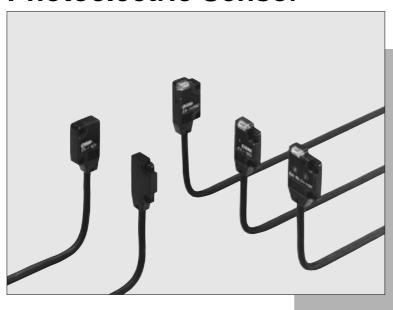
# EX-10 SERIES

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



Amplifier Built-in Extraordinarily Small and Slim Size

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

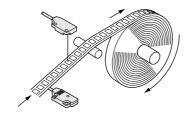
#### Smallest Body, Just 3.5mm Thick

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).



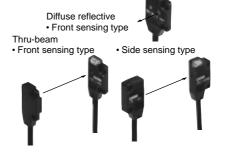
#### **High-speed Response Time: 0.5ms**

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.



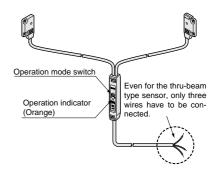
#### Waterproof

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 startup.



#### **Globally Usable**

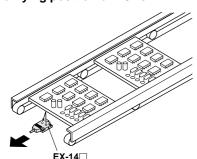
PNP output type which is much in demand in Europe is available. Of course, it conforms to the EMC directive.

#### **Red Beam Makes Beam Alignment Easy**

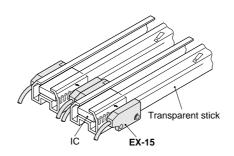
The red LED beam projected from the emitter helps you to align the sensor heads.

#### **APPLICATIONS**

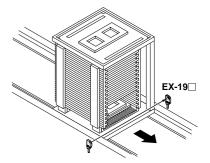
#### Verifying position of PCBs



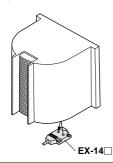
#### **Detecting ICs**



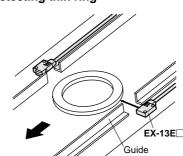
**Detecting PCB rack** 



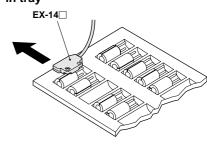
**Detecting wafer cassette** 



**Detecting thin ring** 



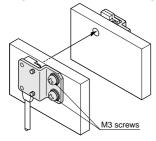
Checking for absence of capacitor in tray



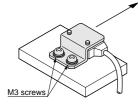
#### Mountable with M3 Screws

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

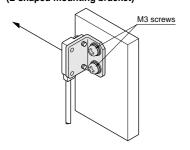
 MS-EX10-1 [Cold rolled carbon steel (SPCC)] and MS-EX10-11 [Stainless steel (SUS304)] (mounting bracket for the front sensing type)



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

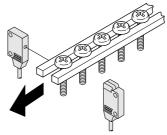


 MS-EX10-3 [Cold rolled carbon steel (SPCC)] and MS-EX10-13 [Stainless steel (SUS304)] (L-shaped mounting bracket)



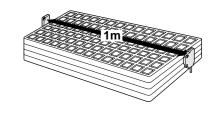
#### 

**EX-11** $\square$ , **EX-11E** $\square$ , **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.



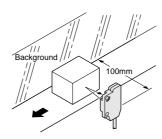
#### Long Sensing Range: 1m (EX-19□)

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.

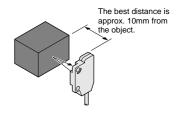


#### **Background Suppression (EX-14**□)

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.



#### **ORDER GUIDE**

	Туре	)	Appearance		Sensing range	Model No.	Output operation	Min. sensing object	
					450	EX-11A	Light-ON	#1mm opaque object (Setting distance between the emitter and the receiver: 150mm	
					150mm	EX-11B	Dark-ON		
					500mm	EX-13A	Light-ON	\$\delta 2\text{mm opaque object}  \( \setting \text{distance between the} \)	
	Thru-beam	Front sensing	Ш		500mm	EX-13B	Dark-ON	emitter and the receiver: 500mm	
					( 1 1 m	EX-19A NEW	Light-ON	\$\phi\$2mm opaque object    (Setting distance between the)	
		ont s	H		1m	EX-19B NEW	Dark-ON	emitter and the receiver: 1m	
ut		From With operation mode switch on the bifurcation	ם ב		150mm	EX-15	Switchable either Light-ON	\$\$\phi\$1mm opaque object (Setting distance between the emitter and the receiver: 150mm)  \$\$\phi\$2mm opaque object (Setting distance between the emitter and the receiver: 500mm)	
		With operati			500mm	EX-17	or Dark-ON		
outp	_				150mm	EX-11EA	Light-ON		
NPN output					Toomin	EX-11EB	Dark-ON	emitter and the receiver: 150mm	
Z		ing			500mm	EX-13EA	Light-ON		
		sens			000	EX-13EB	Dark-ON	\emitter and the receiver: 500mm	
		Side sensing With operation mode switch on the bifurcation			150mm	EX-15E	Switchable either Light-ON		
		With operati switch on th			500mm	EX-17E	or Dark-ON		
	Convergent effective Diffused beam type)	Front sensing			2 to 25mm (Note 1)	EX-14A	Light-ON		
	Convergent reflective (Diffused beam	Fronts			(Convergent point: 10mm)	EX-14B	Dark-ON	(Setting distance: 10mm)	
	Thru-beam				150mm	EX-11A-PN NEW	Light-ON		
		ing	П		Toomin	EX-11B-PN NEW	Dark-ON	\emitter and the receiver: 150mm	
		Front sensing	]-		500mm	EX-13A-PN NEW	Light-ON		
			Н		COOMIN	EX-13B-PN NEW	Dark-ON	\emitter and the receiver: 500mm	
			u		( 1m	EX-19A-PN NEW	Light-ON		
Ħ					),,,	EX-19B-PN NEW	Dark-ON	emitter and the receiver: 1m	
outp		Side sensing			150mm	EX-11EA-PN NEW	Light-ON		
PNP output				<b>→</b>  _		EX-11EB-PN NEW	Dark-ON	emitter and the receiver: 150mm	
ш					500mm	EX-13EA-PN NEW	Light-ON		
						EX-13EB-PN NEW	Dark-ON	\emitter and the receiver: 500mm	
	Convergent eflective Diffused beam type)	Front sensing			2 to 25mm (Note 1)	NEW EX-14A-PN	Light-ON		
	Convergent reflective (Diffused beam	Front (			(Convergent point: 10mm)	NEW EX-14B-PN	Dark-ON	(Setting distance: 10mm)	

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					
	MS-EX10-1	Mounting bracket for the front sensing type sensor [Cold rolled carbon steel (SPCC)] (The thru-beam type sensor needs two brackets.)					
	MS-EX10-2	Mounting bracket for the side sensing type sensor [Cold rolled carbon steel (SPCC)] (The thru-beam type sensor needs two brackets.)					
Sensor mounting	MS-EX10-3	L-shaped mounting bracket sensor [Cold rolled carbon steel (SPCC)] (The thru-beam type sensor needs two brackets.)					
bracket	MS-EX10-11	Mounting bracket for the front sensing type sensor [Stainless steel (SUS30 (The thru-beam type sensor needs two brackets.)					
	MS-EX10-12	Mounting bracket for the side sensing type sensor [Stainless steel (SUSC) (The thru-beam type sensor needs two brackets.)					
	MS-EX10-13	L-shaped mounting bracket [Stainless steel (SUS304)] (The thru-beam type sensor needs two brackets.)					
	OS-EX10-12	Sensing range: 600mm [EX-19□] Slit on one side 250mm [EX-13□, EX-17] ∴ Min. sensing object:					
	(Slit size	· Sensing range: 400mm [EX-19□] Slit on both sides 200mm [EX-13□, EX-17] · Min. sensing object:					
Slit mask	OS-EX10-15	· Sensing range: 800mm [EX-19□] Slit on one side 350mm [EX-13□] · Min. sensing object:					
Silt mask	(Slit size $\phi$ 1.5mm)	· Sensing range: 500mm [EX-19□] Slit on both sides 300mm [EX-13□] · Min. sensing object:					
	OS-EX10E-12	Slit on one side Sensing range: 250mm [EX-13E□, EX-17E] · Min. sensing object:					
	(Slit size φ1.2mm)	Slit on both sides Sensing range: 200mm [EX-13E□, EX-17E] · Min. sensing object:					
Sensor checker (Note)	CHX-SC2	It is useful for beam alignment of thru-beam type sensors. The optimum receiver position is given by indicators, as well as, an audio signal.					

Note: Refer to P.378∼ for details of the sensor checker **CHX-SC2**.

#### Sensor mounting bracket

• MS-EX10-1

• MS-EX10-11



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



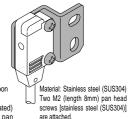
Material: Stainless steel (SUS304) Two M2 (length 4mm) pan head screws [stainless steel (SUS304)] are attached.

#### • MS-EX10-2

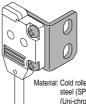


Material: Cold rolled carbon steel (SPCC)
(Uni-chrome plated)
Two M2 (length 8mm) pan head screws are attached.

#### • MS-EX10-12



#### • 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



#### Slit mask

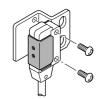
- OS-EX10-12
- OS-EX10-15





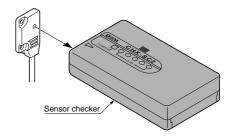
• OS-EX10E-12

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



Tighten along with the sensor mounting bracket.

#### Sensor checker



#### **SPECIFICATIONS**

		Туре	Thru-beam					Convergent reflective Thru-beam • with operation mode switch on bifurcation					
							Front sensing	•					
	Madal	Light-ON				EX-13EA(-PN)			Ĭ				
Item	Model No.	Dark-ON				EX-13EB(-PN)		EX-14B(-PN)	EX-15 (Note 1)	<b>EX-15E</b> (Note 1)	<b>EX-17</b> (Note 1)	(Note 1)	
Sensing ra	ange			150mm		500mm		2 to 25mm (Note 2) (Conv. point: 10mm)	150mm		500mm		
Min. sensing object			φ1mm opaque object   Setting distance   between emitter   and receiver: 150mm   φ2mm opaque object   Setting distance   between emitter   and receiver: 500mm			stance smitter			\$\phi 1mm opaque object   Setting distance between emitter and receiver: 150mm \$\phi 2mm opaque object   Setting distance between emitter ar receiver: 500mm			stance emitter and	
Hysteresis	s							15% or less of operation distance					
Repeatabi (perpendic		nsing axis)	0.05mm or less					0.1mm or less	0.05mm or less				
Supply vo	ltage		12 to 24V DC ± 10% Ripple F						10% or less				
Current co	onsumptio	n	Emitter: 10mA or less, Receiver: 15mA or less					20mA or less	30mA or less				
Output			<npn output="" type=""> NPN open-collector transistor  • Maximum sink current: 50mA  • Applied voltage: 30V DC or less (between output and 0V)  • Residual voltage: 1V or less (at 50mA sink current)  0.4V or less (at 16mA sink current)  <pnp output="" type=""> PNP open-collector transistor  • Maximum source current: 50mA  • Applied voltage: 30V DC or less (between output and + V)  • Residual voltage: 1V or less (at 50mA source current)  0.4V or less (at 16mA source current)</pnp></npn>					NPN open-collector transistor  • Maximum sink current: 100mA  • Applied voltage: 30V DC or less (between output and 0V)  • Residual voltage: 1.5V or less (at 100mA sink current) 0.4V or less (at 16mA sink current)					
Utiliza	ation cate	gory	DC-12 or DC-13										
Short	t-circuit pro	otection	Incorporated										
Response time			0.5ms or less										
Operation	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 be	eam indica	ator						Red LED (lights up under light received condition), located on the receiver					
Stability in	ndicator		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					
Pollut	tion degre	е	3 (Industrial environment)										
Prote	ection		IP67 (IEC)										
	Ambient temperature		— 25 to + 55°C (No dew condensation or icing allowed), Storage: −30 to +70°C										
Ambie	Ambient humidity		35 to 85% RH, Storage: 35 to 85% RH										
T Ambie	ent illumin	ance	Sunlight: 10,000ℓx at the light-receiving face, Incandescent light: 3,000ℓx at the light-receiving face										
EMC			Emission: EN50081-2, Immunity: EN50082-2										
Ambie	ge withsta	ndability	1,000V AC for one min. between all supply termin						onnected together and enclosure				
ய் Insula	ation resis	tance	$20 M\Omega,$ or more, with 250V DC megger between all sup					supply termination	minals connected together and enclosure				
Vibra	tion resista	ance		10 to 500Hz frequency, 3mm amplitude in					Z directions for two hours each				
Shock	k resistan	ce	500m/s² acceleration (50G approx.) in X, Y and Z directions for three times each										
Emitting element			Red LED (modulated)										
Material			Enclosure: Polyethylene terephthalate Lens: Polyalylate					Enclosure: Polyethylene terephthalate Lens: Polyalylate, Bifurcation: Polyalylate					
Cable			0.1mm <sup>2</sup> 3-core (thru-beam type emitter: 2-core) cabtyre cable, 2m long					e, 2m long	0.2mm² 3-core cabtyre cable, 2m long (beyond bifurcation; from emitter/receiver to bifurcation: 0.5m long)				
Cable exte	Cable extension			Extension up to total 50m is possible with 0.3mm², or more, (thru-beam type: emitter and receiver).					Extension up to total 100m is possible with 0.3mm², or more, cable.				
Weight			En	nitter: 20g ap	prox., Recei	ver: 20g appr	ox.	20g approx.	55g approx.			-	
Accessories				Mounting screws: 2 sets  Mounting screws: 1 set  Mounting screws: 2 sets, Adjusting screwdrive				/driver: 1 No.					

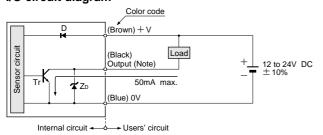
Notes: 1) Either Light-ON or Dark-ON can be selected by the operation mode switch (located on the bifurcation).

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



#### I/O circuit diagram

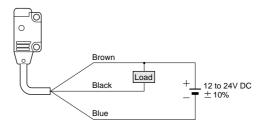


Note: The emitter of the thru-beam type sensor does not incorporate the output.

Symbols ... D: Reverse supply polarity protection diode ZD: Surge absorption zener diode

# Tr: NPN output transistor

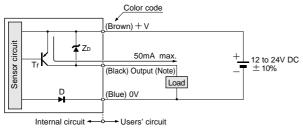
#### Wiring diagram



# EX-11 -PN EX-13 -PN EX-19 -PN EX-14 -PN

#### PNP output type

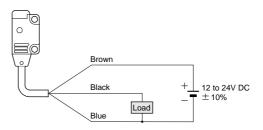
#### I/O circuit diagram



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

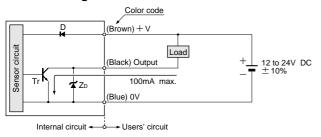
Symbols ... D: Reverse supply polarity protection diode Zo: Surge absorption zener diode
Tr: PNP output transistor

#### Wiring diagram



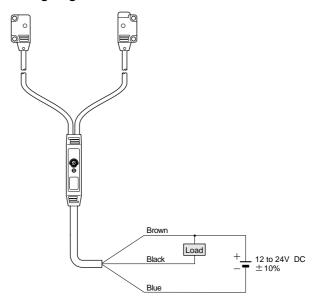
### NPN output type

#### I/O circuit diagram



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

#### Wiring diagram

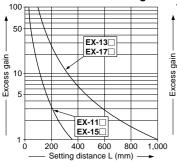


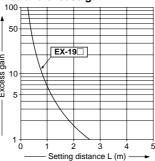
#### SENSING CHARACTERISTICS (TYPICAL)

#### All models

Thru-beam type

#### Correlation between setting distance and excess gain

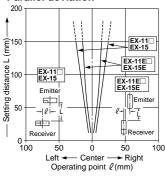


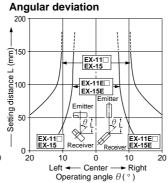


# EX-11 EX-11E EX-15

Thru-beam type

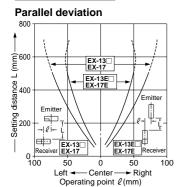


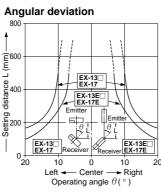


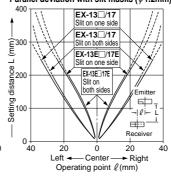


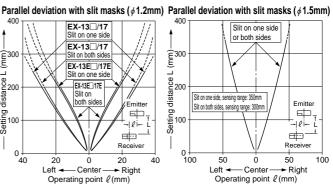
# EX-13 EX-13E EX-17E

Thru-beam type





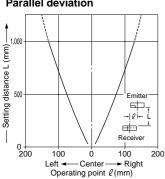


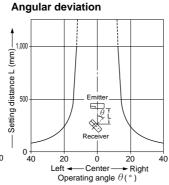


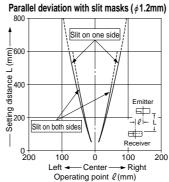
#### EX-19□

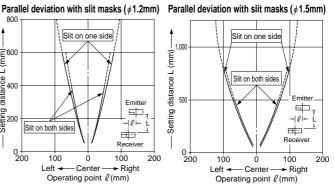
Thru-beam type

#### Parallel deviation









#### **SUNX**

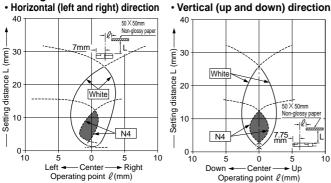
#### SENSING CHARACTERISTICS (TYPICAL)

#### EX-14□

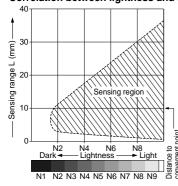
Convergent reflective type

#### Sensing fields

· Horizontal (left and right) direction



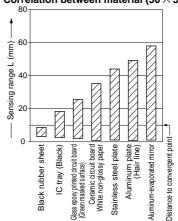
#### Correlation between lightness and sensing range



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.

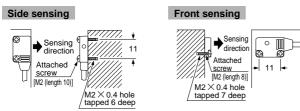
#### PRECAUTIONS FOR PROPER USE

Refer to P.820~ for general precautions.



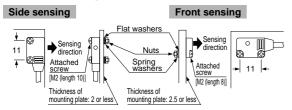
This product is not a safety sensor. Its use is not intended or designed to protect life and prevent body injury or property damage from dangerous parts of machinery. It is a normal object detection sensor.

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



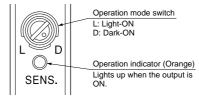
The tightening torque should be 0.2N·m or less.

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



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

#### Operation mode switch (EX-15, EX-15E, EX-17 and EX-17E only)

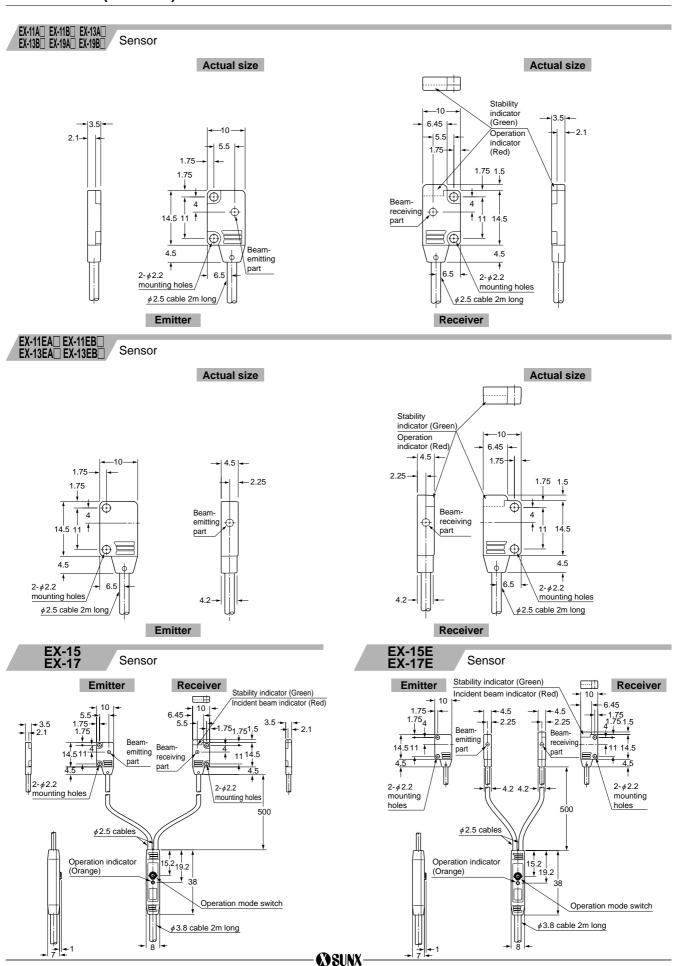


Switch position	Description					
<b>₽</b> D	Light-ON mode is set when the switch is turned fully clockwise (L side).					
L D	Dark-ON mode is set when the switch is turned fully counterclockwise(D side).					

#### **Others**

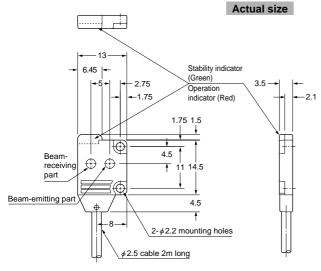
• Do not use during the initial transient time (50ms) (EX-15, EX-15E, EX-17 and EX-17E: 100ms) after the power supply is switched on.

#### **DIMENSIONS (Unit: mm)**



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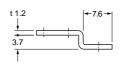
## Sensor



#### MS-EX10-1

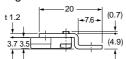
Sensor mounting bracket (Optional)

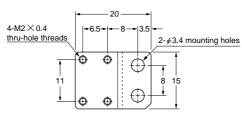




### **Assembly dimensions**

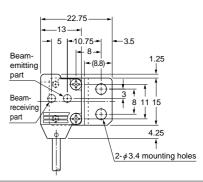
Mounting drawing with **EX-14**□





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

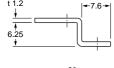
Two M2 (length 4mm) pan head screws are attached.

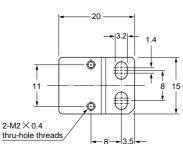


#### MS-EX10-2

Sensor mounting bracket (Optional)

#### Actual size

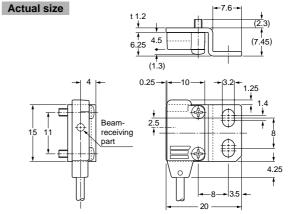




Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated) Two M2 (length 8mm) pan head screws are attached.

#### **Assembly dimensions**

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



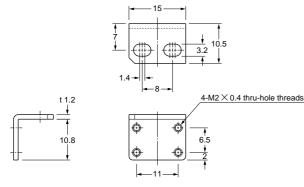
**SUNX** 

#### **DIMENSIONS (Unit: mm)**

#### MS-EX10-3

Sensor mounting bracket (Optional)

#### Actual size



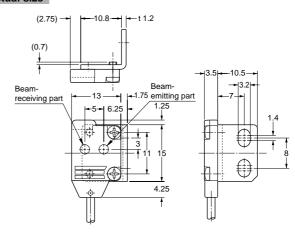
Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated)

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

#### **Assembly dimensions**

Mounting drawing with **EX-14**□

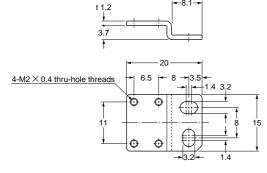
#### Actual size



#### MS-EX10-11

Sensor mounting bracket (Optional)

#### Actual size



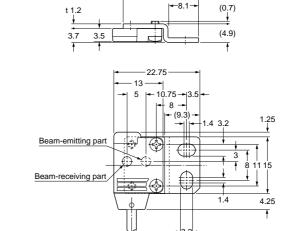
Material: Stainless steel (SUS304)

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

#### Assembly dimensions

Actual size

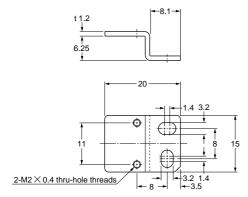
Mounting drawing with **EX-14**□



#### MS-EX10-12

Sensor mounting bracket (Optional)

#### Actual size

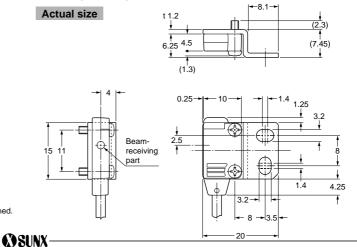


Material: Stainless steel (SUS304)

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

#### **Assembly dimensions**

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

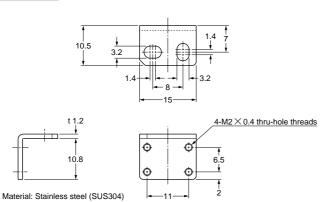


#### **DIMENSIONS (Unit: mm)**

#### MS-EX10-13

Sensor mounting bracket (Optional)

#### Actual size



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

