

ExtremeSwitching™

# **Installing Transceivers and Optical Components on Ethernet Routing Switch 3600 Series**

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# Chapter 1: Preface

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## Purpose

This document provides installation instructions and technical specifications for the following:

- Small form factor pluggable (SFP) transceivers
- SFP plus (SFP+) transceivers

For a list of supported transceivers, see the latest product-specific release notes. Information in the release notes takes precedence over information in this document.

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## Training

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- A description of the failure
- A description of any action(s) 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

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### About this task

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### Procedure

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4. Type your email address.
5. Type your job title.
6. Select the industry in which your company operates.
7. Confirm your geographic information is correct.
8. Select the products for which you would like to receive notifications.
9. Click **Submit**.



## Chapter 2: New in this release

There are no new feature changes in this document.

# Chapter 3: Safety and equipment care information

This chapter contains important safety and regulatory information.

Read this section before you install Small Form Factor Pluggable (SFP) and Small Form Factor Pluggable Plus (SFP+).

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## Fiber optic equipment care

Use the information in this section to properly maintain and care for fiber optic equipment.

Transceivers are static sensitive.

Dust contamination can reduce the performance of optical parts in transceivers. When you store a transceiver, or after you disconnect it from a fiber optic cable, always keep a dust cover over the optical bore.

Dispose of this product according to all national laws and regulations.

To prevent equipment damage, observe the following electrostatic discharge (ESD) precautions when you handle or install the components:

- Ground yourself and the equipment to an earth or building ground. Use a grounded workbench mat (or foam that dissipates static charge) and a grounding wrist strap. The wrist strap must touch the skin and you must ground it through a one megaohm resistor.
- Do not touch anyone who is not grounded.
- Leave all components in their ESD-safe packaging until installation, and use only a static-shielding bag for all storage, transport, and handling.
- Clear the area of synthetic materials, such as polyester, plastic, vinyl, or styrofoam because these materials carry static electricity that damages the equipment.

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## Fiber optic cable care

Although reinforcing material and plastic insulation protects the glass fiber in fiber optic cable, it is subject to damage.

Use the following precautions to avoid damaging the glass fiber:

- Do not kink, knot, or vigorously flex the cable.
- Do not bend the cable to less than a 40 mm radius.
- Do not stand on fiber optic cable; keep the cable off the floor.
- Do not pull fiber optic cable harder than you do a cable containing copper wire of comparable size.
- Do not allow a static load of more than a few pounds on a section of the cable.
- Place protective caps on fiber optic connectors that are not in use.
- Store unused fiber optic patch cables in a cabinet, on a cable rack, or flat on a shelf.

Frequent overstressing of fiber optic cable causes progressive degeneration that leads to failure.

If you suspect damage to a fiber optic cable, either due to mishandling or an abnormally high error rate observed in one direction, reverse the cable pairs. If the high error rate appears in the other direction, replace the cable.

 **Warning:**

**Risk of equipment damage**

Do not crush fiber optic cable. If fiber optic cable is in the same tray or duct with large, heavy electrical cables, the weight of the electrical cable can damage the fiber optic cable.

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## Fiber optic connector care

Before you connect fiber optic connectors to transmission equipment, test equipment, patch panels, or other connectors, ensure fiber optic connectors are clean. The performance of an optical fiber connector depends on how clean the connector and coupling are at the time of connection.

A damaged or dirty connector can damage a connector with which it pairs. A connector must be clean before you insert it into a transmitter or receiver.

Never clean an optical connector while it carries light. Optical power can cause ignition of the cleaning material when it contacts the end of the optical connector and can destroy the connector. Typical cleaning materials, for example, tissues saturated with alcohol, combust almost instantaneously after you expose them to optical power levels of +15 dBm or higher.

Visually inspect the connector to determine cleanliness and to determine if it needs replacing. You must replace a connector that has a scratch across the core, or a scratch that appears to end in the core.

The proper connector cleaning method depends on the connector contaminants:

- Judge cleanliness by visual inspection with a fiber microscope. First inspect the connector, and then clean as required.

 **Danger:**

**Risk of eye injury**

When you inspect a connector, ensure that light sources are off. The light source in fiber optic cables can damage your eyes.

- If you suspect only the possibility of dust particles, for example, if you leave a connector uncapped in a clean environment, use high-quality canned air or a reel cleaner, for example, a Cletop, to clean the connector. A reel cleaner is a good choice to ensure that no dust contaminates the connector.
- If the connector is visibly dirty or you suspect contamination by chemicals (for example, matching gel), use high-quality alcohol and canned air to clean the connector. This method is the most thorough cleaning method. In some cases, a reel cleaner can suffice.

The more surface manipulation you apply to the connector, the more likely you are to damage the connector.

When you insert a connector ferrule into a connector or adapter, ensure that the ferrule tip does not touch the outside of the mating connector or adapter. This action can produce scratches and dirt deposits on the connector.

To help prevent connectors from collecting dust, cover them when not in use. To avoid the transfer of oil or other contaminants from your fingers to the end face of the ferrule, handle connectors with care. Do not touch the connector end face.

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## Cleaning single connectors

Clean connectors so that the optical signal is minimally attenuated by the connector.

Perform this procedure if you suspect more than dust contamination.

**Before you begin**

- You need a lens-grade, lint-free tissue, for example, Kimwipes.
- You need an optical-grade isopropyl alcohol (IPA) (98% or more pure).
- You need a high-quality canned compressed air with extension tube.

Compressed air must be free of dust, water, and oil, or filmy deposits or scratches on the surface of the connector can result.

- You need a fiber optic microscope to inspect connectors.

 **Danger:**

**Risk of eye injury**

When you inspect a connector, ensure that light sources are off. The light source used in fiber optic cables can damage your eyes.

To avoid getting debris in your eyes, wear safety glasses when you work with the canned air duster.

To avoid eye irritation on contact, wear safety glasses when you work with isopropyl alcohol.

### Procedure

1. Remove dust or debris by applying canned air to the cylindrical and end-face surfaces of the connector.
2. Gently wipe the cylindrical and end-face surfaces with a tissue dampened with optical-grade isopropyl alcohol.
3. Gently wipe the cylindrical and end-face surfaces with a dry tissue.

#### Important:

Do not let the IPA evaporate; wipe it dry immediately. Alcohols can leave a residue that is difficult to remove.

4. Dry the connector surfaces by applying canned air.
5. Inspect the connector to ensure it is clean and undamaged.

To prevent contamination, do not touch the connector surfaces after cleaning; and cover connectors with dust caps if they are not in use.

---

## Cleaning duplex connectors

Clean connectors so that the optical signal is minimally attenuated by the connector.

Perform this procedure when you suspect more than dust contamination.

### Before you begin

- You need a lens-grade, lint-free tissue, for example, Kimwipes.
- You need an optical-grade isopropyl alcohol (IPA) (98% or more pure).
- You need a high-quality canned compressed air with extension tube.

Compressed air must be free of dust, water, and oil, or filmy deposits or scratches on the surface of the connector can result.

- You need a fiber optic microscope to inspect connectors.

### About this task

#### Danger:

##### Risk of eye injury

When you inspect a connector, ensure that light sources are off. The light source in fiber optic cables can damage your eyes.

To avoid getting debris in your eyes, wear safety glasses when you work with the canned air duster.

To avoid eye irritation on contact, wear safety glasses when you work with isopropyl alcohol.

## Procedure

1. Remove or retract the shroud.

On removable shroud connectors, hold the shroud on the top and bottom at the letter designation, apply medium pressure, and then pull it free from the connector body. Do not discard the shroud.

### OR

On retractable shroud connectors, hold the shroud in the retracted position.

2. Remove dust or debris by applying canned air to the cylindrical and end-face surfaces of the connector.
3. Gently wipe the cylindrical and end-face surfaces of both ferrules using a tissue saturated with optical-grade isopropyl alcohol.
4. Gently wipe the cylindrical and end-face surfaces with a dry tissue.

### Important:

Do not let the IPA evaporate; wipe it dry immediately. Alcohols can leave a residue that is difficult to remove.

5. Blow dry the connector surfaces with canned air.
6. Inspect the connector to ensure it is clean and undamaged.
7. Using care to not touch the clean ferrules, gently push the shroud back onto the connector until it seats and locks in place.

---

## Cleaning receptacles

Clean connector receptacles or ports so that the optical signal is minimally attenuated by the connection.

### Before you begin

- You need an optical-grade isopropyl alcohol (IPA) (98% or more pure).
- You need cleaning swabs (also called cleaning sticks or wands).
- You need a high-quality canned compressed air with extension tube.

Compressed air must be free of dust, water, and oil, or filmy deposits or scratches on the surface of the connector can result.

 **Warning:****Risk of equipment damage**

To avoid contamination, only clean optical ports if you see evidence of contamination or reduced performance exists, or during their initial installation.

To prevent oil contamination of connectors, use only high-quality canned compressed air.

Do not allow the air extension tube to touch the bottom of the optical port.

**Procedure**

1. Remove dust or debris by blowing canned air into the optical port of the device using the canned air extension tube.
2. Clean the optical port by inserting a wand moistened with alcohol into the receptacle and rotating it.

Use each cleaning wand to clean only one optical port.

3. Dry the optical port by inserting a dry wand into the receptacle and rotating it.

 **Important:**

Do not let the IPA evaporate; wipe it dry immediately. Alcohols can leave a residue that is difficult to remove.

4. Remove lint by blowing compressed air into the optical port.
5. Reconnect the optical connector and check for proper function.

If you do not reinstall the connector, use a protective cap.

If problems persist, ensure that the connector or receptacle is free from damage.

# Chapter 4: Supported transceivers and DACs information

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## Supported transceivers

The following tables list supported SFP and SFP+ transceivers for the Ethernet Routing Switch 3600 Series.

The following tables display only transceivers that are currently supported and available in the price book. Some transceivers might have gone end-of-sale (EOS). For more information, see [End of sale transceivers and cables](#) on page 42.

**!** **Important:**

Extreme Networks recommends that you only use the qualified transceivers documented in this document. If you use other vendor transceivers, Extreme Networks does not support them.

---

## Supported SFP transceivers

The following table lists and describes the SFP transceiver models.

Model	Part number	Description
100BASE-FX SFP	1300 nm, 100 Mbps Ethernet, multimode fiber, duplex LC connector	AA1419074–E6
1000BASE-T SFP	Gigabit Ethernet, RJ–45 connector	AA1419043–E6
1000BASE-SX DDI SFP	850 nm, Gigabit Ethernet, duplex LC connector	AA1419048–E6
1000BASE-LX DDI SFP	1310 nm, Gigabit Ethernet, duplex LC connector	AA1419049–E6
1000BASE-ZX DDI CWDM SFP	70 km, Gigabit Ethernet, duplex LC connector	AA1419065–E6
1000BASE-BX10 DDI SFP	1310 nm (tx) and 1490 nm (rx), Gigabit Ethernet, single-fiber LC connector	AA1419069–E6 (10 km at 1310 nm ) and mating pair AA1419070–E6 (10 km at 1490 nm)

SFP transceivers are hot-swappable input and output enhancement components that permit Gigabit Ethernet ports to link with other Gigabit Ethernet ports over various media types.



The system also supports Coarse Wavelength Division Multiplexer (CWDM) SFPs. CWDM technology consolidates multiple optical channels on a common optical fiber. CWDM uses multiple wavelengths to expand available bandwidth.

CWDM SFPs support high speed data communications for Metropolitan Area Networks (MAN). The system uses a grid of eight CWDM optical wavelengths in both ring and point-to-point configurations. All components are color-coded by wavelength.

**! Important:**

The attainable cable length can vary depending on the quality of the fiber optic cable used.

Use Digital Diagnostic Monitoring (DDM) to monitor SFP laser operating characteristics. Support for Digital Diagnostic Interfaces (DDI—an interface that supports DDM) involves data collection and alarm and warning monitoring. Static data collection includes SFP vendor information, DDI support information, and DDI alarm and warning threshold values. Dynamic data collection includes temperature, supply voltage, laser bias current, transmit power, and receive power. DDM works during active laser operation without affecting data traffic.

The switch only checks warning and alarm status bits during initialization and during requests for dynamic data. If the system asserts or clears an alarm or warning, the system logs a message and generates a trap. The system maps DDM warning and alarm messages into Warning and Fatal message categories for system logging purposes. If you activate the `ddm-alarm-portdown` option, DDI shuts down the corresponding port if a high or low alarm occurs on the port.

---

## Supported SFP+ transceivers

SFP+ transceivers are hot-swappable input and output enhancement components that allow 10-gigabit connections. All SFP+ transceivers use LC connectors to provide precision keying and low interface losses.

The following table lists and describes the SFP+ transceiver models.

Model	Description	Part number
10GBASE-LR/LW SFP+	10 km, 1310 nm SMF	AA1403011–E6
10GBASE-ER/EW SFP+	40 km, 1550 nm SMF	AA1403013–E6
10GBASE-SR/SW SFP+	400 m, 850 nm MMF	AA1403015–E6
10GBASE-BX10 SFP+	10 km	AA1403169–E6 and AA1403170–E6

---

## Supported DACs

The following table shows the supported direct attach cables (DAC).

---

## SFP+ DAC specifications

The following table provides a list of the supported SFP+ direct attach cables (DAC).

Model	Description	Part number
10GBASE-CX SFP+ DAC 2-pair twinaxial copper cable	SFP+ DAC 10 meter	AA1403018-E6
10GBASE-CX SFP+ DAC 2-pair twinaxial copper cable	SFP+ DAC 3 meter	AA1403019-E6
10GBASE-CX SFP+ DAC 2-pair twinaxial copper cable	SFP+ DAC 5 meter	AA1403020-E6

# Chapter 5: SFP

This chapter provides installation procedures and specifications for small form factor pluggable (SFP) transceivers.

---

## SFP transceivers

This section describes how to select and install small form factor pluggable (SFP) transceivers.

---

### Selecting an SFP

Use an SFP transceiver to connect a device motherboard to a fiber optic or unshielded twisted pair network cable. Select the appropriate transceiver to provide the required reach.

#### Procedure

1. Determine the required reach.

Depending on the product, SFP transceivers are available for cable distances of up to 100 meters (m), 550 m, 10 kilometers (km), 40 km, 70 km, and 120 km.

2. Determine the required media and connector type.

You need fiber optic cable for a reach over 100 m.

Possible media include CAT5, single mode fiber, and multimode fiber. Possible connectors include LC, MT-RJ, and RJ-45.

3. If the media is optical fiber, determine wavelength restrictions or requirements.

To expand available bandwidth on a common optical fiber, use Coarse Wavelength Division Multiplexing (CWDM) SFP transceivers.

4. Determine if you need digital diagnostic monitoring (DDM). DDM is enabled by default.

---

### Installing an SFP

Install an SFP to provide an interface between the device and the network cable.

## Before you begin

- Verify that the SFP is the correct model for your network configuration.
- Before you install the fiber, ensure that the connector is clean.

### **Danger:**

#### **Risk of eye injury by laser**

Fiber optic equipment can emit laser or infrared light that can injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables are connected to a light source.

### **Electrostatic alert:**

ESD can damage electronic circuits. Do not touch electronic hardware unless you wear a grounding wrist strap or other static-dissipating device.

### **Warning:**

#### **Risk of equipment damage**

Only trained personnel can install this product.

## About this task

Installing an SFP takes approximately 3 minutes.

## Procedure

1. Remove the SFP from its protective packaging.
2. Grasp the SFP transceiver between your thumb and forefinger.
3. Insert the device into the port on the module.

Depending on the module type, you must insert some SFP transceivers into the port with the bail facing up and some SFP transceivers with the bail facing down.

### **Warning:**

#### **Risk of equipment damage**

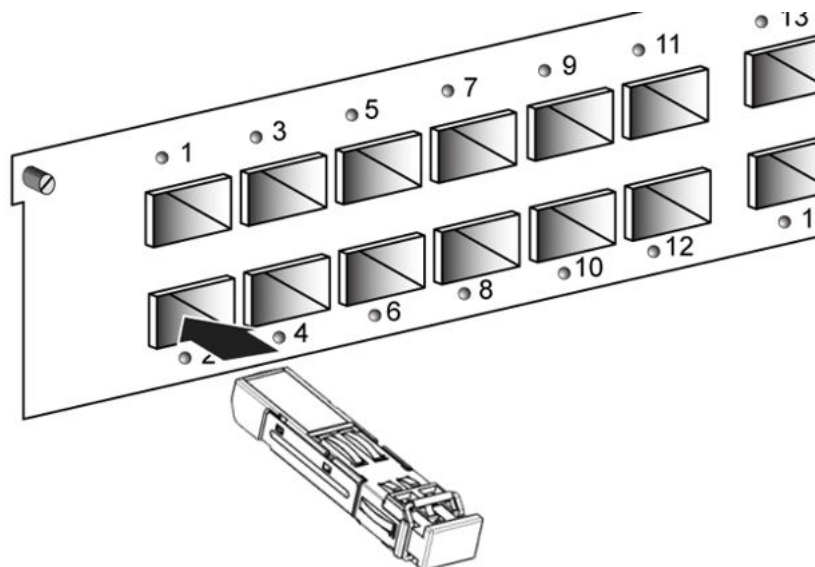
Transceivers are keyed to prevent incorrect insertion. If the transceiver resists pressure, do not force it; turn it over, and reinsert it.

Apply a light pressure to the device until it clicks and locks into position.

4. Remove the dust cover from the optical bore, and insert the fiber optic connector.

## Example

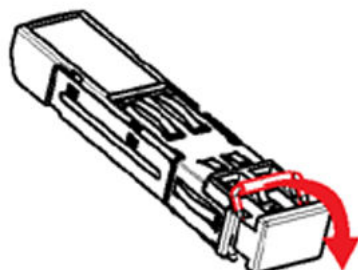
The following figure shows an example installation of a bore plug transceiver with the bail latch facing up. The figure does not represent a specific product.



## Job aid

Depending on the transceiver manufacturer, the SFP transceiver can use different types of locking and extractor mechanisms.

The following figure shows the typical mechanism used on SFP transceivers; other locking mechanisms exist although they are not shown here. In the following figure, the SFP transceiver uses the bore plug. Pull the bail to release the device.




---

## Removing an SFP

Remove an SFP to replace it or to commission it elsewhere.

### Before you begin

- Wear an antistatic wrist strap.

**⚠ Danger:**

**Risk of eye injury by laser**

Fiber optic equipment can emit laser or infrared light that can injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables connect to a light source.

 **Electrostatic alert:**

ESD can damage electronic circuits. Do not touch electronic hardware unless you wear a grounding wrist strap or other static-dissipating device.

### Procedure

1. Disconnect the network fiber optic cable from the SFP connector.
2. Depending on your SFP model, there are different locking mechanisms to release the SFP transceiver. The following describes the typical mechanism used on SFP transceivers; other locking and extractor mechanisms exist, although they are not described here.
  - Bail latch: Pull the swing-down latch handle to the fully lowered position and hold the handle to extract the module.
3. Slide the SFP out of the module SFP slot.

If the SFP does not slide easily from the module slot, use a gentle side-to-side rocking motion while firmly pulling the SFP from the slot.

4. Affix dust covers over the fiber optic bore and connector.
5. Store the SFP in a safe place until needed.

 **Important:**

If you discard the SFP transceiver, dispose of it according to all national laws and regulations.

---

## SFP specifications

This section provides technical specifications for the supported small form factor pluggable (SFP) models. Use this information to aid in proper network design.

The specifications in this section meet or exceed those specified in the applicable IEEE standards, where they exist.

In these specifications, unless otherwise noted, receiver sensitivity is the minimum average input optical power for which the receiver is guaranteed to meet the bit error rate (BER) of 10<sup>-12</sup>.

---

## SFP labels

The label on a typical SFP transceiver contains a serial number, a bar code, a manufacturer code, an interface type, and a part number.

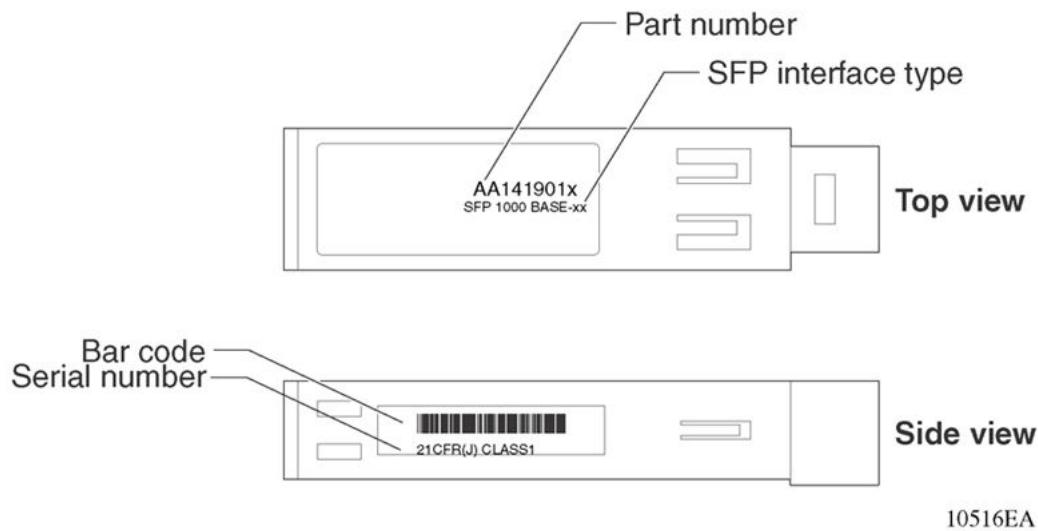


Figure 1: SFP label

## General SFP specifications

The following table describes general SFP specifications.

Table 1: General SFP specifications

Parameter	Description
Dimensions (H x W x D)	8.5 x 13.4 x 56.4 millimeters (0.33 x 0.53 x 2.22 inches), unless otherwise stated.
Operating temperature	-5 to 85 °C for RoHS -E6 models
Storage temperature	-40 to 85 °C
Maximum supply current	300 mA, unless otherwise stated
Maximum power consumption	1.0 W, unless otherwise stated

## Supported SFP transceivers

The following section provides specifications for the supported SFP transceivers.

### 1000BASE-T SFP specifications

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

The part number for this model is AA1419043-E6.

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

The following table describes the 1000BASE-T SFP specifications.

**Table 2: IEEE 802.3z 1000BASE-T SFP specifications**

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

## 100BASE-FX SFP specifications

The 100BASE-FX SFP provides 100 Mbps Ethernet Carrier Sense Multiple Access with Collision Detection (CSMA-CD) connectivity using multimode optical fiber. The part number for this model is AA1419074-E6.

The following table describes the 100BASE-FX SFP specifications.

**Table 3: 100BASE-FX SFP specifications**

Parameter	Specifications
Maximum electrical power consumption	1.5 W
Connectors	Duplex LC
Cabling	<ul style="list-style-type: none"> <li>• 62.5 <math>\mu</math>m MMF optic cable</li> <li>• 50 <math>\mu</math>m MMF optic cable</li> </ul>
Distance	<ul style="list-style-type: none"> <li>• Up to 2 km using 500 MHz-km MMF optic cable</li> </ul>
Wavelength	1300 nm
Link optical power budget	10 dB
<b>Transmitter characteristics</b>	
Maximum launch power	-14 dBm
Minimum launch power	-23.5 to -20 dBm
<b>Receiver characteristics</b>	
Receiver sensitivity	-33.5 dBm
Maximum input power	-14 dBm

## 1000BASE-SX DDI SFP specifications

The 1000BASE-SX DDI SFP transceiver has a reach of up to 550 m using 50  $\mu$ m MMF, and of 275 m using 62.5  $\mu$ m MMF. This SFP transceiver operates at 850 nm. The part number is AA1419048-E6.

The following table describes standards, connectors, cabling, and distance for the 1000BASE-SX DDI SFP transceivers.



**Table 4: 1000BASE-SX SFP DDI (550 m) specifications**

Parameter	Specifications
Maximum electrical power consumption	1 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
<b>Transmitter characteristics</b>	
Launch power	-9.5 to -4.0 dBm
<b>Receiver characteristics</b>	
Receiver sensitivity	-17 dBm
Maximum receiver power	0 dBm

## 1000BASE-LX DDI SFP specifications

This SFP transceiver provides 1000BASE-LX Gigabit Ethernet connectivity at 1310 nanometers (nm) using single mode or multimode optical fiber. The part number is AA1419049-E6.

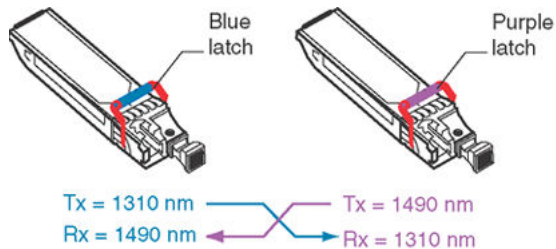
**Table 5: 1000BASE-LX DDI SFP specifications**

Parameter	Specifications
Maximum electrical power consumption	1.0 watt (W)
Connectors	Duplex LC
Cabling	<ul style="list-style-type: none"> <li>• 50 micrometer (<math>\mu\text{m}</math>) multimode fiber (MMF)</li> <li>• 62.5 <math>\mu\text{m}</math> multimode fiber</li> <li>• 9 <math>\mu\text{m}</math> single mode fiber (SMF)</li> </ul>
Distance	<ul style="list-style-type: none"> <li>• Up to 550 meters (m) using MMF</li> <li>• Up to 10 kilometers (km) using SMF</li> </ul>
Data rate	1.0 Gbps
Line rate (8B/10B code)	1.25 Gbps
Link optical power budget	9.5 dB
<b>Transmitter characteristics</b>	
Launch power	-9.5 to -3.0 dBm
<b>Receiver characteristics</b>	
Receiver sensitivity	-19.0 dBm
Maximum receiver power	-3.0 dBm

## 1000BASE-BX bidirectional SFP transceivers

The 1000BASE-BX bidirectional DDI SFP transceivers provides Gigabit Ethernet connectivity over a single fiber.

In the following figure, the transmit (Tx) and receive (Rx) paths share the same fiber by using two different wavelengths. One model transmits at 1310 nm and receives at 1490 nm, while the mating model transmits at 1490 nm and receives at 1310 nm. You can only connect a mating pair.



The long wavelength optical transceivers used in these models provide variable distance ranges using single mode fiber optic cabling.

You can use 1000BASE-BX SFP transceivers to double the number of your fiber links. For example, if you install 20 fiber pairs with 20 conventional ports connected, you can use 1000BASE-BX SFP transceivers to expand to 40 ports, using the same fiber.

The following table provides the reach and part numbers for each mating pair.

**Table 6: 1000BASE-BX SFP transceivers**

Reach	1310 nm	1490 nm
10 km	AA1419069-E6	AA1419070-E6

## 1000BASE-BX10 bidirectional DDI SFP specifications

The 1000BASE-BX10 SFP transceivers (part numbers AA1419069-E6 and AA1419070-E6) can attain a reach of up to 10 km.

The following table describes standards, connectors, cabling, and distances for the 1000BASE-BX10 SFP transceiver.

**Table 7: IEEE 802.3ah 1000BASE-BX10 bidirectional SFP 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

Parameter	Specification
Maximum transmitter and dispersion power penalty	3.3 dB
<b>Transmitter characteristics</b>	
Maximum launch power	-3.0 dBm
Minimum launch power	-9.0 dBm
<b>Receiver characteristics</b>	
Maximum receiver sensitivity	-19.5 dBm
Maximum input power (maximum average receive power)	-3.0 dBm

### 1000BASE-BX40 bidirectional SFP specifications

The 1000BASE-BX40 SFP transceivers (part numbers AA1419076-E6 and AA1419077-E6) can attain a reach of up to 40 km. The minimum IL is 6 dB.

The following table describes standards, connectors, cabling, and distances for the 1000BASE-BX40 SFP transceiver.

**Table 8: 1000BASE-BX40 bidirectional SFP specifications**

Parameter	Specifications
Connectors	Single-fiber LC
Data rate	1.0 Gbps
Line rate (8B/10B code)	1.25 Gbps
Distance	Up to 40 km with SMF
Wavelength	1310 nm and 1490 nm
Link optical power budget	20.0 dB
Maximum transmitter and dispersion power penalty	3.3 dB
<b>Transmitter characteristics</b>	
Maximum launch power	3.0 dBm
Minimum launch power	-3.0 dBm
<b>Receiver characteristics</b>	
Maximum receiver sensitivity	-23 dBm
Maximum input power (maximum average receive power)	-3.0 dBm

### 1000BASE-BX10 bidirectional DDI SFP specifications

The 1000BASE-BX10 SFP transceivers (part numbers AA1419069-E6 and AA1419070-E6) can attain a reach of up to 10 km.

The following table describes standards, connectors, cabling, and distances for the 1000BASE-BX10 SFP transceiver.

**Table 9: IEEE 802.3ah 1000BASE-BX10 bidirectional SFP 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
Maximum transmitter and dispersion power penalty	3.3 dB
<b>Transmitter characteristics</b>	
Maximum launch power	−3.0 dBm
Minimum launch power	−9.0 dBm
<b>Receiver characteristics</b>	
Maximum receiver sensitivity	−19.5 dBm
Maximum input power (maximum average receive power)	−3.0 dBm

## 1000BASE-ZX DDI CWDM 70 km SFP specifications

The following table describes specifications for CWDM SFP transceivers numbered AA1419061-E6 to AA1419068-E6\*.

### Warning:

#### Risk of equipment damage

To prevent damage to the optical receiver, ensure that at least 8 dB of attenuation is present between the transmit and receive ports.

\* This transceiver has reached end of sale (EOS). For more information about EOS transceivers and recommended replacements for your product, or to determine existing availability for EOS transceivers, see [Locating end of sale notices](#) on page 42.

### Important:

AA1419065–E6 remains available to purchase.

**Table 10: 1000BASE-ZX CWDM SFP (70 km) specifications**

Parameter	Specifications
Maximum electrical power consumption	1.0 W
Connectors	Duplex LC
Cabling	SMF, 9 μm
Data rate	1.0 Gbps
Line rate (8B/10B code)	1.25 Gbps

<b>Parameter</b>	<b>Specifications</b>
Link optical power budget	24 dB
Maximum dispersion power penalty	2 dB at 70 km
<b>Transmitter characteristics</b>	
Launch power	0 to 5.0 dBm
<b>Receiver characteristics</b>	
Receiver sensitivity	-24 dBm
Maximum receiver power	-3.0 dBm

# Chapter 6: SFP+

This chapter provides installation procedures and specifications for small form factor pluggable plus (SFP+) transceivers.

---

## SFP+ transceivers

This section describes how to select and install small form factor pluggable plus (SFP+) transceivers.

Use an SFP+ transceiver to connect a device motherboard to fiber optic or direct attached cables, up to 15 meters in length. SFP+ transceivers are similar to SFP transceivers in physical appearance but SFP+ transceivers support 10-gigabit per second (Gbps) connections. SFP+ modules do not interoperate with SFP modules.

### Important:

Extreme Networks recommends that you only use the qualified transceivers documented in this document. If you use other vendor transceivers, Extreme Networks does not support them.

---

## Selecting an SFP+

Use an SFP+ transceiver for 10 Gigabit per second (Gbps) Ethernet connections over optical fiber.

### About this task

Select the appropriate transceiver to provide the required reach. Depending on the product, you can obtain SFP+ transceivers for cable distances of up to 15 meters (m), 400 m, 10 kilometers (km), 40 km, and 70 km. Alternatively, you can use a direct attach cable (10GBASE-CX) to connect ports for cable distances of up to 15 meters.

### Procedure

1. Determine the required reach.
2. Determine wavelength restrictions or requirements.

---

## Installing an SFP+

Install an SFP+ transceiver to provide a 10 Gigabit Ethernet interface between the device and other network devices.

### Before you begin

#### Important:

Do not install an SFP+ transceiver in an SFP slot. The two transceivers look the same but function differently. Ensure the slot is an SFP+ slot.

- Verify that the SFP+ transceiver is the correct model for your network configuration.
- Before you install the fiber, ensure that the connector is clean.

#### Danger:

##### Risk of eye injury by laser

Fiber optic equipment can emit laser or infrared light that can injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables connect to a light source.

#### Electrostatic alert:

ESD can damage electronic circuits. Do not touch electronic hardware unless you wear a grounding wrist strap or other static-dissipating device.

#### Warning:

##### Risk of equipment damage

Only trained personnel can install this product.

### About this task

Installing an SFP+ transceiver takes approximately 3 minutes.

### Procedure

1. Remove the SFP+ transceiver from its protective packaging.
2. Grasp the SFP+ transceiver between your thumb and forefinger.
3. Insert the device into the port on the module.

Depending on the module type, you must insert some SFP+ transceivers into the port with the bail facing up and some SFP+ transceivers with the bail facing down.

#### Warning:

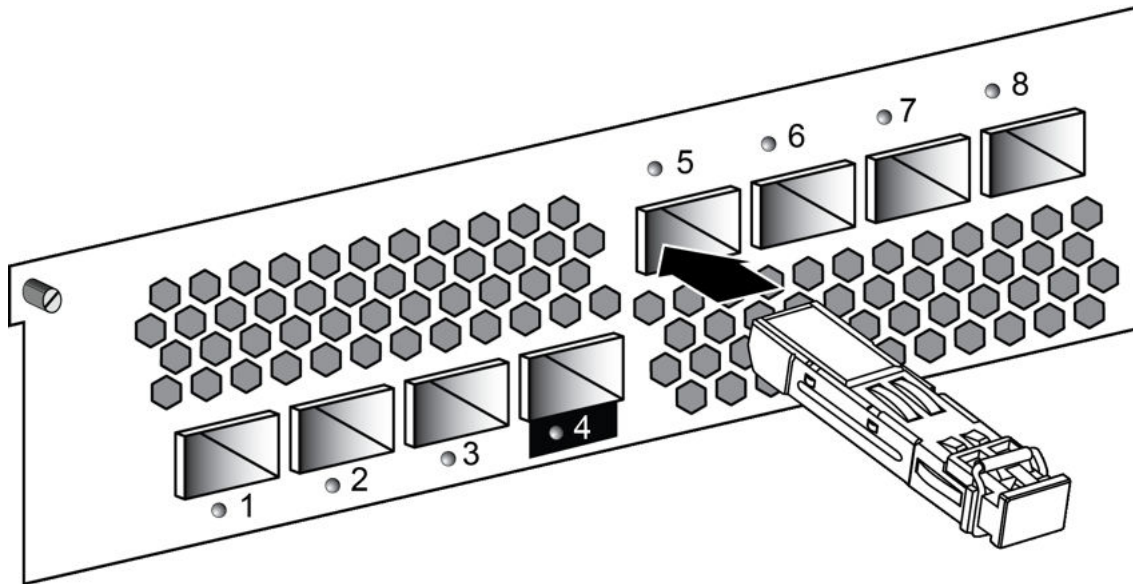
##### Risk of equipment damage

SFP+ transceivers are keyed to prevent incorrect insertion. If the SFP+ transceiver resists pressure, do not force it; turn it over, and reinsert it.

Apply a light pressure to the SFP+ transceiver until the device clicks and locks into position in the module.

4. Remove the dust cover from the SFP+ optical bores, and insert the fiber optic cable.

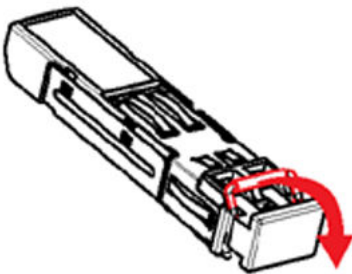
**Example**



**Job aid**

Depending on the transceiver manufacturer, the SFP+ transceiver uses bail-latch type of locking and extractor mechanism.

The following figure shows typical mechanism used on SFP+ transceivers; other locking and extractor mechanisms exist. SFP+ transceivers are similar to SFP transceivers in physical appearance. In the following figure, the SFP+ transceiver still contains the bore plug. Pull the bail to release the device.



---

**Removing an SFP+**

Remove an SFP+ transceiver to replace it or to commission it elsewhere.



## Before you begin

- Wear an antistatic wrist strap.

### **Danger:**

#### **Risk of eye injury by laser**

Fiber optic equipment can emit laser or infrared light that can injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables connect to a light source.

### **Electrostatic alert:**

ESD can damage electronic circuits. Do not touch electronic hardware unless you wear a grounding wrist strap or other static-dissipating device.

## Procedure

1. Disconnect the network fiber optic cable from the SFP+ connector.
2. Pull the swing-down latch handle to the fully lowered position, and hold the handle to extract the module.
3. Slide the SFP+ transceiver out of the module SFP+ slot.

If the SFP+ does not slide easily from the module slot, use a gentle side-to-side rocking motion while firmly pulling the SFP+ transceiver from the slot.

4. Affix dust covers over the fiber optic bore and connector.
5. Store the SFP+ transceiver in a safe place until needed.

### **Important:**

If you discard the SFP+ transceiver, dispose of it according to all national laws and regulations.

---

## SFP+ specifications

This section provides technical specifications for the supported 10-gigabit SFP+ models. Use these specifications to aid in network design.

The specifications in this section support the IEEE 802.3-2012 standard. For more information, see the IEEE 802.3 document. All SFP+ transceivers meet or exceed these standards.

---

## SFP+ labels

The typical SFP+ transceiver has a label on the top and bottom or side of the transceiver. The following figures show example labels. Sometimes alternate labels are used depending on the size of the device and space available for label information. Some devices do not have a label.

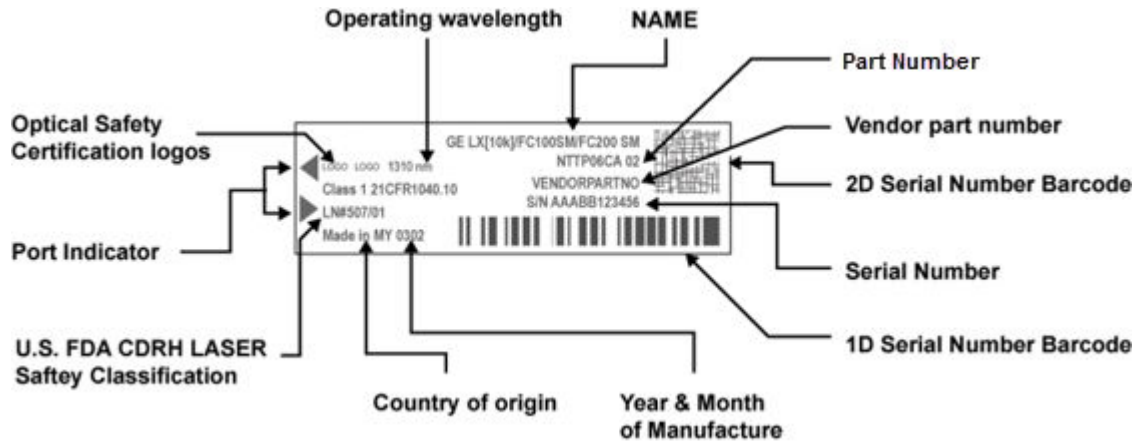


Figure 2: SFP+ top label



Figure 3: SFP+ bottom label

## General SFP+ specifications

The following table describes general SFP+ specifications.

Table 11: General SFP+ specifications

Parameter	Specifications
Dimensions (H x W x D)	8.5 x 13.4 x 56.4 millimeters (0.33 x 0.53 x 2.22 inches), unless otherwise stated.
Connectors	LC ultra physical contact (UPC)
Storage temperature	-40 to 85 °C
Operating temperature	0 to 70 °C for RoHS -E6 models up to 85 °C for high temperature models

## Supported SFP+ transceivers

The following section provides specifications for the supported SFP+ transceivers.

### 10GBASE-T SFP+ transceiver

The 10GBASE-T SFP+ transceiver provides 10 Gigabit Ethernet connectivity using a single eight pin RJ-45 connector.

The 10GBASE-T SFP+ only operates at 10 Gigabits per second (Gbps) speed. Operation at 10/100/1000 Megabits per second (Mbps) speeds are not supported.

The part number for this model is AA1403043-E6.

The maximum power of the SFP+ transceiver is 2.5 watts (W) at 30 meters (m).

The following table describes the 10GBASE-T SFP+ specifications.

**Table 12: IEEE 802.3z 10GBASE-T SFP specifications**

Parameter	Specifications
Connectors	RJ-45
Cabling	Cat 6a/7 for 10 Gb Ethernet
Distance	up to 30 m (over Cat 6a/7 cable)

## 10GBASE-SR/SW SFP+ specifications

The 10GBASE-SR/SW SFP+ transceivers provides 10 GbE service at 850 nm.

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

### Caution:

#### Risk of equipment damage

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

The following table lists the specifications for the 10GBASE-SR/SW SFP+ transceivers. The part number of this SFP+ transceiver is AA1403015-E6.

**Table 13: IEEE 802.3ae 10GBASE-SR/SW SFP+ transceiver specifications**

Parameter	Specifications
Data rate	10 Gigabits per second (Gbps)
Line rate (64B/66B code)	10.3125 Gbps $\pm$ 100 parts per million (ppm)
Center wavelength range	840 to 860 nanometers (nm), nominal 850 nm
Distance	Using 62.5 $\mu$ m MMF optic cable: <ul style="list-style-type: none"> <li>• 160 MHz-km fiber: 2 to 26 m</li> <li>• 200 MHz-km fiber: 2 to 33 m</li> </ul> Using 50 $\mu$ m MMF optic cable: <ul style="list-style-type: none"> <li>• 400 MHz-km fiber: 2 to 66 m</li> <li>• 500 MHz-km fiber: 2 to 82 m</li> <li>• 2000 MHz-km fiber: 2 to 300 m</li> <li>• 4700 MHz-km fiber (OM4): 2 to 400 m</li> </ul>
Link optical power budget	3.8 dB
Maximum transmitter and dispersion penalty	3.9 dB at 300 m

Parameter	Specifications
<b>Transmitter characteristics</b>	
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
<b>Receiver characteristics</b>	
Average receive power for BER $10^{-12}$	-9.9 to -1.0 dBm
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

## 10GBASE-LRM SFP+ specifications

The 10GBASE-LRM SFP+ transceiver provides 10 GbE service at a wavelength of 1310 nm. This SFP+ transceiver supports a reach of up to 220 m on 62.5  $\mu$ m multimode fiber (MMF), as specified in IEEE 802.3-2015 CL68. This SFP+ transceiver can also be used with standard single mode fiber (SMF) to attain a reach of up to 300 m.

The following table lists the transmitter and receiver specifications for the 10GBASE-LRM SFP+ transceiver. The part number of this SFP+ transceiver is AA1403017-E6.

In this table, the OMA, average launch power, and peak power specifications apply at TP2, after accounting for patch cord loss.

**Table 14: 10GBASE-LRM SFP+ transceiver specifications**

Parameter	Specifications
Data rate	10 Gbps
Line rate (64B/66B code)	10.3125 Gbps $\pm$ 100 ppm
Center wavelength range	1260 to 1355 nm; 1310 nm nominal
Distance	Up to 220 m on 62.5 $\mu$ m MMF Up to 300 m on SMF
Link optical power budget	1.7 to 1.9 dB
Maximum transmitter waveform and dispersion penalty (TWDP)	4.7 dB
<b>Transmitter characteristics</b>	
Average launch power	-6.5 to 0.5 dBm
Peak launch power	3 dBm
Root-mean-square spectral width	2.4 to 4 nm
Launch power in OMA	-4.5 to 1.5 dBm

Parameter	Specifications
Minimum extinction ratio	3.5 dB
Optical return loss tolerance (minimum)	-20 dB
<b>Receiver characteristics</b>	
Receiver damage threshold	1.5 dBm
Receiver reflectance (maximum)	-12 dB

For more information about the conditions used for the stressed receiver tests, and other information, see the IEEE 802.3–2012 standard.

The following table (from IEEE 802.3–2012) describes the maximum channel insertion loss. The channel insertion loss includes both attenuation and connector loss (1.5 dB); therefore the maximum fiber attenuation is 0.2 to 0.4 dB.

**Table 15: 10GBASE-LRM channel insertion loss and range**

Fiber type (core diameter and OFL bandwidth)	Range	Maximum channel insertion loss
62.5 µm (FDDI grade) • 160 MHz-km at 850 nm • 500 MHz-km at 1300 nm	Up to 220 m	1.9 dB
62.5 µm (ISO/IEC OM1) • 200 MHz-km at 850 nm • 500 MHz-km at 1300 nm	Up to 220 m	1.9 dB
50 µm (ISO/IEC OM2) • 500 MHz-km at 850 nm • 500 MHz-km at 1300 nm	Up to 220 m	1.9 dB
50 µm • 400 MHz-km at 850 nm • 400 MHz-km at 1300 nm	Up to 100 m	1.7 dB
50 µm (ISO/IEC OM3) • 1500 MHz-km at 850 nm (includes laser launch bandwidth) • 500 MHz-km at 1300 nm (includes laser launch bandwidth)	Up to 220 m	1.9 dB

The following abbreviations are used in the preceding tables:

- FDDI – Fiber Distributed Data Interface
- ISO – International Standards Organization
- IEC – International Electrotechnical Commission

- OFL – Over Filled Launch

## 10GBASE-LR/LW SFP+ specifications

The 10GBASE-LR/LW SFP+ transceiver 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 more information about the 10GBASE-LR/LW SFP+ transceiver, including test and measurement information, see the IEEE 802.3ae standard.

The following table lists the transmitter and receiver specifications for the 10GBASE-LR/LW SFP+ transceiver. The part number of this SFP+ transceiver is AA1403011-E6.

**Table 16: IEEE 802.3ae 10GBASE-LR/LW SFP+ transceiver specifications**

Parameter	Specifications
Center wavelength range	1260 to 1355 nm; 1310 nm nominal
Distance	Up to 10 km
Link optical power budget	9.4 dB
Maximum transmitter and dispersion penalty	3.2 dB at 10 km
<b>Transmitter characteristics</b>	
Line rate (nominal)	10GBASE-LR 10.3125 Gbps $\pm$ 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
Maximum transmitter reflectance	-12 dB
<b>Receiver characteristics</b>	
Line rate (nominal)	10GBASE-LR 10.3125 Gbps $\pm$ 100 ppm (10 GbE)
Average receive power for BER $10^{-12}$	-14.4 dBm to 0.5 dBm
Receiver damage threshold	1.5 dBm
Maximum receiver sensitivity in OMA	-12.6 dBm
Maximum receiver reflectance	-12 dB
Stressed receiver sensitivity in OMA	-10.3 dBm

Examples of an OFF transmitter are as follows: no power supplied to the PDM, laser shutdown for safety conditions, activation of a PMD\_global\_transmit\_disable or other optional transmitter shutdown condition.

## 10GBASE-ER/EW SFP+ specifications

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.

The following table lists the transmitter and receiver specifications for the 10GBASE-ER/EW SFP+ transceiver. The part number of this SFP+ transceiver is AA1403013-E6.

**Table 17: IEEE 802.3ae 10GBASE-ER/EW SFP+ transceiver specifications**

Parameter	Specifications
Line rate (nominal)	10GBASE-ER/EW 10.3125 Gb/s $\pm$ 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
<b>Transmitter characteristics</b>	
Launch power	−4.7 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
Minimum optical modulation amplitude	−1.7 dBm
Maximum average launch power of OFF transmitter	−30 dBm
Minimum extinction ratio	3.0 dB
Maximum $RIN_{12OMA}$	−128 dB/Hz
Maximum optical return loss tolerance	−21 dB
<b>Receiver characteristics</b>	
Average receive power for BER $10^{-12}$	− 15.8 dBm 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

The following list shows examples of an OFF transmitter:

- No power supplied to the PDM.
- Laser shutdown for safety conditions.
- Activation of `PMD_global_transmit_disable` or other optional transmitter shutdown condition.

## 10GBASE-CX specifications

The 10GBASE-CX is a 2-pair twinaxial copper cable that plugs into the SFP+ socket and connects two 10 Gigabit ports. The reach for this cable is up to 15 m with a bit error rate (BER) that is better than  $10^{-12}$ .

The 10GBASE-CX is a lower cost alternative to the optical SFP+ devices.

For more information about test and measurement information and additional specifications, see the IEEE 802.3–2012 standard. For more information about the supported DACs and BOCs for your hardware platform, see the *Supported Transceiver, BOCs, and DACs* chapter in this document.

## 10GBASE-ZR/ZW SFP+ specifications

The following table lists the transmit and receive specifications for the 10GBASE-ZR/ZW SFP+ transceiver. The part number of this SFP+ transceiver is AA1403016-E6.

### Warning:

Risk of BER increase

For proper SFP+ transceiver operation, ensure that at least 11 dB of attenuation is present between the transmit and receive ports.

The reach for this SFP+ transceiver is up to 70 km\* at a wavelength of 1550 nm.

**Table 18: 10GBASE-ZR/ZW SFP+ specifications**

Parameter	Specifications
Line rate (nominal)	10GBASE-ZR 10.3125 Gbps $\pm$ 100 ppm (10 GbE)
Distance	Up to 70 km *
Link optical power budget	24 dB
Dispersion power penalty	3.0 dB at 70 km (G.652 fiber)
Minimum attenuation between transmit and receive ports	11 dB
<b>Transmitter characteristics</b>	
Center wavelength range	1530 to 1565 nm, nominal 1550 nm
Average launch power	0 to 4.0 dBm
Optical modulation amplitude (minimum)	-1.7 dBm
Extinction ratio (ER) (minimum)	8.2 dB
Maximum transmitter reflectance	-12 dB
<b>Receiver characteristics</b>	
Wavelength range	1280 to 1575 nm. Sensitivity specified for 1530 to 1565 nm.
Maximum receiver sensitivity (average power)	-24 dBm
Maximum receiver (average) power, BER $10^{-12}$	-7.0 dBm
Receiver damage threshold (average power)	+5.0 dBm



Parameter	Specifications
Receiver reflectance (maximum)	-27 dB

\* Achievable link distance is primarily dependent on cable plant insertion loss. 70 km is not possible in some situations.

# Chapter 7: End of sale transceivers and cables

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## Locating end of sale notices

To view the End of Sale notices, go to the Extreme Networks Website at <https://extremeportal.force.com/>.


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## End of sale SFP transceivers

The transceivers in the following table have reached end of sale (EOS).

**Table 19: Discontinued SFP transceivers**

Model	Part number	Date EOS	Replacement
1000BASE-SX	AA1419013-E5	December 31, 2014	AA1419048-E6
1000BASE-SX MT-RJ	AA1419014-E5		—
1000BASE-LX	AA1419015-E5	December 31, 2014	AA1419049-E6
1000BASE-XD CWDM	AA1419025-E5 to AA1419032-E5	June 30, 2012	
1000BASE-ZX CWDM	AA1419033-E5 to AA1419040-E5	June 30, 2012	—
1000BASE-XD DDI 1330 nm	AA1419050-E6	September 30, 2014	—
1000BASE-XD DDI 1550 nm	AA1419051-E6	September 30, 2014	AA1419057-E6
1000BASE-ZX DDI 1550 nm	AA1419052-E6	September 30, 2014	AA1419065-E6
1000BASE- XD DDI 40 km	AA1419053-E6 to AA1419060-E6	December 14, 2016	—
1000BASE-ZX DDI CWDM 70 km	AA1419061-E6 to AA1419068-E6	June 13, 2016	AA1419065-E6

Model	Part number	Date EOS	Replacement
	 <b>Important:</b> AA1419065-E6 remains available for purchase.		
1000BASE-EX DDI	AA1419071-E6	June 2016	—
T1 Ethernet over TDM mini-GBIC	AA1419075-E6	June 2016	—
1000BASE-BX40	AA1419076-E6 and AA1419077-E6	June 2016	—

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## End of sale SFP+ transceivers

The transceivers in the following table have been identified as end of sale (EOS). For more information about EOS transceivers and recommended replacements for your product or to determine existing availability for these transceivers, see [Locating end of sale notices](#) on page 42.

**Table 20: Discontinued SFP+ transceivers**

Model	Part number	Date EOS	Replacement
10GBASE CWDM DDI (40 km)	AA1403153-E6 TO AA1403160-E6	September 30, 2017	—
10GBASE CWDM DDI (70 km)	AA1403161-E6 TO AA1403168-E6	September 30, 2017	—

# Chapter 8: Translations of safety messages

This chapter contains translations of the safety messages, which are found throughout this document.

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## Class A electromagnetic interference warning statement

 **Warning:**

**Risk of electromagnetic interference**

This device is a Class A product. Operation of this equipment in a residential area is likely to cause harmful interference, in which case users are required to take appropriate measures necessary to correct the interference at their own expense.

 **Warning:**

**AVERTISSEMENT**

Le périphérique est un produit de Classe A. Le fonctionnement de cet équipement dans une zone résidentielle risque de causer des interférences nuisibles, auquel cas l'utilisateur devra y remédier à ses propres frais.

 **Warning:**

**WARNUNG**

Dies ist ein Gerät der Klasse A. Bei Einsatz des Geräts in Wohngebieten kann es Störungen des Radio- und Fernsehempfangs verursachen. In diesem Fall muss der Benutzer alle notwendigen Maßnahmen ergreifen, die möglicherweise nötig sind, um die Störungen auf eigene Rechnung zu beheben.

 **Warning:**

**ADVERTENCIA**

Este es un producto clase A. El uso de este equipo en áreas residenciales puede causar interferencias nocivas, en cuyo caso, se requerirá que los usuarios tomen cualquier medida necesaria para corregir la interferencia por cuenta propia.

**⚠ Warning:****AVISO**

Este dispositivo é um produto Classe A. Operar este equipamento em uma área residencial provavelmente causará interferência prejudicial; neste caso, espera-se que os usuários tomem as medidas necessárias para corrigir a interferência por sua própria conta.

**⚠ Warning:****AVVISO**

Questo dispositivo è un prodotto di Classe A. Il funzionamento di questo apparecchio in aree residenziali potrebbe causare interferenze dannose, nel cui caso agli utenti verrà richiesto di adottare tutte le misure necessarie per porre rimedio alle interferenze a proprie spese.

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## Electrostatic discharge warning statement

**⚠ Electrostatic alert:**

ESD can damage electronic circuits. Do not touch electronic hardware unless you wear a grounding wrist strap or other static-dissipating device.

**⚠ Electrostatic alert:****ELEKTROSTATIKWARNUNG**

Elektronische Schaltkreise können durch elektrostatische Entladung beschädigt werden. Berühren Sie elektronische Hardware nur, wenn Sie ein Erdungsarmband oder ein anderes Statik ableitendes Medium tragen.

**⚠ Electrostatic alert:****ALERTA DE ELECTROESTÁTICA**

Una descarga electroestática puede dañar los circuitos electrónicos. No toque el hardware electrónico a no ser que utilicé una muñequera antiestática u otro dispositivo disipador de estática.

**⚠ Electrostatic alert:****ALERTA CONCERNANT LES DÉCHARGES ÉLECTROSTATIQUES**

Une décharge électrostatique (DES) peut endommager les circuits électroniques. Ne touchez pas le matériel électronique, à moins de mettre à votre poignet une bande de mise à la masse ou autre dispositif dissipant l'électricité statique.

**⚠ Electrostatic alert:****ALERTA DE ELETROSTÁTICA**

ESD pode danificar circuitos eletrônicos. Não toque em equipamentos eletrônicos a menos que esteja utilizando pulseira de aterramento ou outro dispositivo para dissipação de energia estática.

 **Electrostatic alert:**

**AVVISO ELETTROSTATICO**

Le scariche elettrostatiche (ESD) possono danneggiare i circuiti elettronici. Non toccare i componenti elettronici senza aver prima indossato un braccialetto antistatico o un altro dispositivo in grado di dissipare l'energia statica.

---

## Laser eye safety danger statement

 **Danger:**

**Risk of eye injury by laser**

Fiber optic equipment can emit laser or infrared light that can injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables are connected to a light source.

 **Danger:**

**DANGER**

Risques de blessure oculaire par lumière laser

L'équipement de fibres optiques peut émettre une lumière laser ou infrarouge nuisible à vos yeux. Ne regardez jamais en direction de fibres optiques ou d'un port connecteur. Supposez toujours que les câbles de fibres optiques sont connectés à une source de lumière.

 **Danger:**

**GEFAHR**

Risiko einer Augenverletzung durch Laser

Risiko einer Augenverletzung durch Laser Glasfasergeräte können Laserstrahlen oder ultraviolettes Licht aussenden, das Ihre Augen verletzen kann. Schauen Sie nie direkt in einen Glasfaserleiter oder Verbindungsanschluss. Gehen Sie immer davon aus, dass Glasfaserkabel mit einer Lichtquelle verbunden sind.

 **Danger:**

**PELIGRO**

Riesgo de lesión en los ojos por láser

El equipo de fibra óptica puede emitir una luz láser o infrarroja que dañe sus ojos. Nunca mire un puerto de fibra óptica o conector. Siempre asuma que los cables de fibra óptica están conectados a una fuente de luz.

 **Danger:**

**PERIGO**

O laser pode causar ferimentos no olho

O equipamento de fibra ótica pode emitir laser ou luz infravermelha que pode causar danos a sua vista. Nunca olhe para dentro da fibra ótica ou da porta do conector. Tenha sempre em mente que os cabos de fibra ótica estão ligados a uma fonte de luz.

 **Danger:**

**PERICOLO**

Rischio di ustioni agli occhi dovute al laser

Le apparecchiature con fibre ottiche possono emettere raggi laser o infrarossi in grado di provocare ferite agli occhi. Non guardare mai all'interno di una porta di connessione o una fibra ottica. Tenere sempre presente che i cavi a fibra ottica sono collegati a una sorgente luminosa.

---

## Laser eye safety connector inspection danger statement

 **Danger:**

**Risk of eye injury**

When you inspect a connector, ensure that light sources are off. The light source used in fiber optic cables can damage your eyes.

 **Danger:**

**DANGER**

Risques de blessure oculaire

Assurez-vous que toutes les sources de lumière ont été désactivées avant de procéder au contrôle d'un connecteur. La source de lumière utilisée dans les câbles de fibres optiques risque de provoquer des lésions oculaires.

 **Danger:**

**GEFAHR**

Verletzungsrisiko der Augen

Achten Sie bei der Kontrolle der Anschlüsse darauf, dass die Lichtquellen abgeschaltet sind. Die für die Glasfaserkabel verwendeten Lichtquellen können Augenschäden hervorrufen.

 **Danger:**

**PELIGRO**

Riesgo de lesiones oculares

Cuando inspeccione un conector, controle que las fuentes de luz estén apagadas. La fuente de luz que utilizan los cables de fibra óptica puede ocasionar daños en la vista.

 **Danger:**

**PERIGO**

Risco de ferimento nos olhos

Ao inspecionar um conector, verifique se as fontes luminosas estão desligadas. A fonte luminosa usada nos cabos de fibra ótica pode causar danos a seus olhos.

 **Danger:**

**PERICOLO**

Rischio di lesioni agli occhi

Quando si esamina un connettore, assicurarsi che le sorgenti di luce siano spente. La sorgente di luce utilizzata nei cavi a fibre ottiche potrebbero danneggiare gli occhi.

---

## Connector cleaning safety danger statement

 **Danger:**

**Risk of eye injury**

When you inspect a connector, ensure that light sources are off. The light source used in fiber optic cables can damage your eyes. To avoid getting debris in your eyes, wear safety glasses when you work with the canned air duster. To avoid eye irritation on contact, wear safety glasses when you work with isopropyl alcohol.

 **Danger:**

**DANGER**

Risques de blessure oculaire

Assurez-vous que toutes les sources de lumière ont été désactivées avant de procéder au contrôle d'un connecteur. La source de lumière utilisée dans les câbles de fibres optiques risque de provoquer des lésions oculaires. Pour éviter tout risque de projection vers les yeux, portez des lunettes de protection lorsque vous utilisez la bombe dépoussiérante à air comprimé. Pour éviter tout risque d'irritation oculaire, portez des lunettes de protection lorsque vous utilisez de l'alcool à 90°.



 **Danger:****GEFAHR**

Verletzungsrisiko der Augen

Achten Sie bei der Kontrolle der Anschlüsse darauf, dass die Lichtquellen abgeschaltet sind. Die für die Glasfaserkabel verwendeten Lichtquellen können Augenschäden hervorrufen. Zum Schutz vor Schmutzteilchen tragen Sie eine Schutzbrille, wenn Sie mit einem Pressluft-Spray arbeiten. Zum Schutz vor Augenirritationen tragen Sie eine Schutzbrille, wenn Sie mit Isopropanol arbeiten.

 **Danger:****PELIGRO**

Riesgo de lesiones

Cuando inspeccione un conector, controle que las fuentes de luz estén apagadas. La fuente de luz que utilizan los cables de fibra óptica puede ocasionar daños en la vista. Cuando trabaje con el pulverizador de aire envasado, utilice gafas de seguridad para evitar el ingreso de residuos en los ojos. Utilice gafas de seguridad cuando trabaje con alcohol isopropilo para evitar irritación en los ojos.

 **Danger:****PERIGO**

Risco de ferimento nos olhos

Ao inspecionar um conector, verifique se as fontes luminosas estão desligadas. A fonte luminosa usada nos cabos de fibra óptica pode causar danos a seus olhos. Para evitar que seus olhos sejam atingidos por resíduos, use óculos de segurança ao trabalhar com lata de ar comprimido. Para evitar irritação dos olhos, use óculos de segurança ao trabalhar com álcool isopropílico.

 **Danger:****PERICOLO**

Rischio di lesioni agli occhi

Quando si esamina un connettore, assicurarsi che le sorgenti di luce siano spente. La sorgente di luce utilizzata nei cavi a fibre ottiche potrebbero danneggiare gli occhi. Per evitare l'accidentale introduzione di detriti negli occhi, indossare gli occhiali di sicurezza quando si lavora con un'impolveratrice ad aria compressa. Per evitare irritazioni oculari da contatto, indossare gli occhiali di sicurezza quando si lavora con alcool isopropilico.

---

## Optical fiber damage warning statement

 **Warning:**

**Risk of equipment damage**

Do not crush fiber optic cable. If fiber optic cable is in the same tray or duct with large, heavy electrical cables, the weight of the electrical cable can damage the fiber optic cable.

 **Warning:**

**AVERTISSEMENT**

Risques d'endommagement de l'équipement

N'exercez pas de pression sur les câbles de fibres optiques. Ne placez pas de câbles de fibres optiques dans la même caisse ou dans le même fourreau que des câbles électriques lourds car leur poids risquerait de les endommager.

 **Warning:**

**WARNUNG**

Risiko von Geräteschäden

Das Glasfaserkabel darf nicht zerdrückt werden. Wenn sich ein Glasfaserkabel zusammen mit großen und schweren Elektrokabeln im gleichen Kabelkanal oder in der gleichen Führung befindet, kann es durch das Gewicht der Elektrokabel beschädigt werden.

 **Warning:**

**ADVERTENCIA**

Riesgo de daños en los equipos

Evite aplastar los cables de fibra óptica. Si el cable de fibra óptica se encuentra en la misma bandeja o conducto que otros cables eléctricos grandes y pesados, puede dañarse.

 **Warning:**

**AVISO**

Risco de danos ao equipamento

Não amasse o cabo de fibra ótica. Se o cabo de fibra ótica estiver na mesma bandeja ou duto com cabos elétricos longos e pesados, ele pode ser danificado pelo peso do cabo elétrico.

 **Warning:**

**Avvertenza**

Rischio di danno all'apparecchio

Non schiacciare o piegare il cavo a fibre ottiche. Se il cavo a fibre ottiche è posizionato in un vassoio o condotto con cavi elettrici pesanti e di grosse dimensioni, esso potrebbe essere danneggiato dal peso dei cavi elettrici.

---

## Optical fiber connector damage warning statement

 **Warning:**

**Risk of equipment damage**

To prevent further contamination, clean fiber optic equipment only when you see evidence of contamination.

To prevent contamination, cover the optical ports of all active devices with a dust cap or optical connector.

To avoid the transfer of oil or other contaminants from your fingers to the end face of the ferrule, handle connectors with care.

 **Warning:**

**AVERTISSEMENT**

Risques d'endommagement de l'équipement

Pour éviter tout risque de nouvelle contamination, nettoyez uniquement le matériel en fibre optique lorsque les preuves de contamination sont avérées.

Pour éviter tout risque de contamination, assurez-vous que tous les ports optiques des périphériques sous tension sont protégés par un capuchon anti-poussière ou par un connecteur optique.

Manipulez les connecteurs avec précaution afin d'éviter toute application d'huile provenant de vos doigts ou d'autres contaminants sur l'extrémité de la ferrule.

 **Warning:**

**WARNUNG**

Risiko von Geräteschäden

Zur Vermeidung weiterer Verunreinigungen reinigen Sie die Glasfiber-Ausrüstung nur dann, wenn sie offensichtlich kontaminiert ist.

Zur Vermeidung von Verunreinigungen schützen Sie die optischen Ports aller aktiven Geräte mit einer Staubkappe oder einem optischen Steckverbinder.

Zur Vermeidung von Verunreinigungen des hinteren Muffenteils durch Öl von den Fingern oder durch andere Kontaminationsstoffe behandeln Sie die Anschlüsse vorsichtig.

 **Warning:**

**ADVERTENCIA**

Riesgo de daños en los equipos

Limpie los equipos de fibra óptica únicamente cuando existan rastros de contaminación para evitar diseminarla aun más.

Para evitar la contaminación, controle que los puertos ópticos de todos los dispositivos activos estén cubiertos con una tapa protectora o un conector óptico.

Maneje los conectores con cuidado para no contaminar la superficie de los casquillos con la grasa de los dedos ni otros contaminantes.

 **Warning:**

**AVISO**

Risco de danos ao equipamento

Para evitar contaminação futura, limpe o equipamento ótico apenas quando houver evidência de contaminação.

Para evitar a contaminação, verifique se as portas óticas de todos os dispositivos ativos estão cobertas com uma proteção contra pó ou conector ótico.

Para evitar a transferência de óleo ou outro agente contaminador de seus dedos para a extremidade final da ponteira, manuseie os conectores com cuidado.

 **Warning:**

**Avvertenza**

Rischio di danno all'apparecchio

Per evitare ulteriori contaminazioni, pulire l'apparecchio a fibre ottiche solo in presenza di evidente contaminazione.

Per evitare contaminazioni, assicurarsi che le porte ottiche di tutti i dispositivi attivi siano coperte da un tappo antipolvere o da un connettore ottico.

Per evitare il trasferimento di olio o di altri agenti contaminanti dalle dita alla parte finale della ghiera, maneggiare con cura i connettori.

---

## SFP damage warning statement

 **Warning:**

**Risk of equipment damage**

SFPs are keyed to prevent incorrect insertion. If the SFP resists pressure, do not force it; turn it over, and reinsert it.

 **Warning:**

**AVERTISSEMENT**

Risques d'endommagement de l'équipement

Afin d'éviter tout risque d'insertion incorrecte, les modules SFP sont verrouillés. Si vous ne parvenez pas à insérer un module SFP, ne forcez pas. Retournez-le et renouvelez l'opération.

 **Warning:**

**WARNUNG**

Risiko von Geräteschäden

Die SFPs sind so konstruiert, dass ein falsches Einsetzen verhindert wird. Lässt sich ein SFP auch auf Druck hin nicht einsetzen, versuchen Sie nicht, es gewaltsam einzusetzen, sondern drehen Sie es um, und setzen Sie es erneut ein.

 **Warning:**

**ADVERTENCIA**

Riesgo de daños en los equipos

Los módulos SFP cuentan con cuñas que no permiten insertarlos de forma incorrecta. Si el módulo SFP opone resistencia a la presión, no lo fuerce; gírelo e insértelo nuevamente.

 **Warning:**

**AVISO**

Risco de danos ao equipamento

Os SFPs são chaveados para evitar inserção indevida. Se o SFP resistir à pressão, não o force; inverta e recoloque-o.

 **Warning:**

**Avvertenza**

Rischio di danni all'apparecchio

Gli SFP dispongono di chiavi in modo da evitarne l'inserimento errato. Se l'SFP resiste alla pressione, non forzarlo ma capovolgerlo e reinserirlo.

# Glossary

<b>attenuation</b>	The decrease in signal strength in an optical fiber caused by absorption and scattering.
<b>bit error rate (BER)</b>	The ratio of the number of bit errors to the total number of bits transmitted in a specific time interval.
<b>cable plant</b>	All the optical elements, such as fiber connectors and splices, between a transmitter and a receiver.
<b>coarse wavelength division multiplexing (CWDM)</b>	A technology that uses multiple optical signals with different wavelengths to simultaneously transmit in the same direction over one fiber, and then separates by wavelength at the distant end.
<b>demultiplexing</b>	The wavelength separation in a wavelength-division multiplexing system. The opposite of multiplexing.
<b>dense wavelength division multiplexing (DWDM)</b>	A technology that uses many optical signals (16 or more) with different wavelengths to simultaneously transmit in the same direction across one fiber, and then separate by wavelength at the distant end.
<b>dispersion</b>	<p>The broadening of input pulses as they travel the length of an optical fiber. The following types of dispersion exist:</p> <ul style="list-style-type: none"><li>• modal dispersion—caused by the many optical path lengths in a multimode fiber</li><li>• chromatic dispersion—caused by the differential delay at various wavelengths in an optical fiber</li><li>• waveguide dispersion—caused by light traveling through both the core and cladding materials in single-mode fibers</li></ul>
<b>Gigabit Ethernet (GbE)</b>	Ethernet technology with speeds up to 100 Gbps.
<b>light emitting diode (LED)</b>	A semiconductor diode that emits light when a current passes through it.
<b>media</b>	A substance that transmits data between ports; usually fiber optic cables or category 5 unshielded twisted pair (UTP) copper wires.

<b>metropolitan area network (MAN)</b>	A broadband network that covers an area larger than a Local Area Network.
<b>multimode fiber (MMF)</b>	A fiber with a core diameter larger than the wavelength of light transmitted that you can use to propagate many modes of light. Commonly used with LED sources for low speed and short distance lengths. Typical core sizes (measured in microns) are 50/125, 62.5/125 and 100/140.
<b>multiplexing</b>	Carriage of multiple channels over a single transmission medium; a process where a dedicated circuit is shared by multiple users. Typically, data streams intersperse on a bit or byte basis (time division), or separate by different carrier frequencies (frequency division).
<b>nanometer (nm)</b>	One billionth of a meter ( $10^{-9}$ meter). A unit of measure commonly used to express the wavelengths of light.
<b>QSFP+</b>	A hot pluggable, quad small form-factor pluggable plus (QSFP+) transceiver, which is used in 40 Gbps and 4x10 Gbps Ethernet applications. 4x10 Gbps requires channelization support.
<b>SFP</b>	A hot pluggable, small form-factor pluggable (SFP) transceiver, which is used in Ethernet applications up to 1 Gbps.
<b>SFP+</b>	A hot pluggable, small form-factor pluggable plus (SFP+) transceiver, which is used in Ethernet applications up to 10 Gbps. It is similar in physical appearance to SFP transceivers.
<b>single-mode fiber (SMF)</b>	One of the various light waves transmitted in an optical fiber. Each optical signal generates many modes, but in single-mode fiber only one mode is transmitted. Transmission occurs through a small diameter core (approximately 10 micrometers), with a cladding that is 10 times the core diameter. These fibers have a potential bandwidth of 50 to 100 gigahertz (GHz) per kilometer.
<b>unshielded twisted pair (UTP)</b>	A cable with one or more pairs of twisted insulated copper conductors bound in a single plastic sheath.
<b>XFP</b>	A pluggable 10 gigabit transceiver capable of providing different optical media for a switch. The XFP is similar to an SFP transceiver but is larger in size.