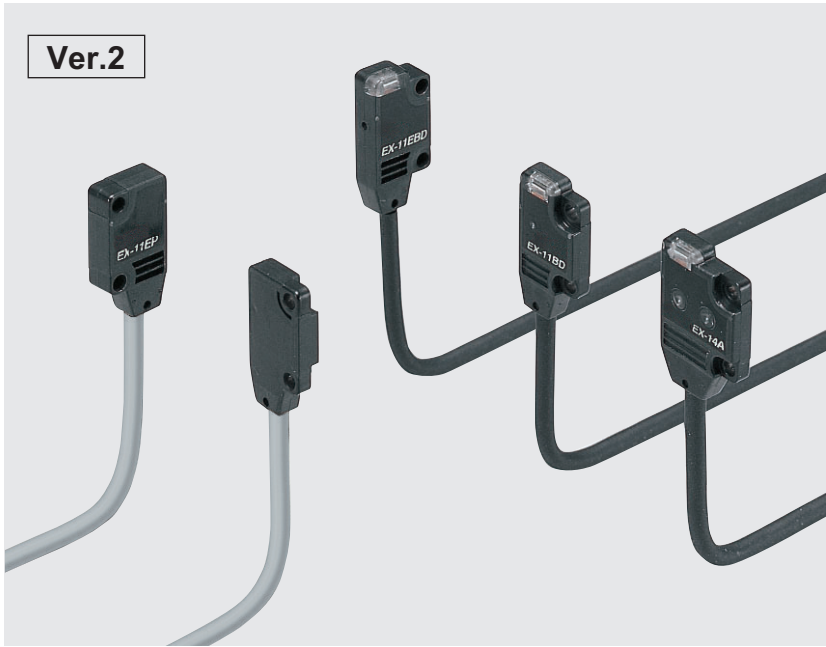
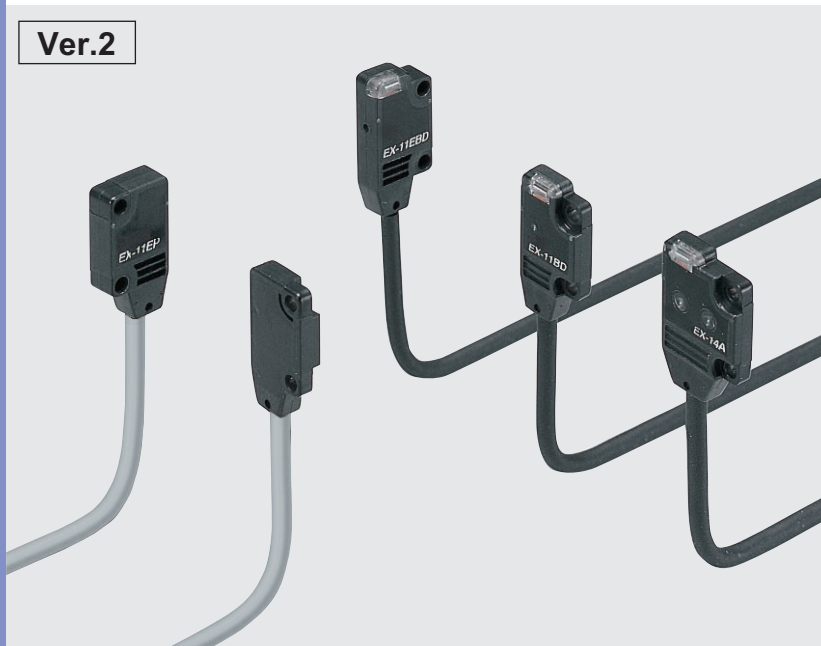


Amplifier Built-in  
**Ultra-slim Photoelectric Sensor**

**EX-10** SERIES Ver.2



# EX-10 SERIES Ver.2



Ver.2



## Amplifier built-in extraordinarily small and slim size

### Smallest body, just 3.5 mm 0.138 in thick

It can be mounted in a very small space as its size is just  $W10 \times H14.5 \times D3.5$  mm  
 $W0.394 \times H0.571 \times D0.138$  in  
 (thru-beam, front sensing type).



### Flexible mounting

The diffuse reflective type sensor is front sensing and is so thin that it gives an impression of being just pasted on the mounting base. The thru-beam type is available as front sensing type, as well as, side sensing type, allowing flexible mounting.

Thru-beam  
 • Front sensing type      • Side sensing type      Diffuse reflective  
 • Front sensing type

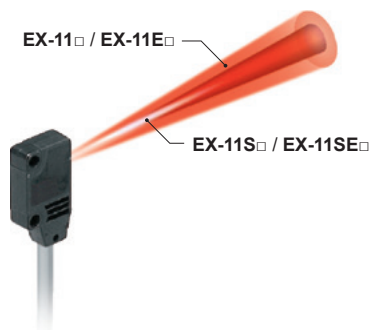


### A wide variety of narrow-beam type! Light diffusion is approx. 1/2 of standard type.

EX-□S□

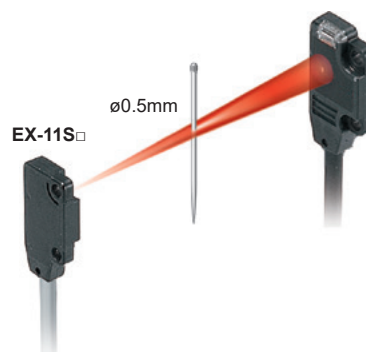
Less interference with no slit, narrow-pitch can be set.

The pitch of installation is 1/2 of conventional models, so that the close-installation is possible. No cost is necessary to purchase or install a slit.



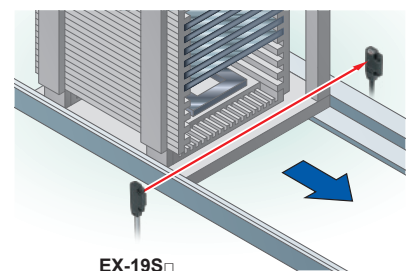
Possible to sense a minute object less than  $\varnothing 0.5$  mm  $\varnothing 0.039$  in with no slit.

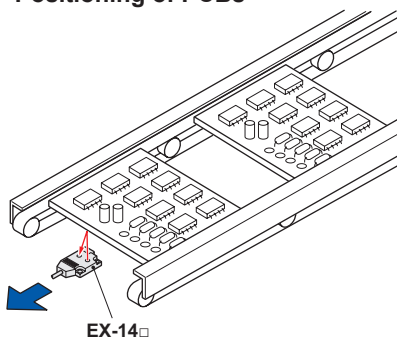
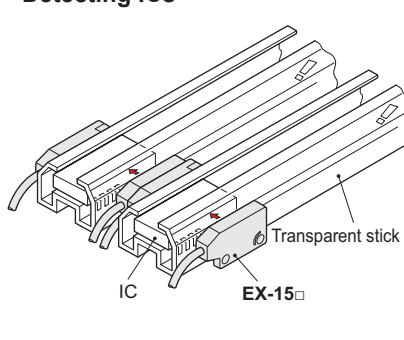
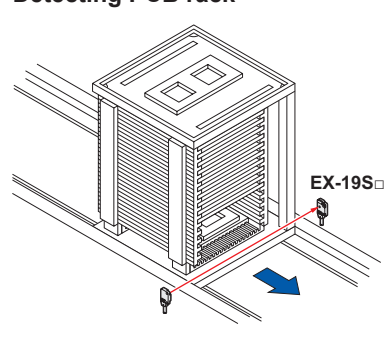
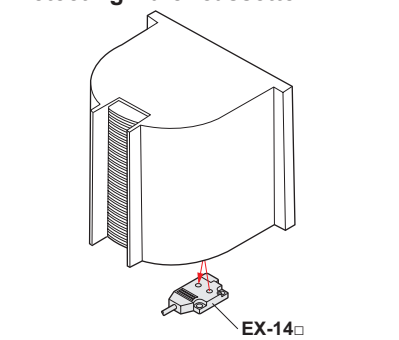
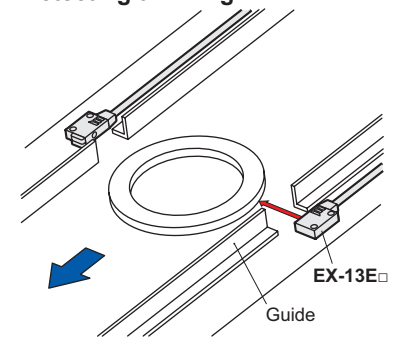
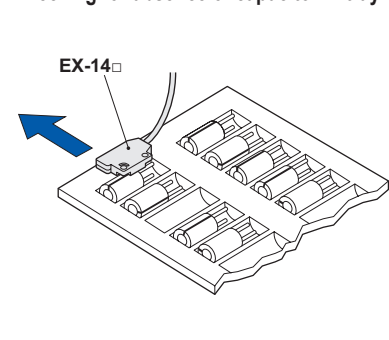
The series is applicable to sense a minute object without any cost.



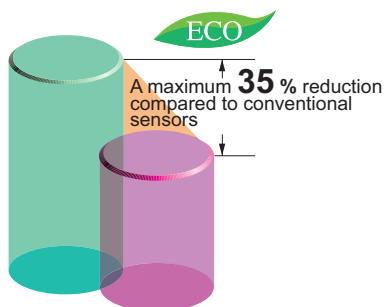
Long sensing range of 1 m 3.281 ft with narrow beam

A long 1 m 3.281 ft sensing range is possible with narrow beam.

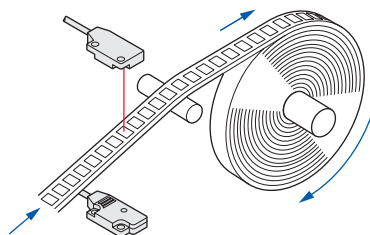


**APPLICATIONS****Positioning of PCBs****Detecting ICs****Detecting PCB rack****Detecting wafer cassette****Detecting thin ring****Checking for absence of capacitor in tray****BASIC PERFORMANCE****Electric power saving**

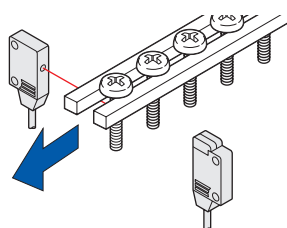
The EX-10 series achieves reductions in power consumption of up to 65%. These sensors contribute to environmental friendliness.

**High-speed response time: 0.5 ms**

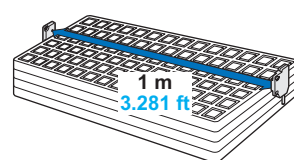
The sensor is suitable for detecting small and high-speed traveling objects.

**Minimum sensing object:  $\phi 1$  mm  $\phi 0.039$  in EX-11(E)□, EX-15(E)□**

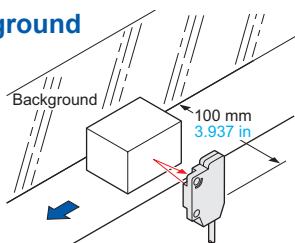
EX-11□, EX-11E□, EX-15 and EX-15E are incorporated with  $\phi 1$  mm  $\phi 0.039$  in slit masks so that  $\phi 1$  mm  $\phi 0.039$  in, or more, object can be detected. Hence, they are suitable for precise positioning or small parts detection.

**Long sensing range: 1 m 3.281 ft EX-19(E)□**

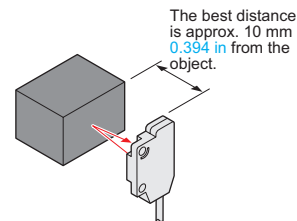
A sensing range of 1 m 3.281 ft has been realized with a slim size of just 3.5 mm 0.138 in. It can be used to detect even wide IC trays.

**Background suppression****Hardly affected by background**

Even a specular background separated by 100 mm 3.937 in, or more, is not detected. (However, the background should be directly opposite. A spherical or curved background may be detected.)

**Black object reliably detected**

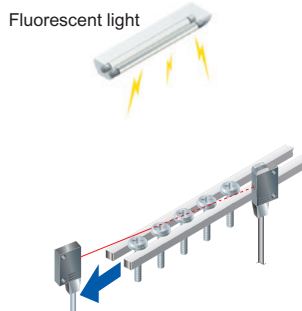
It can reliably detect dark color objects since it is convergent reflective type.

**EX-14□**

## ENVIRONMENTAL RESISTANCE

### Incorporated an inverter countermeasure circuit

The EX-10 series become significantly stronger against inverter light and other extraneous light.



### Waterproof IP67

The sensors features an IP67 rating to allow their use in process lines where water is used or splashed. Rust-resistant stainless steel sensor mounting brackets are available.

Note: If water splashes on the sensor during sensing operation, it may sense water as an object.

### Bending durability

**EX-□-R**

Bending-resistant cable type EX-□-R is available. It is most suitable for moving parts, such as robot arm, etc.

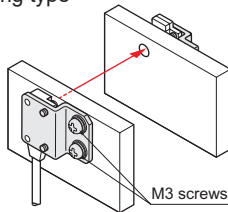
## MOUNTING / SIZE

### Mountable with M3 screws

Non-corrosive stainless steel type sensor mounting bracket is also available.

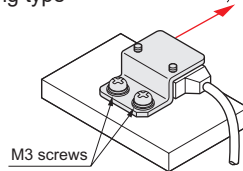
- **MS-EX10-1**  
[Cold rolled carbon steel (SPCC)]

**MS-EX10-11**  
[Stainless steel (SUS304)]  
(mounting bracket for the front sensing type)



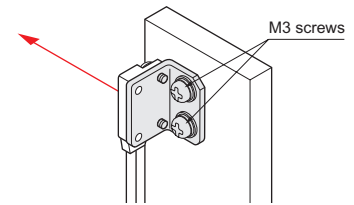
- **MS-EX10-2**  
[Cold rolled carbon steel (SPCC)]

**MS-EX10-12**  
[Stainless steel (SUS304)]  
(mounting bracket for the side sensing type)



- **MS-EX10-3**  
[Cold rolled carbon steel (SPCC)]

**MS-EX10-13**  
[Stainless steel (SUS304)]  
(L-shaped mounting bracket)



Note: Sensor mounting brackets can not be used for the narrow beam type (EX-□S□).

### Red beam makes beam alignment easy

The red LED beam projected from the emitter helps you to align the sensor heads.

## OTHERS

### Compliant with safety standards! (excluding EX-15□ / 17□ and PNP output type)

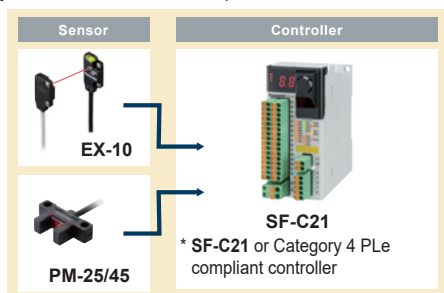
#### Sensor unit complies with Category 1 PLc.

ISO 13849-1: 2015 Safety-related parts of control systems  
Part 1: General principles for design

#### A Category 3 PLd Safety System can be built

By using Category 4 PLe compliant controllers together with our sensors. Sensor redundancy is required!

- Category 3, PLd construction example



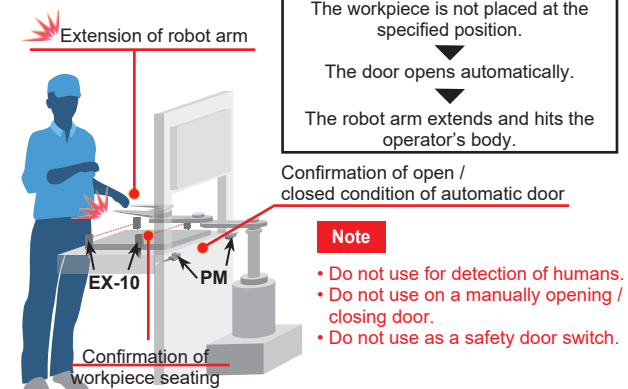
- Do not use the two outputs from PM-25/45 series unit for achieving the redundancy (duplication) of safety circuit.

\* For more information, see our website or product flyer.

Can be retrofit and installed in a very small space as a safety-standard-compliant photoelectric sensor for added safety.

Example of use: For detection of opening / closing of door in front of load port / EFEM robot

- When robot arm is the source of hazards




### Less resources used

Based on environmental considerations, simplified packaging is used in order to reduce waste. In addition, the bag is made from polyethylene which produces no toxic gases even when burned.



## ORDER GUIDE

Type	Appearance	Sensing range	Model No.(Note 2)		Output operation	Output	
			NPN output	PNP output			
Standard type	Thru-beam Front sensing <small>With operation mode switch on the bifurcation</small>	150 mm 5.906 in	EX-11A	EX-11A-PN	Light-ON	NPN open-collector transistor or PNP open-collector transistor	
			EX-11B	EX-11B-PN	Dark-ON		
		500 mm 19.685 in	EX-13A	EX-13A-PN	Light-ON		
			EX-13B	EX-13B-PN	Dark-ON		
		1 m 3.281 ft	EX-19A	EX-19A-PN	Light-ON		
			EX-19B	EX-19B-PN	Dark-ON		
	Thru-beam Side sensing <small>With operation mode switch on the bifurcation</small>	150 mm 5.906 in	EX-15	—	Switchable either Light-ON or Dark-ON		
		500 mm 19.685 in	EX-17	—	Switchable either Light-ON or Dark-ON		
		150 mm 5.906 in	EX-11EA	EX-11EA-PN	Light-ON		
			EX-11EB	EX-11EB-PN	Dark-ON		
		500 mm 19.685 in	EX-13EA	EX-13EA-PN	Light-ON		
			EX-13EB	EX-13EB-PN	Dark-ON		
	Convergent reflective (Diffused beam type) Front sensing		2 to 25 mm 0.079 to 0.984 in (Note 1) (Convergent point: 10 mm 0.394 in)	EX-14A	EX-14A-PN		Light-ON
				EX-14B	EX-14B-PN		Dark-ON
Narrow beam type	Thru-beam Front sensing	150 mm 5.906 in	EX-11SA	EX-11SA-PN	Light-ON	NPN open-collector transistor or PNP open-collector transistor	
			EX-11SB	EX-11SB-PN	Dark-ON		
		500 mm 19.685 in	EX-13SA	EX-13SA-PN	Light-ON		
			EX-13SB	EX-13SB-PN	Dark-ON		
		1 m 3.281 ft	EX-19SA	EX-19SA-PN	Light-ON		
		EX-19SB	EX-19SB-PN	Dark-ON			
	Thru-beam Side sensing	150 mm 5.906 in	EX-11SEA	EX-11SEA-PN	Light-ON		
			EX-11SEB	EX-11SEB-PN	Dark-ON		
		500 mm 19.685 in	EX-13SEA	EX-13SEA-PN	Light-ON		
			EX-13SEB	EX-13SEB-PN	Dark-ON		

**NOTE:** Mounting bracket is not supplied with the sensor. Please select from the range of optional sensor mounting brackets (MS-EX10-□). Sensor mounting brackets (MS-EX10-□) can not be used for the narrow beam type (EX-□S□).

Notes: 1) The sensor does not detect even a specular background if it is separated by 100 mm 3.937 in or more. (However, the background should be directly opposite. A spherical or curved background may be detected.)

2) The model No. with "P" shown on the label affixed to the thru-beam type sensor is the emitter, "D" shown on the label is the receiver.

### Bending-resistant cable type

Bending-resistant cable type is also available for NPN output type. (excluding narrow beam type EX-□S□ and sensor with operation mode switch on the bifurcation EX-15□/17□)

When ordering this type, suffix "-R" to the model No.

(e.g.) Bending-resistant cable type of EX-11A is "EX-11A-R".

### 5 m 16.404 ft cable length type

5 m 16.404 ft cable length type (standard: 2 m 6.562 ft) is also available for NPN output type. (excluding narrow beam type EX-□S□ and bending-resistant cable type)

When ordering this type, suffix "-C5" to the model No.

(e.g.) 5 m 16.404 ft cable length type of EX-11A is "EX-11A-C5".

## OPTIONS

NOTE: Sensor mounting brackets can not be used for the narrow beam type (EX-□S□).

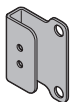
Designation	Model No.	Description
Sensor mounting bracket (Note 1)	<b>MS-EX10-1</b>	Mounting bracket for the front sensing type sensor [Cold rolled carbon steel (SPCC)] (The thru-beam type sensor needs two brackets.)
	<b>MS-EX10-2</b>	Mounting bracket for the side sensing type sensor [Cold rolled carbon steel (SPCC)] (The thru-beam type sensor needs two brackets.)
	<b>MS-EX10-3</b>	L-shaped mounting bracket sensor [Cold rolled carbon steel (SPCC)] (The thru-beam type sensor needs two brackets.)
	<b>MS-EX10-11</b>	Mounting bracket for the front sensing type sensor [Stainless steel (SUS304)] (The thru-beam type sensor needs two brackets.)
	<b>MS-EX10-12</b>	Mounting bracket for the side sensing type sensor [Stainless steel (SUS304)] (The thru-beam type sensor needs two brackets.)
	<b>MS-EX10-13</b>	L-shaped mounting bracket [Stainless steel (SUS304)] (The thru-beam type sensor needs two brackets.)
Slit mask	<b>OS-EX10-12</b> (Slit size $\phi 1.2$ mm $\phi 0.047$ in)	Slit on one side <ul style="list-style-type: none"> <li>Sensing range: 600 mm <b>23.622 in</b> [EX-19□]</li> <li>250 mm <b>9.843 in</b> [EX-13□, EX-17□]</li> <li>Min. sensing object: <math>\phi 2</math> mm <b><math>\phi 0.079</math> in</b></li> </ul>
		Slit on both sides <ul style="list-style-type: none"> <li>Sensing range: 400 mm <b>15.748 in</b> [EX-19□]</li> <li>200 mm <b>7.874 in</b> [EX-13□, EX-17□]</li> <li>Min. sensing object: <math>\phi 1.2</math> mm <b><math>\phi 0.047</math> in</b></li> </ul>
	<b>OS-EX10-15</b> (Slit size $\phi 1.5$ mm $\phi 0.059$ in)	Slit on one side <ul style="list-style-type: none"> <li>Sensing range: 800 mm <b>31.496 in</b> [EX-19□]</li> <li>350 mm <b>13.780 in</b> [EX-13□, EX-17□]</li> <li>Min. sensing object: <math>\phi 2</math> mm <b><math>\phi 0.079</math> in</b></li> </ul>
		Slit on both sides <ul style="list-style-type: none"> <li>Sensing range: 500 mm <b>19.685 in</b> [EX-19□]</li> <li>300 mm <b>11.811 in</b> [EX-13□, EX-17□]</li> <li>Min. sensing object: <math>\phi 1.5</math> mm <b><math>\phi 0.059</math> in</b></li> </ul>
	<b>OS-EX10E-12</b> (Slit size $\phi 1.2$ mm $\phi 0.047$ in)	Slit on one side <ul style="list-style-type: none"> <li>Sensing range: 400 mm <b>15.748 in</b> [EX-19E□] (Note 2)</li> <li>250 mm <b>9.843 in</b> [EX-13E□, EX-17E□]</li> <li>Min. sensing object: <math>\phi 1.2</math> mm <b><math>\phi 0.047</math> in</b> [EX-19E□] (Note 2)</li> <li><math>\phi 2</math> mm <b><math>\phi 0.079</math> in</b> [EX-13E□, EX-17E□]</li> </ul>
		Slit on both sides <ul style="list-style-type: none"> <li>Sensing range: 200 mm <b>7.874 in</b> [EX-13E□, EX-17E□]</li> <li>Min. sensing object: <math>\phi 1.2</math> mm <b><math>\phi 0.047</math> in</b></li> </ul>
Mounting screw	<b>MS-M2</b>	Mounting screws with washers (50 pcs. lot). It can mount securely as it is spring washer attached.

Notes: 1) Can not be used for the narrow beam type (EX-□S□).

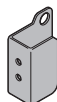
2) Since EX-19E□ has a built-in  $\phi 1$  mm  $\phi 0.039$  in slit in the emitter, be sure to mount it in the receiver.

### Slit mask

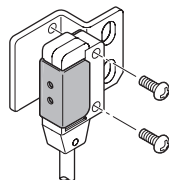
- OS-EX10-12
- OS-EX10-15



- OS-EX10E-12



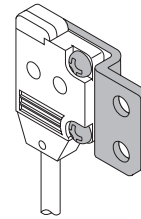
Example of mounting  
(OS-EX10E-12)



Tighten along with the sensor mounting bracket.

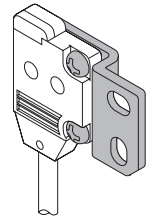
### Sensor mounting bracket

- MS-EX10-1



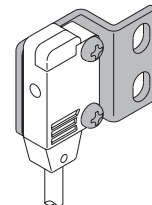
Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated)  
Two M2 (length 4 mm **0.157 in**) pan head screws are attached.

- MS-EX10-11



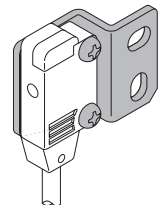
Material: Stainless steel (SUS304)  
Two M2 (length 4 mm **0.157 in**) pan head screws [stainless steel (SUS304)] are attached.

- MS-EX10-2



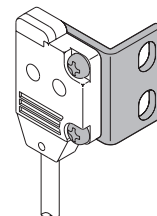
Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated)  
Two M2 (length 8 mm **0.315 in**) pan head screws are attached.

- MS-EX10-12



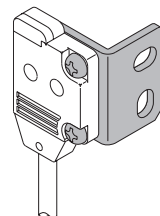
Material: Stainless steel (SUS304)  
Two M2 (length 8 mm **0.315 in**) pan head screws [stainless steel (SUS304)] are attached.

- MS-EX10-3



Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated)  
Two M2 (length 4 mm **0.157 in**) pan head screws, and two M2 (length 8 mm **0.315 in**) pan head screws are attached.

- MS-EX10-13



Material: Stainless steel (SUS304)  
Two M2 (length 4 mm **0.157 in**) pan head screws [stainless steel (SUS304)] and two M2 (length 8 mm **0.315 in**) pan head screws [stainless steel (SUS304)] are attached.



## SPECIFICATIONS

Item	Type		Thru-beam · standard type					
	Model No. (Note 2)		Front sensing	Side sensing	Front sensing	Side sensing	Front sensing	Side sensing
		Light-ON		<b>EX-11A(-PN)</b>	<b>EX-11EA(-PN)</b>	<b>EX-13A(-PN)</b>	<b>EX-13EA(-PN)</b>	<b>EX-19A(-PN)</b>
		Dark-ON	<b>EX-11B(-PN)</b>	<b>EX-11EB(-PN)</b>	<b>EX-13B(-PN)</b>	<b>EX-13EB(-PN)</b>	<b>EX-19B(-PN)</b>	<b>EX-19EB(-PN)</b>
Applicable regulations and certifications			CE Marking (EMC Directive, RoHS Directive), UKCA Marking (EMC Regulations, RoHS Regulations), ISO 13849-1 (Category 1, PLc) (Note 3), UL Recognition certification (Note 4)					
Sensing range			150 mm <b>5.906 in</b>		500 mm <b>19.685 in</b>		1 m <b>3.281 ft</b>	
Min. sensing object			$\varnothing 1$ mm <b><math>\varnothing 0.039</math> in</b> opaque object (Completely beam interrupted object) (Setting distance between emitter and receiver: 150 mm <b>5.906 in</b> )		$\varnothing 2$ mm <b><math>\varnothing 0.079</math> in</b> opaque object (Completely beam interrupted object) (Setting distance between emitter and receiver: 500 mm <b>19.685 in</b> )		$\varnothing 2$ mm <b><math>\varnothing 0.079</math> in</b> opaque object (Completely beam interrupted object) (Setting distance between emitter and receiver: 1 m <b>3.281 ft</b> )	
Hysteresis			—					
Repeatability (perpendicular to sensing axis)			0.05 mm <b>0.002 in</b> or less					
Supply voltage			12 to 24 V DC $\pm 10$ % Ripple P-P 10 % or less					
Current consumption			Emitter: 10 mA or less, Receiver: 10 mA or less					
Output			<NPN output type> NPN open-collector transistor <ul style="list-style-type: none"> <li>Maximum sink current: 50 mA</li> <li>Applied voltage: 30 V DC or less (between output and 0 V)</li> <li>Residual voltage: 2 V or less (at 50 mA sink current) 1 V or less (at 16 mA sink current)</li> </ul>			<PNP output type> PNP open-collector transistor <ul style="list-style-type: none"> <li>Maximum source current: 50 mA</li> <li>Applied voltage: 30 V DC or less (between output and +V)</li> <li>Residual voltage: 2 V or less (at 50 mA source current) 1 V or less (at 16 mA source current)</li> </ul>		
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)					
Incident beam indicator			—					
Stability indicator			Green LED (lights up under stable light received condition or stable dark condition)					
Environmental resistance	Pollution degree		3 (Industrial environment)					
	Protection		IP67 (IEC)					
	Ambient temperature		-25 to +55 °C <b>-13 to +131 °F</b> (No dew condensation or icing allowed), Storage: -30 to +70 °C <b>-22 to +158 °F</b>					
	Ambient humidity		35 to 85 % RH, Storage: 35 to 85 % RH					
	Ambient illuminance		Incandescent light: 3,000 lx or less at the light-receiving face					
	Voltage withstandability		1,000 V AC for one min. between all supply terminals connected together and enclosure					
	Insulation resistance		20 M $\Omega$ , or more, with 250 V DC megger between all supply terminals connected together and enclosure					
	Vibration resistance		10 to 500 Hz frequency, 3 mm <b>0.118 in</b> double amplitude in X, Y and Z directions for two hours each					
	Shock resistance		500 m/s <sup>2</sup> acceleration (50 G approx.) in X, Y and Z directions three times each					
Emitting element			Red LED [Peak emission wavelength: 680 nm <b>0.027 mil</b> ( <b>EX-19E</b> ): 624 nm <b>0.025 mil</b> ], modulated]					
Material			Enclosure: Polyarylate, Lens: Polyarylate					
Cable (Note 5)			0.1 mm <sup>2</sup> 3-core (thru-beam type emitter: 2-core) cabtyre cable, 2 m <b>6.562 ft</b> long					
Cable extension			Extension up to total 50 m <b>164 ft</b> is possible with 0.3 mm <sup>2</sup> , or more, cable (thru-beam type: emitter and receiver). (Note 6)					
Weight			Net weight (each emitter and receiver): 20 g approx., Gross weight: 50 g approx.					
Accessories			Mounting screws: 1 set					

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

2) Model Nos. having the suffix "**PN**" are PNP output type.

3) Conformed from December 2021 production.

4) Except 5 m **16.404 ft** cable length type. (**EX-19E-C5** is included in the certified products.)

5) The bending-resistant cable type (model Nos. having suffix "**R**") has a 0.1 mm<sup>2</sup> 3-core (thru-beam type emitter: 2-core) bending-resistant cabtyre cable, 2 m **6.562 ft** long.

6) For safety applications, do not exceed 30 m **98.425 ft**.

## SPECIFICATIONS

Item	Type		Thru-beam · narrow beam type					Convergent reflective (Diffused beam type)	Thru-beam · with operation mode switch on bifurcation				
			Front sensing	Side sensing	Front sensing	Side sensing	Front sensing	Front sensing	Front sensing	Side sensing	Front sensing	Side sensing	
	Model No. (Note 2)	Light-ON	EX-11SA(-PN)	EX-11SEA(-PN)	EX-13SA(-PN)	EX-13SEA(-PN)	EX-19SA(-PN)	EX-14A(-PN)	EX-15 (Note 3)	EX-15E (Note 3)	EX-17 (Note 3)	EX-17E (Note 3)	
		Dark-ON	EX-11SB(-PN)	EX-11SEB(-PN)	EX-13SB(-PN)	EX-13SEB(-PN)	EX-19SB(-PN)	EX-14B(-PN)					
Applicable regulations and certifications			CE Marking (EMC Directive, RoHS Directive), UKCA Marking (EMC Regulations, RoHS Regulations), ISO 13849-1 (Category 1, PLC) (Note 4), UL Recognition certification (Note 5)					RoHS Directive, UL Recognition certification (Note 5)					
Sensing range			150 mm <b>5.906 in</b>		500 mm <b>19.685 in</b>		1 m <b>3.281 ft</b>	2 to 25 mm <b>0.079 to 0.984 in</b> (Note 6) (Conv. point: 10 mm <b>0.394 in</b> )	150 mm <b>5.906 in</b>		500 mm <b>19.685 in</b>		
Min. sensing object			ø0.5 mm <b>ø0.002 in</b> opaque object (Completely beam interrupted object) (Note 7)	ø1 mm <b>ø0.039 in</b> opaque object (Completely beam interrupted object) (Note 7)		ø2 mm <b>ø0.079 in</b> opaque object (Completely beam interrupted object) (Note 7)		ø0.1 mm <b>ø0.004 in</b> copper wire (Setting distance: 10 mm <b>0.394 in</b> )	ø1 mm <b>ø0.039 in</b> opaque object (Completely beam interrupted object) (Setting distance between emitter and receiver: 150 mm <b>5.906 in</b> )		ø2 mm <b>ø0.079 in</b> opaque object (Completely beam interrupted object) (Setting distance between emitter and receiver: 500 mm <b>19.685 in</b> )		
Hysteresis			—————					15 % or less of operation distance (Note 6)	—————				
Repeatability (perpendicular to sensing axis)			0.05 mm <b>0.002 in</b> or less					0.1 mm <b>0.004 in</b> or less	0.05 mm <b>0.002 in</b> or less				
Supply voltage			12 to 24 V DC ±10 %					Ripple P-P 10 % or less					
Current consumption			Emitter: 10 mA or less, Receiver: 10 mA or less					13 mA or less	25 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: 2 V or less (at 50 mA sink current) 1 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: 2 V or less (at 50 mA source current) 1 V or less (at 16 mA source current)			NPN open-collector transistor • Maximum sink current: 100 mA • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 2 V or less (at 100 mA sink current) 1 V or less (at 16 mA sink 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)					Orange LED (lights up when the output is ON), located on the bifurcation					
Incident beam indicator			—————					Orange LED (lights up under light received condition), located on the receiver					
Stability indicator			Green LED (lights up under stable light received condition or stable dark condition)					Green LED (lights up under stable light received condition or stable dark condition), located on the receiver					
Environmental resistance	Pollution degree		3 (Industrial environment)					—————					
	Protection		IP67 (IEC)					—————					
	Ambient temperature		-25 to +55 °C <b>-13 to +131 °F</b> (No dew condensation or icing allowed), Storage: -30 to +70 °C <b>-22 to +158 °F</b>					—————					
	Ambient humidity		35 to 85 % RH, Storage: 35 to 85 % RH					—————					
	Ambient illuminance		Incandescent light: 3,000 lx or less at the light-receiving face					—————					
	Voltage withstandability		1,000 V AC for one min. between all supply terminals connected together and enclosure					—————					
	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 <b>0.118 in</b> double amplitude in X, Y and Z directions for two hours each					—————					
Shock resistance		500 m/s <sup>2</sup> acceleration (50 G approx.) in X, Y and Z directions three times each					—————						
Emitting element			Red LED (Peak emission wavelength: 650 nm <b>0.026 mil</b> , modulated)					Red LED (Peak emission wavelength: 680 nm <b>0.027 mil</b> , modulated)					
Material			Enclosure: Polyarylate Lens: Polyarylate					Enclosure: Polyarylate Lens: Polyarylate, Bifurcation: Polyarylate					
Cable (Note 8)			0.1 mm <sup>2</sup> 3-core (thru-beam type emitter: 2-core) cabtyre cable, 2 m <b>6.562 ft</b> long					0.2 mm <sup>2</sup> 3-core cabtyre cable, 2 m <b>6.562 ft</b> long (beyond bifurcation; from emitter / receiver to bifurcation: 0.5 m <b>1.640 ft</b> long)					
Cable extension			Extension up to total 50 m <b>164 ft</b> is possible with 0.3 mm <sup>2</sup> , or more, cable (thru-beam type: emitter and receiver). (Note 9)					Extension up to total 100 m <b>328 ft</b> is possible with 0.3 mm <sup>2</sup> , or more, cable.					
Weight			Net weight (each emitter and receiver): 20 g approx., Gross weight: 50 g approx.					Net weight: 20 g approx., Gross weight: 40 g approx.	Net weight: 55 g approx., Gross weight: 80 g approx.				
Accessories			Mounting screws: 1 set					Mounting screws: 1 set	Mounting screws: 1 set, Adjusting screwdriver: 1 pc.				

- Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C **+73.4 °F**.  
2) Model Nos. having the suffix "-PN" are PNP output type. 3) Either Light-ON or Dark-ON can be selected by the operation mode switch.  
4) Conformed from December 2021 production. 5) Except 5 m **16.404 ft** cable length type.  
6) The sensing range and the hysteresis of convergent reflective type sensor are specified for white non-glossy paper (50 × 50 mm **1.969 × 1.969 in**) as the object.  
7) The min. sensing objects are specified in case the emitter / receiver sensing range is to set the maximum.  
8) The bending-resistant cable type (model Nos. having suffix "-R") has a 0.1 mm<sup>2</sup> 3-core (thru-beam type emitter: 2-core) bending-resistant cabtyre cable, 2 m **6.562 ft** long.  
9) For safety applications, do not exceed 30 m **98.425 ft**.

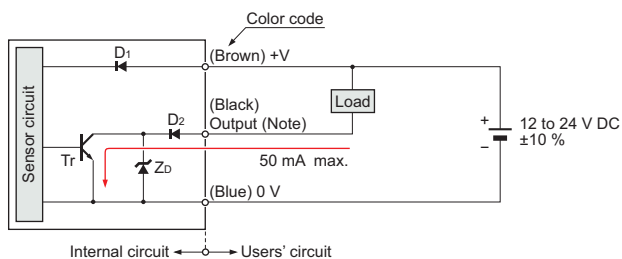


## I/O CIRCUIT AND WIRING DIAGRAMS

EX-11□ EX-11S□ EX-13□ EX-13S□ EX-19□ EX-19S□ EX-14□

NPN output type

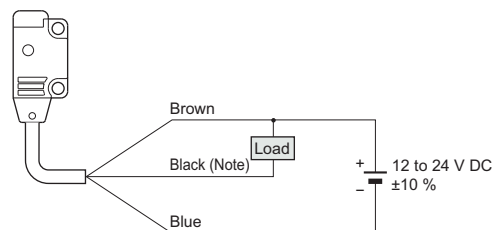
### I/O circuit diagram



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

Symbols ... D1: Reverse supply polarity protection diode  
D2: Reverse output polarity protection diode  
ZD: Surge absorption zener diode  
Tr: NPN output transistor

### Wiring diagram

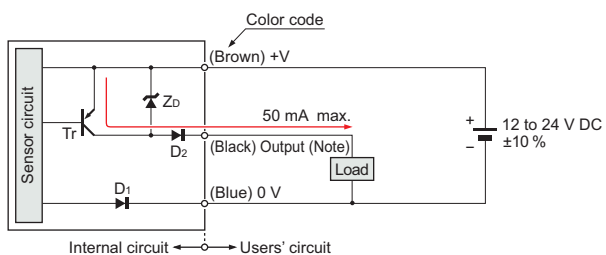


Note: The emitter of the thru-beam type sensor does not incorporate the black wire.

EX-11□-PN EX-11S□-PN EX-13□-PN EX-13S□-PN EX-19□-PN EX-19S□-PN EX-14□-PN

PNP output type

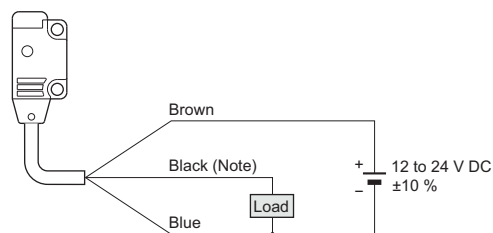
### I/O circuit diagram



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

Symbols ... D1: Reverse supply polarity protection diode  
D2: Reverse output polarity protection diode  
ZD: Surge absorption zener diode  
Tr: PNP output transistor

### Wiring diagram

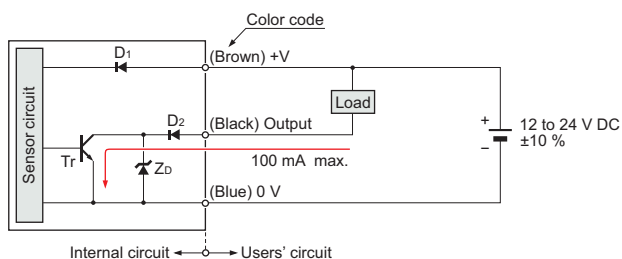


Note: The emitter of the thru-beam type sensor does not incorporate the black wire.

EX-15□ EX-15E□ EX-17□ EX-17E□

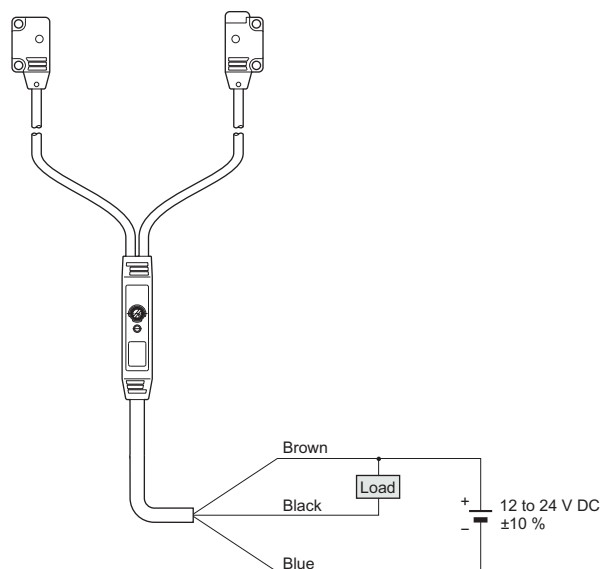
NPN output type

### I/O circuit diagram



Symbols ... D1: Reverse supply polarity protection diode  
D2: Reverse output polarity protection diode  
ZD: Surge absorption zener diode  
Tr: NPN output transistor

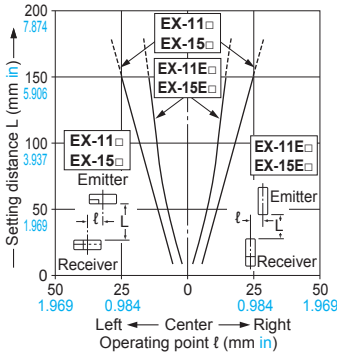
### EX-15□, EX-15E□, EX-17□, EX-17E□ wiring diagram



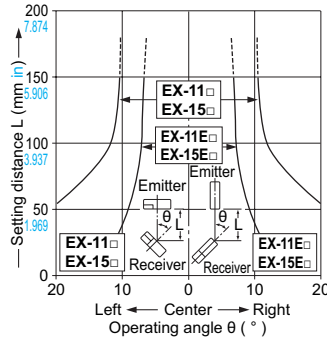
**SENSING CHARACTERISTICS (TYPICAL)**

**EX-11□ EX-11E□ EX-15□ EX-15E□ Thru-beam type**

**Parallel deviation**

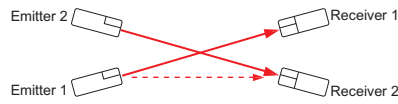


**Angular deviation**

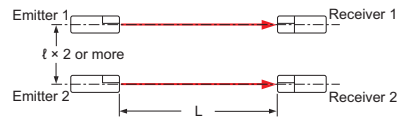


\*Optical properties of side sensing types (**EX-□E□**)

Due to the optical properties of side sensing types, note that sensing may be affected if multiple sensors are positioned in such a way that optical axes intersect as shown in the diagram below.



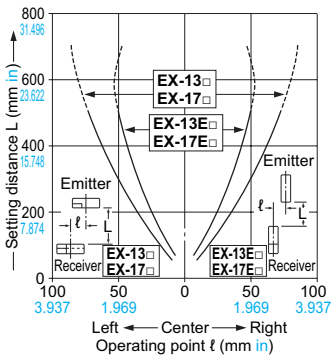
Beam from Emmitter 1 may be caught by Receiver 2.



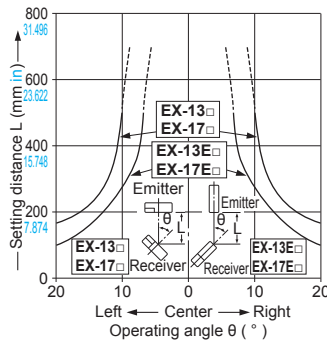
There is no problem when sensors are installed in parallel (although the distance between sensors should be  $\ell \times 2$  or more).

**EX-13□ EX-13E□ EX-17□ EX-17E□ Thru-beam type**

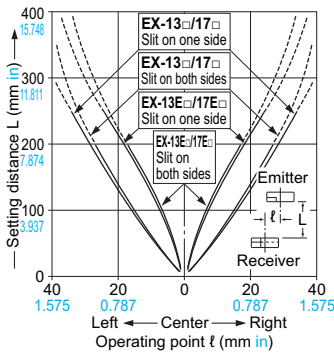
**Parallel deviation**



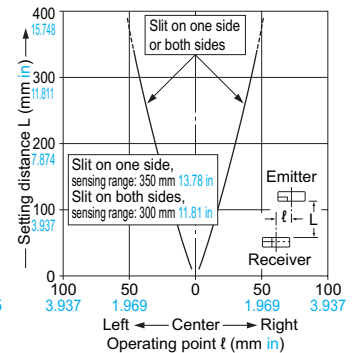
**Angular deviation**



**Parallel deviation with slit masks (ø1.2 mm ø0.047 in)**

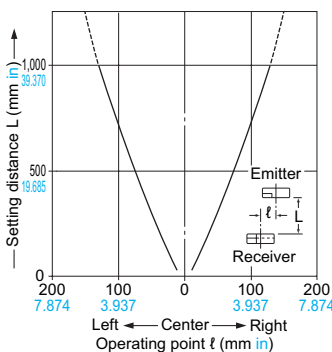


**Parallel deviation with slit masks (ø1.5 mm ø0.059 in)**

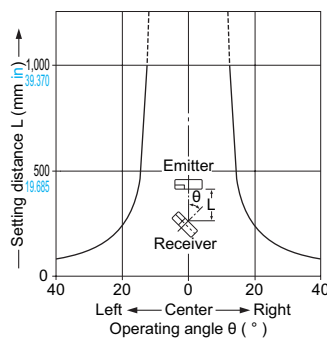


**EX-19□ Thru-beam type**

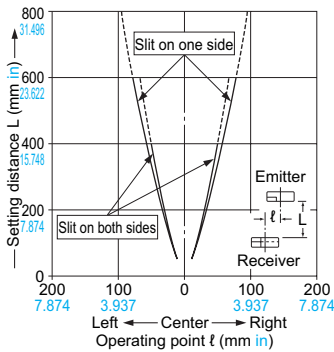
**Parallel deviation**



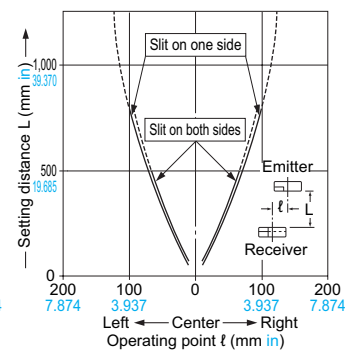
**Angular deviation**



**Parallel deviation with slit masks (ø1.2 mm ø0.047 in)**

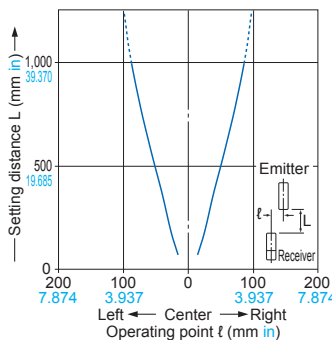


**Parallel deviation with slit masks (ø1.5 mm ø0.059 in)**



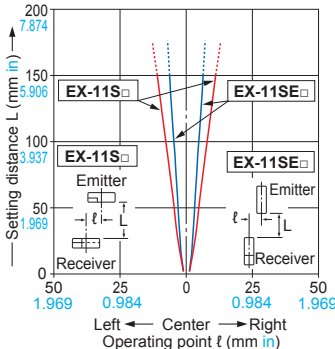
**EX-19E□ Thru-beam type**

**Parallel deviation**



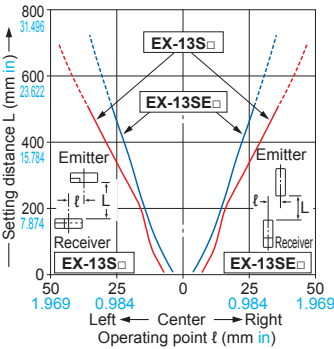
**EX-11S□/EX-11SE□ Thru-beam type**

**Parallel deviation**



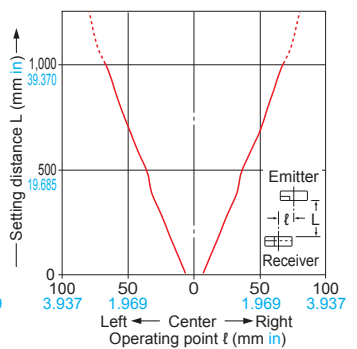
**EX-13S□/EX-13SE□ Thru-beam type**

**Parallel deviation**



**EX-19S□ Thru-beam type**

**Parallel deviation**



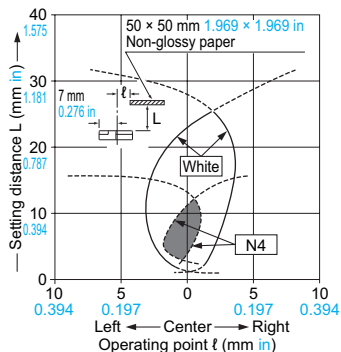
## SENSING CHARACTERISTICS (TYPICAL)

EX-14□

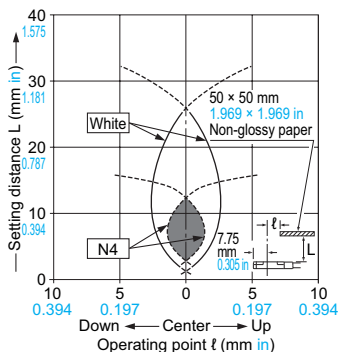
Convergent reflective type

### Sensing fields

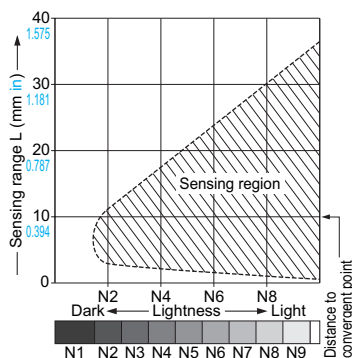
• Horizontal (left and right) direction



• Vertical (up and down) direction



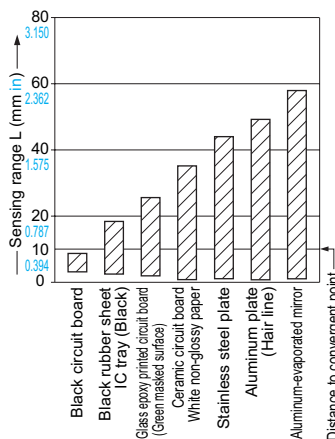
### Correlation between lightness and sensing range



The sensing region (typical) 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 (typical) 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.

## PRECAUTIONS FOR PROPER USE

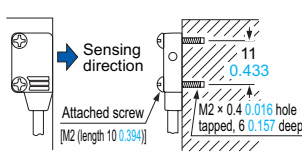


- Never use this product as a sensing device for personnel protection.
- In case of using sensing devices for personnel protection, use products which meet laws and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.

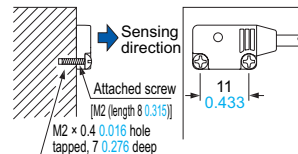
### Mounting

• In case of mounting on tapped holes (Unit: mm in)

#### Side sensing



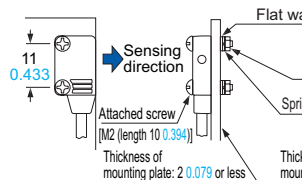
#### Front sensing



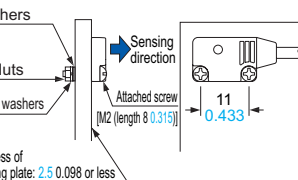
The tightening torque should be 0.2 N·m or less.

• In case of using attached screws and nuts (Unit: mm in)

#### Side sensing



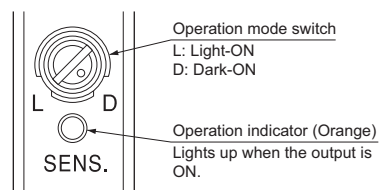
#### Front sensing



The tightening torque should be 0.2 N·m or less.

### Operation mode switch

(EX-15□, EX-15E□, EX-17□ and EX-17E□ only)



Switch position	Description
	Light-ON mode is set when the switch is turned fully clockwise (L side).
	Dark-ON mode is set when the switch is turned fully counterclockwise (D side).

### Others

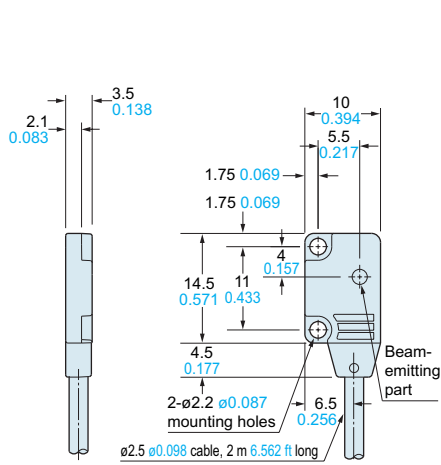
- This product has been developed / produced for industrial use only.
- This product is suitable for indoor use only.
- Do not use during the initial transient time (50 ms) after the power supply is switched on.
- Excess bending of the cable or stress applied to the cable may disconnect the internal lead wire.

**DIMENSIONS (Unit: mm in)**

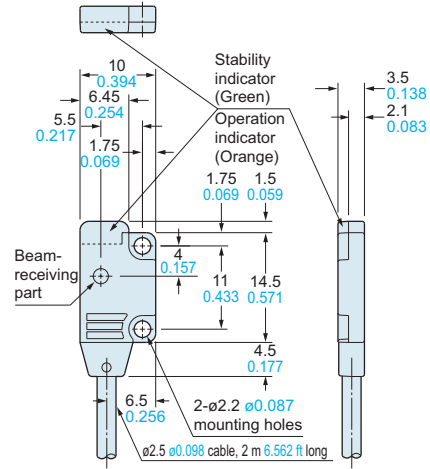
The CAD data can be downloaded from our website.

EX-11□ EX-11S□ EX-13□ EX-13S□ EX-19□ EX-19S□

Sensor



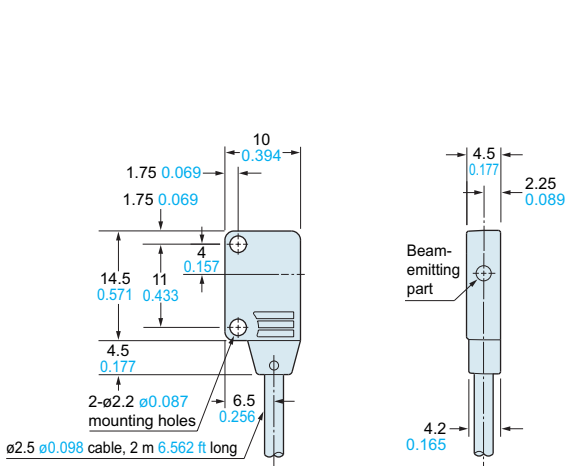
**Emitter**



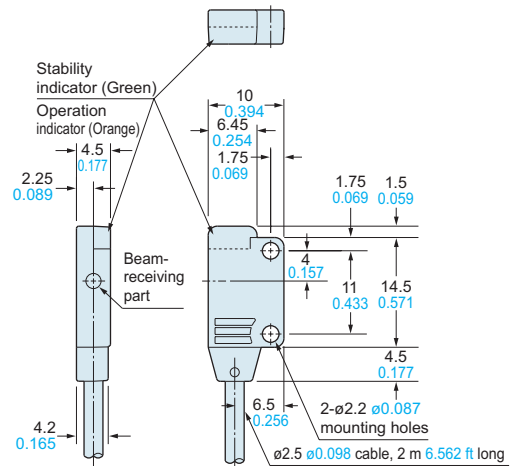
**Receiver**

EX-11E□ EX-11SE□ EX-13E□ EX-13SE□ EX-19E□

Sensor



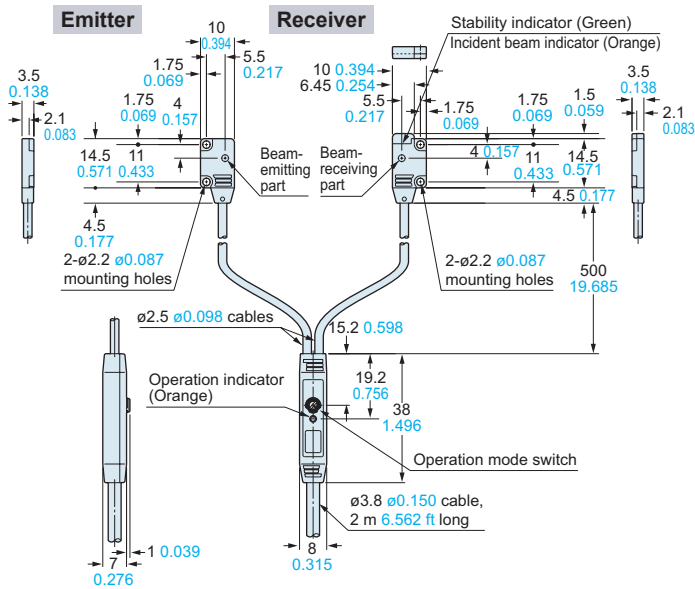
**Emitter**



**Receiver**

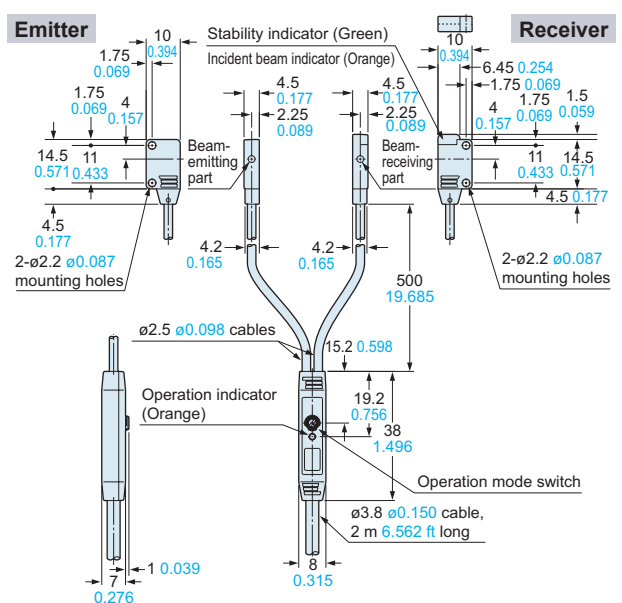
EX-15 EX-17

Sensor



EX-15E EX-17E

Sensor

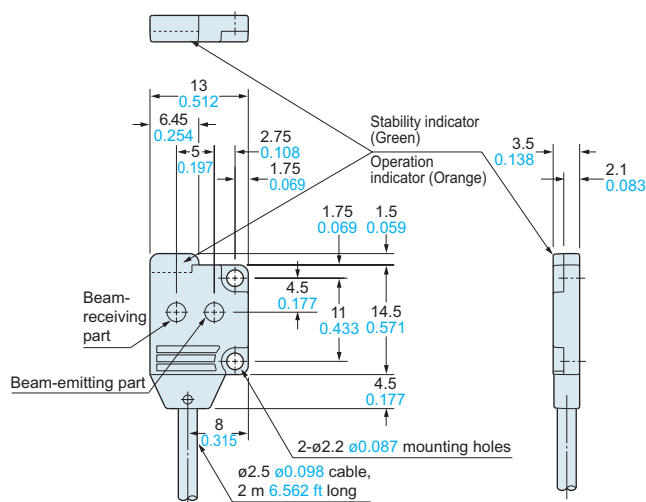


**DIMENSIONS (Unit: mm in)**

The CAD data can be downloaded from our website.

**EX-14□**

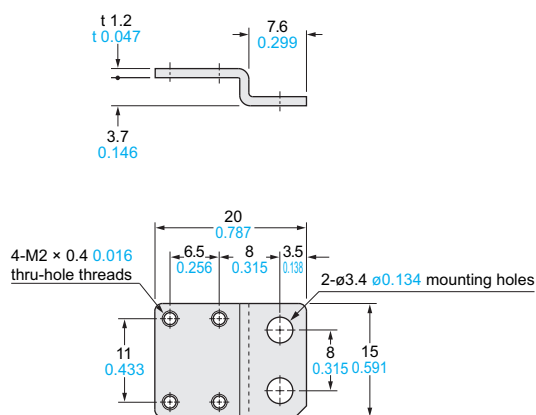
Sensor

**MS-EX10-1**

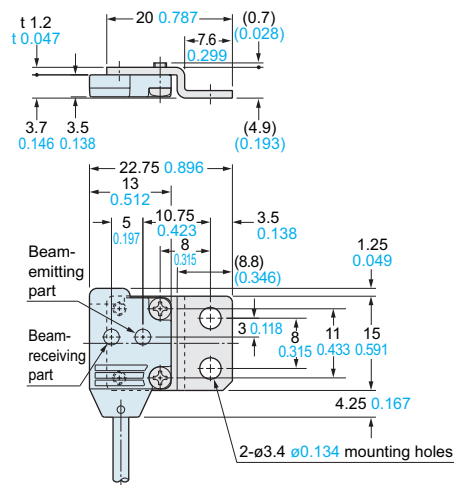
Sensor mounting bracket (Optional)

**Assembly dimensions**

Mounting drawing with EX-14□

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

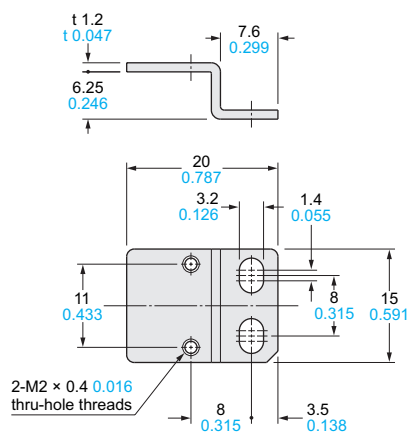
Two M2 (length 4 mm 0.157 in) pan head screws are attached.

**MS-EX10-2**

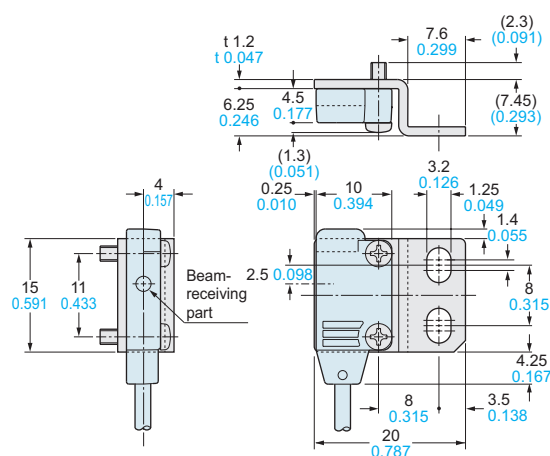
Sensor mounting bracket (Optional)

**Assembly dimensions**

Mounting drawing with EX-11E□ and EX-13E□

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

Two M2 (length 8 mm 0.315 in) pan head screws are attached.

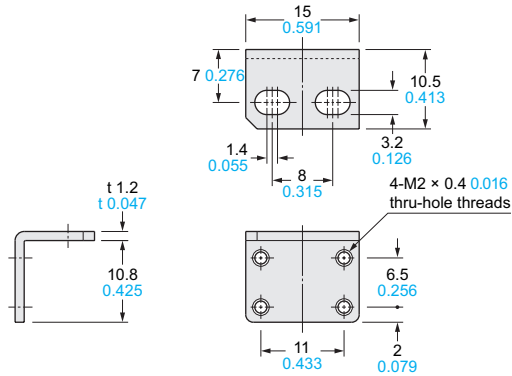


**DIMENSIONS (Unit: mm in)**

The CAD data can be downloaded from our website.

**MS-EX10-3**

Sensor mounting bracket (Optional)

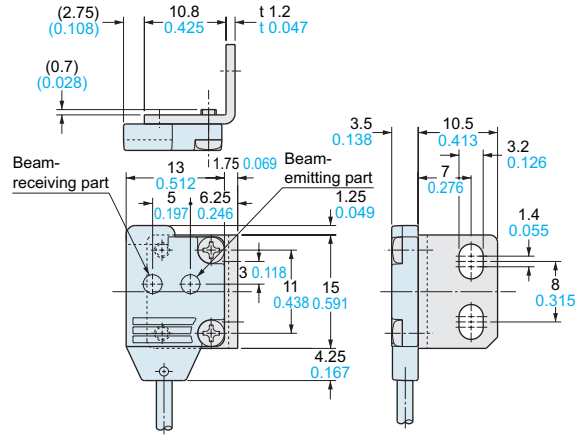


Material: Cold rolled carbon steel (SPCC)  
(Uni-chrome plated)

Two M2 (length 4 mm 0.157 in) pan head screws and two M2 (length 8 mm 0.315 in) pan head screws are attached.

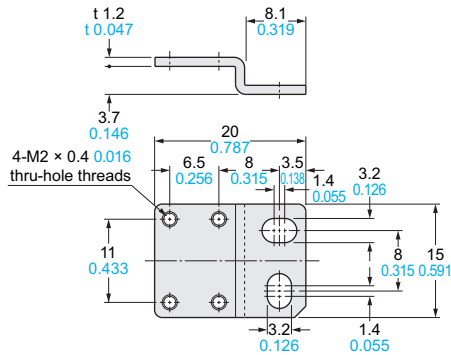
**Assembly dimensions**

Mounting drawing with EX-14□



**MS-EX10-11**

Sensor mounting bracket (Optional)

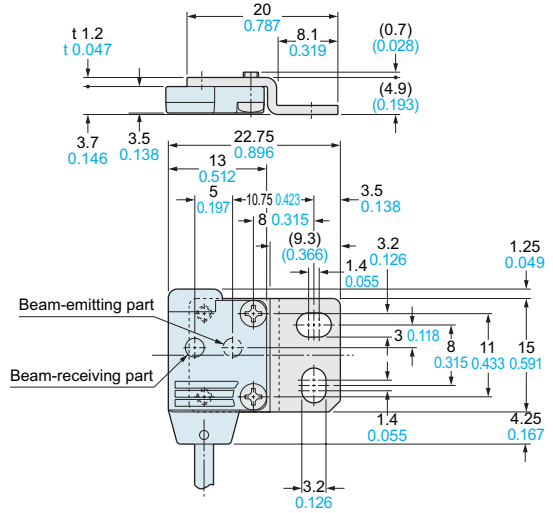


Material: Stainless steel (SUS304)

Two M2 (length 4 mm 0.157 in) pan head screws [stainless steel (SUS304)] are attached.

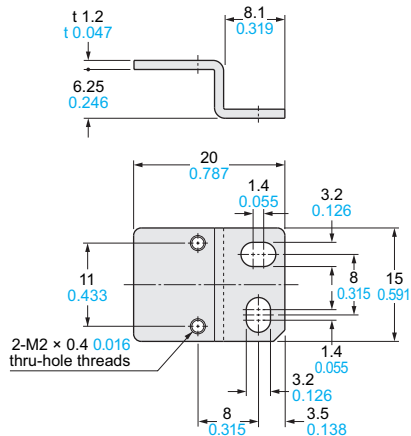
**Assembly dimensions**

Mounting drawing with EX-14□



**MS-EX10-12**

Sensor mounting bracket (Optional)

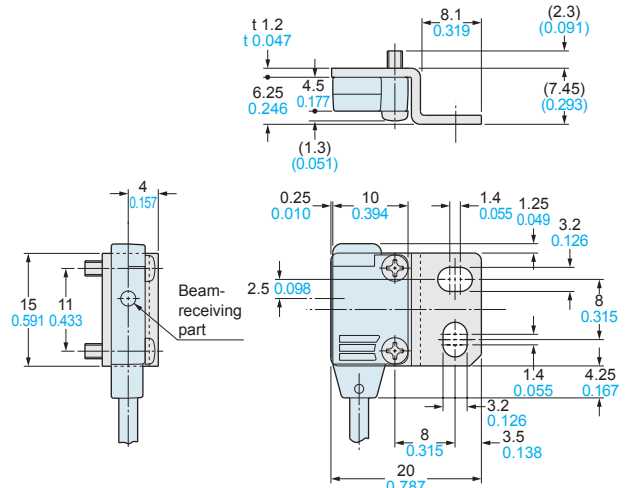


Material: Stainless steel (SUS304)

Two M2 (length 8 mm 0.315 in) pan head screws [stainless steel (SUS304)] are attached.

**Assembly dimensions**

Mounting drawing with EX-11E□ and EX-13E□



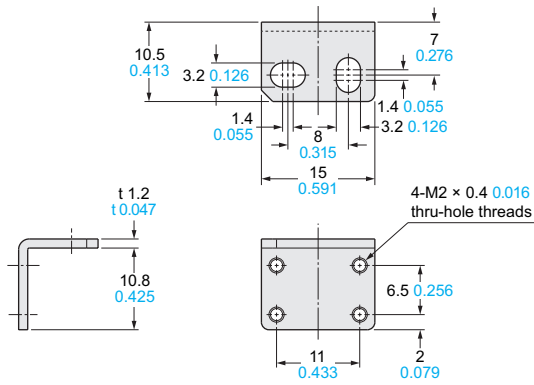


**DIMENSIONS (Unit: mm in)**

The CAD data can be downloaded from our website.

**MS-EX10-13**

Sensor mounting bracket (Optional)

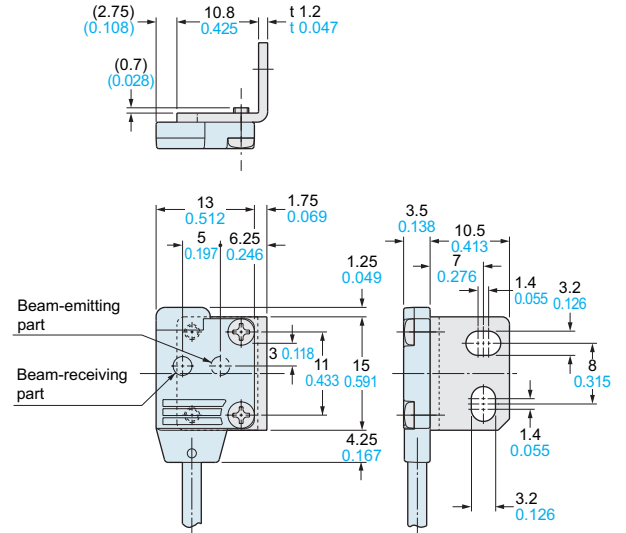


Material: Stainless steel (SUS304)

Two M2 (length 4 mm 0.157 in) pan head screws [stainless steel (SUS304)] and two M2 (length 8 mm 0.315 in) pan head screws [stainless steel (SUS304)] are attached.

**Assembly dimensions**

Mounting drawing with EX-14□



## Disclaimer

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