EX-20 SERIES

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

PNP output type available

Light intensity monitor

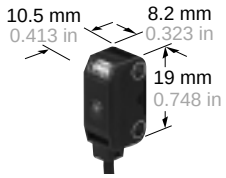
Miniature-sized and still mountable with M3 screws

Conforming to EMC Directive

UL Recognition (Excluding 5 m cable length type)

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.



Incorporates a sensitivity adjuster even in this size

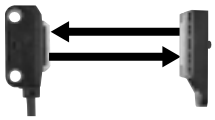
The sensor incorporates a sensitivity adjuster in spite of its miniature size. It is convenient when you need fine adjustment. Further, the receiver of the thru-beam, side sensing type sensor incorporates an operation mode switch which can change the output operation.

Long sensing range

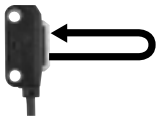
The **EX-20** series achieves long distance sensing [thru-beam type: 2 m 6.562 ft, retro-reflective type: 200 mm 7.874 in (when using the attached reflector), diffuse reflective type: 160 mm 6.299 in], despite its miniature size.
Hence, it is usable even on a wide conveyor.

Thru-beam type

Retroreflective type

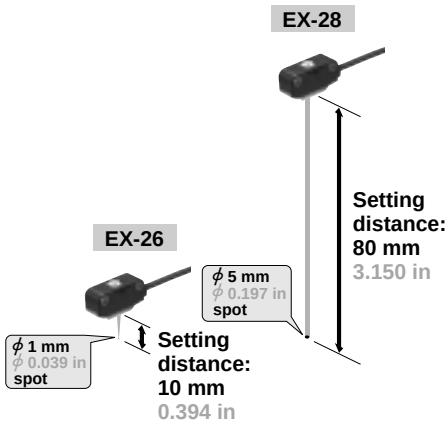


Diffuse reflective type



Clear beam spot using 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.



Bright 2-color indicator

A bright 2-color indicator (orange, green LED) has been incorporated in all types.

Waterproof

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

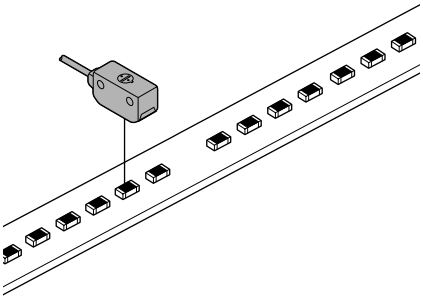
Note: However, take care that if it is exposed to water splashes during operation, it may detect a water drop itself.

Globally usable

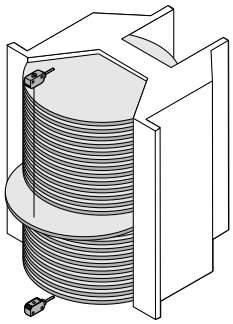
PNP output type, which is much in demand in Europe, is also available.
Of course, it conforms to the EMC Directive and approved UL Recognition (excluding 5 m 16.404 ft cable length type).

APPLICATIONS

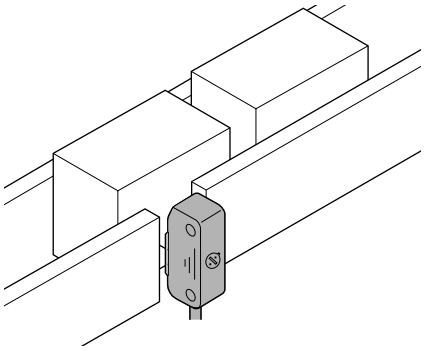
Detecting chip components



Checking protrusion of wafer



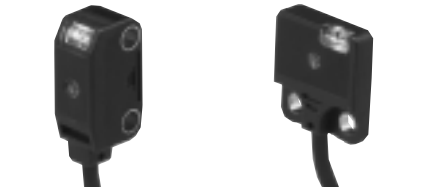
Sensing objects from an opening



Two types for suitable mounting

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

Side sensing type **Front sensing type**

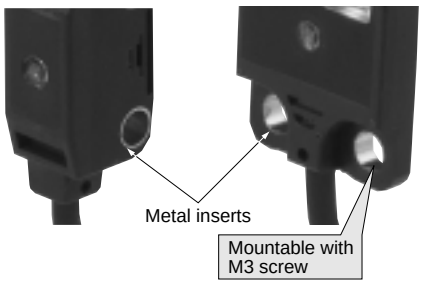


(With sensitivity adjuster) (Without sensitivity adjuster)

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.

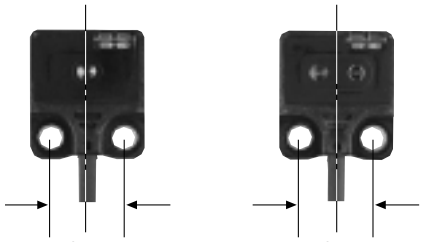
Side sensing type **Front sensing type**



Identical size

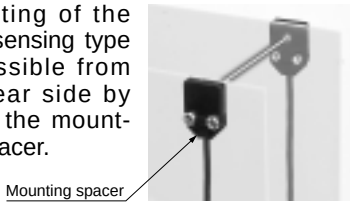
Front sensing type of thru-beam type and diffuse reflective type sensors have identical appearance. Moreover, since the mounting holes are symmetrical with respect to the beam axis center, the design becomes easy.

Thru-beam type **Diffuse reflective type**



Mounting spacer for front sensing type is available

Mounting of the front sensing type is possible from the rear side by using the mounting spacer.

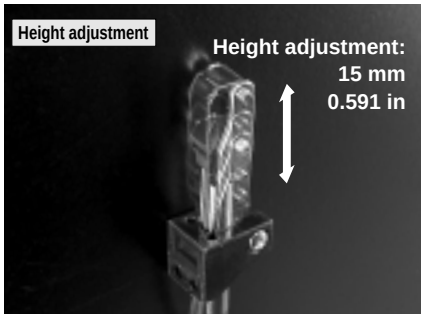


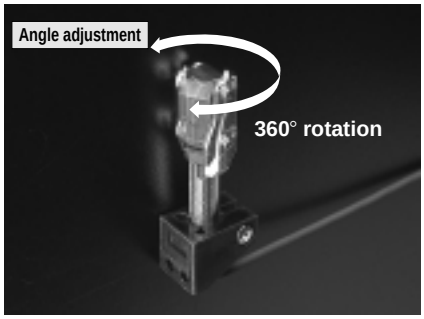
Slit mask is available

ϕ0.5 mm ϕ0.020 in round slit mask and 0.5×3 mm 0.020×0.118 in rectangular slit mask are available for both side sensing type and front sensing type sensors.

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.





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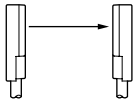
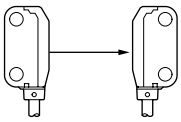
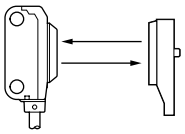
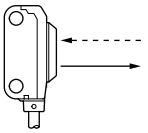
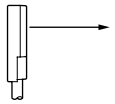
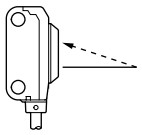
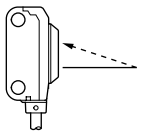
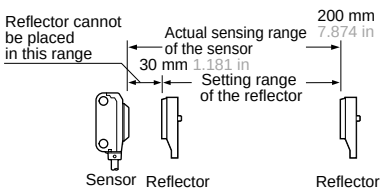
ORDER GUIDE

Type		Appearance	Sensing range	Model No.	Output	Output operation
Thru-beam	Front sensing		1 m 3.281 ft	**EX-21A**	NPN open-collector transistor	Light-ON
				EX-21A-PN	PNP open-collector transistor	
				EX-21B	NPN open-collector transistor	Dark-ON
				EX-21B-PN	PNP open-collector transistor	
	Side sensing		2 m 6.562 ft	**EX-23**	NPN open-collector transistor	Switchable either Light-ON or Dark-ON
				EX-23-PN	PNP open-collector transistor	
Retroreflective	Side sensing		30 to 200 mm 1.181 to 7.874 in (Note 1)	**EX-29A**	NPN open-collector transistor	Light-ON
				EX-29A-PN	PNP open-collector transistor	
				EX-29B	NPN open-collector transistor	Dark-ON
				EX-29B-PN	PNP open-collector transistor	
Diffuse reflective	Side sensing		5 to 160 mm 0.197 to 6.299 in (Note 2)	**EX-22A**	NPN open-collector transistor	Light-ON
				EX-22A-PN	PNP open-collector transistor	
				EX-22B	NPN open-collector transistor	Dark-ON
				EX-22B-PN	PNP open-collector transistor	
Convergent reflective — Diffused beam type	Front sensing		2 to 25 mm 0.079 to 0.984 in (Convergent point: 10 mm 0.394 in)	**EX-24A**	NPN open-collector transistor	Light-ON
				EX-24A-PN	PNP open-collector transistor	
				EX-24B	NPN open-collector transistor	Dark-ON
				EX-24B-PN	PNP open-collector transistor	
Convergent reflective — Small spot beam type	Side sensing		6 to 14 mm 0.236 to 0.551 in (Convergent point: 10 mm 0.394 in)	**EX-26A**	NPN open-collector transistor	Light-ON
				EX-26A-PN	PNP open-collector transistor	
				EX-26B	NPN open-collector transistor	Dark-ON
				EX-26B-PN	PNP open-collector transistor	
Narrow-view reflective — Long distance spot beam type	Side sensing		45 to 115 mm 1.772 to 4.528 in	**EX-28A**	NPN open-collector transistor	Light-ON
				EX-28A-PN	PNP open-collector transistor	
				EX-28B	NPN open-collector transistor	Dark-ON
				EX-28B-PN	PNP open-collector transistor	

NOTE: Mounting bracket is not supplied with the sensor. Please select from the range of optional sensor mounting brackets (four types).

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 30 mm 1.181 in away.
However, if the reflector is set 100 mm 3.937 in or less away, the sensing object should be opaque.
2) In case of using this product at a sensing range of 50 mm 1.969 in or less, take care that the sensitivity adjustment range becomes extremely narrow.



ORDER GUIDE

Without reflector type and 5 m 16.404 ft cable length type

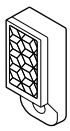
Without reflector type and 5 m 16.404 ft cable length type (standard: 2 m 6.562 ft) are also available.

• Table of Model Nos.

Type				Standard	Without reflector type	5 m 16.404 ft cable length type	Without reflector & 5 m 16.404 ft cable length type
NPN output	Thru-beam	Front sensing		**EX-21A**	—	**EX-21A-C5**	—
				EX-21B	—	**EX-21B-C5**	—
		Side sensing		**EX-23**	—	**EX-23-C5**	—
	Retroreflective	Side sensing		**EX-29A**	**EX-29A-Y**	**EX-29A-C5**	**EX-29A-Y-C5**
				EX-29B	**EX-29B-Y**	**EX-29B-C5**	**EX-29B-Y-C5**
	Diffuse reflective	Side sensing		**EX-22A**	—	**EX-22A-C5**	—
				EX-22B	—	**EX-22B-C5**	—
	Convergent reflective	Diffused beam type	Front sensing	**EX-24A**	—	**EX-24A-C5**	—
				EX-24B	—	**EX-24B-C5**	—
		Small spot beam type	Side sensing	**EX-26A**	—	**EX-26A-C5**	—
				EX-26B	—	**EX-26B-C5**	—
	Narrow-view reflective	Long distance spot beam type	Side sensing	**EX-28A**	—	**EX-28A-C5**	—
				EX-28B	—	**EX-28B-C5**	—
PNP output	Thru-beam	Front sensing		**EX-21A-PN**	—	—	—
				EX-21B-PN	—	—	—
		Side sensing		**EX-23-PN**	—	—	—
	Retroreflective	Side sensing		**EX-29A-PN**	**EX-29A-PN-Y**	—	—
				EX-29B-PN	**EX-29B-PN-Y**	—	—
	Diffuse reflective	Side sensing		**EX-22A-PN**	—	—	—
				EX-22B-PN	—	—	—
	Convergent reflective	Diffused beam type	Front sensing	**EX-24A-PN**	—	—	—
				EX-24B-PN	—	—	—
		Small spot beam type	Side sensing	**EX-26A-PN**	—	—	—
				EX-26B-PN	—	—	—
	Narrow-view reflective	Long distance spot beam type	Side sensing	**EX-28A-PN**	—	—	—
				EX-28B-PN	—	—	—

Accessory

• **RF-200** (Reflector)



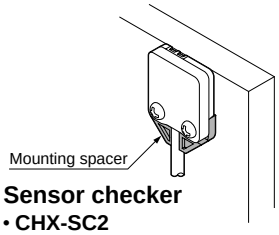
EX-20

OPTIONS

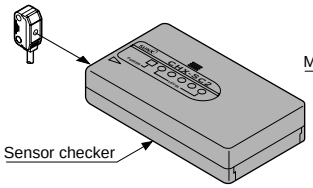
Designation		Model No.	Description	
Round slit mask (For thru-beam type sensor only)	For front sensing type	**OS-EX20-05** (Slit size ϕ0.5 mm 0.020 in)	Slit on one side	• Sensing range: 200 mm 7.874 in • Min. sensing object: ϕ2.6 mm ϕ0.102 in
			Slit on both sides	• Sensing range: 40 mm 1.575 in • Min. sensing object: ϕ0.5 mm ϕ0.020 in
	For side sensing type	**OS-EX20E-05** (Slit size ϕ0.5 mm 0.020 in)	Slit on one side	• Sensing range: 350 mm 13.780 in • Min. sensing object: ϕ3 mm ϕ0.118 in
			Slit on both sides	• Sensing range: 70 mm 2.756 in • Min. sensing object: ϕ0. 5mm ϕ0.020 in
Rectangular slit mask (For thru-beam type sensor only)	For front sensing type	**OS-EX20-05×3** (Slit size 0.5×3 mm 0.020×0.118 in)	Slit on one side	• Sensing range: 600 mm 23.622 in • Min. sensing object: ϕ2.6 mm ϕ0.102 in
			Slit on both sides	• Sensing range: 300 mm 11.811 in • Min. sensing object: 0.5×3 mm 0.020×0.118 in
	For side sensing type	**OS-EX20E-05×3** (Slit size 0.5×3 mm 0.020×0.118 in)	Slit on one side	• Sensing range: 800 mm 31.496 in • Min. sensing object: ϕ3 mm ϕ0.118 in
			Slit on both sides	• Sensing range: 400 mm 15.748 in • Min. sensing object: 0.5×3 mm 0.020×0.118 in
Reflector (For retroreflective type sensor only)		**RF-210**	• Sensing range: 50 to 400 mm 1.969 to 15.748 in • Min. sensing object: ϕ30 mm ϕ1.181 in	
Reflector mounting bracket		**MS-RF21-1**	Protective mounting bracket for **RF-210** It protects the reflector from damage and maintains alignment.	
Reflective tape (For retroreflective type sensor only)		**RF-11**	• Ambient temperature: −25 to +50 °C −13 to +122 °F • Ambient humidity: 35 to 85 % RH Notes: i) Keep the tape free from 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: 70 to 200 mm 2.756 to 7.874 in
		RF-12		• Sensing range: 60 to 280 mm 2.362 to 11.024 in
Sensor mounting bracket		**MS-EX20-1**	Back angled mounting bracket for front sensing type sensor (The thru-beam type sensor needs two brackets.)	
		MS-EX20-2	Foot angled mounting bracket for side sensing type sensor (The thru-beam type sensor needs two brackets.)	
		MS-EX20-3	L-shaped mounting bracket for front sensing type sensor (The thru-beam type sensor needs two brackets.)	
		MS-EX20-4	Back angled mounting bracket for side sensing type sensor (The thru-beam type sensor needs two brackets.)	
Universal sensor mounting bracket [For **EX-23**□ only]		**MS-EX20-5**	It can adjust the height and the angle of the sensor. (Two brackets are needed.)	
Mounting spacer (For front sensing type sensor only)		**MS-EX20-FS**	It is used when mounting the front sensing type from the rear side. (One set consists of 10 pcs.)	
Sensor checker (Note)		**CHX-SC2**	It is useful for beam alignment of thru-beam type sensors. The optimum receiver position is given by indicators, as well as an audio signal.	

Note: Refer to p.414～ for details of the sensor checker **CHX-SC2**.

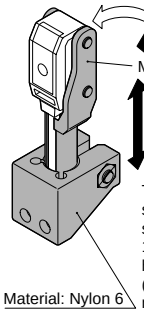
Mounting spacer
• **MS-EX20-FS**



Sensor checker
• **CHX-SC2**



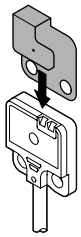
Universal sensor mounting bracket
• **MS-EX20-5**



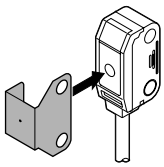
Two M3 (length 12 mm 0.472 in) screws with washers [stainless steel (SUS304)], one M3 (length 10 mm 0.394 in) hexagon-socket-head bolt [stainless steel (SUS304)], and one M3 hexagon nut [stainless steel (SUS304)] are attached.

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

• **OS-EX20-05**

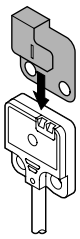


• **OS-EX20E-05**

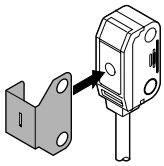


Rectangular slit mask
Fitted on the front face of the sensor with one-touch.

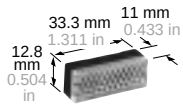
• **OS-EX20-05×3**



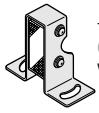
• **OS-EX20E-05×3**



Reflector
• **RF-210**

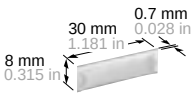


Reflector mounting bracket
• **MS-RF21-1**

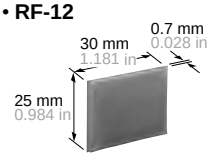


Two M3 (length 12 mm 0.472 in) screws with washers are attached.

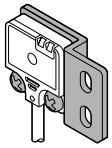
Reflective tape
• **RF-11**



• **RF-12**

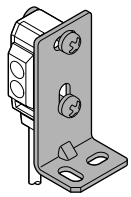


Sensor mounting bracket
• **MS-EX20-1**



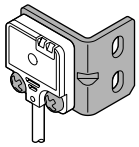
Material: Stainless steel (SUS304)
Two M3 (length 5 mm 0.197 in) pan head screws [stainless steel (SUS304)] are attached.

• **MS-EX20-2**



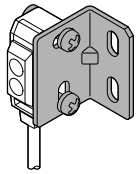
Material: Stainless steel (SUS304)
Two M3 (length 14 mm 0.551 in) screws with washers [stainless steel (SUS304)] are attached.

• **MS-EX20-3**



Material: Stainless steel (SUS304)
Two M3 (length 5 mm 0.197 in) pan head screws [stainless steel (SUS304)] are attached.

• **MS-EX20-4**

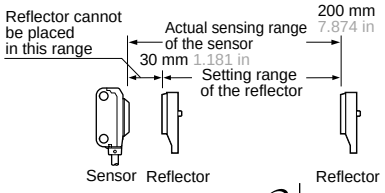


Material: Stainless steel (SUS304)
Two M3 (length 14 mm 0.551 in) screws with washers [stainless steel (SUS304)] are attached.

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			1 m 3.281 ft	2 m 6.562 ft	30 to 200 mm 1.181 to 7.874 in (Note 3)	5 to 160 mm 0.197 to 6.299 in (Note 4) with white non-glossy paper (200 × 200 mm) (7.874 × 7.874 in)	2 to 25 mm 0.079 to 0.984 in (Conv. point: 10 mm 0.394 in) with white non-glossy paper (50 × 50 mm) (1.969 × 1.969 in)	6 to 14 mm 0.236 to 0.551 in (Conv. point: 10 mm 0.394 in) with white non-glossy paper (50 × 50 mm 1.969 × 1.969 in), spot diameter φ1 mm φ0.039 in with setting distance 10 mm 0.394 in	45 to 115 mm 1.772 to 4.528 in with white non-glossy paper (100 × 100 mm 3.937 × 3.937 in), spot diameter φ5 mm φ0.197 in with setting distance 80 mm 3.150 in
Sensing object			Min. φ2.6 mm φ0.102 in opaque object (Setting distance between emitter and receiver: 1 m 3.281 ft)	Min. φ3 mm φ0.118 in opaque object (Setting distance between emitter and receiver: 2 m 6.562 ft)	φ15 mm φ0.591 in or more opaque or translucent object (Note 3)	Opaque, translucent or transparent object	Min. φ0.1 mm φ0.004 in copper wire (Setting distance: 10 mm 0.394 in)	Min. φ0.1 mm φ0.004 in copper wire (Setting distance: 10 mm 0.394 in)	Opaque, translucent or transparent object (Min. φ1 mm φ0.039 in copper wire at setting distance 80 mm 3.150 in)
Hysteresis			———			15 % or less of operation distance			
Repeatability (perpendicular to sensing axis)			0.05 mm 0.002 in or less		0.5 mm 0.020 in or less	0.3 mm 0.012 in or less	0.1 mm 0.004 in or less (Setting distance: 10 mm 0.394 in)	0.05 mm 0.002 in or less (Setting distance: 10 mm 0.394 in)	0.3 mm 0.012 in or less
Supply voltage			12 to 24 V DC ± 10 % Ripple P-P 10 % or less						
Current consumption			Emitter: 10 mA or less, Receiver: 15 mA or less		20 mA or less				
Output			<NPN output type> NPN open-collector transistor • Maximum sink current: 50 mA • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 1 V or less (at 50 mA sink current) 0.4 V or less (at 16 mA sink current)		<PNP output type> PNP open-collector transistor • Maximum source current: 50 mA • Applied voltage: 30 V DC or less (between output and + V) • Residual voltage: 1 V or less (at 50 mA source current) 0.4 V or less (at 16 mA source current)				
	Utilization category		DC-12 or DC-13						
	Short-circuit protection		Incorporated						
Response time			0.5 ms 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	
Operation mode switch			———	Located on the receiver	———				
Environmental resistance	Pollution degree		3 (Industrial environment)						
	Protection		IP67 (IEC)						
	Ambient temperature		− 25 to + 55 °C − 13 to + 131 °F (No dew condensation or icing allowed), Storage: − 30 to + 70 °C − 22 to + 158 °F						
	Ambient humidity		35 to 85 % RH, Storage: 35 to 85 % RH						
	Ambient illuminance		Sunlight: 10,000 ℓx at the light-receiving face, Incandescent light: 3,000 ℓx at the light-receiving face						
	EMC		EN 50081-2, EN 50082-2, EN 60947-5-2						
	Voltage withstandability		1,000 V AC for one min. between all supply terminals connected together and enclosure						
	Insulation resistance		20 MΩ, or more, with 250 V DC megger between all supply terminals connected together and enclosure						
	Vibration resistance		10 to 500 Hz frequency, 3 mm 0.118 in amplitude (20 G max.) in X, Y and Z directions for two hours each						
	Shock resistance		500 m/s² acceleration (50 G approx.) in X, Y and Z directions for three times each						
Emitting element			Red LED (modulated)						
Material			Enclosure: Polyethylene terephthalate, Lens: Polyalylate						
Cable			0.1 mm² 3-core (thru-beam type sensor emitter: 2-core) cabtyre cable, 2 m 6.562 ft long						
Cable extension			Extension up to total 50 m 164.042 ft is possible with 0.3 mm², or more, cable (thru-beam type: both emitter and receiver).						
Weight			Emitter: 20 g approx., Receiver: 20 g approx.		20 g approx.				
Accessories			———	Adjusting screwdriver: 1 pc.	**RF-200** (Reflector): 1 pc. Adjusting screwdriver: 1 pc.	Adjusting screwdriver: 1 pc.	———	Adjusting screwdriver: 1 pc.	

Notes: 1) Model Nos. having the suffix '**-PN**' are PNP output type.
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 30 mm 1.181 in away. However, if the reflector is set 100 mm 3.937 in or less away, the sensing object should be opaque.
4) In case of using this product at a sensing range of 50 mm 1.969 in or less, take care that the sensitivity adjustment range becomes extremely narrow.

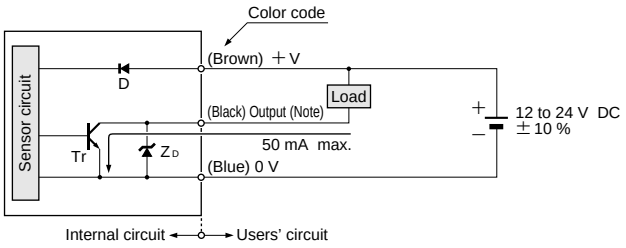


EX-20

I/O CIRCUIT AND WIRING DIAGRAMS

NPN output type

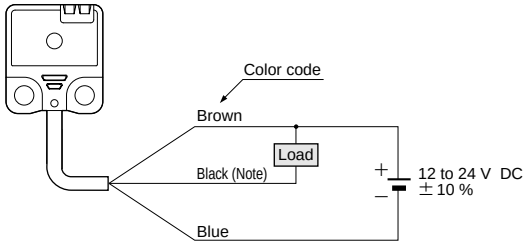
I/O circuit diagram



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

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

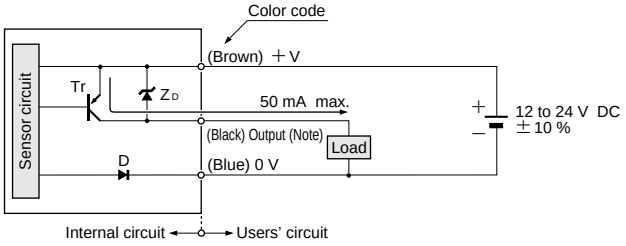
Wiring diagram



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

PNP output type

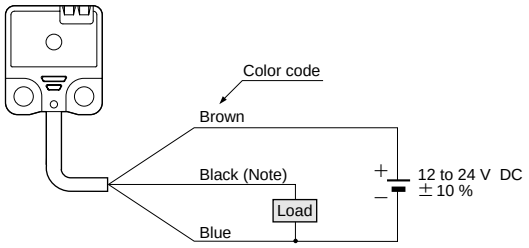
I/O circuit diagram



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

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

Wiring diagram

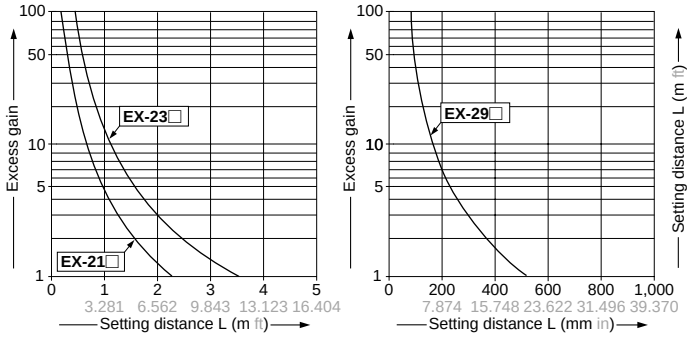


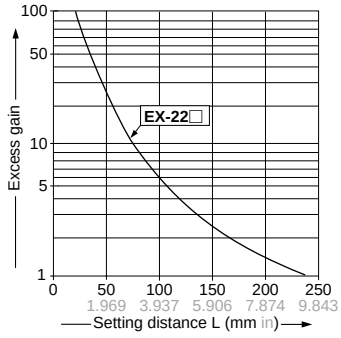
Note: The emitter of the thru-beam type sensor does not incorporate the black wire.

SENSING CHARACTERISTICS (TYPICAL)

EX-21□ EX-23□ EX-29□ EX-22□

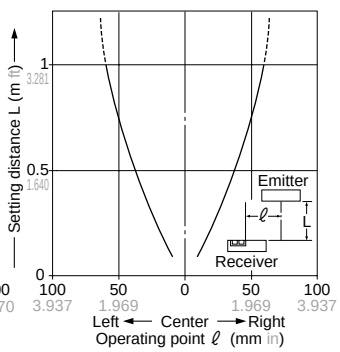
Correlation between setting distance and excess gain



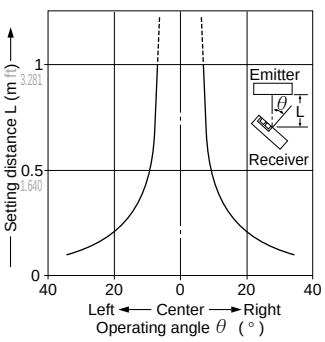


EX-21□ Thru-beam type

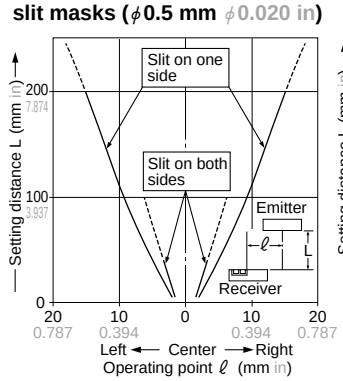
Parallel deviation



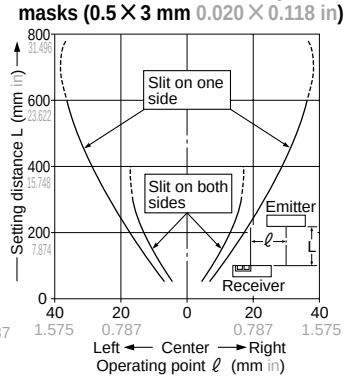
Angular deviation



Parallel deviation with round slit masks (ϕ0.5 mm ϕ0.020 in)



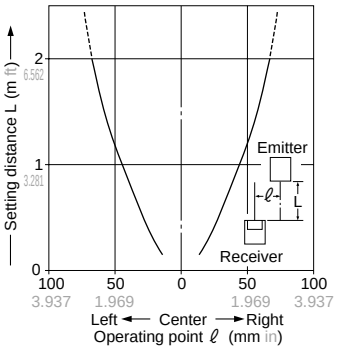
Parallel deviation with rectangular slit masks (0.5 × 3 mm 0.020 × 0.118 in)



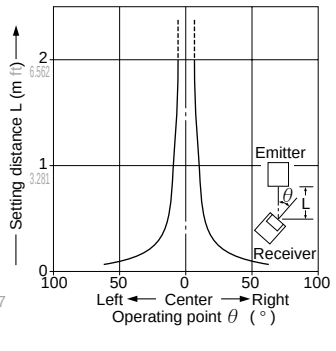
SENSING CHARACTERISTICS (TYPICAL)

EX-23□ Thru-beam type

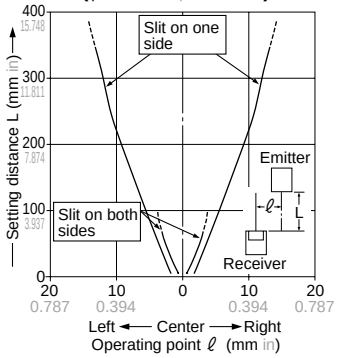
Parallel deviation



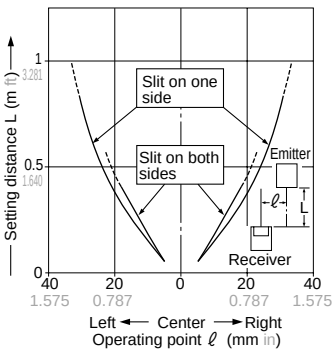
Angular deviation



Parallel deviation with round slit masks (ϕ0.5 mm ϕ0.020 in)

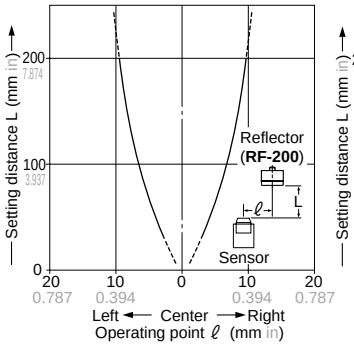


Parallel deviation with rectangular slit masks (0.5×3 mm 0.020×0.118 in)

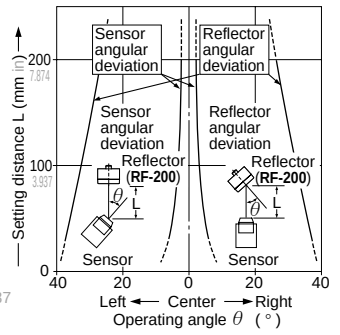


EX-29□ Retroreflective type

Parallel deviation

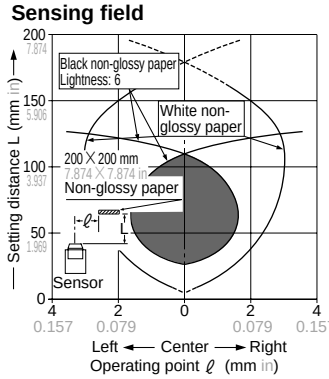


Angular deviation

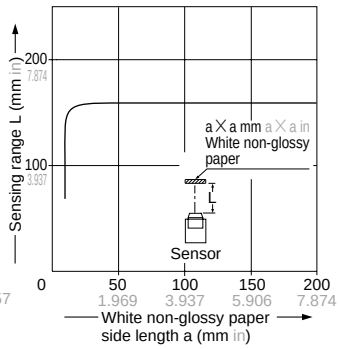


EX-22□ Diffuse reflective type

Sensing field



Correlation between sensing object size and sensing range

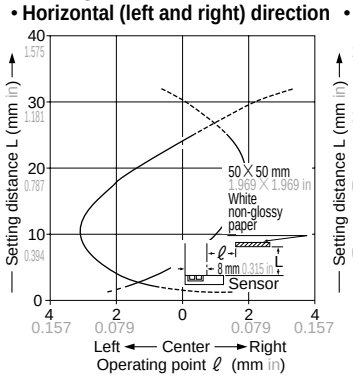


As the sensing object size becomes smaller than the standard size (white non-glossy paper 200×200 mm 7.874×7.874 in), the sensing range shortens, as shown in the left graph.

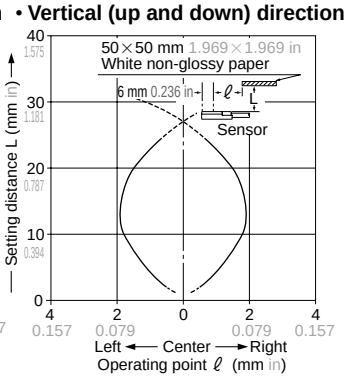
EX-24□ Convergent reflective type

Sensing fields

• Horizontal (left and right) direction



• Vertical (up and down) direction

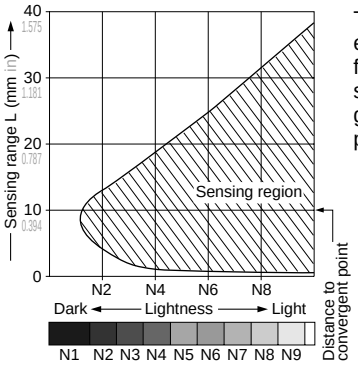


EX-20

SENSING CHARACTERISTICS (TYPICAL)

EX-24□ Convergent reflective type

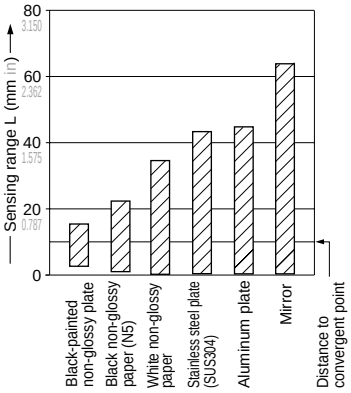
Correlation between lightness and sensing range



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 × 50 mm 1.969 × 1.969 in) and sensing range

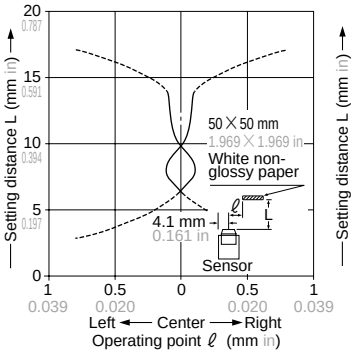


The bars in the graph indicate the sensing range for the respective material. However, there is a slight variation in the sensing range depending on the product. Further, if there is a reflective object (conveyor, etc.) in the background of the sensing object, since it affects the sensing, separate it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

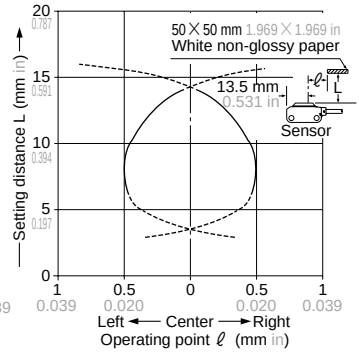
EX-26□ Convergent reflective type

Sensing field

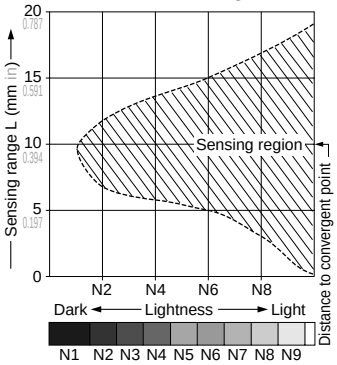
• Horizontal (left and right) direction



• Vertical (up and down) direction



Correlation between lightness and sensing range

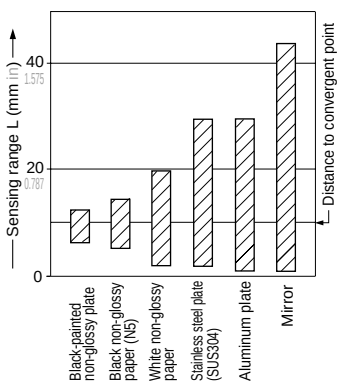


The sensing region is represented by oblique lines in the left figure. However, the sensitivity should be set with enough margin because of slight variation in products.

(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 × 50 mm 1.969 × 1.969 in) and sensing range

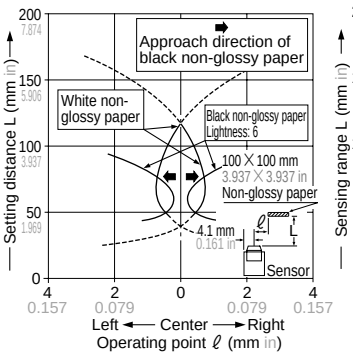


The bars in the graph indicate the sensing range for the respective material. However, there is a slight variation in the sensing range depending on the product. Further, if there is a reflective object (conveyor, etc.) in the background of the sensing object, since it affects the sensing, separate it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

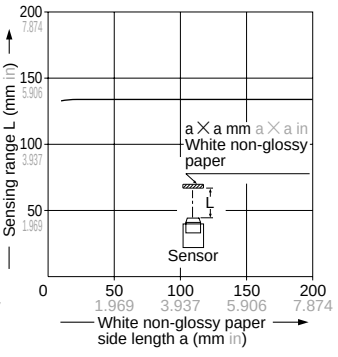
(The graph is drawn for the maximum sensitivity setting.)

EX-28□ Narrow-view reflective type

Sensing field



Correlation between sensing object size and sensing range



As the sensing object size becomes smaller than the standard size (white non-glossy paper 100 × 100 mm 3.937 × 3.937 in), the sensing range shortens, as shown in the left graph.

PRECAUTIONS FOR PROPER USE

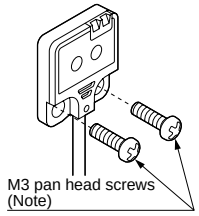
Refer to p.1135～ for general precautions.

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.

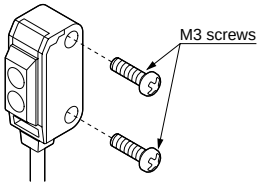
Mounting

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

Front sensing



Side sensing

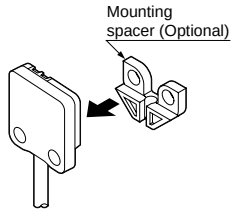


Note: When mounting the front sensing type sensor, use M3 pan head screws without washers, etc.

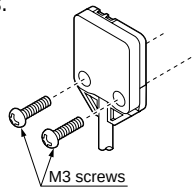
• When mounting the front sensing type from the backside, fit the mounting spacer (**MS-EX20-FS**) and fix with screws.

Mounting method

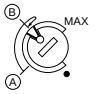
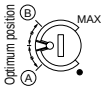
① Fit the mounting spacer on the sensor.



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



Sensitivity adjustment (side sensing type only)

Step	Sensitivity adjuster	Description
①		Turn the sensitivity adjuster fully counterclockwise 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 attached 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 50 mm 1.969 in or less, take care that the sensitivity adjustment range becomes extremely narrow.

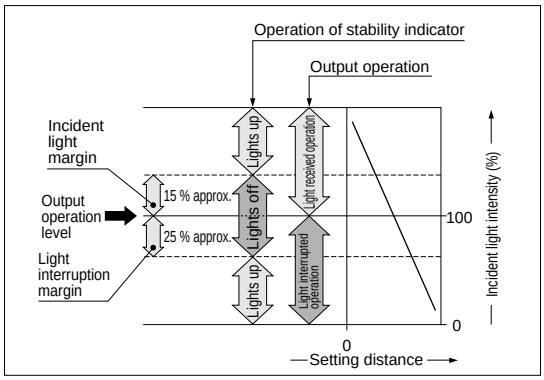
Operation mode switch (EX-23□ only)

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

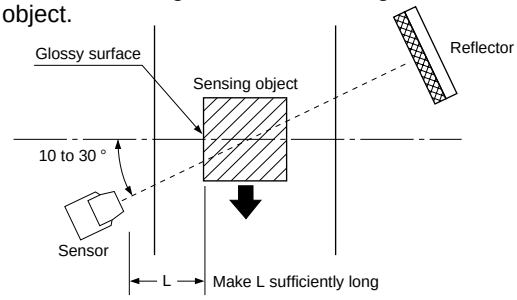
Stability indicator

• The stability indicator (green) lights up when the incident 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.



Glossy object sensing [EX-29□(-PN)]

• Please take care of the following points when detecting materials having a gloss.
① Make L, shown in the diagram, sufficiently long.
② Install at an angle of 10 to 30 degrees to the sensing object.



Wiring

• Make sure that the power supply is off while wiring.
• 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.

Others

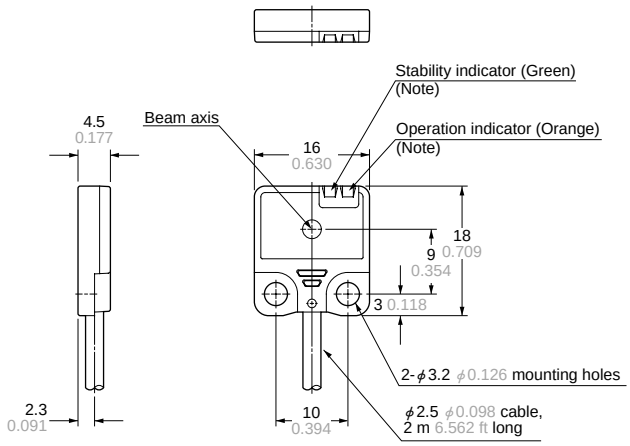
• Do not use during the initial transient time (50 ms) after the power supply is switched on.
• If sensors are mounted close together and the ambient temperature is near the maximum rated value, provide for enough heat radiation / ventilation.
• If a reflective object is present in the background, the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

EX-20

DIMENSIONS (Unit: mm in)

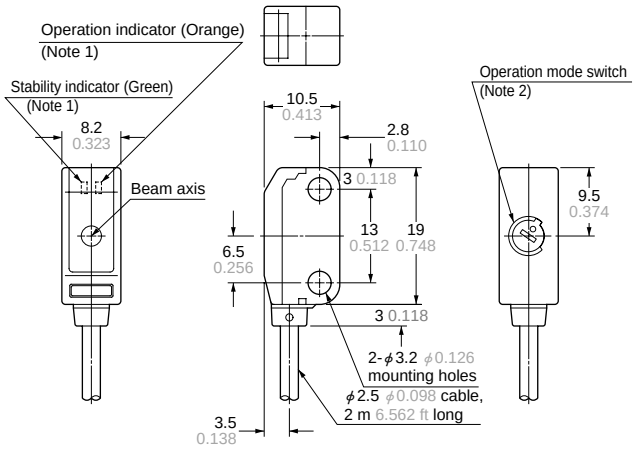
The CAD data in the dimensions can be downloaded from the SUNX website: http://www.sunx.co.jp/

EX-21□ Sensor



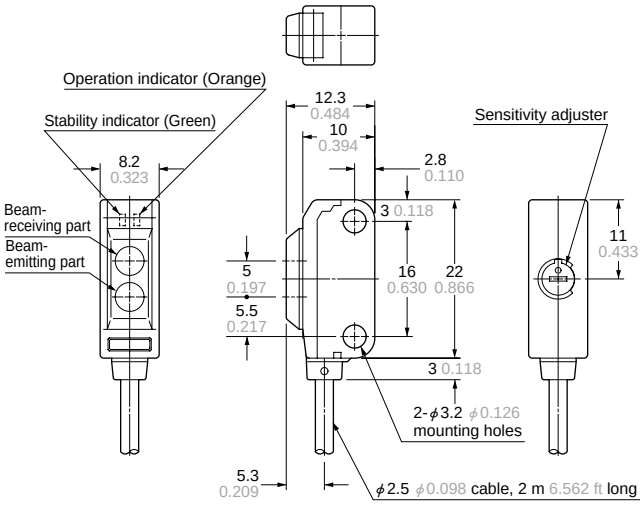
Note: Not incorporated on the emitter.

EX-23□ Sensor

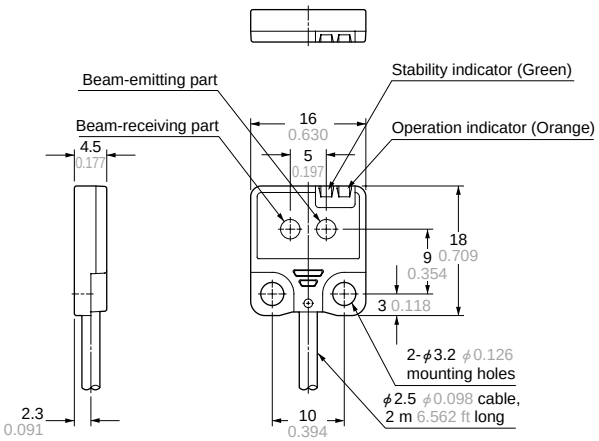


Notes: 1) Not incorporated on the emitter.
2) It is the sensitivity adjuster on the emitter.

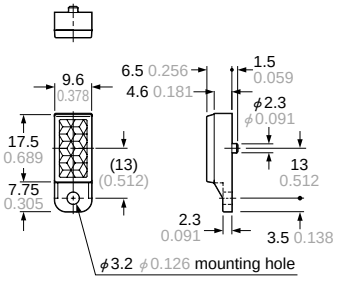
EX-29□ EX-22□ EX-26□ EX-28□ Sensor



EX-24□ Sensor

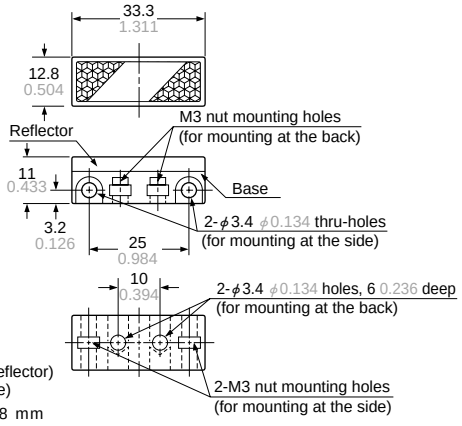


RF-200 Reflector (Accessory for the retroreflective type sensor)



Material: Acrylic (Reflector)
ABS (Base)

RF-210 Reflector (Optional)



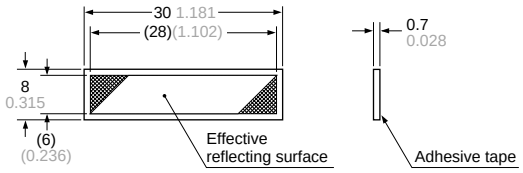
Material: Acrylic (Reflector)
ABS (Base)

Two M3 (length 8 mm 0.315 in) screws with washers and two nuts are attached.

DIMENSIONS (Unit: mm in)

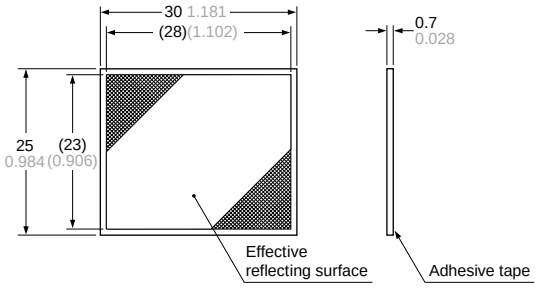
The CAD data in the dimensions can be downloaded from the SUNX website: http://www.sunx.co.jp/

RF-11 Reflective tape (Optional)



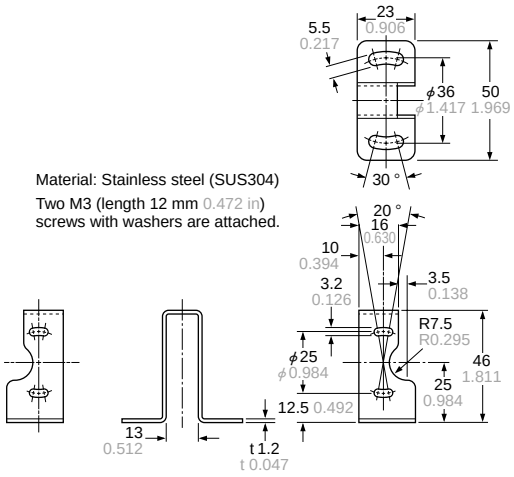
Material: Acrylic

RF-12 Reflective tape (Optional)



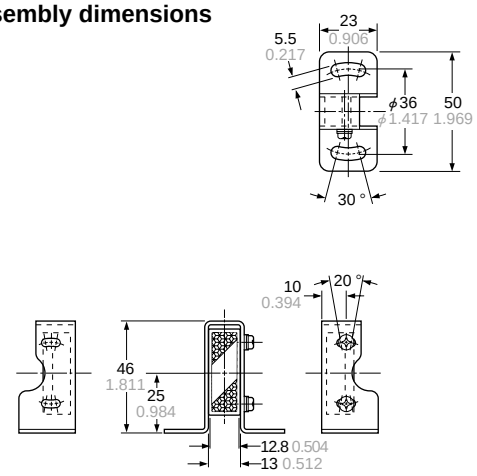
Material: Acrylic

MS-RF21-1 Reflector mounting bracket for **RF-210** (Optional)

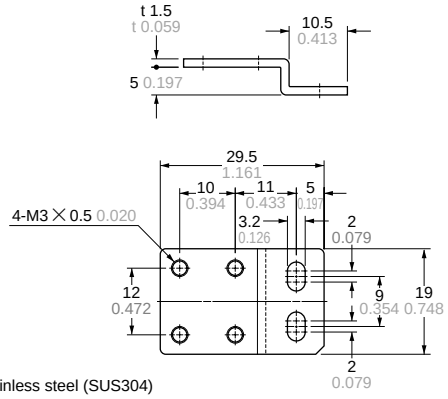


Material: Stainless steel (SUS304)
Two M3 (length 12 mm 0.472 in) screws with washers are attached.

Assembly dimensions

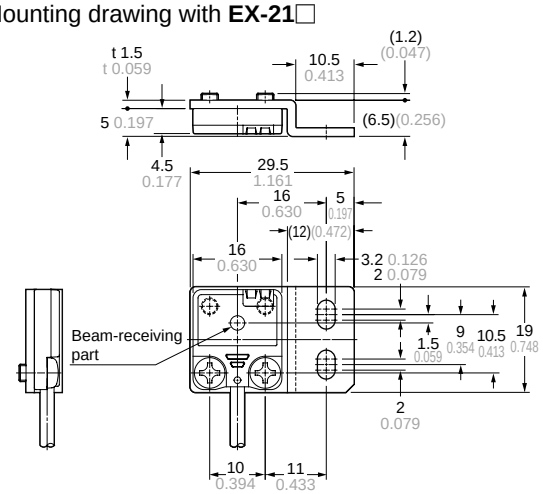


MS-EX20-1 Sensor mounting bracket (Optional)



Material: Stainless steel (SUS304)
Two M3 (length 5 mm 0.197 in) pan head screws [stainless steel (SUS304)] are attached.

Assembly dimensions
Mounting drawing with **EX-21**□

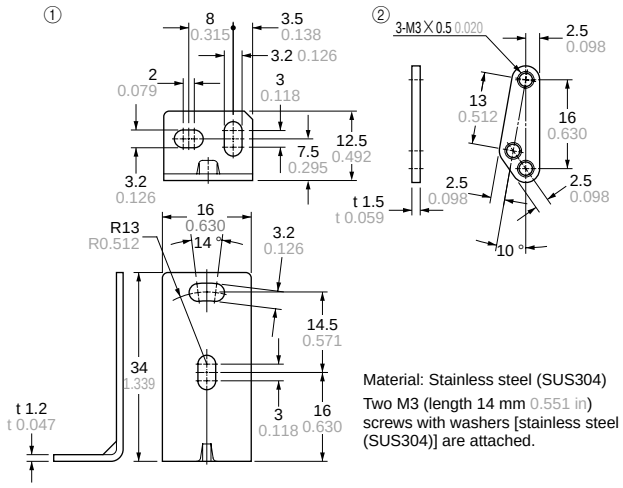


EX-20

DIMENSIONS (Unit: mm in)

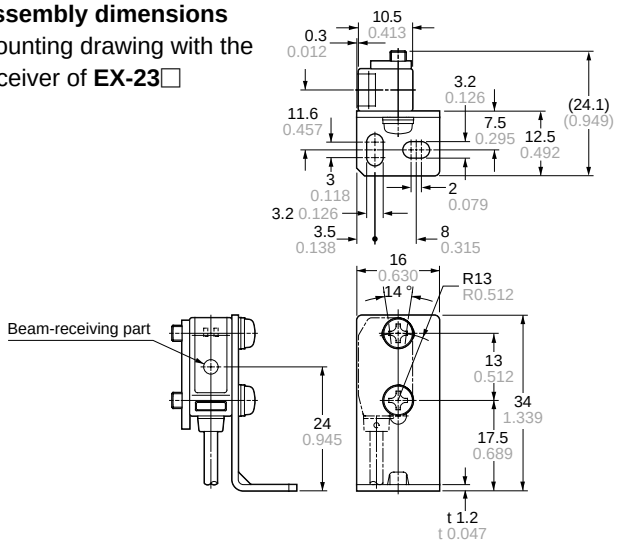
The CAD data in the dimensions can be downloaded from the SUNX website: http://www.sunx.co.jp/

MS-EX20-2 Sensor mounting bracket (Optional)

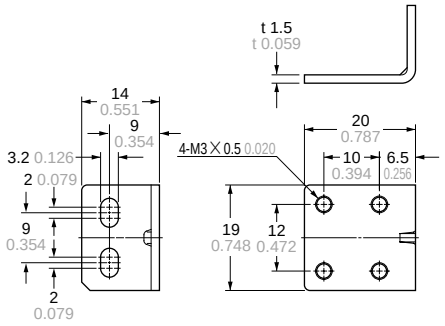


Material: Stainless steel (SUS304)
Two M3 (length 14 mm 0.551 in) screws with washers [stainless steel (SUS304)] are attached.

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

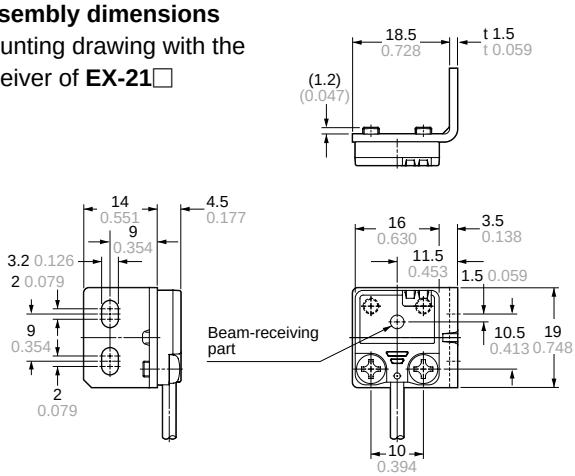


MS-EX20-3 Sensor mounting bracket (Optional)

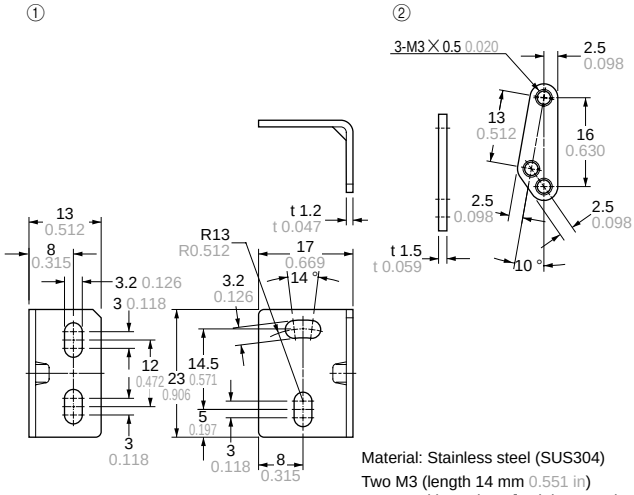


Material: Stainless steel (SUS304)
Two M3 (length 5 mm 0.197 in) pan head screws [stainless steel (SUS304)] are attached.

Assembly dimensions
Mounting drawing with the receiver of **EX-21□**

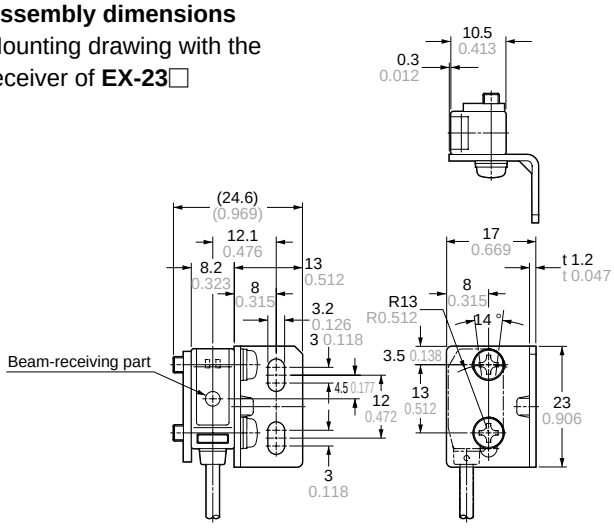


MS-EX20-4 Sensor mounting bracket (Optional)



Material: Stainless steel (SUS304)
Two M3 (length 14 mm 0.551 in) screws with washers [stainless steel (SUS304)] are attached.

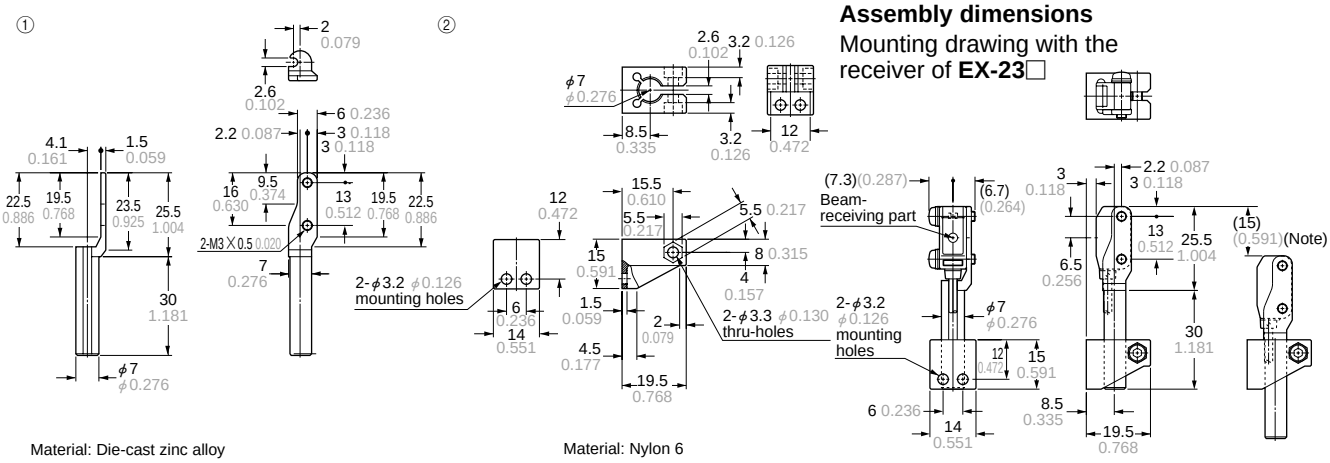
Assembly dimensions
Mounting drawing with the receiver of **EX-23□**



DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from the SUNX website: http://www.sunx.co.jp/

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



Material: Die-cast zinc alloy

Two M3 (length 12 mm 0.472 in) screws with washers [stainless steel (SUS304)], one M3 (length 10 mm 0.394 in) hexagon-socket-head bolt [stainless steel (SUS304)], and one M3 hexagon nut [stainless steel (SUS304)] are attached.

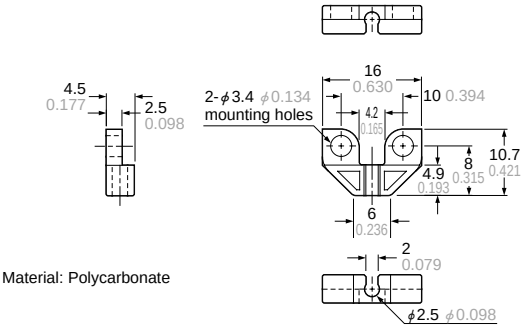
Material: Nylon 6

Assembly dimensions

Mounting drawing with the receiver of **EX-23**□

Note: This is the adjustable range of the movable part.

MS-EX20-FS Mounting spacer (Optional)



Material: Polycarbonate

Assembly dimensions

Mounting drawing with the receiver of **EX-21**□