### Adjustable Range Reflective Photoelectric Sensor

**EQ-500 SERIES**

**Related Information**
- General terms and conditions .......... F-17
- Sensor selection guide ................. P.283~
- Glossary of terms / General precautions .......... P.1359~ / P.1405
- China’s CCC mark ........................ P.1409

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**Long range sensing capability to 2.5 m 8.202 ft**

**Stable sensing unaffected by color or gloss**

#### Long sensing range

An adjustable range to 2.5 m 8.202 ft allows plenty of space for installation. 1 m 3.281 ft sensing range type also available. Adjust the volume easily to suit your needs when using at close range.

#### Impervious to variations color or angle

The optical system has been optimized. Since the sensor is hardly influenced at all by angles or the gloss of objects compared to the previous model, it is possible to detect both white objects and black objects at almost a constant distance.

The difference in sensing range between white non-glossy paper and gray non-glossy paper (lightness: 5) is approx 5% when set at a distance of 2 m 6.562 ft.

#### Hardly affected by background objects

Because the sensor doesn’t detect objects outside the preset sensing field by using the 2-segment photodiode adjustable range system, it will not malfunction even if someone walks behind the sensing object or machines or conveyors are in the background.

Note: Please note that malfunction may occur when there are specular objects or objects with a mirror-like surface in the background.

Refer to the "PRECAUTIONS FOR PROPER USE" section.

#### Convenient terminal block type

Cabling enabled by way of a terminal block that eliminates waste.

#### OPERABILITY

An easy to set adjuster with indicator

Equipped with a 2-turn adjuster with indicator, making it easy to set for short or long distances.

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**Web:** www.clrwtr.com  
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APPLICATIONS

Level check within the hopper
The distance to the object can be set to enable residual amount sensing in the hopper regardless of color.

Confirmation of the passage of packages on a conveyor belt
Can accurately detect packages even if they vary in size and color.

VARIETIES

Equipped with both NPN and PNP outputs
We've added a DC-voltage type with NPN and PNP transistor outputs all in one sensor. Its BGS / FGS function controls any background effects for more stable sensing.

Multi-voltage
Because it can function with 24 to 240 V AC and 12 to 240 V DC, almost any power supply anywhere in the world will do.

Convenient timer function models
Types with an ON-delay / OFF-delay timer available. OFF-delay, e.g. useful when the response of the connected device is slow, ON-delay, e.g. useful to detect objects that take a long time to move.
- Operation: ON-delay, OFF-delay
- Timer period: 0.1 to 5 sec.
  (individual setting possible)

FUNCTIONS

BGS / FGS functions make even the most challenging settings possible!

The BGS function is best suited for background not present
When object and background are separated
BGS (Background suppression) function
The sensor judges that an object is present when light is received at position A of the light-receiving element (2-segment element). This is useful if the object and background are far apart. The BGS function is best suited for background not present.

The FGS function is best suited for background present
When object and background are close together
FGS (Foreground suppression) function
The sensor judges that no object is present when light is received at position B of the light-receiving element (2-segment element) (The conveyor is detected). This function is useful if the object and the background are close together or if the object is glossy or uneven. However, sensing is impossible if there is no background (conveyor, etc.).

Note: Refer to “BGS / FGS function” of “PRECAUTIONS FOR PROPER USE” for operation of BGS / FGS function.
ENVIROMENTAL RESISTANCE

Little affected by contamination on lens

Even if the lens surface gets somewhat dirty from dust particles, there is very little change in the operation field, by usage adjustable range system.

Waterproof

IP67 protection permits use in environments where water may splash.

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

ORDER GUIDE

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<th>Timer function</th>
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<td>With timer</td>
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<td>EQ-501</td>
<td>0.328 to 3.281 ft</td>
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<tr>
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<td></td>
<td>0.1 to 2.5 m</td>
<td>EQ-501T</td>
<td>0.328 to 8.202 ft</td>
<td>Relay 1a</td>
<td>ON-delay / OFF-delay timer (Timer period: 0.1 to 5 sec.)</td>
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<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>0.1 to 0.3 m</td>
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<td></td>
<td>ON-delay / OFF-delay timer (Timer period: 0.1 to 5 sec.)</td>
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<tr>
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<td>0.1 to 1.0 m</td>
<td>EQ-512</td>
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<td>0.1 to 0.3 m</td>
<td>EQ-512T</td>
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<td></td>
<td>ON-delay / OFF-delay timer (Timer period: 0.1 to 5 sec.)</td>
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OPTION

<table>
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<tr>
<th>Designation</th>
<th>Model No.</th>
<th>Description</th>
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<td>Sensor mounting bracket</td>
<td>MS-EQ5-01</td>
<td>Foot / back angled mounting bracket</td>
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Sensor mounting bracket

• MS-EQ5-01

Two M5 (length 30 mm 1.181 in) screws with washers and two nuts are attached.
## SPECIFICATIONS

<table>
<thead>
<tr>
<th>Type</th>
<th>Multi-voltage</th>
<th>DC-voltage</th>
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<tr>
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<td>With timer</td>
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<tr>
<td>Item</td>
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<td>EQ-501T</td>
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### Notes:
1. Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C ±3.4 °F.
2. The adjustable range stands for the maximum sensing range which can be set with the distance adjuster. The sensor can also detect an object 0.1 m 0.328 ft, or more, away.
3. The adjustable range, sensing range and hysteresis are specified for white non-glossy paper (200 × 200 mm 7.874 × 7.874 in) as the object.
4. Note that the detection may be unstable depending on the mounting conditions or the sensing object. In the state that this product is mounted, be sure to check the operation with the actual sensing object. Refer to "Automatic interference prevention function" and "PRECAUTIONS FOR PROPER USE" for details.
### I/O CIRCUIT AND WIRING DIAGRAMS

**EQ-501(T) EQ-502(T)**

- **I/O circuit diagram**
  - Terminal No. 1: Supply voltage 24 to 240 V AC ±10% or 12 to 240 V DC ±10%
  - Terminal No. 2: Relay contact output (1a)
  - Internal circuit

- **Terminal arrangement diagram**

**EQ-511(T) EQ-512(T)**

- **I/O circuit diagram**
  - Terminal No. 1: Supply voltage 24 to 240 V AC ±10%
  - Terminal No. 2: Relay contact output (1a)
  - Internal circuit

- **Terminal arrangement diagram**

### SENSING CHARACTERISTICS (TYPICAL)

**EQ-501(T) EQ-502(T)**

#### Sensing fields
- Setting distance: 1 m 3.281 ft
- Setting distance: 2.5 m 8.202 ft

#### Correlation between material
- (200 × 200 mm 7.874 × 7.874 in) and sensing range

- These bars indicate the sensing range with the respective objects when the distance adjuster is set to a sensing range of 2.5 m 8.202 ft / 1 m 3.281 ft long, respectively, with white non-glossy paper.

#### Correlation between color
- (200 × 200 mm 7.874 × 7.874 in non-glossy paper) and sensing range

- These bars indicate the sensing range with the respective colors when the distance adjuster is set to a sensing range of 2.5 m 8.202 ft / 1 m 3.281 ft long, respectively, with white non-glossy paper.

**EQ-511(T) EQ-512(T)**

#### Correlation between sensing object size and sensing range
- This curve shows the characteristics with the maximum sensing range set to 2.5 m 8.202 ft, with white non-glossy paper (200 × 200 mm 7.874 × 7.874 in).
### Sensing Characteristics (Typical)

**EQ-502 (T)**  
- **Sensing fields**  
  - Setting distance: 0.5 m 1.640 ft  
  - Setting distance: 1 m 3.281 ft  

**EQ-512 (T)**  
- **Sensing fields**  
  - Setting distance: 0.5 m 1.640 ft  
  - Setting distance: 1 m 3.281 ft  

**Correlation between color (200 × 200 mm 7.874 × 7.874 in non-glossy paper) and sensing range**
- Emitted beam
- Correlation between sensing object size and sensing range
- Setting distance L (m ft)
- Sensing range L (m ft)

**Correlation between material (200 × 200 mm 7.874 × 7.874 in) and sensing range**
- These bars indicate the sensing range with the respective objects when the distance adjuster is set to a sensing range of 1 m 3.281 ft / 0.5 m 1.640 ft long, respectively, with white non-glossy paper.

### Precautions for Proper Use

**Mounting**
- The tightening torque should be 0.8 N·m or less.
- Care must be taken regarding the sensor mounting direction with respect to the object’s direction of movement.

**Correct**
- Sensing object

**Incorrect**
- Sensing object

**Automatic interference prevention function**
- When the sensors are mounted closely, use them in the interference prevented area, as shown below.

**Note**
- The tightening torque should certainly be tightened to maintain water-resistance; the tightening torque of the screws should be 0.3 to 0.5 N·m.

**Incorrect**
- Sensing object

- When detecting a specular object (aluminum or copper foil, etc.) or an object having a glossy surface or coating, please note that there are cases when the object may not be detected due to a change in angle, wrinkles on the object surface, etc.
- If a specular body is present in the background, faulty 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.

- The tightening torque should be 0.8 N·m or less.
- Care must be taken regarding the sensor mounting direction with respect to the object’s direction of movement.

- When a specular body is present below the sensor, use the sensor by tilting it slightly upwards to avoid faulty operation.

- This product is not easily affected by the reflected light intensity since this sensor is the adjustable range reflective type. When the reflected light intensity is remarkably low, the sensing range may be affected. In that case, mount the sensor, while checking light-up of the stable indicator (green).

- The mounting screws of the terminal cover and display cover should certainly be tightened to maintain water-resistance; the tightening torque of the screws should be 0.3 to 0.5 N·m.

**Incorrect**
- Specular face

**Correct**
- Specular face

**Note**
- The detection may be unstable depending on the mounting conditions or the sensing object to be used. In the state that this product is mounted, be sure to check the operation with the actual sensing object to be used.
### PRECAUTIONS FOR PROPER USE

**Wiring**
- Check all wiring before applying power since incorrect wiring may damage the internal circuit. Also, carefully tighten the terminal screws so that the wires of adjacent terminals do not touch.
- To maintain water-resistance, the cable should have an outer diameter between ø9 to ø11 mm ø0.354 to ø0.433 in with a smooth covering material that allows the attached conduit connector to be securely tightened; the tightening torque of the screw should be of 1.5 to 2.0 N·m.
- If an external surge voltage exceeding 4 kV is impressed (DC-voltage type: 1 kV), the internal circuit will be damaged, and a surge suppressing element should be used.
- To prepare the cable end as shown below.
- The size of conduit is M20 × 1.5 mm ø0.354 to ø0.433 in.
- If pressure terminals are to be used, affix the connected cable end as shown below. If the Mounting hole for the terminal cover fixing screws inclines 70 degrees to the terminal cover, as shown in the figure below. To avoid damaging this product or screw, take care when tightening or loosening a screw.

**Conduit connector construction and cabling**
- Dimensions of the conduit connector and cabling

**Part description**
- Stability indicator (Green)
- Distance adjuster (2-turn)
- OFF-delay timer adjuster (Note 2)
- ON-delay timer adjuster (Note 2)
- Operation indicator (Orange)
- Operation mode switch (Note 1)

Notes: 1) The operation mode switch of the DC-voltage type is the DIP switch. Refer to ‘DC-voltage type’ of ‘Operation mode switch’ for details.
2) Incorporated on EQ-6-T only.

**Operation mode switch**

<table>
<thead>
<tr>
<th>Multi-voltage type (L-ON / D-ON mode only)</th>
</tr>
</thead>
</table>

**DC-voltage type**

**BGS / FGS function (DC-voltage type only)**
- DC-voltage type sensor incorporates BGS / FGS function. Select either the BGS or FGS function depending on the positions of the background and sensing object.
- BGS / FGS function is set with the operation mode switch.
- FGS function is used when the sensing object contacts the background (conveyor, etc).
- Depends on a selection of either BGS or FGS function, the output operation changes as follows.

**Dimensions of the suitable crimp terminals** (Unit: mm in)

<table>
<thead>
<tr>
<th>Round type</th>
<th>Y-shaped type</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø3.6 or less</td>
<td>ø3.6 or less</td>
</tr>
<tr>
<td>ø3.6 or more</td>
<td>ø3.6 or more</td>
</tr>
<tr>
<td>7.5 or less</td>
<td>7.5 or less</td>
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<tr>
<td>7.5 or more</td>
<td>7.5 or more</td>
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</tbody>
</table>

Note: Use crimp terminals with insulating sleeves. Recommended crimp terminal: Nominal size 1.25 × 3.5 0.049 × 0.138. The tightening torque for the terminal screws should be 0.3 to 0.5 N·m.
PRECAUTIONS FOR PROPER USE

Timer function (EQ-5□T only)

- EQ-5□T incorporates an OFF-delay timer, which is useful when the response of the connected device is slow, etc., and an ON-delay timer, which is useful for detecting objects that move slowly, for example.
- The OFF-delay and ON-delay timers can be used simultaneously.
- For DC-voltage type, set the DIP switch for the timer mode to ‘Timer ON’ side.

Stability indicator

- Since the EQ-500 series uses 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.
- Furthermore, the stability indicator (green) shows the margin of the setting distance.

Others

- Do not use during the initial transient time (50 ms) after the power supply is switched on.
- Its distance adjuster is mechanically operated. Do not drop; avoid other shocks.

DIMENSIONS (Unit: mm in)

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

Assembly dimensions with sensor mounting bracket

Material: Cold rolled carbon steel (SPCC)

Two M5 (length 30 mm 1.181 in) screws with washers and two nuts are attached.