

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 1
- Installing the Chassis Ground Cable, on page 7
- Installing an AC or DC Power Tray, on page 9
- Installing Power Modules, on page 10
- Installing the DC Power Front Connection Adapter, on page 13
- Connecting Power to the Chassis, on page 21
- Disconnecting AC or DC Power, on page 25
- Powering On the Chassis, on page 28

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 5 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.

The Cisco NCS 4009 chassis supports two types of AC power cords: International and NEMA (USA).

Figure 1: International AC Power Cord (Cisco PID NCS4K-AC-CBL-IEC)

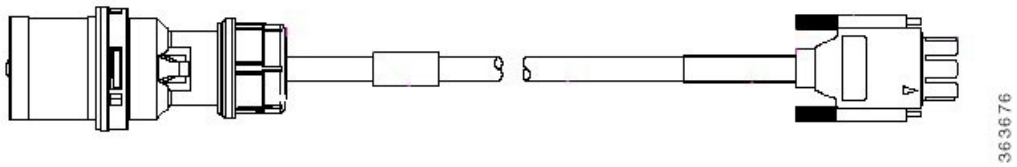
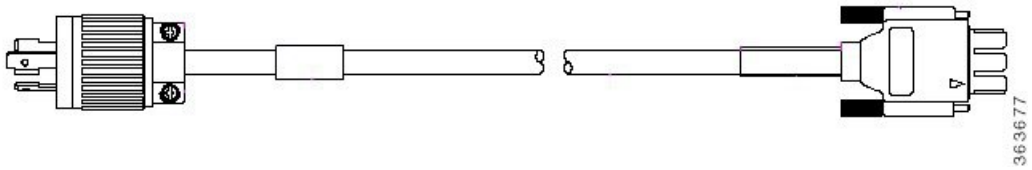


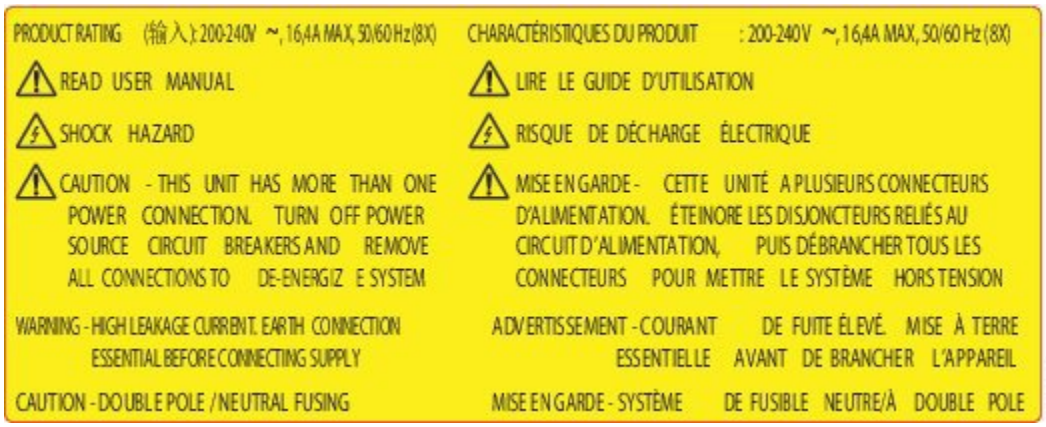
Figure 2: NEMA AC Power Cord (Cisco PID NCS4K-AC-CBL-NEMA)



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 3: 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

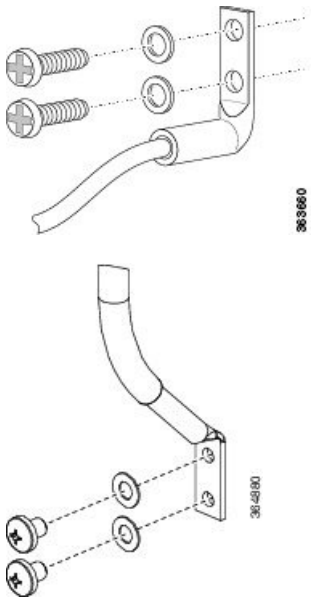
Warning **Only trained and qualified personnel should be allowed to install, replace, or service this equipment.** Statement 1030

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 4: 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:

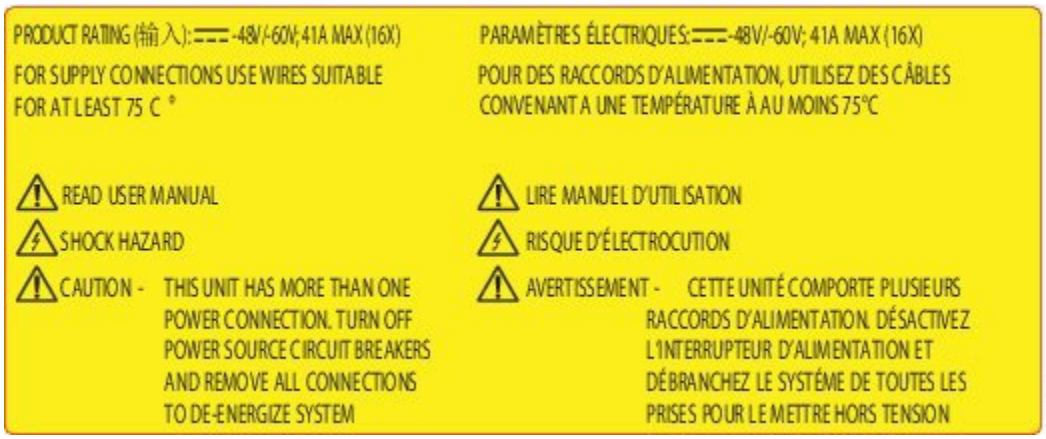
- In some cases, the source DC cable leads might have a positive (+) or a negative (–) label. This is a relatively safe indication of the polarity, *but you must verify the polarity by measuring the voltage between the DC cable leads* . Be sure that the positive (+) and negative (–) cable leads match 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

The rating label is shown in the figure below.

Figure 5: Rating Label for NCS 4009 DC Chassis

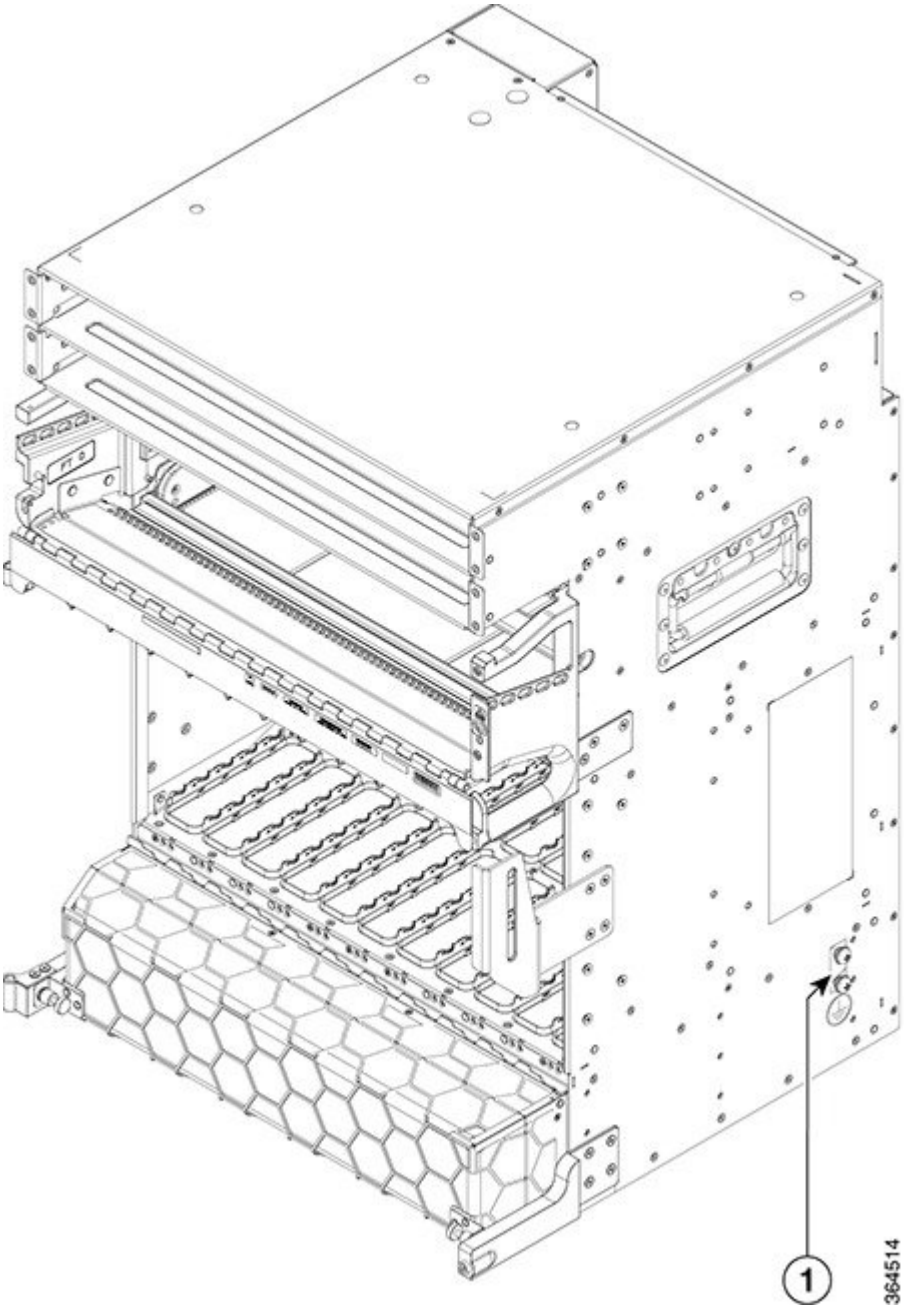


NEBS Supplemental Unit Bonding and Grounding Guidelines

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 6: 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 4: Typical DC Power Cable Lugs, on page 4).

- 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.

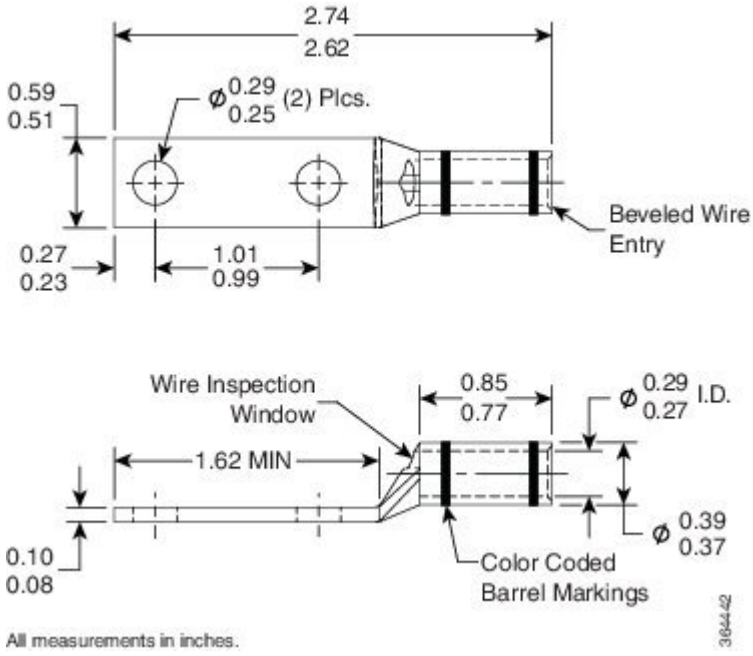
Required Tools and Equipment

- 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 7: Straight Barrel Grounding Lug



Steps

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

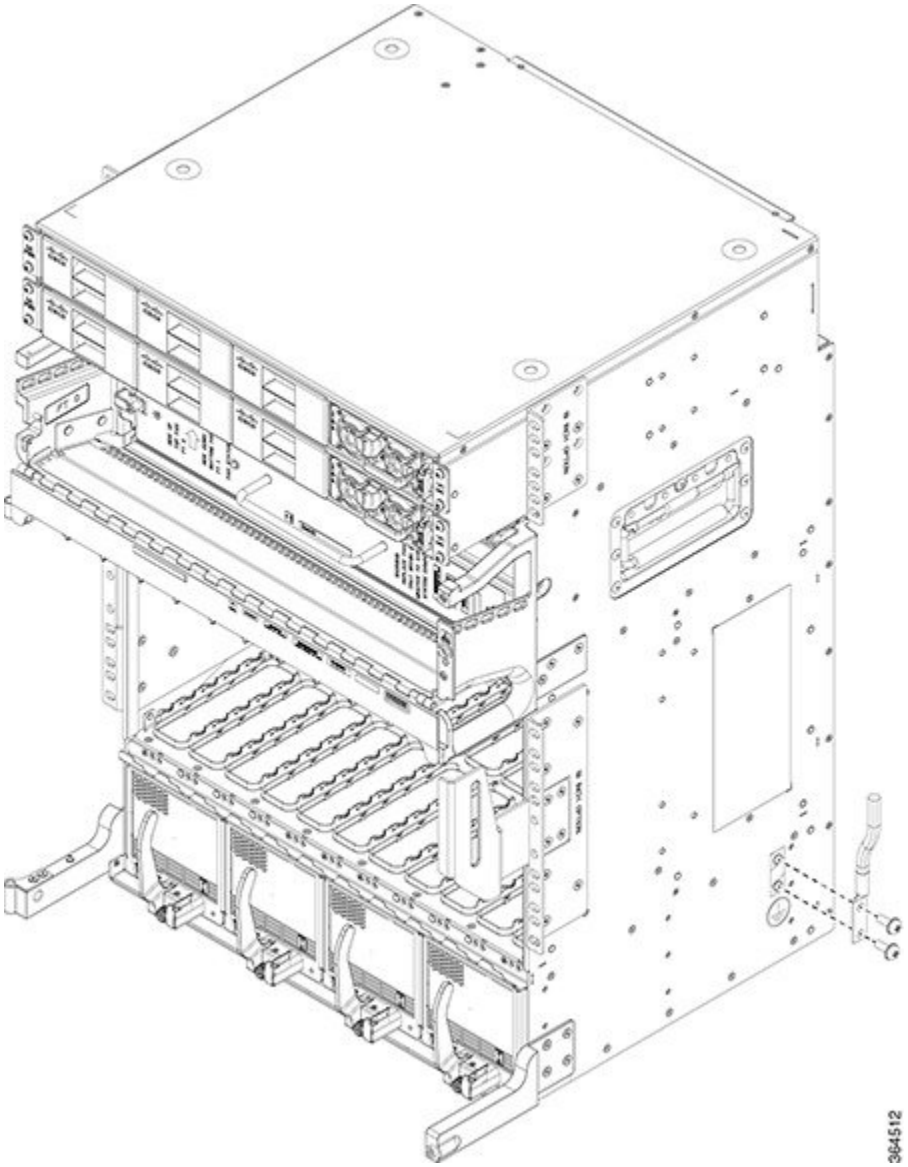
Procedure

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 8: 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:

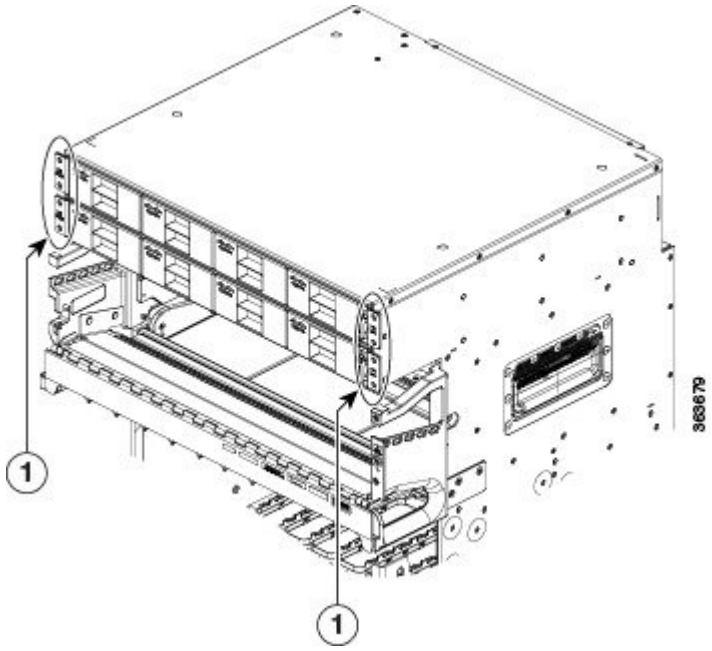
Procedure

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 9: 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 1: Power Module LED Status Indicator Lights, on page 11 describes the LED status indicator lights of the power module.

Table 1: 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.

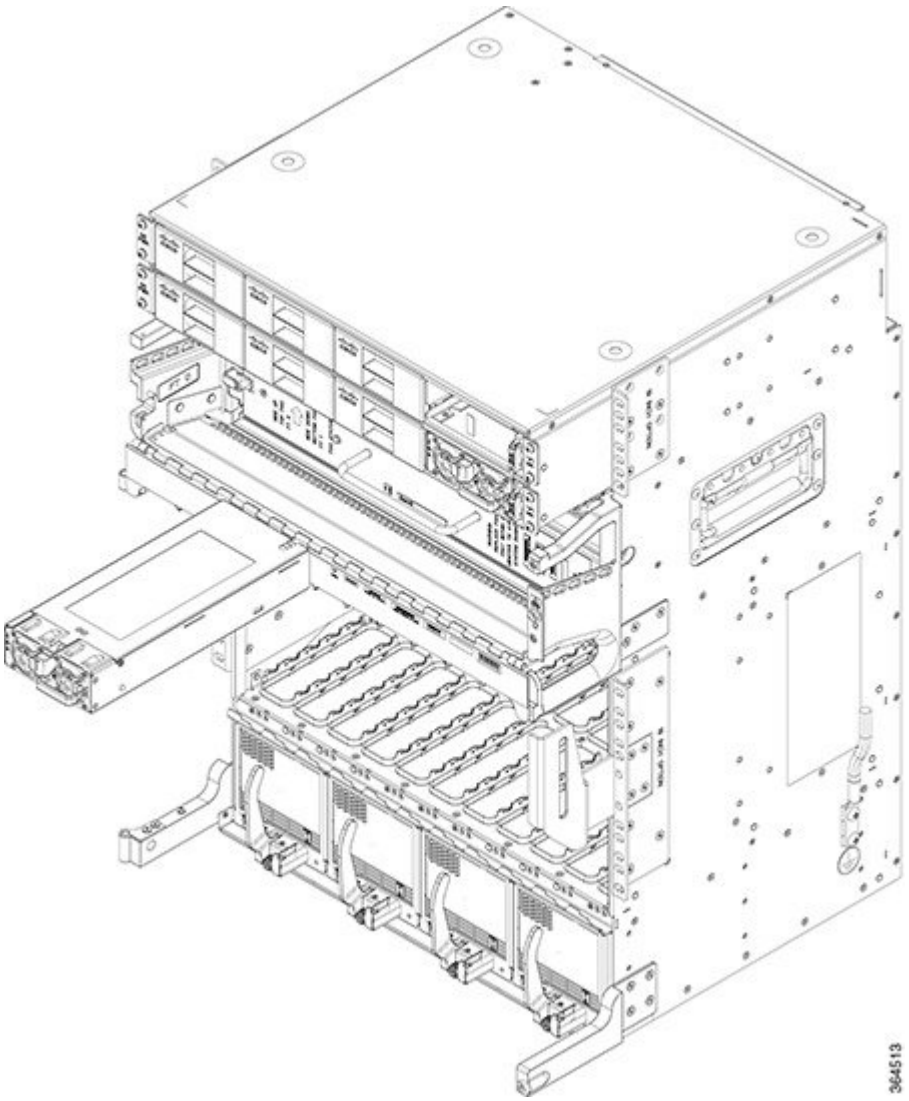
Follow these steps to install the AC or DC power modules into the chassis:

Procedure

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

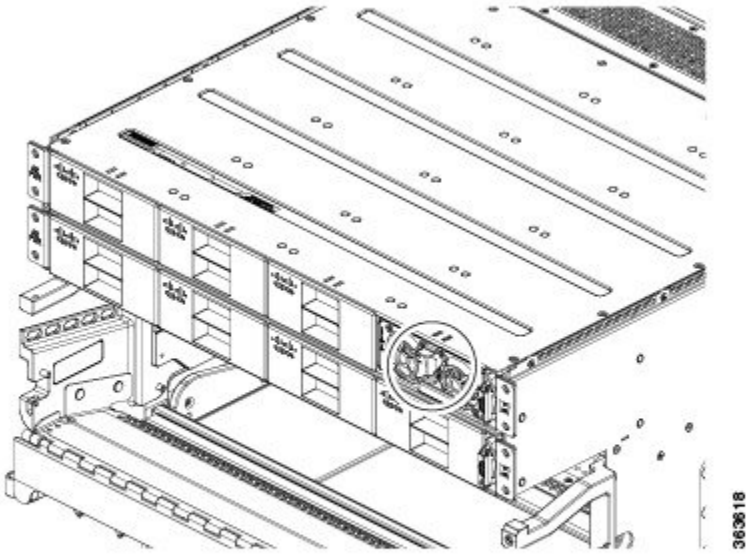
Step 2 Using two hands to support the power module, slide it into the power tray.

Figure 10: Example of Inserting the AC Power Module



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

Figure 11: Example of Securing the Snap Hook (AC)

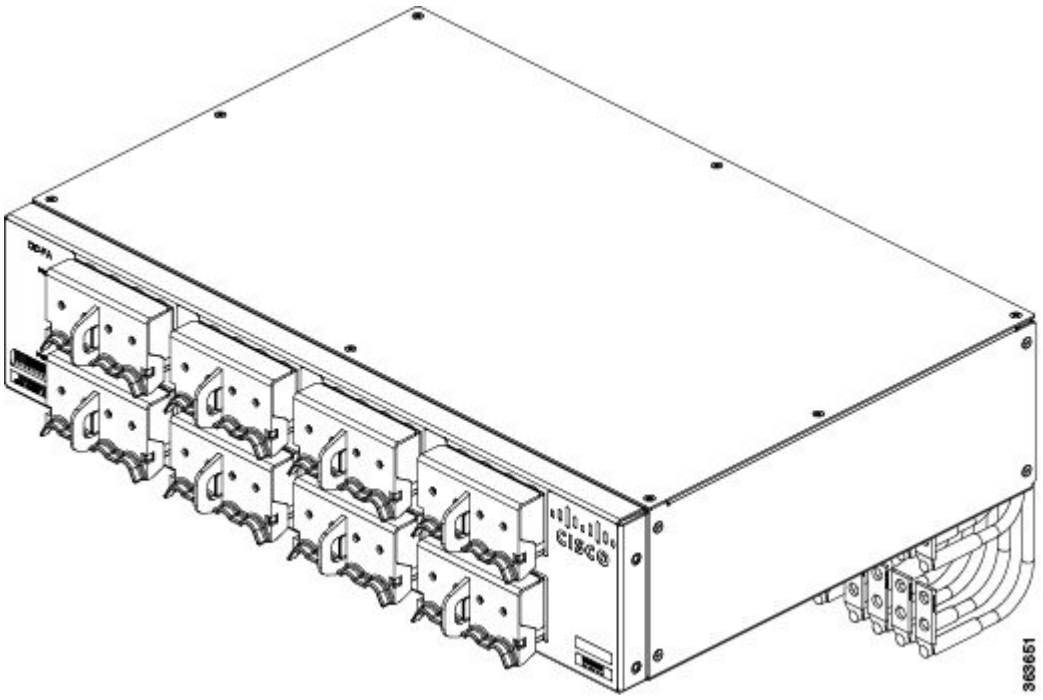


Step 4 Repeat these steps for the other AC or DC power modules.

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 12: 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

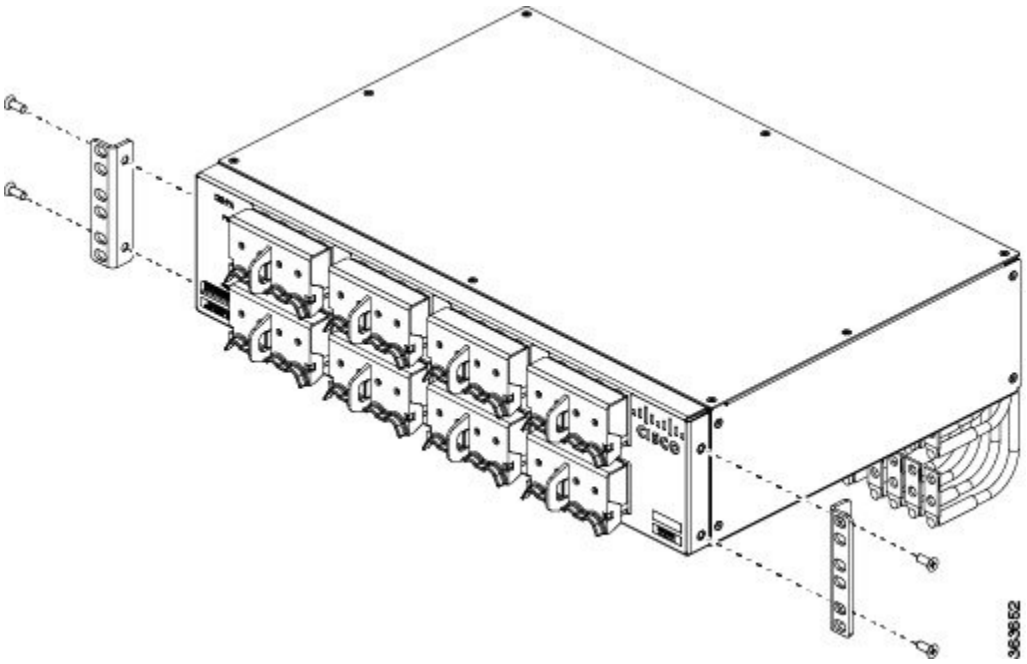
- 6-inch, number-1 Phillips screwdriver
- One DC Power Front Connection Adapter (NCS4K-DC-FA, includes brackets)
- 3/8 Ratchet Wrench, 7/16 Socket, and a Torque Wrench

Steps

Procedure

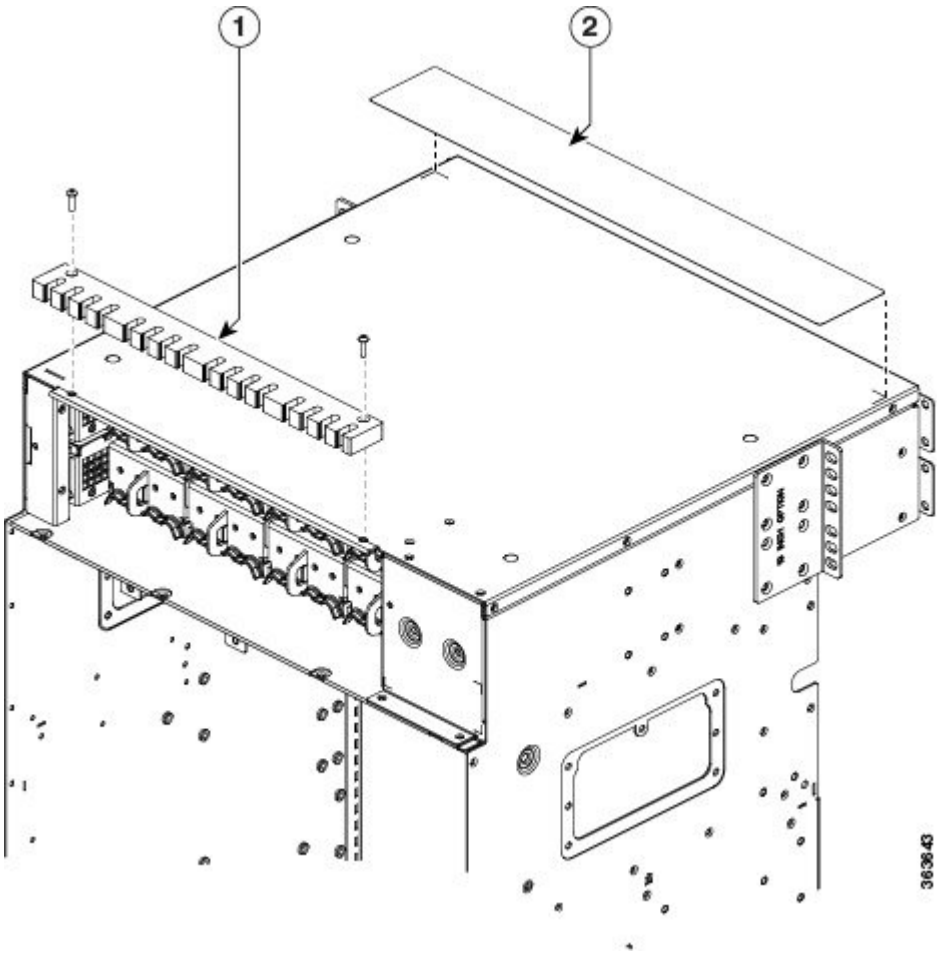
Step 1 Install the DC-FA (front access) brackets on the sides toward the front of the DC adapter. There are three different types of bracket depending upon rack type: ANSI 19 inch or 23 inch and ETSI. Choose the correct type for your specific rack.

Figure 13: 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.

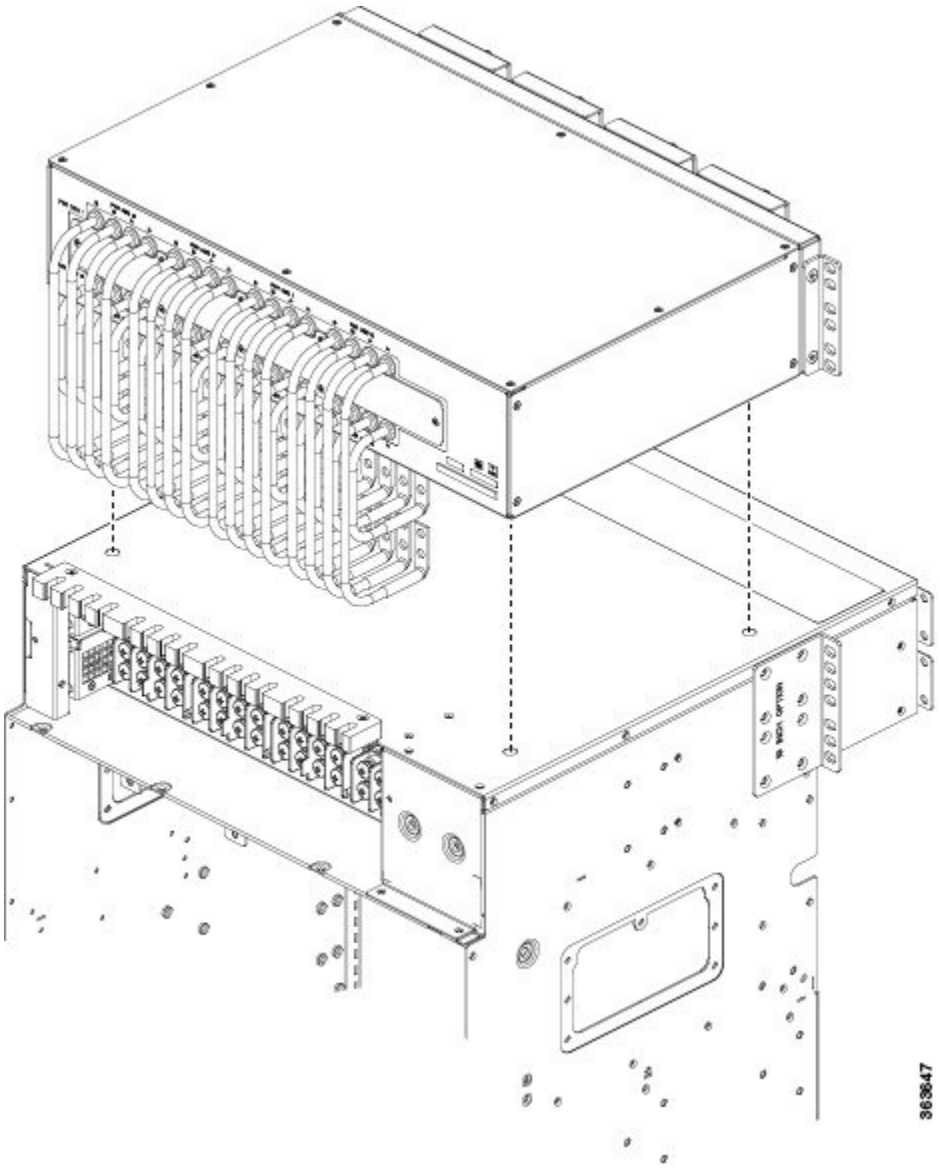
Figure 14: Attaching Rear Cable Guide and Insulator Sheet



1	Rear cable guide	2	Insulator sheet

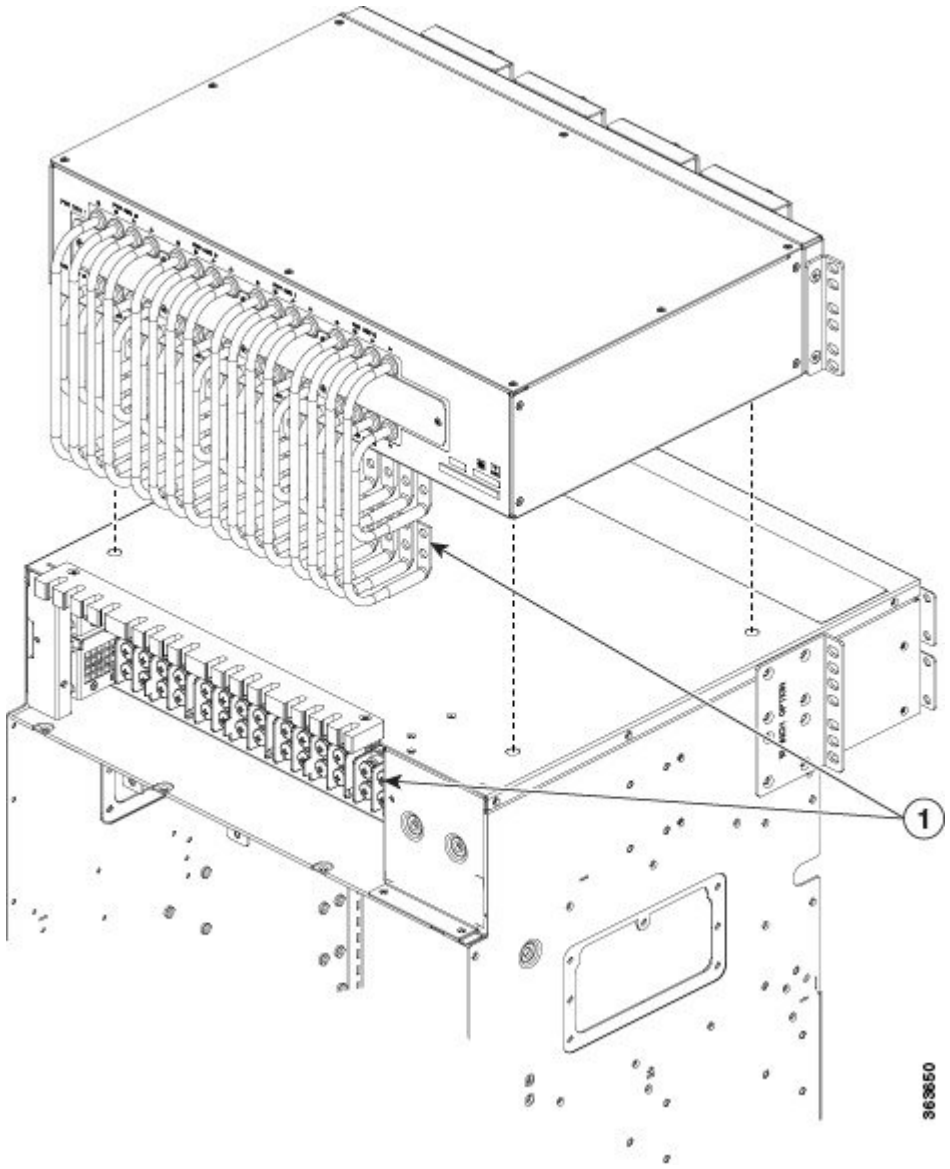
Step 3 Place the DC adapter on top of the chassis using the embossed references on the top chassis cover.

Figure 15: 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.

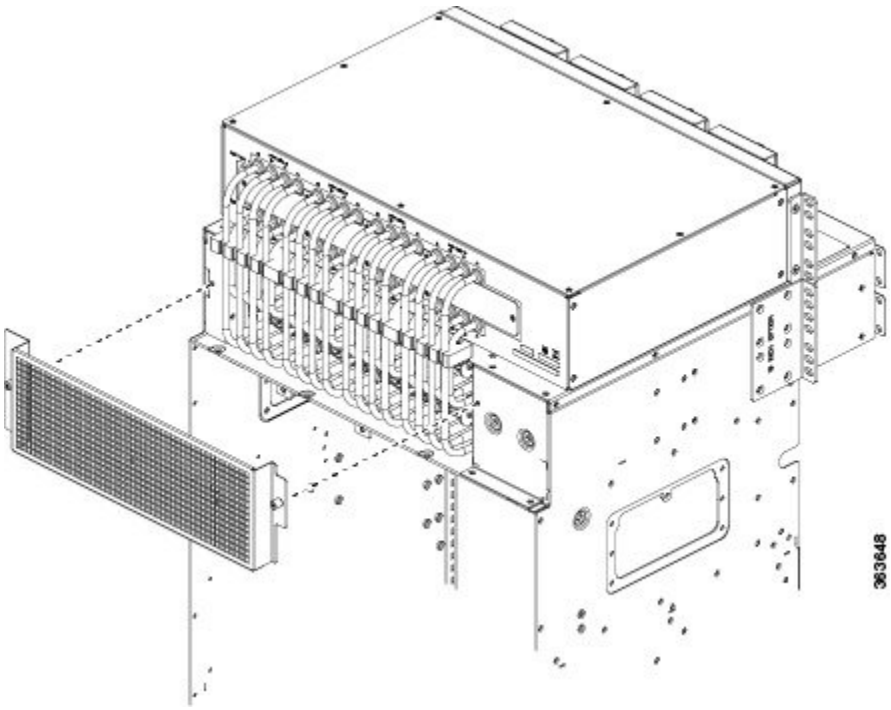
Figure 16: Connecting Power Cables



1	Connect power cables to chassis terminal blocks

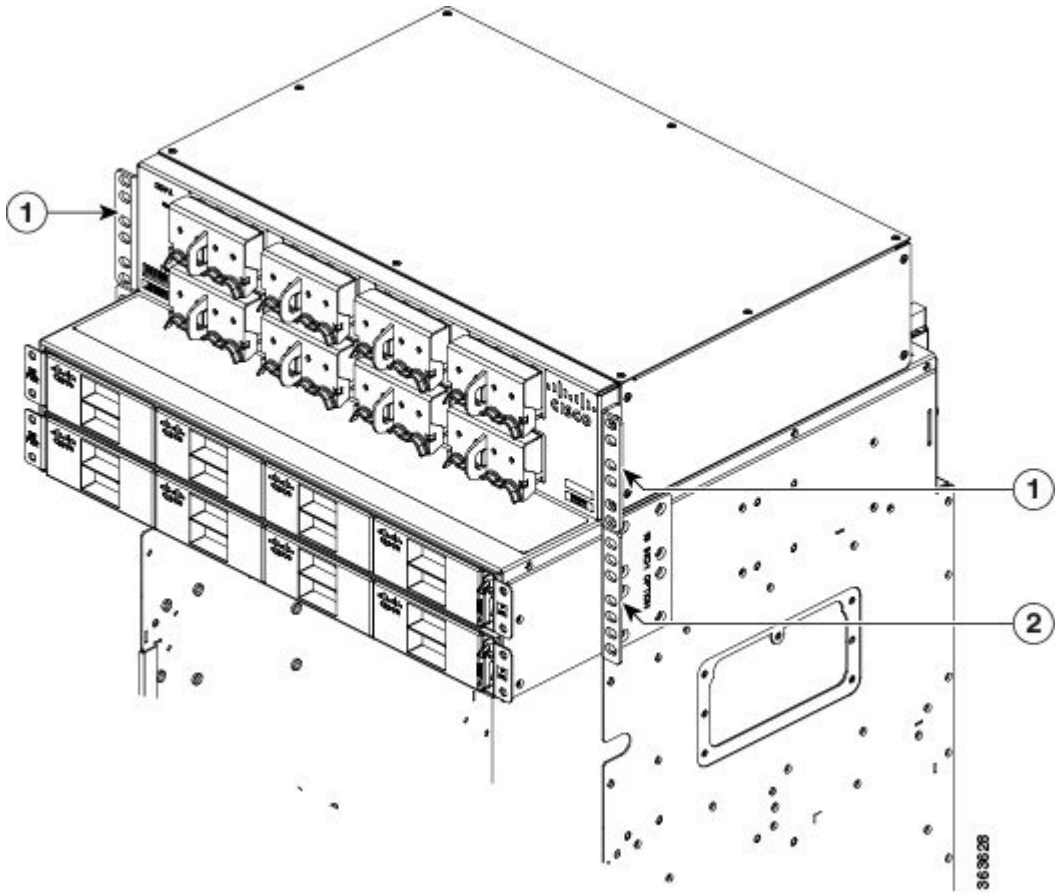
Step 5 Install the rear cover to protect the cables.

Figure 17: 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.

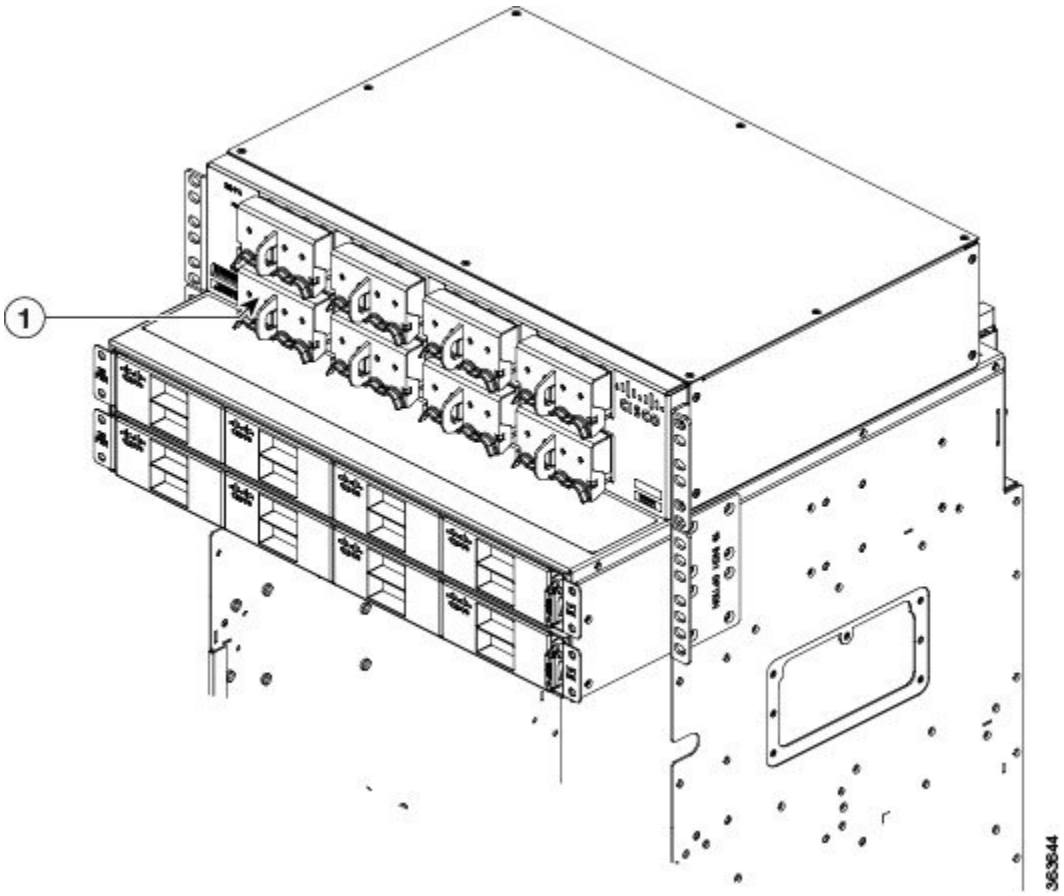
Figure 18: Chassis Brackets and DC Adapter Brackets



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 21.

Figure 19: 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.

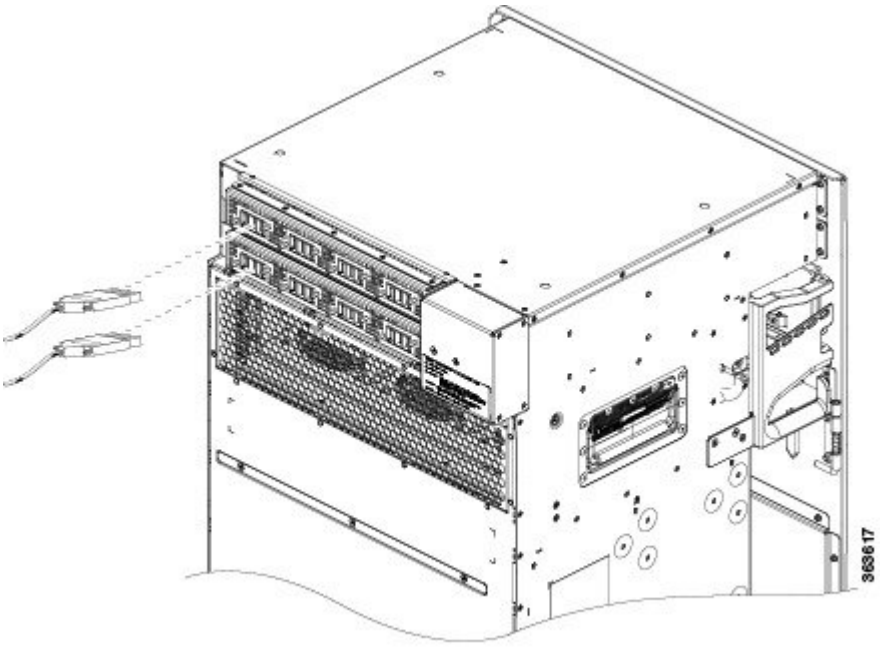
Step 3 Verify that the permanent ground connection (central office grounding system) has been installed to the NEBS grounding location on the chassis.

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 20: 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 28.

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 21: DC Power Tray Rear Panel

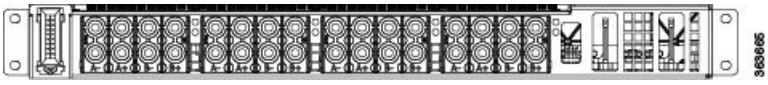
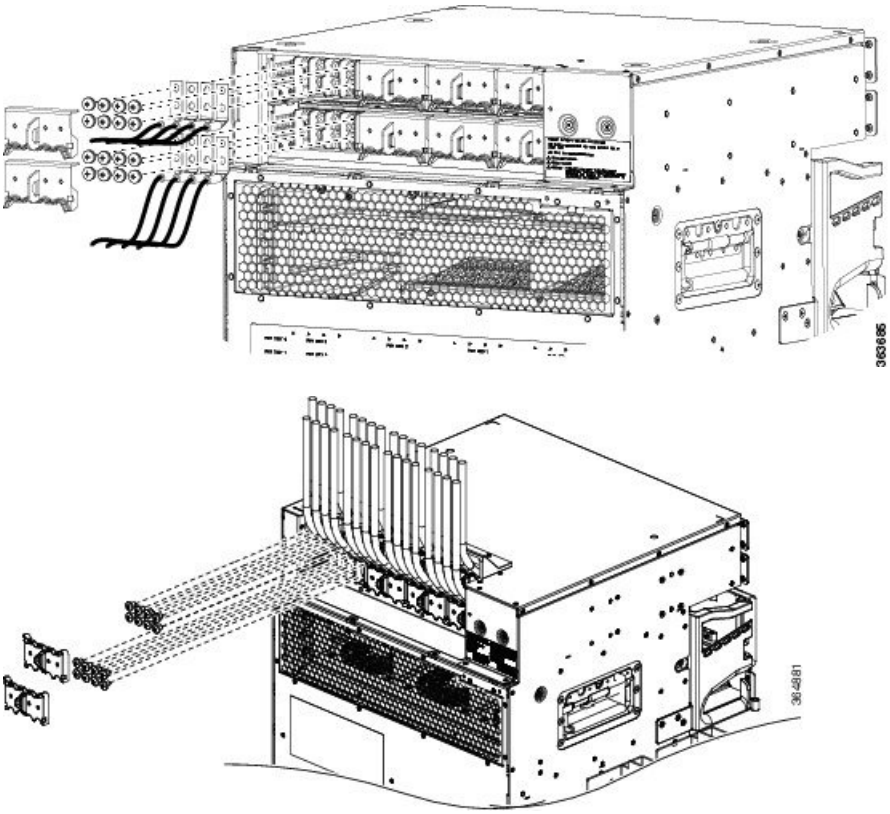
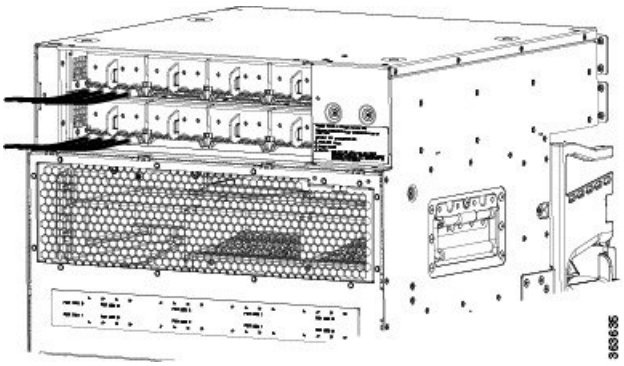


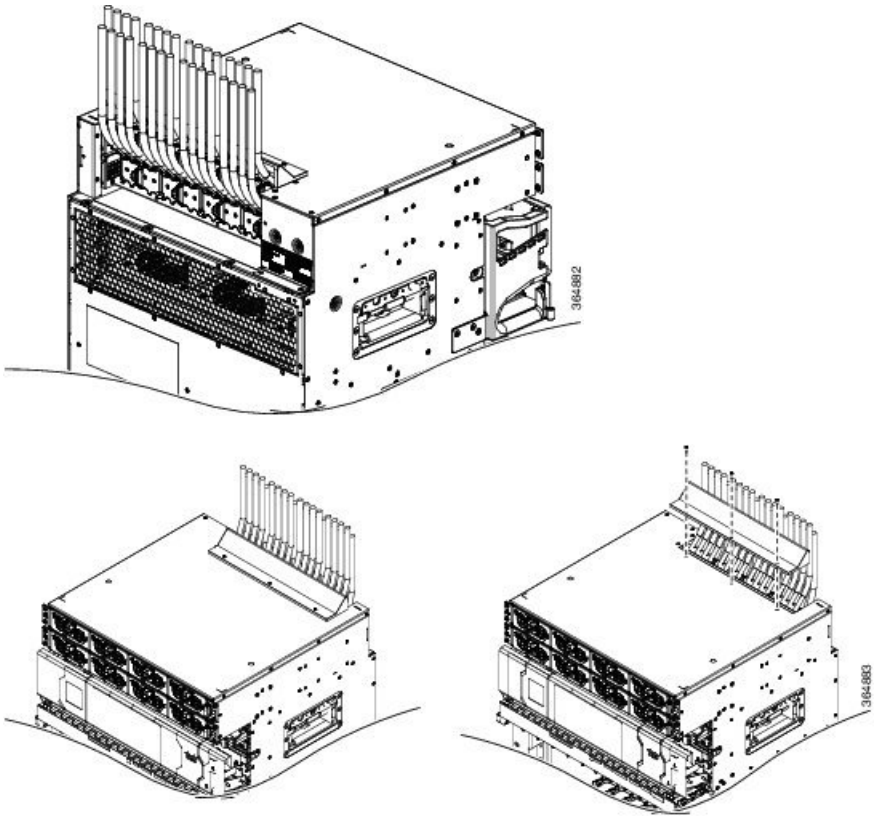
Figure 22: Typical Power Connections to a Power Tray for a Single DC Power Module—Power System



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

Figure 23: Typical Plastic Safety Covers over the Power Tray Connection Terminals





Step 7 Proceed to the Powering On the Chassis, on page 28.

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.

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 21

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

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 22.

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.