

OMRON

Model E4A-3K

Ultrasonic Switch

INSTRUCTION SHEET

Thank you for selecting OMRON product. This sheet primarily describes precautions required in installing and operating the product.

Before operating the product, read the sheet thoroughly to acquire sufficient knowledge of the product. For your convenience, keep the sheet at your disposal.

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PRECAUTIONS ON SAFETY

● Meaning of Alert Symbols



Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death. Additionally there may be significant property damage.

● Alert statements



This product is not designed or rated for ensuring safety of persons. Do not use it for such purpose.

Serious Electric shock is likely to occur. Do not touch the terminals while the power is supplied.

Serious Electric shock is likely to occur. Do not disassemble or touch inner circuits when power is supplied.

■ Ratings/Performance

Supply voltage	AC100/200 type	AC 100/110/200/220V ± 10% 50/60Hz
	AC120/240 type	AC 120/240 ± 10% 50/60Hz
	DC type	DC 24V ± 10% ripple ± 10%
Power Consumption	AC type	Approx. 2.5V A
	DC type	150mA max.
Detecting Distance	0.3 to 3m (with switch of 0.3~2m and 1.3~3m)	
Standard Detecting Object	100 dia. mm, metal or plastic round tube of 1,500mm length	
Minimum Detecting Object	50mm × 50mm flat plate	
Ultrasonic Oscillating Frequency	40kHz	
Directional Angle	half value angle 25°	
Response Time	Operation time 0.25 sec. round time 0.5 sec.	
Control Output	Contact output 1 c 220V AC 3A cos dia. =1, DC 24V 3A cos dia. =1	
Ambient Operating Temperature	-20 to +55°C (No freezing allowed)	
Ambient Operating Humidity	45 to 85% RH	
Insulation Resistance	20MQ min. (at DC 500V)	
Dielectric Strength	AC 1,500V 50/60Hz for 1 min.	
Vibration	Durability : 10 to 25Hz, Amplitude, 1.5mm in three directions for 2 hours, respectively.	
Impact	Durability : 500m/s ² in six directions for 3 times, respectively	
Service Life (Output Relay)	mechanically : 20 million min. electrically : 0.1 million min.	
Weight	about 500g (Sensor itself) about 600g (including mounting bracket)	
Degree of protection	IEC60529 IP60	

● How to set detecting distance

(a) In case of moving vertically to ultrasonic beam (general detecting object), we make it a standard to set the detecting distance for the detecting object's surface to pass through the center of operation range. According to this, minimum detecting height $h=0.2d$. Consequently, in detecting a lower object and discriminating a small difference of object which has various height has to shorten detecting distance.

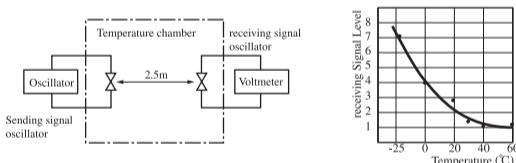
(b) In case of moving parallel to ultrasonic beam, (detection of level, height) operating distance=detecting distance. In case floor, wall, conveyor exist closed to the detecting object, the detecting distance between detecting object and detecting distance setting point must be more than 0.1d. Set detecting distance d as for the detecting surface enter the operation range for more than 0.1d.

● Operation Confirmation

After finishing detecting distance adjustment, please confirm operation by passing detecting object. Next, please remove the detecting object. If operating indicator is completely "OFF", adjustment is finished. If the light is flashing it means the switch may operate affected by the outside condition, for example, the wind and the temperature. In that case, reset the setting position and angle. After resetting the setting position, be sure to confirm detecting distance and operation.

PRECAUTIONS FOR CORRECT USE

- Do not use the sensor in the following places.
 - Exposed to violent temperature fluctuations.
 - At high humidities with possible dew condensation.
 - Exposed to violent vibrations.
- Wiring
 - Avoid laying the cable close to any high-voltage and intense-current lines.
 - Be careful not to confuse the polarities of the terminals.
- Cleaning
 - Do not use any types of thinner.
- Sensor's mounting angle
 - For level or distance control, the detection signal's stability is affected by a detectable object's reflecting surface. With the type of detectable object in mind, determine the angle of repose and position the sensor so that the ultrasonic beam hits against the reflecting surface at a right angle.
- Obstacles around the sensor
 - Prevent the ultrasonic beam from getting scattered and causing irregular reflection from the side rope in particular. Otherwise the sensor may malfunction.
- Installation
 - Using the accompanying mounting nuts or the sensor mounting holes, place and fix the sensor. (For details, see the external dimensions.)
 - Make sure the sensor is tight in position. Vibrations may damage or dislocate the sensor, resulting in poor detection.
- Ambient conditions
 - Use the sensor within the specified temperatures and outdoor conditions in order to maintain the reliability and service life.
 - The ultrasonic proximity switch is activated through the air. Avoid a place where there is big temperature difference and violent air convection.
 - Air disturbance (violent change in air stream) — hot air at an air curtain, for example — in the work range may result in malfunction.
 - Jet noise being generated from an air nozzle contains many different frequency components and greatly affects the sensor. Do not use the sensor near such equipment.
 - Make sure there is no waterdrops over the sensor surfaces (transmitting and receiving parts). Otherwise the detection distance may be shorter.
 - Objects coated with fine powder, cotton and other sound-absorbing materials (reflective type) are impossible to detect.
- Attenuation characteristics due to temperature
 - Ultrasonic wave in the air attenuates with the increase of temperature as shown in the following figure.
 - Generally, temperature range is -10 to +40°C for stable use.



(9) Reverberation

The sound wave multiple reflects on the wall or the floor when it drives in the enclosed small room or strong supersonic wave power is put by synchronous driving. In that case, the supersonic wave that the sensor oscillates keeps existing without attenuating at long time. This is called a reverberation. The sensor might be judged that there is a reflection from the object, and malfunction when the reverberation is long. The following measures are recommended.

- The operation mode is switched to B mode.
- The installation applies the angle without keeping parallel on the wall or the floor.
- The sound wave absorption material such as cloths is put on the wall or the floor.

Please note that E4A-3K might not be able to be used in the small room completely enclosed due to the malfunction by the reverberation.

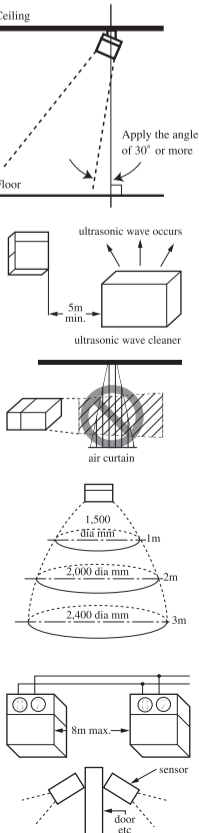
(10) This ultrasonic switch is used only indoors. Do not use at the highly humid place, rainy or snowy place or vapour. Place apart from such as ultrasonic washing machine or ultrasonic molding machine for more than 5 meters.

(11) Do not install the switch where the wind from the air curtain, the air conditioner and so on blows through the operating area. An air curtain will cause the diffused reflection and the extinction of the ultrasonic wave and malfunction or non-operation.

(12) Please be careful to install at appropriate place and direction. As shown in the following figure, the diffused reflection becomes the reason of misoperation within the range as indicated. In case of misoperation, indicator flashes. In adjusting, please confirm the indicator is "OFF" when removing the detecting object. Besides, the range indicated in the figure is just a "reference".

(13) When more than two types E4A-3K are spaced within every 8m, the synchronous operating is necessary. Follow the external connection diagram for the lining of the synchronous operating.

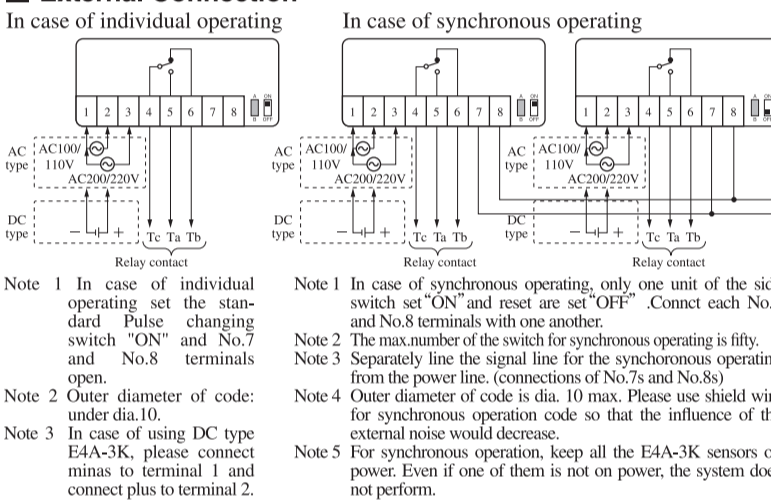
(14) Please be sure to wire synchronously also in case that each sensor is parted by door etc. as shown in the figure.



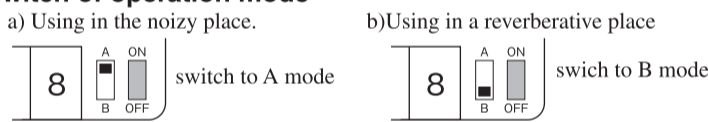
PRECAUTIONS FOR SAFE USE

- Follow the important safety points below
- Do not use where flammable gases or objects are present.
 - Do not disassemble, repair or remodeling.
 - Fully tighten all terminal block screws and check terminal names.
 - Please use the suited terminal.
 - Please lock the mechanisms such as the terminal stands and cables surely.
 - Use a power supply voltage inside the specified voltage range.
 - Use with a load not exceeding the rated load.

■ External Connection



■ Switch of operation mode



The influence of turbulence can be minimized by using A mode in the environment where a random noise exists, and by using B mode in the place with the reverberation. Please refer to clause (9) of "Precautions of Correct Use" for use in the place where a lot of reverberations exist.

■ Detecting operation range and unsensible range

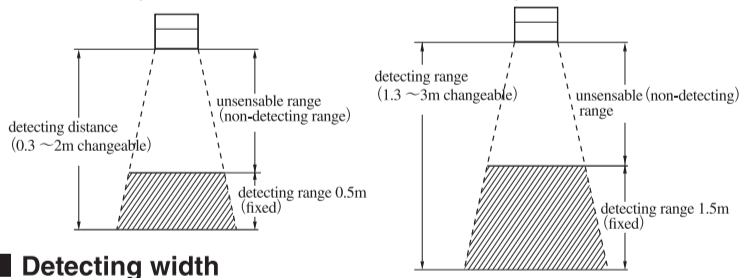
The operating range of type E4A-3K ultrasonic switch is shown in the following figure. This is varied by distance-change over switch;

0.3~2m : 0.5m
1.3~3m : 1.5m

However, detecting distance = operation range when operation range ≥ detecting distance. In case of arranging the detecting distance, please note this point. Besides, even in the unsensible range, some objects are detectable for the sake of multiple reflection.

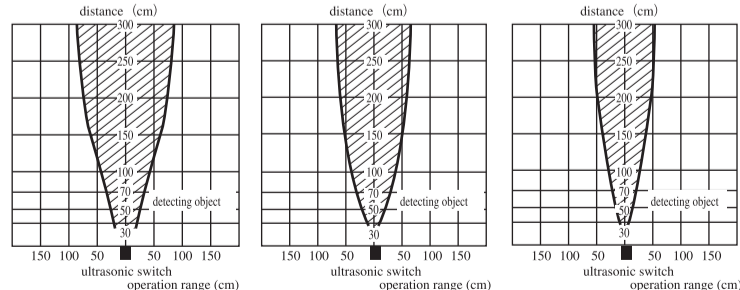
Please do not use in this range because of the unstability of operation.

Distance change over switch : 0.3~2m Distance change over switch : 1.3~3m

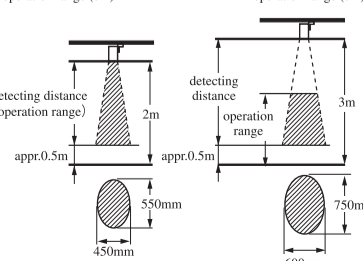


■ Detecting width

Detecting width is the operating range when moving detecting object vertically to the ultrasonic beam at a certain distance. Detecting width of ultrasonic switch varies according to detecting distance and detecting object's size, and facing condition.

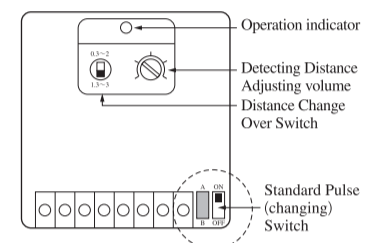


In case of installing on the ceilings for the purpose of detecting human beings except ensuring safety, the detecting width is as follows.



■ Adjustment Method

Confirmation of norm pulse switch
In case of synchronous operating, this is used. Generally, please set "ON". (Refer the section of External connection)

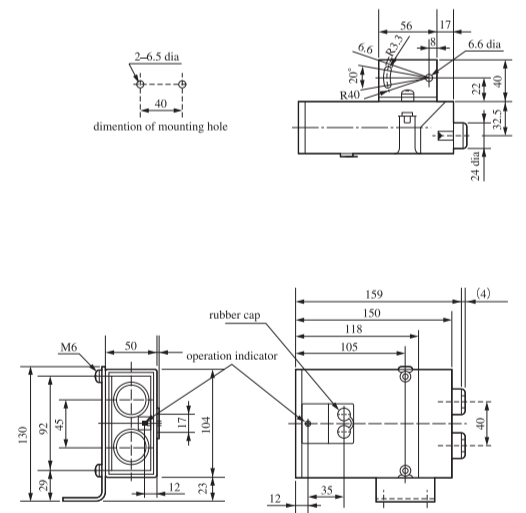


Detecting distance adjustment
When adjusting the detecting distance, please take off the rubber cap of ultrasonic switch. After adjustment, be sure to put on the rubber cap.

- Set the distance change over switch. Please set at 0.3~2m side or 1.3~3m side according to the detecting distance and operating range. When setting, place driver at nob groove of switch.
- Set the detecting distance according to the detecting distance adjuster. Place a flat plate of 20cm × 20cm on the setting point of detecting distance, facing the ultrasonic switch. Then slowly turn the detecting distance adjuster to the right (distance becomes longer) and adjust at the relay operating point. (Operating indicator is "ON")

■ External dimensions

Model E4A-3K (Unit : mm)



Suitability for Use

THE PRODUCTS CONTAINED IN THIS SHEET ARE NOT SAFETY RATED. THEY ARE NOT DESIGNED OR RATED FOR ENSURING SAFETY OF PERSONS, AND SHOULD NOT BE RELIED UPON AS A SAFETY COMPONENT OR PROTECTIVE DEVICE FOR SUCH PURPOSES. Please refer to separate catalogs for OMRON's safety rated products.

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of the products in the customer's application or use of the product.

Take all necessary steps to determine the suitability of the product for the systems, machines, and equipment with which it will be used. Know and observe all prohibitions of use applicable to this product.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCT IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM. See also Product catalog for Warranty and Limitation of Liability.

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