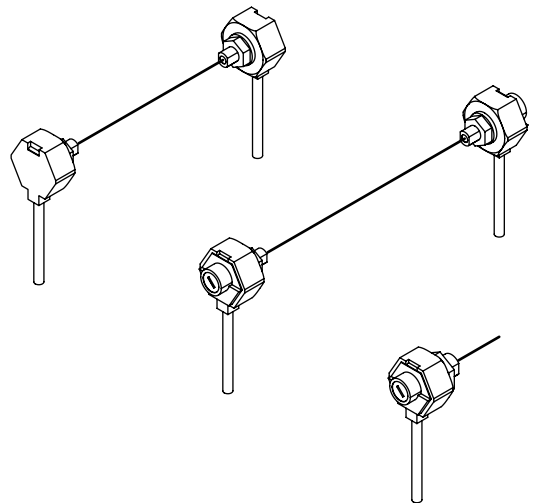


Amplifier Built-in Type Threaded  
Miniature Photoelectric Sensor

## EX-30 Series

# USER'S MANUAL

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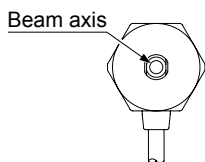
# 1. Cautions

## WARNING

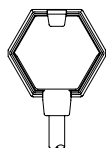
- Never use this product as a sensing device for personnel protection.
  - In case of using devices for personnel protection, use products which meet laws and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.
- 
- This product has been developed / produced for industrial use only.
  - The thin cable 0.1mm<sup>2</sup> is used for this product. Thus, take care that if the cable is pulled with excessive force, it may cause cable break.
  - Extension up to total 50m (emitter and receiver each of thru-beam type) is possible with a 0.3mm<sup>2</sup>, or more of conductor cross-section area cable. However, in order to reduce noise, make the wiring as short as possible.
  - Make sure that stress by forcible bend or pulling is not applied directly to the sensor cable joint.
  - Make sure to carry out wiring in the power supply OFF condition.
  - Take care that wrong wiring will damage the sensor.
  - Do not run the wires together with high-voltage lines or power lines or put them in the same raceway. This can cause malfunction due to induction.
  - Verify that the supply voltage variation is within the rating.
  - If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
  - In case noise generating equipment (switching regulator, inverter motor, etc.) is used in the vicinity of this product, connect the frame ground (F.G.) terminal of the equipment to an actual ground.
  - Do not use during the initial transient time (50ms) after the power supply is switched ON.
  - Make sure to use an isolation transformer for the DC power supply. If an auto-transformer (single winding transformer) is used, this product or the power supply may get damaged.
  - In case a surge is generated from power supply, take countermeasures such as connecting a surge absorber to the origin of the surge.
  - Take care that the sensor is not directly exposed to fluorescent lamp from a rapid-starter lamp, a high frequency lighting device or sunlight etc., as it may affect the sensing performance.
  - This sensor is suitable for indoor use only.
  - Do not use this sensor in places having excessive vapor, dust, etc., or where it may come in contact with corrosive gas, etc.
  - Take care that the product does not come in contact with oil, grease, organic solvents such as thinner, etc., strong acid or alkaline.
  - In case of using the sensor at a place where static electricity is generated, use a metal mounting plate. Also, ensure to ground the mounting plate.

# 2. Part Description

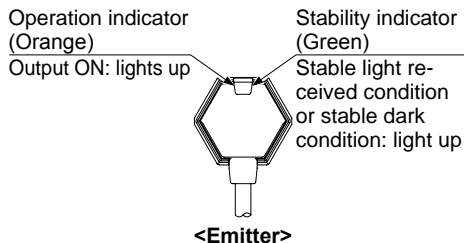
## Thru-beam type EX-31



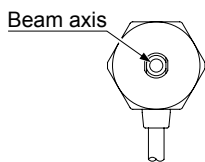
<Emitter / Receiver>



<Receiver>

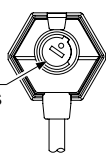


## Thru-beam type EX-33

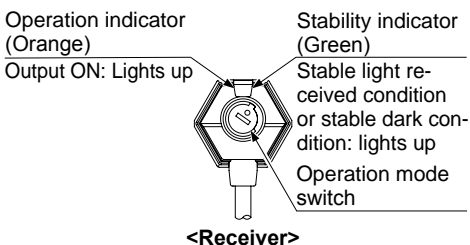


<Emitter / Receiver>

Sensitivity adjuster  
Sensing range becomes longer when turned clockwise



<Emitter>

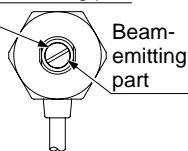


Operation mode switch	Operation	Description
	Light-ON	The operation mode becomes Light-ON when the operation mode switch turned clockwise (L side) until it stops.
	Dark-ON	The operation mode becomes Dark-ON when the operation mode switch turned counter-clockwise (D side) until it stops

Note: Use the flathead screwdriver (please arrange separately) to turn the operation mode switch slowly. Turning with excessive strength will cause damage to the operation mode switch.

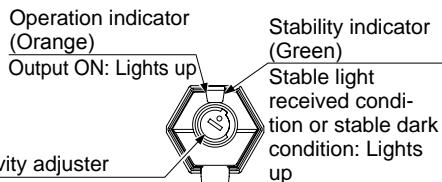
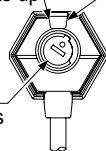
## Diffuse reflective EX-32

Beam-receiving part



Beam-emitting part

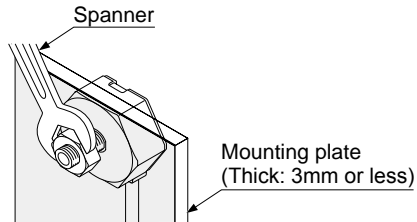
Sensitivity adjuster  
Sensing range becomes longer when turned clockwise



# 3. Mounting

## 3-1 Mounting the sensor

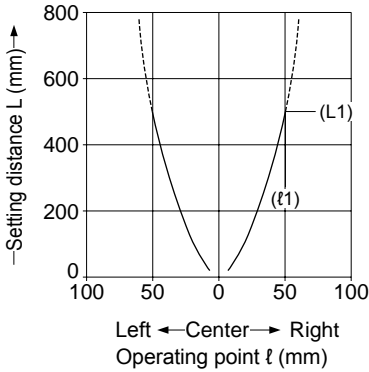
- Mount the sensor on a mounting plate 3mm or less thick and use the enclosed nut and toothed lock washer for mounting.
- When the nut is tightened, hold the the sensor with hand or a spanner etc. and the tightening torque should be 0.6N·m or less. (diffuse reflective type **EX-32**□: 1N·m or less)  
Do not tighten the sensor itself.



## 3-2 Installation interval

- This product does not incorporate auto interference prevention function. In case aligning 2 of this sensors closely, follow diagrams below. (typical)
- Find out the operating point  $\ell 1$  on the parallel deviation diagram for the setting distance L. Separate sensors by  $2 \times \ell$  or more.

Parallel deviation diagram (typical) of Thru-beam type EX-31□



### <Installation interval for EX-31□>

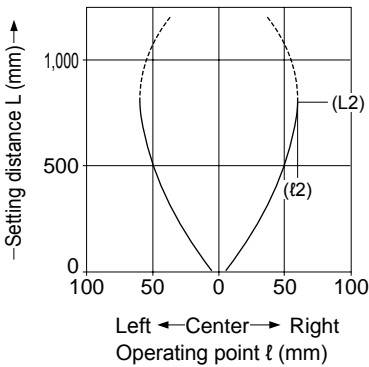
In case using at sensing distance (L1) 500mm, the operation point ( $\ell 1$ ) is approx. 50.3mm according to left diagram.

The installation interval is

Approx.  $50.3\text{mm} \times 2 = \text{approx. } 100.6\text{mm}$

Thus, install **EX-31**□ to approx. 100.6mm or more away.

Parallel deviation diagram (typical) of Thru-beam type EX-33□



### <Installation interval for EX-33□>

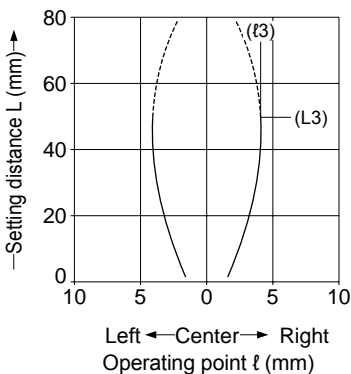
In case using at sensing distance (L2) 800mm, the operation point ( $\ell 2$ ) is approx. 60.2mm according to left diagram.

The installation interval is

Approx.  $60.2\text{mm} \times 2 = \text{approx. } 120.4\text{mm}$

Thus, install **EX-33**□ to approx. 120.4mm or more away.

Sensing field diagram (typical) Diffuse reflective type EX-32□



### <Installation interval for EX-32□>

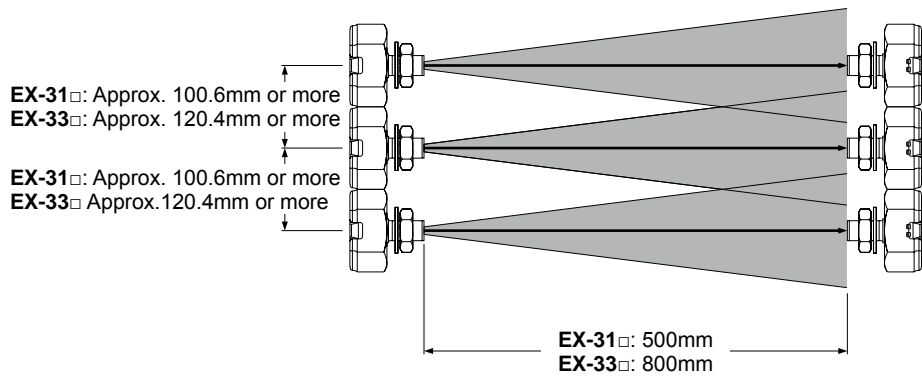
In case using at sensing distance (L3) 50mm, the operation point ( $\ell 3$ ) is approx. 9.1mm according to left diagram.

The installation interval is

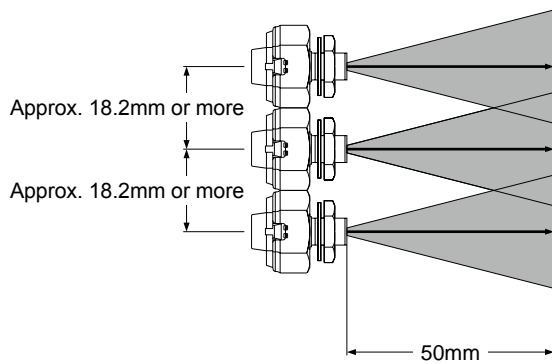
Approx.  $9.1\text{mm} \times 2 = \text{approx. } 18.2\text{mm}$

Thus, install **EX-32**□ to approx. 18.2mm or more away.

**Thru-beam type EX-31□ / EX-33□**

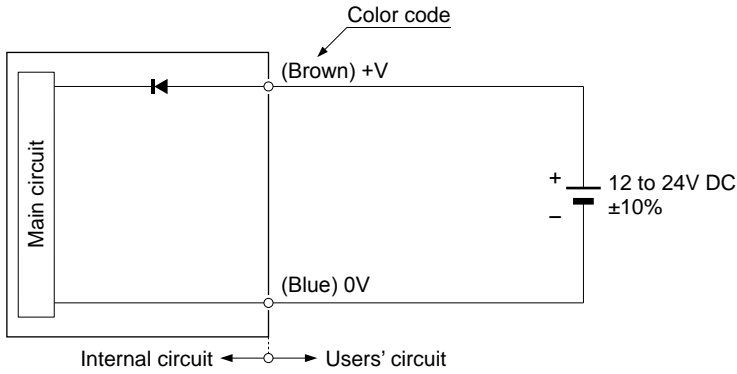


**Diffuse reflective type EX-32□**

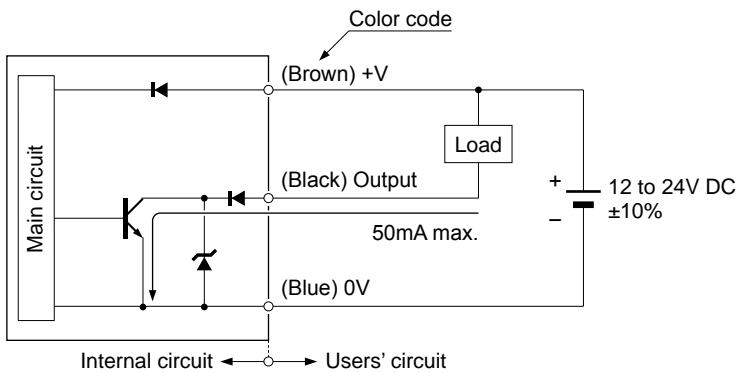


# 4. I/O Circuit Diagram

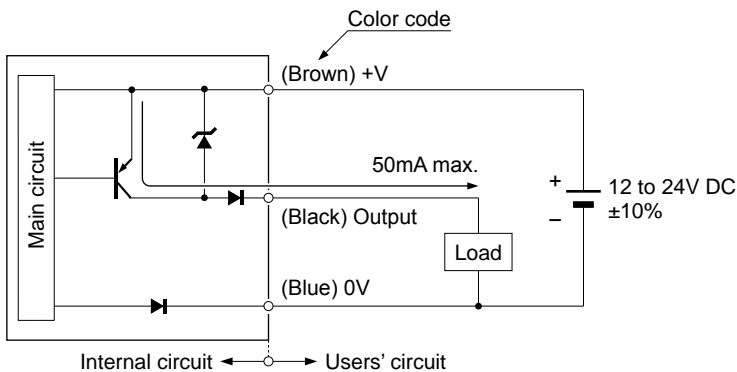
**NPN output type and PNP output type: Emitter of thru-beam type EX-31□ / EX-33□**



**NPN output type: Receiver of Thru-beam type EX-31□ / EX-33□, Diffuse reflective type EX-32□**



**PNP output type: Receiver of Thru-beam type EX-31□-PN / EX-33□-PN, Diffuse reflective type EX-32□-PN**



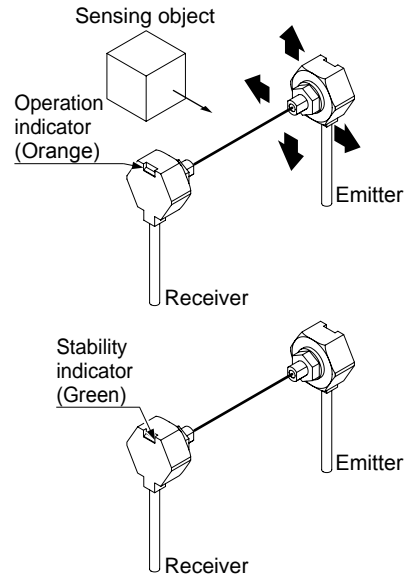


# 5. Adjustment

## 5-1 Beam alignment (Thru-beam type EX-31□ / EX-33□)

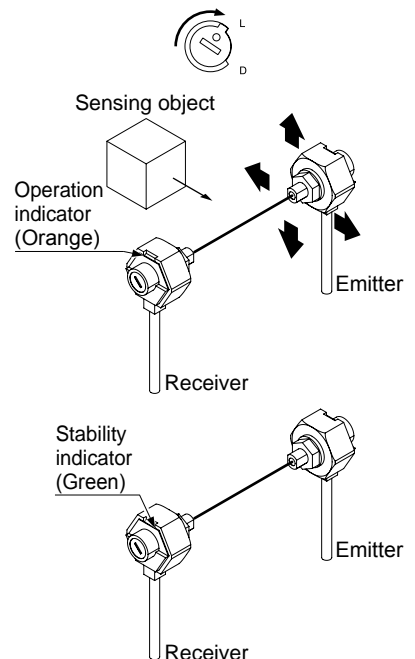
### Thru-beam type EX-31□

1. Place the emitter and the receiver face to face along a straight line, move the emitter in the up, down, left and right directions, in order to determine the range of the light received condition with the help of the operation indicator (orange). Then, set the emitter at the center of this range.
2. Similarly, adjust for up, down, left and right angular movement of the emitter.
3. Further, perform the angular adjustment for the receiver also.
4. Check that the stability indicator (green) lights up.



### Thru-beam type EX-33□

1. Set the operation mode switch to the L side (Light-ON mode position).
2. Place the emitter and the receiver face to face along a straight line, move the emitter in the up, down, left and right directions, in order to determine the range of the light received condition with the help of the operation indicator (orange). Then, set the emitter at the center of this range.
3. Similarly, adjust for up, down, left and right angular movement of the emitter.
4. Further, perform the angular adjustment for the receiver also.
5. Check that the stability indicator (green) lights up.
6. Choose the operation mode, as per your requirement, with the operation mode switch.



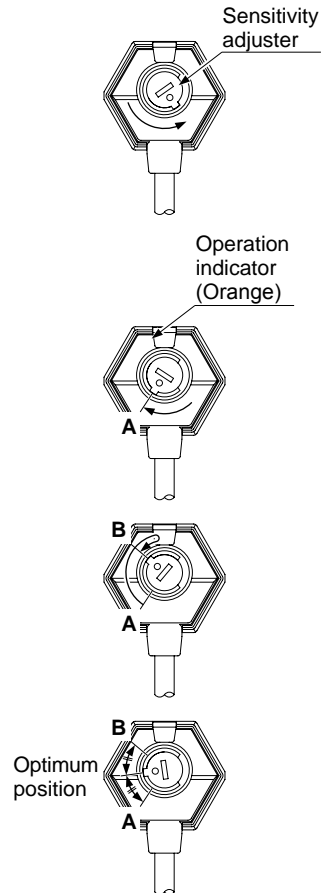
## 5-2 Sensitivity adjustment (Thru-beam type EX-33□, Diffuse reflective type EX-32□)

### Thru-beam type EX-33□

- When using EX-33□, turn the sensitivity adjuster fully clockwise to the MAX. position. However, if the beam penetrates a sensing object, adjust the sensitivity as follows.

### Step

1. Turn the sensitivity adjuster fully counterclockwise to the minimum sensitivity position.
2. In the light received condition, turn the sensitivity adjuster slowly clockwise and confirm the point **A** where the sensor enters the “Light” state operation.
3. In the dark condition, turn the sensitivity adjuster further clockwise until the sensor enters the “Light” state operation and then bring it back to confirm point **B** where the sensor just returns to the “Dark” state operation.
4. The position at the middle of points **A** and **B** is the optimum sensing position.

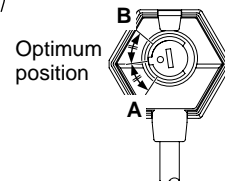
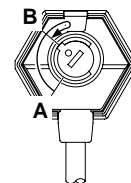
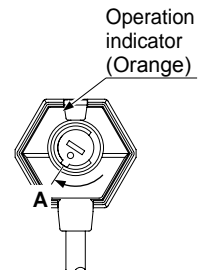
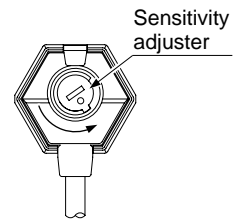


Note: Use the flathead screwdriver (purchase separately) to turn the adjuster slowly. Turning with excessive strength will cause damage to the adjuster.

## Diffuse reflective type EX-32□

### Step

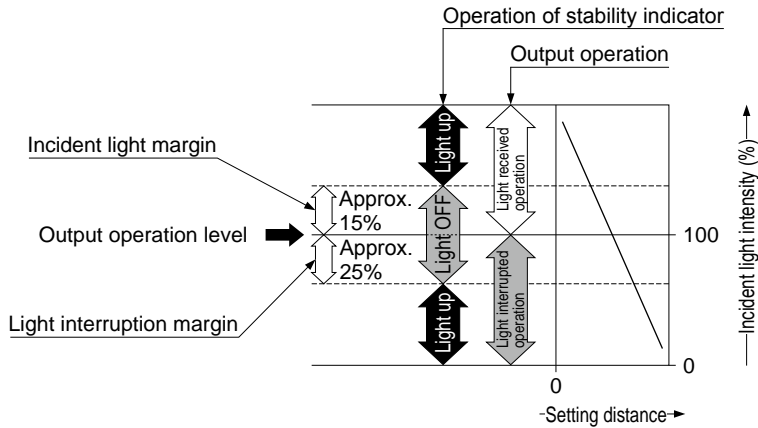
1. Turn the sensitivity adjuster fully counterclockwise to the minimum sensitivity position
2. In the light received condition, turn the sensitivity adjuster slowly clockwise and confirm the point **A** where the sensor enters the "Light" state operation.
3. In the dark condition, turn the sensitivity adjuster further clockwise until the sensor enters the "Light" state operation and then bring it back to confirm point **B** where the sensor just returns to the "Dark" state operation.  
(If the sensor does not enter the "Light" state operation even when the sensitivity adjuster is turned fully clockwise, the position is point **B**.)
4. The position at the middle of points **A** and **B** is the optimum sensing position.



Note: Use the flathead screwdriver (purchase separately) to turn the adjuster slowly. Turning with excessive strength will cause damage to the adjuster.

# 6. Stability Indicator

- The stability indicator (green) lights up when the incident light intensity has sufficient margin with respect to the operation level. Incident light intensity level is such that the stability indicator light up, stable sensing can be done without the light received operation and the light interrupted operation being affected by a change in ambient temperature or supply voltage.



# 7. Option

## 7-1 Beam Slit Mask (Thru-beam type EX-31□ / EX-33□)

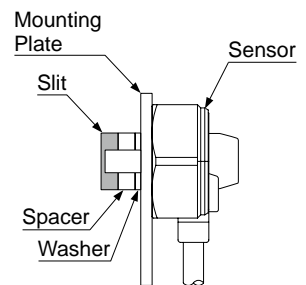
- Apply the optional slit mask (**OS-EX30-1**) when detecting small objects or for increasing the accuracy of sensing position.  
However, the sensing range is reduced when the slit mask is mounted.

Type	Model No.		Slit size	Sensing distance		Minimal sensing object	
	Slit	Sensor		Applying on one side	Applying on both side	Applying on one side	Applying on both side
Slit	OS-EX30-1	EX-31□	ø1mm	200mm	150mm	ø2mm	ø1mm
		EX-33□		320mm	240mm		

### Mounting method

1. Insert the sensor into the mounting plate.
2. Fit the washer and spacers enclosed with the slit mask.  
Note that the number of spacers to be fitted differs with the mounting plate thickness, as given in the table on the right.
3. Mount the slit mask. Make sure that the tightening torque is 0.6N·m or less.

Mounting plate thickness	No. of spacers
3mm	0 pc.
2mm	1 pc.
1mm	2 pcs.



# 8. Specifications

Type		Thru-beam type			Diffuse reflective type		
				Operation mode switch			
Model No. (Note 1)	NPN output	EX-31A	EX-31B	EX-33	EX-32A	EX-32B	
	PNP output	EX-31A-PN	EX-31B-PN	EX-33-PN	EX-32A-PN	EX-32B-PN	
Sensing range		500mm		800mm	50mm (Note 2)		
Sensing object		ø2mm opaque object (Completely beam interrupted object)			Opaque, Translucent or transparent object (Note 3)		
Hysteresis		-			15% or less of operation distance (Note 2)		
Repeatability (Perpendicular to sensing axis)		0.05mm or less			0.5mm or less		
Supply voltage		12 to 24V DC ±10% Ripple P-P 10% or less					
Current consumption		Emitter: 10mA or less, Receiver: 10mA or less			13mA or less		
Output		<b>&lt;NPN output type&gt;</b> NPN open-collector transistor <ul style="list-style-type: none"> <li>• Maximum sink current: 50mA</li> <li>• Applied voltage: 30V DC or less (between output and 0V)</li> <li>• Residual voltage: 2V or less (at 50mA sink current) 0.4V or less (at 16mA sink current)</li> </ul>			<b>&lt;PNP output type&gt;</b> PNP open-collector transistor <ul style="list-style-type: none"> <li>• Maximum source current: 50mA</li> <li>• Applied voltage: 30V DC or less (between output and +V)</li> <li>• Residual voltage: 2V or less (at 50mA source current) 0.4V or less (at 16mA source current)</li> </ul>		
Output operation		Light-ON	Dark-ON	Switchblade either Light-ON or Dark ON	Light-ON	Dark-ON	
Short-circuit protection		Incorporated					
Response time		0.5ms or less					
Protection		IP67 (IEC)					
Ambient temperature		-25 to +55°C (No dew condensation or icing allowed), Storage: -30 to +70°C					
Ambient humidity		35 to 85% RH, Storage: 35 to 85% RH					
Emitting element		Red LED					
Material		Enclosure: Die-cast zinc (Nickel plated) Enclosure cover: Polycarbonate Lens: Polycarbonate			Enclosure: Die-cast zinc (Nickel plated) Enclosure cover: Polycarbonate Lens: Acrylic		
Cable		0.1mm <sup>2</sup> 3-core (thru-beam type sensor emitter: 2-core) cabtyre cable, 2m					
Wight	Net weight	Emitter: Approx. 20g, Receiver: Approx. 20g			Approx. 20g		
	Gross weight	Approx. 65g			Approx. 45g		
Accessory		Nut: 2 pcs., Toothed lock washer: 2 pcs.			Nut: 1 pc., Toothed lock washer: 1 pc.		

Notes: 1) The model No. with suffix "P" shown on the label affixed to the thru-beam type sensor is emitter. "D" shown on the label is receiver.

(e.g.) Emitter of **EX-31A: EX-31P**, Receiver of **EX-31A: EX-31AD**

5m cable length type is also available for NPN output type (excluding **EX-33**)

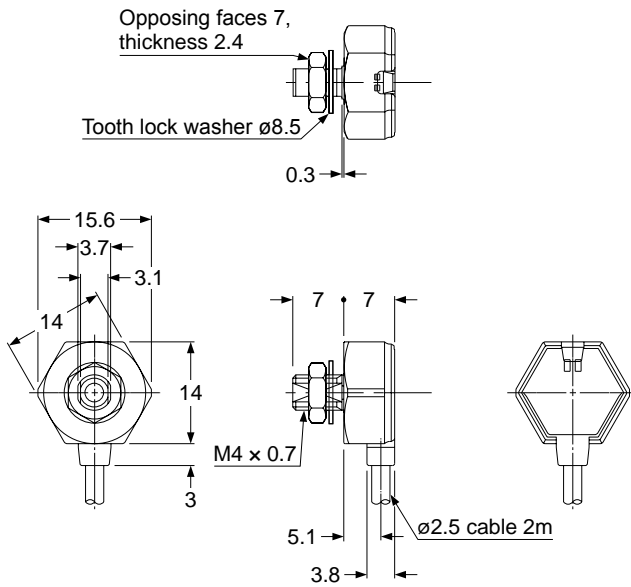
When ordering this type, suffix "-C5" to the model No.

(e.g.) 5m cable length type of **EX-31A** is "**EX-31A-C5**"

- 2) The sensing range of diffuse reflective type is specified with non-glossy paper (200 × 200mm) as sensing object
- 3) Make sure to confirm detection with an actual sensor before use

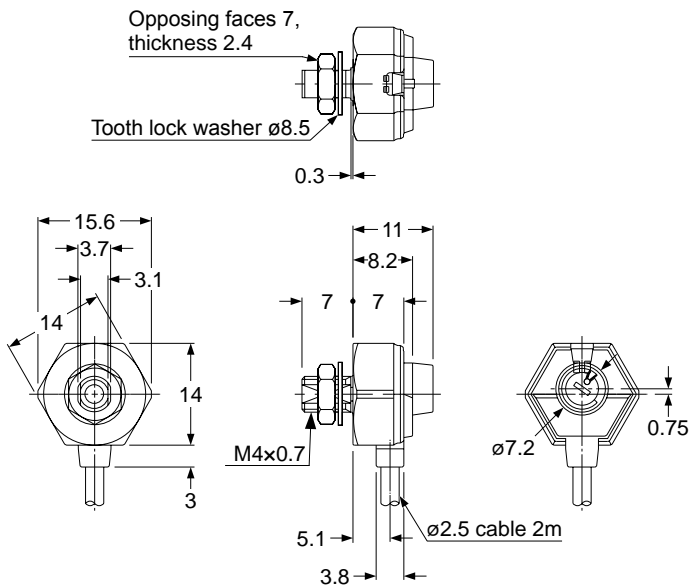
# 9. Dimensions

## Thru-beam type EX-31 (Emitter and Receiver)



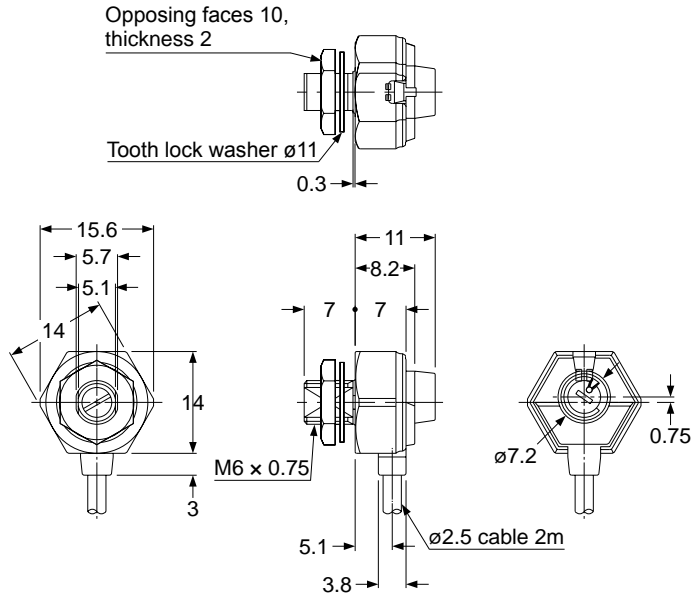
(Unit: mm)

## Thru-beam type EX-33 (Emitter and Receiver)



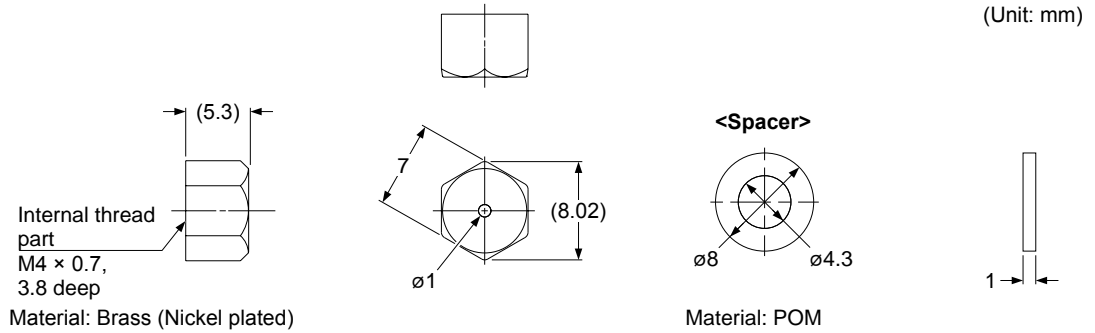
(Unit: mm)

**Diffuse reflective type EX-32**



(Unit: mm)

**Slit mask OS-EX30-1 (optional)**



(Unit: mm)



(MEMO)

Please contact .....

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