

Product information

Capacitive

Level measurement in bulk solids

VEGACAL 62

VEGACAL 65

VEGACAL 66

VEGACAL 67



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Take note of safety instructions for Ex applications



Please note the Ex specific safety information that you can find at www.vega.com and that comes with each instrument. In hazardous areas you should take note of the appropriate regulations, conformity and type approval certificates of the sensors and power supply units. The sensors must only be operated on intrinsically safe circuits. The permissible electrical values are stated in the certificate.

1 Description of the measuring principle

Measuring principle

Probe, measured product and vessel wall form an electrical capacitor. The capacitance is influenced by three main factors.

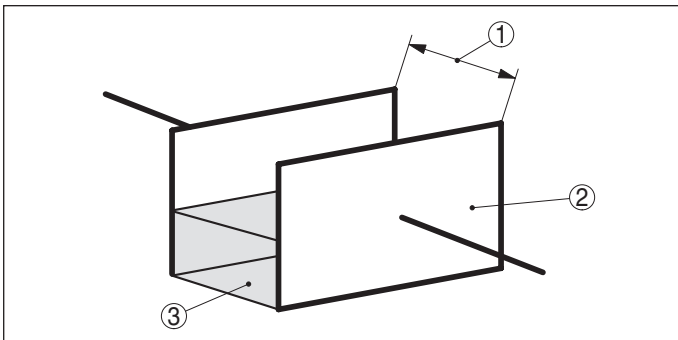


Fig. 1: Functional principle - Plate capacitor

- 1 Distance between the electrode surfaces
- 2 Size of the electrode surfaces
- 3 Type of dielectric between the electrodes

The probe and the vessel wall are the capacitor plates. The measured product is the dielectric. Due to the higher dielectric constant of the product compared to air, the capacitance increases as the probe is gradually covered.

The capacitance as well as the resistance change are converted by the electronics module into a level-proportional signal.

The more constant the conductivity, concentration and temperature of a product, the better the conditions for admittance measurement. Changes in the measuring conditions are generally less critical when detecting materials with high DK values.

The sensors are maintenance free and rugged and can be implemented in all areas of industrial measurement engineering.

Admittance probes have no minimum distances or dead band in which measurement is not possible.

Whereas partly insulated versions are predominantly used for solids, fully insulated versions are preferred for liquids.

Corrosive and adhesive products

Implementation in very adhesive or corrosive products is no problem. Since the admittance measuring principle places no special requirements on mounting, a host of different applications can be equipped with VEGACAL series 60 probes.

Wide application range

With measuring ranges up to 32 m (105 ft), the sensors are well suited for tall vessels. Temperatures up to 200 °C (392 °F) and pressures from vacuum to 64 bar (928 psig) cover a wide range of applications.

1.2 Application examples

Bulk solids silo

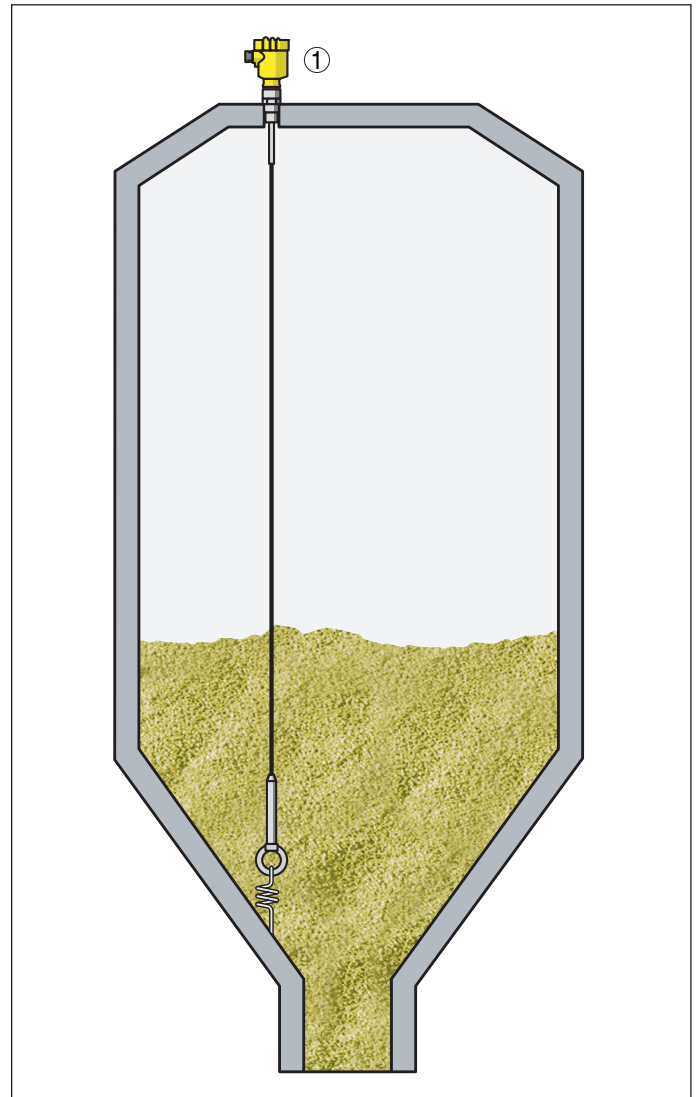


Fig. 2: High solid silo

- 1 VEGACAL 65 in solid silo

In the building industry, cement and additives are stored in tall silos. VEGACAL admittance sensors are used in silos up to 32 m (105 ft) high. In smaller silos where no lateral forces arise, it is also possible to use rod probes.

During the filling of the silo, large amounts of dust and noise are generated. Depending on the consistency of the solid and the kind of filling, the material cones that form can be very different. Admittance probes are not influenced by these conditions, and as a result, filling levels are always measured reliably.

The flexible suspension cable avoids excessive mechanical loads caused by movements of the bulk material.

To prevent the electrode from touching the vessel wall, the cable probe should be firmly anchored. In our line of accessories, you can find a straining spring which can be applied to avoid cable overload when anchoring.

Advantages:

- Insensitive to filling noise
- Wide application range
- Rugged construction
- High abrasion resistance

Wall mounting

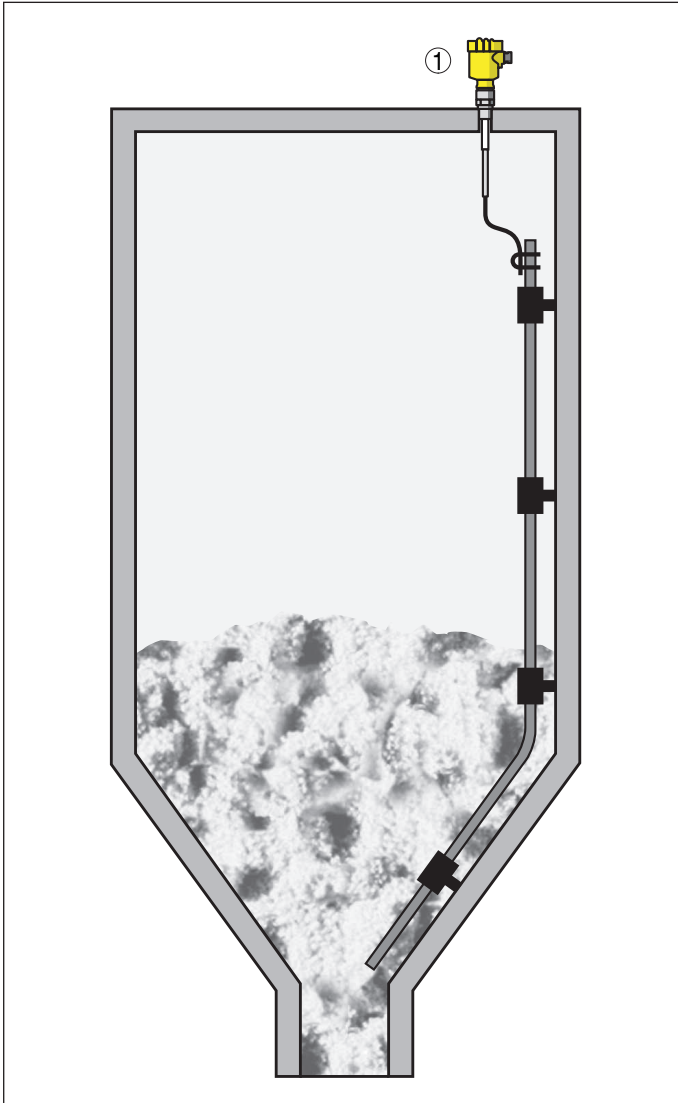


Fig. 3: Lateral wall mounting in the solid silo

1 VEGACAL 65 with probe by the customers

If strong abrasion is expected in the silo or the mechanical forces acting on the probe are too large, an electrode built by the user can be implemented to increase the service life of the measuring system. The contact to the measuring probe is usually made at the top, and is accomplished with e.g. pipe clamps or a screwed fastening. But it can actually be located anywhere along the entire length of the electrode (brought in laterally or from below). It is only important that electrode be completely isolated from the vessel and installed at a min. distance of approx. 200 mm from the wall.

Advantages:

- Rugged - therefore long service life
- independent of the mounting position
- Unaffected by the shape of the material cone
- No dead bands
- Low min. distance

2 Type overview

VEGACAL 62



VEGACAL 65



VEGACAL 66





Preferred applications	Solids, non-conductive liquids	Solids, non-conductive liquids	Solids, liquids
Version	Rod - partly insulated	Cable - partly insulated	Cable - insulated
Insulation	PTFE	PA	PTFE
Length	0.2 ... 6 m (0.656 ... 19.69 ft)	0.4 ... 32 m (1.312 ... 104.99 ft)	0.4 ... 32 m (1.312 ... 104.99 ft)
Process fitting	Thread from G $\frac{3}{4}$, flanges	Thread from G1, flanges	Thread from G $\frac{3}{4}$, flanges
Process temperature	-50 ... +200 °C (-58 ... +392 °F)	-50 ... +200 °C (-58 ... +392 °F)	-50 ... +150 °C (-58 ... +302 °F)
Process pressure	-1 ... 64 bar/-100 ... 6400 kPa (-14.5 ... 928 psig)	-1 ... 64 bar/-100 ... 6400 kPa (-14.5 ... 928 psig)	-1 ... 40 bar/-100 ... 4000 kPa (-14.5 ... 580 psig)



VEGACAL 67






Preferred applications	Bulk solids under high temperatures
Version	Rod - partly insulated, cable - partly insulated
Insulation	Ceramic
Length	Rod: 0.28 ... 6 m (0.919 ... 19.69 ft) Cable: 0.5 ... 40 m (1.64 ... 131.23 ft)
Process fitting	Thread from G1½
Process temperature	-50 ... +400 °C (-58 ... +752 °F)
Process pressure	-1 ... 16 bar/-100 ... 1600 kPa (-14.5 ... 232 psig)

3 Housing overview

Plastic PBT		
Protection rating	IP 66/IP 67	IP 66/IP 67
Version	Single chamber	Double chamber
Application area	Industrial environment	Industrial environment

Aluminium		
Protection rating	IP 66/IP 67, IP 66/IP 68 (1 bar)	IP 66/IP 67, IP 66/IP 68 (1 bar)
Version	Single chamber	Double chamber
Application area	Industrial environment with increased mechanical stress	Industrial environment with increased mechanical stress

Stainless steel 316L			
Protection rating	IP 66/IP 67	IP 66/IP 67, IP 66/IP 68 (1 bar)	IP 66/IP 67, IP 66/IP 68 (1 bar)
Version	Single chamber, electropolished	Single chamber, precision casting	Double chamber, precision casting
Application area	Aggressive environment, food processing, pharmaceutical	Aggressive environment, extreme mechanical stress	Aggressive environment, extreme mechanical stress

4 Mounting instructions

Pressure/Vacuum

The process fitting must be sealed if there is gauge or low pressure in the vessel. Check if the seal material is resistant against the measured product and the process temperature.

Insulating measures in metal vessels such as e.g. covering the thread with teflon tape can interrupt the necessary electrical connection to the vessel. Ground the probe on the vessel.

Mounting socket

In adhesive products, the probe should protrude into the vessel (horizontal mounting), to avoid buildup. In such cases, avoid sockets for flanges and threaded fittings.

Inflowing medium

If VEGACAL is mounted in the filling stream, unwanted false measurement signals can be generated. For this reason, mount VEGACAL at a position in the vessel where no disturbances, e.g. from filling openings, agitators, etc., can occur.

This applies particularly to instrument versions with a longer probe.

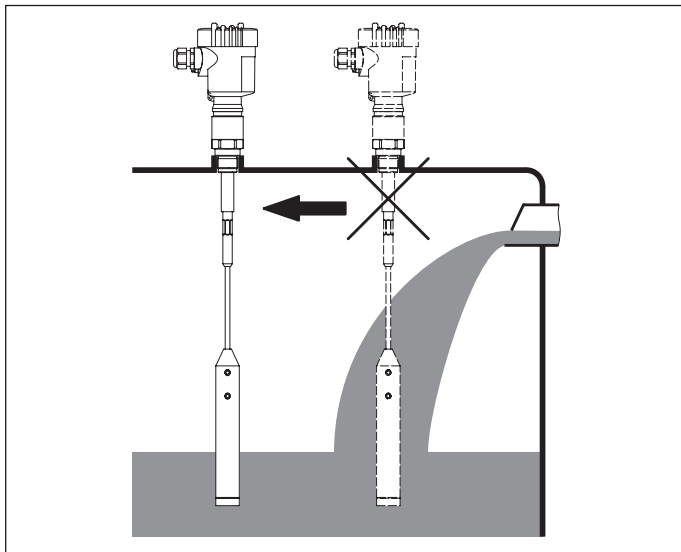


Fig. 15: Inflowing medium

Tensile load

If the cable version is used, make sure the max. tensile load of the suspension cable is not exceeded. Also keep the permissible roof load of your vessel in mind. This should be considered especially when using the instrument for very heavy solids and long meas. lengths. The max. permissible tensile load is stated in chapter "Technical data".

Material cone

Material cones can form in silos containing bulk solids, thereby altering the measuring result. Please keep this in mind when installing the sensor in the vessel. We recommend selecting an installation location where the probe detects an average value of the material cone.

The probe must be mounted in a way that takes the arrangement of the filling and emptying apertures into account.

To compensate measurement errors caused by the material cone in cylindrical vessels, the sensor must be mounted at a distance of $d/6$ from the vessel wall.

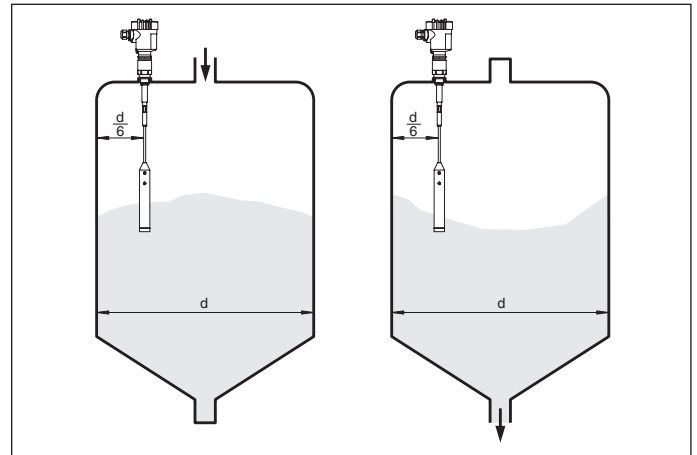


Fig. 16: Filling and emptying centred

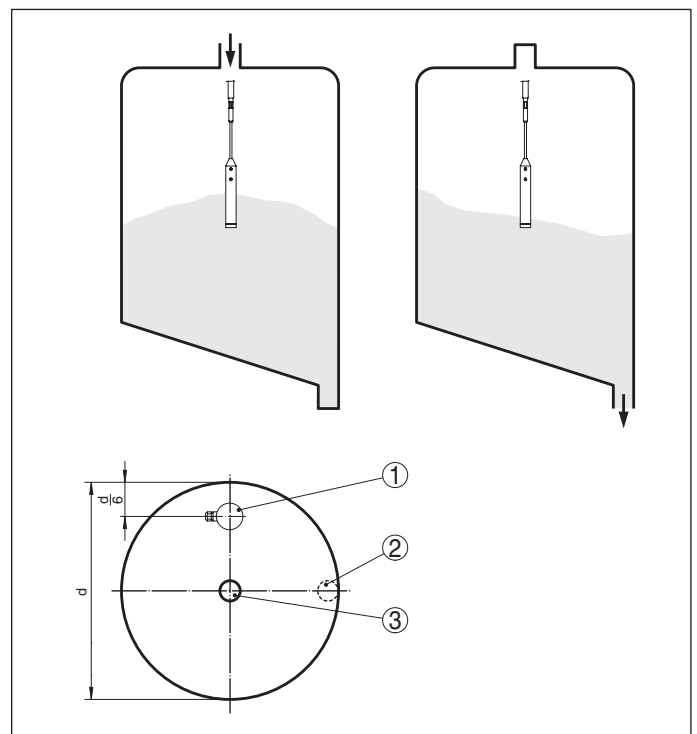


Fig. 17: Filling in the centre, emptying laterally

- 1 VEGACAL
- 2 Discharge opening
- 3 Filling opening

Vessel forms

If possible, the admittance probe should be mounted vertically or parallel to the counter electrode. This applies particularly to applications in non-conductive products.

In cylindrical tanks, spherical tanks or other asymmetrical tank forms, nonlinear level values are generated due to the varying distance to the vessel wall.

Vessel material

Metal vessel

Make sure that the mechanical connection of the probe to the vessel is electrically conductive to ensure sufficient grounding.

Use conductive seals, such as those made of copper or lead, etc. Insulating measures, such as covering the thread with Teflon tape, can interrupt the necessary electrical connection with metal vessels. For this reason, ground the probe on the vessel or use a conductive seal material.

Non-conductive vessels

In non-conductive vessels, e.g. plastic tanks, the second pole of the capacitor must be provided separately, e.g. in the form of a concentric tube. To ensure sufficient grounding in concrete vessels, you should connect the ground terminal of the measuring probe to the steel reinforcement of the vessel.

Corrosive, abrasive products

Various isolating materials are available for very corrosive or abrasive products. If metal is not chemically resistant to the medium, use a plated flange.

Condensation

If condensation forms on the vessel top, the resulting liquid draining off can cause measurement errors (bridging) particularly with partly insulated probes.

For that reason, use a screening tube. The screening tube is permanently attached to the probe and must be specified in the order. The length of the screening tube depends on the amount of condensate and its flow behaviour.

Operating temperatures

If the housing is subject to high ambient temperatures, you have to either use a temperature adapter or disconnect the electronics from the probe and install it in a separate housing at a cooler place (from a process temperature of 200 °C).

With process temperatures up to 300 °C you can use a high temperature probe. With temperatures up to 400 °C, the electronics must be additionally located in a separate housing.

Make sure that the probe is not covered by an existing vessel insulation.

The temperature ranges of the probes are listed in chapter "Technical data".

Fasten

Rod versions

During operation, the probe must not touch any installations or the vessel wall. The measured value can also change if the distance to the vessel wall changes considerably. If necessary, secure the end of the probe (insulated).

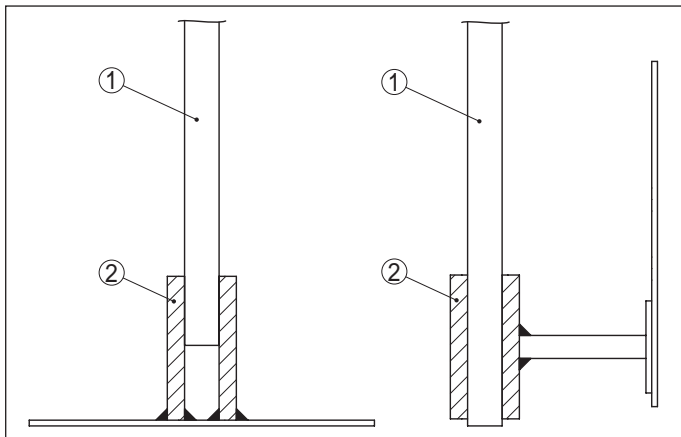


Fig. 18: Fasten the probe

- 1 Probe - fully insulated
- 2 Metal socket
- 3 Probe - bare
- 4 Plastic or ceramic socket

Cable versions

Long cable versions are particularly susceptible to product movement, i.e. they may touch the vessel wall or "swim" to the top of the measured product. For that reason, the measuring probe should be firmly secured.

In the gravity weight there is a thread (M12), e.g. for a ring bolt (article no. 2.27424). The thread is already insulated in the gravity weight.

Make sure that the probe cable is not completely taut. Avoid tensile loads on the cable. In our line of accessories you will find a straining spring that

can be applied to avoid cable overload.

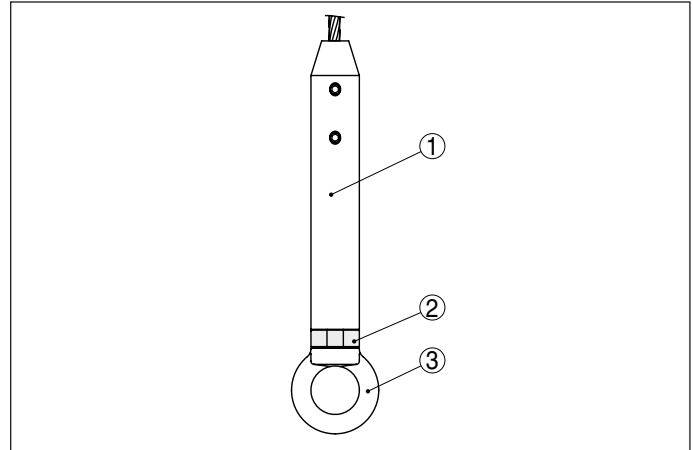


Fig. 19: Fasten the probe

- 1 Gravity weight (316L)
- 2 Threaded insert M12 insulated, of PEEK
- 3 Ring bolt M12 of 316L (article no. 2.27423)

In vessels with conical bottom it can be advantageous to mount the sensor in the centre of the vessel, as measurement is then possible down to the bottom.

Measurement is not possible over the length of the gravity weight of the fully insulated probe. The measuring range of the probe ends at the upper edge of the gravity weight.

Protective cover

To protect the sensor against pollution and strong heat due to the sun, you can snap a weather protective cover onto the sensor housing.

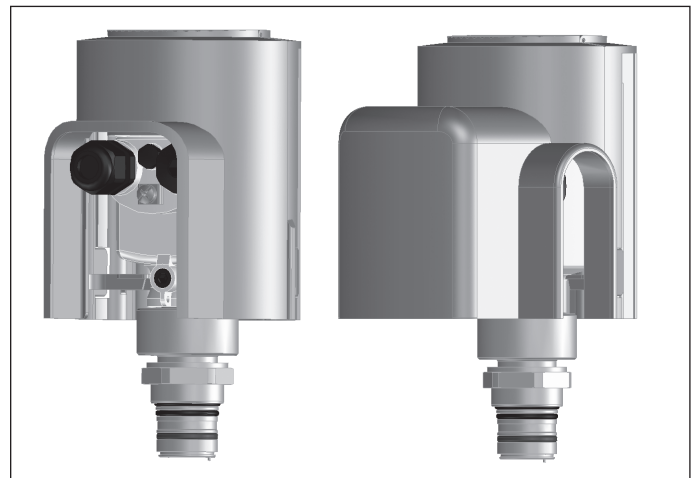


Fig. 20: Weather protection cover in different versions

5 Electrical connection

5.1 General requirements

The supply voltage range can differ depending on the instrument version. You can find exact specifications in chapter "Technical data".

The national installation standards as well as the valid safety regulations and accident prevention rules must be observed.



In hazardous areas you must take note of the respective regulations, conformity and type approval certificates of the sensors and power supply units.

5.2 Voltage supply

General information

Supply voltage and current signal are carried on the same two-wire cable. The requirements on the power supply are specified in chapter "Technical data".

Two-wire 4 ... 20 mA/HART, > 4 ... < 20 mA

The VEGA power supply units VEGATRENN 149AEx, VEGASTAB 690, VEGADIS 371 as well as VEGAMET signal conditioning instruments are suitable for power supply. When one of these instruments is used, a reliable separation of the supply circuits from the mains circuits according to DIN VDE 0106 part 101 is ensured for the sensor.

Profibus PA

Power is supplied by a Profibus DP/PA segment coupler or a VEGALOG 571 EP input card.

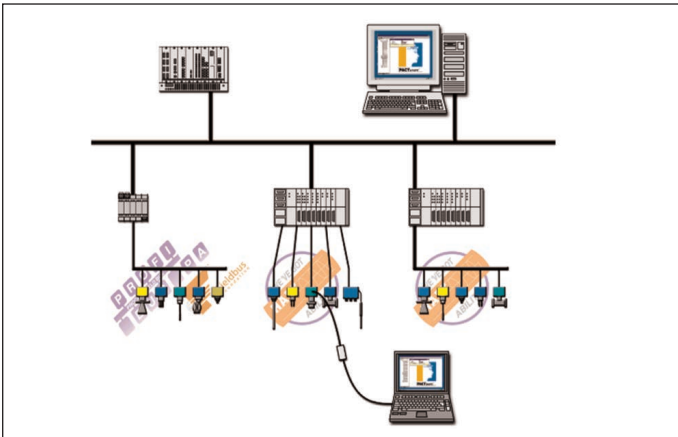


Fig. 21: Integration of instruments in a Profibus PA system via segment coupler DP/PA or data recording systems with Profibus PA input card

Foundation Fieldbus

Power supply via the H1 Fieldbus cable.

5.3 Connection cable

General information

The sensors are connected with standard cable without screen. An outer cable diameter of 5 ... 9 mm ensures the seal effect of the cable entry.

Two-wire 4 ... 20 mA/HART, > 4 ... < 20 mA

If electromagnetic interference is expected, screened cable should be used for the signal lines.

Profibus PA, Foundation Fieldbus

The installation must be carried out according to the appropriate bus specification. The sensor is connected respectively with screened cable according to the bus specification. Make sure that the bus is terminated via appropriate terminating resistors.

For power supply, an approved installation cable with PE conductor is also required.



In Ex applications, the corresponding installation regulations must be noted for the connection cable.

5.4 Connection of the cable screen and grounding

Two-wire 4 ... 20 mA/HART, > 4 ... < 20 mA

The cable screen must be connected on both ends to ground potential. If potential equalisation currents are expected, the connection on the evaluation side must be made via a ceramic capacitor (e.g. 1 nF, 1500 V).

Profibus PA, Foundation Fieldbus

In systems with potential separation, the cable screen is connected directly to ground potential on the power supply unit, in the connection box and directly on the sensor.

In systems without potential equalisation, connect the cable screen directly to ground potential only at the power supply unit and at the sensor - do not connect to ground potential in the connection box or T-distributor.

5.5 Wiring plan

Single chamber housing

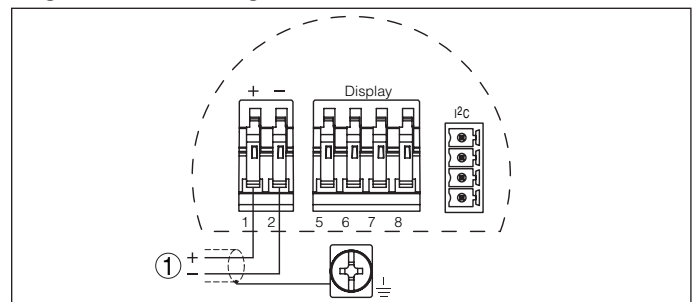


Fig. 22: Connection HART two-wire, Profibus PA, Foundation Fieldbus

1 Voltage supply and signal output

Two-wire output > 4 ... < 20 mA

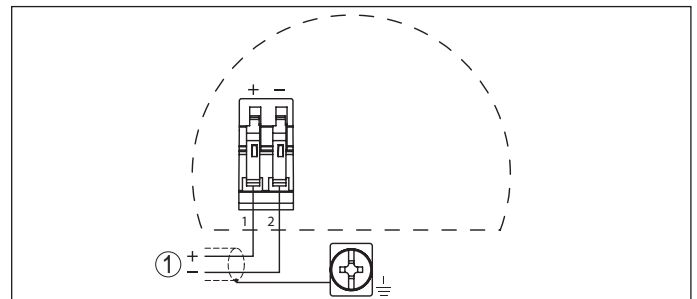


Fig. 23: Connection > 4 ... < 20 mA (not standardised) for connection to a signal conditioning instrument

1 Voltage supply/Signal output

Double chamber housing - two-wire

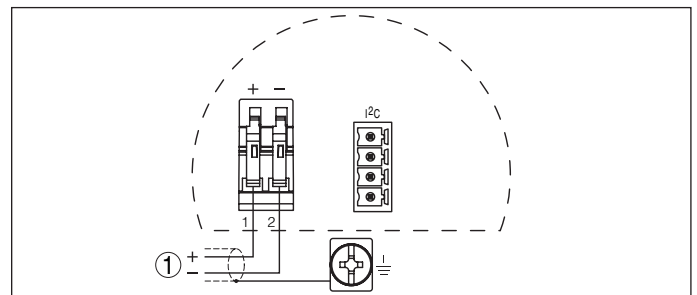


Fig. 24: Connection HART two-wire, Profibus PA, Foundation Fieldbus

1 Voltage supply and signal output

6 Adjustment

6.1 Adjustment on the measurement loop

Via the display and adjustment module through keys

The plug-in display and adjustment module is used for measured value indication, adjustment and diagnosis. It is equipped with an illuminated full dot matrix as well as four keys for adjustment.



Fig. 25: Display and adjustment module with single chamber housing

Via the display and adjustment module through magnetic pen

With the Bluetooth version of the display and adjustment module, the sensor can also be adjusted with the magnetic pen. This is done right through the closed lid (with inspection window) of the sensor housing.



Fig. 26: Display and adjustment module - with adjustment via magnetic pen

Via a PC with PACTware/DTM

The interface converter VEGACONNECT is required for connection of the PC. The converter is placed on the sensor instead of the display and adjustment module and connected to the USB interface of the PC.



Fig. 27: Connection of the PC via VEGACONNECT and USB

- 1 VEGACONNECT
- 2 Sensor
- 3 USB cable to the PC
- 4 PC with PACTware/DTM

PACTware is an adjustment software for configuration, parameter adjustment, documentation and diagnosis of field devices. The corresponding device drivers are called DTMs.

6.2 Operation in the measurement loop environment - wireless via Bluetooth

Via a smartphone/tablet

The display and adjustment module with integrated Bluetooth functionality allows wireless connection to smartphones/tablets with iOS or Android operating system. The adjustment is carried out via the VEGA Tools app from the Apple App Store or Google Play Store.

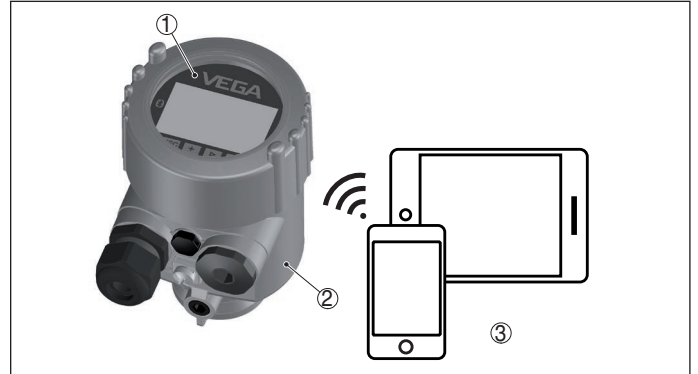


Fig. 28: Wireless connection to smartphones/tables

- 1 Display and adjustment module
- 2 Sensor
- 3 Smartphone/Tablet

Via a PC with PACTware/DTM

The wireless connection from the PC to the sensor is carried out via the Bluetooth USB adapter and a display and adjustment module with integrated Bluetooth function. The adjustment is carried out via the PC with PACTware/DTM.



Fig. 29: Connection of the PC via Bluetooth adapter

- 1 Display and adjustment module
- 2 Sensor
- 3 Bluetooth USB adapter
- 4 PC with PACTware/DTM

6.3 Adjustment carried out at position remote from the measuring point - wired

Via external display and adjustment units

For this, the external display and adjustment units VEGADIS 81 and 82 are available. The adjustment is carried out via the keys of the built-in display and adjustment module.

The VEGADIS 81 is mounted at a distance of 50 m from the sensor and directly to the sensor electronics. VEGADIS 82 is looped directly into the signal cable at any point.

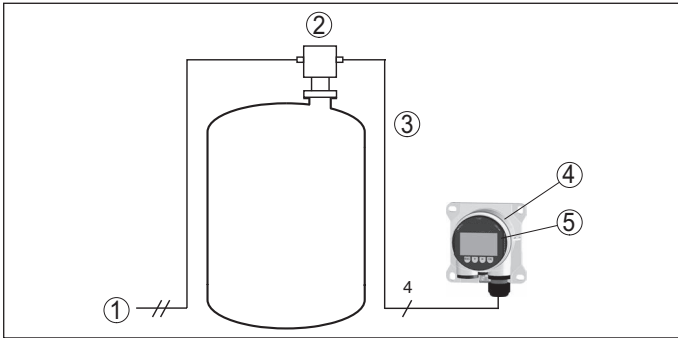


Fig. 30: Connection of VEGADIS 81 to the sensor

- 1 Voltage supply/Signal output sensor
- 2 Sensor
- 3 Connection cable sensor - external display and adjustment unit
- 4 External display and adjustment unit
- 5 Display and adjustment module

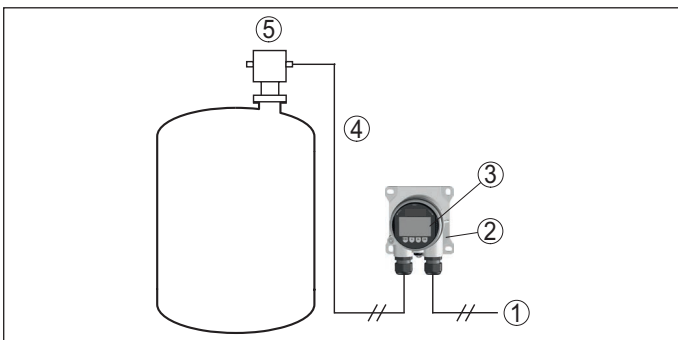


Fig. 31: Connection of VEGADIS 82 to the sensor

- 1 Voltage supply/Signal output sensor
- 2 External display and adjustment unit
- 3 Display and adjustment module
- 4 ... 20 mA/HART signal cable
- 5 Sensor

Via a PC with PACTware/DTM

The sensor adjustment is carried out via a PC with PACTware/DTM.

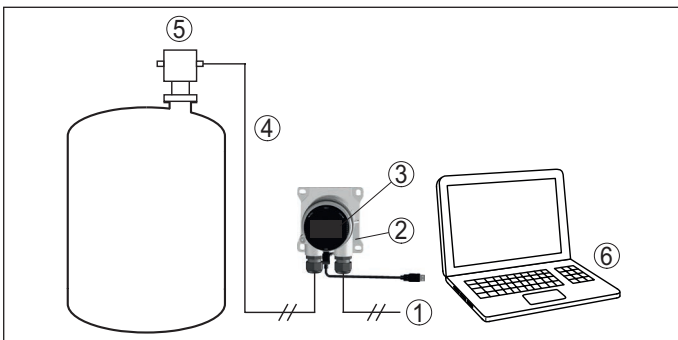


Fig. 32: Connection of VEGADIS 82 to the sensor, adjustment via PC with PACTware

- 1 Voltage supply/Signal output sensor
- 2 External display and adjustment unit
- 3 VEGACONNECT
- 4 ... 20 mA/HART signal cable
- 5 Sensor
- 6 PC with PACTware/DTM

6.4 Adjustment carried out at position remote from the measuring point - wireless through mobile network

As an option, the radio module PLICSMOBILE can be mounted into a plics® sensor with double chamber housing. It is used for transmission of measured values and for remote parameter adjustment of the sensor.

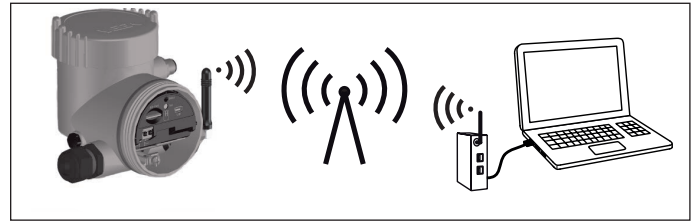


Fig. 33: Transmission of measured values and remote parameter adjustment of the sensor via mobile phone network.

6.5 Alternative adjustment programs

DD adjustment programs

Device descriptions as Enhanced Device Description (EDD) are available for DD adjustment programs such as, for example, AMS™ and PDM.

The files can be downloaded at www.vega.com/downloads under "Software".

Field Communicator 375, 475

Device descriptions for the instrument are available as EDD for parameter adjustment with the Field Communicator 375 or 475.

For the integration of the EDD in the Field Communicator 375 or 475, the software "Easy Upgrade Utility" is required which is available from the manufacturer. This software is updated via the Internet and new EDDs are automatically taken over into the device catalogue of this software after they are released by the manufacturer. They can then be transferred to a Field Communicator.

7 Dimensions

Housing

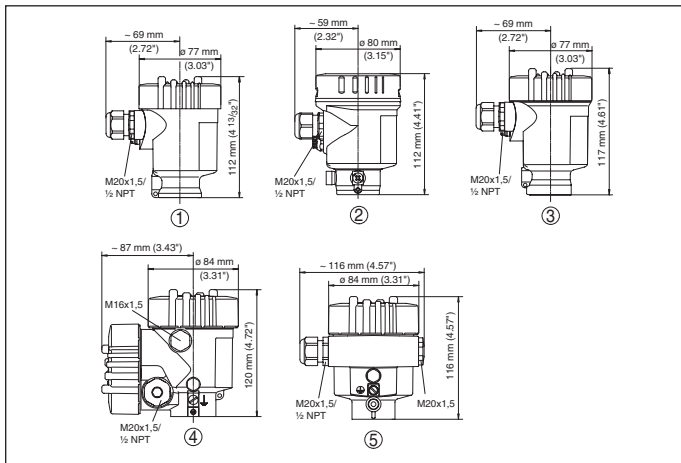


Fig. 34: Housing versions

- 1 Plastic housing
- 2 Stainless steel housing
- 3 Stainless steel housing - precision casting
- 4 Aluminium double chamber housing¹⁾
- 5 Aluminium housing

VEGACAL 62

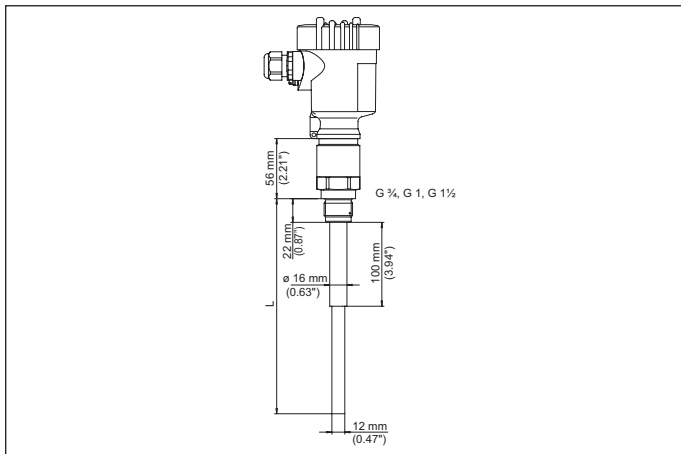


Fig. 35: VEGACAL 62 - threaded version

L Sensor length, see chapter "Technical data"

VEGACAL 65

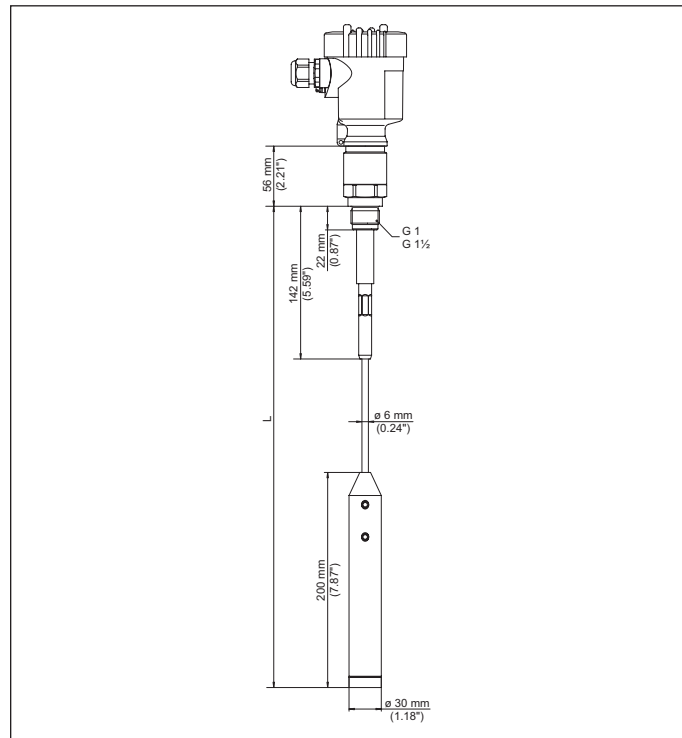


Fig. 36: VEGACAL 65 - threaded version

VEGACAL 66

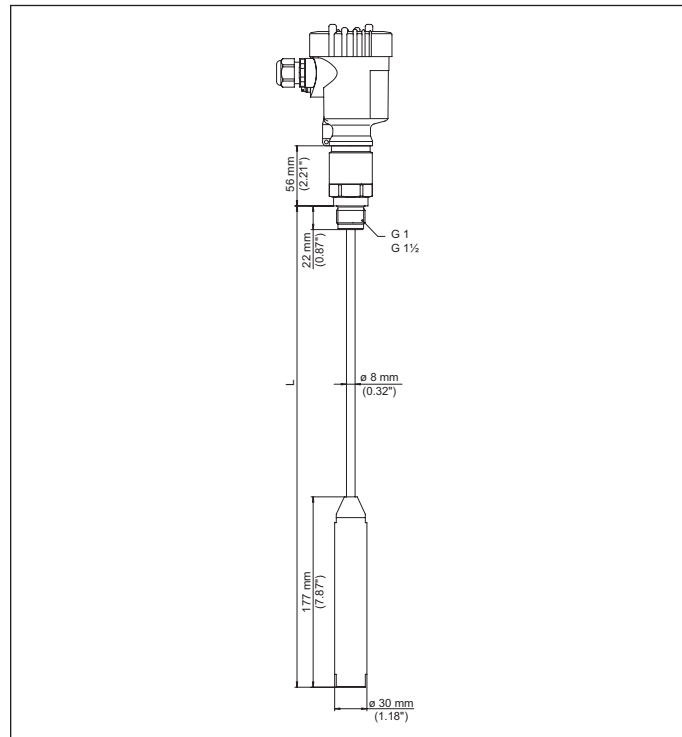


Fig. 37: VEGACAL 66 - threaded version

L Sensor length, see chapter "Technical data"

¹⁾ Not with electronics version two-wire output > 4 ... < 20 mA.

VEGACAL 67

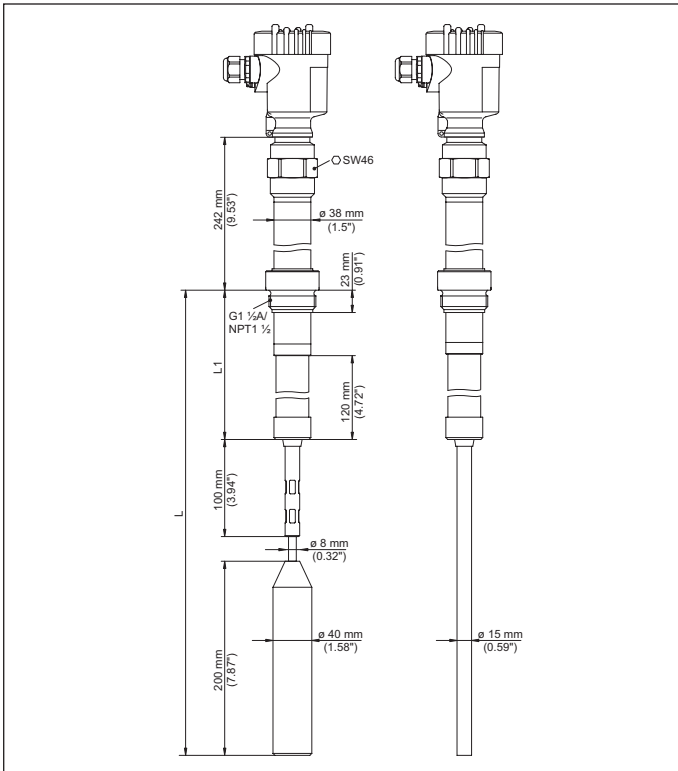


Fig. 38: VEGACAL 67 - threaded version G1½ and 1½ NPT, -50 ... +300 °C (-58 ... +572 °F)

Version -50 ... +400 °C (-58 ... +752 °F) only with external housing.
See supplementary instructions manual "External housing - VEGACAP, VEGACAL"

L Sensor length, see chapter "Technical data"

L1 Supporting tube length, see chapter "Technical data"



All statements concerning scope of delivery, application, practical use and operating conditions of the sensors and processing systems correspond to the information available at the time of printing.
Subject to change without prior notice

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