OMRON

Ultrasonic Proximity Sensor | E4B

Rectangular Ultrasonic Proximity Sensor with Built-in Amplifier

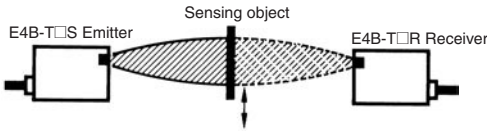
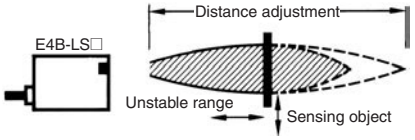
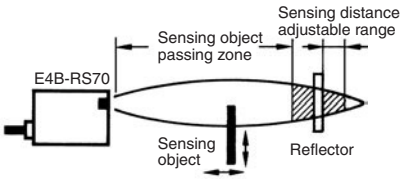
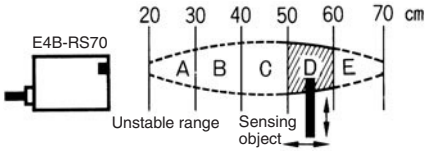
- Stable operation for a variety of objects regardless of color, transparency, or material (metallic or non-metallic).
- Ultrasonic beam expansion of approx. 8°. Detect small objects of 20 x 20 mm min.
- With reflective models, setting sensing zones ensures detection without influence by the background.

Ordering Information

Sensor **(Refer to Dimensions on page 8.)**

Output configuration	Sensing method		Sensing distance	Model
DC switching NPN (normally open or closed selectable)	Through-beam		50 cm	E4B-TS50E4
			100 cm	E4B-T1E4
	Reflective	Convergent reflective (Distance adjustable)	5 to 20 cm	E4B-LS20E4
			20 to 70 cm	E4B-LS70E4
		Convergent reflective (Zone setting)	20 to 70 cm Sensing zone	E4B-RS70E4

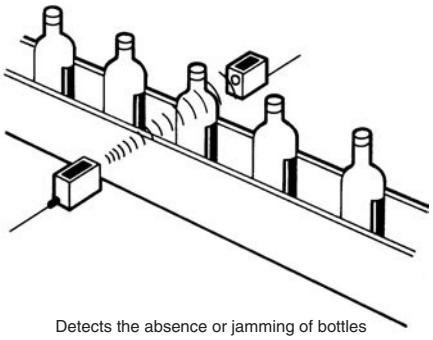
■ Sensing Method

Through-beam			Detects the attenuation or interrupted condition of the ultrasonic beam caused by the object passing between the Emitter and Receiver.	
Reflective	Convergent reflective distance		Detects only the beam reflected from the object existing within the sensing distance range set with the distance adjuster.	
	Convergent reflective zone	Sensing object passing zone	Detects the object with the interruption of the normal beam reflected from the reflector.	
		Convergent reflective	Detects only the beam reflected from the object existing in the sensing range set with the distance selector.	

Note: An object may be detected due to multiple reflection if the object is in the unstable range where the distance adjuster is ineffective, in which case however, the detection of the object will not be stable. Therefore, do not attempt to use the E4B to detect an object in the unstable range.

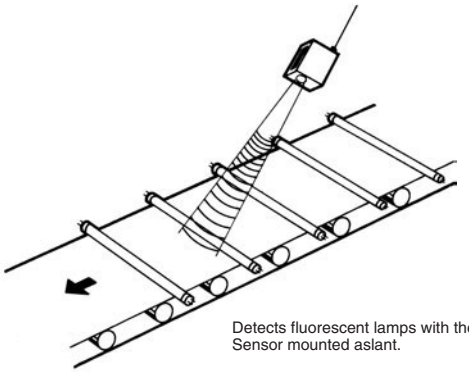
Application Examples

Detection of a variety of transparent bottles in bottle manufacturing, drink processing, and food processing lines



Detects the absence or jamming of bottles

Detection of fluorescent lamps



Detects fluorescent lamps with the Sensor mounted aslant.

Specifications

■ Ratings/Characteristics

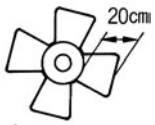
Item / Model		E4B-TS50E4	E4B-T1E4	E4B-LS20E4	E4B-LS70E4	E4B-RS70E4
Sensing method		Through-beam		Convergent reflective distance		Convergent reflective zone
Sensing distance		50 cm	1 m	5 to 20 cm	20 to 60 cm (20 to 70 cm) (see note 1)	20 to 60 cm (20 to 70 cm) (see note 1) (in 10-cm divisions)
Supply voltage		12 to 24 VDC ± 10% (10.8 to 26.4 VDC) with a max. ripple ±10% (p-p)				
Current consumption	**12 VDC**	Emitter: 155 mA max. Receiver: 30 mA max.	Emitter: 70 mA max. Receiver: 30 mA max.	100 mA max.		
	24 VDC	Emitter: 80 mA max. Receiver: 30 mA max.	Emitter: 50 mA max. Receiver: 30 mA max.	50 mA max.		
Standard sensing object		10 x 10 cm flat plate		4 x 4 cm flat plate		
Differential travel		---		20% max. of sensing distance		3 cm max.
Directional angle (see note 2)		±8° max.				
Ultrasonic oscillation frequency		Approx. 200 kHz				
Response frequency (see note 4)		50 Hz	10 Hz	50 Hz	20 Hz	
Operating mode		Incident or interrupted (selectable)				
Control output		NPN, 100 mA at 30 VDC (with a residual voltage of 1.5 V max.) and an output resistance of 4.7 kΩ				
Indicators		SENSING indicator (red LED) and STABILITY indicator (green LED)				
Ultrasonic speed compensation		No				Yes
Ambient temperature		Operating: –10°C to 55°C				
Ambient humidity		Operating: 35% to 95%				
Temperature influence		±10% max. of sensing distance at 20°C in the temperature range of –10°C and 55°C				
Voltage influence		±5% max. of sensing distance at a voltage between 90% and 110% of the rated power supply voltage				
Residual voltage		1.5 V max. under a load current of 100 mA and a cord length of 2 m				
Insulation resistance		20 MΩ min. (at 500 VDC) between current carry parts and case				
Dielectric strength		1,000 V (50/60 Hz) for 1 min between current carry parts and case				
Vibration resistance		Destruction: 10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions				
Shock resistance		Destruction: 500 m/s^2 (approx. 50G) 3 times each in X, Y, and Z directions.				
Degree of protection (see note 3)		IEC IP66 (JEM IP66 water resistive)				
Weight (with 2-m-long cord and Mounting Bracket)		Approx. 600 g (with Emitter and Receiver)		Approx. 300 g		
Materials		Case: ABS, Oscillator: Ceramic				

Note: **1.** These are the available sensing distances at an ambient temperature range between 0°C and 45°C.

2. This is the half-value angle obtainable at a signal of –6 dB.

3. The enclosure rating indicates the degree of protection of the case, which will depend on the operating condition.

4. The response frequencies are values obtained with the E4B used for detecting a rotating propeller-shaped disc as shown on the right.

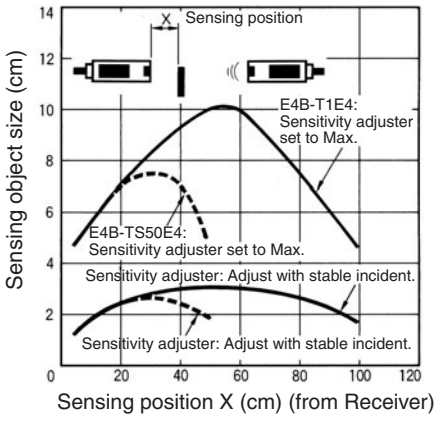


Space:Blade = 1:1

Engineering Data

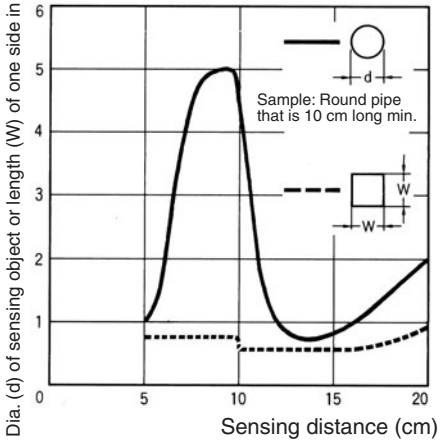
Operating Distance vs. Sensing Object Size (Typical)

E4B-TS50E4, E4B-T1E4



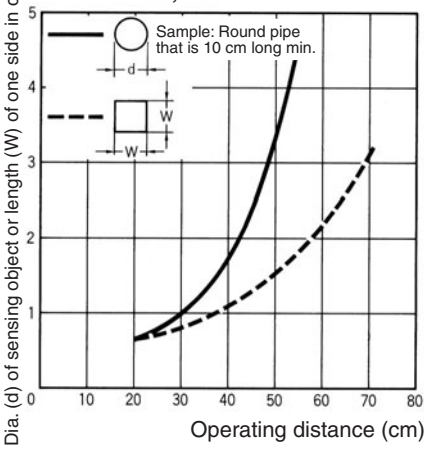
Note: The curve with the sensitivity adjuster set to maximum indicates the size of the sensing object.

E4B-LS20E4



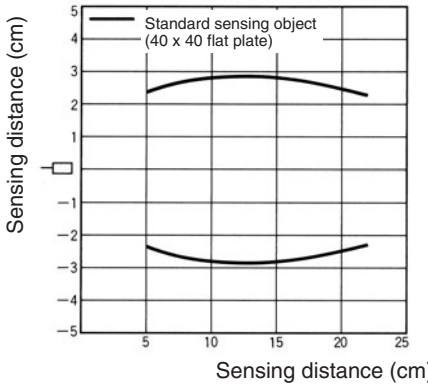
Note: The sensing method will change when the sensing distance exceeds 10 cm. As a result, the detectable diameters will change greatly.

E4B-LS70E4, E4B-RS70E4

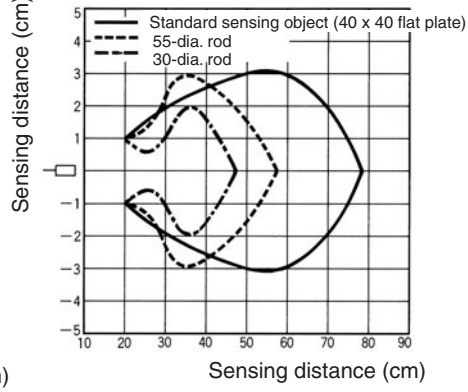


Operating Range Diagram (Typical)

E4B-LS20E4

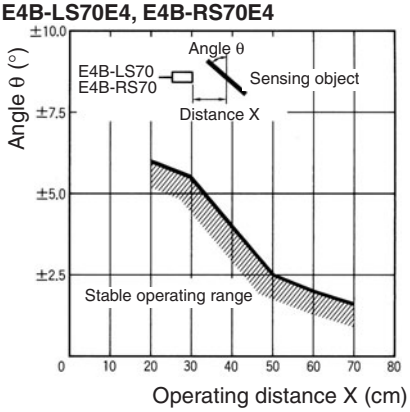


E4B-LS70E4, E4B-RS70E4



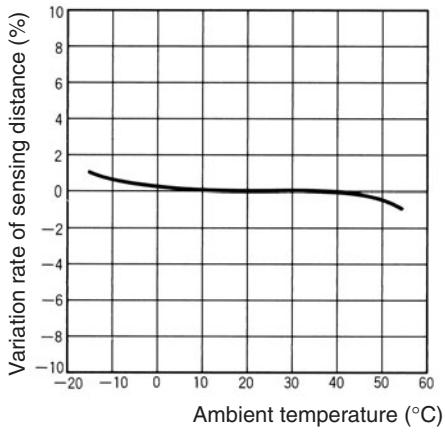
Operating Distance vs. Sensing Object Angle (Typical)

E4B-LS70E4, E4B-RS70E4



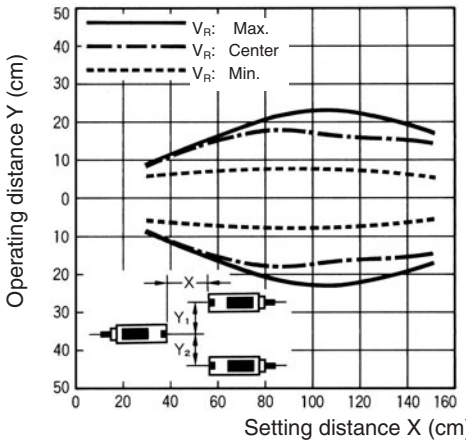
Ambient Temperature vs. Variation Rate of Sensing Distance (Typical)

E4B-LS70E4, E4B-RS70E4



Sensitivity Adjuster Position vs. Parallel Movement Characteristics

E4B-T1E4



Note: Obtain the point that turns Y_1 and Y_2 ON while changing the sensing distance (X).

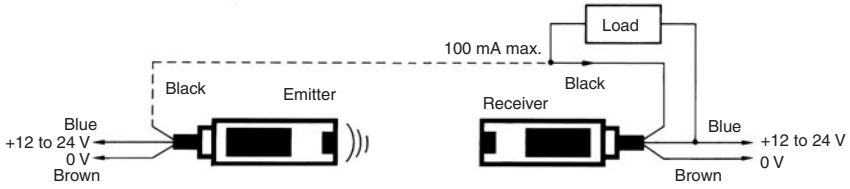
■ Adjustments

Indicators

1. STABILITY Indicator (Green)
   When this indicator is lit, the ultrasonic input into the Receiver is sufficient, or its interruption is small enough, to ensure the smooth operation of the E4B. Do not operate the E4B when this indicator is not lit.
2. SENSING Indicator (Red)
   When this indicator is lit, the Receiver has ultrasonic input.

Indicator of Through-beam Emitter

1. Incident Indicator
   Lit when there is ultrasonic input.
   To use this indicator of the Emitter as an SENSING indicator like the indicator on the Receiver, connect the black lead wires of the Emitter and Receiver together.



Note: Be sure not to make mistakes in polarity when connecting the above wires. In other words, both brown lead wires must connect to +DCV or 0 V and both blue lead wires must connect to 0 V or +DCV. Otherwise, the indicator of the Emitter will be lit when the ultrasonic beam is interrupted.

2. Power Indicator
   Lit when the E4B is turned ON.
   If the above connections are not possible (e.g., the Receiver and Emitter use different power supplies), this indicator will be used as a power indicator.

Connections of Black (White) Lead Wire of Emitter

Power connection example	Short-circuited
Brown: +DCV Blue: 0 V	0 V blue
Brown: 0 V Blue: DCV	+DCV blue

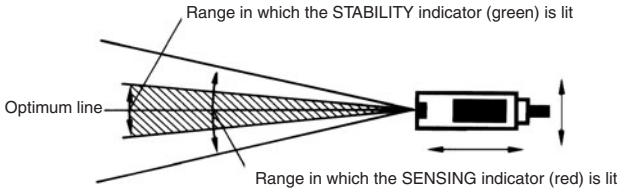
Note: The indicator will not be lit if the above wires are not connected correctly.

Beam Axis, Sensitivity, and Distance Adjustments

1. E4B-T1 and E4B-TS50 Through-beam Models

Set the SENSITIVITY adjuster of the Receiver to maximum.

Move the Emitter and Receiver vertically and horizontally until the SENSING indicator of the Receiver is lit and secure the Emitter and Receiver at the midpoint of the range within which the STABILITY indicator is lit.



Pass the sensing object through the sensing range and adjust the sensitivity so that the SENSING indicator turns ON and OFF according to the presence or absence of the sensing object while the STABILITY indicator is lit continuously.

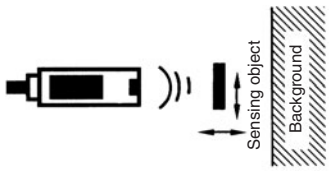
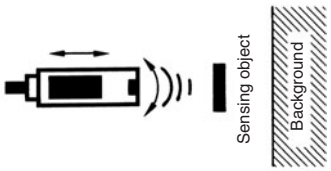
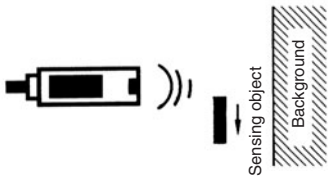
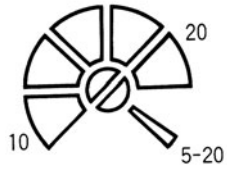
If the STABILITY indicator is not lit while the Sensor is in operation, this may indicate a possible operational error. Check or readjust the sensitivity.

If the Emitter and Receiver are set at a distance shorter than the rated sensing distance, reduce the sensitivity to within the range in which the STABILITY indicator is lit. This will increase the immunity of the Sensor against noise.

The parallel movement characteristics (i.e., the mutual interference distance) and sensing object size vary with the sensitivity adjustment. Refer to *Engineering Data* and make the optimum adjustments.

2. E4B-LS20* and E4B-LS70 Convergent Reflective Distance Model

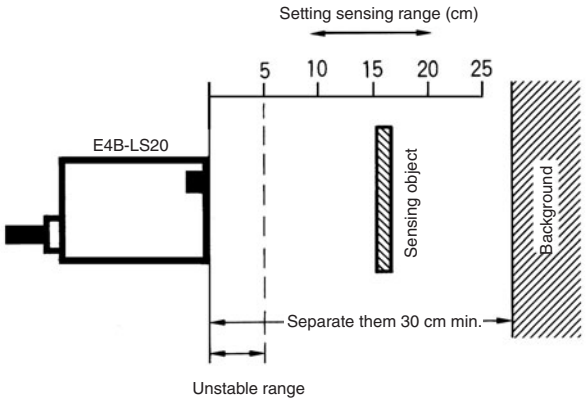
Locate the Sensor so that both the STABILITY and SENSING indicators will be lit when the sensing object is placed at the sensing position, and the STABILITY indicator will be lit and the SENSING indicator will turn OFF when the sensing object is removed.

Step	1	2	3
Sensing			
Distance adjuster		---	---
Adjustment procedure	Place the sensing object at the sensing position and turn the distance adjuster clockwise gradually until both the SENSING and STABILITY indicators are lit.	Move the Emitter and Receiver vertically and horizontally and secure the Emitter and Receiver at the midpoint of the range within which the STABILITY indicator is lit.	Remove the sensing object and check that the SENSING indicator is OFF and the STABILITY indicator is continuously lit.

Note: If the STABILITY indicator is not lit while the Sensor is in operation, this indicates a possible operational error. Check or readjust the sensitivity.

Note: ***E4B-LS20**
The sensing distance is adjustable within a range of 10 to 20 cm with the distance adjuster.

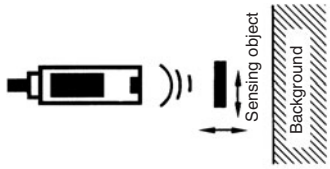
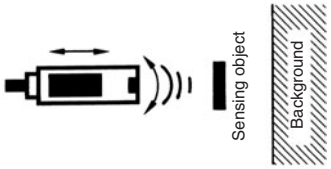
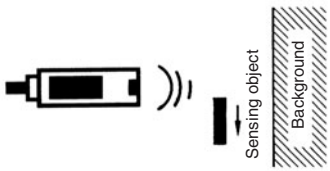
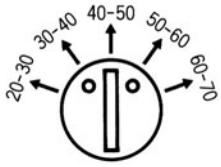
Sensing distance	Position of distance adjuster
5 to 10 cm	Set to the position 5-20. The distance range will be 5 to 23 cm in this case due to the characteristics of the ultrasonic beam.
10 to 20 cm	The adjuster can be set freely within a range of 10 to 20 cm. The object can be detected within a range of 5 to 10 cm in this case due to multiple ultrasonic reflection.



3. E4B-RS70 Convergent Reflective Zone

General Use

Locate the Sensor so that both the STABILITY and SENSING indicators will be lit when the sensing object is placed at the sensing position and the STABILITY indicator will be lit and the SENSING indicator will be off when the sensing object is removed.

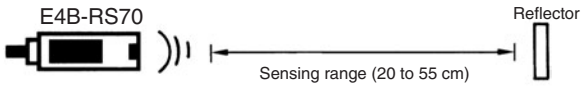
Step	1	2	3
Sensing			
Distance selector		---	---
Adjustment procedure	Place the sensing object at the sensing position and turn the distance selector clockwise gradually until both the SENSING and STABILITY indicators are lit.	Move the Emitter and Receiver vertically and horizontally and secure the Emitter and Receiver at the midpoint of the range within which the STABILITY indicator is lit.	Remove the sensing object and check that the SENSING indicator is OFF and the STABILITY indicator is continuously lit.

Note: **1.** If the STABILITY indicator is not lit while the Sensor is in operation, this indicates a possible operational error. Check or readjust the sensitivity.

2. If the background object is within a distance of 1.5 m from the sensing head, the SENSING indicator may be lit and the STABILITY indicator may not be lit in spite of the absence of the sensing object. In such a case, give priority to the adjustment of the indicators with the sensing object located at the sensing position.

Retroreflective Use

The retroreflective model assures the stable detection of objects under irregular and unstable reflection conditions (e.g., if the sensing objects are different in surface or size, if they are passed through diagonally, or if they are warped or move in a wave-like way).

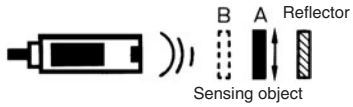
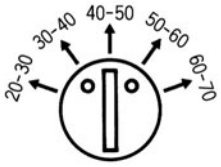


ℓ: Near the midpoint of the sensing range (e.g., 45, 55, or 65 cm)

The Reflector must be at least 4 x 4 cm in size and made of a material that is efficiently reflective (such as a metal plate). The E39-R1 for photomicrosensors is ideal.

Be sure that the reflector is not set within the sensing range.

Set the distance selector to the desired position, fix the reflector around the midpoint of the set sensing range, and check that both the SENSING and STABILITY indicators are lit.

Step	1	2	3
Sensing			
Distance selector		---	---
Adjustment procedure	Set the distance selector to the desired zone position, mount the Reflector at or near the midpoint of the set zone, and confirm that both the STABILITY and SENSING indicators are lit.	Move the Emitter and Receiver vertically and horizontally and secure the Emitter and Receiver at the midpoint of the range within which the STABILITY indicator is lit.	Remove the sensing object and check that the SENSING indicator is OFF and the STABILITY indicator is continuously lit.

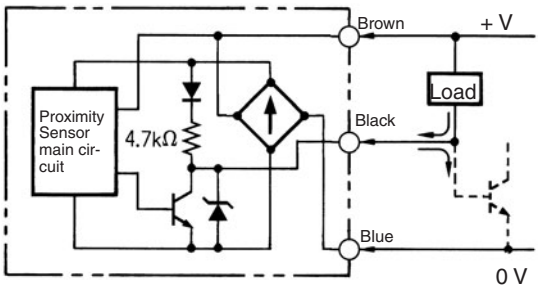
Note: **1.** If the STABILITY indicator is not lit while the Sensor is in operation, this indicates a possible operational error. Check or readjust the sensitivity.

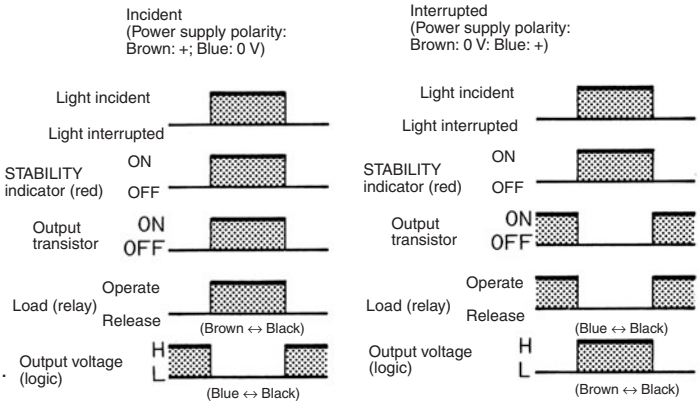
2. If the sensing object is in position A parallel to the Reflector as shown above, the SENSING indicator may be lit and the STABILITY indicator may not be lit depending on the position of the sensing object. In such a case, give priority to the adjustment of the STABILITY indicator when the beam is incident by means of the reflector.

Operation

■ Output Circuits

NPN Models Switching DC



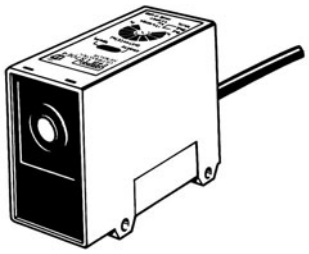


Note: 1. 100 mA max. (load current)
2. Required when the transistor circuit is connected.

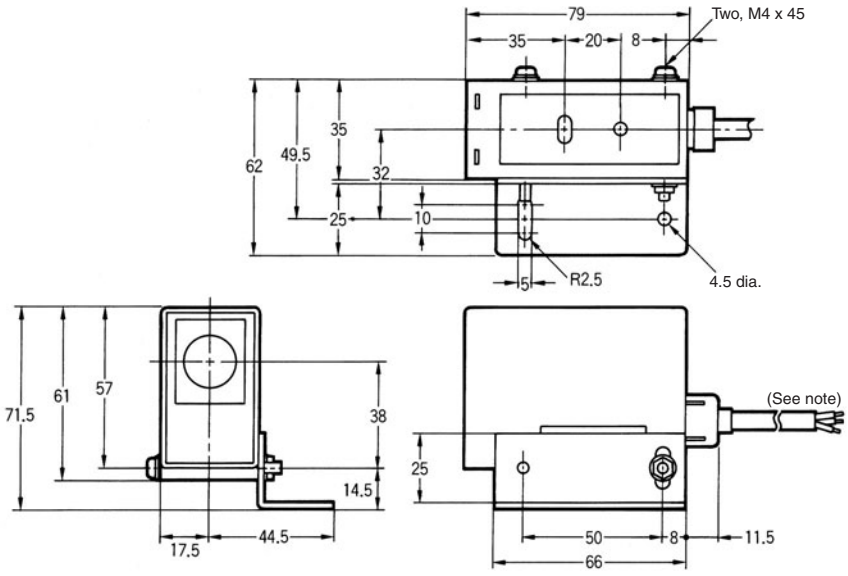
Dimensions

Note: All units are in millimeters unless otherwise indicated.

E4B-TS50
E4B-T1
E4B-LS20
E4B-LS70
E4B-RS70



Note: Vinyl-insulated round cord with three conductors, 6 dia.; standard length: 2 m



Precautions

■ Correct Use

Sensor Mounting Angle

If the E4B 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 E4B 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 E4B by using the nuts provided with the E4B or the mounting holes of the E4B. Refer to *Dimensions* for details.

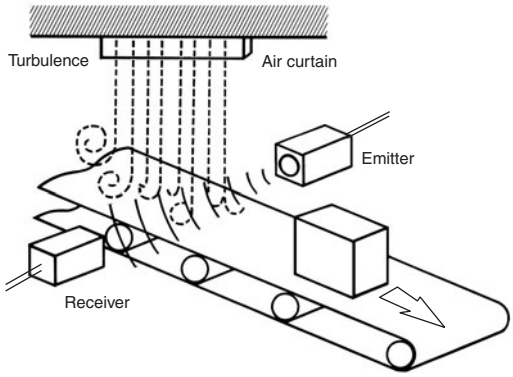
Do not strike the Sensor with any hammer or other object, otherwise the E4B will no longer be water-resistant.

If the E4B is not mounted securely, the E4B 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 E4B at a temperature exceeding the rated range or outdoors, otherwise the reliability and life of the E4B will decrease.

The Ultrasonic Reflective Sensor utilizes the air as a beam transmission media. Do not use the E4B 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 E4B may malfunction.



The jetting sound of air nozzles includes noise of a wide frequency range, which will affect the operation of the E4B. Do not use an air nozzle near the E4B.

The sensing distance of the E4B will decrease if there is any water drops on the surface of the emitter or receiver.

The through-beam 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.

CSM_2_1_0310
D065-E1

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

OMRON Corporation
Industrial Automation Company

Sensing Devices Division H.Q.
Application Sensors Division
Shiokoji Horikawa, Shimogyo-ku,
Kyoto, 600-8530 Japan
Tel: (81)75-344-7068/Fax: (81)75-344-7107

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2010.8

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

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Industrial Automation Company

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OCEAN CHIPS
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Телефон: 8 (812) 309-75-97 (многоканальный)
Факс: 8 (812) 320-03-32
Электронная почта: ocean@oceanchips.ru
Web: http://oceanchips.ru/
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А