Product information

Capacitive

Level detection in liquid

VEGACAP 62
VEGACAP 63
VEGACAP 64
VEGACAP 66
VEGACAP 69

Document ID: 29983

Contents

1 Description of the measuring principle 3
2 Type overview 5
3 Housing overview 6
4 Mounting instructions 7
5 Electrical connection 9
6 Adjustment 11
7 Dimensions 12

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.

29983-EN-160930

1 Description of the measuring principle

Measuring principle

The VEGACAP series consists of capacitive sensors for level detection.

The instruments are designed for industrial use in all areas of process technology and are universally applicable.

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

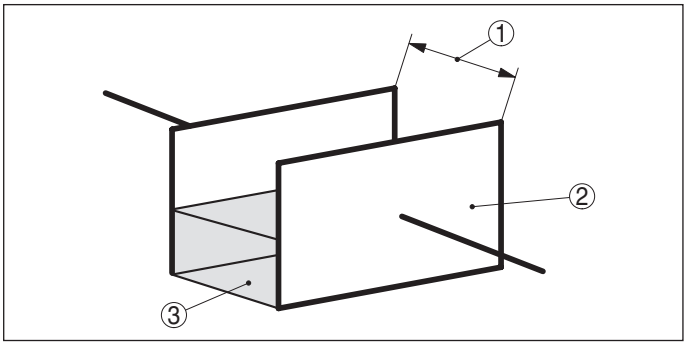

Fig. 1: Functional principle - Plate capacitor

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.

A level change causes a change in capacitance which is processed by the electronics and converted into an appropriate switching command.

The more constant the conductivity, concentration and temperature of a product, the better the conditions for capacitive 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.

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

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

1.2 Application examples

Non-conductive liquids

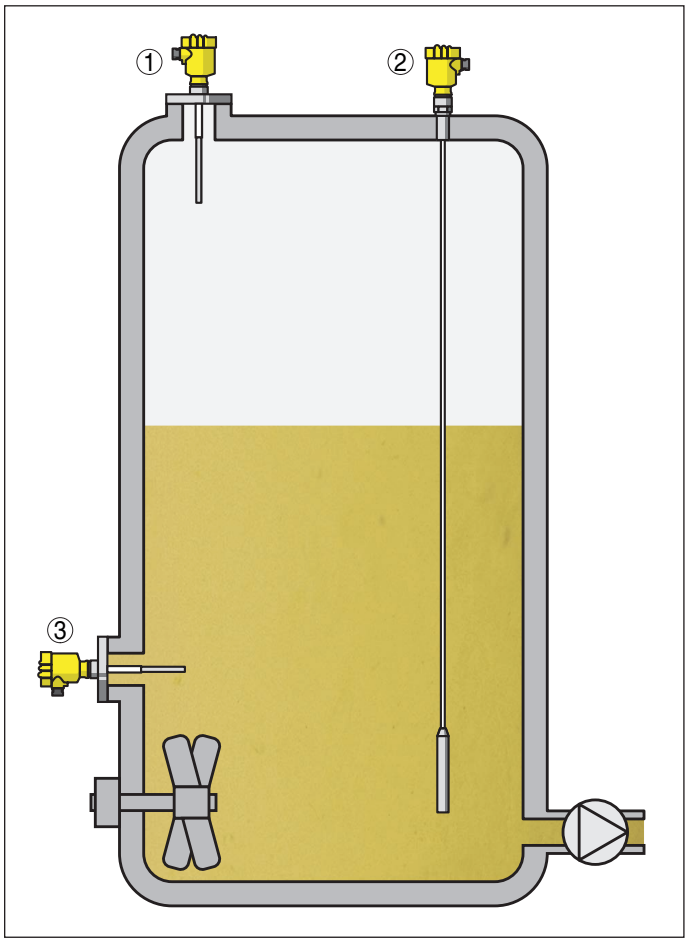

Fig. 2: Level detection in non-conductive liquids

1 VEGACAP 62 level switch for full signalling/overfill protection
2 VEGACAP 66 level switch for empty signalling/dry run protection
3 VEGACAP 62 level switch for level detection - laterally mounted

Capacitive level switches have proven themselves for application in non-conductive liquids (dielectric value < 5). They are used as overfill protection systems (WHG) as well as dry run protection systems. The mounting position is arbitrary (from above, laterally or from below). Typical products are hydrocarbons or solvents.

Laterally mounted or applied with an angled probe from above, the instrument switches reliably and very precisely, even in changing products. When mounted from above, the switching point can be changed afterwards and adapted to the application. By compensating its own inherent capacitance, the instrument is able to detect products with dielectric values >1.5 reliably.

Advantages:

- Insensitive to buildup
- Overfill protection/Dry run protection
- Maintenance-free
- Very precise when mounted laterally or used with angled probe

Conductive liquids

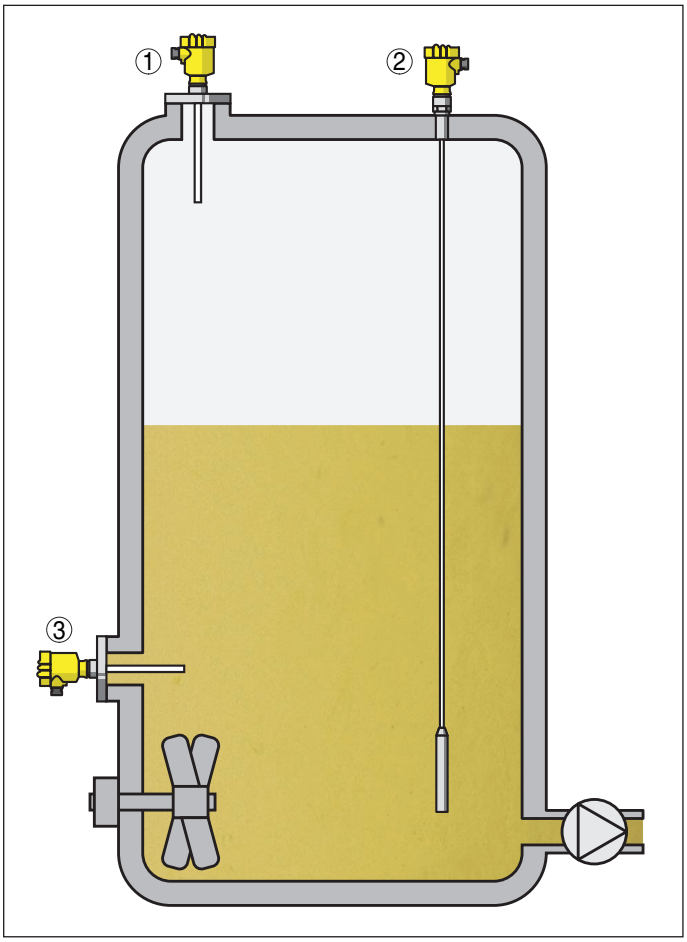

Fig. 3: Level detection in conductive liquids

1 VEGACAP 63 level switch for full signalling/overfill protection
2 VEGACAP 66 level switch for empty signalling/dry run protection
3 VEGACAP 63 level switch for level detection - laterally mounted

As a rule, fully insulated probes are used in conductive liquids and products with a dielectric value > approx. 5.

If the switching point must be very precise, we recommend lateral mounting - a horizontally mounted rod gets covered quickly over its entire length and has a much more reliable switching function.

To achieve an extremely accurate switching point, a partly insulated probe can be implemented. When the level reaches the set limit, the sensor generates a short circuit and thus provides a reliable, reproducible signal.

Advantages:

- Chemically highly resistant materials
- Maintenance-free
- Plated flanges
- Simple setup

Conductive, adhesive liquids

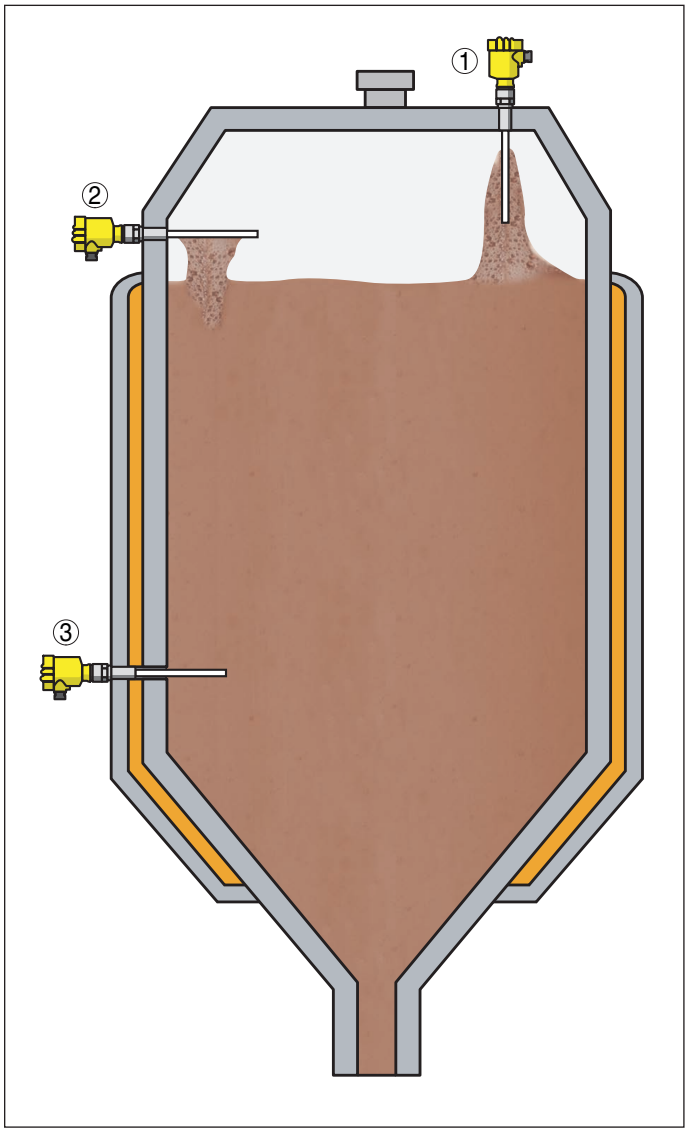

Fig. 4: Level detection in non-conductive, adhesive liquids

1 VEGACAP 63 level switch for full signalling/overfill protection
2 VEGACAP 64 level switch for full signalling/overfill protection - laterally mounted
3 VEGACAP 64 level switch for empty signalling/dry run protection - laterally mounted

The capacitive level switch VEGACAP 64 is particularly suitable for lateral installation as overfill and dry run protection in adhesive, conductive products. Due to the mechanical construction with active screening segment and active measuring tip, buildup several centimeters thick does not influence the measuring result. Pinpoint switching accuracy is always ensured.

If bridging on the process fittings can be precluded through vertical installation, the configuration with active screen segment is not necessary. For vertical installation in such adhesive products, a fully insulated VEGACAL 63 rod probe is sufficient as overfill protection.

Advantages:

- Suitable for very adhesive products
- Simple setup
- Maintenance-free
- Rugged construction
- Chemically highly resistant materials

2 Type overview

VEGACAP 62

VEGACAP 63

VEGACAP 64

Preferred applications	Liquids, non-conductive	Liquids, conductive	Liquids, conductive
Version	Rod - partly insulated	Rod - fully insulated	Rod - fully insulated
Insulation	PTFE	PTFE	PTFE
Length	0.2 … 6 m (0.656 … 19.69 ft)	0.2 … 6 m (0.656 … 19.69 ft)	0.2 … 4 m (0.656 … 13.12 ft)
Process fitting	Thread from G¾, flanges	Thread from G¾, flanges	Thread from G¾, flanges
Process temperature	-50 … +200 °C (-58 … +392 °F)	-50 … +200 °C (-58 … +392 °F)	-50 … +200 °C (-58 … +392 °F)
Process pressure	-1 … 64 bar/-100 … 6400 kPa (-14.5 … 928 psig)	-1 … 64 bar/-100 … 6400 kPa (-14.5 … 928 psig)	-1 … 64 bar/-100 … 6400 kPa (-14.5 … 928 psig)

VEGACAP 66

VEGACAP 69

Preferred applications	Solids, liquids	Liquids
Version	Cable - insulated	Double rod - fully insulated
Insulation	PTFE	FEP
Length	0.4 … 32 m (1.312 … 105 ft)	0.2 … 4 m (0.656 … 13.12 ft)
Process fitting	Thread from G¾, flanges	Flange (PP or PTFE)
Process temperature	-50 … +200 °C (-58 … +392 °F)	-40 … +100 °C (-40 … +212 °F)
Process pressure	-1 … 64 bar/-100 … 6400 kPa (-14.5 … 928 psig)	-1 … 2 bar/-100 … 200 kPa (-14.5 … 29 psig)

29983-EN-160930

3 Housing overview

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

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

4 Mounting instructions

Switching point
VEGACAP can be mounted in any position.

In case of horizontal installation, the instrument must be mounted in such a way that the probe is at the height of the requested switching point.

In case of vertical installation, the instrument must be mounted so that the probe is immersed approx. 50 … 100 mm in the product when the desired switching point is reached.

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.

Measuring range
Please note that with fully insulated cable probes, measurement in the area of the gravity weight is not possible (L - length of the gravity weight).

With fully insulated rod probes, measurement is not possible within the 20 mm of the probe tip (L - 20 mm).

If necessary, use a correspondingly longer meas. probe.

Filling opening
Install the meas. probe in such a way that the probe does not protrude directly into the filling stream. Should such an installation location be necessary, mount a suitable baffle above or in front of the probe.

Agitators
Due to agitators, equipment vibration or similar, the probe can be subjected to strong lateral forces. For this reason, do not use an overly long probe with VEGACAP, but check if you can mount a VEGACAP level switch on the side of the vessel in horizontal position.

Excessive system vibration or shocks, e.g. caused by agitators or turbulence in the vessel (e.g. from fluidisation) can cause the probe of VEGACAP to vibrate in resonance. This can lead to increased material stress. Should a longer rod probe be necessary, you can provide a suitable support or guy directly above the end of the probe to stabilise it.

Bare probes must have an insulated support, fully insulated ones can have a bare metallic support.

Inflowing medium
If VEGACAP is mounted in the filling stream, unwanted false measurement signals can be generated. For this reason, mount VEGACAP 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.

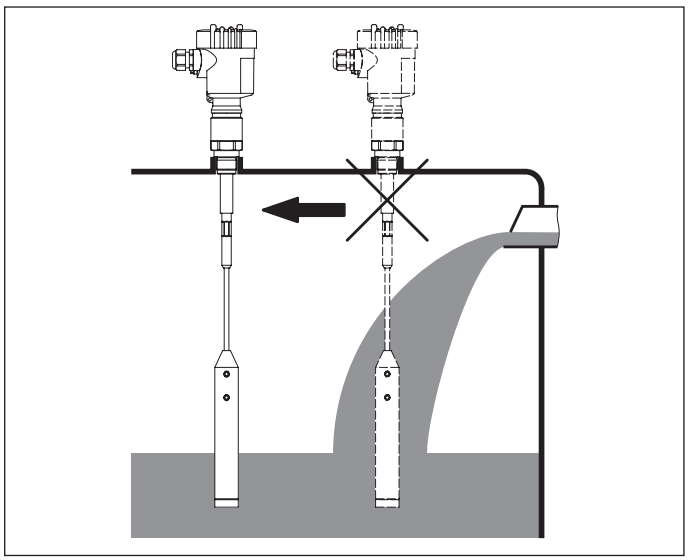

Fig. 14: Inflowing medium

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.

Length of the level detection probe
Keep in mind when ordering the instrument that when the switching point is reached the probe must be sufficiently immersed according to the desired filling level, and that the depth of immersion depends on the electrical properties (dielectric value) of the medium. An electrode for level detection in oil (dielectric value ~2) requires a considerably deeper immersion than one used in water (dielectric value ~81).

As a rule:

- Non-conductive products > 50 mm
- Conductive products > 30 mm

Lateral load
Make sure that the probe is not subjected to strong lateral forces. Mount the probe at a position in the vessel where no interfering influence, e.g. from agitators, filling opening etc. can occur. This applies particularly to very long rod and cable probes.

Product movement
Mount the probe in such a way that the probe cannot touch the vessel wall and that the screening tube cannot be bent or broken.

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 e.g. copper, lead etc.

Insulating measures such as e.g. covering the thread with teflon tape can interrupt the necessary electrical connection. If this is necessary, use the ground terminal on the housing to connect the instrument with the vessel.

Non-conductive vessels
In non-conductive vessels, e.g. plastic tanks, the second pole of the capacitor must be provided separately. Use a double rod electrode.

When using a standard probe, this can be e.g. the metal supporting structure of the vessel.

It might be necessary to attach a suitable grounding surface. Attach a very wide grounding surface outside on the vessel wall, e.g. wire textile laminated into the vessel wall or a metal foil glued to the outside of the vessel.

Connect the grounding surface to the ground terminal on the housing.

Rod probes
Install rod probes in such a way that the probe projects freely into the vessel. When the instrument is mounted in a tube or socket, buildup can form which impairs the measurement. This applies mainly to adhesive products.

Influencing factors
In practice, the dielectric value is subject to certain fluctuations. The following factors can influence of the capacitive measuring principle:

- Concentration (mixing ratio of the product - provided it is not conductive)
- Temperature
- Conductivity (below 50 µS/cm)

The more constant the above mentioned factors, the better the conditions for capacitive measurement. Changes in the conditions are generally not critical in products with high dielectric value.

If a very precise switching point is required, or if the the product changes or has a low dielectric value, we recommend lateral mounting - a horizontally mounted rod gets covered quickly over its entire length and has a much more reliable switching function.

You can either mount a standard measuring probe laterally or use an angled measuring probe.

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.

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*".

Dielectric constant
In products with low dielectric value and slight level changes you should try to increase the capacitance change. If the dielectric value is less than 1.5, special measures are necessary to ensure that the level is detected reliably. E.g. additional surfaces can be attached or a screening tube used with high sockets, etc.

For applications with high sockets and products with low dielectric value you can compensate the strong influence of the metal socket with a concentric tube.

Electrically conductive products react like products with very high dielectric value.

A detailed list with dielectric values is available on our homepage under "*Services - Downloads- Lists of measured products*".

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.

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.

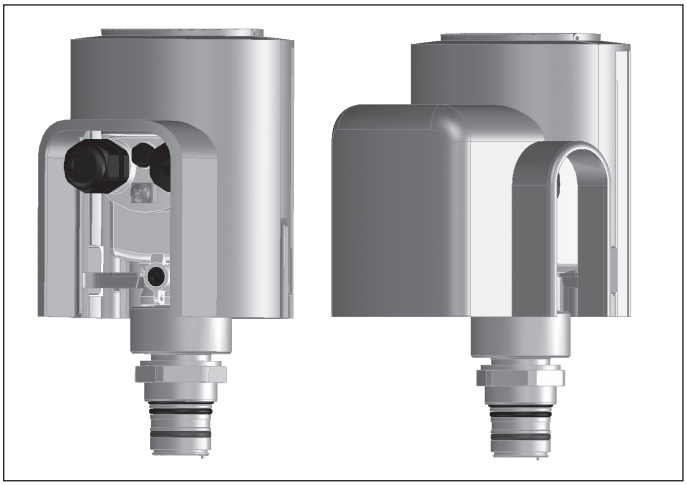

Fig. 15: Weather protection cover in different versions

5 Electrical connection

5.1 Preparing the connection

Note safety instructions
Always keep in mind the following safety instructions:

- Connect only in the complete absence of line voltage

Take note of safety instructions for Ex applications

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

Select power supply
Connect the operating voltage according to the following diagrams. Oscillators with relay output and contactless electronic switch are designed in protection class 1. To maintain this protection class, it is absolutely necessary that the ground conductor be connected to the internal ground terminal. Take note of the general installation regulations. As a rule, connect VEGACAP to vessel ground (PA), or in case of plastic vessels, to the next ground potential. On the side of the housing there is a ground terminal between the cable entries. This connection serves to drain off electrostatic charges. In Ex applications, the installation regulations for hazardous areas must be given priority.

The data for power supply are specified in chapter "*Technical data*".

Select connection cable
VEGACAP is connected with standard cable with round cross section. An outer cable diameter of 5 … 9 mm (0.2 … 0.35 in) ensures the seal effect of the cable gland.

If cable with a different diameter or wire cross section is used, exchange the seal or use an appropriate cable connection.

In hazardous areas, use only approved cable connections for VEGACAP.

Select connection cable for Ex applications

Take note of the corresponding installation regulations for Ex applications.

5.2 Wiring plan

Relay output
We recommend connecting VEGACAP in such a way that the switching circuit is open when there is a level signal, line break or failure (safe state).

The relays are always shown in non-operative condition.

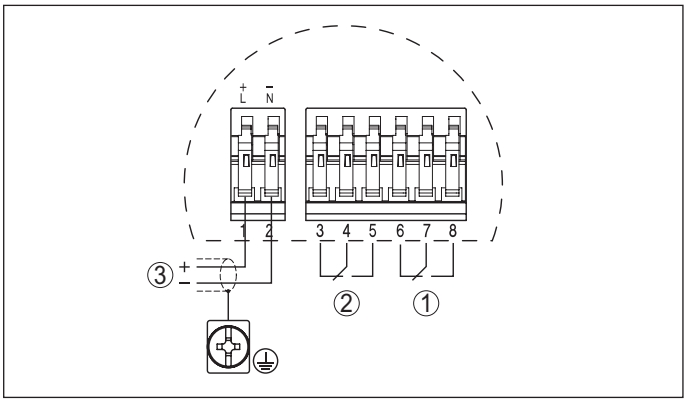

Fig. 16: Wiring plan, single chamber housing

1 Relay output
2 Relay output
3 Voltage supply

Transistor output
We recommend connecting VEGACAP in such a way that the switching circuit is open when there is a level signal, line break or failure (safe state).

The instrument is used to control relays, contactors, magnet valves, warning lights, horns as well as PLC inputs.

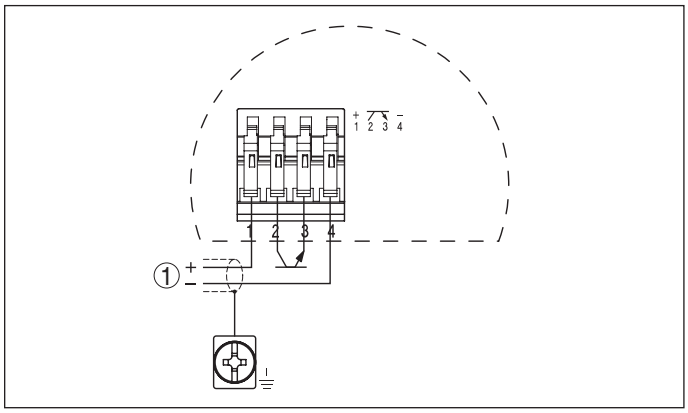

Fig. 17: Wiring plan, single chamber housing

1 Voltage supply

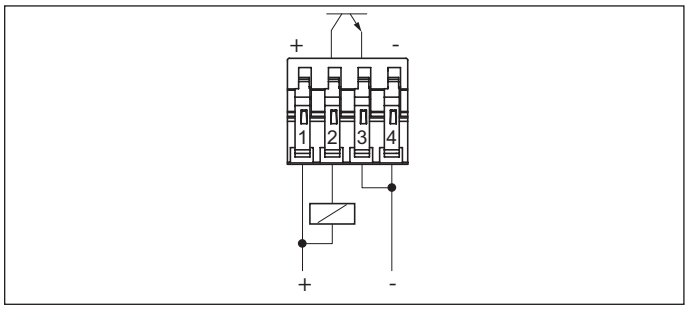

Fig. 18: NPN action

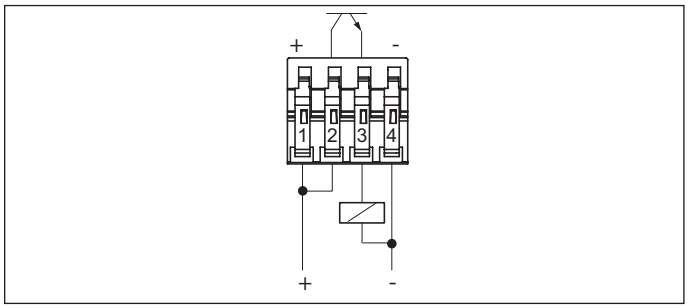

Fig. 19: PNP action

Contactless electronic switch
We recommend connecting VEGACAP in such a way that the switching circuit is open when there is a level signal, line break or failure (safe state).

The contactless electronic switch is always shown in non-operative condition.

The instrument is used for direct control of relays, contactors, magnet valves, warning lights, horns etc. It must not be operated without an intermediately connected load, because the electronics would be destroyed if connected directly to the mains. It is not suitable for connection to low voltage PLC inputs.

Domestic current is temporarily lowered below 1 mA after switching off the load so that contactors, whose holding current is lower than the constant domestic current of the electronics, are reliably switched off.

When VEGACAP is used as part of an overfill protection system according to WHG, also note the regulations of the general type approval.

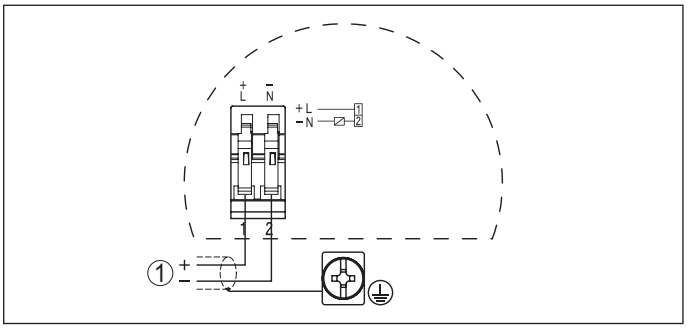

Fig. 20: Wiring plan, single chamber housing

1 Voltage supply

Two-wire output

We recommend connecting VEGACAP in such a way that the switching circuit is open when there is a level signal, line break or failure (safe state).

For connection to a VEGATOR signal conditioning instrument dto. Ex. The sensor is powered by the connected VEGATOR signal conditioning instrument. Further information is available in chapter "*Technical data*", "*Ex-technical data*" are available in the supplied "*Safety information manual*".

The wiring example is applicable for all suitable signal conditioning instruments.

Take note of the operating instructions manual of the signal conditioning instrument. Suitable signal conditioning instruments are listed in chapter "*Technical data*".

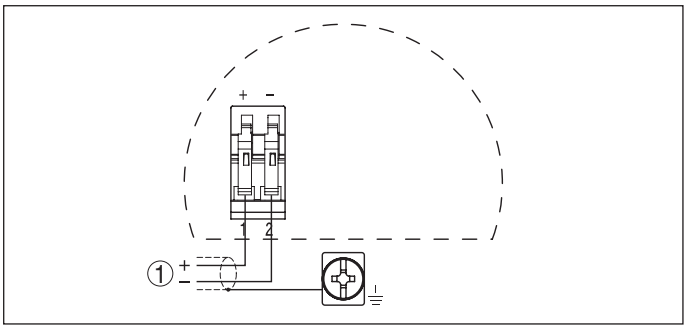

Fig. 21: Wiring plan, single chamber housing

1 Voltage supply

6 Adjustment

6.1 Adjustment, general

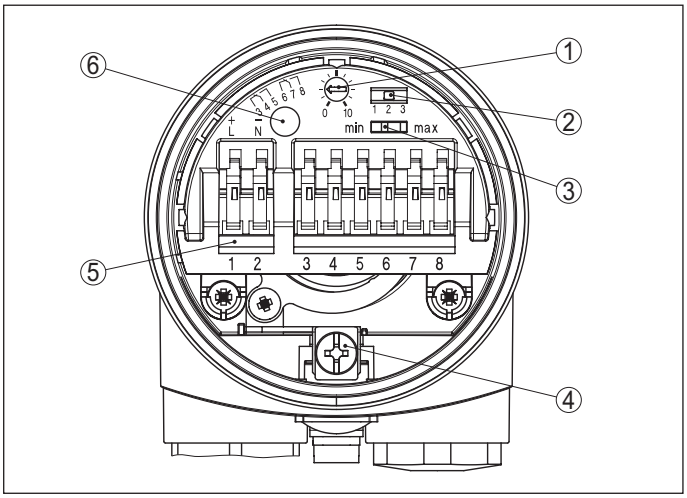

Fig. 22: Adjustment elements electronics module, e.g. relay output (CP60R)

1 Potentiometer for switching point adaptation (not with two-wire electronics)
2 Range switch
3 DIL switch for mode adjustment (not with two-wire electronics)
4 Ground terminal
5 Connection terminals
6 Control lamp

Switching point adaptation (1)
By using the potentiometer you can adapt the switching point of VEGACAP to the medium.

With two-wire electronics the switching point is adjusted on the signal conditioning instrument. For that reason there is no potentiometer.

Range switch (2)
Select the capacitance range of the probe with the mode switch.

With the potentiometer (1) and the mode switch (2) you can change the switching point of the probe or adapt the sensitivity of the probe to the electrical properties of the product and the conditions in the vessel.

This is necessary that the point level switch can for example also detect products with very low or very high dielectric constant reliably.

Capacitance range

- Range 1: 0 … 20 pF (sensitive)
- Range 2: 0 … 85 pF
- Range 3: 0 … 450 pF (insensitive)

Examples of dielectric values: air = 1, oil = 2, acetone = 20, water = 81 etc.

Turn the potentiometer (1) anticlockwise to make the probe more sensitive.

Mode adjustment (3)
With the mode adjustment (min./max.) you can change the switching condition of the output. You can set the required mode (max. - max. detection or overflow protection, min. - min. detection or dry run protection).

With two-wire electronics the mode is selected on the signal conditioning instrument. For that reason there is no mode switch.

LED display (6)
Diode for indication of the switching status (with plastic housing visible from outside).

7 Dimensions

Housing

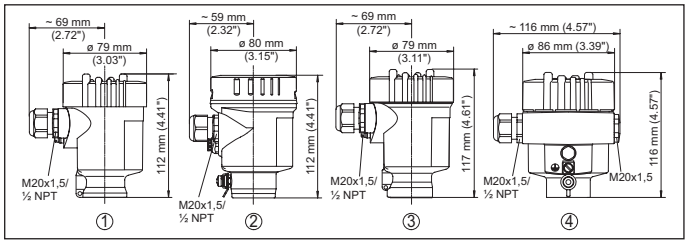

Fig. 23: Housing versions

1 Plastic housing
2 Stainless steel housing
3 Stainless steel housing - precision casting
3 Aluminium housing

VEGACAP 62

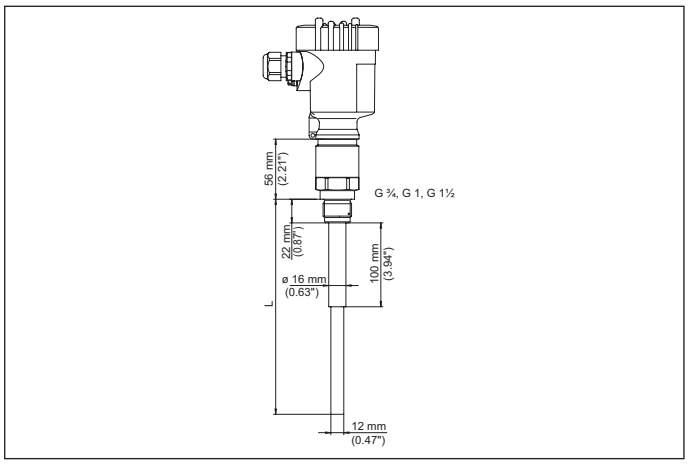

Fig. 24: VEGACAP 62 - threaded version

L Sensor length, see chapter "Technical data"

VEGACAP 63

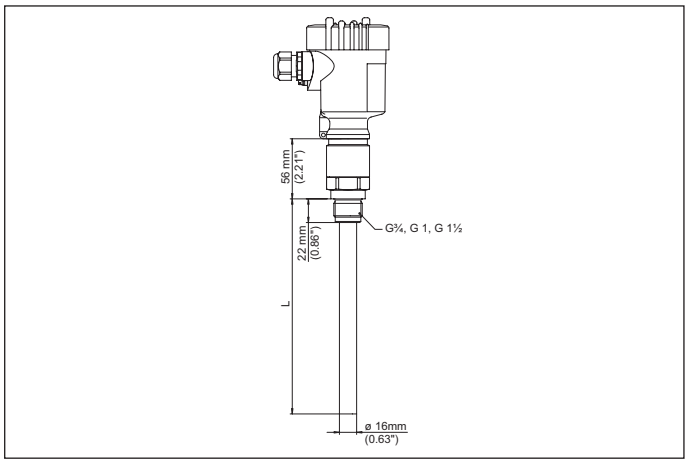

Fig. 25: VEGACAP 63 - threaded version

L Sensor length, see chapter "Technical data"

VEGACAP 64

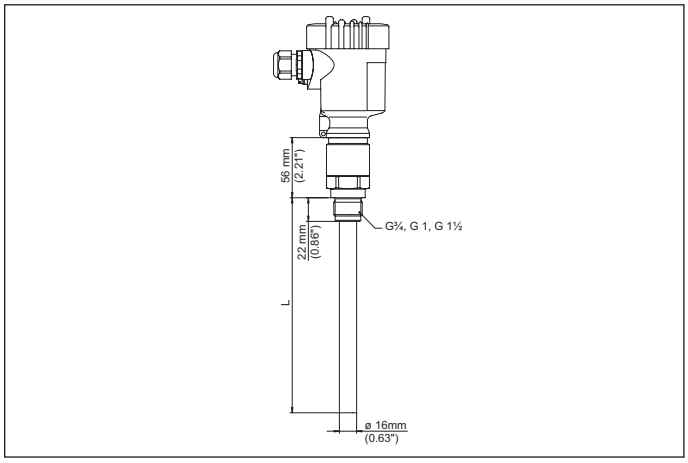

Fig. 26: VEGACAP 64 - threaded version

L Sensor length, see chapter "Technical data"

VEGACAP 66

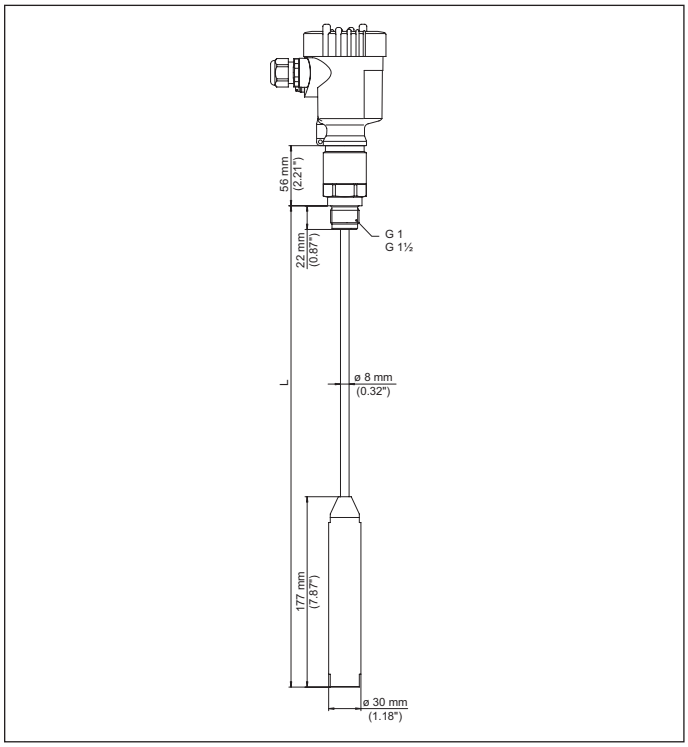

Fig. 27: VEGACAP 66 - threaded version

L Sensor length, see chapter "Technical data"

VEGACAP 69

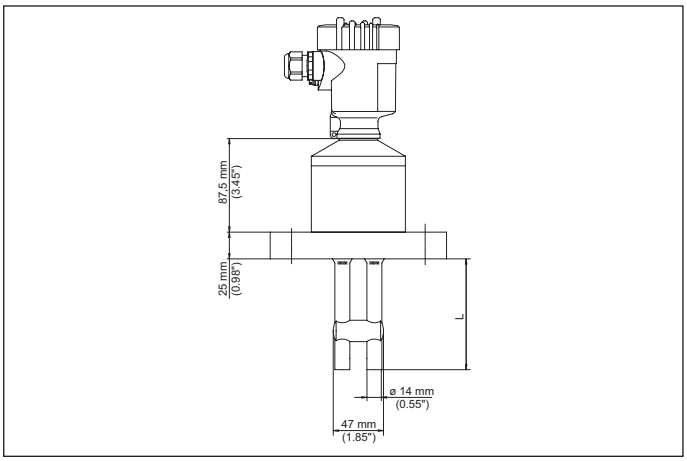

Fig. 28: VEGACAP 69

L Sensor length, see chapter "Technical data"

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