

ECAP level transmitter is a capacitive level sensor for level measurement of conductive liquid, low conductive liquid, granulated materials with solid particles, adhesive and acid/basic liquids.

When a material comes between electrode rod and tank wall, a capacitance change occurs and when this change exceed adjustment threshold, contact output is delivered.

Full-empty calibration can be performed easily and safely.

Different designs and different solution related to industrial level measurement are offered especially for machinery manufacturers.

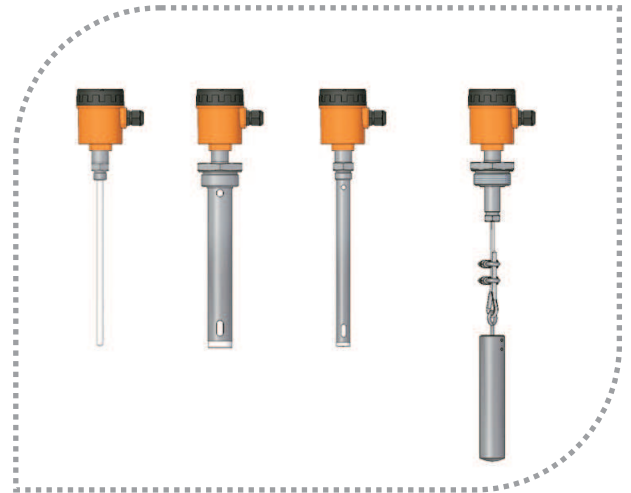
Application Areas

Liquid tanks, food machines, cooling liquid tanks, shipping, glycol tanks, brine, waste water tanks.

Oil tanks, CO2 liquid tanks, high temperature tanks, non-conductive liquids.

Grain stores, cement, sand feed, flour, milk powder, organic and plastic granule.

Sticky hot and high viscosity liquid, acid and chemical liquids.



ECAP

CAPACITIVE LEVEL TRANSMITTER

ECAP 101 / 102 / 103 / 107

ECAP 202 / 203 / 204 / 205 / 20S

ECAP 304 / 305 / 306 / 30S

ECAP 408A / 408B / 408T / 408Tp

Advantages :

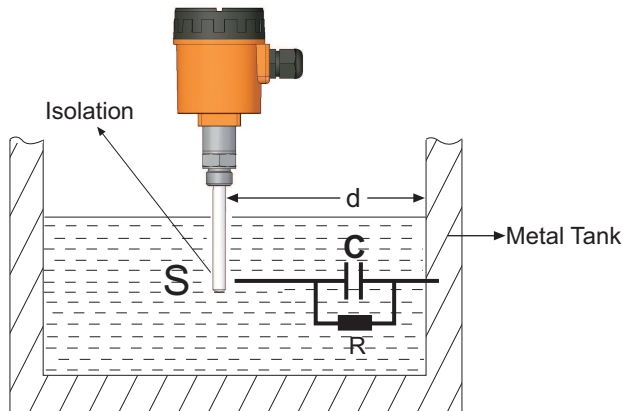
- * There are no moving parts.
- * High pressure and temperature resistant design.
- * Modular structure with easy assembly.
- * Not affected by foam, liquid splashes.
- * Not affected by vibration, has robust mechanical structure.
- * Zero span adjustment is easy.
- * Measurement along whole sensor.
- * Operability with reverse assembly.

Technical Specifications:

Measurable Material	Conductive liquids Low conductive liquids Solids particulate materials Adhesive and acid/basic liquids
Supply	9-36 VDC
Signal Output	4-20 mA two wire Std. 0-20 mA - 4-20 mA, 0-10 V three wire Opt.
Accuracy	± % 0,5 , ± % 0,8 , ± % 1
Linearity	% 0,5
Capacity Range	1pF...3nF
Min. Di-Electric Constant	1,6 ε _r
Connection Material	304 St.St. Opt.316 St.St.
Isolation Material	PFA Std. Opt. PEEK, PTFE , Rubber, FKM
Housing Material	PBT Std., Ops. Aluminium, St.St.
Working Pressure	(-) 1 bar...100 bar (Depending on the model)
Working Temperature	(-) 40 °C / (+) 150 °C (Depending on the model) 200 °C with cooling apparatus (-) 196° For Cryogenic Tank (-) 50 °C...(+) 80 °C For NBR FKM (-) 30 °C...(+) 200 °C 400 °C with ceramic isolation
Ambient Temperature	(-)20 °C / (+) 60 °C
Display	With LED-Power and Contact LED
Isolation	Max. 500 W
Power Consumption	Max. 50m W
Electrical Connection	Terminal
Protection Class(EN60529)	PBT-IP 66 , Aluminium , St.St. IP 65
Test	EMC, Low voltage
Max.Tensile Force	Max. 40 Nm
Weight	295 g. for ECAP 101 250 mm

Working Principle :

Capacitance definition, assuming two parallel conductive plates are used;



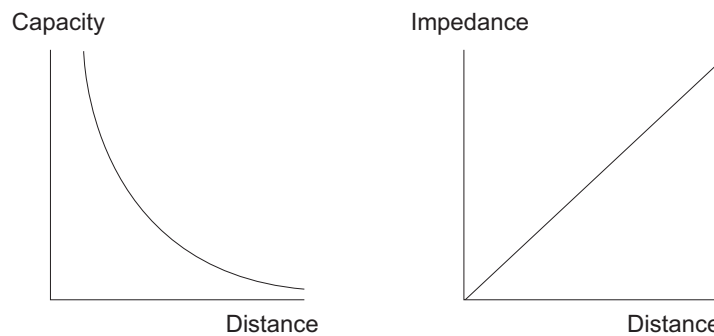
$$C = \frac{\epsilon_0 \cdot \epsilon_r \cdot S}{d}$$

C: Capacity , Farad

S: Surface Area , m²

d: Distance , m

However, there are scarcely any sensor type which this definition can be practically utilized. Above Formula can no longer be reliable especially when residual areas increase due to large distance (d) (which is usually the case). Thus, measuring impedance for distance measurements give more accurate results than capacitance measurement.



Impedance definition $Z = R + jL\omega + (jC\omega)^{-1}$ R is defined as real component and represent ambient conductivity.

$jL\omega$ second component is defined as inductive reactance. This component is present even if we perform capacitive measurement. However we neglect this. Since we evaluate results based on electrostatic properties of the environment, no error will occur. Resulting impedance definition is $Z = R + (jC\omega)^{-1}$.

Measurement is made by charge transfer in our capacitive sensors. Total impedance is defined as $Z = V / I$.

I (current) $I = Q / t$

Q (Coulomb)

T (sec)

Capacitive reactance we desire to measure is $(jC\omega)^{-1}$. Meaning that charge and impedance have the same phase.

To summarize, charge transferred to medium is directly proportional with capacitive reactance.

For sensors manufactured as coaxial;

a: Central electrode radius

b: Outer screen radius

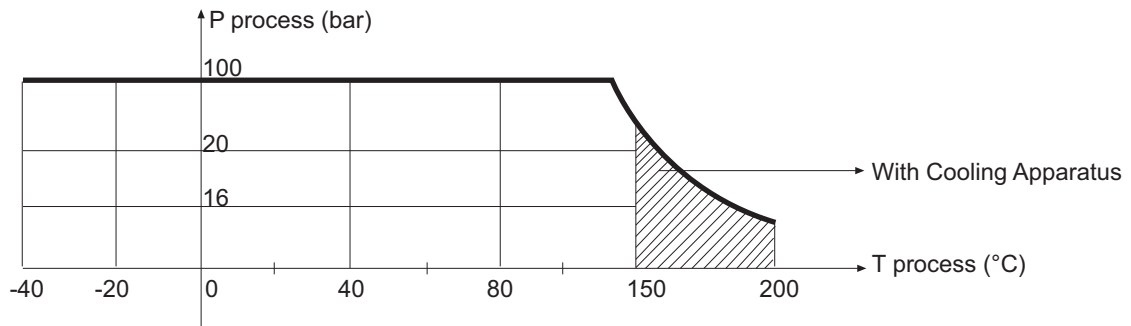
L: length

$$C = \frac{2 \cdot \pi \cdot \epsilon_0 \cdot \epsilon_r}{\ln(b/a)} \cdot L$$

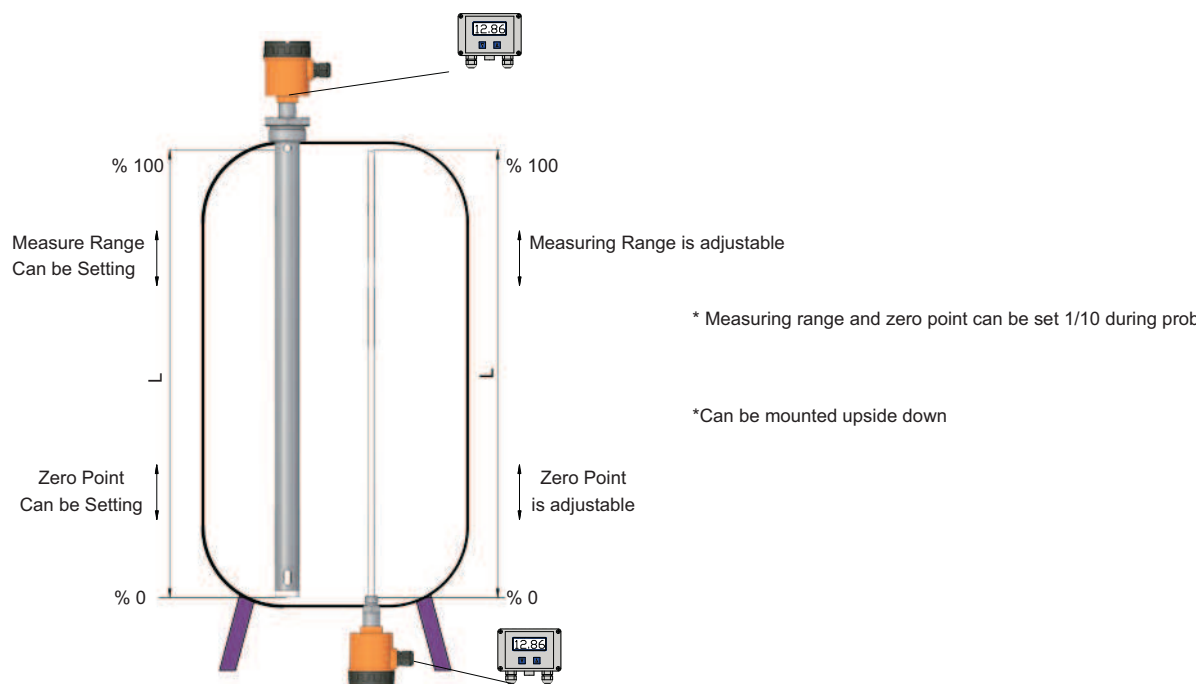
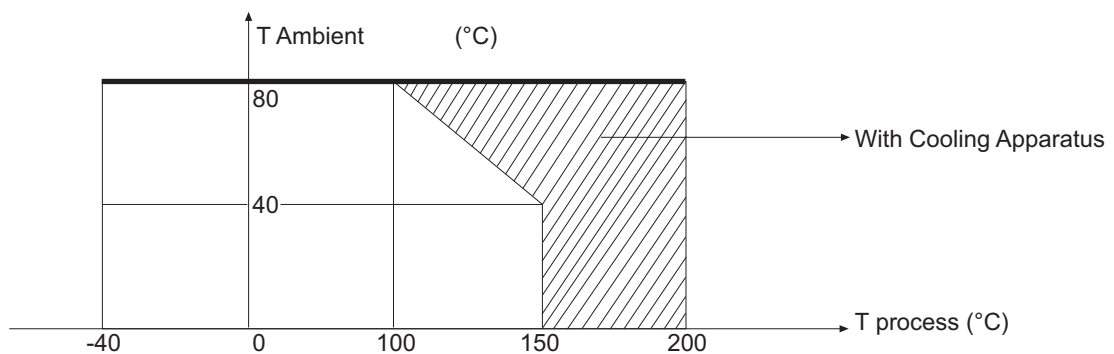
Impedance is calculated by this definition

Excitation applied between 10 KHz...250 KHz based on length for all our models. ($\omega = 2 \times \pi \times f$)
 Linearity error that may be caused by conductivity component (R) effect is prevented by electronic circuit design and mechanical design. Reduced to a level lower than 1ppm, acceptable as zero.

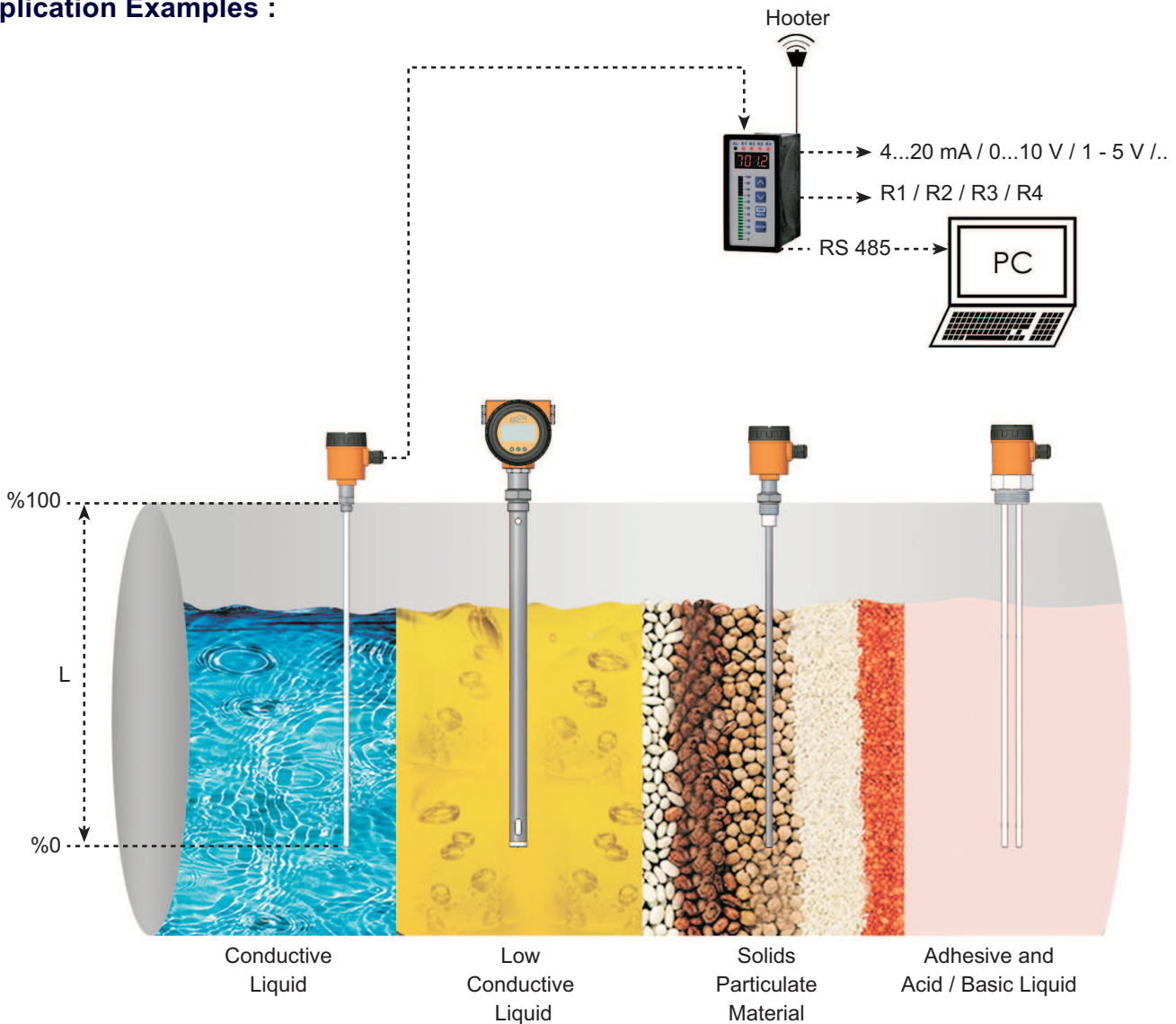
Process Pressure / Temperature Chart



Environment Pressure / Temperature Chart

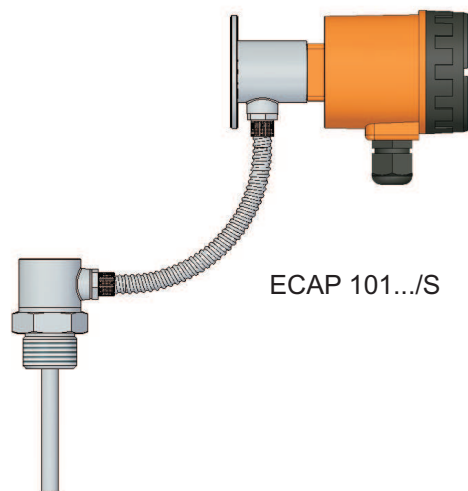


Application Examples :

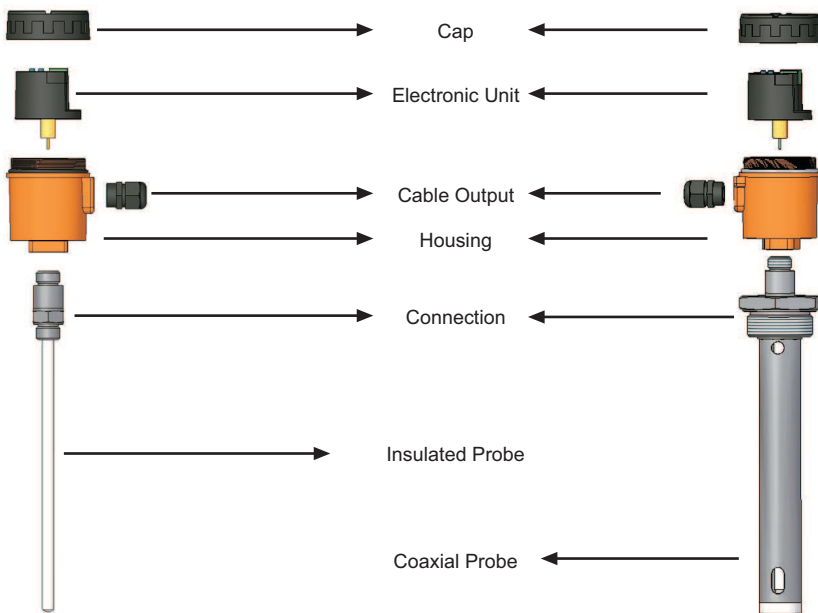


Electronic Unit with Cable:

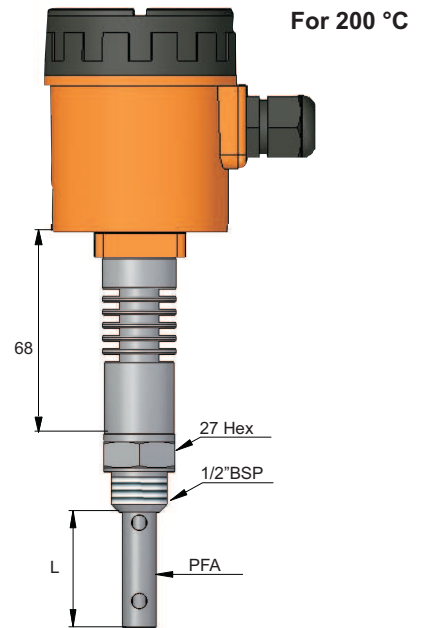
Electronic unit and sensor component can be separated by a cable that protected against exterior conditions for easy calibration on site. Thanks to the properties of cable, easy assembly for user is possible without affecting capacitive measurement.



Parts:

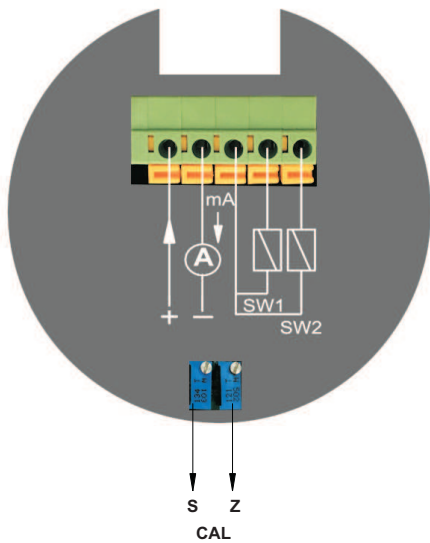


Cooling :



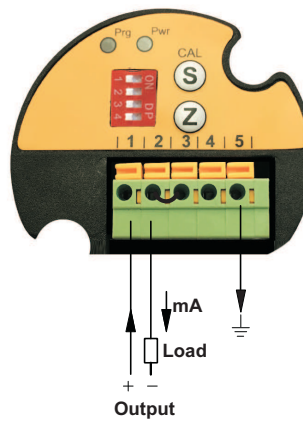
Electrical Connection :

**B010 Aluminium Housing
(For Double Cell)**

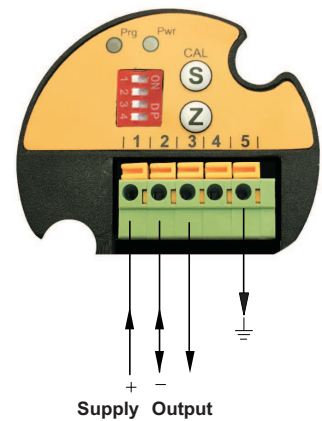


4-20 mA Two Wire + 2 PNP NO

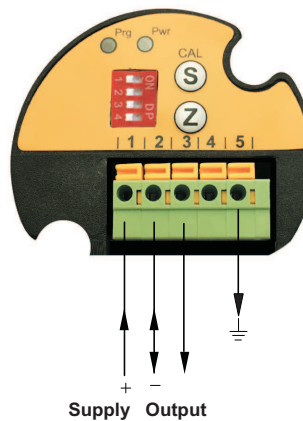
4-20 mA Two Wire



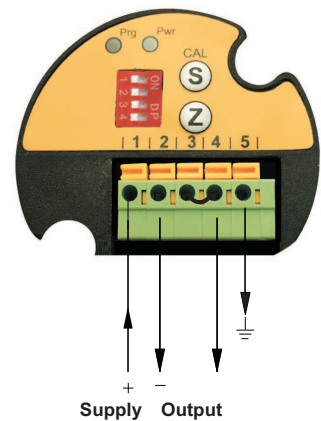
4-20 mA Three Wire



0-20 mA Three Wire



0-10 V Three Wire



Identification of Calibration Buttons :

Z (Starting Range-Zero) : Measurement starting point - 4 mA

Zero adjustment (zero): 4 mA adjustment is performed at factory exit, assuming tank is completely empty. If adjustment is needed again, 4 mA output adjustment can be performed by Z calibration after the tank is filled until initial level.

S (Measuring Range-Span): Measuring peak point - 20 mA

Measurement field (span) adjustment: 20 mA is adjusted at factory exit, assuming tank is filled up to length of electrode. If adjustment is needed again, 20 mA output adjustment can be performed by S calibration after filling the tank up to a desired level.

Switch Settings of Output Signal :

When setting output signal, only the 3rd and 4th switches are active and configuration is defined only if the circuit energized.

Power Supply : 9-36 VDC

Max. Load Resistance : $(R_L) = (V_{sup} - 3) / 0.02 [\Omega]$

Changes are not effective during normal operation.



4-20 mA Two Wire



4-20 mA Three Wire



or

0-20 mA Three Wire



0-10 V Three Wire

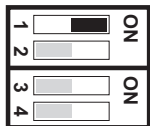
Calibration :

Only the switch 1 is active at first. When SW1 brought into "ON" position, red led light starts winking with 1 second interval.

Zero level adjust (SW1 is on position): Z button must be kept pressed until the green led is flashed.

Span level adjust (SW1 is on position): S button must be kept pressed until the green led is flashed.

After calibration, when SW1 brought into off position, it saves settings to memory and turn back into normal working condition.



S → Span Level

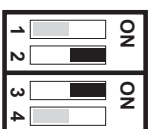
Z → Zero Level

Shifting Span Point :



Make SW2 ON

It becomes active when SW2 brought into ON position.



Make SW3 ON while SW2 ON.

If SW3 brought into ON position, while SW2 is in ON position.

The span point that's set before, shifts upper. When it came to the desired value, the switch should be taken to the off position.



Make SW4 ON while SW2 ON.

If SW4 brought into ON position, while SW2 is in ON position.

The span point that's set before, shifts down, towards. When it came to the desired value, the switch should be taken to the off position.

Shifting Zero Point :



Make SW2 ON before SW1 ON.

It becomes active when SW2 brought into ON position and then SW1 brought into ON position.



Make SW3 ON while SW2+SW1 ON.

If SW3 brought into ON position, while SW2+SW1 are in ON position.

The span point that's set before, shifts upper. When it came to the desired value, the switch should be taken to the off position.

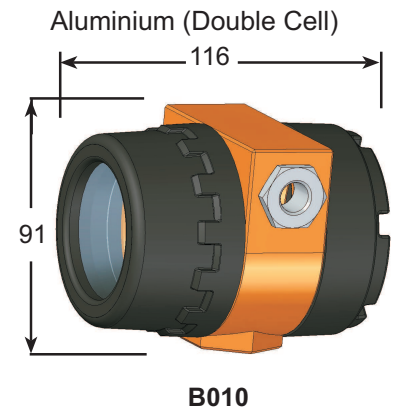
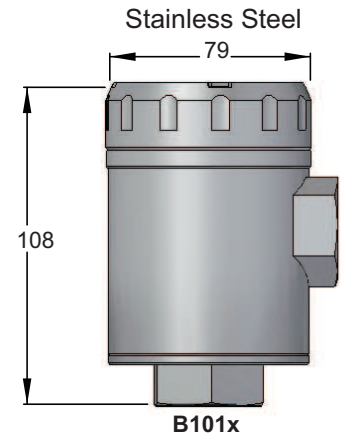
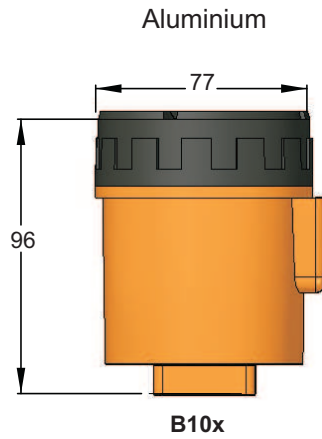
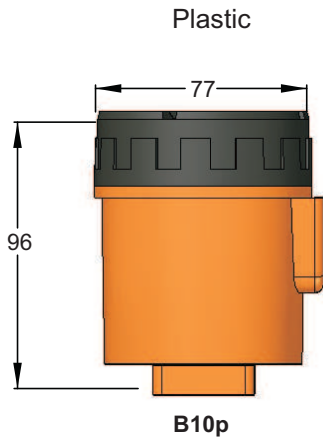


Make SW4 ON while SW2+SW1 ON.

If SW4 brought into ON position, while SW2+SW1 are in ON position.

The zero point that's set before, shifts down. When it came to the desired value, the switch should be taken to the off position.

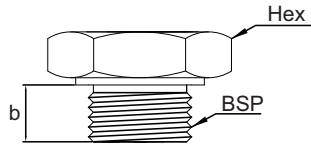
Housing :



ORDER CODE	TYPE	MATERIAL	PROTECTION CLASS	TEMPERATURE (°C)	SIZE a x b x c (mm)
055	B10p	Plastic (PBT)	IP 65	(-) 40...(+) 150	96 x 77
062	B20p	Plastic (PBT)	IP 65	(-) 40...(+) 150	132 x 104
335	B10x	Aluminium	IP 65	(-) 40...(+) 150	96 x 77
376	B20x	Aluminium	IP 66	(-) 40...(+) 200	132 x 104
307	B010	Aluminium (Double Cell)	IP 68	(-) 40...(+) 100	91 x 116
102	B101x	Stainless Steel	IP 65	(-) 40...(+) 150	108 x 79

Mechanical Connection :

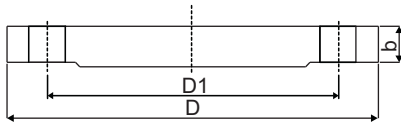
Thread



(ISO228-1)

Order Code	Dimension B	Hex [mm]	Thread b (mm)
001	1/8" BSP	17	12
002	1/4" BSP	17	12
003	3/8" BSP	24	20
004	1/2" BSP	27	14
005	3/4" BSP	32	14
006	1" BSP	41	23
007	1 1/4" BSP	51	23
008	1 1/2" BSP	60	23
009	2" BSP	70	23

Flanged



(ISO1092-1)

Order Code	PN 16	D (mm)	D1 (mm)	b (mm)
103	DN 25	165	85	16
104	DN 32	140	100	16
106	DN 50	165	125	18
108	DN 80	200	160	20
109	DN 100	220	180	20

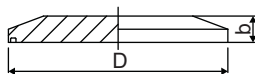
(ISO1092-1)

Order Code	PN 40	D (mm)	D1 (mm)	b (mm)
303	DN 25	115	85	18
304	DN 32	140	100	20
306	DN 50	165	125	20
308	DN 80	200	160	20
309	DN 100	235	190	24

(ANSI B16.5)

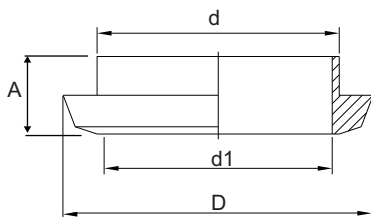
Order Code	150 LBS	D (mm)	D1 (mm)	b (mm)
606	DN 50	152,4	121	19
607	DN 65	177,8	139,7	22,2
608	DN 80	190,5	152,4	23,8
609	DN 100	228,6	157,2	23,8

Clamp



Order Code	(ISO2852) Measurement	D (mm)	b (mm)
851	DN 32	50,5	15
852	DN 50	64	17
853	DN 65	91	17

Dairy

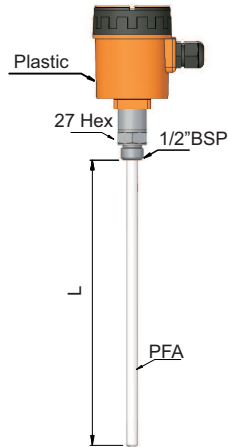


Order Code	Measurement	Measurement	D (mm)	d1 (mm)	A (mm)
870	DN 40	DN 40	56	48	13
871	DN 50	DN 50	68	61	14
872	DN 100	DN 100	121	114	20

CONDUCTIVE LIQUIDS

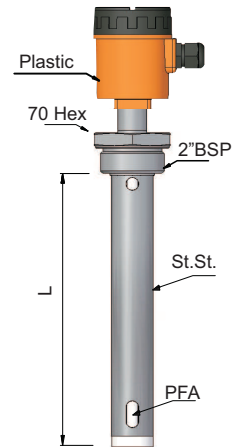
Sample Models:

ECAP 101
Fully Insulated
Conductive Tank



Max. 4 m.
(-) 1 bar...(+) 100 bar
(-) 40 °C...(+) 150 °C

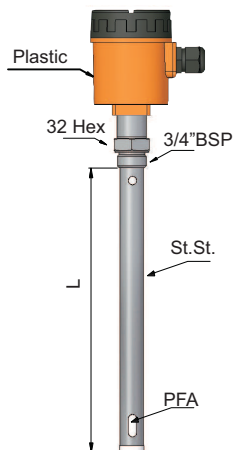
ECAP 102
Fully Insulated Coaxial Probe
Insulated Tank



Max. 4 m.
(-) 1 bar...(+) 100 bar
(-) 40 °C...(+) 150 °C

ECAP 103

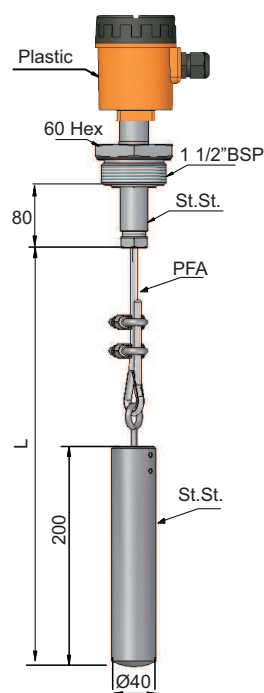
Fully Insulated Coaxial Probe
Insulated Tank



Max. 1 m.
(-) 1 bar...(+) 100 bar
(-) 40 °C...(+) 150 °C

ECAP 107

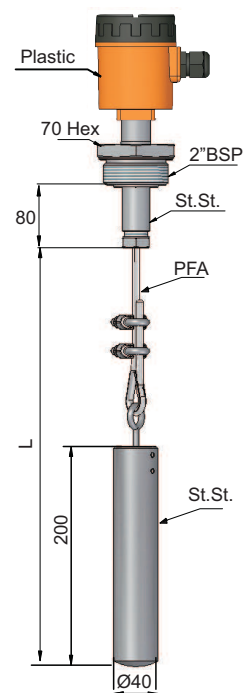
Fully Insulated Rope
Conductive Tank



Max. 16 m.
(-) 1 bar...(+) 60 bar
(-) 40 °C...(+) 150 °C

ECAP 107

Fully Insulated Rope
Conductive Tank



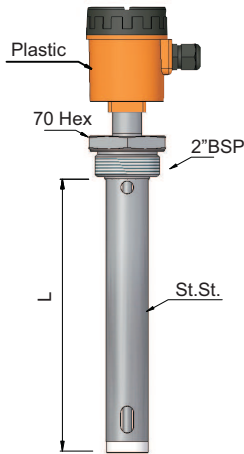
Max. 32 m.
(-) 1 bar...(+) 60 bar
(-) 40 °C...(+) 150 °C

Sample Models:

LOW CONDUCTIVE LIQUIDS

ECAP 202

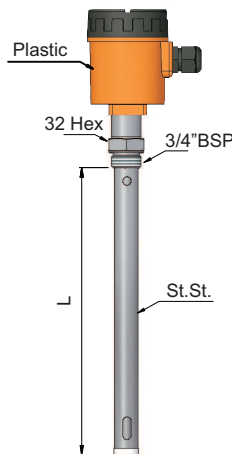
Partly Insulated Coaxial Probe
Conductive / Insulating Tank



Max. 4 m.
(-) 1 bar...(+) 100 bar
(-) 40 °C...(+) 150 °C

ECAP 203

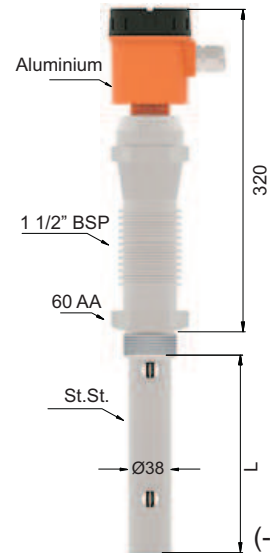
Partly Insulated Coaxial Probe
Conductive / Insulating Tank



Max. 1 m.
(-) 1 bar...(+) 100 bar
(-) 40 °C...(+) 150 °C

ECAP 205

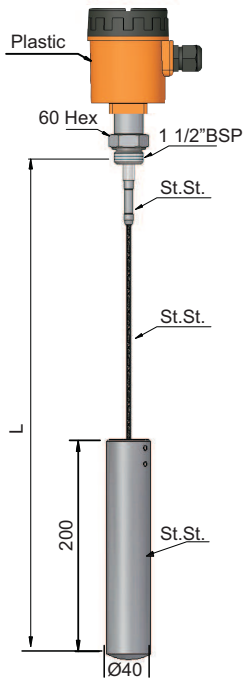
Partly Insulated Coaxial Probe
Conductive / Insulating Tank



Max. 4 m.
(-) 1 bar...(+) 25 bar
(-) 40 °C...(+) 400 °C

ECAP 204

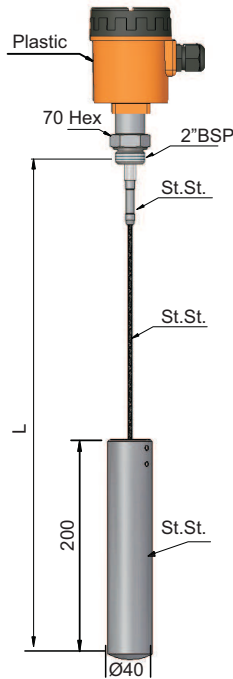
Partly Insulated Rope
Conductive Tank



Max 16 m.
(-) 1 bar...(+) 60 bar
(-) 40 °C...(+) 150 °C

ECAP 204

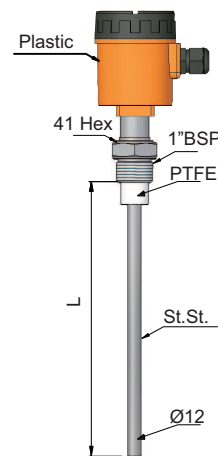
Partly Insulated Rope
Conductive Tank



Max. 32 m.
(-) 1 bar...(+) 60 bar
(-) 40 °C...(+) 150 °C

ECAP 205

Partly Insulated Probe
Conductive Tank

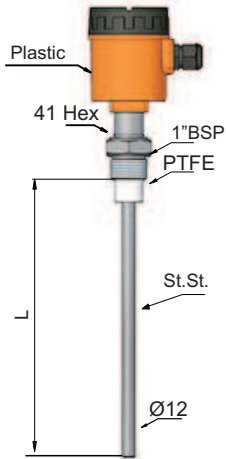


Max. 6 m.
(-) 1 bar...(+) 60 bar
(-) 40 °C...(+) 150 °C

SOLIDS PARTICULATE MATERIALS

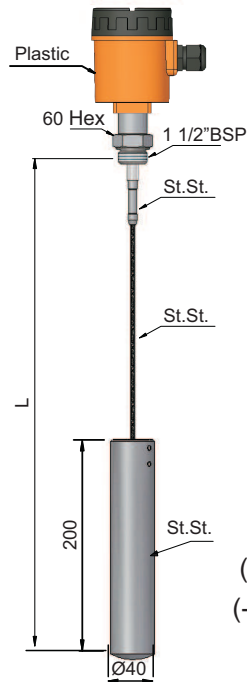
Sample Models:

ECAP 305
Partly Insulated Probe
Conductive Tank



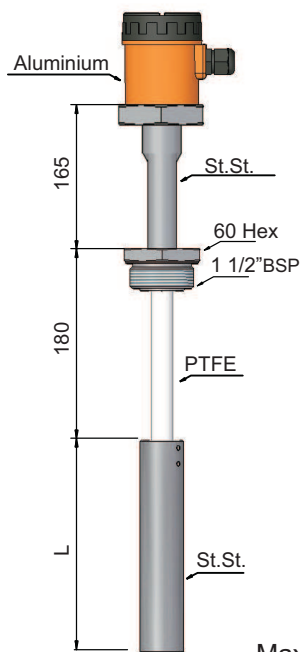
Max. 6 m.
(-) 1 bar...(+) 60 bar
(-) 40 °C...(+) 150 °C

ECAP 304
Partly Insulated Rope
Conductive Tank



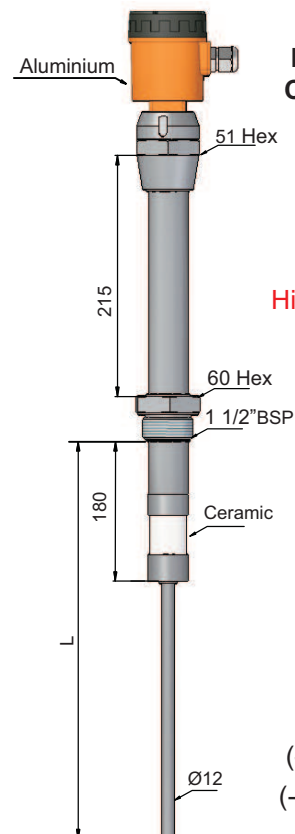
Max. 16 m.
(-) 1 bar...(+) 60 bar
(-) 40 °C...(+) 150 °C

ECAP 306
PTFE İzoleli Prob
Conductive Tank



Max. 1 m.
(-) 1 bar...(+) 25 bar
(-) 40 °C...(+) 200 °C

ECAP 30S
Ceramic Partly
Insulated Probe
Conductive Tank



High Temperature
Version

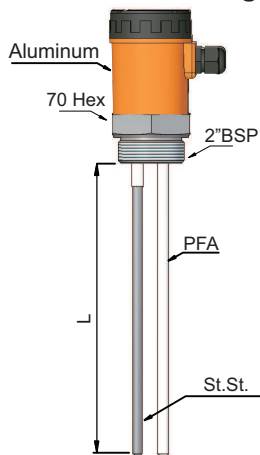
Max. 4 m.
(-) 1 bar...(+) 25 bar
(-) 40 °C...(+) 400 °C

ADHESIVE AND ACID / BASIC LIQUIDS

Sample
Models:

ECAP 408A

**Double Probe (Single Fully Insulated)
Conductive / Insulating Tank**

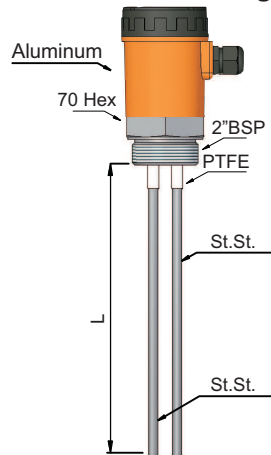


Max. 4 m.

(-) 1 bar...(+) 100 bar
(-) 40 °C...(+) 150 °C

ECAP 408B

**Double Partly Insulated Probe
Conductive / Insulating Tank**

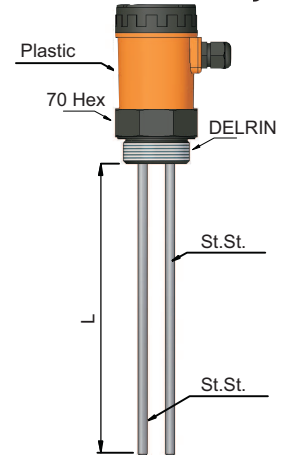


Max. 6 m.

(-) 1 bar...(+) 60 bar
(-) 40 °C...(+) 150 °C

ECAP 408B

**Double Partly Insulated Probe
Conductive / Insulating Tank**

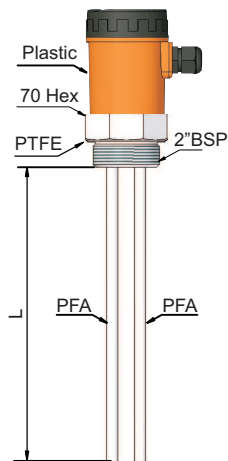


Max. 6 m.

(-) 1 bar...(+) 25 bar
(-) 20 °C...(+) 80 °C

ECAP 408T

**Double Fully Insulated Probe
Conductive / Insulating Tank**

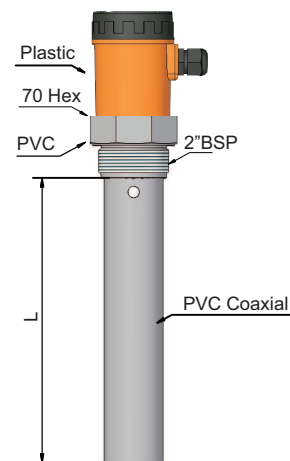


Max. 1 m.

(-) 1 bar...(+) 25 bar
(-) 40 °C...(+) 150 °C

ECAP 408Tp

**Double Fully Insulated
PVC Coaxial Probe
Conductive / Insulating Tank**



Max. 1 m.

(-) 1 bar...(+) 6 bar
(-) 0 °C...(+) 60 °C

Order Form : Please consider sample models when coding.

1 MODEL ECAP

Conductive Liquids.....	1	Solids Particulate Materials.....	3
Non-Conductive Liquids	2	Adhesive and Acid / Basic Materials.....	4

2 CERTIFICATE

None.....	0	(EN10204-3-1)Material Certification.....	1
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3 PROBE TYPE (MAX. LENGHT)

Single Probe - Insulated (Max. 4 m.)	1	Double Probe - Single Insulated (Max. 4 m.)	8A
Single Probe - Coaxial (Max. 4 m.) Ø 38	2	Double Probe - Non-Isolated (Max. 6 m.)	8B
Single Probe - Thin Coaxial (Max. 1 m.), Ø 21	3	Double Probe - Double Insulated (Max. 4 m.)	8T
Rope - Non-Insolated (Max. 32 m.)	4	Double Probe - Double Insulated, PVC Coaxial (Max. 4 m.) ..	8Tp
Single Probe - Non-Insolated (Max. 6 m.)	5	Double Probe Thin - Double Insulated (Max. 1 m.)	8Tm
Single Probe - High Temperature (Max. 4 m.)	6	Ceramic Insulated Probe (Max. 4 m.)	S
Rope - Insulated (0 ... 32 m.).....	7	Special.....	x

4 PROBE DIAMETER (Ø)

.....mm	Special.....	x
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5 STEM LENGHT

.....mm	
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6 PROCESS TEMPERATURE

150 °C (Standard).....	0	(-) 196 °C For Cryogenic Tank	2
200 °C with Cooling Apparatus	1	230 °C with Peek Insulated	3
		400 °C with Seramic Insulated	4

7 CONNECTION

Thread (ISO 228-1)	Clamp (ISO 2852)	ISO Flange(1092-1)	ASA Flanged (B16.5)
1/2" BSP	DN 25 - PN 16 ... 851	DN 25 - PN 40 ... 103	DN 50 - 150 lb ... 606
3/4" BSP	DN 32 - PN 16 ... 852	DN 32 - PN 40 ... 104	DN 65 - 150 lb ... 607
1" BSP.....	DN 50 - PN 16 ... 853	DN 50 - PN 40 ... 106	DN 80 - 150 lb ... 608
1 1/2" BSP.....		DN 80 - PN 40 ... 108	DN 100 - 150 lb ... 609
2" BSP.....		DN 100 - PN 16 ... 109	
1/2" NPT.....			
3/4" NPT.....			

8 OUTPUT

4-20 mA two wire	19	3 - 180 ohm	23
4-20 mA three wire	20	10-180 ohm	24
0-10 V three wire	21	240-33 ohm	25
0-20 mA three wire	22	4-20 mA two wire+relay	26
		Special.....	x

9 HOUSING

Plastic housign , B10p	055	Aluminium housign , B20x	376
Plastic housign , B20p	062	Aluminium, Double Cap (B010).....	307
Aluminium housign , B10x	335	Stainless Steel housign , B101x.....	102
		Special.....	x

10 INSULATION MATERIAL

PBT.....	65	Polyamide.....	69
PTFE.....	66	Seramic.....	70
PFA.....	67	Rubber.....	81
PEEK.....	68	FKM.....	84
		Special.....	x

11 CONNECTION MATERIAL

316 Stainless Steel	02	Delrin.....	63
Brass.....	41	PVDF.....	64
PVC.....	61	PBT.....	65
Polypropylene.....	62	PTFE.....	66
		Special.....	x

12 ELECTRICAL CONNECTION

With Terminal.....	00	Special.....	x
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13 OPTIONAL

None.....	/ 0	Seperable Electronic Unit.....	/ S
With By - Pass Tube.....	/ T	Double Cell Digital Display.....	/ EDS02
		Wall Apparatus.....	/ W
		Special.....	x

SAMPLE

ECAP 101 - Ø 10 - 300 mm - 0 - 006 - 21 - 055 - 66 - 02 - 00 / 0

For conductive liquids, L= 300 mm, 1" BSP , 0-10 V, Aluminium housign , Ø 10 Probe