Capacitance Level Sensor
E7B

Compact Switch Ideal for High-sensitivity Level Control

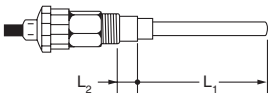
- Ideal for small tank level control.
- Large 100-mA switching capacity.
- Improved detection system minimizes mutual interference, thus permitting two Switch Units to be spaced as close as 300 mm.
- Submersible and oil-resistant construction permits outdoor operation and level detection for any type of oil.
- Easy-to-monitor LED operation indicator.

Ordering Information

■ List of Models

Classification		L_1	L_2	
			20 mm	100 mm
General purpose	Stainless-steel electrode	150 mm	E7B-111	E7B-113
		300 mm	E7B-121	E7B-123
		600 mm	E7B-141	E7B-143
	Plastic-covered electrode	150 mm	E7B-111M	E7B-113M
		300 mm	E7B-121M	E7B-123M
Low sensitivity	Plastic-covered electrode	150 mm	E7B-311M	E7B-313M
		300 mm	E7B-321M	E7B-323M

Length of Electrode



L_1: Sensitive electrode section
L_2: Insensitive electrode section

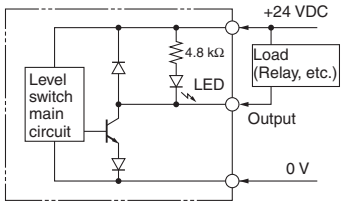
Specifications

■ Ratings

Item	Type	
	E7B-1□□ E7B-1□□M	E7B-3□□M
Supply voltage	24 VDC (ripple: 10% max.)	
Operating voltage range	±15% of rated voltage	
Current consumption	21 mA max.	
Oscillation frequency	Approx. 600 kHz	
Operating sensitivity	E7B-1□□: 0 to 20 pF E7B-1□□M: 0 to 40 pF	0 to 100 pF
Stable operating sensitivity (See note.)	E7B-1□□: 1.5 pF max. E7B-1□□M: 3.0 pF max.	5.0 pF max.
Control output	Solid-state output: 24 VDC, 100 mA max. (Output resistance: 6.8 kΩ)	

Note: Stable operating sensitivity for which all factors such as variations due to temperature and voltage fluctuations, changes in dielectric constants of substances to be detected, etc., have been taken into account.

Output Stage Circuit Diagram



Residual voltage when operated: 2 V max.
(under max. load between output and 0 V)

■ Characteristics

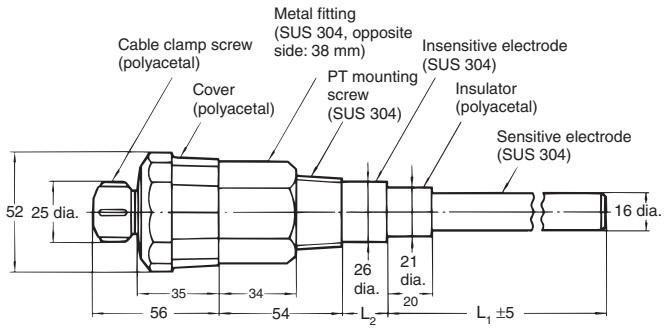
Item	Type	
	E7B-1□□ E7B-1□□M	**E7B-3□□M**
Variation due to temperature fluctuation	E7B-1□□: 0.8 pF max. E7B-1□□M: 1.6 pF max. (within ambient operating temperature range)	1.5 pF max. (within ambient operating temperature range)
Variation due to voltage fluctuation	E7B-1□□: 0.2 pF max. E7B-1□□M: 0.4 pF max. (within operating voltage range)	1.0 pF max. (within operating voltage range)
Min. permissible resistance by material adhering to electrode (See note.)	E7B-1□□: 50 kΩ min. E7B-1□□M: 30 kΩ min.	30 kΩ min.
Insulation resistance	Data are excluded because case is grounded.	
Dielectric strength		
Vibration (mechanical durability)	10 to 25 Hz, 1.5-mm double amplitude	
Shock (mechanical durability)	196 m/s^2	
Pressure resistance of electrode	1.57 MPa max.	
Ambient temperature	Operating: −10°C to 70°C	
Humidity	35% to 95%	
Degree of protection	Submersible construction (JIS C0920), IP67 (IEC 144)	
Weight (circuit section)	Approx. 600 g (E7B-111)	

Note: Resistance when the sensitive and insensitive electrodes are short-circuited by a substance to be detected.

Dimensions

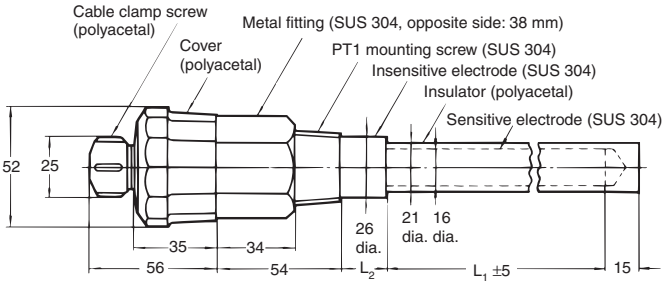
Note: All units are in millimeters unless otherwise indicated.

E7B-□□□



Type	L_1	L_2
E7B-111	150 mm	20 mm
E7B-121	300 mm	
E7B-141	600 mm	
E7B-113	150 mm	100 mm
E7B-123	300 mm	
E7B-143	600 mm	

E7B-□□□M



Note: SUS 304 is equivalent to AISI-304.

Type	L_1	L_2
E7B-111M/-311M	150 mm	20 mm
E7B-121M/-321M	300 mm	
E7B-113M/-313M	150 mm	100 mm
E7B-123M/-323M	300 mm	

Accessories (Order Separately)

■ Controller unit

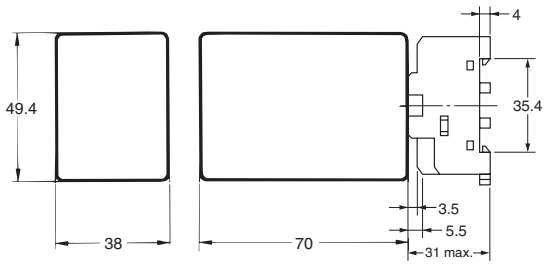
The multi-functional E7U Controller Unit is employed as the exclusive power supply for the E7B Level Switch.

Specifications

Supply voltage	100/110/120/200/220/240 VAC ±10%, 50/60 Hz
Power consumption	4 VA max.
Output voltage and current	24 VDC, 35 mA
Control output	220 VAC, 2 A, p.f. = 1,100,000 operations (under max. load) 12 VDC, 10 mA, 10,000,000 operations (under min. load) Twin contact SPDT
Insulation resistance	5 MΩ min. (at 500 VDC)
Vibration	Mechanical durability: 10 to 25 Hz, 1.5-mm double amplitude
Shock	Mechanical durability: 50 m/s^2 (approx. 5G)
Ambient temperature	Operating: −10°C to 40°C
Humidity	45% to 85%

Dimensions

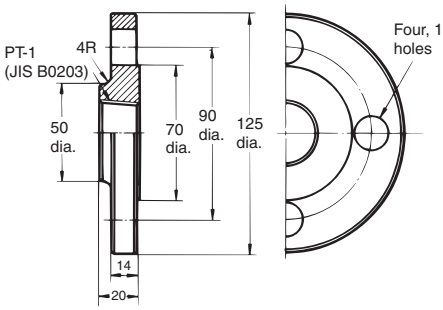
E7U



Note: PF113A-E Track Mounted Socket is supplied with the E7U Controller Unit as an accessory. (PF113A-E can be used as a front connecting socket.)

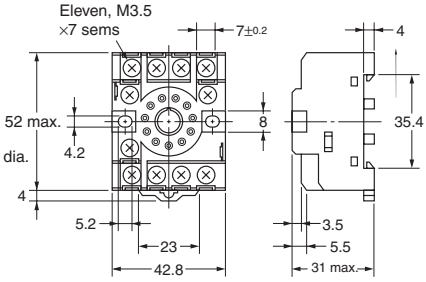
Flange

A flange is availabe as an optional accessory for mounting the Level Switch. The flange is made of SUS304 (AISI-304) which satisfies the JIS Standard 16K25 (16 kg/cm^2 and nominal diameter of 25), and can be attached to the electrode by merely screwing the electrode into the tapped center hole of the flange.

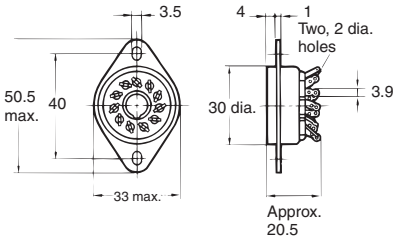


Connecting Sockets

PF113A-E

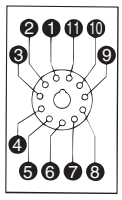


PL11



Terminal Arrangement

PF113A-E



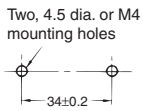
(Top View)

PL11

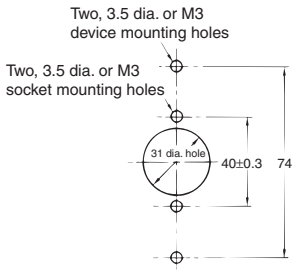
(Bottom View)

Mounting Holes

PF113A-E

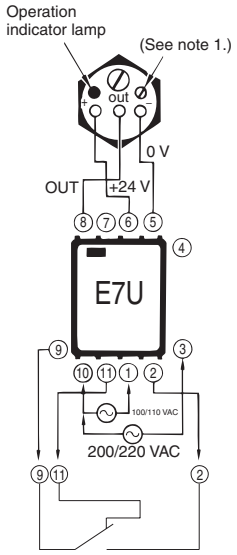


PL11

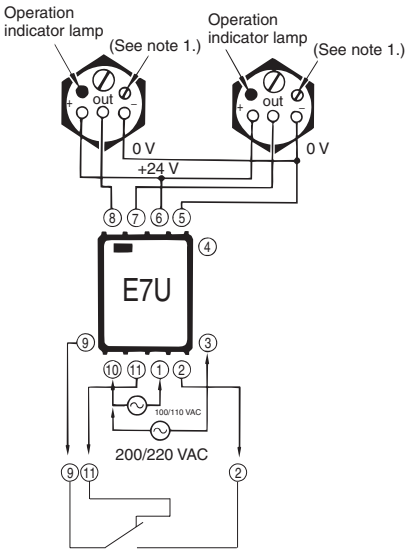


Connections

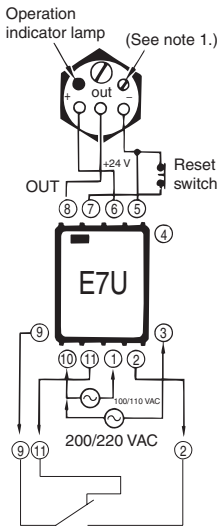
Single-unit Control



2-unit Control



Self-holding Control



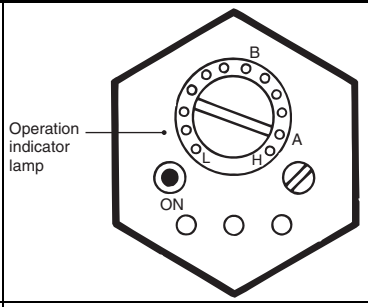
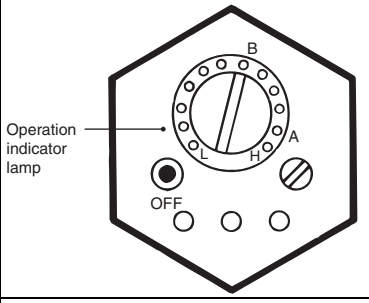
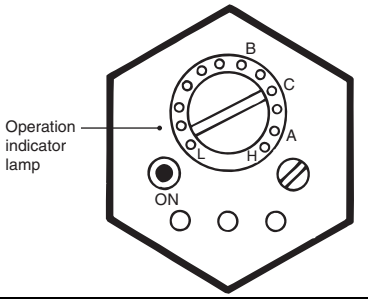
Note: 1. Coil adjusting screw: To prevent the switch from malfunction, do not touch this screw during the adjustment.

2. The E7B is provided with adequate countermeasures against surge. However, when connecting wires between the power source and the Level Switch, avoid routing the Switch cable through the same duct or conduit tube as that used for the power line.

3. When wiring the Level Switch, employ three-core vinyl cabtyre cables (0.75 mm^2) conforming with JIS C-3312 or those having finished outer diameters of 9 to 10 mm.

Adjustments

Make the necessary arrangements to permit the surface (or level) of the material in the tank to be physically moved up and down.

Item	Step		
	1	2	3
Dial setting			
Remarks	With the tank empty or with the surface of the material in the tank adequately distanced from the sensitive electrode (normally more than 10 cm from the electrode), turn the adjusting knob clockwise to the “H” side to determine point A at which the operation indicator lamp lights.	With the material filled in the tank to sufficiently cover the sensitive electrode, turn the adjusting knob counterclockwise to the “L” side to determine point B at which the operation indicator lamp goes off.	With the tank empty again, turn the adjusting knob to the “H” side to confirm point A at which the operation indicator lamp lights. Set the adjusting knob to point C, which is the midpoint between points A and B, to complete the sensitivity adjustment for the level switch.

Note: 1. If the substance to be controlled is of an adhesive nature, the position of point A may not be steady. In such a case, recheck point A after operating the Level Switch for a short period of time.

2. If the operating indicator lamp does not turn OFF while turning the adjusting knob to the “L” side, the point at which the adjusting knob can no longer be turned counterclockwise may be considered point B.

Dielectric Constants (εs) of Various Substances

- Use the OMRON E7A Level Switch for control of asterisked materials "*", instead of E7B, which is less resistant to chemicals.

E7B-14□ (1.5 ≤ εs ≤ 2.0)

Material	εs	Material	εs	Material	εs	Material	εs
Aluminum powder	1.6 min.	Ferrosilicon	1.38 min.	Polyvinyl chloride (powdered)	1.5	Soybeans (exoleated)	1.8
Barium carbonate	1.58	Granulated sugar (powdered)	1.5 to 2.2				
Calcium carbonate	1.8 to 2.4			Rosin (powdered)	1.65	Sulfur (powdered)*	1.5 to 1.8
Calcium phosphate*	1.9 to 3.2	Mucilage (powdered)	1.7 to 1.8	Sawdust (watery)	1.7 min.		
Ferric oxide (powdered)	1.4 min.	Polyester pellet	1.5	Sesame (grain)	1.8 to 2.0	Talc	1.6 min.
		Polyethlene pellet	1.7	Silk	1.3 to 2.0	Tobacco (cut)	1.5 to 1.7
Ferrite (powdered)*	1.4 to 1.8	Polypropylene pellet	1.5 to 1.8	Slaked lime (powdered)	1.8 to 3.0	Vinyl alcohol	1.8 to 2.0
Ferrochromium	1.5 min.	Polystyrene pellet	1.5			Zinc oxide	1.7

E7B-12□ (2.0 ≤ εs ≤ 2.5)

Material	εs	Material	εs	Material	εs	Material	εs
Aluminum hydro-oxide	2.2	Ethylene resin	2.2 to 2.3	Phenol pellet	2 to 2.6	Rubber (vulcanized)	2.0 to 3.5
Aluminum fluoride	2.2	Freon*	2.2	Polybutylene*	2.3	Shellac	2.3 to 3.8
Alumina	2 min.	Glass beads	2 to 2.5	Polyethylene	2.3 to 2.4	Silica alumina	2.0
Aluminum oxide	2.14	Ionomer	2.1 to 2.3	Polypropylene resin	2.0 to 2.2	Silicone	2.4
Asbestos	2.0	Isooctane	2.1	Polysterol	2.4 to 2.6	Styrene resin	2.3 to 2.4
Benzene*	2.3	Methacryl resin	2.2 to 3.2	Polystyrol	2.0 to 2.6	Styrol resin	2.4 to 2.8
Bleaching powder	2.0	Mineral oils (See note.)	2 to 2.5	Polyvinyl alcohol	2.0	Teflon	2.0
Clay (powdered)	1.8 to 2.8	Paper	2 to 2.5	Pressboard	2.0 to 2.6	Toluene*	2.3
Coal tar*	2 to 3	Paraffin	2.1 to 2.5	Red oxide (rouge)	2.6	Wood (watery)	2.0 to 6
Dextrin*	2.2	Paraffin chloride	2.27	Rubber (crude)	2.1 to 2.7		

Note: The mineral oils include A, B and C heavy oils, naphtha*, kerosene*, light oil, gasoline, etc.

E7B-11□ (2.5 ≤ εs)

Material	εs	Material	εs	Material	εs	Material	εs
ABS	2.4 to 4.1	Coffee bean cake	2.4 to 2.6	Methanol	12	Sodium carbonate	2.7
Acetate	3.2 to 7	Cottonseed oil	3.1	Mica	4.5 to 7.5	Sodium dichromate	2.9
Acrylic resin	2.7 to 4.5	Ebonite	2.5 to 2.9	Naphthalene*	2.5	Soybean oil	2.9 to 3.5
Alcohol*	16 to 31	Epoxy resin	2.5 to 6	Nylon	3 to 5	Soybean cake	2.8
Alkyd resin	3.5 to 5	Ethyl alcohol*	23	Paints*	5 to 8	Sulfur (liquid)	3.4
Aluminous porcelain	8 to 11	Feed (soybean meal, etc.)	3 to 5	Palm cake	3.1	Sugar	3
Amino alkyd resin	3.9			Phenol	3 to 12	Steatite	5 to 7
Asbestos	3 to 3.6	Flux	3 to 5	Phosphate rock	4	Thinner*	3.7
Asphalt*	2.7	Formalin	23	Polyacetal resin	2.6 to 3.7	Turpentine oil*	2.5
Barium nitrate	5.9	Glass beads	3.1	Polycarbonate	2.9 to 3	Urea resin	3.42
Barley (grain)	3 to 4	Glycerin	45	Polyester resin	2.8 to 4.5	Urethane	6.5 to 7.1
Calcium	3	Grape sugar	3 to 4	Polyurethane	5 to 5.3	Vanadium sulfide	3.1
Calcium phosphate	1.9 to 3.2	Graphite	12 to 13	Quartz	3.7 to 4.1	Vinyl chloride (powdered)	5.8 to 6.4
Carbide powder	5.8 to 7.0	Gravel	5.4 to 5.6	Quartz sand	2.5 to 3.5		
Carbon dioxide	2.6	Gum arabic	2.9	Rice flour	3.7	Vinyl chloride (granulous)	3.2 to 4
Carbolic acid	9.89	Gypsum	2.5 to 6	Salt	3 to 15		
Celluloid	4.1	Linseed oil*	3.2 to 3.5	Sand	3 to 5	Wheat (grain)	3 to 5
Cellulose	6.7	Corn cake	2.6	Silicone varnish	2.8 to 3.3	Wheat flour	2.5 to 3
Chloroform*	4.8	Margarine (crude)	3	Silicone resin (liquid)	3.5 to 5	Xylene	2.7
Cocoa bean cake	2.5 to 3.5	Melamine resin	4.7 to 10.2	Silver chloride	11.2		

E7B-□□□M

Use this switch for various electroconductive substances including –

- Water solutions
- Watery grains
- Watery sand
- Metal powders

Precautions

■ Hints on Correct Use

- When two or more Level Switches are to be used in the same tank, be sure to provide a distance of more than 300 mm between the two electrodes. However, with substances having a dielectric constant of 2.5 or more ($\varepsilon s \geq 2.5$), the two sensitive electrodes may be placed as close as 100 mm apart.
- When the sensitive electrode is to be placed in parallel with the tank wall, be sure to provide a distance of more than 100 mm between the electrode and tank wall.

OMRON

■ Specification Confirmation Sheet

Before ordering the E7B, please fill out the following sheet and consult your OMRON representative.

Fill out or check the necessary items.

Document No.

Company: **Section:**		**Date:** **Name:**	
Material to be Measured		**Mounting Conditions**	
Material		**Flange**	☐Required ☐Not required
Type	☐Liquid ☐Powder ☐Pellet ☐Other	**Between the E7B and the Controller**	Approx. m
Dielectric constant (εs)*		**Operating Conditions**	
* If the dielectric constant of the material is not known, refer to the tables of dielectric constants in this datasheet to estimate the dielectric constant. If the material is not listed, send 200 g min of the material as a sample to your OMRON representative.		**Operating environment**	☐Indoors ☐Outdoors
		Material of tank	☐Plastic resin ☐Metal
Electrical conductivity	☐Yes ☐No	**Temperature of tank**	Approx. °C
Corrosiveness	☐Yes ☐No	**Pressure of tank**	
Stickiness	☐Yes ☐No		
Quantity and Delivery Date		**Models**	
Quantity	Probe Head: Controller:	**Model no. of Probe Head**	E7B-
Delivery date			

Remarks: Describe the shape and dimensions of the tank, the locations of its inlet and outlet, and the mounting position of the Probe Head with sketches.

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. F055-E1-01