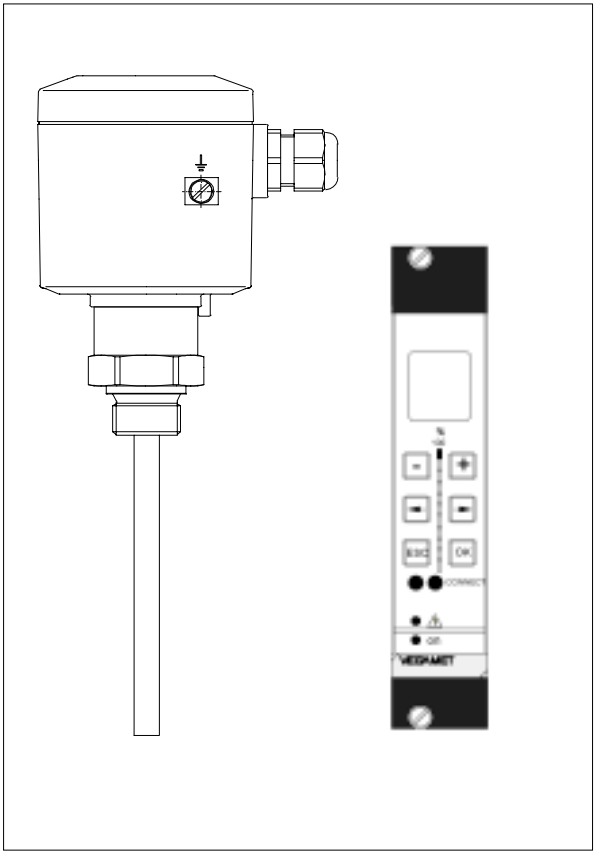
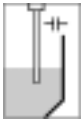
Level and Pressure

Operating Instruction

Capacitive electrodes EK ...
with signal conditioning instrument





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.

Note Ex-area

Please note the attached approval documents (yellow binder) and especially the included safety data sheet.

Contents

1 Product description

1.1 Function and configuration

Capacitive electrodes series EK detect levels of virtually any medium, unaffected whether liquids, powders, granules or pastes. This is also valid for adhesive mediums.

The electrode measures also the level capacitance and the ohmic resistance (admittance processing). Hence also problematic mediums and solids with fluctuating humidity contents can be detected.

By the use of screening tubes and screen segments, inactive areas can be provided on the probe where pollution, condensation or permanent build-up do not influence the measuring result.

Measuring principle

Electrode, medium and vessel wall form an electrical capacitor.

The capacitance of the capacitor is mainly influenced by three factors:
- distance of the electrode plates (a)
- size of the electrode plates (b)
- kind of dielectricum between the electrodes (c)

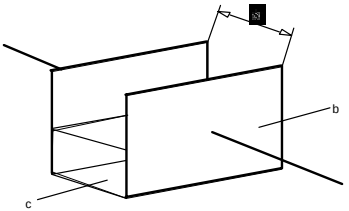


Fig. 1.1 Plate capacitor (schematic demonstration)

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

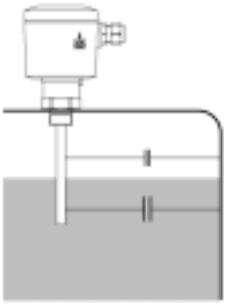


Fig. 1.2 Capacitance change with covered electrode

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 indicated or further processed.

You require a capacitive electrode series EK with oscillator and a signal conditioning instrument VEGAMET, converting the proportional current of the oscillator into standardised current and voltage signals.

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

The floating signal of the electrode electronics is in the range 4 ... 20 mA and can be therefore connected without additional potential separation to other processing systems such as e.g. VEGALOG.

In addition to the continuous measurement, also levels can be detected (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 EK with appropriate signal conditioning instruments VEGATOR are available. A switching command can be either triggered when the electrode is covered or uncovered.

1.2 Types and versions

Type[9] / Version	EK 11	EK 21	EK 24	EK 26	EK 31	EK 42
Continuous	•	•	•		•	•
Level detection	•	•	•	•	•	•
Partly insulated	•				•	
Fully insulated		•	•	•		•
Oscillators						
E 14	•	•			•	•
E 15	•	•			•	•
E 15 Ex	•	•			•	•
E 17	•	•			•	•
E 17 Ex	•	•			•	•
E 18	•	•	•	•	•	•
E 18 Ex	•	•	•	•	•	•
Approvals						
CENELEC EEx ia IIC T6	•	•	•	•	•	•
PTB-Zone 0 EEx ia IIC T6	•	•	•	•	•	•
Overfill protection acc. to WHG	•	•	•	•	•	•
German Lloyd[1]	•	•	•	•	•	•
Lloyds Register of Shipping[1]	•	•	•	•	•	•
American Bureau of Shipping[1]	•	•	•	•	•	•
Bureau Veritas[1]	•	•	•	•	•	•
RINA[1]	•	•	•	•	•	•
Mechanical connection						
G $^3/_4$ A	•	•	•	•	•	•
G 1 A	•	•	•	•	•	•
$^3/_4$" NPT	•	•	•	•	•	•
1" NPT	•	•	•	•	•	•
Flange plated		•		•		
Electrode material						
Steel		•		•		
StSt	•[2]	•[2]	•[3]		•[4]	•[3]
Isolating material[5]						
PTFE	•	•		•	•	
FEP			•			•
PE	•	•			•	

Type*) / Version	EK 11	EK 21	EK 24	EK 26	EK 31	EK 42
Concentric tube						
StSt	•	•				
Screening tube (option)						
StSt	•	•		•	•	•
Temperature adapter (option)						
StSt	•	•		•	•	
Housing material						
Plastic (IP 66)	•	•	•	•	•	•
Aluminium - plastic coated (IP 66 and 67)	•	•	•	•	•	•
Others						
Bending of electrode [6]	•	•[7]				

*) All instrument types also Ex0
1) applied
2) 1.4435
3) 1.4571
4) 1.4401
5) For electrodes certified for Ex-Zone 0, only PTFE and FEP are approved as isolating material.
6) Bending max. 90°
7) EK 21 only with PTFE with 3,2 mm isolation thickness

1.3 Technical data

Housing

Housing material	plastic PBT (Polyester) or Aluminium plastic coated
Protection	
- plastic housing	IP 66
- Aluminium housing	IP 66 and 67 (meets both protections)
Cable entry	1 pce. M20 x 1,5
Terminals	for max. 1,5 mm² cross-section area of conductor

Mechanical connection

Material	1.4435 (316 L)
Thread	G $^3/_4$ A or $^3/_4$" NPT G 1 A or 1" NPT
Flange	flange versions, plated

Electrode

Material	EK 11	1.4435 (316 L)
	EK 21	steel (St 37), 1.4435 (316 L)
	EK 31	1.4401 (316 L)
	EK 24, 42	1.4571 (316 L)
Length		
- rod	max. 3 m	
- cable	max. 20 m	
Isolation	see "Isolating materials"	
Max. tensile strength		
- EK 31	3 KN	
- EK 42	3 KN	

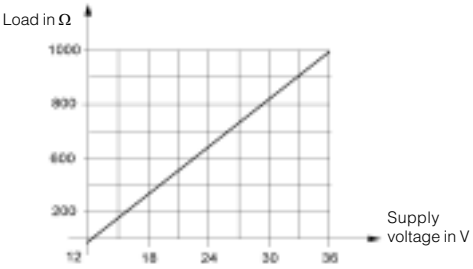
Ambient conditions

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

Oscillators E14, E15, E17, E18

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

For Ex-applications note the permissible electrical connection values stated in the certificate.



Accessory

Straining spring of 1.4571 (EK 42, EK 52, EK 53)	
- load	approx. 185 mm (stressed)
- tensile load	approx. 200 N

Weight

Basic weight (e.g. EK 24)	approx. 0,8 kg
Rod weight	ø 6 mm - 0,23 kg/m
	ø 10 mm - 0,62 kg/m
Cable weight (EK 31)	approx. 40 g/m

Oscillators in two-wire technology for capacitive electrodes EK

Type	Application	Meas. range	Frequency	Signal cond.instr.
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	as E15, however for use in hazardous areas acc. to CENELEC, PTB zone 0 as well as zone 1 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	as E17, however for use in hazardous areas acc. to CENELEC, PTB zone 0 as well as zone 1 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 acc. to the principle of phase selective admittance processing especially for adhesive mediums and for the 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]	as E18, however for the use in hazardous areas acc. to CENELEC, PTB zone 0 as well as zone 1 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	470 kHz	VEGAMET Ex VEGALOG [1] (VEGATOR Ex)

[1] with safety barrier
[2] see following page

Oscillator E18

The oscillator E18 with the patented processing (phase selective admittance processing) extends the application range of capacitive level measurement technology.

In conjunction with the fully insulated rod electrode EK 24 the oscillator E18 compensates even very conductive build-up.

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

The oscillator E18 processes the measuring currents according to their phase position. Measuring current with a defined phase shifting as they occur with build-up or humidity changes are filtered out.

Humidity change

A humidity change in solids causes a change of the dielectric constant figure (ε_r). In parallel the ohmic value of the medium changes. Due to the change also a phase shifting of the measuring currents is caused.

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

When using the oscillator E18 humidity changes of 15 % vol. do not influence the accuracy of the measurement. Even layering of product with different humidity does not play a role for the measuring accuracy.

When the humidity contents exceeds 15 % vol., fully and partly insulated electrodes react differently (see also "Fig. 1.3 Humidity change"). Whereby the measured value on fully insulated electrodes raises with steady level, the measured value on partly insulated electrodes drops.

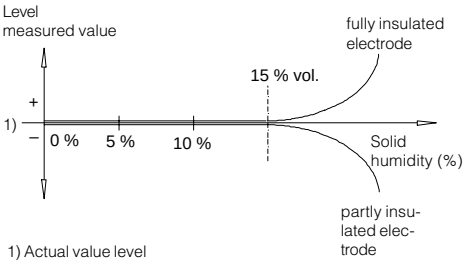
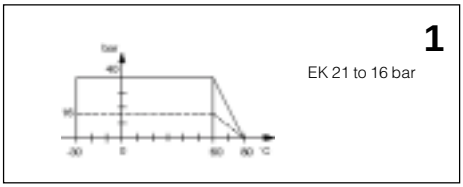


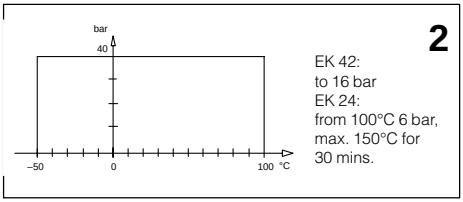
Fig. 1.3 Humidity change

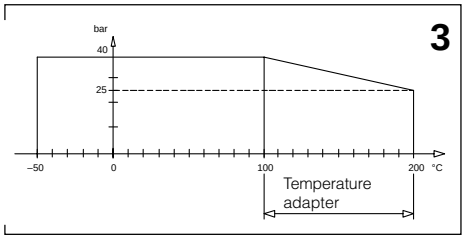
Product temperature and operating pressure[1)]

The figures in the tables relate to the pictures on this page. The statements on pressure are valid for screw connections G $^3/_4$ A, $^3/_4$"NPT, G 1 A, 1"NPT.
With flange versions you have to note their nominal pressure.
All electrodes are also suitable for vacuum (-1 bar).

For electrodes certified for Ex-Zone 0 only PTFE and FEP are approved as isolating material acc. to ATEX II 1/2 G EEx ia II C T6.







Mechanical connection, 1.4435 (316 L)

Isolation / Electrode type	PE	PTFE	FEP
EK 11	1	3	-
EK 21	1	3	-
EK 21 with flange	-	2	-
EK 24	-	-	2
EK 26	-	3	-
EK 26 with flange	-	2	-
EK 31	1	3	-
EK 42	-	2	-

1) For Ex-applications the permissible temperatures and pressures stated in the certificate should be noted. Additionally note the table on the following page.

Electronics temperature

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

The stated values are obligatory for applications in hazardous areas. Note for these applications also the appropriate legal documents (test reports, 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[1)]	-40°C ...	80°C	75°C	80°C	69°C	58°C

1) Ambient temperature on the oscillator

1.4 Approvals

Explosion protection

Only certified capacitive electrodes EK**Ex 0 must be used in hazardous areas with combustible gases, vapours or fog.
Capacitive electrodes EK**Ex 0 are suitable for the use in hazardous areas of zone 1 and zone 0. Proof for the explosion protection of these instruments is the EC-type approval and the conformity certificate possibly with national zone 0 - annex. These documents are generally attached to the instrument.
When the capacitive electrodes are mounted or operated in hazardous areas, the Ex-installation regulations must be noted.
The information and regulations of the supplied certificates (EC-type approval, conformity certificate) of the capacitive electrodes as well as of the appropriate instrument (signal conditioning instrument, separator, safety barrier) must be noted.

- The mounting of Ex-systems must be generally carried out by skilled staff.
- The capacitive electrodes must be powered by an intrinsically safe circuit; the permissible electrical values are stated in the appropriate certificate.
- Capacitive electrodes with electrostatically chargeable plastic parts are provided with a warning label informing about measures which must be taken to avoid dangers caused by electrostatic discharges. Note the contents of the warning label.
- The explosion protection of the instrument used is only ensured when the limit temperatures stated in the certificate are not exceeded.
- ˇ In case of danger due to oscillation or vibration, the appropriate parts of the capacitive electrodes must be secured.
- After shortening of the electrode cable, it must be noted that the weight is sufficiently secured by means of pins.

WHG

The electrodes EK ... Ex0 are also approved as part of an overfill protection for vessels storing water endangering liquids.

Ship approvals

For the use on ships, type approval certificates are available of several ship classification authorities (GL, LRS, ABS, BV, RINA).

For electrodes certified for Ex-Zone 0, only PTFE and FEP are permitted as isolating materials acc. to ATEX II 1/2 G EEx ia IIC T6.

CE-approval

The capacitive electrodes EK 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

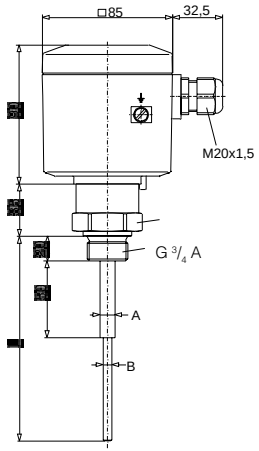
Zone 2

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

1.5 Dimensions

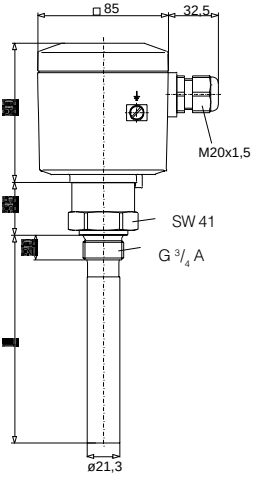
Dimensions of the capacitive electrodes type EK

Type EK 11 (partly insulated)

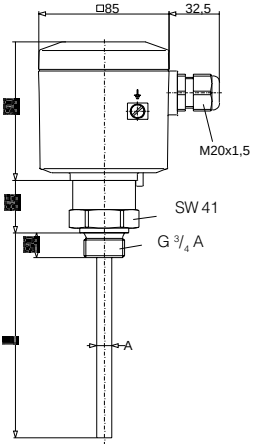


L (min. 100 mm, max. 3000 mm)

EK 11 with concentric tube

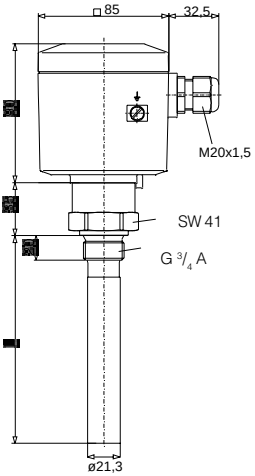


Type EK 21 (fully insulated)



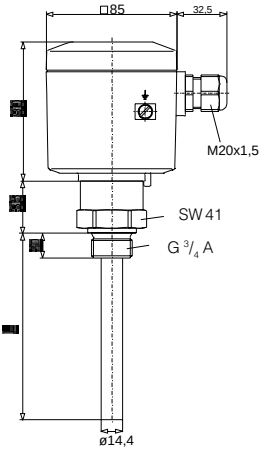
L (min. 100 mm, max. 3000 mm)

EK 21 with concentric tube



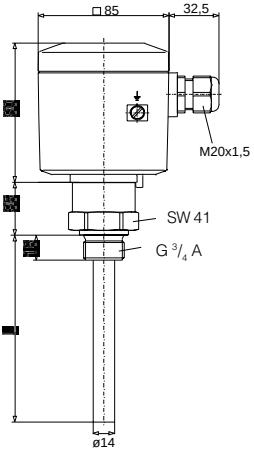
L (min. 100 mm, max. 3000 mm)

Type EK 24 (fully insulated, for adhesive products)



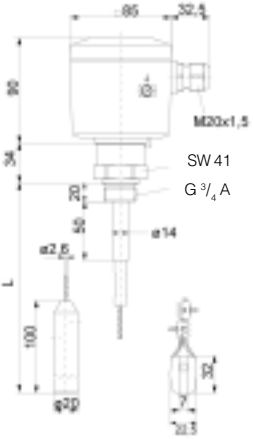
L (min. 120 mm, max. 3000 mm)

Type EK 26



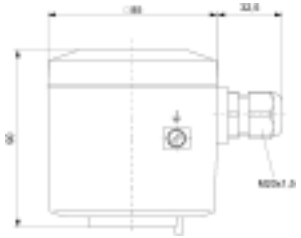
Isolation	A outer-ø	B rod-ø
PE 2,0 mm	14 mm	10 mm
PTFE 2,0 mm	10 mm	6 mm
PTFE 2,0 mm	14 mm	10 mm

Type EK 31 (partly insulated)



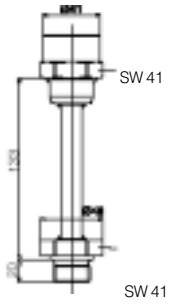
L (min. 400 mm, max. 20000 mm)

Housing



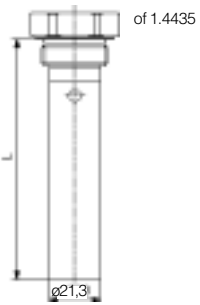
Housing of plastic / Aluminium

Temperature adapter

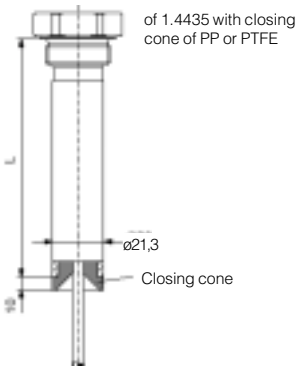


of galvanized steel or 1.4571

Concentric tube

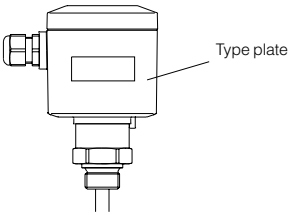


Screening tube



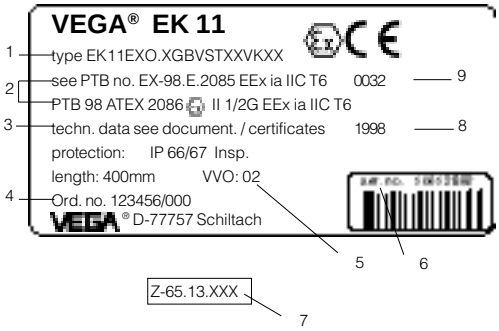
1.6 Type plate

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



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

Configuration of the type plate (example)



1 Master data of the order no.
2 Ex-certification number
Explosion protection version - note the information and regulations of the certificate
3 Data of the electronics / Approvals
4 No. of the order confirmation/Pos.-no.
5 Number of the electrode type
6 Serial number
7 Test mark when used as part of an overfill protection for vessels storing water endangering liquids - note the information and regulations of the general type approval
8 Manufacturing year
9 Number of the test authority

Order code
Detailed information on the order code you will find in the "Product Information Capacitive“ or in the "VEGA-Pricelist“.

2 Mounting

2.1 Mounting instructions

General

Different mediums and requirements to the measurement require various installations. Hence the following instructions should be noted.

Length of the level electrode

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

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

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 opening etc. occur. This is mainly valid for very long rod and cable electrodes.

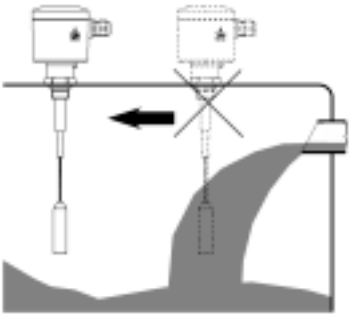


Fig. 2.1 Lateral load

Extraction forces

In case of strong extraction forces e.g. during filling or settling of solids, high tensile loads can be caused.

In these cases use for short measuring distances a rod electrode, as a rod is generally more stable. If due to the length or the mounting position a cable electrode should be necessary, the electrode should not be strained, but only equipped with a gravity weight as then 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 must be sealed at the thread. Use the attached seal ring. Check if 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 electrical connection in case of metal vessels. Hence earth the electrode on the vessel.

Shortening of the electrode

The dimensions of fully insulated electrodes are fixed and must not be modified. Each modification will destroy the instrument.

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

When the cable should be considerably shortened, it can happen that an adjustment of the electrode is not possible. A new compensation of the electrode will be necessary in this case. Note the serial number of the electrode and call one of our sales engineers.

The electrode is compensated to the appropriate electrode length. For this reason you should already state in the order if you want to shorten the electrode.

Cable electrode EK 31 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 (EK 31) 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.

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

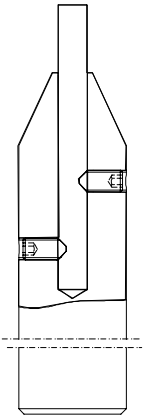


Fig. 2.2 Shortening of the electrode

Filling opening

Install the electrode such that it does not protrude directly into the 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. Fig. 2.3

Horizontal installation

The electrodes can be mounted horizontally to reach a very exact switch point with level detection. We recommend to mount the electrode approx. 20° inclined to the bottom, so that build-up can be avoided.
Fig. 2.3

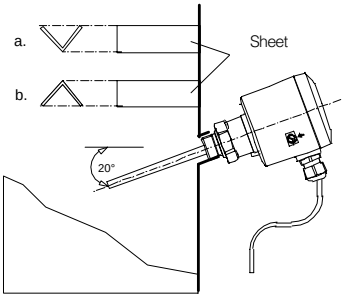


Fig. 2.3 Horizontal installation

Humidity from outside

After installation turn the cable entries of horizontally mounted instruments to the bottom to avoid humidity ingress. The instrument housing is rotational by approx. 330°. In case of vertically installed electrodes, loop the connection line to the electrode housing to the bottom so that rain or 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).

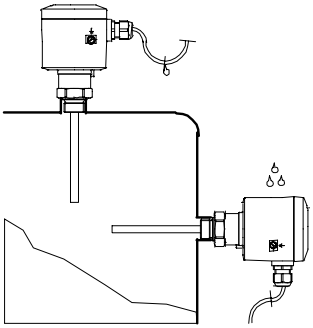


Fig. 2.4 Humidity

Cable entries

When mounting outside, on cooled vessels or in humid areas where cleaning is made e.g. with steam or high pressure, the sealing 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 5 mm to 9 mm.

Aluminium vessels

Use for Aluminium vessels an electrode with steel thread. The combination Aluminium on Aluminium should be avoided, as the thread "seizes“ when being screwed and cannot be loosened after some time without being damaged.

Metal vessels

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 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 products.
(see fig. 2.5)

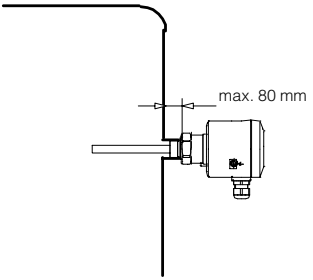


Fig. 2.5 Rod electrodes

Cable electrodes in solids

Dependent on the kind of solid and position or 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 the continuous level measurement.

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

When fixing the cable electrode avoid high tensile strengths. An appropriate fixing spring avoiding overloading of the cable is listed in our pricelist as accessory (see fig. 2.6)

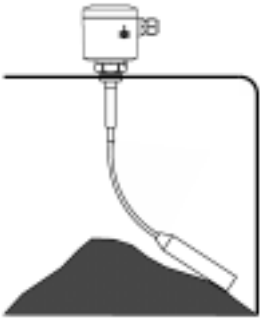


Fig. 2.6 Cable electrode in solids

Lateral installation

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 (see fig. 2.7)

If there are struts or a roof at the installation place of the electrode, you should check if a rod electrode of the requested length can be mounted. If a mounting of the 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 caused between cable and vessel wall and that the electrode cable cannot touch the vessel wall due to product movements. Use a fixing weight or a fixing insulator.

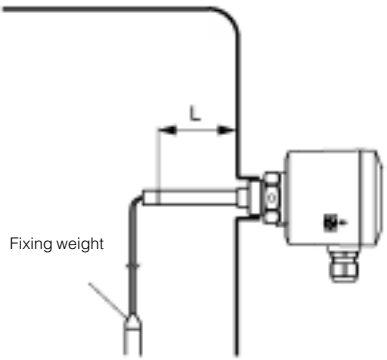


Fig. 2.7 Continuous electrodes

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 the measuring errors caused by the material cone, you should install the electrode at a distance of $^{d}/_{6}$ from the vessel wall.

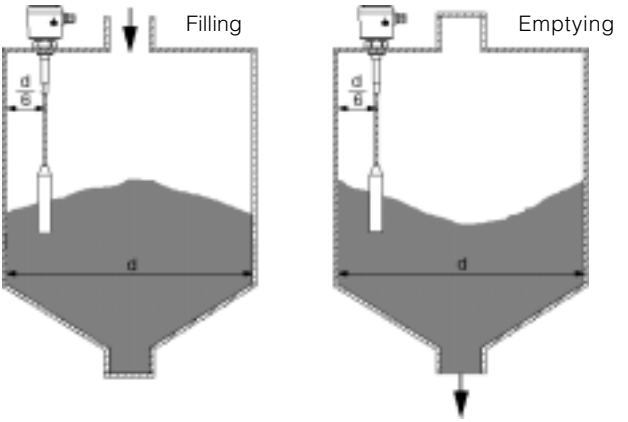


Fig. 2.8 Material cone, filling and emptying centered

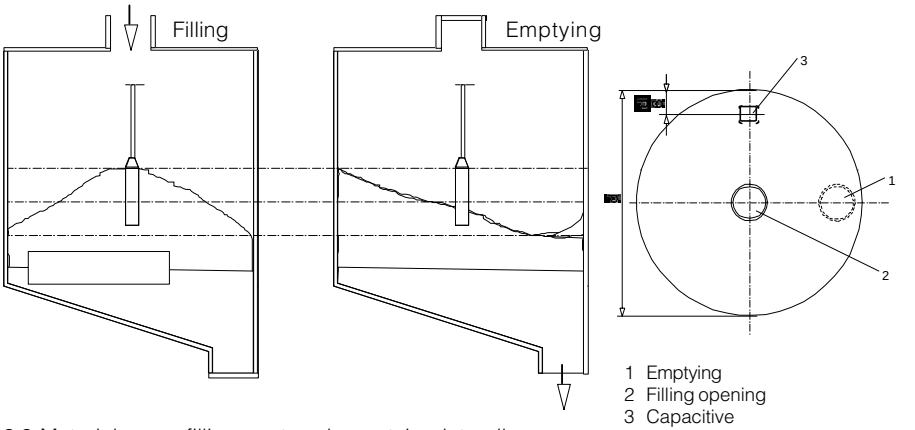


Fig. 2.9 Material cone, filling centered, emptying laterally

3 Electrical connection

3.1 Connection instructions

Note
Switch off the power supply before starting connection work.

The electrical connection must be made dependent on the installed oscillator. The installed electronics type is stated on the type plate of the oscillator. Connect the supply voltage according 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.

Skilled staff
Instruments operated in Ex-areas must only be mounted by skilled staff. They must note the mounting regulations and the supplied EC-type approvals and conformity certificates.

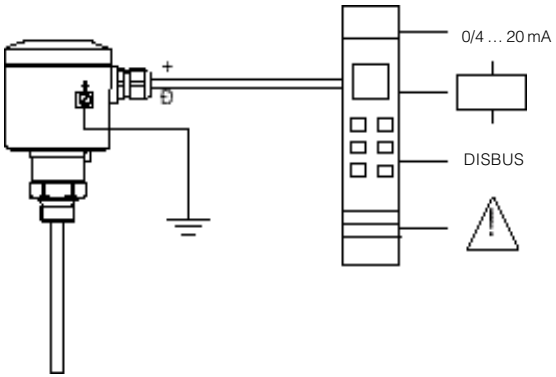
When capacitive electrodes are mounted on vessels which must be protected according to TRbF 100 no. 8, para.1 against inflammation due to lightning, they have to be equipped with the external overvoltage arrester type B 62-36 G or the internal overvoltage protection unit type CB 2-36.

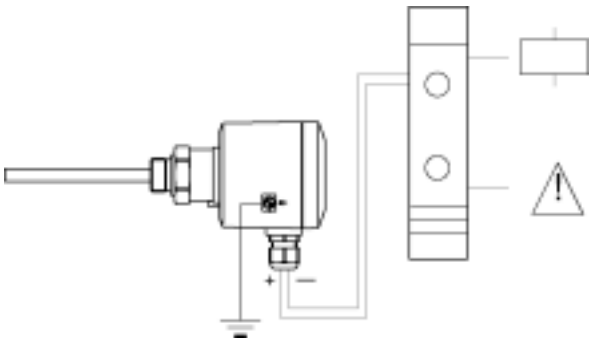
3.2 Wiring plan

The electrical connection of the sensor to 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.

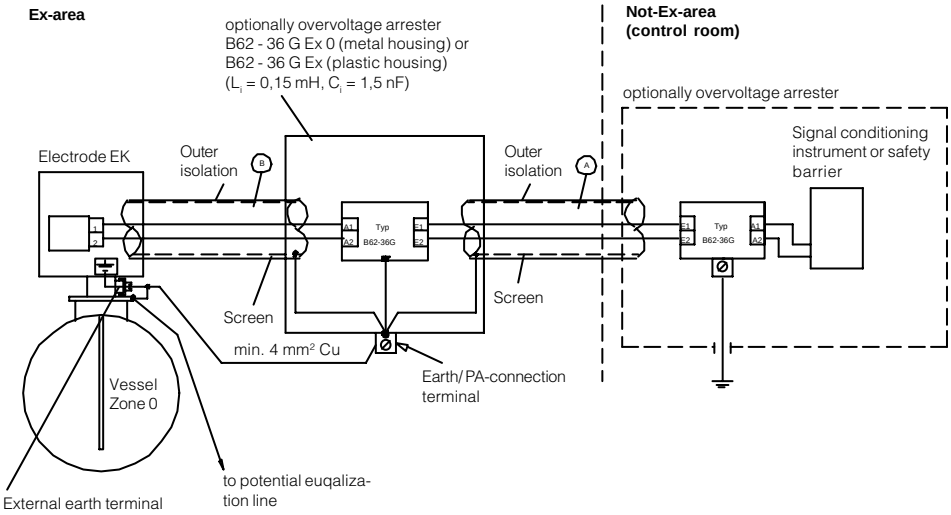
As the oscillators have different characteristics (approx. 5 %), it can be necessary to readjust the signal conditioning instrument after electronics exchange.





Capacitive electrode with external overvoltage protection unit

Vessel without cathodic corrosion protection



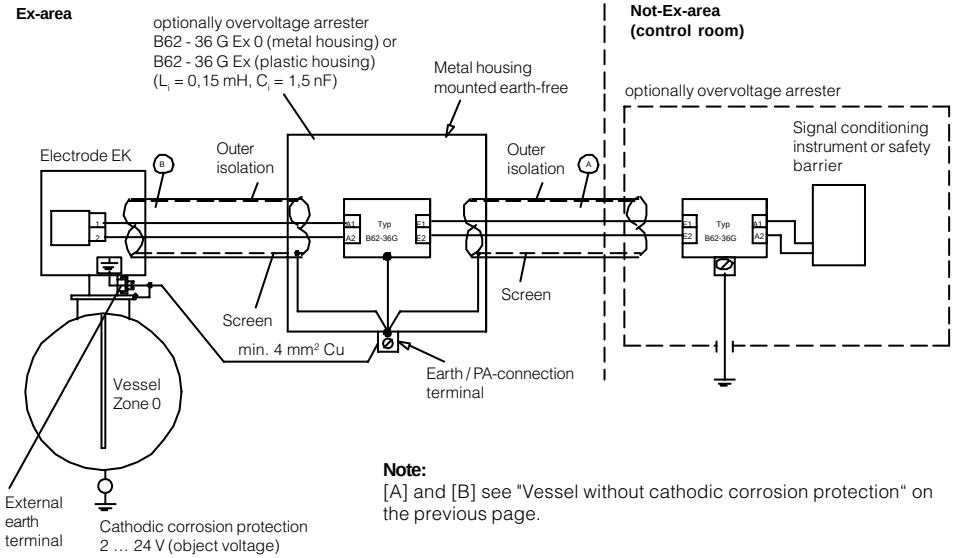
Note:

[A] Between control room and overvoltage protection system a suitable cable, if necessary a metal cover or screen, should be used. Screen or metal cover - if necessary - must only be connected to the electrode side of the overvoltage arrester.

[B] Between overvoltage protection system and capacitive electrode a suitable cable with metal cover, screen or a suitable cable with metal protection tube should be used (screen, metal cover or protection tube must be connected to the potential equalisation).

Test voltage of the cable A and B: ≤ 500 V AC

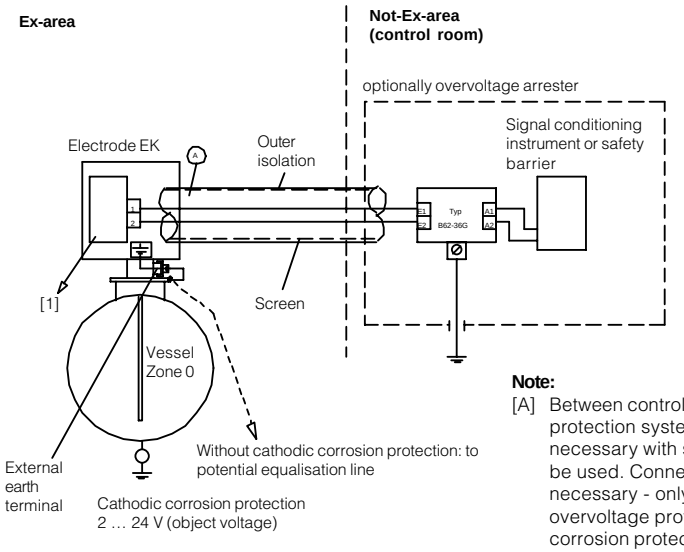
Vessel with cathodic corrosion protection



Note:
[A] and [B] see "Vessel without cathodic corrosion protection" on the previous page.

Capacitive electrode with integral overvoltage protection module

Vessel with/without cathodic corrosion protection



Note:
[A] Between control room and overvoltage protection system a suitable cable, if necessary with screen or metal cover, should be used. Connect screen or metal cover - if necessary - only to the electrode side of the overvoltage protection system. With cathodic corrosion protection the cable must be provided with an outer isolation.

4 Set-up

4.1 General adjustment

When you state with your order already the medium to be measured, the electrode will be adjusted by VEGA. The DK-value and the conductivity of the medium as well as the length of the electrode will be considered.

For the set-up the electrode must be adjusted with the original medium.

For adjustment of the electrode, the housing cover must be opened. With the changeover switch on the oscillator you can choose the sensitivity range of the electrode.

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

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 stage I.
- Choose the requested mode (A - overfill protection, B - dry run protection) on the signal conditioning instrument.
- Fill the vessel to the requested level.
- Carry out the adjustment. Turn the potentiometer on the signal conditioning instrument (VEGATOR) very slowly until the signal lamp changes condition.
  Should the adjusted measuring range not be sufficient to find the switch point, you have to set the changeover switch to the next higher stage (II or III). Note also the switch point adjustment of the signal conditioning instrument.

Horizontally installed electrodes

- Set the changeover switch on the oscillator of the electrode to the appropriate stage.
  Note the following conditions:
  EK with E14, E15
  - non-conductive medium range 1
  - conductive medium to 0,25 m range 2
    to 0,25 m range 3
  - EK 26 with E18 range 1

  If there is no other information, the oscillators E14, E15 and E18 are preadjusted to range 1.
- Choose the requested mode (A - overfill protection, B - dry run protection) on the signal conditioning instrument.
- 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. Therefore turn the potentiometer on 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 above the value 7, you should set the changeover switch to range 2.
- Note the position of the potentiometer.
- 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).
- Note the position of the potentiometer.
- Set the potentiometer to the average value of the two noted values.

4.3 Continuous level measurement

When you state the medium with your order, the oscillator of the electrode is already preadjusted. In this case the medium is stated on the order confirmation.

- Choose with the changeover switch on the oscillator the stage according to the following schedule.
  Take 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.
  When the medium has a DK-value which is between the values stated in the table, the max. permissible electrode length per measuring range must be averaged appropriately.
  In case of larger lengths or when there is nothing else stated in the table, choose range 3.
  If you are not sure, set the changeover switch always to the next higher stage.

Medium EK-type	Non-conductive and DK = 2		Non-conductive and DK = 10		Conductive [1] or DK > 50	
EK 11	0 - 5,5 m ––	range 1	0 - 0,8 m 0,8 - 4,5 m	range 1 range 2	–– ––	
EK 11 with concentric tube	0 - 1,5 m ––	range 1	0 - 0,15 m 0,15 - 0,9 m	range 1 range 2	–– ––	
EK 18	0 - 6 m ––	range 1	0 - 1 m 1 - 5,5 m	range 1 range 2	–– ––	
EK 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
EK 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
EK 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
EK 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
EK 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
EK 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
EK 26	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
EK 31	0 - 6 m 6 - 30 m	range 1 range 2	0 - 1 m 1 - 5 m	range 1 range 2	–– ––	
EK 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

[1] Oscillator E17 from a conductivity > 10 µS, oscillator E18 from a conductivity > 100 µS.

Signal conditioning instrument VEGAMET series 300

When the electrode is not already preadjusted by VEGA, you have to choose the measuring range.

- Set the changeover switch on the capacitive electrode EK according to the table on the previous page.
- Turn the potentiometer for the full adjustment approx. 22 turns clockwise.
- Empty the vessel to the requested min. level.
- Turn the potentiometer for the empty adjustment anticlockwise until the pointer of the indicating instrument is at 0.
- Fill the vessel to the requested max. level. The indication shows more than 100 %.
- Turn the potentiometer for the full adjustment anticlockwise until the pointer is at 100 %. When the indication cannot be set to 100 %, proceed as follows:
  - when the indication does not reach 100 %, you have to set the changeover switch on the electrode one stage lower.
  - when the indication exceeds 100 % and cannot be reset, you have to set the changeover switch to the next higher stage.

  In both cases you have to repeat the adjustment.

Signal conditioning instrument VEGAMET 614, VEGAMET series 500

When the electrode is not already preadjusted by VEGA, you have to choose the measuring range.

- Set the changeover switch on the capacitive electrode EK 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 the signal conditioning instrument displays the fault signal E014, this message is explained in the operating instruction of the signal conditioning instrument under "Error code". When sensor and connection line work without problems, probably a wrong range of the capacitive electrode was chosen. Set the changeover switch to the next higher stage.
  - When the signal conditioning instrument displays the fault signal E017, set the changeover switch on the electrode to the next lower stage.

Signal conditioning instrument VEGAMET series 600

(except VEGAMET 614)

When the electrode is not already preadjusted by VEGA, you have to choose the measuring range.

- Set the changeover switch on the capacitive electrode EK 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 set 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 stage.
  - When the indication exceeds 100 % (10,0 V) and cannot be reset, you have to set the changeover switch of the electrode to the next higher stage.
    In both cases you have to repeat the adjustment.

5 Diagnosis

5.1 Simulation

Test switch

A test switch can be optionally integrated in the housing to simulate a switching condition. By pushing the test switch, an additional capacitance is connected. Just 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 used to simulate a max. level (overfill 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 a full signal. The connected instruments will be activated.

Note

It is absolutely necessary to reset the test switch to basic position (position 0) after the test.

5.2 Maintenance

The instrument is maintenance free.

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 short-term malfunctions of the instrument which are caused by wrong adjustment or defect on the sensor or the connection lines.

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

5.4 Failure removal

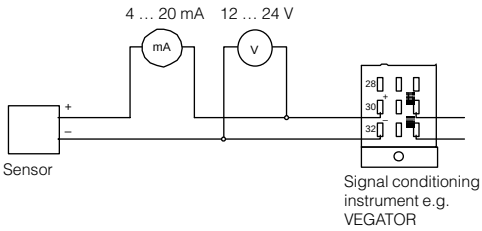
Failure
The red failure-LED of the signal conditioning instrument lights

Measure, failure removal
Check the sensor inputs on the following failures:
- short-circuit on the input
- sensor not correctly connected
- 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, trigger a fault signal on the signal conditioning instruments.

Measure the current on the connection line to the sensor.

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



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

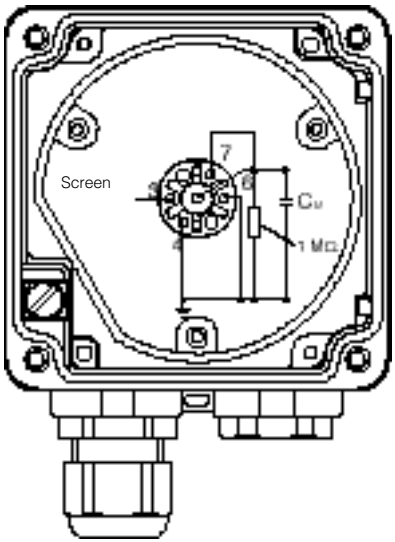
a. Current value < 2 mA
- Check the supply voltage on the connection line to the sensor. The voltage should be approx. 17 … 24 V.
  Should you measure a value below 17 V, the signal conditioning instrument is defect. In this case send the instrument to VEGA for repair.
- Should the red failure lamp continue to light, separate the connection line from the signal conditioning instrument and connect a resistor of 2,2 kOhm to the sensor inputs of the signal conditioning instrument. Should the failure lamp continue to light, the signal conditioning instrument is defect. In this case return the instrument to VEGA for repair.
- Should the failure lamp extinguish, connect the signal conditioning instrument again. Separate the sensor from the connection line and connect instead a resistor of 2,2 kOhm.
- Should the failure lamp continue to light, perhaps 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.

b. Current value > 22 mA
- Check all connections and the connection line to the sensor.
- Should the red failure lamp continue to light, separate the sensor from the connection line and connect instead a resistor of 2,2 kOhm. When the failure lamp extinguishes, the sensor is defect. Check the connected sensor.
- Should the failure lamp continue to light, connect the sensor again. Separate the signal conditioning instrument from the connection line and connect a resistor of 2,2 kOhm to the sensor input.
- Should the failure lamp continue to light, the signal conditioning instrument is defect. In this case send the instrument to VEGA for repair.
- When the failure lamp extinguishes, this is perhaps a short-circuit in the connection line. Check the connection line to the sensor.

Failure
Sensor defect, measurement does not react to level changes

Measure, failure removal

Test of the internal connections:
- Remove the housing cover.
- Loosen the three screws with a screwdriver and pull the oscillator out of the housing. Use flat pliers to pull the oscillator easily out of the housing. Hold the oscillator on the extension of the separating wall between the sensor connections.
- Measure with an ohmmeter (range MΩ) the resistance values between the following contacts:



C_M - Capacitor

Contact 4 against middle pin (1)
The resistor must be 1 MΩ.
If the resistor is less, this means humidity in the housing or a failure in the electrode isolation. A possible reason could be a not isolated electrode used in a conductive (humid) medium.
If the resistor 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 return the electrode for repair to 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.
- Short-circuit (0 ... 3 Ω), optimum connection
- Resistance > 3 Ω
  - 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 covered flanges must be in any case connected via the earth terminal to the vessel.

Contact 7 against middle pin (1)
The resistor must be infinite (>10 MΩ).
If the resistor is less, humidity penetrated or the compensation capacitor is defect.

Contact 3 against 4
In case of electrodes without screen, the resistor is infinite (>10 MΩ). With EK 26 the resistor should be 1 MΩ. In case of lower values, the electrode isolation is defect or humidity penetrated into the instrument housing.
In case of higher values there is a bonding failure in the adapter plate or the resistor is defect.

Contact 4 against 6
With older sensors the resistor is infinite, with newer electrodes <3 Ω. In case of values between 3 Ω and 10 MΩ there is a defect.

When you cannot find a failure in the electrode, then replace the oscillator by a similar type (if available) or send the electrode for repair to VEGA.
If the failure disappears after insertion of the new replacement electronics, the adjustment on the signal conditioning instrument should be repeated as the oscillators have different characteristics.

HiTECH
Technologies, Inc.

A TECHNOLOGY FOR
EVERY LEVEL APPLICATION

HiTECH Technologies, Inc.

301 Oxford Valley Road - Building 505
Yardley, PA 19067-7706
Tel: 215. 321. 6012; Fax: 215. 321. 6067
Tech Support (Toll Free) 866-DrLevel or 888-NIVELCO
Email: info@DrLevel.com or info@hitechtech.com
Web Site: www.DrLevel.com or www.hitechtech.com

CE