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SUNX

INSTRUCTION MANUAL

Slim type Automatic Sensitivity Stetting Fiber Sensor

FX-7 Series

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 standard, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.

Basic explanation

1 SPECIFICATIONS

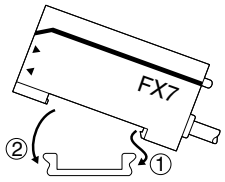
Item \ Type		NPN output			PNP output
		Standard type	External synchronization input type	Remote sensitivity setting type	Standard type
Model No.	Red LED	FX-7	FX-75	FX-77	FX-7P
	Green LED	FX-7G	FX-75G	FX-77G	FX-7GP
Supply voltage		12 to 24V DC ± 10%, Ripple P-P 10% or less			
Current consumption		30mA or less			
Sensing output		〈**NPN output type**〉 NPN open-collector transistor • Maximum sink current: 100mA • Applied voltage: 30V DC or less (between sensing output and 0V) • Residual voltage: 1.0V or less (at 100mA sink current) 0.4V or less (at 16mA sink current)		〈**PNP output type**〉 PNP open-collector transistor • Maximum source current: 100mA • Applied voltage: 30V DC or less (between sensing output and +V) • Residual voltage: 2.0V or less (at 100mA source current) 1.0V or less (at 16mA source current)	
	Output operation	Selectable either Sensing-ON or Non-sensing-ON by the ON/OFF buttons			
	Short-circuit protection	Incorporated			
Self-diagnosis output		〈**NPN output type**〉 NPN open-collector transistor • Maximum sink current: 50mA • Applied voltage: 30V DC or less (between self-diagnosis output and 0V) • Residual voltage: 1.0V or less (at 50mA sink current) 0.4V or less (at 16mA sink current)		〈**PNP output type**〉 PNP open-collector transistor • Maximum source current: 50mA • Applied voltage: 30V DC or less (between self-diagnosis output and +V) • Residual voltage: 2.0V or less (at 50mA source current) 1.0V or less (at 16mA source current)	
	Output operation	ON under unstable sensing (this signal lasts approx. 40ms) or ON when sensing output is short-circuited (signal lasts till short-circuit is rectified) (Note 2)			
	Short-circuit protection	———			
External inputs (• External synchronization input • Emission disable input • Remote sensitivity setting input)		———	Signal condition • High ... 4.5 to 30V, or open • Low ... 0 to 1V • Input impedance: 10kΩ		———
Response time		0.5ms or less (When using interference prevention function: 0.7ms or less)			
Timer function		Approx. 40ms fixed off-delay timer (Selectable with timer operation selection switch) (Except for **FX-75, FX-75G**)			
Ambient temperature		–10 to +50°C (No dew condensation or icing allowed), Storage: –20 to +70°C			
Ambient humidity		35 to 85% RH, Storage: 35 to 85% RH			
Material		Enclosure: Heat-resistant ABS, Enclosure cover: Polycarbonate, Fiber lock lever: PPS			
Accessory		**MS-DIN-2** (Amplifier mounting bracket): 1 No.			

Notes: 1) Plug-in connector type is specified by suffix **'J'** at the end of the model number. (Standard type only)
e.g.) Plug-in connector type of **FX-7** is **'FX-7J'** .
2) The remote sensitivity setting type are in the ON state for approx. 40ms even after accepting the remote sensitivity setting input.

2 MOUNTING

How to mount the amplifier

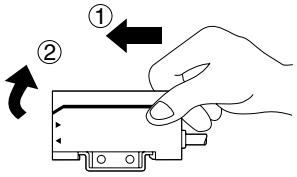
① Fit the rear part on the attached amplifier mounting bracket (**MS-DIN-2**) or a 35mm width DIN rail.
② Press down the front part of the amplifier on the amplifier mounting bracket (**MS-DIN-2**) or the DIN rail to fit it.



Attached amplifier mounting bracket or 35mm width DIN rail.

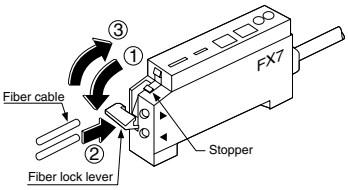
How to remove the amplifier

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

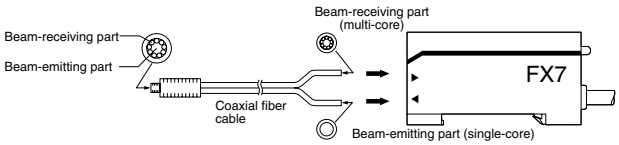


How to connect the fiber cables

① Snap the fiber lock lever down.
② Insert fiber cables slowly into the inlets until they stop. (Note 1)
③ Lock the fiber lock lever in the original position, till you feel a click.



Notes: 1) In case the fiber cables are not inserted to a position where they stop, the sensing range reduces.
2) With the coaxial reflective type fiber, such as, **FD-G4**, **FD-FM2**, insert the center fiber cable (single-core) into the beam-emitting inlet and the outer fiber cable (multi-core) into the beam-receiving inlet. If they are inserted in reverse, the sensing accuracy will deteriorate.



3 CAUTIONS

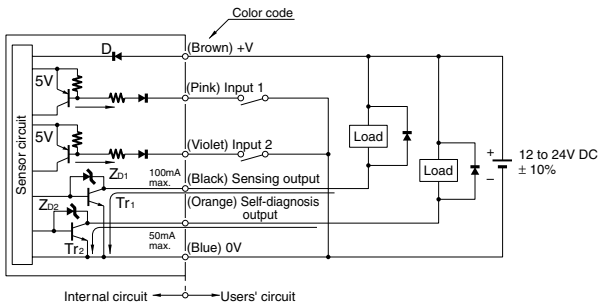
- Make sure to carry out the wiring in the power supply off condition.
- Verify that the supply voltage variation is within the rating.
- If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
- In 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.
- Do not use during the initial transient time (0.5 sec.) after the power supply is switched on.
- The self-diagnosis output is not incorporated with a short-circuit protection circuit. Do not connect it directly to a power supply or a capacitive load.
- 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.
- Extension up to total 100m is possible with a 0.3mm^2, or more, cable.
- Avoid dust, dirt, and steam.
- Take care that the product does not come in direct contact with water, oil, grease or organic solvents, such as, thinner, etc.

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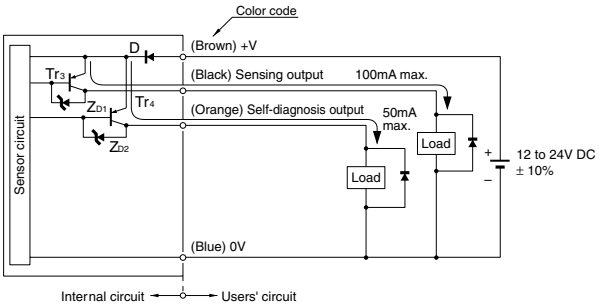
4 TYPICAL WIRING DIAGRAMS

● **I/O circuit diagrams**

NPN output type



PNP output type



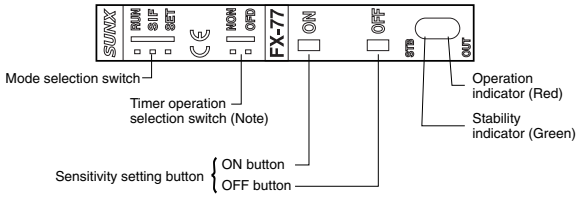
Note: The designation of input wires differ depending on the model.

Input \ Model No.	FX-7(P) FX-7G(P)	FX-75 FX-75G	FX-77 FX-77G
Input 1	———	External synchronization input (ES)	Remote sensitivity setting ON input (R.ON)
Input 2	———	Emission disable input (CONT.)	Remote sensitivity setting OFF input (R.OFF)

Symbols … D: Reverse supply polarity protection diode
Z_{D1}, Z_{D2}: Surge absorption zener diode
Tr_1, Tr_2: NPN output transistor
Tr_3, Tr_4: PNP output transistor

5 ADJUSTMENTS

● **Part description**



Note: Synchronization selection switch for **FX-75**, **FX-75G**.

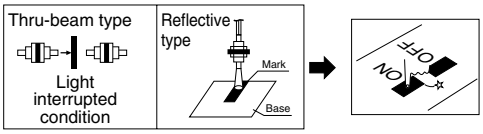
● **Use of sensitivity setting buttons (Common for all models)**

1. Place the fiber cable within the sensing range. (Note 1)
2. Set the mode selection switch to 'SET'



【 For sensing output ON with object present 】

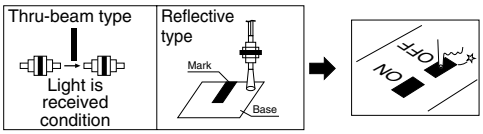
3. Press ON button with the object present.



4. When ON state is recognized by the sensor, stability indicator (green) will flash.



5. Press OFF button with the object absent.



6. The stability indicator will flash twice if the sensitivity gap between ON state and OFF state is sufficient and a stable detection is possible.
The stablility indicator will flash continuously if stable detection is not possible. (Note 2)

7. Set the mode selection switch to 'RUN'.
The sensitivity setting buttons become ineffective. So, even if the buttons are pressed by mistake , the registered sensitivity will remain unchanged.



【 For sensing output ON with object absent 】

Press ON button with object absent.

Press OFF button with object present.

Notes: 1) Refer to the catalog as the sensing range differs according to the type of fiber cable. The sensing range of the reflective type fiber cable is the value for white non-glossy paper. The actual sensing distance differs according to the color of the sensing object, its surface condition, etc.
2) The sensitivity can also be set under unstable sensing condition. But the severe condition may affect the sensing.
3) The set sensitivity is stored in an EEPROM. Since the EEPROM has a lifetime, the sensitivity setting cannot be done for more than 100,000 times.
4) Do not move or bend the fiber cable after the sensitivity setting. Detection may become unstable.

How to set the maximum sensitivity

① Set the mode selection switch to 'SET'.
② ● In case of Light-ON operation
In the dark condition, press the ON button and then the OFF button successively. (or, make the remote sensitivity setting ON input and then the OFF input Low successively.)
● In case of Light-OFF operation
In the dark condition, press the OFF button and then the ON button successively. (or, make the remote sensitivity setting OFF input and then the ON input Low successively.)
③ Set the mode selection switch to 'RUN'.

〈**Applications**〉
- For getting a long sensing range with reflective type sensor.
- For using thru-beam type sensor in an unfavorable sensing environment.

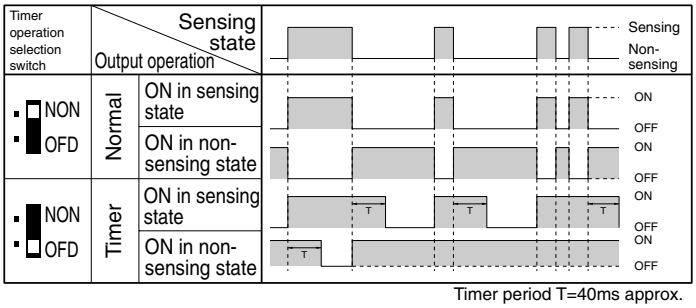
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Explanation of functions

● Off-delay timer function
(For standard and remote sensitivity setting types only)

- Standard and remote sensitivity setting types have an approx. 40ms fixed off-delay timer. The timer works when the timer operation selection switch is set to 'OFD'. The output is extended for a certain period of time, and is useful when the response time of the connecting device is slow or when the sensing signal from a tiny object is too short.

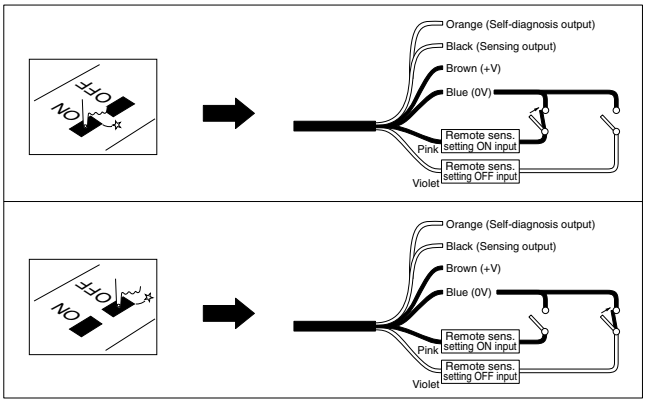
〈**Time chart**〉



Timer period T=40ms approx.

● Use of remote sensitivity setting input
(For FX-77, FX-77G only)

- Basically, the method is similar to that described in 'Use of sensitivity setting buttons'. However, instead of pressing the sensitivity setting buttons, make the remote sensitivity setting inputs Low.

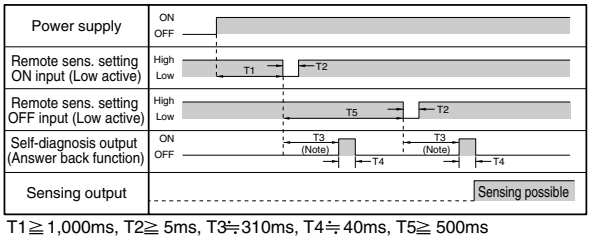


〈**Signal condition**〉

State	Signal condition
High	4.5 to 30V or open
Low	0 to 1V

Input impedance: 10kΩ

〈**Time chart**〉



T1≧1,000ms, T2≧ 5ms, T3≒310ms, T4≒ 40ms, T5≧ 500ms

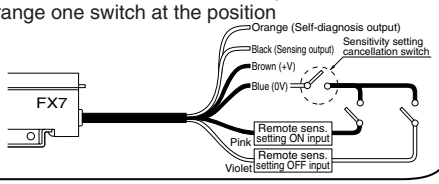
Note: During period T3, do not change the incident light intensity by moving the object, etc.

〈**Answer back function**〉

- The self-diagnosis output turns ON for approx. 40ms when ON input or OFF input is accepted by the sensor. (This output does not turn ON if there is no sensitivity difference between ON input and OFF input and stable sensing is not achieved.)

● Cancelling the setting made by remote sensitivity setting inputs

- Sensitivity registered by remote sensitivity setting inputs has a priority over the manual setting and it cannot be cancelled manually. To cancel the remote sensitivity setting, arrange one switch at the position shown in the figure, and make it open. (The sensitivity will be locked.) Turn on the switch for making sensitivity settings effective.



● Sensitivity margin indicating function (Incorporated in all models)

- After setting the sensitivity, the margin of the sensitivity can be visually confirmed. The sensitivity margin can be confirmed by the number of times the stability indicator (green) blinks when the mode selection switch is changed from 'SET' to 'SIF' or 'RUN'.

No. of blinks	0	1	2	3	4	5
Relation with the stability indicator	STB ● Lights off OUT		STB ○ Lights on OUT			
Margin	Low ◄					► High

- Normally, the margin should be set as large as possible. (Method of increasing the margin: shorten the sensing distance, use the optimum fiber cable, etc.)

● Interference prevention function (Incorporated in all models)

- The **FX-7** series has a built-in interference prevention function. Two fiber cables can be mounted very closely by setting different emission frequencies.

〈**How to set**〉

Step	Operation
1.	Set the mode selection switch to 'SET'.
2.	Press 'ON' and 'OFF' buttons simultaneously for minimum two seconds continuously. The stability indicator (green) will blink.
3.	Press 'ON' button. (The stability indicator will blink twice.) [Response time: 0.5ms or less (Note)]
4.	Set the mode selection switch to 'RUN'. (This completes the setting for one sensor.)
5.	Apply steps 1 and 2 for the second sensor.
6.	Press 'OFF' button. (The stability indicator will blink twice.) [Response time: 0.7ms or less (Note)]
7.	Set the mode selection switch to 'RUN' (This completes the setting.)

〈**How to cancel**〉

Step	Operation
1.	Press 'ON' and 'OFF' buttons simultaneously for minimum two seconds continuously. The stability indicator (green) will blink.
2.	Press 'ON' and 'OFF' buttons simultaneously again. (The stability indicator will flash twice.)

Note: When using the interference prevention function, the hysteresis and the response time increase as compared to that during normal operation. Always check the operation after setting the interference prevention function.

A mark can be put on the nameplate on the side of the sensor body for identification. Please use this, when required.

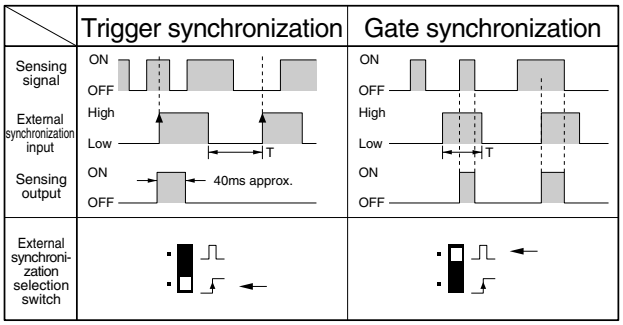
Button	Emitting frequency	Response time
ON	FREQ.1 BROWN , +V BLACK , OUT BLUE , 0V ORANGE , ALM PINK , R.ON VIOLET , R.OFF FREQ.1 ■ FREQ.2 □	0.5ms or less
OFF	FREQ.2 BROWN , +V BLACK , OUT BLUE , 0V ORANGE , ALM PINK , R.ON VIOLET , R.OFF FREQ.1 □ FREQ.2 ■	0.7ms or less

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● External synchronization function (For FX-75, FX-75G only)

● By using external synchronization function, the timing for making detection can be specified.
Trigger synchronization and gate synchronization are available.

〈**Time chart**〉

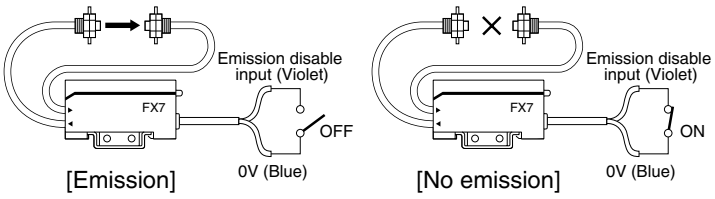


T≧0.5ms (When using interference prevention function: T≧0.7ms)

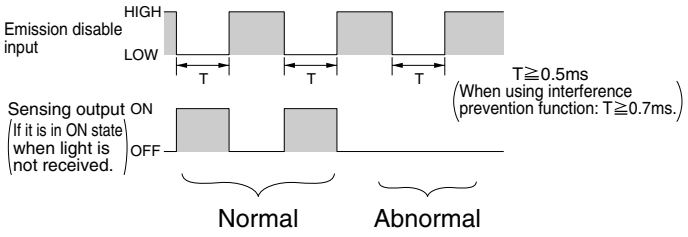
Note: If you do not use the external synchronization, set the switch on gate synchronization and make the external synchronization input open (High).

● Emission disable function (For FX-75, FX-75G only)

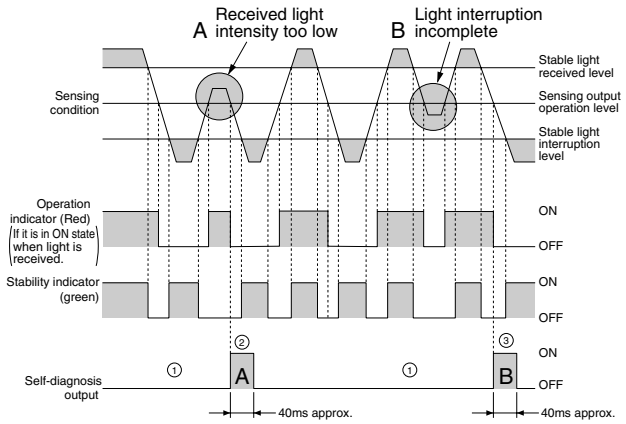
● Emission stops when emission disable input (violet) is set Low. The sensing output can be turned ON and OFF without a sensing object and this can be used for start-up inspections.



● It is judged that sensor operation is normal if sensing output follows the ON and OFF of the emission disable input, and is abnormal if it does not follow.



● Self-diagnosis function (Incorporated in all models)



①The self-diagnosis output transistor is 'OFF' during stable sensing.

②If the sensor does not reach at either stable light receiving level or stable light interruption level when sensing output turns ON or OFF, the self-diagnosis output turns ON and then turns OFF after approx. 40ms. Further, the self-diagnosis output changes at the time when the sensing output changes from light received to light interrupted state. (The operation of the sensing output is not affected.)

③There is a time delay in turning ON of the self-diagnosis output when light interruption is insufficient.

● Sensitivity shift function (Incorporated in all models)

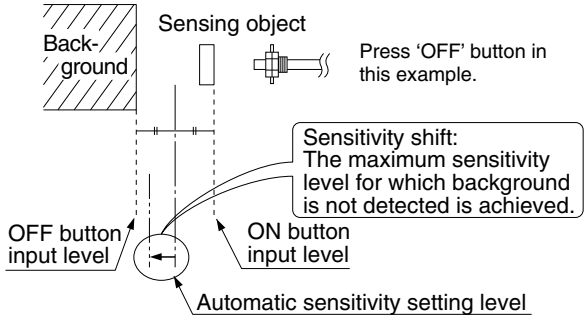
● This is used for setting the maximum sensitivity for which the reflective type does not detect the background, or for sensing tiny objects with the thru-beam type.

〈**Reflective type**〉

1. Make normal sensitivity setting.
(Refer to section **5 ADJUSTMENTS**)
2. Set the mode selection switch to 'SIF'.



3. Press the sensitivity setting button again which was pressed with background.



4. Set the mode selection switch to 'RUN'.

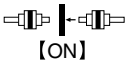


〈**Thru-beam type**〉

1. Make normal sensitivity setting.
(Refer to section **5 ADJUSTMENTS**)
2. Set the mode selection switch to 'SIF'.



3. Press the sensitivity setting button again which was pressed with the sensing object.



Press 'ON' button in this example.

4. Set the mode selection switch to 'RUN'.



〈**Sensing of a tiny object with the thru-beam type**〉

1. Set the mode selection switch to 'SET'.



2. Press 'OFF' button (or ON button) without the sensing object.
3. Press 'ON' button (or OFF button) when light is completely interrupted.
4. Set the mode selection switch to 'SIF'.



5. Press the button again which was pressed without the sensing object.
6. Set the mode selection switch to 'RUN'.



Notes: 1) If sensing is not possible, apply normal sensitivity setting method, or use one of the small diameter fiber cables.
2) For **FX-77**, **FX-77G**, the sensitivity shift cannot be made by using remote sensitivity setting input.

SUNX Limited www.sunxsensors.com

Head Office
2431-1 Ushiyama-cho, Kasugai-shi, Aichi, 486-0901, Japan
Phone: +81-(0)568-33-7211 FAX: +81-(0)568-33-2631
Overseas Sales Dept.
Phone: +81-(0)568-33-7861 FAX: +81-(0)568-33-8591

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