



Installing the RPMC and the Fabric Cards

This chapter provides details about RPMC and fabric cards for the NCS 4000 FCC.

- [Route Processor Multi Chassis Card, on page 1](#)
- [Fabric Card, on page 2](#)
- [Guidelines for Installing a Card, on page 4](#)
- [Installing a Fabric Card or a Route Processor Multi Chassis Card , on page 5](#)
- [Online Insertion and Removal of a Fabric Card or Route Processor Multi Chassis Card, on page 8](#)
- [Verifying the Installation of a Card, on page 10](#)

Route Processor Multi Chassis Card

The Route Processor Multi Chassis (RPMC) card (PID: NCS4KF-RPMC) is a 56-port combination card. The RPMC card integrates a Shelf Controller and the Switch for the NCS 4000 Control Ethernet into one physical card. The RPMC card controls the route processing, the fabric cards, and the management functions for the FCC and its components. The alarm LEDs on the RPMC card indicate active alarm conditions.

The RPMC cards are inserted into two dedicated slots on the front of the FCC. One RPMC card installs into slot RPMC0 SC0/SW0 on the upper card cage, and the other installs into slot RPMC1 SC1/SW1 on the lower card cage. Both the upper and lower cardslots are identical. The secondary card is installed for redundancy, so that the loss or removal of a single card does not bring down the FCC. At least one RPMC card must be operational for the FCC to function.

The cable management brackets are preinstalled on the RPMC card.



Caution All SFP+ and QSFP+ optical ports on the RPMC card are required to be populated with either SFP+/QSFP+ optics or SFP+/QSFP+ dust plugs. This requirement is to adhere to the system EMC and safety compliance guidelines.

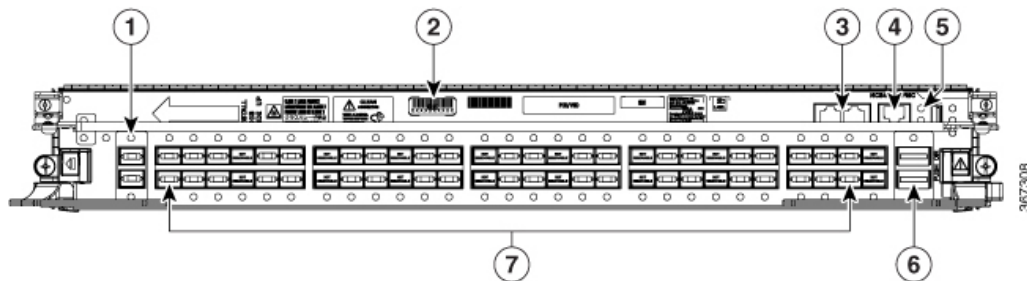


Note Only two RPMC cards, with their switch portions operational (that is, participating in Ethernet control plane traffic), are supported in an entire multichassis system.

Table 1: RPMC Card Physical Characteristics

Card Type	Height	Depth	Width	Weight
RPMC	22.37 in. (56.8 cm) including ejector projection at sides.	2.75 in. (7.0 cm) 3.45 in. (8.76 cm) without exterior cosmetics.	11.19 in. (28.4 cm) without ejector projection from faceplate.	14.96 lb (5.89 kg)

Figure 1: RPMC Card Front Panel Ports



1	Two 10GE expansion ports (EXP 0 and EXP 1)	5	USB 2.0 port
2	Serial number label	6	Two QSFP+ 40GE optical ports (HS0 and HS1)
3	Two EIA232 serial console ports: (CON 0 and CON1)	7	56 SFP+ 10GE optical ports, left to right (0–28–55 at top)
4	RJ-45 Ethernet management port		

The RPMC card's external ports include:

- 10GE expansion ports: used to expand the internal control Ethernet network to the LCC by connecting through the SW switch ports. The ports are identical in functionality. Each port can handle 10GE operations through the SFP+ modules. The supported SFP+ modules are: ONS-SC+-10G-LR and ONS-SC+-10G-SR.
- EIA-232 serial console ports.
- RJ-45 Ethernet management port: RJ-45 copper 10/100/1000 Mbps full duplex port.
- USB 2.0 port (type A receptacle): used to attach a storage device to the FCC. This USB port is used only for storage devices.
- QSFP+ 40GE optical ports: Quad Small-Form-factor Pluggable (QSFP) 40GE ports that are used for communication between two RPMC cards. The supported QSFP+ module is, QSFP-40G-SR4.
- SFP+ 10GE optical ports: control plane connectivity between the FCC and the LCC.

Fabric Card

The Cisco NCS 4000 switch fabric (PID: NCS4KF-FC2-C) has a 3-stage, cell-based architecture with four fabric planes. The fabric card (FC) implements the second stage of the switch fabric. The FCs provide the

switching functionality for the routing system and perform the cross-connect function, enabling the line cards (LC) to interact with each other.

The NCS4KF-SA-DC chassis can accommodate eight FCs. The chassis remains always populated with all eight fabric cards, except during replacement.

Table 2: NCS4KF-FC2-C Card Physical Characteristics

Card Type	Height	Depth	Width	Weight
Fabric Card	22.37 inches (56.8 cm) including the ejector projection on the sides.	11.19 inches (28.4 cm) without ejector projection from faceplate. 12.9 inches (32.79 cm) with ejectors.	3.49 inches (8.87 cm)	18 lb (8.2 kg), when shipped.

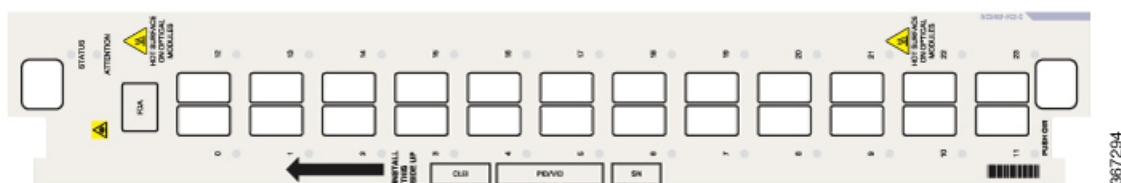
The cable management brackets are preinstalled on the FC.

The connections between the LCC and the FCC are implemented through several bidirectional optical links. Pluggable CXP2 form-factor optics are used for these interconnects. CXP2 optical modules are used on the NCS4KF-FC2-C fabric card in the FCC and on the NCS4016-FC2-M fabric card in the LCC. CXP2 connects the fabric cards that are a part of the LCC and FCC. The CXP2 module uses a 24-fiber MPO connector that supports 12 bidirectional optical links up to 100 meters of OM4 multimode fiber. The NCS4KF-FC2-C fabric card supports up to 24 CXP2 modules.



Caution All CXP2 optical ports on the NCS4KF-FC2-C fabric card are required to be populated with either CXP2 optics (ONS-CXP2-SR25) or with CXP2 dust plugs. It is mandatory to use CXP2 dust plugs in the unused CXP2 optical ports to adhere to EMC and safety compliance guidelines.

The metal surfaces of the CXP2 optical module, when used in the NCS4KF-FC2-C card, may reach high temperatures. The *Hot Optical Module* label is indicated on the fabric card, as shown in the following figure.



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

Follow the procedure to remove the optical modules from the system:

- Shut down the plane on which the pluggable is installed (X is the fabric plane number- its range is from 0 to 3).

```

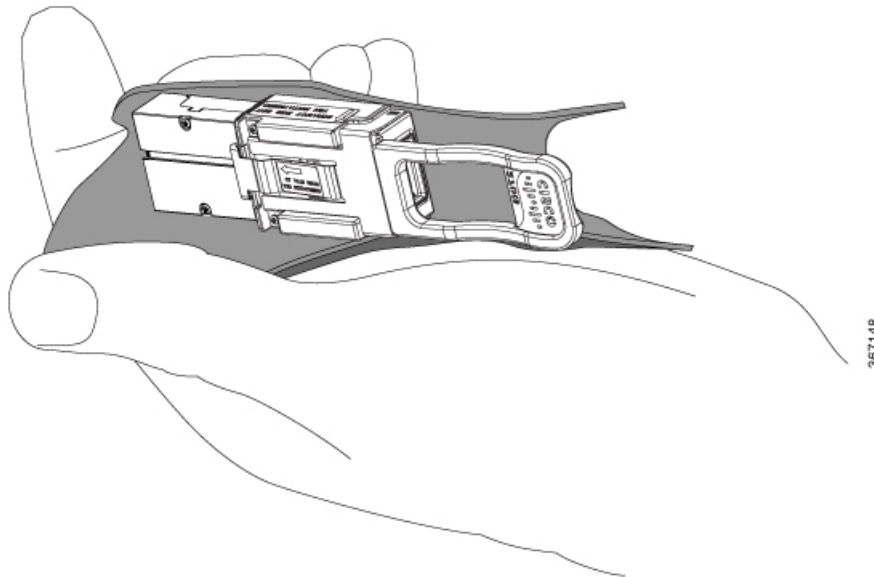
config
controller fabric plane X
shutdown
commit
        
```

- 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.
- Unshut the plane.

```
config
no controller fabric plane 0 shutdown
commit
```

- Hold the optical module only by the pull tab. You can place the optical module on an insulation pad, as shown in the following figure. The insulation pad is a part of the FC packaging.

Figure 2: Optical Module on an Insulation Pad



Guidelines for Installing a Card

- Every card has a label (with an arrow) on its faceplate indicating the side that is up for installation.
- Every card has a key, which 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. If you insert a card into the wrong cardslot or upside down, the key gets blocked against the chassis card guide. The key will not slide through the slot. If the key is blocked, remove the card and insert it in the correct cardslot.
- Online insertion and removal (OIR) is supported, enabling you to install a card while the FCC is in operation. During OIR, routing information is maintained, and ensures session preservation. We recommend that you perform a graceful shutdown, to shut down a fabric card before removing it from the FCC. See [Online Insertion and Removal of a Fabric Card or Route Processor Multi Chassis Card](#), on page 8.
- When installing a fabric card, you must first push the OIR button, which is on both the upper and lower ejectors for the mechanical latch to be released.
- The different cards in the FCC are attached to the FCC itself by 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 may vary from card to card, but generally they are in the same locations: on the upper and bottom ends of the faceplate.

- The FCC is shipped with the cardslots containing impedance carriers to help maintain chassis stiffness and prevent any damage to the chassis during shipment.



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



Caution The FCC slots should not be empty at any given time. The fabric cardslots are always populated with FCs, except during replacement of an FC. If necessary, the RPMC cardslot can be populated with an impedance carrier. The impedance carriers are different for fabric cards and RPMC cards.

Installing a Fabric Card or a Route Processor Multi Chassis Card

To install a fabric card or an RPMC card, follow these steps.



Note The RPMC cards are hot-swappable, meaning that each card can be replaced without disrupting data flow in the router.



Caution To prevent electromagnetic interference, the RPMC card ships with two QSFP plugs installed on the two QSFP ports. A QSFP plug must be installed on any empty QSFP ports always.



Caution To prevent electromagnetic interference, the RPMC card ships with SFP+ plugs installed in all 56 ports. The plugs in a few SFP+ ports are nonremovable to avoid their use in cable routing. An SFP+ plug must be installed on empty SFP+ ports.



Warning **Class I and Class 1M laser products.** Statement 291



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

- Open the front door, if installed.
- For installing an FC or RPMC card, remove the impedance carrier from the slot as the chassis is shipped with impedance carriers. For the detailed procedure, see the [Removing an Impedance Carrier](#) section in the Removing and Replacing Chassis Components chapter.

Required Tools and Equipment

- ESD-preventive wrist strap
- Number-2 Phillips screwdriver or number-2 common (flat-head) screwdriver
- RPMC card (Cisco PID NCS4KF-RPMC) or FC (Cisco PID NCS4KF-FC2-C)

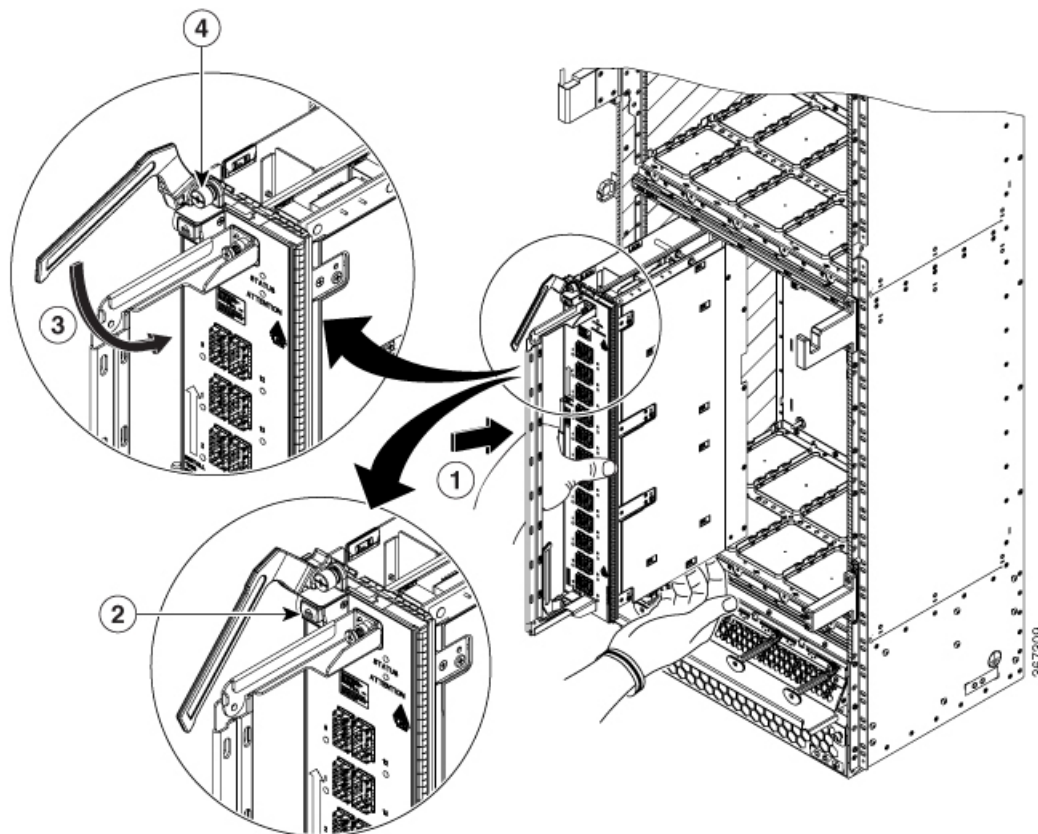
Procedure

Step 1

Attach the ESD-preventive wrist strap to your wrist. Connect its leash to one of the two ESD jacks on the front side of the FCC. (See the [Safety Guidelines](#) section in the Overview chapter.) You can also connect the ESD-preventive wrist strap leash to any bare metal surface on the FCC.

Caution Always wear the ESD band while installing or removing a card.

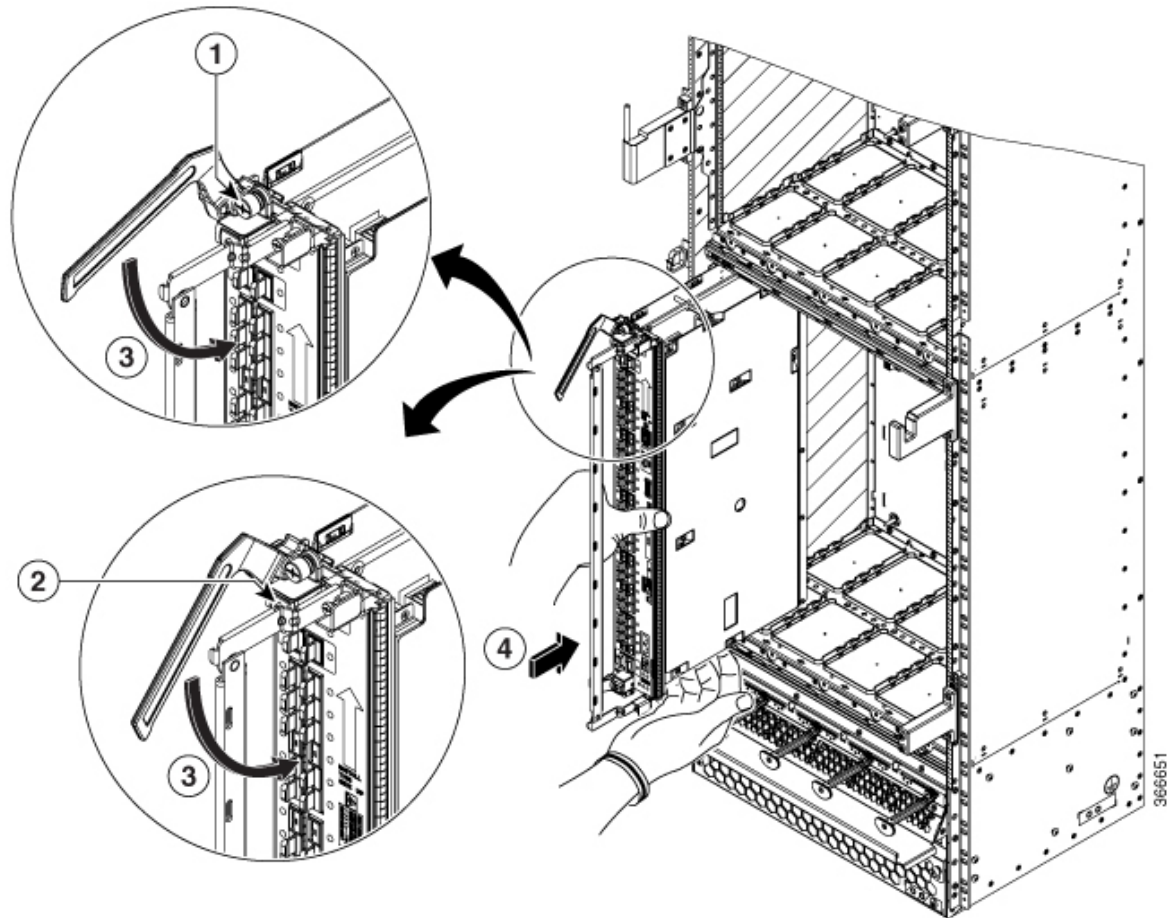
Figure 3: Installing a Fabric Card



1	Direction of insertion	3	Ejector lever
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2	Ejector button	4	Captive screw
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Figure 4: Installing an RPMC Card



1	Captive screw	3	Ejector lever
2	Ejector button	4	Direction of insertion

Step 2 Remove the card from its antistatic packaging.

Step 3 Orient the card according to the *up* arrow, as indicated on the faceplate.

Note If the card does not slide easily into the slot during installation, the slot or the orientation may be wrong.

Step 4 Use both hands while inserting the card. Use one hand on the faceplate and the other hand along the base of the card to guide it into a slot.

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 5 Press the OIR button (at the bottom) and the ejector button (at the top) to release the ejector levers.

Step 6 Carefully slide the card completely 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 card until the ejector lever hooks are fully latched.

Note FCs and RPMC cards have guide pins that contact the backplane connector as you slide a card into its slot.

Step 7 Pivot the ejector levers toward the faceplate of the card. Do not force the card; the ejector levers properly seat the card against the backplane. If the captive screws are difficult to tighten, ensure that the ejector lever is properly secured to the catch. Also, check that the card is properly seated in the slot.

Step 8 Use a number-2 Phillips screwdriver to tighten the captive screw or screws next to each card ejector lever to ensure proper EMI shielding. This action prevents the card from becoming partially dislodged from the backplane. Tighten the captive screws using 10.60 in-lb (1.20 Nm).

Note For a new installation, do not tighten any fabric cards until all cards have been inserted and seated. For maintenance or replacement of a failed fabric card, loosen the fabric card on both sides of the failed FC and the FC to be replaced. Remove only the FC that needs replacement.

Online Insertion and Removal of a Fabric Card or Route Processor Multi Chassis Card

To perform a graceful OIR of a fabric card (FC) or Route Processor Multi Chassis (RPMC) card, follow these steps:



Caution Perform OIR of a card at a temperature of 30⁰C or lower.



Note The RPMC card is hot-swappable. Perform these tasks when you are certain that the secondary RPMC card in the FCC is operational. The secondary card automatically assumes control. Failure to follow these guidelines can result in interruptions in data communications and network connectivity.



Note 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.

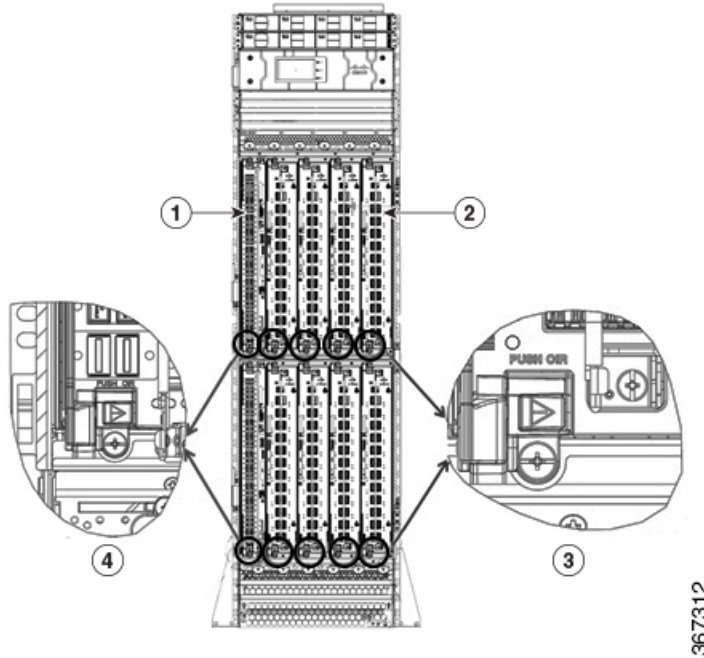


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Figure 5: OIR Procedure for FC and RPMC Card



1	Fiber guide (RPMC card)	3	OIR button (FC)
2	Fiber guide (FC)	4	OIR button (RPMC card)

Before you begin

Open the chassis door.

Procedure

Step 1

Shut down the plane and the FC.

X is the plane on which the FC is installed.

```
config
controller fabric plane X
shutdown
commit
```

This step is not applicable for the RPMC card.

Step 2 Press the OIR button (red-colored) which is at the bottom. The OIR button is clearly indicated with the words *Push OIR* shown on the faceplate.

The Card Status LED starts blinking (yellow color). The blinking continues for 120 seconds. After 120 seconds, the LED displays a steady yellow. Use the **show led** command to get the current status of an LED.

Caution Do not remove the card until the blinking completely stops.

If the active RPMC card is reloaded or the active LED manager process is restarted, the LED starts blinking again. (The LED restarts blinking even if it has stopped blinking after the specified 120 seconds.)

Step 3 Press the ejector button (gray-colored) which is at the top.

Step 4 Remove the cables from the card.

Step 5 Remove the fiber guide by loosening the screws at the top and bottom.

Step 6 Remove the optical modules.

Step 7 Loosen the two captive screws that are located at the top and bottom of the card.

Step 8 Pivot the ejector levers away from the faceplate.

Step 9 Remove the card from the chassis.

Step 10 Install the new card in the empty slot within five minutes of removal time. For a detailed installation procedure, see the [Installing a Fabric Card or a Route Processor Multi Chassis Card](#), on page 5 section of this chapter.

Warning The FC or RPMC card in the upper shelf must be replaced within the time limit of five minutes. If not, the corresponding card in the bottom shelf and the cards that are next to the card that is to be replaced, is shut down. The main chassis remains operational.

We also recommend that an FC or RPMC card in the lower shelf is replaced within the time limit of five minutes. This replacement within that time limit ensures that the other cards and the chassis continue to function normally.

Step 11 Use the number-2 Phillips screwdriver to tighten the captive screws on the card using 10 in-lb (1.12 Nm).

Step 12 Plug in the optical modules and the fiber connections.

Use dust plugs in the empty optical module slots.

Step 13 Unshut the plane. Wait for ten minutes for the FC to be operational.

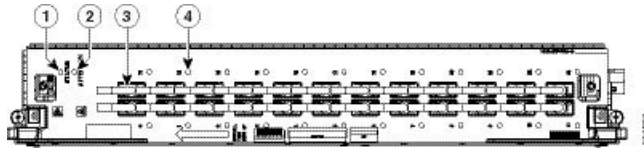
```
config
no controller fabric plane X shutdown
commit
end
```

This step is not applicable for the RPMC card.

Verifying the Installation of a Card

This section describes how to verify that an FC or RPMC card is properly installed and is working correctly in the Cisco NCS 4000 FCC. Use the Status LED, located on the faceplate of the card to verify the correct installation of the card.

Figure 6: Fabric Card Front Panel



1	Status LED	3	24 CXP2 ports (0–11 and 12–23)
2	Attention LED	4	24 CXP2 port LEDs (one per port)

On the fabric card, the 24 CXP2 LEDs indicate the status of the CXP2 links. Each FC slot must be configured as a fabric instance for the CXP2 port LED to light up. For example:

```
controller fabric plane 0
instance 0
location F0/FC0
```

Figure 7: RPMC Front Panel



1	Status LED	5	Two QSF LEDs (Q1 port 56 and Q0 port 56)
2	Attention LED	6	MGMT port LEDs (Link and Activity)
3	Two expansion port LEDs (EXP0 and EXP1)	7	Three alarm LEDs (Critical, Major, Minor)
4	56 SFP LEDs (0 to 27 on the left, 28 to 55 on the right)		

Table 3: LED Indicators on the FC and RPMC Card

LED	LED Color	Description
STATUS	Green	The card is properly installed and powered-up with no faults.
	Yellow	The software initialization is in progress during bootup or a fault exists on the board.
	Blinking yellow (slow)	The card is not fully seated or the slot has detected a parity error. Note The flashing (blinking) yellow LED is also used during the OIR procedure.
	Off	No power is applied to the card.

LED	LED Color	Description
ATTENTION	Blue	On: The card needs attention. Off: The card does not require attention.
CXP2 (0-23) (available only on the FC)	Green	The port is correctly connected.
	Red	One or more links are down.
	Off	The CXP2 module is not present or is not fully inserted in the card.
QSFP SFP MGMT EXPANSION PORT (available only on the RPMC card)	Green	The port is working correctly.
	Blinking green	When the port is sending (Tx) and receiving (Rx) data, the LED flashes green.
ALARM (available only on the RPMC card)	Orange	Active alarm on the card or in the system.
	Off	No Alarm on card or in the system.

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

- Ensure that the card is seated firmly in the FCC slot. To verify the installation, check if the faceplate of the card is even with the faceplates of the other installed cards.
- Ensure that the ejector levers are latched and that the captive screws are fastened properly. Reseat the card if necessary.



Note To confirm the location of the card that needs attention, use the **hw-module attention-led location** command. The Attention LED of the faulty card is lit up.
