

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

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Preface

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- Changes to This Document, on page ix
- Audience, on page xi
- Purpose, on page xi
- Organization, on page xi
- Conventions, on page xii
- Obtaining Documentation and Submitting a Service Request, on page xiii

Changes to This Document

The following table lists the technical changes made to this document since it was first printed.

Table 1: New and Changed Information

Date	Change Summary
April 2021	Added support for A99-10X400GE-X-SE and A99-10X400GE-X-TR line cards. Also referred as Cisco ASR 9900 Series 5th Generation 10-port 400 Gigabit Ethernet line card.
April 2020	Added support for: • A99-32X100GE-X-SE, and A99-32X100GE-X-TR line cards. Also referred as Cisco ASR 9900 Series 5th Generation 32-port 100 Gigabit Ethernet line card. • A9K-20HG-FLEX-SE, A9K-20HG-FLEX-TR, A9K-8HG-FLEX-SE, and A9K-8HG-FLEX-TR line cards. Also referred as Cisco ASR 9000 Series 5th Generation High-Density Multi-Rate line cards.
August 2019	Added support for Staircase FEC for A9K-MPA-1X200GE MPA with CFP2-DCO, A9K-MPA-1X100GE MPA with CFP2, and A9K-MPA-2X100GE MPA with CFP2. Added steps for safe removal of CFP2-DCO modules.
May 2019	Added support for A9K-MPA-1X200GE MPA with CFP2-DCO.
January 2019	Added support for A9K-16X100GE-CM, A99-32X100GE-CM, and A99-16X100GE-X-SE line cards.

Date	Change Summary
December 2018	Added support for A9K-16X100GE-TR and A99-32X100GE-TR line cards. Added support for 32-port GE Modular Port Adapter (MPA) with MACsec.
March 2018	Added support for A9K-24X10GE-1G-CM and A9K-48X10GE-1G-CM line cards.
December 2017	Added support for A9K-4X100GE line card.
July 2017	• The MOD-400 modular line card (A9K-MOD400-TR, A9K-MOD400-SE) is supported on the IOS XR 64-bit platform with the A9K-MPA-2x100GE MPA and CPAK-100G-SR10,CPAK-10x10G-LR, and CPAK-100G-LR4 optics. • GLC-LH-SMD, GLC-ZX-SMD, and GLC-TE optics are supported on the Cisco ASR 9000 Series 24-Port Dual-Rate 10GE/1GE Line Card and Cisco ASR 9000 Series 48-Port Dual-Rate 10GE/1GE Line Card (on the IOS XR 32-bit)
March 2017	Added information about new line cards (A9K-24X10GE-1G-TR, A9K-24X10GE-1G-SE, A9K-48X10GE-1G-TR, A9K-48X10GE-1G-SE, A9K-MOD200-CM) Added new optics supported in IOS XR Release 6.2.1.
August 2016	Added information on the following consumption-model and non consumption-model line cards: A99-8X100GE-CM (ASR 9000 8-port 100GE Consumption Model Line Card) A99-8X100GE A99-12X100GE-CM (ASR 9000 12-port 100GE Consumption Model Line Card)
July 2016	Added information about consumption-model of MOD 400 (A9K-MOD400-CM)
May 2016	Added information about new line cards (A99-12X100GE, A9K-MOD200-SE, A9K-MOD200-TR) MPA (A9K-MPA-1X100GE, A9K-MPA-2X100GE)
December 2015	Added support for 2X100GE MPA, 8x100GE OTN/WAN card with 7-fabric.
September 2015	Added new line cards (A9K-MOD400-SE, A9K-MOD400-TR, A9K-8X100GE-CM, and A9K-400GE-DWDM-TR), MPA (A9K-MPA-20x10GE), and CPAK adapter (CVR-CPAK-QSFP40).
April 2015	Added new next generation line cards 4x100GE (A9K-4X100GE-TR and A9K-4X100GE-SE), 8X100GE (A9K-8X100GE-TR and A9K-8X100GE-SE), and 40GE CPAK breakout support.
January 2015	Added new 8X100GE (A9K-8X100GE-L-SE) next generation line card, 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.

Date	Change Summary
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.
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.

Organization

This guide includes the following sections:

Section	Title	Description
1	Overview, on page 1	Provides instructions for installing the hardware and connecting external network interface cables.

Section	Title	Description
2	Installing and Removing Line Cards and Transceiver Modules, on page 79	Provides instructions for installing and removing line cards and transceiver modules.
3	Verifying and Troubleshooting Line Card Installation, on page 147	Provides procedures for verifying the line card installation.
A	Technical Specifications, on page 157	Lists the specifications for the Ethernet line cards for the Cisco ASR 9000 Series Aggregation Services Router.

Conventions

This document 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.

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

Warning IMPORTANT SAFETY INSTRUCTIONS

Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Read the installation instructions before using, installing, or connecting the system to the power source. Use the statement number at the beginning of each warning statement to locate its translation in the translated safety warnings for this device.

SAVE THESE INSTRUCTIONS

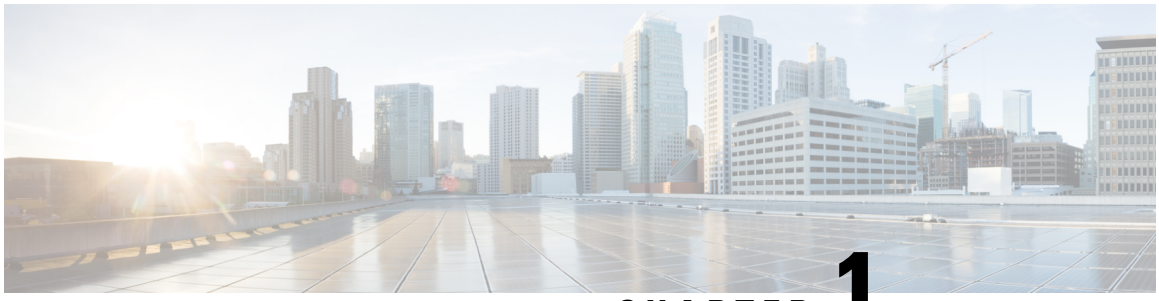


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CHAPTER 1

Overview

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

- Ethernet Line Cards and MPAs, on page 1
- Cisco IOS XR Software Release and Hardware Revision Requirements, on page 7
- Ethernet Line Card and MPA Comparison, on page 11
- 10-Gigabit Ethernet Line Cards, on page 16
- 100-Gigabit Ethernet Line Cards, on page 37
- 400-Gigabit Ethernet Line Cards, on page 50
- IPoDWDM Ethernet Line Cards, on page 54
- Multi-Rate Line Cards, on page 55
- Modular Line Cards and Modular Port Adapters, on page 56

Ethernet Line Cards and MPAs

The following tables list the Cisco ASR 9000 Series Ethernet line cards and MPAs (Modular Port Adapters) and their corresponding Cisco product identification numbers (PIDs), organized by generation.

Note RS-FEC are a group of error-correcting codes that are used in mass storage systems to correct the burst errors associated with media defects. All line cards and MPAs that support OTN mode support RS-FEC. In the LAN mode, by default, SR4, CWDM4, and PSM4 optics are enabled with RS-FEC (in accordance to the IEEE Standard).

Table 2: Cisco ASR 9000 Series Ethernet Line Cards: 1st Generation

Ethernet Line Card	Cisco Product Number
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 and SFP	A9K-2T20GE-L
4-Port 10GE Line Card with XFP	A9K-4T-B

Ethernet Line Card	Cisco Product Number
4-Port 10GE Extended Line Card with XFP	A9K-4T-E
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
8-Port 10GE DX Extended Line Card with XFP	A9K-8T/4-E
8-Port 10GE Line Rate Card with XFP	A9K-8T-B
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
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

Table 3: Cisco ASR 9000 Series Ethernet Line Cards: 2nd Generation

Ethernet Line Card	Cisco Product Number
1-Port 100GE DX Line Card, Service Edge Optimized with CFP	A9K-1X100GE-SE
1-Port 100GE DX Line Card, Packet Transport Optimized with CFP	A9K-1X100GE-TR
4-Port 10GE + 16-Port GE Combination Line Card, Packet Transport Optimized, with SFP and SFP+	A9K-4T16GE-TR
4-Port 10GE + 16-Port GE Extended Combination Line Card, Service Edge Optimized, with SFP and SFP+	A9K-4T16GE-SE
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, Service Edge Optimized with SFP+	A9K-36X10GE-SE
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
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

Ethernet Line Card	Cisco Product Number
1-Port 40GE Modular Port Adapter (MPA), with QSFP+	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-20X1GE
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

Table 4: Cisco ASR 9000 Series Ethernet Line Cards: 3rd Generation

Ethernet Line Card	Cisco Product Number
24-Port 10GE/1GE Line Card, Packet Transport Optimized with SFP+ or SFP	A9K-24X10GE-1G-TR
24-Port 10GE/1GE Line Card, Service Edge Optimized with SFP+ or SFP	A9K-24X10GE-1G-SE
24-Port 10GE/1GE Line Card, Consumption Model with SFP+ or SFP	A9K-24X10GE-1G-CM
48-Port 10GE/1GE Line Card, Packet Transport Optimized with SFP+ or SFP	A9K-48X10GE-1G-TR
48-Port 10GE/1GE Line Card, Service Edge Optimized with SFP+ or SFP	A9K-48X10GE-1G-SE
48-Port 10GE/1GE Line Card, Consumption Model with SFP+ or SFP	A9K-48X10GE-1G-CM
4-Port 100GE Ethernet Line Card, Packet Transport Optimized with CPAK	A9K-4X100GE-TR
4-Port 100GE Ethernet Line Card, Service Edge Optimized with CPAK	A9K-4X100GE-SE
8-Port 100GE Line Card, Packet Transport Optimized with CPAK	A9K-8X100GE-TR
8-Port 100GE Line Card, Service Edge Optimized with CPAK	A9K-8X100GE-SE
8-Port 100GE Line Card, Consumption Model Optimized with CPAK	A9K-8X100GE-CM
8-Port 100GE Line Card, Service Edge Optimized, with CPAK (LAN version)	A9K-8X100G-LB-SE
8-Port 100GE Line Card, Transport Optimized, with CPAK (LAN version)	A9K-8X100G-LB-TR
4-Port 100GE Line Card, with QSFP28	A9K-4X100GE

Ethernet Line Card	Cisco Product Number
2-Port 100G + 20-Port 10 GE Combination IPoDWDM Line Card with CFP2 and SFP+, Packet Transport Optimized	A9K-400GE-DWDM-TR
20-Port 10-Gigabit Ethernet Modular Port Adapter (MPA) with SFP+	A9K-MPA-20x10GE
20-Port 10-Gigabit Ethernet Modular Port Adapter (MPA) - Consumption Model	A9K-MPA-20x10GE-CM
1-Port 100GE Modular Port Adapter (MPA)	A9K-MPA-1x100GE
1-Port 200GE Modular Port Adapter (MPA)	A9K-MPA-1X200GE
2-Port 100GE Modular Port Adapter (MPA)	A9K-MPA-2x100GE
2-Port 100GE Modular Port Adapter (MPA) - Consumption Model	A9K-MPA-2x100GE-CM
32-port GE Modular Port Adapter (MPA) with MACsec	A9K-MPA-32X1GE
200 Gigabyte Modular Line Card, Packet Transport Optimized	A9K-MOD200-TR
200 Gigabyte Modular Line Card, Service Edge Optimized	A9K-MOD200-SE
400 Gigabyte Modular Line Card, Packet Transport Optimized	A9K-MOD400-TR
400 Gigabyte Modular Line Card, Service Edge Optimized	A9K-MOD400-SE
400 Gigabyte Modular Line Card, Consumption Model Optimized	A9K-MOD400-CM

Table 5: Cisco ASR 9900 Series Ethernet Line Cards: 3rd Generation

Ethernet Line Card	Cisco Product Number
8-Port 100GE Line Card, Transport Optimized with CPAK	A99-8X100GE-TR
8-Port 100GE Line Card, Service Edge Optimized with CPAK	A99-8X100GE-SE
8-Port 100GE Line Card, Consumption Model with CPAK	A99-8X100GE-CM
12-Port 100GE Line Card, with QSFP28	A99-12X100GE
12-Port 100GE Line Card, Consumption Model with QSFP28	A99-12X100GE-CM
7 Fabric 48-Port Dual-Rate 10GE/1GE Line Card, Service Edge Optimized	A99-48X10GE-1G-SE
7 Fabric 48-Port Dual-Rate 10GE/1GE Line Card, Transport Optimized	A99-48X10GE-1G-TR

Table 6: Cisco ASR 9000 Series Ethernet Line Cards: 4th Generation

Ethernet Line Card	Cisco Product Number
16-port 100GE Line Card, Transport Optimized with QSFP28/QSFP+	A9K-16X100GE-TR
16-port 100GE Line Card, Consumption Model with QSFP28/QSFP+	A9K-16X100GE-CM
16-port 100GE Line Card, Service Edge Optimized with QSFP28/QSFP+	A99-16X100GE-X-SE

Table 7: Cisco ASR 9900 Series Ethernet Line Cards: 4th Generation

Ethernet Line Card	Cisco Product Number
32-port 100GE Line Card, Transport Optimized with QSFP28/QSFP+	A99-32X100GE-TR
32-port 100GE Line Card, Consumption Model with QSFP28	A99-32X100GE-CM

Table 8: Cisco ASR 9000 Series Ethernet Line Cards: 5th Generation

Ethernet Line Card	Cisco Product Number
2T Combo Line Card, Service Edge Optimized	A9K-20HG-FLEX-SE
2T Combo Line Card, Transport Optimized	A9K-20HG-FLEX-TR
800G Combo Line Card, Service Edge Optimized	A9K-8HG-FLEX-SE
800G Combo Line Card, Transport Optimized	A9K-8HG-FLEX-TR
400G Combo Line Card, Service Edge Optimized	A9K-4HG-FLEX-SE
400G Combo Line Card, Transport Optimized	A9K-4HG-FLEX-TR
400G Combo Line Card, Transport Optimized	A9K-400GE-X-SE
400G Combo Line Card, Transport Optimized	A9K-4HG-FLEX-X-SE

Table 9: Cisco ASR 9900 Series Ethernet Line Cards: 5th Generation

Ethernet Line Card	Cisco Product Number
32-port 100GE Line Card with QSFP28/QSFP+, Service Edge Optimized	A99-32X100GE-X-SE
32-port 100GE Line Card with QSFP28/QSFP+, Transport Optimized	A99-32X100GE-X-TR

Ethernet Line Card	Cisco Product Number
10-port 400GE Line Card with QSFP-DD, Service Edge Optimized	A99-10X400GE-X-SE
10-port 400GE Line Card with QSFP-DD, Transport Optimized	A99-10X400GE-X-TR
400G Combo Line Card, Service Edge Optimized	A99-4HG-FLEX-SE
400G Combo Line Card, Transport Optimized	A99-4HG-FLEX-TR
400G Combo Line Card, Transport Optimized	A99-400GE-X-SE
400G Combo Line Card, Transport Optimized	A99-4HG-FLEX-X-SE

The following table lists the Cisco ASR 9000 chassis and the supported Ethernet line cards and MPAs .

Table 10: Cisco ASR 9000 Chassis and Ethernet Line Card Compatibility

Chassis	Ethernet Line Card
Cisco ASR 9006, Cisco ASR 9010 **Note** Support for 3rd generation and later line cards requires v2 fan trays (ASR-9006-FAN-V2 or ASR-9010-FAN-V2)	• Cisco ASR 9000 Series Ethernet Line Cards: 1st Generation • Cisco ASR 9000 Series Ethernet Line Cards: 2nd Generation • Cisco ASR 9000 Series Ethernet Line Cards: 3rd Generation • Cisco ASR 9000 Series Ethernet Line Cards: 4th Generation • Cisco ASR 9000 Series Ethernet Line Cards: 5th Generation
Cisco ASR 9904, Cisco ASR 9910, Cisco ASR 9912, and Cisco ASR 9922	• Cisco ASR 9000 Series Ethernet Line Cards: 2nd Generation • Cisco ASR 9000 Series Ethernet Line Cards: 3rd Generation • Cisco ASR 9900 Series Ethernet Line Cards: 3rd Generation • Cisco ASR 9000 Series Ethernet Line Cards: 4th Generation • Cisco ASR 9900 Series Ethernet Line Cards: 4th Generation • Cisco ASR 9000 Series Ethernet Line Cards: 5th Generation
Cisco ASR 9906	• Cisco ASR 9000 Series Ethernet Line Cards: 3rd Generation • Cisco ASR 9900 Series Ethernet Line Cards: 3rd Generation • Cisco ASR 9000 Series Ethernet Line Cards: 4th Generation • Cisco ASR 9900 Series Ethernet Line Cards: 4th Generation • Cisco ASR 9000 Series Ethernet Line Cards: 5th Generation

Cisco ASR 9000 Series Routers line cards do not support voltage monitoring. Hence, no alarm is raised when voltage thresholds are crossed.

Cisco IOS XR Software Release and Hardware Revision Requirements

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

Table 11: Cisco ASR 9000 Series Ethernet Line Card and MPA

Ethernet Line Card	Product Number	Minimum IOS XR Software Release	Initial Support on IOS XR 64-bit Release	Required Hardware Version
40-Port GE Line Card	A9K-40GE-B	3.7.2	Unsupported	1.0
40-Port GE Extended Line Card	A9K-40GE-E	3.7.2	Unsupported	1.0
40-Port GE Low Queue Line Card	A9K-40GE-L	3.9.0	Unsupported	1.0
8-Port 10GE DX Line Card	A9K-8T/4-B	3.7.2	Unsupported	1.0
8-Port 10GE DX Extended Line Card	A9K-8T/4-E	3.7.2	Unsupported	1.0
8-Port 10GE DX Low Queue Line Card	A9K-8T/4-L	3.9.0	Unsupported	1.0
4-Port 10GE Line Card	A9K-4T-B	3.7.2	Unsupported	1.0
4-Port 10GE Extended Line Card	A9K-4T-E	3.7.2	Unsupported	1.0
4-Port 10GE Low Queue Line Card	A9K-4T-L	3.9.0	Unsupported	1.0
8-Port 10GE Line Rate Card	A9K-8T-B	3.9.1	Unsupported	1.0
8-Port 10GE Extended Line Rate Card	A9K-8T-E	3.9.0	Unsupported	1.0
8-port 10GE 80G Low Queue Line Rate Card	A9K-8T-L	3.9.0	Unsupported	1.0
2-Port 10GE + 20-Port GE Combination Line Card	A9K-2T20GE-B	3.9.0	Unsupported	1.0
2-Port 10GE + 20-Port GE Extended Combination Line Card	A9K-2T20GE-E	3.9.0	Unsupported	1.0
2-Port 10GE + 20-Port GE Low Queue Combination Line Card	A9K-2T20GE-L	3.9.1	Unsupported	1.0
16-Port 10GE DX Medium Queue Line Card	A9K-16T/8-B	3.9.1	Unsupported	1.0
24-Port 10GE DX Line Card, Packet Transport Optimized	A9K-24X10GE-TR	4.2.0	Unsupported	1.0
24-Port 10GE DX Line Card, Service Edge Optimized	A9K-24X10GE-SE	4.2.0	Unsupported	1.0

Ethernet Line Card	Product Number	Minimum IOS XR Software Release	Initial Support on IOS XR 64-bit Release	Required Hardware Version
2-Port 100GE DX Line Card, Packet Transport Optimized	A9K-2X100GE-TR	4.2.0	Unsupported	1.0
2-Port 100GE DX Line Card, Service Edge Optimized	A9K-2X100GE-SE	4.2.0	Unsupported	1.0
80 Gigabyte Modular Line Card, Packet Transport Optimized	A9K-MOD80G-TR	4.2.0	Unsupported	1.0
80 Gigabyte Modular Line Card, Service Edge Optimized	A9K-MOD80G-SE	4.2.0	Unsupported	1.0
160 Gigabyte Modular Line Card, Packet Transport Optimized	A9K-MOD160G-TR	4.2.0	Unsupported	1.0
160 Gigabyte Modular Line Card, Service Edge Optimized	A9K-MOD160G-SE	4.2.0	Unsupported	1.0
20-Port GE Modular Port Adapter (MPA)	A9K-MPA-20X1GE	4.2.0	6.2.1	1.0
2-port 10GE Modular Port Adapter (MPA)	A9K-MPA-2X10GE	4.2.0	6.3.2	1.0
4-Port 10GE Modular Port Adapter (MPA)	A9K-MPA-4X10GE	4.2.0	6.2.1	1.0
1-Port 100GE Modular Port Adapter (MPA)	A9K-MPA-1X100GE	6.0.1	6.3.1	1.0 3.0—required for CFP2-DCO digital optics
2-Port 100GE Modular Port Adapter (MPA)	A9K-MPA-2X100GE	6.0.1	6.2.2	1.0 4.0—required for CFP2-DCO digital optics
2-Port 100GE Modular Port Adapter (MPA), Consumption Model	A9K-MPA-2X100GE-CM	6.1.2	Unsupported	1.0 2.0—required for CFP2-DCO digital optics
32-Port GE Modular Port Adapter (MPA)	A9K-MPA-32X1GE	6.6.1	6.6.1	1.0
160 Gigabyte Modular Line Card, Packet Transport Optimized	A9K-MOD160G-TR	4.2.1	Unsupported	1.0
160 Gigabyte Modular Line Card, Service Edge Optimized	A9K-MOD160G-SE	4.2.1	Unsupported	1.0
2-port 40GE Modular Port Adapter (MPA)	A9K-MPA-2X40GE	4.2.1	6.3.1	1.0

Ethernet Line Card	Product Number	Minimum IOS XR Software Release	Initial Support on IOS XR 64-bit Release	Required Hardware Version
36-Port 10GE Line Card, Packet Transport Optimized	A9K-36X10GE-TR	4.2.2 4.2.2 is the hardware release. The CCO release is 4.2.3.	Unsupported	1.0
36-Port 10GE Line Card, Service Edge Optimized	A9K-36X10GE-SE	4.2.2	Unsupported	1.0
1-Port 100GE DX Line Card, Packet Transport Optimized	A9K-1X100GE-TR	4.2.2	Unsupported	1.0
1-Port 100GE DX Line Card, Service Edge Optimized	A9K-1X100GE-SE	4.2.2	Unsupported	1.0
2-Port 10GE Modular Port Adapter (MPA)	A9K-EP-2T	4.2.0	Unsupported	1.0
1-Port 40GE Modular Port Adapter (MPA)	A9K-MPA-1X40GE	4.2.3	6.3.1	1.0
8-port 10GE Modular Port Adapter (MPA)	A9K-MPA-8X10GE	4.3.1	6.3.2	1.0
40-Port GE Line Card, Packet Transport Optimized	A9K-40GE-TR	5.2.2	Unsupported	1.0
40-Port GE Line Card, Service Edge Optimized	A9K-40GE-SE	5.2.2	Unsupported	1.0
4-Port 10GE + 16-Port GE Combination Line Card, Packet Transport Optimized	A9K-4T16GE-TR	5.3.0	Unsupported	1.0
4-Port 10GE + 16-Port GE Extended Combination Line Card, Service Edge Optimized	A9K-4T16GE-SE	5.3.0	Unsupported	1.0
8-Port 100GE Line Card, Service Edge Optimized	A9K-8X100GE-L-SE	5.3.0	6.1.2	1.0
8-Port 100GE Line Card, Consumption Model	A99-8X100GE-CM	6.1.1	6.1.2	1.0
8-Port 100GE Line Card, Packet Transport optimized	A99-8X100GE-TR	6.1.1	6.1.2	1.0
8-Port 100GE Line Card, Service Edge optimized	A99-8X100GE-SE	6.1.1	6.1.2	1.0
4-Port 100GE Line Card, Packet Transport Optimized	A9K-4X100GE-TR	5.3.1	6.1.2	1.0
4-Port 100GE Line Card, Service Edge Optimized	A9K-4X100GE-SE	5.3.1	6.1.2	1.0
8-Port 100GE Line Card, Packet Transport Optimized	A9K-8X100GE-TR	5.3.1	6.1.2	1.0
8-Port 100GE Line Card, Service Edge Optimized	A9K-8X100GE-SE	5.3.1	6.1.2	1.0
8-Port 100GE Line Card, Consumption Model Optimized	A9K-8X100GE-CM	5.3.2	6.1.2	1.0
4-Port 100GE Line Card	A9K-4X100GE	6.2.3 6.3.2	6.4.1	1.0

Ethernet Line Card	Product Number	Minimum IOS XR Software Release	Initial Support on IOS XR 64-bit Release	Required Hardware Version
12-Port 100GE Line Card	A99-12X100GE	6.0.1	6.1.2	1.0
12-Port 100GE Line Card, Consumption Model	A99-12X100GE-CM	6.1.1	6.1.2	1.0
400 Gigabyte Modular Line Card, Packet Transport Optimized	A9K-MOD400-TR	5.3.2	6.2.1	1.0
400 Gigabyte Modular Line Card, Service Edge Optimized	A9K-MOD400-SE	5.3.2	6.2.1	1.0
400 Gigabyte Modular Line Card, Consumption Model Optimized	A9K-MOD400-CM	6.1.1	6.2.1	1.0
200 Gigabyte Modular Line Card, Packet Transport Optimized	A9K-MOD200-TR	6.0.1	6.2.1	1.0
200 Gigabyte Modular Line Card, Service Edge Optimized	A9K-MOD200-SE	6.0.1	6.2.1	1.0
2-Port 100G + 20-Port 10 GE Combination IPoDWDM Line Card with CFP2 and SFP+, Packet Transport Optimized	A9K-400GE-DWDM-TR	5.3.2	6.2.1	1.0
20-Port 10-Gigabit Ethernet Modular Port Adapter (MPA) with SFP+	A9K-MPA-20x10GE	5.3.2	6.2.1	1.0
24-Port 10GE/1GE Line Card, Packet Transport Optimized	A9K-24X10GE-1G-TR	6.2.1	6.3.2	1.0
24-Port 10GE/1GE Line Card, Service Edge Optimized	A9K-24X10GE-1G-SE	6.2.1	6.3.2	1.0
24-Port 10GE/1GE Line Card, Service Edge Optimized	A9K-24X10GE-1G-CM	6.3.2	6.4.1	1.0
48-Port 10GE/1GE Line Card, Packet Transport Optimized	A9K-48X10GE-1G-TR	6.2.1	6.3.2	1.0
48-Port 10GE/1GE Line Card, Service Edge Optimized	A9K-48X10GE-1G-SE	6.2.1	6.3.2	1.0
48-Port 10GE/1GE Line Card, Service Edge Optimized	A9K-48X10GE-1G-CM	6.3.2	6.4.1	1.0
7 Fabric 48-Port Dual-Rate 10GE/1GE Line Card, Service Edge Optimized	A99-48X10GE-1G-SE	6.5.2	6.5.2	1.0
7 Fabric 48-Port Dual-Rate 10GE/1GE Line Card, Transport Optimized	A99-48X10GE-1G-TR	6.5.2	6.5.2	1.0

Ethernet Line Card	Product Number	Minimum IOS XR Software Release	Initial Support on IOS XR 64-bit Release	Required Hardware Version
1-Port 200GE Modular Port Adapter (MPA) **Note** • This MPA supports only CFP2-DCO optics. • Only Version 2.0 of the MPA is NEBS compliant.	A9K-MPA-1X200GE	6.6.2	Unsupported	1.0 and 2.0
400G Combo Line Card, Transport Optimized	A9K-4HG-FLEX-TR	7.4.1	7.4.1	1.0
400G Combo Line Card, Service Edge Optimized	A9K-4HG-FLEX-SE	7.4.1	7.4.1	1.0
400G Combo Line Card, Transport Optimized	A99-4HG-FLEX-TR	7.4.1	7.4.1	1.0
400G Combo Line Card, Service Edge Optimized	A99-4HG-FLEX-SE	7.4.1	7.4.1	1.0

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.

The digitally signed images are supported from Cisco IOS XR release 6.0.1 on following line cards:

- A9K-4X100GE-SE/TR
- A99-8X100GE-SE/TR
- A9K-MOD400-SE/TR/CM
- A9K-MOD200-SE/TR/CM
- A9K-400G-DWDM-TR
- A99-12X100GE

For more information on digitally signed images, see *Cisco ASR 9000 Series Aggregation Services Router System Management Configuration Guide*.

Ethernet Line Card and MPA Comparison

The first generation Cisco ASR 9000 line cards are available in base, extended, and low-queue versions. All other generations of line cards are available in Transport and Service Edge versions. All versions are functionally

equivalent, but vary in configuration scale and buffer capacity. The following table provides comparative information about the various line cards and MPAs. For detailed information about the various transceiver modules, see Cisco Transceiver Modules on Cisco.com.

For supported transceivers modules, refer to the Transceiver Module Group (TMG) Compatibility Matrix Tool:

https://tmgmatrix.cisco.com

Table 12: Cisco Ethernet Line Card or MPA Hardware Comparison

Cisco Series Ethernet Line Card or MPA	Product Number	Number of Ports	Module Type
2-Port 10GE + 20-Port GE Combination Line Card	A9K-2T20GE-B	2x10GE 20xGE	XFP (10GE ports) SFP (GE ports)
2-Port 10GE + 20-Port GE Extended Combination Line Card	A9K-2T20GE-E	2x10GE 20xGE	XFP (10GE ports) SFP (GE ports)
2-Port10GE + 20-Port GE Low Queue Combination Line Card	A9K-2T20GE-L	2x10GE 20xGE	XFP (10GE ports) SFP (GE 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+

Cisco Series Ethernet Line Card or MPA	Product Number	Number of Ports	Module Type
24-Port 10GE/1GE Line Card, Packet Transport Optimized **Note** The 24-Port 10GE/1GE Line Card accepts SFP and SFP+ modules.	A9K-24X10GE-1G-TR	24	SFP+ (10GE ports) SFP (GE ports)
24-Port 10GE/1GE Line Card, Service Edge Optimized **Note** The 24-Port 10GE/1GE Line Card accepts SFP and SFP+ modules.	A9K-24X10GE-1G-SE	24	SFP+ (10GE ports) SFP (GE ports)
24-Port 10GE/1GE Line Card, Consumption Model **Note** The 24-Port 10GE/1GE Line Card accepts SFP and SFP+ modules.	A9K-24X10GE-1G-CM	24	SFP+ (10GE ports) SFP (GE ports)
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
48-Port 10GE/1GE Line Card, Packet Transport Optimized **Note** The 48-Port 10GE/1GE Line Card accepts SFP and SFP+ modules.	A9K-48X10GE-1G-TR	48	SFP+ (10GE ports) SFP (GE ports)
48-Port 10GE/1GE Line Card, Service Edge Optimized **Note** The 48-Port 10GE/1GE Line Card accepts SFP and SFP+ modules.	A9K-48X10GE-1G-SE	48	SFP+ (10GE ports) SFP (GE ports)
48-Port 10GE/1GE Line Card, Consumption Model **Note** The 48-Port 10GE/1GE Line Card accepts SFP and SFP+ modules.	A9K-48X10GE-1G-CM	48	SFP+ (10GE ports) SFP (GE ports)

Cisco Series Ethernet Line Card or MPA	Product Number	Number of Ports	Module Type
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
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
4-Port 100GE Line Card, Packet Transport Optimized	A9K-4X100GE-TR	4	CPAK
4-Port 100GE Line Card, Service Edge Optimized	A9K-4X100GE-SE	4	CPAK
8-Port 100GE Line Card, Packet Transport Optimized	A9K-8X100GE-TR	8	CPAK
8-Port 100GE Line Card, Service Edge Optimized	A9K-8X100GE-SE	8	CPAK
8-Port 100GE Line Card, Consumption Model Optimized	A9K-8X100GE-CM	8	CPAK
8-Port 100GE Line Card, Service Edge Optimized (LAN version)	A9K-8X100GE-L-SE	8	CPAK
2-Port 100G + 20-Port 10 GE Combination IPoDWDM Line Card with CFP2 and SFP+, Packet Transport Optimized	A9K-400GE-DWDM-TR	2x100GE 20x10GE	CFP2(100GE ports) SFP+(10GE ports)
4-port 100 GE Line Card	A9K-4X100GE	4	QSFP28
12-port 100 GE Line Card	A99-12X100GE	12	QSFP28
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	—	—
200 Gigabyte Modular Line Card, Packet Transport Optimized	A9K-MOD200-TR	—	—

Cisco Series Ethernet Line Card or MPA	Product Number	Number of Ports	Module Type
200 Gigabyte Modular Line Card, Service Edge Optimized	A9K-MOD200-SE	—	—
400 Gigabyte Modular Line Card, Packet Transport Optimized	A9K-MOD400-TR	—	—
400 Gigabyte Modular Line Card, Service Edge Optimized	A9K-MOD400-SE	—	—
400 Gigabyte Modular Line Card, Consumption Model Optimized	A9K-MOD400-CM	—	—
20-Port GE Modular Port Adapter (MPA)	A9K-MPA-20X1GE	20	SFP
32-Port GE Modular Port Adapter (MPA)	A9K-MPA-32X1GE	32	SFP, CSFP
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+
1-Port 100GE Modular Port Adapter (MPA)	A9K-MPA-1x100GE	1	CFP2-DCO and CPAK
1-Port 200GE Modular Port Adapter (MPA)	A9K-MPA-1X200GE	1	CFP2-DCO
2-Port 100GE Modular Port Adapter (MPA)	A9K-MPA-2x100GE	2	CFP2-DCO and CPAK
20-Port 10-Gigabit Ethernet Modular Port Adapter (MPA) with SFP+	A9K-MPA-20x10GE	20	SFP+
7 Fabric 48-Port Dual-Rate 10GE/1GE Line Card, Service Edge Optimized **Note** The 48-Port 10GE/1GE Line Card accepts SFP and SFP+ modules.	A99-48X10GE-1G-SE	48	SFP+ (10GE ports) SFP (GE ports)
7 Fabric 48-Port Dual-Rate 10GE/1GE Line Card, Transport Optimized **Note** The 48-Port 10GE/1GE Line Card accepts SFP and SFP+ modules.	A99-48X10GE-1G-TR	48	SFP+ (10GE ports) SFP (GE ports)

Cisco Series Ethernet Line Card or MPA	Product Number	Number of Ports	Module Type
400G Combo Line Card, Transport Optimized	A9K-4HG-FLEX-TR	44	• 24 ports of SFP+ • 16 ports of SPF28 • 4 ports of QSFP28/QSFP+ **Note** The line card has an aggregate bandwidth of 400Gb.
400G Combo Line Card, Service Edge Optimized	A9K-4HG-FLEX-SE		
400G Combo Line Card, Transport Optimized	A99-4HG-FLEX-TR		
400G Combo Line Card, Service Edge Optimized	A99-4HG-FLEX-SE		

Caution Use only optical modules (SFP, SFP+, XFP, QSFP, CFP, and CPAK) 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.

Note It is strongly recommended to wait for 60 seconds before successive insertion or removal of optics. Failure in following this recommendation may affect the functionality of the optics. This applies to all the various optics form factors such as SFP, SFP+, XFP, QSFP, QSFP28, CFP, CFP2 and CPAK.

Note While inserting the QSFP, configure the port to the corresponding mode. For example, configure 1xFortyGigE mode for 40G optics and 4xTenGigE mode for 4x10G optics

If the ports are not configured to the appropriate mode and the optics are inserted in the default 100G mode, then an alarm is raised.

Therefore, for optics to function it is important for the corresponding operational mode to be configured.

10-Gigabit Ethernet Line Cards

Note All Ethernet line cards have port Status LEDs on their front panels. Each SFP or XFP port 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 Line Card LEDs, page 134).

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.

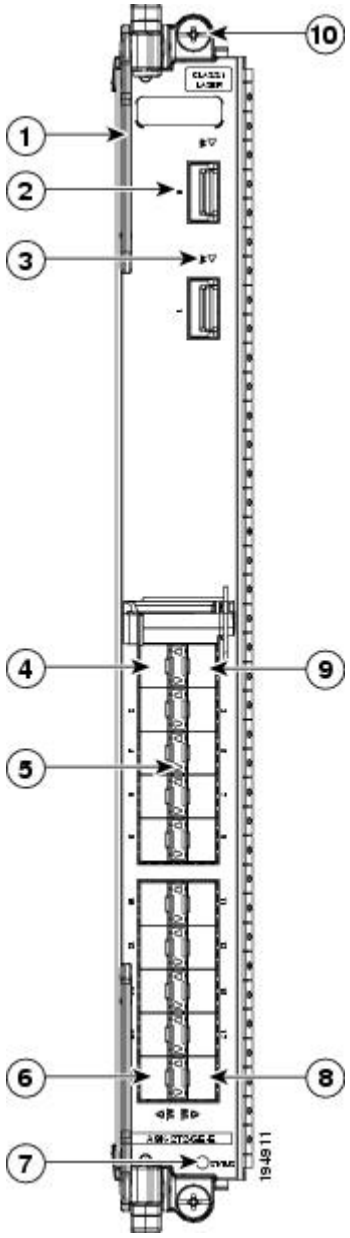
The two XFP modules can be 10GE multimode connections The 20 SFP cages support either fiber-optic or copper Gigabit Ethernet transceivers.

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 Line Card LEDs, on page 148.

The following figure shows the 2-Port 10GE + 20-Port GE combination line card front panel and LEDs.

Figure 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.

For a list of the optics and connectors used by the two 10GE ports on the 2-Port 10GE + 20-Port GE combination line and for a list of all supported SFP modules, see https://tmgmatrix.cisco.com.

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).

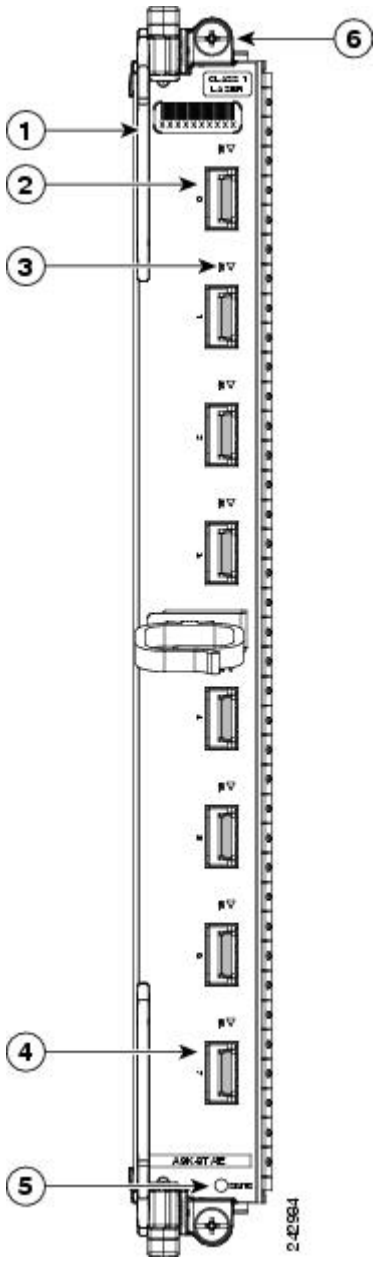
Oversubscription results from port pairs sharing the same Network Processor Unit (NPU). The oversubscribed port pairs are port 0:port 4, port 1:port 5, port 2:port 6 and port 3:port 7.

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 Line Card LEDs, on page 148.

The following figure shows the 8-Port 10GE line card front panel and LEDs.

Figure 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

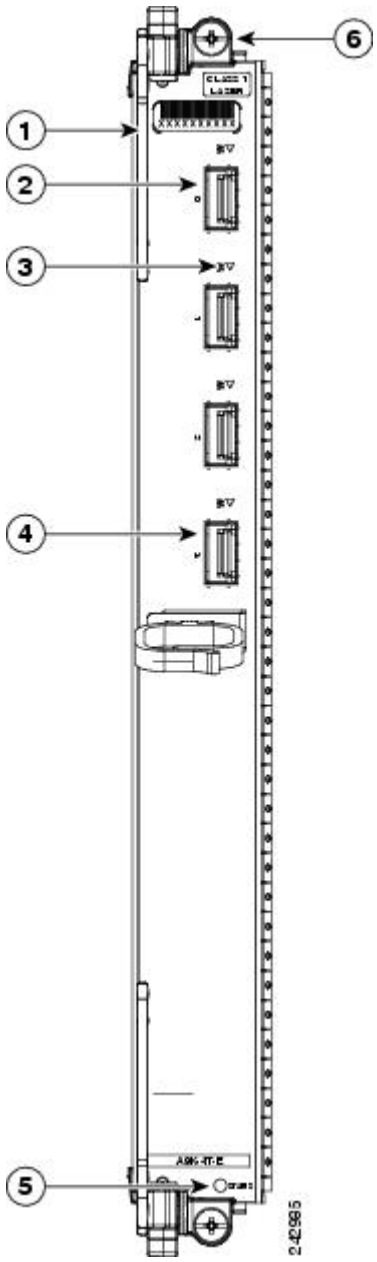
The 4-Port 10-Gigabit Ethernet (GE) line card provides four cages for XFP Ethernet optical interface modules that operate at a rate of 10 Gbps. The four XFP modules can be 10GE Ethernet multimode connections. For supported tranceiver modules, see

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 Line Card LEDs, on page 148.

The following figure shows the 4-Port 10GE line card front panel and LEDs.

Figure 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

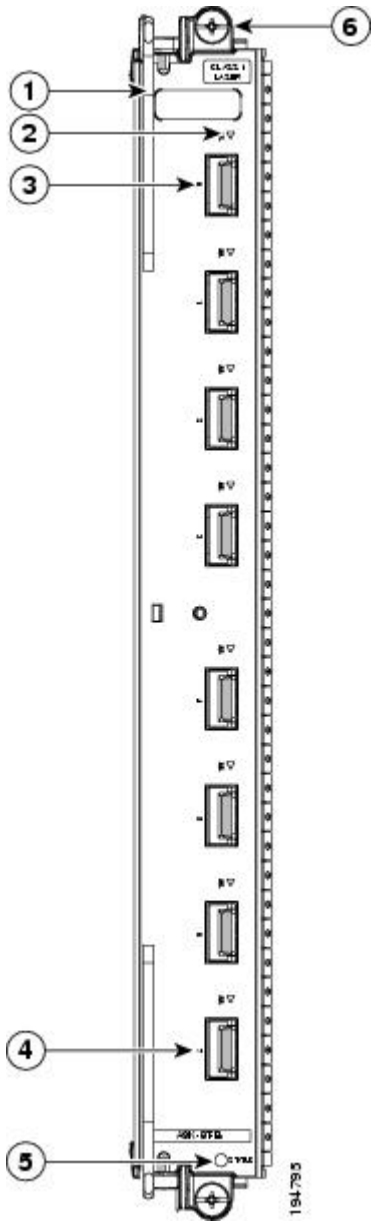
The 8-Port 10-Gigabit Ethernet (GE) 80 Gbps line rate card provides eight cages for XFP Ethernet optical interface modules that operate at a rate of 10 Gbps. The eight XFP modules can be10GE multimode connections. The 8-Port 10GE line card is a full 80 Gbps line rate card.

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 Line Card LEDs, on page 148. See Technical Specifications, on page 157 for a list of all XFPs supported on the 8-Port 10GE 80 Gbps line rate card.

The following figure shows the 8-Port 10GE 80 Gbps line rate card front panel and connectors.

Figure 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-Port 10GE + 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. This 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.

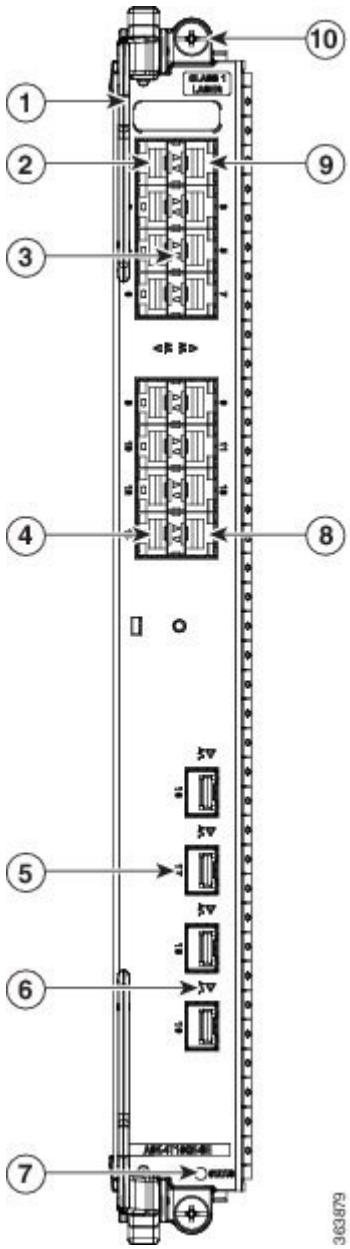
Each SFP and SFP+ cage on the 4-Port 10GE + 16-Port GE combination line card has an adjacent Link LED visible on the front panel. The Link LED indicates the status of the associated SFP or SFP+ port, as described in Line Card LEDs, on page 148.

The following figure shows the 4-Port 10GE + 16-Port GE combination 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 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	10 GE port 17 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.

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).

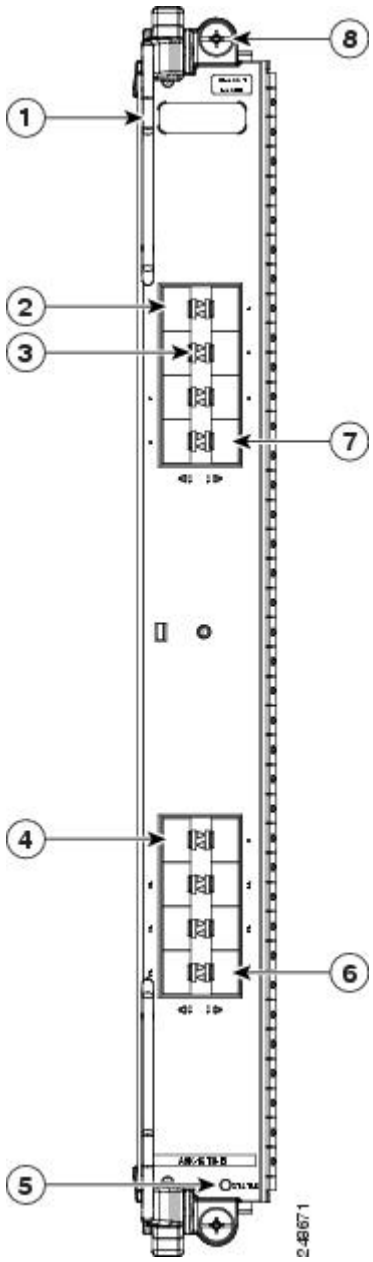
- With two RSP cards installed in the router, the 16-Port 10GE line card can achieve greater than a 2:1 oversubscription rate. Each port pair sharing an NPU can reach 7.31 Gbps per port, so the maximum bandwidth with two RSPs in the system is 117 Gbps.
- With a single RSP card installed in the router, 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 Line Card LEDs, on page 148.

The following figure shows the 16-Port 10GE oversubscribed line card front panel and connectors.

Figure 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)

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.

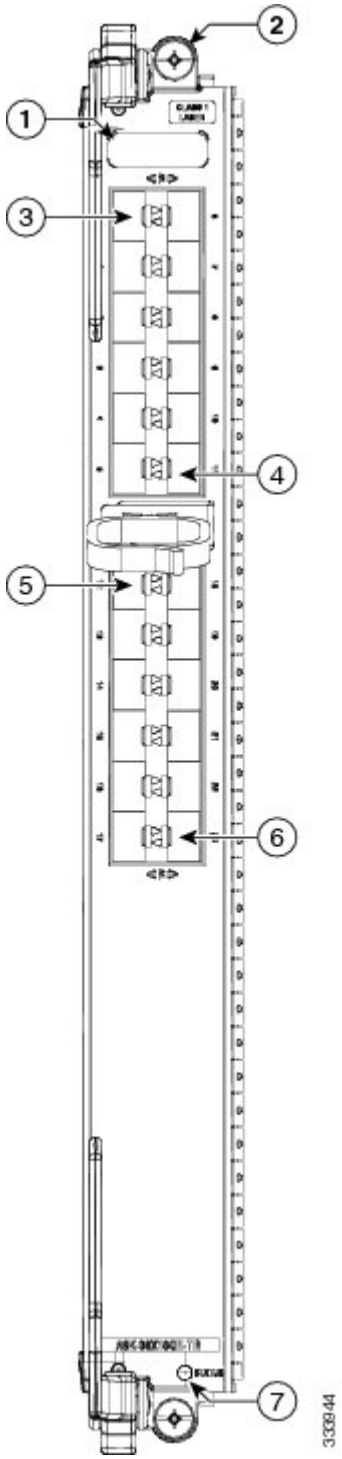
- With two RSP cards installed in the router, the 24-Port 10GE line card runs at line rate.
- With a single RSP card installed in the router, the 24-Port 10GE line card is a 220 Gbps line rate card.

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 Line Card LEDs, on page 148.

The following figure shows the 24-Port 10GE line card front panel and connectors.

Figure 7: 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		

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

Note Oversubscription will be supported on this line card in a future release of IOS XR 6.2.x train.

The 24-Port 10-Gigabit Ethernet (10GE)/Gigabit Ethernet (GE) line card has twenty-four dual-rate ports that accept 10GE SFP+ or 1GE SFP modules.

Note The 24-port line card has a single Network Processor Unit (NPU). Configuring more than 20x10GE ports per NPU could result in line drops across all ports, depending on the packet size and traffic type. See Configuring the Dual-Rate Line Cards for information on specifying the port speed.

The 24-Port 10GE/1GE line card is available in these variants:

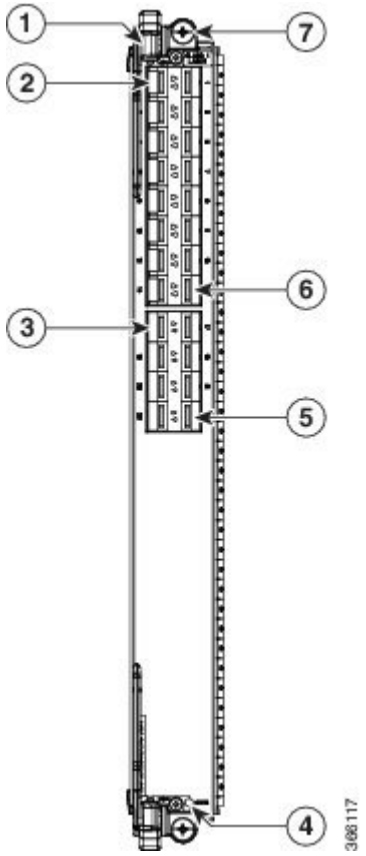
- -SE (Service Edge Optimized)
- -TR (Packet Transport Optimized)
- -CM (Consumption Model)

The -SE and -TR variants are functionally equivalent, but vary in configuration scale and buffer capacity. The -CM variant is same as the -SE variant except that the -CM variant functions on Consumption Based Pricing Model supported with Smart Licensing. For details related to the Consumption Based Pricing Model, see the chapter *Software Entitlement* in the *Cisco ASR 9000 Series Aggregation Services Router System Management Configuration Guide*.

Each SFP+ cage on the 24-Port 10GE/1GE 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 Line Card LEDs, on page 148.

The following figure shows the 24-Port 10GE/1GE line card front panel connectors and indicators.

Figure 8: 24-Port 10-Gigabit Ethernet/Gigabit Ethernet Line Card

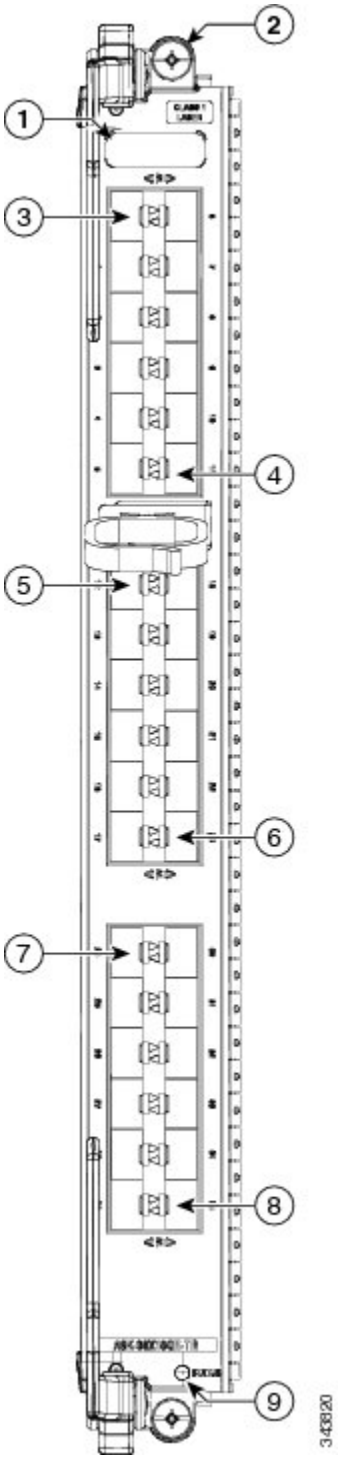


1	Ejector lever (one of two)	5	Port 23 SFP+ cage
2	Port 0 SFP+ cage	6	Port 15 SFP+ cage
3	Port 16 SFP+ cage	7	Captive installation screw (one of two)
4	Line card status LED		

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

The 36-Port 10-Gigabit Ethernet (GE) line card has thirty-six 10-Gigabit SFP+ (10GE SFP) module ports. The following figure shows the 36-Port 10GE line card front panel connectors and indicators.

Figure 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		

48-Port 10-Gigabit Ethernet/Gigabit Ethernet Line Card with SFP+ or SFP

Note Oversubscription will be supported on this line card in a future release of IOS XR 6.2.x train.

The 48-Port 10-Gigabit Ethernet (10GE)/Gigabit Ethernet (GE) line card has forty-eight dual-rate ports that accept 10GE SFP+ or 1GE SFP modules.

Note The 48-port line card has two NPUs (one for each group of 24 ports). Configuring more than 20x10GE ports per NPU could result in line drops across all ports, depending on the packet size and traffic type. See Configuring the Dual-Rate Line Cards for information on specifying the port speed.

The 48-Port 10GE/1GE line card is available in these variants:

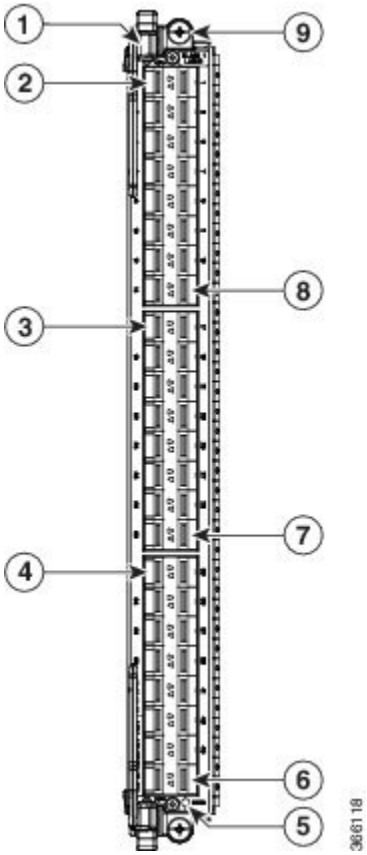
- -SE (Service Edge Optimized)
- -TR (Packet Transport Optimized)
- -CM (Consumption Model)

The -SE and -TR variants are functionally equivalent, but vary in configuration scale and buffer capacity. The -CM variant is same as the -SE variant except that the -CM variant functions on Consumption Based Pricing Model supported with Smart Licensing. For details related to the Consumption Based Pricing Model, see the *Software Entitlement* chapter in the *Cisco ASR 9000 Series Aggregation Services Router System Management Configuration Guide*.

Each SFP+ cage on the 48-Port 10GE/1GE 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 Line Card LEDs, on page 148.

The following figure shows the 48-Port 10GE/1GE line card front panel connectors and indicators.

Figure 10: 48-Port 10-Gigabit Ethernet/Gigabit Ethernet Line Card



1	Ejector lever (one of two)	6	Port 47 SFP+ cage
2	Port 0 SFP+ cage	7	Port 31 SFP+ cage
3	Port 16 SFP+ cage	8	Port 15 SFP+ cage
4	Port 32 SFP+ cage	9	Captive installation screw (one of two)
5	Line card status LED		

40-Port Gigabit Ethernet Line Card with SFP

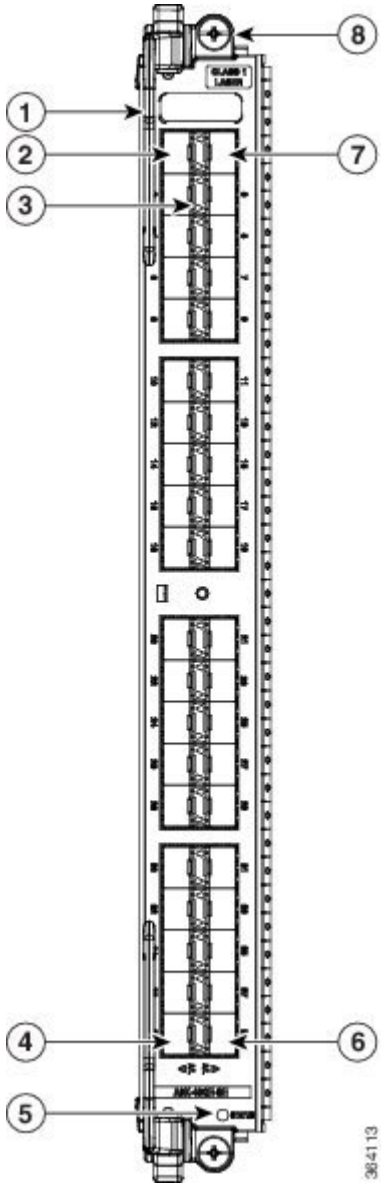
The 40-Port Gigabit Ethernet (GE) line card provides 20 double-stacked SFP (40 total) cages that support either fiber-optic or copper transceivers.

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 Line Card LEDs, on page 148.

The following figure shows 40-Port GE line card front panel and connectors.

Figure 11: 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)

100-Gigabit Ethernet Line Cards

Caution It is strongly recommended to wait for 60 seconds before successive insertion or removal of optics. Failure in following this recommendation may affect the functionality of the optics. This applies to all the various optics form factors such as SFP, SFP+, XFP, QSFP, QSFP28, CFP, CFP2 and CPAK.

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 100GE 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 Line Card LEDs, on page 148.

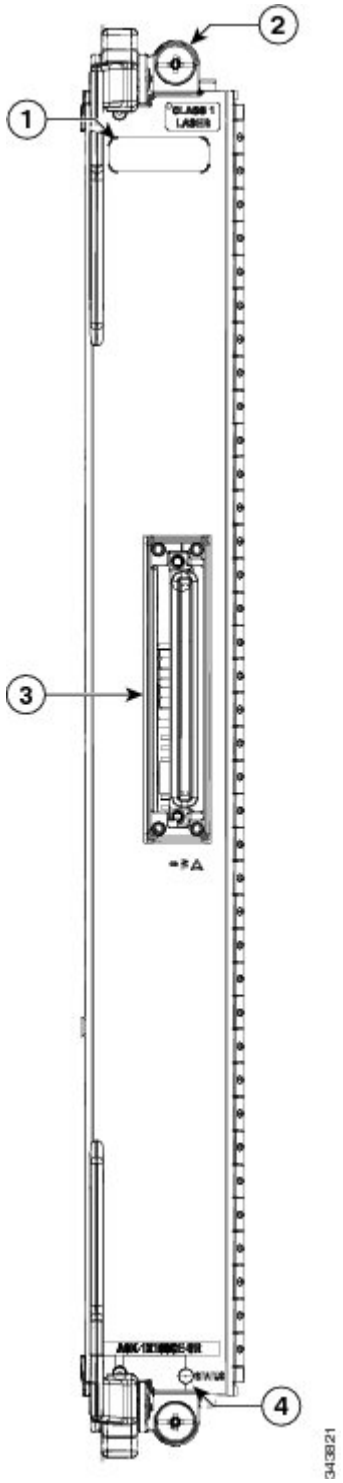
The following table lists the supported optics and connectors for 1-port 100GE line card.

Table 13: Supported CFP Optics for Cisco 1-Port 100GE Line Card

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

The following figure shows the 1-port 100GE line card front panel and connector.

Figure 12: 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

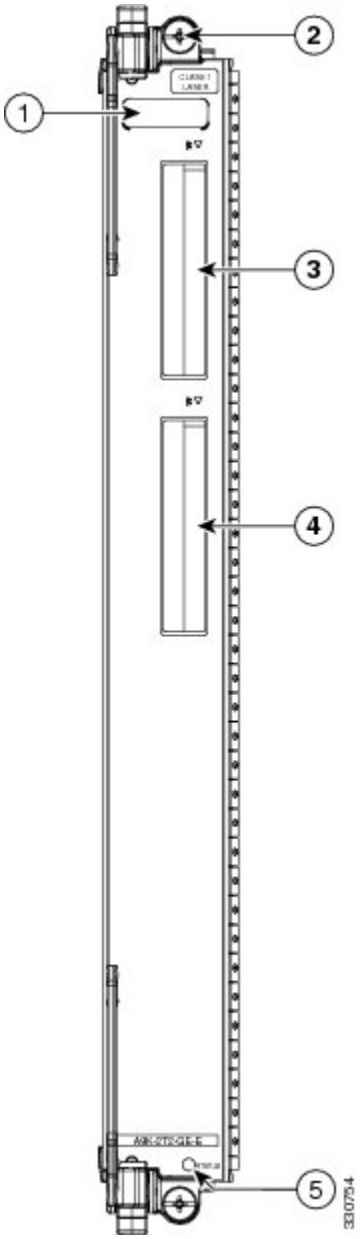
The 2-Port 100-Gigabit Ethernet (GE) line card provides two CFP cages for CFP Ethernet optical interface modules that operate at a rate of 100 Gbps. The two CFP modules can be 100GE multimode connections.

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 100GE 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 Line Card LEDs, on page 148.

The following figure shows the 2-Port 100GE line card front panel and LEDs.

Figure 13: 2-Port 100-Gigabit Ethernet Line Card



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

4-Port 100-Gigabit Ethernet Line Card with CPAK

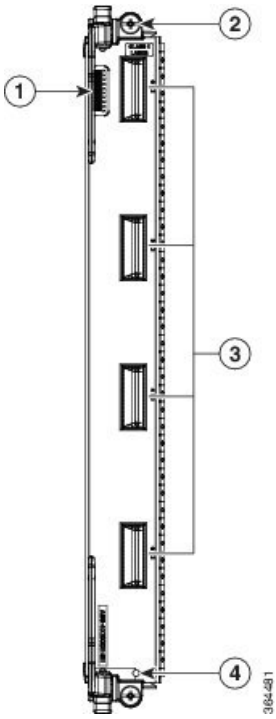
The 4-Port 100GE line card provides four CPAK cages for CPAK modules that operate at a rate of 100 Gbps.

The line card is available in -SE (Service Edge Optimized) and -TR (Packet Transport Optimized) variants. The two variants are functionally equivalent, but vary in configuration scale and buffer capacity.

Each CPAK cage on the 4-port 100GE 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 Line Card LEDs, on page 148.

The following figure shows the 4-Port 100GE line card front panel and connectors.

Figure 14: 4-Port 100-Gigabit Ethernet Line Card



1	Ejector lever (one of two)	4	Four 100GE CPAK connectors
2	Captive installation screw (one of two)	5	Status LED

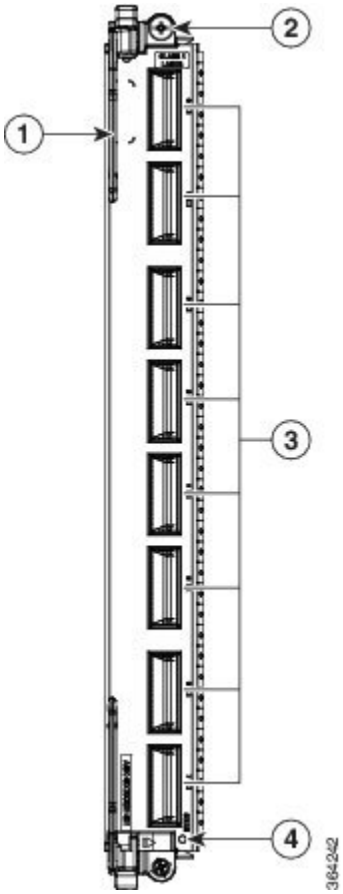
8-Port 100-Gigabit Ethernet Line Card with CPAK

The 8-Port 100-Gigabit Ethernet (GE) line card provides eight CPAK cages for CPAK modules that operate at a rate of 100 Gbps.

Each CPAK cage on the 8-Port 100GE 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 Line Card LEDs, on page 148.

The following figure shows the 8-Port 100GE line card front panel and connectors.

Figure 15: 8-Port 100-Gigabit Ethernet Line Card



1	Ejector lever (one of two)	3	Eight 100GE CPAK connectors
2	Captive installation screw (one of two)	4	Status LED

This line card is available in two versions. The LAN version line card is available as an Service Edge Optimized (-SE) variant only. The OTN version line card is available in three variants:

- Service Edge Optimized (-SE)
- Packet Transport Optimized (-TR)
- Consumption Model Optimized (-CM)

The -SE and -TR variants are functionally equivalent, but vary in configuration scale and buffer capacity. The -CM variant is same as the -SE variant except that the -CM variant functions on Consumption Based Pricing Model supported with Smart Licensing. For details related to the Consumption Based Pricing Model, see the chapter *Software Entitlement on the Cisco ASR 9000 Series Router* in *Cisco ASR 9000 Series Aggregation Services Router System Management Configuration Guide*. For the -CM variant, you need to purchase a

minimum of 20 of foundational software licenses each of which licenses 10G worth of bandwidth. The foundational software licenses are available in four types based on the software features:

- IP/MPLS - For ports that use only IP/MPLS software feature.
- IP/MPLS + L2VPN - For ports that uses IP/MPLS with layer 2 Ethernet Flow Point (EFP) software feature.
- IP/MPLS + L3VPN - For ports that uses IP/MPLS with layer 3 Virtual Routing and Forwarding (VRF) software feature.
- IP/MPLS + L2VPN + L3VPN - For ports that uses IP/MPLS with layer 2 EFP as well as layer 3 VRF software features.

Additionally, each foundational software license is available in two tiers called as basic and advanced that provide lower and higher scale support respectively for the supported software feature. You can also optionally purchase additional licenses for specific software features that are not included in the foundational licenses. These additional licenses are available metered on a per 10G bandwidth basis or for the entire router.



Note If you are installing the 8-port 100-Gigabit Ethernet Line Cards (TR and SE variants) in the chassis, ensure that V2 fan trays are installed in all the fan tray slots.

16-Port 100-Gigabit Ethernet Line Card with QSFP28/QSFP+

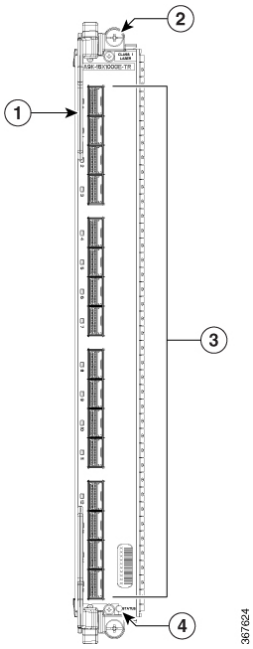
The 16-Port 100-Gigabit Ethernet (GE) line card provides sixteen ports for QSFP28/QSFP+ modules that operate at a rate of 100 Gbps.

Each line card has a single tristate Status LED to display card status. Each QSFP28/QSFP+ port on the line card has a port status LED visible on the front panel. The LEDs are described in Line Card LEDs, on page 148.

When the 16-port 100GE Line Card with QSFP28/QSFP+ is inserted in a Cisco ASR 9922 chassis, you must use the ASR 9922 Fan Tray V3.

The following figure shows the 16-Port 100-GE line card front panel and LEDs.

Figure 16: 16-Port 100-Gigabit Ethernet Line Card with QSFP28/QSFP+



1	Ejector lever (one of two)	3	Sixteen 100GE QSFP28/QSFP+ connecto
2	Captive installation screw (one of two)	4	Status LED

32-Port 100-Gigabit Ethernet Line Card with QSFP28/QSFP+

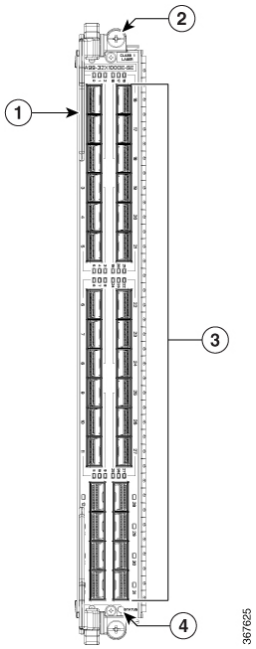
The 32-Port 100-Gigabit Ethernet (GE) line card provides thirty two ports for QSFP28/QSFP+ modules that operate at a rate of 100 Gbps.

Each line card has a single tristate Status LED to display card status. Each QSFP28/QSFP+ port on the line card has a port status LED visible on the front panel. The LEDs are described in Line Card LEDs, on page 148.

When the 32-port 100GE Line Card with QSFP28/QSFP+ is inserted in a Cisco ASR 9922 chassis, you must use the ASR 9922 Fan Tray V3. In a 32-port 100GE Line Card, QSFP+ is permitted only from port 0 to port 20.

The following figure shows the 32-Port 100-GE line card front panel and LEDs.

Figure 17: 32-Port 100-Gigabit Ethernet Line Card with QSFP28/QSFP+



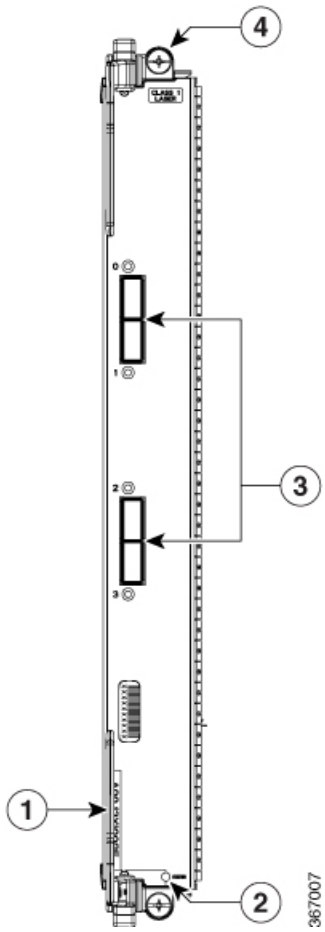
1	Ejector lever (one of two)	3	Thirty Two 100GE QSFP28 connectors
2	Captive installation screw (one of two)	4	Status LED

4-Port 100-Gigabit Ethernet Line Card with QSFP28

The 4-Port 100-Gigabit Ethernet (GE) line card provides four ports for QSFP28 modules that operate at a rate of 100 Gbps.

Each line card has a single tristate Status LED to display card status. Each QSFP28 port on the line card has a port status LED visible on the front panel. The LEDs are described in Line Card LEDs, on page 148. The following figure shows the 4-Port 100-GE line card front panel and LEDs.

Figure 18: 4-Port 100-Gigabit Ethernet Line Card with QSFP28



1	Ejector lever (one of two)	3	Four 100GE QSFP28 connectors
2	Status LED	4	Captive installation screw (one of two)

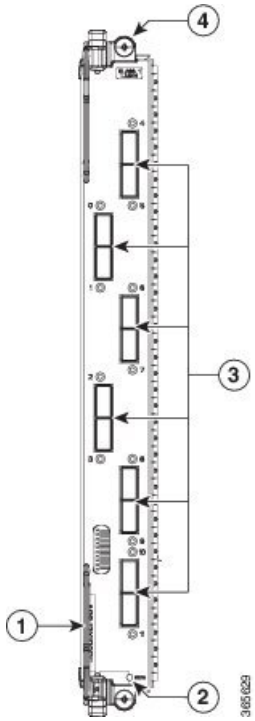
Note If the 4-port 100GE line card is inserted in a chassis, it is important to use filler panels that have two screens [A9K-LC-FILR-V2]. This ensures optimal cooling and EMI.

12-Port 100-Gigabit Ethernet Line Card with QSFP28

The 12-Port 100-Gigabit Ethernet (GE) line card provides twelve ports for QSFP28 modules that operate at a rate of 100 Gbps.

Each line card has a single tristate Status LED to display card status. Each QSFP28 port on the line card has a port status LED visible on the front panel. The LEDs are described in Line Card LEDs, on page 148. The following figure shows the 12-Port 100-GE line card front panel and LEDs.

Figure 19: 12-Port 100-Gigabit Ethernet Line Card with QSFP28



1	Ejector lever (one of two)	3	Twelve 100GE QSFP28 connectors
2	Status LED	4	Captive installation screw (one of two)

Note The 12-port 100-Gigabit Ethernet Line card with QSFP28 is also supported on IOS XR 64-bit environment.

Note If the 12-port 100GE line card is inserted in a chassis, it is important to use filler panels that have two screens [A9K-LC-FILR-V2]. This ensures optimal cooling and EMI.

32-Port 100-Gigabit Ethernet Line Card with QSFP28/QSFP+

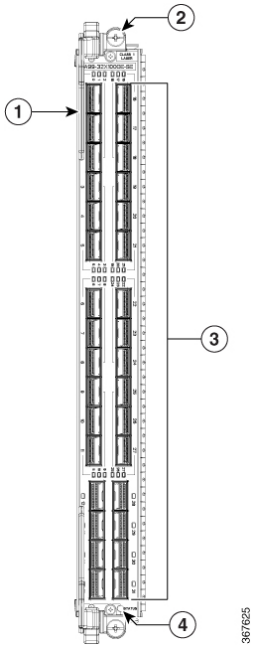
The 32-Port 100-Gigabit Ethernet (GE) line card provides thirty two ports for QSFP28/QSFP+ modules that operate at a rate of 100 Gbps.

Each line card has a single tristate Status LED to display card status. Each QSFP28/QSFP+ port on the line card has a port status LED visible on the front panel. The LEDs are described in Line Card LEDs, on page 148.

When the 32-port 100GE Line Card with QSFP28/QSFP+ is inserted in a Cisco ASR 9922 chassis, you must use the ASR 9922 Fan Tray V3. In a 32-port 100GE Line Card, QSFP+ is permitted only from port 0 to port 20.

The following figure shows the 32-Port 100-GE line card front panel and LEDs.

Figure 20: 32-Port 100-Gigabit Ethernet Line Card with QSFP28/QSFP+



1	Ejector lever (one of two)	3	Thirty Two 100GE QSFP28 connectors
2	Captive installation screw (one of two)	4	Status LED

20-Port 100-Gigabit Ethernet Line Card with QSFP28/QSFPDD

The 20-Port 100-Gigabit Ethernet (GE) line card provides:

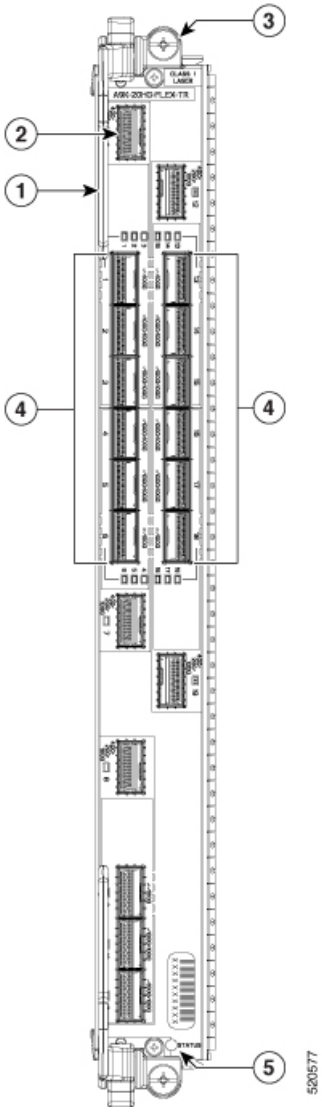
- Fifteen QSFP28 ports capable of 10Gb, 40Gb, and 100Gb Ethernet traffic support.
- Five QSFP-DD ports capable of 10Gb, 40Gb, 100Gb, 200Gb, and 400Gb Ethernet traffic support.

Each line card has a single tristate Status LED to display card status. Each QSFP28/QSFPDD port on the line card has a port status LED visible on the front panel. The LEDs are described in Line Card LEDs.

When the 20-port 100GE Line Card with QSFP28/QSFPDD is inserted in a Cisco ASR 9922 chassis, you must use the ASR 9922 Fan Tray V3.

The following figure shows the 20-Port 100-GE line card front panel and LEDs.

Figure 21: 20-Port 100-Gigabit Ethernet Line Card with QSFP28/QSFPDD



1	Ejector lever (one of two)	4	Fifteen 100GE QSFP28 connectors
2	Five 400GE QSFP-DD connectors	5	Status LED
3	Captive installation screw (one of two)		

8-Port 100-Gigabit Ethernet Line Card with QSFP28/QSFPDD

The 8-Port 100-Gigabit Ethernet (GE) line card provides:

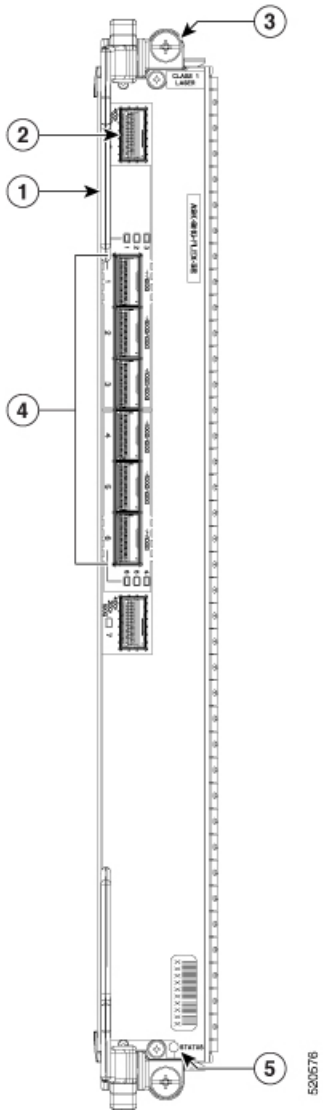
- Six QSFP28 ports capable of 10Gb, 40Gb, and 100Gb Ethernet traffic support.
- Two QSFP-DD ports capable of 10Gb, 40Gb, 100Gb, 200Gb, and 400Gb Ethernet traffic support.

Each line card has a single tristate Status LED to display card status. Each QSFP28/QSFPDD port on the line card has a port status LED visible on the front panel. The LEDs are described in Line Card LEDs.

When the 8-port 100GE Line Card with QSFP28/QSFPDD is inserted in a Cisco ASR 9922 chassis, you must use the ASR 9922 Fan Tray V3.

The following figure shows the 8-Port 100-GE line card front panel and LEDs.

Figure 22: 8-Port 100-Gigabit Ethernet Line Card with QSFP28/QSFPDD



1	Ejector lever (one of two)	4	Six 100GE QSFP28 connectors
2	Two 400GE QSFP-DD connectors	5	Status LED
3	Captive installation screw (one of two)		

400-Gigabit Ethernet Line Cards

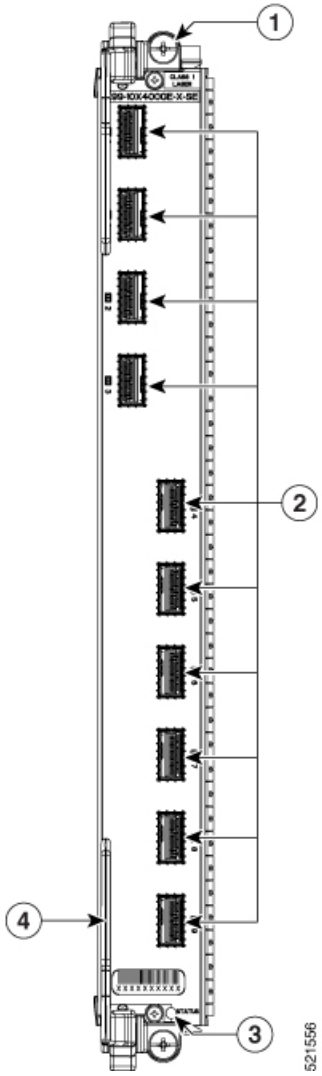
Caution All Ethernet line cards have port Status LEDs on their front panels. Each QSFPDD port has an adjacent LED to indicate the status of the associated port. In addition, each line card has a single tristate Status LED to display card status.

10-Port 400-Gigabit Ethernet Line Cards with QSFPDD

The 10-Port 400-Gigabit Ethernet (GE) line card provides ten ports for QSFPDD modules that are capable of 10Gb, 40Gb, 100Gb, 200Gb, and 400Gb Ethernet traffic support.

Each line card has a single tristate Status LED to display card status. Each QSFPDD port on the line card has a port status LED visible on the front panel. The LEDs are described in Line Card LEDs.

Figure 23: 10-Port 400-Gigabit Ethernet Line Card with QSFPDD



1	Captive installation screw (one of two)	3	Status LED
2	Ten 400GE QSFPDD connectors	4	Ejector lever (one of two)

A9K-4HG-FLEX-X-SE and A99-4HG-FLEX-X-SE line card

Table 14: Feature History Table

Hardware	Release Information	Feature Description
A99-4HG-FLEX-X-SE line card	Release 25.2.1	The A99-4HG-FLEX-X-SE line card supports front panel bandwidth of 400 Gbps through optics ports. The front panel consists of these ports: • 4 QSFP28 ports capable of 100Gb, 40Gb • 16 SFP28 ports capable of 25Gb, 10Gb, 1Gb • 24 SFP+ ports capable of 10Gb, 1Gb The A99-4HG-FLEX-X-SE line card is optimized for use in Cisco ASR 9900 series routers only.
A9K-4HG-FLEX-X-SE line card	Release 25.1.1	The A9K-4HG-FLEX-X-SE line card supports front panel bandwidth of 400 Gbps through optics ports. The front panel consists of these ports: • 4 QSFP28 ports capable of 100Gb, 40Gb • 16 SFP28 ports capable of 25Gb, 10Gb, 1Gb • 24 SFP+ ports capable of 10Gb, 1Gb The A9K-4HG-FLEX-X-SE line card is optimized for use in Cisco ASR 9000 and ASR 9900 series routers.

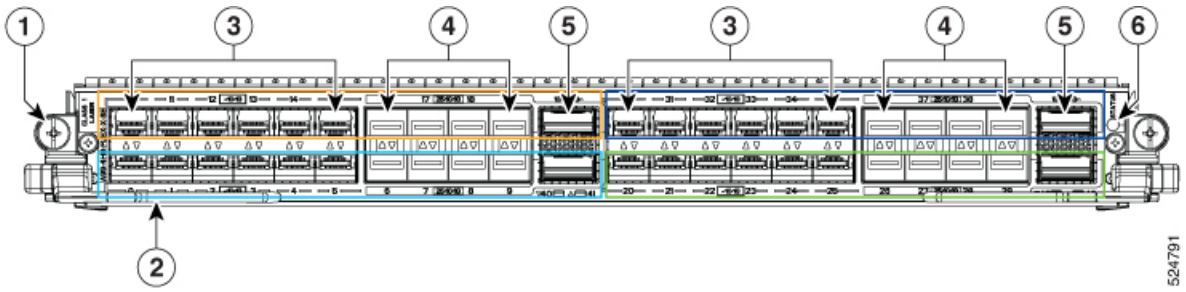
The A9K-4HG-FLEX-X-SE and A99-4HG-FLEX-X-SE series are 5th generation 400 Gigabit Ethernet line cards. Both provide a front panel bandwidth of 400 Gbps and support high-density, high-performance routing.

Supported Routers

- The A9K-4HG-FLEX-X-SE Ethernet line card is supported on Cisco ASR 9006, 9010, 9904, 9906, 9910, 9912, and 9922.
- The A99-4HG-FLEX-X-SE Ethernet line card is supported on Cisco ASR 9904, 9906, 9910, 9912, and 9922.

To support the A9K-4HG-FLEX-X-SE line card, the router must run Cisco IOS XR Release 25.1.1 or later is required. For the A99-4HG-FLEX-X-SE line card, Cisco IOS XR Release 25.2.1 or later is required.

Figure 24: A9K-4HG-FLEX-X-SE and A99-4HG-FLEX-X-SE line card



1	Captive installation screw (one of two)	4	16 SFP28/SFP+ ports (2 groups of 8)
2	Ejector lever (one of two)	5	4 QSFP28/QSFP+ ports (2 groups of 2)
3	24 SFP+ ports (2 groups of 12)	6	Status LED

Table 15: Supported port type and configurations

Color Group	Port Number	Bandwidth	Port Type	Port # (Optics)		
				Option 1	Option 2	Option 3
Blue	0 to 5	10G/1G	SFP+/SFP	10x1	10x10	—
	6 to 9	25G/10G/1G	SFP28/SFP+/SFP	10x1	10x10	4x25
Yellow	10 and 15	10G/1G	SFP+/SFP	10x1	10x10	—
	16 to 19	25G/10G/1G	SFP28/SFP+/SFP	10x1	10x10	4x25
Green	20 to 25	10G/1G	SFP+/SFP	10x1	10x10	—
	26 to 29	25G/10G/1G	SFP28/SFP+/SFP	10x1	10x10	4x25
Dark Blue	30 to 35	10G/1G	SFP+/SFP	10x1	10x10	—
	36 to 39	25G/10G/1G	SFP28/SFP+/SFP	10x1	10x10	4x25
Blue	40	100G/40G	QSFP28/QSFP+	1x40	1x100	—
Yellow	41	100G/40G	QSFP28/QSFP+	1x40	1x100	—
Green	42	100G/40G	QSFP28/QSFP+	1x40	1x100	—

Color Group	Port Number	Bandwidth	Port Type	Port # (Optics)		
				Option 1	Option 2	Option 3
Dark Blue	43	100G/40G	QSFP28/QSFP+	1x40	1x100	—

Note Class B performance is supported on all ports 1G, 10G, 25G, 40G and 100G.

Route processors:

- A9K-RSP5-SE/TR
- A99-RP3-SE/TR

Class C performance is supported on all ports 1G, 10G, 25G, 40G and 100G.

Route processors:

- A9K-RSP5-X-SE/TR
- A99-RP3-X-SE/TR

IPoDWDM Ethernet Line Cards

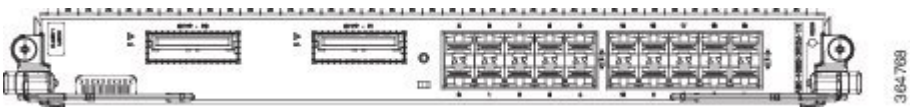
2-Port 100G + 20-Port 10-Gigabit Ethernet Combination IPoDWDM Line Card with CFP2 and SFP+

The 2-Port 100G + 20-Port 10-Gigabit Ethernet Combination IPodWDM Line Card with CFP2 and SFP+ provides two double stacked 2x5 cage assemblies (total 20 ports) for SFP+ Ethernet optical interface modules and two cages of 100G coherent transceiver CFP2. The line card is available only in -TR (Packet Transport Optimized) version.

Each SFP+ and CFP2 cage has an adjacent Link LED visible on the front panel. The Link LED indicates the status of the associated SFP+ or CFP2 cage, as described in Line Card LEDs, on page 148.

The following figure shows this line card's front panel and connectors.

Figure 25: 2-Port 100G + 20-Port 10-Gigabit Ethernet Combination IPoDWDM Line Card with CFP2 and SFP+



Multi-Rate Line Cards

The multi-rate line cards have flexible interfaces that support various optics and data rates, providing flexibility to mix and match interface types on the same line card.

400G Combo Multi-Rate Line Card

The 400G combo multi-rate line card has 44 ports:

- 24 SFP+ ports capable of 10GE
- 16 SPF28 ports capable of 10GE or 25GE
- 4 QSFP+ or QSFP28 ports capable of 40GE or 100GE

Note The line card has an aggregate bandwidth of 400GE. See the table below for supported port configurations.

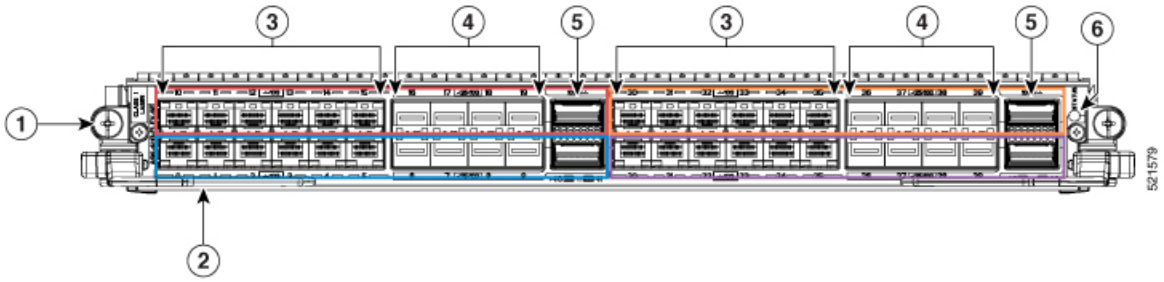
Note You must use the Cisco ASR 9922 Fan Tray V3 while operating 400G Combo Multi-Rate Line Card (e.g., A9K-4HG-FLEX-TR) in a Cisco ASR 9922 router.

The line card ports are color-coded in the following manner:

- Ports 0 – 5 (blue), 10 – 15 (red), 20 – 25 (magenta), 30 – 35 (orange) support 10GE SFP+ modules
- Ports 6 – 9 (blue), 16 – 19 (red), 26 – 29 (magenta), 36 – 39 (orange) support 10GE SFP+ or 10GE/25GE SFP28 modules
- Ports 40 (blue), 41 (red), 42 (magenta), 43 (orange) support 40GE QSFP+ or 100GE QSFP28 modules

Note SFP28/QSFP+/QSFP28 optics for particular color group are mutually exclusive. Only one of the optics type can be used at a time.

Figure 26: 400G Combo Multi-Rate Line Card



1	Captive installation screw (one of two)	4	16 SFP28/SFP+ ports (2 groups of 8)

2	Ejector lever (one of two)	5	4 QSFP28/QSFP+ ports (2 groups of 2)
3	24 SFP+ ports (2 groups of 12)	6	Status LED

Each group of colored ports supports up to 100GE. The following port configurations are supported:

Table 16: 400GE Combo Multi-Rate Line Card Port Configurations

Color Group	**Blue**			**Red**			**Magenta**			**Orange**			
Port # (Optics)	0–5 (SFP+)	6–9 (SFP28)	40 (QSFP+/ QSFP28)	10–15 (SFP+)	16–19 (SFP28)	41 (QSFP+/ QSFP28)	20–25 (SFP+)	26–29 (SFP28)	42 (QSFP+/ QSFP28)	30–35 (SFP+)	36–39 (SFP28)	43 (QSFP+/ QSFP28)	**Agg BW (GE)**
Option 1	–	4x25/ 1x40/ 1x100		–	4x25/ 1x40/ 1x100		–	4x25/ 1x40/ 1x100		–	4x25/ 1x40/ 1x100		160-400
Option 2	–	4x25/ 1x40/ 1x100		–	4x25/ 1x40/ 1x100		–	4x25/ 1x40/ 1x100		6x10	4x10	–	220-400
Option 3	–	4x25/ 1x40/ 1x100		–	4x25/ 1x40/ 1x100		6x10	4x10	–	6x10	4x10	–	280-400
Option 4	–	4x25/ 1x40/ 1x100		6x10	4x10	–	6x10	4x10	–	6x10	4x10	–	340-400
Option 5	6x10	4x10	–	6x10	4x10	–	6x10	4x10	–	6x10	4x10	–	400

For a list of the optics and connectors used by the 400GE combo multi-rate line card and for a list of all supported transceiver modules, see https://tmgmatrix.cisco.com.

Modular Line Cards and Modular Port Adapters

There are four types of modular line cards (MLCs) as follows:

- 80-Gb card
- 160-Gb card
- 200-Gb card
- 400-Gb card

Each type of card is available in -SE (Service Edge Optimized) and -TR (Packet Transport Optimized) variants. The two variants are functionally equivalent, but vary in configuration scale and buffer capacity.

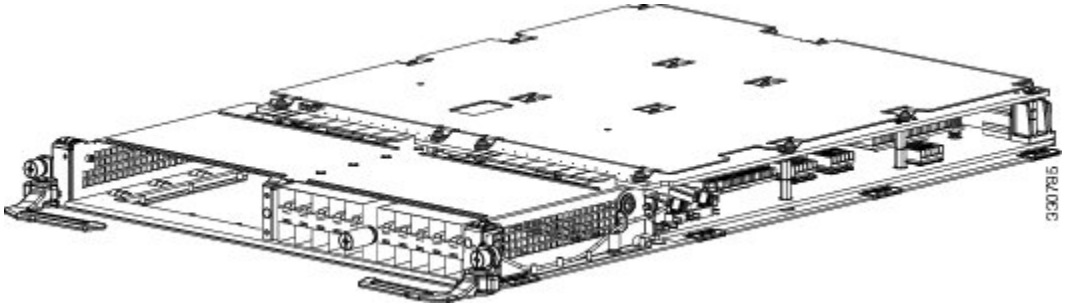
The 400 Gigabyte Modular Line Cards only support the following MPAs (Modular Port Adapters):

- 2-port 10GE Modular Port Adapter (MPA) with XFP
- 4-Port 10GE Modular Port Adapter (MPA) with XFP
- 8-port 10GE Modular Port Adapter (MPA) with SFP+
- 2-port 40GE Modular Port Adapter (MPA), with QSFP+

- 1-Port 40GE Modular Port Adapter (MPA), with QSFP+
- 20-Port 10-Gigabit Ethernet Modular Port Adapter (MPA) with SFP+
- 1-Port 100-Gigabit Ethernet Modular Port Adapter with CFP2-DCO and CPAK
- 1-Port 200-Gigabit Ethernet Modular Port Adapter with CFP2-DCO
- 2-Port 100-Gigabit Ethernet Modular Port Adapter with CFP2-DCO and CPAK
- 32-port GE Modular Port Adapter (MPA) with MACsec

The following figure shows the front panel of the modular line card with a 20-port Gigabit Ethernet MPA installed in bay 1.

Figure 27: Modular Line Card



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

1-Port 100-Gigabit Ethernet Modular Port Adapter with CFP2

The 1-Port 100-Gigabit Ethernet (GE) modular port adapter (MPA) supports LAN/WAN/OTN mode and provides a single cage of coherent transceiver CFP2 module that operate at a rate of 100 Gbps. The 1-Port 100GE MPA is supported in both bay 0 and bay 1 of 400 Gigabit Modular Line Card (A9K-MOD400-SE, A9K-MOD400-TR) and 200 Gigabit Modular Line Card (A9K-MOD200-SE, A9K-MOD200-TR).

This MPA supports 10X10 and 2X40 breakout configuration.

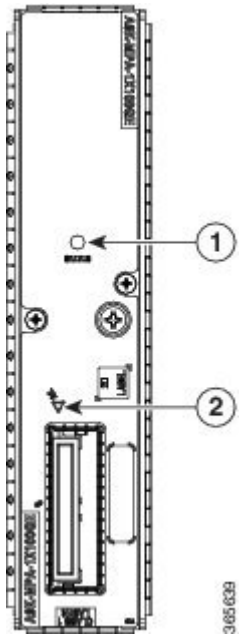
Note

- V02 version of the CFP2-DCO module is introduced. V02 version of the optical module supports Staircase FEC. Staircase FEC is an industry standard that enables high-speed optical communications. The version ID information of the optical module can be obtained from the output of the `show inventory` command.
- This MPA does not support 1X40 breakout configuration.
- The CFP2 Digital Coherent Optics (DCO) are supported with the following hardware versions (VID):

Line Card PID	MPA PID	MPA Hardware Version (VID)
A9K-MOD200-TR A9K-MOD200-SE A9K-MOD400-TR A9K-MOD400-SE	A9K-MPA-1x100GE	V03

The CFP2 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 CFP2 port and the Status LED indicates the status for the MPA

Figure 28: 1-Port 100-Gigabit Ethernet Modular Port Adapter with CFP2



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

The following table shows the LED behavior when interface type is 100G breakout is configured:

Table 17: LED Behavior When Interface Type is 100G

Port LED State	Status
Off	Port is shutdown.
Red	100G interface is in down state.
Green	100G interface is in up state.
Blinking Green and Amber	100G interface is up and carrying traffic.

Table 18: LED Behavior When Breakout is Configured

Port LED State	Status
Off	Ports are shutdown.
Red	Link is down for at least one of the enabled ports.
Green	At least one port is enabled and link is up on all enabled ports.
Blinking Green and Amber	At least one port is enabled and link is up on all enabled ports.

You can use a CFP2 adapter to connect the CPAK transceivers to the MPA. The router only detects a connected CPAK transceiver module and does not detect the physically intermediate CFP2 adapter. The show inventory command shows the connected CPAK transceiver module.

This table lists the CFP2 adapters and the supported CPAK modules:

CFP2 Adaptor	Supported CPAK transceiver module
CVR-CFP2-CPAK4	CPAK-100G-LR4 CPAK-100G-ER4L CPAK-100G-CWDM4
CVR-CFP2-CPAK10	CPAK-100G-SR10 CPAK-10X10G-LR CPAK-10X10G-ERL

Caution Plugging a non-supported CPAK to a CFP2 adapter can damage the CFP2 adapter. Ensure that you read the PID label on the CFP2 adapter carefully.

Caution We recommend that you wait for 60 seconds before successive insertion or removal of optics. Failing to follow this recommendation may affect the functionality of optics.

Note When you use the CPAK optical module with the CFP2 adapter, you must remove and insert both parts. Removing or inserting the CPAK optical module without having removed or inserted the CFP2 adapter results in the "not a valid part" error.

Caution The metal surfaces of CPF2-DCO modules may exhibit high temperatures and thus be unsafe for handling with bare hands.

For more information about how to remove the CFP2-DCO module, see Safe Removal of CFP2-DCO Modules, on page 99.

1-Port 200-Gigabit Ethernet Modular Port Adapter with CFP2-DCO

The 1-Port 200-Gigabit Ethernet (GE) modular port adapter (MPA) supports OTN mode and provides a single cage of coherent transceiver CFP2-DCO module that operate at a rate of 100 Gbps or 200Gbps. The 1-Port 200GE MPA is supported in both bay 0 and bay 1 of 400 Gigabit Modular Line Card (A9K-MOD400-SE, A9K-MOD400-TR) and only on Bay 0 of 200 Gigabit Modular Line Card (A9K-MOD200-SE, A9K-MOD200-TR).

Note

- V02 version of the CFP2-DCO module is introduced. V02 version of the optical module supports Staircase FEC. Staircase FEC is an industry standard that enables high-speed optical communications. The version ID information of the optical module can be obtained from the output of the `show inventory` command.
- This MPA does not support any breakout configuration.

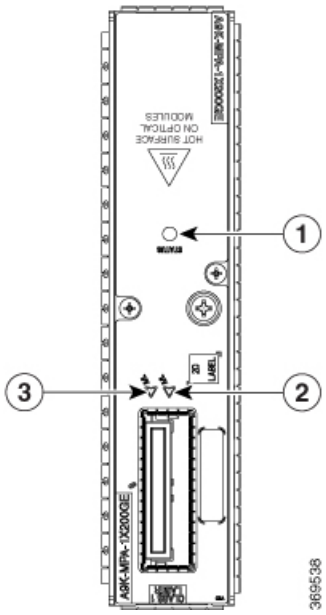
The MPA provides one port of CFP2-DCO transceiver that can operate at 100GE (included) or 200GE with the CFP2-LIC-UPG-200G upgrade license. The 200GE rate is supported by combining two 100G Interfaces at the back end requiring two separate MAC/IP addresses to be assigned.

Note The CFP2 Digital Coherent Optics (DCO) are supported with the following hardware versions (VID):

Line Card PID	MPA PID	MPA Hardware Version (VID)
A9K-MOD200-TR A9K-MOD200-SE A9K-MOD400-TR A9K-MOD400-SE	A9K-MPA-1x200GE	V00

The CFP2 cage on the MPA has two adjacent A/L (Active/Link) LEDs visible on the front panel. The A/L LEDs indicates the status of the associated CFP2 port and the Status LED indicates the status of the MPA.

Figure 29: 1-Port 200-Gigabit Ethernet Modular Port Adapter with CFP2-DCO



1	Status LED	2 and 3	A/L (Active/Link) LED

The following table shows the LED behavior when interface type is 100G:

Table 19: LED Behavior When Interface Type is 100G

Port LED State	Status
Off	Port is shutdown.
Red	100G interface is in down state.
Green	100G interface is in up state.
Blinking Green and Amber	100G interface is up and carrying traffic.

Caution Plugging a non-supported CPAK to a CFP2 adapter can damage the CFP2 adapter. Ensure that you read the PID label on the CFP2 adapter carefully.

Caution We recommend that you wait for 60 seconds before successive insertion or removal of optics. Failing to follow this recommendation may affect the functionality of optics.

Caution The metal surfaces of CPF2-DCO modules may exhibit high temperatures and thus be unsafe for handling with bare hands. A hot surface warning label is provided on the faceplate of the MPA where the optical module is inserted.

For more information about how to remove the CFP2-DCO module, see Safe Removal of CFP2-DCO Modules, on page 99.

2-Port 100-Gigabit Ethernet Modular Port Adapter with CFP2

The 2-Port 100-Gigabit Ethernet (GE) modular port adapter (MPA) supports LAN/WAN/OTN mode and provides two cages of coherent transceiver CFP2 modules that operate at a rate of 100 Gbps.

The 2-Port 100GE MPA is supported on both bay 0 and bay 1 of 400 Gigabit Modular Line Card (A9K-MOD400-SE, A9K-MOD400-TR, A9K-MOD400-CM) and on bay 0 of the 200-Gigabit Line Card (A9K-MOD200-SE, A9K-MOD200-TR).

This MPA supports 10X10 and 2X40 breakout configuration.

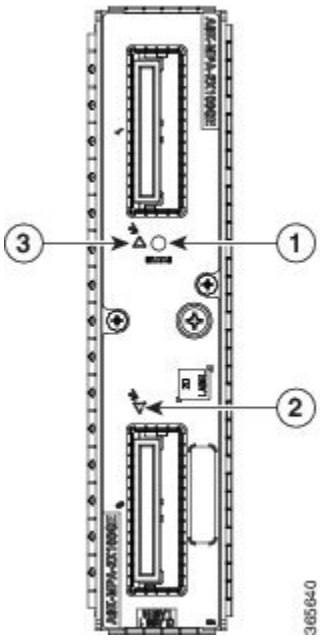
Note

- V02 version of the CFP2-DCO module is introduced. V02 version of the optical module supports Staircase FEC. Staircase FEC is an industry standard that enables high-speed optical communications. The version ID information of the optical module can be obtained from the output of the `show inventory` command output.
- This MPA does not support 1X40 breakout configuration.
- The CFP2 Digital Coherent Optics (DCO) are supported with the following hardware versions (VID):

Line Card PID	MPA PID	MPA Hardware Version (VID)
A9K-MOD200-TR A9K-MOD200-SE A9K-MOD400-TR A9K-MOD400-SE	A9K-MPA-2x100GE	V04
A9K-MOD400-CM	A9K-MPA-2x100GE-CM	V02

Each CFP2 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 CFP2 port and the Status LED indicates the status for the MPA.

Figure 30: 2-Port 100-Gigabit Ethernet Modular Port Adapter with CFP2



1	Status LED	3	A/L (Active/Link) LED
2	A/L (Active/Link) LED		

The following table shows the LED behavior when interface type is 100G:

Table 20: LED Behavior When Interface Type is 100G

Port LED State	Status
Off	Port is shutdown.
Red	100G interface is in down state.
Green	100G interface is in up state.
Blinking Green and Amber	100G interface is up and carrying traffic.

The following table shows the LED behavior when breakout is configured:

Table 21: LED Behavior When Breakout is Configured

Port LED State	Status
Off	Ports are shutdown.
Red	Link is down for at least one of the enabled ports.
Green	At least one port is enabled and link is up on all enabled ports.

Port LED State	Status
Blinking Green and Amber	Traffic is flowing on at least one enabled ports and no enabled ports are down

You can use a CFP2 adapter to connect the CPAK transceivers to the MPA. The router only detects a connected CPAK transceiver module and does not detect the physically intermediate CFP2 adapter. The show inventory command shows the connected CPAK transceiver module.

This table lists the CFP2 adapters and the supported CPAK modules:

CFP2 Adaptor	Supported CPAK transceiver module
CVR-CFP2-CPAK4	CPAK-100G-LR4 CPAK-100G-ER4L CPAK-100G-CWDM4
CVR-CFP2-CPAK10	CPAK-100G-SR10 CPAK-10X10G-LR CPAK-10X10G-ERL

Caution Plugging a non-supported CPAK to a CFP2 adapter can damage the CFP2 adapter. Ensure that you read the PID label on the CFP2 adapter carefully.

Caution We recommend that you wait for 60 seconds before successive insertion or removal of optics. Failing to follow this recommendation may affect the functionality of optics.

Caution The metal surfaces of CPF2-DCO modules may exhibit high temperatures and thus be unsafe for handling with bare hands.

For more information about how to remove the CFP2-DCO module, see Safe Removal of CFP2-DCO Modules, on page 99.

20-Port Gigabit Ethernet Modular Port Adapter with SFP

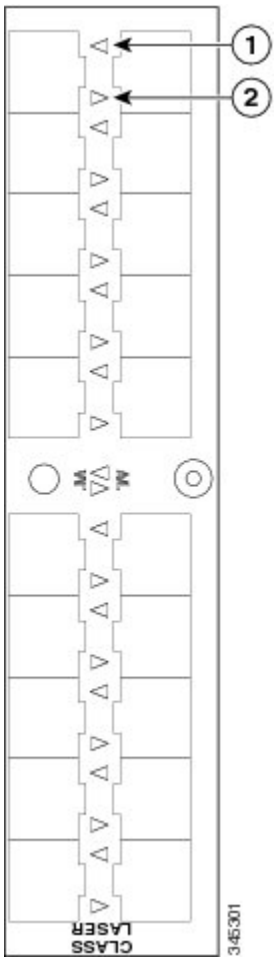
The 20-Port Gigabit Ethernet (GE) modular port adapter (MPA) provides 10 double-stacked SFP (20 total) cages that support either fiber-optic or copper GE transceivers.

Each SFP cage on the 20-Port 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 *20-Port Gigabit Ethernet MPA LEDs* . See Technical Specifications, on page 157 for a list of all SFP modules supported on the 20x1GE modular port adapter.

Note Note: This MPA is not compatible with the consumption-model MOD400 line card.

The following figure shows the 20-Port GE MPA and corresponding LEDs.

Figure 31: 20-Port Gigabit Ethernet Modular Port Adapter



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

Table 22: 20-Port Gigabit Ethernet MPA 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 and amber when there is traffic activity.

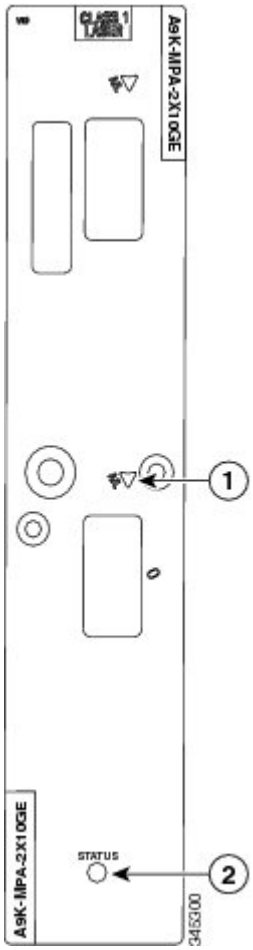
	Amber	On	Port is enabled and the link is down.
STATUS	Off	Off	Modular port adapter power is off.
	Green	On	Modular port adapter is ready and operational.
	Amber	On	Modular port adapter power is on and good, and modular port adapter is being configured.

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.

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 the below table *2-Port 10-Gigabit Ethernet MPA LEDs*, and a Status LED for the MPA as shown in the following figure.

Figure 32: 2-Port 10-Gigabit Ethernet Modular Port Adapter



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

Table 23: 2-Port 10-Gigabit Ethernet MPA 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 and amber when there is traffic activity.
	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.

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 the following figure. The A/L LED indicates the status of the associated XFP port, as described in the below table *4-Port 10-Gigabit Ethernet MPA LEDs* .

Figure 33: 4-Port 10-Gigabit Ethernet Modular Port Adapter

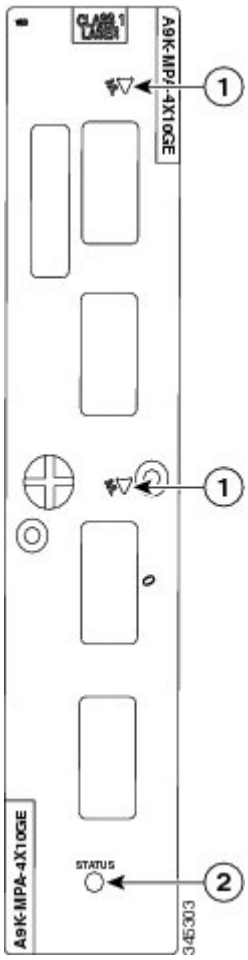


Table 24: 4-Port 10-Gigabit Ethernet MPA LEDs

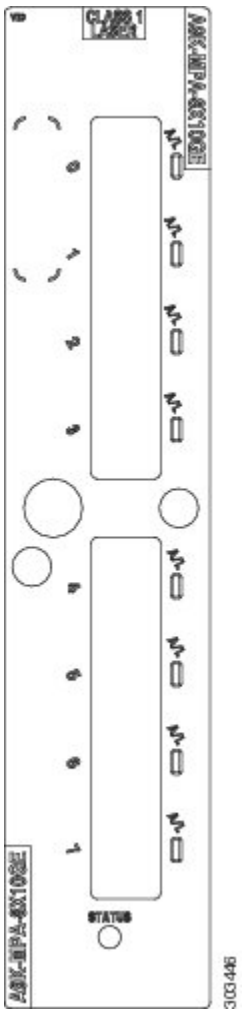
LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up. The MPA A/L (Active/Link) LED will blink green and amber when there is traffic activity.
	Amber	On	Port is enabled and the link is down.
STATUS	Off	Off	Modular port adapter power is off.
	Green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

Note Each SFP+ cage on the 8-Port 10GE MPA has an adjacent A/L (Active/Link) LED of the card as shown in the following figure

Note This MPA is not compatible with MOD400 consumption-model line card

Figure 34: 8-Port 10-Gigabit Ethernet Modular Port Adapter



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

Table 25: 8-Port 10-Gigabit Ethernet MPA LEDs

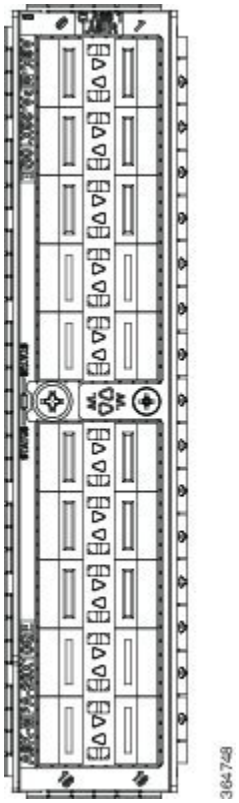
LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up.
	Amber	On	Port is enabled and the link is down.
STATUS	Off	Off	MPA power is off.
	Green	On	MPA is ready and operational.
	Amber	On	The MPA power is on and working is being configured.

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

The 20-Port 10-Gigabit Ethernet (GE) modular port adapter (MPA) provides two 2x5 double-stacked cages for SFP+ Ethernet optical interface modules.

Each SFP+ cage on the 20-Port 10GE MPA has an adjacent A/L (Active/Link) LED visible on the front panel of the card as shown in the following figure. The A/L (Active/Link) LED indicates the status of the associated SFP+ port, as described in Modular Port Adapter LEDs , on page 148.

Figure 35: 20-Port 10-Gigabit Ethernet Modular Port Adapter with SFP+



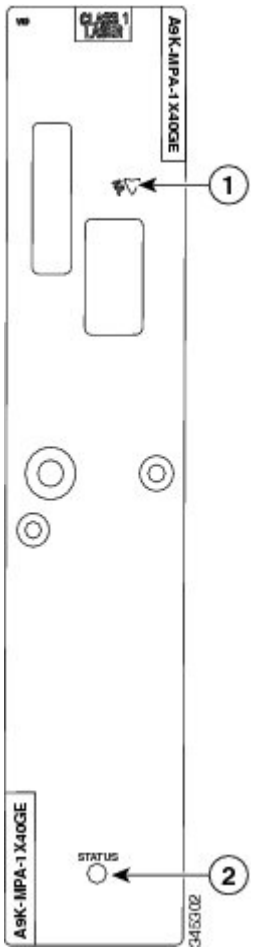
Note LED status could be wrong when a port is put into loopback internal mode on Gigabit Ethernet interface for 20x1EP. Loopback internal is used for debugging purpose.

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.

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 *1-Port 40-Gigabit Ethernet MPA LEDs* table below and a Status LED as shown in the following figure.

Figure 36: 1-Port 40-Gigabit Ethernet Modular Port Adapter



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

Table 26: 1-Port 40-Gigabit Ethernet MPA 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.

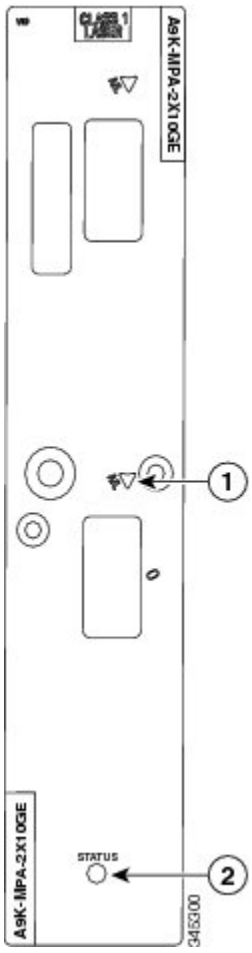
2-Port 40-Gigabit Ethernet Modular Port Adapter with QSFP+

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.

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 *2-Port 40-Gigabit Ethernet MPA LEDs* table below, and a Status LED for the MPA as shown in the following figure.

Note Note: This MPA is not compatible with consumption-model MOD400 line card.

Figure 37: 2-Port 40-Gigabit Ethernet Modular Port Adapter



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

Table 27: 2-Port 40-Gigabit Ethernet MPA 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.

32-Port Gigabit Ethernet Modular Port Adapter with MACsec

The 32-Port Gigabit Ethernet (GE) modular port adapter (MPA) provides support for MACsec security. The key functionality of this MPA is to provide MACsec feature over 32 ports of 1GE over 16 Compact SFP (CSFP) modules. This MPA uses dual channel 1GE Compact-SFP technology (CSFP) to increase the port density. Along with CSFP, this MPA also supports all other types of traditional SFPs.

This MPA is supported on MOD 200 and OD 400 line cards.

Each SFP cage on the 32-Port 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.

Figure 38: SFP Ports on 32-Port Gigabit Ethernet Modular Port Adapter with MACsec

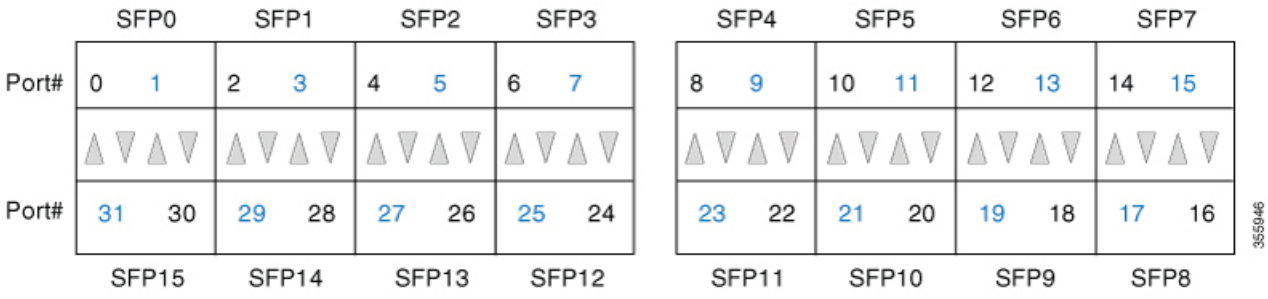
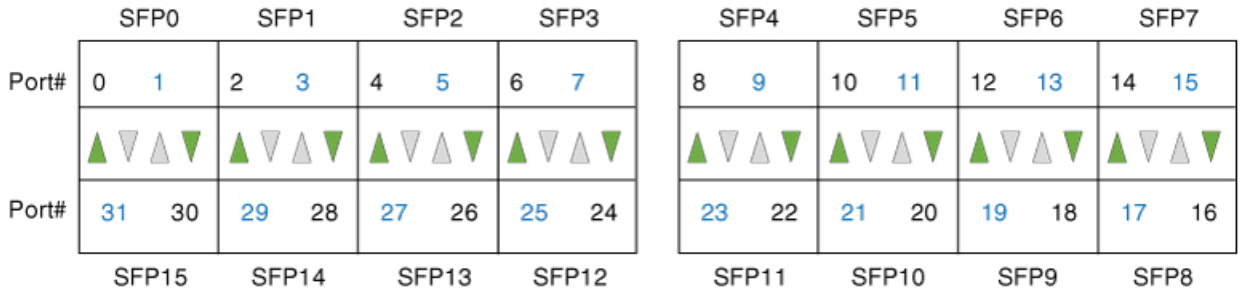


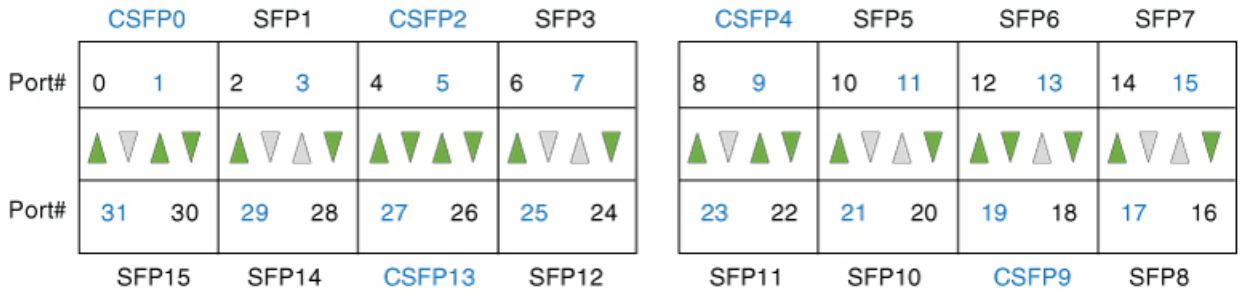
Figure 39: SFP Ports with Link Up on a 32-Port Gigabit Ethernet Modular Port Adapter with MACsec



The SFP slot 0 slot starts from top left and increments towards right till SFP slot 7. The SFP slot 8 is at the bottom right and increments towards left till SFP slot 15. If all SFP optics are plugged in, then port numbers are in even starting from 0 to 31 [For example: Starting from slot 0,2,4,6,8 till slot 30].

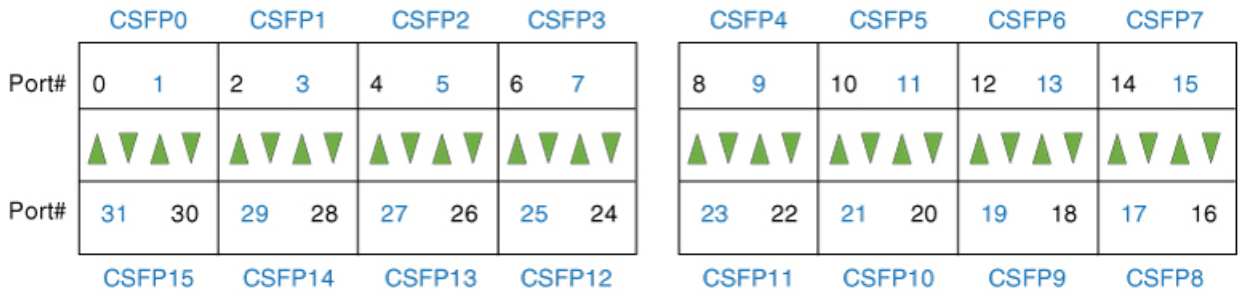
It is possible to have a mix of SFP and CSFP optics in this MPA. If all SFP slots are populated with SFPs, the number of slots is 16.

Figure 40: SFP and CSFP Ports on a 32-Port Gigabit Ethernet Modular Port Adapter with MACsec



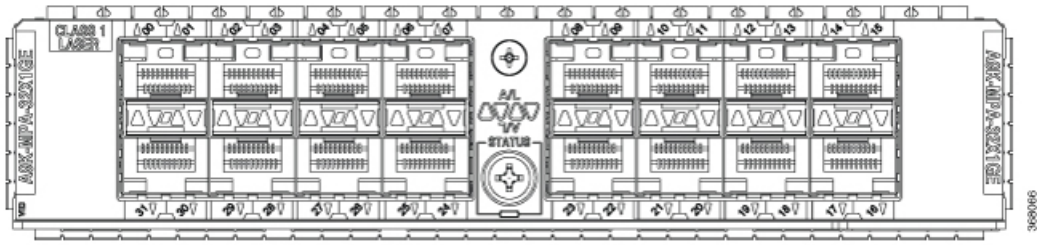
If all the CSFP ports are used, the port numbering will be contiguous from slot 0 to 31.

Figure 41: CSFP Ports on a 32-Port Gigabit Ethernet Modular Port Adapter with MACsec



The following figure shows the 32-Port GE MPA and corresponding LEDs.

Figure 42: 32-Port Gigabit Ethernet MPA with MACsec



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 and amber when there is traffic activity.
	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 modular port adapter is being configured.

Compatibility Matrix for MOD 200 and MOD 400 Line Cards

The following tables list the MPAs supported with MOD200 (A9K-MOD200-SE, A9K-MOD200-TR) and MOD400 (A9K-MOD400-SE, A9K-MOD400-TR) line cards.

Table 28: MPA supported on A9K-MOD200-SE and A9K-MOD200-TR

Bay 0	Bay 1
2x100G-MPA 20x10G-MPA	None

Bay 0	Bay 1
1x100G-MPA	1x100G-MPA
8x10G-MPA	8x10G-MPA
4x10G-MPA	4x10G-MPA
2x10G-MPA	2x10G-MPA
2x40G-MPA	2x40G-MPA
1x40G-MPA	1x40G-MPA
20x1G-MPA	20x1G-MPA
A9K-MPA-32X1GE	A9K-MPA-32X1GE

Table 29: MPAs Supported on A9K-MOD400-SE and A9K-MOD400-TR

Bay 0	Bay 1
20x10G-MPA	20x10G-MPA
2x100G-MPA	2x100G-MPA
1x100G-MPA	1x100G-MPA
8x10G-MPA	8x10G-MPA
4x10G-MPA	4x10G-MPA
2x10G-MPA	2x10G-MPA
2x40G-MPA	2x40G-MPA
1x40G-MPA	1x40G-MPA
20x1G-MPA	20x1G-MPA
A9K-MPA-32X1GE	A9K-MPA-32X1GE

Note 100G CPAK modules, CPAK-100G-ER4L and CPAK-100G-CWDM4, are supported on 100G line cards from Release 6.3.2 onwards. Refer to CPAK module support table for more information.

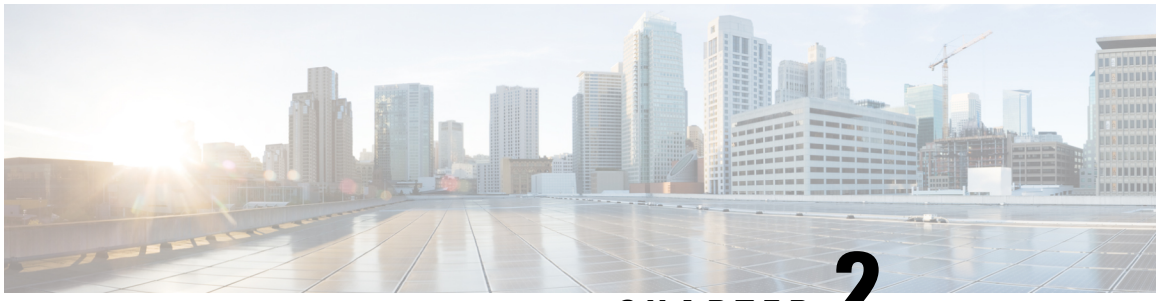
The following table lists the MPAs supported with consumption-model MOD400 (A9K-MOD400-CM) line card.

Note The consumption-model MPAs can only be used only with consumption-model line cards.

Table 30: MPAs Supported on A9K-MOD400-CM

Bay 0	Bay 1
A9K-MPA20X10GE-CM	A9K-MPA20X10GE-CM

Bay 0	Bay 1
A9K-MPA2X100GE-CM	A9K-MPA2X100GE-CM



CHAPTER 2

Installing and Removing Line Cards and Transceiver Modules

This chapter includes procedures for installing and removing line cards and transceiver modules in the Cisco ASR 9000 Series Aggregation Services Router.

For hardware installation and configuration information for the Cisco ASR 9000 Series Router, see the http://www.cisco.com/c/en/us/td/docs/routers/asr9000/hardware/installation/guide/asr9kHIGbk.html

- Safety , on page 79
- Laser Safety, on page 80
- Preventing Electrostatic Discharge, on page 81
- Required Tools and Equipment, on page 81
- Removing and Installing a Line Card, on page 82
- Installing and Removing a Modular Line Card, on page 89
- Installing and Removing Modular Port Adapters, on page 95
- Installing and Removing SFP Modules, on page 107
- Installing and Removing XFP Modules, on page 117
- Installing and Removing 100-Gigabit Ethernet CFP Transceiver Modules, on page 122
- Install and Remove QSFP Transceiver Modules, on page 127
- Installing and Removing CPAK Transceiver or Adapter Modules, on page 131
- Line Card Cable Management, on page 136
- Cables and Connectors, on page 140

Safety

Before you install or remove a line card or transceiver module, review the safety warnings listed in the http://www.cisco.com/c/en/us/td/docs/routers/asr9000/hardware/rcsi/regulatory/compliance/asr9krcsi.html

To avoid injuring yourself or damaging the equipment.

- 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 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:

Warning This product is a Class 1 laser product.

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

Laser/LED Safety for MPAs

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 the figure below.

Figure 43: 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.

Warning This product is a Class 1 laser product.

The multimode aperture contains a Class 1 LED warning label, as shown in the figure below.

Figure 44: Class 1 LED Warning Label for Multimode Port



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

- 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

This section includes the following topics:

Installation Guidelines

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 line card while the router 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 line card prior to removing it from the chassis. See Steps for OIR Line Card Removal and Insertion, on page 88.

  The following table displays the supported line cards, ports, and OIR duration for QDD-400G-ZR-S and QDD-400G-ZRP-S optical modules:

Table 31: Supported Line Cards, Ports, and OIR Duration for QDD-400G-ZR-S and QDD-400G-ZRP-S Optical Modules

Line card	Supported front panel ports	Maximum supported OIR duration at mean sea level (MSL) with QDD-400G-ZR-S and QDD-400G-ZRP-S optical modules
A9K-20HG-FLEX-SE/A9K-20HG-FLEX-TR	0, 7, 8, 12, 19	1 minute at 30°C (or 86°F)
A9K-8HG-FLEX-SE/A9K-8HG-FLEX-TR	0, 7	3 minutes at 30°C (or 86°F)
A99-10X400GE-X-SE/A99-10X400GE-X-TR	3, 5, 6, 7, 9	1 minute at 30°C (or 86°F)
A9903-20HG-PEC	0, 4, 8, 12, 16	45 seconds at 30°C (or 86°F)

Note When you perform a graceful shutdown on a line card, cefcFRUInserted and cefcFRURemoved traps are not generated.

- 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, 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 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.

Note 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.

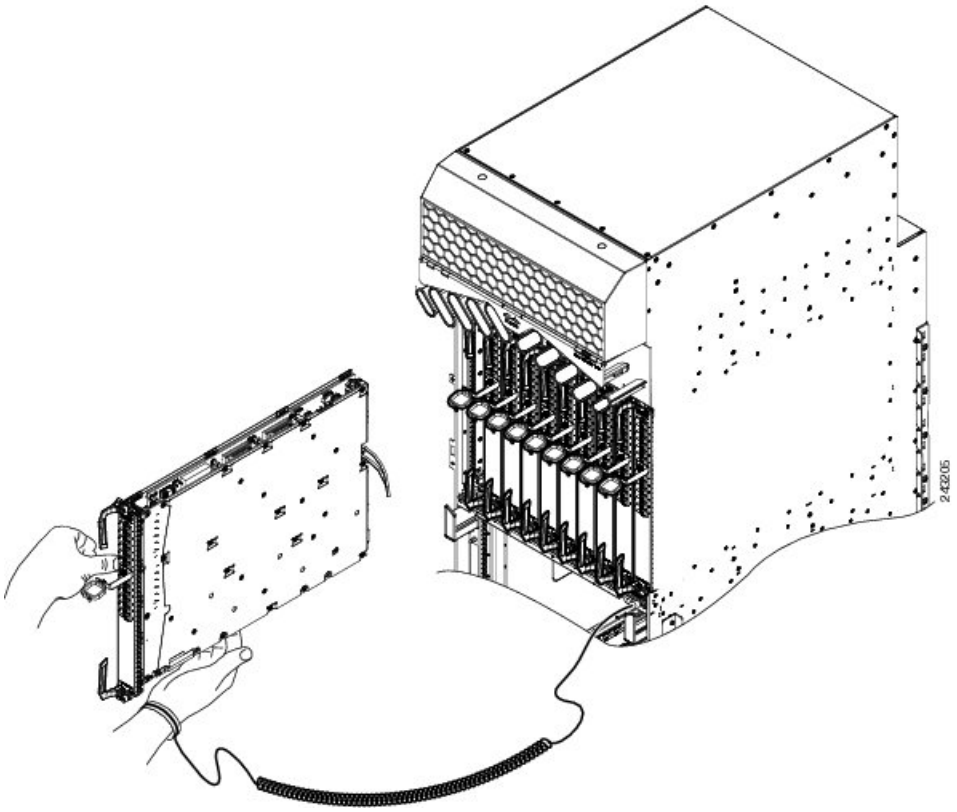
For line card configuration information, see Verifying and Troubleshooting Line Card Installation, on page 147.

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 the figure below or Figure 46: Removing a Line Card (Cisco ASR 9922 Router Shown), on page 86 as a reference and follow these steps:

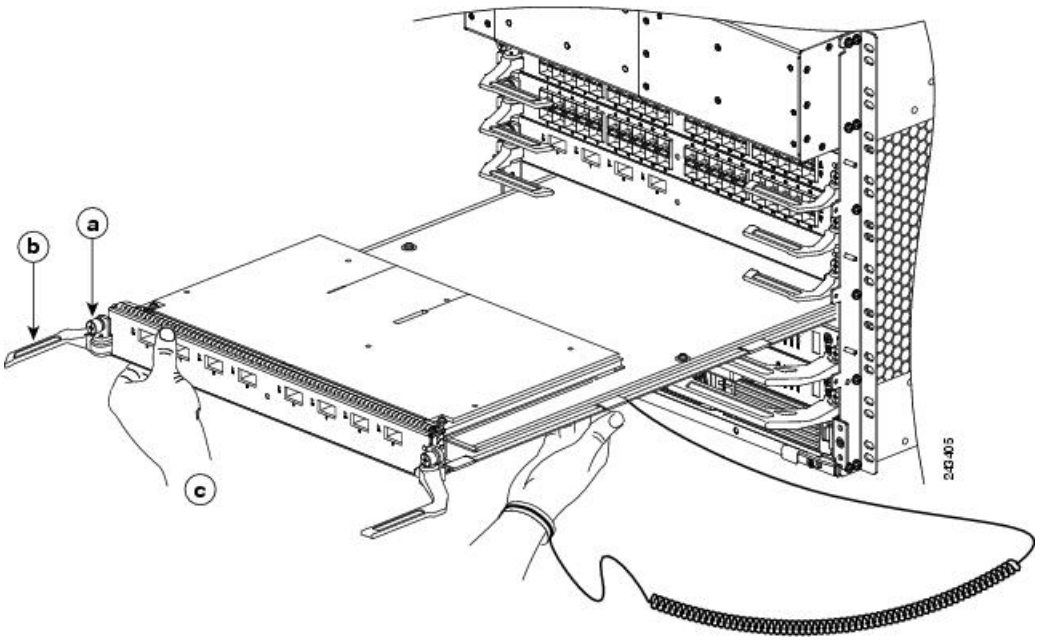
1. Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.
2. Disconnect and remove all interface cables from the ports; note the current connections of the cables to the ports on the line card.
3. Detach the line card cable-management bracket from the line card.
4. Use a screwdriver to loosen the captive screw at each end of the line card front panel.

Figure 45: Removing a Line Card (Cisco ASR 9912 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 46: Removing a Line Card (Cisco ASR 9922 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.

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

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

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.

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.

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.

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:

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

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 45: Removing a Line Card (Cisco ASR 9912 Router Shown), on page 85 or Figure 46: Removing a Line Card (Cisco ASR 9922 Router Shown), on page 86). Position the card for insertion into the card cage slot. Avoid touching the line card printed circuit board, components, or any connector pins.

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 through 19) are inserted upside down.

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.
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.

7. Install the cable-management bracket. See Installing a Line Card Cable Management Bracket, on page 138.
8. Install the interface cables. See Installing and Removing Fiber-Optic Interface Cables, on page 142.
9. For information on installing SFP and XFP modules, seeInstalling and Removing SFP Modules, on page 107and Installing and Removing XFP Modules, on page 117.
10. For help in troubleshooting the hardware installation, see Verifying and Troubleshooting Line Card Installation, on page 147.

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.

1. Shut down the line card location with the **(admin-config) hw-module shutdown location 0/0/CPU0** command.
2. Confirm that the LEDs have gone from green to off.
3. Physically remove the line card to be replaced.
4. Physically insert the replacement line card.

5. Return the line card to the up state with the **(admin-config) no hw-module shutdown location 0/0/CPU0** command.

Installing and Removing a Modular Line Card

This section includes the following topics:

Before you perform the following procedures, make sure you review the safety guidelines. See Safety , on page 79 and Preventing Electrostatic Discharge, on page 81.

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 Series 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.

Required Tools and Equipment

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

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

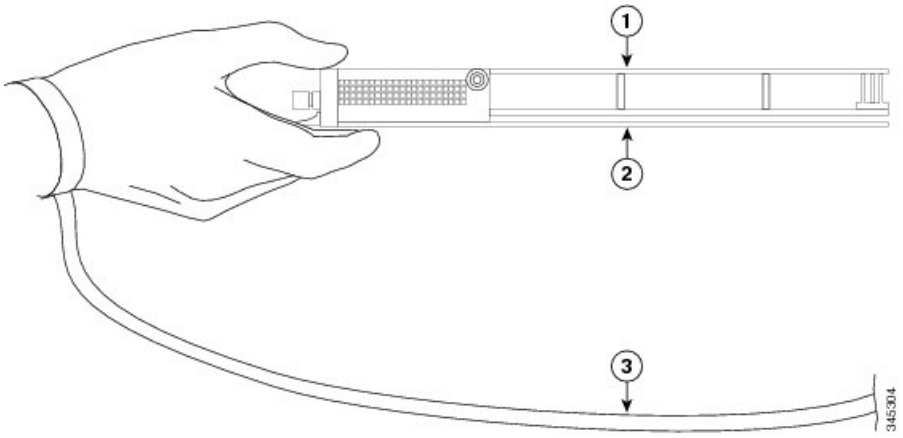
Handling a Modular Line Card

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.

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 47: Handling a Modular Line Card



1	Metal Carrier	2	Printed Circuit Board
3	Grounding Strap		

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.

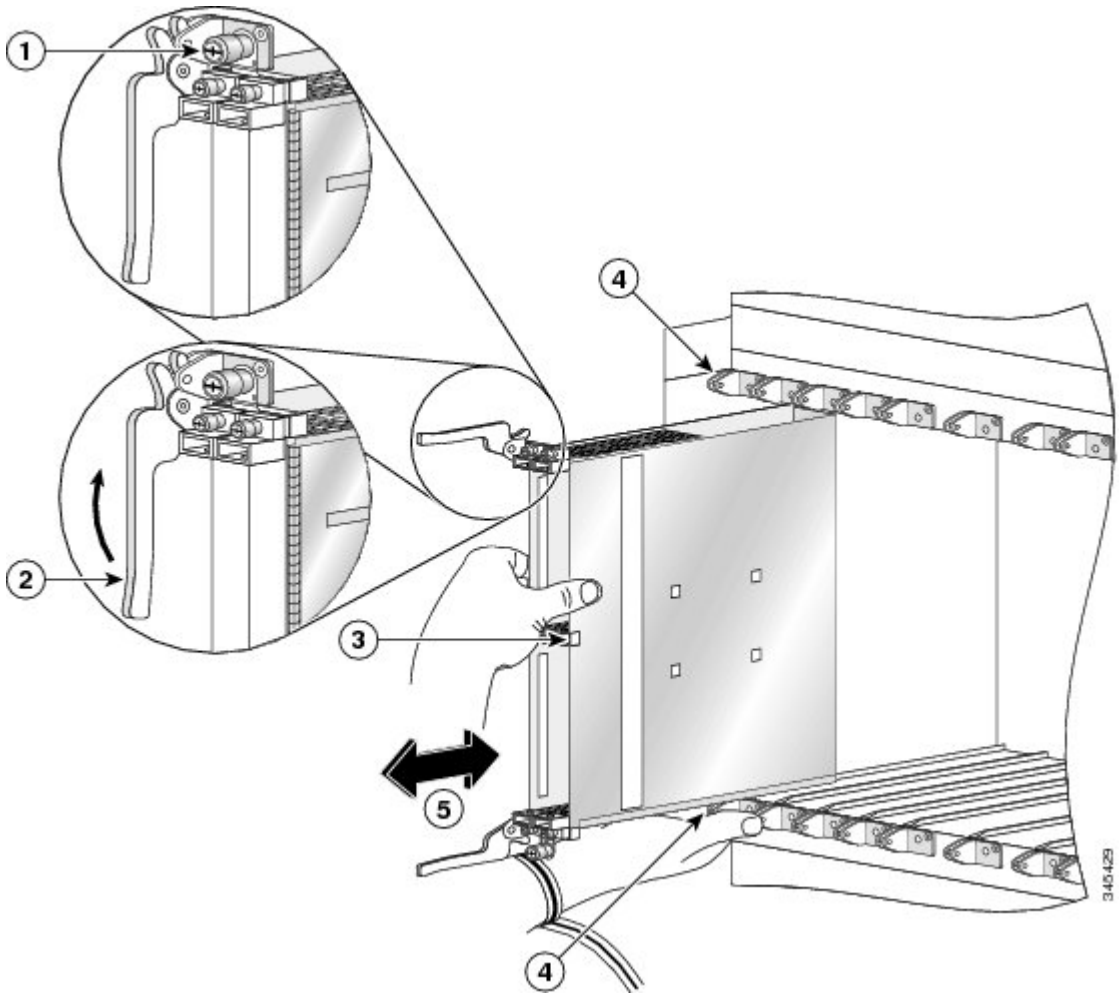
Removing a Modular Line Card

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 the figure below as a reference and follow these steps:

1. Attach an ESD-preventive wrist strap and follow its instructions for use.
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.
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 the figure below).

Figure 48: 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.

1. 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 (see the above figure).
2. Grasp the ejector levers and pull the MLC halfway out of the slot.
3. 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 (see the above figure). Avoid touching the MLC printed circuit board, components, or any connector pins.
4. 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.
5. 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.

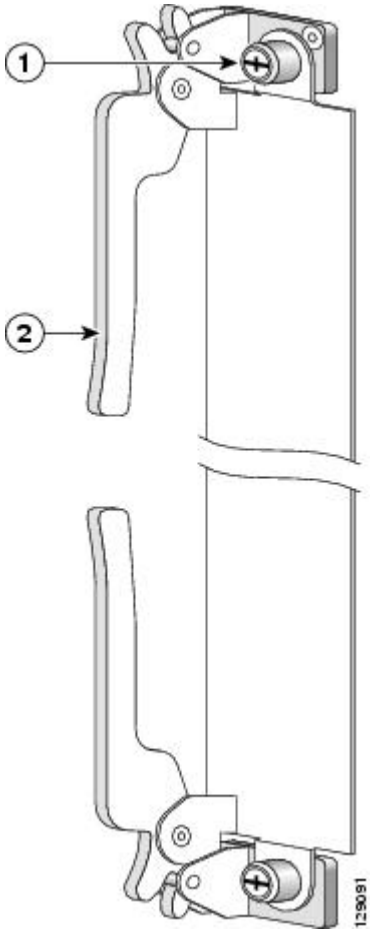
To install a modular line card, follow these steps:

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

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.
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 (see the figure below).

Figure 49: 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.

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.
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.

7. Install the MPAs and SFP modules in the MPAs that use them. See Installing and Removing Modular Port Adapters, on page 95.
8. If you are replacing a MLC, install the MPA in the same bays as you noted in Step 2 under Removing a Line Card, on page 84.
9. Install the interface cables.

Installing and Removing Modular Port Adapters

The following sections describe how to install or remove MPA:

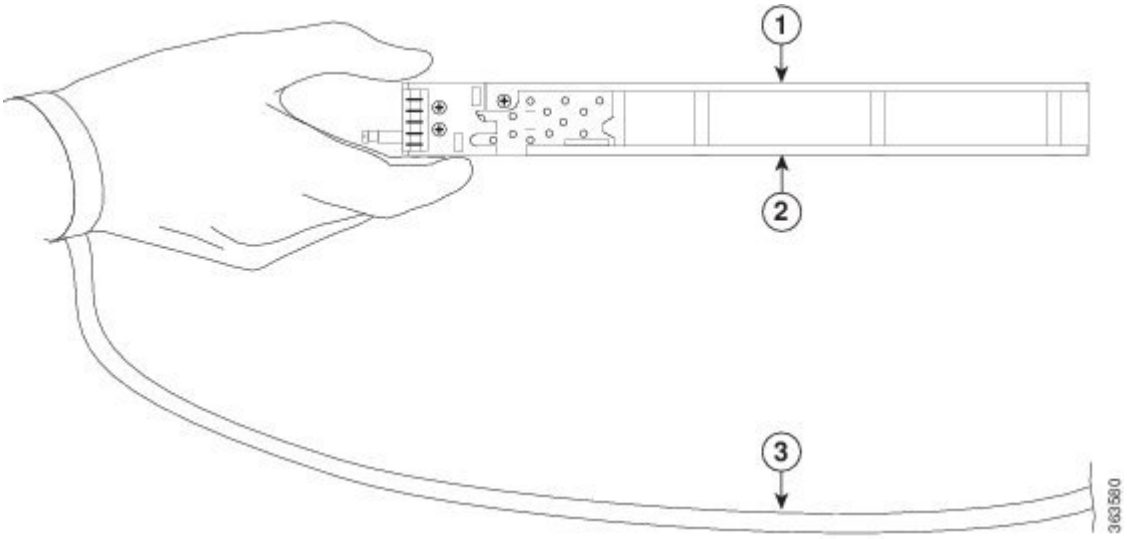
Handling Modular Port Adapters

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 (See the figure below).

When a bay is not in use, a blank 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 50: 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.

Caution Cisco IOS XR Software 6.6.1 and later releases support online insertion and removal (OIR) of Cisco NCS 5500 series modular port adapters (MPAs).

Cisco NCS 5500 series modular port adapters (MPAs) support online insertion and removal (OIR).

Limitation:

- During online insertion and removal of MPA on the Cisco ASR 9000 Series router, the field-programmable gate array (FPGA) turns off and the physical interface (PHY) is unavailable to inhibit the clock. As a result, you will observe a SyncE jump of 80 - 120 ns on downstream nodes.

Modular port adapters (MPAs) support the following 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 chapter of the *Cisco ASR 9000 Series Aggregation Services Router System Management Command Reference* for command syntax.

- Managed OIR

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

- Shut down the MPA with the **hw-module subslot** *rack/slot/subslot* **shutdown** command.
- Confirm that the LEDs have gone from green to off.
- Execute the **do show platform** command to verify that the MPA to be removed is in the disabled state.
- Physically remove the MPA to be replaced.
- Physically insert the replacement MPA. After inserting the MPA in the slot, tighten the MPA screw located on the right side within 10 seconds. Ensure that you first tighten the right screw and then the left.

Note Tighten the captive screws on the MPA within 10 seconds. Otherwise, the MPA shuts down and moves to **Disabled** state. To recover the MPA, tighten both the captive screws and then execute the **hw-module subslot** *rack/slot/subslot* **reload** command.

- Return the MPA to the up state with the **no hw-module subslot** *rack/slot/subslot* **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 card (MLC).

Note After you remove the MPA from the slot, wait for 60 seconds before you reinsert the MPA.

Note After you unscrew both ejector screws, wait for 15 seconds before removing MPA from the slot.

To remove and install a MPA, do the following:

1. To insert the MPA, 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.
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 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. Push the MPA inside the slot until you hear a click. Continue to push the MPA further until you hear a second click. The MPA is fully seated only after the second click is heard.

3. After the MPA is properly seated, use a number 2 Phillips screwdriver to tighten the captive screws on the MPA. Ensure that you first tighten the right screw and then the left.

Note Tighten the captive screws on the MPA within 10 seconds. Otherwise, the MPA shuts down and moves to **Disabled** state. To recover the MPA, tighten both the captive screws and then execute the **hw-module subslot** *rack/slot/subslot* **reload** command.

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

4. To remove the MPA from the MLC, use a number 2 Phillips screwdriver to loosen the captive screws on the MPA. Ensure that you first loosen the right screw and then the left.
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.

Safe Removal of CFP2-DCO Modules

The CFP2-DCO modules, when in use, can exhibit high temperatures. Therefore, we recommend that you do not handle these optical modules with bare hands while removing them from ports of MPAs.

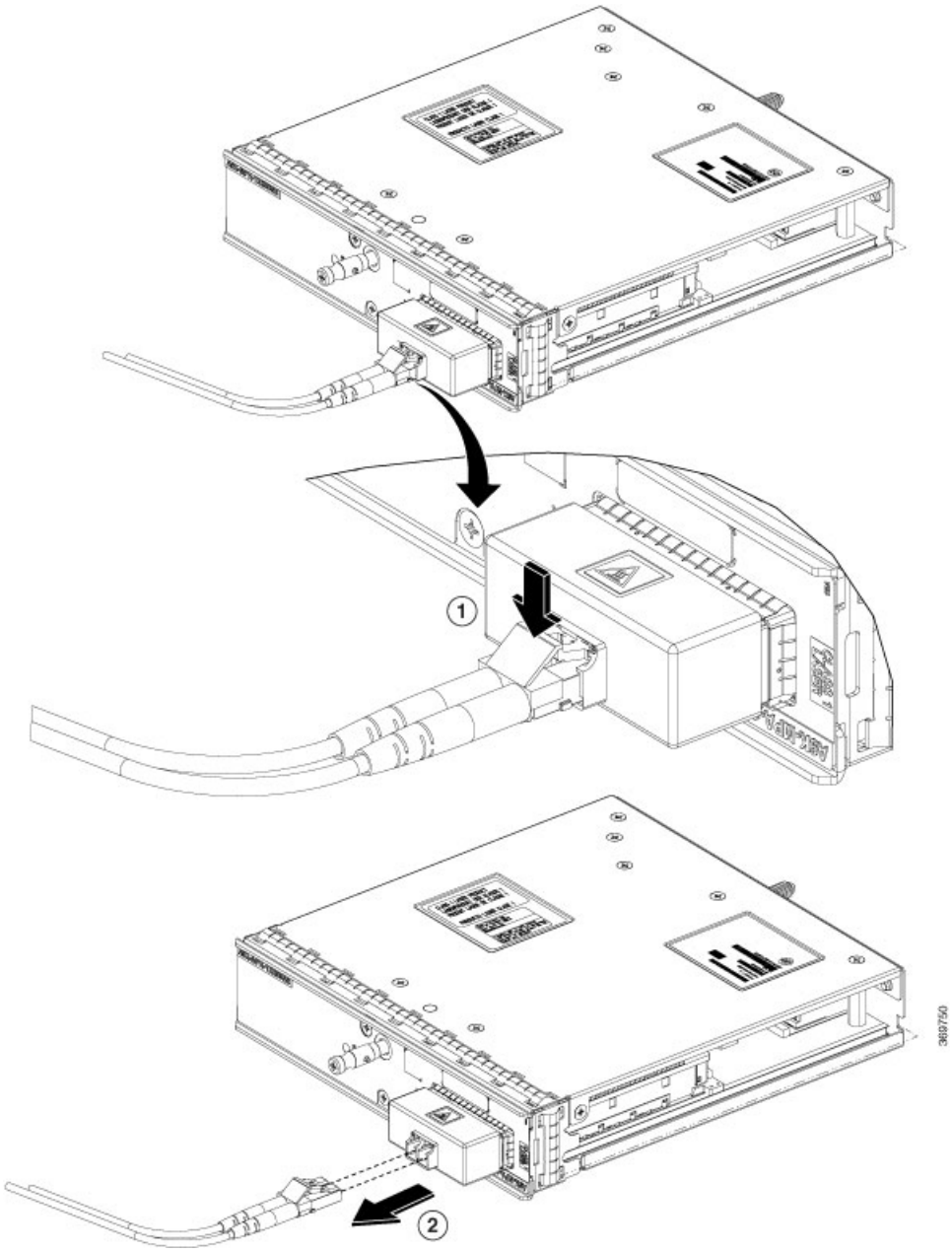
Use the following steps to remove CFP2-DCO modules from a router safely:

1. Use the interface `shutdown` command to shut down the port from which you want to remove the CFP2-DCO module, and then wait for 60 seconds.
2. Press the latch and pull the cable assembly out from the optical module. After you have pulled the cables out, pull the CFP2-DCO module out.

Note

- The CFP2-DCO modules may have become hot. Therefore, hold the latch to pull out the optical module from the port.
- We recommend that you use a thermally insulated pad to handle the optical module when you draw it out of the connector.
- While removing optical cables, ensure that there is minimal disturbance to the adjacent cables.

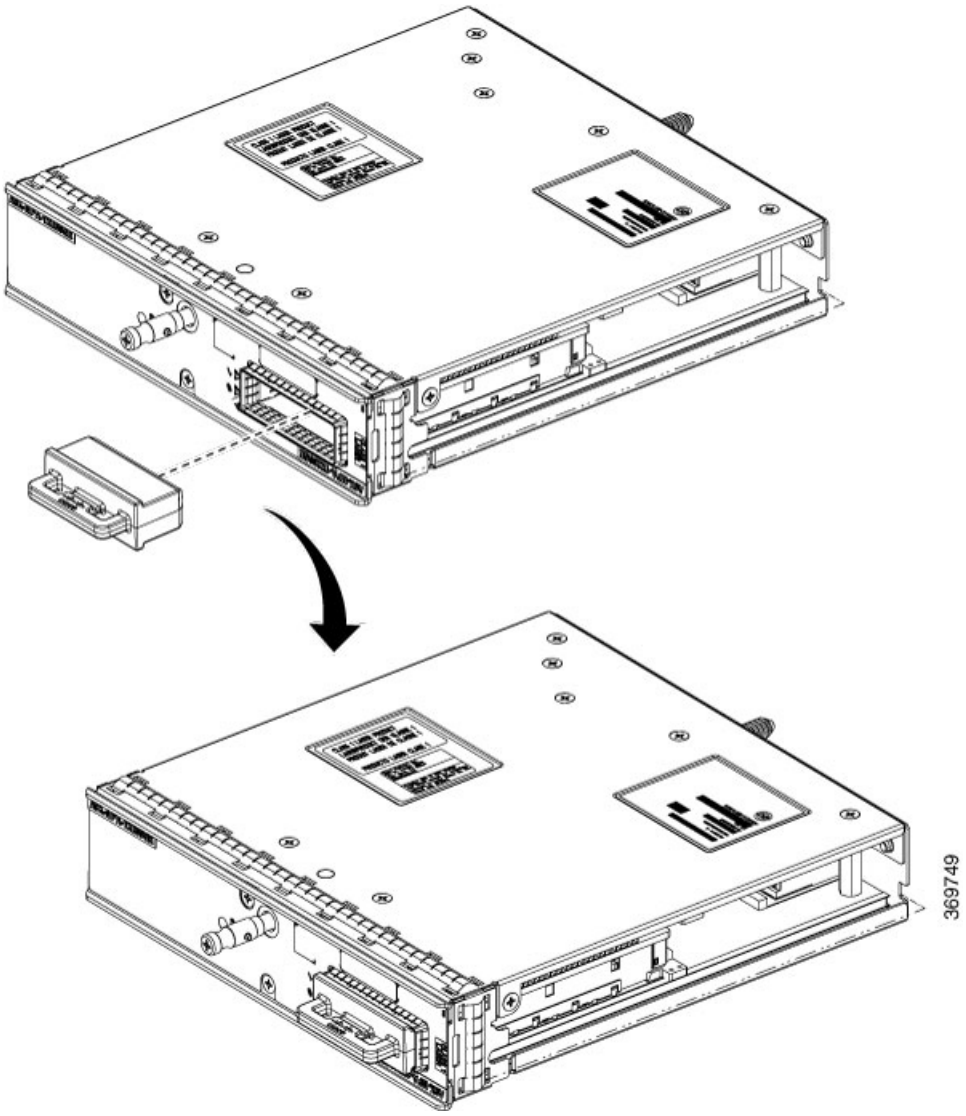
Figure 51: Removal of CFP2-DCO Modules



1	Press the latch on the cables and pull them out.	2	Pull out the optical module by holding its latch.

3. After you have removed the optical module, cover the port with a CFP2 dust plug.

Figure 52: Covering Port with CFP2 Dust Plug



4. Secure the cables of the optical module at a suitable place to prevent them from hanging midair.

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:

1. Observe the console display messages and verify that the system discovers the MLC, while the system reinitializes each interface, as follows:
   a. 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.
   b. 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.
   c. When the MLC and MPA STATUS LEDs are green, all associated interfaces are configurable.

   See *Cisco ASR 9000 Series Router Getting Started Guide* and *Cisco 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.

2. 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, on page 147.

Note New interfaces are not available until you configure them.

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.

1. Use the **show running-config** command to display the system configuration. Verify that the configuration includes the new MPA interfaces.
2. Display information about the installed modular line cards (MLCs) using the **show diag** command.
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.

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

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

The following tables describe the show commands you can use to display modular port adapter (MPA) information.

Table 32: 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 33: 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:

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.
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.
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.

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 are lit 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.

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.

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*.

   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.

7. When the interfaces are up, check the activity of each MPA by observing the carrier LED.
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.
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*), or a service representative for assistance.

To configure the new interface, see the *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 A9K-MOD160G, and the Cisco A9K-MOD80G-H. For more information on command syntax, refer to the guides listed in the *Obtaining Documentation and Submitting a Service Request* 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#
```

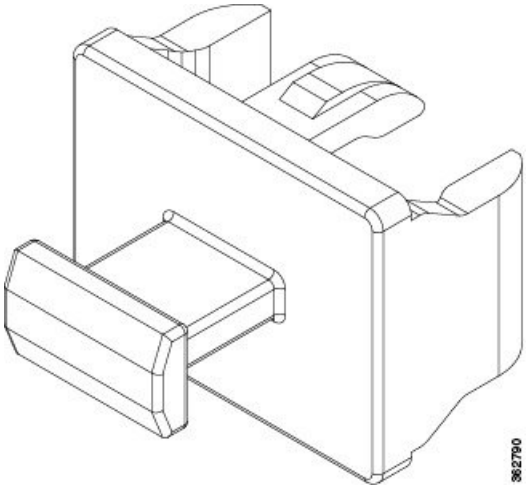
If the connection fails, verify that you have the correct IP address for the destination device and that the destination device is active (powered on), and then repeat the **ping** command.

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, on page 80.

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

Figure 53: 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.

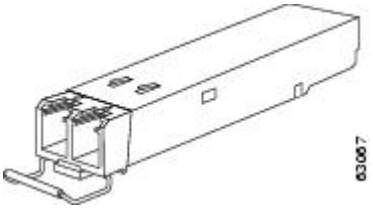
SFP and SFP+ modules use one of four different latching devices to install and remove the module from a port. The four types of SFP module latching devices are described in the following sections:

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 (see the figure below).

Figure 54: Bale Clasp SFP or SFP+ Module

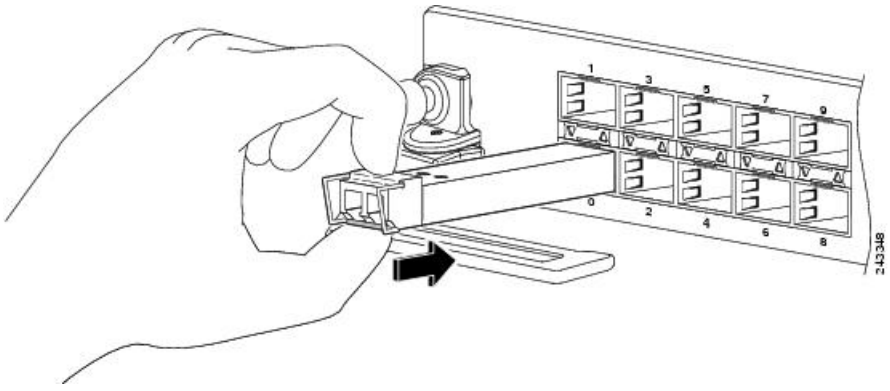


Installing a Bale Clasp SFP or SFP+ Module

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

1. Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.
2. Close the bale clasp before inserting the SFP module.
3. Line up the SFP module with the port and slide it into the port (see the figure below .

Figure 55: Installing a Bale Clasp SFP Module into a Port



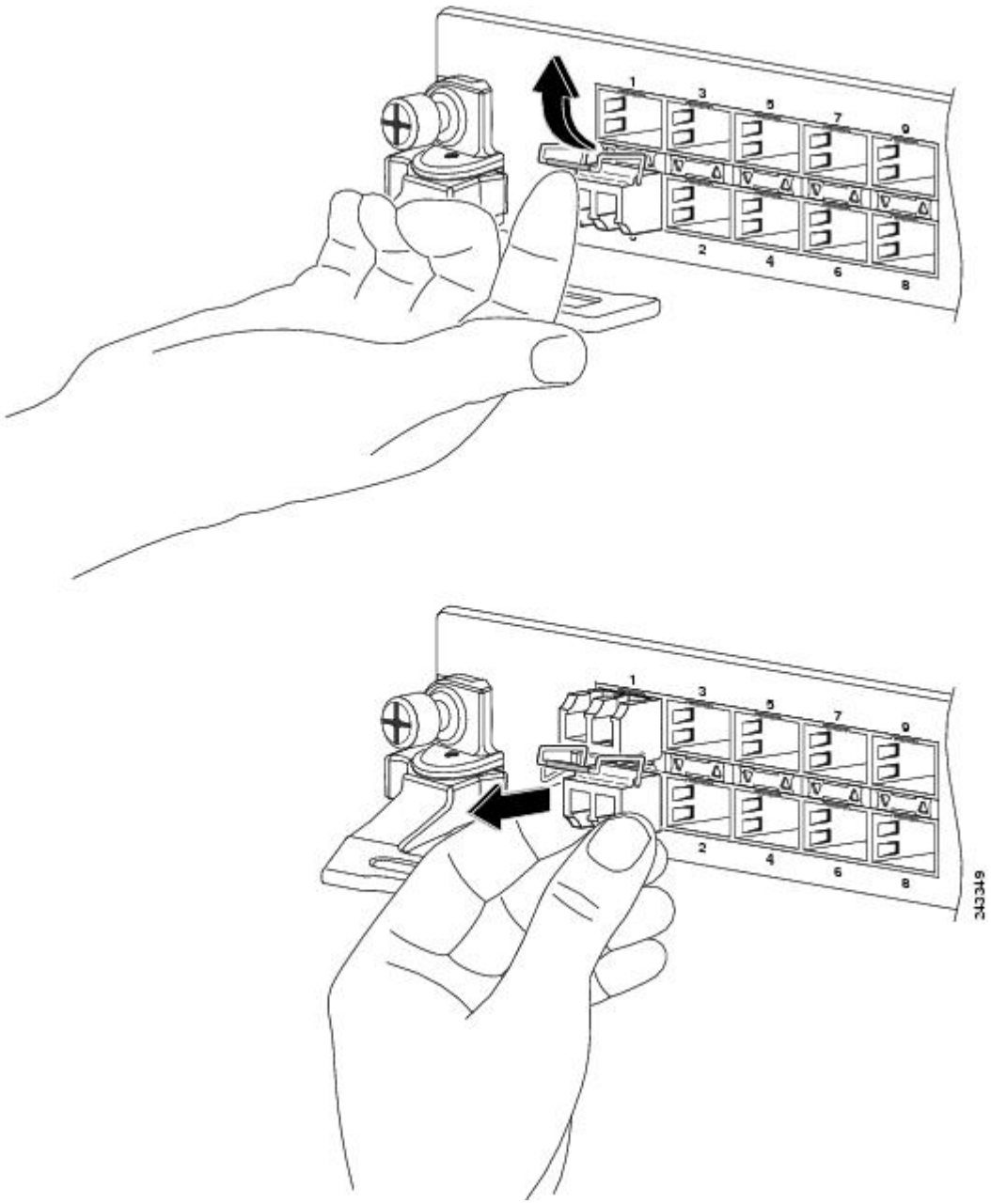
Note When installing an SFP or SFP+ module, you should hear a click as the triangular pin on the bottom of the SFP module snaps into the hole in the receptacle, indicating that the module is correctly seated and secured in the receptacle. Verify that the SFP modules are completely seated and secured 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:

1. Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.
2. Disconnect and remove all interface cables from the ports; note the current connections of the cables to the ports on the line card.
3. Open the bale clasp on the SFP module with your index finger in a downward direction, as shown in the figure below. 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.
4. Grasp the SFP module between your thumb and index finger and carefully remove it from the port, as shown in the figure below.

Figure 56: Removing a Bale Clasp SFP or SFP+ Module

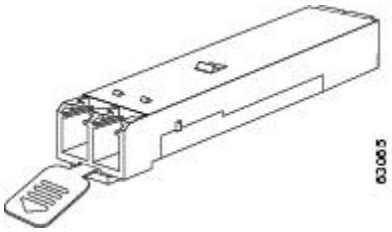


5. Place the removed SFP module on an antistatic mat, or immediately place it in a static shielding bag if you plan to return it to the factory.
6. Protect your line card by inserting clean SFP module cage covers into the optical module cage when there is no SFP module installed.

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 as shown in the following figure.

Figure 57: Mylar Tab SFP or SFP+ Module

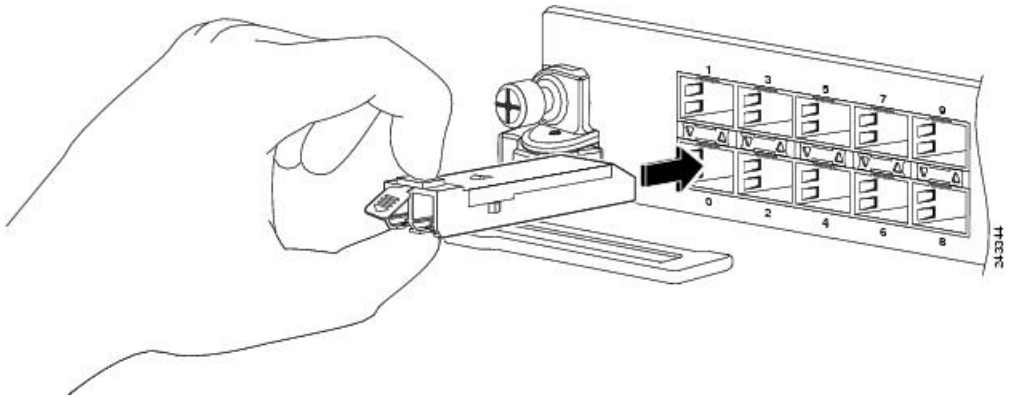


Installing a Mylar Tab SFP or SFP+ Module

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

1. Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.
2. Line up the SFP module with the port, and slide it into place as shown in the following figure.

Figure 58: 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.

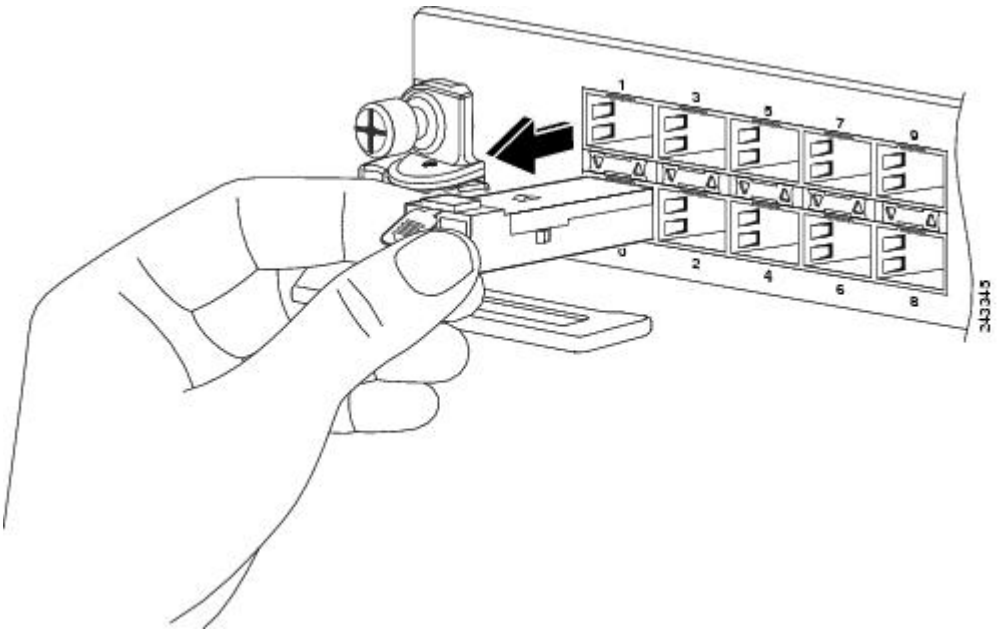
Removing a Mylar Tab SFP or SFP+ Module

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

1. Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.
2. Disconnect and remove all interface cables from the ports; note the current connections of the cables to the ports on the line card.

3. Pull the tab gently in a slightly downward direction until it disengages from the port, then pull the SFP module out as shown in the following figure.

Figure 59: Removing a Mylar Tab SFP Module



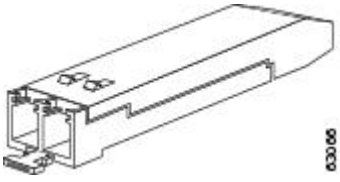
4. Place the removed SFP module on an antistatic mat, or immediately place it in a static shielding bag if you plan to return it to the factory.
5. Protect your line card by inserting clean SFP module cage covers into the optical module cage when there is no SFP module installed.

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 to remove the SFP module from a port as shown in the following figure.

Figure 60: Actuator Button SFP or SFP+ Module

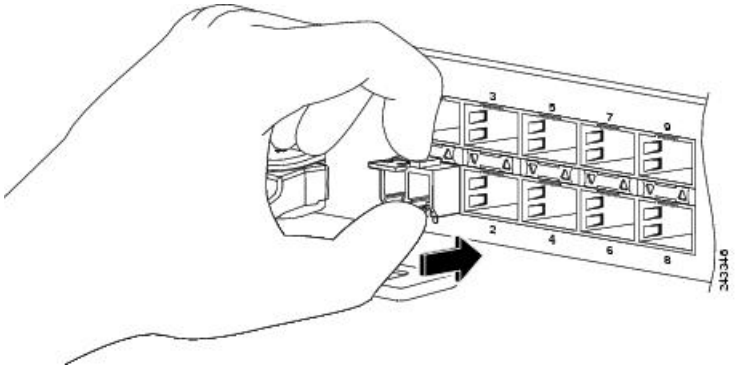


Installing an Actuator Button SFP Module

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

1. Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.
2. Line up the SFP module with the port and slide it in until the actuator button clicks into place as shown in the following figure. 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 61: Installing an Actuator Button SFP or SFP+ Module



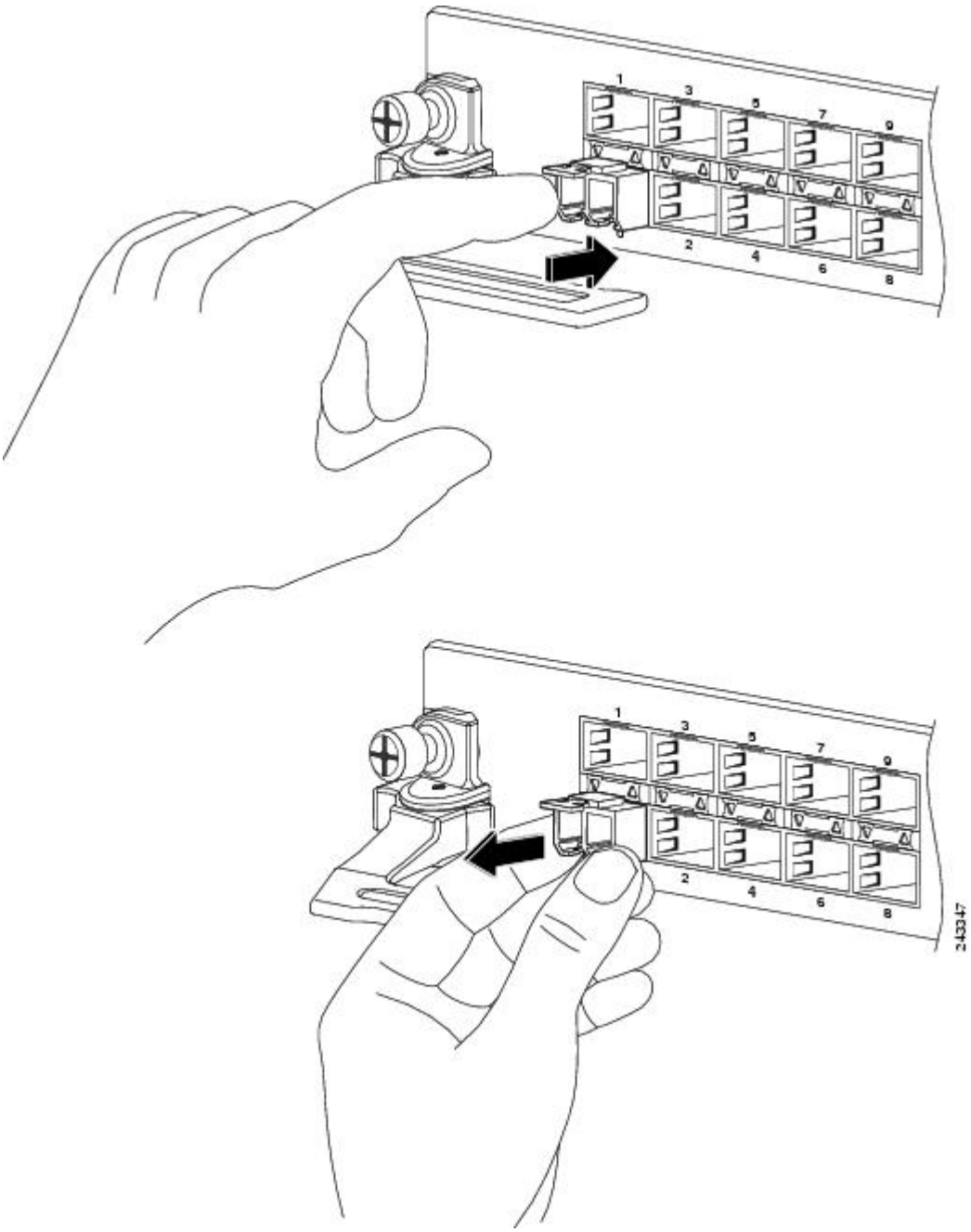
Note When installing an SFP module, you should hear a click as the triangular pin on the bottom of the SFP module snaps into the hole in the receptacle, indicating that the module is correctly seated and secured in the receptacle. Verify that the SFP modules are completely seated and secured in their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

1. Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.
2. Disconnect and remove all interface cables from the ports; note the current connections of the cables to the ports on the line card.
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 (see the figure below).

Figure 62: Removing an Actuator Button SFP or SFP+ Module from a Port

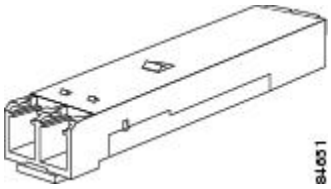


4. Grasp the actuator button between your thumb and index finger and carefully pull the SFP module from the port.
5. Place the removed SFP module on an antistatic mat, or immediately place it in a static shielding bag if you plan to return it to the factory.
6. Protect your line card by inserting clean 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 (see the figure below).

Figure 63: Slide Tab SFP or SFP+ Module

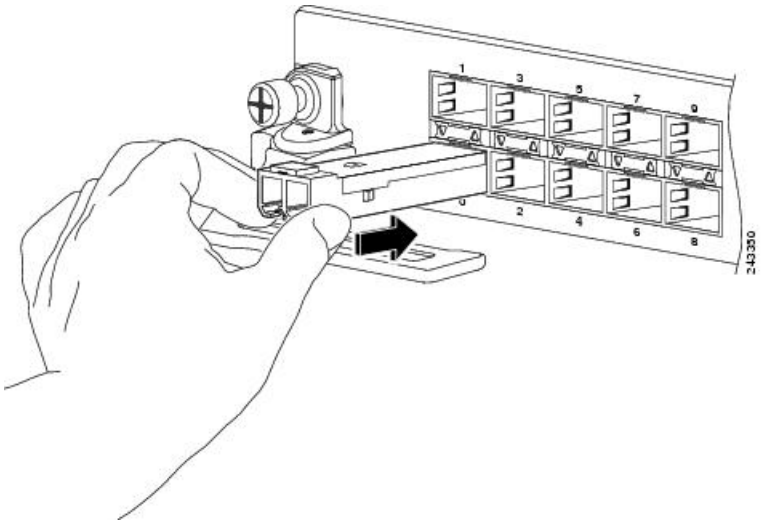


Installing a Slide Tab SFP or SFP+ Module

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

1. Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.
2. Line up the SFP module with the port and gently push on it until it snaps into the slot tightly (see the figure below).

Figure 64: 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.

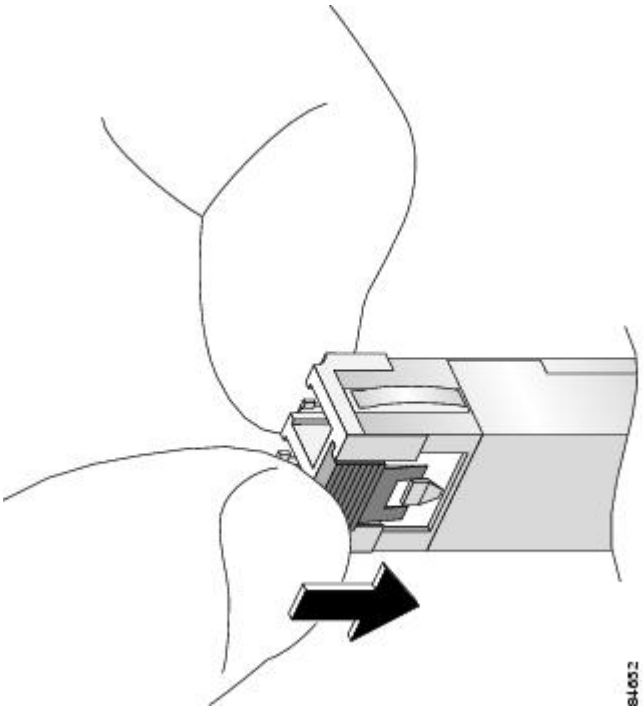
Removing a Slide Tab SFP or SFP+ Module

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

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

2. Disconnect and remove all interface cables from the ports; note the current connections of the cables to the ports on the line card.
3. Grasp the SFP module between your thumb and index finger.
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 (see the figure below).

Figure 65: Disengaging the Slide Tab

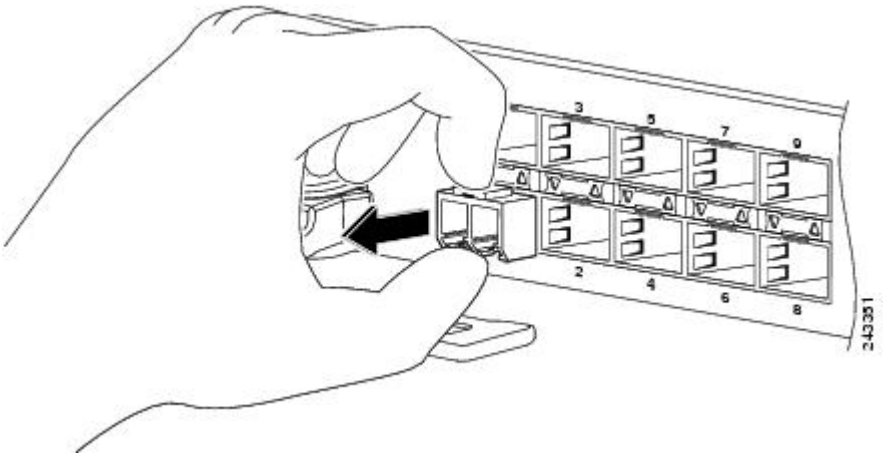


5. With the tab still pushed, carefully pull the SFP module from the port as shown in the figure below.

⚠

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 66: Removing a Slide Tab SFP or SFP+ Module

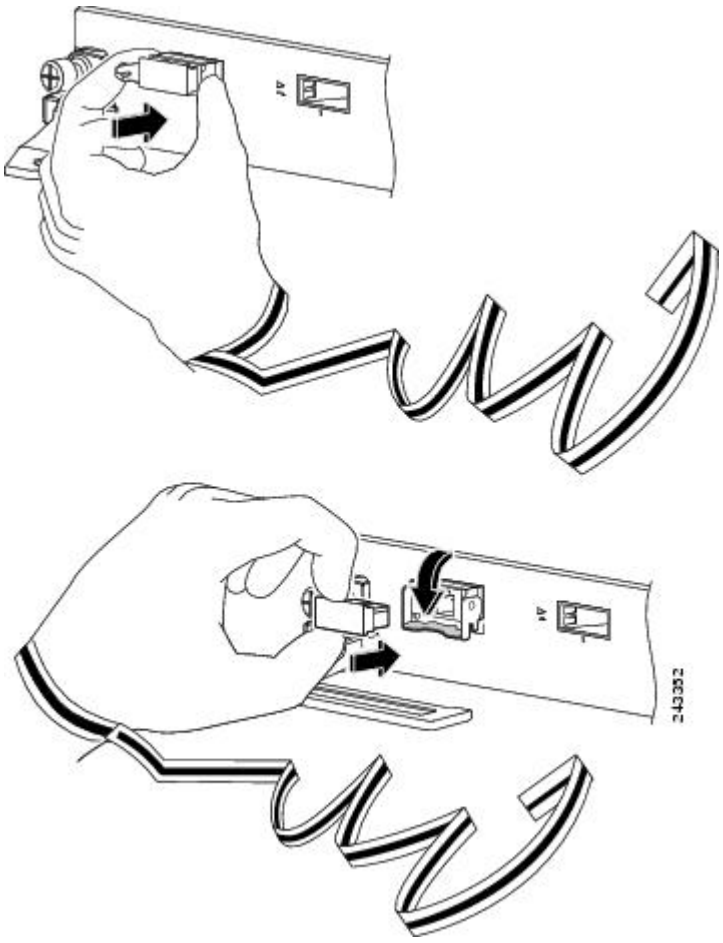


6. Place the removed SFP module on an antistatic mat, or immediately place it in a static shielding bag if you plan to return it to the factory.
7. Protect your line card by inserting clean SFP module cage covers into the optical module cage when there is no SFP module installed.

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 (see the figure below). The XFP transceiver module connects the electrical circuitry of the system with the optical network.

Figure 67: 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 We 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:

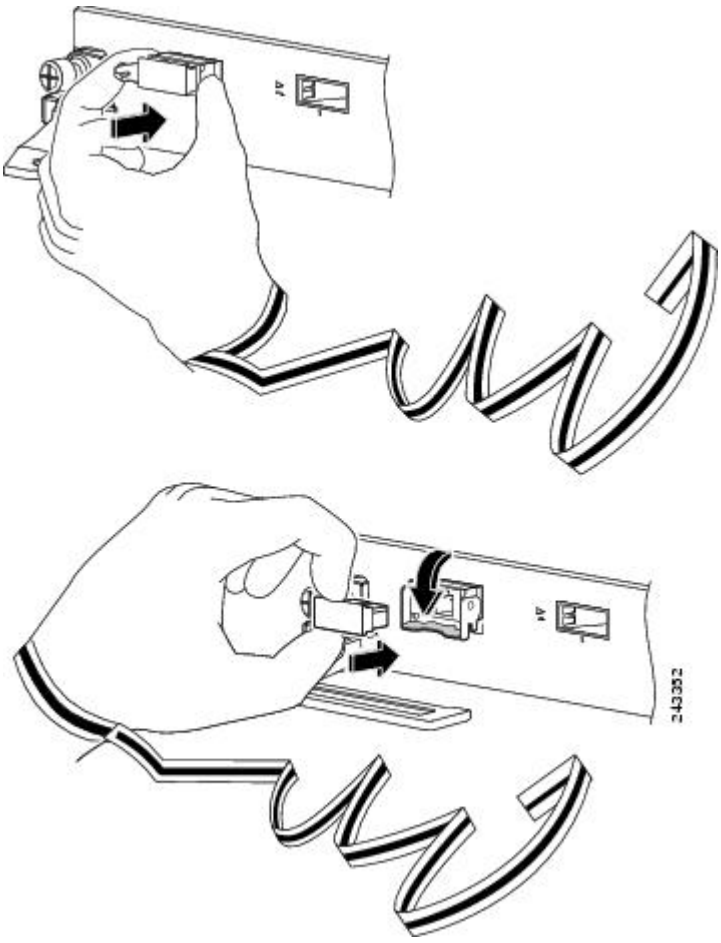
1. Remove the XFP transceiver from its protective packaging.

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

2. Check the label on the XFP transceiver body to verify that you have the correct model for your network.
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.
4. Remove the optical bore dust plug from the XFP transceiver.
5. Pivot the bale clasp up so that it is parallel with the transceiver body (see the figure below).
6. Continue sliding the XFP transceiver into the socket until the XFP transceiver is mated with the transceiver socket connector.
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 (see the figure below).

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

Figure 68: Installing the 10-Gigabit Ethernet XFP Transceiver Module



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

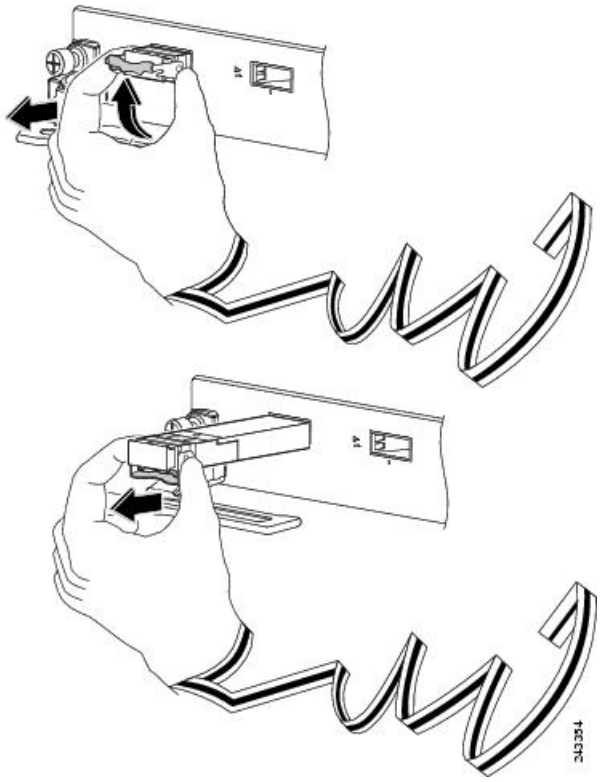
Caution The XFP transceiver is a static-sensitive device. Always use an ESD wrist strap or similar individual grounding device when handling XFP transceivers or coming into contact with modules.

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

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

2. Pivot the XFP transceiver bale clasp up to release the XFP transceiver from the socket (see the figure below).
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 (see the figure below).
4. Immediately place the XFP transceiver in an antistatic bag.

Figure 69: Removing the 10-Gigabit Ethernet XFP Transceiver Module



Cabling a 10-Gigabit Ethernet XFP Transceiver Module

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

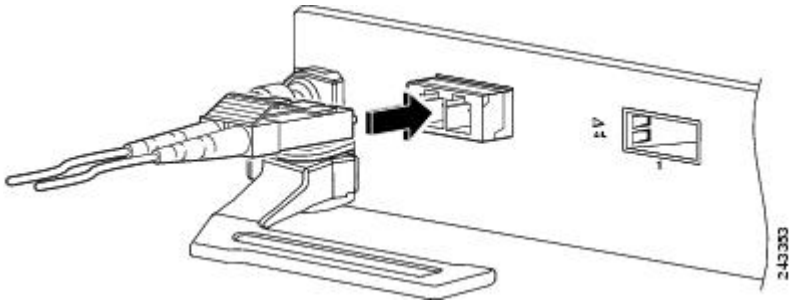
- Always keep the protective dust plugs on the unplugged fiber-optic cable connectors and the transceiver optical bores until you are ready to make a connection.
- Always inspect and clean the LC connector end faces just before making any connections. See Cleaning Fiber-Optic Connectors.
- Always grasp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

To cable a 10-Gigabit Ethernet XFP transceiver module:

1. Remove the dust plugs from the optical network interface cable LC connectors (Figure 68: Installing the 10-Gigabit Ethernet XFP Transceiver Module, on page 120). Save the dust plugs for future use.

2. Inspect and clean the LC connector's fiber-optic end faces.
3. Remove the dust plugs from the XFP transceiver module optical bores.
4. Immediately attach the network interface cable LC connectors to the XFP transceiver module (see the figure below) for an illustration of cabling the XFP transceiver module).

Figure 70: Cabling a 10-Gigabit Ethernet XFP Transceiver Module



Installing and Removing 100-Gigabit Ethernet CFP Transceiver Modules

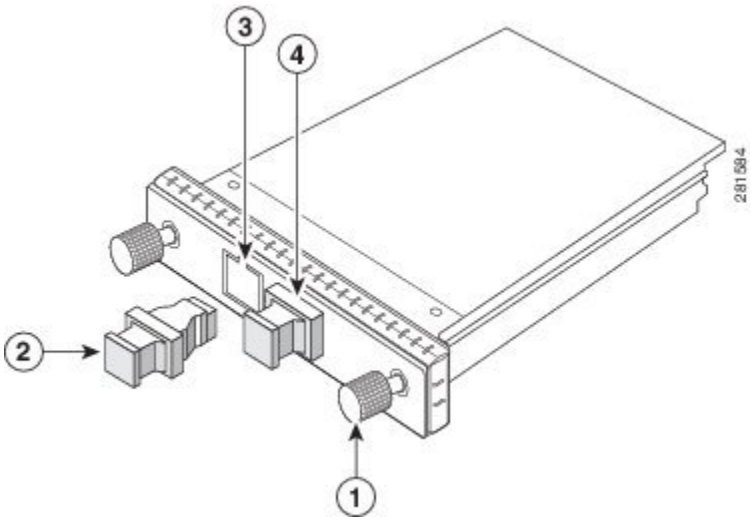
This section provides the installation, cabling, and removal instructions for the Cisco 100-Gigabit C Form-factor Pluggable (CFP) transceiver modules. The modules are hot-swappable input/output (I/O) devices that connect the system's module port electrical circuitry with either a copper or a fiber-optic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

Overview

The Cisco 100-Gigabit Ethernet CFP transceiver modules are hot-swappable I/O devices that plug into 100-Gigabit Ethernet module ports.

Note 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.

Figure 71: CFP Transceiver



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

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.

Installing a CFP Transceiver Module

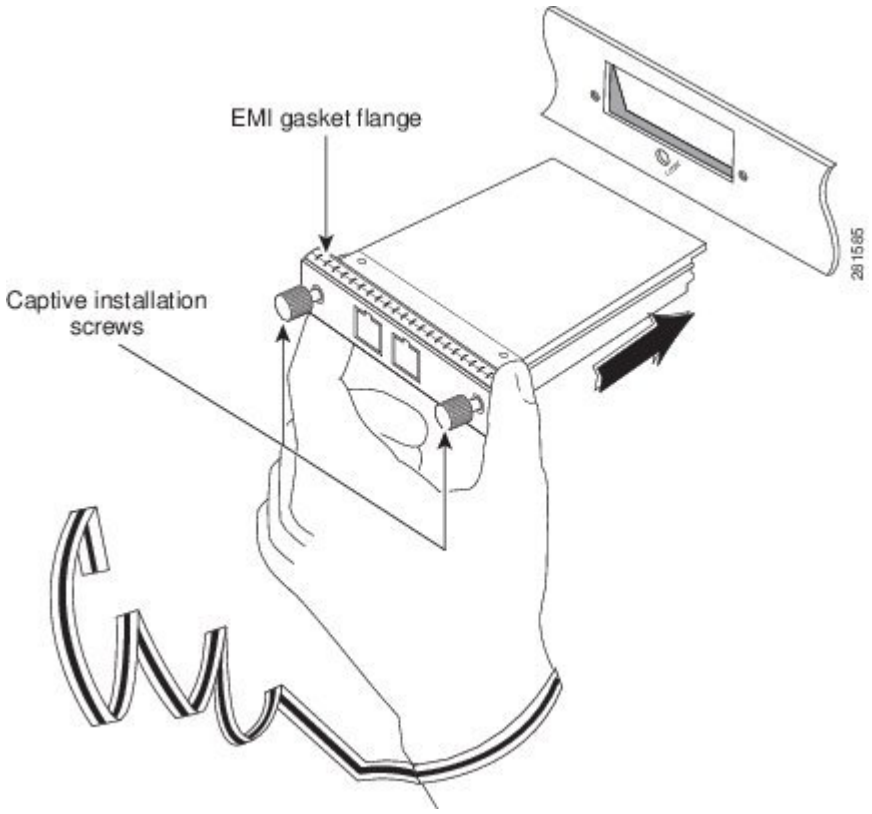
⚠

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:

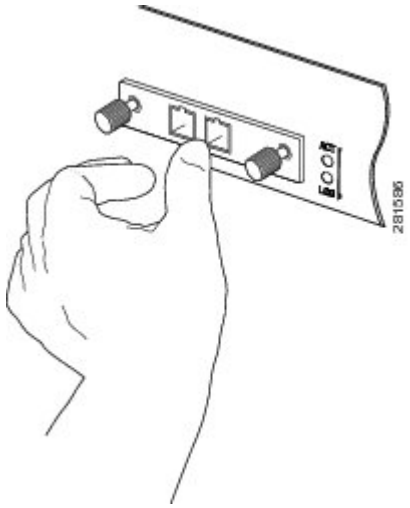
1. Remove the CFP transceiver from its protective packaging.
2. Check the label on the CFP transceiver body to verify that you have the correct model for your network.
3. Remove the dust plug from the CFP transceiver module optical port and set it aside.
4. Align the CFP device into the transceiver port socket of your networking module, and slide it in until the CFP transceiver EMI gasket flange makes contact with the module faceplate (see the figure below).

Figure 72: Installing a CFP Transceiver Module



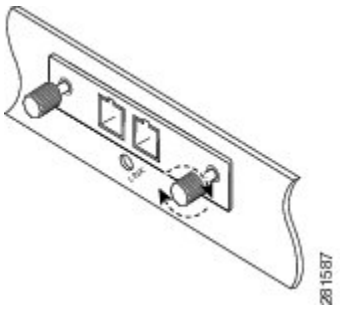
5. Press firmly on the front of the CFP transceiver with your thumb to fully seat it in the transceiver socket. (see the figure below.)

Figure 73: Seating the CFP Transceiver Module in the Socket



6. Gently tighten the two captive installation screws on the transceiver to secure the CFP transceiver in the socket (see the figure below).

Figure 74: Securing a CFP Transceiver Module

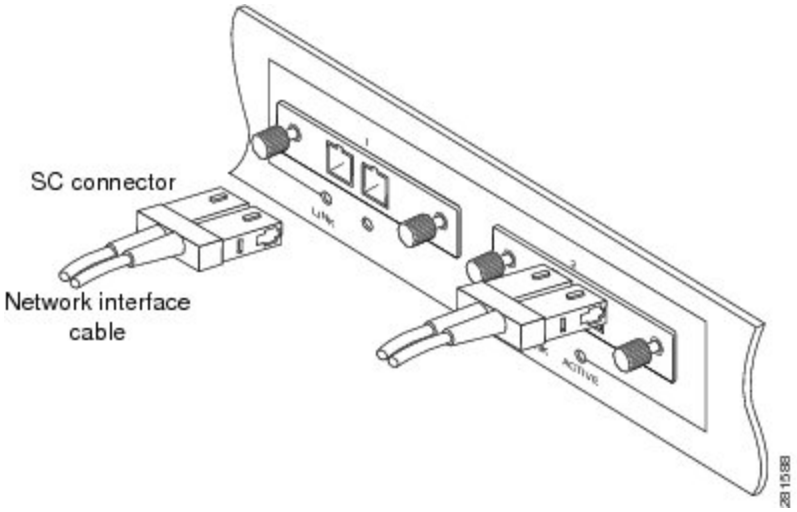


7. Reinstall the dust plug into the CFP transceiver's optical bore until you are ready to attach the network interface cable.

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 (see the figure below).

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

Figure 75: Cabling an Optical CFP Transceiver Module with SC Connectors



Removing a CFP Transceiver Module

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 This product is a Class 1 laser product.

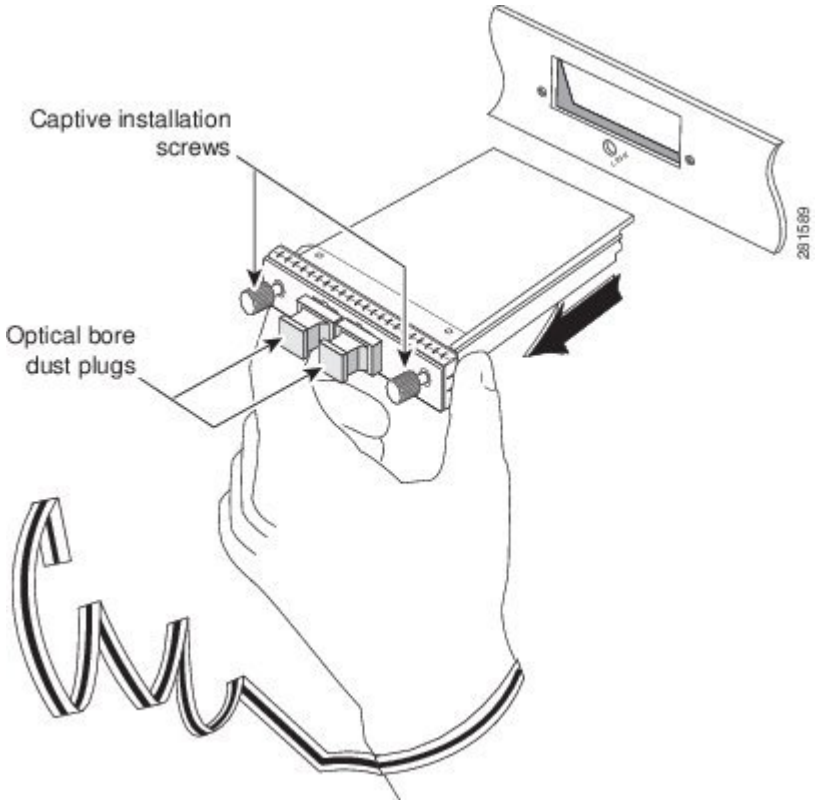
Warning Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.

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

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

1. Disconnect the network fiber-optic cable from the CFP transceiver connectors. Immediately reinstall the dust plugs in the CFP transceiver optical bores.
2. Loosen the two captive installation screws that secure the CFP to the networking module.
3. Slide the CFP transceiver out of the module socket (see the figure below). Immediately place the CFP transceiver in antistatic protective packaging.

Figure 76: Removing a CFP Transceiver Module



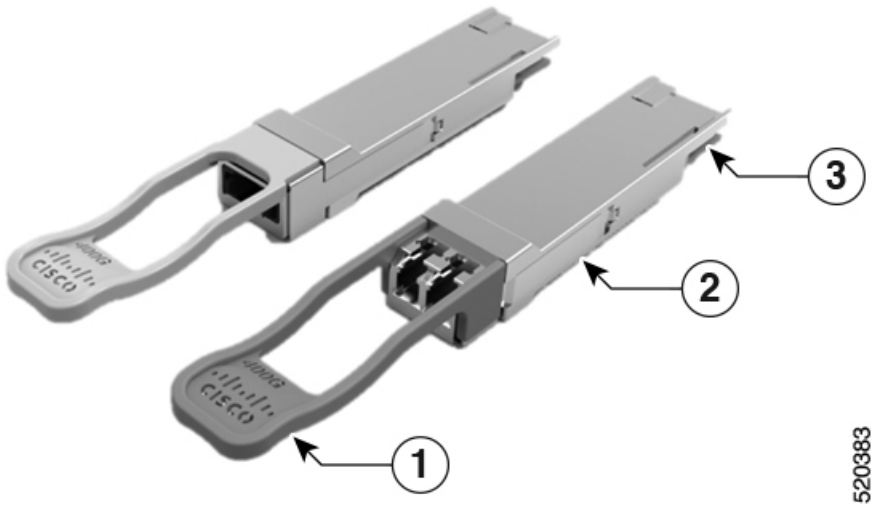
Install and Remove QSFP Transceiver Modules

Note In this section, QSFP refers to QSFP+, QSFP28, and QSFP-DD. Refer to the *Cisco Optical Transceiver Handling Guide* for additional details on optical transceivers.

This section provides the installation, cabling, and removal instructions for the Quad Small Form-Factor Pluggable (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.

The following figure shows the 400-Gigabit QSFP-DD transceiver module.

Figure 77: 400-Gigabit QSFP-DD Transceiver Module



1	Pull-tab	2	QSFP-DD transceiver body
3	Electrical connection to the module circuitry		

Warning This icon is a hot surface warning. To avoid personal injury, do not touch without proper protection.



Required Tools and Equipment

You need these tools to install the 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 information on inspecting and cleaning fiber-optic connections, see Cleaning Fiber-Optic Connectors, on page 144.

Installing the 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 system modules.

The QSFP transceiver module has a pull-tab latch. To install a QSFP transceiver module, follow these steps:

Procedure

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

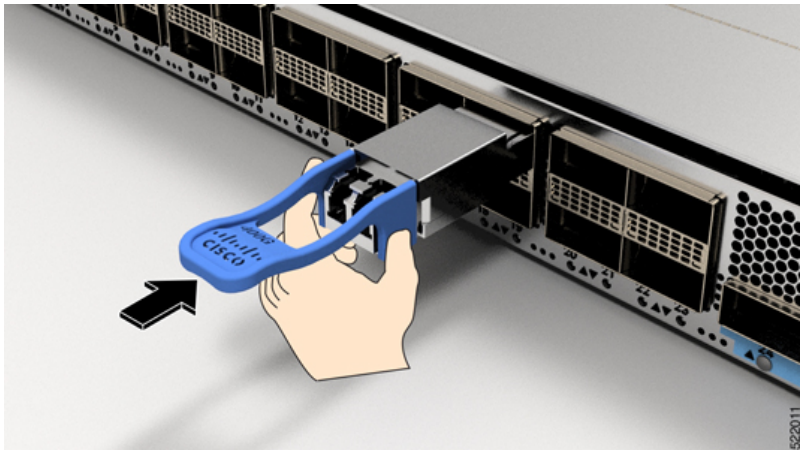
Step 2 Remove the transceiver module from its protective packaging.

Step 3 Check the label on the transceiver module body to verify that you have the correct model for your network. Do not remove the dust plug until you're ready to attach the network interface cable. Dust plug is not shown in the images.

Step 4 Hold the transceiver by the pull-tab so that the identifier label is on the top.

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

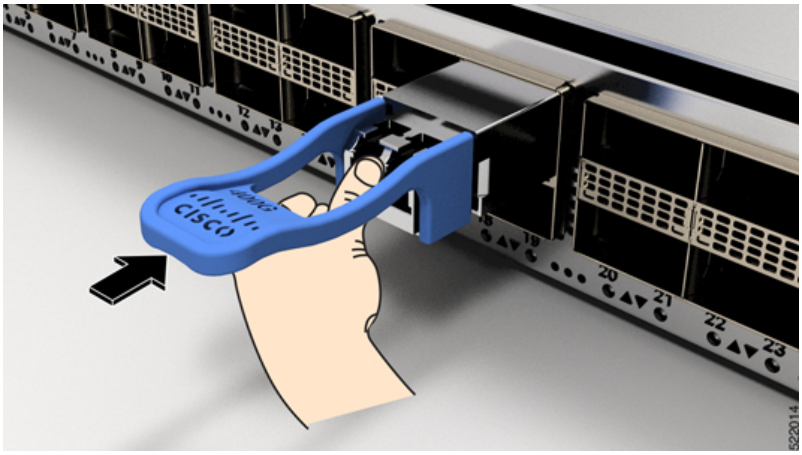
Figure 78: Installing the QSFP Transceiver Module



Step 6 Press firmly on the front of the transceiver module with your thumb to fully seat the transceiver in the module's transceiver socket (see the below figure).

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

Figure 79: Seating the QSFP Transceiver Module



Attach the Optical Network Cable

Before you begin

Before you remove the dust plugs and make 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. For complete information on inspecting and cleaning fiber-optic connections, see the *Inspection and Cleaning Procedures for Fiber-Optic Connections* document.
- Grasp the MPO connector only by the housing to plug or unplug a fiber-optic cable.

Note 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.

Procedure

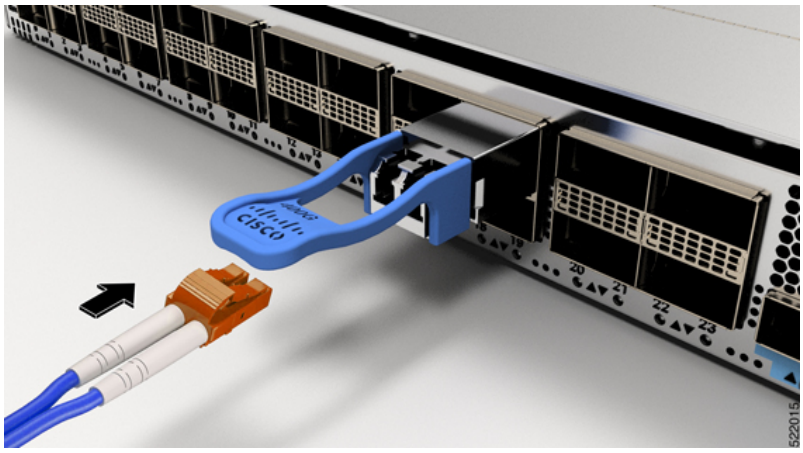
Step 1 Remove the dust plugs from the optical network interface cable MPO connectors. Save the dust plugs for future use.

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

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

Step 4 Immediately attach the network interface cable MPO connectors to the transceiver module (see the figure below).

Figure 80: Cabling a Transceiver Module



Removing the 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 transceiver modules or coming into contact with modules.

To remove a QSFP transceiver module, follow these steps:

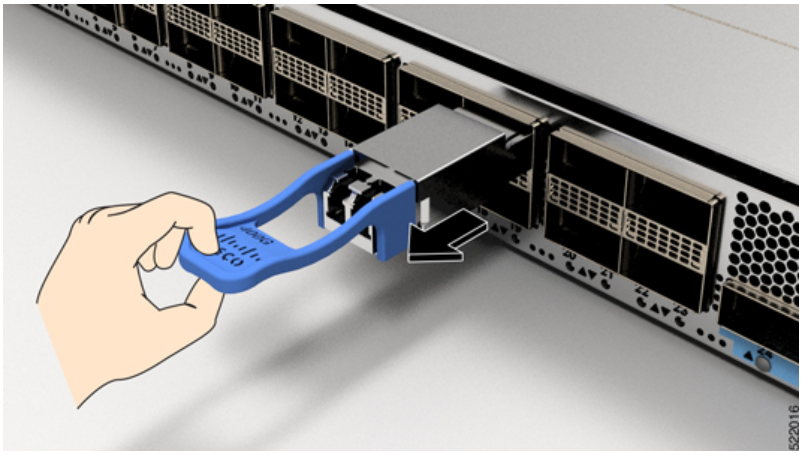
Procedure

Step 1 Disconnect the network interface cable from the transceiver connector.

Step 2 Install the dust plug immediately into the transceiver's optical bore

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

Figure 81: Removing the QSFP Transceiver Module



Step 4 Slide the transceiver out of the socket.

Step 5 Place the transceiver module into an antistatic bag.

Installing and Removing CPAK Transceiver or Adapter Modules

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

CPAK Module Overview

The Cisco CPAK transceiver module is a hot-swappable input/output device that plugs into a Cisco port on the 4-port and 8-port 100-Gigabit Ethernet line cards (See 4-Port 100-Gigabit Ethernet Line Card with CPAK, on page 40 and 8-Port 100-Gigabit Ethernet Line Card with CPAK, on page 40).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 multifiber push-on (MPO) or duplex SC connector on the optical interface.

The following types of CPAK modules or adapters are supported:

- CPAK 100GBASE-SR10

  Delivers 100-Gbps links over 24-fiber ribbon cables terminated with MPO/MTP connectors. It can also be used in 10 x 10-Gbps mode along with ribbon-to-duplex-fiber breakout cables for connectivity to ten 10GBASE-SR optical interfaces and has the option to breakout to 2X40G-Gbps interfaces. It supports link lengths of 100m and 150m on laser-optimized OM3 and OM4 multifiber cables. OTN rates are also supported.

- CPAK 100GBASE-SR4

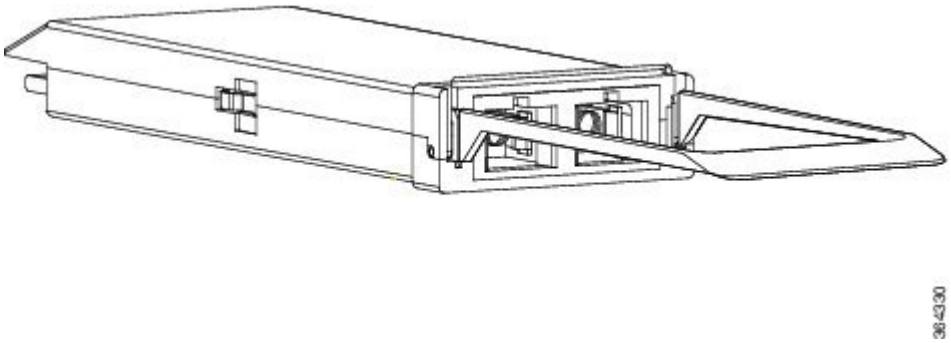
  Supports link lengths of up to 70m (100m) over OM3 (OM4) Multimode Fiber with MPO-12 connectors. It primarily enables high-bandwidth 100G optical links over 12-fiber parallel fiber terminated with MPO-12 multifiber connectors. CPAK-100GE-SR4 supports 100GBase Ethernet rate. This module supports 100G LAN mode only; OTN modes and breakout are not supported.

- CPAK 100GBASE-LR4

  Supports 100-Gbps optical links over standard single-mode fiber (SMF, G.652) terminated with SC connectors. Nominal power consumption is less than 5.5W.

  The LR4 module is IEEE 802.3ba-compliant and supports link lengths of up to 10 km over standard SMF, G.652. It delivers an aggregate data signal of 100-Gbps, carried over four wavelength-division multiplexing (WDM) wavelengths operating at a nominal 25 Gbps per lane in LAN mode. OTU4 rate is also supported. Optical multiplexing and demultiplexing of the four wavelengths are managed within the module.

  Figure 82: Example of 100-Gigabit Ethernet CPAK Transceiver Module



- CPAK 10x10G-LR

  Used in 10 x 10-Gbps mode along with ribbon-to-duplex SMF breakout cables for connectivity to ten 10GBASE-LR optical interfaces. It supports link lengths up to 10km over standard SMF, G.652. The module delivers 10Gbps industry-standard links, and optionally 40 Gbps links for CPAK-to-CPAK applications.

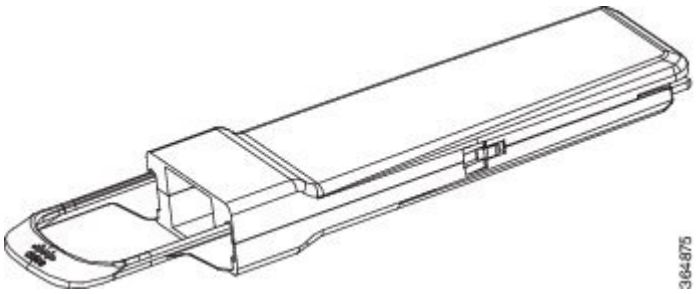
- CPAK 100GBASE-PSM4

  The Cisco CPAK-100G-PSM4 Module supports link lengths of up to 500 meters over Single-Mode Fiber (SMF) with MPO connectors. The 100 Gigabit Ethernet signal is carried over 12-fiber parallel fiber terminated with MPO multifiber connectors. This module supports 100G LAN mode only; OTN modes and breakout are not supported.

- CPAK adapter module

  The CPAK adapter module is a hot-swappable pluggable adapter module that serves as a physical host for a 40GE QSFP+ transceiver module and enables a 40GE QSFP+ transceiver module to be connected to a CPAK port. From the QSFP+ transceiver module perspective, the CPAK adapter module is the host device. From the CPAK port perspective, the adapter module is a CPAK transceiver module. The CPAK adapter module is powered only if it has a QSFP+ transceiver plugged in. Hence, the router detects the CPAK adapter only when the adapter holds a QSFP transceiver module.

Figure 83: CPAK Adapter Module



Apart from physical hosting the QSFP+ transceiver module, the CPAK adapter provides following functions:

- Provide inrush control, voltage regulation, and power filtering.
- Manage the CPAK and QSFP+ low-speed signals, and register map.
- Signal conditioning retimers.
- Terminate unused channels (channels 4 to 9).

For enabling the CPAK adapter and QSFP module, you need to configure the 1X40 breakout interface with the **hw-module location rack/slot/CPU0** command in global configuration mode. Example:

```
Router# configure terminal
Router(config)# hw-module location 0/1/CPU0 port 3 breakout 1xFortyGigE
Router(config)# commit
```

Note 2x40G Breakout mode is not supported.

The CPAK adapter module supports only the following 40GE QSFP+ transceiver modules:

- QSFP-40G-LR4
- QSFP-40GE-LR4
- QSFP-40G-ER

CPAK Module Installation and Removal

Note When you use the CPAK optical module with the CFP2 adapter, you must remove and insert both parts. Removing or inserting the CPAK optical module without having removed or inserted the CFP2 adapter results in the "not a valid part" error.

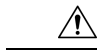
Required Tools and Equipment

You need these tools to install the CPAK transceiver or adapter 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, on page 144.

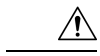
Installing the CPAK Transceiver or Adapter Module



Caution The CPAK transceiver or adapter 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 or adapter module, follow these steps:

1. Attach an ESD wrist strap to yourself and a properly grounded point on the chassis or the rack.
2. Remove the CPAK module from its protective packaging.
3. Check the label on the CPAK module to verify that you have the correct model for your network.
4. Remove the optical bore dust plug and set it aside.
5. Align the CPAK module in front of the module's socket opening and carefully slide the CPAK module into the socket until the module makes contact with the socket electrical connector.
6. Press firmly on the front of the CPAK module with your thumb to fully seat the module in the module's socket.



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

Reinstall the dust plug into the CPAK transceiver or adapter 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 single mode 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 http://www.cisco.com/c/en/us/td/docs/routers/ncs6000/breakout_panel/ncs_breakoutpanel.html

1. Remove the dust plugs from the optical network interface cable MPO connectors. Save the dust plugs for future use.
2. Inspect and clean the MPO connector's fiber-optic end faces. To clean the connector, you can purchase an MPO connector cleaner, such as the US Conec 7104 IBC In-Bulhead Adapter Cleaner" from a third-party vendor.
3. Remove the dust plugs from the CPAK module optical bores.
4. Immediately attach the network interface cable MPO connectors to the CPAK module.

Removing the CPAK transceiver or adapter module

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

Note To connect the CPAK optical module in the A9K-MPA-1X200GE, A9K-MPA-2X100GE, and A9K-MPA-1X100GE modular port adapters (MPAs) that operate in the Cisco ASR 9000 Series 400G and 200G modular line cards, you must use the CVR-CFP2-CPAK adapter. During an OIR of the CPAK optical module from the system, you must remove the optics along with adapter. Removing the optical module and the adapter separately can result in alarms.

To remove a CPAK module, follow these steps:

1. Disconnect the network interface cable from the CPAK module connector.
2. Immediately install the dust plug into the module's optical bore.
3. Grasp the tab and gently pull straight out to release the module from the socket.
4. `%Slide the module out of the socket. ;`
5. Place the CPAK module 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 http://www.cisco.com/c/en/us/td/docs/routers/asr9000/hardware/installation/guide/asr9kHIGbk.html 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)

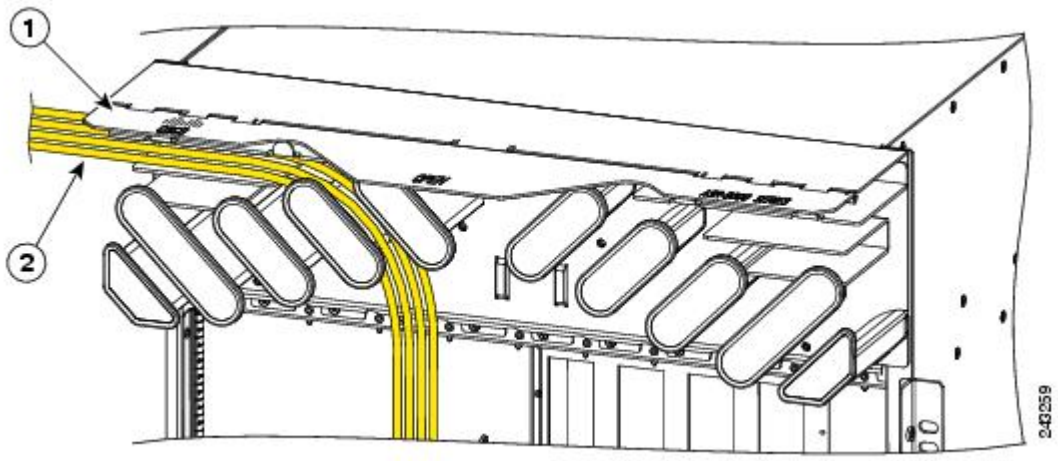
Note The illustrations in this section show one type of line card, but the line card cable-management procedures in this section are the same regardless of the specific line card.

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. The figure below 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 84: 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

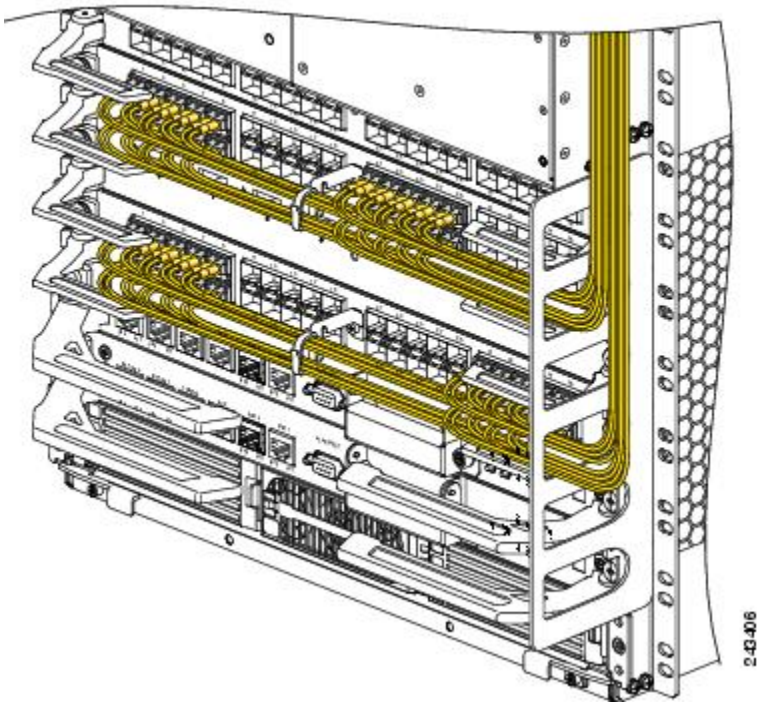
Each line card has its own cable routing slot in the cable management tray. For example, the cables shown in the figure above are cables being routed to line card 3 in slot 3 in a Cisco ASR 9010 Router.

Router Cable Management Brackets

The Cisco ASR 9006 Router provides for a cable management bracket on each side of the router chassis. The following figure shows a typical cable routing for the Cisco ASR 9006 Router.

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

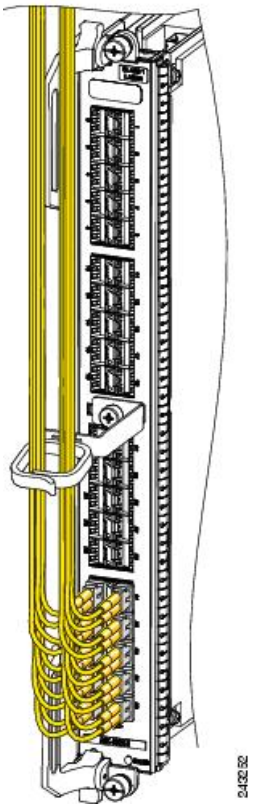
Figure 85: Example Cable Routing through Cisco ASR 9006 Router Cable Management Brackets



Line Card Cable Management Bracket

This section describes the line card cable-management bracket. The following figure shows the line card cable-management bracket attached to a 40-Port Gigabit Ethernet line card.

Figure 86: 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.

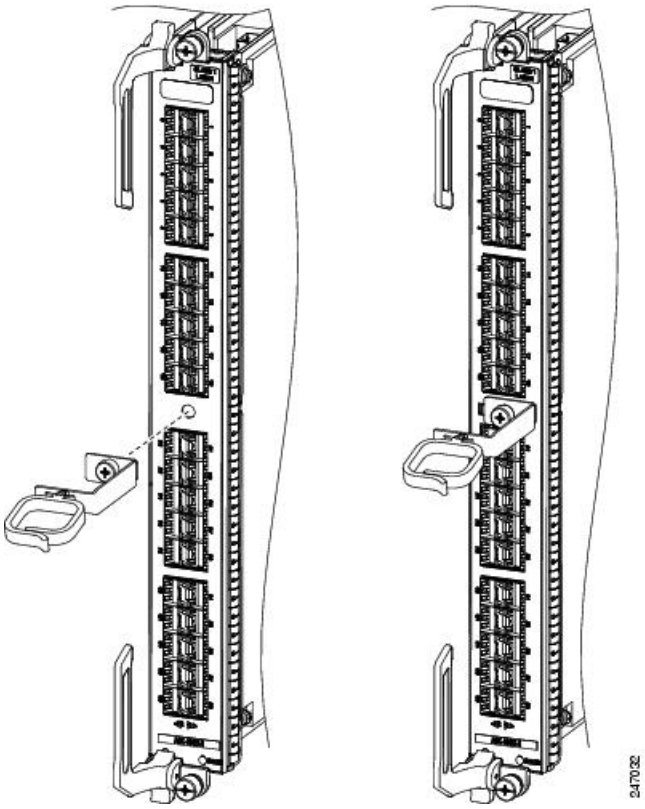
Caution Do not use the cable-management bracket as a handle to pull out or push in the line card. The cable-management bracket is designed to hold the interface cables and may break if you use the bracket to push, pull, or carry the line card after it is removed from the router.

Installing a Line Card Cable Management Bracket

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

1. Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.
2. Position the cable-management bracket over the front of the line card front panel.
3. Insert and tighten the captive screw(s) to secure the bracket (see the above figure).
4. Starting with the port on the line card closest to the bracket, connect each interface cable to the intended port (see Figure 86: Cable-Management Bracket, on page 138).

Figure 87: Cable-Management Bracket Installation and Removal



Removing a Line Card Cable-Management Bracket

To remove a line card cable-management bracket, follow these steps (see Installing a Line Card Cable Management Bracket, on page 138):

1. Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.
2. Note the current interface cable connections to the ports on each line card.
3. Starting with the interface cable for the bottom port on the line card, disconnect the cable from the line card interface.
4. Repeat Step 3 for all remaining interface cables, proceeding from the bottom ports upward, then proceed to Step 5.
5. Loosen the captive installation screw on the cable-management bracket and remove the bracket from the line card (Figure 87: Cable-Management Bracket Installation and Removal, on page 139).

For information on connecting and disconnecting interface cables, see *Installing and Removing Fibre-Optic Interface Cables.*.

Cables and Connectors

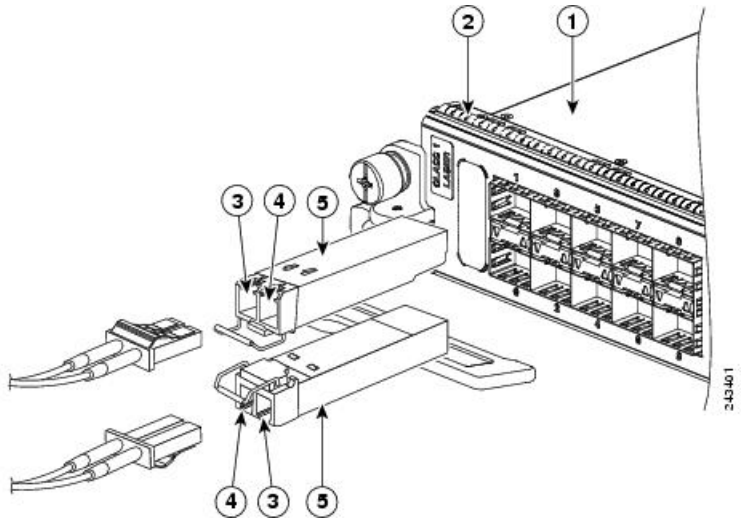
Gigabit Ethernet Interfaces

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 (see the figure below). 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 88: 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)		

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 , on page 154.

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.

Fiber-Optic Interface Cables

Depending on the line card (see Ethernet Line Card Comparison), 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.

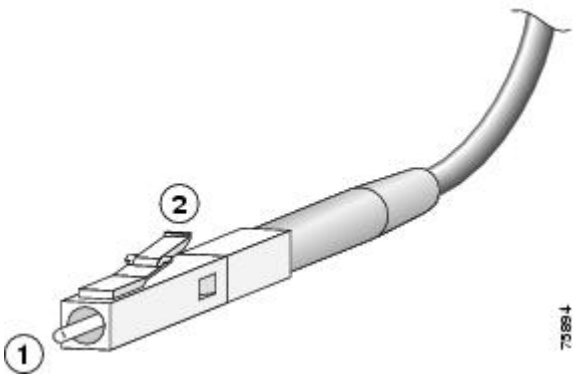
The following types of cables are used with line cards to connect your router to another router or switch:

- 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 below *Simplex LC Cable Connector* and *Duplex LC Cable Connector.*

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

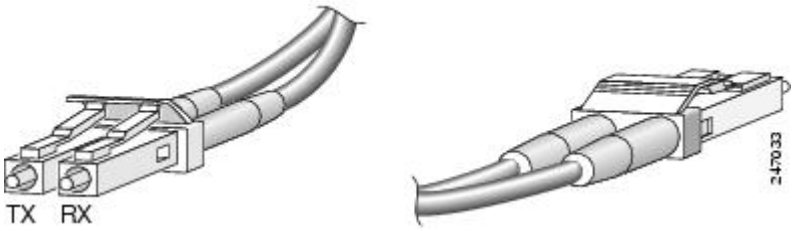
Warning Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.

Figure 89: Simplex LC Cable Connector



1	LC connector	2	Spring-action disconnect latch

Figure 90: 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, on page 144 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 89: Simplex LC Cable Connector, on page 142) or one duplex LC connector (Figure 90: Duplex LC Cable Connector , on page 142).

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.

Warning This product is a Class 1 laser product.

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, on page 144 for more information.

To install a cable, follow these steps:

1. Remove the connector dust cover if one is present.
2. Align the connector end of the cable to the appropriate port. Observe the RX and TX cable relationship on the cables.
3. Attach fiber cable between the port in the line card and the device to which the line card is connected.
4. Insert the fiber cable connector until it clicks and locks into place.
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:

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

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

3. Insert a dust plug into the optical port openings of each port that is not being used.
4. Use a screwdriver to loosen the captive installation screw of the line card cable management bracket.
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:

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

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.
2. Use clean, dry, oil-free compressed air to remove any residual dust from the connector.
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 the Step 1 and Step 2 indicated above.

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

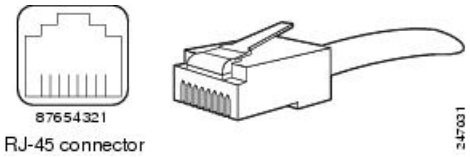
Type RJ-45 10/100/1000BASE-T Copper Cables

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

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 91: RJ-45 Cable 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

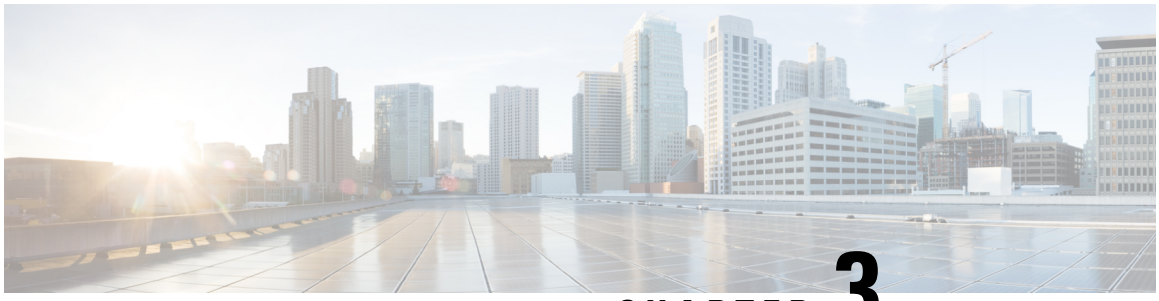
To remove line card cables, follow these steps:

1. Attach an ESD-preventive wrist or ankle strap to your wrist and follow its instructions for use.
2. Disconnect the interface cable connectors from the line card interface ports.

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

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

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.



CHAPTER 3

Verifying and Troubleshooting the Line Card Installation

This chapter contains information about the following topics:

- Verifying and Troubleshooting Line Card Installation, on page 147
- Configuring and Troubleshooting Line Card Interface Cards, on page 150

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, on page 150.

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:

1. Check that the Card Status LED is on (green) to verify that the card is operating normally.
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.
3. If one of the conditions above is not met, see Advanced Line Card Troubleshooting, on page 155 to identify any possible problems.

Line Card LEDs

You can use the Line Card Status LED or the Port Status LEDs on the line card front panels to verify proper operation or troubleshoot a failure. The following table describes the port and card status LEDs.

Table 34: 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. The following table describes the modular port adapter LEDs.

Table 35: Modular Port Adapter LEDs

Color	State	Meaning
A/L LED (one per port)		
Off	Off	Port is administratively shut down.
Green	On	Port is administratively enabled and the link is up.
Red	On	Port is administratively enabled and the link is down.
Blinking	On	Line activity is occurring. The LED blinks green-amber-green.
STATUS LED (one per card)		

Color	State	Meaning
Off	Off	Modular port adapter power is not enabled.
Red	On	Modular port adapter has encountered an hardware error.
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:

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.
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.
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.
4. 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.
5. 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.
6. 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

The following table 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 36: Default Interface Configuration Parameters

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:

1. Enter EXEC mode:

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

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

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

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
```

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.

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
```

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.

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
```

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
```

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
```

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).

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.

Configuring the Dual-Rate Line Cards



Note Oversubscription will be supported on these line cards in a future release of IOS XR 6.2.x train.

The 24-port and 48-port dual-rate line cards support GE and 10GE speeds.



Note See *24-Port 10-Gigabit Ethernet/Gigabit Ethernet Line Card with SFP+ or SFP* and *48-Port 10-Gigabit Ethernet/Gigabit Ethernet Line Card with SFP+ or SFP* sections in the *Cisco ASR 9000 Series Aggregation Services Router Ethernet Line Card Installation Guide* for information on the line cards.

Note The 24-port line card has a single Network Processor Unit (NPU). The 48-port line card has two NPUs (one for each group of 24 ports). Configuring more than 20x10GE ports per NPU could result in line drops across all ports, depending on the packet size and traffic type.

To configure the port mode for either GE or 10GE, use the **hw-module location** *location* **port-mode** *run-length***x***speed*[**,***run-length***x***speed*] command, where:

- *run-length* – The number of consecutive same-speed ports, divisible by 4. Valid values are:
  - 24-port line card: 4, 8, 12, 16, 20, 24
  - 48-port line card: 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48
- *speed* – Valid values are 1 (for GE) or 10 (for 10GE)

Note Observe the following restrictions:

- The total for *run-length* must equal the total number of ports (either 24 or 48).
- If you configure the speed of the first port in a set of 12 ports to 1 (GE), then all 12 ports in that set must be 1G (for example: 12x1). If you configure the speed of the first port in a set of 12 ports to 10 (10G), then ports can be mixed in groups of 4 (for example: 4x10,4x1,4x10; or 8x10,4x1; or 12x10).
  - The following example is a valid port-mode configuration on the 48-port line card:

    ```
    port-mode 4x10,8x1,12x10,12x1,12x10
    ```

  - The following example is not a valid port-mode configuration on the 48-port line card:

    ```
    port-mode 4x1,8x10,12x10,12x1,12x10
    ```

The following procedure is for configuring the port speed on the 48-port 10-Gigabit Ethernet/Gigabit Ethernet Line Cards:

1. 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
   ```

2. Specify the port mode:

   ```
   RP/0/RSP0/CPU0:router(config)# hw-module location 0/5/CPU0 port-mode
   4x10,8x1,12x10,12x1,12x10
   ```

3. Enter the **commit** command to commit all changes you made to the running configuration:

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

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, 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:

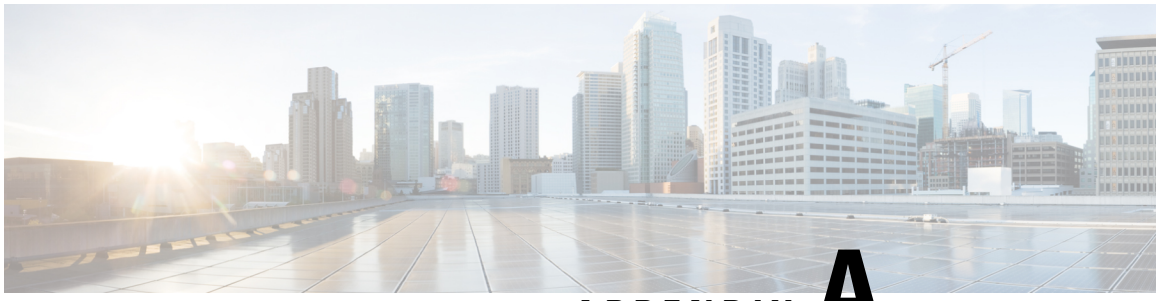
- Console Logs and Syslog Information—This information is crucial if multiple symptoms are occurring. If the router is configured to send logs to a Syslog server, you may see some information on what has occurred. For console logs, it is best to be directly connected to the router on the console port 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.



APPENDIX A

Technical Specifications

This appendix lists the specifications for the Ethernet line cards for the Cisco ASR 9000 Series Aggregation Services Router.

- Ethernet Line Card Power Consumption Values, on page 157
- Ethernet Line Card Physical Dimensions, on page 160
- Transceiver Module Specifications, on page 160

Ethernet Line Card Power Consumption Values

Table 37: 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)

Description	Power Consumption Values
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)
24-Port 10-Gigabit Ethernet/1-Gigabit Ethernet Line Card (-TR, -SE, -CM)	420 W at 81°F (27°C) 550 W at 104°F (40°C) 560 W at 122°F (50°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)
48-Port 10-Gigabit Ethernet/1-Gigabit Ethernet Line Card (-TR, -SE, -CM)	700 W at 81°F (27°C) 810 W at 104°F (40°C) 850 W at 122°F (50°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)
4-Port 100-Gigabit Ethernet Line Card (OTN version)	1000 W at 81°F (27°C) 1050 W at 104°F (40°C) 1100 W at 122°F (50°C)
8-Port 100-Gigabit Ethernet Line Card (LAN version)	1050 W at 81°F (27°C) 1100 W at 104°F (40°C) 1150 W at 122°F (50°C)

Description	Power Consumption Values
8-Port 100-Gigabit Ethernet Line Card (OTN version)	1100 W at 81°F (27°C) 1150 W at 104°F (40°C) 1200 W at 122°F (50°C)
4-Port 100-Gigabit Line Card	450 W at 80.6°F (27°C) 475 W at 104°F (40°C) 500 W at 122°F (55°C)
12-Port 100-Gigabit Line Card	1170 W at 80.6°F (27°C) 1150 W at 104°F (40°C) 1200 W at 122°F (50°C)
16-port 100-Gigabit Ethernet Line Card (-TR or -CM)	675 W at 81°F (27°C) 700 W at 104°F (40°C) 750 W at 122°F (50°C)
16-port 100-Gigabit Ethernet Line Card (-SE)	1125 W at 77°F (25°C) 1150 W at 104°F (40°C) 1225 W at 131°F (55°C)
32-port 100-Gigabit Ethernet Line Card (-TR or -CM)	1325 W at 81°F (27°C) 1350 W at 104°F (40°C) 1425 W at 122°F (50°C)
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)
400 Gigabyte Modular Line Card (-TR or -SE)	520 W at 77°F (25°C) 560 W at 104°F (40°C) 600 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)

Description	Power Consumption Values
2-Port 100G + 20-Port 10 GE Combination IPoDWDM Line Card with CFP2 and SFP+ (-TR)	520 W at 77°F (25°C) 560 W at 104°F (40°C) 600 W at 131°F (55°C)

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.

Ethernet Line Card Physical Dimensions

For physical specifications, refer to the ASR 9000 Series line card data sheets:

https://www.cisco.com/c/en/us/products/routers/asr-9000-series-aggregation-services-routers/datasheet-listing.html

Transceiver Module Specifications

For supported transceivers modules, refer to the Transceiver Module Group (TMG) Compatibility Matrix Tool:

https://tmgmatrix.cisco.com

For transceiver module descriptions and specifications, refer to the data sheets:

Data Sheets

40-Gigabit QSFP and 100-Gigabit QSFP28 - 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

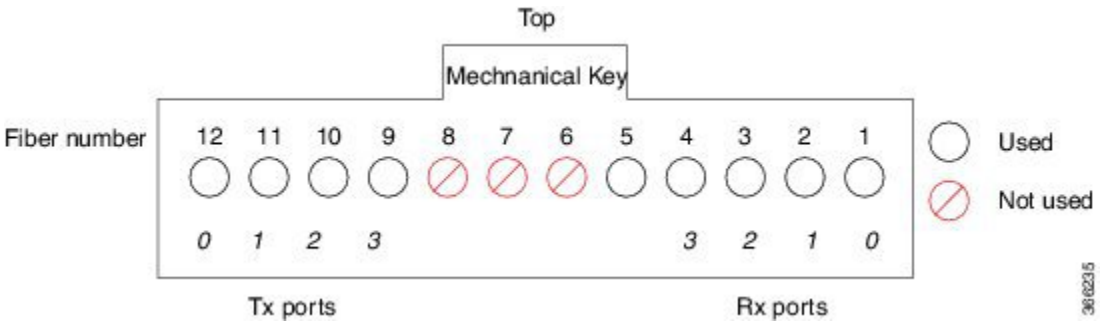
Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
9	LPMode_Reset	19	GND	29	VccTx		
10	VccRx	20	GND	30	Vcc1		

MPO-12 Connector Pin Specifications

The following figure shows the pinouts and corresponding fiber numbers for the CPAK multifiber push-on (MPO-12) male connector.

Note In the following figure, the male MPO connector alignment pins are on the CPAK side so the cable MPO connectors will be female.

Figure 92: MPO-12 100-Gigabit Connector Pinouts



Looking into the receptacle of the CPAK module with the mechanical key on top, the fibers are numbered 12 through 1 (left to right). Fibers 12, 11, 10, and 9 are used for the optical Tx signals. Fibers 4, 3, 2, and 1 are used for the optical Rx signals.

CPAK Connector Types

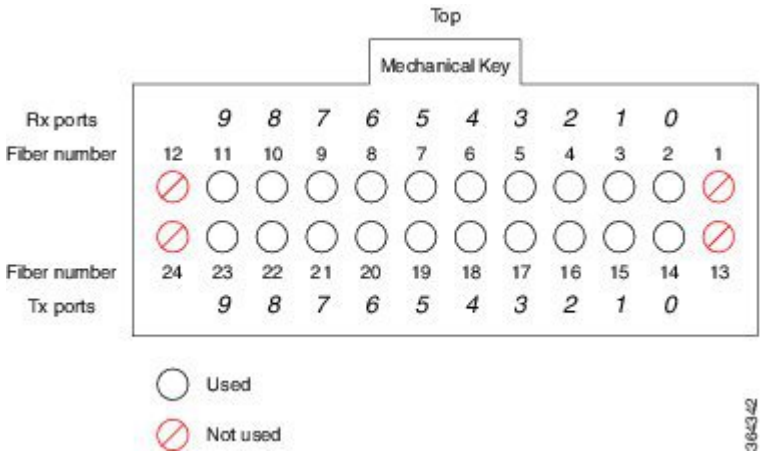
CPAK Product Number	Speed	Distance	Mode	Connector Types
CPAK-100G-SR10	100G 10x10G SR 2x40G SR4	100m	Multi-mode	MPO-24 to MPO-24 (100G) MPO-24 to LC breakout (10x10G) MPO-24 to MPO-12 breakout (2X40G)
CPAK-100G-SR4	100G	70m (OM3) 100m (OM4)	Multi-mode	MPO-12
CPAK-100G-LR4	100G	10m	Single-mode	SC
CPAK-10x10G-LR	10G	10m	Single-mode	MPO-24 to LC breakout

MPO-24 Connector Pin Specifications

The following figures show the pinouts and corresponding fiber numbers for the CPAK multifiber push-on (MPO-24) male connector in 100G mode and 2X40G mode.

Note In the following figures, the male MPO connector alignment pins are on the CPAK side so the cable MPO connectors will be female.

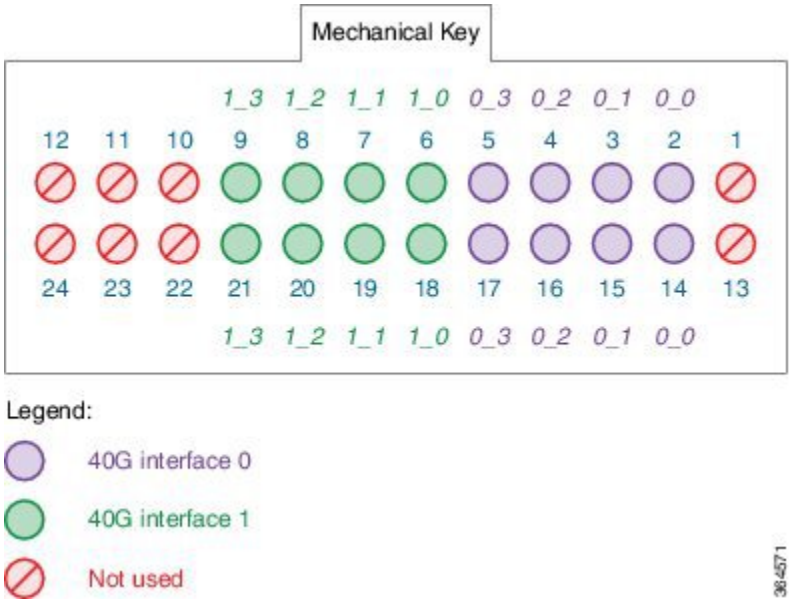
Figure 93: MPO-24 100-Gigabit Connector Pinouts



Looking into the receptacle of the CPAK module 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

Figure 94: MPO-24 100-Gigabit Connector Pinouts (2X40 Mode)



Looking into the receptacle of the CPAK module with the mechanical key on top, the fibers are numbered as follows:

- Top row, left to right: Fibers are numbered 12 through 1. Fibers 9, 8, 7, 6, 5, 4, 3, 2 are used for the optical Rx signals.
- Bottom row, left to right: Fibers are numbered 24 through 13. Fibers 21, 20, 19, 18, 17, 16, 15, and 14 are used for the optical Tx signals

CPAK Breakout Cable Options

A CPAK optical module can either be configured as a fixed 1 x 100GE port, 2 x 40G ports, or 10 x 10GE ports by using a fiber-optic breakout cable. The breakout cable contains several fibers (each with its own jacket) surrounded by one common jacket. The following sections describe the 2X40G breakout configurations for the CPAK-100G-SR10 and CPAK-10x10-LR optical modules.

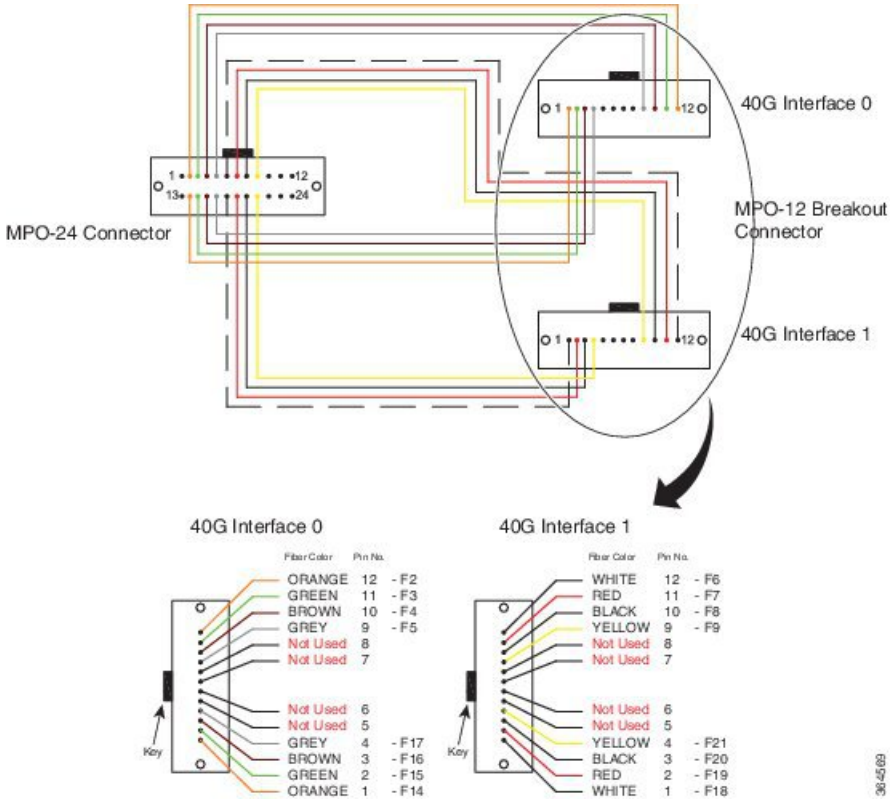
Note Cisco does not provide the breakout cable. You can purchase this cable from a third-party vendor.

CPAK-100G-SR10 2X40G Breakout

The following figure shows the 2X40G breakout for the CPAK-100G-SR10 optical module. In this example the 24-fiber MPO trunk breaks out into two 12-fiber MPO-12 connectors for two 40G connections (interface 0 and interface 1).

Technical Specifications

Figure 95: 2x40GE Breakout for CPAK-100G-SR10 Optical Module



The following table shows the pinouts for the 100G side connector. Pins 1, 10, 11, 12, 13, 22, 23, and 24 are not used.

Table 38: 100G to 2X40G Y-Cable Pinouts (100G Side)

Connector		Module Receptacle		
Connector ID	**Fiber ID**	**Receptacle Fiber**	**40 G Interface_Lane**	**TX/RX**
MPO1	F1	1	—	—
MPO2	F2	2	0_0	RX
MPO3	F3	3	0_1	RX
MPO4	F4	4	0_2	RX
MPO5	F5	5	0_3	RX
MPO6	F6	6	1_0	RX
MPO7	F7	7	1_1	RX
MPO8	F8	8	1_2	RX
MPO9	F9	9	1_3	RX

Connector		Module Receptacle		
Connector ID	**Fiber ID**	**Receptacle Fiber**	**40 G Interface_Lane**	**TX/RX**
MPO10	F10	10	—	—
MPO11	F11	11	—	—
MPO12	F12	12	—	—
MPO13	F13	13	—	—
MPO14	F14	14	0_0	TX
MPO15	F15	15	0_1	TX
MPO16	F16	16	0_2	TX
MPO17	F17	17	0_3	TX
MPO18	F18	18	1_0	TX
MPO19	F19	19	1_1	TX
MPO20	F20	20	1_2	TX
MPO21	F21	21	1_3	TX
MPO22	F22	22	—	—
MPO23	F23	23	—	—
MPO24	F24	24	—	—

The following table shows the pinouts for 40G interface 0 and 40G interface 1. For both interfaces, pins 5, 6, 7, and 8 are not used.

Table 39: 100G to 2X40G Y-Cable Pinouts (40G Side)

40 G Interface 0				
Connector		**Module Receptacle**		
Connector ID	**Fiber ID**	**Receptacle Fiber**	**40 G Interface_Lane**	**TX/RX**
MPO1	F14	1	0_0	RX
MPO2	F15	2	0_1	RX
MPO3	F16	3	0_2	RX
MPO4	F17	4	0_3	RX
MPO5	F13	5	—	—
MPO6	F23	6	—	—

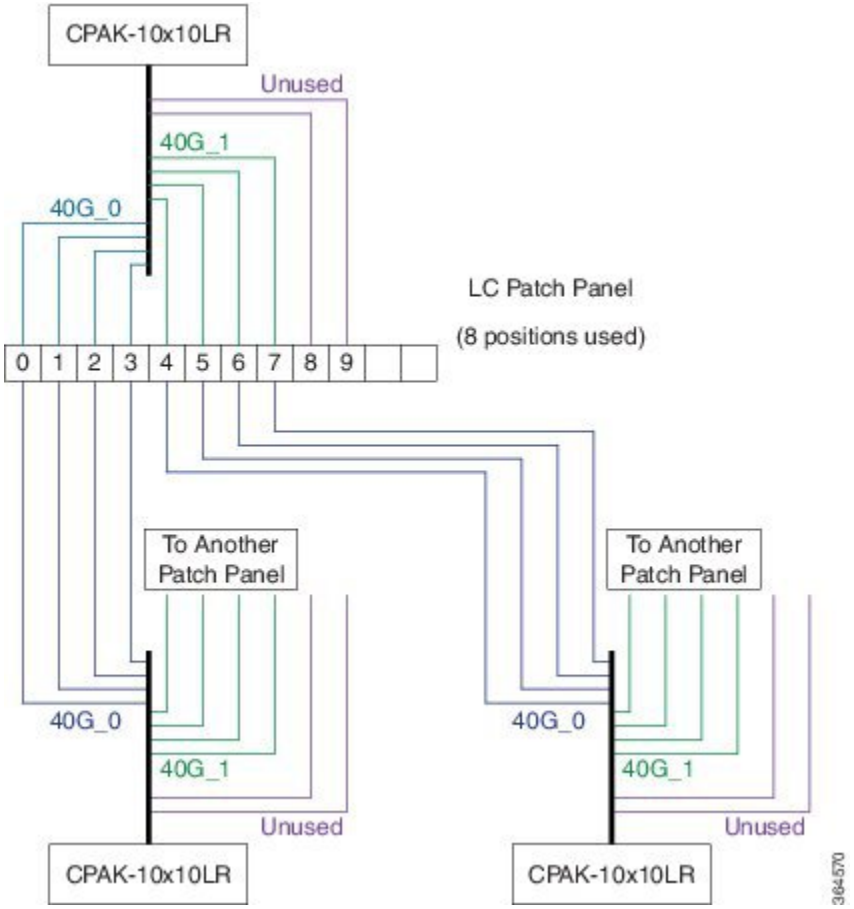
MPO7	F24	7	—	—
MPO8	F1	8	—	—
MPO9	F5	9	0_3	TX
MPO10	F4	10	0_2	TX
MPO11	F3	11	0_1	TX
MPO12	F2	12	0_0	TX
40 G Interface 1				
Connector		**Module Receptacle**		
Connector ID	**Fiber ID**	**Receptacle Fiber**	**40 G Interface_Lane**	**TX/RX**
MPO1	F18	1	1_0	RX
MPO2	F19	2	1_1	RX
MPO3	F20	3	1_2	RX
MPO4	F21	4	1_3	RX
MPO5	F22	5	—	—
MPO6	F12	6	—	—
MPO7	F11	7	—	—
MPO8	F10	8	—	—
MPO9	F9	9	1_3	TX
MPO10	F8	10	1_2	TX
MPO11	F7	11	1_1	TX
MPO12	F6	12	1_0	TX

CPAK-10x10G-LR 2X40 Breakout

The following figure shows the 2X40G breakout for the CPAK-10x10-LR optical module. An MPO-24 APC(angle-polished connector) ribbon fiber breakout to 10x10G LC SM fibers is used at each CPAK. Only the first 8 fibers are used in this breakout. Two groups of 4 lanes are patched (as needed) to an intermediate LC patch panel.

The CPAK-10X10G-LR module can only use network interface cables with the angle-polished contact (APC) face type.

Figure 96: Fiber Breakout for 10x10LR CPAK-to-CPAK (optional 2x40G mode)



Technical Specifications