Operating Instructions

Radar sensor for continuous level measurement of liquids

VEGAPULS 64

4 … 20 mA/HART - two-wire

Document ID: 51141

Contents

51141-EN-160407

Safety instructions for Ex areas

Take note of the Ex specific safety instructions for Ex applications. These instructions are attached as documents to each instrument with Ex approval and are part of the operating instructions manual.

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1 About this document

1.1 Function

This operating instructions manual provides all the information you need for mounting, connection and setup as well as important instructions for maintenance and fault rectification. 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 specialist personnel. The contents of this manual should be made available to these personnel and put into practice by them.

1.3 Symbols used

Information, tip, note
This symbol indicates helpful additional information.

Caution: If this warning is ignored, faults or malfunctions can result.

Warning: If this warning is ignored, injury to persons and/or serious damage to the instrument can result.

Danger: If this warning is ignored, serious injury to persons and/or destruction of the instrument can result.

Ex applications
This symbol indicates special instructions for Ex applications.

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

→ **Action**
This arrow indicates a single action.

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

Battery disposal
This symbol indicates special information about the disposal of batteries and accumulators.

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2 For your safety

2.1 Authorised personnel

All operations described in this operating instructions manual must be carried out only by trained specialist 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

VEGAPULS 64 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 the instrument can give rise to application-specific hazards, e.g. vessel overfill or damage to system components through incorrect mounting or adjustment. Also the protective characteristics of the instrument can be influenced.

2.4 General safety instructions

This is a state-of-the-art instrument complying with all prevailing regulations and guidelines. 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.

During the entire duration of use, the user is obliged to determine the compliance of the necessary occupational safety measures with the current valid rules and regulations and also take note of new regulations.

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.

The safety approval markings and safety tips on the device must also be observed.

Depending on the instrument version, the emitting frequencies are in the C, K or W band range. The low emitting frequencies are far below the internationally approved limit values. When used correctly, the device poses no danger to health.

2.5 CE conformity

The device fulfils the legal requirements of the applicable EC guidelines. By affixing the CE marking, we confirm successful testing of the product.

You can find the CE Certificate of Conformity in the download section of our homepage.

2.6 NAMUR recommendations

NAMUR is the automation technology user association in the process industry in Germany. The published NAMUR recommendations are accepted as the standard in field instrumentation.

The device fulfils the requirements of the following NAMUR recommendations:

- NE 21 – Electromagnetic compatibility of equipment
- NE 43 – Signal level for malfunction information from measuring transducers
- NE 53 – Compatibility of field devices and display/adjustment components
- NE 107 – Self-monitoring and diagnosis of field devices

For further information see www.namur.de.

2.7 Radio license for Europe

The instrument is approved according to EN 302372-1/2 V1.2.1 (2011-02) for use in closed vessels.

For operation inside of closed vessels, the following conditions must be fulfilled:

- The instrument must be permanently mounted on a closed vessel made of metal, reinforced concrete, or comparable attenuating materials.
- Flanges, process fittings and mounting accessories must ensure the microwave impermeability of the vessel and not let the radar signal escape to the outside
- If necessary, existing viewing windows in the vessel must be coated with a microwave impermeable material (e.g. electrically conductive coating)
- Manholes and flanges on the vessel must be closed and sealed to avoid penetration of the radar signal
- The instrument should be preferably mounted on top of the vessel with antenna orientation downward
- The instrument must only be installed and maintained by appropriately qualified staff

2.8 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.

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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

Type label

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

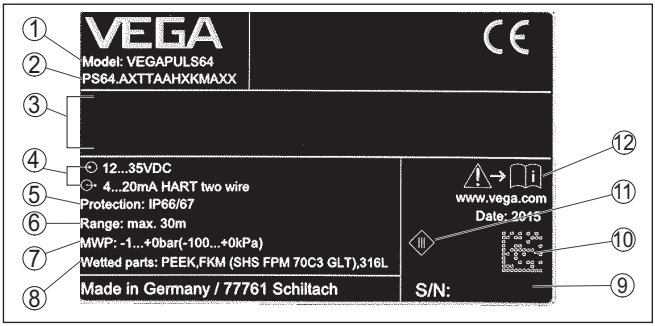


Fig. 1: Layout of the type label (example)

1 *Instrument type*
2 *Product code*
3 *License label*
4 *Power supply and signal output, electronics*
5 *Protection rating*
6 *Measuring range*
7 *Process and ambient temperature, process pressure*
8 *Material, wetted parts*
9 *Serial number of the instrument*
10 *Data-Matrix-Code for smartphone app*
11 *Symbol of the device protection class*
12 *Reminder to observe the instrument documentation*

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)
- Order-specific sensor data for an electronics exchange (XML)
- Test certificate (PDF) - optional

Go to www.vega.com "*VEGA Tools*" and "*Instrument search*". Enter the serial number.

Alternatively, you can access the data via your smartphone:

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

Scope of this operating instructions manual

This operating instructions manual applies to the following instrument versions:

- Hardware version from 1.0.0
- Software version from 1.1.0

Scope of delivery

The scope of delivery encompasses:

- Radar sensor
- Optional accessory
- Documentation
  - Quick setup guide VEGAPULS 64
  - Instructions for optional instrument features
  - Ex-specific "*Safety instructions*" (with Ex versions)
  - If necessary, further certificates
- DVD "*Software*", included therein
  - PACTware/DTM Collection
  - Driver software

Information:
In this operating instructions manual, the optional instrument features are described. The respective scope of delivery results from the order specification.

3.2 Principle of operation

Application area

VEGAPULS 64 is a radar sensor for continuous level measurement of liquids.

Special advantages result from the small process fittings for small tanks and the very good focussing in applications in large tanks. This is made possible by the sensor's functional principle: distance measurement through frequency shifting with an especially small beam angle.

The instrument is available with different antenna systems and accessories for virtually all applications and processes.

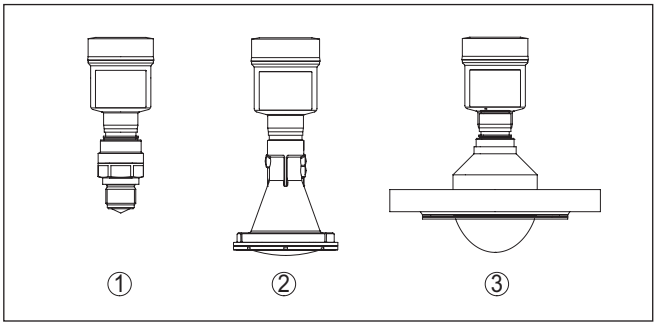


Fig. 2: Antenna systems VEGAPULS 64

1 Thread with integrated horn antenna
2 Plastic horn antenna
3 Flange with encapsulated antenna system

Functional principle

The instrument emits a continuous radar signal through its antenna. This signal is frequency modulated in the form of a sawtooth wave.

The emitted signal is reflected by the medium and received by the antenna as an echo.

The frequency of the received signal always deviates from the actual emitting frequency. The frequency difference is proportional to the distance and thus to the filling height. This difference is calculated via special algorithms in the sensor electronics. The determined filling height is then converted into a corresponding output signal and outputted as the measured value.

3.3 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 humidity 20 … 85 %

3.4 Accessories and replacement parts

PLICSCOM

The display and adjustment module PLICSCOM is used for measured value indication, adjustment and diagnosis. It can be inserted into the sensor and removed at any time.

You can find further information in the operating instructions "*Display and adjustment module PLICSCOM*" (Document-ID 27835).

VEGACONNECT

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

	parameter adjustment of these instruments, the adjustment software PACTware with VEGA-DTM is required. You can find further information in the operating instructions "*Interface adapter VEGACONNECT*" (Document-ID 32628).
VEGADIS 81	The VEGADIS 81 is an external display and adjustment unit for VEGA plics® sensors. For sensors with double chamber housing the interface adapter "*DISADAPT*" is also required for VEGADIS 81. You can find further information in the operating instructions "*VEGADIS 81*" (Document-ID 43814).
DISADAPT	The adapter "*DISADAPT*" is an accessory part for sensors with double chamber housings. It enables the connection of VEGADIS 81 to the sensor housing via an M12 x 1 plug. You can find further information in the supplementary instructions "*Adapter DISADAPT*" (Document-ID 45250).
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. You can find further information in the operating instructions "*VEGADIS 82*" (Document-ID 45300).
PLICSMOBILE T61	PLICSMOBILE T61 is an external GSM/GPRS radio unit for transmission of measured values and for remote parameter adjustment of plics® sensors. Adjustment is carried out via PACTware/DTM and the integrated USB connection. You can find further information in the supplementary instructions "*PLICSMOBILE T61*" (Document-ID 37700).
Protective cap	The protective cover protects the sensor housing against soiling and intense heat from solar radiation. You will find additional information in the supplementary instructions manual "*Protective cover*" (Document-ID 34296).
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. You can find additional information in the supplementary instructions manual "*Flanges according to DIN-EN-ASME-JIS*".
Flanges with plastic horn antenna	For mounting the instrument with plastic horn antenna to a socket, two flange versions are available: the combi compression flange and the adapter flange You can find additional information in chapter "*Mounting*" of this operating instruction.
Mounting strap with plastic horn antenna	A mounting strap is available for mounting the instrument with plastic horn antenna to the wall or ceiling.

You can find additional information in chapter "*Mounting*" of this operating instruction.

Electronics module

Electronics module "VEGAPULS series 60" is a replacement part for radar sensors of VEGAPULS series 60. A different version is available for each type of signal output.

You can find further information in the operating instructions "*Electronics module VEGAPULS series 60*" (Document-ID 36801).

4 Mounting

4.1 General instructions

Protection against moisture

Protect your instrument against moisture ingress through the following measures:

- Use the recommended cable (see chapter "*Connecting to power supply*")
- Tighten the cable gland
- Loop the connection cable downward in front of the cable gland

This applies particularly to:

- Outdoor mounting
- Installations in areas where high humidity is expected (e.g. through cleaning processes)
- Installations on cooled or heated vessels

Suitability for the process conditions

Make sure 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 are particularly:

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

You can find detailed information on the process conditions in chapter "*Technical data*" as well as on the type label.

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. The dust protection caps do not provide sufficient protection against moisture.

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 versions, plastic horn antenna

Mounting strap

The optional mounting strap allows simple mounting of the instrument on a wall, ceiling or boom. Especially in the case of open vessels, this

is a simple and effective way to align the sensor to the surface of the bulk solid material.

The following versions are available:

- Length 300 mm
- Length 170 mm

Mounting strap - Ceiling mounting

The instrument is normally mounted vertically with a bracket on the ceiling.

This allows swivelling the sensor up to 180° for optimal orientation and rotating for optimal connection.

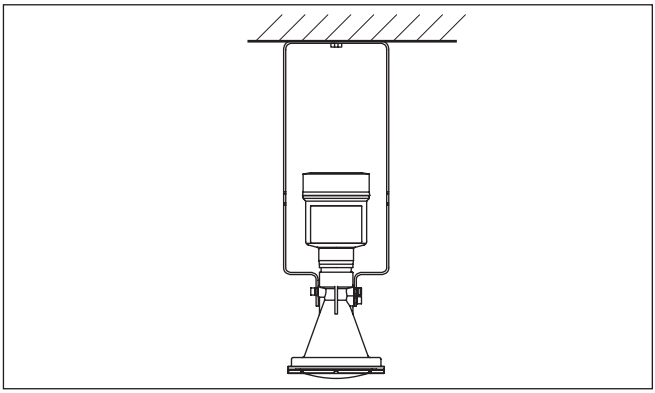


Fig. 3: Ceiling mounting via the mounting strap with length 300 mm

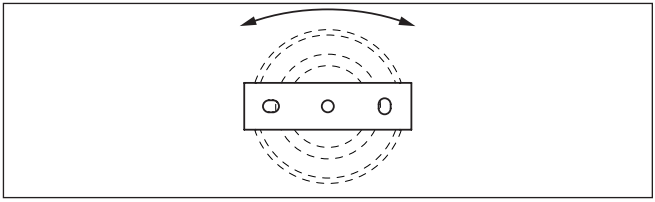


Fig. 4: Rotating with ceil mounting

Mounting strap - Wall mounting

As an alternative the strap mounting is carried out horizontally or obliquely.

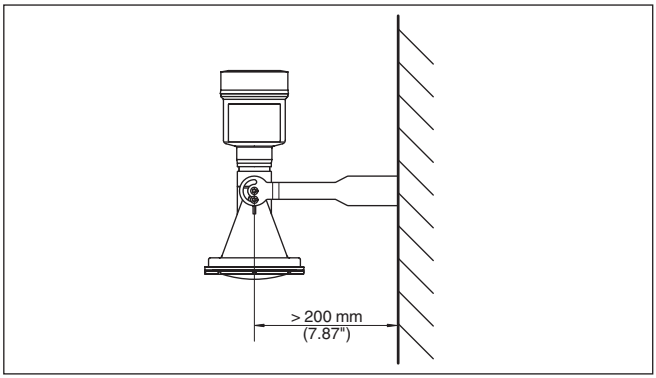


Fig. 5: Wall mounting horizontally via the mounting strap with length 170 mm

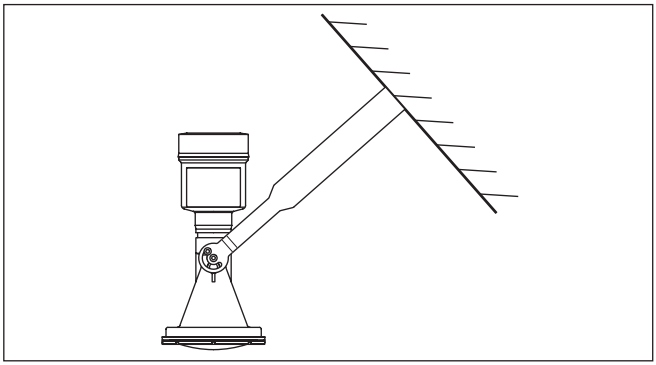


Fig. 6: Wall mounting with inclined wall via the mounting strap with length 300 mm

Flange

Two versions are available for mounting the instrument on a socket:

- Combi compression flange fitting to DN 80 (ASME 3" and JIS 80)
- Adapter flange from DN 100 (ASME 4" or JIS 100)

The combi compression flange is suitable for different flange standards and can be used for simple applications. It comes unassembled and not sealed against the radar sensor and can thus only be used unpressurized. It can be retrofitted on instruments with single chamber housing, retrofitting to a double chamber housing is not possible.

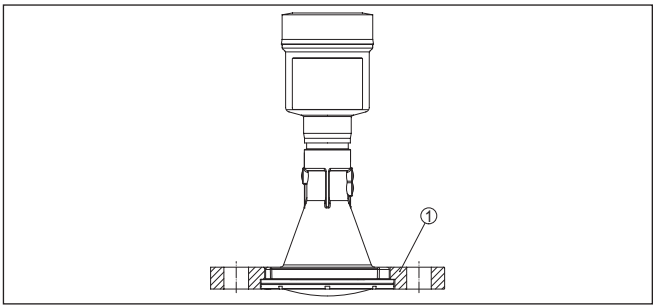


Fig. 7: Combi compression flange

1 Combi compression flange

The adapter flange is available in different flange sizes. It is permanently connected with the radar sensor and sealed.

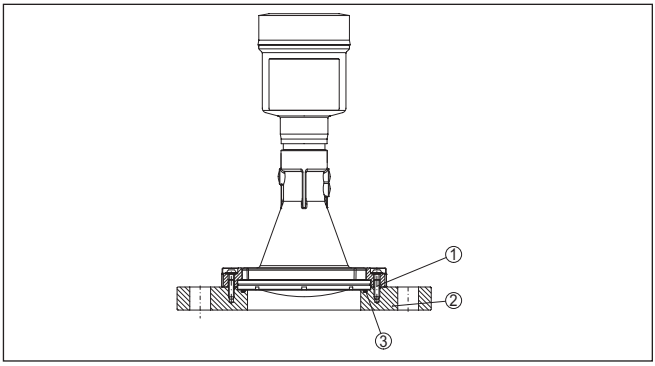


Fig. 8: Adapter flange

1 Connection screw
2 Adapter flange
3 Process seal

You can find drawings of these mounting options in chapter "*Dimensions*".

4.3 Mounting preparations, mounting strap

The mounting strap is supplied unassembled (optionally) and must be screwed to the sensor before setup with three hexagon socket screws M5 x 10 and spring washers. Max. torque, see chapter "*Technical data*". Required tools: Allen wrench size 4.

There are two different variants of screwing the strap to the sensor, see following illustration:

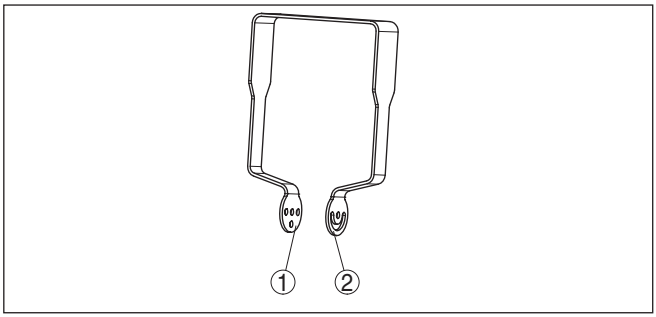


Fig. 9: Mounting strap for screwing to the sensor

1 For angle of inclination in steps
2 For angle of inclination, infinitely variable

Depending on the selected variant, the sensor can be rotated in the strap:

- Single chamber housing
  - Angle of inclination in three steps 0°, 90° and 180°
  - Angle of inclination 180°, infinitely variable
- Double chamber housing
  - Angle of inclination 90°, infinitely variable
  - Angle of inclination in two steps 0° and 90°

4.4 Mounting instructions

Polarisation

Radar sensors for level measurement emit electromagnetic waves. The polarization is the direction of the electrical component of these waves.

The polarization direction is marked by a nose on the housing, see following drawing:

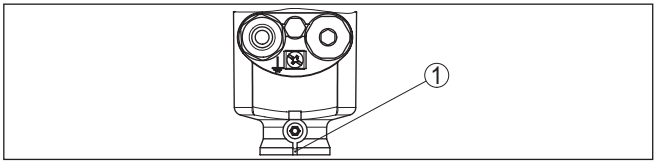


Fig. 10: Position of the polarisation

1 Nose for marking the direction of polarisation

Information:
When the housing is rotated, the direction of polarization changes and hence the influence of the false echo on the measured value. Please keep this in mind when mounting or making changes later.

Installation position

When mounting the sensor, keep a distance of at least 200 mm (7.874 in) from the vessel wall. If the sensor is installed in the center of dished or round vessel tops, multiple echoes can arise. However,

these can be suppressed by an appropriate adjustment (see chapter "*Setup*").

If you cannot maintain this distance, you should carry out a false signal storage during setup. This applies particularly if buildup on the vessel wall is expected. In such cases, we recommend repeating the false signal storage at a later date with existing buildup.

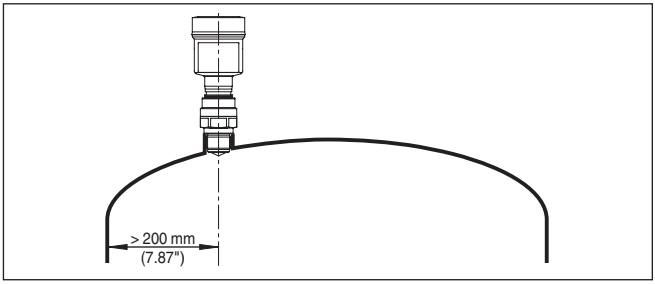


Fig. 11: Mounting of the radar sensor on round vessel tops

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

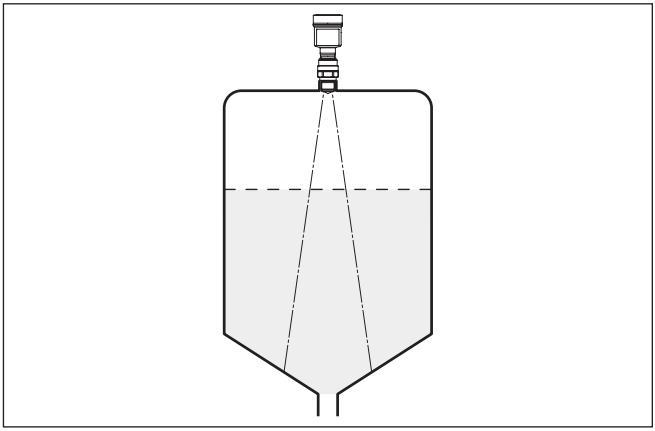


Fig. 12: Mounting of the radar sensor on vessels with conical bottom

Inflowing medium

Do not mount the instruments in or above the filling stream. Make sure that you detect the product surface, not the inflowing product.

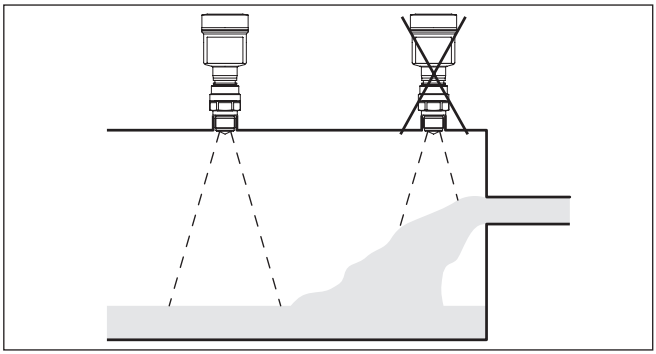


Fig. 13: Mounting of the radar sensor with inflowing medium

Socket with threaded fitting

The socket piece should be dimensioned in such a way that the antenna end protrudes at least 5 mm (0.2 in) out of the socket.

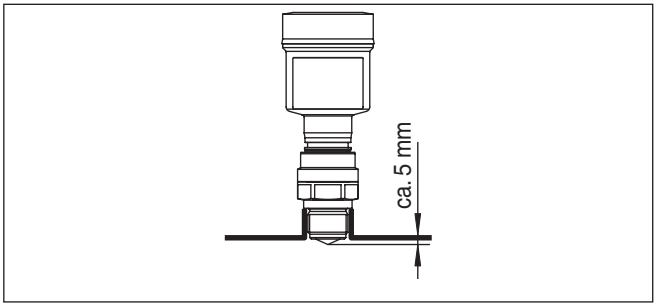


Fig. 14: Recommended socket mounting

If the reflective properties of the medium are good, you can mount VEGAPULS 64 on sockets which are higher than the length of the antenna. You will find recommended values for socket heights in the following illustration. The socket end should be smooth and burr-free, if possible also rounded. After installation you must carry out a false echo storage.

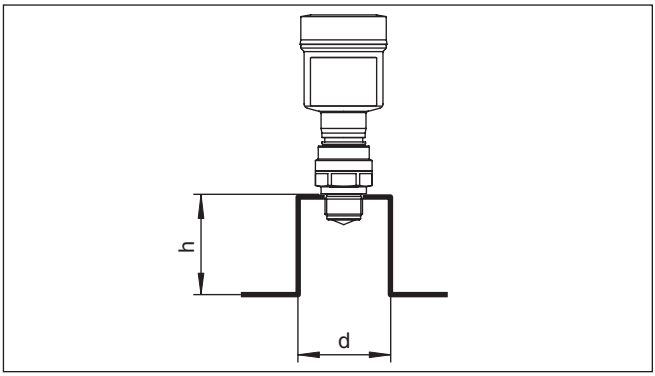


Fig. 15: Deviating socket dimensions

Information:
When mounting on longer sockets, we recommend carrying out a false echo storage (see chapter "*Parameter adjustment*").

The below charts specify the max. socket length h depending on the diameter d.

Socket diameter d	Socket length h
40 mm	≤ 200 mm
50 mm	≤ 250 mm
80 mm	≤ 300 mm
100 mm	≤ 400 mm
150 mm	≤ 500 mm

Socket diameter d	Socket length h
1½"	≤ 7.9 in
2"	≤ 9.9 in
3"	≤ 11.8 in
4"	≤ 15.8 in
6"	≤ 19.7 in

Socket with flange connection

The mounting socket should be as short as possible and its end rounded. This reduces false echoes from the vessel mounting socket.

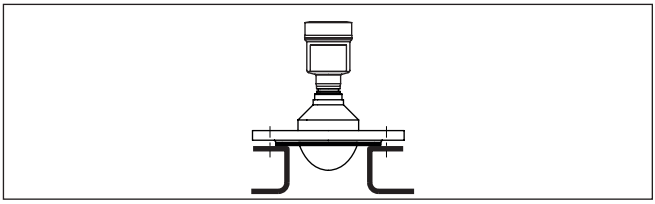
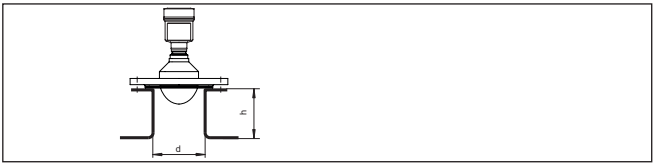


Fig. 16: Recommended socket mounting

If the medium has good reflective properties, you can also mount the VEGAPULS 64 on longer sockets. Approximate socket heights are shown in the following illustration.

Information:
When mounting on longer sockets, we recommend carrying out a false echo storage (see chapter "*Parameter adjustment*").



The below charts specify the max. pipe socket length h depending on the diameter d.

Socket diameter d	Socket length h
80 mm	≤ 200 mm
100 mm	≤ 300 mm
150 mm	≤ 500 mm

Socket diameter d	Socket length h
3"	≤ 11.8 in
4"	≤ 15.8 in
6"	≤ 19.7 in

Sensor orientation

In liquids, direct the sensor as perpendicular as possible to the product surface to achieve optimum measurement results.

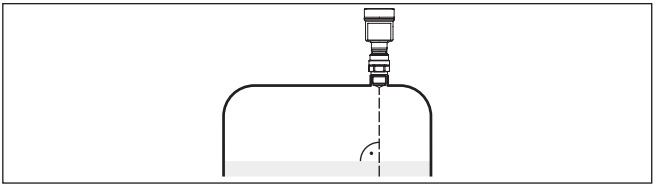


Fig. 18: Alignment in liquids

Vessel installations

The mounting location of the radar sensor should be a place where no other equipment or fixtures cross the path of the radar signals.

Vessel installations, such as e.g. ladders, limit switches, heating spirals, struts, etc., can cause false echoes and impair the useful echo. Make sure when planning your measuring point that the radar sensor has a "clear view" to the measured product.

In case of existing vessel installations, a false echo storage should be carried out during setup.

If large vessel installations such as struts or supports cause false echoes, these can be attenuated through supplementary measures.

Small, inclined sheet metal baffles above the installations scatter the radar signals and prevent direct interfering reflections.

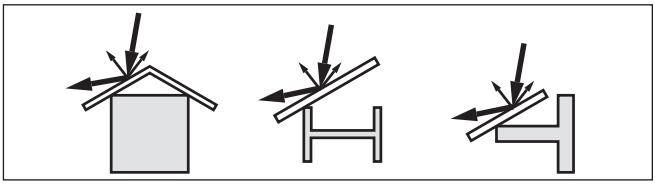


Fig. 19: Cover flat, large-area profiles with deflectors

Agitators

If there are agitators in the vessel, a false signal suppression should be carried out with the agitators in motion. This ensures that the interfering reflections from the agitators are saved with the blades in different positions.

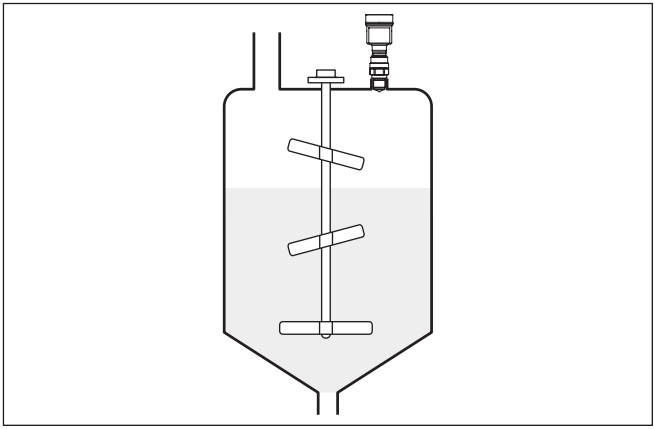


Fig. 20: Agitators

Foam generation

Through the action of filling, stirring and other processes in the vessel, compact foam can form on the product surface, damping the emitted signals considerably.

If foam is causing measurement errors, the largest possible radar antenna should be used.

As an alternative, sensors with guided microwave can be used. These are unaffected by foam generation and are best suited for such applications.

4.5 Measurement setup - Flow

Flow measurement with rectangular overfall

The short examples give you introductory information on flow measurement. Detailed planning information is available from flume manufacturers and in special literature.

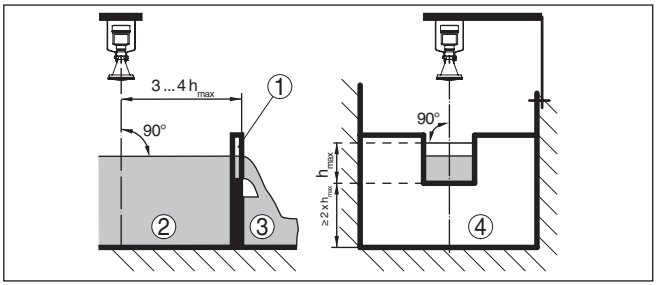


Fig. 21: Flow measurement with rectangular overfall: $d_{min.}$ = min. distance of the sensor (see chapter "Technical data"); $h_{max.}$ = max. filling of the rectangular spillway

1 Overflow orifice (side view)
2 Headwater
3 Tailwater
4 Overfall orifice (view from tailwater)

In general, the following points must be observed:

- Install the sensor on the headwater side
- Installation in the centre of the flume and vertical to the liquid surface
- Distance to the overfall orifice
- Distance of orifice opening above ground
- Min. distance of the orifice opening to tailwater
- Min. distance of the sensor to max. storage level

Flow measurement with Khafagi Venturi flume

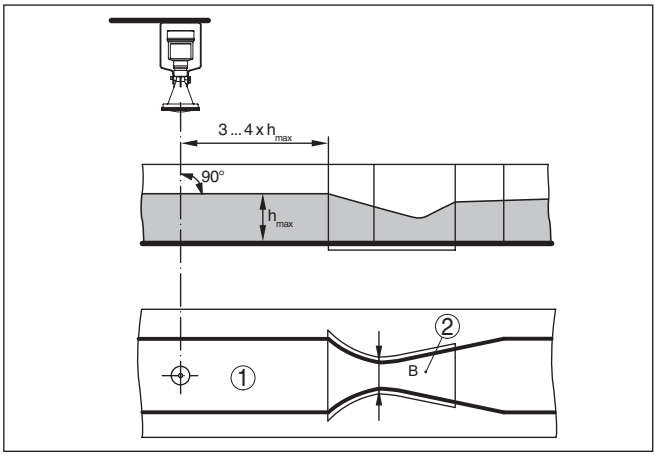


Fig. 22: Flow measurement with Khafagi-Venturi flume: $h_{max.}$ = max. filling of the flume; B = tightest constriction in the flume

1 Position sensor
2 Venturi flume

In general, the following points must be observed:

- Installation of the sensor at the inlet side

- Installation in the centre of the flume and vertical to the liquid surface
- Distance to the Venturi flume
- Min. distance of the sensor to max. storage level

5 Connecting to power supply

5.1 Preparing the connection

Safety instructions

Always keep in mind the following safety instructions:

Warning:
Connect only in the complete absence of line voltage.

- The electrical connection must only be carried out by trained personnel authorised by the plant operator.
- If overvoltage surges are expected, overvoltage arresters should be installed.

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.

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)
- 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 screen. If electromagnetic interference is expected which is above the test values of EN 61326-1 for industrial areas, screened cable should be used.

Screened cable generally necessary in HART multidrop mode.

Use cable with round cross section for instruments with housing and cable gland. To ensure the seal effect of the cable gland (IP protection rating), find out which cable outer diameter the cable gland is suitable for.

Use a cable gland fitting the cable diameter.

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.

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

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

Cable screening and grounding

If screened cable is required, the cable screen must be connected on both ends to ground potential. In the sensor, the screen 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 and CCP systems (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.

Information:
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 Connecting

Connection technology

The voltage supply and signal output are connected via the spring-loaded terminals in the housing.

Connection to the display and adjustment module or to the interface adapter is carried out via contact pins in the housing.

Information:
The terminal block is pluggable and can be removed from the electronics. To do this, lift the terminal block with a small screwdriver and pull it out. When reinserting the terminal block, you should hear it snap in.

Connection procedure

Proceed as follows:

1. Unscrew the housing lid
2. If a display and adjustment module is installed, remove it by turning it slightly to the left.
3. Loosen compression nut of the cable gland and remove blind plug
4. 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
5. Insert the cable into the sensor through the cable entry

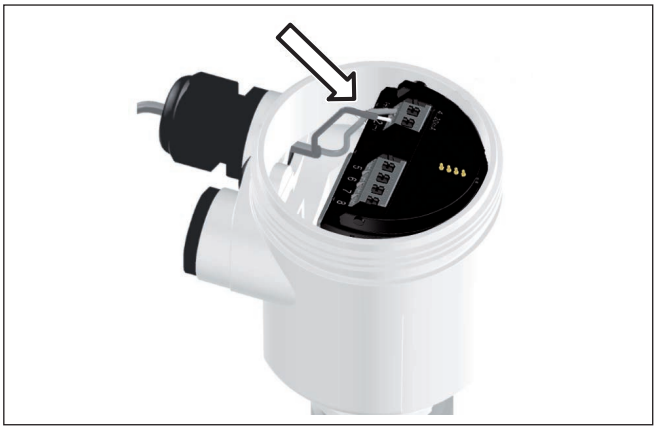


Fig. 23: Connection steps 5 and 6 - Single chamber housing

Fig. 24: Connection steps 5 and 6 - Double chamber housing

6. Insert the wire ends into the terminals according to the wiring plan

Information:
Solid cores as well as flexible cores with wire end sleeves are inserted directly into the terminal openings. In case of flexible cores without end sleeves, press the terminal from above with a small screwdriver, the terminal opening is then free. When the screwdriver is released, the terminal closes again.

You can find further information on the max. wire cross-section under "*Technical data - Electromechanical data*"

7. Check the hold of the wires in the terminals by lightly pulling on them
8. Connect the screen to the internal ground terminal, connect the external ground terminal to potential equalisation

9. Tighten the compression nut of the cable entry gland. The seal ring must completely encircle the cable
10. Reinsert the display and adjustment module, if one was installed
11. Screw the housing lid back on

The electrical connection is finished.

5.3 Wiring plan, single chamber housing

The following illustration applies to the non-Ex as well as to the Ex-ia version.

Electronics and terminal compartment

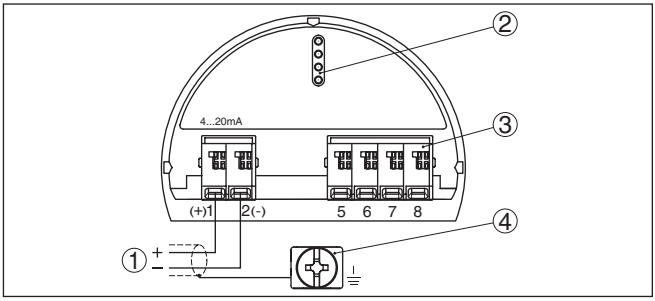


Fig. 25: Electronics and terminal compartment, single chamber housing

1 Voltage supply, signal output
2 For display and adjustment module or interface adapter
3 For external display and adjustment unit
4 Ground terminal for connection of the cable screen

5.4 Wiring plan, double chamber housing

The following illustrations apply to the non-Ex as well as to the Ex-ia version.

Electronics compartment

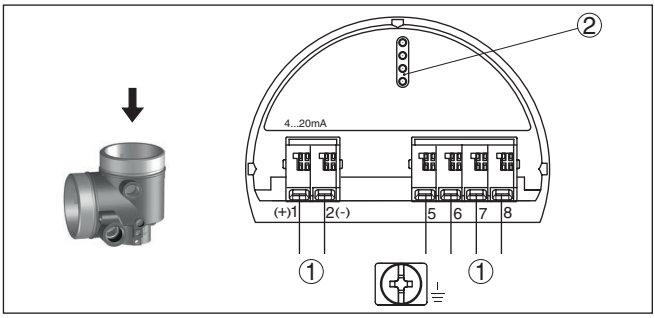


Fig. 26: Electronics compartment, double chamber housing

1 Internal connection to the terminal compartment
2 For display and adjustment module or interface adapter

Terminal compartment

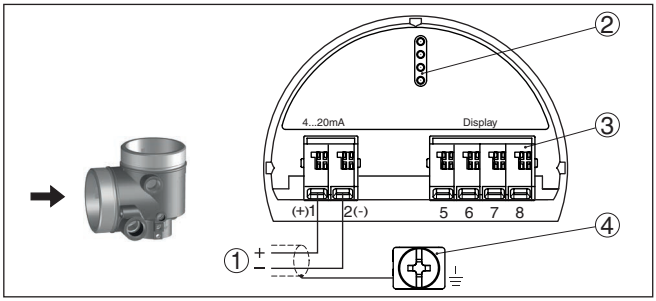


Fig. 27: Terminal compartment, double chamber housing

1 Voltage supply, signal output
2 For display and adjustment module or interface adapter
3 For external display and adjustment unit
4 Ground terminal for connection of the cable screen

Information:
Parallel use of an external display and adjustment unit and a display and adjustment module in the terminal compartment is not supported.

5.5 Double chamber housing Ex d

Electronics compartment

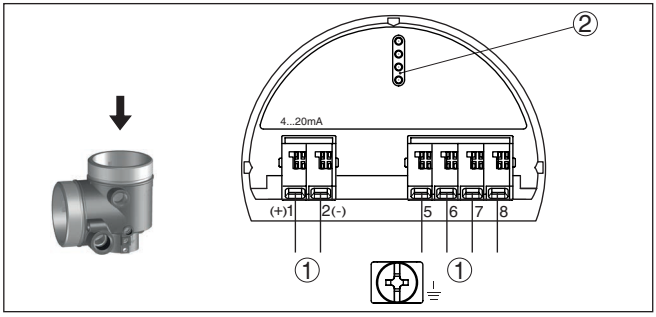


Fig. 28: Electronics compartment, double chamber housing Ex d

1 Internal connection to the terminal compartment
2 For display and adjustment module or interface adapter

Terminal compartment

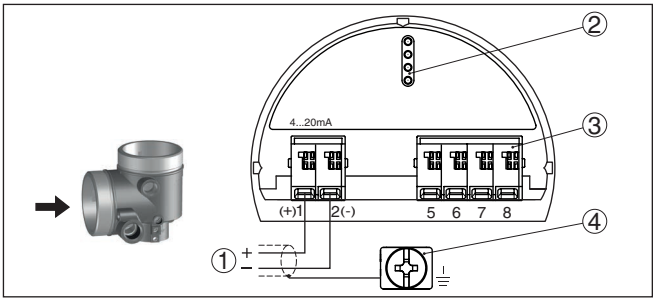


Fig. 29: Terminal compartment, double chamber housing

1 Voltage supply, signal output
2 For display and adjustment module or interface adapter
3 For external display and adjustment unit
4 Ground terminal for connection of the cable screen

Information:
Parallel use of an external display and adjustment unit and a display and adjustment module in the terminal compartment is not supported.

5.6 Double chamber housing with DISADAPT

Electronics compartment

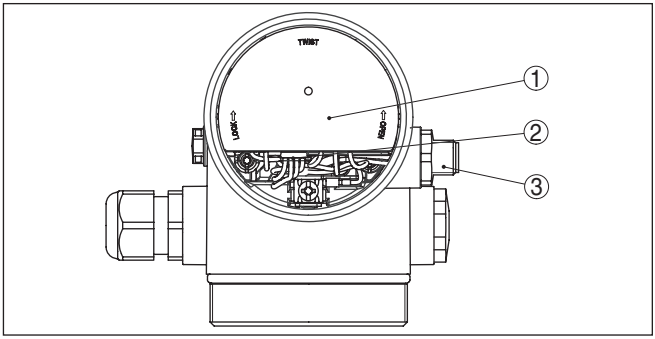


Fig. 30: View to the electronics compartment with DISADAPT for connection of the external display and adjustment unit

1 DISADAPT
2 Internal plug connection
3 Plug connector M12 x 1

Assignment of the plug connector

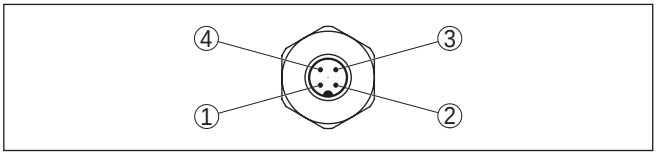


Fig. 31: View to the plug connector M12 x 1

1 Pin 1
2 Pin 2
3 Pin 3
4 Pin 4

Contact pin	Colour connection cable in the sensor	Terminal, electronics module
Pin 1	Brown	5
Pin 2	White	6
Pin 3	Blue	7
Pin 4	Black	8

5.7 Wiring plan - version IP 66/IP 68, 1 bar

Wire assignment, connection cable

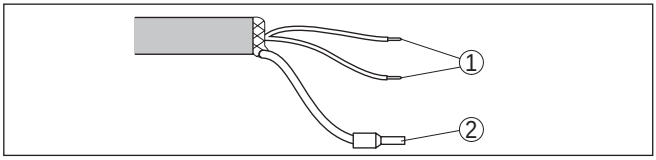


Fig. 32: Wire assignment in permanently connected connection cable

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

5.8 Switch-on phase

After connecting the instrument to power supply or after a voltage recurrence, the instrument carries out a self-check for approx. 30 s:

- Internal check of the electronics
- Indication of the status message "*F 105 Determine measured value*" on the display or PC
- The output signal jumps to the set fault current

As soon as a plausible measured value is found, the corresponding current is outputted to the signal cable. The value corresponds to the actual level as well as the settings already carried out, e.g. factory setting.

6 Set up with the display and adjustment module

6.1 Insert display and adjustment module

The display and adjustment module can be inserted into the sensor and removed again at any time. You can choose any one of four different positions - each displaced by 90°. It is not necessary to interrupt the power supply.

Proceed as follows:

1. Unscrew the housing lid
2. Place the display and adjustment module on the electronics in the desired position and turn it to the right until it snaps in.
3. Screw housing lid with inspection window tightly back on

Disassembly is carried out in reverse order.

The display and adjustment module is powered by the sensor, an additional connection is not necessary.

Fig. 33: Installing the display and adjustment module in the electronics compartment of the single chamber housing

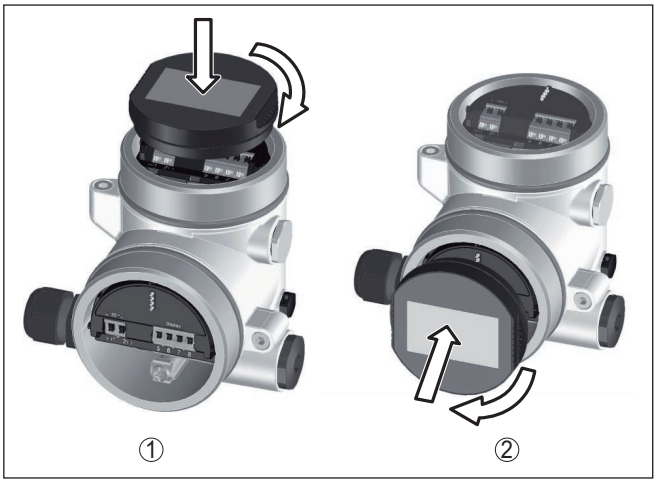


Fig. 34: Installing the display and adjustment module in the double chamber housing

1 In the electronics compartment
2 In the terminal compartment

Note:
If you intend to retrofit the instrument with a display and adjustment module for continuous measured value indication, a higher lid with an inspection glass is required.

6.2 Adjustment system

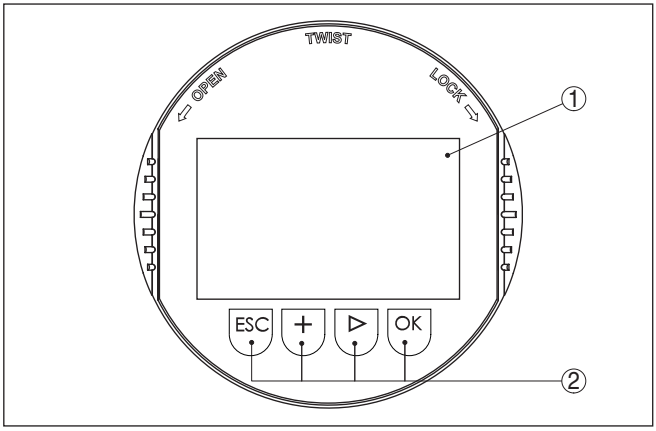


Fig. 35: Display and adjustment elements

1 LC display
2 Adjustment keys

Key functions

- ***[OK]*** key:

- Move to the menu overview
- Confirm selected menu
- Edit parameter
- Save value

- ***[->]*** key:
  - Presentation, change measured value
  - Select list entry
  - Select menu items in the quick setup menu
  - Select editing position

- ***[+]*** key:
  - Change value of the parameter

- ***[ESC]*** key:
  - Interrupt input
  - Jump to next higher menu

Adjustment system

The instrument is operated via the four keys of the display and adjustment module. The individual menu items are shown on the LC display. You can find the functions of the individual keys in the previous illustration.

Time functions

When the ***[+]*** and ***[->]*** keys are pressed quickly, the edited value, i.e. the cursor, moves by one position. When the keys are pressed longer than 1 s, the cursor moves continuously.

When the ***[OK]*** and ***[ESC]*** keys are pressed simultaneously for more than 5 s, the display returns to the main menu. The menu language is then switched over to "*English*".

Approx. 60 minutes after the last pressing of a key, an automatic reset to measured value indication is triggered. Any values not confirmed with ***[OK]*** will not be saved.

6.3 Measured value indication - Selection national language

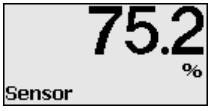
Measured value indication

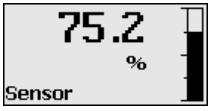
With the ***[->]*** key you move between three different indication modes.

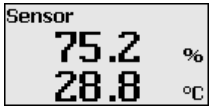
In the first view, the selected measured value is displayed in large digits.

In the second view, the selected measured value and a corresponding bar graph presentation are displayed.

In the third view, the selected measured value as well as a second selectable value, e.g. the temperature of the electronics, are displayed.



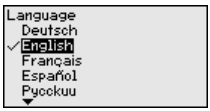




During the initial setup of an instrument shipped Ex works, use the "***OK***" key to get to the menu "*National language*".

Selection of national language

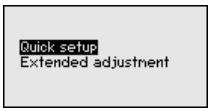
This menu item is used to select the national language for further parameter adjustment. You can change the selection via the menu item "*Setup - Display, Menu language*".



With the "***OK***" key you move to the main menu.

6.4 Parameter adjustment - Quick setup

To quickly and easily adapt the sensor to the application, select the menu item "*Quick setup*" in the start graphic on the display and adjustment module.



Select the individual steps with the ***[->]*** key.

After the last step, "*Quick setup terminated successfully*" is displayed briefly.

Information:
The echo curve of setup is stored automatically during the quick setup.

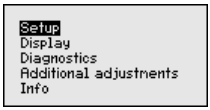
The return to the measured value indication is carried out through the ***[->]*** or ***[ESC]*** keys or automatically after 3 s

You can find "*Extended adjustment*" in the next sub-chapter.

6.5 Parameter adjustment - Extended adjustment

Main menu

The main menu is divided into five sections with the following functions:



Setup: Settings, e.g., for measurement loop name, units, application, adjustment, signal output

Display: Settings, e.g., for language, measured value display, lighting

Diagnosis: Information, for example, on device status, peak value, simulation, echo curve

Additional adjustments: Date/Time, reset, copy function, scaling, current output, false signal suppression, linearization, HART mode, special parameters

Info: Instrument name, hardware and software version, calibration date, instrument features

In the main menu item "*Setup*", the individual submenu items should be selected one after the other and provided with the correct

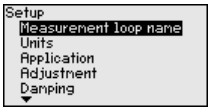
parameters to ensure optimum adjustment of the measurement. The procedure is described in the following.

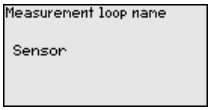
Setup - Measurement loop name

Here you can assign a suitable measurement loop name. Push the "***OK***" key to start the editing. With the "**+**" key you change the sign and with the "**->**" key you jump to the next position.

You can enter names with max. 19 characters. The character set comprises:

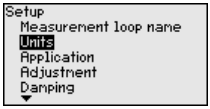
- Capital letters from A … Z
- Numbers from 0 … 9
- Special characters + - / _ blanks

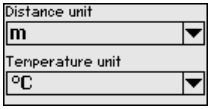




Setup - Units

In this menu item you select the distance unit and the temperature unit.

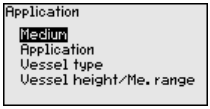




For the distance units you can choose between m, in and ft and for the temperature units °C, °F and K.

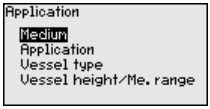
Setup - Application

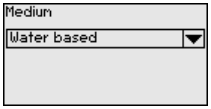
This menu item allows you to adapt the sensor to the measuring conditions.



Medium

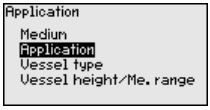
The following options are available:

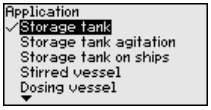


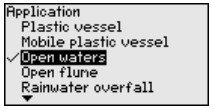


Application

The following options are available:







The following features form the basis of the applications:

- Storage tank:

- Setup: large-volumed, upright cylindrical, spherical
- Product speed: slow filling and emptying

51141-EN-160407

- Process/measurement conditions:
  - Condensation
  - Smooth product surface
  - High requirements on measurement accuracy
- Properties, sensor:
  - Low sensitivity to sporadic false echoes
  - Stable and reliable measured values through averaging
  - High accuracy
  - Short reaction time of the sensor not required

- Storage tank with product circulation:

- Setup: large-volumed, upright cylindrical, spherical
- Product speed: slow filling and emptying
- Installations: small laterally mounted or large top mounted stirrer
- Process/measurement conditions:
  - Relatively smooth product surface
  - High requirements on measurement accuracy
  - Condensation
  - Slight foam generation
  - Overfilling possible
- Properties, sensor:
  - Low sensitivity to sporadic false echoes
  - Stable and reliable measured values through averaging
  - High accuracy, because not set for max. speed
  - False signal suppression recommended

- Storage tank on ships (Cargo Tank):

- Product speed: slow filling and emptying
- Vessel:
  - Installations in the bottom section (bracers, heating spirals)
  - High sockets 200 … 500 mm, also with large diameters
- Process/measurement conditions:
  - Condensation, buildup by movement
  - Max. requirement on measurement accuracy from 95 %
- Properties, sensor:
  - Low sensitivity to sporadic false echoes
  - Stable and reliable measured values through averaging
  - High accuracy
  - False signal suppression required

- Stirrer vessel (reactor):

- Setup: all vessel sizes possible
- Product speed:
  - Fast to slow filling possible
  - Vessel is filled and emptied very often
- Vessel:
  - Socket available
  - Large agitator blades of metal
  - Vortex breakers, heating spirals
- Process/measurement conditions:
  - Condensation, buildup by movement
  - Strong spout generation
  - Very agitated surface, foam generation

- Properties, sensor:
  - Higher measurement speed through less averaging
  - Sporadic false echoes are suppressed

- Dosing vessel:
- Setup: all vessel sizes possible
- Product speed:
  - Fast filling and emptying
  - Vessel is filled and emptied very often
- Vessel: tight installation situation
- Process/measurement conditions:
  - Condensation, buildup on the antenna
  - Foam generation
- Properties, sensor:
  - Measurement speed optimized by virtually no averaging
  - Sporadic false echoes are suppressed
  - False signal suppression recommended

- Plastic tank:
- Vessel:
  - Instrument fix mounted or built in
  - Measurement through the vessel top, if appropriate to the application
  - With empty vessel, the measurement can go through the bottom
- Process/measurement conditions:
  - Condensation on the plastic ceiling
  - In outdoor facilities, water and snow on vessel top possible
- Properties, sensor:
  - False signals outside the vessel are not taken into consideration
  - False signal suppression recommended

- Transportable plastic tank:
- Vessel:
  - Material and thickness different
  - Measurement through the vessel top
- Process/measurement conditions:
  - Measured value jump with vessel change
- Properties, sensor:
  - Quick adaptation to changing reflection conditions due to vessel change
  - False signal suppression required

- Open water (gauge measurement):
- Rate of level change: slow level change
- Process/measurement conditions:
  - Large distance from sensor to water surface
  - Extreme damping of output signal due to wave generation
  - Ice and condensation on the antenna possible
  - Spiders and insects build nests in the antennas
  - Floating material and animals sporadically appear on water surface
- Properties, sensor:

- Stable and reliable measured values through frequent averaging
- Insensitive in the close range

- Open flume (flow measurement):

- Rate of level change: slow level change
- Process/measurement conditions:
  - Ice and condensation on the antenna possible
  - Spiders and insects build nests in the antennas
  - Smooth water surface
  - Exact measurement result required
  - Distance to the water surface normally relatively large
- Properties, sensor:
  - Stable and reliable measured values through frequent averaging
  - Insensitive in the close range

- Rain water spillover (weir):

- Rate of level change: slow level change
- Process/measurement conditions:
  - Ice and condensation on the antenna possible
  - Spiders and insects build nests in the antennas
  - Turbulent water surface
  - Sensor flooding possible
- Properties, sensor:
  - Stable and reliable measured values through frequent averaging
  - Insensitive in the close range

- Demonstration:

- Adjustment for all applications which are not typically level measurement
  - Instrument demonstration
  - Object recognition/monitoring (additional settings required)
- Properties, sensor:
  - Sensor accepts all measured value changes within the measuring range immediately
  - High sensitivity to interference, because virtually no averaging

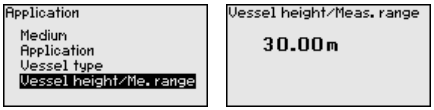
Vessel form

Apart from the medium and the application, the vessel form itself can influence the measurement. To adapt the sensor to these measuring conditions, this menu item offers different options for vessel bottom and ceiling for certain applications.

Enter the requested parameters via the appropriate keys, save your settings with ***[OK]*** and jump to the next menu item with the ***[ESC]*** and the ***[->]*** key.

Vessel height/Measuring range
Through this selection the operating range of the sensor is adapted to the vessel height, which considerably increases measurement certainty under different basic conditions.

The min. adjustment must be carried out independently of this.



Enter the requested parameters via the appropriate keys, save your settings with ***[OK]*** and jump to the next menu item with the ***[ESC]*** and the ***[->]*** key.

Caution:
If liquids with different dielectric constants separate in the vessel, for example through condensation, the radar sensor can detect under certain circumstances only the medium with the higher dielectric constant. Keep in mind that layer interfaces can cause faulty measurements.

If you want to measure the total height of both liquids reliably, please contact our service department or use an instrument specially designed for interface measurement.

Setup - Adjustment

Since the radar sensor is a distance measuring instrument, the distance from the sensor to the product surface is measured. To indicate the actual level, an allocation of the measured distance to the percentage height must be carried out.

To perform the adjustment, enter the distance with full and empty vessel, see the following example:

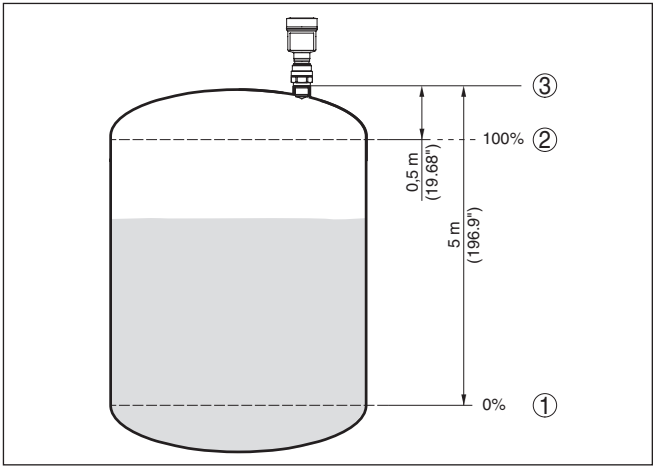


Fig. 36: Parameter adjustment example min./max. adjustment

1 Min. level = max. measuring distance
2 Max. level = min. measuring distance
3 Reference plane

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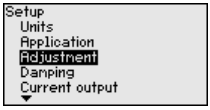
If these values are not known, an adjustment with the distances of e.g. 10 % and 90 % is possible. Starting point for these distance specifications is always the sealing surface of the thread or flange. You can find specifications on the reference plane in chapter "*Technical data*". The actual level is calculated on the basis of these settings.

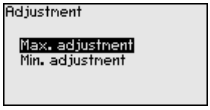
The actual product level during this adjustment is not important, because the min./max. adjustment is always carried out without changing the product level. These settings can be made ahead of time without the instrument having to be installed.

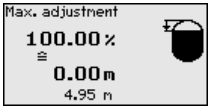
Setup - Max. adjustment

Proceed as follows:

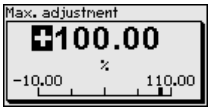
1. Select with ***[->]*** the menu item Max. adjustment and confirm with ***[OK]***.



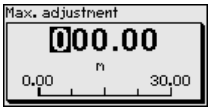




2. Prepare the percentage value for editing with ***[OK]*** and set the cursor to the requested position with ***[->]***.



3. Set the requested percentage value with ***[+]*** and save with ***[OK]***. The cursor jumps now to the distance value.

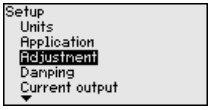


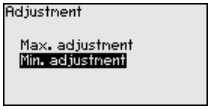
4. For the full vessel, enter the distance value in m matching the percentage value.
5. Save settings with ***[OK]*** and move with ***[ESC]*** and ***[->]*** to Min. adjustment.

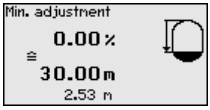
Setup - Min. adjustment

Proceed as follows:

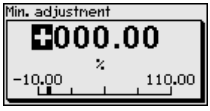
1. Select with ***[->]*** the menu item "*Min. adjustment*" and confirm with ***[OK]***.



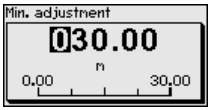




2. Edit the percentage value with ***[OK]*** and set the cursor to the requested position with ***[->]***.



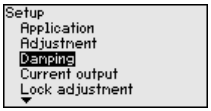
3. Set the requested percentage value with ***[+]*** and save with ***[OK]***. The cursor jumps now to the distance value.

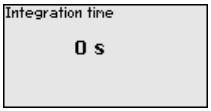


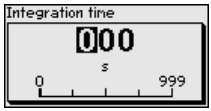
4. Enter the suitable distance value in m for the empty vessel (e.g. distance from the sensor to the vessel bottom) corresponding to the percentage value.

Setup - Damping

To damp process-dependent measured value fluctuations, set an integration time of 0 … 999 s in this menu item.



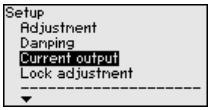


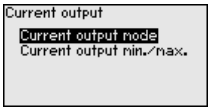


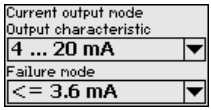
The default setting is a damping of 0 s.

Setup - Current output mode

In the menu item "*Current output mode*" you determine the output characteristics and reaction of the current output in case of failure.



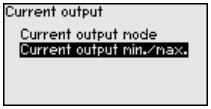


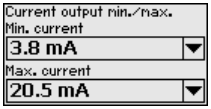


The default setting is output characteristics 4 … 20 mA, failure mode < 3.6 mA.

Setup - Current output Min./Max.

In the menu item "*Current output Min./Max.*", you determine the reaction of the current output during operation.





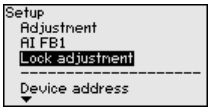
The default setting is min. current 3.8 mA and max. current 20.5 mA.

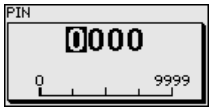
Lock/unlock setup - Adjustment

In the menu item "*Lock/unlock adjustment*", you can protect the sensor parameters against unauthorized or inadvertent modification. The PIN is activated/deactivated permanently.

With active PIN, only the following adjustment functions are possible without entering a PIN:

- Select menu items and show data
- Read data from the sensor into the display and adjustment module.

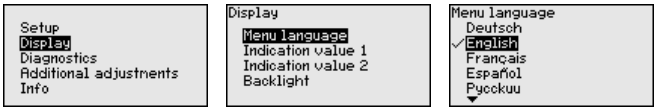




Caution:
With active PIN, adjustment via PACTware/DTM as well as other systems is also blocked.

Display - Menu language

This menu item enables the setting of the requested national language.



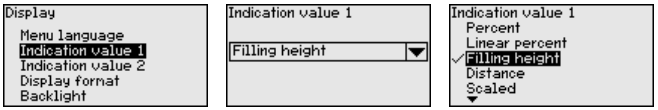
The following languages are available:

- German
- English
- French
- Spanish
- Russian
- Italian
- Dutch
- Portuguese
- Japanese
- Chinese
- Polish
- Czech
- Turkish

In the delivery status, the VEGAPULS 64 is set to the ordered national language.

Display - Displayed value 1 and 2

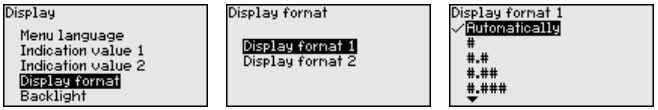
In this menu item you can define the way measured values are indicated on the display.



The default setting for the displayed value is "*Distance*".

Display - Display format

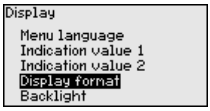
In this menu item you define the number of decimal positions with which the measured value is displayed.



The default setting for the display format is "*Automatically*".

Display - Backlight

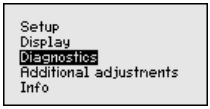
The display and adjustment module has a backlight for the display. In this menu item you can switch the lighting on or off. You can find the required operating voltage in chapter "*Technical data*".

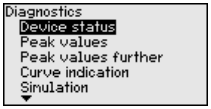


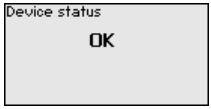
In delivery status, the lighting is switched on.

Diagnostics - Device status

In this menu item, the device status is displayed.



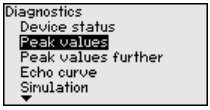


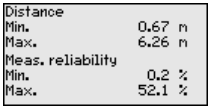


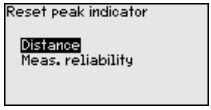
Diagnosis - Peak value

The min. and max. measured value, the measurement certainty as well as the min. and max. electronics temperature are stored in the sensor. The values are displayed in menu item "*Peak value*" or "*Further peak values*".

A reset menu is opened with the ***[OK]*** key in the respective peak value window:



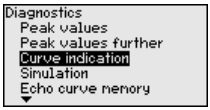


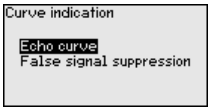


With the ***[OK]*** key in the reset menu, the peak values are reset to the current measured value.

Diagnoses - Curve indication

The "*Echo curve*" shows the signal strength of the echoes over the measuring range in dB. The signal strength enables an evaluation of the quality of the measurement.



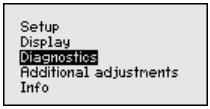


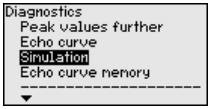
The selected curve is continuously updated. A submenu with zoom functions is opened with the ***[OK]*** key:

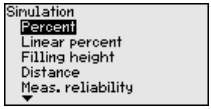
- "X-Zoom": Zoom function for the meas. distance
- "Y-Zoom": 1, 2, 5 and 10x signal magnification in "*dB*"
- "Unzoom": Reset the presentation to the nominal measuring range without magnification

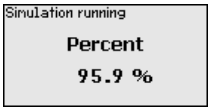
Diagnosis - Simulation

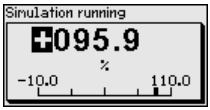
In this menu item you can simulate measured values via the current output. This allows the signal path to be tested, e.g. through downstream indicating instruments or the input card of the control system.







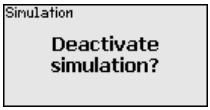




Select the requested simulation variable and set the requested value.

Caution:
During simulation, the simulated value is outputted as 4 … 20 mA current value and as digital HART signal. The status message within the context of the asset management function is "*Maintenance*".

To deactivate the simulation, you have to push the ***[ESC]*** key and confirm the message



with the ***[OK]*** key.

Information:
The sensor terminates the simulation automatically after 60 minutes.

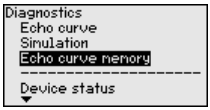
Diagnostics - Echo curve memory

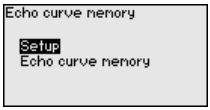
The function "*Setup*" allows the echo curve to be saved at the time of setup.

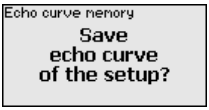
Information:
This is generally recommended, however, for use of the Asset Management functions it is absolutely necessary. Saving should be carried out with a very low level.

The function "*Echo curve memory*" allows up to ten individual echo curves to be stored, for example to detect the measurement behaviour of the sensor in different operating conditions.

With the adjustment software PACTware and the PC, the stored echo curves can be displayed with high resolution and used to recognize signal changes over time. In addition, the echo curve saved during setup can also be displayed in the echo curve window and compared with the current echo curve.

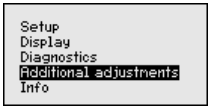


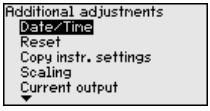




Additional adjustments - Date/Time

In this menu item, the internal clock of the sensor is set to the requested time and time format. At the time of shipment from factory, the instrument is set to CET (Central European Time).



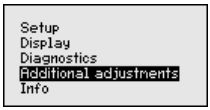


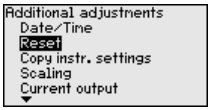
Additional adjustments - Reset

During a reset, the parameter settings carried out by the user are reset to the default values (see below table).

Proceed as follows:

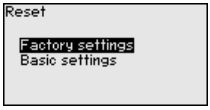
1. Select with ***[->]*** under "*Additional adjustments*" the menu item "*Reset*" and confirm with ***[OK]***.





2. Confirm with ***[OK]*** and select the requested reset function with ***[->]***

3. Confirm with ***[OK]***, for approx. 5 s the message "*Resetting*" is displayed, then the selection window appears.



Caution:
For the duration of the reset, the set trouble signal is outputted via the current output. Within the context of the asset management function, the message "*Maintenance*" is outputted.

The following reset functions are available:

Delivery status: Restores the parameter settings at the time of shipment from the factory, incl. the order-specific settings. Any created false signal suppression, user-programmable linearization curve as well as measured value and echo curve memory is deleted. The event and parameter modification memories remain unaffected.

Basic settings: Resets the parameter settings, incl. special parameters, to the default values of the respective instrument. Any stored false signal suppression or user programmable linearisation curve, as well as the measured value memory, is deleted. Order-related settings are not taken over into the current parameters after this reset.

The following table shows the scope of the reset function and the default values of the instrument:

Menu	Menu item	Default value
Setup	Measurement loop name	Sensor
	Units	Distance in m Temperature in °C
	Application	Medium: Water solution Application: Storage tank Vessel top: Dished form Vessel bottom: Dished form Vessel height/Measuring range: 30 m
	Min. adjustment	30 m
	Max. adjustment	0,000 m(d)
	Damping	0.0 s
	Current output mode	Output characteristics: 4 … 20 mA Failure mode: < 3.6 mA ▼
	Current output Min./Max.	Min. current: 3.8 mA Max. current: 20.5 mA
Display	Displayed value 1	Filling height
	Displayed value 2	Electronics temperature
	Backlight	Switched on
Additional adjustments	Date/Time	Time format: 24 h
	Scaling size	Volume l
	Scaling format	100.00 lin %, 100 l 0.00 lin %, 0 l
	Current output 1 and 2 size	Lin %
	Current output 1 and 2 adjustment	100.00 %, 100 l 0.00 %, 0 l
	Linearization	Linear
	HART mode	HART address: 0 Loop current mode: Analogue current output

Additional adjustments - Copy instrument settings

The instrument settings are copied with this function. The following functions are available:

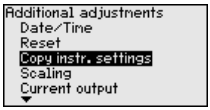
Read from sensor: Read data from sensor and store into the display and adjustment module

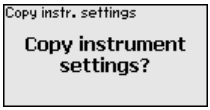
Write into sensor: Store data from the display and adjustment module back into the sensor

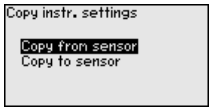
The following data or settings for adjustment of the display and adjustment module are saved:

- All data of the menu "*Setup*" and "*Display*"

- The menu items "*Reset, Date/Time*" in the menu "*Additional settings*"
- The user-programmable linearization curve





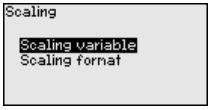


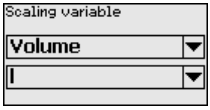
The copied data are permanently saved in an EEPROM memory in the display and adjustment module and remain there even in case of power failure. From there, they can be written into one or more sensors or kept as backup for a possible electronics exchange.

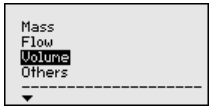
Note:
Before the data are saved in the sensor, a safety check is carried out to determine if the data match the sensor. In the process the sensor type of the source data as well as the target sensor are displayed. If the data do not match, a fault message is outputted or the function is blocked. The data are saved only after release.

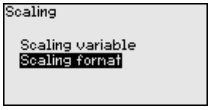
Additional settings - Scaling

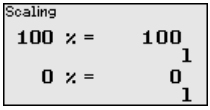
In the menu item "*Scaling*" you define the scaling variable and the scaling format for the indication of the level measured value for 0 % and 100 % on the display, for example as volume in l.





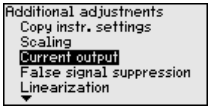


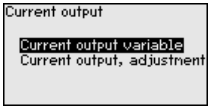


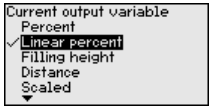


Additional settings - Current output (size)

In menu item "*Current output, variable*" you specify which measured variable the current output refers to.

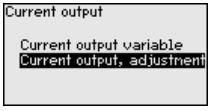


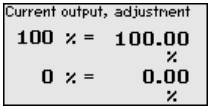




Additional settings - Current output (adjustment)

In menu item "*Current output, adjustment*" you can assign a respective measured value to the current output.





Additional adjustments - False signal suppression

The following circumstances cause interfering reflections and can influence the measurement:

- High sockets
- Vessel internals such as struts

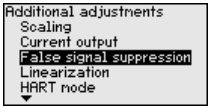
- Agitators
- Buildup or welded joints on vessel walls

Note:
A false signal suppression detects, marks and saves these false signals so that they are no longer taken into account in the level measurement.

This should be done with a low level so that all potential interfering reflections can be detected.

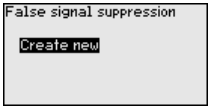
Proceed as follows:

1. Select with ***[->]*** the menu item "*False signal suppression*" and confirm with ***[OK]***.



2. Confirm again with ***[OK]***.

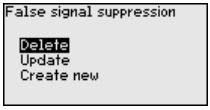
3. Confirm again with ***[OK]***.



4. Confirm again with ***[OK]*** and enter the actual distance from the sensor to the product surface.
5. All interfering signals in this section are detected by the sensor and stored after confirming with ***[OK]***.

Note:
Check the distance to the product surface, because if an incorrect (too large) value is entered, the existing level will be saved as a false signal. The level would then no longer be detectable in this area.

If a false signal suppression has already been saved in the sensor, the following menu window appears when selecting "*False signal suppression*":



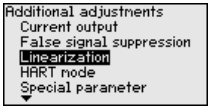
Delete: An already created false signal suppression will be completely deleted. This is useful if the saved false signal suppression no longer matches the metrological conditions in the vessel.

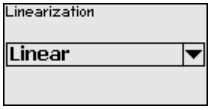
Extend: is used to extend an already created false signal suppression. This is useful if a false signal suppression was carried out with too high a level and not all false signals could be detected. When

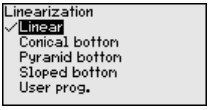
selecting "*Extend*", the distance to the product surface of the created false signal suppression is displayed. This value can now be changed and the false signal suppression can be extended to this range.

Additional adjustments - Linearization

A linearization is necessary for all vessels in which the vessel volume does not increase linearly with the level. Corresponding linearization curves are preprogrammed for these vessels. They represent the correlation between the level percentage and vessel volume. The linearization applies to the measured value indication and the current output.







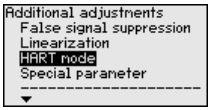
Additional adjustments - HART mode

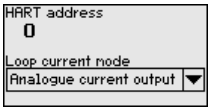
In this menu item you specify the HART mode and enter the address for multidrop mode.

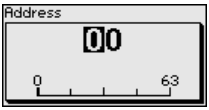
In the mode "*Fixed current output*" up to 63 sensors can be operated on one two-wire cable (Multidrop operation). An address between 0 and 63 must be assigned to each sensor.

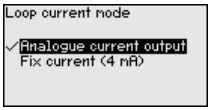
If you select the function "*Analogue current output*", a 4 … 20 mA signal is output in multidrop mode.

In the mode "*Fixed current (4 mA)*" a fixed 4 mA signal is output independently of the actual level.







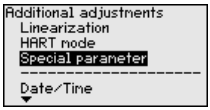


The default setting is "*Analogue current output*" and the address "*00*".

Additional adjustments - Special parameters

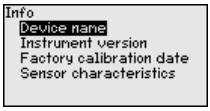
In this menu item you gain access to the protected area where you can enter special parameters. In exceptional cases, individual parameters can be modified in order to adapt the sensor to special requirements.

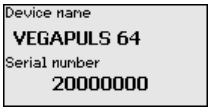
Change the settings of the special parameters only after having contacted our service staff.



Info - Instrument name

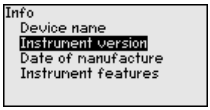
In this menu item, you can read out the instrument name and the instrument serial number:

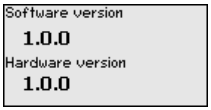




Info - Instrument version

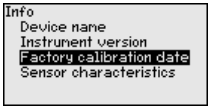
In this menu item, the hardware and software version of the sensor is displayed.





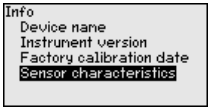
Info - Factory calibration date

In this menu item, the date of factory calibration of the sensor as well as the date of the last change of sensor parameters are displayed via the display and adjustment module or via the PC.



Info - Sensor characteristics

In this menu item, the features of the sensor such as approval, process fitting, seal, measuring range, electronics, housing and others are displayed.



6.6 Saving the parameter adjustment data

Backup on paper

We recommended noting the adjusted data, e.g. in this operating instructions manual, and archiving them afterwards. They are thus available for multiple use or service purposes.

Backup in the display and adjustment module

If the instrument is equipped with a display and adjustment module, the data in the sensor can be saved in the display and adjustment module. The procedure is described in the menu "*Additional adjustments*" in the menu item "*Copy sensor data*". The data remain there permanently even if the sensor power supply fails.

The following data or settings for adjustment of the display and adjustment module are saved:

- All data of the menu "*Setup*" and "*Display*"
- In the menu "*Additional settings*" the items "*Sensor-specific units, temperature unit and linearization*"
- The values of the user programmable linearization curve

The function can also be used to transfer settings from one instrument to another instrument of the same type. If it is necessary to exchange a sensor, the display and adjustment module is inserted into the replacement instrument and the data are likewise written into the sensor via the menu item "*Copy sensor data*".

7 Setup with PACTware

7.1 Connect the PC

Via the interface adapter directly on the sensor

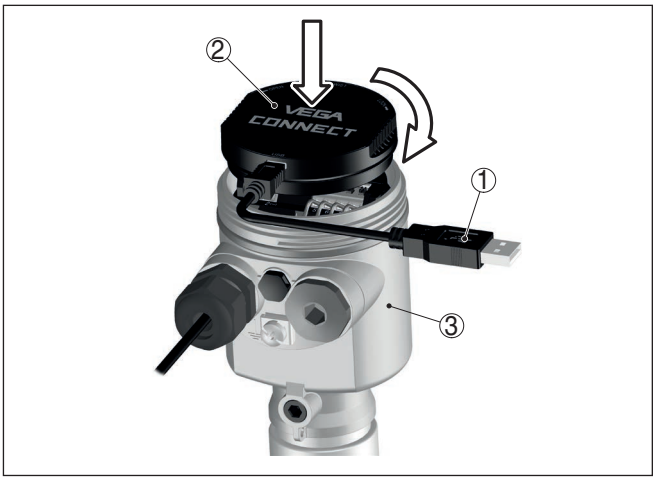


Fig. 37: Connection of the PC directly to the sensor via the interface adapter

1 USB cable to the PC
2 Interface adapter VEGACONNECT
3 Sensor

Via the interface adapter and HART

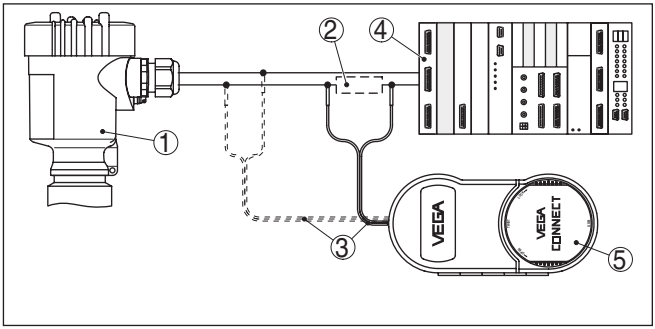


Fig. 38: Connecting the PC via HART to the signal cable

1 Sensor
2 HART resistance 250 Ω (optional depending on evaluation)
3 Connection cable with 2 mm pins and terminals
4 Processing system/PLC/Voltage supply
5 Interface adapter, for example VEGACONNECT 4

Note:
With power supply units with integrated HART resistance (internal resistance approx. 250 Ω), an additional external resistance is not necessary. This applies, e.g. to the VEGA instruments VEGATRENN 149A, VEGAMET 381, VEGAMET 391. Common Ex separators are

also usually equipped with a sufficient current limiting resistance. In such cases, the interface converter can be connected parallel to the 4 … 20 mA cable (dashed line in the previous illustration).

7.2 Parameter adjustment

Prerequisites

For parameter adjustment of the instrument via a Windows PC, the configuration software PACTware and a suitable instrument driver (DTM) according to FDT standard are required. The latest PACTware version as well as all available DTMs are compiled in a DTM Collection. The DTMs can also be integrated into other frame applications according to FDT standard.

Note:

To ensure that all instrument functions are supported, you should always use the latest DTM Collection. Furthermore, not all described functions are included in older firmware versions. You can download the latest instrument software from our homepage. A description of the update procedure is also available in the Internet.

Further setup steps are described in the operating instructions manual "*DTM Collection/PACTware*" attached to each DTM Collection and which can also be downloaded from the Internet. Detailed descriptions are available in the online help of PACTware and the DTMs.

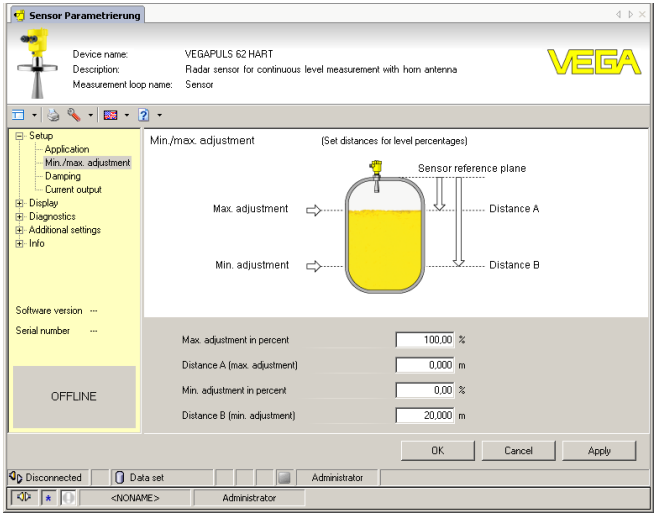


Fig. 39: Example of a DTM view

Standard/Full version

All device DTMs are available as a free-of-charge standard version and as a full version that must be purchased. In the standard version, all functions for complete setup are already included. An assistant for simple project configuration simplifies the adjustment considerably. Saving/printing the project as well as import/export functions are also part of the standard version.

In the full version there is also an extended print function for complete project documentation as well as a save function for measured value and echo curves. In addition, there is a tank calculation program as well as a multiviewer for display and analysis of the saved measured value and echo curves.

The standard version is available as a download under www.vega.com/downloads and "*Software*". The full version is available on CD from the agency serving you.

7.3 Saving the parameter adjustment data

We recommend documenting or saving the parameter adjustment data via PACTware. That way the data are available for multiple use or service purposes.

8 Set up with other systems

8.1 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*".

8.2 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.

9 Diagnosis, asset management and service

9.1 Maintenance

If the instrument is used correctly, no maintenance is required in normal operation.

In some applications, buildup on the antenna system can influence the measuring result. Depending on the sensor and application, take measures to avoid heavy soiling of the antenna system. If necessary, clean the antenna system in certain intervals.

9.2 Measured value and event memory

The instrument has several memories which are available for diagnostic purposes. The data remain there even in case of voltage interruption.

Measured value memory

Up to 100,000 measured values can be stored in the sensor in a ring memory. Each entry contains date/time as well as the respective measured value. Storable values are for example:

- Distance
- Filling height
- Percentage value
- Lin. percent
- Scaled
- Current value
- Meas. certainty
- Electronics temperature

When the instrument is shipped, the measured value memory is active and stores distance, measurement certainty and electronics temperature every 3 minutes.

The requested values and recording conditions are set via a PC with PACTware/DTM or the control system with EDD. Data are thus read out and also reset.

Event memory

Up to 500 events are automatically stored with a time stamp in the sensor (non-deletable). Each entry contains date/time, event type, event description and value. Event types are for example:

- Modification of a parameter
- Switch-on and switch-off times
- Status messages (according to NE 107)
- Error messages (according to NE 107)

The data are read out via a PC with PACTware/DTM or the control system with EDD.

Echo curve memory

The echo curves are stored with date and time and the corresponding echo data. The memory is divided into two sections:

Echo curve of the setup: This is used as reference echo curve for the measurement conditions during setup. Changes in the measurement conditions during operation or buildup on the sensor can thus be recognized. The echo curve of the setup is stored via:

- PC with PACTware/DTM
- Control system with EDD
- Display and adjustment module

Further echo curves: Up to 10 echo curves can be stored in a ring buffer in this memory section. Further echo curves are stored via:

- PC with PACTware/DTM
- Control system with EDD

9.3 Asset Management function

The instrument features self-monitoring and diagnostics according to NE 107 and VDI/VDE 2650. In addition to the status messages in the following tables, detailed error messages are available under menu item "*Diagnostics*" via the display and adjustment module, PACTware/DTM and EDD.

Status messages

The status messages are divided into the following categories:

- Failure
- Function check
- Out of specification
- Maintenance requirement

and explained by pictographs:

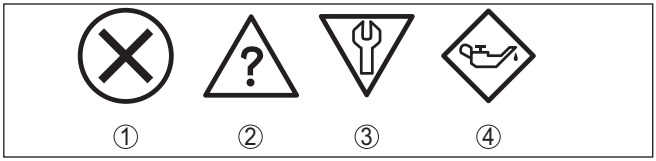


Fig. 40: Pictographs of the status messages

1 Failure - red
2 Out of specification - yellow
3 Function check - orange
4 Maintenance - blue

Failure: Due to a malfunction in the instrument, a failure message is outputted.

This status message is always active. It cannot be deactivated by the user.

Function check: The instrument is in operation, the measured value is temporarily invalid (for example during simulation).

This status message is inactive by default. It can be activated by the user via PACTware/DTM or EDD.

Out of specification: The measured value is unstable because the instrument specification is exceeded (e.g. electronics temperature).

This status message is inactive by default. It can be activated by the user via PACTware/DTM or EDD.

Maintenance: Due to external influences, the instrument function is limited. The measurement is affected, but the measured value is

still valid. Plan in maintenance for the instrument because a failure is expected in the near future (e.g. due to buildup).

This status message is inactive by default. It can be activated by the user via PACTware/DTM or EDD.

Failure

The following table shows the error codes in the status message "*Failure*" and gives information on the reason and rectification. Keep in mind that some information is only valid with four-wire instruments.

Code Text message	Cause	Rectification	DevSpec State in CMD 48
F013 no measured value available	– Sensor does not detect an echo during operation – Antenna system dirty or defective	– Check or correct installation and/or parameter adjustment – Clean or exchange process component or antenna	Bit 0 of Byte 0…5
F017 Adjustment span too small	– Adjustment not within specification	– Change adjustment according to the limit values (difference between min. and max. ≥ 10 mm)	Bit 1 of Byte 0…5
F025 Error in the linearization table	– Index markers are not continuously rising, for example illogical value pairs	– Check linearization table – Delete table/Create new	Bit 2 of Byte 0…5
F036 No operable software	– Failed or interrupted software update	– Repeat software update – Check electronics version – Exchanging the electronics – Send instrument for repair	Bit 3 of Byte 0…5
F040 Error in the electronics	– Hardware defect	– Exchanging the electronics – Send instrument for repair	Bit 4 of Byte 0…5
F080 General software error	– General software error	– Disconnect operating voltage briefly	Bit 5 of Byte 0…5
F105 Determine measured value	– The instrument is still in the start phase, the measured value could not yet be determined	– Wait for the end of the switch-on phase – Duration depending on the version and parameter adjustment up to approximately 3 min.	Bit 6 of Byte 0…5
F113 Communication error	– EMC interference – Transmission error with the external communication with 4-wire power supply unit	– Remove EMC influences – Exchange 4-wire power supply unit or electronics	Bit 12 of Byte 0…5

Code Text message	Cause	Rectification	DevSpec State in CMD 48
F125 Impermissible electronics temperature	– Temperature of the electronics in the non-specified range	– Check ambient temperature – Isolate electronics – Use instrument with higher temperature range	Bit 7 of Byte 0…5
F260 Error in the calibration	– Error in the calibration carried out in the factory – Error in the EEPROM	– Exchanging the electronics – Send instrument for repair	Bit 8 of Byte 0…5
F261 Error in the instrument settings	– Error during setup – False signal suppression faulty – Error when carrying out a reset	– Repeat setup – Carry out a reset	Bit 9 of Byte 0…5
F264 Installation/Setup error	– Adjustment not within the vessel height/measuring range – Max. measuring range of the instrument not sufficient	– Check or correct installation and/or parameter adjustment – Use an instrument with bigger measuring range	Bit 10 of Byte 0…5
F265 Measurement function disturbed	– Sensor no longer carries out a measurement – Operating voltage too low	– Check operating voltage – Carry out a reset – Disconnect operating voltage briefly	Bit 11 of Byte 0…5

Function check

The following table shows the error codes and text messages in the status message "*Function check*" and provides information on causes as well as corrective measures.

Code Text message	Cause	Rectification	DevSpec State in CMD 48
C700 Simulation active	– A simulation is active	– Finish simulation – Wait for the automatic end after 60 mins.	"Simulation Active" in "Standardized Status 0"

Out of specification

The following table shows the error codes and text messages in the status message "*Out of specification*" and provides information on causes as well as corrective measures.

Code Text message	Cause	Rectification	DevSpec State in CMD 48
S600 Impermissible electronics temperature	– Temperature of the electronics in the non-specified range	– Check ambient temperature – Isolate electronics – Use instrument with higher temperature range	Bit 8 of Byte 14…24

Code Text message	Cause	Rectification	DevSpec State in CMD 48
S601 Overfilling	– Danger of vessel overfilling	– Make sure that there is no further filling – Check level in the vessel	Bit 9 of Byte 14…24
S603 Impermissible operating voltage	– Operating voltage below specified range	– Check electrical connection – If necessary, increase operating voltage	Bit 11 of Byte 14…24

Maintenance

The following table shows the error codes and text messages in the status message "*Maintenance*" and provides information on causes as well as corrective measures.

Code Text message	Cause	Rectification	DevSpec State in CMD 48
M500 Error with the reset delivery status	– With the reset to delivery status, the data could not be restored	– Repeat reset – Load XML file with sensor data into the sensor	Bit 0 of Byte 14…24
M501 Error in the non-active linearization table	– Hardware error EEPROM	– Exchanging the electronics – Send instrument for repair	Bit 1 of Byte 14…24
M502 Error in the event memory	– Hardware error EEPROM	– Exchanging the electronics – Send instrument for repair	Bit 2 of Byte 14…24
M503 Meas. reliability too low	– The echo/noise ratio is too small for reliable measurement – Antenna dirty or defective	– Check installation and process conditions – Change polarisation direction – Use instrument with higher sensitivity – Clean the antenna	Bit 3 of Byte 14…24
M504 Error on an device interface	– Hardware defect	– Check connections – Exchanging the electronics – Send instrument for repair	Bit 4 of Byte 14…24
M505 No echo available	– Sensor does not detect an echo during operation – Antenna dirty or defective	– Clean the antenna – Use a more suitable antenna/sensor – Remove possible false echoes – Optimize sensor position and orientation	Bit 5 of Byte 14…24
M506 Installation/Setup error	– Error during setup	– Check or correct installation and/or parameter adjustment	Bit 6 of Byte 14…24

Code Text message	Cause	Rectification	DevSpec State in CMD 48
M507 Error in the instrument settings	– Error during setup – Error when carrying out a reset – False signal suppression faulty	– Carry out reset and repeat setup	Bit 7 of Byte 14…24

9.4 Rectify faults

Reaction when malfunction occurs

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

Procedure for fault rectification

The first measures are:

- Evaluation of fault messages, for example via the display and adjustment module
- Checking the output signal
- Treatment of measurement errors

Further comprehensive diagnostics options are available with a PC with PACTware and the suitable DTM. In many cases, the reasons can be determined in this way and faults rectified.

Check the 4 … 20 mA signal

Connect a multimeter in the suitable measuring range according to the wiring plan. The following table describes possible errors in the current signal and helps to eliminate them:

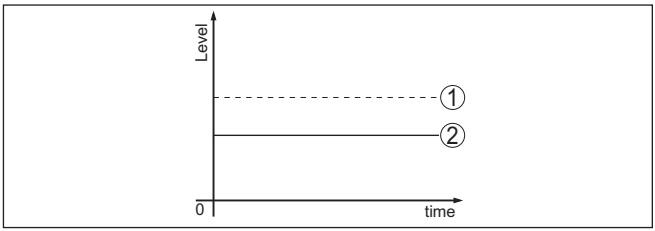
Error	Cause	Rectification
4 … 20 mA signal not stable	– Fluctuations of the measured variable	– Set damping appropriate to the instrument via the display and adjustment module or PACTware/DTM
4 … 20 mA signal missing	– Electrical connection faulty	– Check connection according to chapter "*Connection steps*" and if necessary, correct according to chapter "*Wiring plan*"
	– Voltage supply missing	– Check cables for breaks; repair if necessary
	– Operating voltage too low or load resistance too high	– Check, adapt if necessary
Current signal greater than 22 mA or less than 3.6 mA	– Electronics module in the sensor defective	– Exchange the instrument or send it in for repair

Treatment of measurement errors with liquids

The below tables show typical examples of application-related measurement errors with liquids. The measurement errors are differentiated according to the following:

- Constant level
- Filling
- Emptying

The images in column "*Error pattern*" show the real level as a broken line and the level displayed by the sensor as a continuous line.

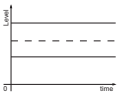
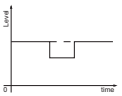
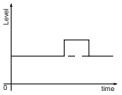


1 Real level
2 Level displayed by the sensor

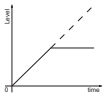
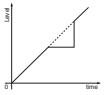
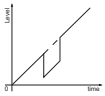
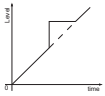
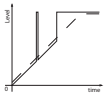
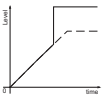
Notes:

- Wherever the sensor displays a constant value, the reason could also be the fault setting of the current output to "*Hold value*"
- If the level indication is too low, the reason could be a line resistance that is too high

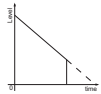
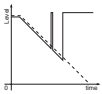
Measurement error with constant level

Fault description	Error pattern	Cause	Rectification
1. Measured value shows a too low or too high level		– Min./max. adjustment not correct	– Adapt min./max. adjustment
		– Incorrect linearization curve	– Adapt linearization curve
		– Installation in a bypass tube or standpipe, hence running time error (small measurement error close to 100 %/large error close to 0 %)	– Check parameter "Application" with respect to vessel form, adapt if necessary (bypass, standpipe, diameter)
2. Measured value jumps towards 0 %		– Multiple echo (vessel top, product surface) with amplitude higher than the level echo	– Check parameter "Application", especially vessel top, type of medium, dished bottom, high dielectric constant, and adapt if necessary
3. Measured value jumps towards 100 %		– Due to the process, the amplitude of the level echo sinks – A false signal suppression was not carried out	– Carry out a false signal suppression
		– Amplitude or position of a false signal has changed (e.g. condensation, buildup); false signal suppression no longer matches actual conditions	– Determine the reason for the changed false signals, carry out false signal suppression, e.g. with condensation

Measurement error during filling

Fault description	Error pattern	Cause	Rectification
4. Measured value remains unchanged during filling		– False signals in the close range too big or level echo too small – Strong foam or spout generation – Max. adjustment not correct	– Eliminate false signals in the close range – Check measurement situation: Antenna must protrude out of the socket, installations – Remove contamination on the antenna – In case of interferences due to installations in the close range: Change polarisation direction – Create a new false signal suppression – Adapt max. adjustment
5. Measured value remains in the bottom section during filling		– Echo from the tank bottom larger than the level echo, for example, with products with $\varepsilon_r < 2.5$ oil-based, solvents	– Check parameters Medium, Vessel height and Floor form, adapt if necessary
6. Measured value remains momentarily unchanged during filling and then jumps to the correct level		– Turbulence on the product surface, quick filling	– Check parameters, change if necessary, e.g. in dosing vessel, reactor
7. Measured value jumps towards 0 % during filling		– Amplitude of a multiple echo (vessel top - product surface) is larger than the level echo	– Check parameter "Application", especially vessel top, type of medium, dished bottom, high dielectric constant, and adapt if necessary
		– The level echo cannot be distinguished from the false signal at a false signal position (jumps to multiple echo)	– In case of interferences due to installations in the close range: Change polarisation direction – Chose a more suitable installation position
8. Measured value jumps towards 100 % during filling		– Due to strong turbulence and foam generation during filling, the amplitude of the level echo sinks. Measured value jumps to false signal	– Carry out a false signal suppression
9. Measured value jumps sporadically to 100 % during filling		– Varying condensation or contamination on the antenna	– Carry out a false signal suppression or increase false signal suppression with condensation/contamination in the close range by editing
10. Measured value jumps to ≥ 100 % or 0 m distance		– Level echo is no longer detected in the close range due to foam generation or false signals in the close range. The sensor goes into overfill protection mode. The max. level (0 m distance) as well as the status message "Overfill protection" are outputted.	– Check measuring site: Antenna must protrude out of the socket – Remove contamination on the antenna – Use a sensor with a more suitable antenna

Measurement error during emptying

Fault description	Error pattern	Cause	Rectification
11. Measured value remains unchanged in the close range during emptying		– False signal larger than the level echo – Level echo too small	– Eliminate false signal in the close range. Check: Antenna must protrude from the socket – Remove contamination on the antenna – In case of interferences due to installations in the close range: Change polarisation direction – After eliminating the false signals, the false signal suppression must be deleted. Carry out a new false signal suppression
12. Measured value jumps towards 0 % during emptying		– Echo from the tank bottom larger than the level echo, for example, with products with ε_r < 2.5 oil-based, solvents	– Check parameters Medium type, Vessel height and Floor form, adapt if necessary
13. Measured value jumps sporadically towards 100 % during emptying		– Varying condensation or contamination on the antenna	– Carry out false signal suppression or increase false signal suppression in the close range by editing – With bulk solids, use radar sensor with purging air connection

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.

9.5 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, the electronics module can be ordered through the agency serving you. The electronics modules are adapted to the respective sensor and differ in signal output or voltage supply.

The new electronics module must be loaded with the default settings of the sensor. These are the options:

- In the factory
- Or on site by the user

In both cases, the serial number of the sensor is needed. The serial numbers are stated on the type label of the instrument, on the inside of the housing as well as on the delivery note.

When loading on site, first of all the order data must be downloaded from the Internet (see operating instructions manual "*Electronics module*").

Caution:
All user-specific settings must be entered again. Hence, you have to carry out a new setup after the electronics exchange.

If you have stored the data of the parameter adjustment during the first setup of the sensor, you can transfer these to the replacement electronics module. A new setup is no more necessary.

9.6 Software update

The following components are required to update the instrument software:

- Instrument
- Voltage supply
- Interface adapter VEGACONNECT
- PC with PACTware
- Current instrument software as file

You can find the current instrument software as well as detailed information on the procedure in the download area of our homepage: www.vega.com.

Caution:
Instruments with approvals can be bound to certain software versions. Therefore make sure that the approval is still effective after a software update is carried out.

You can find detailed information in the download area at www.vega.com.

9.7 How to proceed if a repair is necessary

You can find an instrument return form as well as detailed information of the procedure in the download area on our homepage: www.vega.com.

By doing this you help us carry out the repair quickly and without having to call back for needed information.

If a repair is necessary, please proceed as follows:

- 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
- Please contact the agency serving you to get the address for the return shipment. You can find the agency on our home page www.vega.com.

10 Dismount

10.1 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 products etc.

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

10.2 Disposal

The instrument consists of materials which can be recycled by specialised recycling companies. We use recyclable materials and have designed the parts to be easily separable.

Correct disposal avoids negative effects on humans and the environment and ensures recycling of useful raw materials.

Materials: see chapter "*Technical data*"

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

WEEE directive 2002/96/EG
This instrument is not subject to the WEEE directive 2002/96/EG and the respective national laws. Pass the instrument directly on to a specialised recycling company and do not use the municipal collecting points. These may be used only for privately used products according to the WEEE directive.

11 Supplement

11.1 Technical data

Materials and weights

316L corresponds to 1.4404 or 1.4435

Materials, wetted parts with plastic horn antenna	
– Adapter flange	PP-GF30 black
– Seal, adapter flange	FKM (COG VI500), EPDM (COG AP310)
– Antenna cone	PBT-GF 30
– Focussing lense	PP
Materials, wetted parts on thread with integrated antenna	
– Process fitting	316L
– Antenna	PEEK
– seal, antenna system	FKM, FFKM
– Process seal	Klingersil C-4400
Materials, wetted parts for flange with encapsulated antenna system	
– Flange	316L
– Flange plating	PTFE
– Antenna encapsulation	PTFE
Material, wetted parts rinsing air connection	
– Rinsing air connection	PP-GFK
– Seal	FKM (COG VI500), EPDM (COG AP310)
Materials, non-wetted parts	
– Compression flange	PP-GF30 black
– Mounting strap	316L
– Fixing screws, mounting strap	316L
– Fixing screws, adapter flange	304
– Plastic housing	plastic PBT (Polyester)
– Aluminium die-casting housing	Aluminium die-casting AlSi10Mg, powder-coated - basis: Polyester
– Stainless steel housing	316L
– Cable gland	PA, stainless steel, brass
– Sealing, cable gland	NBR
– Blind plug, cable gland	PA
– Seal between housing and housing lid	Silicone SI 850 R, NBR silicone-free
– Inspection window in housing cover (optional)	Polycarbonate
– Ground terminal	316L
Process fitting	
– Flanges	DIN from DN 80, ASME from 3"

Weights

– Instrument (depending on housing, process fitting and antenna)	approx. 2 … 17.2 kg (4.409 … 37.92 lbs)

Torques

Max. torques, threaded version

– G¾	30 Nm (22.13 lbf ft)
– G1½	200 Nm (147.5 lbf ft)

Max. torques, version plastic horn antenna

– Mounting screws, mounting strap on sensor housing	4 Nm (2.950 lbf ft)
– Flange screws, compression flange DN 80	5 Nm (3.689 lbf ft)
– Flange screws, adapter flange DN 100	7 Nm (5.163 lbf ft)

Torques, version flange with encapsulated antenna system

– Required torque of the flange screws	60 Nm (44.25 lbf ft)
– Recommended torque for tightening the flange screws	60 … 100 Nm (44.25 … 73.76 lbf ft)

Max. torques for NPT cable glands and Conduit tubes

– Plastic housing	10 Nm (7.376 lbf ft)
– Aluminium/Stainless steel housing	50 Nm (36.88 lbf ft)

Input variable

Measured variable	The measured quantity is the distance between the end of the sensor antenna and the product surface. The reference plane for the measurement is the sealing surface on the hexagon or the lower side of the flange.

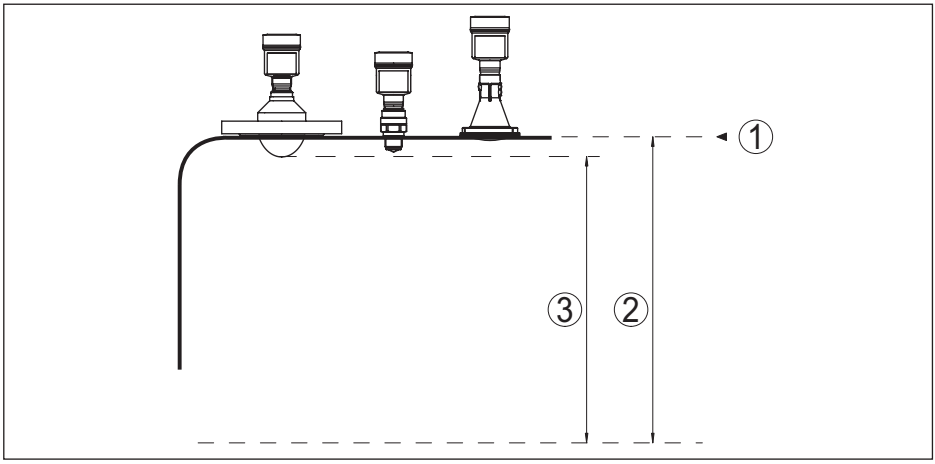


Fig. 55: Data of the input variable

1 Reference plane
2 Measured variable, max. measuring range
3 Utilisable measuring range (depending on the antenna system)

Max. measuring range	30 m (98.43 ft)
Recommended measuring range (depending on the antenna system)	
– Plastic horn antenna	up to 30 m (98.43 ft)
– Thread with integrated horn antenna ¾"	up to 10 m (32.81 ft)
– Thread with integrated horn antenna 1½"	up to 20 m (65.62 ft)
– Flange DN 50, 2" with encapsulated antenna system	up to 25 m (82.02 ft)
– Flange from DN 80, 3" with encapsulated antenna system	up to 30 m (98.43 ft)

Output variable	
Output signal	4 … 20 mA/HART
Range of the output signal	3.8 … 20.5 mA/HART (default setting)
Signal resolution	0.3 µA
Resolution, digital	< 1 mm (0.039 in)
Failure signal current output (adjustable)	mA-value unchanged 20.5 mA, 22 mA, < 3.6 mA
Max. output current	22 mA
Starting current	≤ 3.6 mA; ≤ 10 mA for 5 ms after switching on
Load	see load diagram under Power supply
Damping (63 % of the input variable), adjustable	0 … 999 s

HART output values according to HART 7.0[1)]	
– PV (Primary Value)	Lin. percent
– SV (Secondary Value)	Distance
– TV (Third Value)	Meas. certainty
– QV (Fourth Value)	Electronics temperature
Fulfilled HART specification	7.0
Further information on Manufacturer ID, Device ID, Device Revision	See website of HART Communication Foundation

Accuracy (according to DIN EN 60770-1)

Process 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)
Installation reference conditions	
– Min. distance to internal installations	> 200 mm (7.874 in)
– Reflector	Flat plate reflector
– False reflections	Biggest false signal, 20 dB smaller than the useful signal
Deviation with liquids	See following diagrams

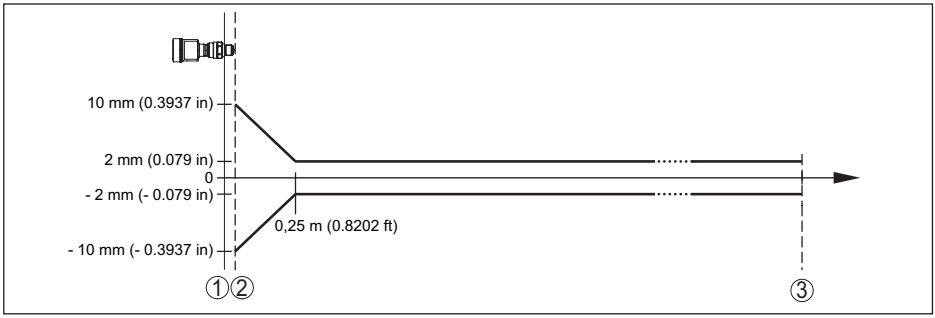


Fig. 56: Deviation under reference conditions - thread with integrated horn antenna

1 Reference plane
2 Antenna edge
3 Recommended measuring range

1) Default values can be assigned individually.

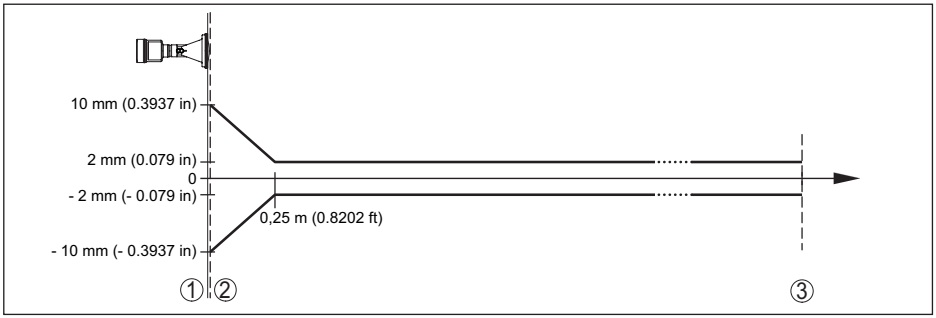


Fig. 57: Deviation under reference conditions - plastic horn antenna

1 Reference plane
2 Antenna edge
3 Recommended measuring range

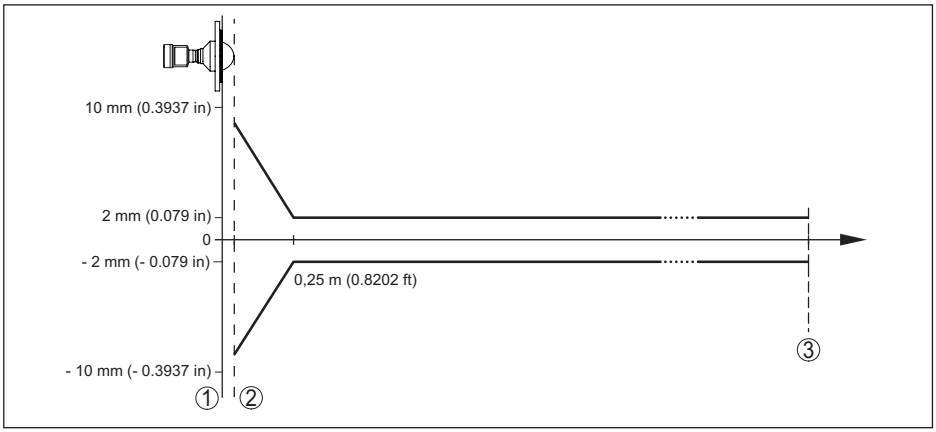


Fig. 58: Deviation under reference conditions - flange with encapsulated antenna system

1 Reference plane
2 Antenna edge
3 Recommended measuring range

Repeatability	≤ ±1 mm
Deviation with bulk solids	The values depend to a great extent on the application. Binding specifications are thus not possible.

Variables influencing measurement accuracy

Specifications apply to the digital measured value

Temperature drift - Digital output	±3 mm/10 K, max. 10 mm

Specifications apply also to the current output

Temperature drift - Current output	±0.03 %/10 K relating to the 16 mA span max. ±0.3 %

Deviation on the current output through analogue/digital conversion

– Non-Ex and Ex-ia version	< ±15 µA
– Ex-d-ia version	< ±40 µA

Characteristics and performance data

Measuring frequency	W-band (79 GHz technology)
Measuring cycle time approx.[2]	700 ms
Step response time[3]	≤ 3 s
Beam angle[4]	
– Plastic horn antenna	3°
– Thread ¾" with integrated horn antenna	14°
– Thread 1½" with integrated horn antenna	7°
– Flange DN 50/2" with encapsulated antenna system	6°
– Flange DN 80/3" with encapsulated antenna system	3°
– Hygienic fittings	6°
Emitted HF power (depending on the parameter adjustment)[5]	
– Average spectral transmission power density	-3 dBm/MHz EIRP
– Max. spectral transmission power density	+34 dBm/50 MHz EIRP
– Max. power density at a distance of 1 m	< 3 µW/cm²

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 temperature

Antenna lens	Seal	Process temperature (measured on the process fitting)
PP	FKM (SHS FPM 70C3 GLT)	-40 … +80 °C (-40 … +176 °F)
	EPDM (COG AP310)	-40 … +80 °C (-40 … +176 °F)
PEEK	FKM (SHS FPM 70C3 GLT)	-40 … +130 °C (-40 … +266 °F)
		-40 … +200 °C (-40 … +392 °F)
	EPDM (COG AP302)	-40 … +130 °C (-40 … +266 °F)

[2] With operating voltage $U_B \geq 24$ V DC

[3] Time span after a sudden distance change from 1 m to 5 m until the output signal reaches 90 % of the final value for the first time (IEC 61298-2). Valid with operating voltage $U_B \geq 24$ V DC

[4] Outside the specified beam angle, the energy level of the radar signal is 50% (-3 dB) less.

[5] EIRP: Equivalent Isotropic Radiated Power.

Antenna lens	Seal	Process temperature (measured on the process fitting)
PTFE	PTFE	-40 … +130 °C (-40 … +266 °F)
		-40 … +200 °C (-40 … +392 °F)

Ambient temperature - Process temperature

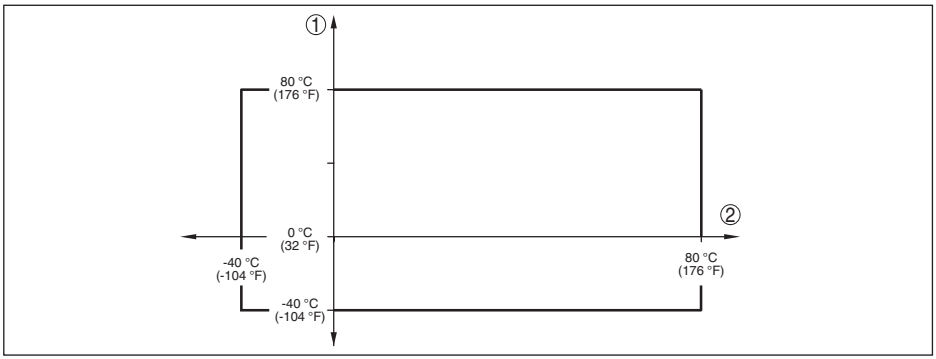


Fig. 59: Ambient temperature - Process temperature, plastic horn antenna

1 Ambient temperature
2 Process temperature

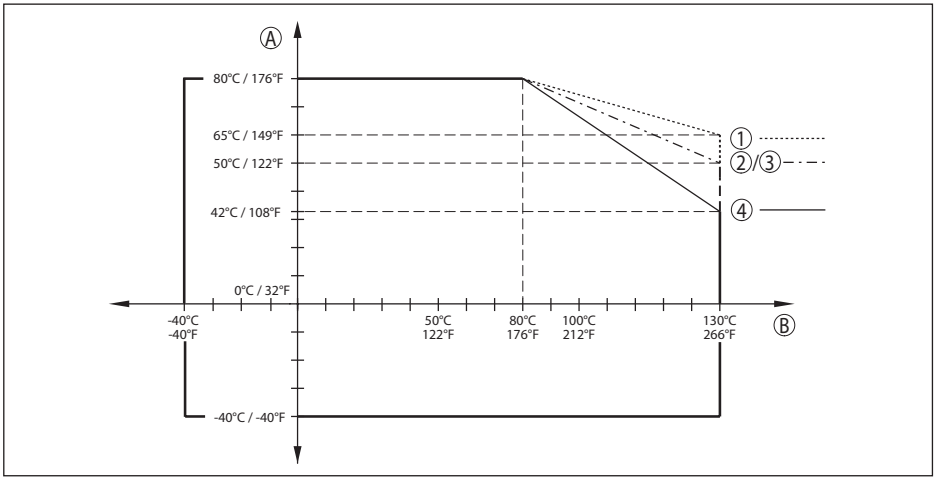


Fig. 60: Ambient temperature - Process temperature, thread G¾ and G1½ with integrated horn antenna up to +130 °C (+266 °F)

A Ambient temperature
B Process temperature
1 Aluminium housing
2 Plastic housing
3 Stainless steel housing, precision casting
4 Stainless steel housing, electropolished

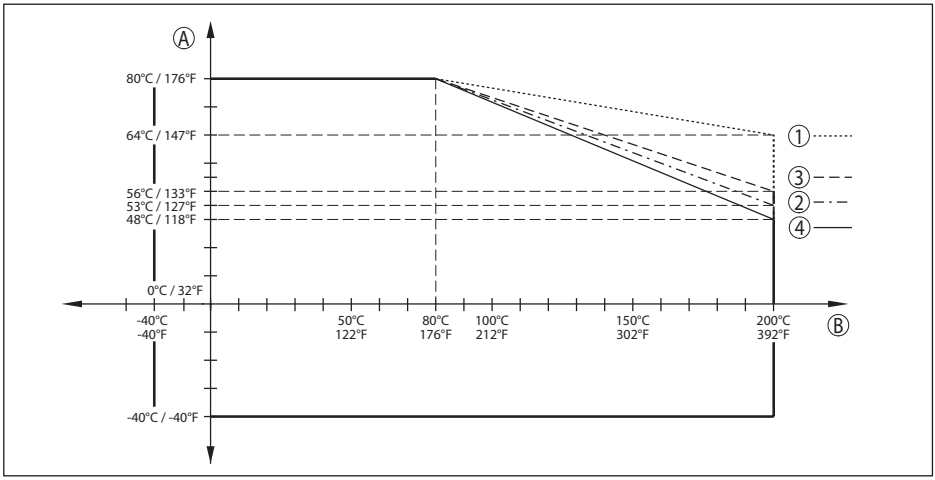


Fig. 61: Ambient temperature - Process temperature, thread G¾ and G1½ with integrated horn antenna up to +200 °C (+392 °F)

A Ambient temperature
B Process temperature
1 Aluminium housing
2 Plastic housing
3 Stainless steel housing, precision casting
4 Stainless steel housing, electropolished

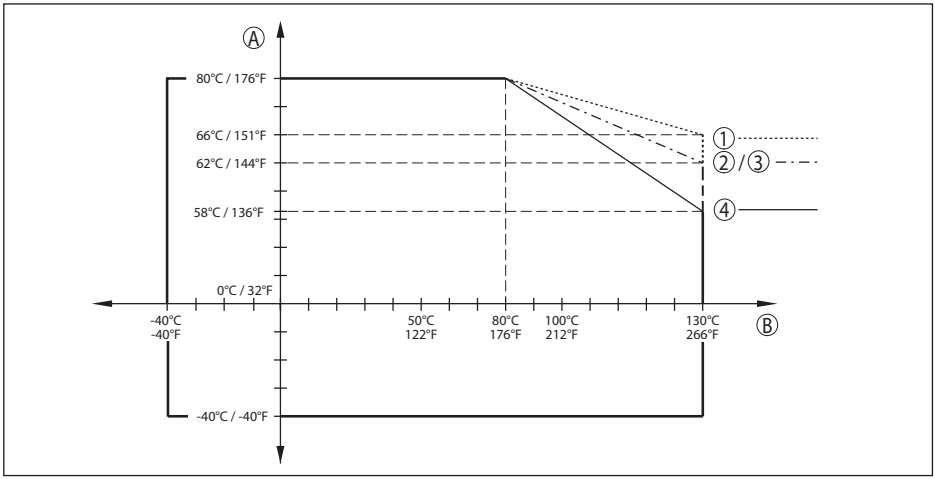


Fig. 62: Ambient temperature - Process temperature, flange DN 50/2" and DN 80/3" with encapsulated antenna system up to +130 °C (+266 °F)

A Ambient temperature
B Process temperature
1 Aluminium housing
2 Plastic housing
3 Stainless steel housing, precision casting
4 Stainless steel housing, electropolished

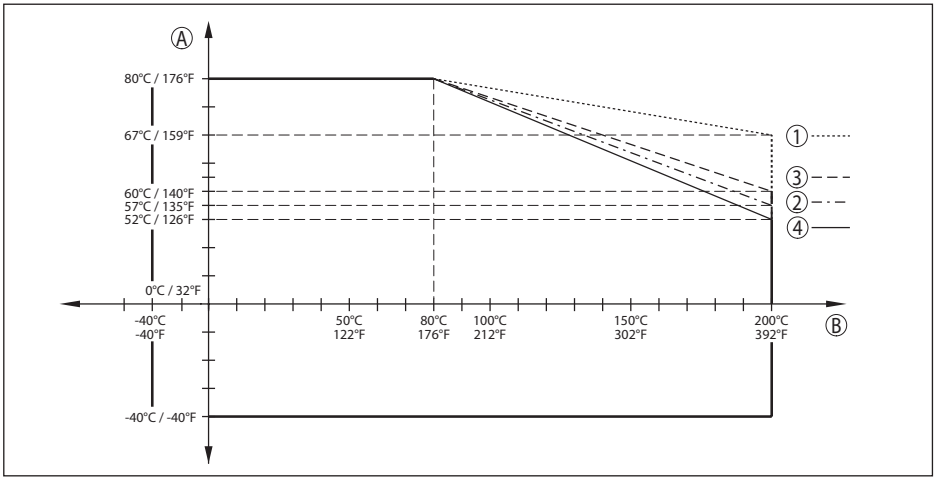


Fig. 63: Ambient temperature - Process temperature, flange DN 50/2" and DN 80/3" with encapsulated antenna system up to +200 °C (+392 °F)

A Ambient temperature
B Process temperature
1 Aluminium housing
2 Plastic housing
3 Stainless steel housing, precision casting
4 Stainless steel housing, electropolished

Vessel pressure

Vessel pressure

– Plastic horn antenna	-1 … 2 bar (-100 … 200 kPa/-14.5 … 29.1 psig)
– Plastic horn antenna - Version with adapter flange from DN 100 PP or PP-GF 30	-1 … 1 bar (-100 … 100 kPa/-14.5 … 14.5 psig)
– Thread with integrated horn antenna	-1 … 20 bar (-100 … 2000 kPa/-14.5 … 290.1 psig)
– Flange with encapsulated antenna system	-1 … 16 bar (-100 … 2000 kPa/-14.5 … 232.0 psig)
Vessel pressure relating to the flange nominal pressure stage	see supplementary instructions manual "*Flanges according to DIN-EN-ASME-JIS*"

Mechanial stresses

Vibration resistance - Plastic horn antenna

– With adapter flange	2 g at 5 … 200 Hz according to EN 60068-2-6 (vibration with resonance)
– with mounting strap	1 g at 5 … 200 Hz according to EN 60068-2-6 (vibration with resonance)
Vibration resistance - Thread with integrated horn antenna, flange with encapsulated antenna system	4 g at 5 … 200 Hz according to EN 60068-2-6 (vibration with resonance)
Shock resistance	100 g, 6 ms according to EN 60068-2-27 (mechanical shock)

Data on rinsing air connection

Max. permissible pressure 6 bar (87.02 psig)

Air volume, depending on pressure (recommended range)

Plastic horn antenna	Air volume	
Pressure	**Without reflux valve**	**With reflux valve**
0.2 bar (2.9 psig)	3.3 m³/h	-
0.4 bar (5.8 psig)	5 m³/h	-
0.6 bar (8.7 psig)	6 m³/h	1 m³/h
0.8 bar (11.6 psig)	-	2.1 m³/h
1 bar (14.5 psig)	-	3 m³/h
1.2 bar (17.4 psig)	-	3.5 m³/h
1.4 bar (20.3 psig)	-	4.2 m³/h
1.6 bar (23.2 psig)	-	4.4 m³/h
1.8 bar (20.3 psig)	-	4.8 m³/h
2 bar (23.2 psig)	-	5.1 m³/h

Connection

- Thread G⅛

Reflux valve - (optional, is absolutely necessary for Ex applications)

- Material 316Ti
- Thread G⅛
- Seal FKM (SHS FPM 70C3 GLT), EPDM (COG AP310)
- For connection G⅛
- Opening pressure 0.5 bar (7.25 psig)
- Nominal pressure stage PN 250

Electromechanical data - version IP 66/IP 67 and IP 66/IP 68; 0.2 bar

Options of the cable entry

- Cable entry M20 x 1.5, ½ NPT
- Cable gland M20 x 1,5; ½ NPT (cable ø see below table)
- Blind plug M20 x 1.5; ½ NPT
- Closing cap ½ NPT

Material cable gland	Material seal insert	Cable diameter				
		4.5 … 8.5 mm	**5 … 9 mm**	**6 … 12 mm**	**7 … 12 mm**	**10 … 14 mm**
PA	NBR	–	●	●	–	●
Brass, nickel-plated	NBR	●	●	●	–	–
Stainless steel	NBR	–	●	●	–	●

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 IP 66/IP 68 (1 bar)

Options of the cable entry	
– Cable gland with integrated connection cable	M20 x 1.5 (cable: ø 5 … 9 mm)
– Cable entry	½ NPT
– Blind plug	M20 x 1.5; ½ NPT
Connection cable	
– Wire cross-section	0.5 mm² (AWG 20)
– Wire resistance	< 0.036 Ω/m
– Tensile strength	< 1200 N (270 lbf)
– Standard length	5 m (16.4 ft)
– Max. length	180 m (590.6 ft)
– Min. bending radius	25 mm (0.984 in) with 25 °C (77 °F)
– Diameter approx.	8 mm (0.315 in)
– Colour - Non-Ex version	Black
– Colour - Ex-version	Blue

Display and adjustment module

Display element	Display with backlight
Measured value indication	
– Number of digits	5
– Size of digits	W x H = 7 x 13 mm
Adjustment elements	4 keys
Protection rating	
– unassembled	IP 20
– mounted in the housing without lid	IP 40
Materials	
– Housing	ABS
– Inspection window	Polyester foil

Interface to the external display and adjustment unit

Data transmission	Digital (I²C-Bus)
Connection cable	Four-wire

Sensor version	Configuration, connection cable			
	Cable length max.	Standard cable	Special cable	Screened
4 … 20 mA/HART	50 m	●	–	●

Integrated clock	
Date format	Day.Month.Year
Time format	12 h/24 h
Time zone Ex factory	CET
Rate deviation max.	10.5 min/year

Additional output parameter - Electronics temperature	
Output of the temperature values	
– Analogue	Via the current output
– Digital	Via the digital output signal - depending on the electronics version
Range	-40 … +85 °C (-40 … +185 °F)
Resolution	< 0.1 K
Accuracy	±3 K

Voltage supply	
Operating voltage U_B	
– Non-Ex instrument	12 … 35 V DC
– Ex-d instrument	12 … 35 V DC
– Ex ia instrument	12 … 30 V DC
Operating voltage U_B - illuminated display and adjustment module	
– Non-Ex instrument	18 … 35 V DC
– Ex-d instrument	18 … 35 V DC
– Ex ia instrument	18 … 30 V DC
Reverse voltage protection	Integrated
Permissible residual ripple - Non-Ex, Ex-ia instrument	
– for 12 V< U_B < 18 V	≤ 0.7 V_{eff} (16 … 400 Hz)
– for 18 V< U_B < 35 V	≤ 1.0 V_{eff} (16 … 400 Hz)
Load resistor	
– Calculation	(U_B - U_{min})/0.022 A
– Example - Non-Ex instrument with U_B= 24 V DC	(24 V - 12 V)/0.022 A = 545 Ω

Electrical protective measures

Protection rating

Housing material	Version	IP-protection class	NEMA protection
Plastic	Single chamber	IP 66/IP 67	Type 4X
	Double chamber	IP 66/IP 67	Type 4X

Housing material	Version	IP-protection class	NEMA protection
Aluminium	Single chamber	IP 66/IP 68 (0.2 bar) IP 68 (1 bar)	Type 6P Type 6P
	Double chamber	IP 66/IP 67 IP 66/IP 68 (0.2 bar) IP 68 (1 bar)	Type 4X Type 6P Type 6P
Stainless steel, electro-polished	Single chamber	IP 66/IP 68 (0.2 bar)	Type 6P
Stainless steel, precision casting	Single chamber	IP 66/IP 68 (0.2 bar) IP 68 (1 bar)	Type 6P Type 6P
	Double chamber	IP 66/IP 67 IP 66/IP 68 (0.2 bar) IP 68 (1 bar)	Type 4X Type 6P Type 6P

Protection rating (IEC 61010-1) III

Approvals

Instruments with approvals can have different technical specifications depending on the version.

For that reason the associated approval documents of these instruments have to be carefully noted. They are part of the delivery or can be downloaded under www.vega.com, "*VEGA Tools*" and "*Instrument search*" as well as in the download area.

11.2 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*".

Plastic housing

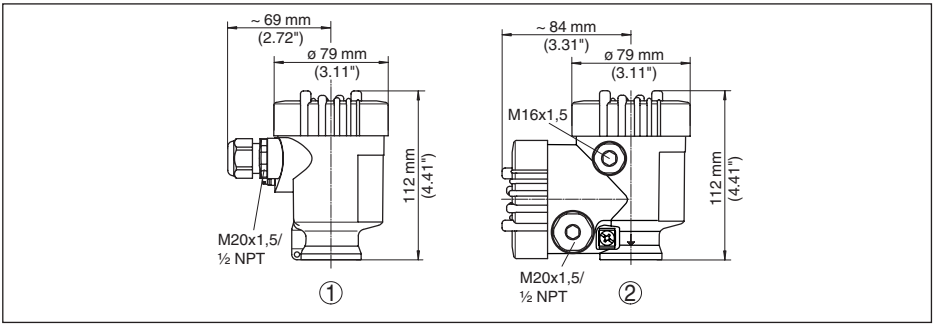


Fig. 64: Housing versions with protection rating IP 66/IP 67 - with integrated display and adjustment module the housing is 9 mm/0.35 in higher

1 Single chamber version
2 Double chamber version

Aluminium housing

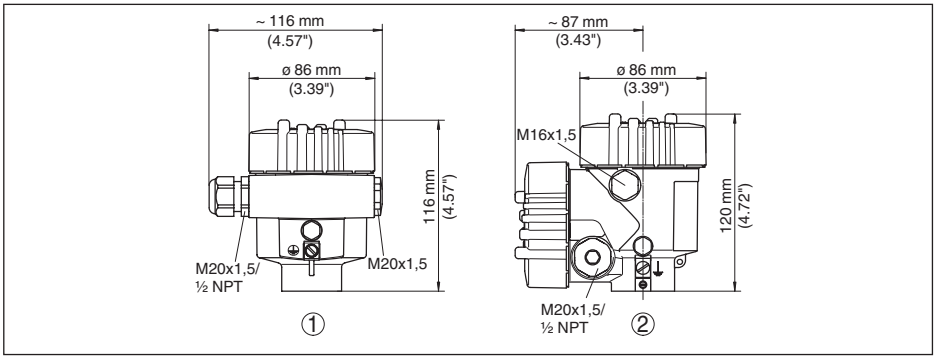


Fig. 65: Housing versions with protection rating IP 66/IP 68 (0.2 bar) - with integrated display and adjustment module the housing is 9 mm/0.35 in higher

1 Single chamber version
2 Double chamber version

Aluminium housing with protection rating IP 66/IP 68 (1 bar)

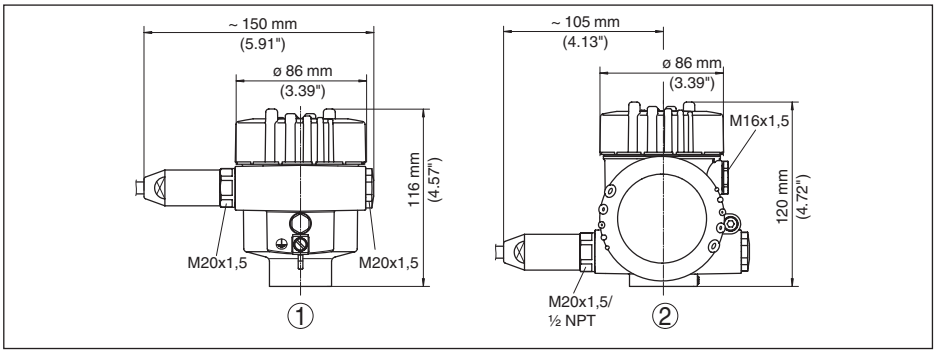


Fig. 66: Housing version with protection rating IP 66/IP 68 (1 bar) - with integrated display and adjustment module the housing is 9 mm/0.35 in higher

1 Single chamber version
2 Double chamber version

Stainless steel housing

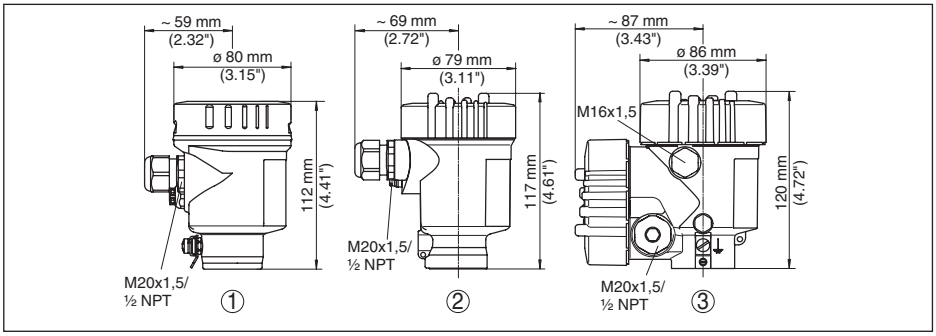


Fig. 67: Housing versions with protection rating IP 66/IP 68 (0.2 bar) - with integrated display and adjustment module the housing is 9 mm/0.35 in higher

1 Single chamber version, electropolished
2 Single chamber version, precision casting
3 Double chamber version, precision casting

Stainless steel housing with protection rating IP 66/IP 68, 1 bar

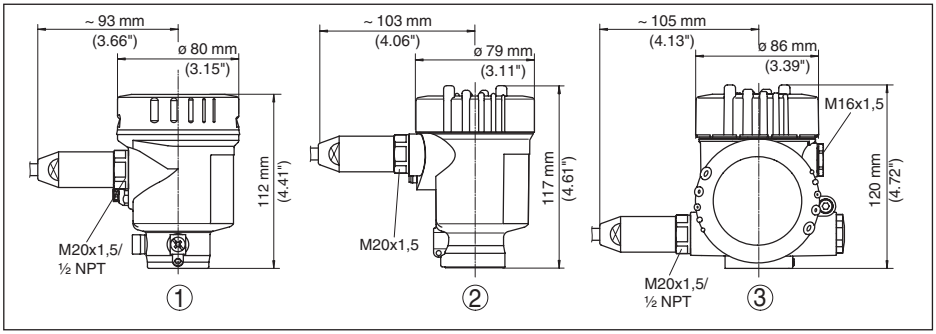


Fig. 68: Housing version with protection rating IP 66/IP 68 (1 bar) - with integrated display and adjustment module the housing is 9 mm/0.35 in higher

1 Single chamber version, electropolished
2 Single chamber version, precision casting
3 Double chamber version, precision casting

VEGAPULS 64, plastic horn antenna with compression flange

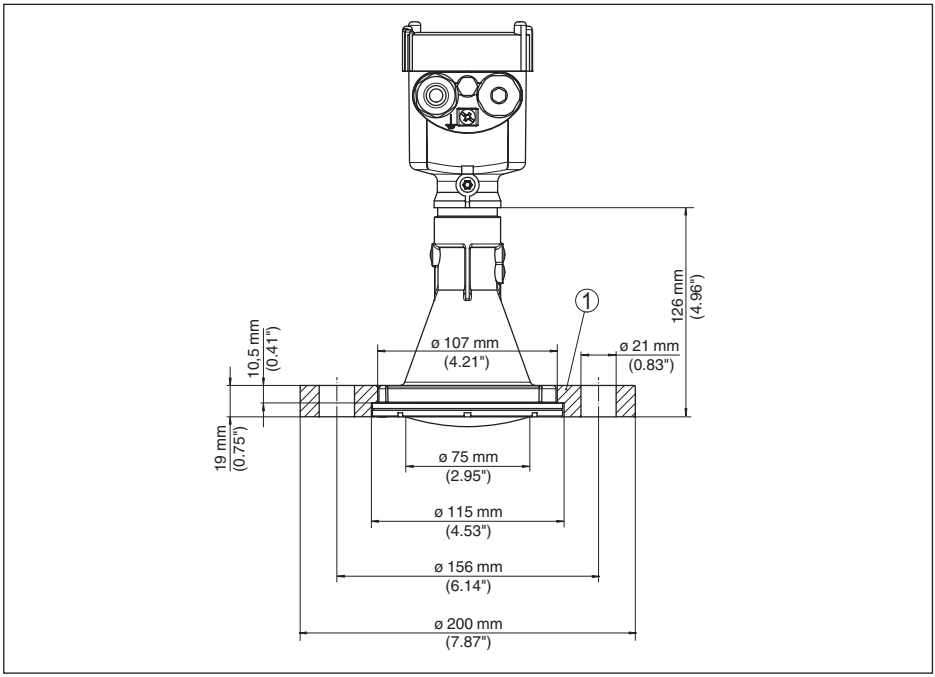


Fig. 69: Radar sensor with compression flange

1 Compression flange

VEGAPULS 64, plastic horn antenna with compression flange and rinsing connection

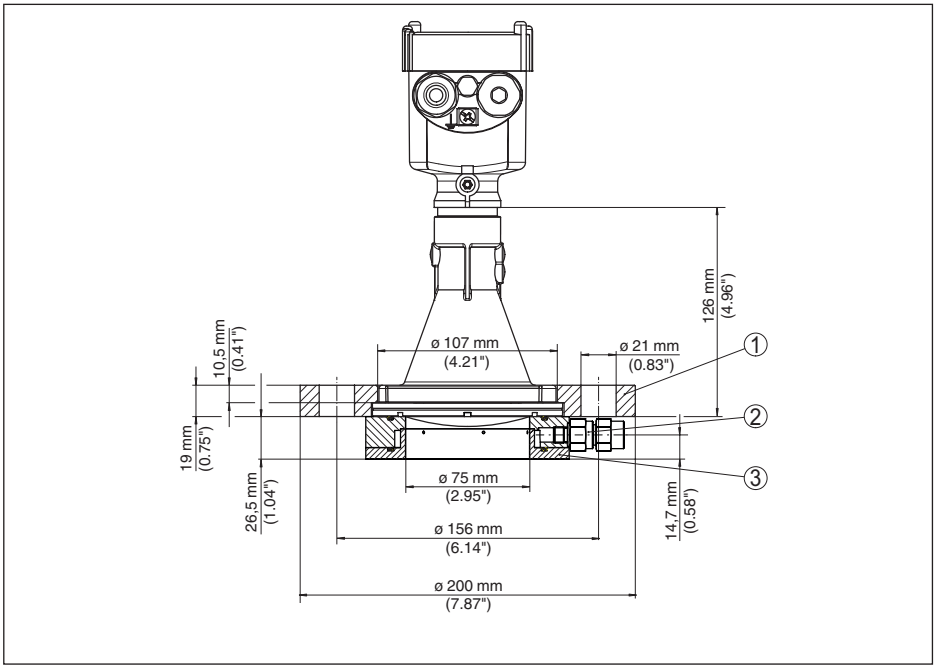


Fig. 70: Radar sensor with compression flange and rinsing connection

1 *Compression flange*
2 *Reflux valve*
3 *Rinsing connection*

VEGAPULS 64, plastic horn antenna with adapter flange

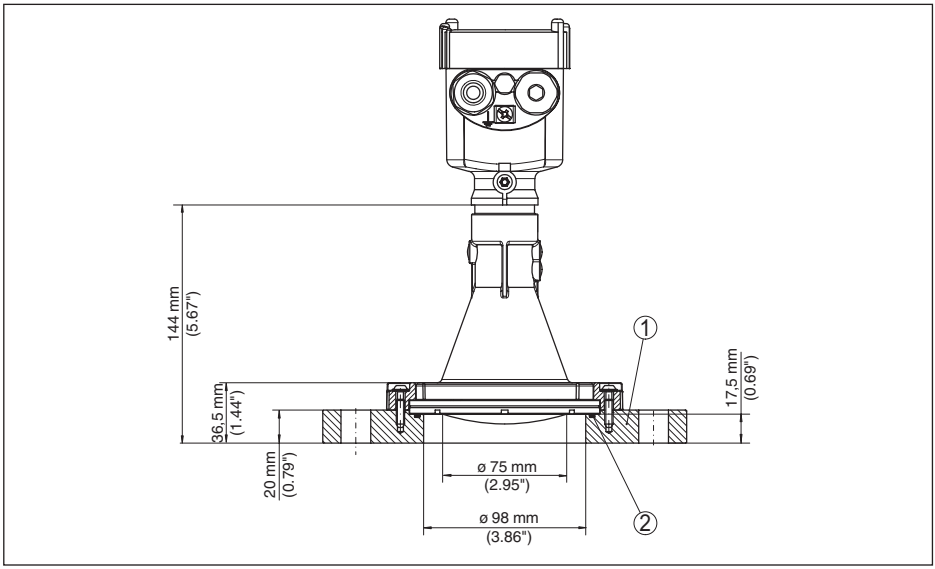


Fig. 71: Radar sensor with adapter flange

1 Adapter flange
2 Process seal

VEGAPULS 64, plastic horn antenna mit adapter flange und rinsing connection

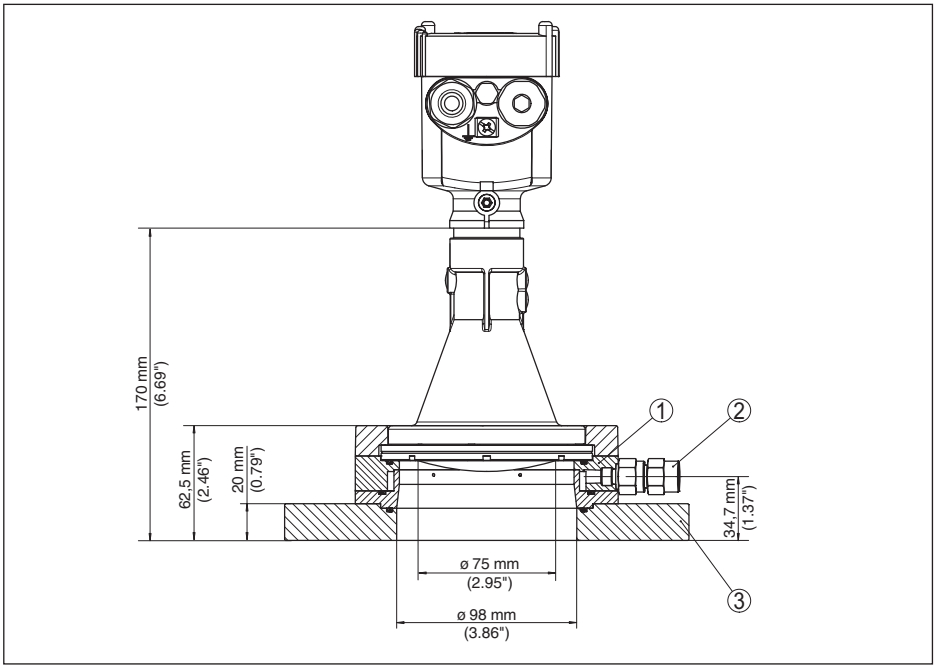


Fig. 72: VEGAPULS 64, adapter flange and rinsing connection

1 Rinsing air connection
2 Reflux valve
3 Adapter flange

VEGAPULS 64, plastic horn antenna with mounting strap

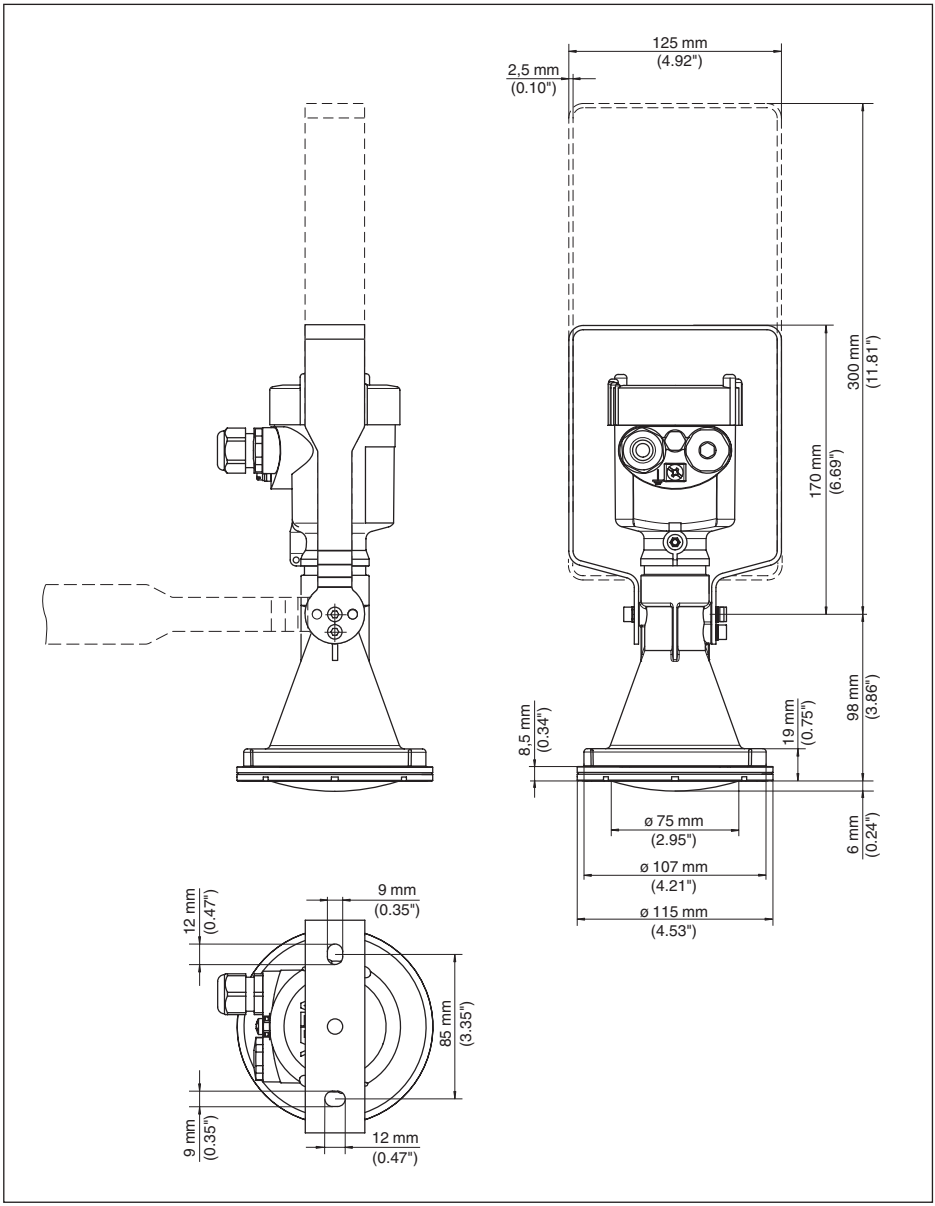


Fig. 73: VEGAPULS 64, plastic horn antenna, mounting strap in 170 or 300 mm length

VEGAPULS 64, thread with integrated horn antenna

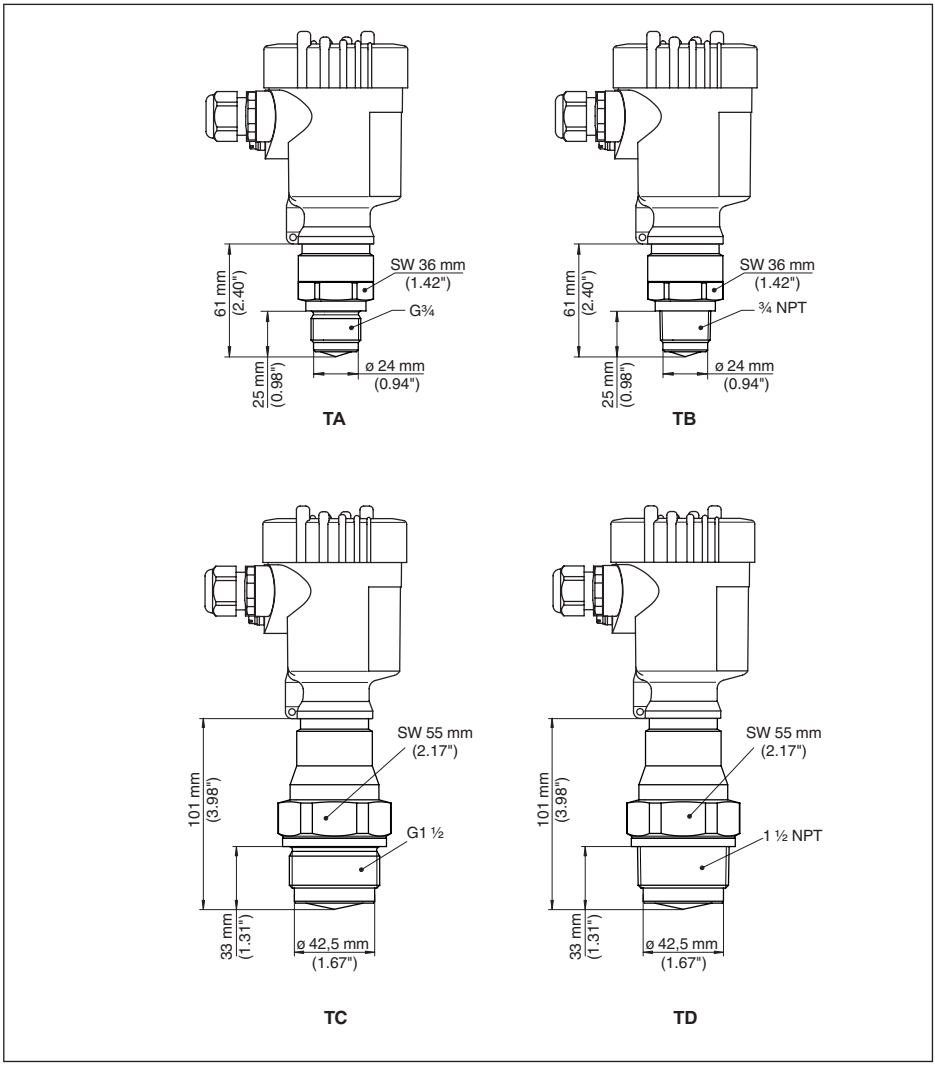


Fig. 74: VEGAPULS 64, thread with integrated horn antenna

TA G¾ (DIN 3852-E)
TB ¾ NPT (ASME B1.20.1)
TC G1½ (DIN 3852-A)
TD 1½ NPT (ASME B1.20.1)

VEGAPULS 64, flange with encapsulated antenna system DN 50

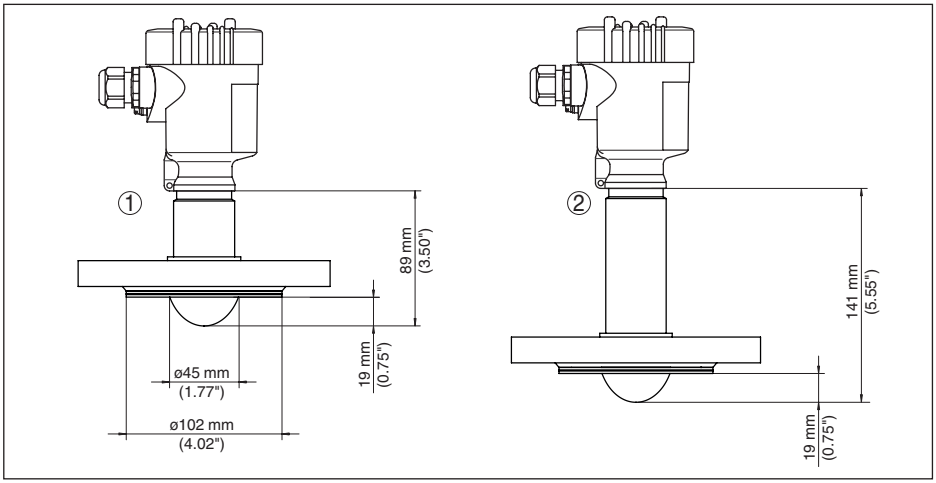


Fig. 75: VEGAPULS 64, encapsulated antenna system DN 50

1 Version up to 130 °C (266 °F)
2 Version up to 200 °C (392 °F)

VEGAPULS 64, flange with encapsulated antenna system DN 80

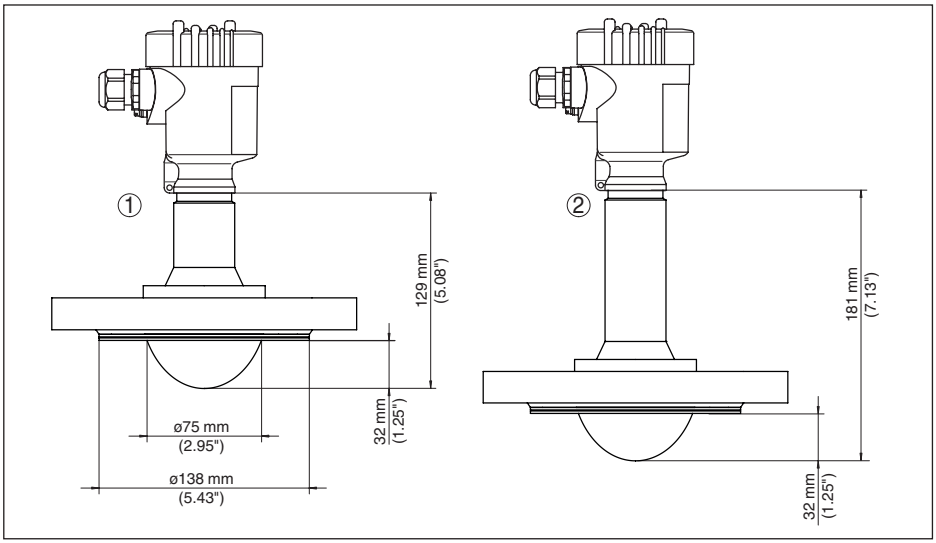


Fig. 76: VEGAPULS 64, encapsulated antenna system DN 80

1 Version up to 130 °C (266 °F)
2 Version up to 200 °C (392 °F)

11.3 Industrial property rights

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