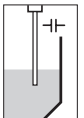
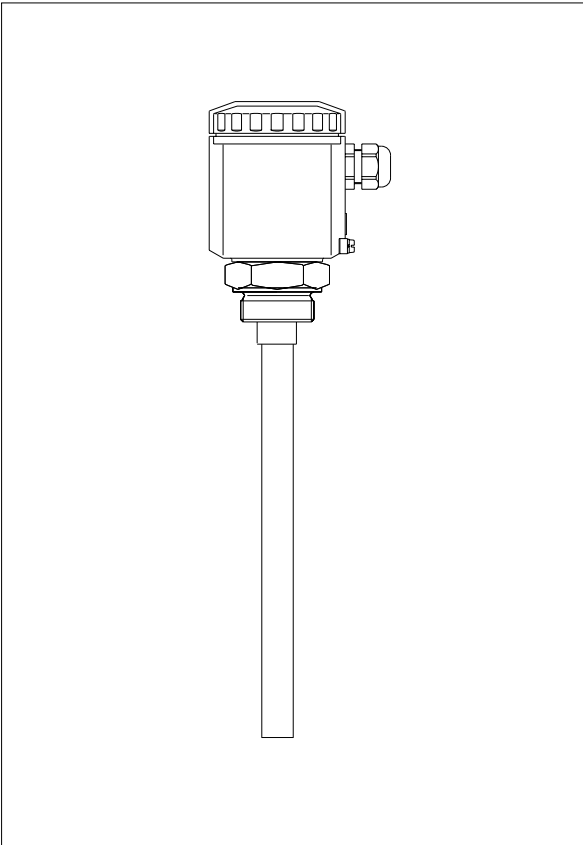


Operating Instruction

Capacitive electrodes EL ...



Safety information

The described module must only be installed and operated as described in this operating instruction. Please note that other action can cause damage for which VEGA does not take responsibility.

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Safety information	2
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1 Product description

1.1 Function and configuration

Capacitive electrodes series EL detect levels of virtually all kind of products, whether liquids, granules or pastes. This is also valid for adhesive products.

The electrode measures the capacitance and the product resistance (admittance processing). Hence also problematic products such as adhesive, conductive products and solids with fluctuating humidity contents can be measured.

When using screening tubes and screening segments, inactive parts can be created on the probe where pollution, condensation or permanent build-up do not influence the meas. result.

Meas. principle

Electrode, medium and vessel wall form an electrical capacitor.

The capacitance of the capacitor is generally influenced by three factors:

- distance of the electrode surfaces (a)
- size of the electrode surfaces (b)
- kind of dielectricum between the electrodes (c)

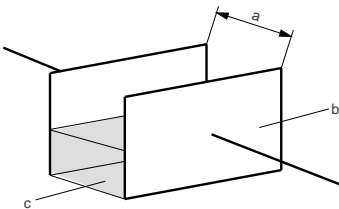


Fig. 1.1 Plate capacitor (schematic drawing)

The electrode and the vessel wall are the capacitor plates. The medium is the dielectricum. Due to the higher dielectric constant value (DK-figure) of the medium against air, the capacitance of the capacitor increases with the degree of the electrode covering.

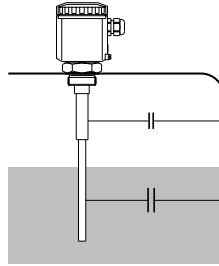


Fig. 1.2 Capacitance change with covering

The capacitance change is converted by the oscillator into a level proportional, floating current in the range of 4 ... 20 mA or into a switching command.

Continuous level measurement

With the continuous level measurement, the appropriate level is continuously detected and converted into a level proportional signal which is either directly displayed or further processed.

A capacitive electrode series EL with oscillator and a signal conditioning instrument VEGAMET are required which converts the proportional current of the oscillator into standardized current and voltage signals.

The continuous measurement requires a constant dielectric constant figure ϵ_r i.e. the medium should have constant features.

The floating meas. signal of the electrode electronics is in the range of 4 ... 20 mA and connection to other processing systems such as e.g. VEGALOG is hence possible without additional potential separation.

In addition to the continuous measurement also level detection is possible (VEGAMET or VEGAMET + VEGASEL).

Level detection

Level switches should signal when certain levels are reached, e.g. max. or min. levels. These levels are detected at a fixed point and converted into a switching command.

For level detection capacitive electrodes EL with the appropriate signal conditioning instruments VEGATOR are available. A switching command can be either triggered when the electrode is cover or uncovered.

1.2 Types and versions

Version \ Type	EL 11	EL 18	EL 21	EL 24	EL 26	EL 28	EL 29	EL 31	EL 33	EL 34	EL 42	EL 52	EL 53	EL 60 ¹⁾	EL 61 ¹⁾	EL 82	EL 92	EL 84	EL 86
Continuous	•	•	•	•		•	•	•	•	•	•	•	•	•	•				
Level detection	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Partly insulated	•	•						•	•	•				•	•	•		•	•
Fully insulated			•	•	•	•					•	•	•				•		
Approvals																			
CENELEC EEx ia IIC T6	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•				
PTB-Zone 0 EEx ia IIC T6	•		•	•	•			•			•								
StEx	•							•						•	•	•			
Overfill protection acc. to WHG	•		•	•	•		•	•			•								
Overfill protection acc. to VbF	§ 16 of VbF deleted since Dec. 1996																		
German Lloyd	•		•	•	•			•	•	•	•	•	•						
Lloyds Register of Ship.	applied																		
American Bureau of Ship.	applied																		
Mechanical connection																			
G 1/2 A		•				•													
G 1 A	•		•		•			•	•			•							
NPT 1 1/2"	•		•		•			•	•	•	•	•	•	•	•				
G 1 1/2 A	•		•	•	•			•	•	•	•	•	•	•	•				
Tri-Clamp 1 1/2"	•		•		•														
Tri-Clamp 2"	•		•	•	•				•			•							
Bolting DN 50	•		•	•	•														
Flange	•		•		•			•	•	•	•	•	•	•			•	•	
Flange plated			•		•														
Screw adapter																			
PP	•		•	•	•						•	•							
PTFE	•		•	•	•						•	•							
Electrode material																			
Steel	•		•		•			•	•	•	•	•	•	•	•			•	
StSt	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Type	EL 11	EL 18	EL 21	EL 24	EL 26	EL 28	EL 29	EL 31	EL 33	EL 34	EL 42	EL 52	EL 53	EL 60 ¹⁾	EL 61 ¹⁾	EL 82	EL 92	EL 84	EL 86	
Version																				
Isolation material																				
PTFE	•	•	•		•	•		•	•		•	•				•	•			
PP	•							•										•	•	
PE/PA 12										•				•						
PFA			•		•															
FEP				•			•													
PE			•																	
Ceramic														•	•					
Concentric tube																				
Steel	•		•	•																
StSt	•		•	•																
Screening tube (option)																				
Steel	•		•	•				•	•	•	•	•	•							
StSt	•		•	•				•	•	•	•	•	•							
Temperature adapter (option)																				
Steel	•		•		•			•	•			•		• ²⁾	• ²⁾					
StSt	•		•		•			•	•			•		• ²⁾	• ²⁾					
PA	•		•	•				•	•		•	•				•	•			
Housing material																				
Plastic (IP 66)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
StSt 1.4301 (IP 67)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Others																				
Separate housing	•	•	•	•	•	•		•	•		•	•		•	•					
Adapter ³⁾	•		•					•				•								
Overvoltage protection ELB2-36 (integrated)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Test switch	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Overvoltage arrester ⁴⁾	•		•					•	•	•	•	•	•	•	•	•	•	•	•	•
Bending of electrode ⁵⁾	•	•	• ⁶⁾																	

1) only in solid applications

2) special temperature adapter (standard)

3) for combustible liquids in pressurized vessels, e.g. liquid gas, ammonia

4) for high electrostatic discharges, e.g. plastic granules

5) bending max. 90°

6) EL 21 only with PTFE 3,2 mm isolation thickness

1.3 Technical data

Housing

Housing material	plastic PBT (Polyester) or StSt (1.4301)
Protection	
- plastic housing	IP 66
- StSt-housing	IP 67
Cable entry	1 x Pg 16
Terminals	for max. 1,5 mm ² cross-section area of conductor

Mechanical connection

Material	galvanized steel (St 37), 1.4571 (StSt), Aluminium
Thread	G 1 1/2 A or 1 1/2" NPT
Flange	different flange versions

Electrode

Material	steel (St 37), 1.4571 (StSt)
Length	
- rod	max. 4 m
- cable	max. 25 m
Isolation	see "Isolation materials"
Max. tensile load	
- EL 31	20 KN
- EL 33, 34, 52 53	15 KN

Ambient conditions

Ambient temperature on the housing	-40°C ... +80°C
Product temperature	see "Product temperature and operating pressure"
Storage and transport temperature	-40°C ... +80°C
Operating pressure	see "Product temperature and operating pressure"

Oscillators

Protection class	II
Overvoltage category	III
Meas. frequency	see table on following page
Capacitance ranges	see table on following page
Connection voltage	12 ... 36 V DC (supply via signal conditioning instrument)
Potential separation	min. 500 V DC (except E14)

Accessory

Straining spring of 1.4571 (EL 42, EL 52, EL 53)	
- length	approx. 185 mm (under tension)
- tensile force	approx. 200 N
Fixing angle of steel or 1.4571	with thread G 1 1/2 A or G 1 1/2 A
Abrasion protection	of steel (EL 31 and EL 34 [up to max. 6 m])
Plug connection	in Pg. (IP 65)
Gravity weight	of 1.4571 (EL 31, EL 33, EL 34: length 100, 150, 200 mm)

Weight

Basic weight (e.g. EL 24)
Rod weight

approx. 1,4 kg
approx. 1,4 kg/m

Approvals (deviating technical data)

Supply and signal circuit in classification intrinsic safety EEx ia IIC only for connection to a certified intrinsically safe circuit with the following max. values:

$U_o = 29 \text{ V}$	$U_o = 24 \text{ V}$
$I_k = 116 \text{ mA}$	$I_k = 131 \text{ mA}$
$P = 841 \text{ mW}$	$P = 786 \text{ mW}$

Regulation on combustible liquids (VbF)

Formerly the regulation on combustible liquids (VbF) prescribed that systems storing, filling or conveying combustible liquids must be equipped with a type approved overfill protection. Acc. to the new edition of VbF of December 1996 the overfill protection must no more be provided with a type approval acc. to VbF (§ 12 is deleted).

Dependent on the installed oscillator, the effective inner inductances L_i and effective inner capacitances C_i are:

E15 Ex, E17 Ex:	$L_i = 0,1 \text{ mH}$	$C_i = 9 \text{ nF}$
E18 Ex:	$L_i = 0,06 \text{ mH}$	$C_i = 4 \text{ nF}$

For electrodes with integral overvoltage protection module type ELB 2-36 in addition an effective inner inductance L_i of 0,15 mH and an effective inner capacitance C_i of 2,5 nF must be considered.

Oscillators in two-wire technology for capacitive electrodes EL

Type	Application	Meas. range	Meas. frequency	Signal conditioning instrument
E14	Level detection in general	I: 0 ... 25 pF II: 0 ... 100 pF III: 0 ... 400 pF	400 kHz	VEGATOR VEGALOG
E15	Level detection in general with potential separation	I: 0 ... 25 pF II: 0 ... 100 pF III: 0 ... 400 pF	400 kHz	VEGATOR VEGALOG
E15 Ex	like E15, however for the use in hazardous areas according to CENELEC, PTB zone 0 as well as zone 0 and StEx zone 10 and as part of an overfill protection acc. to WHG (VbF)	I: 0 ... 25 pF II: 0 ... 100 pF III: 0 ... 400 pF	400 kHz	VEGATOR Ex VEGALOG ¹⁾
E17	Continuous level measurement in general or level detection with potential separation	I: 0 ... 120 pF II: 0 ... 600 pF III: 0 ... 3000 pF	40 kHz	VEGAMET VEGALOG (VEGATOR)
E17 Ex	like E17, however for the use in hazardous areas according to CENELEC, PTB zone 0 as well as zone 0 and StEx Zone 10 and as part of an overfill protection acc. to WHG (VbF)	I: 0 ... 120 pF II: 0 ... 600 pF III: 0 ... 3000 pF	40 kHz	VEGAMET Ex VEGALOG ¹⁾ (VEGATOR Ex)
E18 ²⁾	Continuous level measurement or level detection with potential separation according to the principle of phase selective admittance processing especially for adhesive products and for use in solids with varying humidity	I: 0 ... 120 pF II: 0 ... 600 pF III: 0 ... 3000 pF	470 kHz	VEGAMET VEGALOG (VEGATOR)
E18 Ex ²⁾	like E18, however for the use in hazardous areas according to CENELEC, PTB zone 0 as well as zone 0 and StEx zone 10 and as part of an over fill protection acc. to WHG (VbF)	I: 0 ... 120 pF II: 0 ... 600 pF III: 0 ... 3000 pF	470 kHz	VEGAMET Ex VEGALOG ¹⁾ (VEGATOR Ex)

¹⁾ with safety barrier

²⁾ see following page

Oscillator E18

Oscillator E18 with patented processing (phase selective admittance processing) extends the application area of the capacitive level measurement technology.

In conjunction with the fully insulated rod electrode EL 24 the oscillator E18 compensates also strong conductive build-up.

Mounted into an individual rod or cable electrode type EL, E18 ensures also the exact measurement of solids with varying humidity contents.

The oscillator E18 processes the meas. currents acc. to their phase position. Meas. currents with a defined phase shifting as they can occur with build-up or humidity changes, are hence filtered out.

Humidity change

A humidity change in solids causes also a change of the dielectric constant figure (ϵ_r). Furthermore the resistance of the product changes. Due to the change also a phase shifting of the meas. currents will be caused.

With a capacitive measurement, even smallest humidity changes cause meas. errors. Typical products are e.g. sand, aggregate in the cement industry, hop or plastic granules (after drying).

When using oscillator E18 modifications up to a humidity contents of 15 % vol. do not influence the accuracy of the measurement. Even layerings of different humid mediums do not play a role for the meas. accuracy.

When the humidity contents is higher than 15 % vol. the fully and partly insulated electrodes react differently (see also "Fig. 1.3 Humidity change"). Whereas the measured value with fully insulated electrodes increases with steady level, the measured value reduces with partly insulated electrodes.

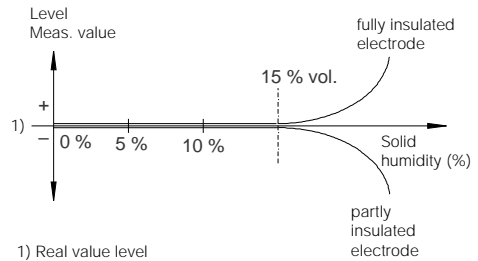


Fig. 1.3 Humidity change

Product temperature and operating pressure

The figures of the tables relate each to the figures on this page. The stated pressures are valid for screw connections G 1 1/2 A, NPT 1 1/2" and R 1 1/2".

Boltings DN 50 acc. to DIN 11 851 only up to max. 25 bar. With flange version you have to note their nominal pressure.

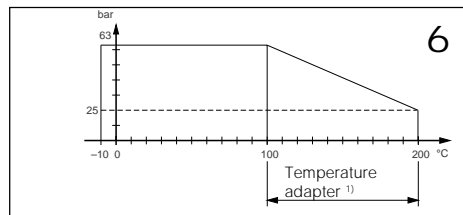
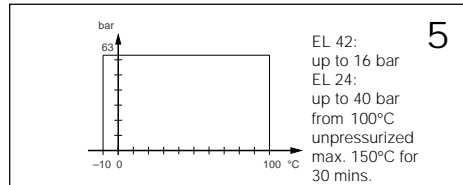
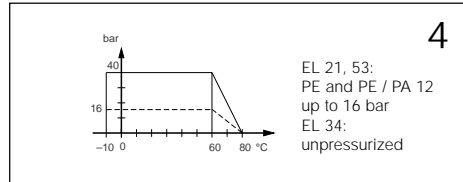
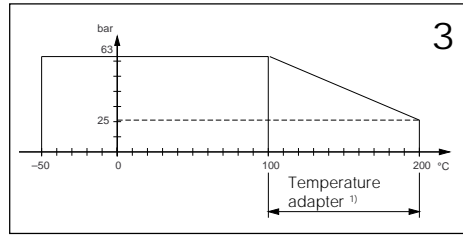
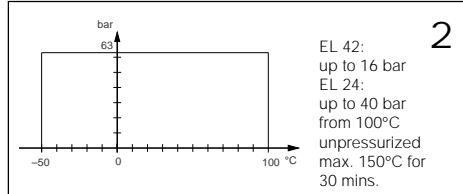
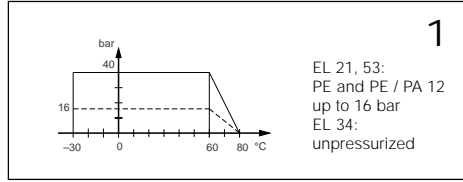
All electrodes are also suitable for vacuum (-1 bar).

Mechanical connection, 1.4571

Isolation / Electrode type	PE	PP	PTFE	PE/PA 12	PFA	FEP
EL 11	-	1	3	-	-	-
EL 18	-	-	2	-	-	-
EL 21	1	-	3	-	3	-
EL 21	-	-	2	-	-	-
EL 24	-	-	-	-	-	2
EL 26	-	-	3	-	3	-
EL 26	-	-	2	-	-	-
EL 28	-	-	2	-	-	-
EL 31	-	1	3	-	-	-
EL 33	-	-	3	-	-	-
EL 34 unpressurized	-	-	-	1	-	-
EL 42	-	-	2	-	-	-
EL 52	-	-	3	-	-	-
EL 53	-	-	-	1	-	-

Mechanical connection, steel (St 37)

Isolation / Electrode type	PE	PP	PTFE	PE/PA 12	PFA	FEP
EL 11	-	4	6	-	-	-
EL 21	4	-	6	-	6	-
EL 21	-	-	5	-	-	-
EL 24	-	-	-	-	-	5
EL 26	-	-	6	-	6	-
EL 26	-	-	5	-	-	-
EL 31	-	4	6	-	-	-
EL 33	-	-	6	-	-	-
EL 34 unpressurized	-	-	-	4	-	-
EL 42	-	-	5	-	-	-
EL 52	-	-	6	-	-	-
EL 53	-	-	-	4	-	-



¹⁾ Temperature adapter of PA up to 150°C, from 100°C unpressurized

Mechanical connection, Aluminium

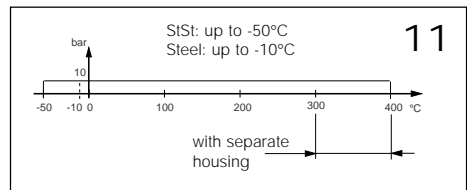
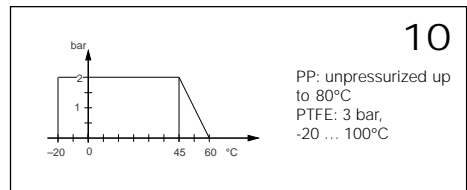
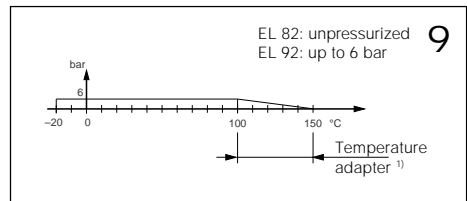
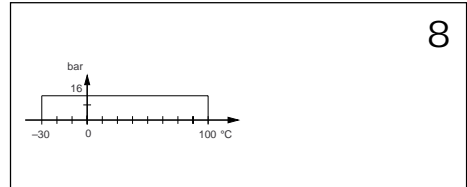
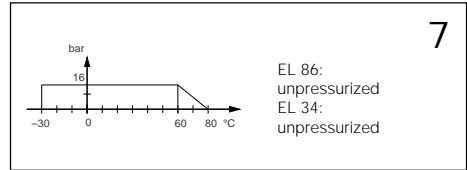
Isolation / Electrode type	PE	PP	PTFE	PE/PA 12	PFA
EL 11	-	7	∞	-	-
EL 21	7	-	∞	-	∞
EL 26	-	-	∞	-	∞
EL 31	-	7	8	-	-
EL 33	-	-	8	-	-
EL 34 unpressurized	-	-	-	7	-
EL 42	-	-	8	-	-
EL 52	-	-	8	-	-
EL 53	-	-	-	7	-
EL 82 unpressurized	-	-	9	-	-
EL 92	-	-	9	-	-

Mechanical connection, PP, PVC, PTFE, screw adapter

Isolation / Electrode type	FEP	PP	PTFE
EL 29	10	10	10
EL 86	-	7	-

High temperature electrode

Isolation / Electrode type	ceramic
EL 60	11
EL 61	11



¹⁾ Temperature adapter of PA up to 150°C, from 100°C unpressurized

Electronics temperature

The following product and ambient temperatures must be kept so that the limit temperature on the electronics will not be exceeded.



The stated values are definite for applications in hazardous areas. Note for these applications also the legal documents (test certificates, type approvals and conformity certificates).

Temperature class T6

Product temperature -40°C ... +60°C
 Ambient temperature -40°C ... +60°C

Temperature class T5

Product temperature -40°C ... +75°C
 Ambient temperature -40°C ... +75°C

Temperature classes T4 ... T1 (or no Ex)

Without temperature adapter

- Product temperature -40°C ... +100°C
 - Ambient temperature -40°C ... +80°C

With temperature adapter

		Plastic housing		Metal housing		
Product temperature	-40°C ...	180°C	200°C	150°C	175°C	200°C
Ambient temperature	-40°C ...	80°C	75°C	80°C	69°C	58°C

1.4 Approvals

- The capacitive electrodes type EL are available with the following approvals:
- explosion protection (CENELEC, Zone 0)
 - overfill protection acc. to WHG, (VbF)
 - dust-explosion protection Zone 10
 - ship approvals (GL, LRS, ABS)

For these applications note the appropriate legal documents (test reports, test certificates, type approvals and conformity certificates). These documents are supplied with the appropriate instrument.

CE-approval

The capacitive electrodes type EL meet the protective regulations of EMVG (89/336/EWG) and NSR (72/23/EWG). The conformity has been judged acc. to the following standards:

EMVG	Emission	EN 50 081 - 1
	Susceptibility	EN 50 082 - 2
NSR		EN 61 010 - 1

PTB-Zone 0 (EEx ia IIC)

Continuous level measurement

Instrument	Conformity certificate PTB-no.	Oscillator	Conformity certificate PTB-no.	Signal conditioning instrument VEGAMET	Conformity certificate PTB-no.	Aux. level switch VEGASEL PTB-no. Ex-80/2160
Capacitive electrodes ¹⁾	Ex-96.D.2021	E17 Ex	Ex-95.D.2041 U	513 Ex, 514 Ex 515 Ex 602 Ex VEGATRENN 544 Ex	Ex-95.D.2145 X Ex-95.D.2161 X Ex-95.D.2095 Ex-95.D.2145 X	543 ... 547 643
Capacitive electrodes ¹⁾	Ex-96.D.2021	E18 Ex	Ex-95.D.2042 U	513 Ex, 514 Ex 515 Ex 602 Ex VEGATRENN 544 Ex	Ex-95.D.2145 X Ex-95.D.2161 X Ex-95.D.2095 Ex-95.D.2145 X	543 ... 547 643

All instruments with appropriate oscillator type E17 Ex, E18 Ex in conjunction with safety barrier type 145 can be connected to not-Ex-two-wire level switches VEGATOR as well as to VEGALOG 571, hence the conformity certificate PTB-no. Ex-85.B.2038 must be noted.

1) Type EL 11 Ex0, EL 21 Ex0, EL 24 Ex0, EL 31 Ex0, EL 42 Ex0

Level detection with fault monitoring

Instrument	Conformity certificate PTB-no.	Oscillator	Conformity certificate PTB-no.	Level switch VEGATOR	Conformity certificate PTB-no.
Capacitive electrodes ¹⁾	Ex-96.D.2021	E15 Ex	Ex-95.D.2040 U	521 Ex, 522 Ex 523 Ex, 527 Ex 621 Ex, 622 Ex	Ex-95.D.2065 X Ex-95.D.2073 X Ex-96.D.2068
Capacitive electrodes ²⁾	Ex-96.D.2021	E18 Ex	Ex-95.D.4042 U	521 Ex, 522 Ex 523 Ex, 527 Ex 621 Ex, 622 Ex	Ex-95.D.2065 X Ex-95.D.2073 X Ex-96.D.2068

All instruments with appropriate oscillator type 15 Ex, E18 Ex in conjunction with safety barrier type 145 can be connected to not-Ex-two-wire level switch VEGATOR as well as to VEGALOG 571, hence the conformity certificate PTB-no. Ex-85.B.2038 must be noted.

¹⁾ Type EL 11 Ex0, EL 21 Ex0, EL 24 Ex0, EL 31 Ex0, EL 42 Ex0

²⁾ Type EL 26 Ex0

CENELEC (EEx ia IIC)

Continuous level measurement

Instrument	Conformity certificate PTB-no.	Oscillator	Conformity certificate PTB-no.	Signal cond. instrument VEGAMET or VEGATRENN	Conformity certificate PTB-no.	Aux. level switch VEGASEL PTB-no. Ex-80/2160
Capacitive electrodes ¹⁾	Ex-95.D.2097	E17 Ex	Ex-95.D.2041 U	513 Ex, 514 Ex 515 Ex 602 Ex 544 Ex	Ex-95.D.2145 X Ex-95.D.2161 X Ex-95.D.2095 Ex-95.D.2145 X	543 ... 547 643
Capacitive electrodes ¹⁾	Ex-95.D.2097	E18 Ex	Ex-95.D.2042 U	513 Ex, 514 Ex 515 Ex 602 Ex 544 Ex	Ex-95.D.2145 X Ex-95.D.2161 X Ex-95.D.2095 Ex-95.D.2145 X	543 ... 547 643

All above mentioned instruments can be connected except the compact instruments in conjunction with safety barrier type 145 to suitable not-Ex two-wire instruments VEGAMET as well as VEGALOG 571, hence conformity certificate PTB-no. Ex-85.B.2038 must be noted.

¹⁾ Type EL 11 Ex, EL 18 Ex, EL 21 Ex, EL 24 Ex, EL 28 Ex, EL 29 Ex, EL 31 Ex, EL 33 Ex, EL 34 Ex, EL 42 Ex, EL 52 Ex, EL 53 Ex, EL 60 Ex, EL 61 Ex

Level detection with fault monitoring

Instrument	Conformity certificate PTB-no.	Oscillator	Conformity certificate PTB-no.	Level switch VEGATOR	Conformity certificate PTB-no.
Capacitive electrodes ¹⁾	Ex-95.D.2097	E15 Ex	Ex-95.D.2040 U	521 Ex, 522 Ex 523 Ex, 527 Ex 621 Ex, 622 Ex	Ex-95.D.2065 X Ex-95.D.2073 X Ex-96.D.2068
Capacitive electrodes ²⁾	Ex-95.D.2097	E18 Ex	Ex-95.D.4042 U	521 Ex, 522 Ex 523 Ex, 527 Ex 621 Ex, 622 Ex	Ex-95.D.2065 X Ex-95.D.2073 X Ex-96.D.2068

All above mentioned instruments in conjunction with safety barrier type 145 can be connected to suitable not-Ex-two-wire instruments VEGATOR as well as to VEGALOG 571, hence the conformity certificate PTB-no. Ex-85.B.2038 must be noted.

¹⁾ Type EL 11 Ex, EL 18 Ex, EL 21 Ex, EL 24 Ex, EL 28 Ex, EL 29 Ex, EL 31 Ex, EL 33 Ex, EL 34 Ex, EL 42 Ex, EL 52 Ex, EL 53 Ex, EL 60 Ex, EL 61 Ex

²⁾ Type EL 26 Ex

Zone 2

According to DIN VDE 0165 instruments in hazardous areas of zone 2 can be used without approval; they must meet the regulations of paragraph 6.3 of this VDE-regulation. The accordance of the instruments with these requirements is confirmed by Messrs. VEGA in a manufacturer declaration.

WHG - Water Resources Law

Continuous level measurement with auxiliary level switch

Instrument	Oscillator	Level switch VEGAMET	Test certificate no.	Aux. level switch VEGASEL
Capacitive electrodes ¹⁾	E17 EX E18 EX	602 EX 513 EX, 514 EX 515 EX	Z-65.13-123	643 543 ... 547

¹⁾ EL 11 EXS, EL 21 EX0, EL 24 EX0, EL 29 EX, EL 31 EX0, EL 42 EX0

Level detection

Instrument	Oscillator	Level switch VEGATOR	Test certificate no.
Capacitive electrodes ¹⁾	E15 EX E17 EX E18 EX	521 EX, 522 EX, 523 EX, 527 EX, 621 EX, 622 EX	Z-65.13-105

1) EL 11 EX0, EL 21 EX0, EL 24 EX0, EL 26 EX0, EL 29 EX0, EL 31 EX0, EL 42 EX0

StEx Zone 10

Continuous level measurement with auxiliary level switch

Instrument	Oscillator	Level switch	Aux. level switch VEGASEL	Certificate BVS-no.
Capacitive electrodes ¹⁾	E17 EX E18 EX	VEGAMET 602 EX 513 EX, 514 EX 515 EX VEGATRENN 544 Ex	All aux. level switches with 0/4...20 mA or 0/2 ... 10 V input	96.Y.8006

¹⁾ EL 11 EXS, EL 31 EXS, EL 60 EXS, EL 61 EXS, EL 82 EXS

Level detection

Instrument	Oscillator	Level switch VEGATOR	Certificate BVS-no.
Capacitive electrodes ¹⁾	E15 EX E17 EX E18 EX	521 EX, 522 EX, 523 EX 527 EX, 621 EX, 622 EX	96.Y.8006

¹⁾ EL 11 EXS, EL 31 EXS, EL 60 EXS, EL 61 EXS, EL 82 EXS

Zone 11

According to DIN VDE 0165 instruments can be used in hazardous areas of zone 11 without approval; they must meet the requirements of paragraph 7.1. of this VDE-regulation. The accordance of the instruments with these requirements is confirmed by Messrs. VEGA in a manufacturer declaration.

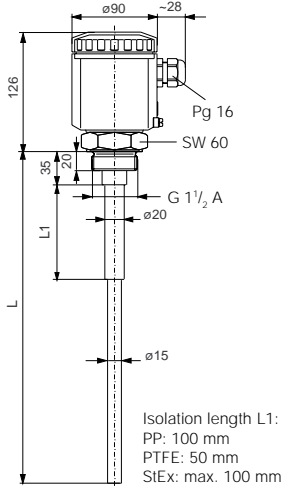
1.5 Dimensions

Dimensions of the capacitive electrodes type EL

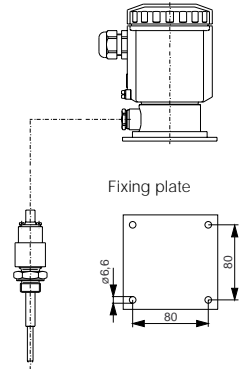
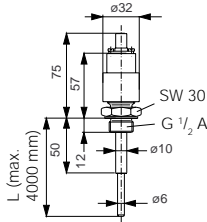
Type EL 11 (partly insulated)

Type EL 18 (partly insulated)

Type EL 18 with separate housing



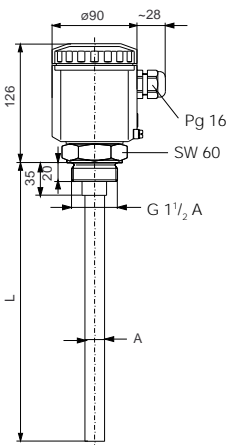
L (min. 100 mm, max. 4000 mm)



Type EL 21 (fully insulated)

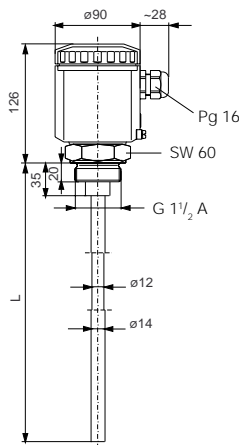
Type EL 24 (fully insulated, for adhesive products)

Type EL 26 (fully insulated, for adhesive products)

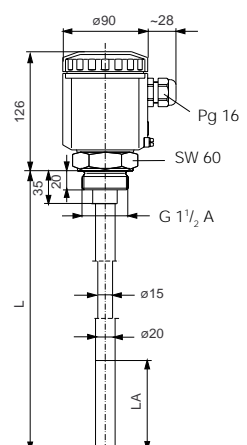


L (min. 100 mm, max. 4000 mm)

Isolation	A	Outer-ø
PE 2,0 mm	20 mm	20 mm
PTFE 2,0 mm	20 mm	20 mm
PTFE 3,2 mm	16 mm	16 mm
PFA 2,0 mm	20 mm	20 mm

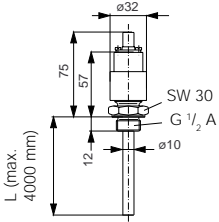


L (min. 120 mm, max. 4000 mm)

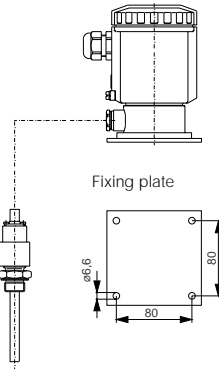


L (min. 200, max. 4000 mm)
 LA = active length (standard 100 mm)

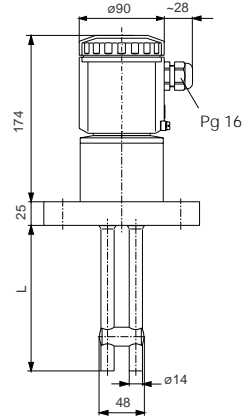
Type EL 28 (fully insulated)



Type EL 28 with separate housing

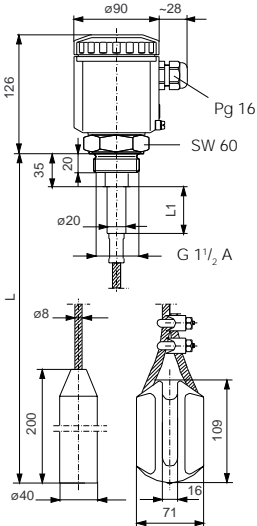


Type EL 29 (fully insulated)

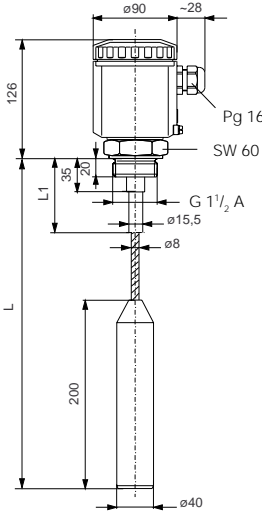


L (min. 120, max. 3000 mm)

Type EL 31 (partly insulated)

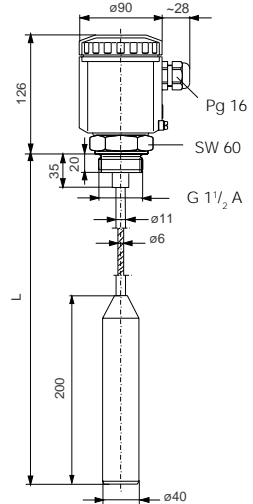


Type EL 33 (partly insulated)



L (min. 400 mm, max. 25000 mm)

Type EL 34 (partly insulated)

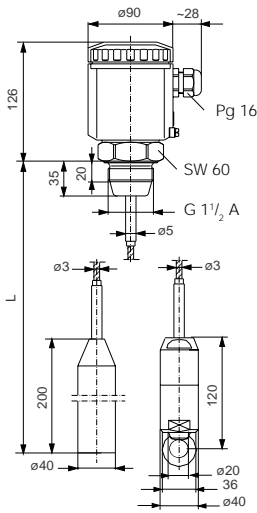


L (min. 400 mm, max. 25000 mm)

L (min. 400 mm, max. 25000 mm)

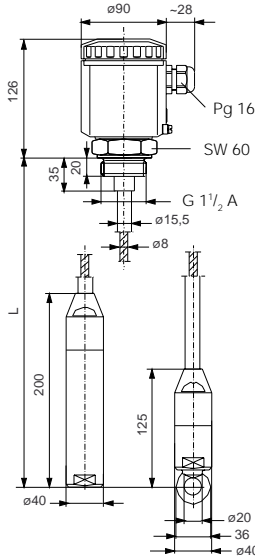
Isolation length L1:
PP: 100 mm
PTFE: 50 mm
STEx: max. 100 mm

Type EL 42 (fully insulated)



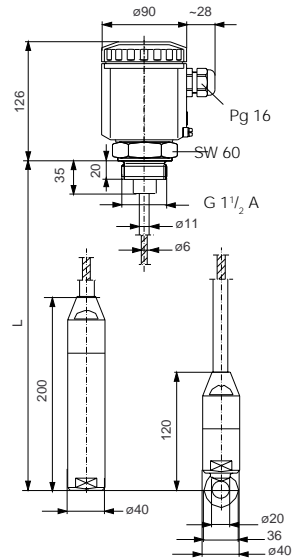
L (min. 400 mm, max. 25000 mm)

Type EL 52 (fully insulated)



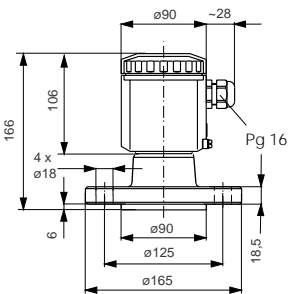
L (min. 400 mm, max. 25000 mm)

Type EL 53 (fully insulated)

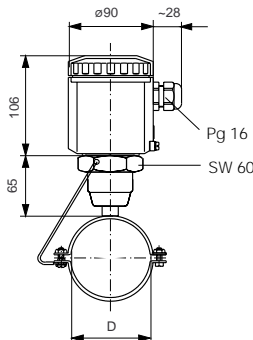


L (min. 400 mm, max. 25000 mm)

**Type EL 82 / EL 92
(partly / fully insulated)
(plate electrode)**

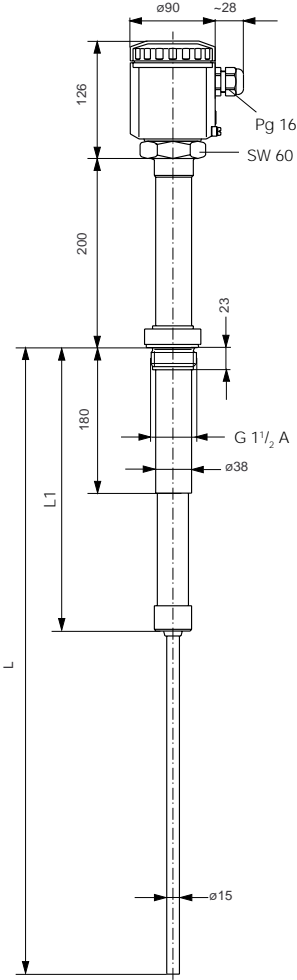


**Type EL 84
(pipe clamp electrode)**



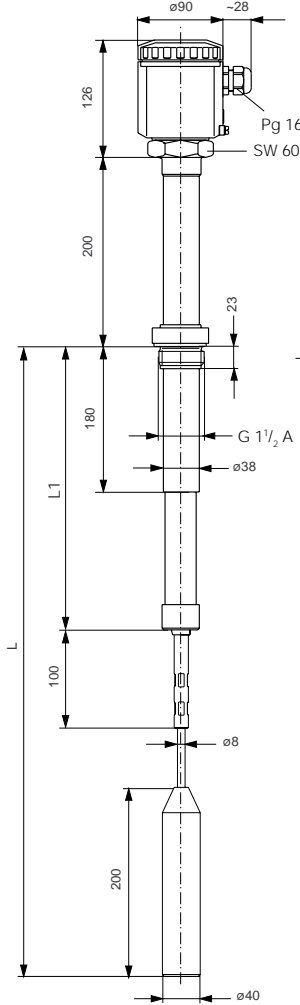
Tube outer diameter D:
1.4571: min. 20 mm ... max. 650 mm
CuZn: min. 20 mm ... max. 300 mm

Type EL 60 (partly insulated, high temperature electrode)



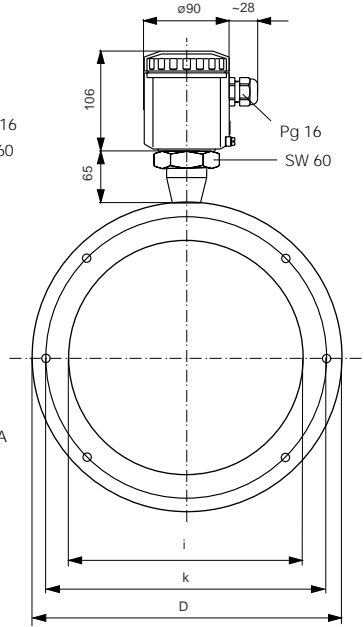
L (min. 400 mm, max. 4000 mm)
 L1: Standard 300 mm,
 min. 200 mm,
 max. 1700 mm

Type EL 61 (partly insulated, high temperature electrode)



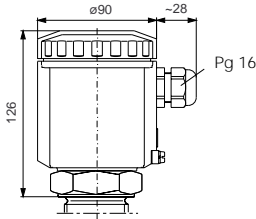
L (min. 600 mm, max. 4000 mm)
 L1: Standard 300 mm,
 min. 200 mm,
 max. 1700 mm

Type EL 86 (annular electrode)

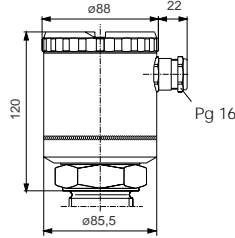


Different versions:
 l: min. 100 mm ... max. 400 mm
 k: min. 160 mm ... max. 450 mm
 D: min. 190 mm ... max. 480 mm

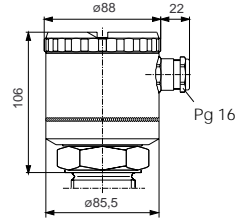
Housing



Housing (K) of plastic, IP 66

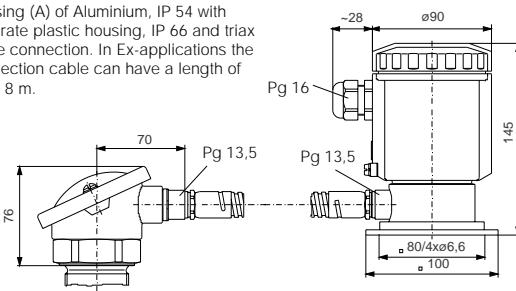


Housing (V) of 1.4301, IP 67 for integral overvoltage protection

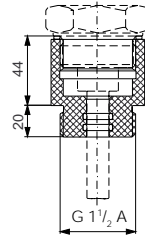


Housing (V) of 1.4301, IP 67 without overvoltage protection

Housing (A) of Aluminium, IP 54 with separate plastic housing, IP 66 and triax cable connection. In Ex-applications the connection cable can have a length of max. 8 m.



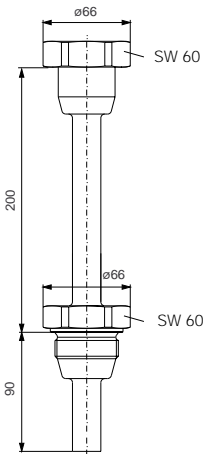
Screw adapter of PP or PTFE



Adapter

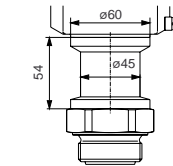
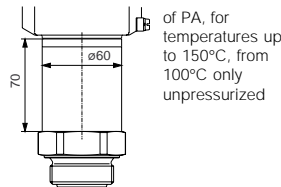
for combustible liquids in pressurized vessels, e.g. liquid gas, ammonia

Temperature adapter



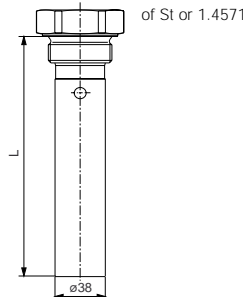
of galvanized steel or 1.4571

Temperature adapter

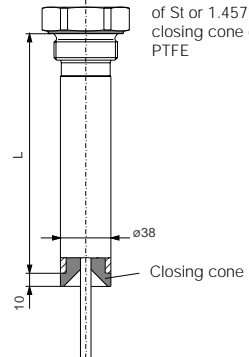


Screening tube

Concentric tube

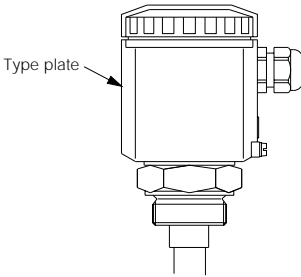


of St or 1.4571 with closing cone of PP or PTFE



1.6 Type plate

Please check before mounting and electrical connection if you use the suitable instrument. Please note the type plate which is located as follows:



The type plate contains important data required for mounting and connection. The configuration and the parts of the type plate are explained in the following example.

Configuration of the type plate (example)

	VEGA® EL 21 EX0	
1	type EL21EX0.XGBASTX see PTB no. EX-96.D.2021 EEX Ia IIC T6	
2	techn. data see document. / certificates protection: IP 66; 01/PTB-no. Ex-96.D.2021 length.....mm	
3	AB-NR. 123456/78	

- 1 Master data of the order-no.
- 2 Data of the electronics / approvals
- 3 No. of the order confirmation/Pos.-no.
- 4 Serial number

Order code

Exact information to the order code are given in the "Product Information Capacitive" or in the "VEGA-pricelist".

2 Mounting

2.1 Mounting instructions

General

The different mediums and the requirements to the measurement require different installation positions. Hence note the following instructions.

Length of the level electrode

Note when ordering the electrodes, that the electrode must be sufficiently covered at the requested level according to the electrical features of the medium (DK-value).

E.g. an electrode for level detection in oil ($\epsilon_r \sim 2$) requires a considerably higher covering than in water ($\epsilon_r \sim 81$).

Lateral load

Note that the electrode is not subjected to strong lateral forces. Mount the electrode in a position in the vessel where no interfering influences such as e.g. stirrers, filling openings etc. occur. This is mainly valid for very long rod and cable electrodes.

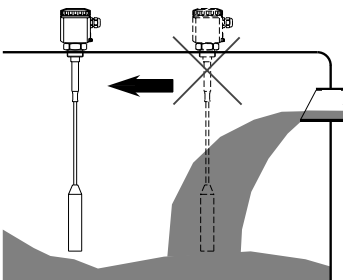


Fig. 2.1 Lateral load

Plate electrode

Mount the plate electrode such that the electrode must be flush to the vessel wall. The wall thickness of the vessel should not exceed 20 mm. Chamfer the inner edge of the hole so that no build-up is caused on the edge.

Extracting forces

In case of strong extracting forces e.g. due to material inflow, high tensile loads can be caused.

In these cases use for short meas. distances a rod electrode, as generally a rod is more stable. If due to the length or the installation position a cable electrode should be necessary, the electrode should not be fixed but just provided with a gravity weight as the cable can more easily follow the product movements. Note that the electrode cable does not touch the vessel wall.

Pressure

In case of gauge or low pressure in the vessel, the mounting boss on the thread must be sealed. Use the attached seal ring. Check whether the seal ring is resistant against the medium.

Isolating measures such as e.g. the covering of the thread with Teflon tape, can interrupt the necessary electrical connection in metal vessels. Hence earth the electrode on the vessel.

Shortening of the electrode

Fully insulated electrodes are fixed dimensioned and their dimensions must not be modified. Any modification will destroy the instrument.

Partly insulated cable or rod electrodes can be shortened afterwards. Note that due the own capacitance change also the switch point can change.

When the cable is extremely shortened, it can happen that the electrode cannot be adjusted. In this case the electrode must be re-compensated. Note the serial number of the electrode and call one of our technicians.

The electrode is compensated to the individual electrode length. For this reason you should state already when ordering if you want to shorten the electrode.

Cable electrodes EL 31, EL 33 and EL 34 can be shortened afterwards (see fig. 2.2). Loosen the two pins on the gravity weight (hexagon) and remove the two pins. Pull the cable out of the gravity weight.

To avoid splicing of the steel cable (EL 31, EL 33) during cutting, you have to tin the cable around the cutting position with a copper bit or strongly tighten the cable with a wire. Shorten the electrode cable with a metal cutting saw or a cutting-off wheel by the requested length.

Isolated cables (EL 34) must not be tinned as they cannot splice. Shift the cable into the hole of the gravity weight (isolated cables: with the isolation) and clamp the cable with the two pins. With isolated electrode cable, the tips of the two pins must go through the cable isolation to ensure contact of the gravity weight with the metal cable.

Carry out an adjustment. The instruction is under "4.1 Adjustment".

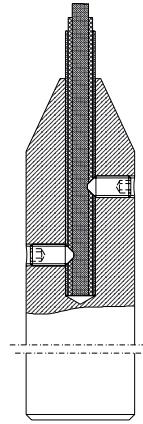


Fig. 2.2 Shortening of the electrode

Filling opening

Install the electrode such that it does not protrude directly into a strong filling stream. Should such an installation place be necessary, mount a suitable sheet above or in front of the electrode e.g. L 80 x 8 DIN 1028, etc.

Horizontal mounting

The electrodes can be mounted horizontally to reach an exact switch point with level detection. We recommend to mount the electrode approx. 20° inclined to the bottom, so that build-up is avoided.

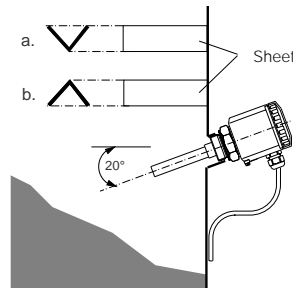


Fig. 2.3 Horizontal mounting

Humidity from outside

Turn the cable entries of horizontally mounted instruments after installation to the bottom to avoid humidity ingress. The instrument housing can be hence rotated by approx. 330°. For vertically installed electrodes loop the connection line to the electrode housing to the bottom so that rain and condensation water can drain off.

This is mainly valid for mounting outside, in areas where humidity must be expected (e.g. by cleaning processes) or on cooled or heated vessels (see fig. 2.4).

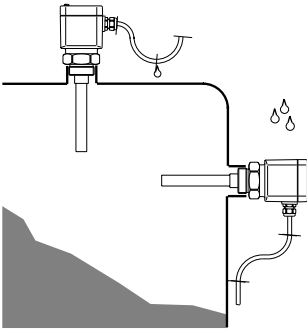


Fig. 2.4 Humidity

Cable entries

When mounting outside, on cooled vessels or in humid areas where cleaning is made e.g. with steam or high pressure, the seal of the cable entry is very important.

Use cable with a round cross-section area of conductor and tighten the cable entry. The cable entry is suitable for cable diameters of 4 mm up to 12 mm.

Two Pg-seal rings are attached to the instrument:

- for cable diameter of 4 ... 9 mm
- for cable diameter of 5 ... 12 mm.

Use the smallest possible seal ring.

Aluminium vessel

In Aluminium vessels use an electrode with steel mounting thread. Combination Aluminium on Aluminium should be avoided as the thread "seizes" and can no more be removed after some time without damage.

Metal vessel

Note that the mechanical connection of the electrode is electrically conductive connected with the vessel to ensure sufficient earth.

Use conductive seals such as e.g. copper, lead etc. Isolating measures such as covering the thread with Teflon tape can interrupt the necessary electrical connection. In this case use the earth terminal on the housing to connect the electrode to the vessel wall.

Non-conductive vessels

In non-conductive vessels, e.g. plastic tanks, the second pole of the capacitor must be provided separately, e.g. by a concentric tube or the use of a double rod electrode.

When using a standard electrode, a suitable earth plate is necessary. Hence provide a possibly large earth plate, e.g. wire braiding laminated into the vessel wall or metal foil which is glued to the vessel. Connect the earth plate with the earth terminal on the housing.

Rod electrode

Mount the rod electrode such that the electrode protrudes into the vessel. When mounting in a tube or a socket, build-up can be caused which can influence the measurement. This is particularly the case with viscous or adhesive mediums.

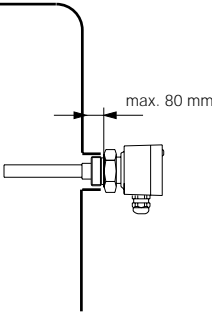


Fig. 2.5 Rod electrodes

Cable electrode in solids

Dependent on the kind of solid and position or the kind of filling the cable electrode can "float" despite of the gravity weight. The electrode (cable) is pushed by the solid to the vessel wall or to the top and wrong measured values are caused. This should be avoided with continuous measurement.

In this case use a fixing weight to fasten the cable electrode.

When fastening the cable electrode avoid high tensile strengths. Appropriate fixing spring avoiding overloading of the cable is listed in our pricelist as accessory.

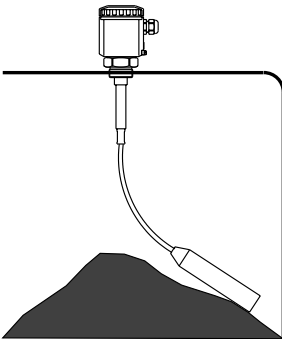


Fig. 2.6 Cable electrode in solids

Continuous electrodes

With electrodes, delivering continuous measured values, the electrode must only be installed vertically. Should the installation from top not be possible, the electrodes can also be mounted laterally.

When in the installation place of the electrode there are struts or a roof, you should check if a rod electrode with the required length can be mounted. If mounting of a rod electrode is not possible, use a cable electrode.

Under the accessory in our pricelist you find a screening tube and a closing cone or a bent rod electrode by which the electrode can be also mounted laterally. Choose the length (L) of the screening tube such that no product bridges can be built between cable and vessel wall and that the electrode cable cannot touch the vessel wall due to product movements. Use a fixing weight.

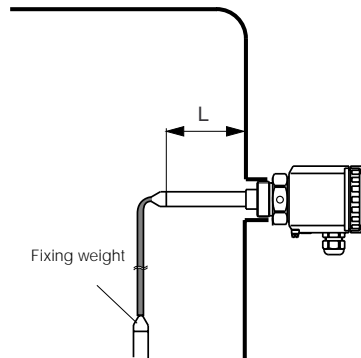


Fig. 2.7 Continuous electrodes

Material cone

Note when installing the electrodes into the vessel, that material cones can be caused with solids which can change the switch point. We recommend to choose an installation place where the electrode detects an average value of the material cone.

According to the position of the filling and emptying opening in the vessel, the electrode must be installed appropriately. To compensate meas. errors caused by the material cone, you should install the electrode at a distance of approx. $\frac{d}{6}$ from the vessel wall.

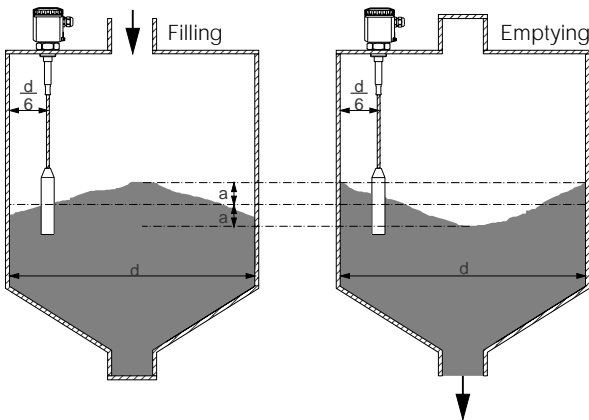


Fig. 2.8 Material cone, filling and emptying centered

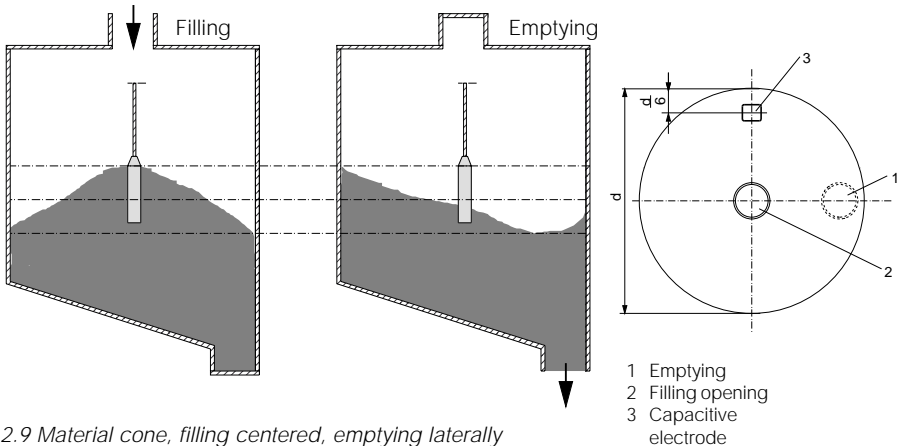


Fig. 2.9 Material cone, filling centered, emptying laterally

3 Electrical connection

3.1 Connection instructions

Note

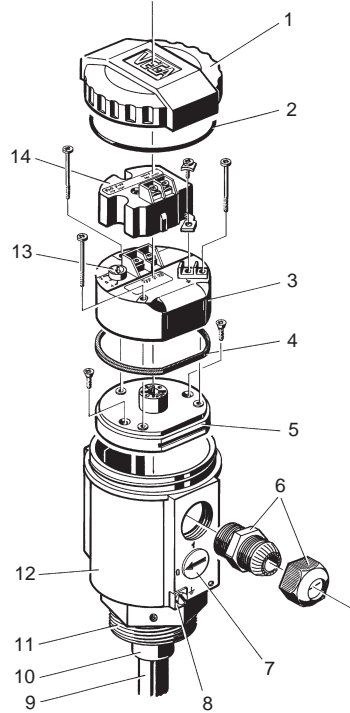
Switch off the power supply before starting connection work.

The electrical connection must be carried out dependent on the integral oscillator. The integral oscillator is stated on the type plate on the oscillator. Connect the supply voltage acc. to the following connection diagrams.

Note

If strong electromagnetic interferences have to be expected, we recommend to use screened cable. The screening of the cable should only be earthed at one sensor end (electrode).

Generally connect the electrode with vessel ground (PA). For this purpose there is a terminal laterally on the housing. This connection is additionally for the mass reference potential as well as to drain off electrostatic charges.



- 1 Housing cover
- 2 Seal ring
- 3 Oscillator
- 4 Cellular rubber seal
- 5 Socket plate
- 6 Cable entry
- 7 Test switch (option)
- 8 Earth terminal
- 9 Electrode
- 10 Isolation
- 11 Mechanical connection
- 12 Housing
- 13 Changeover switch
- 14 Overvoltage protection module (option)

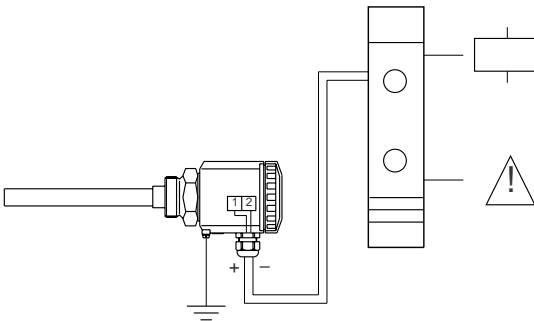
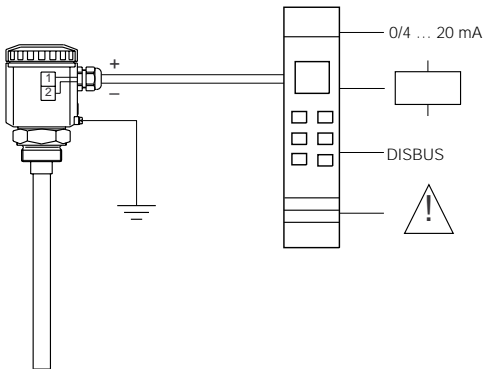
3.2 Connection plan

The electrical connection of the sensor on the signal conditioning instrument is stated in the operating instruction of the appropriate signal conditioning instrument.

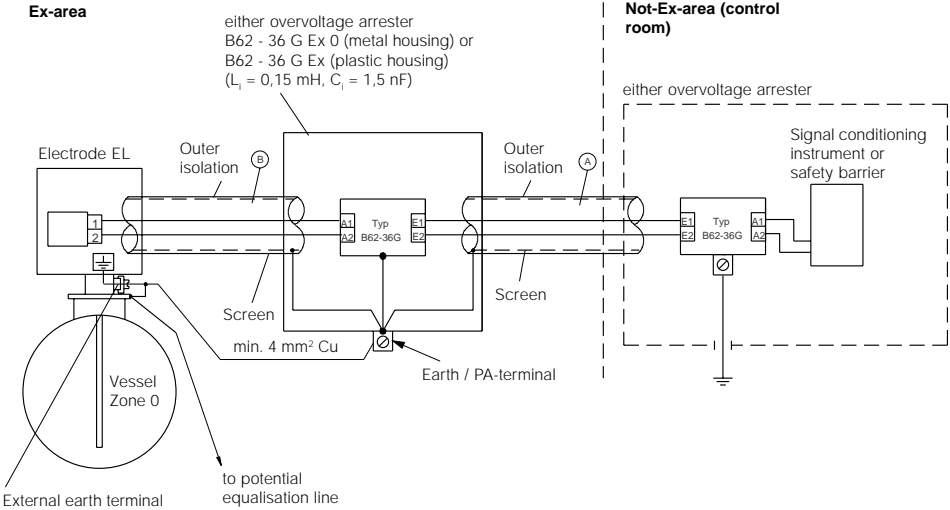
Note

The oscillator is independent of the electrode and can be exchanged locally.

As the oscillators have certain tolerances (approx. 5 %), it can be necessary to re-adjust the signal conditioning instrument after having exchanged the electronics.



Capacitive electrode with external overvoltage protection unit
Vessel without cathodic corrosion protection

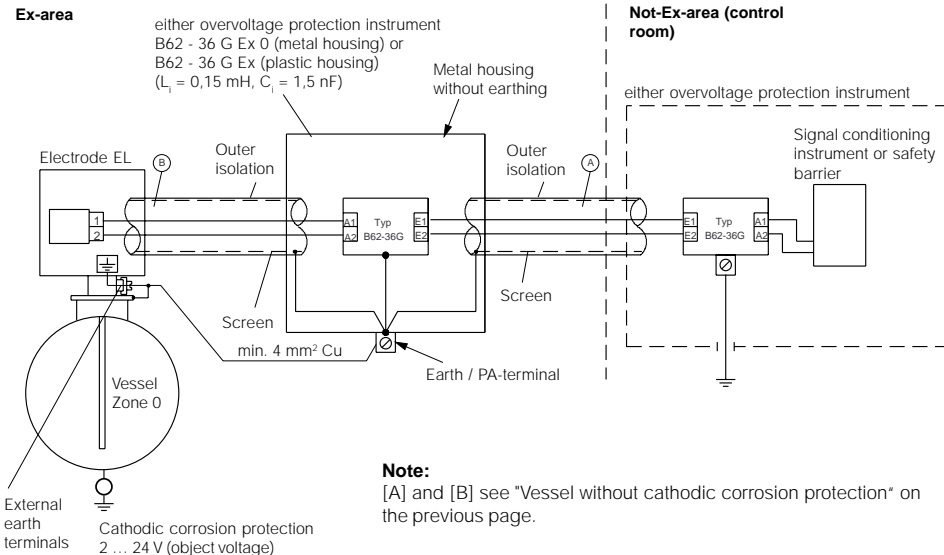


Note:

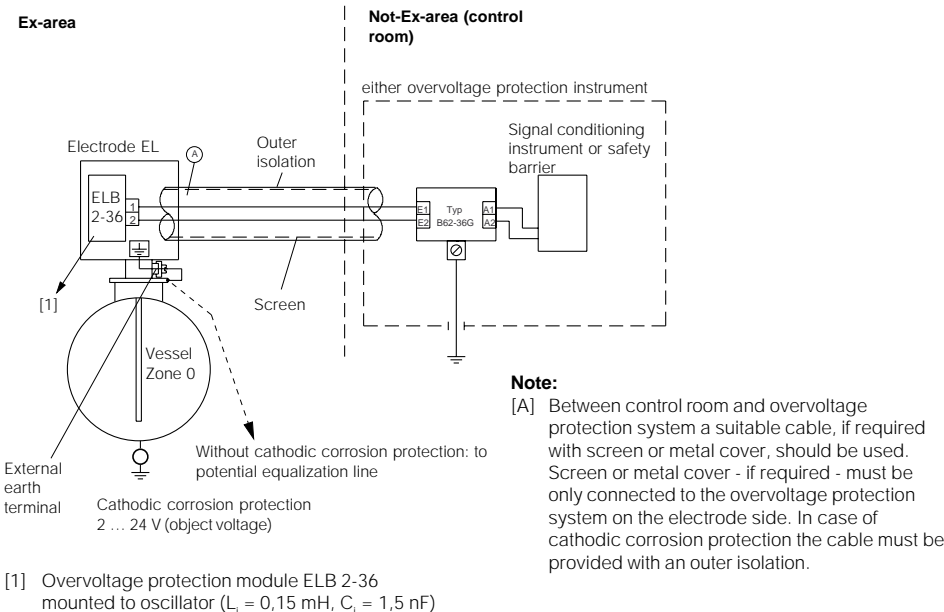
- [A] Between control room and overvoltage protection system a suitable cable, if required with screen or metal cover, should be used. Screen or metal cover - if required - must be only connected to the overvoltage protection system on the electrode side.
- [B] Between overvoltage protection system and capacitive electrode a suitable cable with metal cover, screen or a suitable cable with metal protection tube must be used (screen, metal cover or protective tube must be connected to the potential equalization).

Test voltage of cable A and B: ≥ 500 V AC

Vessel with cathodic corrosion protection



Capacitive electrode with integral overvoltage protection module Vessel with/without cathodic corrosion protection



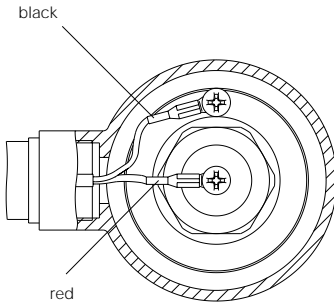
Separate housing

When there are ambient temperatures of more than 80° C on the housing, a temperature adapter must be used or the electronics must be separated from the electrode and located at a cool place. Hence the electronics can be mounted in a separate housing at a distance of up to 8 m from the electrode. Electrode and housing are dispatched completely mounted.

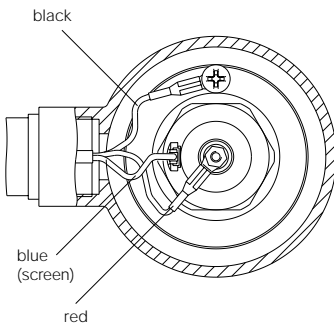
Carry out the adjustment according to the following figures. Only use VEGA-triax cable.

Choose the cable connection as short as possible.

Capacitive rod and cable electrodes EL



Electrode EL 26 (EL 35) for adhesive products



4 Set-up

4.1 General adjustment

When you state with the order already the measured product, the electrode will be adjusted appropriately. The dielectric constant value and the conductivity of the product as well as the electrode length are considered.

The figures in brackets relate to the figure under chapter "3 Electrical connection". During set-up the electrode must be adjusted with the original medium.

For adjustment of the electrode you have to open the housing cover. On the oscillator you can choose with the changeover switch (13) the sensitivity range of the electrode.

	E14, E15	E17, E18
Step I (sensitive)	0...25pF	0...120pF
Step II (standard)	0...100pF	0...600pF
Step III (less sensitive)	0...400pF	0...3000pF

The instruction for adjustment or switch point adjustment is stated in the operating instruction of the appropriate signal conditioning instrument.

4.2 Level detection

Vertically installed electrodes

- Set the changeover switch on the oscillator of the electrode to step I.
- Choose on the signal conditioning instrument the desired mode (A - overflow protection, B - protection against dry running of pumps).
- Fill the vessel up to the requested level.
- Carry out the adjustment. Turn the potentiometer of the signal conditioning instrument (VEGATOR) very slowly until the control lamp changes condition. Should the adjusted meas. range not be sufficient to find the switch point, you have to set the changeover switch to the next higher step (II or III). Also note the switch point adjustment of the signal conditioning instrument.

Horizontally mounted electrodes

- Set the changeover switch on the oscillator of the electrode to the appropriate step. Note the following conditions:

- product non-conductive	Range 1
- product conductive	Range 2
- EL 11 in conductive product	Range 2
- EL 21 in conductive product:	
EL 21 (2 mm-isolation)	
0 - 0,05 m length	Range 1
0,05 - 0,25 m length	Range 2
EL 21 (3,2 mm-isolation)	
0 - 0,1 m length	Range 1
0,1 - 0,5 m length	Range 2
- If no other information exists, the oscillators E14, E15 and E18 are generally preadjusted to range 1.
- On the signal conditioning instrument choose the required mode (A - overflow protection, B - protection against dry running of pumps).
- Make sure that the integration time is switched off (see operating instruction of the signal conditioning instrument).
- Empty the vessel or lower the level at least up to 100 mm below the electrode.
- Carry out the empty adjustment. Turn the potentiometer of the signal conditioning instrument (VEGATOR) very slowly clockwise until the relay control lamp lights (mode A) or extinguishes (mode B).
 - When the potentiometer on the signal conditioning instrument is set above the value 7, you should set the changeover switch to range 2.
- Fill the vessel until the electrode is completely covered.
- Carry out the full adjustment. Turn the potentiometer on the signal conditioning instrument (VEGATOR) very slowly clockwise until the relay control lamp lights (mode A) or extinguishes (mode B).

4.3 Continuous level measurement

When you have already stated the measured product with the order, the oscillator of the electrode is already preadjusted. In this case the measured product is mentioned on the order confirmation.

- Choose with the changeover switch on the oscillator of the electrode the step according to the following table.

Note the column corresponding to your medium and choose by means of the length of your electrode the suitable range.

The stated lengths partly do not correspond to the actually available electrodes. If you are not sure always set the changeover switch to the next higher step.

Medium EL-Type	Non-conductive and DK = 2		Non-conductive and DK = 10		Conductive ¹⁾ or DK > 50	
EL 11	0 - 5,5 m ---	Range 1	0 - 0,8 m 0,8 - 4,5 m	Range 1 Range 2	---	---
EL 11 with concentric tube	0 - 1,5 m ---	Range 1	0 - 0,15 m 0,15 - 0,9 m	Range 1 Range 2	---	---
EL 18	0 - 6 m ---	Range 1	0 - 1 m 1 - 5,5 m	Range 1 Range 2	---	---
EL 21 (2 mm-isolation)	0 - 5 m ---	Range 1	0 - 1,1 m 1,1 - 6 m	Range 1 Range 2	0 - 0,25 m 0,25 - 1,4 m	Range 1 Range 2
EL 21 (2 mm-isolation) with concentric tube	0 - 2 m ---	Range 1	0 - 0,5 m 0,5 - 2,5 m	Range 1 Range 2	0 - 0,3 m 0,3 - 1,7 m	Range 1 Range 2
EL 21 (3,2 mm-isolation)	0 - 6 m ---	Range 1	0 - 1,5 m 1,5 - 6 m	Range 1 Range 2	0 - 0,6 m 0,6 - 3 m	Range 1 Range 2
EL 21 (3,2 mm-isolation with concentric tube)	0 - 3,5 m ---	Range 1	0 - 1 m 1 - 5,5 m	Range 1 Range 2	0 - 0, m 0,7 - 4 m	Range 1 Range 2
EL 24	0 - 6 m ---	Range 1	0 - 1 m 1 - 5,5 m	Range 1 Range 2	0 - 0,15 m 0,15 - 0,8 m	Range 1 Range 2
EL 24 with concentric tube	0 - 2 m ---	Range 1	0 - 0,4 m 0,4 - 2 m	Range 1 Range 2	0 - 0,15 m 0,15 - 0,9 m	Range 1 Range 2
EL 28	0 - 6 m ---	Range 1	0 - 1,5 m 1,5 - 6 m	Range 1 Range 2	0 - 0,5 m 0,5 - 2,8 m	Range 1 Range 2
EL 29	0 - 6 m ---	Range 1	0 - 1 m 1 - 5 m	Range 1 Range 2	0 - 0,3 m 0,3 - 1,8 m	Range 1 Range 2
EL 31	0 - 6 m 6 - 30 m	Range 1 Range 2	0 - 1 m 1 - 5 m	Range 1 Range 2	---	---
EL 33	0 - 6 m 6 - 30 m	Range 1 Range 2	0 - 1 m 1 - 5 m	Range 1 Range 2	---	---
EL 34	0 - 6 m 6 - 30 m	Range 1 Range 2	0 - 1 m 1 - 5,5 m	Range 1 Range 2	---	---
EL 42	0 - 9 m 9 - 30 m	Range 1 Range 2	0 - 2 m 2 - 10 m	Range 1 Range 2	0 - 0,8 m 0,8 - 4,5 m	Range 1 Range 2
EL 52	0 - 6 m 6 - 30 m	Range 1 Range 2	0 - 1,6 m 1,6 - 8 m	Range 1 Range 2	0 - 0,7 m 0,7 - 4 m	Range 1 Range 2
EL 53	0 - 6,5 m 6,5 - 30 m	Range 1 Range 2	0 - 1,5 m 1,5 - 8 m	Range 1 Range 2	0 - 0,5 m 0,5 - 2,5 m	Range 1 Range 2
EL 60	0 - 5,5 m ---	Range 1	0 - 0,8 m 0,8 - 4,5 m	Range 1 Range 2	---	---
EL 61	0 - 6 m 6 - 30 m	Range 1 Range 2	0 - 1 m 1 - 5 m	Range 1 Range 2	---	---

¹⁾ Oscillator E17 up from a conductivity > 10 µS, oscillator E18 up from a conductivity > 100 µS.

Signal conditioning instrument VEGAMET series 300

In case the electrode is not already preadjusted, you have to choose the meas. range.

- Adjust the changeover switch on the capacitive electrode EL according to the table on the previous page.
 - Turn the potentiometer for full adjustment approx. 22 turns clockwise.
 - Empty the vessel to the desired min. level.
 - Turn the potentiometer for empty adjustment anticlockwise until the pointer of the indicating instrument is set to 0.
 - Fill the vessel to the desired max. level. The indication shows more than 100 %.
 - Turn the potentiometer for full adjustment anticlockwise until the pointer is set to 100 %. If it is not possible to set the indication to 100 % proceed as follows:
 - When the indication does not reach 100 % you have to adjust the changeover switch on the electrode one step lower.
 - When the indication exceeds 100 % and cannot be reset, you have to adjust the changeover switch to the next higher step.
- In both cases you have to repeat the adjustment.

Signal conditioning instrument VEGAMET 614, VEGAMET series 500

In case the electrode is not already preadjusted, you have to choose the meas. range.

- Adjust the changeover switch on the capacitive electrode EL according to the table on the previous page.

- Carry out the adjustment on the signal conditioning instrument (see operating instruction of the signal conditioning instrument: "Adjustment with medium").
 - When on the signal conditioning instrument fault signal E014 is triggered, look in the operating instruction of the signal conditioning instrument under "Error codes". When sensor and connection line work without problems, probably the range of the capacitive electrode is wrong. Set the changeover switch to the next higher step.
 - When on the signal conditioning instrument fault signal E017 is triggered, set the changeover switch on the electrode to the next lower step.

Signal conditioning instrument VEGAMET series 600 (except VEGAMET 614)

In case the electrode is not already preadjusted, you have to choose the meas. range.

- Adjust the changeover switch on the capacitive electrode EL according to the table on the previous page.
 - Carry out the adjustment according to the operating instruction of the signal conditioning instrument (see operating instruction of the signal conditioning instrument "Adjustment").
- When the indication cannot be adjusted to 100 % (10,0 V) proceed as follows:
- When the indication does not reach 100 % (10,0 V) you have to set the changeover switch on the electrode to the next lower step.
 - When the indication exceeds 100 % (10,0 V) and cannot be reset, you must set the changeover switch of the electrode to the next higher step.
- In both cases you have to repeat the adjustment.

5 Diagnosis

5.1 Simulation

Test switch

For simulation of a switching condition, a test switch can be optionally integrated in the housing. By pushing the test switch an additional capacitance is switched. Hence only the function of the oscillator and the connected instruments are tested.

Note

When the changeover switch is set to position 3, it can be possible that the connected capacitance is not sufficient to carry out a test.

The test switch can be only used for simulation of a max. level (overflow protection).

Test

Set the test switch to position 1. The changeover of the test switch to position 1 increases the capacitance of the uncovered electrode so that the oscillator responds and triggers an alarm signal. The connected instruments are activated.

Note

After the test it is absolutely necessary to reset the test switch to basic position (position 0).

5.2 Maintenance

The instrument is maintenancefree.

5.3 Repair

Due to safety and guarantee reasons repair work beside the wiring must only be made by VEGA-staff.

In case of a defect please return the appropriate instrument with a short description of the error to our repair department.

Failures are shortterm malfunctions of the instrument which are caused by wrong adjustment or defects on the sensor or the connection lines.

Failures, possible reasons and their removal are stated under "5.4 Failure removal".

5.4 Failure removal

Failure

The red failure LED of the signal conditioning instrument lights

Measure, failure removal

Check the sensor inputs on the following failures:

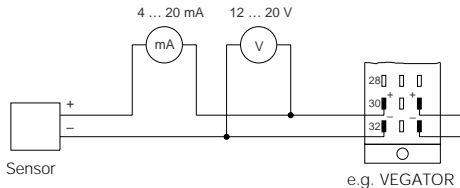
- Sensor not connected correctly
- Sensor line interrupted
- Supply voltage too low

Check if the sensor is connected correctly.

- Failures on the sensor, effecting a current change below 2 mA or above 23 mA lead to a fault signal on the signal conditioning instrument.

Measure the current on the connection line to the sensor.

The terminal voltage on the sensor in standard condition is at least 12 V.



Note with Ex-systems, that the Ex-protection is not influenced by the meas. instruments.

a. Current value < 2 mA

- Check the supply voltage on the connection line to the sensor. The voltage should be approx. 18 ... 24 V.

Should you measure a value below 18 V, this means a defect in the signal conditioning instrument. In this case return the instrument for repair to VEGA.

- Should the red failure lamp still light, separate the connection line from the signal conditioning instrument and connect a resistor of 1 k Ω to the sensor inputs of the signal conditioning instrument.

When the failure lamp continues to light, the signal conditioning instrument is defect. In this case return the instrument for repair to VEGA.

- When the failure lamp extinguishes, connect the signal conditioning instrument again. Separate the sensor from the connection line and connect a resistor of 1 k Ω .
- When the failure lamp still lights, probably the connection line is interrupted. Check the connection line to the sensor.
- When the failure lamp extinguishes, the sensor is defect. Check the connected sensor.

Failure

Sensor defect, measurement does react on level changes

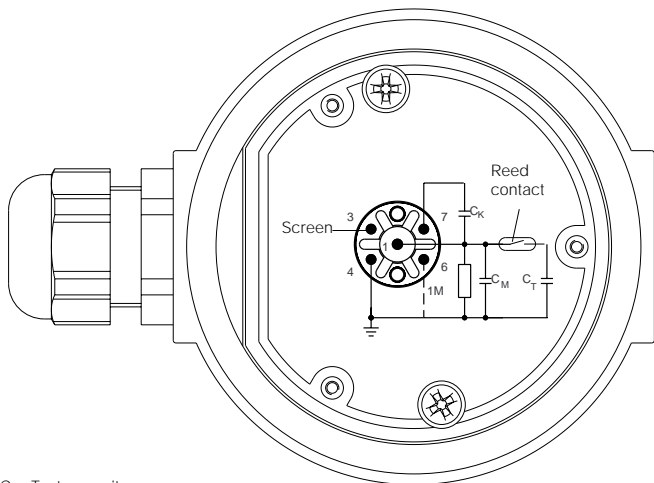
b. Current value > 22 mA

- Check all connections and the connection line to the sensor.
- When the red failure lamp still lights, separate the sensor from the connection line and connect a resistor of 1 kΩ .
When the signal lamp extinguishes, the sensor is defect. Check the connected sensor.
- When the failure lamp continues to light, connect the sensor again. Separate the signal conditioning instrument from the connection line and connect a resistor of 1 kΩ to the sensor input.
- When the failure lamp still lights, the signal conditioning instrument is defect. In this case return the instrument for repair to VEGA.
- When the failure lamp extinguishes, there is probably a shortcircuit in the connection line. Check the connection line to the sensor.

Measure, failure removal

Check the internal connections:

- Remove the housing cover.
- Loosen the three screws with a screwdriver and pull the oscillator out of the housing. With flat pliers you can easily pull the oscillator out of the housing. Touch the oscillator on the extension of the separating wall between the sensor connections.
- Measure with an Ohm-Meter (range MΩ) the resistance values between the following contacts:



C_T - Test capacitor
 C_M - Meas. capacitor
 C_K - Compensation capacitor

Contact 4 against middle pin (1)

The resistance must be $1\text{ M}\Omega$.

If the resistance is less, this means humidity in the housing or a failure in the electrode isolation. A possible reason could be a not isolated electrode which is used in conductive (humid) product.

If the resistance is higher or if the connection is interrupted, the reason is mainly a bonding failure in the adapter plate or a defect resistor due to strong electrostatic discharge.

In both cases the electrode must be repaired at VEGA.

Contact 4 against vessel

The connection between contact 4 and the metal vessel (not instrument hexagon or electrode flange) should be as good as possible. Measure with an ohmmeter (range very low) the resistance value between contact 4 and the vessel.

- Shortcircuit ($0 \dots 3\ \Omega$), optimum connection
- Resistance $> 3\ \Omega$
 - corrosion on the mounting boss or flange
 - probably the mounting boss was covered with Teflon tape or similar

Check the connection to the vessel. If there is no connection, you can connect a line from the earth terminal outside to the vessel.

Note that coated flanges must be in any case connected via the earth terminal to the vessel.

Contact 7 against middle pin (1)

The resistance must be infinite ($>10\text{ M}\Omega$).

If the resistance is less, humidity penetrated or the compensation capacitor is defect.

Contact 3 against 4

On electrodes without screen the resistance is infinite ($>10\text{ M}\Omega$). On EL 26 the resistance must be $1\text{ M}\Omega$. In case of lower values, the electrode isolation is defect or humidity penetrated into the instrument housing.

In case of higher values, a bonding failure in the adapter plate is the case or the resistor is defect.

Contact 4 against 6

In case of older sensors and EL 29 the resistance is infinite, with new electrodes $<3\ \Omega$. In case of values between $3\ \Omega$ and $10\text{ M}\Omega$ there is a defect.

When you cannot find a failure on the electrode, replace the oscillator against a similar replacement type (if available) or send the electrode for repair to VEGA.

If the failure does not disappear after inserting of a replacement electronics, the adjustment on the signal conditioning instrument should be repeated as the oscillators have certain tolerances.

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