



**CC-Link IE TSN Certified**  
**10/100/1000BASE-T to 100/1000BASE-X**  
**Media Converter**

**KGC-301/C**

**Installation Guide**



DOC.241022

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## CE NOTICE

Marking by the symbol indicates compliance of this equipment to the EMC directive of the European Community. Such marking is indicative that this equipment meets or exceeds the following technical standards:

EMC Class A

EN 61000-6-4

EN 61000-6-2

IEC 61000-4-2

IEC 61000-4-3

IEC 61000-4-4

IEC 61000-4-5

IEC 61000-4-8

IEC 61000-4-11

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# 1. Introduction

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The KGC-301/C is a CC-Link IE TSN Certified Gigabit Ethernet media converter series that provides the following features:

## **Data Conversion between different Media types and Speed**

The media converter supports the following conversions:

- 1000Mbps (1000BASE-T) copper to/from 1000Mbps (1000BASE-X) fiber
- 100Mbps (100BASE-TX) copper to/from 1000Mbps (1000BASE-X) fiber
- 10Mbps (10BASE-T) copper to/from 1000Mbps (1000BASE-X) fiber
- 1000Mbps (1000BASE-T) copper to/from 100Mbps (100BASE-FX) fiber
- 100Mbps (100BASE-TX) copper to/from 100Mbps (100BASE-FX) fiber
- 10Mbps (10BASE-T) copper to/from 100Mbps (100BASE-FX) fiber

## **Smart Forwarding**

If the data line rates configured are same on the copper port and the fiber port, the fast direct conversion forwarding mode is used. Otherwise, store-and-forward mode is adopted automatically.

## **Dual-speed Fiber Connectivity**

The SFP fiber port slot can be installed with different optional SFP optical fiber transceiver to support multimode or single mode fiber for short reach up to long reach distance. The SFP can support both 1000BASE-X and 100BASE-FX fiber connection. This feature extends a wider application range with this device.

## **Link Fault Pass-Through**

This feature can force the link to shut down as soon as it notices that the other link has failed. It allows a link partner on one cable segment can notice a link fault occurred on the other segment and give application a chance to react.

## 1.1 Features

### Basic functions

- Tri-speed 10/100/1000Mbps copper to dual-speed 1G/100Mbps fiber conversion
- Support full wire speed conversion
- Support jumbo frame conversion
- Provide direct conversion with shortest latency between two links at same line rate
- Support transparent conversion of any packet types with no packet modification
- Support auto-negotiation with link partners
- Provide link fault pass through function for media converter applications
- Provide SFP slot on fiber port for mounting variety of fiber options

## 1.2 Product Panels

The following figure illustrates the front panel and rear panel of the device:



Front



Rear

## 1.3 Specifications

### UTP - 10/100/1000 Twisted-pair Copper Port

Compliance	IEEE 802.3 10Base-T, IEEE 802.3u 100Base-TX, IEEE 802.3ab 1000Base-T
Connectors	Shielded RJ-45 jacks
Pin assignments	Auto MDI/MDI-X detection
Configuration	Auto-negotiation, manual DIP switch settings
Transmission rate	10Mbps, 100Mbps, 1000Mbps

Duplex support	Full/Half duplex
Network cable	Cat.5 UTP

### **SFP - Dual-speed Fiber Port**

Compliance	IEEE 802.3z 1000Base-X, IEEE 802.3u 100BASE-FX
Connectors	SFP for optional SFP type fiber transceivers
Configuration	Auto speed detection, Fixed on auto-negotiation 1000Mbps Full duplex
Transmission rate	1000Mbps, 100Mbps (Dual-speed support)
Network cables	MMF 50/125 $\mu$ m 62.5/125 $\mu$ m, SMF 9/125 $\mu$ m
Eye safety	IEC 825 compliant

### **LED Indicators**

PWR	Power status
TP-LINK	UTP Copper port link and activity status
TP-1G	UTP Copper port data rate status
FX-LINK	SFP fiber port link and activity status
FX-1G	SFP fiber port data rate status
MCU	Diagnostic status

### **SW - Configuration DIP Switches**

SW1-SW3	UTP copper port configuration
SW4	SFP fiber port configuration
SW5	Link Fault Pass Through function setting

### **Basic Functions**

MAC Addresses	Support up to 1K entries under store-and-forward mode No limitation under direct conversion mode
Forwarding technology	Direct conversion mode when copper port and fiber port are at same line rate Store and forward mode when two ports are at different line rates
Forwarded packet types	Transparent forwarding for all packet types under direct conversion mode All packet types except PAUSE packets under store and forward mode
Maximum packet length	Jumbo frame support up to 16Kbytes
Flow control	Active under store and forward mode IEEE 802.3x pause frame base for full duplex operation Back pressure for half duplex operation

### **DC IN - DC Power Input**

Interfaces	Screwed terminal block: + & – contacts DC Jack ( -D 6.3mm / + D 2.0mm)
Operating Input Voltages	+12 ~ +60VDC
Power consumption	2.4W max. @60V

### **Mechanical**

Dimension (base)	108 x 72.5 x 23mm
Housing	Enclosed metal with no fan
Mounting	Desktop mounting, wall mounting, Din-rail mounting

### **Environmental**

Operating Temperature	Typical -40°C ~ +75°C
Storage Temperature	-40°C ~ +85°C
Relative Humidity	5% ~ 90%

### **Approvals**

FCC	Part 15 rule Class A
CE	EMC Class A EN 61000-6-4 EN 61000-6-2
VCCI	Class A
CC-Link	CC-Link IE TSN
IEEE 802.3	Isolation RJ-45 interface vs. Frame Ground Isolation RJ-45 interface vs. DC IN interface Isolation DC IN interface vs. Frame Ground Isolation test – Withstand voltage test, 1.5KVAC 10mA 60 seconds
IEC 60068-2-64	Vibration
IEC 60068-2-27	Shock test



## 2. Installation

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### 2.1 Unpacking

The product package contains:

- The device unit
- QR code label linking to product documentation cloud

### 2.2 Safety Cautions

To reduce the risk of bodily injury, electrical shock, fire and damage to the product, observe the following precautions.

	Do not service any product except as explained in your system documentation.
	Opening or removing covers may expose you to electrical shock.
	Only a trained service technician should service components inside these compartments.
	If any of the following conditions occur, unplug the product from the electrical outlet and replace the part or contact your trained service provider: <ul style="list-style-type: none"><li>- The power cable, extension cable, or plug is damaged.</li><li>- An object has fallen into the product.</li><li>- The product has been exposed to water.</li><li>- The product has been dropped or damaged.</li><li>- The product does not operate correctly when you follow the operating instructions.</li></ul>
	Do not push any objects into the openings of your system. Doing so can cause fire or electric shock by shorting out interior components.
	Operate the product only from the type of external power source indicated on the electrical ratings label. If you are not sure of the type of power source required, consult your service provider or local power company.

## 2.3 Mounting the Media Converter

The media converter can be mounted on a desktop or shelf or a wall. Make sure that there is proper heat dissipation from and adequate ventilation around the device. Do not place heavy objects on the device.

### Desktop mounting



### Wall mounting

The device has one mounting wall on the bottom side to support wall mounting.

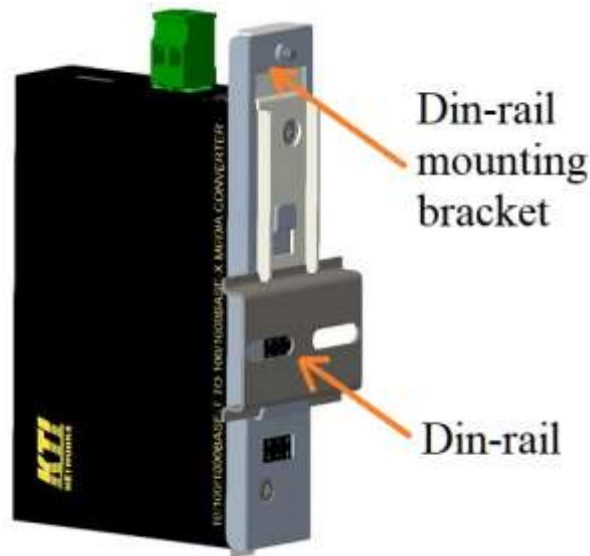
Wall mounting hole  
on bottom case



## Din-Rail mounting

For a Din-Rail chassis, the device can support mounting on a Din-Rail. The following figure shows an example after bracket installation:

1. Install the mounting bracket onto the back of the device with screws as shown below:
2. Attach bracket to the lower edge of the DIN rail and push the unit upward a little bit until the bracket can clamp on the upper edge of the DIN rail.
3. Clamp the device to the DIN rail and make sure it is mounted securely.

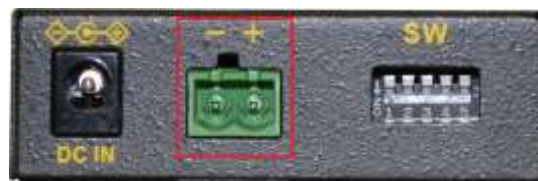


## 2.4 Applying Power

### DC Power Connectors

The device is featured with two different DC power input connectors for supporting different types of external AC-DC power supply or AC-DC power adapters.

### 2.4.1 DC power Terminal Block



Connector: European 2P flange terminal block



DC Power input contacts:

Pin	1	-	DC - Negative (-) input terminal
	2	+	DC + Negative (+) input terminal

Terminal Plug: A 2P flange terminal plug

Power wires: 24 ~ 12AWG (IEC 0.5~2.5mm<sup>2</sup>)

Wire length: 1 meter max.

VDC input rating: +12V ~ +60V

## 2.4.2 DC Power Jack



Contact Connector: DC Jack (- $\emptyset$  6.3mm/+ $\emptyset$  2.0mm) for external AC-DC power adapter

Contacts:

Contact	Marking	Remark
Center ( $\emptyset$ 2.0mm)	<+>	DC power input (+)
Outer ( $\emptyset$ 6.3mm)	<->	DC power input (-)

VDC input rating: +12V ~ +48V

## 2.5 Making UTP Connections

The 10/100/1000 twisted-pair copper port supports the following connection types and distances:

### Network Cables

10BASE-T: 2-pair UTP Cat. 3,4,5 , EIA/TIA-568B 100-ohm

100BASE-TX: 2-pair UTP Cat. 5, EIA/TIA-568B 100-ohm

1000BASE-T: 4-pair UTP Cat. 5 or higher (Cat.5e is recommended), EIA/TIA-568B 100-ohm

Link distance: Up to 100 meters

### Auto MDI/MDI-X Function

This function allows the port to auto-detect the twisted-pair signals and adapts itself to form a valid MDI to MDI-X connection with the remote connected device automatically. No matter a straight through cable or crossover cable is connected, the ports can sense the receiving pair automatically and configure itself to match the rule for MDI to MDI-X connection. It simplifies the cable installation.

### Auto-negotiation Function

The port is featured with auto-negotiation function and full capability to support connection to any Ethernet devices. The port performs a negotiation process for the speed and duplex configuration with the connected device automatically when each time a link is being established. If the connected device is also auto-negotiation capable, both devices will come out the best configuration after negotiation process. If the connected device is incapable in auto-negotiation, the port will sense the speed and use half duplex for the connection.

### 2.5.1 UTP Configuration DIP Switches

For making proper connection to an auto-negotiation INCAPABLE device, it is suggested to set port configuration to one of non-auto (forced) operating modes and specify speed and duplex mode which match the configuration used by the connected device. Any change of DIP SW1~SW3 setting will take effect immediately even when the device is in operation.

DIP SW (switches) SW1, SW2, SW3

SW1	SW2	SW3	Mode
OFF	OFF	OFF	Auto 10/100/1000 FDX/HDX (Factory default)
OFF	OFF	ON	Fixed 1000M FDX *
ON	OFF	OFF	Fixed 100M FDX
ON	OFF	ON	Fixed 100M HDX
ON	ON	OFF	Fixed 10M FDX
ON	ON	ON	Fixed 10M HDX

Auto: Auto-negotiation enabled

\*: auto-negotiation disabled

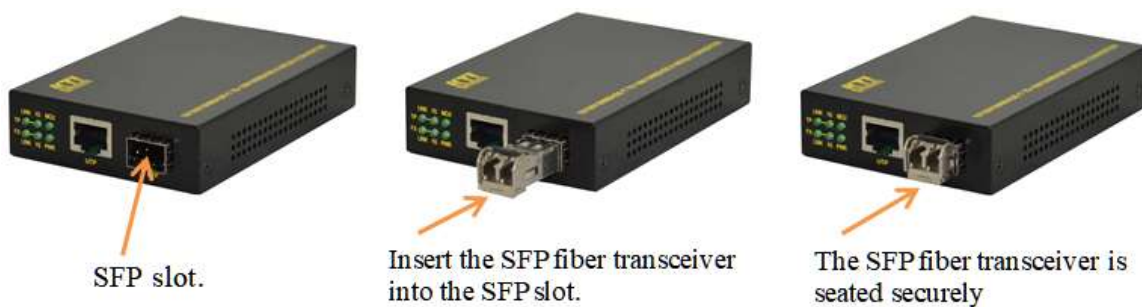
## 2.6 Making Fiber Connection

The mini-GBIC SFP port must be installed with an SFP fiber transceiver for making fiber connection. Your device may come with an SFP transceiver pre-installed when it was shipped.

### Installing SFP Fiber Transceiver

To install an SFP fiber transceiver into the SFP port, the steps are:

1. Turn off the power to the device.
2. Insert the SFP fiber transceiver into the SFP port. Normally, a bail is provided for every SFP transceiver. Hold the bail and make insertion.
3. Until the SFP transceiver is seated securely in the slot, place the bail in lock position.

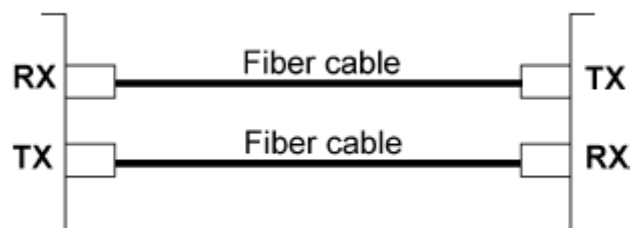


### Dual Speed Support

The SFP port supports 1000BASE-X based SFP fiber transceivers and 100BASE-FX based SFP fiber transceivers. Select "Auto" for port configuration. The system will detect the type of the installed transceiver and configure the port properly and automatically by default.

### Connecting Fiber Cables

LC connectors are commonly equipped on most SFP transceiver modules. Identify TX and RX connector before making cable connection. The following figure illustrates a connection example between two fiber ports:



Make sure the Rx-to-Tx connection rule is followed on the both ends of the fiber cable.

### Network Cables

Multimode (MMF) - 50/125 $\mu$ m, 62.5/125 $\mu$ m

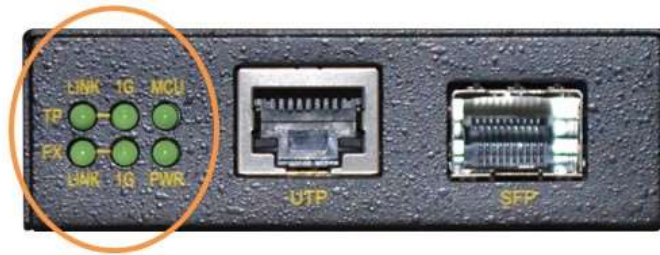
Single mode (SMF) - 9/125 $\mu$ m

## 2.6.1 SFP Configuration DIP Switch (SW4)

SW4	Mode
OFF	1000Mbps, Full duplex, Auto-negotiation enabled (Factory default)
ON	Auto detection Full duplex Line rate, 1000Mbps or 100Mbps is determined by detecting the data rate information embedded in the installed SFP transceiver

*Note: The setting change of SW4 takes effect after next device power-up.*

## 2.7 LED Indication

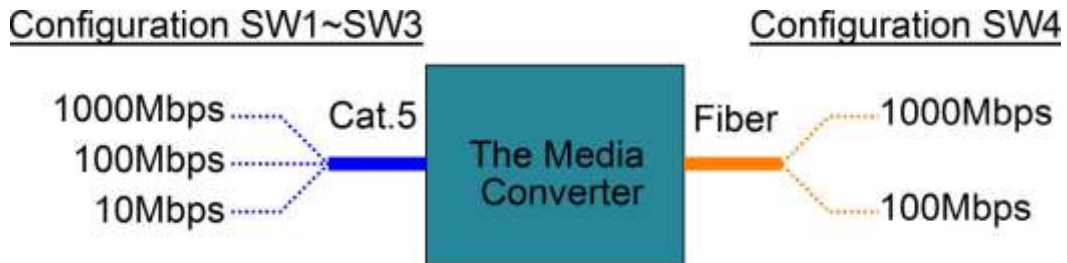


LED	State	Interpretation
PWR	ON	The device is powered on.
TP-LINK	OFF	The UTP port is link down.
	ON	The UTP port is link up.
TP-1G	OFF	The UTP port line rate is 10 or 100Mbps.
	ON	The UTP port line rate is 1000Mbps.
FX-LINK	OFF	The SFP port is link down.
	ON	The SFP port is link up.
FX-1G	OFF	The SFP port line rate is 100Mbps.
	ON	The SFP port line rate is 1000Mbps.
MCU	ON	No diagnostic error detected
	Blink	Diagnostic error detected

## 3 Media Converter Functions

### 3.1 Line Rate Conversion

The device supports the following data conversions between fiber cable and twisted-pair Cat.5 (copper) cable:



The data line rate on twisted-pair copper segment depends on the link speed finally established with the link partner. However, the line rate can be fixed at one specific line rate by setting UTP configuration DIP switches (SW1 ~ SW3).

The data line rate on fiber segment is fixed at 1000Mbps by factory default. However, the line rate configuration, called auto-detection mode can be set at line rate that matches the type of the installed SFP fiber transceiver by setting SFP configuration DIP switch (SW4).

### 3.2 Packet Forwarding

The packet forwarding method between twisted-pair port and SFP fiber port of the device depends on the configured data line rates on both ports. Refer to the following table:

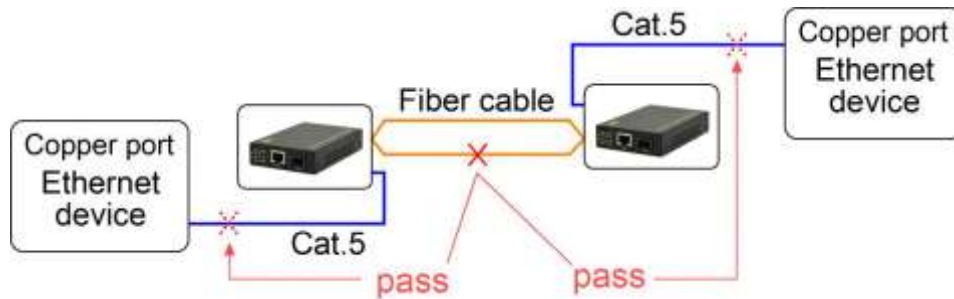
Configuration	UTP & SFP at same line rate	UTP & SFP at different line rates
Forwarding technology used	Direct conversion	Store-and-forward
Advantage	The shortest latency	Bad packets are filtered
Jumbo frame forwarding	Support	Support
Performance	Full wire speed	Full wire speed
Forwarded packet types	All (Transparently)	All except PAUSE frame
Flow control	Disabled	Enabled
Packet storm protection	No	Enabled for Broadcast storm Multicast storm ICMP storm ARP storm



### 3.3 Link Fault Pass Through Function

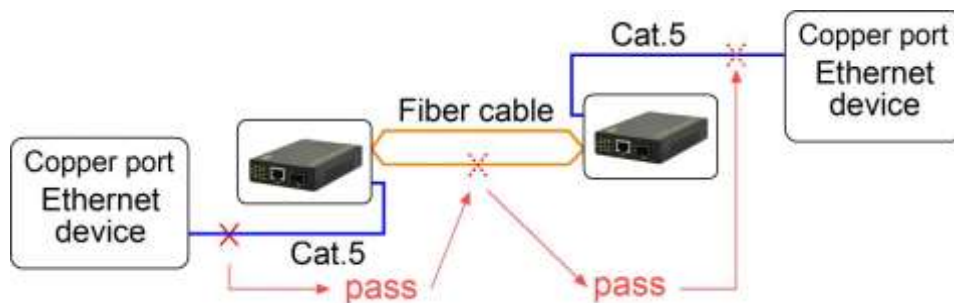
When the Link Fault Pass Through (LFPT) function is enabled. When the media converter detects a link fault on one port segment, it will force the other port segment link down. It looks like that a link fault is passed from one port to the other.

**Scenario 1:** The following drawing illustrates a link fault occurs on the fiber cable (any one cable in a duplex fiber connection). The link fault is forwarded to both copper link partners finally by LFPT operation of two media converters.



Both Ethernet devices will also detect a link fault on each Cat.5 connection, although the real fault occurs on the fiber connection exactly.

**Scenario 2:** The following drawing illustrates a real link fault occurs on one Cat.5 and the link fault is passed to the other Cat.5 over two converters and the fiber cable by LFPT operation. Finally, the other link partner also detects a link fault.



#### Advantage

This function allows two remote link partners of the media converters detect the link fault finally no matter where the exact fault occurs. It allows the upper application takes necessary action in case a real link fault occurs in any cable segment.

### 3.3.1 LFPT Configuration DIP Switch (SW5)

The LFPT function can be enabled by setting SW5 as below:

SW5	LFPT
OFF	Disabled (Factory default)
ON	Enabled

*Note: The setting change of SW5 takes effect after next device power-up.*

Under certain condition, LFPT function is not supported. See the following table:

SW4	SFP Port Mode	LFPT Function
OFF	1000Mbps, Full duplex, Auto-negotiation enabled (Factory default)	Supported
ON	Auto detection Full duplex Line rate, 1000Mbps or 100Mbps is determined by detecting the data rate information embedded in the installed SFP transceiver	Supported only at line rate of 1000Mbps (Not at line rate of 100Mbps)

# Appendix A. Models & Optical Specifications

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## Model Definition

KGC-301/C      Managed model with no pre-installed SFP transceiver

KGC-301/C -xxxx      Managed model with pre-installed SFP transceiver

## SFP with 1000BASE-X fiber transceiver

<u>Model Ext.</u>	<u>FiberCon.</u>	<u>Reference Fiber Distance (Typ.)</u>
-SX	1000M LC	Duplex MMF 500m
-LX	1000M LC	Duplex MMF 550m, SMF 10km
-LX20	1000M LC	Duplex SMF 20km
-LX30	1000M LC	Duplex SMF 30km
-LX50	1000M LC	Duplex SMF 50km
-LX70	1000M LC	Duplex SMF 70km

## Bi-directional WDM over single SMF

-W3510	1000M LC	Simplex SMF 10km
-W5310	1000M LC	Simplex SMF 10km
-W3520	1000M LC	Simplex SMF 20km
-W5320	1000M LC	Simplex SMF 20km
-W3410	1000M LC	Simplex SMF 10km
-W4310	1000M LC	Simplex SMF 10km

## SFP with 100BASE-FX fiber transceiver

<u>Model Ext.</u>	<u>FiberCon.</u>	<u>Reference Fiber Distance (Typ.)</u>
-FM	100M LC	Duplex MMF 2km
-FS30	100M LC	Duplex SMF 30km
-FS60	100M LC	Duplex SMF 60km
-FS100	100M LC	Duplex SMF 100km

## Bi-directional WDM over single SMF

-FW3520	100M LC	Simplex SMF 20km
-FW5320	100M LC	Simplex SMF 20km

### Optical 1000BASE-X Specifications

<u>Model Ext.</u>	<u>Wavelength</u>	<u>Tx Power</u> <sup>*1</sup>	<u>Rx Sen.</u> <sup>*2</sup>	<u>Max.Rx</u> <sup>*3</sup>
-SX	850nm	-9.5~ -4	-18	0
-LX	1310nm	-9.5~ -3	-20	-3
-LX20	1310nm	-8~ -2	-23	-1
-LX30	1310nm	-4~ +1	-24	-3
-LX50	1550nm	-4~ +1	-24	-3
-LX70	1550nm	0~ +5	-24	-3

### Bi-Direction WDM over single SMF

-W3510	T1310/R1550	-9~ -3	-21	-1
-W5310	T1550/R1310	-9~ -3	-21	-1
-W3520	T1310/R1550	-8~ -2	-23	-1
-W5320	T1550/R1310	-8~ -2	-23	-1
-W3410	T1310/R1490	-9~ -3	-21	-1
-W4310	T1490/R1310	-9~ -3	-21	-1

### Optical 100BASE-FX Specifications

<u>Model Ext.</u>	<u>Wavelength</u>	<u>Tx Power</u> <sup>*1</sup>	<u>Rx Sen.</u> <sup>*2</sup>	<u>Max.Rx</u> <sup>*3</sup>
-FM	1310nm	-20~ -14	-31	-8
-FS30	1310nm	-15~ -8	-34	0
-FS60	1310nm	-5~ 0	-35	0
-FS100	1550nm	-5~ 0	-35	0

### Bi-Direction WDM over single SMF

-FW3520	T1310/R1550	-14~ -8	-32	0
-FW5320	T1550/R1310	-14~ -8	-32	0

<sup>\*1</sup> Tx Power : Transmitter power (min. ~ max., unit: dBm)

<sup>\*2</sup> Rx Sen. : Receiver sensitivity (unit: dBm)

<sup>\*3</sup> Max.Rx. : Maximal Received power (unit.: dBm)