

EX-10 SERIES Ver.2

Ver.2



(Excluding EX-15□/EX-17□)



(Excluding EX-15□/EX-17□)

Recognition
(Excluding some models)PNP
output
type available

Amplifier built-in extraordinarily small and slim size

Smallest body, just 3.5 mm 0.138 in thick

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



Flexible mounting

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

Thru-beam
 • Front sensing type



• Side sensing type



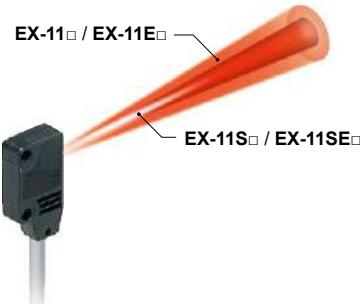
Diffuse reflective
 • Front sensing type



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

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

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

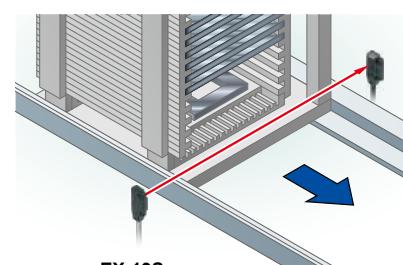


Possible to sense a minute object less than ø0.5 mm ø0.039 in with no slit.

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

Long sensing range of 1 m 3.281 ft with narrow beam

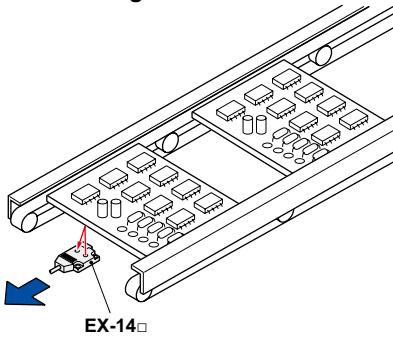
A long 1 m 3.281 ft sensing range is possible with narrow beam.



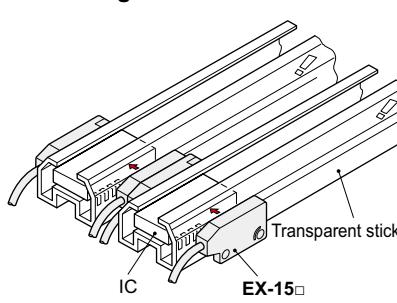
EX-19S□

APPLICATIONS

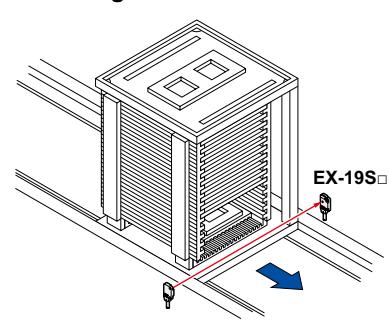
Positioning of PCBs



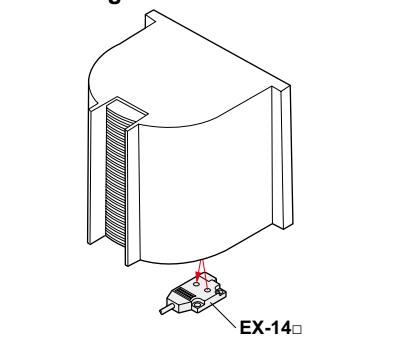
Detecting ICs



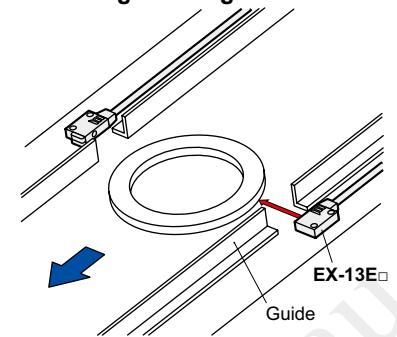
Detecting PCB rack



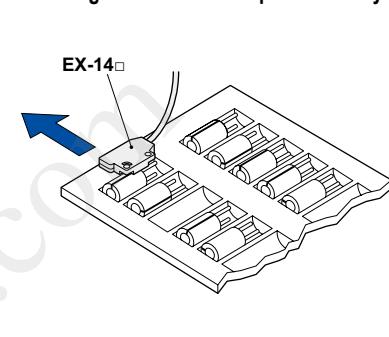
Detecting wafer cassette



Detecting thin ring



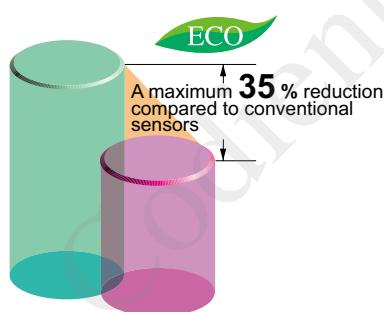
Checking for absence of capacitor in tray



BASIC PERFORMANCE

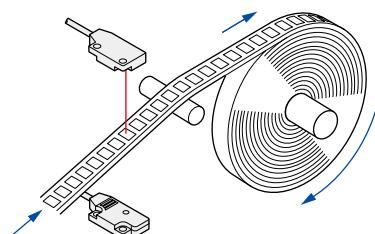
Electric power saving

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



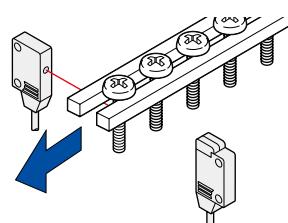
High-speed response time: 0.5 ms

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



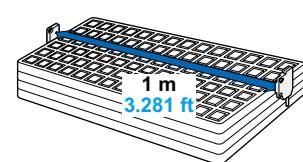
Minimum sensing object: ø1 mm 0.039 in EX-11(E)□, EX-15(E)□

EX-11□, EX-11E□, EX-15 and EX-15E are incorporated with ø1 mm 0.039 in slit masks so that ø1 mm 0.039 in, or more, object can be detected. Hence, they are suitable for precise positioning or small parts detection.



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

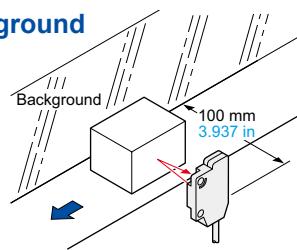
A sensing range of 1 m 3.281 ft has been realized with a slim size of just 3.5 mm 0.138 in. It can be used to detect even wide IC trays.



Background suppression

Hardly affected by background

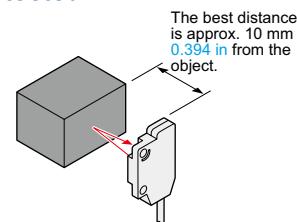
Even a specular background separated by 100 mm 3.937 in, or more, is not detected. (However, the background should be directly opposite. A spherical or curved background may be detected.)



EX-14□

Black object reliably detected

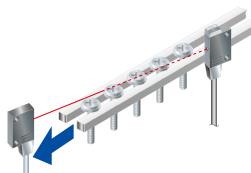
It can reliably detect dark color objects since it is convergent reflective type.



ENVIRONMENTAL RESISTANCE

Incorporated an inverter countermeasure circuit

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



Waterproof IP67

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

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

Bending durability

EX-□-R

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

MOUNTING / SIZE

Mountable with M3 screws

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

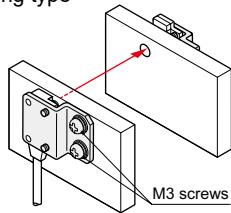
• MS-EX10-1

[Cold rolled carbon steel (SPCC)]

MS-EX10-11

[Stainless steel (SUS304)]

(mounting bracket for the front)
(sensing type)



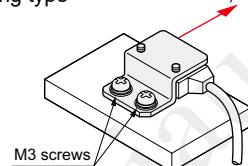
• MS-EX10-2

[Cold rolled carbon steel (SPCC)]

MS-EX10-12

[Stainless steel (SUS304)]

(mounting bracket for the side)
(sensing type)



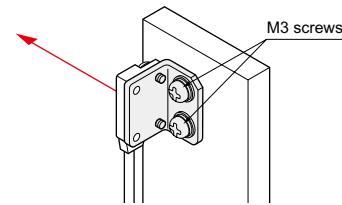
• MS-EX10-3

[Cold rolled carbon steel (SPCC)]

MS-EX10-13

[Stainless steel (SUS304)]

(L-shaped mounting bracket)



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

Red beam makes beam alignment easy

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

OTHERS

Compliant with safety standards! (excluding EX-15□ / 17□)

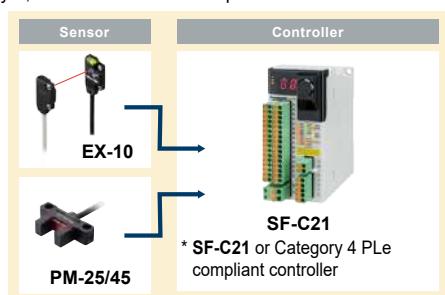
Sensor unit complies with Category 1 PLc.

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

A Category 3 PLd Safety System can be built

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

■ Category 3, PLd construction example



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

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

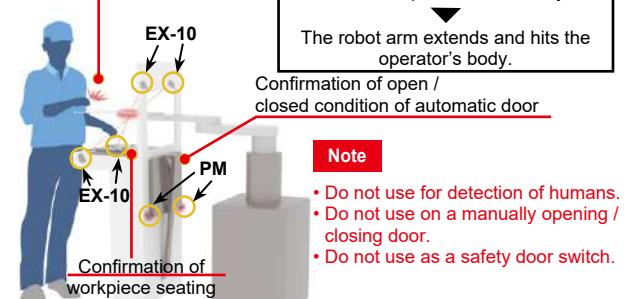
Can be retrofit and installed in a very small space as a safety-standard-compliant photoelectric sensor for added safety.

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

- When robot arm is the source of hazards



Extension of robot arm



Less resources used

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



■ ORDER GUIDE

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

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

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

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

Bending-resistant cable type

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

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

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

5 m 16.404 ft cable length type

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

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

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

■ OPTIONS

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

Designation	Model No.	Description				
Sensor mounting bracket (Note 1)	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.)				
	MS-EX10-3	L-shaped mounting bracket sensor [Cold rolled carbon steel (SPCC)] (The thru-beam type sensor needs two brackets.)				
	MS-EX10-11	Mounting bracket for the front sensing type sensor [Stainless steel (SUS304)] (The thru-beam type sensor needs two brackets.)				
	MS-EX10-12	Mounting bracket for the side sensing type sensor [Stainless steel (SUS304)] (The thru-beam type sensor needs two brackets.)				
Slit mask	OS-EX10-12 (Slit size $\varnothing 1.2\text{ mm } \varnothing 0.047\text{ in}$)	<table border="0"> <tr> <td>Slit on one side</td> <td> <ul style="list-style-type: none"> Sensing range: 600 mm 23.622 in [EX-19□] 250 mm 9.843 in [EX-13□, EX-17□] Min. sensing object: $\varnothing 2\text{ mm } \varnothing 0.079\text{ in}$ </td> </tr> <tr> <td>Slit on both sides</td> <td> <ul style="list-style-type: none"> Sensing range: 400 mm 15.748 in [EX-19□] 200 mm 7.874 in [EX-13□, EX-17□] Min. sensing object: $\varnothing 1.2\text{ mm } \varnothing 0.047\text{ in}$ </td> </tr> </table>	Slit on one side	<ul style="list-style-type: none"> Sensing range: 600 mm 23.622 in [EX-19□] 250 mm 9.843 in [EX-13□, EX-17□] Min. sensing object: $\varnothing 2\text{ mm } \varnothing 0.079\text{ in}$ 	Slit on both sides	<ul style="list-style-type: none"> Sensing range: 400 mm 15.748 in [EX-19□] 200 mm 7.874 in [EX-13□, EX-17□] Min. sensing object: $\varnothing 1.2\text{ mm } \varnothing 0.047\text{ in}$
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Slit on both sides	<ul style="list-style-type: none"> Sensing range: 400 mm 15.748 in [EX-19□] 200 mm 7.874 in [EX-13□, EX-17□] Min. sensing object: $\varnothing 1.2\text{ mm } \varnothing 0.047\text{ in}$ 					
OS-EX10-15 (Slit size $\varnothing 1.5\text{ mm } \varnothing 0.059\text{ in}$)	<table border="0"> <tr> <td>Slit on one side</td> <td> <ul style="list-style-type: none"> Sensing range: 800 mm 31.496 in [EX-19□] 350 mm 13.780 in [EX-13□, EX-17□] Min. sensing object: $\varnothing 2\text{ mm } \varnothing 0.079\text{ in}$ </td> </tr> <tr> <td>Slit on both sides</td> <td> <ul style="list-style-type: none"> Sensing range: 500 mm 19.685 in [EX-19□] 300 mm 11.811 in [EX-13□, EX-17□] Min. sensing object: $\varnothing 1.5\text{ mm } \varnothing 0.059\text{ in}$ </td> </tr> </table>	Slit on one side	<ul style="list-style-type: none"> Sensing range: 800 mm 31.496 in [EX-19□] 350 mm 13.780 in [EX-13□, EX-17□] Min. sensing object: $\varnothing 2\text{ mm } \varnothing 0.079\text{ in}$ 	Slit on both sides	<ul style="list-style-type: none"> Sensing range: 500 mm 19.685 in [EX-19□] 300 mm 11.811 in [EX-13□, EX-17□] Min. sensing object: $\varnothing 1.5\text{ mm } \varnothing 0.059\text{ in}$ 	
Slit on one side	<ul style="list-style-type: none"> Sensing range: 800 mm 31.496 in [EX-19□] 350 mm 13.780 in [EX-13□, EX-17□] Min. sensing object: $\varnothing 2\text{ mm } \varnothing 0.079\text{ in}$ 					
Slit on both sides	<ul style="list-style-type: none"> Sensing range: 500 mm 19.685 in [EX-19□] 300 mm 11.811 in [EX-13□, EX-17□] Min. sensing object: $\varnothing 1.5\text{ mm } \varnothing 0.059\text{ in}$ 					
OS-EX10E-12 (Slit size $\varnothing 1.2\text{ mm } \varnothing 0.047\text{ in}$)	<table border="0"> <tr> <td>Slit on one side</td> <td> <ul style="list-style-type: none"> Sensing range: 400 mm 15.748 in [EX-19E□] (Note 2) 250 mm 9.843 in [EX-13E□, EX-17E□] Min. sensing object: $\varnothing 1.2\text{ mm } \varnothing 0.047\text{ in}$ [EX-19E□] (Note 2) $\varnothing 2\text{ mm } \varnothing 0.079\text{ in}$ [EX-13E□, EX-17E□] </td> </tr> <tr> <td>Slit on both sides</td> <td> <ul style="list-style-type: none"> Sensing range: 200 mm 7.874 in [EX-13E□, EX-17E□] Min. sensing object: $\varnothing 1.2\text{ mm } \varnothing 0.047\text{ in}$ </td> </tr> </table>	Slit on one side	<ul style="list-style-type: none"> Sensing range: 400 mm 15.748 in [EX-19E□] (Note 2) 250 mm 9.843 in [EX-13E□, EX-17E□] Min. sensing object: $\varnothing 1.2\text{ mm } \varnothing 0.047\text{ in}$ [EX-19E□] (Note 2) $\varnothing 2\text{ mm } \varnothing 0.079\text{ in}$ [EX-13E□, EX-17E□] 	Slit on both sides	<ul style="list-style-type: none"> Sensing range: 200 mm 7.874 in [EX-13E□, EX-17E□] Min. sensing object: $\varnothing 1.2\text{ mm } \varnothing 0.047\text{ in}$ 	
Slit on one side	<ul style="list-style-type: none"> Sensing range: 400 mm 15.748 in [EX-19E□] (Note 2) 250 mm 9.843 in [EX-13E□, EX-17E□] Min. sensing object: $\varnothing 1.2\text{ mm } \varnothing 0.047\text{ in}$ [EX-19E□] (Note 2) $\varnothing 2\text{ mm } \varnothing 0.079\text{ in}$ [EX-13E□, EX-17E□] 					
Slit on both sides	<ul style="list-style-type: none"> Sensing range: 200 mm 7.874 in [EX-13E□, EX-17E□] Min. sensing object: $\varnothing 1.2\text{ mm } \varnothing 0.047\text{ in}$ 					
Mounting screw	MS-M2	Mounting screws with washers (50 pcs. lot). It can mount securely as it is spring washer attached.				

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

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

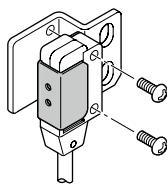
Slit mask

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



- **OS-EX10E-12**

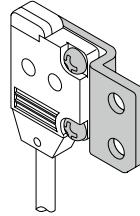
Example of mounting
(OS-EX10E-12)



Tighten along with the sensor mounting bracket.

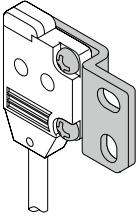
Sensor mounting bracket

- **MS-EX10-1**



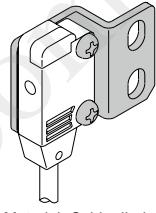
Material: Cold rolled carbon steel (SPCC)
(Uni-chrome plated)
Two M2 (length 4 mm **0.157 in**) pan head screws are attached.

- **MS-EX10-11**

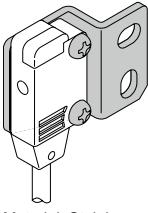


Material: Stainless steel (SUS304)
Two M2 (length 4 mm **0.157 in**) pan head screws [stainless steel (SUS304)] are attached.

- **MS-EX10-2**

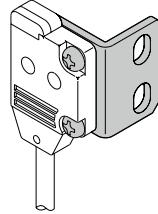


Material: Cold rolled carbon steel (SPCC)
(Uni-chrome plated)
Two M2 (length 8 mm **0.315 in**) pan head screws [stainless steel (SUS304)] are attached.

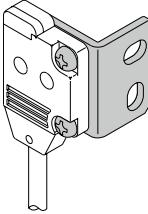


Material: Stainless steel (SUS304)
Two M2 (length 8 mm **0.315 in**) pan head screws [stainless steel (SUS304)] are attached.

- **MS-EX10-3**



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



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

SPECIFICATIONS

Type		Thru-beam · standard type										
		Front sensing	Side sensing	Front sensing	Side sensing	Front sensing	Side sensing					
Item	Model No. (Note 2)	Light-ON	EX-11A(-PN)	EX-11EA(-PN)	EX-13A(-PN)	EX-13EA(-PN)	EX-19A(-PN)	EX-19EA(-PN)				
	Dark-ON	EX-11B(-PN)	EX-11EB(-PN)	EX-13B(-PN)	EX-13EB(-PN)	EX-19B(-PN)	EX-19EB(-PN)					
Applicable regulations and certifications		CE Marking (EMC Directive, RoHS Directive), UKCA Marking (EMC Regulations, RoHS Regulations), ISO 13849-1 (Category 1, PLC) (Note 3), UL Recognition certification (Note 4)										
Sensing range		150 mm 5.906 in		500 mm 19.685 in		1 m 3.281 ft						
Min. sensing object		ø1 mm ø0.039 in opaque object (Completely beam interrupted object) Setting distance between emitter and receiver: 150 mm 5.906 in		ø2 mm ø0.079 in opaque object (Completely beam interrupted object) Setting distance between emitter and receiver: 500 mm 19.685 in		ø2 mm ø0.079 in opaque object (Completely beam interrupted object) Setting distance between emitter and receiver: 1 m 3.281 ft						
Hysteresis		—										
Repeatability (perpendicular to sensing axis)		0.05 mm 0.002 in or less										
Supply voltage		12 to 24 V DC ±10 % Ripple P-P 10 % or less										
Current consumption		Emitter: 10 mA or less, Receiver: 10 mA or less										
Output	<NPN output type> NPN open-collector transistor • Maximum sink current: 50 mA • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 2 V or less (at 50 mA sink current) 1 V or less (at 16 mA sink current)				<PNP output type> PNP open-collector transistor • Maximum source current: 50 mA • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 2 V or less (at 50 mA source current) 1 V or less (at 16 mA source current)							
	Utilization category	DC-12 or DC-13										
Short-circuit protection		Incorporated										
Response time		0.5 ms or less										
Operation indicator		Orange LED (lights up when the output is ON)										
Incident beam indicator		—										
Stability indicator		Green LED (lights up under stable light received condition or stable dark condition)										
Environmental resistance	Pollution degree	3 (Industrial environment)										
	Protection	IP67 (IEC)										
	Ambient temperature	-25 to +55 °C -13 to +131 °F (No dew condensation or icing allowed), Storage: -30 to +70 °C -22 to +158 °F										
	Ambient humidity	35 to 85 % RH, Storage: 35 to 85 % RH										
	Ambient illuminance	Incandescent light: 3,000 lx or less at the light-receiving face										
	Voltage withstandability	1,000 V AC for one min. between all supply terminals connected together and enclosure										
	Insulation resistance	20 MΩ, or more, with 250 V DC megger between all supply terminals connected together and enclosure										
	Vibration resistance	10 to 500 Hz frequency, 3 mm 0.118 in double amplitude in X, Y and Z directions for two hours each										
Shock resistance		500 m/s ² acceleration (50 G approx.) in X, Y and Z directions three times each										
Emitting element		Red LED [Peak emission wavelength: 680 nm 0.027 mil (EX-19E : 624 nm 0.025 mil), modulated]										
Material		Enclosure: Polyarylate, Lens: Polyarylate										
Cable (Note 5)		0.1 mm ² 3-core (thru-beam type emitter: 2-core) cabtyre cable, 2 m 6.562 ft long										
Cable extension		Extension up to total 50 m 164 ft is possible with 0.3 mm ² , or more, cable (thru-beam type: emitter and receiver). (Note 6)										
Weight		Net weight (each emitter and receiver): 20 g approx., Gross weight: 50 g approx.										
Accessories		Mounting screws: 1 set										

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

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

3) Conformed from December 2021 production.

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

5) The bending-resistant cable type (model Nos. having suffix **-R**) has a 0.1 mm² 3-core (thru-beam type emitter: 2-core) bending-resistant cabtyre cable, 2 m **6.562 ft** long.

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

SPECIFICATIONS

Type		Thru-beam · narrow beam type					Convergent reflective (Diffused beam type)	Thru-beam · with operation mode switch on bifurcation									
		Front sensing	Side sensing	Front sensing	Side sensing	Front sensing	Front sensing	Front sensing	Side sensing	Front sensing	Side sensing						
Item	Model No. (Note 2)	Light-ON	EX-11SA(-PN)	EX-11SEA(-PN)	EX-13SA(-PN)	EX-13SEA(-PN)	EX-19SA(-PN)	EX-14A(-PN)	EX-15 (Note 3)	EX-15E (Note 3)	EX-17 (Note 3)	EX-17E (Note 3)					
	Dark-ON	EX-11SB(-PN)	EX-11SEB(-PN)	EX-13SB(-PN)	EX-13SEB(-PN)	EX-19SB(-PN)	EX-14B(-PN)										
Applicable regulations and certifications		CE Marking (EMC Directive, RoHS Directive), UKCA Marking (EMC Regulations, RoHS Regulations), ISO 13849-1 (Category 1, PLC) (Note 4), UL Recognition certification (Note 5)					RoHS Directive, UL Recognition certification (Note 5)										
Sensing range		150 mm 5.906 in	500 mm 19.685 in	1 m 3.281 ft	2 to 25 mm 0.079 to 0.584 in (Note 6) (Conv. point: 10 mm 0.394 in)	150 mm 5.906 in	500 mm 19.685 in										
Min. sensing object		ø0.5 mm ø 0.002 in opaque object (Completely beam interrupted object) (Note 7)	ø1 mm ø0.039 in opaque object (Completely beam interrupted object) (Note 7)	ø2 mm ø0.079 in opaque object (Completely beam interrupted object) (Note 7)	ø0.1 mm ø0.004 in copper wire (Setting distance: 10 mm 0.394 in)	ø1 mm ø0.039 in opaque object (Completely beam interrupted object) (Setting distance between emitter and receiver: 150 mm 5.906 in)	ø2 mm ø0.079 in opaque object (Completely beam interrupted object) (Setting distance between emitter and receiver: 500 mm 19.685 in)										
Hysteresis		—					15% or less of operation distance (Note 6)	—									
Repeatability (perpendicular to sensing axis)		0.05 mm 0.002 in or less					0.1 mm 0.004 in or less	0.05 mm 0.002 in or less									
Supply voltage		12 to 24 V DC ±10 %					Ripple P-P 10 % or less										
Current consumption		Emitter: 10 mA or less, Receiver: 10 mA or less					13 mA or less	25 mA or less									
Output		<NPN output type> NPN open-collector transistor			<PNP output type> PNP open-collector transistor			NPN open-collector transistor									
		• Maximum sink current: 50 mA • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 2 V or less (at 50 mA sink current) 1 V or less (at 16 mA sink current)			• Maximum source current: 50 mA • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 2 V or less (at 50 mA source current) 1 V or less (at 16 mA source current)			• Maximum sink current: 100 mA • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 2 V or less (at 100 mA sink current) 1 V or less (at 16 mA sink current)									
Utilization category		DC-12 or DC-13					—										
Short-circuit protection		Incorporated					—										
Response time		0.5 ms or less					—										
Operation indicator		Orange LED (lights up when the output is ON)					Orange LED (lights up when the output is ON), located on the bifurcation										
Incident beam indicator		—					Orange LED (lights up under light received condition), located on the receiver										
Stability indicator		Green LED (lights up under stable light received condition or stable dark condition)					Green LED (lights up under stable light received condition or stable dark condition), located on the receiver										
Environmental resistance	Pollution degree	3 (Industrial environment)					—										
	Protection	IP67 (IEC)					—										
	Ambient temperature	-25 to +55 °C -13 to +131 °F (No dew condensation or icing allowed), Storage: -30 to +70 °C -22 to +158 °F					—										
	Ambient humidity	35 to 85 % RH, Storage: 35 to 85 % RH					—										
	Ambient illuminance	Incandescent light: 3,000 lx or less at the light-receiving face					—										
	Voltage withstandability	1,000 V AC for one min. between all supply terminals connected together and enclosure					—										
	Insulation resistance	20 MΩ, or more, with 250 V DC megger between all supply terminals connected together and enclosure					—										
	Vibration resistance	10 to 500 Hz frequency, 3 mm 0.118 in double amplitude in X, Y and Z directions for two hours each					—										
Shock resistance		500 m/s ² acceleration (50 G approx.) in X, Y and Z directions three times each					—										
Emitting element		Red LED (Peak emission wavelength: 650 nm 0.026 mil , modulated)					Red LED (Peak emission wavelength: 680 nm 0.027 mil , modulated)										
Material		Enclosure: Polycarbonate Lens: Polycarbonate					Enclosure: Polycarbonate Lens: Polycarbonate, Bifurcation: Polycarbonate										
Cable (Note 8)		0.1 mm ² 3-core (thru-beam type emitter: 2-core) cabtyre cable, 2 m 6.562 ft long					0.2 mm ² 3-core cabtyre cable, 2 m 6.562 ft long (beyond bifurcation; from emitter / receiver to bifurcation: 0.5 m 1.640 ft long)										
Cable extension		Extension up to total 50 m 164 ft is possible with 0.3 mm ² , or more, cable (thru-beam type: emitter and receiver). (Note 9)					Extension up to total 100 m 328 ft is possible with 0.3 mm ² , or more, cable.										
Weight		Net weight (each emitter and receiver): 20 g approx., Gross weight: 50 g approx.					Net weight: 20 g approx., Gross weight: 40 g approx.										
Accessories		Mounting screws: 1 set					Mounting screws: 1 set, Adjusting screwdriver: 1 pc.										

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

2) Model Nos. having the suffix **-PN** are PNP output type. 3) Either Light-ON or Dark-ON can be selected by the operation mode switch.

4) Conformed from December 2021 production. 5) Except 5 m **16.404 ft** cable length type.

6) The sensing range and the hysteresis of convergent reflective type sensor are specified for white non-glossy paper (50 × 50 mm **1.969 × 1.969 in**) as the object.

7) The min. sensing objects are specified in case the emitter / receiver sensing range is to set the maximum.

8) The bending-resistant cable type (model Nos. having suffix **-R**) has a 0.1 mm² 3-core (thru-beam type emitter: 2-core) bending-resistant cabtyre cable, 2 m **6.562 ft** long.

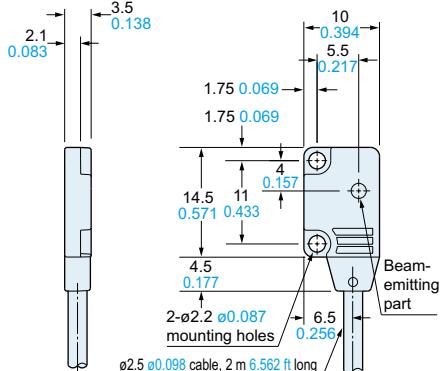
9) For safety applications, do not exceed 30 m **98.425 ft**.

DIMENSIONS (Unit: mm in)

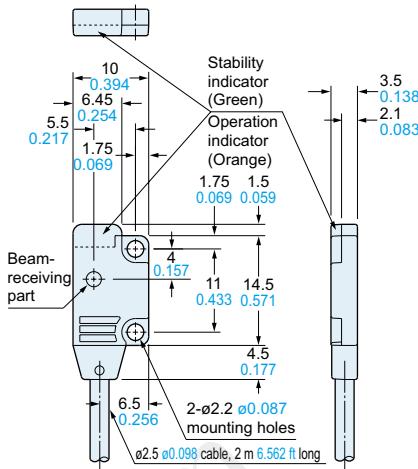
The CAD data can be downloaded from our website.

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

Sensor



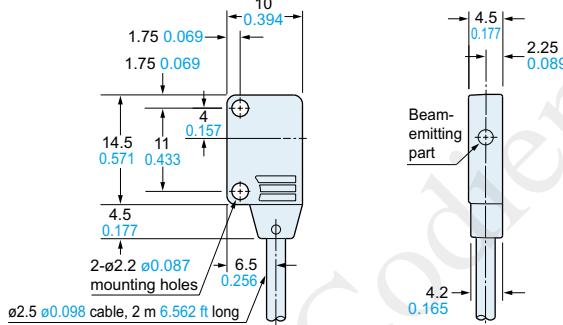
Emitter



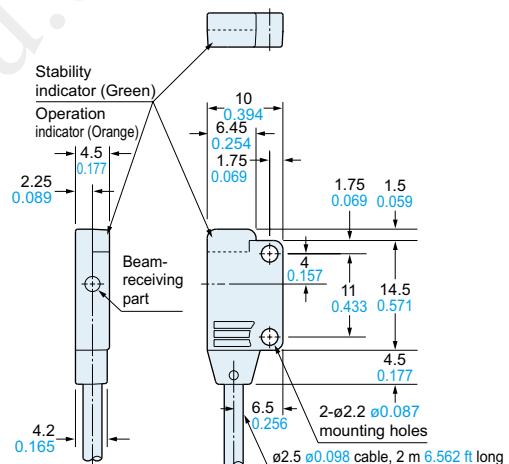
Receiver

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

Sensor



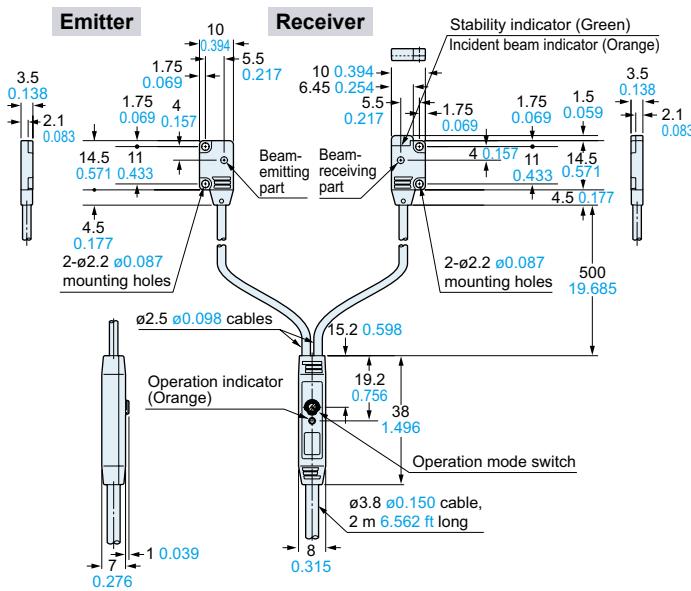
Emitter



Receiver

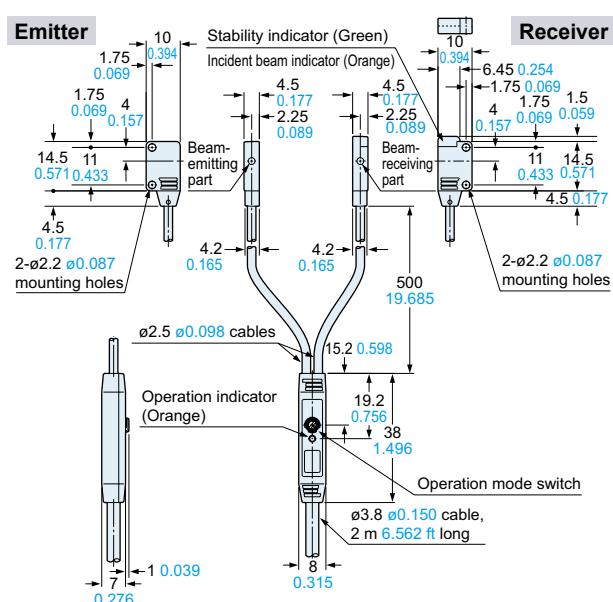
EX-15 EX-17

Sensor



EX-15E EX-17E

Sensor

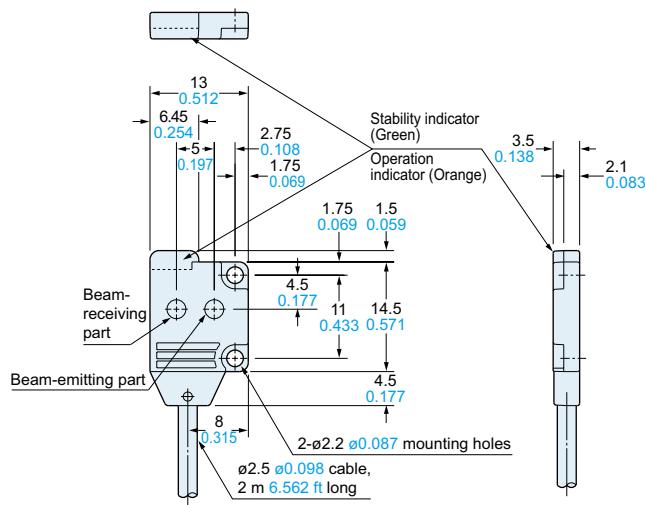


DIMENSIONS (Unit: mm in)

The CAD data can be downloaded from our website.

EX-14□

Sensor

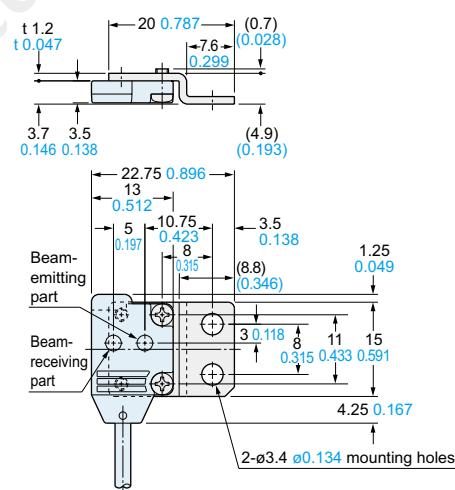


MS-EX10-1

Sensor mounting bracket (Optional)

Assembly dimensions

Mounting drawing with EX-14□



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

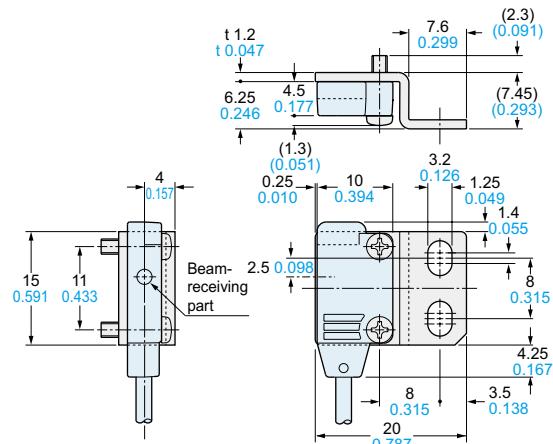
Two M2 (length 4 mm 0.157 in) pan head screws are attached.

Two MZ (length + 1)

Sensor mounting bracket (Optional)

Assembly dimensions

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

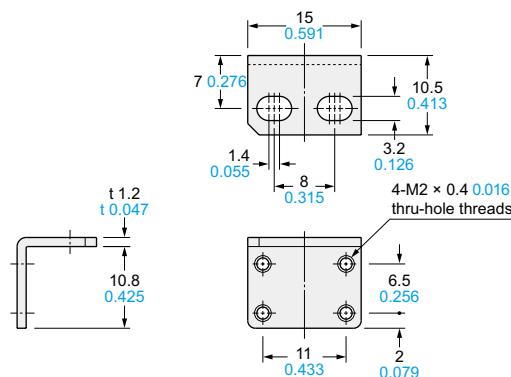


Material: Cold rolled carbon steel (SPCC)
(Uni-chrome plated)

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

DIMENSIONS (Unit: mm in)

The CAD data can be downloaded from our website.

MS-EX10-3

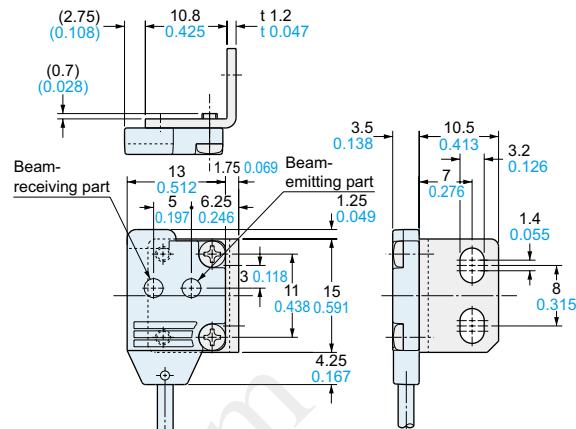
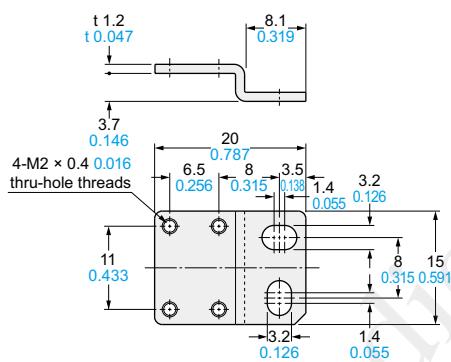
Material: Cold rolled carbon steel (SPCC)
(Uni-chrome plated)

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

Sensor mounting bracket (Optional)

Assembly dimensions

Mounting drawing with EX-14

**MS-EX10-11**

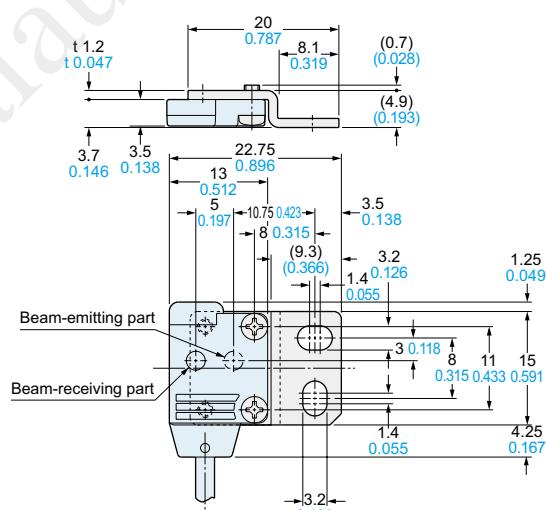
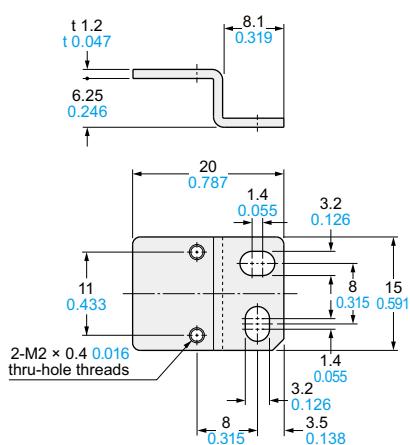
Material: Stainless steel (SUS304)

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

Sensor mounting bracket (Optional)

Assembly dimensions

Mounting drawing with EX-14

**MS-EX10-12**

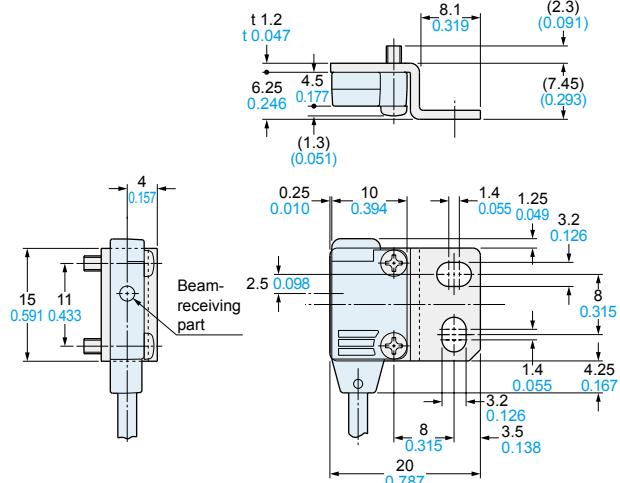
Material: Stainless steel (SUS304)

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

Sensor mounting bracket (Optional)

Assembly dimensions

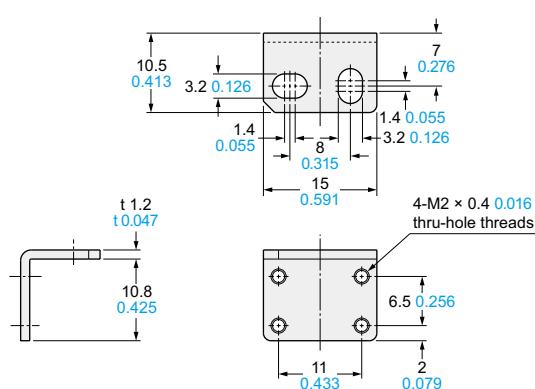
Mounting drawing with EX-11E and EX-13E



DIMENSIONS (Unit: mm in)

The CAD data can be downloaded from our website.

MS-EX10-13



Material: Stainless steel (SUS304)

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

Sensor mounting bracket (Optional)

Assembly dimensions

Mounting drawing with EX-14□

