SUNX

INSTRUCTION MANUAL

Ultra-compact Photoelectric Sensor **Amplifier Built-in Type**

EX-20 Series

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

⚠ This product is not a safety sensor. Its use is not intended or designed to protect life and prevent body injury or property damage from dangerous parts of machinery. It is a normal object detection sensor.

1 SPECIFICATIONS

Item \ Type		Thru-beam		Retroreflective	Diffuse reflective	Convergent reflective		Narrow-view reflective
						Diffused beam type	Small spot beam type	Long distance spot beam type
		Front sensing	Side sensing	Side sensing	Side sensing	Front sensing	Side sensing	Side sensing
Model No. (Note 1)	Light-ON	**EX-21A(-PN)**	**EX-23(-PN)** (Note 2)	**EX-29A(-PN)**	**EX-22A(-PN)**	**EX-24A(-PN)**	**EX-26A(-PN)**	**EX-28A(-PN)**
	Dark-ON	**EX-21B(-PN)**		**EX-29B(-PN)**	**EX-22B(-PN)**	**EX-24B(-PN)**	**EX-26B(-PN)**	**EX-28B(-PN)**
Sensing range		1m	2m	30 to 200mm (Note 3)	5 to 160mm (With 200×200mm white non-glossy paper (Note 4))	2 to 25mm (Conv. point: 10mm) (With 50×50mm white non-glossy paper)	6 to 14mm (Conv. point: 10mm) (With 50×50mm white non-glossy paper, spot diameter ø1mm with setting distance 10mm.)	45 to 115mm (With 100×100mm white non-glossy paper, spot diameter ø5mm with setting distance 80mm.)
Sensing object		Min. ø2.6mm opaque object (Setting distance between emitter and receiver: 1m)	Min. ø3mm opaque object (Setting distance between emitter and receiver: 2m)	ø15mm or more opaque or translucent object (Note 3)	Opaque, translucent or transparent object	Min. ø0.1mm copper wire (Setting distance: 10mm	Min. ø0.1mm copper wire (Setting distance: 10mm	Opaque, translucent or transparent object (Min. ø1mm copper wire wich setting distance 80mm
Hysteresis		———			15% or less of operation distance			
Repeatability (perpendicular to sensing axis)		0.05mm or less		0.5mm or less	0.3mm or less	0.1mm or less (Setting distance: 10mm)	0.05mm or less (Setting distance: 10mm)	0.3mm or less
Supply voltage		12 to 24V DC±10% Ripple P-P 10% or less						
Current consumption		Emitter: 10mA or less, Receiver: 15mA or less		20mA or less				
Output		〈**EX-□A**, **EX-□B**, **EX-23**〉 NPN open-collector transistor • Maximum sink current: 50mA • Applied voltage: 30V DC or less (between output and 0V) • Residual voltage: 1V or less (at 50mA sink current) 0.4V or less (at 16mA sink current)			〈**EX-□A-PN**, **EX-□B-PN**, **EX-23-PN**〉 PNP open-collector transistor • Maximum source current: 50mA • Applied voltage: 30V DC or less (between output and +V) • Residual voltage: 1V or less (at 50mA source current) 0.4V or less (at 16mA source current)			
Short-circuit protection		Incorporated						
Response time		0.5ms or less						
Operation indicator		Orange LED (lights up when the output is ON) (thru-beam type: located on the receiver)						
Stability indicator		Green LED (lights up under stable light received condition or stable dark condition) located on the receiver		Green LED (lights up under stable light received condition or stable dark condition)				
Sensitivity adjuster		———	Continuously variable adjuster, located on the emitter	Continuously variable adjuster		———		Continuously variable adjuster
Protection		IP67 (IEC)						
Ambient temperature		–25 to +55°C (No dew condensation or icing allowed), Storage: –30 to +70°C						
Ambient humidity		35 to 85% RH, Storage: 35 to 85% RH						
Emitting element		Red LED (modulated)						
Material		Enclosure: Polyethylene terephthalate, Lens: Polyalylate						
Cable		0.1mm² 3-core (thru-beam type sensor emitter: 2-core) cabtyre cable, 2m long						
Weight		Emitter, receiver: 20g approx. each		20g approx.				
Accessories		———	Adjusting screwdriver: 1 No.	**RF-200** (Reflector): 1 No. Adjusting screwdriver: 1 No.	Adjusting screwdriver: 1 No.	———		Adjusting screwdriver: 1 No.

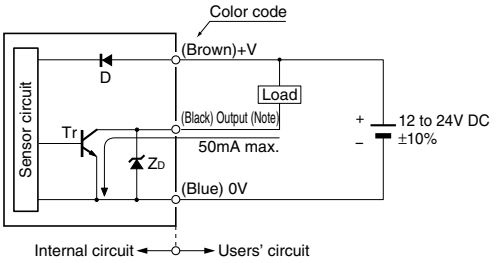
Notes: 1) Model Nos. having the suffix **'-PN'** are PNP output type.
The retroreflective type having the suffix **'-Y'** at the end of the model No. does not have the reflector **RF-200** enclosed with it.
2) Either Light-ON or Dark-ON can be selected by the operation mode switch (located on the receiver).
3) The sensing range and the sensing object of the retroreflective type sensor are specified for the **RF-200** reflector. Further, the sensing range is the possible setting range for the reflector. The sensor can detect an object less than 30mm away. However, if the reflector is set 100mm or less away, the sensing object should be opaque.
4) In case of using this product at a sensing range of 50mm or less, take care that the sensitivity adjustment range becomes extremely narrow.

2 CAUTIONS

- **EX-24A(-PN)** and **EX-24B(-PN)** are not incorporated with a sensitivity adjuster. If there is a reflective object (conveyor, etc.) in the background, since it may affect the sensing, use these models by keeping enough distance from the reflective object.
- If a reflective object is present in the background, the sensing of **EX-28A(-PN)** and **EX-28B(-PN)** may be affected. When setting the sensor, make sure to confirm that the reflective object has no effect. In case the reflective object affects the sensing, take measures such as removing the reflective object or coloring it in black, etc.
- If sensors are mounted close together and the ambient temperature is near the maximum rated value, provide for enough heat radiation/ventilation.
- Make sure to carry out the wiring in the power supply off condition.
- 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 use during the initial transient time (50ms) after the power supply is switched on.
- Extension up to total 50m (thru-beam type: both emitter and receiver) is possible with 0.3mm², or more, cable.
- Make sure that stress is not applied directly to the sensor cable joint.
- 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.
- Take care that the sensor is not directly exposed to fluorescent light from a rapid-starter lamp or a high frequency lighting device, as it may affect the sensing performance.
- Avoid dust, dirt and steam.
- Take care that the sensor does not come in direct contact with water, oil, grease, or organic solvents, such as, thinner, etc.

3 I/O CIRCUIT DIAGRAMS

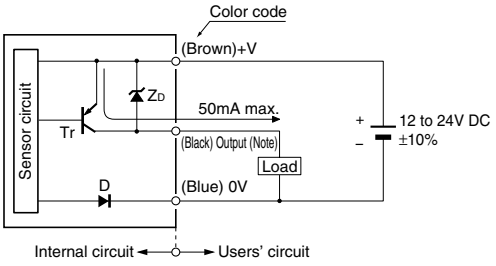
● **EX-□A**, **EX-□B**, **EX-23** / NPN output type



Note: The emitter of thru-beam type sensor does not incorporate the output.

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

● **EX-□A-PN**, **EX-□B-PN**, **EX-23-PN** / PNP output type

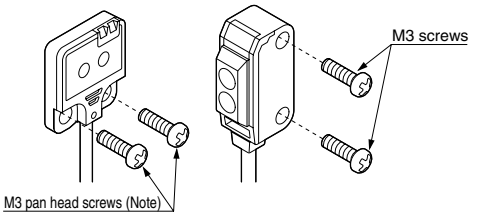


Note: The emitter of thru-beam type sensor does not incorporate the output.

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

4 MOUNTING

● Mount using M3 screws. The tightening torque should be 0.5N·m or less.

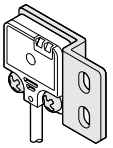


Note: When mounting the front sensing type sensor, use M3 pan head screws without washers, etc.

● Sensor mounting brackets (optional) are available. In case the sensor is mounted on a sensor mounting bracket the tightening torque should be 0.5N·m or less.

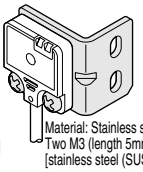
Sensor mounting bracket for front sensing type

• **MS-EX20-1**



Material: Stainless steel (SUS304)
Two M3 (length 5mm) pan head screws [stainless steel (SUS304)] are attached.

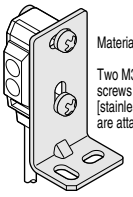
• **MS-EX20-3**



Material: Stainless steel (SUS304)
Two M3 (length 5mm) pan head screws [stainless steel (SUS304)] are attached.

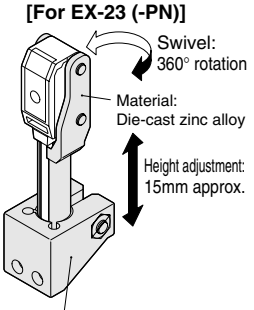
Sensor mounting bracket for side sensing type

• **MS-EX20-2**



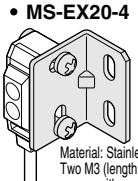
Material: Stainless steel (SUS304)
Two M3 (length 14mm) screws with washers [stainless steel (SUS304)] are attached.

• **MS-EX20-5 [For EX-23 (-PN)]**



Material: Nylon 6
Two M3 (length 12mm) screws with washers [stainless steel (SUS304)], one M3(length10mm) hexagon-socket-head bolt [stainless steel (SUS304)], and one M3 hexagon nut [stainless (SUS304)] are attached.

• **MS-EX20-4**

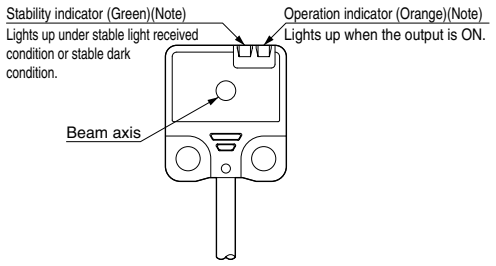


Material: Stainless steel (SUS304)
Two M3 (length 14mm) screws with washers [stainless steel (SUS304)] are attached.

5 ADJUSTMENTS

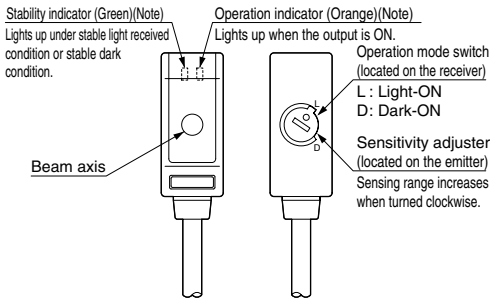
● **Parts description**

EX-21□



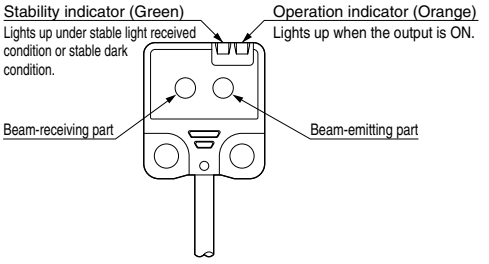
Note: Not incorporated on the emitter.

EX-23□

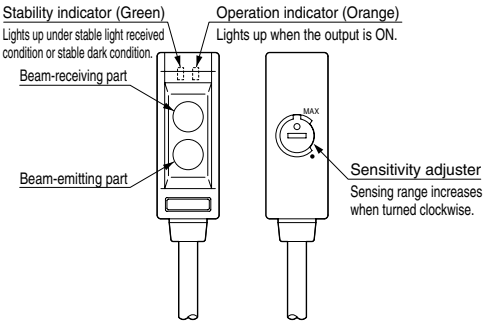


Note: Not incorporated on the emitter.

EX-24□



EX-22□/26□/28□/29□



● **Operation mode switch [EX-23 (-PN) only]**

Switch position	Description
	Light-ON mode is obtained when the operation mode switch (located on the receiver) is turned fully clockwise (L side).
	Dark-ON mode is obtained when the operation mode switch (located on the receiver) is turned fully counterclockwise (D side).

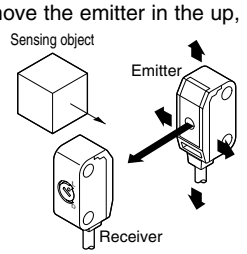
Note: Operation mode switch should be turned fully till it stops.

● **Light beam alignment**

Thru-beam type sensor

① In case of **EX-23(-PN)**, set the operation mode switch to the Light-ON mode position (L side).

② Placing the emitter and the receiver face to face along a straight line, move the emitter in the up, down, left and right directions, in order to determine the range of the light received condition with the help of the operation indicator. Then, set the emitter at the center of this range.



③ Similarly, adjust for up, down, left and right angular movement of the emitter.

④ Further, perform the angular adjustment for the receiver also.

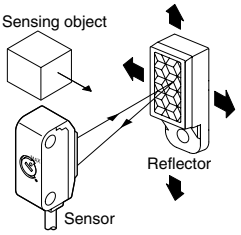
⑤ Check that the stability indicator lights up.

⑥ In case of **EX-23(-PN)**, choose the operation mode, Light-ON or Dark-ON, as per your requirement, with the operation mode switch.

Retroreflective type sensor

① Turn the sensitivity adjuster fully clockwise to the maximum sensitivity position (MAX).

② Placing the sensor and the reflector face to face along a straight line, move the reflector in the up, down, left and right directions, in order to determine the range of the light received condition with the help of the operation indicator. Then, set the reflector at the center of this range.



③ Similarly, adjust for up, down, left and right angular movement of the reflector.

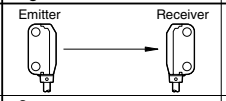
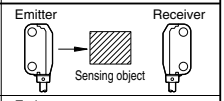
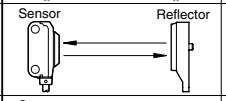
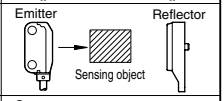
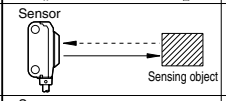
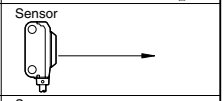
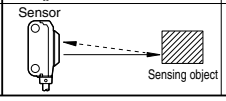
④ Further, perform the angular adjustment for the sensor also.

⑤ Check that the stability indicator lights up.

● **Sensitivity adjustment (Side sensing type only)**

Step	Sensitivity adjuster	Description
①		Turn the sensitivity adjuster fully counter-clockwise to the minimum sensitivity position (• mark).
②		In the light received condition, turn the sensitivity adjuster slowly clockwise and confirm the point Ⓐ where the sensor enters the 'Light' state operation.
③		In the dark condition, turn the sensitivity adjuster further clockwise until the sensor enters the 'Light' state operation and then bring it back to confirm point Ⓑ where the sensor just returns to the 'Dark' state operation. (If the sensor does not enter the 'LIght' state operation even when the sensitivity adjuster is turned fully clockwise, this extreme position is point Ⓑ .)
④		The position at the middle of points Ⓐand Ⓑ is the optimum sensing position.

Notes: 1) Use the accessory adjusting screwdriver to turn the adjuster slowly. Turning with excessive strength will damage the adjuster.
2) In case of using **EX-22□(-PN)** at a sensing range of 50mm or less, take care that the sensitivity adjustment range becomes extremely narrow.

Type	Light received condition	Dark condition
Thru-beam		
Retroreflective		
Diffuse reflective		
Convergent reflective Narrow-view reflective		

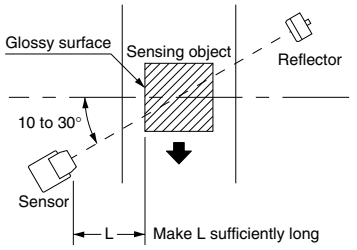
Relation between sensing output and indicators

In case of Light-ON				In case of Dark-ON		
Stability indicator	Operation indicator	Output	Sensing condition	Output	Operation indicator	Stability indicator
☼	☼	ON	Stable light receiving	OFF	●	☼
●			Unstable light receiving			●
	●	OFF	Unstable dark condition	ON	☼	
☼			Stable dark condition			☼

☼: lights up ●: lights off

6 RETROREFLECTIVE TYPE SENSOR [EX-29□(-PN)]

● When sensing a glossy object, mount the sensor at an angle to the object surface.



7 SLIT MASK (Optional) (Thru-beam type sensor only)

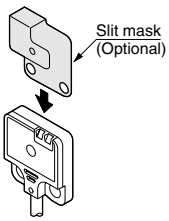
● Apply a slit mask when detecting small objects or for increasing the accuracy of sensing position.
However, the sensing range is reduced when the slit mask is mounted.

- Slit mask for **EX-21□** **OS-EX20-05** (Slit size ø0.5mm)
  OS-EX20-05 × 3 (Slit size 0.5 × 3mm)
- Slit mask for **EX-23□** **OS-EX20E-05** (Slit size ø0.5mm)
  OS-EX20E-05 × 3 (Slit size 0.5 × 3mm)

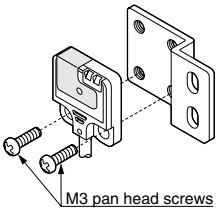
● The slit mask should be mounted on the sensor before mounting the sensor.

Mounting method

① Put the slit mask on the sensor as shown in the right figure.



② Align the mounting holes of the slit mask and the sensor and mount with two M3 screws [in case of **EX-21 □(-PN)**, M3 pan head screws]. The tightening torque should be 0.5N·m or less.

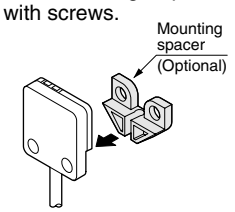


8 MOUNTING SPACER (Optional) (Front sensing type only)

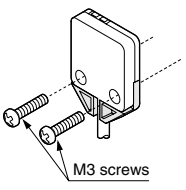
● When mounting the front sensing type from the backside, fit the mounting spacer (**MS-EX20-FS**) and fix with screws.

Mounting method

① Fit the mounting spacer on the sensor.



② Align the mounting holes of the mounting spacer and the sensor and mount with M3 screws. The tightening torque should be 0.5N·m or less.



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