

**PLANET Fiber Transceiver**  
**MFB-Series/MGB-Series/MTB-Series**

User's Manual

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## **FCC NOTICE (Class B)**

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

## **CE Mark Warning**

Operation of this equipment in a residential environment could cause radio interference.

## WEEE Warning



To avoid the potential effects on the environment and human health as a result of the presence of hazardous substances in electrical and electronic equipment, end users of electrical and electronic equipment should understand the meaning of the crossed-out wheeled bin symbol. Do not dispose of WEEE as unsorted municipal waste and have to collect such WEEE separately.

## Revision

User's Manual of PLANET SFP/SFP+ Mini-GBIC Transceiver

**For Models:** MFB-SERIES/MGB-SERIES/MTB-SERIES

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# **1. Overview**

Thank you for purchasing PLANET SFP/SFP+ Mini-GBIC Transceiver which includes the Ethernet module of the MFB, MGB and MTB families.

The MFB family's Fast Ethernet SFP module can be installed into PLANET Switch products with 100BASE-FX SFP interface. The distance can be extended from 2km (multi-mode, LC) to up to 120km (single-mode, LC).

The MGB family's Gigabit Ethernet SFP module can be installed into PLANET Switch products with 1000BASE-SX/LX and 2500BASE-X SFP interface. The distance can be extended from 100m (TP) and 2km (multi-mode/single-mode, LC) to up to 120km (single-mode, LC).

The MTB family's 10G Ethernet SFP+ module can be installed into PLANET products with 10G SFP+ interface. The SFP+ transceivers can be extended from a distance of 300m (multi-mode, LC) to up to 80km (single-mode, LC). The deployment distance of 10G can be extended to 30 meters

## ***2. Checklist***

Your SFP/SFP+ Package should contain the following items:

- The SFP/SFP+ Transceiver Module x 1
- The User's Manual x 1

If any item is missing or damaged, please consult the dealer from whom you purchased your SFP/SFP+ Mini-GBIC Ethernet transceiver module.

### ***3. Introduction and Model List***

#### **3-1 The MFB-Series Mini-GBIC Transceiver Module List**

##### **Fast Ethernet Transceiver (100BASE-X SFP)**

| <b>Model</b> | <b>Speed (Mbps)</b> | <b>Connector Interface</b> | <b>Fiber Mode</b> | <b>Distance</b> | <b>Wavelength (nm)</b> | <b>Operating Temp.</b> |
|--------------|---------------------|----------------------------|-------------------|-----------------|------------------------|------------------------|
| MFB-FX       | 100                 | LC                         | Multi-Mode        | 2km             | 1310nm                 | 0 ~ 60°C               |
| MFB-F20      | 100                 | LC                         | Single Mode       | 20km            | 1310nm                 | 0 ~ 60°C               |
| MFB-F40      | 100                 | LC                         | Single Mode       | 40km            | 1310nm                 | 0 ~ 60°C               |
| MFB-F60      | 100                 | LC                         | Single Mode       | 60km            | 1310nm                 | 0 ~ 60°C               |
| MFB-F120     | 100                 | LC                         | Single Mode       | 120km           | 1550nm                 | 0 ~ 60°C               |
| MFB-TFX      | 100                 | LC                         | Multi-Mode        | 2km             | 1310nm                 | -40 ~ 85°C             |
| MFB-TF20     | 100                 | LC                         | Single Mode       | 20km            | 1310nm                 | -40 ~ 85°C             |



### Fast Ethernet Transceiver (100BASE-BX, Single Fiber Bi-directional SFP)

| Model     | DDM | Speed (Mbps) | Connector Interface | Fiber Mode  | Distance | Wavelength (TX) | Wavelength (RX) | Operating Temp. |
|-----------|-----|--------------|---------------------|-------------|----------|-----------------|-----------------|-----------------|
| MFB-FA20  | --  | 100          | WDM (LC)            | Single Mode | 20km     | 1310nm          | 1550nm          | 0 ~ 60°C        |
| MFB-FB20  | --  | 100          | WDM (LC)            | Single Mode | 20km     | 1550nm          | 1310nm          | 0 ~ 60°C        |
| MFB-TFA20 | --  | 100          | WDM (LC)            | Single Mode | 20km     | 1310nm          | 1550nm          | -40~85°C        |
| MFB-TFB20 | --  | 100          | WDM (LC)            | Single Mode | 20km     | 1550nm          | 1310nm          | -40~85°C        |
| MFB-TFA40 | --  | 100          | WDM (LC)            | Single Mode | 40km     | 1310nm          | 1550nm          | -40~85°C        |
| MFB-TFB40 | --  | 100          | WDM (LC)            | Single Mode | 40km     | 1550nm          | 1310nm          | -40~85°C        |
| MFB-TSA   | YES | 100          | WDM (LC)            | Multi-Mode  | 2km      | 1310nm          | 1550nm          | -40~85°C        |
| MFB-TSB   | YES | 100          | WDM (LC)            | Multi-Mode  | 2km      | 1550nm          | 1310nm          | -40~85°C        |



1. When shorter single mode fiber cables are used, you might need to insert an in-line optical attenuator in the link to avoid overloading the receiver. Follow the I-TUT G652 document for the same fiber cable length.
2. The attenuation coefficient mentioned in the following chapters is for reference only.

| Attenuation coefficient | Wavelength region | Typical link value |
|-------------------------|-------------------|--------------------|
|                         | 1260nm-1360nm     | 0.5 dB/km          |
|                         | 1530nm-1565nm     | 0.4 dB/km          |

| Physical<br>Fiber Cable Length “n” km | SFP Model | MFB-F20<br>MFB-TF20 | MFB-F40 | MFB-F60 | MFB-F120 |
|---------------------------------------|-----------|---------------------|---------|---------|----------|
| 10 < n < 20                           |           | 2 dB                | 4-6 dB  | 8-10 dB | 25-27 dB |
| 20 < n < 40                           |           | --                  | 2-4 dB  | 6-8 dB  | 23-25 dB |
| 40 < n < 60                           |           | --                  | --      | 2-4 dB  | 18-20 dB |

| Physical<br>Fiber Cable Length “n” km | SFP Model | MFB-TSA<br>MFB-TSB | MFB-TFA10<br>MFB-TFB10 | MFB-FA20 / MFB-FB20<br>MFB-TFA20 / MFB-TFB20 | MFB-TFA40<br>MFB-TFB40 |
|---------------------------------------|-----------|--------------------|------------------------|----------------------------------------------|------------------------|
| 0.22 < n < 2                          |           | 1 dB               | --                     | --                                           | --                     |
| 10 < n < 20                           |           | --                 | --                     | 2 dB                                         | 4-6 dB                 |
| 20 < n < 40                           |           | --                 | --                     | --                                           | 2-4 dB                 |
| 40 < n < 60                           |           | --                 | --                     | --                                           | --                     |

### 3-2 The MGB-Series Mini-GBIC Transceiver Module List

Gigabit Ethernet Transceiver (1000BASE-X SFP)

| Model         | DDM | Speed (Mbps) | Connector Interface | Fiber Mode  | Distance | Wavelength (nm) | Operating Temp. |
|---------------|-----|--------------|---------------------|-------------|----------|-----------------|-----------------|
| MGB-GT        | --  | 1000         | Copper              | --          | 100m     | --              | 0 ~ 60°C        |
| MGB-SX (V2)   | YES | 1000         | LC                  | Multi Mode  | 550m     | 850nm           | 0 ~ 60°C        |
| MGB-SX2 (V2)  | YES | 1000         | LC                  | Multi Mode  | 2km      | 1310nm          | 0 ~ 60°C        |
| MGB-LX (V2)   | YES | 1000         | LC                  | Single Mode | 20km     | 1310nm          | 0 ~ 60°C        |
| MGB-L40       | YES | 1000         | LC                  | Single Mode | 40km     | 1310nm          | 0 ~ 60°C        |
| MGB-L80       | YES | 1000         | LC                  | Single Mode | 80km     | 1550nm          | 0 ~ 60°C        |
| MGB-L120 (V2) | YES | 1000         | LC                  | Single Mode | 120km    | 1550nm          | 0 ~ 60°C        |

|              |     |      |        |             |      |        |            |
|--------------|-----|------|--------|-------------|------|--------|------------|
| MGB-TGT      | --  | 1000 | Copper | --          | 100m | --     | -40 ~ 85°C |
| MGB-TSX      | YES | 1000 | LC     | Multi Mode  | 550m | 850nm  | -40 ~ 85°C |
| MGB-TSX2     | YES | 1000 | LC     | Multi Mode  | 2km  | 1310nm | -40 ~ 85°C |
| MGB-TLX (V2) | YES | 1000 | LC     | Single Mode | 20km | 1310nm | -40 ~ 85°C |
| MGB-TL30     | YES | 1000 | LC     | Single Mode | 30km | 1310nm | -40 ~ 85°C |
| MGB-TL40     | YES | 1000 | LC     | Single Mode | 40km | 1310nm | -40 ~ 85°C |
| MGB-TL70     | YES | 1000 | LC     | Single Mode | 70km | 1550nm | -40 ~ 85°C |
| MGB-TL80     | YES | 1000 | LC     | Single Mode | 80km | 1550nm | -40 ~ 85°C |

## Gigabit Ethernet Transceiver (1000BASE-BX, Single Fiber Bi-directional SFP)

| Model                          | DDM | Speed (Mbps) | Connector Interface | Fiber Mode  | Distance | Wavelength (TX) | Wavelength (RX) | Operating Temp. |
|--------------------------------|-----|--------------|---------------------|-------------|----------|-----------------|-----------------|-----------------|
| MGB-LA10 (V2)<br>MGB-LB10 (V2) | YES | 1000         | WDM (LC)            | Single Mode | 10km     | 1310nm          | 1550nm          | 0 ~ 60°C        |
|                                |     | 1000         | WDM (LC)            | Single Mode | 10km     | 1550nm          | 1310nm          | 0 ~ 60°C        |
| MGB-LA20 (V2)<br>MGB-LB20 (V2) | YES | 1000         | WDM (LC)            | Single Mode | 20km     | 1310nm          | 1550nm          | 0 ~ 60°C        |
|                                |     | 1000         | WDM (LC)            | Single Mode | 20km     | 1550nm          | 1310nm          | 0 ~ 60°C        |
| MGB-LA40 (V2)<br>MGB-LB40 (V2) | YES | 1000         | WDM (LC)            | Single Mode | 40km     | 1310nm          | 1550nm          | 0 ~ 60°C        |
|                                |     | 1000         | WDM (LC)            | Single Mode | 40km     | 1550nm          | 1310nm          | 0 ~ 60°C        |
| MGB-LA80<br>MGB-LB80           | YES | 1000         | WDM (LC)            | Single Mode | 80km     | 1490nm          | 1550nm          | 0 ~ 60°C        |
|                                |     | 1000         | WDM (LC)            | Single Mode | 80km     | 1550nm          | 1490nm          | 0 ~ 60°C        |

|                                  |     |      |          |             |      |        |        |            |
|----------------------------------|-----|------|----------|-------------|------|--------|--------|------------|
| MGB-TSA<br>MGB-TSB               | YES | 1000 | WDM (LC) | Multi Mode  | 2km  | 1310nm | 1550nm | -40 ~ 85°C |
|                                  |     | 1000 | WDM (LC) | Multi Mode  | 2km  | 1550nm | 1310nm | -40 ~ 85°C |
| MGB-TLA10 (V2)<br>MGB-TLB10 (V2) | YES | 1000 | WDM (LC) | Single Mode | 10km | 1310nm | 1550nm | -40 ~ 85°C |
|                                  |     | 1000 | WDM (LC) | Single Mode | 10km | 1550nm | 1310nm | -40 ~ 85°C |
| MGB-TLA20<br>MGB-TLB20           | YES | 1000 | WDM (LC) | Single Mode | 20km | 1310nm | 1550nm | -40 ~ 85°C |
|                                  |     | 1000 | WDM (LC) | Single Mode | 20km | 1550nm | 1310nm | -40 ~ 85°C |
| MGB-TLA40<br>MGB-TLB40           | YES | 1000 | WDM (LC) | Single Mode | 40km | 1310nm | 1550nm | -40 ~ 85°C |
|                                  |     | 1000 | WDM (LC) | Single Mode | 40km | 1550nm | 1310nm | -40 ~ 85°C |
| MGB-TLA60<br>MGB-TLB60           | YES | 1000 | WDM (LC) | Single Mode | 60km | 1310nm | 1550nm | -40 ~ 85°C |
|                                  |     | 1000 | WDM (LC) | Single Mode | 60km | 1550nm | 1310nm | -40 ~ 85°C |

|                          |     |      |          |             |       |        |        |            |
|--------------------------|-----|------|----------|-------------|-------|--------|--------|------------|
| MGB-TLA80<br>MGB-TLB80   | YES | 1000 | WDM (LC) | Single Mode | 80km  | 1490nm | 1550nm | -40 ~ 85°C |
|                          |     | 1000 | WDM (LC) | Single Mode | 80km  | 1550nm | 1490nm | -40 ~ 85°C |
| MGB-TLA120<br>MGB-TLB120 | YES | 1000 | WDM (LC) | Single Mode | 120km | 1490nm | 1550nm | -40 ~ 85°C |
|                          |     | 1000 | WDM (LC) | Single Mode | 120km | 1550nm | 1490nm | -40 ~ 85°C |

### **Gigabit Ethernet Transceiver (2500BASE-X SFP)**

| Model       | DDM | Speed (Mbps) | Connector Interface | Fiber Mode  | Distance | Wavelength (nm) | Operating Temp. |
|-------------|-----|--------------|---------------------|-------------|----------|-----------------|-----------------|
| MGB-2GTSR   | YES | 2500         | LC                  | Multi Mode  | 300m     | 850nm           | -40 ~ 85°C      |
| MGB-2GTLR2  | YES | 2500         | LC                  | Single Mode | 2km      | 1310nm          | -40 ~ 85°C      |
| MGB-2GTLR20 | YES | 2500         | LC                  | Single Mode | 20km     | 1310nm          | -40 ~ 85°C      |



## Gigabit Ethernet Transceiver (1000BASE-BX, Single Fiber Bi-directional SFP)

| Model       | DDM | Speed (Mbps) | Connector Interface | Fiber Mode  | Distance | Wavelength (TX) | Wavelength (RX) | Operating Temp. |
|-------------|-----|--------------|---------------------|-------------|----------|-----------------|-----------------|-----------------|
| MGB-2GTLA20 | YES | 2500         | WDM (LC)            | Single Mode | 20km     | 1310nm          | 1550nm          | -40 ~ 85°C      |
| MGB-2GTLB20 |     | 2500         | WDM (LC)            | Single Mode | 20km     | 1550nm          | 1310nm          | -40 ~ 85°C      |

| Physical Fiber Cable Length "n" km | SFP Model | MGB-LX | MGB-L40 | MGB-L80  | MGB-L120 |
|------------------------------------|-----------|--------|---------|----------|----------|
| 10 < n < 20                        |           | --     | 5-7 dB  | 13-15 dB | 25-27 dB |
| 20 < n < 40                        |           | --     | 3-5 dB  | 10-12 dB | 23-25 dB |
| 40 < n < 60                        |           | --     | --      | 5-7 dB   | 18-20 dB |

| Physical Fiber Cable Length "n" km \ SFP Model | MGB-TLX | MGB-TL40 | MGB-TL80 |
|------------------------------------------------|---------|----------|----------|
| 10 < n < 20                                    | --      | 5-7 dB   | 13-15 dB |
| 20 < n < 40                                    | --      | 3-5 dB   | 10-12 dB |
| 60 < n < 80                                    | --      | --       | 5-7 dB   |

| Physical Fiber Cable Length "n" km \ SFP Model | MGB-LA10<br>MGB-LB10<br>MGB-TLA10<br>MGB-TLB10 | MGB-LA20<br>MGB-LB20<br>MGB-TLA20<br>MGB-TLB20 | MGB-LA40<br>MGB-LB40<br>MGB-TLA40<br>MGB-TLB40 | MGB-LA60<br>MGB-LB60<br>MGB-TLA60<br>MGB-TLB60 | MGB-LA80<br>MGB-LB80<br>MGB-TLA80<br>MGB-TLB80 |
|------------------------------------------------|------------------------------------------------|------------------------------------------------|------------------------------------------------|------------------------------------------------|------------------------------------------------|
| 10 < n < 20                                    | --                                             | 2 dB                                           | 4-6 dB                                         | 8-10 dB                                        | 13-15 dB                                       |
| 20 < n < 40                                    | --                                             | --                                             | 2-4 dB                                         | 6-8 dB                                         | 10-12 dB                                       |
| 40 < n < 60                                    | --                                             | --                                             | --                                             | 2-4 dB                                         | 5-7 dB                                         |
| 60 < n < 80                                    | --                                             | --                                             | --                                             | --                                             | 2-4 dB                                         |

### 3-3 The MTB-Series Mini-GBIC Transceiver Module List

#### 10Gbps SFP+ (10G Ethernet/10GBASE)

| Model    | DDM | Speed (Mbps) | Connector Interface | Fiber Mode  | Distance   | Wavelength (nm) | Operating Temp. |
|----------|-----|--------------|---------------------|-------------|------------|-----------------|-----------------|
| MTB-RJ   | --  | 10G          | Copper              | --          | 30m        | --              | 0 ~ 70°C        |
| MTB-SR   | YES | 10G          | LC                  | Multi-Mode  | Up to 300m | 850nm           | 0 ~ 60°C        |
| MTB-SR2  | YES | 10G          | LC                  | Single Mode | 2km        | 1310nm          | 0 ~ 60°C        |
| MTB-LR   | YES | 10G          | LC                  | Single Mode | 10km       | 1310nm          | 0 ~ 60°C        |
| MTB-LR20 | YES | 10G          | LC                  | Single Mode | 20km       | 1310nm          | 0 ~ 60°C        |
| MTB-LR40 | YES | 10G          | LC                  | Single Mode | 40km       | 1310nm          | 0 ~ 60°C        |
| MTB-LR60 | YES | 10G          | LC                  | Single Mode | 60km       | 1550nm          | 0 ~ 60°C        |

|           |     |     |        |             |            |        |            |
|-----------|-----|-----|--------|-------------|------------|--------|------------|
| MTB-LR80  | YES | 10G | LC     | Single Mode | 80km       | 1550nm | 0 ~ 60°C   |
| MTB-TRJ   | --  | 10G | Copper | --          | 30m        | --     | -40 ~ 85°C |
| MTB-TSR   | YES | 10G | LC     | Multi-Mode  | Up to 300m | 850nm  | -40 ~ 85°C |
| MTB-TSR2  | YES | 10G | LC     | Single Mode | 2km        | 1310nm | -40 ~ 85°C |
| MTB-TLR   | YES | 10G | LC     | Single Mode | 10km       | 1310nm | -40 ~ 85°C |
| MTB-TLR20 | YES | 10G | LC     | Single Mode | 20km       | 1310nm | -40 ~ 85°C |
| MTB-TLR40 | YES | 10G | LC     | Single Mode | 40km       | 1310nm | -40 ~ 85°C |
| MTB-TLR60 | YES | 10G | LC     | Single Mode | 60km       | 1550nm | -40 ~ 85°C |
| MTB-TLR80 | YES | 10G | LC     | Single Mode | 80km       | 1550nm | -40 ~ 85°C |

## 10Gigabit Ethernet Transceiver (10GBASE-BX, Single Fiber Bi-directional SFP)

| Model                | DDM | Speed (Mbps) | Connector Interface | Fiber Mode  | Distance | Wavelength (TX) | Wavelength (RX) | Operating Temp. |
|----------------------|-----|--------------|---------------------|-------------|----------|-----------------|-----------------|-----------------|
| MTB-LA10<br>MTB-LB10 | YES | 10G          | WDM (LC)            | Single Mode | 10km     | 1270nm          | 1330nm          | 0 ~ 60°C        |
|                      |     | 10G          | WDM (LC)            | Single Mode | 10km     | 1330nm          | 1270nm          | 0 ~ 60°C        |
| MTB-LA20<br>MTB-LB20 | YES | 10G          | WDM (LC)            | Single Mode | 20km     | 1270nm          | 1330nm          | 0 ~ 60°C        |
|                      |     | 10G          | WDM (LC)            | Single Mode | 20km     | 1330nm          | 1270nm          | 0 ~ 60°C        |
| MTB-LA40<br>MTB-LB40 | YES | 10G          | WDM (LC)            | Single Mode | 40km     | 1270nm          | 1330nm          | 0 ~ 60°C        |
|                      |     | 10G          | WDM (LC)            | Single Mode | 40km     | 1330nm          | 1270nm          | 0 ~ 60°C        |
| MTB-LA60<br>MTB-LB60 | YES | 10G          | WDM (LC)            | Single Mode | 60km     | 1270nm          | 1330nm          | 0 ~ 60°C        |
|                      |     | 10G          | WDM (LC)            | Single Mode | 60km     | 1330nm          | 1270nm          | 0 ~ 60°C        |

|                        |     |     |          |             |      |        |        |            |
|------------------------|-----|-----|----------|-------------|------|--------|--------|------------|
| MTB-LA70<br>MTB-LB70   | YES | 10G | WDM (LC) | Single Mode | 70km | 1270nm | 1330nm | 0 ~ 60°C   |
|                        |     | 10G | WDM (LC) | Single Mode | 70km | 1330nm | 1270nm | 0 ~ 60°C   |
| MTB-TLA20<br>MTB-TLB20 | YES | 10G | WDM (LC) | Single Mode | 20km | 1270nm | 1330nm | -40 ~ 85°C |
|                        |     | 10G | WDM (LC) | Single Mode | 20km | 1330nm | 1270nm | -40 ~ 85°C |
| MTB-TLA40<br>MTB-TLB40 | YES | 10G | WDM (LC) | Single Mode | 40km | 1270nm | 1330nm | -40 ~ 85°C |
|                        |     | 10G | WDM (LC) | Single Mode | 40km | 1330nm | 1270nm | -40 ~ 85°C |
| MTB-TLA60<br>MTB-TLB60 | YES | 10G | WDM (LC) | Single Mode | 60km | 1270nm | 1330nm | -40 ~ 85°C |
|                        |     | 10G | WDM (LC) | Single Mode | 60km | 1330nm | 1270nm | -40 ~ 85°C |

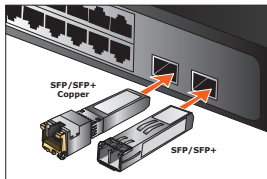
| Physical<br>Fiber Cable Length “n” km | SFP Model | MTB-LA20<br>MTB-LB20 | MTB-LA40<br>MTB-LB40 | MTB-LA60<br>MTB-LB60 |
|---------------------------------------|-----------|----------------------|----------------------|----------------------|
| 10 < n < 20                           |           | 2 dB                 | 4-6 dB               | 8-10 dB              |
| 20 < n < 40                           |           | --                   | 2-4 dB               | 6-8 dB               |
| 40 < n < 60                           |           | --                   | --                   | 2-4 dB               |

## 4. Installation and Removal of Transceiver Module

### 4-1 Installing the SFP/SFP+ Mini-GBIC Transceiver Module

Please follow these steps to install the SFP/SFP+ Mini-GBIC module:

1. Power on the Switch and place the Switch on a flat surface. Install the new SFP/SFP+ Mini-GBIC module by inserting it into the slot and sliding it in until it stops (See **Figure 1**). Press it firmly until you hear the module snap into place. Never force, twist or bend the SFP/SFP+ Mini-GBIC module. The SFP/SFP+ Mini-GBIC module slides in smoothly and the Switch will automatically detect the new module.



**Figure 1:** Inserting the SFP/SFP+ Mini-GBIC Module

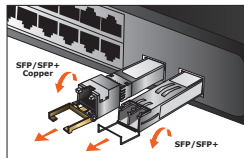
2. After the TP/Fiber connection is made successfully, check the LEDs to verify that if there is a link and a proper connection at the port.

Please refer to the user's manual for more about the Switch or module's management.



## 4-2 Removing the SFP/SFP+ Transceiver Module

1. Make sure there is no network activity by consulting or checking with the network administrator.
2. Remove the Fiber Optic Cable gently (See **Figure 2**).
3. Turn the handle of the SFP/SFP+ Transceiver module to the horizontal level.
4. Pull out the SFP/SFP+ Transceiver module gently through the handle.



**Figure 2:** Removing the SFP/SFP+ Mini-GBIC Module



Warning

Never pull out the SFP/SFP+ Transceiver module without pulling the handle or the push bolts on the module. Directly pulling out the SFP/SFP+ Transceiver module would damage the SFP/SFP+ Transceiver module of the device.

### 4-3 Connecting the UTP Cable

The 1G/2.5G/5G/10GBASE-T port uses RJ45 socket -- similar to phone jack -- for connection of unshielded twisted-pair cable (UTP). The 802.3ab/802.3bz/802.3ae Ethernet standard requires Category 5 UTP for 100Mbps 100BASE-TX. 1G/2.5G/5G/10GBASE-T uses Cat5e/6/7 UTP (see table below). Maximum distance is 100 meters (328 feet).

| Standard   | Transfer Speed | Cable Requirement 100M |
|------------|----------------|------------------------|
| 10GBASE-T  | 10000Mbit/s    | Cat 6A/7               |
| 5GBASE-T   | 5000Mbit/s     | Cat 6/6A/7             |
| 2.5GBASE-T | 2500Mbit/s     | Cat 5e/6/6A/7          |
| 1000BASE-T | 1000Mbit/s     | Cat 5e/6/6A/7          |



#### Note

Be sure the connected network devices support MDI/MDI-X. If it does not support, then use the crossover Category 5e cable.

# Appendix A

## A.1 Fiber Optic Cable Connection Parameters

The wiring details are shown below:

### ■ Fiber Optic Patch Cables:

| Standard    | Fiber Type  | Cable Specifications   |
|-------------|-------------|------------------------|
| 100BASE-FX  | Multi-mode  | 50/125μm or 62.5/125μm |
| 100BASE-FX  | Single mode | 9/125μm                |
| 100BASE-BX  | Multi-mode  | 50/125μm               |
| 1000BASE-SX | Multi-mode  | 50/125μm or 62.5/125μm |
| 1000BASE-LX | Single mode | 9/125μm                |
| 1000BASE-BX | Single mode | 9/125μm                |

|            |             |                        |
|------------|-------------|------------------------|
| 10GBASE-SR | Multi-mode  | 50/125µm or 62.5/125µm |
| 10GBASE-LR | Single mode | 9/125µm                |
| 10GBASE-BX | Single mode | 9/125µm                |

## Safety Notice

Fiber-optic SFP modules are equipped with a Class 1 laser, which emits invisible radiation. Read the following safety warning carefully.



Note

Class 1 Laser Product  
Complies with FDA Regulation 21 CFR 1040.10 and 1040.11



Warning

Class 1 radiation is present when the device or system is powered up.



Warning

Only trained and qualified personnel should be allowed to install or replace these modules.