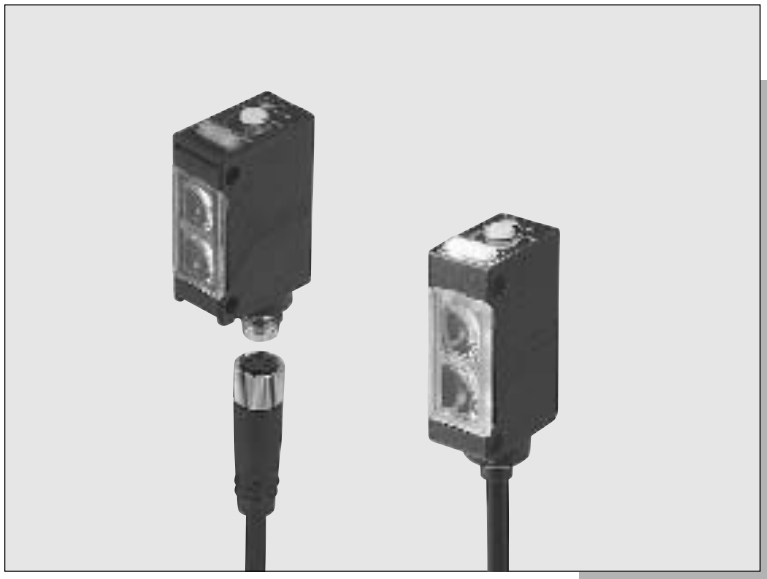
EQ-20 SERIES

Product is discontinued - Successor CX400

Amplifier Built-in Adjustable Range & Fixed-focus Reflective Photoelectric Sensor



Detects Any Color Object at a Certain Distance

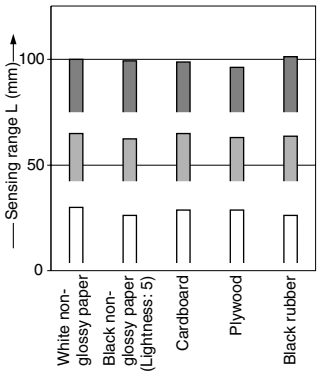
CE Marked
Conforming to EMC Directive

Not Affected by Object Color or Background

The sensor can detect objects at a consistent distance regardless of their color.
Moreover, it does not detect the background beyond the setting distance.

(However, when the background is specular, it may be necessary to change the angle of the sensor.)

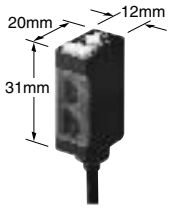
EQ-23: Correlation between material (50×50mm) and sensing range (typical)



····100mm
····65mm
····30mm
These bars indicate the sensing range with the respective objects when the distance adjuster is set at the sensing range of 100mm, 65mm and 30mm long, each, with white non-glossy paper.

Compact Size

It saves you space.
(Cable type: W12×H31×D20mm)

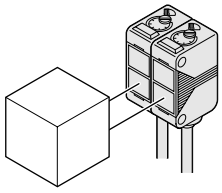


Red LED Light Source

The sensor emits a visible red LED beam so that the alignment is simple.

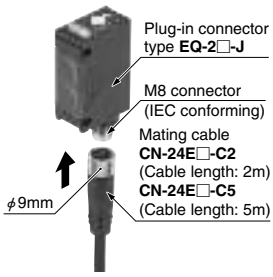
Automatic Interference Prevention Function

The **EQ-20** series is incorporated with an automatic interference prevention function so that two sets of sensors can be installed closely together or facing each other.



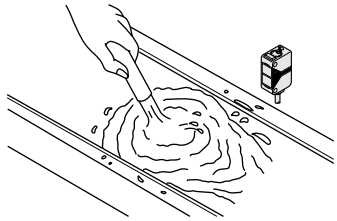
Plug-in Connector Type Is Available

Plug-in connector type, which can be easily disconnected for replacement, is available. In case a problem occurs, anyone can replace the sensor in a minute.



Waterproof

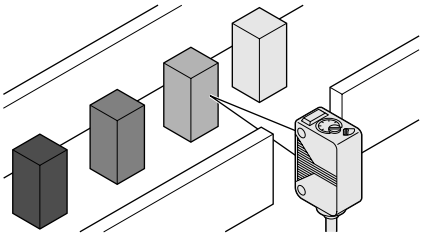
The sensor can be hosed down because of its IP67 construction and the non-corrosive stainless steel mounting bracket. It can be safety used on a food processing line or an assembly line subject to water splashes.



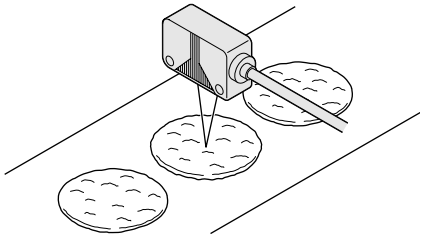
Note: However, take care that if it is exposed to water splashes during operation, it may detect a water drop itself.

APPLICATIONS

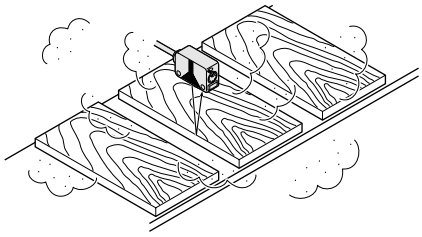
Detecting diversely colored objects



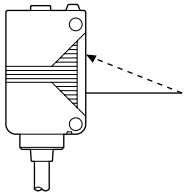
Detecting baked rice crackers



Detecting plywood boards

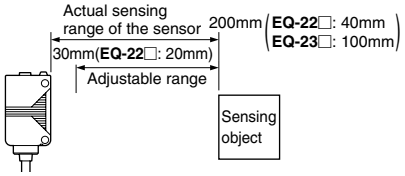


ORDER GUIDE

Type	Appearance	Adjustable range (Note 1)	Model No.	Output
NPN output type		20 to 40mm	**EQ-22**	NPN open-collector transistor
		30 to 100mm	**EQ-23**	
		30 to 200mm	**EQ-24**	
PNP output type		20 to 40mm	**EQ-22-PN**	PNP open-collector transistor
		30 to 100mm	**EQ-23-PN**	
		30 to 200mm	**EQ-24-PN**	

NOTE: Mounting bracket is not supplied with the sensor. Please select from the range of optional sensor mounting brackets (two types).

Note 1: The adjustable range stands for the maximum sensing range which can be set with the adjuster.
The sensor can also detect an object less than 30mm (**EQ-22**□: 20mm) away.



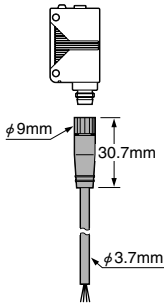
Plug-in connector type

Plug-in connector type is available.
When ordering this type, add suffix '**-J**' to the model No.
(e.g.) Plug-in connector type of **EQ-22-PN** is '**EQ-22-PN-J**'.
Please order the suitable mating cable separately.

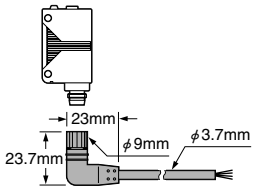
• Mating cable

Type	Model No.	Description	
Straight	**CN-24E-C2**	Length: 2m	0.2mm² 4-core cabtyre cable with connector on one end Cable outer diameter: ϕ3.7mm
	CN-24E-C5	Length: 5m	
Elbow	**CN-24EL-C2**	Length: 2m	
	CN-24EL-C5	Length: 5m	

• CN-24E-C2, CN-24E-C5



• CN-24EL-C2, CN-24EL-C5

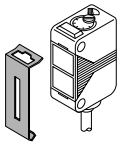


OPTIONS

Designation	Model No.	Description
Narrow-view slit mask (Note 1)	**OS-EQ2-1**	It makes the sensing view narrow. (Slit size: 1.5 × 18mm)
Sensor mounting bracket (Note 2)	**MS-EQ2-1**	Back angled mounting bracket
	MS-EQ2-2	Foot angled mounting bracket
Universal sensor mounting stand	**MS-AJ**	Basic assembly
	MS-AJ-A	Lateral arm assembly

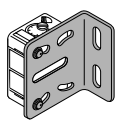
Notes: 1) Applying the slit mask on **EQ-24**□ shortens the adjustable range to '30 to 160mm'. It is not available for plug-in connector type.
2) For the plug-in connector type, leave space under the sensor for plug-in connection with the mating cable.

Narrow-view slit mask



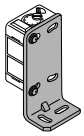
Sensor mounting bracket

• MS-EQ2-1



Two M3 (length 18mm) screws with washers are attached.

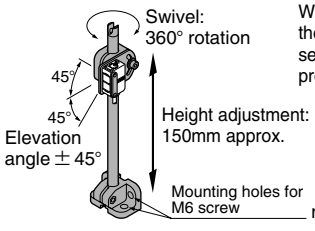
• MS-EQ2-2



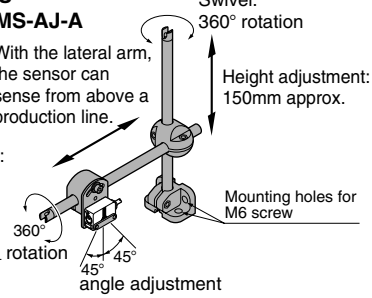
Two M3 (length 18mm) screws with washers are attached.

Universal sensor mounting stand

• MS-AJ



• MS-AJ-A

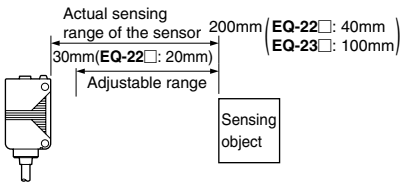


EQ-20

SPECIFICATIONS

Item \ Type / Model No.		NPN output type			PNP output type		
		EQ-22	**EQ-23**	**EQ-24**	**EQ-22-PN**	**EQ-23-PN**	**EQ-24-PN**
Adjustable range (Note 1)		20 to 40mm	30 to 100mm	30 to 200mm	20 to 40mm	30 to 100mm	30 to 200mm
Sensing range (with white non-glossy paper and at MAX. adjustment)		0 to 40mm	0 to 100mm	0 to 200mm	0 to 40mm	0 to 100mm	0 to 200mm
Hysteresis		5% or less of operation distance		20% or less of operation distance	5% or less of operation distance		20% or less of operation distance
Repeatability		Along sensing axis: 1mm or less, Perpendicular to sensing axis: 0.2mm or less (with white non-glossy paper)					
Supply voltage		12 to 24V DC ± 10% Ripple P-P 10% or less					
Current consumption		45mA or less			50mA or less		
Sensing output		NPN open-collector transistor • Maximum sink current: 100mA • Applied voltage: 30V DC or less (between sensing output and 0V) • Residual voltage: 1V or less (at 100mA sink current) 0.4V or less (at 16mA sink current)			PNP open-collector transistor • Maximum source current: 100mA • Applied voltage: 30V DC or less (between sensing output and + V) • Residual voltage: 1V or less (at 100mA source current) 0.4V or less (at 16mA source current)		
	Utilization category	DC-12 or DC-13					
	Output operation	Switchable either Detection-ON or Detection-OFF					
	Short-circuit protection	Incorporated					
Self-diagnosis output		NPN open-collector transistor • Maximum sink current: 80mA • Applied voltage: 30V DC or less (between self-diagnosis output and 0V) • Residual voltage: 1V or less (at 80mA sink current) 0.4V or less (at 16mA sink current)			PNP open-collector transistor • Maximum source current: 80mA • Applied voltage: 30V DC or less (between self-diagnosis output and + V) • Residual voltage: 1V or less (at 80mA source current) 0.4V or less (at 16mA source current)		
	Output operation	ON under unstable sensing condition					
	Short-circuit protection	———					
Response time		1ms or less					
Operation indicator		Red LED (lights up when the sensing output is ON)					
Stability indicator		Green LED (lights up under stable light received condition or stable dark condition)					
Distance adjuster		2-turn adjuster with indicator					
Automatic interference prevention function		Incorporated (Two units of sensors can be mounted closely.)					
Environmental resistance	Pollution degree	3 (Industrial environment)					
	Protection	IP67 (IEC)					
	Ambient temperature	− 20 to + 55°C (No dew condensation or icing allowed), Storage: − 25 to + 70°C					
	Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH					
	Ambient illuminance	Sunlight: 10,000ℓx at the light-receiving face, Incandescent light: 3,000ℓx at the light-receiving face					
	EMC	Emission: EN50081-2, Immunity: EN50082-2					
	Voltage withstandability	1,000V AC for one min. between all supply terminals connected together and enclosure					
	Insulation resistance	20MΩ, or more, with 250V DC megger between all supply terminals connected together and enclosure					
	Vibration resistance	10 to 500Hz frequency, 3mm amplitude in X, Y and Z directions for two hours each					
	Shock resistance	500m/s² acceleration (50G approx.) in X, Y and Z directions for three times each					
Emitting element		Red LED (modulated)					
Material		Enclosure: PBT, Lens: Polycarbonate, Indicator cover: Polycarbonate					
Cable		0.2mm² 4-core oil, heat and cold resistant cabtyre cable, 2m long					
Cable extension		Extension up to total 100m is possible with 0.3mm², or more, cable.					
Weight		50g approx.					
Accessory		Adjusting screwdriver: 1 No.					

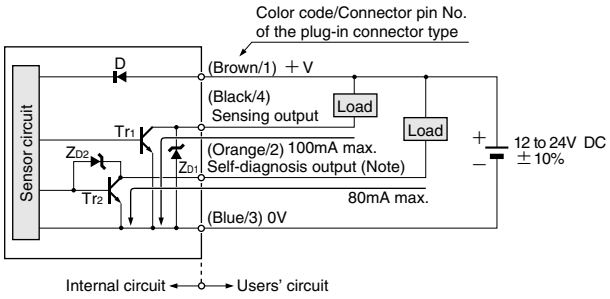
Notes: 1) The adjustable range stands for the maximum sensing range which can be set with the adjuster.
The sensor can also detect an object less than 30mm (**EQ-22**□: 20mm) away.



I/O CIRCUIT AND WIRING DIAGRAMS

NPN output type

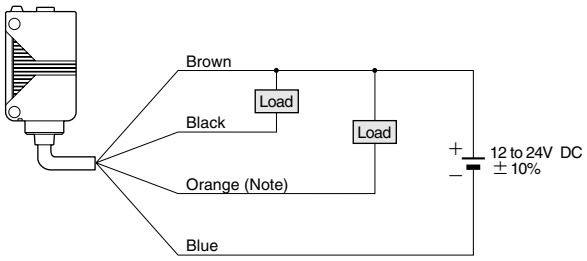
I/O circuit diagram



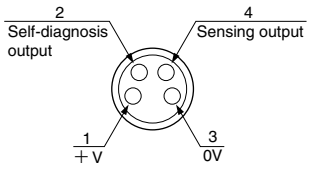
Note: When the mating cable is connected to the plug-in connector type, the color of the self-diagnosis output wire is white.

Symbols ... D: Reverse supply polarity protection diode
Z_{D1}, Z_{D2}: Surge absorption zener diode
Tr_1, Tr_2 : NPN output transistor

Wiring diagram

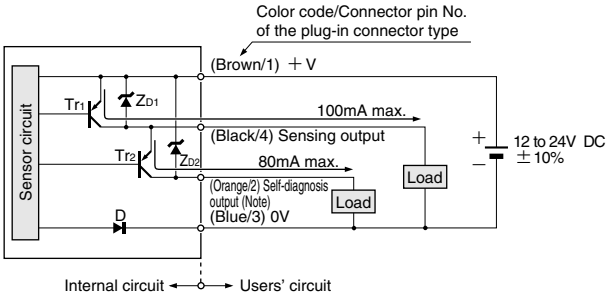


Connector pin position (Plug-in connector type)



PNP output type

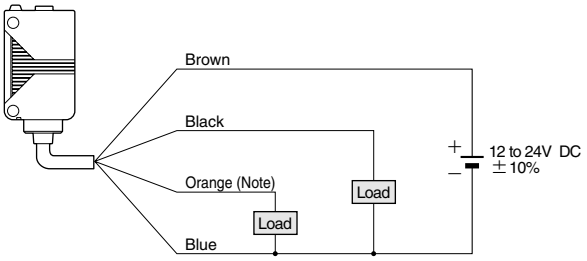
I/O circuit diagram



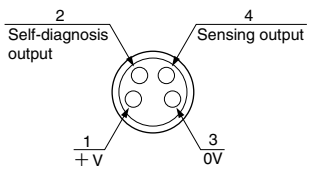
Note: When the mating cable is connected to the plug-in connector type, the color of the self-diagnosis output wire is white.

Symbols ... D: Reverse supply polarity protection diode
Z_{D1}, Z_{D2}: Surge absorption zener diode
Tr_1, Tr_2 : PNP output transistor

Wiring diagram



Connector pin position (Plug-in connector type)



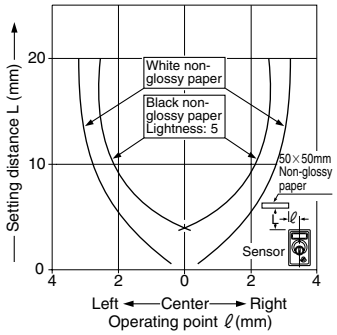
EQ-20

SENSING CHARACTERISTICS (TYPICAL)

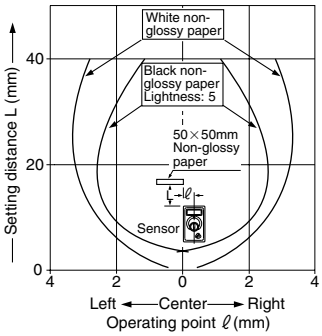
EQ-22□

Sensing fields

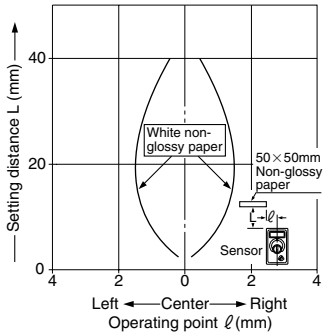
• Setting distance: 20mm



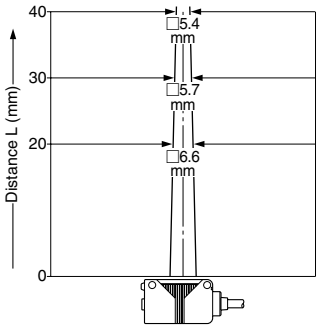
• Setting distance: 40mm



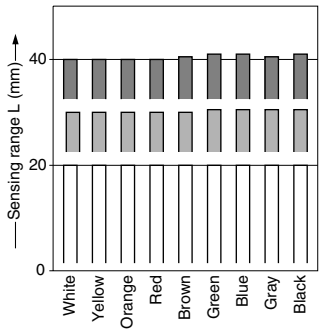
• Setting distance: 40mm with slit mask



Emitted beam



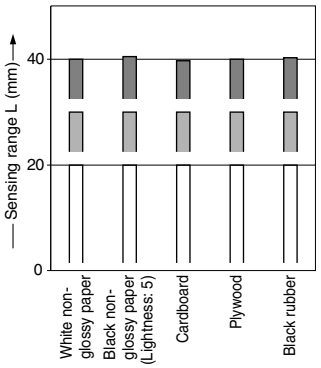
Correlation between color (50 × 50mm) and sensing range



····40mm
····30mm
····20mm

These bars indicate the sensing range with the respective colors when the distance adjuster is set at the sensing range of 40mm, 30mm and 20mm long, each, with white color.

Correlation between material (50 × 50mm) and sensing range



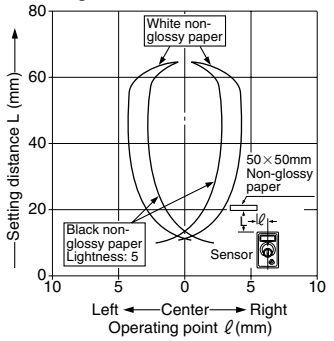
····40mm
····30mm
····20mm

These bars indicate the sensing range with the respective objects when the distance adjuster is set at the sensing range of 40mm, 30mm and 20mm long, each, with white non-glossy paper.

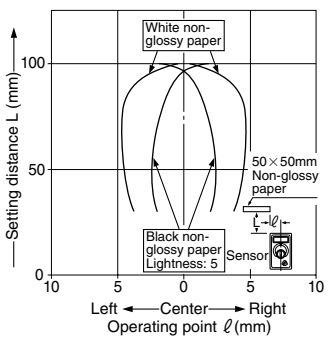
EQ-23□

Sensing fields

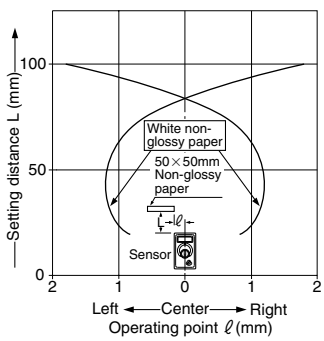
• Setting distance: 65mm



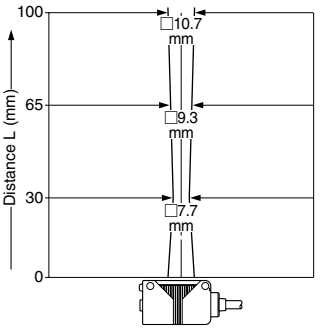
• Setting distance: 100mm



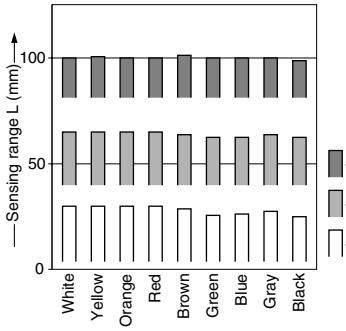
• Setting distance: 100mm with slit mask



Emitted beam



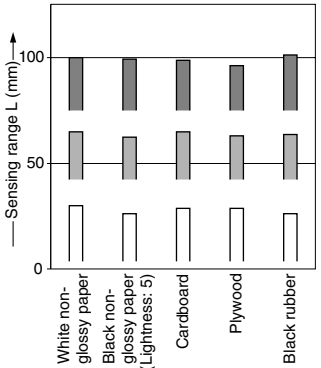
Correlation between color (50 × 50mm) and sensing range



····100mm
····65mm
····30mm

These bars indicate the sensing range with the respective colors when the distance adjuster is set at the sensing range of 100mm, 65mm and 30mm long, each, with white color.

Correlation between material (50 × 50mm) and sensing range



····100mm
····65mm
····30mm

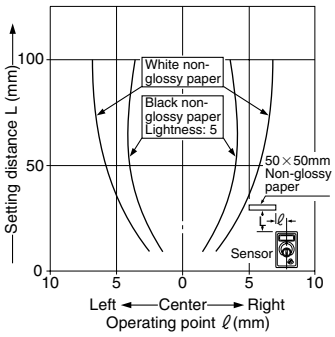
These bars indicate the sensing range with the respective objects when the distance adjuster is set at the sensing range of 100mm, 65mm and 30mm long, each, with white non-glossy paper.

SENSING CHARACTERISTICS (TYPICAL)

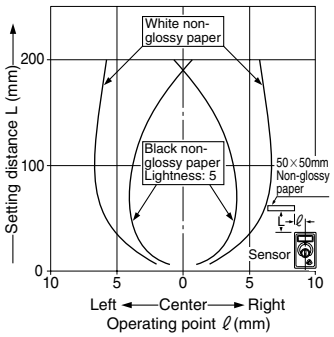
EQ-24□

Sensing fields

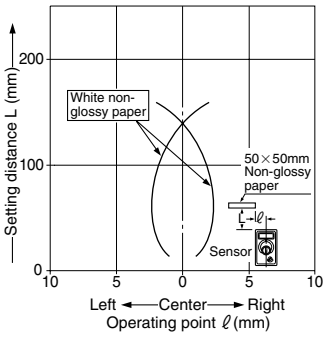
• Setting distance: 100mm



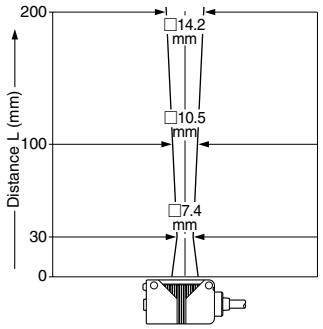
• Setting distance: 200mm



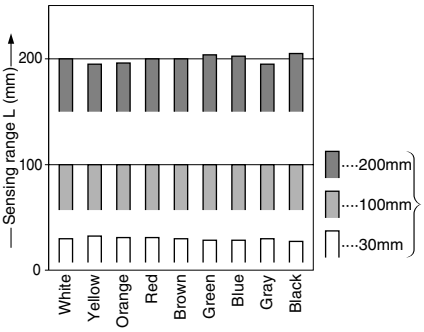
• With slit mask (adjuster at MAX.)



Emitted beam

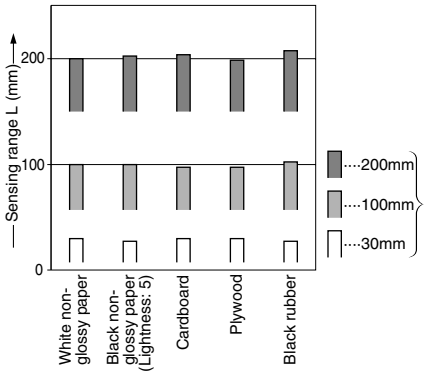


Correlation between color (50 × 50mm) and sensing range



These bars indicate the sensing range with the respective colors when the distance adjuster is set at the sensing range of 200mm, 100mm and 30mm long, each, with white color.

Correlation between material (50 × 50mm) and sensing range



These bars indicate the sensing range with the respective objects when the distance adjuster is set at the sensing range of 200mm, 100mm and 30mm long, each, with white non-glossy paper.

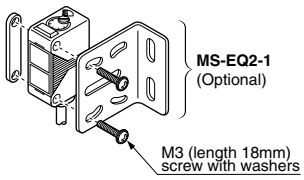
EQ-20

PRECAUTIONS FOR PROPER USE

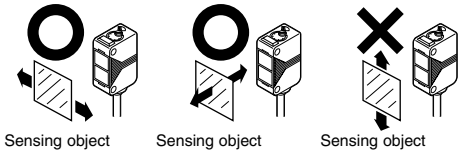
This product is not a safety sensor. Its use is not intended or designed to protect life and prevent body injury or property damage from dangerous parts of machinery. It is a normal object detection sensor.

Mounting

• Tightening torque should be 0.5N·m or less.



• Care must be taken regarding the sensor mounting direction with respect to the object's direction of movement.



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) 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 the sensor, use the sensor by tilting it slightly upwards to avoid wrong operation.

• 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 the sensor at an inclination and confirm the operation with the actual sensing object.

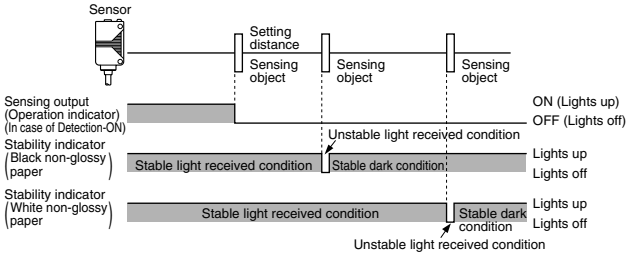
• Please take care that the sensor will compulsorily go to the light received (ON) condition if excessive ambient light is received.

• Please note that when the distance adjuster is set to NEAR, a dead zone is present just in front of the sensing surface.

Stability indicator

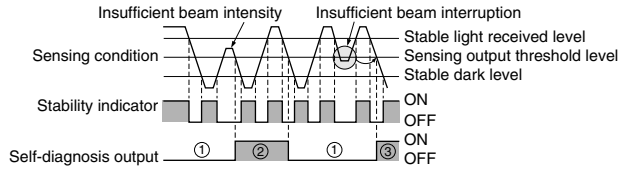
• The **EQ-20** series uses a PSD as its beam receiving device and detects the incident beam position rather than the light intensity. Hence, the output corresponds to the distance.

Further, the stability indicator indicates the margin in the incident light intensity. The distance at which it lights up/turns off differs depending on the reflectivity of the sensing object, as shown in the figure below, and is not related to the operation of the output. Do not use the sensor in the condition in which the stability indicator is off (unstable light received condition).



Self-diagnosis function

• The sensor diagnoses the incident light intensity, and if it is reduced due to dirt or dust, or beam misalignment, an output is generated.



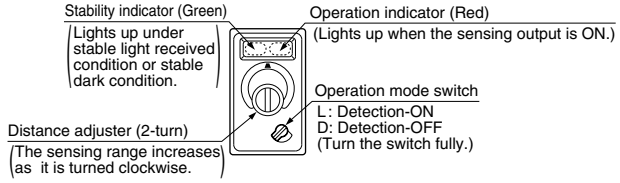
① The self-diagnosis output transistor stays in the 'OFF' state during stable sensing.

② When the sensing output changes, if the incident light intensity does not reach the stable light received level or the stable dark level, the self-diagnosis output becomes ON.
Further, the self-diagnosis output changes state when the sensing output changes from Light to Dark state. (The operation of the sensing output is not affected.)

③ In case of insufficient beam interruption, there will be a time lag before the self-diagnosis output turns ON.

Distance adjustment

<Adjusters>



<Adjusting procedure>

Step	Description	Distance adjuster
①	Turn the distance adjuster fully counterclockwise to the minimum sensing range position. (30mm approx., **EQ-22**□: 20mm approx.)	NEAR FAR
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.	Ⓐ NEAR FAR
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.)	Ⓐ Ⓑ NEAR FAR
④	The optimum position to stably detect objects is the center point between (A) and (B).	Ⓐ Optimum position Ⓑ NEAR FAR

Note: In order to protect itself, the distance adjuster idles if turned fully.

Wiring

• The self-diagnosis output is not incorporated with a short-circuit protection circuit. Do not connect it directly to a power supply or a capacitive load.

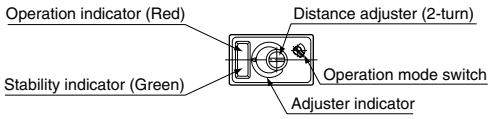
Others

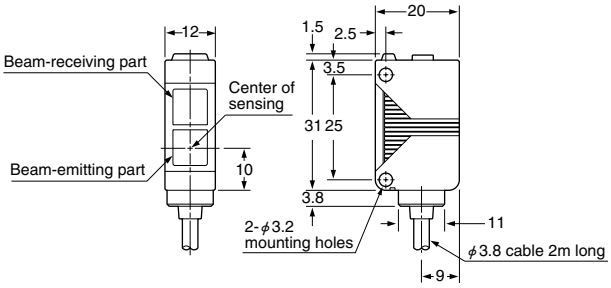
• Do not use during the initial transient time (50ms) after the power supply is switched on.

• When connecting the mating cable to the plug-in connector type, the tightening torque should be 0.4N·m or less.

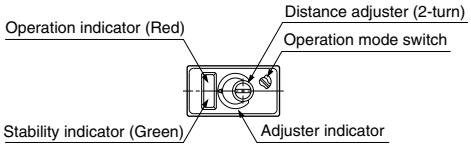
DIMENSIONS (Unit: mm)

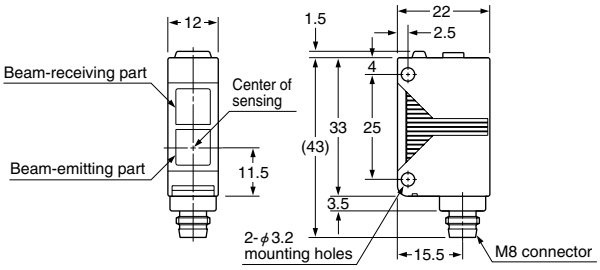
EQ-2□ EQ-2□-PN Sensor



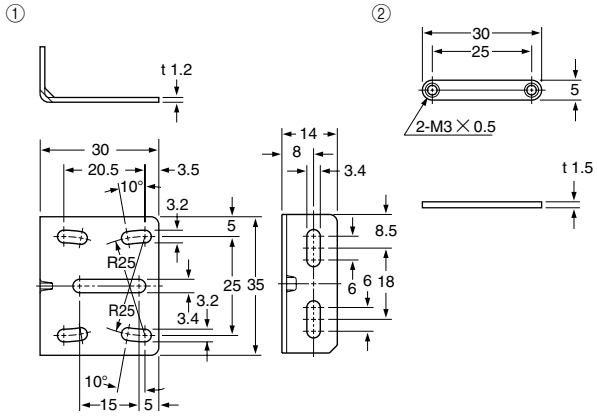


EQ-2□-J EQ-2□-PN-J Sensor



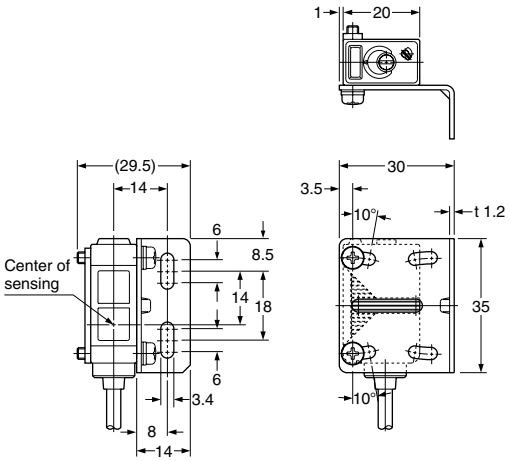


MS-EQ2-1 Sensor mounting bracket (Optional)

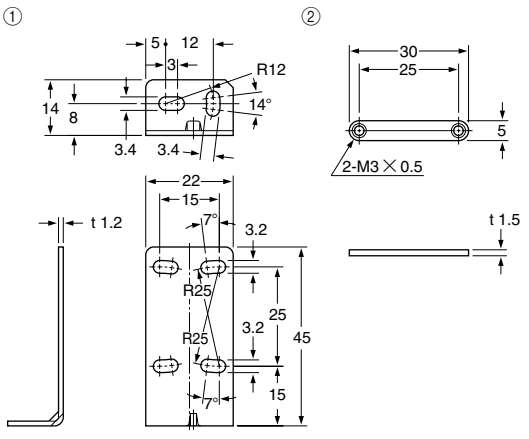


Material: Stainless steel (SUS304)
Two M3 (length 18mm) screws with washers are attached.

Assembly dimensions
Mounting drawing with **EQ-22□**



MS-EQ2-2 Sensor mounting bracket (Optional)



Material: Stainless steel (SUS304)
Two M3 (length 18mm) screws with washers are attached.

Assembly dimensions
Mounting drawing with **EQ-22□**