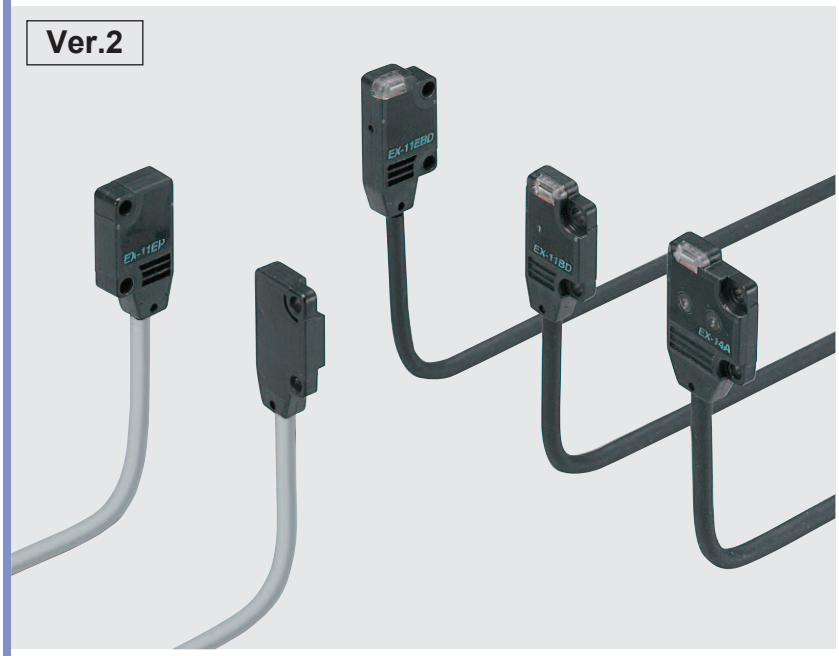
Ultra-slim Photoelectric Sensor Amplifier Built-in

EX-10 SERIES Ver.2

Related Information
■ General terms and conditions..... F-17
■ Glossary of terms / General precautions ..... P.1359~ / P.1405
■ Sensor selection guide..... P.283~
■ Korea's S-mark..... P.1410

Ver.2



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

Recognition

Certified (Some models only)

PNP output type available

Amplifier built-in extraordinarily small and slim size

Smallest body, just 3.5 mm 0.138 in thick

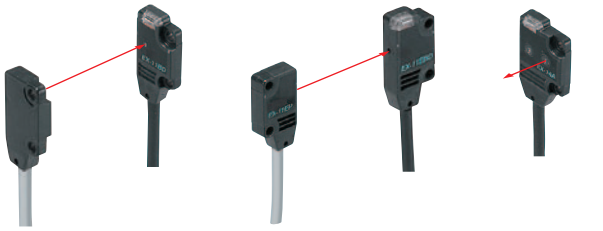
It can be mounted in a very small space as its size is just W10 × H14.5 × D3.5 mm W0.394 × H0.571 × D0.138 in (thru-beam, front sensing type).

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

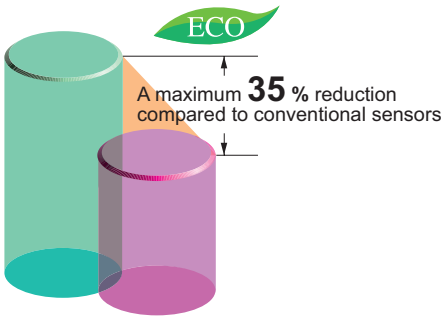


BASIC PERFORMANCE

Electric power saving *

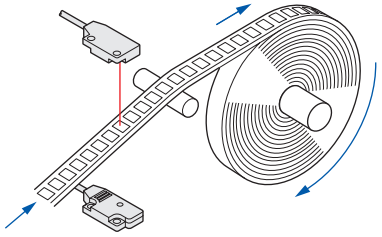
The **EX-10** series achieves reductions in power consumption of up to 65 %. These sensors contribute to environmental friendliness.

* Effective from production in October 2010.



High-speed response time: 0.5 ms

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



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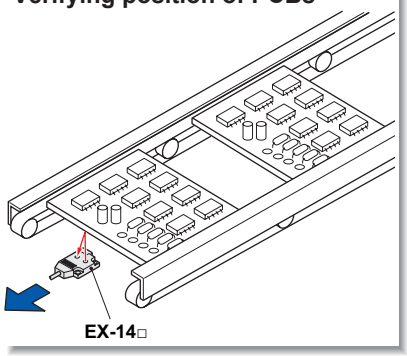
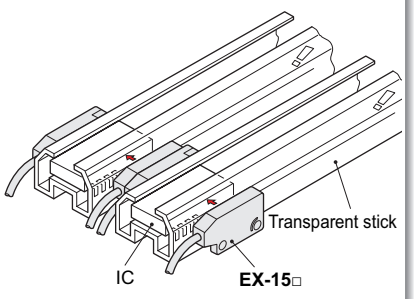
APPLICATIONS

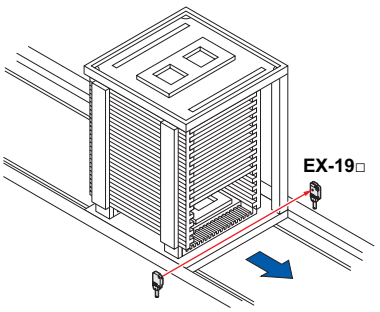
Verifying position of PCBs



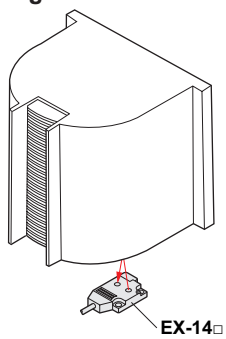
Detecting ICs



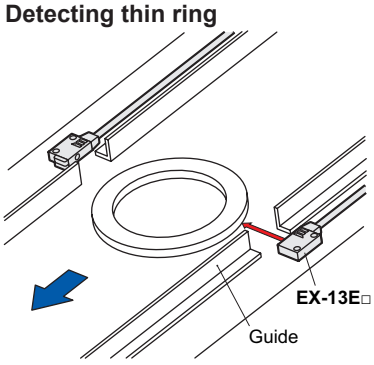
Detecting PCB rack



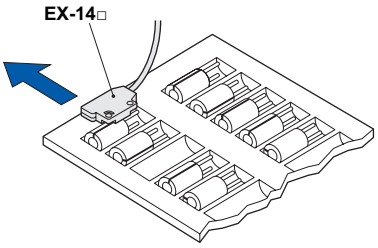
Detecting wafer cassette



Detecting thin ring



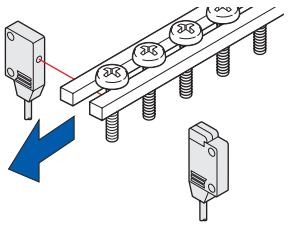
Checking for absence of capacitor in tray



BASIC PERFORMANCE

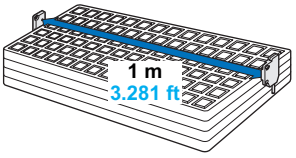
Minimum sensing object: ø1 mm ø0.039 in EX-11(E)□, EX-15(E)□

EX-11□, **EX-11E□**, **EX-15** and **EX-15E** are incorporated with ø1 mm ø0.039 in slit masks so that ø1 mm ø0.039 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□

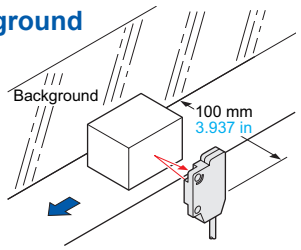
A sensing range of 1 m 3.281 ft has been realized with a slim size of just 3.5 mm 0.138 in. It can be used to detect even wide IC trays.



Background suppression EX-14□

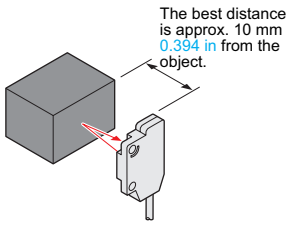
Hardly affected by background

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



Black object reliably detected

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

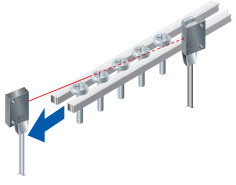


ENVIRONMENTAL RESISTANCE

Incorporated an inverter countermeasure circuit *

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

* Effective from production in October 2010.



Waterproof IP67

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.

Bending durability EX-□-R

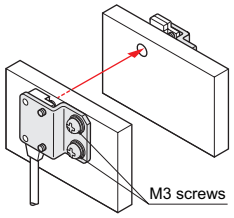
Flexible cable type **EX-□-R** is available. It is most suitable for moving parts, such as robot arm, etc.

MOUNTING / SIZE

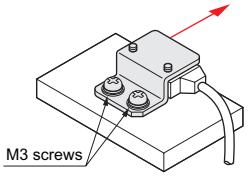
Mountable with M3 screws

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

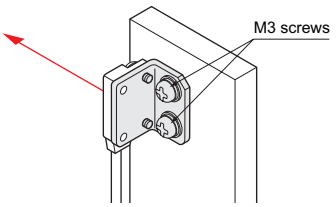
- **MS-EX10-1**
  [Cold rolled carbon steel (SPCC)]
  MS-EX10-11
  [Stainless steel (SUS304)]
  (mounting bracket for the front sensing type)



- **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)



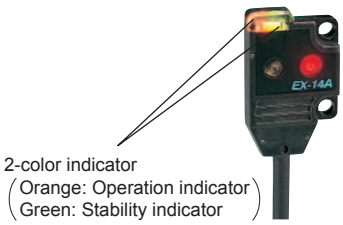
Red beam makes beam alignment easy

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

FUNCTIONS

Bright 2-color indicator

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

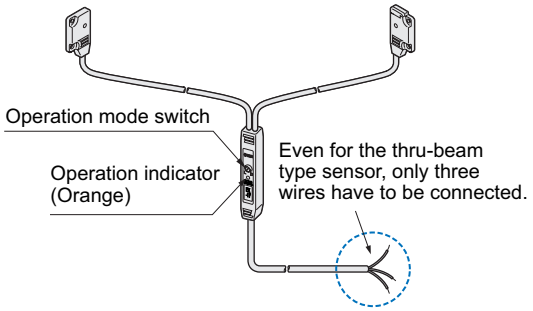


VARIETIES

Operation mode switch

EX-15□/17□

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.



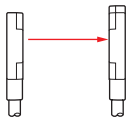
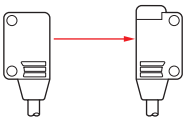
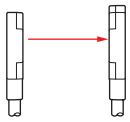
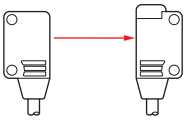
OTHERS

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.

* Effective from production in October 2010.

ORDER GUIDE

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

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.
(e.g.) Emitter of **EX-11A**: **EX-11P**, Receiver of **EX-11A**: **EX-11AD**

ORDER GUIDE

Flexible cable type

Flexible cable type is also available for NPN output type. (excluding sensor with operation mode switch on the bifurcation **EX-15□/17□**)
When ordering this type, suffix "**-R**" to the model No.
(e.g.) Flexible 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 flexible 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**".

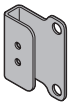
OPTIONS

Designation	Model No.	Description	
Sensor mounting bracket	**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.)	
	MS-EX10-13	L-shaped mounting bracket [Stainless steel (SUS304)] (The thru-beam type sensor needs two brackets.)	
Slit mask	**OS-EX10-12** (Slit size ø1.2 mm ø0.047 in)	Slit on one side	• Sensing range: 600 mm 23.622 in [**EX-19□**] 250 mm 9.843 in [**EX-13□**, **EX-17□**] • Min. sensing object: ø2 mm ø0.079 in
		Slit on both sides	• Sensing range: 400 mm 15.748 in [**EX-19□**] 200 mm 7.874 in [**EX-13□**, **EX-17□**] • Min. sensing object: ø1.2 mm ø0.047 in
	OS-EX10-15 (Slit size ø1.5 mm ø0.059 in)	Slit on one side	• Sensing range: 800 mm 31.496 in [**EX-19□**] 350 mm 13.780 in [**EX-13□**] • Min. sensing object: ø2 mm ø0.079 in
		Slit on both sides	• Sensing range: 500 mm 19.685 in [**EX-19□**] 300 mm 11.811 in [**EX-13□**] • Min. sensing object: ø1.5 mm ø0.059 in
	OS-EX10E-12 (Slit size ø1.2 mm ø0.047 in)	Slit on one side	• Sensing range: 250 mm 9.843 in [**EX-13E□**, **EX-17E□**] • Min. sensing object: ø2 mm ø0.079 in
		Slit on both sides	• Sensing range: 200 mm 7.874 in [**EX-13E□**, **EX-17E□**] • Min. sensing object: ø1.2 mm ø0.047 in
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.	
Mounting screw	**MS-M2**	Mounting screws with washers (50 pcs. lot). It can mount securely as it is spring washer attached.	

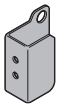
Note: Refer to the sensor checker **CHX-SC2** pages for details.

Slit mask

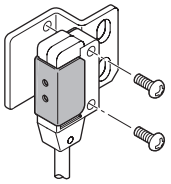
• **OS-EX10-12**
• **OS-EX10-15**



• **OS-EX10E-12**



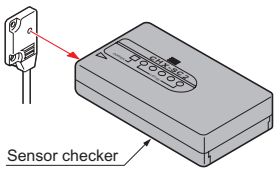
Example of mounting (**OS-EX10E-12**)



Tighten along with the sensor mounting bracket.

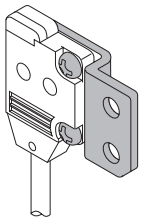
Sensor checker

• **CHX-SC2**



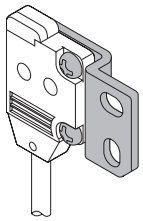
Sensor mounting bracket

• **MS-EX10-1**



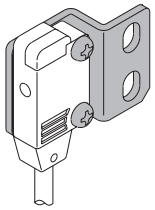
Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated)
Two M2 (length 4 mm 0.157 in) pan head screws are attached.

• **MS-EX10-11**



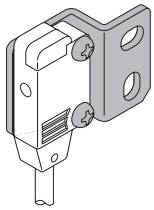
Material: Stainless steel (SUS304)
Two M2 (length 4 mm 0.157 in) pan head screws [stainless steel (SUS304)] are attached.

• **MS-EX10-2**



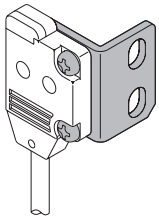
Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated)
Two M2 (length 8 mm 0.315 in) pan head screws are attached.

• **MS-EX10-12**



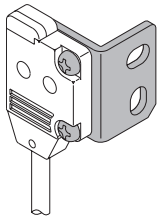
Material: Stainless steel (SUS304)
Two M2 (length 8 mm 0.315 in) pan head screws [stainless steel (SUS304)] are attached.

• **MS-EX10-3**



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

• **MS-EX10-13**



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

SPECIFICATIONS

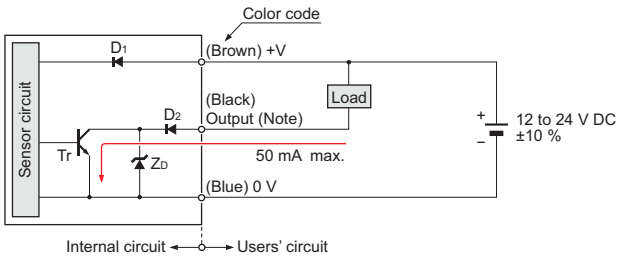
Item \ Type		Thru-beam					Convergent reflective (Diffused beam type)	Thru-beam · with operation mode switch on bifurcation			
		Front sensing	Side sensing	Front sensing	Side sensing	Front sensing	Front sensing	Front sensing	Side sensing	Front sensing	Side sensing
Model No. (Note 2)	Light-ON	EX-11A(-PN)	EX-11EA(-PN)	EX-13A(-PN)	EX-13EA(-PN)	EX-19A(-PN)	EX-14A(-PN)	EX-15 (Note 3)	EX-15E (Note 3)	EX-17 (Note 3)	EX-17E (Note 3)
	Dark-ON	EX-11B(-PN)	EX-11EB(-PN)	EX-13B(-PN)	EX-13EB(-PN)	EX-19B(-PN)	EX-14B(-PN)				
Sensing range		150 mm 5.906 in		500 mm 19.685 in		1 m 3.281 ft	2 to 25 mm 0.079 to 0.984 in (Note 4) (Conv. point: 10 mm 0.394 in)	150 mm 5.906 in		500 mm 19.685 in	
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)	ø0.1 mm ø0.004 in copper wire (Completely beam interrupted object) (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 4)	———			
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 • Maximum sink current: 50 mA • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 2 V or less (at 50 mA sink current) 1 V or less (at 16 mA sink current) <PNP output type> PNP open-collector transistor • Maximum source current: 50 mA • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 2 V or less (at 50 mA source current) 1 V or less (at 16 mA source current)						NPN open-collector transistor • Maximum sink current: 100 mA • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 2 V or less (at 100 mA sink current) 1 V or less (at 16 mA sink current)			
	Utilization category	DC-12 or DC-13						———			
	Short-circuit protection	Incorporated									
Response time		0.5 ms or less									
Operation indicator		Orange LED (lights up when the output is ON)						Orange LED (lights up when the output is ON), located on the bifurcation			
Incident beam indicator		———						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 −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 at the light-receiving face									
	EMC	EN 60947-5-2						———			
	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 amplitude in X, Y and Z directions for two hours each									
	Shock resistance	500 m/s² acceleration (50 G approx.) in X, Y and Z directions for three times each									
Emitting element		Red LED (Peak emission wavelength: 680 nm 0.027 mil, modulated)									
Material		Enclosure: Polyethylene terephthalate Lens: Polyalylate						Enclosure: Polyethylene terephthalate Lens: Polyalylate, Bifurcation: Polyalylate			
Cable (Note 5)		0.1 mm² 3-core (thru-beam type emitter: 2-core) cabtyre cable, 2 m 6.562 ft long						0.2 mm² 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 mm², or more, cable (thru-beam type: emitter and receiver).						Extension up to total 100 m 328 ft is possible with 0.3 mm², or more, cable.			
Weight		Net weight (each emitter and receiver): 20 g approx., Gross weight: 60 g approx.					Net weight: 20 g approx. Gross weight: 40 g approx.	Net weight: 55 g approx., Gross weight: 80 g approx.			
Accessories		Mounting screws: 1 set					Mounting screws: 1 set	Mounting screws: 1 set, Adjusting screwdriver: 1 pc.			

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
2) Model Nos. having the suffix "**-PN**" are PNP output type.
3) Either Light-ON or Dark-ON can be selected by the operation mode switch (located on the bifurcation).
4) 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.
5) The flexible cable type (model Nos. having suffix "**-R**") has a 0.1 mm² 3-core (thru-beam type emitter: 2-core) flexible cabtyre cable, 2 m 6.562 ft long.

I/O CIRCUIT AND WIRING DIAGRAMS

EX-11□ EX-13□ EX-19□ EX-14□ — NPN output type

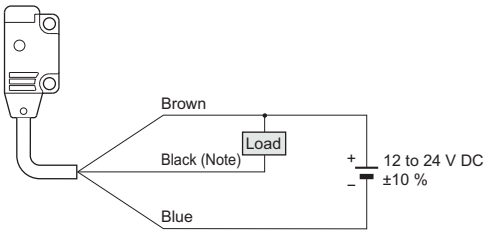
I/O circuit diagram



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

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

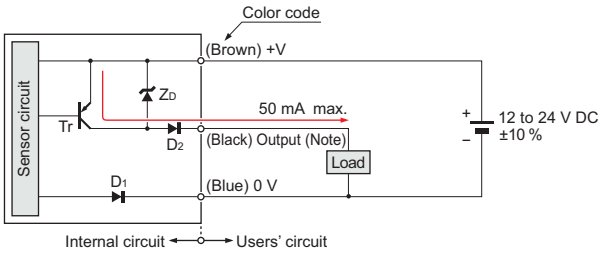
Wiring diagram



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

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

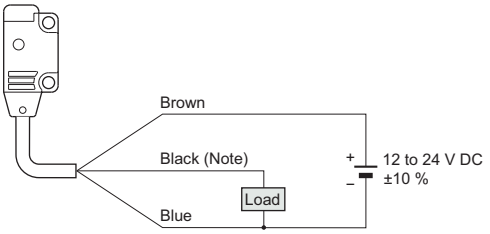
I/O circuit diagram



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

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

Wiring diagram



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

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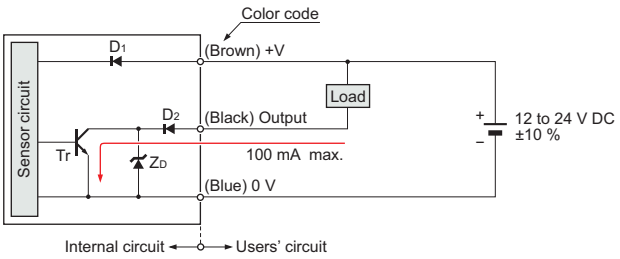
I/O CIRCUIT AND WIRING DIAGRAMS

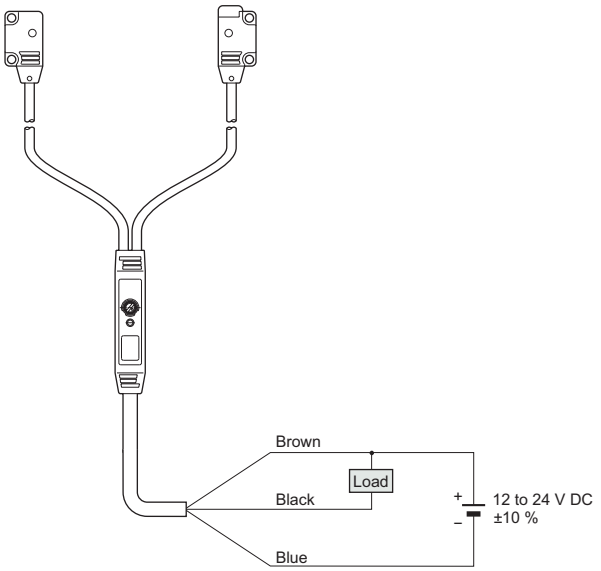
EX-15□ EX-15E□ EX-17□ EX-17E□ EX-17W — NPN output type

I/O circuit diagram



Symbols … D_1: Reverse supply polarity protection diode
D_2: Reverse output polarity protection diode
Z_D: Surge absorption zener diode
Tr : NPN output transistor

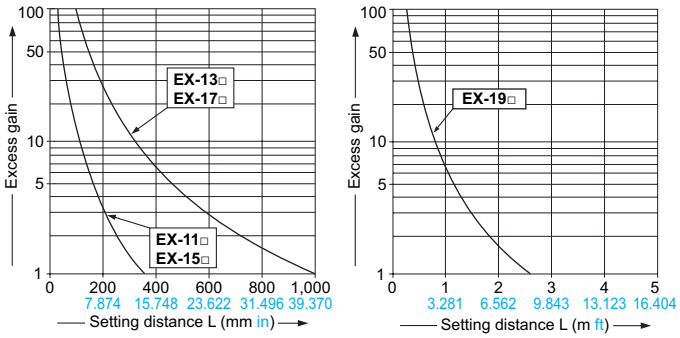
EX-15□, EX-15E□, EX-17□, EX-17E□ wiring diagram



SENSING CHARACTERISTICS (TYPICAL)

All models — Thru-beam type

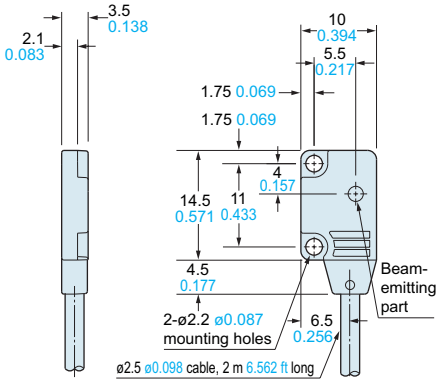
Correlation between setting distance and excess gain



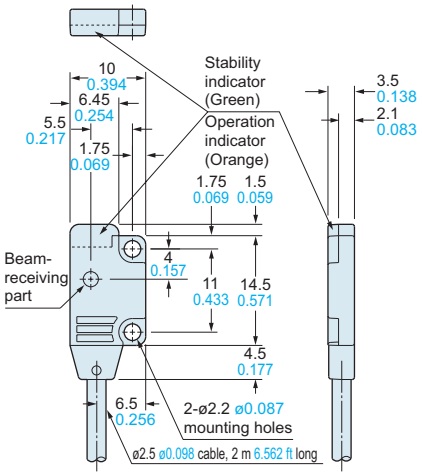
DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from our website.

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

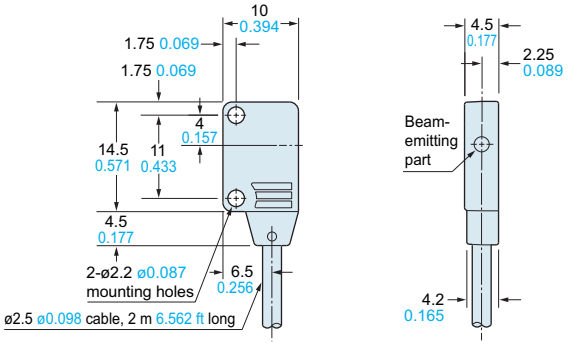


Emitter

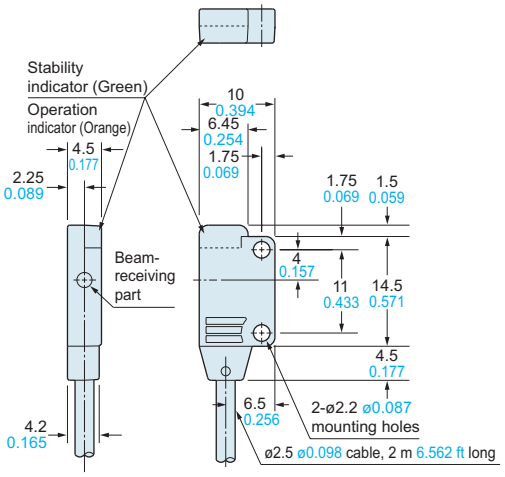


Receiver

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

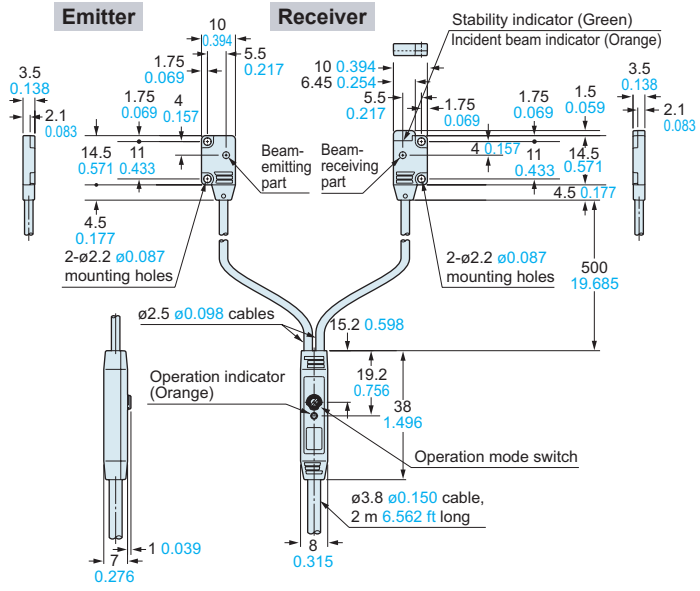


Emitter

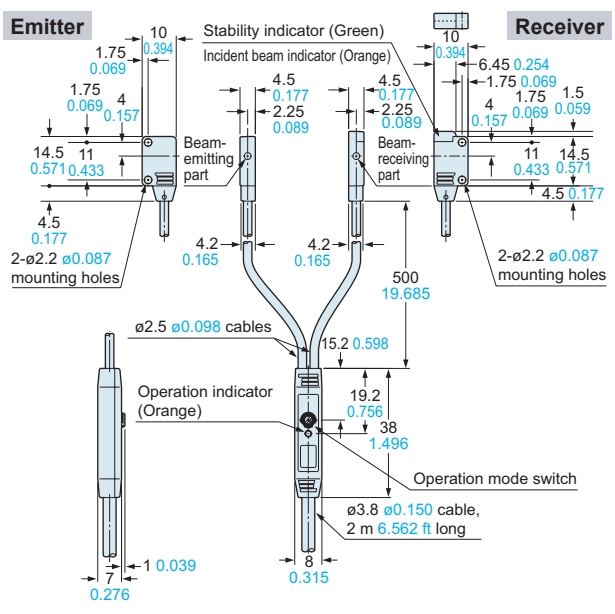


Receiver

EX-15 EX-17 — Sensor



EX-15E EX-17E — Sensor



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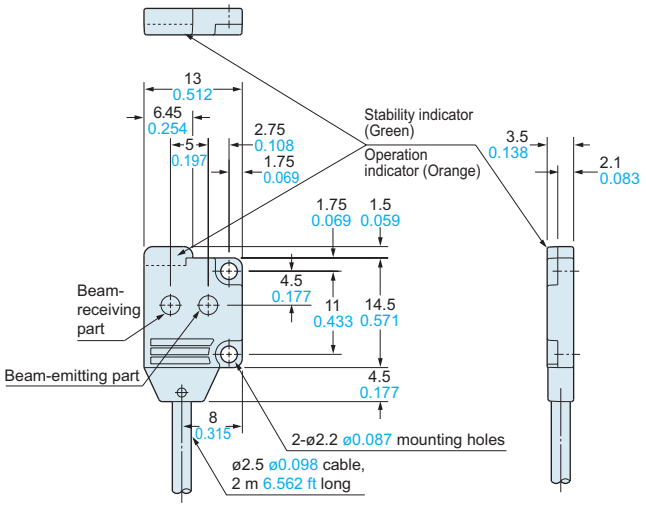
DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from our website.

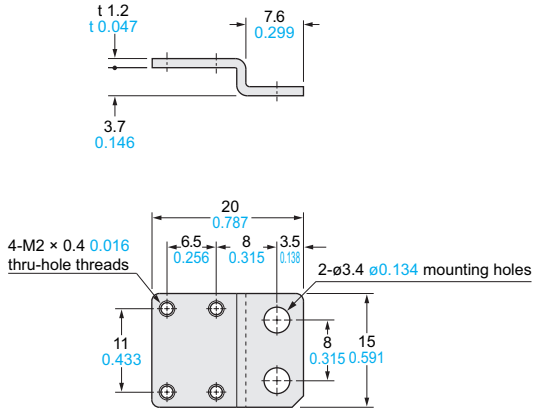
EX-14A□ EX-14B□

Sensor



MS-EX10-1

Sensor mounting bracket (Optional)

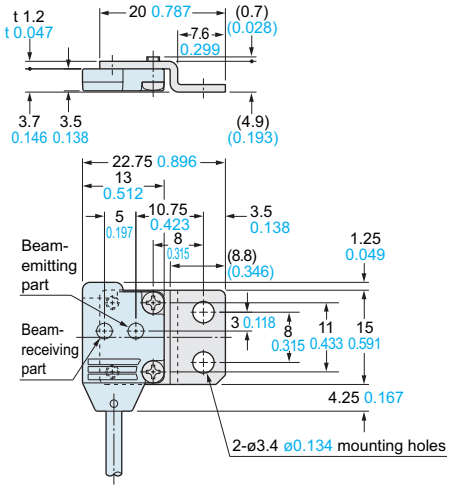


Material: Cold rolled carbon steel (SPCC)
(Uni-chrome plated)

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

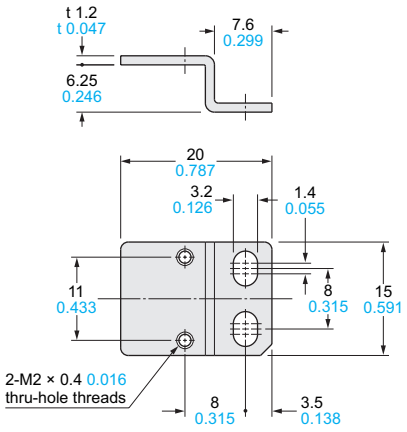
Assembly dimensions

Mounting drawing with **EX-14**□



MS-EX10-2

Sensor mounting bracket (Optional)

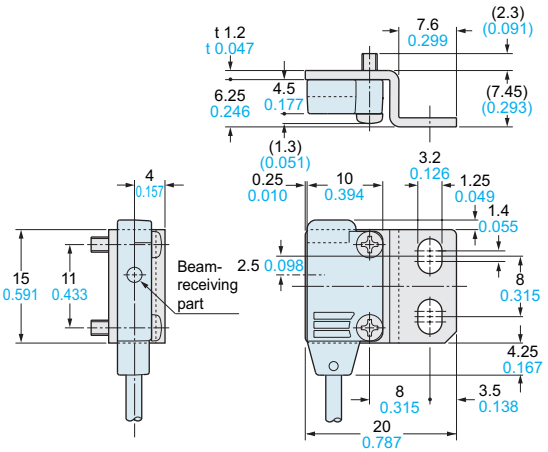


Material: Cold rolled carbon steel (SPCC)
(Uni-chrome plated)

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

Assembly dimensions

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



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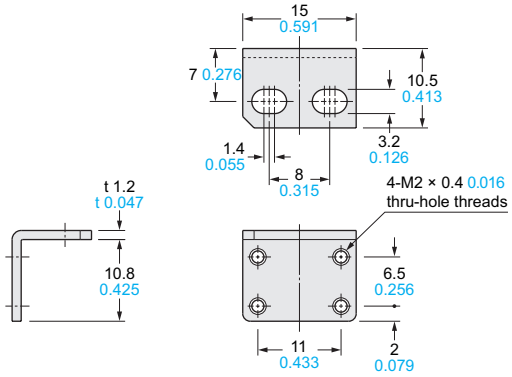
DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from our website.

MS-EX10-3

Sensor mounting bracket (Optional)

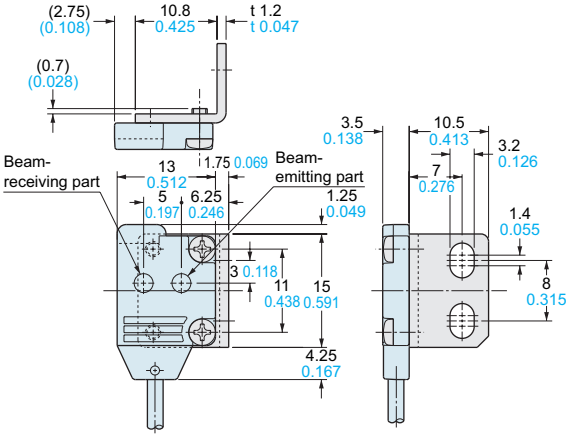


Material: Cold rolled carbon steel (SPCC)
(Uni-chrome plated)

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

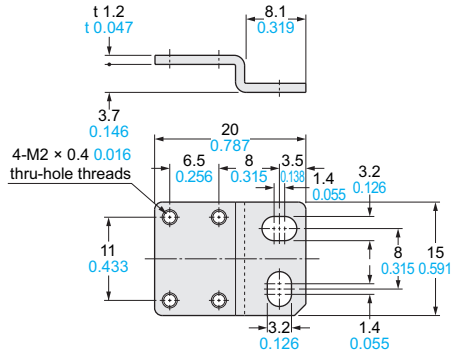
Assembly dimensions

Mounting drawing with **EX-14□**



MS-EX10-11

Sensor mounting bracket (Optional)

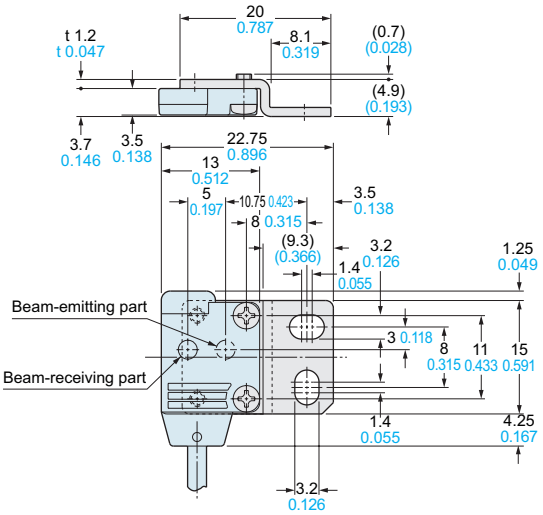


Material: Stainless steel (SUS304)

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

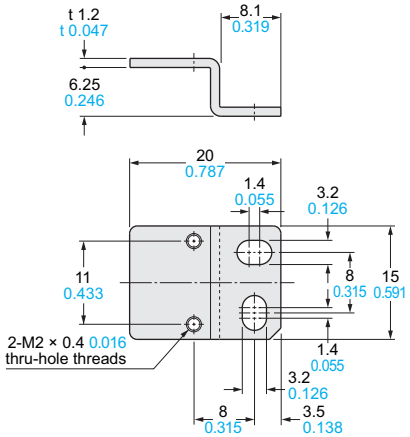
Assembly dimensions

Mounting drawing with **EX-14□**



MS-EX10-12

Sensor mounting bracket (Optional)

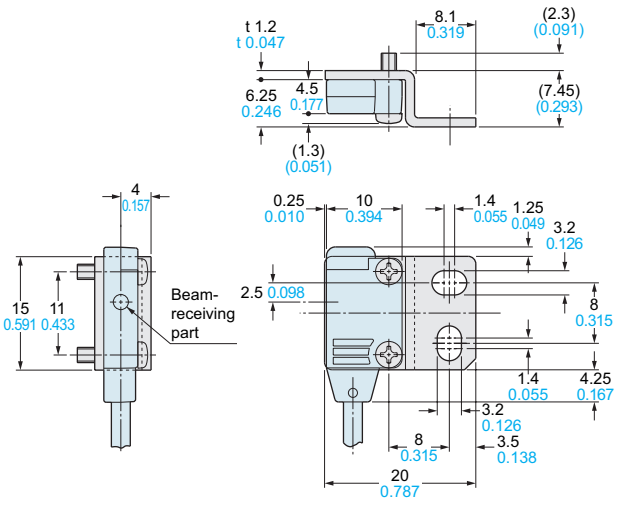


Material: Stainless steel (SUS304)

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

Assembly dimensions

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



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DIMENSIONS (Unit: mm in)

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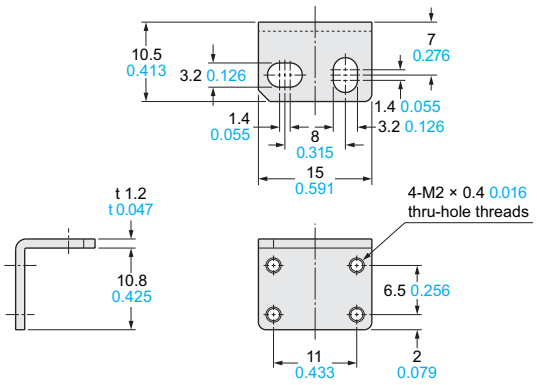
MS-EX10-13

Sensor mounting bracket (Optional)



Material: Stainless steel (SUS304)

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

Assembly dimensions

Mounting drawing with **EX-14**□