MP Motion Sensor (AMN1)

FEATURES
1. The world’s smallest with a built-in amplifier
   Extremely compact. Ideal for use in miniaturized devices.
2. Dual lens colors (white and black) are provided
   With an ultrasmall design and dual lens colors (white and black), it is inconspicuous, allowing the user to select either white or black to match the equipment color. This provides greater flexibility in equipment design.
3. Both digital output and analog output (with adjustable sensitivity) are available.
4. Built-in amplifier for easy use
   Has a built-in amplifier, and can be connected directly to a microcomputer.
   - Block diagram of the digital output circuit
   - Block diagram of the analog output circuit

5. Detects even slight motion of a person
   With our sensor, even slight motions made by people will be detected easily.
   - Fine motion detection capability within approximately 2 meters of sensor.
     Standard type:
     Detects movement of approximately 30cm (11.81 inch).
     Slight motion detection type:
     Detects movement of approximately 20cm (7.87 inch).

6. Noise withstanding capability
   Circuitry is contained in a TOS metal package, providing at least twice the noise withstanding capability as conventional type.
   - Comparison example of noise withstanding capability

APPLICATIONS
1. Home appliances
   Useful for saving energy in air conditioner, television, personal computer, or ventilator and air purifier
2. Amusement machine market
   Useful for saving energy and for automated guidance in theme parks and large video games
3. Equipment in service market
   Useful for automated guidance, automated announcements and energy saving in vending machines, ATMs, etc.
4. Lighting market
   Automated on/off controls, etc. for lamps, desk lamps, indoor lights, halls, stairway lights, etc.

ORDERING INFORMATION
Output
1: Digital output
2: Analog output
Detection performance
1: Standard detection type
2: Slight motion detection type
3: Spot detection type
4: 10m detection type
Feature
1: PC board mounting type
Operating voltage
1: 5V DC
Lens color
1: Black
2: White

NaPiOn web page URL:
http://www.napion.com/
PRODUCT TYPES

1. Digital output

<table>
<thead>
<tr>
<th>Rated operating voltage</th>
<th>Detection performance</th>
<th>Ambient temperature</th>
<th>Lens color</th>
<th>Part No.</th>
<th>Packing quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 to 6 V DC</td>
<td>Standard detection type</td>
<td>$-20 \text{ to } +60^\circ C$</td>
<td>Black</td>
<td>AMN11111</td>
<td>50 pcs.</td>
</tr>
<tr>
<td></td>
<td>Slight motion detection type</td>
<td>$-20 \text{ to } +60^\circ C$</td>
<td>White</td>
<td>AMN11112</td>
<td>1,000 pcs.</td>
</tr>
<tr>
<td></td>
<td>Spot detection type</td>
<td>$-20 \text{ to } +60^\circ C$</td>
<td>Black</td>
<td>AMN12111</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>White</td>
<td>AMN12112</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10m detection type</td>
<td></td>
<td>Black</td>
<td>AMN13111</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>White</td>
<td>AMN13112</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Black</td>
<td>AMN14111</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>White</td>
<td>AMN14112</td>
<td></td>
</tr>
</tbody>
</table>

2. Analog output

<table>
<thead>
<tr>
<th>Rated operating voltage</th>
<th>Detection performance</th>
<th>Ambient temperature</th>
<th>Lens color</th>
<th>Part No.</th>
<th>Packing quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5 to 5.5 V DC</td>
<td>Standard detection type</td>
<td>$-20 \text{ to } +60^\circ C$</td>
<td>Black</td>
<td>AMN21111</td>
<td>50 pcs.</td>
</tr>
<tr>
<td></td>
<td>Slight motion detection type</td>
<td>$-20 \text{ to } +60^\circ C$</td>
<td>White</td>
<td>AMN21112</td>
<td>1,000 pcs.</td>
</tr>
<tr>
<td></td>
<td>Spot detection type</td>
<td>$-20 \text{ to } +60^\circ C$</td>
<td>Black</td>
<td>AMN22111</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>White</td>
<td>AMN22112</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10m detection type</td>
<td></td>
<td>Black</td>
<td>AMN23111</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>White</td>
<td>AMN23112</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Black</td>
<td>AMN24111</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>White</td>
<td>AMN24112</td>
<td></td>
</tr>
</tbody>
</table>

PERFORMANCE

1. Detection performance

<table>
<thead>
<tr>
<th>Items</th>
<th>Standard detection type</th>
<th>Slight motion detection type</th>
<th>Spot detection type</th>
<th>10m detection type</th>
<th>Conditions of objects to be detected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated detection distance*Remark 1</td>
<td>5m 16.404ft (Max.)</td>
<td>2m 6.562ft (Max.)</td>
<td>5m 16.404ft (Max.)</td>
<td>10m 32.808ft (Max.)</td>
<td>1. Detectable difference in temperature between the target and background for the spot type is more than 4°C 39.2°F.</td>
</tr>
<tr>
<td>Detection range</td>
<td>Horizontal Remark 2</td>
<td>Vertical Remark 2</td>
<td></td>
<td></td>
<td>2. Movement speed (Standard detection type/Spot detection type/10m detection type: 1.0 m/s) Slight motion detection type: 0.5 m/s</td>
</tr>
<tr>
<td></td>
<td>100°</td>
<td>82°</td>
<td>38°</td>
<td>110°</td>
<td>3. Detection object = human body (size is 700mm × 250mm: 27.559inch × 9.843inch, but for the slight motion detection type the size is 200mm × 200mm: 7.874inch × 7.874inch)</td>
</tr>
<tr>
<td></td>
<td>Vertical Remark 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>91°</td>
<td>91°</td>
<td>22°</td>
<td>93°</td>
<td></td>
</tr>
<tr>
<td>Detection zone*Remark 3</td>
<td>64 zones</td>
<td>104 zones</td>
<td>24 zones</td>
<td>80 zones</td>
<td></td>
</tr>
</tbody>
</table>

2. Rating (Measuring condition: ambient temp. = 25°C 77°F) (Common to All types)

<table>
<thead>
<tr>
<th>Items</th>
<th>Specified value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply voltage</td>
<td>–0.3 to 7 V DC</td>
<td></td>
</tr>
<tr>
<td>Usable ambient temperature</td>
<td>–20 to 60°C –4 to +140°F</td>
<td>No freezing and condensing at low temperature.</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>–20 to 70°C –4 to +158°F</td>
<td></td>
</tr>
</tbody>
</table>

3. Electrical characteristics (Measuring condition: ambient temp. = 25°C 77°F; operating voltage = 5V) (Common to All types)

1. Digital output

<table>
<thead>
<tr>
<th>Items</th>
<th>Symbol</th>
<th>Specified value</th>
<th>Measured conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operating voltage</td>
<td>Vdd</td>
<td>3.0 V DC</td>
<td></td>
</tr>
<tr>
<td>Typical</td>
<td></td>
<td>6.0 V DC</td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retired consumption current</td>
<td>lw</td>
<td>170 µA</td>
<td></td>
</tr>
<tr>
<td>Typical</td>
<td></td>
<td>300 µA</td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output (when detecting)</td>
<td>Vout</td>
<td></td>
<td>Vout 7 Vdd –0.5</td>
</tr>
<tr>
<td>Voltage</td>
<td>Vdd –5</td>
<td></td>
<td>Vout Vdd (Same as operating voltage)</td>
</tr>
<tr>
<td>Circuit stability time</td>
<td>Twu</td>
<td>7 s</td>
<td>Open when not detecting</td>
</tr>
<tr>
<td>Typical</td>
<td></td>
<td>30 s</td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remark: The current which is consumed during detection consists of the standby consumed current plus the output current.
Remark: Circuit stability time: 45s max. (45s max. for the 10m detection type)

While the circuitry is stabilizing after the power is turned on, the sensor output is not fixed in the “on” state or “off” state. This is true regardless of whether or not the sensor has detected anything.

**[Timing chart]**

1) Digital output

<table>
<thead>
<tr>
<th>Power supply</th>
<th>ON</th>
<th>OFF</th>
<th>Detection state</th>
<th>Detect</th>
<th>Not detect</th>
<th>Sensor output</th>
<th>ON</th>
<th>OFF</th>
<th>Circuit stability time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vdd 4.5 V DC</td>
<td></td>
<td></td>
<td>GND 5.5 V DC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>45 s</td>
</tr>
</tbody>
</table>

Remark: Circuit stability time: 45s max. (45s max. for the 10m detection type)

While the circuitry is stabilizing after the power is turned on, the sensor output is not fixed in the “on” state or “off” state. This is true regardless of whether or not the sensor has detected anything.

2) Analog output

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Vdd</th>
<th>GND</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Detection state (Comparator decision output)</th>
<th>Detect</th>
<th>Not detect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vout 2.3 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output offset average voltage Voff 2.5 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steady-state noise Vn 130 m Vp-p</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit stability time Twu 7 s</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: To set to the same detection performance as the digital type, set the output voltage to the offset voltage (2.5V) ±0.45V (i.e. 2.95V or more and 2.05V or less).

Remark: Circuit stability time: 30s max.

While the circuitry is stabilizing after the power is turned on, the sensor output is not fixed in the “on” state or “off” state. This is true regardless of whether or not the sensor has detected anything.
DETECTION PERFORMANCE

1. Standard detection type

X-Y cross section

Remarks: 1. The X-Y cross-sectional diagram shows the detection area.
2. The differences in the detection zone patterns are indicative of the projections of the 16 lenses with single focal point and with five optical axes. An object whose temperature differs from the background temperature and which crosses inside the detection zone will be detected.

2. Slight motion detection type

X-Y cross section

Remarks: 1. The X-Y cross-sectional diagram shows the detection area.
2. The differences in the detection zone patterns are indicative of the projections of the 26 lenses with single focal point and with three optical axes. An object whose temperature differs from the background temperature and which crosses inside the detection zone will be detected.
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3. Spot detection type

The detection zone has the polarity shown in the diagram on the right. When targets enter both the + and – zones with the same timing, the signals are cancelled each other, thus in this case there is a possibility that the object cannot be detected at the maximum specified detection distance.

4. 10m detection type

Remarks: 1. The X-Y cross-sectional diagram shows the detection area.
2. The differences in the detection zone patterns are indicative of the projections of the 6 lenses with single focal point and with two optical axes. An object whose temperature differs from the background temperature and which crosses inside the detection zone will be detected.

5. Notes regarding the detection zone

The detection zone has the polarity shown in the diagram on the right. When targets enter both the + and – zones with the same timing, the signals are cancelled each other, thus in this case there is a possibility that the object cannot be detected at the maximum specified detection distance.
HOW TO USE

1. Wiring diagram
   1) Digital output

   ![Digital Output Diagram]

   - Vdd: Input power source (DC)
   - GND: GND
   - Out: Output (Comparator)
   - Iout: Max. 100 µA

2) Analog output

   ![Analog Output Diagram]

   - Vdd: Input power source (DC)
   - GND: GND
   - Out: Output (Comparator)
   - Microcomputer, A/D converter etc.

2. Timer circuit example
   1) Digital output

   ![Timer Circuit Diagram]

   Note: This is the reference circuit which drives the MP motion sensor. Install a noise filter for applications requiring enhanced detection reliability and noise withstanding capability. Differences in the specifications of electronic components to which the units are connected sometimes affect their correct operation; please check the units' performance and reliability for each application.

2) Analog output

   ![Timer Circuit Diagram]

   Note: This circuit is a sample of a drive circuit for the MP Motion Sensor. Its noise resistance and long-term reliability are not considered or investigated. To improve the detection reliability and noise resistance of the circuit, consider adding a noise filter. Matsushita Electric Works, Ltd. accepts no responsibility for damages resulting from the use of this circuit.

3. Installation

   Install the sensor so that people will be entering from the X or Y direction shown below. If persons approach the sensor from the Z direction, detection distance will be shortened.
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DIMENSIONS

1. Standard detection type

Recommended PC board pattern (BOTTOM VIEW)

Notes: 1. In order to ensure proper detection, install it with the lens exposed at least 3.5mm (.138 inch).
2. As for panel mounting hole, tapering or making a large size hole should be done.
3. The height dimension does not include the remaining molding gate.

2. Slight motion detection type

Recommended PC board pattern (BOTTOM VIEW)

Notes: 1. In order to ensure proper detection, install it with the lens exposed at least 2.4mm (.094 inch).
2. As for panel mounting hole, tapering or making a large size hole should be done.
3. The height dimension does not include the remaining molding gate.
3. Spot detection type

Recommended PC board pattern (BOTTOM VIEW)

Notes:
1. As for panel mounting hole, tapering or making a large size hole should be done.
2. The height dimension does not include the remaining molding gate.

4. 10m detection type

Recommended PC board pattern (BOTTOM VIEW)

Notes:
1. In order to ensure proper detection, install it with the lens exposed at least 5.6mm exposed at least 5.6mm.
2. As for panel mounting hole, tapering or making a large size hole should be done.
3. The height dimension does not include the remaining molding gate.

NOTES

1. Checkpoints relating to principle of operation

MP motion sensors are passive infrared sensors which detect changes in the infrared rays. They may fail to detect successfully if a heat source other than a human being is detected or if there are no temperature changes in or movement of a heat source. Care must generally be taken in the following cases. The performance and reliability of the sensors must be checked out under conditions of actual use.

<1> Cases where a heat source other than a human being is detected.

1) When a small animal enters the detection range.
2) When the sensor is directly exposed to sunlight, a vehicle’s headlights, an incandescent light or some other source of far infrared rays.
3) When the temperature inside the detection range has changed suddenly due to the entry of cold or warm air from an air-conditioning or heating unit, water vapor from a humidifier, etc.

<2> Cases where it is difficult to detect the heat source

1) When an object made of glass, acrylic or other subject which far infrared rays have difficulty passing through is located between the sensor and what is to be detected.
2) When the heat source inside the detection range hardly moves or when it moves at high speed; for details on the movement speed, refer to the section on the performance ratings.
3) The sensor may be damaged if it is exposed to static with a voltage exceeding ±200V. Therefore, do not touch its terminals directly, and exercise adequate care in the handling of the sensor.
4) When the leads are to be soldered, solder them by hand for less than 3 seconds at a temperature of less than 350°C / 662°F at the tip of the soldering iron. Avoid using a solder bath since this will cause a deterioration in the sensor’s performance.
5) Do not attempt to clean the sensor. Cleaning fluid may enter inside the lens area causing a deterioration in performance.

For the general precautions, refer to the Notes for Motion Sensors on page 24.