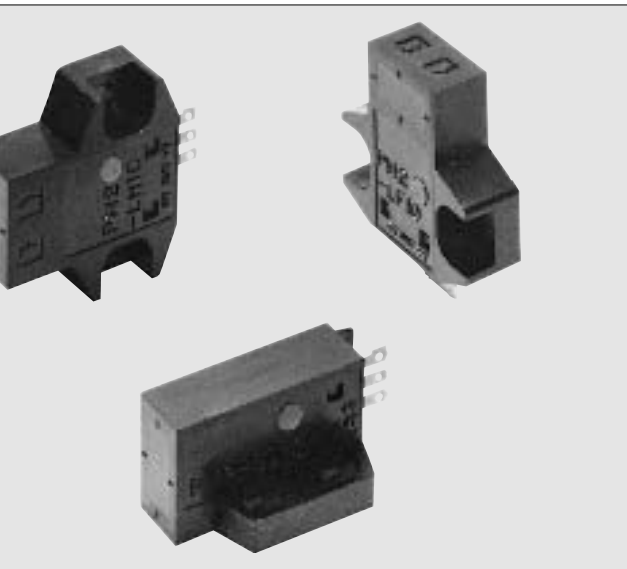


# M2

## SERIES

### Convergent Reflective Micro Photoelectric Sensor

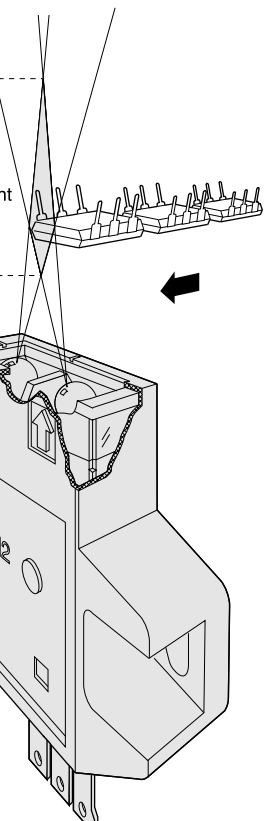


**Convergent reflection sensing ensures stable detection**



#### Operation by convergent reflective mode

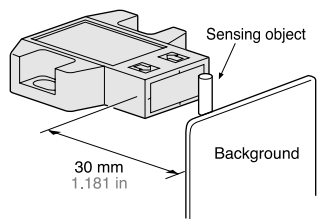
Detection characteristics are improved since it is convergent reflective and senses a limited area.



#### Not affected by background

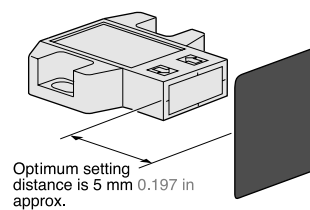
Even a specular background does not affect the sensing performance if the sensor is located 30 mm 1.181 in away from it.

(However, the specular background should be a plane surface, directly facing the sensor. A spherical or curved background may be detected.)



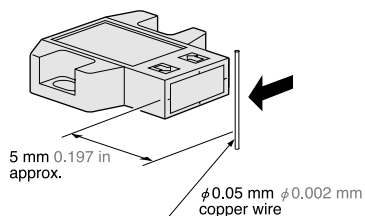
#### Dark object detectable

Since the sensor is very sensitive, it can detect even a dark object of low reflectivity.



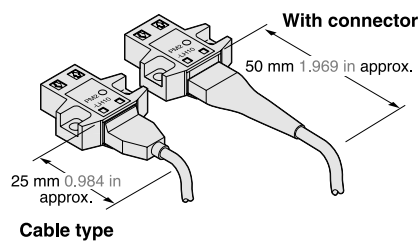
#### Minute object detectable

A  $\phi 0.05$  mm  $\phi 0.002$  in copper wire can be detected at a distance of 5 mm 0.197 in.



#### Cable type is also available

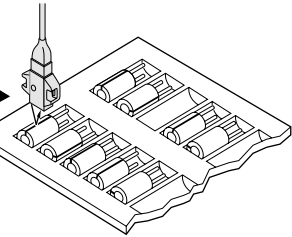
Cumbersome soldering is not required. It saves space and improves reliability.



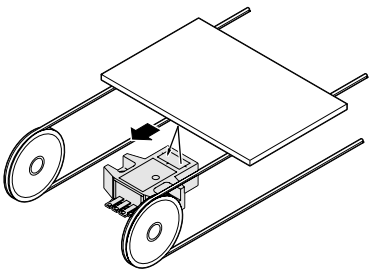
# PM2

## APPLICATIONS

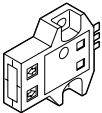
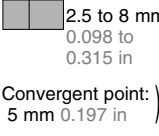
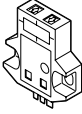
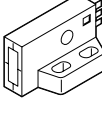
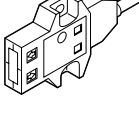
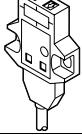
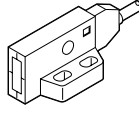
capacitors in a tray



Sensing printed circuit boards



## PRODUCT GUIDE

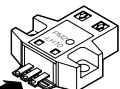
| Appearance   | Sensing range  | Model No.    | Output                        | Output operation |
|--|--|--------------|-------------------------------|------------------|
|  |  <p>2.5 to 8 mm<br/>0.098 to 0.315 in<br/>(Convergent point:<br/>5 mm 0.197 in)</p> | PM2-LH10     | NPN open-collector transistor | Light-ON         |
|  |  | PM2-LH10B    |                               | Dark-ON          |
|  |  | PM2-LF10     |                               | Light-ON         |
|  |  | PM2-LF10B    |                               | Dark-ON          |
|  |  | PM2-LL10     |                               | Light-ON         |
|  |  | PM2-LL10B    |                               | Dark-ON          |
|  |  | PM2-LH10-C1  |                               | Light-ON         |
|  |  | PM2-LH10B-C1 |                               | Dark-ON          |
|  |  | PM2-LF10-C1  |                               | Light-ON         |
|  |  | PM2-LF10B-C1 |                               | Dark-ON          |
|  |  | PM2-LL10-C1  |                               | Light-ON         |
|  |  | PM2-LL10B-C1 |                               | Dark-ON          |

## CONNECTORS

| Model No. | Description         |
|-----------|---------------------|
| CN-13     | Dedicated connector |

Connector  
• CN-13

Mating cable  
• CN-13-C1  
• CN-13-C3



## SPECIFICATIONS

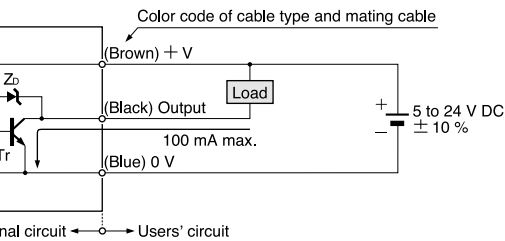
| Type                               | Connector type   |                  |                      | Cable type   |                     |                      |
|------------------------------------|--|------------------|----------------------|--|---------------------|----------------------|
|                                    | Top sensing  | Front sensing    | L type (Top sensing) | Top sensing  | Front sensing       | L type (Top sensing) |
| Model No.<br>Light-ON              | <b>PM2-LH10</b>  | <b>PM2-LF10</b>  | <b>PM2-LL10</b>      | <b>PM2-LH10-C1</b>   | <b>PM2-LF10-C1</b>  | <b>PM2-LL10-C1</b>   |
| Dark-ON                            | <b>PM2-LH10B</b>   | <b>PM2-LF10B</b> | <b>PM2-LL10B</b>     | <b>PM2-LH10B-C1</b>  | <b>PM2-LF10B-C1</b> | <b>PM2-LL10B-C1</b>  |
| Setting distance                   | 2.5 to 8 mm 0.098 to 0.315 in (Conv. point: 5 mm 0.197 in) with white non-glossy paper (15 × 15 mm 0.591 in × 0.591 in) (Note 1)   |                  |                      |  |                     |                      |
| Wire diameter                      | φ0.05 mm φ0.002 in copper wire (Setting distance: 5 mm 0.197 in)   |                  |                      |  |                     |                      |
| Setting distance (to sensing axis) | 20 % or less of operation distance with white non-glossy paper (15 × 15 mm 0.591 × 0.591 in)   |                  |                      |  |                     |                      |
| Setting distance (to sensing axis) | 0.08 mm 0.003 in or less (Note 2)  |                  |                      |  |                     |                      |
| Operating voltage                  | 5 to 24 V DC ± 10 % Ripple P-P 5 % or less   |                  |                      |  |                     |                      |
| Current consumption                | Average: 25 mA or less, Peak: 80 mA or less  |                  |                      |  |                     |                      |
| Output transistor                  | NPN open-collector transistor<br><ul style="list-style-type: none"> <li>• Maximum sink current: 100 mA</li> <li>• Applied voltage: 30 V DC or less (between output and 0 V)</li> <li>• Residual voltage: 1 V or less (at 100 mA sink current)<br/>0.4 V or less (at 16 mA sink current)</li> </ul> |                  |                      |  |                     |                      |
| Output category                    | DC-12 or DC-13   |                  |                      |  |                     |                      |
| Output protection                  | Incorporated   |                  |                      |  |                     |                      |
| Response time                      | 0.8 ms or less   |                  |                      |  |                     |                      |
| Indicator                          | Red LED (lights up when the output is ON)  |                  |                      |  |                     |                      |
| Operating temperature              | 3 (Industrial environment)   |                  |                      |  |                     |                      |
| Storage temperature                | - 10 to + 55 °C + 14 to + 131 °F (No dew condensation or icing allowed), Storage: - 25 to + 80 °C - 13 to + 176 °F   |                  |                      |  |                     |                      |
| Humidity                           | 45 to 85 % RH, Storage: 45 to 85 % RH  |                  |                      |  |                     |                      |
| Illuminance                        | Sunlight: 11,000 lx at the light-receiving face, Incandescent light: 3,500 lx at the light-receiving face  |                  |                      |  |                     |                      |
| Compliance                         | EN 50081-2, EN 50082-2, EN 60947-5-2   |                  |                      |  |                     |                      |
| Vibration resistance               | 10 to 55 Hz frequency, 1.5 mm 0.059 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   |                  |                      |  |                     |                      |
| Light source                       | Infrared LED (modulated)   |                  |                      |  |                     |                      |
| Enclosure                          | Enclosure: Polycarbonate, Terminal part: HSM (Ag plated)   |                  |                      | Enclosure: Polycarbonate, Fixed cable part: PBT                      |                     |                      |
| Cable                              | _____  |                  |                      | 0.2 mm <sup>2</sup> 3-core cabtyre cable, 1 m 3.281 ft long (Note 3) |                     |                      |
| Weight                             | Total 2 m 6.562 ft is possible with 0.3 mm <sup>2</sup> , or more, cable.<br>If the cable is extended for 2 m 6.562 ft, or more, a capacitor of 10 μF must be connected between + V and 0 V terminals.   |                  |                      | _____  |                     |                      |
| Weight                             | 4.5 g approx.  |                  | 4 g approx.          |  | 25 g approx.        |                      |

Sensing range may extend up to 12.5 mm 0.492 in with white non-glossy paper due to product variation.  
Repeatability is specified for white non-glossy paper (15 × 15 mm 0.591 × 0.591 in) at a setting distance of 5 mm 0.197 in.  
Setting distance cannot be extended.

# PM2

## CIRCUIT AND WIRING DIAGRAMS

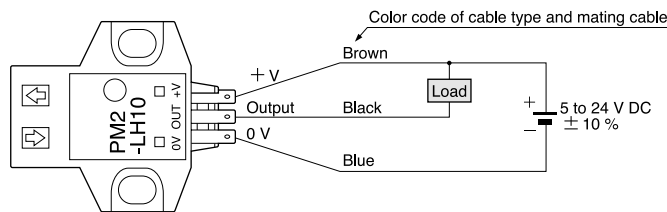
### Circuit diagram



Be sure to connect terminals correctly as the sensor does not incorporate a reverse polarity protection circuit.

Zd: Surge absorption zener diode  
Tr: NPN output transistor

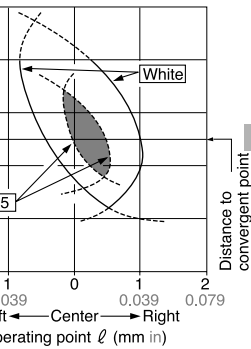
### Wiring diagram



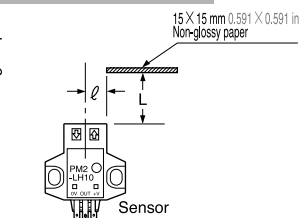
## SENSING CHARACTERISTICS (TYPICAL)

### Sensing fields

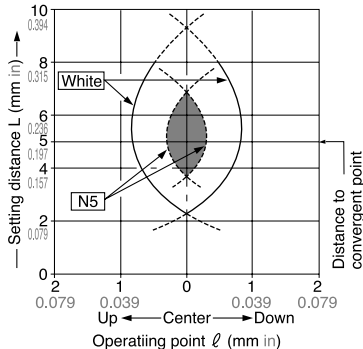
#### Horizontal (left and right) direction



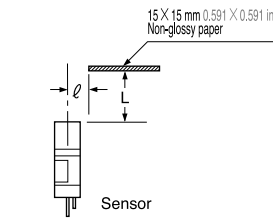
#### Horizontal direction



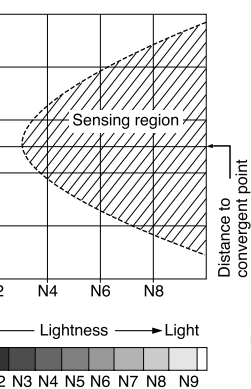
#### Vertical (up and down) direction



#### Vertical direction



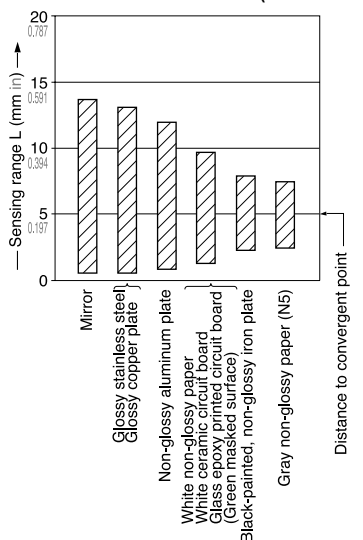
### Correlation between lightness and sensing range



The sensing region is represented by oblique lines in the left figure. However, the sensitivity should be set with enough margin because of slight variation in products.

(Lightness shown on the left may differ slightly from the actual object condition.)

### Correlation between material (15 X 15 mm 0.591 X 0.591 in) and sensing range



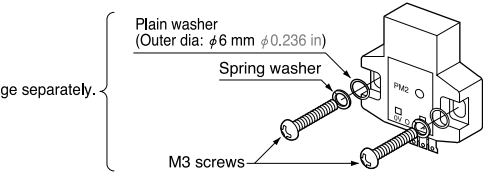
The bars in the graph indicate the sensing range for the respective material. However, there is a slight variation in the sensing range depending on the product. Further, if there is a reflective object (conveyor, etc.) in the background of the sensing object, since it affects the sensing, separate it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

CONDITIONS FOR PROPER USE

Models

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.

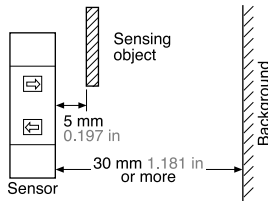
When mounting the sensor with screws, use M3 screws and the tightening torque should be 0.49 N·m or less. Use small, round type plain washers (φ6 mm).



Be sure to connect terminals correctly as the sensor incorporates a reverse polarity protection circuit.

If the sensor is being used in a noisy environment, example: a motor or a solenoid, or if equipment, such as a solenoid or electromagnetic valve, which generates electromagnetic noise, is present near the sensor, connect a surge protector to the equipment.

The minimum setting distance to conversion is 5 mm (0.197 in). The sensor is not affected by a specular background if the sensing object is located 30 mm or more, away from the sensor.



The specular background should be a plane directly facing the sensor. A spherical or curved background may be detected.

During the initial transient time (50 ms) after the power supply is switched on.

Ensure that the product does not come in direct contact with oil, grease, or organic solvents, such as, thinner, etc.

Connector type

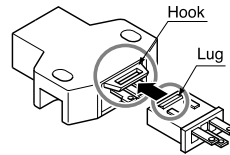
Cautions in plugging or unplugging a connector



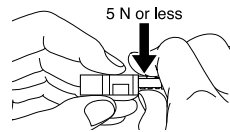
- Do not plug or unplug a connector more than 10 times.
- Be sure not to give stress more than 5 N to a terminal of both a connector and a sensor. If you do not follow the above cautions, it will cause a poor contact.

Procedures of plugging or unplugging a connector

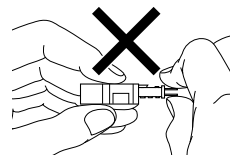
① Insert a connector straight into a sensor until the connector lug is locked by the sensor hook.



② When unplugging, give as much stress as a connector lug can be relieved from a hook. Then unplug it.



Caution: Be sure to hold a connector when plugging or unplugging it. Do not hold a terminal or a cable when plugging or unplugging the connector. Otherwise, it will cause a poor contact.



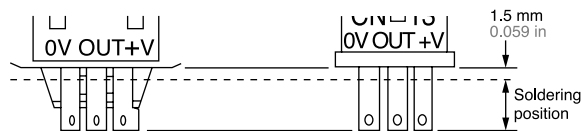
Soldering (Both connector CN-13 and sensor)

• If soldering is done directly on the terminals, strictly adhere to the conditions given below.

|                       |                           |
|-----------------------|---------------------------|
| Soldering temperature | 260 °C 500 °F or less     |
| Soldering time        | 10 sec. or less           |
| Soldering position    | Refer to the below figure |

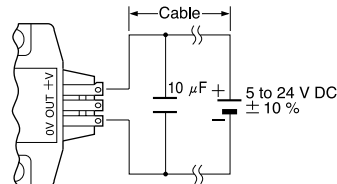
Sensor

Connector



Wiring

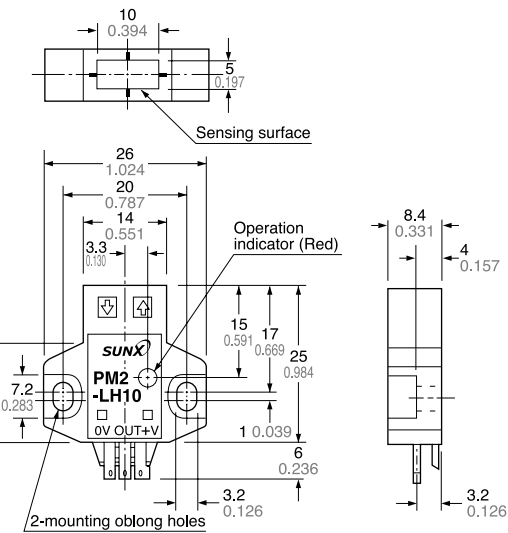
- The cable length must be 2 m (6.562 ft), or less, with 0.3 mm<sup>2</sup>, or more, cable. If the cable is extended for more than 2 m (6.562 ft), connect a capacitor of 10 μF approx. between +V and 0 V terminals.



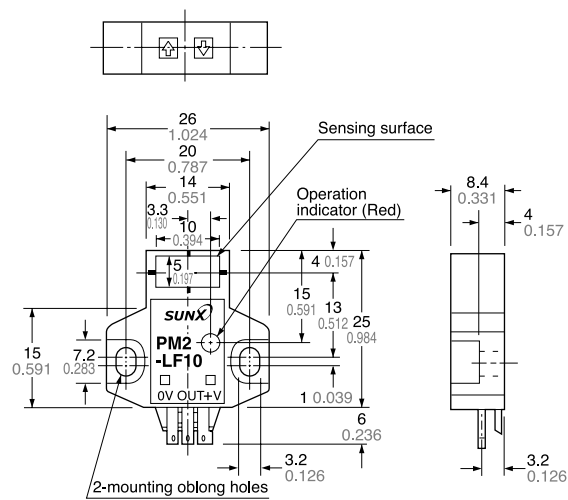
# PM2

ENSIONS (Unit: mm in)

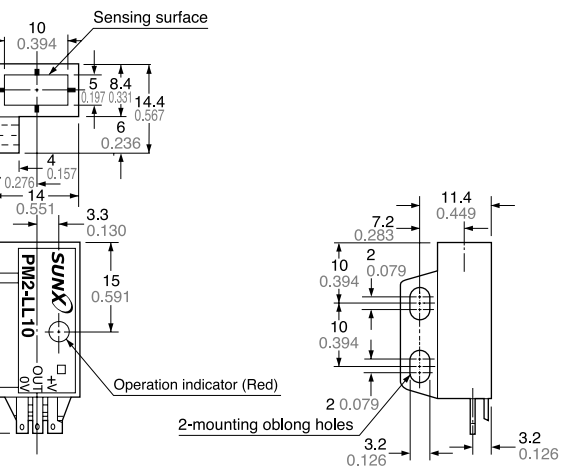
## PM2-LH10 PM2-LH10B Sensor



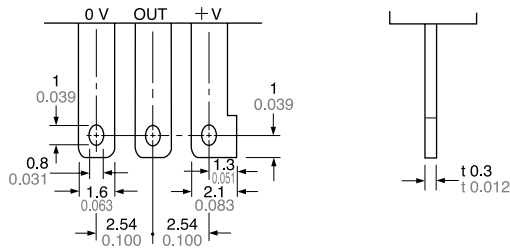
## PM2-LF10 PM2-LF10B Sensor



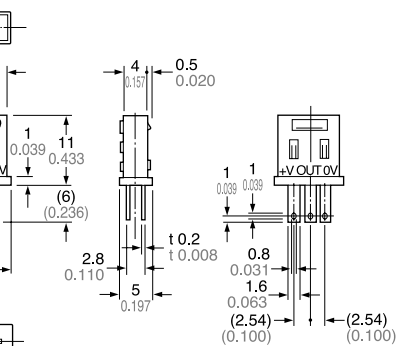
## PM2-LL10 PM2-LL10B Sensor



### ※ Terminal part (Connector type)

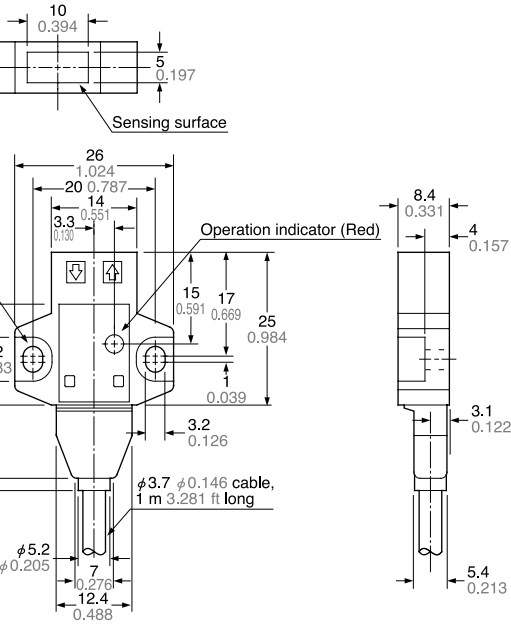


## PM2-N-13 Connector (Optional)

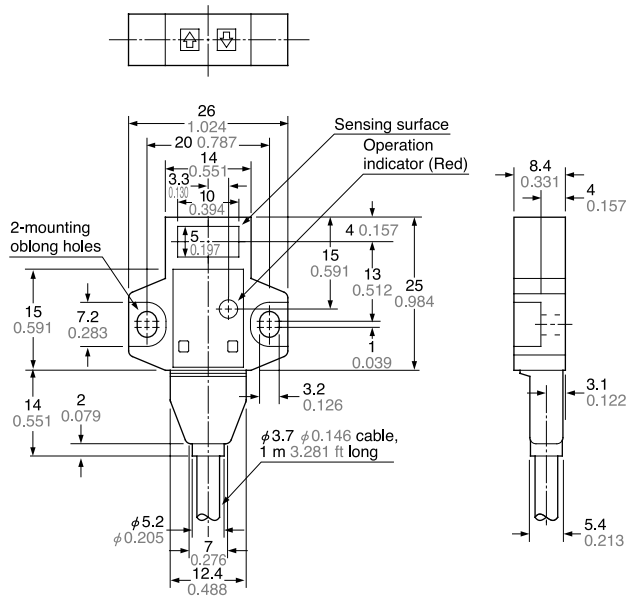


ENSIONS (Unit: mm in)

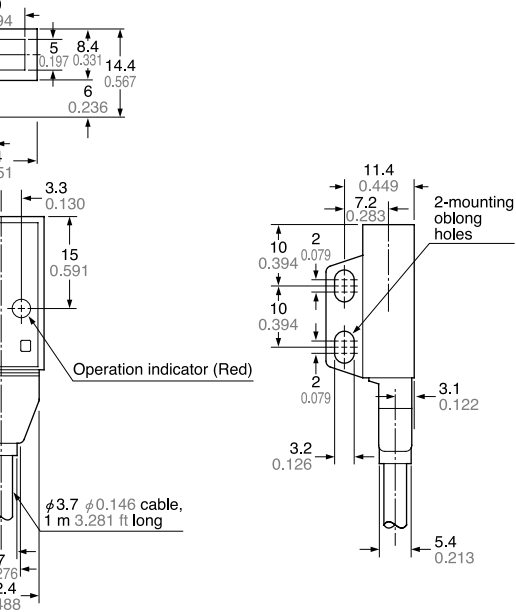
0-C1  
0B-C1 Sensor



PM2-LF10-C1  
PM2-LF10B-C1 Sensor



0-C1  
0B-C1 Sensor



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