SUNX

INSTRUCTION MANUAL

Manual Setting Fiber Sensor

Red LED type | **Blue LED type** | **Green LED type**

FX-311(P) FX-311B(P) FX-311G(P)

Thank you very much for using SUNX products. Please read this Instruction Manual carefully and thoroughly for the correct and optimum use of this product. Kindly keep this manual in a convenient place for quick reference.

WARNING

- **Never use this product as a sensing device for personnel protection.**
- **In case of using sensing devices for personnel protection, use products which meet standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.**

1 SPECIFICATIONS

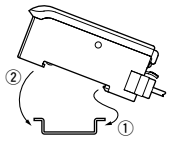
Item \ Type		Red LED type	Blue LED type	Green LED type
Model No.	NPN output	**FX-311**	**FX-311B**	**FX-311G**
	PNP output	**FX-311P**	**FX-311BP**	**FX-311GP**
Power voltage		12 to 24V DC ± 10% Ripple P-P 10% or less		
Power consumption		840mW or less (current consumption 35mA or less at 24V supply voltage)		
Output		**<NPN output type>** NPN open-collector transistor • Maximum sink current: 100mA (Note 1) • Applied voltage: 30V DC or less (between output and 0V) • Residual voltage: 1.5V or less [at 100mA (Note 1) sink current]	**<PNP output type>** PNP open-collector transistor • Maximum source current: 100mA (Note 1) • Applied voltage: 30V DC or less (between output and +V) • Residual voltage: 1.5V or less [at 100mA (Note 1) source current]	
Output operation		Selectable either Light-ON or Dark-ON		
Short-circuit protection		Incorporated		
Response time		Selectable: 250μs or less (for STD, S-D), 2ms or less (for LONG)	Selectable: 150μs or less (for FAST), 250μs or less (for STD), 2ms or less (for LONG)	
Operation indicator		Orange LED (lights up when the output is ON)		
Stability indicator		Green LED (lights up under stable light-received condition or stable dark condition)		
Sensitivity adjuster		12-turn potentiometer with indicator (Pointer part: red backlight)		
Timer function		Incorporated with OFF-delay timer, selectable either effective (approx. 10ms or 40ms) or ineffective (Note 2)		
Interference prevention function		Incorporated (up to four fibers can be mounted adjacently)		
Ambient temperature		–10 to +55°C (If 4 to 7 units are connected in cascade: –10 to +50°C, if 8 to 16 units are connected in cascade: –10 to +45°C) (No dew condensation or icing allowed), Storage: –20 to +70°C		
Ambient humidity		35 to 85% RH, Storage: 35 to 85% RH		
Emitting element		Red LED (modulated)	Blue LED (modulated)	Green LED (modulated)
Material		Enclosure: Heat-resistant ABS, Transparent cover: Polycarbonate		
Weight		15g approx.		

Notes: 1) 50mA if five, or more, amplifiers are connected together.
2) The red backlight of the pointer part lights up when the power is turned ON and when the sensitivity is adjusted.
3) The cable for amplifier connection is not supplied as an accessory. Make sure to use the optional quick-connection cables given below.
Main cable (3-core): **CN-73-C1** (cable length 1m), **CN-73-C2** (cable length 2m)
CN-73-C5 (cable length 5m)
Sub cable (1-core): **CN-71-C1** (cable length 1m), **CN-71-C2** (cable length 2m)
CN-71-C5 (cable length 5m)

2 CAUTIONS

- Make sure to carry out the wiring in the power supply off condition.
- Verify that the supply voltage variation is within the rating.
- Take care that if a voltage exceeding the rated range is applied, or if an AC power supply is directly connected, the sensor may get burnt or damaged.
- In case noise generating equipment (switching regulator, inverter motor, etc.) is used in the vicinity of this product, connect the frame ground (F.G.) terminal of the equipment to an actual ground.
- If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
- Do not use during the initial transient time (0.5 sec.) after the power supply is switched on.
- Take care that short-circuiting or wrong wiring of the load may burn or damage the sensor.
- Do not run the wires together with high-voltage lines or power lines or put them in the same raceway. This can cause malfunction due to induction.
- Make sure to use the optional quick-connection cable for the connection of the amplifier. Extension up to total 100m is possible with 0.3mm^2, or more, cable. However, in order to reduce noise, make the wiring as short as possible.
- This sensor is suitable for indoor use only.
- Avoid dust, dirt, and steam.
- Take care that the product does not come in direct contact with organic solvents, such as, thinner, etc.
- This sensor cannot be used in an environment containing inflammable or explosive gases.
- Never disassemble or modify the sensor.

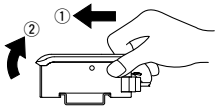
3 MOUNTING



35mm width DIN rail

How to mount the amplifier

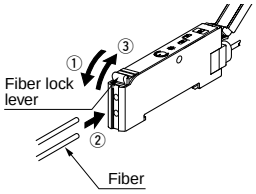
① Fit the rear part of the mounting section of the amplifier on a 35mm width DIN rail.
② Press down the rear part of the mounting section of the unit on the 35mm width DIN rail and fit the front part of the mounting section to the DIN rail.



How to remove the amplifier

① Push the amplifier forward.
② Lift up the front part of the amplifier to remove it.

Note: Please take care that if the front part is lifted up without pushing the amplifier forward, the hooks on the rear part of the mounting section are likely to break.



How to connect the fiber cables

① Snap the fiber lock lever down.
② Insert the fiber cables slowly into the inlets until they stop. (Note 1)
③ Return the fiber lock lever to the original position, till it stops.

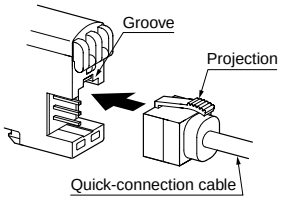
Notes: 1) In case the fiber cables are not inserted to a position where they stop, the sensing range reduces. However, in case of a flexible fiber, take care that it may bend inside the amplifier, during insertion.
2) With the coaxial reflective type fiber, such as, **FD-G4** or **FD-FM2**, insert the single-core fiber cable into the beam-emitting inlet and the multi-core fiber cable into the beam-receiving inlet. If they are inserted in reverse, the sensing accuracy will deteriorate.

4 CONNECTION

Make sure to connect or disconnect the quick-connection cable in the power supply off condition.

Connection method

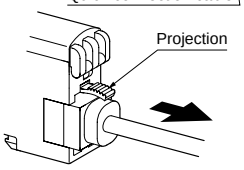
① Holding the connector of the quick-connection cable, align its projection with the groove at the top portion of the amplifier connector.
② Insert the connector till a click is felt.



Disconnection method

① Pressing the projection at the top of the quick-connection cable connector, pull out the connector.

Note: Take care that if the connector is pulled out without pressing the projection, the projection may break. Do not use a quick-connection cable whose projection has broken. Further, do not pull by holding the cable, as this can cause a cable-break.

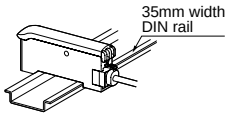


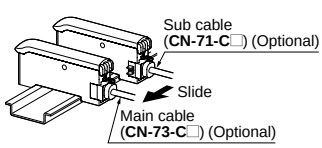
5 CASCADING AMPLIFIERS

- Make sure to add or remove the amplifiers in the power supply off condition.
- Make sure to check the allowable ambient temperature, as it depends on the number of amplifiers connected in cascade.
- In case two, or more, amplifiers are connected in cascade, make sure to mount them on a DIN rail.
- When connecting in cascade, mount the amplifiers close to each other, fitting them between the optional end plates (**MS-DIN-E**) mounted at the two ends.
- Up to maximum 15 amplifiers can be added (total 16 amplifiers connected in cascade.)
- When connecting more than two amplifiers in cascade, use the sub cable (**CN-71-C**□) as the quick-connection cable for the second amplifier onwards.
- Note that settings other than that of the interference prevention function cannot be transmitted between this product and the digital fiber sensor **FX-30**□. Therefore, in case both models of amplifiers are mounted in cascade, make sure to mount identical models together.

Cascading method

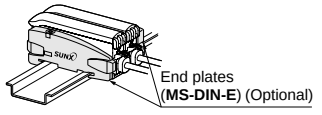
① Mount the amplifiers, one by one, on the 35mm width DIN rail.
(For details, refer to '**3 MOUNTING**'.)
② Slide the amplifiers next to each other, and connect the quick-connection cables.
③ Mount the optional end plates (**MS-DIN-E**) at both the ends to hold the amplifiers between their flat sides.
④ Tighten the screws to fix the end plates (**MS-DIN-E**).

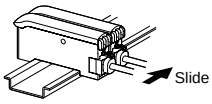




Dismantling method

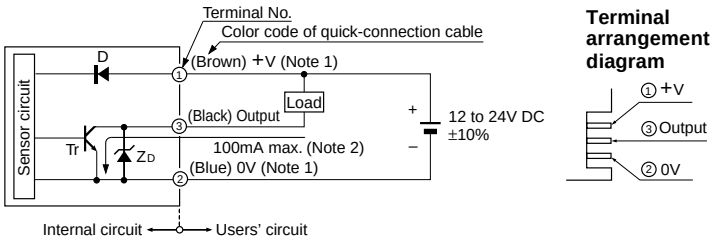
① Loosen the screws of the end plates (**MS-DIN-E**).
② Remove the end plates (**MS-DIN-E**).
③ Slide the amplifiers and remove them one by one.
(For details, refer to '**3 MOUNTING**'.)





6 I/O CIRCUIT DIAGRAMS

●FX-311□ / NPN output type

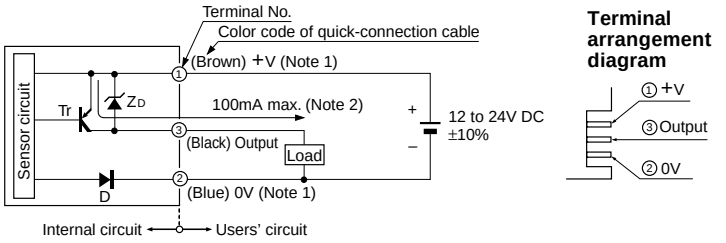


Terminal arrangement diagram

Notes: 1) The quick-connection sub cable does not have +V (brown) and 0V (blue). Supply voltage is supplied from the connector of the quick-connection main cable.
2) 50mA max. if 5 amplifiers, or more, are connected together.

Symbols... D : Reverse supply polarity protection diode
ZD : Surge absorption zener diode
Tr : NPN output transistor

●FX-311□P / PNP output type



Terminal arrangement diagram

Notes: 1) The quick-connection sub cable does not have +V (brown) and 0V (blue). Supply voltage is supplied from the connector of the quick-connection main cable.
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Symbols... D : Reverse supply polarity protection diode
ZD : Surge absorption zener diode
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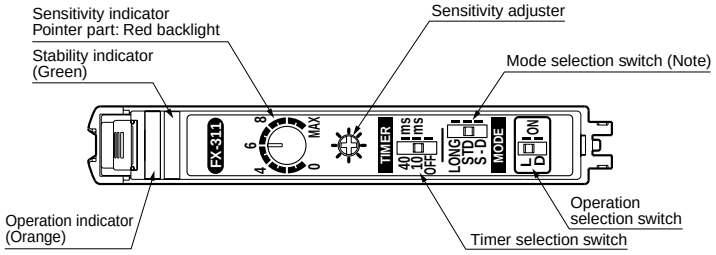
7 PART DESCRIPTION



Note: The mode selected by the mode selection switch for **FX-311B(P)** and **FX-311G(P)** is 'LONG', 'STD' or 'FAST'.

8 MODE SELECTION SWITCH

- For **FX-311(P)**, the most suitable sensing mode can be selected according to the application from LONG (long range distance), STD (standard) or S-D (reduced intensity). Furthermore, for **FX-311B(P)** and **FX-311G(P)**, the sensing mode can be selected from LONG (long range distance), STD (standard) or FAST (high speed sensing).
- Make sure to carry out sensitivity adjustment after mode setting.

<FX-311(P)>

Mode	Mode selection switch	Application	Response time
LONG	LONG / STD / S-D	Used in case long distance sensing is required. (However, the response time is longer than in STD mode.)	2ms
STD	LONG / STD / S-D	Used for general sensing application.	250μs
S-D	LONG / STD / S-D	Since the emitted light amount is restricted in this mode, it is suitable for delicate sensing, such as when the received light is saturated due to too short a sensing distance or when detecting translucent objects, etc.	

<FX-311B(P), FX-311G(P)>

Mode	Mode selection switch	Application	Response time
LONG	LONG / STD / FAST	Used in case long distance sensing is required. (However, the response time is longer than in STD mode.)	2ms
STD	LONG / STD / FAST	Used for general sensing application.	250μs
FAST	LONG / STD / FAST	Used in case high speed sensing is required.	150μs

9 SENSITIVITY ADJUSTMENT

- Adjust the sensitivity, observing the operation indicator (orange). However, since the condition for lighting up of the indicator depends on the combination of the sensing condition and the selected operation of L/D-ON, verify it from the table on the right.

☼ : Lights up ● : Lights off

Sensing condition	Operation	Operation indicator
Light	L-ON (Light ON)	☼
	D-ON (Dark ON)	●
Dark	L-ON (Light ON)	●
	D-ON (Dark ON)	☼

- The sensitivity adjuster is a 12-turn potentiometer. The maximum sensitivity is obtained by turning it fully clockwise.
- The pointer shows the present sensitivity level.
- **Assist function**
  This product incorporates an 'assist function', which helps to easily search the optimum sensitivity position by flashing of the pointer. In order to make 'assist function' effective, switch the operation selection switch in the order L-ON (Light ON) → D-ON (Dark ON) → L-ON (Light ON).

Notes: 1) 'Assist function' cannot be used when adjusting sensitivity for moving objects.
2) 'Assist function' turns off automatically once the sensitivity adjustment has been completed.
3) In case 'assist function' is not to be used, set the operation selection switch to D-ON (Dark ON) and wait for 2 sec., or more, to make 'assist function' ineffective.

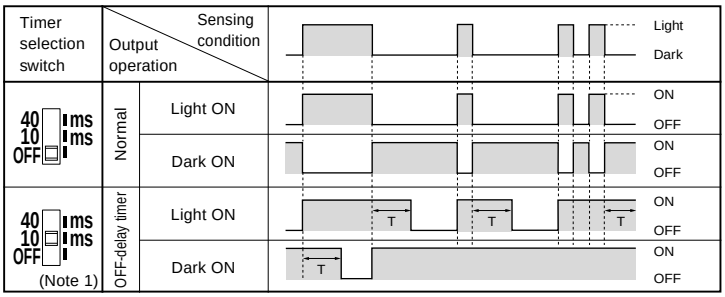
Step	Sensing method: Reflective type	Sensing method: Thru-beam type	Operation	Sensitivity indicator
①	★Make sure that the operation selection switch is set to L-ON (Light ON). In case 'assist function' is to be used, switch the operation selection switch in the order of L-ON (Light ON) → D-ON (Dark ON) → L-ON (Light ON).		Turn the sensitivity adjuster fully counterclockwise. (Minimum sensitivity)	0 MAX
②	Beam received	Beam received	In the beam received condition, slowly turn the adjuster clockwise and find the point Ⓐ where the sensor is switched ON. The pointer flashes once at the point Ⓐ. (Note 1)	ON Ⓐ 0 MAX
③	Beam not received	Beam not received	In the beam not received condition, slowly turn the adjuster further clockwise until the sensor goes into the ON state again. Once it is switched on, turn the adjuster counterclockwise a little and find the point Ⓑ where it is switched OFF. The pointer flashes twice at the point Ⓑ. (Note 2) (If the sensor does not go into the ON state, MAX is the point Ⓑ.)	OFF Ⓑ 0 MAX ON
④			Turn the adjuster towards the point Ⓐ from the point Ⓑ slowly. The pointer starts flashing when it approaches the optimum sensitivity point and flashes faster at the optimum sensitivity point for 3 sec. This point is the optimum sensitivity point. (Note 2)	Optimum point Ⓐ Ⓑ 0 MAX
⑤	Select either L-ON (Light ON) or D-ON (Dark ON) according to your application.			

Notes: 1) When 'assist function' is not used, the pointer does not flash.
2) When 'assist function' is not used, the middle point of Ⓐ and Ⓑ is regarded as the optimum sensitivity point.
3) In order to protect the mechanism, the sensitivity adjuster idles when over turned, which may result in a backlash of 1 to 2 divisions.
4) Depending upon the sensing conditions, stable sensing may be possible at a position which is slightly shifted from the optimum sensitivity point.
5) Do not move or bend the fiber cable after the sensitivity adjustment. Detection may become unstable.

10 TIMER FUNCTION

- This product incorporates an OFF-delay timer function. The delay time can be selected as either 10ms. approx. or 40ms. approx. with the timer selection switch. Since the output is extended by a fixed period, it is useful when the connected device has a slow response time or when small objects are being sensed and the output signal width is small.

<Time chart>



Note: The diagram shows the case when 10ms. delay time is selected.
Delay time T: 10ms. approx. (when set to 10ms.)
40ms. approx. (when set to 40ms.)

11 INTERFERENCE PREVENTION FUNCTION

- This product incorporates an automatic interference prevention function. If the amplifiers are mounted in cascade, since a different emission timing is automatically set for up to 4 amplifiers, up to 4 sets of fibers can be mounted closely. Further, even if the amplifiers are mounted closely along with the digital fiber sensor **FX-30**□, the interference prevention function works. However, in case both models of amplifiers are mounted in cascade, mount identical models together.

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