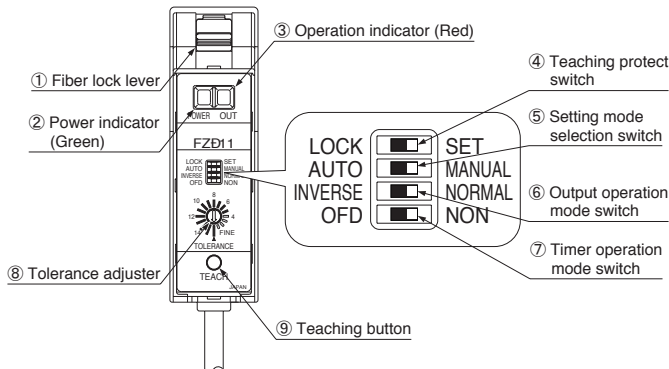


INSTRUCTION MANUAL

Photoelectric Sensor Color Detection Fiber Sensor Amplifier FZ-10 Series

1 FUNCTIONAL DESCRIPTION

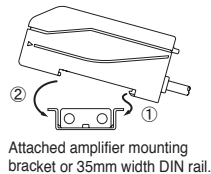


Description	Function
① Fiber lock lever	Locks or unlocks fiber cables.
② Power indicator (Green)	Lights up when the power is ON, blinks during auto-teaching. Both blink alternately when a manual-teaching error occurs.
③ Operation indicator (Red)	Lights up when the output is ON. Both blink simultaneously when the output is short-circuited.
④ Teaching protect switch	The teaching button is ineffective if the switch is set on 'LOCK', but is effective if the switch is set on 'SET'.
⑤ Setting mode selection switch	Manual-teaching is selected if the switch is set on 'MANUAL'. Auto-teaching is selected if the switch is set on 'AUTO'.
⑥ Output operation mode switch	Coincident-ON is selected if the switch is set on 'NORMAL'. Incoincident-ON is selected if the switch is set on 'INVERSE'.
⑦ Timer operation mode switch	The OFF-delay timer is ineffective if the switch is set on 'NON', but is effective if the switch is set on 'OFD'.
⑧ Tolerance adjuster	Determines the tolerance of equivalence, with respect to the reference color that the sensor has been taught, in 16 grades.
⑨ Teaching button	Teaches the sensor the target color as the criterion (reference color.) (While the button is held, the sensor emits blue, red, and green beams one after the other.)

2 MOUNTING

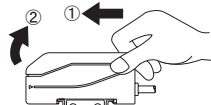
How to mount the amplifier

- Fit the rear part of the amplifier on the attached amplifier mounting bracket (**MS-DIN-3**) or a 35mm width DIN rail.
- Press down the front part of the amplifier on the amplifier mounting bracket (**MS-DIN-3**) or the 35mm width DIN rail to fit it.



How to remove the amplifier

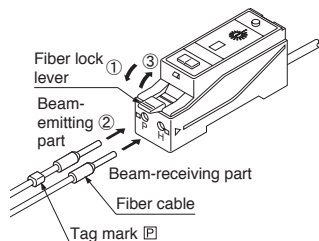
- Push the amplifier forward.
- Lift up the front part of the amplifier to remove it.



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

How to connect the fiber cables

- Unlock the fiber lock lever by lowering it.
- Insert the beam-emitting fiber cable tagged with the mark 'P' into the beam-emitting part 'P', and the beam-receiving fiber cable into the beam-receiving part 'D'. They should be inserted gradually until the position where they stop. If the emitting fiber cable and the receiving fiber cable are reversely inserted, proper operation cannot be obtained.
- Lock the fiber lock lever to the original position.



Notes: 1) The fiber heads of the **FD-L51** and / or the **FD-L52** and / or the **FD-L53** and / or the **FD-L54** can be closely mounted together as long as their spots do not overlap each other.
2) Refer to the fiber's Instruction Manual for the fiber tip fitting method.

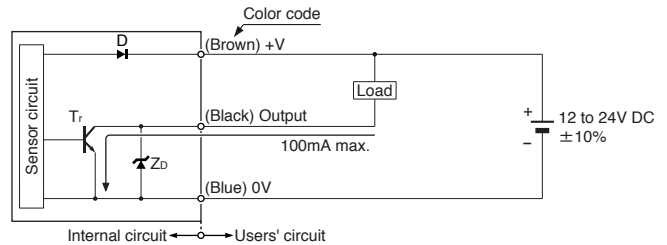
Thank you very much for using SUNX products. Please read this Instruction Manual carefully and thoroughly for the correct and optimum use of this product. Kindly keep this manual in a convenient place for quick reference.



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

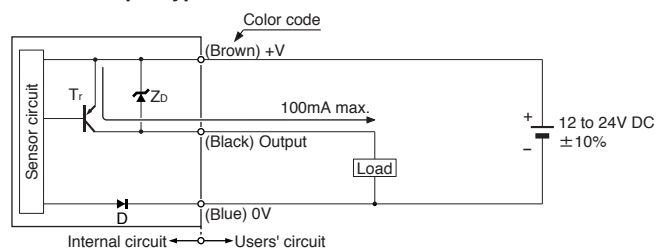
3 I/O CIRCUIT DIAGRAMS

● NPN output type / FZ-11



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

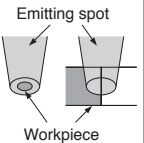
● PNP output type / FZ-11P



Symbols ... D : Reverse supply polarity protection diode
Zd : Surge absorption zener diode
Tr : PNP output transistor

4 SETTING

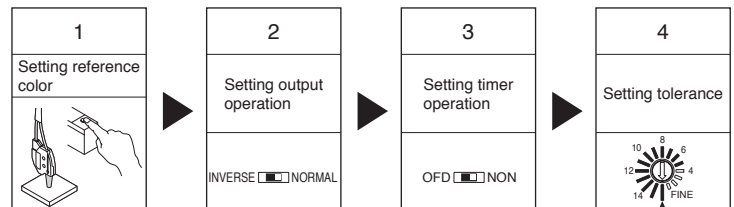
- During teaching, the **FZ-10** series resolves the color projected by the spot into red, green, and blue components which are processed as numerical values and stored into the EEPROM memory. If, during teaching, the spot area is not filled by one uniform color, such as when the target objects are smaller than the spot area, or are partly projected upon, then colors other than the one you want to detect may also be sensed. Make sure that objects fill the whole spot area during teaching, as well as, sensing.



The taught data is saved in the EEPROM even when the sensor power supply is switched off. However, the guaranteed rewrite operations are limited to 100,000 times because of its lifetime.

- To manipulate the DIP switches, use a pair of tweezers, etc., with a tip width of 0.8mm approx.

● Procedure



1. Setting reference color

- Prepare a sample object bearing the target color you want to detect. Choose manual teaching or auto-teaching.

Setting by manual-teaching

- Teaching the reference color on a stationary object.

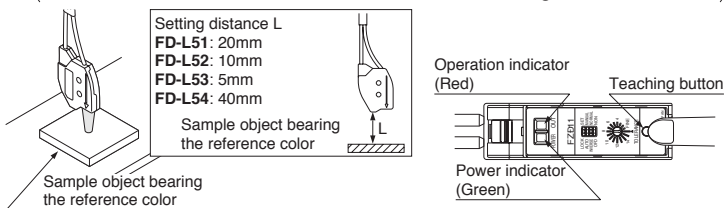
- Set the tolerance adjuster at the 16th grade (▲ mark) with the adjusting screwdriver.



- Set the teaching protect switch on 'SET'.
- Set the setting mode selection switch on 'MANUAL'.



- ④ Place the sample object, bearing the reference color, under the fiber head at the setting distance. The surface of the sample object must face the fiber head at right angle to the beam axis, and the reference color must fill the whole spot area.
(Press the teaching button and release it. Then, the sensor recognizes) the reference color as the criterion and starts sensing.



*** In case teaching is not properly done.**

- The operation indicator (red) and the power indicator (green) blink alternately.
- Repeat the teaching operation after confirming that the light spot is projected at right angle to the reference color sample and that the distance to the sample is appropriate.



- ⑤ Set teaching protect switch on 'LOCK'.

After the teaching, test the sensing. If the sensor identifies other similar colors that you do not want to detect, set the tolerance to be finer.
(Refer to '4. Setting tolerance' for more details.)

Setting by auto-teaching

- Teaching the reference color on a moving object.

(If the sample object includes colors other than the reference color, perform manual teaching. The sample object must contain only one uniform color for correct auto-teaching.)

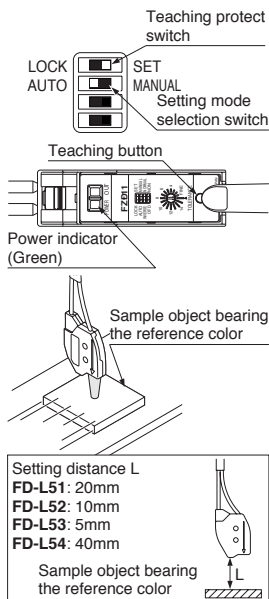
- ① Set the tolerance adjuster at the 16th grade (▲ mark) with the adjusting screwdriver.
- ② Set the teaching protect switch on 'SET'.
- ③ Set the setting mode selection switch on 'AUTO'.



- ④ Press the teaching button and release it. Then, the sensor enters into the waiting state.
(The sensor recognizes the background color, then enters into the waiting state and the power indicator (green) starts blinking.)

- ⑤ Run the sample object at the setting distance.

- The sensor recognizes the first coming color other than the background color as the criterion.
- The traveling speed must satisfy the following two conditions.
 - (1) It should be 300 mm/sec. or more.
 - (2) The reference color must be exposed to the spot for 3ms or more.
- After the sample object moves away, the sensor takes 50ms approx. to complete the teaching. The sensor is not operable in this period.
- The sensor automatically starts sensing after recognizing the reference color as the criterion, and the power indicator (green) stops blinking and lights up continuously.



*** In case teaching is not properly done.**

- The power indicator (green) keeps blinking. The sensor still stays in the waiting state.
- Make sure of the perpendicularity of the sample object to the beam axis, the setting distance between the fiber head and the sample, the time duration for which the sample passes through the beam, and the consistency of the background color during the teaching. Then, run the sample object again.
- If your reference color is similar to the background color, the teaching may fail if the tolerance is set at the 16th grade (▲ mark). Make the tolerance of the background color narrower with the tolerance adjuster from the 1st to the 15th grade according to the contrast between these colors. Then, run the sample object again.
(Refer to '4. Setting tolerance' for more details.)



- ⑥ Set teaching protect switch on 'LOCK'.

- If you want to change to manual-teaching while the sensor is in the auto-teaching waiting state, set the setting mode selection switch on 'MANUAL'. The sensor enters the teaching error state with the operation indicator (red) and the power indicator (green) blinking alternately. Now, carry out manual-teaching.
- To stop teaching during the auto-teaching waiting state, switch off the power supply once.
- If the output operation mode switch and the timer operation mode switch are operated during the auto-teaching waiting state, although the operation indicator operates, the output does not change till auto-teaching is completed.

2. Setting output operation

- Either Coincident-ON or Incoincident-ON can be selected.

Output operation	Operation	Output operation mode switch
Coincident-ON	Set the output operation mode switch on 'NORMAL'.	INVERSE NORMAL
Incoincident-ON	Set the output operation mode switch on 'INVERSE'.	INVERSE NORMAL

3. Setting timer operation

- The **FZ-10** series is incorporated with an OFF-delay timer fixed for 40ms approx. The OFF-delay timer operates when the timer operation mode switch is set on 'OFD'. Since the output signal is extended by a fixed time interval, this function is useful when the connected device has a slow response time or if small objects are being detected, resulting in a short output signal width.

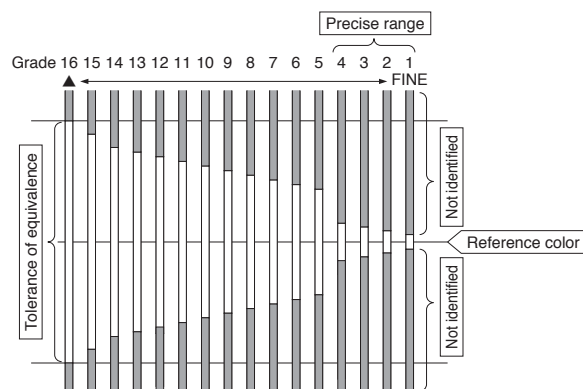
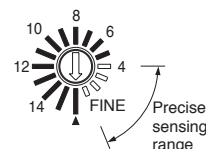
Time chart

Timer operation mode switch	Operation	Sensing condition	Output
OFD NON	Normal	Coincident-ON	ON OFF
		Incoincident-ON	ON OFF
OFD NON	Timer	Coincident-ON	ON OFF
		Incoincident-ON	ON OFF

Timer period: T = 40ms approx.

4. Setting tolerance

- The tolerance adjuster determines the tolerance of equivalence with respect to the reference color in 16 grades.
- Set the arrow mark of the adjuster to the desired grade from 1st to 16th using the adjusting screwdriver.
- When the grade is changed, the output is turned ON, once, for resetting.
- Even if the grade is changed, the reference color taught earlier does not change until the sensor is taught again.
- When performing auto-teaching, it is possible that teaching may fail depending upon the tolerance grade. If this happens, change the tolerance grade and repeat the teaching.
- For 16th to 5th grade, color identification is done based upon the color (red, green, blue) component ratio. For 4th to 1st grade (precise range), brightness is also considered for color identification. Hence, when the adjuster is set to the FINE side (4th to 1st grade), minute difference in gloss or color shades are also detected.



● Tolerance in precise range (4th to 1st grade)

- Within the precise range, color is identified in all aspects of hue, chroma, and lightness. Hence, the sensor can discriminate the reference color from others even if there is a subtle difference in glossiness or density.
- After the tolerance is set within the precise range, the sensor should be used under an ambient temperature of +15 to +35°C. Also, periodical teaching should be done to maintain the stable sensing conditions. Before teaching, wait for a warm-up time of 10min. approx. after switching on the power supply.
- Please take care that extraneous light or vibration may affect the detectability.

5 SPECIFICATIONS

Type	NPN output		PNP output	
Item \ Model No.	FZ-11		FZ-11P	
Applicable fibers				
FD-L51 (Note 1), FD-L52, FD-L53, FD-L54				
Sensing object				
Opaque or translucent object larger than the spot diameter of the applicable fiber				
Supply voltage				
12 to 24V DC ±10% Ripple P-P 10% or less				
Current consumption				
45mA or less				
Output	NPN open-collector transistor		PNP open-collector transistor	
	• Maximum sink current: 100mA		• Maximum source current: 100mA	
	• Applied voltage: 30V DC or less (between output and 0V)		• Applied voltage: 30V DC or less (between output and +V)	
	• Residual voltage: 1V or less (at 100mA sink current)		• Residual voltage: 1V or less (at 100mA source current)	
	0.4V or less (at 16mA sink current)		0.4V or less (at 16mA source current)	
Output operation	Switchable either Coincident-ON or Incoincident-ON			
Short-circuit protection	Incorporated			
Response time	1ms or less (3ms or less when auto-teaching has been engaged)			
Tolerance	Adjustable in 16 grades with the tolerance adjuster			
Ambient temperature	-10 to +55°C (No dew condensation or icing allowed) (Note 2) Storage: -20 to +70°C			
Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH			
Emitting element	Red LED・Green LED・Blue LED (modulated)			
Material	Enclosure: ABS, Case cover: Polycarbonate, Fiber lock lever: PPS			
Cable	0.2mm ² 3-core cabtyre cable, 2m long			
Weight	85g approx.			
Accessories	MS-DIN-3 (Amplifier mounting bracket): 1 pc., Adjusting screwdriver: 1 pc.			

Notes: 1) Since fiber **FD-L51** (standard type) is easily affected by specular reflection, it is possible that teaching may not be properly done or sensing may be unstable if objects of high reflectivity (mirror, plated objects, copper foil, etc.) are sensed. When such objects are to be sensed, please use **FD-L52** (high precision type) or **FD-L53** (extremely small spot type) and make sure that the projected optical beam is perpendicular to the object surface.

2) The amplifier should be used under the ambient temperature of +15 to +35°C when the tolerance adjuster is set from the 1st grade of the 4th grade, which provide fine color resolution.

6 CAUTIONS

- This product has been developed / produced for industrial use only.
- Make sure that the power supply is off while wiring.
- Take care that wrong wiring will damage the sensor.
- 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 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.
- Do not use during the initial transient time (0.5 sec.) after the power supply is switched on.
- Take care that the sensor is not directly exposed to fluorescent lamp from a rapid-starter lamp, a high frequency lighting device or sunlight etc., as it may affect the sensing performance.
- Extension up to total 100m, or less, is possible with 0.3mm², or more, cable. However, in order to reduce noise, make the wiring as short as possible.
- Make sure that stress by forcible bend or pulling is not applied to the sensor cable joint.
- This sensor is suitable for indoor use only.
- Do not use this sensor in places having excessive vapor, dust, etc., or where it may come in contact with corrosive gas, etc.
- Take care that the sensor does not come in contact with water, oil, grease, organic solvents, such as, thinner etc., strong acid or alkaline.
- After the settings, make sure to fit the case cover on the amplifier before use. Do not move or bend the fiber cable. If so, the operation may become unstable.
- Periodical teaching should be done to maintain stable sensing conditions.

7 INTENDED PRODUCTS FOR CE MARKING

- The models listed under '**5** SPECIFICATIONS' come with CE Marking.
- As for all other models, please contact our office.



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