Operating Instructions

Capacitive high temperature probe for level measurement of bulk solids

VEGACAL 67

For connection to a controller

Document ID: 31761

Contents

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1 About this document

1.1 Function

This instruction provides all the information you need for mounting, connection and setup as well as important instructions for maintenance, fault rectification, the exchange of parts and the safety of the user. Please read this information before putting the instrument into operation and keep this manual accessible in the immediate vicinity of the device.

1.2 Target group

This operating instructions manual is directed to trained personnel. The contents of this manual must be made available to the qualified personnel and implemented.

1.3 Symbols used

Document ID
This symbol on the front page of this instruction refers to the Document ID. By entering the Document ID on www.vega.com you will reach the document download.

Information, note, tip: This symbol indicates helpful additional information and tips for successful work.

Note: This symbol indicates notes to prevent failures, malfunctions, damage to devices or plants.

Caution: Non-observance of the information marked with this symbol may result in personal injury.

Warning: Non-observance of the information marked with this symbol may result in serious or fatal personal injury.

Danger: Non-observance of the information marked with this symbol results in serious or fatal personal injury.

Ex applications
This symbol indicates special instructions for Ex applications.

- **List**
  The dot set in front indicates a list with no implied sequence.

1. **Sequence of actions**
   Numbers set in front indicate successive steps in a procedure.

Disposal
This symbol indicates special instructions for disposal.

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2 For your safety

2.1 Authorised personnel

All operations described in this documentation must be carried out only by trained, qualified personnel authorised by the plant operator.

During work on and with the device, the required personal protective equipment must always be worn.

2.2 Appropriate use

VEGACAL 67 is a sensor for continuous level measurement.

You can find detailed information about the area of application in chapter " *Product description*".

Operational reliability is ensured only if the instrument is properly used according to the specifications in the operating instructions manual as well as possible supplementary instructions.

2.3 Warning about incorrect use

Inappropriate or incorrect use of this product can give rise to application-specific hazards, e.g. vessel overfill through incorrect mounting or adjustment. Damage to property and persons or environmental contamination can result. Also, the protective characteristics of the instrument can be impaired.

2.4 General safety instructions

This is a state-of-the-art instrument complying with all prevailing regulations and directives. The instrument must only be operated in a technically flawless and reliable condition. The operator is responsible for the trouble-free operation of the instrument. When measuring aggressive or corrosive media that can cause a dangerous situation if the instrument malfunctions, the operator has to implement suitable measures to make sure the instrument is functioning properly.

The safety instructions in this operating instructions manual, the national installation standards as well as the valid safety regulations and accident prevention rules must be observed by the user.

For safety and warranty reasons, any invasive work on the device beyond that described in the operating instructions manual may be carried out only by personnel authorised by the manufacturer. Arbitrary conversions or modifications are explicitly forbidden. For safety reasons, only the accessory specified by the manufacturer must be used.

To avoid any danger, the safety approval markings and safety tips on the device must also be observed.

2.5 Conformity

The device complies with the legal requirements of the applicable country-specific directives or technical regulations. We confirm conformity with the corresponding labelling.

The corresponding conformity declarations can be found on our homepage.

2.6 Installation and operation in the USA and Canada

This information is only valid for USA and Canada. Hence the following text is only available in the English language.

Installations in the US shall comply with the relevant requirements of the National Electrical Code (NEC - NFPA 70) (USA).

Installations in Canada shall comply with the relevant requirements of the Canadian Electrical Code (CEC Par I) (Canada).

2.7 Environmental instructions

Protection of the environment is one of our most important duties. That is why we have introduced an environment management system with the goal of continuously improving company environmental protection. The environment management system is certified according to DIN EN ISO 14001.

Please help us fulfil this obligation by observing the environmental instructions in this manual:

- Chapter " *Packaging, transport and storage*"
- Chapter " *Disposal*"

3 Product description

3.1 Configuration

Scope of delivery

The scope of delivery encompasses:

- Level sensor VEGACAL 67

The further scope of delivery encompasses:

- Documentation
  - Operating instructions VEGACAL 67
  - Instructions for optional instrument features
  - Ex-specific " *Safety instructions*" (with Ex versions)
  - If necessary, further certificates

Information:
Optional instrument features are also described in this operating instructions manual. The respective scope of delivery results from the order specification.

Scope of this operating instructions

This operating instructions manual applies to the following instrument versions:

- Hardware from 1.0.0
- Software from 1.3.0
- Only for instrument versions without SIL qualification

Constituent parts

The VEGACAL 67 consists of the components:

- Process fitting with probe
- Housing with electronics
- Housing cover, optionally available with display and adjustment module

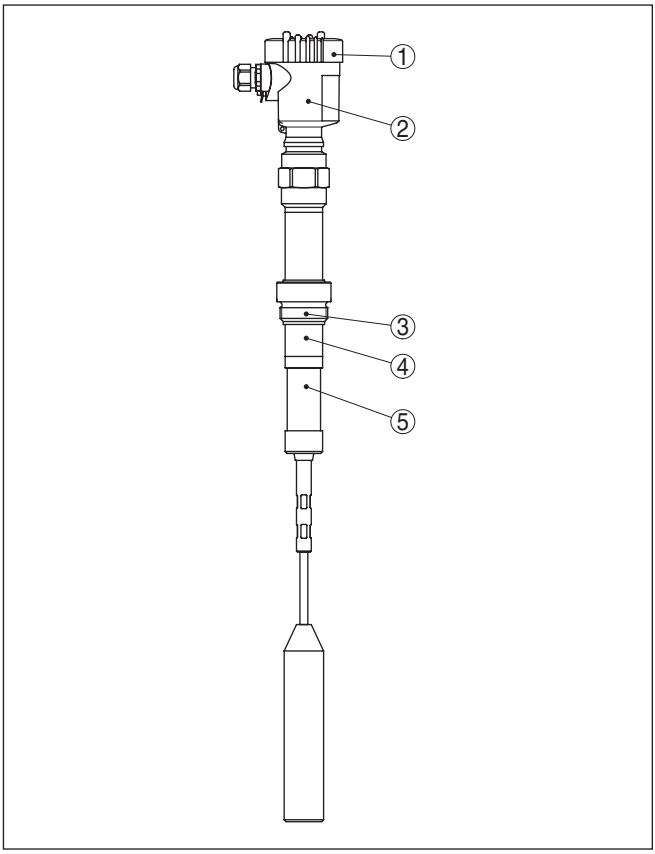

Fig. 1: VEGACAL 67 with plastic housing

1 Housing lid
2 Housing with electronics
3 Process fitting
4 Supporting tube
5 Ceramic insulator

Type label

The type label contains the most important data for identification and use of the instrument:

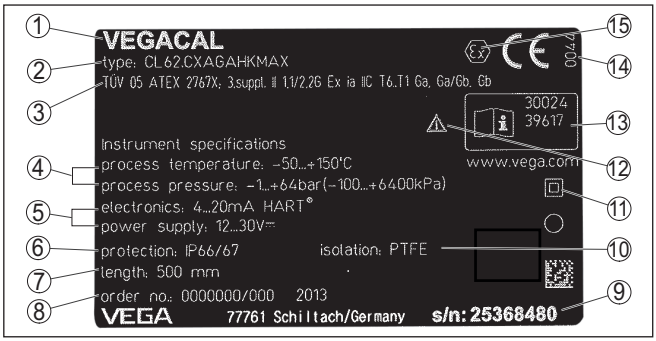

Fig. 2: Layout of the type label (example)

1 *Instrument type*
2 *Product code*
3 *Approvals*
4 *Process and ambient temperature, process pressure*
5 *Power supply and signal output, electronics*
6 *Protection rating*
7 *Probe length*
8 *Order number*
9 *Serial number of the instrument*
10 *Material wetted parts*
11 *Symbol of the device protection class*
12 *Reminder to observe the instrument documentation*
13 *ID numbers, instrument documentation*
14 *Notified authority for CE marking*
15 *Approval directives*

With the serial number, you can access the delivery data of the instrument via " www.vega.com", " *Search*". You can find the serial number on the inside of the instrument as well as on the type label on the outside.

Serial number - Instrument search

The type label contains the serial number of the instrument. With it you can find the following instrument data on our homepage:

- Product code (HTML)
- Delivery date (HTML)
- Order-specific instrument features (HTML)
- Operating instructions and quick setup guide at the time of shipment (PDF)
- Test certificate (PDF) - optional

Move to " www.vega.com" and enter in the search field the serial number of your instrument.

Alternatively, you can access the data via your smartphone:

- Download the VEGA Tools app from the " *Apple App Store*" or the " *Google Play Store*"
- Scan the QR-code on the type label of the device or
- Enter the serial number manually in the app

3.2 Principle of operation

Application area

The VEGACAL 67 is a level sensor for continuous level measurement of bulk solids at high process temperatures.

Functional principle

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

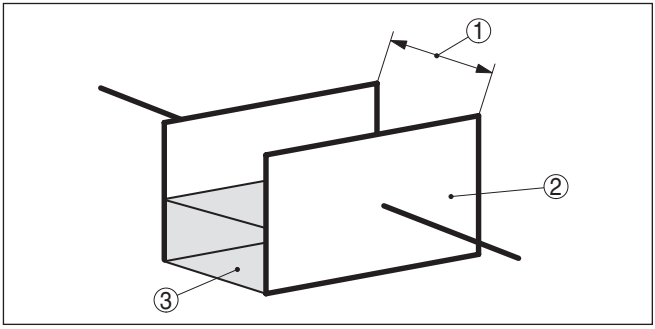

Fig. 3: Functional principle - Plate capacitor

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.

Voltage supply

4 … 20 mA two-wire electronics for voltage supply and measured value transmission on the same cable.

The supply voltage range can differ depending on the instrument version.

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

3.3 Adjustment

VEGACAL 67 measurement signals can be evaluated with the following:

- With a VEGAMET controller

The measuring range must be selected on the electronics module of the probe.

The full and empty adjustment can be carried out on a VEGAMET controller or the analogue input card of a PLC.

3.4 Packaging, transport and storage

Packaging

Your instrument was protected by packaging during transport. Its capacity to handle normal loads during transport is assured by a test based on ISO 4180.

The packaging of standard instruments consists of environment-friendly, recyclable cardboard. For special versions, PE foam or PE foil is also used. Dispose of the packaging material via specialised recycling companies.

Transport

Transport must be carried out in due consideration of the notes on the transport packaging. Nonobservance of these instructions can cause damage to the device.

Transport inspection

The delivery must be checked for completeness and possible transit damage immediately at receipt. Ascertained transit damage or concealed defects must be appropriately dealt with.

Storage

Up to the time of installation, the packages must be left closed and stored according to the orientation and storage markings on the outside.

Unless otherwise indicated, the packages must be stored only under the following conditions:

- Not in the open
- Dry and dust free
- Not exposed to corrosive media
- Protected against solar radiation
- Avoiding mechanical shock and vibration

Storage and transport temperature

- Storage and transport temperature see chapter " *Supplement - Technical data - Ambient conditions*"
- Relative moisture 20 … 85 %

Lifting and carrying

With instrument weights of more than 18 kg (39.68 lbs) suitable and approved equipment must be used for lifting and carrying.

3.5 Accessories

The instructions for the listed accessories can be found in the download area on our homepage.

VEGACONNECT

The interface adapter VEGACONNECT enables the connection of communication-capable instruments to the USB interface of a PC.

VEGADIS 81

The VEGADIS 81 is an external display and adjustment unit for VEGA plics® sensors.

VEGADIS 82

VEGADIS 82 is suitable for measured value indication and adjustment of sensors with HART protocol. It is looped into the 4 … 20 mA/HART signal cable.

PLICSMOBILE T81

The PLICSMOBILE T81 is an external GSM/GPRS/UMTS radio unit for transmission of measured values and for remote parameter adjustment of HART sensors.

External housing

If the standard sensor housing is too big or in case of strong vibrations, an external housing can be used.

Then the sensor housing is made of stainless steel. The electronics is located in the external housing which can be mounted in a distance of up to 10 m (32.8 ft) to the sensor by using a connection cable.

Three different external sensor housings are available.

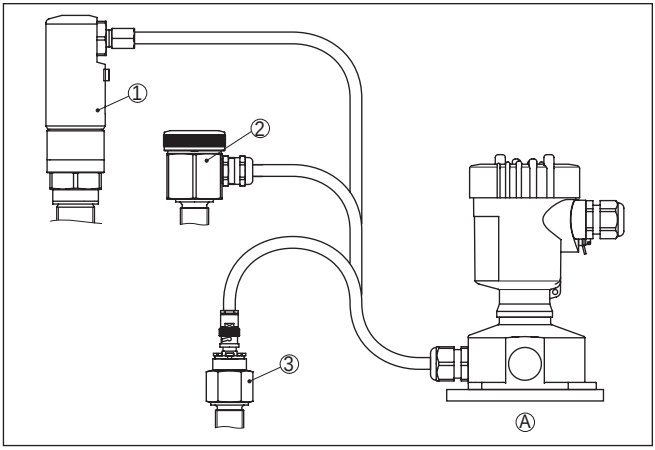

Fig. 4: External housing

A Instrument housing
1 Sensor housing, stainless steel (316L), IP68 (10 bar)
2 Sensor housing, stainless steel (316L), IP67
3 Sensor housing, stainless steel (316L), BNC plug IP54

Protective cover

The protective cover protects the sensor housing against soiling and intense heat from solar radiation.

Flanges

Screwed flanges are available in different versions according to the following standards: DIN 2501, EN 1092-1, BS 10, ASME B 16.5, JIS B 2210-1984, GOST 12821-80.

4 Mounting

4.1 General instructions

Process conditions

Note:
For safety reasons, the instrument must only be operated within the permissible process conditions. You can find detailed information on the process conditions in chapter " *Technical data*" of the operating instructions or on the type label.

Hence make sure before mounting that all parts of the instrument exposed to the process are suitable for the existing process conditions.

These are mainly:

- Active measuring component
- Process fitting
- Process seal

Process conditions in particular are:

- Process pressure
- Process temperature
- Chemical properties of the medium
- Abrasion and mechanical influences

Installation position

Select such a mounting location that the instrument is within easy reach for mounting and connecting. For this purpose the housing can be rotated by 330° without any tools being required.

Screwing in

Devices with threaded fitting are screwed into the process fitting with a suitable wrench via the hexagon.

See chapter " *Dimensions*" for wrench size.

Warning:
The housing or the electrical connection may not be used for screwing in! Depending on the device version, tightening can cause damage, e. g. to the rotation mechanism of the housing.

Welding work

Before beginning the welding work, remove the electronics module from the sensor. By doing this, you avoid damage to the electronics through inductive coupling.

Ground the probe before welding directly on the rod or cable.

Handling

With threaded versions, the housing must not be used to screw in the instrument! Applying tightening forces on the housing can damage its internal parts.

Use the hexagon for screwing in.

Protection against moisture

Use the recommended cables (see chapter " *Connecting to power supply*") and tighten the cable gland.

You can give your instrument additional protection against moisture penetration by leading the connection cable downward in front of the cable gland. Rain and condensation water can thus drain off. This

applies mainly to outdoor mounting as well as installation in areas where high humidity is expected (e.g. through cleaning processes) or on cooled or heated vessels.

To maintain the housing protection, make sure that the housing lid is closed during operation and locked, if necessary.

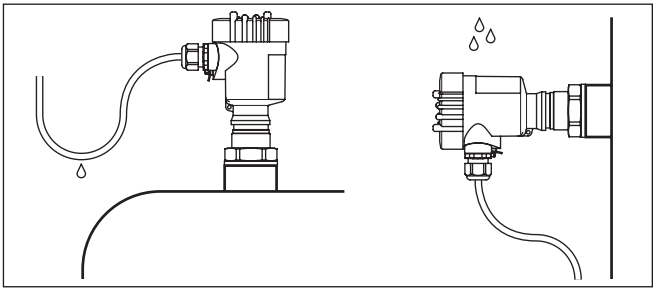

Fig. 5: Measures against moisture ingress

Pressure/Vacuum

The process fitting must be sealed if there is gauge or low pressure in the vessel. Before use, check if the sealing material is resistant against the measured product and the process temperature.

The max. permissible pressure is specified in chapter " *Technical data*" or on the type label of the sensor.

Insulating measures, such as e.g. 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.

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.

Vessel shapes

If possible, the capacitive 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.

Use a concentric tube in non-conductive products or linearize the meas. signal.

Cable entries - NPT thread
Cable glands

Metric threads
In the case of instrument housings with metric thread, the cable glands are screwed in at the factory. They are sealed with plastic plugs as transport protection.

You have to remove these plugs before electrical connection.

NPT thread
In the case of instrument housings with self-sealing NPT threads, it is not possible to have the cable entries screwed in at the factory. The free openings for the cable glands are therefore covered with red dust protection caps as transport protection.

Prior to setup you have to replace these protective caps with approved cable glands or close the openings with suitable blind plugs.

4.2 Mounting instructions

Inflowing medium

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

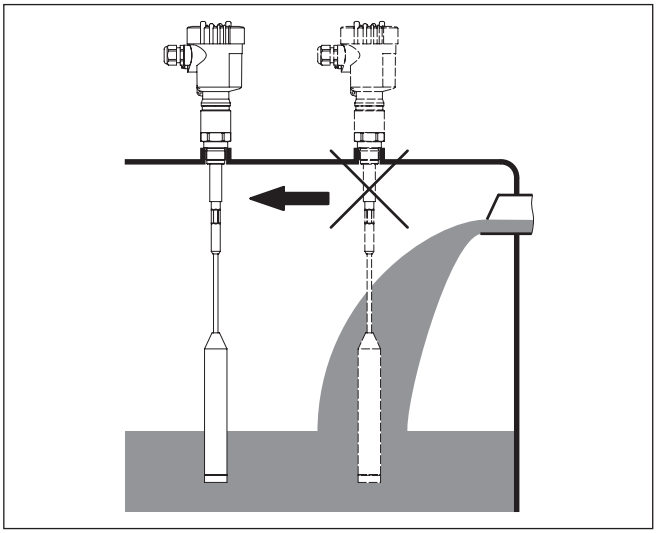

Fig. 6: Inflowing medium

Tensile load

Make sure that the max. permissible tensile load of the suspension cable is not exceeded. The danger of this happening exists particularly with very heavy solids and large meas. lengths. The max. permissible load is stated in chapter " *Technical data*".

5 Connecting to power supply

5.1 Preparing the connection

Safety instructions

Always keep in mind the following safety instructions:

- Carry out electrical connection by trained, qualified personnel authorised by the plant operator
- If overvoltage surges are expected, overvoltage arresters should be installed

Warning:
Only connect or disconnect in de-energized state.

Voltage supply

Power supply and current signal are carried on the same two-wire cable. The operating voltage can differ depending on the instrument version.

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

Provide a reliable separation between the supply circuit and the mains circuits according to DIN EN 61140 VDE 0140-1.

Power the instrument via an energy-limited circuit acc. to IEC 61010-1, e.g. via Class 2 power supply unit.

Keep in mind the following additional factors that influence the operating voltage:

- Lower output voltage of the power supply unit under nominal load (e.g. with a sensor current of 20.5 mA or 22 mA in case of fault signal)
- Influence of additional instruments in the circuit (see load values in chapter " *Technical data*")

Connection cable

The instrument is connected with standard two-wire cable without shielding. If electromagnetic interference is expected which is above the test values of EN 61326-1 for industrial areas, shielded cable should be used.

Use cable with round cross section for instruments with housing and cable gland. Use a cable gland suitable for the cable diameter to ensure the seal effect of the cable gland (IP protection rating).

We generally recommend the use of shielded cable for HART multidrop mode.

Cable glands

Metric threads:
In the case of instrument housings with metric thread, the cable glands are screwed in at the factory. They are sealed with plastic plugs as transport protection.

Note:
You have to remove these plugs before electrical connection.

NPT thread:
In the case of instrument housings with self-sealing NPT threads, it is not possible to have the cable entries screwed in at the factory. The

free openings for the cable glands are therefore covered with red dust protection caps as transport protection.

Note:
Prior to setup you have to replace these protective caps with approved cable glands or close the openings with suitable blind plugs.

On plastic housings, the NPT cable gland or the Conduit steel tube must be screwed into the threaded insert without grease.

Max. torque for all housings, see chapter " *Technical data*".

Cable screening and grounding

If shielded cable is required, we recommend connecting the cable screening on both ends to ground potential. In the sensor, the cable screening is connected directly to the internal ground terminal. The ground terminal on the outside of the housing must be connected to the ground potential (low impedance).

In Ex systems, the grounding is carried out according to the installation regulations.

In electroplating plants as well as plants for cathodic corrosion protection it must be taken into account that significant potential differences exist. This can lead to unacceptably high currents in the cable screen if it is grounded at both ends.

Note:
The metallic parts of the instrument (process fitting, sensor, concentric tube, etc.) are connected with the internal and external ground terminal on the housing. This connection exists either directly via the conductive metallic parts or, in case of instruments with external electronics, via the screen of the special connection cable.

You can find specifications on the potential connections inside the instrument in chapter " *Technical data*".

5.2 Connection procedure

Proceed as follows:

1. Unscrew the housing lid
2. Loosen compression nut of the cable gland and remove blind plug
3. Remove approx. 10 cm (4 in) of the cable mantle, strip approx. 1 cm (0.4 in) of insulation from the ends of the individual wires
4. Insert the cable into the sensor through the cable entry
5. Lift the opening levers of the terminals with a screwdriver (see following illustration)
6. Insert the wire ends into the open terminals according to the wiring plan
7. Press down the opening levers of the terminals, you will hear the terminal spring closing
8. Check the hold of the wires in the terminals by lightly pulling on them

9. Connect the shielding to the internal ground terminal, connect the external ground terminal to potential equalisation
10. Tighten the compression nut of the cable entry gland. The seal ring must completely encircle the cable
11. Screw the housing lid back on

The electrical connection is finished.

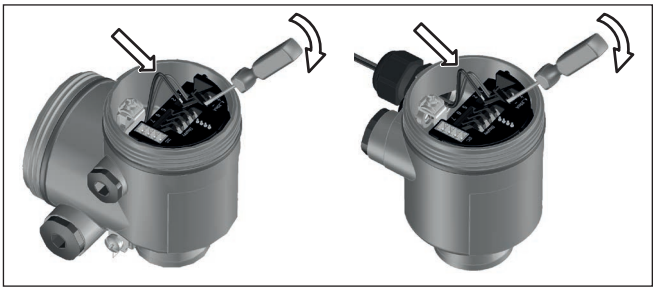

Fig. 7: Connection steps 6 and 7

5.3 Wiring plan - single chamber housing

Housing overview

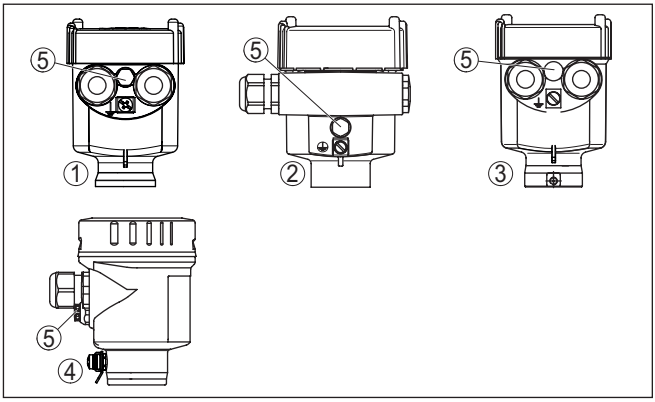

Fig. 8: Material versions, single chamber housing

1 Plastic
2 Aluminium
3 Stainless steel (precision casting)
4 Stainless steel (electro-polished)
5 Filter element for air pressure compensation of all material versions. Blind plug with version IP66/IP68 (1 bar) for Aluminium and stainless steel

Electronics and connection compartment

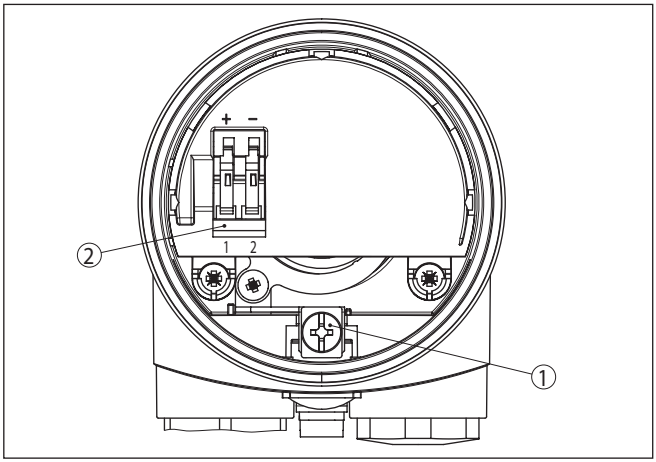

Fig. 9: Electronics and connection compartment - single chamber housing

1 Ground terminal for connection of the cable screening
2 Spring-loaded terminals for voltage supply

Wiring plan

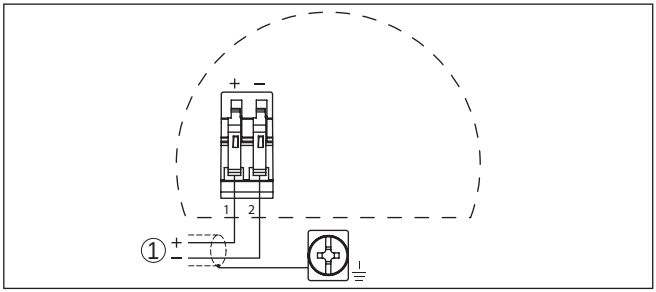

Fig. 10: Wiring plan - single chamber housing

1 Voltage supply/Signal output

5.4 Wiring plan - version IP66/IP68 (1 bar)

Wire assignment, connection cable

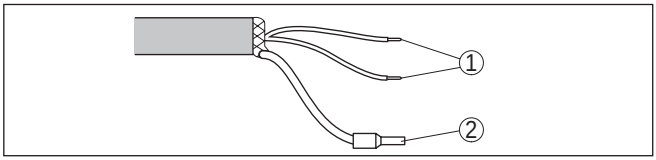

Fig. 11: Wire assignment, connection cable

1 Brown (+) and blue (-) to power supply or to the processing system
2 Shielding

6 Setup with a controller

6.1 General information

Function/Configuration

During setup, the probe must be calibrated with the medium that will later be measured. To adjust the probe, open the housing cover. You can select the sensitivity range on the electronics module by means of the measuring range selection switch.

- range 1: 0 … 120 pF
- Range 2: 0 … 600 pF
- Range 3: 0 … 3000 pF

The adjustment is described in the operating instructions manual of the respective controller.

6.2 Adjustment system

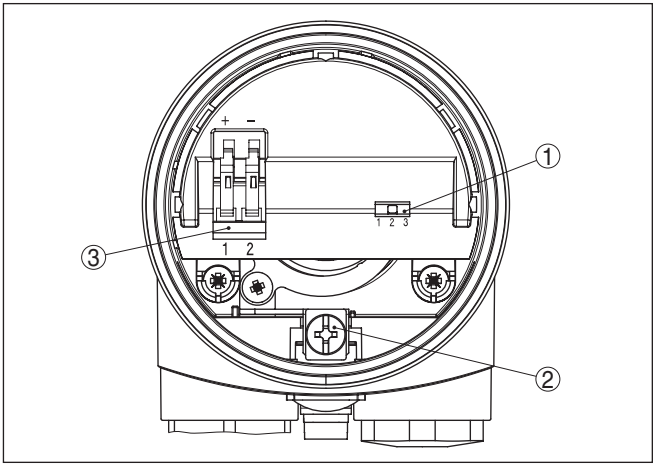

Fig. 12: Display and adjustment elements - Oscillator

1 DIL switch for measuring range selection
2 Ground terminal
3 Connection terminals

Measuring range selection switch (1)

With the measuring range selection switch (1) you can adapt the sensitivity of the probe to the electrical properties of the measured medium and the conditions in the vessel. This is necessary to ensure that the output current range is a big as possible. The resolution of the probe is thus also correspondingly increased.

Due to this, the probe can for example also detect products with very low or very high dielectric constant reliably.

- range 1 (sensitive): 0 … 120 pF
- range 2 (standard): 0 … 600 pF
- range 3 (less sensitive): 0 … 3000 pF

6.3 Continuous level measurement

General information

Continuous measurement requires a constant dielectric value, i.e. the measured product should have constant properties.

Select the stage with the measuring range selection switch on the electronics module of the probe according to the following table.

Look in the row that corresponds to your product and select an appropriate range according to the length of your probe.

The listed lengths do not completely correspond to those of the actually available measuring probes. If the product has a dielectric constant that lies between the values stated in the table, the max. permissible electrode length for each range must be calculated accordingly. For longer lengths or if there is no information available in the chart, select range 3. If you are not sure, always set the measuring range selection switch to the next higher stage.

	VEGACAL 67
non-conductive and dielectric constant = 2	0 - 6 m = range 1/6 - 30 m = range 2
non-conductive and dielectric constant = 10	0 - 1 m = range 1/1 - 5 m = range 2
conductive or dielectric constant > 50	-

Tab. 1: Range setting

Tip:
For min. adjustment the vessel should be as empty as possible, and for max. adjustment, as full as possible. If the vessel is already full, start with max. adjustment.

Analogue input card of a PLC

1. Set range changeover switch on the capacitive probe according to the above table
2. When connecting to an analogue input card of a PLC, take note of the operating instructions manual of the input card. The vessel must be as empty as possible for empty adjustment and as full as possible for full adjustment.

If the indication cannot be set to 100 %, proceed as follows:

- If the indication does not reach 100 %, you have to set the range selection switch on the probe one stage lower.
- If the indication exceeds 100 % and cannot be reset, you have to set the range selection switch of the probe to the next higher stage. In both cases you have to repeat the adjustment.

VEGAMET series 300, 600 controller

1. Set range changeover switch on the capacitive probe according to the above table
2. Carry out the adjustment on the controller (see operating instructions manual of the controller: "Adjustment with medium")

When connecting to an analogue input card of a PLC, take note of the operating instructions manual of the input card. The vessel must be as empty as possible for empty adjustment and as full as possible for full adjustment.

If the indication cannot be set to 100 %, proceed as follows:

- If the indication does not reach 100 %, you have to set the range selection switch on the probe one stage lower.
- If the indication exceeds 100 % and cannot be reset, you have to set the range selection switch of the probe to the next higher stage. In both cases you have to repeat the adjustment.

7 Diagnostics and servicing

7.1 Maintenance

Maintenance

If the device is used properly, no special maintenance is required in normal operation.

Cleaning

The cleaning helps that the type label and markings on the instrument are visible.

Take note of the following:

- Use only cleaning agents which do not corrode the housings, type label and seals
- Use only cleaning methods corresponding to the housing protection rating

7.2 Rectify faults

Reaction when malfunction occurs

The operator of the system is responsible for taking suitable measures to rectify faults.

Causes of malfunction

The device offers maximum reliability. Nevertheless, faults can occur during operation. These may be caused by the following, e.g.:

- Sensor
- Process
- Voltage supply
- Signal processing

Fault rectification

The first measure to take is to check the output signal. In many cases, the causes can be determined this way and the faults quickly rectified.

Reaction after fault rectification

Depending on the reason for the fault and the measures taken, the steps described in chapter " *Setup*" must be carried out again or must be checked for plausibility and completeness.

24 hour service hotline

Should these measures not be successful, please call in urgent cases the VEGA service hotline under the phone no. **+49 1805 858550**.

The hotline is also available outside normal working hours, seven days a week around the clock.

Since we offer this service worldwide, the support is provided in English. The service itself is free of charge, the only costs involved are the normal call charges.

Checking the current signal

Connect a multimeter in the suitable measuring range according to the wiring plan.

Error	Cause	Rectification
Current signal not stable	Level fluctuations	Adjust damping in the controller or process control system

Error	Cause	Rectification
Current signal missing	Wrong connection to voltage supply	Check connection according to chapter " *Connection steps*" and if necessary, correct according to chapter " *Wiring plan*"
	No power supply	Check cables for breaks; repair if necessary
	Operating voltage too low or load resistance too high	Check, adapt if necessary
Current signal >22 mA	Short-circuit due to bridging by conductive buildup between process fitting and electrode	Remove buildup - if necessary, mount a protective tube
	Shortcircuit in the probe, e.g. because of moisture in the housing	Remove the electronics module. Check the resistance between the marked plug connections. See the following instructions.
	Electronics module defective	Exchange the instrument or send it in for repair

Check the resistance in the probe

Remove the electronics module. Check the resistance between the two plug connections.

There must no longer be a connection (high impedance). If there is still a connection, exchange the instrument or return it for repair

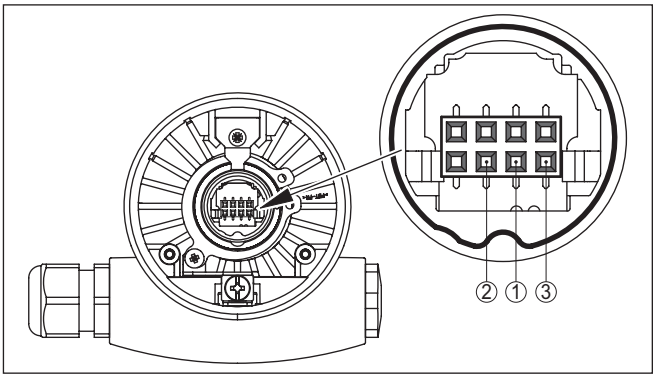

Fig. 13: Check the resistance in the probe

1 Shielding
2 Measuring probe
3 Ground potential

In Ex applications, the regulations for the wiring of intrinsically safe circuits must be observed.

7.3 Exchanging the electronics module

If the electronics module is defective, it can be replaced by the user.

In Ex applications, only instruments and electronics modules with appropriate Ex approval may be used.

If there is no electronics module available on site, one can be ordered from the VEGA agency serving you.

7.4 Shortening the electrode

Shortening the electrode

The probe (cable) can be shortened by any length.

1. Loosen the two pins on the gravity weight (hexagon) and remove the pins.
2. Pull the cable out of the gravity weight.
3. To avoid splicing of the steel cable, tin the cable before shortening with a soldering iron and tighten the wire.
4. Shorten the cable with a cut-off wheel or metal saw at the lower end. Make sure the length is correct before shortening.

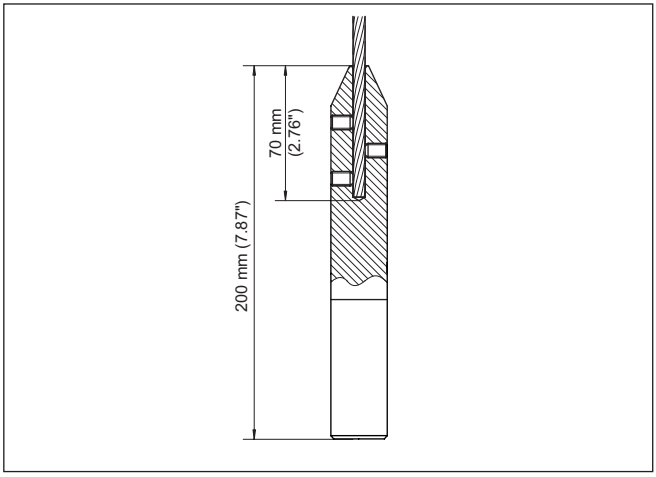

Fig. 14: Take the gravity weight into account and shorten the cable respectively

5. Shift the gravity weight again flush to the cable and fix it with the two pins.
6. Carry out an adjustment. See " *Setup procedure, carry out min. adjustment - carry out max. adjustment*".

7.5 How to proceed if a repair is necessary

You can find an instrument return form as well as detailed information about the procedure in the download area of our homepage. By doing this you help us carry out the repair quickly and without having to call back for needed information.

Proceed as follows in case of repair:

- Print and fill out one form per instrument
- Clean the instrument and pack it damage-proof
- Attach the completed form and, if need be, also a safety data sheet outside on the packaging
- Ask the agency serving you to get the address for the return shipment. You can find the agency on our homepage.

8 Dismount

8.1 Dismounting steps

Warning:
Before dismounting, be aware of dangerous process conditions such as e.g. pressure in the vessel or pipeline, high temperatures, corrosive or toxic media etc.

Take note of chapters " *Mounting*" and " *Connecting to voltage supply*" and carry out the listed steps in reverse order.

8.2 Disposal

Pass the instrument on to a specialised recycling company and do not use the municipal collecting points.

Remove any batteries in advance, if they can be removed from the device, and dispose of them separately.

If personal data is stored on the old device to be disposed of, delete it before disposal.

If you have no way to dispose of the old instrument properly, please contact us concerning return and disposal.

9 Supplement

9.1 Technical data

Note for approved instruments

The technical data in the respective safety instructions which are included in delivery are valid for approved instruments (e.g. with Ex approval). These data can differ from the data listed herein, for example regarding the process conditions or the voltage supply.

All approval documents can be downloaded from our homepage.

General data	
Material 316L corresponds to 1.4404 or 1.4435	
Process fitting	G1½, 1½ NPT
Materials, wetted parts	
– Process fitting - thread	316L
– Process fitting - flange	316L
– Process seal	Klingersil C-4400 (instruments with threaded fitting)
– Insulation (partly insulated)	Ceramic (KER 221 according to DIN 40685)
– Probe - rod, ceramic partly insulated (ø 15 mm/0.591 in)	316L
– Probe - cable, ceramic partly insulated (ø 8 mm/0.315 in) [1]	316 (1.4401)
– Cable - Ceramic insulated cable probe with crimping sleeve	316 (1.4401)
– Gravity weight	316L
Materials, non-wetted parts	
– Plastic housing	Plastic PBT (Polyester)
– Aluminium die-cast housing	Aluminium die-casting AlSi10Mg, powder-coated (Basis: Polyester)
– Stainless steel housing (precision casting)	316L
– Stainless steel housing (electropolished)	316L
– Seal between housing and housing lid	Silicone
– Inspection window in housing cover (optional)	Plastic housing: Polycarbonate (UL746-C listed) Metal housing: Glass [2]
– Ground terminal	316L
– Cable gland	PA, stainless steel, brass
– Sealing, cable gland	NBR
– Blind plug, cable gland	PA
Process fittings	
– Pipe thread, cylindrical (DIN 3852-A)	G1½

[1] Cable connected electrically conductive with the gravity weight.
[2] Aluminium, stainless steel (precision casting) and Ex d housing

– Pipe thread, conical (ASME B1.20.1)	1½ NPT
– Flanges	DIN from DN 40, ASME from 1½"
Weight	
– Instrument weight (depending on process fitting)	0.8 … 4 kg (0.18 … 8.82 lbs)
– Gravity weight	1800 g (64 oz)
– Rod weight: ø 15 mm (0.591 in)	1400 g/m (15 oz/ft)
– Cable weight: ø 8 mm (0.315 in)	400 g/m (4.4 oz/ft)
– Cable weight - Ceramic insulated cable probe with crimping sleeve	180 g/m (4.4 oz/ft)
Sensor length (L)	
– Rod (ø 15 mm/0.591 in)	0.275 … 6 m (0.902 … 19.69 ft)
– Cable (ø 8 mm/0.315 in)	0.53 … 40 m (1.74 … 131.23 ft)
– Cable - Ceramic insulated cable probe with crimping sleeve	0.53 … 40 m (1.74 … 131.23 ft)
Supporting tube length L1	0.2 … 5.6 m (0.656 … 18.37 ft)
Max. lateral load	10 Nm (7.4 lbf ft)
Max. tensile load (cable)	
– Ceramic partly insulated: ø 8 mm (0.315 in)	10 KN (2248 lbf)
– Cable - Ceramic insulated cable probe with crimping sleeve	10 KN (2248 lbf)
Max. torque (process fitting - thread)	
– Cable weight: ø 8 mm (0.315 in)	80 Nm (58 lbf ft)
– Cable - Ceramic insulated cable probe with crimping sleeve	80 Nm (58 lbf ft)
Torque for NPT cable glands and Conduit tubes	
– Plastic housing	max. 10 Nm (7.376 lbf ft)
– Aluminium/Stainless steel housing	max. 50 Nm (36.88 lbf ft)

Output variable	
Output signal	in the range of 4 … 20 mA
Suitable controllers	e.g. VEGAMET 141, 381, 391, 624, 841, 842, 861, 862
Fault signal	> 22 mA
Current limitation	28 mA
Load	see load diagram under Power supply
Damping (63 % of the input variable)	0.1 s
Met NAMUR recommendation	NE 43

Input variable	
Measured variable	level of non-conductive liquids and solids
Measuring principle	phase-selective admittance processing (PSA)

Measuring range	
– range 1	0 … 120 pF
– range 2	0 … 600 pF
– range 3	0 … 3000 pF
Measuring frequency	430 kHz

Measurement accuracy (according to DIN EN 60770-1)

Reference conditions according to DIN EN 61298-1	
– Temperature	+18 … +30 °C (+64 … +86 °F)
– Relative humidity	45 … 75 %
– Air pressure	+860 … +1060 mbar/+86 … +106 kPa (+12.5 … +15.4 psig)
Temperature error	
– < 120 pF	< 1 pF
– > 120 pF	1 % of the current measured value
Linearity error	< 0.25 % of the complete measuring range

Ambient conditions

Ambient, storage and transport temperature	-40 … +80 °C (-40 … +176 °F)

Process conditions

For the process conditions, please also note the specifications on the type label. The lowest value always applies.

Process pressure	-1 … 16 bar/-100 … 1600 kPa (-14.5 … 232 psig)
Process pressure	
– Standard version	-1 … 16 bar/-100 … 1600 kPa (-14.5 … 232 psig)
– Ceramic insulated cable probe with crimping sleeve / -50 … +350 °C	-1 … 10 bar/-100 … 1000 kPa (-14.5 … 145 psig)
Process temperature (thread or flange temperature)	
– Standard	-50 … +300 °C (-58 … +572 °F)
– Ceramic insulated cable probe with crimping sleeve / -50 … +350 °C	-50 … +350 °C (-58 … +662 °F)
– with external housing	-50 … +400 °C (-58 … +752 °F)

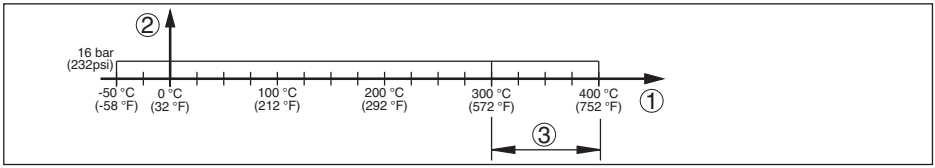

Fig. 15: Process temperature - Process pressure

1 Process temperature
2 Process pressure
3 Temperature range with external housing

Dielectric constant	≥ 1.5

Electromechanical data - version IP66/IP67 and IP66/IP68 (0.2 bar)

Options of the cable entry	
– Cable entry	M20 x 1.5; ½ NPT [3]
– Cable gland	M20 x 1.5; ½ NPT
– Blind plug	M20 x 1.5; ½ NPT
– Closing cap	½ NPT
Wire cross-section (spring-loaded terminals)	
– Massive wire, stranded wire	0.2 … 2.5 mm² (AWG 24 … 14)
– Stranded wire with end sleeve	0.2 … 1.5 mm² (AWG 24 … 16)

Electromechanical data - version IP66/IP68 (1 bar)

Cable entry	
– Single chamber housing	– 1 x IP68 cable gland M20 x 1.5; 1 x M20 x 1.5 blind plug or: – 1 x closing cap ½ NPT, 1 x ½ NPT blind plug

Voltage supply

Operating voltage	12 … 36 V DC

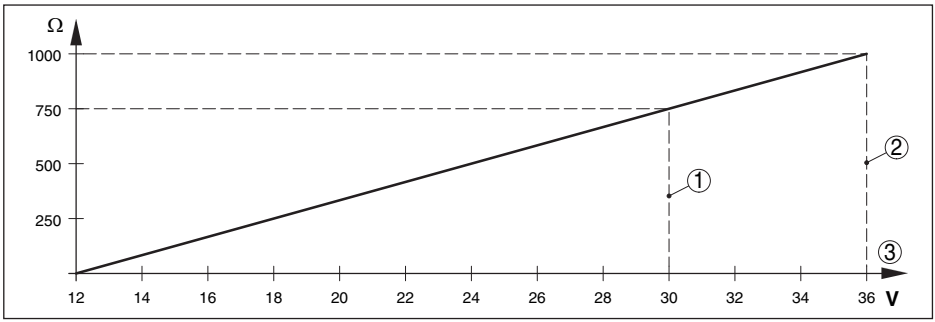

Fig. 16: Voltage diagram

1 Voltage limit Ex ia instrument
2 Voltage limit non-Ex
3 Operating voltage

Permissible residual ripple	
– < 100 Hz	U_{ss} < 1 V
– 100 Hz … 10 kHz	U_{ss} < 10 mV
Load	see diagram

Potential connections and electrical separating measures in the instrument

Electronics	Non-floating

[3] Depending on the version M12 x 1, according to ISO 4400, Harting, 7/8" FF.

Galvanic separation

– between electronics and metallic parts of the device	Reference voltage 500 V AC
Conductive connection	Between ground terminal and metallic process fitting

Electrical protective measures

Protection rating

Housing material	Version	IP-protection class	NEMA protection
Plastic	Single chamber	IP66/IP67	Type 4X
	Double chamber	IP66/IP67	Type 4X
Aluminium	Single chamber	IP66/IP68 (0.2 bar) IP68 (1 bar)	Type 6P Type 6P
	Double chamber	IP66/IP67 IP66/IP68 (0.2 bar) IP68 (1 bar)	Type 4X Type 6P Type 6P
Stainless steel (electro-polished)	Single chamber	IP66/IP68 (0.2 bar)	Type 6P
Stainless steel (precision casting)	Single chamber	IP66/IP68 (0.2 bar) IP68 (1 bar)	Type 6P Type 6P
	Double chamber	IP66/IP67 IP66/IP68 (0.2 bar) IP68 (1 bar)	Type 4X Type 6P Type 6P

Connection of the feeding power supply unit	Networks of overvoltage category III
Altitude above sea level	
– by default	up to 2000 m (6562 ft)
– with connected overvoltage protection	up to 5000 m (16404 ft)
Pollution degree [4]	4
Protection class	II (IEC 61010-1)

9.2 Dimensions

The following dimensional drawings represent only an extract of all possible versions. Detailed dimensional drawings can be downloaded at www.vega.com/downloads under " *Drawings*".

[4] When used with fulfilled housing protection

Housing in protection IP66/IP67 and IP66/IP68 (0.2 bar)

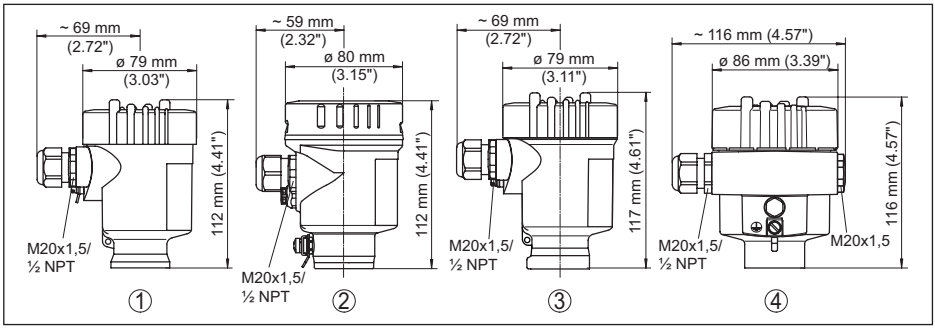

Fig. 17: Housing versions in protection IP66/IP67 and IP66/IP68 (0.2 bar)

1 *Plastic single chamber (IP66/IP67)*
2 *Stainless steel single chamber (electropolished)*
3 *Stainless steel single chamber (precision casting)*
4 *Aluminium - single chamber*

Housing in protection IP66/IP68 (1 bar)

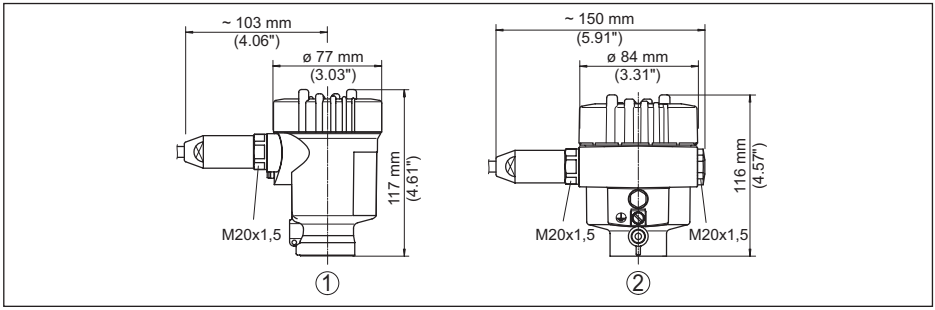

Fig. 18: Housing versions with protection rating IP66/IP68 (1 bar)

1 *Stainless steel single chamber*
2 *Aluminium - single chamber*

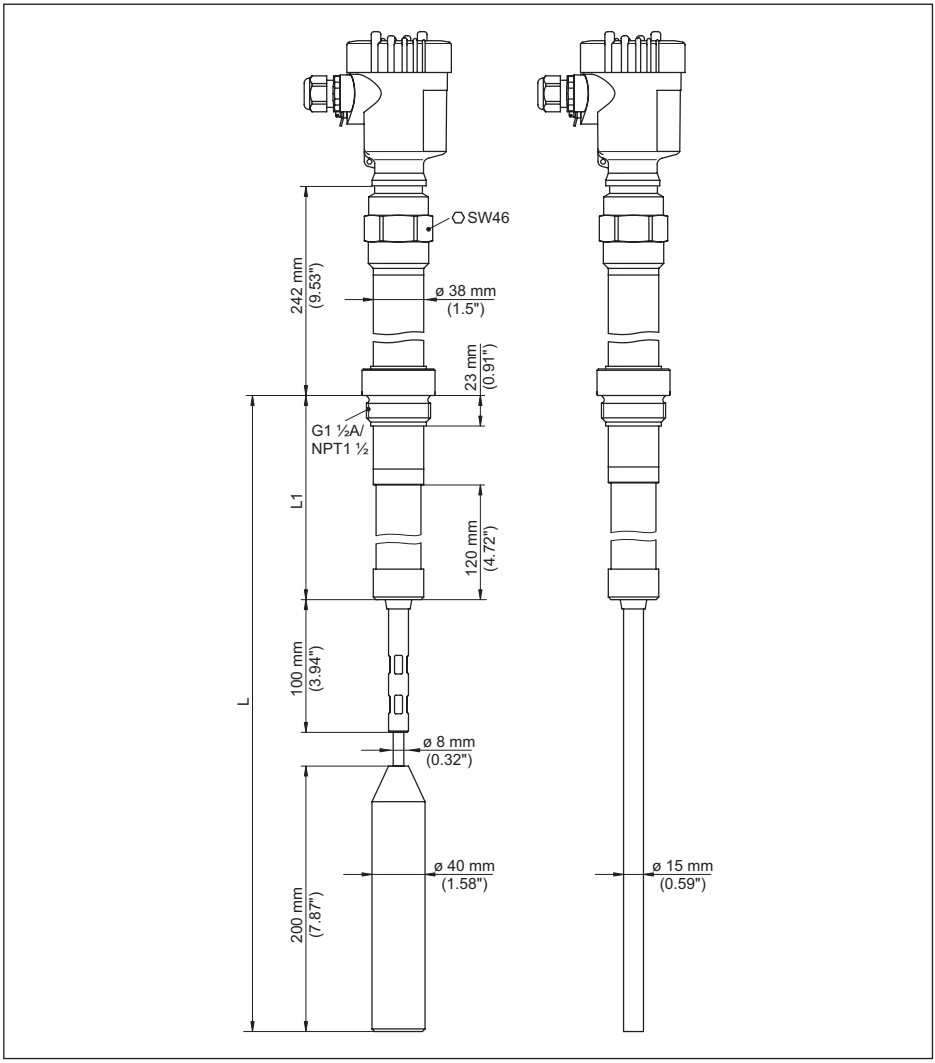

Fig. 19: VEGACAL 67, threaded version G1½ A (ISO 228 T1) and 1½ NPT, -50 … +300 °C (-58 … +572 °F)

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"

Ceramic insulated cable probe with crimping sleeve / -50 … +350 °C

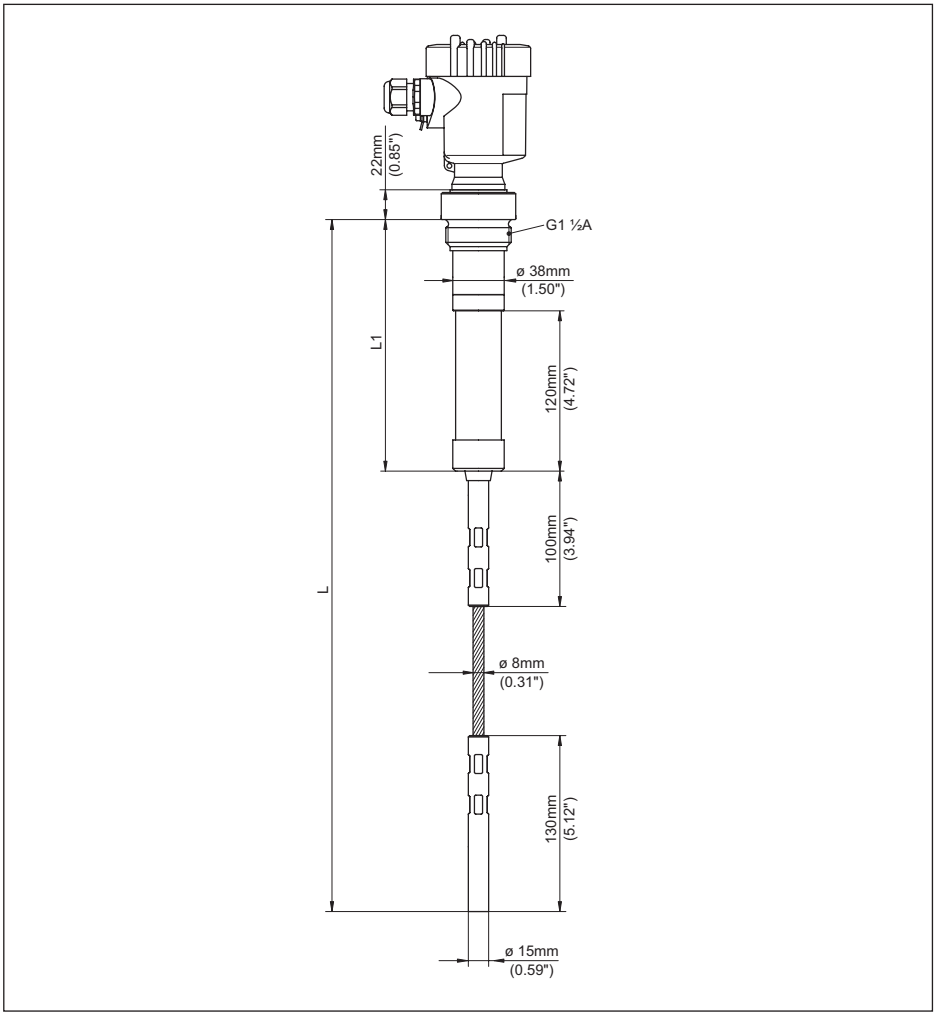

Fig. 20: VEGACAL 67, ceramic insulated cable probe with crimping sleeve / -50 … +350 °C [5]

L Sensor length, see chapter " Technical data"
L1 Supporting tube length, see chapter " Technical data"

[5] Only in conjunction with Aluminium or stainless steel housing

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