Building Gate Access Control

-Human temperature monitoring using the Thermal IR sensor-
The contactless Thermal IR sensor can support temperature monitoring applications such as on an access gate or entryway.

Omron IR sensor key feature

1. Touchless
   Suitable for gate access applications

2. I2C digital output
   Ease for customer to utilize data

3. PCB module type
   Chipset includes software to convert readings to temperature.
   Customer does not need to develop own calculations

*Note: Omron IR sensor provide only temperature data, and system side algorism are all depend on customer.
Omron has a broad product portfolio of IR sensor.

**Matrix type (4x4) is recommended** for gate access control applications.

<table>
<thead>
<tr>
<th></th>
<th>D6T-1A-01</th>
<th>D6T-1A-02</th>
<th>D6T-8L-09</th>
<th>D6T-8L-09H</th>
<th>D6T-44L-06</th>
<th>D6T-44L-06H</th>
<th>D6T-32L-01A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pixel number</td>
<td>1x1</td>
<td>1x1</td>
<td>1x8 (8pixel)</td>
<td>1x8 (8pixel)</td>
<td>4x4 (16pixel)</td>
<td>4x4 (16pixel)</td>
<td>32x32 (1024pixel)</td>
</tr>
<tr>
<td>Appearance &amp; Pixel image (+1)</td>
<td><img src="image1" alt="Pixel image" /></td>
<td><img src="image2" alt="Pixel image" /></td>
<td><img src="image3" alt="Pixel image" /></td>
<td><img src="image4" alt="Pixel image" /></td>
<td><img src="image5" alt="Pixel image" /></td>
<td><img src="image6" alt="Pixel image" /></td>
<td><img src="image7" alt="Pixel image" /></td>
</tr>
<tr>
<td>FOV (Field of view)</td>
<td>X : 58° Y : 58°</td>
<td>X : 26.5° Y : 26.5°</td>
<td>X : 54.5° Y : 5.5°</td>
<td>X : 54.5° Y : 5.5°</td>
<td>X : 44.2° Y : 45.7°</td>
<td>X : 44.2° Y : 45.7°</td>
<td>X : 90° Y : 90°</td>
</tr>
<tr>
<td>Object temp</td>
<td>5 to 50°C</td>
<td>-40 to 80°C</td>
<td>5 to 50°C</td>
<td>5 to 200°C</td>
<td>5 to 50°C</td>
<td>5 to 200°C</td>
<td>0 to 200°C</td>
</tr>
<tr>
<td>Operating temp</td>
<td>0 to 60°C</td>
<td>-40 to 80°C</td>
<td>5 to 50°C</td>
<td>0 to 60°C</td>
<td>0 to 50°C</td>
<td>0 to 50°C</td>
<td>-10 to 70°C</td>
</tr>
<tr>
<td>Temp resolution (NETD)</td>
<td>0.02°C</td>
<td>0.06°C</td>
<td>0.03°C</td>
<td>0.03°C</td>
<td>0.06°C</td>
<td>0.06°C</td>
<td>0.33°C</td>
</tr>
<tr>
<td>Object temp accuracy</td>
<td>±1.5°C max (+2)</td>
<td>±3°C max (+3)</td>
<td>±3°C max (+3)</td>
<td>±3°C max (+3)</td>
<td>±3°C max (+3)</td>
<td>±3°C max (+3)</td>
<td>±3°C max (+3)</td>
</tr>
<tr>
<td>Consumption</td>
<td>3.5mA typ</td>
<td>5mA typ</td>
<td>19mA typ</td>
<td>19mA typ</td>
<td>19mA typ</td>
<td>19mA typ</td>
<td>19mA typ</td>
</tr>
<tr>
<td>Comm interface</td>
<td>I2C</td>
<td>I2C</td>
<td>I2C</td>
<td>I2C</td>
<td>I2C</td>
<td>I2C</td>
<td>I2C</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>4.5 to 5.5VDC</td>
<td>4.5 to 5.5VDC</td>
<td>4.5 to 5.5VDC</td>
<td>4.5 to 5.5VDC</td>
<td>4.5 to 5.5VDC</td>
<td>4.5 to 5.5VDC</td>
<td>4.5 to 5.5VDC</td>
</tr>
</tbody>
</table>

*1 : Actual output of D6T sensor is only temperature figure (not thermal image).

*2 : Measurement condition (1) Tx=25°C, Ta=25°C (2) Tx=45°C, Ta=25°C (3) Tx=45°C, Ta=45°C. Detail conditions are listed in data sheet.

*3 : Measurement condition Tx=25°C, Ta=25°C central 16 pixel area
Why Matrix Type (4x4) is Recommended

- IR sensor output is average temperature in each pixel.
- Typical required distance of gate access application is around 50cm.
- Matrix type makes it easy to separate human from background temperature.

Matrix type (4x4)

- Background
- Background + Human
- Human

Single Pixel type (1x1)

- Background + Human in FOV
- Output is average temp of human face + background
Tips | 2 point calibration by customer

● Omron IR sensor guarantees absolute temperature accuracy of ±1.5°C (*1)
● If higher accuracy is needed within a certain range, **customer calibration** is recommended (*2)
● 2 point calibration is a better way to improve accuracy.

---

**How to?**

1. Set the object (blackbody) temperature to the lower (\(y_0\)) and upper (\(y_1\)) limits of your operating temperature range.
2. For each sensor, read the sensor output \(x_0\) and \(x_1\) at the points \(y_0\) and \(y_1\).
   * It is recommended to start reading data 15 minutes after turning on the sensor and the average is based on the measurement data from at least 10 points
3. The sensor output value is corrected by incorporating a calculation formula for correction into the master MCU. If the sensor output value is \(x\) and the corrected object temperature is \(y\), the formula is below.
   \[
   y = y_0 + \left( \frac{y_1 - y_0}{x_1 - x_0} \right) (x - x_0)
   \]

---

**Result**

Accuracy can improve to ±0.2°C by 2 point calibration. (*3)

- Calibration condition: \(T_x=32^\circ C\) and \(38^\circ C\)
- Test condition: \(T_x=35^\circ C\) / \(T_a=25^\circ C\) and \(20^\circ C\)

**Ex.)**

In the case where the read data from a blackbody at 32°C and 37°C with D6T is 32.1°C and 37.2°C, when the sensor output value is 35.0 °C, the object temperature after correction is the below.

\[
y = 32 + \left( 37 - 32 \right) \times \left( \frac{35.0 - 32.1}{37.2 - 32.1} \right) = 34.8^\circ C
\]

---

*1 : Not include D6T-32L-01A. Measurement condition (1) \(T_x=25^\circ C, T_a=25^\circ C\) (2) \(T_x=45^\circ C, T_a=25^\circ C\) (3) \(T_x=45^\circ C, T_a=45^\circ C\). Detail conditions are listed in data sheet.
*2 : Technical information of calibration in this document is reference. Omron never guarantee any calibration result in customer side.
*3 : This is Omron internal test result without any guarantee for customer.
Omron IR sensor guarantees absolute temperature accuracy of ±1.5°C (*1)

If higher accuracy is needed within a certain range, **customer calibration** is recommended (*2)

**1 point calibration** is a faster way to improve accuracy, but with limited improvement

---

**How to?**

1. Set the object (blackbody) temperature to the center \((x_0)\) of your operating temperature range.

2. Read the output data \(P_n(x_0)\) for each sensor and calculate the difference \(e_0\) from \(x_0\).

\[
e_0 = x_0 - P_n(x_0)
\]

3. The sensor output value is corrected by incorporating a calculation formula for correction into the master MCU. If the sensor output value is \(P_n\) and the corrected object temperature is \(y\), the formula is below.

\[
y = P_n + e_0
\]

---

**Result**

5pcs sample test: After calibration

The error increases as you move away from the corrected point.

(For example) \(x_0 = \pm 2\) °C

Maximum error \(e_{max} \approx \pm 0.3\) °C

---

*1 : Not include D6T-32L-01A.Measurement condition (1) Tx=25°C, Ta=25°C (2) Tx=45°C, Ta=25°C (3) Tx=45°C, Ta=45°C. Detail conditions are listed in data sheet.

*2 : Technical information of calibration in this document is reference. Omron never guarantee any calibration result in customer side.

*3 : This is Omron internal test result without any guarantee for customer.
Tips | How to read black body temperature

- Both calibration through “application + sensor” and “sensor only” can work to improve accuracy.
- Below slide shows detailed way of calibration using only the sensor, by the customer

Key point 1: The distance between D6T and the black body depends on the FOV.

Key point 2: Do not hold sensor in your hand when measuring. The sensor can be affected by temperature of hand.

Be sure to attach sensor to a fixed jig or an enclosure of product and measure it from this point.

Example of sensor fixing method

Connecting multiple D6T sensors

Distance setting for calibration by black body

The distance between the D6T and Blackbody must be adjusted according to the size of the blackbody.

<table>
<thead>
<tr>
<th>Type</th>
<th>Direction</th>
<th>FOV</th>
<th>Detection area (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>d = 50</td>
</tr>
<tr>
<td>D6T-1A-01</td>
<td>X / Y</td>
<td>58°</td>
<td>55.4</td>
</tr>
<tr>
<td>D6T-1A-02</td>
<td>X / Y</td>
<td>26.5°</td>
<td>23.5</td>
</tr>
<tr>
<td>D6T-8L-09</td>
<td>X</td>
<td>54.8°</td>
<td>51.5</td>
</tr>
<tr>
<td></td>
<td>Y</td>
<td>5.5°</td>
<td>4.8</td>
</tr>
<tr>
<td>D6T-44L-06</td>
<td>X</td>
<td>44.2°</td>
<td>40.6</td>
</tr>
<tr>
<td></td>
<td>Y</td>
<td>45.7°</td>
<td>42.1</td>
</tr>
<tr>
<td>D6T-32L-01A</td>
<td>X / Y</td>
<td>90°</td>
<td>100.0</td>
</tr>
</tbody>
</table>
If you need further information...

**IR sensor contact list**
Please contact Omron sales or distributors directly, or send web inquiry using the links below.

- **EU**: [http://components.omron.eu/](http://components.omron.eu/)
- **Greater China**: [https://www.ecb.omron.com.cn/web/cn/contact-us-form?inquiryType=sensor&support=1](https://www.ecb.omron.com.cn/web/cn/contact-us-form?inquiryType=sensor&support=1)
- **Asia pacific**: [https://ecb.omron.com.sg/web/ap/contact-us-form?inquiryType=sensor&support=1](https://ecb.omron.com.sg/web/ap/contact-us-form?inquiryType=sensor&support=1)

**IR sensor data sheet**
Please download data sheet from below link.


**Another solution**
In addition to IR sensor, Omron has face image sensing technology for gate access control.