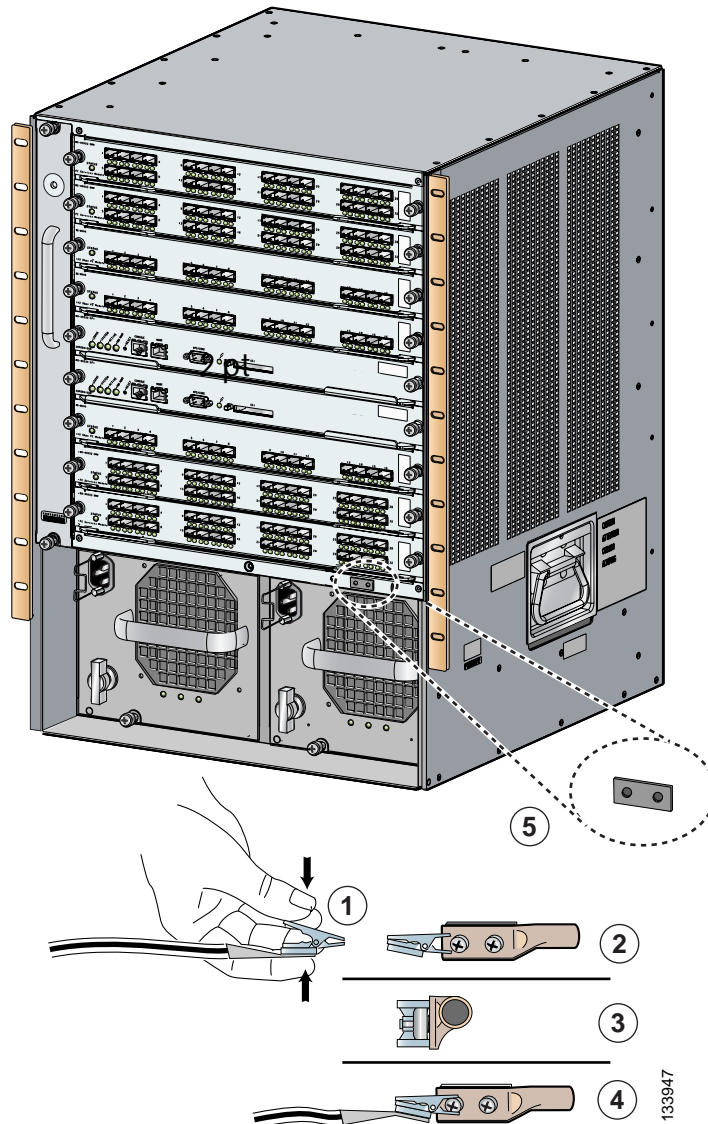


Note The spring clip jaws do not open wide enough to fit directly over the head of the lug screw or the lug barrel.

- 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.

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Figure 1-10 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.

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

**Caution**

For safety reasons, check the resistance value of the antistatic strap periodically. 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-hole 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.

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- 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.



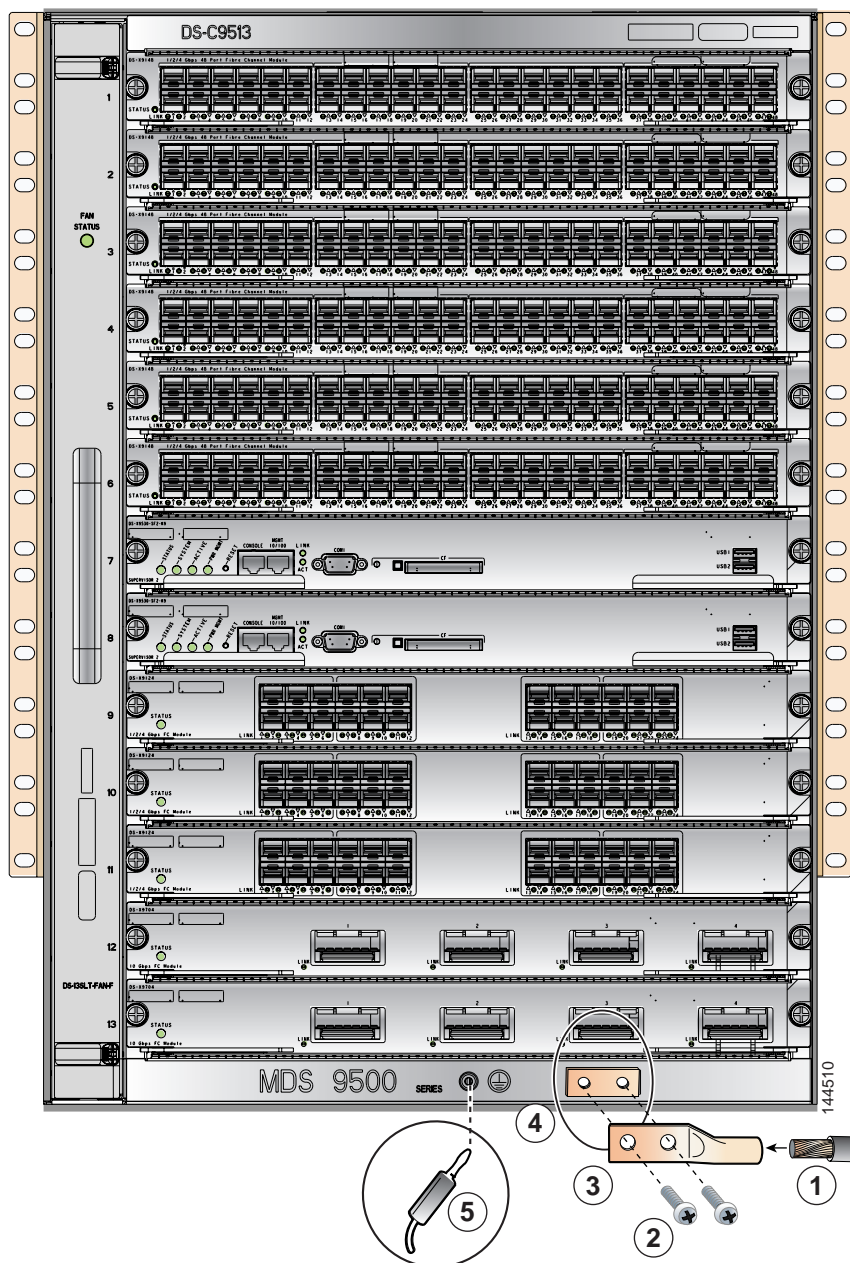
Warning

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

[Figure 1-11](#) shows the system ground location on the front panel of the Cisco MDS 9513 chassis.

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Figure 1-11 System Ground Location on the Cisco MDS 9513 Chassis (Front)

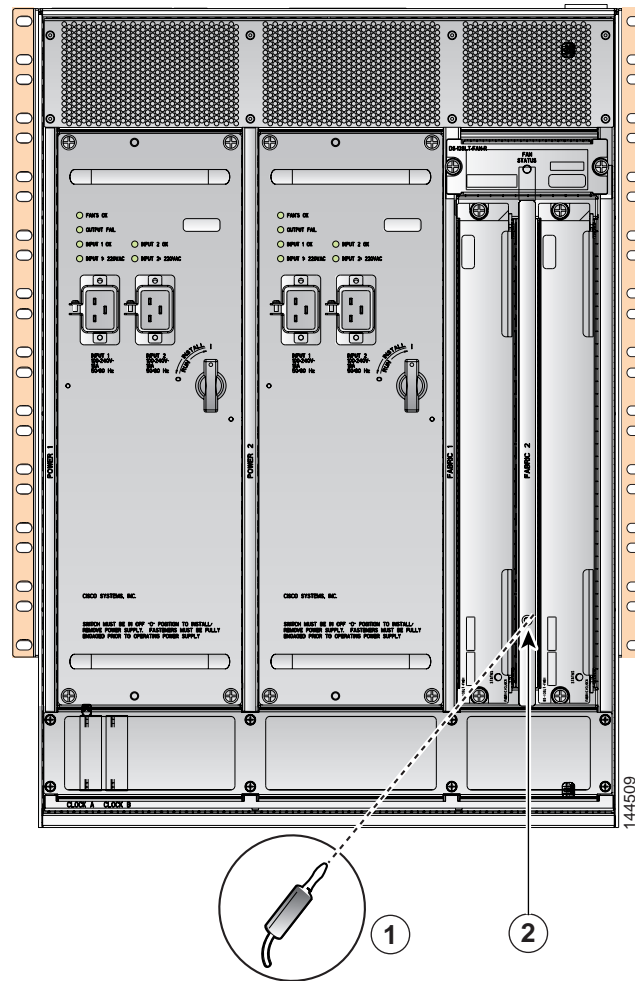


1	Grounding cable	4	Close-up of grounding pad on switch
2	Screws, M4, with square cone washers	5	ESD plug
3	NRTL listed grounding lug		

Figure 1-12 shows the ESD ground location on the rear panel of the Cisco MDS 9513 chassis.

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Figure 1-12 ESD Ground Location on the Cisco MDS 9513 Chassis (Rear)



1	ESD plug	2	ESD socket
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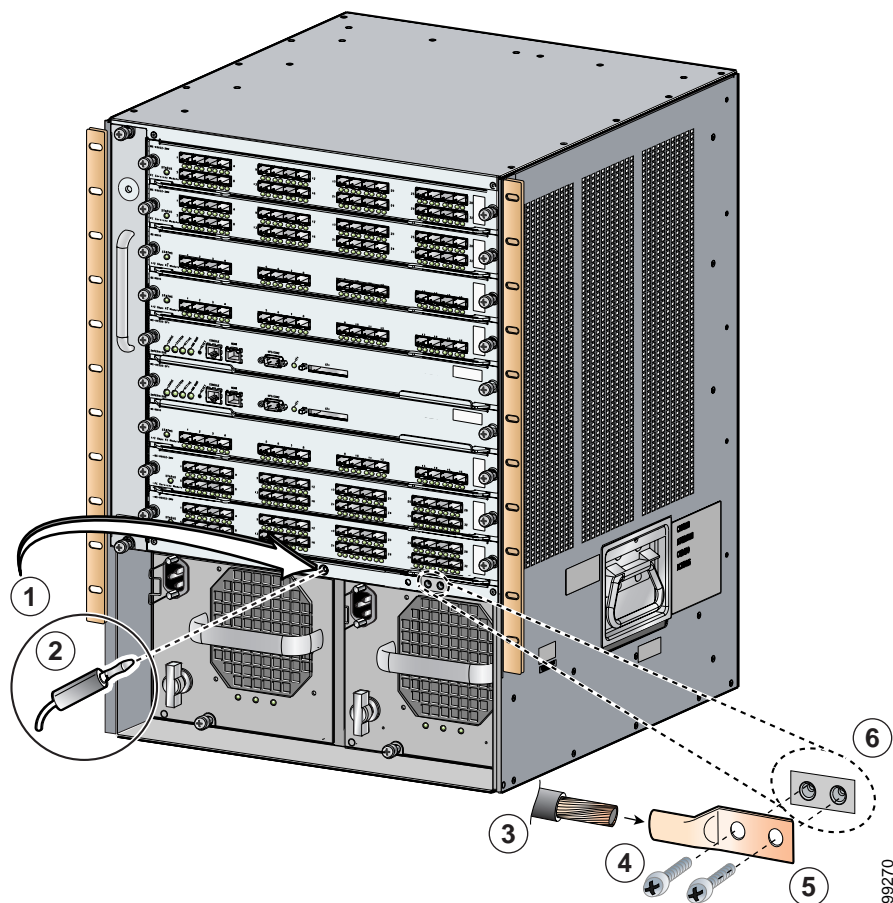
Caution

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 1-13 shows the system ground location on the Cisco MDS 9509 chassis.

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Figure 1-13 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



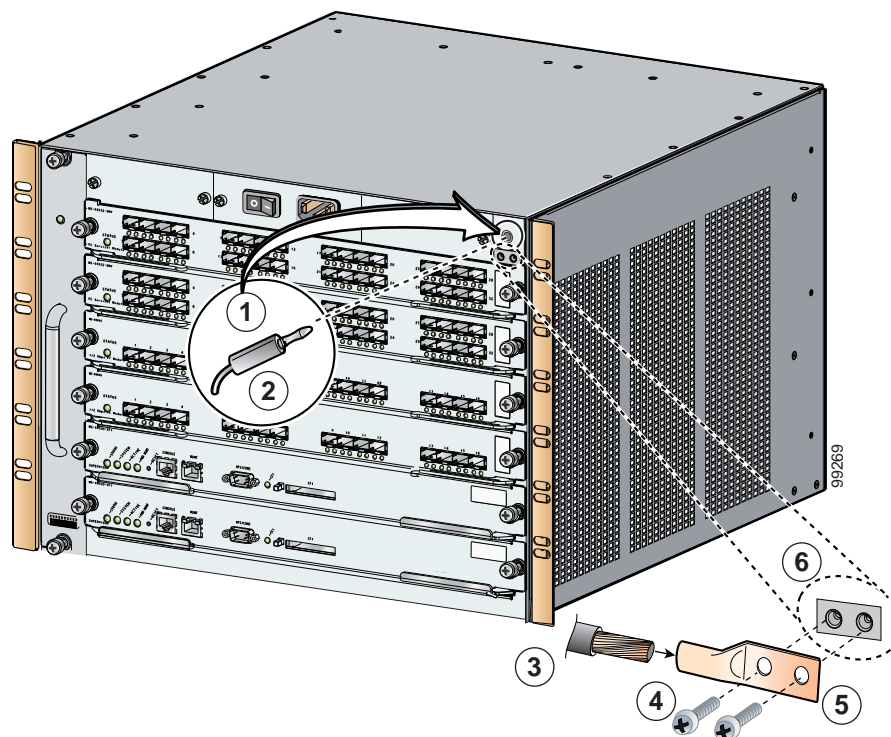
Caution

Grounding the chassis is required for Cisco MDS 9506 Directors that have DC power supplies, and Cisco recommends grounding for all other chassis types, although 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, copper conductor (wires) must be used and the copper conductor must comply with the NEC code for ampacity.

Figure 1-14 shows the system ground location on the Cisco MDS 9506 chassis.

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Figure 1-14 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.
-

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Starting Up the Switch

This section provides the following information:

- [Connecting the Power Supplies, page 1-28](#)
- [Powering Up the Switch and Verifying Component Installation, page 1-36](#)



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 1, “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, page 1-29](#)
- [Providing Power to an AC Power Supply for the Cisco MDS 9509 and Cisco MDS 9506 Directors, page 1-30](#)
- [Providing Power to a DC Power Supply in the Cisco MDS 9509 Director, page 1-33](#)
- [Providing Power to a DC Power Supply in the Cisco MDS 9506 Director, page 1-34](#)

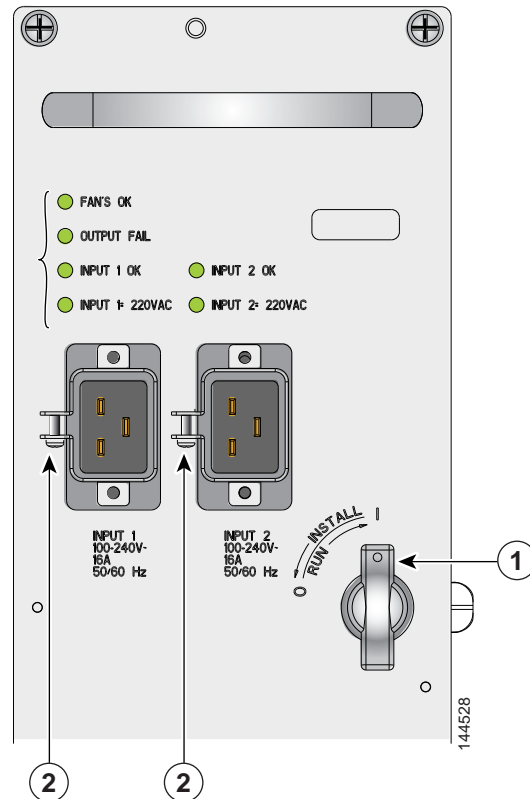
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Providing Power to an AC Power Supply for the Cisco MDS 9513 Director

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 that the cable cannot be pulled out. Each power supply has two AC power connections (as shown in [Figure 1-15](#)).

Figure 1-15 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 (I) 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 1-2 on page 1-11](#) for power supply LED details.

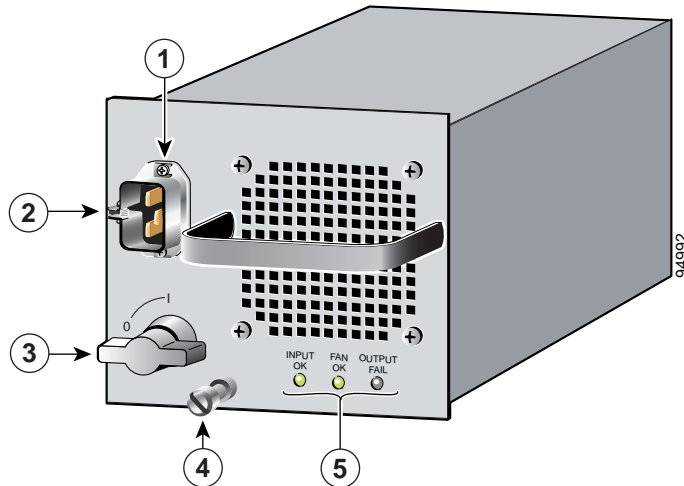
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Providing Power to an AC Power Supply for the Cisco MDS 9509 and Cisco MDS 9506 Directors

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 1-16 shows a 2500-W AC power supply for the Cisco MDS 9509 Director.

Figure 1-16 2500-W AC Power Supply for the Cisco MDS 9509 Director

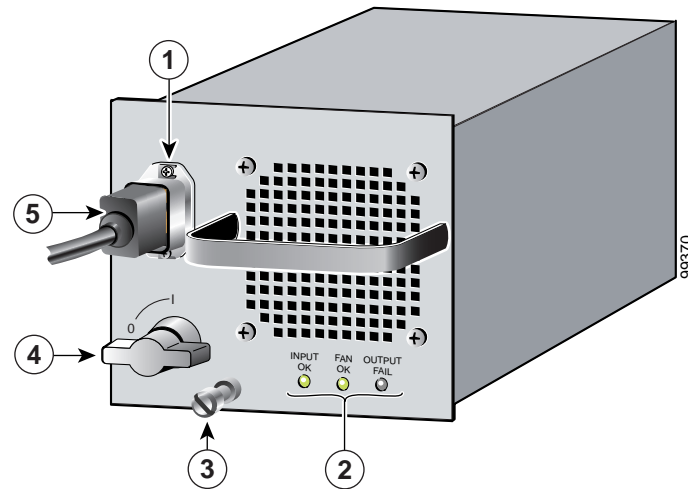


1	AC power connection	4	Captive screws
2	Power cable retainer	5	Power supply LEDs
3	Power supply switch		

Figure 1-17 shows a 4000-W AC power supply for the Cisco MDS 9509 Director.

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Figure 1-17 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		

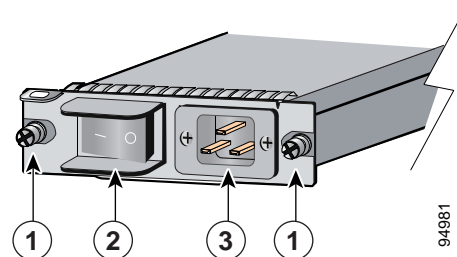


Caution

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 1-18 shows an AC PEM for a Cisco MDS 9506 Director.

Figure 1-18 AC PEM for Cisco MDS 9506 Director

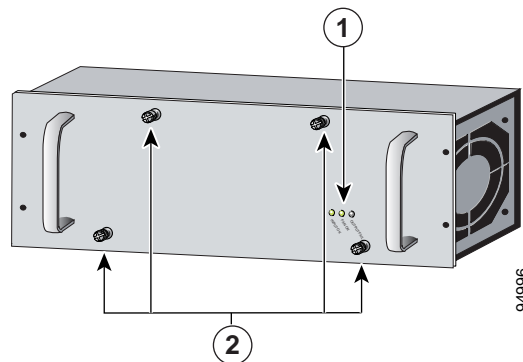


1	Captive screws	3	AC power connection
2	PEM switch		

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Figure 1-19 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 1-19 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 that 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 1-11.

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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



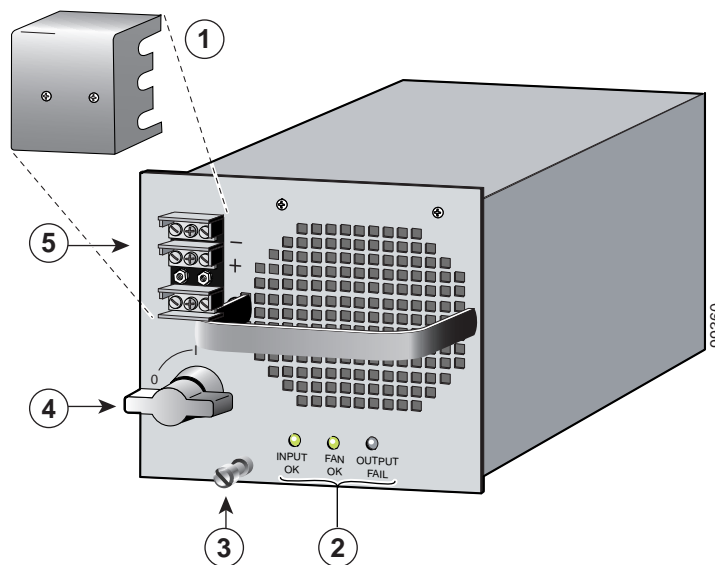
Warning

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

For more information on DC power supply for the MDS 9509 Director, see the [“System Grounding” section on page 1-17](#).

Figure 1-20 shows the 2500-W DC power supply.

Figure 1-20 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.

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- Step 2** Ensure that the system (earth) ground connection is made. See the “System Grounding” section on page 1-17.
- Step 3** Turn the power switch on the power supply to off (0).
- Step 4** Unfasten 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:
- Identify the ground, negative, and positive DC cables and verify that all are copper and sized per local and national installation requirements.
 - Strip the cable ends to allow for metal-to-metal contact.
 - 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

- Secure the cables in place by tightening the terminal block screws.
- Replace the terminal block cover and fasten 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

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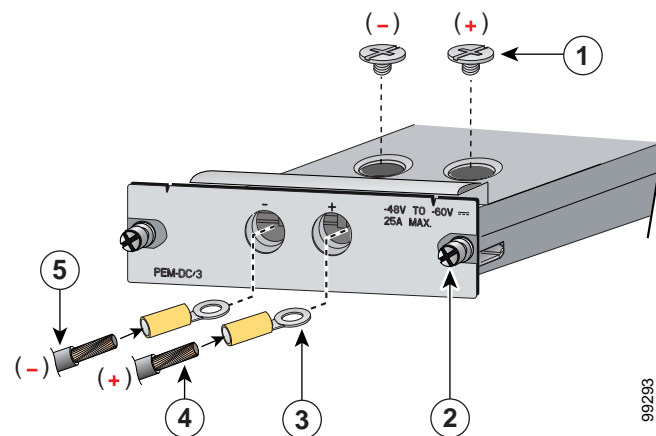
Warning

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

For more information on DC power supply in the MDS 9506 Director, see the [“System Grounding” section on page 1-17](#).

Figure 1-21 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 1-21 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 1-17](#).
- 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.

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- 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, see the *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide* or the *Cisco DCNM SAN Fundamentals Configuration Guide*.

For instructions on connecting to the console port, see the [“Connecting to the Console Port” section on page 1-2](#)).

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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 1-17](#), and that the power cables are connected to outlets that have the required AC or DC power voltages. See [Appendix 1, “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 (I) 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 1, “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.

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**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/en/US/support/tsd_cisco_worldwide_contacts.html.

Step 11 Verify that the system software has booted and the switch has initialized without error messages. If any problems occur, see 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 1, “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, see the *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide* or the *Cisco DCNM SAN Fundamentals Configuration Guide*.

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

This section provides the following information:

- [Removing Supervisor Modules, page 1-39](#)
- [Installing Supervisor Modules, page 1-40](#)
- [Removing a Caching Services Module, page 1-44](#)
- [Removing Other Switching and Services Modules, page 1-45](#)
- [Installing a Switching or Services Module, Including Caching Services Modules, page 1-45](#)
- [Verifying Installation of Supervisor, Switching, and Services Modules, page 1-46](#)
- [Removing and Installing a Crossbar Module, page 1-47](#)

**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

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**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 1-6.

**Note**

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

Removing Supervisor Modules

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

- Step 1** Shut down the crossbar switching fabric functionality in the supervisor module of the Cisco MDS 9509 and 9506 Directors by using 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** Upload the current configuration to a server if the switch has only one supervisor module. For information about the correct command, see the *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide*.
- Step 3** Fail over to the standby supervisor if the switch has two supervisor modules and the supervisor you are removing is currently active. For information on how to fail over a supervisor module, see the *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide*.
- Step 4** Disconnect any network interface cables attached to the module.
- Step 5** Loosen the two captive screws on the module being removed.
- Step 6** 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 7** Place the module on an antistatic mat or antistatic foam, or immediately reinstall it in another slot.
- Step 8** Install a filler panel on an empty slot to keep the chassis dust-free 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

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Installing Supervisor Modules

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

Supervisor-1, Supervisor- 2, and Supervisor-2A modules cannot be used in the same switch, except for migration purposes. Both the active and standby supervisor modules must be of the same type, either Supervisor-1 or Supervisor-2 modules. For Cisco MDS 9513 Directors, both supervisor modules must be Supervisor-2 modules.



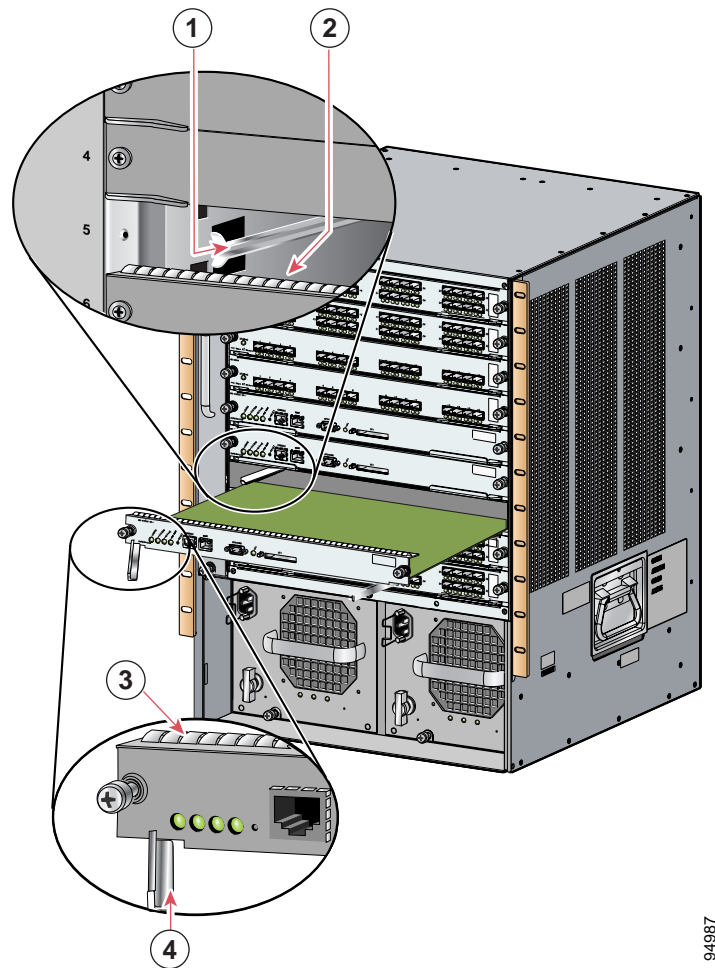
Note

When inserting a new line card into a slot, ensure the new line card is of the same model as the existing line card. If there is a mismatch in the line card models, the line card configurations are removed from the configuration file.

-
- Step 1** Before installing any modules in the chassis, Cisco recommends installing the chassis in the rack. See the [“Installing the Chassis in a Cabinet or Rack” section on page 1-6](#).
 - 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 1-45](#).
 - Step 5** Open both the ejector levers on the new or replacement module completely. (See [Figure 1-22](#).)

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Figure 1-22 Positioning a Module in the Chassis



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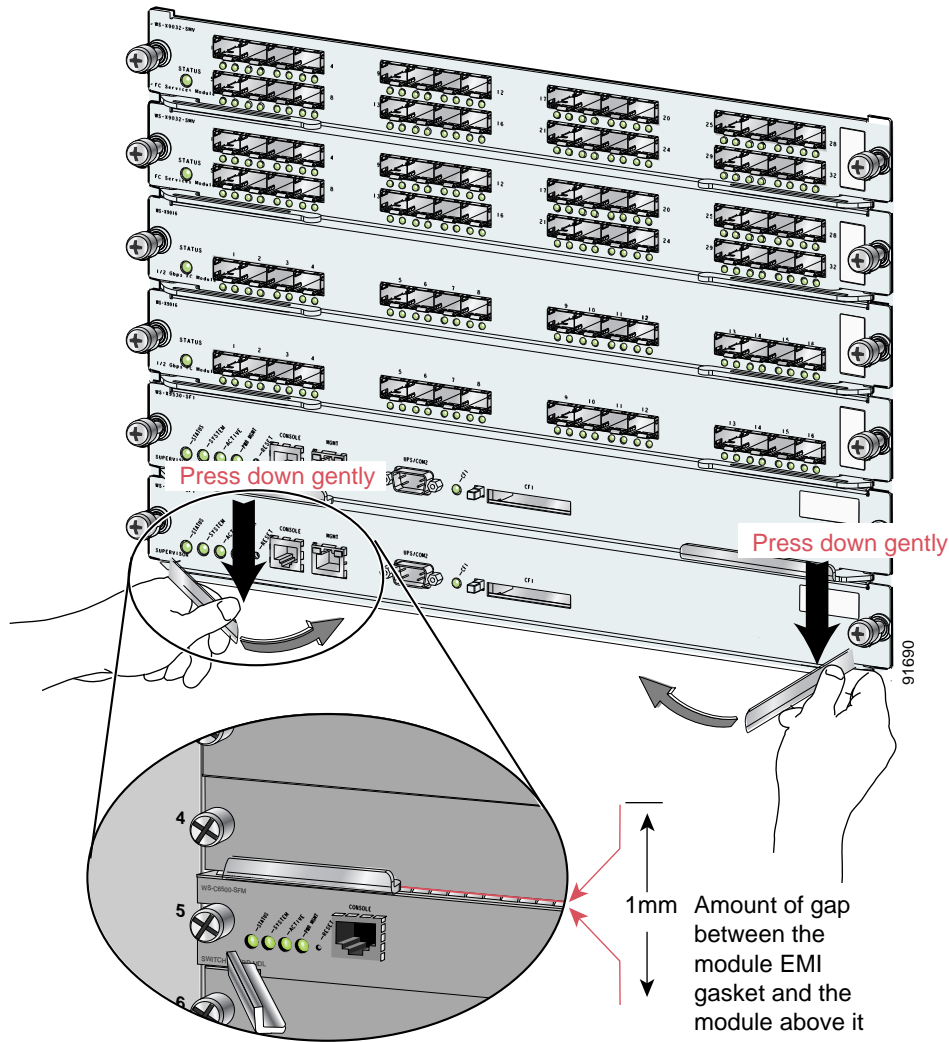
1	Slot guides	3	EMI Gasket
2	EMI Gasket	4	Ejector level (fully extended)

Step 6 Position the module in the chassis as follows:

- 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 1-23](#)).

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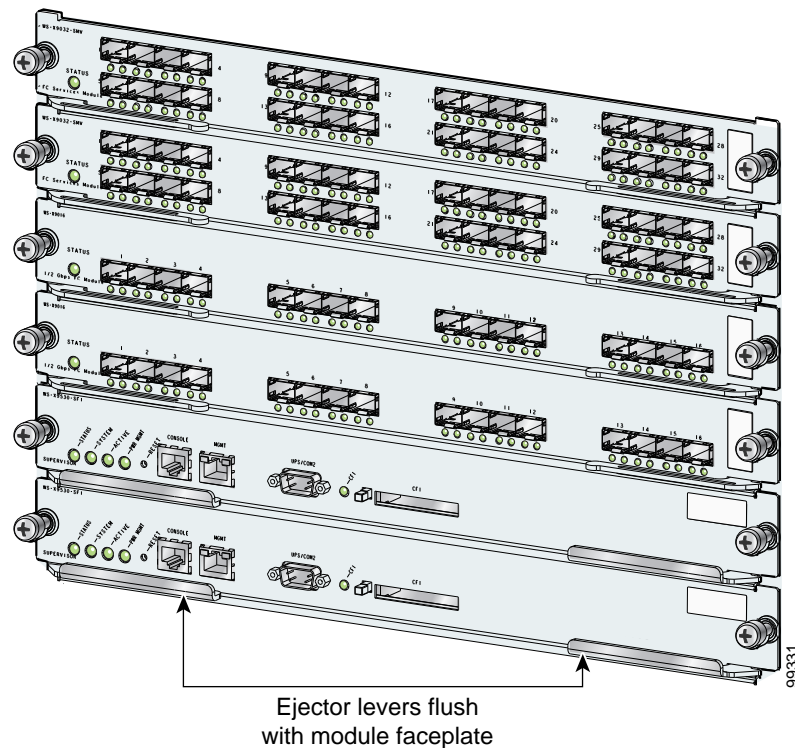
Figure 1-23 Clearing the EMI Gasket



- 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 1-24](#).)

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Figure 1-24 *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.

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 or NX-OS Release 4.1(1b), download the configuration from the server to the nonvolatile memory of the supervisor. *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide*.

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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, see the *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide*.
- Step 2** Ensure that 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 1-22 on page 1-41](#)) 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 the chassis dust-free and to 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

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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:
- Place your thumbs on the left and right ejector levers and simultaneously rotate the levers outward to unseat the module from the backplane connector.
 - 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 the chassis dust-free 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, Cisco recommends installing the chassis in the rack. See the [“Installing the Chassis in a Cabinet or Rack”](#) section on page 1-6.
- 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.

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- 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 1-45.
- Step 6** Open both the ejector levers on the new or replacement module completely. (See [Figure 1-22](#).)
- Step 7** Position the module in the chassis as follows:
- 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.
 - 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 1-23](#).)
 - 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 1-24](#).)



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

- 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.

- 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.
- 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 or NX-OS Release 4.1(1b), download the configuration from the server to the nonvolatile memory of the supervisor. For more information, see the *Cisco MDS 9000 Family NX-OS Fundamentals 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.

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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, see the *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide*.

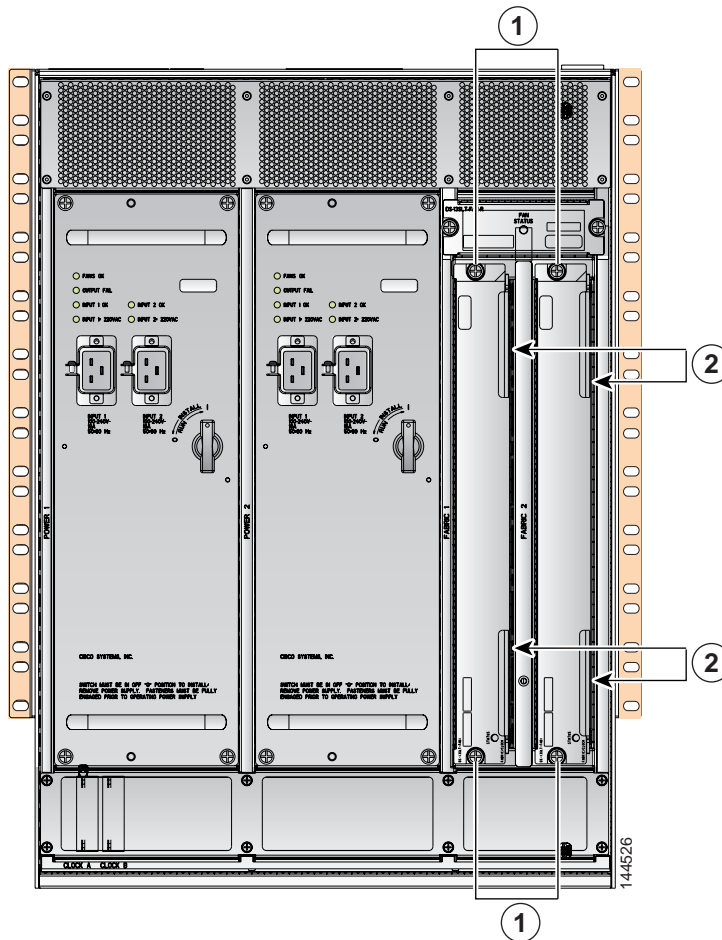
Removing and Installing a Crossbar Module

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** Shut down the crossbar module by using 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:
- 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 1-25](#).)
 - Hold the front edge of the module and slide the module partially out of the slot. Do not touch the module circuitry.

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Figure 1-25 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 the chassis dust-free 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

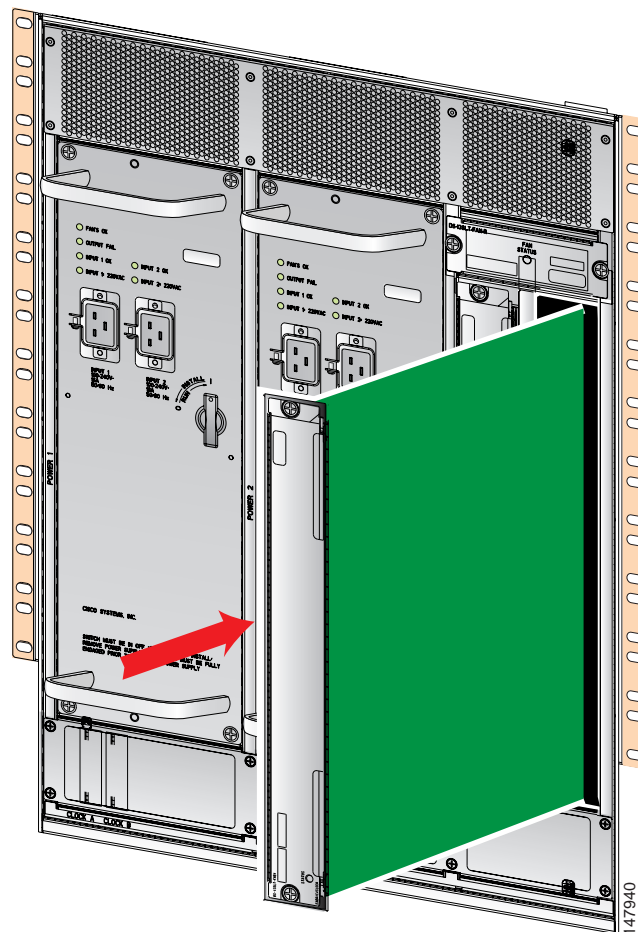
To install a crossbar module in the Cisco MDS 9513 Director, follow these steps:

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

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- Step 2** Open both the ejector levers on the new or replacement module completely.
- Step 3** Position the module in the chassis as follows:
- 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.
 - 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 1-26](#).)

Figure 1-26 *Installing the Crossbar Module*



- 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.

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

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**Note**

Ensure the ejector levers are completely closed before tightening the captive screws. Failure to completely 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 must be performed only 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, page 1-50](#)
- [Maintaining the Disk Drives on the Caching Services Module, page 1-51](#)

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 this message is displayed, 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 percent of capacity.

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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:

- [Removing and Installing the Power Supplies on the Cisco MDS 9513 Director, page 1-52](#)
- [Removing an AC Power Supply from the Cisco MDS 9513 Director, page 1-52](#)
- [Installing an AC Power Supply in the Cisco MDS 9513 Director, page 1-54](#)
- [Removing an AC Power Supply from the Cisco MDS 9509 Director, page 1-56](#)
- [Installing an AC Power Supply in the Cisco MDS 9509 Director, page 1-57](#)
- [Removing a DC Power Supply from the Cisco MDS 9509 Director, page 1-61](#)
- [Installing a DC Power Supply in the Cisco MDS 9509 Director, page 1-62](#)
- [Removing and Installing the PEMs on the Cisco MDS 9506 Director, page 1-64](#)
- [Removing an AC or DC Power Supply from the Cisco MDS 9506 Director, page 1-67](#)
- [Installing an AC or DC Power Supply in the Cisco MDS 9506 Director, page 1-67](#)

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.

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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



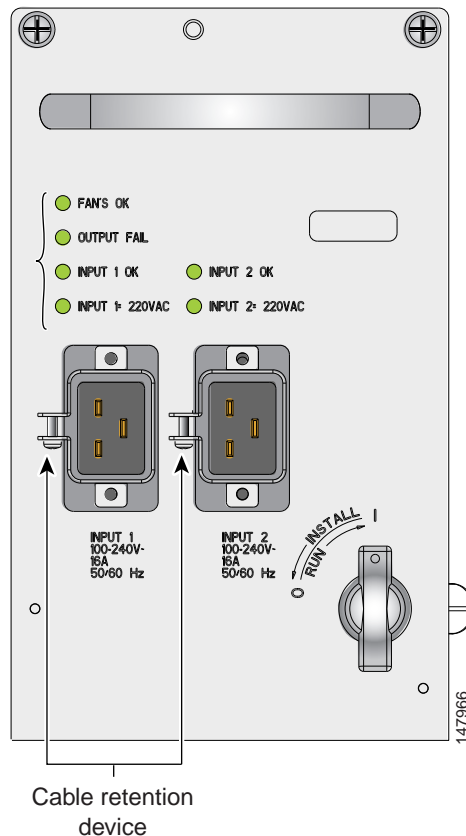
Warning

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 (O) 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 1-27 Cable Retention Device on the 6000W Power Supply



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

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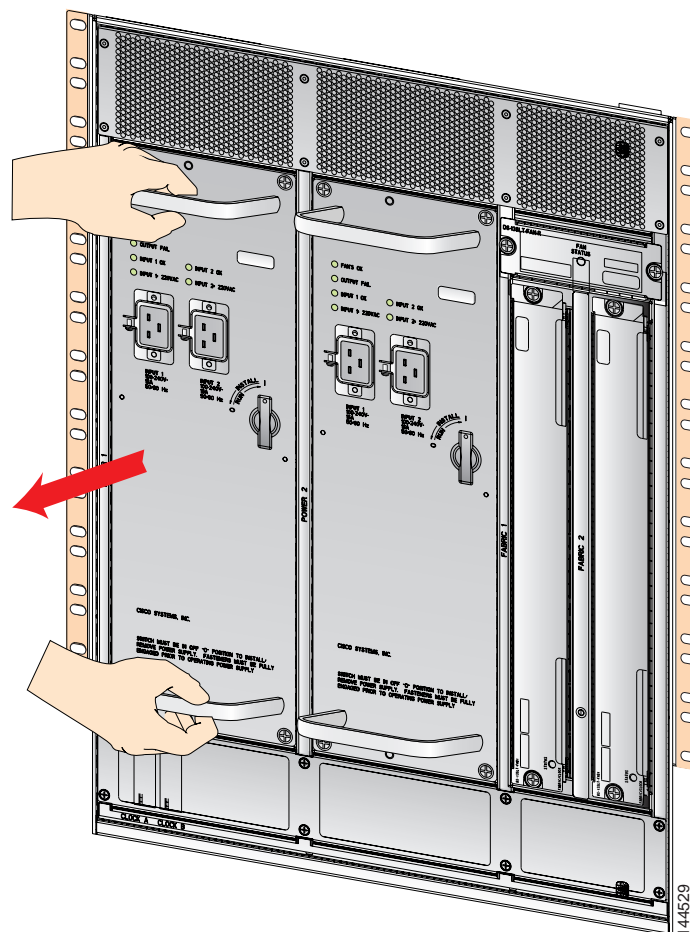
Caution Use both hands to install and remove power supplies. Each power supply weighs 34.2 lbs (15.5 kg).

- Step 5** Grasp the power supply handles and slide the power supply partially out of the chassis, about four to five inches. (See [Figure 1-28](#).)
- 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 1-28 *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 so that the weight of the unit will be fully supported once it is removed.

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**Caution**

To avoid damage to the panel fasteners, do not place the power supply down on the perforated ends. Place the power supply down on the flat sheet metal sides or on the two brackets found on the rear of the power 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 that has 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 power supply down on the flat sheet metal sides or on the two brackets found on the rear of the power 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 1-17](#).

Step 2

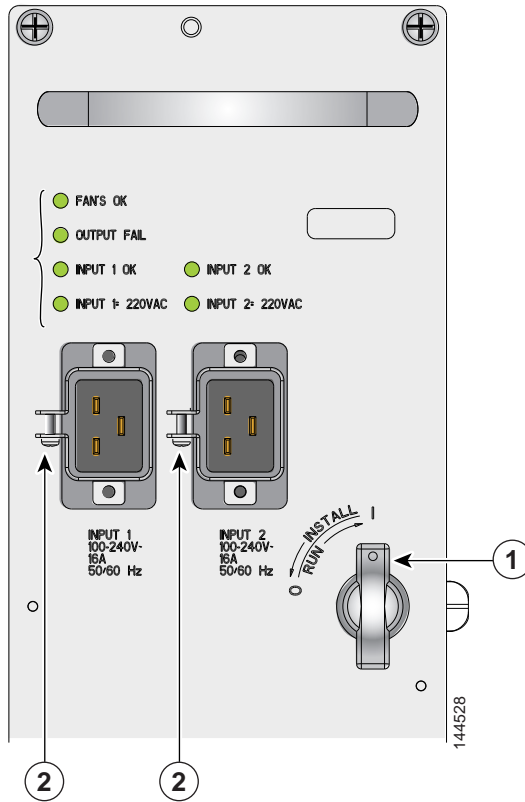
If a filler panel is installed, remove the filler panel from the power supply bay by loosening the captive screw.

Step 3

Ensure that the power switch is in the off (0) position on the power supply you are installing. (See [Figure 1-29](#).)

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Figure 1-29 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 that 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 (I) 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.

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See [Table 1-2 on page 1-11](#) 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 (O) 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 hardwired and cannot be removed from the power supply.

- Step 4** Loosen the captive screw.



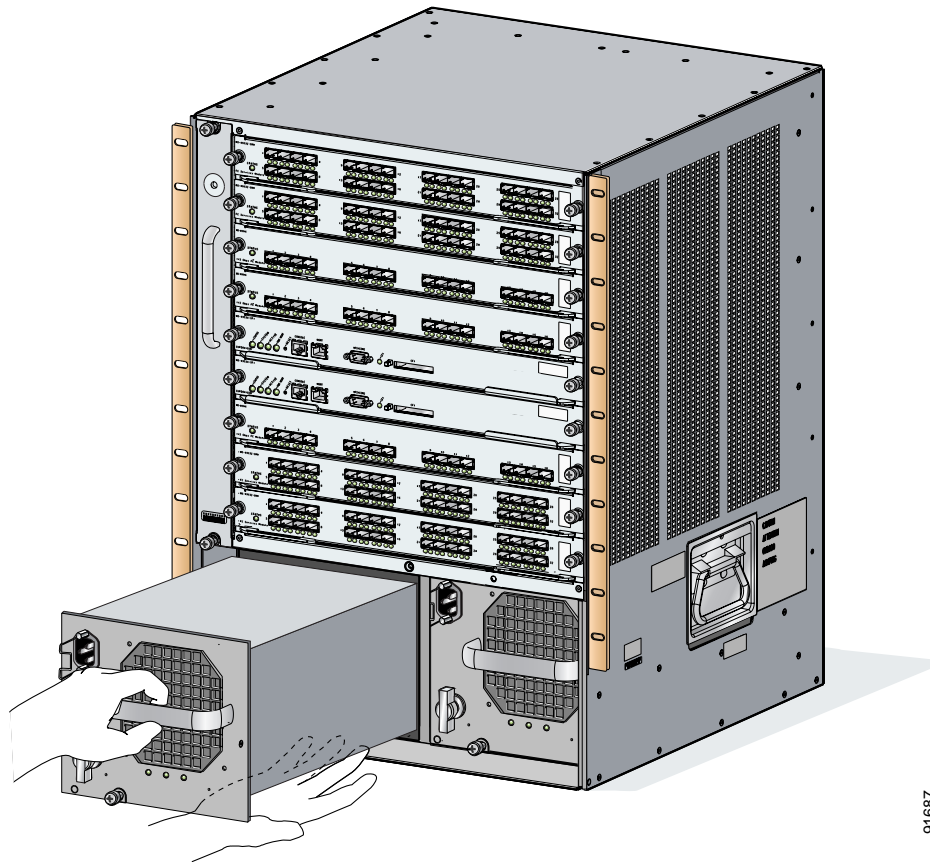
Caution

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 1-30](#), 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.

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Figure 1-30 Handling a Power Supply for the Cisco MDS 9509 Director



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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 that the power cable for the 4000-W power supply is hardwired 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).

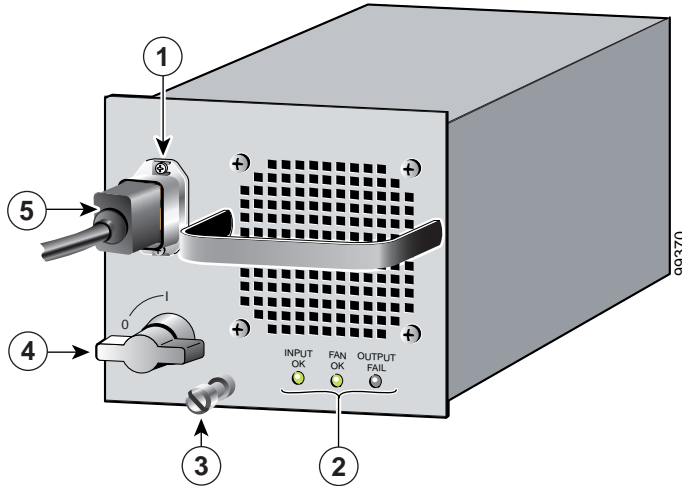
To install an AC power supply in the Cisco MDS 9509 Director, follow these steps:

- Step 1** Ensure that the system (earth) ground connection has been made. See the [“System Grounding” section on page 1-17](#).
- Step 2** If a filler panel is installed, remove the filler panel from the power supply bay by loosening the captive screw.

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- Step 3** Ensure that the power switch is in the off (0) position on the power supply you are installing. See [Figure 1-33](#) and [Figure 1-31](#) for the location of the switch.

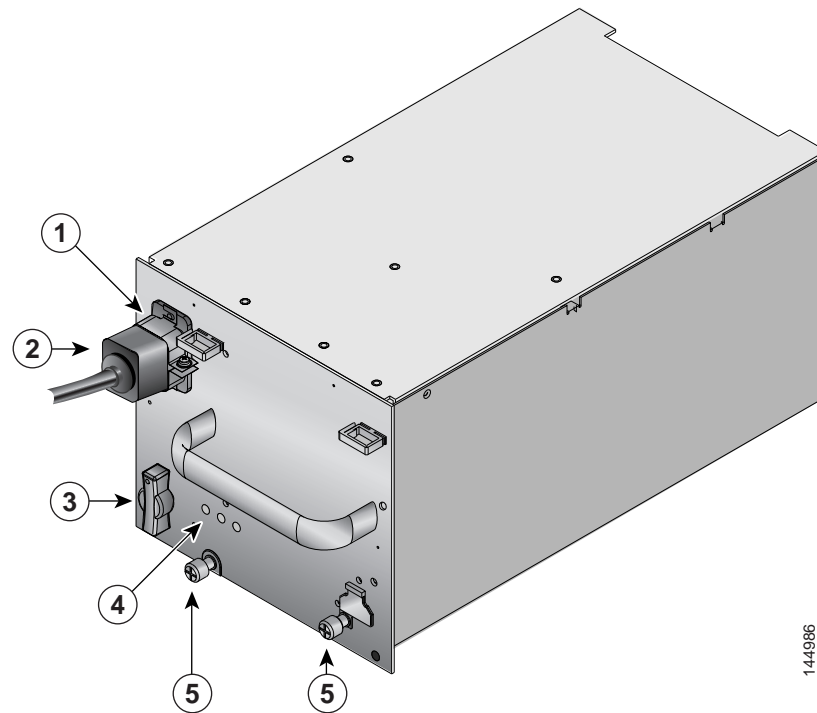
Figure 1-31 4000-W AC Power Supply for the Cisco MDS 9509 Director



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

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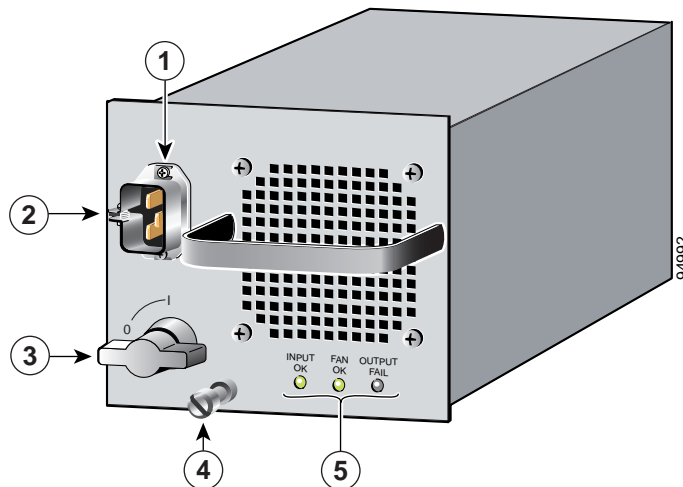
Figure 1-32 3000-W AC Power Supply for the Cisco MDS 9509 Director



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

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Figure 1-33 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 that the cable cannot be pulled out.



Note The AC power cable for the 4000-W power supply is hardwired 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 (I) 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 *Cisco MDS 9000 Family Troubleshooting Guide*. If you cannot resolve an issue, contact your customer service representative.

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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 1-34](#).)
- 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.

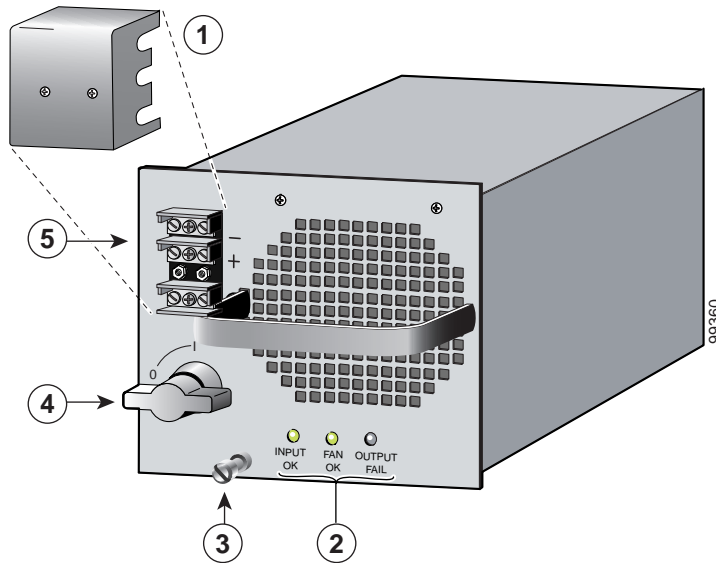


Warning

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

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Figure 1-34 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 [Figure 1-34](#), 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.

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

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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 1-28](#).

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

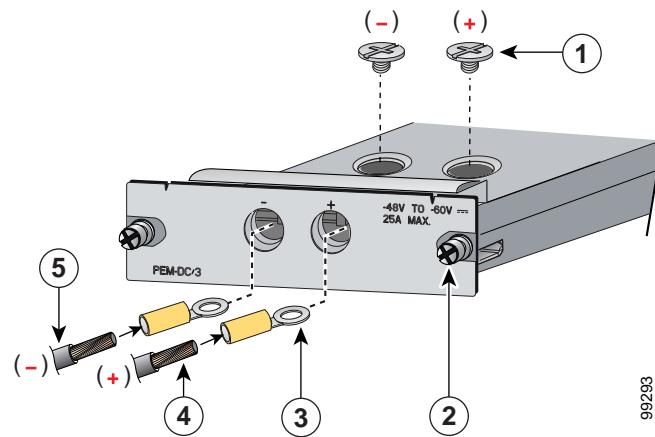
Before performing any of the following procedures, ensure that power is removed from the DC circuit. Statement 1003

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 1-35](#) for the location of the terminal block screws.

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Figure 1-35 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.

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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 1-17](#).
- 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 1-30](#).



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.

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 1-17](#).
- 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 1-34](#).
- 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.

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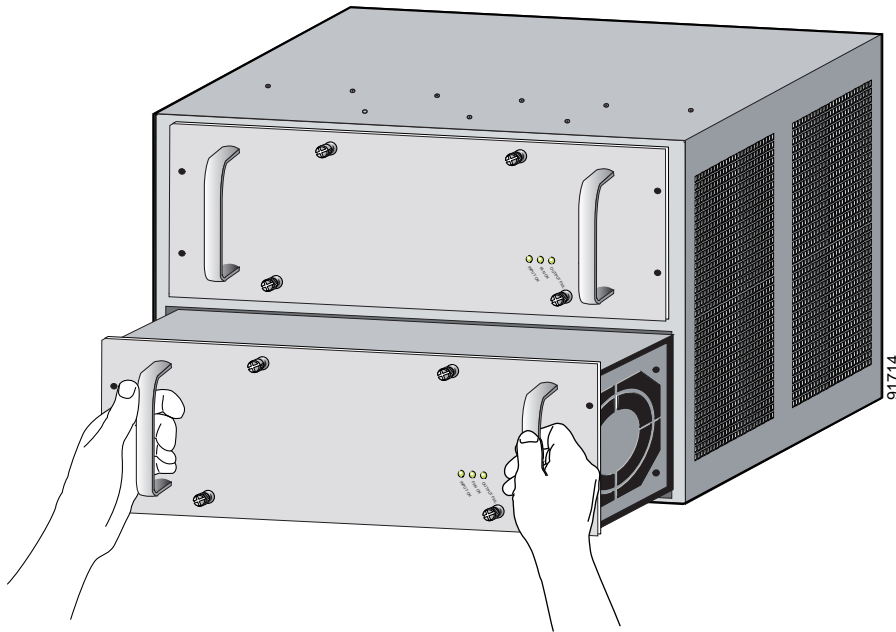
- OUTPUT FAIL LED is off.

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 1-64.
- Step 2** Loosen the captive screws on the power supply.
- Step 3** Grasp both power supply handles as shown in [Figure 1-36](#) and slide the power supply completely out of the chassis.

Figure 1-36 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:

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-
- Step 1** Ensure that the system (earth) ground connection has been made. See the “[System Grounding](#)” section on page 1-17.
- 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 1-28.



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.
-

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 after 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, Cisco recommends guiding the cables for the system out of the right side of the chassis.

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**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, page 1-69](#)
- [Installing a Front Fan Module on the Cisco MDS 9513 Director, page 1-70](#)
- [Removing the Crossbar Module Fan Tray, page 1-71](#)
- [Installing the Crossbar Module Fan Tray, page 1-72](#)
- [Removing a Front Fan Module on the Cisco MDS 9509 Director, page 1-73](#)
- [Installing a Front Fan Module on the Cisco MDS 9509 Director, page 1-73](#)
- [Removing a Front Fan Module on the Cisco MDS 9506 Director, page 1-74](#)
- [Installing a Front Fan Module on the Cisco MDS 9506 Director, page 1-74](#)

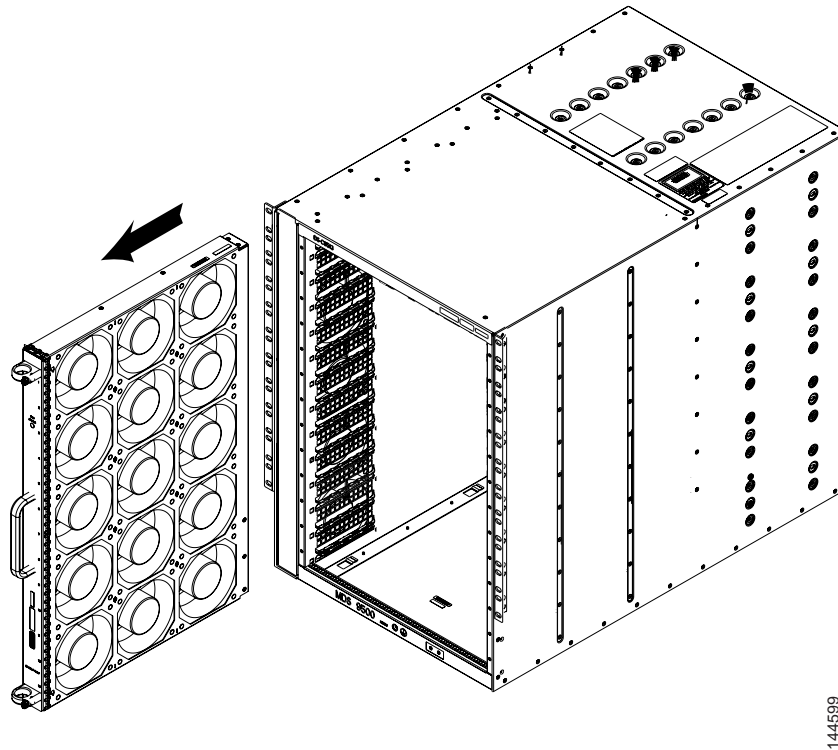
Removing a Front Fan Module on the Cisco MDS 9513 Director

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 1-37.](#))

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Figure 1-37 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 1-39](#).)
- 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 occurs, contact your customer service representative for a replacement part.

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**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/en/US/support/tsd_cisco_worldwide_contacts.html.

Removing the Crossbar Module Fan Tray

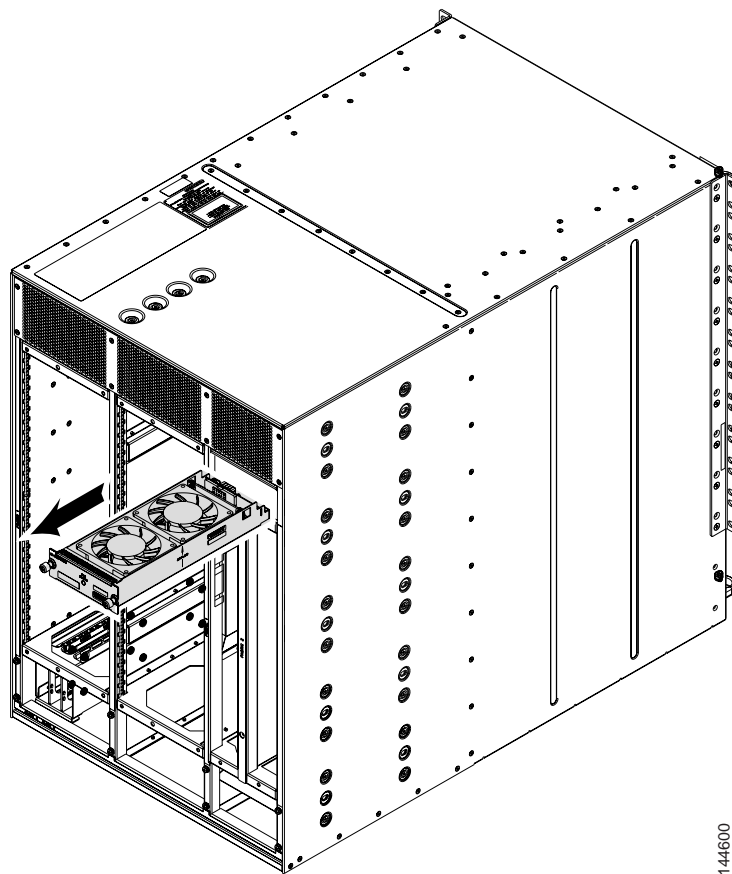
The crossbar module fan tray is designed to be removed and replaced while the system is operating without presenting an electrical hazard or damage to the system, provided the replacement is performed promptly. The crossbar module fan tray is used only in the Cisco MDS 9513 Director. It is installed 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 1-38](#).)

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Figure 1-38 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 1-38](#).)
 - b. Slide the module carefully into the slot until 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.
-

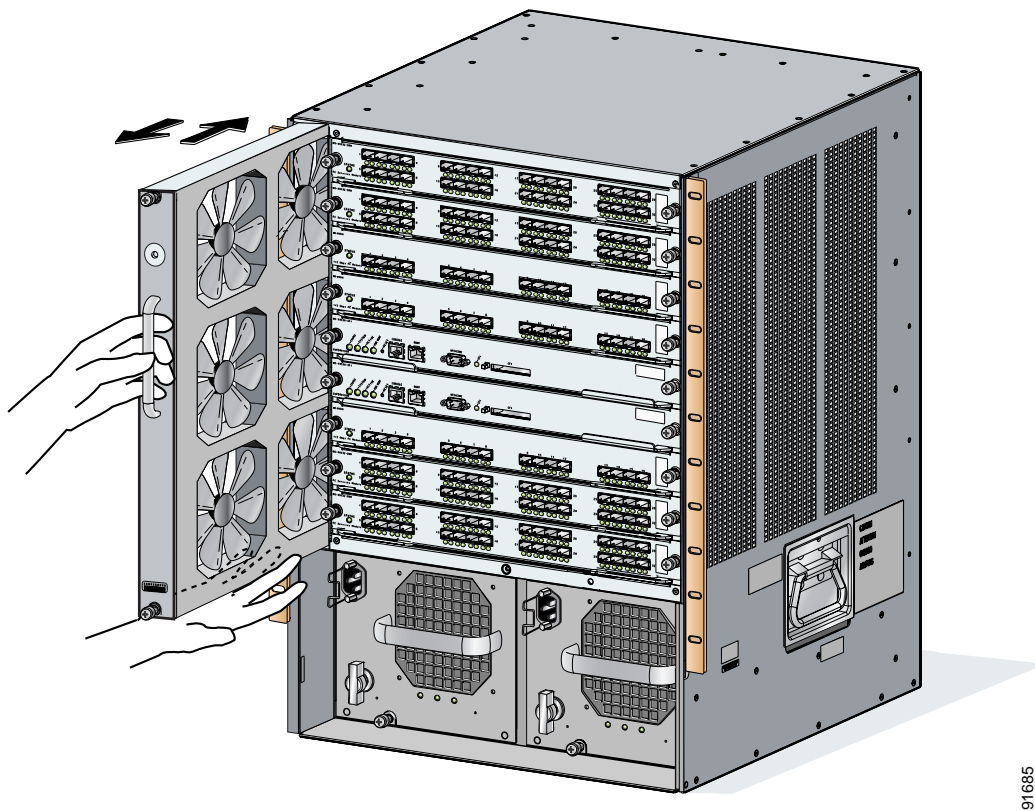
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Removing a Front Fan Module on the Cisco MDS 9509 Director

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 1-39](#)) by turning them counterclockwise; use 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 1-39 Handling the Fan Module for the Cisco MDS 9509 Director



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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 1-39](#).)
- 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.

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- 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 occurs, 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/en/US/support/tsd_cisco_worldwide_contacts.html.

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 1-39](#)) by turning them counterclockwise; use 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 occurs, contact your customer service representative for a replacement part.

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**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/en/US/support/tsd_cisco_worldwide_contacts.html.

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, see the *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide* or the *Cisco DCNM SAN Fundamentals 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, see the *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide* or the *Cisco DCNM SAN Fundamentals 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.

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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, Cisco recommends 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 1-77](#)
- [Installing a Clock Module into the Cisco MDS 9513 Director, page 1-79](#)
- [Removing a Clock Module from the Cisco MDS 9509 Director, page 1-80](#)
- [Installing a Clock Module into the Cisco MDS 9509 Director, page 1-83](#)
- [Removing a Clock Module from the Cisco MDS 9506 Director, page 1-83](#)
- [Installing a Clock Module into the Cisco MDS 9506 Director, page 1-86](#)

Before installing the clock module, check the contents of your kit. [Table 1-5](#) lists the contents of the clock module replacement kit, part number DS-C9513-CL.

Table 1-5 *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:

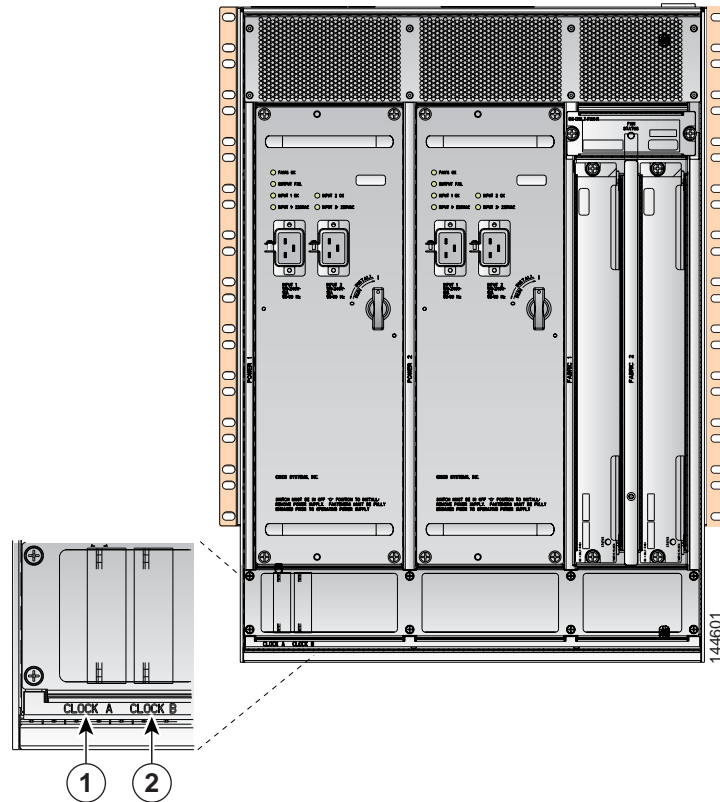
- Number 2 Phillips screwdriver
- Your own ESD-prevention equipment or the disposable grounding wrist strap included with all upgrade kits, field-replaceable units (FRUs), and spares

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Removing a Clock Module from the Cisco MDS 9513 Director

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 1-40](#) shows the clock modules in a rear view of the Cisco MDS 9513 Director with the back panel removed. Cisco recommends that the failed clock module be replaced during a maintenance window.

Figure 1-40 Clock Module Location on the Cisco MDS 9513 Director (Rear View)



1	Clock A (CLK A)	2	Clock B (CLK B)
---	-----------------	---	-----------------



Caution

Always wear 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.

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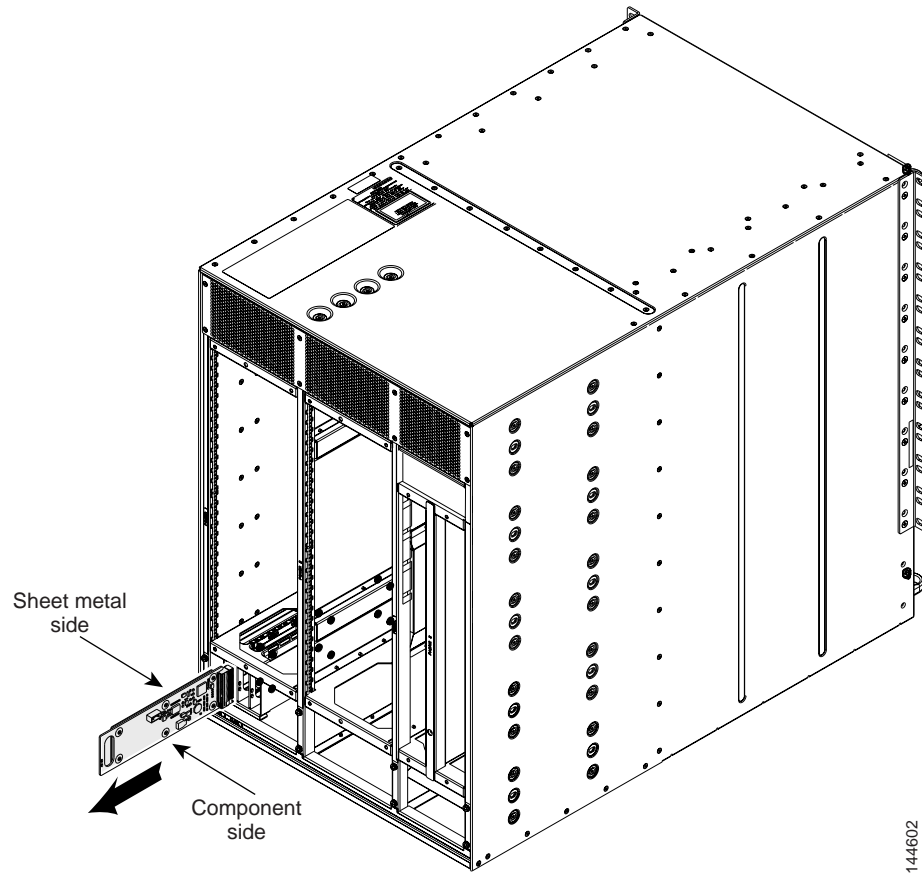


Note Note the position and orientation of the clock module before you remove it from the director chassis because you must install the new clock module in the same position.

Step 3 Verify the LEDs on the clock modules.

Step 4 Disconnect and gently remove the module, placing it on an antistatic mat or foam. (See [Figure 1-41](#).)

Figure 1-41 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.

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Installing a Clock Module into the Cisco MDS 9513 Director

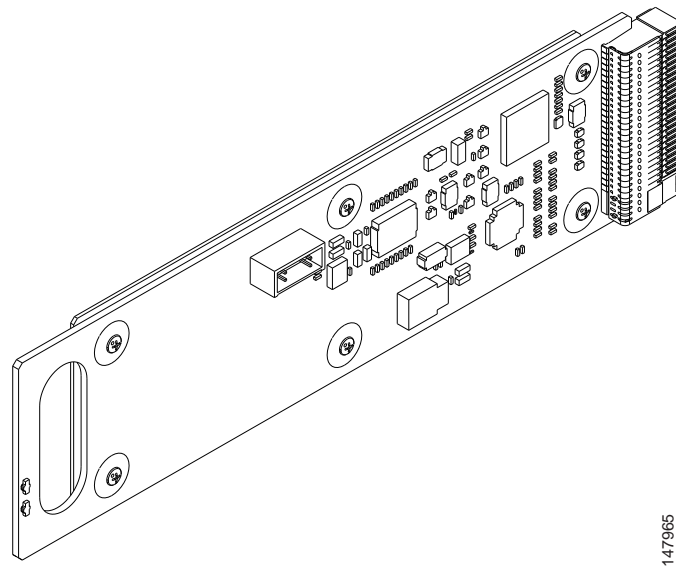
**Caution**

Always wear 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 (See [Figure 1-42](#)).
- Step 2** Hold the module with the backplane connectors away from you and the circuit board facing the right.

Figure 1-42 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 1-28](#).

**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.

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- OUTPUT FAIL LED is off.

Removing a Clock Module from the Cisco MDS 9509 Director

Before installing the clock module, check the contents of your kit. [Table 1-6](#) lists the contents of the clock module replacement kit, part number DS-C9509-CL=.

Table 1-6 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:

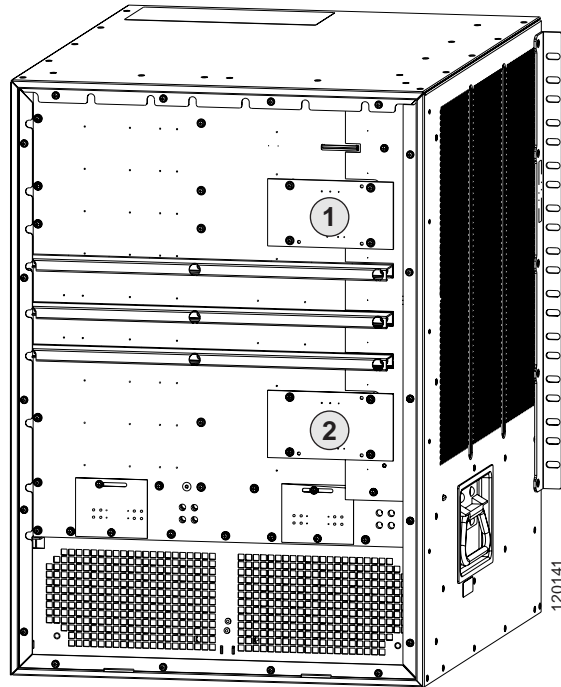
- Number 1 Phillips screwdriver
- Your own ESD-prevention equipment or the disposable grounding wrist strap included with all upgrade kits, field-replaceable units (FRUs), and spares

Clock modules are connected to the rear of the Cisco MDS 9509 Director using two connectors.

[Figure 1-43](#) shows the clock modules in a rear view of the Cisco MDS 9509 Director with the back panel removed.

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Figure 1-43 Clock Module Location on the Cisco MDS 9509 Director (Rear View)



Cisco MDS 9509

1	Clock A (CLK A)	2	Clock B (CLK B)
---	-----------------	---	-----------------



Caution

Always wear 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 1-33.



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.



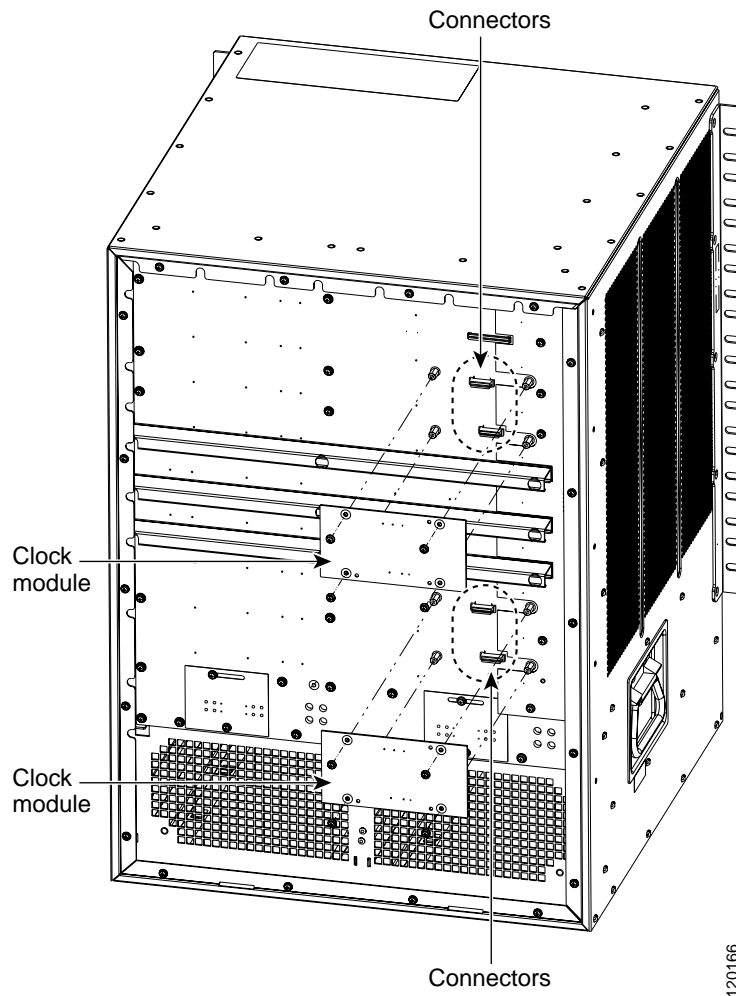
Note

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.

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Step 3 Remove the four screws that secure the clock module to the backplane. (See [Figure 1-44](#).)

Figure 1-44 Clock Module Replacement on the Cisco MDS 9509 Director (Rear View)



Step 4 Disconnect and gently 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.

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Installing a Clock Module into the Cisco MDS 9509 Director



Caution

Always wear 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 1-28](#).



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.

Removing a Clock Module from the Cisco MDS 9506 Director

Before replacing the clock module, check the contents of your kit. [Table 1-7](#) lists the contents of the clock module replacement kit, part number DS-C9506-CL=.

Table 1-7 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

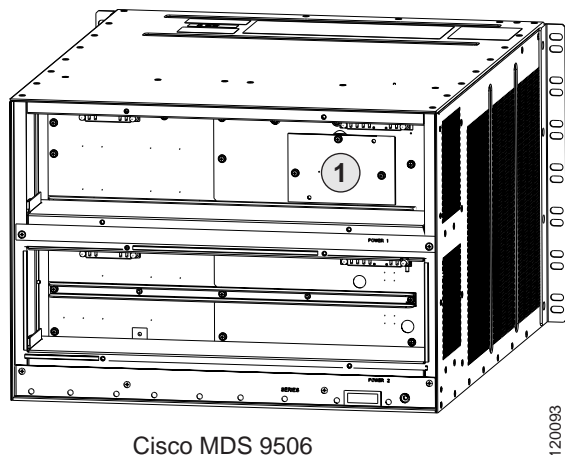
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These tools are required to remove and install a clock module:

- 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 1-45](#) shows the rear view of the Cisco MDS 9506 Director with both power supplies removed.

Figure 1-45 Clock Module Location on the Cisco MDS 9506 Director (Rear View)



1	Clock module
---	--------------



Caution

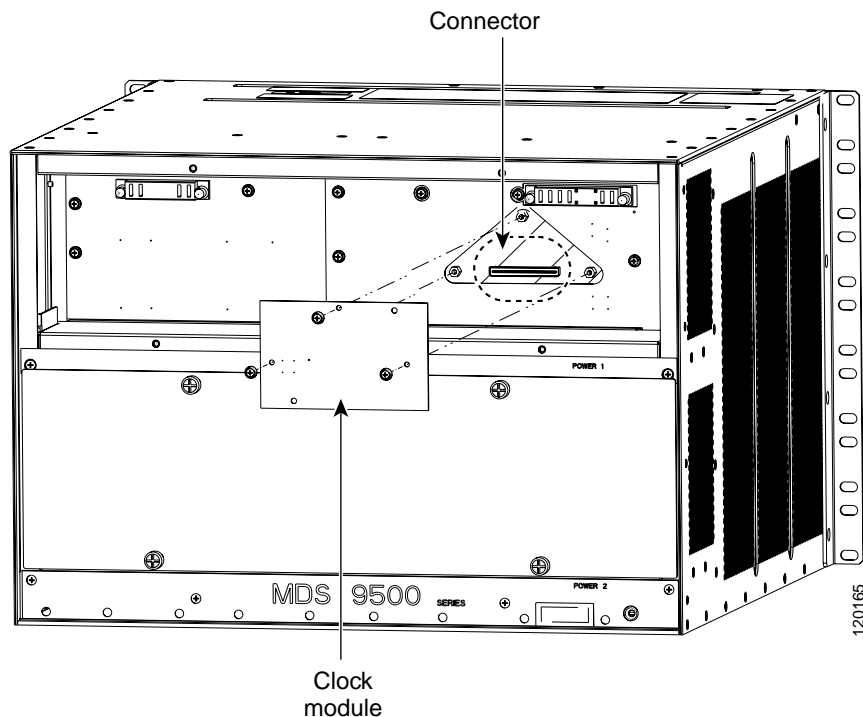
Always wear an ESD wrist strap when handling modules or coming into contact with internal components.

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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 1-64.
- 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 1-46](#)).

Figure 1-46 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.

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Installing a Clock Module into the Cisco MDS 9506 Director



Caution

Always wear 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.
-
- 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 1-28.



Note

You must install the new clock module in the same position that you removed it.



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.
-



Migrating to Generation 4 8-Gbps Advanced Fibre Channel Switching Modules

This appendix describes the tasks associated with preparing the Cisco MDS 9500 Series switches to support Generation 4 8-Gbps Advanced Fibre Channel switching modules.

This appendix includes the following sections:

- [Overview, page 1-1](#)
- [Usage Guidelines, page 1-2](#)
- [Migration Procedures for Generation 4 Modules, page 1-3](#)
- [Upgrading to Fabric 3 Module, page 1-9](#)

Overview

Cisco MDS NX-OS Release 5.2 supports the following Generation 4 8-Gbps Advanced Fibre Channel switch modules:

- Cisco MDS 9000 48-Port 8-Gbps Advanced Fibre Channel module (DS-X9248-256K9)
- Cisco MDS 9000 32-Port 8-Gbps Advanced Fibre Channel module (DS-X9232-256K9)

The Cisco MDS 8-Gbps Advanced Fibre Channel switching modules are supported on Cisco MDS 9513 Director, Cisco MDS 9509 Director, and Cisco MDS 9506 Director. On Cisco MDS 9513 Director, the Cisco MDS NX-OS Release 5.2 supports two fabric modules, which are also known as crossbar modules for the MDS 9513 Director:

- Cisco MDS 9513 Fabric 3 module, DS-13SLT-FAB3 (Generation-4 module)
- Cisco MDS 9513 Fabric 2 module, DS-13SLT-FAB2 (Generation-3 module)

The Cisco MDS 9513 Director runs on Cisco MDS NX-OS Release 5.2 and can use the Cisco MDS 9513 Fabric 2 or Cisco MDS 9513 Fabric 3 modules to support the Cisco MDS 9000 48-Port 8-Gbps Advanced Fibre Channel module and the Cisco MDS 9000 32-Port 8-Gbps Advanced Fibre Channel module. With the new Cisco MDS 9513 Fabric 3 module, the 8-Gbps Advanced modules in Cisco MDS 9513 Director will provide full 256-Gbps backplane bandwidth with complete connectivity. The modules do not lose any ports if one fabric card goes down. With the Cisco MDS 9513 Fabric 2 module, the 8-Gbps Advanced modules in Cisco MDS 9513 Director provide 96-Gbps backplane bandwidth.

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The Cisco MDS 9509 Director and the Cisco MDS 9506 Director also support the Generation 4 8-Gbps Advanced Fibre Channel switching modules. The switches require Supervisor-2A or Supervisor-2 modules and Cisco MDS NX-OS Release 5.2 or a later release to support the Generation 4 8-Gbps Advanced Fibre Channel switching modules. However, the Cisco MDS 9509 Director and the Cisco MDS 9506 Director support only up to 96-Gbps backplane bandwidth.

Usage Guidelines

In preparation for using the Cisco MDS 9513 Fabric 3 module and the Generation 4 8-Gbps Advanced Fibre Channel switching modules in an MDS 9513 Director, be aware of the following usage guidelines:

- MDS 9513 Fabric 3 module is supported only with Cisco NX-OS Release 5.2 or a later release.
- You cannot use any Generation 4 8-Gbps Advanced Fibre Channel module in a Cisco MDS 9513 Director, Cisco MDS 9509 Director, or Cisco MDS 9506 Director until you upgrade to Cisco NX-OS Release 5.2 or a later release.
- Supervisor-2 or Supervisor-2A modules are required for the Cisco MDS 9509 Director and the Cisco MDS 9506 Director to support any Generation 4 8-Gbps Advanced Fibre Channel Switching module.



Note Supervisor-2A module is required to support the Cisco MDS 9000 8-Port 10-Gbps FCoE module.

- Before installing the Cisco MDS 9000 8-Port 10-Gbps FCoE module or the Generation 4 8-Gbps Advanced Fibre Channel module, ensure that the configurations associated with LUN zoning, read-only zoning, and broadcast zoning are removed from the chassis. If you try to power up the modules with any one of the configurations present, the operation will fail.
- When a new Cisco MDS 9000 8-Port 10-Gbps FCoE module or the Generation 4 8-Gbps Advanced Fibre Channel module is installed in an existing chassis, and broadcast zoning is already enabled in any of the VSANs, the modules will not power up. You need to first disable broadcast zoning by entering the **no zone broadcast enable vsan** *vsan_id* command, and then power up the modules. To verify that broadcast zoning is enabled in the VSAN, enter the **show zone status vsan** *vsan_id* command.
- Although broadcast zoning is not completely deprecated in the Cisco NX-OS Release 5.2, the broadcast zoning configurations are disabled in the VSAN if the Cisco MDS 9000 8-Port 10-Gbps FCoE module or the Generation 4 8-Gbps Advanced Fibre Channel module is online in the chassis. If you change the zone mode to enhanced when either of these modules is online, broadcast zoning will not be enabled. When these modules are not online broadcast zoning is automatically enabled in the VSAN when you change the zone mode enhanced.
- You must do the following to increase the bandwidth capabilities of the Cisco MDS 9513 switch:
 - Upgrade to Cisco NX-OS Release 5.2 or a later release.
 - Migrate from the existing Cisco MDS 9513 Fabric 2 or Cisco MDS 9513 Fabric 1 modules in the Cisco MDS 9513 chassis to Cisco MDS 9513 Fabric 3 modules.
 - If needed, reload the switch to enable the increased bandwidth. A switch reload is not necessary for specific upgrades.
 - If you install the Cisco MDS 9513 Fabric 3 module, the active slot bandwidth of Cisco MDS 9513 Director is 256-Gbps.

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- Once you upgrade to Cisco NX-OS Release 5.2 or a later release, a downgrade to an earlier Cisco NX-OS release will be disruptive. Following the downgrade, the Generation 4 8-Gbps Advanced Fibre Channel Switching modules in the switch will not power up.

Table A-1 lists the types of Generation 4 modules that the Cisco MDS 9513 Director supports.

Table 1-1 *Module Support Matrix for the Cisco MDS 9513 Director*

Generation 4 Module	Fabric Module	Software Release
Cisco MDS 9000 48-port 8-Gbps Advanced Fibre Channel module (DS-X9248-256K9)	Cisco MDS 9513 Fabric 3 module	Cisco NX-OS Release 5.2 or a later release.
Cisco MDS 9000 32-port 8-Gbps Advanced Fibre Channel module (DS-X9232-256K9)	Cisco MDS 9513 Fabric 3 module	Cisco NX-OS Release 5.2 or a later release.

Migration Procedures for Generation 4 Modules

This section describes the steps to migrate to and begin using a Generation 4 8-Gbps Advanced Fibre Channel module. It includes the following sections:

- [Migrating to Cisco MDS 8-Gbps Advanced Fibre Channel Module, page 1-3](#)
- [Fabric Modes on the Cisco 9513 Director, page 1-4](#)
- [Migration Scenarios, page 1-4](#)

Migrating to Cisco MDS 8-Gbps Advanced Fibre Channel Module

To migrate to the Cisco MDS 9000 48-port 8-Gbps Advanced Fibre Channel module (DS-X9248-256K9) or to the Cisco MDS 9000 32-port 8-Gbps Advanced Fibre Channel module (DS-X9232-256K9), follow these steps:

-
- Step 1** Upgrade to Cisco MDS NX-OS Release 5.2 or a later release. Follow the correct upgrade path for your switch:
- From all 5.0(x) releases, you can upgrade directly to Cisco MDS NX-OS Release 5.2.
 - From all 4.2(x) and 4.1(x) releases, upgrade to any 5.0(x), release and then upgrade to NX-OS Release 5.2 or a later release.
 - From all SAN-OS 3.3(x) releases, upgrade to the latest NX-OS 4.x release, upgrade to any 5.0(x) release, and then upgrade to NX-OS Release 5.2 or a later release.
 - From all SAN-OS 3.2(x), 3.1(x), and 3.0(x) releases, upgrade to any 3.3(x) release, upgrade to the latest NX-OS Release 4.x, and then upgrade to any 5.0(x) release, and then upgrade to NX-OS Release 5.2 or a later release.
 - For additional upgrade paths from earlier releases, see the *Cisco MDS 9000 Release Notes for MDS NX-OS Release 5.2(1)*.
- Step 2** Install the Fabric 3 module in the Cisco MDS 9513 Director to use the full bandwidth capability of the 8-Gbps Advanced Fibre Channel modules. To install a Fabric 3 module, refer to the “[Upgrading to Fabric 3 Module](#)” section.

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Note The 256-Gbps bandwidth capability of the 8-Gbps Advanced Fibre Channel modules require the Fabric 3 module in the Cisco MDS 9513 Director.

- Step 3** Perform a switch reload. In certain migration scenarios a switch reload is required for the Cisco MDS 9513 Director to change to the fabric mode that supports the Generation 4 module.
- Step 4** Install the Cisco MDS 9000 48-port 8-Gbps Advanced Fibre Channel module (DS-X9248-256K9) or the Cisco MDS 9000 32-port 8-Gbps Advanced Fibre Channel module (DS-X9232-256K9).

Fabric Modes on the Cisco 9513 Director

A Cisco MDS 9513 Director supports two fabric modes:

- Database (DB) mode
- Bitmap (BM) mode

To determine the fabric mode on a Cisco MDS 9513 switch, enter the **show hardware fabric-mode** command. The following examples show the outputs for the two modes for Cisco NX-OS Release 5.2.

DB Mode:

```
switch# show hardware fabric-mode
Fabric mode supports FCoE, Gen2, and above linecards
```

BM Mode:

```
switch# sh hardware fabric-mode
Fabric mode supports only one configuration of Gen3 linecards - 4/44 host-optimized 8G
FC linecard
```

Migration Scenarios

The following sections describe different scenarios for migrating to a Generation 4 module, depending on the configuration and type of Cisco MDS 9500 Series switch. Use these examples as a guide to the process of upgrading to Generation 4 modules:

- [Cisco MDS 9513—Nondisruptive Upgrade Scenario from DB Fabric Mode, page 1-4](#)
- [Cisco MDS 9513— Upgrade Scenario from BM Fabric Mode, NX-OS Release 4.x, page 1-6](#)
- [Cisco MDS 9513— Upgrade Scenario from BM Fabric Mode, SAN-OS Release 3.x, page 1-7](#)
- [Cisco MDS 9509 or MDS 9506— Upgrade Scenario, Any NX-OS Release, page 1-8](#)

Cisco MDS 9513—Nondisruptive Upgrade Scenario from DB Fabric Mode

Current Configuration

- Currently installed release— Cisco NX-OS Release 5.0(x), Cisco NX-OS Release 4.2(x), or Cisco NX-OS Release 4.1(x). (See Step 1 or Step 2 for the exact upgrade path, depending on the release.)
 - Enter the **show version** command to determine the current version of the Cisco NX-OS release.
- Fabric module— Fabric 2

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- Enter the **show module xbar** command to show the current Fabric module. The following example shows the output of **show module xbar** command:

```
switch# show module xbar
Xbar  Ports  Module-Type                Model                Status
-----
1      0      Fabric Module 2             DS-13SLT-FAB2       ok
2      0      Fabric Module 2             DS-13SLT-FAB2       ok
```

- Currently installed switching modules— At least one 24-port or 48-port 8-Gbps Fibre Channel switching module.
 - Enter the **show module** command to display the currently installed modules.
- Current fabric mode— Supports 8-Gbps Fibre Channel modules.
 - Enter the **show hardware fabric-mode** command to verify the fabric mode. The following example shows the output of **show hardware fabric-mode** command:

```
switch# show hardware fabric-mode
Fabric mode supports 8G FC and above modules
```

Migration Steps

- Step 1** If you are running Cisco MDS NX-OS Release 5.0(x), then upgrade to Cisco MDS NX-OS Release 5.2. Refer to the upgrade procedure described in the *Cisco MDS 9000 Family NX-OS Software Upgrade Downgrade Guide*.
- Step 2** If you are running Cisco NX-OS Release 4.2(x) or Cisco NX-OS Release 4.1(x), then upgrade Cisco MDS NX-OS Release 5.0(x), and then upgrade to Cisco MDS NX-OS Release 5.2. Refer to the upgrade procedure described in the *Cisco MDS 9000 Family NX-OS Software Upgrade Downgrade Guide*.
- Step 3** Replace one of the fabric modules with a Fabric 3 module and wait for it to come online. See [Appendix 1, “Upgrading to Fabric 3 Module”](#) section for instructions. Enter the **show module xbar** command to verify that the module is online. The following example shows the output of **show module xbar** command:

```
switch# show module xbar
Xbar  Ports  Module-Type                Model                Status
-----
1      0      Fabric Module 3             DS-13SLT-FAB3       ok
2      0      Fabric Module 2             DS-13SLT-FAB2       ok
```



Note The coexistence of different Fabric Modules is supported only during the migration procedure.

- Step 4** Replace the other fabric module with a Fabric 3 module and wait for it to come online. Enter the **show module xbar** command to verify that the module is online. The following example shows the output of **show module xbar** command:

```
switch# show module xbar
Xbar  Ports  Module-Type                Model                Status
-----
1      0      Fabric Module 3             DS-13SLT-FAB3       ok
2      0      Fabric Module 3             DS-13SLT-FAB3       ok
```

- Step 5** Add an 8-Gbps Advanced Fibre Channel module or replace an existing switching module with an 8-Gbps Advanced Fibre Channel module. Enter the **show hardware fabric-mode** command to verify the fabric mode.

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The following example shows the output of **show hardware fabric-mode** command:

```
switch# show hardware fabric-mode
fabric mode supports FCoE, Gen2, and above linecards
```

Cisco MDS 9513— Upgrade Scenario from BM Fabric Mode, NX-OS Release 4.x

Current Configuration

- Currently installed release— Cisco NX-OS Release 4.2(x) or Release 4.1(x).
 - Enter the **show version** command to determine the current version of the Cisco NX-OS release.
- Fabric module— Fabric 1 or Fabric 2
 - Enter the **show module xbar** command to verify the current Fabric Module. The following example shows the output of **show module xbar** command:

```
switch# show module xbar
```

Xbar	Ports	Module-Type	Model	Status
1	0	Fabric Module 2	DS-13SLT-FAB2	ok
2	0	Fabric Module 2	DS-13SLT-FAB2	ok

- Currently installed switching modules— Cisco MDS 9000 4/44-port 8-Gbps Host Optimized Fibre Channel switching module, or any 1-, 2-, or 4-Gbps Fibre Channel switching module.
 - Enter the **show module** command to verify the current switching module.
- Current fabric mode— Supports 8-Gbps Fibre Channel modules.
 - Enter the **show hardware fabric-mode** command to verify the fabric mode. The following example shows the output of **show hardware fabric-mode** command:

```
switch# show hardware fabric-mode
Fabric mode supports only one configuration of 8G FC modules - 4/44 Host-Optimized 8G FC module.
```

Migration Steps

- Upgrade to any Cisco MDS NX-OS 5.0(x) release, and then upgrade to Cisco MDS NX-OS Release 5.2. Refer to the upgrade procedure described in the *Cisco MDS 9000 Family NX-OS Software Upgrade Downgrade Guide*.
- Replace both fabric modules with Fabric 3 modules. See [Appendix 1, “Upgrading to Fabric 3 Module”](#) section for instructions. The modules go into failure state until you reload the switch. Enter the **show module xbar** command to verify the status of the modules. The following example shows the output of **show module xbar** command, when the modules are in failure state:

```
switch# show module xbar
```

Xbar	Ports	Module-Type	Model	Status
1	0	Fabric Module 3	DS-13SLT-FAB3	failure
2	0	Fabric Module 3	DS-13SLT-FAB3	failure

```
Xbar Power-Status Reason
```

Xbar	Sw	Hw	World-Wide-Name(s) (WWN)
1	failure	Unknown.	Issue show system reset xbar ...
2	failure	Unknown.	Issue show system reset xbar ...

```
Xbar Sw Hw World-Wide-Name(s) (WWN)
```

1	NA	0.2	--
---	----	-----	----

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```

2      NA      0.2      --

Xbar  MAC-Address(es)      Serial-Num
---  -
1      NA      JAF1511BTFG
2      NA      JAF1511BTJ
* this terminal session
switch#

```

Step 3 Reload the switch. Enter the **reload** command.

Step 4 Verify the fabric mode. Enter the **show hardware fabric-mode** command to verify the fabric mode.

The following example shows the output of **show hardware fabric-mode** command:

```

switch# show hardware fabric-mode
fabric mode supports FCoE, Gen2, and above linecards

```

Step 5 Add an 8-Gbps Advanced Fibre Channel module or replace an existing switching module with an 8-Gbps Advanced Fibre Channel module.

Cisco MDS 9513— Upgrade Scenario from BM Fabric Mode, SAN-OS Release 3.x

Current Configuration

- Currently installed release— Cisco NX-OS Release 3.x (See Step 1 or Step 2 for the exact upgrade path, depending on the Release 3.x.)
 - Enter the **show version** command to verify the current version of the Cisco NX-OS release.
- Fabric module— Fabric 1 or Fabric 2
 - Enter the **show module xbar** command to verify the current Fabric Module. The following example shows the output of **show module xbar** command:

```

switch# show module xbar
Xbar  Ports  Module-Type      Model      Status
---  -
1      0      Fabric Module 2      DS-13SLT-FAB2      ok
2      0      Fabric Module 2      DS-13SLT-FAB2      ok

```

- Current fabric mode— Supports Cisco MDS 9000 4/44-port 8-Gbps Host Optimized Fibre Channel switching module.
 - Enter the **show hardware fabric-mode** command to verify the fabric mode. The following example shows the output of **show hardware fabric-mode** command:

```

switch# show hardware fabric-mode
Fabric mode supports only one configuration of 8G FC modules - 4/44 Host-Optimized 8G FC module.

```

Migration Steps

- Step 1** If you are running any Cisco SAN-OS Release 3.3(x), upgrade to the latest Cisco MDS NX-OS Release 4.x, then upgrade to any Cisco MDS NX-OS Release 5.0(x), and then upgrade to Cisco MDS NX-OS Release 5.2. Refer to the upgrade procedure described in the *Cisco MDS 9000 Family NX-OS Software Upgrade Downgrade Guide*.
- Step 2** If you are running any Cisco SAN-OS Release 3.2(x), 3.1(x), or 3.0(x), upgrade to Cisco SAN-OS Release 3.3(x), upgrade to the latest Cisco MDS NX-OS Release 4.x, then upgrade to any Cisco MDS NX-OS Release 5.0(x), and then upgrade to Cisco MDS NX-OS Release 5.2. Refer to the upgrade procedure described in the *Cisco MDS 9000 Family NX-OS Software Upgrade Downgrade Guide*.

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- Step 3** Replace both fabric modules with Fabric 3 modules. The modules go into failure state until you reload the switch. Enter the **show module xbar** command to verify the status of the modules. The following example shows the output of **show module xbar** command, when the modules are in failure state:

```
switch# show module xbar
Xbar Ports  Module-Type                               Model                Status
---  ---  ---
1      0      Fabric Module 3                                DS-13SLT-FAB3        failure
2      0      Fabric Module 3                                DS-13SLT-FAB3        failure
Xbar Power-Status Reason
---  ---  ---
1      failure      Unknown. Issue show system reset xbar ...
2      failure      Unknown. Issue show system reset xbar ...
Xbar Sw      Hw      World-Wide-Name(s) (WWN)
---  ---  ---
1      NA          0.2      --
2      NA          0.2      --
Xbar MAC-Address(es)                               Serial-Num
---  ---
1      NA          JAF1511BTFG
2      NA          JAF1511BTfJ
```

* this terminal session

switch#

- Step 4** Reload the switch.

- Step 5** Verify the fabric mode. Enter the **show hardware fabric-mode** command to verify the fabric mode.

The following example shows the output of **show hardware fabric-mode** command:

```
switch# show hardware fabric-mode
fabric mode supports FCoE, Gen2, and above linecards
```

- Step 6** Add an 8-Gbps Advanced Fibre Channel module or replace an existing switching module with an 8-Gbps Advanced Fibre Channel module.

Cisco MDS 9509 or MDS 9506— Upgrade Scenario, Any NX-OS Release

Migration Steps

- Step 1** Install a Supervisor-2 or Supervisor-2A module if one is not already installed.
- Step 2** Upgrade to Cisco MDS NX-OS Release 5.2. See the *Cisco MDS 9000 Release Notes for MDS NX-OS Release 5.2(1)* for supported software upgrade paths.
- Step 3** Reload the switch. Enter the **reload** command.
- Step 4** Add an 8-Gbps Advanced Fibre Channel module or replace an existing switching module with an 8-Gbps Advanced Fibre Channel module.
- Step 5** Verify the fabric mode. Enter the **show hardware fabric-mode** command to verify the fabric mode.

The following example shows the output of **show hardware fabric-mode** command:

```
switch# show hardware fabric-mode
fabric mode supports FCoE, Gen2, and above linecards
```


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Upgrading to Fabric 3 Module

Prior to upgrading, observe the following differences in the Cisco MDS 9513 Fabric 1, Cisco MDS 9513 Fabric 2, and Cisco MDS 9513 Fabric 3 modules:

- The Cisco MDS 9513 Fabric 1 module (DS-13SLT-FAB1) has a light-blue surface above the top-most captive screw on the front of the module.
- The Cisco MDS 9513 Fabric 2 module (DS-13SLT-FAB2) has a light-pink surface above the top-most captive screw on the front of the module.
- The Cisco MDS 9513 Fabric 3 module (DS-13SLT-FAB3) has a light-green surface above the top-most captive screw on the front of the module.

Upgrading to Fabric 3 Module can be performed depending upon the following scenarios:

- [Migrating from Fabric 2 Module \(DB Mode\) to Fabric 3 Module \(DB Mode\)](#)
- [Migrating from Fabric 2 Module \(BM Mode\) to Fabric 3 Module \(DB Mode\)](#)
- [Migrating from Fabric 1 Module \(BM Mode\) to Fabric 3 Module \(DB Mode\)](#)

Migrating from Fabric 2 Module (DB Mode) to Fabric 3 Module (DB Mode)

Examine the slots for the fabric modules at the rear of the Cisco MDS 9513 chassis. The left slot is marked Fabric 1 and the right slot is marked Fabric 2. The slot name does not have any significance in terms of which fabric module can be installed in it. The Cisco MDS 9513 Fabric 3 module (DS-13SLT-FAB3) can be installed in either slots.

To remove a Cisco MDS 9513 Fabric 2 module from the Cisco MDS 9513 Director and replace it with a Cisco MDS 9513 Fabric 3 module, follow these steps:



Note

Coexistence of Fabric Module-2 and Fabric Module-3 is supported only during the migration procedure.

- Step 1** Connect a PC to the console port on the active supervisor module and log in to the switch.
- Step 2** Upgrade to Cisco NX-OS Release 5.2. Refer to the upgrade procedure described in the *Cisco MDS 9000 Family NX-OS Software Upgrade Downgrade Guide*.
- Step 3** Save the running configuration. Enter the **copy running-configuration startup-configuration** command.
- Step 4** Shut down the fabric module in slot 2 by entering the **poweroff xbar 2** command.

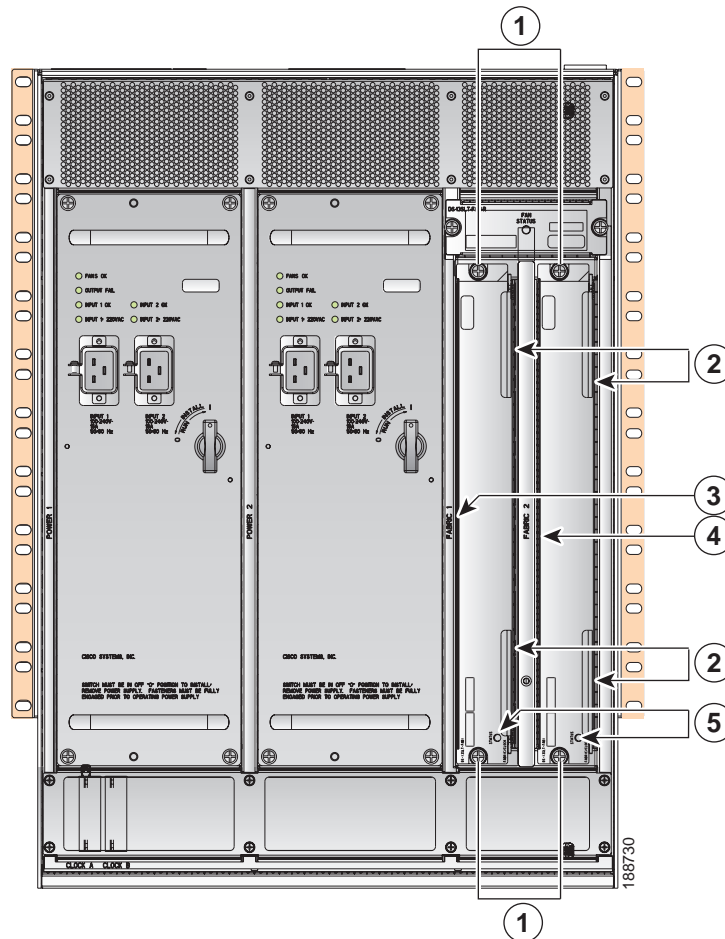
The following example shows how to shut down the standby supervisor and associated fabric module in slot 2:

switch(config)# **poweroff xbar 2**
switch(config)#
- Step 5** Enter the **show module xbar** command to verify that the module is powered down.
- Step 6** Attach a ESD wrist strap according to the instructions in the [“Preventing Electrostatic Discharge Damage” section on page 1-19](#).
- Step 7** Confirm that the power LED is red, which indicates that the modules are powered off, and then loosen the two captive screws on the module being removed. See [Figure 1-1](#).

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- Step 8** Remove the module from the chassis as follows:
- Place your thumbs on the top and bottom ejector levers and simultaneously rotate the levers outward to unseat the module from the midplane connector.
 - Hold the front edge of the module and slide the module partially out of the slot. Do not touch the module circuitry.

Figure 1-1 Captive Screws and Ejector Levers on the Fabric Module



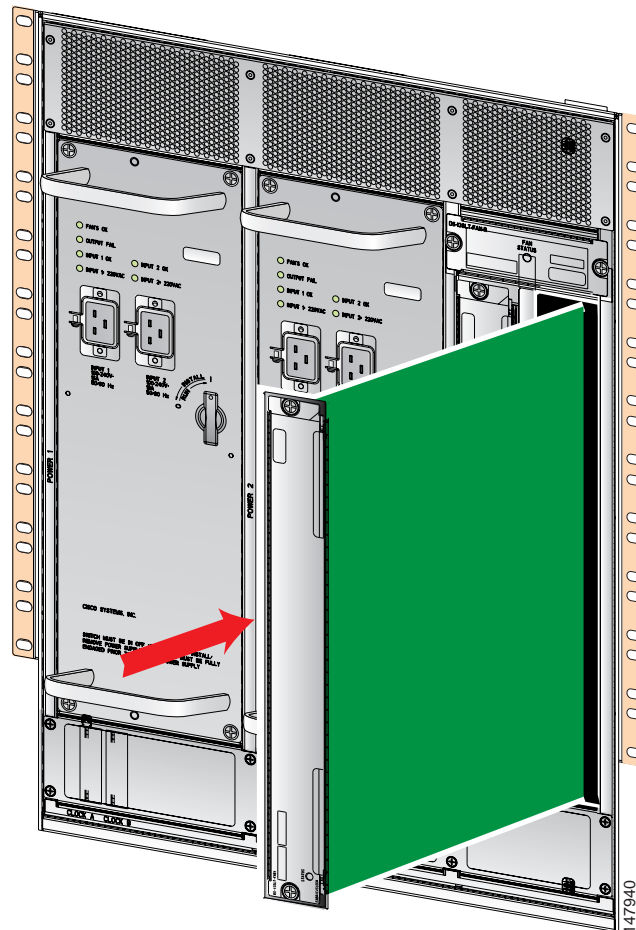
1	Captive screws	4	Fabric slot 2 label
2	Ejector levers	5	Power LEDs
3	Fabric slot 1 label		

- Step 9** Place the Cisco MDS 9513 Fabric 2 module on an antistatic surface.
- Step 10** On the Cisco MDS 9513 Fabric 3 module to be installed, ensure that the ejector levers are completely open.
- Step 11** Position the Cisco MDS 9513 Fabric 3 module in the chassis as follows (See [Figure 1-2](#)):
- Position the module in the empty slot. Ensure that you align the sides of the module carrier with the slot guides on each side of the slot.

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- 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.

Figure 1-2 *Installing a Fabric 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 completely seat the module in the midplane connector. The ejector levers are completely closed when they are flush with the front of the module.



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

- e. Tighten the two captive screws on the module until they are finger tight.

Step 12 Power up the Fabric 3 module. Enter the **no poweroff xbar 2** command.

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```
switch(config)# no poweroff xbar 2
switch(config)#
```

Step 13 Wait for sometime for the LED to turn green, if it does not, check to see if the module is seated correctly in the slot. When the power LED on the front of the module is green, enter the **show module xbar** command to verify if the Fabric 3 module has powered up.

Step 14 Enter the **poweroff xbar 1** command to shut down the fabric module in slot 1.

Step 15 Perform the steps 6 through 11 to replace the fabric module.

Step 16 Power up the Fabric 3 module. Enter the **no poweroff xbar 1** command.

```
switch(config)# no poweroff xbar 1
switch(config)#
```

Step 17 Wait for the Fabric 3 module to come online. Enter the **show module xbar** command to verify if the Fabric 3 module has powered up.

The following example shows the output of the **show module xbar** command, which indicates that the fabric modules have been installed successfully:

```
switch# show module xbar
Xbar  Ports  Module-Type                      Model                      Status
---  -
1      0      Fabric Module 3                    DS-13SLT-FAB3             ok
2      0      Fabric Module 3                    DS-13SLT-FAB3             ok
```

Step 18 Verify the fabric mode by entering the **show hardware fabric-mode** command. For example:

```
switch# show hardware fabric-mode
Fabric mode supports FCoE, Gen2, and above linecards
```

Step 19 Insert the Generation 4 8-Gbps Advanced Fibre Channel modules.

Step 20 Enter the **show module** command to verify that the system can detect the Generation 4 8-Gbps Advanced Fibre Channel modules.

```
switch# show module
Mod  Ports  Module-Type                      Model                      Status
---  -
1      48      1/2/4/8/10 Gbps Advanced FC Module DS-X9248-256K9             ok
2      16      16x1GE, Storage Services Node       DS-X9316-SSNK9             ok
3      22      4x1GE IPS, 18x1/2/4Gbps FC Module   DS-X9304-18K9              ok
4      48      1/2/4/8 Gbps FC Module              DS-X9248-96K9              ok
5      32      1/2/4/8/10 Gbps Advanced FC Module   DS-X9232-256K9             ok
6      48      1/2/4/8 Gbps FC Module              DS-X9248-96K9              ok
7      0        Supervisor/Fabric-2a                 DS-X9530-SF2AK9            active *
8      0        Supervisor/Fabric-2a                 DS-X9530-SF2AK9            ha-standby
9      12      1/2/4 Gbps FC Module                DS-X9112                   ok
10     8        10 Gbps FCoE Module                 DS-X9708-K9                ok
11     8        10 Gbps FCoE Module                 DS-X9708-K9                ok
12     48      1/2/4/8 Gbps FC Module              DS-X9248-96K9              ok
13     8        10 Gbps FCoE Module                 DS-X9708-K9                ok
Mod  Sw      Hw      World-Wide-Name(s) (WWN)
---  -
1      5.2(1)  0.2101  20:01:00:0d:ec:b6:d7:40 to 20:30:00:0d:ec:b6:d7:40
2      5.2(1)  1.2     --
3      5.2(1)  1.4     20:81:00:0d:ec:b6:d7:40 to 20:92:00:0d:ec:b6:d7:40
4      5.2(1)  1.1     20:c1:00:0d:ec:b6:d7:40 to 20:f0:00:0d:ec:b6:d7:40
5      5.2(1)  0.2101  21:01:00:0d:ec:b6:d7:40 to 21:20:00:0d:ec:b6:d7:40
6      5.2(1)  1.1     21:41:00:0d:ec:b6:d7:40 to 21:70:00:0d:ec:b6:d7:40
7      5.2(1)  1.7     --
8      5.2(1)  1.1     --
9      5.2(1)  1.0     22:01:00:0d:ec:b6:d7:40 to 22:0c:00:0d:ec:b6:d7:40
10     5.2(1)  0.107   --
11     5.2(1)  0.109   --
12     5.2(1)  1.1     22:c1:00:0d:ec:b6:d7:40 to 22:f0:00:0d:ec:b6:d7:40
13     5.2(1)  0.107   --
```

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```

Mod  MAC-Address(es)                               Serial-Num
---  -
1    00-31-42-54-44-50 to 00-31-42-54-44-54 JAF1511BTDP
2    00-23-eb-4e-ec-14 to 00-23-eb-4e-ec-28 JAE14130EFB
3    00-24-c4-5f-ee-cc to 00-24-c4-5f-ee-d4 JAE14130397
4    00-0d-ec-75-96-a0 to 00-0d-ec-75-96-a4 JAE1324BXRI
5    00-30-43-45-45-52 to 00-30-43-45-45-56 JAF1510CEER
6    00-0d-ec-75-97-bc to 00-0d-ec-75-97-c0 JAE1324C6QE
7    00-23-5e-9a-53-74 to 00-23-5e-9a-53-78 JAE1326D90X
8    00-23-eb-4f-64-2c to 00-23-eb-4f-64-30 JAF1442EPQF
9    00-14-a9-74-ec-a8 to 00-14-a9-74-ec-ac JAB1002005H
10   68-ef-bd-a8-33-58 to 68-ef-bd-a8-33-6c JAF1440CDBF
11   68-ef-bd-a8-3a-d8 to 68-ef-bd-a8-3a-ec JAF1444AGMF
12   00-13-80-a8-ef-70 to 00-13-80-a8-ef-74 JAE130313RS
13   68-ef-bd-a8-31-28 to 68-ef-bd-a8-31-3c JAF1440CCST

Xbar  Ports  Module-Type                               Model                               Status
---  -
1     0      Fabric Module 3                          DS-13SLT-FAB3                       ok
2     0      Fabric Module 3                          DS-13SLT-FAB3                       ok

Xbar  Sw      Hw      World-Wide-Name(s) (WWN)
---  -
1     NA      0.305  --
2     NA      0.4    --

Xbar  MAC-Address(es)                               Serial-Num
---  -
1     NA      JAF1429FDGB
2     NA      JAF1453BDBL

* this terminal session
switch#

```



Note

If you are already running Gen4 cards on Fab2, the same steps hold good for Fab-2 to 3 upgrade process. The only caveat is, until the Fab is upgraded to Fab3, the Gen4 cards would not be able to deliver 256Gig and would offer only 96Gig per slot bandwidth.

Migrating from Fabric 2 Module (BM Mode) to Fabric 3 Module (DB Mode)

Examine the slots for the fabric modules at the rear of the Cisco MDS 9513 chassis. The left slot is marked Fabric 1 and the right slot is marked Fabric 2. The slot name does not have any significance in terms of which fabric module can be installed in it. The Cisco MDS 9513 Fabric 3 module (DS-13SLT-FAB3) can be installed in either slots.

To remove a Cisco MDS 9513 Fabric 2 module from the Cisco MDS 9513 Director and replace it with a Cisco MDS 9513 Fabric 3 module, follow these steps:

- Step 1** Connect a PC to the console port on the active supervisor module and log in to the switch.
- Step 2** Upgrade to Cisco NX-OS Release 5.2. Refer to the upgrade procedure described in the *Cisco MDS 9000 Family NX-OS Software Upgrade Downgrade Guide*.
- Step 3** Save the running configuration. Enter the **copy running-configuration startup-configuration** command.

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Step 4 Shut down the fabric modules one by one, by entering the **poweroff xbar slot** command.

```
switch(config)# poweroff xbar 1  
switch(config)#
```

Step 5 Enter the **show module xbar** command to verify that the module is powered down.

Step 6 Attach a ESD wrist strap according to the instructions in the [“Preventing Electrostatic Discharge Damage” section on page 1-19](#).

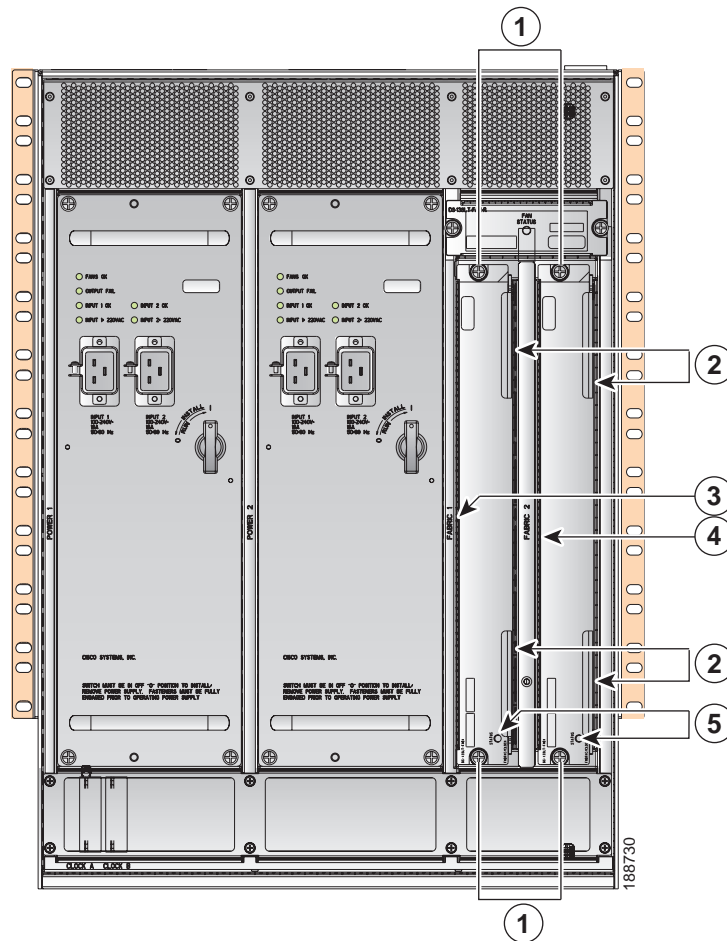
Step 7 Confirm that the power LED is red, which indicates that the modules are powered off, and then loosen the two captive screws on the module being removed. See [Figure 1-3](#).

Step 8 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.
- b. Hold the front edge of the module and slide the module partially out of the slot. Do not touch the module circuitry.

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Figure 1-3 Captive Screws and Ejector Levers on the Fabric Module

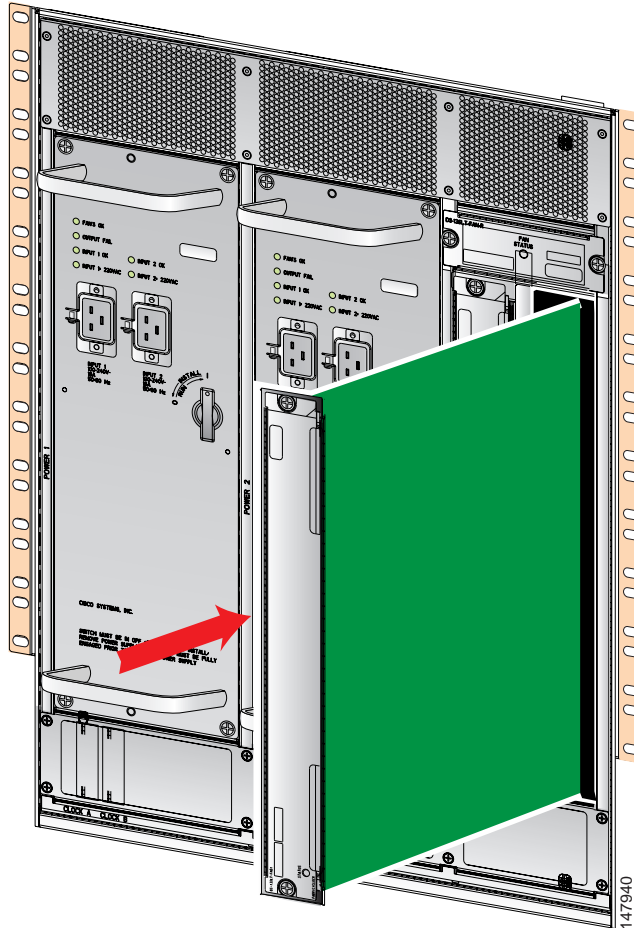


1	Captive screws	4	Fabric slot 2 label
2	Ejector levers	5	Power LEDs
3	Fabric slot 1 label		

- Step 9** Place the Cisco MDS 9513 Fabric 2 module on an antistatic surface.
- Step 10** On the Cisco MDS 9513 Fabric 3 module to be installed, ensure that the ejector levers are completely open.
- Step 11** Position the Cisco MDS 9513 Fabric 3 module in the chassis as follows (See [Figure 1-4](#)):
- Position the module in the empty slot. Ensure that you align the sides of the module carrier with the slot guides on each side of the slot.
 - 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.

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Figure 1-4 Installing a Fabric 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 completely seat the module in the midplane connector. The ejector levers are completely closed when they are flush with the front of the module.



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

- e. Tighten the two captive screws on the module until they are finger tight.

Step 12 Perform the steps 6 through 11 to replace the Fabric Modules in both the slots.

Step 13 Power up each Fabric 3 module by entering the following commands:

```
switch(config)# no poweroff xbar 1
switch(config)# no poweroff xbar 2
```


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The modules will go into failure state. The power LED on the front panel will be red. To verify the status of the fabric module enter the **show module xbar** command:

```
switch# show module xbar
Xbar Ports  Module-Type                               Model                               Status
---
1      0      Fabric Module 3                               DS-13SLT-FAB3                       failure
2      0      Fabric Module 3                               DS-13SLT-FAB3                       failure
Xbar Power-Status Reason
---
1      failure      Unknown. Issue show system reset xbar ...
2      failure      Unknown. Issue show system reset xbar ...
Xbar Sw      Hw      World-Wide-Name(s) (WWN)
---
1      NA      0.2      --
2      NA      0.2      --
Xbar MAC-Address(es)                               Serial-Num
---
1      NA
2      NA
JAF1511BTFG
JAF1511BTfJ
* this terminal session
switch#
```

Step 14 Reload the switch. Enter the **reload** command.

Step 15 Enter the **show module xbar** command to confirm that the fabric modules are active.

```
switch# show module xbar
Xbar Ports  Module-Type                               Model                               Status
---
1      0      Fabric Module 3                               DS-13SLT-FAB3                       ok
2      0      Fabric Module 3                               DS-13SLT-FAB3                       ok
```

Step 16 Verify the fabric mode by entering the **show hardware fabric-mode** command. For example:

```
switch# show hardware fabric-mode
Fabric mode supports FCoE, Gen2, and above linecards
```

Step 17 Insert the Cisco MDS 9000 Generation 4 8-Gbps Advanced Fibre Channel modules.

Step 18 Enter the **show module xbar** command to verify that the system can detect the Cisco MDS 9000 Generation 4 8-Gbps Advanced Fibre Channel modules and that they are up.

```
switch# show module
Mod  Ports  Module-Type                               Model                               Status
---
1      48      1/2/4/8/10 Gbps Advanced FC Module       DS-X9248-256K9                      ok
2      16      16x1GE, Storage Services Node             DS-X9316-SSNK9                      ok
3      22      4x1GE IPS, 18x1/2/4Gbps FC Module         DS-X9304-18K9                      ok
4      48      1/2/4/8 Gbps FC Module                    DS-X9248-96K9                      ok
5      32      1/2/4/8/10 Gbps Advanced FC Module       DS-X9232-256K9                      ok
6      48      1/2/4/8 Gbps FC Module                    DS-X9248-96K9                      ok
7      0      Supervisor/Fabric-2a                       DS-X9530-SF2AK9                     active *
8      0      Supervisor/Fabric-2a                       DS-X9530-SF2AK9                     ha-standby
9      12      1/2/4 Gbps FC Module                      DS-X9112                            ok
10     8      10 Gbps FCoE Module                       DS-X9708-K9                        ok
11     8      10 Gbps FCoE Module                       DS-X9708-K9                        ok
12     48      1/2/4/8 Gbps FC Module                    DS-X9248-96K9                      ok
13     8      10 Gbps FCoE Module                       DS-X9708-K9                        ok
Mod  Sw      Hw      World-Wide-Name(s) (WWN)
---
1      5.2(1)  0.2101  20:01:00:0d:ec:b6:d7:40 to 20:30:00:0d:ec:b6:d7:40
2      5.2(1)  1.2      --
3      5.2(1)  1.4      20:81:00:0d:ec:b6:d7:40 to 20:92:00:0d:ec:b6:d7:40
4      5.2(1)  1.1      20:c1:00:0d:ec:b6:d7:40 to 20:f0:00:0d:ec:b6:d7:40
5      5.2(1)  0.2101  21:01:00:0d:ec:b6:d7:40 to 21:20:00:0d:ec:b6:d7:40
6      5.2(1)  1.1      21:41:00:0d:ec:b6:d7:40 to 21:70:00:0d:ec:b6:d7:40
7      5.2(1)  1.7      --
```

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```

8   5.2(1)          1.1      --
9   5.2(1)          1.0      22:01:00:0d:ec:b6:d7:40 to 22:0c:00:0d:ec:b6:d7:40
10  5.2(1)          0.107    --
11  5.2(1)          0.109    --
12  5.2(1)          1.1      22:c1:00:0d:ec:b6:d7:40 to 22:f0:00:0d:ec:b6:d7:40
13  5.2(1)          0.107    --
Mod  MAC-Address(es)                               Serial-Num
---  -
1    00-31-42-54-44-50 to 00-31-42-54-44-54  JAF1511BTDP
2    00-23-eb-4e-ec-14 to 00-23-eb-4e-ec-28  JAE14130EFB
3    00-24-c4-5f-ee-cc to 00-24-c4-5f-ee-d4  JAE14130397
4    00-0d-ec-75-96-a0 to 00-0d-ec-75-96-a4  JAE1324BXRI
5    00-30-43-45-45-52 to 00-30-43-45-45-56  JAF1510CEER
6    00-0d-ec-75-97-bc to 00-0d-ec-75-97-c0  JAE1324C6QE
7    00-23-5e-9a-53-74 to 00-23-5e-9a-53-78  JAE1326D90X
8    00-23-eb-4f-64-2c to 00-23-eb-4f-64-30  JAF1442EPQF
9    00-14-a9-74-ec-a8 to 00-14-a9-74-ec-ac  JAB1002005H
10   68-ef-bd-a8-33-58 to 68-ef-bd-a8-33-6c  JAF1440CDBF
11   68-ef-bd-a8-3a-d8 to 68-ef-bd-a8-3a-ec  JAF1444AGMF
12   00-13-80-a8-ef-70 to 00-13-80-a8-ef-74  JAE130313RS
13   68-ef-bd-a8-31-28 to 68-ef-bd-a8-31-3c  JAF1440CCST
Xbar Ports  Module-Type                               Model              Status
---  -
1    0        Fabric Module 3                        DS-13SLT-FAB3      ok
2    0        Fabric Module 3                        DS-13SLT-FAB3      ok
Xbar Sw      Hw      World-Wide-Name(s) (WWN)
---  -
1    NA        0.305  --
2    NA        0.4    --
Xbar MAC-Address(es)                               Serial-Num
---  -
1    NA        JAF1429FDGB
2    NA        JAF1453BDBL
* this terminal session
switch#

```

Migrating from Fabric 1 Module (BM Mode) to Fabric 3 Module (DB Mode)

Examine the slots for the fabric modules at the rear of the Cisco MDS 9513 chassis. The left slot is marked Fabric 1 and the right slot is marked Fabric 2. The slot name does not have any significance in terms of which fabric module can be installed in it. The Cisco MDS 9513 Fabric 3 module (DS-13SLT-FAB3) can be installed in either slots.

To remove a Cisco MDS 9513 Fabric 1 module from the Cisco MDS 9513 Director and replace it with a Cisco MDS 9513 Fabric 3 module, follow these steps:



Note

Performing an upgrade from Cisco MDS 9513 Fabric 1 module to Cisco MDS 9513 Fabric 3 module is a disruptive process.

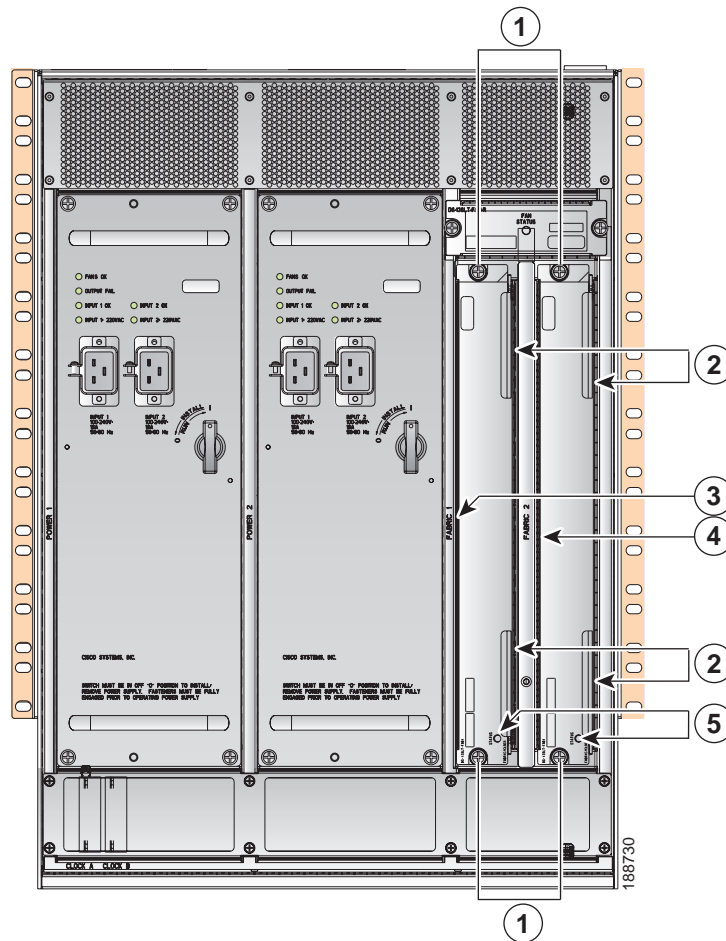
- Step 1** Connect a PC to the console port on the active supervisor module and log in to the switch.
- Step 2** Upgrade to Cisco NX-OS Release 5.2. Enter the **install all kickstart bootflash:bootimage system bootflash:isanimage** command. For more instructions, refer to the upgrade procedure described in the *Cisco MDS 9000 Family NX-OS Software Upgrade Downgrade Guide*.

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- Step 3** Save the running configuration. Enter the **copy running-configuration startup-configuration** command.
- Step 4** Shut down the fabric modules one by one, by entering the **poweroff xbar slot** command.
- The following example shows how to shut down the fabric module:
- ```
switch(config)# poweroff xbar 2
switch(config)#
```
- Step 5** Enter the **show module xbar** command to verify that the module is powered down.
- Step 6** Attach a ESD wrist strap according to the instructions in the [“Preventing Electrostatic Discharge Damage” section on page 1-19](#).
- Step 7** Confirm that the power LED is red, which indicates that the modules are powered off, and then loosen the two captive screws on the module being removed. See [Figure 1-5](#).
- Step 8** Remove the module from the chassis as follows:
- Place your thumbs on the top and bottom ejector levers and simultaneously rotate the levers outward to unseat the module from the midplane connector.
  - Hold the front edge of the module and slide the module partially out of the slot. Do not touch the module circuitry.

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**Figure 1-5** Captive Screws and Ejector Levers on the Fabric Module

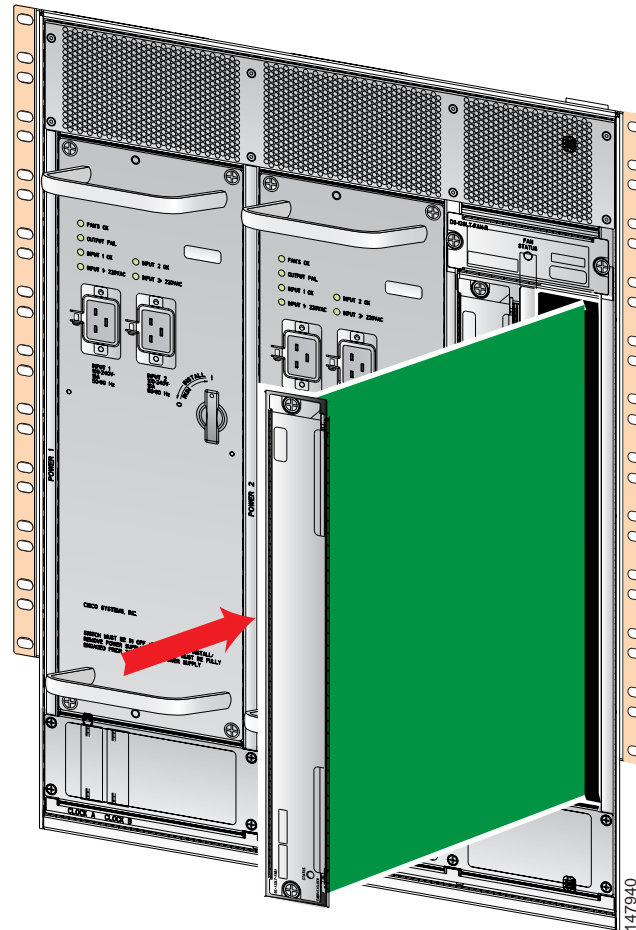


|   |                     |   |                     |
|---|---------------------|---|---------------------|
| 1 | Captive screws      | 4 | Fabric slot 2 label |
| 2 | Ejector levers      | 5 | Power LEDs          |
| 3 | Fabric slot 1 label |   |                     |

- Step 9** Place the Cisco MDS 9513 Fabric 1 module on an antistatic surface.
- Step 10** On the Cisco MDS 9513 Fabric 3 module to be installed, ensure that the ejector levers are completely open.
- Step 11** Position the Cisco MDS 9513 Fabric 3 module in the chassis as follows (See [Figure 1-6](#)):
- Position the module in the empty slot. Ensure that you align the sides of the module carrier with the slot guides on each side of the slot.
  - 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.

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**Figure 1-6** Installing a Fabric 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 completely seat the module in the midplane connector. The ejector levers are completely closed when they are flush with the front of the module.



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

- e. Tighten the two captive screws on the module until they are finger tight.

**Step 12** Perform the steps 6 through 11 to replace the fabric modules in both the slots.

**Step 13** Power up each Fabric 3 module by entering the following commands:

```
switch(config)# no poweroff xbar 1
switch(config)# no poweroff xbar 2
switch(config)#
```

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The modules will go into failure state and the power LED on the front panel will be red. Enter the **show module xbar** command to verify the status of the modules. The following example shows the output of **show module xbar** command, when the modules are in failure state:

```
switch# show module xbar
Xbar Ports Module-Type Model Status
--- --- ---
1 0 Fabric Module 3 DS-13SLT-FAB3 failure
2 0 Fabric Module 3 DS-13SLT-FAB3 failure
Xbar Power-Status Reason
--- --- ---
1 failure Unknown. Issue show system reset xbar ...
2 failure Unknown. Issue show system reset xbar ...
Xbar Sw Hw World-Wide-Name(s) (WWN)
--- --- ---
1 NA 0.2 --
2 NA 0.2 --
Xbar MAC-Address(es) Serial-Num
--- ---
1 NA JAF1511BTFG
2 NA JAF1511BTFJ
* this terminal session
switch#
```

**Step 14** Reload the switch. Enter the **reload** command.

**Step 15** Enter the **show module xbar** command to confirm that the fabric modules are active.

```
switch# show module xbar
Xbar Ports Module-Type Model Status
--- --- ---
1 0 Fabric Module 3 DS-13SLT-FAB3 ok
2 0 Fabric Module 3 DS-13SLT-FAB3 ok
```

**Step 16** Verify the fabric mode by entering the **show hardware fabric-mode** command. For example:

```
switch# show hardware fabric-mode
Fabric mode supports FCoE, Gen2, and above linecards
```

**Step 17** Insert the Cisco MDS 9000 Generation 4 8-Gbps Advanced Fibre Channel modules.

**Step 18** Enter the **show module** command to verify that the system can detect the Cisco MDS 9000 Generation 4 8-Gbps Advanced Fibre Channel modules and that they are up.

```
switch# show module
Mod Ports Module-Type Model Status
--- --- ---
1 48 1/2/4/8/10 Gbps Advanced FC Module DS-X9248-256K9 ok
2 16 16x1GE, Storage Services Node DS-X9316-SSNK9 ok
3 22 4x1GE IPS, 18x1/2/4Gbps FC Module DS-X9304-18K9 ok
4 48 1/2/4/8 Gbps FC Module DS-X9248-96K9 ok
5 32 1/2/4/8/10 Gbps Advanced FC Module DS-X9232-256K9 ok
6 48 1/2/4/8 Gbps FC Module DS-X9248-96K9 ok
7 0 Supervisor/Fabric-2a DS-X9530-SF2AK9 active *
8 0 Supervisor/Fabric-2a DS-X9530-SF2AK9 ha-standby
9 12 1/2/4 Gbps FC Module DS-X9112 ok
10 8 10 Gbps FCoE Module DS-X9708-K9 ok
11 8 10 Gbps FCoE Module DS-X9708-K9 ok
12 48 1/2/4/8 Gbps FC Module DS-X9248-96K9 ok
13 8 10 Gbps FCoE Module DS-X9708-K9 ok
Mod Sw Hw World-Wide-Name(s) (WWN)
--- --- ---
1 5.2(1) 0.2101 20:01:00:0d:ec:b6:d7:40 to 20:30:00:0d:ec:b6:d7:40
2 5.2(1) 1.2 --
3 5.2(1) 1.4 20:81:00:0d:ec:b6:d7:40 to 20:92:00:0d:ec:b6:d7:40
4 5.2(1) 1.1 20:c1:00:0d:ec:b6:d7:40 to 20:f0:00:0d:ec:b6:d7:40
5 5.2(1) 0.2101 21:01:00:0d:ec:b6:d7:40 to 21:20:00:0d:ec:b6:d7:40
6 5.2(1) 1.1 21:41:00:0d:ec:b6:d7:40 to 21:70:00:0d:ec:b6:d7:40
```

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```

7 5.2(1) 1.7 --
8 5.2(1) 1.1 --
9 5.2(1) 1.0 22:01:00:0d:ec:b6:d7:40 to 22:0c:00:0d:ec:b6:d7:40
10 5.2(1) 0.107 --
11 5.2(1) 0.109 --
12 5.2(1) 1.1 22:c1:00:0d:ec:b6:d7:40 to 22:f0:00:0d:ec:b6:d7:40
13 5.2(1) 0.107 --

Mod MAC-Address(es) Serial-Num
--- -
1 00-31-42-54-44-50 to 00-31-42-54-44-54 JAF1511BTDP
2 00-23-eb-4e-ec-14 to 00-23-eb-4e-ec-28 JAE14130EFB
3 00-24-c4-5f-ee-cc to 00-24-c4-5f-ee-d4 JAE14130397
4 00-0d-ec-75-96-a0 to 00-0d-ec-75-96-a4 JAE1324BXRI
5 00-30-43-45-45-52 to 00-30-43-45-45-56 JAF1510CEER
6 00-0d-ec-75-97-bc to 00-0d-ec-75-97-c0 JAE1324C6QE
7 00-23-5e-9a-53-74 to 00-23-5e-9a-53-78 JAE1326D90X
8 00-23-eb-4f-64-2c to 00-23-eb-4f-64-30 JAF1442EPQF
9 00-14-a9-74-ec-a8 to 00-14-a9-74-ec-ac JAB1002005H
10 68-ef-bd-a8-33-58 to 68-ef-bd-a8-33-6c JAF1440CDBF
11 68-ef-bd-a8-3a-d8 to 68-ef-bd-a8-3a-ec JAF1444AGMF
12 00-13-80-a8-ef-70 to 00-13-80-a8-ef-74 JAE130313RS
13 68-ef-bd-a8-31-28 to 68-ef-bd-a8-31-3c JAF1440CCST

Xbar Ports Module-Type Model Status
--- -
1 0 Fabric Module 3 DS-13SLT-FAB3 ok
2 0 Fabric Module 3 DS-13SLT-FAB3 ok

Xbar Sw Hw World-Wide-Name(s) (WWN)
--- -
1 NA 0.305 --
2 NA 0.4 --

Xbar MAC-Address(es) Serial-Num
--- -
1 NA JAF1429FDGB
2 NA JAF1453BDBL

* this terminal session
switch#

```

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## Migrating to Generation 3 8-Gbps Fibre Channel Switching Modules

---

This appendix describes the tasks associated with readying the MDS 9500 Series to support Generation 3 8-Gbps Fibre Channel switching modules. It presents an overview of the Generation 3 8-Gbps modules, provides usage guidelines for the modules, and describes three procedures for migrating hardware and upgrading software to enable use of these modules in an MDS 9513 Director.

This appendix includes the following sections:

- [Overview, page 1-1](#)
- [Usage Guidelines, page 1-2](#)
- [Before You Begin Upgrading the MDS 9513 Director, page 1-3](#)
- [Migration Procedures for the MDS 9513 Director, page 1-3](#)
- [Migration Procedure for the MDS 9509 Director and MDS 9506 Director, page 1-12](#)

### Overview

Cisco MDS NX-OS 4.1(1b) supports the following Generation 3 8-Gbps modules:

- MDS 9000 4/44-port 8-Gbps Host-Optimized Fibre Channel module (DS-X9248-48K9)
- MDS 9000 24-port 8-Gbps Fibre Channel module (DS-X9224-96K9)
- MDS 9000 48-port 8-Gbps Fibre Channel module (DS-X9248-96K9)

In addition, Cisco MDS NX-OS 4.1(1b) supports two fabric modules, which are also known as crossbar modules, for the MDS 9513 Director:

- MDS 9513 Fabric 2 module, DS-13SLT-FAB2
- MDS 9513 Fabric 1 module, DS-13SLT-FAB1



**Note**

The Generation 3 8-Gbps Fibre Channel Switching Modules also work with the Fabric Module-3. For more information, see [Upgrading to Fabric 3 Module, page 1-9](#)

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The MDS 9513 Director requires Cisco MDS NX-OS Release 4.1(1b) or later and the MDS 9513 Fabric 2 modules to support the MDS 9000 48-port 8-Gbps Fibre Channel module and the MDS 9000 24-port 8-Gbps Fibre Channel module. Two MDS 9513 Fabric 2 modules can double the active backplane bandwidth of the MDS 9513 Director to 192-Gbps full duplex per slot when used in conjunction with these two Generation 3 modules.

The MDS 9513 Director requires Cisco MDS NX-OS Release 4.1(1b) or later, but does not require the MDS 9513 Fabric 2 modules to support the MDS 9000 4/44-port 8-Gbps Host-optimized Fibre Channel module.

The MDS 9509 Director and the MDS 9506 Director also support the Generation 3 8-Gbps modules. The switches require Supervisor-2 modules and Cisco MDS NX-OS 4.1(1b) to support the Generation 3 8-Gbps modules.

**Note**

To upgrade to NX-OS Release 4.1(1b) from SAN-OS Release 3.2(3a) or earlier, first upgrade to SAN-OS Release 3.3(1x) and then upgrade to NX-OS Release 4.1(1b).

## Usage Guidelines

In preparation for using the MDS 9513 Fabric 2 module and the Generation 3 8-Gbps modules in an MDS 9513 Director, be aware of the following usage guidelines:

- Cisco SAN-OS Release 3.x supports the MDS 9513 Fabric 2 module.
- Until you upgrade to Cisco NX-OS Release 4.1(1b) or later and reload the switch, a MDS 9513 Fabric 2 module functions like a MDS 9513 Fabric 1 module.
- You cannot use any Generation 3 8-Gbps module in a MDS 9513 Director, MDS 9509 Director, or MDS 9506 Director until you upgrade to NX-OS Release 4.1(1b) or later.
- Supervisor-2 modules are required for the MDS 9509 Director and the MDS 9506 Director to support any Generation 3 8-Gbps module.
- You must do the following to enable the increased bandwidth capabilities of the MDS 9513 Fabric 2 modules:
  - Upgrade from Cisco SAN-OS Release 3.x to NX-OS Release 4.1(1b) or later.
  - Migrate the existing MDS 9513 Fabric 1 modules in the MDS 9513 chassis to MDS 9513 Fabric 2 modules.
  - Reload the switch to enable the increased bandwidth.
- If you install just one MDS 9513 Fabric 2 module, the active slot bandwidth of MDS 9513 Director is 96-Gbps full duplex.
- Once you upgrade to Cisco NX-OS Release 4.1(1b) or later and reload the switch, a downgrade to Cisco SAN-OS release 3.x will be disruptive. Following the downgrade, the Generation 3 8-Gbps modules in the switch will not power up.

[Table A-1](#) lists the types of Generation 3 modules that the MDS 9513 Director supports.

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**Table 1-1**      *Module Support Matrix for the MDS 9513 Director*

| Generation 3 Module                                            | Fabric Module                                        | Software Release    |
|----------------------------------------------------------------|------------------------------------------------------|---------------------|
| MDS 9000 4/44-port 8-Gbps Host-Optimized module, DS-X9248-48K9 | MDS 9513 Fabric 1 module or MDS 9513 Fabric 2 module | Cisco NX-OS 4.1(1b) |
| MDS 9000 48-port 8-Gbps Fibre Channel module, DS-X9248-96K9    | MDS 9513 Fabric 2 module                             | Cisco NX-OS 4.1(1b) |
| MDS 9000 24-port 8-Gbps Fibre Channel module, DS-X9224-96K9    | MDS 9513 Fabric 2 module                             | Cisco NX-OS 4.1(1b) |

## Before You Begin Upgrading the MDS 9513 Director

The sections that follow present three procedures for readying an MDS 9513 Director to support the Generation 3 8-Gbps modules. Before you begin one of these procedures, do the following:

- Review the steps involved in each procedure, and then choose the one that best fits your business needs. In particular, decide which of the following you want to do:
  - Install the MDS 9000 4/44-port 8-Gbps Host-Optimized module and retain the MDS 9513 Fabric 1 module in the switch.
  - Install the MDS 9513 Fabric 2 modules and continue to run Cisco MDS SAN-OS Release 3.x software in preparation for use of a Generation 3 module at a later time.
  - Install the MDS 9513 Fabric 2 modules for immediate use of any Generation 3 module.

Your choice will determine which procedure you should follow.

- Observe the following differences in the MDS 9513 Fabric 1 and MDS 9513 Fabric 2 modules:
  - The MDS 9513 Fabric 1 module, DS-13SLT-FAB1, has a light blue surface above the top-most captive screw on the front of the module.
  - The MDS 9513 Fabric 2 module, DS-13SLT-FAB2, has a light pink surface above the top-most captive screw on the front of the module.
- Examine the slots for the fabric modules at the rear of the MDS 9513 chassis. The left slot is marked Fabric 1 and the right slot is marked Fabric 2. The slot name does not have any meaning in terms of which fabric module can be installed in it. The MDS 9513 Fabric 2 module, DS-13SLT-FAB2, can be installed in either slot, and the MDS 9513 Fabric 1 module DS-13SLT-FAB1, can be installed in either slot.

## Migration Procedures for the MDS 9513 Director

This section presents three procedures for migrating your hardware and upgrading your software in the MDS 9513 to make it ready for the Generation 8-Gbps modules. Each procedure lists the tasks involved and the benefits of the particular procedure.

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## Installing the MDS 9000 4/44-Port 8-Gbps Host-Optimized Module

This procedure allows you to start using an 8-Gbps module, without replacing the MDS 9513 Fabric 1 modules in the switch. The procedure consists of the following tasks:

- Upgrade the MDS 9513 Director to Cisco NX-OS 4.1(1b).
- Install the MDS 9000 4/44-port 8-Gbps Host-Optimized module.

This procedure offers the following benefits:

- There is no service disruption. The upgrade to Cisco NX-OS Release 4.1(1b) or later is nondisruptive.
- You immediately realize the benefit of the faster 8-Gbps port speed.

To nondisruptively upgrade to Cisco NX-OS Release 4.1(1b) or later, and install the MDS 9000 4/44-port 8-Gbps Host-Optimized module, follow these steps:

- 
- Step 1** Connect a PC to the console port on the active supervisor module and log in to the switch.
- Step 2** Verify that the MDS 9513 Director is running Cisco SAN-OS Release 3.x by entering the **show version** command at the command line.

This example shows the output of the **show version** command:

```
switch# show version
Cisco Storage Area Networking Operating System (SAN-OS) Software
TAC support: http://www.cisco.com/tac
Copyright (c) 2002-2006, Cisco Systems, Inc. All rights reserved.
The copyrights to certain works contained herein are owned by
other third parties and are used and distributed under license.
Some parts of this software may be covered under the GNU Public
License or the GNU Lesser General Public License. A copy of
each such license is available at
http://www.gnu.org/licenses/gpl.html and
http://www.gnu.org/licenses/lgpl.html
Software
BIOS: version 1.1.0
loader: version 1.2(2)
kickstart: version 3.0(3) [gdb]
system: version 3.0(3) [gdb]

BIOS compile time: 10/24/03
kickstart image file is: bootflash:///boot-3.0.3
kickstart compile time: 9/15/2006 10:00:00 [10/02/2006 06:26:25]
system image file is: bootflash:///isan-3.0.3
system compile time: 9/15/2006 10:00:00 [10/02/2006 06:45:25]
```

- Step 3** Upgrade to Cisco NX-OS Release 4.1(1b) or later. Refer to the upgrade procedure described in the *Cisco MDS 9000 Family NX-OS Interfaces Configuration Guide*.
- Step 4** Verify that the switch is running Cisco NX-OS Release 4.1(1b) or later by entering the **show version** command.

This example shows the output of the **show version** command:

```
switch# show version
Cisco Nexus Operating System (NX-OS) Software
TAC support: http://www.cisco.com/tac
Copyright (c) 2002-2008, Cisco Systems, Inc. All rights reserved.
The copyrights to certain works contained herein are owned by
other third parties and are used and distributed under license.
Some parts of this software are covered under the GNU Public
```

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```
License. A copy of the license is available at
http://www.gnu.org/licenses/gpl.html.
Software
 BIOS: version 1.0.7
 loader: version N/A
 kickstart: version 4.2(1)
 system: version 4.2(1)
 BIOS compile time: 08/26/08
 kickstart image file is: bootflash:/bootimage
 kickstart compile time: 10/12/2020 25:00:00 [09/06/2008 01:36:07]
 system image file is: bootflash:/isanimage
 system compile time: 8/22/2008 0:00:00 [09/06/2008 02:48:50]
Hardware
 cisco MDS 9513 (13 Slot) Chassis ("Supervisor/Fabric-2")
 Motorola, 7447A, altivec with 1032472 kB of memory.
 Processor Board ID JAE1217FOFI
Device name: sw5-qa01
 bootflash: 1023120 kB
 slot0: 511664 kB (expansion flash)
Kernel uptime is 1 day(s), 9 hour(s), 12 minute(s), 4 second(s)
Last reset at 518531 usecs after Sun Sep 7 01:29:37 2008
Reason: Reset triggered due to Switchover Request by User
 System version: 4.2(1)
 Service:
```

- Step 5** Install the MDS 9000 4/44-port 8-Gbps Host-Optimized Fibre Channel module.
- Step 6** Refer to the *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide* or the *Cisco Fabric Manager Fundamentals Configuration Guide* for information on how to configure the module.

## Installing MDS 9513 Fabric 2 Modules and Running Cisco SAN-OS 3.x

This procedure allows you to prepare your switch for the future installation of an MDS 48-port 8-Gbps module or an MDS 9000 24-port 8-Gbps module. The procedure consists of the following tasks:

- Replace the MDS 9513 Fabric 1 modules with MDS 9513 Fabric 2 modules.

This procedure offers the following benefits:

- There is no service disruption. The installation of the MDS 9513 Fabric 2 modules is nondisruptive, and you can continue running Cisco SAN-OS Release 3.x.
- You have completed the MDS 9513 hardware upgrade.
- You can schedule time for proceeding with the software upgrade and the installation of Generation 3 modules at a later time.

To nondisruptively remove a MDS 9513 Fabric 1 module from the Cisco MDS 9513 Director and replace it with a MDS 9513 Fabric 2 module, follow these steps:

- Step 1** Connect a PC to the console port on the active supervisor module and log in to the switch.
- Step 2** Enter the **show module** command to determine which supervisor and its associated fabric module are in active mode.

The supervisor module in slot 7 is associated with the fabric module in the Fabric 1 slot and the supervisor module in slot 8 is associated with the fabric module in the Fabric 2 slot.

The following example shows the output of the **show module** command, which indicates that the supervisor in slot 7 is active and the supervisor in slot 8 is in standby mode.

*Send documentation comments to [mdsfeedback-doc@cisco.com](mailto:mdsfeedback-doc@cisco.com)*

```
switch# show module
Mod Ports Module-Type Model Status
--- ---
7 0 Supervisor/Fabric-2 DS-X9530-SF2-K9 active*
8 0 Supervisor/Fabric-2 DS-X9530-SF2-K9 ha-standby
```

- Step 3** If the supervisor module in slot 7 is active, shut down the standby supervisor and fabric module by entering the **out-of-service xbar 2** command.

The following example shows how to shut down the standby supervisor and associated fabric module in slot 2.

```
switch# out-of-service xbar 2
```

- Step 4** If the supervisor module in slot 8 is active, shut down the standby supervisor and fabric module by entering the **out-of-service xbar 1** command.

The following example shows the output of the **show module** command and then shows how to shut down the standby supervisor (in slot 7) and its associated fabric module in the Fabric 1 slot.

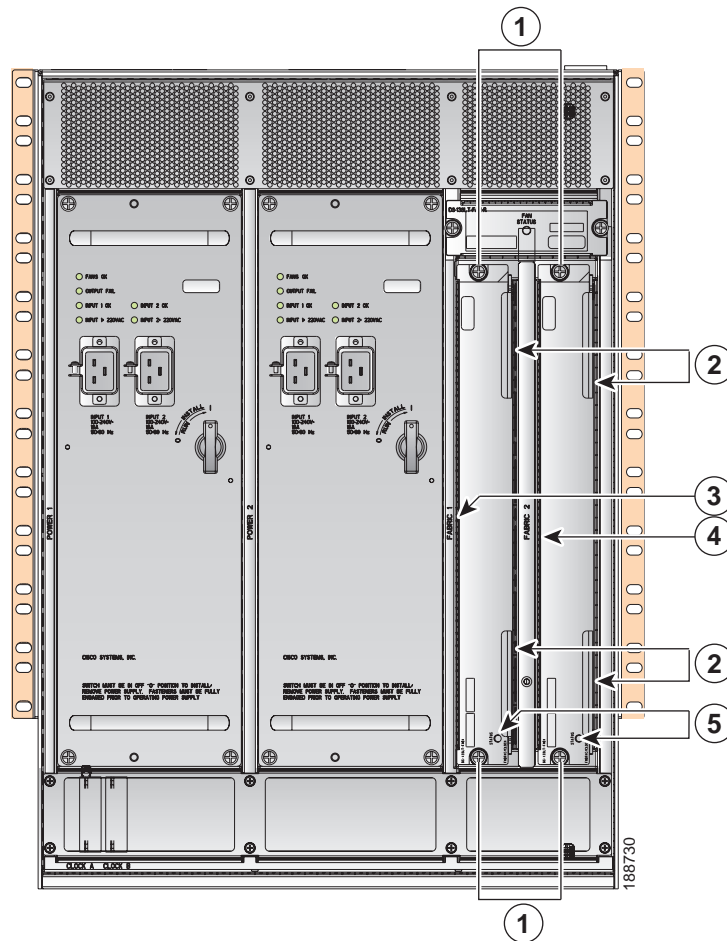
```
switch# show module
Mod Ports Module-Type Model Status
--- ---
7 0 Supervisor/Fabric-2 DS-X9530-SF2-K9 ha-standby
8 0 Supervisor/Fabric-2 DS-X9530-SF2-K9 active *
```

```
switch# out-of-service xbar 1
```

- Step 5** Enter the **show module xbar** command to verify that the standby supervisor module is powered down.
- Step 6** Attach a ESD wrist strap according to the instructions in the section [“Preventing Electrostatic Discharge Damage”](#) section on page 1-19.
- Step 7** Confirm that the LED light is red, which indicates that the module is powered off, and then loosen the two captive screws on the module being removed.
- Step 8** Remove the module from the chassis as follows:
- 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 1-1](#))
  - Hold the front edge of the module and slide the module partially out of the slot. Do not touch the module circuitry.

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**Figure 1-1** Captive Screws and Ejector Levers on the Fabric Module



|   |                     |   |                     |
|---|---------------------|---|---------------------|
| 1 | Captive screws      | 2 | Ejector levers      |
| 3 | Fabric slot 1 label | 4 | Fabric slot 2 label |
| 5 | Power LEDs          |   |                     |

**Step 9** Place the MDS 9513 Fabric 1 module on an antistatic surface.

**Step 10** On the MDS 9513 Fabric 2 module to be installed, ensure that the ejector levers are completely open.

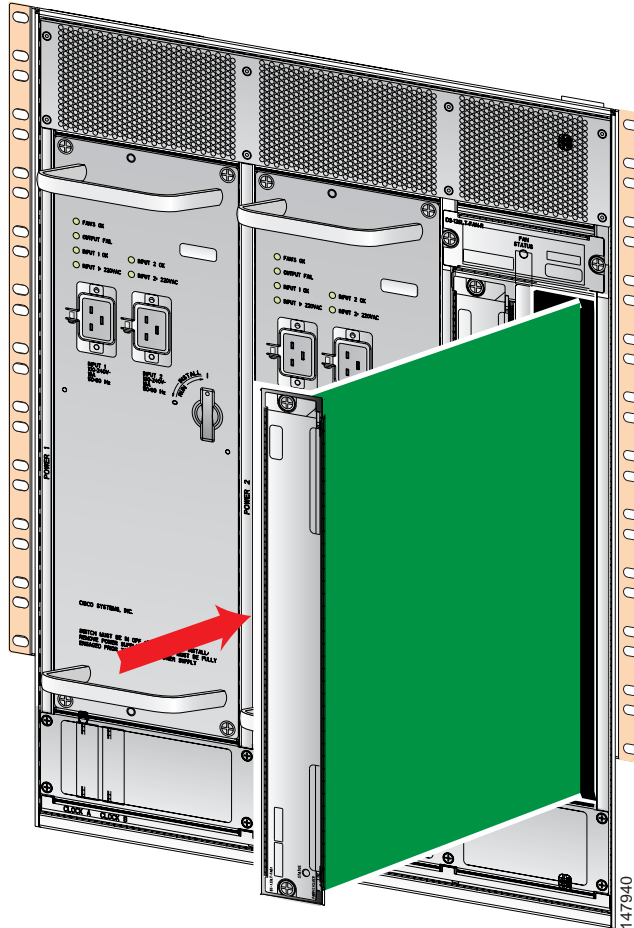
**Step 11** Position the MDS 9513 Fabric 2 module in the chassis as follows:

- Position the module in the empty slot. Ensure that you align the sides of the module carrier with the slot guides on each side of the slot.
- 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 1-2](#).)



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**Figure 1-2** *Installing a Fabric 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 completely seat the module in the midplane connector. The ejector levers are completely closed when they are flush with the front of the module.



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

- e. Tighten the two captive screws on the module until they are finger tight.

**Step 12** Verify that the LED light on the front of the module is green. The light should come on within five seconds of the module being inserted. If it does not, check to see if the module is seated correctly in the slot.

**Step 13** Enter the **system switchover** command to put the other supervisor in active mode.



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- Step 14** Move the console cable to the console port on the active supervisor.
- Step 15** Enter the **show module** command to confirm which supervisor module is active.
- Step 16** Enter the **out-of-service xbar slot** command (where *slot* refers to the external fabric module slot number) to shut down the standby supervisor
- Step 17** Remove the out-of-service fabric module and install a MDS 9513 Fabric 2 module by repeating steps 7 through 12.
- Step 18** After you have replaced both MDS 9513 Fabric 1 modules, enter the **show module xbar** command to verify that the system can detect the MDS 9513 Fabric 2 modules and that their status is ok.

This example shows the output of the **show module xbar** command:

```
switch# show module xbar
Xbar Ports Module-Type Model Status

1 0 Fabric Module 2 DS-13SLT-FAB2 ok
2 0 Fabric Module 2 DS-13SLT-FAB2 ok

Xbar Sw Hw World-Wide-Name(s) (WWN)

1 NA 2.0 --
2 NA 2.0 --

Xbar MAC-Address(es) Serial-Num

1 NA JAF1207ARRS
2 NA JAE1212BPR0

* this terminal session
switch#
```

The MDS 9513 Director with the MDS 9513 Fabric 2 modules should function as it did prior to the migration procedure. Until you upgrade to Cisco NX-OS Release 4.1(1b) or later and reload the switch, the MDS 9513 Fabric 2 modules function like MDS 9513 Fabric 1 modules.

## Installing MDS 9513 Fabric 2 Modules and Installing MDS 9000 24-Port or 48-Port 8-Gbps Modules

This procedure allows you to install the MDS 9513 Fabric 2 modules and activate the increased backplane bandwidth of the MDS 9513 Director. The procedure consists of the following tasks:

- Upgrade to NX-OS Release 4.1(1b) or later. This is a nondisruptive procedure.
- Replace the MDS 9513 Fabric 1 modules with MDS 9513 Fabric 2 modules.
- Install the MDS 9000 48-port or 24-port 8-Gbps Fibre Channel modules.
- Activate the higher bandwidth capabilities of the MDS 9513 Fabric 2 modules.

This procedure offers the following benefits:

- You double the active backplane bandwidth to 192-Gbps full duplex per slot on the MDS 9513 Director once you activate the increased bandwidth capabilities of the MDS 9513 Fabric 2 modules through a reload or power cycle.
- You simplify the migration process if you choose to power down the switch and install all the hardware modules at one time.

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Activating the higher bandwidth capabilities of the MDS 9513 Fabric 2 modules can occur in one of two ways:

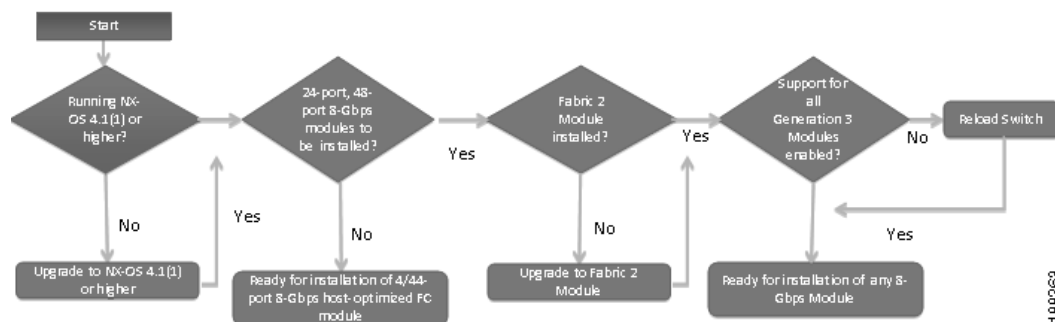
- You can enter the **reload** command after a nondisruptive installation of the MDS 9513 Fabric 2 modules.
- You can power down the switch, install the MDS 9513 Fabric 2 modules, and then power up the switch.

Both methods are disruptive. The latter method is a best practice because it requires fewer steps. Depending on which method you choose, follow the instructions in either the “[Installing the MDS 9513 Fabric 2 Modules and Activating Higher Bandwidth by Reloading the Switch](#)” section on page 1-10 or in the “[Installing the MDS 9513 Fabric 2 Modules and Activating Higher Bandwidth by Powering Down the Switch](#)” section on page 1-11.

## Installing the MDS 9513 Fabric 2 Modules and Activating Higher Bandwidth by Reloading the Switch

Figure 1-3 shows the process flow that occurs when you reload the switch to activate the higher bandwidth capabilities of the MDS 9513 Fabric 2 modules.

**Figure 1-3** Strategy 2: Migration Process Flow



To reload the switch to activate the increased bandwidth capabilities of the MDS 9513 Fabric 2 modules, follow these steps:

- Step 1** Upgrade to Cisco NX-OS Release 4.1(1b) or later. Refer to the upgrade procedure described in the *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide* or the *Cisco Fabric Manager Fundamentals Configuration Guide*.
- Step 2** Verify that the switch is running Cisco NX-OS Release 4.1(1b) or later by entering the **show version** command.
- Step 3** Enter the **copy running-config startup-config** command to save a copy of the current switch configuration.
- Step 4** Check the type of fabric modules that are present in the chassis by entering the **show module xbar** command.
- Step 5** If there are MDS 9513 Fabric 1 modules in the chassis, replace them according to the instructions in the “[Installing MDS 9513 Fabric 2 Modules and Running Cisco SAN-OS 3.x](#)” section on page 1-5.
- Step 6** Enter the **show hardware fabric-mode** command to display information about Generation 3 module support.

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The following example shows the output of the **show hardware fabric-mode** command, which indicates that support for the MDS 9000 48-port and 24-port 8-Gbps Generation 3 modules has not been enabled for the switch:

```
switch# show hardware fabric-mode
Fabric mode supports only one configuration of Gen3 Linecards - 4/44 Host-Optimized 8G FC Linecard.
switch#
Failure message for Gen3 cards for fabric2 in the above fabric-mode:switch# 2008 Jul 24
10:27:58 switch %XBAR-2-INCOMPATIBLE_CONFIG: Fabric mode does not support linecard in slot
4 . Please reload the switch to support 24-port and 48-port 8G FC linecards.
```

**Step 7** Enter the **reload** command to enable the increased bandwidth capabilities of the MDS 9513 Fabric 2 modules.

**Step 8** When the switch comes back up, install the MDS 9000 48-port or 24-port 8-Gbps Fibre Channel modules.

**Step 9** Enter the **show hardware fabric-mode** command to verify that increased bandwidth capabilities are activated.

The following example shows the output of the **show hardware fabric-mode** command, and indicates that support for the MDS 9000 48-port and 24-port 8-Gbps Generation 3 modules has been activated:

```
switch# show hardware fabric-mode
Fabric mode supports Gen3 and above linecards.
switch#
```

**Step 10** Refer to the *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide* or the *Cisco Fabric Manager Fundamentals Configuration Guide* for information on how to configure the MDS 9000 48-port or 24-port 8-Gbps Fibre Channel modules.

## Installing the MDS 9513 Fabric 2 Modules and Activating Higher Bandwidth by Powering Down the Switch

To power down the switch to activate the increased bandwidth capabilities of the MDS 9513 Fabric 2 modules, follow these steps:

- Step 1** Upgrade to Cisco NX-OS Release 4.1(1b) or later. Refer to the upgrade procedure described in the *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide*.
- Step 2** Verify that the switch is running Cisco NX-OS Release 4.1(1b) or later by entering the **show version** command.
- Step 3** Enter the **copy running-config startup-config** command to save a copy of the current switch configuration.
- Step 4** Power down the switch by turning the power supply switch at the rear of the power supply counterclockwise to the off position on both power supplies.
- Step 5** Remove the MDS 9513 Fabric 1 modules and replace them with MDS 9513 Fabric 2 modules. See steps 5 through 10 in the [“Installing MDS 9513 Fabric 2 Modules and Running Cisco SAN-OS 3.x” section on page 1-5](#).
- Step 6** Install the MDS 9000 48-port or 24-port 8-Gbps Fibre Channel modules.
- Step 7** Power up the switch by turning the power supply switch at the rear of the power supply clockwise to the on position on both power supplies.

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- Step 8** Enter the **show hardware fabric-mode** command to verify that increased bandwidth capabilities are activated:

The following example shows the output of the **show hardware fabric-mode** command, and indicates that support for the MDS 9000 48-port and 24-port 8-Gbps Generation 3 modules has been activated.

```
switch# show hardware fabric-mode
Fabric mode supports Gen3 and above linecards.
switch#
```

- Step 9** Refer to the *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide* or the *Cisco Fabric Manager Fundamentals Configuration Guide* for information on how to configure the MDS 9000 48-port or 24-port 8-Gbps Fibre Channel modules.

## Migration Procedure for the MDS 9509 Director and MDS 9506 Director



**Note** Do not upgrade to NX-OS Release 4.1(1b) or later if a Supervisor-1 module is installed.

To use any Generation 3 8-Gbps module in an MDS 9509 Director or MDS 9506 Director, follow these steps:

- Step 1** Log in to the switch.
- Step 2** Verify that the switch is running Cisco NX-OS Release 4.1(1b) by entering the **show version** command. If the switch has NX-OS Release 4.x or higher installed, then Supervisor-2 module is already installed on the switch. Skip to step 7 to install any Generation 3 8-Gbps module.
- Step 3** Enter the **show module** command to determine which supervisor module is in active mode and which is in standby module. Supervisor modules are installed in slot 5 and slot 6 on the MDS 9509 Director and MDS 9506 Director.

The following example shows the output of the **show module** command:

```
switch# show module

Mod Ports Module-Type Model Status
--- -
4 22 4x1GE IPS, 18x1/2/4Gbps FC Modul DS-X9304-18K9 ok
5 0 Supervisor/Fabric-1 DS-X9530-SF1-K9 active *
6 0 Supervisor/Fabric-1 DS-X9530-SF1-K9 ha-standby

Mod Sw Hw World-Wide-Name(s) (WWN)
--- -
4 4.1(0.182) 0.304 20:c1:00:05:30:00:a7:9e to 20:d2:00:05:30:00:a7:9e
5 4.1(0.182) 4.0 --
6 4.1(0.182) 0.0 --

Mod MAC-Address(es) Serial-Num
--- -
4 00-19-56-be-65-d0 to 00-19-56-be-65-d8 JAB1107027K
5 00-0c-30-0d-2b-b8 to 00-0c-30-0d-2b-bc JAB074004VE
6 00-05-30-00-52-f2 to 00-05-30-00-52-f6 NA
```

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- Step 4** If the switch has Supervisor-1 modules installed, remove the modules according to the instructions in the “[Removing Supervisor Modules](#)” section on page 1-39. If the switch has Supervisor-2 modules installed, then skip to Step 6.
- Step 5** Install Supervisor-2 modules according to the instructions in the “[Installing Supervisor Modules](#)” section on page 1-40. Refer to the Migrating from Supervisor-1 Modules to Supervisor-2 Modules procedure described in the *Cisco MDS 9000 Family NX-OS Interfaces Configuration Guide*.
- Step 6** Upgrade to Cisco NX-OS 4.1(1b). Refer to the upgrade procedure described in the *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide*.
- Step 7** Install any Generation 3 8-Gbps module.
- Step 8** Refer to the *Cisco MDS 9000 Family NX-OS Interfaces Configuration Guide* or the *Cisco Fabric Manager Interfaces Configuration Guide* for information on how to configure a Generation 3 8-Gbps module.
-

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# CHAPTER 1

## 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 DCNM SAN.
- 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 DCNM SAN.
- 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 and NX-OS. On the double-decker connector, USB port 1 is on the upper position and port 2 is on the lower 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:

- [Preparing for Network Connections, page 1-2](#)
- [Connecting to the Console Port, page 1-2](#)
- [Connecting to the COM1 Port, page 1-4](#)
- [Connecting to the MGMT 10/100/1000 Ethernet Port, page 1-6](#)
- [Connecting to the MGMT 10/100 Ethernet Port, page 1-7](#)
- [Connecting to a Fibre Channel Port, page 1-9](#)

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**Caution**

When running power and data cables in overhead or subfloor 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 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

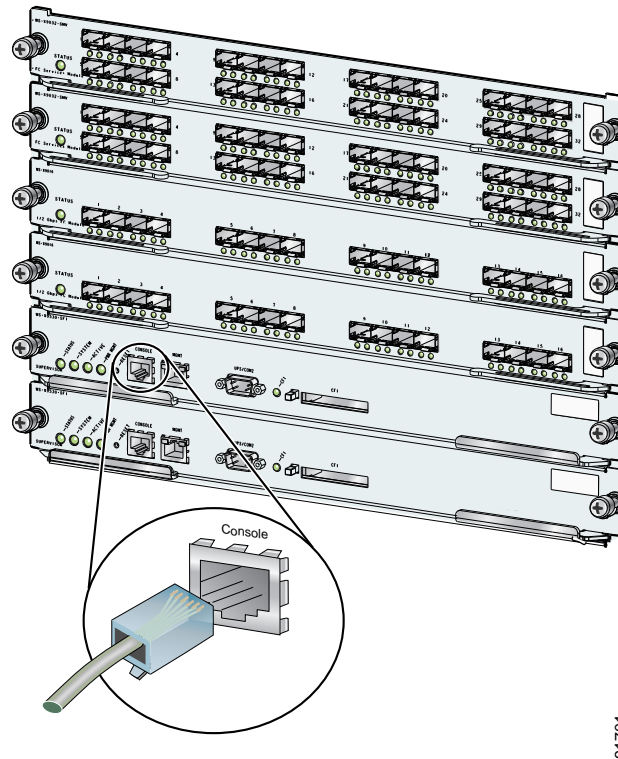
The console port, labeled “Console,” is an RS-232 port with an RJ-45 interface (see [Figure 1-1](#)). It is an asynchronous (async) serial port; any device connected to this port must be capable of asynchronous transmission.

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.



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**Figure 1-1** 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 or NX-OS Release 4.1(1b) or later.



**Caution**

The console port can be used to connect to a modem, however, 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.

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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.
- 

## 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 1-2](#)). 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, see the *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide*.

**Note**

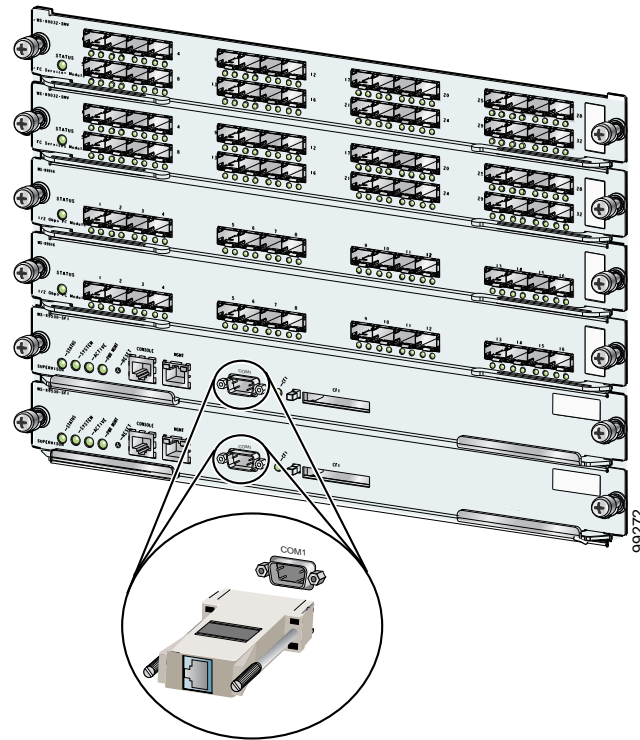
---

Switches running Cisco MDS SAN-OS Release 1.2(1a) or later NX-OS Release 4.1(1b) or later support the connection of a COM1 port to a modem.

---

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**Figure 1-2** 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.
  - Connect the adapters using the RJ-45 to RJ-45 rollover cable (or equivalent crossover cable).

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- Step 2** If the default settings for the COM1 are modified, see the *Cisco MDS 9000 Family NX-OS Fundamentals 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

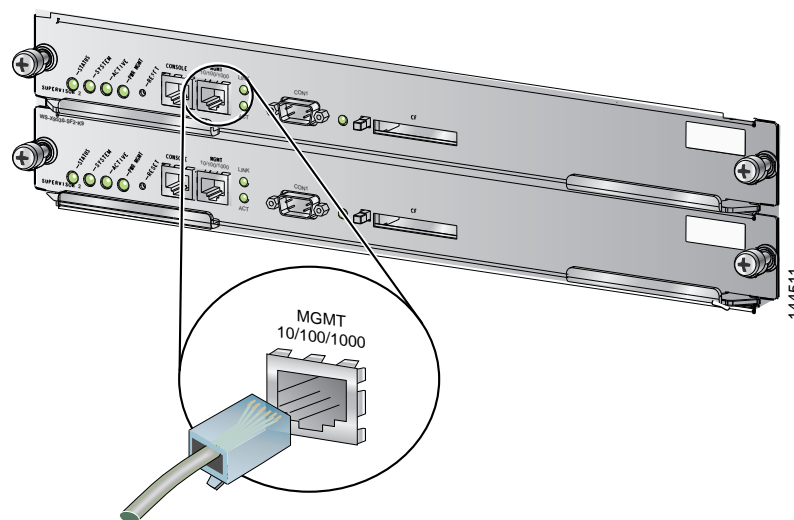


### Caution

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. For more information, see the *Cisco MDS 9000 Family NX-OS Fundamentals 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 1-3](#).) You can use this port to access and manage the switch by IP address, such as through Cisco DCNM SAN.

**Figure 1-3** Connecting to the MGMT 10/100/1000 Ethernet Port on the Supervisor-2 Module for the Cisco MDS 9500 Series



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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.
- 



**Note**

For high availability, connect the MGMT 10/100/1000 Ethernet port on the active Supervisor-2 module and on the standby Supervisor-2 module to the same network or VLAN. The active supervisor module owns the IP address used by both of these Ethernet connections. On a switchover, the newly activated supervisor module takes over this IP address. This process requires an Ethernet connection to the newly activated supervisor module.

---

## Connecting to the MGMT 10/100 Ethernet Port



**Caution**

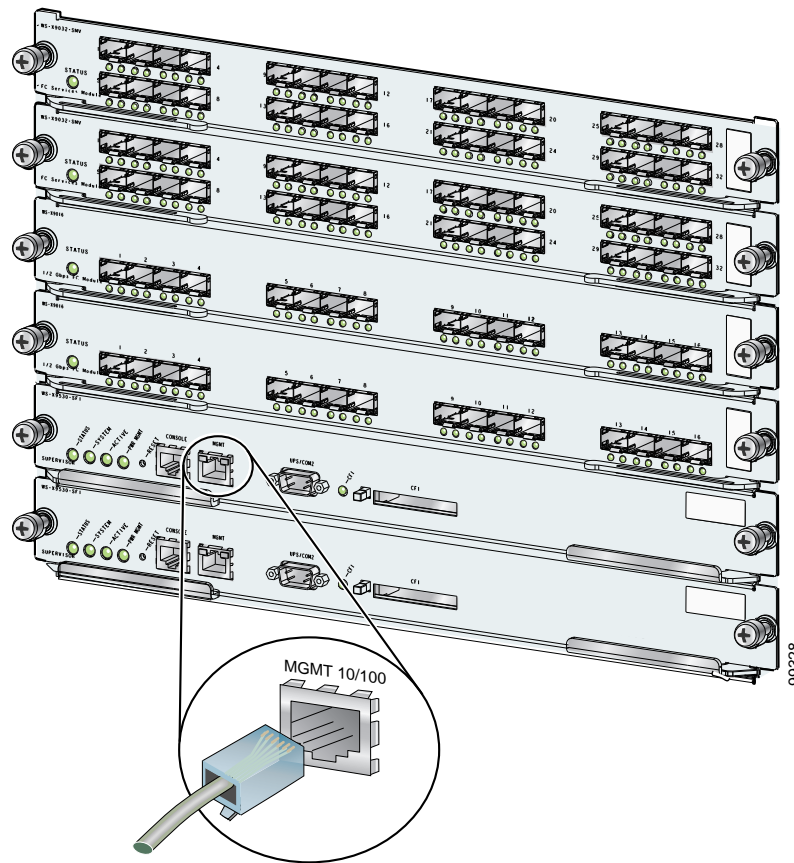
To prevent an IP address conflict, do not connect the MGMT 10/100 Ethernet port to the network until the initial configuration is complete. For more information, see the *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide*.

---

The Supervisor-1 module supports an autosensing MGMT 10/100 Ethernet port (labeled “MGMT 10/100”) and has an RJ-45 interface. (See [Figure 1-4](#).) You can use this port to access and manage the switch by IP address, such as through Cisco DCNM SAN.

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**Figure 1-4** 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.
- 



**Note**

For high availability, connect the MGMT 10/100 Ethernet port on the active Supervisor-1 module and on the standby Supervisor-1 module to the same network or VLAN. The active supervisor module owns the IP address used by both of these Ethernet connections. On a switchover, the newly activated supervisor module takes over this IP address. This process requires an Ethernet connection to the newly activated supervisor module.

---

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## 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, see the *Cisco MDS 9000 Family NX-OS Fundamentals 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. For information on how to get the list of supported SFP transceivers for your software release, see the *Cisco MDS 9000 Family Release Notes for Cisco MDS NX-OS*.



**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, page 1-9](#)
- [Removing and Installing SFP Transceivers, page 1-12](#)
- [Removing and Installing Cables into SFP Transceivers, page 1-14](#)
- [Maintaining SFP Transceivers and Fiber-Optic Cables, page 1-16](#)

## 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.



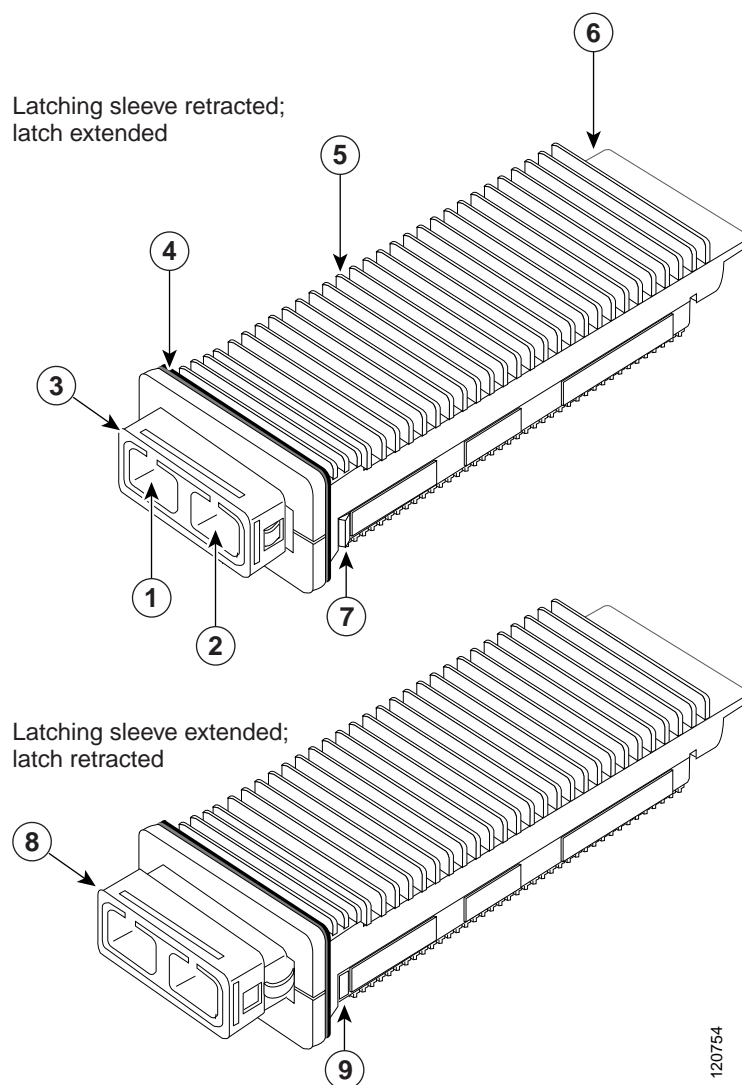
**Note**

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 [“Transceiver Specifications” section on page 1-20](#).

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The Cisco MDS 9000 Family supports X2 transceivers with SC connectors. (See [Figure 1-5](#).)

**Figure 1-5** 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       |   |                            |



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## 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:
- Record the cable and port connections for later reference.
  - Press the release latch on the cable, grasp the connector near the connection point, and gently pull the connector from the transceiver.
  - 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 that 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. Ensure that 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.

---

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## 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.

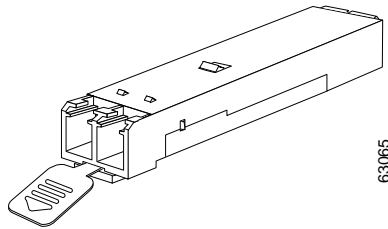
**Note**

Use only Cisco SFP transceivers on the Cisco MDS 9200 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 [“Transceiver Specifications” section on page 1-20](#).

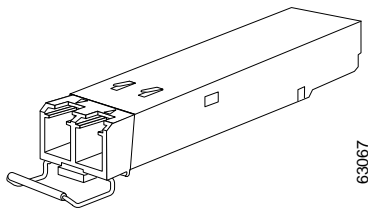
The Cisco MDS 9000 Family supports SFP transceivers with the following two types of latching devices:

- Mylar tab latch ([Figure 1-6](#))
- Bale-clasp latch ([Figure 1-7](#))

**Figure 1-6** *SFP Transceiver with Mylar Tab Latch*



**Figure 1-7** *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.

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- 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.

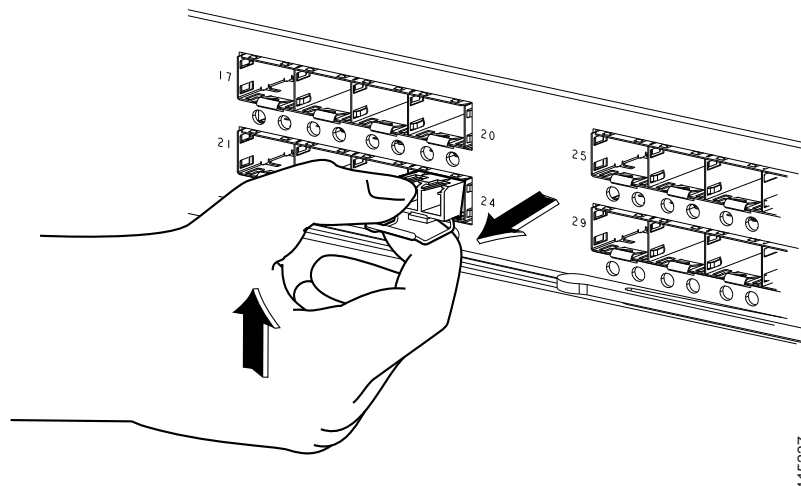
**Step 3** Remove the transceiver from the port:

- 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 reseal 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 1-8](#)). Be careful not to damage the port cage during this process.

**Figure 1-8** *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.

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## 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 that 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.

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- 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

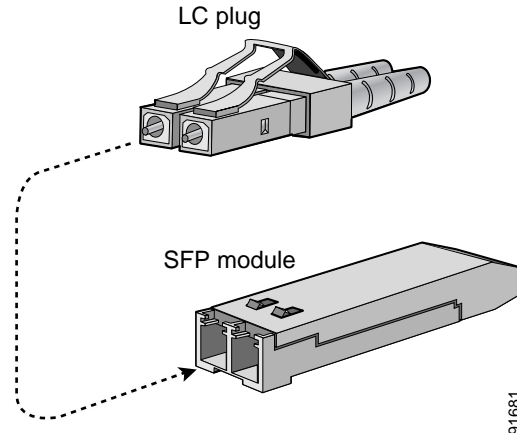
**Caution**

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 1-9](#)).

**Figure 1-9** Connecting the LC-Type Cable to a Fibre Channel Port

**Caution**

If the cable does not install easily, ensure that it is correctly oriented before continuing.

For instructions on verifying connectivity, see the *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide* or the *Cisco DCNM SAN Fundamentals Configuration Guide*.

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## 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.



## Cabinet and Rack Installation

---

This appendix provides information on the cabinet and rack installation and includes the following sections:

- [Cabinet and Rack Requirements, page 1-1](#)
- [Cisco MDS 9000 Family Telco and EIA Shelf Bracket, page 1-6](#)
- [Cisco MDS 9500 Shelf Bracket, page 1-13](#)

## 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
- Two-post 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 1-3 and the [“Requirements Specific to Solid-Walled Cabinets”](#) section on page 1-4.
- 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 Two-Post Telco Racks”](#) section on page 1-6.

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## Cabinet and Rack Requirements for the Cisco MDS 9513 Chassis

The cabinet or rack must also meet the following requirements for the Cisco MDS 9513 chassis:

- 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.
- The distance between the rack-mounting rails for four-post EIA racks must be at least 26.56 inches (67.46 cm). For more information, see [“Installing the Cisco MDS 9513 Director in a Rack” section on page 1-7](#).
- 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 4.0 inches (10.16 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 1-11](#).

## Cabinet and Rack Requirements for the Cisco MDS 9509 and Cisco MDS 9506 Chassis

The cabinet or rack must also meet the following requirements:

- The minimum vertical rack space per chassis:
  - 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 1-11](#).



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## 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 1-1](#), perforated cabinets must meet the requirements listed under [Perforated Cabinet Requirements for the Cisco MDS 9513 Chassis](#).

### Perforated Cabinet Requirements for the Cisco MDS 9513 Chassis

The perforated cabinet requirements for the Cisco MDS 9513 chassis are as follows:

- The front and rear doors must have at least a 60 percent open area (per square inch) perforation pattern, with at least 80 percent perforated.
- Cisco recommends that the roof should be solid.
- Cisco recommends an open cabinet floor to enhance cooling.

A perforated cabinet that conforms to these requirements is available from Panduit Corporation:

#### **Panduit Corporation**

17301 South Ridgeland Avenue

Tinley Park, IL 60477

Contact: (708) 532-1800

Cabinet P/N: CN4-2

Cabinet description: Net-Access cabinet, 31.5 in. W X 40 in. D X 84 in. H (800 mm x 1017 mm x 2134 mm), 45 RU cable management on front and rear of front posts.

Panduit cabinet part number CN1 may be upgraded to MDS 9513-compatible cabinet CN4-2 by purchasing additional Panduit parts. Contact Panduit Corporation for more information.

A new cabinet that conforms to these requirements is available from Chatsworth Products:

#### **Chatsworth Products, Inc.**

31425 Agoura Road

Westlake Village, CA 91361

Customer Service and Technical Support phone number 800 834-4969

Cabinet: P/N: NF3K-113C-C42

Cabinet description: The N-Series TeraFrame Network Cabinet, 31.4 in. W X 40.4 in. D X 83.4 in. H (798 mm x 1025 mm x 2118 mm), 45 RU

For more information see <http://www.chatsworth.com/ciscoteraframe>

### Perforated Cabinet Requirements for the Cisco MDS 9509 and the Cisco MDS 9506 Chassis

The perforated cabinet requirements for the Cisco MDS 9506 and MDS 9509 chassis are as follows:

- 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.
- Cisco recommends that the roof should be perforated with at least a 20 percent open area.
- Cisco recommends an open or perforated cabinet floor to enhance cooling.

*Send documentation comments to [mdsfeedback-doc@cisco.com](mailto:mdsfeedback-doc@cisco.com)*

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)

A new cabinet that conforms to these requirements is available from Panduit Corporation:

**Panduit Corporation**

17301 South Ridgeland Avenue

Tinley Park, IL 60477

Customer Service and Technical Support phone number: 800 777-3300.

Cabinet P/N: CN4-1

Cabinet description: Net-Access cabinet, 31.5 in. W X 40 in. D X 84 in. H (800 mm x 1017 mm x 2134 mm), 45 RU cable management on front and rear of front posts

For more information see <http://www.panduit.com/index.htm>.

A new cabinet that conforms to these requirements is available from Chatsworth Products:

**Chatsworth Products, Inc.**

31425 Agoura Road

Westlake Village, CA 91361

Customer Service and Technical Support phone number 800 834-4969

Cabinet: P/N: NF2K-113C-C42

Cabinet description: The N-Series TeraFrame Network Cabinet, 31.4 in. W X 40.4 in. D X 83.4 in. H (798 mm x 1025 mm x 2118 mm), 45 RU

For more information see: <http://www.chatsworth.com/ciscoteraframe>



**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 (nonperforated) 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 1-1, solid-walled cabinets must meet the following requirements:

### Solid-Walled Cabinet Requirements for the Cisco MDS 9513 Chassis

The solid-walled cabinet requirements for the Cisco MDS 9513 chassis are as follows:

- Perforated front and back doors and solid or open side panels.

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- A recommended cabinet depth of 36 to 42 inches (91.4 to 106.7 cm) to allow the doors to close and adequate airflow.
- Bottom of cabinet should be open to enhance airflow.
- 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.

## Solid-Walled Cabinet Requirements for the Cisco MDS 9509 and the Cisco MDS 9506 Chassis

The solid-walled cabinet requirements for the Cisco MDS 9509 and the Cisco MDS 9506 chassis are as follows:

- 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.
- Nonperforated (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 1-1, if mounting the chassis in an open rack (no side panels or doors), ensure that 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.

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- 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 Two-Post Telco Racks

In addition to the requirements listed in the “[General Requirements for Cabinets and Racks](#)” section on [page 1-1](#), two-post 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**

Two-post telco racks are not intended for 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 9200 Series during installation. After 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 a cabinet using the optional telco and EIA shelf bracket kit. It includes the following information:

- [Rack-Mounting Guidelines, page 1-7](#)
- [Before Installing the Rack-Mount Support Brackets, page 1-7](#)
- [Before Installing the Shelf Brackets, page 1-8](#)
- [Installing the Shelf Bracket Kit into a Two-Post Telco Rack, page 1-9](#)
- [Installing the Shelf Bracket Kit into a Four-Post EIA Rack, page 1-10](#)
- [Installing the Switch on the Rack-Mount Support Brackets, page 1-11](#)
- [Installing the Switch on the Shelf Brackets, page 1-12](#)
- [Removing the Shelf Bracket Kit \(Optional\), page 1-12](#)

**Note**

This optional kit is not provided with the switch; to order the kit, contact your switch supplier.

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## 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 the rack meets the following requirements:

- The specifications listed in the “[Cabinet and Rack Requirements](#)” section on page 1-1.
- The depth of the rack between the front-mounting 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 1, “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 9222i<br>MDS 9216i<br>MDS 9216A | MDS 9100           |
|-------------------|---------------------|---------------------|---------------------|-------------------------------------|--------------------|
| EIA (4-Post)      | 45 lb<br>(20.41 kg) | 45 lb<br>(20.41 kg) | 30 lb<br>(13.61 kg) | 15 lb<br>(6.8 kg)                   | 7.5 lb<br>(3.4 kg) |
| Telco<br>(2-Post) | Do not use.         | Do not use.         | 60 lb<br>(27.22 kg) | 30 lb<br>(13.61 kg)                 | 15 lb<br>(6.8 kg)  |

## 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 1-1](#) lists the contents of the optional shelf bracket kit.

**Table 1-1**      *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 |

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## Before Installing the Shelf Brackets

Before installing the shelf brackets, check the contents of your kit. [Table 1-2](#) lists the contents of the optional shelf bracket kit.

**Table 1-2**      *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:

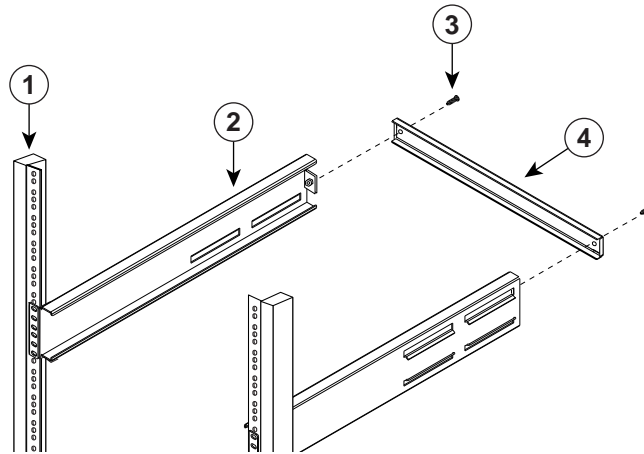
- Number 2 Phillips screwdriver
- Tape measure and level (to ensure shelf brackets are level)

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## Installing the Shelf Bracket Kit into a Two-Post Telco Rack

Figure 1-1 shows the installation of the shelf bracket kit into a two-post telco rack.

**Figure 1-1** *Installing the Shelf Bracket Kit into a Two-Post 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 two-post telco rack, follow these steps:

- Step 1** Position a shelf bracket inside a rack-mounting rail as shown in Figure 1-1. 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).

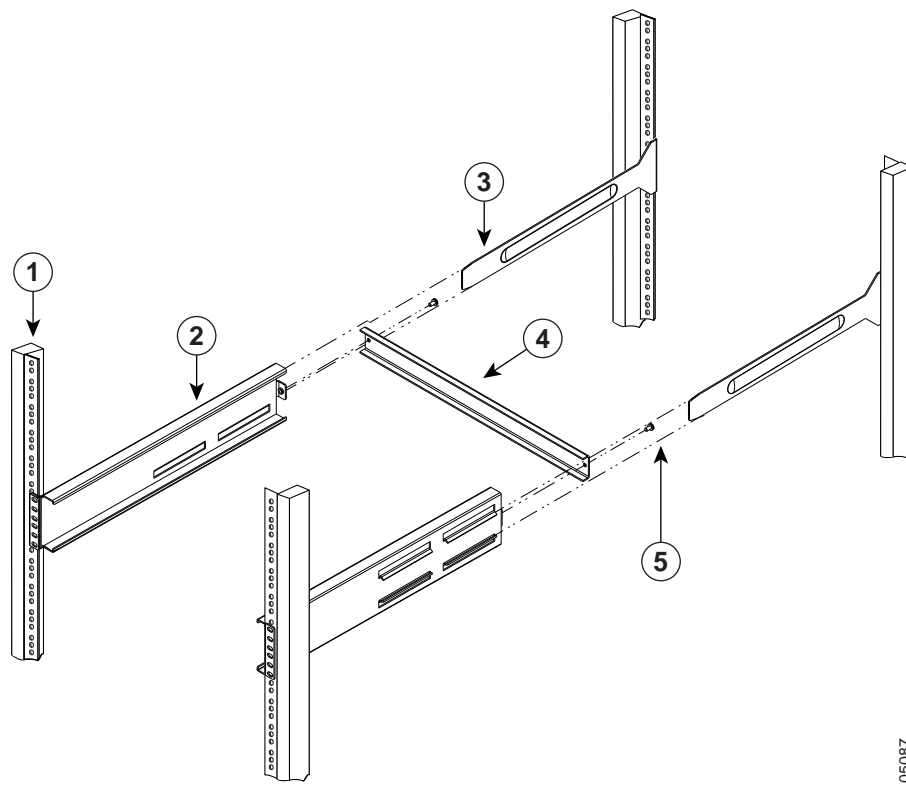
- Step 2** Repeat with the other shelf bracket.
- Step 3** Verify that the shelf brackets are at the same height (using the level or tape measure as desired).
- Step 4** Attach the crossbar to the rear of the shelf brackets as shown in Figure 1-1, using the 10-32 screws.

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## Installing the Shelf Bracket Kit into a Four-Post EIA Rack

Figure 1-2 shows the installation of the shelf bracket kit into a four-post EIA rack.

**Figure 1-2**      *Installing the Shelf Bracket Kit into an EIA Rack*



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|   |                         |   |                   |
|---|-------------------------|---|-------------------|
| 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 1-2](#). 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).



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- Step 4** Attach the crossbar to the shelf brackets as shown in [Figure 1-2](#), using the 10-32 screws.
- Step 5** Insert the slider rails into the shelf brackets as shown in [Figure 1-2](#). 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 1-6](#).



**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

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**Warning**

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

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**Note**

Before you install, operate, or service the system, see the *Regulatory Compliance and Safety Information for the Cisco MDS 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 1-6](#).



**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.

---

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## 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 1-6](#).



### 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, see the *Regulatory Compliance and Safety Information for the Cisco MDS 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 1-6](#).



### Caution

Cisco recommends 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 that 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.

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- 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 nonthreaded 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 1-1](#).



**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 nonthreaded rack or cabinet using the optional Cisco MDS 9500 Shelf Bracket Kit. It includes the following information:

- [Rack-Mounting Guidelines, page 1-14](#)
- [Before Installing the Shelf Brackets, page 1-14](#)
- [Installing the Cisco MDS 9500 Shelf Bracket Kit into a Cabinet or Rack, page 1-15](#)
- [Installing the Switch on the Shelf Brackets, page 1-16](#)

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## Rack-Mounting Guidelines

**Caution**

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

Before rack-mounting the chassis, ensure that the cabinet or the rack meets the following requirements:

- The specifications listed in the “[Cabinet and Rack Requirements](#)” section on [page 1-1](#).
- The depth of the rack between the front-mounting and rear-mounting rails is fixed at 18 inches (45.7 cm).
- The depth of the rack between the front-mounting and rear-mounting rails is fixed at 26.56 inches (67.4 cm) for a Cisco MDS 9513 Director.
- The cabinet or rack-mounting rails are nonthreaded.
- 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 1, “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 1-3](#) lists the contents of the optional shelf bracket kit.

**Table 1-3**                      *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:

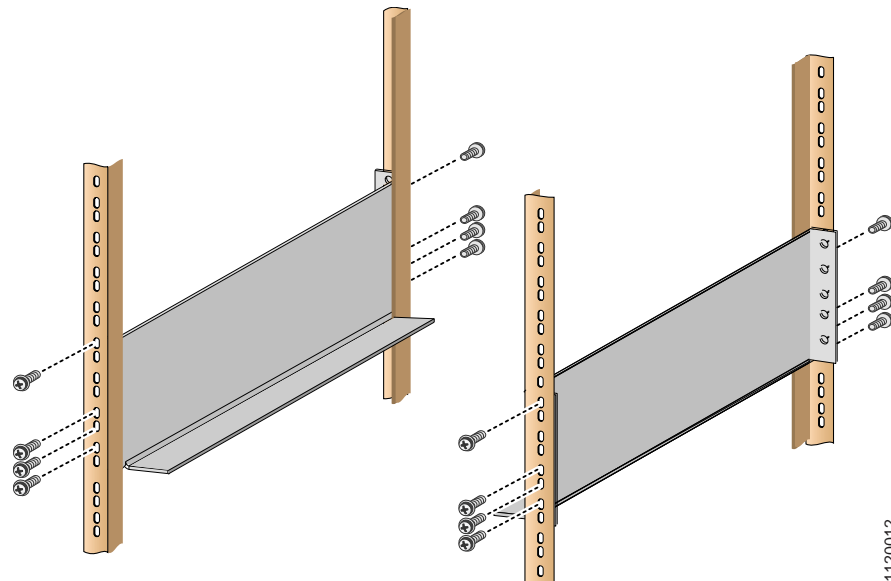
- Number 2 Phillips screwdriver
- Tape measure and level (to ensure shelf brackets are level)

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## Installing the Cisco MDS 9500 Shelf Bracket Kit into a Cabinet or Rack

Figure 1-3 shows the installation of the Cisco MDS 9500 Shelf Bracket Kit into a four-post rack.

**Figure 1-3** *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 1-3. 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).

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## 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 1-6](#).



### 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, see the *Regulatory Compliance and Safety Information for the Cisco MDS 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 nonthreaded 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 1-6](#).



### Caution

We recommend grounding the chassis, although the rack is already grounded. There is a grounding pad with two threaded M4 holes on the chassis for attaching a grounding lug.



## Technical Specifications

This appendix provides technical specifications and includes the following sections:

- [Switch Specifications, page 1-1](#)
- [Module Specifications, page 1-4](#)
- [Power Specifications for the Cisco MDS 9513 Director, page 1-6](#)
- [Power Specifications for the Cisco MDS 9509 Director, page 1-10](#)
- [Power Specifications for the Cisco MDS 9506 Director, page 1-15](#)
- [Transceiver Specifications, page 1-22](#)



Note

Specifications for cables and connectors are provided in [Appendix 1, “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 1-1](#) lists the environmental specifications for the Cisco MDS 9500 Series.

**Table 1-1** *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                            |

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Table 1-2 lists the physical specifications for the Cisco MDS 9513 Director.

**Table 1-2**      *Physical Specifications for the Cisco MDS 9513 Director*

| Description           | Specification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dimensions<br>(HxWxD) | 24.5 x 17.5 x 28 in. (62.2 x 44.5 x 71.1 cm)<br>Chassis requires 14 RU <sup>1</sup> , 15 RU with a rack-mount kit.<br>Chassis depth including cable guide is 33 in. (83.8 cm).<br><br>Crossbar module: 1.7 x 14.0 x 11.2 in. (4.4 x 35.6 x 28.4 cm)                                                                                                                                                                                                                                                                                                     |
| Weight                | Chassis only: 101 lb (45.36 kg)<br>Fully loaded chassis <sup>2</sup> : 375 lb (170.10 kg)<br><br>System fan tray: 18 lbs (8.2 kg)<br>Crossbar module fan tray: 2.25 lbs (1.02 kg)                                                                                                                                                                                                                                                                                                                                                                       |
| Power supply          | 6000-W, AC input<br>33 lb (15 kg)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Airflow               | 275 to 325 lfm <sup>3</sup> through system fan module, or 90 cfm <sup>4</sup> per supervisor, switching, or services module. Total of 1150 cfm if all slots are filled.<br><br>Spacing requirements: <ul style="list-style-type: none"> <li>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).</li> </ul> |

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 1-3 lists the physical specifications for the Cisco MDS 9509 Director.

**Table 1-3**      *Physical Specifications for the Cisco MDS 9509 Director*

| Description           | Specification                                                                                                                                                                                                                                                         |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dimensions<br>(HxWxD) | 24.5 x 17.25 x 18.8 in. (62.2 x 43.8 x 47.8 cm)<br>Chassis requires 14 RU <sup>1</sup> plus space for shelf brackets.<br>Chassis depth including cable guide is 21.64 in. (55.0 cm).                                                                                  |
| Weight                | Chassis only: 55 lb (24.9 kg)<br>Chassis configured with two supervisor modules, and 2500-W power supplies: 120 lb (54.4 kg)<br>Chassis configured with two supervisor modules, and 4000-W power supplies: 140 lb (63.5 kg)<br><br>System fan tray: 10.5 lb (5.0 kg). |



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**Table 1-3** *Physical Specifications for the Cisco MDS 9509 Director (continued)*

| Description  | Specification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Power supply | 4000-W, AC input<br>3000-W, AC input<br>2500-W, AC input<br>2500-W, DC input                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Airflow      | 300 lfm <sup>2</sup> through system fan module, or 80 cfm <sup>3</sup> per supervisor, switching, or services module. Total of 720 cfm if all slots are filled.<br><br>Spacing requirements: <ul style="list-style-type: none"> <li>• 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.</li> <li>• 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).</li> </ul> |

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 1-4 lists the physical specifications for the Cisco MDS 9506 Director.

**Table 1-4** *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).<br>Chassis requires 7 RU <sup>1</sup> .<br>Chassis depth including cable guides is 26.75 inches (67.9 cm).                                                          |
| Weight             | Chassis only: 46 lb (20.9 kg).<br>Chassis configured with two supervisor modules, fan module, and two power supplies: 86 lb (39 kg).<br>System fan tray: 7.70 lbs (3.49 kg)<br>1900W AC power supply: 11 lbs (4.99 kg) |

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**Table 1-4** *Physical Specifications for the Cisco MDS 9506 Director (continued)*

| Description  | Specification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Power supply | 1900-W, AC input<br>1900-W, DC input                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Airflow      | 300 lfm <sup>2</sup> through system fan module, or 80 cfm <sup>3</sup> per supervisor, switching, or services module (total of 480 cfm if all slots are filled).<br>Spacing requirements: <ul style="list-style-type: none"> <li>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.</li> <li>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).</li> </ul> |

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 1-5 lists the specifications for the Cisco MDS 9500 Series supervisor modules, services modules, and switching modules.

**Table 1-5** *Cisco MDS 9500 Series Module Specifications*

| Description                                                     | Specification                    |
|-----------------------------------------------------------------|----------------------------------|
| <b>Environmental Requirements</b>                               |                                  |
| Temperature, certified for operation (module intake of ambient) | 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) |
| <b>Physical Characteristics</b>                                 |                                  |

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**Table 1-5** Cisco MDS 9500 Series Module Specifications (continued)

| Description | Specification                                                                                                                                                          |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dimensions  | 1.75 x 15.5 x 16.5 in. (4.4 x 39.4 x 41.9 cm)<br><br><b>Note</b> 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 1-6 lists the weight for each module in the Cisco MDS 9000 Family.

**Table 1-6** Weight of Modules in the Cisco MDS 9000 Family

| Module                                                 | Weight             |
|--------------------------------------------------------|--------------------|
| 8-port 10-Gbps FCoE module                             | 8 lb (3.63 kg)     |
| 48-Port 8-Gbps Advanced Fibre Channel Switching module | 10.0 lb (4.5 kg)   |
| 32-Port 8-Gbps Advanced Fibre Channel Switching module | 10.0 lb (4.5 kg)   |
| MDS 9513 256-Gbps Fabric 3 Module                      | 5 lb (2.26 kg)     |
| 16-port Storage Services Node                          | 10.0 lb (4.5 kg)   |
| 48-port 8-Gbps switching module                        | 10.25 lb (4.65 kg) |
| 24-port 8-Gbps switching module                        | 10.25 lb (4.65 kg) |
| 4/44-port 8-Gbps Host-Optimized switching module       | 9.75 lb (4.42 kg)  |
| Fabric 2 external crossbar module (DS-13SLT-FAB2)      | 6 lb (2.7 kg)      |
| Fabric 1 external crossbar module (DS-13SLT-FAB1)      | 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)      |

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**Table 1-6** *Weight of Modules in the Cisco MDS 9000 Family (continued)*

| Module                            | Weight            |
|-----------------------------------|-------------------|
| MSM-18/4                          | 8.5 lb (3.86 kg)  |
| MPS-14/2                          | 10 lb (4.5 kg)    |
| Supervisor-2A for MDS 9500 Series | 7.25 lb (3.3 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 1-7 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 1-7** *Caching Services Module Battery Specifications*

| Attribute               | Value                                                                                                                                                                                     |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Nominal voltage         | 9.6 V                                                                                                                                                                                     |
| Rated capacity          | Typical discharge capacity at 0.2C rate: 2100 mAh<br>Minimum discharge capacity at 0.2C rate: 2000 mAh<br>Minimum discharge capacity at 5C rate: 1800 mAh<br>(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, page 1-7](#)
- [Component Power Requirements and Heat Dissipation for the Cisco MDS 9513 Director, page 1-7](#)
- [AC Power Consumption for the Cisco MDS 9513 Director, page 1-9](#)

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## 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 1-8 lists the specifications for the Cisco MDS 9513 power supplies.

**Table 1-8**      *Specifications for Cisco MDS 9513 Power Supplies*

| Description                   | Specification                                                                                                                                                                                                                                                                                           |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>6000-W AC Power Supply</b> |                                                                                                                                                                                                                                                                                                         |
| Type                          | Autorangeing input with power factor corrector.                                                                                                                                                                                                                                                         |
| Voltage                       | 100 to 240 VAC ( $\pm 10\%$ ).                                                                                                                                                                                                                                                                          |
| Current rating                | 16 A maximum at 100 to 120 VAC and 2900-W output.<br>16 A maximum at 200 to 240 VAC and 6000-W output.                                                                                                                                                                                                  |
| Frequency                     | 50 to 60 Hz (nominal) ( $\pm 3$ Hz for full range).                                                                                                                                                                                                                                                     |
| Output capacity               | One AC power connection @ 110 VAC = No output<br>Two AC power connection @ 110 VAC = 2900 W output<br>One AC power connection @ 220 VAC = 2900 W output<br>One AC power connection @ 110 VAC and one AC power connection @ 220 VAC = 2900 W output<br>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

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Table 1-9 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 1-9 is based on worst-case conditions. Typical numbers are approximately 30 percent below the numbers listed here.

**Table 1-9** Requirements and Heat Dissipation for 6000-W AC Power Supplies

| Module Type/<br>Product Number                                                                             | NX-OS<br>Release | SAN-OS<br>Release | Power<br>Required<br>(watts) | Heat<br>Dissipation<br>(BTU/hr) | Input Current    |                      |                      |                      |
|------------------------------------------------------------------------------------------------------------|------------------|-------------------|------------------------------|---------------------------------|------------------|----------------------|----------------------|----------------------|
|                                                                                                            |                  |                   |                              |                                 | 90 VAC<br>(amps) | 120<br>VAC<br>(amps) | 180<br>VAC<br>(amps) | 240<br>VAC<br>(amps) |
| Fan tray 1 (front panel),<br>DS-13SLT-FAN-F                                                                |                  | 3.x               | 248                          | 1059                            | 3.44             | 2.58                 | 1.72                 | 1.29                 |
| Fan tray 2 (rear panel),<br>DS-13SLT-FAN-R                                                                 |                  | 3.x               | 70                           | 299                             | 0.97             | 0.73                 | 0.49                 | 0.36                 |
| Cisco MDS 9513 chassis,<br>DS-C9513, with front<br>(DS-13SLT-FAN-F) and rear<br>(DS-13SLT-FAN-R) fan trays |                  | 3.x               | 318                          | 1358                            | 4.41             | 3.31                 | 2.21                 | 1.65                 |
| Cisco MDS 9000 8-Port 10-Gbps<br>FCoE module (DS-X9708-K9)                                                 | 5.2              |                   | 150                          | 640                             | 2.08             | 1.56                 | 1.04                 | 0.78                 |
| 48-Port 8-Gbps Advanced Fibre<br>Channel Switching<br>module(DS-X9248-256K9)                               | 5.2              |                   | 310                          | 1387                            | 4.51             | 3.39                 | 2.26                 | 1.69                 |
| 32-Port 8-Gbps Advanced Fibre<br>Channel Switching<br>module(DS-X9232-256K9)                               | 5.2              |                   | 302                          | 1323                            | 4.31             | 3.23                 | 2.15                 | 1.61                 |
| Cisco MDS 9513 256-Gbps Fabric<br>3 Module (DS-13SLT-FAB3)                                                 | 5.2              |                   | 83                           | 427                             | 1.39             | 1.04                 | 0.69                 | 0.52                 |
| Supervisor-2A,<br>DS-X9530-SF2A-K9                                                                         | 5.2              |                   | 126                          | 538                             | 1.75             | 1.31                 | 0.88                 | 0.66                 |
| Supervisor-2, DS-X9530-SF2-K9                                                                              |                  | 3.x               | 126                          | 538                             | 1.75             | 1.31                 | 0.88                 | 0.66                 |
| 48-port 4-Gbps switching module,<br>DS-X9148                                                               |                  | 3.x               | 185                          | 790                             | 2.57             | 1.93                 | 1.28                 | 0.96                 |
| 24-port 4-Gbps switching module,<br>DS-X9124                                                               |                  | 3.x               | 147                          | 628                             | 2.04             | 1.53                 | 1.02                 | 0.77                 |
| 12-port 4-Gbps switching module,<br>DS-X9112                                                               |                  | 3.x               | 132                          | 564                             | 1.83             | 1.38                 | 0.92                 | 0.69                 |
| 4-port 10-Gbps switching module,<br>DS-X9704                                                               |                  | 3.x               | 172                          | 734                             | 2.39             | 1.79                 | 1.19                 | 0.90                 |
| 18/4 Multiservice module,<br>DS-X9304-18K9                                                                 |                  | 3.2.(1)           | 200                          | 855                             | 2.78             | 2.08                 | 1.39                 | 1.04                 |
| Crossbar module, DS-13SLT-FAB1,<br>DS-13SLT-FAB2                                                           |                  | 3.x               | 63                           | 269                             | 0.88             | 0.66                 | 0.44                 | 0.33                 |

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**Table 1-9** Requirements and Heat Dissipation for 6000-W AC Power Supplies (continued)

| Module Type/<br>Product Number                                        | NX-OS<br>Release | SAN-OS<br>Release | Power<br>Required<br>(watts) | Heat<br>Dissipation<br>(BTU/hr) | Input Current    |                      |                      |                      |
|-----------------------------------------------------------------------|------------------|-------------------|------------------------------|---------------------------------|------------------|----------------------|----------------------|----------------------|
|                                                                       |                  |                   |                              |                                 | 90 VAC<br>(amps) | 120<br>VAC<br>(amps) | 180<br>VAC<br>(amps) | 240<br>VAC<br>(amps) |
| 48-port 8-Gbps switching module,<br>DS-X9248-96K9                     | 4.x              |                   | 298                          | 1273                            | 4.14             | 3.11                 | 2.07                 | 1.55                 |
| 24-port 8-Gbps switching module,<br>DS-X9224-96K                      | 4.x              |                   | 273                          | 1163                            | 3.79             | 2.84                 | 1.90                 | 1.42                 |
| 4/44-port 8-Gbps Host-Optimized<br>switching module,<br>DS-X9248-48K9 | 4.x              |                   | 214                          | 915                             | 2.98             | 2.23                 | 1.49                 | 1.12                 |
| 16-port Storage Services Node,<br>DS-X9316-SSNK9                      | 4.2(1)           |                   | 298                          | 1273                            | 4.14             | 3.11                 | 2.08                 | 1.55                 |

## AC Power Consumption for the Cisco MDS 9513 Director

Table 1-10 shows the typical AC power consumption for a Cisco MDS 9513 Director.

**Table 1-10** Typical AC Power Consumption for a Cisco MDS 9513 Director

| Module Type / Product Number                                                                                                                                                                                                                                 | Typical AC Power Consumption<br>(Watts) |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| Cisco MDS 9513 chassis, DS-C9513, with front (DS-13SLT-FAN-F) and rear (DS-13SLT-FAN-R) fan trays, two Supervisor-2 (DS-X9530-SF2-K9) or Supervisor-2A (DS-X9530-SF2A-K9) modules, and two crossbar modules (DS-13SLT-FAB1, DS-13SLT-FAB2, or DS-13SLT-FAB3) | 697                                     |
| 48-port 4-Gbps switching module, DS-X9148                                                                                                                                                                                                                    | 181                                     |
| 24-port 4-Gbps switching module, DS-X9124                                                                                                                                                                                                                    | 127                                     |
| 12-port 4-Gbps switching module, DS-X9112                                                                                                                                                                                                                    | 107                                     |
| 4-port 10-Gbps switching module, DS-X9704                                                                                                                                                                                                                    | 162                                     |
| 48-port 8-Gbps switching module, DS-X9248-96K9                                                                                                                                                                                                               | 230                                     |
| 24-port 8-Gbps switching module, DS-X9224-96K                                                                                                                                                                                                                | 221                                     |
| 4/44-port 8-Gbps Host-Optimized switching module,<br>DS-X9248-48K9                                                                                                                                                                                           | 175                                     |
| 16-port Storage Services Node, DS-X9316-SSNK9                                                                                                                                                                                                                | 257                                     |
| 8-port 10-Gbps FCoE module, DS-X9708-K9                                                                                                                                                                                                                      | 107                                     |
| 48-Port 8-Gbps Advanced Fibre Channel Switching module,<br>DS-X9248-256K9                                                                                                                                                                                    | 267                                     |
| 32-Port 8-Gbps Advanced Fibre Channel Switching module,<br>DS-X9232-256K9                                                                                                                                                                                    | 243                                     |

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# Power Specifications for the Cisco MDS 9509 Director

This section includes the following topics:

- [Specifications for the Cisco MDS 9509 Power Supplies, page 1-10](#)
- [Component Power Requirements and Heat Dissipation for the Cisco MDS 9509 Director, page 1-11](#)
- [AC Power Consumption for the Cisco MDS 9509 Director, page 1-15](#)

## 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 1-11](#) lists the specifications for the Cisco MDS 9509 power supplies.

**Table 1-11**      *Specifications for Cisco MDS 9509 Power Supplies*

| Description                   | Specification                                                                                                                                                                                                                                                    |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>2500-W AC Power Supply</b> |                                                                                                                                                                                                                                                                  |
| Type                          | Autoranging input with power factor corrector.                                                                                                                                                                                                                   |
| Voltage                       | 100 to 240 VAC ( $\pm 10\%$ ).                                                                                                                                                                                                                                   |
| Current rating                | 16 A maximum at 100 to 120 VAC and 1300-W output.<br>16 A maximum at 200 to 240 VAC and 2500-W output.<br><b>Note</b> For current ratings of plugs, see <a href="#">Figure 1-5 on page 1-9</a> .                                                                 |
| Frequency                     | 50 to 60 Hz (nominal) ( $\pm 3$ Hz for full range).                                                                                                                                                                                                              |
| Output capacity               | 1325 W maximum (100 to 120 VAC).<br>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 15 A; 5 V at 5 A; 12 V at 12 A; 42 V at 55.5 A.                                                                                                                                                                                                         |
| <b>2500-W DC Power Supply</b> |                                                                                                                                                                                                                                                                  |
| 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.<br><b>Note</b> 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).                                                                                                                                                                                                                                 |



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**Table 1-11** Specifications for Cisco MDS 9509 Power Supplies (continued)

| Description                   | Specification                                                                                                                                                                          |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Output voltage                | 3.3 V at 15 A; 5 V at 5 A; 12 V at 12 A; 42 V at 55.5 A.                                                                                                                               |
| <b>3000-W AC Power Supply</b> |                                                                                                                                                                                        |
| Type                          | Autoranging input with power factor corrector.                                                                                                                                         |
| Voltage                       | 100 to 240 VAC ( $\pm 10\%$ ).                                                                                                                                                         |
| Current rating                | 17.6 A maximum at 100 to 120 VAC and 1400-W output.<br>17.6 A maximum at 200 to 240 VAC and 3000-W output.<br>For current ratings of plugs, see <a href="#">Figure 1-5 on page 1-9</a> |
| Frequency                     | 50 to 60 Hz (nominal) ( $\pm 3$ Hz for full range).                                                                                                                                    |
| Output capacity               | 1400 W maximum (100 to 120 VAC).<br>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 15 A; 12 V at 12 A; 42 V at 66 A.                                                                                                                                             |
| <b>4000-W AC Power Supply</b> |                                                                                                                                                                                        |
| Type                          | High-line input with power factor corrector, 220 VAC, single-phase circuit.                                                                                                            |
| Voltage                       | 200 to 240 VAC ( $\pm 10\%$ ).                                                                                                                                                         |
| Current rating                | 23 A<br><b>Note</b> For current ratings of plugs, see <a href="#">Figure 1-8 on page 1-11</a> .                                                                                        |
| Frequency                     | 50/60 Hz (nominal) ( $\pm 3\%$ 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

When sizing the air-conditioning requirements for an installation, consider heat dissipation. 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 1-12](#) and [Table 1-13](#) 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 1-12](#) and [Table 1-13](#) is based on worst-case conditions. Typical numbers are approximately 30 percent below the numbers listed here.

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**Table 1-12** Requirements and Heat Dissipation for 2500-, 3000-, and 4000-W AC Power Supplies

| Module Type/<br>Product Number                             | NX-OS<br>Release | SAN-OS<br>Release | Power<br>Required<br>(watts) | Heat<br>Dissipation<br>(BTU/hr) | Input Current    |                      |                      |                      |
|------------------------------------------------------------|------------------|-------------------|------------------------------|---------------------------------|------------------|----------------------|----------------------|----------------------|
|                                                            |                  |                   |                              |                                 | 90 VAC<br>(amps) | 120<br>VAC<br>(amps) | 180<br>VAC<br>(amps) | 240<br>VAC<br>(amps) |
| Cisco MDS 9509 chassis with fan<br>module<br>DS-C9509      |                  | 3.x               | 210                          | 897                             | 2.92             | 2.19                 | 1.46                 | 1.09                 |
|                                                            |                  | 2.x and<br>1.x    | 216                          | 920                             | 3.00             | 2.25                 | 1.50                 | 1.13                 |
| Supervisor/fabric 1<br>DS-X9530-SF1                        |                  | 3.x               | 210                          | 897                             | 2.92             | 2.19                 | 1.46                 | 1.09                 |
|                                                            |                  | 2.x and<br>1.x    | 220                          | 940                             | 3.05             | 2.29                 | 1.53                 | 1.15                 |
| Supervisor-2, DS-X9530-SF2-K9                              |                  | 3.x               | 126                          | 538                             | 1.75             | 1.31                 | 0.88                 | 0.66                 |
| 48-port 4-Gbps switching module,<br>DS-X9148               |                  | 3.x               | 185                          | 790                             | 2.57             | 1.93                 | 1.28                 | 0.96                 |
|                                                            |                  | 2.x and<br>1.x    | —                            | —                               | —                | —                    | —                    | —                    |
| 24-port 4-Gbps switching module,<br>DS-X9124               |                  | 3.x               | 147                          | 628                             | 2.04             | 1.53                 | 1.02                 | 0.77                 |
|                                                            |                  | 2.x and<br>1.x    | —                            | —                               | —                | —                    | —                    | —                    |
| 12-port 4-Gbps switching module,<br>DS-X9112               |                  | 3.x               | 132                          | 564                             | 1.83             | 1.38                 | 0.92                 | 0.69                 |
|                                                            |                  | 2.x and<br>1.x    | —                            | —                               | —                | —                    | —                    | —                    |
| 4-port 10-Gbps switching module,<br>DS-X9704               |                  | 3.x               | 172                          | 734                             | 2.39             | 1.79                 | 1.19                 | 0.90                 |
|                                                            |                  | 2.x and<br>1.x    | —                            | —                               | —                | —                    | —                    | —                    |
| 32-port 1-Gbps/2-Gbps Fibre<br>Channel module,<br>DS-X9032 |                  | 3.x               | 191                          | 816                             | 2.65             | 1.99                 | 1.33                 | 0.99                 |
|                                                            |                  | 2.x and<br>1.x    | 200                          | 855                             | 2.78             | 2.08                 | 1.39                 | 1.04                 |
| 16-port 1-Gbps/2-Gbps Fibre<br>Channel module,<br>DS-X9016 |                  | 3.x               | 210                          | 897                             | 2.92             | 2.19                 | 1.46                 | 1.09                 |
|                                                            |                  | 2.x and<br>1.x    | 220                          | 940                             | 3.05             | 2.29                 | 1.53                 | 1.15                 |
| 18/4 Multiservice module,<br>DS-X9304-18K9                 |                  | 3.2.(1)           | 200                          | 855                             | 2.78             | 2.08                 | 1.39                 | 1.04                 |
| MPS-14/2 module DS-X9302-14K9                              |                  | 3.x               | 200                          | 854                             | 2.78             | 2.08                 | 1.39                 | 1.04                 |
|                                                            |                  | 2.x and<br>1.x    | 227                          | 970                             | 3.15             | 2.37                 | 1.57                 | 1.19                 |
| 8-port IPS module<br>DS-X9308-SMIP                         |                  | 3.x               | 200                          | 854                             | 2.78             | 2.08                 | 1.39                 | 1.04                 |
|                                                            |                  | 2.x and<br>1.x    | 220                          | 940                             | 3.05             | 2.29                 | 1.53                 | 1.15                 |
| 4-port IPS module<br>DS-X9304-SMIP                         |                  | 3.x               | 160                          | 683                             | 2.22             | 1.67                 | 1.11                 | 0.83                 |
|                                                            |                  | 2.x and<br>1.x    | 185                          | 789                             | 2.57             | 1.93                 | 1.28                 | 0.96                 |

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**Table 1-12** Requirements and Heat Dissipation for 2500-, 3000-, and 4000-W AC Power Supplies (continued)

| Module Type/<br>Product Number                                               | NX-OS<br>Release | SAN-OS<br>Release | Power<br>Required<br>(watts) | Heat<br>Dissipation<br>(BTU/hr) | Input Current    |                      |                      |                      |
|------------------------------------------------------------------------------|------------------|-------------------|------------------------------|---------------------------------|------------------|----------------------|----------------------|----------------------|
|                                                                              |                  |                   |                              |                                 | 90 VAC<br>(amps) | 120<br>VAC<br>(amps) | 180<br>VAC<br>(amps) | 240<br>VAC<br>(amps) |
| 32-port SSM<br>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<br>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<br>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                 |
| 48-port 8-Gbps switching module,<br>DS-X9248-96K9                            | 4.x              |                   | 298                          | 1273                            | 4.14             | 3.11                 | 2.07                 | 1.55                 |
| 24-port 8-Gbps switching module,<br>DS-X9224-96K                             | 4.x              |                   | 273                          | 1163                            | 3.79             | 2.84                 | 1.90                 | 1.42                 |
| 4/44-port 8-Gbps Host-Optimized<br>switching module,<br>DS-X9248-48K9        | 4.x              |                   | 214                          | 915                             | 2.98             | 2.23                 | 1.49                 | 1.12                 |
| 16-port Storage Services Node,<br>DS-X9316-SSNK9                             | 4.2(1)           |                   | 298                          | 1273                            | 4.14             | 3.11                 | 2.08                 | 1.55                 |
| Cisco MDS 9000 8-Port 10-Gbps<br>FCoE module (DS-X9708-K9)                   | 5.2              |                   | 150                          | 640                             | 2.08             | 1.56                 | 1.04                 | 0.78                 |
| 48-Port 8-Gbps Advanced Fibre<br>Channel Switching<br>module(DS-X9248-256K9) | 5.2              |                   | 310                          | 1387                            | 4.51             | 3.39                 | 2.26                 | 1.69                 |
| 32-Port 8-Gbps Advanced Fibre<br>Channel Switching<br>module(DS-X9232-256K9) | 5.2              |                   | 302                          | 1323                            | 4.31             | 3.23                 | 2.15                 | 1.61                 |
| Supervisor-2A,<br>DS-X9530-SF2A-K9                                           | 5.2              |                   | 126                          | 538                             | 1.75             | 1.31                 | 0.88                 | 0.66                 |

**Table 1-13** Power Requirements and Heat Dissipation for the 2500-W DC Power Supply

| Module Type/<br>Product Number                        | SAN-OS Release | Power<br>Required<br>(watts) | Heat<br>Dissipation<br>(BTU/hr) | Input Current    |                  |
|-------------------------------------------------------|----------------|------------------------------|---------------------------------|------------------|------------------|
|                                                       |                |                              |                                 | 48 VDC<br>(amps) | 60 VDC<br>(amps) |
| Cisco MDS 9509<br>chassis with fan module<br>DS-C9509 | 3.x            | 210                          | 956                             | 5.83             | 4.67             |
|                                                       | 2.x and 1.x    | 216                          | 983                             | 6.00             | 4.80             |

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**Table 1-13**      *Power Requirements and Heat Dissipation for the 2500-W DC Power Supply (continued)*

| Module Type/<br>Product Number                            | SAN-OS Release | Power<br>Require<br>d (watts) | Heat<br>Dissipation<br>(BTU/hr) | Input Current    |                  |
|-----------------------------------------------------------|----------------|-------------------------------|---------------------------------|------------------|------------------|
|                                                           |                |                               |                                 | 48 VDC<br>(amps) | 60 VDC<br>(amps) |
| Supervisor/fabric 1<br>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<br>module<br>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<br>module<br>DS-X9016 | 3.x            | 210                           | 956                             | 5.83             | 4.67             |
|                                                           | 2.x and 1.x    | 220                           | 1000                            | 6.10             | 4.88             |
| MSM-18/4 module, DS-X9304-18K9                            | 3.2(1)         | 200                           | 855                             | 2.78             | 2.08             |
| MPS-14/2 module<br>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<br>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<br>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<br>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<br>DS-X9032-SMV                               | 3.x            | 281                           | 1279                            | 7.81             | 6.24             |
|                                                           | 2.x and 1.x    | 295                           | 1342                            | 8.19             | 6.56             |
| CSM<br>DS-X9560-SMC                                       | 3.x            | 200                           | 910                             | 5.56             | 4.44             |
|                                                           | 2.x and 1.x    | 210                           | 956                             | 5.83             | 4.67             |

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## AC Power Consumption for the Cisco MDS 9509 Director

Table 1-14 shows the typical AC power consumption for the Cisco MDS 9509 Director

**Table 1-14** Typical AC Power Consumption for a Cisco MDS 9509 Director

| Module Type / Product Number                                                                                                  | Typical AC Power Consumption (Watts) |
|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| Cisco MDS 9509 chassis, DS-C9509, with fan module, and two Supervisor-2 (DS-X9530-SF2-K9) or Supervisor-2A (DS-X9530-SF2A-K9) | 380                                  |
| Cisco MDS 9509 chassis, DS-C9509, with fan module, and two Supervisor-1 (DS-X9530-SF1-K9)                                     | 622                                  |
| 48-port 4-Gbps switching module, DS-X9148                                                                                     | 181                                  |
| 24-port 4-Gbps switching module, DS-X9124                                                                                     | 127                                  |
| 12-port 4-Gbps switching module, DS-X9112                                                                                     | 107                                  |
| 4-port 10-Gbps switching module, DS-X9704                                                                                     | 162                                  |
| 32-port 1-Gbps/2-Gbps Fibre Channel module, DS-X9032                                                                          | 174                                  |
| 16-port 1-Gbps/2-Gbps Fibre Channel module, DS-X9016                                                                          | 144                                  |
| Cisco MDS 9000 Family 18/4 - port Multiservice module                                                                         | 199.8                                |
| MPS-14/2 module, DS-X9302-14K9                                                                                                | 178                                  |
| 32-port SSM, DS-X9032-SSM                                                                                                     | 211                                  |
| 8-port IPS module, DS-X9308-SMIP                                                                                              | 175                                  |
| 4-port IPS module, DS-X9304-SMIP                                                                                              | 128                                  |
| 48-port 8-Gbps switching module, DS-X9248-96K9                                                                                | 230                                  |
| 24-port 8-Gbps switching module, DS-X9224-96K                                                                                 | 221                                  |
| 4/44-port 8-Gbps Host-Optimized switching module, DS-X9248-48K9                                                               | 175                                  |
| 16-port Storage Services Node, DS-X9316-SSNK9                                                                                 | 257                                  |
| Cisco MDS 9000 8-Port 10-Gbps FCoE module (DS-X9708-K9)                                                                       | 107                                  |
| 48-Port 8-Gbps Advanced Fibre Channel Switching module(DS-X9248-256K9)                                                        | 267                                  |
| 32-Port 8-Gbps Advanced Fibre Channel Switching module(DS-X9232-256K9)                                                        | 243                                  |
| Supervisor-2A, DS-X9530-SF2A-K9                                                                                               | 697                                  |

## Power Specifications for the Cisco MDS 9506 Director

This section includes the following topics:

- [Specifications for the Cisco MDS 9506 Power Supplies, page 1-17](#)
- [Component Power Requirements and Heat Dissipation for the Cisco MDS 9506 Director, page 1-18](#)

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- [AC Power Consumption for the Cisco MDS 9506 Director, page 1-21](#)

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## 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 1-15](#) lists the specifications for the Cisco MDS 9506 power supplies.

**Table 1-15**      *Specifications for Cisco MDS 9506 Power Supplies*

| Description                   | Specification                                                                                                                                                                                                                                                    |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1900-W AC Power Supply</b> |                                                                                                                                                                                                                                                                  |
| Type                          | Autoranging input with power factor corrector.                                                                                                                                                                                                                   |
| Voltage                       | 100 to 240 VAC ( $\pm 10\%$ ).                                                                                                                                                                                                                                   |
| Current rating                | 12 A maximum at 100 to 120 VAC and 1050-W output.<br>12 A maximum at 200 to 240 VAC and 1900-W output.<br><b>Note</b> For current ratings of plugs, see <a href="#">Figure 1-5 on page 1-9</a> .                                                                 |
| Frequency                     | 50/60 Hz (nominal) ( $\pm 3$ Hz for full range).                                                                                                                                                                                                                 |
| Output capacity               | 1050 W maximum (at input of 100 to 120 VAC).<br>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.                                                                                                                                                                                                                   |
| <b>1900-W DC Power Supply</b> |                                                                                                                                                                                                                                                                  |
| 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.<br><b>Note</b> 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.                                                                                                                                                                                                                   |

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## Component Power Requirements and Heat Dissipation for the Cisco MDS 9506 Director

When sizing the air-conditioning requirements for an installation, consider heat dissipation. The power and heat associated with a Cisco MDS 9506 Director varies depending upon the following:

- Power supply type
- Switching module type and number of switching modules installed
- Average switching traffic levels

Table 1-16 and Table 1-17 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 1-16 and Table 1-17 is based on worst-case conditions. Typical numbers are approximately 30 percent below the numbers listed here.

**Table 1-16** Power Requirements and Heat Dissipation for the 1900-W AC Power Supply

| Module Type/<br>Product Number                                               | NX-OS<br>Release | SAN-OS<br>Release | Power<br>Required<br>(watts) | Heat<br>Dissipation<br>(BTU/hr) | Input Current    |                      |                      |                      |
|------------------------------------------------------------------------------|------------------|-------------------|------------------------------|---------------------------------|------------------|----------------------|----------------------|----------------------|
|                                                                              |                  |                   |                              |                                 | 90 VAC<br>(amps) | 120<br>VAC<br>(amps) | 180<br>VAC<br>(amps) | 240<br>VAC<br>(amps) |
| Cisco MDS 9506 chassis with fan<br>module<br>DS-C9506                        |                  | 3.x               | 126                          | 538                             | 1.75             | 1.31                 | 0.88                 | 0.66                 |
|                                                                              |                  | 2.x and<br>1.x    | 126                          | 538                             | 1.75             | 1.32                 | 0.88                 | 0.66                 |
| Supervisor/fabric 1<br>DS-X9530-SF1                                          |                  | 3.x               | 210                          | 897                             | 2.92             | 2.19                 | 1.46                 | 1.09                 |
|                                                                              |                  | 2.x and<br>1.x    | 220                          | 940                             | 3.05             | 2.29                 | 1.53                 | 1.15                 |
| Cisco MDS 9000 8-Port 10-Gbps<br>FCoE module (DS-X9708-K9)                   | 5.2              |                   | 150                          | 640                             | 2.08             | 1.56                 | 1.04                 | 0.78                 |
| 48-Port 8-Gbps Advanced Fibre<br>Channel Switching<br>module(DS-X9248-256K9) | 5.2              |                   | 310                          | 1387                            | 4.51             | 3.39                 | 2.26                 | 1.69                 |
| 32-Port 8-Gbps Advanced Fibre<br>Channel Switching<br>module(DS-X9232-256K9) | 5.2              |                   | 302                          | 1323                            | 4.31             | 3.23                 | 2.15                 | 1.61                 |
| Supervisor-2A,<br>DS-X9530-SF2A-K9                                           | 5.2              |                   | 126                          | 538                             | 1.75             | 1.31                 | 0.88                 | 0.66                 |
| Supervisor-2, DS-X9530-SF2-K9                                                |                  | 3.x               | 126                          | 538                             | 1.75             | 1.31                 | 0.88                 | 0.66                 |
| 48-port 4-Gbps switching module,<br>DS-X9148                                 |                  | 3.x               | 185                          | 790                             | 2.57             | 1.93                 | 1.28                 | 0.96                 |
|                                                                              |                  | 2.x and<br>1.x    | —                            | —                               | —                | —                    | —                    | —                    |
| 24-port 4-Gbps switching module,<br>DS-X9124                                 |                  | 3.x               | 147                          | 628                             | 2.04             | 1.53                 | 1.02                 | 0.77                 |
|                                                                              |                  | 2.x and<br>1.x    | —                            | —                               | —                | —                    | —                    | —                    |



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**Table 1-16 Power Requirements and Heat Dissipation for the 1900-W AC Power Supply (continued)**

| Module Type/<br>Product Number                            | NX-OS<br>Release | SAN-OS<br>Release | Power<br>Required<br>(watts) | Heat<br>Dissipation<br>(BTU/hr) | Input Current    |                      |                      |                      |
|-----------------------------------------------------------|------------------|-------------------|------------------------------|---------------------------------|------------------|----------------------|----------------------|----------------------|
|                                                           |                  |                   |                              |                                 | 90 VAC<br>(amps) | 120<br>VAC<br>(amps) | 180<br>VAC<br>(amps) | 240<br>VAC<br>(amps) |
| 12-port 4-Gbps switching module,<br>DS-X9112              |                  | 3.x               | 132                          | 564                             | 1.83             | 1.38                 | 0.92                 | 0.69                 |
|                                                           |                  | 2.x and<br>1.x    | —                            | —                               | —                | —                    | —                    | —                    |
| 4-port 10-Gbps switching module,<br>DS-X9704              |                  | 3.x               | 172                          | 734                             | 2.39             | 1.79                 | 1.19                 | 0.90                 |
|                                                           |                  | 2.x and<br>1.x    | —                            | —                               | —                | —                    | —                    | —                    |
| 32-port 1-Gbps/2-Gbps Fibre<br>Channel module<br>DS-X9032 |                  | 3.x               | 191                          | 816                             | 2.65             | 1.99                 | 1.33                 | 0.99                 |
|                                                           |                  | 2.x and<br>1.x    | 200                          | 855                             | 2.78             | 2.08                 | 1.39                 | 1.04                 |
| 16-port 1-Gbps/2-Gbps Fibre<br>Channel module<br>DS-X9016 |                  | 3.x               | 210                          | 897                             | 2.92             | 2.19                 | 1.46                 | 1.09                 |
|                                                           |                  | 2.x and<br>1.x    | 220                          | 940                             | 3.05             | 2.29                 | 1.53                 | 1.15                 |
| 18/4 Multiservice module,<br>DS-X9304-18K9                |                  | 3.2.(1)           | 200                          | 855                             | 2.78             | 2.08                 | 1.39                 | 1.04                 |
| MPS-14/2 module<br>DS-X9302-14K9                          |                  | 3.x               | 200                          | 854                             | 2.78             | 2.08                 | 1.39                 | 1.04                 |
|                                                           |                  | 2.x and<br>1.x    | 227                          | 970                             | 3.15             | 2.37                 | 1.57                 | 1.19                 |
| 8-port IPS module<br>DS-X9308-SMIP                        |                  | 3.x               | 200                          | 854                             | 2.78             | 2.08                 | 1.39                 | 1.04                 |
|                                                           |                  | 2.x and<br>1.x    | 220                          | 940                             | 3.05             | 2.29                 | 1.53                 | 1.15                 |
| 4-port IPS module<br>DS-X9304-SMIP                        |                  | 3.x               | 160                          | 683                             | 2.22             | 1.67                 | 1.11                 | 0.83                 |
|                                                           |                  | 2.x and<br>1.x    | 185                          | 789                             | 2.57             | 1.93                 | 1.28                 | 0.96                 |
| 32-port SSM<br>DS-X9032-SSM                               |                  | 3.x               | 281                          | 1200                            | 3.90             | 2.93                 | 1.95                 | 1.46                 |
|                                                           |                  | 2.x and<br>1.x    | 295                          | 1260                            | 4.10             | 3.07                 | 2.05                 | 1.54                 |
| 32-port ASM<br>DS-X9032-SMV                               |                  | 3.x               | 281                          | 1200                            | 3.90             | 2.93                 | 1.95                 | 1.46                 |
|                                                           |                  | 2.x and<br>1.x    | 295                          | 1260                            | 4.10             | 3.07                 | 2.05                 | 1.54                 |
| CSM<br>DS-X9560-SMC                                       |                  | 3.x               | 200                          | 854                             | 2.78             | 2.08                 | 1.39                 | 1.04                 |
|                                                           |                  | 2.x and<br>1.x    | 210                          | 907                             | 2.95             | 2.22                 | 1.48                 | 1.11                 |
| 48-port 8-Gbps switching module,<br>DS-X9248-96K9         | 4.x              |                   | 298                          | 1273                            | 4.14             | 3.11                 | 2.07                 | 1.55                 |
| 24-port 8-Gbps switching module,<br>DS-X9224-96K          | 4.x              |                   | 273                          | 1163                            | 3.79             | 2.84                 | 1.90                 | 1.42                 |

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**Table 1-16** *Power Requirements and Heat Dissipation for the 1900-W AC Power Supply (continued)*

| Module Type/<br>Product Number                                     | NX-OS<br>Release | SAN-OS<br>Release | Power<br>Required<br>(watts) | Heat<br>Dissipation<br>(BTU/hr) | Input Current    |                      |                      |                      |
|--------------------------------------------------------------------|------------------|-------------------|------------------------------|---------------------------------|------------------|----------------------|----------------------|----------------------|
|                                                                    |                  |                   |                              |                                 | 90 VAC<br>(amps) | 120<br>VAC<br>(amps) | 180<br>VAC<br>(amps) | 240<br>VAC<br>(amps) |
| 4/44-port 8-Gbps Host-Optimized switching module,<br>DS-X9248-48K9 | 4.x              |                   | 214                          | 915                             | 2.98             | 2.23                 | 1.49                 | 1.12                 |
| 16-port Storage Services Node<br>(DS-X9316-SSNK9)                  | 4.2(1)           |                   | 298                          | 1273                            | 4.14             | 3.11                 | 2.08                 | 1.55                 |

**Table 1-17** *Power Requirements and Heat Dissipation for the 1900-W DC Power Supply*

| Module Type/<br>Product Number                            | SAN-OS Release | Power<br>Required<br>(watts) | Heat<br>Dissipation<br>(BTU/hr) | Input Current    |                  |
|-----------------------------------------------------------|----------------|------------------------------|---------------------------------|------------------|------------------|
|                                                           |                |                              |                                 | 48 VDC<br>(amps) | 60 VDC<br>(amps) |
| Cisco MDS 9506<br>chassis with fan module<br>DS-C9506     | 3.x            | 126                          | 573                             | 3.50             | 2.80             |
|                                                           | 2.x and 1.x    | 126                          | 573                             | 3.50             | 2.80             |
| Supervisor/fabric 1<br>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<br>Fibre Channel module<br>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<br>Fibre Channel module<br>DS-X9016 | 3.x            | 210                          | 956                             | 5.83             | 4.67             |
|                                                           | 2.x and 1.x    | 220                          | 1000                            | 6.10             | 4.88             |
| 18/4 Multiservice<br>module,<br>DS-X9304-18K9             | 3.2.(1)        | 200                          | 855                             | 2.78             | 2.08             |
| MPS-14/2 module<br>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<br>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<br>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<br>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<br>DS-X9032-SMV                               | 3.x            | 281                          | 1279                            | 7.81             | 6.24             |
|                                                           | 2.x and 1.x    | 295                          | 1342                            | 8.19             | 6.56             |
| CSM<br>DS-X9560-SMC                                       | 3.x            | 200                          | 910                             | 5.56             | 4.44             |
|                                                           | 2.x and 1.x    | 210                          | 955                             | 5.83             | 4.66             |

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## AC Power Consumption for the Cisco MDS 9506 Director

Table 1-18 shows the typical AC power consumption for the Cisco MDS 9506 Director.

**Table 1-18** Typical AC Power Consumption for a Cisco MDS 9506 Director

| Module Type / Product Number                                                                                                          | Typical AC Power Consumption (Watts) |
|---------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| Cisco MDS 9506 chassis, DS-C9506, with fan module, and two Supervisor-2 (DS-X9530-SF2-K9) or Supervisor-2A (DS-X9530-SF2A-K9) modules | 395                                  |
| Cisco MDS 9506 chassis, DS-C9506, with fan module, and two Supervisor-1 (DS-X9530-SF1-K9)                                             | 624                                  |
| 48-port 4-Gbps switching module, DS-X9148                                                                                             | 181                                  |
| 24-port 4-Gbps switching module, DS-X9124                                                                                             | 127                                  |
| 12-port 4-Gbps switching module, DS-X9112                                                                                             | 107                                  |
| 4-port 10-Gbps switching module, DS-X9704                                                                                             | 162                                  |
| 32-port 1-Gbps/2-Gbps Fibre Channel module, DS-X9032                                                                                  | 174                                  |
| 16-port 1-Gbps/2-Gbps Fibre Channel module, DS-X9016                                                                                  | 144                                  |
| Cisco MDS 9000 Family 18/4 - port Multiservice module                                                                                 | 199.8                                |
| MPS-14/2 module, DS-X9302-14K9                                                                                                        | 178                                  |
| 32-port SSM, DS-X9032-SSM                                                                                                             | 211                                  |
| 8-port IPS module, DS-X9308-SMIP                                                                                                      | 175                                  |
| 4-port IPS module, DS-X9304-SMIP                                                                                                      | 128                                  |
| 48-port 8-Gbps switching module, DS-X9248-96K9                                                                                        | 230                                  |
| 24-port 8-Gbps switching module, DS-X9224-96K                                                                                         | 221                                  |
| 4/44-port 8-Gbps Host-Optimized switching module, DS-X9248-48K9                                                                       | 175                                  |
| 16-port Storage Services Node (DS-X9316-SSNK9)                                                                                        | 257                                  |
| Cisco MDS 9000 8-Port 10-Gbps FCoE module (DS-X9708-K9)                                                                               | 107                                  |
| 48-Port 8-Gbps Advanced Fibre Channel Switching module(DS-X9248-256K9)                                                                | 267                                  |
| 32-Port 8-Gbps Advanced Fibre Channel Switching module(DS-X9232-256K9)                                                                | 243                                  |
| Supervisor-2A, DS-X9530-SF2A-K9                                                                                                       | 697                                  |

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## Transceiver Specifications

The Cisco MDS 9500 Series is compatible with X2, SFP, and SFP+ transceivers and cables that have SC and LC connectors. For more information, see the Cisco MDS 9000 Family Pluggable Transceivers data sheet at this URL:

[http://www.cisco.com/en/US/prod/collateral/ps4159/ps6409/ps4358/product\\_data\\_sheet09186a00801bc698.html](http://www.cisco.com/en/US/prod/collateral/ps4159/ps6409/ps4358/product_data_sheet09186a00801bc698.html) .



## Cable and Port Specifications

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This appendix provides the cable and port specifications, and includes the following sections:

- [Cables and Adapters Provided, page 1-1](#)
- [Console Port, page 1-2](#)
- [COM1 Port, page 1-3](#)
- [MGMT 10/100/1000 Ethernet Port, page 1-5](#)
- [MGMT 10/100 Ethernet Port, page 1-6](#)
- [Supported Power Cords and Plugs, page 1-7](#)

## 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**

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Additional cables and adapters can be ordered from your customer service representative.

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**Note**

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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/en/US/support/tsd\\_cisco\\_worldwide\\_contacts.html](http://www.cisco.com/en/US/support/tsd_cisco_worldwide_contacts.html)

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## 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 1-1](#) lists the pinouts for the console port on the Cisco MDS 9500 Series.

**Table 1-1 Console Port Pinouts**

| Pin            | Signal |
|----------------|--------|
| 1 <sup>1</sup> | 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 1-2](#) lists the pinouts for the console port, the RJ-45 rollover cable, and the RJ-45/DSUB F/F adapter.

**Table 1-2 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            |

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## 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 1-3](#) lists the pinouts for the console port, the RJ-45 rollover cable, and the DB-9F/RJ-45F PC terminal.

**Table 1-3** 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 1-4](#) 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 1-4** COM1 Port Pinouts

| Pin | Signal |
|-----|--------|
| 1   | DCD    |
| 2   | RxD    |
| 3   | TxD    |
| 4   | DTR    |
| 5   | GND    |
| 6   | DSR    |
| 7   | RTS    |

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**Table 1-4** *COM1 Port Pinouts (continued)*

| Pin | Signal |
|-----|--------|
| 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 1-5](#) 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 1-5** *Port Mode Signaling and Pinouts for Modem with DB-25 Connection*

| COM1 Port | DB-9F/RJ45 F 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    |

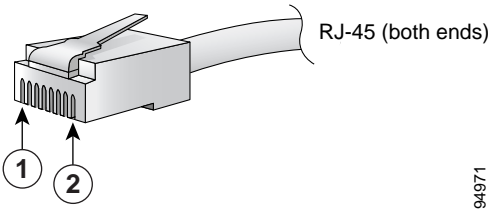


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# MGMT 10/100/1000 Ethernet Port

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 1-1](#)).

**Figure 1-1** RJ-45 Interface Cable Connector



|   |       |   |       |
|---|-------|---|-------|
| 1 | Pin 1 | 2 | Pin 8 |
|---|-------|---|-------|

[Table 1-6](#) 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.

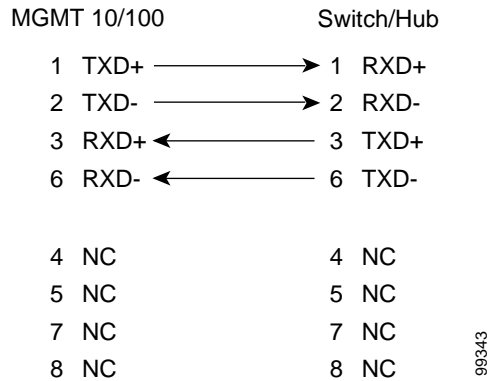
**Table 1-6** 10/100/1000BASE-T Management Port Cable Pinout (MDI)

| Pin | Signal   |
|-----|----------|
| 1   | TD+      |
| 2   | TD-      |
| 3   | RD+      |
| 6   | RD-      |
| 4   | Not used |
| 5   | Not used |
| 7   | Not used |
| 8   | Not used |

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Figure 1-2 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).

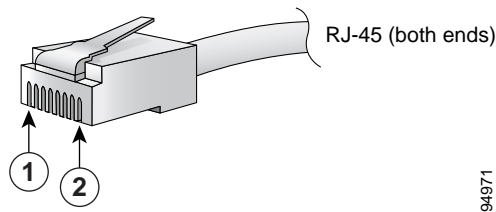
**Figure 1-2 Twisted-Pair 10/100/1000BASE-T Cable Schematic**



## 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 1-3).

**Figure 1-3 RJ-45 Interface Cable Connector**



|   |       |   |       |
|---|-------|---|-------|
| 1 | Pin 1 | 2 | Pin 8 |
|---|-------|---|-------|

Table 1-7 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 1-7 10/100BASE-T Management Port Cable Pinout (MDI)**

| Pin | Signal |
|-----|--------|
| 1   | TD+    |
| 2   | TD-    |
| 3   | RD+    |

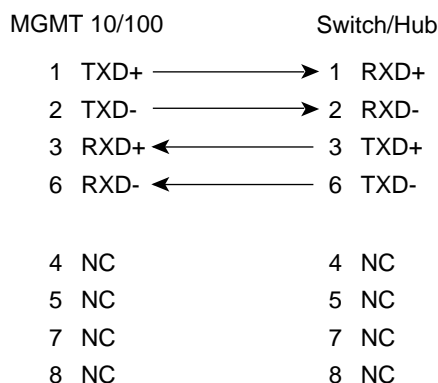
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**Table 1-7** 10/100BASE-T Management Port Cable Pinout (MDI) (continued)

| Pin | Signal   |
|-----|----------|
| 6   | RD–      |
| 4   | Not used |
| 5   | Not used |
| 7   | Not used |
| 8   | Not used |

Figure 1-4 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 1-4** Twisted-Pair 10/100BASE-T Cable Schematic



99343

## 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 1-8 lists the power cords for the Cisco MDS 9500 Series switches and provides their lengths in feet and meters.

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**Table 1-8 Power Cords for the MDS 9500 Series Switches**

| Description                                                     | Length |        |
|-----------------------------------------------------------------|--------|--------|
|                                                                 | Feet   | Meters |
| <b>MDS 9513 and MDS 9509 - 3000W Power Supply</b>               |        |        |
| 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    |
| Power Cord, 250VAC 16A Korea, Src Plug CEE (7) VII              | 14.83  | 4.5    |
| Cabinet Jumper Power Cord, 250VAC 16A, C20-C19 Connectors       | 9      | 2.74   |
| <b>MDS 9509 - 2500W Power Supply</b>                            |        |        |
| Power Cord, 250VAC 20A NEMA, 6-20 Plug, USA                     | 13.12  | 4      |
| Power Cord, 250VAC 20A NEMA L6-20 Twist Lock Plug, USA          | 13.58  | 4.14   |
| Power Cord, 250VAC 16A CEE 7/7 Plug, EU                         | 13.12  | 4      |
| Power Cord, 250VAC 16A IEC 309 Plug, International              | 13.58  | 4.14   |
| Power Cord, 250VAC 16A SEV 1011 Plug, Switzerland               | 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   |
| <b>MDS 9506</b>                                                 |        |        |
| 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, 250VAC 16A 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   |

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**Table 1-8**      *Power Cords for the MDS 9500 Series Switches (continued)*

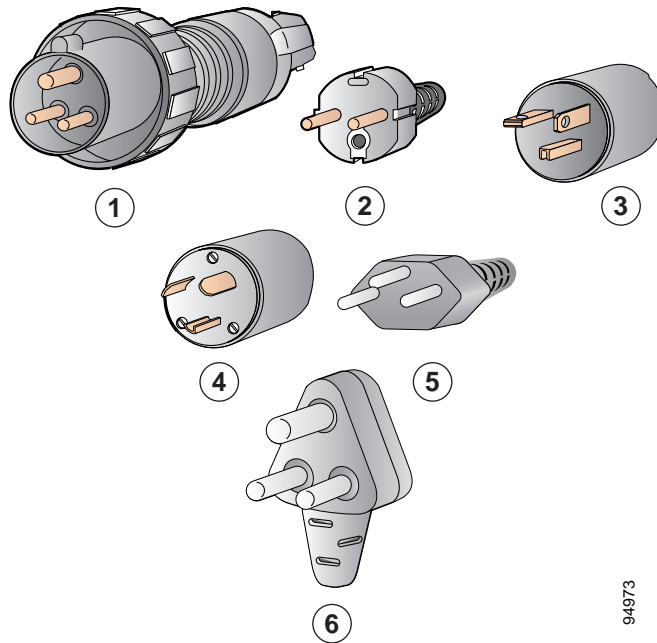
| Description                                              | Length |        |
|----------------------------------------------------------|--------|--------|
|                                                          | Feet   | Meters |
| Power Cord, 250VAC 16A SI16S3 Plug, Israel               | 13.94  | 4.25   |
| Power Cord, 250VAC 13A BS1363 Plug (13A fuse), UK        | 13.94  | 4.25   |
| Power Cord, 250VAC 10A GB1002 Plug, China                | 13.94  | 4.25   |
| Power Cord, 250VAC 13A KSC8305 Plug, Korea               | 13.94  | 4.25   |
| Power Cord, 250VAC 15A CNS10917-2 Plug, Taiwan           | 13.94  | 4.25   |
| Cabinet Jumper Power Cord, 250VAC 16A C20-C19 Connectors | 9      | 2.74   |

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## Supported Plugs for 6000-W AC, 2500-W AC, and 1900-W AC Power Supplies

Figure 1-5 shows the supported plugs for the 6000-W AC, 3000-W AC, 2500-W AC, and 1900-W AC power supplies.

**Figure 1-5** 6000-W AC, 3000-W AC, 2500-W AC, and 1900-W AC Power Supply Plugs

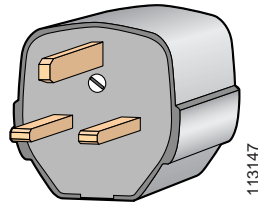


|          |                                                                                              |          |                                                                                           |
|----------|----------------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------------|
| <b>1</b> | International<br>(6000 W, 3000 W, 2500 W, and 1900 W)<br>IEC 309 (20 A)                      | <b>4</b> | North America (locking)<br>(6000 W, 3000 W, 2500 W, and 1900 W)<br>NEMA L6-20 plug (20 A) |
| <b>2</b> | Europe<br>(6000 W, 3000 W, 2500 W, and 1900 W)<br>CEE 7/7 (16 A)                             | <b>5</b> | Switzerland<br>(6000 W, 3000 W, 2500 W, and 1900 W)<br>23 G SEV 1011 (16 A)               |
| <b>3</b> | North America (non-locking)<br>(6000 W, 3000 W, 2500 W, and 1900 W)<br>NEMA 6-20 plug (20 A) | <b>6</b> | South Africa<br>(6000 W, 3000 W, 2500 W, and 1900 W)<br>EL 208, SABS 164-1 (16 A)         |

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Figure 1-6 shows an additional plug that is supported for the 1900-W AC power supply only.

**Figure 1-6** Additional Power Supply Plug Supported for 1900-W Only



|   |                                                                  |
|---|------------------------------------------------------------------|
| 1 | United Kingdom<br>BS89/13, BS 1363/A<br>(13 A; replaceable fuse) |
|---|------------------------------------------------------------------|

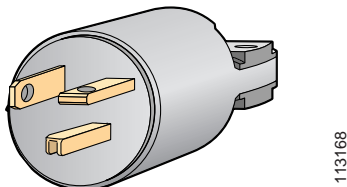
Figure 1-7 shows an additional plug that is supported for the 3000-W and 2500-W power supply, using 110 VAC.



**Note**

Using the plug in Figure 1-7 at 110 VAC results in 1300 W available to the system.

**Figure 1-7** Additional Power Supply Plug Supported for 3000-W and 2500-W 110 VAC Only



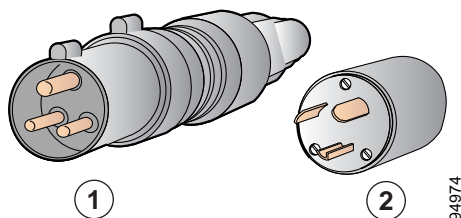
|   |                                                                                  |
|---|----------------------------------------------------------------------------------|
| 1 | NEMA 5-20P<br>North American power cord product ID: CAB-7513AC<br>110 VAC (20 A) |
|---|----------------------------------------------------------------------------------|

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## Supported Plugs for the 4000-W AC Power Supply

Figure 1-8 shows the supported plugs for the 4000-W AC power supply. The power cable on the 4000 W power supply is nondetachable.

**Figure 1-8** 4000-W Power Supply Plugs

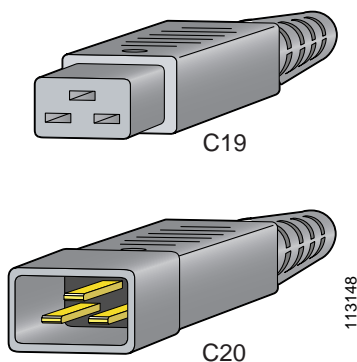


|   |                                                                   |   |                                                                                   |
|---|-------------------------------------------------------------------|---|-----------------------------------------------------------------------------------|
| 1 | International<br>(4000-W power supply)<br>IEC 60309 (3 0A, 250 V) | 2 | North America (Locking)<br>(4000-W power supply)<br>NEMA L6-30 plug (30 A, 250 V) |
|---|-------------------------------------------------------------------|---|-----------------------------------------------------------------------------------|

## Jumper Power Cord

Figure 1-9 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 1-9** 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<br>Power cord product ID:CAB-C19-CBN<br>250 VAC 16 A, C20-C19 connectors |
|---|--------------------------------------------------------------------------------------------------------------------------------------------|



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## Power Supply AC Power Cords

Table 1-9 lists the specifications for the 6000 W AC power cords that are available for the AC-input power supply. Included in the table are references to illustrations of the power cords.

**Table 1-9** *Power Supply AC Power Cords*

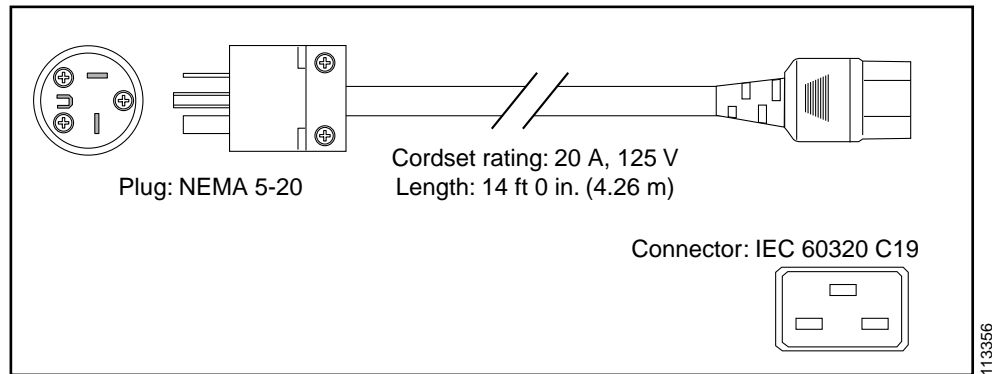
| Locale                    | Power Cord Part Number | Source Plug Type | Cordset Rating | Power Cord Reference Illustration |
|---------------------------|------------------------|------------------|----------------|-----------------------------------|
| North America/Japan       | CAB-9K2A-NA            | NEMA 5-20        | 20 A, 125 VAC  | <a href="#">Figure 1-10</a>       |
| US/Japan                  | CAB-9K16A-US2          | NMEA L6-20       | 16 A, 250 VAC  | <a href="#">Figure 1-11</a>       |
| Australia                 | CAB-9K16A-AUS          | AU20S3           | 16 A, 250 VAC  | <a href="#">Figure 1-12</a>       |
| China                     | CAB-9k16A-CH           | GB16C            | 16 A, 250 VAC  | <a href="#">Figure 1-13</a>       |
| Switzerland               | CAB-9K16A-SW           | SEV 5934         | 16 A 250 VAC   | <a href="#">Figure 1-14</a>       |
| Continental Europe        | CAB-9K16A-EU           | CEE7/7           | 16 A 250 VAC   | <a href="#">Figure 1-15</a>       |
| Cabinet Jumper Power Cord | CAB-C19-CBN            | C 20-C19         | 16 A 250 VAC   | <a href="#">Figure 1-16</a>       |

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## AC Power Cord Illustrations

This section contains the AC power cord illustrations. An AC power cord can be used with several power supplies. See the power supply specifications tables for the correct AC power cord illustrations for your power supply.

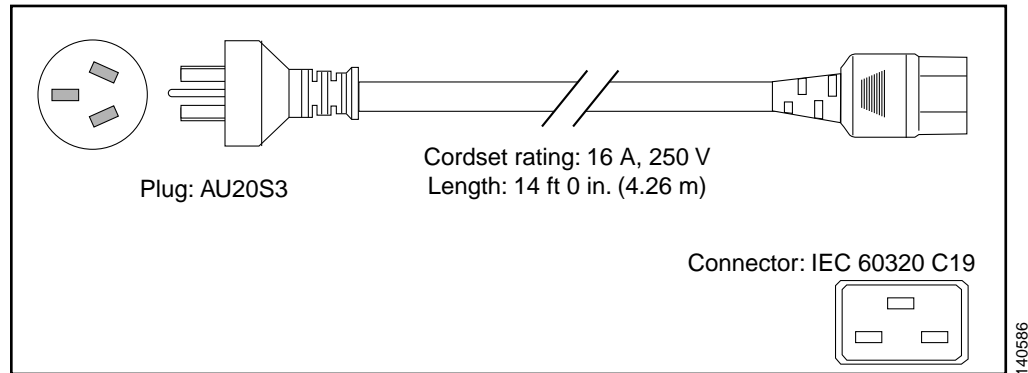
**Figure 1-10**      **CAB-9K20A-NA**



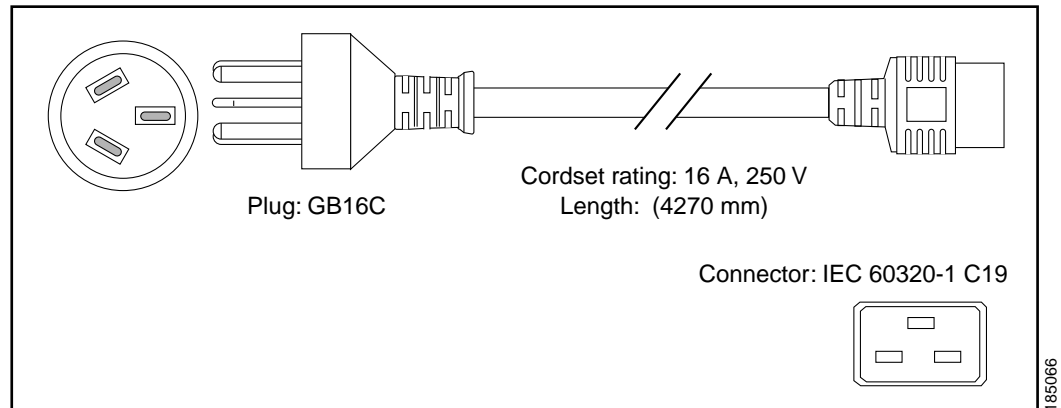
**Figure 1-11**      **CAB-9K16A-US2**

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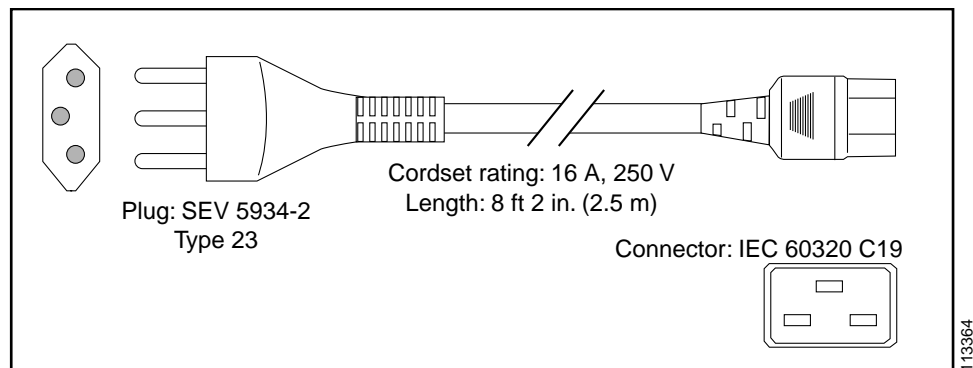
**Figure 1-12 CAB-9K16A-AUS**



**Figure 1-13 CAB-9K16A-CH**

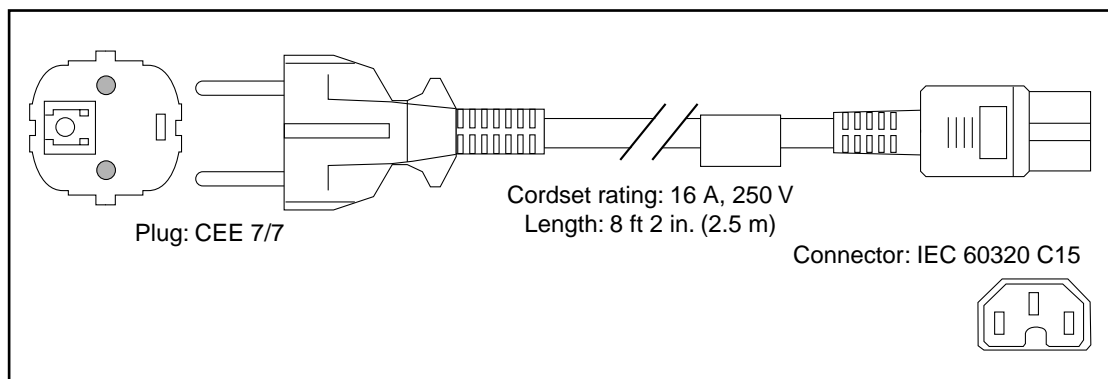


**Figure 1-14 CAB-9K16A-SW**

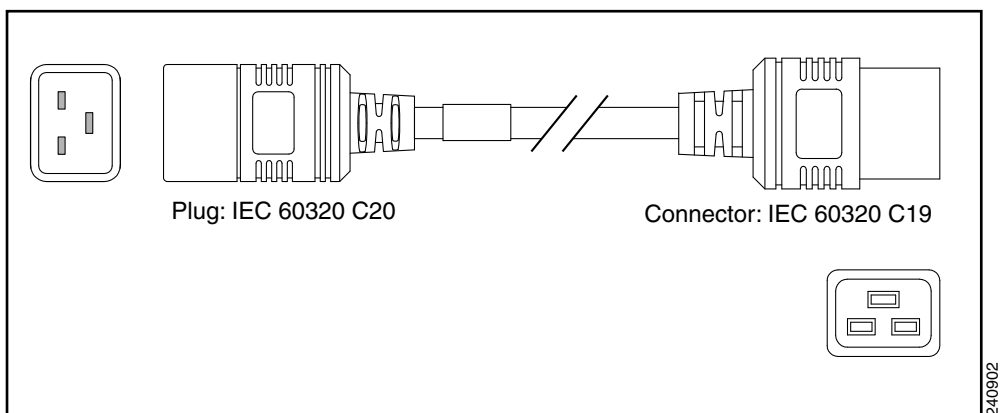


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**Figure 1-15** *CAB-9K16A-EU*



**Figure 1-16** *CAB-C19-CBN*





## Site Planning and Maintenance Records

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This appendix provides a Site Planning list and includes the following records to use when installing the Cisco MDS 9500 Series:

- [Contacting Customer Service, page 1-1](#)
- [Site Preparation Checklist, page 1-4](#)
- [Contact and Site Information, page 1-6](#)
- [Chassis and Module Information, page 1-7](#)



**Note**

For information on how to query the switch for configuration information, see *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide* or the *Cisco DCNM SAN Fundamentals Configuration Guide*.

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## 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 1-2.
- 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/en/US/support/tsd\\_cisco\\_worldwide\\_contacts.html](http://www.cisco.com/en/US/support/tsd_cisco_worldwide_contacts.html)

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## Finding the Chassis Serial Number

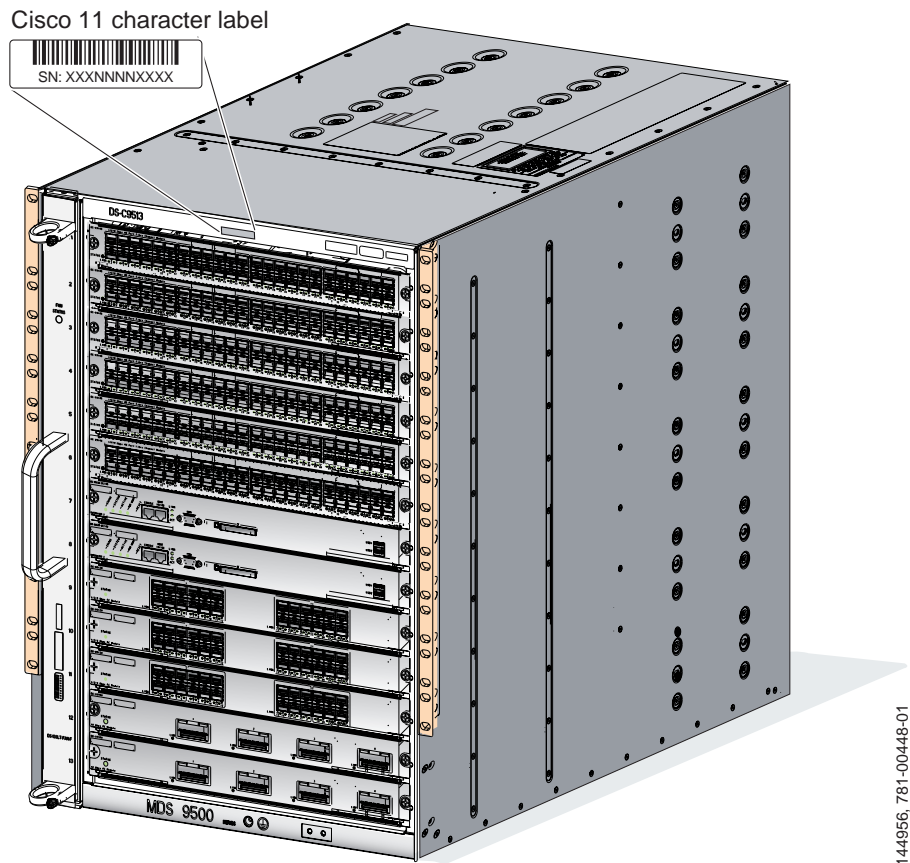


### Tip

If you have CLI access, enter the **show sprom backplane 1** command to display the backplane contents, including the switch serial number.

Figure 1-1 shows the location of the serial number label on the Cisco MDS 9513 Director.

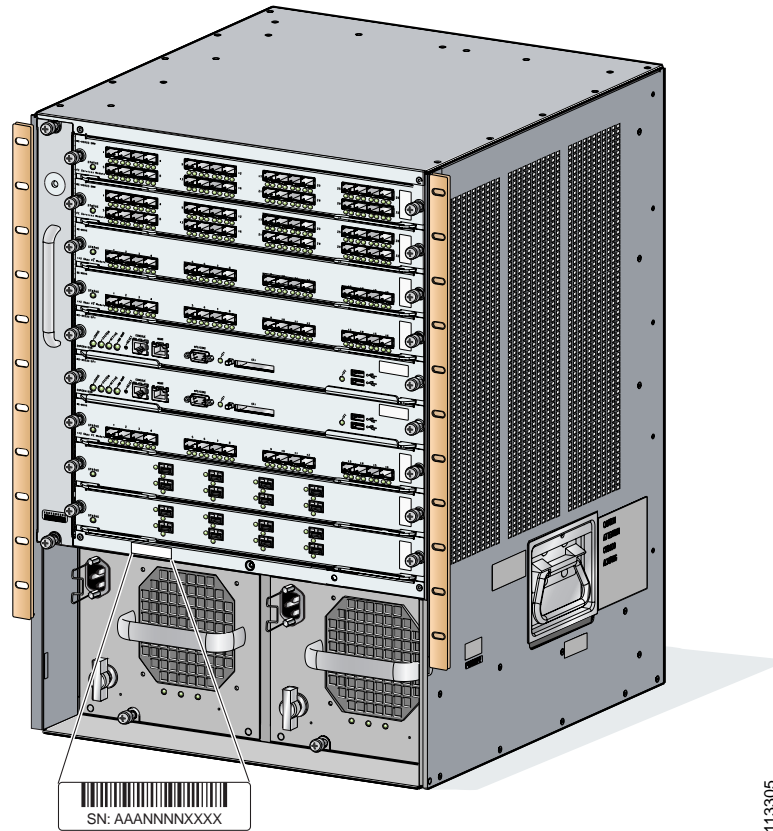
*Figure 1-1 Serial Number Location on Cisco MDS 9513 Director*



In later releases of the Cisco MDS 9509 Director, the chassis serial number label was moved, as shown in Figure 1-2. Earlier releases may have the serial number label on the right side instead of the left.

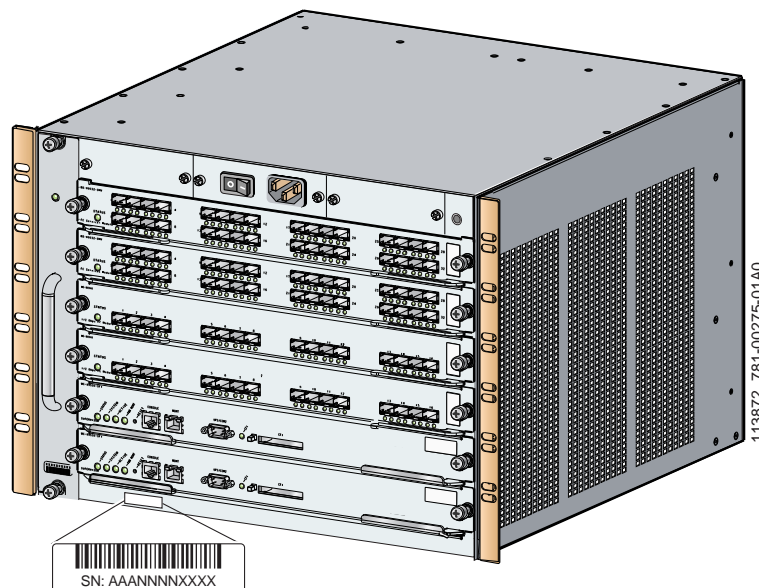
*Send documentation comments to [mdsfeedback-doc@cisco.com](mailto:mdsfeedback-doc@cisco.com)*

**Figure 1-2** Serial Number Location on Cisco MDS 9509 Director



The Cisco MDS 9506 Director chassis serial number label is shown in Figure 1-3.

**Figure 1-3** Serial Number Location on Cisco MDS 9506 Director



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## 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 1-1](#) lists the site planning tasks that Cisco recommends completing before installing the Cisco MDS 9500 Series.

Consider heat dissipation when sizing the air-conditioning requirements for an installation. See [Table 1-1 on page 1-1](#) for the environmental requirements. See the “[Power Specifications for the Cisco MDS 9513 Director](#)” section on [page 1-6](#), the “[Power Specifications for the Cisco MDS 9509 Director](#)” section on [page 1-10](#), and the “[Power Specifications for the Cisco MDS 9506 Director](#)” section on [page 1-15](#) for power and heat ratings.

**Table 1-1**      *Site Planning Checklist*

| Task No. | Planning Activity                                                                                                                                                                                                                                                                                                                                             | Verified By | Time | Date |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------|------|
| 1        | Space evaluation: <ul style="list-style-type: none"> <li>• Space and layout</li> <li>• Floor covering</li> <li>• Impact and vibration</li> <li>• Lighting</li> <li>• Maintenance access</li> </ul>                                                                                                                                                            |             |      |      |
| 2        | Environmental evaluation: <ul style="list-style-type: none"> <li>• Ambient temperature</li> <li>• Humidity</li> <li>• Altitude</li> <li>• Atmospheric contamination</li> <li>• Air flow</li> </ul>                                                                                                                                                            |             |      |      |
| 3        | Power evaluation: <ul style="list-style-type: none"> <li>• Input power type</li> <li>• Power receptacles (20 A)<sup>1</sup></li> <li>• Receptacle proximity to the equipment</li> <li>• Dedicated (separate) circuits for redundant power supplies</li> <li>• UPS<sup>2</sup> for power failures</li> <li>• DC systems: proper gauge wire and lugs</li> </ul> |             |      |      |
| 4        | Grounding evaluation: <ul style="list-style-type: none"> <li>• Circuit breaker size</li> <li>• CO ground (AC- and DC-powered systems)</li> </ul>                                                                                                                                                                                                              |             |      |      |



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**Table 1-1** Site Planning Checklist (continued)

| Task No. | Planning Activity                                                                                                                                                                                                      | Verified By | Time | Date |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------|------|
| 5        | Cable and interface equipment evaluation: <ul style="list-style-type: none"> <li>• Cable type</li> <li>• Connector type</li> <li>• Cable distance limitations</li> <li>• Interface equipment (transceivers)</li> </ul> |             |      |      |
| 6        | EMI <sup>3</sup> evaluation: <ul style="list-style-type: none"> <li>• Distance limitations for signaling</li> <li>• Site wiring</li> <li>• RFI<sup>4</sup> levels</li> </ul>                                           |             |      |      |

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

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## Contact and Site Information

Use the following worksheet (Table 1-2) to record contact and site information.

**Table 1-2**      *Contact and Site Information*

|                             |  |
|-----------------------------|--|
| <b>Contact person</b>       |  |
| <b>Contact phone</b>        |  |
| <b>Contact e-mail</b>       |  |
| <b>Building/site name</b>   |  |
| <b>Data center location</b> |  |
| <b>Floor location</b>       |  |
| <b>Address (line 1)</b>     |  |
| <b>Address (line 2)</b>     |  |
| <b>City</b>                 |  |
| <b>State</b>                |  |
| <b>Zip code</b>             |  |
| <b>Country</b>              |  |

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## Chassis and Module Information

Use the following worksheets (Table 1-3 and Table 1-4) to record information about the chassis and modules.

Contract number\_\_\_\_\_

Chassis serial number\_\_\_\_\_

Product number\_\_\_\_\_

**Table 1-3**      *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 1-4**      *Module Information*

| Slot | Module Type | Module Serial Number | Notes |
|------|-------------|----------------------|-------|
| 1    |             |                      |       |
| 2    |             |                      |       |
| 3    |             |                      |       |
| 4    |             |                      |       |
| 5    | Supervisor  |                      |       |

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**Table 1-4**      *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.