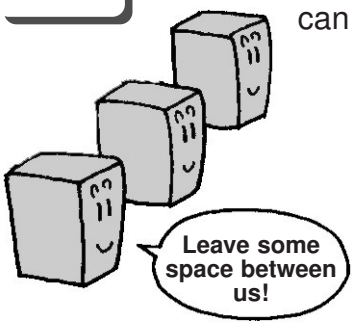
Circuitry

Q1 I would like to use two sensors simultaneously to expand the detection area. Will the sensors interfere with each other?

See here as well!

A

Yes. In order to avoid reciprocal interference when emissions occur simultaneously, install the MA motion sensors (built-in oscillation circuit type) with the following spacing, or use an external trigger type for which operation can be adjusted by the trigger signal input.



Product number	AMB1***	AMB2***	AMB3***
Standard detection distance	Short type	Middle type	Long type
Distance between sensors	5 cm	10 cm	20 cm

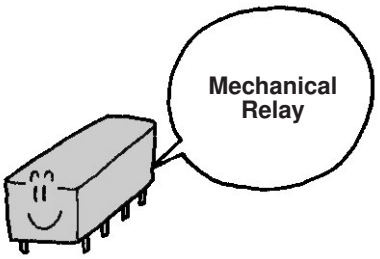
Q2 How should I design the circuit for output using a relay?

See here as well!

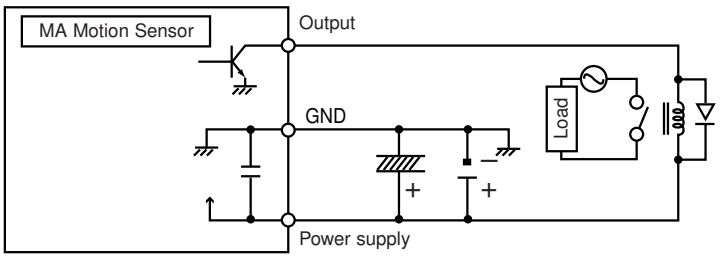
Q3

A

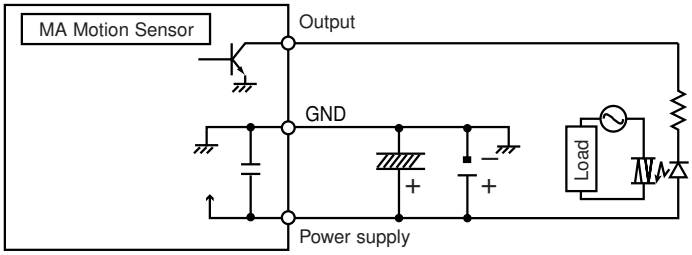
Refer to the following circuits

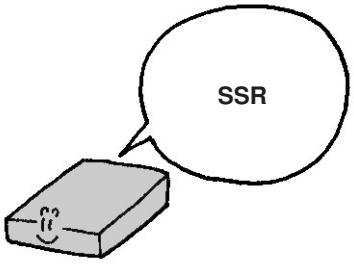


1. Mechanical relay drive



2. For SSR drive





Q3

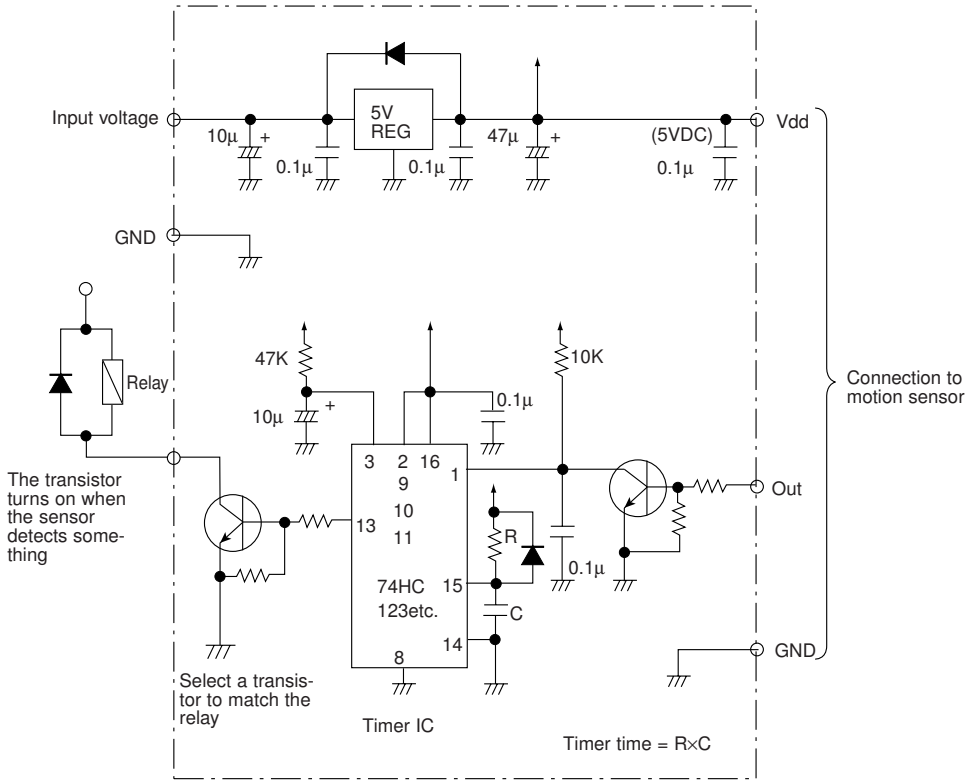
What kind of circuit should be used to set the time (timer time) of the output signal?

See here as well!
Q2

A

Refer to the following circuit.

Example of a relay drive circuit using a timer circuit



Note 1) Each timer IC manufacturer requires different values for the resistance (R) and capacitance (C) used for the time setting. Check with the manufacturer for these values before designing the circuit.

Note 2) This circuit is an example circuit for driving the MA Motion Sensor. Please note that we bear no responsibility for any damages or loss arising from the use of this circuit. To increase reliability and noise tolerance, add noise filter. Note that specification changes in the electronic components may prevent the circuit from operating correctly. Be sure to verify performance and reliability when designing the circuit.

Q 4 Can a power source voltage other than 5 V be used?

See here as well!

A

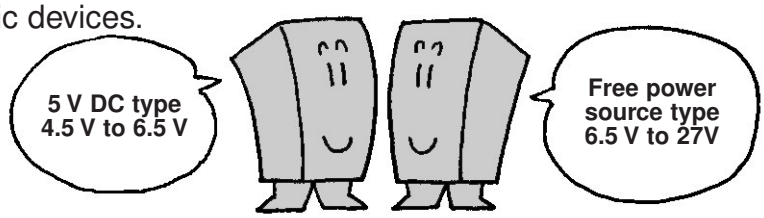
Yes.

Two types are available:

1) 5V DC type (4.5 V to 6.5 V DC)

2) Free power source type (6.5 V to 27 V DC)

These two types provide compatibility with most common electronic devices.



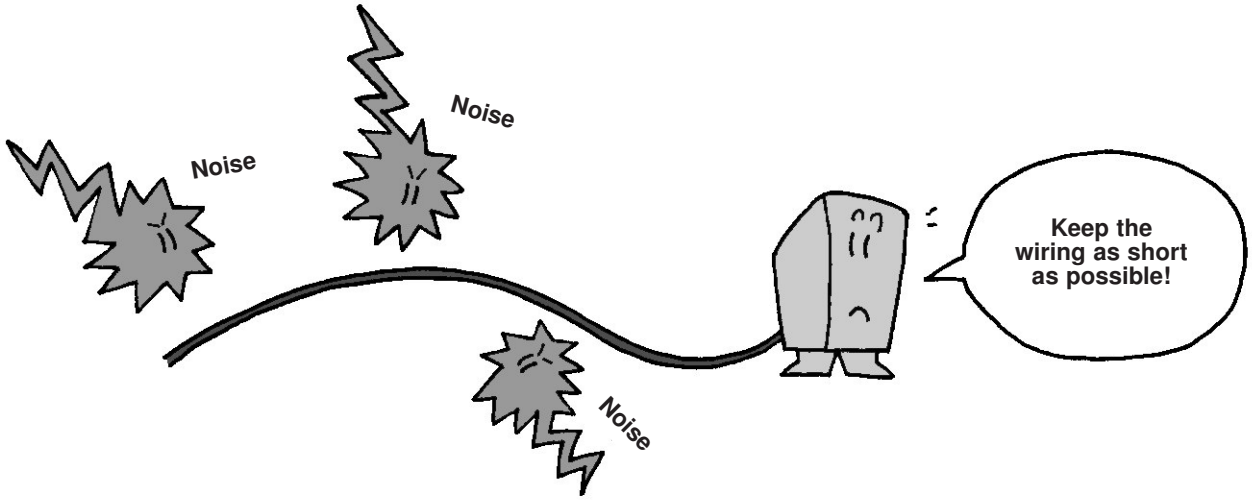
Q 5 I would like to extend the wiring to 3 meters. Is this possible?

See here as well!

Q26

A

In order to protect the internal circuit and reduce the influence of noise from the surrounding environment keep the wiring as short as possible within three meters. If inverters, motors, switching devices, or other devices are in close proximity, special caution is needed. If the sensor is going to be used in an environment with considerable noise, add a capacitor to the power input pin of the sensor.



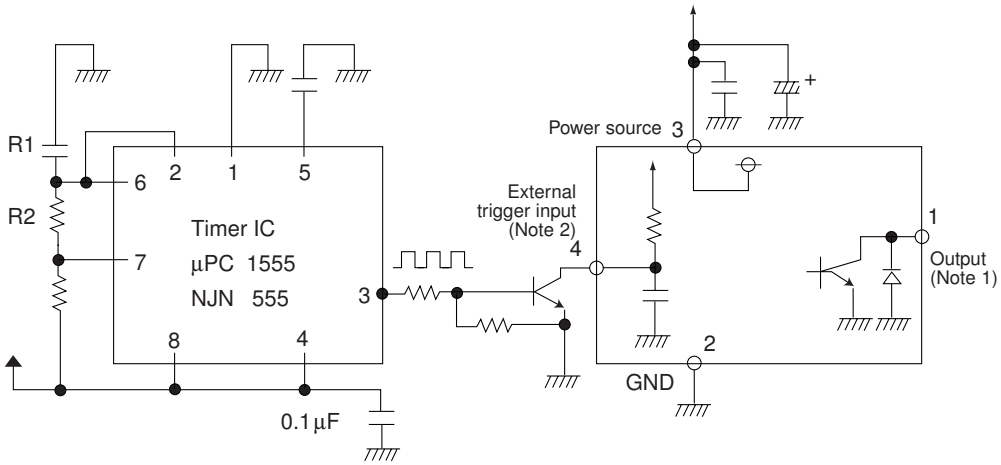
Q6

I need to design pulse generating circuit using the external trigger type. Could you show an example drive circuit?

See here as well!
Q7

A

Example drive circuit



Notes: 1. The output transistor has an open collector structure.
Detection status: Output transistor ON (connected to GND)
Non-detection status: Output transistor OFF (open state)

Notes: 2. The status of the external trigger input is as follows:
Open at the high level
GND (less than 0.8V) at the low level
Under no circumstances must a high-level voltage be applied.

Notes:

This is a sample circuit for driving an MA Motion Sensor. Noise protection was not taken into consideration.

To increase reliability and protect against noise, add a noise filter to the input. In addition, add a circuit that accepts the output in synchronization with the start signal and issues a detection signal when the same output is repeated several times in succession.

Please note that we bear no responsibility for any damages or loss arising from the use of this circuit.

Performance

Q 7 Is detection performance affected by the type of clothing worn?

See here as well!
Q8

A

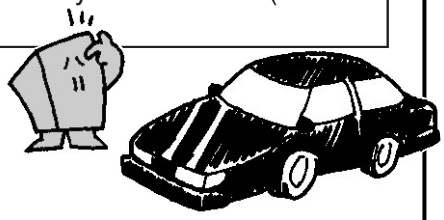
The effect of clothing is negligible.

Light intensity type sensors, which have been in common use, detect an object based on the amount of reflected light and for this reason tend to be affected by the type of clothing worn. The MA Motion Sensor is a distance measurement type sensor, and variations in the detected distance due to differences in clothing material or color are negligible.

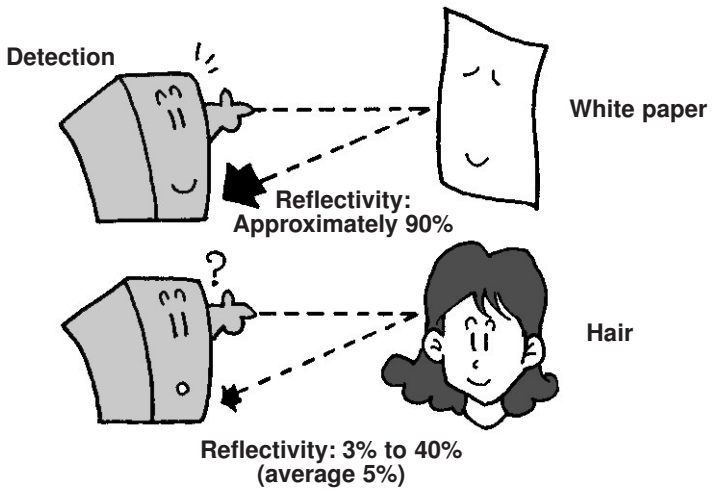
Stable detection is possible of objects having a reflectance ranging from 90% to 18%.

The reflectance of clothing and body parts is indicated below.

Detectable objects	* Objects with a high reflectance White cloth, white shirts, white sport shirts * Intermediate objects Objects with a colored pattern * Objects with a low reflectance Black formal clothing, fluffy or furry materials such as black fur, lustrous materials such as black lame
Objects that cannot be detected	Mirrors, objects with metallic coating, mirror-like objects in which you can see your reflection (black car body, metal plates)



Reference:
Reflectance of human skin: Approximately 40%
Reflectance of hair: 3% to 40% (average 5%)



Q8

Why is a detection signal output even though no object is in the detection area?

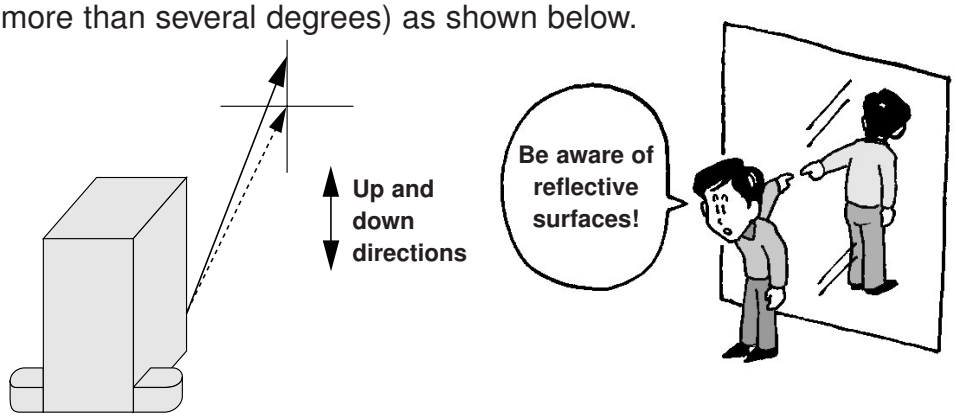
See here as well!

Q7 Q26
Q9 Q27
Q11 Q28
Q12

A

1. Is there anything in front of the MA Motion Sensor with a reflective surface such as a mirror, metallic plate, or marble?

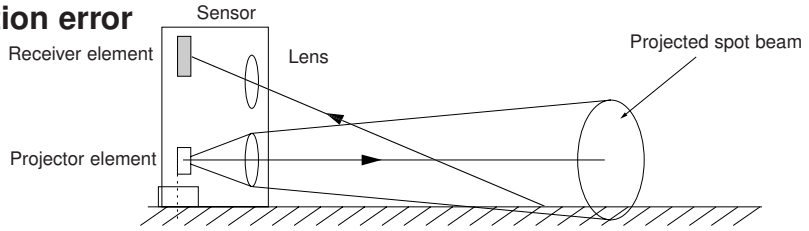
Just as light reflects in a mirror, the infrared light emitted by the sensor will reflect off of an object with a reflective surface and return to the sensor. If this occurs, change the angle of attachment of the sensor slightly (no more than several degrees) as shown below.



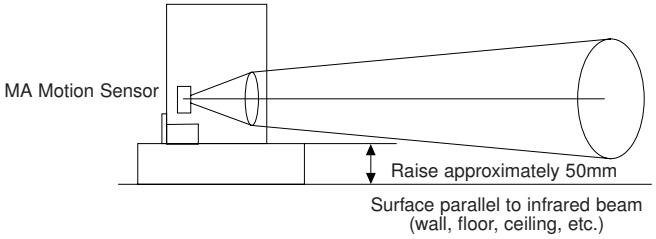
2. Is the sensor detecting the surface on which it is installed?

The sensor emits infrared light in the form of a spot beam that gradually expands. The beam projector element is in the bottom part of the sensor, and thus if the sensor is installed on a surface parallel to the beam (wall, floor or ceiling), the beam may hit the surface and reflect back into the sensor. We recommend that you raise the sensor slightly off of the installation surface (approx. 50mm).

Detection error



Recommended installation



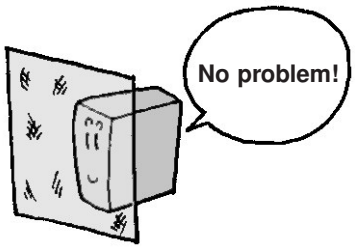
Q 9 Does dirt on the front cover (filter) affect performance?

See here as well!
Q24
Q27
Q28

A

Dirt has almost no effect.

The MA Motion Sensor takes the detected difference in distance between an object with 90% reflectance and an object with 18% reflectance as “distance measurement error”. Even if the reflected light intensity decreases to 1/5 its original value due to dirt, the distance measurement error will still be under this value.



Q 10 What is the output wavelength of the sensor’s infrared LED?

See here as well!
Q11

A

The output reaches a momentary (max. 10 µs) power of 180 mW, and the wavelength is approximately 900 nm. This is about the same as a typical remote control.

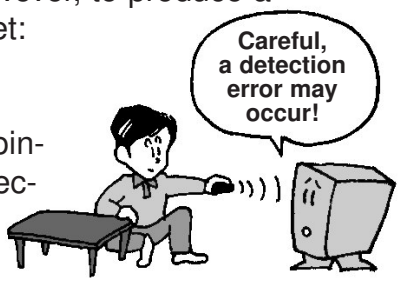
Q 11 Does a remote control ever cause detection errors?

See here as well!

A

The sensor uses the same type of light emitting element as a remote control, and as such detection errors are possible. However, to produce a detection error the following conditions must be met:

* The remote control must be within the field of detection of the sensor.
* The timing of remote control operation must coincide with the interval of several tens of microseconds that the MA Motion Sensor accepts light.
* Sufficient power is required.



Due to these conditions, random operation of a remote control pointed toward the MA Motion Sensor will result in erroneous detection only once every several tens of times.

Q12 Does temperature affect the detection distance?

See here as well!
Q13

A

Yes.

The area reflective type MA Motion Sensor detects an object based on the position of the infrared beam that reflects off of the object and returns to the sensor. When the temperature changes, differences in the coefficients of linear expansion of the sensor components can cause the distance between the lenses, and the distance between the projector and receiver elements, to expand or contract. This changes the position of the returning infrared beam and thus the detection distance.
The amount of the change is several percent over the operating temperature range of the sensor (–25°C to 75°C).

Q13 Is it possible to select a new setting for the detection distance after receiving the sensor?

See here as well!
Q12
Q14
Q15

A

No, you cannot set the detection distance once the sensor has been shipped from the factory.

The rated detection distance is determined by the lens position adjustment. Since this procedure is done at the factory before shipping you cannot set this afterwards once the sensor has been shipped. Please select a sensor according to your application with the appropriate detection distance from the products provided below.

AMB [*] [*] [*] [*] [ ] [ ]

Rated detection distance

Area reflective type MA Motion Sensor			
Type / Model number	**Short type**	**Middle type**	**Long type**
02	-	20 cm	-
03	-	30 cm	30 cm
04	-	40 cm	40 cm
05	5 cm	50 cm	50 cm
06	6 cm	60 cm	60 cm
07	7 cm	70 cm	70 cm
08 (No display on middle type)	8 cm	80 cm	80 cm
09	9 cm	-	90 cm
10 (No display on short type)	10 cm	-	100 cm
11	11 cm (Note)	-	110 cm
12	12 cm (Note)	-	120 cm
13	13 cm (Note)	-	130 cm
14	14 cm (Note)	-	140 cm
15	15 cm (Note)	-	150 cm
16	-	-	160 cm
17	-	-	170 cm
18	-	-	180 cm
19	-	-	190 cm
20 (No display on long type)		-	200 cm

Note:
Not kept in stock.
Please consult us.

Q 14

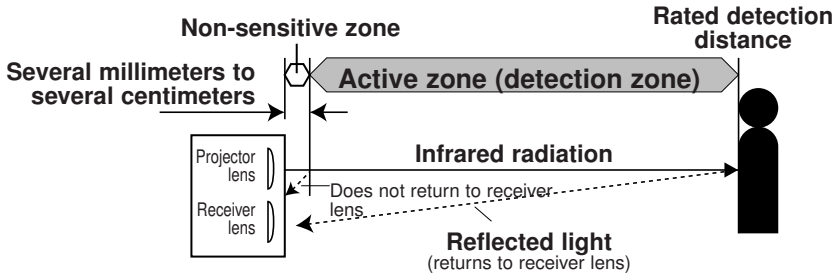
Can detection take place when the object is closer than the rated detection distance?

See here as well!
Q13
Q15
Q23

A

Yes.

The sensor emits an infrared beam, measures the distance to the person (object) by means of the light reflected back, and determines whether or not the object is within the detection distance.
However, with the exception of the non-sensitive zone in the immediate proximity of the sensor where light reflected off the object cannot return to the receiver lens, the sensor detects objects anywhere within the rated detection distance.



Q 15 What are the characteristics of the detection area?

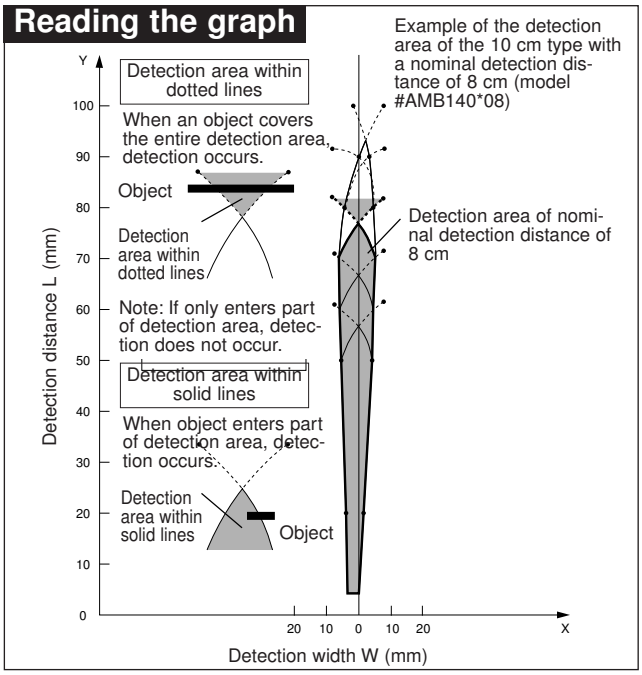
See here as well!

Q13
Q14
Q23

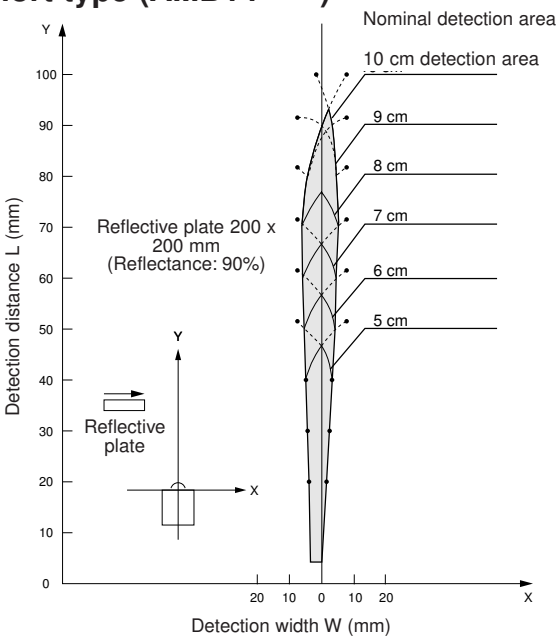
A

The characteristics are shown in the following diagrams.

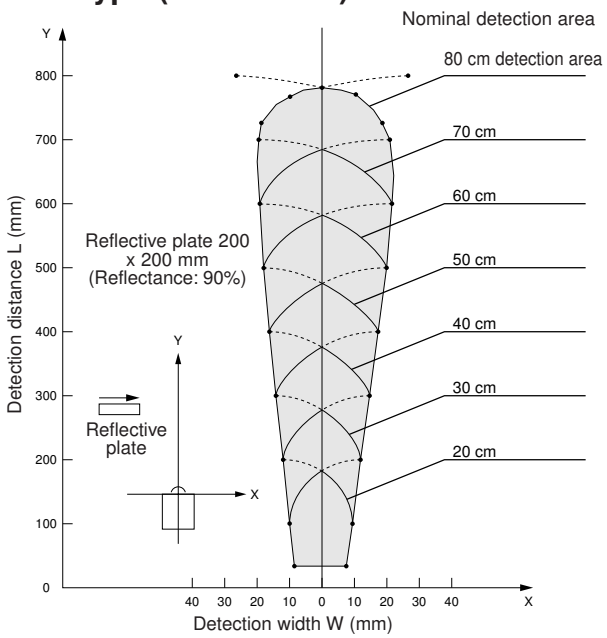
Reading the graph



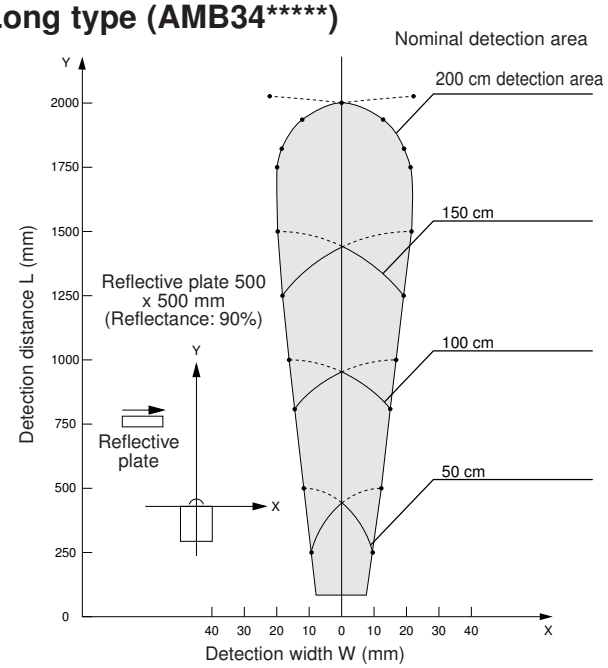
Short type (AMB14*****)



Middle type (AMB24*****)



Long type (AMB34*****)



Q16

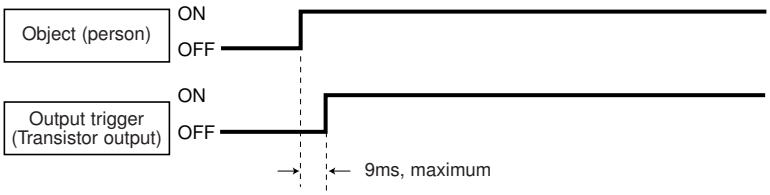
How long does it take (response time) for the detection signal to be output after a person or object enters the detection area?

See here as well!

A

A maximum of 9 ms.

The built-in oscillation circuit type is set to measure at a maximum period of 9 ms, and thus the response time is a maximum of 9 ms.
However, the average is about 8 ms.



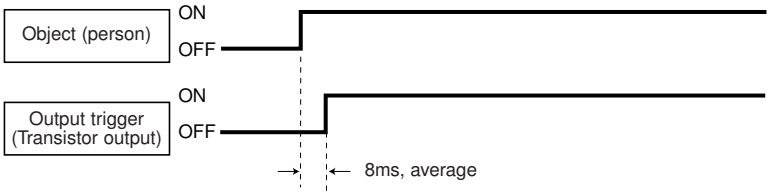
Q17

If the detection state persists, what happens to the output?

See here as well!

A

The output remains in the ON state.



Q18

Does the sensor have good weather resistance?

See here as well!

Q19
Q24

A

The front window of the MA Motion Sensor is made with polycarbonite. This plastic has particularly superb weather resistance even compared to other plastics.

Q19 What is your policy with respect to aging deterioration?

See here as well!
Q18

A

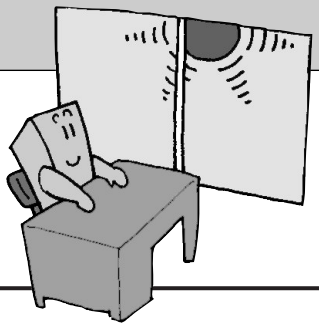
We estimate the life of the sensor based on testing in the operating environment of the components having the greatest effect on operation.
In the case of the MA Motion Sensor, the light emitting diode has the most effect on operation. We estimate the life of the diode based on accelerated reliability tests (THB tests, etc.). The tests indicate that the sensor should operate without problem for 10 years or more, a result that past products have held up.

Q20 How bright is 30,000 Lx?

See here as well!
Q30

A

The brightness inside a window on a clear summer day.



Q21 Assuming battery power will be used, what is the life of the batteries?

See here as well!

A

Conditions
Typical current consumption over one month of use.
•3240 mA H/month typ. (Built-in oscillation circuit type)
•106 mA H/month typ. (External triggering type on 1 sec/time of trigger period)

<Comparative table of battery lives>

Battery type	Manufacturer	Model number	Size(one battery)	Voltage	Capacity	Life(months) of built-in oscillation circuit type	Life(months) of external triggering type
Lithium	Matsushita Battery Industrial	BR-CT2P	ø26x50	3 V (x 2 batteries)	5000 mAh	1.5	47.2
		BR-P2P	ø19.5x36x2	6 V (x 1 battery)	1200 mAh	0.4	11.3
Alkaline		LR20(PG)	ø34.2x61.5	1.5 V (x 4 batteries)	4030 mAh	1.2	38.0
Nickel cadmium	Sanyo Electric	N-4000D	ø34x61	1.2 V (x 5 batteries)	4000 mAh	1.2	37.7

If you need a low current consumption battery, please consult us.

Terminology

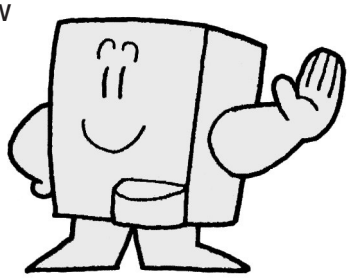
Q 22 What is open collector output?

See here as well!

A

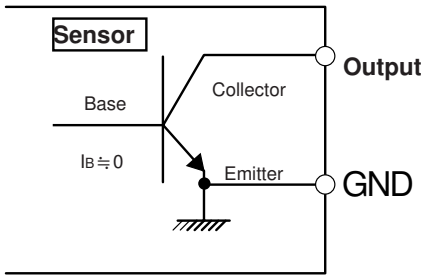
A transistor is used in the output. When the sensor detects a person or object, the transistor turns on and current flows from the collector to the emitter, outputting a signal.

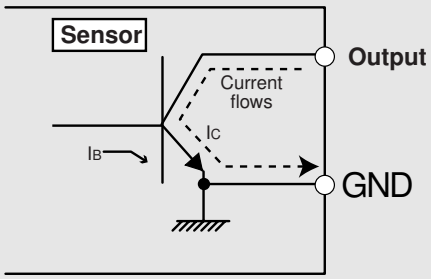
When open collector output is used, the current flow and voltage applied to the load connected to the output can be set as desired. This enables wide range of use in sequencers and other devices.



Non-detection state (Transistor is OFF)	Detection state (Transistor is ON)

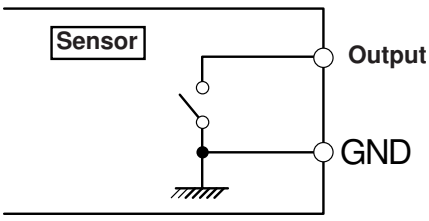
Schematic of output circuit

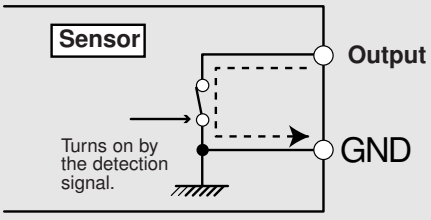




(IB: Base current
IC: Collector current)

Image of output circuit





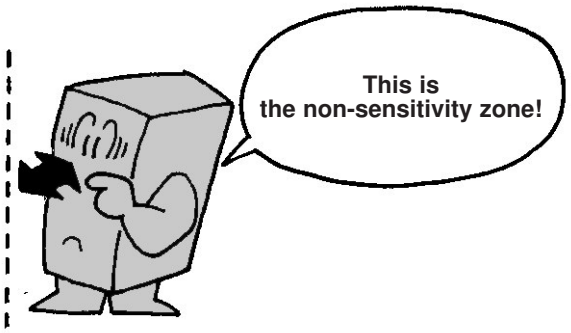
Q23 What is the non-sensitivity zone?

See here as well!
Q14
Q15
Q27

A

This is the area extending from several millimetres in front of the sensor to several tens of millimetres where the sensor does not operate.

The sensor detects the presence of an object based on the position of entry in the receiver element of the light reflected off the object. If the object is in immediate proximity to the sensor, the light emitted from the sensor does not return to the receiver element and the object is not detected. As the sensor will be incorporated into a device, it is frequently used with a front cover, and the non-sensitivity zone keeps the cover from being detected and helps the sensor operate normally.



Using Sensors

Q24 Is outdoor use possible?

See here as well!
Q9
Q25
Q27

A

Basically, you should not.

This sensor is designed for indoor use (for common indoor electronic devices). If you need to use a sensor outdoors, take measures to waterproof the sensor and protect it from dust, condensation, and freezing. There are many causes of temperature changes outdoors, and detection errors may result.

Q25 What should be done about waterproofing?

See here as well!
Q24
Q27

A

The sensor itself is not waterproof. When incorporating the sensor into the device, design the structure to be waterproof. However, please use a material in front of the sensor such as glass or acrylic that allows the transmission of infrared rays.

Q 26 What points are important when installing the motion sensor?

See here as well!
Q5
Q8

A

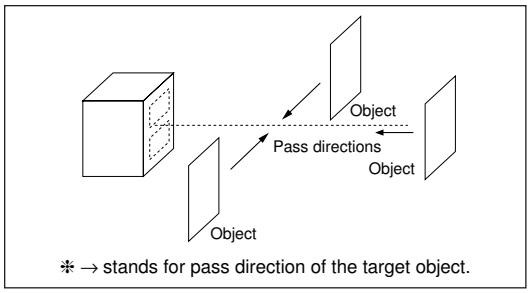
The MA Motion Sensor is designed primarily for indoor use.

The number of detection times and the presence of an object

Noise from external sources and other factors can cause the unexpected output of a detection signal. For applications requiring greater detection reliability, we recommend that you design the circuit so that the device activates only after several detection signals are output, not just one.

How to install the sensor

<Recommended installation direction>



Install the sensor so that it points in the direction shown at left with respect to the direction of entry of the object.

<Recommended installation height>

The infrared beam emitted from the sensor spreads over a certain angle with respect to the front of the sensor. If you install the sensor so that the beam travels parallel to the installation surface (such as a wall, floor or ceiling), we recommend that you raise the sensor slightly off of the surface (about 50 mm). (Refer to Q8)

Front cover

Wiring length

To minimize the effects of noise, keep the wiring as short as possible. If the sensor is to be used in a high-noise environment, add capacitors to the sensor power input and the output.

Effects other than the detection area

Operating environment

Performance of power source

Q27 What points are important when installing a cover (filter) on the front of the sensor?

See here as well!
Q9
Q23
Q28

A

Required cover (front filter) specifications

Use a cover that transmits infrared light (wavelength: 900 nm).

Material: Acrylic, glass, or similar material

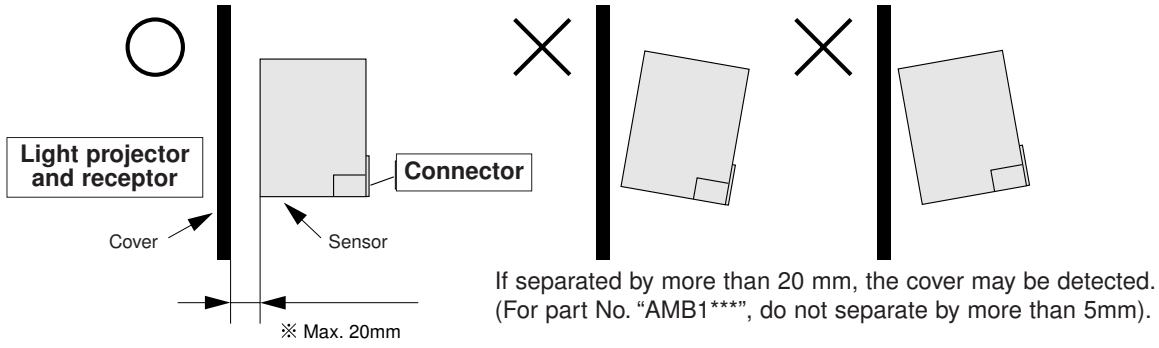
Surface condition: To prevent light dispersion, the surface roughness should be 1µm R-Max (ground glass is not acceptable)

Color: As long as the material optically transmits infrared light (wavelength: 900 nm), any visible color is acceptable. (You must be able to see through the plate.)

Thickness: Use a plate with a maximum thickness of 2 mm. (If the cover is too thick, dirt on the cover may accidentally trigger detection.)

How to install the cover

Install the cover so that it is parallel to the front face of the sensor.

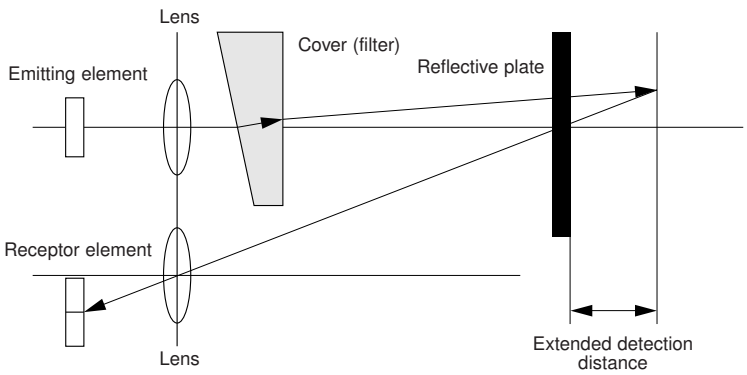


If separated by more than 20 mm, the cover may be detected. (For part No. "AMB1***", do not separate by more than 5mm).

Covers of non-uniform thickness

As shown below, the detection distance can be lengthened by placing a cover or filter of non-uniform thickness in front of the sensor to produce a prism effect.

<Example>



Q 28 Can the sensor be used if the front is half covered?

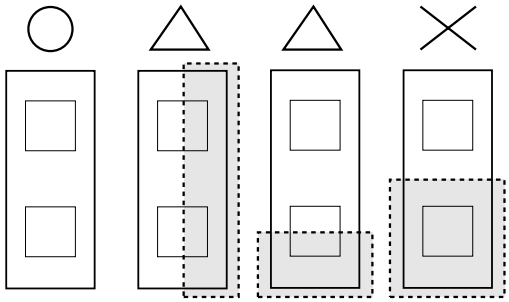
See here as well!

Q9
Q27

A

The area reflective type MA Motion Sensor is a distance measurement type sensor and thus it tends not to be affected by the intensity of light reflected from the detected object. For this reason, the sensor can detect if its front face is half covered; however, performance is noticeable impaired.

Before using the sensor, verify detection performance using the object you with to detect.



Q 29 Is it okay to wipe the sensor with ethanol?

See here as well!

A

Yes.

The front face of the lenses and the case are made of polycarbonite.
In general, this material is resistant to water, alcohol, oil, salt, and weak acids.
Alcohol: methanol, ethanol, etc.
Oils and fats: turbine oil, grease, etc.

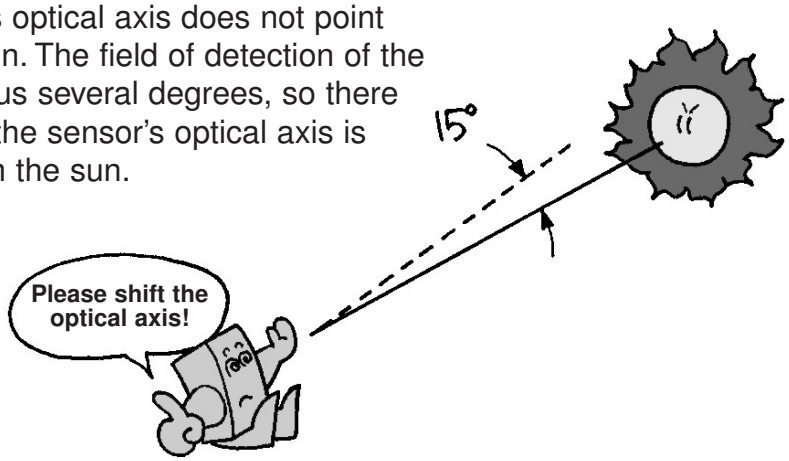
Do not use the following chemicals:
Gasoline, thinner, ammonia, caustic soda, toluene

Q30 Should I assume that detection is not possible in direct light?

See here as well!
Q20

A

The maximum ambient operating illumination of the sensor is 30,000 Lx. Even in bright sunlight, and even if light shines directly on the sensor or on the object of detection, the sensor will operate correctly as long as the illumination does not exceed 30,000 Lx.
However, if an inverter light is directly within the detection area of the sensor (plus or minus several degrees), the sensor will not operate correctly. This is because the sensor cannot distinguish between light emitted from the sensor and light from the inverter light.
The sensor will operate correctly in the direction of the sun as long as its optical axis does not point directly toward the sun. The field of detection of the sensor is plus or minus several degrees, so there will be no problem if the sensor's optical axis is shifted 15° away from the sun.

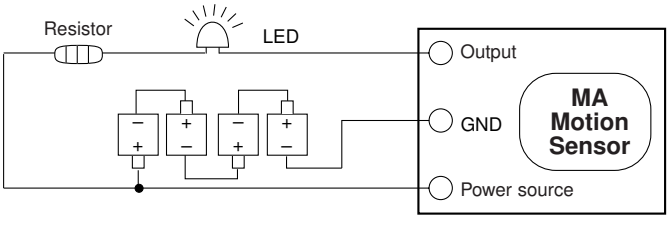


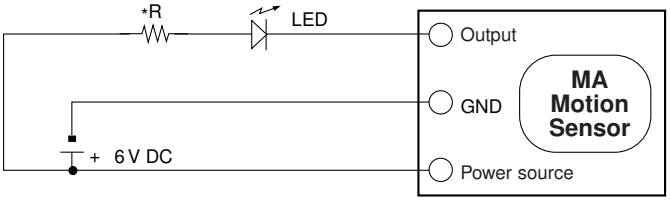
Q31 Is there an easy way to verify sensor operation?

See here as well!
Q21

A

Connect the sensor as shown at right to have an LED illuminate when the sensor detects a person or object.





* Use a resistor value appropriate for the current that is to flow through the LED.

Reliability Data of MA Motion Sensor

Conditions of measurement: temperature = 25 ± 5˚C, humidity = 40 to 70%, air pressure = 86 to 106 kPa

Tested characteristic	Test conditions	Pass/fail criteria	Test result
Heat resistance	Temperature: 85 ± 3˚C Test time: 96 hours	After test: Change in detection distance performance is no more than ±30% of initial value. Visual inspection reveals no structural abnormalities.	Number of pieces tested: n = 6 Defective pieces: c = 0 Passed
Resistance to thermal shock	Low temperature: -30 ± 3˚C High temperature: 85 ± 3˚C Time of one cycle: 30 minutes each for high and low temperatures Number of cycles: 100	After test: Change in detection distance performance is no more than ±30% of initial value. Visual inspection reveals no structural abnormalities.	Number of pieces tested: n = 6 Defective pieces: c = 0 Passed
Low temperature resistance	Temperature: -30 ± 3˚C Test time: 96 hours	After test: Change in detection distance performance is no more than ±30% of initial value. Visual inspection reveals no structural abnormalities.	Number of pieces tested: n = 6 Defective pieces: c = 0 Passed
Operating temperature range	Low temperature limit: -25 ± 3˚C High temperature limit: 75 ± 3˚C	During test: no errors, operation failures, or damage. Change in detection distance performance is no more than ±20% of the value at 25˚C.	Number of pieces tested: n = 6 Defective pieces: c = 0 Passed
Temperature/ humidity cycle	Temperature: -10 ± 3˚C to 65 ± 3˚C Humidity: 90% Time of one cycle: 24 hours Number of cycles: 10	After test: Change in detection distance performance is no more than ±30% of initial value. Visual inspection reveals no structural abnormalities.	Number of pieces tested: n = 6 Defective pieces: c = 0 Passed
Vibration resistance	Vibration frequency: 10 to 55 Hz Amplitude: 1.5 mm Direction of application: 3 directions Application time: 30 minutes each directions	After test: Change in detection distance performance is no more than ±30% of initial value. Visual inspection reveals no structural abnormalities.	Number of pieces tested: n = 6 Defective pieces: c = 0 Passed
Shock resistance	Shock value: 100 G Direction of application: 3 directions Application times: 3 times each	After test: Change in detection distance performance is no more than ±30% of initial value. Visual inspection reveals no structural abnormalities.	Number of pieces tested: n = 6 Defective pieces: c = 0 Passed
Output characteristics	Power source voltage: Nominal power source voltage Output load voltage: 30 V DC	Leakage current: 3 µA or less (Measured with micro-ammeter when output Tr is OFF)	Number of pieces tested: n = 3 Defective pieces: c = 0 Passed
Dropping tolerance (No Packing)	Height: 80 cm Direction of drop: 6 directions Number of times: Once each direction Drop surface: vinyl chloride tile	After test: No destruction. Visual inspection reveals no structural abnormalities.	Number of pieces tested: n = 6 Defective pieces: c = 0 Passed