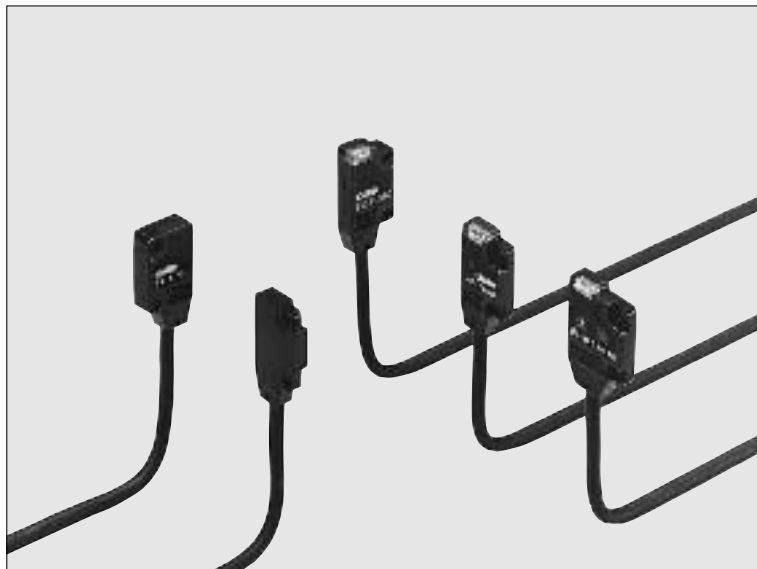


# EX-10 SERIES

## 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□)

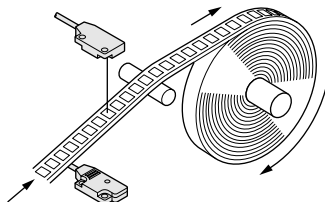
#### Smallest Body, Just 3.5mm Thick

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



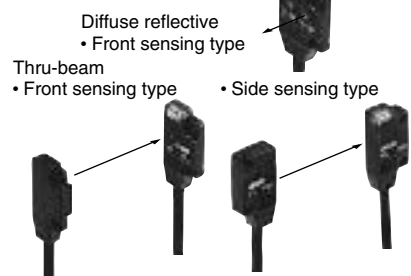
#### High-speed Response Time: 0.5ms

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)

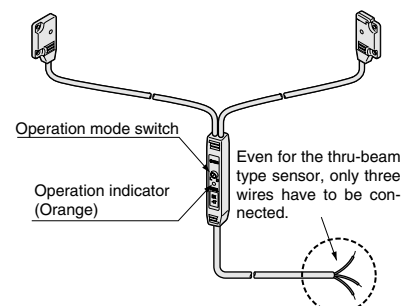
#### Waterproof

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.



Operation mode switch  
Operation indicator (Orange)  
Even for the thru-beam type sensor, only three wires have to be connected.

#### Globally Usable

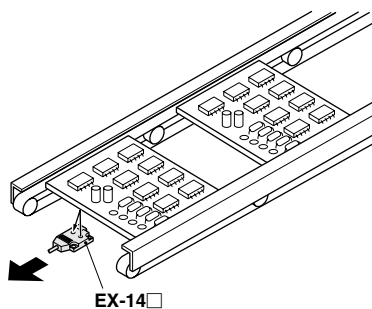
PNP output type which is much in demand in Europe is available. Of course, it conforms to the EMC directive.

#### Red Beam Makes Beam Alignment Easy

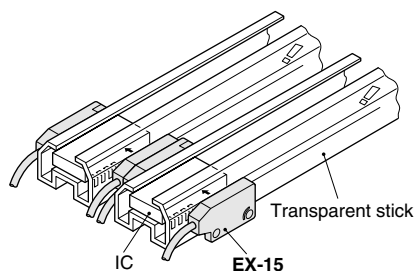
The red LED beam projected from the emitter helps you to align the sensor heads.

## APPLICATIONS

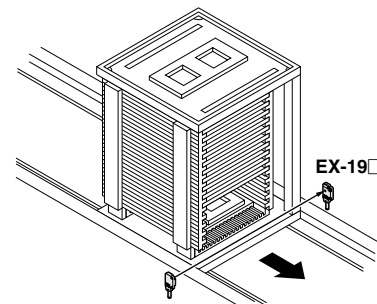
### Verifying position of PCBs



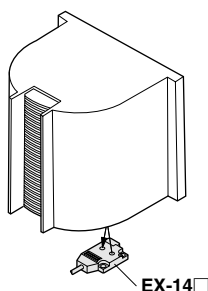
### Detecting ICs



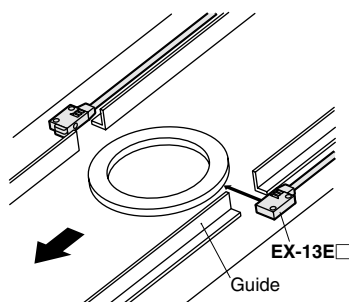
### Detecting PCB rack



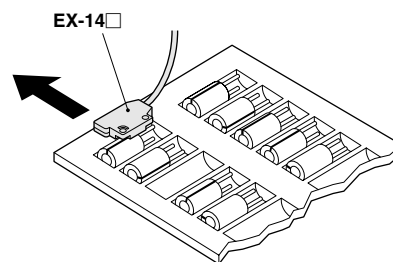
### Detecting wafer cassette



### Detecting thin ring



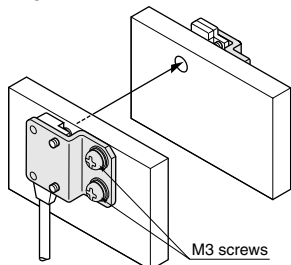
### Checking for absence of capacitor in tray



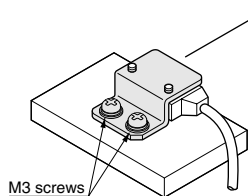
## Mountable with M3 Screws

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

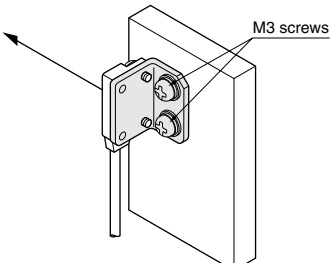
- MS-EX10-1 [Cold rolled carbon steel (SPCC)] and MS-EX10-11 [Stainless steel (SUS304)] (mounting bracket for the front sensing type)



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

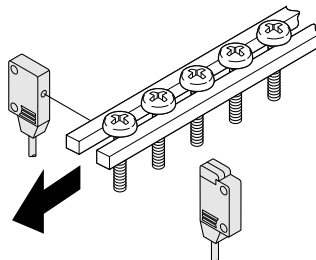


- MS-EX10-3 [Cold rolled carbon steel (SPCC)] and MS-EX10-13 [Stainless steel (SUS304)] (L-shaped mounting bracket)



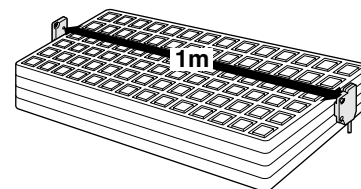
## Minimum Sensing Object: $\phi$ 1mm

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.



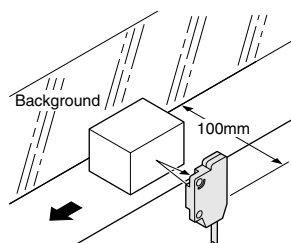
## Long Sensing Range: 1m (EX-19)

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.

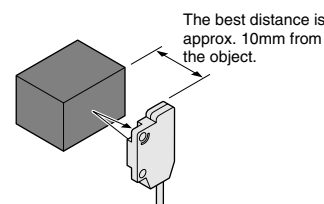


## Background Suppression (EX-14)

- **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 <small>With operation mode switch on the bifurcation</small>	150mm	EX-11A	Light-ON	φ1mm opaque object (Setting distance between the emitter and the receiver: 150mm)
				EX-11B	Dark-ON	
			500mm	EX-13A	Light-ON	φ2mm opaque object (Setting distance between the emitter and the receiver: 500mm)
				EX-13B	Dark-ON	
			1m	EX-19A	Light-ON	φ2mm opaque object (Setting distance between the emitter and the receiver: 1m)
				EX-19B	Dark-ON	
	150mm	EX-15	Switchable either Light-ON or Dark-ON	φ1mm opaque object (Setting distance between the emitter and the receiver: 150mm)		
					500mm	EX-17
	Side sensing <small>With operation mode switch on the bifurcation</small>	150mm	EX-11EA	Light-ON		
					EX-11EB	Dark-ON
			500mm	EX-13EA		
					EX-13EB	Dark-ON
			150mm	EX-15E		
					500mm	EX-17E
Convergent reflective (Diffused beam type)	Front sensing	2 to 25mm (Note 1) (Convergent point: 10mm)	EX-14A	Light-ON		
			EX-14B	Dark-ON		
PNP output	Thru-beam	Front sensing	150mm	EX-11A-PN	Light-ON	φ1mm opaque object (Setting distance between the emitter and the receiver: 150mm)
				EX-11B-PN	Dark-ON	
			500mm	EX-13A-PN	Light-ON	φ2mm opaque object (Setting distance between the emitter and the receiver: 500mm)
				EX-13B-PN	Dark-ON	
			1m	EX-19A-PN	Light-ON	φ2mm opaque object (Setting distance between the emitter and the receiver: 1m)
				EX-19B-PN	Dark-ON	
	Side sensing	150mm	EX-11EA-PN	Light-ON	φ1mm opaque object (Setting distance between the emitter and the receiver: 150mm)	
						EX-11EB-PN
			500mm	EX-13EA-PN	Light-ON	
						EX-13EB-PN
Convergent reflective (Diffused beam type)	Front sensing	2 to 25mm (Note 1) (Convergent point: 10mm)	EX-14A-PN	Light-ON	φ0.1mm copper wire (Setting distance: 10mm)	
			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).**

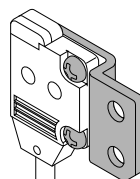
Note 1: The sensor does not detect even a specular background if it is separated by 100mm or more. (However, the background should be directly opposite.)

## 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 <ul style="list-style-type: none"> <li>· Sensing range: 600mm [EX-19□]</li> <li>· 250mm [EX-13□, EX-17]</li> <li>· Min. sensing object: <math>\phi</math> 2mm</li> </ul>
		Slit on both sides <ul style="list-style-type: none"> <li>· Sensing range: 400mm [EX-19□]</li> <li>· 200mm [EX-13□, EX-17]</li> <li>· Min. sensing object: <math>\phi</math> 1.2mm</li> </ul>
	<b>OS-EX10-15</b> (Slit size $\phi$ 1.5mm)	Slit on one side <ul style="list-style-type: none"> <li>· Sensing range: 800mm [EX-19□]</li> <li>· 350mm [EX-13□]</li> <li>· Min. sensing object: <math>\phi</math> 2mm</li> </ul>
		Slit on both sides <ul style="list-style-type: none"> <li>· Sensing range: 500mm [EX-19□]</li> <li>· 300mm [EX-13□]</li> <li>· Min. sensing object: <math>\phi</math> 1.5mm</li> </ul>
	<b>OS-EX10E-12</b> (Slit size $\phi$ 1.2mm)	Slit on one side <ul style="list-style-type: none"> <li>· Sensing range: 250mm [EX-13E□, EX-17E]</li> <li>· Min. sensing object: <math>\phi</math> 2mm</li> </ul>
		Slit on both sides <ul style="list-style-type: none"> <li>· Sensing range: 200mm [EX-13E□, EX-17E]</li> <li>· Min. sensing object: <math>\phi</math> 1.2mm</li> </ul>
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.

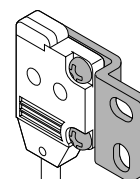
### Sensor mounting bracket

#### • MS-EX10-1



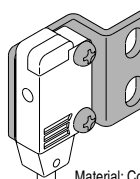
Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated)  
Two M2 (length 4mm) pan head screws are attached.

#### • MS-EX10-11



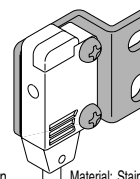
Material: Stainless steel (SUS304)  
Two M2 (length 4mm) pan head screws [stainless steel (SUS304)] are attached.

#### • MS-EX10-2



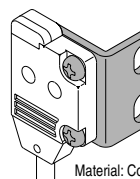
Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated)  
Two M2 (length 8mm) pan head screws are attached.

#### • MS-EX10-12



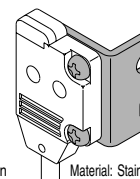
Material: Stainless steel (SUS304)  
Two M2 (length 8mm) pan head screws [stainless steel (SUS304)] are attached.

#### • 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.

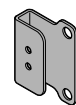
#### • MS-EX10-13



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

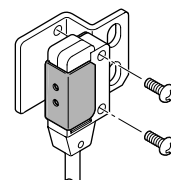
#### • OS-EX10-12 • OS-EX10-15



#### • OS-EX10E-12

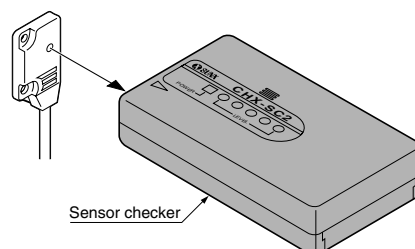


### Example of mounting (OS-EX10E-12)



Tighten along with the sensor mounting bracket.

### Sensor checker



# EX-10

## SPECIFICATIONS

Item	Model No.	Type	Thru-beam					Convergent reflective	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
			Light-ON	EX-11A(-PN)	EX-11EA(-PN)	EX-13A(-PN)	EX-13EA(-PN)	EX-19A(-PN)	EX-14A(-PN)	EX-15 (Note 1)	EX-15E (Note 1)	EX-17 (Note 1)
Dark-ON	EX-11B(-PN)	EX-11EB(-PN)	EX-13B(-PN)	EX-13EB(-PN)	EX-19B(-PN)	EX-14B(-PN)						
Sensing range			150mm		500mm		1m	2 to 25mm (Note 2) (Conv. point: 10mm)	150mm		500mm	
Min. sensing object			∅ 1mm opaque object (Setting distance between emitter and receiver: 150mm)		∅ 2mm opaque object (Setting distance between emitter and receiver: 500mm)		∅ 2mm opaque object (Setting distance between emitter and receiver: 1m)	∅ 0.1mm copper wire (Setting distance: 10mm)	∅ 1mm opaque object (Setting distance between emitter and receiver: 150mm)		∅ 2mm opaque object (Setting distance between emitter and receiver: 500mm)	
Hysteresis			—————					15% or less of operation distance	—————			
Repeatability (perpendicular to sensing axis)			0.05mm or less					0.1mm or less	0.05mm or less			
Supply voltage			12 to 24V DC ± 10% Ripple P-P10% or less									
Current consumption			Emitter: 10mA or less, Receiver: 15mA or less				20mA or less	30mA or less				
Output			<NPN output type> NPN open-collector transistor <ul style="list-style-type: none"> <li>• Maximum sink current: 50mA</li> <li>• Applied voltage: 30V DC or less (between output and 0V)</li> <li>• Residual voltage: 1V or less (at 50mA sink current) 0.4V or less (at 16mA sink current)</li> </ul> <PNP output type> PNP open-collector transistor <ul style="list-style-type: none"> <li>• Maximum source current: 50mA</li> <li>• Applied voltage: 30V DC or less (between output and +V)</li> <li>• Residual voltage: 1V or less (at 50mA source current) 0.4V or less (at 16mA source current)</li> </ul>					NPN open-collector transistor <ul style="list-style-type: none"> <li>• Maximum sink current: 100mA</li> <li>• Applied voltage: 30V DC or less (between output and 0V)</li> <li>• Residual voltage: 1.5V or less (at 100mA sink current) 0.4V or less (at 16mA sink current)</li> </ul>				
	Utilization category		DC-12 or DC-13					—————				
	Short-circuit protection		Incorporated									
Response time			0.5ms or less									
Operation indicator			Red Led (lights up when the output is ON)					Orange LED (lights up when the output is ON), located on the bifurcation				
Incident beam indicator			—————					Red 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 (No dew condensation or icing allowed), Storage: - 30 to + 70°C									
	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		Emission: EN50081-2, Immunity: EN50082-2					—————				
	Voltage withstandability		1,000V AC for one min. between all supply terminals connected together and enclosure									
	Insulation resistance		20MΩ, or more, with 250V DC megger between all supply terminals connected together and enclosure									
	Vibration resistance		10 to 500Hz frequency, 3mm amplitude in X, Y and Z directions for two hours each									
Shock resistance		500m/s <sup>2</sup> acceleration (50G approx.) in X, Y and Z directions for three times each										
Emitting element			Red LED (modulated)									
Material			Enclosure: Polyethylene terephthalate Lens: Polyallylate					Enclosure: Polyethylene terephthalate Lens: Polyallylate, Bifurcation: Polyallylate				
Cable			0.1mm <sup>2</sup> 3-core (thru-beam type emitter: 2-core) cabtyre cable, 2m long					0.2mm <sup>2</sup> 3-core cabtyre cable, 2m long (beyond bifurcation; from emitter/receiver to bifurcation: 0.5m long)				
Cable extension			Extension up to total 50m is possible with 0.3mm <sup>2</sup> , or more, cable (thru-beam type: emitter and receiver).					Extension up to total 100m is possible with 0.3mm <sup>2</sup> , or more, cable.				
Weight			Emitter: 20g approx., Receiver: 20g approx.				20g approx.	55g approx.				
Accessories			Mounting screws: 2 sets					Mounting screws: 1 set	Mounting screws: 2 sets, Adjusting screwdriver: 1 No.			

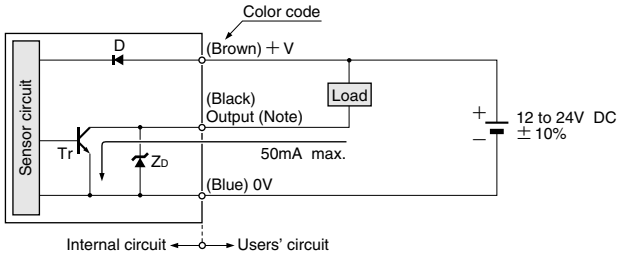
Notes: 1) Either Light-ON or Dark-ON can be selected by the operation mode switch (located on the bifurcation).

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

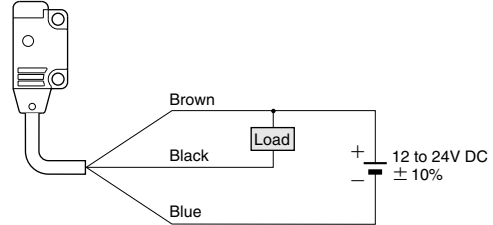
### I/O circuit diagram



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

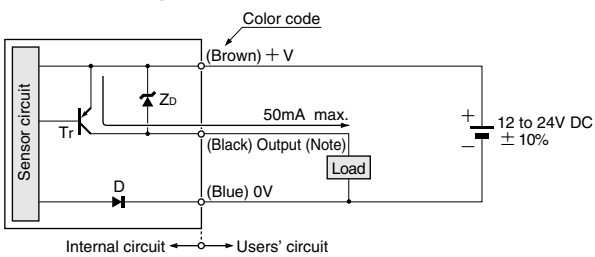
Symbols ... D: Reverse supply polarity protection diode  
Zd: Surge absorption zener diode  
Tr: NPN output transistor

### Wiring diagram



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

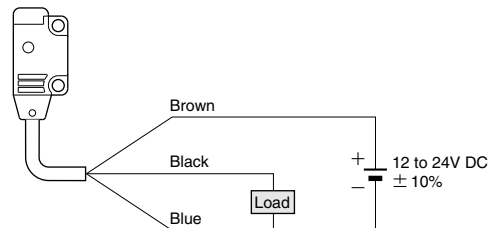
### I/O circuit diagram



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

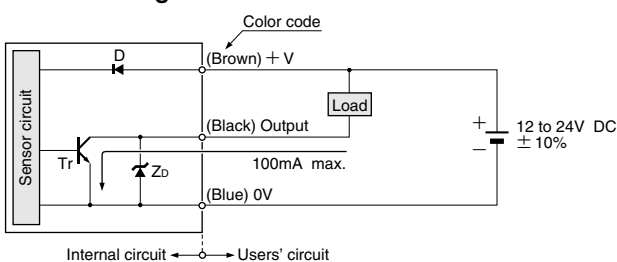
Symbols ... D: Reverse supply polarity protection diode  
Zd: Surge absorption zener diode  
Tr: PNP output transistor

### Wiring diagram



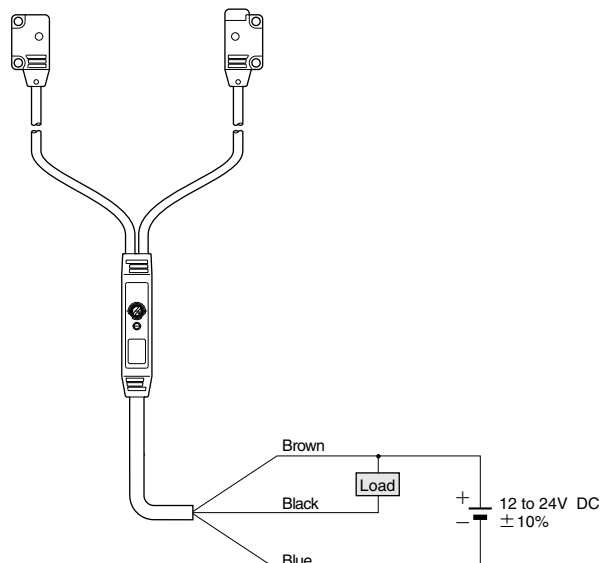
EX-15 EX-15E  
EX-17 EX-17E NPN output type

### I/O circuit diagram



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

### Wiring diagram

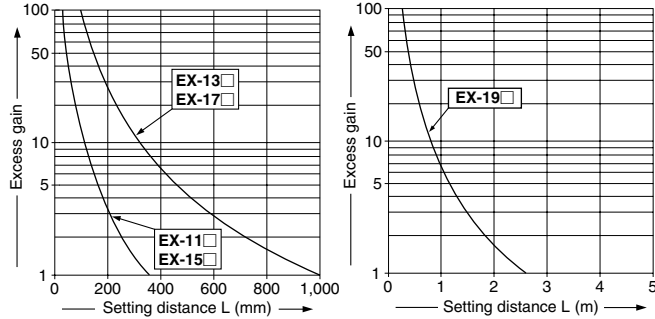


# EX-10

## SENSING CHARACTERISTICS (TYPICAL)

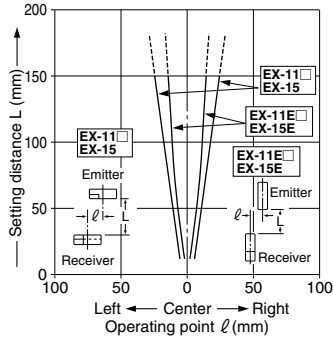
### All models Thru-beam type

#### Correlation between setting distance and excess gain

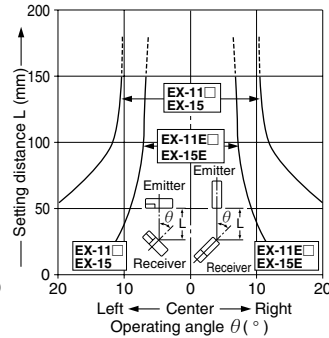


### EX-11, EX-11E, EX-15, EX-15E Thru-beam type

#### Parallel deviation

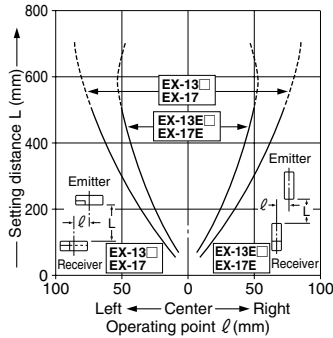


#### Angular deviation

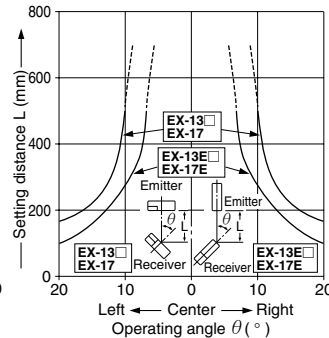


### EX-13, EX-13E, EX-17, EX-17E Thru-beam type

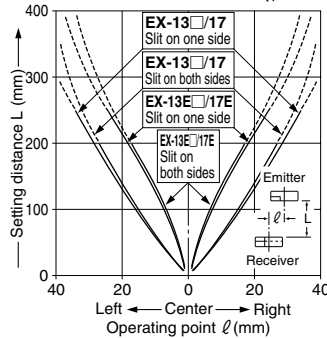
#### Parallel deviation



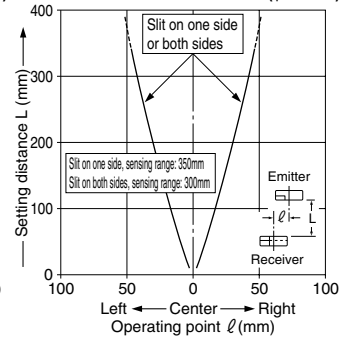
#### Angular deviation



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

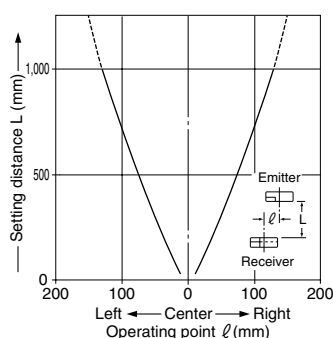


#### Parallel deviation with slit masks ( $\phi$ 1.5mm)

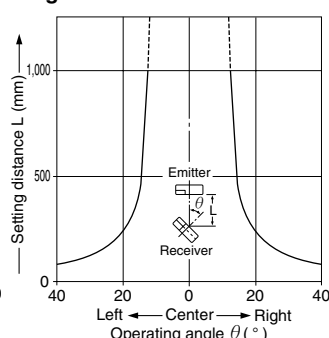


### EX-19 Thru-beam type

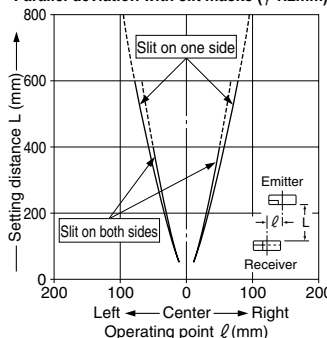
#### Parallel deviation



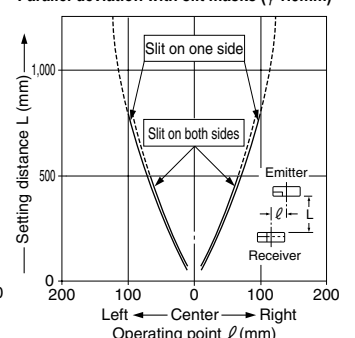
#### Angular deviation



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



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

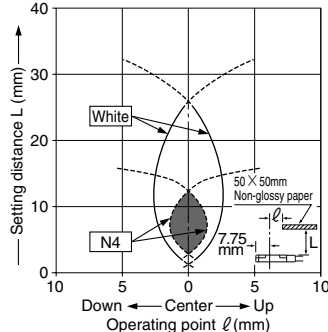
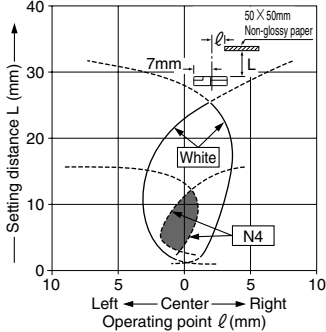


## SENSING CHARACTERISTICS (TYPICAL)

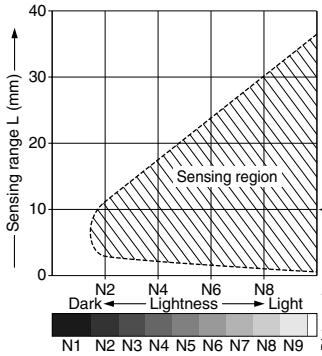
### EX-14 Convergent reflective type

#### Sensing fields

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



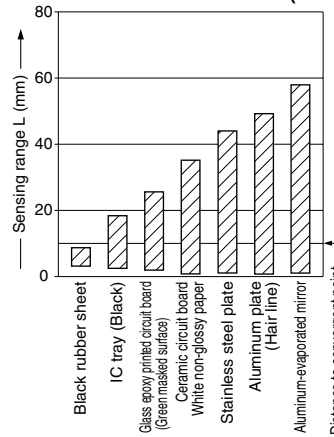
#### Correlation between lightness and sensing range



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

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

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



The bars 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

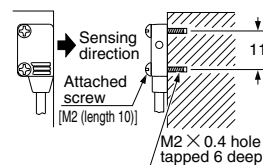


This product is not a safety sensor. Its use is not intended or designed to protect life and prevent body injury or property damage from dangerous parts of machinery. It is a normal object detection sensor.

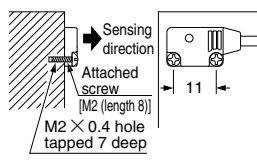
### Mounting

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

#### Side sensing



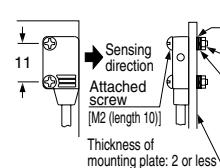
#### Front sensing



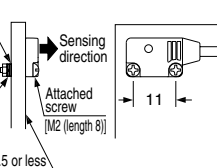
The tightening torque should be 0.2N·m or less.

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

#### Side sensing

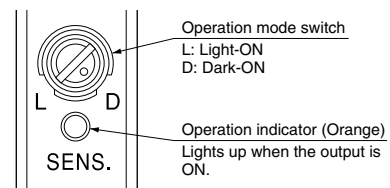


#### Front sensing



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

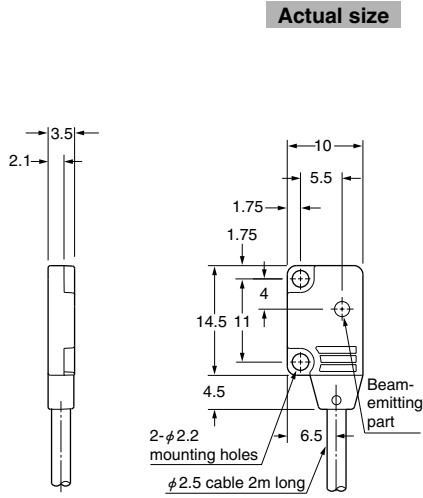
- Do not use during the initial transient time (50ms) (EX-15, EX-15E, EX-17 and EX-17E: 100ms) after the power supply is switched on.



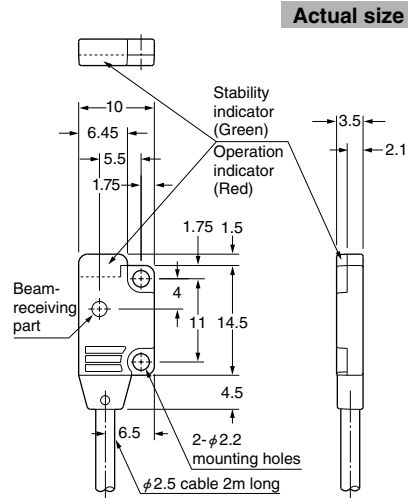
# EX-10

## DIMENSIONS (Unit: mm)

EX-11A □ EX-11B □ EX-13A □  
EX-13B □ EX-19A □ EX-19B □ Sensor

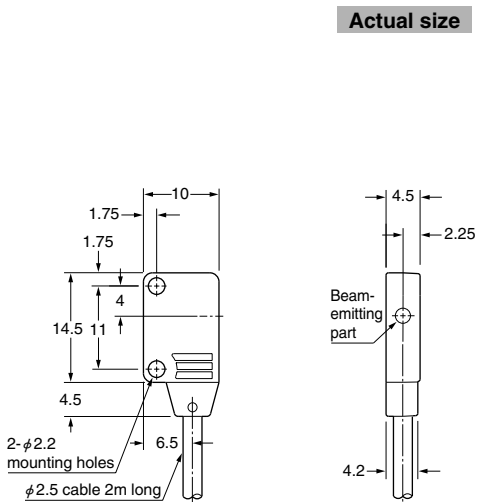


**Emitter**

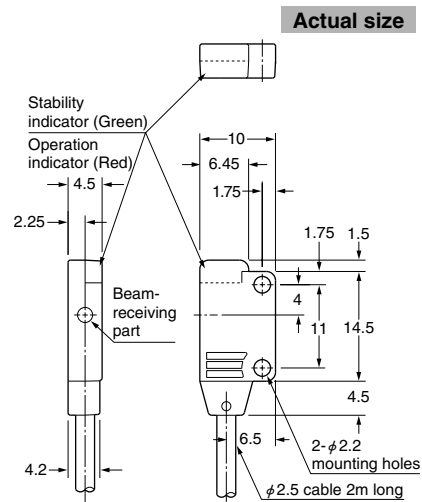


**Receiver**

EX-11EA □ EX-11EB □  
EX-13EA □ EX-13EB □ Sensor

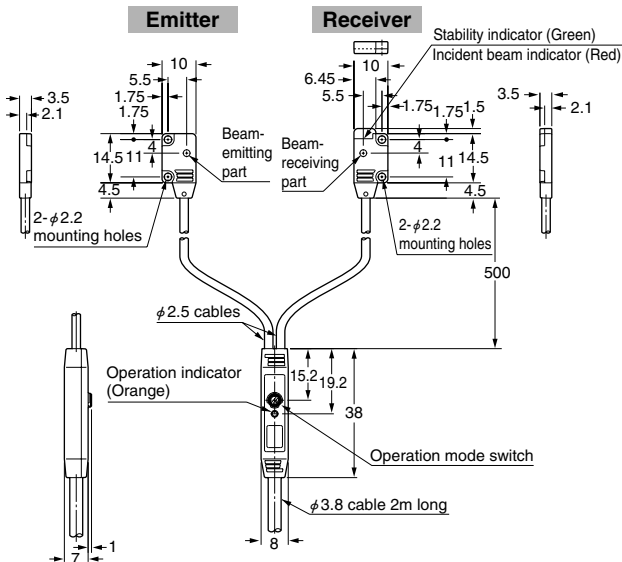


**Emitter**

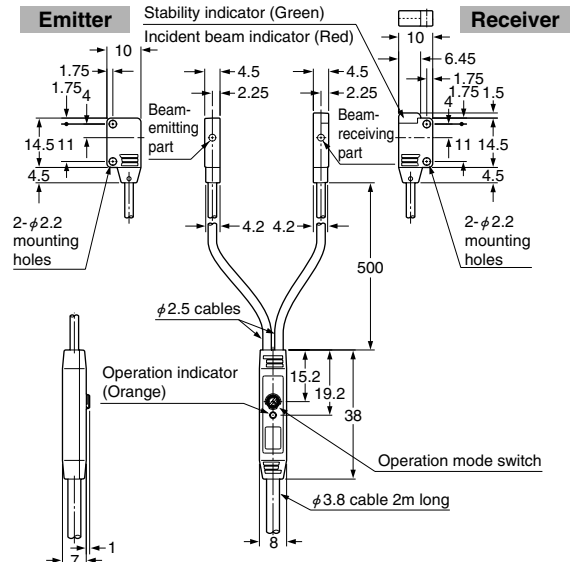


**Receiver**

EX-15  
EX-17 Sensor



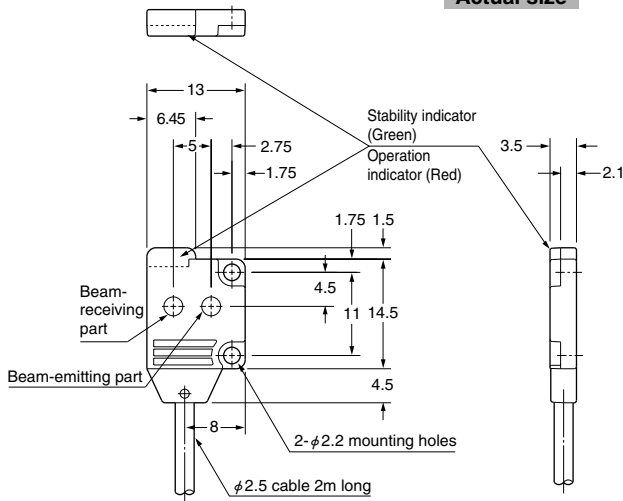
EX-15E  
EX-17E Sensor



## DIMENSIONS (Unit: mm)

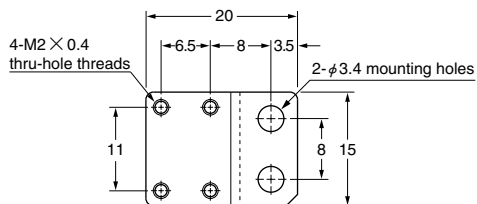
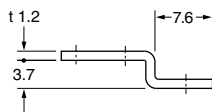
**EX-14A** □  
**EX-14B** □ Sensor

Actual size



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

Actual size

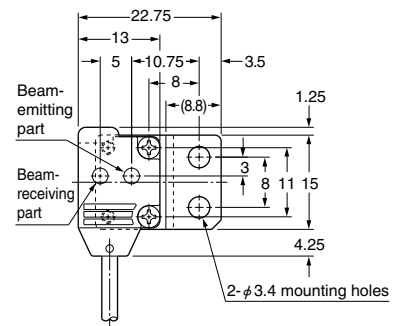
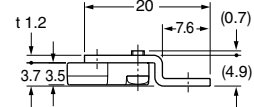


Material: Cold rolled carbon steel (SPCC)  
(Uni-chrome plated)

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

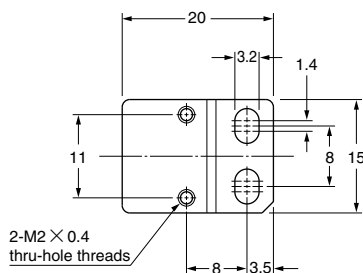
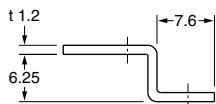
Assembly dimensions

Mounting drawing with EX-14 □



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

Actual size



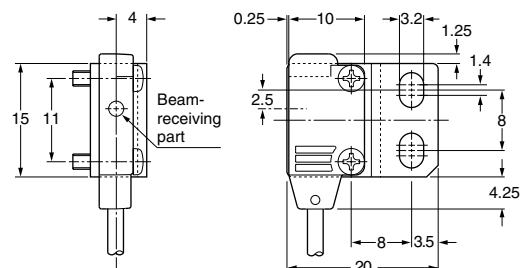
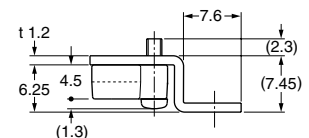
Material: Cold rolled carbon steel (SPCC)  
(Uni-chrome plated)

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

Assembly dimensions

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

Actual size

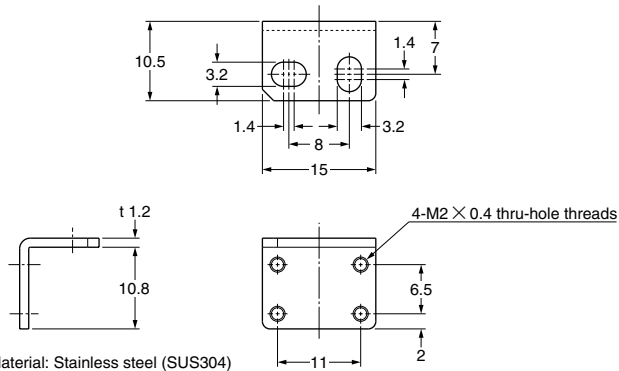




## DIMENSIONS (Unit: mm)

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

#### Actual size



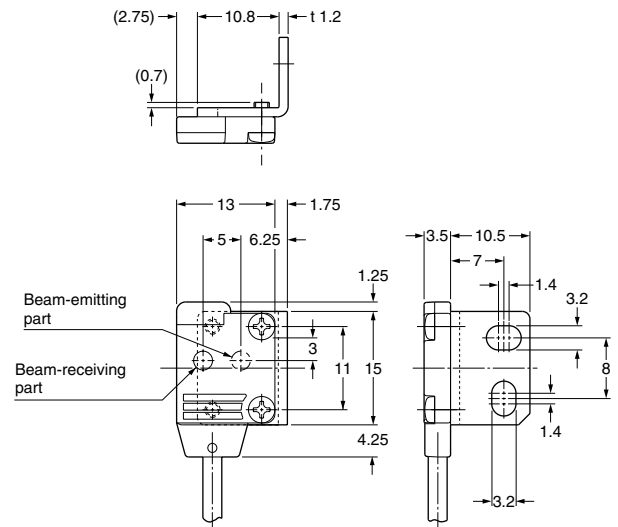
Material: Stainless steel (SUS304)

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



Beam-emitting part

Beam-receiving part