Extreme networks

Pluggable Transceivers Installation Guide

Table of Contents

Preface

This guide provides descriptions of the pluggable transceivers and cables supported by Extreme Networks® switches and routers, along with information about how to install and use them.

The following types of pluggable modules are included:
- Extreme Networks SFP Modules on page 17
- Extreme Networks SFP+ Modules on page 39
- Extreme Networks 25 Gb SFP28 Modules on page 53
- Extreme Networks 40 Gb QSFP+ Modules on page 58
- Extreme Networks 100 Gb QSFP28 Modules on page 70
- Port Adapters on page 97
- Direct-Attach Cables on page 81
- Extreme Networks XFP Modules on page 99
- Extreme Networks CFP2 Modules on page 106

For each pluggable module, the Extreme Optics tool, at https://optics.extremenetworks.com/, lists supported hardware platforms and usage considerations. See The Extreme Optics Compatibility Website on page 12 for tips on how to use the tool.

Use only Extreme Networks-certified pluggable modules with Extreme Networks switches and routers.

Text Conventions

Unless otherwise noted, information in this document applies to all supported environments for the products in question. Exceptions, like command keywords associated with a specific software version, are identified in the text.

When a feature, function, or operation pertains to a specific hardware product, the product name is used. When features, functions, and operations are the same across an

entire product family, such as ExtremeSwitching switches or SLX routers, the product is referred to as *the switch* or *the router*.

Table 1: Notes and warnings

Icon	Notice type	Alerts you to…
	Tip	Helpful tips and notices for using the product.
	Note	Useful information or instructions.
	Important	Important features or instructions.
	Caution	Risk of personal injury, system damage, or loss of data.
	Warning	Risk of severe personal injury.

Table 2: Text

Convention	Description
`screen displays`	This typeface indicates command syntax, or represents information as it appears on the screen.
The words *enter* and *type*	When you see the word *enter* in this guide, you must type something, and then press the Return or Enter key. Do not press the Return or Enter key when an instruction simply says *type*.
Key names	Key names are written in boldface, for example **Ctrl** or **Esc**. If you must press two or more keys simultaneously, the key names are linked with a plus sign (+). Example: Press **Ctrl**+**Alt**+**Del**

Table 2: Text (continued)

Convention	Description
Words in italicized type	Italics emphasize a point or denote new terms at the place where they are defined in the text. Italics are also used when referring to publication titles.
NEW!	New information. In a PDF, this is searchable text.

Table 3: Command syntax

Convention	Description
bold text	Bold text indicates command names, keywords, and command options.
italic text	Italic text indicates variable content.
[ ]	Syntax components displayed within square brackets are optional. Default responses to system prompts are enclosed in square brackets.
{ **x** | **y** | **z** }	A choice of required parameters is enclosed in curly brackets separated by vertical bars. You must select one of the options.
x | **y**	A vertical bar separates mutually exclusive elements.
< >	Nonprinting characters, such as passwords, are enclosed in angle brackets.
…	Repeat the previous element, for example, `member[member...]`.
\	In command examples, the backslash indicates a "soft" line break. When a backslash separates two lines of a command input, enter the entire command at the prompt without the backslash.

Documentation and Training

Find Extreme Networks product information at the following locations:

Current Product Documentation
Release Notes
Hardware and software compatibility for Extreme Networks products
Extreme Optics Compatibility
Other resources such as white papers, data sheets, and case studies

Extreme Networks offers product training courses, both online and in person, as well as specialized certifications. For details, visit www.extremenetworks.com/education/.

Help and Support

If you require assistance, contact Extreme Networks using one of the following methods:

Extreme Portal

Search the GTAC (Global Technical Assistance Center) knowledge base; manage support cases and service contracts; download software; and obtain product licensing, training, and certifications.

The Hub

A forum for Extreme Networks customers to connect with one another, answer questions, and share ideas and feedback. This community is monitored by Extreme Networks employees, but is not intended to replace specific guidance from GTAC.

Call GTAC

For immediate support: (800) 998 2408 (toll-free in U.S. and Canada) or 1 (408) 579 2826. For the support phone number in your country, visit: www.extremenetworks.com/support/contact

Before contacting Extreme Networks for technical support, have the following information ready:

- Your Extreme Networks service contract number, or serial numbers for all involved Extreme Networks products
- A description of the failure
- A description of any actions already taken to resolve the problem
- A description of your network environment (such as layout, cable type, other relevant environmental information)
- Network load at the time of trouble (if known)
- The device history (for example, if you have returned the device before, or if this is a recurring problem)
- Any related RMA (Return Material Authorization) numbers

Subscribe to Product Announcements

You can subscribe to email notifications for product and software release announcements, Field Notices, and Vulnerability Notices.

1. Go to The Hub.
2. In the list of categories, expand the **Product Announcements** list.
3. Select a product for which you would like to receive notifications.
4. Select **Subscribe**.
5. To select additional products, return to the **Product Announcements** list and repeat steps 3 and 4.

You can modify your product selections or unsubscribe at any time.

Send Feedback

The Information Development team at Extreme Networks has made every effort to ensure that this document is accurate, complete, and easy to use. We strive to improve our documentation to help you in your work, so we want to hear from you. We welcome all feedback, but we especially want to know about:

- Content errors, or confusing or conflicting information.
- Improvements that would help you find relevant information.
- Broken links or usability issues.

To send feedback, do either of the following:

- Access the feedback form at https://www.extremenetworks.com/documentation-feedback/.
- Email us at documentation@extremenetworks.com.

Provide the publication title, part number, and as much detail as possible, including the topic heading and page number if applicable, as well as your suggestions for improvement.

The Extreme Optics Compatibility Website

The Extreme Optics Compatibility website displays supported hardware platforms, technical specifications, and usage considerations for pluggable optical devices (transceivers and cables) used in all Extreme Networks operating environments.

To access the site, open https://optics.extremenetworks.com/ in a web browser.

View Supported Optics

Use the Extreme Optics Compatibility website to view and capture reports about optics support in Extreme Networks operating environments.

To use the Extreme Optics Compatibility website, do the following:
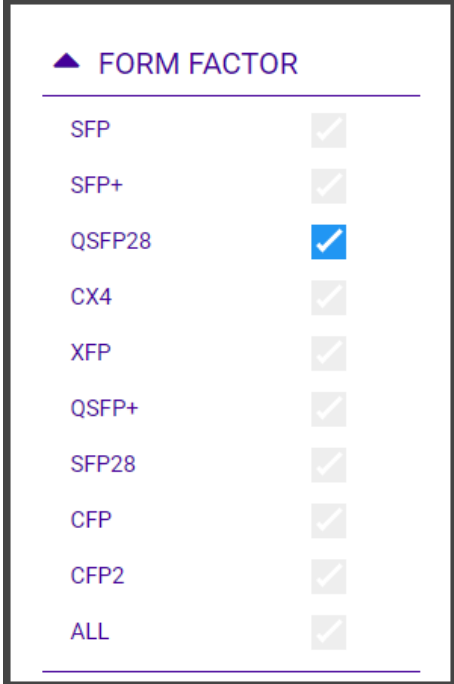
1. Open https://optics.extremenetworks.com/ in a web browser.

   A Quick Start page, with basic usage instructions, opens.
2. In the top row, select an operating environment, such as **EXOS** or **VSP**.

   A report shows all supported optical components (transceivers and cables) for the selected environment, and the hardware platforms with which they are compatible.

3. To narrow the scope of the report, do any of the following:

- In the **Series** list in the upper left corner, select a specific hardware platform, for example VSP 4900. The report adjusts to show optical components for that platform.

- In the area below the **Series** list, select a value for one or more of the following: Fiber Type, Physical Layer, Bit Rate, and Form Factor. In this example, Form Factor QSFP28 is selected. The report adjusts to show optical components that match all of the specified characteristics (logical *and*).

- Above the report table, move one or both sliders to narrow the range of reaches, or maximum operating distances. In this example, the report adjusts to show components with a reach between 15 meters and 10 km.
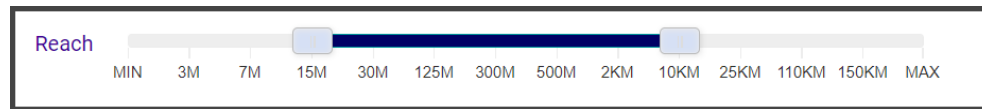
- In the search box in the upper right corner, enter all or part of a component part number (SKU). Then select the magnifying-glass icon. In this example, the report adjusts to show components with SKUs containing `40g-dacp` that meet the other specified criteria.

4. If necessary, adjust any of the settings in step 3 to change the report contents.

After viewing the report, you can save it for sharing or for later use. You can also export the data in the report to a spreadsheet (CSV) format. For details, see Create, Save, Share, and Export Reports on page 14.

Create, Save, Share, and Export Reports

You can create custom reports by adjusting search criteria in the Extreme Optics Compatibility website. Then you can save the reports, share them, and export them to a spreadsheet (CSV) format.

The following example of a custom report shows (1) 100 Gb QSFP28 transceivers, with (2) a range of 15 meters or greater, supported in the (3) ExtremeXOS operating environment.
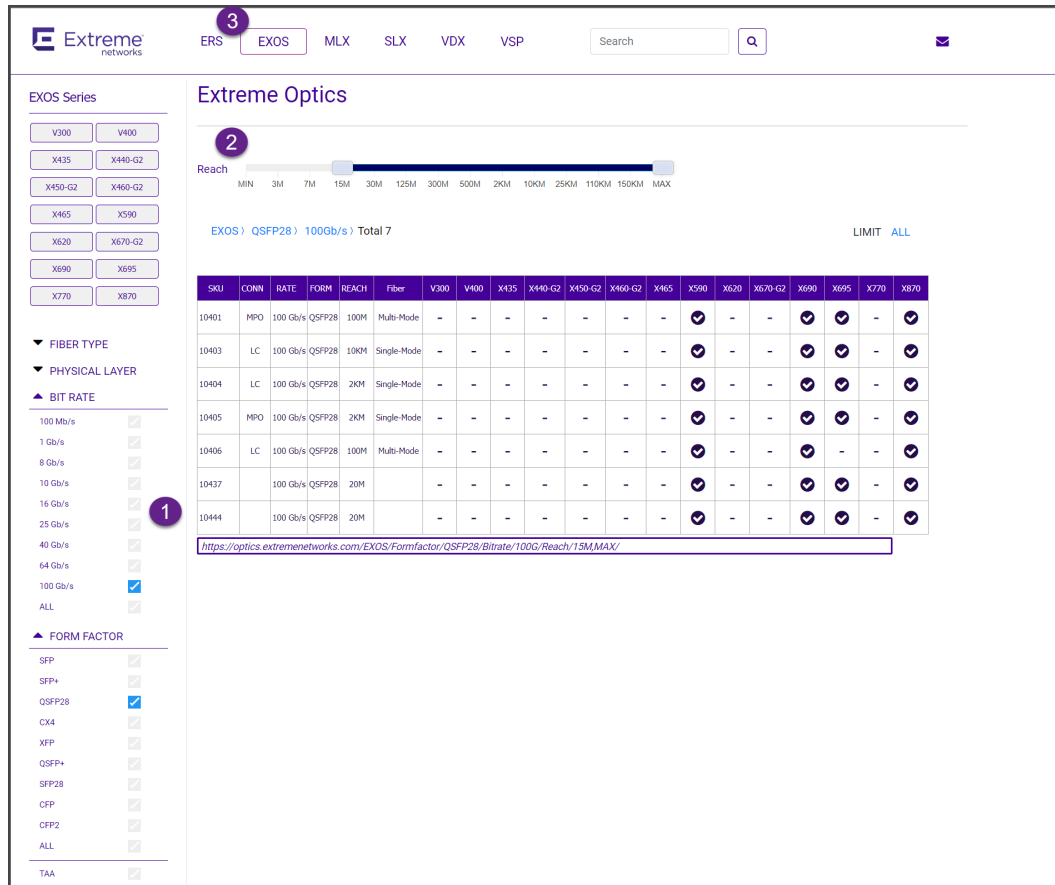
Figure 1: Sample Extreme Optics Compatibility report

Save a Report

To save a report, select the ⚡ icon to copy its URL to your clipboard. (The URL is also displayed at the bottom of the results table in the report.) Later, when you paste the URL into a browser's address field, the Extreme Optics Compatibility website will display the same report.

💡 **Tip**
Store the URLs for your saved reports as browser bookmarks.

For example, in the custom report described earlier, the URL
is `https://optics.extremenetworks.com/EXOS/Formfactor/QSFP28/Bitrate/100G/Reach/15M,MAX/`

Share a Saved Report

After copying the report's URL, paste it into an email or a plaintext file for sharing with others.

Export a Report

To export the report in CSV (comma-separated variable format), select the icon.

The CSV file is added to your default download directory. Use your preferred spreadsheet program to display it.

Extreme Networks SFP Modules

Extreme Networks switches and routers support SFP (small form factor pluggable) interface modules, also known as mini-GBICs.

The topics in this section pertain to SFP modules. For descriptions of SFP+ modules, see Extreme Networks SFP+ Modules on page 39.

Extreme Networks devices support both optical and copper SFP modules. Each module provides 100 Mbps or 1000 Mbps optical connections. The type of switch, router, or other component determines the compatible type of SFP module.

Use only Extreme Networks-certified SFP, SFP+, and SFP28 modules in the SFP port on the hardware. These modules are available from Extreme Networks.

For current information about hardware support and the minimum required software for SFP modules, refer to the most recent version of the Extreme Optics website.

The information in this guide about hardware platform support is current as of the date this guide was published. Support for specific SFP types might have been added to other switches or I/O modules besides those listed in this guide.

100FX SFP Module for Gigabit Ethernet Ports

Part number: 10063

The 100FX SFP module for GE (Gigabit Ethernet) ports provides optical links up to 2 km long using multimode fiber cable.

The 100FX SFP module for GE ports conforms to the 100FX-MMF standard.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

100FX SFP (GE Ports) Specifications

The following table lists specifications for the The 100FX SFP module for GE ports.

Table 4: 100FX SFP module (GE Ports) Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	-20 dBm	NA	-14 dBm
Center wavelength	1270 nm	1310 nm	1380 nm
Receiver			
Receive sensitivity	NA	NA	-31 dBm
Average receive power (max)	NA	NA	-14 dBm
Operating Distance			
62.5/125 µm MMF	2 m	NA	2000 m
50/125 µm MMF	2 m	NA	2000 m

100FX SFP Module for Fast Ethernet Ports

Part number: 10067

The 100FX SFP module for fast Ethernet (FE) ports provides a 100-Mbps optical link using LC connectors and 1310-nm MMF (multimode fiber) cable. The maximum transmission distance for this connection is 2 km.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

100FX SFP for FE Ports Specifications

The following table lists specifications for the 100FX (FE Ports) SFP module.

Table 5: 100FX (FE Ports) SFP Module Specifications

Parameter	Minimum	Maximum
Transmitter		
Average launch power	-20 dBm	-14 dBm
Center wavelength	1270 nm	1380 nm
Receiver		
Receive sensitivity	-31 dBm	NA
Average receive power (max)	NA	-14 dBm
Operating Distance		
62.5/125 μm MMF	2 m	2000 m
50/125 μm MMF	2 m	2000 m

100BASE-FX SFP Module

Part number: AA1419074-E6

The 100BASE-FX SFP transceiver provides 100 Mbps Ethernet Carrier Sense Multiple Access with Collision Detection (CSMA-CD) connectivity using multimode optical fiber.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

100BASE-FX SFP Module Specifications

The following table lists specifications for the 100BASE-FX SFP transceiver.

Table 6: 100BASE-FX SFP Module Specifications

Parameter	Specification
Maximum electrical power consumption	1.5 watt (W)
Connectors	Duplex LC
Cabling	62.5 μm MMF optic cable 50 μm MMF optic cable

Table 6: 100BASE-FX SFP Module Specifications (continued)

Parameter	Specification
Distance	Up to 2 km using 500 MHz-km MMF optic cable
Wavelength	1300 nm
Link optical power budget	10 dB
Transmitter	
Maximum launch power	–14 dBm
Minimum launch power	–23.5 to –20 dBm
Receiver	
Receiver sensitivity	–33.5 dBm
Maximum input power	–14 dBm

LX100 SFP Module

Part number: 10064

The LX100 SFP module provides a 1000BASE-X optical link up to 100 km long using LC connectors and SMF cable.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

LX100 SFP specifications

The following table lists specifications for the LX100 SFP module.

Table 7: LX100 SFP Module Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	1 dBm	3 dBm	5 dBm
Center wavelength	1480 nm	1550 nm	1580 nm
Receiver			
Receive sensitivity	NA	NA	–30 dBm
Average receive power	NA	NA	–9 dBm
Operating wavelength	1260 nm	1550 nm	1580 nm
Operating distance	NA	NA	100 km

100BASE-LX10 SFP Module

Part number: 10066

The 100BASE-LX10 SFP module provides a 100-Mbps optical connection using LC connectors and SMF cable. The maximum transmission distance for this connection is 10 km.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

100BASE-LX10 SFP Specifications

The following table lists specifications for the 100BASE-LX10 SFP module.

Table 8: 100BASE-LX10 SFP Module Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	–15 dBm	–10 dBm	–8 dBm
Center wavelength	1260 nm	1310 nm	1360 nm
Receiver			
Receive sensitivity	NA	NA	–25 dBm
Average receive power	NA	NA	–8 dBm
Operating wavelength	1260 nm	1310 nm	1360 nm
Link			
Link Power Budget	NA	NA	10 dB
Operating distance	NA	NA	10 km

100BASE-BX Bidirectional SFP Modules

Part numbers: 10058, 10059

The 100BASE-BX SFP modules include the 100BASE-BX-U SFP module and the 100BASE-BX-D SFP module. These two SFP modules are used together in an ExtremeSwitching or Summit switch to permit a bidirectional 100-Mbps Ethernet connection using a single strand of SMF cable and LC connectors.

The 100BASE-BX-U SFP module is always connected to the 100BASE-BX-D SFP module. The 100BASE-BX-D SFP operates at wavelengths of 1550-nm TX/1310-nm RX wavelength), and the 1000BASE-BX-U SFP operates at wavelengths of 1310 nm TX/1550 nm RX. The maximum transmission distance for this connection is 10 km. The 100BASE-BX SFP modules conform to the IEEE 802.3ah standard.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

100BASE-BX Bidirectional SFP Specifications

The 100BASE-BX SFP modules conform to the IEEE 802.3ae standard.

The following table lists specifications for the 100BASE-BX SFP modules.

Table 9: 100BASE-BX SFP Modules Specifications

Parameter	Minimum	Maximum
Transmitter		
Average launch power	–9 dBm	–3 dBm
Center wavelength (100BASE-BX10-D)	1480 nm	1580 nm
Center wavelength (100BASE-BX10-U)	1260 nm	1360 nm
Receiver		
Receive sensitivity	–20 dBm	NA
Average receive power (max)	NA	–3 dBm
Link		
Link power budget	NA	11 dBm
Operating distance	NA	10 km

> **Note**
> The 100BX bidirectional SFPs include two SFP optical devices, the 100BASE-BX-U SFP and the 100BASE-BX-D SFP, which must be used as a pair to create a single fiber bidirectional connection.

Dual-speed 100LX/1000LX and Industrial Grade 100LX/1000LX SFP Module

Part numbers: 10060, 10060H

The dual-speed 100LX/1000LX SFP and industrial 100LX/1000LX SFP modules operate at either 100 Mbps or 1000 Mbps over SMF links up to 10 km long. Operating at 100 Mbps, these dual-speed SFPs conform to the 100BASE-LX standard. Operating at 1000 Mbps, the dual-speed SFP conforms to the 1000BASE-LX standard.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

Optical Budget Calculation

The 100LX/1000LX SFP modules also comply with the 100LX-SMF standard.

To use the 100LX/1000LX SFP module in 100LX-MMF operation, a minimum attenuation of 6 dB is required. After the SFP module is installed, connect a 6-dB attenuator to the transmitter side (Tx) of the SFP module. Next, connect the attenuator to the single-mode end of a mode conditioning patch cord. The mode conditioning patch cord transitions the SFP module from SMF to MMF operation.

When in SMF operation, either 100LX-SMF or 1000LX, measure the cable plant losses with a 1310 nm light source and verify this to be within budget. When you calculate the maximum distance attainable using optical cable with a specified loss per kilometer (for example, 0.25 dB/km), Extreme Networks recommends that 3 dB of the total budget be reserved for losses induced by cable splices or connectors and operating margin.

Note
The 100LX/1000LX SFP module detects link status based only on the presence of light in the receive cable. Therefore, if a single strand is broken, the link partner on the other port will not detect link down.

Dual-speed 100LX/1000LX SFP Specifications

Operating at 100 Mbps, the dual-speed SFPs conform to the 100BASE-LX10 standard. Operating at 1000 Mbps, the dual-speed SFPs conform to the 1000BASE-LX standard.

The following table lists specifications for the Dual-speed 100LX/1000LX SFP modules.

Table 10: Dual-speed 100LX/1000LX SFP Specifications

Parameter	100FX/100LX	1000LX
Average launch power range with 9 μm SMF	-20 dBm to -14 dBm	-3 dBm to -11 dBm
Receiver power range with 9 μm SMF	-8 dBm to -25 dBm	-3 dBm to -19 dBm
Optical link budget with 9 μm SMF	10 dB	8 dB
Center wavelength range	1270 to 1355	1270 to 1355
Operating distance range over each optical fiber type (see Optical Budget Calculation):		
62.5/125 μm MMF	2 to 2000 m	2 to 550 m
50/125 μm MMF	2 to 2000 m	2 to 550 m
9/125 μm SMF	2 to 10,000 m	2 to 10,000 m

1000BASE-T SFP Module

Part number: AA1419043-E6

The 1000BASE-T SFP transceiver provides Gigabit Ethernet connectivity using a single eight-pin RJ-45 connector.

The maximum current requirement of the SFP is 375 milliamperes (mA) at 5 volts (V).

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

1000BASE-T SFP Module Specifications

The following table describes standards, connectors, cabling, and distance for the 1000BASE-T SFP transceiver.

Table 11: 1000BASE-T SFP Module Specifications

Parameter	Specification
Standards	IEEE 802.3z, IEEE 802.3ab
Connectors	RJ-45
Cabling	CAT5E or better UTP
Distance	Up to 100 m

1 Gb SX and Industrial Grade SX SFP Modules

Part numbers: 10051H, I-MGBIC-GSX, AA1419048-E6

The Industrial Grade SX SFP modules provide a 1000BASE-X optical connection using LC connectors and MMF (multimode fiber) cable up to 550 meters long. The SX SFP module conforms to the 1000BASE-SX standard.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

Optical Budget Calculation

When you plan an installation using the SX SFP module, Extreme Networks recommends that 3 dB of the total budget be reserved for losses induced by cable splices or connectors and operating margin.

There is no minimum attenuation or minimum cable length restriction.

SX SFP Specifications

The SX and Industrial Grade SX SFPs conform to the 1000BASE-SX standard.

The SX SFP module operates at a commercial temperature range (0°C to 70°C). The Industrial Grade SX SFP modules operate at a wide temperature range (-40°C to 85°C).

The following table lists specifications for the SX and Industrial Grade SX SFP modules.

Table 12: SX and Industrial Grade SX SFP Modules Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	-9 dBm	-6 dBm	-2.5 dBm
Center wavelength	830 nm	850 nm	860 nm
Receiver			
Receive sensitivity	NA	NA	-17 dBm
Average receive power (max)	NA	NA	0 dBm
Operating wavelength	770 nm	850 nm	860 nm
Link			
Link power budget	NA	NA	7.5 dB
Operating distance	NA	NA	550 m

1 Gb SX SFP DDI Modules

Part numbers: MGBIC-LC01, AA1419048-E6

The 1000BASE-SX DDI SFP transceiver has a reach of up to 550 m using 50 μm MMF, and of 275 m using 62.5 μm MMF. This SFP transceiver operates at 850 nm.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

1 Gb SX SFP DDI Module Specifications

The following table describes standards, connectors, cabling, and distance for the 1000BASE-SX DDI SFP transceiver operating at 500 m.

Table 13: 1 Gb SX SFP DDI Module Specifications

Parameter	Specification
Maximum electrical power consumption	1.0 watt (W)
Connector	Duplex LC
Cabling	MMF
Data rate	1.0 Gbps
Line rate (8B/10B code)	1.25 Gbps
Link optical power budget	7.5 dB
Transmitter	
Launch power	-9.5 to -4.0 dBm
Receiver	
Receiver sensitivity	-17 dBm
Maximum receiver power	0 dBm

1 Gb LX Industrial Grade SFP for Multimode Fiber

Part number: I-MGBIC-LC03

The LX Industrial Grade SFP module supports 1000BASE-X connection using LC connectors and OM1 multimode fiber up to 2 km, and supports OM2/OM3/OM4 multimode fiber up to 1 km, without the use of mode conditioning patch cords. This LX Industrial Grade SFP module operates at a wide temperature range (-40°C to 85°C).

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

LX Industrial Grade SFP for Multimode Fiber Specifications

The following table lists specifications for the LX Industrial Grade SFP module for multimode fiber.

Table 14: LX Industrial Grade SFP for Multimode Fiber: Specifications

Parameter	Minimum	Typical	Maximum
Average launch power	-9 dBm	NA	-1 dBm
Center wavelength	1270 nm	1310 nm	1355 nm

Table 14: LX Industrial Grade SFP for Multimode Fiber: Specifications (continued)

Parameter	Minimum	Typical	Maximum
Receiver sensitivity	-19 dBm	NA	-1 dBm
Operating distance - OM1 MMF 62.5 µm	NA	NA	2 km
Operating distance - OM2/OM3/OM4 MMF	NA	NA	1 km

> **Note**
> No mode conditioning patch cord is required.

1 Gb LX and Industrial Grade LX SFP Modules

Part numbers: I-MGBIC-GLX, AA1419049-E6, 10052H (Industrial Grade), 10072H (Industrial Grade, 10-pack)

The LX and Industrial Grade LX SFP modules provide a 1000BASE-X optical connection using LC connectors and SMF (single-mode fiber) cable up to 10 km long.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

Optical Budget Calculation

Measure cable plant losses with a 1310 nm light source and verify this to be within budget.

When you calculate the maximum distance attainable using optical cable with a specified loss per kilometer (for example, 0.25 dB/km), Extreme Networks recommends that 3 dB of the total budget be reserved for losses induced by cable splices or connectors, and operating margin. There is no minimum system budget or minimum cable length restriction because the maximum receive power is the same as the maximum transmit power. There is no minimum attenuation or minimum cable length restriction.

LX SFP Specifications

The LX and Industrial Grade LX SFPs conform to the 1000BASE-LX standard.

The LX SFP modules operate at a commercial temperature range (0°C to 70°C). The Industrial Grade LX SFP module operates at a wide temperature range (-40°C to 85°C).

The following table lists specifications for the LX and Industrial Grade LX SFP modules. The specifications listed are for parts I-MGBIC-GLX and 10052H. Specifications for other parts are substantially similar but might not be identical.

Table 15: LX and Industrial Grade LX SFP Modules

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	-9.5 dBm	-5 dBm	-3 dBm
Center wavelength	1270 nm	1310 nm	1355 nm
Receiver			
Receive sensitivity	NA	NA	-19 dBm
Average receive power (max)	NA	NA	-3 dBm
Operating wavelength	1270 nm	1310 nm	1355 nm
Link			
Link power budget	NA	NA	8 dB
Operating distance - SMF	NA	NA	10 km
Operating distance - MMF **Note:** OM1 and OM2 MMF require mode conditioning patch cord.	NA	NA	550 m

1 Gb LX SFP LC DDI Modules

Part numbers: MGBIC-LC09, AA1419049-E6

The 1000BASE-LX SFP LC DDI transceiver provides 1000BASE-LX Gigabit Ethernet connectivity at 1310 nanometers (nm) using single mode or multimode optical fiber.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

1 Gb LX SFP LC DDI Module Specifications

The following table lists the specifications for the 1000BASE-LX SFP LC DDI transceiver.

Table 16: 1 Gb LX SFP LC DDI Module Specifications

Parameter	Specification
Maximum electrical power consumption	1.0 watt (W)
Connectors	Duplex LC

Table 16: 1 Gb LX SFP LC DDI Module Specifications (continued)

Parameter	Specification
Cabling	50 micrometer (µm) MMF (multimode fiber) 62.5 µm multimode fiber 9 µm SMF (single mode fiber)
Distance	- Up to 550 meters (m) using MMF - Up to 10 kilometers (km) using SMF
Data rate	1.0 Gbps
Line rate (8B/10B code)	1.25 Gbps
Link optical power budget	9.5 dB
Transmitter	
Launch power	-9.5 to -3.0 dBm
Receiver	
Receiver sensitivity	-19.0 dBm
Maximum receiver power	-3.0 dBm

ZX SFP Module

Part number: 10053H

The ZX SFP module is a long-haul SFP that provides a 1000BASE-X optical connection using LC connectors and SMF cable up to 80 km long.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

Optical Budget Calculation

Measure cable plant losses with a 1550 nm light source and verify this to be within budget.

When you calculate the maximum distance attainable using optical cable with a specified loss per kilometer (for example, 0.25 dB/km), Extreme Networks recommends that you reserve 3 dB of the total budget for losses induced by cable splices or connectors and operating margin. A minimum system budget or attenuation is required to prevent saturation of the receiver.

ZX SFP Specifications

The following table lists specifications for the ZX SFP module.

Table 17: ZX SFP Module Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	-2 dBm	0 dBm	3 dBm
Center wavelength	1530 nm	1550 nm	1570 nm
Receiver			
Receive sensitivity	NA	NA	-24 dBm
Average receive power (max)	NA	NA	-3 dBm
Operating wavelength	1530 nm	1550 nm	1570 nm
Operating distance	NA	NA	80 km

1000BASE-BX10 Bidirectional 10 km DDI SFP Modules

Part numbers: AA1419069-E6, AA1419070-E6

The 1000BASE-BX10 bidirectional DDI SFP transceivers can attain a reach of up to 10 km.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

1000BASE-BX10 bidirectional DDI SFP Module Specifications

The following table lists transmitter and receiver specifications for the 1000BASE-BX10 bidirectional DDI transceivers.

Table 18: 1000BASE-BX10 bidirectional DDI Module Specifications

Parameter	Specification
Connectors	Single-fiber LC
Data Rate	1.0 Gbps
Line rate (8B/10B code)	1.25 Gbps
Distance	Up to 10 km
Wavelength	1310 nm and 1490 nm
Link optical power budget	11.0 dB

Table 18: 1000BASE-BX10 bidirectional DDI Module Specifications (continued)

Parameter	Specification
Maximum transmitter and dispersion power penalty	3.3 dB
Transmitter	
Maximum launch power	–3.0 dBm
Minimum launch power	–9.0 dBm
Receiver	
Maximum receiver sensitivity	–19.5 dBm
Maximum input power (maximum average receive power)	–3.0 dBm

1000BASE-BX Bidirectional 10 km SFP Modules

Part numbers: 10056H, 10057H, MGBIC-BX10-D, MGBIC-BX10-U

The 1000BASE-BX SFP modules include the 1000BASE-BX-U SFP module and the 1000BASE-BX-D SFP module. These two SFP modules are used together to permit a bidirectional GE (Gigabit Ethernet) connection using a single strand of SMF cable and LC connectors.

The 1000BASE-BX-D SFP module operates at wavelengths of 1490 nm TX/1310 nm RX, and the 1000BASE-BX-U SFP module operates at wavelengths of 1310 nm TX/1490 nm RX. The 1000BASE-BX-U SFP module is always connected to the 1000BASE-BX-D SFP module. The maximum transmission distance for this connection is 10 km. The 1000BASE-BX SFP modules conform to the IEEE 802.3ah 1000BASE-BX10 standard.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

1000BASE-BX Bidirectional SFP Specifications

The MGBIC-BX10-D/-U SFP modules operate at a commercial temperature range (0°C to 70°C). The 10056H/10057H Industrial Grade SX SFP modules operate at a wide temperature range (-40°C to 85°C)

The following table lists specifications for the 1000BASE-BX Bidirectional SFP modules.

Table 19: 1000BASE-BX Bidirectional SFP Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	-9 dBm	NA	-3 dBm
Center wavelength (1000BASE-BX10-D)	1480 nm	1490 nm	1550 nm
Center wavelength (1000BASE-BX10-U)	1260 nm	1310 nm	1360 nm
Receiver			
Receive sensitivity	NA	NA	-19 dBm
Average receive power (max)	NA	NA	-3 dBm
Link			
Link power budget	NA	NA	8 dBm
Operating distance	NA	NA	10 km

> **Note**
> The 1000BX bidirectional SFPs include two SFP optical devices, the 1000BASE-BX-U SFP and the 1000BASE-BX-D SFP, which must be used as a pair to create a single fiber bidirectional connection.

1000BX Bidirectional 40 km SFP Modules for Gigabit Ethernet Ports

Part numbers: MGBIC-BX40-D, MGBIC-BX40-U

These two SFP modules are used together to permit a bidirectional GE (Gigabit Ethernet) connection using a single strand of SMF cable and LC connectors up to 40 km. Bidirectional modules must be used in -D and –U pairs.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

1000BX Bidirectional 40 km SFP Module (GE Ports) Specifications

The following table lists specifications for the 1000BX bidirectional 40 km SFP module for GE ports.

Table 20: 1000BX Bidirectional 40 km SFP Module (GE Ports) Specifications

Parameter	Minimum	Typical	Maximum
Average launch power	-5 dBm	NA	0 dBm
Center wavelength (MGBIC-BX40-D)	1480 nm	1490 nm	1550 nm
Center wavelength (MGBIC-BX40-U)	1260 nm	1310 nm	1360 nm
Receiver sensitivity	-22 dBm	NA	0 dBm
Operating distance	NA	NA	40 km

1000BX Bidirectional 120 km SFP Modules for Gigabit Ethernet Ports

Part numbers: MGBIC-BX120-D, MGBIC-BX120-U

These two SFP modules are used together to permit a bidirectional GE (Gigabit Ethernet) connection using a single strand of SMF cable and LC connectors up to 120 km. Bidirectional modules must be used in -D and –U pairs.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

1000BX Bidirectional 120 km SFP Module (GE Ports) Specifications

The following table lists specifications for the 1000BX bidirectional 120 km SFP module for GE ports.

Table 21: 1000BX Bidirectional 120 km SFP Module (GE Ports) Specifications

Parameter	Minimum	Typical	Maximum
Average launch power	-5 dBm	NA	0 dBm
Center wavelength (MGBIC-BX120-D)	NA	1590 nm	NA
Center wavelength (MGBIC-BX120-U)	NA	1490 nm	NA
Receiver sensitivity	-22 dBm	NA	0 dBm
Operating distance	NA	NA	120 km

10/100/1000BASE-T Copper SFP and Industrial Grade SFP Modules

Part numbers: 10065 (copper), 10070H (Industrial Grade), 10071H (Industrial Grade, 10-pack)

The 10/100/1000BASE-T SFP modules provide a 100-Mbps connection using Category 5 cable.

Note

If the 10/100/1000BASE-T copper SFP GBIC is plugged into a 10G SFP+ port, the GBIC functions only at 1G speeds.

For a complete listing of compatible cables and optical transceivers, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only.

10/100/1000BASE-T Copper SFP Specifications

The 10/100/1000BASE-T copper SFP module is compatible with the Gigabit Ethernet standard and 1000Base-T standard as specified in the IEEE 802.3ab standard.

The 10/100/1000BASE-T copper SFP module operates at a commercial temperature range (0°C to 70°C).

The Industrial Grade 10/100/1000BASE-T copper SFP module operates at a wide temperature range (-40°C to 85°C).

The following table lists specifications for the 10/100/1000BASE-T copper SFP module. The specifications listed are for part 10065. Specifications for other parts are substantially similar but might not be identical.

Table 22: 10/100/1000BASE-T Copper SFP Specifications

Parameter	Value
Supply current	375 mA maximum
Link distance for each speed	
1 Gbps	100 m using Cat5e cable
100 Mbps	150 m using Cat5e cable
10 Mbps	250 m using Cat5e cable

1000BASE-T Copper SFP Module

Part numbers: MGBIC-02

The MGBIC-02 1000BASE-T copper SFP operates only at 1G speed.

For a complete listing of compatible cables and optical transceivers, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only.

1000BASE-T Copper SFP Specifications

The 1000BASE-T copper SFP module is compatible with the Gigabit Ethernet standard and 1000Base-T standard as specified in the IEEE 802.3ab standard.

The MGBIC-02 1000BASE-T copper SFP module operates at an extended case temperature range of -40°C to 85°C.

The following table lists specifications for the 1000BASE-T copper SFP module.

Table 23: 1000BASE-T Copper SFP Specifications

Parameter	Value
1 Gbps	100 m using Cat5e cable

Installing and Removing an SFP, SFP+, or SFP28 Module

The following topics describe how to install, replace, and remove SFP-formatted modules (SFP, SFP+, and SFP28).

- Preparing to Install or Replace an SFP Module on page 35
- Installing an SFP Module on page 35
- Connecting Fiber Cables on page 37
- Removing an SFP Module on page 37

Preparing to Install or Replace an SFP Module

Complete the following tasks before inserting the SFP module:

1. Inspect and clean the fiber tips, coupler, and connectors.
2. Prepare and clean an external attenuator, if needed.
3. When handling fiber cables, take the following precautions to prevent damage to the cables:
   a. Do not stretch the fiber.
   b. Make sure the bend radius of the fiber is not less than 2 inches (5.08 cm).
4. Extreme Networks recommends the following guidelines when installing or replacing SFP modules on an active network:
   a. Use the same type of SFP module at each end of the link, except for the 1000BASE-BX and 100BASE-BX bidirectional SFP modules. The bidirectional SFP modules include a D-type and a U-type. You must use one D-type SFP and one U-type SFP together to allow for a single fiber bidirectional connection.
   b. Connect one end of the link to the Tx port. Without an attenuator, measure the total loss from the Tx port to the other site of the link. The total loss must not exceed the total optical system budget.

Installing an SFP Module

You can add or remove SFP modules in your switch without powering off the system.

Figure 2 and Figure 3 on page 37 show the types of SFP modules and connectors.

> **Note**
> The bidirectional SFP modules combine two SFP optical devices that must be used as a pair to establish the bidirectional connection over a single fiber. Module C and Module D in Figure 2 show the pair of SFPs for a bidirectional SFP module.

> **Warning**
> Optical SFPs contain Class 1 lasers. Invisible laser radiation can occur when laser connections are unplugged. Do not stare into the beam. This device is compliant with FCC 21 CFR 1040.10 and EN60825-1A2:2001.

> **Caution**
> To prevent ESD damage to an SFP module, always use an appropriately grounded ESD-preventive wrist strap when installing or removing the module. Handle the module by its sides only. Never touch the card-edge connectors at the insertion end of the module.
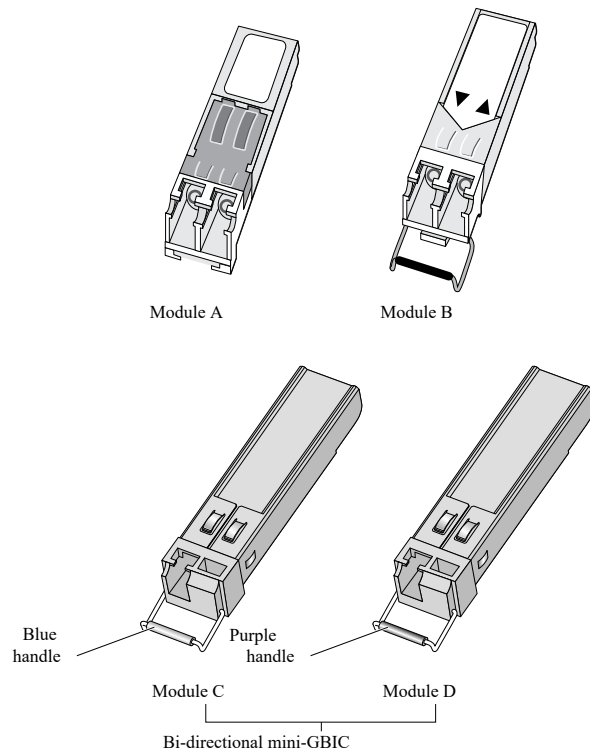
Figure 2: Optical SFP Module Types and Connectors
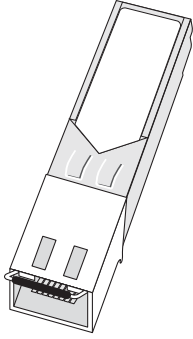
Figure 3: Copper SFP Module

1. Holding the SFP module by its sides, insert the SFP module into the port on the switch.
2. Slide the SFP module into the port until you hear it click.

    If the SFP module has a handle, push up on the handle to secure the SFP module.

> **Note**
> Disconnect fiber-optic cable from an optical SFP module before removing the SFP module from the port.

Connecting Fiber Cables

Before you connect fiber cables to the dual-speed 100FX/1000LX SFP module or the LX100 SFP module, note the following information about these SFP modules.

100FX/1000LX SFP Module

The 100FX/1000LX SFP module complies with the 100FX-SMF standard.

In order to use the 100FX/1000LX SFP module in 100FX-MMF operation, a minimum attenuation of 6 dB is required. After the SFP module is installed, connect a 6-dB attenuator to the transmitter side (Tx) of the SFP module. Then connect the attenuator to the single-mode end of a mode conditioning patch cord. The mode conditioning patch cord transitions the SFP module from SMF to MMF operation.

LX100 SFP Module

To prevent permanent damage to the LX100 SFP module, always check the optical input power of the receiver before you insert the fiber cable.

The maximum optical input power is -9 dBm. If you use an optical loopback for diagnostics, the loopback requires a minimum of 12 dB optical attenuation. The recommended attenuation range is 12 to 20 dB.

Removing an SFP Module

1. Disconnect the optical cable from the SFP module.

2. Unlatch the SFP module in one of the following ways:

   a. On an SFP module similar to Module A in Figure 2 on page 36, press and hold the black plastic tab at the bottom of the connector.

   b. On an SFP module similar to Module B, Module C, or Module D in Figure 2 on page 36, rotate the front handle down.

3. Pull the SFP module out of the port on the switch.

Extreme Networks SFP+ Modules

Extreme Networks switches and routers support SFP+ interface modules, also known as mini-GBICs.

The topics in this section pertain to SFP+ modules. For descriptions of SFP modules, see Extreme Networks SFP Modules on page 17.

Extreme Networks devices support both optical and copper SFP+ modules. Each module provides 10 Gb optical connections. The type of switch, router, or other component determines the compatible type of SFP+ module.

Use only Extreme Networks-certified SFP, SFP+, and SFP28 modules in the SFP port on the hardware. These modules are available from Extreme Networks.

For current information about hardware support and the minimum required software for SFP+ modules, refer to the most recent version of the Extreme Optics website.

The information in this guide about hardware platform support is current as of the date this guide was published. Support for specific SFP+ types might have been added to other switches or I/O modules besides those listed in this guide.

SR SFP+ Module

Part numbers: 10301, AA1403015-E6

The SR SFP+ module provides a 10 Gb optical connection using LC connectors and multimode fiber cable up to 300 meters long.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

SR SFP+ Specifications

The SR SFP+ module conforms to the 10GBASE-SR standard.

The following table lists specifications for the SR SFP+ module. Note that the operating distance range depends on the module's type and modal bandwidth.

Table 24: SR SFP+ Module Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	-7.3 dBm	NA	-1 dBm
Center wavelength	840 nm	850 nm	860 nm
Receiver			
Receive sensitivity	NA	NA	-11 dBm
Average receive power (max)	NA	NA	-1 dBm
Operating wavelength	840 nm	850 nm	860 nm
Link			
Link power budget	NA	NA	7.5 dB
Operating Distance Range			
62.5 µm MMF (160 MHz*km)	NA	NA	26 m
62.5 µm MMF (200 MHz*km)	NA	NA	33 m
50 µm MMF (400 MHz*km)	NA	NA	66 m
50 µm MMF (500 MHz*km)	NA	NA	82 m
50 µm MMF (2000 MHz*km)	NA	NA	300 m
50 µm MMF (4700 MHz*km)	NA	NA	400 m

SR High Temperature SFP+ Module

Part numbers: 10G-SR-SFP300M-ET, AA1403015-E6HT

The 10GBASE-SR/SW SFP+ high temperature transceivers (0°C to 85°C) provide 10 GbE service at 850 nm, over distances of 300 m (10G-SR-SFP300M-ET) or 10 km (AA1403015-E6HT).

> ⚠️ **Warning**
>
> To prevent damage to the optical receiver, ensure that at least 1 dB of attenuation exists between the transmit and receive ports.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

SR SFP+ High Temperature Module Specifications

For more information about the 10GBASE-SR/SW SFP+ high temperature transceiver, including test and measurement information, see the IEEE 802.3ae standard.

The following table lists specifications for the 10 km transceiver. The specifications listed are for part AA1403015-E6HT. Specifications for other parts are substantially similar but might not be identical.

Table 25: SR SFP+ High Temperature Module Specifications

Parameter	Specification
Data rate	10 Gigabits per second (Gbps)
Line rate (64B/66B code)	10.3125 Gbps ± 100 parts per million (ppm)
Center wavelength range	840 to 860 nanometers (nm), nominal 850 nm
Distance	Up to 10 km
Link optical power budget	9.4 dB
Maximum transmitter and dispersion penalty	3.2 dB at 10 km
Operating case temperature range	-5°C to 85°C
Transmitter	
Line rate (nominal)	10GBASE-LR 10.3125 Gbps ±100 ppm (10 GbE)
Average launch power	-8.2 to 0.5 dBm
Minimum launch power in OMA minus transmission and dispersion penalty (TDP)	-6.2 dBm
Minimum optical modulation amplitude	-5.2 dBm
Minimum extinction ratio	3.5 dB
Maximum optical return loss tolerance	-12 dB

Table 25: SR SFP+ High Temperature Module Specifications (continued)

Parameter	Specification
Maximum transmitter reflectance	-12 dB
Receiver	
Line rate (nominal)	10GBASE-LR 10.3125 Gbps ± 100 ppm (10 GbE)
Average receive power for BER 10^{-12}	-14.4 dBm to 0.5 dBm
Maximum average receive power for damage	-1.5 dBm
Maximum receiver sensitivity in OMA	-12.6 dBm
Maximum receiver reflectance	-12 dB
Stressed receiver sensitivity in OMA	-10.3 dBm

LR SFP+ Module

Part numbers: 10302, AA1403011-E6

The LR SFP+ module provides a 10 Gb optical connection using LC connectors and single-mode fiber cable up to 10 kilometers long.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

LR SFP+ Specifications

The LR SFP+ module conforms to the 10GBASE-LR standard.

The following table lists specifications for the LR SFP+ module.

Table 26: LR SFP+ Module Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	-8.2 dBm	NA	0.5 dBm
Center wavelength	1260 nm	1310 nm	1355 nm
Receiver			
Average receive power (max)	–14.4 dBm	NA	–1 dBm
Center wavelength	1260 nm	1310 nm	1355 nm
Maximum receiver sensitivity in OMA	NA	NA	–12.6 dBm
Operating distance	NA	NA	10 km

LR/LW High Temperature SFP+ Module

Part number: AA1403011-E6HT

The 10GBASE-LR/LW SFP+ high temperature transceiver (–5°C to 85°C) provides 10 GbE or OC-192 service at a nominal wavelength of 1310 nm. This SFP+ transceiver can attain link lengths of up to 10 km.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

LR/LW SFP+ High Temperature Module Specifications

For more information about the 10GBASE-LR/LW SFP+ (–5°C to 85°C), including test and measurement information, see the IEEE 802.3ae standard.

The following table lists the specifications for this transceiver.

Table 27: LR/LW SFP+ High temperature Module Specifications

Parameter	Specification
Center wavelength range	1260 to 1355 nm; 1310 nm nominal
Distance	Using 62.5 µm MMF optic cable: • 160 MHz-km fiber: 2 to 26 m • 200 MHz-km fiber: 2 to 33 m Using 50 µm MMF optic cable: • 400 MHz-km fiber: 2 to 66 m • 500 MHz-km fiber: 2 to 82 m • 2000 MHz-km fiber (OM3): 2 to 300 m • 4700 MHz-km fiber (OM4): 2 to 400 m
Link optical power budget	3.8 dB
Maximum transmitter and dispersion penalty	3.9 dB at 300 m
Operating case temperature range	0°C to 85°C
Transmitter	
Root-mean-square spectral width	0.05 to 0.40 nm
Launch power	-7.3 to -1.0 dBm
Minimum extinction ratio	3.0 dB
Maximum optical return loss tolerance	-12 dB
Receiver	
Average receive power for BER 10^{-12}	-9.9 dBm to -1.0 dBm

Table 27: LR/LW SFP+ High temperature Module Specifications (continued)

Parameter	Specification
Receiver damage threshold	0 dBm
Maximum receiver sensitivity in OMA	-11.1 dBm
Maximum receiver reflectance	-12 dB
Stressed receiver sensitivity in OMA	-7.5 dBm

ER SFP+ Module

Part numbers: 10309, AA1403013-E6

The ER SFP+ module provides a 10 Gb optical connection using LC connectors and single-mode fiber cable up to 40 kilometers long.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

ER SFP+ Specifications

The ER SFP+ module conforms to the 10GBASE-ER standard.

The following table lists specifications for the ER SFP+ module.

Table 28: ER SFP+ Module Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	-4.7 dBm	NA	4 dBm
Center wavelength	1530 nm	1550 nm	1565 nm
Receiver			
Average receive power (max)	–15.8 dBm	NA	–1 dBm
Center wavelength	1530 nm	1550 nm	1565 nm
Maximum receiver sensitivity in OMA	NA	NA	–14.1 dBm
Operating distance	NA	NA	40 km

LRM SFP+ Module

Part numbers: 10303, AA1403017-E6

The LRM SFP+ module provides a 10 Gb optical connection using LC connectors and MMF (multimode fiber) cable up to 220 meters long. It can also be used with standard SMF (single mode fiber) to attain a reach of up to 300 meters.

To ensure that specifications are met over Fiber Distributed Digital Interface (FDDI) grade OM1 and OM2 fibers, the transmitter should be coupled through a mode conditioning patch cord. No mode conditioning patch cord is required for applications over OM3 fiber.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

LRM SFP+ Specifications

The LRM SFP+ module conforms to the 10GBASE-LRM standard.

The following table lists specifications for the LRM SFP+ module.

Table 29: LRM SFP+ Module: Transmitter

Parameter	Minimum	Maximum
Transmitter		
Average launch power	–6.5 dBm	0.5 dBm
Center wavelength	1260 nm	1355 nm
Receiver		
Average receive power (max)	–6.5 dBm	0.5 dBm
Center wavelength	1260 nm	1355 nm
Maximum receiver sensitivity in OMA	NA	1.5 dBm
Operating distance (MMF)	NA	220 m
Operating distance (SMF)	NA	300 m

ZR SFP+ Module

Part numbers: 10310, AA1403016-E6

The ZR SFP+ module is a long-haul SFP+ module that provides a 10GBASE-X optical connection using LC connectors and SMF cable up to 80 km long.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

Optical Budget Calculation

Measure cable plant losses with a 1550 nm light source and verify this to be within budget.

When you calculate the maximum distance attainable using optical cable with a specified loss per kilometer (for example, 0.25 dB/km), Extreme Networks recommends that you reserve 3 dB of the total budget for losses induced by cable splices or connectors and operating margin. A minimum system budget or attenuation is required to prevent saturation of the receiver.

ZR SFP+ Specifications

The following table lists specifications for the ZR SFP+ module.

Table 30: ZR SFP+ Specifications

Parameter	Minimum	Typical	Maximum
Average launch power	0 dBm	NA	4 dBm
Center wavelength	1530 nm	1550 nm	1570nm
Receiver sensitivity in OMA	NA	NA	–24 dBm
Average Receive Power (max)	NA	NA	-7 dBm
Operating Wavelength	530	550	1570
Operating Distance	NA	NA	80 km

Tunable DWDM SFP+ Module

Part number: 10325

The Tunable DWDM SFP+ module can be configured for up to 102 DWDM channels when used in a supported switch over single-mode fiber. The transceiver supports 102 DWDM channels on a 50 GHz frequency spacing grid.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

Tunable DWDM SFP+ Module Specifications

The following table lists specifications for the Tunable DWDM SFP+ module.

on page 47 lists the transmitter center wavelength associated with each configurable channel on the tunable DWDM module.

Table 31: Tunable DWDM SFP+ Specifications

Parameter	Minimum	Maximum
Transmitter		
Power	-1 dBm	3 dBm
Wavelength - tunable to 50GHz spacing	1528.38 nm (196.15 THz)	1568.77 nm (191.10 THz)
Receiver		
Receiver sensitivity	-24 dBm	-7 dBm
Wavelength	1260 nm	1600 nm
Operating distance (nominal on SMF)		80 km
Connector	Duplex LC	
Fiber type	SMF (single-mode fiber)	

When used with a DWDM multiplexor, the nominal distance needs to be adjusted for any additional attenuation introduced by the multiplexor in the optical path.

Table 32: Tunable DWDM SFP+ and XFP Module: TX Wavelengths and Channel Assignments

TX Wavelength	Channel	TX Wavelength	Channel	TX Wavelength	Channel	TX Wavelength	Channel
1568.77 nm	11	1558.17 nm	24	1547.72 nm	37	1537.40 nm	50
1568.36 nm	1150	1557.77 nm	2450	1547.32 nm	3750	1537.00 nm	5050
1567.95 nm	12	1557.36 nm	25	1546.92 nm	38	1536.61 nm	51
1567.54 nm	1250	1556.96 nm	2550	1546.52 nm	3850	1536.22 nm	5150
1567.13 nm	13	1556.55 nm	26	1546.12 nm	39	1535.82 nm	52
1566.72 nm	1350	1556.15 nm	2650	1545.72 nm	3950	1535.43 nm	5250
1566.31 nm	14	1555.75 nm	27	1545.32 nm	40	1535.04 nm	53
1565.90 nm	1450	1555.34 nm	2750	1544.92 nm	4050	1534.64 nm	5350
1565.50 nm	15	1554.94 nm	28	1544.53 nm	41	1534.25 nm	54
1565.09 nm	1550	1554.54 nm	2850	1544.13 nm	4150	1533.86 nm	5450
1564.68 nm	16	1554.13 nm	29	1543.73 nm	42	1533.47 nm	55
1564.27 nm	1650	1553.73 nm	2950	1543.33 nm	4250	1533.07 nm	5550

Table 32: Tunable DWDM SFP+ and XFP Module: TX Wavelengths and Channel Assignments (continued)

TX Wavelength	Channel	TX Wavelength	Channel	TX Wavelength	Channel	TX Wavelength	Channel
1563.86 nm	17	1553.33 nm	30	1542.94 nm	43	1532.68 nm	56
1563.45 nm	1750	1552.93 nm	3050	1542.54 nm	4350	1532.29 nm	5650
1563.05 nm	18	1552.52 nm	31	1542.14 nm	44	1531.90 nm	57
1562.64 nm	1850	1552.12 nm	3150	1541.75 nm	4450	1531.51 nm	5750
1562.23 nm	19	1551.72 nm	32	1541.35 nm	45	1531.12 nm	58
1561.83 nm	1950	1551.32 nm	3250	1540.95 nm	4550	1530.72 nm	5850
1561.42 nm	20	1550.92 nm	33	1540.56 nm	46	1530.33 nm	59
1561.01 nm	2050	1550.52 nm	3350	1540.16 nm	4650	1529.94 nm	5950
1560.61 nm	21	1550.12 nm	34	1539.77 nm	47	1529.55 nm	60
1560.20 nm	2150	1549.72 nm	3450	1539.37 nm	4750	1529.16 nm	6050
1559.79 nm	22	1549.32 nm	35	1538.98 nm	48	1528.77 nm	61
1559.39 nm	2250	1548.91 nm	3550	1538.58 nm	4850	1528.38 nm	6150
1558.98 nm	23	1548.51 nm	36	1538.19 nm	49	NA	NA
1558.58 nm	2350	1548.11 nm	3650	1537.79 nm	4950	NA	NA

CWDM SFP+ Module

Part number: AA1403165-E6

The CWDM (coarse wavelength division multiplexing) SFP+ module provides a 10 Gb optical connection at distances up to 70 km.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

CWDM SFP+ Module Specifications

The following table lists specifications for the CWDM SFP+ module.

Table 32 on page 47 lists the transmitter center wavelength associated with each configurable channel on the tunable DWDM module.

Table 33: CWDM SFP+ Specifications

Parameter	Value
Reach	70 km
Center wavelength assignment	1551 nm
Minimum insertion loss: Tx and Rx	10 dB

10GBASE ER/EW SFP+ Module

Part number: AA1403013-E6

The 10GBASE ER/EW SFP+ transceiver provides a reach of up to 40 km at a wavelength of 1550 nm.

For more information about the 10GBASE-ER/EW SFP+ transceiver, including test and measurement information, see the IEEE 802.3ae standard..

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

10GBASE ER/EW SFP+ Module Specifications

The following table lists specifications for the IEEE 802.3ae 10GBASE ER/EW SFP+ transceiver.

Table 34: 10GBASE ER/EW SFP+ Module Specifications

Parameter	Specification
Line rate (nominal)	10GBASE-ER/EW 10.3125 Gb/s ±100 ppm (10 GbE)
Center wavelength range	1530 to 1565 nm; nominal 1550 nm
Distance	Up to 40 km
Link optical power budget	15 dB
Transmitter and dispersion power penalty	3.0 dB at 40 km
Transmitter	
Launch power	−47 to 4.0 dBm
Minimum side mode suppression ratio	30 dB
Minimum launch power in OMA minus transmission and dispersion penalty (TDP)	−2.1 dBm

Table 34: 10GBASE ER/EW SFP+ Module Specifications (continued)

Parameter	Specification
Minimum optical modulation amplitude	–1.7 dBm
Maximum average launch power of OFF transmitter	–30 dBm
Minimum extinction ratio	3.0 dB
Maximum $RIN_{12}OMA$	–128 dB/Hz
Maximum optical return loss tolerance	–21 dB
Receiver	
Average receive power for BER 10^{-12}	–15.8 to –1.0 dBm
Maximum receive power for damage	4.0 dBm
Maximum receiver sensitivity in OMA	–14.1 dBm
Maximum receiver reflectance	–26 dB
Stressed receiver sensitivity in OMA	–11.3 dBm
Receive electrical 3 dB upper cutoff frequency (maximum)	12.3 GHz

10 Gb Bidirectional 10 km SFP+ Module

Part numbers: 10GB-BX10-D, 10GB-BX10-U, AA1403169-E6, AA1403170-E6

These SFP+ modules are used together in pairs to permit a bidirectional 10-gigabit Ethernet connection using a single strand of SMF cable and LC connectors up to 10 km. Bidirectional modules must be used in –D and –U pairs.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

10 Gb Bidirectional 10 km SFP+ Module Specifications

The following table lists specifications for the 10 Gb bidirectional 10 km SFP+ module.

Table 35: 10 Gb Bidirectional 10 km SFP+ Module Specifications

Parameter	Minimum	Typical	Maximum
Average launch power	-5 dBm	NA	0 dBm
Center wavelength (10GB-BX10-D)	NA	1270 nm	NA
Center wavelength (10GB-BX10-U)	NA	1330 nm	NA

Table 35: 10 Gb Bidirectional 10 km SFP+ Module Specifications (continued)

Parameter	Minimum	Typical	Maximum
Receiver sensitivity	-14 dBm	NA	0.5 dBm
Operating distance	NA	NA	10 km

10 Gb Bidirectional 40 km SFP+ Module

Part numbers: 10GB-BX40-D, 10GB-BX40-U

These two SFP+ modules are used together to permit a bidirectional 10-gigabit Ethernet connection using a single strand of SMF cable and LC connectors up to 40 km. Bidirectional modules must be used in –D and –U pairs.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

10 Gb Bidirectional 40 km SFP+ Module Specifications

The following table lists specifications for the 10 Gb bidirectional 40 km SFP+ module.

Table 36: 10 Gb Bidirectional 40 km SFP+ Module Specifications

Parameter	Minimum	Typical	Maximum
Average launch power	2 dBm	NA	7 dBm
Center wavelength (10GB-BX40-D)	NA	1270 nm	NA
Center wavelength (10GB-BX40-U)	NA	1330 nm	NA
Receiver sensitivity	-14 dBm	NA	0.5 dBm
Operating distance	NA	NA	40 km
Recommended minimum link attenuation	6.5 dB	NA	NA

10GBASE-T Ethernet SFP+ Module

Part numbers: 10338, AA1403043-E6

The 10GBASE-T copper SFP+ module provides a 10 Gb connection using unshielded twisted pair (UTP) Category 6A cable. The module uses an RJ45 connector.

> **Note**
> The 10GBASE-T copper SFP+ module operates only at 10 Gb speed.

The supported configuration for this module is to populate every second 10 Gb SFP+ port in the system, with no more than half of the 10 Gb SFP+ ports configured with these modules. For every 10GBASE-T copper SFP+ module that is installed, an adjacent SFP+ port must remain unused.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only.

10GBASE-T Ethernet SFP+ Specifications

The 10GBASE-T copper SFP+ module is compatible with the Gigabit Ethernet 10GBASE-T standard, up to distances of 30 meters.

The 10GBASE-T copper SFP+ module operates at a temperature range of -5°C to 85°C.

The following table lists specifications for the 10GBASE-T copper SFP+ module.

Table 37: 10GBASE-T Ethernet SFP+ Specifications

Parameter	Value
Connector	RJ45
Link distance for each speed	
10 Gbps	30 m using Cat6a cable or better

Installing and Removing an SFP+ Module

To install, replace, or remove an SFP+ module, follow the instructions in Installing and Removing an SFP, SFP+, or SFP28 Module on page 35.

Extreme Networks 25 Gb SFP28 Modules

Some Extreme Networks switches support the use of 25 Gb SFP28 pluggable optical modules. Each module provides one 25-gigabit transmit and receive channel.. Use of 25Gb SFP28 modules in QSFP28 ports requires the use of the QSFP28 to SFP28 adapter (part no. 10506).

Use only Extreme Networks-certified SFP, SFP+, and SFP28 modules in the SFP port on the hardware. These modules are available from Extreme Networks.

We recommend enabling Forward Error Correction (FEC) when you use 25 Gb SFP28 optical modules.

You can insert or remove SFP28 modules without powering down the system.

The information in this guide about hardware platform support is current as of the date this guide was published. Support for specific SFP28 types might have been added to other switches or I/O modules besides those listed in this guide.

For current information about hardware support and the minimum required software for SFP28 modules, refer to the most recent version of the Extreme Optics website.

25 Gb SR SFP28 Module

Part numbers: 10501, 25G-SR-SFP100M

The SR SFP28 module provides a 25 Gb optical connection using an LC duplex optical connector over one pair of OM3 or OM4 multimode fibers. The SR SFP28 module is compatible with OM3 or OM4 MMF duplex cables.

One data lane operates in each direction, at 25 Gbps up to 70 meters using OM3 fiber or up to 100 meters using OM4 fiber.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

25 Gb SR SFP28 Module Specifications

The 25 Gb SR SFP28 module conforms to the 802.3 25GBASE-SR standard.

This module is a Class 1 laser device.

The following table lists specifications for the 25 Gb SR SFP28 module. The specifications listed are for part 10501. Specifications for other parts are substantially similar but might not be identical.

Table 38: 25 Gb SR SFP28 Module Specifications

Parameter	Minimum	Maximum
Transmitter		
Average launch power	-8.4 dBm	2.4 dBm
Center wavelength	850 nm	
Receiver		
Average receive power (max)	-10.3 dBm	3 dBm
Operating wavelength	850 nm	
Operating Distance Range		
OM3 fiber	0.5 m	70 m
OM4 fiber	0.5 m	100 m
Forward Error Correction on Host Switch	IEEE 802.3 Clause 108/Clause 91 RS-FEC	

25 Gb SR-Lite MMF (Multimode Fiber) SFP28 Module

Part number: 10502

The SR-Lite MMF SFP28 module provides a 25 Gb optical connection using a duplex LC optical connector over one pair of multimode fiber. The SR-Lite SFP28 module can support operation with FEC disabled or lite-FEC (Clause 74 Base-R/Firecode) for lower latency applications.

One data lane operates in each direction, at 25 Gbps up to 70 meters using OM3 fiber or up to 100 meters using OM4 fiber with FEC configured on the host switch (or up to 30 meters using OM3 fiber and 40 meters using OM4 fiber without FEC configured).

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

25 Gb SR-Lite MMF SFP28 Module Specifications

The SR-Lite MMF SFP28 module conforms to the 802.3 25GBASE-SR standard.

This module is a Class 1 laser device.

The following table lists specifications for the SR-Lite SFP28 module.

Table 39: 25 Gb SR-Lite MMF SFP28 Module Specifications

Parameter	Minimum	Maximum
Transmitter		
Average launch power	-8.4 dBm	2.4 dBm
Center wavelength		850 nm
Receiver		
Average receive power (max)	-10.3 dBm	2.4 dBm
Operating wavelength		850 nm
Operating Distance		
OM3 MMF fiber	0.5 m	70 m RS-FEC 50 m with Base-R FEC 30 m with no FEC
OM4 MMF fiber	0.5 m	100 m RS-FEC 70 m with Base-R FEC 40 m with no FEC
Forward Error Correction on Host Switch	IEEE 802.3 Clause 108/Clause 91 RS-FEC IEEE 802.3 Clause 74 Base-R/Firecode FEC Optional no FEC operation	

25 Gb ESR MMF (Multimode Fiber) SFP28 Module

Part number: 10503

The ESR SFP28 module provides a 25 Gb optical connection using an LC duplex optical connector over one pair of OM3 or OM4 multimode fibers.

One data lane operates in each direction, at 25 Gbps up to 200 meters using OM3 fiber or up to 300 meters using OM4 fiber.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

25 Gb ESR SFP28 Module Specifications

The 25 Gb ESR SFP28 module conforms to the 802.3 25GBASE-SR standard.

This module is a Class 1 laser device.

The following table lists specifications for the 25 Gb ESR SFP28 module.

Table 40: 25 Gb ESR SFP28 Module Specifications

Parameter	Minimum	Maximum
Transmitter		
Average launch power	-8.4 dBm	2.4 dBm
Center wavelength	850 nm	
Receiver		
Average receive power (max)	-11.9 dBm	3.0 dBm
Operating wavelength	850 nm	
Operating Range		
OM3 fiber	0.5 m	200 m RS-FEC
OM4 fiber	0.5 m	300 m RS-FEC
Forward Error Correction on Host Switch	IEEE 802.3 Clause 108/Clause 91 RS-FEC	

25 Gb LR 10 km SFP28 Module

Part numbers: 10504, 25G-LR-SFP10KM

The LR SFP28 module provides a 25 Gb optical Ethernet connection using LC duplex optical connectors over SMF (single-mode fiber).

One data lane operates in each direction, at 25.78 Gbps using single-mode fiber.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

25 Gb LR SFP28 Module Specifications

The LR SFP28 module conforms to the 802.3 25GBASE-LR standard.

The following table lists specifications for the 25 Gb LR SFP28 module. The specifications listed are for part 10504. Specifications for other parts are substantially similar but might not be identical.

Table 41: 25 Gb LR SFP28 Specifications

Parameter	Minimum	Maximum
Transmitter		
Average launch power	-6.5 dBm	2.5 dBm
Center wavelength	1310 nm	
Receiver		
Average receive power, each lane	-11.3 dBm	2.5 dBm
Link		
Operating distance: SMF (single-mode fiber)	2 m	10 km
Forward Error Correction on Host Switch	No FEC Required	

Installing and Removing an SFP28 Module

To install, replace, or remove an SFP28 module, follow the instructions in Installing and Removing an SFP, SFP+, or SFP28 Module on page 35.

Extreme Networks 40 Gb QSFP+ Modules

Extreme Networks switches support the use of 4 x 10 Gb QSFP+ pluggable optical modules. These modules provide four 10-gigabit transmit and receive channels in a single module, for an aggregate bandwidth of 40 Gbps. QSFP+ modules are used in ExtremeSwitching, Summit, and BlackDiamond switches.
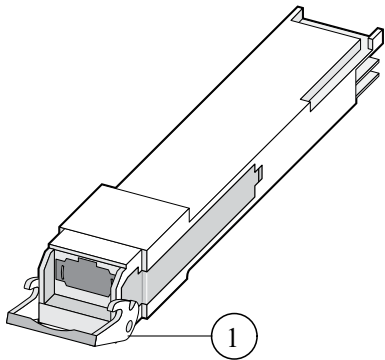
Figure 4: QSFP+ Optical Module (Release Handle)

You can insert or remove QSFP+ modules without powering down the system.

The information in this guide about hardware platform support for QSFP+ modules is current as of the date this guide was published. Support for QSFP+ modules might have been added to other switches or I/O modules besides those listed in this guide.

For current information about hardware support and the minimum required software for QSFP+ modules, refer to the most recent version of the Extreme Optics website.

40 Gb SR4 QSFP+ Module

Part numbers: 10319, 40G-SR4-QSFP150M, 40G-SR4-QSFP150M-NT, AA1404005-E6

The SR4 QSFP+ module provides a 40 Gb optical connection using MTP® (MPO) optical connectors over four pairs of parallel multimode fiber. The SR4 QSFP+ module is compatible with OM3 or OM4 MMF female MTP/MPO 8- or 12-fiber cables.

This optical module integrates four data lanes in each direction with 40 Gbps aggregate bandwidth. Each lane can operate at 10.3125 Gbps up to 100 meters using OM3 fiber or up to 150 meters using OM4 fiber. The SR4 QSFP+ module conforms to the 802.3ba D3.2 (40GBASE-SR4) standard.

For a complete listing of compatible cables and optical transceivers, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

40 Gb SR4 QSFP+ Module Specifications

The 40 Gb SR4 QSFP+ module conforms to the 802.3ba D3.2 (40GBASE-SR4) standard.

This module is a Class 1M laser device.

The following table lists specifications for the 40 Gb SR4 QSFP+ module. The specifications listed are for part 10319. Specifications for other parts are substantially similar but might not be identical.

Table 42: 40 Gb SR4 QSFP+ Module Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power, each lane	-7.6 dBm	NA	2.4 dBm
Center wavelength	840 nm	850 nm	860 nm
Receiver			
Stressed receiver sensitivity in OMA, each lane	NA	NA	-5.4 dBm
Average receive power (max), each lane	-9.5 dBm	NA	2.4 dBm
Operating wavelength	840 nm	850 nm	860 nm
Other Specifications			
Link power budget	1.9 dB	NA	10 dB

Table 42: 40 Gb SR4 QSFP+ Module Specifications (continued)

Parameter	Minimum	Typical	Maximum
Operating distance range: OM3 fiber	NA	NA	100 m
Operating distance range: OM4 fiber	NA	NA	150 m

40 Gb ESR4 QSFP+ Module

Part numbers: 40GB-ESR4-QSFP, AA1404006-E6

The ESR4 extended range QSFP+ module provides a 40 Gb optical connection using MTP® (MPO) optical connectors over four pairs of parallel multimode fiber.The ESR4 QSFP+ module is compatible with OM3 or OM4 MMF female MTP/MPO 8- or 12-fiber cables.

This optical module integrates four data lanes in each direction with 40 Gbps aggregate bandwidth. Each lane operates at 10.3125 Gbps up to 300 meters using OM3 fiber or up to 400 meters using OM4 fiber. The ESR4 extended range 40Gb QSFP+ transceiver is interoperable with standard 40GBASE-SR4 interfaces within the supported range of the 40Gb SR4 interface. The ESR4 extended range QSFP+ transceiver is also compatible with any 10GBASE-SR interface, when used in 10Gb Ethernet breakout mode, up to 300 meters using OM3 fiber or up to 400 meters using OM4 fiber.

For a complete listing of compatible cables and optical transceivers, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

40 Gb SR4 QSFP+ Module Specifications

The following table lists specifications for the 40 Gb ESR4 QSFP+ module

Table 43: 40 Gb ESR4 QSFP+ Module Specifications

Parameter	Minimum	Typical	Maximum
Line rate	NA	NA	10.3125 Gbps
Operating distance	NA	NA	300 m (OM3 fiber) 400 m (OM4 fiber)
Transmitter			
Average launch power, each lane	-7.6 dBm	NA	2.4 dBm
Optical modulation amplitude (OMA), each lane	-5.6 dBm	NA	3 dBm

Table 43: 40 Gb ESR4 QSFP+ Module Specifications (continued)

Parameter	Minimum	Typical	Maximum
Center wavelength	840 nm	850 nm	860 nm
Receiver			
Average receive power (max), each lane	-9.9 dBm	NA	2.4 dBm
Optical modulation amplitude (OMA), each lane	-7.5 dBm	NA	3 dBm
Operating wavelength	840 nm	850 nm	860 nm

40 Gb LM4 QSFP+ Module

Part number: 10334

The LM4 QSFP+ module (10334) provides a 40 Gb optical connection on a duplex single pair of fibers using single-mode fiber or multimode fiber. It is a cost-effective option for transferring data reliably up to 1 kilometer using single-mode fiber, up to 160 meters using optical multimode fiber (OM4), or up to 140 meters using optical multimode fiber (OM3).

For a complete listing of compatible cables and optical transceivers, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

40 Gb LM4 QSFP+ Module Specifications

The following table lists specifications for the 40 Gb LM4 QSFP+ module.

Table 44: 40 Gb LM4 QSFP+ Specifications

Parameter	Minimum	Maximum
Transmitter		
Average launch power, each lane: MMF	-7.0 dBm	4.3 dBm
Average launch power, each lane: SMF	-10.0 dBm	2.3 dBm
Center wavelength	1264.5 nm	1277.5 nm
	1284.5 nm	1297.5 nm
	1304.5 nm	1317.5 nm
	1324.5 nm	1337.5 nm
Receiver		
Stressed receiver sensitivity in OMA, each lane		-11.5 dBm
Average receive power each lane: MMF	-10.0 dBm	4.3 dBm

Table 44: 40 Gb LM4 QSFP+ Specifications (continued)

Parameter	Minimum	Maximum
Average receive power each lane: SMF	-13.7 dBm	2.3 dBm
Operating wavelength	1264.5 nm	1277.5 nm
	1284.5 nm	1297.5 nm
	1304.5 nm	1317.5nm
	1324.5 nm	1337.5 nm
FOO		
Operating distance: SMF (single-mode fiber)	NA	1 km
Operating distance: MMF OM4	NA	160 m
Operating distance: MMF OM3	NA	140 m

40 Gb LM4 MMF (Multimode Fiber) QSFP+ Module

Part number: AA1404002-E6

This transceiver operates up to 80 meters on 50 µm MMF cable plant and is compliant with channel insertion loss specified in IEEE standard 802.3-2012, Table 52-10, for 2000 (OM3) or 4700 MHz*km (OM4) 50 µm multimode fiber.

> **Note**
> Channel insertion loss includes connectors.

The 40GBASE-LM4 QSFP+ transceiver supports a link configuration of a backbone cable between patch panels with one jumper from the transceiver to the patch panel at each end. All ends support duplex LC connectors. Connector return loss requirement is 20 dB or greater (reflectance –20 dB or less).

Other 10GBASE-S transceivers and link parameters do not apply, as the LM4 operates in the 1310 nm region. The 40GBASE-LM4 QSFP+ transceiver contains four transmitters where the signal is internally multiplexed to the Tx port and contains four receivers where the signal is internally demultiplexed at the Rx port.

The 40GBASE-LM4 QSFP+ transceiver replaces a 40GBASE-SR4 QSFP+ transceiver for applications up to 80 meters. The transceiver uses one pair of MMF fibers and a duplex LC connector versus the eight fibers with MPO/MTP connectors that are used with the 40GBASE-SR4 QSFP+ transceiver. The transceiver is not interoperable with 40GBASE-SR4 or 10GBASE-SR transceivers.

For a complete listing of compatible cables and optical transceivers, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

40 Gb LM4 MMF QSFP+ Module Specifications

The following table lists the overall specifications along with the transmitter, cable plant, and receiver specifications for the 40GBASE LM4 MMF QSFP+ transceiver.

Table 45: 40 Gb LM4 MMF QSFP+ Specifications

Parameter	Specification
Data rate (nominal)	4 X 10 Gbps
Nominal transmitter center wavelengths	1271, 1291, 1311, 1331
Link distance (OM3 and OM4)	Up to 80 m maximum
Operating temperature range	0°C to 70°C
Transmitter	
Maximum total average launch power	10.3 dBm
Maximum average launch power, each lane	4.3 dBm
Maximum average launch power of OFF transmitter	-30 dBm
Maximum optical return loss tolerance	20 dB
Receiver	
Maximum average receive power, each lane	4.3 dBm
Maximum input optical power	Tolerates direct Tx to Rx connection
Stressed receiver sensitivity	-5.0 dBm
Applicable Cable Plant	
Maximum insertion loss, including connectors	2.6 dB (OM3) or 2.9 dB (OM4)
Minimum optical return loss	20 dB
Maximum link distance	80 m

40 Gb LR4 QSFP+ Module

Part numbers: 10320, 40GB-LR4-QSFP, AA1404001-E6

The LR4 QSFP+ module provides a 40 Gb optical connection using LC optical connectors. This optical module integrates four data lanes on separate CWDM wavelengths in each direction for 40 Gbps aggregate bandwidth. Each lane operates at 10.3125 Gbps up to 10 km using single-mode fiber.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

40 Gb LR4 QSFP+ Module Specifications

The 40 Gb LR4 QSFP+ module conforms to the 802.3ba (40GBASE-LR4) standard.

The following table lists specifications for the 40 Gb LR4 QSFP+ module.

Table 46: 40 Gb LR4 QSFP+ Specifications

Parameter	Minimum	Maximum
Transmitter		
Average launch power, each lane	-7.0 dBm	2.3 dBm
Center wavelength	1264.5 nm	1277.5 nm
	1284.5 nm	1297.5 nm
	1304.5 nm	1317.5 nm
	1324.5 nm	1337.5 nm
Receiver		
Stressed receiver sensitivity in OMA, each lane	NA	-11.5 dBm
Average receive power each lane	2.3 dBm	-13.7 dBm
Operating wavelength	1264.5 nm	1277.5 nm
	1284.5 nm	1297.5 nm
	1304.5 nm	1317.5nm
	1324.5 nm	1337.5 nm
Link		
Link power budget	NA	6.7 dB
Operating distance: SMF (single-mode fiber)	NA	10 km

40 Gb LR4 PSM (Parallel Single-Mode) QSFP+ Module

Part number: 10326

The 40 Gb QSFP+ PSM transceiver (10326) supports up to 10 km over single-mode fiber using an 8 parallel fiber MPO interface. Each fiber pair can be broken out to a 10 Gb Ethernet connection, compatible with up to four 10GBASE-LR interfaces. The MPO to 4xLC SMF patch cord (10327) can be used to break out the 4-fiber pair of the MPO parallel connector to four separate fiber pairs.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

40 Gb LR4 PSM QSFP+ Module Specifications

The following table lists specifications for the 40 Gb LR4 PSM QSFP+ module.

Table 47: 40 Gb LR4 PSM QSFP+ Specifications

Parameter	Value
Transmitter	
Power	1.5 dBm (maximum) -6 dBm (minimum)
Center wavelength	1310 nm
Receiver	
Receiver sensitivity	2.3 dBm (maximum) -12.7 dBm (minimum)
Wavelength	1355 nm (maximum) 1260 nm (minimum)
Operating distance (nominal)	10 km
Connector	MPO/MTP 8 fiber
Fiber type	SMF (single-mode fiber)

For 10 Gb breakout, the MPO to 4xLC duplex connectors SMF fanout patch cord (10327) can be used with the 40 Gb LR4 PSM QSFP+ module.

40 Gb ER4 QSFP+ Module

Part numbers: 10335, AA1404003-E6

The ER4 QSFP+ module provides a 40 Gb optical connection using LC optical connectors. This optical module integrates four data lanes in each direction with 40 Gbps aggregate bandwidth. Each lane can operate at 10.3125 Gbps up to 40 km using single-mode fiber.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

40 Gb ER4 QSFP+ Module Specifications

The following table lists specifications for the ER4 QSFP+ module.

Table 48: 40 Gb ER4 QSFP+ Specifications

Parameter	Minimum	Maximum
Transmitter		
Average launch power, each lane	-2.7dBm	4.5 dBm
Center wavelength	1264.5 nm	1277.5 nm
	1284.5 nm	1297.5 nm
	1304.5 nm	1317.5 nm
	1324.5 nm	1337.5 nm
Receiver		
Average receive power each lane	-21.2 dBm	-4.5 dBm
Operating wavelength	1264.5 nm	1277.5 nm
	1284.5 nm	1297.5 nm
	1304.5 nm	1317.5nm
	1324.5 nm	1337.5 nm
Link		
Operating distance: SMF (nominal on single-mode fiber)	NA	40 km

> **Note**
> Minimum 9dB attenuation recommended for optical path.

40 Gb Bidirectional MMF (Multimode Fiber) QSFP+ Module

Part number: 10329

The Bidirectional QSFP+ module provides 40 Gb connections over a single pair of MMF cables (OM3/OM4), using bidirectional optical connections on each fiber. Each fiber carries bidirectional 20 Gb data channels at distances up to 100 meters.

Only single 40 Gb Ethernet channels are supported. Four-by-10 Gb Ethernet channel breakout is not supported with this module. Duplex LC connectors are used on the transceiver.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

40 Gb Bidirectional MMF QSFP+ Module Specifications

The following table lists specifications for the Bidirectional MMF QSFP+ module.

Table 49: 40 Gb Bidirectional MMF QSFP+ Specifications

Parameter	Value
Transmitter	
Average launch power, each lane	5 dBm (maximum) -4 dBm (minimum)
Center wavelength: Tx1	850 nm
Center wavelength: Tx2	900 nm
Receiver	
Average receive power each lane	5 dBm (maximum) -7 dBm (minimum)
Operating wavelength: Rx1	900 nm
Operating wavelength: Rx2	850 nm
Link	
Link power budget	3 dB
Operating distance: OM3 / OM4 MMF	100 m
Connection	Duplex LC

Installing a QSFP+ or QSFP28 Module

You can install or remove QSFP modules in your switch without powering off the system.

> ⚠️ **Warning**
> QSFP modules contain Class 1M lasers. Invisible laser radiation can occur when laser connections are unplugged. Do not stare into the beam. This device is compliant with IEC 60825-1 Amendment 2 and CFR21Section 1040.

1. Remove the QSFP module from its antistatic container and remove the dust covers from the module optical connector.

   If your module has a protective pad covering the card-edge connector, remove it. Store the antistatic container, dust covers, and card-edge connector protective pad in a clean location from which they can be easily retrieved if you need to uninstall the module.

2. Remove any rubber dust covers from the port where you are installing the QSFP module.

3. Holding the QSFP module by its sides, insert the QSFP module into the port on the switch or module (see Figure 5).
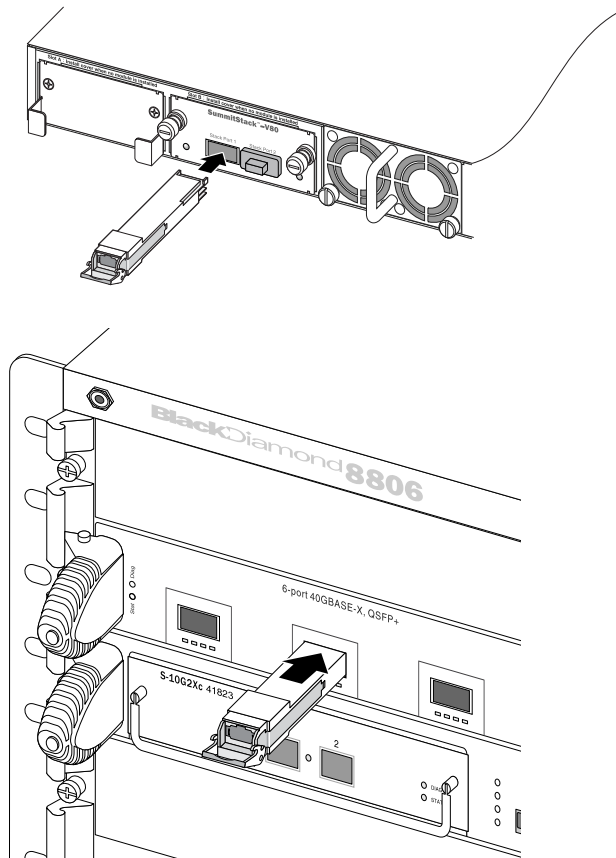
Figure 5: Installing a QSFP Module (ExtremeSwitching, Summit, and 8000 Series Switches)

4. Slide the QSFP module into the port until you hear it click into place.
5. Push up on the handle to secure the QSFP module in the switch (see Figure 6).
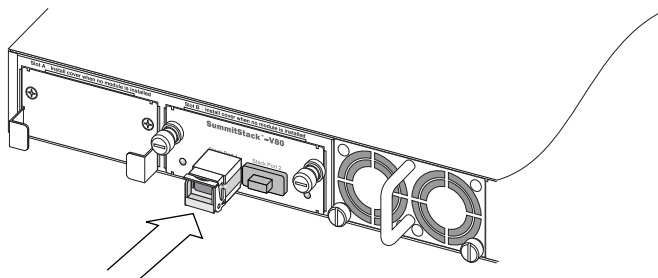
Figure 6: Installed QSFP Module

If you are installing only one QSFP module, make sure that all unoccupied ports are covered with a rubber dust cover, which is shipped with the Summit option card or BlackDiamond I/O module.

Removing a QSFP+ or QSFP28 Module

You can remove a QSFP module from your Extreme Networks switch without powering off the system.

> **Note**
> Disconnect fiber-optic cable from a QSFP module before removing the QSFP module from the port.

1. Rotate the handle (bail latch) on the QSFP module downward (see Figure 7).
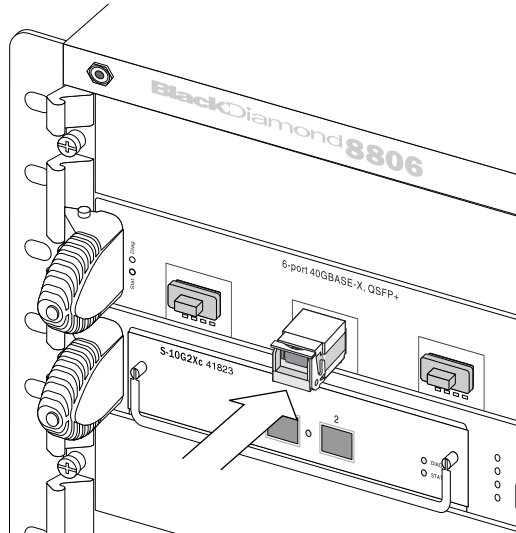
Figure 7: Removing a QSFP Module

2. Pull the connector out of the port.

Extreme Networks 100 Gb QSFP28 Modules

Some Extreme Networks switches support the use of 100 Gb QSFP28 pluggable optical modules. These modules provide four 25-gigabit transmit and receive channels in a single module, for an aggregate bandwidth of 100 Gbps.
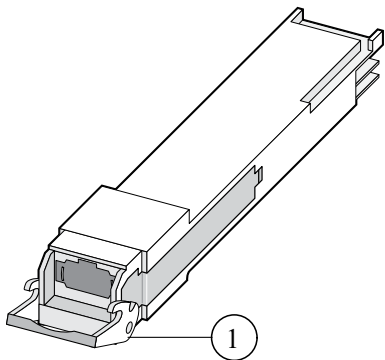
Figure 8: QSFP28 Optical Module (Release Handle)

You can insert or remove QSFP28 modules without powering down the system.

The following types of optical QSFP28 interfaces are described in this guide:

- 100 Gb SR4 MMF (Multimode Fiber) QSFP28 Module on page 71
- 100 Gb LR4 10 km QSFP28 Module on page 72
- 100 Gb CWDM4 2 km SMF QSFP28 Module on page 75

The information in this guide about hardware platform support for QSFP28 modules is current as of the date this guide was published. Support for QSFP28 modules might have been added to other switches or I/O modules besides those listed in this guide.

For current information about hardware support and the minimum required software for QSFP28 modules, refer to the most recent version of the Extreme Optics website.

100 Gb SR4 MMF (Multimode Fiber) QSFP28 Module

Part number: 10401, AA1405005-E6

The SR4 MMF QSFP28 module provides a 100 Gb optical connection using MTP® (MPO) optical connectors over four pairs of parallel multimode fiber. The SR4 MMF QSFP28 module is compatible with OM3 or OM4 MMF female MTP/MPO 8- or 12-fiber cables.

This optical module integrates four data lanes in each direction with 100 Gbps aggregate bandwidth. Each lane can operate at 25 Gbps up to 70 meters using OM3 fiber or up to 100 meters using OM4 fiber.

The 100 Gb SR4 QSFP28 transceiver is compatible with the MPO 8 parallel fiber to 4 x 4 LC duplex connectors, OM3 5-meter multimode patch cord (9380014-5M).

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

100 Gb SR4 MMF QSFP28 Module Specifications

The SR4 MMF QSFP28 module conforms to the 802.3bm-2015 (100GBASE-SR4) standard.

This module is a Class 1 laser device.

The following table lists specifications for the SR4 QSFP28 module.

Table 50: 100 Gb SR4 MMF QSFP28 Module Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power, each lane	-8.4 dBm	NA	2.4 dBm

Table 50: 100 Gb SR4 MMF QSFP28 Module Specifications (continued)

Parameter	Minimum	Typical	Maximum
Center wavelength	840 nm	850 nm	860 nm
Receiver			
Average receive power (max), each lane	-10.3 dBm	NA	2.4 dBm
Operating wavelength	840 nm	850 nm	860 nm
Operating Distance Range			
OM3 fiber	0.5 m	NA	70 m
OM4 fiber	0.5 m	NA	100 m

100 Gb LR4 10 km QSFP28 Module

Part numbers: 10403, 100G-LR4-QSFP2KM, AA1405001-E6

The LR4 QSPF28 module provides a 100 Gb optical Ethernet connection using LC duplex optical connectors over SMF (single-mode fiber).

This optical module integrates four data lanes on separate WDM (wave division multiplexed) wavelengths in each direction for 100 Gbps aggregate bandwidth. Each lane operates at 25.78 Gbps using single-mode fiber.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

100 Gb LR4 QSFP28 Module Specifications

The LR4 QSFP28 module conforms to the 802.3ba 100GBASE-LR4 standard.

The following table lists specifications for the 100 Gb LR4 QSFP28 module. The specifications listed are for part 10403. Specifications for other parts are substantially similar but might not be identical.

Table 51: 100 Gb LR4 QSFP28 Specifications

Parameter	Minimum	Maximum
Transmitter		
Average launch power, each lane	-4.3 dBm	4.5 dBm
Center wavelength	1294.53 nm	1296.59 nm
	1299.02 nm	1301.09 nm
	1303.54 nm	1305.63 nm

Table 51: 100 Gb LR4 QSFP28 Specifications (continued)

Parameter	Minimum	Maximum
	1308.09 nm	1310.19 nm
Receiver		
Average receive power, each lane	-10.6 dBm	4.5 dBm
Operating wavelength	1294.53 nm	1296.59 nm
	1299.02 nm	1301.09 nm
	1303.54 nm	1305.63 nm
	1308.09 nm	1310.19 nm
Link		
Operating distance: SMF (single-mode fiber)	2 m	10 km

100 Gb ER4 Lite 40 km QSFP28 Module

Part number: 100G-ER4LT-QSFP40KM

The ER4-Lite QSPF28 module provides a 100 Gb optical Ethernet connection over SMF (single-mode fiber), at distances up to 40 km.

LAN-WDM optics transmit the 100 Gigabit Ethernet (100G) signal over duplex single-mode fibers multiplexing/demultiplexing four 25G wavelengths within the transceiver. Transmission over 30 km links does not require Forward Error Correction (FEC), while FEC enabled on the hosts at both ends of the link is required for up to 40 km links. The 100G QSFP28 ER4-lite optic interoperates with 100G ER4 CFP and CFP2 optics over up to 30 km links.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

100 Gb ER4-Lite QSFP28 Module Specifications

The following table lists specifications for the 100 Gb ER4-Lite QSFP28 module.

Table 52: 100 Gb ER4-Lite QSFP28 Module Specifications

Form Factor	QSFP28
Aggregate Data Rate	103.1Gb/s (4 x 25.78125Gb/s)
Link Reach	30km without FEC, 40km with RS-FEC on the host
Optical Interface	4x25G LAN-WDM optical lanes (1295.6,1300.1,1304.6, 1309.1 nm)

Table 52: 100 Gb ER4-Lite QSFP28 Module Specifications (continued)

Electrical Interface	4x25G electrical lanes
Optical Receptacle	LC
Fiber Connection	Duplex Single Mode
Bail Color	Red
Operating temperature range	0-70 °C (32 to 158 °F)
Power Dissipation	Max 5.0W
Digital Diagnostic Monitors	Yes
TX Output Power per lane	Min. 0.5dBm (OMA) / -2.5dBm (average)
TDP per lane	Max 2.0dBm (OMA)
RX Overload	Max -3.5dBm (average)
RX Sensitivity	-14.8dBm (OMA) for 30km links (no FEC)
RX Sensitivity	-18.5dBm (OMA) for 40km links (with FEC)
Stressed RX Sensitivity	-13.0dBm (OMA) for 30km links (no FEC)
Stressed RX Sensitivity	-16.0dBm (OMA) for 40km links (with FEC)

100 Gb ESR4 QSFP28 Module

Part numbers: 100G-QSFP-ESR4, 100G-ESR4-QSFP300M

Description

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

100 Gb ESR4 QSFP28 Module Specifications

The following table lists specifications for the 100 Gb ESR4 QSFP28 module. The specifications listed are for part 100G-QSFP-ESR4. Specifications for other parts are substantially similar but might not be identical.

Table 53: 100 Gb ESR4 QSFP28 Module Specifications

Parameter	Value
Physical characteristics	
Operating wavelength	850 nm
Fiber type	MMF
Maximum reach	300 meters

Table 53: 100 Gb ESR4 QSFP28 Module Specifications (continued)

Parameter	Value
Standards	
IEEE standards	802.3bm
North America safety standards	UL/ CSA 60 950, CDRH Class 1
EU safety standards	EN 60 950 , EN 60 825 Class 1
Digital Optical Monitoring	Yes

100 Gb CWDM4 2 km SMF QSFP28 Module

Part numbers: 10404, 100G-CWDM4-QSFP2KM

The CWDM (coarse wavelength division multiplexing) QSFP28 module provides a 100 Gb optical connection using LC duplex optical connectors over single-mode fiber at distances up to 2 km.

This optical module integrates four data lanes on separate CWDM wavelengths in each direction for 100 Gbps aggregate bandwidth. Each lane operates at 25.78 Gbps using single-mode fiber.

Note that 100 Gb CWDM4 uses different wavelengths for the four 25 Gb data lanes than are used for 100 Gb LR4. As a result, 100 Gb CWDM4 interfaces are not compatible with 100 Gb LR4 interfaces.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

100 Gb CWDM4 QSFP28 Module Specifications

The CWDM4 QSFP28 module conforms to the 100G CWDM4 MSA 2 km Optical specification.

The following table lists specifications for the CWDM4 QSFP28 module. The specifications listed are for part 10404. Specifications for other parts are substantially similar but might not be identical.

Table 54: 100 Gb CWDM4 QSFP28 Specifications

Parameter	Minimum	Maximum
Transmitter		
Average launch power, each lane	-4.0 dBm	2.5 dBm
Center wavelength	1264.5 nm	1277.5 nm

Table 54: 100 Gb CWDM4 QSFP28 Specifications (continued)

Parameter	Minimum	Maximum
	1284.5 nm	1297.5 nm
	1304.5 nm	1317.5 nm
	1324.5 nm	1337.5 nm
Receiver		
Average receive power, each lane	-10 dBm	4.5 dBm
Operating wavelength	1264.5 nm	1277.5 nm
	1284.5 nm	1297.5 nm
	1304.5 nm	1317.5nm
	1324.5 nm	1337.5 nm
Link		
Operating distance: SMF (single-mode fiber)	2 m	2 km

100 Gb CWDM4-Lite SMF QSFP28 Module

Part number: 10450

Each CWDM4-Lite (coarse wavelength division multiplexing, 4-lane) QSFP28 module provides a 100 Gb optical connection using LC duplex optical connectors over single-mode fiber up to 500 meters.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

100 Gb CWDM4-Lite QSFP28 Module Specifications

The following table lists specifications for the CWDM4-Lite QSFP28 modules.

Table 55: 100 Gb CWDM4-Lite QSFP28 Specifications

Parameter	Value	
Operating distance (nominal)	500 meters	
Connector	Duplex LC	
Fiber type	SMF	

Table 55: 100 Gb CWDM4-Lite QSFP28 Specifications (continued)

Parameter	Value	
Case Operating Temperature	15° to 55°C **Note:** Reduced operating temperature range from conventional commercial range.	
Forward Error Correction	IEEE 802.3 Clause 91 RS-FEC required on host switch	
Transmitter		
Power per lane	-7.5 dBm (min) 2.5 dBm (max)	
Center wavelengths	1271 / 1291 / 1311 / 1331 nm	
Receiver		
Receiver sensitivity per lane	-11.0 dBm (min) 2.5 dBm (max)	
Wavelength	1264.5 nm (min) 1337.5 nm (max)	

100 Gb PSM4 (Parallel Single-Mode) QSFP28 Module

Part number: 10405

The 100 Gb QSFP28 PSM transceiver supports up to 2 km over single-mode parallel fiber using an 8 parallel fiber MPO interface. The 100Gb QSFP28 PSM transceiver has an integrated 3-meter fiber pigtail that is terminated with an 8 fiber male (with guide pins) MPO connector.

Figure 9 shows the transceiver, its integrated pigtail, and its MPO connector.
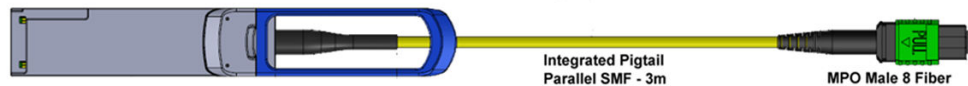
Figure 9: 100 Gb PSM4 QSFP28 Transceiver with Integrated Parallel SMF Pigtail

Patch cords, patch panels, or cassettes connecting to the 100 Gb PSM transceiver's pigtail MPO connector should have a female MPO (no guide pins) 8- or 12-SMF connector with APC polish on the MPO ferrule.

Each fiber pair can be broken out to a 25 Gb Ethernet connection, compatible with up to four 25 Gb Consortium compatible 25 Gb Ethernet interfaces for connections up to 2 km. The MPO-to-4xLC SMF fanout patch cord (10327) can be used to break out the 4-fiber pair of the MPO parallel connector to four separate fiber pairs.

> **Note**
> To connect properly, part 10327 requires a type A MPO adapter.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

100 Gb PSM4 QSFP28 Module Specifications

The following table lists specifications for the PSM4 QSFP28 module.

Table 56: 100 Gb PSM4 QSFP28 Specifications

Parameter	Value	
Operating distance (nominal)	2 km	
Connector	Integrated 3-meter pigtail terminated with an MPO 8 fiber male (with guide pins) connector	
Fiber type	8-fiber parallel SMF (single-mode fiber)	
Cabling requirement for connecting to MPO pigtail	8- or 12-fiber MPO (pin-less female) connector with 8° APC on MPO ferrule	
Transmitter		
Power per lane	-9.4 dBm (min) 2 dBm (max)	
Center wavelength	1310 nm	
Receiver		
Receiver sensitivity per lane	-12.7 dBm (min) 2 dBm (max)	
Wavelength	1295 nm (min) 1325 nm (max)	

100 Gb SWDM4 QSFP28 Module

Part numbers: 10406, 100G-SWDM4-QSFP100M

The 100 Gb QSFP28 SWDM4 (Short-wave, wave division multiplexed 4-lane) transceiver supports up to 100 meter connections on OM3 and OM4 multimode fiber using duplex fiber.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

100 Gb SWDM4 QSFP28 Module Specifications

The following table lists specifications for the SWDM4 QSFP28 module. The specifications listed are for part 10406. Specifications for other parts are substantially similar but might not be identical.

Table 57: 100 Gb SWDM4 QSFP28 Specifications

Parameter	Value	
Operating distance (nominal)	75 m OM3 100 m OM4 150 m OM5	
Connector	Duplex LC	
Fiber type	Duplex multimode fiber: OM3 / OM4 / OM5	
Forward Error Correction	IEEE 802.3 Clause 91 RS-FEC required on host switch	
Transmitter		
Power per lane	-3 dBm (min) 3.6 dBm (max)	
Center wavelengths	850 / 880 / 910 / 940 nm	
Receiver		
Receiver sensitivity per lane	-5.2 dBm (min) 3.4 dBm (max)	
Wavelengths	850 / 880 / 910 / 940 nm	

100 Gb Bidirectional LC MMF (Multimode Fiber) QSFP28 Module

Part number: 10407

The Bidirectional LC MMF (multimode fiber) QSFP28 module provides 100 Gb connections over a single pair of MMF cables (OM3/OM4), using bidirectional optical connections on each fiber. Each fiber carries bidirectional 20 Gb data channels at distances up to 100 meters.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

100 Gb Bidirectional LC MMF QSFP28 Module Specifications

The following table lists specifications for the Bidirectional LC MMF QSFP28 module.

Table 58: 100 Gb Bidirectional LC MMF QSFP28 Module Specifications

Parameter	Value
Transmitter	
Average launch power, each lane	5 dBm (maximum) -4 dBm (minimum)
Center wavelength: Tx1	850 nm
Center wavelength: Tx2	900 nm
Receiver	
Average receive power each lane	5 dBm (maximum) -7 dBm (minimum)
Operating wavelength: Rx1	900 nm
Operating wavelength: Rx2	850 nm
Link	
Link power budget	3 dB
Operating distance: OM3 / OM4 MMF	100 m
Connection	Duplex LC

Installing and Removing a QSFP28 Module

To install, replace, or remove a QSFP28 module, follow the instructions in Installing a QSFP+ or QSFP28 Module on page 67 and Removing a QSFP+ or QSFP28 Module on page 69.

Direct-Attach Cables

Direct-attach copper and fiber cables provide connections between unpopulated SFP+, SFP28, QSFP+, and QSFP28 ports.

This section describes direct-attach cables that are used with Extreme Networks optical modules.

Types of Direct-Attach Cables

Extreme Networks switches support the following types of direct-attach cables that connect to SFP or QSFP modules:

- 10 Gb SFP+ direct-attach passive cable
- 10 Gb SFP+ direct-attach active optical cable
- 25 Gb SFP28 direct-attach passive cable
- 25 Gb SFP28 direct-attach active optical cable
- 40 Gb QSFP+ direct-attach passive copper cable
- 40 Gb QSFP+ direct-attach active optical cable
- 100 Gb QSFP28 direct-attach passive copper cable
- 100 Gb QSFP28 direct-attach active optical cable

The type of device and compatible optical module determine the compatible type of direct-attach cable.

Use only Extreme Networks-certified cables, available from Extreme Networks, to make connections to the SFP or QSFP port on the switch or I/O module.

You can connect or disconnect direct-attach cables without powering down the system.

10 Gb SFP+ Direct-Attach Cables

The SFP+ direct-attach cables provide a 10 Gb copper connection between unpopulated SFP+ ports.

The cables are available in lengths from 1 meter to 20 meters. The cables are terminated in connectors that are inserted directly into the SFP+ cages in place of optical SFP+ modules.
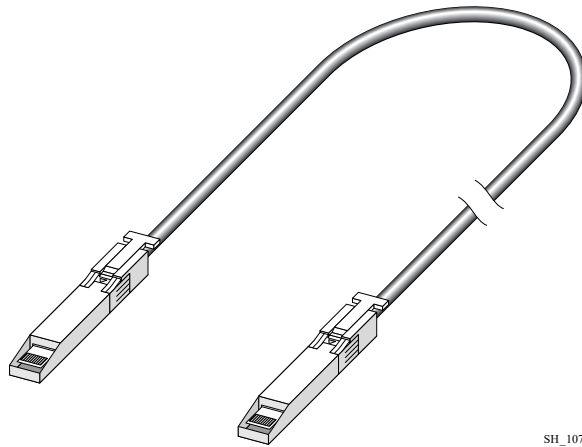
SH_107

Figure 10: SFP+ Direct-Attach Cable: Type A
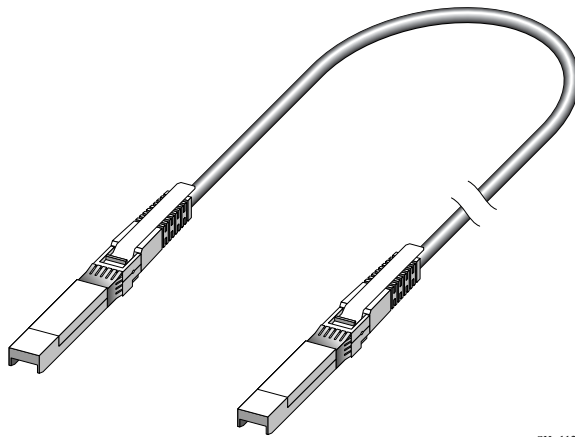
SH_112

Figure 11: SFP+ Direct-Attach Cable: Type B

Table 59 on page 82 and Table 60 on page 83 list the available 10 Gb SFP+ direct-attach cables.

Table 59: 10 Gb SFP+ Passive Copper Direct-Attach Cables

Length	Part number
1 meter	10304
	10G-SFP-TWX-P-0101
	10GB-C01-SFPP
3 meters	10305
	10G-SFP-TWX-P-0301
	10GB-C03-SFPP

Table 59: 10 Gb SFP+ Passive Copper Direct-Attach Cables (continued)

Length	Part number
5 meters	10306
	10G-SFP-TWX-P-0501
10 meters	10307
	10GB-C10-SFPP

Table 60: 10 Gb SFP+ Active Optical Direct-Attach Cables

Length	Part number
1 meter	10G-DACA-SFP1M
	10G-SFP-TWX-0101
	XEN-TWX-0111
3 meters	10G-DACA-SFP3M
	AA1403019-E6
	10G-SFP-TWX-0301
	XEN-TWX-0311
5 meters	10G-DACA-SFP5M
	AA1403020-E6
	10G-SFP-TWX-0501
	XEN-TWX-0511
7 meters	10G-SFP-AOC-0701
	10G-AOC-SFP7M
	AA1403022-E6
10 meters	10G-SFP-AOC-1001
	10G-AOC-SFP10M
	10GB-F10-SFPP
	AA1403018-E6
15 meters	AA1403021-E6
20 meters	10GB-F20-SFPP

See the Extreme Optics website for hardware compatible with 10 Gb SFP+ direct-attach cables.

Connecting an SFP+ Direct-Attach Cable

To connect an SFP+ direct-attach cable, follow these steps.

1. Holding the SFP+ connector by its sides, insert the connector into the port on the switch.

   See Figure 12 and Figure 13.
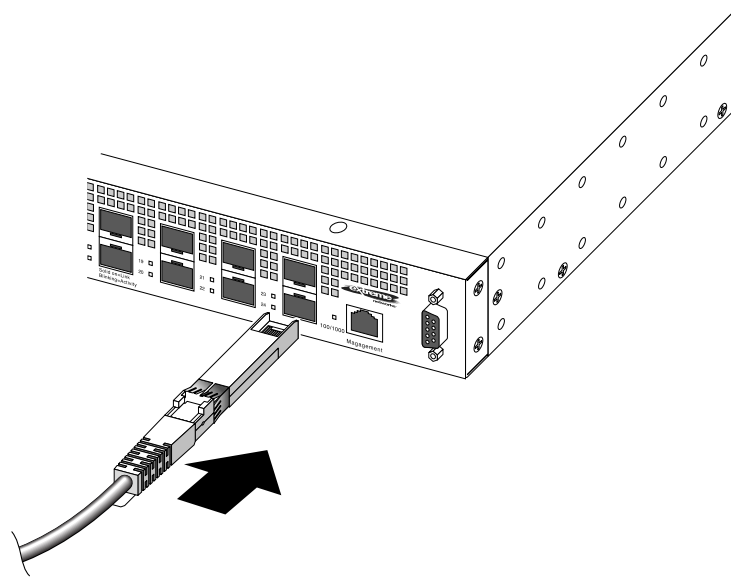
Figure 12: Connecting an SFP+ Direct-Attach Cable to a Front-Panel Port (Cable Type B shown)
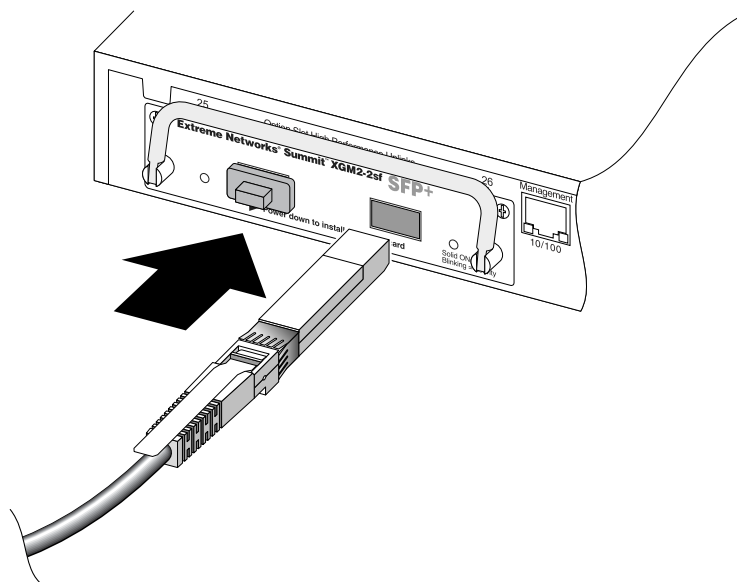
Figure 13: Connecting an SFP+ Direct-Attach Cable to an XGM2-2sf Option Card (Cable Type B shown)

2. Slide the connector into the port until you hear it click into place.

Disconnecting an SFP+ Direct-Attach Cable

To disconnect an SFP+ direct-attach cable:

1. If the cable connector is similar to cable A in Figure 10 on page 82, push the release latch toward the port on the switch.
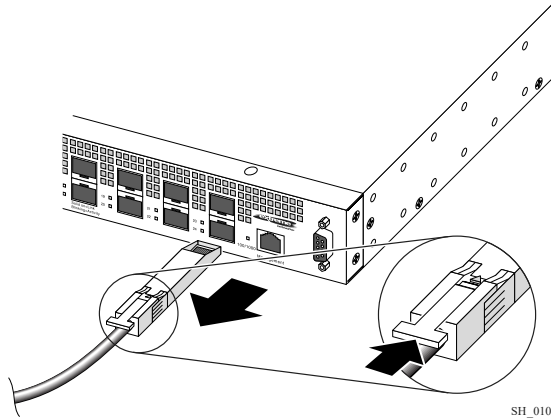
Figure 14: Disconnecting an SFP+ Direct-Attach Cable (Cable Type A)

If the connector is similar to cable B in Figure 11 on page 82, pull the tab away from the switch port.
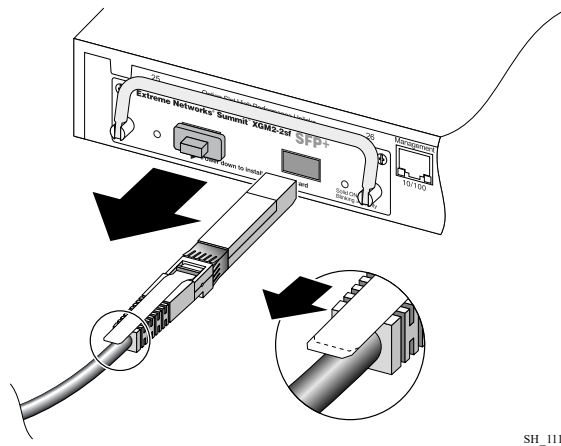
Figure 15: Disconnecting an SFP+ Direct-Attach Cable (Cable Type B)

2. Pull the connector out of the port.

25 Gb SFP28 Direct-Attach Cables

The SFP28 direct-attach cables are available to provide the following types of connections:

• Single-connection cables provide a 25 Gb bidirectional copper or optical connection between unpopulated SFP28 ports.
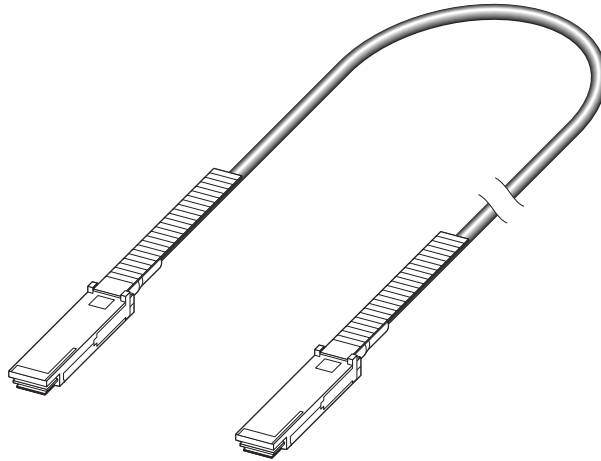
Figure 16: Passive copper cable
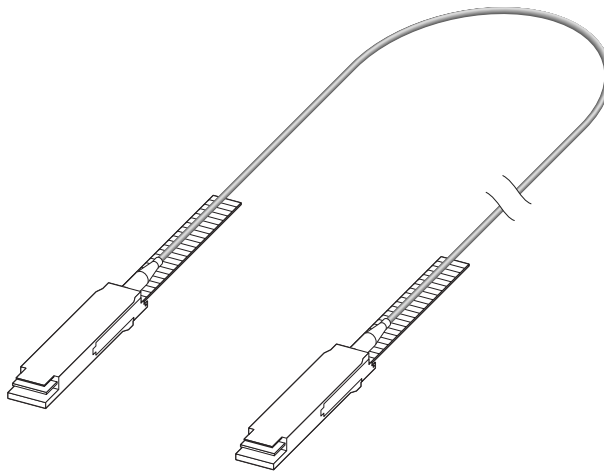
Figure 17: Active optical cable

These cables are available in lengths from 1 meter to 20 meters and are terminated in connectors that are inserted directly into the SFP., SFP+, or SFP28 cages in place of optical modules.

We recommend enabling Forward Error Correction (FEC) when you use 25 Gb SFP28 direct-attach cables.

Table 61 on page 87 and Table 62 on page 87 list the available 25 Gb SFP28 direct-attach cables.

Table 61: 25 Gb SFP28 Passive Copper Direct-Attach Cables

Length	Part number
1 meter	10520
	25G-DACP-SFP1M
	25G-SFP28-TWX-P-0101
3 meters	10521
	25G-DACP-SFP3M
	25G-SFP28-TWX-P-0301
5 meters	10522

Table 62: 25 Gb SFP28 Active Optical Direct-Attach Cables

Length	Part number
10 meters	10530
20 meters	10531

See the Extreme Optics website for hardware compatible with 25 GbSFP28 direct-attach cables.

To connect or disconnect a SFP28 direct-attach cable, refer to Connecting an SFP+ Direct-Attach Cable on page 84 and Disconnecting an SFP+ Direct-Attach Cable on page 85.

40 Gb QSFP+ Direct-Attach Cables

The 40 Gb QSFP+ direct-attach cables are available to provide the following types of connections:

- Single-connection cables provide a 40 Gb (4 x 10 Gb) bidirectional copper or optical connection between unpopulated QSFP+ ports.
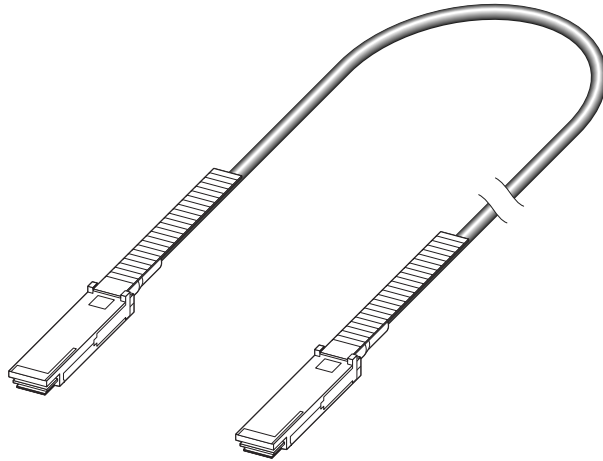
Figure 18: Passive copper cable
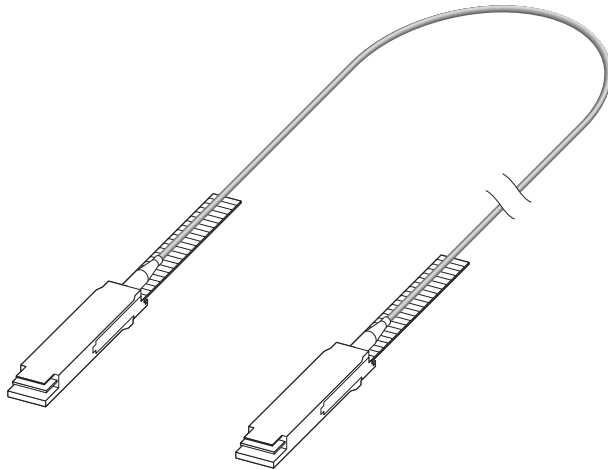
Figure 19: Active optical cable

- Fan-out (or breakout) cables provide four 10 Gb bidirectional copper connections to a single QSFP+ port.
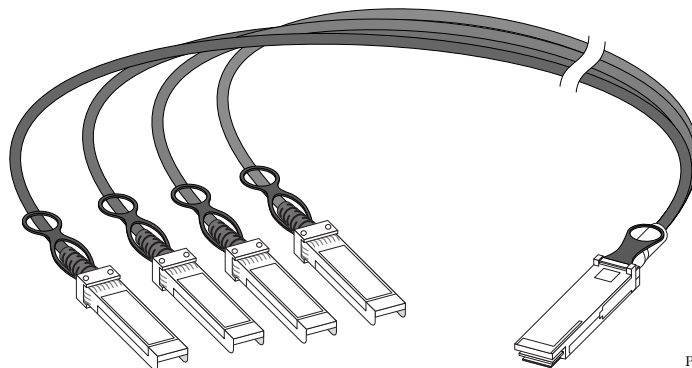
PL_008

Figure 20: QSFP+ Fan-out (Breakout) Copper Cable

These cables are available in lengths from 0.5 meter to 100 meters and are terminated in connectors that are inserted directly into the QSFP+ or SFP+ cages in place of optical modules.

The following tables list the available 40 Gb QSFP+ direct-attach cables.

Table 63: 40 Gb QSFP+ Passive Copper Direct-Attach Cables

Length	Part number
0.5 meter	10311
	40G-DACP-QSFPZ5M
	40GB-C0.5-QSFP
	AA1404037-E6
1 meter	10312
	40G-QSFP-C-0101
	40G-QSFP-QSFP-P-0101
	40GB-C01-QSFP
	40G-DACP-QSFP1M
	AA1404029-E6
2 meters	AA1404030-E6
3 meters	10313
	40G-QSFP-QSFP-P-0301
	40GB-C03-QSFP
	40G-DACP-QSFP3M
	AA1404031-E6
3 meters (26 AWG)	10313A
5 meters	10323
	40G-QSFP-QSFP-P-0501
	40G-QSFP-C-0501
	40G-DACP-QSFP5M
	AA1404032-E6
7 meters	40GB-C07-QSFP

Table 64: 40 Gb QSFP+ Direct-Attach Active Optical Cables

Length	Part number
1 meter	40G-DACA-QSFP1M
	40G-QSFP-QSFP-C-0101

Table 64: 40 Gb QSFP+ Direct-Attach Active Optical Cables (continued)

Length	Part number
3 meters	10336
	40G-AOC-QSFP3M
	40G-DACA-QSFP3M
	40G-QSFP-QSFP-C-0301
5 meters	10337
	40G-AOC-QSFP5M
	40G-DACA-QSFP5M
	40G-QSFP-QSFP-C-0501
10 meters	10315
	40G-QSFP-QSFP-AOC-1001
	40G-AOC-QSFP10M
	40GB-F10-QSFP
	AA1404028-E6
20 meters	10316
	40G-AOC-QSFP20M
	40GB-F20-QSFP
100 meters	10318
	40G-AOC-QSFP100M

Table 65: 40 Gb QSFP+ Direct-Attach Passive Copper Fan-Out Cables

Length	Part number
1 meter	10202
	40G-DACP-QSFP4SFP1M
	AA1404033-E6
2 meters	10203
	40G-DACP-QSFP4SFP2M
3 meters	10321
	40G-DACP-QSFP4SFP3M
	10GB-4-C03-QSFP
	AA1404035-E6
5 meters	10322
	40G-DACP-QSFP4SFP5M
	AA1404036-E6

Table 66: 40 Gb QSFP+ Direct-Attach Active Optical Fan-Out Cables

Length	Part number
1 meter	40G-DACA-QSFP4SFP1M
	40G-QSFP-4SFP-C-0101
3 meters	40G-DACA-QSFP4SFP3M
	40G-QSFP-4SFP-C-0301
5 meters	40G-DACA-QSFP4SFP5M
	40G-QSFP-4SFP-C-0501
10 meters	10GB-4-F10-QSFP
	40G-QSFP-4SFP-AOC-1001
	AA1404041-E6

See the Extreme Optics website for hardware compatible with 40 Gb QSFP+ direct-attach cables.

Connecting a QSFP+ or QSFP28 Direct-Attach Cable

> **Note**
> For 100-gigabit ports, only QSFP28 cables are supported .Do not attempt to insert a QSFP+ cable into a 100-gigabit port.

To connect a QSFP+ or QSFP28 cable, follow these steeps.

1. Holding the QSFP+ or QSFP28 connector by its sides, insert the connector into the port on the switch.

   See Figure 21 and Figure 22 for passive copper cable and for active optical cable.
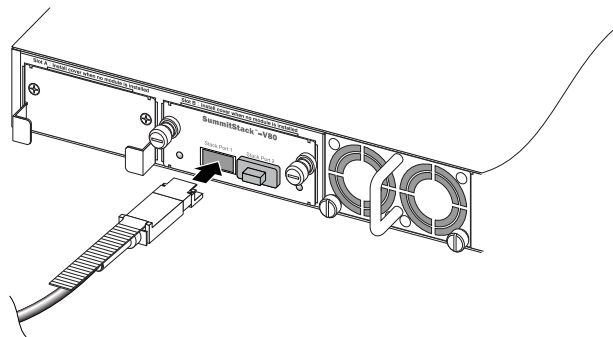
Figure 21: Connecting a Direct-Attach Cable to a SummitStack-V80 Module (Passive Copper Cable)
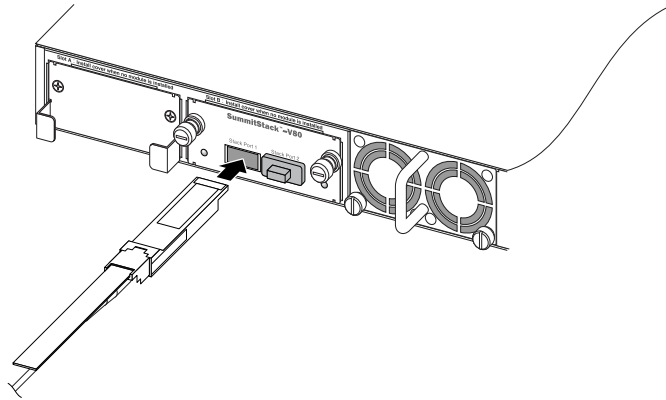
Figure 22: Connecting a Direct-Attach Cable to a SummitStack-V80 Module (Active Optical Cable)

2. Push the connector into the port until you hear it click into place.

Disconnecting a QSFP+ or QSFP28 Direct-Attach Cable

To disconnect a QSFP+ or QSFP28 cable, follow these steeps.

1. Hold the connector firmly as you pull the release tab away from the stacking port (see Figure 23).
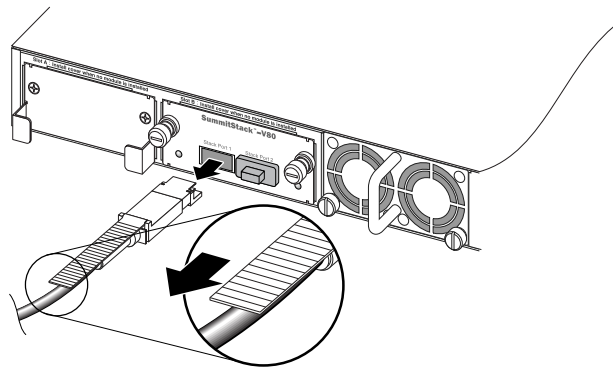
Figure 23: Disconnecting a Direct-Attach Cable (Passive Copper Cable and Active Optical Cable)

2. Pull the connector out of the port.

100 Gb QSFP28 Direct-Attach Cables

The QSFP28 direct-attach cables are available to provide the following types of connections:

• Single-connection cables provide a 100 Gb bidirectional copper or optical connection between unpopulated QSFP28 ports.
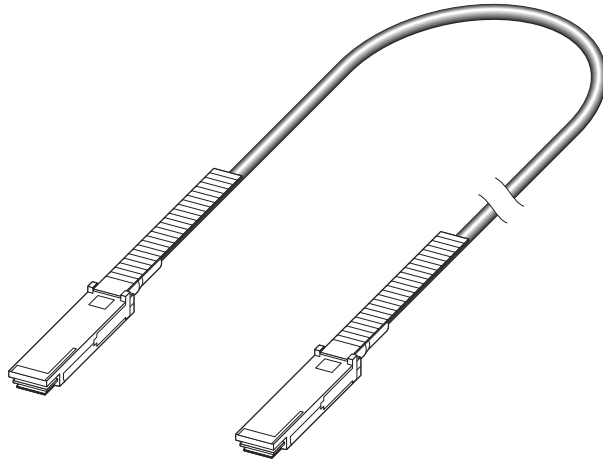
Figure 24: Passive copper cable
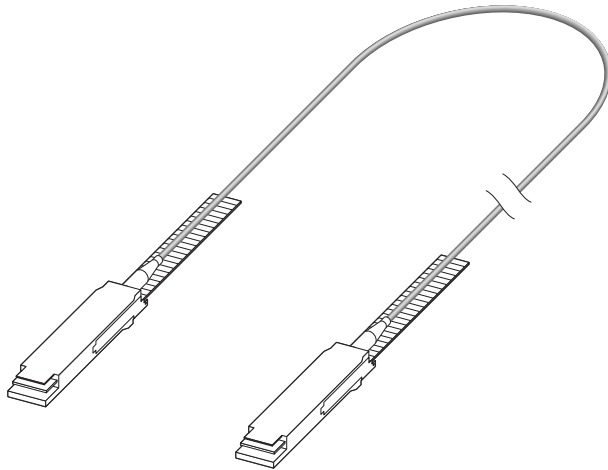
Figure 25: Active optical cable

- Fan-out (or breakout) cables provide multiple, bidirectional copper connections to a single QSFP28 port. This has the effect of partitioning the port – for example, partitioning a 100 Gb port into two QSFP28 50 Gb ports or four QSFP28 25Gb ports on a network adapter or another switch.
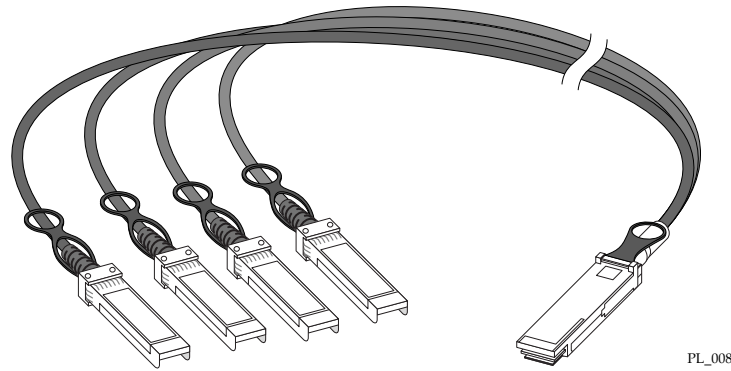
Figure 26: QSFP28 Fan-out (Breakout) Copper Cable

These cables are available in lengths from 1 meter to 20 meters and are terminated in connectors that are inserted directly into the QSFP28 or SFP28 cages in place of optical modules.

The following tables list the available 100 Gb QSFP28 direct-attach cables.

Table 67: 100 Gb QSFP28 Passive Copper Direct-Attach Cables

Length	Part number
0.5 meter	10410
1 meter	10411
	100G-DACP-QSFP1M
	100G-QSFP-QSFP-P-0101
	AA1405029-E6
3 meters	10413
	100G-DACP-QSFP3M
	100G-QSFP-QSFP-P-0301
	AA1405031-E6
5 meters	10414
	100G-DACP-QSFP5M
	100G-QSFP-QSFP-P-0501
	AA1405032-E6

Table 68: 100 Gb QSFP28-4xSFP28 Passive Copper Breakout (4x25 Gb) Cables

Length	Part number
1 meter	10421
	100G-DACP-QSFP4SFP1M
	100G-QSFP-4SFP-P-0101
3 meters	10423
	100G-DACP-QSFP4SFP3M
	100G-QSFP-4SFP-P-0301
5 meters	10424

Table 69: 100 Gb QSFP28 QSFP28-2xQSFP28 Passive Copper Breakout (2x50 Gb) Cables

Length	Part number
1 meter	10426
3 meters	10428

Table 70: 100 Gb QSFP28 Direct-Attach Active Optical Cables

Length	Part number
5 meters	10434
7 meters	10435
10 meters	10436
	100G-AOC-QSFP10M-TA
	100G-QSFP-QSFP-AOC-1001
20 meters	10437

Table 71: 100 Gb QSFP28 QSFP28-4xSFP28 Direct-Attach Active Optical Breakout (4x25 Gb) Cables

Length	Part number
5 meters	10441
7 meters	10442

Table 71: 100 Gb QSFP28 QSFP28-4xSFP28 Direct-Attach Active Optical Breakout (4x25 Gb) Cables (continued)

Length	Part number
10 meters	10443
20 meters	10444

Table 72: 100 Gb QSFP28 QSFP28-2xQSFP28 Direct-Attach Active Optical Breakout (2x50 Gb) Cables

Length	Part number
5 meters	10446
7 meters	10447
10 meters	10448
20 meters	10449

See the Extreme Optics website for hardware compatible with 100 Gb QSFP28 direct-attach cables.

To connect or disconnect a QSFP28 direct-attach cable, refer to Connecting a QSFP+ or QSFP28 Direct-Attach Cable on page 91 and Disconnecting a QSFP+ or QSFP28 Direct-Attach Cable on page 92.

Other Connector Types

This section describes connectors that enable devices with different data rates and form factors to work together.

Port Adapters

QSFP port adapters can be used to support a single 10 Gb SFP+ or 25 Gb SFP28 optical transceiver in a 40Gb QSFP+ or 100Gb QSFP28 port that has been partitioned. A single SFP+ or SFP28 transceiver is inserted into the adapter to provide a single optical interface. The single transceiver is connected to Lane 1 of the partitioned port. Lanes 2, 3, and 4 are unused.

CFP2 port adapters can be used to support a 100 Gb QSFP28 optical transceiver in a 100 Gb CFP2 port.
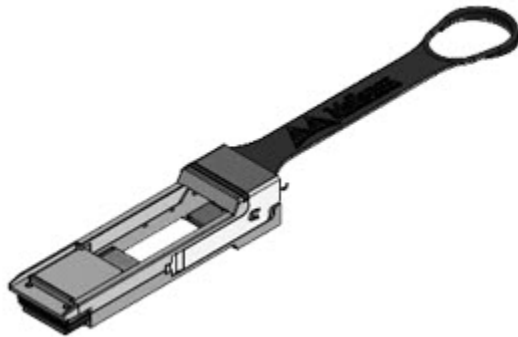
Figure 27: QSFP Port Adapter

The following table lists the available QSFP and CFP2 port adapters.

Table 73: Port Adapters

Description	Port speed	Part number	Notes
QSFP+ to SFP+ adapter	40 Gb	QSFP-SFPP-ADPT	Use in partitioned QSFP+ ports to support SFP+ optical transceivers.
QSFP28 to SFP28 adapter	100 Gb	10506	Use in partitioned QSFP28 ports to support SFP28 transceivers.
CFP2 to QSFP28 adapter	100 Gb	CFP2-TO-QSFP28-MOD	Use in CFP2 ports to support QSFP28 transceivers
CFP2 to QSFP28 adapter	100 Gb	100G-ADPT-CFP2-QSFP	Use in CFP2 ports to support QSFP28 transceivers

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Patch Cables

Optical-fiber patch cables enable connections between modules with MPO connectors and modules with 4xLC connectors.

The following table lists the available patch cables.

Table 74: Patch Cables

Description	Length	Part number	Notes
Patch-Fiber 10M MPO-4xLC SMF	10 meters	10327	MPO to 4xLC connector, single-mode (requires a type A MPO adapter)
Patch-Fiber 5M MPO-4xLC MMF	5 meters	10332	MPO to 4xLC connector, multimode
Patch-Fiber 5M MPO-4xLC MMF	5 meters	9380014-5M	MPO to 4xLC connector, multimode

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Extreme Networks XFP Modules

XFP modules are 10-gigabit modules that convert serial electrical signals to external serial optical or electrical signals.
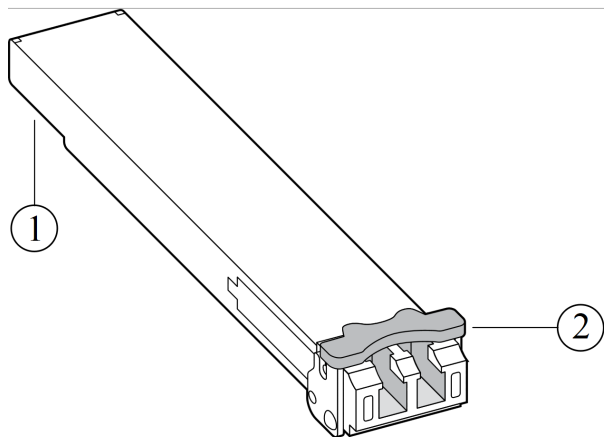
Figure 28: XFP Module

1 = Card edge connector	2 = Handle

XFP modules can be installed or replaced in an Extreme Networks switch, I/O module, or router without powering off the system. All Extreme Networks XFP modules comply with IEEE 802.3ae standards and with the latest XFP MSA (multi-source agreement).

Extreme Networks switches and modules support the following types of XFP modules. Each type has an LC duplex connector.

Table 75: XFP Module Types

Description	Part no.	Notes
ER XFP module	10124	Uses SMF cable for links up to 40 km
ZR XFP module	10125	Uses SMF cable for links up to 80 km
Tunable DWDM XFP modules	10200	Uses SMF cable for links up to 80 km

For a complete listing of hardware compatible with these modules, see the Extreme Optics website.

XFP Specifications

ER XFP Module

Part number: 10124

The following table lists the specifications for the ER XFP module.

Table 76: ER XFP Module Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	−4.7 dBm	NA	4 dBm
Center wavelength	1530 nm	NA	1565 nm
Receiver			
Average receiver power (max)	−11.8 dBm	NA	−1 dBm
Center wavelength	1260 nm	NA	1580 nm
Maximum receiver sensitivity in OMA	NA	NA	14.1 dBm
Operating distance	NA	NA	40 km

ZR XFP Module

Part number: 10125

---

† OMA=10log10[2P{(A-1)/(A+1)}], A = 10(Er/10), P = 10(Pf/10)

The following table lists the specifications for the ZR XFP module.

Table 77: ZR XFP Module Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	0.5 dBm	2 dBm	4 dBm
Center wavelength	1530 nm	1550 nm	1565 nm
Receiver			
Average receiver power (max)	NA	NA	–7 dBm
Center wavelength	NA	1550 nm	NA
Receiver sensitivity	–24 dBm	NA	NA
Operating distance	NA	NA	80 km

Tunable DWDM XFP Module (10200)

Part number: 10200

The following table lists specifications for the tunable DWDM XFP module.

Table 32 on page 47 lists the transmitter center wavelength associated with each configurable channel on the tunable DWDM module.

Table 78: Tunable DWDM XFP Module Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	–1 dBm	NA	3 dBm
Center wavelength	NA	See Table 32 on page 47	NA
Receiver			
Average receiver power (max)	NA	NA	–7 dBm
Center wavelength	1260 nm	NA	1600 nm
Receiver sensitivity	–24 dBm	NA	NA
Operating distance	NA	NA	80 km

Installing an XFP Module

You can install or remove an XFP module in your Extreme Networks switch without powering off the system.

> ⚠️ **Warning**
> XFP modules contain Class 1 lasers. Invisible laser radiation can occur when laser connections are unplugged. Do not stare into the beam. This device is compliant with FCC 21 CFR 1040.10 and EN60825-1A2:2001.

> ⚠️ **Caution**
> To prevent ESD damage to the XFP module, always use an appropriately grounded ESD-preventive wrist strap when installing or removing the module. Handle the module by its sides only. Never touch the card-edge connectors at the insertion end of the module.

1. Remove the XFP module from its antistatic container and remove the dust covers from the module optical connectors.

   If your module has a protective pad covering the card-edge connector, remove it. Store the antistatic container, dust covers, and card-edge connector protective pad in a clean location from which they can be easily retrieved if you need to uninstall the module.

2. Remove any rubber dust covers from the port where you are installing the XFP module.

   On a Summit option card, move the handle to an upright position to access the XFP ports (see Figure 29).
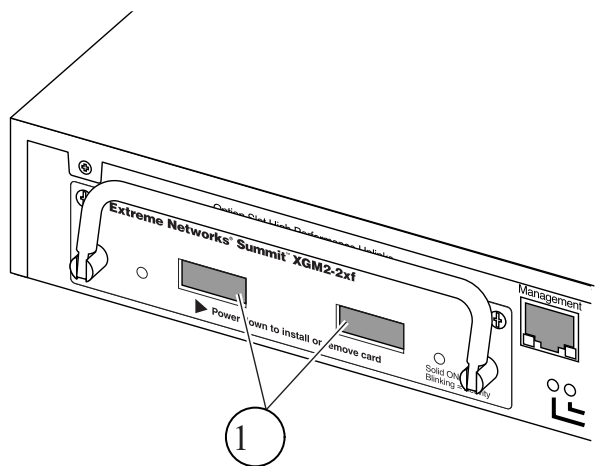
Figure 29: Accessing the XFP Ports

3. Make sure that the XFP handle (bail latch) is rotated all the way up.
4. Holding the module by its sides, partially insert the XFP module into the XFP port.

   See Figure 30 and Figure 31.
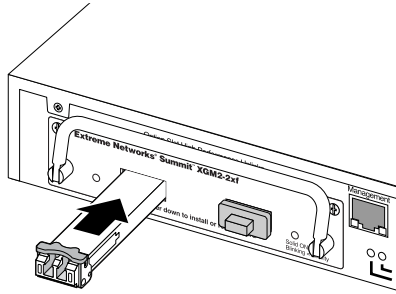
Figure 30: Installing an XFP Module (ExtremeSwitching and Summit Switches)
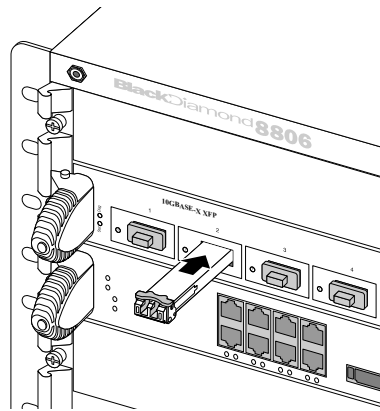
Figure 31: Installing an XFP Module (BlackDiamond 8800 series switches)

5. Slide the XFP module as far as possible into the slot until you hear it click, indicating that it is firmly attached.

   See Figure 32 and Figure 33.
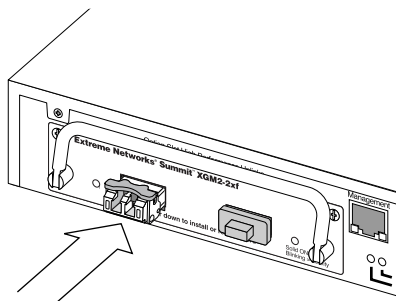
Figure 32: Installed XFP Module ExtremeSwitching and Summit Switches)
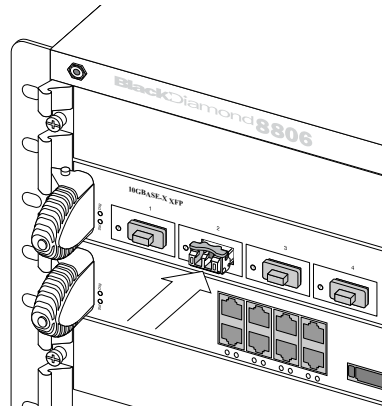
Figure 33: Installed XFP Module (ExtremeSwitching 8000 series Switches)

6. If you are installing only one XFP module, make sure that all unoccupied ports are covered with rubber dust covers, which are shipped with the option card or I/O module.

> **Note**
> To prevent permanent damage to a ZR XFP or DWDM XFP module, always check the optical input power of the receiver before inserting the fiber cable. The maximum optical input power for these XFPs is –7 dBm. If you use an optical loopback for diagnostics, the loopback requires a minimum of 15 dB optical attenuation. The recommended attenuation range is 15 to 20 dB.
>
> To ensure that your XFP module is undamaged upon installation, you can correlate factory test data with your installation site test data by consulting the average power reference values shown on the XFP module test data sheet (part no. 121080-00) enclosed with the module.

Removing an XFP Module

You can remove an XFP module from your Extreme Networks switch or I/O module without powering off the system.

The XFP module is shown in Figure 28 on page 99.

> **Note**
> Disconnect fiber-optic cable from an XFP module before removing the XFP module from the port.

1. Rotate the handle (bail latch) on the XFP module downward (see Figure 34).

2. Carefully pull the XFP module out of the port (see Figure 34).
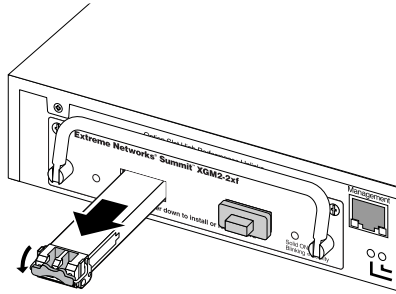
Figure 34: Removing an XFP Module

3. Place the dust covers back into the XFP module connectors.
4. Place the XFP module immediately into an antistatic container to protect it from ESD damage and dust.

Extreme Networks CFP2 Modules

Extreme Networks' CFP2 modules provide transmit and receive channels in a single pluggable optical module, for an aggregate bandwidth of 100 Gbps.

CFP2 modules are used in Extreme Networks BlackDiamond switches. Two CFP2 modules are available: SR10 and LR4. The CFP2 SR10 module can be used for distances up to 150 meters, while the CFP2 LR4 module can be used for distances up to 10 kilometers.

You can insert or remove CFP2 modules without powering down the system.

The information in this guide about hardware platform support for CFP2 modules is current as of the date this guide was published. Support for CFP2 modules might have been added to other switches or I/O modules besides those listed in this guide.

For current information about hardware support and the minimum required software for CFP2 modules, refer to the most recent version of the Extreme Optics website.

CFP2 LR4 Module

Part number: 10330

The CFP2 LR4 is an optic transceiver for 100 Gb Ethernet applications.

The module supports 100 Gigabit data rate that can reach up to 10 kilometers over standard single-mode fiber (G.652). Data is transmitted using four 25 Gigabit data lanes. The CFP2 LR4 module uses an LC connector.
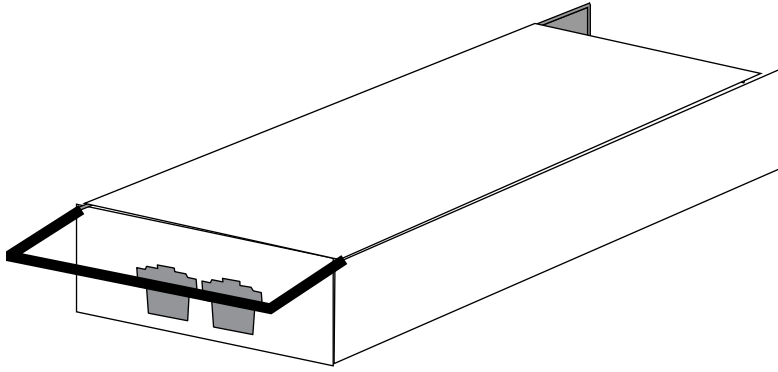
Figure 35: CFP2 LR4 Optical Module (Bail Latch Open Position)
The CFP2 LR4 module is supported in the BlackDiamond X series switch.

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

CFP2 LR4 Specifications

Extreme Networks' CFP2 optical module form factor, optical/electrical connection, and digital diagnostic interface are designed according to IEEE 802.3ba standards.

Mechanical dimensions, connecters, and footprint of the module conform to the CFP MSA CFP2 Hardware Specification Revision 1.0 July 31, 2013 standard.

This module is a Class 1M laser device.

The following table lists specifications for the CFP2 LR4 module.

Table 79: CFP2 LR4 Module Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average Output Power in OMA	-1.3 dBm	NA	4.5 dBm
Center wavelength	1295 nm	NA	1310 nm
Receiver			
Receiver sensitivity in OMA	-8.6 dBm	NA	4.5 dBm
Average receive power (max), each lane	NA	NA	4.5 dBm
Operating wavelength	1295 nm	NA	1310 nm

CFP2 SR10 Module

Part number: 10331

The CFP2 SR10 module is a 10-channel pluggable, parallel, fiber-optic transceiver for 100 Gigabit Ethernet applications.

The transceiver supports high speed serial links over multimode fiber for link distances up to 100 meters with OM3 fiber or 150 meters with OM4 fiber. With an optional break-out cable, the CFP2 SR10 module can support ten 10-gigabit data lanes. The CFP2 SR10 module uses a 24-fiber MPO fiber optic connector.
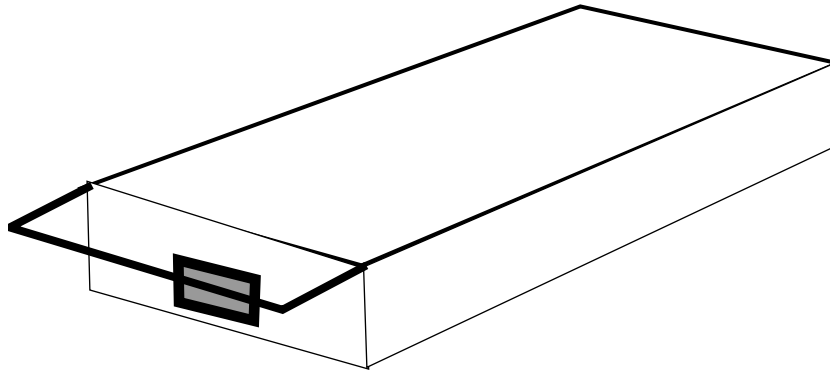
Figure 36: CFP2 SR10 Optical Module (Bail latch Open Position)

For a complete listing of hardware compatible with these modules, see the Extreme Optics Compatibility website.

Transmission distances are provided as a nominal guide only. To determine achievable distances, refer to the device's optical specifications and to the specific characteristics of your fiber installation.

CFP2 SR10 Specifications

The CFP2 SR10 module is compliant to 100 GbE specifications 802.3ba (100GBASE-SR10, CAUI and CPPI) up to 100 meters OM3 and 150 meters OM4 fiber.

Mechanical dimensions, connecters, and footprint of the module conform to the CFP MSA CFP2 Hardware Specification Revision 1.0 July 31, 2013 standard.

This module is a Class 1M laser device.

The following table lists specifications for the CFP2 SR10 module.

Table 80: CFP2 SR10 Module Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power, each lane	-6.5 dBm	NA	4.0 dBm
Center wavelength	840 nm	NA	860 nm
Receiver			
Stressed receiver sensitivity in OMA, each lane	-5.4 dBm	NA	-

Table 80: CFP2 SR10 Module Specifications (continued)

Parameter	Minimum	Typical	Maximum
Average receive power (max), each lane	-9.5 dB	NA	2.4 dBm
Operating wavelength	840 nm	NA	860 nm
Operating Distance			
OM3 fiber OM4 fiber	NA	NA	100 m 150 m

Installing a CFP2 Module

You can install or remove CFP2 modules in your switch without powering off the system.

> ⚠️ **Warning**
>
> CFP2 modules contain Class 1M lasers. Invisible laser radiation can occur when laser connections are unplugged. Do not stare into the beam. This device is compliant with IEC 60825-1 Amendment 2 and CFR21Section 1040.

1. Remove the CFP2 module from its antistatic container and remove the dust covers from the module optical connector.

   If your module has a protective pad covering the card-edge connector, remove it. Store the antistatic container, dust covers, and card-edge connector protective pad in a clean location from which they can be easily retrieved if you need to uninstall the module.

2. Remove any rubber dust covers from the port where you are installing the CFP2 module.

3. Holding the CFP2 module by its sides, insert the CFP2 module into the port on the switch or module. The latch handle should be in the open position, with the handle up.
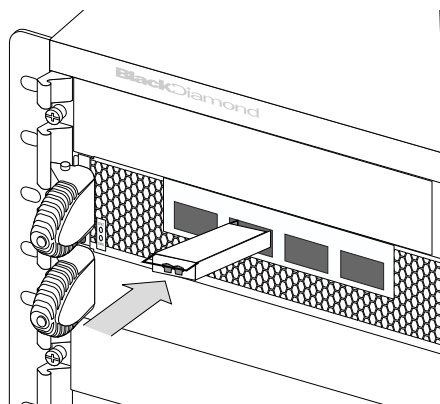
Figure 37: Installing a CFP2 Module (CFP2 LR4 module shown)

4. Slide the CFP2 module into the port until you hear it click into place. The front of the module should be flush against the front panel of the chassis.

5. Rotate the handle down 90 degrees to the closed position to secure the CFP2 module in the chassis. The handle should be flush against the front to the module.
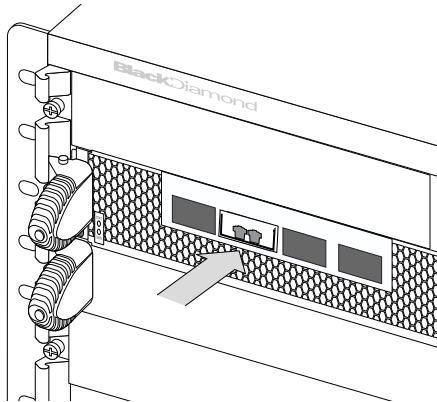
Figure 38: Installed CFP2 Module (BlackDiamond X8 series switch)

If you are installing only one CFP2 module, make sure that all unoccupied ports are covered with a rubber dust cover.

Removing a CFP2 Module

You can remove a CFP2 module from your Extreme Networks switch without powering off the system.

> **Note**
>
> Disconnect fiber-optic cable from a CFP2 module before removing the CFP2 module from the port.

1. Rotate the handle (bail latch) on the CFP2 module upward. Be sure that you rotate the bail latch up the full 90 degrees. The open position is perpendicular to the closed position.
2. Pull the connector out of the port.

Removal of Licensing Requirement for Third-Party Optical Devices

Beginning with ExtremeXOS 15.5, customers required a 3rd Party Optics Feature license to use 40G or 100G optical interfaces without restrictions.

With the following ExtremeXOS release versions, this is no longer a requirement:

- 15.5.5
- 15.6.3.1-patch1-9
- 15.7.3
- 16.1.2.14-patch1-1
- 16.2.1
- 21.1.1
- 22.1.1

Applicable Cautions and Warnings

⚠️ **Caution**

Beginning with ExtremeXOS 15.4, customers adding new unapproved third-party 40G or 100G optical interface modules to their Extreme Networks switches will receive an informational message via SNMP/Syslog. This message will indicate that they have an unapproved third-party 40G or 100G optic and that in ExtremeXOS 15.5 a third party 40G/100G feature license will be required for full functionality of the new hardware. Customers can use a feature license to remove this warning message.

⚠️ **Caution**

Beginning with ExtremeXOS 15.5, customers needed to purchase a 3rd Party Optics Feature license to achieve full functionality of new unapproved third-party 40G or 100G optical interfaces. If customers do not use the feature license for these new modules, they will receive an informational message via SNMP/Syslog. The message will indicate that they have an unapproved third-party 40G or 100G optic and that a feature license is required for full functionality of the new hardware. Using versions of ExtremeXOS 15.5 earlier than 15.5.5, customers will have 90 days to obtain the feature pack before the port's egress bandwidth is rate-limited to 25% of line rate. Use of version 15.5.5 or any of the versions listed above removes the requirement for a third party license feature pack and no restrictions on the use of the unapproved 40G or 100G transceivers will be imposed.

⚠️ **Warning**

Extreme Networks authorized and certified optical modules are tested to work in all supported Extreme Networks hardware and switching equipment. Extreme Networks does not provide any warranty or compliance statement pertaining to any third-party non-approved hardware. Use of non-approved optics modules and corresponding interface modules is solely at your own risk and without any liability, warrant, or service obligation by Extreme Networks. Extreme Networks recommends use and integration of only manufacturer-certified hardware as expressly referenced within the applicable Extreme Networks product documentation. In addition, any non-approved third-party optic modules in use by you shall be compliant with all regulatory standards as applicable to the location of operation that may include but are not limited to NRTL, FCC CFR 21 1040.10, CDRH Letter of Approval, CE marked, EN60825-1 and or GR-468.

Use of Third-Party Optical Modules

Extreme Networks optical modules are tested to work in all supported Extreme Networks switches. We recommend that all customers use Extreme Networks optical modules in their Extreme Networks switches. Extreme Networks assumes no liability for third-party optical modules. Although Extreme Networks does not block third-party optical modules, we cannot ensure that all third-party optical modules operate properly in all Extreme Networks switches. The customer assumes all risks associated with using third-party optical modules in Extreme Networks switches.

We recommend that customers purchase optical devices that have been authorized and qualified by Extreme Networks, as described on Extreme Networks' then-current price lists.

The ExtremeXOS 15.5 release created a new requirement for customers to purchase a feature license pack named *3rd Party Optics Feature*. Like other feature-pack licenses, once you apply the license to a specific switch, the feature is enabled for the life of the switch. Without such a license, switches with 40G and 100G hardware ports that are inserted with unapproved third-party optics modules will have 90 days before the

egress traffic on that particular port is automatically limited to 25% of line rate. This license requirement is removed in the ExtremeXOS versions listed above.

> **Note**
>
> The restriction is flagged by `show port conf` command output, and warning messages are issued when third-party 40G and 100G optical devices are inserted. The restriction is lifted when the 3rd Party Optics Feature license is installed.

The user of the ExtremeXOS 3rd Party Optics Feature is solely responsible for the use of optic devices that comply with applicable standards and safety requirements. The use of non-compliant optic modules may result in damage to the equipment or personal injury. Extreme Networks does not provide any warranty or compliance statement pertaining to any third party non-approved hardware, including unapproved third-party optic modules. See the applicable hardware manual for further details.

When using versions of ExtremeXOS that require a 3rd Party Optics Feature license, the ExtremeXOS 3rd Party Optics Feature has the following caveats and restrictions:

- After reading and interpreting the license information, the system maintains a flag that indicates the presence of the optics license.
- When you insert the optical transceiver after the 3rd Party Optics Feature license is installed, no further action is necessary.
- If the device is an Extreme Networks optical transceiver, no further action is necessary.
- If the optical transceiver is restricted, the system sets a flag, R.
- If the optical transceiver is restricted, the system installs an egress rate limiter of 25% associated with the port.
- If the device is restricted, the system generates a warning EMS message that indicates the restriction.
- If you remove the optical transceiver, the following conditions occur:
  ◦ The system unsets the flag that indicates a restriction in the port.
  ◦ The system removes the egress rate limiter associated with the port, or restores a configured one.
- When you enable a port, the following conditions occur:
  ◦ The system determines if the port is restricted.
  ◦ The system generates a warning message to a console with restricted ports.
  ◦ The system generates a warning EMS message that indicates a restriction.
- When you enable a license, the system reads and interprets the new license information. If it determines the optics license is now active, and it was not active before, the following conditions occur:
  ◦ Sets the "optics license present" flag.
  ◦ Searches the port list for restricted ports.
  ◦ Removes the egress rate limiter associated with the port, or restores a configured one.

Safety Information

> **warning**
> Read the following safety information thoroughly before installing Extreme Networks products. Failure to follow this safety information can lead to personal injury or damage to the equipment.

Only trained and qualified service personnel (as defined in IEC 60950-1 and AS/NZS 3260) should install, replace, or perform service to Extreme Networks switches and their components. Qualified personnel have read all related installation manuals, have the technical training and experience necessary to be aware of the hazards to which they are exposed in performing a task, and are aware of measures to minimize the danger to themselves or other persons.

Fiber Optic Ports and Optical Safety

The following safety warnings apply to all optical devices used in Extreme Networks equipment that are removable or directly installed in an I/O module or chassis system. These devices include, but are not limited to, gigabit interface converters (GBICs);

SFP optical modules (mini-GBICs) and SFP+ optical modules; QSFP+ optical modules; XENPAK transceivers; and XFP laser optic modules.

> **Warning**
>
> Laser optic modules become very hot after prolonged use. Take care when removing a laser optic module from the chassis or option card. If the laser optic module is too hot to touch, disengage the laser optic module and allow it to cool before removing it completely.
>
> When working with laser optic modules, always take the precautions listed below to prevent exposure to hazardous radiation:
>
> - Never look at the transmit LED/laser through a magnifying device while it is powered on.
> - Never look directly at a fiber port on the switch or at the ends of a fiber cable when they are powered on.
> - Invisible laser radiation can occur when the connectors are open. Avoid direct eye exposure to the beam when optical connections are unplugged.
> - Never alter, modify, or change an optical device in any way other than suggested in this document.

GBIC, SFP (Mini-GBIC), SFP+, QSFP+, XENPAK, and XFP Regulatory Compliance

Extreme Networks pluggable optical modules and direct-attach cables meet the following regulatory requirements.

- Class 1 or Class 1M Laser Product
- EN60825-1:2007 2nd Ed. or later, European standard
- FCC 21 CFR Chapter 1, Subchapter J in accordance with FDA & CDRH requirements
- Application of CE Mark in accordance with 2004/108/EEC EMC Directive and the 2006/95/EC Low Voltage Directives
- UL and/or CSA registered component for North America
- 47 CFR Part 15, Class A when installed into Extreme products

Sicherheitshinweise

> **Warning**
>
> Lesen Sie die folgenden Sicherheitshinweise aufmerksam durch, ehe Sie Extreme Networks-Produkte installieren. Eine Missachtung dieser Sicherheitshinweise kann zu Verletzungen oder zu einer Beschädigung des/r Geräte/s führen.

Extreme Networks-Geräte und deren Komponenten dürfen nur durch geschulte und qualifizierte Wartungstechniker (wie in IEC 60950-1 und AS/NZS 3260 definiert) installiert, ausgetauscht oder gewartet werden.

Dieses qualifizierte Personal muss den Inhalt aller zugehörigen Installationsanleitungen kennen sowie über die technische Ausbildung und Erfahrung verfügen, um die Gefahren, die mit der Ausführung einer Aufgabe assoziiert sind, zu kennen und zu wissen, wie sie diese Gefahren für sich selbst und Dritte minimieren können.

LWL-Ports und optische Sicherheit

Folgende Sicherheitswarnung gilt für alle optischen Geräte, die in Extreme Networks-Geräten eingesetzt werden und entweder herausnehmbar sind oder direkt in einem E/A-Modul oder im Chassissystem eingebaut sind. Solche Geräte sind nicht nur Gigabit-Interface-Konverter (GBICs), steckbare Kleinformfaktormodule (SFP) (oder Mini-GBICs), QSFP+ Module, XENPAK Sendeempfänger und laseroptische XFP-Module.

> **Warning**
>
> Laseroptische Module können bei längerem Gebrauch sehr heiß werden. Seien Sie beim Ausbau eines laseroptischen Moduls aus dem Modul oder der Optionskarte äußerst vorsichtig. Wenn das laseroptische Modul zum Anfassen zu heiß ist, trennen Sie das laseroptische Modul und lassen Sie es abkühlen, ehe Sie es komplett ausbauen.
>
> Ergreifen Sie beim Arbeiten mit laseroptischen Modulen die nachfolgenden Vorsichtsmaßnahmen, um eine Aussetzung gegenüber gefährlicher Strahlung zu vermeiden.

- Blicken Sie auf keinen Fall durch ein Vergrößerungsglas in die Sendediode/den Laser, solange die Sendediode aktiv ist.
- Blicken Sie auf keinen Fall in den LWL-Port am Switch oder auf die Stirnflächen eines aktiven LWL-Kabels.
- Bei offenen Anschlüssen kann unsichtbare Laserstrahlung abgegeben werden. Vermeiden Sie eine direkte Aussetzung der Augen gegenüber dem Strahl, wenn die optischen Anschlüsse offen (ohne Stecker) sind.
- Optische Geräte dürfen auf keine andere Weise als in diesem Dokument empfohlen verändert, modifiziert oder umgebaut werden.

Konformität von GBIC, SFP (Mini-GBIC), QSFP+, XENPAK undXFP

Steckbare optische Module von Extreme Networks und direkt angeschlossene Kabel erfüllen folgende gesetzliche Vorschriften:

- Laserprodukt der Klasse 1 oder Klasse 1M
- EN60825-1:2007 2. Ausgabe oder später, Europäische Norm
- FCC 21 CFR Kapitel 1, Paragraph J in Übereinstimmung mit FDA- und CDRH-Bestimmungen
- Anwendung des CE-Zeichens gemäß der EMV-Richtlinie 2004/108/EEC und der Niederspannungsrichtlinie 2006/95/EC
- UL und/oder CSA-geprüfte Komponente für Nordamerika
- 47 CFR Teil 15, Klasse A bei Einbau in Extreme-Produkte

Customer Use of Third-Party Optics

Warning

Extreme Networks authorized and certified optical modules are tested to work in all supported Extreme Networks hardware and switching equipment. Extreme Networks does not provide any warranty or compliance statement pertaining to any third-party non-approved hardware. Use of non-approved optics modules and corresponding interface modules is solely at your own risk and without any liability, warrant, or service obligation by Extreme Networks. Extreme Networks recommends use and integration of only manufacturer-certified hardware as expressly referenced within the applicable Extreme Networks product documentation. In addition, any non-approved third-party optic modules in use by you shall be compliant with all regulatory standards as applicable to the location of operation that may include but are not limited to NRTL, FCC CFR 21 1040.10, CDRH Letter of Approval, CE marked, EN60825-1 and or GR-468.

Index

Numerics

T

technical support
    contacting 10
third-party optical modules
    use of 112
tunable DWDM SFP+
    features 46
    ITU channels 46
    specifications 46
tunable DWDM XFP
    features 99
    specifications 101

W

warnings 7
website, *see* Extreme Optics Compatibility

X

XEN-TWX-0111 83
XEN-TWX-0311 83
XEN-TWX-0511 83
XFP module
    ER XFP 100
    features 99
    installing 102
    LR XFP 100, 101
    removing 104
    tunable DWDM 101
    types 99
    ZR XFP 100

Z

ZR SFP+ module
    features 45, 46
    optical system budget 45, 46
    specifications 45, 46
ZR XFP
    features 99
    specifications 100
ZX SFP module
    features 29, 30
    optical system budget 29, 30
    specifications 29, 30