

Hardware Installation Guide for Cisco NCS 4000 Series

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Preface

This hardware installation guide describes how to install and remove a Cisco Network Convergence System (NCS) 4016 chassis and NCS 4009 chassis and its components. The Cisco NCS 4016 chassis and Cisco NCS 4009 chassis are converged optical service platforms in the Cisco NCS 4000 Series family.

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Audience

This guide is intended for chassis installers and Cisco installation partners who are responsible for installing the Cisco NCS 4000 Series chassis and its components. The installers are expected to have installed networking hardware in the past. No additional knowledge of routing or the Cisco IOS XR software is assumed.

Document Organization

This document is organized into the following chapters:

Chapter	Description
Installation Roadmap for NCS 4016, on page 1	This chapter lists the steps to install the Cisco NCS 4016 chassis and its components and prepare the system for operation.
Chassis Overview, on page 3	This chapter provides an overview of the Cisco NCS 4016 chassis and components.
Site Planning Considerations, on page 17	This chapter describes the general considerations to address while planning for the installation of the Cisco NCS 4016 chassis.

Chapter	Description
Installing Power Components , on page 23	This chapter provides instructions on how to install and reinstall power components in the Cisco NCS 4016 chassis. It also covers connecting and disconnecting power and powering on the chassis.
Installing Route Processor Cards, Fabric Cards, and Line Cards, on page 53	This chapter provides instructions on how to install route processor (RP) cards, fabric cards (FCs), line cards (LCs) and their associated components in the Cisco NCS 4016 chassis.
Removing and Replacing Chassis Components, on page 249	This chapter provides instructions on how to remove and replace components from the Cisco NCS 4016 chassis.
System Product IDs, on page 147	This appendix provides information about the product IDs for the Cisco NCS 4016 chassis and its components.
System Specifications, on page 151	This appendix contains tables that list the specifications for the main components of the Cisco NCS 4016 chassis.
Installation Roadmap for NCS 4009, on page 155	This chapter lists the steps to install the Cisco NCS 4009 chassis and its components and prepare the system for operation.
Chassis Overview, on page 157	This chapter provides an overview of the Cisco NCS 4009 chassis and components.
Installing Power Components, on page 171	This chapter provides instructions on how to install and reinstall power components in the Cisco NCS 4009 chassis. It also covers connecting and disconnecting power and powering on the chassis.
Installing Route Processor Cards, Fabric Cards, and Line Cards, on page 199	This chapter provides instructions on how to install route processor (RP) cards, fabric cards (FCs), line cards (LCs) and their associated components in the Cisco NCS 4009 chassis.
Removing and Replacing Chassis Components, on page 249	This chapter provides instructions on how to remove and replace components from the Cisco NCS 4009 chassis.
System Product IDs, on page 285	This appendix provides information about the product IDs for the Cisco NCS 4009 chassis and its components.
System Specifications, on page 289	This appendix contains tables that list the specifications for the main components of the Cisco NCS 4009 chassis.

Conventions

This document uses the following conventions:

Convention	Indication
bold font	Commands and keywords and user-entered text appear in **bold** font.
italic font	Document titles, new or emphasized terms, and arguments for which you supply values are in *italic* font.
[ ]	Elements in square brackets are optional.
{x | y | z }	Required alternative keywords are grouped in braces and separated by vertical bars.
[x | y | z]	Optional alternative keywords are grouped in brackets and separated by vertical bars.
string	A nonquoted set of characters. Do not use quotation marks around the string or the string will include the quotation marks.
courier font	Terminal sessions and information the system displays appear in courier font.
< >	Nonprinting characters such as passwords are in angle brackets.
[ ]	Default responses to system prompts are in square brackets.
!, #	An exclamation point (!) or a pound sign (#) at the beginning of a line of code indicates a comment line.



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



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



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



Timesaver Means *the described action saves time* . You can save time by performing the action described in the paragraph.



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

Warning Statements using this symbol are provided for additional information and to comply with regulatory and customer requirements.

IMPORTANT SAFETY INSTRUCTIONS

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

SAVE THESE INSTRUCTIONS

Waarschuwing **BELANGRIJKE VEILIGHEIDSINSTRUCTIES**

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 de standaard praktijken om ongelukken te voorkomen. Gebruik het nummer van de verklaring onderaan de waarschuwing als u een vertaling van de waarschuwing die bij het apparaat wordt geleverd, wilt raadplegen.

BEWAAR DEZE INSTRUCTIES

Varoitus **TÄRKEITÄ TURVALLISUUSOHJEITA**

Tämä varoitusmerkki merkitsee vaaraa. Tilanne voi aiheuttaa ruumiillisia vammoja. Ennen kuin käsittelet laitteistoa, huomioi sähköpiirien käsittelemiseen liittyvät riskit ja tutustu onnettomuuksien yleisiin ehkäisytapoihin. Turvallisuusvaroitusten käännökset löytyvät laitteen mukana toimitettujen käännettyjen turvallisuusvaroitusten joukosta varoitusten lopussa näkyvien lausuntonumeroiden avulla.

SÄILYTÄ NÄMÄ OHJEET

Attention **IMPORTANTES INFORMATIONS DE SÉCURITÉ**

Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant entraîner des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers liés aux circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions des avertissements figurant dans les consignes de sécurité traduites qui accompagnent cet appareil, référez-vous au numéro de l'instruction situé à la fin de chaque avertissement.

CONSERVEZ CES INFORMATIONS

Warnung **WICHTIGE SICHERHEITSHINWEISE**

Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu Verletzungen führen kann. Machen Sie sich vor der Arbeit mit Geräten mit den Gefahren elektrischer Schaltungen und den üblichen Verfahren zur Vorbeugung vor Unfällen vertraut. Suchen Sie mit der am Ende jeder Warnung angegebenen Anweisungsnummer nach der jeweiligen Übersetzung in den übersetzten Sicherheitshinweisen, die zusammen mit diesem Gerät ausgeliefert wurden.

BEWAHREN SIE DIESE HINWEISE GUT AUF.

Avvertenza **IMPORTANTI ISTRUZIONI SULLA SICUREZZA**

Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di intervenire su qualsiasi apparecchiatura, occorre essere al corrente dei pericoli relativi ai circuiti elettrici e conoscere le procedure standard per la prevenzione di incidenti. Utilizzare il numero di istruzione presente alla fine di ciascuna avvertenza per individuare le traduzioni delle avvertenze riportate in questo documento.

CONSERVARE QUESTE ISTRUZIONI

Advarsel **VIKTIGE SIKKERHETSINSTRUKSJONER**

Dette advarselssymbolet betyr fare. Du er i en situasjon som kan føre til skade på person. Før du begynner å arbeide med noe av utstyret, må du være oppmerksom på farene forbundet med elektriske kretser, og kjenne til standardprosedyrer for å forhindre ulykker. Bruk nummeret i slutten av hver advarsel for å finne oversettelsen i de oversatte sikkerhetsadvarslene som fulgte med denne enheten.

TA VARE PÅ DISSE INSTRUKSJONENE

Aviso **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

Este símbolo de aviso significa perigo. Você está em uma situação que poderá ser causadora de lesões corporais. Antes de iniciar a utilização de qualquer equipamento, tenha conhecimento dos perigos envolvidos no manuseio de circuitos elétricos e familiarize-se com as práticas habituais de prevenção de acidentes. Utilize o número da instrução fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham este dispositivo.

GUARDE ESTAS INSTRUÇÕES

¡Advertencia! **INSTRUCCIONES IMPORTANTES DE SEGURIDAD**

Este símbolo de aviso indica peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considere los riesgos de la corriente eléctrica y familiarícese con los procedimientos estándar de prevención de accidentes. Al final de cada advertencia encontrará el número que le ayudará a encontrar el texto traducido en el apartado de traducciones que acompaña a este dispositivo.

GUARDE ESTAS INSTRUCCIONES

Varning! **VIKTIGA SÄKERHETSANVISNINGAR**

Denna varningssignal 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 vanliga förfaranden för att förebygga olyckor. Använd det nummer som finns i slutet av varje varning för att hitta dess översättning i de översatta säkerhetsvarningar som medföljer denna anordning.

SPARA DESSA ANVISNINGAR

Figyelem **FONTOS BIZTONSÁGI ELOÍRÁSOK**

Ez a figyelmezeto jel veszélyre utal. Sérülésveszélyt rejto helyzetben van. Mielott bármely berendezésen munkát végezte, legyen figyelemmel az elektromos áramkörök okozta kockázatokra, és ismerkedjen meg a szokásos balesetvédelmi eljárásokkal. A kiadványban szereplo figyelmeztetések fordítása a készülékhez mellékelt biztonsági figyelmeztetések között található; a fordítás az egyes figyelmeztetések végén látható szám alapján keresheto meg.

ORIZZE MEG EZEKET AZ UTASÍTÁSOKAT!

Предупреждение **ВАЖНЫЕ ИНСТРУКЦИИ ПО СОБЛЮДЕНИЮ ТЕХНИКИ БЕЗОПАСНОСТИ**

Этот символ предупреждения обозначает опасность. То есть имеет место ситуация, в которой следует опасаться телесных повреждений. Перед эксплуатацией оборудования выясните, каким опасностям может подвергаться пользователь при использовании электрических цепей, и ознакомьтесь с правилами техники безопасности для предотвращения возможных несчастных случаев. Воспользуйтесь номером заявления, приведенным в конце каждого предупреждения, чтобы найти его переведенный вариант в переводе предупреждений по безопасности, прилагаемом к данному устройству.

СОХРАНИТЕ ЭТИ ИНСТРУКЦИИ

警告 重要的安全性说明

此警告符号代表危险。您正处于可能受到严重伤害的工作环境中。在您使用设备开始工作之前，必须充分意识到触电的危险，并熟练掌握防止事故发生的标准工作程序。请根据每项警告结尾提供的声明号码来找到此设备的安全性警告说明的翻译文本。

请保存这些安全性说明

警告 安全上の重要な注意事項

「危険」の意味です。人身事故を予防するための注意事項が記述されています。装置の取り扱い作業を行うときは、電気回路の危険性に注意し、一般的な事故防止策に留意してください。警告の各国語版は、各注意事項の番号を基に、装置に付属の「Translated Safety Warnings」を参照してください。

これらの注意事項を保管しておいてください。

주의 중요 안전 지침

이 경고 기호는 위험을 나타냅니다. 작업자가 신체 부상을 일으킬 수 있는 위험한 환경에 있습니다. 장비에 작업을 수행하기 전에 전기 회로와 관련된 위험을 숙지하고 표준 작업 관례를 숙지하여 사고를 방지하십시오. 각 경고의 마지막 부분에 있는 경고문 번호를 참조하여 이 장치와 함께 제공되는 번역된 안전 경고문에서 해당 번역문을 찾으십시오.

이 지시 사항을 보관하십시오.

Aviso **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

Este símbolo de aviso significa perigo. Você se encontra em uma situação em que há risco de lesões corporais. Antes de trabalhar com qualquer equipamento, esteja ciente dos riscos que envolvem os circuitos elétricos e familiarize-se com as práticas padrão de prevenção de acidentes. Use o número da declaração fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham o dispositivo.

GUARDE ESTAS INSTRUÇÕES

Advarsel **VIGTIGE SIKKERHEDSANVISNINGER**

Dette advarselssymbol betyder fare. Du befinder dig i en situation med risiko for legemesbeskadigelse. Før du begynder arbejde på udstyr, skal du være opmærksom på de involverede risici, der er ved elektriske kredsløb, og du skal sætte dig ind i standardprocedurer til undgåelse af ulykker. Brug erklæringsnummeret efter hver advarsel for at finde oversættelsen i de oversatte advarsler, der fulgte med denne enhed.

GEM DISSE ANVISNINGER

تحذير **إرشادات الأمان الهامة**

يوضح رمز التحذير هذا وجود خطر. وهذا يعني أنك متواجد في مكان قد ينتج عنه التعرض لإصابات. قبل بدء العمل، احذر مخاطر التعرض للصدمات الكهربائية وكن على علم بالإجراءات القياسية للحيلولة دون وقوع أي حوادث. استخدم رقم البيان الموجود في أخر كل تحذير لتحديد مكان ترجمته داخل تحذيرات الأمان المترجمة التي تأتي مع الجهاز.
قم بحفظ هذه الإرشادات

Upozorenje **VAŽNE SIGURNOSNE NAPOMENE**

Ovaj simbol upozorenja predstavlja opasnost. Nalazite se u situaciji koja može prouzročiti tjelesne ozljede. Prije rada s bilo kojim uređajem, morate razumjeti opasnosti vezane uz električne sklopove, te biti upoznati sa standardnim načinima izbjegavanja nesreća. U prevedenim sigurnosnim upozorenjima, priloženima uz uređaj, možete prema broju koji se nalazi uz pojedino upozorenje pronaći i njegov prijevod.

SAČUVAJTE OVE UPUTE

Upozornění **DŮLEŽITÉ BEZPEČNOSTNÍ POKYNY**

Tento upozorňující symbol označuje nebezpečí. Jste v situaci, která by mohla způsobit nebezpečí úrazu. Před prací na jakémkoliv vybavení si uvědomte nebezpečí související s elektrickými obvody a seznamte se se standardními opatřeními pro předcházení úrazům. Podle čísla na konci každého upozornění vyhledejte jeho překlad v přeložených bezpečnostních upozorněních, která jsou přiložena k zařízení.

USCHOVEJTE TYTO POKYNY

Προειδοποίηση ΣΗΜΑΝΤΙΚΕΣ ΟΔΗΓΙΕΣ ΑΣΦΑΛΕΙΑΣ

Αυτό το προειδοποιητικό σύμβολο σημαίνει κίνδυνο. Βρίσκεστε σε κατάσταση που μπορεί να προκαλέσει τραυματισμό. Πριν εργαστείτε σε οποιοδήποτε εξοπλισμό, να έχετε υπόψη σας τους κινδύνους που σχετίζονται με τα ηλεκτρικά κυκλώματα και να έχετε εξοικειωθεί με τις συνήθεις πρακτικές για την αποφυγή ατυχημάτων. Χρησιμοποιήστε τον αριθμό δήλωσης που παρέχεται στο τέλος κάθε προειδοποίησης, για να εντοπίσετε τη μετάφρασή της στις μεταφρασμένες προειδοποιήσεις ασφαλείας που συνοδεύουν τη συσκευή.

ΦΥΛΑΞΤΕ ΑΥΤΕΣ ΤΙΣ ΟΔΗΓΙΕΣ

אזהרה **הוראות בטיחות חשובות**

סימן אזהרה זה מסמל סכנה. אתה נמצא במצב העלול לגרום לפציעה. לפני שתעבוד עם ציוד כלשהו, עליך להיות מודע לסכנות הכרוכות במעגלים חשמליים ולהכיר את הנהלים המקובלים למניעת תאונות. השתמש במספר ההוראה המסופק בסופה של כל אזהרה כד לאתר את התרגום באזהרות הבטיחות המתורגמות שמצורפות להתקן.

שמור הוראות אלה

Opomena

ВАЖНИ БЕЗБЕДНОСНИ НАПАТСТВИЈА
Симболот за предупредување значи опасност. Се наоѓате во ситуација што може да предизвика телесни повреди. Пред да работите со опремата, бидете свесни за ризикот што постои кај електричните кола и треба да ги познавате стандардните постапки за спречување на несреќни случаи. Искористете го бројот на изјавата што се наоѓа на крајот на секое предупредување за да го најдете неговиот период во преведените безбедносни предупредувања што се испорачани со уредот.
ЧУВАЈТЕ ГИ ОВИЕ НАПАТСТВИЈА

Ostrzeżenie

WAŻNE INSTRUKCJE DOTYCZĄCE BEZPIECZEŃSTWA

Ten symbol ostrzeżenia oznacza niebezpieczeństwo. Zachodzi sytuacja, która może powodować obrażenia ciała. Przed przystąpieniem do prac przy urządzeniach należy zapoznać się z zagrożeniami związanymi z układami elektrycznymi oraz ze standardowymi środkami zapobiegania wypadkom. Na końcu każdego ostrzeżenia podano numer, na podstawie którego można odszukać tłumaczenie tego ostrzeżenia w dołączonym do urządzenia dokumencie z tłumaczeniami ostrzeżeń.

NINIEJSZE INSTRUKCJE NALEŻY ZACHOWAĆ

Upozornenie

DÔLEŽITÉ BEZPEČNOSTNÉ POKYNY

Tento varovný symbol označuje nebezpečenstvo. Nachádzate sa v situácii s nebezpečenstvom úrazu. Pred prácou na akomkoľvek vybavení si uvedomte nebezpečenstvo súvisiace s elektrickými obvodmi a oboznámte sa so štandardnými opatreniami na predchádzanie úrazom. Podľa čísla na konci každého upozornenia vyhľadajte jeho preklad v preložených bezpečnostných upozorneniach, ktoré sú priložené k zariadeniu.

USCHOVAJTE SI TENTO NÁVOD

Related Documentation

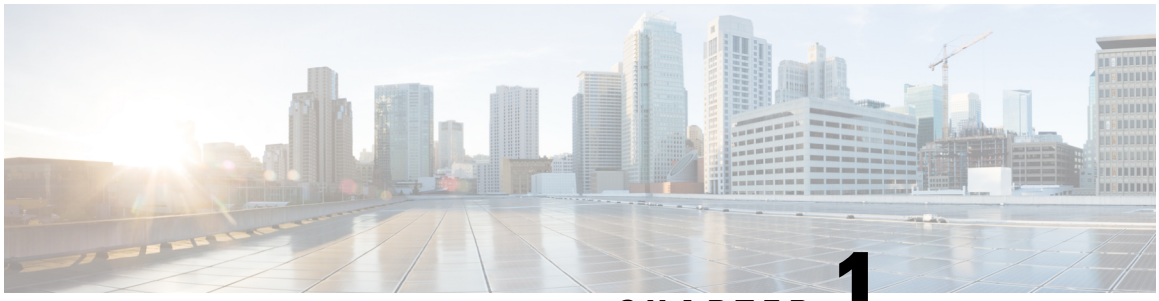
For complete planning and installation information, see the following documents:

- *Regulatory Compliance and Safety Information for Cisco NCS 4000 Series*
- *Hardware Installation Guide for the Cisco NCS 4000 Series*
- *Configuration Guide for Cisco NCS 4000 Series*
- *Command Reference for Cisco NCS 4000 Series*

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, using the Cisco Bug Search Tool (BST), submitting a service request, and gathering additional information, see *What's New in Cisco Product Documentation* at: http://www.cisco.com/c/en/us/td/docs/general/whatsnew/whatsnew.html .

Subscribe to *What's New in Cisco Product Documentation* , which lists all new and revised Cisco technical documentation as an RSS feed and delivers content directly to your desktop using a reader application. The RSS feeds are a free service.



CHAPTER 1

Installation Roadmap for NCS 4016

This chapter lists the steps to install the Cisco NCS 4016 chassis and its components and prepare the system for operation.

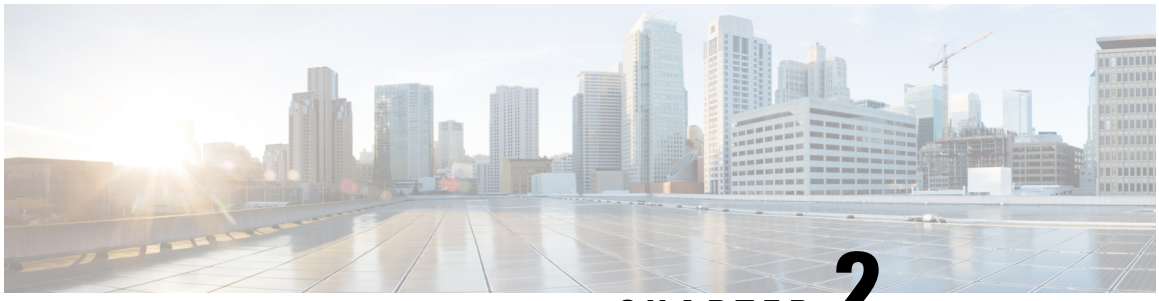
- Installation Roadmap, on page 1

Installation Roadmap

This table lists the steps to install the Cisco NCS 4016 chassis and its components and prepare the system for operation. Use this table as a checklist to ensure that all components are properly installed in the correct order. For information about a step, see the respective book or section of this installation guide.

Table 1: Overview of Installation Steps

Step	See
Verify that the chassis is secured in the rack. **Note** For ease of installation, the cosmetic door should be removed.	Cisco Network Convergence System 4000 Series Unpacking, Moving, and Securing Guide
Ground the chassis.	Installing the Chassis Ground Cable, on page 30
Verify that the power components are installed.	Installing Power Components, on page 23
Verify that the ECU/ECU2 is installed.	
Verify that the fan trays are installed.	Removing and Replacing the Fan Tray, on page 129
Connect the AC or DC power cord.	Disconnecting AC or DC Power, on page 49
Power on the chassis.	Powering On the Chassis, on page 51
Install cards and remaining components in the chassis.	Installing Route Processor Cards, Fabric Cards, and Line Cards, on page 53
Re-install the cosmetic door.	Removing and Replacing the Front Door, on page 123



CHAPTER 2

Chassis Overview

This chapter provides an overview of the Cisco NCS 4016 chassis and components.

- About the Cisco NCS 4016 Chassis, on page 3
- Chassis Components, on page 6
- Chassis Cable Management, on page 11
- Safety Guidelines, on page 11

About the Cisco NCS 4016 Chassis

The Cisco NCS 4016 chassis contains an upper card cage and a lower card cage, each with 11 cards (22 total). The following cards are supported:

- 2 slots for route processor cards (RPs)
- 16 slots for line cards (LCs)
- 4 slots for fabric cards (FCs)

The Cisco NCS 4016 chassis is rack mountable. It is compatible with the following standard rail spacing:

- ANSI 19-inch or 23-inch
- ETSI

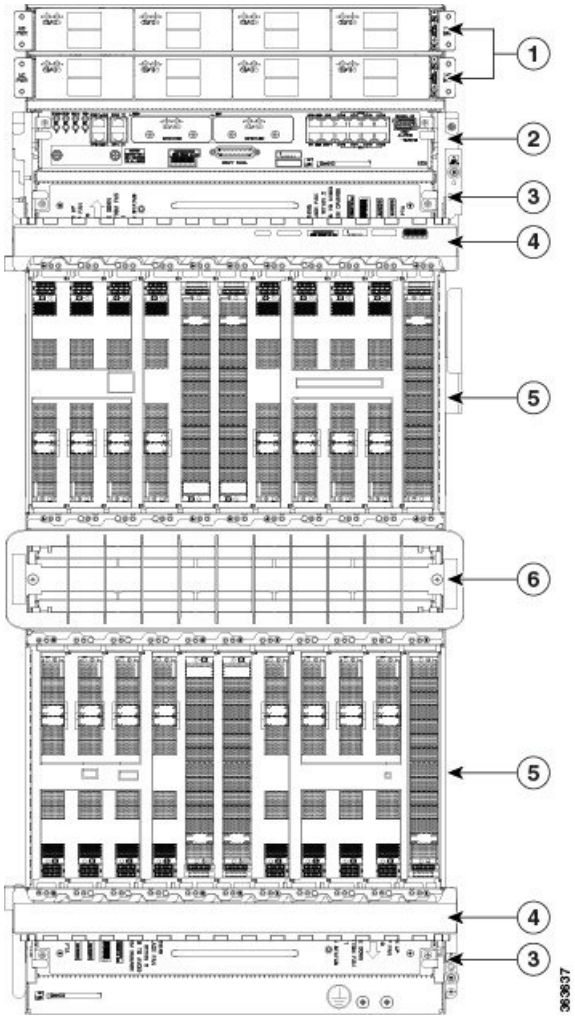
Note For the ANSI 19-inch rack, the minimum front opening must be 17.72 inches (450 mm) to allow for chassis insertion.The installation kit includes different brackets for each type of rack.

The Cisco NCS 4016 chassis contains its own power and cooling systems. Power systems are available using AC or DC power. Two fan trays are located in the top and bottom slots of the chassis.

Note The installation of a Cisco NCS 4016 chassis may require space, power, and cooling modifications to a facility. Therefore, you should plan the site well in advance of the scheduled delivery of the chassis system.

This figure shows the front view of the Cisco NCS 4016 chassis.

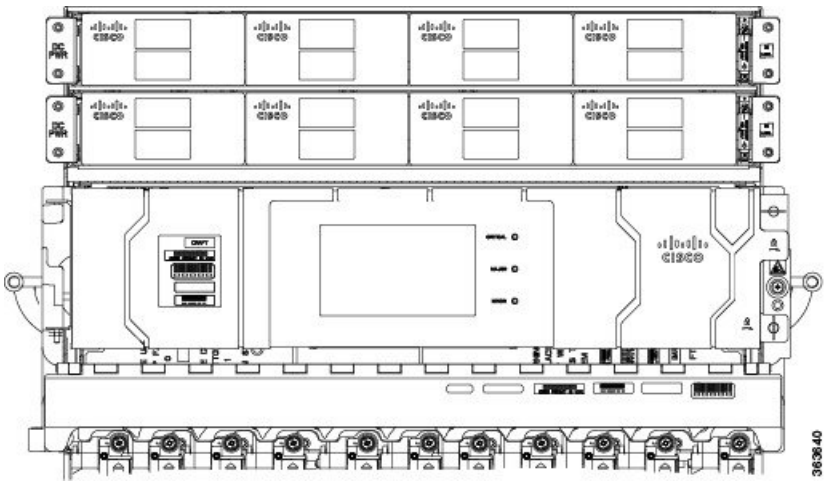
Figure 1: Front View of the Cisco NCS 4016 Chassis



1	Power trays (2)	4	Fiber management areas (2)
2	External connection unit (ECU/ECU2) • Craft panel is attached on top of the ECU/ECU2 (not shown, see Figure 2: Partial Chassis View with Craft Panel, on page 5) • Air outlet is on back	5	Card cages (2) each containing: • 8 LC slots • 2 FC slots (in center) • 1 RP slot (at side)
3	Fan trays (2)	6	Air inlet

This figure shows the partial chassis view with craft panel.

Figure 2: Partial Chassis View with Craft Panel



The following figures show partial rear views of the Cisco NCS 4016 chassis.

Note There are two air outlets on the rear of the chassis. One is at the top behind the ECU/ECU2 and one is below the bottom fan tray.

Figure 3: Rear View of the Cisco NCS 4016 AC Chassis

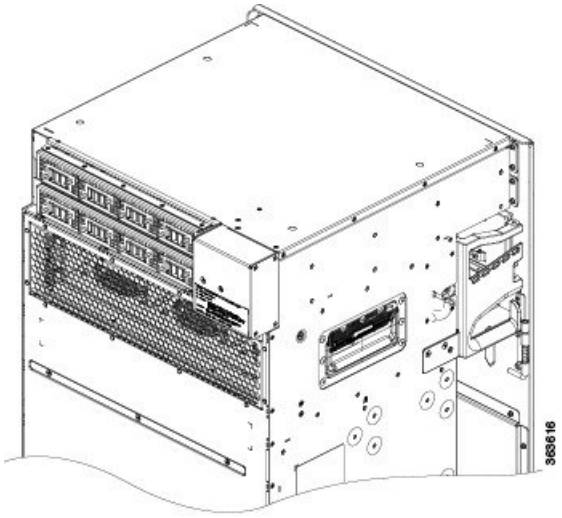


Figure 4: Rear View of the Cisco NCS 4016 DC Chassis

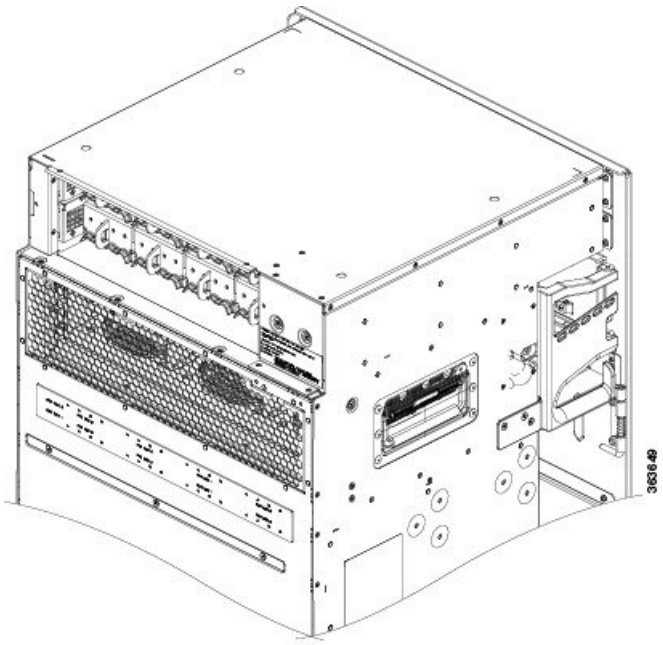
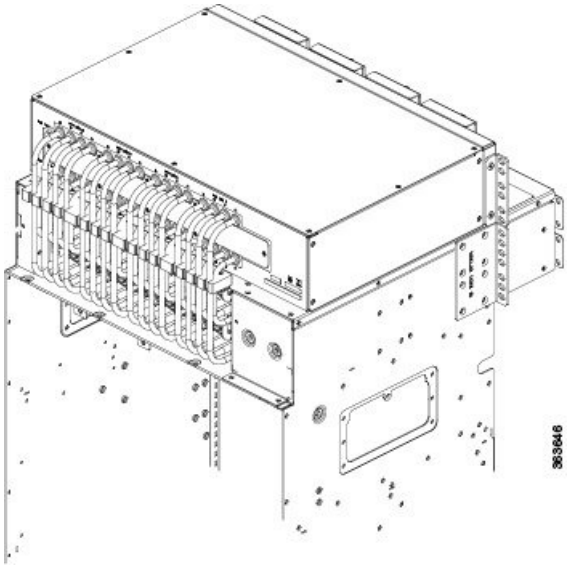


Figure 5: Rear View of the Cisco NCS 4016 DC Chassis with DC Power Front Connection Adapter



Chassis Components

This table lists the main components of the Cisco NCS 4016 chassis.

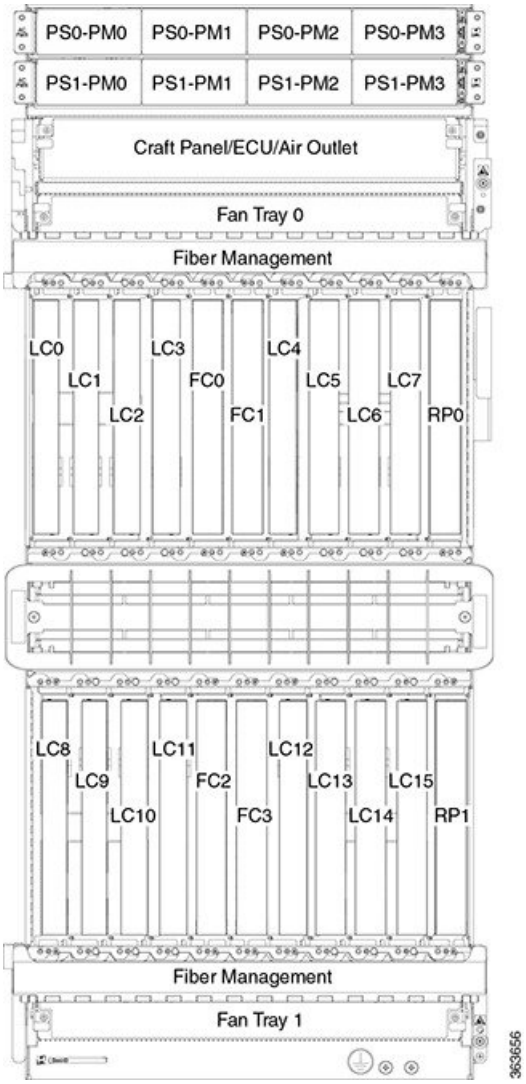
Table 2: Main Components of the Cisco NCS 4016 Chassis

Component	Description
route processor cards (RPs)	Two RP cards (RP0/RP1) are inserted into the front of the chassis. These cards provide the intelligence of the system by functioning as the system controller and providing route processing and chassis management. The RP cards also monitor system alarms and control the system fans. The LEDs on the front panel indicate active alarm conditions.
fabric cards (FCs)	Four FCs are inserted into the front of the chassis. The FCs provide the switch fabric for the routing system and performs the cross-connect function of the routing system, connecting every LC to each other. The switch fabric receives ingress user data from one LC slot and performs the switching necessary to route the data to the appropriate egress LC slot.
line cards (LCs)	As many as sixteen LCs can be inserted into the front of the chassis. These cards provide the physical interfaces and optical connections for the user data.
external connection unit (ECU/ECU2)	The ECU/ECU2 provides all shelf electrical I/O connectivity to the active and standby route-processor cards. The ECU/ECU2 is located behind the craft panel. ECU2 has four timing expansion (TE) ports on front panel. Two are primary ports and the other two are meant for redundancy and fail over. These TE ports are used for connecting NCS 4000 chassis in the multi chassis configuration.
craft panel	The craft panel can install, configure, monitor, and troubleshoot the Cisco NCS 4016 chassis applications at the node and at the network level. The craft panel is located on top of the ECU/ECU2.
fan trays	Two fan trays are inserted into the front of the chassis at the top and bottom. The top fan tray (behind the craft panel) cools the top card rack and the bottom fan tray covers the bottom card rack. Each fan tray contains six axial fans. The fans pull cooling air through the chassis from the front to rear.
air filter	Two independent air filters are located in the middle of the chassis behind the plastic inlet grill. One is dedicated to the top card rack and the other to the bottom card rack. We recommend that you change the air filter every three months. The filter is sold in packs of 5 (Cisco PID NCS4K-FTF=).
power trays	Two power trays provide redundant power to the chassis. Both AC and DC power trays are available. Each power tray holds up to four AC or DC power modules. A power tray is a field serviceable unit (FSU). A mixture of AC and DC power is not supported in the chassis. **Note** You must power off the chassis before replacing a power tray.
fiber management trays	Two fiber management trays are located on the front of the chassis. One is above the top card rack and the other is below the bottom card rack.

Chassis Slot Numbers

This section identifies the location and slot numbers for the cards and power modules that plug into the chassis.

Figure 6: Cisco NCS 4016 Chassis Slot Numbers



Note Cards in the top and bottom card cages are not inserted in the same direction. If you consider , the above figure, as a reference, cards in the bottom card cage are inserted upside down.

The chassis has the following card slots:

- Sixteen LC slots:
  - Eight in the top card cage (LC0 to LC7)
  - Eight in the bottom card cage (LC8 to LC15)

- Two RP slots:
  - One in the top card cage (RP0)
  - One in the bottom card cage (RP1)
- Four FC slots:
  - Two in the top card cage (FC0, FC1)
  - Two in the bottom card cage (FC2, FC3)
- Two fan trays for redundancy at the top and the bottom of the chassis
- One external connection unit (ECU/ECU2) located above the top fan tray behind the craft panel
- Two fiber management areas at the top and the bottom of the chassis
- One air inlet and two air outlets
- Eight power modules for redundancy
- The upper four AC or DC power trays (0-3) are contained within power shelf 0 (PS0) and the lower four AC or DC power trays (4-7) are contained within power shelf 1 (PS1).

The cards have electrical plugs at the back that plug into electrical connectors on the shelf backplane. When the ejectors are fully closed, the card plugs into the assembly backplane.

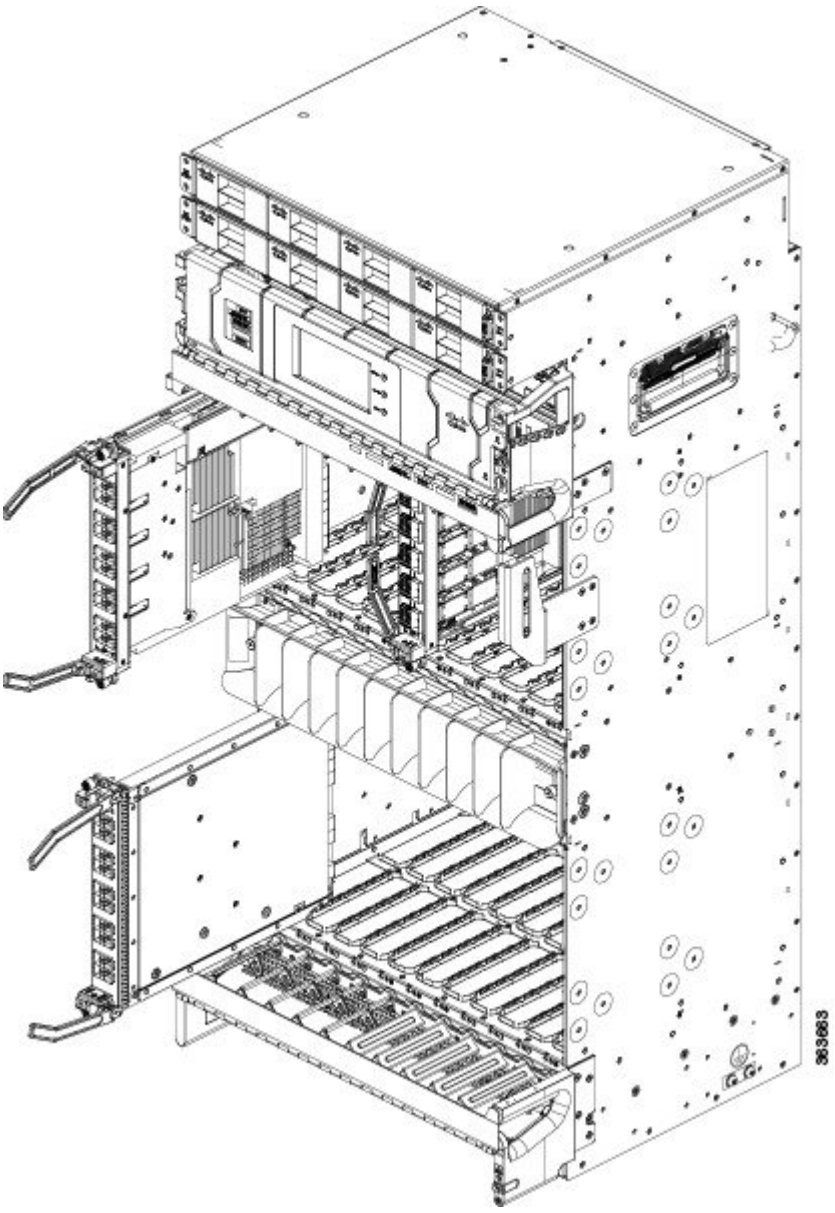
The chassis has eight power modules for redundancy:

- The upper four power modules are contained within power tray 0 (PS0). They are named as follows: PS0-PM0, PS0-PM1, PS0-PM2, and PS0-PM3.
- The lower four power modules are contained within power tray 1 (PS1). They are named as follows: PS1-PM0, PS1-PM1, PS1-PM2, and PS1-PM3.

Card Slot Requirements

This figure shows card installation for the Cisco NCS 4016 chassis.

Figure 7: Installing Cards in the Cisco NCS 4016 Chassis



The Cisco NCS 4016 chassis has 22 card slots numbered sequentially from left to right. Slots FC0 through FC3 are dedicated to fabric cards. Slots RP0 and RP1 are reserved for route processor cards.

Shelf assembly slots have symbols indicating the type of cards that you can install in them. Each Cisco NCS 4016 card has a corresponding symbol. The symbol on the card must match the symbol on the slot.

Table 3: Slot and Card Symbols

Symbol Color/Shape	Definition
Orange/Circle	Slots LC0 through LC15. Only install line cards with a circle symbol on the faceplate.

Symbol Color/Shape	Definition
Pink/Triangle	Slots LC0 through LC15. Only install line cards with circle or a triangle symbol on the faceplate.
Blue/Hexagon	Slots LC0 through LC15. Only install line cards with a blue hexagon symbol on the faceplate.
Purple/Square	Slots RP0 and RP1. Only install route processor cards with a square symbol on the faceplate.
Lilac/Cross	Slots FC0 through FC3. Only install fabric cards with a cross symbol on the faceplate.

Chassis Cable Management

The Cisco NCS 4016 chassis has cable management features for the front side only. The horizontal cable management brackets are located above and below the card cages.

Safety Guidelines

Before you perform any Cisco NCS 4009 chassis installation procedures, review the safety guidelines in this section to avoid injuring yourself or damaging the equipment.

Note Review the safety warnings listed in Regulatory Compliance and Safety Information for the Cisco Network Convergence System 4000 Series before installing, configuring, or troubleshooting any installed card.

Note Power off the system before removing or installing a power tray.

The following guidelines are for your safety and to protect equipment. The guidelines do not include all hazards. Be alert.

- Never attempt to lift an object that might be too heavy for you to lift by yourself.
- Keep the work area clear and dust-free during and after installation. Do not allow dirt or debris to enter into any laser-based components.
- Keep tools and chassis components away from walk areas.
- Do not wear loose clothing, jewelry, and other items that could get caught in the chassis while working with the chassis and its components.
- Use Cisco equipment in accordance with its specifications and product-usage instructions.
- Do not work alone if potentially hazardous conditions exist.

- Make sure that your installation follows national and local electrical codes: in the United States, National Fire Protection Association (NFPA) 70, United States National Electrical Code; in Canada, Canadian Electrical Code, part I, CSA C22.1; in other countries, International Electrotechnical Commission (IEC) 60364, part 1 through part 7.
- Connect only a DC power source that follows the safety extra-low voltage (SELV) requirements in UL/CSA/IEC/EN 60950-1 and AS/NZS 60590 to the DC input power system.
- Make sure that you have a readily accessible two-poled disconnect device incorporated in the fixed configuration wiring of a DC input power system.
- Make sure that you provide short-circuit (overcurrent) protection as part of the building installation.

Safety Labels

Cisco NCS 4000 Series chassis is classified as Hazard Level 1M as per IEC 60825-1, since it includes optical pluggable devices Laser Class 1 or 1M.

The Class 1M Laser Product label is shown in the following figure.

Figure 8: Class 1M Laser Product Label



This section explains the significance of the safety labels attached to the NCS 4016 chassis. You must understand all warning labels before working on the chassis.

Figure 9: Class 1M Laser Product Label



Safety Precaution for Module Installation and Removal

Ensure to observe the following safety precautions when you are working with the chassis modules.

Warning

Statement 1051—Laser Radiation

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

Figure 10: Class 1M Laser Product Label



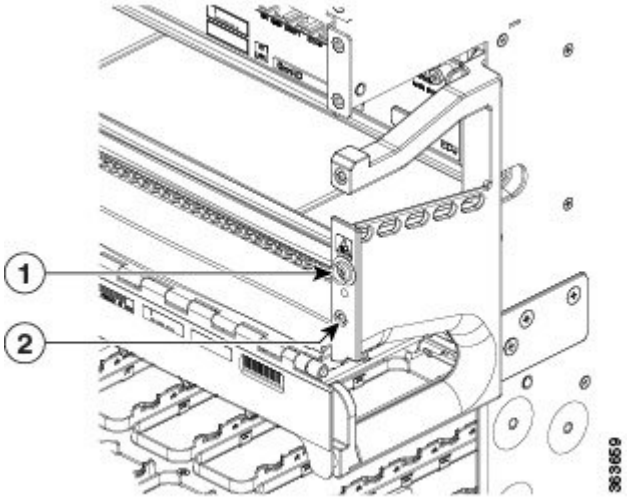
Preventing Electrostatic Discharge

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. We recommend use of an ESD-preventive wrist strap whenever you handle network equipment or one of its components.

Following are guidelines for preventing ESD damage:

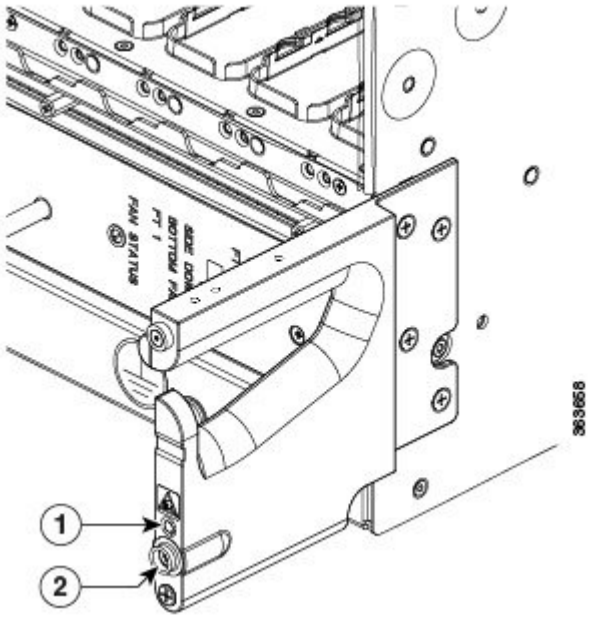
- Always use an ESD-preventive wrist or ankle strap, and ensure that it makes good skin contact. Connect the equipment end of the connection cord to an ESD jack (Figure 11: ESD Jacks—Top of Chassis, on page 14 and Figure 12: ESD Jacks—Bottom of Chassis , on page 14) or a bare metal surface on the chassis (ensure the chassis is grounded).
- Handle a card by its ejector levers, when applicable, or its metal carrier only; avoid touching the board or connector pins.
- Place a removed card board side up on an antistatic surface or in a static-shielding bag. If you plan to return the component to the factory, immediately place it in a static-shielding bag.
- Avoid contact between a card and clothing. The wrist strap protects the board from only ESD voltage on the body; ESD voltage on clothing can still cause damage.

Figure 11: ESD Jacks—Top of Chassis



1	Top ETSI connection point	2	Top ANSI jacket point

Figure 12: ESD Jacks—Bottom of Chassis



1	Bottom ANSI jacket point	2	Bottom ETSI connection point

Network Equipment-Building System (NEBS) Statements

NEBS describes the environment of a typical United States Regional Bell Operating Company (RBOC) central office. NEBS is the most common set of safety, spatial, and environmental design standards applied to telecommunications equipment in the United States. It is not a legal or regulatory requirement, but rather an industry requirement.

The following NEBS statements apply to the Cisco NCS 4016:

Note **Statement 7001—**ESD Mitigation

This equipment may be ESD sensitive. Always use an ESD ankle or wrist strap before handling equipment. Connect the equipment end of the ESD strap to an unfinished surface of the equipment chassis or to the ESD jack on the equipment if provided.

Warning **Statement 7003**—Shielded Cable Shielded Cable Requirements for Intrabuilding Lightning Surge

The intrabuilding port(s) of the equipment or subassembly must use shielded intrabuilding cabling/wiring that is grounded at both ends.

The following port(s) are considered intrabuilding ports on this equipment:

ETH0, ETH1, ETH2, 1588, EMS, CRAFT

Warning **Statement 7005**—Intrabuilding Lightning Surge and AC Power Fault

The intrabuilding port(s) of the equipment or subassembly must not be metallically connected to interfaces that connect to the outside plant (OSP) or its wiring. These interfaces are designed for use as intrabuilding interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE) and require isolation from the exposed OSP cabling. The addition of primary protectors is not sufficient protection to connect these interfaces metallically to OSP wiring.

This statement applies to the intrabuilding ports listed below:

ETH0, ETH1, ETH2, 1588, EMS, CRAFT

Note **Statement 7012**—Equipment Interfacing with AC Power Ports

Connect this equipment to AC mains that are provided with a surge protective device (SPD) at the service equipment that complies with NFPA 70, the National Electrical Code (NEC).

Note **Statement 7013—**Equipment Grounding Systems—Common Bonding Network (CBN)

This equipment is suitable for installations using the CBN.

Note **Statement 7015—**Equipment Bonding and Grounding

When you use thread-forming screws to bond equipment to its mounting metalwork, remove any paint and nonconductive coatings and clean the joining surfaces. Apply an antioxidant compound before joining the surfaces between the equipment and mounting metalwork.

Note **Statement 7016**—Battery Return Conductor

The battery return conductor of this equipment shall be treated as (DC-I).

Note **Statement 7018—**System Recover Time

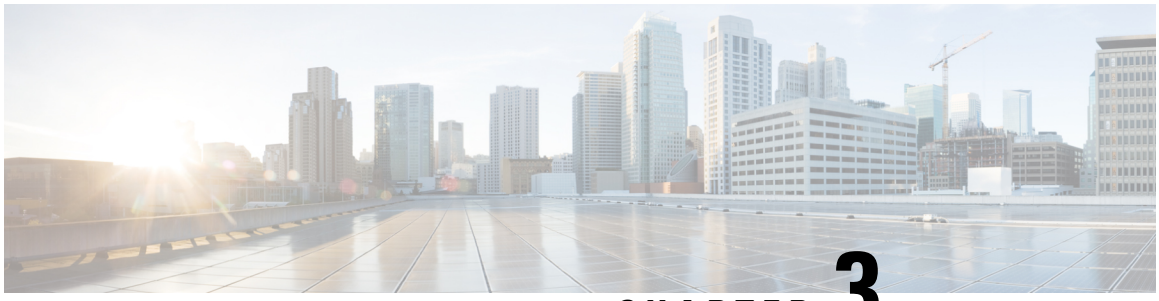
The equipment is designed to boot up in less than 30 minutes provided the neighboring devices are fully operational.

Note **Statement 8015—**Installation Location Network Telecommunications Facilities

This equipment is suitable for installation in network telecommunications facilities.

Note **Statement 8016—**Installation Location Where the National Electric Code (NEC) Applies

This equipment is suitable for installation in locations where the NEC applies.



CHAPTER 3

Site Planning Considerations

This chapter describes the general considerations to address while planning for the installation of the Cisco NCS 4016 chassis. As you plan for your system, keep in mind the specifications listed in System Specifications, on page 151

- Basic Site and Installation Planning, on page 17
- Equipment Rack Considerations, on page 18
- Aisle Spacing and Maintenance Access Floor Plan, on page 19
- Cable Management, on page 20
- Noise Control, on page 21
- Cisco Installation Services, on page 21
- System Testing, Certification, and Warranties, on page 22

Basic Site and Installation Planning

As you plan for basic site and installation requirements, consider the following:

- Does the installation site have adequate power for the routing system?
- Can the routing system be positioned close to the AC or DC power source, and are the power receptacles easy to reach?
- Does the site have appropriate equipment racks with space available in which to install the system? Are additional equipment racks required?
- Is there a scissor lift or similar lifting device available to lift the chassis into the equipment rack?

In addition, make sure that the installation site meets the following access requirements:

- At least 36 inches (92 cm) of clearance exists between rows of equipment racks. This space is needed to access components in the chassis. Additional clearance may be necessary for installation.
- Enough room exists for the system console terminal, and that the console cable is long enough to reach the routing system from the terminal.
- Fan tray exhaust vents are not blocked, and airflow at the bottom of the chassis is not blocked.

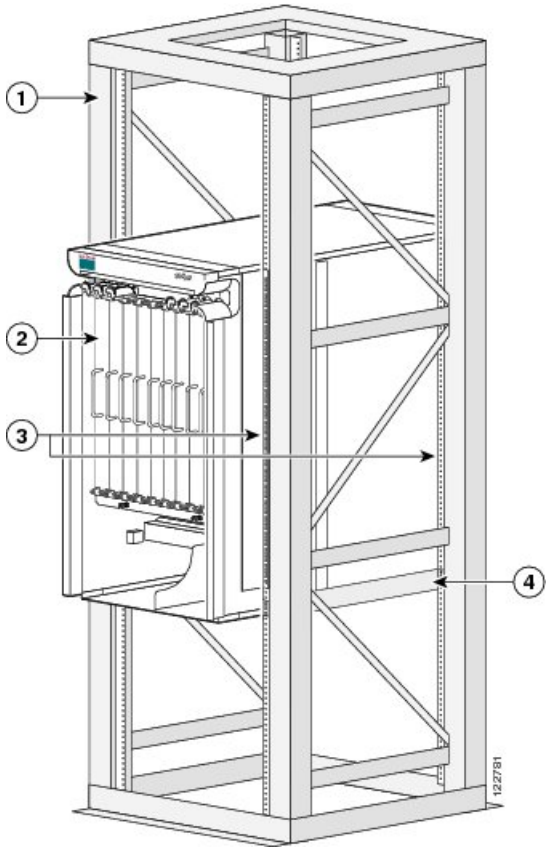
When planning the site, you should think about potential expansion of the system. Consider the following:

- Equipment rack space for additional chassis
- Power and cooling requirements for additional chassis
- Cable management for routing system cables

Equipment Rack Considerations

A fully loaded Cisco NCS 4016 chassis weighs 412 lb (187 kg). The chassis is mounted in a two-post or a four-post rack. This image shows a four-post rack.

Figure 13: Cisco NCS 4016 Chassis Mounted in an Equipment Rack



1	Equipment rack	3	Vertical mounting brackets
2	Cisco NCS 4016 chassis	4	Horizontal mounting brackets

Warning **The chassis should be mounted on a rack that is permanently affixed to the building.** Statement 1049

Note We recommend that you use a scissor lift or similar lifting device to position the chassis in the rack and to hold the chassis in place while you bolt it to the rack. *A forklift is not recommended for this purpose* .

As you plan the installation of the chassis into the equipment rack, consider the following:

- Make sure that the floor mounting bolts on the equipment rack are accessible, especially if annual retorquing of bolts is required.
- For chassis installation, you must have access to the vertical mounting rails at each corner of the equipment rack.
- Consider whether the area around the rack is large enough to accommodate the scissor lift (or similar lifting device) and installation personnel.
- A minimum of 48 mounting screws (10-32 x 5/8 in. socket head cap screws are provided with the chassis) are needed to secure the chassis to the rack. To secure the chassis to the rack, install twelve screws on each of the four vertical mounting brackets.



Note If you plan to use mounting screws other than the ones shipped with the chassis, you can use 10-32, 10-24, 12-24, or M5 screws. (M6 and 1/4-20 screws do not fit.)

- The rack should have horizontal shelf brackets to place the chassis on. The brackets must be able to support at least 650 lb. (294.8 kg). If the rack does not have horizontal mounting rails, a set of rails is included in the installation kit, which is available as an option (NCS4K-INST-KIT=).



Caution Standard rack-mounting screws are not strong enough to secure the chassis to the equipment rack. Use only those mounting screws that are shipped with the chassis.

For complete instructions on mounting and securing the chassis to a rack, see the *Cisco Network Convergence System 4000 Series Routers Unpacking, Moving, and Securing Guide* .

Aisle Spacing and Maintenance Access Floor Plan

The floor plan for the Cisco NCS 4016 chassis must include enough space to install the chassis in the equipment rack and allow sufficient airflow for the system. The floor plan must also provide enough room to access chassis components for maintenance (for example, to remove fan trays, power modules, cables, and air filters).



Note For chassis installation, make sure that enough room exists in front of the chassis to accommodate installation personnel and the scissor lift (or similar lifting device) used to hold the chassis in the rack while it is bolted in.

Front and Rear Clearances

The site requires the following front and rear clearances for chassis installation and maintenance access:

- To install the chassis in the equipment rack: approximately 40 inches (101.6cm)
- To service components and allow system airflow (both in front of and behind the chassis): 36 inches (91.4 cm)

Note Maintain at least 6 inches (15.2 cm) of clearance at both the inlet and exhaust openings on the chassis and on the power modules to allow sufficient airflow.

Cable Management

As the size of the routing system increases, the cabling required for the chassis increases. For example, a fully loaded Cisco NCS 4016 chassis has more cables connected to it than a partially loaded chassis. The cabling runs must be carefully planned. The basic configurations for various routing systems should be arranged to minimize the complexity and length of the cable runs. Precut and terminated cables are considered part of the basic configuration.

- CONSOLE or AUX RJ-45 RS-232 serial ports on the route processor cards for terminal connections
- Ethernet ports on the route processor cards for connecting network management equipment
- Modular service cards (MSCs) and physical layer interface modules (PLIMs) for data connections

The upper and lower cable management trays are for organizing these interface cables to keep the front of the chassis clear and to eliminate sharp bends in the cables.

Caution Excessive bending can damage interface cables.

Route Processor Cables

As you consider system cabling, see the table below, to determine the types of cables required to connect to ports on the route processor (RP).

Table 4: Route Processor Cables

RP Port	Required Cable Type
Ethernet management	STP[1] cable (Category 5 or better). Required for enhanced immunity to external electromagnetic disturbance levels of 10 V/m and 10 Vrms
Alarm	Shielded cable. Required for EMC compliance.
External (BITS) clock	Cat5 or better unshielded twisted pair (UTP) cable. Required for EMC compliance.

RP Port	Required Cable Type
Timing expansion port (TE ports)	Cables listed below to be used for TE ports on ECU2: • 15m cable (Cisco PID ONS-SYNC-CBL-15=) • 25m cable (Cisco PID ONS-SYNC-CBL-25=) • 50m cable (Cisco PID ONS-SYNC-CBL-50=) • 75m cable (Cisco PID ONS-SYNC-CBL-75=) • 100m cable (Cisco PID ONS-SYNC-CBL-100=) Choose the cable, depending on the length required to connect between the chassis in multi-chassis setup. **Note** ECU2 is a must requirement for the multi-chassis configuration.

[1] STP = shielded twisted-pair

Interface Cables

You must provide the interface cables

Because the type and number of interfaces can vary, plan these cable runs prior to the installation. When planning the cable runs, consider the following:

- Number and type of interface connections (OC-48/STM-16 or STS-48, OC-192/STM-64 or STS-192, OC-768/STM-256 or STS-768, 10-Gigabit Ethernet, and 100-Gigabit Ethernet)
- Termination at the other end of the cables (such as patch panel or optical transport equipment)
- Proper length and termination of cables

Noise Control

The Cisco NCS 4016 chassis has some built-in noise reduction, such as fan speed control. If the routing system is installed in an environment where excessive noise could be harmful to personnel, some other noise reduction options could be attempted. Passive noise reduction could include the installation of foam panels to insulate the surrounding area from the noise.

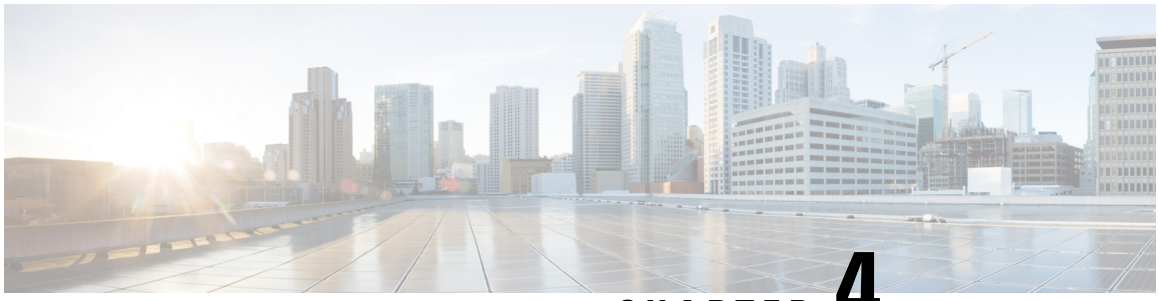
Additional noise-reduction measures have to be designed on an individual site basis.

Cisco Installation Services

Cisco or a Cisco partner can provide a complete installation, from planning to power up. For information about Cisco or Cisco partner installation services, consult Cisco Customer Advocacy.

System Testing, Certification, and Warranties

After the routing system has been installed, it must be tested and certified. Consult Cisco Customer Advocacy for information about testing, certification, and warranties.



CHAPTER 4

Installing Power Components

This chapter provides instructions on how to install and reinstall power components in the Cisco NCS 4016 chassis. It also covers connecting and disconnecting power and powering on the chassis.

The Cisco NCS 4016 chassis ships with power trays and power modules installed.

- Installing Power Components, on page 23

Installing Power Components

Power Connection Guidelines

You can configure the AC chassis with an AC input and the DC chassis with a DC input power subsystem. Ensure all power connection wiring conforms to the rules and regulations in the National Electrical Code (NEC) as well as local codes.

Each power tray includes 4 power modules each. The chassis has two power trays for redundancies (each tray can provide the full power to the chassis). The power tray provides electrical connections to the chassis backplane. Each power module can be individually plugged in or out from the tray.

Caution Each Cisco NCS 4016 chassis is powered by only one type of input: AC or DC. A hybrid (AC+DC) power configuration is not supported.

Caution Proper grounding is necessary to avoid damage from lightning and power surges. See the NEBS Supplemental Unit Bonding and Grounding Guidelines, on page 29 for grounding requirements.

AC-Powered Chassis

AC power modules operate in the input range of 180 VAC to 264 VAC, 47 to 63 Hz (nominal input level of 200 to 240 VAC).

Power redundancy requirements vary based on the system configuration (number and type of line cards, etc.). AC-powered systems are 2N protected. A minimum of two power supplies are required for redundant operation.

Each of the AC power inputs requires a separate dedicated branch circuit. Note that the circuit breaker and fuse lockout procedures should follow the rules and regulations in the National Electrical Code (NEC) and any local codes. For a list of the nominal and acceptable value ranges for source AC power, see Table 2 .

The Cisco NCS 4016 chassis supports two types of AC power cords: International and NEMA (USA).

Figure 14: International AC Power Cord (Cisco PID NCS4K-AC-CBL-IEC)

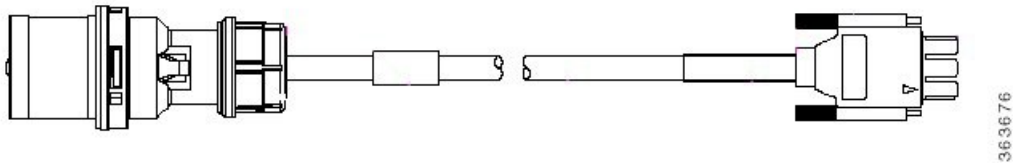
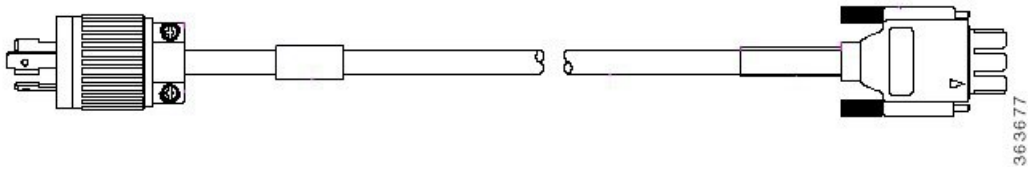


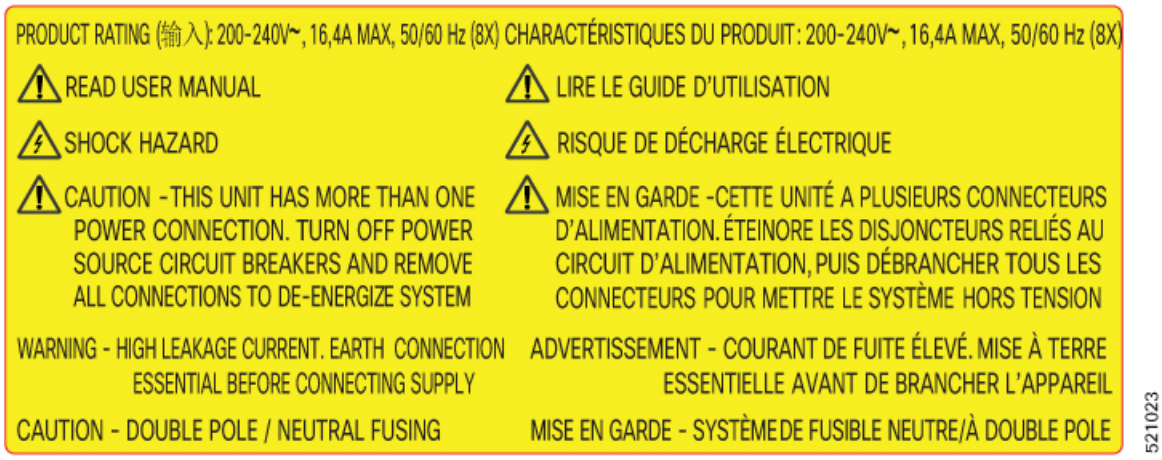
Figure 15: NEMA AC Power Cord (Cisco PID NCS4K-AC-CBL-NEMA)



Note Before connecting AC input power cords to the power system, make sure that the power cords are not energized.

The rating label is shown in the figure below.

Figure 16: Rating Label for NCS 4016 AC Chassis



DC-Powered Chassis

Use a 6 AWG wire rated 75°C minimum, for DC power modules connection. The system accepts a nominal input voltage of -48 VDC or -60VDC, with an operational tolerance range of -40.5 to -72 VDC. One dedicated,

commensurately rated DC power source is required for each power module connection. Each power feed shall be provided with a double pole breaker, rated not more than 60A, with medium delay.

Note Follow the power and sizing requirements for your site.

Note The Short Circuit protection Breaker shall not be rated more than 60A.

Power redundancy requirements vary based on the system configuration (number and type of line cards, etc.). DC-powered systems are N+1 protected.

Power connections to the power tray for each DC power module requires four cables: two source cables and two return cables.

For DC power cables, we recommend 6 AWG high-strand-count copper wire cables, rated 75°C minimum. The size of the cables depends on your chassis location from the source power. Follow your local practices for determining cable size. DC power cables are not available from Cisco, but they are available from any commercial cable vendor.

You must terminate DC power cables using cable lugs at the power tray end. The appropriate lugs are provided in the installation kit with 6 AWG cable.

Warning **Hazardous voltage or energy may be present on power terminals. Always replace cover when terminals are not in service. Be sure uninsulated conductors are not accessible when cover is in place.** Statement 1086

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

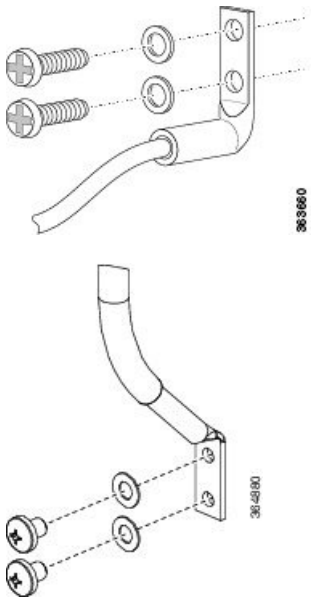
Note Before connecting DC power cables to the power system, make sure that the input power cords are not energized.

Note Ensure that there is a readily accessible disconnect device incorporated in the building's installation wiring.

Note Circuit breaker and fuse lockout procedures should follow the rules and regulations in the National Electrical Code (NEC) and any local codes.

DC power cable lugs can either be 90-degree or 45-degree. The following figure shows the lug type required for DC input cable connections.

Figure 17: Typical DC Power Cable Lugs



Warning To avoid shock hazard, be sure to apply shrink wrap tubing around the wire entry area of the lug.

The color coding of source DC power cable leads depends on the color coding of the site DC power source. Because there is no color code standard for source DC wiring, be sure that power source cables are connected to the power modules using the proper positive (+) and negative (–) polarity:

- In some cases, the source DC cable leads might have a positive (+) or a negative (–) label. This is a relatively safe indication of the polarity, *but you must verify the polarity by measuring the voltage between the DC cable leads* . Be sure that the positive (+) and negative (–) cable leads match the positive (+) and negative (–) labels on the power module when making the measurement.
- A green (or green and yellow) cable typically indicates that it is a ground cable.

Caution DC power modules contain reverse voltage protection circuitry to prevent damage to the power module if it detects a reverse polarity condition. No damage should occur from reverse polarity, but you should correct a reverse polarity condition immediately.

For a list of the nominal and acceptable value ranges for source DC power, see Power Specifications, on page 290

The rating label is shown in the figure below.

Figure 18: Rating Label for NCS 4016 DC Chassis



General Power and Grounding Requirements

This section describes the power and grounding requirements you must consider when planning the site facilities for the routing system.

Note A qualified electrician should review the information in these sections to ensure that the installation site meets these requirements. For larger system configurations, consult a facilities electrical expert to understand the load that the routing system may put on the facility power plant.

General power and grounding requirements are:

- Installation of the routing system must follow national and local electrical codes:
  - In the United States: United States National Fire Protection Association (NFPA) 70 and United States National Electrical Code (NEC).
  - In Canada: Canadian Electrical Code, part I, CSA C22.1.
  - In other countries: International Electrotechnical Commission (IEC) 60364, parts 1 through 7.
- Two separate and independent AC or DC power sources are needed to provide 2N redundancy for system power. Each power source requires its own circuit breaker.
- Each power source must provide clean power to the site. If necessary, install a power conditioner.
- The site must provide short-circuit (over-current) protection for devices.
- Proper grounding is required at the site to ensure that equipment is not damaged by lightning and power surges. In addition:
  - Chassis grounding is required for AC and DC-powered systems.
  - For AC-powered systems, a grounding-type AC power outlet is required.
- Site power planning must include the power requirements for any external terminals and test equipment you will use with your system.

Note Be sure to review the safety warnings in the Cisco Network Convergence System *Regulatory Compliance and Safety Information for the Cisco Network Convergence System 4000 Series Routers* before attempting to install the routing system.

DC Power Requirements

Observe the following guidelines for DC-powered shelves. In addition, be sure to review the requirements described in the General Power and Grounding Requirements, on page 27.

- A DC-powered chassis requires up to a maximum of 12,250 watts of DC input power when the chassis is fully loaded.
- All power connection wiring must conform to the rules and regulations in the National Electrical Code (NEC) and any local codes. In addition, make sure that the wiring conforms to any internal requirements at the installation site.
- Each DC power source must comply with the safety extra-low voltage (SELV) requirements in UL 60950-1, CSA-C22.2 No. 60950-1, EN60950-1, AS/NZS 60950, and IEC60950-1.
- A DC-powered system should be installed in a restricted access area in accordance with the National Electric Code, ANSI/NFPA 70.
- All components in the area where DC input power is accessible must be properly insulated.

If it is not possible to rely on the identification of the earthed conductor in the DC mains supply, whereby the equipment is not provided with a two-pole disconnect device, then a two-pole disconnect device is to be provided external to the equipment.

AC Power Requirements

In addition to the requirements in the General Power and Grounding Requirements, on page 27, AC input power requirements are as follows:

- An AC-powered chassis requires up to a maximum of 12,000 watts of AC input power when the chassis is fully loaded.
- Two separate and independent AC power sources are required for N+N redundancy, one for each power shelf. Each power shelf should be connected to a different power source to provide 2N power redundancy in case a power source fails. The system will operate with power to only one shelf but will not have N+N redundancy.
- Each AC power source must provide single-phase AC power, and have its own circuit breaker.
- The AC power receptacles used to plug in the chassis must be the grounding type. The grounding conductors that connect to the receptacles should connect to protective earth ground at the service equipment.
- AC single-phase input:
  - Single-phase, 200 to 240 VAC nominal, 50 to 60 Hz, 16.4A maximum.
  - Each AC power shelf contains four specific single phase AC inlet connectors. These connectors can accept four AC power cords provided by Cisco. AC power cords provided by Cisco can have a IEC-309 plug 32A rated for International power systems, or a NEMA L6-30P plug 30A rated for North America Power Systems.

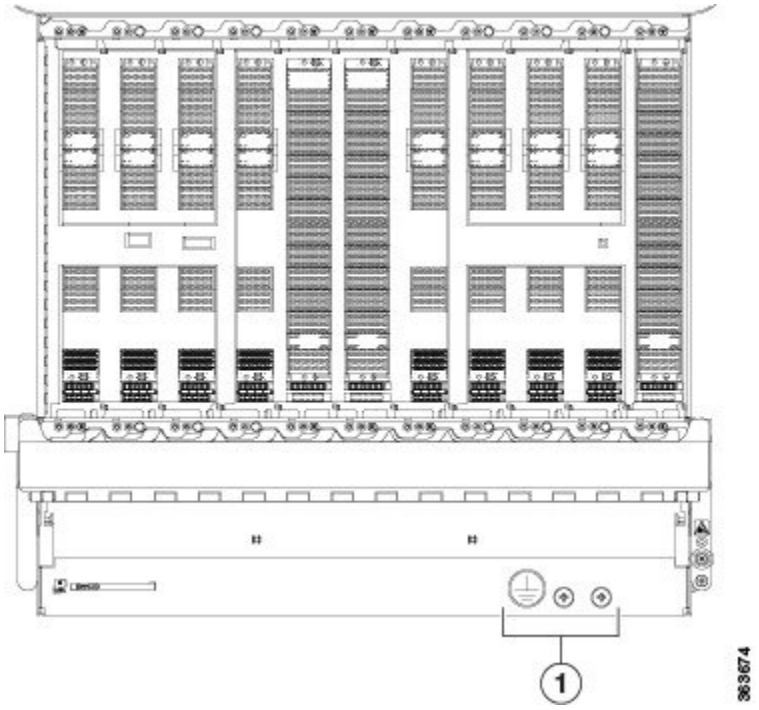
Note The external breaker current rating can be less than 30A, depending on the chassis configuration. Please refer to the national installation rules for the correct rating of the breakers or fuses.

NEBS Supplemental Unit Bonding and Grounding Guidelines

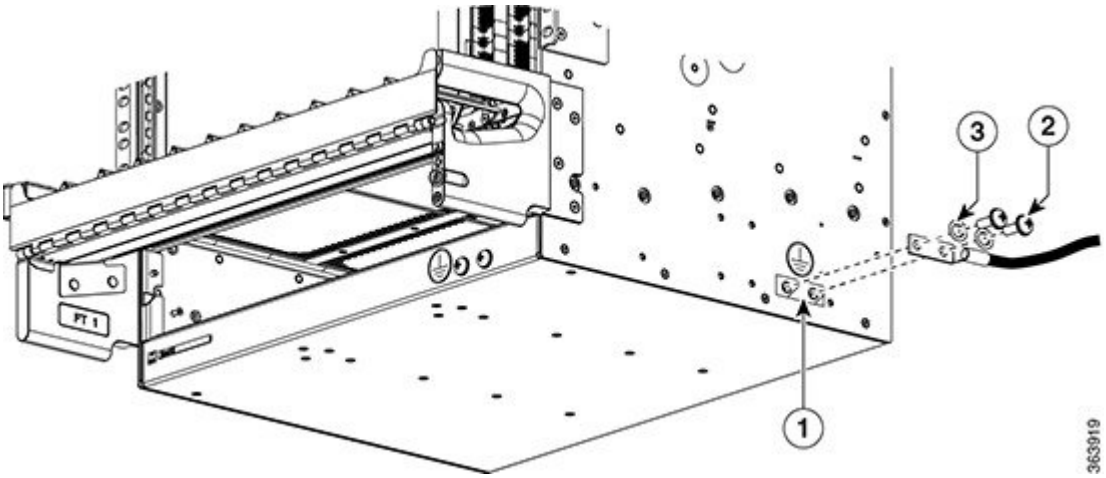
You must connect the central office ground system or interior equipment grounding system permanently to one of the two supplemental bonding and grounding connections on the back or side of the chassis to meet Network Equipment Building System (NEBS) requirements as well as safety compliance requirements. These grounding points are referred to as the NEBS bonding and grounding points

Note These bonding and grounding connections satisfy the Telcordia NEBS requirements for supplemental bonding and grounding connections. If you are not installing the chassis in a NEBS environment, you can choose to bypass these guidelines and rely on the safety earth ground connections to the AC power modules.

Figure 19: NEBS Bonding and Grounding Points on the Cisco NCS 4016 Chassis



1	NEBS grounding point on front of chassis



1	NEBS grounding point on right side of the chassis	2	Screws
3	Lock washers		

To ensure a satisfactory supplemental ground connection to the chassis, use the following parts:

- One grounding lug, which has two M6 bolt holes with 0.625- to 0.75-inch (15.86- to 19.05-mm) spacing between them, and a wire receptacle able to accept a 4-AWG or larger, multistrand copper wire. This lug (part of the kit) is similar to those used for the DC input power supply leads.
- Two M6 round-head screws and two locking washers (nickel-plated brass is ideal).
- One grounding wire. Although we recommend at least 4-AWG multistrand copper wire, the wire diameter and length depend on your chassis location and site environment.

Note These parts are not available from Cisco (with the exception of the grounding lug), but they are available from commercial vendors.

Installing the Chassis Ground Cable

This section describes how to install a ground cable to either NEBS bonding and grounding point on the front or side of the Cisco NCS 4016 chassis.

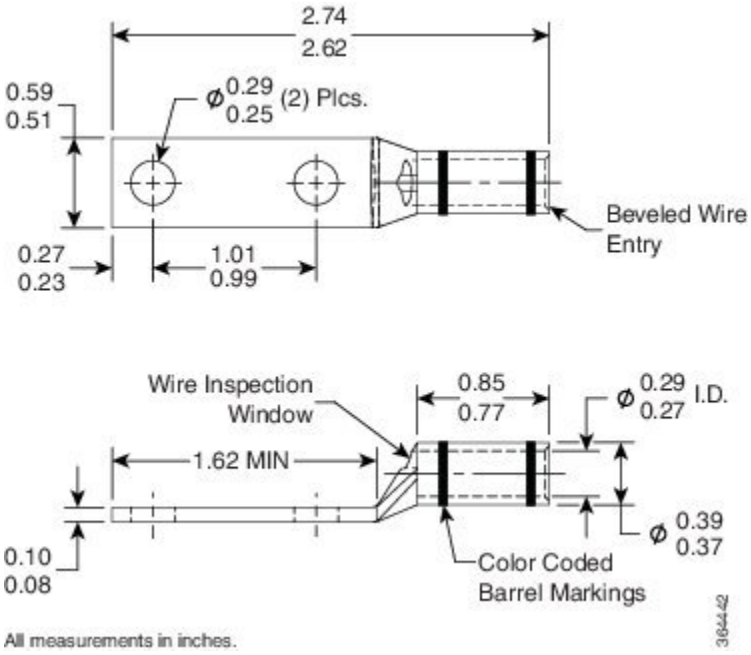
Required Tools and Equipment

- Ground lug and screws (provided in chassis accessory kit)
- Ground cable
- Crimping tool and lug specific die
- 3/8-inch drive socket wrench
- 3/8-inch drive torque wrench rated to include 35 in-lb (3.95 N-m).

To ensure a satisfactory ground connection, we recommend 4-AWG multistrand copper ground cable. This cable is not available from Cisco; it is available from any commercial cable vendor. The cable should be sized according to local and national installation requirements.

Note The DC return of this system should remain isolated from the system frame and chassis (DC-I: Isolated DC Return).

Figure 20: Straight Barrel Grounding Lug



Steps

To attach the ground cable to the chassis, perform the following steps:

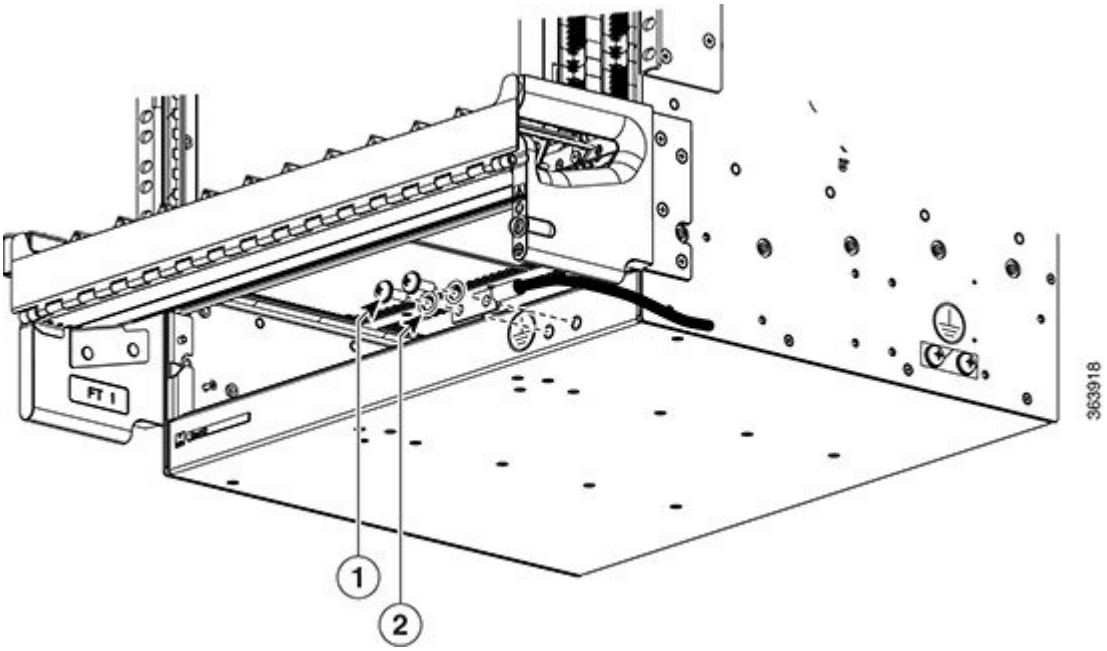
Procedure

Step 1 Use the crimping tool mandated by the lug manufacturer to crimp the lug to the ground cable.

Step 2 Use the torque-driver to attach the lug and ground cable to either grounding point .

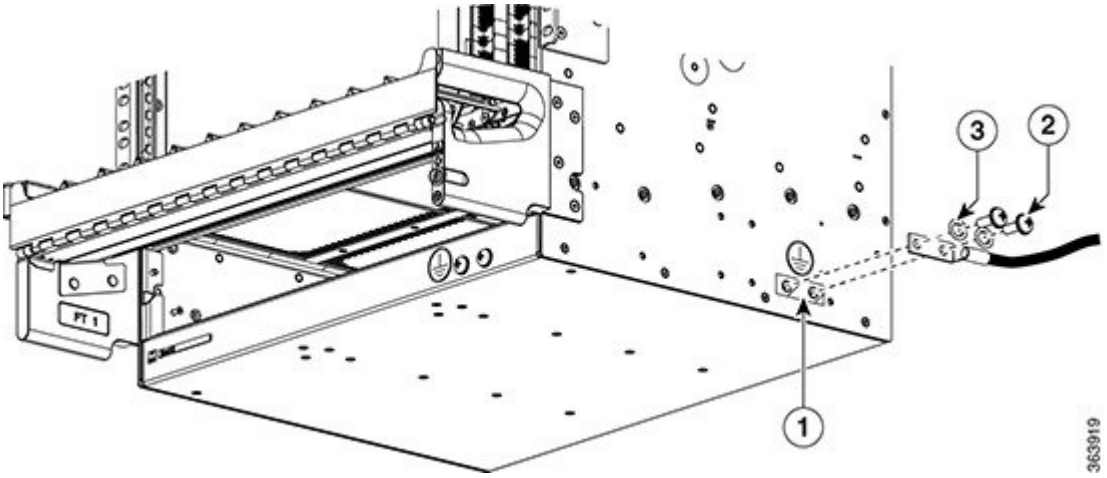
Note
The two grounding point screws are required for proper bonding and grounding of the chassis and should not be removed.

Figure 21: Attaching to Front NEBS Bonding and Grounding Point



1	Screws	2	Lock washers

Figure 22: Attaching to Side NEBS Bonding and Grounding Point



1	NEBS grounding point on right side of the chassis	2	Screws
3	Lock washers		

Step 3 Use the torque wrench to tighten the bolts to a torque of 35 in-lb (3.95 N-m).

Step 4 Connect the other end of the ground cable to a grounding point at your site, according to site requirements.

Installing an AC or DC Power Tray

The power tray is preinstalled on the Cisco NCS 4016 chassis. The following procedure describes how to install an AC or DC power tray in the chassis.

Required Tools and Equipment

- 6-inch, number-2 Phillips screwdriver
- Cisco NCS 4016 power trays (NCS4016-SA-AC or NCS4016-SA-DC)

Steps

Follow these steps to install an AC or DC power tray into the chassis:

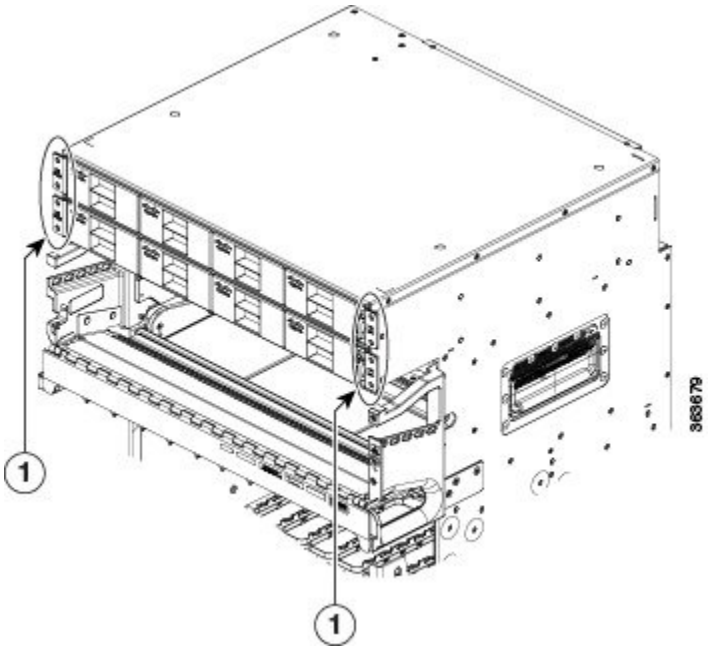
Procedure

Step 1 Slide the power tray into the bay until it engages its mating connector on the chassis.

Step 2 Fully seat the power tray into its mating connector and seat the power tray mounting ears against the chassis mounting ears.

Step 3 Install and tighten two screws (for each power tray) through the power tray mounting ears on each side into the screw holes in the chassis mounting ears to secure the tray to the chassis.

Figure 23: Screws on Power Tray Mounting Ears



1	Screws on the power tray mounting ears

Installing Power Modules

The following procedures describe how to install power modules into the chassis. The installation procedure is the same for both AC or DC modules.

Caution Never force a power module into the power tray if you feel any resistance! The power modules are keyed to prevent AC modules from being plugged into a DC power tray or a DC module into an AC power tray. Forcing a module into the incorrect tray can cause damage to the module and the tray.

Each power module has three status LEDs located on the front left side of its faceplate.

Table 5: Power Module LED Status Indicator Lights

LED Name	Color	Meaning
Input OK	Green	• On: The input voltage is present and within regulation range. • Blinking: The input voltage is present but out of regulation range. • Off: The input voltage is not present.
Output OK	Green	• On: The output voltage is on. • Blinking: The power module is in a power limit or over current condition. • Off: The output voltage is off.
Fault	Red	• On: An internal fault is detected within the power module. • Off: No internal faults detected on the power module.

Installing AC or DC Power Modules

The following section describes how to install AC or DC power modules.

Required Tools and Equipment

- Cisco NCS 4016 power modules (NCS4K-AC-PSU=)
- Cisco NCS 4016 power modules (NCS4K-DC-PSU-V1)

Steps

Caution To prevent damage to the power tray backplane connector, do not use excessive force when inserting the power module into the power tray.

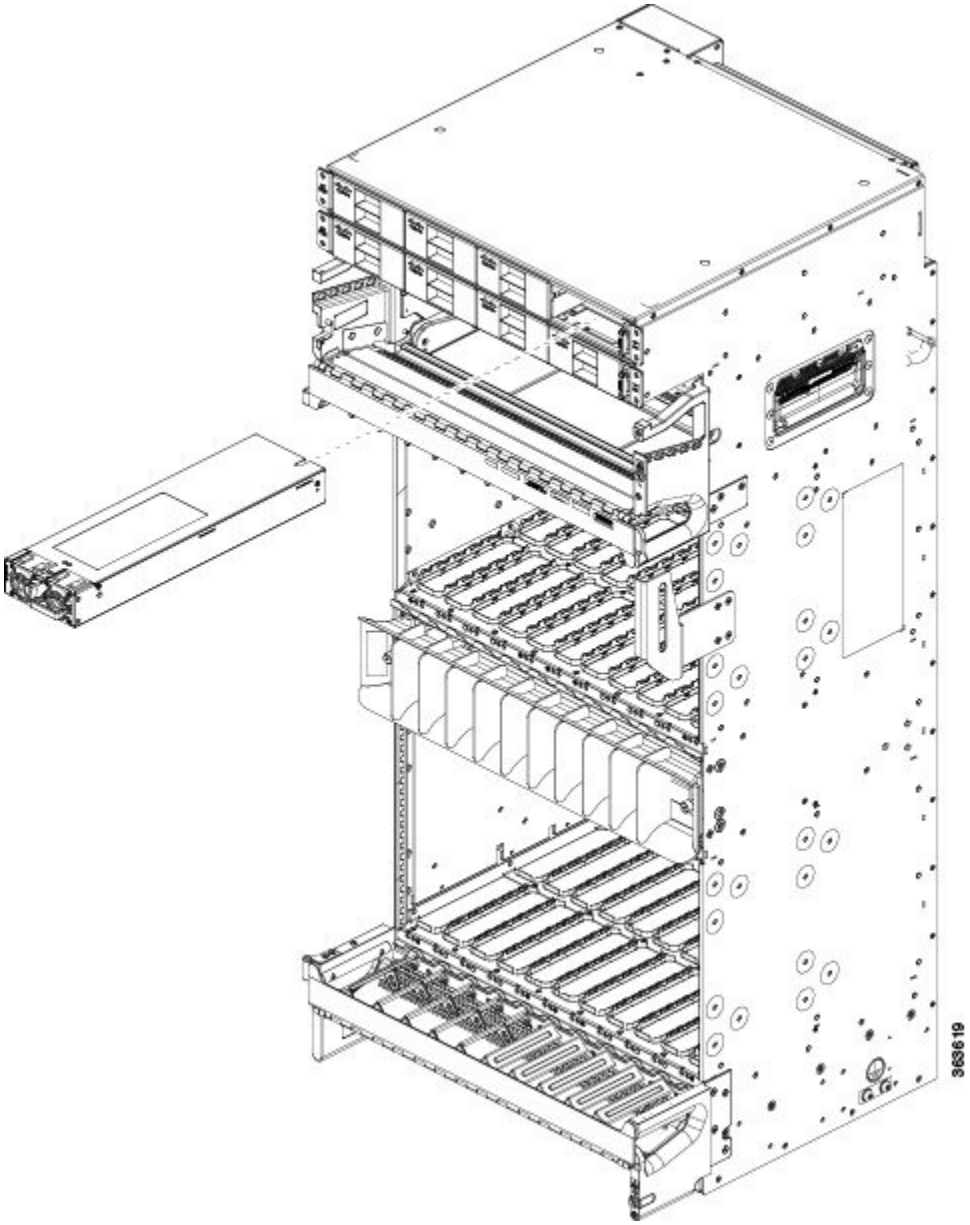
Follow these steps to install the AC or DC power modules into the chassis:

Procedure

Step 1 Remove the filler caps from the slots where you want to install the power modules.

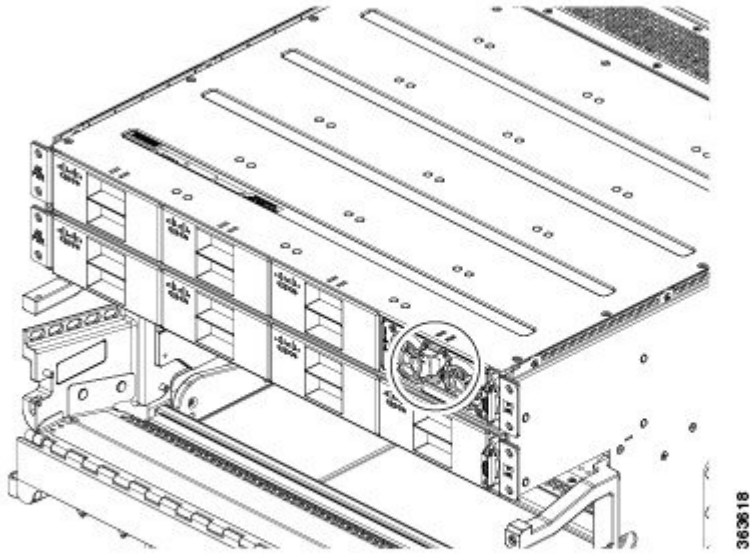
Step 2 Using two hands to support the power module, slide it into the power tray.

Figure 24: Example of Inserting the AC Power Module



Step 3 Secure the power module into the power tray using the snap hook.

Figure 25: Example of Securing the Snap Hook (AC)

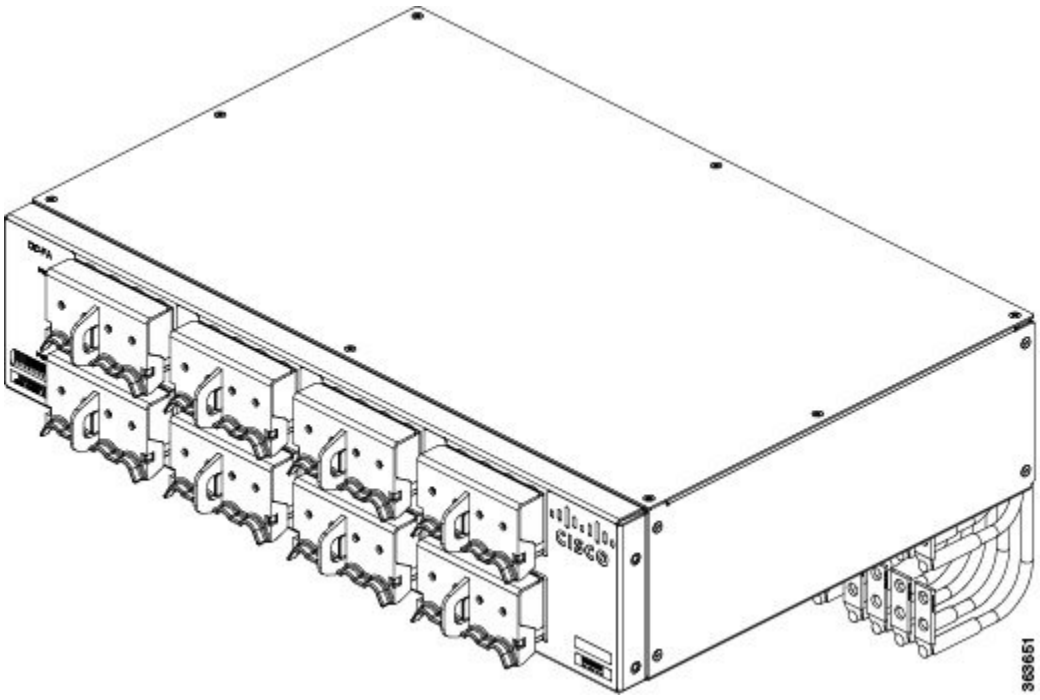


Step 4 Repeat these steps for the other AC or DC power modules.

Installing the DC Power Front Connection Adapter

If you have limited access to the back of the chassis, or limited space behind the chassis, you can use the DC Power Front Connection Adapter. This DC adapter moves the DC power connections from the back of the chassis to the front of the chassis. This may be desirable in ETSI rack installations.

Figure 26: DC Power Front Connection Adapter



Prerequisites

- If the rear to front power adapter is going to be used, then the sub assembly needs to be attached first to the chassis and then both units installed in a rack or cabinet.
- The Cisco NCS 4016 chassis should be completely removed from the packaging and installed in the rack or cabinet.

Required Tools and Equipment

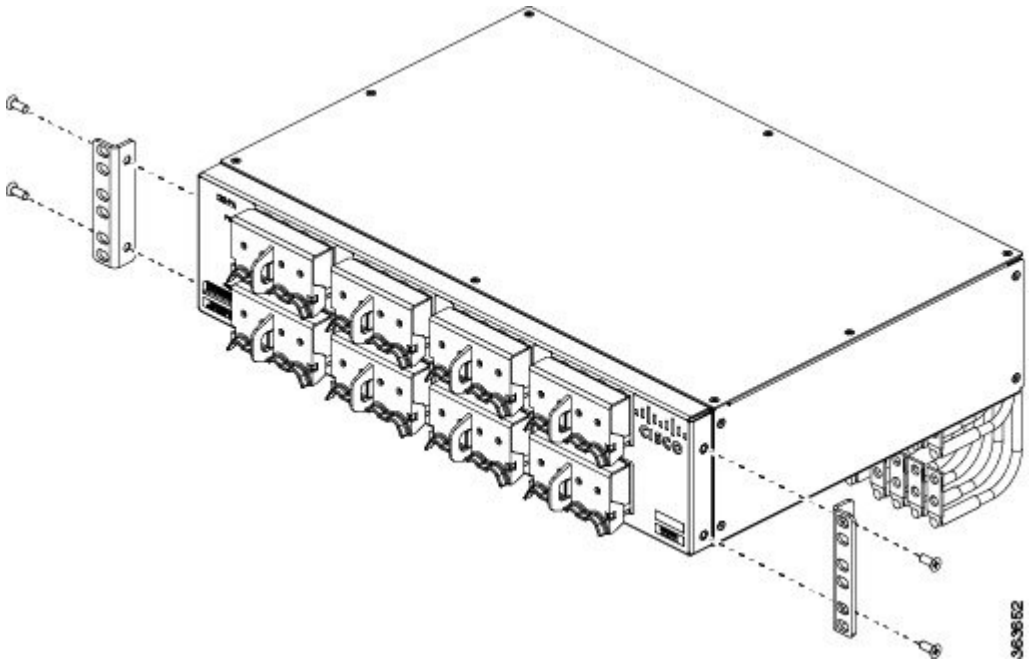
- 6-inch, number-1 Phillips screwdriver
- One DC Power Front Connection Adapter (NCS4K-DC-FA, includes brackets)
- 3/8 Ratchet Wrench, 7/16 Socket, and a Torque Wrench

Steps

Procedure

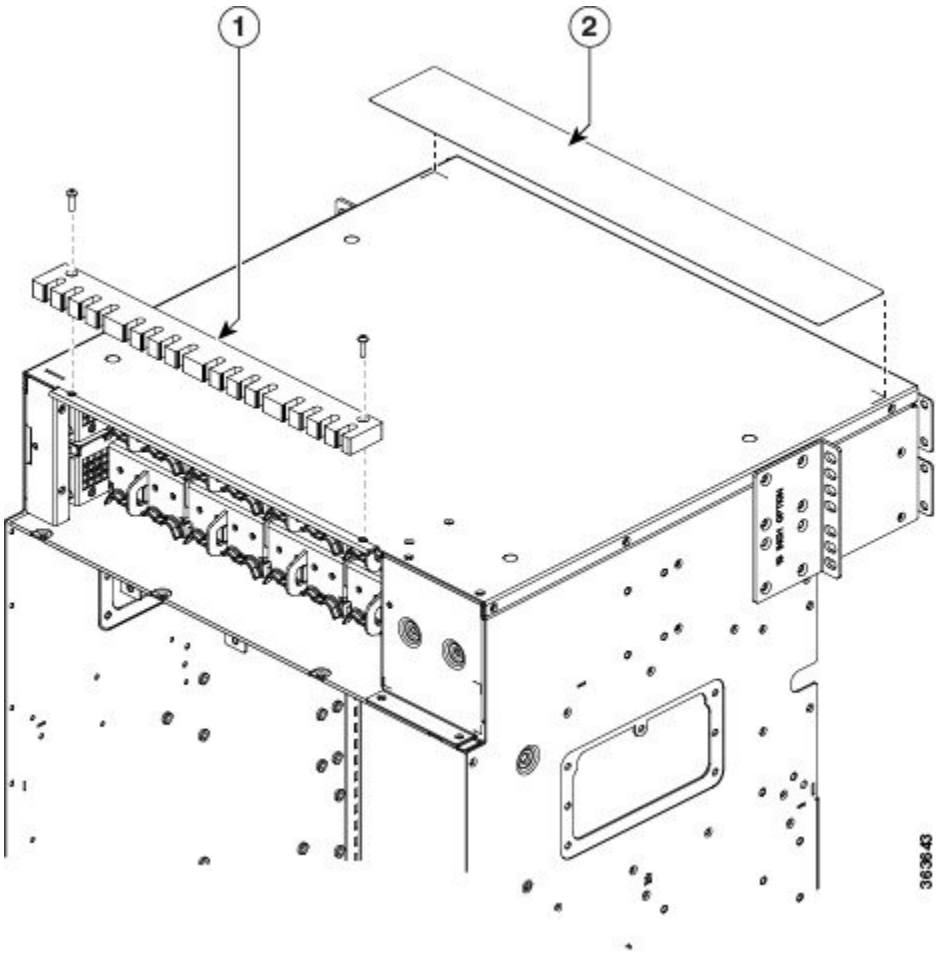
Step 1 Install the DC-FA (front access) brackets on the sides toward the front of the DC adapter. There are three different types of bracket depending upon rack type: ANSI 19 inch or 23 inch and ETSI. Choose the correct type for your specific rack.

Figure 27: Installing the DC-FA Brackets



Step 2 Attach the rear cable guide on top of the chassis toward the rear, and attach the insulator sheet on top of the chassis toward the front .

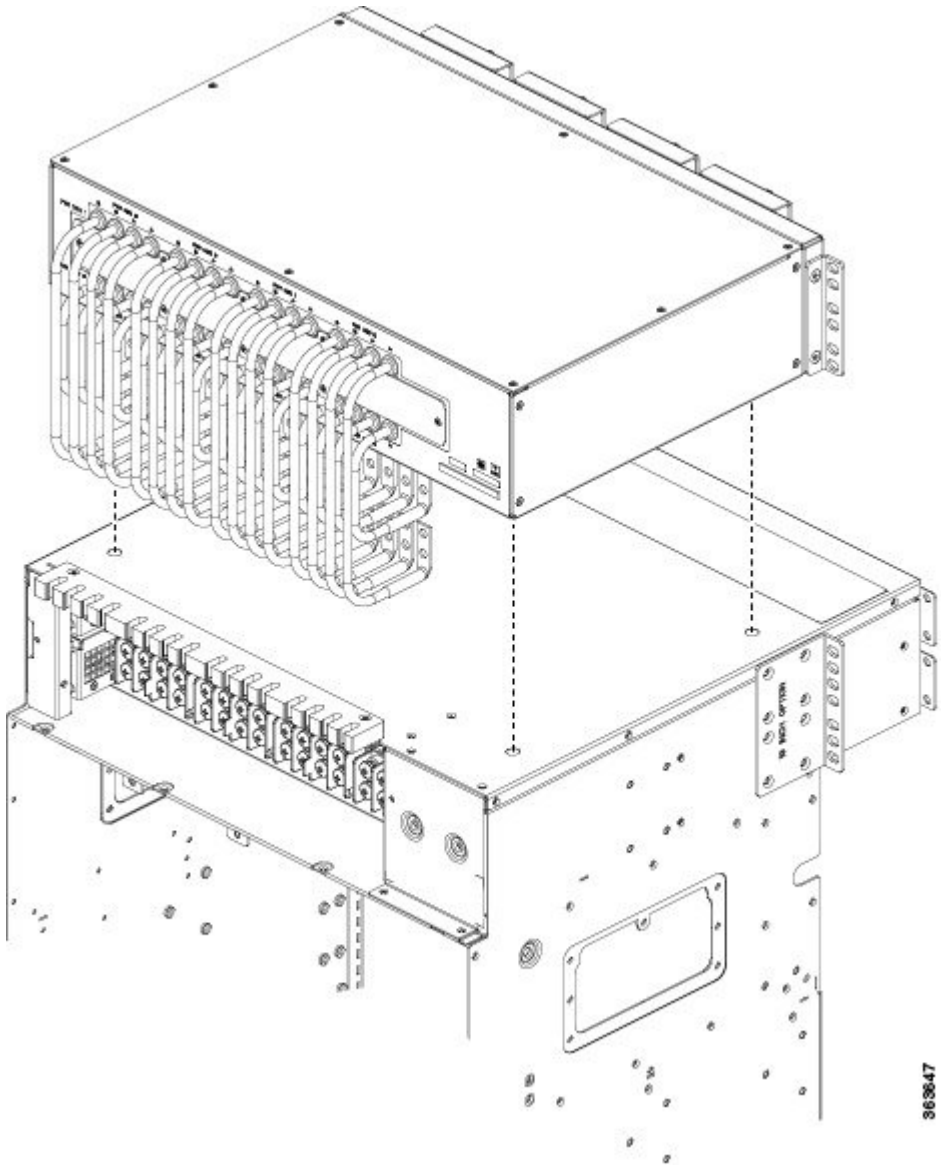
Figure 28: Attaching Rear Cable Guide and Insulator Sheet



1	Rear cable guide	2	Insulator sheet

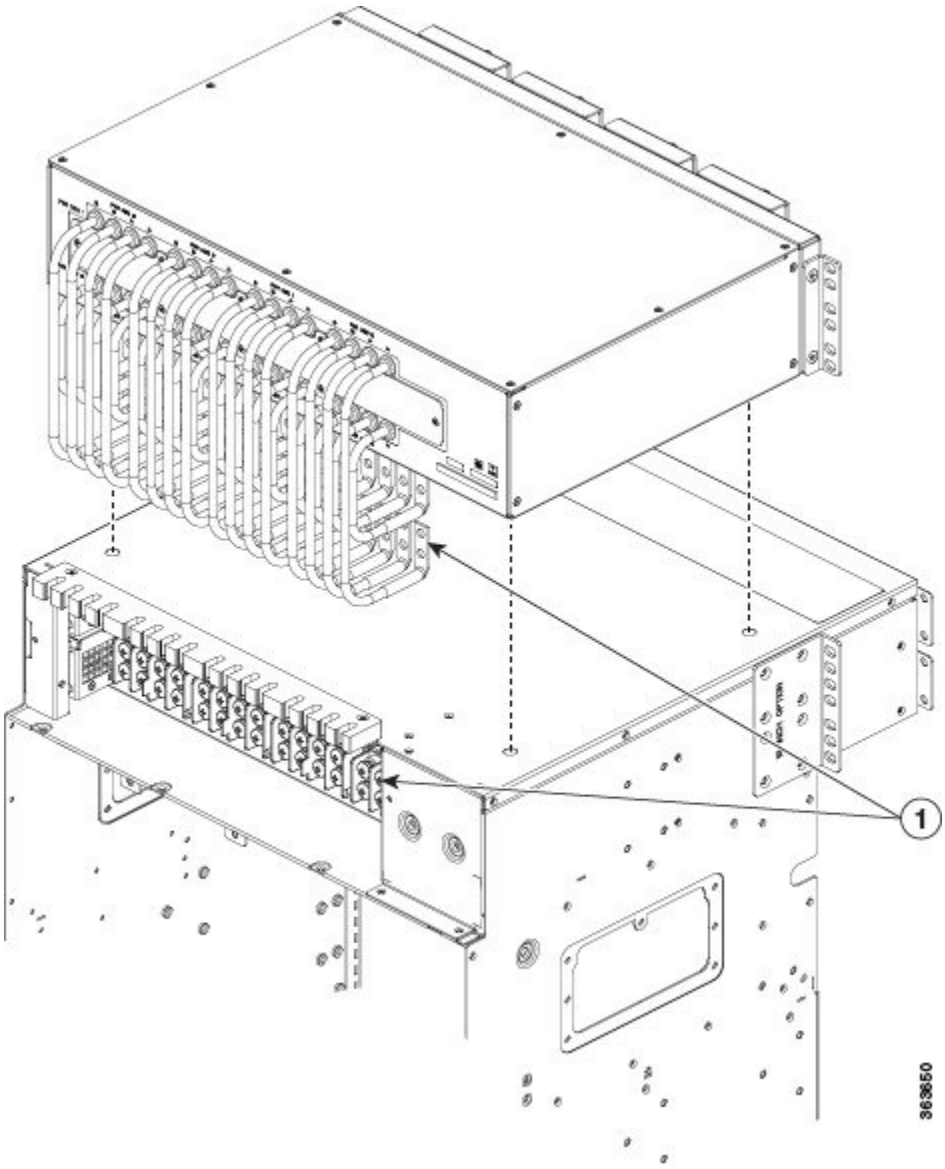
Step 3 Place the DC adapter on top of the chassis using the embossed references on the top chassis cover.

Figure 29: Placing DC Adapter on Top of Chassis



Step 4 Connect the power cables on the rear of the of DC adapter to the chassis terminal blocks. Follow the connections scheme as shown on the labels available on the DC adapter and the chassis.

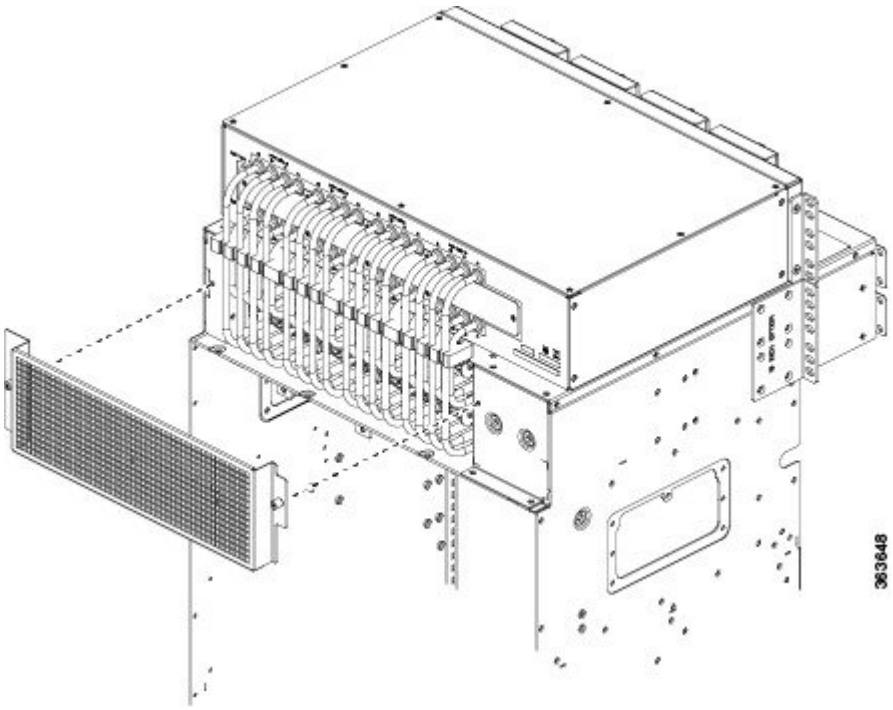
Figure 30: Connecting Power Cables



1	Connect power cables to chassis terminal blocks

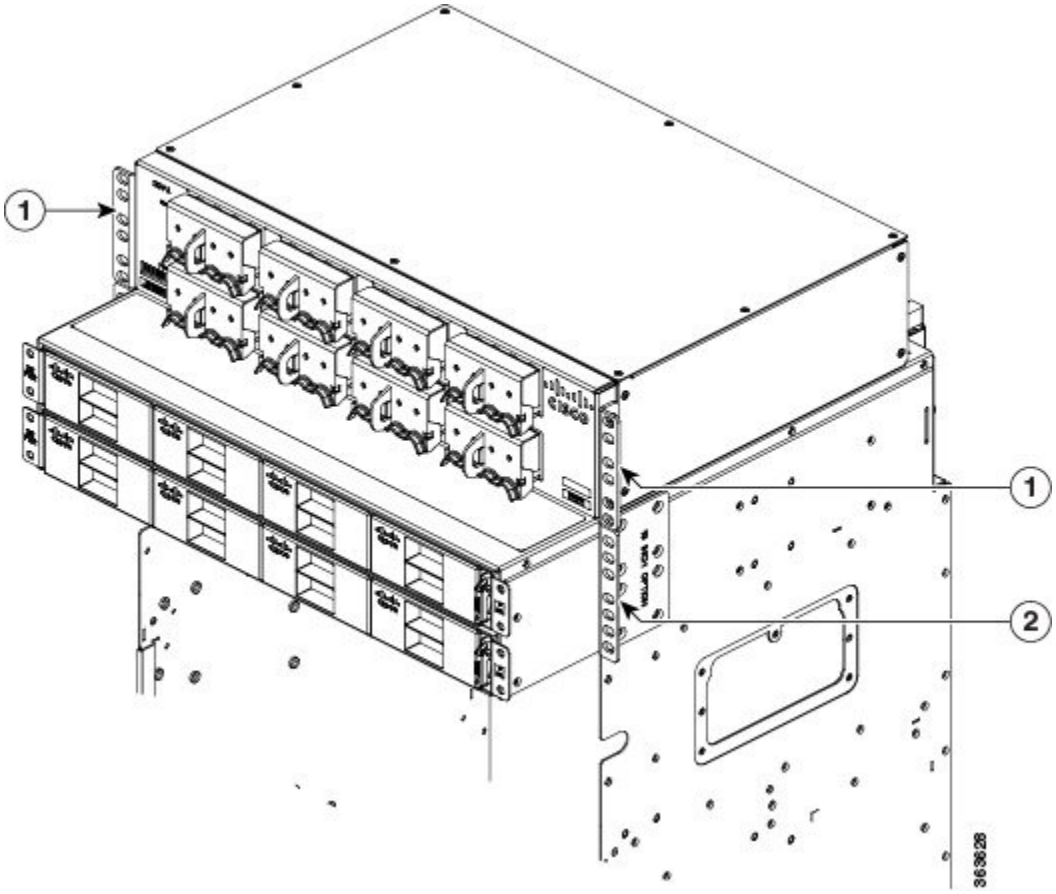
Step 5 Install the rear cover to protect the cables.

Figure 31: Installing the Rear Cover



Step 6 Install the chassis and DC adapter subassembly in the rack or cabinet. Attach the chassis brackets and DC brackets to the rack.

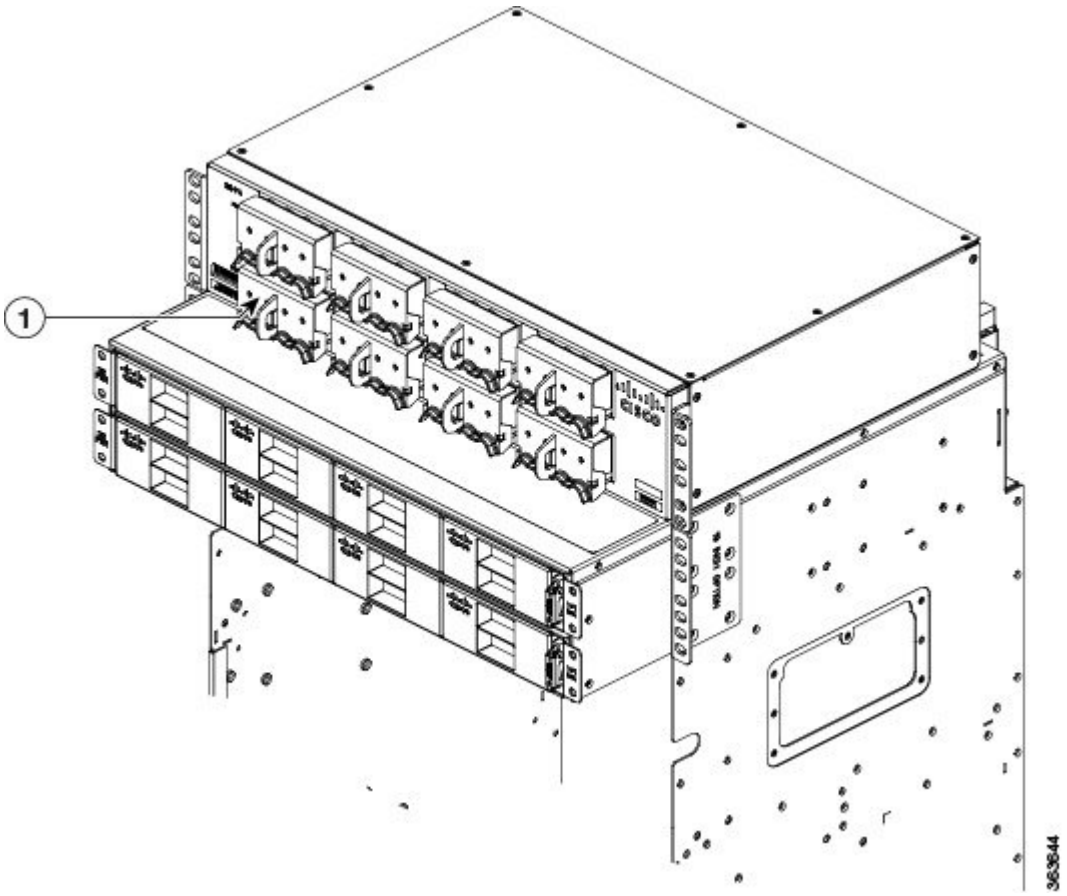
Figure 32: Chassis Brackets and DC Adapter Brackets



1	DC adapter brackets	2	Chassis brackets (one on other side is not visible)

Step 7 Connect the power cables coming from batteries or from the PDU unit to the DC adapter terminal blocks on the front side of the unit . See the Connecting Power to the Chassis, on page 44.

Figure 33: Connecting Power Cables to Terminal Blocks



1	Terminal Blocks

Connecting Power to the Chassis

Use one of the following procedures to connect power to your chassis:

Connecting Power to an AC-Powered Chassis

Follow these steps to connect the AC power cords to the chassis.

Note Connect each AC power supply to a dedicated power source (branch circuit). Each AC input power supply operates at a nominal input level of 200 to 240 VAC.

Procedure

Step 1 Check that the power switch is set to the OFF (0) position. The power switch is on the right of the power tray.

Step 2 Check that the circuit breaker assigned to the AC power source you are connecting is set to off.

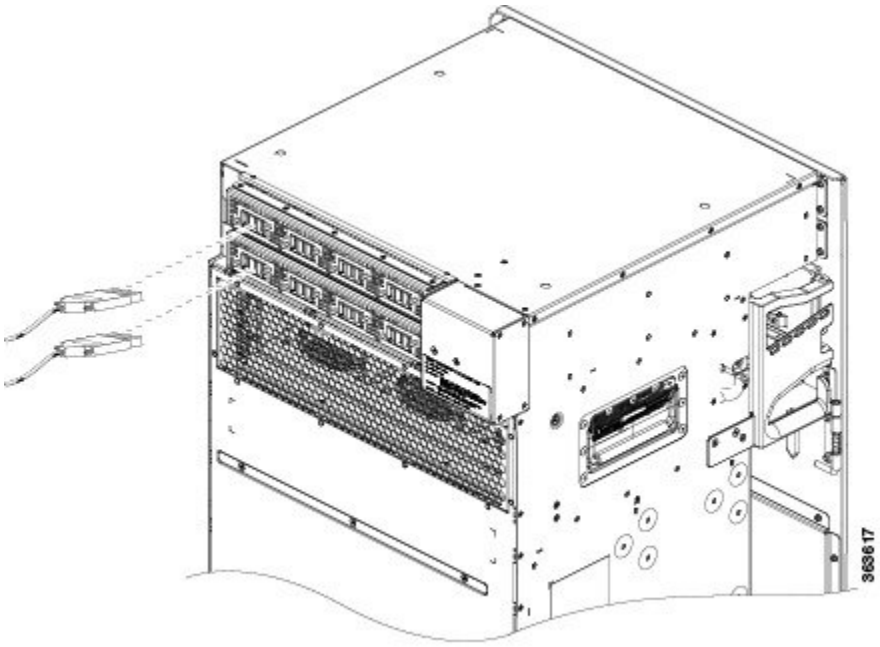
Step 3 Verify that the permanent ground connection (central office grounding system) has been installed to the NEBS grounding location on the chassis.

Warning
To ensure that power remains off while you are performing this procedure, lock-out/tag-out the circuit breaker switch in the OFF (0) position until you are ready to turn it on.

Step 4 Plug the AC power cord into the receptacle at the rear of the AC power tray.

Step 5 Tighten the screw that clamps the AC power cord plug in place.

Figure 34: Typical AC Power Connections to an AC Power Tray



Step 6 Plug the other end of the AC power cord into the AC source receptacle.

Step 7 Proceed to the Powering On the Chassis, on page 51.

Connecting Power to a DC-Powered Chassis

This section contains the procedures to connect the DC source power cables to a DC-powered chassis.

The color coding of source DC power cable leads depends on the color coding of the site DC power source. Because there is no color code standard for source DC wiring, you must be sure that power source cables are connected to the power module with the proper positive (+) and negative (–) polarity:

- In some cases, the source DC cable leads might have a positive (+) or a negative (–) label. This is a relatively safe indication of the polarity, *but you must verify the polarity by measuring the voltage between the DC cable leads* . Be sure that the positive (+) and negative (–) cable leads match the positive (+) and negative (–) labels on the power module when making the measurement.
- Green (or green and yellow) cable typically indicates that it is a ground cable.

Caution DC power modules contain circuitry to trip the breaker on the power module if the power module detects a reverse polarity condition. No damage should occur from reverse polarity, but you should correct a reverse-polarity condition immediately.

Warning To ensure that power remains off while you are performing this procedure, lock-out/tag-out the DC circuit breaker switch in the OFF (0) position until you are ready to turn it on.

Follow these steps to connect the DC source power cables to a DC power tray:

Procedure

Step 1 Verify that the power switch is set to the OFF (0) position. The power switch is on the right of the power tray.

Step 2 Remove the clear plastic safety covers that fit over the DC power connection terminal studs.

Step 3 Verify the following resistance values on both power shelves:

- The resistance between the positive and negative power terminal studs of each input must be greater than 90 KOhm.
- The resistance between each positive terminal stud and bare metal surface on the power shelf must be greater that 10 MOhms.
- The resistance between each negative terminal stud and bare metal surface on the power shelf must be greater that 10 MOhms.

Note
Typical hand held Ohm meters will not measure 10 MOhms; instead they will auto range to acquire a measurement and give an out-of-range reading. This is an acceptable reading provided that the meter is in calibration.

Step 4 Connect the DC power cables in the following order:

a) Positive cable first.
b) Negative cable last.

Step 5 Repeat Step-4 for the other power modules installed in the tray.

Warning
To prevent injury and damage to the equipment, always attach the ground and source DC power cable lugs to power tray terminals in the following order: (1) positive (+) to positive (+), (2) negative (–) to negative (–).

Caution
Do not over tighten the nuts that secure the DC power cables to the power tray terminals. The nuts should be tightened using the 7/16 hex socket and torque wrench to a torque of 45 to 50 in-lb.

Figure 35: DC Power Tray Rear Panel

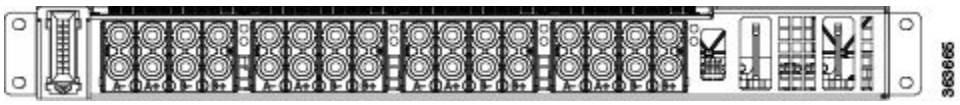
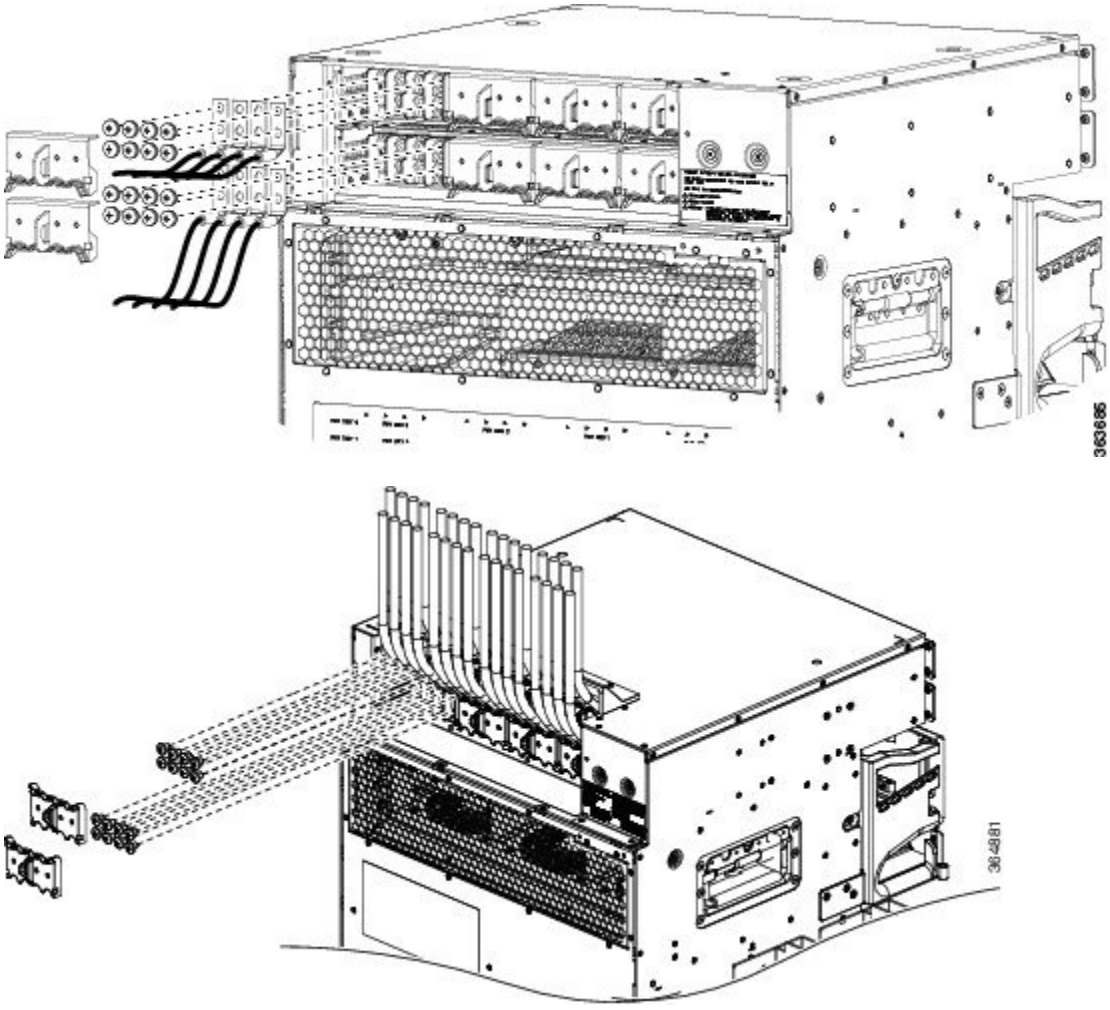
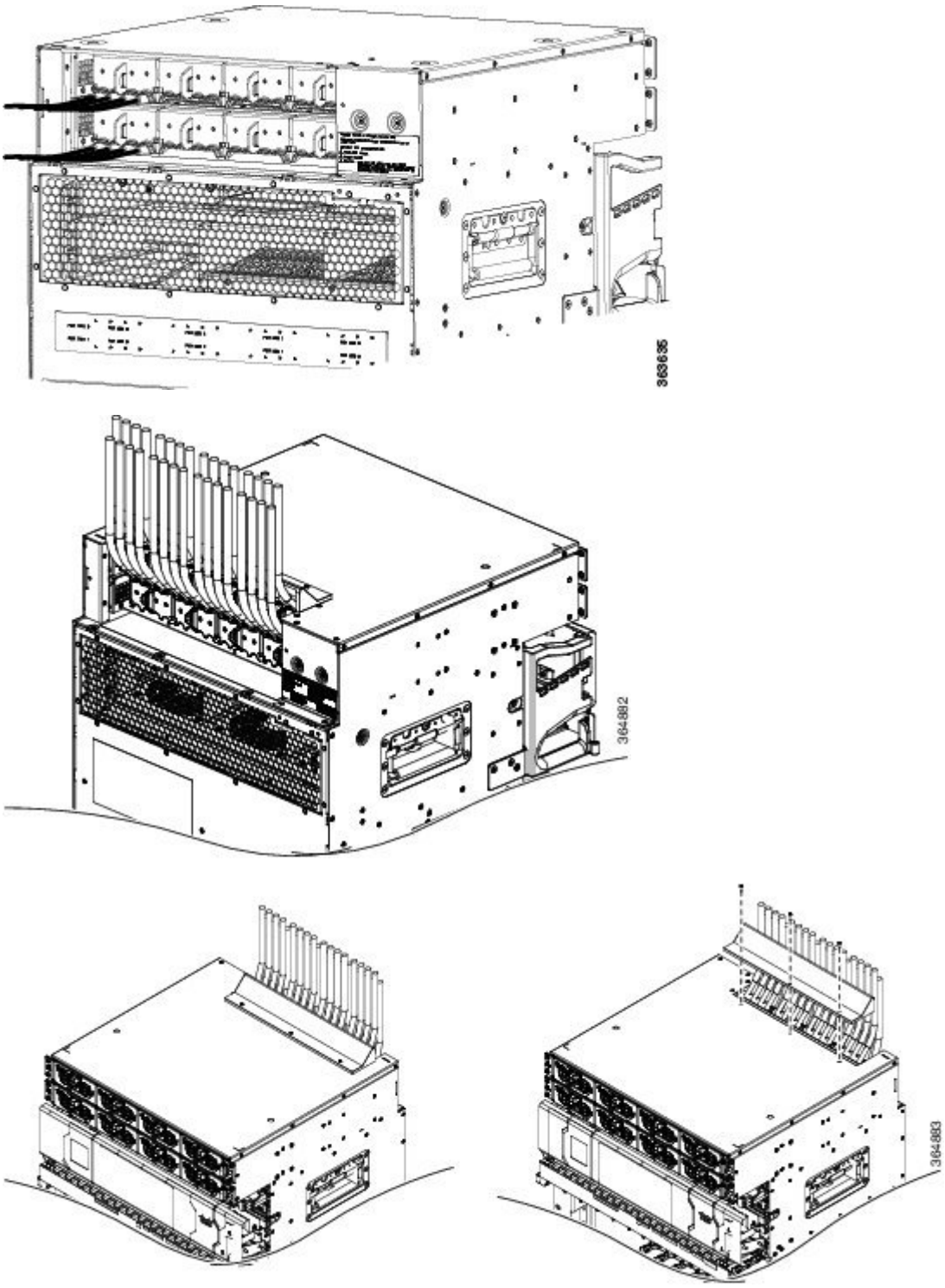


Figure 36: Typical Power Connections to a Power Tray for a Single DC Power Module—Power System



Step 6 Replace the clear plastic safety covers over the connection terminal studs.

Figure 37: Typical Plastic Safety Covers over the Power Tray Connection Terminals



Step 7 Proceed to the Powering On the Chassis, on page 51.

Disconnecting AC or DC Power

The following sections explain how to disconnect AC or DC power to the Cisco NCS 4016 chassis.

Disconnecting AC Power

Follow these steps to disconnect an individual AC power cord:

Procedure

Step 1 Power off (0) the circuit breaker assigned to the AC power source that you are disconnecting.

Step 2 Un-tighten the screw that clamps the AC power cord.

Step 3 Unplug the AC power cord from the power tray receptacle.

Caution
Do not turn off the switch on the power tray to remove AC power cords. An individual AC power cord can be unplugged while the system is powered from other AC power sources.

Disconnecting AC Power

If it becomes necessary to disconnect all AC power from the chassis, follow these steps:

Note Do not disconnect all power from the chassis to replace components, including power modules. See Removing and Replacing Chassis Components, on page 105.

Procedure

Step 1 Set the power switch at the rear of the AC power tray to the OFF (0) position.

Step 2 Power off (0) the circuit breakers assigned to the AC power sources that you are disconnecting.

Warning
To ensure that power remains off while you are performing this procedure, lock-out/tag-out the circuit breaker switch in the OFF (0) position until you are ready to turn it on.

Step 3 Loosen the retainer bracket that holds the AC power cords to the power tray receptacle.

Step 4 Unplug the AC power cords from the power tray receptacles.

Reconnecting AC Power

To reconnect an individual AC power cord to a power tray, see Connecting Power to an AC-Powered Chassis, on page 44

Disconnecting DC Power

Caution It is not necessary to disconnect all power from the chassis to replace components, including power modules. See Removing the Power Components, on page 113

Follow these steps to disconnect an individual DC power source from a power tray:

Procedure

Step 1 Power off the circuit breaker assigned to the DC power source you are disconnecting.

Warning
To ensure that power remains off while you are performing this procedure, lock-out/tag-out the circuit breaker switch in the OFF (0) position until you are ready to turn it on.

Step 2 Remove the clear plastic safety covers that fit over the DC power connection terminal studs.

Warning
To prevent injury and damage to the equipment, always remove the source DC power cables from the power tray terminals *in the following order* : (1) negative (–), (2) positive (+).

Step 3 Disconnect the DC power cables from their terminals in the following order and note the color of each cable:

a) Negative (PWR) cables first.
b) Positive (RTN) cables last.

Step 4 Repeat Step-1 through Step-3 for the other power module distribution that needs to be removed.

Disconnecting DC Power

If it becomes necessary to disconnect all DC power from the chassis, follow these steps:

Note This procedure describes how to disconnect DC power from all power modules in a single DC power tray. The procedure is the same for each DC power tray, if more than one is installed.

Caution If only one power tray is installed, performing the following procedure turns off all power to the chassis.

Procedure

Step 1 Set the power tray switch to the OFF (0) position.

Step 2 Power off (0) the circuit breaker assigned to the DC power source you are disconnecting.

Warning
To ensure that power remains off while you are performing this procedure, lock-out/tag-out the circuit breaker switch in the OFF (0) position until you are ready to turn it on.

Step 3 Remove the clear plastic safety covers that fit over the DC power connection terminal studs.

Warning
To prevent injury and damage to the equipment, always remove the source DC power cables from the power tray terminals *in the following order* : (1) negative (–), (2) positive (+).

Step 4 Disconnect the DC power cables from their terminals in the following order and note the color of each cable:

a) Negative (PWR) cables first.
b) Positive (RTN) cables last.

Step 5 Repeat Step 1 through Step 4 for the other power tray, if installed.

Reconnecting DC Power

To reconnect DC power to a DC power tray, see Connecting Power to a DC-Powered Chassis, on page 45.

Powering On the Chassis

Follow these steps to turn on power to an AC-powered or DC-powered chassis:

Procedure

Step 1 Power on the circuit breaker to your power sources one at a time.

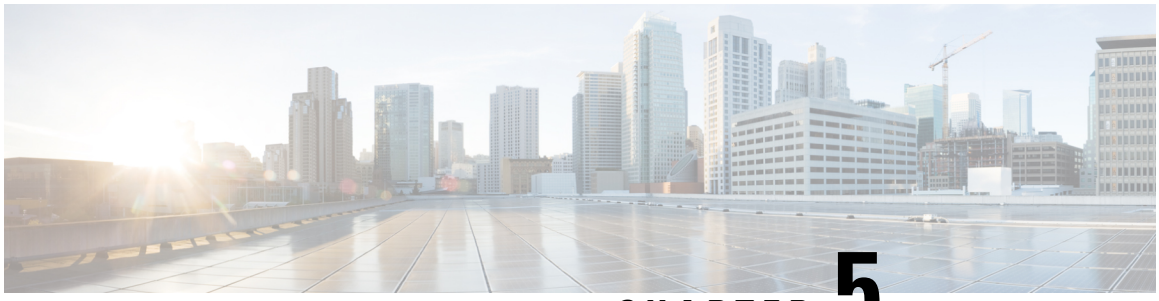
Step 2 Verify that the correct Power Input LED on each power module in the tray is lit (one input on the LED flashes and both inputs on the LED are solid). Continue with steps 1 and 2 until all inputs have been verified.

Note
On the DC power tray, the Power Input LED is lit solid green if both DC feeds are valid and blinks green if only a single DC feed is valid.

Step 3 Set the power tray 0 switch (Feed A in case of AC chassis).

Step 4 Verify that the Power Output LED on each power module in the tray is lit.

Step 5 Repeat Step 3 and Step 4 for powe tray 1 (Feed B in case of AC chassis).



CHAPTER 5

Installing Route Processor Cards, Fabric Cards, and Line Cards

This chapter provides instructions on how to install route processor (RP) cards, fabric cards (FCs), line cards (LCs) and their associated components in the Cisco NCS 4016 chassis.

- About Installing Cards and Associated Components, on page 53
- Installing and Removing a Filler Card, on page 55
- About RP Cards, on page 57
- Installing an RP Card, on page 58
- About Fabric Cards, on page 63
- Installing a Fabric Card, on page 64
- About Line Cards, on page 70
- Installing a Line Card, on page 94
- Connecting Line Card Network Interface Cables, on page 98
- Connecting Cables to the RP, on page 101

About Installing Cards and Associated Components

Preventing Electrostatic Discharge

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. We recommend use of an ESD-preventive wrist strap whenever you handle network equipment or one of its components.

- Always use an ESD-preventive wrist or ankle strap, and ensure that it makes good skin contact. Connect the equipment end of the connection cord to an ESD jack or a bare metal surface on the chassis (ensure that the chassis is grounded).
- Handle a card by its ejector levers, when applicable, or its metal carrier only; avoid touching the board or connector pins (see the Guidelines for Installing and Removing a Card, on page 54).
- Place a removed card board-side-up on an antistatic surface or in a static-shielding bag. If you plan to return the component to the factory, immediately place it in a static-shielding bag.
- Avoid contact between a card and clothing. The wrist strap protects the board from only ESD voltage on the body; ESD voltage on clothing can still cause damage.
- Be careful not to lay any tools on the aluminum honeycomb panel, or insert your fingers into the panel.

Guidelines for Installing and Removing a Card

- Online (in-service) insertion and removal (OIR) is supported, enabling you to remove and install cards while the chassis is operating. OIR is seamless to users on the network, maintains all routing information, and ensures session preservation. You do not need to notify the software or reset the power. You have the option of using the Cisco IOS XR **shutdown** command before removing a card.



Note OIR removes power to a specific slot before the card is replaced. The power remains on for all other card slots.

- The different cards in the Cisco NCS 4016 chassis are all attached to the chassis itself using a pair of ejector levers and captive screws. The two ejector levers release the card from its backplane connector. The exact locations of the ejector levers and captive screws can vary slightly from card to card, but they are generally in the same locations: on the upper and bottom ends of the faceplate.
- When you remove a card, press the OIR buttons before using the ejector levers to ensure that the connector pins disconnect from the backplane in the sequence expected by the chassis.
- The correct card orientation is shown by the eject symbol on the OIR buttons. The symbol must be oriented upward for cards in the top row, and downward for cards in the bottom row.
- Every FC, LC, and RP card has a key mounted on the board that matches a corresponding slot on the chassis side (top of each card slot). This key-slot mechanism prevents a card from being inserted into the wrong, non-matching card slot. It also prevents a card from being inserted upside down. When a card is inserted into the wrong card slot or upside down, the key will get blocked against the chassis card guide and not slide though the slot. When the key gets blocked, remove the card and find the correct card slot.



Note RP card faceplates are labeled with the square symbol. Card slots on the chassis for RP cards are also labeled with the square symbol. FC faceplates are labeled with the plus symbol. Card slots on the chassis for FCs are also labeled with the plus symbol.

- The chassis is shipped with all card slots containing filler cards to help maintain chassis stiffness and prevent any damage to the chassis during shipment.
- Any unused card slots that are uncovered would allow air used for chassis cooling to escape. Therefore, to ensure proper air flow and maintain system EMC and safety compliance, any unused LC slots must contain filler cards, and all FC and RP cards must remain installed in their card slots.
- Fully insert all FC and RP cards into the chassis before tightening their captive screws.
- For information about the slot numbers, see the “Chassis Slot Numbers” section on page -7 .



Caution The chassis may indicate a hardware failure if you do not follow proper procedures. Remove or install only one card at a time. Allow at least 30 seconds for the chassis to complete its tasks before removing or installing another card.

Installing and Removing a Filler Card

The chassis ships with filler cards installed in the RP, LC, and FC slots.

Caution To ensure thermal regulation in the chassis, keep filler cards installed in all slots that do not have an RP, LC, or FC installed.

This section contains the following procedures:

Installing a Filler Card

This section describes how to install a filler card in the Cisco NCS 4016 chassis.

Prerequisites

Before performing this task, open the front door, if installed, and ensure that the slot in which you are about to install the filler card is empty.

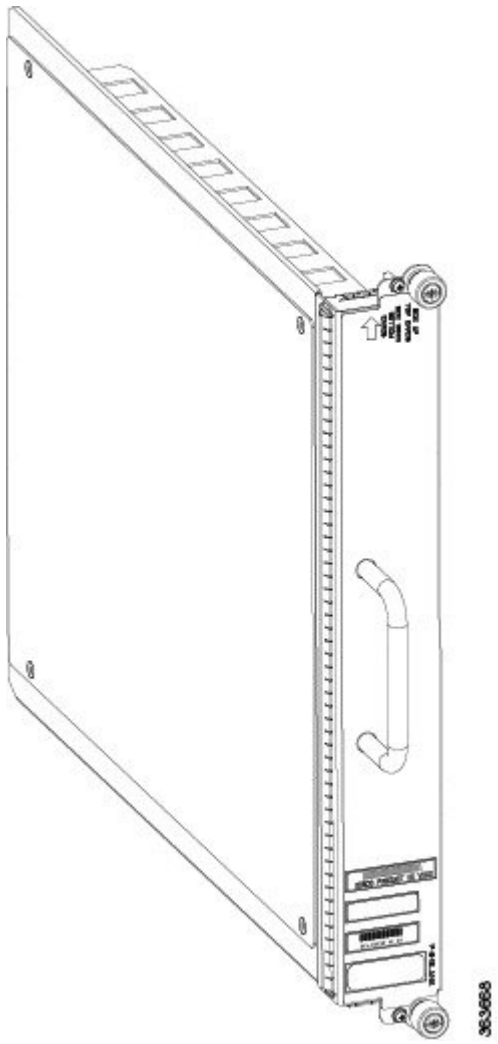
Required Tools and Equipment

- Number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver
- LC filler card (Cisco PID NCS4K-BLANK)

Steps

The following steps describe how to install a filler card.

Figure 38: LC Slot Filler Card



Procedure

Step 1 Determine the correct orientation of the filler card:

- If you are installing the card in the top rack, the arrow should be pointing up.
- If you are installing the card in the bottom rack, the arrow should be pointing down.

Step 2 Use both hands while inserting a filler card. Use one hand on the faceplate and the other hand along the base of the filler card to guide it into the slot.

Step 3 Slide the filler card into the chassis until the captive screw plates are flush with the chassis.

Step 4 Partially tighten the two captive screws on the front panel of the filler card (either by hand or with the number-2 Phillips screwdriver or number-2 common [flat-head] screwdriver) to make sure that they are both engaged.

Step 5 Use the number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver to fully tighten the captive screws to seat the filler card firmly in the slot.

Removing a Filler Card

This section describes how to remove a filler card from the Cisco NCS 4016 chassis.

Prerequisites

Before performing this task, open the front door, if installed.

Required Tools and Equipment

- Number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver

Steps

The following steps describe how to remove a filler card.

Procedure

Step 1 Identify the filler card to be removed from the card cage. Use the number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver, and turn the two captive screws on the front panel of the card counterclockwise to loosen the card from the slot.

Step 2 Grasp the filler card handle with one hand and gently pull it halfway from the slot.

Step 3 Place one hand under the filler card to guide it.

Step 4 Holding the filler card underneath and by the handle, pull it from the slot, and set it carefully aside.

About RP Cards

The Cisco NCS 4016 chassis supports two route processors (RPs). These cards provide the intelligence of the system by functioning as the shelf controllers for DWDM or OTN applications and by providing route processing and chassis management. The RP cards also monitor system alarms and control the system fans. LEDs on the front panel indicate active alarm conditions.

Two RPs per chassis are required for a redundant system. RP cards are inserted into the two dedicated slots in the chassis, located on the top and bottom right in the card cage.

See the Verifying and Troubleshooting the Installation of an RP Card, on page 61 for details about LEDs, troubleshooting, and the front panel of the RP card.

Physical Characteristics

- Height—11.05 in. (280.6 mm)
- Width—1.55 in. (39.4 mm)
- Depth—14.25 in. (362 mm)
- Weight—7.32 lb (3.32 kg)

Installing an RP Card



Warning **Class 1 Laser Product.** Statement 113



Warning **Because invisible radiation may be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to radiation and do not stare into open apertures.** Statement 125

Installing an RP Card

Every Cisco NCS 4016 chassis contains two RP cards in dedicated slots on the right side of the chassis. The RP cards are identical. One RP card installs into slot RP0 on the top side of the chassis, and the second RP card installs into slot RP1 on the bottom side of the chassis. The RP cards are hot-swappable.



Note Orientation of the RP card when inserted into the chassis varies, depending upon whether you are inserting the card into the upper or lower card cage. See the steps for details.

Prerequisites

Before performing this task, open the front door, if installed.

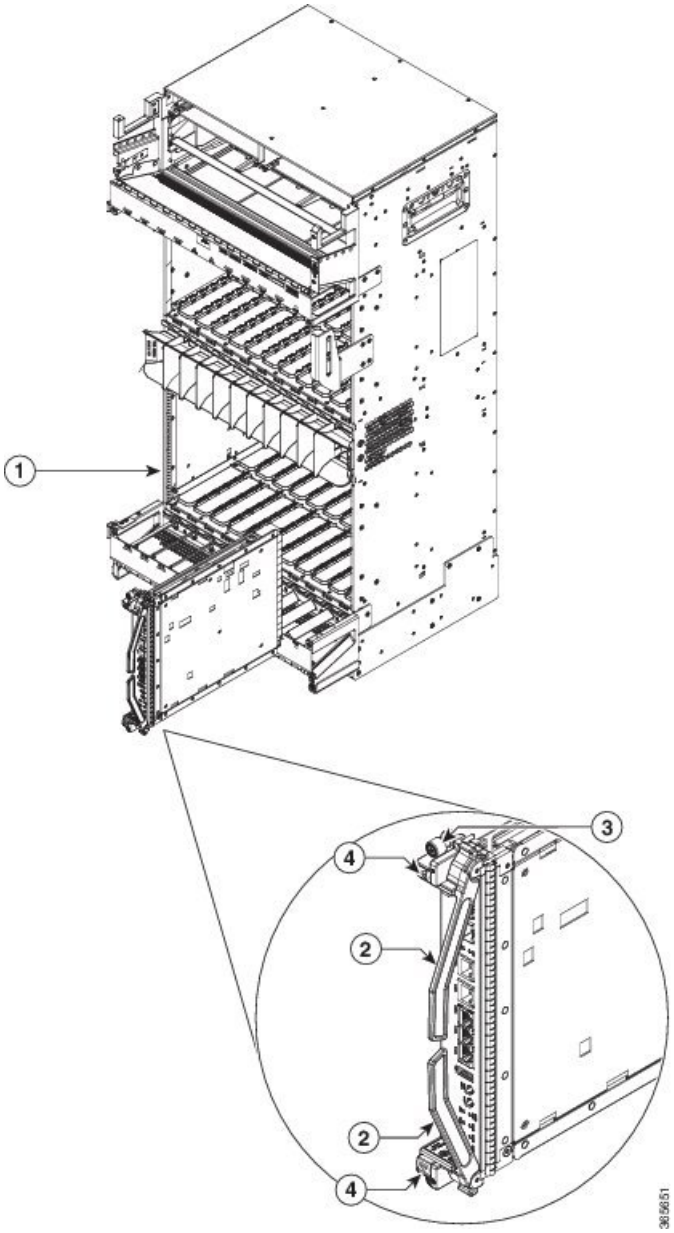
Required Tools and Equipment

- ESD-preventive wrist strap
- Number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver
- RP card (Cisco PID NCS4K-RP)

Steps

The following steps describe how to install an RP card.

Figure 39: Installing an RP Card



1	Direction of insertion	3	Captive screws
2	Ejector levers	4	OIR buttons

Procedure

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the two ESD jacks located on the front or rear side of the chassis. You can also connect the ESD-preventive wrist strap leash to any bare metal surface on the chassis.

Step 2 Remove the card from its antistatic packaging.

Step 3 Place one hand under the card to support and guide it into the correct slot. Slide the card halfway into the slot. Avoid touching the card circuitry or any connectors.

Note
Alignment grooves exist on each slot in the card cage. When you install a card in the card cage, make sure that you align both edges of the card carrier in the slot grooves.

Step 4 Orient the RP:

- If you are inserting the RP into the upper card cage, the arrows on the OIR buttons should be facing up.
- If you are inserting the RP into the lower card cage, the arrows on the OIR buttons should be facing down.

See Figure 40: RP Card Front Panel , on page 61 for an example of the arrows on the OIR buttons. If the card does not slide easily into the slot, the orientation may be wrong or the slot is not for an RP. Reorient the RP, if necessary.

Step 5 Carefully slide the RP into the slot until the ejector levers meet the edges of the card cage, and then *stop* when the ejector lever hooks catch the card cage. If they do not catch, try reinserting the RP until the ejector lever hooks are fully latched.

Step 6 Press the OIR buttons to release the ejectors.

Step 7 Pivot both card ejector levers so that the openings on the card ejector cams at the top and bottom of the card pass over the tabs on each side of the card cage slot.

Caution
Verify that the openings on the card ejector cams pass over the tabs; otherwise, one or both ejector levers might bind when you attempt to close the ejector levers, thereby damaging or breaking one or both ejector levers.

Step 8 Continue sliding the card into the card cage slot until the openings on the card ejector cams engage the tabs on each side of the card cage slot.

Note
RP cards have guide pins that make initial contact with the backplane connector as you slide the card into its slot. After the guide pins make contact, continue pushing on the card carrier until the card ejector levers begin pivoting forward toward the handle in the card carrier.

Step 9 To seat the card in the backplane connector, grasp both card ejector levers and pivot them inward toward the handle in the card carrier until they are flush against the front edge of the card carrier.

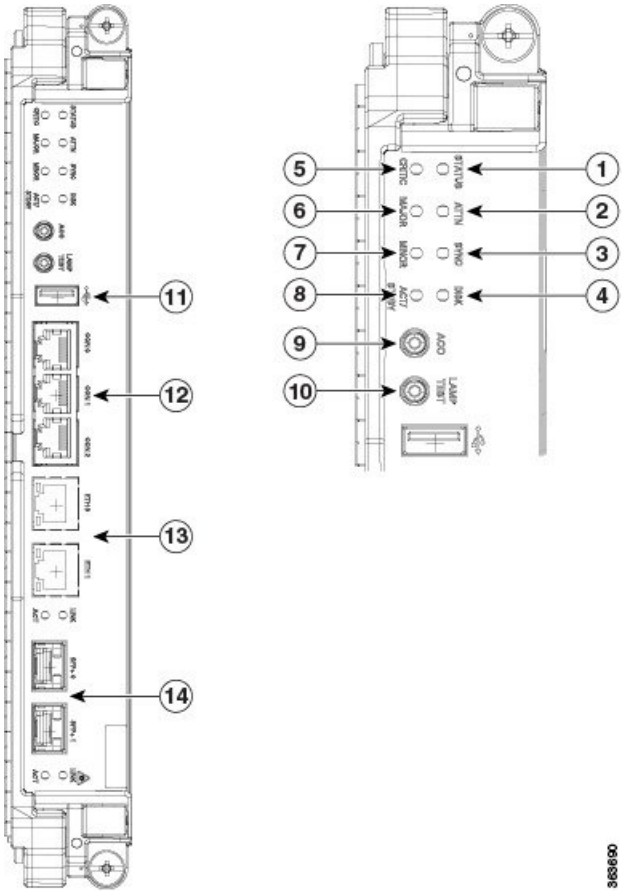
Step 10 Using the number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver, turn the two captive screws on the front panel of the card clockwise to seat the card firmly in the slot. Tighten the captive screws using 10.60 pound/force (lbf) inch (1.20 Nm torque).

Verifying and Troubleshooting the Installation of an RP Card

This section describes how to verify that the RP card has been properly installed and how to troubleshoot the installation in the Cisco NCS 4016 chassis.

This figure shows the front panel of the RP card.

Figure 40: RP Card Front Panel



1	Status LED (card status indicator)	8	Active/ standby LED
2	Attention LED	9	Acknowledge button
3	Sync LED	10	Lamp test button
4	Disc LED	11	External USB port
5	Critical LED	12	Console ports
6	Major LED	13	RJ-45 10/100/1000 copper full-duplex ports (with status LEDs)
7	Minor LED	14	SFP+ 10GE ports (with status LEDs)

Note Only the active RP console port sends and receives messages.

Troubleshooting the RP Card

Use the Status LED, located on the faceplate of the RP card, to verify the correct installation of the card:

- When the card is properly installed and no faults are detected, the card status LED turns green.
- When the card status LED is solid yellow, either software initialization is in progress during bootup or a fault exists on the board.
- When the card status LED is blinking yellow, the card is not fully seated.
- When the card status LED is off, verify that the card is installed correctly. There could be no power applied to the card, a power fault, or a hardware fault.
- Verify that there is power to the card by looking at the indicators on the power tray.

Note To confirm the location of the card that needs attention, the Attention LED can be lit by using the hw-module attention-led location CLI command.

If the installed or replaced card fails to operate or to power on after installation:

- Ensure that the card is seated firmly in the Cisco NCS 4016 chassis slot. One easy way to verify physical installation is to see whether the front faceplate of the card is even with the fronts of the other cards installed in the card cage.
- Ensure that the ejector levers are latched and that the captive screws are fastened properly. If you are uncertain, unlatch the levers, loosen the screws, and attempt to reseat the card.
- Examine the power system to see whether the chassis is receiving power.

In addition to the Status and Attention LEDs, the following table describes the other LEDs on the RP card.

Table 6: Additional LEDs

LED Name	Description	LED Colors
Sync	Indicates that the RP card is receiving external sync.	Green = in sync Yellow = out of sync
Disc	Indicates that the Solid State Disk (SSD) on the RP card is accessed.	Green = access occurring
Critical	Indicates a critical system alarm.	Yellow = an active critical system alarm
Major	Indicates a major system alarm.	Yellow = an active major system alarm
Minor	Indicates a minor system alarm.	Yellow = an active minor system alarm

LED Name	Description	LED Colors
Active/Standby	Indicates that the RP card is in active or standby mode.	Green = active Yellow = standby
RJ45	Indicates the status of the RJ-45 Ethernet link.	Green = on Yellow = active
SFP+	Indicates the status of the SFP+ 10GE ports.	Green = active

About Fabric Cards

The Cisco NCS 4016 chassis supports 4 fabric cards (FCs), which are agnostic cross-connects based on a flexible cell switching architecture used in a Clos configuration. FCs are called agnostic because they will switch a cell with no knowledge of whether they belong to OTN switching or Ethernet switching. Each fabric card hosts three fabric devices, which are equally distributed across the 16 line cards.

FCs provide the switch fabric for the routing system and perform the cross-connect function of the routing system, connecting every LC to each other. The switch fabric receives ingress user data from one LC slot and performs the switching necessary to route the data to the appropriate egress LC slot.

The Cisco NCS 4016 chassis supports, the 200G and 400G fabric cards. The 400G fabric card enables 400G traffic using the 400G line card. The datapath link speed of 400G FC-LC is twice that of the 200G FC-LC.

FC Name	Compatible with 200G LC	Compatible with 400G LC
NCS4016-FC-M (200G)	Yes	No
NCS4016-FC2-M (400G)	Yes	Yes

Twelve pluggable front panel connections allow a single-chassis system to migrate to a back-to-back or multi-chassis configuration.

See the Verifying the Installation of a Fabric Card, on page 69 for details about LEDs, troubleshooting, and to see the front panel of the FC card.

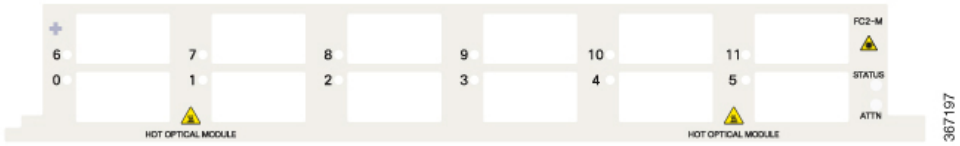
Physical Characteristics

- Height—11.05 in. (280.6 mm)
- Width—1.55 in. (39.4 mm)
- Depth—14.25 in. (362 mm)
- Weight— of the 200G FC is 7.54 lb (3.42 kg); of the 400G FC is 8.92 lb (4.05 kg)

Pluggable CXP2 (ONS-CXP2-SR25) form-factor optics on the NCS4016-FC2-M card, are used to connect a Line Card Chassis (LCC) to another LCC or a LCC to a FCC in a multi chassis operation.

The metal surfaces of the CXP2 optical module when used in the NCS4016-FC2-M card, may reach a high temperature. The *Hot Optical Module* label has been indicated on the NCS4016FC2-M fabric card as shown here.

Figure 41: The NCS4016FC2-M FC with the label

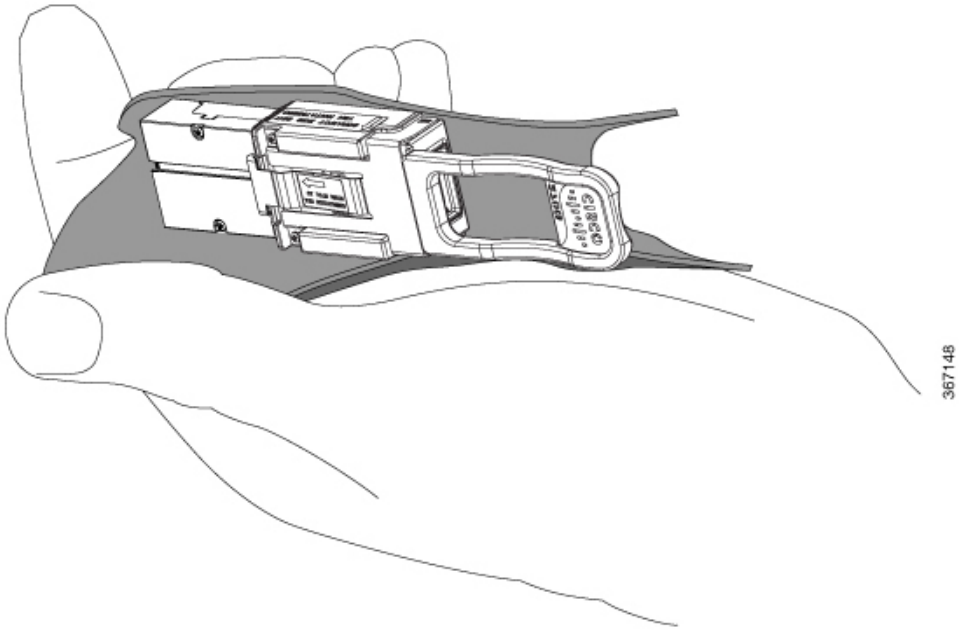


Caution The optical transceiver module (CXP2) may be hot, avoid direct contact with the metal surface.

Follow the procedure to remove the optical module(s) from the system:

- Remove the fiber optical cable from the optical module.
- Remove the optical module from the FC with the help of the pull tab, do not touch the metal surface.
- Hold the optical module only with the pull tab. You can place the optical module on a insulation pad, as shown here.

Figure 42: The optical module on an insulation pad



Installing a Fabric Card

This section contains the following procedures:

Installing a Fabric Card

Attention While installing or removing a line card or fabric card on the NCS 4016 chassis, ensure that the pull tabs of the optical transceiver modules on the adjacent cards do not obstruct the insertion or removal of these cards.

Prerequisites

Before performing this task, open the front door, if installed.

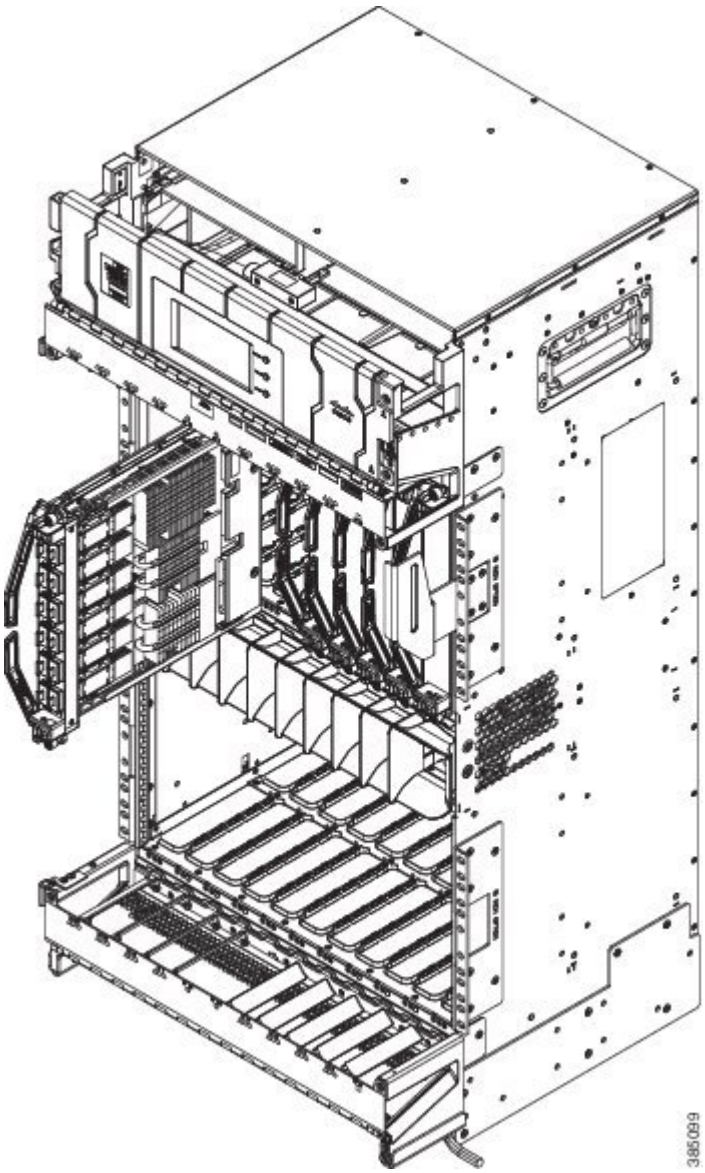
Required Tools and Equipment

- ESD-preventive wrist strap
- Number-2 Phillips screwdriver
- FC (Cisco PID NCS4016-FC-M or Cisco PID NCS4016-FC2-M)

Steps

The following steps describe how to install an FC card.

Figure 43: Installing an FC



Procedure

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the two ESD jacks located on the front or rear side of the chassis. You can also connect the ESD-preventive wrist strap leash to any bare metal surface on the chassis.

Step 2 Remove the FC from its antistatic packaging.

Step 3 Place one hand under the card to support and position the card for insertion into the card cage slot. Avoid touching the card circuitry or any connectors.

Note

Alignment grooves exist on each slot in the card cage. When you install a card in the card cage, make sure that you align both edges of the card carrier in the slot grooves.

Step 4 Orient the FC according to the up arrow on the faceplate. If the card does not slide easily into the slot, the orientation may be wrong or the slot is not for an FC. Reorient the FC, if necessary.

Step 5 Carefully slide the FC into the slot until the ejector levers meet the edges of the card cage, and then *stop* when the ejector lever hooks catch the card cage. If they do not catch, try reinserting the FC until the ejector lever hooks are fully latched.

Step 6 Press the OIR buttons to release the ejectors.

Step 7 Pivot both card ejector levers so that the openings on the card ejector cams at the top and bottom of the card pass over the tabs on each side of the card cage slot.

Caution
Verify that the openings on the card ejector cams pass over the tabs; otherwise, one or both ejector levers might bind when you attempt to close the levers, thereby damaging or breaking one or both of them.

Step 8 Continue sliding the card into the card cage slot until the openings on the card ejector cams engage the tabs on each side of the card cage slot.

Note
FCs have guide pins that make initial contact with the backplane connector as you slide a card into its slot. After the guide pins make contact, continue pushing the card carrier until the card ejector levers begin pivoting forward, toward the handle in the card carrier.

Step 9 To seat the card in the backplane connector, grasp both card ejector levers and pivot them inward toward the handle in the card carrier until they are flush against the front edge of the card carrier.

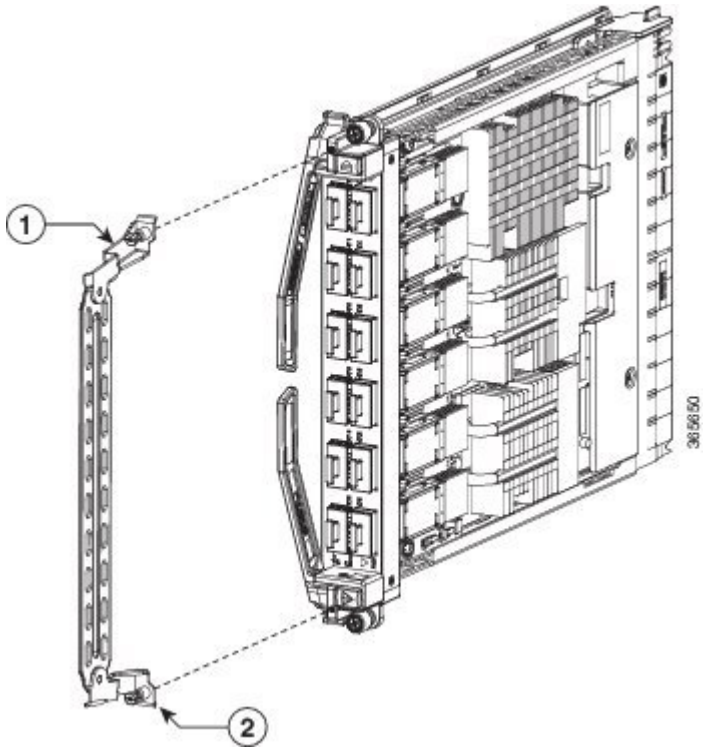
Tip
For easier installation, install all FCs before securing any fasteners.

Step 10 Use the number-2 Phillips screwdriver to turn the two captive screws on the front panel of the card clockwise to seat the card firmly in the slot. Tighten the captive screws using 10.60 pound/force (lbf) inch (1.20 Nm torque).

Step 11 Before attaching the vertical cable management bracket, ensure that the FC has been installed properly. See the Verifying the Installation of a Fabric Card, on page 69.

Step 12 Attach the vertical cable management bracket to the faceplate of the FC using the two screws that came with it. Tighten the screws using 5 to 6.8 pound/force (lbf) inch (0.65 Nm torque). The dark gray arm should be facing up and the light gray arm should be facing down in the lower card cage of the NCS 4016. The dark gray arm should be facing down and the light gray arm should be facing up in the upper card cage of NCS 4016 See the following figure.

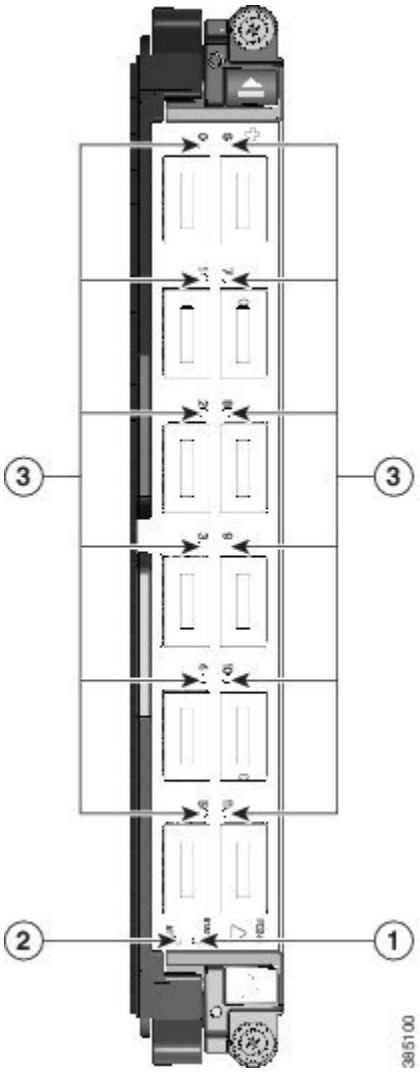
Figure 44: Attaching the Vertical Cable Management Bracket



1	Light gray arm	2	Dark gray arm

Verifying the Installation of a Fabric Card

Figure 45: FC Front Panel



1	Status LED	3	Port LEDs (one per port)
2	Attention LED		

Use the Status LED, located on the faceplate of the FC, to verify the correct installation of the card:

- When the card is properly installed and no faults are detected, the card status LED turns green.
- When the card status LED is solid yellow, either software initialization is in progress during bootup or a fault exists on the board.
- When the card status LED is blinking yellow, the card is not fully seated.
- When the card status LED is off, verify that the card is installed correctly. There could be no power applied to the card, a power fault, or a hardware fault.

- Verify that there is power to the card by looking at the indicators on the power tray.

Note To verify which card needs attention, the Attention LED can be lit using the hw-module attention-led location CLI command.

If the installed or replaced FC fails to operate or power on after installation:

- Ensure that the card is seated firmly in the Cisco NCS 4016 chassis slot. One easy way to verify physical installation is to see whether the front faceplate of the FC is even with the fronts of the other cards installed in the card cage.
- Ensure that the ejector levers are latched and that the captive screws are fastened properly. If you are uncertain, unlatch the levers, loosen the screws, and attempt to reseat the FC.
- Examine the power system to see whether the chassis is receiving power.

About Line Cards

The Cisco NCS 4016 chassis supports Optical Transport Network (OTN) line cards (LCs), packet LCs, and Dense Wavelength-Division Multiplexing (DWDM) line cards. You can have a mix of OTN, packet, and DWDM line cards in the same chassis.

This section describes the following line cards:

For a list of the pluggable optics that are supported, see the Pluggable Optics Support, on page 90.

NCS4K-4H-OPW-QC2 Line Card

The NCS4K-4H-OPW-QC2 line card supports OTN, packet and WDM switching for 400G traffic and contains:

Table 7: Feature History

Feature Name	Release Information	Feature Description
Pluggable Support	Cisco IOS XR Release 6.5.35	The NCS4K-4H-OPW-QC2 line card is compatible with the QSFP-100G-ZR4-S pluggable for ports 0,1,5, and 6, supporting a data rate of 100 Gbps. The QSFP-100G-ZR4-S pluggable supports configurations for Ethernet or Ethernet over OTN controllers only.

- Two CFP2 ports. Each port can support 100 Gbps (DWDM QPSK) or 200Gbps (DWDM 16 QAM) WDM signals
- Four QSFP28/QSFP+ ports

Note The QSFP28 ports also support QSFP+ optics and can be used as 1x40G ports or 4x10G ports.

- Six QSFP+ ports

Note The QSFP+ ports can be split and used as 1x40G ports or 4x10G ports.

The NCS4K-4H-OPW-QC2 line card supports the following port configurations:

- 2-ports of 200 Gbps with CFP2 optics
- 4-ports of 100 Gbps with QSFP28 optics, 10-ports of 40 Gbps with QSFP+ optics, or 10Gbps x 40 ports (4x10G breakout) with QSFP+ optics
- 0,1,5, and 6-ports of 100 Gbps with QSFP-100G-ZR4-S optics

The card needs NCS4016-FC2-M fabric card to function in the NCS 4016 chassis.

The card supports OTN and packet aggregation where both TDM switching and packet forwarding capabilities are combined in a single card. Hence, it can terminate both OTN control plane traffic as well as packet control plane traffic.

The card supports the following data rates:

Protocol	Data Rate	Optic Type
100GE	103.125Gbps	QSFP28
OTU4	112 Gbps	QSFP28
40GE	41.25Gbps	QSFP+
OTU3	43Gbps	QSFP+
OTU3-e1	44.57Gbps	QSFP+
OTU-3e2	44.58Gbps	QSFP+
10GE	10.3125Gbps	QSFP+ BreakOut
OC192	9.953Gbps	QSFP+ BreakOut
OTU2	10.7Gbps	QSFP+ BreakOut
OTU2e	11.09Gbps	QSFP+ BreakOut
OTU2f	11.32Gbps	QSFP+ BreakOut
2x100G QPSK DWDM	200Gbps	CFP2 ACO
2x200G 16QAM DWDM	400Gbps	CFP2 ACO

Protocol	Data Rate	Optic Type
ODU2e	10.3995253164557	QSFP+ BreakOut
ODU2	10.0372739240506	QSFP+ BreakOut
ODU3	40.3192189830509	QSFP+
ODU3e1	41.774364407	QSFP+
ODU3e2	41.7859685595012	QSFP+
ODU4	104.794445814978	QSFP28

Channelization Support

The NCS4K-4H-OPW-QC2 line card supports up to two levels of channelization. The following tables display the channelization modes supported.

Table 8: Single Channelization Support

Parent Payload	Child Payload 1	Child Payload 2
ODU4	ODU3	-
	ODU3e1	-
	ODU3e2	-
	ODU2	-
	ODU2e	-
	ODU1	-
	ODU1e	-
	ODU0	-
	ODUflex	-
100GE	GMP	-
	GFP-F	-
OTU3	ODU3	-
	ODU2	-
	ODU2e	-
	ODU1	-
	ODU0	-

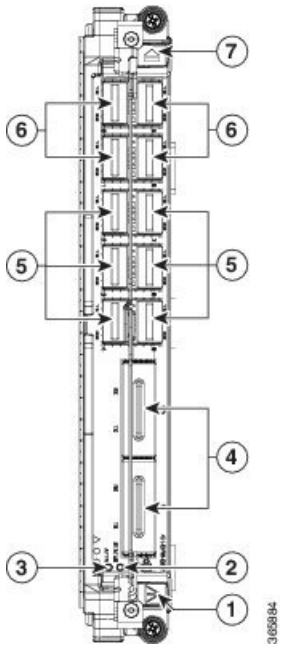
Parent Payload	Child Payload 1	Child Payload 2
40 GE	GFP-F	-
	GMP	-
	ODUflex	-
OTU3e1	ODU2e	-
OTU3e2	ODU2e	-
	ODU1	-
	ODU0	-
	ODUflex	-
OTU2	ODU1	-
	ODU0	-
	ODUflex	-
10GE	GFP-F	-
	GFP-F-EXT	-
OC192	AMP	-
	BMP	-

Table 9: Dual Channelization Support

Parent Payload	Child Payload 1	Child Payload 2
ODU4	ODU3	ODUflex
		ODU0
		ODU1
		ODU1e
		ODU2
		ODU2e
	ODU3e1	ODU2e
	ODU3e2	ODUflex
		ODU0
		ODU1
		ODU2e
	ODU2	ODUflex
		ODU0
		ODU1
	ODU1	ODU0
OTU3	ODU2	ODUflex
		ODU0
		ODU1
	ODU1	ODU0
OTU3e2	ODU1	ODU0
	ODU2e	ODU1
	ODU2e	ODU0
OTU2	ODU1	ODU0

This figure shows the details of the front panel of the NCS4K-4H-OPW-QC2 line card.

Figure 46: Front Panel of the NCS4K-4H-OPW-QC2 Line Card



1	Red ejector	2	Status LED
3	Attention LED	4	CFP2 (DWDM) port
5	QSFP+ port	6	QSFP+ or QSFP 28 port
7	Blue ejector		

Table 10: NCS4K-4H-OPW-QC2 Line Card Descriptions

LED	State	Description
Status	Green	The LC is properly seated and operating correctly.
	Yellow	The LC has one or more errors detected.
	Off	No power is applied to the LC.
Attention [2]	Blue	The card needs attention.
	Off	The card does not need attention.
Port	Green	The link is up (including internal loopback).
	Yellow	The link is down or a hardware failure has occurred.
	Off	The slice is unprovisioned by software, the optics module is missing, or the slice has been powered down.

[2] The Attention LED can be lit only by using the hw-module attention-led location CLI command, which is useful for identifying and verifying which card needs attention.

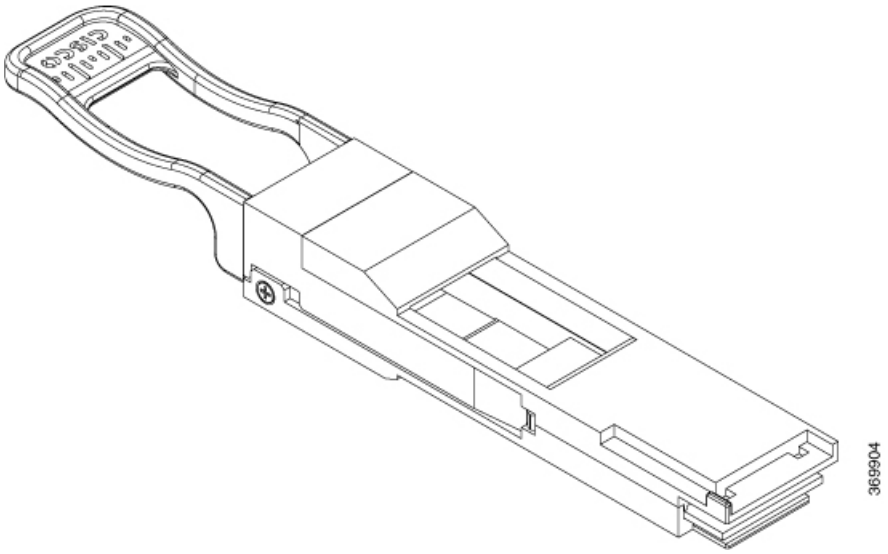
Physical Characteristics

- Height— 11.05 in. (280.6 mm)
- Width— 1.55 in. (39.4 mm)
- Depth— 14.25 in. (362 mm)
- Weight— 8.48 lb (3.85 kg)

QSFP to SFP+ Adapter

QSFP to SFP+ adapter (PID: CVR-QSFP-SFP10G) is a pluggable adapter module that allows a SFP+ optical module to be plugged in to QSFP ports (ports 0 to 9) of the NCS4K-4H-OPW-QC2 line card. The QSFP to SFP+ adapter provides 10G support on the NCS4K-4H-OPW-QC2 line card. The supported SFP+ pluggable is ONS-SC+-10G-ZR.

Figure 47: QSFP to SFP+ Adapter



Insert CVR-QSFP-SFP10G in to the QSFP+ port of the NCS4K-4H-OPW-QC2 line card, followed by the insertion of the SFP+ pluggable.

Table 11: Supported Pluggables and Payloads

Supported Payloads	Pluggable
• OTU2 • OC192 • STM64 • 10Gb • ODUflex	• ONS-SC+-10G-ZR

Use the **show inventory** command to get details of the Cisco devices that are installed in the router. The adapter details are displayed.

NCS4K-4H-QDD-P Line Card

Table 12: Feature History

Feature Name	Release Information	Feature Description
NCS4K-4H-QDD-P Line Card	Cisco IOS XR Release 6.5.35	The NCS4K-4H-QDD-P line card is a new addition to the NCS 4000 platform. It uses the Bright DCO pluggable variant, DP04QSDD-HE0, to scale WDM traffic from 100G to 400G in 100G increments, providing flexibility and high performance across regional, metro, and long-haul routes.This line card has eight port interfaces: • **SFP28 ports**: Four SFP port interfaces. Each supports 25G data. • **QSFP-DD ports**: Four QSFP-DD port interfaces. The interface at port 4 supports up to 400G data, while the remaining three QSFP-DD interfaces support up to 100G data each.

The NCS4K-4H-QDD-P line card supports packet and WDM switching for 400G traffic and contains:

Table 13: NCS4K-4H-QDD-P Port Interfaces

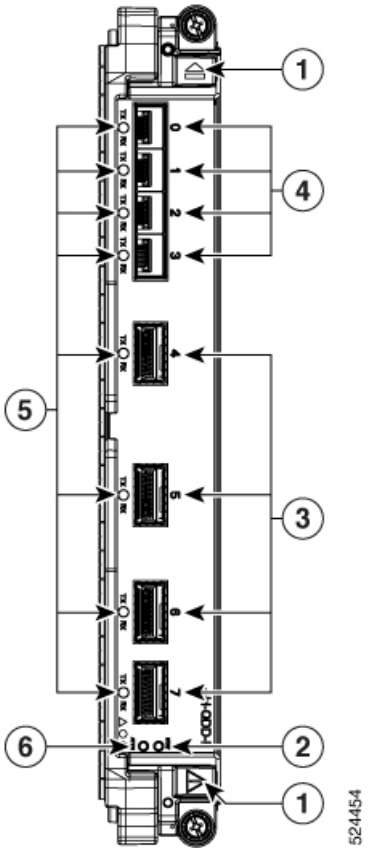
Port Interfaces	Port Numbers	Form Factor	Supported Pluggable Types	Data Rate	Notes
Client	0, 1, 2, 3	SFP28	SFP/SFP+	25GE	In R6.5.35, the NCS4K-4H-QDD-P card supports only SFP pluggables.
	4, 5, 6, 7	QSFP-DD	QSFP-DD QSFP28 SFP+	100GE, 400GE	Only port 4 QSFP-DD interface supports 400GE pluggable. When you use port 4 for 400GE, make sure to keep all other ports idle and covered with dust caps.
Trunk	4, 5, 6, 7	QSFP-DD	QSFP-DCO Bright ZR+	100GE, 400GE	You can configure the QSFP-DD DCO Bright ZR+ pluggable for 100GE at all QSFP-DD ports. When you use the QSFP-DD ports as trunk ports, the SFP ports act as client ports.

The card needs NCS4009-FC2-S fabric card to function in the NCS 4009 chassis.

The card needs NCS4016-FC2-S fabric card to function in the NCS 4016 chassis.

This figure shows the details of the front panel of the NCS4K-4H-QDD-P line card.

Figure 48: Front Panel of the NCS4K-4H-QDD-P Line Card



1	Ejector buttons	2	Status LED
3	QSFP-DD port	4	SFP (DWDM) port
5	Port LEDs	6	Attention LED

NCS4K-4H-QDD-P LED

Table 14: NCS4K-4H-QDD-P Status and Attention LED

LED	State	Description
Status	Green	The LC is properly seated and operating correctly.
	Yellow	The LC has one or more errors detected.
	Off	No power is applied to the LC.
Attention [3]	Blue	The card needs attention.
	Off	The card does not need attention.

LED	State	Description
Port	Green	The link is up (including internal loopback).
	Yellow	The link is down or a hardware failure has occurred.
	Off	The slice is unprovisioned by software, the optics module is missing, or the slice has been powered down.

[3] The Attention LED can be lit only by using the hw-module attention-led location CLI command, which is useful for identifying and verifying which card needs attention.

Client Interface

The NCS4K-4H-QDD-P line card supports the port configurations:

Table 15: NCS4K-4H-QDD-P Client Interface

Port Interface	Slot Port Number	Data Rate for Pluggable Type (Modulation)			
		QSFP-DD (PAM4)		QSFP-28 (NRZ)	SFP28 (NRZ)
SFP	0	-	-	-	25GE
	1	-	-	-	25GE
	2	-	-	-	25GE
	3	-	-	-	25GE
QSFP-DD	4	400GE	4x100GE, 3x100GE, 2x100GE, 1x100GE	100GE	-
	5	-	2x100GE, 1x100GE	100GE	-
	6	-	1x100GE	100GE	-
	7	-	1x100GE	100GE	-

The NCS4K-4H-QDD-P line card supports client data rate in different configurations:

Table 16: NCS4K-4H-QDD-P Client Data Rate Configurations

Data Rate	Pluggable Type	Supported Ports	
		QSFP-DD	SFP
400GE	1x QSFP-DD	4	-
4x100GE	4x QSFP-DD DCO Bright ZR+	4	-

Data Rate	Pluggable Type	Supported Ports	
		QSFP-DD	SFP
3x100GE	4x QSFP-DD DCO Bright ZR+	4	-
2x100GE	4x QSFP-DD DCO Bright ZR+	4, 5	-
1x100GE	4x QSFP-DD DCO Bright ZR+	4, 5, 6, 7	-
2x100GE + 4x25GE	2x QSFP-28 + 4x SFP28	4, 5, 6, 7	0, 1, 2, 3

Trunk Interface

The NCS4K-4H-QDD-P line card uses the DP04QSDD-HE0-19B pluggable for trunk interface. The DP04QSDD-HE0-19B pluggable is a variant of the Bright QSFP-DD DCO pluggable for WDM interface.

The bright DCO pluggable uses Open FEC and Closed FEC to scale trunk data rate from 100G to 400G. This trunk pluggable enables the line card to interoperate with 100G networks. It supports full C-band wavelength tunability and flex grid spacing with 100MHz graularity in tunability.

The trunk interfaces that the line card supports are:

- 1x 400ZR+ 16 QAM
- 2x 200ZR+ QPSK
- 1x 300ZR+ 8QAM + 1x 100ZR+ QPSK
- 1x 200ZR+ QPSK + 2x 100ZR+ QPSK
- 4x 100ZR+ QPSK

Physical Characteristics

- Height— 11.05 in. (280.6 mm)
- Width— 1.55 in. (39.4 mm)
- Depth— 14.25 in. (362 mm)
- Weight— 6.54 lb (2.97 kg)

2-Port 100Gbps and 10-Port 10Gbps OTN and Packet Line Card

The 2-port 100 Gbps and 10-port 10Gbps (NCS4K-2H10T-OP-KS) OTN and packet line card supports the following port configurations:

- 2-ports of 100 Gbps with CPAK optics
- 1-port of 100 Gbps with CPAK optics and 10-ports of 10 Gbps SFP+ optics

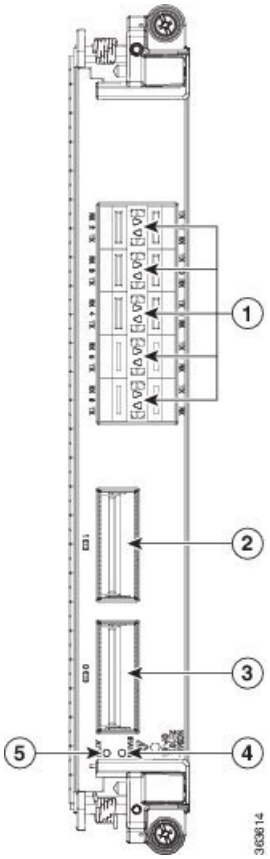
The CPAK 0 port cannot be disabled. The 10SFP+ ports can be used only when and only the CPAK 1 port is disabled.

The card supports OTN and packet aggregation where both TDM switching and packet forwarding capabilities are combined in a single card. Hence, it can terminate both OTN control plane traffic as well as packet control plane traffic.

The card supports up to two-level ODU4, ODU2, ODU2e, ODU1, ODU0, and ODUFlex nested switching functions by interconnecting with the centralized agnostic switch fabric; 100-Gigabit Ethernet signals are mapped using generic mapping procedure (GMP) or Generic Framing Procedure - Framed (GFP-F) over ODU4 according to ITU-T G.709 v3 (Section 17.7.5). The 10 GE signals are mapped using GFP-F mapping over ODU2 and BMP mapping over ODU2e respectively.

This figure shows the details of the front panel of the 2-port 100Gbps and 10-port 10 Gbps OTN and packet line card.

Figure 49: Front Panel of the 2-Port 100 Gbps and 10-Port 10 Gbps OTN and Packet Line Card



1	Port LEDs (one LED on each port) 1	2	CPAK 1 port
3	CPAK 0 port	4	Status LED
5	Attention LED		

1. Port LEDs are triangular in shape and point toward the port that they support.

Table 17: 2-Port 100 Gbps and 10-Port 10 Gbps OTN and Packet Line Card Descriptions

LED	State	Description
Status	Green	The LC is properly seated and operating correctly.
	Yellow	The LC has one or more errors detected.
	Off	No power is applied to the LC.
Attention [4]	Blue	The card needs attention.
	Off	The card does not need attention.
Port	Green	The link is up (including internal loopback).
	Yellow	The link is down or a hardware failure has occurred.
	Off	The slice is unprovisioned by software, the optics module is missing, or the slice has been powered down.

[4] The Attention LED can be lit only by using the hw-module attention-led location CLI command, which is useful for identifying and verifying which card needs attention.

Physical Characteristics

- Height—11.05 in. (280.6 mm)
- Width—1.55 in. (39.4 mm)
- Depth—14.25 in. (362 mm)
- Weight—6.57 lb (2.98 kg)

24-Port Low-Rate OTN Line Card

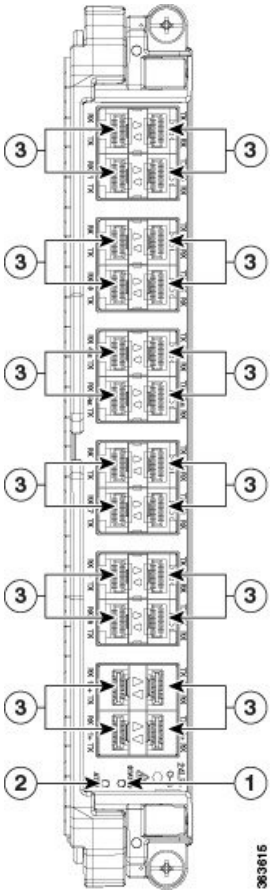
The 24-port low-rate OTN LC (NCS4K-24LR-O-S) supports up to:

- Twenty-four 1GE interfaces through SFP pluggable optics
- Sixteen OC-48/STM-16/OTU1 interfaces through SFP pluggable optics
- Four 10GE/OC-192/OTU2 interfaces through SFP+ pluggable optics

OTU1 and OTU2 ports support generic forward error correction (GFEC). The card supports ODU2, ODU1, ODU0, and ODUFlex switching functions by interconnecting with the centralized agnostic switch fabric.

This figure shows the details of the front panel of the 24-port low-rate OTN LC and LEDs.

Figure 50: 24-Port Low-Rate OTN LC Front Panel and LEDs



1	Status LED	3	Port LEDs (one LED on each port) [5]
2	Attention LED		

[5] Port LEDs are triangular in shape and point toward the port that they support.

Table 18: 24-Port Low-Rate OTN LC Descriptions

LED	State	Description
Status	Green	The LC is properly seated and operating correctly.
	Yellow	The LC has one or more errors detected.
	Off	No power is applied to the LC.
Attention [6]	Blue	The card needs attention.
	Off	The card does not need attention.

LED	State	Description
Port	Green	The link is up (including internal loopback).
	Yellow	The link is down or a hardware failure has occurred.
	Off	The slice is unprovisioned by software, the optics module is missing, or the slice has been powered down.

[6] The Attention LED can be lit only by using the hw-module attention-led location CLI command, which is useful for identifying and verifying which card needs attention.

Physical Characteristics

- Height—11.05 in. (280.6 mm)
- Width—1.55 in. (39.4 mm)
- Depth—14.25 in. (362 mm)
- Weight—5.5 lb (2.5 kg)

20-Port 10GE OTN Line Card

The 20-port 10GE OTN LC (NCS4K-20T-O-S) line card supports any combination of the following interfaces, up to:

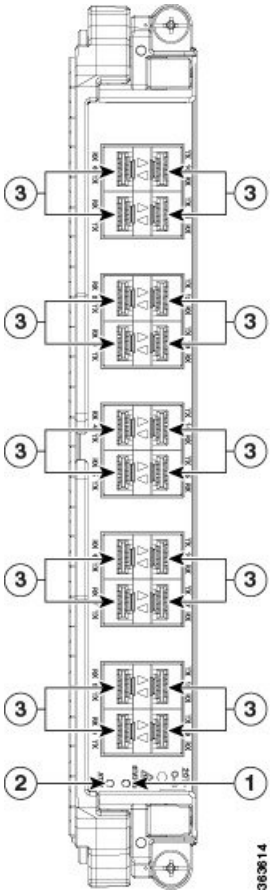
- Twenty 10GE interfaces through SFP+ pluggable optics
- Twenty OC-192/STM-64 interfaces through SFP+ pluggable optics
- Twenty OTU2 interfaces through SFP+ pluggable optics

OTU1 and OTU2 ports support generic forward error correction (GFEC). The card supports up to 2-level ODU4, ODU3, ODU2, ODU1, ODU0, and ODUFlex switching functions by interconnecting with the centralized agnostic switch fabric.

The line card also supports direct interconnection to other slots within the Cisco NCS 4016 chassis to interconnect switched OTN traffic directly to the NCS 4000 2 x 100G CP-DQPSK - Full C band Tunable DWDM line card.

This figure shows the details of the front panel of the 20-port 10GE OTN LC and LEDs.

Figure 51: 20-Port 10GE OTN LC Front Panel and LEDs



1	Status LED	3	Port LEDs (one LED on each port) [7]
2	Attention LED		

[7] Port LEDs are triangular in shape and point toward the port that they support.

Table 19: 20-Port 10GE OTN LC Descriptions

LED	State	Description
Status	Green	The LC is properly seated and operating correctly.
	Yellow	The LC has one or more errors detected.
	Off	No power is applied to the LC.
Attention[8]	Blue	The card needs attention.
	Off	The card does not need attention.

LED	State	Description
Port	Green	The link is up (including internal loopback).
	Yellow	The link is down or a hardware failure has occurred.
	Off	The slice is unprovisioned by software, the optics module is missing, or the slice has been powered down.

[8] The Attention LED can be lit only by using the hw-module attention-led location CLI command, which is useful for identifying and verifying which card needs attention.

Physical Characteristics

- Height—11.05 in. (280.6 mm)
- Width—1.55 in. (39.4 mm)
- Depth—14.25 in. (362 mm)
- Weight—5.5 lb (2.5 kg)

2-Port 100GE OTN Line Card

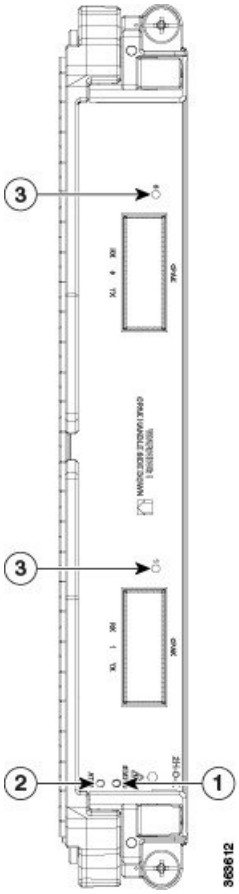
The 2-port 100GE OTN LC (NCS4K-2H-O-K) supports any combination of 100GE and OTU4 interfaces using Cisco CPAK pluggable optics. Two CPAK receptacles are hosted on the faceplate.

Note Insert CPAK modules in the 2-port 100GE OTN LC handle side down.

The card supports up to two-level ODU4, ODU3, ODU2, ODU1, ODU0, and ODUFlex nested switching functions by interconnecting with the centralized agnostic switch fabric; 100-Gigabit Ethernet signals are mapped using generic mapping procedure (GMP) over ODU4 according to ITU-T G.709 v3 (Section 17.7.5).

This figure shows the details of the front panel of the 2-port 100GE OTN LC and LEDs.

Figure 52: 2-Port 100GE OTN LC Front Panel and LEDs



1	Status LED	3	Port LEDs (one LED on each port)
2	Attention LED		

Table 20: 2-Port 100GE OTN LC Descriptions

LED	State	Description
Status	Green	The LC is properly seated and operating correctly.
	Yellow	The LC has one or more errors detected.
	Off	No power is applied to the LC.
Attention [9]	Blue	The card needs attention.
	Off	The card does not need attention.

LED	State	Description
Port	Green	The link is up (including internal loopback).
	Yellow	The link is down or a hardware failure has occurred.
	Off	The slice is unprovisioned by software, the optics module is missing, or the slice has been powered down.

[9] The Attention LED can be lit only by using the hw-module attention-led location CLI command, which is useful for identifying and verifying which card needs attention.

Physical Characteristics

- Height—11.05 in. (280.6 mm)
- Width—1.55 in. (39.4 mm)
- Depth—14.25 in. (362 mm)
- Weight—5.95 lb (2.7 kg)

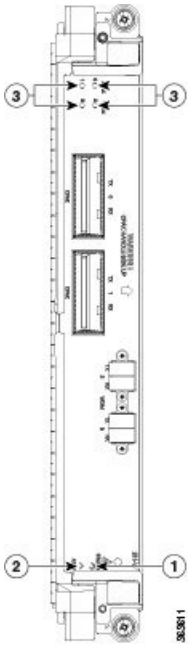
2-Port 100GE DWDM Line Card

The 2-port 100GE DWDM LC (NCS4K-2H-W) can transport two 100GE or OTU4 signals over a 50-GHz spaced, 50-GHz stabilized, ITU-compliant wavelength with more than 4500 km of unregenerated reach. The card also features two CPAK pluggable optics that can map each client signal to a single DWDM line interface.

Note Insert CPAK modules in the 2-port 100GE DWDM LC handle side up.

This figure shows the details of the front panel of the 2-port 100GE DWDM LC and LEDs.

Figure 53: 2-Port 100GE DWDM LC Front Panel and LEDs



1	Status LED	3	Port LEDs, CPAK, and WDM (one LED on each port)
2	Attention LED		

Table 21: 2-Port 100GE DWDM LC Descriptions

LED	State	Description
Status	Green	The LC is properly seated and operating correctly.
	Yellow	The LC has one or more errors detected.
	Off	No power is applied to the LC.
Attention [10]	Blue	The card needs attention.
	Off	The card does not need attention.
Port	Green	The link is up (including internal loopback).
	Yellow	The link is down or a hardware failure has occurred.
	Off	The slice is unprovisioned by software, the optics module is missing, or the slice has been powered down.

[10] The Attention LED can be lit only by using the hw-module attention-led location CLI command, which is useful for identifying and verifying which card needs attention.

Physical Characteristics

- Height—11.05 in. (280.6 mm)
- Width—1.55 in. (39.4 mm)
- Depth—14.25 in. (362 mm)
- Weight—7.8 lb (3.53 kg)

Pluggable Optics Support

Table 22: Feature History

Feature Name	Release Information	Feature Description
QSFP support	Cisco IOS XR Release 6.5.31	The QSFP-100G-FR-S pluggable is supported on the NCS4K-4H-OPW-QC2 line card.

Table 23: Supported Pluggable Optics

Pluggable	Rate and Reach	Product ID	24-Port Low-Rate OTN LC	20-Port 10GE OTN LC	2-Port 100GE OTN LC	NCS4K-4H-OPW-QC2 LC	NCS4K-4H-ODD-P
SFP	25GE LR	SFP-10/25G-LR-I	-	-	-	-	X
	25G ER	SFP-25G-ER-I	-	-	-	-	X
SFP+	10GE SR/SW	ONS-SC+-10G-SR=	X	X	-	-	-
	10GE LR/LW OC-192 SR STM-64 I-64.1 OTU2 P1I1 2D1	ONS-SC+-10G-LR=	X	X	-	-	-
	10GE ER/EW OC-192 IR-2 STM-64 S-64.2 OTU2 P1S1-2D2	ONS-SC+-10G-ER=	X	X	-	-	-
	10GE ZR OC192 LR-2 STM-64 L-64.2 OTU2 P1L1-2D2	ONS-SC+-10G-ZR=	X	X	-	-	-
	C-band tunable	ONS-SC+-10G-C=	X	X	-	-	-

Pluggable	Rate and Reach	Product ID	24-Port Low-Rate OTN LC	20-Port 10GE OTN LC	2-Port 100GE OTN LC	NCS4K-4H-OPW-QC2 LC	NCS4K-4H-ODD-P
CPAK	100GE SR10	CPAK-100G-SR10	-	-	X	-	-
	100GE LR4 OTU4 4I1-9D1F	CPAK-100G-LR4	-	-	X	-	-
QSFP28	100Gbps Multi-rate QSFP28, LR	ONS-QSFP28-LR4	-	-	-	X	X

Pluggable	Rate and Reach	Product ID	24-Port Low-Rate OTN LC	20-Port 10GE OTN LC	2-Port 100GE OTN LC	NCS4K-4H-OPW-QC2 LC	NCS4K-4H-ODD-P
QSFP	100GBASE FR QSFP Transceiver, LC, 2km over SMF(Single mode fiber); G.652 core size (Microns)	QSFP-100G-FR-S	-	-	-	X	X
	100GBASE ZR4 QSFP Transceiver, LC, 80km over SMF(Single mode fiber); G.652 core size (Microns)	QSFP-100G-ZR4-S	-	-	-	X	X
	100GBASE QSFP Transceiver, LC, 25-40km over SMF(Single mode fiber); G.652 core size (Microns)	QSFP-100G-ER4L-S	-	-	-	X	X
	100GBASE LR-S QSFP Transceiver, LC, 25-40km over SMF(Single mode fiber); G.652 core size (Microns)	QSFP-100G-LR-S	-	-	-	-	X
	100GBASE LR4 QSFP Transceiver, LC, 10km over SMF(Single mode fiber); G.652 core size (Microns)	QSFP-100G-LR4-S [11]	-	-	-	X	X

Pluggable	Rate and Reach	Product ID	24-Port Low-Rate OTN LC	20-Port 10GE OTN LC	2-Port 100GE OTN LC	NCS4K-4H-OPW-QC2 LC	NCS4K-4H-ODD-P
QSFP+	4X10G Multirate LR4 QSFP+	QSFP-4X10-MLR	-	-	-	X	-
	QSFP 40G Ethernet - LR4 Lite, LC, 2KM, Enterprise-Class	QSFP-40G-LR4	-	-	-	X	-
	QSFP 40GBASE-ER4 Transceiver Module, LC, 40KM	QSFP-40G-ER4	-	-	-	X	-
	4x10G break out QSFP module with 25km reach. Supports - OC192, STM64,10GE, OTU1e,OTU2, OTU2e	ONS-QSFP-4x10-MER	-	-	-	X	-
QSFP adapter	QSFP to SFP Adapter to support SFP+ Modules with rates:OC192, STM64,10GE, OTU1e,OTU2, OTU2e	CVR-QSFP-SFP10G	-	-	-	X [12]	-
CFP2	100G QPSK / 200G 16-QAM - WDM CFP2 Pluggable	ONS-CFP2-WDM	-	-	-	X	-
	100G QPSK / 200G 16-QAM - WDM CFP2 Pluggable	ONS-CFP2-WDM-2 [13]	-	-	-	X	-

Pluggable	Rate and Reach	Product ID	24-Port Low-Rate OTN LC	20-Port 10GE OTN LC	2-Port 100GE OTN LC	NCS4K-4H-OPW-QC2 LC	NCS4K-4H-ODD-P
QSFP-DD	400G QSFP-DD Transceiver, 400GBASE-FR4, Duplex LC, 2km Duplex SMF	QDD-400G-FR4-S	-	-	-	-	X
	400G QSFP-DD Transceiver, 400GBASE-ER1	DP04QSDD-ER1	-	-	-	-	X
	400G QSFP-DD Transceiver, 400G-LR4, 10km Duplex SMF, 100% compliant with 400GBASE-LR4[6]	QDD-400G-LR4-S	-	-	-	-	X
	QSFP-DD 400G-ZR+ High TX Power DCO Pluggable - C-Band	DP04QSDD-HE0	-	-	-	-	X

[11] The QSFP-100G-LR4-S pluggable is not HW qualified for OTU4, hence supports 100G Ethernet only; no support for breakout configuration.
[12] SFP+ module supported on the QSFP adapter is, ONS-SC+-10G-ZR=
[13] The ONS-CFP2-WDM2 has a minimum frequency tunability of 6.25Hz.

Installing a Line Card

This section contains the following procedures:

Installing a Line Card

Attention While installing or removing a line card or fabric card on the NCS 4016 chassis, ensure that the pull tabs of the optical transceiver modules on the adjacent cards do not obstruct the insertion or removal of these cards.

Prerequisites

Before performing this task, open the front door, if installed.

Caution Remove or install only one LC at a time. Allow at least 30 seconds for the chassis to complete its tasks before removing or installing another LC. The chassis may indicate a hardware failure if you do not follow proper procedures.

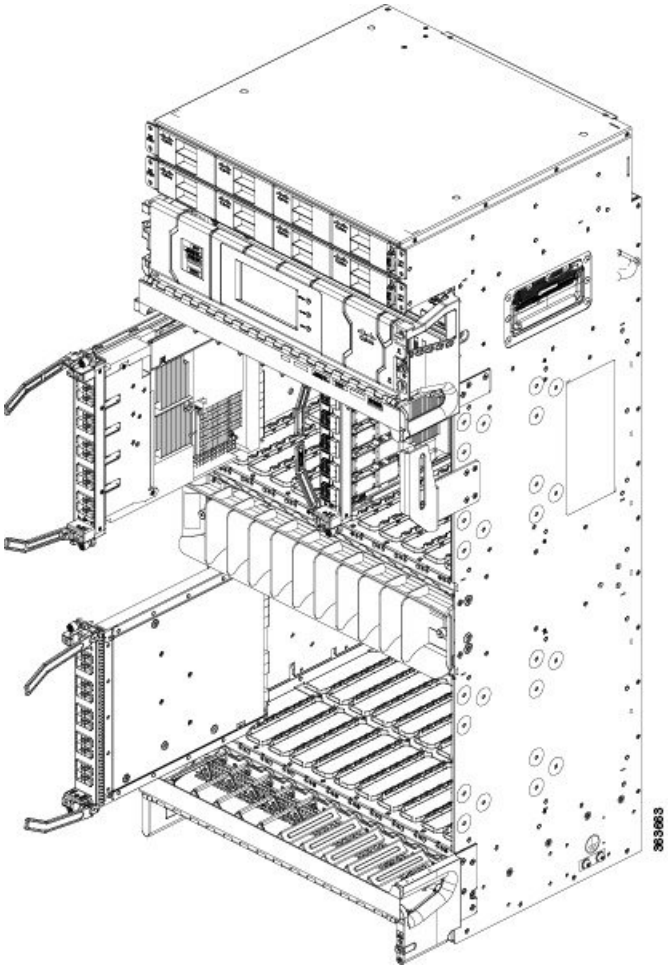
Required Tools and Equipment

- ESD-preventive wrist strap
- Number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver
- LC

Steps

The following steps describe how to install an LC.

Figure 54: Installing an LC



Procedure

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to the ESD jack located on the front or rear of the chassis. You can also connect the ESD-preventive wrist strap leash to any bare metal surface on the chassis.

Step 2 Remove the filler card (see the Removing a Filler Card, on page 57) and set it aside.

Note
Remove only one filler card and install only one LC at a time. Be sure to verify that each LC is fully installed and secured before installing another card.

Step 3 Remove the LC from the antistatic bag.

Caution
To prevent ESD damage, handle an LC by its ejector levers or the LC carrier edges only. Do not touch any of the electrical components, pins, or circuitry.

Step 4 Orient the LC:

- If you are inserting the LC into the upper card cage, the arrows on the OIR buttons should be facing up.
- If you are inserting the LC into the lower card cage, the arrows on the OIR buttons should be facing down.

See Figure 40: RP Card Front Panel , on page 61 for an example of the arrows on the OIR buttons. If the card does not slide easily into the slot, the orientation may be wrong and the rejection flange is stopping the card from going into the slot. Reorient the LC, if necessary.

Step 5 Use both hands while inserting an LC. Use one hand on the faceplate and the other hand along the base of the LC to guide it into a slot.

Step 6 Press the OIR buttons to unlock the ejector levers.

Caution
When adjusting the ejector levers, avoid hitting the top and bottom fiber management features and doors.

Step 7 Make sure that the ejector levers are oriented properly to engage with the pin as the LC slides into the slot. Carefully slide the LC into the slot until the ejector levers engage the catches, and then *stop.*

Step 8 Simultaneously pivot the ejector levers toward the faceplate of the LC. Do not force the LC; the ejector levers properly seat the LC against the backplane.

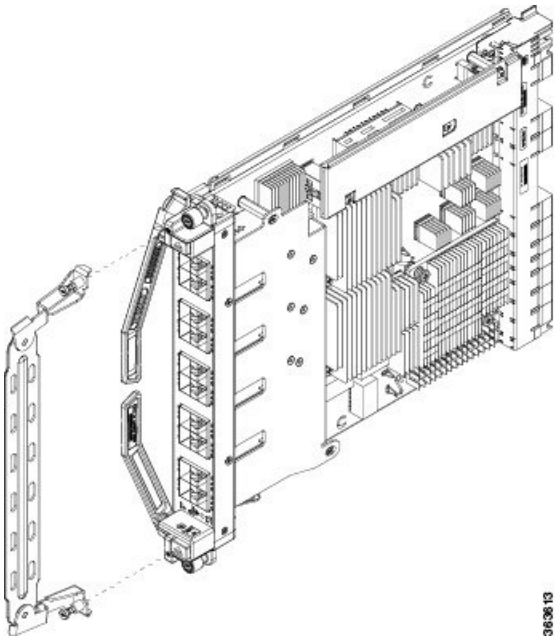
Note
If the captive screws are difficult to tighten, ensure that each ejector lever is properly secured to each catch and that the LC is properly seated in the slot.

Step 9 Use a number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver to tighten the captive screws next to each LC ejector lever to ensure proper EMI shielding and prevent the LC from becoming partially dislodged from the backplane. Tighten the captive screws using 10.60 pound/force (lbf) inch (1.20 Nm torque).

Step 10 Before attaching the vertical cable management bracket, ensure that the LC has been installed properly. See the Verifying the Installation of a Line Card, on page 97.

Step 11 Attach the vertical cable management bracket to the faceplate of the LC using the two screws that came with it. The dark gray arm should be facing up, and the light gray arm should be facing down. See the following figure.

Figure 55: Attaching the Vertical Cable Management Bracket



Verifying the Installation of a Line Card

Use the Status LED, located on the faceplate of the LC, to verify the correct installation of the LC:

- When the card is properly installed and no faults are detected, the status LED turns green.
- When the status LED is solid yellow, either software initialization is in progress during bootup or a fault exists on the card.
- When the status LED is blinking yellow, the card is not fully seated.
- When the status LED is off, verify that the card is installed correctly. There could be no power applied to the card, a power fault, or a hardware fault.
- Verify that there is power to the card by looking at the indicators on the power tray.

If the installed or replaced LC fails to operate or to power on after installation:

- Ensure that the card is seated firmly into the Cisco NCS 4016 chassis slot. One easy way to verify physical installation is to see whether the front faceplate of the card is even with the fronts of the other cards installed in the card cage.
- Ensure that the ejector levers are latched and that the captive screws are fastened properly. If you are uncertain, unlatch the levers, loosen the screws, and attempt to reseat the card.
- Examine the power system to see whether the chassis is receiving power.

Connecting Line Card Network Interface Cables

This section describes how to route the network interface cables through the chassis cable management tray and how to attach the network interface cables to the line card ports.

This procedure uses an 20x10GE OTN line card as an *example* to describe how to attach a network interface cable to a line card port and route the cable through the cable management tray. Depending on which line cards are installed in your system, your cable connection procedure might differ slightly from this example.

Note For cable connection information for your specific line card, refer to the installation and configuration note for that line card. You can access the most current Cisco line card documentation online at: http://www.cisco.com.

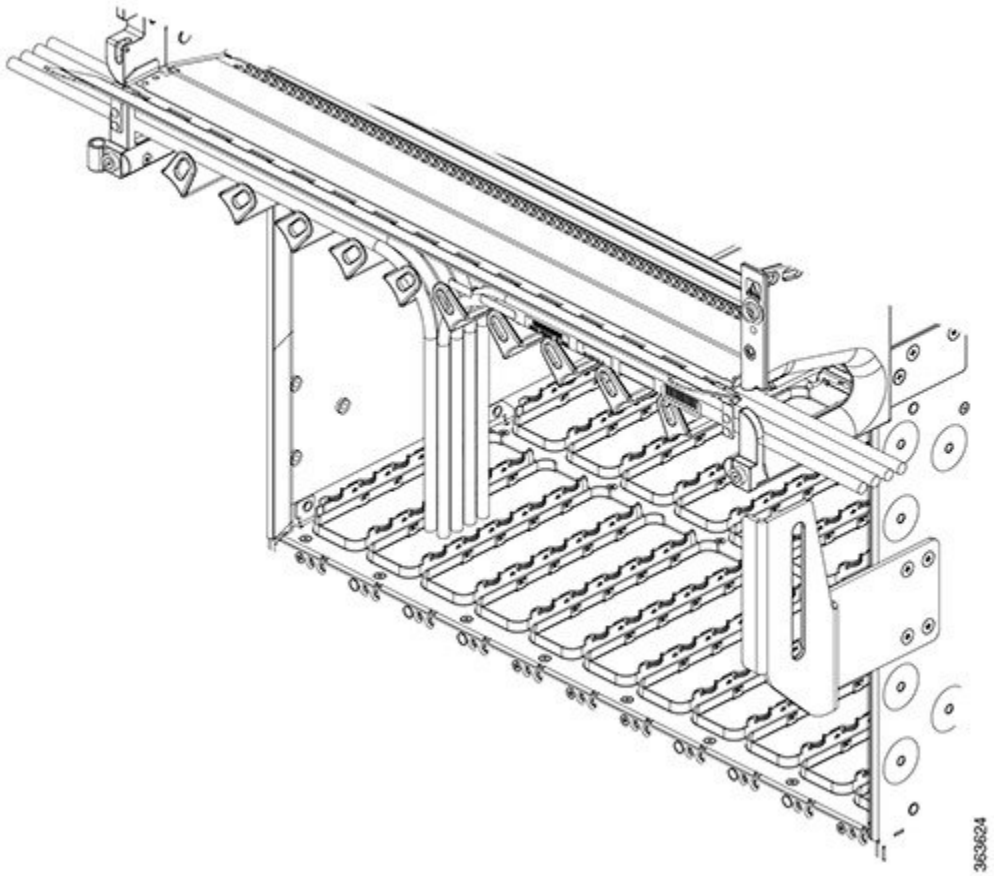
Steps

Follow these steps as an example to route the network interface cables through the cable management tray and connect them to the line card:

Procedure

Step 1 Route an interface cable across the horizontal cable management tray (see the following figure) and down (or up if you are using the lower cable management tray) through the cable tray opening to connect it to the line card.

Figure 56: Routing Interface Cables Through the Upper Cable Management Tray



Step 2 Attach a line card cable management bracket to the line card front panel (see the following figure). This bracket is shipped with the line card.

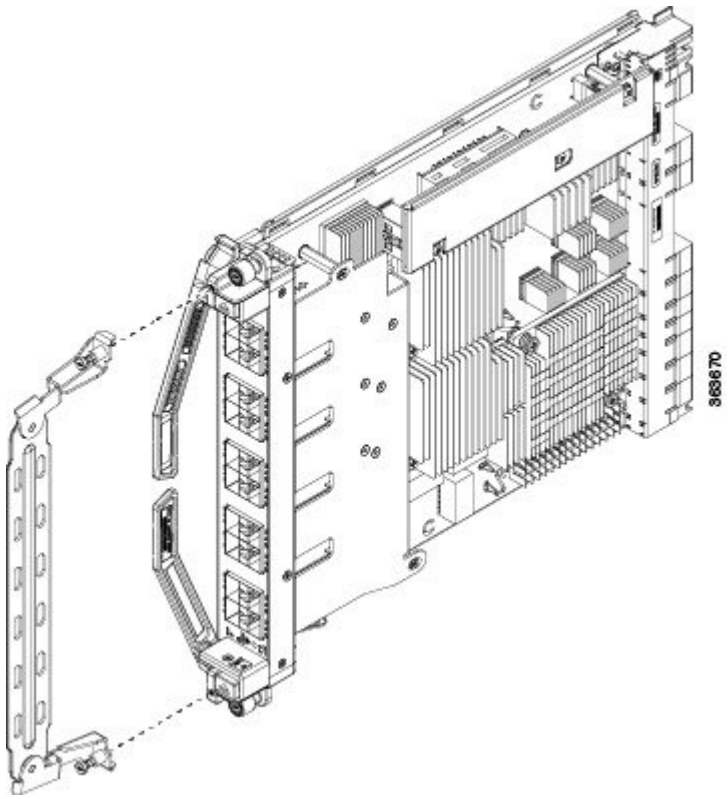
Step 3 Insert the cable connector into its assigned port.

Note
You can use the clamp tool (provided in the chassis installation kit) to help insert (or remove) cable connectors (and pluggables).

Step 4 Install pluggables and fiber connectors.

Step 5 Repeat Step1 through Step 4 for each additional cable connection to that line card.

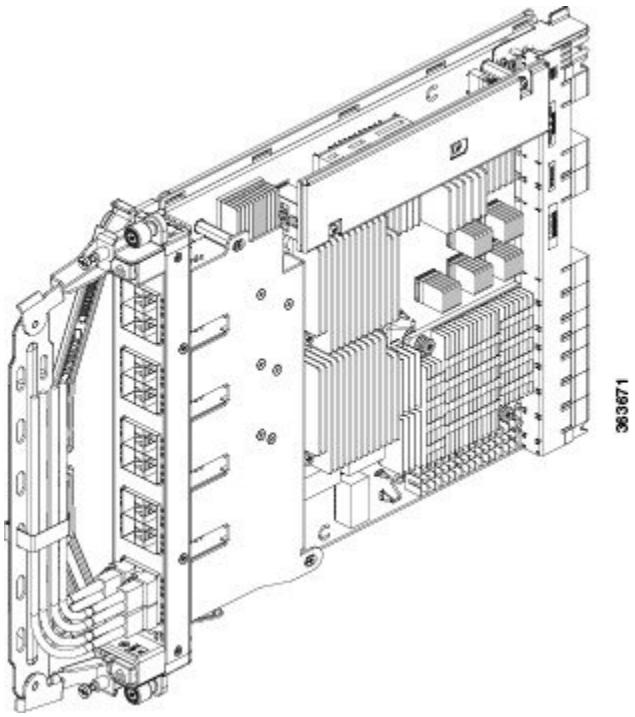
Figure 57: Attaching a Line Card Cable Management Bracket



Step 6 Affix fibers to the vertical brackets. The final connections should appear similar to the following figure.

Caution
Make sure the interface cables do not have any kinks or sharp bends, which can destroy or degrade the ability of the optical fiber to propagate the signal-encoded beam of light accurately from one end of the cable to the other. Always allow adequate strain relief in the interface cable.

Figure 58: Interface Cable Routing Using the Line Card Cable Management Bracket

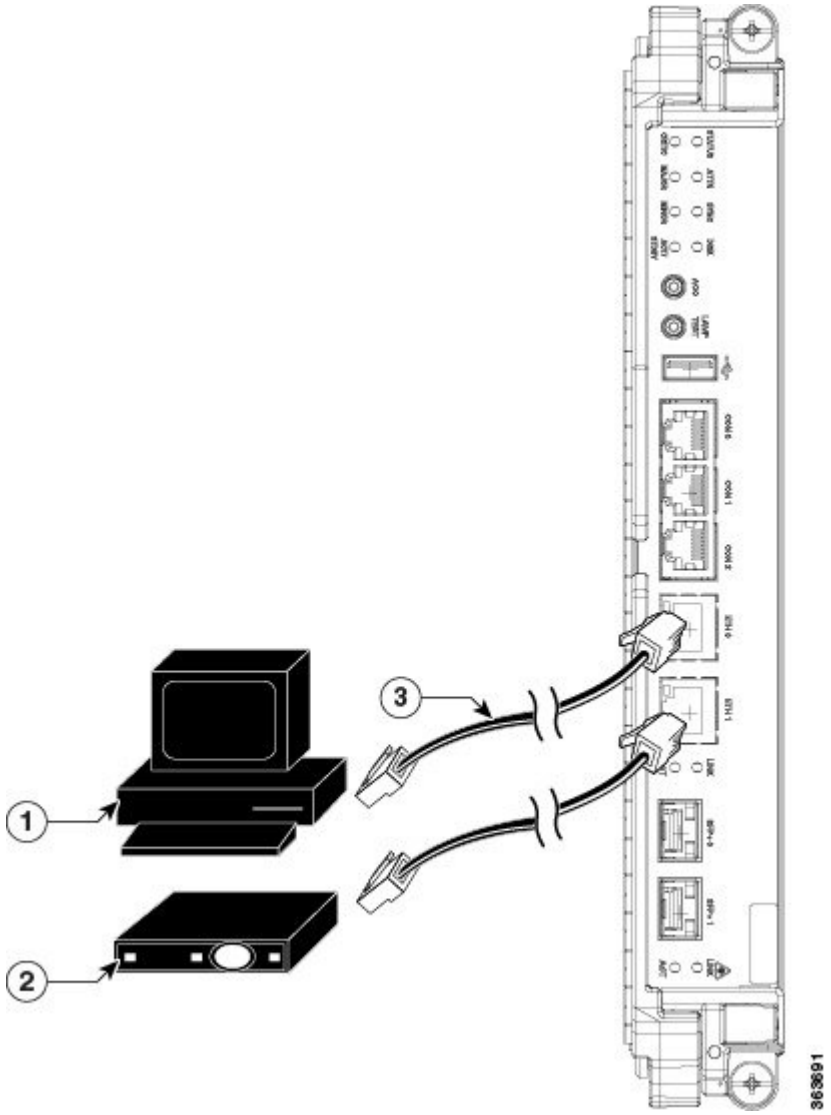


Connecting Cables to the RP

This section describes how to connect cables to the console and Ethernet ports on the RP. The console ports are asynchronous serial ports; any devices connected to these ports must be capable of asynchronous transmission. For example, most modems are asynchronous devices.

This figure shows an example of an RP with data terminal and modem connections called out.

Figure 59: RP Port Connections



1	Console terminal	3	RJ-45 Ethernet cables into RJ-45 ports
2	Modem		

Caution The ports labeled Ethernet and Console are safety extra-low voltage (SELV) circuits. SELV circuits should be connected only to other SELV circuits.

Note RP cables are not available from Cisco, but they are available from any commercial cable vendor.

Note To comply with the intra-building lightning surge requirements of Telecordia GR-1089-CORE, Issue II, Revision 01, February 1999, you must use a shielded cable when connecting to the console and Ethernet ports. A shielded cable is terminated by shielded connectors on both ends, with the cable shield material tied to both connectors.

Connecting to the Console Port

The system console port on the RP is an RJ-45 receptacle for connecting a data terminal to perform the initial configuration of the chassis. The console port requires a straight-through RJ-45 cable.

Follow this procedure to connect a data terminal to the RP console port:

Procedure

Step 1 Set your terminal to these operational values: 115200 bps, 8 data bits, no parity, 1 stop bit (9600 8N1).

Step 2 Power off the data terminal.

Step 3 Attach the terminal end of the cable to the interface port on the data terminal.

Step 4 Attach the other end of the cable to the RP console port.

Step 5 Power on the data terminal.

Connecting to the Ethernet Management Ports

To connect cables to the RP management ports, attach Category 5 UTP cables directly to the MGT LAN 0 and MGT LAN 1 RJ-45 receptacles on the RP.

Note RJ-45 cables are not available from Cisco Systems; they are available from outside commercial cable vendors. Use cables that comply with EIA/TIA-568 standards.

Caution Ethernet management ports are primarily used as Telnet ports into the Cisco NCS 4016 chassis; they are also used for booting or accessing Cisco software images over a network to which an Ethernet port is directly connected. We strongly caution you to consider the security implications of enabling routing functions on these ports.

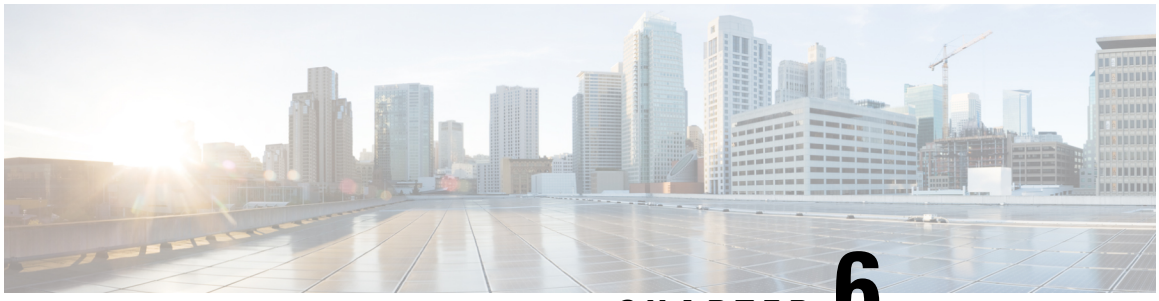
Note The Ethernet interfaces on the RP are end station devices only, not repeaters.

Follow these steps to connect an Ethernet cable to the RP RJ-45 Ethernet receptacle:

Procedure

Step 1 Plug the cable directly into the RJ-45 receptacle.

Step 2 Connect the network end of your RJ-45 cable to a switch, hub, repeater, or other external equipment.



CHAPTER 6

Removing and Replacing Chassis Components

This chapter provides instructions on how to remove and replace components from the Cisco NCS 4016 chassis.

- Removing and Replacing Chassis Components, on page 105

Removing and Replacing Chassis Components

Removing a Line Card

This section describes how to remove a line card from the Cisco NCS 4016 chassis.

Warning **Class 1 Laser Product.** Statement 113

Warning **Because invisible radiation may be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to radiation and do not stare into open apertures.** Statement 125

Warning **For diverging beams, viewing the laser output with certain optical instruments within a distance of 100 mm may pose an eye hazard. For collimated beams, viewing the laser output with certain optical instruments designed for use at a distance may pose an eye hazard.** Statement 282

Prerequisites

Before performing this task, open the front door, if installed.

Caution The system can indicate a hardware failure if you do not follow proper procedures. Remove or install only one LC at a time. Allow at least 30 seconds for the system to complete its tasks before removing or installing another LC.

This procedure is traffic-impacting.

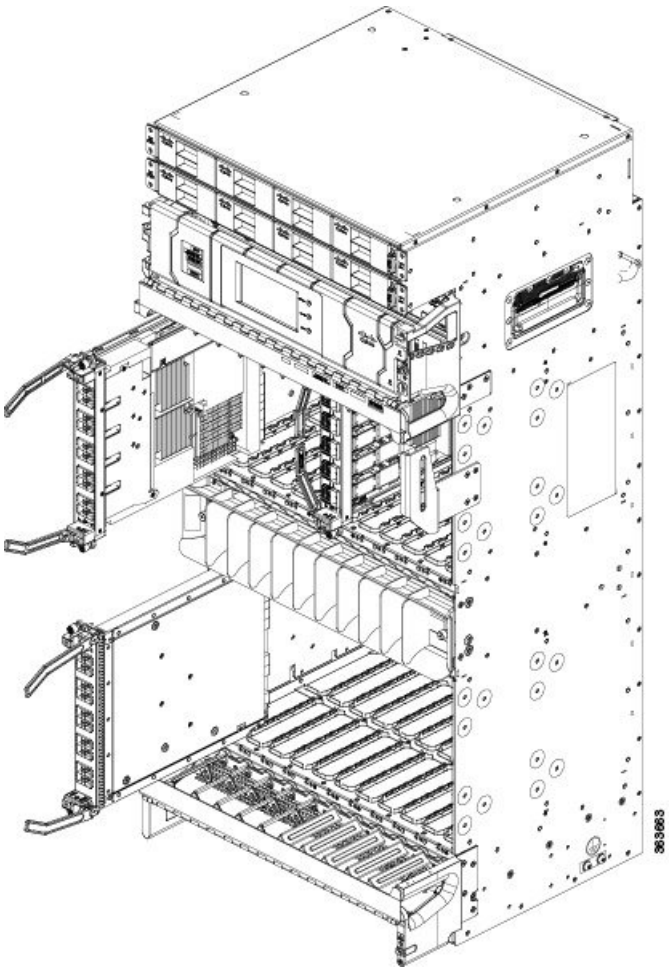
Required Tools and Equipment

- ESD-preventive wrist strap
- Number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver

Steps

The following steps describe how to remove an LC.

Figure 60: Removing an LC



Procedure

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to the ESD jack located on the front or rear side of the chassis. You can also connect the ESD-preventive wrist strap leash to any bare metal surface on the chassis.

Step 2 Identify the card to be removed.

Note
To verify which card needs attention, the Attention LED can be lit using the hw-module attention-led location CLI command.

Step 3 In the **Node View** of CTC, click the **Inventory** tab and set the **Admin State** of the line card to **OOS** (Out Of Service).

This will shut down the Line Card.

Step 4 Press the OIR buttons to unlock the ejector levers, wait for 30 seconds.

Step 5 Use the number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver to loosen the two captive screws holding the card in place.

Caution
When adjusting the ejector levers, avoid hitting the top and bottom fiber management features and doors.

Step 6 Grasp the two card ejector levers and simultaneously pivot both ejector levers 70 degrees away from the front edge of the card carrier to unseat the card from the backplane connector.

Step 7 Touching only the metal card carrier, slide the card from the slot and place it directly into an antistatic sack or other ESD-preventive container.

Warning
Because invisible laser radiation may be emitted from the aperture of the port when no cable is connected, avoid exposure to laser radiation and do not stare into open apertures. Statement 70

Replacing/Reinserting a Line Card

This section describes how to replace/reinsert a line card on the Cisco NCS 4016 chassis.



Warning **Class 1 Laser Product.** Statement 113



Warning **Because invisible radiation may be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to radiation and do not stare into open apertures.** Statement 125

Warning **For diverging beams, viewing the laser output with certain optical instruments within a distance of 100 mm may pose an eye hazard. For collimated beams, viewing the laser output with certain optical instruments designed for use at a distance may pose an eye hazard.** Statement 282

Prerequisites

Before performing this task, open the front door, if installed.

Caution Remove or install only one LC at a time. Allow at least 30 seconds for the chassis to complete its tasks before removing or installing another LC. The chassis may indicate a hardware failure if you do not follow proper procedures.

This procedure is traffic-impacting.

Required Tools and Equipment

- ESD-preventive wrist strap
- Number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver
- LC

Steps

To replace/reinstall the line card:

Procedure

Step 1 Perform the procedure Removing a Line Card, on page 105 to remove the line card that needs to be replaced/reinserted.

Step 2 Perform the procedure Installing a Line Card, on page 94 to install a new card or reinsert the same card that was removed in step1.

Step 3 In the **Node View** of CTC, click the **Inventory** tab.

Step 4 if **Admin State** of the line card is **OOS** (Out of Service) in CTC, then set the **Admin State** of the line card to **IS** (In Service).

Traffic will resume after the card is in service.

Removing an RP Card

This section describes how to remove a route processor card from the Cisco NCS 4016 chassis.

Prerequisites

Before performing this task, open the front door, if installed. The RP cards are hot-swappable.

Perform this task when you are certain that the other RP card in the chassis is operational and, if not already the active RP, is ready to assume control (this happens automatically). Failure to follow these guidelines can result in interruptions in data communications and network connectivity.



Warning **Class 1 Laser Product.** Statement 113



Warning **Because invisible radiation may be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to radiation and do not stare into open apertures.** Statement 125

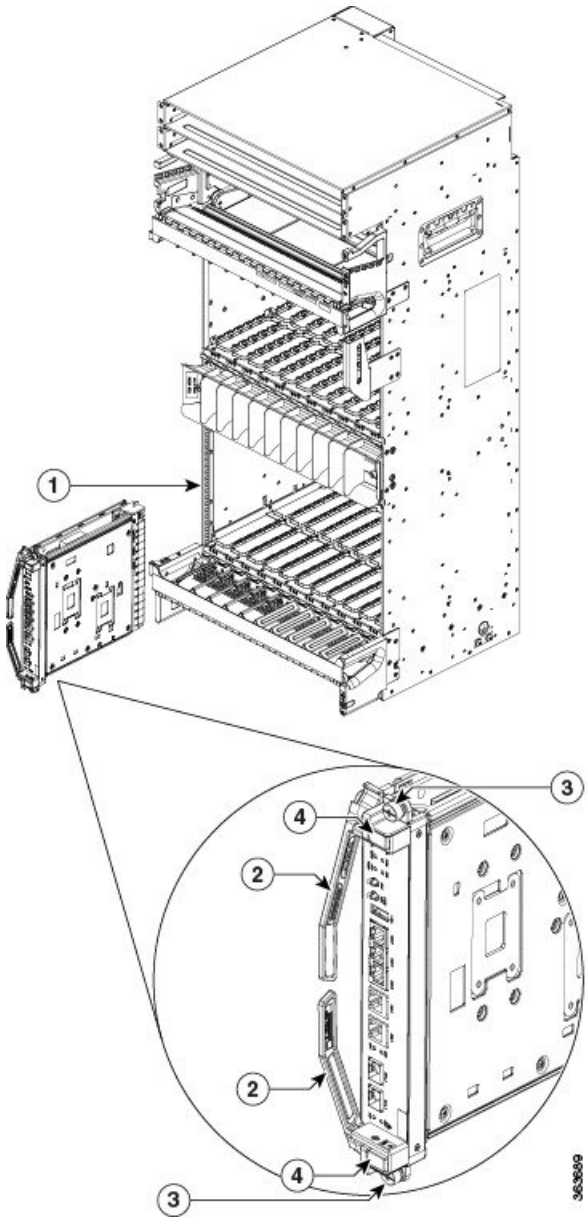
Required Tools and Equipment

- ESD-preventive wrist strap
- Number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver

Steps

The following steps describe how to remove an RP card.

Figure 61: Removing an RP Card



1 - Direction and location of removal	3 - Captive screw (also one on top)
2 - Ejector levers	4 - OIR buttons

Procedure

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the two ESD jacks located on the front or rear side of the chassis. You can also connect the ESD-preventive wrist strap leash to any bare metal surface on the chassis.

Step 2 Identify the card to be removed from the card cage. Reload the RP card to move the active processes to other RPs using the **hw-module location <slot-number> reload** command.

```
sysadmin-vm:0_RP0# hw-module location 0/RP0 reload
```

Note
When the RP is up or booting, you can remove the RP card using the OIR button. Pressing the OIR button to unlock the ejector lever when the RP is Active may impact the traffic.

Step 3 Remove any cables connected to the front panel of the card.

Step 4 Press the OIR buttons to unlock the ejectors. Wait for 30 seconds.

Step 5 Use the number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver to turn the two captive screws on the front panel of the card counterclockwise to loosen the card from the slot.

Caution
To prevent ESD damage, handle an RP card by its ejector levers or the LC carrier edges only. Do not touch any of the electrical components, pins, or circuitry.

Step 6 Simultaneously pivot the ejector levers away from the faceplate to release the RP card from the backplane connectors.

Step 7 Grasp the two card ejector levers and simultaneously pivot both ejector levers 90 degrees away from the front edge of the card carrier to unseat the card from the backplane connector.

Step 8 Grasp the ejector levers with both hands and gently pull the RP card halfway from the slot.

Step 9 Move one hand under the RP card to guide it. Avoid touching the RP card printed circuit board, components, or any connector pins.

Step 10 Touching only the metal card carrier, slide the card from the slot and place it directly into an antistatic sack or other ESD-preventive container. If you plan to return a defective card to the factory, repackage it in the shipping container that you received with the replacement card.

For replacement, wait for 30 seconds after removing the card from the chassis and then, reinsert the new card. For the installation procedure, see Installing an RP Card, on page 58.

Removing a Fabric Card

This section describes how to remove a fabric card from the Cisco NCS 4016 chassis.

Prerequisites

Before performing this task, open the front door, if installed.

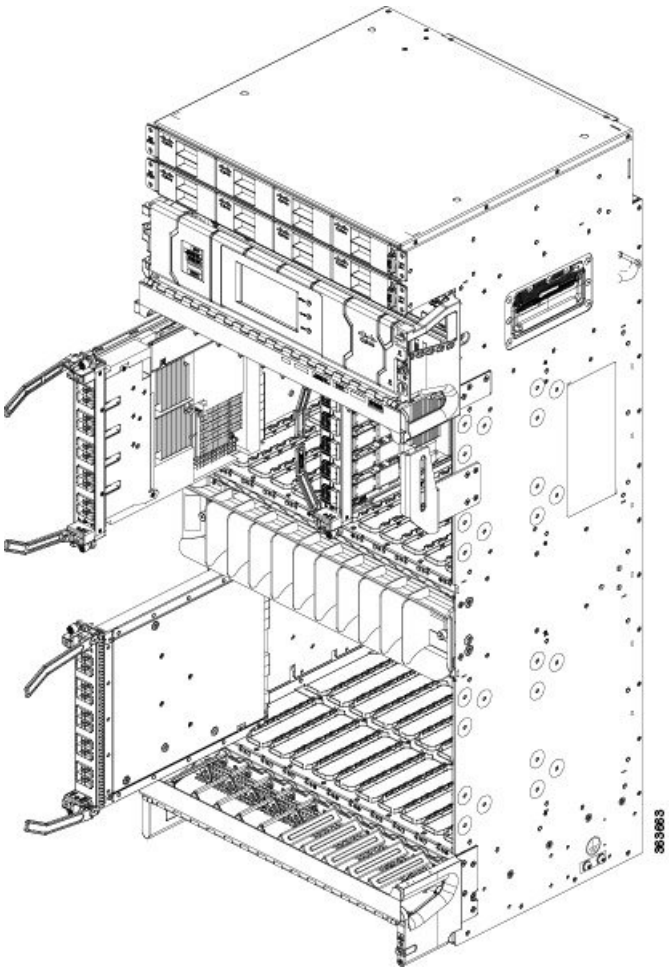
Required Tools and Equipment

- ESD-preventive wrist strap
- Number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver

Steps

The following steps describe how to remove an FC card.

Figure 62: Removing an FC



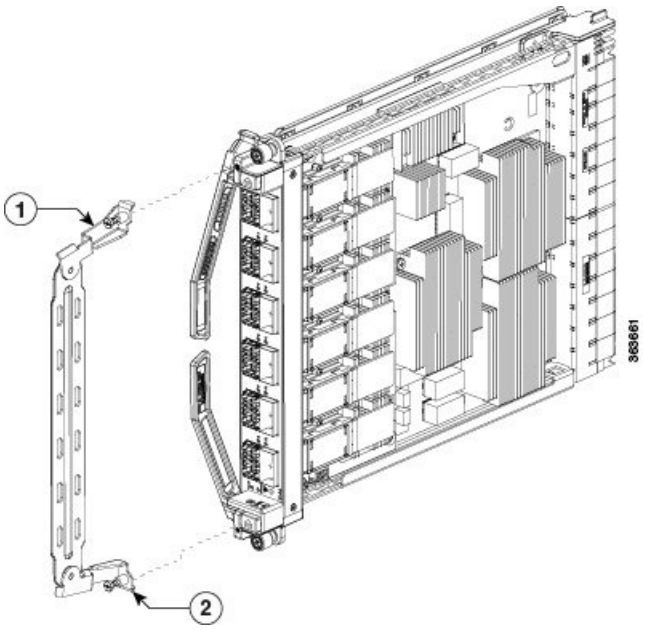
Procedure

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the two ESD jacks located on the front or rear side of the chassis. You can also connect the ESD-preventive wrist strap leash to any bare-metal surface on the chassis.

Step 2 Identify the FC to be removed from the card cage.

Step 3 Remove the vertical cable management bracket by unscrewing the two screws.

Figure 63: Removing the Vertical Cable Management Bracket



1 - Dark gray arm	2 - Light gray arm

Step 4 Press the OIR buttons to unlock the ejectors. Wait for 30 seconds.

Step 5 Use the number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver to turn the two captive screws on the front panel of the card counterclockwise to loosen it from the slot.

Step 6 Grasp the two card ejector levers and simultaneously pivot both ejector levers 70 degrees away from the front edge of the card carrier to unseat the card from the backplane connector.

Step 7 Touching only the metal card carrier, slide the card from the slot and place it directly into an antistatic bag or other ESD-preventive container. If you plan to return the defective card to the factory, repackage it in its original shipping container.

For replacement, wait for 30 seconds after removing the card from the chassis and then, reinsert the new card. For the installation procedure, see Installing a Fabric Card, on page 64.

Removing the Power Components

This section describes how to remove power components from the Cisco NCS 4016 chassis.

Note Although there are differences between AC and DC power trays and power modules, they are removed using the same procedures.

While it is possible to remove power components from the Cisco NCS 4016 chassis separately, some parts (such as the power tray) require that other parts be removed first.

We recommend that you remove the power components in the order outlined in this section.

Removing AC Input Power Cords

This section describes how to remove AC input power cords from a power tray.

Prerequisites

Power off the AC power modules in the tray you want to disconnect.

Note Before removal, make sure that the input power cables are not energized.

Required Tools and Equipment

- ESD-preventive wrist strap
- 6-inch, number-1 Phillips screwdriver

Steps

To remove the AC input power cords, go to the rear of the chassis and perform the following steps:

Procedure

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the two ESD jacks on the rear of the chassis. You can also connect the ESD-preventive wrist strap leash to any bare metal surface on the chassis.

Step 2 Verify that the AC input source breaker is in the off position.

Step 3 Use the screwdriver to loosen the screws that clamp the cords in place.

Step 4 Remove the cords from the cord clamps.

Removing DC Input Power Cables

This section describes how to remove DC input power cables from a power tray terminal block.

Prerequisites

Power off the DC power modules in the tray you want to disconnect.

Note Before removal, make sure that the input power cables are not energized.

Required Tools and Equipment

- ESD-preventive wrist strap
- 6-inch, number-1 Phillips screwdriver
- 3/8-inch ratchet wrench with 7/16-pt. socket
- Voltmeter

Steps

To disconnect DC input power cables, go to the rear of the chassis or the front if the DC rear to front converter box is used and perform the following steps:

Procedure

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the two ESD jacks on the rear of the chassis. You can also connect the ESD-preventive wrist strap leash to any bare metal surface on the chassis.

Step 2 Using the voltmeter, verify that there is no voltage on the cables that are about to be removed.

Step 3 Use the screwdriver to remove the screw that secures the terminal block cover into the mounting standoff.

Step 4 Slide the terminal block cover downward.

Step 5 Remove the terminal block cover.

Step 6 Disconnect the DC power cables from their terminals in the following order and note the color of each cable:

a) Negative (PWR) cables first.
b) Positive (RTN) cables last.

Step 7 Replace the terminal block cover.

Removing the Chassis Ground Cable

This section describes how to remove the chassis ground cable on the Cisco NCS 4016 chassis.

Prerequisites

Before performing this task, completely power off the entire system. Remove all AC or DC input power connections.



Caution Do not remove the chassis ground cable unless the chassis is powered off and to be replaced.

Required Tools and Equipment

- 3/8-inch drive socket wrench
- 10-mm 6-pt. socket

Steps

Procedure

To remove the ground cable from the chassis, remove the two M6 bolts that attach the ground cable to the NEBS grounding point.

Removing a Power Module Slot Cover

This section describes how to remove a power module slot cover from a power module slot in an AC or DC power tray.

Steps

To remove a power module slot cover from the front of a power tray, perform the following steps:

Procedure

Step 1 Gently pinch the tabs on the top of the power module slot cover to partially detach the slot cover from the slot.

Step 2 Slide the power module slot cover out by removing the tabs on the bottom of the power module slot cover from the two holes on the bottom of the slot.

Removing an AC or DC Power Tray

This section describes how to remove a power tray from the Cisco NCS 4016 chassis.

Prerequisites

- Power off the power shelf that houses the power tray you are about to remove.
- Ensure the power tray you are about to remove is empty. It is not necessary to turn off the switch on the power tray to remove individual power modules. Power modules support OIR, so they can be removed and replaced with the power on and the system operating.



Caution The I/O switch on each power shelf disables the output of the power modules in that shelf only. The inputs to the power modules remain hot, as well as the system's internal bus bar (due to the other power shelf).



Warning In case of power tray replacement, first remove the rear power connections before extracting the power tray. In DC, if the power connections are not removed, the connected power cables will prevent the power tray from being extracted. The power lugs could also be shorted with the metal part of the chassis causing physical damage to the equipment or personnel.

Required Tools and Equipment

- 6-inch, number-1 Phillips screwdriver

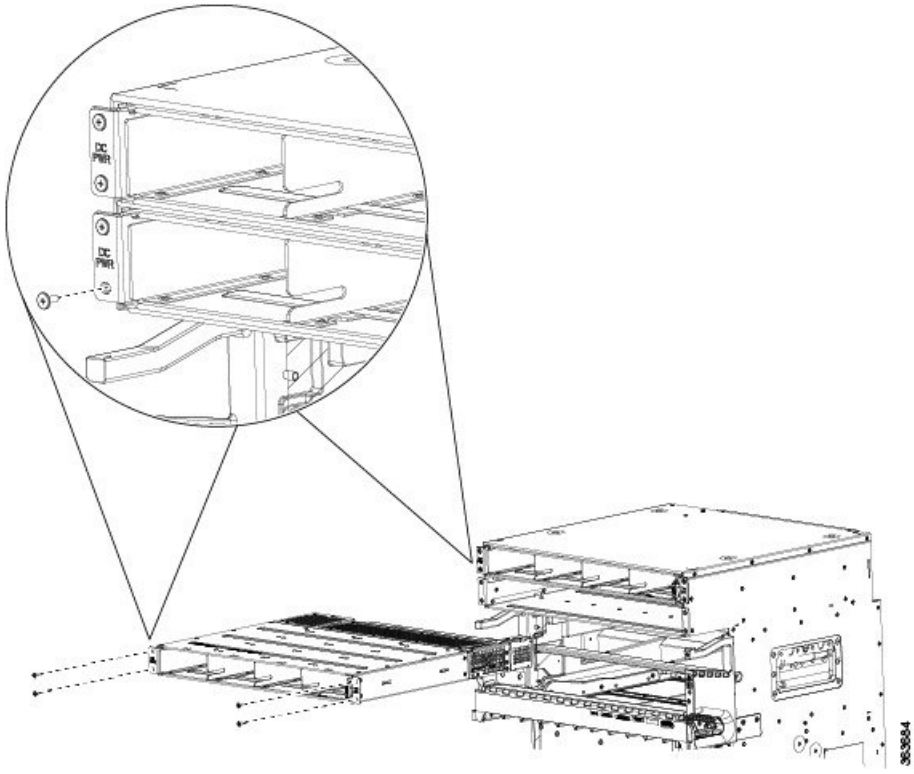
Steps

To remove an AC or DC power tray, perform the following steps:

Procedure

Step 1 Use the screwdriver to loosen the two screws that attach each power tray to the chassis.

Figure 64: Removing a Power Tray from the Chassis



Step 2 Slide the power tray all the way out of the chassis, fully supporting it during removal. You can use the vertical slot dividers to grip the unit.

Caution
Because of the weight of the power tray, and the height at which the power tray is installed in the chassis, you should be especially careful while removing and carrying the power tray. To prevent injury, avoid sudden twists or lateral moves.

Removing an AC or DC Power Module

This section describes how to remove a power module from a power tray.

Note It is not necessary to turn off the switch on the power tray to remove individual power modules. Power modules support OIR, so they can be removed and replaced with the power on and the system operating.

Steps

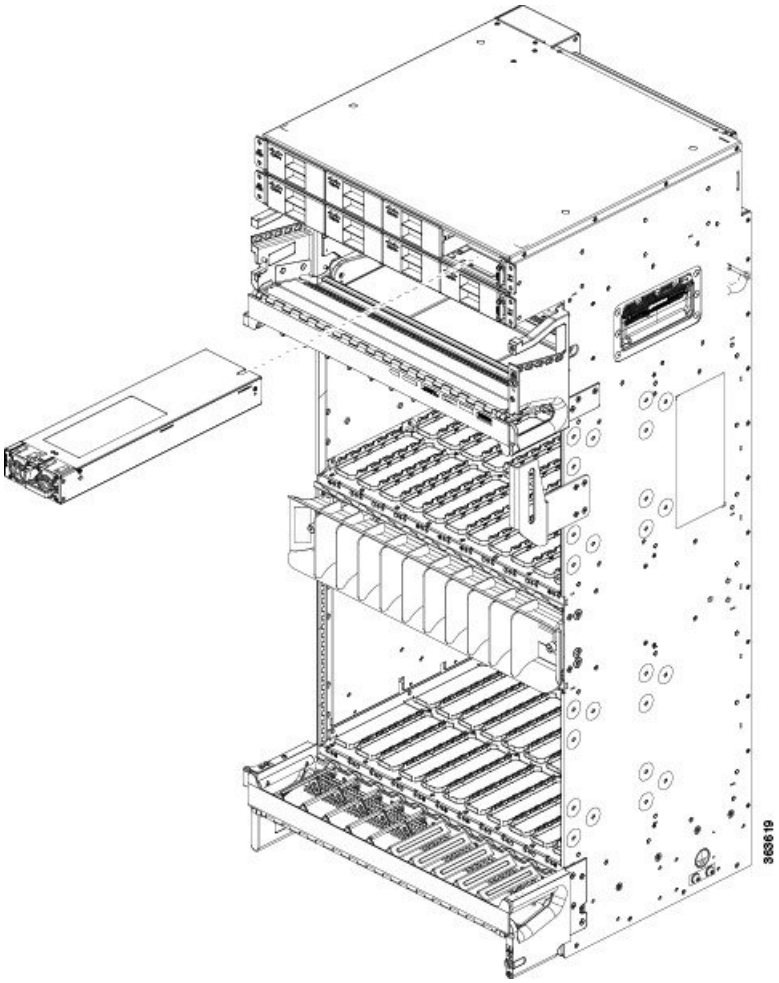
To remove a power module from the front of a power tray, perform the following steps:

Procedure

Step 1 Release the snap hook on the power module.

Step 2 Slide the power module out of its bay in the power tray while supporting it with your other hand. Use the handle available on the front plate of the power module.

Figure 65: Removing a Power Module from a Power Tray



Replacing a Power Module

The following section describes how to replace a power module in a NCS 4016 chassis.

Following are the limitations when a Delta power module (DC power) is replaced with an ACBEL power module (DC power).

- Release 6.1.12 and 6.1.22 software do not support ACBEL PEM, so the FPD upgrade fails and show status is displayed as UPGD FAIL. However the power module will function normally.
- Release 6.1.32 and 6.1.42 software packages come with PSU FPD image version 3.01. Post upgrade, the ACBEL PEM FPD version is shown as 3.01, but it continues to function with its original image, that is, version 4.02.

Follow these steps to replace AC or DC power modules into the chassis:

Procedure

Step 1 Using two hands to support the power module, slide it into the power tray.

Step 2 Secure the power module into the power tray using the snap hook.

Removing and Replacing the Air Filter

This section describes removing and replacing the air filter. The Cisco NCS 4016 chassis is shipped with two air filters installed. The air filters are located in the middle of the chassis behind the plastic grill.

The air filter removes dust from the room air drawn into the chassis by the two fan trays. If they are damaged, dirty, or clogged with dust, they must be replaced with a new air filter. Failure to replace a compromised air filter can result in insufficient air circulation through the chassis and temperature-related environmental alarms.

Caution Never operate the Cisco NCS 4016 chassis without an air filter. Operating a Cisco NCS 4016 chassis without a filter for an extended time can result in damage to the chassis hardware.

Note Inspect the air filters every three months and replace them as needed. Air filters should be disposed of and replaced when they become dirty. According to NEBS guidelines, washing or cleaning them is not allowed. Make sure to order these consumable items separately and keep a spare stock. For PID identification, contact TAC, as these parts cannot be replaced through the RMA process. The filter is sold in packs of 5.

Prerequisites

Before performing this task, open the front door, if installed.

Required Tools and Equipment

- ESD-preventive wrist strap
- Number 1 Phillips screwdriver
- Air filters (Cisco PID NCS4K-FTF=)

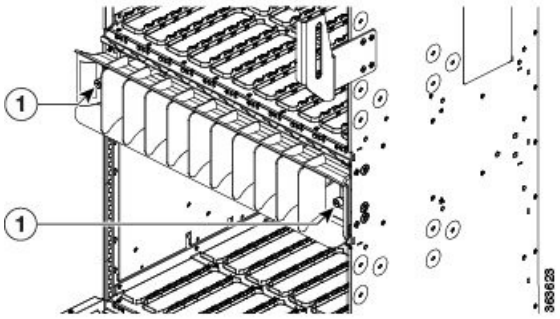
Steps

To remove the air filter:

Procedure

Step 1 Un-tighten the thumb screws on either side of the grill.

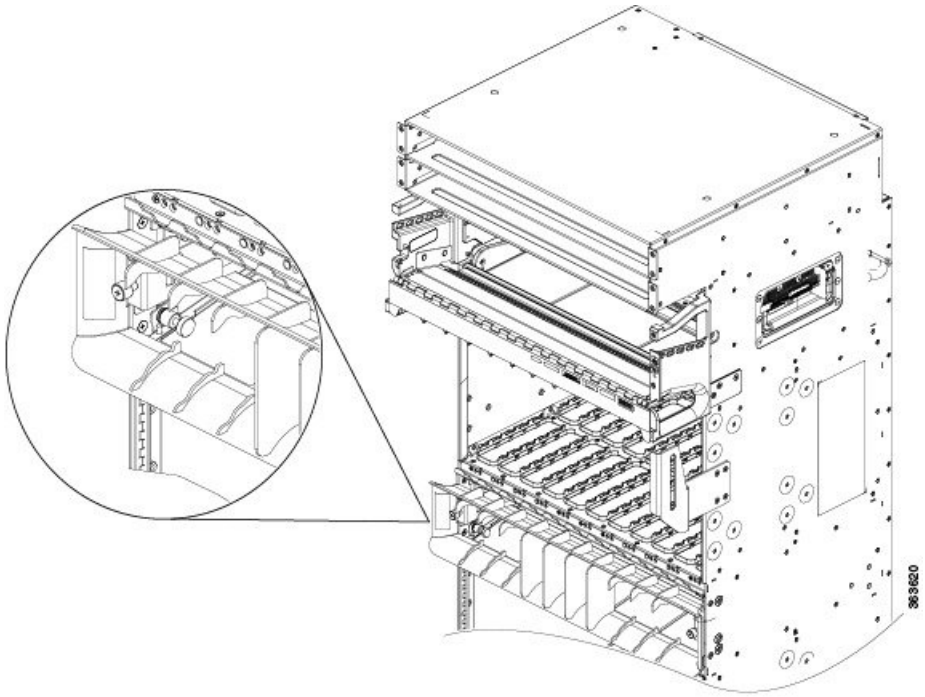
Figure 66: Location of Thumb Screws on Grill



1	Screws on either side of the grill

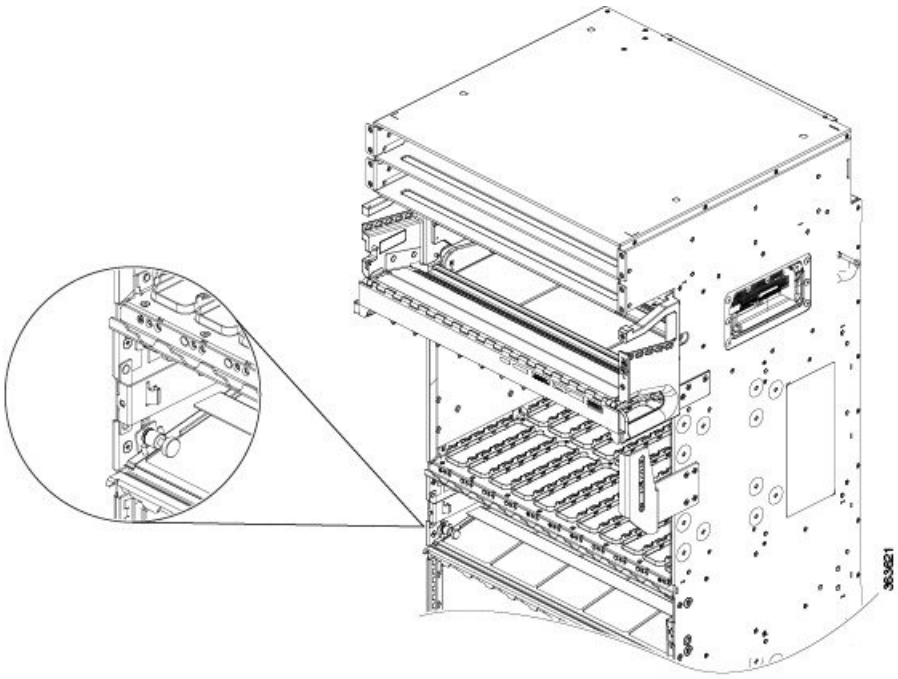
Step 2 Press the latches on the left and the right to release the bezel. Pull out the bezel.

Figure 67: Pressing Latches to Release Bezel



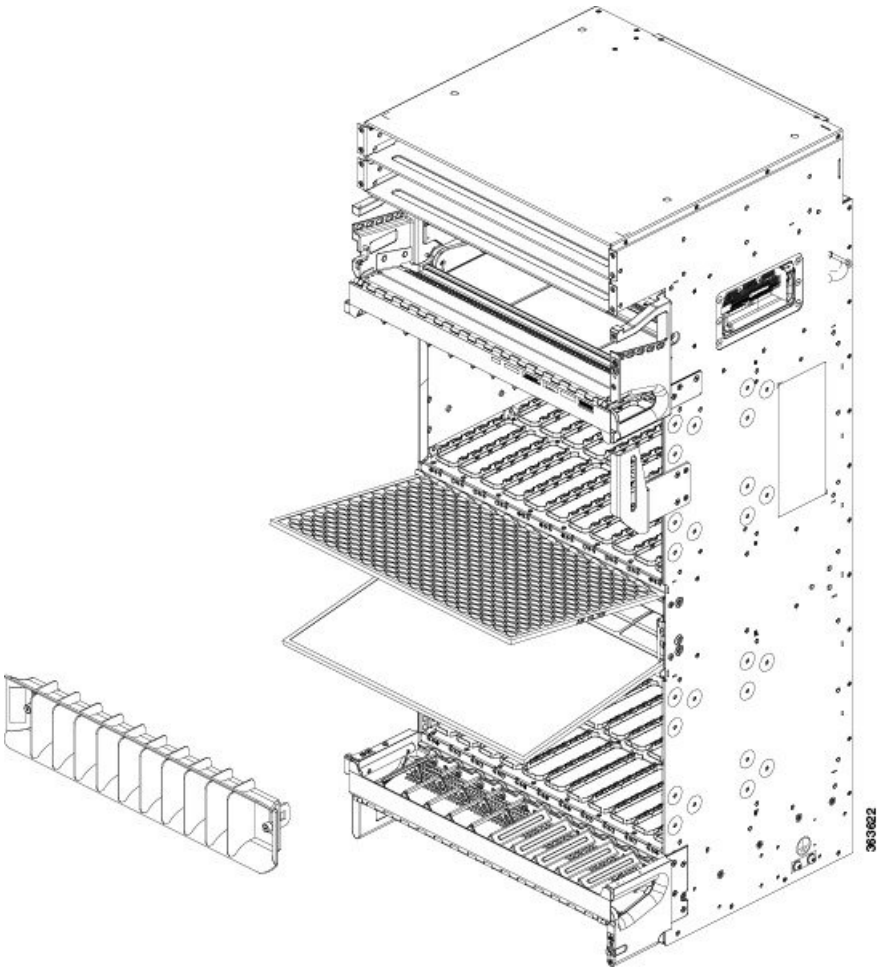
Step 3 Pull out the plungers on the left and the right. Swing the filter trays toward the center of the accessible zone.

Figure 68: Pulling Out the Plungers



Step 4 Pull out the air filters.

Figure 69: Pulling Out the Air Filters



Replacing the Air Filter

To replace the air filter:

Note Verify air flow direction when installing the new air filter. An air flow direction arrow is stamped on the air filter frame and should be installed pointing up.

Procedure

Step 1 Swing up and push in the filter cover.

Step 2 Tighten the two captive screws on the front.

Removing and Replacing the Front Door

This section describes removing and replacing the front door. The Cisco NCS 4016 chassis is shipped with the front door installed. Steps on how to install a key lock are also included.

Required Tools and Equipment

- ESD-preventive wrist strap
- Number 2 Phillips screwdriver, medium and small slot-head screwdrivers
- Front door (Cisco PID NCS4016-DOOR=)

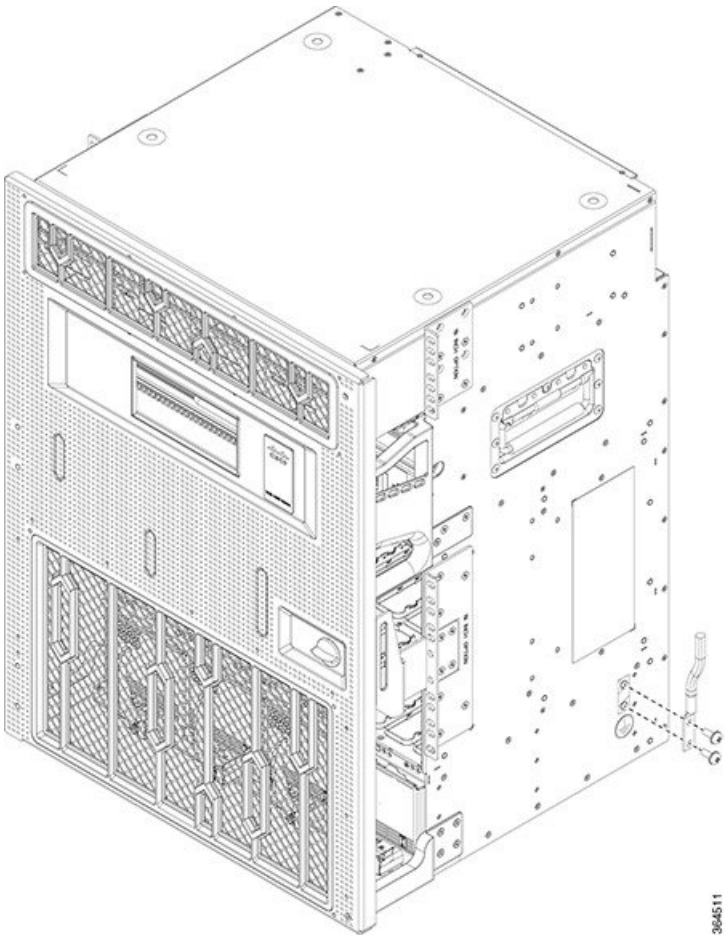
Steps

To remove the front door:

Procedure

Step 1 Turn the knob to unlock the door.

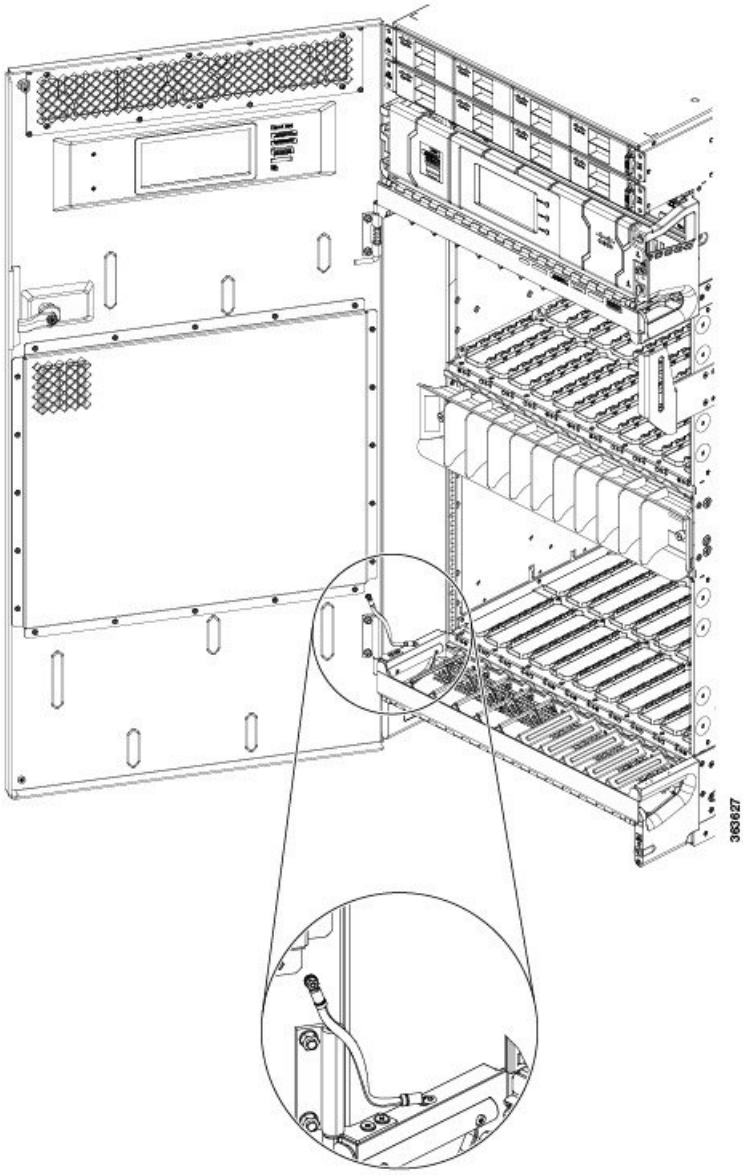
Figure 70: Knob to Unlock Door



Step 2 Open the door.

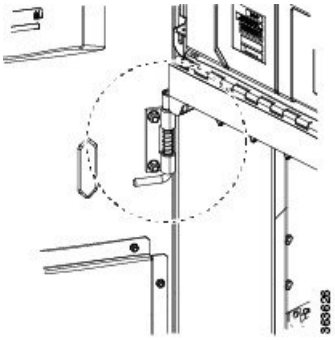
Step 3 Loosen the screw to disconnect the ground cable.

Figure 71: Disconnecting the Ground Cable



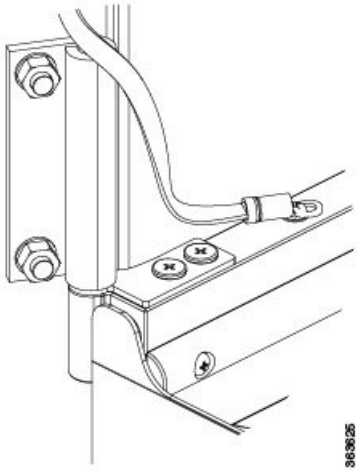
Step 4 Move down the pin to release the door from the chassis hinge.

Figure 72: Pin to Release Door from Hinge



Step 5 Move up the door to release the bottom hinge pin.

Figure 73: Releasing the Bottom Hinge Pin



Replacing the Front Door

To replace the front door:

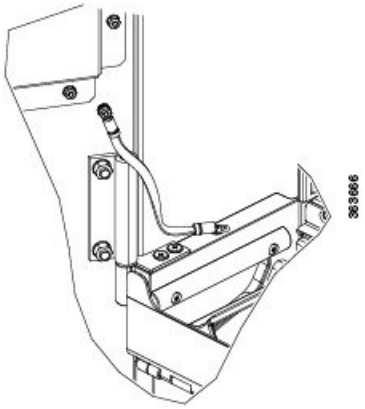
Note Be careful not to crimp any fiber cables that are connected to the MXP/TXP cards or DWDM cards. Some might not have the fiber boot attached.

Procedure

Step 1 Remove the screw and washer from the chassis fixing point.

Step 2 Feed the screw through the ground cable ring lug, through the washer, and then into the machined block.

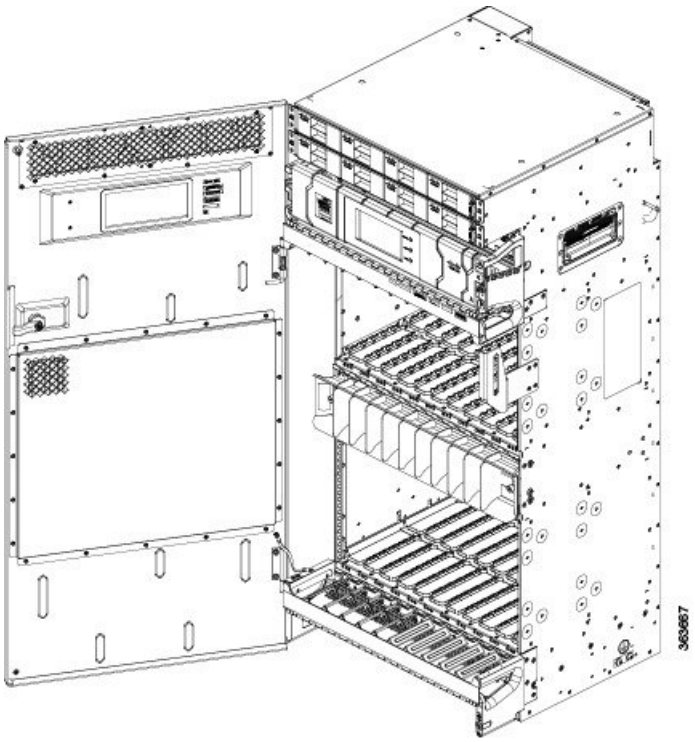
Figure 74: Installing the Door Ground Strap Retrofit Kit



Step 3 Using a Phillips screwdriver, insert and tighten the screws.

The following figure shows the shelf assembly with the front door and ground strap installed.

Figure 75: Shelf Assembly with Door Ground Strap Retrofit Kit Installed (ANSI)



Step 4 Swing the door closed and turn the knob to lock.

Installing the Optional Key Lock

To install the optional key lock:

Procedure

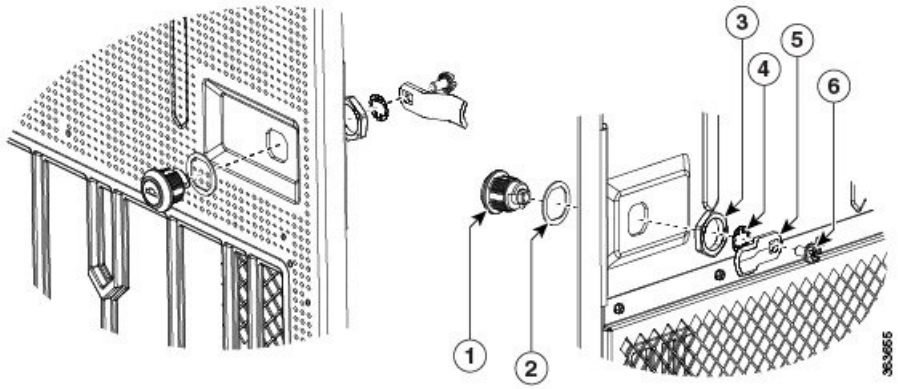
Step 1 Open the door.

Step 2 Disassemble the keyless block:

a) On the rear of the door, loosen the screw and remove the retention feature (latch), lock washer and M22 nut.

b) On the front of the door, pull out the keyless block.

Figure 76: Disassembling the Keyless Block



1	Keyless block	2	Washer
3	M22 nut	4	Lock washer
5	Retention feature	6	Screw

Note
The M22 nut, screw, and lock washer are common in both configurations (keyless and keyed). Only the main block and the retention feature are different.

Step 3 Assemble the key block:

a) On the front of the door, insert the key block and the front washer.
b) On the rear side of the door, lock the retention M22 nut, insert the lock washer and retention feature (latch), and tighten the screw.

Removing and Replacing the Fan Tray

Warning When servicing the system you must remove only one fan tray at a time and replace it in under five minutes. Do not remove both fan trays at the same time.

This section describes how to remove and replace the upper or lower fan tray. The Cisco NCS 4016 chassis is shipped with two fan trays installed.

Note To replace the fan tray, it is not necessary to move any of the cable management facilities.

Prerequisites

Before performing this task, open the front door, if installed.

Required Tools and Equipment

- ESD-preventive wrist strap
- 6-inch, number-1 Phillips screwdriver
- Fan tray (Cisco PID NCS4K-FTA=)

Steps

Caution Do not force a fan tray into place. Doing so can damage the connectors on the fan tray and/or the connectors on the backplane.

To remove the fan tray:

Procedure

Step 1 Loosen the two captive screws that hold the fan tray in place.

Step 2 Rotate the ejectors down or up, depending upon which fan tray you are removing (top or bottom).

Step 3 Slide the fan tray out of the slot.

Replacing the Fan Tray

To replace the fan tray:

Procedure

Step 1 Orient the fan tray as specified on front label, based upon whether you are installing the fan tray in the upper or lower slot.

Figure 77: Upper Fan Tray, Arrow Facing Up

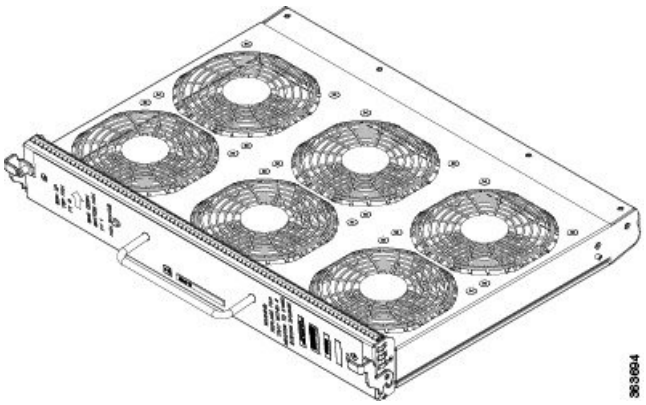
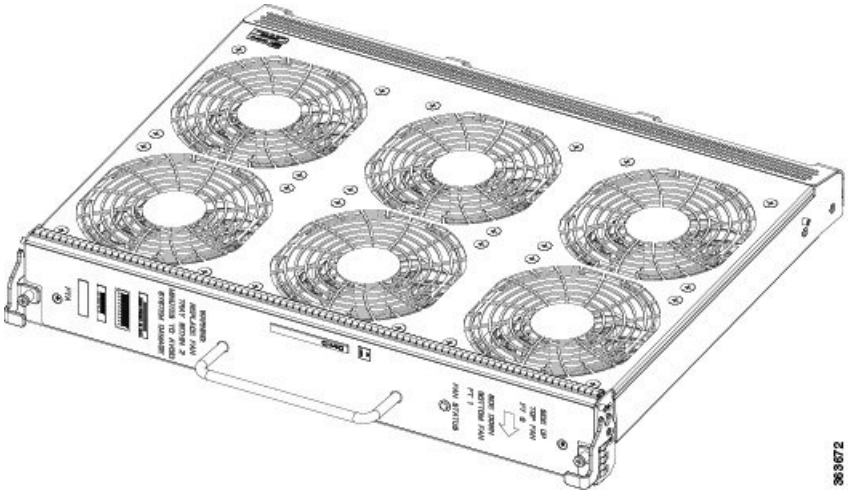


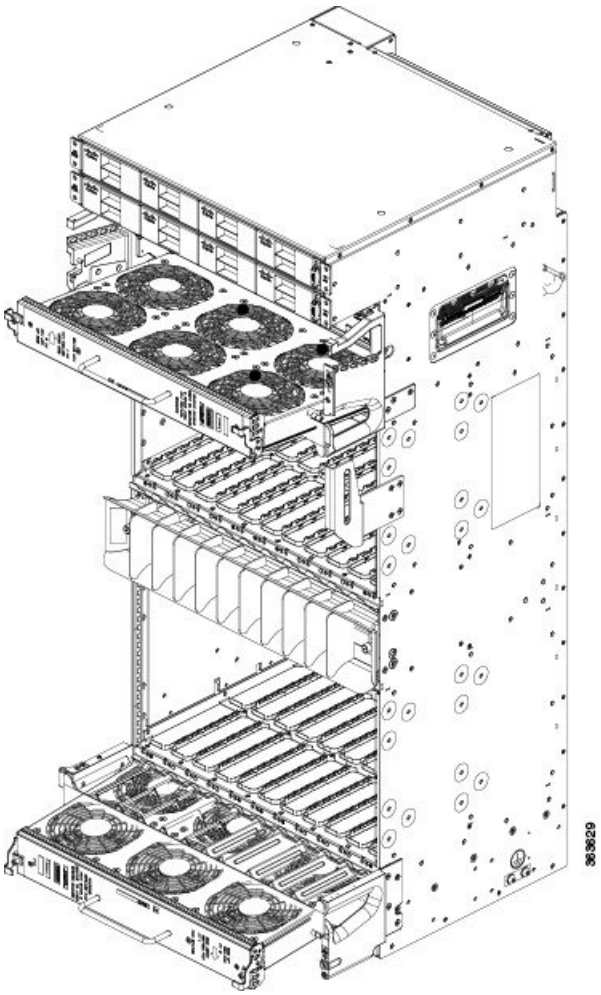
Figure 78: Lower Fan Tray, Arrow Facing Down



Step 2 Move the ejectors up or down into the stop or block position.

Step 3 Slide the fan tray into the chassis slot.Tilt the fan tray up when the fan tray is at an inch distance before it slides completely.

Figure 79: Upper and Lower Fan Trays Inserted into Chassis



Step 4 Check the ejector engagement to be sure it is correct. Complete the ejectors rotation to fully insert the fan trays.

Step 5 Tighten the two captive screws to lock the fan tray in place.

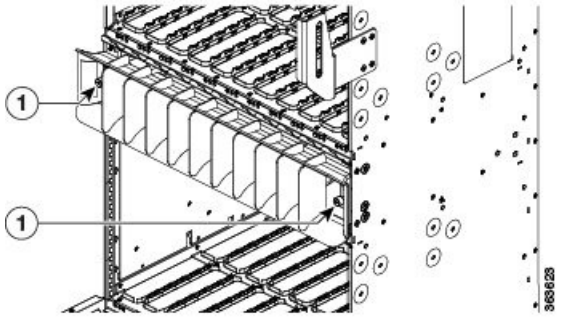
Performing Online Insertion and Removal of Fan Tray

Procedure

Step 1 Open the front door of chassis by unlocking the ejector lever.

Step 2 Loosen the two thumb screws on the plastic grill. See Figure 80: Location of Thumb Screws on Plastic Grill, on page 133.

Figure 80: Location of Thumb Screws on Plastic Grill



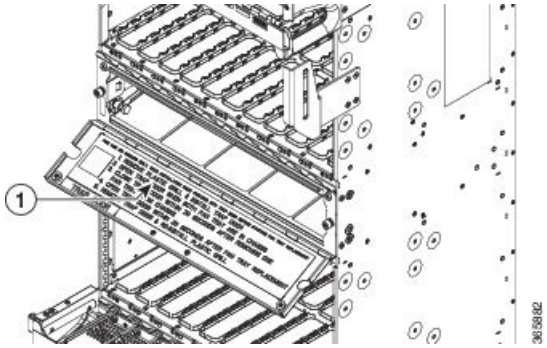
1	Screws on either side of the plastic grill

Step 3 Remove the plastic grill from chassis by pressing the tabs in the chassis and place it in secure place.

Step 4 Place the trap door in chassis in the same area from where the plastic grill was removed.

Caution
Ensure that the trap door opens downward on installation. See Figure 81: Open Trap Door, on page 133.

Figure 81: Open Trap Door



1	Trap Door

Step 5 Tighten thumb screw of trap door assembly.

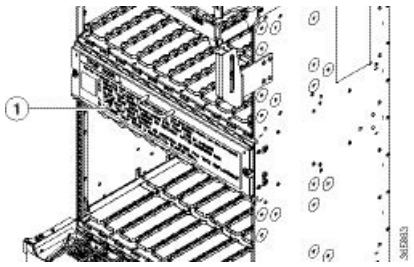
Step 6 Open the trap door so that air inlet is completely open. See Figure 81: Open Trap Door, on page 133.

Step 7 Review the Removing and Replacing the Fan Tray, on page 129 procedure.

Step 8 Remove top or bottom fan tray as required.

Step 9 Close the trap door within 20 seconds after removing the fan tray. See Figure 82: Close Trap Door, on page 134.

Figure 82: Close Trap Door



1	Trap Door

Step 10 Place the new fan tray in the chassis.

Step 11 Open the trap door within 20 seconds after installing fan tray into chassis.

Step 12 Remove trap door by loosening the thumb screws and pressing tabs in the chassis.

Step 13 Re-install the plastic grill into the chassis by tightening the thumb screws.

Step 14 Close front door of the chassis by locking the ejector lever.

Step 15 Pack the trap door and the old fan tray into box. Return the box to Cisco.

Removing the Craft Panel

This section describes how to remove the craft panel. The Cisco NCS 4016 chassis is shipped with the craft panel installed. Normally, it is not necessary to remove the craft panel. However, it can be removed. The craft panel is a field replaceable unit.

Prerequisites

Before performing this task, open the front door, if installed.

Required Tools and Equipment

• ESD-preventive wrist strap

• 6-inch, number-1 Phillips screwdriver

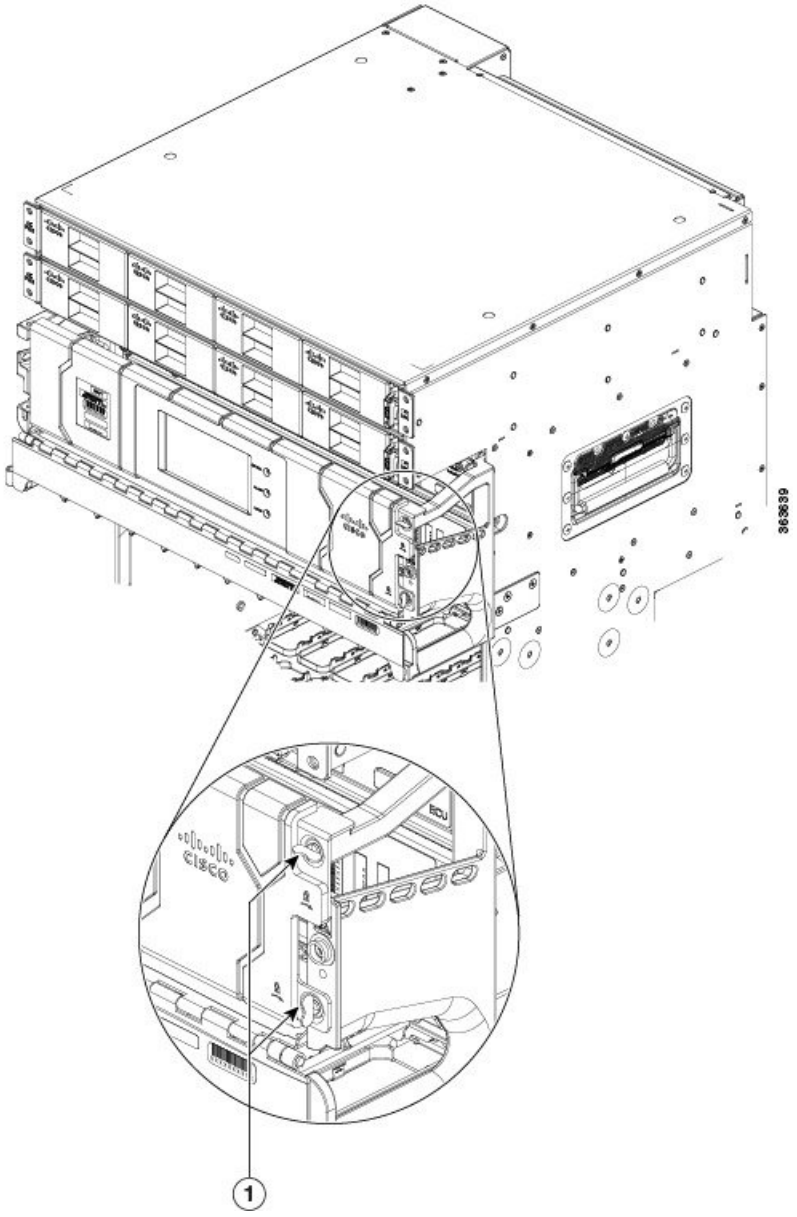
Steps

To remove the craft panel:

Procedure

Step 1 Loosen the two wing-head screws on the right side.

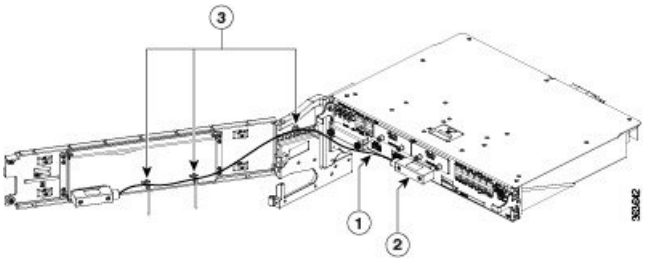
Figure 83: Craft Panel Showing Wing-Head Screws



1- Wing head screws

Step 2 Open the craft panel and rotate it.

Figure 84: Opening the Craft Panel



1 - Craft cable
2 - Connector
3- Three cable ties to hold the LCD cables

Step 3 Disconnect the craft cable from the ECU/ECU2 faceplate.

Step 4 Loosen the two connector screws and remove the connector.

Step 5 Remove the craft panel. Lift up the panel to disengage the hinge pins on the left side from the chassis.

Replacing the Craft Panel

To replace the craft panel:

Procedure

Step 1 Engage the hinge pins on the left side of the chassis.

Step 2 Connect the craft cable to the ECU/ECU2 faceplate.

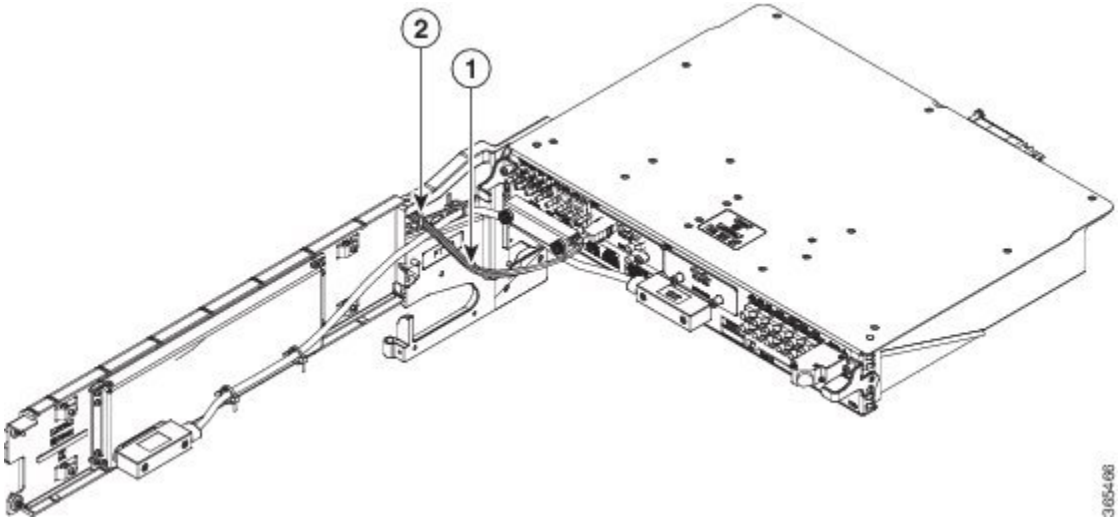
Step 3 Tighten the two connector screws to a torque value of 4.4lbs.

Step 4 Close the craft panel and rotate it.

Step 5 Tighten the two wing-head screws on the right side.

Routing the BITS Cables

Route the BITS cables according to the following image.



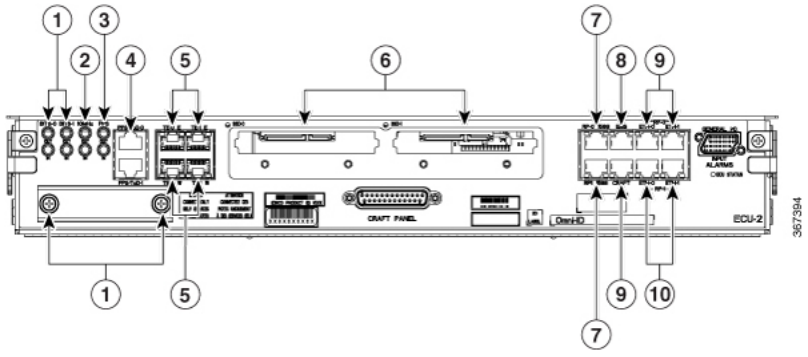
1 - Routing of BITS cables
2 - Cable tie to hold the BITS cables

Routing the Timing Cables

In a multi-chassis configuration, all the LCCs must be phase locked to a common timestamp synchronization pulse of 8 kHz. The timing expansion ports (TE ports) on the ECU2 unit provide this 8 kHz clock between the LCCs for phase synchronization.There are four TE ports available on the ECU2 that provide East and West LCC connectivity for redundancy. The ports are TE-0 East, TE-0 West, TE-1 East, and TE-1 West.

Following are the available ports on the ECU2 :

Figure 85: ECU2 Ports

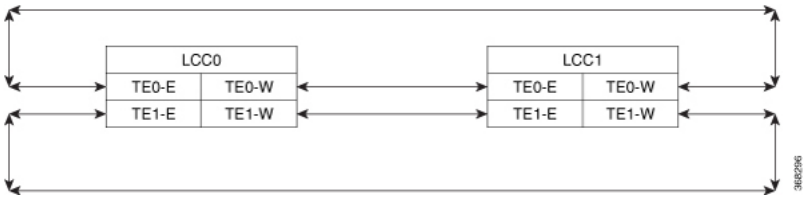


1	BITS	6	SSD
2	10MHz	7	RP
3	PPS	8	EMS
4	PPS/ToD-O	9	CRAFT

5	TE	10	MSM

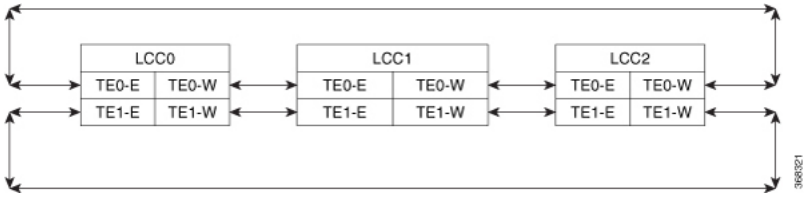
The connections between the TE ports of LCCs is a must for multi-chassis configurations. The following table describes the TE port connections.

Figure 86: ECU2 TE Port Connections for 2+x Configuration



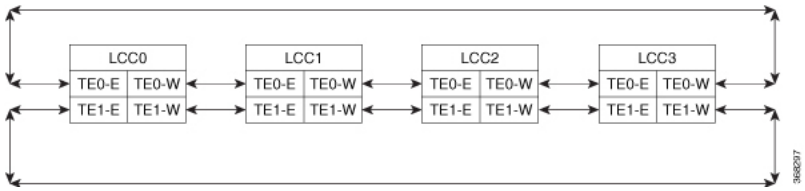
ECU2 Port	LCC0	LCC1	Description
TE0-E	TE0-W (LCC1)	TE0-W (LCC0)	The TE-0 E port on each LCC connects to the TE-0 W port on the next LCC.
TE0-W	TE0-E (LCC1)	TE0-E (LCC0)	The TE-0 W port on each LCC connects to the TE-0 E port on the next LCC.
TE1-E	TE1-W (LCC1)	TE1-W (LCC0)	The TE-1 E port on each LCC connects to the TE-1 W port on the next LCC.
TE1-W	TE1-E (LCC1)	TE1-E (LCC0)	The TE-1 W port on each LCC connects to the TE-1 E port on the next LCC.

Figure 87: ECU2 TE Port Connections for 3+x configuration



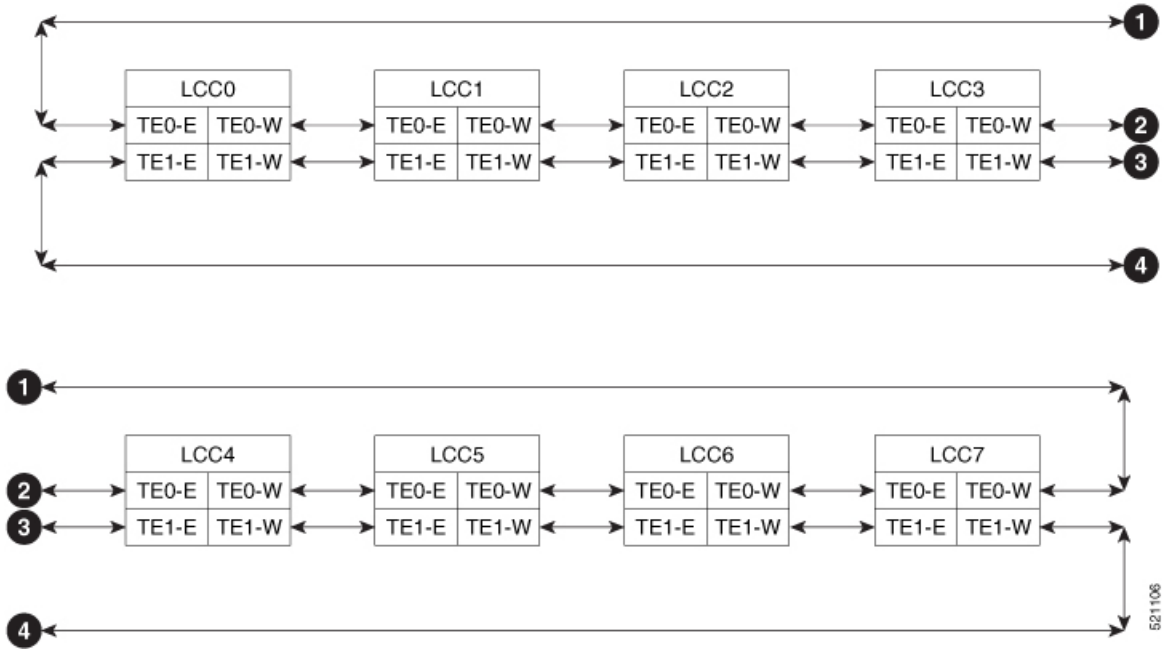
ECU2 Port	LCC0	LCC1	LCC2	Description
TE0-E	TE0-W (LCC2)	TE0-W (LCC0)	TE0-W (LCC1)	The TE-0 E port on each LCC connects to the TE-0 W port on the next LCC.
TE0-W	TE0-E (LCC1)	TE0-E (LCC2)	TE0-E (LCC0)	The TE-0 W port on each LCC connects to the TE-0 E port on the next LCC.
TE1-E	TE1-W (LCC2)	TE1-W (LCC0)	TE1-W (LCC1)	The TE-1 E port on each LCC connects to the TE-1 W port on the next LCC.
TE1-W	TE1-E (LCC1)	TE1-E (LCC2)	TE1-E (LCC0)	The TE-1 W port on each LCC connects to the TE-1 E port on the next LCC.

Figure 88: ECU2 TE Port Connections for 4+x Configuration



ECU2 Port	LCC0	LCC1	LCC2	LCC3	Description
TE0-E	TE0-W (LCC3)	TE0-W (LCC0)	TE0-W (LCC1)	TE0-W (LCC2)	The TE0-E port on each LCC connects to the TE-0 W port on the next LCC.
TE0-W	TE0-E (LCC1)	TE0-E (LCC2)	TE0-E (LCC3)	TE0-E (LCC0)	The TE-0 W port on each LCC connects to the TE-0 E port on the next LCC.
TE1-E	TE1-W (LCC3)	TE1-W (LCC0)	TE1-W (LCC1)	TE1-W (LCC2)	The TE-1 E port on each LCC connects to the TE-1 W port on the next LCC.
TE1-W	TE1-E (LCC1)	TE1-E (LCC2)	TE1-E (LCC3)	TE1-E (LCC0)	The TE-1 W port on each LCC connects to the TE-1 E port on the next LCC.

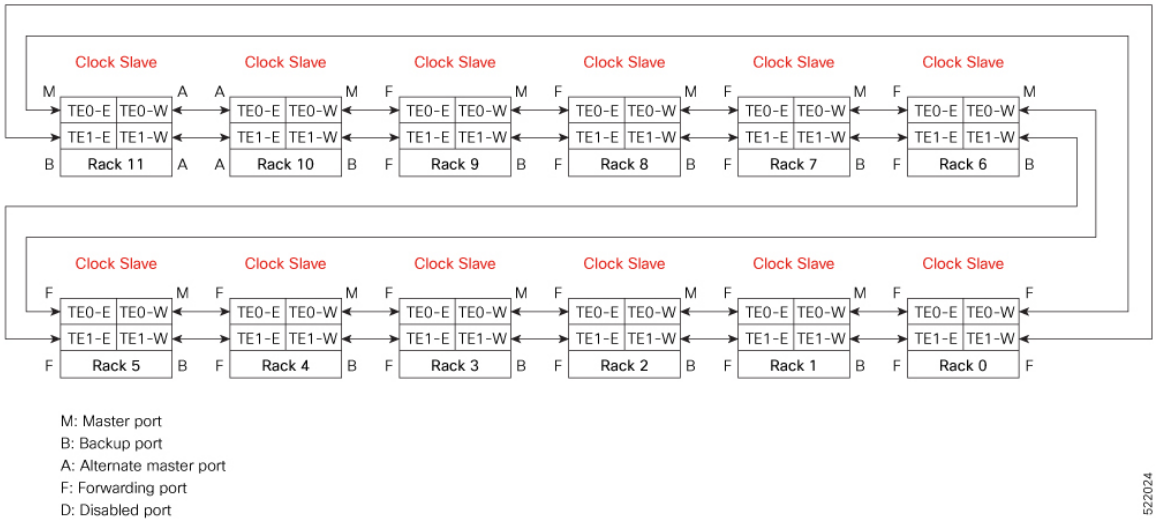
Figure 89: ECU2 TE Port Connections for 8+x Configuration



ECU2 Port	LCC0	LCC1	LCC2	LCC3	Description
TE0-E	TE0-W (LCC7)	TE0-W (LCC0)	TE0-W (LCC1)	TE0-W (LCC2)	The TE0-E port on each LCC connects to the TE0-W port on the previous LCC.
TE0-W	TE0-E (LCC1)	TE0-E (LCC2)	TE0-E (LCC3)	TE0-E (LCC4)	The TE0-W port on each LCC connects to the TE0-E port on the next LCC.
TE1-E	TE1-W (LCC7)	TE1-W (LCC0)	TE1-W (LCC1)	TE1-W (LCC2)	The TE1-E port on each LCC connects to the TE1-W port on the previous LCC.
TE1-W	TE1-E (LCC1)	TE1-E (LCC2)	TE1-E (LCC3)	TE1-E (LCC4)	The TE1-W port on each LCC connects to the TE1-E port on the next LCC.

ECU2 Port	LCC4	LCC5	LCC6	LCC7	Description
TE0-E	TE0-W (LCC3)	TE0-W (LCC4)	TE0-W (LCC5)	TE0-W (LCC6)	The TE0-E port on each LCC connects to the TE-0 W port on the previous LCC.
TE0-W	TE0-E (LCC5)	TE0-E (LCC6)	TE0-E (LCC7)	TE0-E (LCC0)	The TE0-W port on each LCC connects to the TE0-E port on the next LCC.
TE1-E	TE1-W (LCC3)	TE1-W (LCC4)	TE1-W (LCC5)	TE1-W (LCC6)	The TE1-E port on each LCC connects to the TE1-W port on the previous LCC.
TE1-W	TE1-E (LCC5)	TE1-E (LCC6)	TE1-E (LCC7)	TE1-E (LCC0)	The TE1-W port on each LCC connects to the TE1-E port on the next LCC.

Figure 90: ECU2 TE Port Connections for 12+x Configuration



ECU2 Port	LCC0	LCC1	LCC2	LCC3	Description
TE0-E	TE0-W (LCC11)	TE0-W (LCC0)	TE0-W (LCC1)	TE0-W (LCC2)	The TE0-E port on each LCC connects to the TE0-W port on the previous LCC.
TE0-W	TE0-E (LCC1)	TE0-E (LCC2)	TE0-E (LCC3)	TE0-E (LCC4)	The TE0-W port on each LCC connects to the TE0-E port on the next LCC.
TE1-E	TE1-W (LCC11)	TE1-W (LCC0)	TE1-W (LCC1)	TE1-W (LCC2)	The TE1-E port on each LCC connects to the TE1-W port on the previous LCC.
TE1-W	TE1-E (LCC1)	TE1-E (LCC2)	TE1-E (LCC3)	TE1-E (LCC4)	The TE1-W port on each LCC connects to the TE1-E port on the next LCC.

ECU2 Port	LCC4	LCC5	LCC6	LCC7	Description
TE0-E	TE0-W (LCC3)	TE0-W (LCC4)	TE0-W (LCC5)	TE0-W (LCC6)	The TE0-E port on each LCC connects to the TE-0 W port on the previous LCC.
TE0-W	TE0-E (LCC5)	TE0-E (LCC6)	TE0-E (LCC7)	TE0-E (LCC8)	The TE0-W port on each LCC connects to the TE0-E port on the next LCC.
TE1-E	TE1-W (LCC3)	TE1-W (LCC4)	TE1-W (LCC5)	TE1-W (LCC6)	The TE1-E port on each LCC connects to the TE1-W port on the previous LCC.

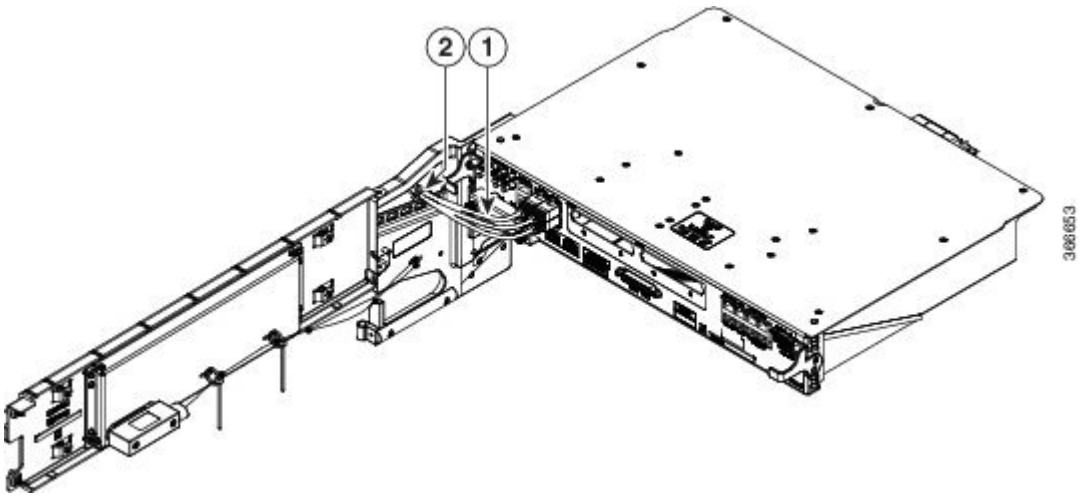
ECU2 Port	LCC4	LCC5	LCC6	LCC7	Description
TE1-W	TE1-E (LCC5)	TE1-E (LCC6)	TE1-E (LCC7)	TE1-E (LCC8)	The TE1-W port on each LCC connects to the TE1-E port on the next LCC.

ECU2 Port	LCC8	LCC9	LCC10	LCC11	Description
TE0-E	TE0-W (LCC7)	TE0-W (LCC8)	TE0-W (LCC9)	TE0-W (LCC10)	The TE0-E port on each LCC connects to the TE0-W port on the previous LCC.
TE0-W	TE0-E (LCC9)	TE0-E (LCC10)	TE0-E (LCC11)	TE0-E (LCC0)	The TE0-W port on each LCC connects to the TE0-E port on the next LCC.
TE1-E	TE1-W (LCC7)	TE1-W (LCC8)	TE1-W (LCC9)	TE1-W (LCC10)	The TE1-E port on each LCC connects to the TE1-W port on the previous LCC.
TE1-W	TE1-E (LCC9)	TE1-E (LCC10)	TE1-E (LCC11)	TE1-E (LCC0)	The TE1-W port on each LCC connects to the TE1-E port on the next LCC.

Automatic switchover between TE ports is supported in case of failures.

Route the Timing cables for ECU2 according to the following image.

Figure 91: Timing Cables for ECU2



1 - Routing of Timing cables
2 - Cable tie to hold the Timing cables

Removing the External Connection Unit

This section describes how to remove the external connection unit (ECU). The ECU/ECU2 provides all shelf electrical I/O connectivity to the active and standby route-processor line cards. The Cisco NCS 4016 chassis is shipped with the ECU/ECU2 installed.

Prerequisites

- Open the front door, if installed.
- Make sure that the craft panel has been removed. See the Removing the Craft Panel, on page 134.

Required Tools and Equipment

- ESD-preventive wrist strap
- 6-inch, number-1 Phillips screwdriver
- ECU (Cisco PID NCS4K-ECU=)
- ECU2 (Cisco PID NCS4K-ECU2=)

Steps

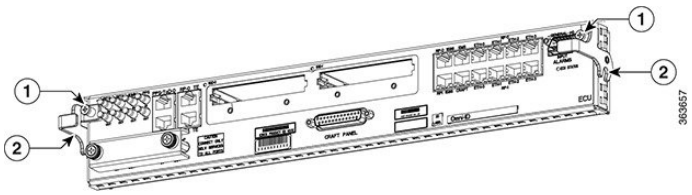
To remove the ECU/ECU2:

Procedure

Step 1 Disconnect all cables from the ECU/ECU2 faceplate.

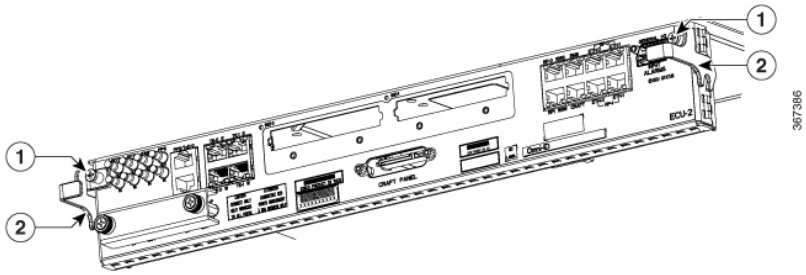
Step 2 Loosen the two captive screws.

Figure 92: ECU



1 - Captive Screw	2 - Ejector

Figure 93: ECU2



1 - Captive Screw	2 - Ejector

Note
For easy extraction, use RJ45 plug with longer lever for timing port and PPS/ToD port.

Step 3 Rotate the ejectors to point down.

Step 4 Grasp the upper and lower portions of the ECU/ECU2 with fingers to pull out the ECU/ECU2 from the chassis.

Replacing the External Connection Unit

To replace the ECU/ECU2:

Procedure

Step 1 Rotate the ejectors to point down.

Step 2 Push the ECU/ECU2 into the chassis.

Step 3 Rotate the ejectors to point up.

Step 4 Tighten the two captive screws.

Step 5 Connect all cables to the ECU/ECU2 faceplate.

Replacing an SSD

The ECU/ECU2 houses two 2.5-in. solid-state drives (SSDs).

Prerequisites

- Open the front door, if installed.
- Make sure that the ECU/ECU2 is installed.

Required Tools and Equipment

- ESD-preventive wrist strap
- 6-inch, number-1 Phillips screwdriver
- SSDs (Cisco PID NCS4K-SSD-100G or NCS4K-SSD-200G=)

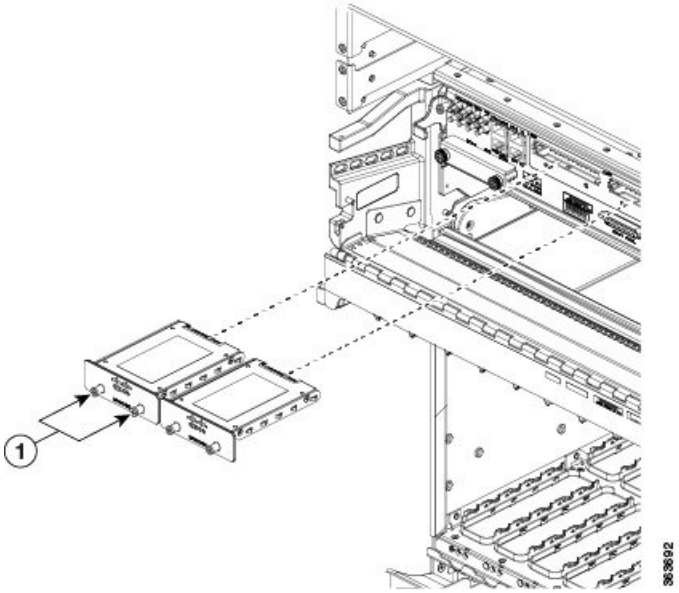
Steps

To remove an SSD:

Procedure

Step 1 Loosen the two captive screws.

Figure 94: Captive Screws on the SSD



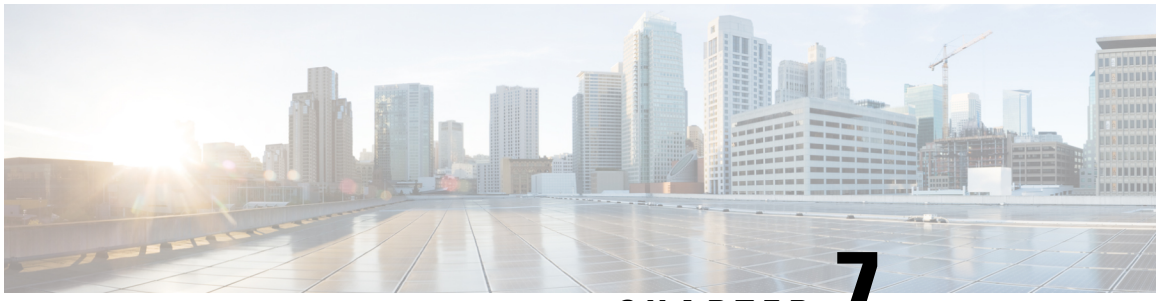
1 - Captive screws

Step 2 Slide out the SSD from the ECU/ECU2 slot.

What to do next

To replace a SSD:

Slide the SSD into the ECU/ECU2 slot and tighten the two captive screws to secure the SSD into place.



CHAPTER 7

System Product IDs

This appendix provides information about the product IDs for the Cisco NCS 4016 chassis and its components.

- System Product IDs, on page 147

System Product IDs

The tables list the components that make up the routing system, their product IDs (part numbers used to order the components), and descriptions.

Note In the following tables, an equals sign (=) at the end of the product ID indicates that the component can be ordered as a spare. For those components, be sure to include the equals sign as part of the product ID.

Component Product IDs

Table 24: Cisco NCS 4016 Chassis Component Product IDs

Component	Product ID	Description
Cisco NCS 4016 chassis	NCS4016-SA-AC= NCS4016-SA-DC=	Cisco NCS 4016 chassis
Installation kit	NCS4K-INST-KIT=	Rack brackets, installation aid brackets, hardware, and other materials necessary for installation
Fabric card	NCS4016-FC-M=	Cisco NCS 4016 fabric card
Route processor card	NCS4K-RP=	Cisco NCS 4016 route processor card
Fan tray	NCS4K-FTA=	Cisco NCS 4016 fan tray
AC power tray	NCS4K-AC-PEM	Cisco NCS 4016 AC power tray
AC power module	NCS4K-AC-PSU=	Cisco NCS 4016 AC power module

Component	Product ID	Description
AC power cord	NCS4K-AC-CBL-IEC= NCS4K-AC-CBL-NEMA=	AC power cord - International AC power cord - North America **Note** Length of each power cord is 4.5 m.
DC power tray	NCS4K-DC-PEM	Cisco NCS 4016 DC power tray
DC power module	NCS4K-DC-PSU-V1	Cisco NCS 4016 DC power module
Cable management and cosmetic package options		
Front plastic cosmetic assemblies	???>	Front cosmetic and cable management kit ** will this be added in future? **>

Line Card Product IDs

Table 25: Cisco NCS Line Card Product IDs

Component	Product ID	Description
24-port low-rate OTN	NCS4K-24LR-O-S=	24-port low-rate OTN line card with SFP or SFP+
20x10GE OTN	NCS4K-20T-O-S=	20-port 10GE OTN line card with SFP+
2x100GE OTN	NCS4K-2H-O-K=	2-port 100GE OTN line card with CPAK
2x100GE DWDM	NCS4K-2H-W=	2-port 100GE DWDM line card with CPAK
Distributed Route Processor		
DRP	CRS-DRP-Option	Cisco CRS-1 Distributed Route Processor (each DRP requires a DRP PLIM)
DRP memory option	CRS-DRP-MEM-4GCRS-DRP-MEM-8G	DRP memory, 4 gigabytes (4G) or 8 gigabytes (8G)
DRP PLIM	CRS-DRP-ACC	DRP physical layer interface module

Cosmetic Product IDs

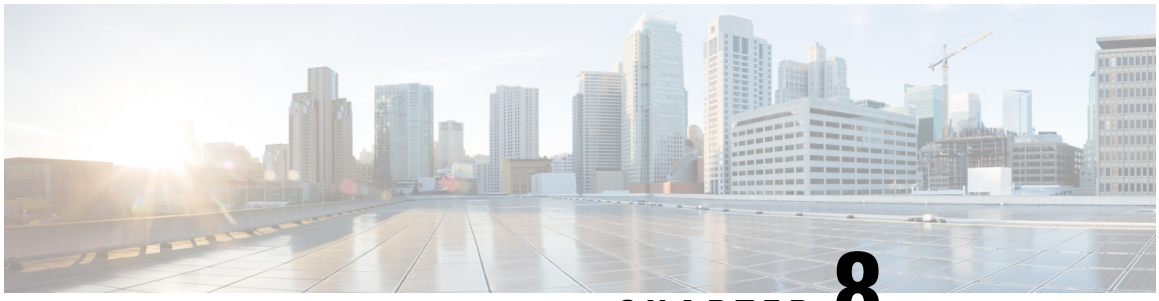
Table 26: Cisco NCS 4016 Cosmetic Product IDs

Component	Product ID	Description
Craft panel display	NCS4K-CRAFT=	Cisco NCS craft panel display kit
Front door	NCS4016-DOOR=	Front door
ECU	NCS4K-ECU=	External Connection Unit
ECU2	NCS4K-ECU2=	External Connection Unit

Accessory Product IDs

Table 27: Cisco NCS 4016 Chassis Accessory Product IDs

Component	Product ID	Description
Chassis filter	NCS4K-FTF=	Cisco NCS 4016 chassis air filter, 5-pack (spare)
Alarm cable	NCS4K-CBL-HKA=	Cisco NCS 4016 alarm cabling
Filler card	NCS4K-BLANK=	Filler cards for empty LC, FC, and RP card slots



CHAPTER 8

System Specifications

This appendix contains tables that list the specifications for the main components of the Cisco NCS 4016 chassis.

- Chassis Specifications, on page 151
- Power Specifications, on page 152
- Environmental Specifications, on page 153
- Regulatory, Compliance, and Safety Specifications, on page 154

Chassis Specifications

This appendix contains tables that list the specifications for the main components of the Cisco NCS 4016 chassis.

Table 28: Cisco NCS 4016 Chassis Specifications

Supported Cards and Modules	• Upto sixteen lincards • Four fabric cards • Two route processor cards • Two fan trays
Chassis Dimensions	
Height	42 in. (106.68 cm) as shipped
Width	19.5 in. (49.53 cm) with front door 18.5 in. (47 cm) without front door
Depth	AC version: 19.05 in. (48.39 cm) with front doorDC version: 17.73 in. (45.03 cm) with front door
Aisle spacing	To install chassis (front): 48 in. (122 cm) To service FRUs (front): 31.7 in. (80.5 cm) To service FRUs (rear): 14.0 in. (35.6 cm)
Weights	

Chassis as shipped	250 lb (113.5 kg)
Chassis in shipping crate with pallet	319 lb (145 kg)
Chassis, fully loaded with power, fan trays, cards, and cosmetics	412 lb (187 kg)
Floor Loading	
Chassis in rack footprint(floor contact area)	Chassis: 2.5 sq ft (0.23 sq m)
Maximum floor loading	263 lb/sq ft
Chassis Cooling	Two fan trays
Chassis airflow	45,300 liters per minute
DC power system airflow	6796 liters per minute
AC power system airflow	5097 liters per minute

Power Specifications

Table 29: Cisco NCS 4016 Chassis Power Specifications

Power Specifications	
Power Trays	Either two AC or two DC power trays (cannot mix AC and DC power trays)
DC power tray	Up to four DC PMs per tray
AC power tray	Up to four AC PMs per tray
Power Redundancy	
DC	Up to 8 power modules can be installed, and only 7are needed to be active at any time. This allows support for 7+1 power redundancy and A and B battery plant dual feeds redundancy.
AC	Up to 8 power modules can be installed, and only 4 are needed to be active at any time. This allows support for 4+4 power redundancy by using two independent AC power sources (4 feeds each).
DC Input	
Nominal input voltage	–48 VDC or –60 VDC(tolerance range: –40 to –72 VDC)
Input current	50 A max at –48 VDC40 A max at –60 VDC60 A at –40 VDC (maximum)
AC Input	Single-phase
Nominal input voltage	200 to 240 VAC (range 180 to 264 VAC)

Power Specifications	
Nominal line frequency	50/60 Hz (range 47 to 63 Hz)
Recommended AC service	30-A (North America) dedicated branch circuit30-A (International) dedicated branch circuit
AC Power Cord Length	167 in. (4.25 m)

Environmental Specifications

Table 30: Cisco NCS 4016 Chassis Environmental Specifications

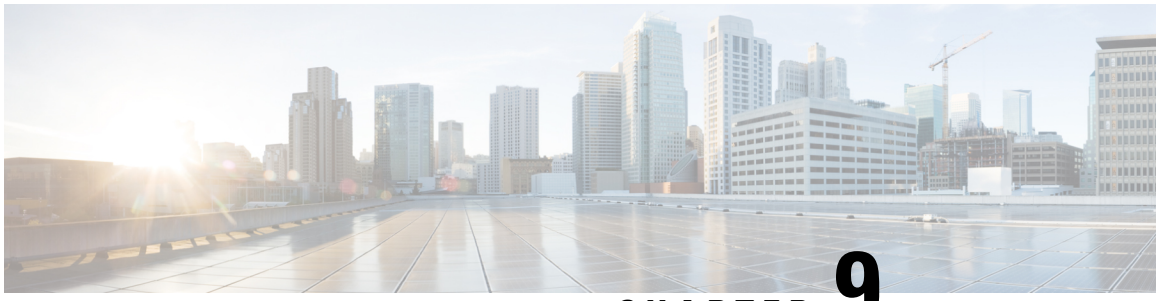
Temperature	Operating, nominal: 41 to 104°F (5° to 40°C) Operating, short-term: 23 to 122°F (–5° to 50°C)[14] Nonoperating: –40 to 158°F (–40° to 70°C)
Humidity	Operating, nominal: 5 to 85%, noncondensing Operating, short-term: 5 to 90%, noncondensing Nonoperating: 5 to 93%, noncondensing
Altitude	Operating: –200 to 13,100 ft (–61 to 4000 m) at 104°F (40°C) Nonoperating: Up to 16,000 ft (4877 m) at –13°F (–25°C), short-term
Chassis airflow	Up to 46,200 liters per minute
Power system airflow	Up to 6800 liters per minute
Air exhaust temperature	95°F (35°C)—at room temperatures of 77 to 84°F (25 to 29°C) 140°F (50°C)—at room temperatures of 95 to 102°F (35 to 39°C) 158°F (60°C)—maximum exhaust temperature on a fully loaded system during worst-case operating conditions (50°C and 6000 ft altitude) For the NCS4K-4H-QDD-P line card, the air exhaust temperature is • 113°F (35°C)—at room temperatures of 77 to 84°F (25 to 29°C) • 129°F (54°C)—at room temperatures of 95 to 102°F (35 to 39°C) • 158°F (70°C)—maximum exhaust temperature on a fully loaded system during worst-case operating conditions (50°C and 6000 ft altitude) **Note** Air temperature rise is 68°F (20°C) on a fully loaded system with fans running at maximum speed.

Air velocity (at exhaust)	500 ft/min (2.55m/s) under typical conditions 27°C 1000 ft/min (5.1m/s) at maximum speed **Note** Software controls the speed of the fans based on measurements from the chassis thermal sensors.
Sound power level(AC and DC power)	Fan speed 5000 RPM, temperature 80°F (27°C):76.1 dB—modular configuration power
Shock and vibration	Designed and tested to meet the NEBS shock and vibration standards defined in GR-63 Issue 4 2012. NCS4K-4H-QDD-P Line Card meets the NEBS shock and vibration standards defined in GR-63 issue 5 and GR-1089 Issue 8.

[14] Short-term refers to a period of not more than 96 consecutive hours and a total of not more than 15 days in 1 year. This refers to a total of 360 hours in any given year, but no more than 15 occurrences during that 1-year period.

Regulatory, Compliance, and Safety Specifications

For information about the regulatory, compliance, and safety standards to which the Cisco NCS 4016 chassis conforms, see Regulatory Compliance and Safety Information for the Cisco Network Convergence System 4000 Series.



CHAPTER 9

Installation Roadmap for NCS 4009

This chapter lists the steps to install the Cisco NCS 4009 chassis and its components and prepare the system for operation.

- Installation Roadmap, on page 155

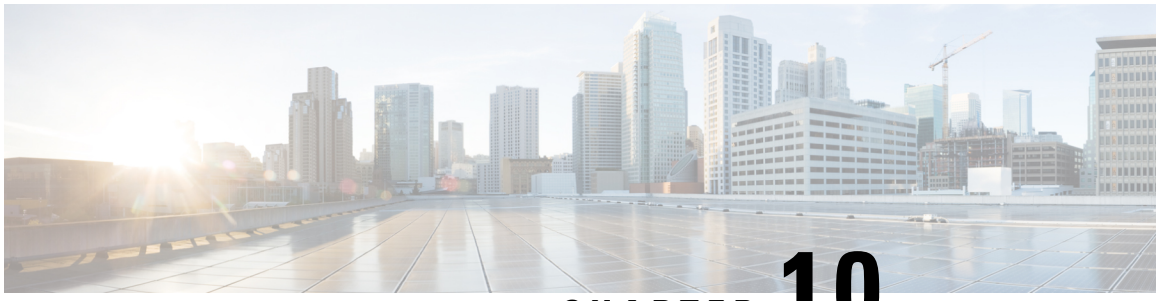
Installation Roadmap

This table lists the steps to install the Cisco NCS 4009 chassis and its components and prepare the system for operation. Use this table as a checklist to ensure that all components are properly installed in the correct order. For information about a step, see the respective book or section of this installation guide.

Table 31: Overview of Installation Steps

Step	See
Verify that the chassis is secured in the rack. **Note** For ease of installation, the cosmetic door should be removed.	Cisco Network Convergence System 4000 Series Unpacking, Moving, and Securing Guide
Ground the chassis.	Installing the Chassis Ground Cable, on page 177
Verify that the power components are installed.	Installing Power Components, on page 171
Verify that the ECU is installed.	
Verify that the fan trays are installed.	Removing the Fan Tray, on page 275 Removing the Fan Tray, on page 275
Connect the AC or DC power cord.	Disconnecting AC or DC Power, on page 195
Power on the chassis.	Powering On the Chassis, on page 198
Install cards and remaining components in the chassis.	Installing Route Processor Cards, Fabric Cards, and Line Cards, on page 199

Step	See
Re-install the cosmetic door.	Replacing the Front Door, on page 269 Replacing the Front Door, on page 269



CHAPTER 10

Chassis Overview

This chapter provides an overview of the Cisco NCS 4009 chassis and components.

- About the Cisco NCS 4009 Chassis, on page 157
- Chassis Components, on page 160
- Chassis Cable Management, on page 164
- Safety Guidelines, on page 164

About the Cisco NCS 4009 Chassis

The following cards are supported in the Cisco NCS 4009 chassis:

- 2 slots for route processor cards (RPs)
- 9 slots for line cards (LCs)
- 4 slots for fabric cards (FCs)

The Cisco NCS 4009 chassis is rack mountable. It is compatible with the following standard rail spacing:

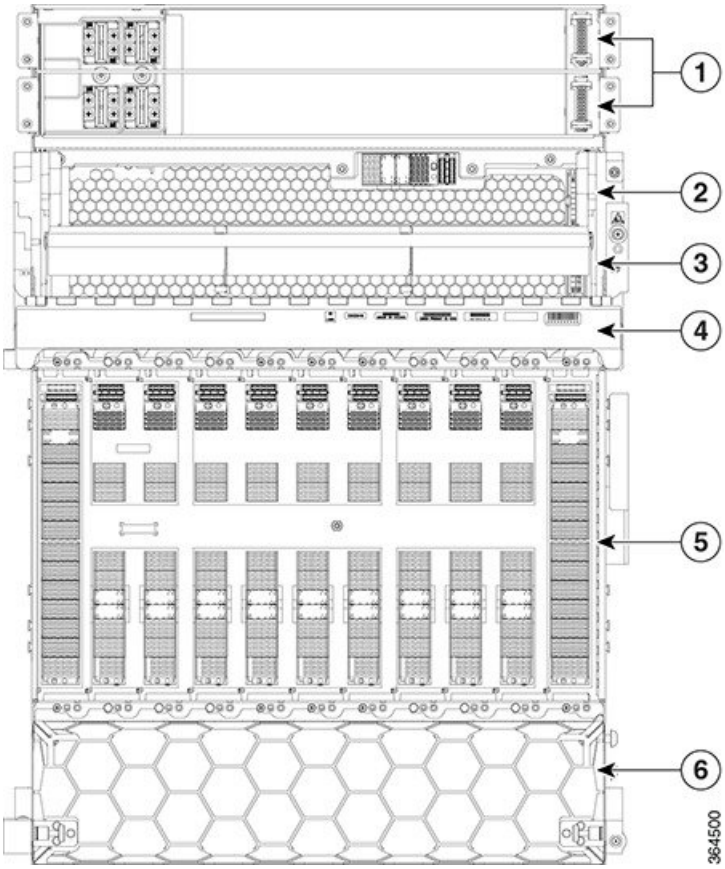
- ANSI 19-inch or 23-inch
- ETSI

Note For the ANSI 19-inch rack, the minimum front opening must be 17.72 inches (450 mm) to allow for chassis insertion.The installation kit includes different brackets for each type of rack.

The Cisco NCS 4009 chassis contains its own power and cooling systems. Power systems are available using AC or DC power. A fan tray is located in the top slot of the chassis.

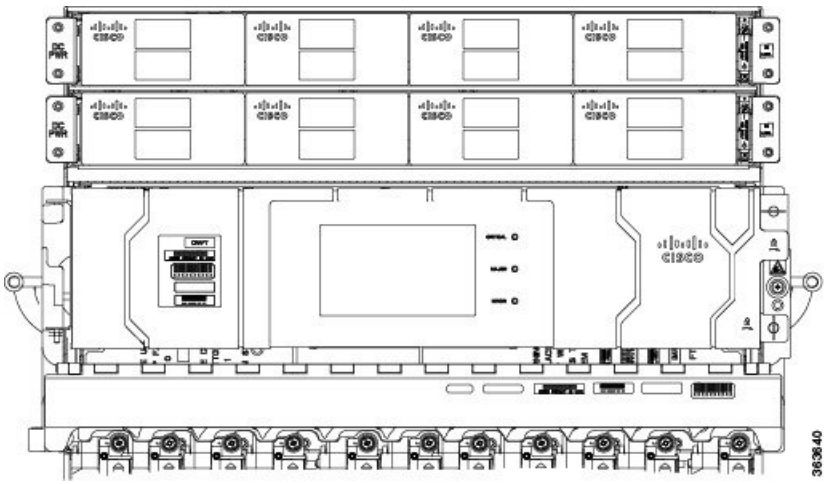
Note The installation of a Cisco NCS 4009 chassis may require space, power, and cooling modifications to a facility. Therefore, you should plan the site well in advance of the scheduled delivery of the chassis system.

Figure 95: Front View of the Cisco NCS 4009 Chassis



1	Power trays (2)	4	Fiber management
2	External Connection Unit (ECU)/Craft Panel/Air Outlet	5	Card cage containing: • 9 line card slots • 2 route processor slots
3	Fan tray	6	4 fabric card slots covered by the inlet air filter

Figure 96: Partial Chassis View with Craft Panel



Note There is an air outlet on the top of chassis below the bottom power tray.

Figure 97: Rear View of the Cisco NCS 4009 AC Chassis

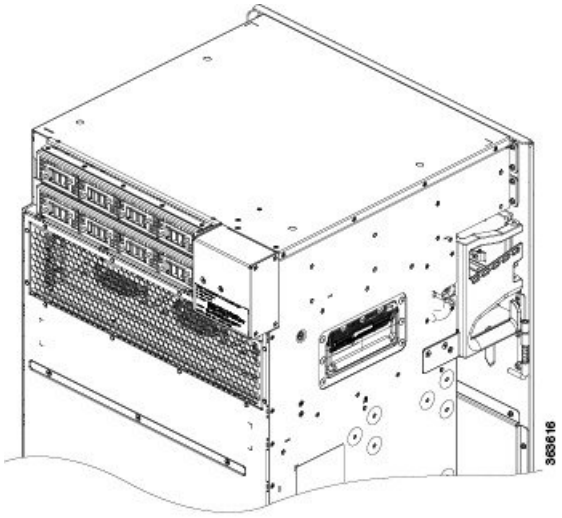


Figure 98: Rear View of the Cisco NCS 4009 DC Chassis

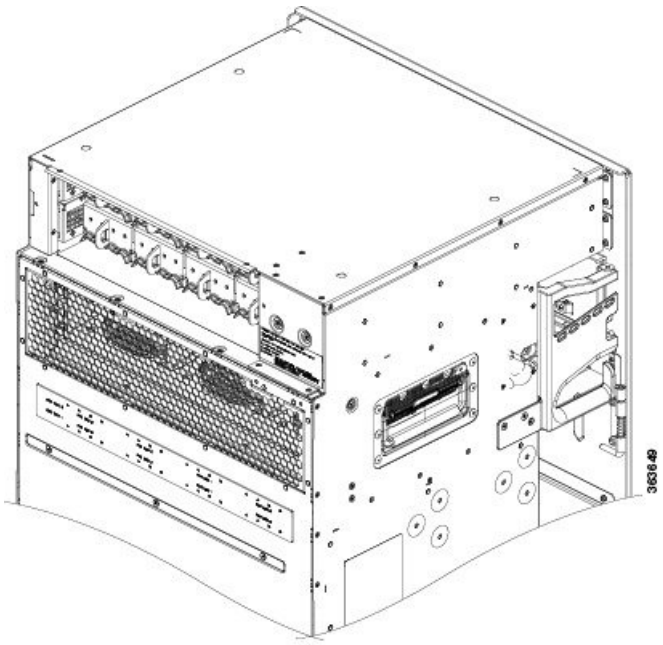
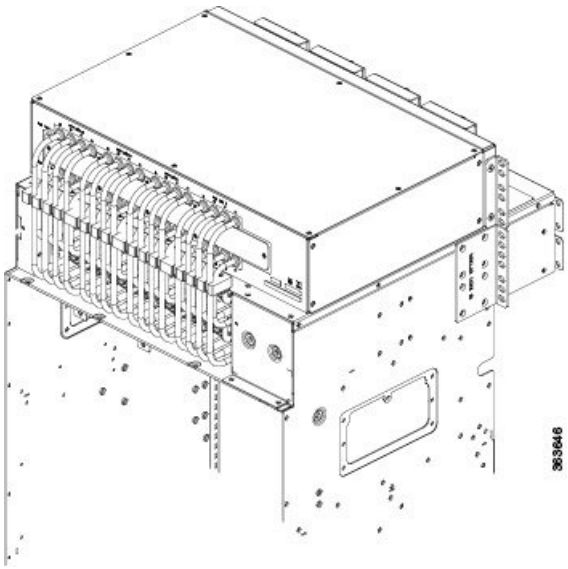


Figure 99: Rear View of the Cisco NCS 4009 DC Chassis with DC Power Front Connection Adapter



Chassis Components

This table lists the main components of the Cisco NCS 4009 chassis.

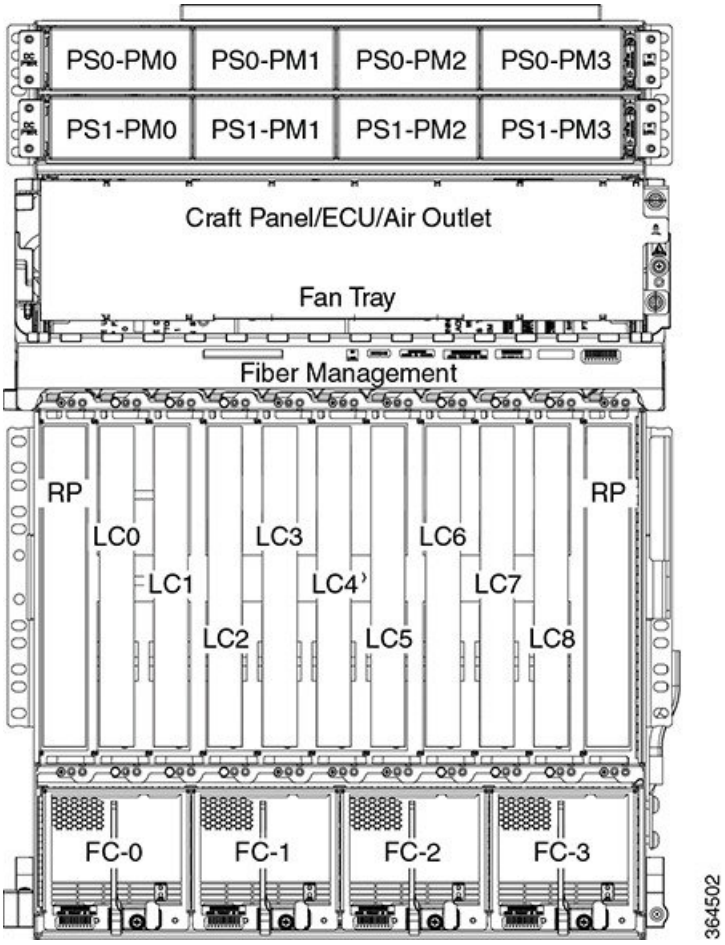
Table 32: Main Components of the Cisco NCS 4009 Chassis

Component	Description
route processor cards (RPs)	Two RP cards (RP0/RP1) are inserted into the front of the chassis. These cards provide the intelligence of the system by functioning as the system controller and providing route processing and chassis management. The RP cards also monitor system alarms and control the system fans. The LEDs on the front panel indicate active alarm conditions.
fabric cards (FCs)	Four FCs are inserted into the bottom of the chassis. The FCs provide the switch fabric for the routing system and performs the cross-connect function of the routing system, connecting every LC to each other. The switch fabric receives ingress user data from one LC slot and performs the switching necessary to route the data to the appropriate egress LC slot.
line cards (LCs)	As many as nine LCs can be inserted into the front of the chassis. These cards provide the physical interfaces and optical connections for the user data.
external connection unit (ECU)	The ECU provides all shelf electrical I/O connectivity to the active and standby route-processor line cards. The ECU is located behind the craft panel.
craft panel	The craft panel can install, configure, monitor, and troubleshoot the Cisco NCS 4009 chassis applications at the node and at the network level. The craft panel is located on top of the ECU.
fan tray	One fan tray is inserted into the front of the chassis behind the craft panel. The fan tray cools the card rack. The fan tray contains six axial fans. The fans pull cooling air through the chassis from front to rear.
air filter	One air filter is located above the slots of the fabric cards.
power trays	Two power trays provide redundant power to the chassis. Both AC and DC power trays are available. Each power tray holds up to four AC or DC power modules. A power tray is a field serviceable unit (FSU). A mixture of AC and DC power is not supported in the chassis. **Note** You must power off the chassis before replacing a power tray.
fiber management tray	A fiber management tray is located on the top of the chassis.

Chassis Slot Numbers

This section identifies the location and slot numbers for the cards and power modules that plug into the chassis.

Figure 100: Cisco NCS 4009 Chassis Slot Numbers



The chassis has the following card slots:

- Nine LC slots (LC0 to LC8)
- Two RP slots (RP0 and RP1)
- Four FC slots (FC0 to FC3)
- One fan tray
- One external connection unit (ECU) located above the fan tray behind the craft panel
- One fiber management tray at the top of the chassis
- One air inlet and one air outlet
- Eight power modules for redundancy
- The upper four AC or DC power trays (0-3) are contained within power shelf 0 (PS0) and the lower four AC or DC power trays (4-7) are contained within power shelf 1 (PS1).

The cards have electrical plugs at the back that plug into electrical connectors on the shelf backplane. When the ejectors are fully closed, the card plugs into the assembly backplane.

The chassis has eight power modules for redundancy:

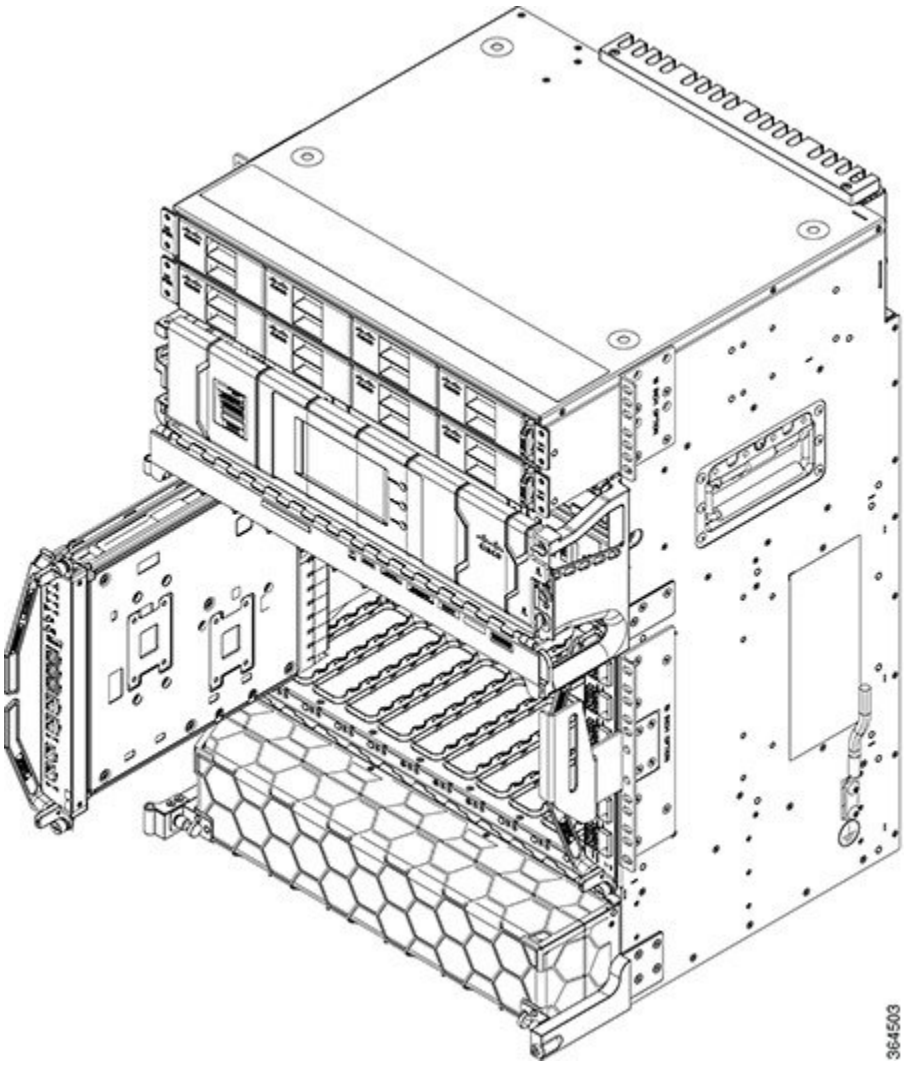
- The upper four power modules are contained within power tray 0 (PS0). They are named as follows: PS0-PM0, PS0-PM1, PS0-PM2, and PS0-PM3.

- The lower four power modules are contained within power tray 1 (PS1). They are named as follows: PS1-PM0, PS1-PM1, PS1-PM2, and PS1-PM3.

Card Slot Requirements

This figure shows card installation for the Cisco NCS 4009 chassis.

Figure 101: Installing Cards in the Cisco NCS 4009 Chassis



Slots FC0 through FC3 are dedicated to fabric cards. Slots RP0 and RP1 are reserved for route processor cards. Slots LC0 to LC8 are reserved for line cards.

Shelf assembly slots have symbols indicating the type of cards that you can install in them. Each Cisco NCS 4009 card has a corresponding symbol. The symbol on the card must match the symbol on the slot.

Table 33: Slot and Card Symbols

Symbol Color/Shape	Definition
Orange/Circle	Slots LC0 through LC8. Only install line cards with a circle symbol on the faceplate.
Pink/Triangle	Slots LC0 through LC8. Only install line cards with circle or a triangle symbol on the faceplate.
Blue/Hexagon	Slots LC0 through LC8. Only install line cards with a blue hexagon symbol on the faceplate.
Purple/Square	Slots RP0 and RP1. Only install route processor cards with a square symbol on the faceplate.
Lilac/Cross	Slots FC0 through FC3. Only install fabric cards with a cross symbol on the faceplate.

Chassis Cable Management

The Cisco NCS 4009 chassis has cable management features for the front side only. The horizontal cable management bracket is located above the card cage.

Safety Guidelines

Before you perform any Cisco NCS 4009 chassis installation procedures, review the safety guidelines in this section to avoid injuring yourself or damaging the equipment.

Note Review the safety warnings listed in Regulatory Compliance and Safety Information for the Cisco Network Convergence System 4000 Series before installing, configuring, or troubleshooting any installed card.

Note Power off the system before removing or installing a power tray.

The following guidelines are for your safety and to protect equipment. The guidelines do not include all hazards. Be alert.

- Never attempt to lift an object that might be too heavy for you to lift by yourself.
- Keep the work area clear and dust-free during and after installation. Do not allow dirt or debris to enter into any laser-based components.
- Keep tools and chassis components away from walk areas.
- Do not wear loose clothing, jewelry, and other items that could get caught in the chassis while working with the chassis and its components.
- Use Cisco equipment in accordance with its specifications and product-usage instructions.

- Do not work alone if potentially hazardous conditions exist.
- Make sure that your installation follows national and local electrical codes: in the United States, National Fire Protection Association (NFPA) 70, United States National Electrical Code; in Canada, Canadian Electrical Code, part I, CSA C22.1; in other countries, International Electrotechnical Commission (IEC) 60364, part 1 through part 7.
- Connect only a DC power source that follows the safety extra-low voltage (SELV) requirements in UL/CSA/IEC/EN 60950-1 and AS/NZS 60590 to the DC input power system.
- Make sure that you have a readily accessible two-poled disconnect device incorporated in the fixed configuration wiring of a DC input power system.
- Make sure that you provide short-circuit (overcurrent) protection as part of the building installation.

Safety Labels

Cisco NCS 4000 Series chassis is classified as Hazard Level 1M as per IEC 60825-1, since it includes optical pluggable devices Laser Class 1 or 1M.

The Class 1M Laser Product label is shown in the following figure.

Figure 102: Class 1M Laser Product Label



This section explains the significance of the safety labels attached to the NCS 4009 chassis. You must understand all warning labels before working on the chassis.

Figure 103: Class 1M Laser Product Label



Safety Precaution for Module Installation and Removal

Ensure to observe the following safety precautions when you are working with the chassis modules.

Warning **Statement 1051—**Laser Radiation

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

Figure 104: Class 1M Laser Product Label



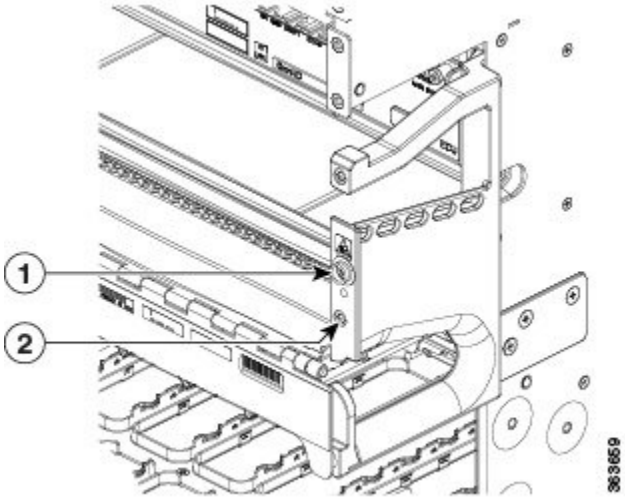
Preventing Electrostatic Discharge

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. We recommend use of an ESD-preventive wrist strap whenever you handle network equipment or one of its components.

Following are guidelines for preventing ESD damage:

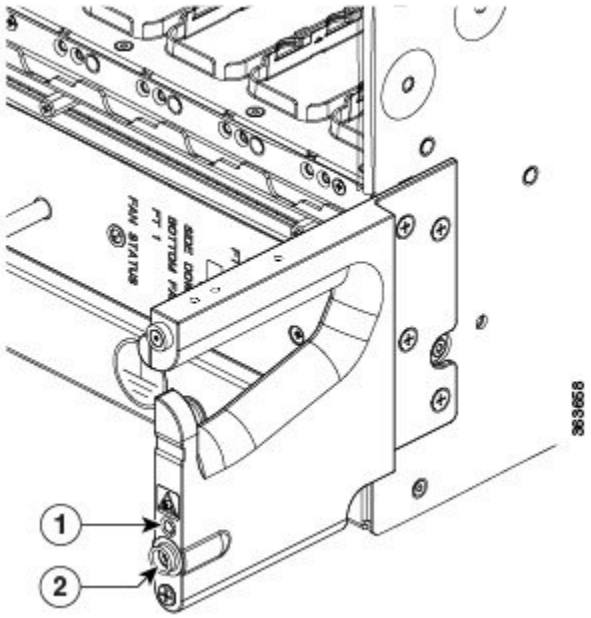
- Always use an ESD-preventive wrist or ankle strap, and ensure that it makes good skin contact. Connect the equipment end of the connection cord to an ESD jack or a bare metal surface on the chassis (ensure the chassis is grounded).
- Handle a card by its ejector levers, when applicable, or its metal carrier only; avoid touching the board or connector pins.
- Place a removed card board side up on an antistatic surface or in a static-shielding bag. If you plan to return the component to the factory, immediately place it in a static-shielding bag.
- Avoid contact between a card and clothing. The wrist strap protects the board from only ESD voltage on the body; ESD voltage on clothing can still cause damage.

Figure 105: ESD Jacks—Top of Chassis



1	Top ETSI connection point	2	Top ANSI jacket point

Figure 106: ESD Jacks—Bottom of Chassis



1	Bottom ANSI jacket point	2	Bottom ETSI connection point

Network Equipment-Building System (NEBS) Statements

NEBS describes the environment of a typical United States Regional Bell Operating Company (RBOC) central office. NEBS is the most common set of safety, spatial, and environmental design standards applied to telecommunications equipment in the United States. It is not a legal or regulatory requirement, but rather an industry requirement.

The following NEBS statements apply to the Cisco NCS 4009:

Note **Statement 7001—**ESD Mitigation

This equipment may be ESD sensitive. Always use an ESD ankle or wrist strap before handling equipment. Connect the equipment end of the ESD strap to an unfinished surface of the equipment chassis or to the ESD jack on the equipment if provided.

Warning **Statement 7003**—Shielded Cable Shielded Cable Requirements for Intrabuilding Lightning Surge

The intrabuilding port(s) of the equipment or subassembly must use shielded intrabuilding cabling/wiring that is grounded at both ends.

The following port(s) are considered intrabuilding ports on this equipment:

ETH0, ETH1, ETH2, 1588, EMS, CRAFT

Warning **Statement 7005**—Intrabuilding Lightning Surge and AC Power Fault

The intrabuilding port(s) of the equipment or subassembly must not be metallically connected to interfaces that connect to the outside plant (OSP) or its wiring. These interfaces are designed for use as intrabuilding interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE) and require isolation from the exposed OSP cabling. The addition of primary protectors is not sufficient protection to connect these interfaces metallically to OSP wiring.

This statement applies to the intrabuilding ports listed below:

ETH0, ETH1, ETH2, 1588, EMS, CRAFT

Note **Statement 7012**—Equipment Interfacing with AC Power Ports

Connect this equipment to AC mains that are provided with a surge protective device (SPD) at the service equipment that complies with NFPA 70, the National Electrical Code (NEC).

Note **Statement 7013—**Equipment Grounding Systems—Common Bonding Network (CBN)

This equipment is suitable for installations using the CBN.



Note **Statement 7015—**Equipment Bonding and Grounding

When you use thread-forming screws to bond equipment to its mounting metalwork, remove any paint and nonconductive coatings and clean the joining surfaces. Apply an antioxidant compound before joining the surfaces between the equipment and mounting metalwork.



Note **Statement 7016**—Battery Return Conductor

The battery return conductor of this equipment shall be treated as (DC-I).



Note **Statement 7018—**System Recover Time

The equipment is designed to boot up in less than 30 minutes provided the neighboring devices are fully operational.



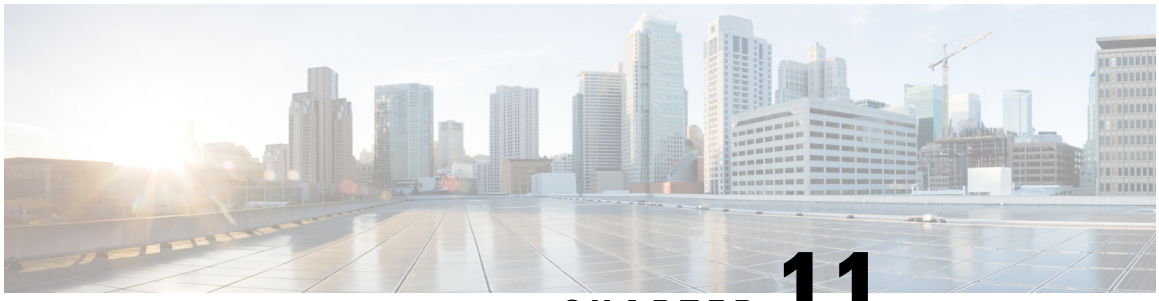
Note **Statement 8015—**Installation Location Network Telecommunications Facilities

This equipment is suitable for installation in network telecommunications facilities.



Note **Statement 8016—**Installation Location Where the National Electric Code (NEC) Applies

This equipment is suitable for installation in locations where the NEC applies.



CHAPTER 11

Installing Power Components

This chapter provides instructions on how to install and reinstall power components in the Cisco NCS 4009 chassis. It also covers connecting and disconnecting power and powering on the chassis.

The Cisco NCS 4009 chassis ships with power trays and power modules installed.

This chapter presents the following topics:

- Power Connection Guidelines, on page 171
- Installing the Chassis Ground Cable, on page 177
- Installing an AC or DC Power Tray, on page 179
- Installing Power Modules, on page 180
- Installing the DC Power Front Connection Adapter, on page 183
- Connecting Power to the Chassis, on page 191
- Disconnecting AC or DC Power, on page 195
- Powering On the Chassis, on page 198

Power Connection Guidelines

You can configure the chassis with either an AC input or DC input power subsystem, so the site power source requirements differ depending on the power subsystem in your chassis. Ensure all power connection wiring conforms to the rules and regulations in the National Electrical Code (NEC) as well as local codes.

Each power tray includes 4 power modules each. The chassis has two power trays for redundancies (each tray can provide the full power to the chassis). The power tray provides electrical connections to the chassis backplane. Each power module can be individually plugged in or out from the tray.

Caution Each Cisco NCS 4009 chassis is powered by only one type of input: AC or DC. A hybrid (AC+DC) power configuration is not supported.

Caution Proper grounding is necessary to avoid damage from lightning and power surges. See the NEBS Supplemental Unit Bonding and Grounding Guidelines, on page 175 for grounding requirements.

AC-Powered Chassis

AC power modules operate in the input range of 180 VAC to 264 VAC, 47 to 63 Hz (nominal input level of 200 to 240 VAC).

Power redundancy requirements vary based on the system configuration (number and type of line cards, etc.). AC-powered systems are 2N protected. A minimum of two power supplies are required for redundant operation.

Each of the AC power inputs requires a separate dedicated branch circuit. Note that the circuit breaker and fuse lockout procedures should follow the rules and regulations in the National Electrical Code (NEC) and any local codes. For a list of the nominal and acceptable value ranges for source AC power, see Power Specifications, on page 290.

The Cisco NCS 4009 chassis supports two types of AC power cords: International and NEMA (USA).

Figure 107: International AC Power Cord (Cisco PID NCS4K-AC-CBL-IEC)

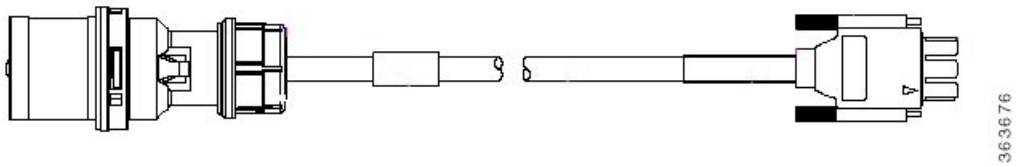
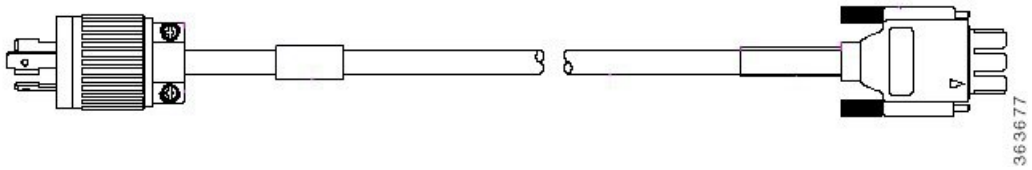


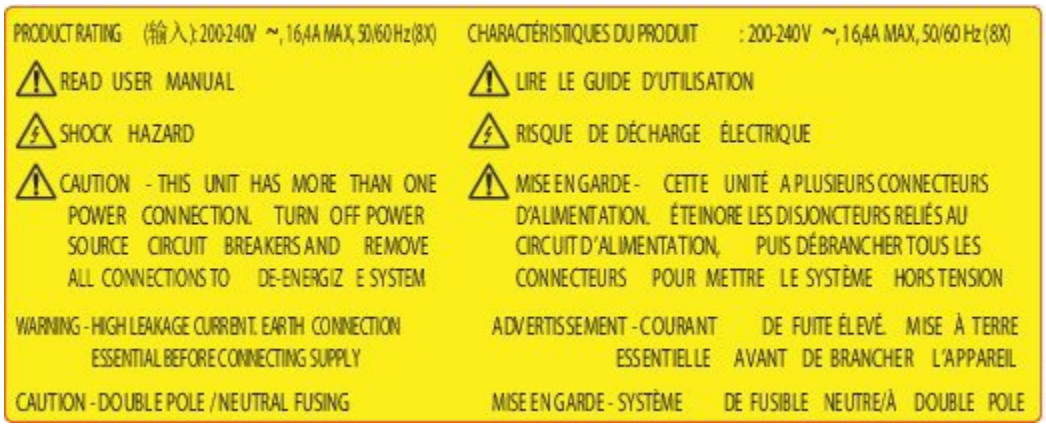
Figure 108: NEMA AC Power Cord (Cisco PID NCS4K-AC-CBL-NEMA)



Note Before connecting AC input power cords to the power system, make sure that the power cords are not energized.

The rating label is shown in the figure below.

Figure 109: Rating Label for NCS 4009 AC Chassis



DC-Powered Chassis

Use a 6 AWG wire rated 75°C minimum, for DC power modules connection. The system accepts a nominal input voltage of -48 VDC or -60VDC, with an operational tolerance range of -40.5 to -72 VDC. One dedicated, commensurately rated DC power source is required for each power module connection. Each power feed shall be provided with a double pole breaker, rated not more than 60A, with medium delay.

Note Follow the power and sizing requirements for your site.

Note The Short Circuit protection Breaker shall not be rated more than 60A.

Power redundancy requirements vary based on the system configuration (number and type of line cards, etc.). DC-powered systems are N+1 protected.

Power connections to the power tray for each DC power module requires four cables: two source cables and two return cables.

For DC power cables, we recommend 6 AWG high-strand-count copper wire cables, rated 75°C minimum. The size of the cables depends on your chassis location from the source power. Follow your local practices for determining cable size. DC power cables are not available from Cisco, but they are available from any commercial cable vendor.

You must terminate DC power cables using cable lugs at the power tray end. The appropriate lugs are provided in the installation kit with 6 AWG cable. Use Panduit part number LCD4-14AF-L or the equivalent.

Warning **Hazardous voltage or energy may be present on power terminals. Always replace cover when terminals are not in service. Be sure uninsulated conductors are not accessible when cover is in place.** Statement 1086

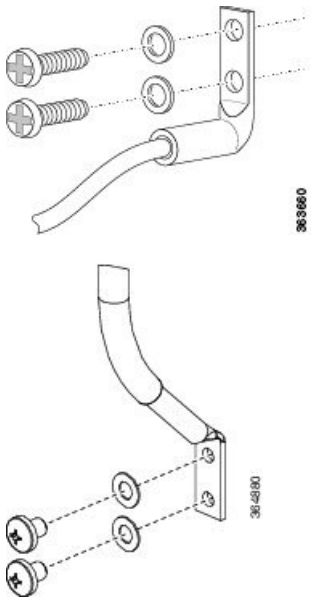
Warning **Only trained and qualified personnel should be allowed to install, replace, or service this equipment.** Statement 1030

Note Before connecting DC power cables to the power system, make sure that the input power cords are not energized.

Note Ensure that there is a readily accessible disconnect device incorporated in the building's installation wiring.

Note Circuit breaker and fuse lockout procedures should follow the rules and regulations in the National Electrical Code (NEC) and any local codes.

Figure 110: Typical DC Power Cable Lugs



Warning To avoid shock hazard, be sure to apply shrink wrap tubing around the wire entry area of the lug.

The color coding of source DC power cable leads depends on the color coding of the site DC power source. Because there is no color code standard for source DC wiring, be sure that power source cables are connected to the power modules using the proper positive (+) and negative (–) polarity:

- In some cases, the source DC cable leads might have a positive (+) or a negative (–) label. This is a relatively safe indication of the polarity, *but you must verify the polarity by measuring the voltage between the DC cable leads* . Be sure that the positive (+) and negative (–) cable leads match the positive (+) and negative (–) labels on the power module when making the measurement.
- A green (or green and yellow) cable typically indicates that it is a ground cable.

Caution DC power modules contain reverse voltage protection circuitry to prevent damage to the power module if it detects a reverse polarity condition. No damage should occur from reverse polarity, but you should correct a reverse polarity condition immediately.

For a list of the nominal and acceptable value ranges for source DC power, see Chassis Specifications, on page 289

The rating label is shown in the figure below.

Figure 111: Rating Label for NCS 4009 DC Chassis

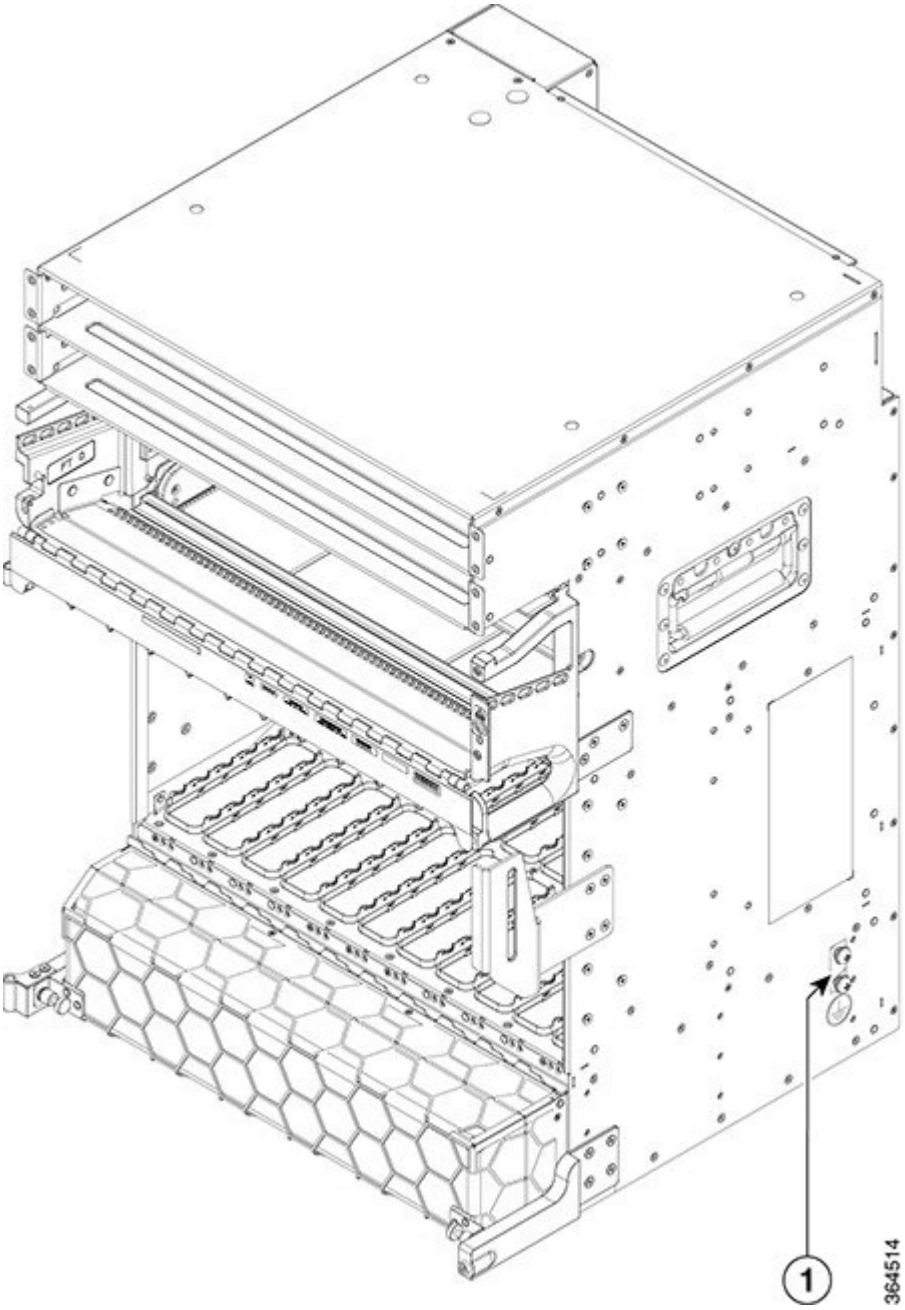


NEBS Supplemental Unit Bonding and Grounding Guidelines

You must connect the central office ground system or interior equipment grounding system permanently to the supplemental bonding and grounding connection on the side of the chassis to meet Network Equipment Building System (NEBS) requirements as well as safety compliance requirements. This grounding point is referred to as the NEBS bonding and grounding point.

Note These bonding and grounding connections satisfy the Telcordia NEBS requirements for supplemental bonding and grounding connections. If you are not installing the chassis in a NEBS environment, you can choose to bypass these guidelines and rely on the safety earth ground connections to the AC power modules.

Figure 112: NEBS Bonding and Grounding Point on the Cisco NCS 4009 Chassis



1	NEBS grounding point on right of chassis

To ensure a satisfactory supplemental ground connection to the chassis, use the following parts:

- One grounding lug, which has two M6 bolt holes with 0.625- to 0.75-inch (15.86- to 19.05-mm) spacing between them, and a wire receptacle able to accept a 2-4-AWG or larger, multistrand copper wire. This lug is similar to those used for the DC input power supply leads (see Figure 110: Typical DC Power Cable Lugs, on page 174).

- Two M6 round-head screws and two locking washers (nickel-plated brass is ideal).
- One grounding wire. Although we recommend at least 2-4-AWG multistrand copper wire, the wire diameter and length depend on your chassis location and site environment.

Note These parts are not available from Cisco (with the exception of the grounding lug), but they are available from commercial vendors.

Installing the Chassis Ground Cable

This section describes how to install a ground cable to the NEBS bonding and grounding point on the side of the Cisco NCS 4009 chassis.

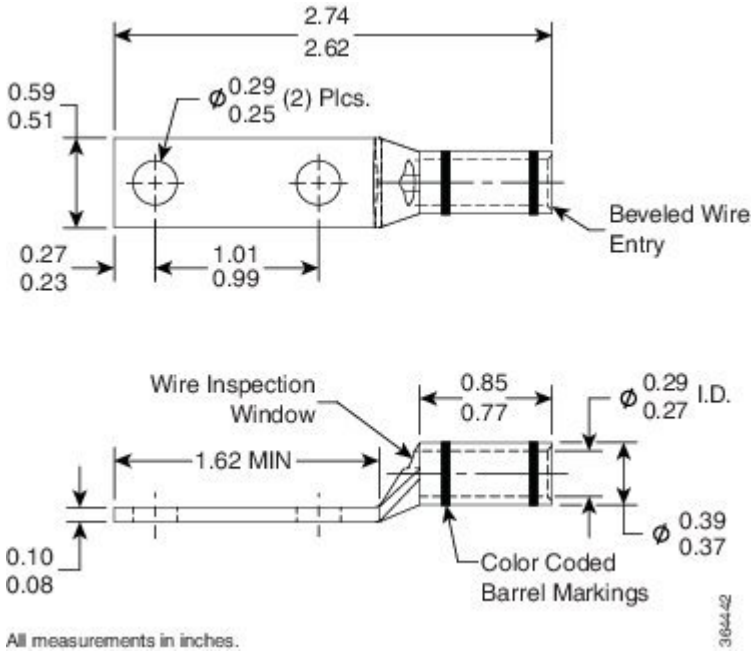
Required Tools and Equipment

- Ground lug and screws (provided in chassis accessory kit)
- Ground cable
- Crimping tool and lug specific die
- 3/8-inch drive socket wrench
- 3/8-inch drive torque wrench rated to include 35 in-lb (3.95 N-m).

To ensure a satisfactory ground connection, we recommend 2-4 AWG multistrand copper ground cable. This cable is not available from Cisco; it is available from any commercial cable vendor such as Panduit. The cable should be sized according to local and national installation requirements.

Note The DC return of this system should remain isolated from the system frame and chassis (DC-I: Isolated DC Return).

Figure 113: Straight Barrel Grounding Lug



Steps

To attach the ground cable to the chassis, perform the following steps:

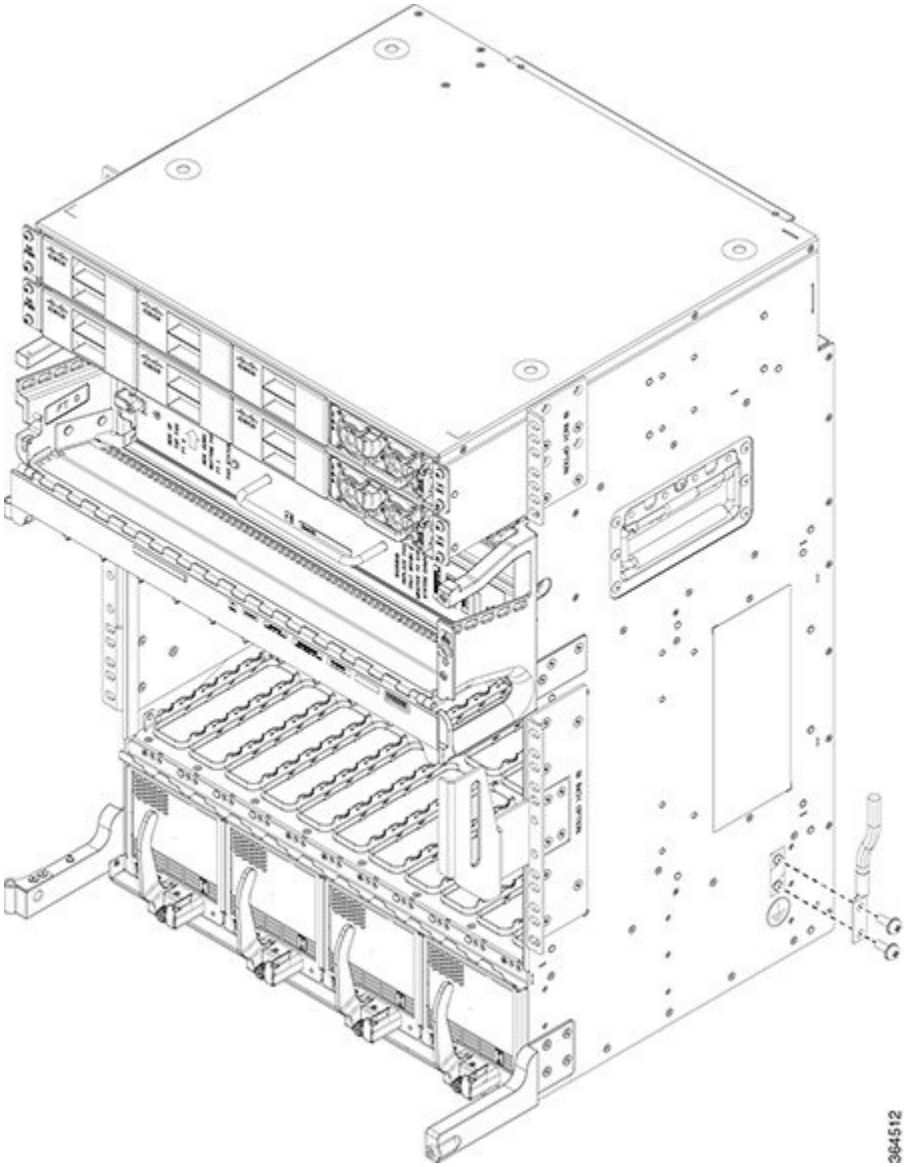
Procedure

Step 1 Use the crimping tool mandated by the lug manufacturer to crimp the lug to the ground cable.

Step 2 Use the socket wrench to attach the lug and ground cable to the grounding point.

Note
The two grounding point screws are required for proper bonding and grounding of the chassis and should not be removed.

Figure 114: Attaching to Side NEBS Bonding and Grounding Point



Step 3 Use the torque wrench to tighten the bolts to a torque of 35 in-lb (3.95 N-m).

Step 4 Connect the other end of the ground cable to a grounding point at your site, according to site requirements.

Installing an AC or DC Power Tray

The power tray is preinstalled on the Cisco NCS 4009 chassis. The following procedure describes how to install an AC or DC power tray in the chassis.

Required Tools and Equipment

- 6-inch, number-1 Phillips screwdriver
- Cisco NCS 4009 power trays (NCS4K-AC-PEM or NCS4K-DC-PEM)

Steps

Follow these steps to install an AC or DC power tray into the chassis:

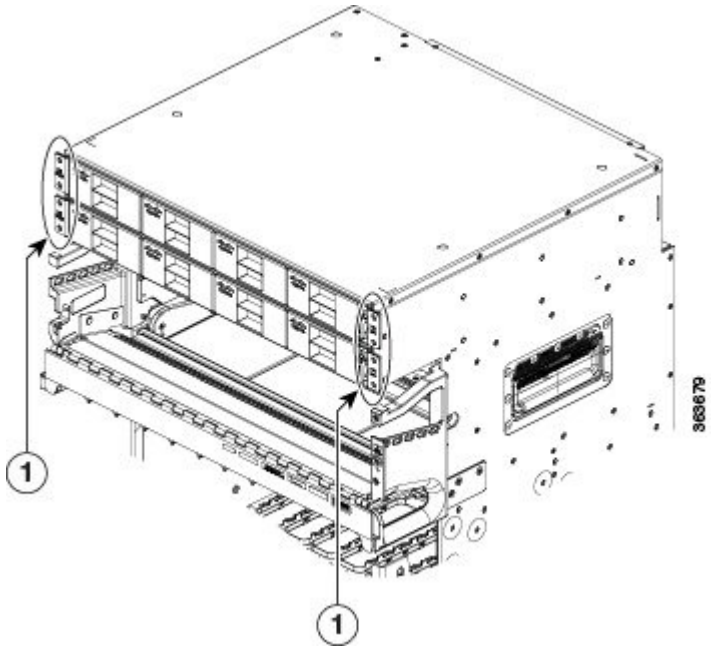
Procedure

Step 1 Slide the power tray into the bay until it engages its mating connector on the chassis.

Step 2 Fully seat the power tray into its mating connector and seat the power tray mounting ears against the chassis mounting ears.

Step 3 Install and tighten two screws (for each power tray) through the power tray mounting ears on each side into the screw holes in the chassis mounting ears to secure the tray to the chassis.

Figure 115: Screws on Power Tray Mounting Ears



1	Screws on the power tray mounting ears

Installing Power Modules

The following procedures describe how to install power modules into the chassis. The installation procedure is the same for both AC or DC modules.

Caution Never force a power module into the power tray if you feel any resistance! The power modules are keyed to prevent AC modules from being plugged into a DC power tray or a DC module into an AC power tray. Forcing a module into the incorrect tray can cause damage to the module and the tray.

Each power module has three status LEDs located on the front left side of its faceplate.

Table 34: Power Module LED Status Indicator Lights, on page 181 describes the LED status indicator lights of the power module.

Table 34: Power Module LED Status Indicator Lights

LED Name	Color	Meaning
Input OK	Green	• On: The input voltage is present and within regulation range. • Blinking: The input voltage is present but out of regulation range. • Off: The input voltage is not present.
Output OK	Green	• On: The output voltage is on. • Blinking: The power module is in a power limit or over current condition. • Off: The output voltage is off.
Fault	Red	• On: An internal fault is detected within the power module. • Off: No internal faults detected on the power module.

Installing AC or DC Power Modules

The following section describes how to install AC or DC power modules.

Required Tools and Equipment

- Cisco NCS 4009 power modules (NCS4K-AC-PSU=)
- Cisco NCS 4009 power modules (NCS4K-DC-PSU=)

Steps

Caution To prevent damage to the power tray backplane connector, do not use excessive force when inserting the power module into the power tray.

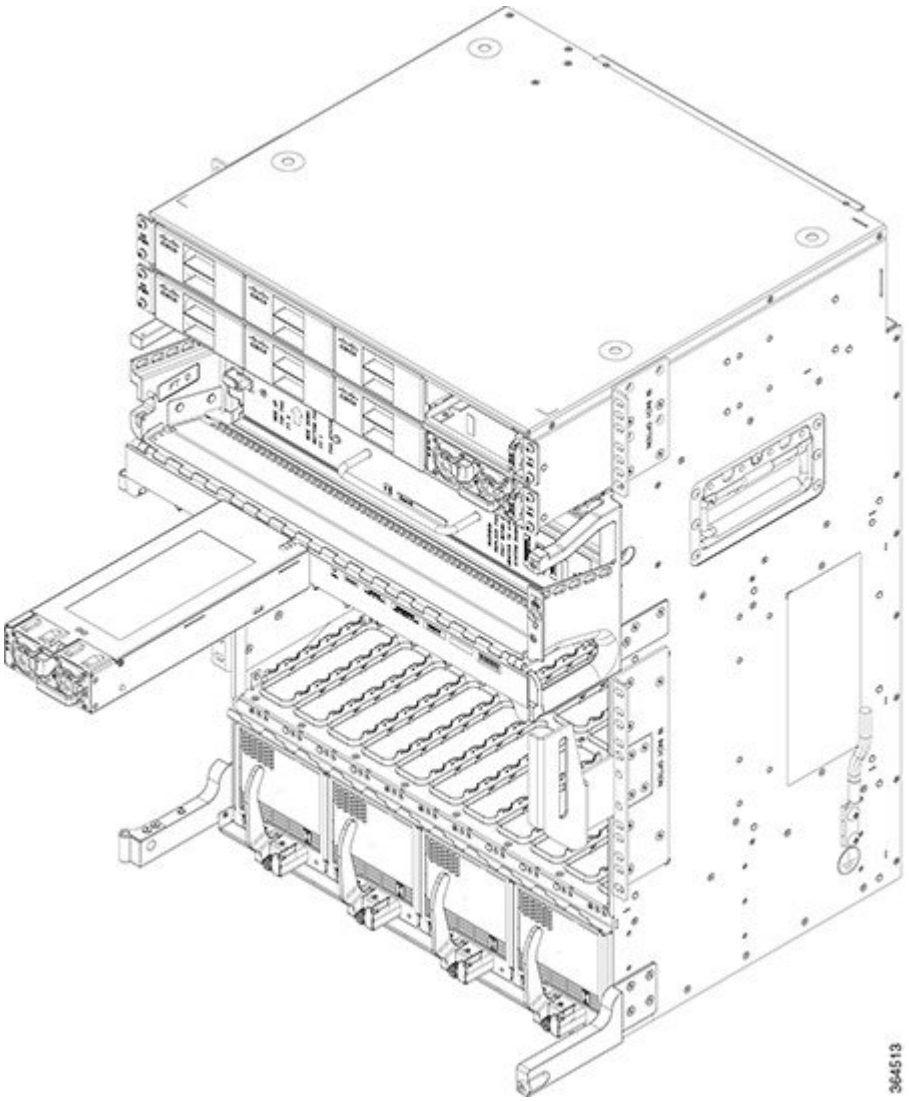
Follow these steps to install the AC or DC power modules into the chassis:

Procedure

Step 1 Remove the filler caps from the slots where you want to install the power modules.

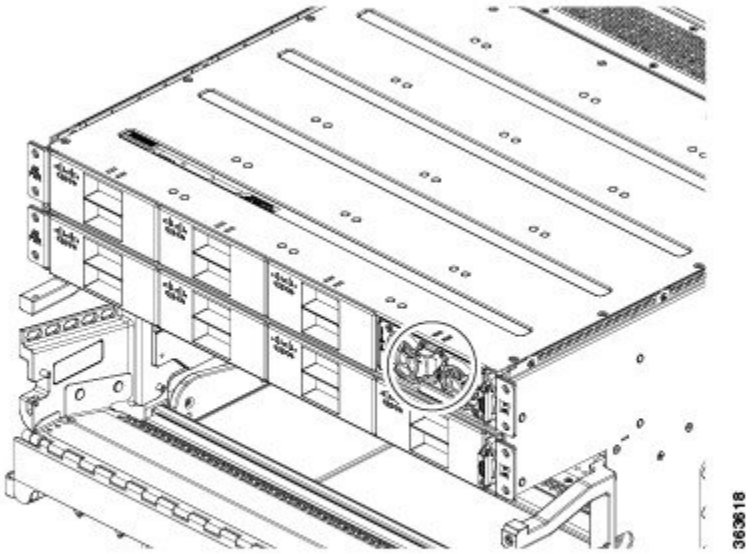
Step 2 Using two hands to support the power module, slide it into the power tray.

Figure 116: Example of Inserting the AC Power Module



Step 3 Secure the power module into the power tray using the snap hook.

Figure 117: Example of Securing the Snap Hook (AC)

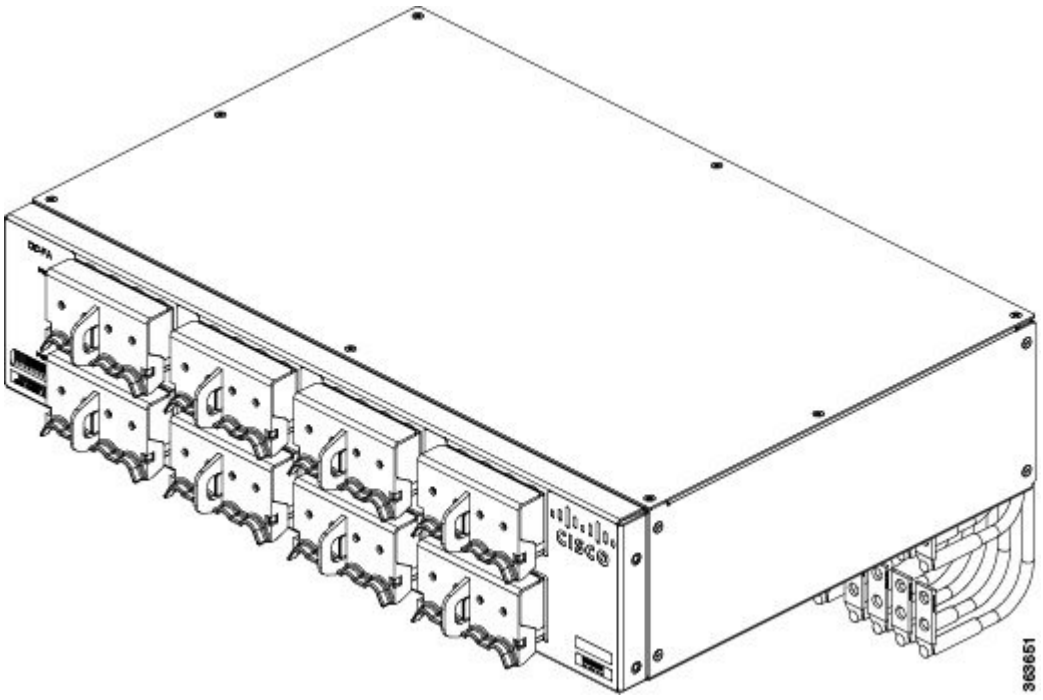


Step 4 Repeat these steps for the other AC or DC power modules.

Installing the DC Power Front Connection Adapter

If you have limited access to the back of the chassis, or limited space behind the chassis, you can use the DC Power Front Connection Adapter. This DC adapter moves the DC power connections from the back of the chassis to the front of the chassis. This may be desirable in ETSI rack installations.

Figure 118: DC Power Front Connection Adapter



Prerequisites

- If the rear to front power adapter is going to be used, the sub assembly needs to be attached first to the chassis and then both units installed in a rack or cabinet.
- The Cisco NCS 4009 chassis should be completely removed from the packaging and installed in the rack or cabinet.

Required Tools and Equipment

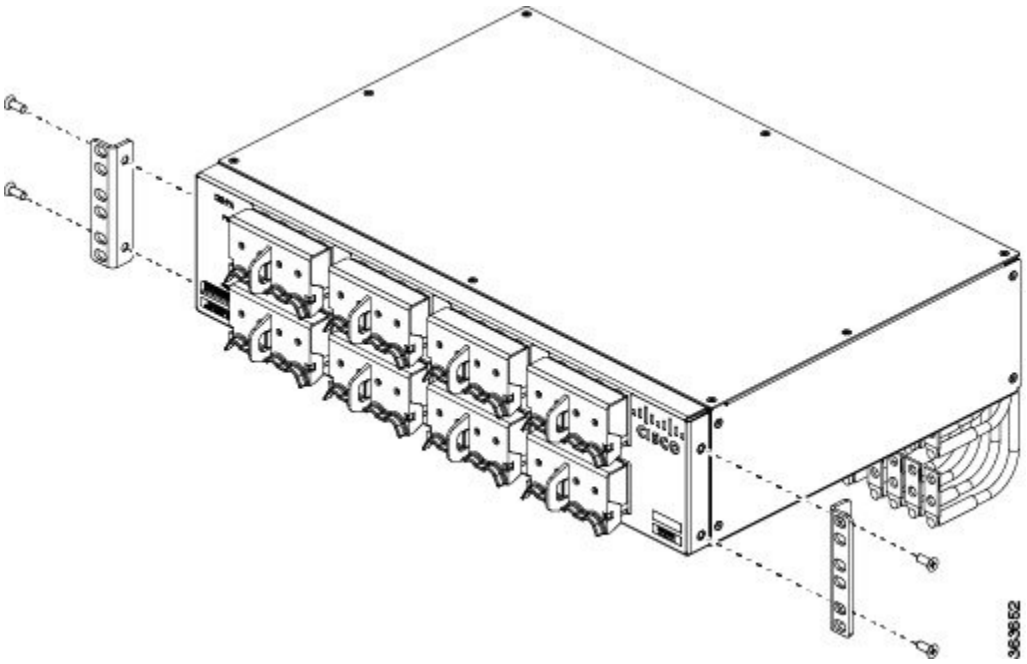
- 6-inch, number-1 Phillips screwdriver
- One DC Power Front Connection Adapter (NCS4K-DC-FA, includes brackets)
- 3/8 Ratchet Wrench, 7/16 Socket, and a Torque Wrench

Steps

Procedure

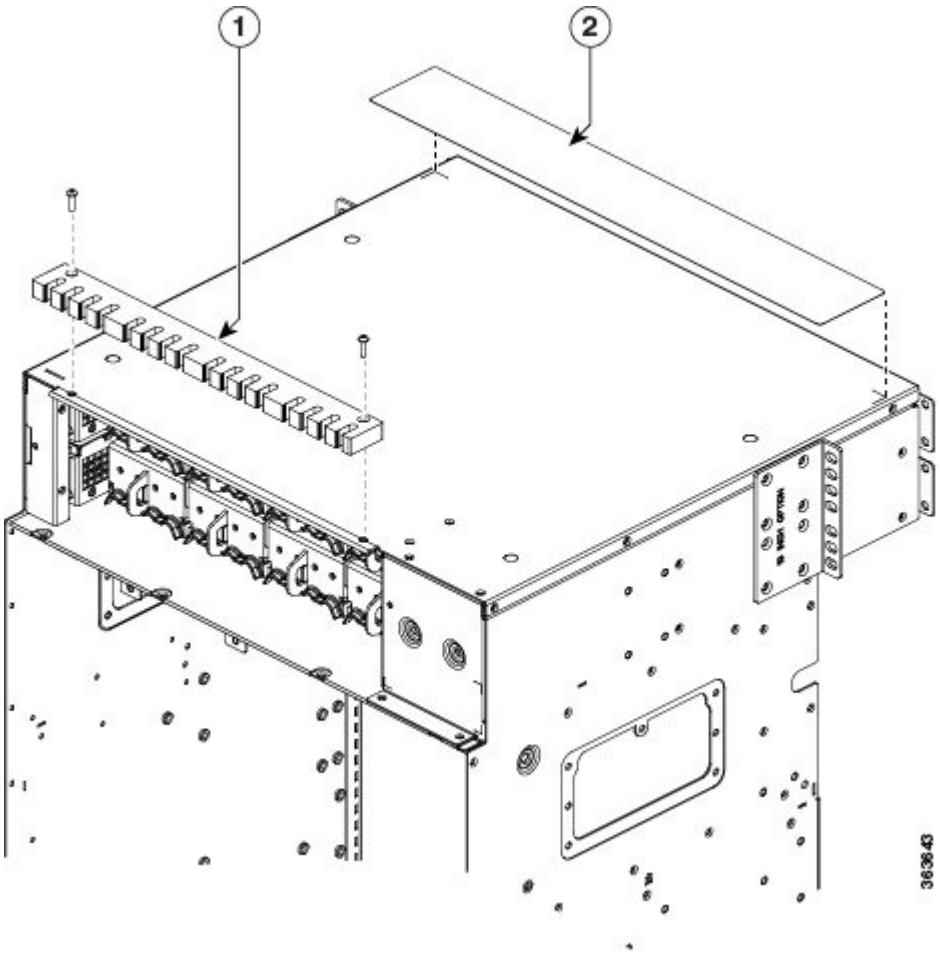
Step 1 Install the DC-FA (front access) brackets on the sides toward the front of the DC adapter. There are three different types of bracket depending upon rack type: ANSI 19 inch or 23 inch and ETSI. Choose the correct type for your specific rack.

Figure 119: Installing the DC-FA Brackets



Step 2 Attach the rear cable guide on top of the chassis toward the rear, and attach the insulator sheet on top of the chassis toward the front.

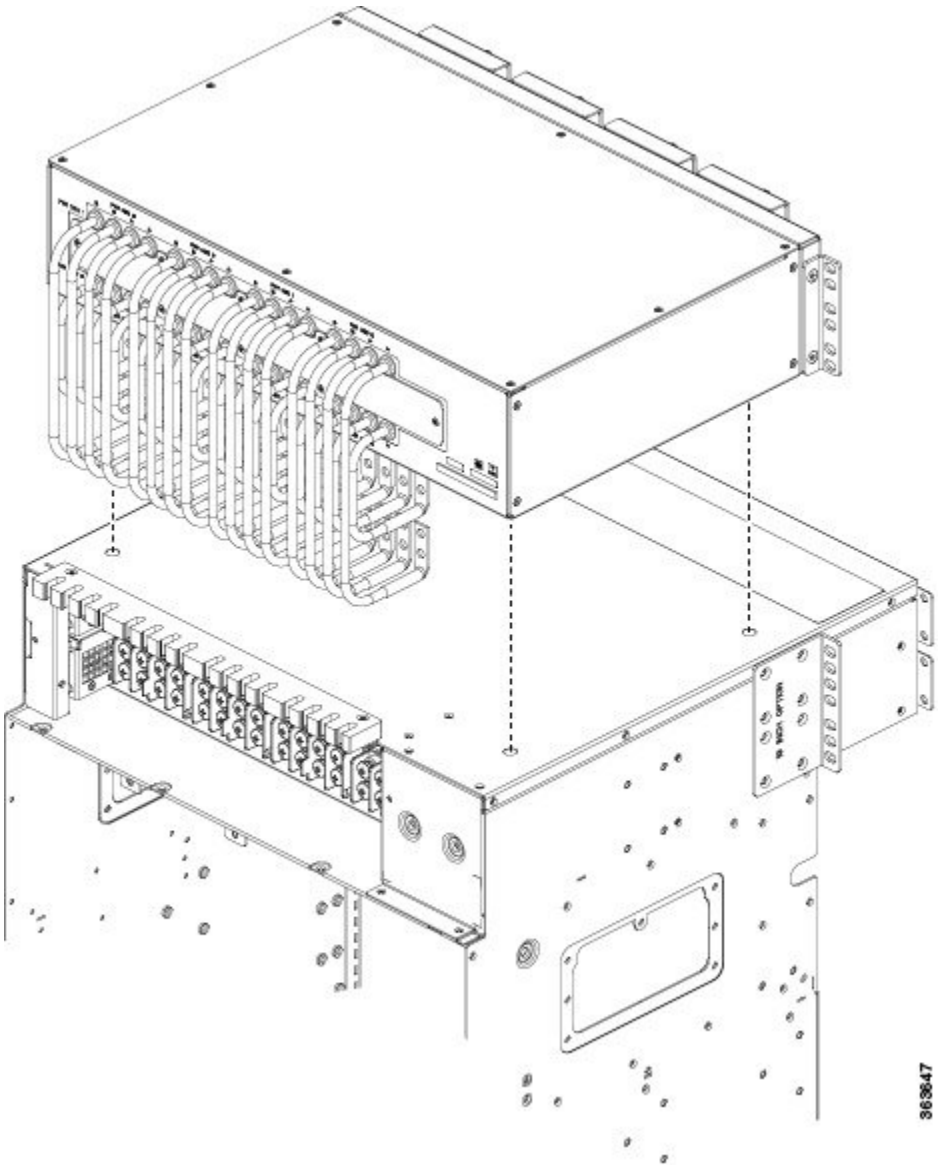
Figure 120: Attaching Rear Cable Guide and Insulator Sheet



1	Rear cable guide	2	Insulator sheet

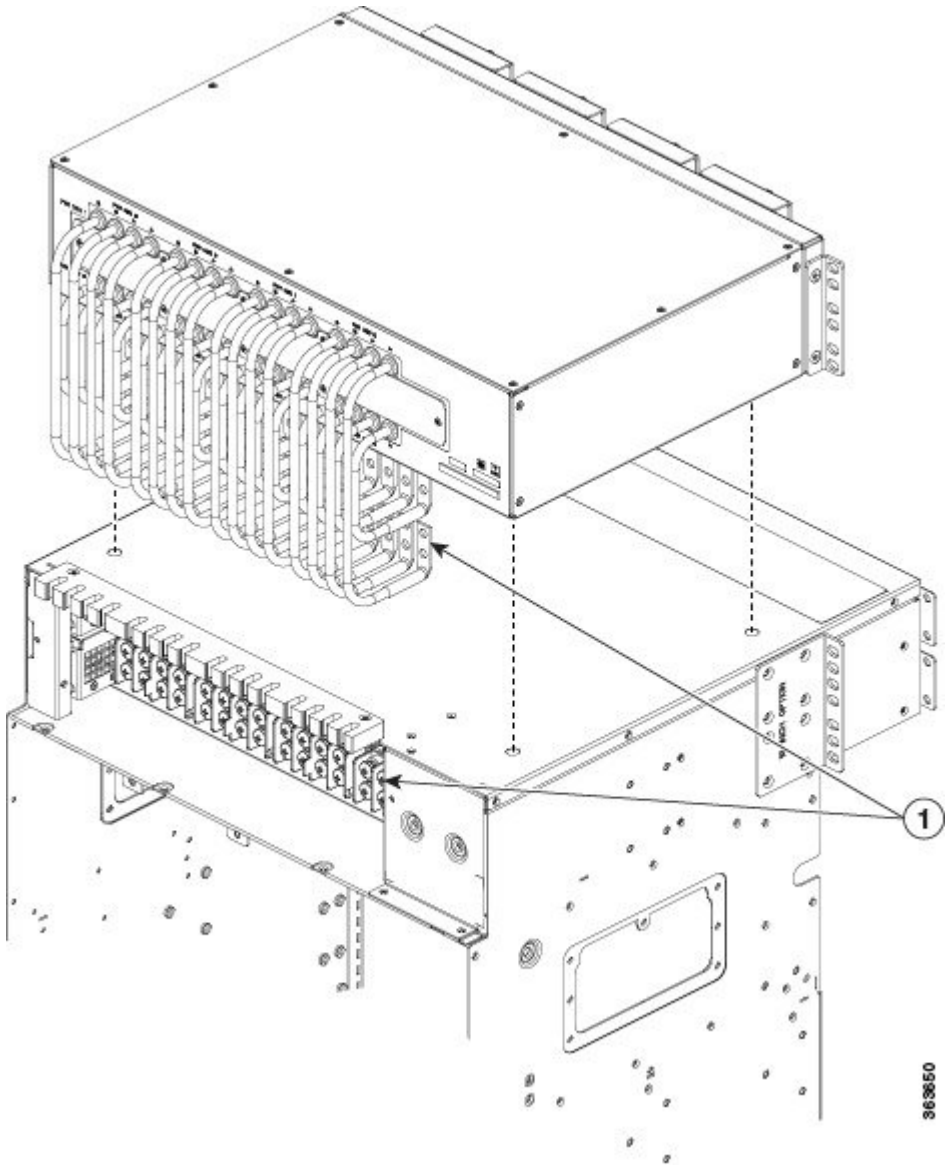
Step 3 Place the DC adapter on top of the chassis using the embossed references on the top chassis cover.

Figure 121: Placing DC Adapter on Top of Chassis



Step 4 Connect the power cables on the rear of the of DC adapter to the chassis terminal blocks. Follow the connections scheme as shown on the labels available on the DC adapter and the chassis.

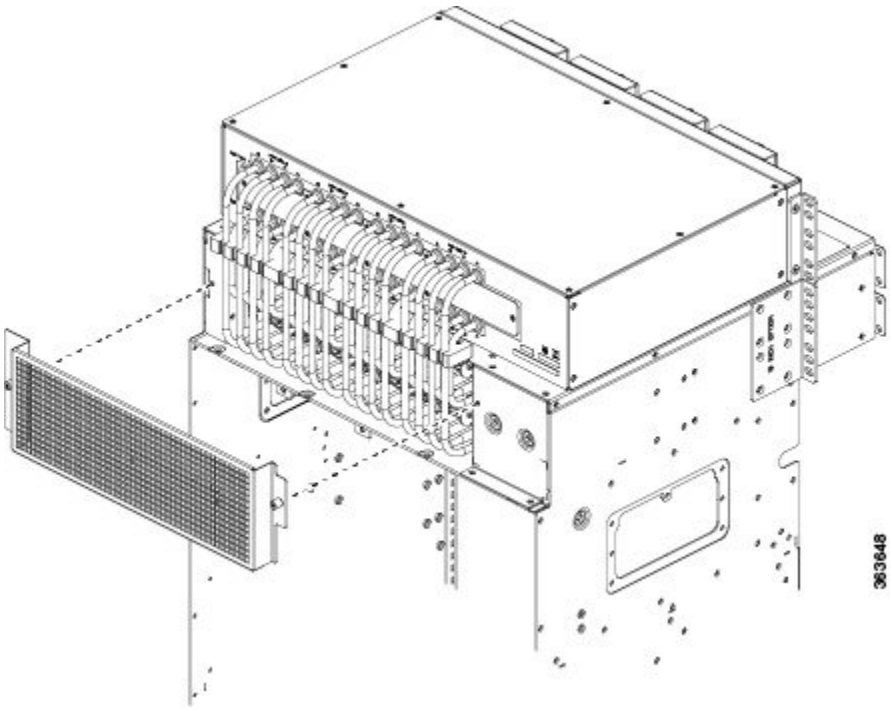
Figure 122: Connecting Power Cables



1	Connect power cables to chassis terminal blocks

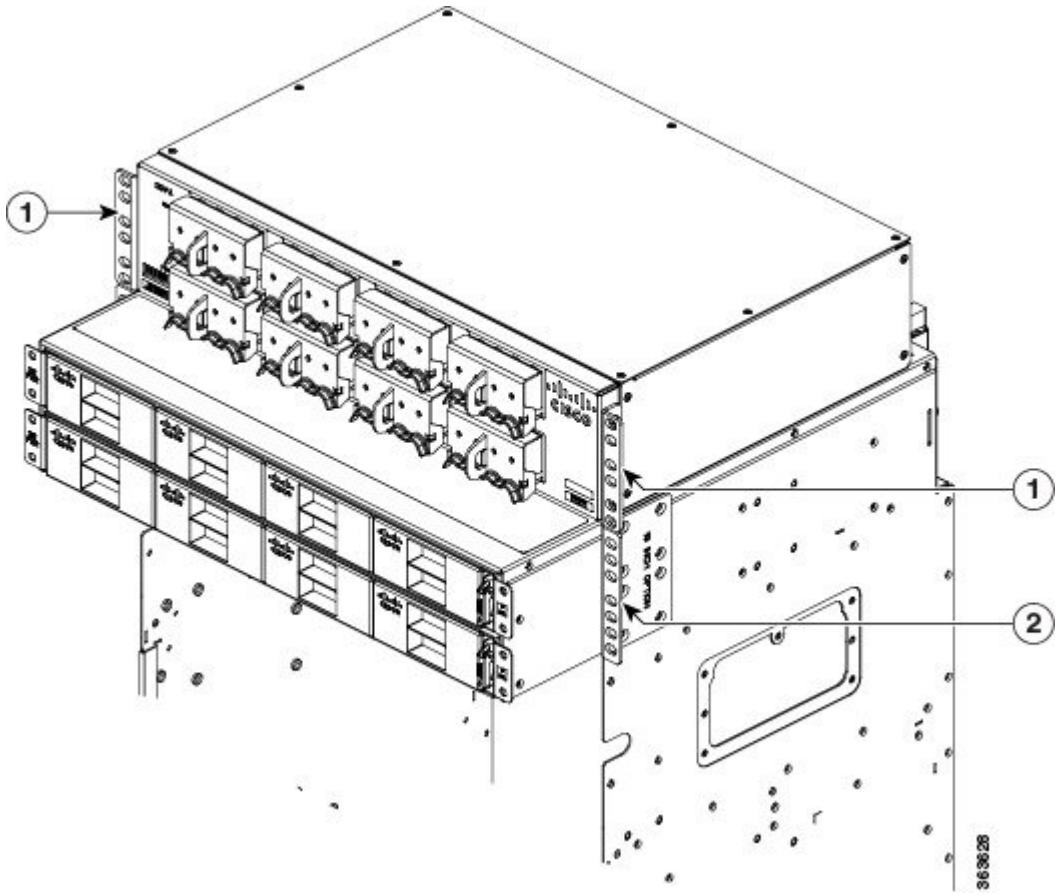
Step 5 Install the rear cover to protect the cables.

Figure 123: Installing the Rear Cover



Step 6 Install the chassis and DC adapter subassembly in the rack or cabinet. Attach the chassis brackets and DC brackets to the rack.

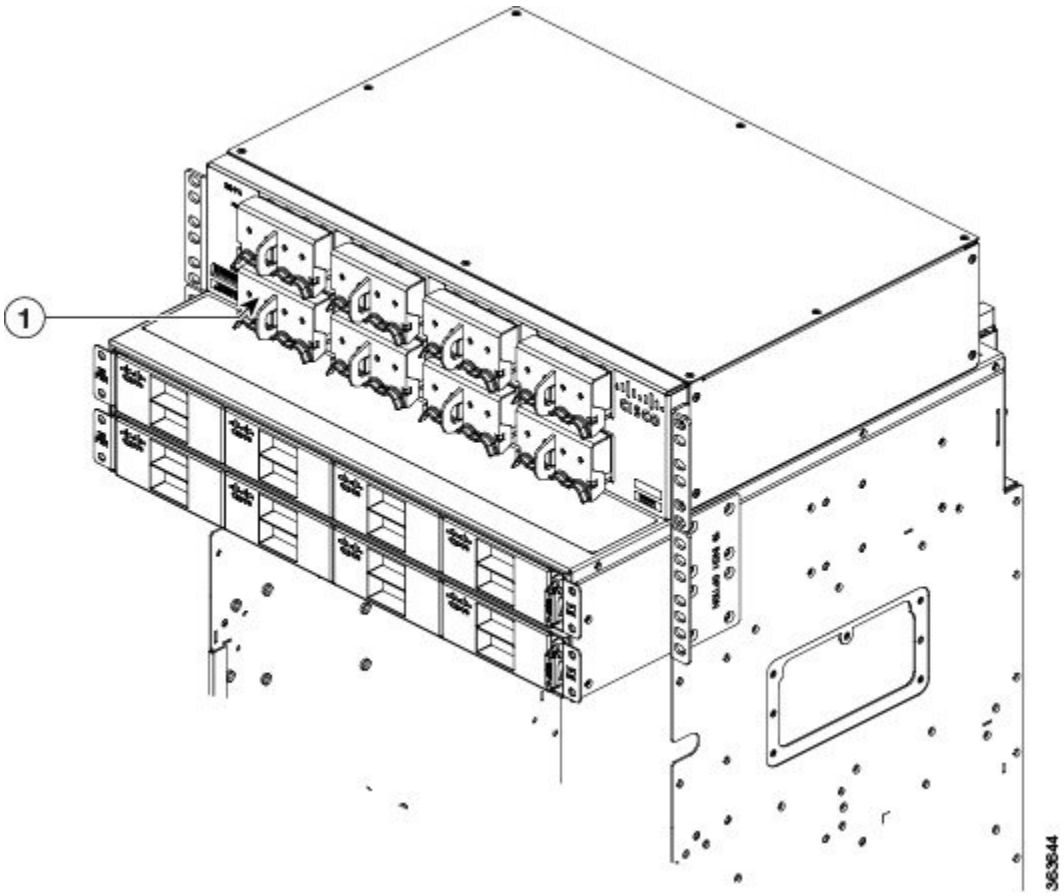
Figure 124: Chassis Brackets and DC Adapter Brackets



1	DC adapter brackets	2	Chassis brackets (one on other side is not visible)

Step 7 Connect the power cables coming from batteries or from the PDU unit to the DC adapter terminal blocks on the front side of the unit . See the Connecting Power to the Chassis, on page 191.

Figure 125: Connecting Power Cables to Terminal Blocks



1	Terminal Blocks

Connecting Power to the Chassis

Use one of the following procedures to connect power to your chassis:

Connecting Power to an AC-Powered Chassis

Follow these steps to connect the AC power cords to the chassis.

Note Connect each AC power supply to a dedicated power source (branch circuit). Each AC input power supply operates at a nominal input level of 200 to 240 VAC.

Procedure

Step 1 Check that the power switch is set to the OFF (0) position. The power switch is on the right of the power tray.

Step 2 Check that the circuit breaker assigned to the AC power source you are connecting is set to off.

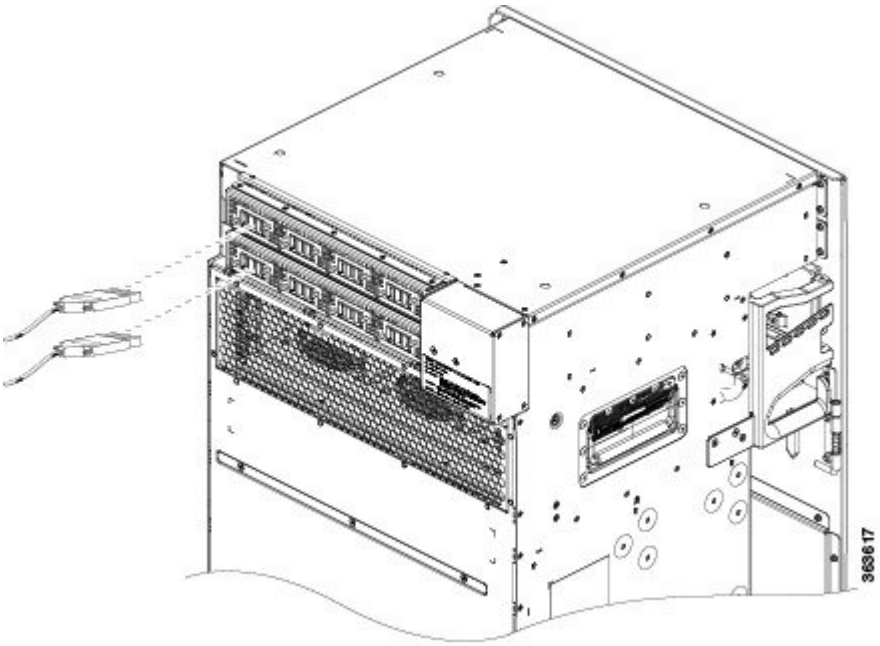
Step 3 Verify that the permanent ground connection (central office grounding system) has been installed to the NEBS grounding location on the chassis.

Warning
To ensure that power remains off while you are performing this procedure, lock-out/tag-out the circuit breaker switch in the OFF (0) position until you are ready to turn it on.

Step 4 Plug the AC power cord into the receptacle at the rear of the AC power tray.

Step 5 Tighten the screw that clamps the AC power cord plug in place.

Figure 126: Typical AC Power Connections to an AC Power Tray



Step 6 Plug the other end of the AC power cord into the AC source receptacle.

Step 7 Proceed to the Powering On the Chassis, on page 198.

Connecting Power to a DC-Powered Chassis

This section contains the procedures to connect the DC source power cables to a DC-powered chassis.

The color coding of source DC power cable leads depends on the color coding of the site DC power source. Because there is no color code standard for source DC wiring, you must be sure that power source cables are connected to the power module with the proper positive (+) and negative (–) polarity:

- In some cases, the source DC cable leads might have a positive (+) or a negative (–) label. This is a relatively safe indication of the polarity, *but you must verify the polarity by measuring the voltage between the DC cable leads* . Be sure that the positive (+) and negative (–) cable leads match the positive (+) and negative (–) labels on the power module when making the measurement.
- Green (or green and yellow) cable typically indicates that it is a ground cable.



Caution DC power modules contain circuitry to trip the breaker on the power module if the power module detects a reverse polarity condition. No damage should occur from reverse polarity, but you should correct a reverse-polarity condition immediately.



Warning To ensure that power remains off while you are performing this procedure, lock-out/tag-out the DC circuit breaker switch in the OFF (0) position until you are ready to turn it on.

Follow these steps to connect the DC source power cables to a DC power tray:

Procedure

Step 1 Verify that the power switch is set to the OFF (0) position. The power switch is on the right of the power tray.

Step 2 Remove the clear plastic safety covers that fit over the DC power connection terminal studs.

Step 3 Verify the following resistance values on both power shelves:

- The resistance between the positive and negative power terminal studs of each input must be greater than 90 KOhm.
- The resistance between each positive terminal stud and bare metal surface on the power shelf must be greater that 10 MOhms.
- The resistance between each negative terminal stud and bare metal surface on the power shelf must be greater that 10 MOhms.

Note
Typical hand held Ohm meters will not measure 10 MOhms; instead they will auto range to acquire a measurement and give an out-of-range reading. This is an acceptable reading provided that the meter is in calibration.

Step 4 Connect the DC power cables in the following order:

a) Positive cable first.
b) Negative cable last.

Step 5 Repeat Step 4 for the other power modules installed in the tray.

Warning
To prevent injury and damage to the equipment, always attach the ground and source DC power cable lugs to power tray terminals in the following order: (1) positive (+) to positive (+), (2) negative (–) to negative (–).

Caution
Do not over tighten the nuts that secure the DC power cables to the power tray terminals. The nuts should be tightened using the 7/16 hex socket and torque wrench to a torque of 45 to 50 in-lb.

Figure 127: DC Power Tray Rear Panel

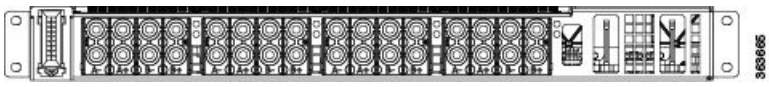
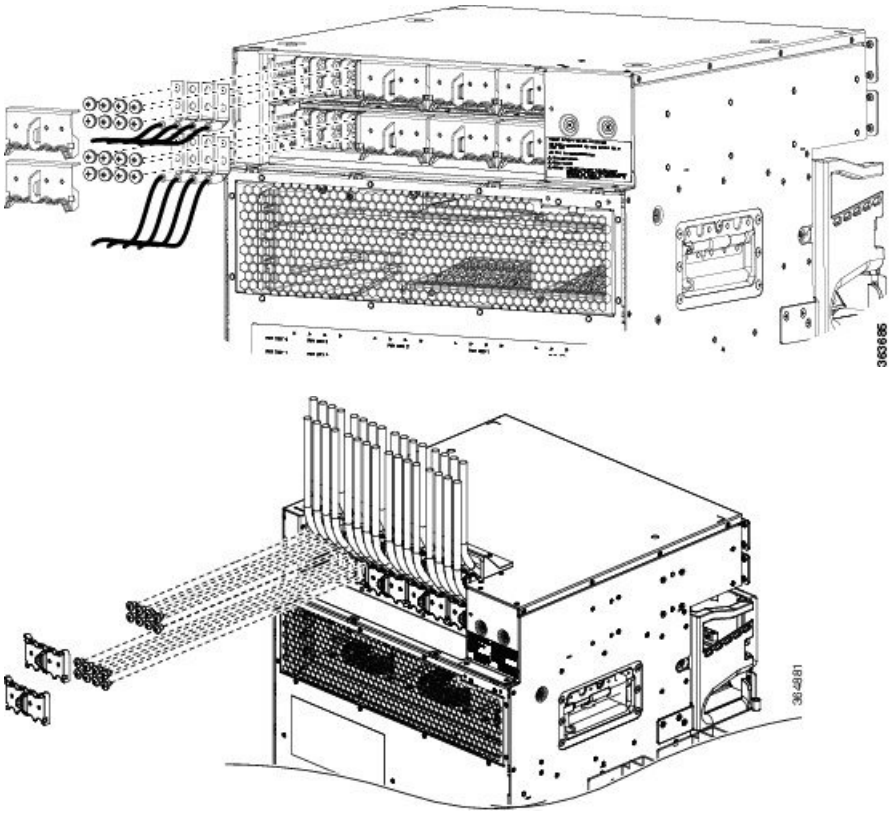
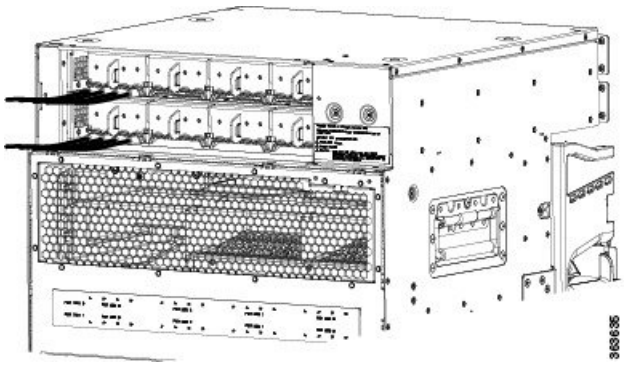


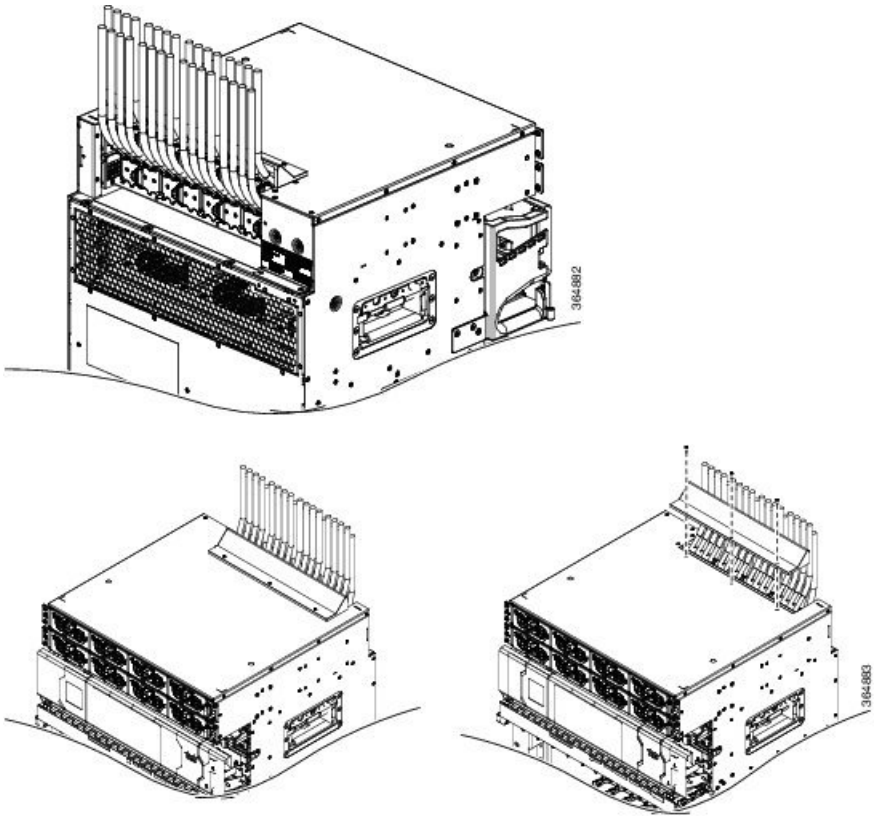
Figure 128: Typical Power Connections to a Power Tray for a Single DC Power Module—Power System



Step 6 Replace the clear plastic safety covers over the connection terminal studs.

Figure 129: Typical Plastic Safety Covers over the Power Tray Connection Terminals





Step 7 Proceed to the Powering On the Chassis, on page 198.

Disconnecting AC or DC Power

The following sections explain how to disconnect AC or DC power to the Cisco NCS 4009 chassis.

Disconnecting AC Power

Follow these steps to disconnect an individual AC power cord:

Procedure

Step 1 Power off (0) the circuit breaker assigned to the AC power source that you are disconnecting.

Step 2 Un-tighten the screw that clamps the AC power cord.

Step 3 Unplug the AC power cord from the power tray receptacle.

Caution

Do not turn off the switch on the power tray to remove AC power cords. An individual AC power cord can be unplugged while the system is powered from other AC power sources.

Disconnecting AC Power

If it becomes necessary to disconnect all AC power from the chassis, follow these steps:

Do not disconnect all power from the chassis to replace components, including power modules. See Removing and Replacing Chassis Components, on page 249.

Procedure

Step 1 Set the power switch at the rear of the AC power tray to the OFF (0) position.

Step 2 Power off (0) the circuit breakers assigned to the AC power sources that you are disconnecting.

Warning
To ensure that power remains off while you are performing this procedure, lock-out/tag-out the circuit breaker switch in the OFF (0) position until you are ready to turn it on.

Step 3 Loosen the retainer bracket that holds the AC power cords to the power tray receptacle.

Step 4 Unplug the AC power cords from the power tray receptacles.

Reconnecting AC Power

To reconnect an individual AC power cord to a power tray, see Connecting Power to an AC-Powered Chassis, on page 191

Disconnecting DC Power



Caution It is not necessary to disconnect all power from the chassis to replace components, including power modules. See Removing and Replacing Chassis Components, on page 249

Follow these steps to disconnect an individual DC power source from a power tray:

Procedure

Step 1 Power off the circuit breaker assigned to the DC power source you are disconnecting.

Warning

To ensure that power remains off while you are performing this procedure, lock-out/tag-out the circuit breaker switch in the OFF (0) position until you are ready to turn it on.

Step 2 Remove the clear plastic safety covers that fit over the DC power connection terminal studs.

Warning
To prevent injury and damage to the equipment, always remove the source DC power cables from the power tray terminals *in the following order* : (1) negative (–), (2) positive (+).

Step 3 Disconnect the DC power cables from their terminals in the following order and note the color of each cable:

a) Negative (PWR) cables first.
b) Positive (RTN) cables last.

Step 4 Repeat Step 1 through Step 3 for the other power module distribution that needs to be removed.

What to do next

If it becomes necessary to disconnect all DC power from the chassis, follow these steps:

Note This procedure describes how to disconnect DC power from all power modules in a single DC power tray. The procedure is the same for each DC power tray, if more than one is installed.

Caution If only one power tray is installed, performing the following procedure turns off all power to the chassis.

Disconnecting DC Power

Procedure

Step 1 Set the power tray switch to the OFF (0) position.

Step 2 Power off (0) the circuit breaker assigned to the DC power source you are disconnecting.

Warning
To ensure that power remains off while you are performing this procedure, lock-out/tag-out the circuit breaker switch in the OFF (0) position until you are ready to turn it on.

Step 3 Remove the clear plastic safety covers that fit over the DC power connection terminal studs.

Warning
To prevent injury and damage to the equipment, always remove the source DC power cables from the power tray terminals *in the following order* : (1) negative (–), (2) positive (+).

Step 4 Disconnect the DC power cables from their terminals in the following order and note the color of each cable:

a) Negative (PWR) cables first.
b) Positive (RTN) cables last.

Step 5 Repeat Step 1 through Step 4 for the other power tray, if installed.

Reconnecting DC Power

To reconnect DC power to a DC power tray, see Connecting Power to a DC-Powered Chassis, on page 192.

Powering On the Chassis

Follow these steps to turn on power to an AC-powered or DC-powered chassis:

Procedure

Step 1 Power on the circuit breaker to your power sources one at a time.

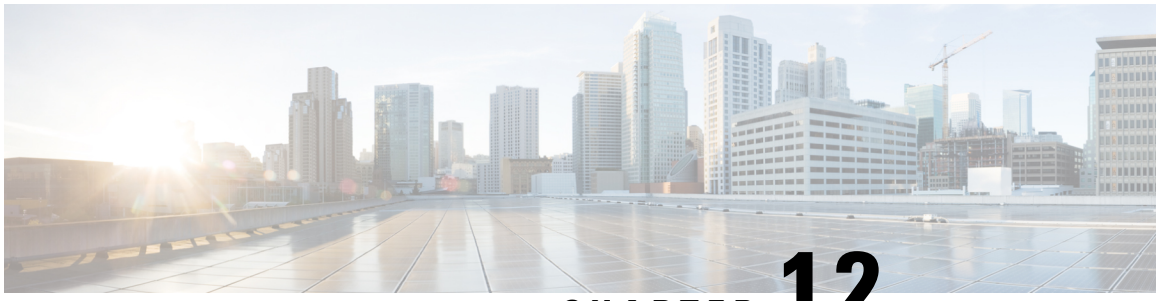
Step 2 Verify that the correct Power Input LED on each power module in the tray is lit (one input on the LED flashes and both inputs on the LED are solid). Continue with steps 1 and 2 until all inputs have been verified.

Note
On the DC power tray, the Power Input LED is lit solid green if both DC feeds are valid and blinks green if only a single DC feed is valid.

Step 3 Set the power tray switch for Feed A to the ON (1) position. This powers on slots PWR MOD 0 through PWR MOD 3.

Step 4 Verify that the Power Output LED on each power module in the tray is lit.

Step 5 Repeat Step 3 and Step 4 for Feed B.



CHAPTER 12

Installing Route Processor Cards, Fabric Cards, and Line Cards

This chapter provides instructions on how to install route processor (RP) cards, fabric cards (FCs), line cards (LCs) and their associated components in the Cisco NCS 4009 chassis.

- About Installing Cards and Associated Components, on page 199
- Installing and Removing a Filler Card, on page 201
- About RP Cards, on page 203
- Installing an RP Card, on page 204
- About Fabric Cards, on page 209
- Installing a Fabric Card, on page 210
- Upgrading a Fabric Card, on page 217
- About Line Cards, on page 218
- Installing a Line Card, on page 239
- Connecting Line Card Network Interface Cables, on page 242
- Connecting Cables to the RP, on page 245

About Installing Cards and Associated Components

Preventing Electrostatic Discharge

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. We recommend use of an ESD-preventive wrist strap whenever you handle network equipment or one of its components.

- Always use an ESD-preventive wrist or ankle strap, and ensure that it makes good skin contact. Connect the equipment end of the connection cord to an ESD jack or a bare metal surface on the chassis (ensure that the chassis is grounded).
- Handle a card by its ejector levers, when applicable, or its metal carrier only; avoid touching the connector pins. (See the Guidelines for Installing and Removing a Card, on page 200 section of this chapter.)
- Place the removed card board-side-up on an antistatic surface or in a static-shielding bag. If you plan to return the component to the factory, immediately place it in a static-shielding bag.

- Avoid contact between a card and clothing. The wrist strap protects the card from only ESD voltage on the body; ESD voltage on clothing can still cause damage.
- Be careful not to lay any tools on the aluminum honeycomb panel, or insert your fingers into the panel.

Guidelines for Installing and Removing a Card

- Online (in-service) insertion and removal (OIR) is supported, enabling you to remove and install cards while the chassis is operating. OIR is seamless to users on the network, maintains all routing information, and ensures session preservation. You do not need to notify the software or reset the power. You have the option of using the Cisco IOS XR **shutdown** command before removing a card.



Note OIR removes power to a specific slot before the card is replaced. The power for all other cardslots is not impacted.

- The different cards in the Cisco NCS 4009 chassis are all attached to the chassis itself using a pair of ejector levers and captive screws. The two ejector levers release the card from its backplane connector. The exact locations of the ejector levers and captive screws can vary slightly, depending on the cards. Generally, the ejector levers and captive screws are located at the upper and bottom ends of the faceplate.
- When you remove a card, press the OIR buttons before using the ejector levers. This action ensures that the connector pins disconnect from the backplane in the sequence as expected by the chassis.
- The eject symbol on the OIR buttons shows the correct card orientation. The symbol must be oriented upward for cards in the top row, and downward for cards in the bottom row.
- Every FC, LC, and RP card has a key that is mounted on the board that matches a corresponding slot on the chassis side (top of each cardslot). This key-slot mechanism prevents a card from being inserted into the wrong, nonmatching cardslot. It also prevents a card from being inserted upside down. When a card is inserted into the wrong cardslot or upside down, the key gets blocked against the chassis card guide. This action will not allow the card to slide though the slot. When the key gets blocked, remove the card and find the correct cardslot.



Note RP card faceplates are labeled with the square symbol. Cardslots on the chassis for RP cards are also labeled with the square symbol. FC faceplates are labeled with the plus symbol. Cardslots on the chassis for FCs are also labeled with the plus symbol.

- The chassis is shipped with all cardslots containing filler cards to help maintain chassis stiffness and prevent any damage to the chassis during shipment.
- Any unused cardslots that are uncovered (filler card not installed) act as an escape path for the air. When the air escapes, it results in overheating of the components in the adjacent slots. Therefore, to ensure proper airflow and maintain system EMC and safety compliance, unused LC slots must contain filler cards. All FC and RP cards must remain installed in their cardslots.
- Fully insert all FC and RP cards into the chassis before tightening their captive screws.
- For information about the slot numbers, see the “Chassis Slot Numbers” section on page -6 .

Caution The chassis may indicate a hardware failure if you do not follow proper procedures. Remove or install only one card at a time. Allow at least 30 seconds for the chassis to complete its tasks before removing or installing another card.

Installing and Removing a Filler Card

Caution To ensure thermal regulation in the chassis, install filler cards in the empty LC slots.

This section contains the following procedures:

Installing a Filler Card

This section describes how to install a filler card in the Cisco NCS 4009 chassis.

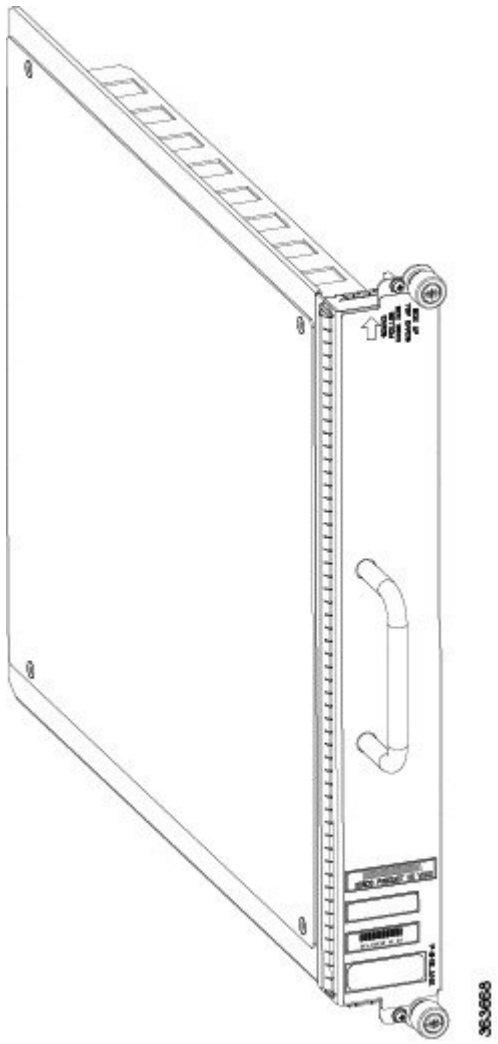
Prerequisites

Open the front door, if installed, and ensure that the slot in which you are about to install the filler card is empty.

Required Tools and Equipment

- Number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver
- LC filler card (Cisco PID NCS4K-BLANK)

Figure 130: LC Slot Filler Card



Steps

The following steps describe how to install a filler card.

Procedure

Step 1 Orient the filler card, as shown in the preceding figure. The arrow on the faceplate must be facing up to insert the card into the card cage.

Step 2 Use both hands while inserting a filler card. Use one hand on the faceplate and the other hand along the base of the filler card to guide it into the slot.

Step 3 Slide the filler card into the chassis until the captive screw plates are flush with the chassis.

Step 4 Partially tighten the two captive screws on the front panel of the filler card (either by hand or with the number-2 Phillips screwdriver or number-2 common [flat-head] screwdriver) to make sure that they are both engaged.

Step 5 Use the number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver to fully tighten the captive screws to seat the filler card firmly in the slot.

Removing a Filler Card

This section describes how to remove a filler card from the Cisco NCS 4009 chassis.

Prerequisites

Before performing this task, open the front door, if installed.

Required Tools and Equipment

- Number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver

Steps

The following steps describe how to remove a filler card.

Procedure

Step 1 Identify the filler card to be removed from the card cage. Use the number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver, and turn the two captive screws on the front panel of the card counterclockwise to loosen the card from the slot.

Step 2 Grasp the filler card handle with one hand and gently pull it half-way from the slot.

Step 3 Place one hand under the filler card to guide it.

Step 4 Holding the filler card underneath and by the handle, pull it from the slot, and set it carefully aside.

About RP Cards

The Cisco NCS 4009 chassis supports two Route Processors (RPs). These cards are the intelligence of the system. They function as the shelf controllers for DWDM or OTN applications and by providing route processing and chassis management. The RP cards also monitor system alarms and control the system fans. LEDs on the front panel indicate active alarm conditions.

Two RPs per chassis are required for a redundant system. RP cards are inserted into the two dedicated slots in the chassis.

See the Verifying and Troubleshooting the Installation of an RP Card, on page 206 for details about LEDs, troubleshooting, and the front panel of the RP card.

Physical Characteristics

- Height—11.05 in. (280.6 mm)
- Width—1.55 in. (39.4 mm)
- Depth—14.25 in. (362 mm)
- Weight—7.32 lb (3.32 kg)

Installing an RP Card

This section contains the following procedures:

Installing an RP Card

Every Cisco NCS 4009 chassis contains two RP cards in dedicated slots that are located on left and right side of the chassis. The RP cards are identical. One RP card installs into slot RP0 on the left side of the chassis. The second RP card installs into slot RP1 on the right side of the chassis. The RP cards are hot-swappable.



Warning **Class 1 Laser Product.** Statement 113



Warning **Because invisible radiation may be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to radiation and do not stare into open apertures.** Statement 125

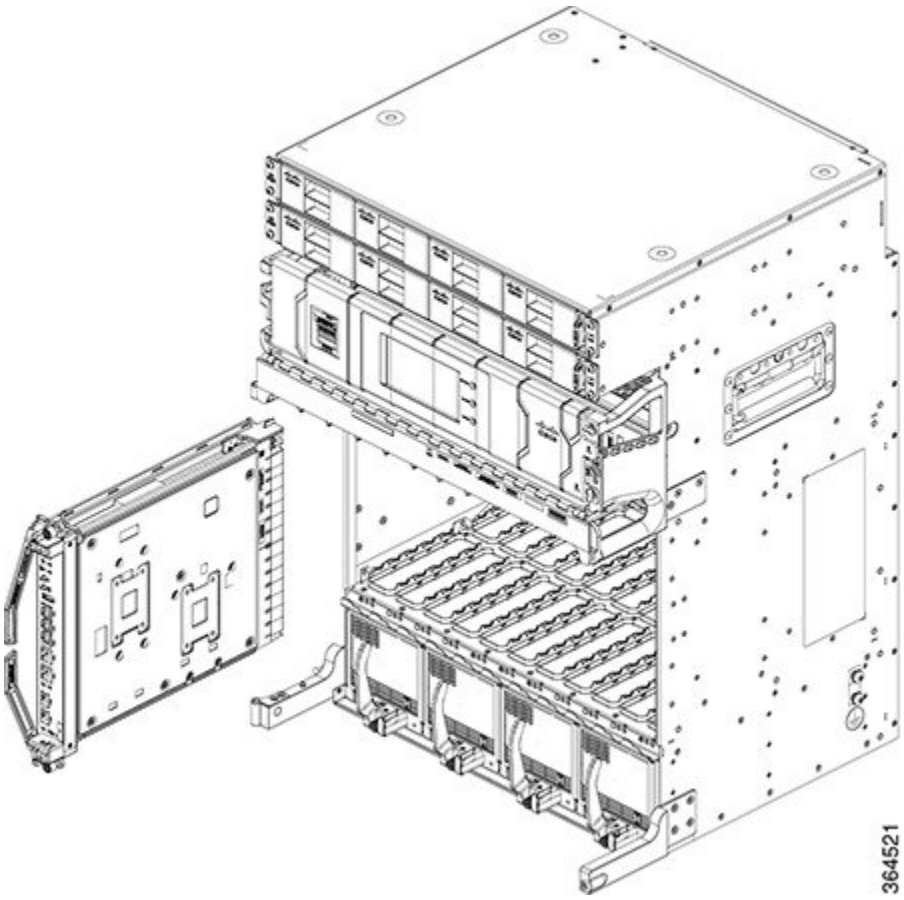
Prerequisites

Before performing this task, open the front door, if installed.

Required Tools and Equipment

- ESD-preventive wrist strap
- Number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver
- RP card (Cisco PID NCS4K-RP)

Figure 131: Installing an RP Card



Steps

The following steps describe how to install an RP card.

Procedure

Step 1 Attach the ESD-preventive wrist strap to your wrist. Connect its leash to one of the two ESD jacks that are located on the front or rear side of the chassis. You can also connect the ESD-preventive wrist strap leash to any bare metal surface on the chassis.

Step 2 Remove the card from its antistatic packaging.

Step 3 Place one hand under the card to support and guide it into the correct slot. Slide the card half-way into the slot. Avoid touching the card circuitry or any connectors.

Note
Alignment grooves exist on each slot in the card cage. When you install a card in the card cage, make sure that you align both edges of the card carrier in the slot grooves.

Step 4 Orient the RP. The arrows on the OIR buttons must be facing up to insert the card into the card cage.

See Figure 132: RP Card Front Panel , on page 207 for an example of the arrows on the OIR buttons. If the card does not slide easily into the slot, the orientation may be wrong or the slot is not for an RP. Reorient the RP, if necessary.

Step 5 Carefully slide the RP into the slot until the ejector levers meet the edges of the card cage. *Stop* when the ejector lever hooks catch the card cage. If they do not catch, try reinserting the RP until the ejector lever hooks are fully latched.

Step 6 Press the OIR buttons to release the ejectors.

Step 7 Pivot both card ejector levers so that the openings on the card ejector cams at the top and bottom of the card pass over the tabs on each side of the card cage slot.

Caution
Verify that the openings on the card ejector pass over the tabs; otherwise, one or both ejector levers might bind when you attempt to close the ejector levers, thereby damaging or breaking one or both ejector levers.

Step 8 Continue sliding the card into the card cage slot until the openings on the card ejector cams engage the tabs on each side of the card cage slot.

Note
RP cards have guide pins that make initial contact with the backplane connector as you slide the card into its slot. After the guide pins make contact, continue pushing on the card carrier until the card ejector levers begin pivoting forward toward the handle in the card carrier.

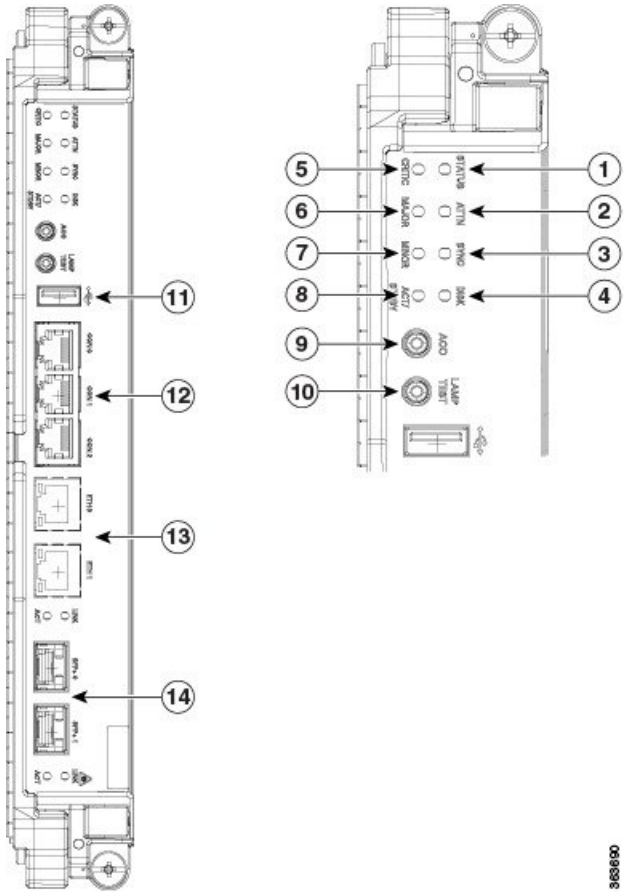
Step 9 To seat the card in the backplane connector, grasp both card ejector levers and pivot them inward toward the handle in the card carrier until they are flush against the front edge of the card carrier.

Step 10 Using the number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver, turn the two captive screws on the front panel of the card clockwise to seat the card firmly in the slot. Tighten the captive screws using 10.60 pound/force (lbf) inch (1.20 Nm torque).

Verifying and Troubleshooting the Installation of an RP Card

This section describes how to verify that the RP card has been properly installed and how to troubleshoot the installation in the Cisco NCS 4009 chassis.

Figure 132: RP Card Front Panel



1	Status LED (card status indicator)	8	Active/standby LED
2	Attention LED	9	Acknowledge button
3	Sync LED	10	Lamp test button
4	Disc LED	11	External USB port
5	Critical LED	12	Console ports
6	Major LED	13	RJ-45 10/100/1000 copper full-duplex ports (with status LEDs)
7	Minor LED	14	SFP+ 10GE ports (with status LEDs)

Note Only the active RP console port sends and receives messages.

Troubleshooting the RP Card

Use the Status LED, located on the faceplate of the RP card, to verify the correct installation of the card:

- When the card is properly installed and no faults are detected, the card status LED turns green.
- When the card status LED is solid yellow, either software initialization is in progress during bootup or a fault exists on the board.
- When the card status LED is blinking yellow, the card is not fully seated.
- When the card status LED is off, verify that the card is installed correctly. There could be no power applied to the card, a power fault, or a hardware fault.
- Verify that there is power to the card by looking at the indicators on the power tray.

Note To confirm the location of the card that needs attention, the Attention LED can be lit by using the hw-module attention-led location CLI command.

If the installed or replaced card fails to operate or to power on after installation:

- Ensure that the card is seated firmly in the Cisco NCS 4009 chassis slot. One easy way to verify that physical installation is correct to check the front faceplate of the card. The front faceplate should be even with the fronts of the other installed cards.
- Ensure that the ejector levers are latched and that the captive screws are fastened properly. If you are uncertain, unlatch the levers, loosen the screws, and attempt to reseat the card.
- Examine the power system to see whether the chassis is receiving power.

In addition to the Status and Attention LEDs, Table 35: Other LEDs, on page 208 describes the other LEDs on the RP card.

Table 35: Other LEDs

LED Name	Description	LED Colors
Sync	Indicates that the RP card is receiving external sync.	Green = in sync Yellow = out of sync
Disc	Indicates that the Solid State Disk (SSD) on the RP card is accessed.	Green = access occurring
Critical	Indicates a critical system alarm.	Yellow = an active critical system alarm
Major	Indicates a major system alarm.	Yellow = an active major system alarm
Minor	Indicates a minor system alarm.	Yellow = an active minor system alarm
Active/standby	Indicates that the RP card is in active or standby mode.	Green = active Yellow = standby
RJ45	Indicates the status of the RJ-45 Ethernet link.	Green = on Yellow = active
SFP+	Indicates the status of the SFP+ 10GE ports.	Green = active

About Fabric Cards

The Cisco NCS 4009 chassis supports 4 fabric cards (FCs). The fabric cards are agnostic cross-connects based on a flexible cell switching architecture that is used in a CLOS configuration. FCs are called agnostic because they switch a cell with no knowledge of whether they belong to OTN or Ethernet. Each fabric card has a crossbar fabric device.

FCs provide the switch fabric for the routing system and perform the cross-connect function, connecting every LC to each other. The switch fabric receives ingress user data from one LC slot and performs the switching necessary to route the data to the appropriate egress LC slot.

The Cisco NCS 4009 chassis supports, the 200G and 400G fabric cards. The 400G fabric card enables 400G traffic using the 400G line card. The datapath link speed of 400G FC-LC is twice that of the 200G FC-LC. The 200G and the 400G fabric cards support single chassis only.

FC Name	Compatible with 200G LC	Compatible with 400G LC
NCS4009-FC-S (200G)	Yes	No
NCS4009-FC2-S (400G) NCS4009-FC2F-S (400G)	Yes	Yes

An Auxiliary Fan Tray (Cisco PID NCS4009-FAN-FC) is attached to the NCS4009-FC2F-S fabric card. The Auxiliary Fan Tray (AFT) and the fan tray present in the front of the chassis (behind the craft panel), provide cooling for the chassis components. For details, see theAuxiliary Fan Tray, on page 210 Auxiliary Fan Tray, on page 210 section of this chapter.

Caution The four NCS4009-FC2F-S fabric cards and the four AFTs must be present in the chassis always except during the replacement of the FC or AFT.

See the Verifying the Installation of a Fabric Card, on page 214 for details about LEDs, troubleshooting, and to see the front panel of the FC card.

Physical Characteristics

- Height—4.05 in. (103.12 mm)
- Depth (NCS4009-FC2-S)—12.97 in. (329.4 mm)

  Depth (NCS4009-FC2F-S)—15.95 inches (405 mm)
- Width—4.21 in. (107.18 mm)
- Weight (NCS4009-FC2-S)—4.4 lb (2 kg)

  Weight (NCS4009-FC2F-S)—5.99 lb (2.718 kg); weight of the FC is 4.96 lb (2.25 kg), weight of the AFT is 1.03 lb (0.468 kg).

Auxiliary Fan Tray

The AFT provides cooling for the chassis by drawing outside air into the chassis.

The AFT is attached to the NCS4009-FC2F-S fabric card in the front. The AFT remains attached to the fabric card always. The only time when the AFT can be detached from the fabric card is when either the fabric card or the AFT has to be replaced. Power is supplied to the AFT through the NCS4009-FC2F-S fabric card.

In case of Envmon process restart, the AFTs run at maximum speed and return to the speed they were earlier running at, after about one minute.

Figure 133: The NCS4009-FC2F-S Fabric Card with the AFT (NCS4009-FAN-FC)

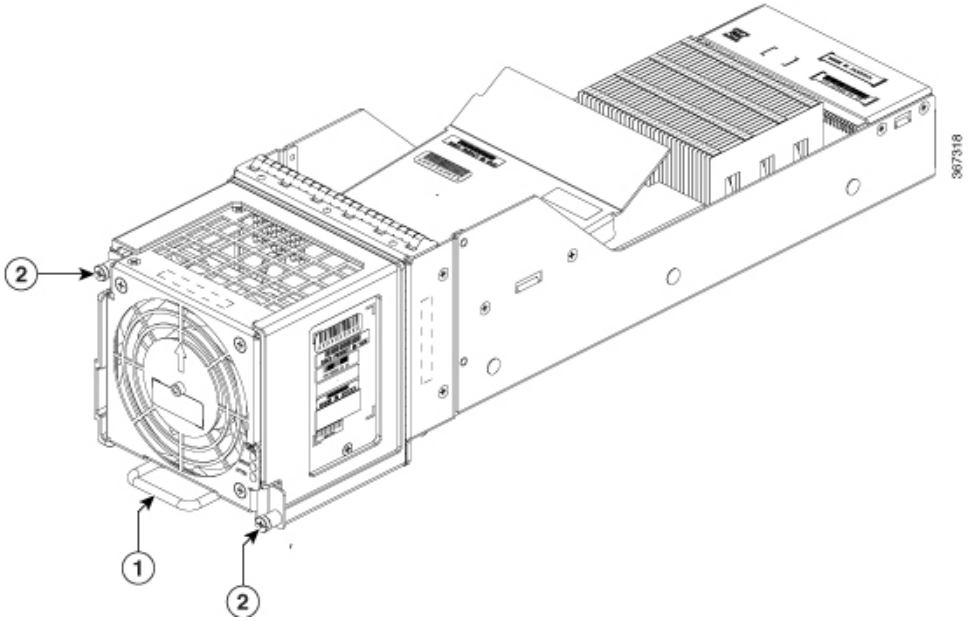


Table 36: Auxiliary Fan Tray

1	Sliding handle
2	Captive screws

NCS4009-FC2-S-KIT comprises the NCS4009-FC2F-S (Fabric Card) and the NCS4009-FAN-FC (Auxiliary Fan Tray).

Installing a Fabric Card

This section contains the following procedures:

Installing a Fabric Card

Prerequisites

Before performing this task, open the front door, if installed.

Required Tools and Equipment

- ESD-preventive wrist strap
- Number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver
- Fabric Card (Cisco PID NCS4009-FC-S or Cisco PID NCS4009-FC2-S or Cisco PID NCS4009-FC2F-S)

Figure 134: Installing a Fabric Card - NCS4009-FC2-S

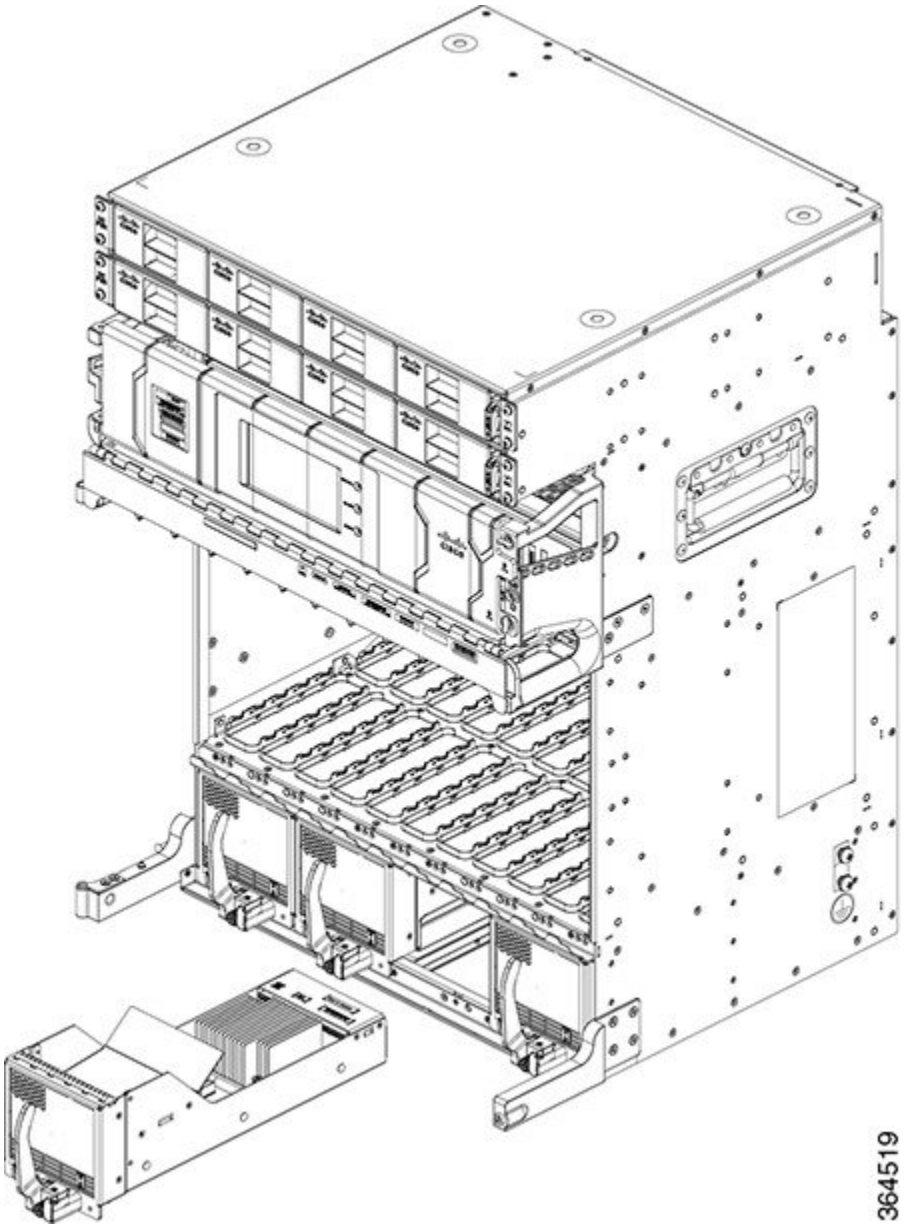


Figure 135: Installing a Fabric Card - NCS4009-FC2F-S

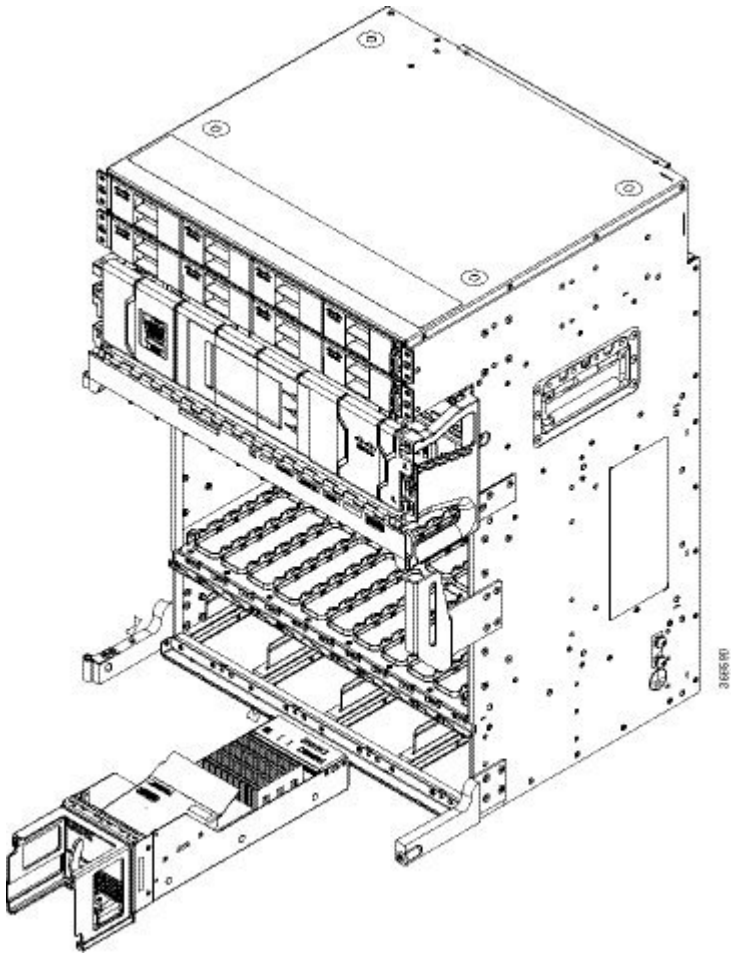
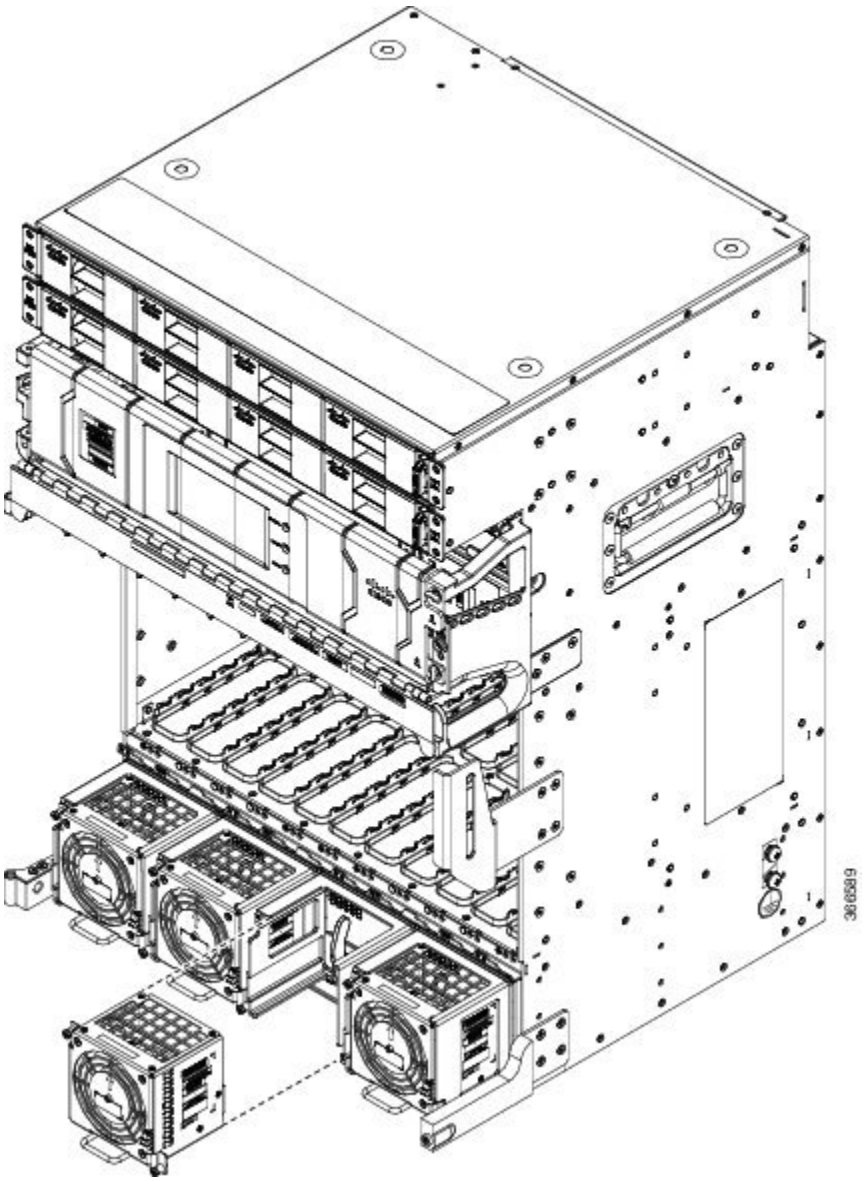


Figure 136: Installing the AFT



Steps

The following steps describe how to install a fabric card.

See here for a graphical representation of the installation of the NCS4009-FC2F-S fabric card and the AFT.

Procedure

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to the ESD jack located on the front side of the chassis. You can also connect the ESD-preventive wrist strap leash to any bare metal surface on the chassis.

Step 2 Remove the FC from its antistatic packaging.

Step 3 Place one hand under the card to support and position the card for insertion into the card cage slot. Avoid touching the card circuitry or any connectors.

Note
Alignment grooves exist on each slot in the card cage. When you install a card in the card cage, make sure that you align both edges of the card carrier in the slot grooves.

Step 4 Orient the FC correctly, as shown in figure 5.

Step 5 Release the ejector lever by pressing the OIR button.

Step 6 Slide the FC completely into the slot until it engages with the backplane connector and the ejector lever meets the edges of the card cage.

Step 7 Pivot the ejector lever toward the faceplate of the card.

Step 8 Use the number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver to tighten the captive screw using 10.60 pound/force (lbf) inch (1.20-Nm torque).

Make sure that the ejector lever is in the vertical position and the fabric card is firmly inserted before tightening the captive screw.

There are two ways to check if the card is operational.

- The Status LED on the faceplate turns green.
- Run the **show platform** command and check if the fabric card is displayed as OPERATIONAL.

Step 9 To install the AFT, slide the AFT into the frame of the fabric card. The connector on the fabric card holds the AFT firmly to the card.

Step 10 Push the sliding handle to its original position.

Step 11 Use the number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver to tighten the two captive screws on the AFT using 6.2 pound/ force (lbf) inch (0.7-Nm torque).

For NCS4009-FC2F-S, check for the LED status on the AFT, and run the **show platform** command (as discussed in step 8) after installing the AFT.

Verifying the Installation of a Fabric Card

The following figure shows the front panel of the fabric card.

Figure 137: FC Front Panel - NCS4009-FC2-S

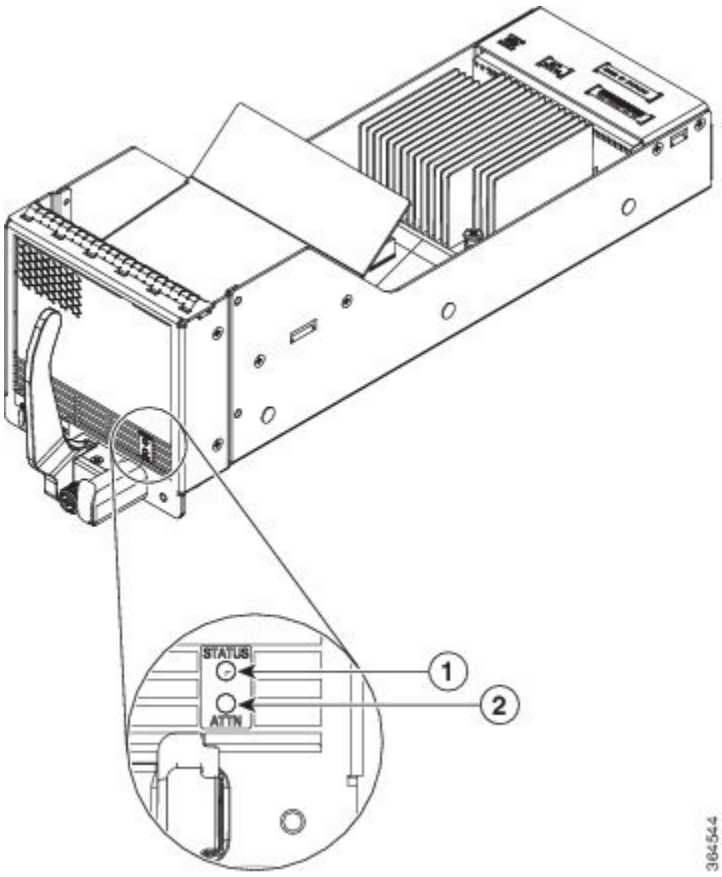


Figure 138: FC Front Panel - NCS4009-FC2F-S

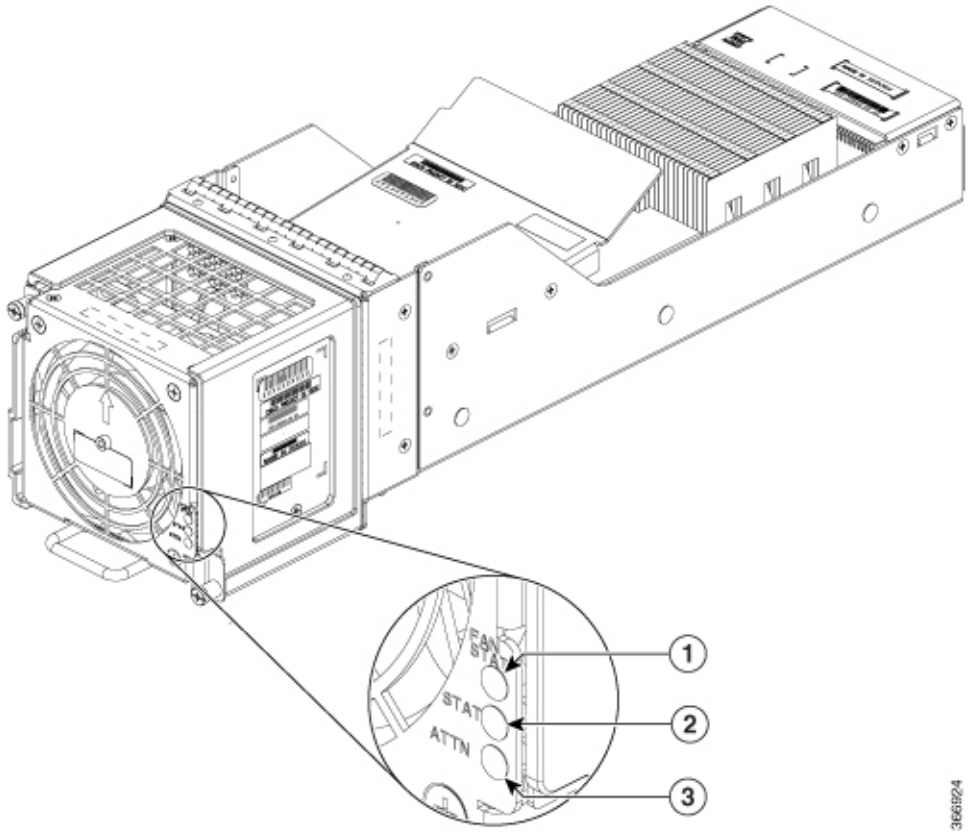


Table 37:

1	Fan Status LED	2	Status LED
3	Attention LED		

Note The LED indications for the NCS4009-FC2F-S fabric card and the AFT are available on the AFT.

Use the Status LED, located on the faceplate of the fabric card, to verify the correct installation of the card and the AFT:

- When the card is properly installed and no faults are detected, the card status LED turns green.
- When the card status LED is solid yellow, either software initialization is in progress during bootup or a fault exists on the board.
- When the card status LED is blinking yellow, the card is not fully seated.
- When the card status LED is off, verify that the card is installed correctly. There could be no power applied to the card, a power fault, or a hardware fault.
- Verify that there is power to the card by looking at the indicators on the power tray.
- The Fan Status LED is green, when the AFT unit is seated correctly and when there are no alarms.
- The Fan Status LED is red, when there is an alarm or when the module voltage is out of range.

Note To verify which card needs attention, the Attention LED can be lit using the hw-module attention-led location CLI command.

If the installed or replaced FC fails to operate or power on after installation:

- Ensure that the card is seated firmly in the Cisco NCS 4009 chassis slot. One easy way to verify physical installation is to see whether the front faceplate of the FC is even with the fronts of the other cards installed in the card cage.
- Ensure that the ejector lever is latched and that the captive screws are fastened properly. If you are uncertain, unlatch the levers, loosen the screws, and attempt to reseat the FC.
- Examine the power system to see whether the chassis is receiving power.

Upgrading a Fabric Card

This task enables you to upgrade from the NCS4009-FC2-S fabric card to the NCS4009-FC2F-S fabric card. After the fabric card is upgraded, upgrade the air filter.

The air filter design for NCS4009-FC2-S and NCS4009-FC2F-S fabric cards is different.

The NCS4009-FC2-S fabric card supports Cisco PID NCS4009-FTF.

The NCS4009-FC2F-S fabric card supports Cisco PID NCS4009-FTF-2.

Prerequisites

Before performing this task, open the front door.

Required Tools and Equipment

- ESD-preventive wrist strap
- Number-2 Phillips screwdriver
- FC: NCS4009-FC2F-S
- AFT: NCS4009-FAN-FC
- Air filter: NCS4009-FTF-2

Procedure

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to the ESD jack located at the front side of the chassis. You can also connect the ESD-preventive wrist strap leash to any bare metal surface on the chassis.

Step 2 Remove the air filter. SeeRemoving the Air Filter, on page 265 section in the Removing and Replacing Chassis Components chapter.

Step 3 Identify the NCS4009-FC2-S fabric card to be removed from the card cage and follow the procedure as discussed in the Removing a Fabric Card, on page 254 section in the Removing and Replacing Chassis Components chapter.

Step 4 Install the NCS4009-FC2F-S fabric card and the AFT. Check the status of the newly installed fabric card before proceeding to upgrade the next fabric card. SeeInstalling a Fabric Card, on page 210 section in this chapter.

Attention
Remove and replace the fabric cards, one by one. Wait for the newly installed fabric card to completely come up before removing and inserting the next fabric card. Run the **show platform** command and check if the fabric card is displayed as OPERATIONAL.

Step 5 Replace the air filter. See Replacing the Air Filter, on page 268 section in the Removing and Replacing Chassis Components chapter.

The supported air filter for the NCS4009-FC2F-S fabric card is Cisco PID NCS4009-FTF-2.

About Line Cards

The Cisco NCS 4009 chassis supports both Optical Transport Network (OTN) line cards (LCs) and Dense Wavelength-Division Multiplexing (DWDM) line cards. You can have a mix of both OTN and DWDM line cards in the same chassis.

This section describes the following line cards:

For a list of the pluggable optics that are supported, see the Pluggable Optics Support, on page 235.

NCS4K-4H-OPW-QC2 Line Card

The NCS4K-4H-OPW-QC2 line card supports OTN, packet, and WDM switching for 400G traffic and contains:

Table 38: Feature History

Feature Name	Release Information	Feature Description
Pluggable Support	Cisco IOS XR Release 6.5.35	The NCS4K-4H-OPW-QC2 line card is compatible with the QSFP-100G-ZR4-S pluggable for ports 0, 1, 5, and 6, supporting a data rate of 100 Gbps. The QSFP-100G-ZR4-S pluggable supports configurations for Ethernet or Ethernet over OTN controllers only.

- Two CFP2 ports. Each port can support 100 Gbps (DWDM QPSK) or 200 Gbps (DWDM 16 QAM) WDM signals
- Four QSFP28/QSFP+ ports

Note The QSFP28 ports also support QSFP+ optics and can be used as 1x40G ports or 4x10G ports.

- Six QSFP+ ports

Note The QSFP+ ports can be split and used as 1x40G ports or 4x10G ports.

The NCS4K-4H-OPW-QC2 line card supports the following port configurations:

- 2-ports of 200 Gbps with CFP2 optics
- 4-ports of 100 Gbps with QSFP28 optics, 10-ports of 40 Gbps with QSFP+ optics, or 10 Gbps x 40 ports (4x10G breakout) with QSFP+ optics
- 0,1,5, and 6 - ports of 100 Gbps with QSFP-100G-ZR4-S optics

Note When the NCS4K-4H-OPW-QC2 line card, installed in an NCS 4009 chassis, uses the CFP2 ports, the temperature limit is 50^{o} C, and the altitude limit is 1800 meters. Violating these limits, may result in traffic loss. When the NCS4K-4H-OPW-QC2 line card, installed in an NCS 4009 chassis, does not use the CFP2 ports, the temperature limit is 55^{o} C, and the altitude limit is 1800 meters.

Note When the NCS4K-4H-OPW-QC2 line card, installed in a NCS 4009 chassis, uses QSFP-100G-ER4 optics, the temperature limit is 50° C and the altitude limit is 1800 meters. In the event of a fan tray Online Insertion and Removal (OIR), the maximum time limit is four minutes at 30°C and 1800 meters altitude. Violating these limits, may result in traffic loss. The optics can be inserted in ports 0, 1, 5, and 6. Empty optical ports must covered with dust caps.

The card needs NCS4009-FC2-S fabric card to function in the NCS 4009 chassis.

The card supports OTN and packet aggregation where both TDM switching and packet forwarding capabilities are combined in a single card. Hence, it can terminate both OTN control plane traffic and packet control plane traffic.

The card supports the following data rates:

Protocol	Data Rate	Optic Type
100GE	103.125 Gbps	QSFP28
OTU4	112 Gbps	QSFP28
40GE	41.25 Gbps	QSFP+
OTU3	43 Gbps	QSFP+

Protocol	Data Rate	Optic Type
OTU3-e1	44.57 Gbps	QSFP+
OTU-3e2	44.58 Gbps	QSFP+
10GE	10.3125 Gbps	QSFP+ BreakOut
OC192	9.953 Gbps	QSFP+ BreakOut
OTU2	10.7 Gbps	QSFP+ BreakOut
OTU2e	11.09 Gbps	QSFP+ BreakOut
OTU2f	11.32 Gbps	QSFP+ BreakOut
2x100G QPSK DWDM	200 Gbps	CFP2 ACO
2x200G 16QAM DWDM	400 Gbps	CFP2 ACO
ODU2e	10.3995253164557	QSFP+ BreakOut
ODU2	10.0372739240506	QSFP+ BreakOut
ODU3	40.3192189830509	QSFP+
ODU3e1	41.774364407	QSFP+
ODU3e2	41.7859685595012	QSFP+
ODU4	104.794445814978	QSFP28

Channelization Support

The NCS4K-4H-OPW-QC2 line card supports up to two levels of channelization. The following tables display the channelization modes supported.

Table 39: Single Channelization Support

Parent Payload	Child Payload 1	Child Payload 2
ODU4	ODU3	-
	ODU3e1	-
	ODU3e2	-
	ODU2	-
	ODU2e	-
	ODU1	-
	ODU1e	-
	ODU0	-
	ODUflex	-
100GE	GMP	-
	GFP-F	-
OTU3	ODU3	-
	ODU2	-
	ODU2e	-
	ODU1	-
	ODU0	-
40 GE	GFP-F	-
	GMP	-
	ODUflex	-
OTU3e1	ODU2e	-
OTU3e2	ODU2e	-
	ODU1	-
	ODU0	-
	ODUflex	-
OTU2	ODU1	-
	ODU0	-
	ODUflex	-

Parent Payload	Child Payload 1	Child Payload 2
10GE	GFP-F	-
	GFP-F-EXT	-
OC192	AMP	-
	BMP	-

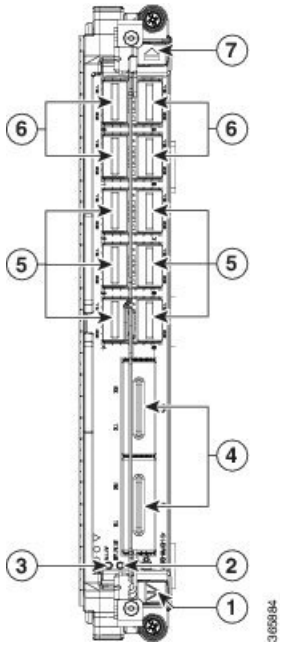
Table 40: Dual Channelization Support

Parent Payload	Child Payload 1	Child Payload 2
ODU4	ODU3	ODUflex
		ODU0
		ODU1
		ODU1e
		ODU2
		ODU2e
	ODU3e1	ODU2e
	ODU3e2	ODUflex
		ODU0
		ODU1
		ODU2e
	ODU2	ODUflex
		ODU0
		ODU1
	ODU1	ODU0
OTU3	ODU2	ODUflex
		ODU0
		ODU1
	ODU1	ODU0

Parent Payload	Child Payload 1	Child Payload 2
OTU3e2	ODU1	ODU0
	ODU2e	ODU1
	ODU2e	ODU0
OTU2	ODU1	ODU0

This figure shows the details of the front panel of the NCS4K-4H-OPW-QC2 line card.

Figure 139: Front Panel of the NCS4K-4H-OPW-QC2 Line Card



1	Red ejector	2	Status LED
3	Attention LED	4	CFP2 (DWDM) port
5	QSFP+ port	6	QSFP+ or QSFP 28 port
7	Blue ejector		

Table 41: NCS4K-4H-OPW-QC2 Line Card Descriptions

LED	State	Description
Status	Green	The LC is properly seated and operating correctly.
	Yellow	The LC has one or more errors detected.
	Off	No power is applied to the LC.

LED	State	Description
Attention [15]	Blue	The card needs attention.
	Off	The card does not need attention.
Port	Green	The link is up (including internal loopback).
	Yellow	The link is down or a hardware failure has occurred.
	Off	The slice is unprovisioned by software, the optics module is missing, or the slice has been powered down.

[15] The Attention LED can be lit only by using the hw-module attention-led location CLI command, which is useful for identifying and verifying which card needs attention.

Physical Characteristics

- Height—11.05 in. (280.6 mm)
- Width—1.55 in. (39.4 mm)
- Depth—14.25 in. (362 mm)
- Weight—8.48 lb (3.85 kg)

NCS4K-4H-QDD-P Line Card

Table 42: Feature History

Feature Name	Release Information	Feature Description
NCS4K-4H-QDD-P Line Card	Cisco IOS XR Release 6.5.35	The NCS4K-4H-QDD-P line card is a new addition to the NCS 4000 platform. It uses the Bright DCO pluggable variant, DP04QSDD-HE0, to scale WDM traffic from 100G to 400G in 100G increments, providing flexibility and high performance across regional, metro, and long-haul routes.This line card has eight port interfaces: • **SFP28 ports**: Four SFP port interfaces. Each supports 25G data. • **QSFP-DD ports**: Four QSFP-DD port interfaces. The interface at port 4 supports up to 400G data, while the remaining three QSFP-DD interfaces support up to 100G data each.

The NCS4K-4H-QDD-P line card supports packet and WDM switching for 400G traffic and contains:

Table 43: NCS4K-4H-QDD-P Port Interfaces

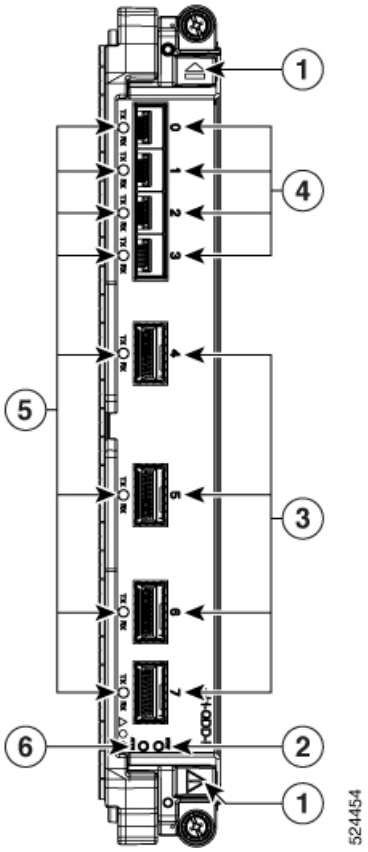
Port Interfaces	Port Numbers	Form Factor	Supported Pluggable Types	Data Rate	Notes
Client	0, 1, 2, 3	SFP28	SFP/SFP+	25GE	In R6.5.35, the NCS4K-4H-QDD-P card supports only SFP pluggables.
	4, 5, 6, 7	QSFP-DD	QSFP-DD	100GE, 400GE	Only port 4 QSFP-DD interface supports 400GE pluggable. When you use port 4 for 400GE, make sure to keep all other ports idle and covered with dust caps.
Trunk	4, 5, 6, 7	QSFP-DD	QSFP-DCO Bright ZR+	100GE, 400GE	You can configure the QSFP-DD DCO Bright ZR+ pluggable for 100GE at all QSFP-DD ports. When you use the QSFP-DD ports as trunk ports, the SFP ports act as client ports.

The card needs NCS4009-FC2-S fabric card to function in the NCS 4009 chassis.

The card needs NCS4016-FC2-S fabric card to function in the NCS 4016 chassis.

This figure shows the details of the front panel of the NCS4K-4H-QDD-P line card.

Figure 140: Front Panel of the NCS4K-4H-QDD-P Line Card



1	Ejector buttons	2	Status LED
3	QSFP-DD port	4	SFP (DWDM) port
5	Port LEDs	6	Attention LED

NCS4K-4H-QDD-P LED

Table 44: NCS4K-4H-QDD-P Status and Attention LED

LED	State	Description
Status	Green	The LC is properly seated and operating correctly.
	Yellow	The LC has one or more errors detected.
	Off	No power is applied to the LC.
Attention [16]	Blue	The card needs attention.
	Off	The card does not need attention.

LED	State	Description
Port	Green	The link is up (including internal loopback).
	Yellow	The link is down or a hardware failure has occurred.
	Off	The slice is unprovisioned by software, the optics module is missing, or the slice has been powered down.

[16] The Attention LED can be lit only by using the hw-module attention-led location CLI command, which is useful for identifying and verifying which card needs attention.

Client Interface

The NCS4K-4H-QDD-P line card supports the port configurations:

Table 45: NCS4K-4H-QDD-P Client Interface

Port Interface	Slot Port Number	Data Rate for Pluggable Type (Modulation)			
		QSFP-DD (PAM4)		QSFP-28 (NRZ)	SFP28 (NRZ)
SFP	0	-	-	-	25GE
	1	-	-	-	25GE
	2	-	-	-	25GE
	3	-	-	-	25GE
QSFP-DD	4	400GE	4x100GE, 3x100GE, 2x100GE, 1x100GE	100GE	-
	5	-	2x100GE, 1x100GE	100GE	-
	6	-	1x100GE	100GE	-
	7	-	1x100GE	100GE	-

The NCS4K-4H-QDD-P line card supports client data rate in different configurations:

Table 46: NCS4K-4H-QDD-P Client Data Rate Configurations

Data Rate	Pluggable Type	Supported Ports	
		QSFP-DD	SFP
400GE	1x QSFP-DD	4	-
4x100GE	4x QSFP-DD DCO Bright ZR+	4	-

Data Rate	Pluggable Type	Supported Ports	
		QSFP-DD	SFP
3x100GE	4x QSFP-DD DCO Bright ZR+	4	-
2x100GE	4x QSFP-DD DCO Bright ZR+	4, 5	-
1x100GE	4x QSFP-DD DCO Bright ZR+	4, 5, 6, 7	-
2x100GE + 4x25GE	2x QSFP-28 + 4x SFP28	4, 5, 6, 7	0, 1, 2, 3

Trunk Interface

The NCS4K-4H-QDD-P line card uses the DP04QSDD-HE0-19B pluggable for trunk interface. The DP04QSDD-HE0-19B pluggable is a variant of the Bright QSFP-DD DCO pluggable for WDM interface.

The bright DCO pluggable uses Open FEC and Closed FEC to scale trunk data rate from 100G to 400G. This trunk pluggable enables the line card to interoperate with 100G networks. It supports full C-band wavelength tunability and flex grid spacing with 100MHz graularity in tunability.

The trunk interfaces that the line card supports are:

- 1x 400ZR+ 16 QAM
- 2x 200ZR+ QPSK
- 1x 300ZR+ 8QAM + 1x 100ZR+ QPSK
- 1x 200ZR+ QPSK + 2x 100ZR+ QPSK
- 4x 100ZR+ QPSK

Physical Characteristics

- Height— 11.05 in. (280.6 mm)
- Width— 1.55 in. (39.4 mm)
- Depth— 14.25 in. (362 mm)
- Weight— 6.54 lb (2.97 kg)

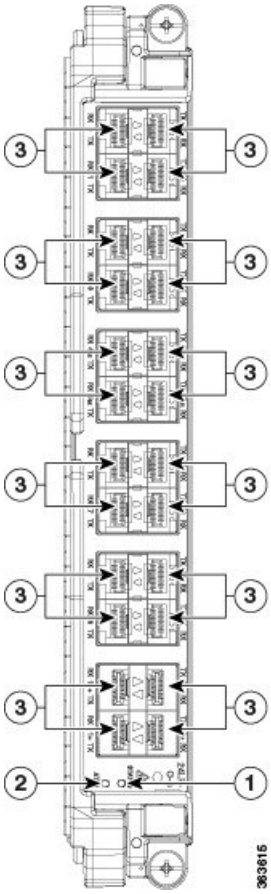
24-Port Low-Rate OTN Line Card

The 24-port low-rate OTN LC (NCS4K-24LR-O-S) supports up to:

- 24 1GE interfaces through SFP pluggable optics
- 16 OC-48/STM-16/OTU1 interfaces through SFP pluggable optics
- Four 10GE/OC-192/OTU2 interfaces through SFP+ pluggable optics

OTU1 and OTU2 ports support generic forward error correction (GFEC). The card supports ODU2, ODU1, ODU0, and ODUFlex switching functions by interconnecting with the centralized agnostic switch fabric.

Figure 141: 24-Port Low-Rate OTN LC Front Panel and LEDs



1	Status LED	3	Port LEDs (one LED on each port) [17]
2	Attention LED		

[17] Port LEDs are triangular in shape and point toward the port that they support.

Table 47: 24-Port Low-Rate OTN LC Descriptions

LED	State	Description
Status	Green	The LC is properly seated and operating correctly.
	Yellow	The LC has one or more errors detected.
	Off	No power is applied to the LC.
Attention [18]	Blue	The card needs attention.
	Off	The card does not need attention.

LED	State	Description
Port	Green	The link is up (including internal loopback).
	Yellow	The link is down or a hardware failure has occurred.
	Off	The slice is unprovisioned by software, the optics module is missing, or the slice has been powered down.

[18] The Attention LED can be lit only by using the hw-module attention-led location CLI command, which is useful for identifying and verifying which card needs attention.

Physical Characteristics

- Height—11.05 in. (280.6 mm)
- Width—1.55 in. (39.4 mm)
- Depth—14.25 in. (362 mm)
- Weight—5.5 lb (2.5 kg)

20-Port 10GE OTN Line Card

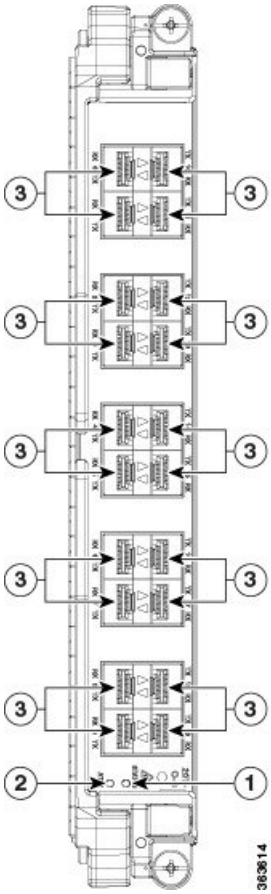
The 20-port 10GE OTN LC (NCS4K-20T-O-S) line card supports any combination of the following interfaces, up to:

- 20 10GE interfaces through SFP+ pluggable optics
- 20 OC-192/STM-64 interfaces through SFP+ pluggable optics
- 20 OTU2 interfaces through SFP+ pluggable optics

OTU1 and OTU2 ports support generic forward error correction (GFEC). The card supports up to 2-level ODU4, ODU3, ODU2, ODU1, ODU0, and ODUFlex switching functions by interconnecting with the centralized agnostic switch fabric.

The line card also supports direct interconnection to other slots within the Cisco NCS 4009 chassis to interconnect switched OTN traffic directly to the NCS 4000 2 x 100G CP-DQPSK - Full C band Tunable DWDM line card.

Figure 142: 20-Port 10GE OTN LC Front Panel and LEDs



1	Status LED	3	Port LEDs (one LED on each port) [19]
2	Attention LED		

[19] Port LEDs are triangular in shape and point toward the port that they support.

Table 48: 20-Port 10GE OTN LC Descriptions

LED	State	Description
Status	Green	The LC is properly seated and operating correctly.
	Yellow	The LC has one or more errors detected.
	Off	No power is applied to the LC.
Attention [20]	Blue	The card needs attention.
	Off	The card does not need attention.

LED	State	Description
Port	Green	The link is up (including internal loopback).
	Yellow	The link is down or a hardware failure has occurred.
	Off	The slice is unprovisioned by software, the optics module is missing, or the slice has been powered down.

[20] The Attention LED can be lit only by using the hw-module attention-led location CLI command, which is useful for identifying and verifying which card needs attention.

Physical Characteristics

- Height—11.05 in. (280.6 mm)
- Width—1.55 in. (39.4 mm)
- Depth—14.25 in. (362 mm)
- Weight—5.5 lb (2.5 kg)

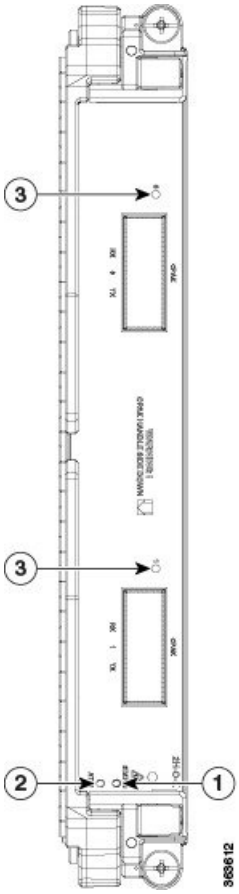
2-Port 100GE OTN Line Card

The 2-port 100GE OTN LC (NCS4K-2H-O-K) supports any combination of 100GE and OTU4 interfaces using Cisco CPAK pluggable optics. Two CPAK receptacles are hosted on the faceplate.

Note Insert CPAK modules in the 2-port 100GE OTN LC handle side down.

The card supports up to two-level ODU4, ODU3, ODU2, ODU1, ODU0, and ODUFlex nested switching functions by interconnecting with the centralized agnostic switch fabric. 100-Gigabit Ethernet signals are mapped using generic mapping procedure (GMP) over ODU4 according to ITU-T G.709 v3 (Section 17.7.5).

Figure 143: 2-Port 100GE OTN LC Front Panel and LEDs



1	Status LED	3	Port LEDs (one LED on each port)
2	Attention LED		

Table 49: 2-Port 100GE OTN LC Descriptions

LED	State	Description
Status	Green	The LC is properly seated and operating correctly.
	Yellow	The LC has one or more errors detected.
	Off	No power is applied to the LC.
Attention [21]	Blue	The card needs attention.
	Off	The card does not need attention.

LED	State	Description
Port	Green	The link is up (including internal loopback).
	Yellow	The link is down or a hardware failure has occurred.
	Off	The slice is unprovisioned by software, the optics module is missing, or the slice has been powered down.

[21] The Attention LED can be lit only by using the hw-module attention-led location CLI command, which is useful for identifying and verifying which card needs attention.

Physical Characteristics

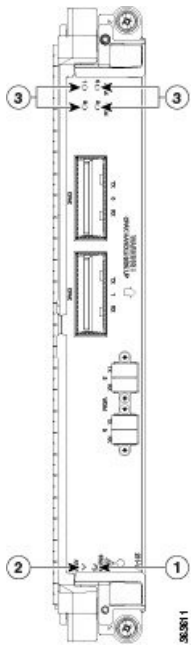
- Height—11.05 in. (280.6 mm)
- Width—1.55 in. (39.4 mm)
- Depth—14.25 in. (362 mm)
- Weight—5.95 lb (2.7 kg)

2-Port 100GE DWDM Line Card

The 2-port 100GE DWDM LC (NCS4K-2H-W) can transport two 100GE or OTU4 signals over a 50 GHz spaced, 50 GHz stabilized, ITU-compliant wavelength with more than 4500 km of unregenerated reach. The card also features two CPAK pluggable optics that can map each client signal to a single DWDM line interface.

Note Insert CPAK modules in the 2-port 100GE DWDM LC handle side up.

Figure 144: 2-Port 100GE DWDM LC Front Panel and LEDs



1	Status LED	3	Port LEDs, CPAK, and WDM (one LED on each port)
2	Attention LED		

Table 50: 2-Port 100GE DWDM LC Descriptions

LED	State	Description
Status	Green	The LC is properly seated and operating correctly.
	Yellow	The LC has one or more errors detected.
	Off	No power is applied to the LC.
Attention [22]	Blue	The card needs attention.
	Off	The card does not need attention.
Port	Green	The link is up (including internal loopback).
	Yellow	The link is down or a hardware failure has occurred.
	Off	The slice is unprovisioned by software, the optics module is missing, or the slice has been powered down.

[22] The Attention LED can be lit only by using the hw-module attention-led location CLI command, which is useful for identifying and verifying which card needs attention.

Physical Characteristics

- Height—11.05 in. (280.6 mm)
- Width—1.55 in. (39.4 mm)
- Depth—14.25 in. (362 mm)
- Weight—7.8 lb (3.53 kg)

Pluggable Optics Support

Table 51: Feature History

Feature Name	Release Information	Feature Description
QSFP support	Cisco IOS XR Release 6.5.31	The QSFP-100G-FR-S pluggable is supported on the NCS4K-4H-OPW-QC2 line card.

The following table describes the pluggable optics that are supported on the line cards.

Table 52: Supported Pluggable Optics

Pluggable	Rate and Reach	Product ID	24-Port Low-Rate OTN LC	20-Port 10GE OTN LC	2-Port 100GE OTN LC	NCS4K-4H-OPW-QC2 LC	NCS4K-4H-ODD-P
SFP	25GE LR	SFP-10/25G-LR-I	-	-	-	-	X
	25G ER	SFP-25G-ER-I	-	-	-	-	X
SFP+	10GE SR/SW	ONS-SC+-10G-SR=	X	X	-	-	-
	10GE LR/LW OC-192 SR STM-64 I-64.1 OTU2 P1I1 2D1	ONS-SC+-10G-LR=	X	X	-	-	-
	10GE ER/EW OC-192 IR-2 STM-64 S-64.2 OTU2 P1S1-2D2	ONS-SC+-10G-ER=	X	X	-	-	-
	10GE ZR OC192 LR-2 STM-64 L-64.2 OTU2 P1L1-2D2	ONS-SC+-10G-ZR=	X	X	-	-	-
	C-band tunable	ONS-SC+-10G-C=	X	X	-	-	-
CPAK	100GE SR10	CPAK-100G-SR10	-	-	X	-	-
	100GE LR4 OTU4 4I1-9D1F	CPAK-100G-LR4	-	-	X	-	-
QSFP28	100Gbps Multi-rate QSFP28, LR	ONS-QSFP28-LR4	-	-	-	X	X

Pluggable	Rate and Reach	Product ID	24-Port Low-Rate OTN LC	20-Port 10GE OTN LC	2-Port 100GE OTN LC	NCS4K-4H-OPW-QC2 LC	NCS4K-4H-ODD-P
QSFP	100GBASE FR QSFP Transceiver, LC, 2km over SMF(Single mode fiber); G.652 core size (Microns)	QSFP-100G-FR-S	-	-	-	X	X
	100GBASE ZR4 QSFP Transceiver, LC, 80km over SMF(Single mode fiber); G.652 core size (Microns)	QSFP-100G-ZR4-S	-	-	-	X	X
	100GBASE QSFP Transceiver, LC, 25-40km over SMF(Single mode fiber); G.652 core size (Microns)	QSFP-100G-ER4L-S	-	-	-	X	X
	100GBASE LR-S QSFP Transceiver, LC, 25-40km over SMF(Single mode fiber); G.652 core size (Microns)	QSFP-100G-LR-S	-	-	-	-	X
	100GBASE LR4 QSFP Transceiver, LC, 10km over SMF(Single mode fiber); G.652 core size (Microns)	QSFP-100G-LR4-S [23]	-	-	-	X	X

Pluggable	Rate and Reach	Product ID	24-Port Low-Rate OTN LC	20-Port 10GE OTN LC	2-Port 100GE OTN LC	NCS4K-4H-OPW-QC2 LC	NCS4K-4H-ODD-P
QSFP+	4X10G Multirate LR4 QSFP+	QSFP-4X10-MLR	-	-	-	X	-
	QSFP 40G Ethernet - LR4 Lite, LC, 2KM, Enterprise-Class	QSFP-40G-LR4	-	-	-	X	-
	QSFP 40GBASE-ER4 Transceiver Module, LC, 40KM	QSFP-40G-ER4	-	-	-	X	-
	4x10G break out QSFP module with 25km reach. Supports - OC192, STM64,10GE, OTU1e,OTU2, OTU2e	ONS-QSFP-4x10-MER	-	-	-	X	-
QSFP adapter	QSFP to SFP Adapter to support SFP+ Modules with rates:OC192, STM64,10GE, OTU1e,OTU2, OTU2e	CVR-QSFP-SFP10G	-	-	-	X [24]	-
CFP2	100G QPSK / 200G 16-QAM - WDM CFP2 Pluggable	ONS-CFP2-WDM	-	-	-	X	-
	100G QPSK / 200G 16-QAM - WDM CFP2 Pluggable	ONS-CFP2-WDM2 [25]	-	-	-	X	-

Pluggable	Rate and Reach	Product ID	24-Port Low-Rate OTN LC	20-Port 10GE OTN LC	2-Port 100GE OTN LC	NCS4K-4H-OPW-QC2 LC	NCS4K-4H-ODD-P
QSFP-DD	400G QSFP-DD Transceiver, 400GBASE-FR4, Duplex LC, 2km Duplex SMF	QDD-400G-FR4-S	-	-	-	-	X
	400G QSFP-DD Transceiver, 400GBASE-ER1	DP04QSDD-ER1	-	-	-	-	X
	400G QSFP-DD Transceiver, 400G-LR4, 10km Duplex SMF, 100% compliant with 400GBASE-LR4-6	QDD-400G-LR4-S	-	-	-	-	X
	QSFP-DD 400G-ZR+ High TX Power DCO Pluggable - C-Band	DP04QSDD-HE0	-	-	-	-	X

[23] The QSFP-100G-LR4-S pluggable is not HW qualified for OTU4, hence supports 100G Ethernet only; no support for breakout configuration.
[24] SFP+ module supported on the QSFP adapter is, ONS-SC+-10G-ZR=
[25] The ONS-CFP2-WDM2 has a minimum frequency tunability of 6.25Hz.

Installing a Line Card

This section contains the following procedures:

Installing a Line Card

Prerequisites

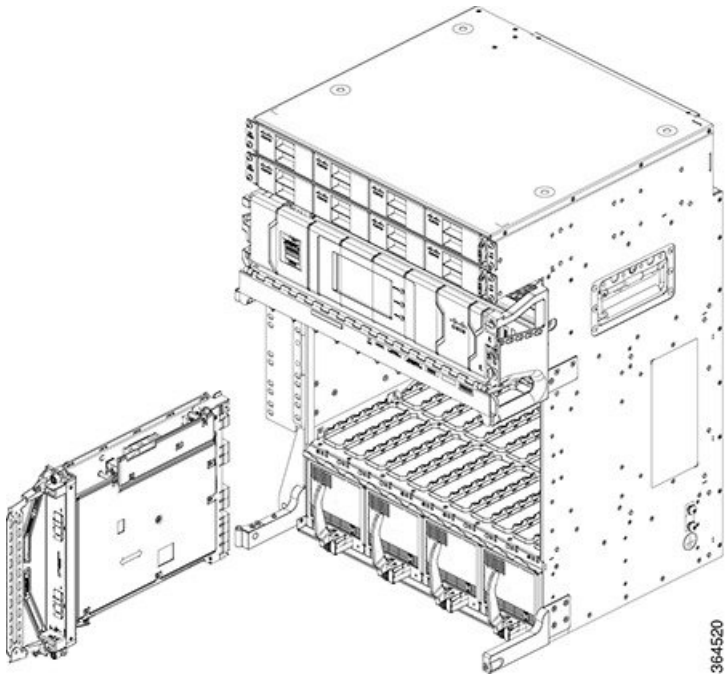
Before performing this task, open the front door, if installed.

Caution Remove or install only one LC at a time. Allow at least 30 seconds for the chassis to complete its tasks before removing or installing another LC. The chassis may indicate a hardware failure if you do not follow proper procedures.

Required Tools and Equipment

- ESD-preventive wrist strap
- Number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver
- LC

Figure 145: Installing a Line Card



Steps

The following steps describe how to install a line card.

Procedure

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to the ESD jack located on the front or rear of the chassis. You can also connect the ESD-preventive wrist strap leash to any bare metal surface on the chassis.

Step 2 Remove the filler card and set it aside.

Note
Remove only one filler card and install only one LC at a time. Be sure to verify that each LC is fully installed and secured before installing another card.

Step 3 Remove the LC from the antistatic bag.

Caution
To prevent ESD damage, handle an LC by its ejector levers or the LC carrier edges only. Do not touch any of the electrical components, pins, or circuitry.

Step 4 Orient the LC. The arrows on the OIR buttons must be facing up.

See Figure 132: RP Card Front Panel , on page 207 for an example of the arrows on the OIR buttons. If the card does not slide easily into the slot, the orientation may be wrong. Check if the rejection flange is stopping the card from going into the slot. Reorient the LC, if necessary.

Step 5 Use both hands while inserting an LC. Use one hand on the faceplate and the other hand along the base of the LC to guide it into a slot.

Step 6 Press the OIR buttons to release the ejectors.

Caution
When adjusting the ejector levers, avoid hitting the top and bottom fiber management features and doors.

Step 7 Make sure that the ejector levers are oriented properly to engage with the pin as the LC slides into the slot. Carefully slide the LC into the slot until the ejector levers engage the catches, and then *stop.*

Step 8 Simultaneously pivot the ejector levers toward the faceplate of the LC. Do not force the LC; the ejector levers properly seat the LC against the backplane.

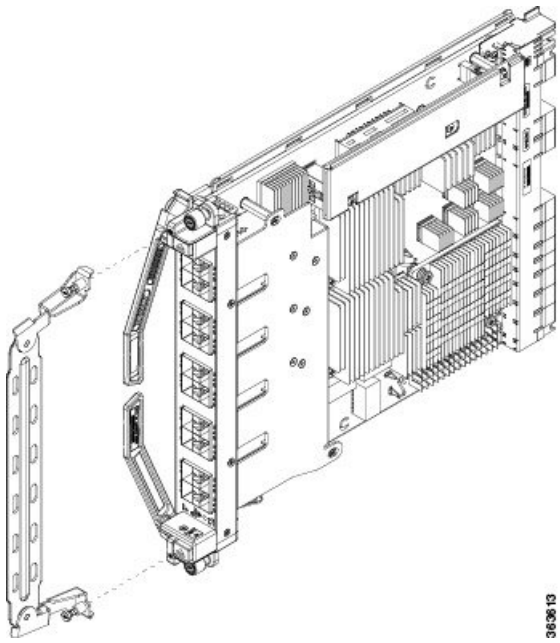
Note
If the captive screws are difficult to tighten, ensure that each ejector lever is properly secured to each catch and that the LC is properly seated in the slot.

Step 9 Use a number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver to tighten the captive screws next to each LC ejector lever to ensure proper EMI shielding. The tightening also prevents the LC from becoming partially dislodged from the backplane. Tighten the captive screws using 10.60 pound/force (lbf) inch (1.20 Nm torque).

Step 10 Before attaching the vertical cable management bracket, ensure that the LC has been installed properly. See the Verifying the Installation of a Line Card, on page 242.

Step 11 Attach the vertical cable management bracket to the faceplate of the LC using the two screws that came with it. The dark gray arm should be facing up, and the light gray arm should be facing down.

Figure 146: Attaching the Vertical Cable Management Bracket



Verifying the Installation of a Line Card

Use the Status LED, located on the faceplate of the LC, to verify the correct installation of the LC:

- When the card is properly installed and no faults are detected, the status LED turns green.
- When the status LED is solid yellow, either software initialization is in progress during bootup or a fault exists on the card.
- When the status LED is blinking yellow, the card is not fully seated.
- When the status LED is off, verify that the card is installed correctly. There could be no power applied to the card, a power fault, or a hardware fault.
- Verify that there is power to the card by looking at the indicators on the power tray.

If the installed or replaced LC fails to operate or to power on after installation:

- Ensure that the card is seated firmly into the Cisco NCS 4009 chassis slot. One easy way to verify the physical installation is to see whether the front faceplate of the card is even with the fronts of the other installed cards.
- Ensure that the ejector levers are latched and that the captive screws are fastened properly. If you are uncertain, unlatch the levers, loosen the screws, and attempt to reseat the card.
- Examine the power system to see whether the chassis is receiving power.

Connecting Line Card Network Interface Cables

This section describes how to route the network interface cables through the chassis cable management tray and how to attach the network interface cables to the line card ports.

This procedure uses an 20x10GE OTN line card as an *example* to describe how to attach a network interface cable to a line card port and route the cable through the cable management tray. Depending on which line cards are installed in your system, your cable connection procedure may differ slightly from this example.

Note For the cable connection information for your specific line card, refer to the installation and configuration note for that line card. You can access the most current Cisco line card documentation online at: http://www.cisco.com.

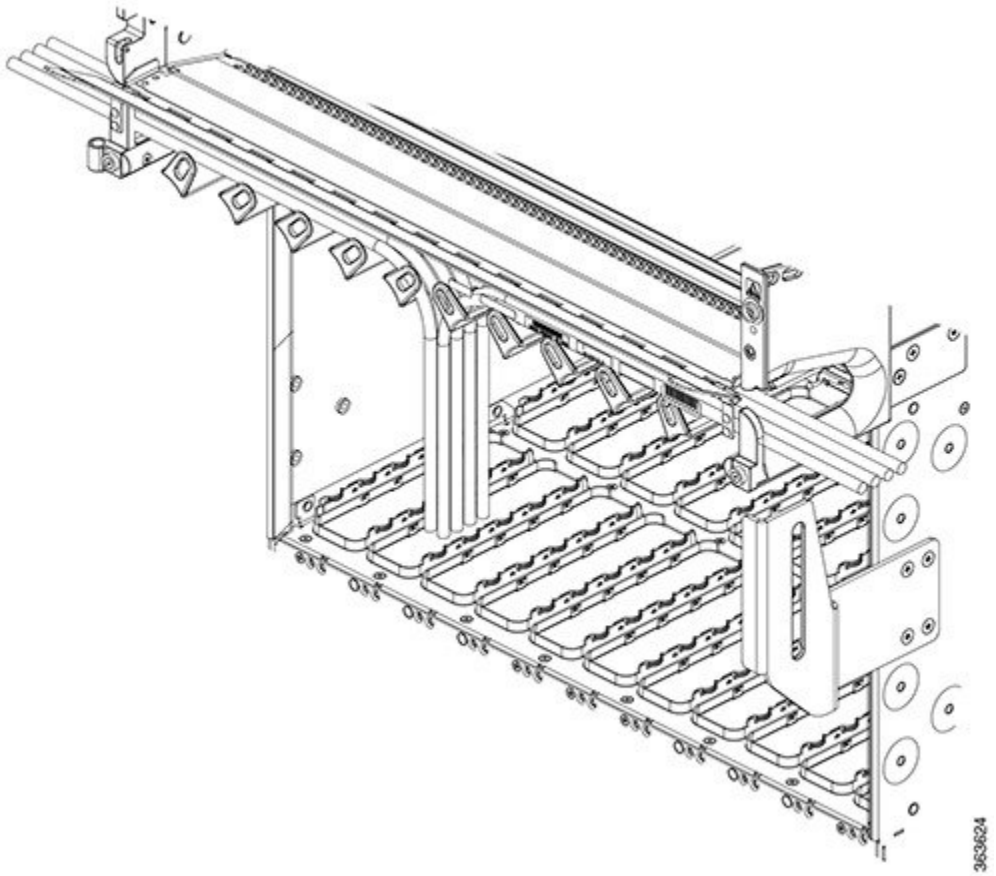
Steps

Follow these steps as an example to route the network interface cables through the cable management tray and connect them to the line card:

Procedure

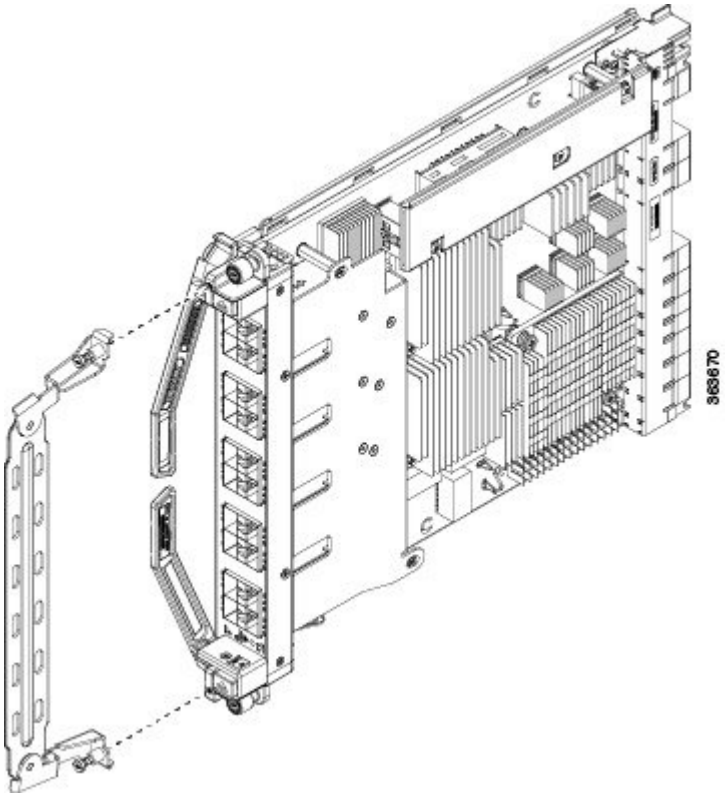
Step 1 Route an interface cable across the horizontal cable management tray and down through the cable tray opening to connect it to the line card.

Figure 147: Routing Interface Cables Through the Cable Management Tray



Step 2 Attach a line card cable management bracket to the line card front panel. This bracket is shipped with the line card.

Figure 148: Attaching a Line Card Cable Management Bracket



Step 3 Insert the cable connector into its assigned port.

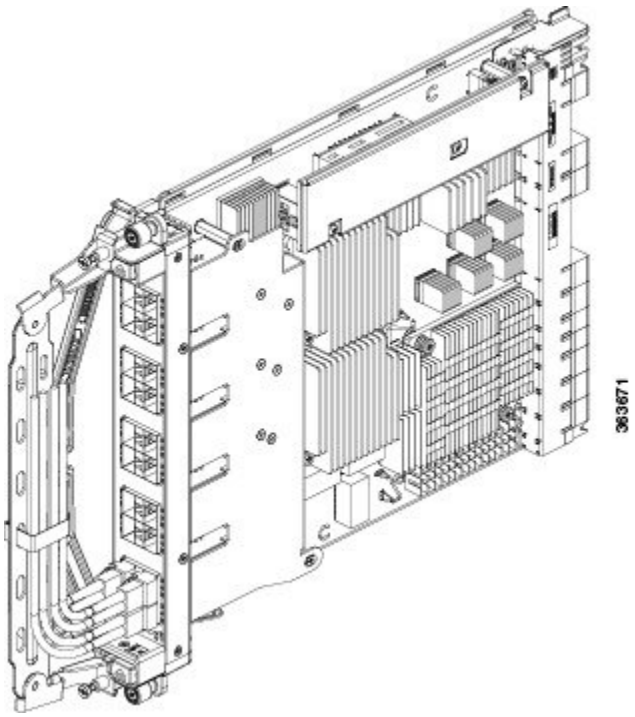
Note
You can use the clamp tool (provided in the chassis installation kit) to help insert (or remove) cable connectors (and pluggables).

Step 4 Install pluggables and fiber connectors.

Step 5 Repeat Step 1 through Step 4 for each additional cable connection to that line card.

Step 6 Affix fibers to the vertical brackets. The final connections should appear similar to the following figure.

Figure 149: Interface Cable Routing Using the Line Card Cable Management Bracket

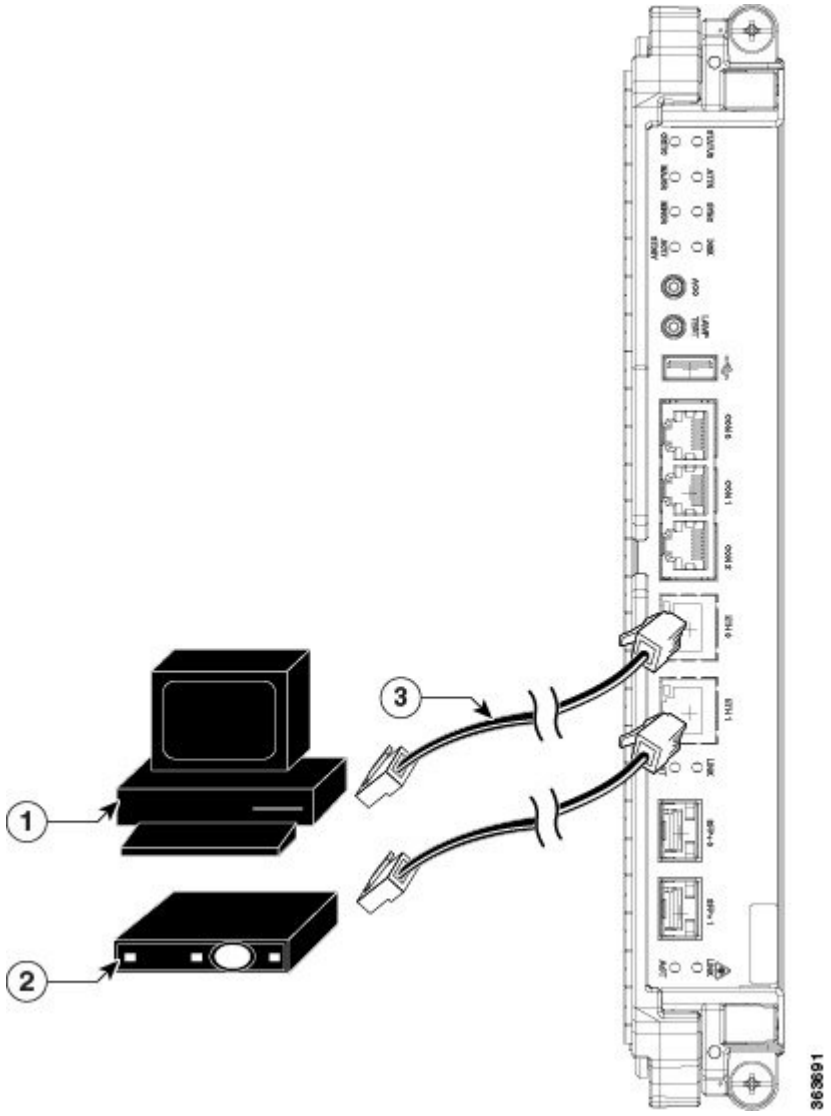


Caution
Make sure that the interface cables do not have any kinks or sharp bends, which can destroy or degrade the ability of the optical fiber to propagate the signal-encoded beam of light accurately from one end of the cable to the other. Always allow adequate strain relief in the interface cable.

Connecting Cables to the RP

This section describes how to connect cables to the console and Ethernet ports on the RP. The console ports are asynchronous serial ports; devices that are connected to these ports must be capable of asynchronous transmission. For example, most modems are asynchronous devices.

Figure 150: RP Port Connections



1	Console terminal	3	RJ-45 Ethernet cables into RJ-45 ports
2	Modem		

Caution The ports that are labeled Ethernet and Console are safety extra-low voltage (SELV) circuits. SELV circuits should be connected only to other SELV circuits.

Note RP cables are not available from Cisco, but they are available from any commercial cable vendor.

Note To comply with the intrabuilding lightning surge requirements of Telecordia GR-1089-CORE, Issue II, Revision 01, February 1999, you must use a shielded cable when connecting to the console and Ethernet ports. A shielded cable is terminated by shielded connectors on both ends, with the cable shield material tied to both connectors.

Connecting to the Console Port

The system console port on the RP is an RJ-45 receptacle for connecting a data terminal to perform the initial configuration of the chassis. The console port requires a straight-through RJ-45 cable.

Follow this procedure to connect a data terminal to the RP console port:

Procedure

Step 1 Set your terminal to these operational values: 115200 bps, 8 data bits, no parity, 1 stop bit (9600 8N1).

Step 2 Power off the data terminal.

Step 3 Attach the terminal end of the cable to the interface port on the data terminal.

Step 4 Attach the other end of the cable to the RP console port.

Step 5 Power on the data terminal.

Connecting to the Ethernet Management Ports

To connect cables to the RP management ports, attach Category 5 UTP cables directly to the MGT LAN 0 and MGT LAN 1 RJ-45 receptacles on the RP.

Note RJ-45 cables are not available from Cisco; they are available from outside commercial cable vendors. Use cables that comply with EIA/TIA-568 standards.

Caution Ethernet management ports are primarily used as Telnet ports into the Cisco NCS 4009 chassis. They are also used for booting or accessing Cisco software images over a network to which an Ethernet port is directly connected. We strongly caution you to consider the security implications of enabling routing functions on these ports.

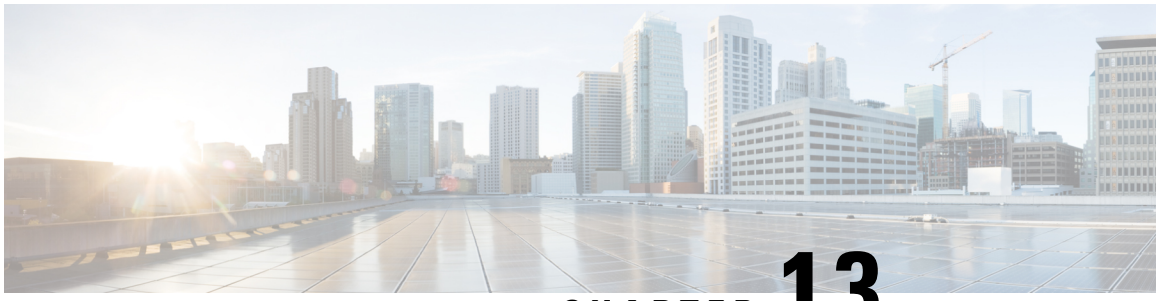
Note The Ethernet interfaces on the RP are end station devices only, not repeaters.

Follow these steps to connect an Ethernet cable to the RP RJ-45 Ethernet receptacle:

Procedure

Step 1 Plug the cable directly into the RJ-45 receptacle.

Step 2 Connect the network end of your RJ-45 cable to a switch, hub, repeater, or other external equipment.



CHAPTER 13

Removing and Replacing Chassis Components

This chapter provides instructions on how to remove and replace components from the Cisco NCS 4009 chassis.

- Removing a Line Card, on page 249
- Replacing or Reinserting a Line Card, on page 251
- Removing an RP Card, on page 252
- Removing a Fabric Card, on page 254
- Removing an Auxiliary Fan Tray , on page 258
- Removing the Power Components, on page 259
- Removing the Air Filter, on page 265
- Replacing the Air Filter, on page 268
- Replacing the Front Door, on page 269
- Removing the Fan Tray, on page 275
- Replacing the Fan Tray, on page 277
- Removing and Replacing the Craft Panel, on page 278
- Replacing the Craft Panel, on page 280
- Routing the BITS Cables, on page 280
- Removing the External Connection Unit, on page 281
- Replacing the External Connection Unit, on page 282

Removing a Line Card

This section describes how to remove a line card from the Cisco NCS 4009 chassis.

Warning **Class 1 Laser Product.** Statement 113

Warning **Because invisible radiation may be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to radiation and do not stare into open apertures.** Statement 125

Warning **For diverging beams, viewing the laser output with certain optical instruments within a distance of 100 mm may pose an eye hazard. For collimated beams, viewing the laser output with certain optical instruments designed for use at a distance may pose an eye hazard.** Statement 282

Prerequisites

Before performing this task, open the front door, if installed.

Caution The system can indicate a hardware failure if you do not follow proper procedures. Remove or install only one LC at a time. Allow at least 30 seconds for the system to complete its tasks before removing or installing another LC.

This procedure is traffic-impacting.

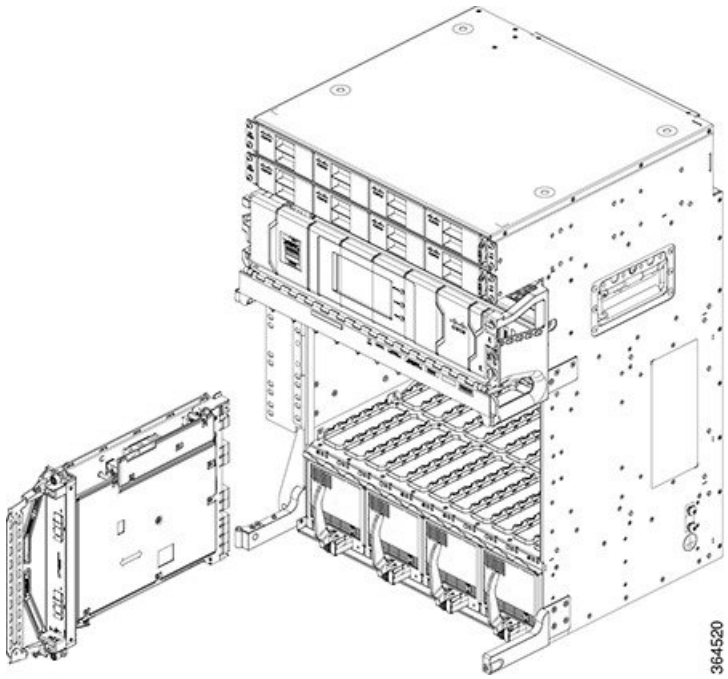
Required Tools and Equipment

- ESD-preventive wrist strap
- Number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver

Steps

The following steps describe how to remove a line card.

Figure 151: Removing a Line Card



Procedure

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to the ESD jack located on the front or rear side of the chassis. You can also connect the ESD-preventive wrist strap leash to any bare metal surface on the chassis.

Step 2 Identify the card to be removed.

Note
To verify which card needs attention, the Attention LED can be lit using the hw-module attention-led location CLI command.

Step 3 In the **Node View** of CTC, click the **Inventory** tab and set the **Admin State** of the line card to **OOS** (Out Of Service).

This will shut down the Line Card.

Step 4 Press the OIR buttons to unlock the ejector levers, wait for 30 seconds.

Step 5 Use the number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver to loosen the two captive screws holding the card in place.

Caution
When adjusting the ejector levers, avoid hitting the top and bottom fiber management features and doors.

Step 6 Grasp the two card ejector levers and simultaneously pivot both ejector levers 70 degrees away from the front edge of the card carrier to unseat the card from the backplane connector.

Step 7 Touching only the metal card carrier, slide the card from the slot and place it directly into an antistatic sack or other ESD-preventive container.

Warning
Because invisible laser radiation may be emitted from the aperture of the port when no cable is connected, avoid exposure to laser radiation and do not stare into open apertures. Statement 70

Replacing or Reinserting a Line Card

This section describes how to replace or reinsert a line card on the Cisco NCS 4009 chassis.



Warning **Class 1 Laser Product.** Statement 113



Warning **Because invisible radiation may be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to radiation and do not stare into open apertures.** Statement 125

Warning **For diverging beams, viewing the laser output with certain optical instruments within a distance of 100 mm may pose an eye hazard. For collimated beams, viewing the laser output with certain optical instruments designed for use at a distance may pose an eye hazard.** Statement 282

Prerequisites

Before performing this task, open the front door, if installed.

Caution Remove or install only one LC at a time. Allow at least 30 seconds for the chassis to complete its tasks before removing or installing another LC. The chassis may indicate a hardware failure if you do not follow proper procedures.

This procedure is traffic-impacting.

Required Tools and Equipment

- ESD-preventive wrist strap
- Number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver
- LC

Steps

To replace/reinstall the line card:

Procedure

Step 1 Perform the procedure Removing a Line Card, on page 249 to remove the line card that needs to be replaced/reinserted.

Step 2 Perform the procedure Installing a Line Card, on page 239 to install a new card or reinsert the same card that was removed in step1.

Step 3 In the **Node View** of CTC, click the **Inventory** tab.

Step 4 if **Admin State** of the line card is **OOS** (Out of Service) in CTC, then set the **Admin State** of the line card to **IS** (In Service).

Traffic will resume after the card is in service.

Removing an RP Card

This section describes how to remove a route processor card from the Cisco NCS 4009 chassis.

Prerequisites

Before performing this task, open the front door, if installed. The RP cards are hot-swappable.

Perform this task when you are certain that the other RP card in the chassis is operational and, if not already the active RP, is ready to assume control (this happens automatically). Failure to follow these guidelines can result in interruptions in data communications and network connectivity.

Warning **Class 1 Laser Product.** Statement 113

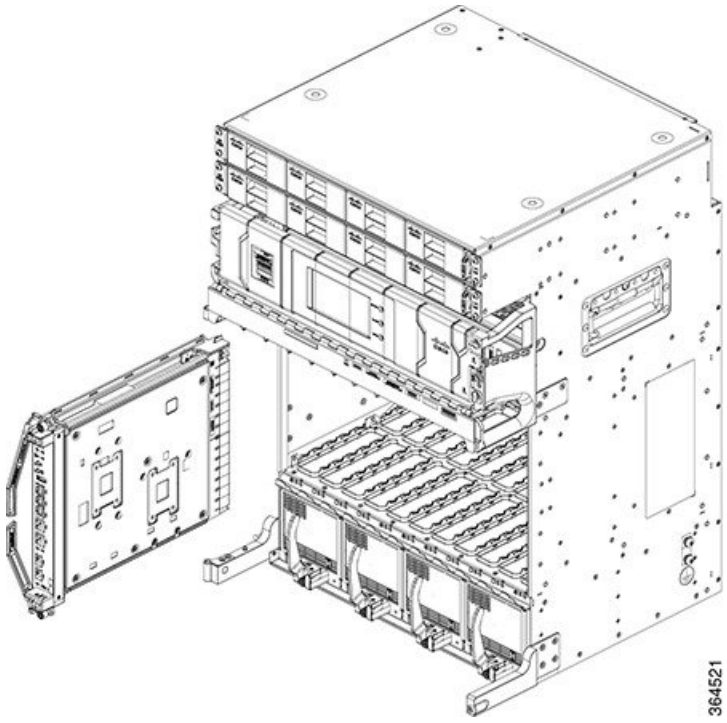
Warning **Because invisible radiation may be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to radiation and do not stare into open apertures.** Statement 125

Required Tools and Equipment

- ESD-preventive wrist strap
- Number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver

Steps

Figure 152: Removing an RP Card



1	Direction and location of removal	3	Captive screw (also one on top)
2	Ejector levers	4	OIR buttons

Procedure

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the two ESD jacks located on the front or rear side of the chassis. You can also connect the ESD-preventive wrist strap leash to any bare metal surface on the chassis.

Step 2 Identify the card to be removed from the card cage. Reload the RP card to move the active processes to other RPs using the **hw-module location <slot-number> reload** command.

```
sysadmin-vm:0_RP0# hw-module location 0/RP0 reload
```

Note
When the RP is up or booting, you can remove the RP card using the OIR button. Pressing the OIR button to unlock the ejector lever when the RP is Active may impact the traffic.

Step 3 Remove any cables connected to the front panel of the card.

Step 4 Press the OIR buttons to unlock the ejectors. Wait for 30 seconds.

Step 5 Use the number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver to turn the two captive screws on the front panel of the card counterclockwise to loosen the card from the slot.

Caution
To prevent ESD damage, handle an RP card by its ejector levers or the LC carrier edges only. Do not touch any of the electrical components, pins, or circuitry.

Step 6 Simultaneously pivot the ejector levers away from the faceplate to release the RP card from the backplane connectors.

Step 7 Grasp the two card ejector levers and simultaneously pivot both ejector levers 90 degrees away from the front edge of the card carrier to unseat the card from the backplane connector.

Step 8 Grasp the ejector levers with both hands and gently pull the RP card halfway from the slot.

Step 9 Move one hand under the RP card to guide it. Avoid touching the RP card printed circuit board, components, or any connector pins.

Step 10 Touching only the metal card carrier, slide the card from the slot and place it directly into an antistatic sack or other ESD-preventive container. If you plan to return a defective card to the factory, repackage it in the shipping container that you received with the replacement card.

For replacement, wait for 30 seconds after removing the card from the chassis and then reinsert the new card. For the installation procedure, see Installing an RP Card , on page 204.

Removing a Fabric Card

This section describes how to remove a fabric card from the Cisco NCS 4009 chassis.

Prerequisites

- Open the front door.
- Remove the air filter. See Removing the Air Filter, on page 265

- Identify the fabric card to be removed and shut down the plane using the command, **controller fabric plane X shutdown**. X denotes the fabric plane and can be in the range 0 to 3.

```
sysadmin-vm:0_RP0(config)# controller fabric plane 0 shutdown
sysadmin-vm:0_RP0(config)# commit
```

- For the NCS4009-FC2F-S fabric card, remove the AFT. See Removing an Auxiliary Fan Tray , on page 258

Required Tools and Equipment

- ESD-preventive wrist strap
- Number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver

Figure 153: Removing a Fabric Card - NCS4009-FC2-S

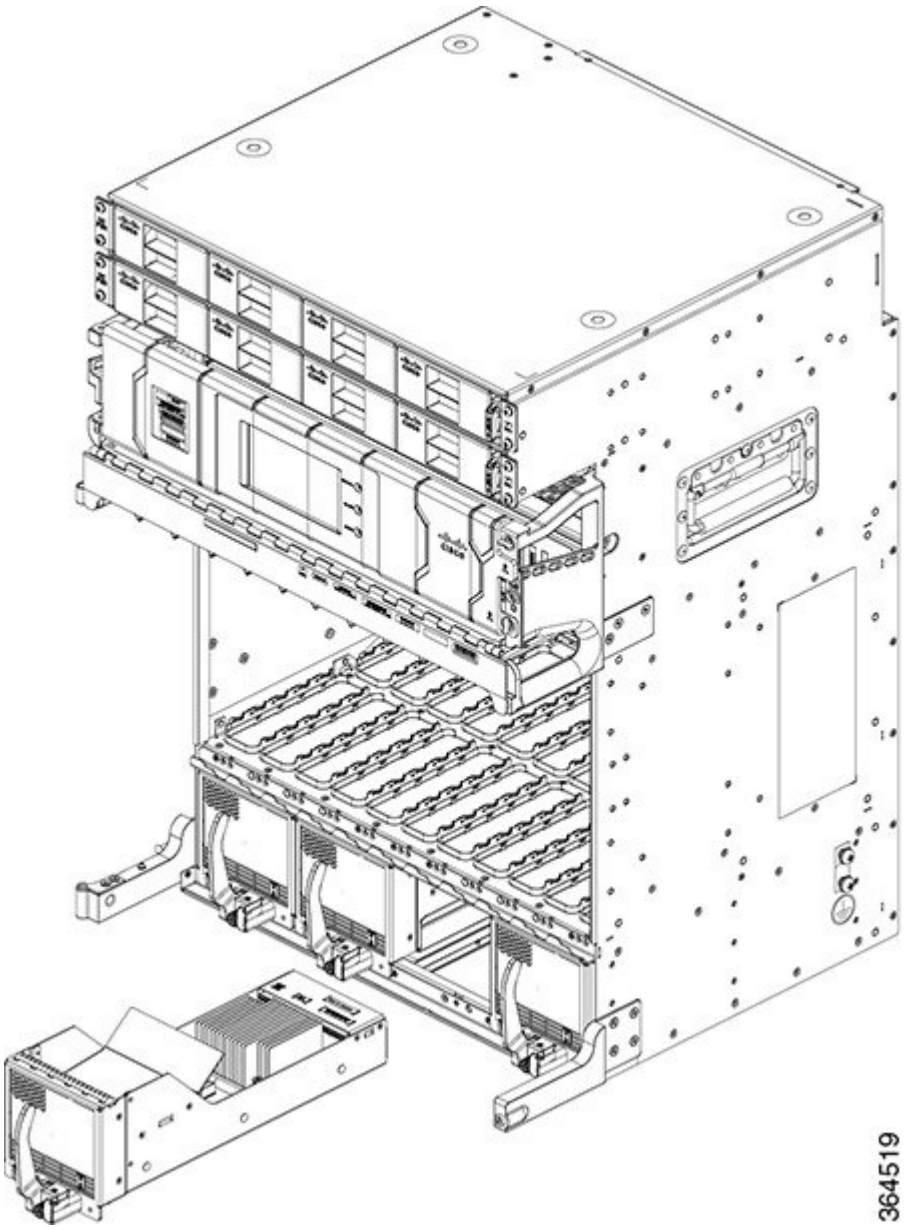
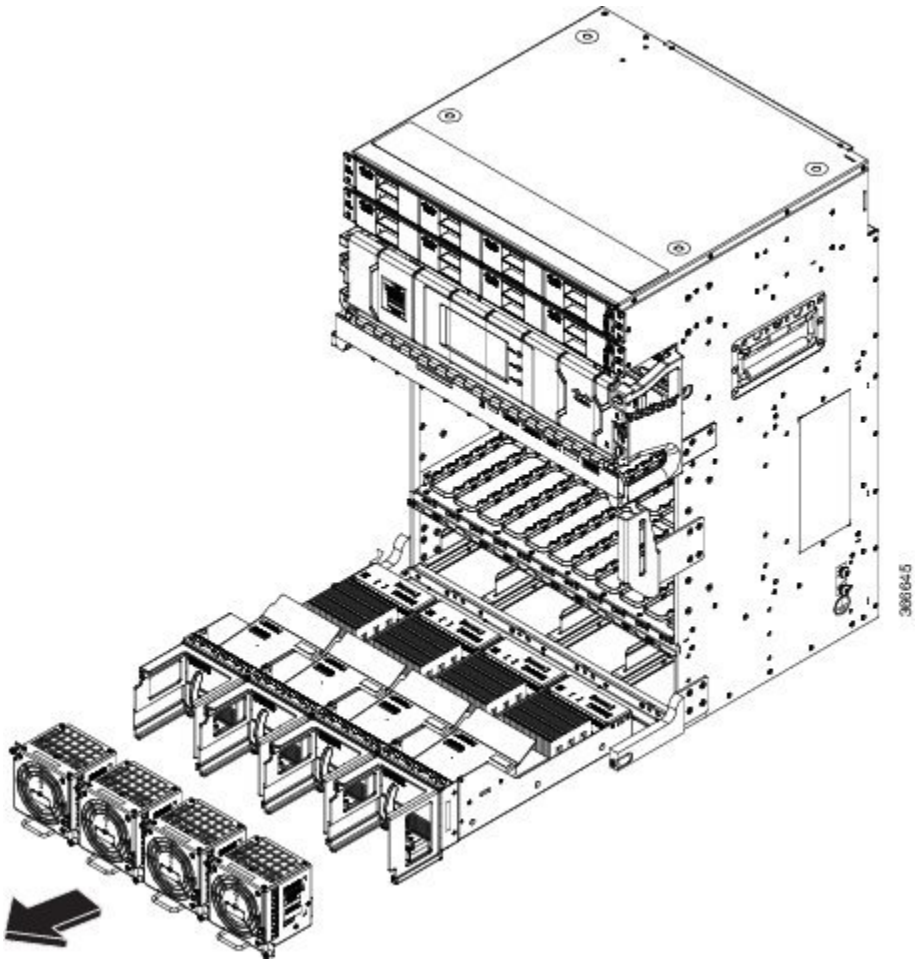


Figure 154: Removing a Fabric Card - NCS4009-FC2F-S



Steps

The following steps describe how to remove a fabric card.

See here for a graphical representation of the removal of the NCS4009-FC2F-S fabric card and the AFT.

Procedure

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to the ESD jack located on the front side of the chassis. You can also connect the ESD-preventive wrist strap leash to any bare-metal surface on the chassis.

Step 2 Use the number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver to turn the captive screw on the front panel of the card counterclockwise to loosen it from the slot.

Step 3 Press the OIR button to unlock the ejector. Wait for 30 seconds.

Step 4 Grasp the card ejector lever and pivot the ejector lever 70 degrees away from the front edge of the card carrier to disengage the card from the backplane connector.

Step 5 Touching only the metal card carrier, slide the card from the slot and place it directly into an antistatic bag or other ESD-preventive container. If you plan to return the defective card to the factory, repackage it in its original shipping container.

For replacement, wait for 30 seconds after removing the card from the chassis and then reinsert the new card. For the installation procedure, see Installing a Fabric Card, on page 210.

Removing an Auxiliary Fan Tray

This section describes how to remove the AFT (Cisco PID NCS4009-FAN-FC).

Warning The maximum time limit for OIR of the AFT is five minutes.

Prerequisites

Before performing this task, remove the air filter.

Required Tools and Equipment

- ESD wrist-strap
- 6-inch, Philips number-2 screwdriver

Steps

The following steps describe how to remove an auxiliary fan tray.

Procedure

Step 1 Loosen the two captive screws on the AFT.

Step 2 Pull the sliding handle out (which is at the base of the AFT).

Step 3 Gently pull the AFT out of the fabric card frame, using the sliding handle.

Warning
The fans might still be turning when you remove the fan assembly from the chassis. Keep fingers, screwdrivers, and other objects away from the openings in the fan assembly's housing. Statement 263



Note
During the removal and replacement of an AFT, the other three AFTs and the primary fan tray run at maximum speed. The AFTs return to the normal speed in one minute, the PFT returns to the normal speed in five minutes.

What to do next

For the replacement procedure of the AFT, follow steps 9 to 11 of Installing a Fabric Card, on page 210

Removing the Power Components

This section describes how to remove power components from the Cisco NCS 4009 chassis.

Note Although there are differences between AC and DC power trays and power modules, they are removed using the same procedures.

While it is possible to remove power components from the Cisco NCS 4009 chassis separately, some parts (such as the power tray) require that other parts be removed first.

We recommend that you remove the power components in the order outlined in this section.

Removing AC Input Power Cords

This section describes how to remove AC input power cords from a power tray.

Prerequisites

Power off the AC power modules in the tray you want to disconnect.

Note Before removal, make sure that the input power cables are not energized.

Required Tools and Equipment

- ESD-preventive wrist strap
- 6-inch, number-1 Phillips screwdriver

Steps

To remove the AC input power cords, go to the rear of the chassis and perform the following steps:

Procedure

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the two ESD jacks on the rear of the chassis. You can also connect the ESD-preventive wrist strap leash to any bare metal surface on the chassis.

Step 2 Verify that the AC input source breaker is in the off position.

Step 3 Use the screwdriver to loosen the screws that clamp the cords in place.

Step 4 Remove the cords from the cord clamps.

Removing DC Input Power Cables

This section describes how to remove DC input power cables from a power tray terminal block.

Prerequisites

Power off the DC power modules in the tray you want to disconnect.

Note Before removal, make sure that the input power cables are not energized.

Required Tools and Equipment

- ESD-preventive wrist strap
- 6-inch, number-1 Phillips screwdriver
- 3/8-inch ratchet wrench with 7/16-pt. socket
- Voltmeter

Steps

To disconnect DC input power cables, go to the rear of the chassis or the front if the DC rear to front converter box is used and perform the following steps:

Procedure

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the two ESD jacks on the rear of the chassis. You can also connect the ESD-preventive wrist strap leash to any bare metal surface on the chassis.

Step 2 Using the voltmeter, verify that there is no voltage on the cables that are about to be removed.

Step 3 Use the screwdriver to remove the screw that secures the terminal block cover into the mounting standoff.

Step 4 Slide the terminal block cover downward.

Step 5 Remove the terminal block cover.

Step 6 Disconnect the DC power cables from their terminals in the following order and note the color of each cable:

a) Negative (PWR) cables first.
b) Positive (RTN) cables last.

Step 7 Replace the terminal block cover.

Removing the Chassis Ground Cable

This section describes how to remove the chassis ground cable on the Cisco NCS 4009 chassis.

Prerequisites

Before performing this task, completely power off the entire system. Remove all AC or DC input power connections.

Caution Do not remove the chassis ground cable unless the chassis is powered off and to be replaced.

Required Tools and Equipment

- 3/8-inch drive socket wrench
- 10-mm 6-pt. socket

Steps

Procedure

To remove the ground cable from the chassis, remove the two M6 bolts that attach the ground cable to the NEBS grounding point.

Removing a Power Module Slot Cover

This section describes how to remove a power module slot cover from a power module slot in an AC or DC power tray.

Steps

To remove a power module slot cover from the front of a power tray, perform the following steps:

Procedure

Step 1 Gently pinch the tabs on the top of the power module slot cover to partially detach the slot cover from the slot.

Step 2 Slide the power module slot cover out by removing the tabs on the bottom of the power module slot cover from the two holes on the bottom of the slot.

Removing an AC or DC Power Tray

This section describes how to remove a power tray from the Cisco NCS 4009 chassis.

Prerequisites

- Power off the power shelf that houses the power tray you are about to remove.
- Ensure the power tray you are about to remove is empty. It is not necessary to turn off the switch on the power tray to remove individual power modules. Power modules support OIR, so they can be removed and replaced with the power on and the system operating.

Caution The I/O switch on each power shelf disables the output of the power modules in that shelf only. The inputs to the power modules remain hot, as well as the system's internal bus bar (due to the other power shelf).

Warning In case of power tray replacement, first remove the rear power connections before extracting the power tray. In DC, if the power connections are not removed, the connected power cables will prevent the power tray from being extracted. The power lugs could also be shorted with the metal part of the chassis causing physical damage to the equipment or personnel.

Required Tools and Equipment

- 6-inch, number-1 Phillips screwdriver

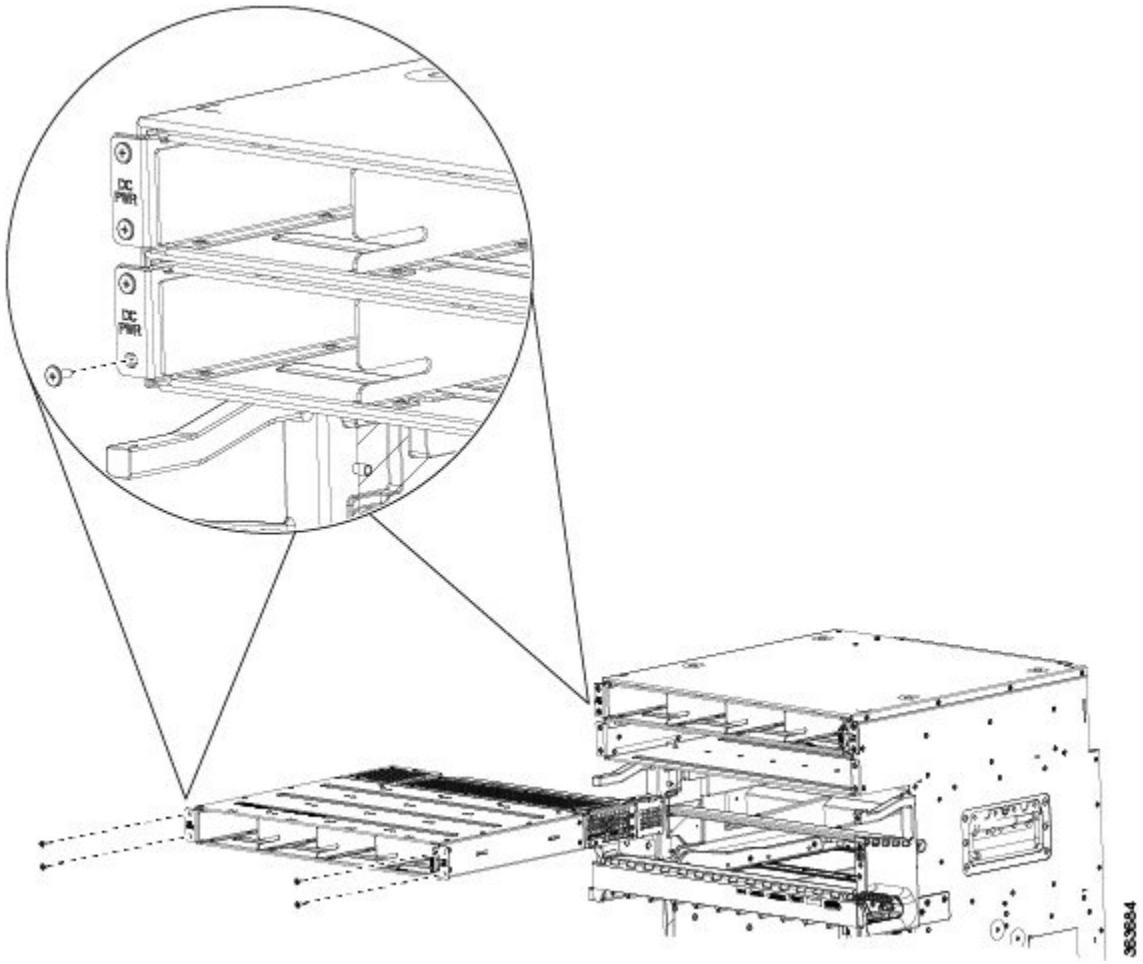
Steps

To remove an AC or DC power tray, perform the following steps:

Procedure

Step 1 Use the screwdriver to loosen the two screws that attach each power tray to the chassis.

Figure 155: Removing a Power Tray from the Chassis



Step 2 Slide the power tray all the way out of the chassis, fully supporting it during removal. You can use the vertical slot dividers to grip the unit.

Caution
Because of the weight of the power tray, and the height at which the power tray is installed in the chassis, you should be especially careful while removing and carrying the power tray. To prevent injury, avoid sudden twists or lateral moves.

Removing an AC or DC Power Module

This section describes how to remove a power module from a power tray.

Note It is not necessary to turn off the switch on the power tray to remove individual power modules. Power modules support OIR, so they can be removed and replaced with the power on and the system operating.

Steps

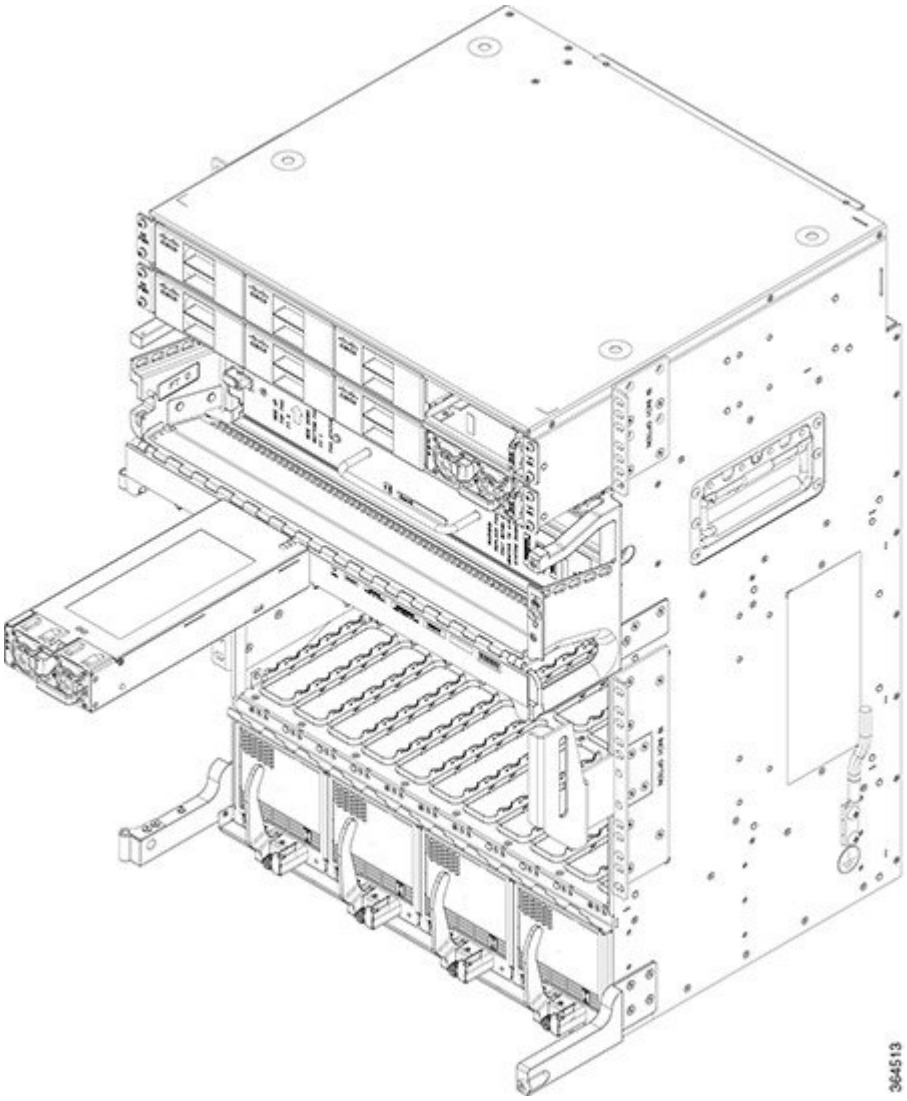
To remove a power module from the front of a power tray, perform the following steps:

Procedure

Step 1 Release the snap hook on the power module.

Step 2 Slide the power module out of its bay in the power tray while supporting it with your other hand. Use the handle available on the front plate of the power module.

Figure 156: Removing a Power Module from a Power Tray



Replacing a Power Module

The following section describes how to replace a power module in a NCS 4009 chassis.

Following are the limitations when a Delta power module (DC power) is replaced with an ACBEL power module (DC power).

- Release 6.1.12 and 6.1.22 software do not support ACBEL PEM, so the FPD upgrade fails and show status is displayed as UPGD FAIL. However the power module will function normally.
- Release 6.1.32 and 6.1.42 software packages come with PSU FPD image version 3.01. Post upgrade, the ACBEL PEM FPD version is shown as 3.01, but it continues to function with its original image, that is, version 4.02.

Follow these steps to replace AC or DC power modules into the chassis:

Procedure

Step 1 Using two hands to support the power module, slide it into the power tray.

Step 2 Secure the power module into the power tray using the snap hook.

Removing the Air Filter

This section describes removing the air filter. The air filter is located in the bottom of the chassis behind the plastic grill.

Note The Cisco NCS 4009 chassis can have two types of air filters, depending on the fabric cards it houses.

- If the installed fabric card is, NCS4009-FC2-S, the air filter is NCS4009-FTF.
- If the installed fabric card is, NCS4009-FC2F-S, the air filter is NCS4009-FTF-2.

The air filter prevents dust from the air in the room, to be drawn into the chassis by the fan tray. If it is damaged, dirty, or clogged with dust, they must be replaced with a new air filter. Failure to replace a compromised air filter can result in insufficient air circulation through the chassis and temperature-related environmental alarms.

Caution Never operate the Cisco NCS 4009 chassis without an air filter. Operating a Cisco NCS 4009 chassis without a filter for an extended time can result in damage to the chassis hardware.

Note Inspect the air filters every three months and replace them as needed. Air filters should be disposed of and replaced when they become dirty. According to NEBS guidelines, washing or cleaning them is not allowed. Make sure to order these consumable items separately and keep a spare stock. For PID identification, contact TAC, as these parts cannot be replaced through the RMA process. The filter is sold in packs of 5.

Prerequisites

Before performing this task, open the front door, if installed.

Required Tools and Equipment

- ESD-preventive wrist strap
- Number-2 Phillips screwdriver
- Air filter (Cisco PID NCS4009-FTF or Cisco PID NCS4009-FTF-2)

Steps

To remove the air filter:

Procedure

Step 1 For Cisco PID NCS4009-FTF, pull the spring-loaded plungers which are located on either side of the lower edge of the air filter. For Cisco PID NCS4009-FTF-2 , loosen the captive screws on the air filter.

Step 2 Pull out the air filter.

Figure 157: Pulling Out the Air Filter (NCS4009-FTF) for NCS4009-FC2-S

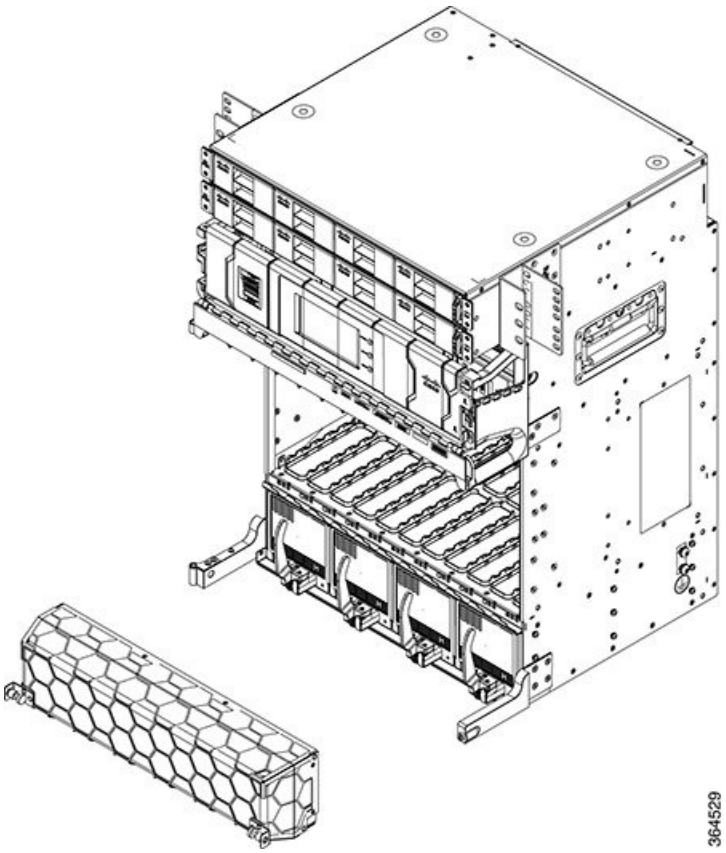
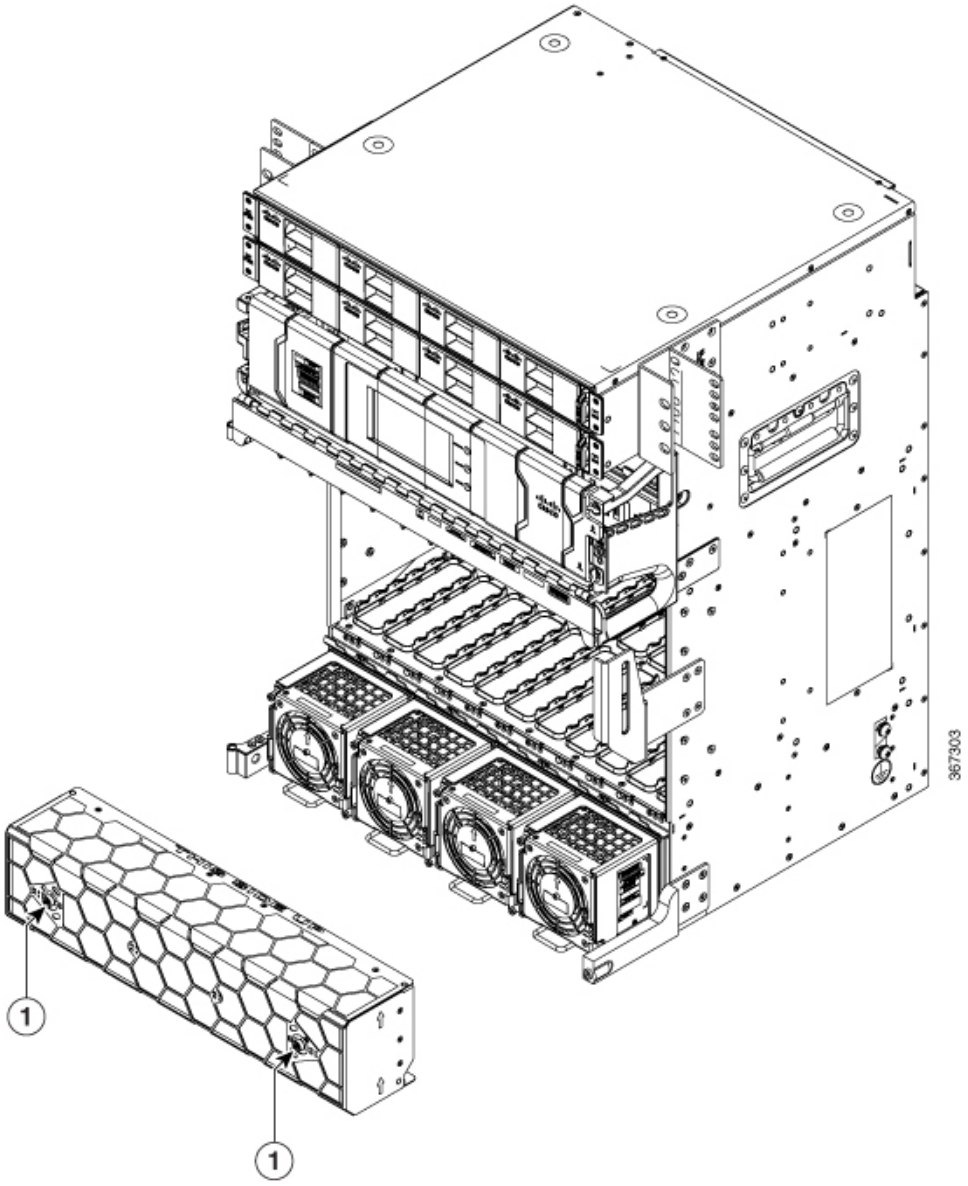


Figure 158: Pulling out the air filter (NCS4009-FTF-2) for NCS4009-FC2F-S



1	Captive screws

Replacing the Air Filter

To replace the air filter:

Note Verify air flow direction when installing the new air filter. An air flow direction arrow is indicated on the air filter frame and should be installed pointing up.

Procedure

Step 1 Place the air filter in its position.

Step 2 For Cisco PID NCS4009-FTF, release the two spring-loaded plungers which are on either side of the lower edge of the air filter. For Cisco PID NCS4009-FTF-2, tighten the two captive screws using 6 pound/force (lbf) inch (0.7 Nm torque).

Replacing the Front Door

This section describes removing and replacing the front door. The Cisco NCS 4009 chassis is shipped with the front door installed. Steps on how to install a key lock are also included.

Required Tools and Equipment

- ESD-preventive wrist strap
- Number 2 Phillips screwdriver, medium and small slot-head screwdrivers
- Front door

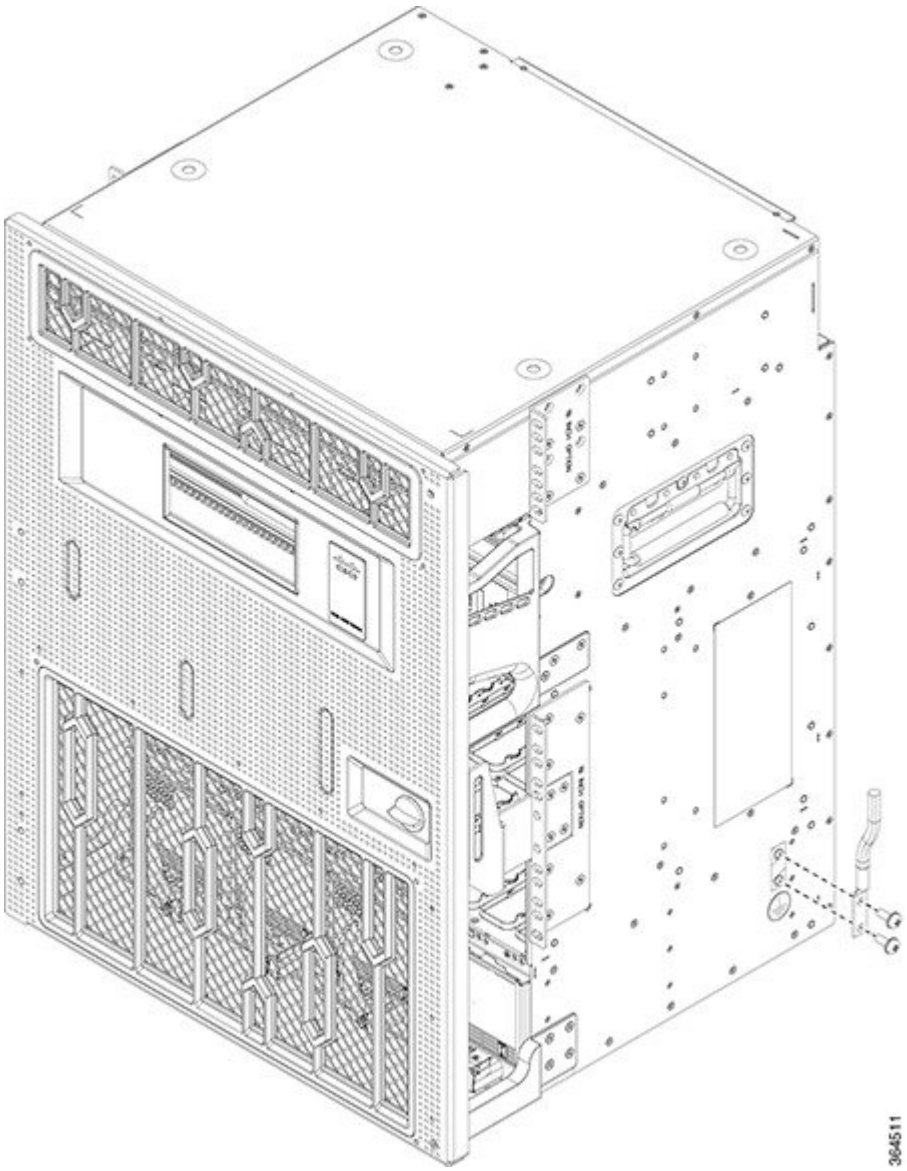
Steps

To remove the front door:

Procedure

Step 1 Turn the knob to unlock the door.

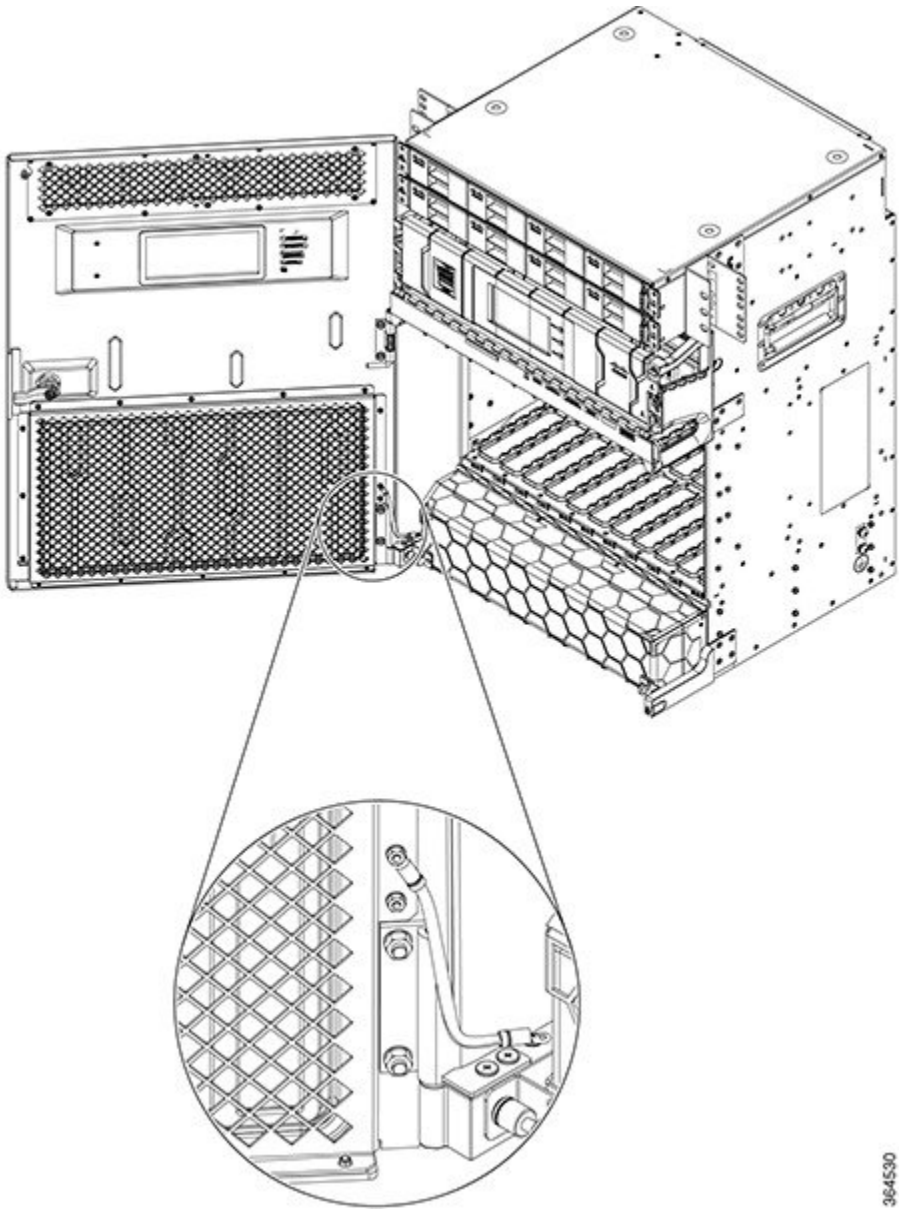
Figure 159: Knob to Unlock Door



Step 2 Open the door.

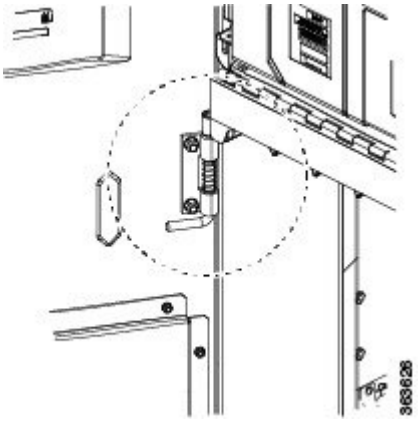
Step 3 Loosen the screw to disconnect the ground cable

Figure 160: Disconnecting the Ground Cable



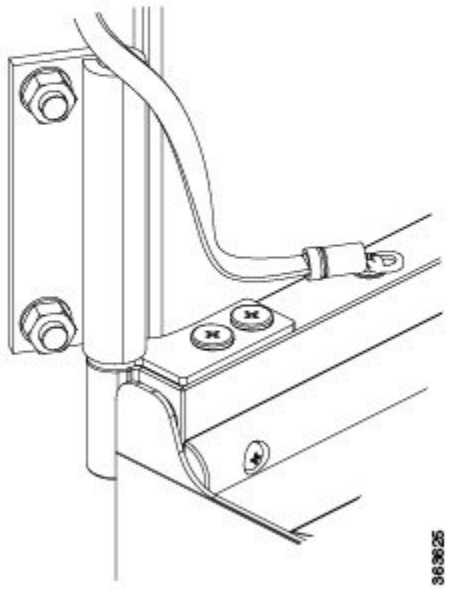
Step 4 Move down the pin to release the door from the chassis hinge.

Figure 161: Pin to Release Door from Hinge



Step 5 Move up the door to release the bottom hinge pin .

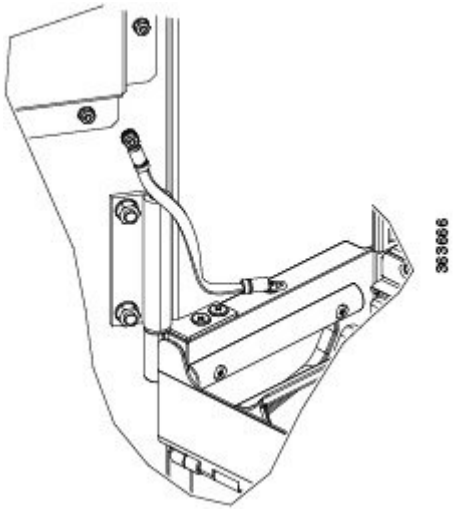
Figure 162: Releasing the Bottom Hinge Pin



Step 6 To replace the front door:

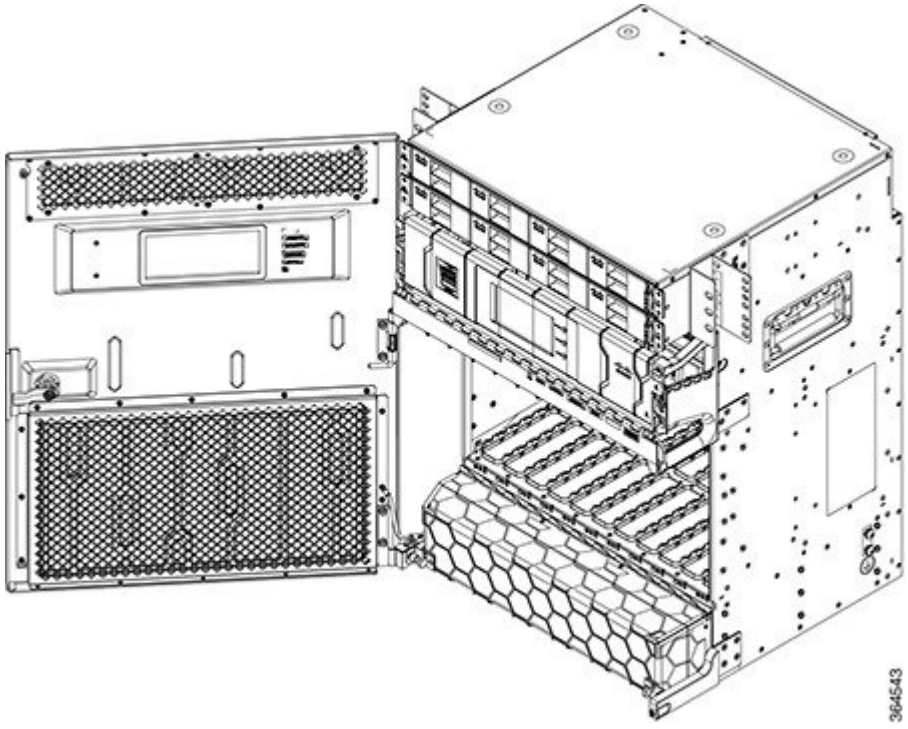
a) Remove the screw and washer from the chassis fixing point.

Figure 163: Installing the Door Ground Strap Retrofit Kit



b) Feed the screw through the ground cable ring lug, through the washer, and then into the machined block.
c) Using a Philips screwdriver, insert and tighten the screws.

Figure 164: Shelf Assembly with Door Ground Strap Retrofit KIt Installed (ANSI)



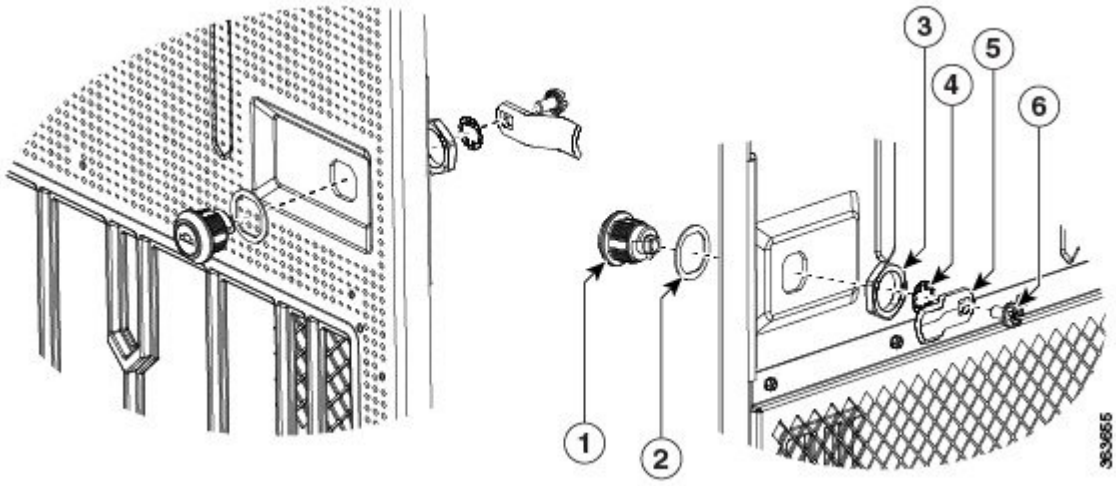
d) Swing the door closed and turn the knob to lock.

Step 7 To install the optional key lock:

a) Open the door.
b) Disassemble the keyless block.

On the rear of the door, loosen the screw and remove the retention feature (latch), lock washer and M22 nut and then, on the front of the door, pull out the keyless block.

Figure 165: Disassembling the keyless block



1- Keyless block	2- Washer
3- M22 nut	4- Lock washer
5- Retention feature	6- Screw

c) Assemble the key block.

On the front of the door, insert the key block and the front washer and then, on the rear side of the door, lock the retention M22 nut, insert the lock washer and retention feature (latch), and tighten the screw.

Removing the Fan Tray

Warning When servicing the system you must remove the fan tray and replace it in under a minute.

Caution For Online Insertion and Removal (OIR) of the fan tray, the maximum time limit is 67 seconds. Violating this limit, results in shutting down of the line cards.

Note When all the four AFTs (NCS4009-FAN-FC) are present along with the fan tray (NCS4K-FTA) in the chassis, the OIR for the fan tray is five minutes.

This section describes how to remove the fan tray shipped with the Cisco NCS 4009 chassis.

Note To replace the fan tray, it is not necessary to move any of the cable management facilities.

Prerequisites

Before performing this task, open the front door, if installed.

Required Tools and Equipment

- ESD-preventive wrist strap
- 6-inch, number-1 Phillips screwdriver
- Fan tray (Cisco PID NCS4K-FTA=)

Steps

Caution Do not force a fan tray into place. Doing so can damage the connectors on the fan tray and/or the connectors on the backplane.

To remove the fan tray:

Procedure

Step 1 Loosen the two captive screws that hold the fan tray in place.

Step 2 Rotate the ejectors down or up, depending upon which fan tray you are removing (top or bottom).

Step 3 Slide the fan tray out of the slot.

Warning
The fans might still be turning when you remove the fan assembly from the chassis. Keep fingers, screwdrivers, and other objects away from the openings in the fan assembly's housing. Statement 263



Note
When the primary fan tray is removed, all the AFTs in the chassis run at maximum speed.

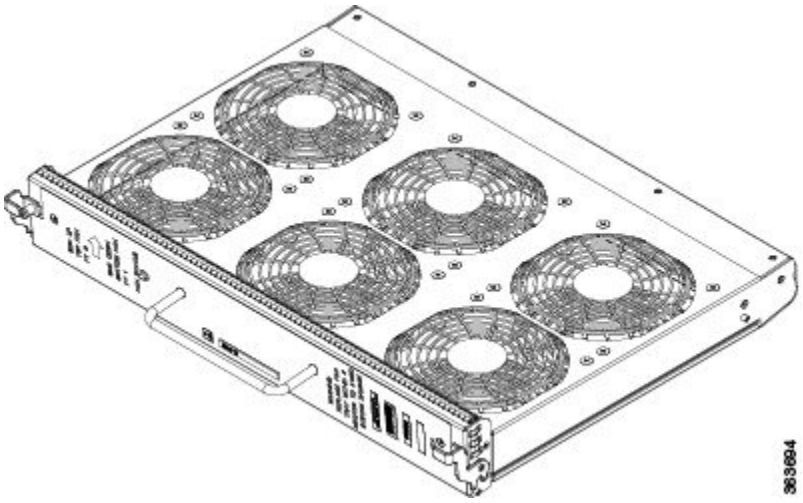
Replacing the Fan Tray

To replace the fan tray:

Procedure

Step 1 Orient the fan tray as specified on front label.

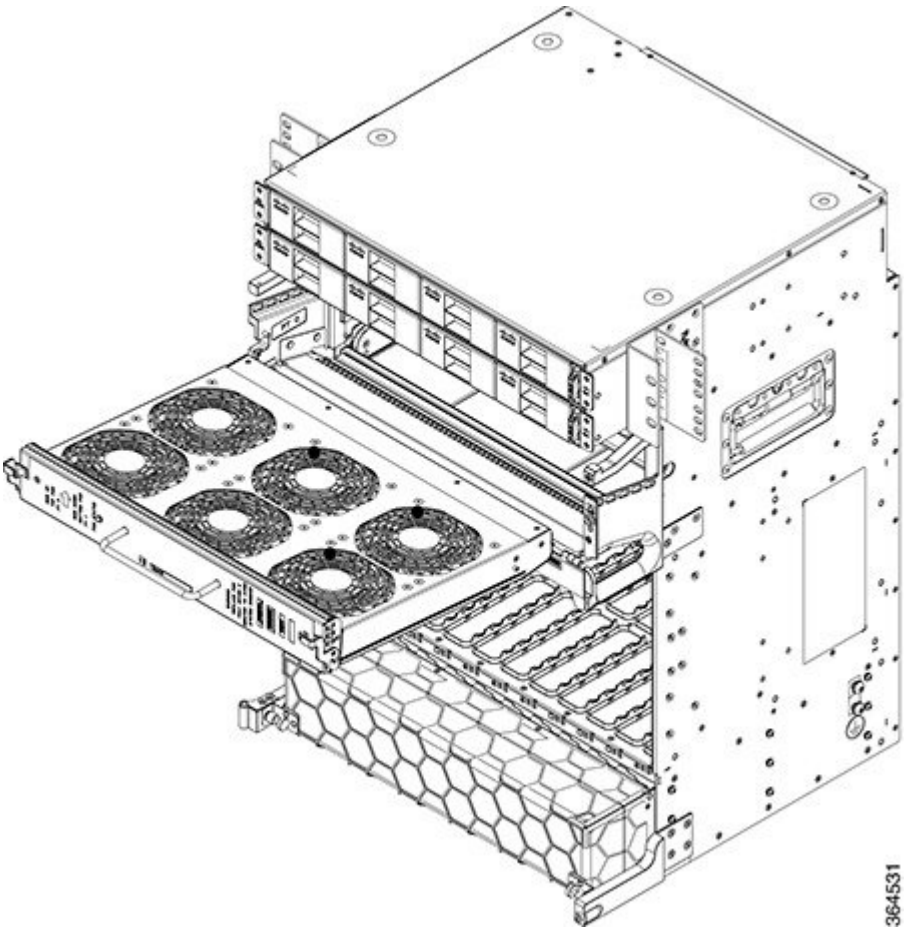
Figure 166: Fan Tray, Arrow Facing Up



Step 2 Move the ejectors up or down into the stop or block position.

Step 3 Slide the fan tray into the chassis slot . Tilt the fan tray up when the fan tray is at an inch distance before it slides completely.

Figure 167: Fan Tray Inserted into Chassis



Step 4 Check the ejector engagement to be sure it is correct. Complete the ejectors rotation to fully insert the fan tray.

Step 5 Tighten the two captive screws to lock the fan tray in place.

Removing and Replacing the Craft Panel

This section describes how to remove and replace the craft panel. The Cisco NCS 4009 chassis is shipped with the craft panel installed. Normally, it is not necessary to remove the craft panel. However, it can be removed. The craft panel is a field replaceable unit.

Prerequisites

Before performing this task, open the front door, if installed.

Required Tools and Equipment

- ESD-preventive wrist strap
- 6-inch, number-1 Phillips screwdriver

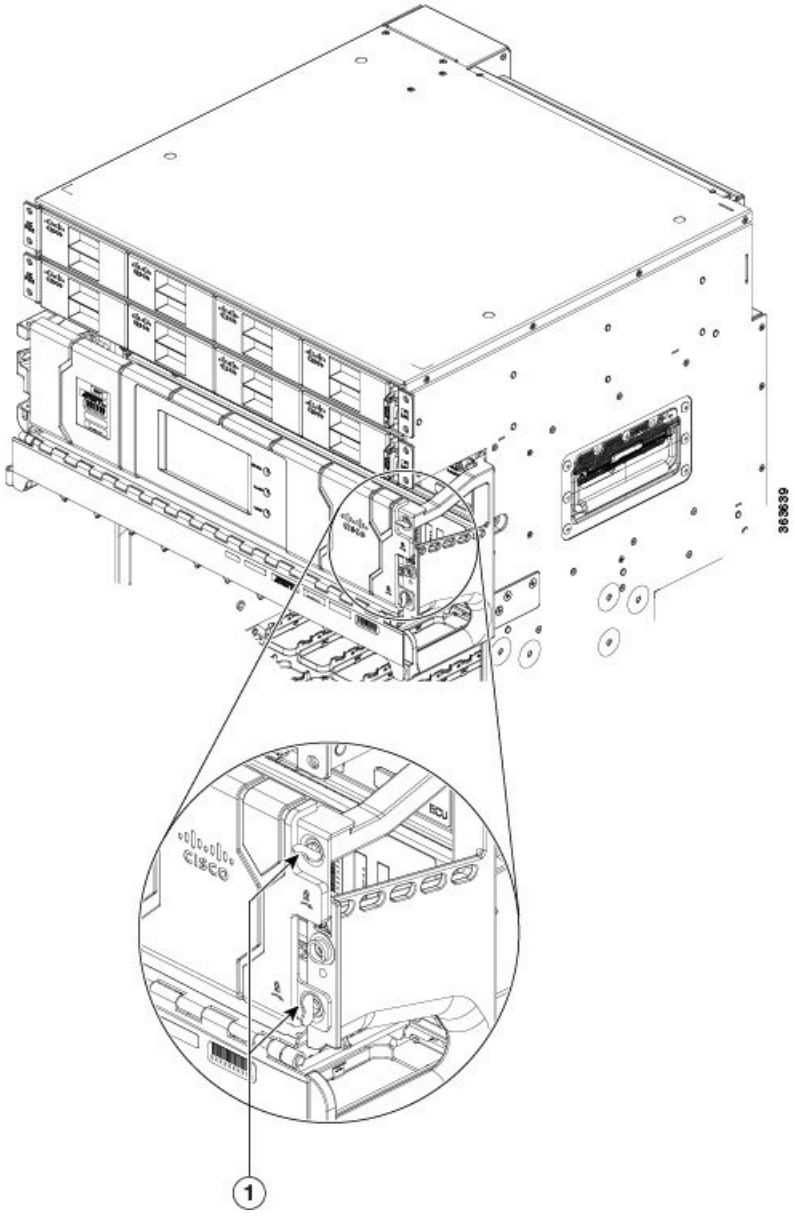
Steps

To remove the craft panel:

Procedure

Step 1 Loosen the two wing-head screws on the right side.

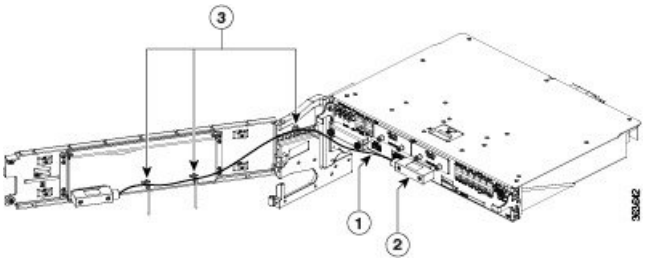
Figure 168: Craft Panel Showing Wing-Head Screws



1	Wing head screws

Step 2 Open the craft panel and rotate it .

Figure 169: Opening the Craft Panel



1	Craft cable
2	Connector
3	Three cable ties to hold the LCD cables

Step 3 Disconnect the craft cable from the ECU faceplate.

Step 4 Loosen the two connector screws and remove the connector.

Step 5 Remove the craft panel. Lift up the panel to disengage the hinge pins on the left side from the chassis.

Replacing the Craft Panel

To replace the craft panel:

Procedure

Step 1 Engage the hinge pins on the left side of the chassis.

Step 2 Connect the craft cable to the ECU faceplate.

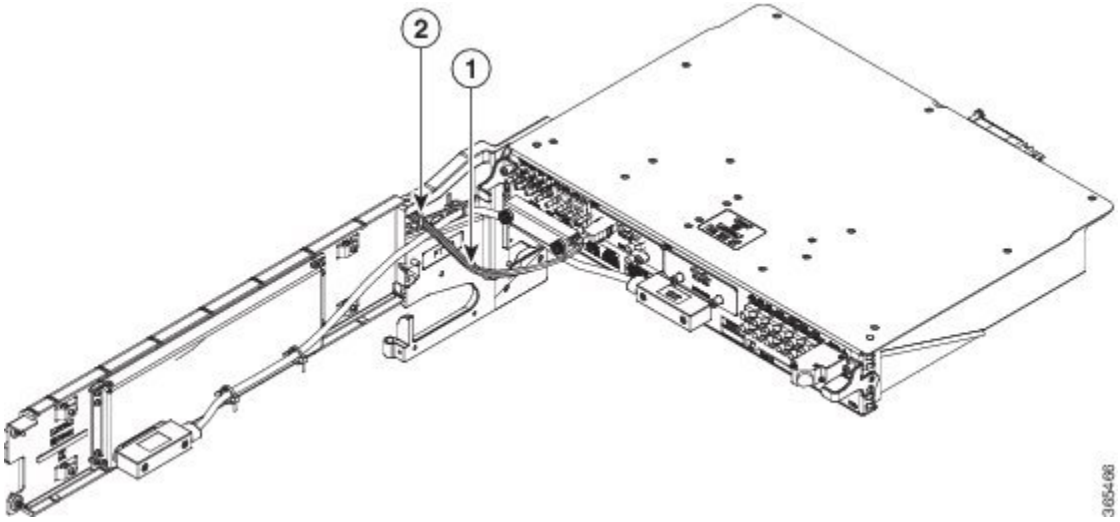
Step 3 Tighten the two connector screws to a torque value of 4.4lbs.

Step 4 Close the craft panel and rotate it.

Step 5 Tighten the two wing-head screws on the right side.

Routing the BITS Cables

Route the BITS cables according to the following image.



1	Routing of BITS cables
2	Cable tie to hold the BITS cables

Removing the External Connection Unit

This section describes how to remove the external connection unit (ECU). The ECU provides all shelf electrical I/O connectivity to the active and standby route-processor line cards. The Cisco NCS 4009 chassis is shipped with the ECU installed.

Prerequisites

- Open the front door, if installed.
- Make sure that the craft panel has been removed. See the Removing and Replacing the Craft Panel, on page 278.

Required Tools and Equipment

- ESD-preventive wrist strap
- 6-inch, number-1 Phillips screwdriver
- ECU (Cisco PID NCS4K-ECU=)

Steps

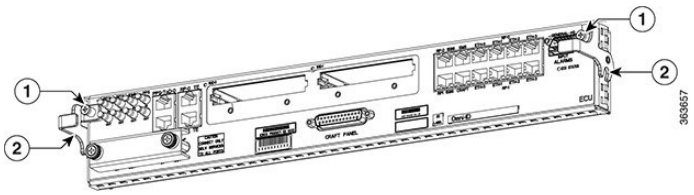
To remove the ECU:

Procedure

Step 1 Disconnect all cables from the ECU faceplate.

Step 2 Loosen the two captive screws.

Figure 170: ECU



1	Captive screw	2	Ejector

Step 3 Rotate the ejectors to point down.

Step 4 Grasp the upper and lower portions of the ECU with fingers to pull out the ECU from the chassis.

Replacing the External Connection Unit

To replace the ECU:

Procedure

Step 1 Rotate the ejectors to point down.

Step 2 Push the ECU into the chassis.

Step 3 Rotate the ejectors to point up.

Step 4 Tighten the two captive screws.

Step 5 Connect all cables to the ECU faceplate.

Replacing an SSD

The ECU houses two 2.5-in. solid-state drives (SSDs).

Prerequisites

- Open the front door, if installed.
- Make sure that the ECU is installed. See the Routing the BITS Cables, on page 280.

Required Tools and Equipment

- ESD-preventive wrist strap
- 6-inch, number-1 Phillips screwdriver
- SSDs (Cisco PID NCS4K-SSD-100G or NCS4K-SSD-200G=)

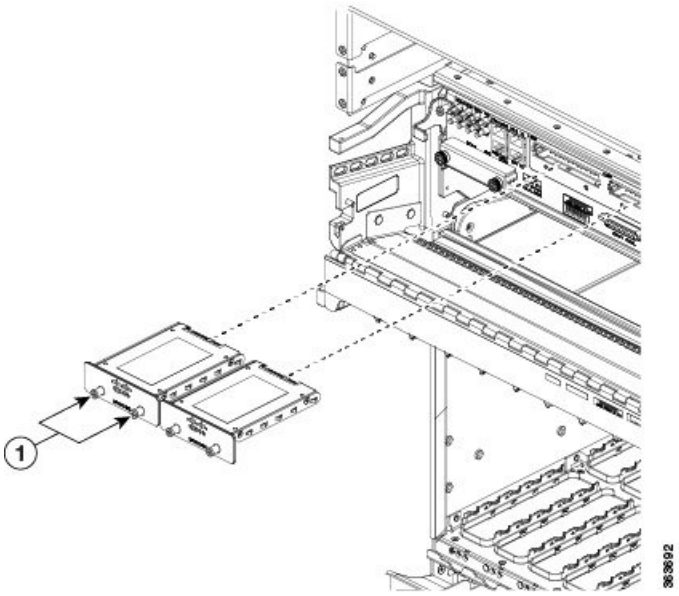
Steps

To remove an SSD:

Procedure

Step 1 Loosen the two captive screws.

Figure 171: Captive Screws on the SSD

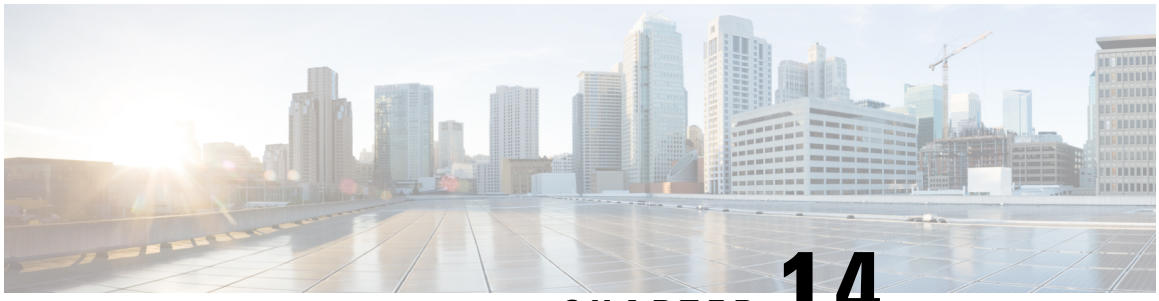


1	Captive screws

Step 2 Slide out the SSD from the ECU slot.

What to do next

To replace a SSD, slide the SSD into the ECU slot and tighten the two captive screws to secure the SSD into place.



CHAPTER 14

System Product IDs

This appendix provides information about the product IDs for the Cisco NCS 4009 chassis and its components.

These tables list the components that make up the routing system, their product IDs (part numbers used to order the components), and descriptions.

Note In the following tables, an equals sign (=) at the end of the product ID indicates that the component can be ordered as a spare. For those components, be sure to include the equals sign as part of the product ID.

- Component Product IDs, on page 285
- Line Card Product IDs, on page 286
- Cosmetic Product IDs, on page 287
- Accessory Product IDs, on page 287

Component Product IDs

This table describes the product IDs of the components.

Table 53: Cisco NCS 4009 Chassis Component Product IDs

Component	Product ID	Description
Cisco NCS 4009 chassis	NCS4009-SA-AC= NCS4009-SA-DC=	Cisco NCS 4009 Chassis
Installation kit	NCS4009-INST-KIT=	Rack brackets, installation aid brackets, hardware, and other materials necessary for installation
Fabric card	NCS4009-FC-S=	Cisco NCS 4009 fabric card
Route processor card	NCS4K-RP=	Cisco NCS 4009 route processor card
Fan tray	NCS4K-FTA=	Cisco NCS 4009 fan tray
AC power tray	NCS4K-AC-PEM	Cisco NCS 4009 AC power tray

Component	Product ID	Description
AC power module	NCS4K-AC-PSU=	Cisco NCS 4009 AC power module
AC power cord	NCS4K-AC-CBL-IEC= NCS4K-AC-CBL-NEMA=	AC power cord - International AC power cord - North America **Note** Length of each power cord is 4.5 m.
DC power tray	NCS4K-DC-PEM	Cisco NCS 4009 DC power tray
DC power module	NCS4K-DC-PSU-V1	Cisco NCS 4009 DC power module
Cable management and cosmetic package options		
Front plastic cosmetic assemblies	???>	Front cosmetic and cable management kit ** will this be added in future? **>

Line Card Product IDs

Table 54: Cisco NCS 4009 Line Card Product IDs , on page 286 describes the product IDs of the line cards.

Table 54: Cisco NCS 4009 Line Card Product IDs

Component	Product ID	Description
24-port low-rate OTN	NCS4K-24LR-O-S=	24-port low-rate OTN line card with SFP or SFP+
20x10GE OTN	NCS4K-20T-O-S=	20-port 10GE OTN line card with SFP+
2x100GE OTN	NCS4K-2H-O-K=	2-port 100GE OTN line card with CPAK
2x100GE DWDM	NCS4K-2H-W=	2-port 100GE DWDM line card with CPAK
Distributed Route Processor		
DRP	CRS-DRP-Option	Cisco CRS-1 Distributed Route Processor (each DRP requires a DRP PLIM)
DRP memory option	CRS-DRP-MEM-4GCRS-DRP-MEM-8G	DRP memory, 4 gigabytes (4G) or 8 gigabytes (8G)
DRP PLIM	CRS-DRP-ACC	DRP physical layer interface module

Cosmetic Product IDs

This table describes the product IDs of the cosmetic components.

Table 55: Cisco NCS 4009 Cosmetic Product IDs

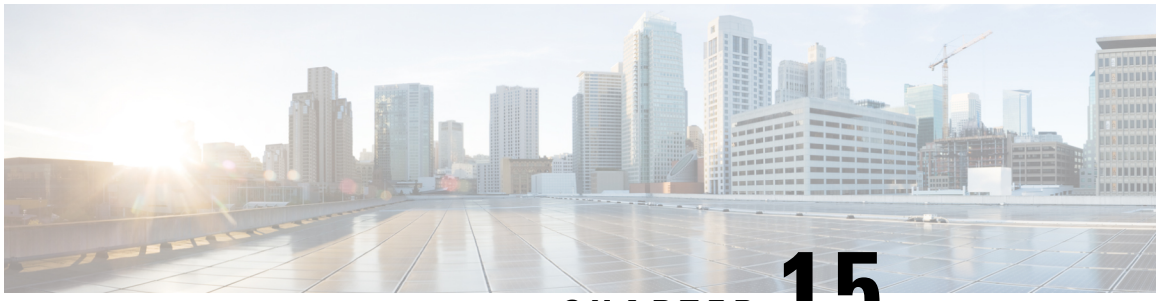
Component	Product ID	Description
Craft panel display	NCS4K-CRAFT=	Cisco NCS craft panel display kit
Front door	NCS4009-DOOR=	NCS 4009 Front door
ECU	NCS4K-ECU=	External Connection Unit

Accessory Product IDs

This table describes the product IDs of the accessory components.

Table 56: Cisco NCS 4009 Chassis Accessory Product IDs

Component	Product ID	Description
Alarm cable	NCS4K-CBL-HKA=	Cisco NCS 4009 alarm cabling
Filler card	NCS4K-BLANK=	Filler cards for empty LC and RP card slots



CHAPTER 15

System Specifications

This appendix contains tables that list the specifications for the main components of the Cisco NCS 4009 chassis.

- Chassis Specifications, on page 289
- Power Specifications, on page 290
- Environmental Specifications, on page 291
- Regulatory, Compliance, and Safety Specifications, on page 292

Chassis Specifications

This table describes the specifications of the Cisco NCS 4009 chassis.

Table 57: Cisco NCS 4009 Chassis Specifications

Chassis Specifications	
Supported Cards and Modules	• Up to nine line cards • Four fabric cards • Two route processor cards • One fan tray
Chassis Dimensions	
Height	26.25 in. (66.68 cm) as shipped
Width	19.5 in. (49.53 cm) with front door 18.5 in. (47 cm) without front door
Depth	AC version: 19.05 in. (48.39 cm) with front doorDC version: 17.73 in. (45.03 cm) with front door
Aisle spacing	To install chassis (front): 23 inches (60 cm) To service FRUs (front): 36 inches (91.4 cm) To service FRUs (rear): 24 inches (61 cm)
Weights	

Chassis Specifications	
Chassis as shipped	164 lb (74.5 kg)
Chassis in shipping crate with pallet	289 lb (131.1 kg)
Chassis, fully loaded with power, fan trays, cards, and cosmetics	363 lb (164.8 kg)
Floor Loading	
Chassis in rack footprint(floor contact area)	Chassis: 2.5 sq ft (0.23 sq m)
Maximum floor loading	145.04 lb/sq ft
Chassis Cooling	One fan tray
Chassis airflow	21181 liters per minute
DC power system airflow	6796 liters per minute
AC power system airflow	5097 liters per minute

Power Specifications

This table describes the power specifications of the Cisco NCS 4009 chassis.

Table 58: Cisco NCS 4009 Chassis Power Specifications

Power Trays	**Either two AC or two DC power trays (cannot mix AC and DC power trays)**
DC power tray	Up to four DC PMs per tray
AC power tray	Up to four AC PMs per tray
Power Redundancy	
DC	Up to 8 power modules can be installed, and only 4 are needed to be active at any time. This allows support for 4+4 power redundancy and A and B battery plant dual feeds redundancy.
AC	Up to 8 power modules can be installed, and only 3 are needed to be active at any time. This allows support for 3+5 power redundancy by using two independent AC power sources (4 feeds each).
DC Input	
Nominal input voltage	–48 VDC or –60 VDC(tolerance range: –40.5VDC to –72 VDC)
Input current	37 A max at –48 VDC29.6 A max at –60 VDC43.9 A max at –40.5 VDC
AC Input	12 A max per feed

Power Trays	Either two AC or two DC power trays (cannot mix AC and DC power trays)
Nominal input voltage	200 to 240 VAC (range 180 to 264 VAC)
Nominal line frequency	50/60 Hz (range 47 to 63 Hz)
Recommended AC service	30-A (North America) dedicated branch circuit30-A (International) dedicated branch circuit
AC Power Cord Length	167 in. (4.25 m)

Environmental Specifications

This table describes the environmental specifications of the Cisco NCS 4009 chassis.

Table 59: Cisco NCS 4009 Chassis Environmental Specifications

Temperature	Operating, nominal: 41 to 104°F (5° to 40°C) Operating, short-term: 23 to 131°F (–5° to 55°C)[26] Nonoperating: –40 to 158°F (–40° to 70°C)
Humidity	Operating, nominal: 5 to 85%, noncondensing Operating, short-term: 5 to 90%, noncondensing Nonoperating: 5 to 93%, noncondensing
Altitude	Operating: –200 to 13,100 ft (–61 to 4000 m) at 104°F (40°C) Up to 4000m for DC version and 3000m for AC version Nonoperating: Up to 16,000 ft (4877 m) at –13°F (–25°C), short-term
Chassis airflow	Up to 21,181 liters per minute
Power system airflow	Up to 6800 liters per minute
Air exhaust temperature	95°F (35°C)—at room temperatures of 77 to 84°F (25 to 29°C) 140°F (50°C)—at room temperatures of 95 to 102°F (35 to 39°C) 158°F (60°C)—maximum exhaust temperature on a fully loaded system during worst-case operating conditions (55°C and 6000 ft altitude) **Note** Air temperature rise is 68°F (20°C) on a fully loaded system with fans running at maximum speed.
Air velocity (at exhaust)	500 ft/min (2.55m/s) under typical conditions 27°C 1000 ft/min (5.1m/s) at maximum speed **Note** Software controls the speed of the fans based on measurements from the chassis thermal sensors.

Sound power level(AC and DC power)	Fan speed 5900 RPM, temperature 80°F (27°C):75.1 dB—modular configuration power
Shock and vibration	Designed and tested to meet the NEBS shock and vibration standards defined in GR-63 Issue 4 2012. NCS4K-4H-QDD-P Line Card meets the NEBS shock and vibration standards defined in GR-63 issue 5 and GR-1089 Issue 8.

[26] Short-term refers to a period of not more than 96 consecutive hours and a total of not more than 15 days in 1 year. This refers to a total of 360 hours in any given year, but no more than 15 occurrences during that 1-year period.

Regulatory, Compliance, and Safety Specifications

For information about the regulatory, compliance, and safety standards to which the Cisco NCS 4009 conforms, see Regulatory Compliance and Safety Information for the Cisco Network Convergence System 4000 Series.