Small / Slim Object Detection Area Sensor

NA1-11

Cross-beam scanning system to detect slim objects

Letters or business cards detectable!

Slim objects can be detected by the cross-beam scanning system.

Emitting and receiving element pitch: 10 mm 0.394 in

A minimum sensing object size of ø13.5 mm ø 0.531 in can be detected by an emitting and receiving element pitch of 10 mm 0.394 in.

Wide area

Though being extremely slim, it has a wide sensing area of 1 m 3.281 ft length and 100 mm 3.937 in width. It is most suitable for object detection on a wide assembly line, or for detecting the dropping of, or incursion by, small objects whose travel path is uncertain.

Just 10 mm 0.394 in thick

It is extremely slim, being just 10 mm 0.394 in thick. Further, it can be mounted in a narrow space as you can select from two cable orientation directions.

Globally usable

It conforms to the EMC Directive and the UL Recognition. Moreover, PNP output type, which is much in demand in Europe, is also available.

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**APPLICATIONS**

**Detected post-cards**

**Detecting falling objects whose path is uncertain**

**Detecting the edges of moving objects**

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**WARNING**  
Never use this product in any personnel safety application.

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**No synchronization wire**

Wiring is saved and made simple as no synchronization wire is required between the emitter and the receiver.

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**Clearly visible indicator**

A clearly visible large indicator, having a 55 mm width, is incorporated on both the emitter and the receiver. Further, if the sensing output is directly connected to the large indicator input, the indicator can be conveniently used as a large operation indicator. Moreover, its operation is selectable between lighting or blinking.

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**Cross-beam Scanning System**

In a conventional area sensor, slim objects cannot be detected since the emitting and the receiving elements are scanned synchronously as a set. In contrast, in **NA1-11**, only the elements 1 to 11 of the emitter are scanned to obtain emission. The elements of the receiver are not scanned, so that when element 1 of the emitter emits light, all the elements of the receiver receive light. Hence, even if there is one element on the receiver which does not receive light, it results in light interrupted operation. With this technique, detection of slim objects is possible.
## ORDER GUIDE

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<thead>
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<th>Appearance</th>
<th>Sensing range (Note1)</th>
<th>Model No.(Note2)</th>
<th>Output</th>
</tr>
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<tbody>
<tr>
<td>NPN output</td>
<td></td>
<td>5 m 16.404 ft</td>
<td>NA1-11</td>
<td>NPN open-collector transistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>cable length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PNP output</td>
<td></td>
<td>0.17 to 1 m 0.558 to 3.281 ft</td>
<td>NA1-11-C5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sensing height: 100 mm 3.937 in</td>
<td>NA1-11-PN</td>
<td>PNP open-collector transistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Element pitch: 10 mm 0.394 in</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1) The sensing range is the possible setting distance between the emitter and the receiver. The sensor can detect an object less than 0.17 m 0.558 ft away.

2) The model No. with suffix "P" shown on the label affixed to the product is the emitter, "D" shown on the label is the receiver.

(e.g.) Emitter of NA1-11: NA1-11P, Receiver of NA1-11: NA1-11D

### OPTIONS

<table>
<thead>
<tr>
<th>Designation</th>
<th>Model No.</th>
<th>Description</th>
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<tbody>
<tr>
<td>Sensor mounting bracket</td>
<td>MS-NA1-1</td>
<td>Four bracket set</td>
</tr>
<tr>
<td></td>
<td>MS-NA2-1</td>
<td>Four M4 (length 15 mm 0.591 in) screws with washers, eight nuts, four hooks, four spacers and eight M4 (length 18 mm 0.709 in) screws with washers are attached. (Spacers are not attached with MS-NA1-1.)</td>
</tr>
</tbody>
</table>

Sensor mounting bracket

- **MS-NA1-1**
  - M4 screws with washers, nuts and hooks are attached.

- **MS-NA2-1**
  - M4 screws with washers, nuts, hooks and spacers are attached.
**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Item</th>
<th>NPN output (NA1-11)</th>
<th>PNP output (NA1-11-PN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensing height</td>
<td>100 mm 3.937 in</td>
<td></td>
</tr>
<tr>
<td>Sensing range (Note 2)</td>
<td>0.17 to 1 m 0.558 to 3.281 ft</td>
<td></td>
</tr>
<tr>
<td>Element pitch</td>
<td>10 mm 0.394 in</td>
<td></td>
</tr>
<tr>
<td>Number of emitting / receiving elements</td>
<td>11 Nos. each on the emitter and the receiver, respectively</td>
<td></td>
</tr>
<tr>
<td>Sensing object</td>
<td>ø13.5 mm ø0.531 in or more opaque object (Note 3)</td>
<td></td>
</tr>
<tr>
<td>Supply voltage</td>
<td>12 to 24 V DC ±10 % Ripple P-P 10 % or less</td>
<td></td>
</tr>
<tr>
<td>Current consumption</td>
<td>Emitter: 80 mA or less, Receiver: 100 mA or less</td>
<td></td>
</tr>
</tbody>
</table>

**Output**
- NPN open-collector transistor
  - Maximum sink current: 100 mA
  - Applied voltage: 30 V DC or less (between 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 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

**Short-circuit protection**
- In Dark state: 5 ms or less, In Light state: 10 ms or less

**Response time**
- Power indicator: Green LED (lights up when the power is ON)
  - Large indicator: Orange LED (lights up or blinks when the large indicator input is Low, lighting pattern is selected by operation mode switch)
- Operation indicator: Orange LED (lights up when the output is ON)
  - Large indicator: Orange LED (lights up or blinks when the large indicator input is High, lighting pattern is selected by operation mode switch)

**Indicators**

**Pollution degree**
- 3 (Industrial environment)

**Protection**
- IP62 (IEC)

**Ambient temperature**
- –10 to 55 °C +14 to +131 °F (No dew condensation or icing allowed), Storage: –20 to +70 °C –4 to +158 °F

**Ambient humidity**
- 35 to 85 % RH, Storage: 35 to 85 % RH

**Ambient illuminance**
- Incandescent light: 3,000 ℓx at the light-receiving face

**EMC**
- EN 60947-5-2

**Voltage withstandability**
- 1,000 V AC for one min. between all supply terminals connected together and enclosure

**Insulation resistance**
- 20 MΩ, or more, with 250 V DC megger between all supply terminals connected together and enclosure

**Vibration resistance**
- 10 to 150 Hz frequency, 1.5 mm 0.059 in amplitude in X, Y and Z directions for two hours each

**Shock resistance**
- 500 m/s² acceleration (50 G approx.) in X, Y and Z directions for three times each

**Emitting element**
- Infrared LED (Peak emission wavelength: 880nm 0.3535μm, cross-beam scanning system)

**Material**

**Cable**
- 0.3 mm² 4-core (emitter: 3-core) oil resistant cable, 2 m 6.562 ft long

**Cable extension**
- Extension up to total 100 m 328.084 ft is possible, for both emitter and receiver, with 0.3 mm², or more, cable.

**Weight**
- Net weight: Emitter 80 g approx., Receiver 85 g approx., Gross Weight: 210 g approx.

Notes:
1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
2) The sensing range is the possible setting distance between the emitter and the receiver. The sensor can detect an object less than 0.17 m 0.558 ft away.
3) Although this product can detect slim objects by using the cross-beam scanning system, the size of the slim object which can be stably detected differs with the setting distance. When this sensor is used to detect slim objects, make sure to confirm stable detection using the actual objects.

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## I/O CIRCUIT AND WIRING DIAGRAMS

### NA1-11

#### I/O circuit diagram

![I/O circuit diagram](image)

Notes:
1. The emitter does not incorporate the output (black).
2. Unused wires must be insulated to ensure that they do not come into contact with wires already in use.

Symbols...:
- D: Reverse supply polarity protection diode
- Z: Surge absorption zener diode
- Tr: NPN output transistor
- E: Large indicator (INDICATOR)

#### Wiring diagram

![Wiring diagram](image)

Notes:
1. The emitter does not incorporate the black lead wire.
2. Unused wires must be insulated to ensure that they do not come into contact with wires already in use.

### NA1-11-PN

#### I/O circuit diagram

![I/O circuit diagram](image)

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1. The emitter does not incorporate the output (black).
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#### Wiring diagram

![Wiring diagram](image)

Notes:
1. The emitter does not incorporate the black lead wire.
2. Unused wires must be insulated to ensure that they do not come into contact with wires already in use.

### SENSING CHARACTERISTICS (TYPICAL)

Correlation between setting distance and excess gain

![Graph](image)

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### Sensing Characteristics (Typical)

**Parallel Deviation**

**Vertical Direction**

**Horizontal Direction**

**Angular Deviation**

**Emitter Angular Deviation**

**Receiver Angular Deviation**

**Correlation between Setting Distance and Minimum Length of Detectable Object**

The minimum length of the detectable object, which lies in a plane perpendicular to the sensor front surface, varies with the setting distance, as shown in the left graph. However, note that the minimum length of the detectable object also varies with the object thickness.

*The sensing object is considered to be placed at the center of the sensing area.*

### Precautions for Proper Use

- Never use this product as a sensing device for personnel protection.
- For sensing devices to be used as safety devices for press machines or for personnel protection, use products which meet laws and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.
- If this product is used as a sensing device for personnel protection, death or serious body injury could result.
- For a product which meets safety standards, use the following products.
  - Type 4: SF4B series
  - Type 2: SF2B series

### Selection of Large Indicator Operation

- Lighting / Blinking is selected by the operation mode switch on the emitter and the receiver.

#### Operation of Large Indicator

<table>
<thead>
<tr>
<th>Operation</th>
<th>Emitter</th>
<th>Operation Mode Switch</th>
<th>Receiver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lighting</td>
<td>LIGHT</td>
<td>BLINK</td>
<td>LIGHT</td>
</tr>
<tr>
<td>Blinking</td>
<td>LIGHT</td>
<td>BLINK</td>
<td>BLINK</td>
</tr>
</tbody>
</table>

### Selection of Output Operation

- The output operation mode is selected by the operation mode switch on the receiver.

The switches must be set with the power supply off. The operation mode does not change if the switch setting is changed with the power supplied.

#### Operation Mode Switch (Receiver)

<table>
<thead>
<tr>
<th>Operation Mode Switch</th>
<th>Output Operation</th>
<th>Operation Indicator (Orange)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-ON</td>
<td>ON in Dark State</td>
<td>Lights up when the output is ON</td>
</tr>
<tr>
<td>L-ON</td>
<td>OFF in Dark State</td>
<td>Lights up when the output is ON</td>
</tr>
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</table>

Note: LIGHT / BLINK switch is not related to the output operation selection.
**PRECAUTIONS FOR PROPER USE**

Refer to General precautions.

**Others**

- Do not use during the initial transient time (0.5 sec.) after the power supply is switched on.
- Although this sensor can detect slim objects by using the cross-beam scanning system, the size of the slim object which can be stably detected differs with the setting distance. Hence, when the sensor is used to detect slim objects, make sure to confirm stable detection using the actual objects.
- In case of this sensor, light from the emitter spreads above and below the sensor. Hence, take care that if there is a reflective object above or below the sensor it will affect the sensing.

* Refer to “Parallel deviation” in “SENSING CHARACTERISTICS (TYPICAL)”.

**DIMENSIONS (Unit: mm in)**

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

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**NA1-11 NA1-11-PN**

Emitter

<table>
<thead>
<tr>
<th>Operation mode switch</th>
<th>Large indicator (Orange)</th>
<th>Power indicator (Green)</th>
</tr>
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<tbody>
<tr>
<td>ø3.7 ø0.146 cable, 2 m 6.562 ft long</td>
<td>ø3.7 ø0.146 cable, 2 m 6.562 ft long</td>
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Receiver

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**DIMENSIONS (Unit: mm in)**

**MS-NA1-1**

Assembly dimensions
Mounting drawing with the receiver

Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated)

Four bracket set

Four M4 (length 15 mm 0.591 in) screws with washers, eight nuts, four hooks and eight M4 (length 18 mm 0.709 in) screws with washers are attached.

Four M4 (length 18 mm 0.709 in) screws with washers are not used for NA1-11.

**MS-NA2-1**

Assembly dimensions
Mounting drawing with the receiver

Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated)

Four bracket set

Four M4 (length 15 mm 0.591 in) screws with washers, eight nuts, four hooks, four spacers and eight M4 (length 18 mm 0.709 in) screws with washers are attached.

**Notes:**

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