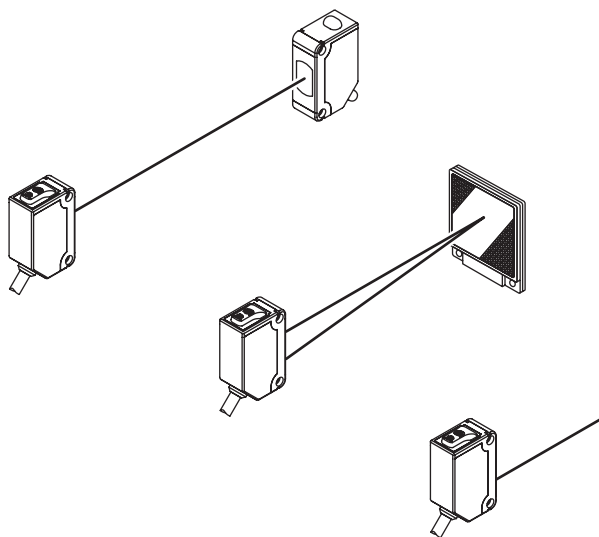


Amplifier Built-in Small Photoelectric
Sensor

CX-400 Series

USER'S MANUAL



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1. Cautions

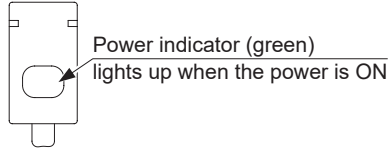
 WARNING
--

- | |
|--|
| <ul style="list-style-type: none">● 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.
 - Make sure to carry out wiring in the power supply off condition.
 - Take care that wrong wiring will damage the sensor.
 - 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 run the wires together with high-voltage lines or power lines, or put them in the same raceway.
 - Do not use during the initial transient time (50 ms) after the power supply is switched ON.
 - 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.
 - Extension up to total 100 m (each emitter and receiver of thru-beam type), or less, is possible with 0.3 mm², or more of conductor area cable.
 - Make sure that stress by forcible bend or pulling is not applied directly to the sensor cable joint.
 - 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.
 - This product cannot be used in an environment containing inflammable or explosive gasses.
 - Never disassemble or modify the product.

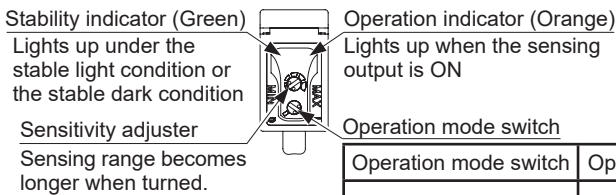
2. Part Description

Standard type

Thru-beam type emitter CX-41□



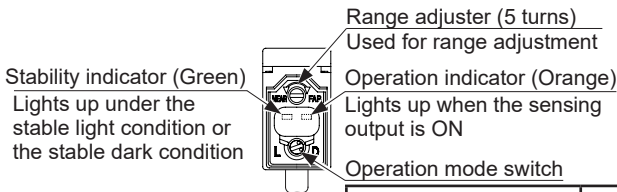
Thru-beam type emitter receiver CX-41□, Retroreflective type CX-49□ / CX-48□ Diffuse reflective type CX-42□



Operation mode switch	Operation	Description
	Light-ON	Light-ON mode is obtained when the operation mode switch (beam-thru type incorporate it in the receiver) is turned fully clockwise (L side).
	Dark-ON	Dark-ON mode is obtained when the operation mode switch (beam-thru type incorporate it in the receiver) is turned fully counterclockwise (D side).

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

Adjustable range reflective type CX-44□

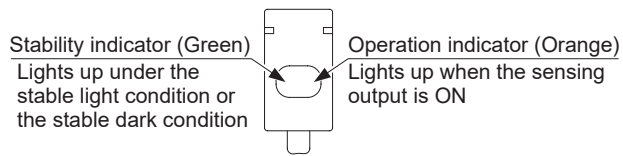


Operation mode switch	Operation	Description
	Detection-ON	Detecting-ON mode is obtained when the operation mode switch is turned fully clockwise (L side).
	Detection-OFF	Not detecting-ON is obtained when the operation mode switch is turned fully counterclockwise (D side)

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

Basic type

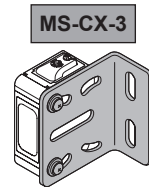
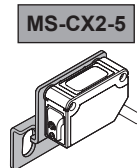
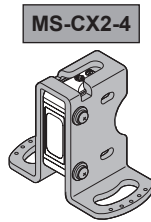
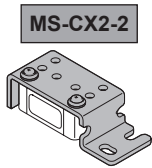
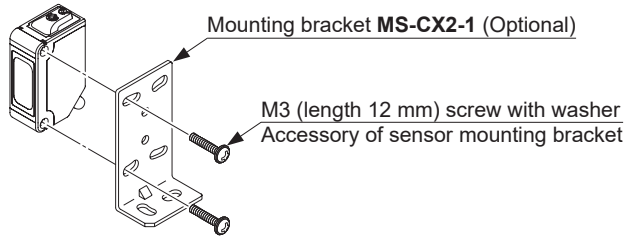
Convergent reflective type CX-46□-C05



3. Mounting

3-1 Mounting to sensor mounting bracket (Optional)

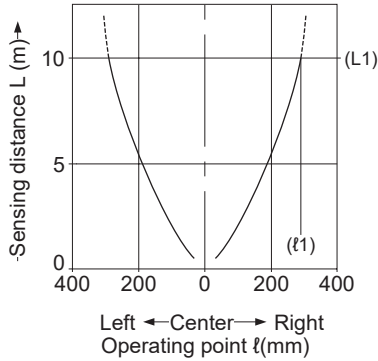
- The tightening torque should be 0.5 N·m or less.



3-2 Installation interval (Thru-beam type CX-41□)

- In case mounting two sets of the **CX-41**□ close together, please mount it as drawing below indicates (typical example)
- Find out the operating point ℓ_1 on the parallel deviation diagram for the setting distance L1. Separate sensors by $2 \times \ell_1$ or more.

CX-41□ parallel deviation diagram (typical)



<Installation interval for CX-411□>

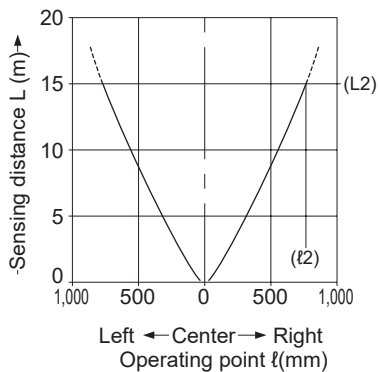
In case using at sensing distance (L1) 10 m, the operation point (ℓ_1) is approx. 295 mm according to diagram above.

The installation interval is

Approx. 295 mm \times 2 = 590 mm

Thus, install **CX-411**□ to 590 mm or more away.

CX-412□ parallel deviation diagram (typical)



<Installation interval for CX-412□>

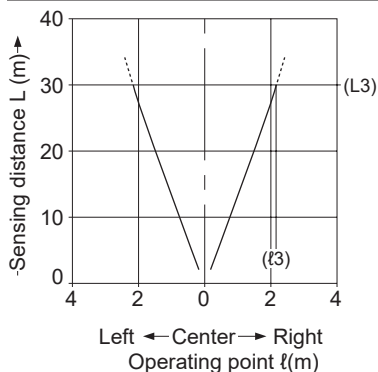
In case using at sensing distance (L2) 15 m, the operation point (ℓ_2) is approx. 790 mm according to diagram above.

The installation interval is

Approx. 790 mm \times 2 = 1,580 mm

Thus, install **CX-412**□ to 1,580 mm or more away.

CX-413□ parallel deviation diagram (typical)



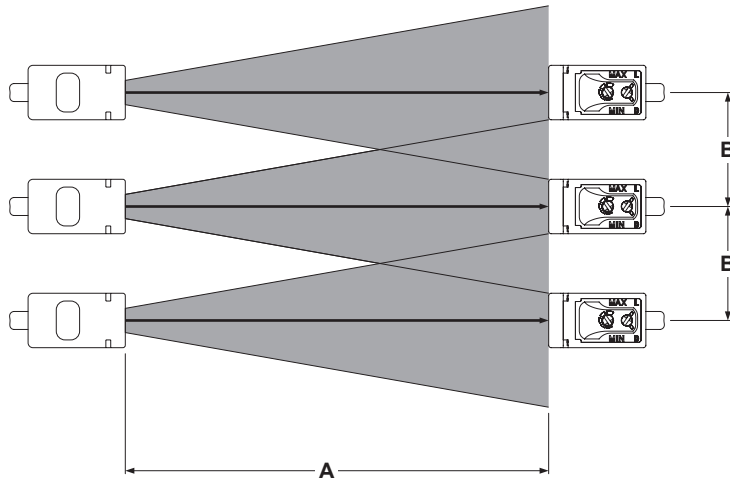
<Installation interval for CX-413□>

In case using at sensing distance (L3) 30 m, the operation point (ℓ_3) is approx. 2.175 m according to diagram above.

The installation interval is

Approx. 2.175 m \times 2 = 4.35 m

Thus, install **CX-413**□ to 4.35 m or more away.

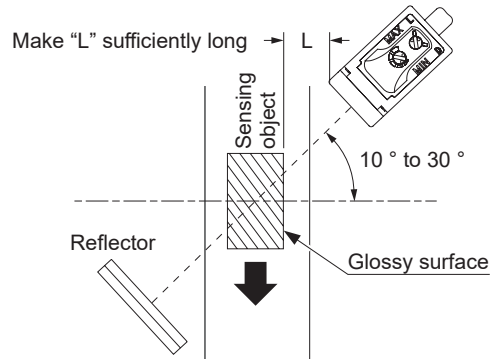


Model No.	A	B
CX-411 □	10 m	Approx. 590 mm or more
CX-412 □	15 m	Approx. 1,580 mm or more
CX-413 □	30 m	Approx. 4.35 m or more

- Since interference function is incorporated in retroreflective type **CX-49**□ / **CX-48**□, diffuse reflective type **CX-42**□, convergent reflective type **CX-46**□-**C05** and adjustable range reflective type **CX-44**□, the 2 sensor heads can be mounted adjacently.

3-3 Mounting when detecting materials having a gloss (Retroreflective type CX-493□ / CX-48□)

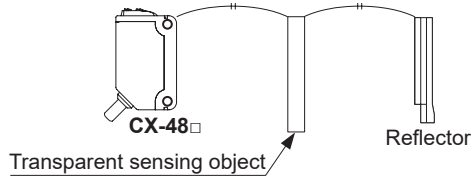
- Please take care of the following points when detecting materials having a gloss with retroreflective type **CX-493□** or retroreflective type for transparent object sensing **CX-48□**.
 1. Make "L", shown in the diagram, sufficiently long. (*1)
 2. Install at an angle of 10 to 30 degrees to the sensing object.



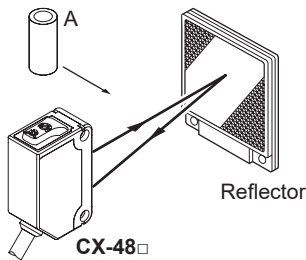
- *1: In case the distance between the sensing object and the sensor is not enough, reflected light from sensing object may enter to the sensor.
- The adjustment is not required for retroreflective type with polarizing filters **CX-491□**.

3-4 Mounting of retroreflective type for transparent objects CX-48□

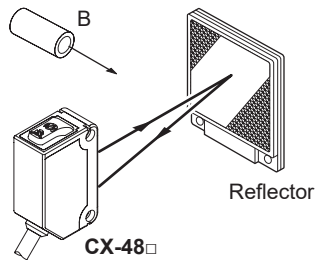
- Optimum sensing is possible when the position of the transparent sensing object is set at the center of the sensor and the reflector. If the sensing position is set near the CX-48□ or the reflector, the sensing may be unstable.



- When the sensor detects an uneven plastic receptacle or glass bottle, the received light intensity may differ with the sensing position or direction. Adjust the sensitivity after confirming the stable sensing condition by turning the sensing object, etc.
- If the object is a transparent cylinder, feed it in a standing, not lying, position as shown in Figure A. The sensor may fail to detect a lying object as shown in Figure B.



Good

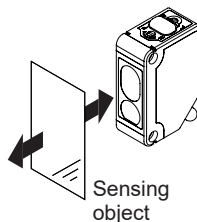


Not good

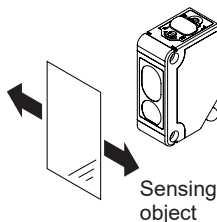
3-5 Mounting of adjustable range reflective type CX-44□

- Care must be taken regarding the sensor mounting direction of CX-44□ with respect to the object's direction of movement.

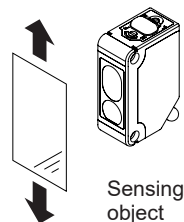
Good



Good

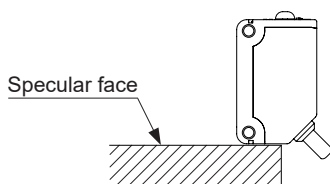


Not good

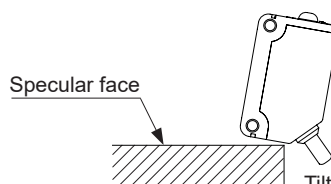


Do not make the sensor detect an object in this direction because it may cause unstable operation.

- When detecting a specular object (aluminum or copper foil, etc.) or an object having a glossy surface or coating, please take care that there are cases when the object may not be detected due to a small change in angle, wrinkles on the object surface, etc.
- When a specular body is present below CX-44□, use CX-44□ by tilting it slightly upwards to avoid wrong operation.

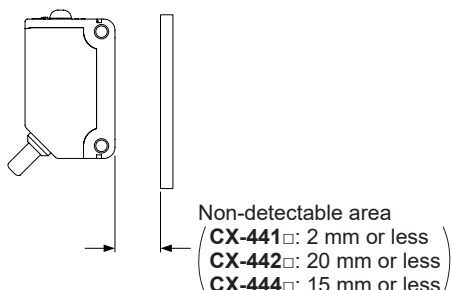


Not good



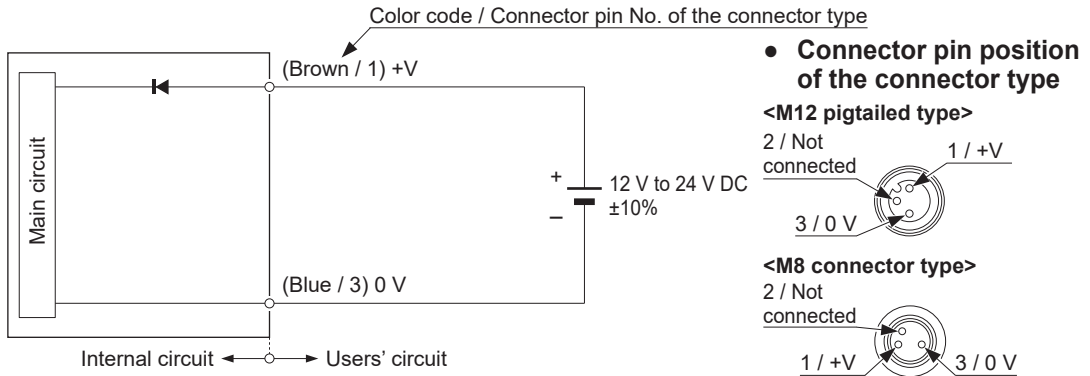
Good

- If a specular body is present in the background, wrong operation may be caused due to a small change in the angle of the background body. In that case, install CX-44□ at an inclination and confirm the operation with the actual sensing object.
- Take care that there is a non-detectable area right in front of CX-44□.

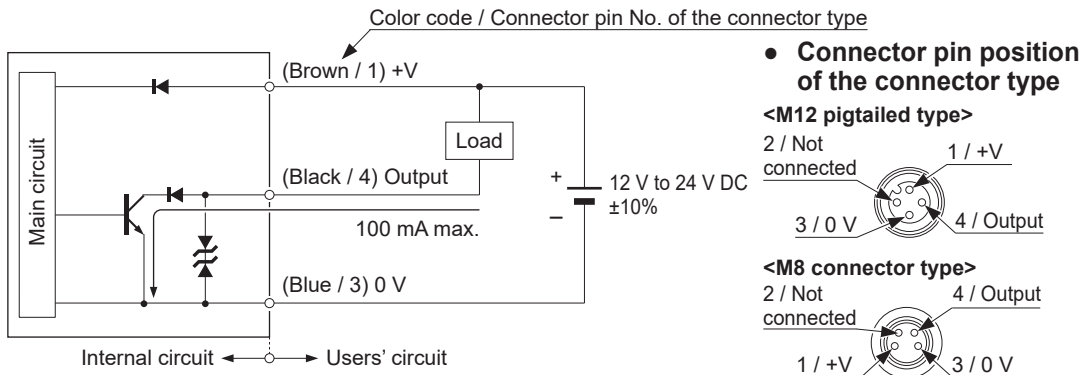


4. I/O Circuit Diagram

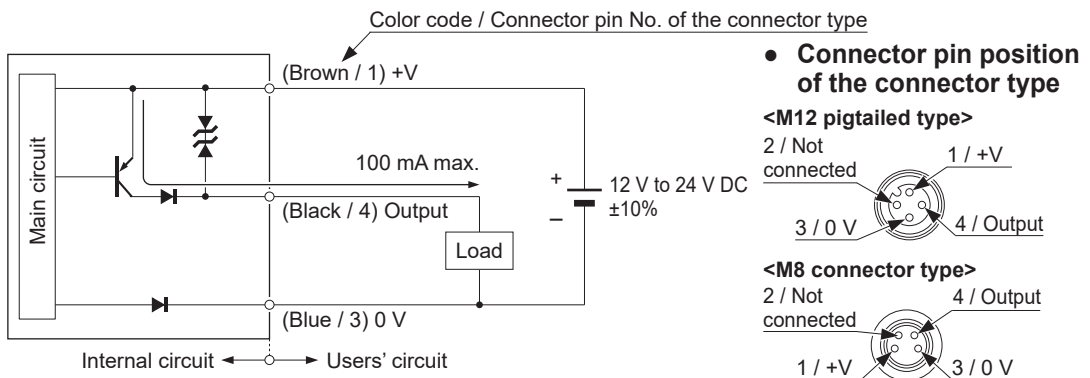
NPN output type and PNP output type common: Thru-beam type CX-41□ emitter



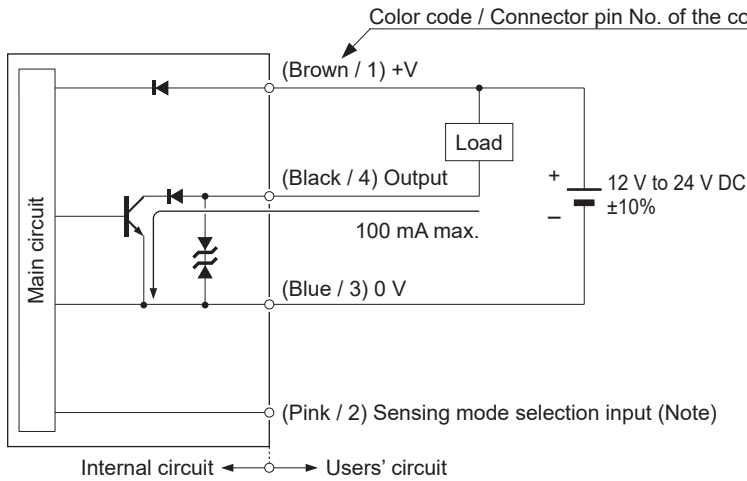
NPN output type: Thru-beam type CX-41□ receiver, Convergent reflective type CX-46□-C05 Retroreflective type CX-49□ / CX-48□ and Diffuse reflective type CX-42□



PNP output type: Thru-beam type CX-41□-P receiver, Convergent reflective type CX-46□-P-C05 Retroreflective type CX-49□-P / CX-48□-P, and Diffuse reflective type CX-42□-P

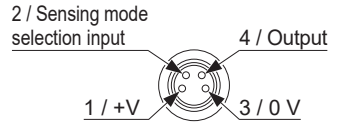


NPN output type / Adjustable range reflective type CX-44□

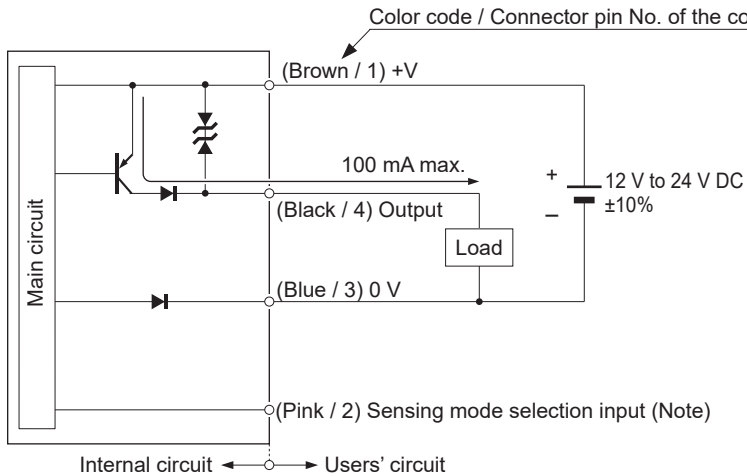


● **Connector pin position of the connector type**

<M8 connector type>

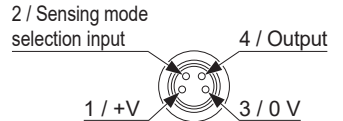


PNP output type / Adjustable range reflective photoelectric type CX-44□-P



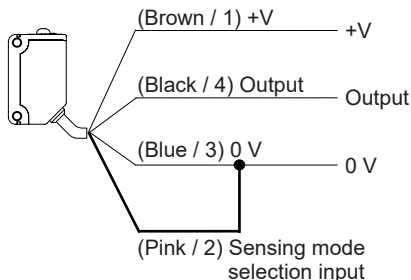
● **Connector pin position of the connector type**

<M8 connector type>

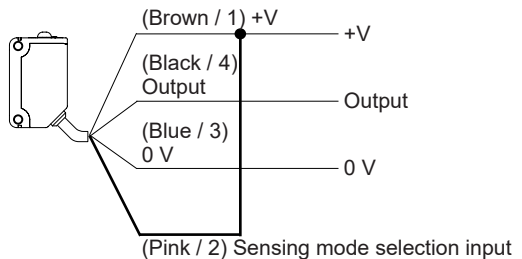


Note: The sensing mode (BGS / FGS function) can be selected by wiring of the sensing mode selection input (pink / 2). For details, refer to "5-3 BGS / FGS FUNCTION (Adjustable range reflective type CX-44□)."

<In case BGS function is used>



<In case FGS function is used>



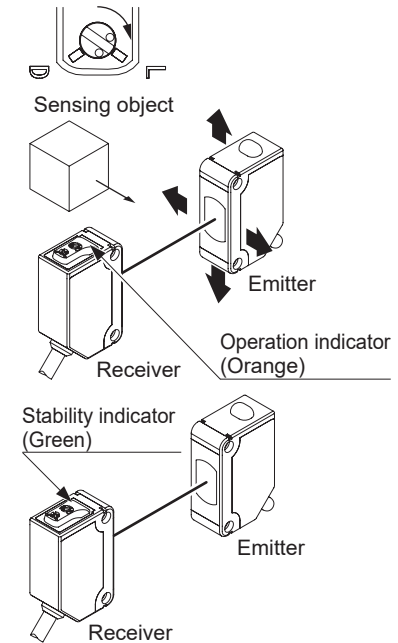
5. Adjustment

5-1 Beam alignment

(Thru-beam type CX-41□, Retroreflective type CX-49□ / CX-48□)

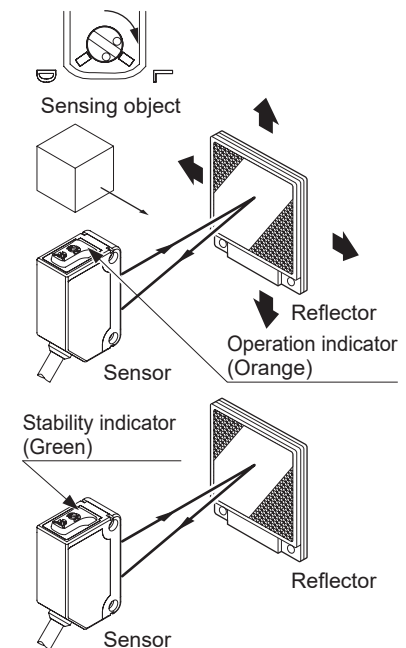
Thru-beam type CX-41□

1. Set the operation mode switch to the Light-ON mode position (L side).
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, Light-ON or Dark-ON, as per your requirement, with the operation mode switch.



Retroreflective type CX-49□ / CX-48□

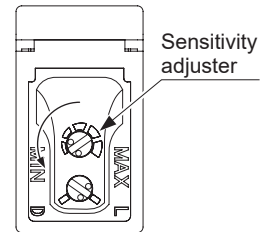
1. Set the operation mode switch to the Light-ON mode position (L side).
2. Placing the sensor and the reflector face to face along a straight line, move the reflector in the up, down, left and right directions, in order to determine the range of the light received condition with the help of the operation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



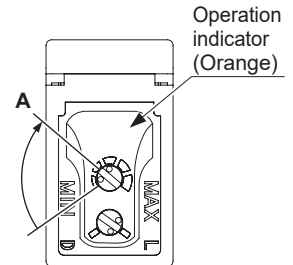
5-2 Sensitivity adjustment (Diffuse reflective type CX-42□)

Step

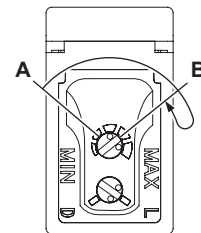
1. Turn the sensitivity adjuster fully counterclockwise to the minimum sensitivity position, MIN.



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.

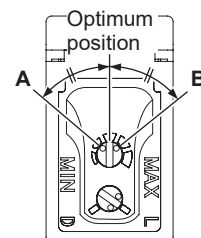


3. In the dark condition, turn the sensitivity adjuster further clockwise until the sensor enters the “Light” state operation and then bring it back to confirm point **B** where the sensor just returns to the “Dark” state operation.



(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.

<Reference>

	Light received condition	Dark condition
Thru-beam type		
Retroreflective type		
Diffuse reflective type Convergent reflective type		

Relation between output and indicators

<Standard type>

In case of Light-ON			Sensing condition	In case of Dark-ON		
Stability indicator (Green)	Operation indicator (Orange)	Output		Output	Operation indicator (Orange)	Stability indicator (Green)
Lights up	Lights up	ON	Stable light receiving	OFF	Turns OFF	Lights up
Turns OFF			Unstable light receiving			Turns OFF
Lights up	Turns OFF	OFF	Unstable dark receiving	ON	Lights up	Turns OFF
			Stable dark receiving			Lights up

<Basic type CX-41□A□-C05, CX-46□A□-C05, CX-491A□-C05-Y>

Stability indicator (Green)	Operation indicator (Orange)	Output	Sensing condition
Lights up	Lights up	ON	Stable dark receiving
Turns OFF			Unstable dark receiving
Lights up	Turns OFF	OFF	Unstable light receiving
Turns OFF			Stable light receiving

<Basic type CX-41□B□-C05, CX-46□B□-C05, CX-491B□-C05-Y>

Stability indicator (Green)	Operation indicator (Orange)	Output	Sensing condition
Lights up	Turns OFF	OFF	Stable light receiving
Turns OFF			Unstable light receiving
Lights up	Lights up	ON	Unstable dark receiving
Turns OFF			Stable dark receiving

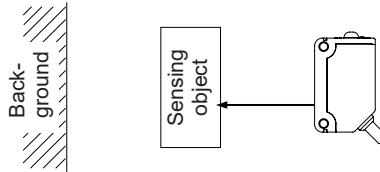
5-3 BGS / FGS function (Adjustable range reflective type CX-44□)

- **CX-44□** incorporates BGS / FGS function.
Select either BGS or FGS function depending on the positions of the background and sensing object. BGS / FGS function can be selected by wiring of the sensing mode selection input (pink / 2), as shown in the figure below.

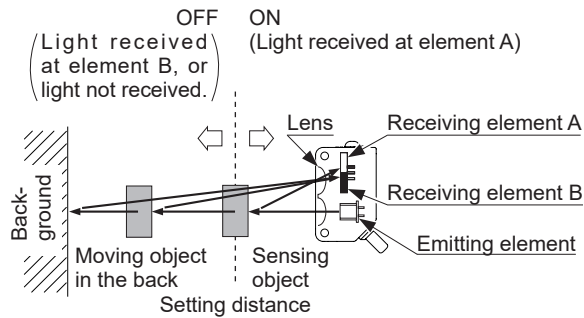
Note: Make sure to connect the sensing mode selection input (pink / 2) to 0 V or +V when using **CX-44□**.

<BGS (Background suppression) function>

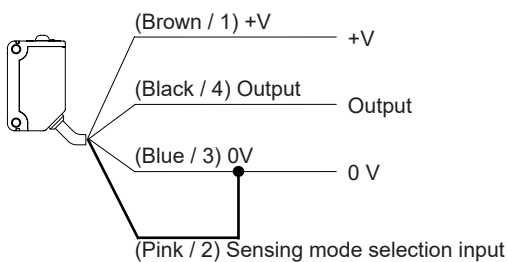
- This function is used when the sensing object is apart from the background.



- The sensor judges that an object is present when light is received at position A of the light-receiving element (2-segment element). The distance adjustment method is the same as the conventional adjustment method.

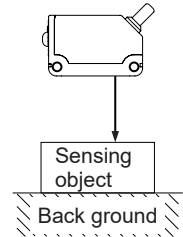


● Wiring for BGS function

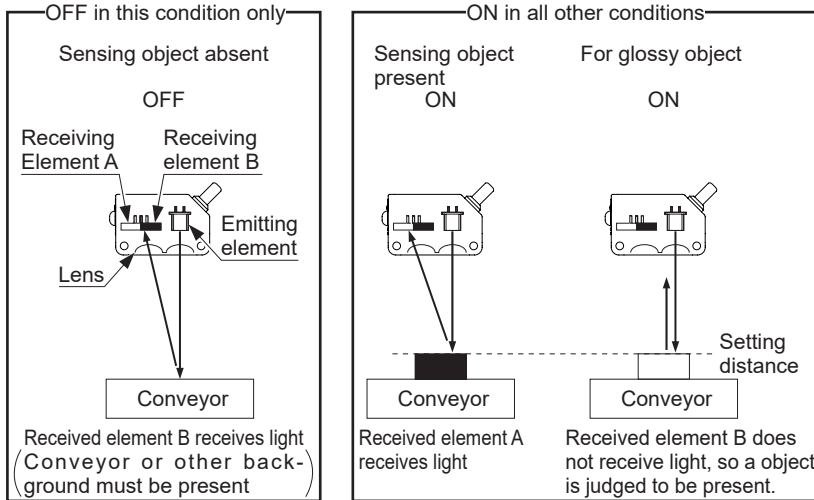


<FGS (Foreground suppression) function>

- This is useful if the object and background are close together, or if the object being sensed is glossy.

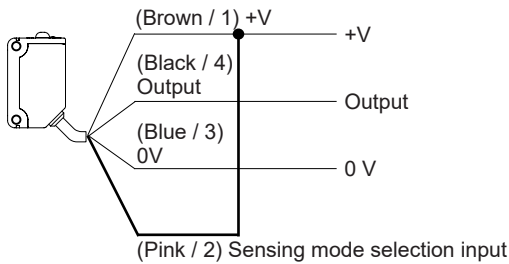


- The sensor Judges that an object is present when no light is received at position B of the light receiving element (2-segment element). Accordingly, even sensing objects that are glossy can be sensed.

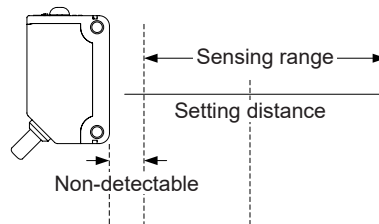


- In case of FGS function, output operation used in dark condition-ON is recommended

• Wiring for FGS function



- Depends on a selection of either BGS or FGS function, the output operation changes as follows.



BGS	L-ON		ON OFF
	D-ON		ON OFF
FGS	L-ON		ON OFF
	D-ON		ON OFF

5-4 Distance adjustment (Adjustable range reflective type CX-44□)

- Be sure to conduct the distance adjustment before using **CX-44□**.
- Since the distance adjuster of this sensor is a 5-turn adjuster, when the point **A** and **B** is adjusted as explained in the table below, there may be more than 1 turn between the point **A** and **B**. Therefore, make sure to remember the turns of both points to find the optimum position.
- Be sure to wire the sensing mode selection input (pink / 2) before distance adjustment. If the wiring is done after the distance adjustment, the sensing area is changed.

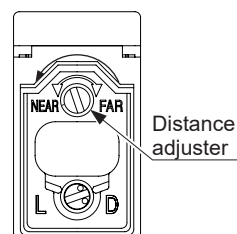
- Turn the distance adjuster gradually and lightly with a flathead screwdriver (purchase separately). In order to protect itself, the distance adjuster idles if turned fully. If the adjuster is idled when distance adjustment is done, carry out the adjustment again.

- **In case BGS function is used.**

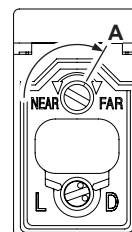
<In case the sensing object is moving from side to side of the sensor>

Step

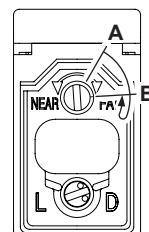
1. Turn the distance adjuster fully counterclockwise to the minimum sensing range position. (approx. 40 mm for **CX-442□**, approx. 20 mm for **CX-441□** and **CX-444□**)



2. Place an object at the required distance from the sensor, turn the distance adjuster gradually clockwise, and find out point **A** where the sensor changes to the light received condition.

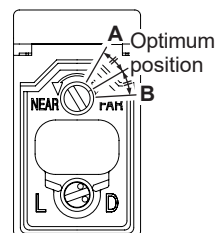


3. Remove the object, turn the distance adjuster further clockwise, and find out point **B** where the sensor changes to the light received condition again with only the background. When the sensor does not go to the light received condition even if the adjuster is fully turned clockwise, point **B** is this extreme point.



(There may be more than 1 turn between the point **A** and **B**,) since this sensor incorporates 5-turn adjuster.

4. The optimum position to stably detect objects is the center point between **A** and **B**.



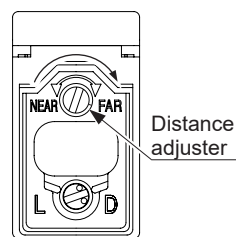
<In case the sensing object is moving back and forth of the sensor>

- Set only with step 1 and step 2. In addition, the sensing position may change depending on sensing object. Be sure to confirm the operation with the actual object.

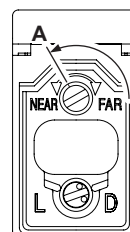
● In case FGS function is used.

Step

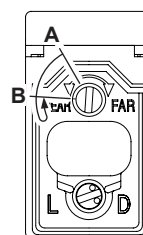
1. Turn the distance adjuster fully clockwise to the maximum sensing range position. (approx. 50 mm for **CX-441**□, approx. 100 mm for **CX-444**□, and approx. 300 mm for **CX-442**□).



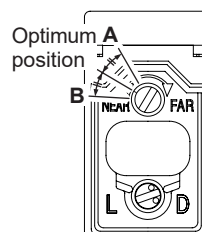
2. Place an object at the required distance from the sensor, turn the distance adjuster gradually counterclockwise, and find out point **A** where the sensor changes to the stable dark condition.



3. Remove the object, turn the distance adjuster further counterclockwise, and find out point **B** where the sensor changes to the stable dark condition again with only the background. When the sensor does not go to the stable dark condition even if the adjuster is fully turned counterclockwise, point **B** is this extreme point. (There may be more than 1 turn between the point **A** and **B**, since this sensor incorporates 5-turn adjuster.)

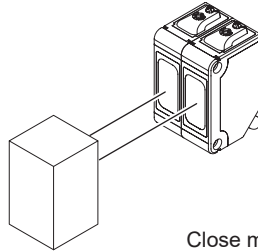


4. The optimum position to stably detect objects is the center point between **A** and **B**.



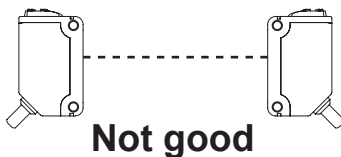
6. Automatic Interference Prevention Function

- Retroreflective type **CX-49**□ / **CX-48**□, diffuse reflective type **CX-42**□, convergent reflective type **CX-46**□-**C05** and adjustable range reflective type **CX-44**□ incorporate the automatic interference prevention function (the sensor automatically adjust the sensing timing). Up to two sets of sensor can be mounted closely. (thru-beam **CX-41**□ does not incorporate this function)

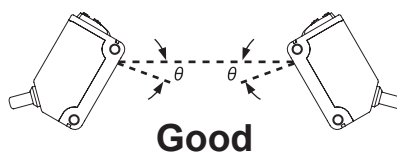


Close mounting of 2 sensors

Note: If **CX-49**□ / **CX-48**□ are mounted facing each other, they should be angled so as not to receive the beam from the opposing sensor or to detect its front face.



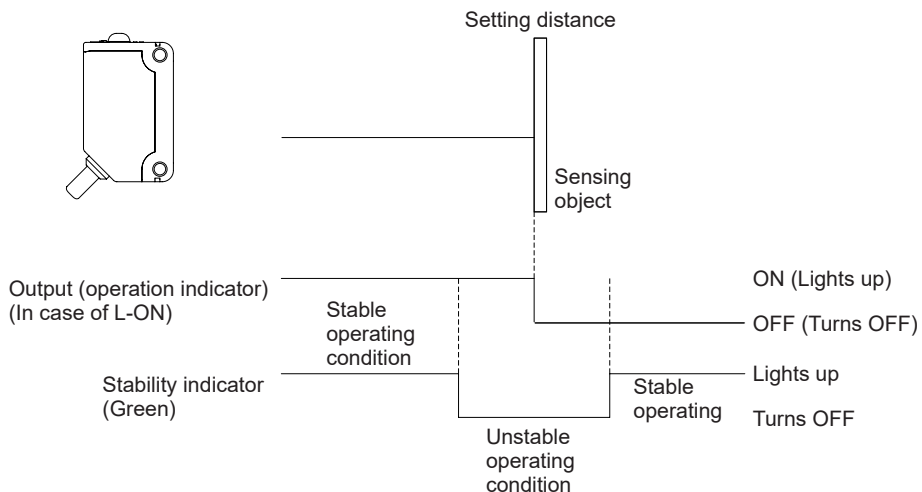
Not good



Good

7. Stability Indicator of Adjustable Range Reflective Type CX-44□

- Since the **CX-44**□ use a 2-segment photodiode as its receiving element, and sensing is done based on the difference in the incident beam angle of the reflected beam from the sensing object, the output and the operation indicator (orange) operate according to the object distance. Further, the stability indicator (green) shows the margin to the setting distance.



8. Retroreflective Type CX-491□ with Polarizing Filters

- As light is polarized by a transparent film or membrane, **CX-491**□ may not detect an object covered or wrapped by transparent film.

In that case, take the following measures.

<Example of sensing objects>

- Can wrapped by clear film
- Aluminum sheet covered by plastic film
- Gold or silver color (glossy) labels or wrapping paper

<Measures>

- Tilt the sensor with respect to the sensing object upon fitting.
- Reduce the sensitivity.
- Increase the distance between the sensor and the sensing object.

9. Option

9-1 Slit mask (Thru-beam type CX-41□)

- With the slit mask **OS-CX-□**, the sensor can detect a small object.
- However, the sensing range is reduced when the slit mask is mounted.

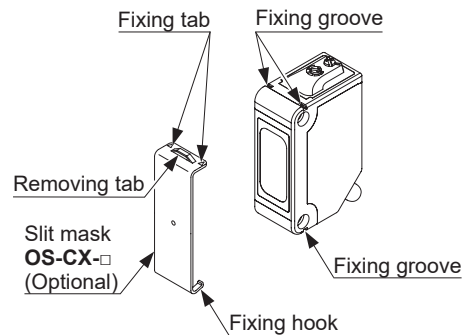
Type	Model No.		Slit size	Sensing distance		Min. sensing object	
	Slit mask	Slit size		Slit on one side	Slit on both side	Slit on one side	Slit on both side
Round slit mask	OS-CX-05	CX-411 □	ø0.5 mm	400 mm	20 mm	ø12 mm	ø0.5 mm
		CX-412 □		600 mm	30 mm		
		CX-413 □		1.2 m	60 mm		
	OS-CX-1	CX-411 □	ø1 mm	900 mm	100 mm	ø12 mm	ø1 mm
		CX-412 □		1.35 m	150 mm		ø1.5 mm
		CX-413 □		2.7 m	300 mm		
	OS-CX-2	CX-411 □	ø2 mm	2 m	400 mm	ø12 mm	ø2 mm
		CX-412 □		3 m	600 mm		ø3 mm
		CX-413 □		6 m	1.2 m		
Rectan- gular slit mask	OX-CX-05×6	CX-411 □	0.5 mm × 6 mm	2 m	400 mm	ø12 mm	0.5 mm × 6 mm
		CX-412 □		3 m	600 mm		
		CX-413 □		6 m	1.2 m		
	OX-CX-1×6	CX-411 □	1 mm × 6 mm	3 m	1 m	ø12 mm	1 mm × 6 mm
		CX-412 □		4.5 m	1.5 m		
		CX-413 □		9 m	3 m		
	OX-CX-2×6	CX-411 □	2 mm × 6 mm	5 m	2 m	ø12 mm	2 mm × 6 mm
		CX-412 □		7.5 m	3 m		
		CX-413 □		15 m	6 m		

How to mount

1. Insert the fixing hook into the fixing groove.
2. Then, pressing the slit mask against the main unit, insert the fixing tab into the fixing groove.

How to remove

1. Insert a screwdriver into the removing tab.
2. Pull forward while lifting the removing tab.

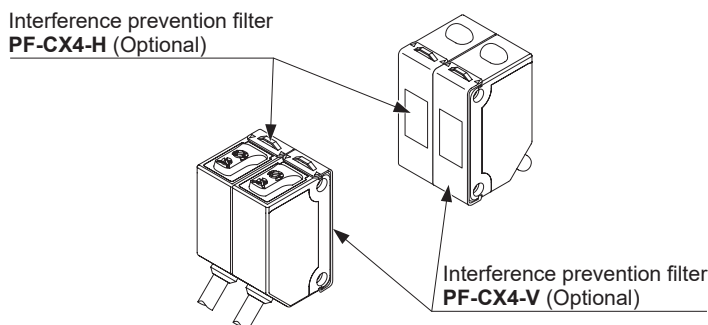


9-2 Interference prevention filter (Thru-beam type CX-411□)

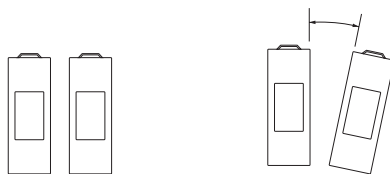
- **PF-CX4-V** is a polarizing filter that passes only vertical light waves and **PF-CX4-H** is a polarizing filter that passes only horizontal light waves.
- By mounting the interference prevention filters **PF-CX4-□**, two sets of the **CX-411□** can be mounted close together.

[Precautions when using this product]

- Note the following precautions when using the product.
 - The sensing distance becomes shorter when an interference prevention filter is mounted.
 - There are two types of interference prevention filters. Mount one type to the emitter and the other type to the receiver.



- If the filter is mounted only to the emitter or only to the receiver, or if the same type of filter is mounted to both the emitter and the receiver, interference cannot be prevented.
- The sensing distance and interference range may be affected if the emitter and receiver with an interference prevention filter mounted to each one are installed at an angle. Install them in parallel to each other.



Good Not good

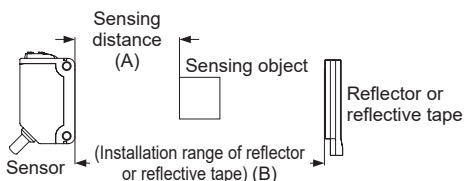
Model No	Direction of thru-beam axis	Color of the bracket	Sensing distance	Min. sensing object
PF-CX4-H	Horizontal	Light brown	5 m	ø12 mm
PF-CX4-V	Vertical	Silver	5 m	ø12 mm

Note: The model No. is not shown on the interference prevention filters. Take care when mounting them on the sensors.

9-3 Reflector / refractive tape (Retroreflective type CX-49□ and CX-48□)

- Refractor **RF-230** are accessory of retroreflective type **CX-49□** and **CX-48□**. (we also offer them without refractor **RF-230**)
- By using reflector (optional) or reflectivity tape (optional), small object can be detected. However, the sensing distance would be shorter by using reflector (optional) or reflectivity tape (optional).

Designation	Model No.		Sensing range A (Note 2)	Installation range of reflector or reflective tape B	Min. sensing object	Description
		Sensor				
Reflector (Note 1) (For retroreflective type sensor only)	RF-230	CX-491□	3 m	0.1 m to 3 m	ø50 mm	<ul style="list-style-type: none"> • Dimension: W50.3 mm × H59.3 mm × D8.3 mm • Thru-hole threads: ø4.6 mm • Attached to the retroreflective type sensor except for the type without a reflector.
		CX-493□	5 m	0.1 m to 5 m		
		CX-481□	50 mm to 500 mm	100 mm to 500 mm		
		CX-482□	0.1 m to 2 m	0.8 m to 2 m		
		CX-483□	0.05 m to 1 m	0.1 m to 1 m		
	RF-210	CX-491□	1 m	0.1 m to 1 m	ø30 mm	<ul style="list-style-type: none"> • Dimension: W33.3 mm×H12.8 mm×D11 mm • Thru-hole threads: ø3.4 mm
		CX-493□	1.5 m	0.1 m to 1.5 m		
		CX-481□	-	-		
		CX-482□	0.1 m to 0.6 m	0.3 m to 0.6 m		
		CX-483□	0.1 m to 0.3 m	0.1 m to 0.3 m		
	RF-220	CX-491□	1.5 m	0.1 m to 1.5 m	ø35 mm	<ul style="list-style-type: none"> • Dimension: W35.3 mm×H42.3 mm×D8.3 mm • Thru-hole threads: ø3.6 mm
		CX-493□	3 m	0.1 m to 3 m		
		CX-481□	50 mm to 300 mm	100 mm to 300 mm		
		CX-482□	0.1 m to 1.3 m	0.5 m to 1.3 m		
		CX-483□	0.1 m to 0.7 m	0.2 m to 0.7 m		
Reflective tape (Note 1) (For retroreflective type sensor only)	RF-11 (Note 3)	CX-491□	0.5 m	0.1 m to 0.5 m	ø30 mm	<ul style="list-style-type: none"> • Dimension: W30 mm×H8 mm×D0.7 mm • Ambient temperature: -25 °C to +50 °C • Ambient humidity: 35 %RH to 85 %RH
		CX-493□	0.8 m	0.1 m to 0.8 m		
		CX-481□	-	-		
		CX-482□	-	-		
		CX-483□	-	-		
	RF-12 (Note 3)	CX-491□	0.7 m	0.1 m to 0.7 m	ø30 mm	<ul style="list-style-type: none"> • Dimension: W30 mm×H25 mm×D0.7 mm • Ambient temperature: -25 °C to +50 °C • Ambient humidity: 35 %RH to 85 %RH
		CX-493□	1.2 m	0.1 m to 1.2 m		
		CX-481□	-	-		
		CX-482□	0.1 m to 0.6 m	0.4 m to 0.6 m		
		CX-483□	-	-		
	RF-13	CX-491□	0.5 m	0.2 m to 0.5 m	ø30 mm	<ul style="list-style-type: none"> • Dimension: W30 mm×H30 mm×D0.5 mm • Ambient temperature: -25 °C to +55 °C • Ambient humidity: 35 %RH to 85 %RH
		CX-493□	-	-		
		CX-481□	-	-		
		CX-482□	-	-		
		CX-483□	-	-		



- Notes: 1) When installing sensors, reflectors, and reflective tapes, be sure to perform beam alignment. Particularly when using the reflector **RF-210** or the reflective tape **RF-11**, more severe adjustment is required compared with the attached reflector **RF-230**.
Install them so that sensor angle can be adjusted in a wide range. For angle adjustment of the sensor or for position adjustment of the reflector or reflective tape, refer to "5-1 Beam alignment".
- 2) The sensing distance A may vary depending on the shape of sensing object. Be sure to check the operation with the actual sensing object.
- 3) Since the reflective tape **RF-11** / **RF-12** has soft surface material, be careful not to press it hard. Otherwise, the prism inside may be smashed, resulting in a shorter sensing distance. Also, do not cut the tape. Otherwise, the performance of the tape cannot be maintained.

10. Specifications

<Standard type>

Type		Thru-beam type			Retroreflective		
			Long sensing range	Ultra long sensing range	With polarizing filters (Note 2)	Long sensing range	
Model No. (Note 1)	NPN output	CX-411	CX-412	CX-413	CX-491	CX-493	
	PNP output	CX-411-P	CX-412-P	CX-413-P	CX-491-P	CX-493-P	
Sensing distance		10 m	15 m	30 m	3 m (Note 3)	5 m (Note 3)	
Sensing object		ø12 mm or more opaque object			ø50 mm more opaque, translucent or specular object (Note 3, 4)	ø50 mm more opaque, translucent object (Note 3, 4))	
Repeatability (Perpendicular to sensing axis)		0.5 mm or less					
Supply voltage		12 V to 24 V DC ±10 % Ripple P-P 10 % or less					
Current consumption		Emitter: 15 mA or less Receiver: 10 mA or less	Emitter: 20 mA or less Receiver: 10 mA or less	Emitter: 25 mA or less Receiver: 10 mA or less	13 mA or less	10 mA or less	
Output		<NPN output type> 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)			<PNP output type> PNP open-collector transistor • Maximum source current: 100 mA • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 2 V or less (at 100 mA source current) 1 V or less (at 16 mA source current)		
Output operation		Switchable either Light-ON or Dark-ON					
Short-circuit protection		Incorporated					
Response time		1 ms or less		2 ms or less	1 ms or less		
Automatic interference prevention function		- (Note 5)	-		Incorporated (Two units of sensors can be mounted closely.)		
Protection		IP67 (IEC)					
Ambient temperature		-25 °C to +55 °C (No dew condensation or icing allowed), Storage: -30 °C to +70 °C					
Ambient humidity		35 % RH to 85 % RH, Storage: 35 % RH to 85 % RH					
Emitting element		Red LED	Infrared LED		Red LED		
Material		Enclosure: PBT, Lens: Acrylic, Indicator cover: Acrylic					
Cable		0.2 mm ² 3-core (2-core for thru-beam type) cabtyre cable, 2 m long					
Weight	Net weight	Emitter: Approx. 45 g, Receiver: Approx. 50 g			Approx. 50 g		
	Gross weight	Approx. 100 g			Approx. 80 g		
Accessory		-			RF-230 (Reflector): 1 pc.		

Type		Diffuse reflective			
		Narrow view			
Model No. (Note 1)	NPN output	CX-424	CX-421	CX-422	CX-423
	PNP output	CX-424-P	CX-421-P	CX-422-P	CX-423-P
Sensing distance		100 mm (Note 6)	300 mm (Note 6)	800 mm (Note 6)	70 mm to 300 mm (Note 6)
Sensing object		Opaque, translucent or transparent object (Note 4)			Opaque, translucent or transparent object (Note 4, 7)
Hysteresis		15 % or less operation distance (Note 6)			
Repeatability (Perpendicular to sensing axis)		1 mm or less			0.5 mm or less
Supply voltage		12 V to 24 V DC \pm 10 % Ripple P-P 10 % or less			
Current consumption		13 mA or less			15 mA or less
Output		<NPN output type> NPN open-collector transistor		<PNP output type> PNP open-collector transistor	
		<ul style="list-style-type: none"> • 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) 		<ul style="list-style-type: none"> • Maximum source current: 100 mA • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 2 V or less (at 100 mA source current) 1 V or less (at 16 mA source current) 	
Output operation		Switchable either Light-ON or Dark-ON			
Short-circuit protection		Incorporated			
Response time		1ms or less			
Automatic interference prevention function		Incorporated (Two units of sensors can be mounted closely.)			
Protection		IP67 (IEC)			
Ambient temperature		-25 °C to +55 °C (No dew condensation or icing allowed), Storage: -30 °C to +70 °C			
Ambient humidity		35 % RH to 85 % RH, Storage: 35 % RH to 85 % RH			
Emitting element		Infrared LED			Red LED
Material		Enclosure: PBT, Lens: Acrylic, Indicator cover: Acrylic			
Cable		0.2 mm ² 3-core cabtyre cable, 2 m long			
Weight	Net weight	Approx. 50 g			
	Gross weight	Approx. 60 g			

Type		Retroreflective type for transparent object sensing		
		Short sensing range		Long sensing range
Model No. (Note 1)	NPN output	CX-481	CX-483	CX-482
	PNP output	CX-481-P	CX-483-P	CX-482-P
Sensing range		50 mm to 500 mm (Note 3)	50 mm to 1,000 mm (Note 3)	0.1 m to 2 m (Note 3)
Installation range of reflector		100 mm to 500 mm (Note 3)	100 mm to 1,000 mm (Note 3)	0.8 m to 2 m (Note 3)
Sensing object		ø50 mm more opaque, translucent or specular object (Note 3, 4)		
Repeatability (Perpendicular to sensing axis)		0.5 mm or less		
Supply voltage		12 V to 24V DC ±10 % Ripple P-P 10 % or less		
Current consumption		10mA or less		
Output		<NPN output type> 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)		<PNP output type> PNP open-collector transistor • Maximum source current: 100 mA • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 2 V or less (at 100 mA source current) 1 V or less (at 16 mA source current)
		Output operation		
Short-circuit protection		Incorporated		
Response time		1 ms or less		
Automatic interference prevention function		Incorporated (Two units of sensors can be mounted closely.)		
Protection		IP67 (IEC)		
Ambient temperature		-25 °C to +55 °C (No dew condensation or icing allowed), Storage: -30 °C to +70 °C		
Ambient humidity		35 % RH to 85 % RH, Storage: 35 % RH to 85 % RH		
Emitting element		Infrared LED		
Material		Enclosure: PBT, Lens: Polycarbonate, Indicator cover: Polycarbonate		
Cable		0.2 mm ² 3-core cabtyre cable, 2 m long		
Weight	Net weight	Approx. 50 g		
	Gross weight	Approx. 80 g		
Accessory		RF-230 (Reflector): 1 pc.		

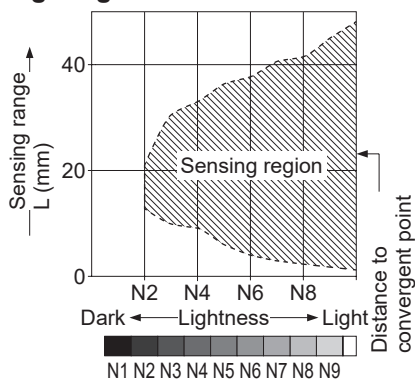
Type		Adjustable Range Reflective type		
		Small spot		
Model No. (Note 1)	NPN output	CX-441	CX-444	CX-442
	PNP output	CX-441-P	CX-444-P	CX-442-P
Adjustable range (Note 8)		20 mm to 50 mm (Note 4)	20 mm to 100 mm (Note 4)	40 mm to 300 mm (Note 4)
Sensing range (With white non-glossy paper)		2 mm to 50 mm (Note 4)	2 mm to 50 mm (When distance is set to 50 mm) 15 mm to 100 mm (When distance is set to 100 mm)	20 mm to 300 mm (Note 4)
Spot diameter		Approx. \varnothing 2 mm (at sensing distance 50 mm)	Approx. \varnothing 9 mm (at sensing distance 100 mm)	Approx. \square 15 mm (at sensing distance 300 mm)
Hysteresis (With white non-glossy paper)		2 % or less of operation distance		5 % or less of operation distance
Repeatability (With white non-glossy paper)		Along sensing axis: 1 mm or less, Perpendicular to sensing axis: 0.2 mm or less		
Supply voltage		12 V to 24 V DC \pm 10 % Ripple P-P 10 % or less		
Power consumption		20 mA or less		
Output		<NPN output type> NPN open-collector transistor		<PNP output type> PNP open-collector transistor
		<ul style="list-style-type: none"> • 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) 		<ul style="list-style-type: none"> • Maximum source current: 100 mA • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 2 V or less (at 100 mA source current) 1 V or less (at 16 mA source current)
Output operation		Switchable either Detection-ON or Detection-OFF		
Short-circuit protection		Incorporated		
Response time		1 ms or less		
Automatic interference prevention function		Incorporated (Two units of sensors can be mounted closely.)		
Protection		IP67 (IEC)		
Ambient temperature		-25 °C to +55 °C (No dew condensation or icing allowed), Storage: -30 °C to +70 °C		
Ambient humidity		35 % RH to 85 % RH, Storage: 35 % RH to 85 % RH		
Emitting element		Red LED		
Material		Enclosure: PBT, Front cover: Polycarbonate, Display cover: Polycarbonate		
Cable		0.2 mm ² 4-core cabtyre cable, 2 m long		
Weight	Net weight	Approx. 55 g		
	Gross weight	Approx. 65 g		

<Basic type>

Type		Convergent reflective type			
		Light-ON	Dark-ON	Light-ON	Dark-ON
Model No.	NPN output	CX-461A-C05	CX-461B-C05	CX-462A-C05	CX-462B-C05
	PNP output	CX-461A-P-C05	CX-461B-P-C05	CX-462A-P-C05	CX-462B-P-C05
Sensing distance		10 mm to 40 mm (Conv. point: 23 mm)		10 mm to 70 mm (Conv. point: 40 mm)	
Spot diameter		Approx. 5 mm × 30 mm (Sensing distance: 30 mm)		Approx. 5 mm × 30 mm (Sensing distance: 60 mm)	
Repeatability (Perpendicular to sensing axis)		1 mm or less			
Supply voltage		12 V to 24 V DC ±10 % Ripple P-P 10 % or less			
Current consumption		15 mA or less			
Output		<NPN output type> NPN open-collector transistor <ul style="list-style-type: none"> • Maximum sink current: 100 mA • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: <ul style="list-style-type: none"> 2 V or less (at 100 mA sink current) 1 V or less (at 16 mA sink current) 		<PNP output type> PNP open-collector transistor <ul style="list-style-type: none"> • Maximum source current: 100 mA • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: <ul style="list-style-type: none"> 2 V or less (at 100 mA source current) 1 V or less (at 16 mA source current) 	
		Short-circuit protection		Incorporated	
Response time		1 ms or less			
Automatic interference prevention function		Incorporated (Two units of sensors can be mounted closely.)			
Protection		IP67 (IEC)			
Ambient temperature		-25 °C to +55 °C (No dew condensation or icing allowed), Storage: -30 °C to +70 °C			
Ambient humidity		35 % RH to 85 % RH, Storage: 35 % RH to 85 % RH			
Emitting element		Red LED			
Material		Enclosure: PBT, Lens: Acrylic, Indicator cover: Acrylic			
Cable		0.2 mm ² 3-core cabtyre cable, 0.5 m long			
Weight	Net weight	Approx. 20 g			
	Gross weight	Approx. 30 g			

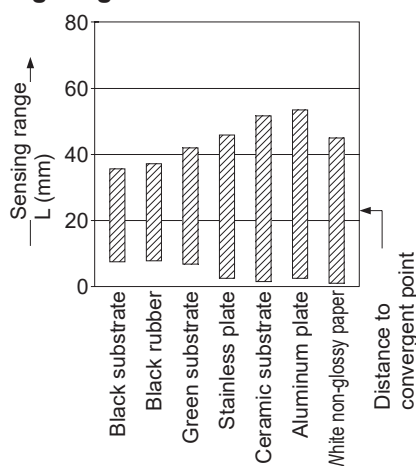
CX-461□-C5

Correlation between lightness and sensing range



The sensing region (typical) is represented by oblique lines in the above figure. However, the sensitivity should be set with enough margin because of slight variation in products. Lightness shown on the above may differ slightly from the actual object condition.

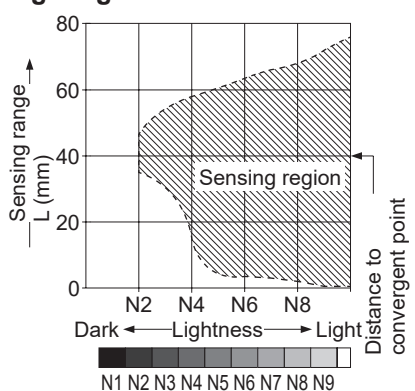
Correlation between material and sensing range



The bars in the graph indicate the sensing range (typical) for the respective material. However, there is a slight variation in the sensing range depending on the product. Further, if there is a reflective object (conveyor, etc.) in the background of the sensing object, since it affects the sensing, separate it by more than twice the sensing range shown in the above figure.

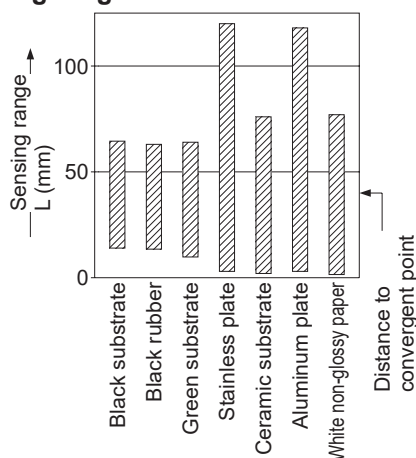
CX-462□-C5

Correlation between lightness and sensing range



The sensing region (typical) is represented by oblique lines in the above figure. However, the sensitivity should be set with enough margin because of slight variation in products. Lightness shown on the above may differ slightly from the actual object condition.

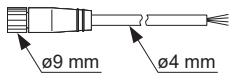
Correlation between material and sensing range



The bars in the graph indicate the sensing range (typical) for the respective material. However, there is a slight variation in the sensing range depending on the product. Further, if there is a reflective object (conveyor, etc.) in the background of the sensing object, since it affects the sensing, separate it by more than twice the sensing range shown in the above figure.

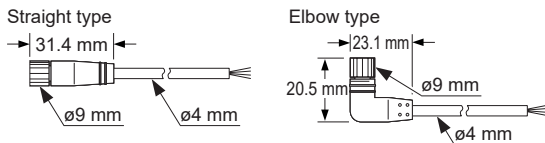
- Notes: 1) The model No. with suffix “-J” is M12 pigtailed type and the model No. with suffix “-Z” is M8 plug-in connector type.
 However, **CX-44□** is not prepared M12 pigtailed type.
 (Example) M12 pigtailed type: **CX-411-J**, M8 connector type: **CX-411-Z**
 Use the connection cables as shown below.

<Connection cable for M12 pigtailed type>



Type	Model No.	Cable length
2 core type	CN-22-C2	2 m
	CN-22-C5	5 m
4 core type	CN-24-C2	2 m
	CN-24-C5	5 m

<Connection cable for M8 plug-in connector type>



Type	Model No.	Cable length
Straight type	CN-24A-C2	2 m
	CN-24A-C5	5 m
Elbow type	CN-24AL-C2	2 m
	CN-24AL-C5	5 m

The model No. with suffix “E” shown on the label affixed to the thru-beam type sensor is the emitter, “D” shown on the label is the receiver.

Thru-beam type sensor emitter: **CX-41□E**, Thru-beam type sensor receiver: **CX-41□D**

The model No. with suffix “-C5” is cable length 5 m type. (Standard: 2 m)

(Example) **CX-411-C5**

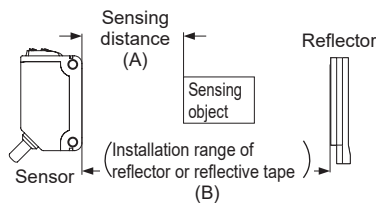
The model No. with suffix “-C05” is cable length 0.5 m type.

(Example) **CX-411A-C05**

The model No. of retroreflective type sensor with the suffix “-Y” is the sensor without the **RF-230** reflector.

(Example) **CX-491-Y**

- The retroreflective type sensor with polarizing filters may not stably detect specular or glossy objects through transparent film since light is polarized by the transparent film.
- The sensing range and the sensing object of the retroreflective type sensor is specified for the **RF-230** reflector. The sensing range represents the actual sensing range of the sensor. The sensing ranges itemized in “A” of the table below may vary depending of the shape of sensing object. Be sure to check the operation with the actual sensing object.

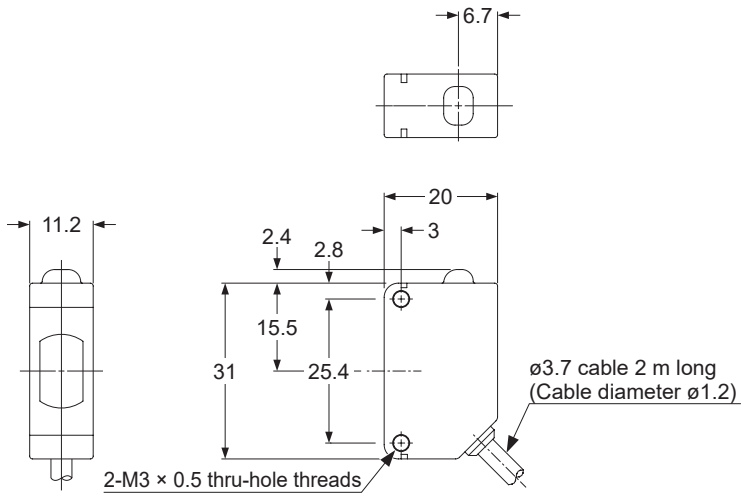


	A	B
CX-491□	0 m to 3 m	0.1 m to 3 m
CX-493□	0 m to 5 m	0.1 m to 5 m
CX-481□	50 mm to 500 mm	100 mm to 500 mm
CX-483□	50 mm to 1,000mm	100 mm to 1,000 mm
CX-482□	0.1 m to 2 m	0.8 m to 2 m

- The sensing may become unstable due to the installation condition or the sensing object. After the installation of this product, be sure to check the operation with the actual sensing object.
- By mounting interference prevention filters (**PF-CX4□**), two sets of the sensor can be mounted close together.
- The sensing range of the diffuse reflective type sensor is specified for white non-glossy paper (200 mm × 200 mm) as the object.
- The minimum sensing object of the diffuse reflective narrow-view type sensor is ø0.5 mm copper wire.
- Distance setting range indicates maximum setting range with the distance adjuster. Sensing the sensing object is possible from 2mm (**CX-442□**: 20 mm).

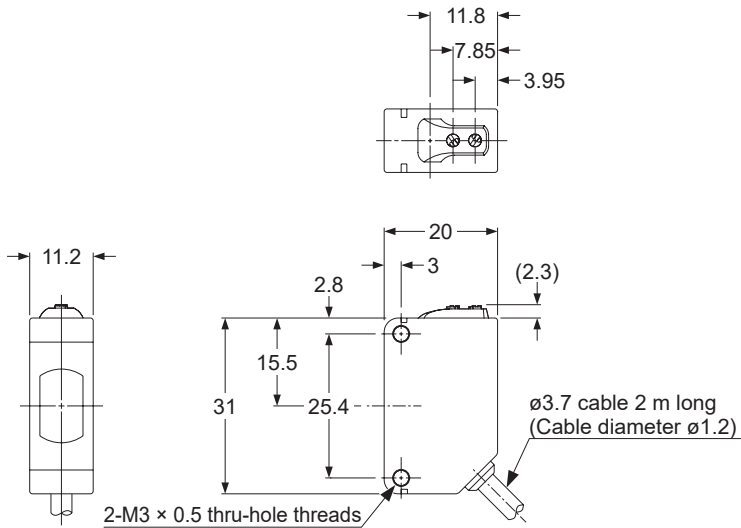
11. Dimensions

Cable type (Standard / Thru-beam type emitter CX-41□)



(Unit: mm)

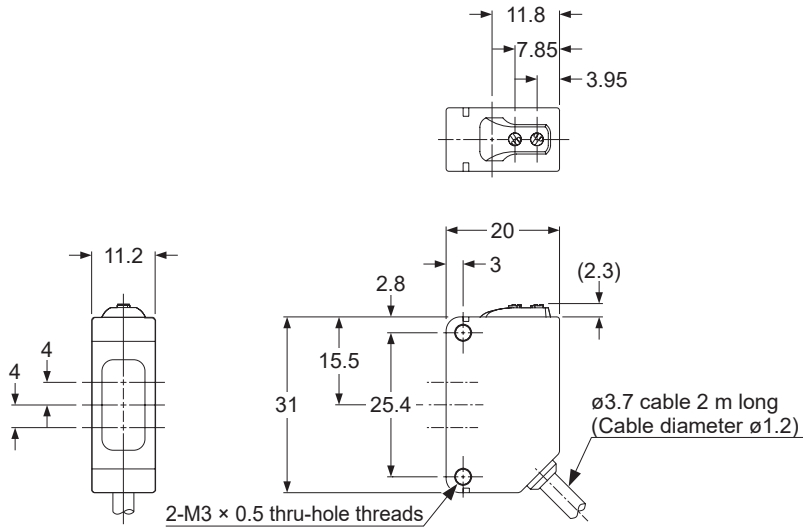
Cable type (Standard / Thru-beam type receiver CX-41□)



(Unit: mm)

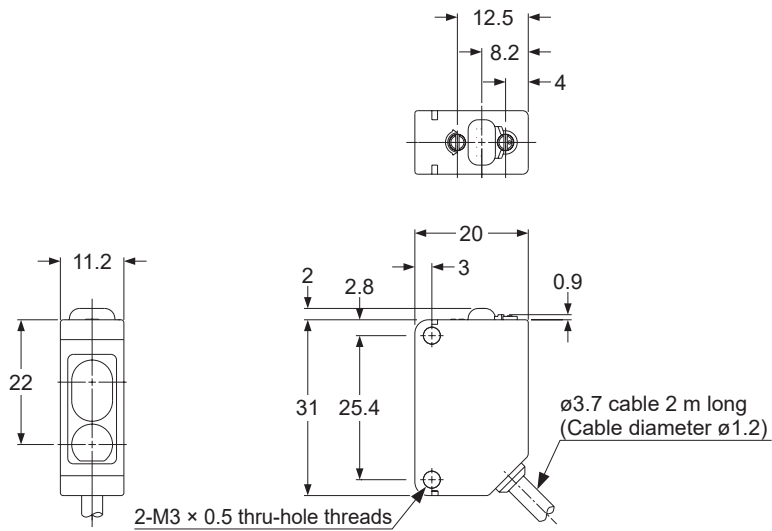
Cable type (Standard / Retroreflective type CX-49□ / CX-48□, Diffuse reflective type CX-42□)

(Unit: mm)

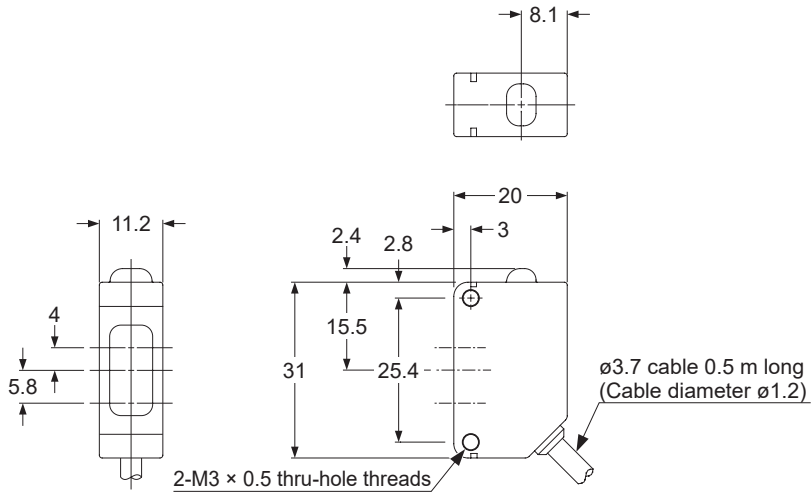


Cable type (Adjustable range reflective type CX-44□)

(Unit: mm)

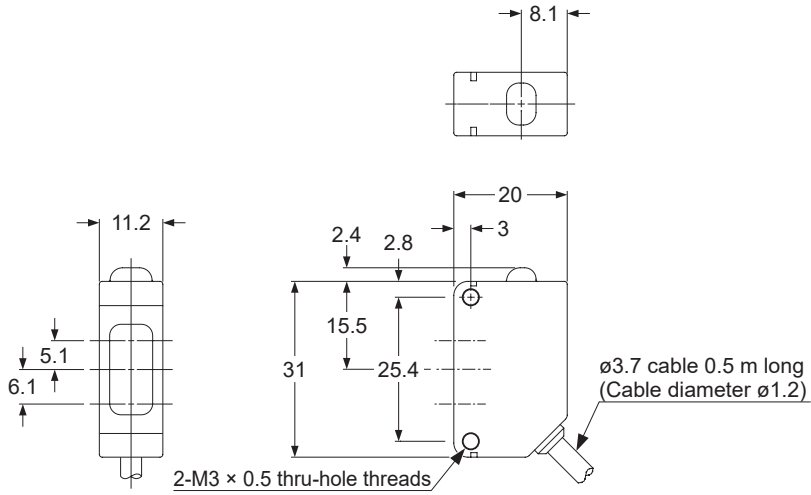


Cable type (Basic / Convergent reflective type CX-461□-C05)



(Unit: mm)

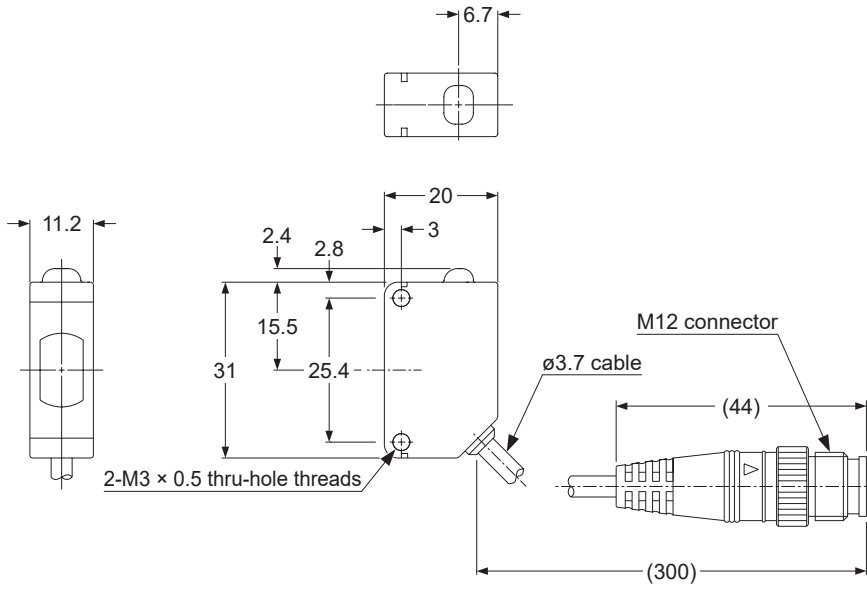
Cable type (Basic / Convergent reflective type CX-462□-C05)



(Unit: mm)

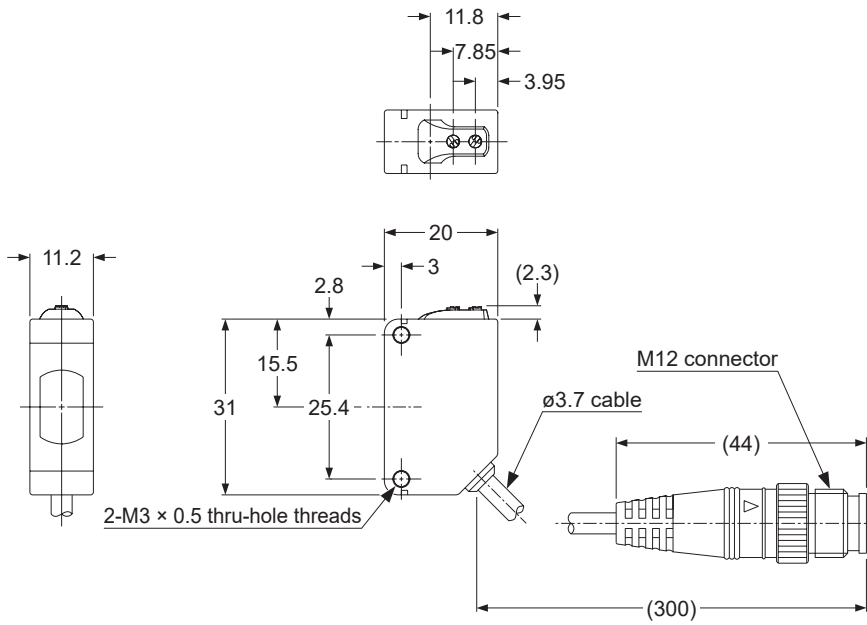
M12 pigtailed type (Thru-beam type emitter CX-41□-J)

(Unit: mm)

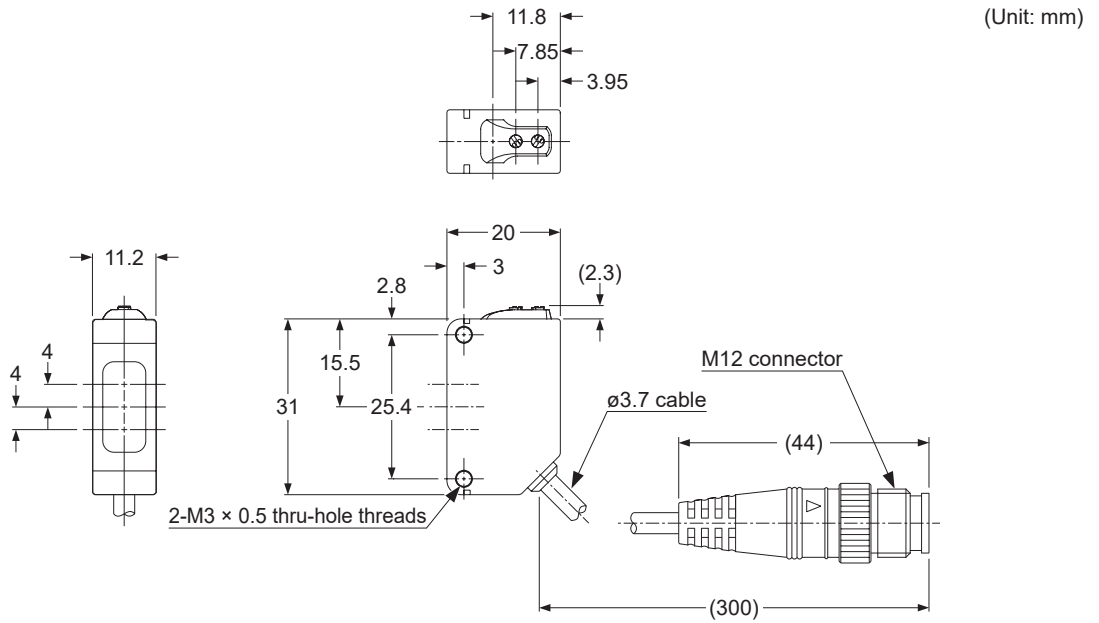


M12 pigtailed type (Thru-beam type receiver CX-41□-J)

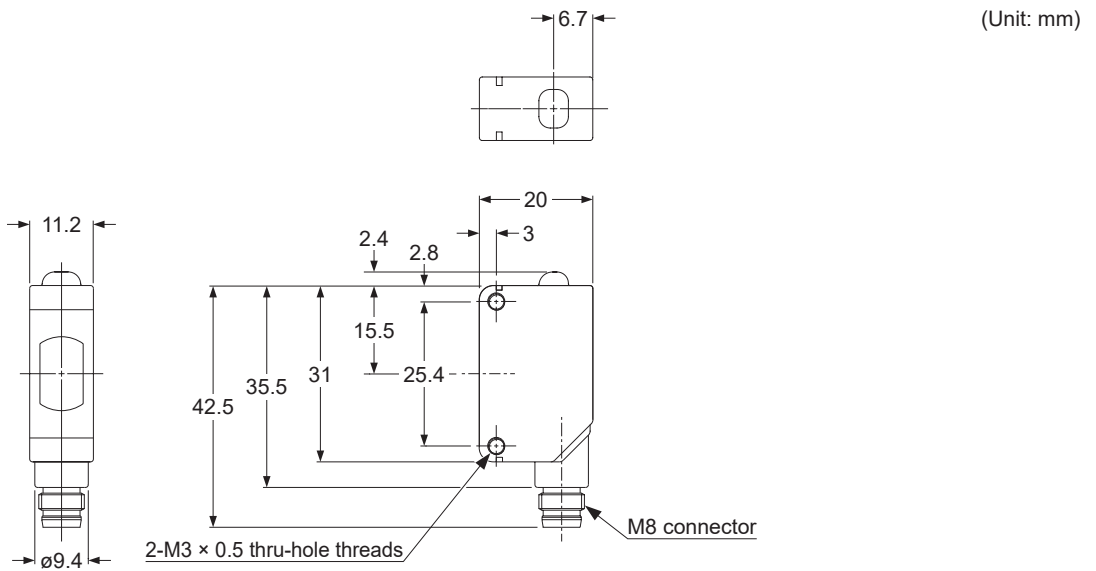
(Unit: mm)



M12 pigtailed type (Retroreflective type CX-49□-J / CX-48□-J, Diffuse reflective type CX-42□-J)

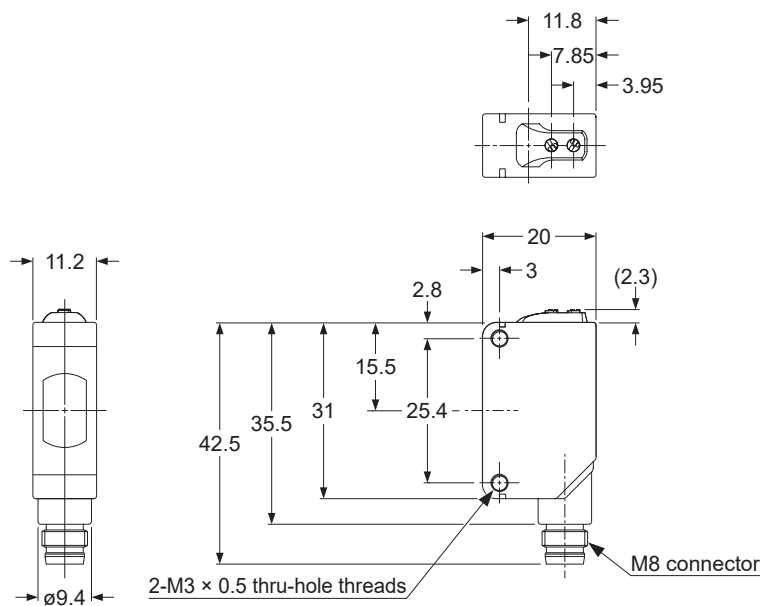


M8 connector type (Thru-beam type emitter CX-41□-Z)



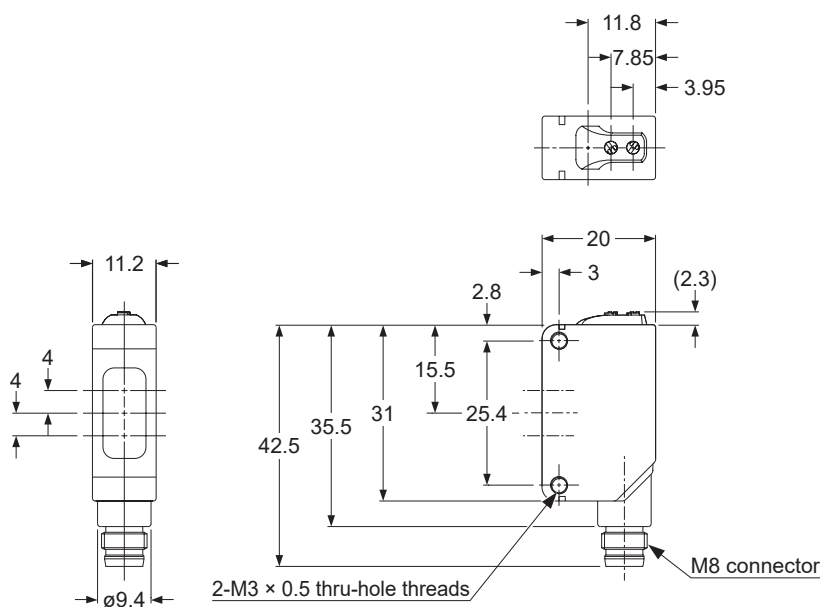
M8 connector type (Thru-beam type CX-41□-Z)

(Unit: mm)



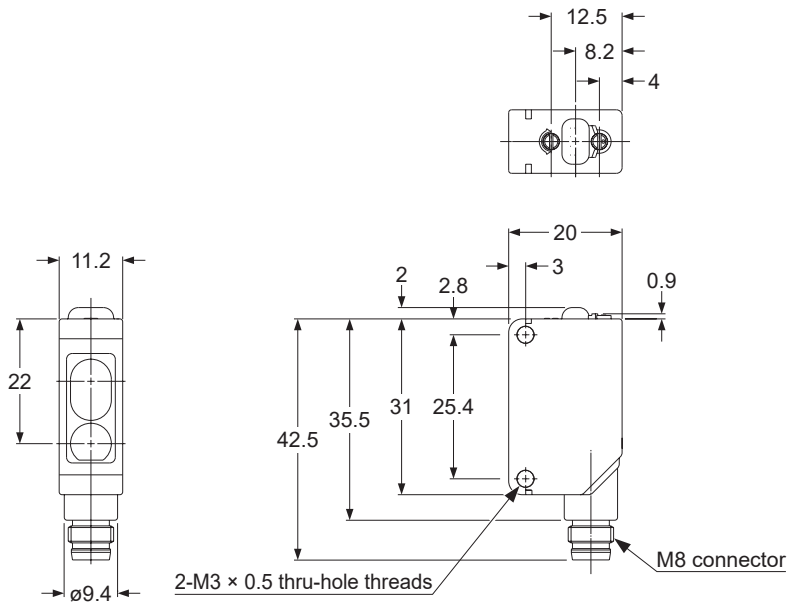
M8 connector type (Retroreflective type CX-49□-Z / CX-48□-Z, Diffuse reflective type CX-42□-Z)

(Unit: mm)

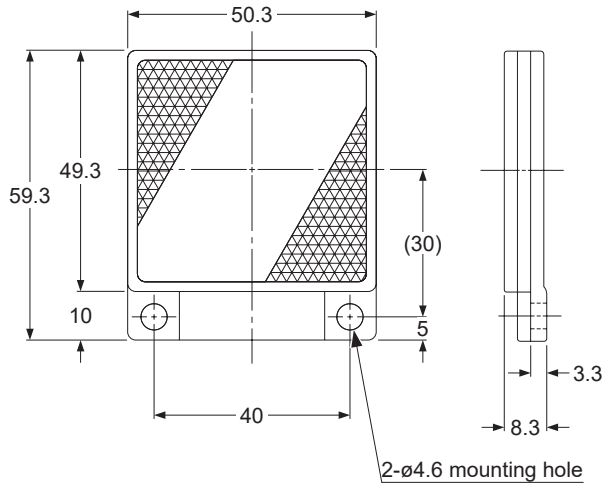


M8 connector (Adjustable range reflective type CX-44□-Z)

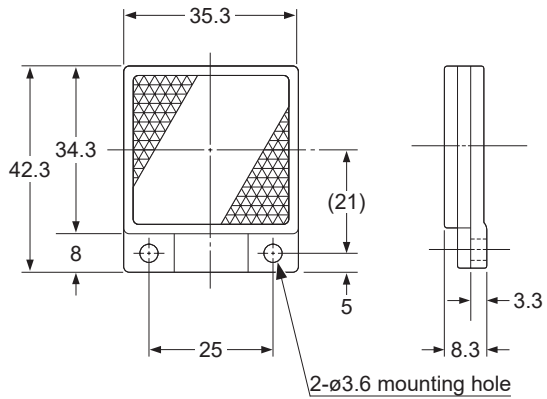
(Unit: mm)



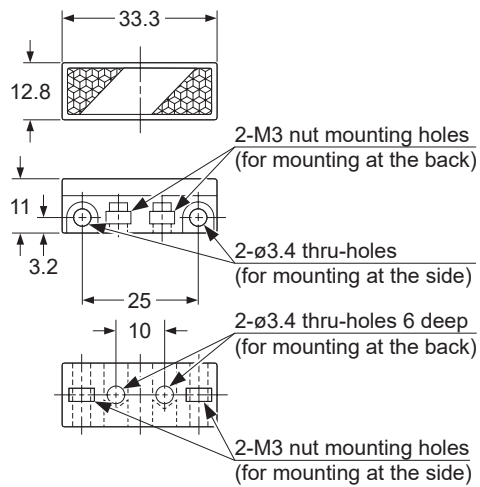
Refractor RF-230



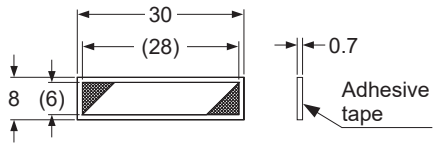
Refractor RF-220



Refractor RF-210

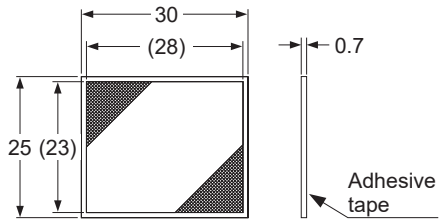


Reflective tape RF-11



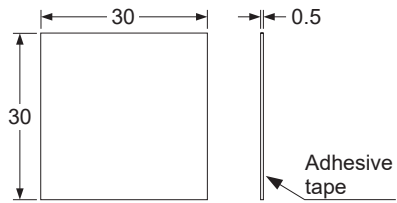
(Unit: mm)

Reflective tape RF-12



(Unit: mm)

Reflective tape RF-13



(Unit: mm)

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June, 2024

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