

ULTRA-COMPACT PHOTOELECTRIC SENSOR

EX-20 SERIES

Mountable with M3 screws!



Isn't this what you wanted?





The Solution to Your Requirements!



Ultra-compact Photoelectric Sensor

SERIES

Requirement 1

The sensor should be smaller.

Solution

Miniaturization by using single chip optical IC!

The beam-receiving photodiode and the A/D conversion circuit have been fabricated on a single chip optical IC (full custom). Hence, in spite of its miniature size, it has a performance and reliability which is equal to or better than the conventional product.



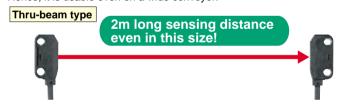
Requirement 2

Even though the sensor is small, it should have enough sensing range.

Solution

Long sensing range realized!

The EX-20 series achieves long distance sensing [thru-beam type: 2m, retroreflective type: 200mm (when using the attached reflector), diffuse reflective type: 160mm], despite its miniature size. Hence, it is usable even on a wide conveyor.



Retroreflective type



200mm long sensing distance even in this size!

Diffuse reflective type



160mm long sensing distance even in this size!

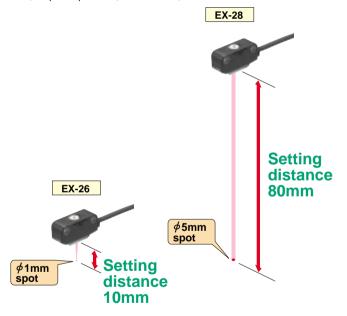
Requirement 3

The beam spot should be clearly visible.

Solution

Clear beam spot by using a red LED dot light source!

The emission area of a dot light source is smaller than that of a conventional LED flat light source, and it is possible to design a high power, narrow beam. Since a red LED dot light source is used, the red beam spot is clear even at a far place, so that alignment and confirmation of sensing position is easy. Further, since the thru-beam type, too, incorporates a visible narrow beam, it can also reliably detect small parts, such as, chip components, lead frames, etc.



Requirement 4

Sensitivity should be adjustable, even though the sensor is small.

Solution

Incorporates a sensitivity adjuster even in this size!

The sensor incorporates a sensitivity adjuster in spite of its miniature size. It is convenient when you need fine adjustment. Further, the receiver of the thru-beam, side sensing type sensor incorporates an operation mode switch which can change the output operation.



Ease of Use Pursued by Designing from the User's Viewpoint!

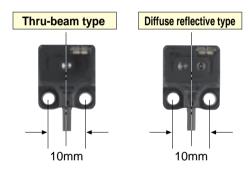
2 types for suitable mounting

Two types, side sensing type and front sensing type are available. Select depending on the place of mounting.



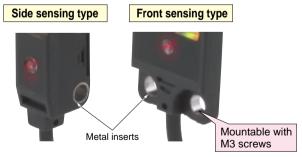
Identical size

Front sensing type of thru-beam type and diffuse reflective type have identical appearance. Moreover, since the mounting holes are symmetrical with respect to the beam axis center, the design becomes easy.



Mounting section reinforced

It can be tightened with M3 screws. Moreover, metal inserts have been provided in the mounting holes so that the product is not damaged even in case of excess tightening.



Globally Usable!

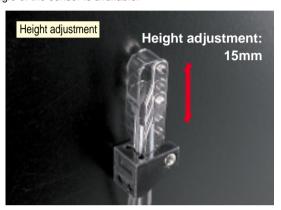
PNP output type which is much in demand in Europe is now available. Of course, it conforms to the EMC directive.

Bright Two-color Indicator

Bright two-color indicator has been incorporated in all types.

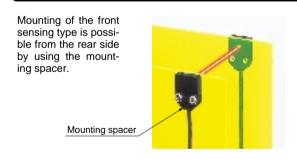
Universal sensor mounting bracket is available

Universal sensor mounting bracket (for thru-beam side sensing type **EX-23** only) which can freely adjust the height and the angle of the sensor is available.





Mounting spacer for front sensing type is available



Waterproof IP67

The sensor can be hosed down because of its IP67 construction. Further, the sensor mounting bracket is also made of stainless steel.

Slit Mask Is Available

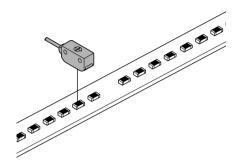
 $\phi\,0.5{\rm mm}$ round slit mask and 0.5 \times 3mm rectangular slit mask are available for both side sensing type and front sensing type.

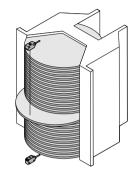
APPLICATIONS

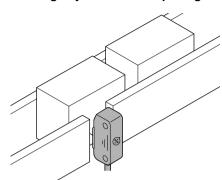
Detecting chip components



Sensing objects from an opening





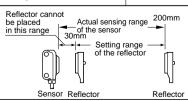


ORDER GUIDE

Туре			Appearance	Sensing range	Model No.	Output	Output operation											
		g			EX-21A	NPN open-collector transistor	- Light-ON											
Thru-beam		ensin	\square —— \square	1m	EX-21A-PN	PNP open-collector transistor	- Dark-ON											
		Front sensing			EX-21B	NPN open-collector transistor												
			U U		EX-21B-PN	PNP open-collector transistor												
		Side sensing		2m	EX-23	NPN open-collector transistor	Switchable either Light-ON or Dark-ON											
		Side so			EX-23-PN	PNP open-collector transistor												
Retroreflective	o C	g	J	30 to 200mm - (Note 1)	EX-29A	NPN open-collector transistor	Light-ON											
	atrorenectiv	Side sensing			EX-29A-PN	PNP open-collector transistor												
					EX-29B	NPN open-collector transistor												
à	2	S			EX-29B-PN	PNP open-collector transistor												
Diffuse reflective	use renective	Side sensing		5 to 160mm (Note 2) EX	EX-22A	NPN open-collector transistor	- Light-ON											
					EX-22A-PN	PNP open-collector transistor	Light-ON											
					EX-22B	NPN open-collector transistor	- Dark-ON											
					EX-22B-PN	PNP open-collector transistor	Baik Oil											
	used light type	Diffused light type Front sensing		2 to 25mm EX-24A	EX-24A	NPN open-collector transistor	- Light-ON											
Φ					EX-24A-PN	PNP open-collector transistor												
lectiv			ront s	ront	ront	ront	ront	ront	ront	ront	ront		(Convergent point: 10mm)	EX-24B	NPN open-collector transistor	- Dark-ON		
nt refl	Diff		₩ 	EX-24E	EX-24B-PN	PNP open-collector transistor	Bulk OIV											
erger	Small spot light type		67		EX-26A	NPN open-collector transistor	- Light-ON											
Convergent reflective			ensin	ensin	ensin		6 to 14mm	EX-26A-PN	PNP open-collector transistor	Light Oiv								
				(Convergent point: 10mm)	EX-26B	NPN open-collector transistor	- Dark-ON											
					EX-26B-PN	PNP open-collector transistor												
Narrow-view reflective	Long distance spot light type	Side sensing			EX-28A	NPN open-collector transistor	- Light-ON											
			ide sensin	ide sensin	Istance spot lig	spot lig	ensin	ensin	ensin	ensin	ensin	ensin	ensin	ensine		45 to 115mm	EX-28A-PN	PNP open-collector transistor
ow-vie							45 to 1150000	EX-28B	NPN open-collector transistor	- Dark-ON								
Narro			<u>ā</u> ដូ		EX-28B-PN	PNP open-collector transistor												

Notes: 1) The sensing range of the retroreflective type sensor is 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.

2) In case of using this product at a sensing range of 50mm or less, take care that the sensitivity adjustment range becomes extremely narrow.



ORDER GUIDE

Package without reflector

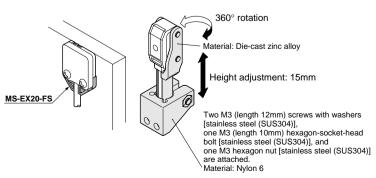
EX-29□ is also available without the reflector RF-200 when ordering this type, add suffix '-Y' at the end of the model No. EX.: EX-29□-Y is EX-29□ without the reflector.

OPTIONS

Designa	ition	Model No.	Description		
— — — — — — — — — — — — — — — — — — —	For front sensing type	OS-EX20-05	Slit on one side • Sensing range: 200mm • Min. sensing object: \$\phi 2.6mm\$		
tound slit mask For thru-beam type sensor only		(Slit size	Slit on both sides • Sensing range: 40mm • Min. sensing object: ϕ 0.5mm		
Round slit mask For thru-beam sensor only	For side sensing type	OS-EX20E-05	Slit on one side • Sensing range: 350mm • Min. sensing object: \$\phi\$3mm		
Rour For sen		(Slit size	Slit on both sides • Sensing range: 70mm • Min. sensing object: \$\phi 0.5mm		
nask /pe	For front sensing type	OS-EX20-05×3	Slit on one side • Sensing range: 600mm • Min. sensing object: \$\phi 2.6mm		
tr slit meam ty		(Slit size 0.5×3 mm)	Slit on both sides • Sensing range: 300mm • Min. sensing object: 0.5 × 3mm		
Rectangular slit mask For thru-beam type	For side sensing type	OS-EX20E-05×3	Slit on one side • Sensing range: 800mm • Min. sensing object: ϕ 3mm		
		(Slit size 0.5 × 3mm)	Slit on both sides • Sensing range: 400mm • Min. sensing object: 0.5 × 3mm		
Reflector (For retroreflective type sensor only)		RF-210	Sensing range: 50 to 400mm Min. sensing object:		
Reflector mounting bracket		MS-RF21-1	Protective mounting bracket for RF-210 Protects the reflector from damage and maintains alignment.		
Reflective / For	ve tape		Ambient temperature: - 25 to + 50°C Ambient humidity: 35 to 85% RH Notes: i) Keep the tape free from	• Sensing range: 70 to 200mm	
retroreflective type sensor only		RF-12	stress. If it is pressed too much, its capability may deteriorate. ii) Do not cut the tape. It will deteriorate the sensing performance.	• Sensing range: 60 to 280mm	
		MS-EX20-1	Back angled mounting bracket for front sensing type (The thru-beam type sensor needs two brackets		
Sensor mounting		MS-EX20-2	Foot angled mounting bracket for side sensing type (The thru-beam type sensor needs two brackets.)		
bracket		MS-EX20-3	L-shaped mounting bracket for front sensing type (The thru-beam type sensor needs two brackets.)		
		MS-EX20-4	Back angled mounting bracket for side sensing type (The thru-beam type sensor needs two brackets.)		
Universal se mounting br [For EX-23(-P)	racket	MS-EX20-5	It can adjust the height and the angle of the sensor. (Two brackets are needed.)		
Mounting sp For front ser type only		MS-EX20-FS	It is used when mounting the front sensing type from the rear side. (One set consists of 10 Nos.)		

Mounting spacer · MS-EX20-FS

Universal sensor mounting bracket • MS-EX20-5



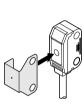
Round slit mask

Fitted on the front face of the sensor with one-touch.

• OS-EX20-05



• OS-EX20E-05



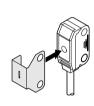
Rectangular slit mask

Fitted on the front face of the sensor with one-touch.

• OS-EX20-05 × 3



• OS-EX20E-05×3



Reflector • RF-210



Reflector mounting bracket • MS-RF-21-1



Two M3 (length 12mm) screws with washers are attached.

Reflective tape

• RF-11



• RF-12



Sensor mounting bracket • MS-EX20-2

• MS-EX20-1



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

3

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

• MS-EX20-3



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

• MS-EX20-4



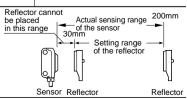
Material: Stainless steel (SUS304) Two M3 (length 14mm) screws with washers [stainless steel (SUS304)] are attached.

SPECIFICATIONS

			Thru-beam Re		Petrorefloctive	Diffuse reflective	Convergent reflective		Narrow-view reflective	
		Туре			Retroreflective	Dilluse reliective	Diffused light type	Small spot light type	Long distance spot light typ	
//			Front sensing	Side sensing	Side sensing	Side sensing	Front sensing	Side sensing	Side sensing	
\	Model	Light-ON	EX-21A(-PN)	EX-23(-PN)	EX-29A(-PN)	EX-22A(-PN)	EX-24A(-PN)	EX-26A(-PN)	EX-28A(-PN)	
Item	No.	Dark-ON	EX-21B(-PN)	(Note 1)	EX-29B(-PN)	EX-22B(-PN)	EX-24B(-PN)	EX-26B(-PN)	EX-28B(-PN)	
Sensing range			1m	2m	30 to 200mm (Note 2)	5 to 160mm (Note 3) with 200 × 200mm white non-glossy paper	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 \$\phi\$1mm at setting distance 10mm	45 to 115mm /with 100 × 100mm white non-glossy pape spot diameter \$5mm a setting distance 80mm	
Sensing object			Min. \$\phi 2.6mm opaque object Setting distance between emitter and receiver: 1m	Min. \$\phi\$3mm opaque object Setting distance between emitter and receiver: 2m		Opaque, translucent or transparent object	Min.	Min. \$\phi 0.1mm copper wire (Setting distance: 10mm)	Opaque, translucent or transparent obje Min. \$\phi\$1mm coppe wire at setting distance 80mm	
Hystere	esis		——————————————————————————————————————							
Repeata (Perpen	ability ndicular to se	nsing 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	t consumptio	n	Emitter: 10mA or less,	Receiver: 15mA or less			20mA or less			
Output			(NPN output type) 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) 0.4V or less (at 16mA source current)							
Util	ilization cate	gory				DC-12 or DC-13				
She	ort-circuit pro	otection	Incorporated							
Respon	nse time		0.5ms or less							
Operati	ion indicator		Orange LED (lights up when the output is ON) (thru-beam type: located on the receiver)							
Stability	y 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 v	Continuously variable adjuster — Continuously variable adjuster				
Operation	Operation mode switch		Located on the receiver							
Pol	Ilution degre	e	3 (Industrial environment)							
_	otection		IP67 (IEC)							
⊆	nbient tempe	rature	— 25 to +55°C (No dew condensation or icing allowed), Storage: −30 to +70°C							
Am	nbient humid	ity			35 to 85% RH, Storage: 35 to 85% RH					
MM at	nbient illumin	ance	Sunlight: 10,000 ℓ x at the light-receiving face, Incandescent light: 3,000 ℓ x at the light-receiving face							
EM			Emission: EN50081-2, Immunity: EN50082-2							
Environmental resista	Itage withsta	ndability			ne min. between a					
_	sulation resis						en all supply terminals connected together and enclosure			
Vib	oration resist	ance	10	· · · · · · · · · · · · · · · · · · ·	ncy, 3mm amplitude (20G max.) in X, Y and Z directions for two hours each					
Shock resistance		500m/s ² acceleration (50G approx.) in X, Y and Z directions for three times each								
Emitting element		Red LED (modulated)								
Material		Enclosure: Polyethylene terephthalate, Lens: Polyalylate								
Cable		0.1mm ² 3-core (thru-beam type sensor emitter: 2-core) cabtyre cable, 2m long								
Cable extension		Extension up to total 50m is possible with 0.3mm ² , or more, cable (thru-beam type: both emitter and receiver).								
Weight Accessories			Emitter: 20g approx., Receiver: 20g approx. 20g approx. Adjusting screwdriver: 1 No. Adjusting screwdriver: 1 No. Adjusting screwdriver: 1 No. Adjusting screwdriver: 1 No.							
lotes: 1) Either Ligh 2) The sensin reflector. F	g range and urther, the so	k-ON can be select the sensing object ensing range is the nm away. However	ted by the operation to the retroreflect possible setting rate	tive type sensor is ange for the reflecto	cated on the recei specified for the R or. The sensor can	F-200 in this ra	r cannot ad Actual ser of the sen:	nsing range 200mn	

should be opaque.

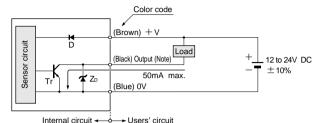
3) In case of using this product at a sensing range of 50mm or less, take care that the sensitivity adjustment range becomes extremely narrow. **SUNX**-



I/O CIRCUIT AND WIRING DIAGRAMS

NPN output type

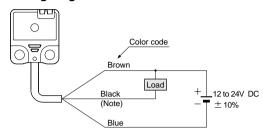
I/O circuit diagram



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

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

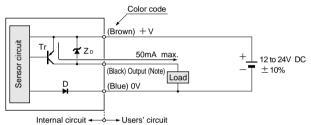
Wiring diagram



Note: The thru-beam type sensor emitter does not incorporate the black wire.

PNP output type

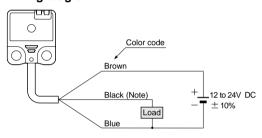
I/O circuit diagram



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

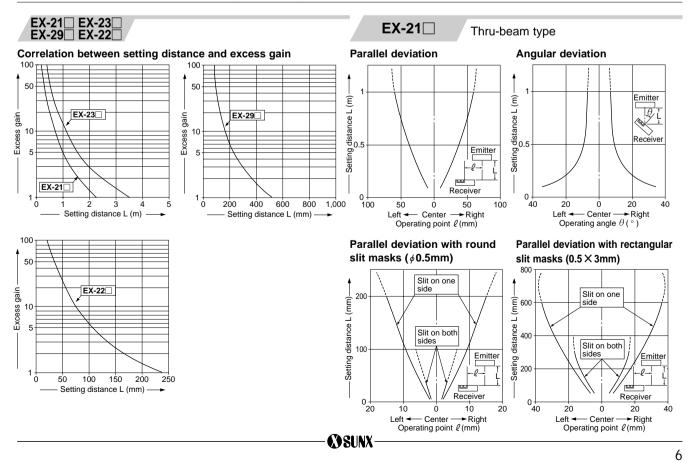
Symbols...D: Reverse supply polarity protection diode Zb: Surge absorption zener diode Tr: PNP output transistor

Wiring diagram



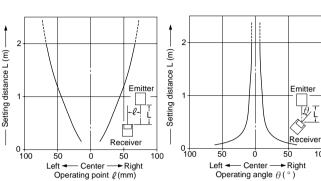
Note: The thru-beam type sensor emitter does not incorporate the black wire.

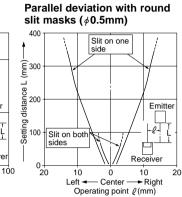
SENSING CHARACTERISTICS (TYPICAL)

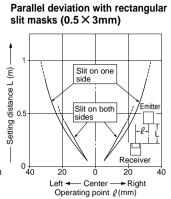


SENSING CHARACTERISTICS (TYPICAL)







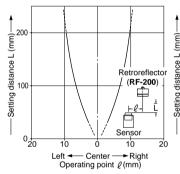


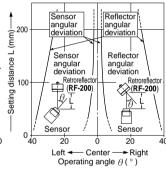
EX-29□

Retroreflective type

Parallel deviation

Angular deviation



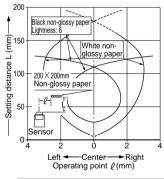


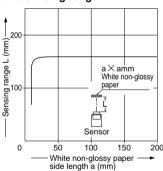
EX-22□

Diffuse reflective type

Sensing field

Correlation between object size and sensing range





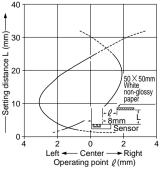
As the object size becomes smaller than the standard size (white non-glossy paper 200×200 mm), the sensing range shortens, as shown in the left graph.

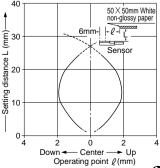
EX-24□

Convergent reflective type

Sensing field

• Horizontal (left and right) direction • Vertical (up and down) direction





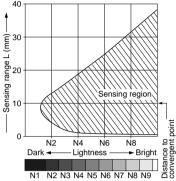
OSUNX

SENSING CHARACTERISTICS (TYPICAL)

EX-24□

Convergent reflective type

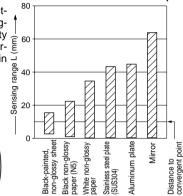
Correlation between lightness and sensing range



The sensing region is represented by oblique lines in the left figure. However, the sensitivity should be set with enough margin because of slight variation in products.

Lightness shown on the left may differ slightly from the actual object condition.

Correlation between material (50 × 50mm) and sensing range



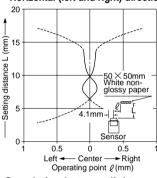
The bars on the graph indicate the sensing range with each object. However, there is a variation in the sensing range depending on the product. Further, if there is a reflective object (conveyor, etc.) in the background of the sensing object, since it affects the sensing, separate it by more than twice the sensing range shown in the left graph.

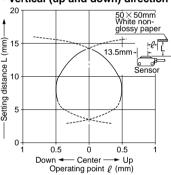
EX-26□

Convergent reflective type

Sensing field

· Horizontal (left and right) direction · Vertical (up and down) direction





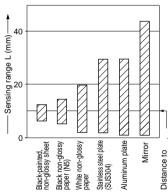
Correlation between lightness and sensing range

The sensing region is represented by oblique lines in the left figure. However, the sensitivity should be set with enough margin because of slight variation in products.

The graph is drawn for the maximum sensitivity setting.

Lightness shown on the left may differ slightly from the actual object condition.

Correlation between material (50 × 50mm) and sensing range



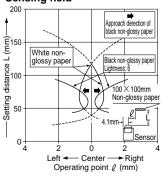
The bars on the graph indicate the sensing range with each object. However, there is a variation in the sensing range depending on the product. Further, if there is a reflective object (conveyor, etc.) in the background of the sensing object, since it affects the sensing, separate it by more than twice the sensing range shown in the left graph, or adjust the sensitivity adjuster.

The graph is drawn for the maximum sensitivity setting.

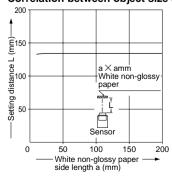
EX-28□

Narrow-view reflective type

Sensing field



Correlation between object size and sensing range



As the object size becomes smaller than the standard size (white non-glossy paper 100×100 mm), the sensing range shortens, as shown in the left graph.

PRECAUTIONS FOR PROPER USE



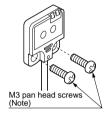
This product is not a safety sensor. Its use is not intended or designed to protect life and prevent body injury or property damage from dangerous parts of machinery. It is a normal object detection sensor.

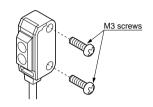
Mounting

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

Front sensing

Side sensing



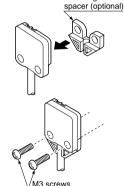


Note: When mounting the front sensing type sensor, use M3 pan head screws without washers, etc.

 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.



Mounting

②Align 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.

Sensitivity adjustment (Side sensing type only)

Step	Sensitivity adjuster	Description
1	MAX	Turn the sensitivity adjuster fully counterclockwise to the minimum sensitivity position (• mark).
2	MAX A	In the light received condition, turn the sensitivity adjuster slowly clockwise and confirm the point (A) where the sensor enters the 'Light' state operation.
3	® MAX	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 (B) 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 (B).
4	Optimum position B WAX	The position at the middle of points (A) and (B) 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 at a sensing distance of 50mm or less, take care that the sensitivity adjustment range becomes extremely narrow

Operation mode switch (EX-23□ only)

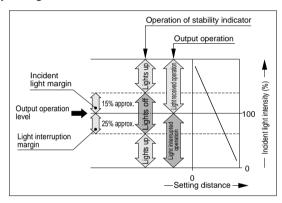
Switch position	Description
'((≪)	Light-ON mode is obtained when the operation mode switch (located on the receiver) is turned fully clockwise (L side).
ι((⊘)	Dark-ON mode is obtained when the operation mode switch (located on the receiver) is turned fully counterclockwise (D side).

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

Stability indicator

 The stability indicator (green) lights up when the incident signal light intensity has sufficient margin with respect to the operation level.

If the incident light intensity level is such that the stability indicator lights up, stable sensing can be done without the light received operation and the light interrupted operation being affected by a change in ambient temperature or supply voltage.



Wiring

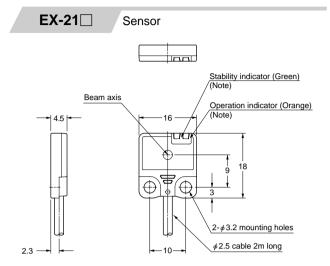
- Make sure to carry out the wiring in the power supply off condition.
- Verify that the supply voltage variation is within the rating.
- If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
- In case noise generating equipment (switching regulator, inverter motor, etc.) is used in the vicinity of this sensor, 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.

Others

- Do not use during the initial transient time (50ms) after the power supply is switched on.
- · 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.
- 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.
- If sensors are mounted close together and the ambient temperature is near the maximum rated value, provide for enough heat radiation/ventilation.

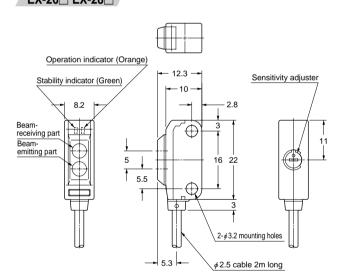


DIMENSIONS (Unit: mm)



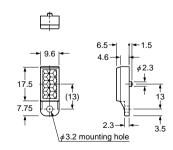
Note: Not incorporated on the emitter.

EX-29 EX-22 Sensor



RF-200

Reflector (Accessory for the retroreflective type sensor)

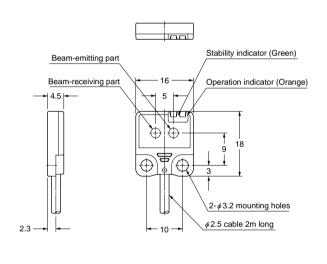


Material: Acrylic (Reflector) ABS (Base)

Operation indicator (Orange) (Note 1) Stability indicator (Green) (Note 1) Stability indicator (Green) (Note 1) 2.8 Beam axis 9.5 6.5 9.5 42.5 cable 2m long

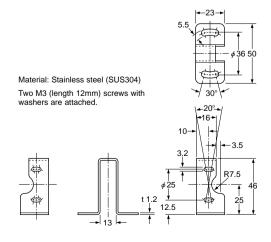
2) It is the sensitivity adjuster on the emitter.

EX-24 Sensor



MS-RF21-1 Ref

Reflector mounting bracket for **RF-210** (Optional)

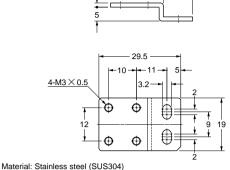


EX-20 SERIES ULTRA-COMPACT PHOTOELECTRIC SENSOR

MS-EX20-1

Sensor mounting bracket (Optional)

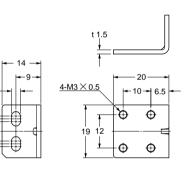
10.5



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

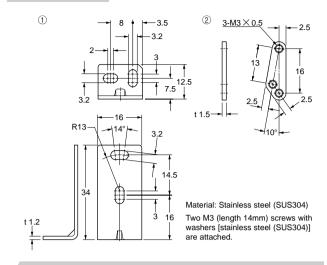
MS-EX20-3

Sensor mounting bracket (Optional)

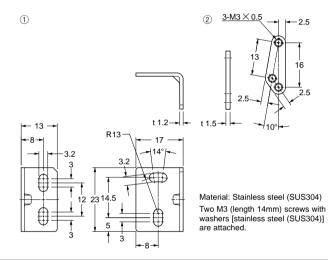


Material: Stainless steel (SUS304) Two M3 (length 5mm) pan head screws [stainless steel (SUS304)] are attached.

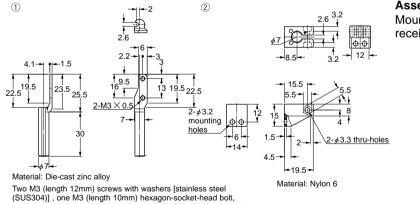
MS-EX20-2 Sensor mounting bracket (Optional)



MS-EX20-4 Sensor mounting bracket (Optional)



MS-EX20-5 Universal sensor mounting bracket (Optional)



Assembly dimensions Mounting drawing with the receiver of EX-23□

Beam- (7.3) - (6.7) 3 - (6.7) 3 - (15) (Note) - (15) (Note

Note: This is the adjustable range of the movable part

and one M3 hexagon nut [stainless steel (SUS304)] are attached.

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All information is subject to change without prior notice.