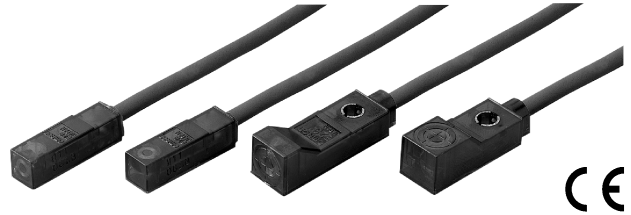


### World's Smallest Square Sensor with Built-in Amplifier

- 5.5 x 5.5 mm type contributes to smaller, space-saving machines and devices.
- Comprehensive range; sensing direction, size, output configuration, operation status.
- Only 2/3 the wiring process required for DC 2-wire.
- Models with different response frequency are available.
- High response frequency (1 kHz).
- Long sensing distance: (E2S-j 1, 1.6 mm)  
(E2S-j 2, 2.5 mm)



### Ordering Information

#### ■ DC 2-wire

Appearance	Sensing surface	Sensing distance	Model	
			Operation status	
			NO (Normally Open)	NC (Normally Closed)
	Front face	1.6mm	E2S-W11(See note)	E2S-W12
	End face		E2S-Q11(See note)	E2S-Q12
	Front face	2.5mm	E2S-W21(See note)	E2S-W22
	End face		E2S-Q21(See note)	E2S-Q22

#### ■ DC 3-wire

Appearance	Sensing surface	Sensing distance	Output configuration	Model	
				Operation status	
				NO (Normally Open)	NC (Normally Closed)
	Front face	1.6mm	NPN	E2S-W13(See note)	E2S-W14
	End face			E2S-Q13(See note)	E2S-Q14
	Front face	2.5mm		E2S-W23(See note)	E2S-W24
	End face			E2S-Q23(See note)	E2S-Q24
	Front face	1.6mm	PNP	E2S-W15(See note)	E2S-W16
	End face			E2S-Q15(See note)	E2S-Q16
	Front face	2.5mm		E2S-W25(See note)	E2S-W26
	End face			E2S-Q25(See note)	E2S-Q26

**Note:** Models with different in response frequency are available(NO only). These model numbers take the form of E2S-j j j B(e.g., E2S-W11B).

### Nomenclature

E2S -    -    -    -    -   

- 1: Compact square series
- 2: Sensing direction  
W: Front face sensing  
Q: End face sensing
- 3: Size and sensing distance (standard sensing object)  
1: 5.5 x 5.5 mm, 1.6 mm (iron)  
2: 8 x 8 mm, 2.5 mm (iron)
- 4: Output  
1: DC 2-wire NO  
2: DC 2-wire NC  
3: DC 3-wire NPN NO  
4: DC 3-wire NPN NC  
5: DC 3-wire PNP NO  
6: DC 3-wire PNP NC
- 5: Different response frequency  
No: Standard  
B: Different response frequency

# Specifications

## ■ Ratings/Characteristics

### DC 2-wire Models

Item		E2S-W11 E2S-W12	E2S-Q11 E2S-Q12	E2S-W21 E2S-W22	E2S-Q21 E2S-Q22
<b>Sensing surface</b>		Front face	End face	Front face	End face
<b>Sensing distance</b>		1.6 mm   15%		2.5 mm   15%	
<b>Setting distance</b>		0 to 1.2 mm		0 to 1.9 mm	
<b>Differential travel</b>		10% max. of sensing distance			
<b>Sensing object</b>		Ferrous metal (refer to <i>Engineering Data</i> for non-ferrous metal)			
<b>Standard sensing object</b>		Iron, 12 x 12 x 1 mm		Iron, 15 x 15 x 1 mm	
<b>Response frequency (see note)</b>		1 kHz min.			
<b>Power supply voltage (operating voltage range)</b>		12 to 24 VDC, ripple (p-p): 10% max.,(10 to 30 VDC)			
<b>Leakage current</b>		0.8 mA max.			
<b>Control output</b>	<b>Switching capacity</b>	3 to 50 mA DC max.			
	<b>Residual voltage</b>	3.0 V max. with a load current of 50 mA and a cable length of 1m			
<b>Indicator</b>		j j 1 models: Operation indicator (red) Setting indicator (green) j j 2 models: Operation indicator (red)			
<b>Operating status (with sensing object approaching)</b>		j j 1 models: NO j j 2 models: NC Refer to <i>Output Circuits</i> and <i>Timing Charts</i> for details			
<b>Circuit protection</b>		Reverse polarity connection and surge absorber			
<b>Ambient temperature</b>		Operating: -25_C to 70_C Storage : -40_C to 85_C (with no icing or condensation)			
<b>Ambient humidity</b>		Operating: 35% to 90% Storage : 35% to 95% (with no condensation)			
<b>Temperature influence</b>		15% max. of sensing distance at 23_C in temperature range of -25_C to 70_C			
<b>Voltage influence</b>		2.5% max. of sensing distance in rated voltage range   10%			
<b>Insulation resistance</b>		50 MΩ min. (at 500 VDC) between current carry parts and case			
<b>Dielectric strength</b>		1,000 VAC, 50/60 Hz for 1 min between current carry parts and case			
<b>Vibration resistance</b>		Destruction: 10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y, and Z direction			
<b>Shock resistance</b>		Destruction: 500 m/s <sup>2</sup> 3 times each in X, Y, and Z direction			
<b>Degree of protection</b>		IEC60529 IP67			
<b>Connection method</b>		Pre-wired (standard length: 1 m)			
<b>Weight (packed state)</b>		Approx. 10 g			
<b>Material</b>	<b>Case</b>	Polyallylate resin.			
<b>Accessories</b>		Mounting bracket			

**Note:** The response frequencies of the DC switching components are average values obtained by measuring in sequence a line-up of standard sensing objects. The space between any adjacent sensing objects was twice the width of a single sensing object and the setting distance was half the maximum sensing distance.

## DC 3-wire Models

Item	E2S-W13 E2S-W14	E2S-Q13 E2S-Q14	E2S-W23 E2S-W24	E2S-Q23 E2S-Q24	E2S-W15 E2S-W16	E2S-Q15 E2S-Q16	E2S-W25 E2S-W26	E2S-Q25 E2S-Q26
Sensing surface	Front face	End face	Front face	End face	Front face	End face	Front face	End face
Sensing distance	1.6 mm   15%		2.5 mm   15%		1.6 mm   15%		2.5 mm   15%	
Setting distance	0 to 1.2 mm		0 to 1.9 mm		0 to 1.2 mm		0 to 1.9 mm	
Differential travel	10% max. of sensing distance							
Sensing object	Ferrous metal (refer to <i>Engineering Data</i> for non-ferrous metal)							
Standard sensing object	Iron, 12 x 12 x 1 mm		Iron, 15 x 15 x 1 mm		Iron, 12 x 12 x 1 mm		Iron, 15 x 15 x 1 mm	
Response frequency (see note)	1 kHz min.							
Power supply voltage (operating voltage range)	12 to 24 VDC ,ripple (p-p): 10% max., (10 to 30 VDC)							
Current consumption	13 mA max. at 24 VDC with no load							
Control output	Switching capacity				PNP open collector output 50 mA max. (30 VDC max.)			
	Residual voltage				1.0 V max. with a load current of 50 mA and a cable length of 1 m			
Indicator	Operation indicator (orange)							
Operating status (with sensing object approaching)	Operation indicator (orange)							
Operating status (with sensing object approaching)	j j 3 models: NO j j 4 models: NC Refer to <i>Output Circuits and Timing Charts</i> for details				j j 3 models: NO j j 4 models: NC Refer to <i>Output Circuits and Timing Charts</i> for details			
Circuit protection	Reverse polarity connection and surge absorber							
Ambient temperature	Operating: -25_C to 70_C Storage : -40_C to 85_C (with no icing or condensation)							
Ambient humidity	Operating: 35% to 90% Storage : 35% to 95% (with no condensation)							
Temperature influence	15% max. of sensing distance at 23_C in temperature range of -25_C to 70_C							
Voltage influence	2.5% max. of sensing distance in rated voltage range   10%							
Insulation resistance	50 MΩ min. (at 500 VDC) between current carry parts and case							
Dielectric strength	1,000 VAC, 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 direction							
Shock resistance	Destruction: 500 m/s <sup>2</sup> 3 times each in X, Y, and Z direction							
Degree of protection	IEC60529 IP67							
Connection method	Pre-wired (standard length: 1 m)							
Weight (packed state)	Approx. 10 g							
Material	Case Polyallylate resin.							
Accessories	Mounting bracket							

**Note:** The response frequencies of the DC switching components are average values obtained by measuring in sequence a line-up of standard sensing objects. The space between any adjacent sensing objects was twice the width of a single sensing object and the setting distance was half the maximum sensing distance.

# Operation

## ■ Output Circuits and Timing charts

### DC 2-wire Models

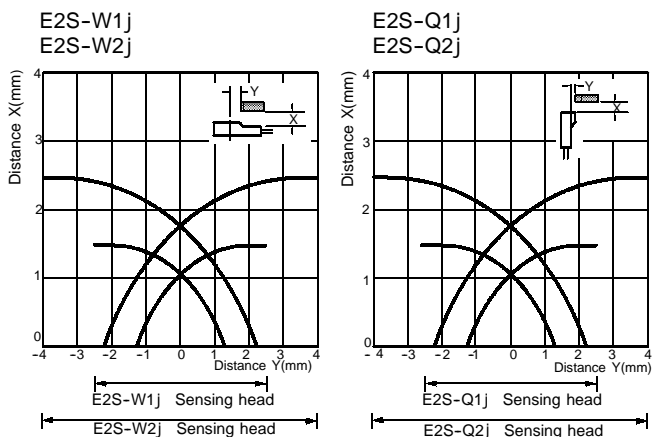
Operation status	Model	Timing charts	Output circuits
NO	E2S-W11 E2S-W21 E2S-Q11 E2S-Q21	<p>Setting indicator (green) ON OFF Operation indicator (red) ON OFF Control output ON OFF</p>	<p>The load can be connected both +V side and 0 V side</p>
NC	E2S-W12 E2S-W22 E2S-Q12 E2S-Q22	<p>Operation indicator (red) ON OFF Control output ON OFF</p>	<p>The load can be connected both +V side and 0 V side</p>

### DC 3-wire Models

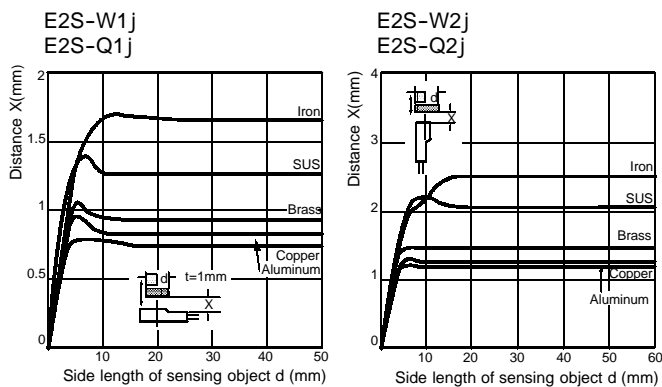
Operation status	Output configuration	Model	Timing charts	Output circuits
NO	NPN	E2S-W13 E2S-W23 E2S-Q13 E2S-Q23	<p>Sensing object: Yes/No</p> <p>Output transistor(load): ON/OFF</p> <p>Operation indicator(orange): ON/OFF</p>	<p>Note: Maximum load current: 50 mA</p>
NC		E2S-W14 E2S-W24 E2S-Q14 E2S-Q24	<p>Sensing object: Yes/No</p> <p>Output transistor(load): ON/OFF</p> <p>Operation indicator(orange): ON/OFF</p>	
NO	PNP	E2S-W15 E2S-W25 E2S-Q15 E2S-Q25	<p>Sensing object: Yes/No</p> <p>Output transistor(load): ON/OFF</p> <p>Operation indicator(orange): ON/OFF</p>	<p>Note: Maximum load current: 50 mA</p>
NC		E2S-W16 E2S-W26 E2S-Q16 E2S-Q26	<p>Sensing object: Yes/No</p> <p>Output transistor(load): ON/OFF</p> <p>Operation indicator(orange): ON/OFF</p>	

# Engineering Data

## Operating Range(Typical)



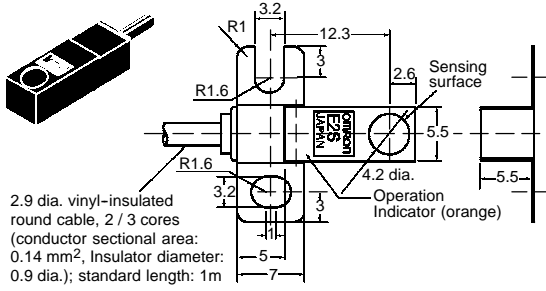
## Sensing Object Size and Material vs. Sensing Distance(Typical)



# Dimensions

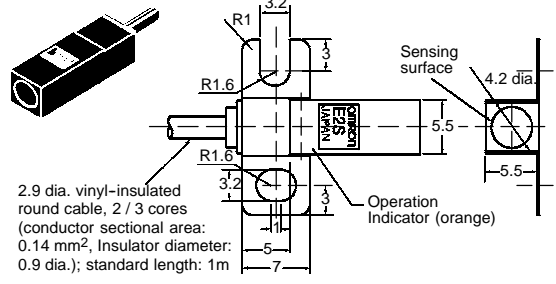
## E2S-W1j

With mounting bracket

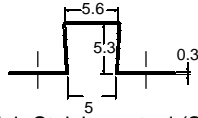
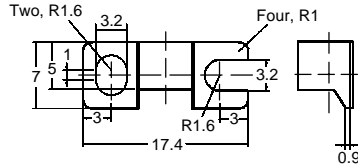


## E2S-Q1j

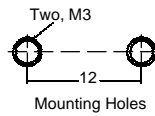
With mounting bracket



Mounting Bracket (see note)



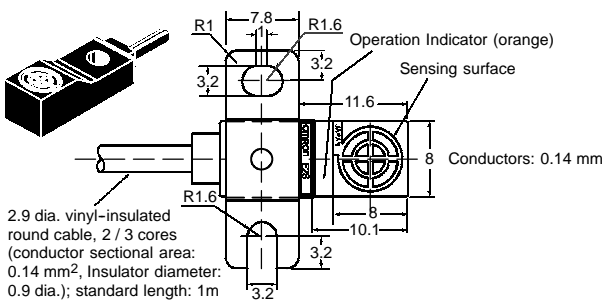
Material: Stainless steel (SUS304)



Note: Provided with E2S-W1j , Q1j

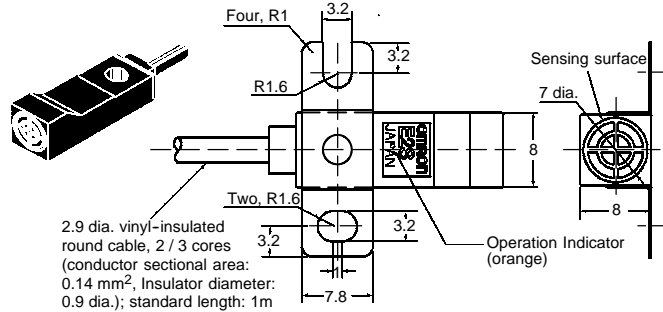
## E2S-W2j

With mounting bracket

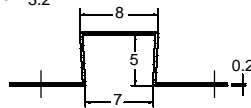
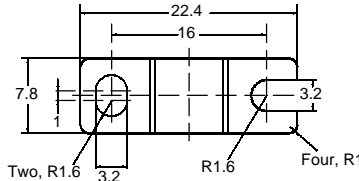


## E2S-Q2j

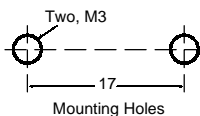
With mounting bracket



Mounting Bracket (see note)



Material: Stainless steel (SUS304)



Note: Provided with E2S-W2j , Q2j

# Precautions

Be sure to heed the following precautions to fully utilize the capabilities of the Sensor.

## General

- Do not impose any voltage exceeding the rated voltage on the Sensor. Do not impose AC voltage on models that operate with DC. In both cases, the Sensor may be damaged.
- Do not short-circuit the load connected to the Sensor, otherwise the Sensor may be damaged. Load short-circuit protection functions operates during use with correct power-supply polarity in the rated voltage range.
- The load must be connected to the Sensor in operation, otherwise the Sensor may be damaged.
- When supplying power to the Sensor, make sure that the polarity of the power is correct, otherwise the Sensor may be damaged.
- Make sure to connect a proper load to the Sensor in operation, otherwise it may be damaged.
- Do not use the Sensor under the environment with explosive or ignition gas.
- Do not disassemble, repair, or modify the product.

## Correct Use

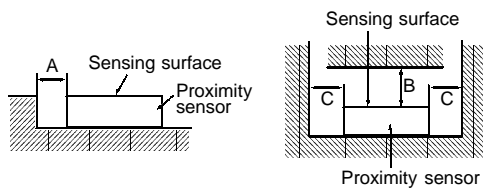
### Installation

#### Effects of Surrounding Metals

Provide a minimum distance as shown in the table below between the Sensor and the surrounding metal.

#### Front face Sensing Type

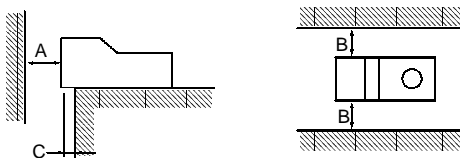
(Not Exceeding The Height of The Sensor Head)



Model	A	B	C
E2S-W1□	0	8	2
E2S-W2□		15	10

(mm)

#### End face Sensing Type



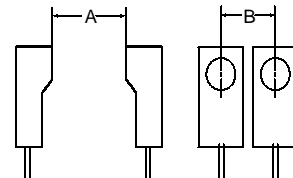
Model	A	B	C
E2S-Q1□	8	3	2
E2S-Q2□	15	10	3

(mm)

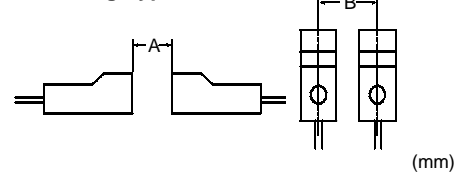
### Mutual Interference

Be sure to space the two sensors at a distance greater than that shown in the table to prevent mutual interference.

#### Front face Sensing Type



#### End face Sensing Type



Model	A	B
E2S-W(Q)1j	50 (40)	20 (5.5)
E2S-W(Q)2j	75 (50)	25 (8)

Note: The above values in parentheses are applicable when using two sensors with different frequencies.

### Power Reset Time

The Sensor is ready to detect objects within 100 ms after the Sensor is turned on. If the Sensor is connected to an independent power supply separately from the load, be sure to turn on the sensor first.

### Power OFF

A single pulse may be output from the Sensor when the power supply is turned off. It is recommended that the load and load line are turned off first.

### Power Transformer

Use only an insulated transformer for the DC power supply. Do not use an autotransformer (single-winding variable-voltage).

### Wiring

Separating from High-tension Lines

Use Metal Conduit.

Pass cable through separate metal conduits to prevent malfunctioning and damage due to positioning proximity-sensor leads alongside power lines or motor lines. The same precaution applies to the DC type.

Do not pull cables with tensile strength exceeding 30 N.

### Mounting

#### Mounting Conditions

Do not strike the Sensor with a hammer or any other tool during the installation of the Sensor, or the Sensor will lose its water-resistive properties.

#### Torque Exceeding

Do not tighten the E2S-W(Q)2j mounting screws to a torque exceeding 0.7 N<sub>m</sub>.

### Maintenance and Inspection

To ensure long-term stable operation, periodically subject the proximity sensor to the same checks as all other control instruments. Conduct the following checks.

1. Check the mounting position of the sensor relative to the detected object. Check for displacement, looseness, and deformation.
2. Check for looseness, defective contact, and discontinuities in the wiring and terminals.
3. Check for attached or accumulated metal powder.
4. Check for abnormal operating temperature and ambient temperature.
5. If the sensor has a setting display lamp, check that the lamp operates correctly.

Never disassemble or repair the sensor.

### Environment

#### Water Resistivity

Do not use the Sensor in water, in the rain, or outdoors.

#### Operating Atmosphere

To ensure stable operation and long sensor life, do not operate the sensor outside the rated temperature range or in outside conditions. Although the proximity sensor has a water-resistive construction, reliability and product life can be further enhanced by installing a cover to prevent water splashing directly on the sensor. Avoid operating the sensor in an atmosphere containing chemical reagents, strong alkalis, or acids (nitric acid, chromic acid, hot concentrated sulfuric acid).

**ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.**

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

Cat. No. E902-E1-1 **In the interest of product improvement, specifications are subject to change without notice.**

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