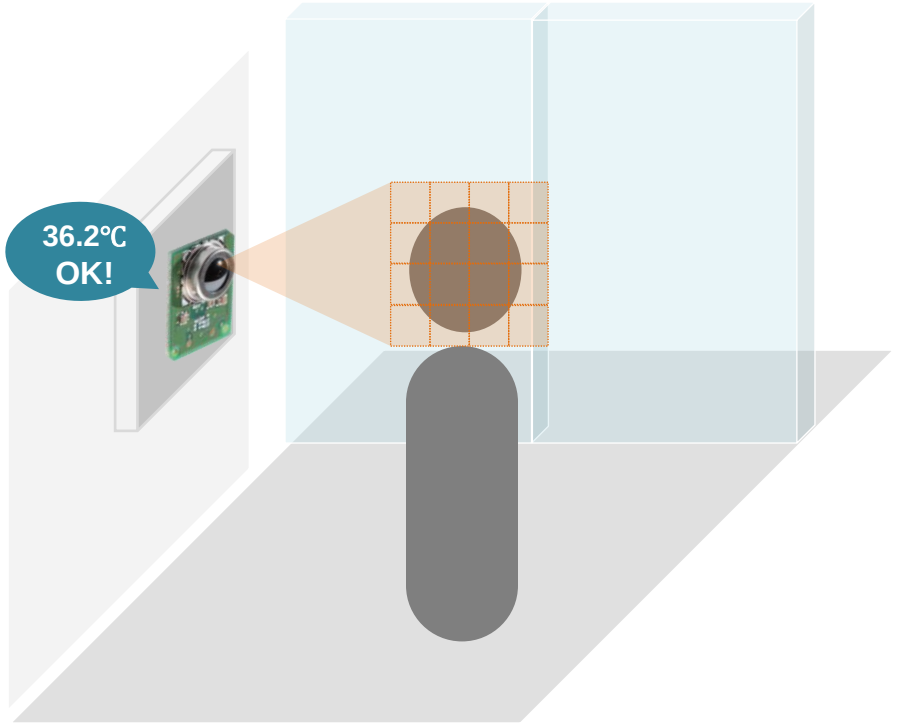
Building Gate Access Control

-Human temperature monitoring using the Thermal IR sensor-

Gate Access Control

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

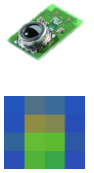
2. **I2C digital output**
   Ease for customer to utilize data

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 IR Sensor Portfolio

- Omron has a broad product portfolio of IR sensor.
- **Matrix type (4x4) is recommended** for gate access control applications.

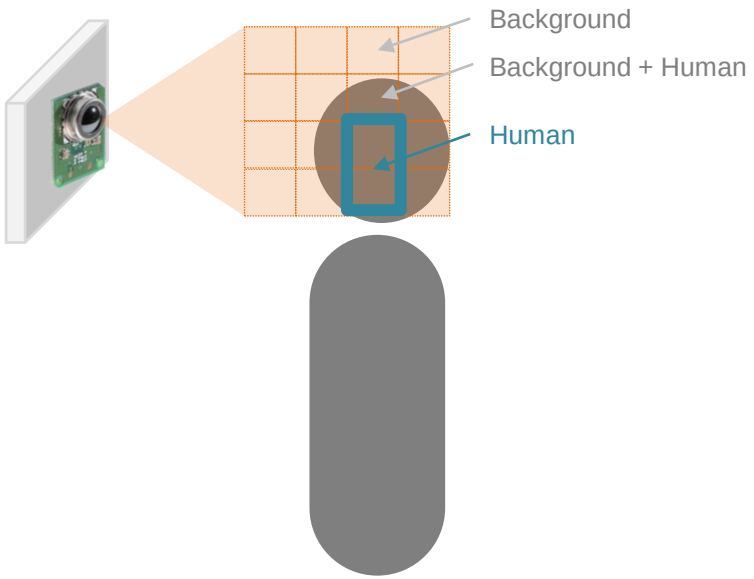
	D6T-1A-01	D6T-1A-02	D6T-8L-09	D6T-8L-09H	D6T-44L-06	D6T-44L-06H	D6T-32L-01A
Pixel number	1x1	1x1	1x8 (8pxcel)	1x8 (8pixel)	4x4 (16pixel)	4x4 (16pixel)	32x32 (1024pixel)
Appearance & Pixel image (*1)							
FOV (Field of view)	X : 58° Y : 58°	X : 26.5° Y : 26.5°	X : 54.5° Y : 5.5°	X : 54.5° Y : 5.5°	X : 44.2° Y : 45.7°	X : 44.2° Y : 45.7°	X : 90° Y : 90°
Object temp	5 to 50℃	-40 to 80℃	5 to 50℃	**5 to 200℃**	5 to 50℃	**5 to 200℃**	**0 to 200℃**
Operating temp	0 to 60℃	-40 to 80℃	0 to 60℃	0 to 60℃	0 to 50℃	0 to 50℃	-10 to 70℃
Temp resolution (NETD)	0.02℃	0.06℃	0.03℃	0.03℃	0.06℃	0.06℃	0.33℃
Object temp accuracy	±1.5℃ max (*2)						±3℃ max (*3)
Consumption	3.5mA typ		5mA typ				19mA typ
Comm interface	I2C						
Supply voltage	4.5 to 5.5VDC						

*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℃, Ta=25℃ central 16 pixel area

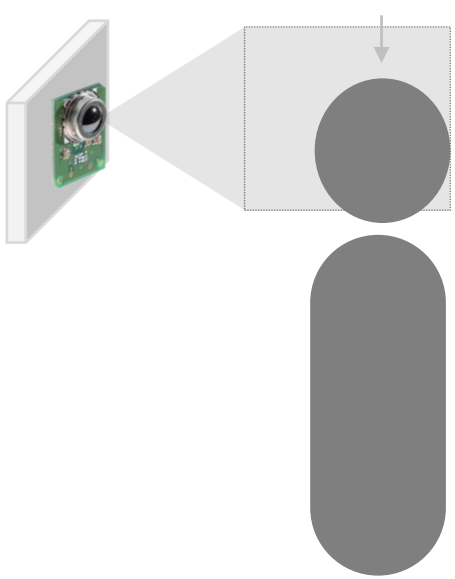
Why Matrix Type (4x4) is Recommended

- 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)



Single Pixel type (1x1)



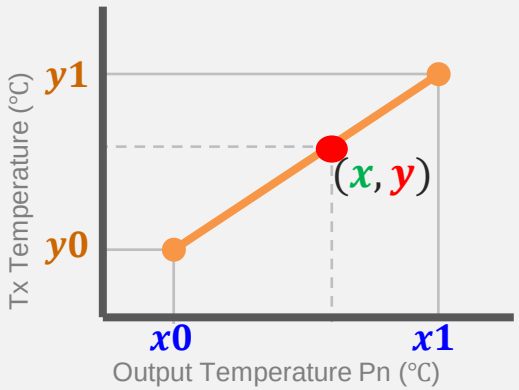
Background + Human in FOV

Output is average temp of human face + background

Tips | 2 point calibration by customer

- Omron IR sensor guarantees absolute temperature accuracy of ±1.5℃ (*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 $(y0)$ and upper $(y1)$ limits of your operating temperature range.

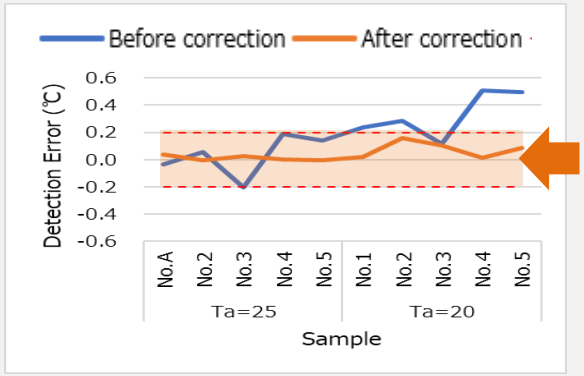
2. For each sensor, read the sensor output $x0$ and $x1$ at the points $y0$ and $y1$.
   ＊It is recommended to start reading data 15 minutes after turning on the sensor and the average is based on the measurement data from at least 10 points

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.

$$y = y0 + (y1 - y0)\frac{x - x0}{x1 - x0}$$

Result

5pcs sample test : Before/After calibration



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

- Calibration condition : Tx=32℃ and 38℃
- Test condition : Tx=35℃ / Ta=25℃ and 20℃

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

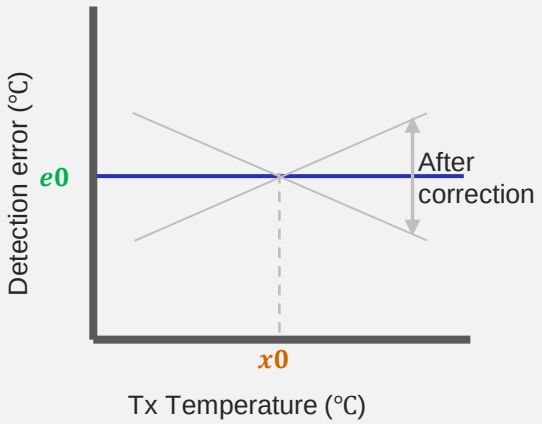
y= 32 + (37 – 32) x (35.0 – 32.1) / (37.2 – 32.1) =**34.8 ℃**

*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 | 1 point calibration by customer

- Omron IR sensor guarantees absolute temperature accuracy of ±1.5℃ (*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 ($x0$) of your operating temperature range.

2.Read the output data $Pn(x0)$ for each sensor and calculate the difference $e0$ from $x0$.

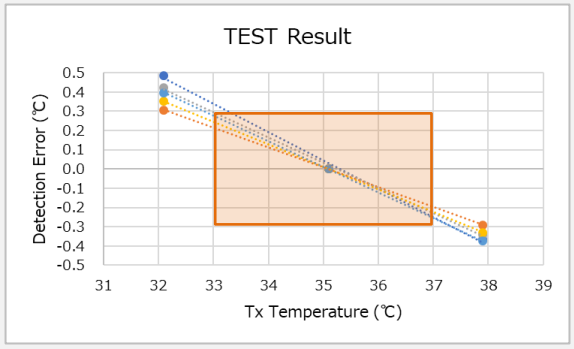
$$e0 = x0 - Pn(x0)$$

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

$$y = Pn + e0$$

Result

5pcs sample test : After calibration



The error increases as you move away from the corrected point.
(For example) $x0$ = ±2 ℃
Maximum error $emax$ ≒ ±0.3℃

Ex.)
In the case where the read data from a blackbody at 35℃ with D6T is 35.3℃,
e0 = 35.0 - 35.3 = -0.3℃

When the sensor output is 35.5 ℃, the object temperature after correction is the following calculation.
y= 35.5 + (-0.3) = 35.2℃

*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.

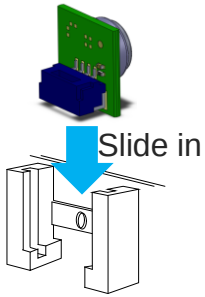
Tips | How to read black body temperature

- 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

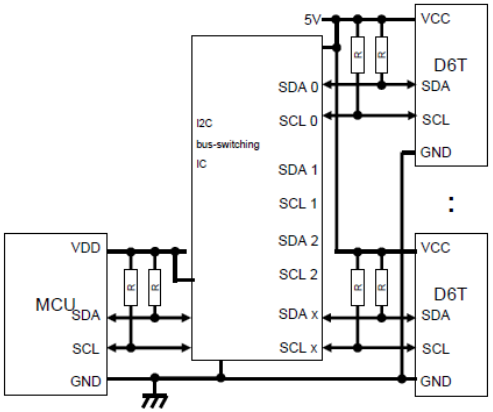
Key point 1: The distance between D6T and the black body depends on the FOV.

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

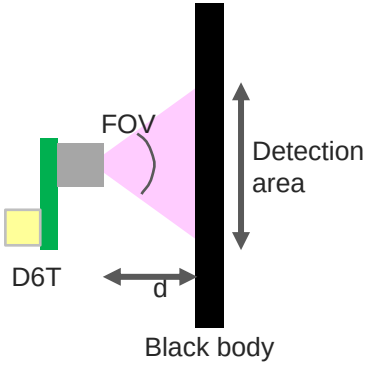


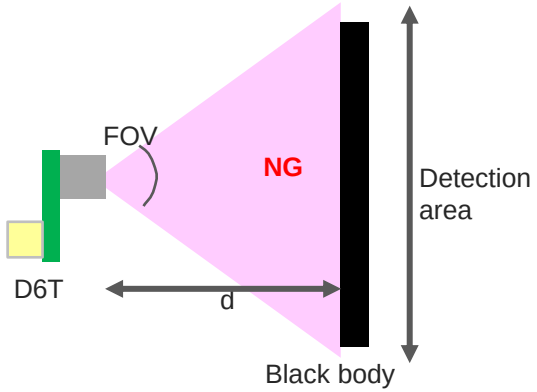
Connecting multiple D6T sensors



Distance setting for calibration by black body

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





Type	Direction	FOV	Detection area (mm)			
			d = 50	d = 100	d = 150	d = 200
D6T-1A-01	X / Y	58°	**55.4**	**110.9**	**166.3**	**221.7**
D6T-1A-02	X / Y	26.5°	**23.5**	**47.1**	**70.6**	**94.2**
D6T-8L-09	X	54.8°	**51.5**	**103.0**	**154.5**	**206.0**
	Y	5.5°	**4.8**	**9.6**	**14.4**	**19.2**
D6T-44L-06	X	44.2°	**40.6**	**81.2**	**121.8**	**162.4**
	Y	45.7°	**42.1**	**84.3**	**126.4**	**168.6**
D6T-32L-01A	X / Y	90°	**100.0**	**200.0**	**300.0**	**400.0**

If you need further information…

IR sensor contact list

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

US : https://www.components.omron.com/web/en/contact-us-form?inquiryType=sensor&support=1

EU : http://components.omron.eu/

Greater China : 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

Japan : https://fm.plus-sensing.omron.com/webapp/form/18934_gacb_78/index.do

IR sensor data sheet

Please download data sheet from below link.

English : https://omronfs.omron.com/en_US/ecb/products/pdf/en_D6T_catalog.pdf

中文：https://omronfs.omron.com/zh_CN/ecb/products/pdf/CN_D6T_Catalog.pdf

日本語：https://omronfs.omron.com/ja_JP/ecb/products/pdf/d6t_new.pdf

Another solution

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

https://www.components.omron.com/mobile/hvc_p2?nodeId=40701010