

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.

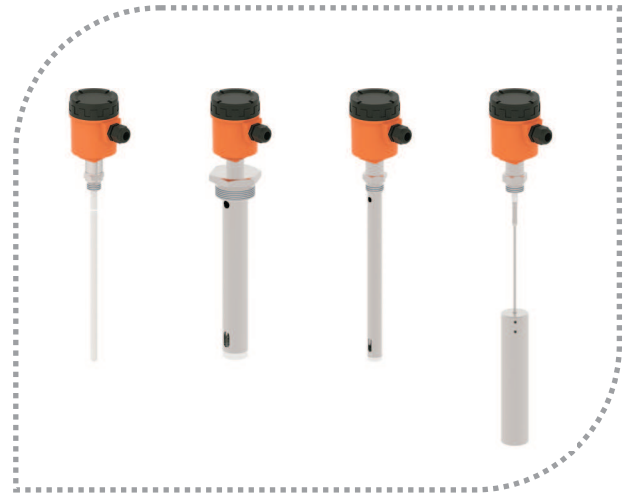
Application Areas

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.



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	$\pm 0,5\%$, $\pm 0,8\%$, $\pm 1\%$
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

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

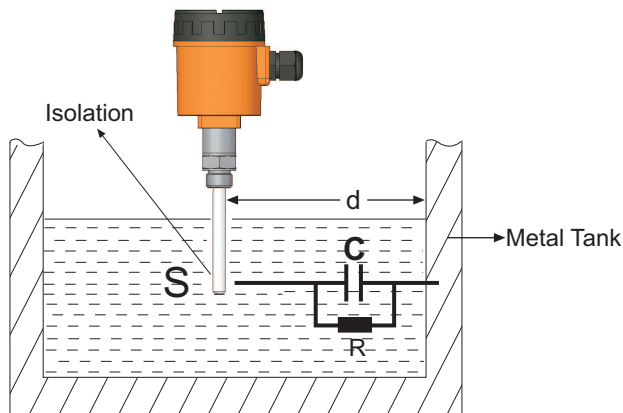
Advantages :

- * 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.



Working Principle :

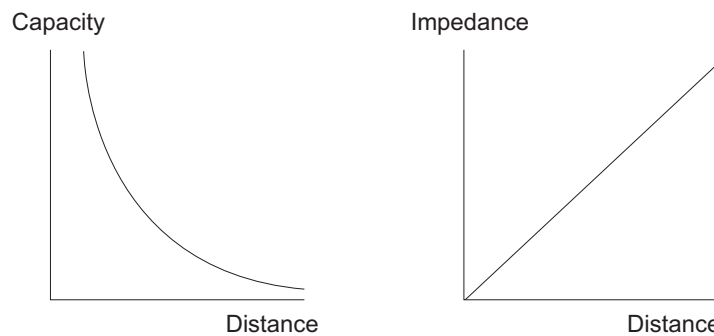
Capacitance definition, assuming two parallel conductive plates are used;



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

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

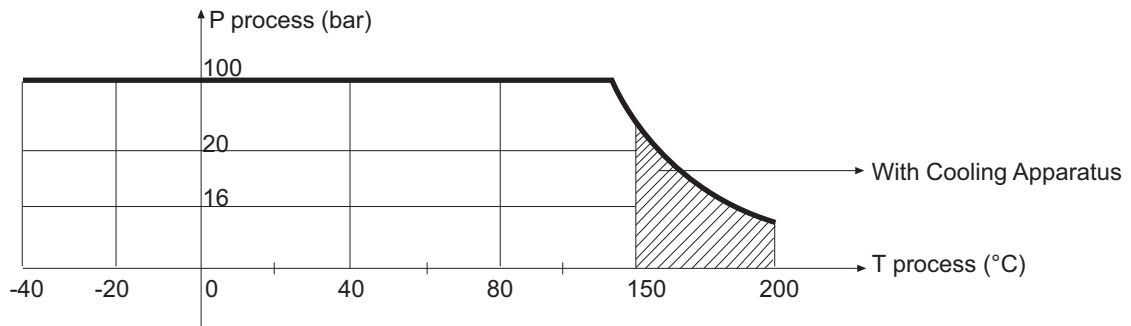
b: Outer screen radius

L: length

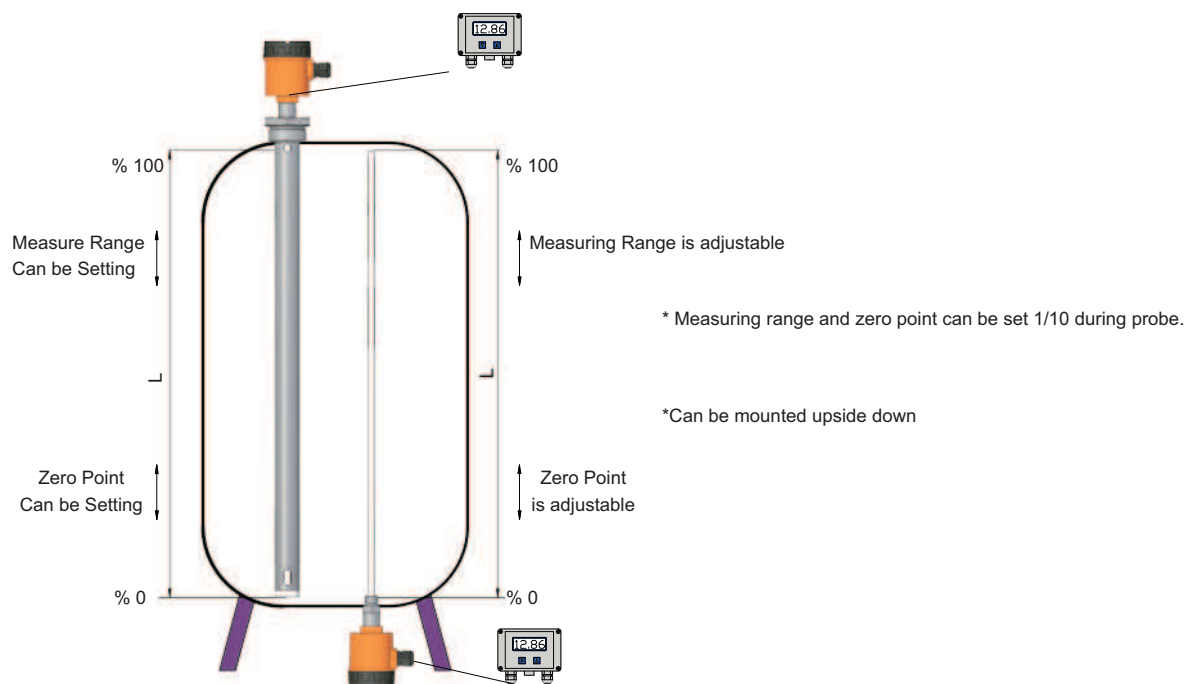
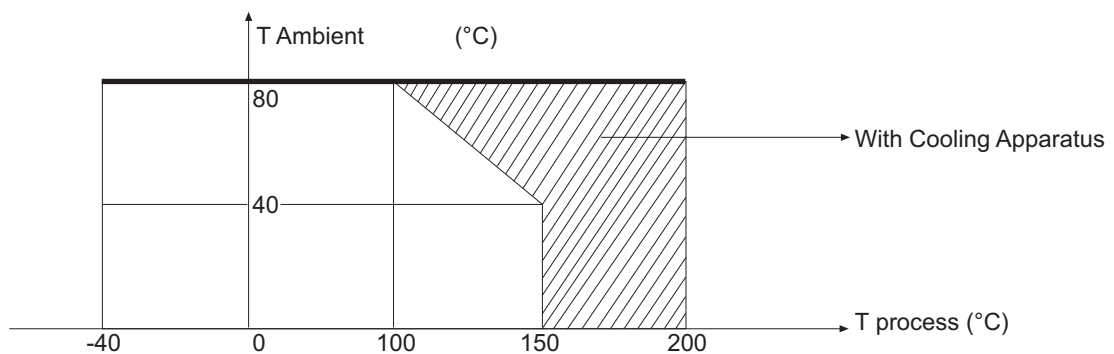
$C = \frac{2 \cdot \pi \cdot \epsilon_0 \cdot \epsilon_r}{\ln(b/a)} \cdot L$ Impedance is calculated by this definition

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.

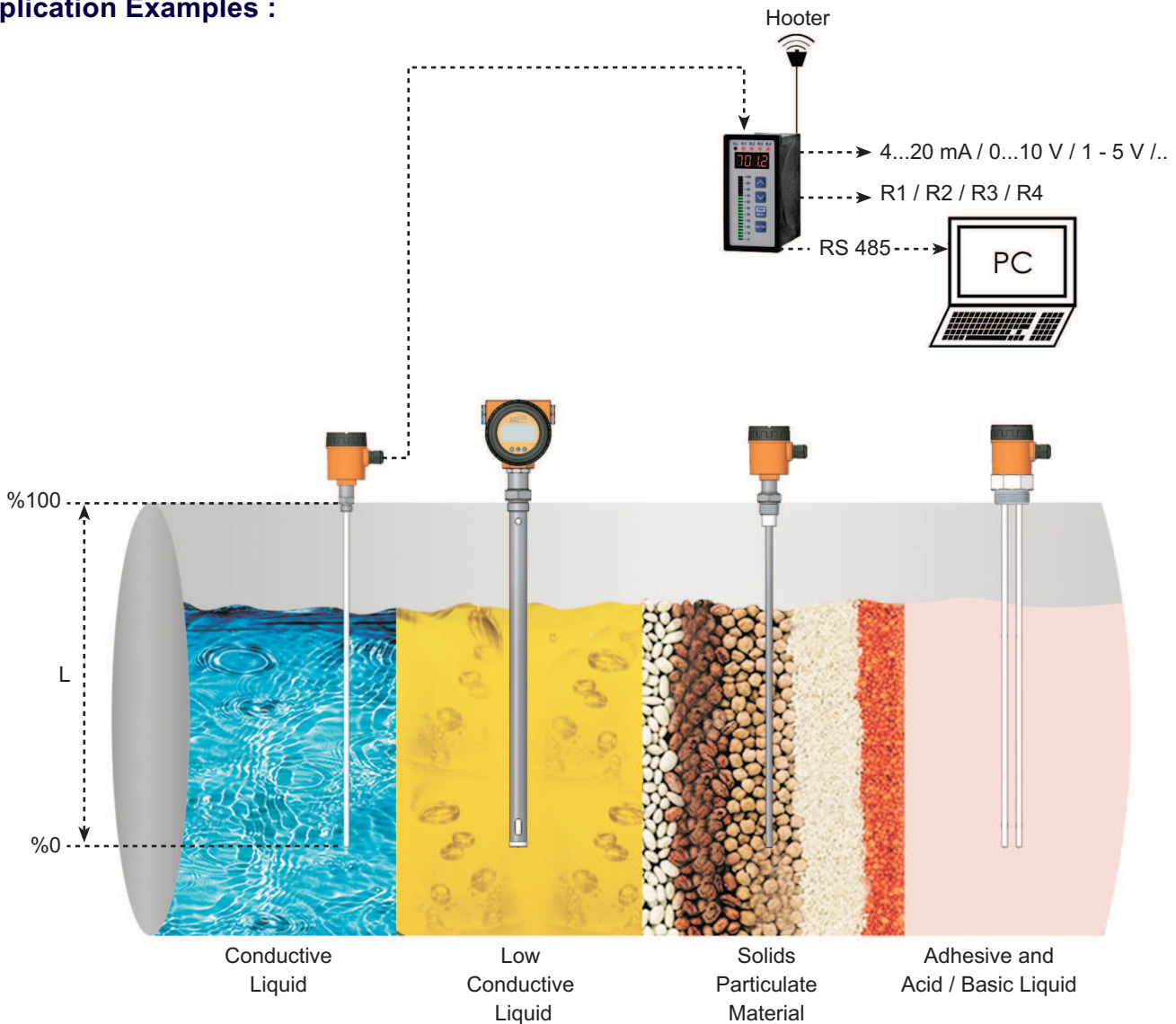
Process Pressure / Temperature Chart



Environment Pressure / Temperature Chart

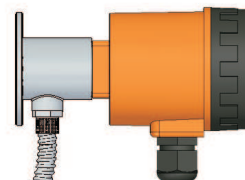


Application Examples :



Electronic Unit with Cable:

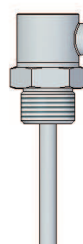
Electronic unit and sensor component can be separated by a cable that protected against exterior conditions for easy calibration on site. Thanks to the properties of cable, easy assembly for user is possible without affecting capacitive measurement.



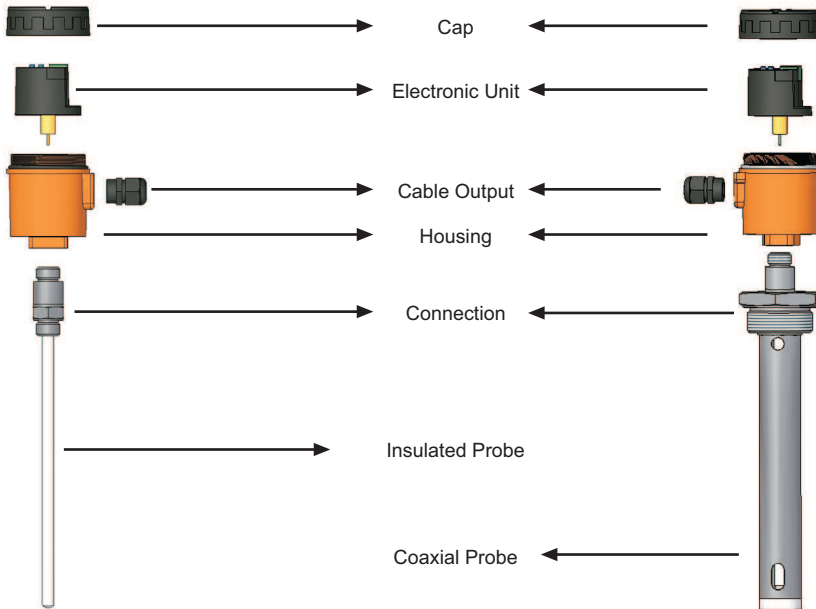
Protection Case:

ECAP 101.../S

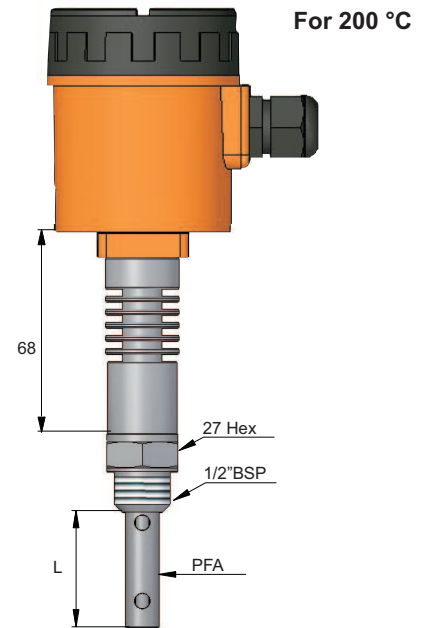
Material : 304 Stainless Steel
 Welded manufacturing
 Opens - Closes Hinged
 To Protect Against external conditions.



Parts:

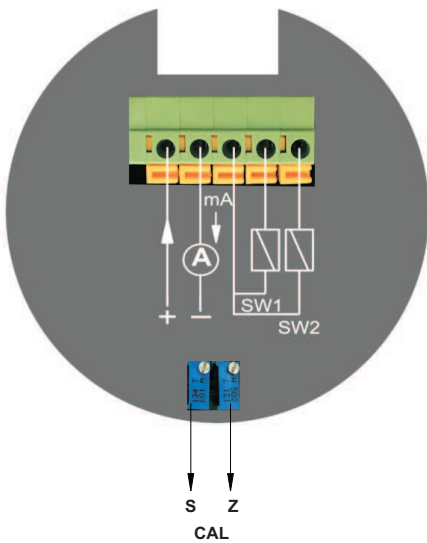


Cooling :



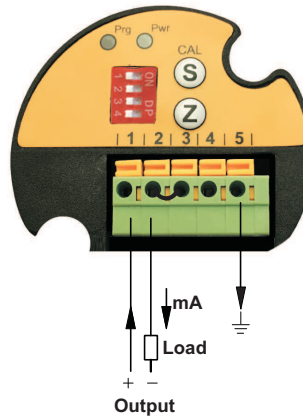
Electrical Connection :

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

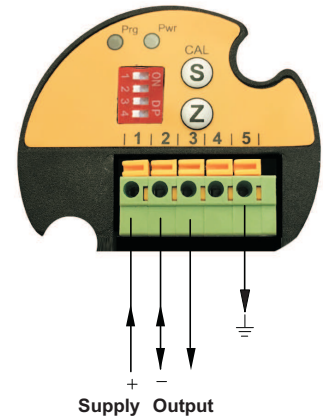


4-20 mA Two Wire + 2 PNP NO

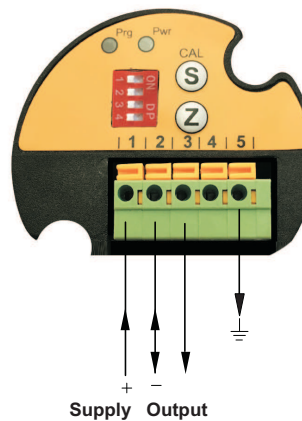
4-20 mA Two Wire



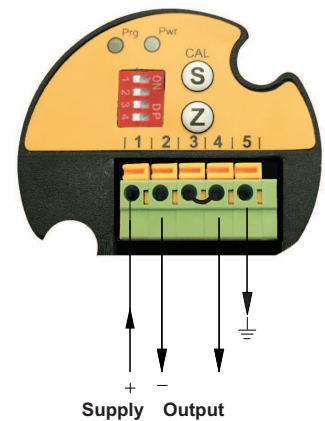
4-20 mA Three Wire



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

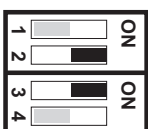
Z → Zero Level

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)
050	B10p	Plastic (PBT)	IP 65	(-) 40...(+) 150	96 x 77
053	B11p	Plastic (PVDF)	IP 65	(-) 40...(+) 120	96 x 77
103	B20p	Plastic (PBT)	IP 65	(-) 40...(+) 150	132 x 104
503	B10x	Aluminium	IP 65	(-) 40...(+) 150	96 x 77
603	B20x	Aluminium	IP 66	(-) 40...(+) 200	132 x 104
750	B22x	Aluminium	IP 66	(-) 40...(+) 150	114x102
851	B010x	Aluminium (Double Cell)	IP 68	(-) 40...(+) 100	91 x 116
800	B101x	Stainless Steel	IP 65	(-) 40...(+) 150	108 x 79

Protection Case:

Material : 304 Stainless Steel
Welded manufacturing
Opens - Closes Hinged
To Protect Against external conditions.



Product Label :

Manufacturer Brand Product Name Approval Sign

ensim SENSORS LEVEL TRANSMITTER

Model ← Type : ECAP101-9400-1-006-19-01-67-02-00/0

Output : 4-20mA

Supply : 24 VDC ± %10

Serial Number ← S.N. : IE20030200-0001

MADE IN TURKIYE www.ensim.com.tr

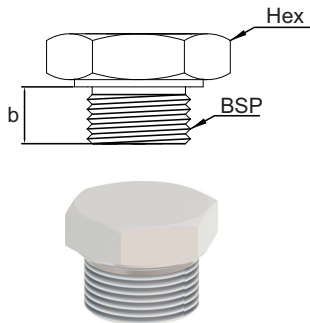
Warning Symbols

Warning Symbols

Manufacturer Website

Mechanical Connection :

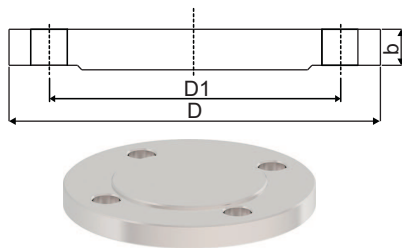
Thread



(ISO228-1)

Order Code	Dimension B	Hex [mm]	Thread b (mm)
0001	1/8" BSP	17	12
0002	1/4" BSP	17	12
0003	3/8" BSP	24	20
0004	1/2" BSP	27	14
0005	3/4" BSP	32	14
0006	1" BSP	41	23
0008	1 1/4" BSP	51	23
0009	1 1/2" BSP	60	23
0012	2" BSP	70	23

Flanged



Order (ISO1092-1)

Order Code	PN 16	D (mm)	D1 (mm)	b (mm)
0502	DN 25	165	85	16
0503	DN 32	140	100	16
0505	DN 50	165	125	18
0507	DN 80	200	160	20
0508	DN 100	220	180	20

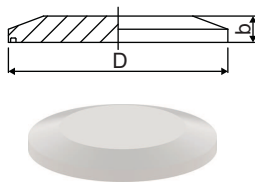
Order (ISO1092-1)

Order Code	PN 40	D (mm)	D1 (mm)	b (mm)
0702	DN 25	115	85	18
0703	DN 32	140	100	20
0705	DN 50	165	125	20
0707	DN 80	200	160	20
0708	DN 100	235	190	24

Order (ANSI B16.5)

Order Code	150 LBS	D (mm)	D1 (mm)	b (mm)
1005	DN 50	152,4	121	19
1006	DN 65	177,8	139,7	22,2
1007	DN 80	190,5	152,4	23,8
1008	DN 100	228,6	157,2	23,8

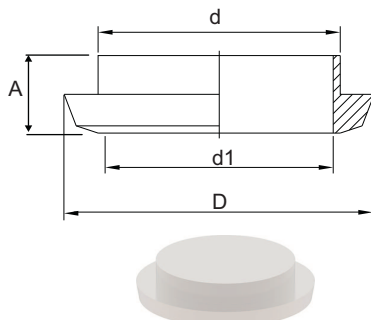
Clamp



Order (ISO2852)

Order Code	Measurement	D (mm)	b (mm)
1501	DN 32	50,5	15
1502	DN 50	64	17
1503	DN 65	91	17

Dairy



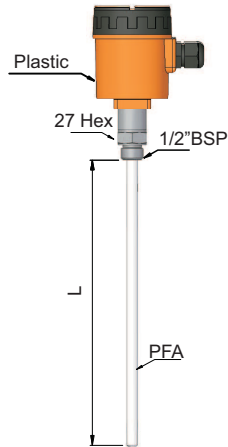
Order

Order Code	Measurement	Measurement	D (mm)	d1 (mm)	A (mm)
1600	DN 40	DN 40	56	48	13
1601	DN 50	DN 50	68	61	14
1602	DN 100	DN 100	121	114	20

CONDUCTIVE LIQUIDS

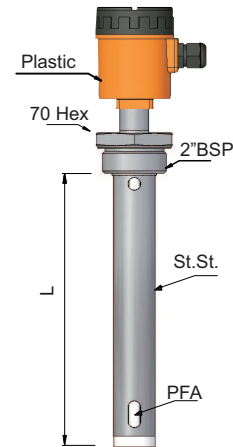
Sample Models:

ECAP 101
Fully Insulated
Conductive Tank



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

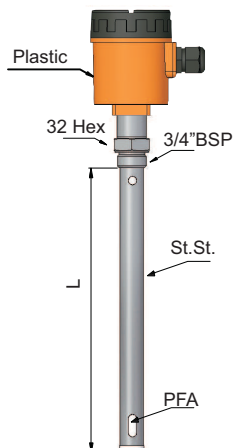
ECAP 102
Fully Insulated Coaxial Probe
Insulated Tank



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

ECAP 103

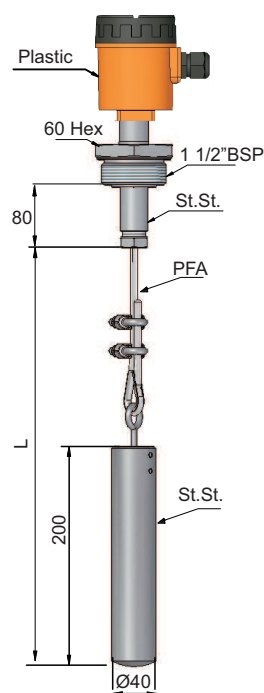
Fully Insulated Coaxial Probe
Insulated Tank



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

ECAP 107

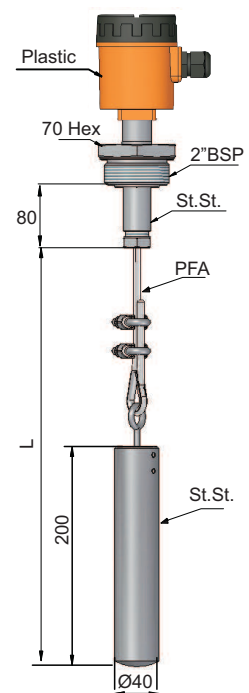
Fully Insulated Rope
Conductive Tank



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

ECAP 107

Fully Insulated Rope
Conductive Tank



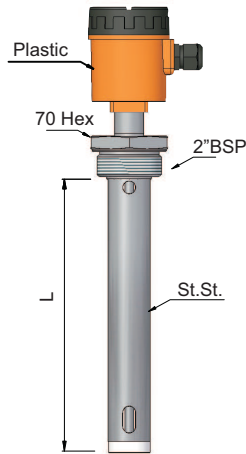
Max. 32 m.
(-) 1 bar...(+) 60 bar
(-) 40 °C...(+) 150 °C

Sample Models:

LOW CONDUCTIVE LIQUIDS

ECAP 202

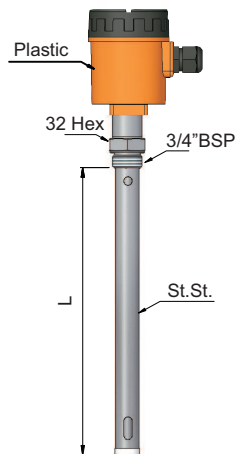
Partly Insulated Coaxial Probe
Conductive / Insulating Tank



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

ECAP 203

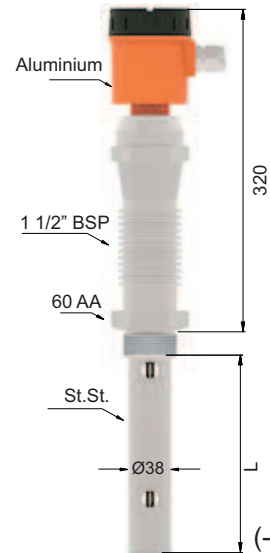
Partly Insulated Coaxial Probe
Conductive / Insulating Tank



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

ECAP 205

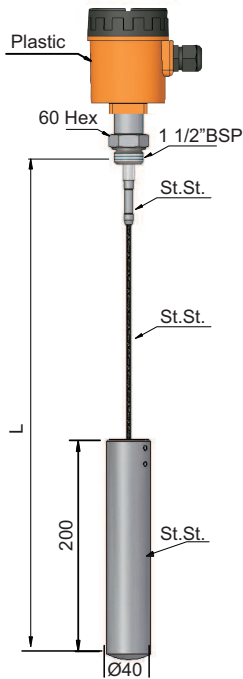
Partly Insulated Coaxial Probe
Conductive / Insulating Tank



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

ECAP 204

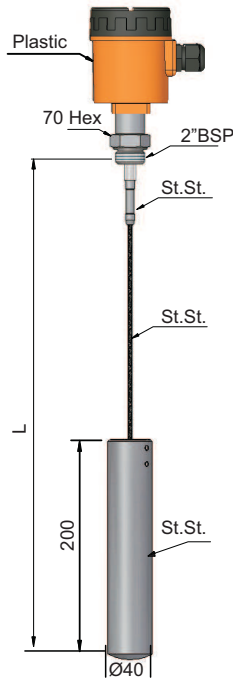
Partly Insulated Rope
Conductive Tank



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

ECAP 204

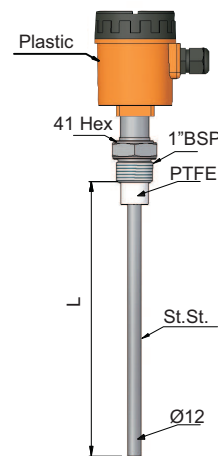
Partly Insulated Rope
Conductive Tank



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

ECAP 205

Partly Insulated Probe
Conductive Tank

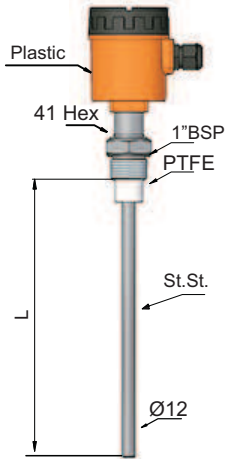


Max. 6 m.
(-) 1 bar...(+) 60 bar
(-) 40 °C...(+) 150 °C

SOLIDS PARTICULATE MATERIALS

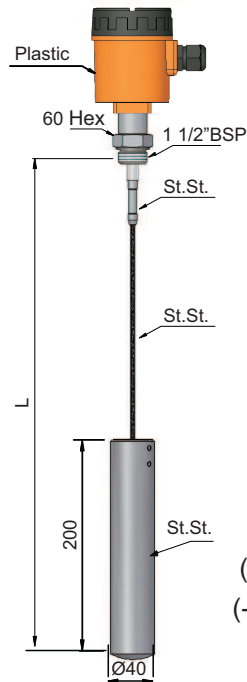
Sample Models:

ECAP 305
Partly Insulated Probe
Conductive Tank



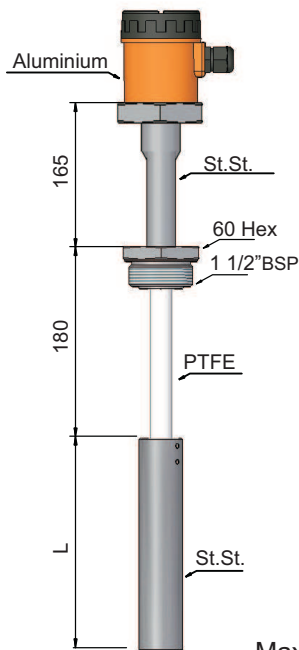
Max. 6 m.
(-) 1 bar...(+) 60 bar
(-) 40 °C...(+) 150 °C

ECAP 304
Partly Insulated Rope
Conductive Tank



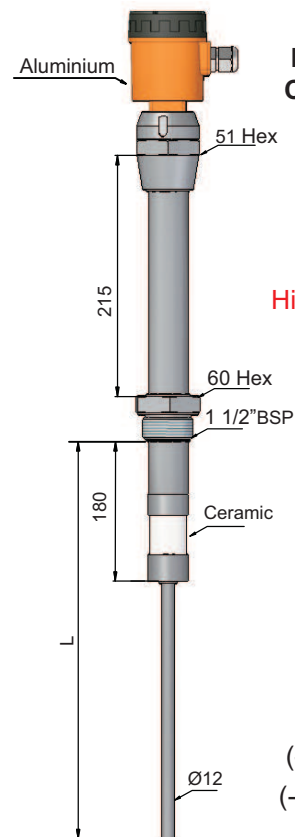
Max. 16 m.
(-) 1 bar...(+) 60 bar
(-) 40 °C...(+) 150 °C

ECAP 306
PTFE Insulated Probe
Conductive Tank



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

ECAP 30S
Ceramic Partly
Insulated Probe
Conductive Tank



High Temperature
Version

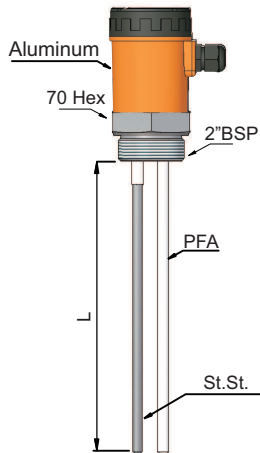
Max. 4 m.
(-) 1 bar...(+) 25 bar
(-) 40 °C...(+) 400 °C

ADHESIVE AND ACID / BASIC LIQUIDS

Sample
Models:

ECAP 408A

Double Probe (Single Fully Insulated)
Conductive / Insulating Tank

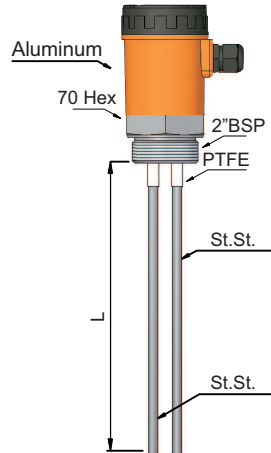


Max. 4 m.

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

ECAP 408B

Double Partly Insulated Probe
Conductive / Insulating Tank

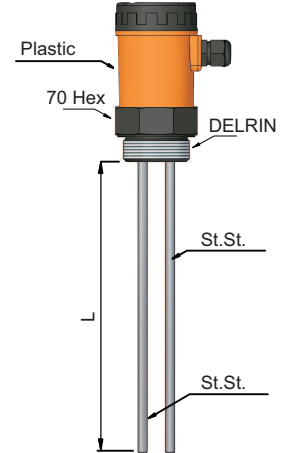


Max. 6 m.

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

ECAP 408B

Double Partly Insulated Probe
Conductive / Insulating Tank

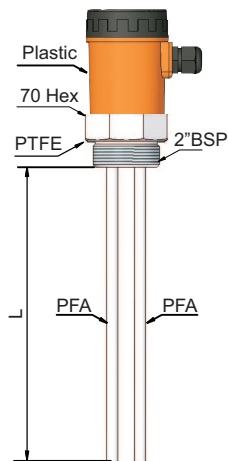


Max. 6 m.

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

ECAP 408T

Double Fully Insulated Probe
Conductive / Insulating Tank

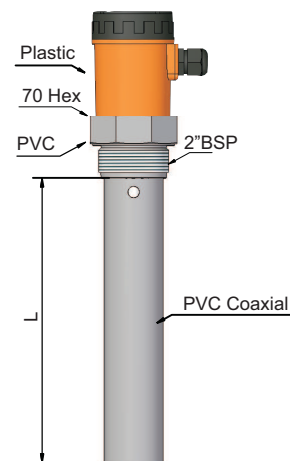


Max. 1 m.

(-) 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 Liquids2	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)

Ø 10 mm (Std.).....10	Ø 8 mm08
	Ø 12 mm.....12

5 STEM LENGHT

.....mm

6 PROCESS TEMPERATURE

150 °C (Standard).....0	(-) 196 °C For Cryogenic Tank2
200 °C with Cooling Apparatus1	230 °C with Peek Insulated3
	400 °C with Ceramic Insulated4

7 CONNECTION

<u>Thread (ISO 228-1)</u>	<u>Clamp (ISO 2852)</u>	<u>ISO Flange(1092-1)</u>	<u>ISO Flange (1092-1)</u>	<u>ASA Flanged (B16.5)</u>
1/2" BSP.....0004	DN 32 - PN 16...1501	DN 25 - PN 16...0502	DN 25 - PN 40...0702	DN 50 - 150lb ... 1005
3/4" BSP0005	DN 50 - PN 16...1502	DN 32 - PN 16...0503	DN 32 - PN 40...0703	DN 65 - 150lb ... 1006
1" BSP.....0006	DN 65 - PN 16...1503	DN 50 - PN 16...0505	DN 50 - PN 40...0705	DN 80 - 150lb ... 1007
1 1/2" BSP.....0010		DN 80 - PN 16...0507	DN 80 - PN 40...0707	DN 100 - 150lb ... 1008
2" BSP.....0012		DN 100 - PN 16...0508	DN 100 - PN 40...0708	
1/2" NPT.....0203				
3/4" NPT.....0204				

8 OUTPUT

4-20 mA two wire19	3 - 180 ohm23
4-20 mA three wire20	10-180 ohm24
0-10 V three wire21	240-33 ohm25
0-20 mA three wire22	4-20 mA two wire+relay26
	Special.....x

9 HOUSING

Plastic Housing , B10p050	Aluminium Housing, B20x603
Plastic Housing , B11p053	Aluminium Housing , B22x750
Plastic Housing , B20p103	Aluminium, Double Cap B010x.....851
Aluminium Housing , B10x503	Stainless Steel Housing , B101x.....800
	Special.....x

10 INSULATION MATERIAL

PBT.....065	Polyamide.....069
PTFE.....066	Seramic.....070
PFA.....067	Rubber.....081
PEEK.....068	FKM.....084
	Steel Shielded Cable (Max. 350 °C).....48
	Special.....x

11 CONNECTION MATERIAL

304 Stainless Steel001	Delrin.....063
316 Stainless Steel002	PVDF.....064
Brass.....041	PBT.....065
PVC.....061	PTFE.....066
Polypropylene.....062	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
Shetter (For the outside of the tank) 304 St. St..../ K6	Wall Apparatus...../ W
	Special.....x

SAMPLE

ECAP 101 - Ø 10 - 300 mm - 0 - 006 - 21 - 050 - 066 - 002 - 00 / 0
For conductive liquids, L= 300 mm, 1" BSP , 0-10 V, Aluminium housign , Ø 10 Probe