



Ruijie Transceiver Modules

Installation and Reference Guide V2.6

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Preface

Thank you for using our products. This manual will guide you through the installation of the device.

This manual describes the functional and physical features and provides the device installation steps, hardware troubleshooting, module technical specifications, and specifications and usage guidelines for cables and connectors.

Audience

It is intended for the users who have some experience in installing and maintaining network hardware. At the same time, it is assumed that the users are already familiar with the related terms and concepts.

Obtaining Technical Assistance

- Ruijie Networks Website: <http://www.ruijienetworks.com/>
- Service Email: service_rj@ruijienetworks.com
- Technical Support: <http://www.ruijienetworks.com/service.aspx>
- Technical Support Hotline: +86-4008-111-000

Related Documents

Documents	Description
Configuration Guide	Describes network protocols and related mechanisms that supported by the product, with configuration examples.
Command Reference	Describes the related configuration commands, including command modes, parameter descriptions, usage guides, and related examples.

Symbol Conventions

 Means reader take note. Notes contain helpful suggestions or references.

 Means **reader be careful**. In this situation, you might do something that could result in equipment damage or loss of data.

1 Mini-GBIC and SFP Modules

1.1 Overview

The SFP (Small Form-Factor Pluggable) transceiver modules are classified into two models: optical SFP modules including duplex SFP modules shown in Figure 1 and BIDI SFP modules in Figure 2, and copper SFP modules in Figure 3. The BIDI SFP module applies different wavelengths in transmission and reception. In such way, the optical signal gets bidirectional transmission in the same optical fiber. The SFP module is an input/output device that supports hot swapping. When installed into the Ethernet port, the SFP is responsible for connecting the port and optical fiber network. The SFP module can be described as a smaller version of the Giga Bitrate Interface Converter (GBIC), also referred to as a mini-GBIC. In addition to applications to the Gigabit Ethernet port, the SFP also supports transceiver applications on FE ports and STM-1 SDH ports. 1000Base-T SFP uses existing copper wires to implement the full-duplex Gigabit connections between high-end workstations and power distribution rooms.

Figure 1 Dual-fiber SFP Module

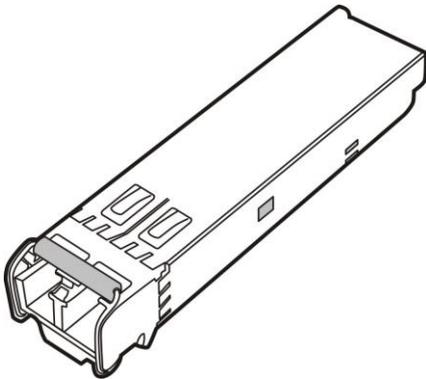


Figure 2 BIDI SFP Module

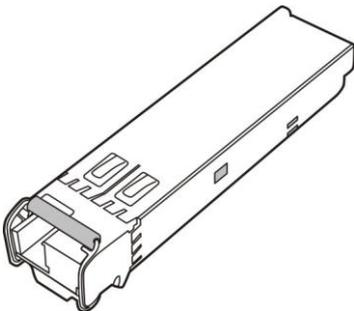


Figure 3 Copper SFP Module

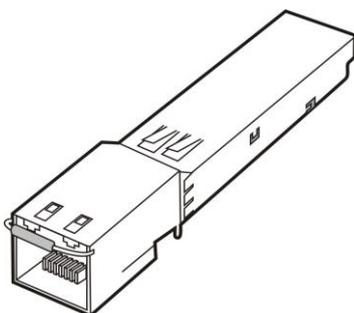
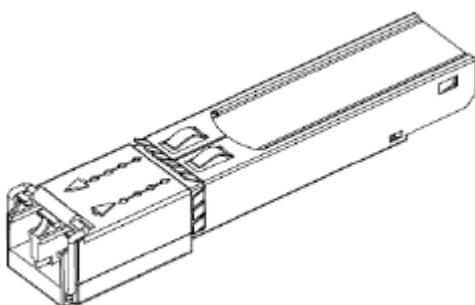


Figure 4 Dual-fiber SFP(SGMII) Module



i The schematic diagrams are for your reference only. The product appearance is subject to the actual model.

1.2 Models and Specifications

Table 1 Existing Models of the Optical SFP Module.

Rate	Standard	SFP Product Model
Ethernet FE	Long wavelength / long distance 100Base-FX	FE-SFP-LX-MM1310 FE-SFP-LX-MM1310-SGMII FE-SFP-LH15-SM1310 FE-eSFP-LH15-SM1310 FE-SFP-LH20-SM1310-SGMII FE-SFP-LX20-SM1310-BIDI FE-SFP-LX20-SM1550-BIDI FE-SFP-LH40-SM1310-BIDI FE-SFP-LH40-SM1550-BIDI
Ethernet GE	Short wavelength 1000Base-SX	MINI-GBIC-SX-MM850 GE-eSFP-SX-MM850 GE-SFP-SX GE-SFP-SX-SM1550-BIDI GE-SFP-SX-SM1310-BIDI
	Long wavelength / long distance 1000Base-LX/LH	MINI-GBIC-LX-SM1310 GE-SFP-LX GE-eSFP-LX-SM1310 GE-SFP-LX-SM1310 MINI-GBIC-LH40-SM1310 GE-SFP-LX20-SM1310-BIDI GE-SFP-LX20-SM1550-BIDI GE-SFP-LH40-SM1310-BIDI GE-SFP-LH40-SM1550-BIDI
	Long wavelength / extended distance 1000Base-ZX	MINI-GBIC-ZX50-SM1550 MINI-GBIC-ZX80-SM1550 MINI-GBIC-ZX100-SM1550
SDH interface 155.52Mbps	Short wavelength	SDH155-SFP-SX-MM850 SDH155-SFP-SX-MM1310

	Long wavelength / long distance	SDH155-SFP-LH15-SM1310
	Long wavelength / extended distance	SDH155-SFP-LH40-SM1310 SDH155-SFP-LH80-SM1550

Table 2 Models of the Copper SFP Module.

Standard	1000Base-T SFP Product Model
1000Base-T	MINI-GBIC-GT

i The types/models of MINI-GBIC and SFP series modules are being updated. If more accurate models of the module are required, please contact Ruijie marketing staff or technical support engineers.

Table 3 Pairing Models of the SFP BIDI Module

Rate/Distance	Pairing Models
100M/20km	FE-SFP-LX20-SM1310-BIDI FE-SFP-LX20-SM1550-BIDI
100M/40km	FE-SFP-LH40-SM1310-BIDI FE-SFP-LH40-SM1550-BIDI
1000M/500m	GE-SFP-SX-SM1310-BIDI GE-SFP-SX-SM1550-BIDI
1000M/20km	GE-SFP-LX20-SM1310-BIDI GE-SFP-LX20-SM1550-BIDI
1000M /40km	GE-SFP-LH40-SM1310-BIDI GE-SFP-LH40-SM1550-BIDI

i BIDI modules must be used in pairs. If FE-SFP-LX20-SM1310-BIDI is used at one end, then FE-SFP-LX20-SM1550-BIDI must be applied to the other end.

Table 4 Temperature/Humidity Requirements of Dual-fiber SFP Modules and Copper SFP Modules

Operating Temperature	0°C to 70°C
Storage Temperature	-40°C to 85°C
Relative Humidity	10% to 90%

Table 5 Temperature/Humidity Requirements of BIDI SFP Modules

Operating Temperature	-40°C to 85°C
Storage Temperature	-40°C to 85°C
Relative Humidity	5% to 95%

1.3 Models and Technical Specifications

Table 6 Models and Technical Specifications of the SFP Module

SFP Model	Wavelength (nm)	Optical Fiber	DDM (Yes/No)	Intensity of Transmitted Light	Intensity of Received Light /
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		Type		/ dBm		dBm	
				MIN	MAX	MAX	MIN
FE-SFP-LX-MM1310	1310	MMF	Yes	-22	-14	-30	-14
FE-SFP-LX-MM1310-SGMII	1310	MMF	No	-20	-15	-28	-8
FE-SFP-LH15-SM1310	1310	SMF	Yes	-15	-8	-28	-8
FE-SFP-LH20-SM1310-SGMII	1310	SMF	No	-15	-8	-28	-8
FE-SFP-LX20-SM1310-BIDI	1310TX/1550RX	SMF	Yes	-15	-7	-28	-8
FE-SFP-LX20-SM1550-BIDI	1550TX/1310RX	SMF	Yes	-15	-7	-28	-8
FE-SFP-LH40-SM1310-BIDI	1310TX/1550RX	SMF	Yes	-7	-2	-32	-8
FE-SFP-LH40-SM1550-BIDI	1550TX/1310RX	SMF	Yes	-7	-2	-32	-8
FE-eSFP-LH15-SM1310	1310	SMF	Yes	-15	-8	-28	-8
MINI-GBIC-SX	850	MMF	No	-9.5	-3	-17	0
MINI-GBIC-LX	1310	SMF	No	-9.5	-3	-20	-3
GE-eSFP-SX-MM850	850	MMF	Yes	-9.5	-3	-17	0
GE-eSFP-LX-SM1310	1310	SMF	Yes	-9.5	-3	-20	-3
GE-SFP-LX-SM1310	1310	SMF	No	-9.5	-3	-20	-3
MINI-GBIC-LH40	1310	SMF	Yes	-2	3	-22	-3
GE-SFP-SX-SM1310-BIDI	1310	MMF	No	-10	-5	-17	-3
GE-SFP-SX-SM1550-BIDI	1550	MMF	No	-10	-5	-17	-3
GE-SFP-LX20-SM1310-BIDI	1310TX/1550RX	SMF	Yes	-9	-3	-20	-3
GE-SFP-LX20-SM1550-BIDI	1550TX/1310RX	SMF	Yes	-9	-3	-20	-3
GE-SFP-LH40-SM1310-BIDI	1310TX/1550RX	SMF	Yes	-5	0	-24	-1
GE-SFP-LH40-SM1550-BIDI	1550TX/1310RX	SMF	Yes	-5	0	-24	-1
MINI-GBIC-ZX50	1550	SMF	Yes	-5	0	-22	-3
MINI-GBIC-ZX80	1550	SMF	Yes	0	4.7	-22	-3
MINI-GBIC-ZX100	1550	SMF	Yes	0	5	-30	-9
SDH155-SFP-SX-MM850	850	MMF	No	-10	-4	-25	0
SDH155-SFP-SX-MM1310	1310	MMF	No	-20	-14	-30	-14
SDH155-SFP-LH15-SM1310	1310	SMF	No	-15	-8	-28	-8
SDH155-SFP-LH40-SM1310	1310	SMF	No	-5	0	-34	-8
SDH155-SFP-LH80-SM1310	1310	SMF	No	-5	0	-34	-8
SDH155-SFP-LH80-SM1550	1550	SMF	No	-5	0	-34	-8
Mini-GBIC-GT	NA	RJ45 cable	No	N/A	N/A	N/A	N/A
GE-SFP-SX	850	MMF	No	-9.5	-3	-17	0
GE-SFP-LX	1310	SMF	No	-9.5	-3	-20	-3

 Based on the specifications of received light intensity, install an attenuator at the link to avoid damage to the following optical modules when using short optical fibers: FE-SFP-LX20-SM1310-BIDI, FE-SFP-LX20-SM1550-BIDI, FE-SFP-LH40-SM1310-BIDI, FE-SFP-LH40-SM1550-BIDI, GE-SFP-LH40-SM1310-BIDI,

GE-SFP-LH40-SM1550-BIDI, MINI-GBIC-LH40-SM1310, MINI-GBIC-ZX50-SM1550, MINI-GBIC-ZX80-SM1550, MINI-GBIC-ZX100-SM1550, SDH155-SFP-LH40-SM1310 and SDH155-SFP-LH80-SM1550.

-  The optical module is a laser device. Please take care of your eyes and do not look into the laser beam directly.
-  To keep the optical module clean, please make sure that the dust cap is mounted when it is not connected to a fiber cable.

Table 7 Module Cabling Specifications

SFP Model	Connector Type	Optical Fiber Type	Core Specification (um)	Maximum Cabling Distance
FE-SFP-LX-MM1310	LC	MMF	62.5/125	2 km
FE-SFP-LX-MM1310-SGMII	LC	MMF	62.5/125	2 km
FE-SFP-LH15-SM1310	LC	SMF	9/125	15 km
FE-SFP-LH20-SM1310-SGMII	LC	SMF	9/125	20 km
FE-SFP-LX20-SM1310-BIDI	LC	SMF	9/125	20 km
FE-SFP-LX20-SM1550-BIDI	LC	SMF	9/125	20 km
FE-SFP-LH40-SM1310-BIDI	LC	SMF	9/125	40 km
FE-SFP-LH40-SM1550-BIDI	LC	SMF	9/125	40 km
FE-eSFP-LH15-SM1310	LC	SMF	9/125	15 km
MINI-GBIC-SX	LC	MMF	62.5/125	275 m
			50/125	550 m
MINI-GBIC-LX	LC	SMF	9/125	10 km
GE-eSFP-SX-MM850	LC	MMF	62.5/125	275 m
			50/125	550 m
GE-eSFP-LX-SM1310	LC	SMF	9/125	10 km
GE-SFP-LX-SM1310	LC	SMF	9/125	10 km
MINI-GBIC-LH40	LC	SMF	9/125	40 km
GE-SFP-SX-SM1310-BIDI	LC	MMF	50/125	500 m
GE-SFP-SX-SM1550-BIDI	LC	MMF	50/125	500 m
GE-SFP-LX20-SM1310-BIDI	LC	SMF	9/125	20 km
GE-SFP-LX20-SM1550-BIDI	LC	SMF	9/125	20 km
GE-SFP-LH40-SM1310-BIDI	LC	SMF	9/125	40 km
GE-SFP-LH40-SM1550-BIDI	LC	SMF	9/125	40 km
MINI-GBIC-ZX50	LC	SMF	9/125	50 km
MINI-GBIC-ZX80	LC	SMF	9/125	80 km
MINI-GBIC-ZX100	LC	SMF	9/125	100 km
SDH155-SFP-SX-MM850	LC	MMF	62.5/125	500 m
SDH155-SFP-SX-MM1310	LC	MMF	62.5/125	2 km
SDH155-SFP-LH15-SM1310	LC	SMF	9/125	15 km
SDH155-SFP-LH40-SM1310	LC	SMF	9/125	40 km
SDH155-SFP-LH80-SM1310	LC	SMF	9/125	80 km
GE-SFP-SX	LC	MMF	62.5/125	275 m
			50/125	550 m
GE-SFP-LX	LC	SMF	9/125	10 km

MINI-GBIC-GT	RJ45 cable	Standard Cat-5 and above unshielded or shielded twist pairs	100 m
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1.4 Module Specifications

Wavelength

Wavelength means the optical wave band for transmission of light signal. Currently, the commonly used XFP optical modules have three centre wavelengths: 850 nm, 1310 nm and 1550 nm. Usually, the wave band of 850 nm is for short-distance transmission and the wave bands of 1310 nm and 1550 nm are for long-distance transmission.

Optical Fiber Type

Optical fibers are classified into two types: single-mode and multimode fibers according to the transmission mode of light in fibers.

A multimode fiber (MMF) has a larger core and transmits light of various modes. But it has a higher modal dispersion. The modal dispersion grows with the increase of transmission distance. The transmission distance of multimode fibers is associated with the transmission rate, core diameter, and modal bandwidth.

A single-mode fiber (SMF) has a smaller core and can transmit one mode of light. Therefore, it has a lower modal dispersion and is applicable to remote communication.

Connector Type

Optical fibers are joined by optical fiber connectors to form fiber jumpers. A fiber jumper is connected to optical modules through an optical fiber connector, so that the optical channel is detachable for the convenience of debugging and maintenance of the optical system. Fiber connectors are in many types. The commonly used lucent connectors (LCs) are shown in Figure 4 and Figure 5

Figure 5 Single-core LC Connector

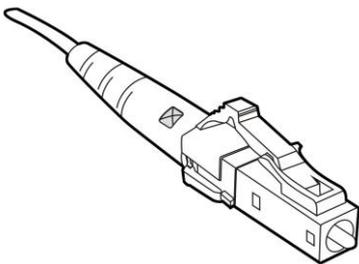
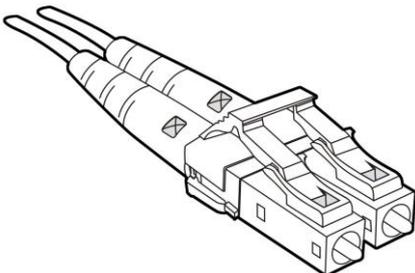


Figure 6 Dual-core LC Connector



DDM

Digital Diagnostic Monitor (DDM) is widely used in optical modules to dynamically measure the temperature, intensity of transmitted and received light, voltage, and laser bias current of the module. You can run commands to get the monitoring result in the host system that supports display of DDM information.

Intensity of Transmitted Light

Intensity of transmitted light refers to the optical output power transmitted from the optical module. The unit is dBm.

Intensity of Received Light

Intensity of received light refers to the optical input power received by the optical module. The unit is dBm. If the actual received light intensity is less than the minimum value, the module may fail in connection or lose many frames. If the actual received light intensity is greater than the maximum value, the module may be damaged.

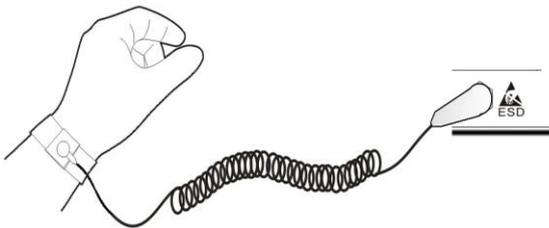
1.5 Module Installation Precautions

1.5.1 Preparation before Installation

Before installation, electron static discharge (ESD) protection is needed. To avoid damages to the SFP modules and electronic devices in the equipment caused by the static electricity generated during the installation, please wear the anti-static wrist strap around the wrist and tighten the lock; make sure that the anti-static wrist strap has a good contact with the skin and is well grounded.

Wearing jack type anti-static wrist strap, for example, is as shown in Figure 6:

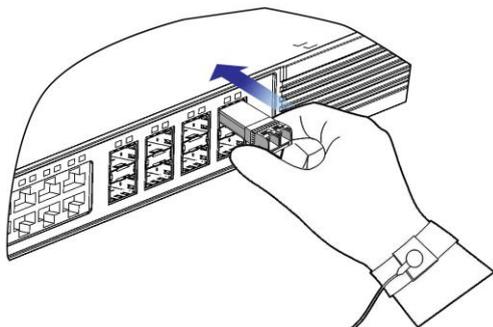
Figure 7 Schematic Diagram for Wearing Jack Type Anti-static Wrist Strap



1.5.2 Installing the SFP Module

1. Reveal the handle of the SFP module to lock against the snap on top of the module, and pinch the both sides of the SFP module to push it levelly and slowly into the optical module slot until the optical module firmly connects to the slot (there would be a click sound if the optical module is correctly connected to the slot), as shown in Figure 7:

Figure 8 Installing the SFP Optical Module

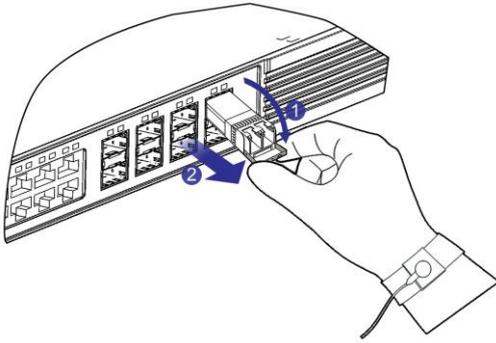


2. When you connect the SFP module to the optical fiber network, use the optical fiber jumper. Based on the connector type of the interconnecting ports, choose the jumper with corresponding connectors.
3. After installing the module of the optical fiber jumper, the switch port indicator “LINK/ACT” will be on; otherwise, check that the optical fiber jumper is correctly connected.
4. If the optical fiber jumper is correctly connected, check whether the connected SFP modules are properly matched.
5. Precautions during installing:
 - The optical module cannot be inserted inversely. If the optical module cannot be inserted to the end along one direction, do not forcibly to push it in and please try another direction.
 - It is recommended that before installing the fiber-optic lines, not remove the protecting rubber on the optical port of optical modules.
 - It is recommended not insert the fiber SFP module with optical fiber directly into the slot. Please proceed with the installation after the optical fiber is pulled out.
 - In the process of installing the SFP module, please do not directly touch the connecting finger part of the SFP modules by hand.
 - Please do not crush, twist, fold fiber or over bend the fiber, otherwise it may lead to reduced system performance or loss of transmitted data.
 - BIDI SFP modules must be used in pairs. For instance, If FE-SFP-LX20-SM1310-BIDI is used at one end, and then FE-SFP-LX20-SM1550-BIDI must be applied to the other end.

1.5.3 Removing the SFP Optical Module

1. Pull out the optical fiber line.
2. Pull the SFP module handle downward to the horizontal position, gently pull the snap, and then pull out the SFP module smoothly. As shown in the Figure 8.

Figure 9 Schematic Diagram for Pulling out the SFP Optical Module



3. Precautions for removing:

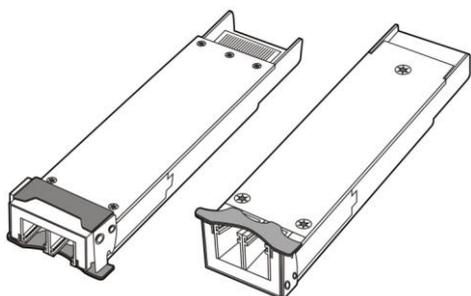
- Please pull out the optical fiber before removing the optical module.
- Please do not forcibly pull out the module without pulling down the handle of the optical module first so as not to cause any damage.
- Please put the dust caps on the detached module and device optical ports immediately to avoid dirt.

2 10G XFP Modules

2.1 Overview

Ruijie Networks provides the following 10G XFP transceiver modules: 10GBASE-SR-XFP, 10GBASE-LR-XFP, 10GBASE-ER-XFP, and XG-XFP-ZR80-SM1550. The 10G XFP transceiver is an input/output device that supports hot swapping. When installed into the 10G Ethernet XFP port or slot, the 10G XFP transceiver is responsible for connecting the port and optical fiber network. The appearance of XFP module is shown in Figure 1.

Figure 1 XFP Modules



i The schematic diagrams are for your reference only. The product appearance is subject to the actual model.

2.2 Models and Technical Specifications

Table 1 XFP Module Models

Model	Wavelength (nm)	Optical Fiber Type	DDM (Yes/No)	Intensity of Transmitted Light/dBm		Intensity of Received Light/dBm	
				Min	Max	Min	Max
10GBASE-SR-XFP	850	MMF	Yes	-5	-1	-7.5	0.5
10GBASE-LR-XFP	1310	SMF	Yes	-4.8	0.5	-10.3	0.5
10GBASE-ER-XFP	1550	SMF	Yes	-1	2	-11.3	-1
XG-XFP-ZR80-SM1550	1550	SMF	Yes	0	4	-23	-7

Do not use short-distance optical fiber connection for the 10GBASE-ER-XFP for avoidance of overloading on the optical transceiver. If the optical power of the module receiver end is greater than or equal to -1 dBm, install an attenuator at the receiver end so that the optical power can be less than -1 dBm.

Do not use short optical fibers for the XG-XFP-ZR80-SM1550 to avoid overloading on the optical transceiver. If the optical power of the module receiver end is greater than or equal to -7 dBm, install an attenuator at the receiver end so that the optical power can be less than -7 dBm.

The optical module is a laser device. Please take care of your eyes and do not look into the laser beam directly.

To keep the optical module clean, please make sure that the dust cap is mounted when it is not connected to a fiber cable.

Table 2 Module Cabling Specifications

Model	Connector Type	Optical Fiber Type	Core Specification (um)	Modal Bandwidth (MHz.km)	Maximum Cabling Distance
10GBASE-SR-XFP	LC	MMF	62.5 /125	200(OM1) 160	33 m 22 m
			50/125	2000(OM3) 500(OM2) 400(OM1)	300 m 82 m 66 m
10GBASE-LR-XFP	LC	SMF	9/125	N/A	10 km
10GBASE-ER-XFP	LC	SMF	9/125	N/A	40 km
XG-XFP-ZR80-SM1550	LC	SMF	9/125	N/A	80 km

2.3 Module Specifications

Wavelength

Wavelength means the wave band for transmission of light signal. Currently, the commonly used XFP optical modules have three centre wavelengths: 850 nm, 1310 nm and 1550 nm. Usually, the wave band of 850 nm is for short-distance transmission and the wave bands of 1310 nm and 1550 nm are for long-distance transmission.

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Connector Type

Optical fibers are joined by optical fiber connectors to form fiber jumpers. A fiber jumper is connected to optical modules through an optical fiber connector, so that the optical channel is detachable for the convenience of debugging and maintenance of the optical system. Fiber connectors are in many types. The commonly used lucent connectors (LCs) are shown in Figure 2 and Figure 3.

Figure 2 Single-core LC Connector

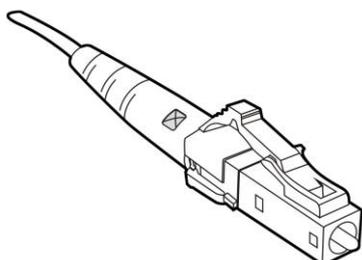
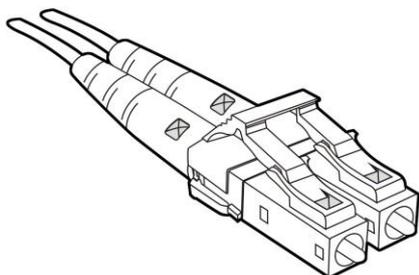


Figure 3 Dual-core LC Connector



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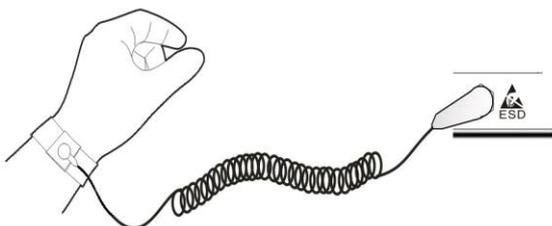
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Wearing jack type anti-static wrist strap, for example, is as shown in Figure 4:

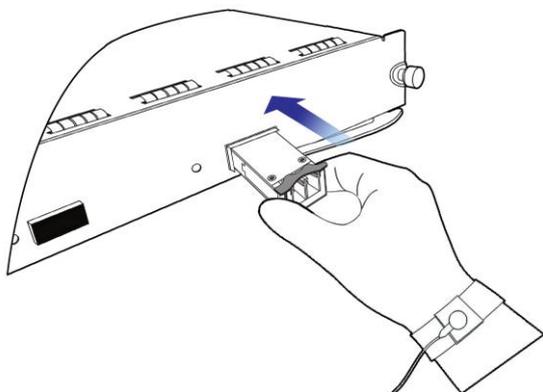
Figure 4 Schematic Diagram for Wearing Jack Type Anti-static Wrist Strap



2.4.2 Installing the XFP Module

1. Reveal the handle of the XFP module to lock against the snap on top of the module, and pinch the both sides of the XFP module to push it levelly and slowly into the optical module slot until the optical module firmly connects to the slot (there would be a click sound if the optical module is correctly connected to the slot), as shown in Figure 5:

Figure 5 Installing the XFP Optical Module



2 When you connect the XFP module to the optical fiber network, use the optical fiber jumper. Based on the connector type of the interconnecting ports, choose the jumper with corresponding connectors.

3. After installing the module of the optical fiber jumper, the switch port indicator “LINK/ACT” will be on; otherwise, check that the optical fiber jumper is correctly connected.

4. Precautions during installing:

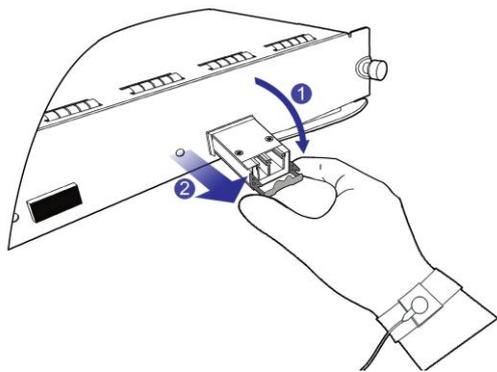
- The optical module cannot be inserted inversely. If the optical module cannot be inserted to the end along one direction, do not forcibly push it in and please try another direction.
- It is recommended that before installing the fiber-optic lines, not remove the protecting rubber on the optical port of optical modules.
- It is recommended not insert the fiber XFP module with optical fiber directly into the slot. Please proceed with the installation after the optical fiber is pulled out.
- In the process of installing the XFP module, please do not directly touch the connecting finger part of the XFP modules by hand.
- Please do not crush, twist, fold fiber or over bend the fiber, otherwise it may lead to reduced system performance or loss of transmitted data.

2.4.3 Removing the SFP+ Optical Module

1. Pull out the optical fiber line.

2. Pull the XFP module handle downward to the horizontal position, gently pull the snap, and then pull out the XFP module smoothly. As shown in the Figure 6.

Figure 6 Schematic Diagram for Pulling out the XFP Optical Module



3. Precautions for removing:

- Please pull out the optical fiber before removing the optical module.
- Please do not forcibly pull out the module without pulling down the handle of the optical module first so as not to cause any damage.
- Please put the dust caps on the detached module and device optical ports immediately to avoid dirt.

3 10G SFP+ Modules

3.1 Overview

The 10G SFP+ transceiver module of Ruijie Networks is composed of an SFP+ optical module or an SFP+ copper cable module, as shown in Figure 1 and Figure 2. The XG-SFP-SR-MM850, XG-SFP-LR-SM1310, XG-SFP-ER-SM1550 and XG-SFP-ZR-SM1550 are optical modules. The XG-SFP-CU1/3/5M are passive copper cable modules. The 10G SFP+ transceiver is an input/output device that supports hot swapping. When connected to a 10G SFP+ Ethernet port or slot through the optical fiber or copper cable, the 10G SFP+ transceiver implements 10G Ethernet transmission.

Figure 1 SFP+ Optical Module

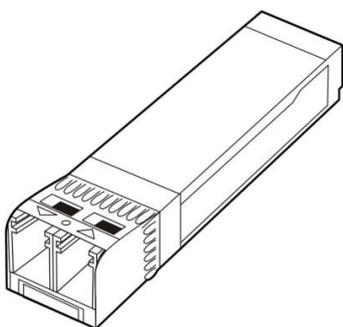


Figure 2 SFP+ Copper Cable Module



i The schematic diagrams are for your reference only. The product appearance is subject to the actual model.

3.2 Models and Technical Specifications

Table 1 SFP+ Optical Module

Model	Wavelength (nm)	DDM (Yes/No)	Optical Fiber Type	Intensity of Transmitted Light/dBm		Intensity of Received Light/dBm	
				Min	Max	Min	Max
XG-SFP-SR-MM850	850	Yes	MMF	-5	-1	-7.5	0.5
XG-SFP-SR-SM1270-BIDI	1270	No	MMF	-3	4	-9	0.5

XG-SFP-SR-SM1330-BIDI	1330	No	MMF	-3	4	-9	0.5
XG-SFP-LR-SM1270-BIDI	1270	No	SMF	-6.5	0.5	-14.4	0.5
XG-SFP-LR-SM1330-BIDI	1330	No	SMF	-6.5	0.5	-14.4	0.5
XG-SFP-eLR-SM1270-BIDI(V1.x)	1270	Yes	SMF	-6	-1	-14.4	-1
XG-SFP-eLR-SM1330-BIDI(V1.x)	1330	Yes	SMF	-6	-1	-14.4	-1
XG-SFP-eLR-SM1270-BIDI(V2.x)	1270	Yes	SMF	-8.5	3.0	-20	3.0
XG-SFP-eLR-SM1330-BIDI(V2.x)	1330	Yes	SMF	-8.5	3.0	-20	3.0
XG-SFP-ER-SM1270-BIDI(V1.x)	1270	Yes	SMF	-1	4.0	-15.0	-1
XG-SFP-ER-SM1330-BIDI(V1.x)	1330	Yes	SMF	-1	4.0	-15.0	-1
XG-SFP-ER-SM1270-BIDI(V2.x)	1270	Yes	SMF	-4.5	7.0	-20	5.0
XG-SFP-ER-SM1330-BIDI(V2.x)	1330	Yes	SMF	-4.5	7.0	-20	5.0
XG-SFP-ZR-SM1490-BIDI	1490	Yes	SMF	-1	3.0	-24	-7
XG-SFP-ZR-SM1550-BIDI	1550	Yes	SMF	0	4.0	-24	-7
XG-SFP-LR-SM1310	1310	Yes	SMF	-8.2	0.5	-14.4	0.5
XG-SFP-ER-SM1550	1550	Yes	SMF	-4.7	4	-11.3	-1
XG-SFP-ZR-SM1550	1550	Yes	SMF	0	4	-24	-7
XS-SFP-SR	850	Yes	MMF	-5	-1	-7.5	0.5
XS-SFP-LR	1310	Yes	SMF	-8.2	0.5	-10.3	0.5

-  Do not use short-distance optical fiber connection for the SFP module with a transmission distance longer than 10km to avoid overloading on the optical transceiver. If the optical power of the module receiver end is greater than or equal to -1 dBm, install an attenuator at the receiver end so that the optical power can be less than -1 dBm.
-  10G SFP+ BIDI modules should be used in pairs. For example, if an XG-SFP-eLR-SM1270-BIDI module is used on one end, apply XG-SFP-eLR-SM1330-BIDI on the other end.
-  The optical module is a laser device. Please take care of your eyes and do not look into the laser beam directly.
-  To keep the optical module clean, please make sure that the dust cap is mounted when it is not connected to a fiber cable.

Table 2 SFP+ Module Cabling Specifications

Model	Connect or Type	Optical Fiber Type	Core Specification (um)	Modal Bandwidth (MHz.km)	Maximum Cabling Distance
XG-SFP-SR-MM850	LC	MMF	62.5/125	200(OM1) 160	33 m 26 m
			50/125	2000(OM3)	300 m

				500(OM2) 400(OM1)	82 m 66 m
XG-SFP-SR-SM1270-BIDI	LC	MMF	50/125	2000(OM3)	300m
XG-SFP-SR-SM1330-BIDI	LC	MMF	50/125	2000(OM3)	300m
XG-SFP-LR-SM1270-BIDI	LC	SMF	9/125	N/A	10km
XG-SFP-LR-SM1330-BIDI	LC	SMF	9/125	N/A	10km
XG-SFP-eLR-SM1270-BIDI	LC	SMF	9/125	N/A	20km
XG-SFP-eLR-SM1330-BIDI	LC	SMF	9/125	N/A	20km
XG-SFP-ER-SM1270-BIDI	LC	SMF	9/125	N/A	40km
XG-SFP-ER-SM1330-BIDI	LC	SMF	9/125	N/A	40km
XG-SFP-ZR-SM1490-BIDI	LC	SMF	9/125	N/A	80km
XG-SFP-ZR-SM1550-BIDI	LC	SMF	9/125	N/A	80km
XG-SFP-LR-SM1310	LC	SMF	9/125	N/A	10 km
XG-SFP-ER-SM1550	LC	SMF	9/125	N/A	40 km
XG-SFP-ZR-SM1550	LC	SMF	9/125	N/A	80 km
XS-SFP-SR	LC	MMF	62.5/125	200(OM1) 160	33m 26m
			50/125	2000(OM3) 500(OM2) 400(OM1)	300m 82m 66m
XS-SFP-LR	LC	SMF	9/125	N/A	10 km

Table 3 10G SFP+ Module Model

Model	Module Type	Connector Type	Copper Cable Length (M)	Conductor Wire Diameter (AWG)	Data Rate (Gb/s)	DDM Supported (Yes/No)
XG-SFP-CU1M	Passive	SFP+	1	28	10.3125	No
XG-SFP-CU3M	Passive	SFP+	3	28	10.3125	No
XG-SFP-CU5M	Passive	SFP+	5	26	10.3125	No
XG-SFP-AOC1M	Active	SFP+	1	\	10.3125	No
XG-SFP-AOC3M	Active	SFP+	3	\	10.3125	No
XG-SFP-AOC5M	Active	SFP+	5	\	10.3125	No
XG-SFP-AOC10M	Active	SFP+	10	\	10.3125	No

i The types/models of the SFP+ series modules are being updated. If more accurate models of the module are required, please contact Ruijie marketing staff or technical support engineers.

i Additional connecting cables are not needed. You just need to plug the cable ends into the appropriate device ports for interconnection.

3.3 Module Specifications

Wavelength

Wavelength means the optical wave band for transmission of light signal. Currently, the commonly used SFP optical modules have three center wavelengths: 850 nm, 1310 nm and 1550 nm. Usually, the wave band of 850 nm is for short-distance transmission and the wave bands of 1310 nm and 1550 nm are for long-distance transmission.

Optical Fiber Type

Optical fibers are classified into two types: single-mode and multimode fibers according to the transmission mode of light in fibers.

A multimode fiber (MMF) has a larger core and transmits light of various modes. But it has a higher modal dispersion. The modal dispersion grows with the increase of transmission distance. The transmission distance of multimode fibers is associated with the transmission rate, core diameter, and modal bandwidth.

A single-mode fiber (SMF) has a smaller core and can transmit one mode of light. Therefore, it has a lower modal dispersion and is applicable to remote communication.

Connector Type

Optical fibers are joined by optical fiber connectors to form fiber jumpers. A fiber jumper is connected to optical modules through an optical fiber connector, so that the optical channel is detachable for the convenience of debugging and maintenance of the optical system. Fiber connectors are in many types. The commonly used lucent connectors (LCs) are shown in Figure 3 and Figure 4.

Figure 3 Single-core LC Connector

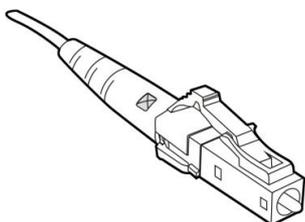
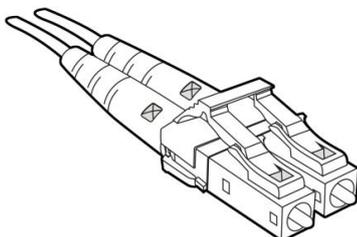


Figure 4 Dual-core LC Connector



DDM

Digital Diagnostic Monitor (DDM) is widely used in optical modules to dynamically measure the temperature, intensity of transmitted and received light, voltage, and laser bias current of the module. You can run commands to get the monitoring result in the host system that supports display of DDM information.

Intensity of Transmitted Light

Intensity of transmitted light refers to the optical output power transmitted from the optical module. The unit is dBm.

Intensity of Received Light

Intensity of received light refers to the optical input power received by the optical module. The unit is dBm. If the actual received light intensity is less than the minimum value, the module may fail in connection or lose many frames. If the actual received light intensity is greater than the maximum value, the module may be damaged.

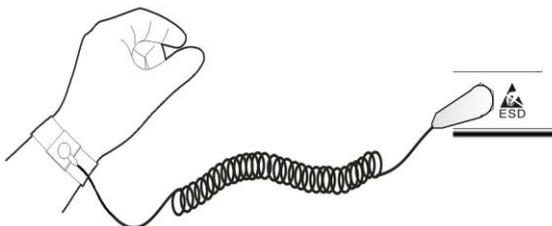
3.4 Module Installation Precautions

3.4.1 Preparation before Installation

Before installation, electron static discharge (ESD) protection is needed. To avoid damages to the electronic devices in the SFP+ optical and copper cable modules caused by the static electricity generated during the installation, please wear the anti-static wrist strap around the wrist and tighten the lock; make sure that the anti-static wrist strap has a good contact with the skin and is well grounded.

Wearing jack type anti-static wrist strap, for example, is as shown in Figure 5:

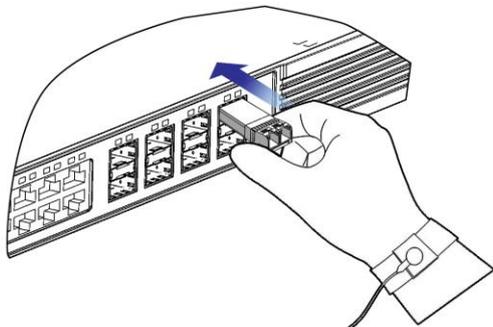
Figure 5 Schematic Diagram for Wearing Jack Type Anti-static Wrist Strap



3.4.2 Installing the 10G SFP+ Optical Module

1. Reveal the handle of the SFP + module to lock against the snap on top of the module, and pinch the both sides of the SFP + module to push it levelly and slowly into the optical module slot until the optical module firmly connects to the slot (there would be a click sound if the optical module is correctly connected to the slot), as shown in Figure 6:

Figure 6 Installing the SFP+ Optical Module



2. When you connect the SFP+ module to the optical fiber network, use the optical fiber jumper. Based on the connector type of the Interconnecting ports, choose the jumper with corresponding connectors.

3. After installing the module of the optical fiber jumper, the switch port indicator “LINK/ACT” will be on; otherwise, check that the optical fiber jumper is correctly connected.

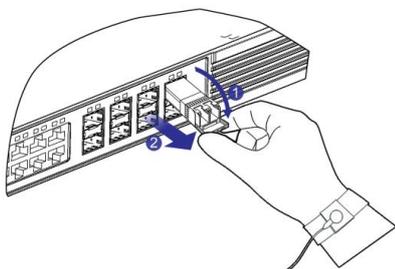
4. Precautions during installing:

- The optical module cannot be inserted inversely. If the optical module cannot be inserted to the end along one direction, do not forcibly push it in and please try another direction.
- It is recommended that before installing the fiber-optic lines, not remove the protecting rubber on the optical port of optical modules.
- It is recommended not insert the fiber SFP + module with optical fiber directly into the slot. Please proceed with the installation after the optical fiber is pulled out.
- In the process of installing the SFP + module, please do not directly touch the connecting finger part of the QSFP + modules by hand.
- Please do not crush, twist, fold fiber or over bend the fiber, otherwise it may lead to reduced system performance or loss of transmitted data.

3.4.3 Removing the SFP+ Optical Module

1. Pull out the optical fiber line.
2. Pull the SFP + module handle downward to the horizontal position, gently pull the snap, and then pull out the SFP + module smoothly. As shown in the Figure 7

Figure 7 Schematic Diagram for Pulling out the SFP+ Optical Module



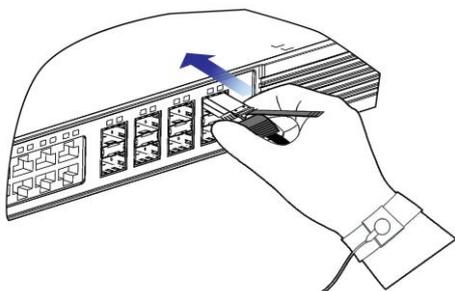
3. Precautions for removing:

- Please pull out the optical fiber before removing the optical module.
- Please do not forcibly pull out the module without pulling down the handle of the optical module first so as not to cause any damage.
- Please put the dust caps on the detached module and device optical ports immediately to avoid dirt.

3.4.4 Installing the SFP+ Copper Cable Module

1. When installing the plug of the SFP+ copper cable module (with power-on), users can use one hand to hold the plug of the copper cable module, and the other hand to lift the copper cable to the direction that is vertical with the front panel of the switch port to make sure the installation direction of the SFP+ module at the end of the copper cable is correct and then gently and smoothly insert it into the SFP+ slot until a click sound is heard. This indicates that the SFP+ copper cable module is correctly installed. As shown in the Figure 8:

Figure 8 Schematic Diagram for Installing the SFP+ Copper Cable



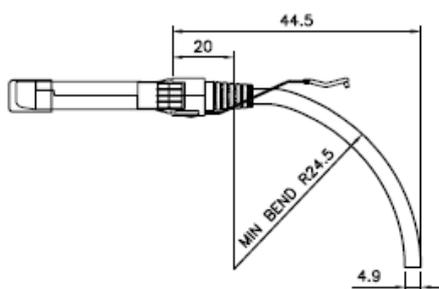
2. After installing the plug of the copper cable module, connect the copper cable to the Ethernet network, and the switch port indicator “LINK/ACT” will be on; otherwise, check that the connector of the copper cable is correctly connected;

3. Precautions during installing:

- The SFP+ connector at the end of the copper cable cannot be inserted inversely. If the optical module cannot be inserted to the end along one direction, do not forcibly push it in and please try another direction.
- In the process of installing copper cable module, please do not directly touch the connecting finger part on the top of the module by hand.
- Please do not crush, twist, fold fiber or over bend the copper cable, otherwise it may lead to reduced system performance or loss of transmitted data.

4. After installing the copper cable interface, please make sure that the bending radius of the copper cable wiring is greater than five times of the outside diameter of the copper cable. Otherwise, the core wires within the copper cable may be pulled too much, causing damage to the copper cable. Assume that the outside diameter of the copper cable is 4.9 mm, and then the minimum bending radius is 24.5 mm, as shown in Figure 4-5.

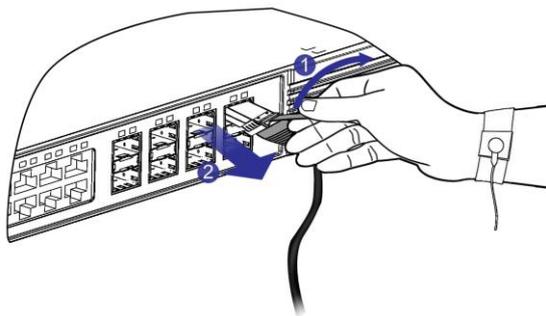
Figure 9 Schematic Diagram of Bending Radius of the Copper Cable



3.4.5 Removing the SFP+ Copper Cable Module

1. When pulling out the SFP+ copper cable module, pull out the pull ring to unlock and then pull out the module smoothly. As shown in the Figure 10.

Figure 10 Schematic Diagram for Pulling out the SFP+ Copper Cable



2. Precautions for removing:

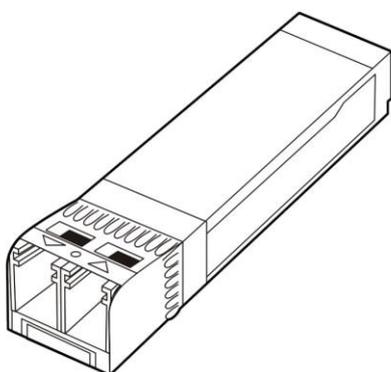
- When removing the SFP+ copper cable, please pull the pull ring of the module levelly, otherwise it would result in the difficulty of pulling out the copper cable and even the damage to the module and slot.
- Please put the dust caps on the detached module and device optical ports immediately to avoid dirt.

4 FC Series Modules

4.1 Overview

The FC series transceiver module of Ruijie Networks is shown in Figure 1. The FC2G-SFP-SR-MM850 transceiver module supports the transmission rates of 1.0625 Gb/s and 2.125 Gb/s, the FC4G-SFP-SR-MM850 supports the rates of 1.0625 Gb/s, 2.125 Gb/s and 4.25 Gb/s, and the FC8G-SFP-SR-MM850 supports rates of 2.125 Gb/s, 4.25 Gb/s and 8.5 Gb/s. The FC transceiver module is an input/output device that supports hot swapping. When connected to an FC port through the optical fiber, the FC transceiver module implements FC data transmission.

Figure 1 FC Series Transceiver Module



i The schematic diagrams are for your reference only. The product appearance is subject to the actual model.

4.2 Models and Technical Specifications

Table 1 FC Series Transceiver Modules

Model	Wavelength (nm)	DDM (Yes/No)	Optical Fiber Type	Intensity of Transmitted Light/dBm		Intensity of Received Light/dBm		
				Min	Max	Rate	Min	Max
FC2G-SFP-SR-MM850	850	Yes	MMF	-9	-3	1.0625 Gb/s	-20(OMA)	0
						2.125 Gb/s	-18(OMA)	0
FC4G-SFP-SR-MM850	850	Yes	MMF	-9	-2.5	1.0625 Gb/s	-20(OMA)	0
						2.125 Gb/s	-18(OMA)	0
						4.25 Gb/s	-15(OMA)	0
FC8G-SFP-SR-MM850	850	Yes	MMF	-9	-2	2.125 Gb/s	-13(OMA)	0
						4.25 Gb/s	-12(OMA)	0
						8.5 Gb/s	-11(OMA)	0

! Unless other specified, intensity of transmitted light and received light is in average.

! The transceiver module is a laser device. Please take care of your eyes and do not look into the laser beam directly.

 To keep the transceiver module clean, please make sure that the dust cap is mounted when it is not connected to a fiber cable.

Table 2 FC Series Transceiver Module Cabling Specifications

Model	Connector Type	Optical Fiber Type	Core Specification (um)	Modal Bandwidth (MHz.km)	Maximum Cabling Distance
FC2G-SFP-SR-MM850	LC	MMF	62.5/125	OM1	300 m (1.0625 Gb/s) 150 m (2.125 Gb/s)
			50/125	OM2	550 m (1.0625 Gb/s) 300 m (2.125 Gb/s)
FC4G-SFP-SR-MM850	LC	MMF	62.5/125	OM1	300 m (1.0625 Gb/s) 150 m (2.125 Gb/s) 70 m (4.25 Gb/s)
			50/125	OM2	550 m (1.0625 Gb/s) 300 m (2.125 Gb/s) 150 m (4.25Gb/s)
FC8G-SFP-SR-MM850	LC	MMF	50/125	OM2	300 m (2.125 Gb/s) 150 m (4.25 Gb/s) 50 m (8.5 Gb/s)
			50/125	OM3	500 m (2.125 Gb/s) 380 m (4.25 Gb/s) 150 m (8.5 Gb/s)

Table 3 Temperature/Humidity Requirements for FC Transceiver Modules

Model	Working Temperature	Storage Temperature	Relative Humidity
FC2G-SFP-SR-MM850	0°C to 70°C	-40°C to 85°C	10% to 90%
FC4G-SFP-SR-MM850	0°C to 70°C	-40°C to 85°C	10% to 90%
FC8G-SFP-SR-MM850	0°C to 70°C	-40°C to 85°C	10% to 90%

 The types/models of the FC series modules are being updated. If more accurate models of the module are required, please contact Ruijie marketing staff or technical support engineers.

4.3 Module Specifications

Wavelength

Wavelength means the optical wave band for transmission of light signal. Currently, the commonly used FC optical modules have the following two main centre wavelengths: 850 nm and 1310 nm. Usually, the wave band of 850 nm is for short-distance transmission and the wave band of 1310 nm is for long-distance transmission.

Optical Fiber Type

Optical fibers are classified into two types: single-mode and multimode fibers according to the transmission mode of light in fibers.

A multimode fiber (MMF) has a larger core and transmits light of various modes. But it has a higher modal dispersion. The modal dispersion grows with the increase of transmission distance. The transmission distance of multimode fibers is associated with the transmission rate, core diameter, and modal bandwidth.

A single-mode fiber (SMF) has a smaller core and can transmit one mode of light. Therefore, it has a lower modal dispersion and is applicable to remote communication.

Connector Type

Optical fibers are joined by optical fiber connectors to form fiber jumpers. A fiber jumper is connected to optical modules through an optical fiber connector, so that the optical channel is detachable for the convenience of debugging and maintenance of the optical system. Fiber connectors are in many types. The commonly used lucent connectors (LCs) are shown in Figure 3 and Figure 4.

Figure 3 Single-core LC Connector

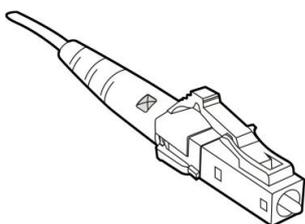
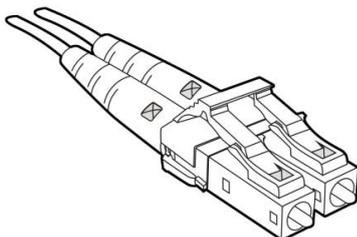


Figure 4 Dual-core LC Connector



DDM

Digital Diagnostic Monitor (DDM) is widely used in optical modules to dynamically measure the temperature, intensity of transmitted and received light, voltage, and laser bias current of the module. You can run commands to get the monitoring result in the host system that supports display of DDM information.

Intensity of Transmitted Light

Intensity of transmitted light refers to the optical output power transmitted from the optical module. The unit is dBm.

Intensity of Received Light

Intensity of received light refers to the optical input power received by the optical module. The unit is dBm. If the actual received light intensity is less than the minimum value, the module may fail in connection or lose many frames. If the actual received light intensity is greater than the maximum value, the module may be damaged.

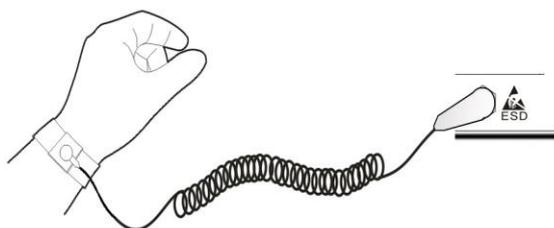
4.4 Module Installation Precautions

4.4.1 Preparation before Installation

Before installation, electron static discharge (ESD) protection is needed. To avoid damages to the electronic devices in the FC series optical modules caused by the static electricity generated during the installation, please wear the anti-static wrist strap around the wrist and tighten the lock; make sure that the anti-static wrist strap has a good contact with the skin and is well grounded.

Wearing jack type anti-static wrist strap, for example, is as shown in Figure 5:

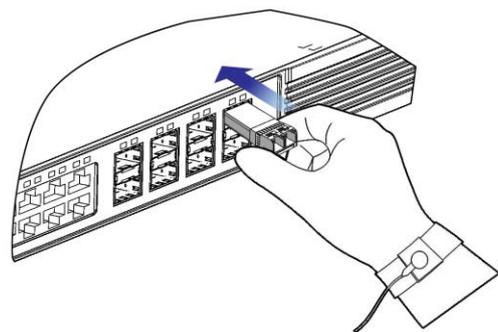
Figure 5 Schematic Diagram for Wearing Jack Type Anti-static Wrist Strap



4.4.2 Installing the FC Series Optical Module

1. Reveal the handle of the FC series transceiver module to lock against the snap on top of the module, and pinch the both sides of the FC series module to push it levelly and slowly into the optical module slot until the optical module firmly connects to the slot (there would be a click sound if the optical module is correctly connected to the slot), as shown in Figure 6:

Figure 6 Installing the FC Series Optical Module



2. When you connect the FC series transceiver module to the optical fiber network, use the optical fiber jumper. Based on the connector type of the Interconnecting ports, choose the jumper with corresponding connectors.

3. After installing the module of the optical fiber jumper, the switch port indicator "LINK/ACT" will be on; otherwise, check that the optical fiber jumper is correctly connected.

4. Precautions during installing:

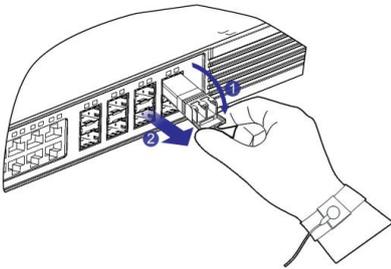
- The optical module cannot be inserted inversely. If the optical module cannot be inserted to the end along one direction, do not forcibly push it in and please try another direction.
- It is recommended that before installing the fiber-optic lines, not remove the protecting rubber on the optical port of optical modules.

- It is recommended not insert the FC series transceiver module with fiber optics directly into the slot. Please proceed with the installation after the optical fiber is pulled out.
- In the process of installing the FC series transceiver module, please do not directly touch the connecting finger part of the FC series transceiver modules by hand.
- Please do not crush, twist, fold fiber or over bend the fiber, otherwise it may lead to reduced system performance or loss of transmitted data.

4.4.3 Removing the FC Series Optical Module

1. Pull out the optical fiber line.
2. Pull the FC series transceiver module handle downward to the horizontal position, gently pull the snap, and then pull out the FC series transceiver module smoothly. As shown in the Figure 7

Figure 7 Schematic Diagram for Pulling out the FC Series Optical Module



3. Precautions for removing:

- Please pull out the optical fiber before removing the optical module.
- Please do not forcibly pull out the module without pulling down the handle of the optical module first so as not to cause any damage.
- Please put the dust caps on the detached module and device optical ports immediately to avoid dirt.

5 40G QSFP+ Modules

5.1 Overview

The 40G QSFP+ transceiver module of Ruijie Networks is composed of a 40G QSFP+ module and copper cables, as shown in Figure 1, Figure 2 and Figure 3. The 40G QSFP+ module is hot-swappable input/output device that plugs into a 40-Gigabit Ethernet QSFP+ switch port through fiber or copper cables.

Figure 1 40G-QSFP-SR-MM850850 / 40G-QSFP-LR4-PSM-SM1310 Module

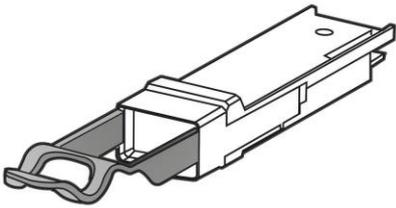


Figure 2 40G-QSFP-LR4-SM1310 Module

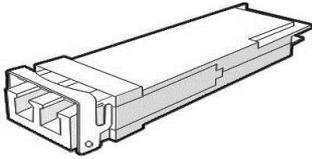


Figure 3 40G QSFP+_QSFP+ Copper Cables



i The schematic diagrams are for your reference only. Product appearance is subject to the actual model.

5.2 Models and Technical Specifications

Table 1 Models and Technical Specifications of 40G QSFP+ Modules

Models	Wavelength (nm)	Fiber Type	DDM Supported (Yes/No)	Transmit (dbm)		Receive (dbm)	
				MIN	MAX	MIN	MAX
40G-QSFP-SR-MM850	(840 ,860)	MMF ¹ (MPO connector)	Yes	-7.6	2.4	-9.5	2.4
40G-QSFP-SR-MM850-BIDI	(840 ,900)	MMF ¹ (LC connector)	No	-4.0	5.0	-4.5	5.0
40G-QSFP-LSR-MM850	(840 ,860)	MMF ¹ (MPO connector)	Yes	-7.5	1.0	-9.9	2.4
40G-QSFP-LR4-SM1310	(1264.5,1277.5) (1284.5,1297.5) (1304.5,1317.5) (1324.5,1337.5)	SMF ² (LC connector)	Yes	-7.0	2.3	13.7	2.3
40G-QSFP-ER4-SM1310	(1264.5,1277.5) (1284.5,1297.5) (1304.5,1317.5) (1324.5,1337.5)	SMF ² (LC connector)	Yes	-2.7	4.5	-21.2	-4.5
40G-QSFP-LR4-PSM-SM1310	(1260,1355)	SMF ² (MPO/APC connector)	Yes	-6.2	0.5	-14.4	2.3

¹ MMF=Multimode fiber

² SMF=Single mode fiber

Table 2 Cabling Specifications

Models	Wavelength (nm)	Fiber Type	Core Size (um)	Modal Bandwidth (MHz/km)	Cable Distance
40G-QSFP-SR-MM850	(840 ,860)	MMF ¹ (MPO connector)	50	2000	100m(OM3)
			50	4700	150m(OM4)
40G-QSFP-SR-MM850-BIDI	(840 ,900)	MMF ¹ (LC connector)	50	2000	100m(OM3)
			50	4700	150m(OM4)
40G-QSFP-LSR-MM850	(840 ,860)	MMF ¹ (MPO connector)	50	2000	300m(OM3)
			50	4700	400m(OM4)
40G-QSFP-LR4-SM1310	(1264.5,1277.5) (1284.5,1297.5) (1304.5,1317.5) (1324.5,1337.5)	SMF ² (LC connector)	9	N/A	10km
40G-QSFP-LR4-PSM-SM1310	(1264.5,1277.5) (1284.5,1297.5) (1304.5,1317.5) (1324.5,1337.5)	SMF ² (LC connector)	9	N/A	40km
40G-QSFP-LR4-PSM-SM1310	(1260,1355)	SMF ² (MPO/APC connector)	9	N/A	10km

 The Digital Diagnostic Monitoring (DDM) of the 40G-QSFP-SR-MM850 model is for temperature and voltage only.

 The optical module is a laser device. Please take care of your eyes and do not look into the laser beam directly.

 To keep the optical module clean, please make sure that the dust cap is mounted when it is not connected to cables.

Table 3 Models of 40G QSFP+ Cables

Model	Type	Connector Type	Cable Length (m)	Conductor size (AWG)	Data Rate (Gb/s)	DDM Supported (Yes/No)
40G-QSFP-STAC K1M	Passive	QSFP+ to QSFP+	1	28	4lanes×10.3125G (Perlane)	No
40G-QSFP-STAC K3M	Passive	QSFP+ to QSFP+	3	28	4lanes x 10.3125G (Perlane)	No
40G-AOC-5M	Active	QSFP+ to QSFP+	5	\	4lanes×10.3125G (Perlane)	No
40G-AOC10M	Active	QSFP+ to QSFP+	10	\	4lanes×10.3125G (Perlane)	No
40G-AOC-20M	Active	QSFP+ to QSFP+	20	\	4lanes×10.3125G (Perlane)	No
40G-AOC-30M	Active	QSFP+ to QSFP+	30	\	4lanes×10.3125G (Perlane)	No

 Additional connecting cables are not needed. You just need to plug the cable ends into the appropriate device ports for interconnection.

Table 4 Temperature/Humidity Requirements for the Modules

Operating Temperature	0°C to 70°C
Storage Temperature	-40°C to 85°C
Relative Humidity	10% to 90%

 The types/models of QSFP+ series modules are being updated. If more accurate models of the module are required, please contact Ruijie marketing staff or technical support engineers.

5.3 Module Specifications

Wavelength

Wavelength means the wave band for transmission of light signal.

Optical Fiber Type

Optical fibers are classified into two types: single-mode and multimode fibers according to the transmission mode of light in fibers.

A multimode fiber (MMF) has a larger core and can transmit light of various modes. But it has a higher modal dispersion. The modal dispersion grows with the increase of transmission distance. The transmission distance of multimode fibers is associated with the transmission rate, core diameter, and modal bandwidth. Please read the instructions for reference.

A single-mode fiber (SMF) has a smaller core and can transmit one mode of light. Therefore, it has a lower modal dispersion and is applicable to remote communication.

Connector Type

Optical fibers are joined by optical fiber connectors to form fiber patch cord. A fiber patch cord is connected to optical modules through an optical fiber connector, so that the optical channel is detachable for the convenience of debugging and maintenance of optical system. The 40G QSFP+ optical fiber connectors have many types. You can select one to fit the interface type of your optical module. Generally, the 40G QSFP+ optical fiber connectors have the following types.

Patch cords for the 40G-QSFP-SR-MM850 module

The 40G-QSFP-SR-MM850 module can be used with multi-mode female MPO connectors only. The coupling end face of the MPO connectors is the physical contact (PC) or ultra physical contact (UPC) patch cord (Type-B defined in Standard TIA-568-C.3), of which the core wires must be multi-mode. Twelve channels can be used. Only 8 among the 12 MPO patch cords are recommended to be applied, namely, Tx1-Tx4 and Rx1-Rx4.

Figure 4 Single-Row 12-Fiber Female MPO Connector

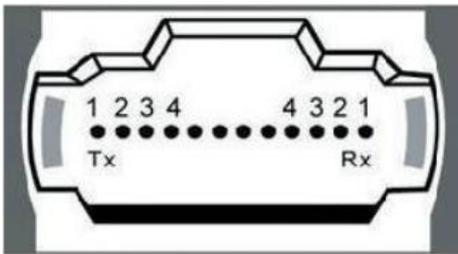
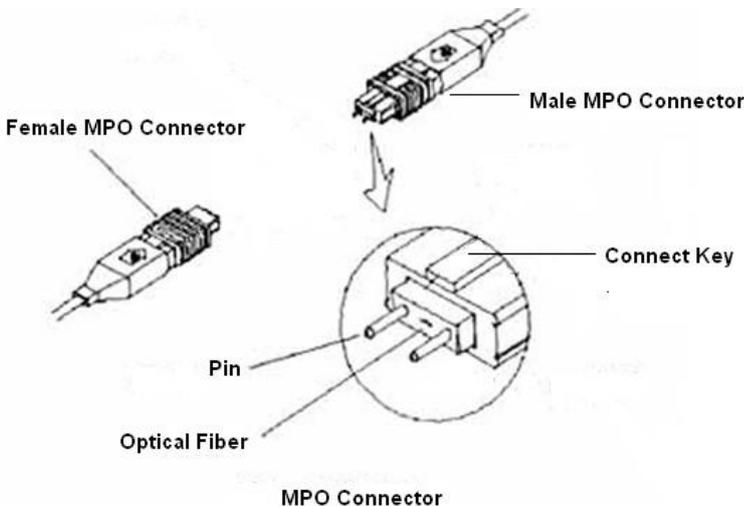


Figure 5 Male and Female MPO Connectors



Only Tx1-Tx4 and Rx1-Rx4 are applied to the 40G-QSFP-SR-MM850 module, as shown in Figure 3-1.

MPO connectors feature male and female connector design. A male connector has solid pins while a female connector has a center conductor with holes in it to accept male pins, as shown in Figure 3-2.

Patch cords for the 40G-QSFP-LR4-PSM-SM1310 module

The 40G-QSFP-LR4-PSM-SM1310 module can be used with single-mode female MPO connectors only. The coupling end face of the MPO connectors is the angled physical contact (APC) patch cord, of which the core wires must be single-mode. Twelve channels can be used. Only 8 among the 12 MPO patch cords are recommended to be applied, namely, Tx1-Tx4 and Rx1-Rx4.

Differences between the single-mode MPO and multi-mode MPO:

The MPO end face can be coupled in multiple modes. MPO connectors can be classified into PC connectors, super physical contact (SPC) connectors, UPC connectors, and APC connectors based on the return loss. The return losses of the PC, SPC, UPC, and APC connectors specified in industrial standards are -35 dB, -40 dB, -50 dB, and -60 dB respectively. The end faces of the PC, SPC, and UPC connectors are all flat, and the only difference lies in the polish quality, which results in different return losses. The end face of the APC connector is polished to have an angle of 8 degrees to reduce the return loss.

The APC end face can be connected to an APC connector only. The APC connector is usually green and the inclination of the end face can be observed with naked eyes.

The coupling end face of the single-mode MPO is APC, as shown in Figure 6. The coupling end face of the multi-mode MPO is PC or UPC, as shown in Figure 7.



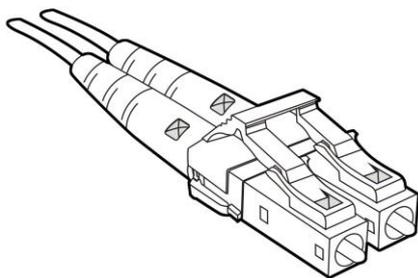
Figure 6 APC



Figure 7 UPC

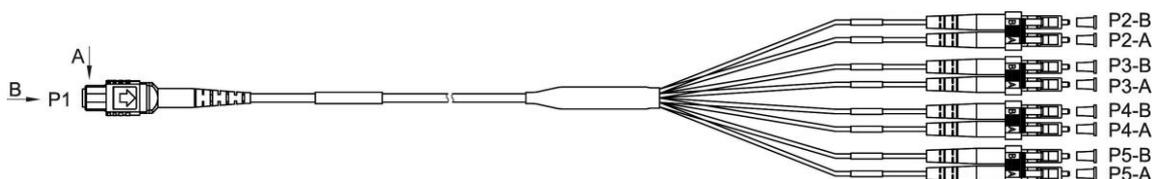
Dual-core LC connector for the 40G-QSFP-LR4-SM1310 module.

Figure 8 Dual-core LC Connector



For devices supporting splitting 40G into 4 *10G, you can use MPO-4*LC fiber patch cords to convert 40G to 4 *10G.

Figure 9 MPO-4*LC Fibers



DDM

Digital Diagnostic Monitor (DDM) is widely used in optical modules to dynamically measure the temperature, intensity of transmitted and received light, voltage, and laser bias current of the module. You can run commands to get the monitoring result on the host system that supports display of DDM information. Different 40G optical modules support different testing items of DDM. Please refer to the instructions on the specific module model.

Intensity of Transmitted Light

Intensity of transmitted light refers to the optical output power transmitted from the optical module. The unit is dBm.

Intensity of Received Light

Intensity of received light refers to the optical input power received by the optical module. The unit is dBm. Before connecting optical modules, please pay attention to the specification of received light intensity. If the actual received light intensity is less than the minimum value, the module may fail in connection or lose many frames. If the actual received light intensity is greater than the maximum value, the module may be damaged.

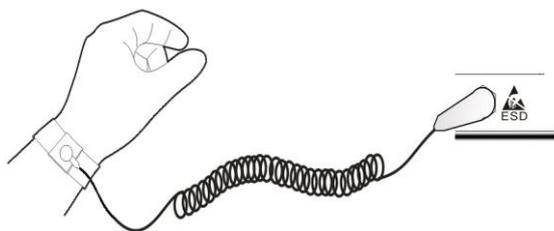
5.4 Module Installation Precautions

5.4.1 Preparation before Installation

Before installation, electron static discharge (ESD) protection is needed. To avoid damage to the QSFP + modules and electronic devices in the equipment by the static electricity generated during the installation, please set the anti-static wrist strap on the wrist and tighten the lock; make sure that the anti-static wrist strap has a good contact with the skin and is well grounded.

Wearing jack type anti-static wrist strap, for example, is as shown in Figure 10:

Figure 10 Schematic Diagram for Wearing Jack Type Anti-static Wrist Strap



5.4.2 Installing the 40G QSFP+ Module

1. For the snap-in module, reveal the handle of the QSFP + module to lock against the snap on top of the module, and use hand to pinch on both sides of the QSFP + module to push it levelly and slowly into the optical module slot until the optical module connects to the slot (there would be a click sound if the optical module is correctly connected to the slot). For the pull-tab module, direct it to the optical module slot and push it slowly into the slot until the optical module connects to the slot (there would be a click sound if the optical module is correctly connected to the slot). The snap-in module is shown in Figure 11, and the pull-tab module is shown in Figure 12:

Figure 11 Installing the Snap-in QSFP+ Module

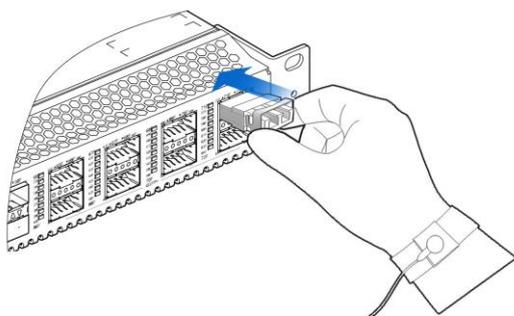
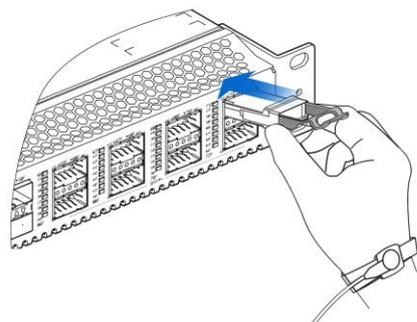


Figure 12 Installing the Pull-tab QSFP+ Module



2. When you connect the 40G QSFP+ module to the optical fiber network, use the optical fiber patch cord. Based on the interface type of the Internet ports, choose the jumper with corresponding interfaces.

3.. After installing the module of the optical fiber patch cord, the switch port indicator “LINK/ACT” will be on; otherwise, check that the optical fiber patch cord is correctly connected.

4. Precautions during installing:

- The optical module cannot be inserted backwards. The correct method of inserting QSFP+ optical module is shown in Figure 11 and Figure 12; the method of inserting QSFP+ cable is shown in Figure 15. If the optical module cannot be inserted to the end from one direction, do not force to push it in and please try another direction.
- It is recommended that before installing the fiber-optic lines, the protecting rubber plug on the optical port of optical modules shall not be pulled out.
- It is recommended that users shall not insert the fiber QSFP + module into which optical fiber has already been inserted directly into the slot. Please proceed with installation after the optical fiber is pulled out.
- In the process of installing QSFP + module, please do not directly touch the connecting finger part of the QSFP + modules by hand.
- Please do not crush, bend, fold fiber or overbend the fiber, otherwise it may lead to reduced system performance or loss of transmitted data.

5.4.3 Removing the 40G QSFP+ Module

1. Pull out the optical fiber line.
2. For the snap-in module, pull the QSFP + module handle downward to the horizontal position, gently pull the snap, and then pull out the QSFP + module smoothly. As shown in the Figure 13. For the pull-tab module, directly pull the tab to remove the QSFP + module steadily. As shown in the Figure 14.

Figure 13 Schematic Diagram for Pulling out the Snap-in QSFP+ Module

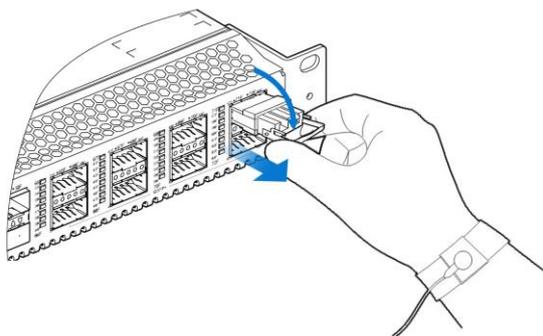
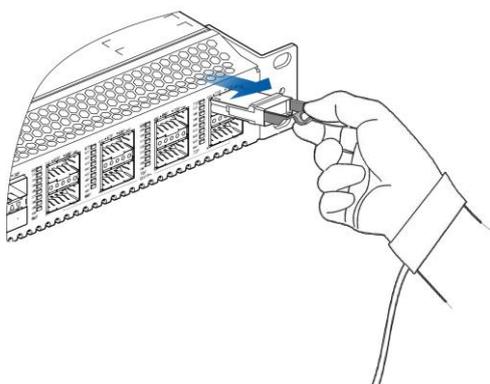


Figure 14 Schematic Diagram for Pulling out the pull-tab QSFP+ Optical Module



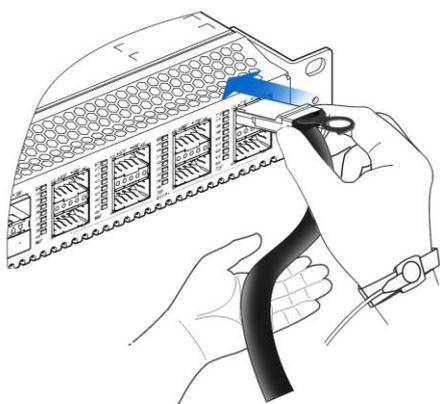
3. Precautions for removing:

- Please pull out the optical fiber before removing the optical module.
- Please do not forcibly pull out the module without pulling down the handle of the optical module first so as not to cause any damage.
- Please put the dust caps on the detached module and device optical ports immediately to avoid dirt.

5.4.4 Installing the 40G QSFP+ Power Cable Module

1. When installing the plug of the 40G QSFP+ power cable module (with power-on), users can use one hand to hold the plug of the power cable module, and the other hand to lift the power cable to the direction that is vertical with the front panel of the switch port to make sure the installation direction of the QSFP+ module at the end of the power cable is correct and then gently and smoothly insert it into the QSFP+ slot until a click sound is heard. This indicates that the 40G QSFP+ power cable module is correctly installed. As shown in the Figure 15:

Figure 15 Schematic Diagram for Installing the QSFP+ Power Cable



2. After installing the plug of the power cable module, connect the power cable to the Ethernet network, and the switch port indicator “LINK/ACT” will be on; otherwise, check that the connector of the power cable is correctly connected;

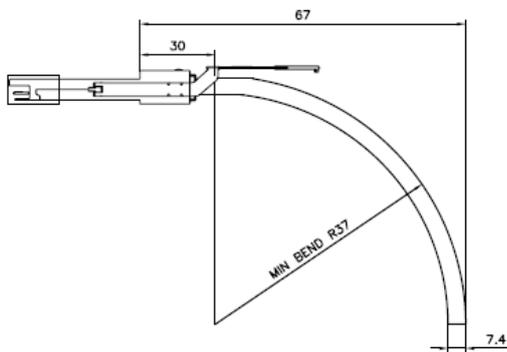
3. Precautions during installing:

- The QSFP+ connector at the end of the power cable cannot be inserted backwards, if it is inserted in one direction and cannot be inserted in the end or forced to be pushed in, please change the direction of installation to verify.

- In the process of installing power cable module, please do not directly touch the connecting finger part on the top of the module by hand.
- Please do not crush, bend, fold fiber or overbend the power cable, otherwise it may lead to reduced system performance or loss of transmitted data.

⚠ After installing the cable interface, please make sure that the bending radius of the cable wiring is greater than five times of outside diameter of the cable. Otherwise, the core wires within the cable may be pulled too much, causing damage of the cable. Assume that the outside diameter of the cable is 7.4 mm, and then the minimum bending radius is 35 mm, as shown in Figure 16.

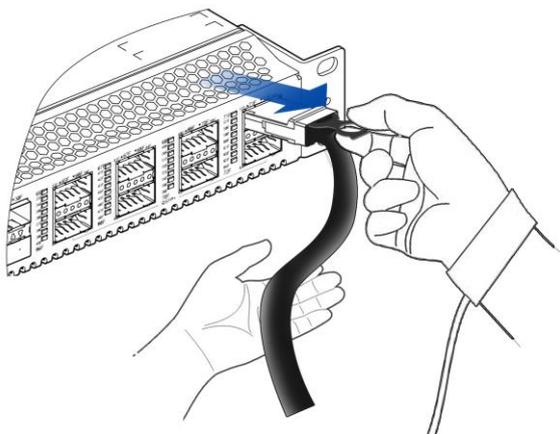
Figure 16 Schematic Diagram of Bending Radius of the Cable



5.4.5 Removing the 40G QSFP+ Power Cable Module

1. When pulling out the 40G QSFP+ power cable module, you can hold the power cable in the hand while pulling out the module pull ring levelly and then the module itself smoothly. As shown in Figure 17.

Figure 17 Schematic Diagram for Pulling out the QSFP+ Power Cable



2. Precautions for removing:

- When removing the QSFP+ power cable, please pull the pull ring of the module levelly, otherwise it would result in the difficulty of pulling out the power cable and even the damage to the module and slot.
- Please put the dust caps on the detached module and device optical ports immediately to avoid dirt.

6 100G QSFP28 Modules

6.1 Overview

The 100G QSFP28 transceiver module of Ruijie Networks is composed of a 100G QSFP28 module and copper cables, as shown in Figure 1, Figure 2, Figure 3 and Figure 4. The 100G QSFP28 module is hot-swappable input/output device that plugs into a 100-Gigabit Ethernet QSFP28 switch port through fiber or copper cables.

Figure 1 100G-QSFP-SR-MM850/100G-QSFP-iLR4-PSM-SM1310 Module

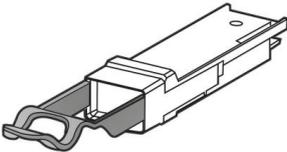


Figure 6-2 100G-QSFP-LR4-SM1310/100G-QSFP-iLR4- SM1310 Module



Figure 6-3 100G QSFP28 Copper Cables



Figure 6-4 100G QSFP28 Fiber Cables



 The schematic diagrams are for your reference only. Product appearance is subject to the actual model.

6.2 Models and Technical Specifications

Table 1 Models and Technical Specifications of 100G QSFP28 Modules

Models	Wavelength (nm)	Fiber Type	DDM Supported (Yes/No)	Transmit (dbm)		Receive (dbm)	
				MIN	MAX	MIN	MAX
100G-QSFP-SR-MM850	(840 ,860)	MMF ¹ (MPO connector)	Yes	-8.4	2.4	-10.3	2.4
100G-QSFP-iLR4-SM1310	(1264.5,1277.5) (1284.5,1297.5) (1304.5,1317.5) (1324.5,1337.5)	SMF ¹ (LC connector)	Yes	-6.5	2.5	-10.0	2.5
100G-QSFP-LR4-SM1310	(1294.53,1296.59) (1299.02,1301.09) (1303.54,1305.63) (1308.09,1310.19)	SMF ¹ (LC connector)	Yes	-4.3	4.5	-10.6	4.5
100G-QSFP-iLR4-PSM-SM1310	(1295,1325)	SMF ¹ (MPO/APC connector)	Yes	-5.5	2	-10.2	2

¹ MMF=Multimode fiber

² SMF=Single mode fiber

Table 2 Cabling Specifications

Models	Wavelength (nm)	Fiber Type	Core Size (um)	Modal Bandwidth (MHz/km)	Cable Distance
100G-QSFP-SR-MM850	(840 ,860)	MMF ¹ (MPO connector)	50	2000	70m(OM3)
			50	4700	100m(OM4)
100G-QSFP-iLR4-SM1310	(1264.5,1277.5) (1284.5,1297.5) (1304.5,1317.5) (1324.5,1337.5)	SMF ¹ (LC connector)	9	N/A	2km
100G-QSFP-LR4-SM1310	(1294.53,1296.59) (1299.02,1301.09) (1303.54,1305.63) (1308.09,1310.19)	SMF ¹ (LC connector)	9	N/A	10km
100G-QSFP-iLR4-PSM-SM1310	(1295,1325)	SMF ¹ (MPO/APC connector)	9	N/A	2km



The Digital Diagnostic Monitoring (DDM) of the 40G-QSFP-SR-MM850 model is for temperature and voltage only.



The optical module is a laser device. Please take care of your eyes and do not look into the laser beam directly.

 To keep the optical module clean, please make sure that the dust cap is mounted when it is not connected to cables.

Table 3 Models of 100G QSFP28 Cables

Model	Type	Connector Type	Cable Length (m)	Conductor size (AWG)	Data Rate (Gb/s)	DDM Supported (Yes/No)
100G-AOC-1M	Active	QSFP28	1	\	4lanes*25.78125 (Perlane)	No
100G-AOC-5M	Active	QSFP28	5	\	4lanes*25.78125 (Perlane)	No
100G-AOC-10M	Active	QSFP28	10	\	4lanes*25.78125 (Perlane)	No

 Additional cables are not needed. You just need to plug the cable ends into the appropriate device ports for interconnection.

Table 4 Temperature/Humidity Requirements for the Modules

Operating Temperature	0°C to 70°C
Storage Temperature	-40°C to 85°C
Relative Humidity	10% to 90%

 The types/models of 100G QSFP28 series modules are being updated. If more accurate models of the module are required, please contact Ruijie marketing staff or technical support engineers.

6.3 Module Specifications

Wavelength

Wavelength means the wave band for transmission of light signal.

Optical Fiber Type

Optical fibers are classified into two types: single-mode and multimode fibers according to the transmission mode of light in fibers.

A multimode fiber (MMF) has a larger core and can transmit light of various modes. But it has a higher modal dispersion. The modal dispersion grows with the increase of transmission distance. The transmission distance of multimode fibers is associated with the transmission rate, core diameter, and modal bandwidth. Please read the instructions for reference.

A single-mode fiber (SMF) has a smaller core and can transmit one mode of light. Therefore, it has a lower modal dispersion and is applicable to remote communication.

Connector Type

Optical fibers are joined by optical fiber connectors to form fiber patch cord. A fiber patch cord is connected to optical modules through an optical fiber connector, so that the optical channel is detachable for the convenience of debugging and maintenance of optical system. The 100G QSFP28 optical fiber connectors have many types. You can select one to fit the interface type of your optical module. Generally, the 100G QSFP28 optical fiber connectors have the following types.

Patch cords for the 100G-QSFP-SR-MM850 module

The 100G-QSFP-SR-MM850 module can be used with multi-mode female MPO connectors only. The coupling end face of the MPO connectors is the physical contact (PC) or ultra physical contact (UPC) patch cord (Type-B defined in Standard TIA-568-C.3), of which the core wires must be multi-mode. Twelve channels can be used. Only 8 among the 12 MPO patch cords are recommended to be applied, namely, Tx1-Tx4 and Rx1-Rx4.

Figure 5 Single-Row 12-Fiber Female MPO Connector

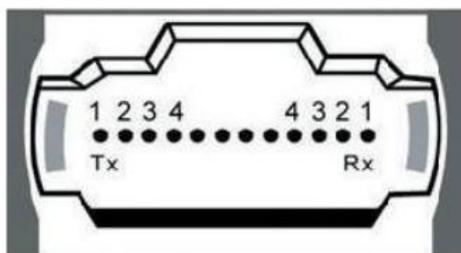
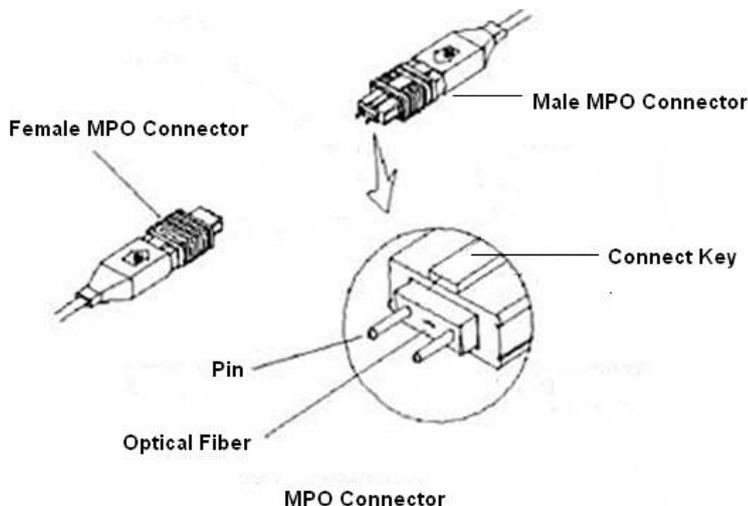


Figure 6 Male and Female MPO Connectors



Only Tx1-Tx4 and Rx1-Rx4 are applied to the 100G-QSFP-SR-MM850 module, as shown in Figure 5.

MPO connectors feature male and female connector design. A male connector has solid pins while a female connector has a center conductor with holes in it to accept male pins, as shown in Figure 6-4.

Patch cords for the 100G-QSFP-iLR4-PSM-SM1310 module

The 100G-QSFP-LR4-PSM-SM1310 module can be used with single-mode female MPO connectors only. The coupling end face of the MPO connectors is the angled physical contact (APC) patch cord, of which the core wires must be single-mode. Twelve channels can be used. Only 8 among the 12 MPO patch cords are recommended to be applied, namely, Tx1-Tx4 and Rx1-Rx4.

Differences between the single-mode MPO and multi-mode MPO:

The MPO end face can be coupled in multiple modes. MPO connectors can be classified into PC connectors, super physical contact (SPC) connectors, UPC connectors, and APC connectors based on the return loss. The return losses of the PC, SPC, UPC, and APC connectors specified in industrial standards are -35 dB, -40 dB, -50 dB, and -60 dB respectively. The end faces of the PC, SPC, and UPC connectors are all flat, and the only difference lies in the polish quality, which results in different return losses. The end face of the APC connector is polished to have an angle of 8 degrees to reduce the return loss.

The APC end face can be connected to an APC connector only. The APC connector is usually green and the inclination of the end face can be observed with naked eyes.

The coupling end face of the single-mode MPO is APC, as shown in Figure 7. The coupling end face of the multi-mode MPO is PC or UPC, as shown in Figure 8.



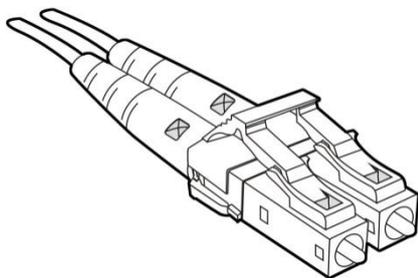
Figure 7 APC



Figure 8 UPC

Dual-core LC connector for the 100G-QSFP-LR4-SM1310 module.

Figure 9 Dual-core LC Connector



DDM

Digital Diagnostic Monitor (DDM) is widely used in optical modules to dynamically measure the temperature, intensity of transmitted and received light, voltage, and laser bias current of the module. You can run commands to get the monitoring

result on the host system that supports display of DDM information. Different 100G optical modules support different testing items of DDM. Please refer to the instructions on the specific module model.

Intensity of Transmitted Light

Intensity of transmitted light refers to the optical output power transmitted from the optical module. The unit is dBm.

Intensity of Received Light

Intensity of received light refers to the optical input power received by the optical module. The unit is dBm. Before connecting optical modules, please pay attention to the specification of received light intensity. If the actual received light intensity is less than the minimum value, the module may fail in connection or lose many frames. If the actual received light intensity is greater than the maximum value, the module may be damaged.

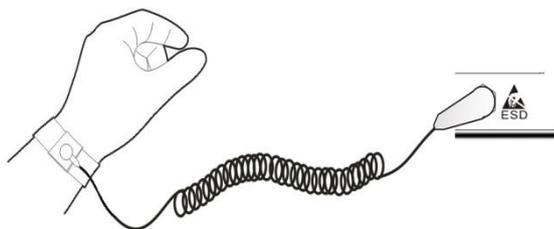
6.4 Module Installation Precautions

6.4.1 Preparation before Installation

Before installation, electron static discharge (ESD) protection is needed. To avoid damage to the QSFP28 modules and electronic devices in the equipment by the static electricity generated during the installation, please set the anti-static wrist strap on the wrist and tighten the lock; make sure that the anti-static wrist strap has a good contact with the skin and is well grounded.

Wearing jack type anti-static wrist strap, for example, is as shown in Figure 10:

Figure 10 Schematic Diagram for Wearing Jack Type Anti-static Wrist Strap



6.4.2 Installing the 100G QSFP28 Module

1. For the snap-in module, reveal the handle of the QSFP28 module to lock against the snap on top of the module, and use hand to pinch on both sides of the QSFP28 module to push it levelly and slowly into the optical module slot until the optical module connects to the slot (there would be a click sound if the optical module is correctly connected to the slot). For the pull-tab module, direct it to the optical module slot and push it slowly into the slot until the optical module connects to the slot (there would be a click sound if the optical module is correctly connected to the slot). The snap-in module is shown in Figure 11, and the pull-tab module is shown in Figure 12:

Figure 11 Installing the Snap-in QSFP+ Module

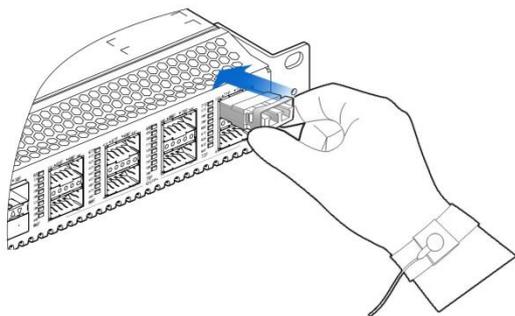
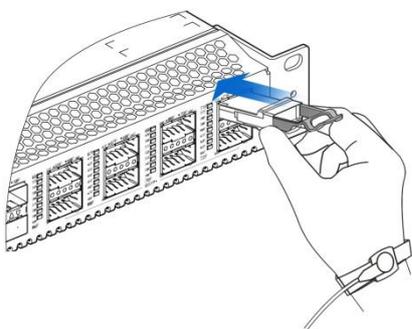


Figure 12 Installing the Pull-tab QSFP+ Module



2. When you connect the 100G QSFP28 module to the optical fiber network, use the optical fiber patch cord. Based on the interface type of the Internet ports, choose the jumper with corresponding interfaces.

3. After installing the module of the optical fiber patch cord, the switch port indicator “LINK/ACT” will be on; otherwise, check that the optical fiber patch cord is correctly connected.

Precautions during installing:

- The optical module cannot be inserted backwards. The correct method of inserting QSFP28 optical module is shown in Figure 11 and Figure 12; the method of inserting QSFP28 cable is shown in Figure 15. If the optical module cannot be inserted to the end from one direction, do not force to push it in and please try another direction.
- It is recommended that before installing the fiber-optic lines, the protecting rubber plug on the optical port of optical modules shall not be pulled out.
- It is recommended that users shall not insert the fiber QSFP28 module into which optical fiber has already been inserted directly into the slot. Please proceed with installation after the optical fiber is pulled out.
- In the process of installing QSFP28 module, please do not directly touch the connecting finger part of the QSFP28 modules by hand.
- Please do not crush, bend, fold fiber or overbend the fiber, otherwise it may lead to reduced system performance or loss of transmitted data.

6.4.3 Removing the 100G QSFP28 Module

1. Pull out the optical fiber line.

2. For the snap-in module, pull the QSFP28 module handle downward to the horizontal position, gently pull the snap, and then pull out the QSFP28 module smoothly. As shown in the Figure 13. For the pull-tab module, directly pull the tab to remove the QSFP28 module steadily. As shown in the Figure 14.

Figure 13 Schematic Diagram for Pulling out the Snap-in QSFP28 Module

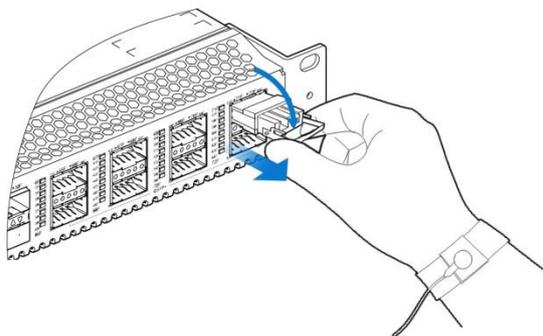
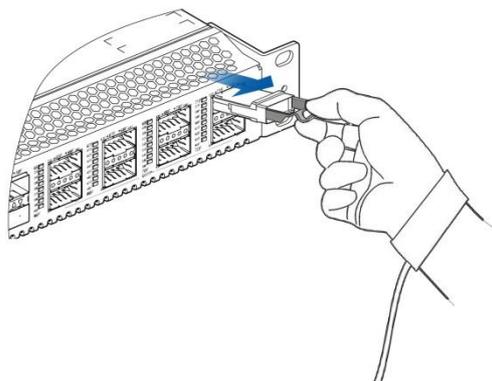


Figure 14 Schematic Diagram for Pulling out the pull-tab QSFP28 Optical Module



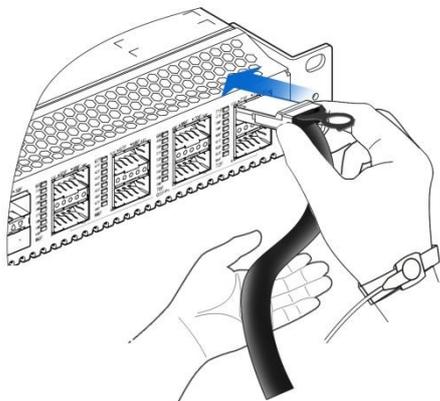
Precautions for removing:

- Please pull out the optical fiber before removing the optical module.
- Please do not forcibly pull out the module without pulling down the handle of the optical module first so as not to cause any damage.
- Please put the dust caps on the detached module and device optical ports immediately to avoid dirt.

6.4.4 Installing the 100G QSFP28 Power Cable Module

1. When installing the plug of the 100G QSFP28 power cable module (with power-on), users can use one hand to hold the plug of the power cable module, and the other hand to lift the power cable to the direction that is vertical with the front panel of the switch port to make sure the installation direction of the QSFP28 module at the end of the power cable is correct and then gently and smoothly insert it into the QSFP28 slot until a click sound is heard. This indicates that the 100G QSFP28 power cable module is correctly installed. As shown in the Figure 15:

Figure 15 Schematic Diagram for Installing the QSFP28 Power Cable



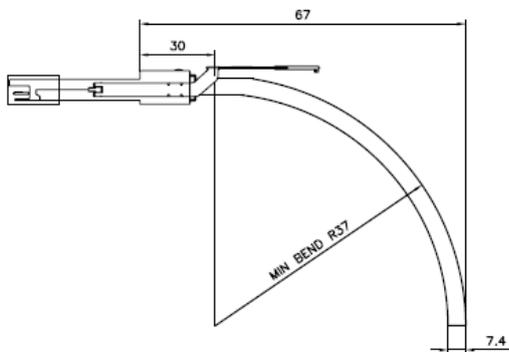
2. After installing the plug of the power cable module, connect the power cable to the Ethernet network, and the switch port indicator “LINK/ACT” will be on; otherwise, check that the connector of the power cable is correctly connected;

Precautions during installing:

- The QSFP28 connector at the end of the power cable cannot be inserted backwards, if it is inserted in one direction and cannot be inserted in the end or forced to be pushed in, please change the direction of installation to verify.
- In the process of installing power cable module, please do not directly touch the connecting finger part on the top of the module by hand.
- Please do not crush, bend, fold fiber or overbend the power cable, otherwise it may lead to reduced system performance or loss of transmitted data.

! After installing the cable interface, please make sure that the bending radius of the cable wiring is greater than five times of outside diameter of the cable. Otherwise, the core wires within the cable may be pulled too much, causing damage of the cable. Assume that the outside diameter of the cable is 7.4 mm, and then the minimum bending radius is 35 mm, as shown in Figure 16.

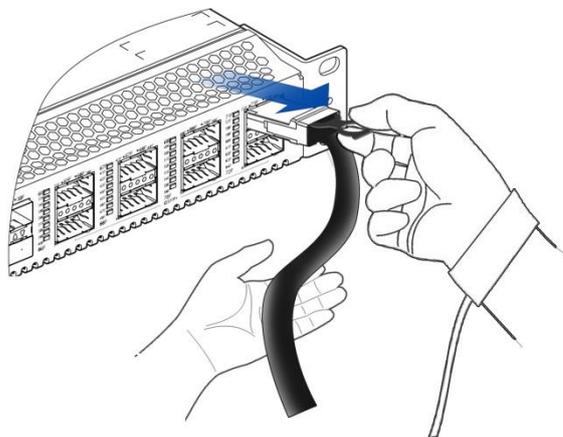
Figure 16 Schematic Diagram of Bending Radius of the Cable



6.4.5 Removing the 100G QSFP28 Power Cable Module

1. When pulling out the 100G QSFP28 power cable module, you can hold the power cable in the hand while pulling out the module pull ring levelly and then the module itself smoothly. As shown in Figure 17.

Figure 17 Schematic Diagram for Pulling out the QSFP28 Power Cable



2. Precautions for removing:

- When removing the QSFP28 power cable, please pull the pull ring of the module levelly, otherwise it would result in the difficulty of pulling out the power cable and even the damage to the module and slot.