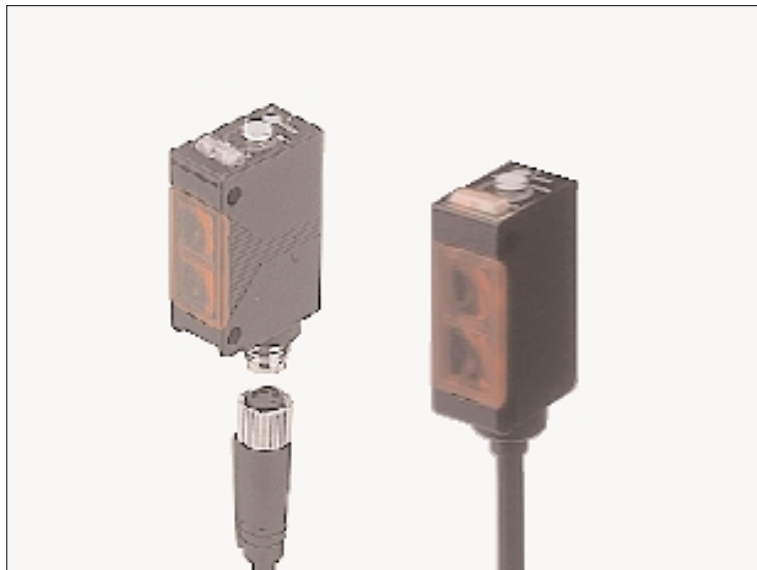


# EQ-20 SERIES

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



Detects any color object at a certain distance



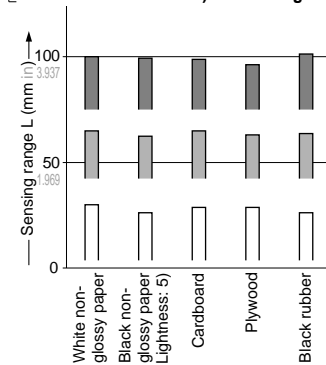
## Not affected by object color or background

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.)

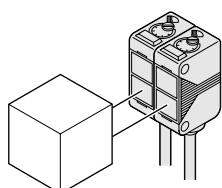
**EQ-23: Correlation between material (50 × 50 mm 1.969 × 1.969 in) and sensing range (typical)**



These bars indicate the sensing range with the respective objects when the distance adjuster is set at the sensing range of 100 mm 3.973 in, 65 mm 2.559 in and 30 mm 1.181 in long, each, with white non-glossy paper.

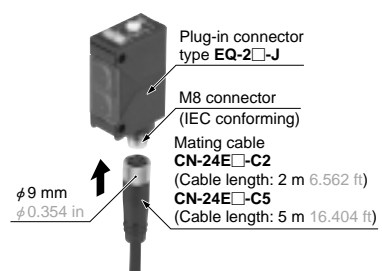
## Automatic interference prevention function

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.



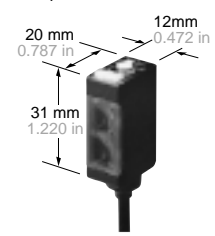
## Plug-in connector type is available

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.



## Compact size

It saves you space. (Cable type: W12 × H31 × D20 mm W0.472 × H1.220 × D0.787 in)

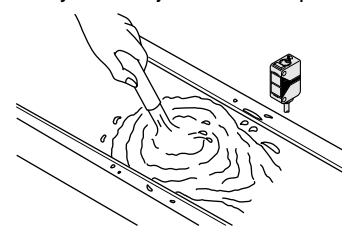


## Red LED Light Source

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

## Waterproof

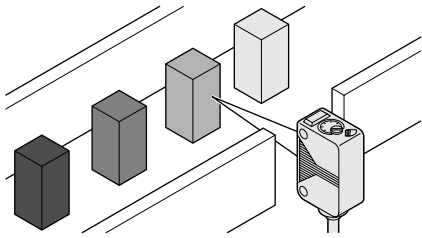
The sensor can be hosed down because of its IP67 construction and the non-corrosive stainless steel mounting bracket (optional). It can be safely used on a food processing line or an assembly line subject to water splashes.



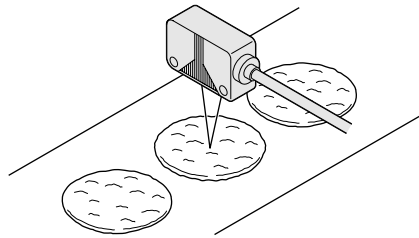
Note: However, take care that if it is exposed to water splashes during operation, it may detect a water drop itself.

## APPLICATIONS

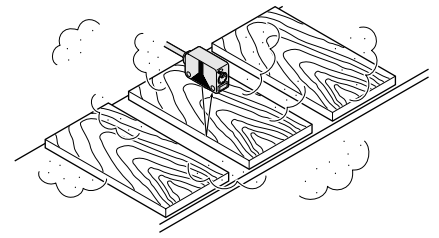
### Detecting diversely colored objects



### Detecting baked rice crackers



### Detecting plywood boards

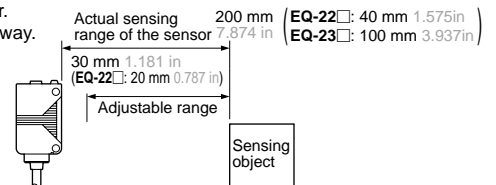


## ORDER GUIDE

Type	Appearance	Adjustable range (Note 1)	Model No.	Output
NPN output type		20 to 40 mm 0.787 to 1.575 in	<b>EQ-22</b>	NPN open-collector transistor
		30 to 100 mm 1.181 to 3.937 in	<b>EQ-23</b>	
		30 to 200 mm 1.181 to 7.874 in	<b>EQ-24</b>	
PNP output type		20 to 40 mm 0.787 to 1.575 in	<b>EQ-22-PN</b>	PNP open-collector transistor
		30 to 100 mm 1.181 to 3.937 in	<b>EQ-23-PN</b>	
		30 to 200 mm 1.181 to 7.874 in	<b>EQ-24-PN</b>	

**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 30 mm 1.181 in (EQ-22□: 20 mm 0.787 in) away.



### 5m 16.404 ft Cable length type, plug-in connector type

5 m 16.404 ft cable length type (standard: 2 m 6.562 ft) and plug-in connector type (standard: cable type) are also available.

#### • Table of Model Nos.

Type	Standard	5 m 16.404 ft cable length type	Plug in connector type (Note 1)
NPN output	<b>EQ-22</b>	<b>EQ-22-C5</b>	<b>EQ-22-J</b>
	<b>EQ-23</b>	<b>EQ-23-C5</b>	<b>EQ-23-J</b>
	<b>EQ-24</b>	<b>EQ-24-C5</b>	<b>EQ-24-J</b>
PNP output	<b>EQ-22-PN</b>	—	<b>EQ-22-PN-J</b>
	<b>EQ-23-PN</b>	—	<b>EQ-23-PN-J</b>
	<b>EQ-24-PN</b>	—	<b>EQ-24-PN-J</b>

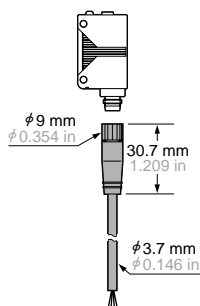
Note: Please order the suitable mating cable separately.

#### • Mating cable

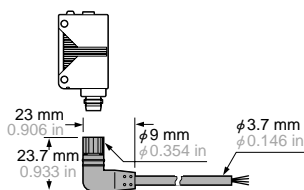
Type	Model No.	Description
Straight	<b>CN-24E-C2</b>	Length: 2 m 6.562 ft
	<b>CN-24E-C5</b>	Length: 5 m 16.404 ft
Elbow	<b>CN-24EL-C2</b>	Length: 2 m 6.562 ft
	<b>CN-24EL-C5</b>	Length: 5 m 16.404 ft

0.2 mm<sup>2</sup> 4-core cabtyre cable with connector on one end  
Cable outer diameter:  $\phi$  3.7 mm  $\phi$  0.146 in

#### • CN-24E-C2, CN-24E-C5



#### • CN-24EL-C2, CN-24EL-C5



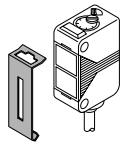
## OPTIONS

Designation	Model No.	Description	
Narrow-view slit mask (Note 1)	<b>OS-EQ2-1</b>	It makes the sensing view narrow (Slit size: 1.5 × 18 mm 0.059 × 0.709 in)	
Sensor mounting bracket (Note 2)	<b>MS-EQ2-1</b>	Back angled mounting bracket	
	<b>MS-EQ2-2</b>	Foot angled mounting bracket	
Universal sensor mounting stand (Note 3)	<b>MS-AJ1</b>	Horizontal mounting type	Basic assembly
	<b>MS-AJ2</b>	Vertical mounting type	
	<b>MS-AJ1-A</b>	Horizontal mounting type	Lateral arm assembly
	<b>MS-AJ2-A</b>	Vertical mounting type	

- Notes: 1) Applying the slit mask on **EQ-24** shortens the adjustable range to '30 to 160 mm 1.181 to 6.299 in'. 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.  
 3) Refer to p.332~ for details of the universal sensor mounting stand.

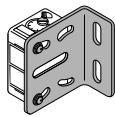
## Narrow-view slit mask

## • OS-EQ2-1



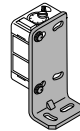
## Sensor mounting bracket

## • MS-EQ2-1



Two M3 (length 18 mm 0.709 in) screws with washers are attached.

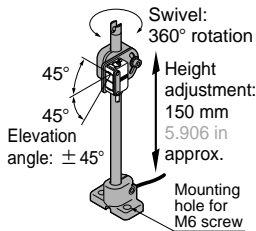
## • MS-EQ2-2



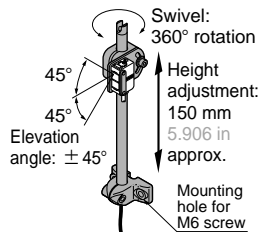
Two M3 (length 18 mm 0.709 in) screws with washers are attached.

## Universal sensor mounting stand

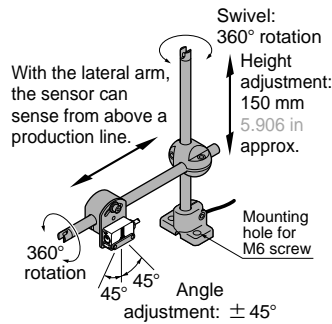
## • MS-AJ1



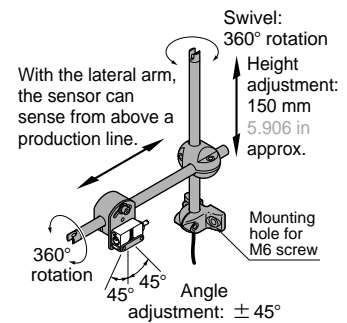
## • MS-AJ2



## • MS-AJ1-A



## • MS-AJ2-A



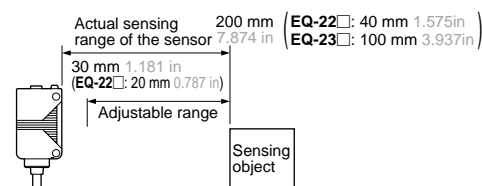
## SPECIFICATIONS

Item	Type	NPN output type			PNP output type		
	Model No.	EQ-22	EQ-23	EQ-24	EQ-22-PN	EQ-23-PN	EQ-24-PN
Adjustable range (Note 1)		20 to 40 mm 0.787 to 1.575 in	30 to 100 mm 1.181 to 3.937 in	30 to 200 mm 1.181 to 7.874 in	20 to 40 mm 0.787 to 1.575 in	30 to 100 mm 1.181 to 3.937 in	30 to 200 mm 1.181 to 7.874 in
Sensing range (with white non-glossy paper and at MAX. adjustment)		0 to 40 mm 0 to 1.575 in	0 to 100 mm 0 to 3.937 in	0 to 200 mm 0 to 7.874 in	0 to 40 mm 0 to 1.575 in	0 to 100 mm 0 to 3.937 in	0 to 200 mm 0 to 7.874 in
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: 1 mm 0.039 in or less, Perpendicular to sensing axis: 0.2 mm 0.008 in or less (with white non-glossy paper)					
Supply voltage		12 to 24 V DC $\pm$ 10 % Ripple P-P 10 % or less					
Current consumption		45 mA or less			50 mA or less		
Sensing output		NPN open-collector transistor • Maximum sink current: 100 mA • Applied voltage: 30 V DC or less (between sensing output and 0 V) • Residual voltage: 1 V or less (at 100 mA sink current) 0.4 V or less (at 16 mA sink current)			PNP open-collector transistor • Maximum source current: 100 mA • Applied voltage: 30 V DC or less (between sensing output and + V) • Residual voltage: 1 V or less (at 100 mA source current) 0.4 V or less (at 16 mA 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: 80 mA • Applied voltage: 30 V DC or less (between self-diagnosis output and 0 V) • Residual voltage: 1 V or less (at 80 mA sink current) 0.4 V or less (at 16 mA sink current)			PNP open-collector transistor • Maximum source current: 80 mA • Applied voltage: 30 V DC or less (between self-diagnosis output and + V) • Residual voltage: 1 V or less (at 80 mA source current) 0.4 V or less (at 16 mA source current)		
	Output operation	ON under unstable sensing condition					
	Short-circuit protection	Incorporated					
Response time		1 ms 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) (Note 2)					
Distance adjuster		2-turn adjuster with indicator					
Automatic interference prevention function		Incorporated (Two units of sensors can be mounted close together.)					
Environmental resistance	Pollution degree	3 (Industrial environment)					
	Protection	IP67 (IEC)					
	Ambient temperature	- 20 to + 55 °C - 4 to + 131 °F (No dew condensation or icing allowed), Storage: - 25 to + 70 °C - 13 to + 158 °F					
	Ambient humidity	35 to 85 % RH, Storage: 35 to 85 % RH					
	Ambient illuminance	Sunlight: 10,000 lx at the light-receiving face, Incandescent light: 3,000 lx at the light-receiving face					
	EMC	EN 50081-2, EN 50082-2, EN 60947-5-2					
	Voltage withstandability	1,000 V AC for one min. between all supply terminals connected together and enclosure					
	Insulation resistance	20 M $\Omega$ , or more, with 250 V DC megger between all supply terminals connected together and enclosure					
Shock resistance	Vibration resistance	10 to 500 Hz frequency, 3 mm 0.118 in amplitude in X, Y and Z directions for two hours each					
	Shock resistance	500 m/s <sup>2</sup> acceleration (50 G 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		0.2 mm <sup>2</sup> 4-core oil, heat and cold resistant cabtyre cable, 2 m 6.562 ft long					
Cable extension		Extension up to total 100 m 328.084 ft is possible with 0.3 mm <sup>2</sup> , or more, cable.					
Weight		50 g approx.					
Accessory		Adjusting screwdriver: 1 pc.					

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 30 mm 1.181 in (EQ-22□: 20 mm 0.787 in) away.

2) Refer to 'PRECAUTIONS FOR PROPER USE' on p.253 for the operation details of the stability indicator.

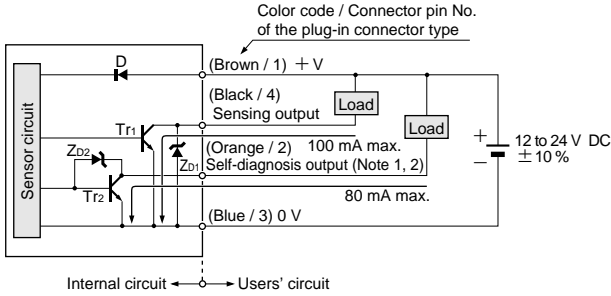


# EQ-20

## I/O CIRCUIT AND WIRING DIAGRAMS

### NPN output type

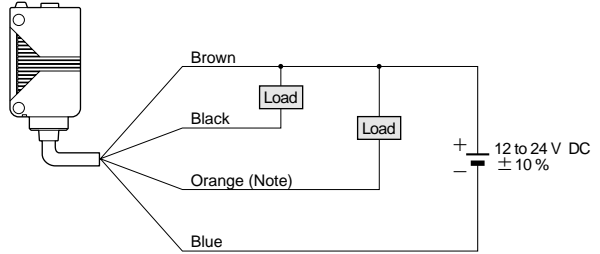
#### I/O circuit diagram



- Notes: 1) When the mating cable is connected to the plug-in connector type, the color of the self-diagnosis output wire is white.  
 2) The self-diagnosis output does not incorporate a short-circuit protection circuit. Do not connect it directly to a power supply or a capacitive load.

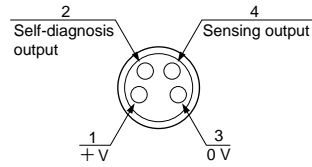
Symbols ... D: Reverse supply polarity protection diode  
 Z<sub>b1</sub>, Z<sub>b2</sub>: Surge absorption zener diode  
 Tr<sub>1</sub>, Tr<sub>2</sub>: NPN output transistor

#### Wiring diagram



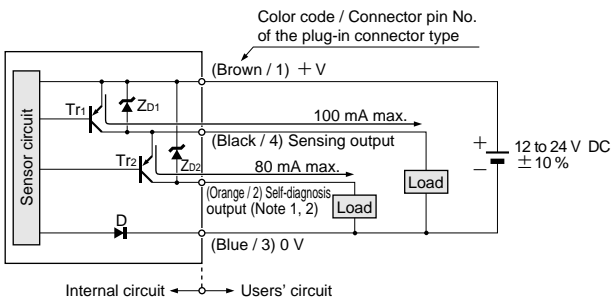
Note: When the mating cable is connected to the plug-in connector type, the color of the self-diagnosis output wire is white.

#### Connector pin position (Plug-in connector type)



### PNP output type

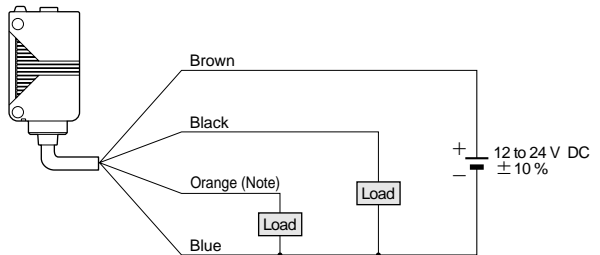
#### I/O circuit diagram



- Notes: 1) When the mating cable is connected to the plug-in connector type, the color of the self-diagnosis output wire is white.  
 2) The self-diagnosis output does not incorporate a short-circuit protection circuit. Do not connect it directly to a power supply or a capacitive load.

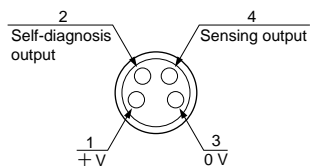
Symbols ... D: Reverse supply polarity protection diode  
 Z<sub>b1</sub>, Z<sub>b2</sub>: Surge absorption zener diode  
 Tr<sub>1</sub>, Tr<sub>2</sub>: PNP output transistor

#### Wiring diagram



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

#### Connector pin position (Plug-in connector type)

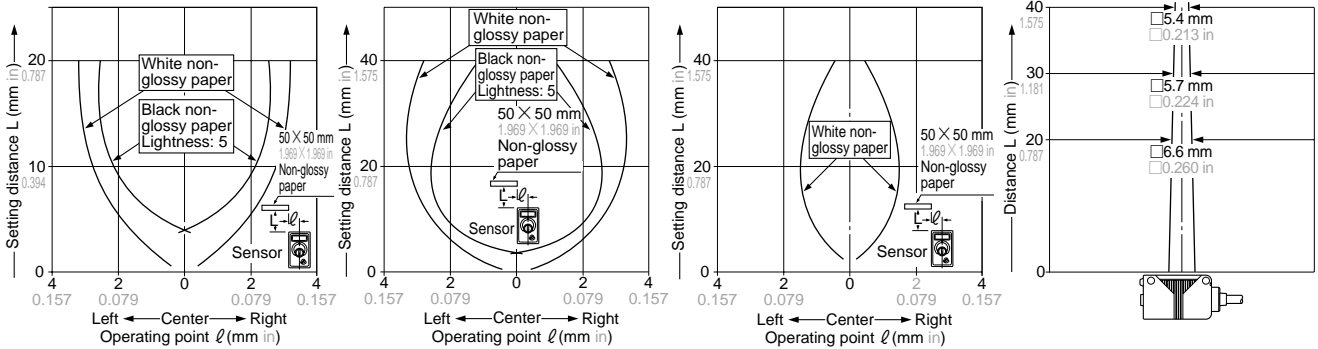


## SENSING CHARACTERISTICS (TYPICAL)

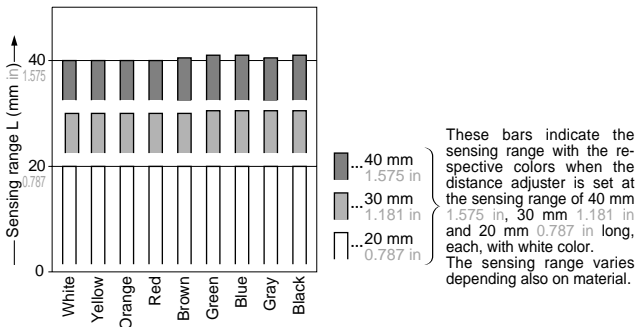
### EQ-22

#### Sensing fields

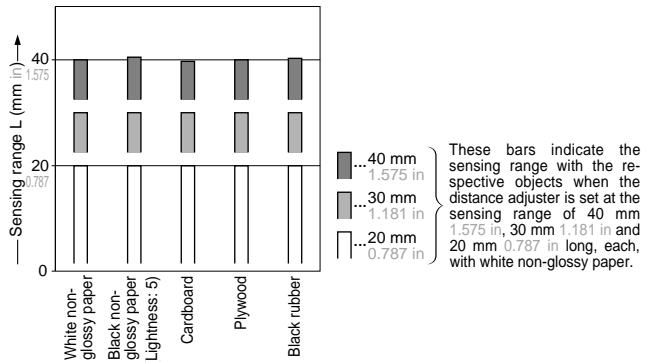
- Setting distance: 20 mm 0.787 in
- Setting distance: 40 mm 1.575 in
- Setting distance: 40 mm 1.575 in with slit mask



#### Correlation between color (50 X 50 mm 1.969 X 1.969 in non glossy paper) and sensing range



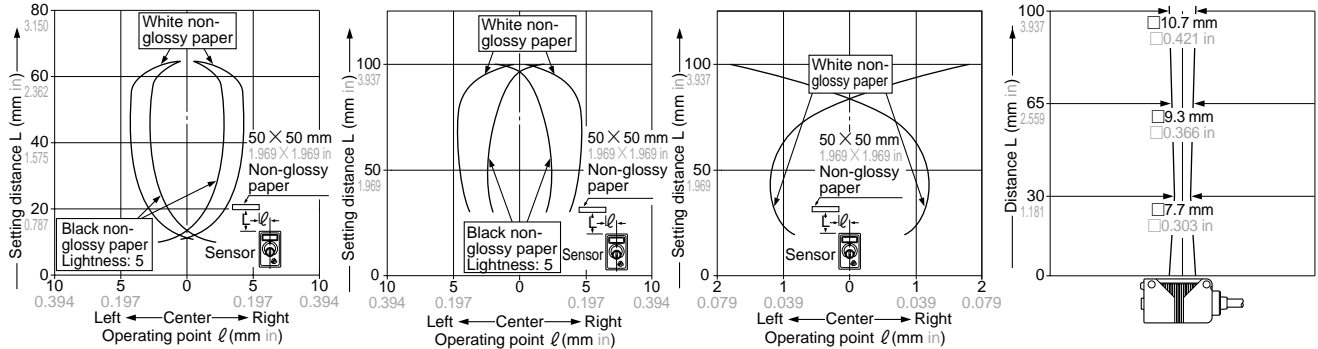
#### Correlation between material (50 X 50 mm 1.969 X 1.969 in) and sensing range



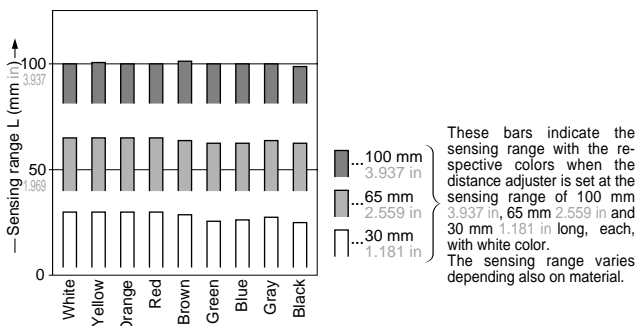
### EQ-23

#### Sensing fields

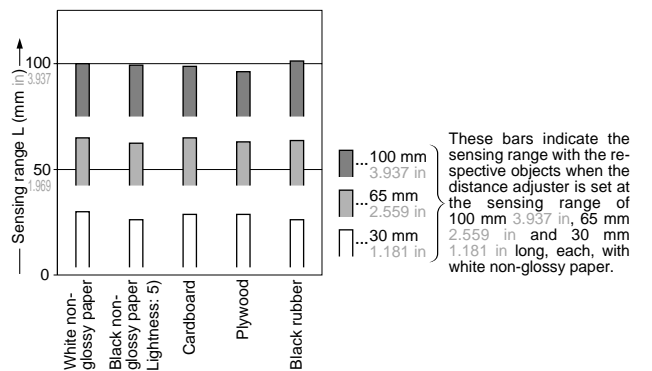
- Setting distance: 65 mm 2.559 in
- Setting distance: 100 mm 3.937 in
- Setting distance: 100 mm 3.937 in with slit mask



#### Correlation between color (50 X 50 mm 1.969 X 1.969 in non glossy paper) and sensing range



#### Correlation between material (50 X 50 mm 1.969 X 1.969 in) and sensing range



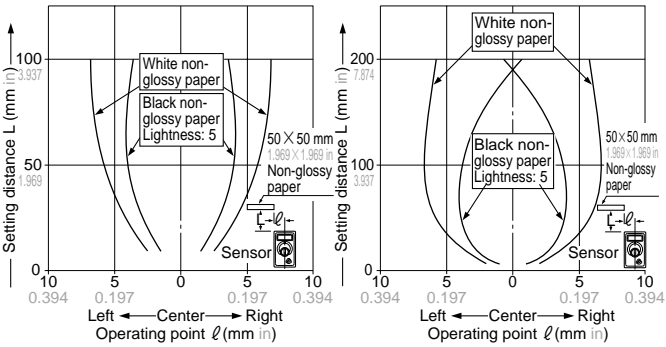
# EQ-20

## SENSING CHARACTERISTICS (TYPICAL)

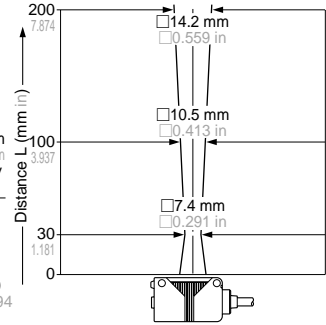
### EQ-24 □

#### Sensing fields

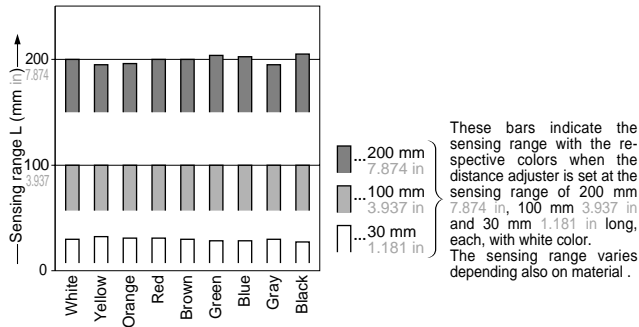
• Setting distance: 100 mm 3.937 in • Setting distance: 200 mm 7.874 in • With slit mask (adjuster at MAX.)



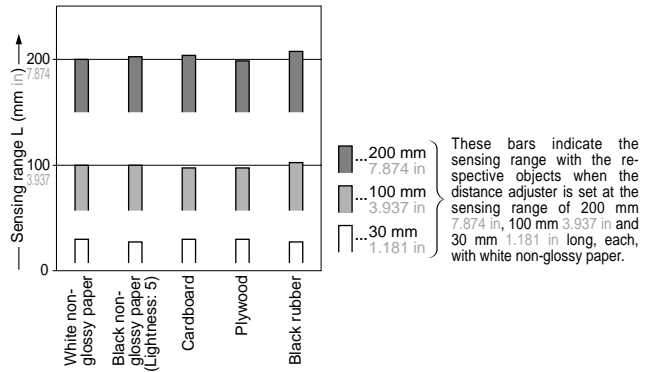
#### Emitted beam



#### Correlation between color (50 X 50 mm 1.969 X 1.969 in) and sensing range




#### Correlation between material (50 X 50 mm 1.969 X 1.969 in) and sensing range



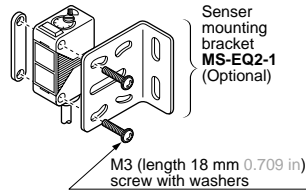
## PRECAUTIONS FOR PROPER USE

Refer to p.1135~ for general precautions.

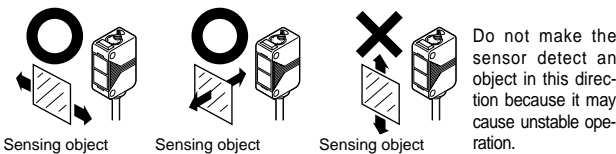
 This product is not a safety sensor. Its use is not intended or designed to protect life and prevent body injury or property damage from dangerous parts of machinery. It is a normal object detection sensor.

### 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.



- 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.

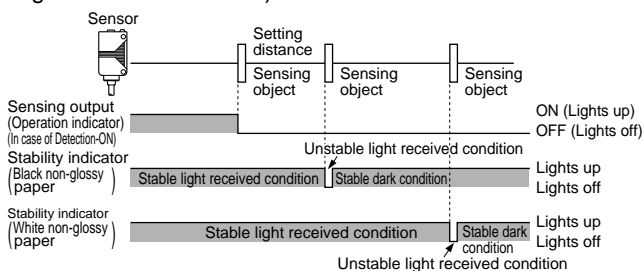
- Please take care that the sensor will compulsorily go to the light received (ON) condition if excessive ambient light is received.

- 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

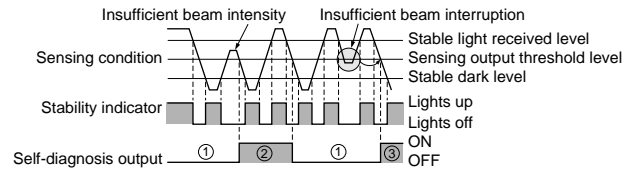
- The EQ-20 series uses a PSD as its beam receiving device and detects the incident beam position rather than the light intensity. Hence, the output corresponds to the distance.

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

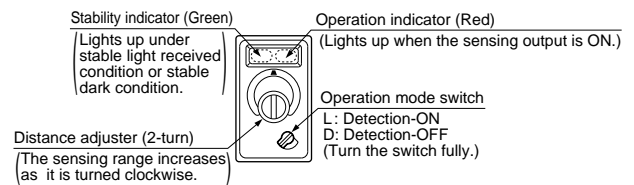
- The sensor diagnoses the incident light intensity, and if it is reduced due to dirt or dust, or beam misalignment, an output is generated.







- 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 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. (30 mm 1.181 in approx., EQ-22□: 20 mm 0.787 in) approx.	
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.)	
④	The optimum position to stably detect objects is the center point between (A) and (B).	

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

### Wiring

- The self-diagnosis output does not incorporate a short-circuit protection circuit. Do not connect it directly to a power supply or a capacitive load.

### Others

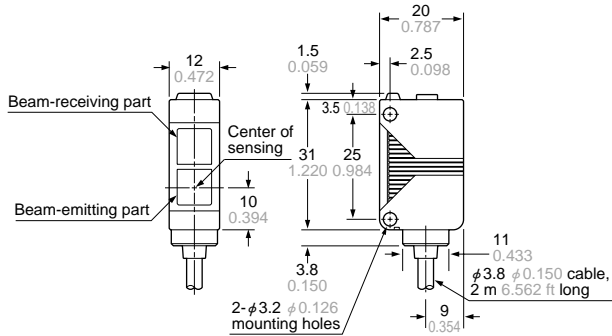
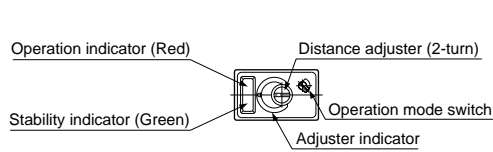
- Do not use during the initial transient time (50 ms) after the power supply is switched on.
- When connecting the mating cable to the plug-in connector type, the tightening torque should be 0.4 N·m or less.



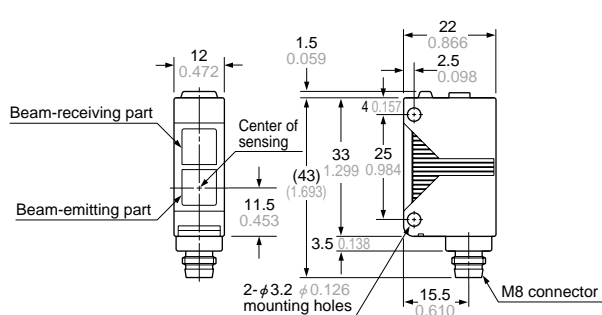
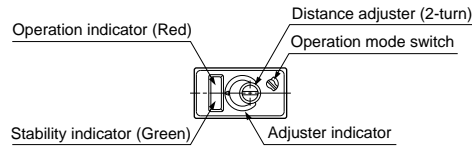
# EQ-20

**DIMENSIONS (Unit: mm in)** The CAD data in the dimensions can be downloaded from the SUNX website: <http://www.sunx.co.jp/>

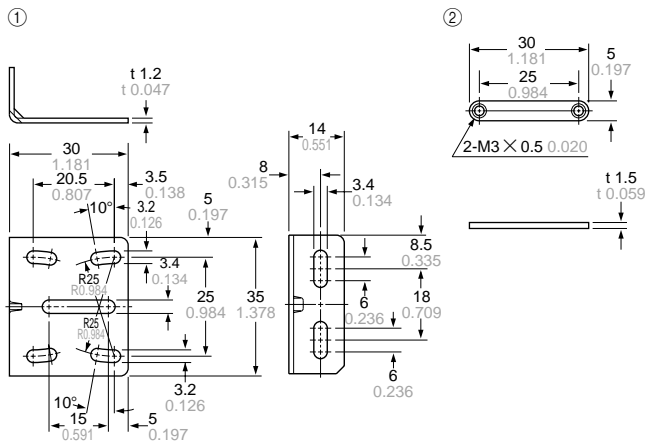
**EQ-2□  
EQ-2□-PN** Sensor



**EQ-2□-J  
EQ-2□-PN-J** Sensor



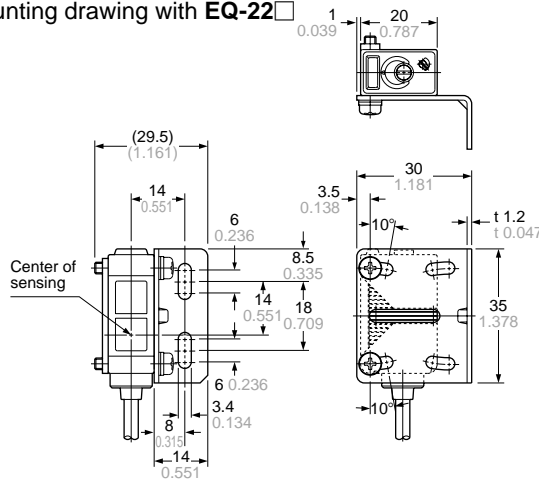
**MS-EQ2-1** Sensor mounting bracket (Optional)



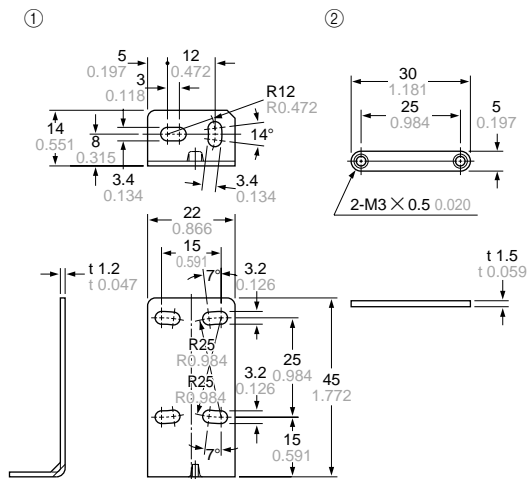
Material: Stainless steel (SUS304)  
Two M3 (length 18 mm 0.709 in) screws with washers are attached.

**Assembly dimensions**

Mounting drawing with EQ-22□



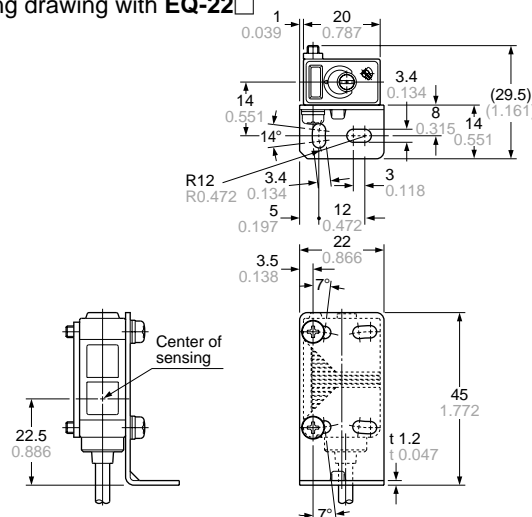
**MS-EQ2-2** Sensor mounting bracket (Optional)



Material: Stainless steel (SUS304)  
Two M3 (length 18 mm 0.709 in) screws with washers are attached.

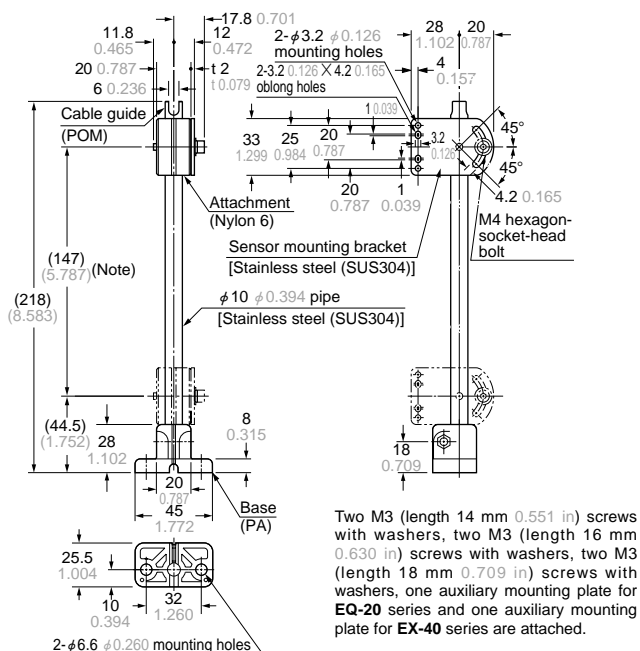
**Assembly dimensions**

Mounting drawing with EQ-22□



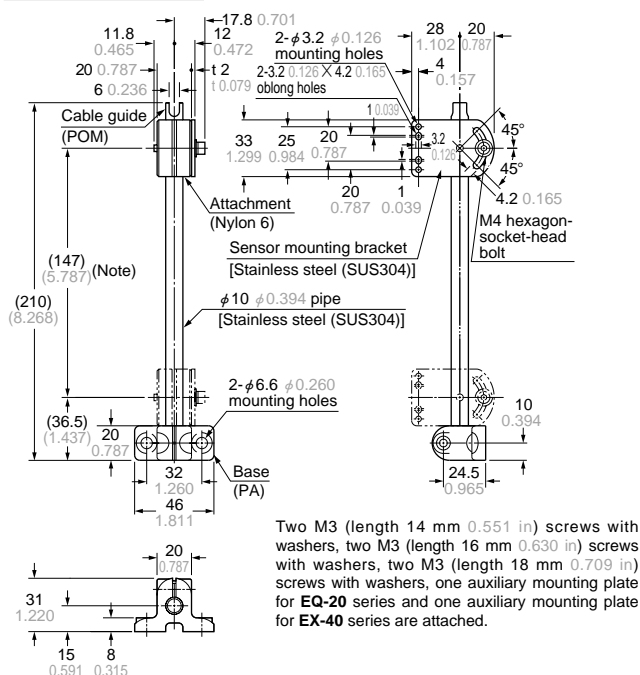
**DIMENSIONS (Unit: mm in)** The CAD data in the dimensions can be downloaded from the SUNX website: <http://www.sunx.co.jp/>

### MS-AJ1 Universal sensor mounting stand (Optional)



Note: The dimensions in the brackets indicate the adjustable range of the movable part.

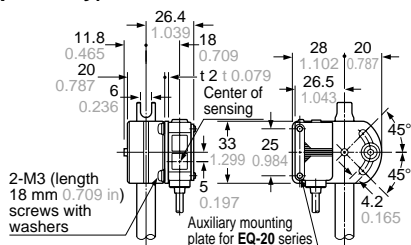
### MS-AJ2 Universal sensor mounting stand (Optional)



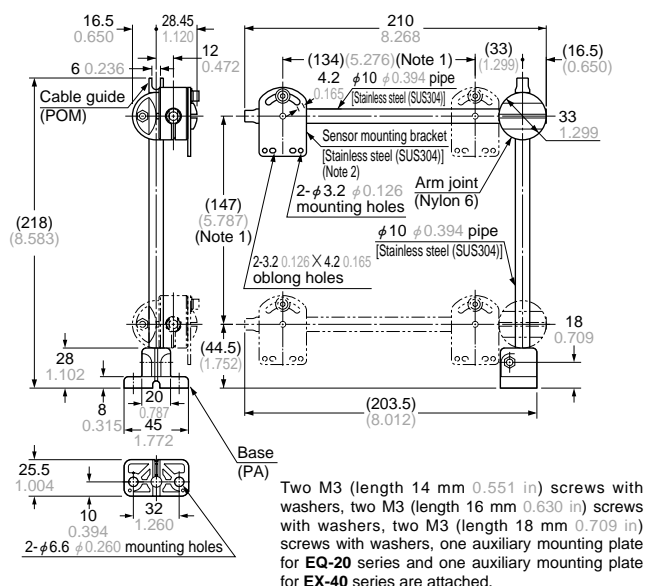
Note: The dimensions in the brackets indicate the adjustable range of the movable part.

### MS-AJ1 MS-AJ2 Universal sensor mounting stand (Optional)

#### Assembly dimensions with EQ-20 series (Mounting part only)

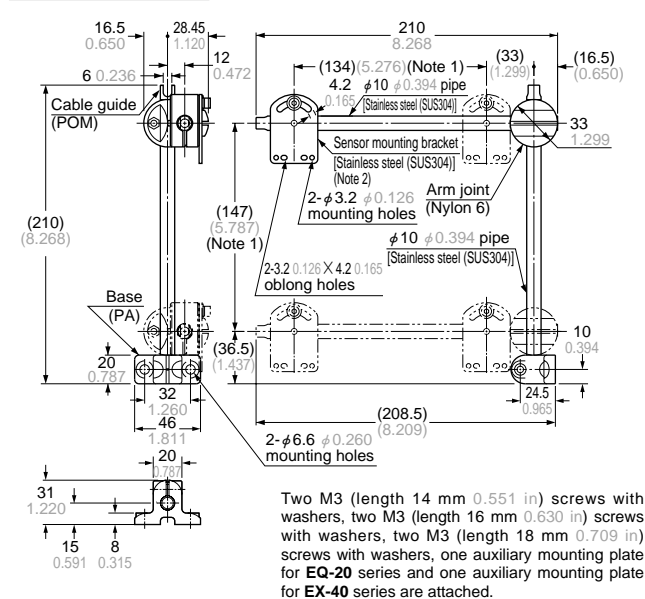


### MS-AJ1-A Universal sensor mounting stand (Optional)



Notes: 1) The dimensions in the brackets indicate the adjustable range of the movable part.  
2) Refer to MS-AJ1/AJ2 for the assembly dimensions with the sensor mounting bracket or sensor.

### MS-AJ2-A Universal sensor mounting stand (Optional)



Notes: 1) The dimensions in the brackets indicate the adjustable range of the movable part.  
2) Refer to MS-AJ1/AJ2 for the assembly dimensions with the sensor mounting bracket or sensor.