Panasonic

((PaPIRs))

FAQ's 2025

PIR MOTION SENSORS

Special designs from Panasonic that provide high sensitivity and reliability

Contents

Operating principle, usage related

Electrical connection, output signal related

Related to product specifications, etc.

■ About sources

The information in this document is based on the respective information as of November 2024.
Product information is subject to change without notice.

■ About the Q&A collection

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Before adopting our products, please confirm the latest information on the products in the specifications, catalogs, etc., and fully evaluate the product on actual equipment to determine its applicability at your own risk.
The contents of this search are our estimates based on official information from each manufacturer at the time of acquisition.
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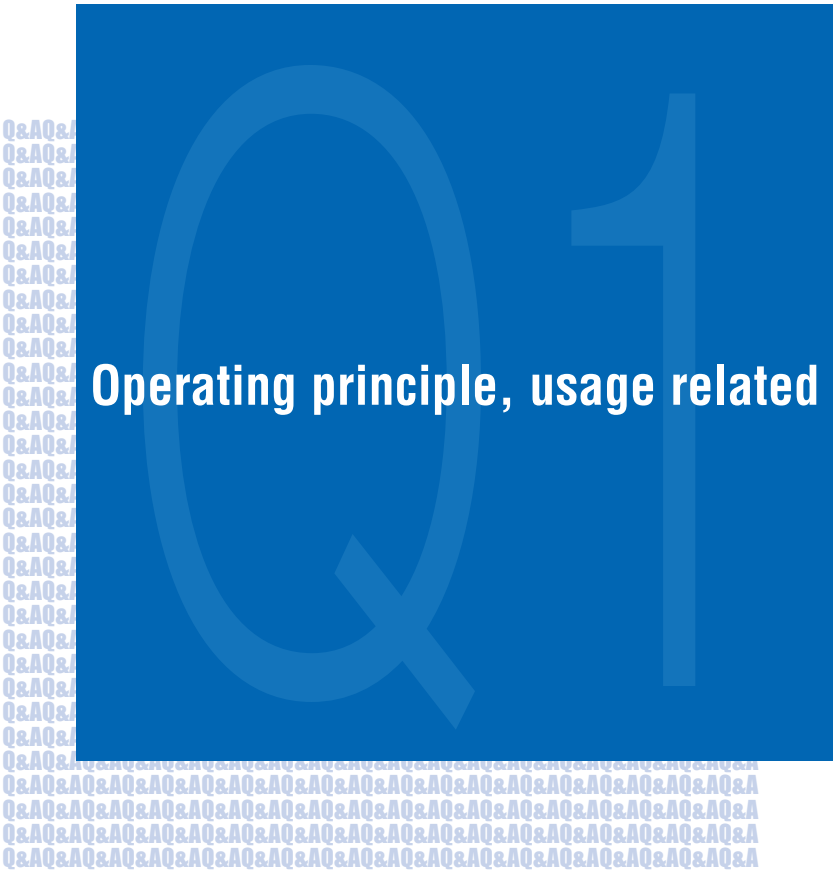

Q1
Operating principle, usage related

Q1-1 Can a single Panasonic Passive Infrared sensor detect the specific position of where person is located in an area?

No, specific position detection of a person is not possible.
Panasonic passive infrared sensors have a QUAD sensing element, meaning only one sensor component with four pyroelectric, heat receiving elements which are all interconnected. The lens determines the size and shape of the detection area, as well as the distribution and number of the switching zones.
Therefore, because there is only one sensor component, it cannot identify where the infrared source is coming from within the detection area.
On the other hand, if you use multiple Panasonic passive infrared sensors, it maybe possible to identify the approximate position of person.

Q1-2 Can Panasonic Passive infrared sensors detect even if human body temperature is lower than ambient temperature?

Yes, detection is possible.
Panasonic Passive infrared sensors are able to detect movement through the interpretation of temperature differentials. A human body can be detected whether it is higher or lower than the ambient temperature. However, since the surface of the human body is affected by the ambient temperature to a certain extent, the sensitivity of the sensor may deteriorate if the body and ambient temperatures equalize.

Q1-3 Do Panasonic Passive infrared sensors detect animals or other objects aside from humans?

Yes, detection is possible.
Pyroelectric sensors react to a change in intensity of infrared radiation within the specified detection criteria. All objects on earth emit infrared radiation and are therefore detected if they are moving and the if change in intensity is large enough to be detected (animals, insects, cleaning robots, curtains, flying objects, rain, etc.).

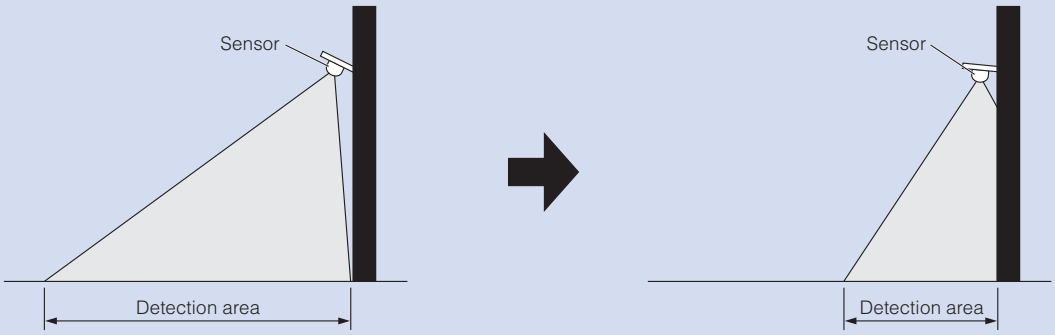
Q1-4 Is light for motion detection constantly emitted from the lens?

No, light is never emitted from the sensor.
PaPIRs are passive infrared sensors, which means that they do NOT emit infrared radiation to detect motion. Instead, the sensor operates by receiving infrared radiation emitted from a moving object. Therefore it is called a “Passive type” sensor.

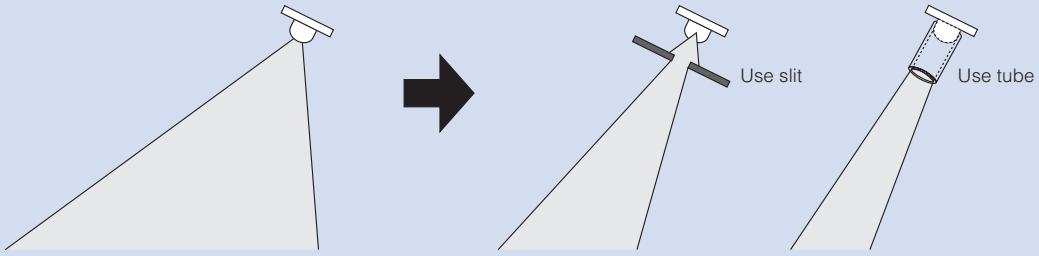
Q1-5 Although the detection range of standard lens type is 5m, is it possible for detection distance to be shorter?

Yes, although the sensor itself can not adjust detection distance on its own due to the principal of its operation. In order to set the limitation of detection range, the sensor should be pointed toward an obstacle such as ground, wall, or ceiling.
Additionally, it is also effective to limit the detection range by blocking the incoming infrared light by using a transmittance reducing material in front of the lens like Polyethylene.
Another possibility would be to use the analog sensor with amplifier output. With this sensor you can adjust the sensitivity to a certain degree by adjusting the switching thresholds within a software or with the help of a window comparator.

● Setting the sensor so it will not detect people who are far away



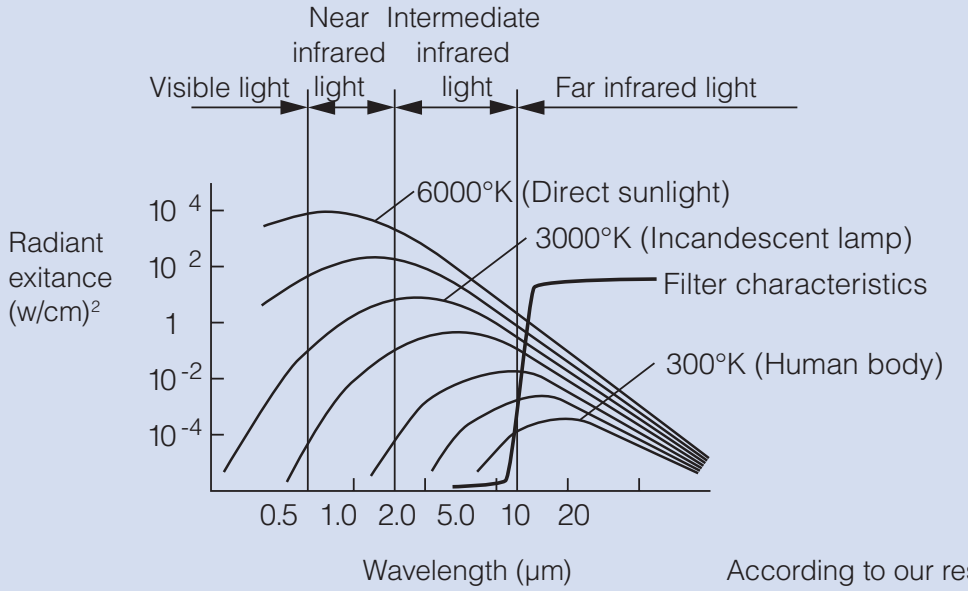
● For detection in only a limited area



Q1-6 How long is the detectable infrared wavelength?

As indicated below, the sensor uses an optical filter with light transmission characteristics of approximately 5µm or longer.
It is defined as a long wavelength (far infrared) which is from approximately 5 - 15µm.

■ Wavelength characteristics



According to our research

Q1-7 What are "pyroelectric elements"?

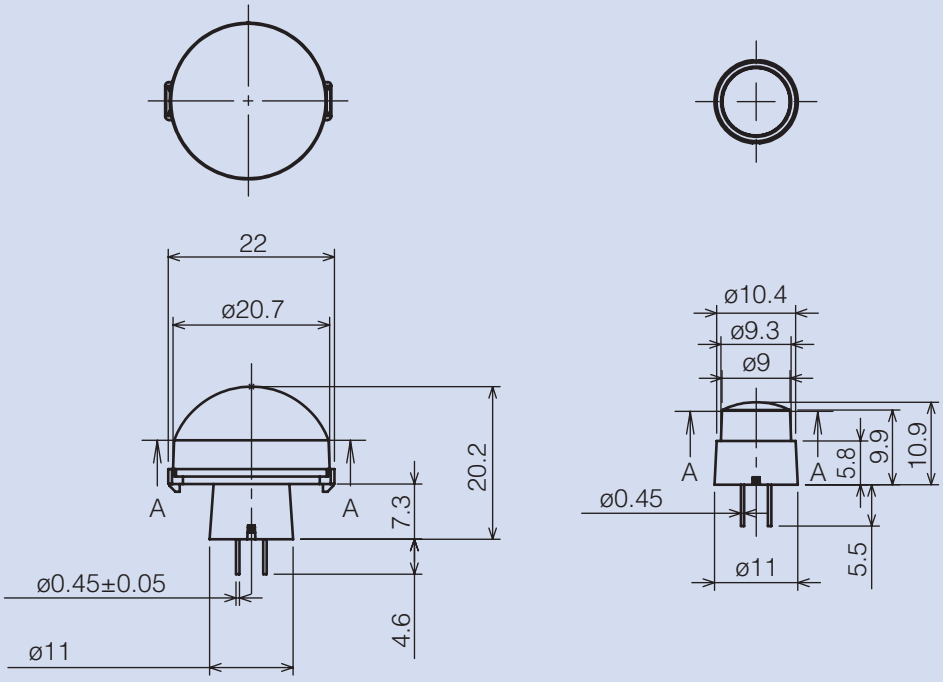
Pyroelectric elements are pyroelectric crystals provided with electrodes. With the help of an optical system, incident infrared radiation emitted by a moving person, for example, is focused on these pyroelectric elements by means of a lens, causing the crystals to change temperature. This temperature change leads to a charge shift at the electrodes. This charge shift generates a measurable voltage which is used to detect moving objects within the specified detection area.
PaPIRs are quad sensors, which means that four pyroelectric crystals are connected together on a carrier substrate. In contrast to sensors with one or only two pyroelectric elements, the probability of a triggering error is reduced with a quad sensor. False triggers can usually be caused by thermal interference sources in the environment, for example, by spontaneous shading of an object heated by the sun or quickly adjustable heat sources.

Q1-8 Is it possible to use PaPIRs in outdoor applications?

Only with certain precautions.
Panasonic passive infrared sensors are designed for indoor use with common indoor electronic devices.
If you need to use a sensor outdoors please take measures to waterproof the sensor and protect it from dust, condensation, and freezing.
There are many causes of temperature changes outdoors and because of that detection errors may result.

Q1-9 How should the sensor be waterproofed?

The sensor itself is not water-proof.
It is necessary to take water-proof measures by using O-rings or gaskets for example or HDPE suitable potting material (please contact potting material experts for HDPE suitable potting materials).
The high-density, long-distance, and low-profile lenses have a step for which O-rings or gasket seals can be placed (maybe CAD based pictures are a little bit more representative here).

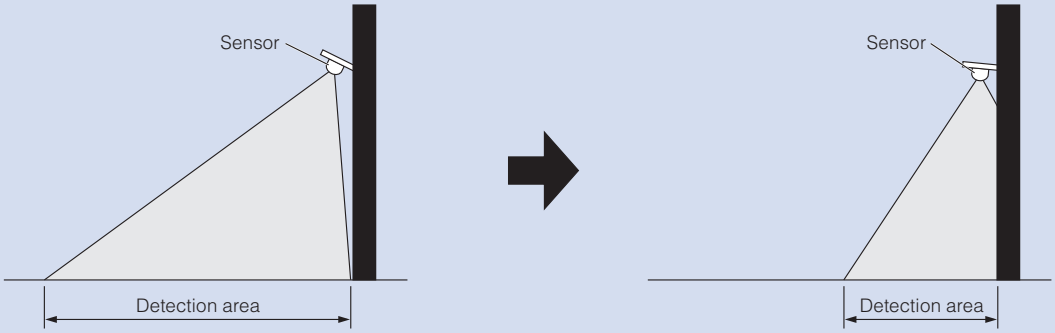


[ø20.45mm (High density & Long-distance)] [ø9.3mm (Low-profile)]

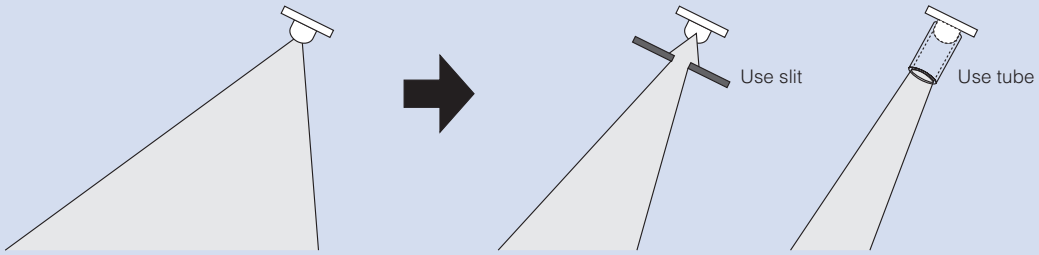
Q1-10 Can I change the detection area?

Yes, you can depending on the setting.
The detection area can be changed by changing the angle of the mounting of the sensor and by placing a cover with a slit or a mask in front of the sensor that limits the area detected by reducing the F.O.V. (Field of View).
If you find it difficult to calculate the desired detection area, please ask us. We can possibly create a field of view simulation upon request.

● Setting the sensor so it will not detect people who are far away



● For detection in only a limited area



Q1-11 Can the sensor be installed on a moving body?

No, the sensor is not suitable for mounting on moving objects.
PaPIRs are normally installed in a stationary devices. When an object enters the detection area, the sensor detects a change in the amount of infrared radiation in the detection area. If the sensor were to move, it would mistake changes in wall and floor temperature for a moving object, which would incorrectly lead to detection.
Strong shocks and vibrations can cause false alarms too, and in the worst case damage the sensor.

Q1-12 Is detection possible when the distance between the person and the sensor is almost zero?

Yes.
Panasonic Passive infrared sensors detect when a human enters or exits the specified detection area.
However, if the person is too close to the sensor, the entire detection area is covered by the upper body, for example. As a result, temperature changes are less likely to occur with small movements in the detection area.
In addition, detection can be difficult if a person moves through the detection area at an extremely short distance, very quickly. In this case, the temperature change could be too fast for the sensor.

Q1-13 Can Panasonic Passive infrared sensors detect through a transparent plate such as glass or acrylic?

No, it cannot a person through these materials.
The wavelength which can be detected by this sensor is over 5μm.
Ordinary, light wavelengths passing through glass are limited to 2μm. Since the sensor can only detect infrared wavelengths greater than 5μm, glass would render the sensor unable to detect a person on the other side.
As an alternative we suggest using a polyethylene sheet which allows for infrared light to pass through. However, if a sensor is placed opposite or close to a window, etc., it may react if the ambient temperature changes quickly enough, for example if the sun is shaded by clouds, etc.

Q1-14 Does the detection sensitivity change due to the ambient temperature?

Yes, it does.
During summer, when the difference between surface temperature of a human body and the background temperature is small, the sensitivity decreases. Conversely, during the winter, the sensitivity can increase all depending on amount of temperature differential between the object and background ambient.

Q1-15 Is there any impact by sunlight?

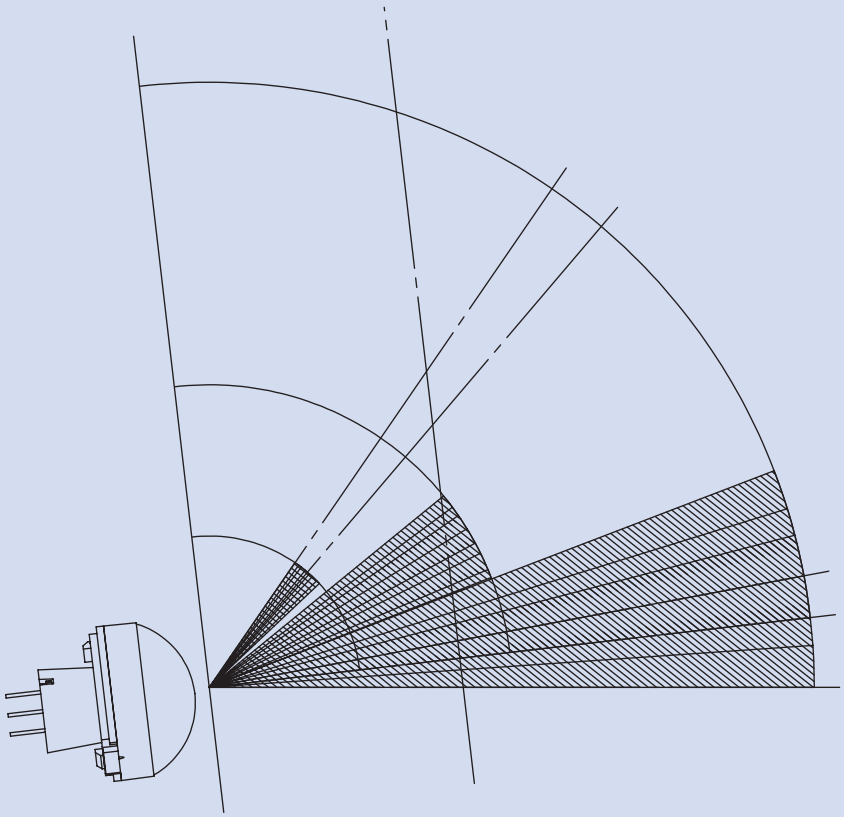
Yes, there is.
When sunlight suddenly illuminates or shades the sensor, a change in temperature occurs.
The sensor may detect this change, and there is a possibility to trigger a false detection.
Therefore, we recommend that the sensor should be installed at a place where it is not in direct sunlight.

Q1-16 How to prevent malfunction by pets?

Here are some examples below.

1. Install the wall-mounted type upside down.
2. Tilt the lens so that the detection area does not reach the ground.
3. Install the sensor in a location higher than the size of your pet.

Note that the pet may still be detected depending on environment, size of the pet and so on.



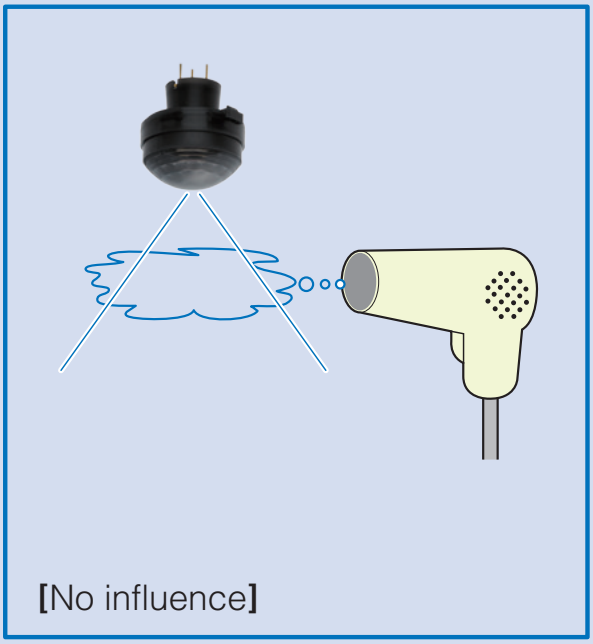
Q1-17 Does airflow around the sensor have any influence on detection performance?

No, unless the airflow is blown directly across the lens or directly at the sensor.
The principle of operation of the sensor is to detect changes in the amount of infrared energy.

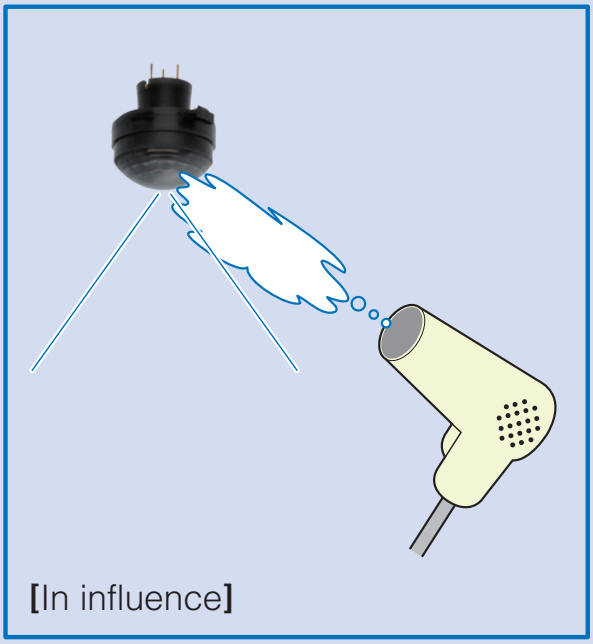
Infrared energy = Temperature x Emissivity of the object

Therefore, because air is 0% emissivity, the sensor does not respond no matter how much the temperature changes.

However, when the airflow blows directly toward the sensor's lens causing the temperature of the lens itself to change, there is the possibility of a false trigger.
In addition, if the airflow changes the background temperature rapidly, the sensor may be sensitive enough to interpret this as warm body movement.



[No influence]



[In influence]

Q1-18 Reference for front cover if needed

It is necessary to transmit infrared rays in the 10μm range, but the materials available are limited, and the only material that can be used for general consumer products is polyethylene (PE).
(Other materials are specialized and expensive, such as Si and Ge.)

However, please note that the transmittance varies depending on the thickness, and at a thickness of 0.5mm, the transmittance is roughly halved.

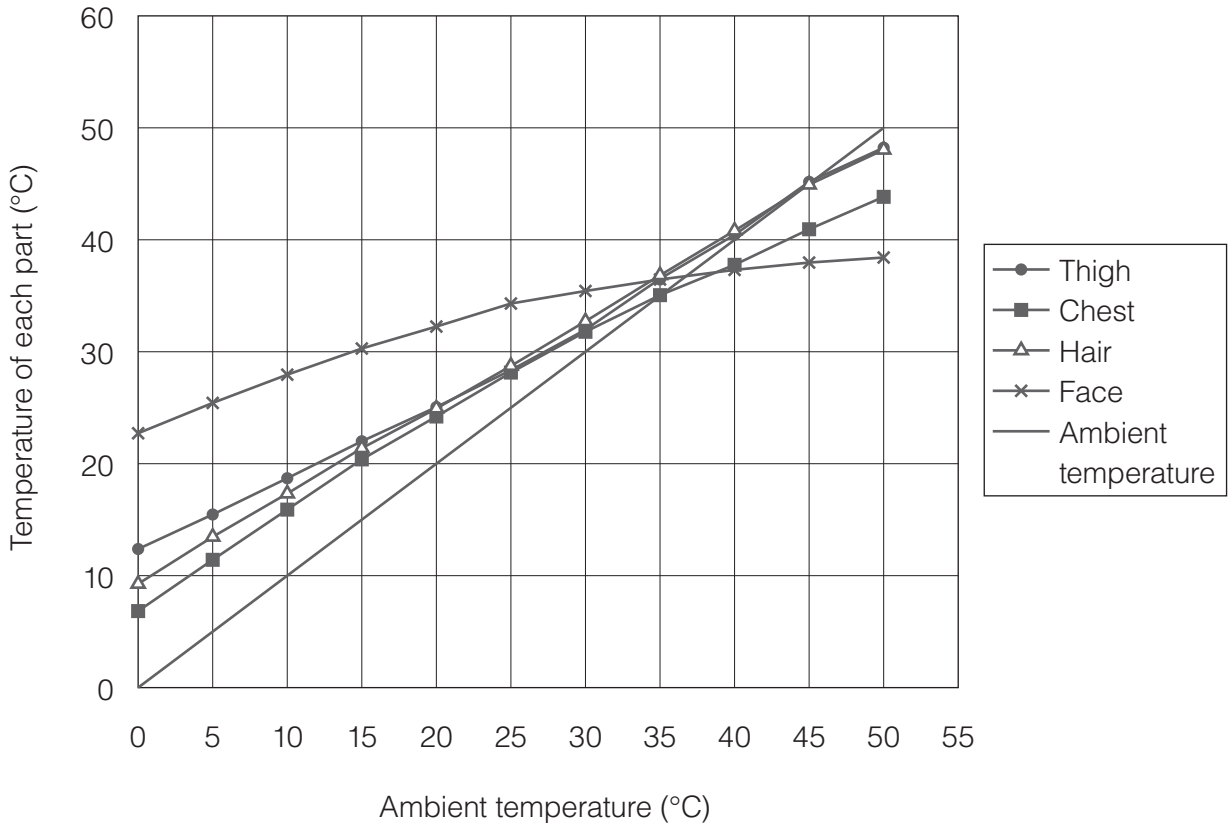
Also, the sensitivity varies depending on the surface roughness of the PE, so please evaluate it in advance.

Q1-19 Does clothing affect detection?

In general, clothing tends to assimilate easily with ambient temperatures.
Therefore, the temperature difference from the ambient temperature is not very large, which is somewhat unfavorable for detection.

It is easier to detect when the skin is exposed, which does not assimilate with the ambient temperature.

(Reference data) Temperatures of various parts of the human body when wearing long-sleeved work clothes



Q1-20 How to determine sensor mulfunction?

If the output signal is stuck in the high state, this is not possible for PaPIRs to function properly, so it is clearly a malfunction.

Other than that, it is not possible to clearly determine a malfunction from the output waveform alone.

You can also make a simple determination by waving your hand in front of the sensor, by covering the sensor with a paper cup and blocking infrared rays by opening and closing it.

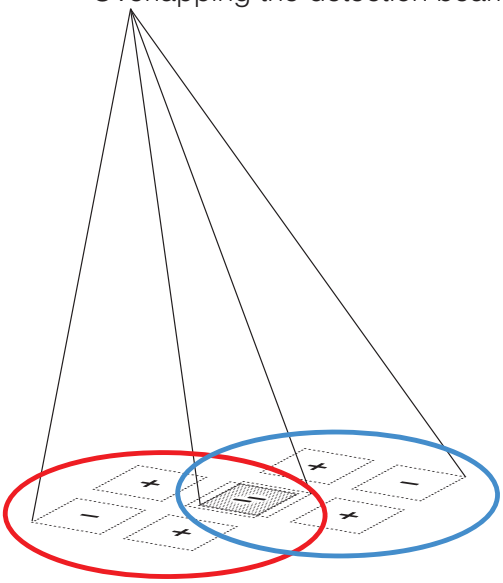
Q1-21 Why is the HMH lenses good at approach sensing?

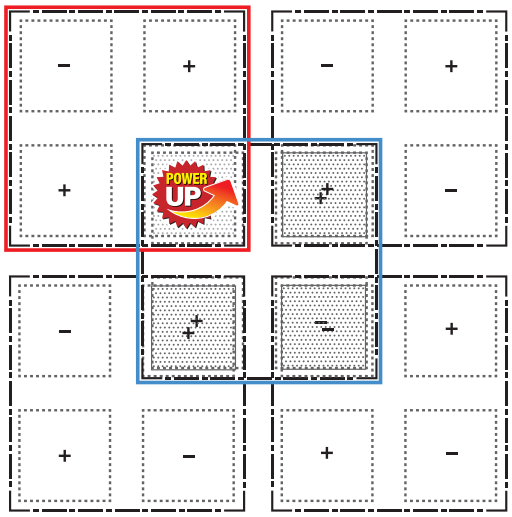
This is because the optical design makes each detection zone highly sensitive and can detect even the slightest shaking when approaching. (Our patent has been acquired)

Strong in detecting approach to the sensor.

= Multiplying the detection sensitivity of each individual detection zone.

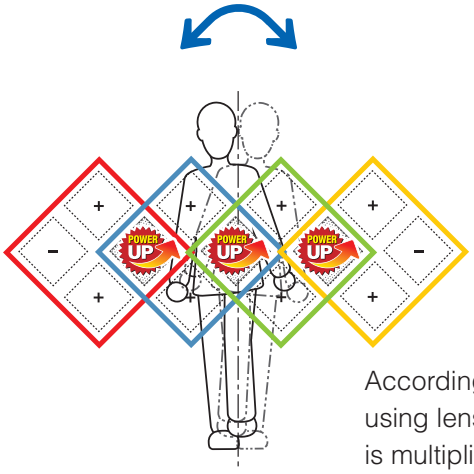
Overlapping the detection beams multiplies the sensitivity of each detection zone.





People walk while slightly swaying from side to side. To detect this swaying, we have developed a more sensitive optical design, enabling approach detection.

Increased detection sensitivity!!!



According to this law, when the detection beams are superimposed using lenses on the top, bottom, left and right, the detection sensitivity is multiplied for all detection beams except for the outermost one.

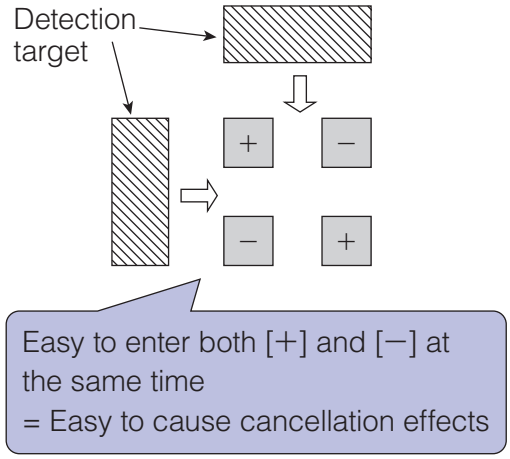
Q1-22 Why is the 45° rotational arrangement strong for horizontal installation and crossing detection?

Because it makes it difficult for simultaneous intrusions to cause a cancellation effect in a polarized detection zone.

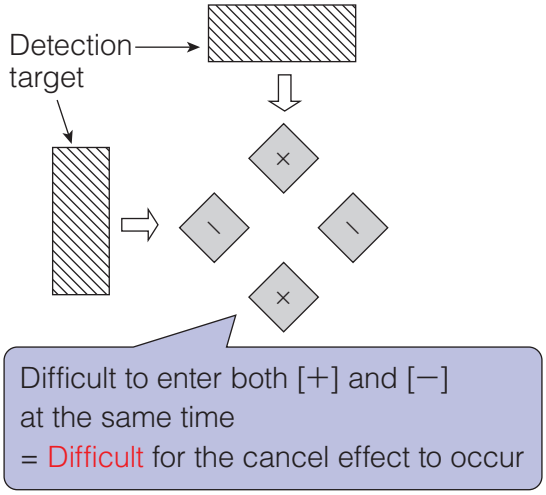
Strong in detecting passage in the horizontal direction.

=Optimizing the polar arrangement of the detection zone.

* Enter both [+] and [–] at the same time, a cancellation effect will occur.
(= It will be harder to detect)



Standard Detection Type



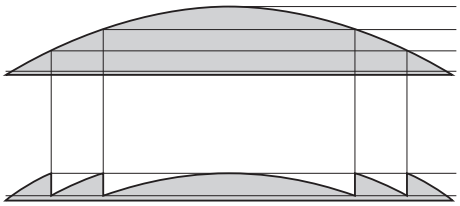
Wall Installation Type
Wide Detection Type
Ultra Wide & Long Distance Detection Type

Q1-23 What is the difference between a single lens and a Fresnel lens?

In general, if the element size is large, it is necessary to take a longer focal length, resulting in a larger lens.
As a countermeasure against thickening lenses, Fresnel lenses are often used.
Since PaPIRs are small PIR elements, they can shorten the focal length, so they did not initially use Fresnel lenses, but recently PaPIRs have begun to use Fresnel lenses as well.

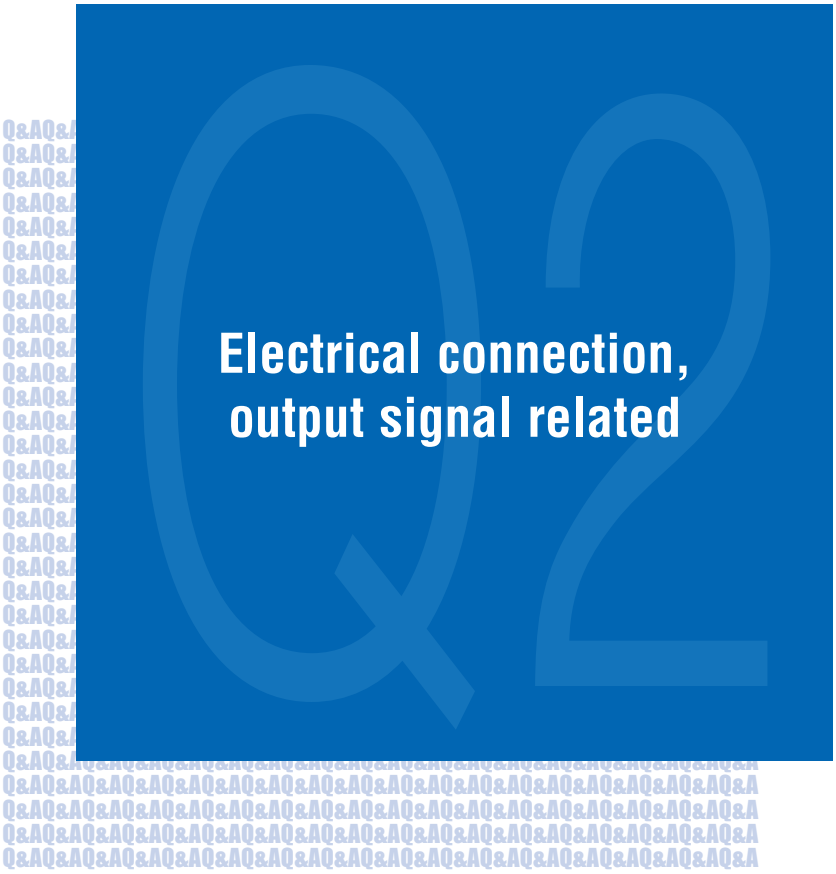
Good imaging performance

=Use of spherical lenses



【Single Lens】

【Fresnel Lens】


Q2
Electrical connection,
output signal related

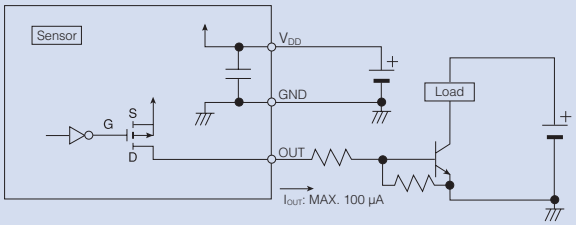
Q2-1 How should the sensor be wired?

1. Below are the functional pin assignments:
   Vdd power source (+)
   GND power source (–)
   Out output terminal

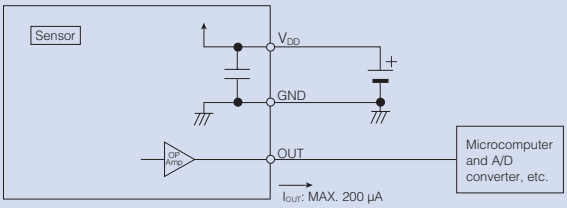
2. Connect the pins as follows:
   - Connect the (+) terminal of the power source to Vdd.
   - Connect the (–) terminal of the power source to GND.

3. Select an output resistor in accordance with Vout.

1) Digital output type

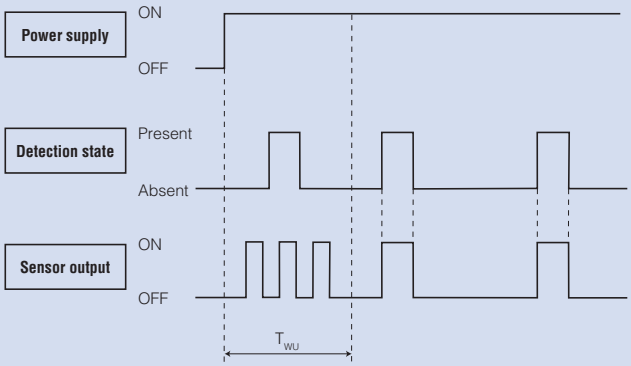


2) Analog output type



Q2-2 Can the circuit stabilization time (wait time) be shortened?

No, it cannot.
The circuit stabilization time is the time required for the internal circuit to stabilize after the power is turned on.
During this time accurate detection cannot take place as the output is unstable.



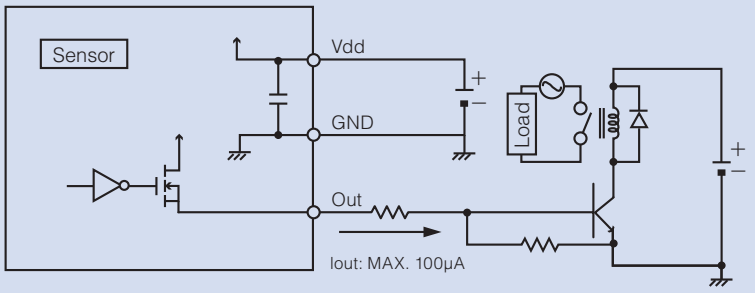
Q2-3 Can the AC load be turned on and off directly?

No, it cannot.
A mechanical relay or solid state relay should be connected to the output of the infrared sensor to turn the AC load on or off.
If a timer is needed, please refer to Q2-6 for an example of a timer circuit.

Circuit example

Circuit example as bellows.

1. For mechanical relay drive

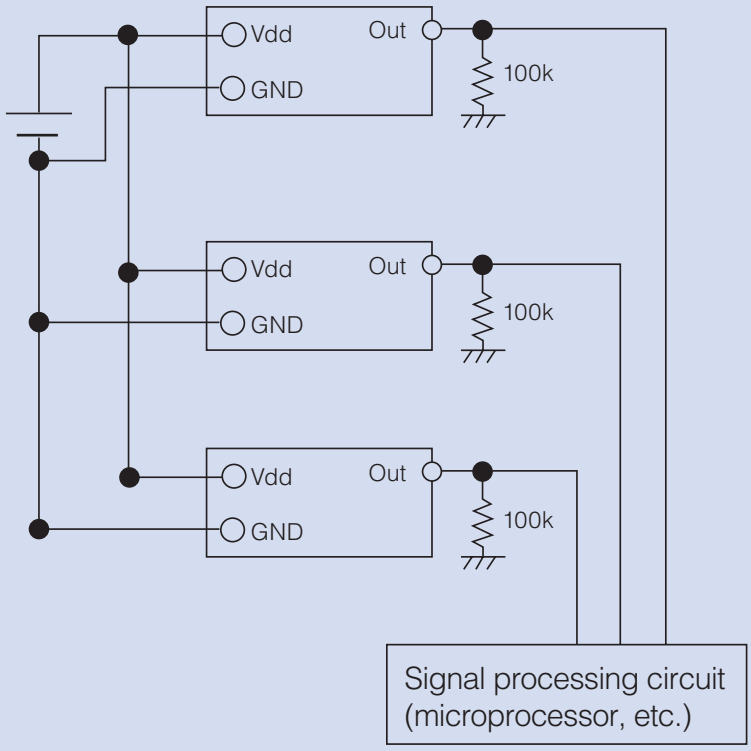


Q2-4 Are there any sensors with an operating voltage of 12V DC or 24V DC?

No, there are not.
A regulator or other circuitry should be used to transform the voltage to 5V DC.

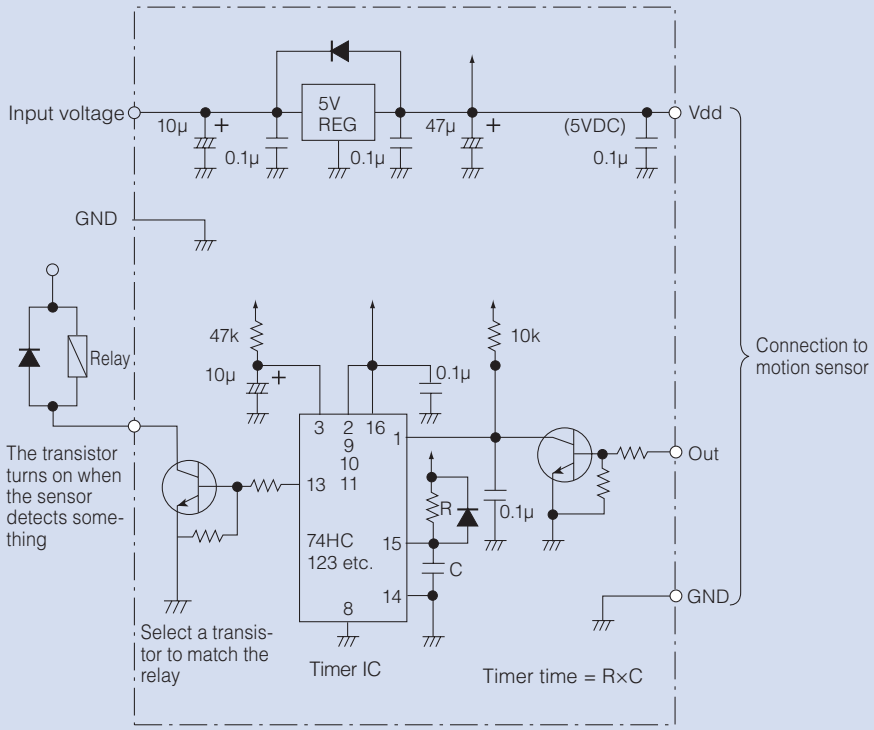
Q2-5 Is it possible to design a common circuit for multiple sensors?

Yes, it is.
A design using parallel connections such as in the example below can be used.



Q2-6 How do I set a timer for the output?

You can set the microprocessor's timer function.
If the device does not have such a function, refer to the following circuit image below to create a timer as an example.



Note 1) Each timer IC manufacturer required different values for the resistance (R) and capacitance (C) used for the time setting. Please confirm with the manufacturer for these values before you design the circuit.

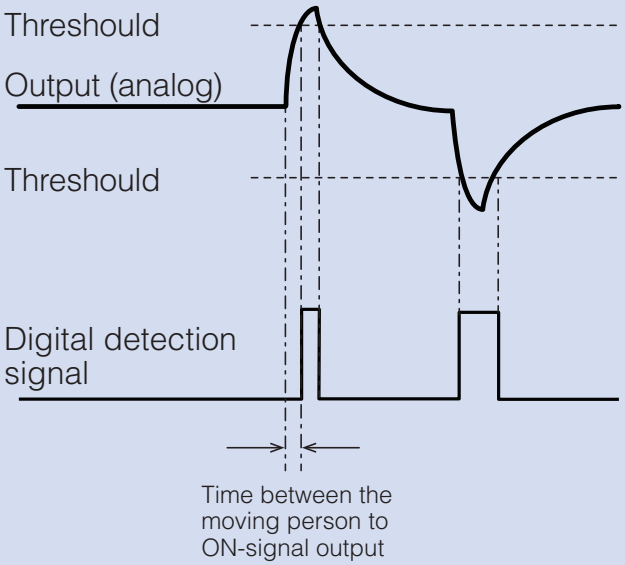
Note 2) This is the reference circuit which drives the motion sensor.
Please note that Panasonic bears no responsibility for any damages or loss arising from the use of this circuit. A noise filter should be installed for applications requiring enhanced detection reliability and noise withstanding capability.

Q2-7 Does the performance change depending on the operating voltage?

The detection performance does not change.

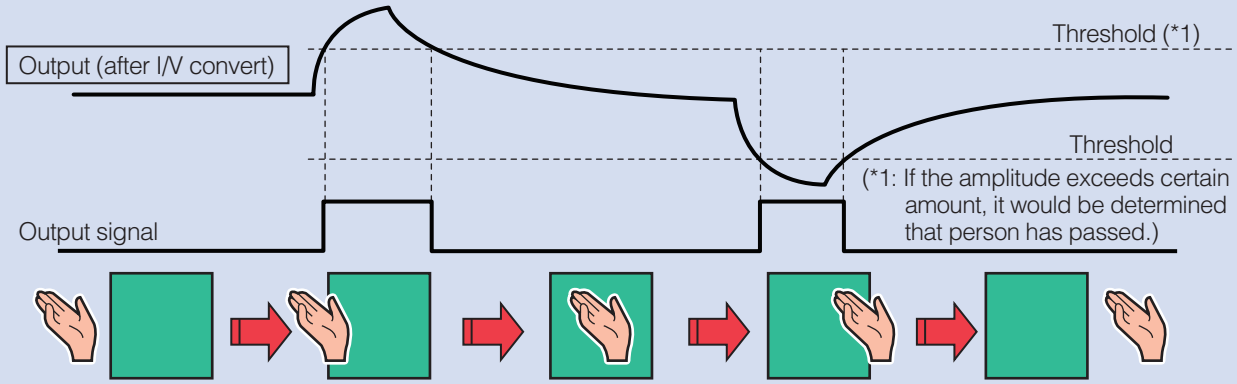
Q2-8 What is the duration for the digital output signal during a detection?

It is depends on certain conditions.
Therefore, it cannot be specified.
Detection occurs when the sensor generates an analog signal that extends beyond its threshold values. The slope of this analog signal can ramp drastically or minimally due to the detected change in temperature or movement speed of the object.



Q2-9 If a person keeps moving in the detection area, what kind of output appears from the digital output type sensor?

The output would be a repetition of ON/OFF.
When the detection state persists, the pyroelectric elements output an analog signal waveform continuously. The output analog signal is amplified by an amplifier circuit and when it exceeds the preset voltage level threshold, the sensor interprets this as motion by converting the signal to a digital ON output.
As the analog signal drops below the voltage threshold, the digital signal goes back to an OFF signal as the output.



Q2-10 What is the duration of the digital output signal from the sensor after a detection?

More than 1ms.
The pyroelectric elements' output differs depending on the temperature difference between the object and its surroundings as well as well as the moving object's speed. The output is amplified by an amplifier, and if the amplified output exceeds the reference voltage, the sensor interprets this as a detection by converting the analog signal to a digital ON output signal.
Although the output time is not always the same, the signal is more than 1ms due to the circuit characteristics.

Q2-11 How much time elapses after the person stops moving within the detection area and before the signal becomes a "definite" OFF?

It cannot be specified because it depends on too many parameters.
It may take some time to turn off depending on the conditions.

Q2-12 Why doesn't the sensor have a timer circuit for setting the output time?

It has become common practice to use the timer function of a microprocessor on the main board, so Panasonic infrared sensors do not implement it.
If you wish to see an example of a timer circuit, refer to Q2-6.

Q2-13 Can the sensor handle external surges and electrical noise?

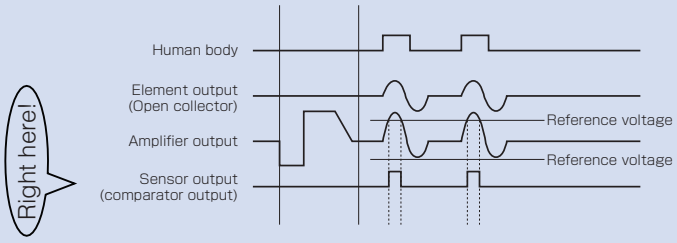
Yes it can handle external surges to a certain extent. It depends on the quality of the power supply and the noise conditions of the surrounding environment such as noise amplitude, noise frequency and cable routing.
In principle, the sensor should be used in a low noise environment.

Reference: The sensor is not affected by mobile phone noise with a minimum distance of 5 centimeters.

Q2-14 What is a comparator?

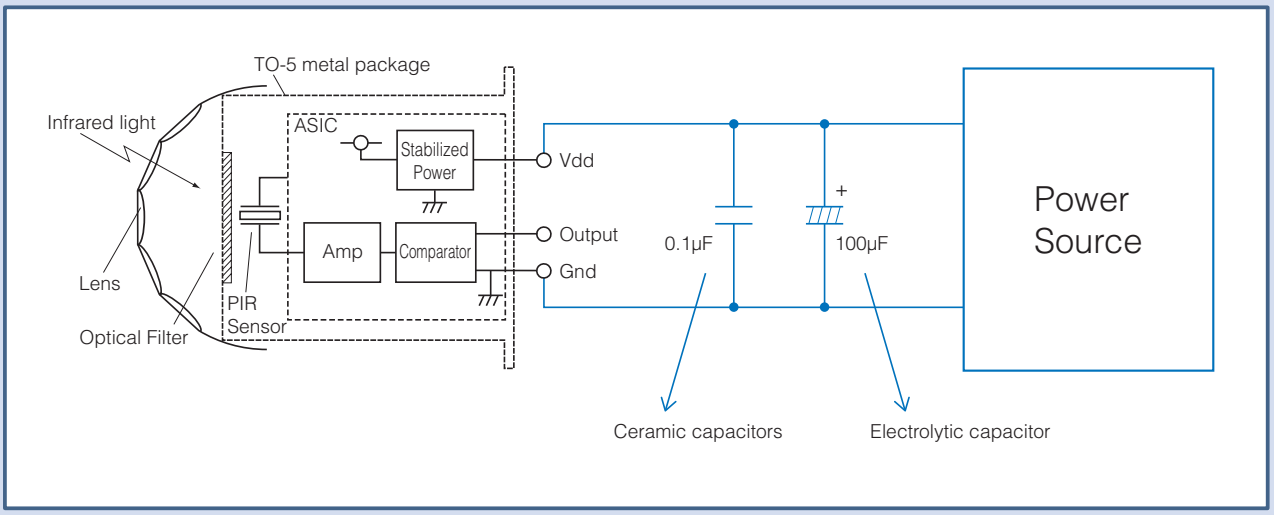
This is a circuit that sets a certain threshold for the analog signal and output ON signal only when that threshold is exceeded.

<Timing chart> ● Standard type



Q2-15 How to enhance resistance against power source noise?

For example, it may be possible to strengthen it by the following method. (Adding a capacitor)

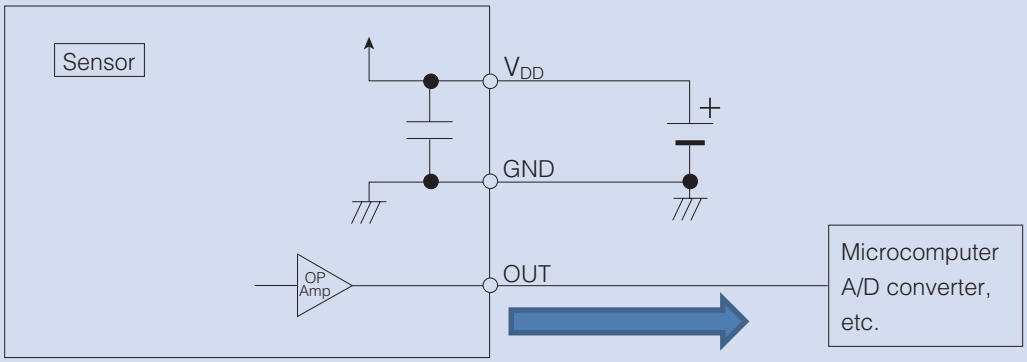


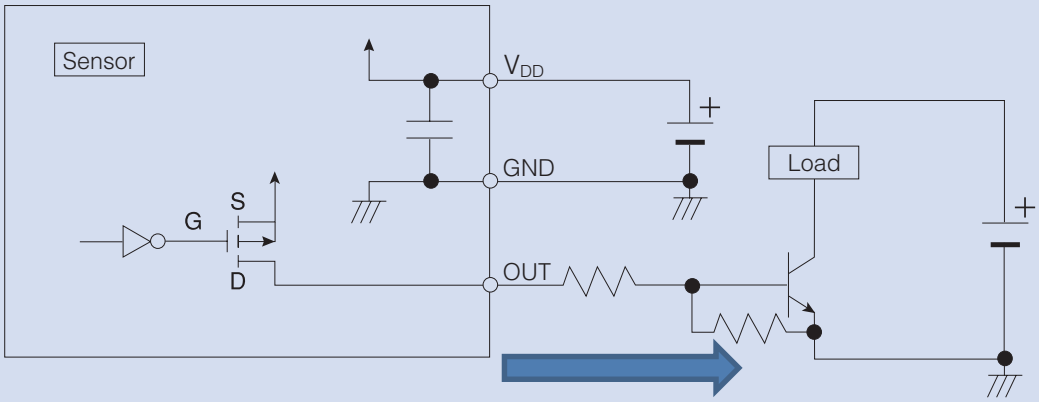
Q2-16 What is the operating process for output current?

PaPIRs have a voltage output (Out) which can only drive a certain current. The digital sensors can drive a maximum of 100µA, whereas the analog sensors (EKMC26-series) can drive up to 200µA.
The user must consider & design the circuit connected to the voltage output so that the specified maximum output current is not exceeded.

Otherwise the sensor shows unstable behavior and in the worst case can be damaged if this value is exceeded.

Panasonic infrared sensors do not work if more than 100µA is output.





Q2-17 What is the mechanism by which the ON signal is generated, and what is the duration of the ON signal?

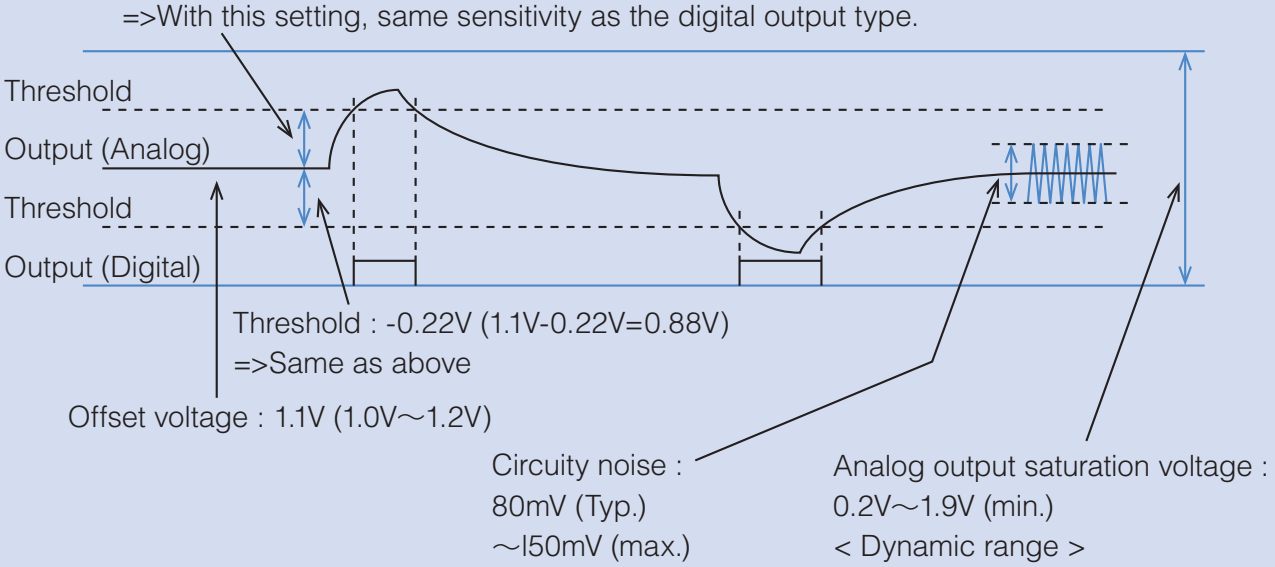
As shown in the diagram below, an ON signal is output only while the analog signal, which corresponds to the change in the amount of infrared energy, exceeds the threshold.
The change in the amount of infrared energy varies depending on the conditions, and even if the object crosses the edge of the detection zone and enters the detection zone, the time it takes for the ON signal to be output is the time it takes for the analog signal to exceed the threshold, which varies depending on the temperature difference with the surroundings, the speed of movement, and other conditions.

Please refer to the example waveform of an analog product in the diagram below.

(There are also cases where the threshold cannot be exceeded and detection is not possible.)

VZ-Analog (EKMC260****)

Power-supply voltage : 3.0V～5.5V



Q2-18 What are the specifications of the extension cable that can be connected to the sensor?

There are no particular acceptable specifications.
We recommend making it as short as possible.

Also, depending on the surrounding noise environment, even a short length may be affected, so we highly recommend evaluating it under actual usage conditions.

Q2-19 What is the recommended value for the open-drain pull-down resistor?

The transistor's output current value is a maximum of 100μA, so for example, when driven at 5V, it will be 5V/100μA = 51kΩ or more.
(The E24 series does not have a 50kΩ resistor, so it will be 51kΩ.)

However, the higher the resistance value, the lower the radiation noise resistance, so a balance is required.

Q2-20 How long is the ON signal held?

An ON signal is output as long as the internal analog signal (differential signal of infrared energy) exceeds the threshold value.

The ON time varies depending on the detection conditions such as the temperature difference with the surroundings, movement speed, target size, etc.

Q2-21 How to assemble with light sensor

It is common to use a light sensor to detect the surrounding brightness, and when it reaches the required level of darkness, use logical control (AND circuit between the light sensor and PIR) to activate the PaPIRs signal.

Q2-22 What is the mechanism behind the circuit stabilization time? (Can it be shortened?)

This is the charging time for the capacitor that constitutes the filter of the analog processing circuit, and the time it takes for the circuit to transition normally to the analog operating point as a result of charging.

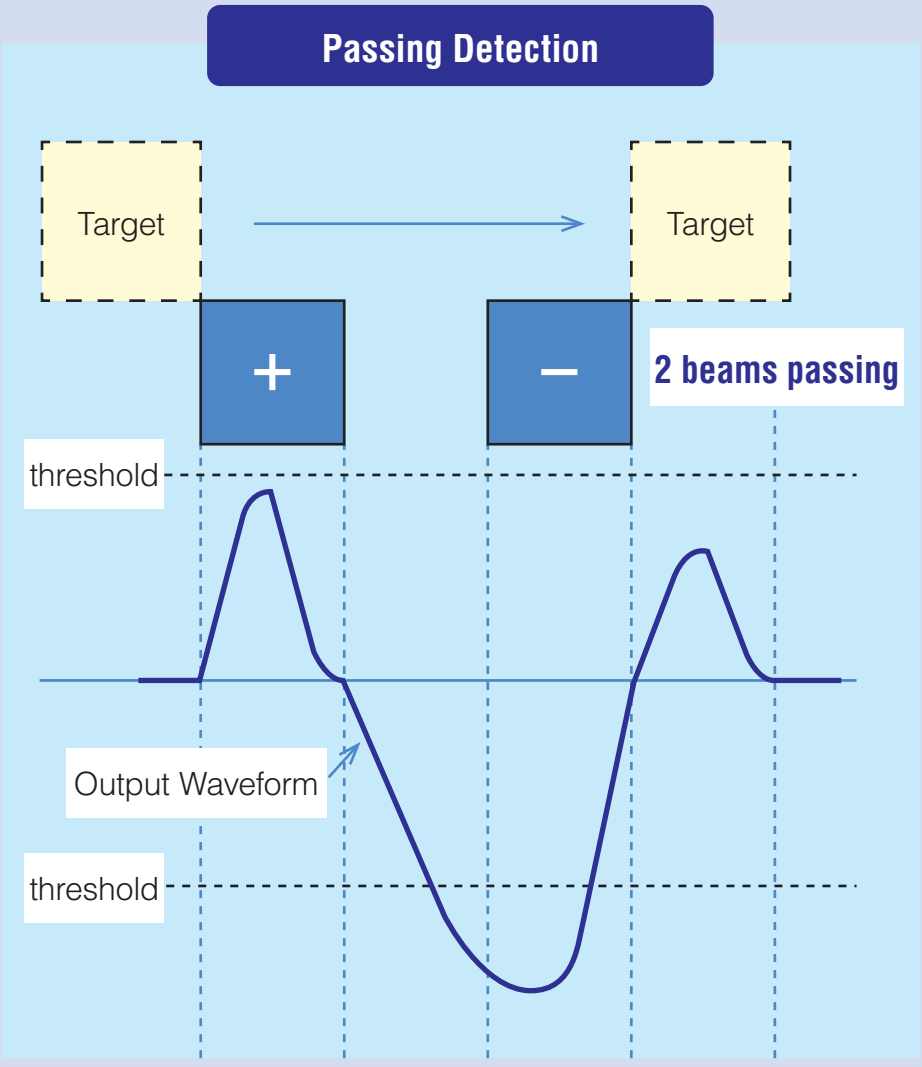
The charging time differs depending on the charge state of the capacitor when charging begins, so it cannot be shortened.

Note that this phenomenon only occurs when the power is first turned on, and will not occur again thereafter unless the power is turned off.

Q2-23 What is the typical waveform of the analog signal when two beams pass, which is a condition for motion detection?

The motion detection meets the specified specifications (specified distance at a temperature difference of 4°C) with two beams passing through.

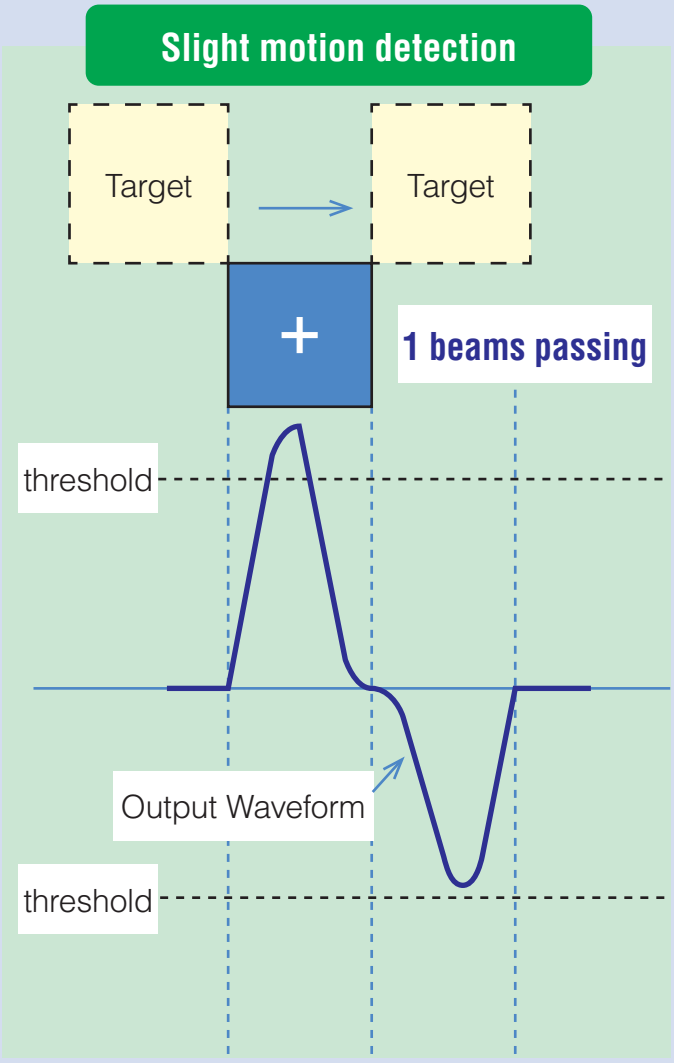
The analog signal waveform when the detection object passes through the detection zone is shown below as an output overview.



Q2-24 What is the typical waveform of the analog signal when one beam passes, which is the condition for detecting slight motion?

Slight motion detection meets the specified specifications (specified distance at a temperature difference of 4°C) with one beam passing.

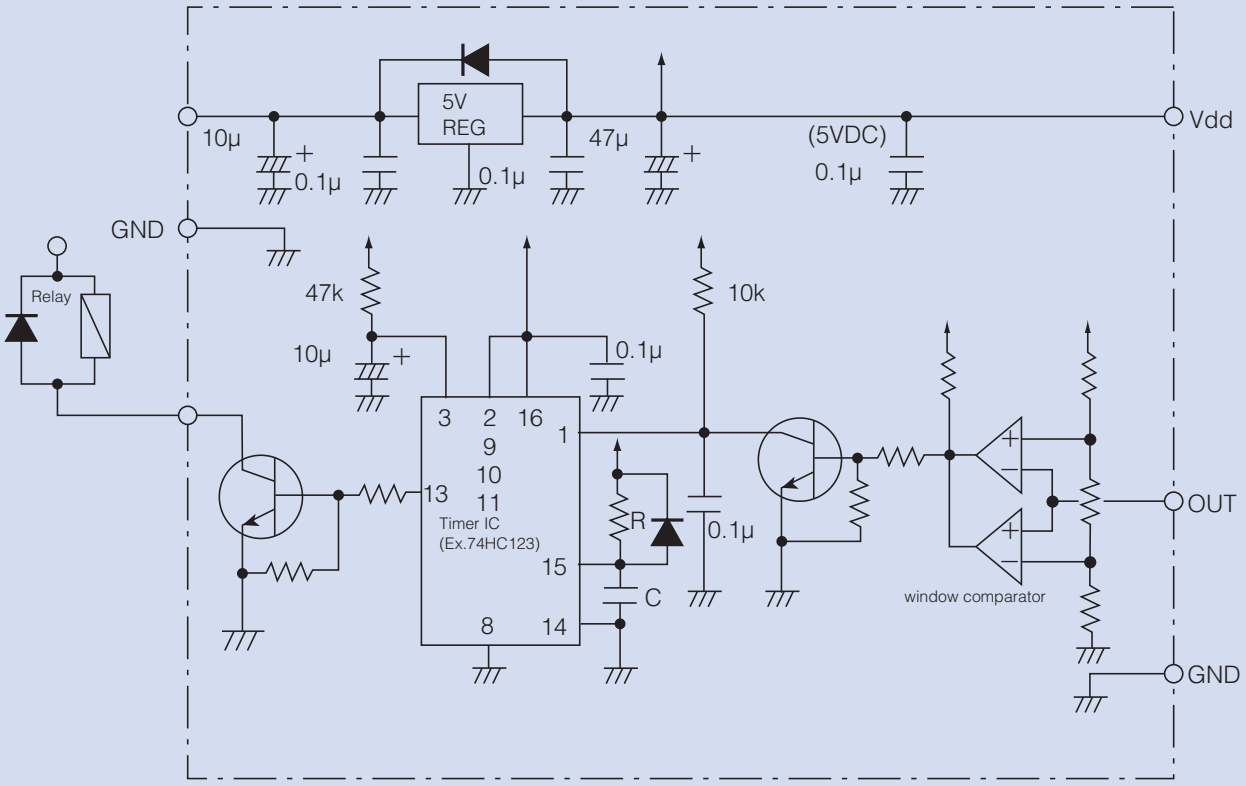
The analog signal waveform when the detection object passes through the detection zone is summarized as the output below.



Q2-25 An example of circuit with window comparator.

As shown in the catalog, it is common to use a microcontroller, but the analog output signal is not processed by the microcontroller, but by an analog circuit.
If you want to set a threshold value, the following wind comparator method is common.

(An example of load control by a timer circuit and a relay is shown.)




Q3
Related to product specifications, etc.

Q3-1 Will the sensor detect anything beyond the “maximum distance” specified in the catalog?

There is a possibility of detection.
This sensor is specified to detect an object based on defined conditions.
The catalogue is written as “Standard detection type 5m” and “Slight motion detection type 2m”, which is our “guaranteed detection distance”.

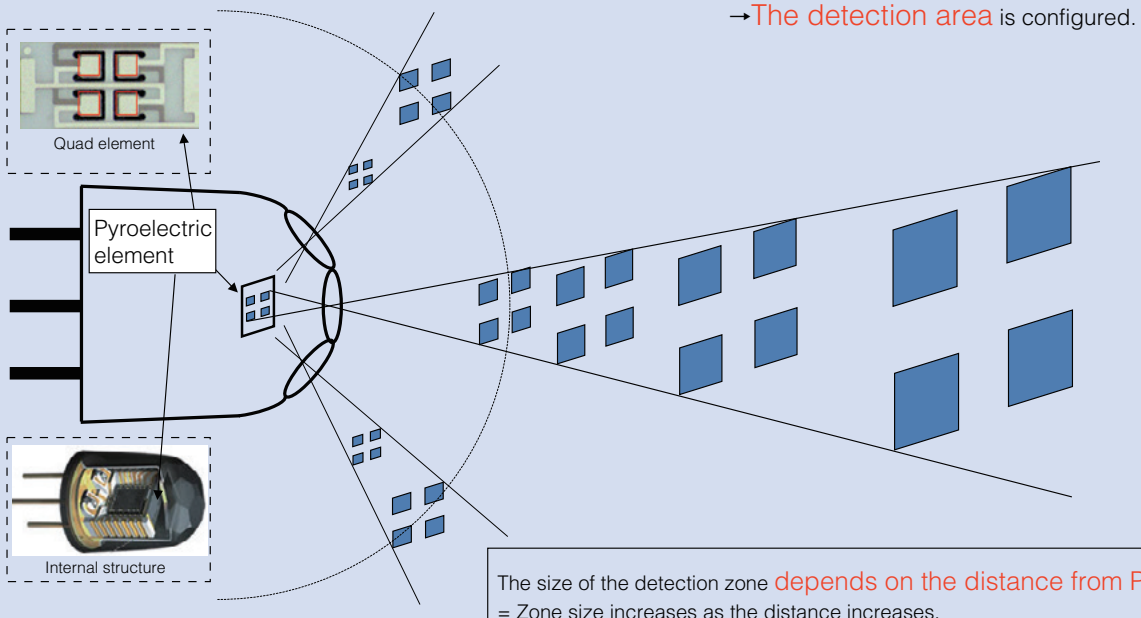
In reality, the detection cases may differs depending on the following factors.
- Temperature difference between target object and surroundings.
- Size of target object and how it overlaps with the detection zones.
- Moving speed of target object.

Therefore, there is the possibility that the sensor detects something beyond the specified “maximum distance”.
In addition, depending on the conditions, there is even the possibility that the sensor may not detect even within the specified detection distance.

Q3-2 How is the detection area of Panasonic infrared sensors determined?

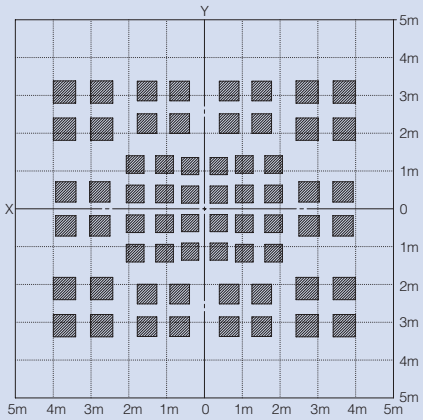
• Detection zone
This is the area where people are detected. There are 4 heat receiving elements inside the sensor, and those elements are projected to the lens creating 4 detection zones per each facet of the lens.
• Detection area
Detection area is where the 4 detection zones are as one group. This is a set of detection zones projected by a single facet on the lens.
• Detection range/distance
If ceiling mounted - Detection range / distance is the installation height that the sensor will detect reliably as per specification.
If wall mounted - Detection range / distance that the sensor will detect reliably.

One pyroelectric element inside PaPIRs is projected in various directions by a lens.
→The detection area is configured.



The size of the detection zone depends on the distance from PaPIRs
= Zone size increases as the distance increases.

X-Y sectional view (3m)



Detection area

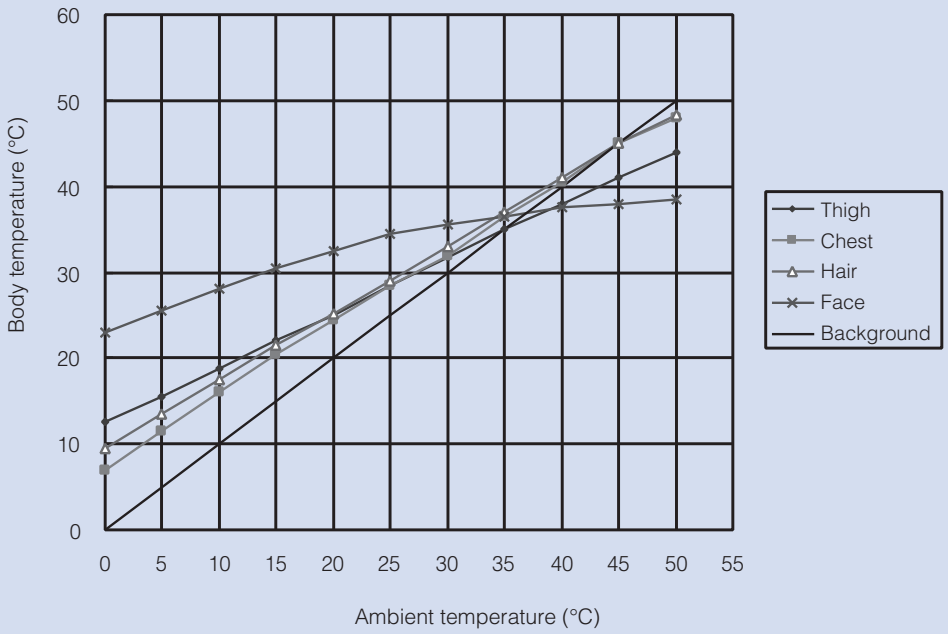
The standard type of PaRIRs (EKMC160111*) consists of 16 lens facets of 5 different shapes. The sensor is composed of 64 detection zones (4 detection zones x 16 lenses).

*Color of lens

Q3-3 What does “temperature difference of 4°C or more against background” mean?

PaPIRs are able to function based on a temperature difference of 4°C between a heat source such as a person and the background such as a floor or wall.
The background is the environmental temperature such as the area around the ground, walls and ceiling. When the person enters detection range of the sensor, the temperature difference between the ambient temperature and object will be detected due to the sensing of change in infrared light.

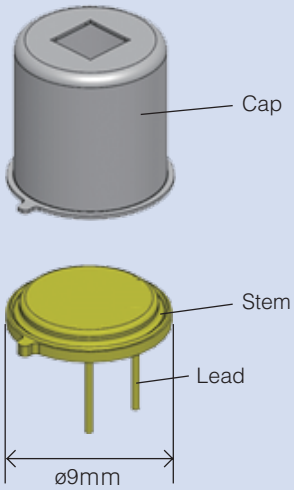
(Reference date) Wearing long-sleeve work clothes



According to our research

Q3-4 What is the TO-5 metal package?

TO-5 is a standard for package size for semiconductors.
As seen in this image, a TO-5 package consists of a metal semiconductor chip mounting 9mm in a diameter, a dish-shaped component called “stem” that holds the external leads, and metal cap that covers the semiconductor chip.

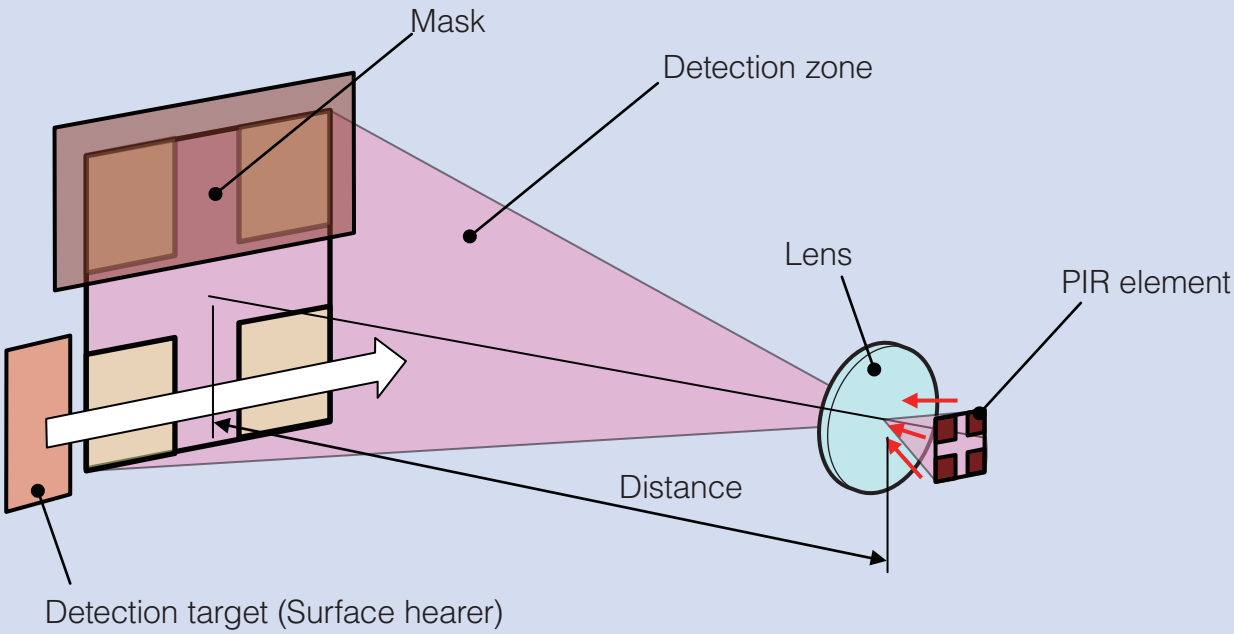


Q3-5 How can we confirm detection performance based on the specification?

The design concept requires that the target object to be detected completely passes through the detection zone.

The conditions are as follows.

- Size of detection target.
- Movement speed of detection target.
- Temperature of detection target. (temperature difference from surroundings)
- Distance between the target and the sensor

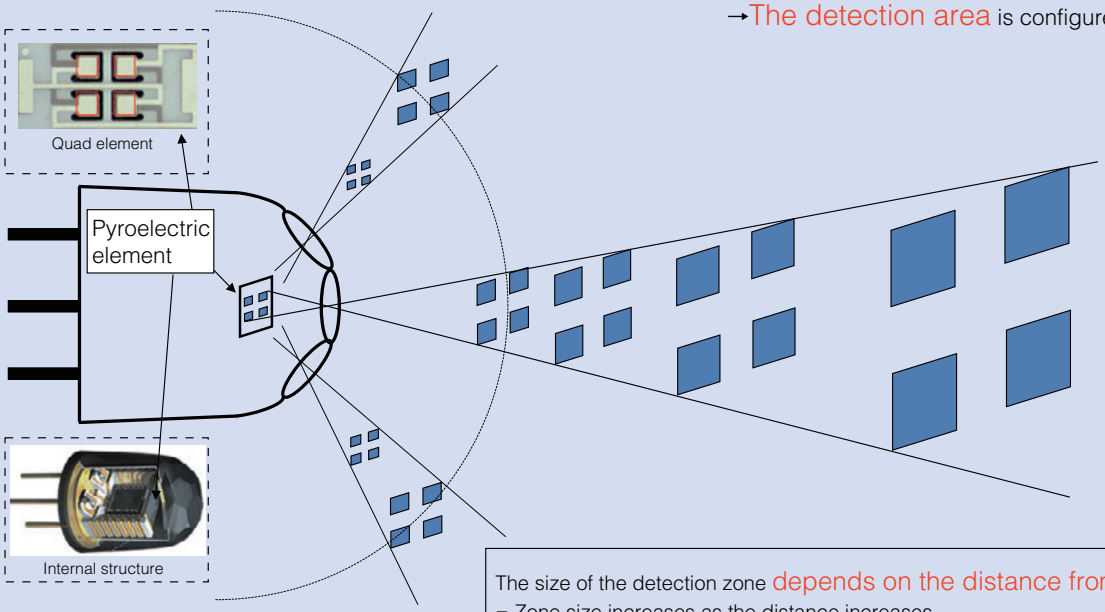


Q3-6 Is there any correlation between sensitivity and distance?

Yes, there is.
Sensitivity is inversely proportional to the size of the detection zone.
(The larger the detection zone, the more difficult it is to detect the object.)

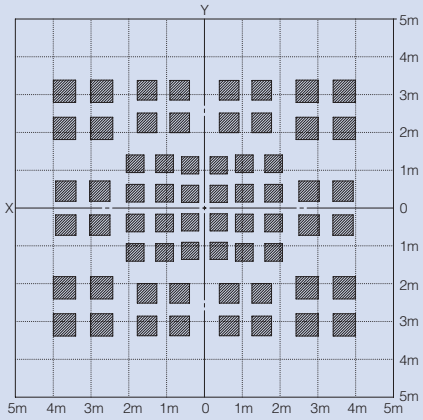
The sensitivity is roughly inversely proportional to the square of the distance as defined by the Inverse Square Law.
The greater the distance, the larger the individual detection zones become. Larger detection zones reduce the sensitivity against small objects or small movements.

One pyroelectric element inside PaPIRs is projected in various directions by a lens.
→The detection area is configured.



The size of the detection zone depends on the distance from PaPIRs
= Zone size increases as the distance increases.

X-Y sectional view (3m)



Detection area

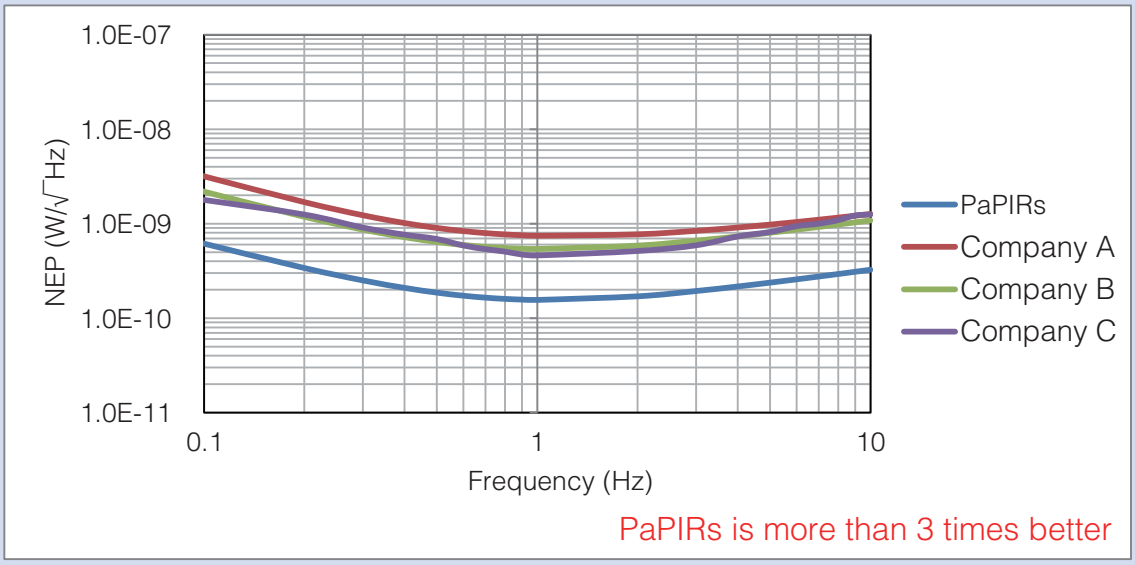
The standard type of PaRIRs (EKMC160111*) consists of 16 lens facets of 5 different shapes. The sensor is composed of 64 detection zones (4 detection zones x 16 lenses).

*Color of lens

Q3-7 What is NEP (Noise Equivalent Power)?

This amount indicates the incident energy intensity when the noise and signal output are equal.
The smaller this value is, the higher the detection capability which means that the noise level is reached with less light incident.

NEP = Noise Equivalent Power



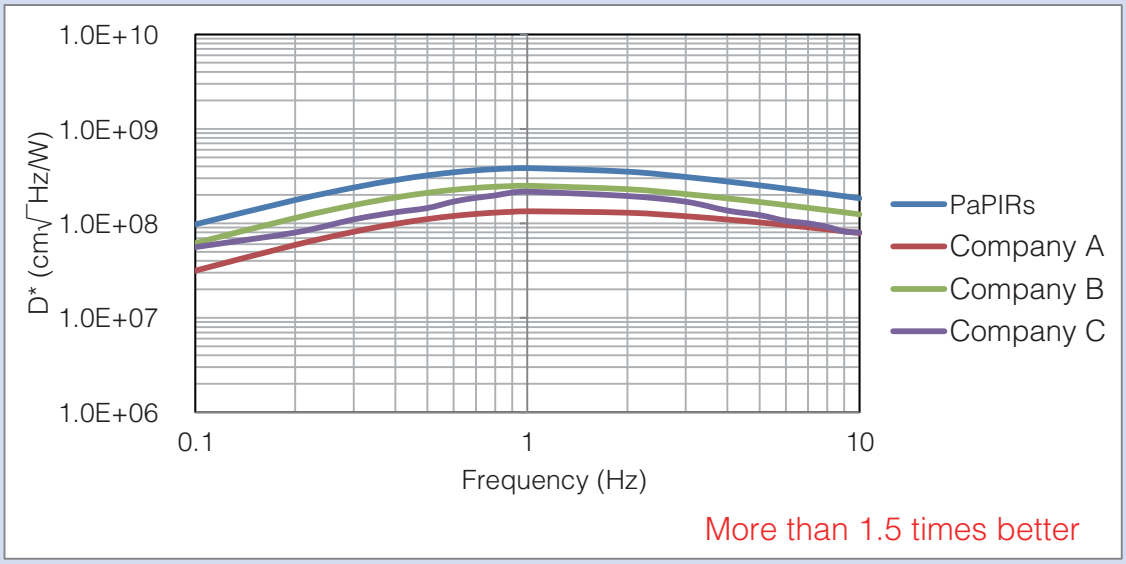
PaPIRs is more than 3 times better

According to our research

Q3-8 What is D* (ratio of detection performance)?

D* This is an index that component of the light receiving area is reflected in NEP.
It indicates the sensor detection performance as actual product.

D*= Detection capability



According to our research

Panasonic has better detection performance even though the sensor has a smaller element compared to other solutions.

Element	PaPIRs	Company A	Company B	Company C
Size (mm)	0.6 × 0.6	2.6 × 0.7	1.0 × 1.0	1.0 × 1.0

Q3-9 Reality of the detection zone

The detection zones listed in catalogs, etc. are merely design values, and the edges are blurred, so please consider the boundaries to be for reference only.

Also, depending on the usage environment (temperature difference with the surroundings, movement speed), the detection signal may not turn ON immediately even if you enter the detection zone.

In principle, it is not possible to detect something reliably like a camera, where entering the field of view is enough to detect it.

Q3-10 Reference for flow and reflow condition

As a general rule, neither flow nor reflow soldering is permitted.
We only guarantee hand soldering.
The reason for this is that the lens will melt and thermal stress will remain in the element.

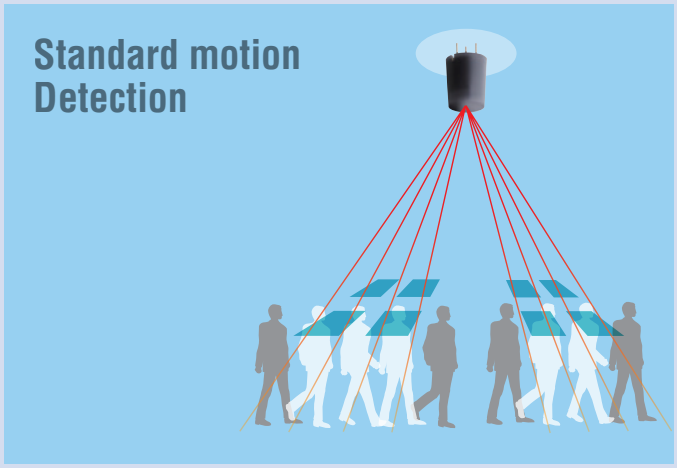
Q3-11 Lifespan and failure rate.

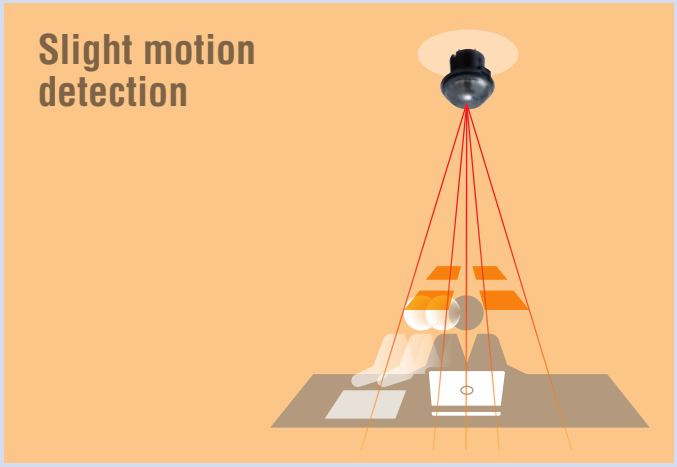
The life span has passed the 500-hour THB test, and based on our proprietary semiconductor accelerated evaluation calculation, we estimate it to be about 5 to 10 years in an indoor environment.

The failure rate is not managed.

Q3-12 What is the difference between standard detection and slight motion detection?

The detection specifications are different, such as slight motion detection when the detection target passes through one zone, and standard detection when the detection target passes through two zones.





Q3-13 What are the detection area and detection distance of the lens-less type?

Since no image is formed optically, no detection zone is formed and the detection area and distance cannot be defined.

The specifications indicate the aperture angle based on the relative positions of the filter and element.

Q3-14 Can PaPIRs itself obtain UL certification?

The sensor alone (even with the lens) is not subject to the standard, so PaPIRs cannot obtain UL certification on its own.

Q3-15 What is the reason for the doubled S/N ratio of PaPIRs+?

1. Sensitivity has been increased by increasing the size of the pyroelectric element itself.

2. Furthermore, sensitivity has been increased by blackening the light-receiving part of the pyroelectric element (the part that reacts to heat).

These two factors have roughly doubled the sensitivity.

Q3-16 Is it possible for PaPIRs+ to achieve doubled sensitivity with any existing lens?

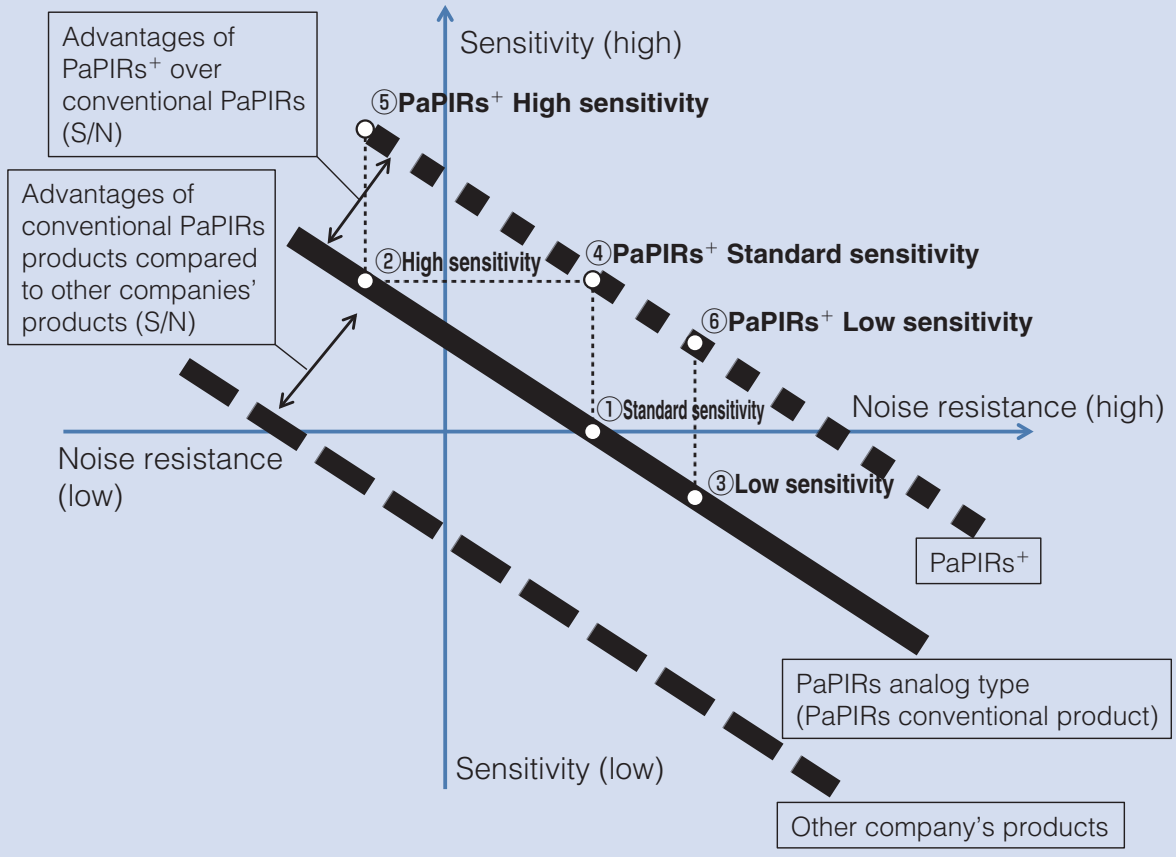
This is not the case.

The sensitivity per unit area has not increased significantly, but rather the sensitivity has been increased by increasing the size of the pyroelectric element.
Therefore, when using an existing lens, depending on the focal length and size of the lens, the detection sensitivity may not double. (= the detection zone at the expected distance will become larger.)

Q3-17 What is the difference between PaPIRs⁺ and existing high sensitivity type?

Conventional high-sensitivity products (high-sensitivity ASIC) and analog types are based on the concept of making effective use of the high S/N ratio of conventional PaPIRs and achieving specialized performance (sensitivity) by combining various aspects of sensitivity and noise resistance, which are in a trade-off relationship.

The PaPIRs⁺ achieves an even higher S/N ratio than conventional PaPIRs, and as shown in the figure below, when the same high sensitivity as conventional products is achieved, noise resistance is improved.



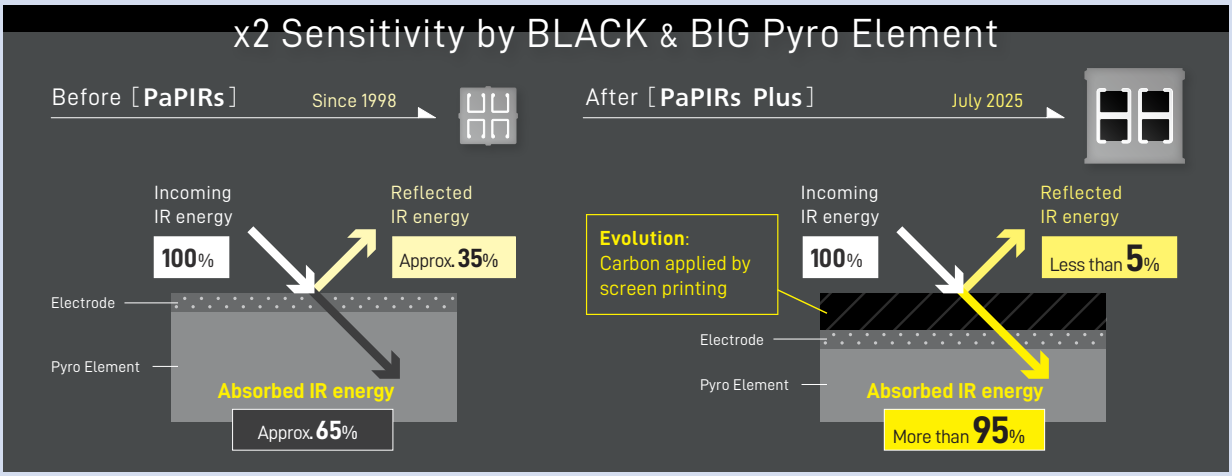
[▬▬▬▬ PaPIRs analog type (conventional PaPIRs)]
Customers can freely set the threshold (① to ③ are supported by pre-setting the threshold)
①: PaPIRs standard sensitivity product ②: PaPIRs high sensitivity product ③: PaPIRs low sensitivity product
(Can be freely designed on the analog line)

[■ ■ ■ ■ ■ PaPIRs⁺]
Higher S/N ratio than conventional PaPIRs (analog type)
④: PaPIRs⁺ standard sensitivity product ⑤: PaPIRs⁺ high sensitivity product
⑥: PaPIRs⁺ low sensitivity product

[▬ ▬ ▬ Competitor's product]
Lower S/N ratio than conventional PaPIRs (analog type)

Q3-18 Why does blackening treatment increase sensitivity?

Conventionally, about 35% of the infrared energy that should have been incident on the element was reflected.
So by blackening the heat receiving part (the part that reacts when it receives heat), the reflected components are reduced, and the heat energy (infrared energy) is efficiently absorbed, resulting in increased sensitivity.



Cautions for use

Basic principles

PaPIRs are pyroelectric infrared sensors that detect variations in infrared rays.
However, detection may not be successful in the following cases: lack of movement or no temperature change in the heat source. They could also detect the presence of heat sources other than a human body. Efficiency and reliability of the system may vary depending on the actual operating conditions:

1) Detecting heat sources other than the human body, such as:
   a) small animals entering the detection area
   b) When a heat source, for example sun light, incandescent lamp, car headlights etc., or strong light beam hit the sensor regardless whether the detection area is inside or outside.
   c) Sudden temperature change inside or around the detection area caused by hot or cold wind from HVAC, or vapor from a humidifier, etc.
2) Difficulty in sensing the heat source
   a) Glass, acrylic or similar materials standing between the target and the sensor may not allow a correct transmission of infrared rays.
   b) Non-movement or quick movements of the heat source inside the detection area. (Please refer to the table on page 8 or 11 for details about movement speed.)
3) Expansion of the detection area
   In case of a considerable difference in the ambient temperature and the human body temperature, the detection area may be larger than the configured detection area.
4) Malfunction / Detection error
   On rare occasions, an erroneous detection signal may be output due to the nature of pyroelectric element. When the application cannot tolerate erroneous detection signals, take countermeasures by introducing a pulse-count circuit, etc.
5) Detection distance
   Panasonic's PIR Motion sensors state the detection distance in the specifications because they are usually provided with the lens (please refer to item 6 for lensless types). The PIR Motion sensor could detect variations in infrared rays however such variations are decided by following three factors.
   - The temperature difference between the target and the surroundings:
     The larger the temperature difference, the easier it is to detect targets.
   - Movement speed: If the target is moving at a slower or faster speed than specified in the tables, the detection ability may be lower.
   - Target size: The human body is the standard. If the target is smaller or larger than specified in the table, the detection ability may be lower.
     The detection distance explained in our data sheet is defined by the three factors mentioned above. Panasonic's standard for the temperature difference between the target and the surrounding is defined as 4°C. The larger the temperature difference, the longer the detection distance. If the temperature difference is 8°C, which is twice as much as the standard, the detection distance will be approx. 1.4 times longer than the distance at 4°C. For example, if targets at a distance of 5m can be detected at 4°C, then the sensor can detect targets at a distance of 7m at 8°C. (This is based on the theory that the detection sensitivity will vary inversely with the square of the distance.)
6) Lensless Type
   The lensless type cannot detect any targets because it is not possible to focus infrared variations into the sensor chip. It is not possible to determine the detection distance and the field of view without a lens. Please provide your own lens based on your lens design concept.
7) Lens material and the plate setting in front of the lens
   Typically, the only material that can be passed by infrared rays is Polyethylene.
   (The lens material of Panasonic's PIR Motion sensors is "High density polyethylene, HDPE".) When you need to set a plate in front of the lens, please choose one made from the Polyethylene. Please note the thickness or color of the plate will affect the detection ability, e.g. it may make the detection distance shorter. Therefore, please confirm by testing the sensor with the plate under realistic conditions.

Cautions

1) Refer to the newest specification regarding optimal operating environment conditions.
2) Do not solder with a soldering iron above 350°C (662°F) or for more than 3 seconds.
   This sensor should be hand-soldered.
3) To maintain stability of the product, always mount it on a printed circuit board.
4) Do not use liquids to wash the sensor. If washing fluid gets into the lens, it can reduce the performance.
5) Do not use a sensor after it has fallen on the ground.
6) The sensor may be damaged by ±200 volts of static electricity.
   Avoid direct hand contact with the pins and be very careful when operating the product.
7) When wiring the product, always use shielded cables and minimize the wiring length to prevent noise disturbances.
8) The inner circuit board can be destroyed by a voltage surge.
   The use of surge absorption elements is highly recommended.
   Surge resistance: below the power supply voltage value indicated in the section on maximum rated values.
9) Please use a stabilized power supply. Noise from the power supply can cause operating errors.
   Noise resistance: max. ±20V (square waves with a width of 50ns or 1µs)
   To reduce the effect of noise from the power supply , install a capacitor on the sensor's power supply pin.
10) Operation errors can be caused by noise from static electricity, lightnings, cell phones, amateur radio, broadcasting offices, etc
11) The detection performance can be reduced by dirt on the lens, please be careful.
12) The lens is made of soft materials (Polyethylene).
    Please avoid adding weight or impacts that may change its shape, causing operation errors or reduced performance.
13) The specified temperature and humidity levels are suggested to prolong usage. However, they do not guarantee durability or environmental resistance.
    Generally, high temperatures or high humidity levels will accelerate the deterioration of electrical components. Please consider both the planned usage and environment to determine the expected reliability and length of life of the product.
14) Do not attempt to clean this product with detergents or solvents such as benzene or alcohol, as these can cause shape or color alterations.
15) Avoid storage in high, low temperature or liquid environments.
    Also, avoid storage in environments containing corrosive gas, dust, salty air etc.
    Adverse conditions may cause performance deterioration and the sensor's main part or the metallic connectors could be damaged.
16) Storage conditions
    Temperature: +5 to +40°C, humidity: 30 to 75%
    Please use within 1 year after delivery.

Safety precautions

Obey the following precautions to prevent injury or accidents.

1) Do not use these sensors under any circumstance in which the range of their ratings, environment conditions or other specifications are exceeded. Using the sensors in any way which causes their specifications to be exceeded may generate abnormally high levels of heat, emit smoke, etc., resulting in damage to the circuitry and possibly causing an accident.
2) Our company is committed to making products of the highest quality and reliability. Nevertheless, all electrical components are subject to natural deterioration, and durability of a product will depend on the operating environment and conditions of use. Continued use after such deterioration could lead to overheating, smoke or fire. Always use the product in conjunction with proper fire-prevention, safety and maintenance measures to avoid accidents, reduction in product life expectancy or break-down.
3) Before connecting, check the pin layout by referring to the connector wiring diagram, specifications diagram, etc., to verify that the connector is connected properly. Mistakes made in connection may cause unforeseen problems in operation, generate abnormally high levels of heat, emit smoke, etc., resulting in damage to the circuitry.
4) Do not use any motion sensor which has been disassembled or remodeled.
5) Failure modes of sensors include short-circuiting, open-circuiting and temperature rises. If this sensor is to be used in equipment where safety is a prime consideration, examine the possible effects of these failures on the equipment concerned, and ensure safety by providing protection circuits or protection devices.
   Example : Safety equipment and devices, traffic signals, burglar and disaster prevention devices, controlling and safety device for trains and motor vehicles

Global Network

Europe

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Austria	Panasonic Industry Austria GmbH
The Netherlands	Panasonic Industry Benelux B.V.
Czech Republic	Panasonic Industry Europe GmbH
France	Panasonic Industry Europe GmbH
	Panasonic Electric Works Sales Western Europe B.V.
Germany	Panasonic Industry Europe GmbH
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Ireland	Panasonic Industry UK Ltd
Italy	Panasonic Industry Italia srl
Nordic Countries	Panasonic Industry Europe GmbH
Poland	Panasonic Industry Poland sp. z o.o.
Spain	Panasonic Industry Europe GmbH
Switzerland	Panasonic Industry Switzerland AG
United Kingdom	Panasonic Industry Europe GmbH
	Panasonic Industry United Kingdom Ltd.

The Americas

United States (Headquarters in NJ)	Panasonic Industrial Devices Sales Company of America
Canada	Panasonic Canada Inc
Brazil	Panasonic Do Brasil Limitada

East Asia

China	Panasonic Industry (China) Co., Ltd.
Hong Kong	Panasonic Industrial Devices Sales (Hong Kong) Co., Ltd.
Taiwan	Panasonic Industrial Devices Sales Taiwan Co., Ltd.
Korea	Panasonic Industrial Devices Sales Korea Co., Ltd.
Japan	Panasonic Industrial Devices Sales Japan Co., Ltd.

Asia-Pacific

Singapore / Indonesia	Panasonic Industry Sales Asia Pacific
Thailand	Panasonic Industrial Devices Sales (Thailand) Co., Ltd.
Malaysia	Panasonic Industrial Devices Sales (M) Sdn. Bhd.
Philippines	Panasonic Manufacturing Philippines Corporation
India	Panasonic Life Solution India Pvt. Ltd.
Vietnam	Panasonic Vietnam Co., Ltd. / Panasonic Sales Vietnam
Turkey	Panasonic Elektronik Satis A.S., PTR.

Panasonic Corporation

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(PIR Motion Sensor PaPIRs)

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