**PM SERIES**

U-shaped Micro Photoelectric Sensor

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**Extremely Small Size**

Ultra-small type PM-24(-R) contributes to the miniaturization of your equipment. Even the small cable type has become very compact.

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**Equipped with Two Independent Outputs**

All models are equipped with two independent outputs – Light-ON and Dark-ON. Hence, one model suffices even if the output is to be used differently, depending upon the location of use. Also, since two independent outputs have been provided, cumbersome handling of the output conversion control input, or fear of logic inversion due to a cable break, is eliminated. The sensor can be connected to the existing wiring as it is.

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**Quick Fitting Hook-up Connector**

Easy to maintain connector type models are available. Its exclusive connector is the industry’s first hook-up connector. Since only crimping with exclusive pliers is to be done, cumbersome soldering or insulation is absolutely not required. Further, connector attached cable is also available.

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**Wide Model Variety**

A wide variety of 17 shapes and 29 models is available. You may select from this wide range to suit the mounting conditions.

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**Meets Global Requirements**

Conforms to Europe’s EMC Directive. Both, NPN and PNP output models are available.

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Note: Ensure to insulate the unused output wire.
### APPLICATIONS

**Sensing the starting point on a rotating body**

The starting point can be sensed by making a slit in the rotating body.

**Determining the pallet position**

Pallet is stopped by sensing the dog.

**Sensing the starting point and overrun of a moving body**

Starting point and overrun is sensed using the dog on the base.

### ORDER GUIDE

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<th>Appearance (mm)</th>
<th>Sensing range</th>
<th>Model No. (Note)</th>
<th>Output</th>
<th>Output operation</th>
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<tbody>
<tr>
<td>K type</td>
<td></td>
<td></td>
<td>PM-K24</td>
<td></td>
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<tr>
<td>L type</td>
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<td>PM-K24-R</td>
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<td></td>
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<tr>
<td>Ultra-small</td>
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<td>PM-L24</td>
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<td></td>
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<tr>
<td>F type</td>
<td></td>
<td></td>
<td>PM-L24-R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R type</td>
<td></td>
<td></td>
<td>PM-F24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U type</td>
<td></td>
<td></td>
<td>PM-F24-R</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>PM-R24</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>PM-R24-R</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PM-U24</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PM-U24-R</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The suffix '-R' indicates a reflection resistant cable type.

5mm (fixed)

NPN open-collector transistor

Incorporated with 2 outputs: Light-ON/Dark-ON
## ORDER GUIDE

<table>
<thead>
<tr>
<th>Type</th>
<th>Appearance (mm)</th>
<th>Sensing range</th>
<th>Model No.</th>
<th>Output</th>
<th>Output operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>K type</td>
<td><img src="image1" alt="Image" /></td>
<td>5mm (fixed)</td>
<td>PM-K44</td>
<td>NPN open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>T type</td>
<td><img src="image2" alt="Image" /></td>
<td></td>
<td>PM-K44P</td>
<td>PNP open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>L type</td>
<td><img src="image3" alt="Image" /></td>
<td></td>
<td>PM-T44</td>
<td>NPN open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>Y type</td>
<td><img src="image4" alt="Image" /></td>
<td></td>
<td>PM-T44P</td>
<td>PNP open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>F type</td>
<td><img src="image5" alt="Image" /></td>
<td></td>
<td>PM-L44</td>
<td>NPN open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>R type</td>
<td><img src="image6" alt="Image" /></td>
<td></td>
<td>PM-L44P</td>
<td>PNP open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>K type</td>
<td><img src="image7" alt="Image" /></td>
<td></td>
<td>PM-Y44</td>
<td>NPN open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>T type</td>
<td><img src="image8" alt="Image" /></td>
<td></td>
<td>PM-Y44P</td>
<td>PNP open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>L type</td>
<td><img src="image9" alt="Image" /></td>
<td></td>
<td>PM-F44</td>
<td>NPN open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>Y type</td>
<td><img src="image10" alt="Image" /></td>
<td></td>
<td>PM-F44P</td>
<td>PNP open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>F type</td>
<td><img src="image11" alt="Image" /></td>
<td></td>
<td>PM-R44</td>
<td>NPN open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>R type</td>
<td><img src="image12" alt="Image" /></td>
<td></td>
<td>PM-R44P</td>
<td>PNP open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>K type</td>
<td><img src="image13" alt="Image" /></td>
<td></td>
<td>PM-K54</td>
<td>NPN open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>T type</td>
<td><img src="image14" alt="Image" /></td>
<td></td>
<td>PM-K54P</td>
<td>PNP open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>L type</td>
<td><img src="image15" alt="Image" /></td>
<td></td>
<td>PM-T54</td>
<td>NPN open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>Y type</td>
<td><img src="image16" alt="Image" /></td>
<td></td>
<td>PM-T54P</td>
<td>PNP open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>F type</td>
<td><img src="image17" alt="Image" /></td>
<td></td>
<td>PM-L54</td>
<td>NPN open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>R type</td>
<td><img src="image18" alt="Image" /></td>
<td></td>
<td>PM-L54P</td>
<td>PNP open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>K type</td>
<td><img src="image19" alt="Image" /></td>
<td></td>
<td>PM-Y54</td>
<td>NPN open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>T type</td>
<td><img src="image20" alt="Image" /></td>
<td></td>
<td>PM-Y54P</td>
<td>PNP open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>L type</td>
<td><img src="image21" alt="Image" /></td>
<td></td>
<td>PM-F54</td>
<td>NPN open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>Y type</td>
<td><img src="image22" alt="Image" /></td>
<td></td>
<td>PM-F54P</td>
<td>PNP open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>F type</td>
<td><img src="image23" alt="Image" /></td>
<td></td>
<td>PM-R54</td>
<td>NPN open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>R type</td>
<td><img src="image24" alt="Image" /></td>
<td></td>
<td>PM-R54P</td>
<td>PNP open-collector transistor</td>
<td></td>
</tr>
</tbody>
</table>
## OPTIONS

<table>
<thead>
<tr>
<th>Designation</th>
<th>Model No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hook-up connector</td>
<td>CN-14H</td>
<td>This connector can be hooked-up on 0.08 to 0.2mm² cable simply in one grip.</td>
</tr>
<tr>
<td></td>
<td>CN-14H-2</td>
<td>Suitable for UL standard cable. This connector can be hooked-up on 0.18 to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.22mm² cable simply in one grip. Wire diameter: ( \phi 1.2 ) to ( \phi 1.52 )mm</td>
</tr>
<tr>
<td>Connector</td>
<td>CN-14</td>
<td>Connector for soldering</td>
</tr>
<tr>
<td>attached cable</td>
<td>CN-14H-C1</td>
<td>Length: 1m For the connector type, with 0.18mm² 4-core cable.</td>
</tr>
<tr>
<td></td>
<td>CN-14H-C3</td>
<td>Length: 3m Cable diameter: ( \phi 3.8 )mm</td>
</tr>
<tr>
<td>Hook-up pliers</td>
<td>CN-HP</td>
<td>These are exclusive pliers for hook-up connectors CN-14H and CN-14H-2</td>
</tr>
<tr>
<td>Mounting screw</td>
<td>MS-M2</td>
<td>Mounting screw with washers for the ultra-small type sensor (50 Nos. lot). It</td>
</tr>
</tbody>
</table>

![Connector](image1)

![Hook-up connector](image2)

![Connector attached cable](image3)

![Hook-up pliers](image4)

![Mounting screw](image5)
### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Type</th>
<th>Ultra-small</th>
<th>Small</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>With inflection resistant cable</td>
<td>With cable</td>
</tr>
<tr>
<td></td>
<td>NPN output type</td>
<td>PM-□24</td>
<td>PM-□24-R</td>
</tr>
<tr>
<td></td>
<td>PNP output type</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Sensing range**: 5mm (fixed)
- **Minimum sensing object**: 0.8 × 1.8mm opaque object
- **Hysteresis**: 0.05mm or less
- **Repeatability**: 0.03mm or less
- **Supply voltage**: 5 to 24V DC ± 10%  Ripple P-P 10% or less
- **Current consumption**: 15mA or less

<table>
<thead>
<tr>
<th>Output</th>
<th>NPN open-collector transistor</th>
<th>PNP open-collector transistor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;NPN output type&gt;</td>
<td>&lt;PNP output type&gt;</td>
</tr>
<tr>
<td></td>
<td>Maximum sink current: 50mA</td>
<td>Maximum source current: 50mA</td>
</tr>
<tr>
<td></td>
<td>Applied voltage: 30V DC or less (between output and 0V)</td>
<td>Applied voltage: 30V DC or less (between output and +V)</td>
</tr>
<tr>
<td></td>
<td>Residual voltage: 0.7V or less (at 50mA sink current)</td>
<td>Residual voltage: 0.7V or less (at 50mA source current)</td>
</tr>
<tr>
<td></td>
<td>0.4V or less (at 16mA sink current)</td>
<td>0.4V or less (at 16mA source current)</td>
</tr>
</tbody>
</table>

- **Utilization category**: DC-12 or DC-13
- **Output operation**: Incorporated with 2 outputs: Light-ON/Dark-ON
- **Response time**: Under light received condition: 20μs or less
- **Operation indicator**: Vermilion LED (lights up under light received condition)

- **Pollution degree**: 3 (Industrial environment)
- **Ambient temperature (Note 2, 3)**: −25 to +55°C (No dew condensation or icing allowed), Storage: −30 to +80°C
- **Ambient humidity**: 35 to 85% RH, Storage: 35 to 85% RH
- **Ambient illuminance**: Fluorescent light: 1,000lx 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**: 50MΩ, or more, with 250V DC megger between all supply terminals connected together and enclosure
- **Vibration resistance**: 10 to 2,000Hz frequency, 1.5mm amplitude in X, Y and Z directions for two hours each
- **Shock resistance**: 15,000m/s² acceleration (1,500G approx.) in X, Y and Z directions for three times each

- **Material**: Enclosure: PBT, Silt cover: Polycarbonate, Terminal part (PM-□54P only): Solder plated
- **Cable**: 0.09mm² 4-core cabtyre cable (PM-□24-R: 0.1mm² inflection, oil and heat resistant cabtyre cable), 1m long
- **Cable extension**: Extension up to total 100m is possible with 0.3mm², or more, cable.
- **Weight**: 10g approx. 15g approx. 3g approx.

Notes:
1. The response frequency is the value when the disc, given in the figure below, is rotated.
2. In case the ultra-small type PM-□24-R is used at an ambient temperature of +50°C, or more, make sure to mount it on a metal body.
3. Take care that the flexibility of the PM-□24-R cable is lost if the ambient temperature in near −10°C.
I/O CIRCUIT AND WIRING DIAGRAMS

**NPN output type**

**I/O circuit diagram**

- Color code for cable type (Note 1)
  - (Brown) + V
  - (Black) Output 1 (Note 2)
  - (Blue) 0V
  - 50mA max.

- Internal circuit

- Users’ circuit

Notes:
1) The color code of the connector attached cable is also the same.
2) Ensure to insulate the unused output wire.

Symbols: $Z_{D1}, Z_{D2}$: Surge absorption zener diode

$T_{r1}, T_{r2}$: NPN output transistor

**Wiring diagram**

- 5 to 24V DC ± 10%

**Output operation**

<table>
<thead>
<tr>
<th>Color code</th>
<th>Output operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>Light-ON</td>
</tr>
<tr>
<td>White</td>
<td>Dark-ON</td>
</tr>
</tbody>
</table>

**PNP output type**

**I/O circuit diagram**

- Color code for cable type (Note 1)
  - (Brown) + V
  - (Black) Output 1 (Note 2)
  - (Blue) 0V
  - 50mA max.

- Internal circuit

- Users’ circuit

Notes:
1) The color code of the connector attached cable is also the same.
2) Ensure to insulate the unused output wire.

Symbols: $Z_{D1}, Z_{D2}$: Surge absorption zener diode

$T_{r1}, T_{r2}$: PNP output transistor

**Wiring diagram**

- 5 to 24V DC ± 10%

**Output operation**

<table>
<thead>
<tr>
<th>Color code</th>
<th>Output operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>Light-ON</td>
</tr>
<tr>
<td>White</td>
<td>Dark-ON</td>
</tr>
</tbody>
</table>

**PRECAUTIONS FOR PROPER USE**

Refer to P.820 for general precautions.

**All 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.

**Wiring**

- Please carry out the wiring carefully since protection circuits against reverse power supply connection and output short-circuit are not incorporated.

**Others**

- Since the sensor is intended for use inside machines, no special countermeasures have been taken against extraneous light. Take care that extraneous light is not directly incident on the beam receiving section.
- Do not use during the initial transient time (50ms) after the power supply is switched on.
- The cable of PM-$24-R$ is a flexible cable usable on a moving base. When the sensor is mounted on a moving base, fix the sensor cable joint so that stress is not applied to it.
- Take care that the flexibility of the PM-$24-R$ cable is lost if the ambient temperature is near $-10^\circ$C.
### PRECAUTIONS FOR PROPER USE

#### All models

**Mounting**
- When fixing the sensor with screws, use M3 screws [M2 screws in case of PM-24-R] and the tightening torque should not exceed the values given below. Further, use small, round type plain washers.
  (M3: \( \varnothing 6 \text{mm} \), M2: \( \varnothing 4.3 \text{mm} \))

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Tightening torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM-24(-R)</td>
<td>0.15N·m</td>
</tr>
<tr>
<td>PM-24(P)</td>
<td>0.5N·m</td>
</tr>
<tr>
<td>PM-25(P)</td>
<td>0.8N·m</td>
</tr>
</tbody>
</table>

Note: In case the ultra-small type PM-24-R is used at an ambient temperature of \(+50^\circ C\), or more, make sure to mount it on a metal body.

**Cable extension**
- Cable extension is possible up to an overall length of 100m with a 0.3mm², or more, cable. However, since a voltage drop shall occur due to the cable extension, ensure that the power supply voltage at the end of the cable attached to the sensor or at the sensor terminals is within the rating.

But, when the overall cable length, including the cable attached to the sensor, is as given below, there is no need to confirm the voltage.

<table>
<thead>
<tr>
<th>Conductor cross-section area</th>
<th>Total cable length</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.08 to 0.1mm²</td>
<td>Up to 5m</td>
</tr>
<tr>
<td>0.2mm²</td>
<td>Up to 10m</td>
</tr>
<tr>
<td>0.3mm²</td>
<td>Up to 20m</td>
</tr>
</tbody>
</table>

**DIMENSIONS (Unit: mm)**

#### PM-24-R

- **Sensor**
  - Beam axis
  - \#4.8 to \#2.7 cable 1m long
  - \#2.5 mounting holes
  - Operation indicator (Vermilion)

#### PM-24-P

- **Sensor**
  - Beam axis
  - \#4.8 to \#2.7 cable 1m long
  - \#2.5 mounting holes
  - Operation indicator (Vermilion)

#### PM-54 PM-54P

**Crimping method**
1. Strip the cable sheath 15mm, or more, and insert the wires into the connector insertion holes till the wire tips reach the end.
2. Crimp with the exclusive hook-up pliers CN-HP.

**Arrangement of connector terminals**
- Refer to the right figure

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

<table>
<thead>
<tr>
<th>Item</th>
<th>Model No.</th>
<th>PM-24(P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soldering temperature</td>
<td>260°C or less</td>
<td></td>
</tr>
<tr>
<td>Soldering time</td>
<td>3 sec. or less</td>
<td></td>
</tr>
<tr>
<td>Soldering position</td>
<td>Refer to the right figure</td>
<td></td>
</tr>
</tbody>
</table>

Caution: Make sure to use the exclusive hook-up pliers CN-HP. Commercially available pliers cannot be used.

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Refer to P.820~ for general precautions.
DIMENSIONS (Unit: mm)

**PM-F24, PM-F24-R**

- Beam axis
- Operation indicator (Vermilion)
- 2.7 cable 1m long
- 2.5 mounting hole

**PM-R24, PM-R24-R**

- Beam axis
- Operation indicator (Vermilion)
- 2.7 cable 1m long
- 2.5 mounting hole

**PM-U24, PM-U24-R**

- Beam axis
- Operation indicator (Vermilion)
- 2.7 cable 1m long
- 2.5 mounting hole

**PM-K44, PM-K44P**

- Beam axis
- 2.9
- Operation indicator (Vermilion)
- 2.7 cable 1m long
- 2.7 cable 1m long
- 2.5 mounting hole

**PM-T44, PM-T44P**

- Beam axis
- Operation indicator (Vermilion)
- 2-oblong mounting holes
- 2.7 cable 1m long

**PM-L44, PM-L44P**

- Beam axis
- Operation indicator (Vermilion)
- 2.7 cable 1m long
- 2.5 mounting hole
PHOTOELECTRIC SENSORS

DIMENSIONS (Unit: mm)

**PM-Y44**
- Sensor Mounting Stand
- MS-AJ
- Beam axis
- Operation indicator (Vermilion)
- 2-3.5 mounting holes
- 2.7 cable 1m long
- 2-oblong mounting holes

**PM-F44**
- Amplifier-separated Type
- Sensor Checker
- SS-A5CHX-SC2
- Beam axis
- Operation indicator (Vermilion)
- 2-3.5 mounting holes
- 2-3.2 mounting holes
- 2-oblong mounting holes

**PM-R44**
- Multi-voltage Type
- SU-7/SH
- Beam axis
- Operation indicator (Vermilion)
- 2-3.5 mounting holes
- 2.7 cable 1m long
- 2-oblong mounting holes

**PM-K54**
- SU-7/SH
- Beam axis
- Operation indicator (Vermilion)
- 2-3.8 mounting holes

**PM-T54**
- Sensor Checker
- CHX-SC2
- Beam axis
- Operation indicator (Vermilion)
- 4-R2
- 2-oblong mounting holes

**PM-L54**
- Beam axis
- Operation indicator (Vermilion)
- 2-3.2 mounting holes
DIMENSIONS (Unit: mm)

PM-Y54  PM-Y54P
Sensor

PM-F54  PM-F54P
Sensor

PM-R54  PM-R54P
Sensor

※Terminal part (PM-F54, PM-F54P)

CN-14  Connector (Optional)

CN-14H  CN-14H-2
Hook-up connector (Optional)

CN-14H-C1  CN-14H-C3
Connector attached cable (Optional)

Model No.  Cable length
CN-14H-C1  1m
CN-14H-C3  3m