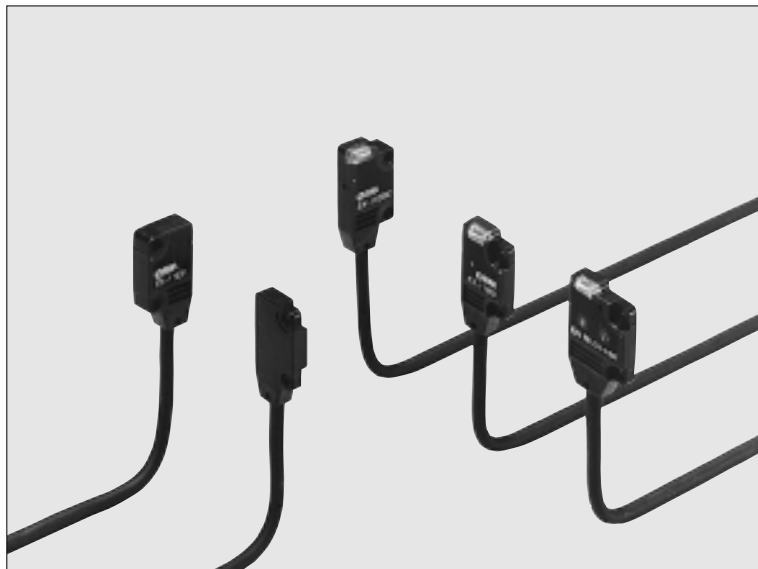


# EX-10 SERIES

## Amplifier Built-in Ultra-slim Photoelectric Sensor



Amplifier Built-in  
Extraordinarily Small  
and Slim Size

**CE Marked**

Conforming to EMC Directive  
(Excluding EX-15□/EX-17□)

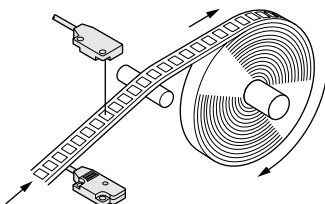
### Smallest Body, Just 3.5mm Thick

It can be mounted in a very small space as its size is just W10×H14.5×D3.5mm (thru-beam, front sensing type).



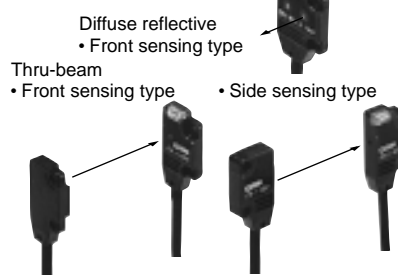
### High-speed Response Time: 0.5ms

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



### 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.



### Bright 2-color Indicator

A convenient 2-color indicator has been incorporated in the miniature body.

2-color indicator  
(Red: Operation indicator)  
(Green: Stability indicator)



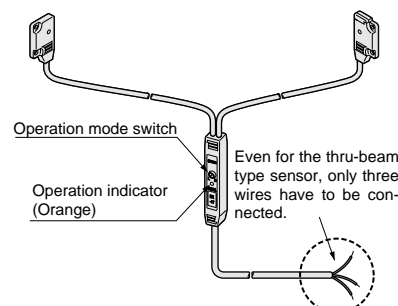
### Waterproof

The sensor can be hosed down because of its IP67 construction and the non-corrosive stainless steel mounting bracket.

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

### Operation Mode Switch

Thru-beam type sensor incorporated with an operation mode switch on the bifurcation is also available. It helps you to test the operability before start-up.



### Globally Usable

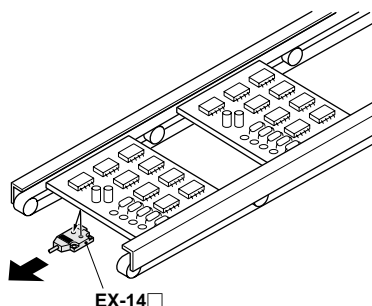
PNP output type which is much in demand in Europe is available. Of course, it conforms to the EMC directive.

### Red Beam Makes Beam Alignment Easy

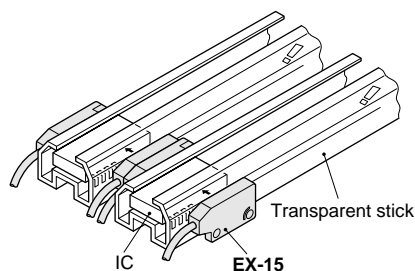
The red LED beam projected from the emitter helps you to align the sensor heads.

## APPLICATIONS

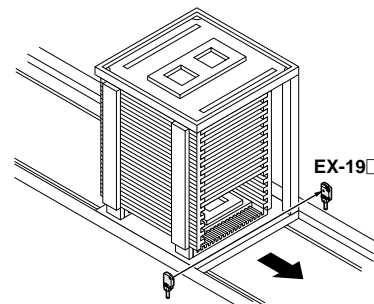
### Verifying position of PCBs



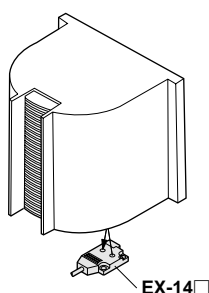
### Detecting ICs



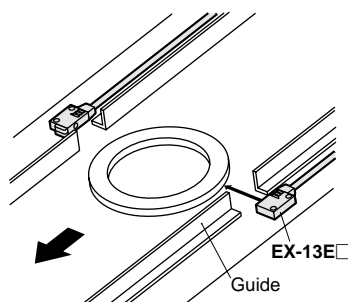
### Detecting PCB rack



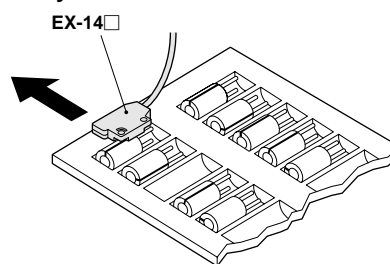
### Detecting wafer cassette



### Detecting thin ring



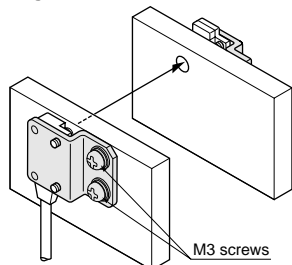
### Checking for absence of capacitor in tray



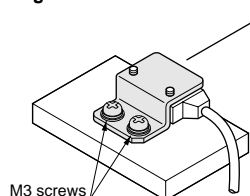
## Mountable with M3 Screws

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

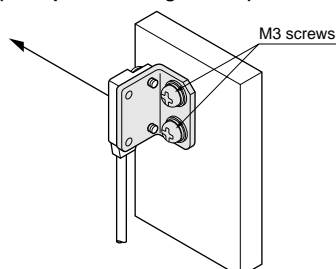
- MS-EX10-1 [Cold rolled carbon steel (SPCC)] and MS-EX10-11 [Stainless steel (SUS304)] (mounting bracket for the front sensing type)



- MS-EX10-2 [Cold rolled carbon steel (SPCC)] and MS-EX10-12 [Stainless steel (SUS304)] (mounting bracket for the side sensing type)

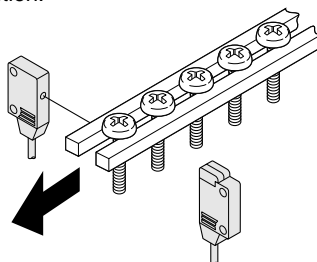


- MS-EX10-3 [Cold rolled carbon steel (SPCC)] and MS-EX10-13 [Stainless steel (SUS304)] (L-shaped mounting bracket)



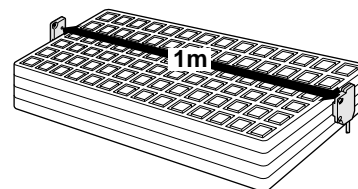
## Minimum Sensing Object: $\phi$ 1mm

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



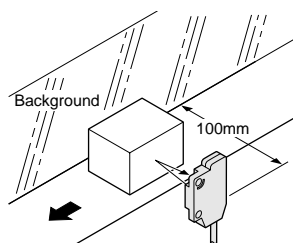
## Long Sensing Range: 1m (EX-19)

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

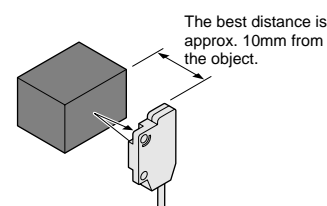


## Background Suppression (EX-14)

- **Not affected by background**  
Even a specular background separated by 100mm, or more, is not detected. (However, the background should be directly opposite.)

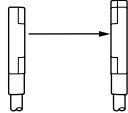



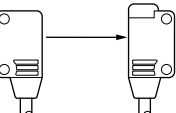



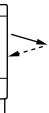

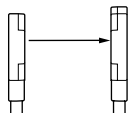



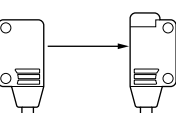






- **Black object reliably detected**  
It can reliably detect dark color objects since it is convergent reflective type.



# EX-10

## ORDER GUIDE

Type		Appearance	Sensing range	Model No.	Output operation	Min. sensing object
NPN output	Thru-beam	Front sensing 	 150mm	EX-11A	Light-ON	φ 1mm opaque object (Setting distance between the emitter and the receiver: 150mm)
				EX-11B	Dark-ON	
			 500mm	EX-13A	Light-ON	φ 2mm opaque object (Setting distance between the emitter and the receiver: 500mm)
				EX-13B	Dark-ON	
			 1m	EX-19A <b>NEW</b>	Light-ON	φ 2mm opaque object (Setting distance between the emitter and the receiver: 1m)
				EX-19B <b>NEW</b>	Dark-ON	
	Side sensing 	With operation mode switch on the bifurcation	 150mm	EX-15	Switchable either Light-ON or Dark-ON	φ 1mm opaque object (Setting distance between the emitter and the receiver: 150mm)
				EX-17		φ 2mm opaque object (Setting distance between the emitter and the receiver: 500mm)
			 500mm	EX-11EA	Light-ON	φ 1mm opaque object (Setting distance between the emitter and the receiver: 150mm)
				EX-11EB	Dark-ON	
			 500mm	EX-13EA	Light-ON	φ 2mm opaque object (Setting distance between the emitter and the receiver: 500mm)
				EX-13EB	Dark-ON	
	Convergent reflective (Diffused beam type)	Front sensing 	 2 to 25mm (Note 1) (Convergent point: 10mm)	EX-14A	Light-ON	φ 0.1mm copper wire (Setting distance: 10mm)
				EX-14B	Dark-ON	
PNP output	Thru-beam	Front sensing 	 150mm	EX-11A-PN <b>NEW</b>	Light-ON	φ 1mm opaque object (Setting distance between the emitter and the receiver: 150mm)
				EX-11B-PN <b>NEW</b>	Dark-ON	
			 500mm	EX-13A-PN <b>NEW</b>	Light-ON	φ 2mm opaque object (Setting distance between the emitter and the receiver: 500mm)
				EX-13B-PN <b>NEW</b>	Dark-ON	
			 1m	EX-19A-PN <b>NEW</b>	Light-ON	φ 2mm opaque object (Setting distance between the emitter and the receiver: 1m)
				EX-19B-PN <b>NEW</b>	Dark-ON	
	Side sensing 	With operation mode switch on the bifurcation	 150mm	EX-11EA-PN <b>NEW</b>	Light-ON	φ 1mm opaque object (Setting distance between the emitter and the receiver: 150mm)
				EX-11EB-PN <b>NEW</b>	Dark-ON	
			 500mm	EX-13EA-PN <b>NEW</b>	Light-ON	φ 2mm opaque object (Setting distance between the emitter and the receiver: 500mm)
				EX-13EB-PN <b>NEW</b>	Dark-ON	
	Convergent reflective (Diffused beam type)	Front sensing 	 2 to 25mm (Note 1) (Convergent point: 10mm)	<b>NEW</b> EX-14A-PN	Light-ON	φ 0.1mm copper wire (Setting distance: 10mm)
				<b>NEW</b> EX-14B-PN	Dark-ON	

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

Note 1: The sensor does not detect even a specular background if it is separated by 100mm or more. (However, the background should be directly opposite.)

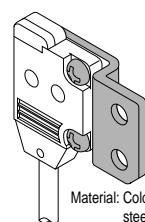
## OPTIONS

Designation	Model No.	Description
Sensor mounting bracket	<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 $\phi$ 1.2mm)	Slit on one side · Sensing range: 600mm [EX-19□] 250mm [EX-13□, EX-17] · Min. sensing object: $\phi$ 2mm
		Slit on both sides · Sensing range: 400mm [EX-19□] 200mm [EX-13□, EX-17] · Min. sensing object: $\phi$ 1.2mm
	<b>OS-EX10-15</b> (Slit size $\phi$ 1.5mm)	Slit on one side · Sensing range: 800mm [EX-19□] 350mm [EX-13□] · Min. sensing object: $\phi$ 2mm
		Slit on both sides · Sensing range: 500mm [EX-19□] 300mm [EX-13□] · Min. sensing object: $\phi$ 1.5mm
	<b>OS-EX10E-12</b> (Slit size $\phi$ 1.2mm)	Slit on one side · Sensing range: 250mm [EX-13E□, EX-17E] · Min. sensing object: $\phi$ 2mm
		Slit on both sides · Sensing range: 200mm [EX-13E□, EX-17E] · Min. sensing object: $\phi$ 1.2mm
Sensor checker (Note)	<b>CHX-SC2</b>	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.378~ for details of the sensor checker **CHX-SC2**.

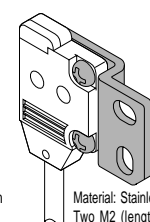
### Sensor mounting bracket

#### • MS-EX10-1



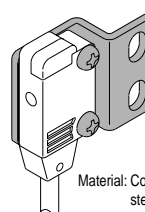
Material: Cold rolled carbon steel (SPCC)  
(Uni-chrome plated)  
Two M2 (length 4mm) pan head screws are attached.

#### • MS-EX10-11



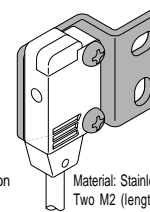
Material: Stainless steel (SUS304)  
Two M2 (length 4mm) pan head screws [stainless steel (SUS304)] are attached.

#### • MS-EX10-2



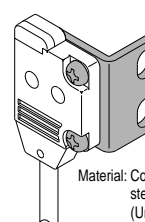
Material: Cold rolled carbon steel (SPCC)  
(Uni-chrome plated)  
Two M2 (length 8mm) pan head screws are attached.

#### • MS-EX10-12



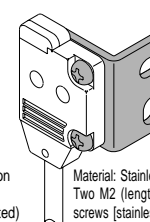
Material: Stainless steel (SUS304)  
Two M2 (length 8mm) pan head screws [stainless steel (SUS304)] are attached.

#### • MS-EX10-3



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

#### • MS-EX10-13



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

### Slit mask

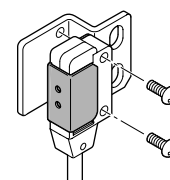
#### • OS-EX10-12 • OS-EX10-15



#### • OS-EX10E-12

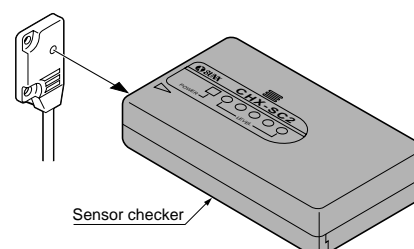


### Example of mounting (OS-EX10E-12)



Tighten along with the sensor mounting bracket.

### Sensor checker



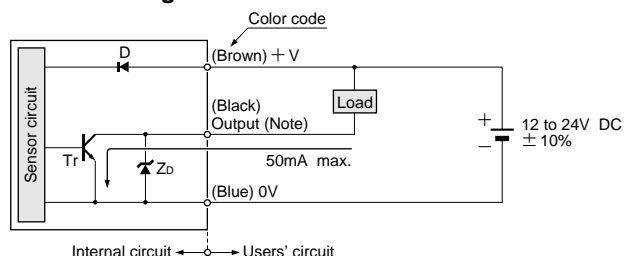
## SPECIFICATIONS

Notes: 1) Either Light-ON or Dark-ON can be selected by the operation mode switch (located on the bifurcation).  
2) The sensing range of convergent reflective type sensor is specified for white non-glossy paper (50 × 50mm) as the object.

## I/O CIRCUIT AND WIRING DIAGRAMS

**EX-11 EX-13**  
**EX-19 EX-14** NPN output type

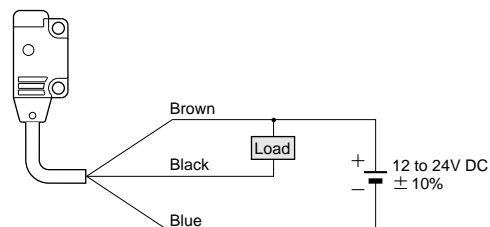
### I/O circuit diagram



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

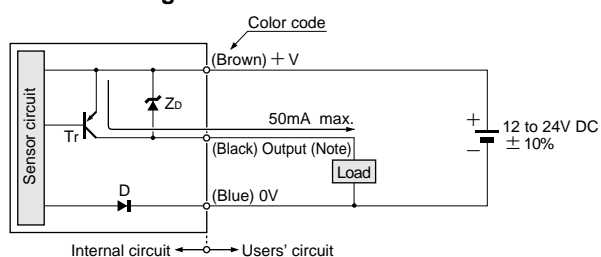
Symbols ... D: Reverse supply polarity protection diode  
Zd: Surge absorption zener diode  
Tr: NPN output transistor

### Wiring diagram



**EX-11-PN EX-13-PN**  
**EX-19-PN EX-14-PN** PNP output type

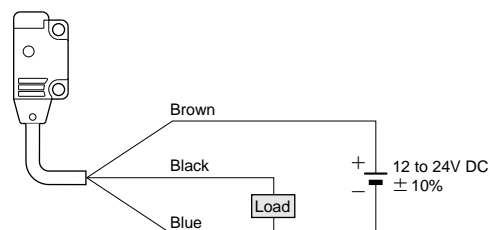
### I/O circuit diagram



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

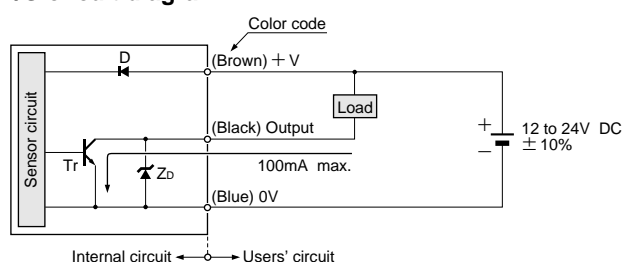
Symbols ... D: Reverse supply polarity protection diode  
Zd: Surge absorption zener diode  
Tr: PNP output transistor

### Wiring diagram



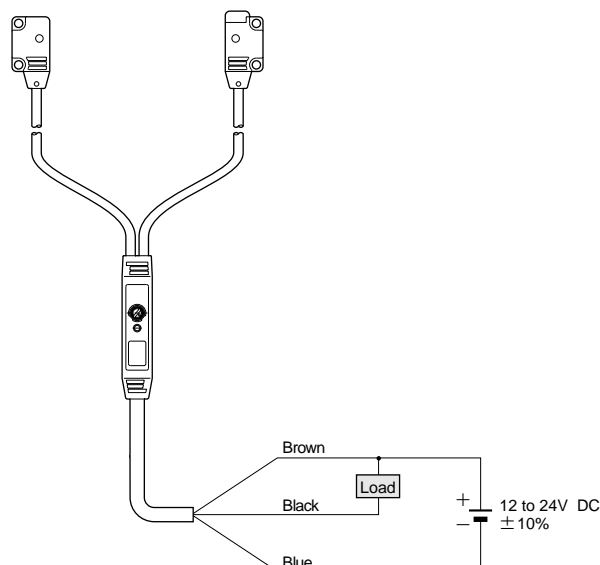
**EX-15 EX-15E**  
**EX-17 EX-17E** NPN output type

### I/O circuit diagram



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

### Wiring diagram

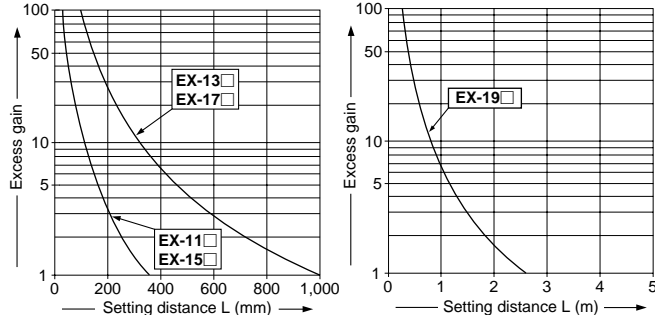


# EX-10

## SENSING CHARACTERISTICS (TYPICAL)

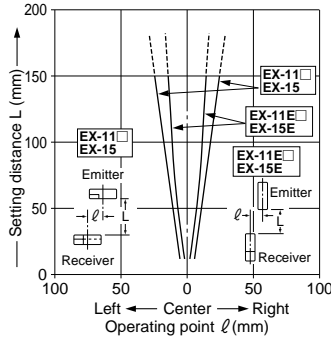
### All models Thru-beam type

#### Correlation between setting distance and excess gain

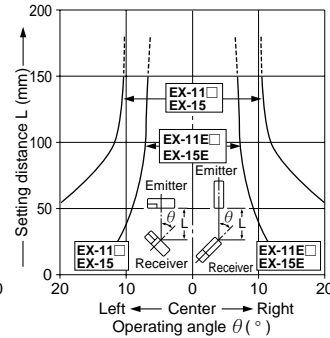


### EX-11 EX-11E EX-15 EX-15E Thru-beam type

#### Parallel deviation

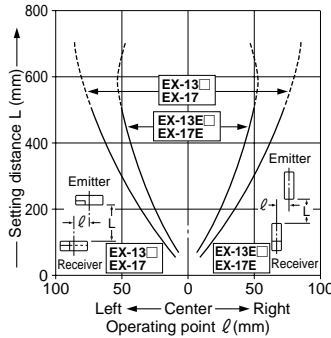


#### Angular deviation

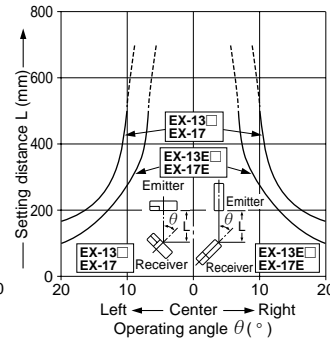


### EX-13 EX-13E EX-17 EX-17E Thru-beam type

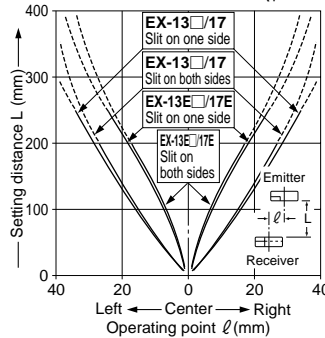
#### Parallel deviation



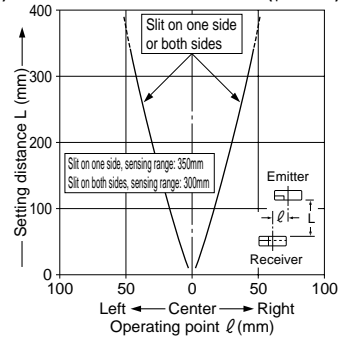
#### Angular deviation



#### Parallel deviation with slit masks ( $\phi 1.2\text{mm}$ )

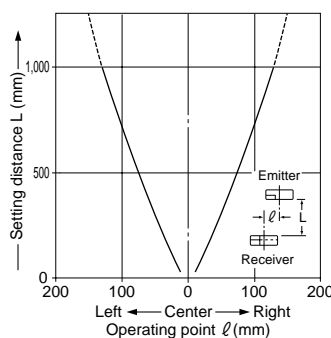


#### Parallel deviation with slit masks ( $\phi 1.5\text{mm}$ )

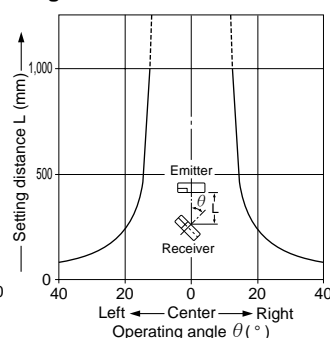


### EX-19 Thru-beam type

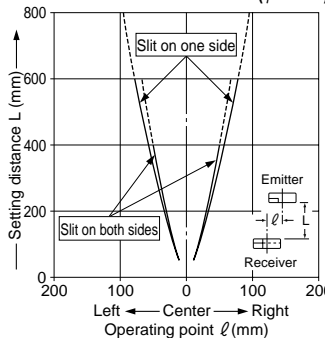
#### Parallel deviation



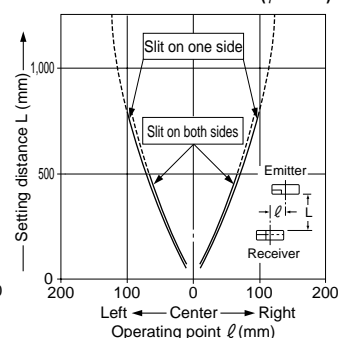
#### Angular deviation



#### Parallel deviation with slit masks ( $\phi 1.2\text{mm}$ )



#### Parallel deviation with slit masks ( $\phi 1.5\text{mm}$ )



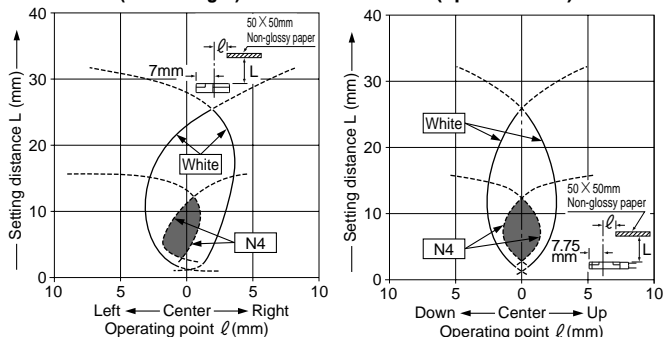
## SENSING CHARACTERISTICS (TYPICAL)

### EX-14

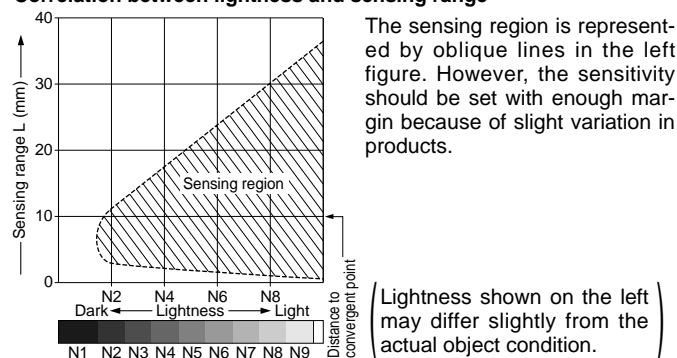
Convergent reflective type

#### Sensing fields

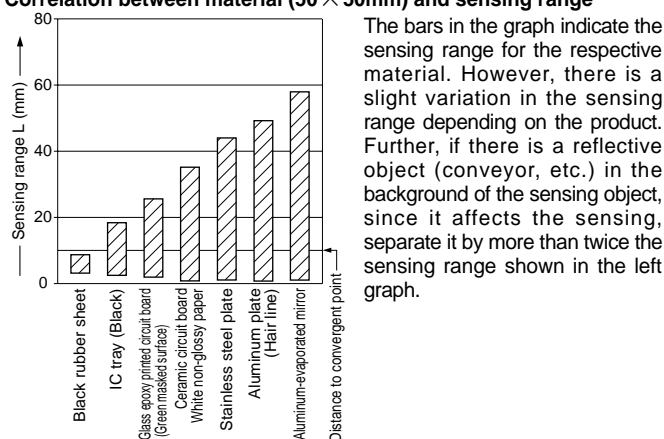
- Horizontal (left and right) direction
- Vertical (up and down) direction



#### Correlation between lightness and sensing range



#### Correlation between material (50 × 50mm) 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.

## PRECAUTIONS FOR PROPER USE

Refer to P.820~ for general precautions.

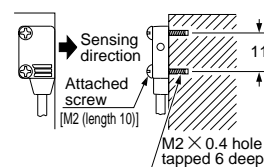


This product is not a safety sensor. Its use is not intended or designed to protect life and prevent body injury or property damage from dangerous parts of machinery. It is a normal object detection sensor.

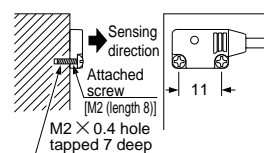
#### Mounting

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

##### Side sensing



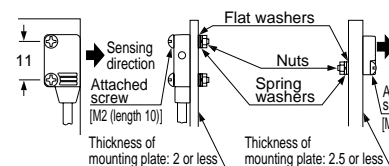
##### Front sensing



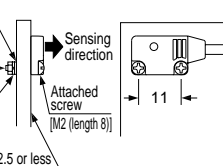
The tightening torque should be 0.2N·m or less.

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

##### Side sensing

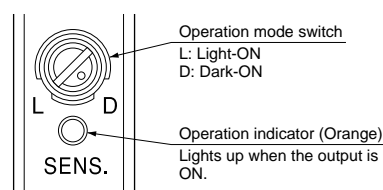


##### Front sensing



The tightening torque should be 0.2N·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

- Do not use during the initial transient time (50ms) (EX-15, EX-15E, EX-17 and EX-17E: 100ms) after the power supply is switched on.



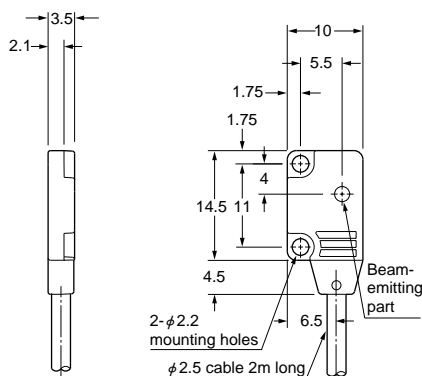
# EX-10

## DIMENSIONS (Unit: mm)

EX-11A EX-11B EX-13A  
EX-13B EX-19A EX-19B

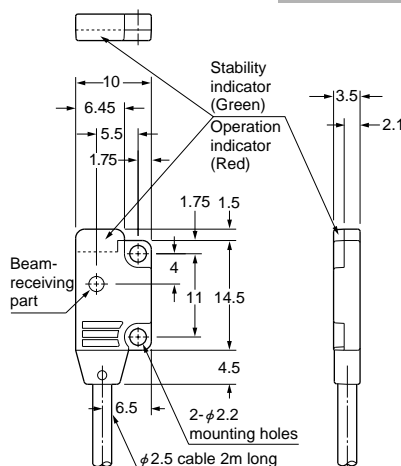
Sensor

Actual size



Emitter

Actual size

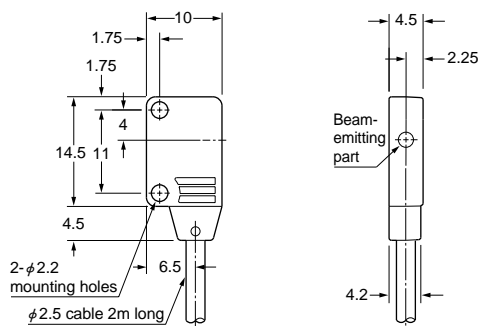


Receiver

EX-11EA EX-11EB  
EX-13EA EX-13EB

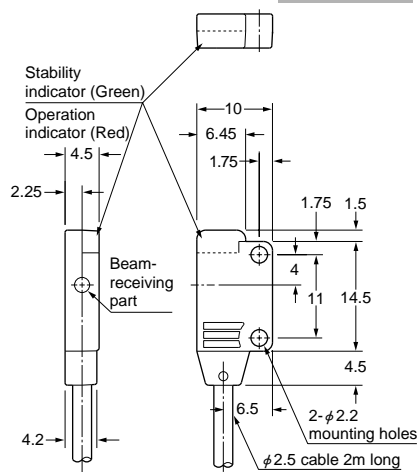
Sensor

Actual size



Emitter

Actual size



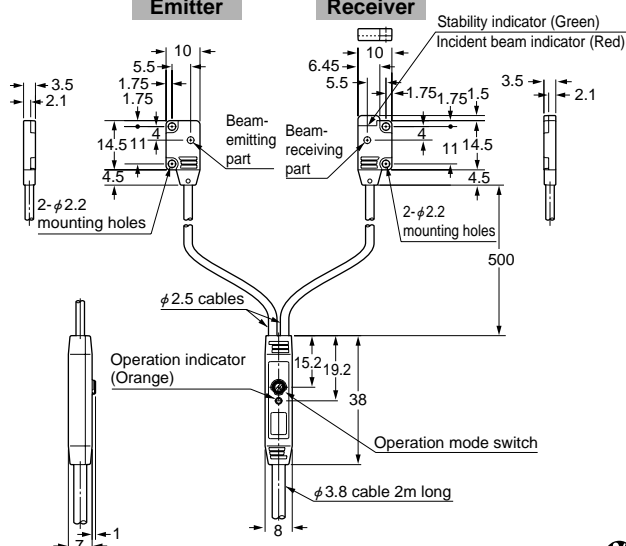
Receiver

EX-15  
EX-17

Sensor

Emitter

Receiver

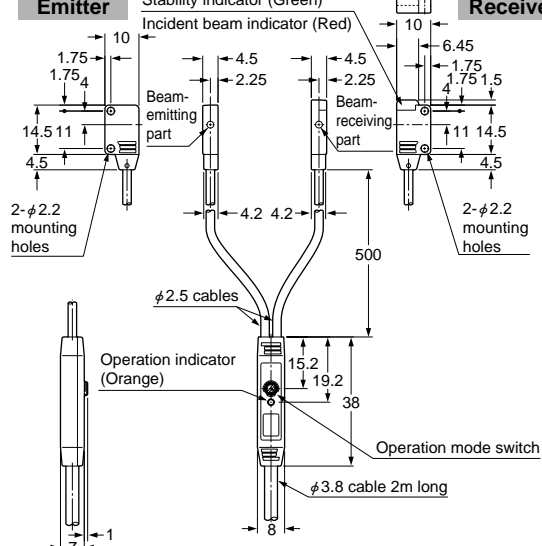


EX-15E  
EX-17E

Sensor

Emitter

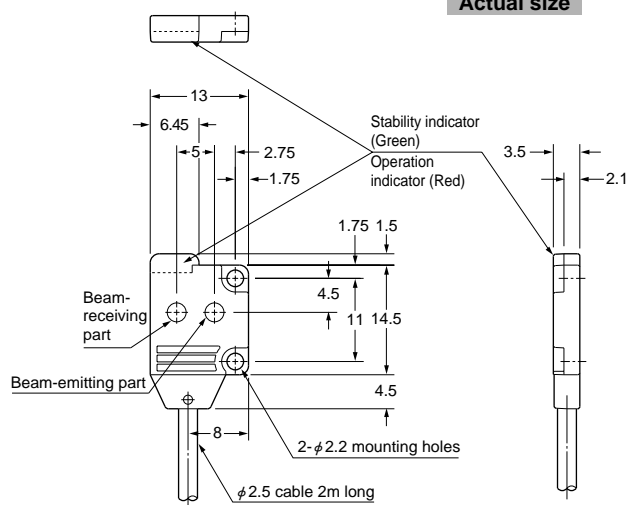
Receiver



## DIMENSIONS (Unit: mm)

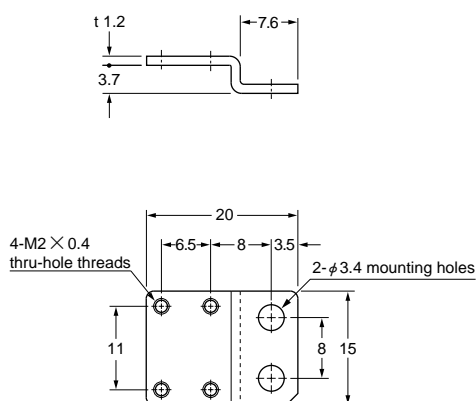
**EX-14A** ☐  
**EX-14B** ☐ Sensor

**Actual size**



**MS-EX10-1** Sensor mounting bracket (Optional)

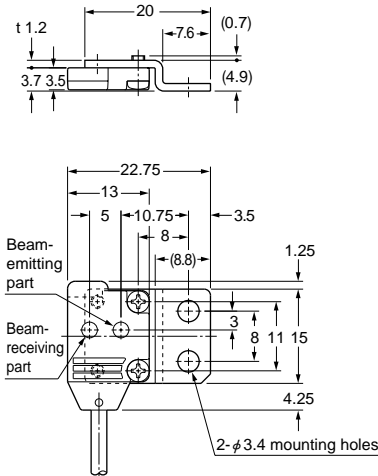
**Actual size**



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

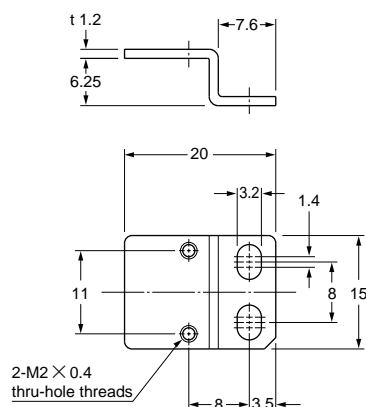
**Assembly dimensions**

Mounting drawing with **EX-14** ☐



**MS-EX10-2** Sensor mounting bracket (Optional)

**Actual size**

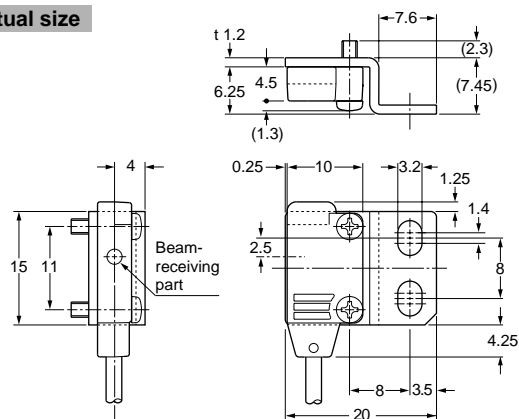


Material: Cold rolled carbon steel (SPCC)  
(Uni-chrome plated)  
Two M2 (length 8mm) pan head screws are attached.

**Assembly dimensions**

Mounting drawing with **EX-11E** ☐ and **EX-13E** ☐

**Actual size**

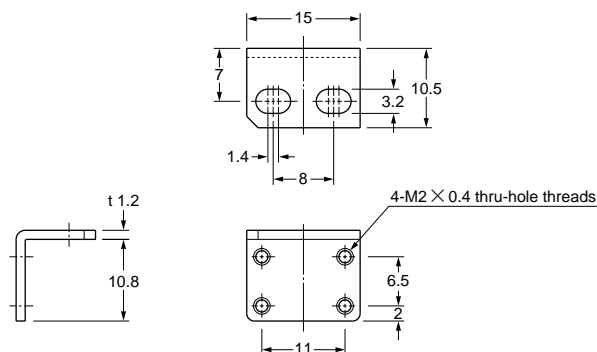


# EX-10

## DIMENSIONS (Unit: mm)

### MS-EX10-3 Sensor mounting bracket (Optional)

#### Actual size



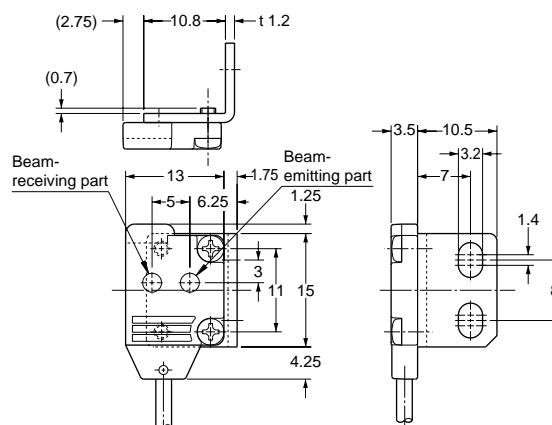
Material: Cold rolled carbon steel (SPCC)  
(Uni-chrome plated)

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

#### Assembly dimensions

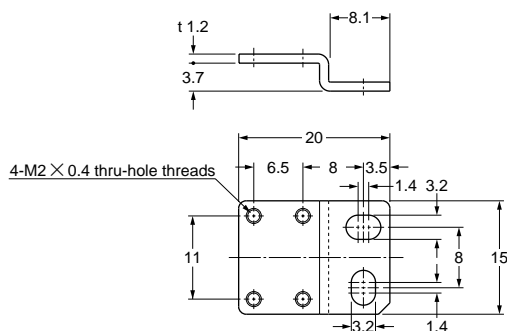
Mounting drawing with EX-14□

#### Actual size



### MS-EX10-11 Sensor mounting bracket (Optional)

#### Actual size



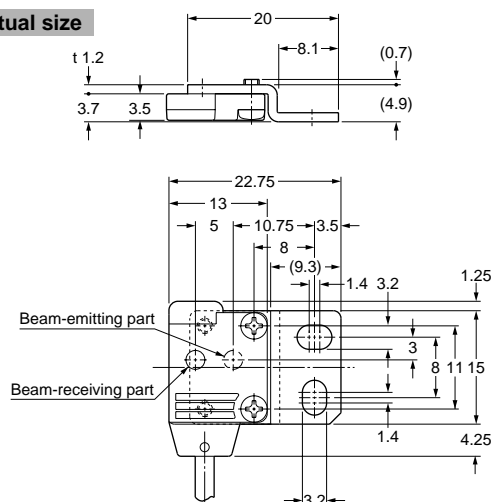
Material: Stainless steel (SUS304)

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

#### Assembly dimensions

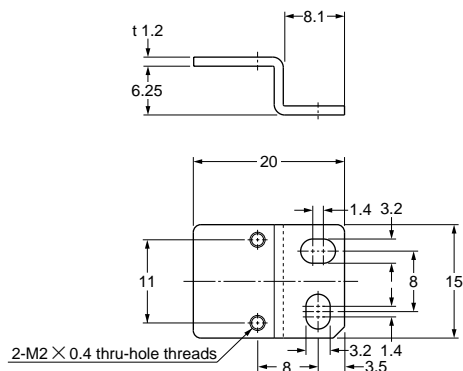
Mounting drawing with EX-14□

#### Actual size



### MS-EX10-12 Sensor mounting bracket (Optional)

#### Actual size



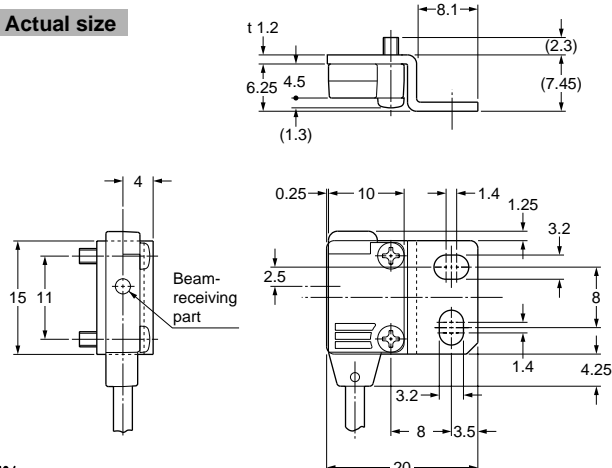
Material: Stainless steel (SUS304)

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

#### Assembly dimensions

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

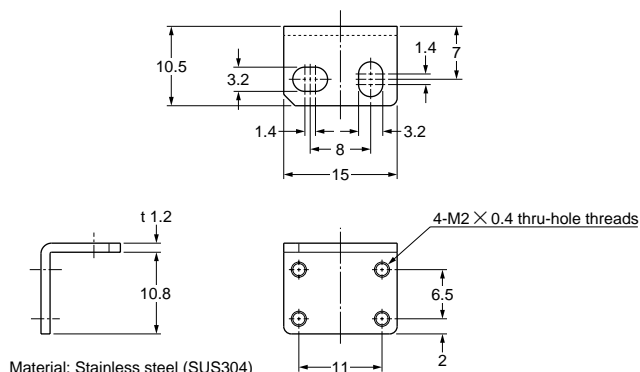
#### Actual size



## DIMENSIONS (Unit: mm)

### MS-EX10-13 Sensor mounting bracket (Optional)

#### Actual size



Material: Stainless steel (SUS304)

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

#### Assembly dimensions

Mounting drawing with EX-14

#### Actual size

