

Color Detection Fiber Sensor

FZ-10 SERIES



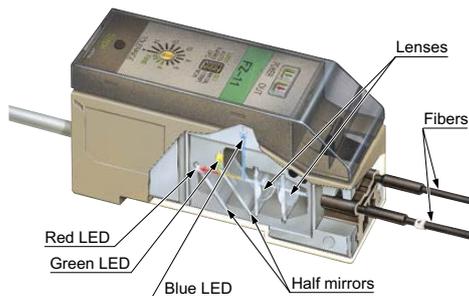
FZ-10 SERIES



Reliable and precise color discrimination

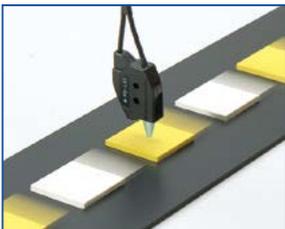
Red, green and blue LEDs

FZ-10 incorporates red, green and blue LEDs as its beam sources, which promise longer lifetime and greater immunity against extraneous light than incandescent lamps and are also maintenance free.



Excellent color detectability

Each of the red, green and blue components is digitally processed so that precise color discrimination is possible.



Can discriminate between white and yellow surfaces.



Dully gold-plated surface is detected.

High-speed response time: 1 ms

Small traveling objects can be sensed even on a high-speed production line, due to its response time of 1 ms.

Easy set up

Just pressing a button recognizes the reference color you want to detect as the criterion. There are two methods to set the criterion, manual teaching and auto-teaching. The tolerance adjuster also allows you to set the tolerance of color equivalence in 16 grades.

Manual teaching

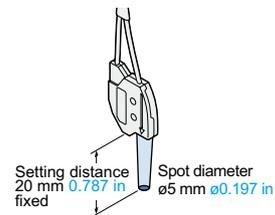
Place an object bearing the reference color under the fiber head and press the teaching button.

Auto-teaching

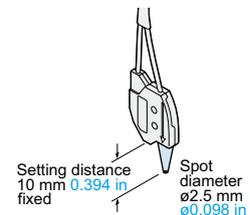
Keep pressing the teaching button until an object bearing the reference color travels past the fiber head.

Four types of fibers are available

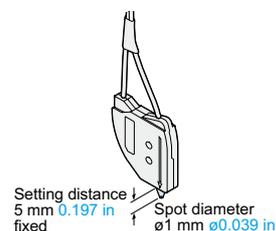
FD-L51 (Standard type)



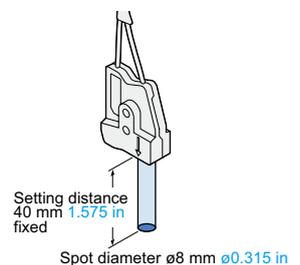
FD-L52 (High precision type)



FD-L53 (Extremely small spot type)

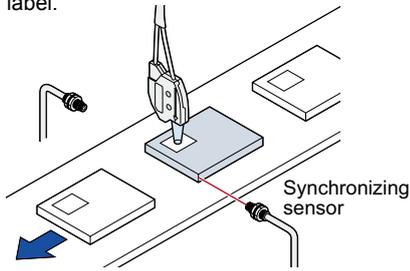


FD-L54 (Long sensing range type)

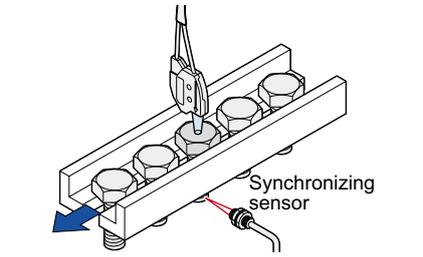


APPLICATIONS**Detecting labels on different colored objects**

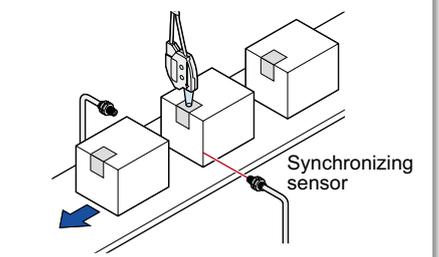
Even if objects are differently colored, **FZ-10** reliably detects the same color label.

**Evaluating if objects are plated or not (Note 1)**

Its precise color resolution discriminates a bare metal surface from a plated metal surface.

**Detecting seals on boxes**

It can reliably detect the presence of a seal on every package in the pharmaceutical, cosmetic, food, tobacco, and software industries.



Notes: 1) **FD-L52** fiber head (high precision type) or **FD-L53** fiber head (extremely small spot type) is recommended for applications in which specular objects, having a high reflective index are to be detected, e.g., evaluating if metal objects are plated or not.

FD-L54 fiber head (long sensing range type) is recommended for applications where the object wavers on the assembly line.

2) **FZ-10** may not be able to detect color depending on object shape, color, glossiness, etc. Please test before actual use and contact our office if you have any questions.

ORDER GUIDE**Amplifiers**

Type	Appearance	Model No.	Emitting element	Output
NPN output type		FZ-11	Red LED Green LED Blue LED	NPN open-collector transistor
PNP output type		FZ-11P		PNP open-collector transistor

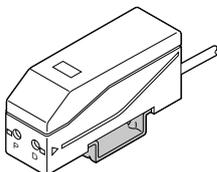
Fibers

Type	Appearance	Sensing range (Note)	Setting distance	Spot diameter	Fiber cable length	Model No.
Standard		14 to 24mm 0.511 to 0.945 in	20 mm 0.787 in (fixed)	ø5 mm ø0.197 in (at the setting distance)	1 m 3.281 ft	FD-L51
High precision		8 to 11mm 0.315 to 0.433 in	10 mm 0.394 in (fixed)	ø2.5 mm ø0.098 in (at the setting distance)	1 m 3.281 ft	FD-L52
Extremely small spot		4 to 6mm 0.157 to 0.236 in	5 mm 0.197 in (fixed)	ø1 mm ø0.039 in (at the setting distance)	1 m 3.281 ft	FD-L53
Long sensing range		30 to 50mm 0.181 to 1.969 in	40 mm 1.575 in (fixed)	ø8 mm ø0.315 in (at the setting distance)	1 m 3.281 ft	FD-L54

Note: The sensing range of each fiber is the range for which white non-glossy paper can be detected at the sensitivity for which teaching has been done with a white non-glossy paper (50 × 50 mm 1.969 × 1.969 in) at the respective rated setting distance and at the 16th grade (▲ mark) of tolerance.

Accessory

- **MS-DIN-3** (Amplifier mounting bracket)

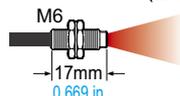
**Notice General-purpose fibers can also be combined**

Color difference distinction by combining general-purpose fibers **FD-62/61G/61/42G** and **FZ-10** series amplifiers is also possible.

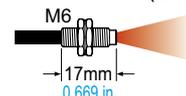
General-purpose fibers have a small tip, and are a free-cut type that where you can cut the fiber length to the desired length, so they can be installed small spaces.

• **FD-62**

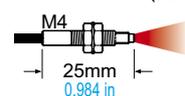
Setting distance:
8mm 0.315 in (fixed)

• **FD-61G / FD-61**

Setting distance:
5mm 0.197 in (fixed)

• **FD-42G**

Setting distance:
4mm 0.157 in (fixed)



Note: They cannot be used for applications requiring detection precision.

SPECIFICATIONS

Amplifiers

Item	Type	NPN output	PNP output
	Model No.	FZ-11	FZ-11P
CE marking directive compliance	EMC Directive, RoHS Directive		
Applicable fibers	FD-L51, FD-L52, FD-L53, FD-L54		
Supply voltage	12 to 24 V DC $\pm 10\%$ Ripple P-P 10 % or less		
Current consumption	45 mA or less		
Sensing object	Opaque or translucent object larger than the spot diameter of the applicable fiber (Note 2)		
Output	NPN open-collector transistor <ul style="list-style-type: none"> • Maximum sink current: 100 mA • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 1 V or less (at 100 mA sink current) 0.4 V or less (at 16 mA sink current) 		PNP open-collector transistor <ul style="list-style-type: none"> • Maximum source current: 100 mA • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 1 V or less (at 100 mA source current) 0.4 V or less (at 16 mA source current)
	Utilization category	DC-12 or DC-13	
	Output operation	Switchable either Coincident-ON or Incoincident-ON	
	Short-circuit protection	Incorporated	
Response time	1 ms or less (3 ms or less when auto-teaching has been engaged)		
Indicators	Power indicator: Green LED (lights up when the power is ON, blinks during auto-teaching) Operation indicator: Red LED (lights up when the output is ON) * Both blink alternately when a manual teaching error occurs Both blink simultaneously when the output is short-circuited		
Timer function	Approx. 40 ms fixed OFF-delay timer (switchable either effective or ineffective)		
Teaching	Button operation, Switchable either manual-teaching or auto-teaching		
Tolerance	Adjustable in 16 grades with the tolerance adjuster		
Environmental resistance	Pollution degree	3 (Industrial environment)	
	Ambient temperature	-10 to +55 °C +14 to +131 °F (No dew condensation or icing allowed) (Note 3), Storage: -20 to +70 °C -4 to +158 °F	
	Ambient humidity	35 to 85 % RH, Storage: 35 to 85 % RH	
	Ambient illuminance	Incandescent light: 3,000 lx or less at the light-receiving face	
	Voltage withstandability	1,000 V AC for one min. between all supply terminals connected together and enclosure (Note 4)	
	Insulation resistance	20 M Ω , or more, with 250 V DC megger between all supply terminals connected together and enclosure (Note 4)	
	Vibration resistance	10 to 150 Hz frequency, 0.75 mm 0.030 in double amplitude in X, Y and Z directions for two hours each	
	Shock resistance	100 m/s ² acceleration (10 G approx.) in X, Y and Z directions three times each	
Emitting element	Red LED / Green LED / Blue LED (Peak emission wavelength: 644 nm 0.025 mil / 525 nm 0.021 mil / 470 nm 0.019 mil , modulated)		
Material	Enclosure: ABS, Case cover: Polycarbonate, Fiber lock lever: PPS		
Cable	0.2 mm ² 3-core cabtyre cable, 2 m 6.562 ft long		
Cable extension	Extension up to total 100 m 328.084 ft is possible with 0.3 mm ² , or more, cable.		
Weight	Net weight: 85 g approx.		
Accessories	MS-DIN-3 (Amplifier mounting bracket): 1 pc., Adjusting screwdriver: 1 pc.		

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C **+73.4 °F**.

2) Make sure to confirm detection with an actual sensor before use.

3) The amplifier should be used under the ambient temperature of +15 to +35 °C **+59 to +95 °F** when the tolerance adjuster is set from the 1st grade to the 4th grade, which provide fine color resolution.

4) The voltage withstandability and the insulation resistance values given in the above table are for the amplifier only.

SPECIFICATIONS

Fibers

Type	Standard	High precision	Extremely small spot	Long sensing range
Item	Model No.	FD-L51	FD-L52	FD-L54
Applicable amplifiers	FZ-11, FZ-11P			
Sensing range (Note 2)	14 to 24 mm 0.511 to 0.945 in	8 to 11 mm 0.315 to 0.433 in	4 to 6 mm 0.157 to 0.236 in	30 to 50 mm 0.181 to 1.969 in
Setting distance	20 mm 0.787 in (fixed)	10 mm 0.394 in (fixed)	5 mm 0.197 in (fixed)	40 mm 1.575 in (fixed)
Spot diameter (at setting distance)	ø5 mm ø0.197 in	ø2.5 mm ø0.098 in	ø1 mm ø0.039 in	ø8 mm ø0.315 in
Allowable bending radius	R25 mm R0.984 in or more (Note 3)			
Fiber cable length	1 m 3.281 ft			
Ambient temperature	-20 to +70 °C -4 to +158 °F (No dew condensation or icing allowed), Storage: -20 to +70 °C -4 to +158 °F			
Ambient humidity	35 to 85 % RH, Storage: 35 to 85 % RH			
Material	Fiber core: Acrylic, Sheath: Polyethylene, Fiber head: Polycarbonate, Lens: Polyallylate (FD-L54: Acrylic)			
Weight	Net weight: 15 g approx.			

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.

2) The sensing range of each fiber is the range for which white non-glossy paper can be detected at the sensitivity for which teaching has been done with a white non-glossy paper (50 × 50 mm 1.969 × 1.969 in) at the respective rated setting distance and at the 16th grade (▲ mark) of tolerance.

3) If the fiber cable is bent at less than R25 mm R0.984 in or less, the detectability may deteriorate.

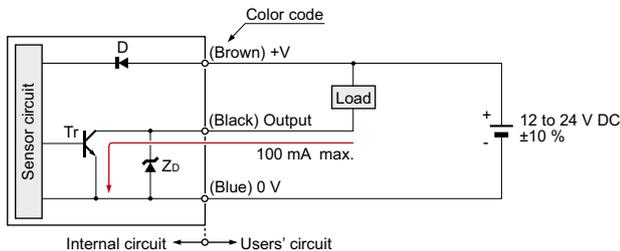
4) Since fiber FD-L51 (standard type) is easily affected by specular reflection, it is possible that teaching may not be properly done or sensing may be unstable if objects of high reflectivity (mirror, plated objects, copper foil, etc.) are sensed. When such objects are to be sensed, please use FD-L52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

I/O CIRCUIT AND WIRING DIAGRAMS

FZ-11

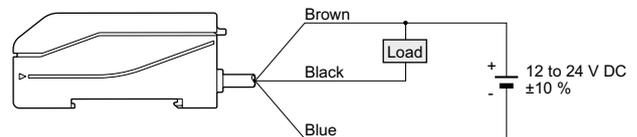
NPN output type

I/O circuit diagram



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

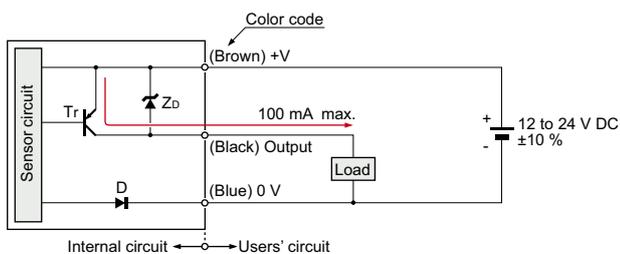
Wiring diagram



FZ-11P

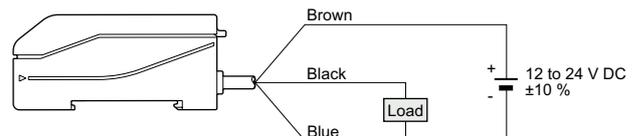
PNP output type

I/O circuit diagram



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

Wiring diagram



PRECAUTIONS FOR PROPER USE

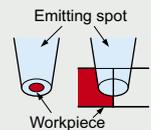
Amplifier



- 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.

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 0.8 mm **0.031 in** approx.



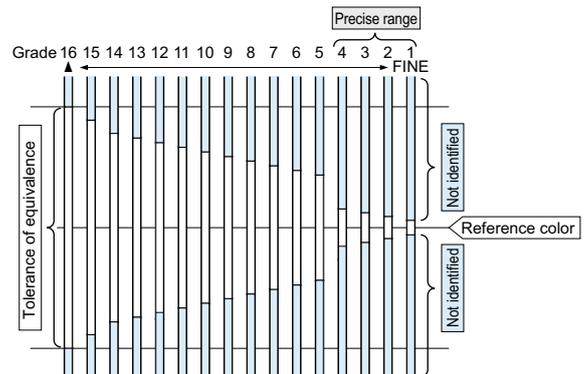
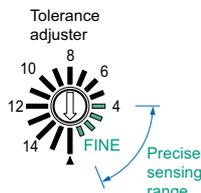
Procedure



- 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 differences in gloss or color shades are also detected.

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.



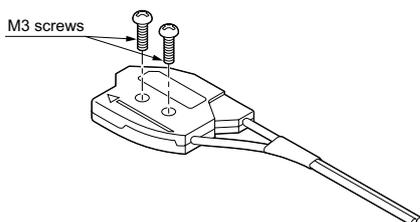
Others

- Do not use during the initial transient time (0.5 sec.) after the power supply is switched on.
- Periodical teaching should be done to maintain stable sensing condition.

Fiber

Mounting

- Mount with two M3 screws with a tightening torque of 0.5 N·m or less.



- Several fiber heads of **FD-L51**, **FD-L52**, **FD-L53** and **FD-L54** can be mounted close together as long as their emitted spots do not overlap.

Others

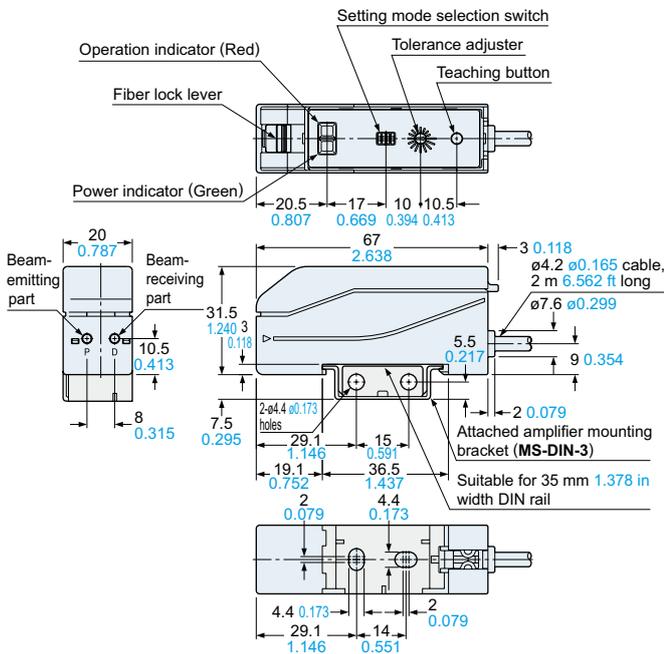
- If the bending radius is smaller than the allowable value, the sensing performance may deteriorate.
- Wipe dirt or stains from the sensing faces with a soft cloth. Do not use any organic solvent for cleaning.
- Ensure that any strong extraneous light is not incident on the receiving face of the fiber head.
- Do not move or bend the fiber cable after the sensitivity setting. Detection may become unstable.
- Keep the fiber head surface intact. If it is scratched or spoiled, the detectability will deteriorate.
- Do not expose the fiber cable to any organic solvents.
- Ensure that the fiber head is not directly exposed to water. A water drop on the fiber head deteriorates the sensing.
- Do not apply excessive tensile force to the fiber cable.

DIMENSIONS (Unit: mm in)

The CAD data can be downloaded from our website.

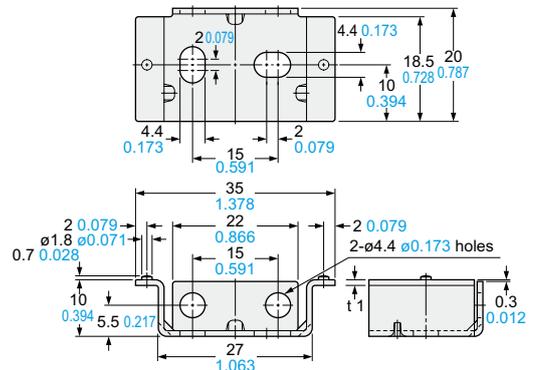
FZ-11 FZ-11P Amplifier

Assembly dimensions with attached amplifier mounting bracket



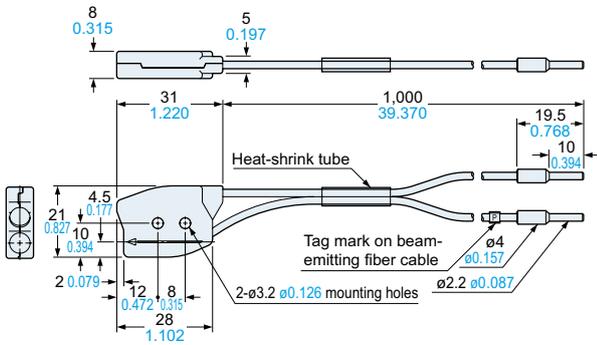
Note: The top view is shown without the cover.

MS-DIN-3 Amplifier mounting bracket (Accessory for amplifier)

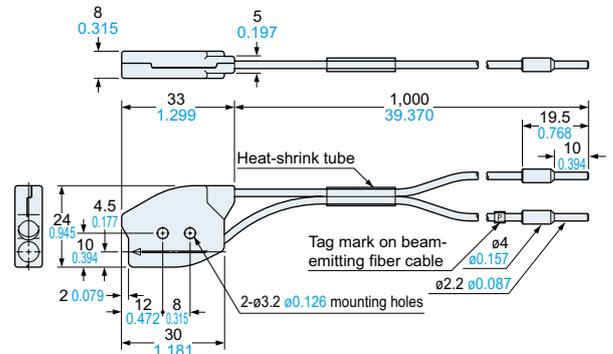


Material: Cold rolled carbon steel (SPCC)
(Uni-chrome plated)

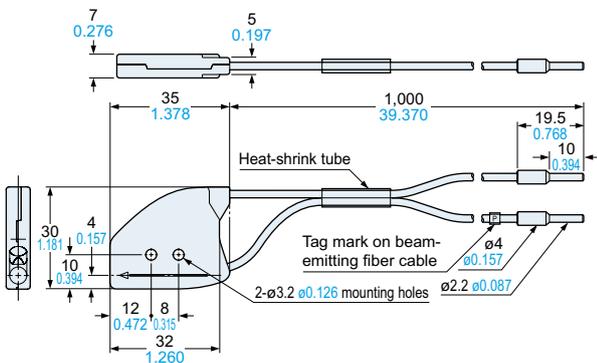
FD-L51 Fiber



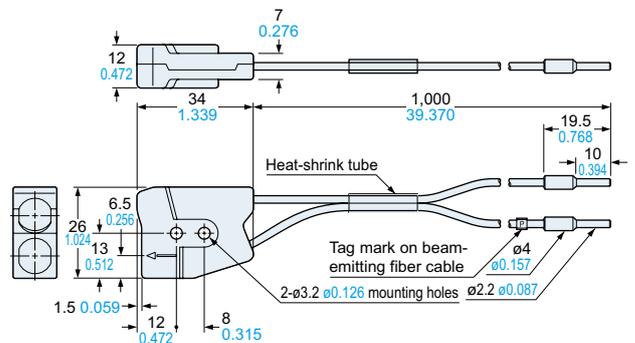
FD-L52 Fiber



FD-L53 Fiber



FD-L54 Fiber



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