

Sensor with an Adjustable Sensing Distance of 0.3 to 3 m Under Stable Operation without Background Interference

- Ensures a stable operating range with minimal side-lobe areas.
- Built-in unstable operation check function allows easy adjustment to a proper mounting direction.
- Mono-block construction with a sensor, power supply, and terminals ensures easy wiring.
- Incorporates synchronous selector and reference pulse I/O terminals ideal for parallel-operation use without mutual interference.

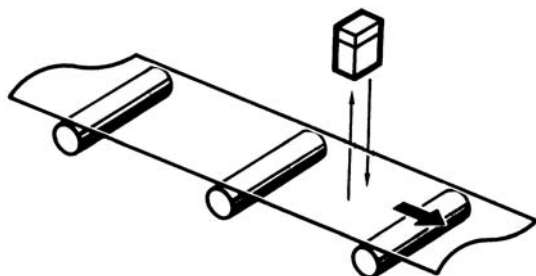


Ordering Information

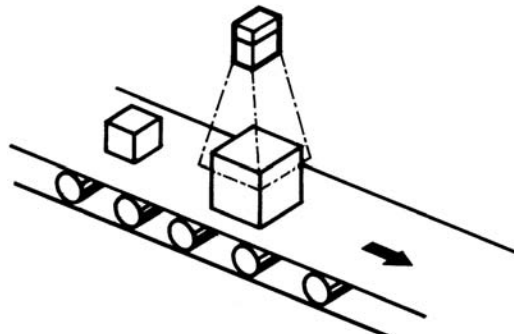
Sensing method	Reflective
Model	E4A-3K

Application Examples

Detection of cellophane, glass, and photosensitive paper



Detection of objects on conveyors or discrimination of object heights



Specifications

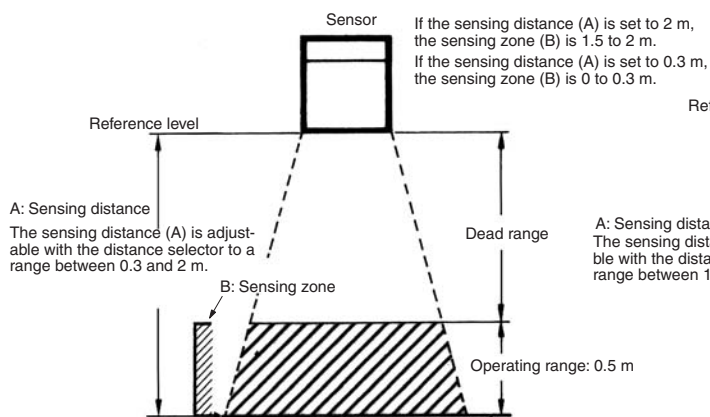
■ Ratings/Characteristics

Supply voltage	100, 110, 200, and 220 VAC \pm 10% at 50/60 Hz (see note)	
Power consumption	Approx. 2.5 VA	
Sensing distance	Adjustable between 0.3 and 3 m (selectable ranges of 0.3 and 2 m or 1.3 and 3 m)	
Standard sensing object	100-mm dia., 1.5-m-long metal or plastic round pipe	
Minimum sensing object	50 x 50 mm flat plate	
Ultrasonic oscillation frequency	Approx. 40 kHz	
Directional angle	Half-value angle: 25°	
Response time	Operate time: 0.25 s; release time: 0.5 s	
Control output	Contact output: SPDT 3 A at 220 VAC, cos dia.=1 or 3 A at 24 VDC, cos dia.=1	
Ambient temperature	Operating: -20°C to 55°C (with no icing)	
Ambient humidity	Operating: 45% to 85%	
Insulation resistance	20 M Ω min. (at 500 VDC)	
Dielectric strength	1,500 VAC, 50/60 Hz for 1 min	
Vibration resistance	Destruction: 10 to 25 Hz, 1.5-mm double amplitude for 2 hrs each in X, Y, and Z directions	
Shock resistance	Destruction: 500 m/s ² (approx. 50G) 3 times each in \pm X, \pm Y, and \pm Z directions	
Life expectancy (output relay)	Mechanical	20,000,000 operations min.
	Electrical	100,000 operations min.
Enclosure rating	IEC IP60	
Weight	Approx. 500 g without Mounting Bracket Approx. 600 g with Mounting Bracket	

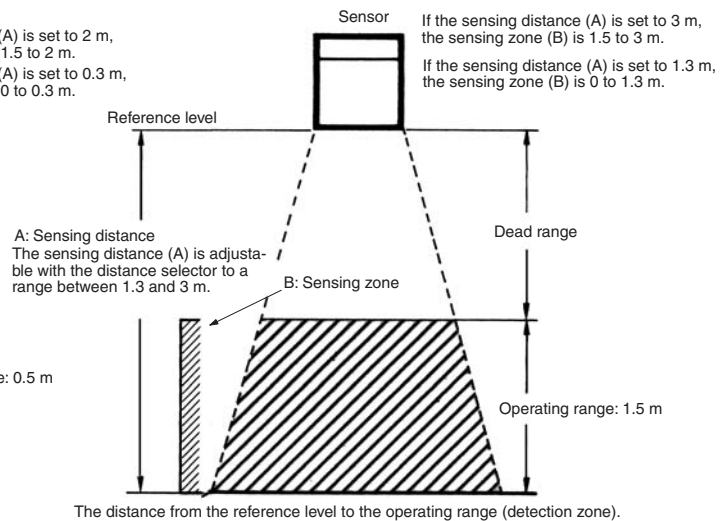
Note: Models operating at 12 to 24 VDC are available. Specify the supply voltage when ordering.

■ Operating and Dead Ranges

1. Distance Selector Set to a Range Between 0.3 and 2 m



2. Distance Selector Set to a Range Between 1.3 and 3 m



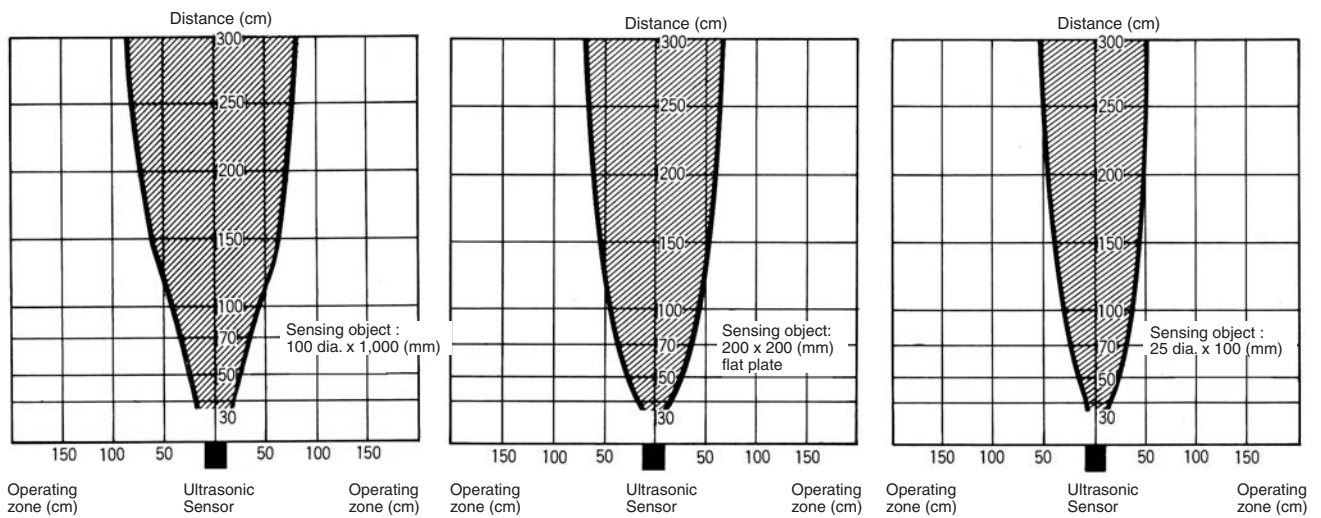
An object may be detected due to multiple reflection if the object is in the dead range, in which case however, the detection of the object will not be stable. Therefore, do not attempt to use the E4A-3K to detect an object in the dead range by making use of multiple reflection.

Note: Multiple reflection is a phenomenon caused by an ultrasonic beam reflected several times repeatedly between the sensing object and the Sensor or nearby objects such as the ceiling.

Engineering Data

■ Operating Zone (Typical Examples)

The operating zone is the sensing range of the E4A-3K at the sensing distance with the sensing object moved vertically towards the ultrasonic beam. The operating zone varies with the sensing distance and sensing object.

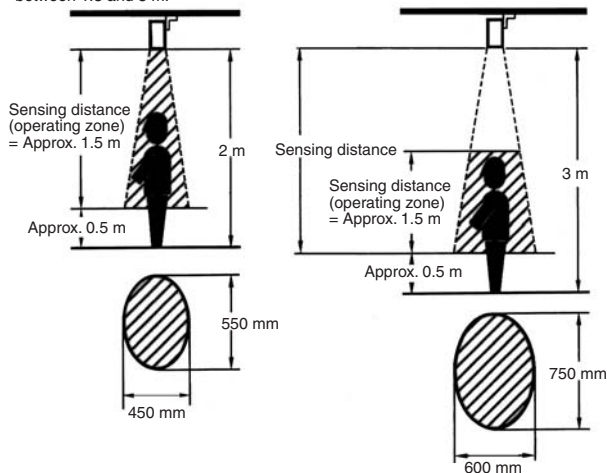


Reference

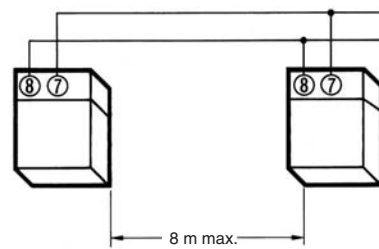
- Each of the following illustrations indicates the operating zone with the E4A-3K mounted to the ceiling for the purpose of detecting the human body. In either case, make sure that the lower limit of the sensing range is approximately 0.5 m above the floor so that the floor will not be detected.

Typical Example

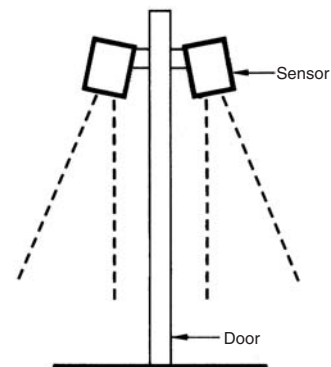
Distance selector set to a range between 1.3 and 3 m.



- If more than one Unit is used within a maximum distance of 8 m, be sure to wire the Units so that the Units will be in synchronous operation. Refer to *External Connections* for details.



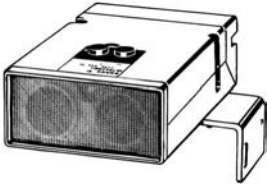
- If there is a door between two Units located for different operating zones as shown in the following illustration, be sure to wire the Units so that the Units will be in synchronous operation.



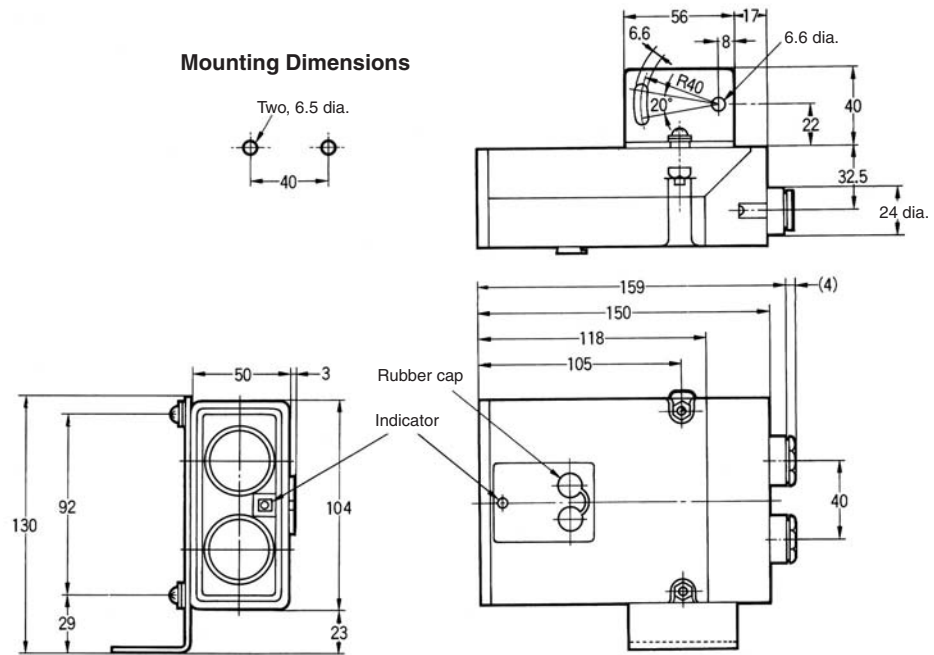
Dimensions

Note: All units are in millimeters unless otherwise indicated.

E4A-3K



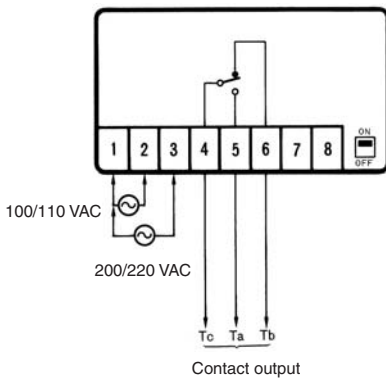
Mounting Dimensions



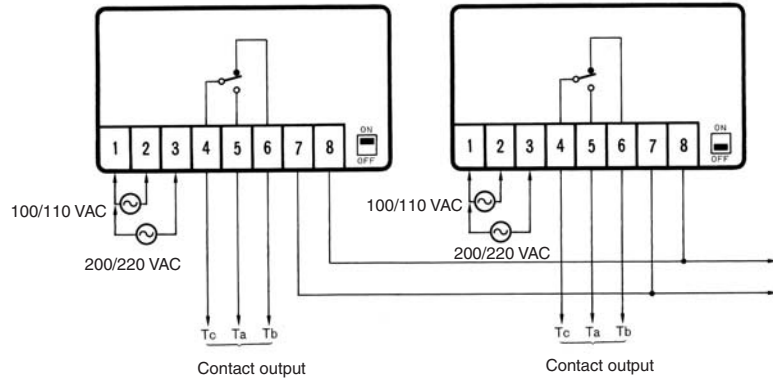
Installation

External Connections

Example of Connections of the E4A-3K in Asynchronous Operation



Example of Connections of the E4A-3K in Synchronous Operation



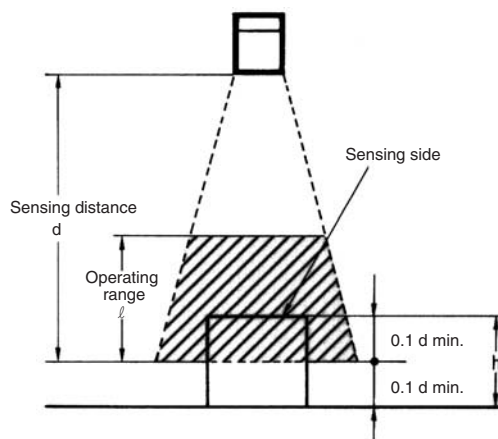
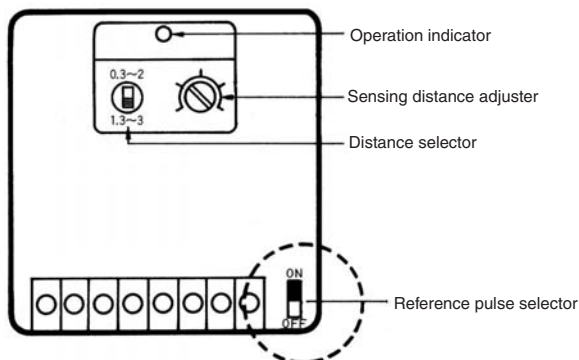
- Note:**
1. If the synchronous operation of the E4A-3K is not required, set the reference pulse selector to ON. Keep terminals 7 and 8 open.
 2. Use a cable with an external diameter of 10 mm max. for wiring.

- Note:**
1. If the synchronous operation of the E4A-3K is required, set the reference pulse selector of only one Unit to ON. Then connect terminal 7 of all the Units together and do the same for terminal 8.
 2. A maximum of 50 Units can be connected in synchronous operation.
 3. Do not wire the lines for synchronous operation use (i.e., wires connecting to terminals 7 and 8) alongside power lines in the same conduit.
 4. Use a shielded cable with an external diameter of 10 mm max. for wiring.
 5. Make sure that all the Units in synchronous operation are turned on, otherwise none of the Units will operate.

Adjustments

Reference Pulse Selector Position

If more than one Unit is used at one location, the Units will need to be in synchronous operation to prevent mutual interference. In that case, set the reference pulse selector of only one Unit to ON. Set the reference pulse selector of each Unit to OFF if the Units are in asynchronous operation. Refer to *External Connections* for details.



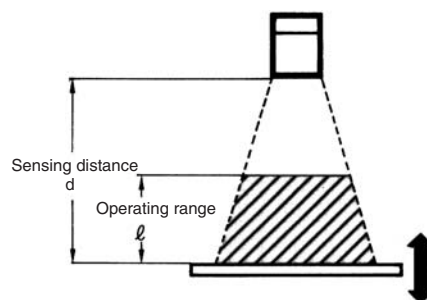
From the above, the minimum height (h) of the sensing object is expressed by $0.2d$. If the sensing object is comparatively low in height or if the E4A-3K is used for the delicate height discrimination of objects, it will be necessary to set the sensing distance to a small value.

- If the sensing object is moving parallel to the ultrasonic beam for level or height detection, the sensing distance will be the distance required for the sensing object to move.

Sensing Distance Adjustments

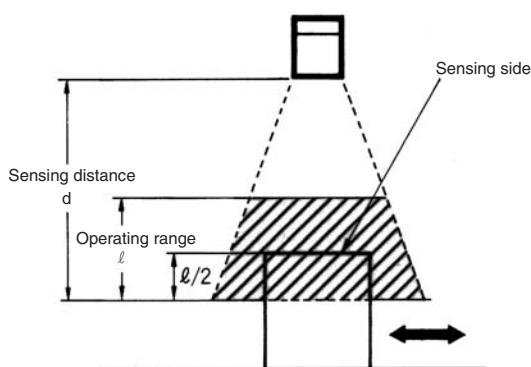
Before adjusting the sensing distance, remove the rubber cap from the top of the E4A-3K. Be sure to put on the rubber cap after the sensing distance is adjusted.

1. Apply a flat-blade screwdriver to the groove of the distance selector to set the distance selector to either a range between 0.3 and 2 m or a range between 1.3 and 3 m according to the desired sensing distance and operating range.
2. To set the sensing distance, first locate a flat plate as a sensing object that is approximately 20-by-20 cm at the desired sensing distance. Then gradually turn the sensing distance adjuster clockwise (i.e., in the direction increasing the sensing distance) until the relay operates. The operation indicator will be lit when the relay operates.



Standard Sensing Distance Settings

- If the sensing object is moving vertically towards the ultrasonic beam (i.e., the E4A-3K is in normal sensing operation), set the sensing distance so that the sensing side of the object passes through the center of the operating range as shown in the following illustration.

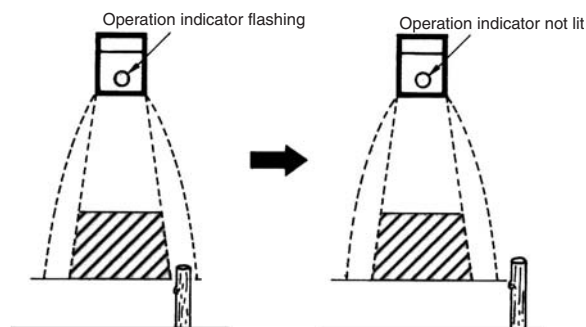


If there is an object, such as a floor, wall, or conveyor, located behind the sensing object, make sure that the distance between the set sensing distance (d) and the background object is $0.1d$ min. Furthermore, make sure that the set sensing distance (d) is at least $0.1d$ closer to the Sensor from the maximum limit of the operating range as shown in the following illustration.

Operation Check

After adjusting the sensing distance, check that the E4A-3K operates properly by locating the sensing object within the operating range. Then remove the sensing object and check that the operation indicator is not lit. The operating indicator may be still be lit or flashing after the sensing object is removed. In that case, the E4A-3K may be malfunctioning due to beam reflection from objects outside the operating range or affected by ambient wind or temperature, in which case, eliminate the cause or change the mounting position or direction of the Sensor.

If the mounting position or direction of the Sensor is changed, be sure to check the sensing distance and the operation of the E4A-3K.



Precautions

■ Correct Use

Sensor Mounting Angle

If the E4A-3K is in level control or distance control of sensing objects, the stability of signal detection will depend on the sensing surface condition of the objects. Considering the repose angle of the objects, mount the E4A-3K so that the ultrasonic beam and the sensing surface of each object meet at right angles to each other.

Surrounding Objects

Make sure that the Sensor is free from surrounding objects that reflect the ultrasonic beam diffusion, otherwise the Sensor may malfunction. In particular, pay the utmost attention so that no side lobe of the ultrasonic beam will be reflected by such objects.

Mounting

Securely mount the E4A-3K by using the nuts provided with the E4A-3K or the mounting holes of the E4A-3K. Refer to *Dimensions* for details.

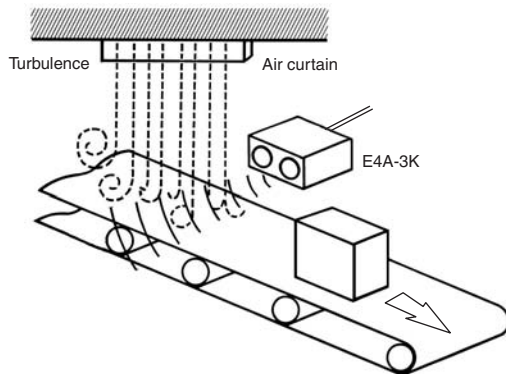
Do not strike the Sensor with any hammer or other object, otherwise the E4A-3K will no longer be water-resistant.

If the E4A-3K is not mounted securely, the E4A-3K may be damaged by vibration or may not detect sensing objects accurately due to a possible change in the mounting position.

Environmental Conditions

Do not use the E4A-3K at a temperature exceeding the rated range or outdoors, otherwise the reliability and life of the E4A-3K will decrease.

The Ultrasonic Reflective Sensor utilizes the air as a beam transmission media. Do not use the E4A-3K in places with radical convection or extreme local temperature changes. For example, if there is a hot air curtain that causes turbulence within the sensing area, the E4A-3K may malfunction.



The jetting sound of air nozzles includes noise of a wide frequency range, which will affect the operation of the E4A-3K. Do not use an air nozzle near the E4A-3K.

The sensing distance of the E4A-3K will decrease if there is any water drops on the surface of the emitter or receiver.

The reflective model may not detect any objects if there is any object absorbing sound, such as powder and cotton, on the surface of the emitter or receiver.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

In the interest of product improvement, specifications are subject to change without notice.

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