Cisco ASR 9000 Series Aggregation Services Router Ethernet Line Card Installation Guide

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Preface

This preface contains the following sections:

Changes to This Document

Table 1 lists the technical changes made to this document since it was first printed.

Table 1 Changes to This Document

Date	Change Summary
January 2015	Added new 8X100 GE (A9K-8X100GE-L-SE) next generation line cards, combination line cards (A9K-4T16GE-TR/A9K-4T16GE-SE), and new optics supported in Cisco IOS XR Release 5.3.0.
October 2014	Added new optics supported in IOS XR Release 5.2.2. and new low cost 40x1G line cards A9K-40GE-TR and A9K-40GE-SE.
September 2014	Added new optics supported in IOS XR Release 5.1.2.
June 2014	Added new optics supported in IOS XR Release 5.2.0
January 2014	Information added about the new Fast Ethernet SFP modules, 10GE SFP+ transceivers, DWDM SFP+ transceivers, and 10GE XFP modules.
May 2013	Information added about the new 8-port 10GE Modular Port Adapter (MPA).
December 2012	Information added about the new XFP-10GER-192IR Multirate 10GBASE-ER and OC-192/STM-64 IR-2 XFP, low power (2.5W) transceiver module.
September 2012	Information added about the new 1-port 40GE Modular Port Adapter (MPA), the new 36-Port 10-Gigabit Ethernet Line Card and the new 1-Port 100-Gigabit Ethernet Line Card, plus updates to the transceiver module information.

Table 1 Changes to This Document

Date	Change Summary
May 2012	Information added about the new 160G modular line card, the new 2-port 10GE Modular Port Adapter (MPA), the new 2-port 40GE Modular Port Adapter (MPA), and the CFP-40G, CFP-100G, and QSFP+ optical modules.
December 2011	Information added about the new 24-port 10GE fixed line card, the 2-port 100-GE fixed line card, and the modular line card supporting the 20-port 1-GE Modular Port Adapter (MPA), the 4-port 10GE Modular Port Adapter (MPA) and the 2-port 10GE Modular Port Adapter (MPA).
May 2010	Information added about the new 16x10GE SFP+ line card and SFP+ transceiver modules. Also added information about additional versions of existing cards and new supported transceiver modules.
December 2009	Information added about the new 8x10GE 80 Gbps Line Rate Card and 2x10GE + 20x1GE Combination Line Card.
March 2009	Initial release of this document.

Audience

This guide is written for hardware installers and system administrators of Cisco routers.

This publication assumes that the user has a substantial background in installing and configuring router and switch-based hardware. The reader should also be familiar with electronic circuitry and wiring practices, and have experience as an electronic or electromechanical technician.

Purpose

This installation guide contains procedures for installing line cards into the router, verifying the installation, and creating a basic startup configuration file.

Document Organization

This installation and configuration guide is organized into the following chapters and appendixes:

- Chapter 1, "Cisco ASR 9000 Series Line Card Product Overview," provides an overview the Cisco ASR 9000 Series Ethernet line cards,
- Chapter 2, "Installing Line Cards in the Cisco ASR 9000 Series Router," provides instructions for installing the hardware and connecting external network interface cables.
- Chapter 3, "Verifying and Troubleshooting the Line Card Installation," provides procedures for verifying the line card installation.
- Appendix A, "Technical Specifications," lists the specifications for the Ethernet line cards for the Cisco ASR 9000 Series Aggregation Services Router.

Document Conventions

This publication uses the following conventions:

- **Ctrl** represents the key labeled *Control*. For example, the key combination **Ctrl-Z** means hold down the **Control** key while you press the **Z** key.

Command descriptions use these conventions:

- Examples that contain system prompts denote interactive sessions, indicating the commands that you should enter at the prompt. For example:

  RP/0/RSP0/CPU0:router#

- Commands and keywords are in **bold** font.
- Arguments for which you supply values are in *italic* font.
- Elements in square brackets ([ ]) are optional.
- Alternative but required keywords are grouped in braces ({ }) and separated by vertical bars (|).

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

Note Means *take note*. Notes contain helpful suggestions or references to materials not contained in this manual.

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

Warning **This warning symbol means *danger*. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the *Regulatory Compliance and Safety Information* document that accompanied this device.** Statement 1071

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Cisco ASR 9000 Series Line Card Product Overview

This chapter provides an overview of the Cisco ASR 9000 Series line cards and includes these sections:

Cisco ASR 9000 Series Ethernet Line Cards

Table 1-1 lists the Cisco ASR 9000 Series Ethernet line cards and corresponding Cisco product numbers. The line cards are supported on all Cisco ASR 9000 Series Routers including the Cisco ASR 9004 Router, Cisco ASR 9006 Router, Cisco ASR 9010 Router, Cisco ASR 9912 Router, and Cisco ASR 9922 Router.

Table 1-1 Cisco ASR 9000 Series Line Cards and Product Numbers

Ethernet Line Card	Cisco Product Number
1-Port 100GE DX Line Card, Service Edge Optimized with CFP [1]	A9K-1X100GE-SE
2-Port 10GE + 20-Port GE Combination Line Card	A9K-2T20GE-B
2-Port 10GE + 20-Port GE Extended Combination Line Card	A9K-2T20GE-E
2-Port 10GE + 20-Port GE Low Queue Combination Line Card with XFP[2] and SFP[3]	A9K-2T20GE-L
4-Port 10GE Line Card with XFP	A9K-4T-B
4-Port 10GE Extended Line Card with XFP	A9K-4T-E
4-Port 10GE + 16-Port GE Combination Line Card, Packet Transport Optimized, with SFP and SFP+[4]	A9K-4T16GE-TR
4-Port 10GE + 16-Port GE Extended Combination Line Card, Service Edge Optimized, with SFP and SFP+	A9K-4T16GE-SE
4-Port 10GE Low Queue Line Card with XFP	A9K-4T-L
8-Port 10GE DX Low Queue Line Card with XFP	A9K-8T/4-L
8-Port 10GE DX Line Card with XFP	A9K-8T/4-B

Table 1-1 Cisco ASR 9000 Series Line Cards and Product Numbers

Ethernet Line Card	Cisco Product Number
8-Port 10GE Line Rate Card with XFP	A9K-8T-B
8-Port 10GE DX Extended Line Card with XFP	A9K-8T/4-E
8-Port 10GE Extended Line Rate Card with XFP	A9K-8T-E
8-port 10GE 80G Low Queue Line Rate Card with XFP	A9K-8T-L
16-Port 10GE DX Medium Queue Line Card with SFP+	A9K-16T/8-B
24-Port 10GE DX Line Card, Packet Transport Optimized with SFP+	A9K-24X10GE-TR
24-Port 10GE Line Card, Service Edge Optimized with SFP+	A9K-24X10GE-SE
36-Port 10GE Line Card, Packet Transport Optimized with SFP+	A9K-36X10GE-TR
36-Port 10GE Line Card, Packet Transport Optimized with SFP+	A9K-36X10GE-TR
36-Port 10GE Line Card, Service Edge Optimized with SFP+	A9K-36X10GE-SE
40-Port GE Line Card with SFP	A9K-40GE-B
40-Port GE Extended Line Card with SFP	A9K-40GE-E
40-Port GE Low Queue Line Card with SFP	A9K-40GE-L
40-Port GE Line Card, Packet Transport Optimized with SFP	A9K-40GE-TR
40-Port GE Line Card, Service Edge Optimized with SFP	A9K-40GE-SE
1-Port 100GE DX Line Card, Packet Transport Optimized with CFP	A9K-1X100GE-TR
2-Port 100GE DX Line Card, Packet Transport Optimized with CFP	A9K-2X100GE-TR
2-Port 100GE DX Line Card, Service Edge Optimized with CFP	A9K-2X100GE-SE
8-Port 100GE Line Card, Service Edge Optimized, with CPAK	A9K-8X100GE-L-SE
1-Port 40GE Modular Port Adapter (MPA), with QSFP+[5]	A9K-MPA-1X40GE
2-port 40GE Modular Port Adapter (MPA), with QSFP+	A9K-MPA-2X40GE
2-port 10GE Modular Port Adapter (MPA) with XFP	A9K-MPA-2X10GE
4-Port 10GE Modular Port Adapter (MPA) with XFP	A9K-MPA-4X10GE
8-port 10GE Modular Port Adapter (MPA) with SFP+	A9K-MPA-8X10GE
20-Port GE Modular Port Adapter (MPA) with SFP	A9K-MPA-20GE
80 Gigabyte Modular Line Card, Packet Transport Optimized	A9K-MOD80-TR
80 Gigabyte Modular Line Card, Service Edge Optimized	A9K-MOD80-SE
160 Gigabyte Modular Line Card, Packet Transport Optimized	A9K-MOD160-TR
160 Gigabyte Modular Line Card, Service Edge Optimized	A9K-MOD160-SE

1. CFP = 100-Gigabit Ethernet optical transceiver module
2. XFP = 10-Gigabit Ethernet small form-factor pluggable transceiver module
3. SFP = Gigabit Ethernet small form-factor pluggable transceiver module
4. SFP+ = 10-Gigabit Ethernet small form-factor pluggable transceiver module
5. QSFP+ = 40-Gigabit Ethernet Quad Small Form-factor Pluggable plus transceiver module

Cisco IOS XR Software Release and Hardware Revision Requirements

The Cisco ASR 9000 line cards have specific Cisco IOS XR software requirements. To ensure compatibility with the software, each line card has a specific hardware revision number. The number is printed on a label affixed to the component side of the card and is displayed by the **show diag** command.Table 1-2 lists the hardware and software requirements for the line cards.

Table 1-2 Cisco IOS XR Release and Hardware Version Compatibility for Cisco ASR 9000 Series Line Cards

Ethernet Line Card	Product Number	Minimum IOS XR Software Release	Required Hardware Version
40-Port GE Line Card	A9K-40GE-B	3.7.2	1.0
40-Port GE Extended Line Card	A9K-40GE-E	3.7.2	1.0
40-Port GE Low Queue Line Card	A9K-40GE-L	3.9.0	1.0
8-Port 10GE DX Line Card	A9K-8T/4-B	3.7.2	1.0
8-Port 10GE DX Extended Line Card	A9K-8T/4-E	3.7.2	1.0
8-Port 10GE DX Low Queue Line Card	A9K-8T/4-L	3.9.0	1.0
4-Port 10GE Line Card	A9K-4T-B	3.7.2	1.0
4-Port 10GE Extended Line Card	A9K-4T-E	3.7.2	1.0
4-Port 10GE Low Queue Line Card	A9K-4T-L	3.9.0	1.0
8-Port 10GE Line Rate Card	A9K-8T-B	3.9.1	1.0
8-Port 10GE Extended Line Rate Card	A9K-8T-E	3.9.0	1.0
8-port 10GE 80G Low Queue Line Rate Card	A9K-8T-L	3.9.0	1.0
2-Port 10GE + 20-Port GE Combination Line Card	A9K-2T20GE-B	3.9.0	1.0
2-Port 10GE + 20-Port GE Extended Combination Line Card	A9K-2T20GE-E	3.9.0	1.0
2-Port 10GE + 20-Port GE Low Queue Combination Line Card	A9K-2T20GE-L	3.9.1	1.0
16-Port 10GE DX Medium Queue Line Card	A9K-16T/8-B	3.9.1	1.0
24-Port 10GE DX Line Card, Packet Transport Optimized	A9K-24X10GE-TR	4.2.0	1.0
24-Port 10GE DX Line Card, Service Edge Optimized	A9K-24X10GE-SE	4.2.0	1.0
2-Port 100GE DX Line Card, Packet Transport Optimized	A9K-2X100GE-TR	4.2.0	1.0
2-Port 100GE DX Line Card, Service Edge Optimized	A9K-2X100GE-SE	4.2.0	1.0
80 Gigabyte Modular Line Card, Packet Transport Optimized	A9K-MOD80G-TR	4.2.0	1.0
80 Gigabyte Modular Line Card, Service Edge Optimized	A9K-MOD80G-SE	4.2.0	1.0
160 Gigabyte Modular Line Card, Packet Transport Optimized	A9K-MOD160G-TR	4.2.0	1.0
160 Gigabyte Modular Line Card, Service Edge Optimized	A9K-MOD160G-SE	4.2.0	1.0
20-Port GE Modular Port Adapter (MPA)	A9K-MPA-20GE	4.2.0	1.0
2-port 10GE Modular Port Adapter (MPA)	A9K-MPA-2X10GE	4.2.0	1.0

Table 1-2 Cisco IOS XR Release and Hardware Version Compatibility for Cisco ASR 9000 Series Line Cards (continued)

Ethernet Line Card	Product Number	Minimum IOS XR Software Release	Required Hardware Version
4-Port 10GE Modular Port Adapter (MPA)	9K-EP-4T	4.2.0	1.0
160 Gigabyte Modular Line Card, Packet Transport Optimized	A9K-MOD160G-TR	4.2.1	1.0
160 Gigabyte Modular Line Card, Service Edge Optimized	A9K-MOD160G-SE	4.2.1	1.0
2-port 40GE Modular Port Adapter (MPA)	A9K-MPA-2X40GE	4.2.1	1.0
36-Port 10GE Line Card, Packet Transport Optimized	A9K-36X10GE-TR	4.2.2[1]	1.0
36-Port 10GE Line Card, Service Edge Optimized	A9K-36X10GE-SE	4.2.2	1.0
1-Port 100GE DX Line Card, Packet Transport Optimized	A9K-1X100GE-TR	4.2.2	1.0
1-Port 100GE DX Line Card, Service Edge Optimized	A9K-1X100GE-SE	4.2.2	1.0
2-Port 10GE Modular Port Adapter (MPA)	A9K-EP-2T	4.2.0	1.0
1-Port 40GE Modular Port Adapter (MPA)	A9K-MPA-1X40GE	4.2.3	1.0
8-port 10GE Modular Port Adapter (MPA)	A9K-MPA-8X10GE	4.3.1	1.0
40-Port GE Line Card, Packet Transport Optimized	A9K-40GE-TR	5.2.2	1.0
40-Port GE Line Card, Service Edge Optimized	A9K-40GE-SE	5.2.2	1.0
4-Port 10GE + 16-Port GE Combination Line Card, Packet Transport Optimized	A9K-4T16GE-TR	5.3.0	1.0
4-Port 10GE + 16-Port GE Extended Combination Line Card, Service Edge Optimized	A9K-4T16GE-SE	5.3.0	1.0
8-Port 100-GE Line Card, Service Edge Optimized	A9K-8X100GE-L-SE	5.3.0	1.0

1. 4.2.2 is the hardware release. The CCO release is 4.2.3.

The **show diag** *slot_number* and **show version** commands display the current hardware configuration of the router, including the system software version that is currently loaded and running. For complete descriptions of **show** commands, see the command reference or configuration guide for the *installed Cisco IOS XR release.*

If the command displays indicate that the Cisco IOS XR software is a version earlier than you need, check the contents of flash memory to determine if the required images are available on your system. The **dir** *devicename* command displays a list of all files stored in flash memory. If you do not have the correct software version, contact Cisco customer service.

For software configuration information, see the Cisco IOS software configuration and command reference publications for the installed Cisco IOS XR release. Also see the Cisco IOS XR software release notes for additional information.

Ethernet Line Card Comparison

Most of the Cisco ASR 9000 line cards are available in base, extended, and low-queue versions. All versions are functionally equivalent, but vary in configuration scale and buffer capacity. Table 1-3 provides comparative information about the various line cards. For detailed information about the various transceiver modules, see *Cisco Transceiver Modules* on Cisco.com.

Table 1-3 Cisco ASR 9000 Ethernet Line Card Hardware Comparison

Cisco ASR 9000 Series Ethernet Line Card	Product Number	Number of Ports	Module Type
2-Port 10GE + 20-Port GE Combination Line Card	A9K-2T20GE-B	2x10GE 20xGE	SFP (GE ports) XFP (10GE ports)
2-Port 10GE + 20-Port GE Extended Combination Line Card	A9K-2T20GE-E	2x10GE 20xGE	SFP (GE ports) XFP (10GE ports)
2-Port10GE + 20-Port GE Low Queue Combination Line Card	A9K-2T20GE-L	2x10GE 20xGE	SFP (GE ports) XFP (10GE ports)
4-Port 10GE+16-Port GE Combination Line Card, Packet Transport Optimized	A9K-4T16GE-TR	4x10GE 16xGE	SFP+ (10GE ports) SFP (GE ports)
4-Port 10GE+ 16-Port GE Extended Combination Line Card, Service Edge Optimized	A9K-4T16GE-SE	4x10GE 16xGE	SFP+ (10GE ports) SFP (GE ports)
4-Port 10GE Line Card	A9K-4T-B	4	XFP
4-Port 10GE Extended Line Card	A9K-4T-E	4	XFP
4-Port 10GE Low Queue Line Card	A9K-4T-L	4	XFP
8-Port 10GE DX Line Card	A9K-8T/4-B	8	XFP
8-Port 10GE DX Extended Line Card	A9K-8T/4-E	8	XFP
8-Port 10GE DX Low Queue Line Card	A9K-8T/4-L	8	XFP
8-Port 10GE Line Rate Card	A9K-8T-B	8	XFP
8-Port 10GE Extended Line Rate Card	A9K-8T-E	8	XFP
8-port 10GE 80G Low Queue Line Rate Card	A9K-8T-L	8	XFP
16-Port 10GE DX Medium Queue Line Card	A9K-16T/8-B	16	SFP+
24-Port 10GE DX Line Card, Packet Transport Optimized	A9K-24X10GE-TR	24	SFP+
24-Port 10GE DX Line Card, Service Edge Optimized	A9K-24X10GE-SE	24	SFP+
36-Port 10GE Line Card, Packet Transport Optimized	A9K-36X10GE-TR	36	SFP+
36-Port 10GE Line Card, Service Edge Optimized	A9K-36X10GE-SE	36	SFP+
40-Port GE Line Card	A9K-40GE-B	40	SFP
40-Port GE Extended Line Card	A9K-40GE-E	40	SFP
40-Port GE Low Queue Line Card	A9K-40GE-L	40	SFP
40-Port GE Line Card, Packet Transport Optimized	A9K-40GE-TR	40	SFP
40-Port GE Line Card, Service Edge Optimized	A9K-40GE-SE	40	SFP
1-Port 100GE DX Line Card, Packet Transport Optimized	A9K-1X100GE-TR	2	CFP
1-Port 100GE DX Line Card, Service Edge Optimized	A9K-1X100GE-SE	1	CFP

Table 1-3 Cisco ASR 9000 Ethernet Line Card Hardware Comparison (continued)

2-Port 100GE DX Line Card, Packet Transport Optimized	A9K-2X100GE-TR	2	CFP
2-Port 100GE DX Line Card, Service Edge Optimized	A9K-2X100GE-SE	2	CFP
2-Port 100GE DX Line Card, Service Edge Optimized	A9K-2X100GE-SE	2	CFP
8-Port 100GE Line Card, Service Edge Optimized	A9K-8X100GE-L-SE	8	CPAK
80 Gigabyte Modular Line Card, Packet Transport Optimized	A9K-MOD80G-TR	—	—
80 Gigabyte Modular Line Card, Service Edge Optimized	A9K-MOD80G-SE	—	—
160 Gigabyte Modular Line Card, Packet Transport Optimized	A9K-MOD160-TR	—	—
160 Gigabyte Modular Line Card, Service Edge Optimized	A9K-MOD160G-SE	—	—
20-Port GE Modular Port Adapter (MPA)	A9K-MPA-20X1GE	20	SFP
8-Port 10GE Modular Port Adapter (MPA)	A9K-MPA-8X10GE	8	SFP+
4-Port 10GE Modular Port Adapter (MPA)	A9K-MPA-4X10GE	4	XFP
2-port 10GE Modular Port Adapter (MPA)	A9K-MPA-2X10GE	2	XFP
2-port 40GE Modular Port Adapter (MPA)	A9K-MPA-2X40GE	2	QSFP+
2-Port 10GE Modular Port Adapter (MPA)	A9K-EP-2T	2	XFP
1-Port 40GE Modular Port Adapter (MPA)	A9K-MPA-1X40GE	1	QSFP+

Caution Use only small form-factor pluggable modules (SFP, SFP+, XFP, QSFP, CFP, and CPAK) modules supplied by Cisco Systems, Inc. in the Cisco ASR 9000 Series line cards. Each module contains an internal serial number that is security programmed by the module manufacturer with information that provides a way for the Cisco IOS XR software to identify and validate the module as qualified to operate with Ethernet line cards. Unapproved modules (those not purchased directly from Cisco) will work, but generate an error message stating that the device is unsupported.

10-Gigabit Ethernet Line Cards

- 2-Port 10-Gigabit + 20-Port Gigabit Ethernet Combination Line Card with XFP, page 1-7
- 4-Port 10-Gigabit Ethernet Line Card with XFP, page 1-11
- 4-Port 10-Gigabit + 16-Port GE Combination Ethernet Line Card with SFP and SFP+, page 1-15
- 8-Port 10-Gigabit Ethernet 80 Gbps Line Rate Card with XFP, page 1-13
- 16-Port 10-Gigabit Ethernet Oversubscribed Line Card with SFP+, page 1-19
- 24-Port 10-Gigabit Ethernet Line Card with SFP+, page 1-21
- 36-Port 10-Gigabit Ethernet Line Card with SFP+, page 1-23

Note All line cards have port Status LEDs on their front panels. Each SFP or XFP power has an adjacent LED to indicate the status of the associated port. In addition, each line card has a single tristate Status LED to display card status (See Status LEDs, page 3-2).

2-Port 10-Gigabit + 20-Port Gigabit Ethernet Combination Line Card with XFP

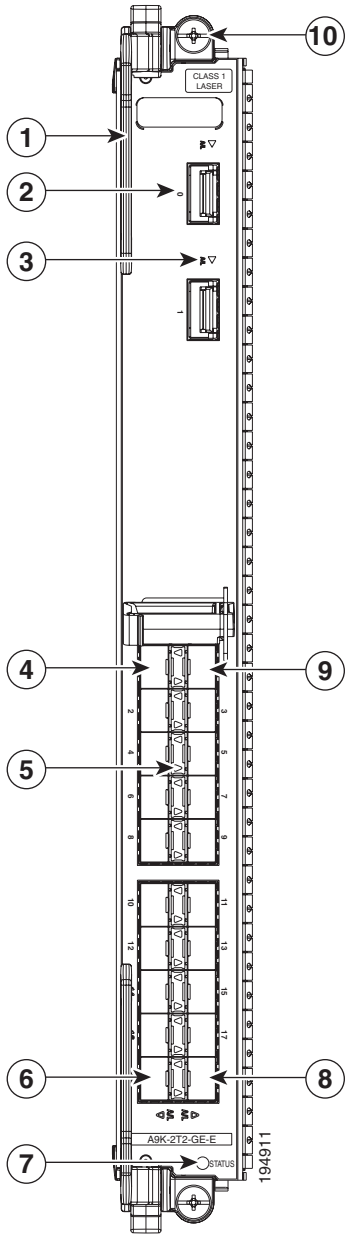
The 2-Port 10-Gigabit + 20-Port Gigabit Ethernet (GE) combination line card provides two cages for XFP Ethernet optical interface modules that operate at a rate of 10 Gbps, and 10 double-stacked cages (20 total) for SFP Ethernet optical modules that operate at a rate of 1 Gbps.

The two XFP modules can be 10GE multimode connections The 20 SFP cages support either fiber-optic or copper Gigabit Ethernet transceivers.

The 2-Port 10GE + 20-Port GE combination line card is available in base, extended, and low-queue versions. All versions are functionally equivalent, but vary in configuration scale and buffer capacity.

Each XFP and SFP cage on the 2-Port 10GE + 20-Port GE combination line card has an adjacent Link LED visible on the front panel. The Link LED indicates the status of the associated XFP or SFP port, as described in Status LEDs, page 3-2. Figure 1-1 shows the line card front panel and LEDs.

Figure 1-1 2-Port 10-Gigabit + 20-Port GE Combination Line Card



1	Ejector lever (one of two)	**6**	1GE port 18 SFP cage
2	10GE port 0 XFP cage	**7**	Status LED
3	XFP port status LED (one per XFP port)	**8**	1GE port 19 SFP cage
4	1GE port 0 SFP cage	**9**	1GE port 1 SFP cage
5	SFP port status LED (one per SFP port)	**10**	Captive installation screw (one of two)

Note The interface numbering starts with zero for the GE and 10GE ports, so this line card has ports identified as Te0/x/0/0 and a Gig0/x/0/0.

Table A-14 summarizes the optics and connectors used by the two 10GE ports on the 2-Port 10GE + 20-Port GE combination line card.

See Table A-2 for a list of all SFP modules supported on the 20x1GE ports on the 2-Port 10GE + 20-Port GE combination line card and their operating parameters.

8-Port 10-Gigabit Ethernet 2:1 Oversubscribed Line Card with XFP

The 8-Port 10GE 2:1 oversubscribed line card provides eight cages for XFP Ethernet optical interface modules that operate at a rate of 10 Gbps. The eight XFP modules can be 10GE multimode connections. The 8-Port 10GE line card is a 40 Gbps line rate card with a maximum line rate of 8 ports at 50 percent (2-1 oversubscribed).

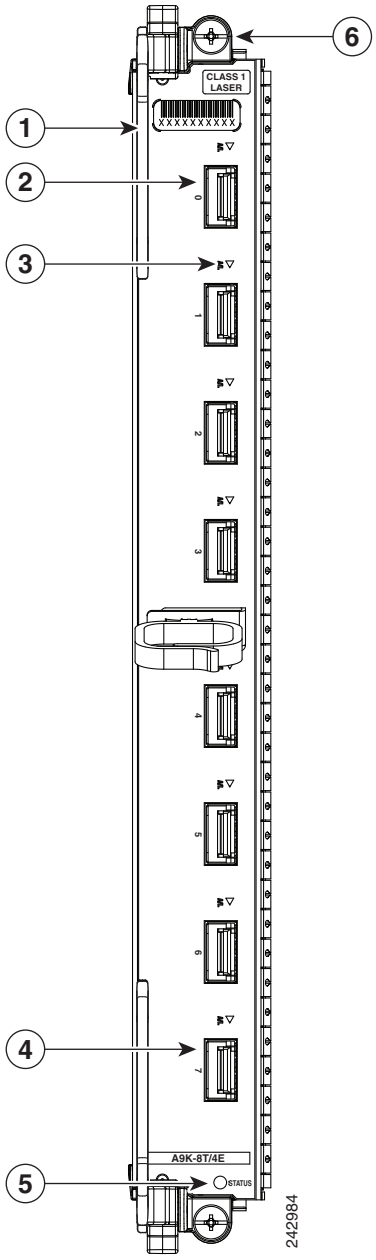
Oversubscription results from port pairs sharing the same Network Processor Unit (NPU). The oversubscribed port pairs are port 0:port 4, port 1:port 5, port 2:port 6 and port 3:port 7.

The 8-Port 10GE line card is available in base, extended, and low-queue versions. All versions are functionally equivalent, but vary in configuration scale and buffer capacity.

Each XFP cage on the 8-Port 10GE line card has an adjacent Link LED visible on the front panel. The Link LED indicates the status of the associated XFP port, as described in Status LEDs, page 3-2. Figure 1-2 shows the line card front panel and LEDs.

See Table A-14 for a list of all XFPs supported on the 8-Port 10GE 2:1 oversubscribed line card and their operating parameters.

Figure 1-2 8-Port 10-Gigabit Ethernet 2:1 Oversubscribed Line Card



1	Ejector lever (one of two)	**4**	Port 7 XFP cage
2	Port 0 XFP cage	**5**	Status LED
3	Port status LED (one per port)	**6**	Captive installation screw (one of two)

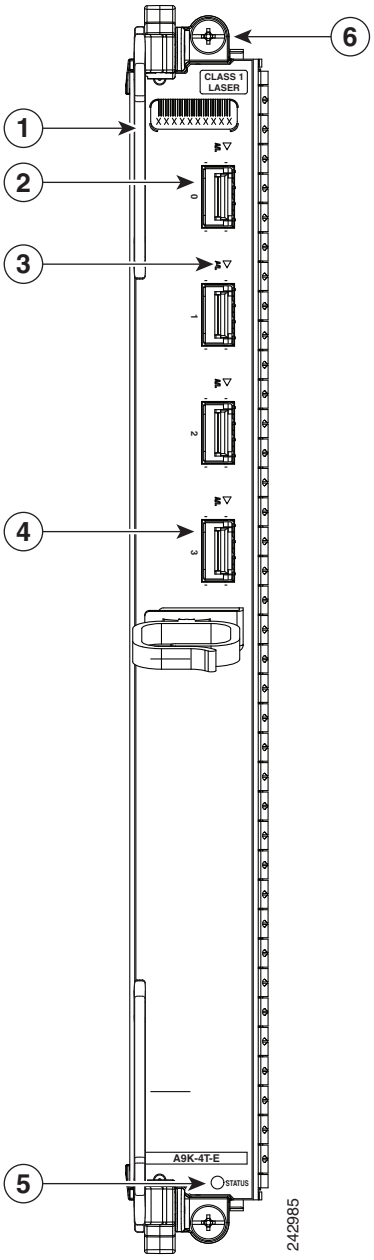
4-Port 10-Gigabit Ethernet Line Card with XFP

The 4-Port 10-Gigabit Ethernet (GE) line card provides four cages for XFP Ethernet optical interface modules that operate at a rate of 10 Gbps. The four XFP modules can be 10GE Ethernet multimode connections. Table A-14 summarizes the optics and connectors used by the 4-Port 10GE line card.

The 4-Port 10GE line card is available in base, extended, and low-queue versions. All versions are functionally equivalent, but vary in configuration scale and buffer capacity.

Each XFP cage on the 4-Port 10GE line card has an adjacent Link LED visible on the front panel. The Link LED indicates the status of the associated XFP port, as described in Status LEDs, page 3-2. Figure 1-3 shows the line card front panel and LEDs.

Figure 1-3 4-Port 10-Gigabit Ethernet Line Card



1	Ejector lever (one of two)	**4**	Port 3 XFP cage
2	Port 0 XFP cage	**5**	Status LED
3	Port status LED (one per port)	**6**	Captive installation screw (one of two)

8-Port 10-Gigabit Ethernet 80 Gbps Line Rate Card with XFP

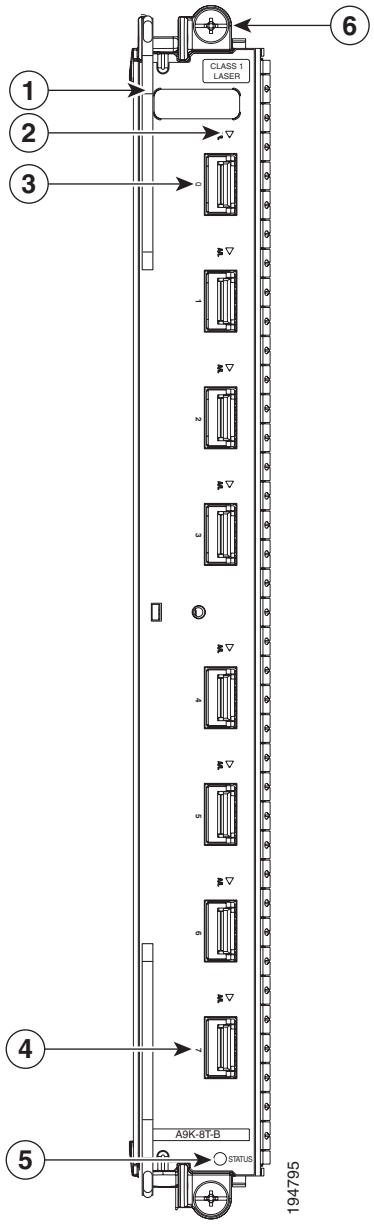
The 8-Port 10-Gigabit Ethernet (GE) 80 Gbps line rate card provides eight cages for XFP Ethernet optical interface modules that operate at a rate of 10 Gbps. The eight XFP modules can be10GE multimode connections. The 8-Port 10GE line card is a full 80 Gbps line rate card.

The 8-Port 10GE 80 Gbps line rate card is available in base, extended, and low-queue versions. All versions are functionally equivalent, but vary in configuration scale and buffer capacity.

Each XFP cage on the 8-Port 10GE 80 Gbps line rate card has an adjacent Link LED visible on the front panel. The Link LED indicates the status of the associated XFP port, as described in Status LEDs, page 3-2. Figure 1-4 shows the line card front panel and connectors.

See Table A-14 for a list of all XFPs supported on the 8-Port 10GE 80 Gbps line rate card and their operating parameters.

Figure 1-4 8-Port 10-Gigabit Ethernet 80 Gbps Line Rate Card



1	Ejector lever (one of two)	**4**	Port 7 XFP cage
2	Port status LED (one per port)	**5**	Line card status LED
3	Port 0 XFP cage	**6**	Captive installation screw (one of two)

4-Port 10-Gigabit + 16-Port GE Combination Ethernet Line Card with SFP and SFP+

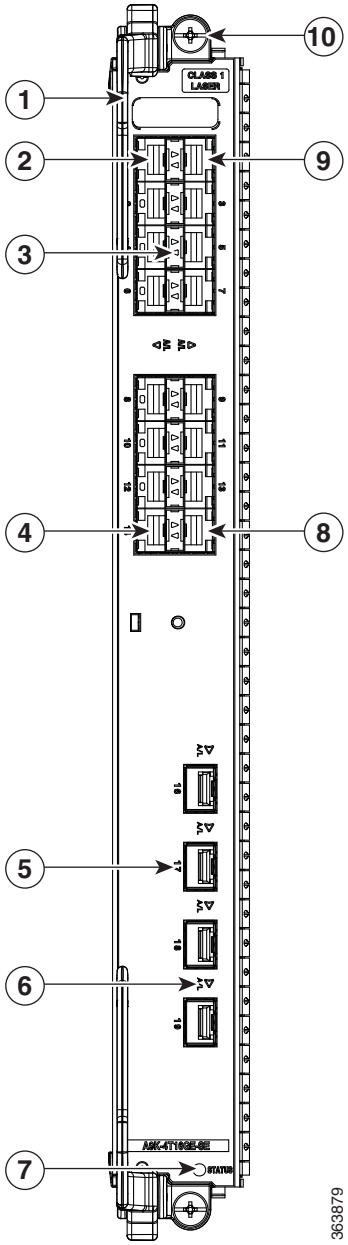
The 4-Port10 GE + 16-Port GE combination line card provides four cages for SFP+ Ethernet optical interface modules that operate at a rate of 10 Gbps, and 8 double-stacked (16 total) cages for SFP Ethernet optical modules that operate at a rate of 1 Gbps.

The 4-Port 10GE + 16-Port GE combination line card is available in either an -SE (Service Edge Optimized) or -TR (Packet Transport Optimized) version. All versions are functionally equivalent, but vary in configuration scale and buffer capacity.

Each SFP and SFP+ cage on the 4-Port 10GE + 16-Port GE combination line card has an adjacent Link LED visible on the front panel. The Link LED indicates the status of the associated SFP or SFP+ port, as described in Status LEDs, page 3-2. Figure 1-5 shows the line card front panel and connectors.

Note The 4-Port 10GE + 16-Port GE combination line card comes with 16x1GE + 2x10GE ports enabled. The two 10GE ports that are enabled by default are Port16 and Port17. To enable the additional two 10GE ports, the license must be enabled. Upon acquiring the license, Port18 and Port19 are enabled.
For information on enabling the license, see the Software Entitlement chapter in the *Cisco ASR 9000 Series Aggregation Services Router System Management Configuration Guide, Release 5.3.x*. The license product number for the A9K-4T16GE-TR card is A9K-2T-TR-LIC. The license product number for the A9K-4T16GE-SE card is A9K-2T-SE-LIC.

Figure 1-5 4-Port 10-Gigabit + 16-Port GE Combination Line Card



1	Ejector lever (one of two)	**6**	Port status LED (one per SFP port)
2	1GE port 0 SFP cage	**7**	Line card status LED
3	Port status LED (one per SFP port)	**8**	1GE port 15 SFP cage
4	1GE port 14 SFP cage	**9**	1GE port 1 SFP cage
5	10GE port 1 SFP+ cage SFP+	**10**	Captive installation screw (one of two)

Note The interface numbering for the GE ports on the line card is Gig0/x/0/0 through Gig0/x/0/15. The interface numbering for the 10GE ports on the line card is tenGigE0/x/0/16 through tenGigE0/x/0/19.

- See Table A-3 and Table A-10 for a list of all SFP+ modules supported on the 4 x10GE ports on the 4-Port 10GE + 16-Port GE combination line card and their operating parameters.
- See Table A-2 and Table A-8 for a list of all SFP modules supported on the 16x1GE ports on the 4-Port 10GE + 16-Port GE combination line card and their operating parameters.

16-Port 10-Gigabit Ethernet Oversubscribed Line Card with SFP+

The 16-Port 10-Gigabit Ethernet (GE) oversubscribed line card provides two stacked 2x4 cage assemblies for SFP+ Ethernet optical interface modules. The 16 SFP+ modules operate at a rate of 10 Gbps.

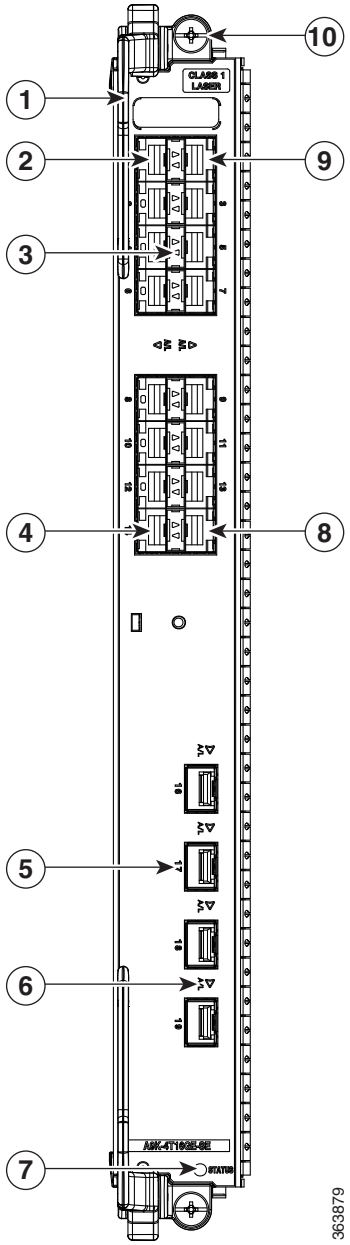
Oversubscription results from port pairs sharing the same NPU. The oversubscribed port pairs are port 0:port 8, port 1:port 9, port 2:port 10, port 3:port 11, port 4:port 12, port 5:port 13, port 6:port 14, and port 7:port 15. The maximum bandwidth per port pair sharing a single NPU is 14.62 Gbps (7.31 Gbps per port).

- With two RSP cards installed in the router, the 16-Port 10GE line card can achieve greater than a 2:1 oversubscription rate. Each port pair sharing an NPU can reach 7.31 Gbps per port, so the maximum bandwidth with two RSPs in the system is 117 Gbps.
- With a single RSP card installed in the router, the 16-Port 10GE line card is an 80 Gbps line rate card with a maximum line rate of 16 ports at 50 percent (2-1 oversubscribed).

The 16-Port 10GE line card is available in a base version.

Each SFP+ cage on the 16-Port 10GE line card has an adjacent Link LED visible on the front panel. The Link LED indicates the status of the associated SFP+ port, as described in Status LEDs, page 3-2. Figure 1-6 shows the line card front panel and connectors.

Figure 1-6 16-Port 10-Gigabit Ethernet Oversubscribed Line Card



1	Ejector lever (one of two)	**5**	Line card status LED
2	Port 0 SFP+ cage	**6**	Port 15 SFP+ cage
3	Port status LED (one per port)	**7**	Port 7 SFP+ cage
4	Port 8 SFP+ cage	**8**	Captive installation screw (one of two)

See Table A-3 for a list of all SFP+ transceiver modules supported on the 16-Port 10GE oversubscribed line card and their operating parameters.

16-Port 10-Gigabit Ethernet Oversubscribed Line Card with SFP+

The 16-Port 10-Gigabit Ethernet (GE) oversubscribed line card provides two stacked 2x4 cage assemblies for SFP+ Ethernet optical interface modules. The 16 SFP+ modules operate at a rate of 10 Gbps (Table A-3).

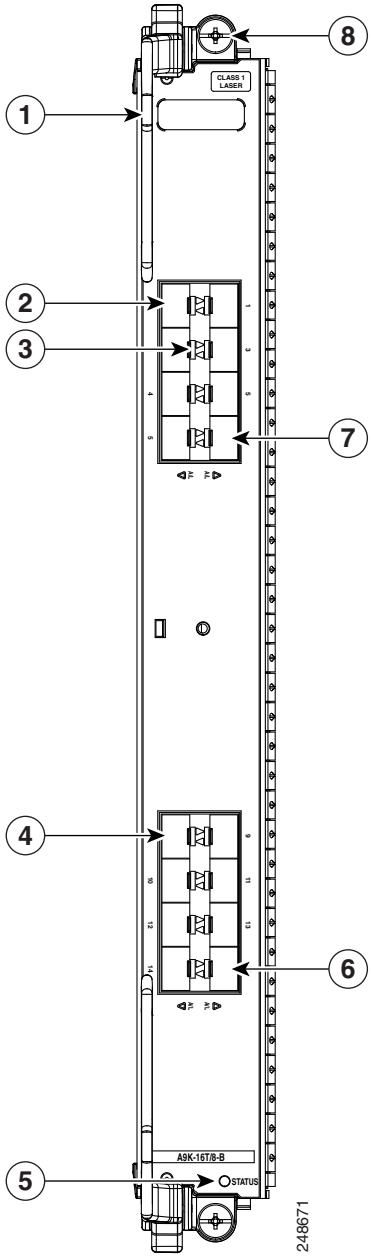
Oversubscription results from port pairs sharing the same NPU. The oversubscribed port pairs are port 0:port 8, port 1:port 9, port 2:port 10, port 3:port 11, port 4:port 12, port 5:port 13, port 6:port 14, and port 7:port 15. The maximum bandwidth per port pair sharing a single NPU is 14.62 Gbps (7.31 Gbps per port).

- With two RSP cards installed in the router, the 16-Port 10GE line card can achieve greater than a 2:1 oversubscription rate. Each port pair sharing an NPU can reach 7.31 Gbps per port, so the maximum bandwidth with two RSPs in the system is 117 Gbps.
- With a single RSP card installed in the router, the 16-Port 10GE line card is an 80 Gbps line rate card with a maximum line rate of 16 ports at 50 percent (2-1 oversubscribed).

The 16-Port 10GE line card is available in a base version.

Each SFP+ cage on the 16-Port 10GE line card has an adjacent Link LED visible on the front panel. The Link LED indicates the status of the associated SFP+ port, as described in Status LEDs, page 3-2. Figure 1-7 shows the line card front panel and connectors.

Figure 1-7 16-Port 10-Gigabit Ethernet Oversubscribed Line Card



1	Ejector lever (one of two)	**5**	Line card status LED
2	Port 0 SFP+ cage	**6**	Port 15 SFP+ cage
3	Port status LED (one per port)	**7**	Port 7 SFP+ cage
4	Port 8 SFP+ cage	**8**	Captive installation screw (one of two)

See Table A-3 for a list of all SFP+ transceiver modules supported on the 16-Port 10GE oversubscribed line card and their operating parameters.

24-Port 10-Gigabit Ethernet Line Card with SFP+

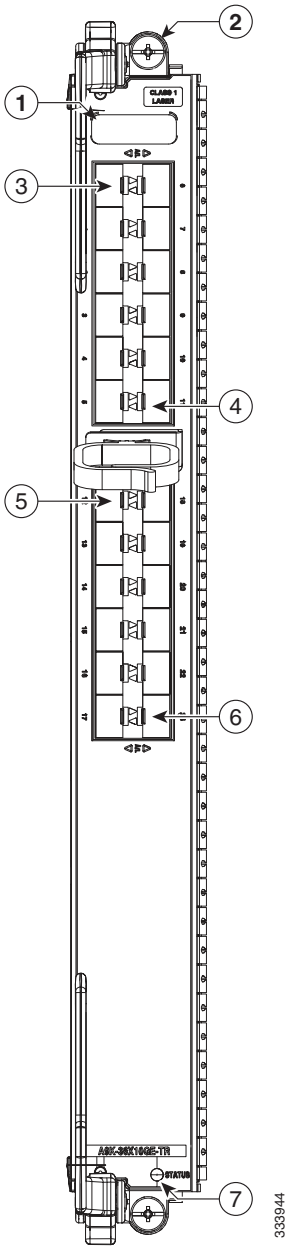
The 24-Port 10-Gigabit Ethernet (GE) line card provides two stacked 2x6 cage assemblies for SFP+ Ethernet optical interface modules. The 24 SFP+ modules operate at a rate of 10 Gbps (Table A-3).

- With two RSP cards installed in the router, the 24-Port 10GE line card runs at line rate.
- With a single RSP card installed in the router, the 24-Port 10GE line card is a 220 Gbps line rate card.

The 24-Port 10GE line card is available in either an -SE (Service Edge Optimized) or -TR (Packet Transport Optimized) version.

Each SFP+ cage on the 24-Port 10GE line card has an adjacent Link LED visible on the front panel. The Link LED indicates the status of the associated SFP+ port, as described in Status LEDs, page 3-2. Figure 1-8 shows the front panel and connectors.

Figure 1-8 24-Port 10-Gigabit Ethernet Line Card



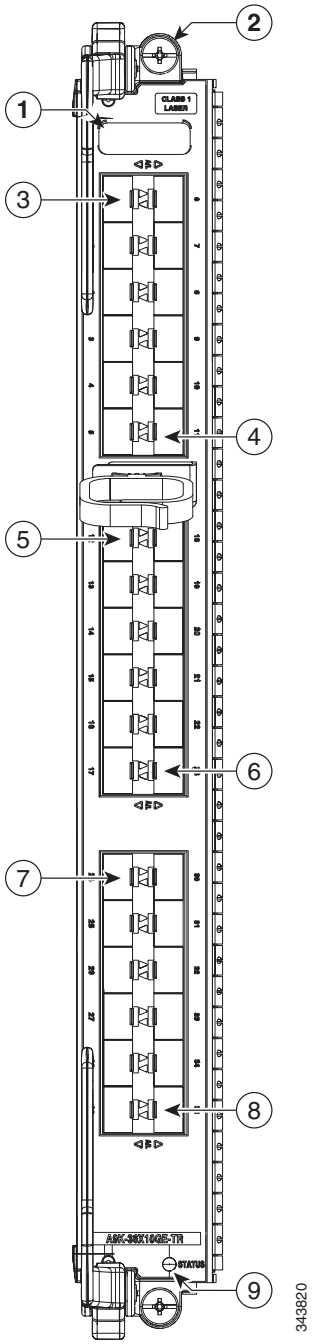
1	Ejector lever (one of two)	**5**	Port 12 SFP+ cage
2	Captive installation screw (one of two)	**6**	Port 23 SFP+ cage
3	Port 0 SFP+ cage	**7**	Line card status LED
4	Port 11 SFP+ cage		

See Table A-3 for a list of all SFP+ transceiver modules supported on the 24-Port 10GE line card and their operating parameters.

36-Port 10-Gigabit Ethernet Line Card with SFP+

The 36-Port 10-Gigabit Ethernet (GE) line card has thirty-six10-Gigabit SFP+ (10GE SFP) module ports. Figure 1-9 shows the line card front panel connectors and indicators.

Figure 1-9 36-Port 10-Gigabit Ethernet Line Card Front Panel



1	Ejector lever (one of two)	**6**	Port 23 SFP+ cage
2	Captive installation screw (one of two)	**7**	Port 24 SFP+ cage
3	Port 0 SFP+ cage	**8**	Port 35 SFP+ cage
4	Port 11 SFP+ cage	**9**	Line card status LED
5	Port 12 SFP+ cage		

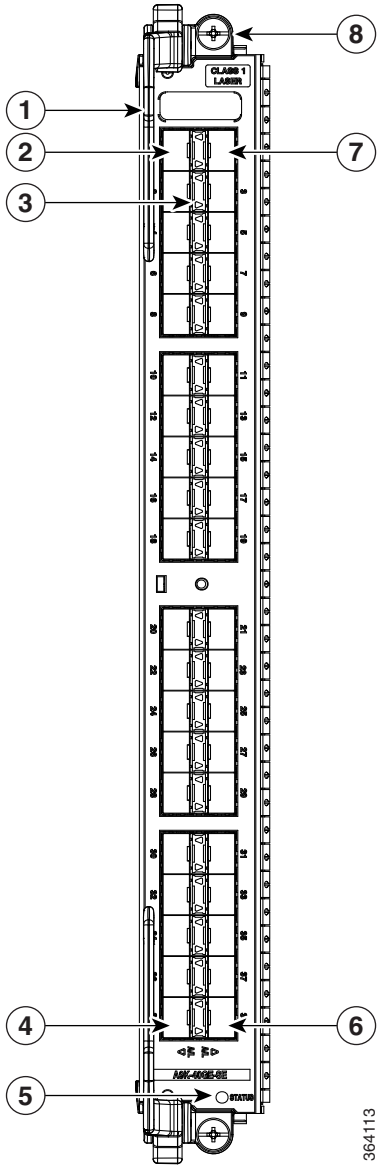
40-Port Gigabit Ethernet Line Card with SFP

The 40-Port Gigabit Ethernet (GE) line card provides 20 double-stacked SFP (40 total) cages that support either fiber-optic or copper transceivers.

The 40-Port GE line card is available in base, extended, low-queue, and next-generation -SE (Service Edge Optimized), or -TR (Packet Transport Optimized) versions. All versions are functionally equivalent, but vary in configuration scale and buffer capacity.

Each SFP cage on the 40-Port GE line card has an adjacent Link LED visible on the front panel. The Link LED indicates the status of the associated SFP port, as described in Status LEDs, page 3-2. Figure 1-10 shows the line card front panel and connectors

Figure 1-10 40-Port Gigabit Ethernet Line Card—A9K-40GE-SE Card Shown



1	Ejector lever (one of two)	**5**	Line card status LED
2	Port 0 SFP cage	**6**	Port 39 SFP cage
3	Port status LED (one per port)	**7**	Port 1 SFP cage
4	Port 38 SFP cage	**8**	Captive installation screw (one of two)

See Table A-2 for a list of all SFP modules supported on the 40x1GE line card, and their operating parameters.

100-Gigabit Ethernet Line Cards

1-Port 100-Gigabit Ethernet Line Card with CFP

The 1-Port 100-Gigabit Ethernet (GE) line card provides one CFP cage for an CFP Ethernet optical interface module that operates at a rate of 100 Gbps. The CFP module can be a 100GE multimode connection.

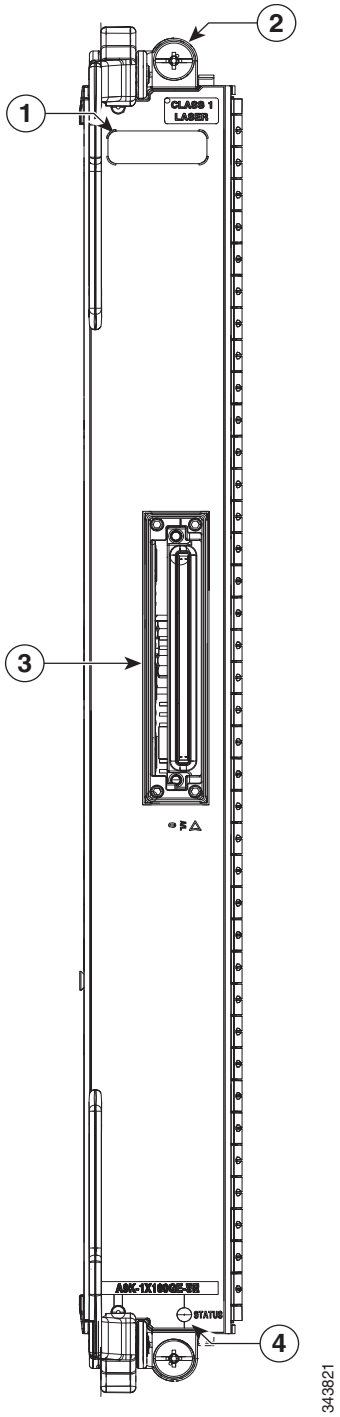
The 1-port 100 GE line card is available in either an -SE (Service Edge Optimized) or -TR (Packet Transport Optimized) version. Both versions are functionally equivalent, but vary in configuration scale and buffer capacity. The CFP cage has an adjacent Link LED visible on the front panel as described in Status LEDs, page 3-2. Figure 1-11 shows the line card front panel and connector.

Table 1-4 lists the optics and connectors used by the 100 GE port on the 1-port 100 GE line card.

Table 1-4 Cisco 100-Gigabit Ethernet CFP Modules for 1-port and 2-Port Line Cards

Part Number	100-Gigabit Ethernet CFP Modules	Maximum Distance
CFP-100G-LR4	100 GE long-reach over 4 WDM lanes (LR4) optics (single-mode fiber)	10 km
CFP-100G-SR10	100 GE over 10 short-reach optical lanes (SR10) optics (multimode fiber)	100 m

Figure 1-11 1-Port 100-Gigabit Ethernet Line Card Front Panel



1	Ejector lever (one of two)	**3**	100 Gigabit Ethernet CFP
2	Captive installation screw (one of two)	**4**	Line card status LED

2-Port 100-Gigabit Ethernet Line Card with CFP

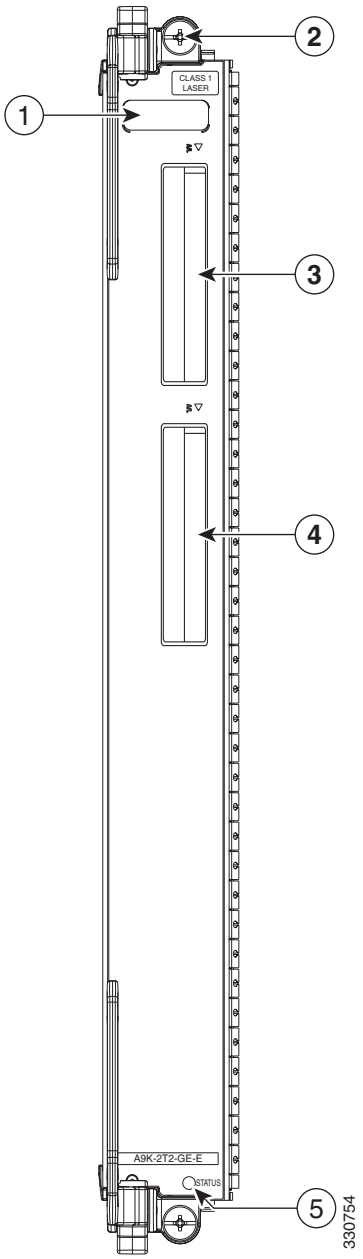
The 2-Port 100-Gigabit Ethernet (GE) line card provides two CFP cages for CFP Ethernet optical interface modules that operate at a rate of 100 Gbps. The two CFP modules can be 100GE multimode connections.

The line card is available in either an -SE (Service Edge Optimized) or -TR (Packet Transport Optimized) version. All versions are functionally equivalent, but vary in configuration scale and buffer capacity.

Each CFP cage on the 2-Port 100 GE line card has an adjacent Link LED visible on the front panel. The Link LED indicates the status of the associated CFP port, as described in Status LEDs, page 3-2. Figure 1-12 shows the line card front panel and LEDs.

See Table 1-4 for the list the optics and connectors used by the two 100 GE ports on the 2-port 100 GE line card.

Figure 1-12 2-Port 100-Gigabit Ethernet Line Card



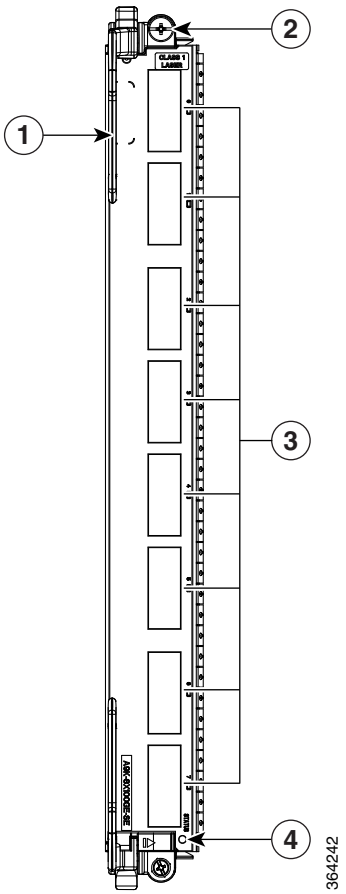
1	Ejector lever (one of two)	**4**	100-Gigabit Ethernet CFP connector (two of two)
2	Captive installation screw (one of two)	**5**	Line card status LED
3	100-GE CFP connector (one of two)		

8-Port 100-Gigabit Ethernet Line Card with CPAK

The 8-Port 100-Gigabit Ethernet (GE) (Service Edge Optimized -SE) line card provides eight CPAK cages for CPAK modules that operate at a rate of 100 Gbps. Each CPAK cage on the 8-Port 100-GE line card has an adjacent Link LED visible on the front panel. The Link LED indicates the status of the associated CPAK port as described in Status LEDs, page 3-2. Figure 1-13 shows the line card front panel and connector.

The Cisco 8-Port 100-Gigabit Ethernet (GE) line card supports the CPAK modules listed in Table A-4.

Figure 1-13 8-Port 100-Gigabit Ethernet Line Card



1	Ejector lever (one of two)	**3**	100-Gigabit Ethernet CPAK connector (one of eight)
2	Captive installation screw (one of two)	**4**	Status LED

Modular Line Cards and Modular Port Adapters

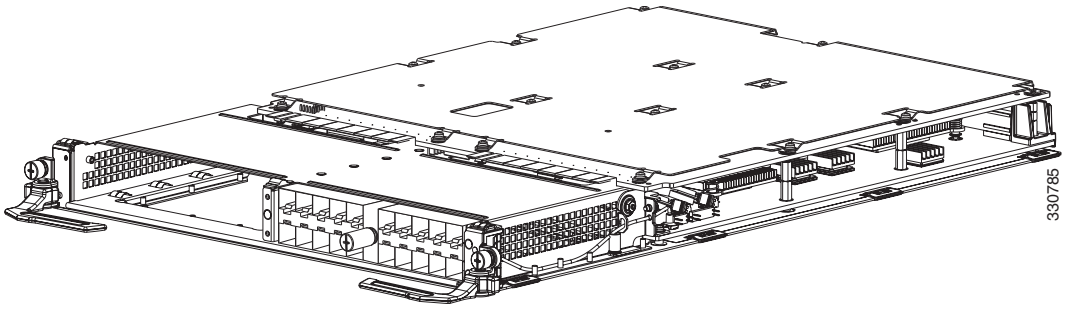
There are two types of modular line cards (MLCs). The 80-Gb card has two network processing units and the 160-Gb card has four network processing units. Each version is available in -SE (Service Engine Optimized) and -TR (Packet Transport Optimized) variants. The two variants are functionally equivalent, but vary in configuration scale and buffer capacity.

The modular line card provides two bays that support the following Modular Port Adapters (MPAs):

- 2-Port 10-Gigabit Ethernet Modular Port Adapter with XFP, page 1-33
- 4-Port 10-Gigabit Ethernet Modular Port Adapter with XFP, page 1-34
- 8-Port 10-Gigabit Ethernet Modular Port Adapter with SFP+, page 1-36
- 20-Port Gigabit Ethernet Modular Port Adapter with SFP, page 1-31
- 1-Port 40-Gigabit Ethernet Modular Port Adapter with QSFP, page 1-38
- 2-Port 40-Gigabit Ethernet Modular Port Adapter with QSFP+, page 1-39

Figure 1-14 shows the front panel of the modular line card with a 20-port Gigabit Ethernet MPA installed in the lower bay.

Figure 1-14 Modular Line Card



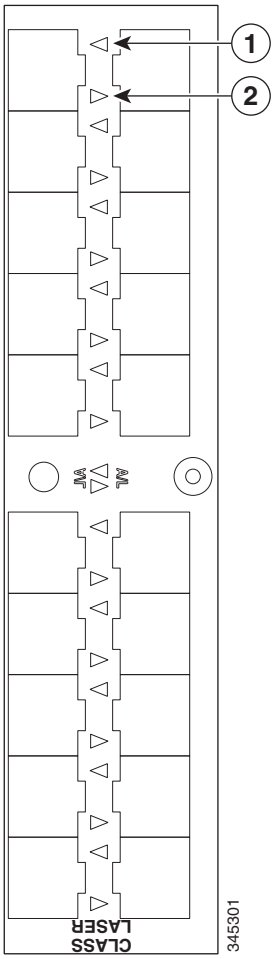
20-Port Gigabit Ethernet Modular Port Adapter with SFP

The 20-Port Gigabit Ethernet (GE) modular port adapter (MPA) provides 10 double-stacked SFP (20 total) cages that support either fiber-optic or copper GE transceivers.

Each SFP cage on the GE MPA has an adjacent A/L (Active/Link) LED visible on the front panel. The A/L LED indicates the status of the associated SFP port, as described in Table 1-5. Figure 1-15 shows the MPA and corresponding LEDs

See Table A-2 for a list of all SFP modules supported on the 20x1GE modular port adapter, and their operating parameters.

Figure 1-15 20-Port Gigabit Ethernet Modular Port Adapter



1	A/L (Active/Link) LED	**2**	Status LED

Table 1-5 describes the 20-Port Gigabit Ethernet MPA LEDs.

Table 1-5 20-Port Gigabit Ethernet Modular Port Adapter LEDs

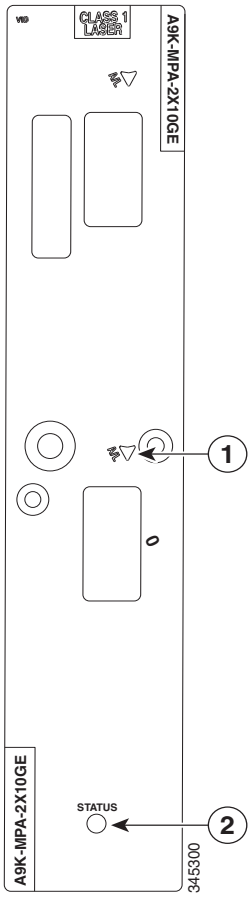
LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up. The MPA A/L (Active/Link) LED will blink green when there is traffic activity.
	Amber	On	Port is enabled and the link is down.
STATUS	Off	Off	Modular port adapter power is off.
	Green	On	Modular port adapter is ready and operational.
	Amber	On	Modular port adapter power is on and good, and modular port adapter is being configured.

2-Port 10-Gigabit Ethernet Modular Port Adapter with XFP

The 2-Port 10-Gigabit Ethernet (GE) modular port adapter (MPA) provides two cages for XFP Ethernet optical interface modules that operate at a rate of 10 Gbps. The two XFP modules can be 10GE multimode or single mode connections (Table A-14).

Each XFP cage on the 4-Port 10GE MPA has an adjacent A/L (Active/Link) LED visible on the front panel. The A/L (Active/link) LED indicates the status of the associated XFP port, as described in Table 1-6, and a Status LED for the MPA as shown in Figure 1-16.

Figure 1-16 2-Port 10-Gigabit Ethernet Modular Port Adapter



1	A/L (Active/Link) LED	**2**	Status LED

Table 1-6 2-Port 10-Gigabit Ethernet Modular Port Adapter LEDs

LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up. The MPA A/L (Active/Link) LED will blink green when there is traffic activity.

Table 1-6 2-Port 10-Gigabit Ethernet Modular Port Adapter LEDs (continued)

LED Label	Color	State	Meaning
	Red	On	Port is enabled and the link is down.
STATUS	Off	Off	Modular port adapter power is off.
	Green	On	Modular port adapter is ready and operational.
	Amber	On	Modular port adapter power is on and good, and the modular port adapter is being configured.

4-Port 10-Gigabit Ethernet Modular Port Adapter with XFP

The 4-Port 10-Gigabit Ethernet (GE) modular port adapter (MPA) provides four cages for XFP Ethernet optical interface modules that operate at a rate of 10 Gbps. The four XFP modules can be 10GE multimode or single mode connections. Table A-14 summarizes the optics and connectors used by the MPA.

The MPA has two types of LEDs: an A/L (Active/Link) LED for each individual port and a Status LED for the MPA as shown in Figure 1-17. The A/L LED indicates the status of the associated XFP port, as described in Table 1-7.

Figure 1-17 4-Port 10-Gigabit Ethernet Modular Port Adapter

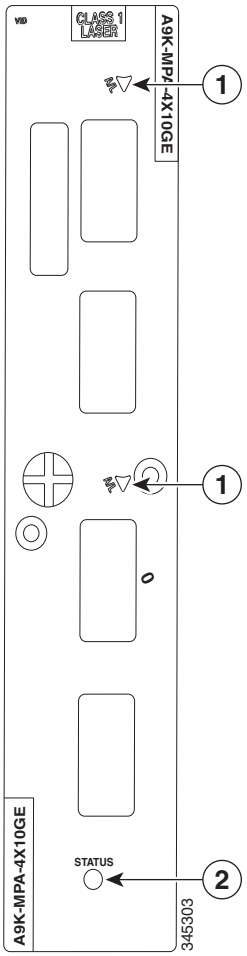


Table 1-7 4-Port 10-Gigabit Ethernet Modular Port Adapter LEDs

LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up. The MPA A/L (Active/Link) LED will blink green when there is traffic activity.
	Amber	On	Port is enabled and the link is down.
STATUS	Off	Off	Modular port adapter power is off.
	Green	On	Modular port adapter is ready and operational.
	Amber	On	Modular port adapter power is on and good, and the modular port adapter is being configured.

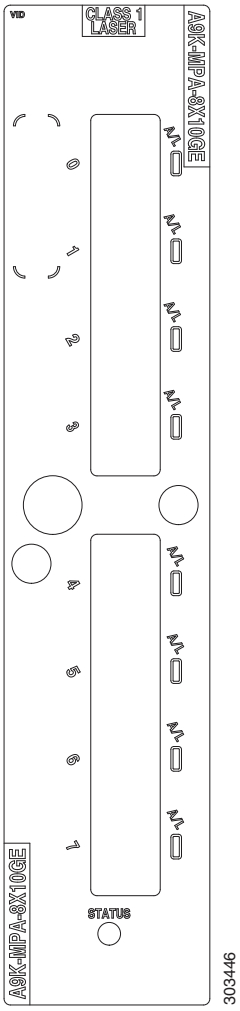
8-Port 10-Gigabit Ethernet Modular Port Adapter with SFP+

The 8-Port 10-Gigabit Ethernet (GE) modular port adapter (MPA) provides eight cages for SFP+ Ethernet optical interface modules that operate at a rate of 10 Gbps.

The 8-Port 10GE MPA is only supported on the160 Gigabyte Modular Line Card (A9K-MOD160-TR and A9K-MOD160-SE). It is not supported on the on the 80 Gigabyte Modular Line Card (A9K-MOD80-TR and A9K-MOD80-SE), or on the Cisco ASR 9001 Router.

Each SFP+ cage on the 8-Port 10GE MPA has an adjacent A/L (Active/Link) LED visible on the front panel of the card (Figure 1-18). The A/L (Active/Link) LED indicates the status of the associated SFP+ port, as described in Table 1-8.

Figure 1-18 8-Port 10-Gigabit Ethernet Modular Port Adapter



1	A/L (Active/Link) LED	**2**	Status LED

Table 1-8 8-Port 10-Gigabit Ethernet Modular Port Adapter LEDs

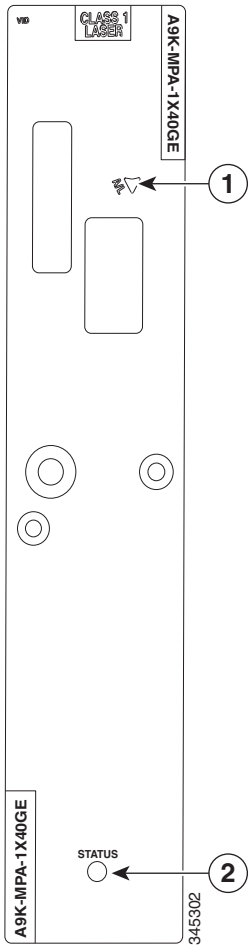
LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up.
	Amber	On	Port is enabled and the link is down.
STATUS	Off	Off	MPA power is off.
	Green	On	MPA is ready and operational.
	Amber	On	The MPA power is on and working is being configured.

1-Port 40-Gigabit Ethernet Modular Port Adapter with QSFP

The 1-Port 40-Gigabit Ethernet (GE) modular port adapter (MPA) provides a cage for a QSFP+ Ethernet optical interface module that operates at a rate of 40 Gbps. The QSFP+ module can support either a 40GE multimode connection or a 40GE single mode connection. Table A-7 summarizes the optics and connectors used by the MPA.

Each QSFP cage on the 1-Port 40GE MPA has an adjacent A/L (Active/Link) LED visible on the front panel. The A/L LED indicates the status of the associated QSFP port, as described in Table 1-9 and a Status LED as shown in Figure 1-19.

Figure 1-19 1-Port 40 Gigabit Ethernet Modular Port Adapter



1	A/L (Active/Link) LED	**2**	Status LED

Table 1-9 1-Port 40 Gigabit Ethernet Modular Port Adapter LEDs

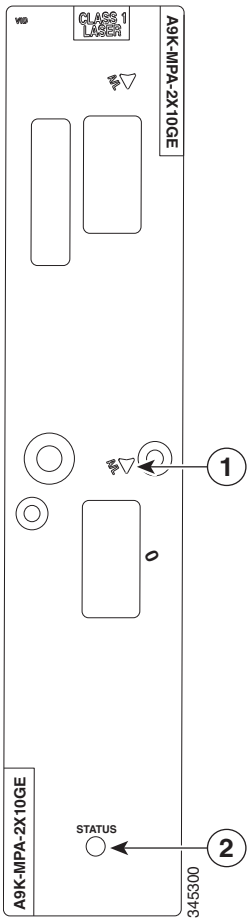
LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up.
	Amber	On	Port is enabled and the link is down.
STATUS	Off	Off	Modular port adapter power is off.
	Green	On	Modular port adapter is ready and operational.
	Amber	On	Modular port adapter power is on and good, and the modular port adapter is being configured.

2-Port 40-Gigabit Ethernet Modular Port Adapter with QSFP+

The 2-Port 40-Gigabit Ethernet (GE) modular port adapter (MPA) provides two cages for QSFP+ Ethernet optical interface modules that operate at a rate of 40 Gbps. The two QSFP+ modules can be 40-Gigabit Ethernet multimode or single mode connections. Table A-7 summarizes the optics and connectors used by the 2-Port 40GE MPA.

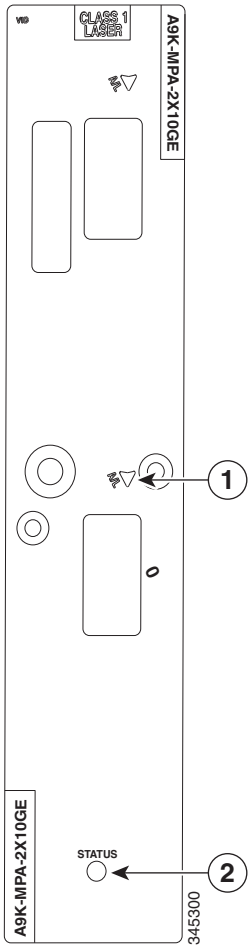
Each QSFP cage on the MPA has an adjacent A/L (Active/Link) LED visible on the front panel. The A/L LED indicates the status of the associated QSFP port as described in Table 1-10, and a Status LED for the MPA as shown in Figure 1-21.

Figure 1-20 2-Port 40-Gigabit Ethernet Modular Port Adapter



1	A/L (Active/Link) LED	**2**	Status LED

Figure 1-21 2-Port 10-Gigabit Ethernet Modular Port Adapter



1	A/L (Active/Link) LED	**2**	Status LED

Table 1-10 2-Port 40-Gigabit Ethernet Modular Port Adapter LEDs

LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up.
	Amber	On	Port is enabled and the link is down.
STATUS	Off	Off	Modular port adapter power is off.
	Green	On	Modular port adapter is ready and operational.
	Amber	On	Modular port adapter power is on and good, and the modular port adapter is being configured.

Installing Line Cards in the Cisco ASR 9000 Series Router

This chapter contains instructions for installing line cards in the Cisco ASR 9000 Series Aggregation Services Router.

For hardware installation and configuration information for the Cisco ASR 9000 Series Router, see the *Cisco ASR 9000 Series Aggregation Services Router Hardware Installation Guide.* The guide includes information on how to install, maintain, and replace router subsystems, such as cooling fans, power supplies, chassis backplanes, and so on. In addition, the installation guide describes the router switch fabric and how it affects operation of the line card, as well as line card slot locations, slot width, and other requirements.

Preparing for Installation

Safety Guidelines

Before you perform any procedure in this publication, review the safety guidelines in this section to avoid injuring yourself or damaging the equipment.

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

Note Before installing, configuring, or maintaining a line card, review the safety warnings listed in the *Regulatory Compliance and Safety Information for Cisco ASR 9000 Series Routers.*

- 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.
- Do not wear loose clothing, jewelry, or other items that could get caught in the router while working with line cards.
- Cisco equipment operates safely when it is used in accordance with its specifications and product usage instructions.

Caution Before working with laser optics, read Laser Safety, page 3-10.

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

Preventing Electrostatic Discharge

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. Electromagnetic interference (EMI) shielding is an integral component of the line card and the modular port adapter. Cisco Systems, Inc. recommends using an ESD-preventive strap whenever you are handling network equipment or one of its components.

The 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 connection socket on the router or to bare metal on the chassis.
- Avoid touching card circuit boards or connector pins. When sliding cards in or out of slots, you should handle them only by the front panel or metal card carrier.
- When carrying a card, carry it only by the metal card carrier or inside a static shielding bag.

Caution To avoid damaging card mechanical components, never carry an Route Switch Processor (RSP), modular port adapter, or line card by the captive installation screws or ejector levers. Doing so can damage these components and cause card insertion problems.

- Place removed line cards or modular port adapters component-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 the line cards or modular port adapters and clothing. The wrist strap only protects the board from ESD voltages on the body; ESD voltages on clothing can still cause damage.

Caution For safety, periodically check the resistance value of the ESD strap. The measurement should be between 1 and 10 megohms.

Required Tools and Equipment

You need the following tools and parts to remove and install line cards or modular port adapters:

- Flat-blade or Phillips screwdriver
- ESD-preventive wrist or ankle strap and instructions
- Interface cables to connect the line card with another router or switch
- Any SFP/XFP modules you need to install (and are not already installed)

Note If you need additional equipment, see Cisco.com or your service representative for ordering information.

Removing and Installing a Line Card

Guidelines for Removing and Installing a Line Card

Caution Be careful to avoid damaging the electromagnetic interference (EMI) gasket that runs along the full length of the card front panel edges. Damage to the EMI gasket can affect the ability of your system to meet EMI requirements.

- Every 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. If you insert a card into the wrong card slot or upside down, the key gets blocked against the chassis card guide and will not slide though the slot. If the key is blocked, remove the card and find the correct card slot.
- Online insertion and removal (OIR) is supported, enabling you to install a card while the FCC is operating. OIR is seamless to users on the network, maintains all routing information, and ensures session preservation. We recommend that you perform a graceful shutdown to shut down a fabric card prior to removing it from the chassis. See Steps for OIR Line Card Removal and Insertion, page 2-10.
- When installing a line card, your must first push the OIR button on both the upper and lower ejectors for the mechanical latch to be released.
- The different cards in the chassis are attached to the chassis itself by a pair of ejector levers and captive screws. The two ejector levers release the card from its midplane connector. The exact locations of the ejector levers and captive screws can vary slightly from card to card, but are generally in the same locations: on the upper and bottom ends of the faceplate.

Caution When installing a line card, always fully tighten both captive installation screws to ensure that the card is correctly seated in the backplane connector. A card that is only partially seated in the backplane might not operate properly, even if it boots.

- The backplane identification (BPID) board monitors OIR by counting the number of card insertions for each slot and saving that information in non-volatile memory. OIR monitoring is done for all line cards, the RSP, and the fan trays. A card insertion is determined by the CAN Bus Controller (CBC) of the inserted card booting up and sending a CBC message which is intercepted by the BPID board. Note that a CBC reset or power cycle on a card will also be interpreted as a card insertion.

  A card with an OIR count that exceeds 175 will generate a minor alarm against that slot. If the card OIR count exceeds 200, a major alarm is generated against that slot. Fan tray insertion counts are not checked against a threshold.

See the *Release Notes for Cisco ASR 9000 Series Aggregation Services Routers for Cisco IOS XR Software* for information about CLI commands for obtaining and resetting card insertion data. The CLI command indicates whether the particular chassis has the version of BPID that supports the counting of the OIR.

- After you reinstall a line card, the router automatically downloads the necessary software from the RSP. Next, the router brings online only those interfaces that match the current configuration and were previously configured as *administratively up*. You must configure all others with the **configure** command.

Caution The router may indicate a hardware failure if you do not follow proper procedures. Remove or insert only one line card at a time. Allow at least 15 seconds for the router to complete the preceding tasks before removing or inserting another line card. After removing and inserting a line card into the same slot, allow at least 60 seconds before removing or inserting another line card.

Step 1 Line cards have two ejector levers to release the card from its backplane connector. Use the levers when you are removing the line card and to seat the line card firmly in its backplane connector when you are installing the line card. The ejector levers align and seat the card connectors in the backplane.

Caution When you remove a line card, always use the ejector levers to ensure that the connector pins disconnect from the backplane in the sequence expected by the router. Any card that is only partially connected to the backplane can halt the router.

When you install a line card, always use the ejector levers to ensure that the card is correctly aligned with the backplane connector; the connector pins should make contact with the backplane in the correct order, indicating that the card is fully seated in the backplane. If a card is only partially seated in the backplane, the router hangs and subsequently crashes.

Caution To avoid damaging card mechanical components, never carry an RSP or line card by the captive installation screws or ejector levers. Doing so can damage these components and cause card insertion problems.

For line card configuration information, see Verifying and Troubleshooting Line Card Installation, page 3-1.

Removing a Line Card

If you are replacing a failed line card, remove the existing line card first, then install the new line card in the same slot. To remove a line card, use Figure 2-1 or Figure 2-2 as a reference and follow these steps:

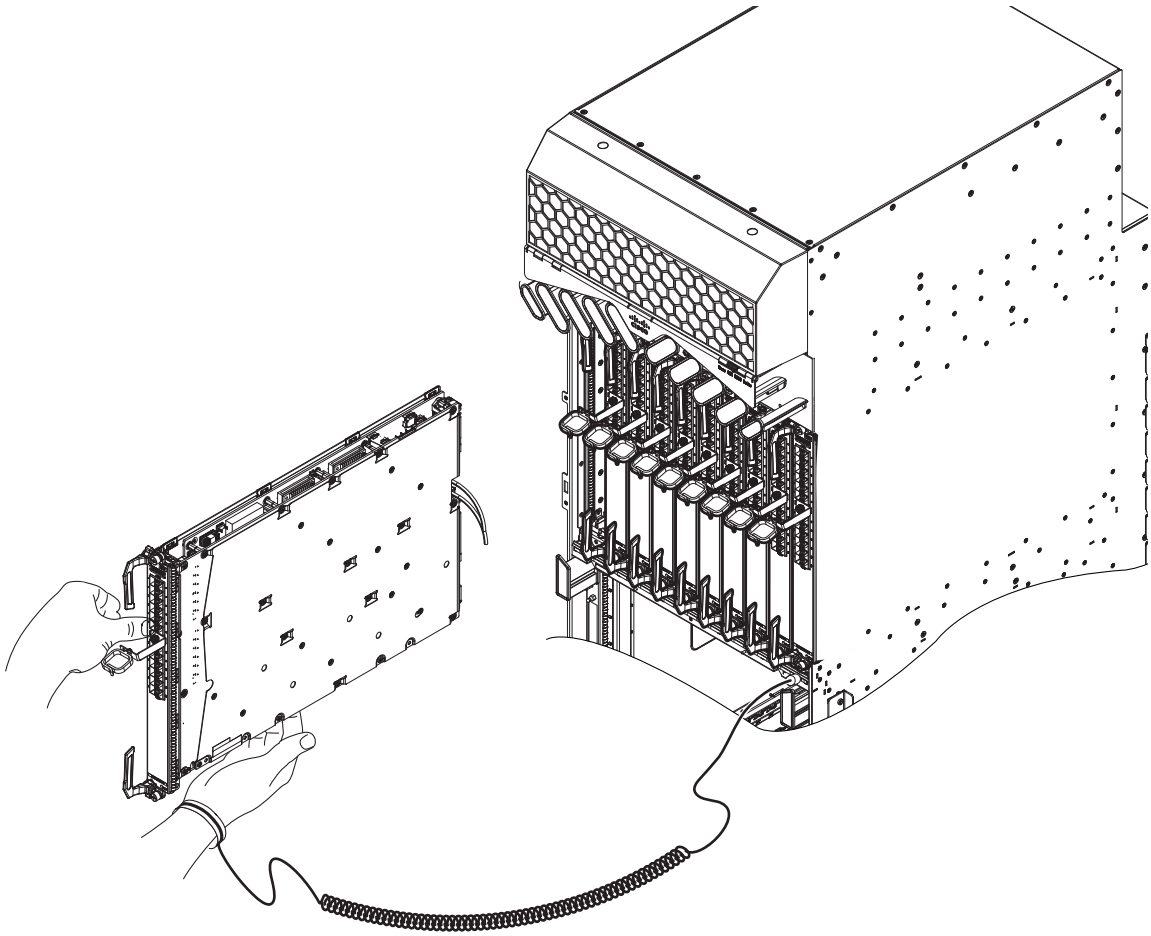
Step 1 Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.

Step 2 Disconnect and remove all interface cables from the ports; note the current connections of the cables to the ports on the line card.

Step 3 Detach the line card cable-management bracket from the line card.

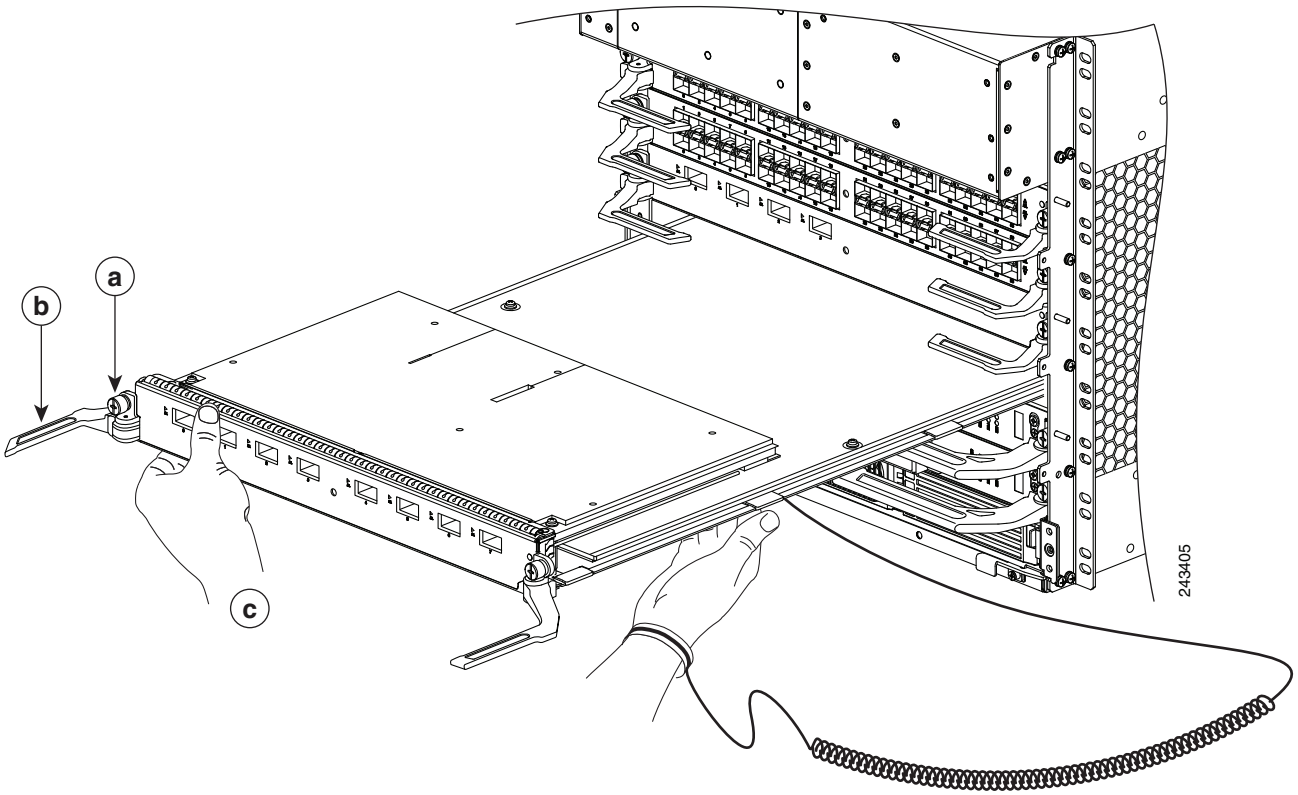
Step 4 Use a screwdriver to loosen the captive screw at each end of the line card front panel.

Figure 2-1 Removing a Line Card—Cisco ASR 9010 Router Shown



a	Loosen the captive screws	**b**	Pivot the ejector levers to unseat the card from the backplane connector	**c**	Slide the card out of the chassis

Figure 2-2 Removing a Line Card —Cisco ASR 9006 Router Shown



a	Loosen the captive screws	**b**	Pivot the ejector levers to unseat the card from the backplane connector	**c**	Slide the card out of the chassis

Caution When you remove a line card, always use the ejector levers to ensure that the line card connector pins disconnect from the backplane in the logical sequence expected by the router. Any line card that is only partially connected to the backplane can halt the router.

Step 5 Simultaneously pivot the ejector levers away from each other to release the line card from the backplane connector.

Step 6 Grasp the ejector levers and pull the line card halfway out of the slot.

Step 7 Grasp the line card and gently pull it straight out of the slot, keeping your other hand under the line card to guide it. Avoid touching the line card printed circuit board, components, or any connector pins.

Step 8 Place the removed line card on an antistatic mat, or immediately place it in an antistatic bag if you plan to return it to the factory.

Step 9 If the line card slot is to remain empty, install a line card blank (Product Number A9K-LC-FILR) to keep dust out of the chassis and to maintain proper airflow through the line card compartment. Secure the line card blank to the chassis by tightening its captive screws.

Caution Be careful not to damage or disturb the EMI spring fingers located on the front edge of the card face plate.

Note Always insert a dust plug in an optical port opening for each port that is not in use.

- For information on disconnecting the interface cables, see Installing and Removing Fiber-Optic Interface Cables, page 2-71.
- For information on removing the cable-management bracket, see Removing a Line Card Cable-Management Bracket, page 2-68.

Installing a Line Card

A line card slides into any available line card slot and connects directly to the backplane. If you install a new line card, you must first remove the line card blank from the available slot.

Note See the installation and configuration guide for your router for information on line card slot types, slot width, and slot location.

Caution When installing a line card, always fully tighten both captive installation screws to ensure that the card is correctly seated in the backplane connector. A card that is only partially seated in the backplane might not operate properly, even if it boots.

Caution The router may indicate a hardware failure if you do not follow proper procedures. Remove or insert only one line card at a time. Allow at least 15 seconds for the router to complete the preceding tasks before removing or inserting another line card.

To install a line card, follow these steps:

Step 1 Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.

Step 2 Choose an available line card slot for the line card, and verify that the line card interface cable is long enough for you to connect the line card with any external equipment.

Caution To prevent ESD damage, handle line cards only by the metal card carrier. Do not touch any of the electrical components or circuitry.

Caution To avoid damaging card mechanical components, never carry an RSP or line card by the captive installation screws or ejector levers. Doing so can damage these components and cause card insertion problems.

Step 3 Grasp the front panel of the line card with one hand and place your other hand under the metal card carrier to support the weight of the card (Figure 2-1 or Figure 2-2). Position the card for insertion into the card cage slot. Avoid touching the line card printed circuit board, components, or any connector pins.

Step 4 Carefully slide the line card into the slot until the ejector levers make contact with the edges of the card cage, then *stop* when the ejector lever hooks catch the lip of the card cage. If they do not catch, try reinserting the line card until the ejector levers are fully latched.

Caution When you install a line card, always use the ejector levers to ensure that the card is correctly aligned with the backplane connector, the card connector pins make contact with the backplane in the correct order, and the card is fully seated in the backplane. A card that is only partially seated in the backplane can cause the router to hang.

Note On the Cisco ASR 9922 Router, the line cards in the lower half of the chassis (slots 10–19) are inserted upside down.

Step 5 Simultaneously pivot both ejector levers toward each other until they are parallel to the line card front panel. This action firmly seats the card in the backplane.

Step 6 Tighten the captive screw on each end of the line card front panel to ensure proper EMI shielding and to prevent the line card from becoming partially dislodged from the backplane. Tighten the captive screws to a torque of 10 +/–1 in-lb.

Caution To ensure adequate space for additional line cards, always tighten the captive installation screws on each newly installed line card *before* you insert any additional line cards. These screws also ensure correct seating in the backplane connector, prevent accidental removal, and provide proper grounding and EMI shielding for the router.

Step 7 Install the cable-management bracket. See Installing a Line Card Cable Management Bracket, page 2-67.

Step 8 Install the interface cables. See Installing and Removing Fiber-Optic Interface Cables, page 2-71.

- For information on installing SFP and XFP modules, see Installing and Removing SFP Modules, page 2-28 and Installing and Removing XFP Modules, page 2-39.
- For help in troubleshooting the hardware installation, see Verifying and Troubleshooting Line Card Installation, page 3-1.

Steps for OIR Line Card Removal and Insertion

Online insertion and removal (OIR) is supported, enabling you to install a card while the line card is operating. Follow these steps when removing or inserting a line card by using the Cisco IOS XR **shutdown** command.

Step 1 Shut down the line card location with the **(admin-config) hw-module shutdown location 0/0/CPU0** command (where *R* is the rack number and *S* is the slot number).

Step 2 Confirm that the LEDs have gone from green to off.

Step 3 Physically remove the line card to be replaced.

Step 4 Physically insert the replacement line card.

Step 5 Return the line card to the up state with the **(admin-config) hw-module shutdown location 0/0/CPU0** command.

Installing Modular Line Cards and Modular Port Adapters

Safety Guidelines

Before you perform any procedure in this publication, review the safety guidelines in this section to avoid injuring yourself or damaging the equipment.

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

Safety Warnings and Electromagnetic Regulatory Statements

Note Safety warnings and electromagnetic compatibility regulatory statements are listed in the *Regulatory Compliance and Safety Information for Cisco ASR 9000 Series Aggregation Services Routers*. Read this guide before installing, configuring, or maintaining a line card.

- 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.
- Do not wear loose clothing, jewelry, or other items that could get caught in the router while working with line cards.
- Cisco equipment operates safely when it is used in accordance with its specifications and product usage instructions.

Electrical Equipment Guidelines

Follow these basic guidelines when working with any electrical equipment:

- Before beginning any procedures requiring access to the chassis interior, locate the emergency power-off switch for the room in which you are working.
- Disconnect all power and external cables before moving a chassis.
- Do not work alone when potentially hazardous conditions exist.
- Never assume that power has been disconnected from a circuit; always check.
- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe; carefully examine your work area for possible hazards such as moist floors, ungrounded power extension cables, and missing safety grounds.

Laser/LED Safety

The single-mode transmitter in the module uses a small laser to transmit the light signal to the network ring. Keep the transmit port covered whenever a cable is not connected to it. Although multimode transceivers typically use LEDs for transmission, it is good practice to keep open ports covered and avoid staring into open ports or apertures. The single-mode aperture port contains a laser warning label, as shown in Figure 2-3.

Figure 2-3 Laser Warning Labels for Single-Mode Port

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

Warning **Class 1 laser product.** Statement 1008

The multimode aperture contains a Class 1 LED warning label, as shown in Figure 2-4.

Figure 2-4 Class 1 LED Warning Label for Multimode Port

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

Warning **Class 1 LED product.** Statement 1027

Preventing Electrostatic Discharge

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. Electromagnetic interference (EMI) shielding is an integral component of the line card. Cisco recommends using an ESD-preventive strap whenever you are handling network equipment or one of its components.

The 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 connection socket on the router or to bare metal on the chassis.
- Handle line cards by the captive installation screws, the provided handle, ejector levers, or the line card metal carrier only; avoid touching the board or connector pins.
- Place removed line cards 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 the line cards and clothing. The wrist strap only protects the board from ESD voltages on the body; ESD voltages on clothing can still cause damage.

Caution For safety, periodically check the resistance value of the ESD strap. The measurement should be between 1 and 10 megohms.

Required Tools and Equipment

You need the following tools and parts to remove and install modular line cards (MLCs) and modular port adapters (MPAs):

- Flat-blade or Phillips screwdriver
- ESD-preventive wrist or ankle strap and instructions
- Interface cables to connect the line card with another router or switch

Installing and Removing a Modular Line Card

- Installing a Modular Line Card, page 2-17
- Removing and Installing a Modular Line Card, page 2-14

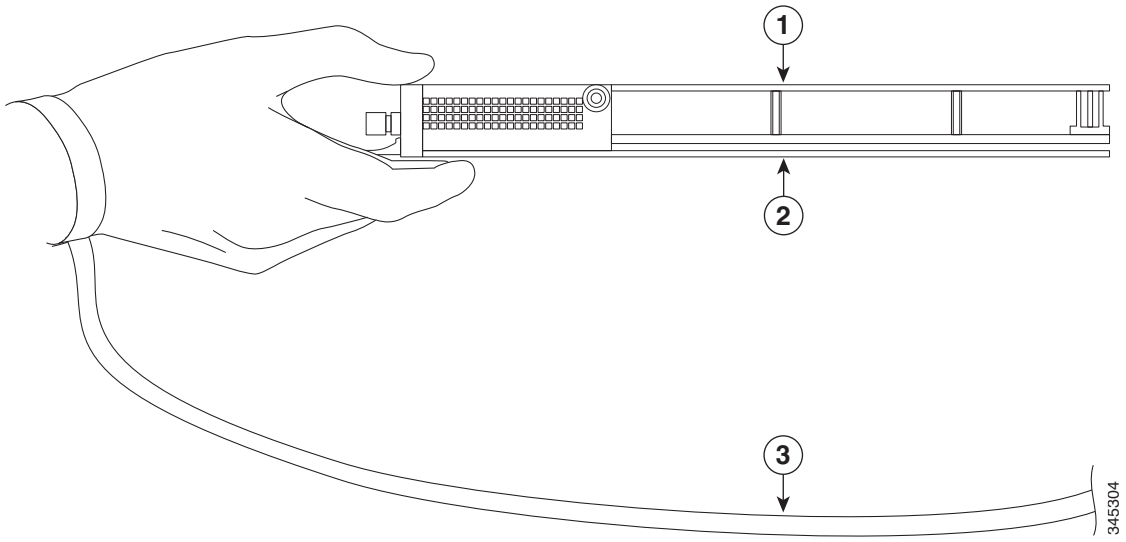
Handling a Modular Line Card

Each modular line card (MLC) circuit board is mounted to a metal carrier and is sensitive to electrostatic discharge (ESD) damage.

Caution Always handle the MLC by the carrier edges and handle; never touch the its components or connector pins (Figure 2-8).

When a slot is not in use, a blank must fill the empty slot to allow the router to conform to electromagnetic interference (EMI) emissions requirements and to allow proper airflow across the installed modules. If you plan to install an MLC in a slot that is not in use, you must first remove the blank.

Figure 2-5 Handling a Modular Line Card



1	Metal Carrier	**2**	Printed Circuit Board
3	Grounding Strap		

Removing and Installing a Modular Line Card

- Guidelines for Modular Line Card Removal and Installation
- Removing a Line Card
- Installing a Modular Line Card

Note Some of the procedures in the following sections use illustrations of a 10-slot Cisco ASR 9000 Series Router to support the descriptions of removing and installing modular line cards. Although the card cages of Cisco ASR 9000 Aggregation Services Routers differ, the designated use of slots and the process of installing and removing a MLC are basically the same. Therefore, separate procedures and illustrations are not included in this guide.

Guidelines for Modular Line Card Removal and Installation

- Online insertion and removal (OIR) is supported, enabling you to remove and install MLCs while the router is operating. OIR is seamless to users on the network, maintains all routing information, and ensures session preservation.

Note With OIR, notifying the software or resetting the power is not required. However, you have the option of using the **hw-module loc rack/slot/CPU0 maint** command before removing a MLC.

- After you reinstall a MLC, the router automatically downloads the necessary software from the Route Switch Processor (RSP). Next, the router brings online only those interfaces that match the current configuration and were previously configured as *administratively up*. You must configure all others with the **configure** command.

Caution The router may indicate a hardware failure if you do not follow proper procedures. Remove or insert only one MLC at a time. Allow at least 15 seconds for the router to complete the preceding tasks before removing or inserting another MLC.

- MLCs have two ejector levers to release the card from its backplane connector. Use the levers when you are removing the MLC and to seat the MLC firmly in its backplane connector when you are installing the ML. The ejector levers align and seat the card connectors in the backplane.

Caution When you remove a MLC, always use the ejector levers to ensure that the connector pins disconnect from the backplane in the logical sequence expected by the router. Any card that is only partially connected to the backplane can halt the router.

When you install a MLC, always use the ejector levers to ensure that the card is correctly aligned with the backplane connector; the connector pins should make contact with the backplane in the correct order, indicating that the card is fully seated in the backplane. A card that is only partially seated in the backplane will cause the router to hang and subsequently crash.

Removing a Modular Line Card

If you are replacing a failed modular line card (MLC), remove the existing MLC first, then install the new MLC in the same slot. To remove a MLC, use Figure 2-6 as a reference and follow these steps:

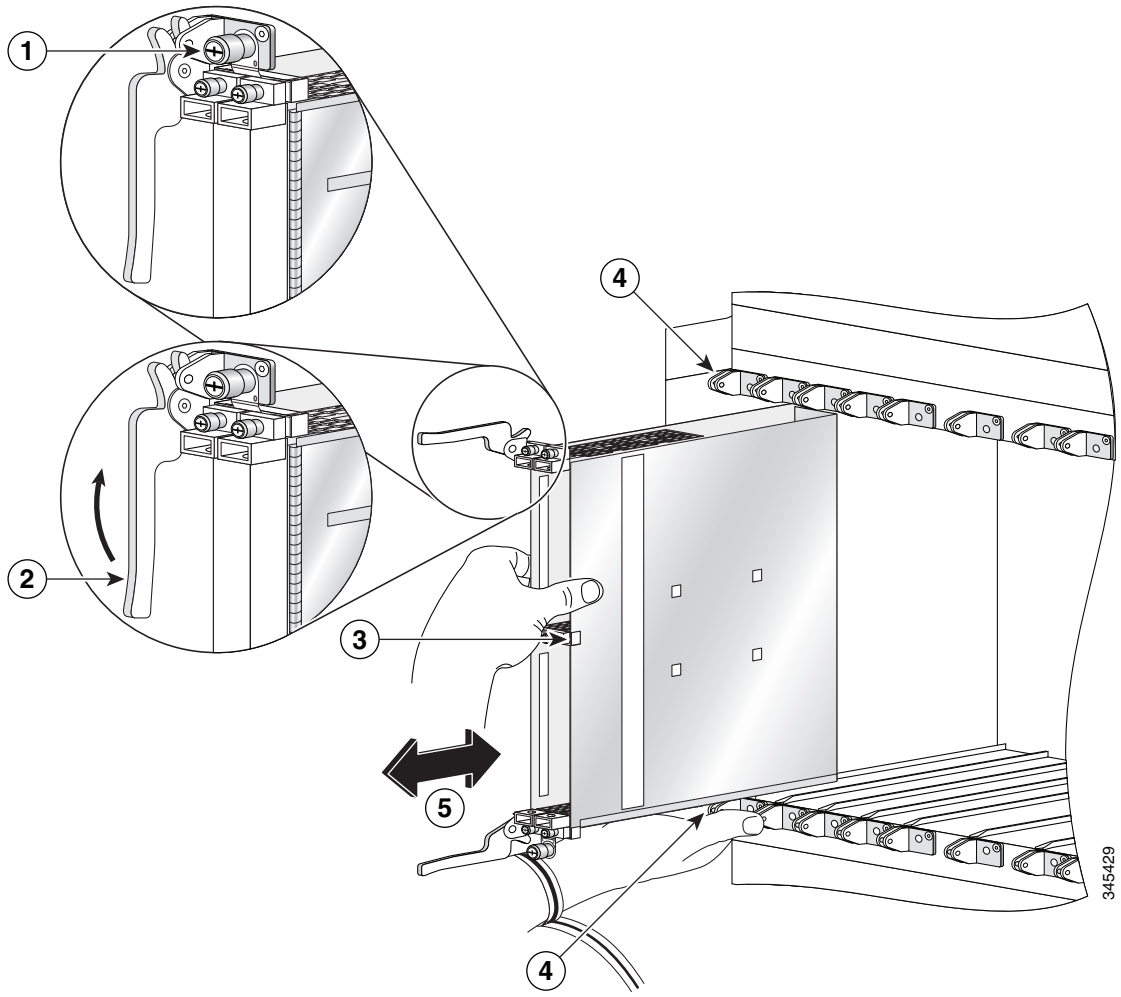
Step 1 Attach an ESD-preventive wrist strap and follow its instructions for use.

Step 2 Disconnect and remove all interface cables from the ports; write down the current connections of the cables to the ports on the MPAs and the MPA locations if you remove the MPA.

Step 3 Detach the cable-management bracket from the MLC.

Use a screwdriver to loosen the captive screw at each end of the MLC faceplate. (See callout 1 on Figure 2-6).

Figure 2-6 Removing and Installing a Modular Line Card



Caution When you remove an MLC, always use the ejector levers to ensure that the MLC connector pins disconnect from the backplane in the logical sequence expected by the router. Any MLC that is only partially connected to the backplane can halt the router.

Step 4 Grasp the two card ejector levers and simultaneously pivot both ejector levers 90 degrees away from the front edge of the card carrier to release the MLC from the backplane connector (Figure 2-6).

Step 5 Grasp the ejector levers and pull the MLC halfway out of the slot.

Step 6 Grasp the MLC by the center and gently pull it straight out of the slot, keeping your other hand under the MLC to guide it (Figure 2-6). Avoid touching the MLC printed circuit board, components, or any connector pins.

Step 7 Place the removed MLC on an antistatic mat, or immediately place it in an antistatic bag if you plan to return it to the factory.

Step 8 If the MLC slot is to remain empty, install a line card blank to keep dust out of the chassis and to maintain proper airflow through the MLC compartment. Secure the line card blank to the chassis by tightening its captive screws.

Installing a Modular Line Card

A modular line card (MLC) slides into any available line card slot and connects directly to the backplane. If you install a new MLC, you must first remove the line card blank from the available slot.

Note See the *Cisco ASR 9000 Series Aggregation Services Router Hardware Installation Guide* for information on line card slot types in order to determine an appropriate slot in which to install the MLC.

Caution The router may indicate a hardware failure if you do not follow proper procedures. Remove or insert only one MLC at a time. Allow at least 15 seconds for the router to complete the preceding tasks before removing or inserting another MLC.

To install a modular line card, follow these steps:

Step 1 Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.

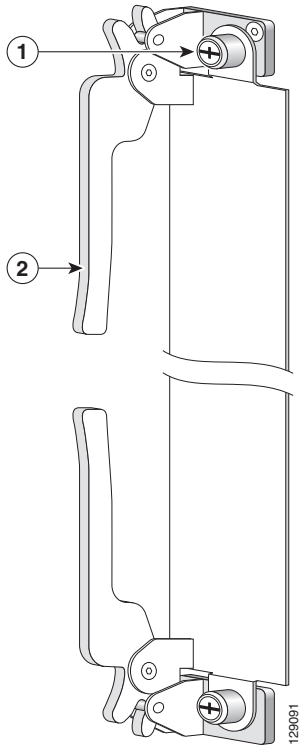
Step 2 Choose an available MLC slot for the card and verify that the MPA interface cables are long enough for you to connect the MLC with any external equipment.

Caution To prevent ESD damage, handle MLCs by the captive installation screws, the provided handle, ejector levers, or the card carrier edges only. Do not touch any of the electrical components or circuitry.

Step 3 Grasp the handle of the MLC with one hand and place your other hand under the card carrier to support the weight of the card; position the card for insertion into the card cage slot. Avoid touching the MLC printed circuit board, components, or any connector pins.

Step 4 Carefully slide the MLC into the slot until the ejector levers make contact with the edges of the card cage, then *stop* when the ejector lever hooks catch the lip of the card cage. If they do not catch, try reinserting the MLC until the ejector lever hooks are fully latched (Figure 2-7).

Figure 2-7 Ejector Levers and Captive Screws



1	Captive screw	**2**	Ejector lever

Caution When you install a MLC, always use the ejector levers to ensure that the card is correctly aligned with the backplane connector, the card connector pins make contact with the backplane in the correct order, and the card is fully seated in the backplane. A card that is only partially seated in the backplane can cause the router to hang and subsequently crash.

Step 5 Simultaneously pivot both ejector levers toward each other until they are perpendicular to the MLC faceplate. This action firmly seats the card in the backplane.

Step 6 Use a 3/16-inch flat-blade screwdriver to tighten the captive screw on each end of the MLC faceplate to ensure proper EMI shielding and to prevent the MLC from becoming partially dislodged from the backplane. Tighten the locking thumbscrews on both sides of the MLC to a torque of between 8.3 and 11 inch-pounds (94 to 124 N-cm). Do not overtighten.

Caution To ensure adequate space for additional MLCs always tighten the captive installation screws on each newly installed MLC *before* you insert any additional MLCs. These screws also prevent accidental removal and provide proper grounding and EMI shielding for the router.

Step 7 Install the MPAs and SFP modules in the modular port adapters (MPAs)s that use them. See Installing and Removing Modular Port Adapters, page 2-19.

Step 8 If you are replacing a MLC install the modular port adapters (MPAs) in the same bays as you noted in Step 2 under Removing a Line Card, page 2-6.

Step 9 Install the interface cables.

Installing and Removing Modular Port Adapters

The following sections describe how to install or remove modular port adapters (MPAs) on the Cisco ASR 9000 Aggregation Services Router. This chapter contains the following sections:

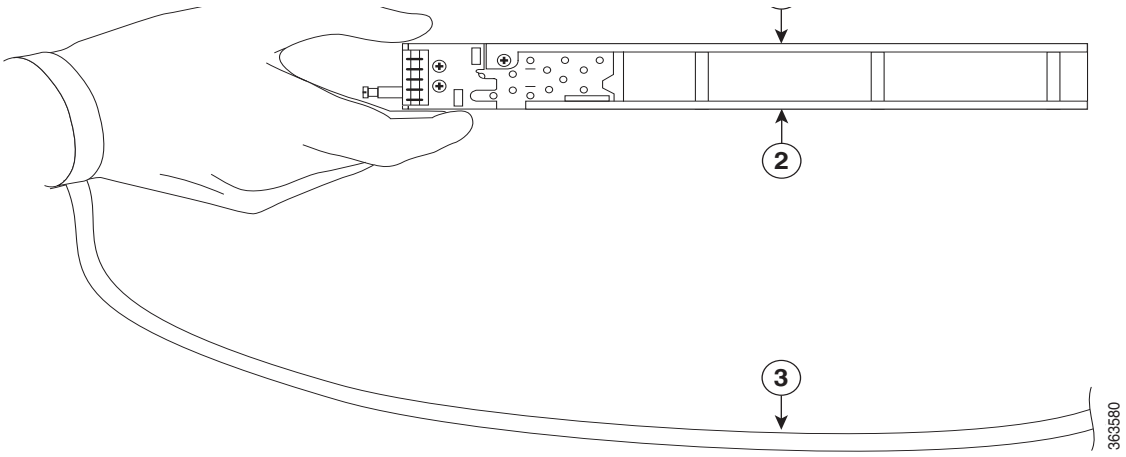
Handling Modular Port Adapters

Each modular port adapter (MPA) circuit board is mounted to a metal carrier and is sensitive to electrostatic discharge (ESD) damage.

Caution Always handle the MPA by the carrier edges and handle; never touch the MPA components or connector pins (Figure 2-8).

When a bay is not in use, a blank ASR 9000 MPA Slot Filler (A9K-MPA-FILR) must fill the empty bay to allow the router or switch to conform to electromagnetic interference (EMI) emissions requirements and to allow proper airflow across the installed modules. If you plan to install a MPA in a bay that is not in use, you must first remove the blank.

Figure 2-8 Handling a Modular Port Adapter



1	Metal Carrier	**2**	Printed Circuit Board
3	Grounding Strap		

Online Insertion and Removal

Cisco ASR 9000 Series Router modular line cards (MLCs) and modular port adapters (MPAs) support online insertion and removal (OIR). Modular port adapters (MPAs) can be inserted or removed independently from the MLC. OIR of a MLC with installed modular port adapters (MPAs) is also supported.

Modular port adapters (MPAs) support the following three types of OIR:

- Soft OIR

  Soft OIR uses the IOS XR **hw-module subslot <rack/slot/subslot> reload**, **hw-module subslot <rack/slot/subslot> shutdown**, and **no hw-module subslot <rack/slot/subslot> shutdown** commands to complete online insertion and removal. Refer to the Hardware Redundancy and Node Administration Commands on the Cisco ASR 9000 Series Router chapter of the Cisco ASR 9000 Series Aggregation Services Router System Management Command Reference online for command syntax.

- Managed OIR

  A managed online insertion and removal of Modular port adapters (MPAs) is comprised of the following steps:

  1. Shut down the MPA with the **hw-module subslot 0/0/1 shutdown** command.
  2. Confirm that the LEDs have gone from green to off.
  3. Execute the do show plat command to verify that the MPA to be removed is in the disabled state.
  4. Physically remove the MPA to be replaced.
  5. Physically insert the replacement MPA
  6. Return the MPA to the up state with the **no hw-module subslot 0/0/1 shutdown** command.

- Hard OIR

  Hard OIR is the physical online insertion and removal of Modular port adapters (MPAs) without software commands. There are three types of hard OIR supported:

  If the bay is empty when the Cisco ASR 9000 Series Router MLC boots, you can do the following:

  - Insert a 20GE MPA
  - Remove and then insert a replacement 20GE MPA
  - Insert a 4 10-GE MPA
  - Remove and then insert a replacement 4 10GE MPA

  If the MLC boots with a 20GE MPA in the bay you can remove and then insert a replacement 20GE MPA or a replacement 4 10GE MPA

  If the MLC boots with a 4 10GE MPA in the bay you can remove and then insert a replacement 4 10GE MPA a or replacement 20GE MPA

Note Cisco recommends waiting for at least 2 minutes before doing successive MPA OIRs (Soft OIR or Hard OIR). An empty bay during the Cisco ASR 9000 Series Router MLC bootup will default to 20GE MPA mode.

Modular Port Adapter Installation and Removal

This section provides step-by-step instructions for removing and installing a modular port adapter (MPA) in a modular line cards (MLC).

Warning **During this procedure, wear grounding wrist straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool, or you could shock yourself.** Statement 94

To remove and install a MPA in a MLC, do the following:

Step 1 To insert the MPA in the MLC, locate the guide rails inside the MLC that hold the MPA in place. They are at the top left and top right of the MPA slot and are recessed about an inch.

Step 2 Carefully slide the MPA all the way in the MLC until the MPA is firmly seated in the MPA interface connector. When fully seated, the MPA might be slightly behind the MLC faceplate.

Note The MPA will slide easily into the slot if it is properly aligned on the tracks. If the MPA does not slide easily, do NOT force it. Remove the MPA and reposition it, paying close attention to engaging it on the tracks.

Step 3 After the MPA is properly seated, use a number 2 Phillips screwdriver to tighten the jackscrew on the MPA.

Note Avoid over torquing the MPA jackscrew when installing the MPA. Tighten the jackscrew on the MPA to a torque of 17 +/-1 inch-pound.

Step 4 To remove the MPA from the MLC, use a number 2 Phillips screwdriver to loosen the lock screw on the MPA.

Step 5 Grasp the MPA and pull the MPA from the MLC. (You have already disconnected the cables from the MPA).

Optical Device Installation and Removal

Any contamination of the fiber connection can cause failure of the component or failure of the whole system. A particle that partially or completely blocks the core generates strong back reflections, which can cause instability in the laser system. Inspection, cleaning, and reinspection are critical steps to take before making fiber-optic connections.

Cleaning Optical Devices

See the *Inspection and Cleaning Procedures for Fiber Optic Connections* document for information on cleaning optical devices.

Checking the Installation

This section describes the procedures you can use to verify the modular line card (MLC) and modular port adapter (MPA) installation, and includes information on the following topics:

Verifying the Installation

This section describes how to verify the MLC and MPA installation by observing the MLC LED states, the MPA LED states, and the information displayed on the console terminal.

When the system has reinitialized all interfaces, the MLC STATUS LED should be green (on) and the MPA STATUS LEDs should be green (on). The port LEDs (C/A and A/L) may be green (on), depending on your connections and configuration. The console screen also displays a message as the system discovers each interface during its reinitialization.

The following sample display shows the events logged by the system as a MLC with a MPA was removed from module slot 4 in the router. In this example, interface 0 (interface 4/0/0) on the MPA was up and active when the MLC was removed from the router. Note that the system logs that the MLC was removed from slot 4 and that interface 4/0/0 is changed to *down*.

```
RP/0/RSP0/CPU0:Dec 21 21:55:21.196 : invmgr[246]: %PLATFORM-INV-6-OIROUT : OIR: Node
0/4/CPU0 removed

RP/0/RSP0/CPU0:Dec 21 21:55:21.176 : invmgr[246]: %PLATFORM-INV-6-OIROUT : OIR: Node 0/4/0
removed
```

When you reinsert the MLC with the installed MPA, the system automatically brings up the interface that was changed to *down* when the MLC was removed.

```
RP/0/RSP0/CPU0:Dec 21 21:55:50.318 : invmgr[246]: %PLATFORM-INV-6-OIRIN : OIR: Node
0/4/CPU0 inserted
...

RP/0/RSP0/CPU0:Dec 21 21:59:12.979 : shelfmgr[371]: %PLATFORM-SHELFMGR-6-NODE_STATE_CHANGE
: 0/4/0 A9K-MPA-4X10GE state:INITIALIZED
..
LC/0/4/CPU0:Dec 19 15:07:33.019 : ifmgr[196]: %PKT_INFRA-LINEPROTO-5-UPDOWN : Line
protocol on Interface GigabitEthernet0/4/0/0, changed state to Up
```

Use the following procedure to verify that a MLC and MPA are installed correctly:

Step 1 Observe the console display messages and verify that the system discovers the MLC, while the system reinitializes each interface, as follows:

- As a MLC is initialized, the STATUS LED will first be amber, indicating that power is on, but the MLC is being configured. When the MLC is active, the STATUS LED will illuminate green.
- Modular port adapters (MPAs) will follow the same sequence after the MLC has completed its initialization. The MPA STATUS LEDs will illuminate amber, turning to green when the modular port adapters (MPAs) become active.

Step 2 When the MLC and MPA STATUS LEDs are green, all associated interfaces are configurable.

See the *Cisco ASR 9000 Series Router Getting Started Guide* and *Cisco ASR 9000 Series Router Interface and Hardware Component Configuration Guide* for configuration instructions.

- If a MLC or MPA is replaced with a module of the same type (as in an OIR or hardware swap), the previous configuration is reinstated when the MLC or MPA becomes active.
- If a MLC or MPA has not been previously installed in the same slot or subslot, then the configuration for all associated interfaces is empty.

Note New interfaces are not available until you configure them.

Step 3 If the modular line cards (MLCs) and modular port adapters (MPAs) have not become active within three minutes, refer to the system console messages. If there is no indication that a field-programmable device (FPD) upgrade is underway, see "Verifying and Troubleshooting the Line Card Installation".

Using show Commands to Verify Modular Line Card and Modular Port Adapter Status

The following procedure uses **show** commands to verify that the new modular port adapters (MPAs) are configured and operating correctly.

Step 1 Use the **show running-config** command to display the system configuration. Verify that the configuration includes the new MPA interfaces.

Step 2 Display information about the installed modular line cards (MLCs) using the **show diag** command.

Step 3 Use the **show hw-module fpd location** <*rack/slot/subslot*> command to verify the FPD version information of the modular port adapters (MPAs) installed in the system.

Note If a MPA does not meet the minimum version required, the FPD may need to be updated. See the *Cisco ASR 9000 Series Aggregation Services Router System Management Configuration Guide* for instructions. If the update fails, the failing module is powered down and an error message displays on the system console.

Step 4 Use the **show platform** command to check the state of all the boards in the chassis, including the MLC and the modular port adapters (MPAs).

The MPA state should be "OK" and the MLC card state should be "IOS XR RUN" in the **show platform** command output

Step 5 Finally, you can use the **show version** command to obtain software version information for the installed modular line cards (MLCs) as well as interfaces available.

Using show Commands to Display Modular Port Adapter Information

Table 2-1 describes the **show** commands you can use to display modular port adapter (MPA) information.

Table 2-1 show Commands to Display Modular Port Adapter Information

Command	Type of Information Provided
show running-config	Router's running configuration and interfaces available in the system.
show platform	Router's installed line card and MPA type, slot, and state information.
show diag	MPA type in that slot, number of ports, hardware revision, part number, and EEPROM contents.
show hw-module fpd location *<rack/slot/subslot>*	FPD version information of modular port adapters (MPAs) in the system.
show version	Cisco IOS XR software version, names and sources of configuration files, and boot images.

Table 2-2 show Commands to Display Modular Port Adapter Information

Command	Type of Information Provided	Example
show controllers *type rack/slot/subslot/port*	Network link status, register contents, and controller chip errors.	**show controllers Gigabit Ethernet 0/0/1/1**
show interfaces *type rack/slot/subslot/port*	Line status and data link protocol status for a particular MPA port. Statistics about data traffic sent and received by the port.	**show interfaces Gigabit Ethernet 0/0/1/1**
show diag *rack/slot/subslot/*	MPA type in that slot, number of ports, hardware revision, part number, and EEPROM contents.	**show diag 0/0/1**
show version	Cisco IOS XR software version and boot images.	**show version**

Note When a MLC is moved to a new slot, the system recognizes the new interfaces but leaves them in the shutdown state until you configure them and change their state to up. When a new MLC is inserted into a slot where a MLC previously resided, provided you reinstall the modular port adapters (MPAs) and interfaces and their cables in the same configuration as in the previous MLCs, the interfaces will come up in the same state as though you reinserted the old MLC.

The following sample display shows the events logged by the system as you insert a *new* MLC in module slot 4.

```
RP/0/RSP0/CPU0:Dec 21 21:55:50.318 : invmgr[246]: %PLATFORM-INV-6-OIRIN : OIR: Node
0/4/CPU0 inserted
...

RP/0/RSP0/CPU0:Dec 21 21:59:12.979 : shelfmgr[371]: %PLATFORM-SHELFMGR-6-NODE_STATE_CHANGE
: 0/4/0 A9K-MPA-4X10GE state:INITIALIZED
..
```

```
LC/0/4/CPU0:Dec 19 15:07:33.019 : ifmgr[196]: %PKT_INFRA-LINEPROTO-5-UPDOWN : Line
protocol on Interface GigabitEthernet0/4/0/0, changed state to Up
```

Use the following procedure to verify that the MLC is installed correctly:

Step 1 Observe the console display messages and verify that the system discovers the MLC, while the system reinitializes each interface, as follows:

- If you installed a new MLC, the STATUS LED should be on (green). The system should recognize all new interfaces but leave them configured as *down*.
- If you replaced a MLC, the STATUS LED should be on (green). The interfaces will come up in the same state as though you reinserted the old MLC.

Step 2 Verify that the STATUS LED on the MPA goes on (is green) and remains on after the reinitialization is complete. If the STATUS LED remains on, proceed to Step 5. If the STATUS LED does not remain on, proceed to Step 3.

Step 3 If the STATUS LED on a MPA fails to go on, the MPA or the MLC might not be fully seated.

- Remove the MPA from the MLC.
- Inspect the MPA. Verify there are no bent pins or parts and that there is nothing lodged in the two devices that could prevent a good connection.
- Insert the MPA in the MLC by sliding the MPA all the way in the MLC until the MPA is firmly seated in the MPA interface connector. When fully seated in the MLC, the MPA might be slightly behind the MLC faceplate. After the MPA is properly seated, use a number 2 Phillips screwdriver to tighten the jackscrew.

Note The MPA will slide easily into the slot if it is properly aligned on the tracks. If the MPA does not slide easily, do NOT force it. Remove the MPA and reposition it, paying close attention to engaging it on the tracks.

- After the system reinitialization, the STATUS LED on the MPA should go on and remain on. If the STATUS LED remains on, proceed to Step 5. If it does not, try reseating the MPA in a different subslot within the MLC.
- If the STATUS LED on a MPA fails to go on after reseating the MPA in a different subslot within the MLC, proceed to Step 4.

Step 4 If the STATUS LED on a MPA still fails to go on, remove the MPA from the MLC, then remove the MLC and install it in another available slot on the router. Wait for the STATUS LED on the MLC to turn green.

- If the STATUS LED goes on, suspect a failed backplane port in the original slot.
- If the STATUS LED fails to go on, remove the MLC and ensure the MPA is firmly seated in its slot. Remove and reinstall it accordingly.
- If the STATUS LED still fails to go on, but other LEDs on the MPA go on to indicate activity, proceed to Step 5 to resume the installation checkout; suspect that the STATUS LED on the MPA or the MPA bay has failed. Contact a service representative to report the problem and obtain further instructions.
- If no LEDs on the MPA:
  - Verify that the MPA is supported on the MLC and that it has the required hardware revision. If the MPA is not supported or has an old hardware revision, the **show diag** command indicates that the MLC is deactivated.

- If there is another MLC available in the router, to test your MPA move the MPA to the other MLC.
- Suspect a faulty MLC. Contact a service representative to report the problem and obtain further instructions.

Note If you move the MPA to a different subslot in the MLC and it works, there are probably issues with the subslot in the MLC. Contact a service representative re: the broken subslot. If you test the MPA in another MLC and it works, the original MLC probably has some issues and needs troubleshooting. Contact a service representative to report the problem and obtain further instructions.

Step 5 If the MPA is new and is not a replacement, configure the new MPA using the instructions in the *Cisco IOS XR Getting Started Guide for the Cisco ASR 9000 Series Router* and *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide*.

Note New interfaces are not available until you configure them.

Step 6 If the MLC is a replacement, use the **show interfaces** command or the **show controllers** command to verify the status of the modular port adapters (MPAs). See Using show Commands to Verify Modular Line Card and Modular Port Adapter Status, page 2-23.

If you replaced a MLC with another MLC with a different MPA installed, the system recognizes the interfaces on the previously configured MPA but does not recognize the new MPA interfaces. The new interfaces remain in the shutdown state until you configure them.

Step 7 When the interfaces are up, check the activity of each MPA by observing the carrier LED.

Step 8 If the carrier LED fails to go on and a cable is connected to the interface port, check the cable connection and make certain it is properly seated in the connector.

Step 9 Repeat Step 1 through Step 8 to verify that any additional modular line cards (MLCs) are properly installed.

If you experience other problems that you are unable to solve, contact TAC (see Obtaining Documentation and Submitting a Service Request, page -xi), or a service representative for assistance.

To configure the new interface, use *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide*.

Using the ping Command to Verify Network Connectivity

This section provides brief descriptions of the **ping** command. The **ping** command allows you to verify that a MPA port is functioning properly and to check the path between a specific port and connected devices at various locations on the network. After you verify that the system and the MLC have booted successfully and are operational, you can use this command to verify the status of the MPA ports. See the *Cisco ASR 9000 Series Aggregation Services Router Getting Started Guide* and *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide* for more information on bringing up and configuring the Cisco ASR 9000 Series Router, the Cisco ASR 9000 A9K-MOD160G, and the Cisco ASR 9000 A9K-MOD80G-H. For more information on command syntax, refer to the publications listed in the Obtaining Documentation and Submitting a Service Request, page -xi for detailed command descriptions and examples.

The **ping** command sends an echo request out to a remote device at an IP address that you specify. After sending a series of signals, the command waits a specified time for the remote device to echo the signals. Each returned signal is displayed as an exclamation point (!) on the console terminal; each signal that is not returned before the specified timeout is displayed as a period (.). A series of exclamation points (!!!!!) indicates a good connection; a series of periods (.....) or the messages [timed out] or [failed] indicate that the connection failed.

Following is an example of a successful **ping** command to a remote server with the IP address 10.1.1.60:

```
Router# ping 10.1.1.60
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 10.1.1.60, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/15/64 ms
Router#
```

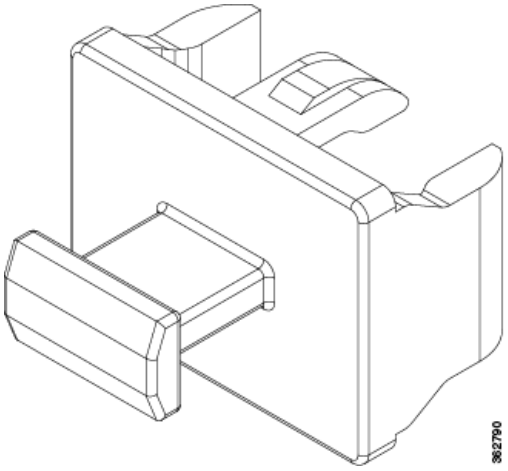
If the connection fails, verify that you have the correct IP address for the destination device and that the destination device is active (powered on), and then repeat the **ping** command.

Installing and Removing SFP Modules

Before you remove or install an SFP or SFP+ module, read the installation information in this section and the safety information in Laser Safety, page 3-10.

Caution Protect the line card by inserting a clean SFP/SFP+ module cage cover (A9K-SFP10G-COVER), shown in Figure 2-9, into the optical module cage when there is no SFP or SFP+ module installed.

Figure 2-9 SFP/SFP+ Module Cage Cover



Caution Protect the SFP or SFP+ modules by inserting clean dust covers into them after the cables are removed. Be sure to clean the optic surfaces of the fiber cables before you plug them back into the optical ports of another module. Avoid getting dust and other contaminants into the optical ports of your SFP or SFP+ modules, because the optics do not work correctly when obstructed with dust.

Caution We strongly recommended that you do not install or remove the SFP or SFP+ module with fiber-optic cables attached to it because of the potential to damage the cable, the cable connector, or the optical interfaces in the module. Disconnect all cables before removing or installing an SFP or SFP+ module.

Removing and inserting an module can shorten its useful life, so you should not remove and insert modules any more often than is absolutely necessary.

SFP and SFP+ modules use one of four different latching devices to install and remove the module from a port. The four types of SFP module latching devices are described in the following sections:

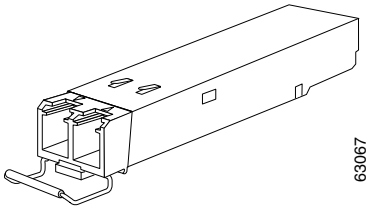
- Bale Clasp SFP or SFP+ Module, page 2-29
- Mylar Tab SFP or SFP+ Module, page 2-32
- Actuator Button SFP or SFP+ Module, page 2-34
- Slide Tab SFP or SFP+ Module, page 2-36

Note When installing an SFP or SFP+ module, you should hear a click as the triangular pin on the bottom of the module snaps into the hole in the receptacle, indicating that the module is correctly seated and secured in the receptacle. Verify that the modules are completely seated and secured in their assigned receptacles on the line card by firmly pushing on each SFP or SFP+ module.

Bale Clasp SFP or SFP+ Module

The bale clasp SFP or SFP+ module has a clasp that you use to remove or install the module (Figure 2-10).

Figure 2-10 Bale Clasp SFP or SFP+ Module



Installing a Bale Clasp SFP or SFP+ Module

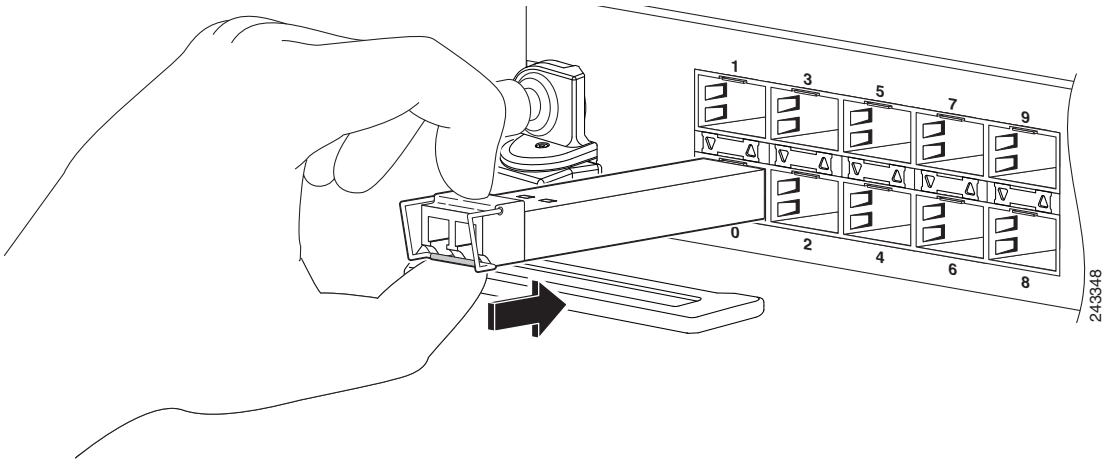
To install this type of SFP or SFP+ module, follow these steps:

Step 1 Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.

Step 2 Close the bale clasp before inserting the SFP module.

Step 3 Line up the SFP module with the port and slide it into the port (Figure 2-11).

Figure 2-11 Installing a Bale Clasp SFP Module into a Port



Note When installing an SFP or SFP+ module, you should hear a click as the triangular pin on the bottom of the SFP module snaps into the hole in the receptacle, indicating that the module is correctly seated and secured in the receptacle. Verify that the SFP modules are completely seated and secured in their assigned receptacles on the line card by firmly pushing on each SFP module.

Removing a Bale Clasp SFP or SFP+ Module

To remove this type of SFP or SFP+ module, follow these steps:

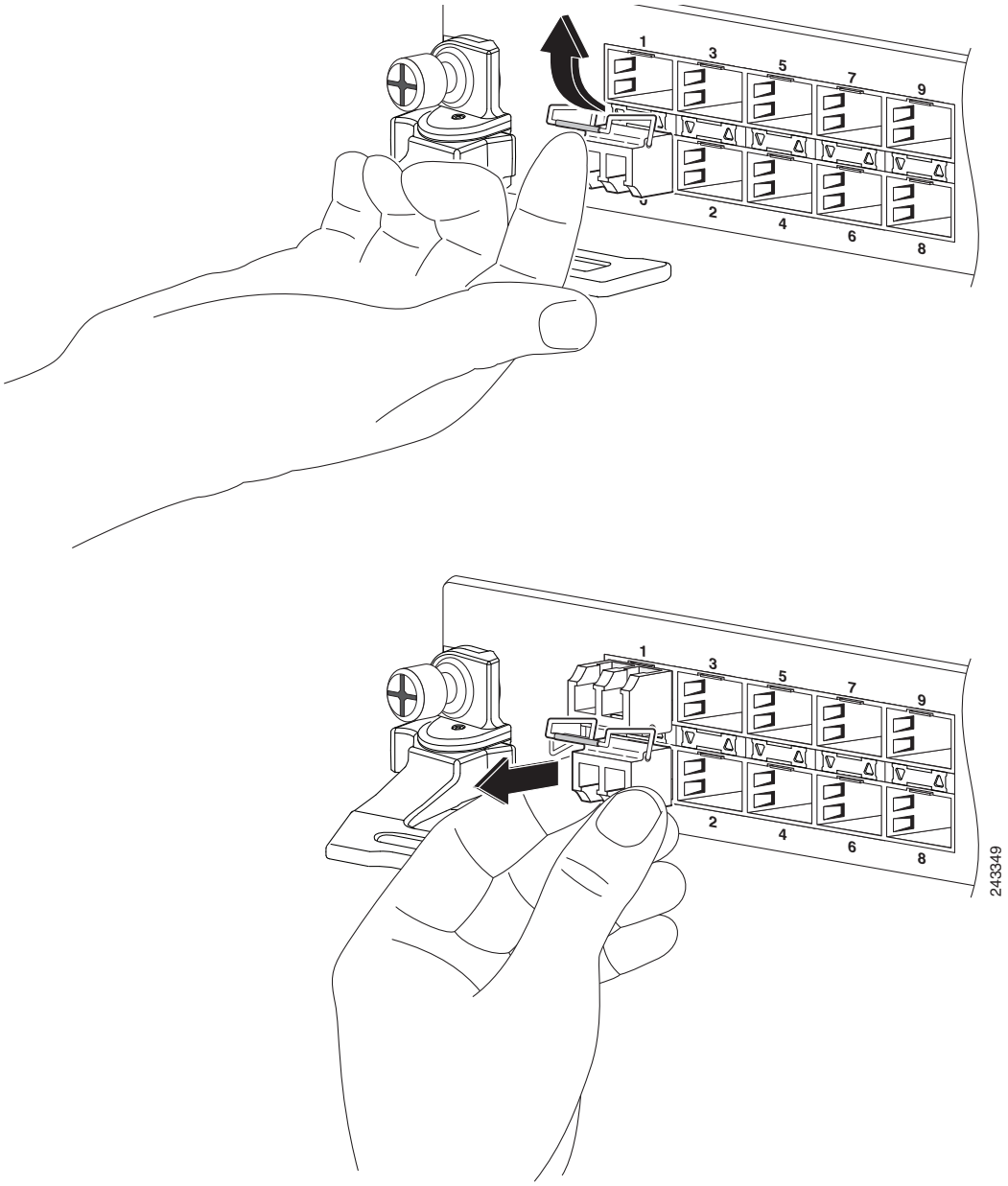
Step 1 Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.

Step 2 Disconnect and remove all interface cables from the ports; note the current connections of the cables to the ports on the line card.

Step 3 Open the bale clasp on the SFP module with your index finger in a downward direction, as shown in Figure 2-12. If the bale clasp is obstructed and you cannot use your index finger to open it, use a small flat-blade screwdriver or other long, narrow instrument to open the bale clasp.

Step 4 Grasp the SFP module between your thumb and index finger and carefully remove it from the port, as shown in Figure 2-12.

Figure 2-12 Removing a Bale Clasp SFP or SFP+ Module



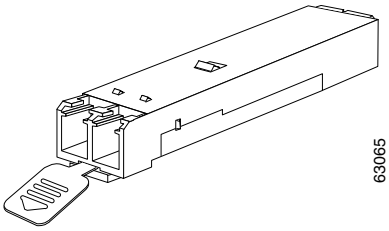
Step 5 Place the removed SFP module on an antistatic mat, or immediately place it in a static shielding bag if you plan to return it to the factory.

Step 6 Protect your line card by inserting clean SFP module cage covers into the optical module cage when there is no SFP module installed.

Mylar Tab SFP or SFP+ Module

The mylar tab SFP or SFP+ module has a tab to pull to remove the module from a port (Figure 2-13).

Figure 2-13 Mylar Tab SFP or SFP+ Module



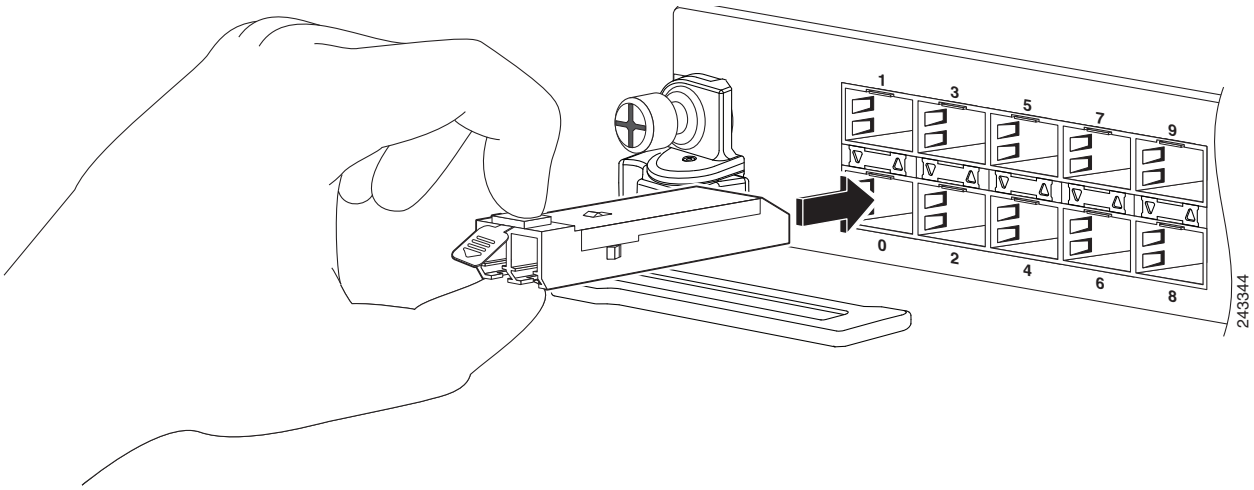
Installing a Mylar Tab SFP or SFP+ Module

To install this type of SFP or SFP+ module, follow these steps:

Step 1 Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.

Step 2 Line up the SFP module with the port, and slide it into place (Figure 2-14).

Figure 2-14 Installing a Mylar Tab SFP Module



Note When installing an SFP module, you should hear a click as the triangular pin on the bottom of the SFP module snaps into the hole in the receptacle, indicating that the module is correctly seated and secured in the receptacle. Verify that the SFP modules are completely seated and secured in their assigned receptacles on the line card by firmly pushing on each SFP module.

Removing a Mylar Tab SFP or SFP+ Module

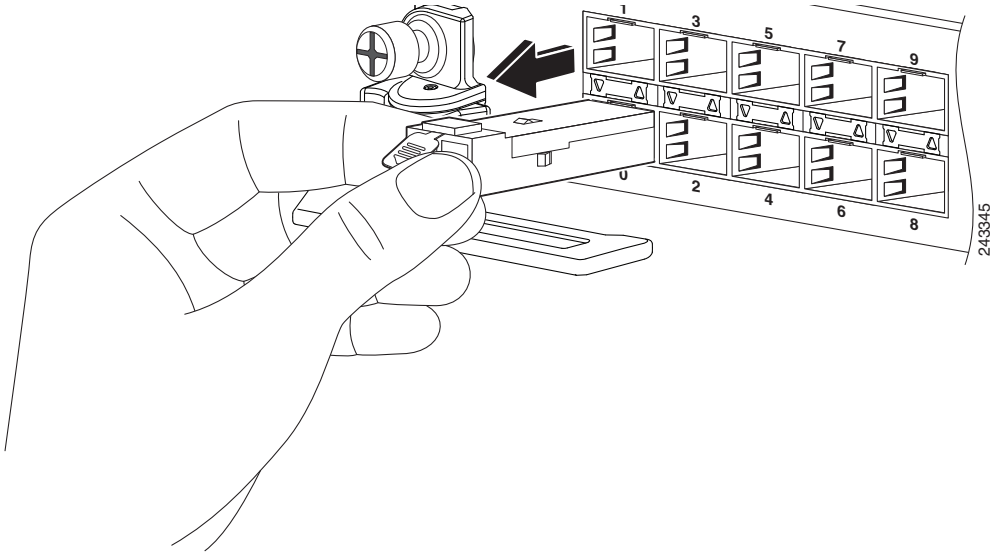
To remove this type of SFP or SFP+ module, follow these steps:

Step 1 Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.

Step 2 Disconnect and remove all interface cables from the ports; note the current connections of the cables to the ports on the line card.

Step 3 Pull the tab gently in a slightly downward direction until it disengages from the port, then pull the SFP module out (Figure 2-15).

Figure 2-15 Removing a Mylar Tab SFP Module



Step 4 Place the removed SFP module on an antistatic mat, or immediately place it in a static shielding bag if you plan to return it to the factory.

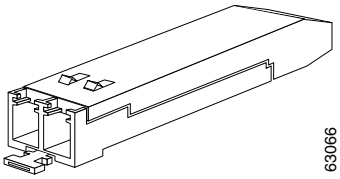
Step 5 Protect your line card by inserting clean SFP module cage covers into the optical module cage when there is no SFP module installed.

Note When pulling the tab to remove the SFP module, be sure to pull in a straight outward motion so you remove the SFP module from the port in a parallel direction. Do not twist or pull the tab, because you might disconnect it from the SFP module.

Actuator Button SFP or SFP+ Module

The actuator button SFP or SFP+ module includes a button that you push in order to remove the SFP module from a port (Figure 2-16).

Figure 2-16 Actuator Button SFP or SFP+ Module



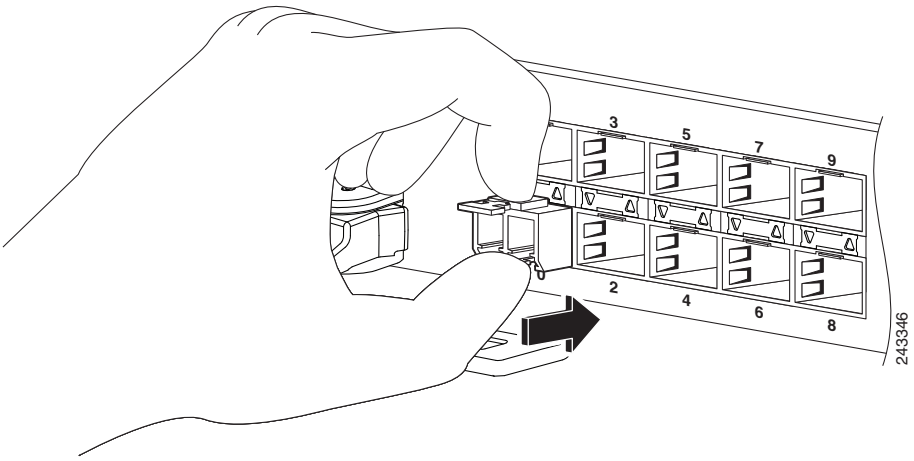
Installing an Actuator Button SFP Module

To install this type of SFP or SFP+ module, follow these steps:

Step 1 Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.

Step 2 Line up the SFP module with the port and slide it in until the actuator button clicks into place (Figure 2-17). Be sure not to press the actuator button as you insert the SFP module because you might inadvertently disengage the SFP module from the port.

Figure 2-17 Installing an Actuator Button SFP or SFP+ Module



Note When installing an SFP module, you should hear a click as the triangular pin on the bottom of the SFP module snaps into the hole in the receptacle, indicating that the module is correctly seated and secured in the receptacle. Verify that the SFP modules are completely seated and secured in their assigned receptacles on the line card by firmly pushing on each SFP module.

Removing an Actuator Button SFP or SFP+ Module

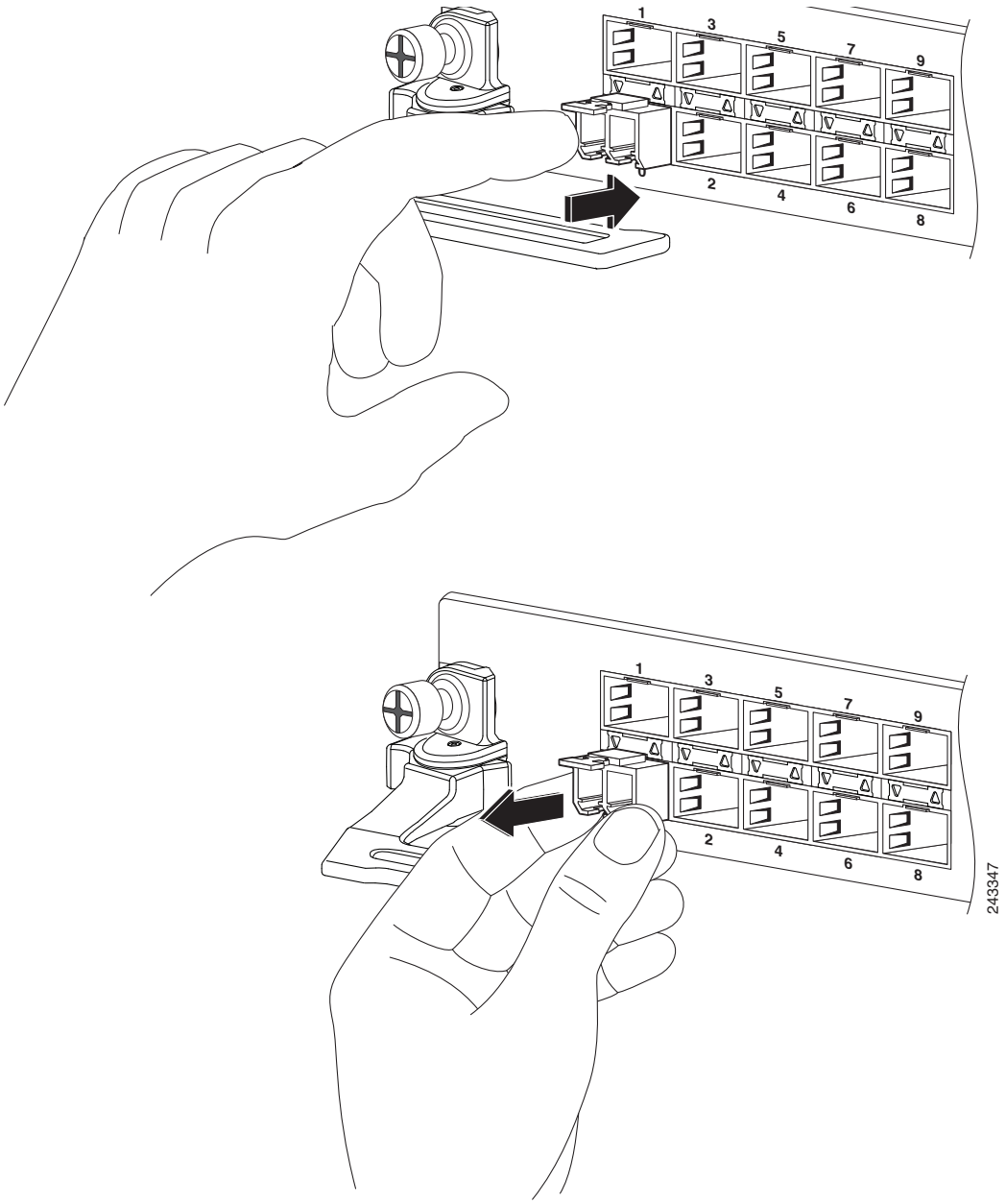
To remove this type of SFP or SFP+ module, follow these steps:

Step 1 Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.

Step 2 Disconnect and remove all interface cables from the ports; note the current connections of the cables to the ports on the line card.

Step 3 Gently press the actuator button on the front of the SFP module until it clicks and the latch mechanism activates, releasing the SFP module from the port (Figure 2-18).

Figure 2-18 Removing an Actuator Button SFP or SFP+ Module from a Port



Step 4 Grasp the actuator button between your thumb and index finger and carefully pull the SFP module from the port.

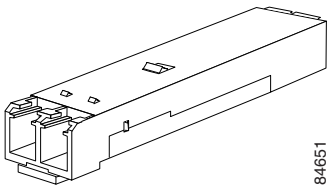
Step 5 Place the removed SFP module on an antistatic mat, or immediately place it in a static shielding bag if you plan to return it to the factory.

Step 6 Protect your line card by inserting clean SFP module cage covers into the optical module cage when there is no SFP module installed.

Slide Tab SFP or SFP+ Module

The slide tab SFP or SFP+ module has a tab underneath the front of the module that you use to disengage the module from a port (Figure 2-19).

Figure 2-19 Slide Tab SFP or SFP+ Module



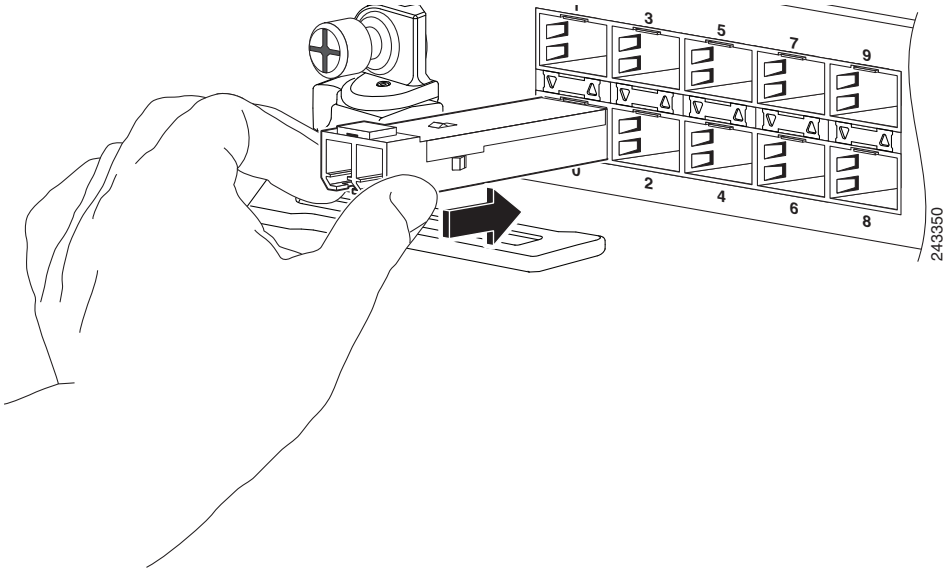
Installing a Slide Tab SFP or SFP+ Module

To install this type of SFP module into a line card, follow these steps:

Step 1 Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.

Step 2 Line up the SFP module with the port and gently push on it until it snaps into the slot tightly (Figure 2-20).

Figure 2-20 Installing a Slide Tab SFP or SFP+ Module



Note When installing an SFP module, you should hear a click as the triangular pin on the bottom of the SFP module snaps into the hole in the receptacle, indicating that the module is correctly seated and secured in the receptacle. Verify that the SFP modules are completely seated and secured in their assigned receptacles on the line card by firmly pushing on each SFP module.

Removing a Slide Tab SFP or SFP+ Module

To remove this type of SFP or SFP+ module, follow these steps:

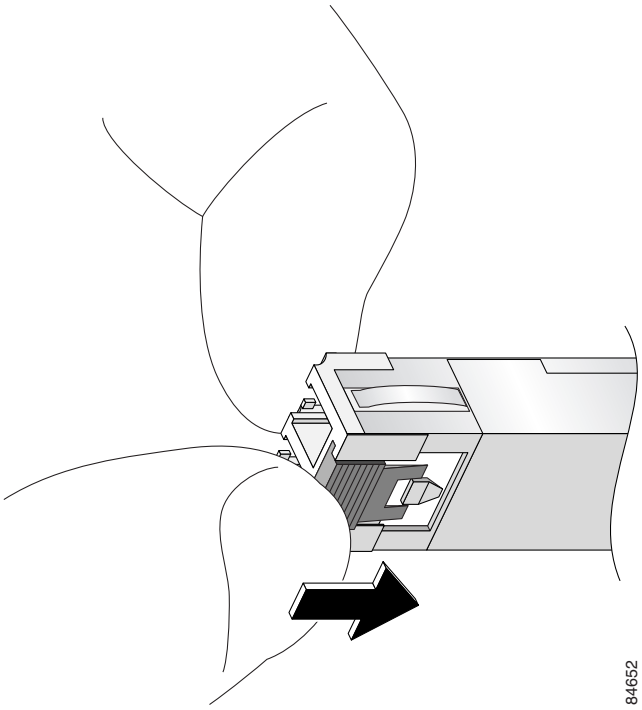
Step 1 Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.

Step 2 Disconnect and remove all interface cables from the ports; note the current connections of the cables to the ports on the line card.

Step 3 Grasp the SFP module between your thumb and index finger.

Step 4 With your thumb, push the slide tab on the bottom front of the SFP module in the direction of the line card to disengage the module from the line card port (Figure 2-21).

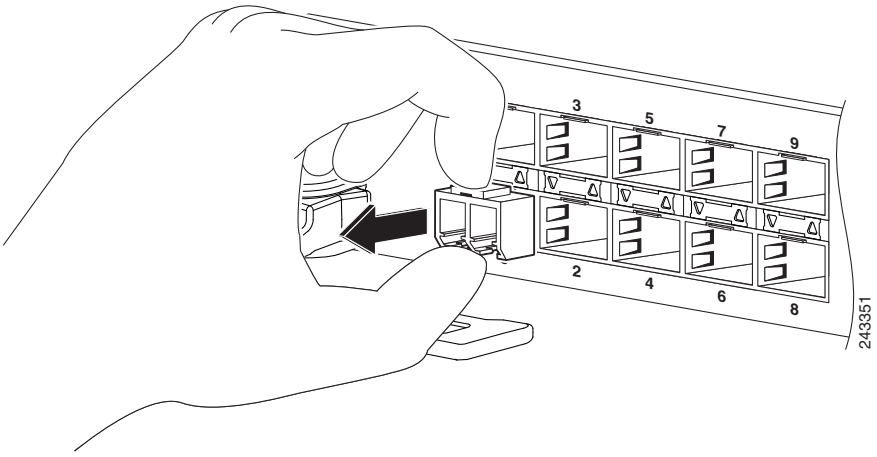
Figure 2-21 Disengaging the Slide Tab



Step 5 With the tab still pushed, carefully pull the SFP module from the port as shown in Figure 2-22.

Caution You must disengage the SFP module by pushing on the slide tab before you can pull out the module. If you pull on the SFP module without disengaging the tab, you can damage the module.

Figure 2-22 Removing a Slide Tab SFP or SFP+ Module



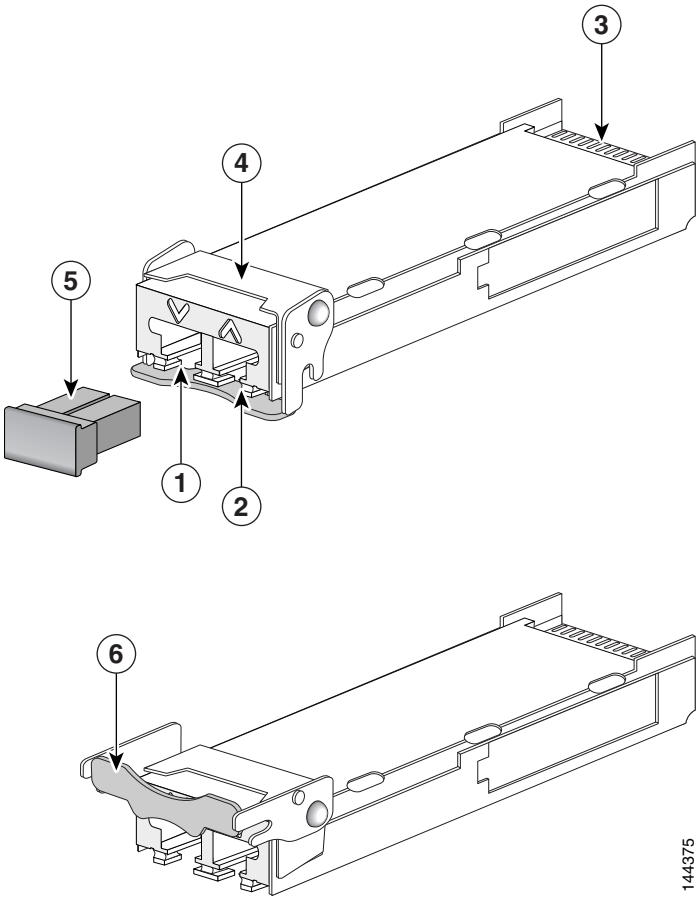
Step 6 Place the removed SFP module on an antistatic mat, or immediately place it in a static shielding bag if you plan to return it to the factory.

Step 7 Protect your line card by inserting clean SFP module cage covers into the optical module cage when there is no SFP module installed.

Installing and Removing XFP Modules

The 10-Gigabit Ethernet(GE) XFP transceiver module is a hot-swappable I/O device that plugs into 10GE ports (Figure 2-23). The XFP transceiver module connects the electrical circuitry of the system with the optical network.

Figure 2-23 10-Gigabit Ethernet XFP Transceiver Module



1	Transmit optical bore	**4**	Bale clasp (locked position)
2	Receive optical bore	**5**	Dust plug
3	Transceiver socket connector	**6**	Bale clasp (unlocked position)

Note The dual LC connector on the XFP transceiver modules supports network interface cables with either Physical Contact (PC) or Ultra-Physical Contact (UPC) polished face types. The dual LC connector on the XFP transceiver modules does not support network interface cables with an Angle Polished Connector (APC) polished face type.

Caution It is strongly recommended that you do not install or remove the XFP module with fiber-optic cables attached to it because of the potential of damaging the cable, the cable connector, or the optical interfaces in the XFP module. Disconnect all cables before removing or installing an XFP module.

Removing and inserting an XFP module can shorten its useful life, so you should not remove and insert XFP modules any more often than is absolutely necessary.

Installing a 10-Gigabit Ethernet XFP Transceiver Module

Caution The XFP transceiver is a static-sensitive device. Always use an ESD wrist strap or similar individual grounding device when handling XFP transceivers or coming into contact with system modules.

To install an XFP transceiver, follow these steps:

Step 1 Remove the XFP transceiver from its protective packaging.

Note Do not remove the optical bore dust plug until directed to do so later in the procedure.

Step 2 Check the label on the XFP transceiver body to verify that you have the correct model for your network.

Step 3 Position the XFP transceiver in front of the XFP socket opening on the module. Slide the XFP transceiver part of the way into the transceiver socket on the system module front panel.

Step 4 Remove the optical bore dust plug from the XFP transceiver.

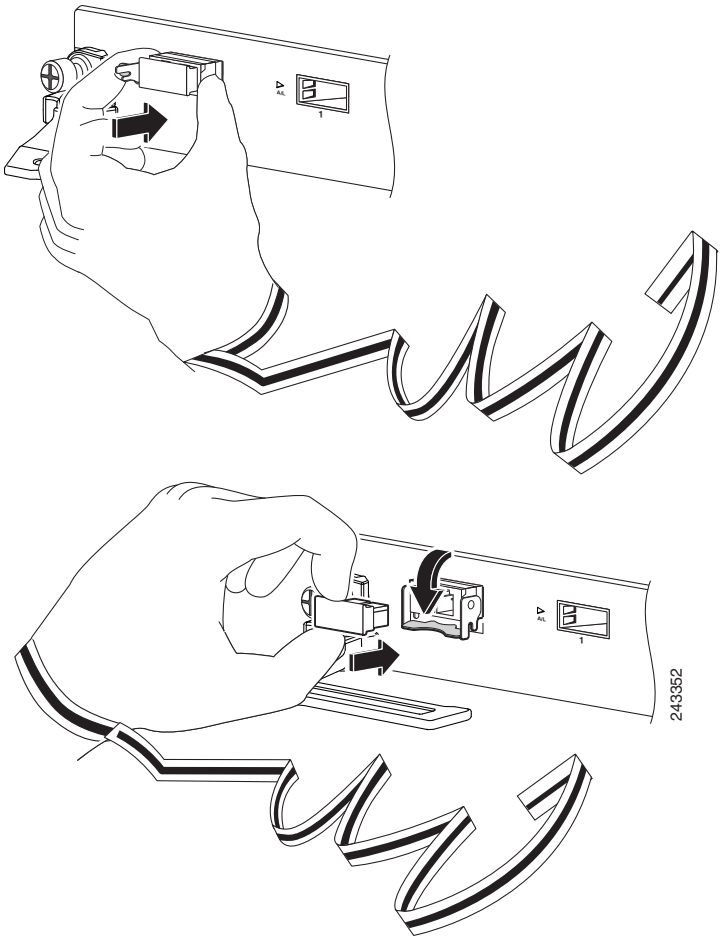
Step 5 Pivot the bale clasp up so that it is parallel with the transceiver body (Figure 2-24).

Step 6 Continue sliding the XFP transceiver into the socket until the XFP transceiver is mated with the transceiver socket connector.

Step 7 Latch the XFP transceiver in the transceiver socket by pivoting the bale clasp down so that the bale clasp is perpendicular to the transceiver body (Figure 2-24).

Caution If the latch is not fully engaged, you may accidentally disconnect the XFP transceiver.

Figure 2-24 Installing the 10-Gigabit Ethernet XFP Transceiver Module



Step 8 Immediately reinstall the dust plug in the XFP transceiver optical bores. Do not remove the dust plug until you are ready to attach the network interface cable.

Note 10-Gigabit XFP transceivers are keyed to prevent incorrect insertion.

Removing a 10-Gigabit Ethernet XFP Transceiver Module

Caution The XFP transceiver is a static-sensitive device. Always use an ESD wrist strap or similar individual grounding device when handling XFP transceivers or coming into contact with modules.

If you are removing an XFP transceiver, follow these steps:

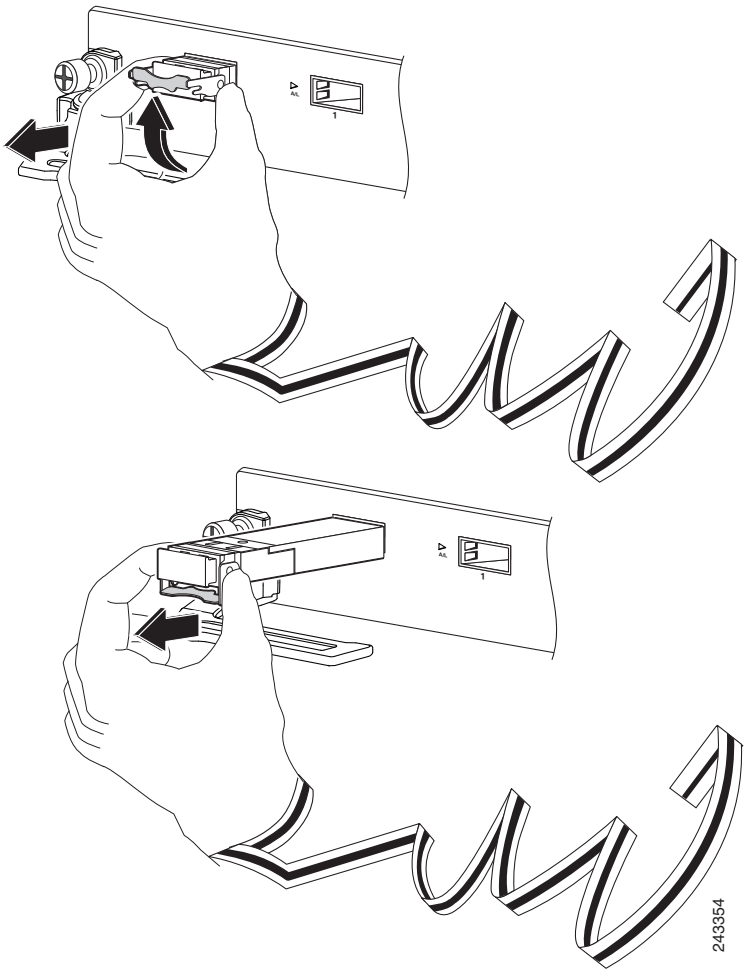
Step 1 Disconnect the network interface cable from the XFP transceiver connectors. Immediately reinstall the dust plug in the fiber-optic cable LC connector.

Step 2 Pivot the XFP transceiver bale clasp up to release the XFP transceiver from the socket (Figure 2-25).

Step 3 Slide the XFP transceiver out of the socket. Pivot the bale clasp down and immediately install the dust plug in the XFP transceiver optical bores (Figure 2-25).

Step 4 Immediately place the XFP transceiver in an antistatic bag.

Figure 2-25 Removing the 10-Gigabit Ethernet XFP Transceiver



Cabling a 10-Gigabit Ethernet XFP Transceiver

Use this procedure to cable 10-Gigabit Ethernet XFP transceivers.

Note Before removing the dust plugs and making any optical connections, follow these guidelines:

- Always keep the protective dust plugs on the unplugged fiber-optic cable connectors and the transceiver optical bores until you are ready to make a connection.
- Always inspect and clean the LC connector end faces just before making any connections. See Cleaning Fiber-Optic Connectors, page 2-73.
- Always grasp the LC connector housing to plug or unplug a fiber-optic cable.

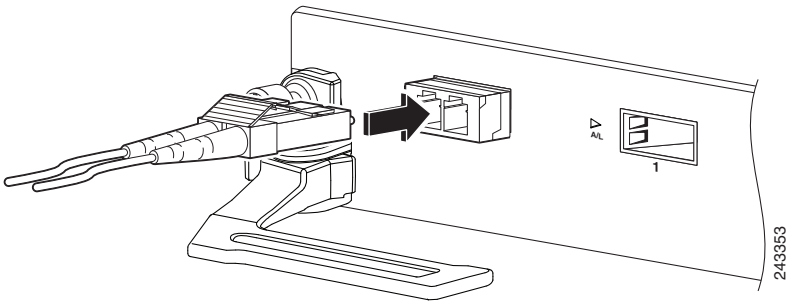
Step 1 Remove the dust plugs from the optical network interface cable LC connectors (Figure 2-24). Save the dust plugs for future use.

Step 2 Inspect and clean the LC connector's fiber-optic end faces.

Step 3 Remove the dust plugs from the XFP transceiver module optical bores.

Step 4 Immediately attach the network interface cable LC connectors to the XFP transceiver module (Figure 2-26) for an illustration of cabling the XFP transceiver module).

Figure 2-26 Cabling a10-Gigabit Ethernet XFP Transceiver Module



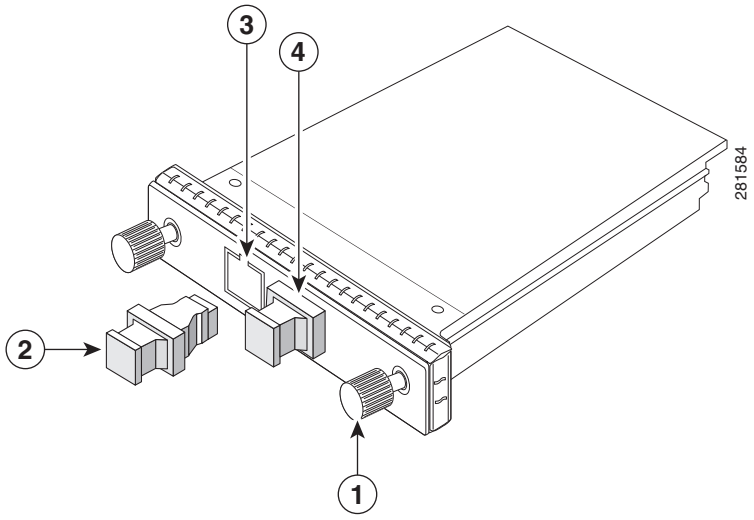
Cisco 100-Gigabit Ethernet CFP Transceiver Modules Installation

This section provides the installation, cabling, and removal instructions for the Cisco 100-Gigabit C Form-factor Pluggable (CFP) transceiver modules. The modules are hot-swappable input/output (I/O) devices that connect the system's module port electrical circuitry with either a copper or a fiber-optic network.

Overview

The 100-Gigabit Ethernet CFP transceivers are hot-swappable I/O devices that plug into 100-Gigabit Ethernet module ports (Figure 2-27).

Figure 2-27 CFP Transceiver



1	Captive installation screws	**2**	Optical bore dust plug
3	Transmit optical bore, SC connector	**4**	Receive optical bore, SC connector

Table 2-3 lists the currently supported types of CFP transceivers.

Table 2-3 CFP Transceiver Product Numbers and Descriptions

CFP Transceiver Module Product Number	Transceiver Description
CFP-100G-LR4	Cisco 100GBASE-LR4 CFP transceiver module for SMF, 1310 nm window, SC connector
CFP-100G-SR10	Cisco 100GBASE-SR10 CFP transceiver module for MMF, 1310 nm window, SC connector

Note The dual SC connectors on the optical CFP transceivers support network interface cables with either Physical Contact (PC) or Ultra-Physical Contact (UPC) flat polished face types. The dual SC connectors on the optical CFP transceivers do not support network interface cables with an Angle Polished Connector (APC) polished face type.

Table 2-4 lists the port cabling and optical transmit and receive specifications for 100-Gigabit CFP transceivers.

Note The minimum cabling distance for the optical CFP transceivers is 6.56 feet (2 meters).

Table 2-4 CFP Transceiver Module Optical Transmit and Receive Specifications

SFP+ Transceiver Module Model	Transceiver Type	Transmit Power (dBm)	Receive Power (dBm)	Transmit and Receive Wavelength (nm)
CFP-100G-LR4	100GBASE-LR4, 1310-nm SMF	4.5 per lane (Max) –4.3 per lane (Min)	4.5 per lane (Max) –10.6 per lane (Min)	Four lanes: 1295.6 1300.1 1304.6 1309.1
CFP-100G-SR10	100GBASE-SR10, 850-nm MMF	-1.0 per lane (Max) -7.6 per lane (Min)	2.4 per lane (Max) –9.5 per lane (Min)	Ten lanes, 840 to 850 nm
CFP-100G-ER4	100GBASE-ER, 1310-nm SMF	2.9 per lane (Max) -2.9 per lane (Min)	4.5 per lane (Max) –20.9 per lane (Min)	Four lanes: 1295.6 1300.1 1304.6 1309.1

Required Tools

You will need these tools to install the CFP transceiver module:

- Small flat-blade screwdriver for removing the CFP transceiver socket cover.
- Wrist strap or other personal grounding device to prevent electro-static discharge (ESD) occurrences.
- Fiber-optic end-face cleaning tools and inspection equipment. For complete information on inspecting and cleaning fiber-optic connections, See Cleaning Fiber-Optic Connectors, page 2-73.

Installing the CFP Transceiver

Caution The CFP transceiver is a static-sensitive device. Always use an ESD wrist strap or similar individual grounding device when handling the CFP transceivers or coming into contact with the modules.

To install a CFP transceiver, follow these steps:

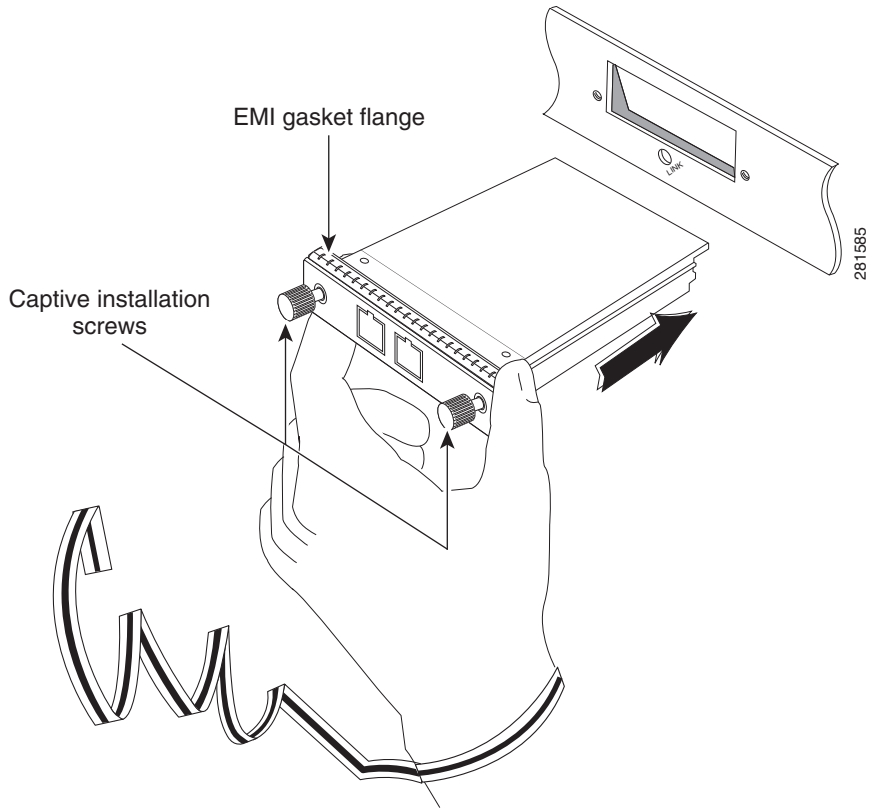
Step 1 Remove the CFP transceiver from its protective packaging.

Step 2 Check the label on the CFP transceiver body to verify that you have the correct model for your network.

Step 3 Remove the dust plug from the CFP transceiver module optical port and set it aside.

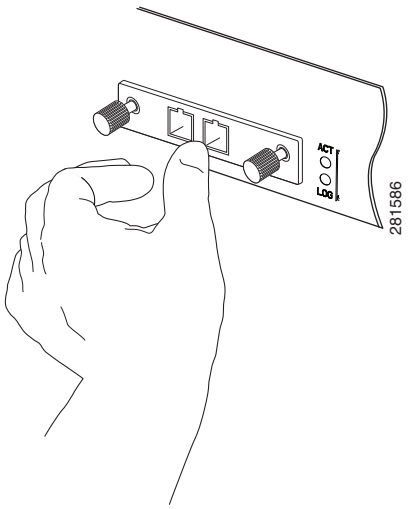
Step 4 Align the CFP device into the transceiver port socket of your networking module, and slide it in until the CFP transceiver EMI gasket flange makes contact with the module faceplate (Figure 2-28).

Figure 2-28 Installing the CFP Transceiver Module



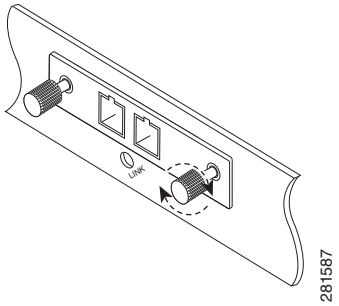
Step 5 Press firmly on the front of the CFP transceiver with your thumb to fully seat it in the transceiver socket. (Figure 2-29.)

Figure 2-29 Seating the CFP Transceiver Module in the Socket



Step 6 Gently tighten the two captive installation screws on the transceiver to secure the CFP transceiver in the socket (Figure 2-30).

Figure 2-30 Securing the CFP Transceiver Module

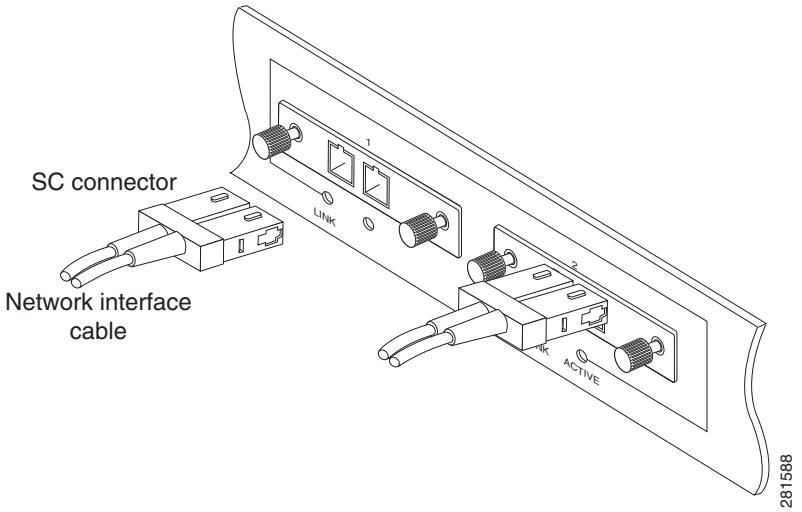


Step 7 Reinstall the dust plug into the CFP transceiver's optical bore until you are ready to attach the network interface cable.

Step 8 When you are ready to attach the network cable interface, remove the dust plugs and inspect and clean fiber connector end faces, and then immediately attach the network interface cable connectors into the CFP transceiver optical bores (Figure 2-31).

For complete information on inspecting and cleaning fiber-optic connections, see Cleaning Fiber-Optic Connectors, page 2-73.

Figure 2-31 Cabling an Optical CFP Transceiver Module with SC Connectors



Removing the CFP Transceiver

Caution The CFP transceiver is a static-sensitive device. Always use an ESD wrist strap or similar individual grounding device when handling the CFP transceivers or coming into contact with the modules.

Warning **Class 1 laser product.** Statement 1008

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

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

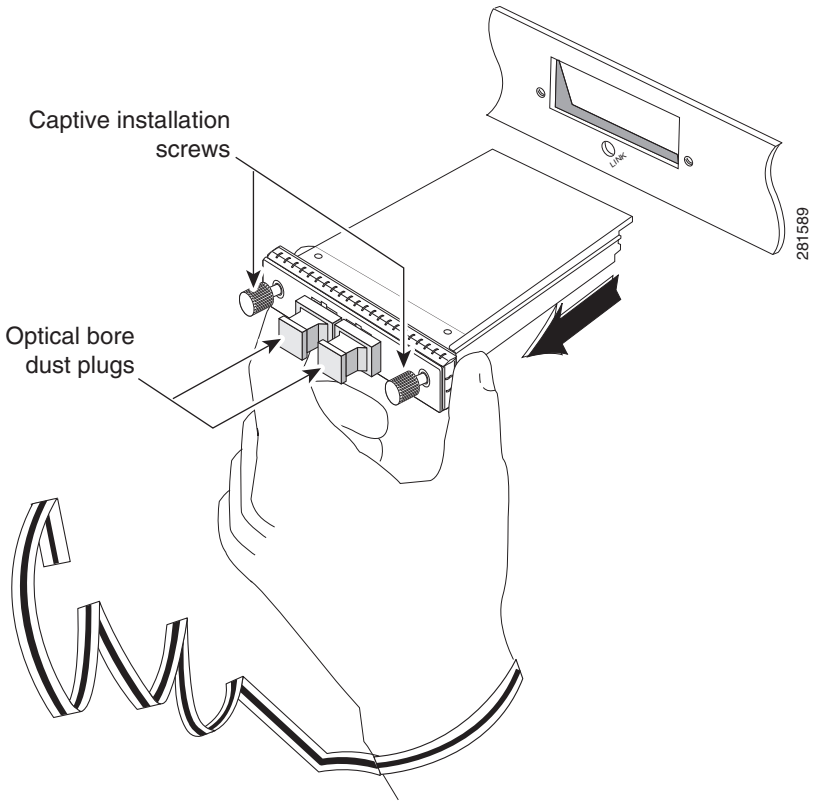
If you need to remove a CFP transceiver, follow these steps:

Step 1 Disconnect the network fiber-optic cable from the CFP transceiver connectors. Immediately reinstall the dust plugs in the CFP transceiver optical bores.

Step 2 Loosen the two captive installation screws that secure the CFP to the networking module.

Step 3 Slide the CFP transceiver out of the module socket (Figure 2-32). Immediately place the CFP transceiver in antistatic protective packaging.

Figure 2-32 Removing a CFP Transceiver Module



Cisco 40-Gigabit QSFP+ Transceiver Modules Installation

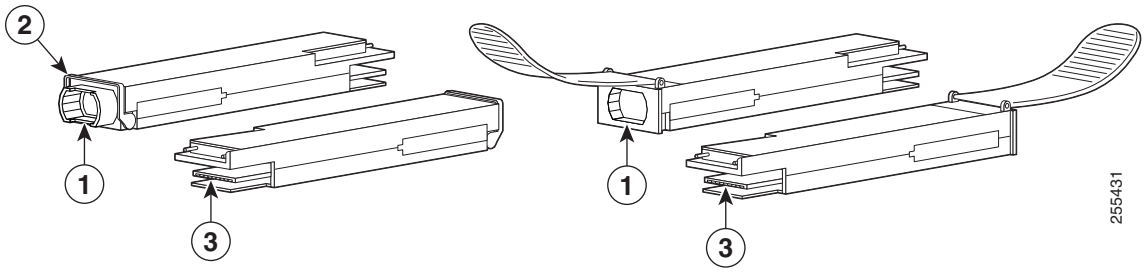
This section provides the installation, cabling, and removal instructions for the 40-Gigabit Quad Small Form-Factor Pluggable Plus (QSFP+) transceiver modules. The modules are hot-swappable input/output (I/O) devices that connect the system's module port electrical circuitry with either a copper or a fiber-optic network.

Overview

The 40-Gigabit (GE) QSFP+ transceiver module is a hot-swappable, parallel fiber-optical module with four independent optical transmit and receive channels. These channels can terminate in another 40-Gigabit QSFP+ transceiver, or the channels can be broken out to four separate 10-Gigabit SFP+ transceivers. The QSFP+ transceiver module connects the electrical circuitry of the system with an optical external network.

Figure 2-33 shows the optical QSFP+ transceiver. The transceiver is used primarily in short reach applications in switches, routers, and data center equipment where it provides higher density than SFP+ modules.

Figure 2-33 40-Gigabit QSFP+ Transceiver Module (Optical)



1	40GBASE QSFP+ transceiver body	**3**	Electrical connection to the module circuitry
2	Bail-clasp latch		

Specifications

For detailed information about Cisco 40GBASE QSFP Modules see the *Cisco 40GBASE QSFP Modules Data Sheet.*

Types of QSFP+ Modules

Table 2-5 lists the QSFP+ transceiver module types.

Table 2-5 40-Gigabit QSFP+ Transceiver Modules

QSFP+ Product Number	Description	Cable Type
QSFP-40G-SR4=	40GBASE-SR4, 4 lanes, 850 nm MMF	MPO
QSFP-40G-LR4=	40GBASE-LR4, 1310 nm, SMF with OTU3 data-rate support	Duplex line card
QSFP-40GE-LR4=	40GBASE LR4, 1310 nm, SMF Ethernet rate only	Duplex line card

QSFP+ Transceiver Port Cabling Specifications

Table 2-6 lists the 40GE optical QSFP+ port cabling specifications.

Table 2-6 QSFP+ Transceiver Port Cabling Specifications

QSFP+ Product Number	Nominal Wavelength (nm)	Cable Type	Core Size (microns)	Modal Bandwidth (MHz/km)	Maximum Cabling Distance
QSFP-40G-SR4=	850	MMF	50.0 50.0	2000 4700	100 m (328 ft) 150 m (492 ft)
QSFP-40G-LR4=	1271 1291 1311 1331	SMF	G.652	-	10km
QSFP-40GE-LR4=	1271 1291 1311 1331	SMF	G.652	-	10 km

QSFP+ 38-Pin Connector Specifications

Table 2-7 lists the 40GE optical QSFP+ 38-pin connector pinouts.

Table 2-7 QSFP+ 38-Pin Connector Specifications

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	GND	11	SCL	21	RX2n	31	Reserved
2	TX2n	12	SDA	22	RX2p	32	GND
3	TX2p	13	GND	23	GND	33	TX3p
4	GND	14	RX3p	24	RX4n	34	TX3n
5	TX4n	15	RX3n	25	RX4p	35	GND
6	TX4p	16	GND	26	GND	36	TX1p
7	GND	17	RX1p	27	ModPrsL	37	TX1n
8	ModSelL	18	RX1n	28	IntL	38	GND
9	LPMode_Reset	19	GND	29	VccTx		
10	VccRx	20	GND	30	Vcc1		

QSFP+ Transceiver Optical Transmit and Receive Specifications

Table 2-8 lists the QSFP+ transceiver modules optical transmit and receive specifications.

Table 2-8 QSFP+ Transceiver Optical Transmit and Receive Specifications

QSFP+ Product Number	Transceiver Operating Mode	Transmit Power (dBm)	Receive Power (dBm)	Transmit and Receive Wavelength (nm)
QSFP-40G-SR4=	40GBASE-SR4, 4 lanes, 850 nm	1 per lane (Max) –7.6 per lane (Min)	2.4 per lane (Max) –9.5 per lane (Min)	850 nm on each lane
QSFP-40G-LR4=	40GBASE-LR4 and OTU3	2.3 per lane (Max) –7 per lane (Min)	2.3 per lane (Max) –13.7 per lane (Min)	Four wavelengths 1271, 1291, 1311 1331
QSFP-40GE-LR4=	40GBASE-LR4	2.3 per lane (Max) –7 per lane (Min)	2.3 per lane (Max) –13.7 per lane (Min)	Four wavelengths 1271, 1291, 1311 1331

Required Tools

You need these tools to install the 40-Gigabit QSFP+ transceiver modules:

- Wrist strap or other personal grounding device to prevent ESD occurrences.
- Antistatic mat or antistatic foam to set the transceiver on.
- Fiber-optic end-face cleaning tools and inspection equipment.

  For complete information on inspecting and cleaning fiber-optic connections, see Cleaning Fiber-Optic Connectors, page 2-73.

Installing the 40-Gigabit QSFP+ Transceiver Module

The QSFP+ transceiver module can have either a bail-clasp latch or a pull-tab latch. Installation procedures for both types of latches are provided.

Caution The QSFP+ transceiver module is a static-sensitive device. Always use an ESD wrist strap or similar individual grounding device when handling QSFP+ transceiver modules or coming into contact with system modules.

To install an QSFP+ transceiver module, follow these steps:

Step 1 Attach an ESD wrist strap to yourself and a properly grounded point on the chassis or the rack.

Step 2 Remove the QSFP+ transceiver module from its protective packaging.

Step 3 Check the label on the QSFP+ transceiver module body to verify that you have the correct model for your network.

Step 4 For optical QSFP+ transceivers, remove the optical bore dust plug and set it aside.

Step 5 For transceivers equipped with a bail-clasp latch:

a. Keep the bail-clasp aligned in a vertical position.

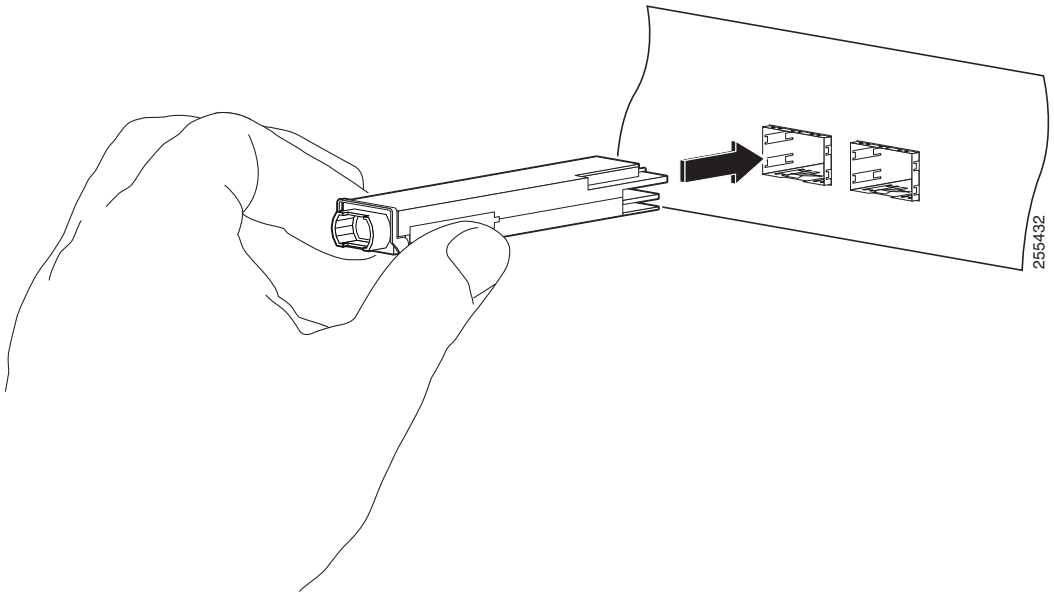
b. Align the QSFP+ transceiver in front of the module's transceiver socket opening and carefully slide the QSFP+ transceiver into the socket until the transceiver makes contact with the socket electrical connector (Figure 2-34).

Step 6 For QSFP+ transceivers equipped with a pull-tab:

a. Hold the transceiver so that the identifier label is on the top.

b. Align the QSFP+ transceiver in front of the module's transceiver socket opening and carefully slide the QSFP+ transceiver into the socket until the transceiver makes contact with the socket electrical connector.

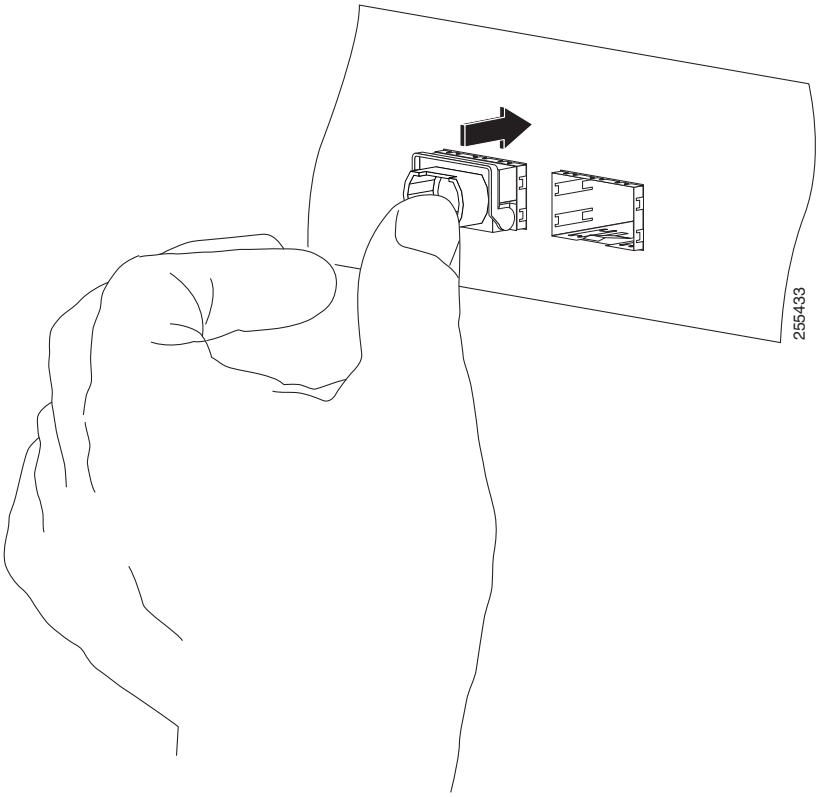
Figure 2-34 Installing the 40-Gigabit QSFP+ Transceiver Module (Optical Transceiver Equipped with a Bail-Clasp Latch Shown)



Step 7 Press firmly on the front of the QSFP+ transceiver with your thumb to fully seat the transceiver in the module's transceiver socket (Figure 2-35).

Caution If the latch is not fully engaged, you might accidentally disconnect the QSFP+ transceiver module.

Figure 2-35 Seating the 40-Gigabit QSFP+ Transceiver Module (Optical Transceiver Equipped with a Bail-Clasp Latch Shown)



Step 8 For optical QSFP+ modules, reinstall the dust plug into the QSFP+ transceivers optical bore until you are ready to attach the network interface cable. Do not remove the dust plug until you are ready to attach the network interface cable.

Attaching the Optical Network Cable

Before removing the dust plugs and making any optical connections, follow these guidelines:

- Keep the protective dust plugs installed in the unplugged fiber-optic cable connectors and in the transceiver optical bores until you are ready to make a connection.
- Inspect and clean the MPO connector end faces just before you make any connections. See the Tip following step 2 in the next procedure for a pointer to a fiber-optic inspection and cleaning white paper.
- Grasp the MPO connector only by the housing to plug or unplug a fiber-optic cable.

Note 40-Gigabit QSFP+ transceiver modules are keyed to prevent incorrect insertion.

Note The multiple-fiber push-on (MPO) connectors on the optical QSFP+ transceivers support network interface cables with either physical contact (PC) or ultra-physical contact (UPC) flat polished face types. The MPO connectors on the optical QSFP+ transceivers do not support network interface cables with an angle-polished contact (APC) face type.

Step 1 Remove the dust plugs from the optical network interface cable MPO connectors. Save the dust plugs for future use.

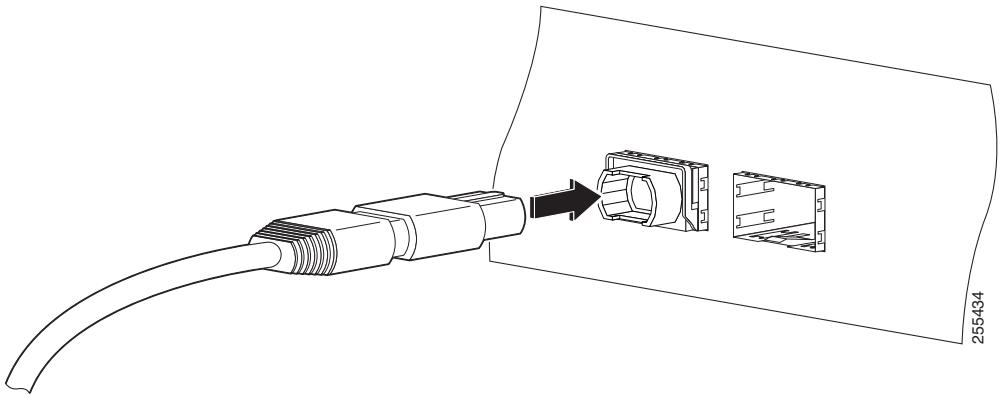
Step 2 Inspect and clean the MPO connector's fiber-optic end faces. See the Tip below for a pointer to a fiber-optic inspection and cleaning white paper.

Note For complete information on inspecting and cleaning fiber-optic connections, see Cleaning Fiber-Optic Connectors, page 2-73.

Step 3 Remove the dust plugs from the QSFP+ transceiver module optical bores.

Step 4 Immediately attach the network interface cable MPO connectors to the QSFP+ transceiver module (Figure 2-36).

Figure 2-36 Cabling a 40-Gigabit QSFP+ Transceiver Module



Removing the 40-Gigabit QSFP+ Transceiver Module

Caution The QSFP+ transceiver module is a static-sensitive device. Always use an ESD wrist strap or similar individual grounding device when handling QSFP+ transceiver modules or coming into contact with modules.

To remove a QSFP+ transceiver, follow these steps:

Step 1 For optical QSFP+ transceivers, disconnect the network interface cable from the QSFP+ transceiver connector.

Step 2 For QSFP+ transceivers equipped with a bail-clasp latch (Figure 2-37, top view):

a. Pivot the bail-clasp down to the horizontal position.

b. Immediately install the dust plug into the transceivers optical bore.

c. Grasp the sides of the QSFP+ transceiver and slide it out of the module socket.

Step 3 For QSFP+ transceivers equipped with a pull tab latch (Figure 2-37, bottom view):

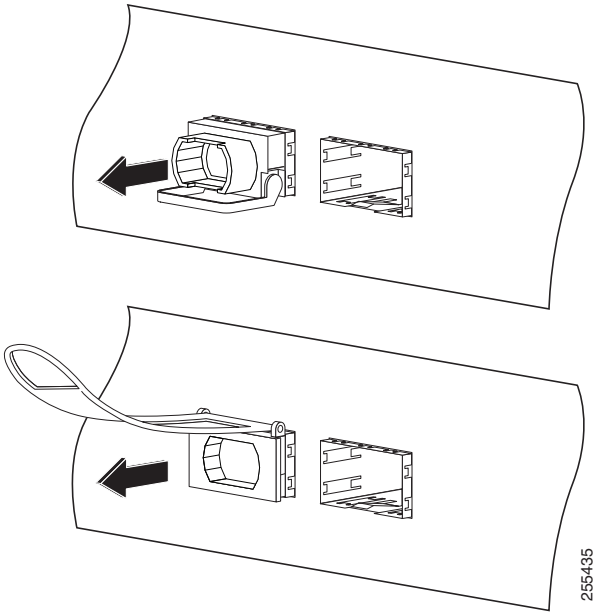
a. Immediately install the dust plug into the transceiver's optical bore.

b. Grasp the tab and gently pull to release the transceiver from the socket.

c. Slide the transceiver out of the socket.

Step 4 Place the QSFP+ transceiver into an antistatic bag.

Figure 2-37 Removing the 40-Gigabit QSFP+ Transceiver Module



Installing and Removing Cisco CPAK Transceiver Modules

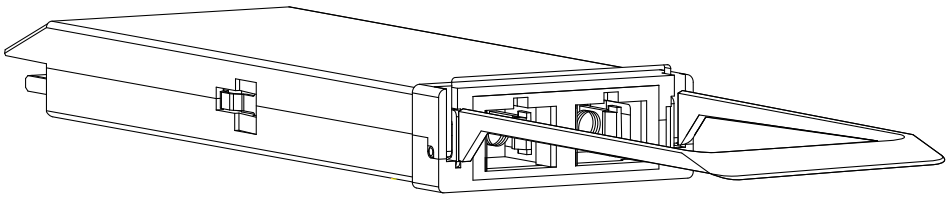
This section provides the installation, cabling, and removal instructions for the CPAK pluggable optical transceiver modules.

Overview

The Cisco CPAK transceiver module is a hot-swappable input/output device that plugs into a Cisco CPAK-module on the 8-port 100-Gigabit Ethernet line card (Figure 1-13).The modules have a total of 82 pins (40 pins on the top row and 42 on the bottom row) on the electrical interface and either a duplex SC or 24 fibers-MPO connector on the optical interface. The following types of CPAK modules are supported:

- Cisco CPAK 100GBASE-LR4 module: Supports link lengths of up to 10 km over standard single-mode fiber (SMF).
- Cisco CPAK 100GBASE-SR10: Supports link lengths of up to 100 m and 150 m on laser-optimized OM3 and OM4 multifiber cables, respectively.
- Cisco CPAK 10x10G-LR module: Supports link lengths of up to 10 km over standard single-mode fiber (SMF).

Figure 2-38 Example of 100-Gigabit Ethernet CPAK Transceiver Module



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CPAK Module Specifications

CPAK Module Cabling Specifications

Table 2-9 provides the cabling specifications for the various CPAK transceiver modules.

Table 2-9 100-Gigabit Ethernet CPAK Module Port Cabling Specifications

CPAK Modules	Wavelength (nm)	Cable Type	Core Size (micron)	Modal Bandwidth (MHz/km)[3]	Cable Distance
CPAK-100G-LR4[1] (4X25G)	1310	SMF (Duplex)	9 micron core SMF per G.652	—	6.2 miles (10 km)
CPAK-10X10G-LR (10X10G)	1310	SMF (MPO-24)	9 micron core SMF per G.652	—	6.2 miles (10 km)
CPAK-100G-SR10	850	MMF (MPO-24)	50.0 50.0	2000 (OM3) 4700 (OM4)	328 feet (100 m) 492 feet (150 m)[2]

1. Minimum cabling distance for -LR4 modules is 6.5 feet (2m), according to the IEEE 802.3ba and uses dual SC/PC connectors.
2. Considered an engineered link with maximum 1dB allocated to connectors and splice loss.
3. Specified at transmission wavelength.

CPAK Module Optical Transmit and Receive Specifications

Table 2-10 lists the CPAK transceiver modules optical transmit and receive specifications.

Table 2-10 CPAK Optical Transmit and Receive Specifications

CPAK Product Number	Transceiver Operating Mode	Transmit Power (dBm)[1]	Receive Power (dBm)[1]	Transmit and Receive Center Wavelength Range (nm)
CPAK-100G-LR4	100GBASE-LR4 1310 nm SMF	Maximum: 4.5 per lane Minimum: -4.3 per lane	Maximum: 4.5 per lane Minimum: -10.6 per lane	Four lanes: 1294.53 to 1296.59 1299.02 to 1301.08 1303.54 to 1305.63 1308.09 to 1310.10
CPAK-10x10G-LR	10x10GBASE-LR	Maximum: -0.5 per lane Minimum: -8.2 per lane	Maximum: 0.5 per lane Minimum: -14.4 per lane	Ten lanes: 260 to 1355 nm
CPAK-100G-SR10	100GBASE-SR10 850 nm SMF	Maximum: -1.0 per lane Minimum: -7.6 per lane	Maximum: 2.4 per lane Minimum: -9.5 per lane	Ten lanes: 850 to 860 nm

1. Transmitter and receiver power are in averages, unless specified.

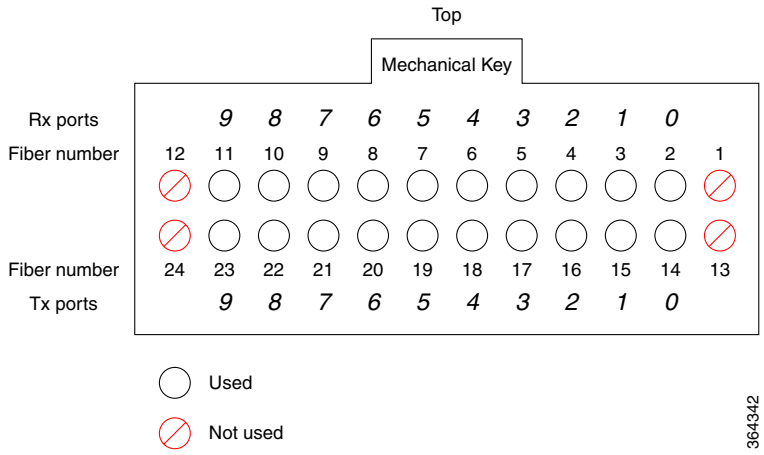
MPO-24 Connector Pin Specifications

Figure 2-39 shows the pinouts and corresponding fiber numbers for the CPAK MPO-24 male connector. Looking into the connector with the mechanical key on top, the fibers are numbered as follows:

- Top row, left to right: Fibers are numbered 12 through 1. Fibers 11, 10, 9, 8, 7, 6, 5, 4, 3, 2 are used for the optical Rx signals (Channel 9 through 0).

- Bottom row, left to right: Fibers are numbered 24 through 13. Fibers 23, 22, 21, 20, 19, 18, 17, 16, 15, and 14 are used for the optical Tx signals (Channels 9 through 0).
- Fibers 1, 12, 13 and 24 are not used.

Figure 2-39 MPO-24 100-Gigabit Connector Pinouts



Required Tools

You need these tools to install the CPAK transceiver modules:

- Wrist strap or other personal grounding device to prevent ESD occurrences.
- Antistatic mat or antistatic foam to set the transceiver on.
- Fiber-optic end-face cleaning tools and inspection equipment.

  For complete information on inspecting and cleaning fiber-optic connections, see Cleaning Fiber-Optic Connectors, page 2-73.

Installing the CPAK Transceiver Module

Caution The CPAK transceiver module is a static-sensitive device. Always use an ESD wrist strap or similar individual grounding device when handling CPAK modules or coming into contact with system modules.

To install a CPAK transceiver module, follow these steps:

Step 1 Attach an ESD wrist strap to yourself and a properly grounded point on the chassis or the rack.

Step 2 Remove the CPAK transceiver module from its protective packaging.

Step 3 Check the label on the CPAK transceiver module to verify that you have the correct model for your network.

Step 4 Remove the optical bore dust plug and set it aside.

Step 5 Align the CPAK transceiver module in front of the module's transceiver socket opening and carefully slide the CPAK transceiver module into the socket until the transceiver makes contact with the socket electrical connector.

Step 6 Press firmly on the front of the CPAK transceiver module with your thumb to fully seat the transceiver in the module's transceiver socket.

Caution If the latch is not fully engaged, you might accidentally disconnect the CPAK transceiver module.

Step 7 Reinstall the dust plug into the CPAK transceiver module optical bore until you are ready to attach the network interface cable. Do not remove the dust plug until you are ready to attach the network interface cable.

Attaching the Optical Network Cable

Before removing the dust plugs and making any optical connections, follow these guidelines:

- Keep the protective dust plugs installed in the unplugged fiber-optic cable connectors and in the transceiver optical bores until you are ready to make a connection.
- Inspect and clean the MPO connector end faces just before you make any connections. See the Tip following step 2 in the next procedure for a pointer to a fiber-optic inspection and cleaning white paper.
- Grasp the MPO connector only by the housing to plug or unplug a fiber-optic cable.

Note For the CPAK-100G-SR10 module, the multiple-fiber push-on (MPO) connectors use network interface cables with either physical contact (PC) or ultra-physical contact (UPC) flat polished face types. The CPAK-10X10G-LR module can only use network interface cables with the angle-polished contact (APC) face type (typical of singlemode fiber MPO assemblies).

Note Cisco also provides a fiber optic breakout panel The breakout panel is an enclosure used to protect and manage fiber optic cables on the Cisco ASR 9000 Series Routers. For detailed instructions on installing and mounting the breakout panel, see the *Cisco Fiber Optic Breakout Panel Installation Guide.*

Step 1 Remove the dust plugs from the optical network interface cable MPO connectors. Save the dust plugs for future use.

Step 2 Inspect and clean the MPO connector's fiber-optic end faces. See Cleaning Fiber-Optic Connectors, page 2-73.

Step 3 Remove the dust plugs from the CPAK module optical bores.

Step 4 Immediately attach the network interface cable MPO connectors to the CPAK module.

Removing the CPAK Transceiver Module

Caution The CPAK transceiver module is a static-sensitive device. Always use an ESD wrist strap or similar individual grounding device when handling CPAK transceiver modules or coming into contact with modules.

To remove a CPAK module, follow these steps:

Step 1 Disconnect the network interface cable from the CPAK module connector.

Step 2 Immediately install the dust plug into the transceiver's optical bore.

Step 3 Grasp the tab and gently pull straight out to release the transceiver from the socket.

Step 4 Slide the transceiver out of the socket.

Step 5 Place the CPAK transceiver into an antistatic bag.

Line Card Cable Management

Cisco ASR 9000 Series Routers include a cable-management system that organizes the interface cables entering and exiting the router, keeping them out of the way and free of sharp bends.

The cable-management system consists of the following separate components:

- A cable-management tray mounted on the Cisco ASR 9010 Router chassis. See the *Cisco ASR 9000 Aggregation Services Router Hardware Installation Guide* for more information.
- A cable-management bracket that attaches to a line card.
- Cable management brackets that attach to the sides of the router chassis (Cisco ASR 9006 Router only)

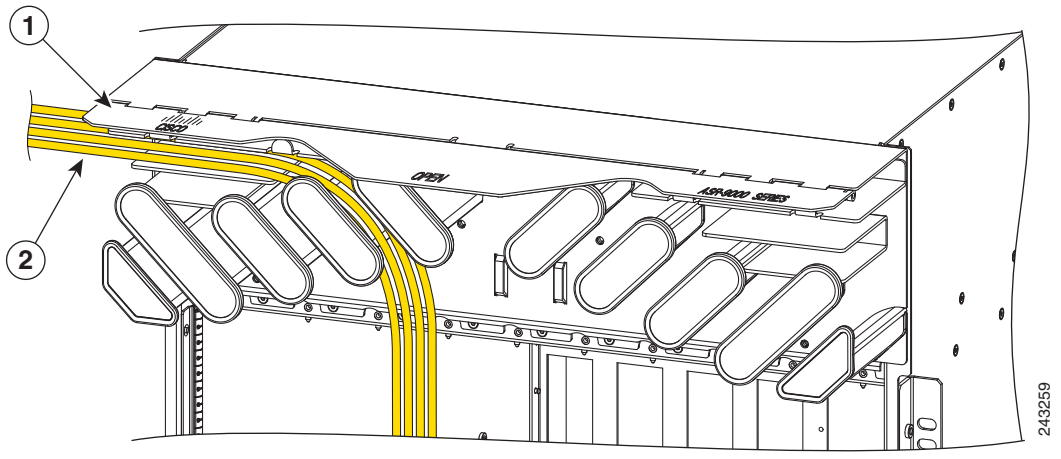
Note The illustrations in this section show one type of line card, but the line card cable-management procedures in this section are the same regardless of the specific line card.

Caution Excessive bending of interface cables can damage the cables.

Cable Management Tray

A cable-management tray is mounted at the top of the Cisco ASR 9010 Router chassis for routing interface cables to the RSP and line cards. Figure 2-40 shows a typical cable routing through the cable-management tray. The tray has a hinged cover that can be raised for greater access to the cable management dividers.

Figure 2-40 Example Cable Routing through the Cisco ASR 9010 Router Cable Management Tray



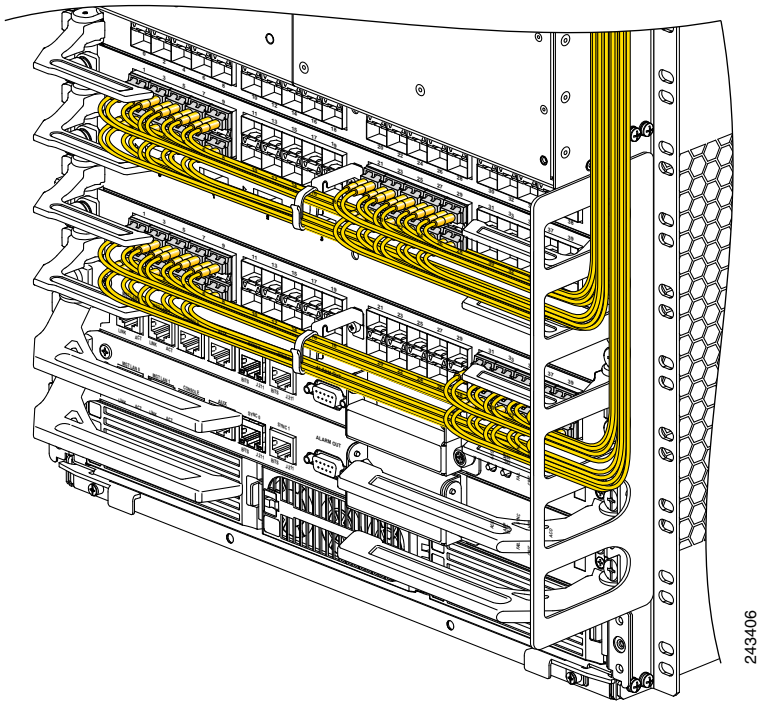
1	Hinged cover (shown in the raised position)	2	Cable bundle routed through the tray

Each line card has its own cable routing slot in the cable management tray. For example, the cables shown in Figure 2-40 are cables being routed to line card 3 in slot 3 in a Cisco ASR 9010 Router.

Router Cable Management Brackets

The Cisco ASR 9006 Router provides for a cable management bracket on each side of the router chassis. Figure 2-41 shows a typical cable routing for the Cisco ASR 9006 Router.

Figure 2-41 Example Cable Routing through Cisco ASR 9006 Router Cable Management Brackets

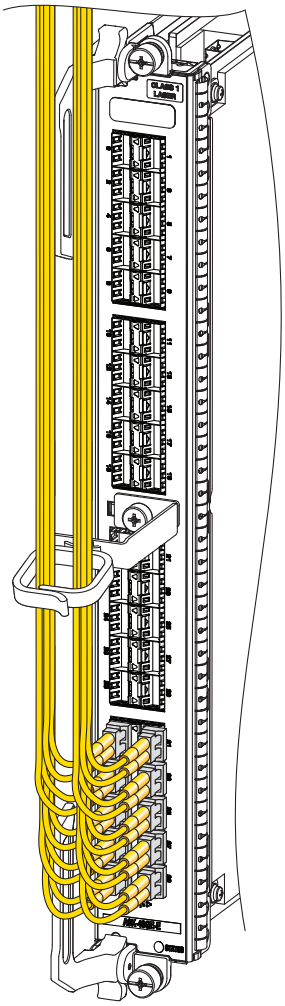


Each line card has its own cable routing slot in the Cisco ASR 9006 Router cable management brackets. For example, the cables shown in Figure 2-41 are cables being routed to line card 0 in slot 3 and line card 2 in slot 5.

Line Card Cable Management Bracket

This section describes the line card cable-management bracket. Figure 2-42 shows the line card cable-management bracket attached to a 40-Port Gigabit Ethernet line card.

Figure 2-42 Cable-Management Bracket



Note When shipped with spare line card orders, the cable-management bracket is not attached to the line card. You must attach the cable-management bracket to the line card before you insert the line card into the router.

Caution Do not use the cable-management bracket as a handle to pull out or push in the line card. The cable-management bracket is designed to hold the interface cables and may break if you use the bracket to push, pull, or carry the line card after it is removed from the router.

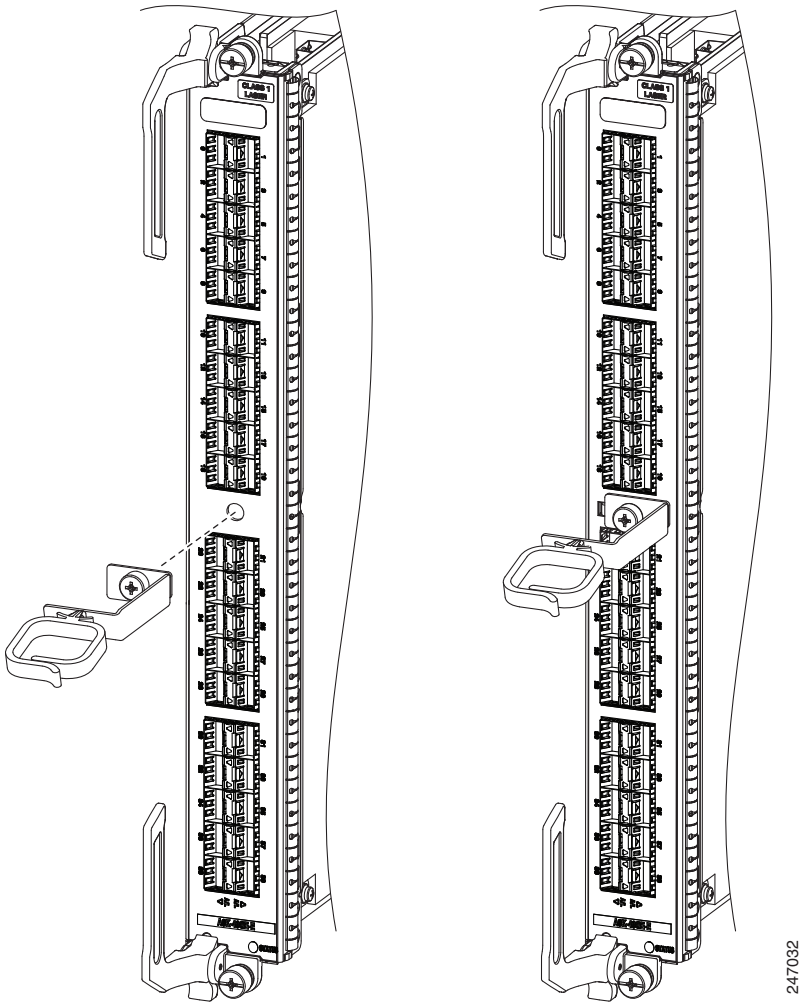
Installing a Line Card Cable Management Bracket

To install a line card cable-management bracket, follow these steps:

Step 1 Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.

Step 2 Position the cable-management bracket over the front of the line card front panel.

Figure 2-43 Cable-Management Bracket Installation and Removal



Step 3 Insert and tighten the captive screw(s) to secure the bracket to the line card (Figure 2-43).

Step 4 Starting with the port on the line card closest to the bracket, connect each interface cable to the intended port (Figure 2-42).

Removing a Line Card Cable-Management Bracket

To remove a line card cable-management bracket, follow these steps (Figure 2-43):

Step 1 Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.

Step 2 Note the current interface cable connections to the ports on each line card.

Step 3 Starting with the interface cable for the bottom port on the line card, disconnect the cable from the line card interface.

Step 4 Repeat Step 3 for all remaining interface cables, proceeding from the bottom ports upward, then proceed to Step 5.

Step 5 Loosen the captive installation screw on the cable-management bracket and remove the bracket from the line card (Figure 2-43).

For information on connecting and disconnecting interface cables, see Installing and Removing Fiber-Optic Interface Cables, page 2-71.

Cables and Connectors

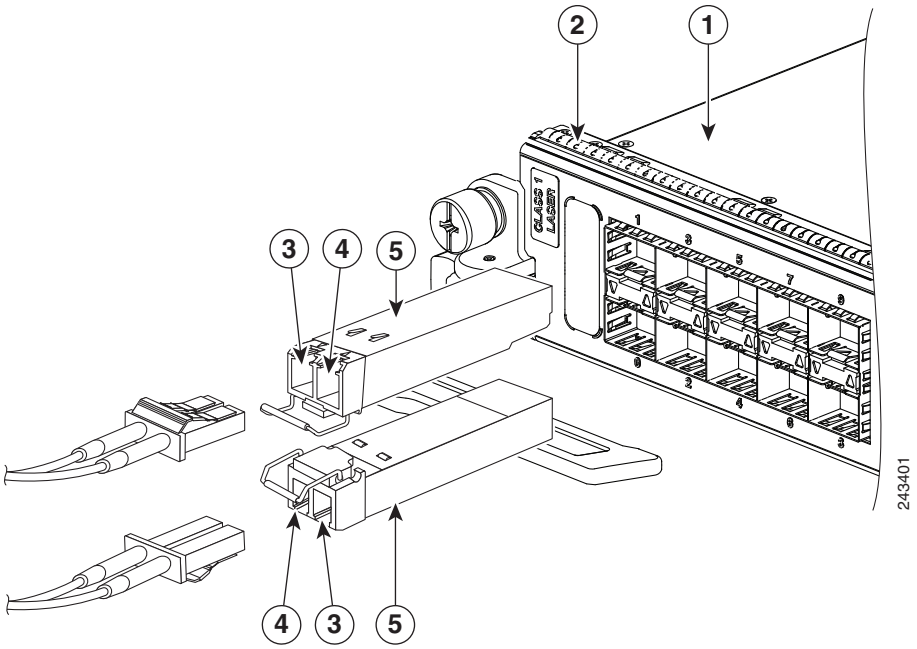
Gigabit Ethernet Interfaces

Gigabit Ethernet SFP Modules

The 40-Port Gigabit Ethernet (GE) line card and the Gigabit Ethernet ports of the 2-Port 10 GE + 20-Port GE combination line card use SFP modules. The Gigabit Ethernet laser optical transceiver module is a field-replaceable small form-factor pluggable (SFP) module that plugs into the receptacle (or cage) located on the line card and provides the Gigabit Ethernet optical interface (Figure 2-44). The module has two optical interfaces—laser transmit (TX) and laser receive (RX)—and an electrical interface (to the line card).

The SFP+ modules used on the 16-Port 10GE oversubscribed line card are enhanced SFP modules.

Figure 2-44 SFP Module and Fiber-Optic Cable



1	Component side of line card	**4**	Receive (RX)
2	EMI gasket	**5**	Top surface of SFP module
3	Transmit (TX)		

For information about which SFP module options are available for the 40-Port Gigabit Ethernet line card and the Gigabit Ethernet ports of the 2-Port 10GE + 20-Port GE combination line card, see Table A-2. For information about which SFP+ module options are available for the 16-Port 10GE oversubscribed line card, see Table A-3.

The SFP modules have LC connectors. The only restriction is that each port must match the specifications on the other end of the cable (short or long wavelength), and must not exceed the recommended cable length for reliable communication.

Fiber-optic transmission specifications identify two types of fiber: single-mode (SMF) and multimode (MMF). The maximum distance for single-mode installations is determined by the amount of light loss in the fiber path. If your environment requires the light to travel close to the typical maximum distance, you should use an optical time domain reflectometer (OTDR) to measure the power loss.

Caution Use only the SFP and SFP+ modules supplied by Cisco Systems, Inc. with your Ethernet line card. Each module contains an internal serial EEPROM that is security-programmed by the module manufacturer with information that provides a way for the Cisco IOS XR software to identify and validate the module as qualified to operate properly with Cisco Ethernet line cards. Unapproved SFP or SFP+ modules (those not purchased directly from Cisco Systems, Inc.) do not work on Ethernet line cards. To verify the version of the installed module, see Verifying the Transceiver Modules, page 3-6.

10-Gigabit Ethernet XFP Modules

The 8-Port 10-Gigabit Ethernet (GE) 2:1 oversubscribed line card, 4-Port 10GE line card, and 8-Port 10GE 80 Gbps line rate card use single-mode fiber-optic cables. The maximum distance for single-mode installations is determined by the amount of light loss in the fiber path. If your environment requires the light to travel close to the typical maximum distance, you should use an OTDR to measure the power loss.

See Cisco 10-Gigabit Ethernet XFP Modules, page A-14 for lists of supported XFP Transceivers.

Fiber-Optic Interface Cables

Depending on the line card (Table 1-1), use a single-mode or multimode fiber-optic interface cable with LC-type connectors to connect an Ethernet interface on the line card in your Cisco ASR 9000 Series Router to another Ethernet interface, router, or switch.

Note Fiber optic cables are not available from Cisco Systems. They can be purchased from cable vendors.

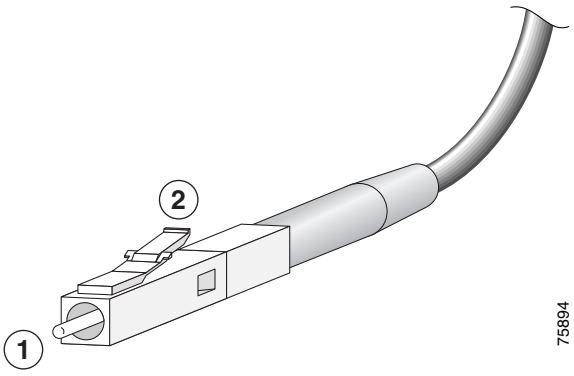
The following types of cables are used with line cards to connect your router to another router or switch:

- Single-mode—Generally yellow in color.
- Multimode—Generally gray or orange in color. Multimode cables are multifiber cables that carry 12 channels of fiber data.
- Lucent connector (LC)—See Figure 2-45 and Figure 2-46.

You can use two cables with simplex connectors, or one cable with dual, keyed connectors.

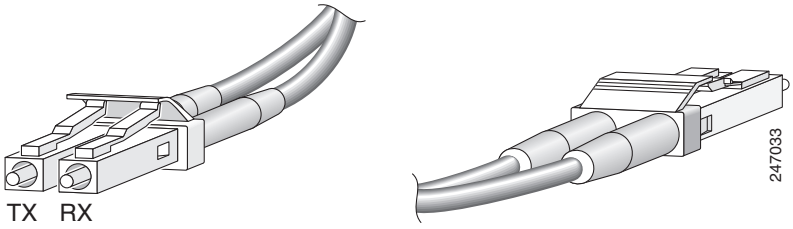
Warning **Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

Figure 2-45 Simplex LC Cable Connector



1	LC connector	2	Spring-action disconnect latch

Figure 2-46 Duplex LC Cable Connector



Note Connectors on the fiber-optic cables must be free of dust, oil, or other contaminants. Before connecting the cable to the line card, carefully clean the fiber-optic connectors using an alcohol wipe or other suitable cleanser. See Cleaning Fiber-Optic Connectors, page 2-73 for more information.

The connector on the cable might be supplied with a dust cover. If it is, remove the dust cover before trying to connect the cable to the line card port.

Installing and Removing Fiber-Optic Interface Cables

This section contains information on installing and removing fiber-optic interface cables to connect your router to another router or switch.

Note Although the line cards differ, the process of installing and removing interface cables is basically the same for each card. Therefore, separate procedures and illustrations are not included in this publication.

Installing Fiber-Optic Interface Cables

To install fiber-optic cables, you can use two LC connectors (Figure 2-45) or one duplex LC connector (Figure 2-46).

Note Optical fiber cables are available from cable vendors. These cables are not available from Cisco.

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

Warning **Class 1 Laser Product.** Statement 1008

Warning **Class 1 LED Product.** Statement 1027

Note Connectors on the fiber-optic cables must be free of dust, oil, or other contaminants. Before connecting the cable to the line card, carefully clean the fiber-optic connectors using an alcohol wipe or other suitable cleanser. See Cleaning Fiber-Optic Connectors, page 2-73 for more information.

To install a cable, follow these steps:

Step 1 Remove the connector dust cover if one is present.

Step 2 Align the connector end of the cable to the appropriate port. Observe the RX and TX cable relationship on the cables.

Step 3 Attach fiber cable between the port in the line card and the device to which the line card is connected.

Step 4 Insert the fiber cable connector until it clicks and locks into place.

Step 5 Repeat these steps until all cabling is complete.

Note The fiber-optic connectors must be free of dust, oil, or other contaminants. Carefully clean the fiber-optic connectors using an alcohol wipe or other suitable cleanser.

Removing Fiber-Optic Interface Cables

To remove line card interface cables, follow these steps:

Step 1 Attach an ESD-preventive wrist or ankle strap to your wrist and follow its instructions for use.

Step 2 Press on the spring-action disconnect latch to disconnect the interface cable connectors from the line card interface ports.

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

Note It is not necessary to remove the interface cables from the line card cable management bracket.

Step 3 Insert a dust plug into the optical port openings of each port that is not being used.

Step 4 Use a screwdriver to loosen the captive installation screw of the line card cable management bracket.

Step 5 Detach the line card cable management bracket and optical fiber cable bundle from the line card and place it carefully out of the way.

Cleaning Fiber-Optic Connectors

Fiber-optic connectors are used to connect two fibers together. When these connectors are used in a communication system, proper connection becomes a critical factor. They can be damaged by improper cleaning and connection procedures. Dirty or damaged fiber-optic connectors can result in communication that is inaccurate or not repeatable.

Fiber-optic connectors differ from electrical or microwave connectors. In a fiber-optic system, light is transmitted through an extremely small fiber core. Because fiber cores are often 62.5 microns or less in diameter, and dust particles range from a tenth of a micron to several microns in diameter, dust and any other contamination at the end of the fiber core can degrade the performance of the connector interface where the two cores meet. Therefore, the connector must be precisely aligned and the connector interface must be absolutely free of foreign material.

Connector loss, or insertion loss, is a critical performance characteristic of a fiber-optic connector. Return loss is also an important factor. *Return loss* specifies the amount of reflected light: the lower the reflection, the better the connection. The best physical contact connectors have return losses of better than –40 dB, but –20 to –30 dB is more common.

The connection quality depends on two factors: the type of connector and the proper cleaning and connection techniques. Dirty fiber connectors are a common source of light loss. Keep the connectors clean at all times, and keep the dust plugs or covers installed when the connectors are not in use.

Before installing any type of cable or connector, use a lint-free alcohol pad from a cleaning kit to clean the ferrule, the protective tube or cone that surrounds the fiber core, and the end-face surface of the fiber core.

As a general rule, any time you detect a significant, unexplained loss of light, clean the connectors. To clean the optical connectors, use a CLETOP fiber optic cleaning cassette and follow the manufacturer's usage instructions.

If a CLETOP cleaning cassette is not available, follow these steps:

Step 1 Use a lint-free tissue soaked in 99 percent pure isopropyl alcohol and gently wipe the end-face of the fiber core. Wait for five seconds for the surfaces to dry and wipe the surfaces a second time.

Step 2 Use clean, dry, oil-free compressed air to remove any residual dust from the connector.

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

Step 3 Use a magnifying glass or inspection microscope to inspect the ferrule at angle. Do not look directly into the aperture. If you detect any contamination, repeat Step 1 and Step 2.

For more information about cleaning fiber-optic connectors, as well as SFP/XFP transceivers, see *Inspection and Cleaning Procedures for Fiber- Optic Connections.*

Type RJ-45 10/100/1000BASE-T Copper Cables

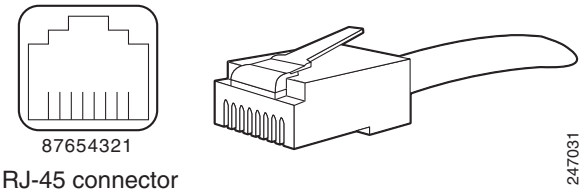
For an Ethernet line card equipped with copper SFP transceivers, use an EIA/TIA–568-compliant cable with MDI wiring and RJ-45 connectors (Figure 2-47) to connect your Cisco ASR 9000 Series Router to another router or switch.

See Table A-2 for information about copper SFP transceivers supported in the Cisco ASR 9000 Series Routers.

Note EIA/TIA–568-compliant cable with MDI wiring and RJ-45 connectors are available from a wide variety of sources. These cables are not available from Cisco Systems, Inc.

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 copper SFP transceiver ports. The shielded cable is terminated by shielded connectors on both ends, with the cable shield material tied to both connectors.

Figure 2-47 RJ-45 Cable Connector



RJ-45 connector

Removing and Installing RJ-45 10/100/1000BASE-T Copper Cables

This section contains information on removing and installing RJ-45 copper cables to connect your router to another router or switch.

Installing RJ-45 Cables

Insert the RJ-45 connector into an open port until the connector clicks and locks into place. Attach one cable between each line card interface and the device to which the line card is connected.

Removing RJ-45 Cables

To remove line card cables, follow these steps:

Step 1 Attach an ESD-preventive wrist or ankle strap to your wrist and follow its instructions for use.

Step 2 Disconnect the interface cable connectors from the line card interface ports.

Note You do not have to remove the interface cables from the line card cable-management bracket.

Step 3 Use a screwdriver to loosen the captive installation screw of the line card cable management bracket.

Step 4 Detach the line card cable management bracket and optical fiber cable bundle from the line card and place it carefully out of the way.

Verifying and Troubleshooting the Line Card Installation

This chapter contains information about the following topics:

Verifying and Troubleshooting Line Card Installation

The following sections provide information about how to verify and troubleshoot line card installations:

Troubleshooting using Cisco IOS XR commands is briefly described in Configuring and Troubleshooting Line Card Interface Cards, page 3-4.

Initial Boot Process

Note All new line cards are designated as *administratively down* by default. Port Status LEDs are off until you configure the interfaces and use the **no shutdown** command.

During a typical line card boot process, the following events occur:

1. The line card receives power and begins executing initialization software.
2. The line card performs internal checks, and prepares to accept the Cisco IOS XR software from the RSP.

3. The RSP loads the line card with its Cisco IOS XR software.

To verify that the line card is working properly:

Step 1 Check that the Card Status LED is on (green) to verify that the card is operating normally.

Step 2 Check that the Port Status LED for the port of interest is on (green or blinking) to verify that the port is active. If the Port Status LED is not on, verify that the associated interface is not shut down.

Step 3 If one of the conditions above is not met, see Advanced Line Card Troubleshooting, page 3-9 to identify any possible problems.

Status LEDs

You can use the Card Status LED or the Port Status LEDs on the line card front panels to verify proper operation or troubleshoot a failure. Table 3-1 describes the port and card status LEDs.

Table 3-1 Port Status and Line Card Status LEDs

Port Status LEDs (one per port)	
Green	Port state is up and a valid physical layer link is established.
Blinking	Line activity is occurring. The LED blinks green-amber-green.
Red	Port is enabled, but there is a link loss or SFP/XFP failure.
Off	Port is administratively shut down.
Card Status LED (one per card)	
Green	Line card has booted properly, and is ready to pass or is passing traffic.
Steady Amber	Line card boot process is underway. When the Cisco IOS XR software finishes loading, the LED turns green.
Blinking Amber	Software configuration error has occurred that prevents the line card from passing traffic. It is possible that the line card is still passing traffic, but there is some degradation.
Red	Line card has encountered a hardware error, and is not passing traffic.
Off	Line card is powered off. The LED might turn off momentarily when switching between the states described above, although the line card has not powered off.

Modular Port Adapter LEDs

The modular port adapters have two types of LEDs: an A/L LED for each individual port and a STATUS LED for the modular port adapter. Table 3-2 describes the modular port adapter LEDs.

Table 3-2 Modular Port Adapter LEDs

LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up. The MPA A/L LED will blink green when there is traffic activity.
	Red	On	Port is enabled and the link is down.
STATUS	Off	Off	Modular port adapter power is not enabled.
	Red	On	Modular port adapter is configure as link down.
	Amber	On	Modular port adapter power is on and there is activity.
	Green	On	Modular port adapter is ready and operational, there is no activity.

Troubleshooting the Installation

Note All new line cards are designated as *administratively down* by default. Status LEDs are off until you configure the interfaces and use the **no shutdown** command.

If the Card Status LED or a Port Status LED does not go on, there is either a problem with the line card installation or a hardware failure. To verify that the line card is installed correctly, follow these steps:

Step 1 If a Port Status LED fails to go on (no activity), but the Card Status LED is on, verify that the initialization sequence has completed successfully. If this is the case, verify that the interface is not shut down. If the interface is not shut down, suspect a circuitry problem with the Port Status LED and contact a service representative for further assistance.

Step 2 If the Card Status LED fails to go on, check the router connections as follows:

a. Verify that the line card board connector is fully seated in the backplane. Loosen the captive installation screws and firmly pivot the ejector levers toward each other until both are parallel to the line card front panel. Tighten the captive installation screws.

b. Verify that all power cords and data cables are firmly connected at both ends.

c. Verify that all components on the card are fully seated and secured to their sockets.

After the line card reinitializes, the Card Status LED on the line card should go on. If the Card Status LED goes on, the installation is complete; if the Card Status LED does not go on, proceed to the next step.

Step 3 If the Card Status LED still fails to go on, remove the line card and try installing it in another available line card slot.

- If the Card Status LED goes on when the line card is installed in the new slot, suspect a failed backplane port in the original line card slot.

- If the Card Status LED still does not go on, halt the installation. Contact a service representative to report the faulty equipment and obtain further instructions.

Step 4 If an error message displays on the console terminal during the line card initialization, see the appropriate reference publication for error message definitions.

If you experience other problems that you cannot solve, contact a Cisco service representative for assistance.

Note If you perform online insertion or removal of the SFP or XFP module without shutting down the interface, a warning message is displayed on the console device.

Configuring and Troubleshooting Line Card Interface Cards

After the person who installed the hardware verifies that the new line card is installed correctly by examining the LEDs, the network administrator can configure the new interface. The following sections provide information on configuring and troubleshooting the line cards:

Configuration Parameters

Table 3-3 lists the default interface configuration parameters that are present when an interface is enabled on a Gigabit Ethernet or 10-Gigabit Ethernet line card. See Cisco IOS XR software documentation for complete information about these parameters.

Table 3-3 Line Card Configuration Default Values

Parameter	Configuration File Entry	Default Value
Flow control	flow-control	egress on ingress off
MTU	mtu	1514 bytes for normal frames 1518 bytes for IEEE 802.1Q tagged frames 1522 bytes for Q-in-Q frames
MAC address	mac address	Hardware burned-in address (BIA)

Line Card Interface Address

A Cisco ASR 9000 Series Router identifies an interface address by its rack number, line card slot number, instance number, and port number, in the format *rack/slot/instance/port*. The *rack* parameter is reserved for multirack systems, so it is always 0 (zero) for the Cisco ASR 9000 Series. The line card slots are numbered from 0 to 7 (Cisco ASR 9010 Router) or 0 to 3 (Cisco ASR 9006 Router).

Instance numbers are reserved for cards that have subslots. This parameter is currently always 0 (zero) for line cards in the Cisco ASR 9000 Series. The ports on the line card are numbered 0, 1, 2, and so on. For example, the *rack/slot/instance/port* address of the fourth port of a line card installed in line card slot 1 is 0/1/0/3. Even if the line card contains only one port, you must use the *rack/slot/instance/port* notation.

Using Configuration Commands

The command line interface (CLI) for Cisco IOS XR software is divided into different command modes. To configure a line card, you enter the correct mode and then enter the commands you need.

When you first log in, you are automatically in EXEC mode. Next, enter the **configure** command to access configuration mode. Then, enter the **interface** command to enter interface configuration mode and specify the interface. You are now in the command mode where you can configure the new interface. Be prepared with the information you will need, such as the interface IP address.

Basic Line Card Configuration

The following procedure is for creating a basic configuration—enabling an interface and specifying IP routing. You might also need to enter other configuration subcommands, depending on the requirements for your system configuration.

The following example shows one way to configure the basic parameters of a line card:

Step 1 Enter EXEC mode:

```
Username: username
Password: password
RP/0/RSP0/CPU0:router#
```

Step 2 Check the status of each port by entering the **show interface** command:

```
RP/0/RSP0/CPU0:router# show interface
```

Step 3 Enter global configuration mode and specify that the console terminal will be the source of the configuration commands:

```
RP/0/RSP0/CPU0:router# configure terminal
```

Step 4 At the prompt, specify the new interface to configure by entering the **interface** command, followed by the *type* (for example, **gigabitethernet** or **tengige**) and *rack/slot/instance/port* (line card rack, slot number, subslot number, port number). Remember that Cisco ASR 9000 Series rack and subslot values are always 0 (zero). For example, to configure port 4 on an 8-Port 10-Gigabit Ethernet line card in line card slot 1:

```
RP/0/RSP0/CPU0:router# interface tengige 0/1/0/3
```

You are now in interface configuration mode.

Step 5 Assign an IP address and subnet mask to the interface with the **ipv4 address** configuration subcommand, as in the following example:

```
RP/0/RSP0/CPU0:router(config-if)# ipv4 address 10.1.2.3 255.255.255.0
```

Step 6 Change the shutdown state to up and enable the interface:

```
RP/0/RSP0/CPU0:router(config-if)# no shutdown
```

The **no shutdown** command passes an **enable** command to the line card. It also causes the line card to configure itself based on the most recent configuration commands received by the line card.

Step 7 If you want to disable the Cisco Discovery Protocol (CDP), which is not required, use this command:

```
RP/0/RSP0/CPU0:router(config-if)# no cdp
```

Step 8 Add any other configuration subcommands required to enable routing protocols and adjust the interface characteristics. Examples of such subcommands are:

```
RP/0/RSP0/CPU0:router(config-if)# flow-control ingress
RP/0/RSP0/CPU0:router(config-if)# mtu 1448
RP/0/RSP0/CPU0:router(config-if)# mac-address 0001.2468.ABCD
```

Step 9 When you have included all the configuration subcommands to complete the configuration, enter the **commit command to commit all changes you made to the running configuration.**

```
RP/0/RSP0/CPU0:router(config-if)# commit
```

Step 10 **Enter Ctrl-Z** to exit configuration mode. If you did not enter the **commit** command, you will be prompted to do so:

```
RP/0/RSP0/CPU0:router(config-if)#
Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:
```

Answer **yes** to commit, **no** to exit without a commit, or **cancel** to cancel the exit (default).

Step 11 Write the new configuration to memory:

```
RP/0/RSP0/CPU0:router# copy run disk0:/config/running/alternate_cfg:/router.cfg
Destination file name (control-c to abort): [/router.cfg]?
The destination file already exists. Do you want to overwrite? [no]: yes
Building configuration.
223 lines built in 1 second
[OK]
```

The system displays an OK message when the configuration has been stored.

Verifying the Transceiver Modules

Use the **show inventory all** command to display SFP or XFP module information for all transceiver modules currently installed in the router. To display SFP or XFP module information for a particular module, you can use the **show inventory location <*slot ID*> command.**

The output of these commands lists such information as the slot ID, transceiver type, description, product ID, version, and serial number.

For example, to list module information for all modules in the router:

```
RP/0/RSP0/CPU0:router# show inventory all
NAME: "module 0/RSP0/CPU0", DESCR: "ASR9K Fabric, Controller, 4G memory"
PID: A9K-RSP-4G         , VID: V01, SN: P3B-2
```

```
NAME: "module compact-Flash 0/RSP0/CPU0", DESCR: " CompactFlash"
PID: cFLASH            , VID: N/A, SN: 000000000301

NAME: "module 0/1/CPU0", DESCR: "40-Port GE Line Card, Requires SFPs"
PID: A9K-40GE-B        , VID: V01, SN: FOC123081J6

NAME: "module mau 0/1/CPU0/2", DESCR: "1000BASE-SX SFP (DOM), MMF, 550/220m"
PID: SFP-GE-S          , VID: V01 , SN: FNS12210HLY

NAME: "module mau 0/1/CPU0/3", DESCR: "1000BASE-SX SFP (DOM), MMF, 550/220m"
PID: SFP-GE-S          , VID: V01 , SN: FNS12210HMJ

NAME: "module mau 0/1/CPU0/7", DESCR: "1000BASE-SX SFP (DOM), MMF, 550/220m"
PID: SFP-GE-S          , VID: V01 , SN: FNS12210HM4

NAME: "module mau 0/1/CPU0/8", DESCR: "1000BASE-SX SFP (DOM), MMF, 550/220m"
PID: SFP-GE-S          , VID: V01 , SN: FNS12210HML

NAME: "module mau 0/1/CPU0/18", DESCR: "1000BASE-SX SFP (DOM), MMF, 550/220m"
PID: SFP-GE-S          , VID: V01 , SN: FNS123605YZ

NAME: "module mau 0/1/CPU0/23", DESCR: "1000BASE-SX SFP (DOM), MMF, 550/220m"
PID: SFP-GE-S          , VID: V01 , SN: FNS12210HM6

NAME: "module mau 0/1/CPU0/30", DESCR: "1000BASE-SX SFP (DOM), MMF, 550/220m"
PID: SFP-GE-S          , VID: V01 , SN: FNS123605ZX

NAME: "module mau 0/1/CPU0/31", DESCR: "1000BASE-SX SFP (DOM), MMF, 550/220m"
PID: SFP-GE-S          , VID: V01 , SN: FNS123605YW

NAME: "module 0/4/CPU0", DESCR: "8-Port 10GE DX Line Card, Requires XFPs"
PID: A9K-8T/4-B        , VID: V1D, SN: FOC123081JA

NAME: "module mau 0/4/CPU0/0", DESCR: "Multirate 10GBASE-LR and OC-192/STM-64 S"
PID: XFP-10GLR-OC192SR  , VID: V02, SN: ONT1207108S

NAME: "module mau 0/4/CPU0/1", DESCR: "Multirate 10GBASE-LR and OC-192/STM-64 S"
PID: XFP-10GLR-OC192SR  , VID: V02, SN: ONT1211104V

NAME: "module mau 0/4/CPU0/3", DESCR: "Multirate 10GBASE-LR and OC-192/STM-64 S"
PID: XFP-10GLR-OC192SR  , VID: V02, SN: ONT121110NF

NAME: "module mau 0/4/CPU0/5", DESCR: "Multirate 10GBASE-LR and OC-192/STM-64 S"
PID: XFP-10GLR-OC192SR  , VID: V02, SN: ONT121110LW

RP/0/RSP0/CPU0:router#
```

To list module information for a single transceiver module:

```
RP/0/RSP0/CPU0:router# show inventory location 0/4/CPU0/0
NAME: "module 0/4/CPU0", DESCR: "8-Port 10GE DX Line Card, Requires XFPs"
PID: A9K-8T/4-B        , VID: V1D, SN: FOC123081JA

NAME: "module mau 0/4/CPU0/0", DESCR: "Multirate 10GBASE-LR and OC-192/STM-64 S"
PID: XFP-10GLR-OC192SR  , VID: V02, SN: ONT1207108S

RP/0/RSP0/CPU0:router#
```

The following example lists SFP+ module information for two 16-Port 10GE line cards:

```
RP/0/RSP0/CPU0:router# show inventory all
Tue Mar 23 18:10:17.401 UTC
NAME: "module 0/RSP0/CPU0", DESCR: "ASR9K Fabric, Controller, 4G memory"
PID: A9K-RSP-4G        , VID: V01, SN: FOC1319825E

NAME: "module compact-Flash 0/RSP0/CPU0", DESCR: " CompactFlash"
PID: cFLASH            , VID: N/A, SN: 000000000301

NAME: "module 0/0/CPU0", DESCR: "16-Port 10GE DX Medium Queue Line Card, Requires SFPs"
PID: A9K-16T/8-B       , VID: V01, SN: FOC135180R6

NAME: "module mau GigabitEthernet0/0/CPU0/5", DESCR: "10GBASE-LR SFP+ Module for SMF"
PID: SFP-10G-LR        , VID: N/A, SN: ECL121900JA

NAME: "module mau GigabitEthernet0/0/CPU0/13", DESCR: "10GBASE-LR SFP+ Module for SMF"
PID: SFP-10G-LR        , VID: V01 , SN: ECL1338022R

NAME: "module 0/2/CPU0", DESCR: "16-Port 10GE DX Medium Queue Line Card, Requires SFPs"
PID: A9K-16T/8-B       , VID: V01, SN: FOC135180R9

NAME: "module mau GigabitEthernet0/2/CPU0/0", DESCR: "10GBASE-LR SFP+ Module for SMF"
PID: SFP-10G-LR        , VID: N/A, SN: ECL121900JZ

NAME: "module mau GigabitEthernet0/2/CPU0/1", DESCR: "10GBASE-LR SFP+ Module for SMF"
PID: SFP-10G-LR        , VID: N/A, SN: ECL121900JY

NAME: "module mau GigabitEthernet0/2/CPU0/3", DESCR: "10GBASE-LR SFP+ Module for SMF"
PID: SFP-10G-LR        , VID: V01 , SN: ONT132600B5

NAME: "module mau GigabitEthernet0/2/CPU0/5", DESCR: "10GBASE-LR SFP+ Module for SMF"
PID: SFP-10G-LR        , VID: V01 , SN: ECL132603DM

NAME: "module mau GigabitEthernet0/2/CPU0/7", DESCR: "10GBASE-LR SFP+ Module for SMF"
PID: SFP-10G-LR        , VID: N/A, SN: ECL121900JM

NAME: "module mau GigabitEthernet0/2/CPU0/8", DESCR: "10GBASE-LR SFP+ Module for SMF"
PID: SFP-10G-LR        , VID: N/A, SN: ECL121900KS

NAME: "module mau GigabitEthernet0/2/CPU0/9", DESCR: "10GBASE-LR SFP+ Module for SMF"
PID: SFP-10G-LR        , VID: N/A, SN: ECL121900KN

NAME: "module mau GigabitEthernet0/2/CPU0/10", DESCR: "10GBASE-LR SFP+ Module for SMF"
PID: SFP-10G-LR        , VID: N/A, SN: ECL121900JJ

NAME: "module mau GigabitEthernet0/2/CPU0/14", DESCR: "10GBASE-LR SFP+ Module for SMF"
PID: SFP-10G-LR        , VID: N/A, SN: ECL121900JR

RP/0/RSP0/CPU0:router
```

Advanced Line Card Troubleshooting

This section briefly describes advanced troubleshooting commands that can be used if a line card fails.

Note This section assumes that you possess basic proficiency in the use of Cisco IOS XR software commands.

By using the commands listed in this section, you should be able to determine the nature of the problems you are having with your line card. The first step is to identify the cause of the line card failure or console errors that you are seeing.

To discover which card may be at fault, it is essential to collect the output from the following commands:

- **show logging**
- **show diag** *slot*
- **show context location** *slot*

Along with these **show** commands, you should also gather the following information:

- Console Logs and Syslog Information—This information is crucial if multiple symptoms are occurring. If the router is configured to send logs to a Syslog server, you may see some information on what has occurred. For console logs, it is best to be directly connected to the router on the console port with logging enabled.
- Additional Data—The **show tech-support** command is a compilation of many different commands, including **show version**, **show running-config**, **show tech ethernet**, **show tech pfi**, and **show stacks**. This information is required when working on issues with the Cisco Technical Assistance Center (Cisco TAC).

For examples of how to use these commands and the resulting output, see the *Cisco ASR 9000 Series Troubleshooting Guide*.

Note It is important to collect the **show tech-support** command data before doing a reload or power cycle. Failure to do so can cause all information about the problem to be lost. Output from these commands varies slightly depending on which line card you are using, but the basic information is the same.

Regulatory, Compliance, and Safety Information

This section contains information on laser safety.

For other regulatory, compliance, and safety information, including translated safety warnings, see the *Cisco ASR 9000 Series Aggregation Services Router Regulatory Compliance and Safety Information*.

Laser Safety

Single-mode Ethernet line cards (all of the line cards) are equipped with a Class 1 laser. Multimode Ethernet line cards (Gigabit Ethernet) are equipped with a Class 1 LED. These devices emit invisible radiation. Do not stare into operational line card ports. The following laser warnings apply to the line cards:

General Laser Warning

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

Class 1 Laser Product Warning (Single-mode)

Warning **Class 1 Laser Product.** Statement 1008

Class 1 LED Product Warning (Multimode)

Warning **Class 1 LED Product (Multimode).** Statement 123

Technical Specifications

This appendix lists the specifications for the Ethernet line cards for the Cisco ASR 9000 Series Aggregation Services Router.

Cisco ASR 9000 Series Routers Environmental Specifications

Table A-1 lists the environmental specifications for the Cisco ASR 9000 Series Router.

Table A-1 Cisco ASR 9000 Series Environmental Specifications

Description	Value
Operating Temperature:[1]	41° to 104°F (5° to 40°C)
Operating Temperature[1,2] (Short term)[3,4]:	23° to 131° F (–5° to 55°C)
Nonoperating Temperature	–4° to 149°F (–20° to 65°C)
Humidity	Operating: 10 to 85 percent noncondensing Nonoperating: 5 to 95 percent noncondensing
Altitude[5]	Operating: 0 to 13,000 ft (0 to 4,000 m) Nonoperating: 0 to 15,000 ft (0 to 4,570 m)
Power Dissipation (Cisco ASR 9010 Router)	7600 W maximum
Power Dissipation (Cisco ASR 9006 Router)	4556 W maximum
Acoustic noise	78 dB at 80.6°F (27°C) maximum
Shock	Operating (halfsine): 21 in/sec (0.53 m/sec) Nonoperating (trapezoidal pulse): 20 G[6], 52 in/sec (1.32 m/sec)
Vibration	Operating: 0.35 Grms[7] from 3 to 500 Hz Nonoperating: 1.0 Grms from 3 to 500 Hz

1. Operating temperature specifications for the router will differ from those listed in this table when 40-port Gigabit Ethernet line cards using GLC-GE-100FX SFP transceiver modules are installed in the router. This is due to the lower temperature specifications of the SFP module. Please contact a Cisco representative for more information.
2. Short term operating temperature specifications for the router will differ from those listed in this table when the 16-port 10-Gigabit Ethernet line card is installed in the router because of the lower temperature specifications of the SFP+ modules that are used in this line card. When using this line card, the maximum operating temperature is 104°F (40°C).
3. Short-term refers to a period of not more than 96 consecutive hours and a total of no 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.).
4. The 24 port 10 Gigabit Ethernet linecard requires high temperature optics to run in the extended temperature range.
5. Operating altitude specifications for the router will differ from those listed in this table when the 16-port 10-Gigabit Ethernet line card is installed in the router. When using the SFP-10G-SR module, the maximum altitude is 5905 ft (1800 m). When using the SFP-10G-LR or SFP-10G-ER modules, the maximum altitude is sea level.
6. G is a value of acceleration, where 1G equals 32.17 ft/sec^2 (9.81 m/sec^2).
7. Grms is the root mean square value of acceleration.

Cisco Fast Ethernet and Gigabit Ethernet SFP Modules

Table A-2 lists the supported Cisco Fast Ethernet and Gigabit Ethernet SFP modules.

Table A-2 Supported Fast Ethernet and Gigabit Ethernet SFP Transceiver Modules

Part Number	Description	Wavelength	Fiber Type	Typical Maximum Distance
Trirate Copper SFPs				
SFP-GE-T	Transceiver Module for Category 5 copper wire	n/a	Copper	328.08 feet (100 m)
GLC-TE	1000BASE-TX Extended Temp SFP	n/a	Copper	328.08 feet (100 m)
Gigabit Ethernet SFPs				
GLC-GE-100FX[1]	100BASE-FX SFP for Gigabit Ethernet ports	1310 nm	MMF	1.24 miles (2 km)
GLC-GE-DR-LX	1000BASE-LX 100M Dual Rate SFP	1310 nm	SMF	6.2 miles (10 km)
GLC-BX-D	1000BASE-BX SFP	1490 nm TX 1310 nm RX	SMF	6.2 miles (10 km)
GLC-BX-U	1000BASE-BX SFP	1310 nm TX 1490 nm RX	SMF	6.2 miles (10 km)
GLC-BX40-DA-I	1000BASE-BX40 SFP	1490 nm	SMF	24.8 miles (40 km)
GLC-BX40-D-I	1000BASE-BX40 SFP	1550 nm	SMF	24.8 miles (40 km)
GLC-BX40-U-I	1000BASE-BX40 SFP	1310 nm	SMF	24.8 miles (40 km)
GLC-BX80-D-I	1000BASE-BX80 SFP	1570 nm	SMF	49.72 miles (80 km)
GLC-BX80-U-I	1000BASE-BX80 SFP	1490 nm	SMF	49.72 miles (80 km)
GLC-SX-MMD	1000BASE-SX SFP	850 nm	MMF	722 to 3281 feet (220 to 1000 m)
GLC-LH-SMD	1000BASE-LH SFP	1310 nm	SMF	6.2 miles (10 km)
GLC-ZX-SMD	1000BASE-ZX SFP	1550 nm	SMF	43.4 miles (70 km)
GLC-EX-SMD	1000BASE-EX SFP	1310 nm	SMF	24.8 miles (40 km)
SFP-GE-S	1000BASE-SX SFP (DOM)	850 nm	MMF	722 to 1805 feet (220 to 550 m)
SFP-GE-L	1000BASE-LX/LH SFP (DOM),	1300 nm	SMF MMF	6.2 miles (10 km) 0.34 mile (550 m)
SFP-GE-Z	1000BASE-ZX SFP (DOM)	1550 nm	SMF	43.5 miles (70 km)
GLC-FE-100EX[2]	100BASE-EX SFP for Fast Ethernet ports	1310 nm	SMF	24.8 miles (40 km)
GLC-FE-100ZX	100BASE-ZX SFP for Fast Ethernet ports	1550 nm	SMF	49.72 miles (80 km)

1. Operating temperature specifications for the router will differ from those listed in Table A-1 when 40-port Gigabit Ethernet line cards using GLC-GE-100FX SFP transceiver modules are installed in the router. This is due to the lower temperature specifications of the SFP module. Please contact a Cisco representative for more information.
2. GLC-FE-100EX, GLC-FE-100ZX, GLC-BX40-D-I, GLC-BX40-U-I, GLC-BX40-DA-I, GLC-BX80-D-I, and GLC-BX80-U-I SFP transceiver modules are supported on the 20-Port Gigabit Ethernet Modular Port Adapter only.

Cisco 10-Gigabit Ethernet SFP+ Transceiver Modules

Table A-3 lists the supported Cisco 10-Gigabit Ethernet SFP+ transceiver modules.

Table A-3 10-Gigabit Ethernet SFP+ Transceiver Modules

Part Number	Description	Wavelength	Fiber Type	Typical Maximum Distance
SFP-10G-ER[1, 2]	Cisco SFP for 10-Gigabit Ethernet Extended Reach	1550 nm	SMF	24.85 miles (40 km)
SFP-10G-LR[1, 2]	Cisco SFP for 10-Gigabit Ethernet Long Reach	1310 nm	SMF	6.21 miles (10 km)
SFP-10G-SR[1, 2]	Cisco SFP for 10-Gigabit Ethernet Short Reach	850 nm	62.5 micron (FDDI grade) 62.5 micron (OM1 grade) 50 micron (OM2 grade) 50 micron (OM3 grade)	82.02 feet (25 m) 65.62 feet (20 m) 262.47 feet (80 m) 984.25 feet (300 m)
SFP-10G-LR-X	Cisco SFP for 10-Gigabit Ethernet Long Reach, extended temperature	1310 nm	SMF	6.21 miles (10 km)
SFP-10G-SR-X	Cisco SFP for 10-Gigabit Ethernet Short Reach, extended temperature	850 nm	62.5 micron (FDDI grade) 62.5 micron (OM1 grade) 50 micron (OM2 grade) 50 micron (OM3 grade)	82.02 feet (25 m) 65.62 feet (20 m) 262.47 feet (80 m) 984.25 feet (300 m)
SFP-10G-ZR[, 1]	Cisco SFP for 10-Gigabit Ethernet Far Reach	1550 nm		49.72 miles (80 km)
SFP-10G-BXD-I[3]	Cisco SFP+ Bidirectional for 10km, downstream	1320 to 1340 nm	SMF	6.21 miles (10 km)
SFP-10G-BXU-I[3]	Cisco SFP+ Bidirectional for 10km, upstream	1260 to 1280 nm	SMF	6.21 miles (10 km)
SFP-10G-BX40D-I[3]	Cisco SFP+ Bidirectional for 40km, downstream	1320 to 1340 nm	SMF	24.85 miles (40 km)
SFP-10G-BX40U-I[3]	Cisco SFP+ Bidirectional for 40km, upstream	1260 to 1280 nm	SMF	24.85 miles (40 km)
ONS-SC+-10G-C[3]	Cisco SFP+ for 10Gigabit Ethernet, Full C Band Tunable DWDM SFP+	Variable	SMF	—
ONS-SC+-10G-SR[3]	Cisco SFP+ for 10-Gigabit Ethernet Short Reach	850nm	MMF	984.25 feet (300 m)
ONS-SC+-10G-ER[3]	Cisco SFP+ for 10-Gigabit Ethernet Extended Reach	1550 nm	SMF	24.85 miles (40 km)
ONS-SC+-10G-LR[3]	Cisco SFP+ for 10-Gigabit Ethernet Long Reach	1310 nm	SMF	6.21 miles (10 km)
ONS-SC+-10G-ZR[3]	Cisco SFP+ for 10-Gigabit Ethernet Far Reach	1550 nm	SMF	49.72 miles (80 km)
10G Copper SFP Cables				

Table A-3 10-Gigabit Ethernet SFP+ Transceiver Modules (continued)

Part Number	Description	Wavelength	Fiber Type	Typical Maximum Distance
SFP-H10GB-ACU7M	Active Twinax cable assembly, 7mm	—	Cooper	7mm
SFP-H10GB-ACU10M	Active Twinax cable assembly, 10mm	—	Cooper	10 mm

1. Operating temperature specifications for the router will differ from those listed in this table when the 16-port 10-Gigabit Ethernet line card is installed in the router because of the lower temperature specifications of the SFP+ modules that are used in this line card. When using this line card, the maximum operating temperature is 104°F (40°C).
2. Operating altitude specifications for the router will differ from those listed in this table when the 16-port 10-Gigabit Ethernet line card is installed in the router. When using the SFP-10G-SR module, the maximum altitude is 5905 ft (1800 m). When using the SFP-10G-LR or SFP-10G-ER modules, the maximum altitude is sea level.
3. These SFP+ transceiver modules are not supported on the A9K-4T16GE-TR and A9K-4T16GE-SE line cards in Cisco IOS XR software release 5.3.0.

Cisco 100-Gigabit Ethernet CPAK Modules

Table A-4 lists the supported Cisco 100-Gigabit Ethernet CPAK modules.

Table A-4 Cisco 100-Gigabit Ethernet CPAK Modules

Part Number	100-Gigabit Ethernet CPAK Modules	Maximum Distance
CPAK-100G-LR4	100GBASE-LR4 CPAK Module for SMF	10 km
CPAK-10X10G-LR	10X10GBASE-LR CPAK Module for SMF	10 km
CPAK-100G-SR10	100GBASE-SR10 CPAK Module for MMF	100m

Cisco 100-Gigabit Ethernet CFP Modules

Table A-5 lists the supported Cisco 100-Gigabit Ethernet CFP modules.

Table A-5 Cisco 100-Gigabit Ethernet CFP Modules

Part Number	100-Gigabit Ethernet CFP Modules	Maximum Distance
CFP-100G-LR4	Multirate 100-Gigabit Ethernet-LR4	1295.56 nm 1300.05 nm 1304.58 nm 1309.14 nm
CFP-100G-SR10	Multirate 100-Gigabit Ethernet-SR10	850 nm
CFP-100G-ER4	Multirate 100-Gigabit Ethernet-ER4	1300 nm

Cisco 40-Gigabit Ethernet CFP Modules

Table A-6 lists the supported Cisco 40-Gigabit Ethernet CFP modules.

Table A-6 Cisco 40-Gigabit Ethernet CFP Modules

Part Number	40-Gigabit Ethernet CPAK Optics	Maximum Distance
CFP-40G-LR4	Multirate 40-Gigabit Ethernet-LR4	1271 nm 1291 nm 1311 nm 1331 nm
CFP-40G-SR4	Multirate 40-Gigabit Ethernet-SR4	1547.5 nm
CFP-40G-FR	Multirate 40-Gigabit Ethernet-FR	850 nm

Cisco 40-Gigabit Ethernet QSFP Modules

Table A-7 lists the supported Cisco 40-Gigabit Ethernet QSFP (Quad Small Form-Factor Pluggable) modules.

Table A-7 Cisco 40-Gigabit Ethernet QSFP Modules

Part Number	40-Gigabit Ethernet QSFP Modules	Maximum Distance
QSFP-40G-SR4	Multirate 40-Gigabit Ethernet-SR4	850 nm
QSFP-40G-SR-BD	Multirate 40-Gigabit Ethernet-SR Bi-directional	832 to 918 nm
QSFP-40G-LR4	Multirate 40-Gigabit Ethernet / 40G OTU3 -LR4	1295.56 nm 1300.05 nm 1304.58 nm 1309.14 nm
QSFP-40GE-LR4	Multirate 40-Gigabit Ethernet only - LR4	1295.56 nm 1300.05 nm 1304.58 nm 1309.14 nm

Cisco DWDM SFP Transceiver Modules

Table A-8 lists the supported Cisco DWDM SFP transceiver modules.

Table A-8 Cisco DWDM SFP Transceiver Modules

Part Number	Description	Wavelength	ITU Grid
DWDM-SFP-6141	1000BASE-DWDM SFP (100 GHz ITU grid)	1561.41 nm	20
DWDM-SFP-6061	1000BASE-DWDM SFP (100 GHz ITU grid)	1560.61 nm	21
DWDM-SFP-5979	1000BASE-DWDM SFP (100 GHz ITU grid)	1559.79 nm	22
DWDM-SFP-5898	1000BASE-DWDM SFP (100 GHz ITU grid)	1558.98 nm	23
DWDM-SFP-5817	1000BASE-DWDM SFP (100 GHz ITU grid)	1558.17 nm	24
DWDM-SFP-5736	1000BASE-DWDM SFP (100 GHz ITU grid)	1557.36 nm	25
DWDM-SFP-5655	1000BASE-DWDM SFP (100 GHz ITU grid)	1556.55 nm	26
DWDM-SFP-5575	1000BASE-DWDM SFP (100 GHz ITU grid)	1555.75 nm	27
DWDM-SFP-5494	1000BASE-DWDM SFP (100 GHz ITU grid)	1554.94 nm	28
DWDM-SFP-5413	1000BASE-DWDM SFP (100 GHz ITU grid)	1554.13 nm	29
DWDM-SFP-5332	1000BASE-DWDM SFP (100 GHz ITU grid)	1553.32 nm	30
DWDM-SFP-5252	1000BASE-DWDM SFP (100 GHz ITU grid)	1552.52 nm	31
DWDM-SFP-5172	1000BASE-DWDM SFP (100 GHz ITU grid)	1551.72 nm	32
DWDM-SFP-5092	1000BASE-DWDM SFP (100 GHz ITU grid)	1550.92 nm	33
DWDM-SFP-5012	1000BASE-DWDM SFP (100 GHz ITU grid)	1550.12 nm	34
DWDM-SFP-4931	1000BASE-DWDM SFP (100 GHz ITU grid)	1549.31 nm	35
DWDM-SFP-4851	1000BASE-DWDM SFP (100 GHz ITU grid)	1548.51 nm	36
DWDM-SFP-4772	1000BASE-DWDM SFP (100 GHz ITU grid)	1547.72 nm	37
DWDM-SFP-4692	1000BASE-DWDM SFP (100 GHz ITU grid)	1546.92 nm	38
DWDM-SFP-4612	1000BASE-DWDM SFP (100 GHz ITU grid)	1546.12 nm	39
DWDM-SFP-4532	1000BASE-DWDM SFP (100 GHz ITU grid)	1545.32 nm	40
DWDM-SFP-4453	1000BASE-DWDM SFP (100 GHz ITU grid)	1544.53 nm	41
DWDM-SFP-4373	1000BASE-DWDM SFP (100 GHz ITU grid)	1543.73 nm	42
DWDM-SFP-4294	1000BASE-DWDM SFP (100 GHz ITU grid)	1542.94 nm	43
DWDM-SFP-4214	1000BASE-DWDM SFP (100 GHz ITU grid)	1542.14 nm	44
DWDM-SFP-4134	1000BASE-DWDM SFP (100 GHz ITU grid)	1541.34 nm	45
DWDM-SFP-4056	1000BASE-DWDM SFP (100 GHz ITU grid)	1540.56 nm	46
DWDM-SFP-3977	1000BASE-DWDM SFP (100 GHz ITU grid)	1539.77 nm	47
DWDM-SFP-3898	1000BASE-DWDM SFP (100 GHz ITU grid)	1539.98 nm	48
DWDM-SFP-3819	1000BASE-DWDM SFP (100 GHz ITU grid)	1538.19 nm	49
DWDM-SFP-3739	1000BASE-DWDM SFP (100 GHz ITU grid)	1537.39 nm	50
DWDM-SFP-3661	1000BASE-DWDM SFP (100 GHz ITU grid)	1536.61 nm	51
DWDM-SFP-3582	1000BASE-DWDM SFP (100 GHz ITU grid)	1535.82 nm	52

Table A-8 Cisco DWDM SFP Transceiver Modules (continued)

Part Number	Description	Wavelength	ITU Grid
DWDM-SFP-3504	1000BASE-DWDM SFP (100 GHz ITU grid)	1535.04 nm	53
DWDM-SFP-3425	1000BASE-DWDM SFP (100 GHz ITU grid)	1534.25 nm	54
DWDM-SFP-3346	1000BASE-DWDM SFP (100 GHz ITU grid)	1533.46 nm	55
DWDM-SFP-3268	1000BASE-DWDM SFP (100 GHz ITU grid)	1532.68 nm	56
DWDM-SFP-3190	1000BASE-DWDM SFP (100 GHz ITU grid)	1531.90 nm	57
DWDM-SFP-3112	1000BASE-DWDM SFP (100 GHz ITU grid)	1531.12 nm	58
DWDM-SFP-3033	1000BASE-DWDM SFP (100 GHz ITU grid)	1530.33 nm	59

Caution Use only the SFP modules supplied by Cisco Systems, Inc. with your Ethernet line card. Each SFP module contains an internal serial EEPROM that is security-programmed by the SFP manufacturer with information that provides a way for Cisco IOS XR software to identify and validate the SFP module to operate properly with Cisco Ethernet line cards. Unapproved SFP modules (those not purchased directly from Cisco Systems, Inc.) do not work on the Ethernet line card. To verify the version of the installed SFP module, see Verifying the Transceiver Modules, page 3-6.

Cisco DWDM SFP+ Transceiver Modules

Table A-9 lists the supported DWDM SFP+ transceiver modules. In the transceiver description, MR refers to multi-rate.

Table A-9 Cisco DWDM SFP+ Transceiver Modules

Part Number	Description	Wavelength	Fiber Type	Typical Maximum Distance
ONS-SC+-10G-C	SFP+ for 10Gigabit Ethernet, Full C Band Tunable DWDM SFP+	Variable	SMF	49.72 miles (80 km)
ONS-SC+-10G-30.3	10G MR, SFP+, 100 GHz, LC	1530.3	SMF	49.72 miles (80 km)
ONS-SC+-10G-31.1	10G MR, SFP+, 100 GHz, LC	1531.1	SMF	49.72 miles (80 km)
ONS-SC+-10G-32.6	10G MR, SFP+, 100 GHz, LC	1532.6	SMF	49.72 miles (80 km)
ONS-SC+-10G-33.4	10G MR, SFP+, 100 GHz, LC	1533.4	SMF	49.72 miles (80 km)
ONS-SC+-10G-34.2	10G MR, SFP+, 100 GHz, LC	1534.2	SMF	49.72 miles (80 km)
ONS-SC+-10G-35.0	10G MR, SFP+, 100 GHz, LC	1535.0	SMF	49.72 miles (80 km)
ONS-SC+-10G-35.8	10G MR, SFP+, 100 GHz, LC	1535.8	SMF	49.72 miles (80 km)
ONS-SC+-10G-36.6	10G MR, SFP+, 100 GHz, LC	1536.6	SMF	49.72 miles (80 km)
ONS-SC+-10G-37.4	10G MR, SFP+, 100 GHz, LC	1537.4	SMF	49.72 miles (80 km)
ONS-SC+-10G-38.1	10G MR, SFP+, 100 GHz, LC	1538.1	SMF	49.72 miles (80 km)
ONS-SC+-10G-38.9	10G MR, SFP+, 100 GHz, LC	1538.9	SMF	49.72 miles (80 km)
ONS-SC+-10G-39.7	10G MR, SFP+, 100 GHz, LC	1539.7	SMF	49.72 miles (80 km)

Table A-9 Cisco DWDM SFP+ Transceiver Modules (continued)

Part Number	Description	Wavelength	Fiber Type	Typical Maximum Distance
ONS-SC+-10G-40.5	10G MR, SFP+, 100 GHz, LC	1540.5	SMF	49.72 miles (80 km)
ONS-SC+-10G-41.3	10G MR, SFP+, 100 GHz, LC	1541.3	SMF	49.72 miles (80 km)
ONS-SC+-10G-42.1	10G MR, SFP+, 100 GHz, LC	1542.1	SMF	49.72 miles (80 km)
ONS-SC+-10G-42.9	10G MR, SFP+, 100 GHz, LC	1542.9	SMF	49.72 miles (80 km)
ONS-SC+-10G-43.7	10G MR, SFP+, 100 GHz, LC	1543.7	SMF	49.72 miles (80 km)
ONS-SC+-10G-44.5	10G MR, SFP+, 100 GHz, LC	1544.5	SMF	49.72 miles (80 km)
ONS-SC+-10G-45.3	10G MR, SFP+, 100 GHz, LC	1545.3	SMF	49.72 miles (80 km)
ONS-SC+-10G-46.1	10G MR, SFP+, 100 GHz, LC	1546.1	SMF	49.72 miles (80 km)
ONS-SC+-10G-47.7	10G MR, SFP+, 100 GHz, LC	1547.7	SMF	49.72 miles (80 km)
ONS-SC+-10G-48.5	10G MR, SFP+, 100 GHz, LC	1548.5	SMF	49.72 miles (80 km)
ONS-SC+-10G-49.3	10G MR, SFP+, 100 GHz, LC	1549.3	SMF	49.72 miles (80 km)
ONS-SC+-10G-50.1	10G MR, SFP+, 100 GHz, LC	1550.1	SMF	49.72 miles (80 km)
ONS-SC+-10G-50.9	10G MR, SFP+, 100 GHz, LC	1550.9	SMF	49.72 miles (80 km)
ONS-SC+-10G-52.5	10G MR, SFP+, 100 GHz, LC	1552.5	SMF	49.72 miles (80 km)
ONS-SC+-10G-53.3	10G MR, SFP+, 100 GHz, LC	1553.3	SMF	49.72 miles (80 km)
ONS-SC+-10G-54.1	10G MR, SFP+, 100 GHz, LC	1554.1	SMF	49.72 miles (80 km)
ONS-SC+-10G-54.9	10G MR, SFP+, 100 GHz, LC	1554.9	SMF	49.72 miles (80 km)
ONS-SC+-10G-55.7	10G MR, SFP+, 100 GHz, LC	1555.7	SMF	49.72 miles (80 km)
ONS-SC+-10G-57.3	10G MR, SFP+, 100 GHz, LC	1557.3	SMF	49.72 miles (80 km)
ONS-SC+-10G-58.1	10G MR, SFP+, 100 GHz, LC	1558.1	SMF	49.72 miles (80 km)
ONS-SC+-10G-58.9	10G MR, SFP+, 100 GHz, LC	1558.9	SMF	49.72 miles (80 km)
ONS-SC+-10G-59.7	10G MR, SFP+, 100 GHz, LC	1559.7	SMF	49.72 miles (80 km)
ONS-SC+-10G-60.6	10G MR, SFP+, 100 GHz, LC	1560.6	SMF	49.72 miles (80 km)
ONS-SC+-10G-61.4	10G MR, SFP+, 100 GHz, LC	1561.4	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP30.3	10G SFP+, 100 GHz, LC	1530.3	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP31.1	10G SFP+, 100 GHz, LC	1531.1	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP32.6	10G SFP+, 100 GHz, LC	1532.6	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP33.4	10G SFP+, 100 GHz, LC	1533.4	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP34.2	10G SFP+, 100 GHz, LC	1534.2	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP35.0	10G SFP+, 100 GHz, LC	1535.0	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP35.8	10G SFP+, 100 GHz, LC	1535.8	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP36.6	10G SFP+, 100 GHz, LC	1536.6	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP37.4	10G SFP+, 100 GHz, LC	1537.4	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP38.1	10G SFP+, 100 GHz, LC	1538.1	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP38.9	10G SFP+, 100 GHz, LC	1538.9	SMF	49.72 miles (80 km)

Table A-9 Cisco DWDM SFP+ Transceiver Modules (continued)

Part Number	Description	Wavelength	Fiber Type	Typical Maximum Distance
ONS-SC+-10G-EP39.7	10G SFP+, 100 GHz, LC	1539.7	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP40.5	10G SFP+, 100 GHz, LC	1540.5	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP41.3	10G SFP+, 100 GHz, LC	1541.3	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP42.1	10G SFP+, 100 GHz, LC	1542.1	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP42.9	10G SFP+, 100 GHz, LC	1542.9	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP43.7	10G SFP+, 100 GHz, LC	1543.7	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP44.5	10G SFP+, 100 GHz, LC	1544.5	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP45.3	10G SFP+, 100 GHz, LC	1545.3	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP46.1	10G SFP+, 100 GHz, LC	1546.1	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP47.7	10G SFP+, 100 GHz, LC	1547.7	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP48.5	10G SFP+, 100 GHz, LC	1548.5	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP49.3	10G SFP+, 100 GHz, LC	1549.3	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP50.1	10G SFP+, 100 GHz, LC	1550.1	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP50.9	10G SFP+, 100 GHz, LC	1550.9	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP52.5	10G SFP+, 100 GHz, LC	1552.5	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP53.3	10G SFP+, 100 GHz, LC	1553.3	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP54.1	10G SFP+, 100 GHz, LC	1554.1	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP54.9	10G SFP+, 100 GHz, LC	1554.9	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP55.7	10G SFP+, 100 GHz, LC	1555.7	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP57.3	10G SFP+, 100 GHz, LC	1557.3	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP58.1	10G SFP+, 100 GHz, LC	1558.1	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP58.9	10G SFP+, 100 GHz, LC	1558.9	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP59.7	10G SFP+, 100 GHz, LC	1559.7	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP60.6	10G SFP+, 100 GHz, LC	1560.6	SMF	49.72 miles (80 km)
ONS-SC+-10G-EP61.4	10G SFP+, 100 GHz, LC	1561.4	SMF	49.72 miles (80 km)

Cisco DWDM SFP+ Fixed Transceiver Modules

Table A-10 lists the DWDM SFP+ fixed transceiver modules.

Table A-10 Cisco DWDM SFP+ Fixed Transceiver Modules

Part Number	Description	Wavelength
DWDM-SFP10G-30.33=	10GBASE-DWDM, 1530.33nm, SFP10G (100-GHz ITU grid)	1530.33nm
DWDM-SFP10G-31.32=	10GBASE-DWDM, 1531.32nm, SFP10G (100-GHz ITU grid)	1531.32nm
DWDM-SFP10G-31.90=	10GBASE-DWDM, 1531.90nm, SFP10G (100-GHz ITU grid)	1531.90nm
DWDM-SFP10G-32.68=	10GBASE-DWDM, 1532.68nm, SFP10G (100-GHz ITU grid)	1532.68nm
DWDM-SFP10G-33.47=	10GBASE-DWDM, 1533.47nm, SFP10G (100-GHz ITU grid)	1533.47nm
DWDM-SFP10G-34.25=	10GBASE-DWDM, 1534.25nm, SFP10G (100-GHz ITU grid)	1534.25nm
DWDM-SFP10G-35.04=	10GBASE-DWDM, 1535.04nm, SFP10G (100-GHz ITU grid)	1535.04nm
DWDM-SFP10G-35.82=	10GBASE-DWDM, 1535.82nm,SFP10G (100-GHz ITU grid)	1535.82nm
DWDM-SFP10G-36.61=	10GBASE-DWDM, 1536.61nm, SFP10G (100-GHz ITU grid)	1536.61nm
DWDM-SFP10G-37.40=	10GBASE-DWDM, 1537.40nm, SFP10G (100-GHz ITU grid)	1537.40nm
DWDM-SFP10G-38.19=	10GBASE-DWDM, 1538.19nm, SFP10G (100-GHz ITU grid)	1538.19nm
DWDM-SFP10G-38.98=	10GBASE-DWDM, 1538.98nm, SFP10G (100-GHz ITU grid)	1538.98nm
DWDM-SFP10G-39.77=	10GBASE-DWDM, 1539.77nm, SFP10G (100-GHz ITU grid)	1539.77nm
DWDM-SFP10G-40.56=	10GBASE-DWDM, 1540.56nm, SFP10G (100-GHz ITU grid)	1540.56nm
DWDM-SFP10G-41.35=	10GBASE-DWDM, 1541.35nm, SFP10G (100-GHz ITU grid)	1541.35nm
DWDM-SFP10G-42.14=	10GBASE-DWDM, 1542.14nm, SFP10G (100-GHz ITU grid)	1542.14nm
DWDM-SFP10G-42.94=	10GBASE-DWDM, 1542.94nm, SFP10G (100-GHz ITU grid)	1542.94nm
DWDM-SFP10G-43.73=	10GBASE-DWDM, 1543.73nm, SFP10G (100-GHz ITU grid)	1543.73nm
DWDM-SFP10G-44.53=	10GBASE-DWDM, 1544.53nm, SFP10G (100-GHz ITU grid)	1544.53nm
DWDM-SFP10G-45.32=	10GBASE-DWDM, 1545.32nm, SFP10G (100-GHz ITU grid)	1545.32nm
DWDM-SFP10G-46.12=	10GBASE-DWDM, 1546.12nm, SFP10G (100-GHz ITU grid)	1546.12nm
DWDM-SFP10G-46.92=	10GBASE-DWDM, 1546.92nm, SFP10G (100-GHz ITU grid)	1546.92nm
DWDM-SFP10G-47.72=	10GBASE-DWDM, 1547.72nm, SFP10G (100-GHz ITU grid)	1547.72nm
DWDM-SFP10G-48.51=	10GBASE-DWDM, 1548.51nm, SFP10G (100-GHz ITU grid)	1548.51nm
DWDM-SFP10G-49.32=	10GBASE-DWDM, 1549.32nm, SFP10G (100-GHz ITU grid)	1549.32nm
DWDM-SFP10G-50.12=	10GBASE-DWDM, 1550.12nm, SFP10G (100-GHz ITU grid)	1550.12nm
DWDM-SFP10G-51.72=	10GBASE-DWDM, 1551.72nm, SFP10G (100-GHz ITU grid)	1551.72nm
DWDM-SFP10G-52.52=	10GBASE-DWDM, 1552.52nm, SFP10G (100-GHz ITU grid)	1552.52nm
DWDM-SFP10G-53.33=	10GBASE-DWDM, 1553.33nm, SFP10G (100-GHz ITU grid)	1553.33nm
DWDM-SFP10G-54.13=	10GBASE-DWDM, 1554.13nm, SFP10G (100-GHz ITU grid)	1554.13nm
DWDM-SFP10G-54.94=	10GBASE-DWDM, 1554.94nm, SFP10G (100-GHz ITU grid)	1554.94nm
DWDM-SFP10G-55.75=	10GBASE-DWDM, 1555.75nm, SFP10G (100-GHz ITU grid)	1555.75nm
DWDM-SFP10G-56.55=	10GBASE-DWDM, 1556.55nm, SFP10G (100-GHz ITU grid)	1556.55nm

Table A-10 Cisco DWDM SFP+ Fixed Transceiver Modules (continued)

Part Number	Description	Wavelength
DWDM-SFP10G-57.36=	10GBASE-DWDM, 1557.36nm, SFP10G (100-GHz ITU grid)	1557.36nm
DWDM-SFP10G-58.17=	10GBASE-DWDM, 1558.17nm, SFP10G (100-GHz ITU grid)	1558.17nm
DWDM-SFP10G-58.98=	10GBASE-DWDM, 1558.98nm, SFP10G (100-GHz ITU grid)	1558.98nm
DWDM-SFP10G-59.79=	10GBASE-DWDM, 1559.79nm,SFP10G (100-GHz ITU grid)	1559.79nm
DWDM-SFP10G-60.61=	10GBASE-DWDM, 1560.61nm,SFP10G (100-GHz ITU grid)	1560.61nm
DWDM-SFP10G-61.41=	10GBASE-DWDM, 1561.41nm, SFP10G (100-GHz ITU grid)	1561.41nm

Cisco DWDM XFP Transceiver Modules

Table A-11 lists the supported DWDM XFP transceiver modules. In the transceiver module description, MR refers to multi-rate.

Table A-11 Cisco DWDM XFP Transceivers

Part Number	Description	Wavelength	Fiber Type	Typical Maximum Distance
ONS-XC-10G-EP31.1	10G MR, XFP, 100 GHz, LC	1531.1	SMF	31.1 miles (50 km)
ONS-XC-10G-EP32.6	10G MR, XFP, 100 GHz, LC	1532.6	SMF	31.1 miles (50 km)
ONS-XC-10G-EP33.4	10G MR, XFP, 100 GHz, LC	1533.4	SMF	31.1 miles (50 km)
ONS-XC-10G-EP34.2	10G MR, XFP, 100 GHz, LC	1534.2	SMF	31.1 miles (50 km)
ONS-XC-10G-EP35.0	10G MR, XFP, 100 GHz, LC	1535.0	SMF	31.1 miles (50 km)
ONS-XC-10G-EP35.8	10G MR, XFP, 100 GHz, LC	1535.8	SMF	31.1 miles (50 km)
ONS-XC-10G-EP36.6	10G MR, XFP, 100 GHz, LC	1536.6	SMF	31.1 miles (50 km)
ONS-XC-10G-EP37.4	10G MR, XFP, 100 GHz, LC	1537.4	SMF	31.1 miles (50 km)
ONS-XC-10G-EP38.1	10G MR, XFP, 100 GHz, LC	1538.1	SMF	31.1 miles (50 km)
ONS-XC-10G-EP38.9	10G MR, XFP, 100 GHz, LC	1538.9	SMF	31.1 miles (50 km)
ONS-XC-10G-EP39.7	10G MR, XFP, 100 GHz, LC	1539.7	SMF	31.1 miles (50 km)
ONS-XC-10G-EP40.5	10G MR, XFP, 100 GHz, LC	1540.5	SMF	31.1 miles (50 km)
ONS-XC-10G-EP41.3	10G MR, XFP, 100 GHz, LC	1541.3	SMF	31.1 miles (50 km)
ONS-XC-10G-EP42.1	10G MR, XFP, 100 GHz, LC	1542.1	SMF	31.1 miles (50 km)
ONS-XC-10G-EP42.9	10G MR, XFP, 100 GHz, LC	1542.9	SMF	31.1 miles (50 km)
ONS-XC-10G-EP43.7	10G MR, XFP, 100 GHz, LC	1543.7	SMF	31.1 miles (50 km)
ONS-XC-10G-EP44.5	10G MR, XFP, 100 GHz, LC	1544.5	SMF	31.1 miles (50 km)
ONS-XC-10G-EP45.3	10G MR, XFP, 100 GHz, LC	1545.3	SMF	31.1 miles (50 km)
ONS-XC-10G-EP46.1	10G MR, XFP, 100 GHz, LC	1546.1	SMF	31.1 miles (50 km)
ONS-XC-10G-EP47.7	10G MR, XFP, 100 GHz, LC	1547.7	SMF	31.1 miles (50 km)
ONS-XC-10G-EP48.5	10G MR, XFP, 100 GHz, LC	1548.5	SMF	31.1 miles (50 km)
ONS-XC-10G-EP49.3	10G MR, XFP, 100 GHz, LC	1549.3	SMF	31.1 miles (50 km)

Table A-11 Cisco DWDM XFP Transceivers (continued)

Part Number	Description	Wavelength	Fiber Type	Typical Maximum Distance
ONS-XC-10G-EP50.1	10G MR, XFP, 100 GHz, LC	1550.1	SMF	31.1 miles (50 km)
ONS-XC-10G-EP50.9	10G MR, XFP, 100 GHz, LC	1550.9	SMF	31.1 miles (50 km)
ONS-XC-10G-EP52.5	10G MR, XFP, 100 GHz, LC	1552.5	SMF	31.1 miles (50 km)
ONS-XC-10G-EP53.3	10G MR, XFP, 100 GHz, LC	1553.3	SMF	31.1 miles (50 km)
ONS-XC-10G-EP54.1	10G MR, XFP, 100 GHz, LC	1554.1	SMF	31.1 miles (50 km)
ONS-XC-10G-EP54.9	10G MR, XFP, 100 GHz, LC	1554.9	SMF	31.1 miles (50 km)
ONS-XC-10G-EP55.7	10G MR, XFP, 100 GHz, LC	1555.7	SMF	31.1 miles (50 km)
ONS-XC-10G-EP57.3	10G MR, XFP, 100 GHz, LC	1557.3	SMF	31.1 miles (50 km)
ONS-XC-10G-E58.1	10G MR, XFP, 100 GHz, LC	1558.1	SMF	31.1 miles (50 km)
ONS-XC-10G-EP58.9	10G MR, XFP, 100 GHz, LC	1558.9	SMF	31.1 miles (50 km)
ONS-XC-10G-EP59.7	10G MR, XFP, 100 GHz, LC	1559.7	SMF	31.1 miles (50 km)
ONS-XC-10G-EP60.6	10G MR, XFP, 100 GHz, LC	1560.6	SMF	31.1 miles (50 km)
ONS-XC-10G-EP61.4	10G MR, XFP, 100 GHz, LC	1561.4	SMF	31.1 miles (50 km)

Cisco CWDM SFP Transceiver Modules

Table A-12 lists the supported CWDM SFP transceiver modules.

Table A-12 CWDM SFP Transceiver Modules

Part Number	Description	Wavelength	Fiber Type	Color Identifier
CWDM-SFP-1470	CWDM SFP for Gigabit Ethernet and 1G/2G FC	1470 nm	SMF	Gray
CWDM-SFP-1490	CWDM SFP for Gigabit Ethernet and 1G/2G FC	1490 nm	SMF	Violet
CWDM-SFP-1510	CWDM SFP for Gigabit Ethernet and 1G/2G FC	1510 nm	SMF	Blue
CWDM-SFP-1530	CWDM SFP for Gigabit Ethernet and 1G/2G FC	1530 nm	SMF	Green
CWDM-SFP-1550	CWDM SFP for Gigabit Ethernet and 1G/2G FC	1550 nm	SMF	Yellow
CWDM-SFP-1570	CWDM SFP for Gigabit Ethernet and 1G/2G FC	1570 nm	SMF	Orange
CWDM-SFP-1590	CWDM SFP for Gigabit Ethernet and 1G/2G FC	1590 nm	SMF	Red
CWDM-SFP-1610	CWDM SFP for Gigabit Ethernet and 1G/2G FC	1610 nm	SMF	Brown

Cisco 10-Gigabit Ethernet CWDM SFP+ Transceiver Modules

Table A-13 lists the supported 10-Gigabit Ethernet CWDM SFP+ transceiver modules.

Table A-13 10GBASE CWDM SFP+ Transceiver Modules

Part Number	Description	Wavelength	Fiber Type	Color Identifier
CWDM-SFP10G-1470	Cisco 10GBASE CWDM SFP+	1470 nm	SMF	Gray
CWDM-SFP10G-1490	Cisco 10GBASE CWDM SFP+	1490 nm	SMF	Violet
CWDM-SFP10G-1510	Cisco 10GBASE CWDM SFP+	1510 nm	SMF	Blue
CWDM-SFP10G-1530	Cisco 10GBASE CWDM SFP+	1530 nm	SMF	Green
CWDM-SFP10G-1550	Cisco 10GBASE CWDM SFP+	1550 nm	SMF	Yellow
CWDM-SFP10G-1570	Cisco 10GBASE CWDM SFP+	1570 nm	SMF	Orange
CWDM-SFP10G-1590	Cisco 10GBASE CWDM SFP+	1590 nm	SMF	Red
CWDM-SFP10G-1610	Cisco 10GBASE CWDM SFP+	1610 nm	SMF	Brown

Cisco 10-Gigabit Ethernet XFP Modules

Table A-14 lists the supported 10-Gigabit Ethernet XFP modules.

Note Version V01 and V02 of the XFP-10GLR-OC192SR 10-Gigabit Ethernet module listed in Table A-14 are not supported.

Note Version V01 of the XFP-10GZR-OC192LR 10-Gigabit Ethernet module listed in Table A-14 is not supported.

Table A-14 Cisco 10-Gigabit Ethernet XFP Modules

Part Number	Description	Wavelength	Fiber Type	Typical Maximum Distance
XFP-10GLR-OC192SR (Version V03, see note)	Multirate 10GBASE-LR and OC-192/STM-64 SR-1 XFP	1310 nm	SMF	6.2 miles (10 km) 10-Gigabit Ethernet 1.24 miles (2 km) OC-192/STM-64 SR1
XFP-10GER-192IR+	Multirate 10GBASE-ER and OC-192/STM-64 IR-2 XFP	1550 nm	SMF	24.85 miles (40 km)
XFP-10GER-192IR-L	Multirate 10GBASE-ER and OC-192/STM-64 IR-2 XFP, low power (2.5W)	1550 nm	SMF	24.85 miles (40 km)
XFP-10GZR-OC192LR (Version V02, see note)	Multirate 10GBASE-ZR and OC-192/STM-64 LR-2 XFP	1550 nm	SMF	49.70 miles (80 km)

Table A-14 Cisco 10-Gigabit Ethernet XFP Modules (continued)

XFP-10G-MM-SR	Multirate 10GBASE-SR	850 nm	MMF	85.3 to 984.3 feet (26 m to 300 m)
ONS-XC-10G-1470	OC192/10GE/OTU2, CWDM, XFP C-Temp,	1470 nm	SMF	24.85 miles (40 km)
ONS-XC-10G-1490	OC192/10GE/OTU2, CWDM, XFP C-Temp,	1490 nm	SMF	24.85 miles (40 km)
ONS-XC-10G-1510	OC192/10GE/OTU2, CWDM, XFP C-Temp,	1510 nm	SMF	24.85 miles (40 km)
ONS-XC-10G-1530	OC192/10GE/OTU2, CWDM, XFP C-Temp,	1530 nm	SMF	24.85 miles (40 km)
ONS-XC-10G-1550	OC192/10GE/OTU2, CWDM, XFP C-Temp,	1550 nm	SMF	24.85 miles (40 km)
ONS-XC-10G-1570	OC192/10GE/OTU2, CWDM, XFP C-Temp,	1570 nm	SMF	24.85 miles (40 km)
ONS-XC-10G-1590	OC192/10GE/OTU2, CWDM, XFP C-Temp,	1590 nm	SMF	24.85 miles (40 km)
ONS-XC-10G-1610	OC192/10GE/OTU2, CWDM, XFP C-Temp,	1610 nm	SMF	24.85 miles (40 km)

Cisco DWDM XFP Transceiver Modules

Table A-15 lists the supported DWDM XFP transceiver modules.

Table A-15 Cisco DWDM XFP Transceiver Modules

Part Number	Description	Wavelength	ITU Grid
DWDM-XFP-60.61	10GBASE-DWDM XFP (100 GHz ITU grid)	1560.61 nm	21
DWDM-XFP-59.79	10GBASE-DWDM XFP (100 GHz ITU grid)	1559.79 nm	22
DWDM-XFP-58.98	10GBASE-DWDM XFP (100 GHz ITU grid)	1558.98 nm	23
DWDM-XFP-58.17	10GBASE-DWDM XFP (100 GHz ITU grid)	1558.17 nm	24
DWDM-XFP-56.55	10GBASE-DWDM XFP (100 GHz ITU grid)	1556.55 nm	26
DWDM-XFP-55.75	10GBASE-DWDM XFP (100 GHz ITU grid)	1555.75 nm	27
DWDM-XFP-54.94	10GBASE-DWDM XFP (100 GHz ITU grid)	1554.94 nm	28
DWDM-XFP-54.13	10GBASE-DWDM XFP (100 GHz ITU grid)	1554.13 nm	29
DWDM-XFP-52.52	10GBASE-DWDM XFP (100 GHz ITU grid)	1552.52 nm	31
DWDM-XFP-51.72	0GBASE-DWDM XFP (100 GHz ITU grid)	1551.72 nm	32
DWDM-XFP-50.92	10GBASE-DWDM XFP (100 GHz ITU grid)	1550.92 nm	33
DWDM-XFP-50.12	10GBASE-DWDM XFP (100 GHz ITU grid)	1550.12 nm	34
DWDM-XFP-48.51	10GBASE-DWDM XFP (100 GHz ITU grid)	1548.51 nm	36
DWDM-XFP-47.72	10GBASE-DWDM XFP (100 GHz ITU grid)	1547.72 nm	37
DWDM-XFP-46.92	10GBASE-DWDM XFP (100 GHz ITU grid)	1546.92 nm	38
DWDM-XFP-46.12	10GBASE-DWDM XFP (100 GHz ITU grid)	1546.12 nm	39
DWDM-XFP-44.53	10GBASE-DWDM XFP (100 GHz ITU grid)	1544.53 nm	41
DWDM-XFP-43.73	10GBASE-DWDM XFP (100 GHz ITU grid)	1543.73 nm	42
DWDM-XFP-42.94	10GBASE-DWDM XFP (100 GHz ITU grid)	1542.94 nm	43
DWDM-XFP-42.14	10GBASE-DWDM XFP (100 GHz ITU grid)	1542.14 nm	44

Table A-15 Cisco DWDM XFP Transceiver Modules (continued)

Part Number	Description	Wavelength	ITU Grid
DWDM-XFP-40.56	10GBASE-DWDM XFP (100 GHz ITU grid)	1540.56 nm	46
DWDM-XFP-39.77	10GBASE-DWDM XFP (100 GHz ITU grid)	1539.77 nm	47
DWDM-XFP-38.98	10GBASE-DWDM XFP (100 GHz ITU grid)	1539.98 nm	48
DWDM-XFP-38.19	10GBASE-DWDM XFP (100 GHz ITU grid)	1538.19 nm	49
DWDM-XFP-36.61	10GBASE-DWDM XFP (100 GHz ITU grid)	1536.61 nm	51
DWDM-XFP-35.82	10GBASE-DWDM XFP (100 GHz ITU grid)	1535.82 nm	52
DWDM-XFP-35.04	10GBASE-DWDM XFP (100 GHz ITU grid)	1535.04 nm	53
DWDM-XFP-34.25	10GBASE-DWDM XFP (100 GHz ITU grid)	1534.25 nm	54
DWDM-XFP-32.68	10GBASE-DWDM XFP (100 GHz ITU grid)	1532.68 nm	56
DWDM-XFP-31.90	10GBASE-DWDM XFP (100 GHz ITU grid)	1531.90 nm	57
DWDM-XFP-31.12	10GBASE-DWDM XFP (100 GHz ITU grid)	1531.12 nm	58
DWDM-XFP-30.33	10GBASE-DWDM XFP (100 GHz ITU grid)	1530.33 nm	59
DWDM-XFP-C	10GBASE-DWDM Tunable XFP (50-GHz ITU grid) 80 Channels	Variable	Variable

Note The DWDM-XFP-C module is not supported in the 4-Port 10 Gigabit Ethernet modular port adapter.

Ethernet Line Card Power Consumption Values

Table A-16 lists the power consumption specifications for the Ethernet line cards.

Caution Be sure that the chassis configuration complies with the required power budgets. Failure to properly verify the configuration may result in an unpredictable state if one of the power units fails. Contact your local sales representative for assistance.

Table A-16 Ethernet Line Card Power Consumption Values

Description	Power Consumption Values
2-Port 10-Gigabit Ethernet + 20-Port Gigabit Ethernet Combination Line Card	315 W at 77°F (25°C) 326 W at 104°F (40°C) 335 W at 131°F (55°C)
4-Port 10-Gigabit Ethernet Line Card	310 W at 77°F (25°C) 320 W at 104°F (40°C) 350 W at 131°F (55°C)
4-Port 10-Gigabit Ethernet + 16-Port Gigabit Ethernet Combination Line Card	225 W at 77°F (25°C) 250 W at 104°F (40°C) 275 W at 131°F (55°C)
8-Port 10-Gigabit Ethernet 2:1 Oversubscribed Line Card	310 W at 77°F (25°C) 320 W at 104°F (40°C) 350 W at 131°F (55°C)
8-Port 10-Gigabit Ethernet 80 Gbps Line Rate Card	565 W at 77°F (25°C) 575 W at 104°F (40°C) 630 W at 131°F (55°C)
16-Port 10-Gigabit Ethernet Oversubscribed Line Card	565 W at 77°F (25°C) 575 W at 104°F (40°C) 630 W at 131°F (55°C)
24-Port 10-Gigabit Ethernet Line Card	775 W at 77°F (25°C) 850 W at 104°F (40°C) 895 W at 131°F (55°C)
36-Port 10-Gigabit Ethernet Line Card	775 W at 77°F (25°C) 850 W at 104°F (40°C) 895 W at 131°F (55°C)
40-Port Gigabit Ethernet Line Card	310 W at 77°F (25°C) 320 W at 104°F (40°C) 350 W at 131°F (55°C)
1-Port 100-Gigabit Ethernet Line Card	800 W at 77°F (25°C) 875 W at 104°F (40°C) 920 W at 131°F (55°C)
2-Port 100-Gigabit Ethernet Line Card	800 W at 77°F (25°C) 875 W at 104°F (40°C) 920 W at 131°F (55°C)
8-Port 100-Gigabit Ethernet Line Card	1050 W at 77°F (25°C) 1100 W at 104°F (40°C) 1150 W at 131°F (55°C)

Table A-16 Ethernet Line Card Power Consumption Values (continued)

Description	Power Consumption Values
80 Gigabyte 2-NPU Modular Line Card (-TR or -SE)	350 W at 77°F (25°C) 400 W at 104°F (40°C) 420 W at 131°F (55°C)
160 Gigabyte 4-NPU Modular Line Card (-TR or -SE)	350 W at 77°F (25°C) 400 W at 104°F (40°C) 420 W at 131°F (55°C)
Modular 4-NPU Line Card (-TR or -SE)	520 W at 77°F (25°C) 590 W at 104°F (40°C) 620 W at 131°F (55°C)

Ethernet Line Card Physical Dimensions

Table A-17 lists the physical dimensions for the Ethernet line cards.

Table A-17 Ethernet Line Card Physical Dimensions

Product Description	Part Number	Height	Width	Depth	Weight
2-Port 10GE, 20-Port GE Low Queue Combo Line Card	A9K-2T20GE-L	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	13.5 +/- .5 pounds 6.1235 +/- .2268 kg
2-Port 10GE, 20-Port GE Medium Queue Combo Line Card	A9K-2T20GE-B	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	13.5 +/- .5 pounds 6.1235 +/- .2268 kg
2-Port 10GE, 20-Port GE High Queue Combo Line Card	A9K-2T20GE-E	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	13.5 +/- .5 pounds 6.1235 +/- .2268 kg
4-Port 10GE Low Queue Line Card	A9K-4T-L	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	18.5 +/- .5 pounds 8.39146 +/- .2268 kg
4-Port 10GE Medium Queue Line Card	A9K-4T-B	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	18.5 +/- .5 pounds 8.39146 +/- .2268 kg
4-Port 10GE Extended Line Card	A9K-4T-E	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	18.5 +/- .5 pounds 8.39146 +/- .2268 kg
4-Port 10GE, 16-Port GE Combo Line Card, Packet Transport Optimized	A9K-4T16GE-TR	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	11.7 +/- .5 pounds 5.307 +/- .2268 kg
4-Port 10GE, 16-Port GE Combo Line Card, Service Edge Optimized	A9K-4T16GE-SE	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	11.7 +/- .5 pounds 5.307 +/- .2268 kg
8-Port 10GE Low Queue Line Card	A9K-8T-L	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	18.5 +/- .5 pounds 8.39146 +/- .2268 kg
8-Port 10GE Low Queue Oversubscribed Line Card	A9K-8T/4-L	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	14.0 +/- .5 pounds 6.35029 +/- .2268 kg
8-Port 10GE Medium Queue Oversubscribed Line Card	A9K-8T/4-B	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	14.0 +/- .5 pounds 6.35029 +/- .2268 kg
8-Port 10GE Oversubscribed Extended Line Card	A9K-8T/4-E	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	14.0 +/- .5 pounds 6.35029 +/- .2268 kg
8-Port 10GE Medium Queue Line Card, requires XFPs	A9K-8T-B	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	18.5 +/- .5 pounds 8.39146 +/- .2268 kg
8-Port 10GE High Queue Line Card	A9K-8T-E	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	18.5 +/- .5 pounds 8.39146 +/- .2268 kg
8-Port 100GE Line Card, Service Edge Optimized	A9K-8X100GE-L-SE	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	28.0 +/- .5 pounds 12.70059 +/- .2268 kg
16-Port 10GE Medium Queue Oversubscribed Line Card,	A9K-16/8T-B	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	18.0 +/- .5 pounds 8.16466 +/- .2268 kg
24-Port 10GE Line Card, Packet Transport Optimized	A9K-24X10GE-TR	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	18.42 pounds 8.3551715 kg

Table A-17 Ethernet Line Card Physical Dimensions (continued)

Product Description	Part Number	Height	Width	Depth	Weight
24-Port 10GE Line Card, Service Edge Optimized	A9K-24X10GE-SE	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	18.42 pounds 8.3551715 kg
36-Port 10GE Line Card, Packet Transport Optimized Requires SFP+ Modules	A9K-36X10GE-TR	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	19.07 pounds 8.6500065 kg
36-Port 10GE Line Card, Service Edge Optimized Requires SFP+ Modules	A9K-36X10GE-SE	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	19.07 pounds 8.6500065 kg
40-Port GE Low Queue Line Card, requires SFPs	A9K-40GE-L	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	13.5 +/- .5 pounds 6.1235 +/- .2268 kg
40-Port GE Medium Queue Line Card, requires SFPs	A9K-40GE-B	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	13.5 +/- .5 pounds 6.1235 +/- .2268 kg
40-Port GE High Queue Line Card, requires SFPs	A9K-40GE-E	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	13.5 +/- .5 pounds 6.1235 +/- .2268 kg
40-Port GE Line Card, Transport Optimized, requires SFPs	A9K-40GE-TR	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	12.19+/- .5 pounds 5.538 +/- .2268 kg
40-Port GE Line Card, Packet Service Edge Optimized, requires SFPs	A9K-40GE-SE	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	12.19 +/- .5 pounds 5.538 +/- .2268 kg
80 Gigabyte Modular Line Card, Packet Transport Optimized	A9K-MOD80-TR	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	15.24 pounds 6.9127477 kg (without EPs)
80 Gigabyte Modular Line Card, Service Edge Optimized	A9K-MOD80-SE	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	15.24 pounds 6.9127477 kg (without EPs)
160 Gigabyte Modular Line Card, Packet Transport Optimized	A9K-MOD160-TR	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	16.34 pounds 7.4117 kg (without EPs)
160 Gigabyte Modular Line Card, Service Edge Optimized	A9K-MOD160-SE	14 inches 35.56 cm	1.72 inches 4.37 cm	20.5 inches 52.07 cm	16.34 pounds 7.4117 kg (without EPs)