Operating Instructions

Radar sensor for continuous level measurement of liquids

VEGAPULS 61

Profibus PA

Document ID: 36501

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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.

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1 About this document

1.1 Function

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

1.2 Target group

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

1.3 Symbols used

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

Information, 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.

2 For your safety

2.1 Authorised personnel

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

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

2.2 Appropriate use

VEGAPULS 61 is a sensor for continuous level measurement.

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

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

2.3 Warning about incorrect use

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

2.4 General safety instructions

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

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. For safety reasons, only the accessory specified by the manufacturer must be used.

To avoid any danger, the safety approval markings and safety tips on the device must also be observed and their meaning read in this operating instructions manual.

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

2.5 EU conformity

The device fulfils the legal requirements of the applicable EU directives. By affixing the CE marking, we confirm the conformity of the instrument with these directives.

You can find the EU conformity declaration on our website under www.vega.com/downloads.

Electromagnetic compatibility
Instruments in four-wire or Ex-d-ia version are designed for use in an industrial environment. Nevertheless, electromagnetic interference from electrical conductors and radiated emissions must be taken into account, as is usual with class A instruments according to EN 61326-1. If the instrument is used in a different environment, the electromagnetic compatibility to other instruments must be ensured by suitable measures.

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 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 was tested according to the latest issue of the following harmonized standards:

- EN 302372 - Tank Level Probing Radar

It is hence approved for use inside closed vessels in countries of the EU.

Use is also approved in EFTA countries, provided the respective standards have been implemented.

For operation inside of closed vessels, points a to f in annex E of EN 302372 must be fulfilled.

2.8 Radio license for USA

This approval is only valid for USA. Hence the following text is only available in the English language.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause interference, and
- This device must accept any interference, including interference that may cause undesired operation of the device

This device is approved for unrestricted use only inside closed, stationary vessels made of metal, concrete and reinforced fiberglass.

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

- This device shall be installed and maintained to ensure a vertically downward orientation of the transmit antenna's main beam. Furthermore, the use of any mechanism that does not allow the main beam of the transmitter to be mounted vertically downward is prohibited.
- Operation of the instrument with encapsulated horn antenna ø 40 mm is only permitted within closed vessels.
- This device shall be installed only at fixed locations. The LPR device shall not operate while being moved or while inside a moving container.
- Hand-held applications are prohibited.
- Marketing to residential consumers is prohibited.

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

2.9 Radio license for Canada

This approval is only valid for Canada. Hence the following texts are only available in the English/French language.

This device complies with Industry Canada's license-exempt RSS standards. Operation is subject to the following conditions:

- This device may not cause interference, and
- This device must accept any interference, including interference that may cause undesired operation of the device

This device has been approved for both closed containers and open-air environments with the following limitations:

- Closed Containers: For installations utilizing a tilt during installation: This device is limited to installation in a completely enclosed container made of metal, concrete or reinforced fiberglass to prevent RF emissions, which can otherwise interfere with aeronautical navigation, the maximum approved tilt angle is 10°.
- Open Air Environment: For operation outside of closed vessels, the following condition must be fulfilled: This device shall be installed and maintained to ensure a vertically downward orientation of the transmit antenna's main beam. Furthermore, the use of any mechanism that does not allow the main beam of the transmitter to be mounted vertically downward is prohibited.
- Operation of the instrument with encapsulated horn antenna ø 40 mm is only permitted within closed vessels.

The installation of the LPR/TLPR device shall be done by trained installers, in strict compliance with the manufacture's instructions.

This device shall be installed only at fixed locations. The LPR device shall not operate while being moved or while inside a moving container.

Hand-held applications are prohibited.

Marketing to residential consumers is prohibited.

The use of this device is on a "no-interference, no-protection" basis. That ist, the user shall accept operatings of high-powered radaar in the same frequency band which may interfere with or damage this device.

However, devices found to interfere with primary licensing operations will be required to be removed at the user's expense.

The installer/user of this device shall ensure that it is at least 10 km from the Dominion Astrophysical Radio Observatory (DRAO) near Penticton, British Columbia. The coordinates of the DRAO are latitude 49°19′15″ N and longitude 119°37′12″W. For devices not meeting this 10 km separation (e.g., those in the Okanagan Valley, British Columbia,) the installer/user must coordinate with, and obtain the written concurrence of, the Director of the DRAO before the equipment can be installed or operated. The Director of the DRAO may be contacted at 250-497-2300 (tel.)or 250-497-2355 (fax). (Alternatively, the Manager, Regulatory Standards, Industry Canada, may be contacted.)

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux conditions suivantes :

- L'appareil ne doit pas produire de brouillage; et
- L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Cet appareil est homologué pour une utilisation dans les cuves fermées et les environnements ouverts avec les restrictions suivantes :

- Cuves fermées : Pour les installations impliquant une inclinaison lors de l'installation : cet appareil ne doit être installé que dans une cuve totalement fermée en en métal, en béton ou en matière plastiqe renforcée de fibres de verre, pour empêcher les émissions RF susceptibles d'interférer avec la navigation aéronautique. L'angle d'inclinaison maximum autorisé est de 10°.
- Environnement ouvert : Pour l'utilisation hors des cuves fermées, la condition suivante doit être remplie : L'appareil doit être installé et entretenu de manière à garantir une orientation verticale vers le bas du faisceau principal de l'antenne émettrice. De plus, l'utilisation de tout mécanisme ne permettant pas l'orientation verticale vers le bas du faisceau principal de l'émetteur est interdite
- Il est uniquement autorisé d'exploiter l'appareil avec capsulé antenne cône ø 40 mm dans des boîtiers fermés.

L'installation d'un dispositif LPR ou TLPR doit être effectuée par des installateurs qualifiés, en pleine conformité avec les instructions du fabricant.

Cet appareil ne doit être installé qu'à des emplacements fixes. L'appareil LPR ne doit pas être utilisé pendant qu'il est en train d'être déplacé ou se trouve dans un conteneur en mouvement.

Les applications portables sont interdites.

La vente à des particuliers est interdite.

Ce dispositif ne peut être exploité qu'en régime de non-brouillage et de non-protection, c'est-à-dire que l'utilisateur doit accepter que des radars de haute puissance de la même bande de fréquences puissent brouiller ce dispositif ou même l'endommager. D'autre part, les capteurs de niveau qui perturbent une exploitation autorisée par licence de fonctionnement principal doivent être enlevés aux frais de leur utilisateur.

La personne qui installe/utilise ce capteur de niveau doit s'assurer qu'il se trouve à au moins 10 km de l'Observatoire fédéral de radio-astrophysique (OFR) de Penticton en Colombie-Britannique. Les coordonnées de l'OFR sont : latitude N 49° 19′ 15″, longitude O 119° 37′ 12″. La personne qui installe/utilise un dispositif ne pouvant respecter cette distance de 10 km (p. ex. dans la vallée de l'Okanagan [Colombie-Britannique]) doit se concerter avec le directeur de l'OFR afin d'obtenir de sa part une autorisation écrite avant que l'équipement ne puisse être installé ou mis en marche. Le directeur de l'OFR peut être contacté au 250-497-2300 (tél.) ou au 250-497-2355 (fax). (Le Directeur des Normes réglementaires d'Industrie Canada peut également être contacté).

2.10 Installation and operation in the USA and Canada

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

Installations in the US shall comply with the relevant requirements of the National Electrical Code (ANSI/NFPA 70).

Installations in Canada shall comply with the relevant requirements of the Canadian Electrical Code.

2.11 Environmental instructions

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

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

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

3 Product description

3.1 Configuration

Type label

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

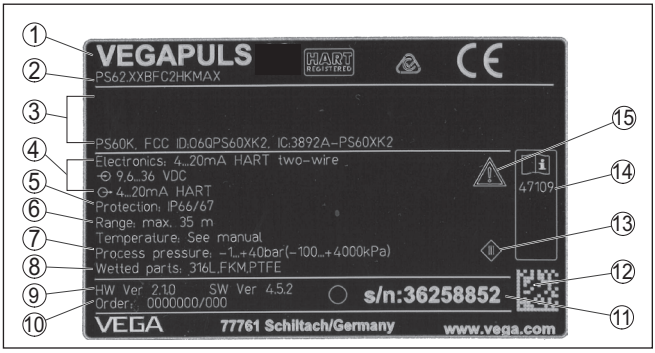

Fig. 1: Layout of the type label (example)

1 *Instrument type*
2 *Product code*
3 *Approvals*
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 *Hardware and software version*
10 *Order number*
11 *Serial number of the instrument*
12 *Data matrix code for VEGA Tools app*
13 *Symbol of the device protection class*
14 *ID numbers, instrument documentation*
15 *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", "*Search*". Enter the serial number.

Alternatively, you can access the data via your smartphone:

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

Scope of this operating instructions

This operating instructions manual applies to the following instrument versions:

- Hardware from 2.1.1
- Software from 4.5.2

Electronics versions

The instrument is available in two different electronics versions. Each version can be identified via the product code on the type label as well as on the electronics.

- Standard electronics type PS60PAK.-
- Electronics with increased sensitivity type PS60PAS.-

Scope of delivery

The scope of delivery encompasses:

- Radar sensor
- Mounting strap with fixing material (optional)
- Documentation
  - Quick setup guide VEGAPULS 61
  - Instructions for optional instrument features
  - Ex-specific "*Safety instructions*" (with Ex versions)
  - If necessary, further certificates

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

3.2 Principle of operation

Application area

The VEGAPULS 61 is a radar sensor for continuous level measurement of liquids under simple process conditions.

Dependent on the application range, different versions are used:

- Level measurement of aggressive liquids in small vessels: **encapsulated antenna system**
- Flow measurement in open flumes or gauge measurement of bodies of water: **Plastic horn antenna**
- Products with an ε_r value ≥ 1.8: **Standard electronics**
- Products with an ε_r value ≥ 1.5, < 1.8; applications with very poor reflective properties: **Electronics with increased sensitivity**

The actual values that can be reached depend on the measurement conditions, the antenna system or the standpipe or bypass.

Functional principle

The antenna of the radar sensor emits short radar pulses with a duration of approx. 1 ns. These pulses are reflected by the product and received by the antenna as echoes. The transit time of the radar pulses from emission to reception is proportional to the distance and hence to the level. The determined level is converted into an appropriate output signal and outputted as 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 %

Lifting and carrying

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

3.4 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 or the external display and adjustment unit and removed at any time.

The integrated Bluetooth module (optional) enables wireless adjustment via standard adjustment devices:

- Smartphone/tablet (iOS or Android operating system)
- PC/notebook with Bluetooth USB adapter (Windows operating system)

You can find further information in the operating instructions "*Display and adjustment module PLICSCOM*" (Document-ID 36433).

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 "*VEGADIS adapter*" is also required for VEGADIS 81.

You can find further information in the operating instructions "*VEGADIS 81*" (Document-ID 43814).

VEGADIS adapter

The VEGADIS adapter 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 "*VEGADIS adapter*" (Document-ID 45250).

Overvoltage protection

The overvoltage arrester B81-35 is used in the single or double chamber housing instead of the connection terminals. It reduces any voltage surges that may reach the signal cables to a harmless level.

You can find further information in the supplementary instructions "*Overvoltage arrester B81-35*" (Document-ID 50708).

Protective cover

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).

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).

Supplementary electronics for Profibus PA

The supplementary electronics is a replacement part for sensors with Profibus PA and double chamber housing.

You can find further information in the operating instructions "*Supplementary electronics for Profibus PA*" (Document-ID 42767).

4 Mounting

4.1 General instructions

Screwing in

On devices with a threaded fitting, the hexagon on the process fitting must be tightened with a suitable wrench.

See chapter "*Dimensions*" for wrench size.

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

Protection against moisture

Protect your instrument against moisture ingress through the following measures:

- Use a suitable connection cable (see chapter "*Connecting to power supply*")
- Tighten the cable gland or plug connector
- When mounting horizontally, turn the housing so that the cable gland or plug connector point downward
- Lead the connection cable downward in front of the cable entry or plug connector.

This applies mainly to outdoor installations, in areas where high humidity is expected (e.g. through cleaning processes) and on cooled or heated vessels.

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

Make sure that the degree of contamination specified in chapter "*Technical data*" meets the existing ambient conditions.

Suitability for the process conditions

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

These are mainly:

- Active measuring component
- Process fitting
- Process seal

Process conditions in particular are:

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

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

Suitability for the ambient conditions

The instrument is suitable for standard and extended ambient conditions acc. to IEC/EN 61010-1.

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4.2 Collar or adapter flange

For mounting the instrument on a socket, a combi compression flange for DN 80 (ASME 3" or JIS 80) is also available for retro fitting. Optionally, the instrument can be also equipped with an adapter flange from DN 100 (ASME 4" or JIS 100).

With the housing versions plastic, aluminium single chamber and stainless steel, the collar flange can be placed directly over the housing. With the aluminium double chamber housing, retroactive mounting in this way is not possible - the mounting type must be specified with the order.

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

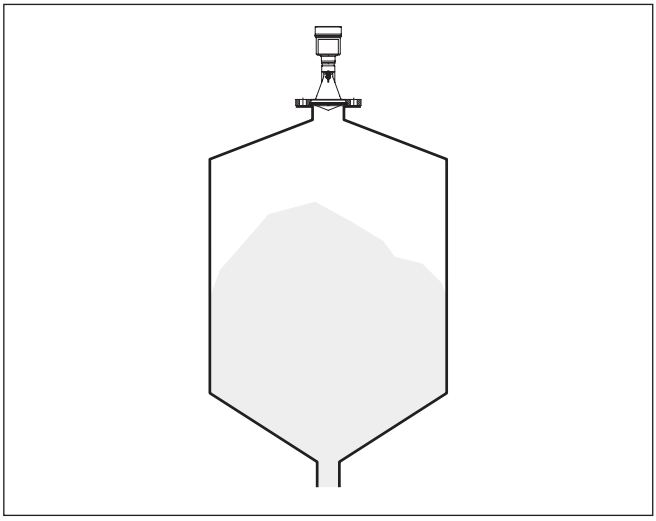


Fig. 2: Flange mounting of the radar sensor

4.3 Mounting preparations, mounting strap

The mounting strap enables simple mounting on the vessel wall or silo top. It is suitable for wall, ceiling or boom mounting. Especially in open vessels this is a very easy and effective way to align the sensor to the bulk solid surface.

The strap is supplied unassembled 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 ways to screw the strap onto the sensor. Depending on the selected version, the sensors can be swivelled in the strap as follows:

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

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

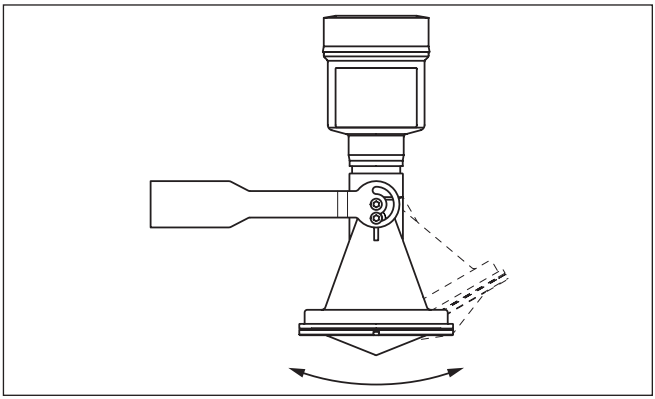


Fig. 3: Adjustment of the angle of inclination

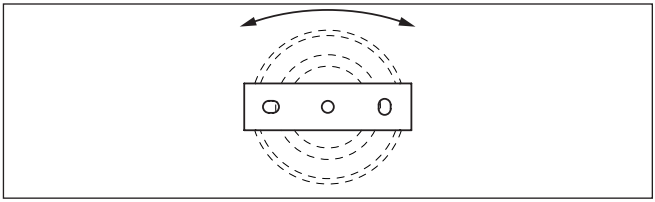


Fig. 4: Turning by fastening in the centre

4.4 Mounting instructions

Tight installation of the plastic horn antenna

For tight installation of the version with plastic horn antenna with compression or adapter flange, the following conditions must be fulfilled:

1. Use suitable flat seal, e.g. of EPDM with Shore hardness 25 or 50
2. Make sure the number of flange screws corresponds to the number of flange holes
3. Tighten all screws with the torque stated in the technical data

Polarisation

The emitted radar impulses of the radar sensor are electromagnetic waves. The polarisation is the direction of the electrical wave component. By turning the instrument in the connection flange or mounting boss, the polarisation can be used to reduce the effects of false echoes.

The position of the polarisation is marked on the process fitting of the instrument.

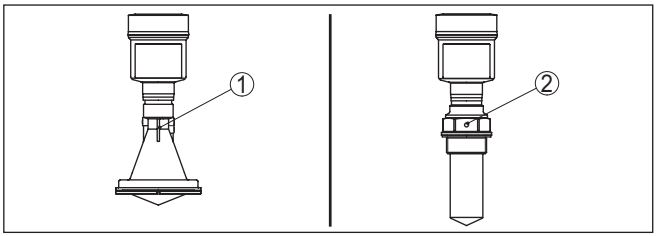


Fig. 5: Position of the polarisation

1 Marking with version with plastic horn antenna
2 Marking with version with encapsulated antenna system

Installation position

When mounting the sensor, keep a distance of at least 200 mm (7.874 in) to the vessel wall. If the sensor is installed in the center of dished or round vessel tops, multiple echoes can arise. These can, however, be suppressed by an appropriate adjustment (see chapter "*Setup*").

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

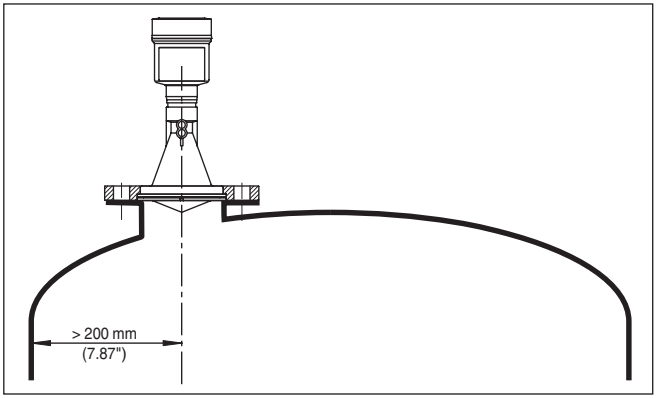


Fig. 6: Mounting of the radar sensor on round vessel tops

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

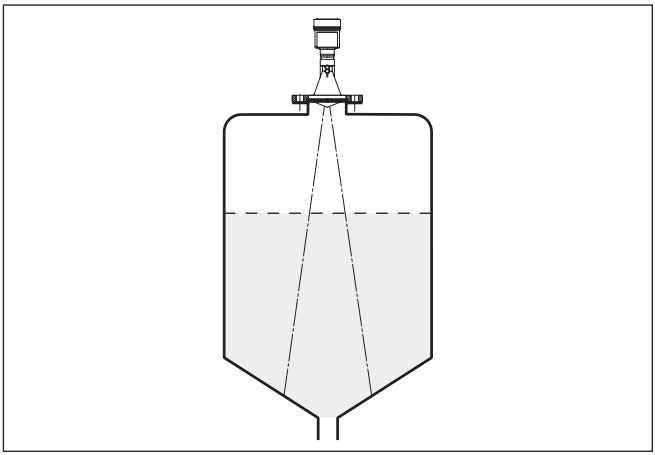


Fig. 7: Mounting of the radar sensor on vessels with conical bottom

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.

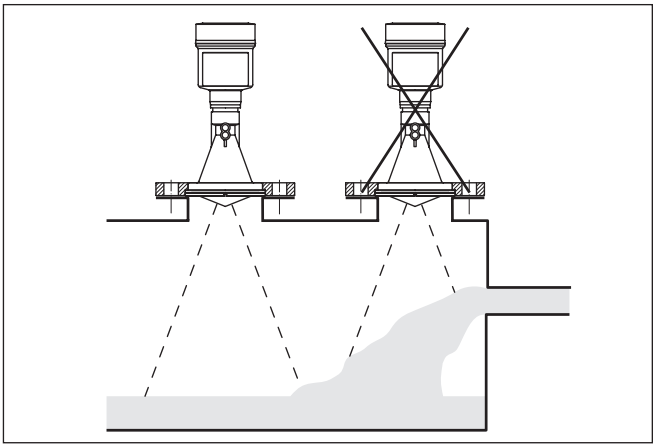


Fig. 8: Mounting of the radar sensor with inflowing medium

Socket with encapsulated antenna system

The socket piece should be dimensioned in such a way that the antenna end protrudes at least 10 mm (0.4 in) out of the socket.

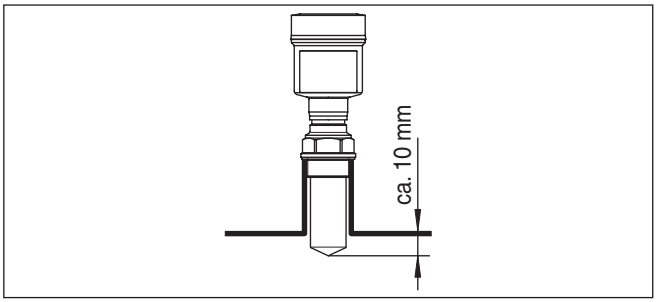


Fig. 9: Recommended socket mounting

If the reflective properties of the medium are good, you can mount VEGAPULS 61 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 signal suppression.

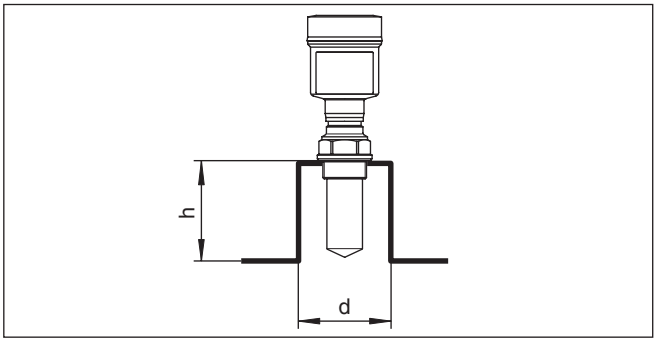


Fig. 10: Deviating socket dimensions

The below chart specifies the max. socket length h depending on the diameter d.

Socket diameter d		Socket length h	
40 mm	1½"	≤ 100 mm	≤ 3.9 in
50 mm	2"	≤ 150 mm	≤ 5.9 in
80 mm	3"	≤ 200 mm	≤ 7.9 in
100 mm	4"	≤ 300 mm	≤ 11.8 in
150 mm	6"	≤ 400 mm	≤ 15.8 in

Socket with plastic horn antenna

A corresponding collar flange for DN 80 (ASME 3" or JIS 80) as well as a suitable adapter flange are available for mounting VEGAPULS 61.

With the housing versions plastic, aluminium single chamber and stainless steel, the collar flange can be placed directly over the housing. With the aluminium double chamber housing, retroactive mount-

ing in this way is not possible - the mounting type must be specified with the order.

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

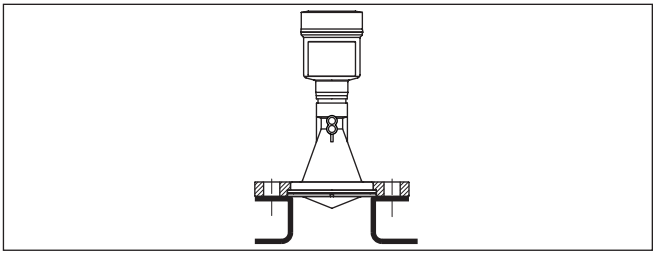
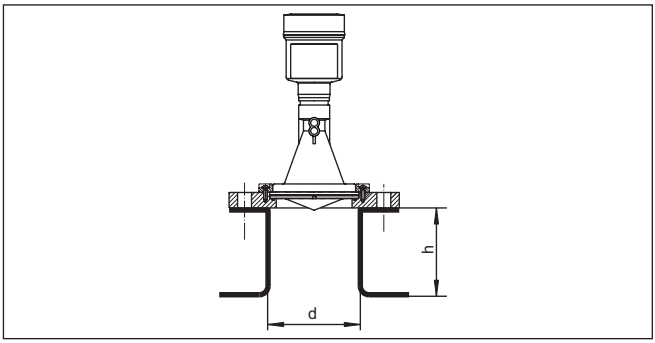


Fig. 11: Recommended socket mounting

If the medium has good reflective properties, VEGAPULS 61 can also be mounted on a longer socket piece. Recommended values for socket heights are specified in the following illustration. You must carry out a false echo storage afterwards.



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

Socket diameter d		Socket length h	
80 mm	3"	≤ 300 mm	≤ 11.8 in
100 mm	4"	≤ 400 mm	≤ 15.8 in
150 mm	6"	≤ 500 mm	≤ 19.7 in

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.

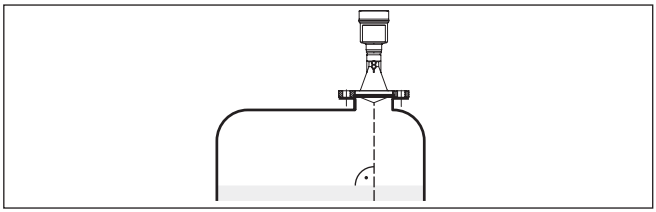


Fig. 13: Alignment in liquids

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 signal suppression 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.

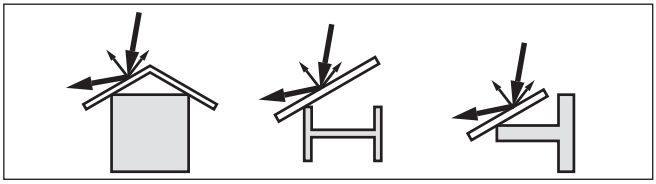


Fig. 14: Cover flat, large-area profiles with deflectors

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.

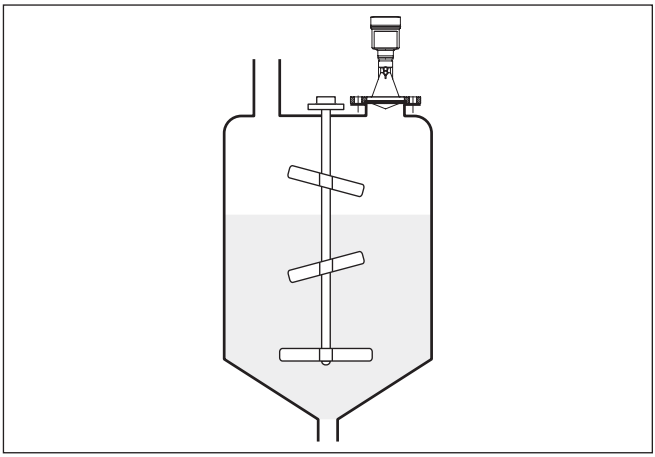


Fig. 15: Agitators

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 foams are causing measurement errors, the biggest possible radar antennas, the electronics with increased sensitivity or low frequency radar sensors (C band) 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 - Pipes

Measurement in a surge pipe

By using a surge pipe in the vessel, the influence of vessel installations and turbulence can be excluded. Under these prerequisites, the measurement of products with low dielectric values (ε_r value ≤ 1.6) is possible.

Note the following illustrations and instructions for measurement in a surge pipe.

Information:
Measurement in a surge pipe is not recommended for extremely adhesive products.

Configuration surge pipe

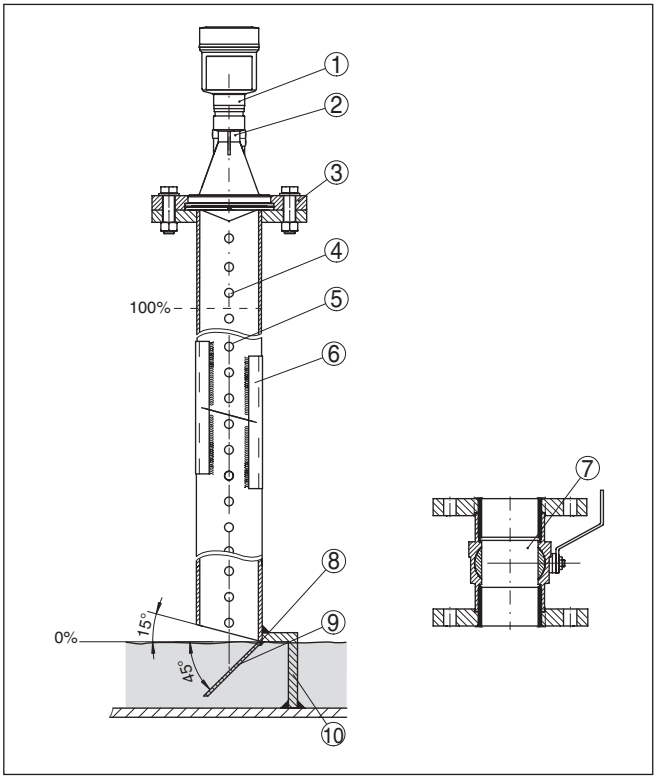


Fig. 16: Configuration surge pipe VEGAPULS 61

1 *Radar sensor*
2 *Polarisation marking*
3 *Thread or flange on the instrument*
4 *Vent hole*
5 *Holes*
6 *Welding connection through U-profile*
7 *Ball valve with complete opening*
8 *Surge pipe end*
9 *Reflector sheet*
10 *Fastening of the surge pipe*

Surge pipe extension

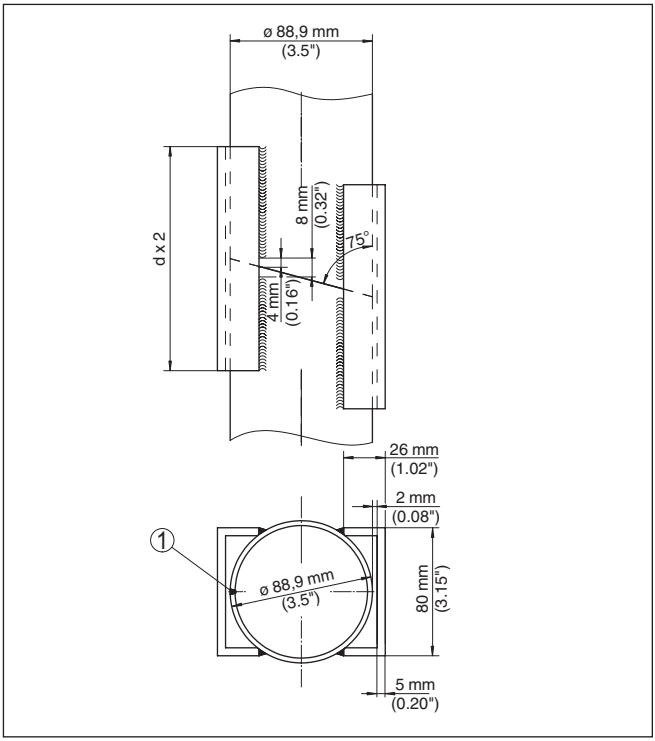


Fig. 17: Welding connection with surge pipe extension for different example diameters

1 Position of the welded joint with longitudinally welded pipes

Instructions and requirements, surge pipe

Instructions of orientation of the polarisation:

- Note marking of the polarisation on the sensor
- With threaded versions, the marking is on the hexagon, with flange versions between two flange holes
- The marking must be in one plane with the holes in the surge pipe

Instructions for the measurement:

- The 100 % point must be below the upper vent hole and the antenna edge
- The 0 % point is the end of the surge pipe
- During parameter adjustment, select "*Application standpipe*" and enter the tube diameter to compensate for errors due to running time shift
- A false signal suppression with the installed sensor is recommended but not mandatory
- The measurement through a ball valve with unrestricted channel is possible

Constructive requirements:

- Material metal, smooth inner surface
- Preferably pultruded or straight beaded stainless steel tube
- Welded joint should be straight and lie in one axis with the holes
- Flanges are welded to the tube according to the orientation of the polarisation
- When using a ball valves, align the transitions on the inside and fix accurately
- Gap size with junctions ≤ 0.1 mm
- Surge pipes must extend all the way down to the requested min. level, as measurement is only possible within the tube
- Diameter of holes ≤ 5 mm, any number OK, on one side or completely through
- The antenna diameter of the sensor should correspond to the inner diameter of the tube
- Diameter should be constant over the complete length

Instructions for surge pipe extension:

- The ends of the extension tubes must be bevelled and exactly aligned
- Welded connection via external U profiles according to illustration above. Length of the U profiles should be at least double the tube diameter
- Do not weld through the pipe wall. The surge pipe must remain smooth inside. Roughness and beads on the inside caused by unintentional penetration should be removed since they cause strong false echoes and encourage buildup
- An extension via welding neck flanges or pipe collars is not recommended.

Measurement in the bypass tube

An alternative to measurement in a surge pipe is measurement in a bypass tube outside of the vessel.

Configuration bypass

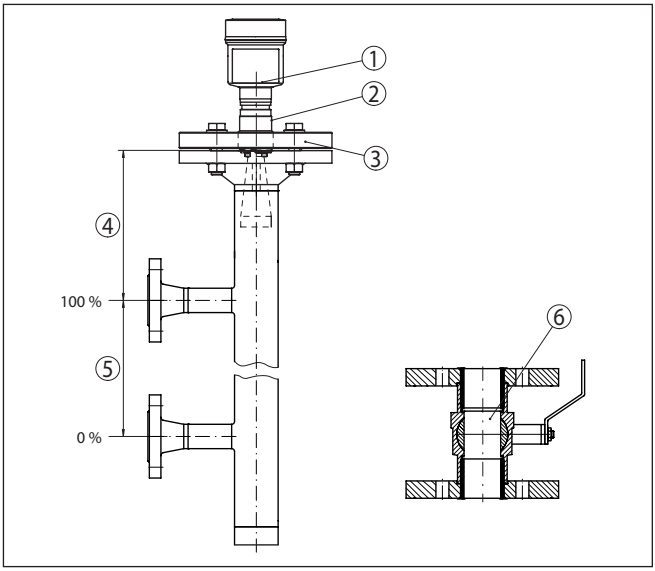


Fig. 18: Configuration bypass

1 Radar sensor
2 Polarisation marking
3 Instrument flange
4 Distance sensor reference plane to upper tube connection
5 Distance of the tube connections
6 Ball valve with complete opening

Instructions and requirements, bypass

Instructions of orientation of the polarisation:

- Note marking of the polarisation on the sensor
- With threaded versions, the marking is on the hexagon, with flange versions between two flange holes
- The marking must be in one plane with the tube connections to the vessel

Instructions for the measurement:

- The 100 % point may not be above the upper tube connection to the vessel
- The 0 % point may not be below the lower tube connection to the vessel
- Min. distance, sensor reference plane to upper edge of upper tube connection > 300 mm
- During parameter adjustment, select "*Application standpipe*" and enter the tube diameter to compensate for errors due to running time shift
- A false signal suppression with the installed sensor is recommended but not mandatory
- The measurement through a ball valve with unrestricted channel is possible

Constructional requirements on the bypass pipe:

- Material metal, smooth inner surface
- In case of an extremely rough tube inner surface, use an inserted tube (tube in tube) or a radar sensor with tube antenna
- Flanges are welded to the tube according to the orientation of the polarisation
- Gap size with junctions ≤ 0.1 mm, for example, when using a ball valve or intermediate flanges with single pipe sections
- The antenna diameter of the sensor should correspond to the inner diameter of the tube
- Diameter should be constant over the complete length

4.6 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.

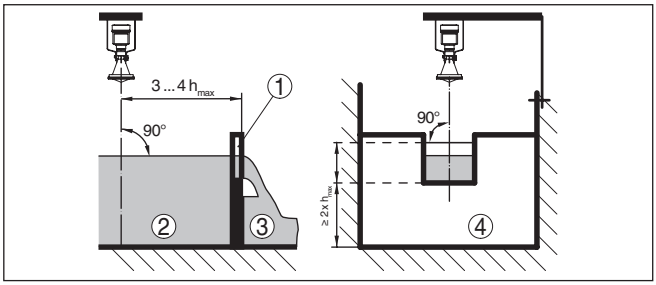


Fig. 19: Flow measurement with rectangular overfall: $d_{min.}$ = min. distance of the sensor (see chapter "Technical data"); $h_{max.}$ = max. filling of the rectangular spillway

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

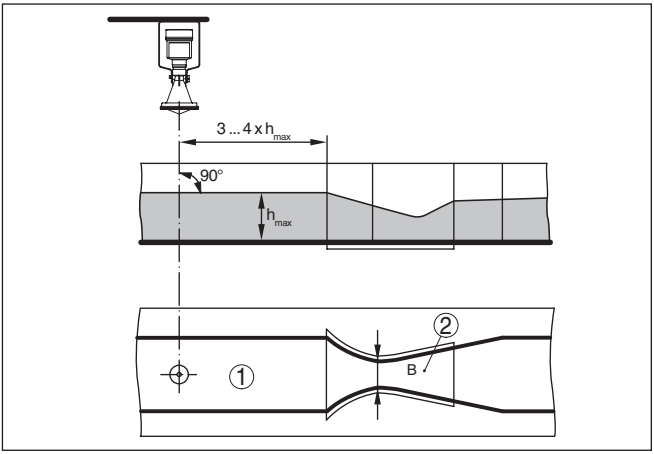


Fig. 20: Flow measurement with Khafagi-Venturi flume: $h_{max.}$ = max. filling of the flume; B = tightest constriction in the flume

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 the bus system

5.1 Preparing the connection

Safety instructions

Always keep in mind the following safety instructions:

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

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

Voltage supply

The voltage supply is provided by a Profibus DP /PA segment coupler.

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

Connection cable

Connection is made with screened cable according to the Profibus specification. Power supply and digital bus signal are carried over the same two-wire connection cable.

Make sure that the cable used has the required temperature resistance and fire safety for max. occurring ambient temperature

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.

Make sure that the entire installation is carried out according to the Profibus specification. In particular, make sure that the bus is terminated with suitable terminating resistors.

You can find detailed information of the cable specification, installation and topology in the "*Profibus PA - User and Installation Guideline*" on www.profibus.com.

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.

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

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

Cable screening and grounding

Make sure that the cable screen and grounding are carried out according to Fieldbus specification. We recommend to connect the cable screening to ground potential on both ends.

In systems with potential equalisation, connect the cable screening directly to ground potential at the power supply unit, in the connection box and at the sensor. The screen in the sensor must be connected directly to the internal ground terminal. The ground terminal outside on the housing must be connected to the potential equalisation (low impedance).

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

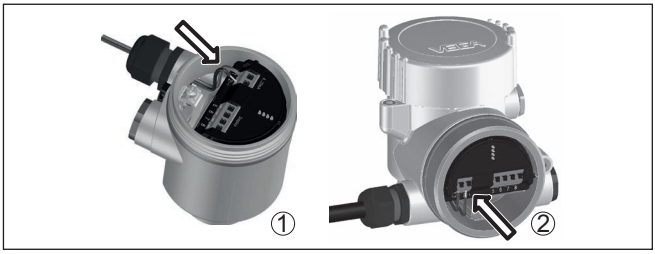


Fig. 21: Connection steps 5 and 6

1 Single chamber housing
2 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 connection compartment

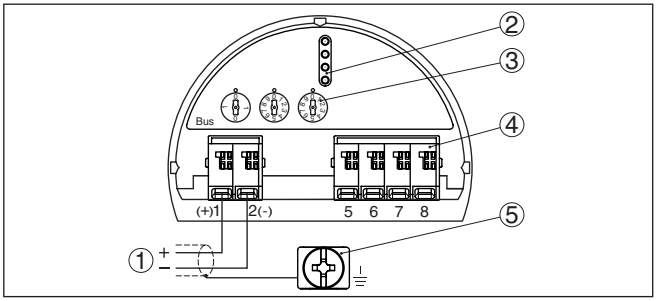


Fig. 22: Electronics and connection compartment - single chamber housing

1 Voltage supply, signal output
2 For display and adjustment module or interface adapter
3 Selection switch for instrument address
4 For external display and adjustment unit
5 Ground terminal for connection of the cable screening

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

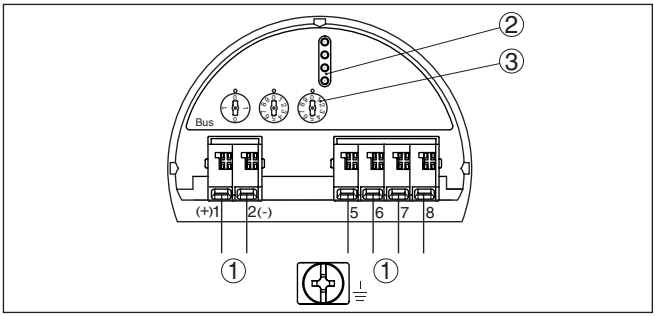


Fig. 23: Electronics compartment - double chamber housing

1 Internal connection to the connection compartment
2 Contact pins for the display and adjustment module or interface adapter
3 Selection switch for bus address

Connection compartment

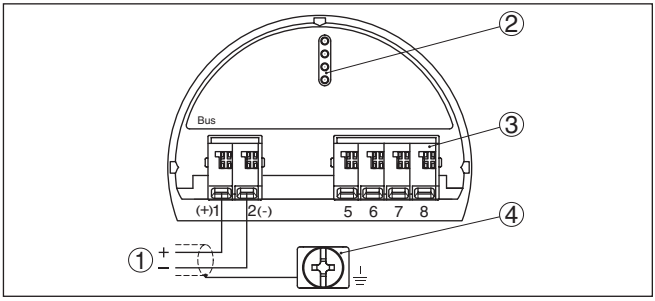


Fig. 24: Connection compartment - double chamber housing

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 screening

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

5.5 Wiring plan, Ex-d-ia double chamber housing

Electronics compartment

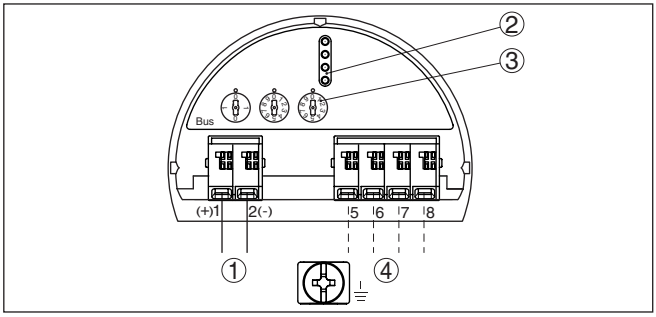


Fig. 25: Electronics compartment - Ex-d-ia double chamber housing

1 *Internal connection to the connection compartment*
2 *Contact pins for the display and adjustment module or interface adapter*
3 *Selection switch for bus address*
4 *Internal connection to the plug connector for external display and adjustment unit (optional)*

Connection compartment

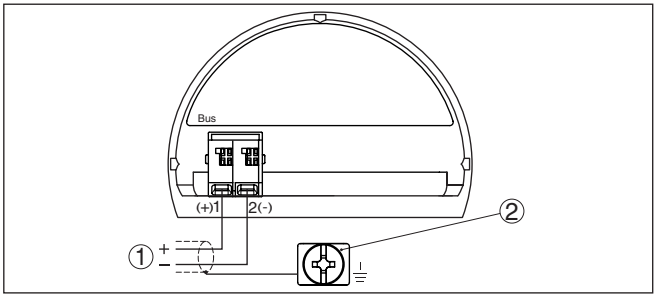


Fig. 26: Connection compartment - Ex-d-ia double chamber housing

1 *Voltage supply, signal output*
2 *Ground terminal for connection of the cable screening*

Plug M12 x 1 for external display and adjustment unit

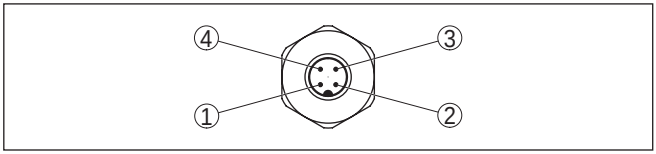


Fig. 27: Top view of the plug connector

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

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

5.6 Double chamber housing with VEGADIS-Adapter

Electronics compartment

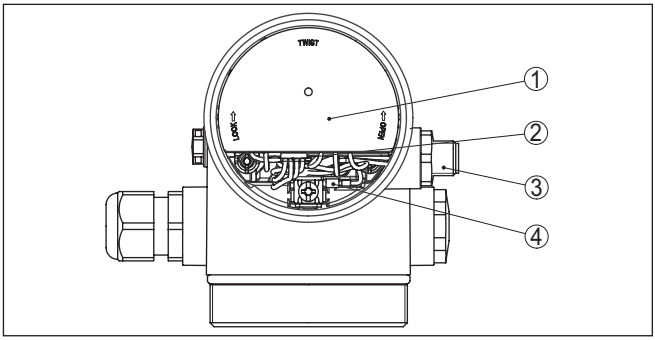


Fig. 28: View to the electronics compartment with VEGADIS adapter for connection of the external display and adjustment unit

1 VEGADIS adapter
2 Internal plug connection
3 Plug connector M12 x 1

Assignment of the plug connector

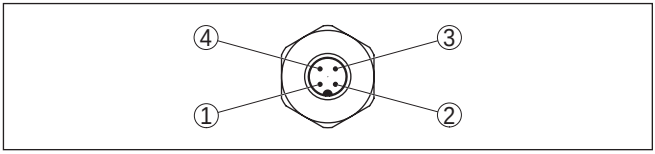


Fig. 29: View to the plug connector M12 x 1

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

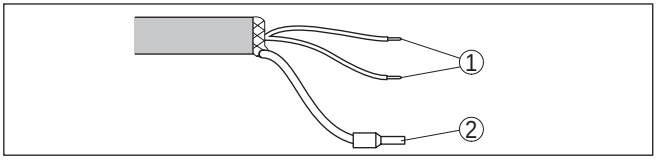


Fig. 30: Wire assignment in permanently connected connection cable

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

5.8 Set instrument address

Instrument address

An address must be assigned to each Profibus PA instrument. The approved addresses are between 0 and 126. Each address must only be assigned once in the Profibus PA network. The sensor is only recognized by the control system if the address is set correctly.

When the instrument is shipped, address 126 is set. This address can be used to test the function of the instrument and to connect it to a Profibus PA network. Then the address must be changed to integrate additional instruments.

The address setting is carried out either via:

- The address selection switch in the electronics compartment of the instrument (address setting via hardware)
- The display and adjustment module (address setting via software)
- PACTware/DTM (address setting via software)

Hardware addressing

The hardware addressing is effective if an address <126 is set with the address selection switches on the instrument. Software addressing is then no longer effective, the set hardware address applies.

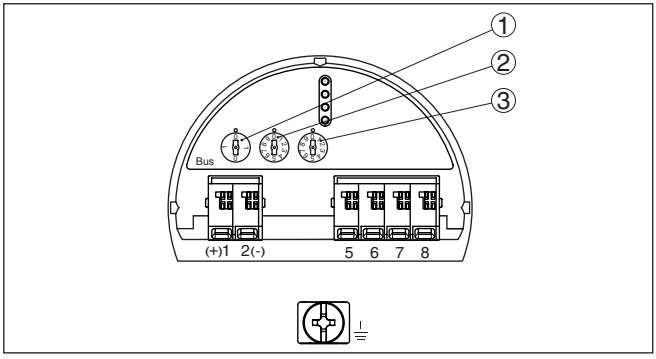


Fig. 31: Address selection switch

1 Addresses <100 (selection 0), addresses >100 (selection 1)
2 Decade of the address (selection 0 to 9)
3 Unit position of the address (selection 0 to 9)

Software addressing

Software addressing is only effective if address 126 or higher is set on the instrument with the address selection switches.

The addressing procedure is described in the operating instructions manual "*Display and adjustment module*.

5.9 Switch-on phase

After VEGAPULS 61 is connected to the bus system, the instrument carries out a self-test for approx. 30 seconds. The following steps are carried out:

- Internal check of the electronics
- Indication of a status message, e.g. "*F 105 Determine measured value*" on the display or PC
- Status byte goes briefly to fault value

Then the actual measured value is output to the signal cable. The value takes into account settings that have already been carried out, e.g. default 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. 32: Installing the display and adjustment module in the electronics compartment of the single chamber housing

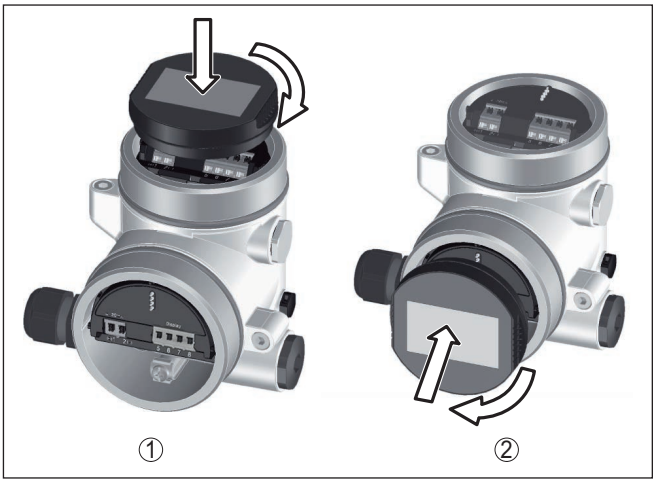


Fig. 33: Installing the display and adjustment module in the double chamber housing

1 In the electronics compartment
2 In the connection 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

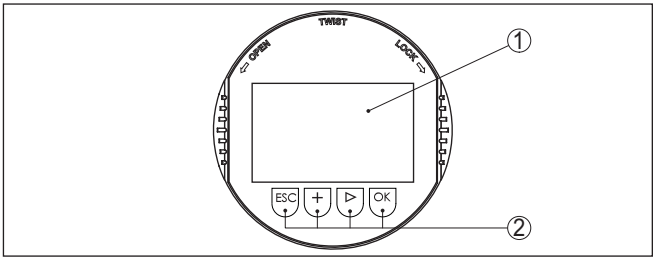


Fig. 34: Display and adjustment elements

1 LC display
2 Adjustment keys

Key functions

- ***[OK]*** key:
  - Move to the menu overview
  - Confirm selected menu
  - Edit parameter
  - Save value
- ***[->]*** key:
  - Change measured value presentation
  - 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

Operating system - Keys direct

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 function of the individual keys in the previous illustration.

Adjustment system - keys via magnetic pen

With the Bluetooth version of the display and adjustment module you can also adjust the instrument with the magnetic pen. The pen operates the four keys of the display and adjustment module right through the closed lid (with inspection window) of the sensor housing.

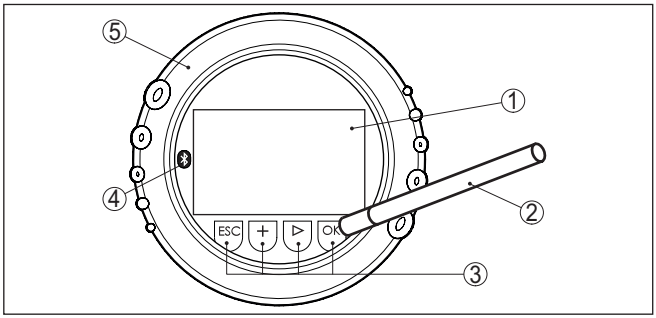


Fig. 35: Display and adjustment elements - with adjustment via magnetic pen

1 LC display
2 Magnetic pen
3 Adjustment keys
4 Bluetooth symbol
5 Lid with inspection window

Time functions

When the ***[+]*** and ***[->]*** keys are pressed quickly, the edited value, or the cursor, changes one value or position at a time. If the key is pressed longer than 1 s, the value or position changes 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 of national language

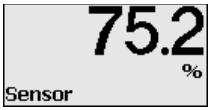
Measured value indication

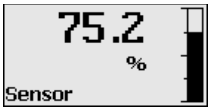
With the ***[->]*** key you move between three different indication modes.

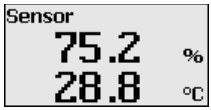
In the first view, the selected measured value is displayed in large digits.

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 with factory settings, 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*".

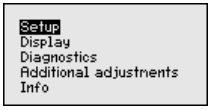
With the "***OK***" key you move to the main menu.

6.4 Parameter adjustment

The instrument is adapted to the application conditions via the parameter adjustment. The parameter adjustment is carried out with an adjustment menu.

Main menu

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



Setup: Settings, for example, to measurement loop name, medium, application, vessel, adjustment, AI FB 1 Channel - scaling - damping

Display: Language setting, settings for the measured value indication as well as lighting

Diagnosis: Information, for example on the instrument status, pointer, measurement reliability, AI FB 1 simulation, echo curve

Further settings: Instrument units, false signal suppression, linearization, sensor address, PIN, date/time, reset, copy sensor data

Info: Instrument name, hardware and software version, date of manufacture, 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.

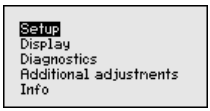
Setup - Measurement loop name

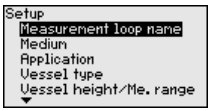
In the menu item "*Sensor TAG*" you edit a twelve-digit measurement loop designation.

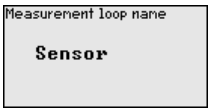
You can enter an unambiguous designation for the sensor, e.g. the measurement loop name or the tank or product designation. In digital systems and in the documentation of larger plants, a singular designation must be entered for exact identification of individual measuring points.

The available digits include:

- Letters from A … Z
- Numbers from 0 … 9
- Special characters +, -, /, -



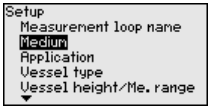


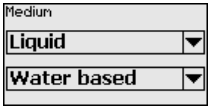


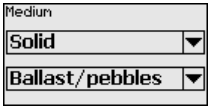
Setup - Medium

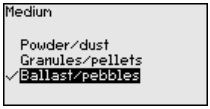
Every medium has different reflective properties. With liquids, there are additional interfering factors such as turbulent product surface and foam generation. With bulk solids, the additional interfering factors are dust generation, angle of repose and secondary echoes from the vessel wall.

To adapt the sensor to these different measuring conditions, the selection "*Liquid*" or "*Bulk solid*" should be made in this menu item.









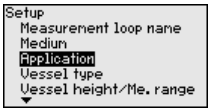
Through this selection, the sensor is optimally adapted to the product, and measurement reliability, particularly in products with poor reflective properties, is considerably increased.

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.

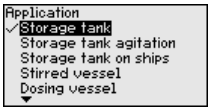
Setup - Application

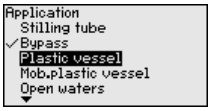
In addition to the medium, also the application, i.e. the measuring site, can influence the measurement.

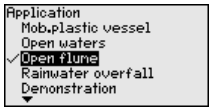
With this menu item, the sensor can be adapted to the applications. The adjustment possibilities depend on the selection "*Liquid*" or "*Bulk solid*" under "*Medium*".



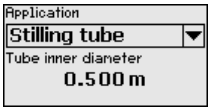
The following options are available when "*Liquid*" is selected:

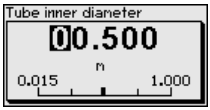






The selection "*Standpipe*" opens a new window in which the inner diameter of the applied standpipe is entered.





Following the characteristics of the applications and the metrological features of the sensor are described.

Note:
Probably the operation of the instrument in the following applications is subject to national restrictions in respect to the radio license (see chapter "*For your safety*"):

- Plastic tank
- Transportable plastic tank
- Open water
- Open flume
- Rain water spillover

Storage tank:
- Setup: large-volumed, upright cylindrical, spherical
- Medium speed: slow filling and emptying
- 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 measurement accuracy
  - Short reaction time of the sensor not required

Storage tank, circulation:
- Setup: large-volumed, upright cylindrical, spherical
- Medium 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 measurement accuracy, because not set for max. speed
  - False signal suppression recommended

Storage tank on ships:
- Medium 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 measurement accuracy
  - False signal suppression required

Stirrer vessel:
- Setup: all vessel sizes possible
- Medium 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
- Medium 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

Standpipe:
- Medium speed: very fast filling and emptying
- Vessel:
  - Vent hole
  - Joins like flanges, weld joints
  - Shifting of the running time in the tube
- Process/measurement conditions:
  - Condensation

  - Buildup
- Properties, sensor:
  - Measurement speed optimized through little averaging
  - Entering the tube inside diameter takes the running time shift into consideration
  - Echo detection sensitivity reduced

Bypass:

- Medium speed:
  - Fast up to slow filling with short up to long bypass tube possible
  - Often the level is hold via a control facility
- Vessel:
  - Lateral outlets and inlets
  - Joins like flanges, weld joints
  - Shifting of the running time in the tube
- Process/measurement conditions:
  - Condensation
  - Buildup
  - Separation of oil and water possible
  - Overfilling into the antenna possible
- Properties, sensor:
  - Measurement speed optimized through little averaging
  - Entering the tube inside diameter takes the running time shift into consideration
  - Echo detection sensitivity reduced
  - 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:
- 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:
- 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:
- 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

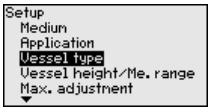
Caution:
If liquids with different dielectric constants separate in the vessel, for example through condensation, the radar sensor can detect under certain circumstances only the medium with the higher dielectric

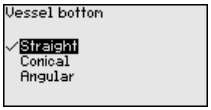
constant. Keep in mind that layer interfaces can cause faulty measurements.

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 - 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.



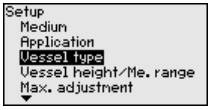


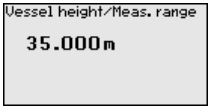
Enter the requested parameters via the appropriate keys, save your settings with ***[OK]*** and jump to the next menu item with the ***[ESC]*** and the ***[->]*** key.

Setup - Vessel height, measuring range

Through this selection the operating range of the sensor is adapted to the vessel height, which considerably increases measurement reliability 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.

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:

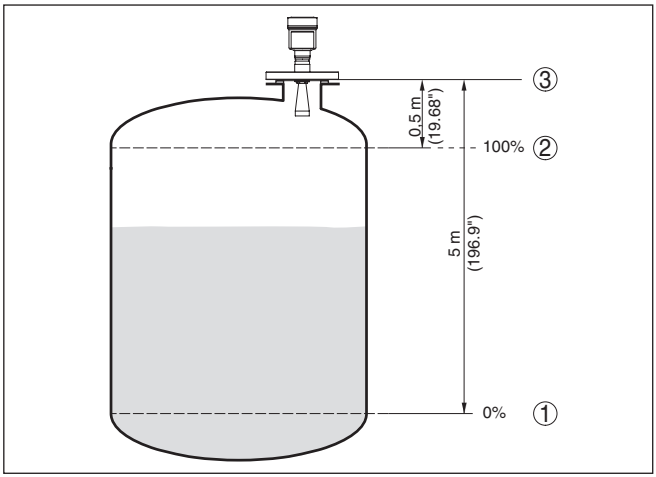


Fig. 36: Parameterisation example, Min./max. adjustment

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

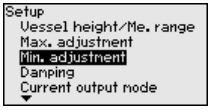
If these values are not known, an adjustment with the distances of e.g. 10 % and 90 % is possible. Starting point for these distance specifications is always the sealing surface of the thread or flange. You can find further specifications on the reference plane in the chapters "*Mounting instructions*"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

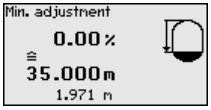
The actual product level during this adjustment is not important, because the min./max. adjustment is always carried out without changing the product level. These settings can be made ahead of time without the instrument having to be installed.

Setup - Min. adjustment

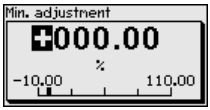
Proceed as follows:

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

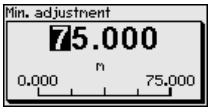




2. Edit the percentage value with ***[OK]*** and set the cursor to the requested position with ***[->]***.



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

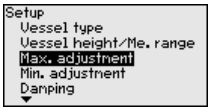


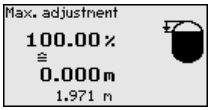
4. Enter the suitable distance value in m for empty vessel (e.g. distance from the sensor to the vessel bottom) corresponding to the percentage value.
5. Save settings with ***[OK]*** and move with ***[ESC]*** and ***[->]*** to the max. adjustment.

Setup - Max. adjustment

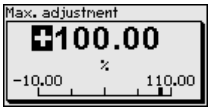
Proceed as follows:

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

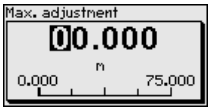




2. Prepare the percentage value for editing with ***[OK]*** and set the cursor to the requested position with ***[->]***.



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

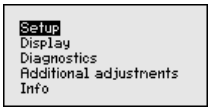


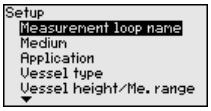
4. Enter the appropriate distance value in m (corresponding to the percentage value) for the full vessel. Keep in mind that the max. level must lie below the min. distance to the antenna edge.
5. Save settings with ***[OK]***

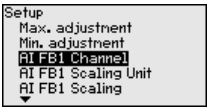
Setup - AI FB1 Channel

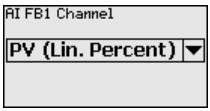
The channel is the input selector switch for function block (FB) of the sensor. Within the function block, additional scalings (Out-Scale) are carried out. In this menu item, the value fir the function block is selected:

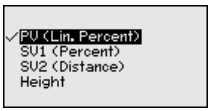
- PV (Primary Value):
  - Linearised percentage value
- SV1 (Secondary Value 1):
  - Percent with radar, guided microwave and ultrasonic sensors
  - Pressure or height with pressure transmitters
- SV2 (Secondary Value 2):
  - Distance with radar, guided microwave and ultrasonic sensors
  - Percent with pressure transmitters
- Height





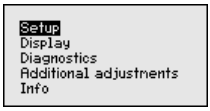


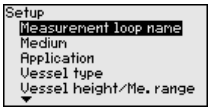


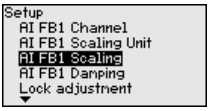


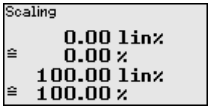
Setup - AI FB1 Scaling

Additional scalings (Out-Scale) are carried out within the function block. In this menu item, the unit of the scaling is entered.



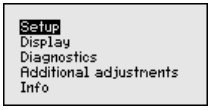


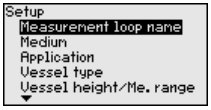


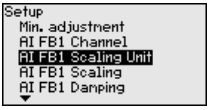


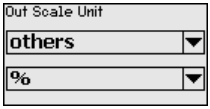
Setup - AI FB1 Scaling unit

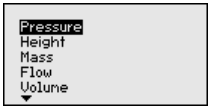
Additional scalings (Out-Scale) are carried out within the function block. In this menu item, the scaling unit is selected. For a better overview, the units are combined in groups:







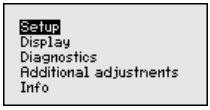


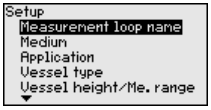


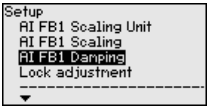
Setup - AI FB1 Damping

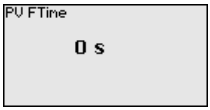
To damp process-dependent measured value fluctuations, set an integration time of 0 … 999 s in this menu item.

Depending on the sensor type, the factory setting is 0 s or 1 s.





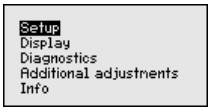


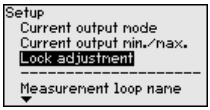


Setup - Lock adjustment

In this menu item, the PIN is activated/deactivated permanently. Entering a 4-digit PIN protects the sensor data against unauthorized access and unintentional modifications. If the PIN is activated perma-

nently, it can be deactivated temporarily (i.e. for approx. 60 min.) in any menu item.





Only the following functions are permitted with activated PIN:

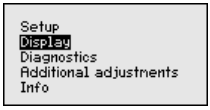
- Select menu items and show data
- Read data from the sensor into the display and adjustment module

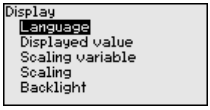
Caution:
When the PIN is active, adjustment via PACTware/DTM as well as other systems is also blocked.

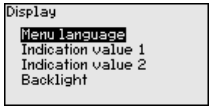
In delivery status, the PIN is "*0000*".

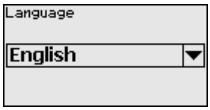
Display - Language

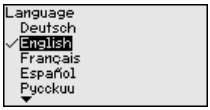
This menu item enables the setting of the requested national language.

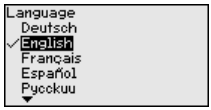












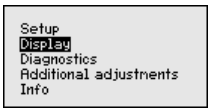
In delivery status, the sensor is set to the ordered national language.

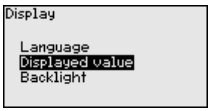
Display - Indicated value

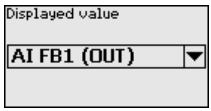
In the menu item "*Display*" you can define which measured value should be presented on the display.

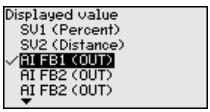
The sensor delivers the following measured values:

- PV (Primary Value): Linearised percentage value
- SV1 (Secondary Value 1): Percentage value after the adjustment
- SV2 (Secondary Value 2): Distance value before the adjustment
- AI FB1 (OUT)
- AI FB2 (OUT)
- AI FB3 (OUT)
- Height



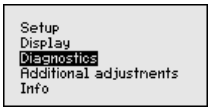


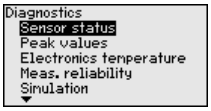


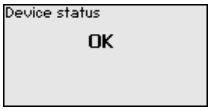


Diagnostics - Device status

In this menu item, the device status is displayed.

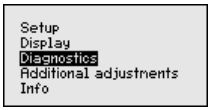


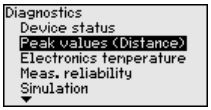


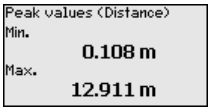


Diagnostics - Peak values (distance)

The respective min. and max. measured distance values are saved in the sensor. The values are displayed in the menu item "*Peak values*".

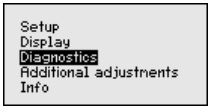


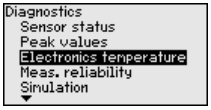


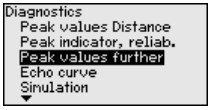


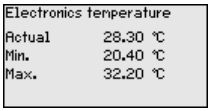
Diagnosis - Electronics temperature

The respective min. and max. measured values of the electronics temperature are saved in the sensor. These values as well as the current temperature value are displayed in the menu item "*Peak values*".



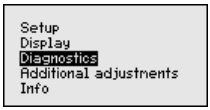


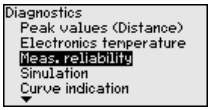


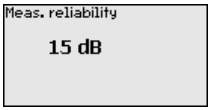


Diagnosis - Measurement reliability

When non-contact level sensors are used, the measurement can be influenced by the respective process conditions. In this menu item, the measurement reliability of the level echo is displayed as a dB value. Measurement reliability equals signal strength minus noise. The higher the value, the more reliable the measurement. A well functioning measurement normally has a value > 10 dB.

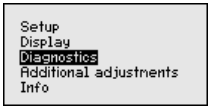


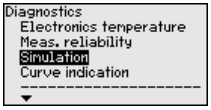


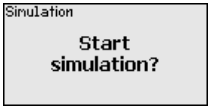


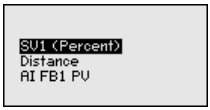
Diagnosis - Simulation

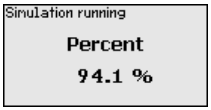
In this menu item you simulate measured values via the signal output. Hence, the signal path can be tested via the segment coupler up to the input card of the control system.

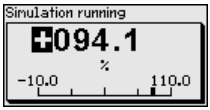












How to start the simulation:

1. Push ***[OK]***

2. Select the requested simulation variable with ***[->]*** and confirm with ***[OK]***.
3. With ***[OK]*** you start the simulation, first of all the actual measured value is displayed in %
4. Start the editing mode with ***[OK]***
5. Set the requested numerical value with ***[+]*** and ***[->]***
6. Push ***[OK]***

Note:
During simulation, the simulated value is output as Profibus PA signal.

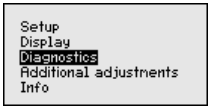
How to interrupt the simulation:

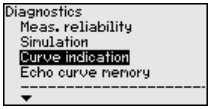
→ Push ***[ESC]***

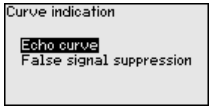
Information:
The simulation is automatically terminated 10 minutes after the last pressing of a key.

Diagnosis - 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.

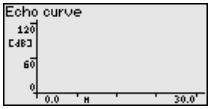


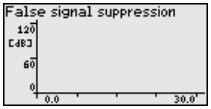




The "*False signal suppression*" displays the saved false echoes (see menu "*Additional settings*") of the empty vessel with signal strength in "dB" over the entire measuring range.

A comparison of echo curve and false signal suppression allows a more detailed statement about measurement reliability.





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

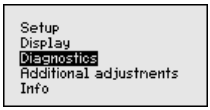
- "X-Zoom": Zoom function for the meas. distance
- "Y-Zoom": 1, 2, 5 and 10x signal magnification in "*dB*"
- "Unzoom": Reset the presentation to the nominal measuring range without magnification

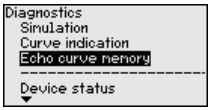
Diagnostics - Echo curve memory

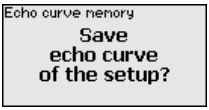
The function "*Echo curve memory*" makes it possible to save the echo curve at the time of setup. This is generally recommended, and it is absolutely necessary if you want to use the Asset Management functions. If possible, the curve should be saved with a low level in the vessel.

With the adjustment software PACTware and a PC, a high resolution echo curve can be displayed and used to recognize signal changes during operation. In addition, the echo curve of setup can be dis-

played in the echo curve window and compared with the current echo curve.

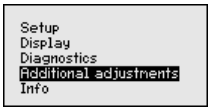


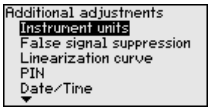


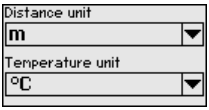


Additional adjustments - Instrument units

In this menu item you select the measured variable of the system and the temperature unit.

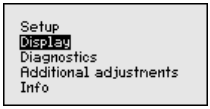


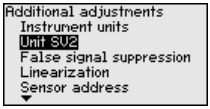


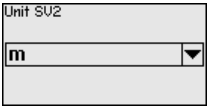


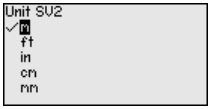
Additional adjustments - Unit SV2

In this menu item, you define the unit of the Secondary Values 2 (SV2):









Additional settings - False signal suppression

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

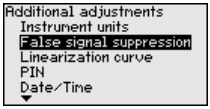
- High mounting sockets
- Vessel internals such as struts
- Agitators
- Buildup or welded joints on vessel walls

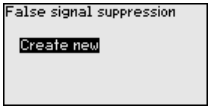
Note:
A false signal suppression detects, marks and saves these false signals to ensure that they are ignored in the level measurement.

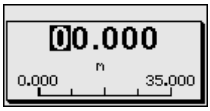
This should be done with the lowest possible level so that all potential interfering reflections can be detected.

Proceed as follows:

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



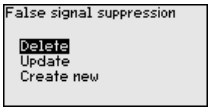




2. Confirm 3-times with ***[OK]*** and enter the actual distance from the sensor to the product surface.
3. All interfering signals in this range are detected by the sensor and stored after being confirmed with ***[OK]***.

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*":



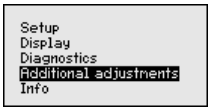
Delete: An already created false signal suppression will be completely deleted. This is useful if the saved false signal suppression no longer matches the metrological conditions in the vessel.

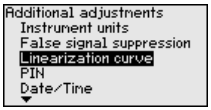
Extend: is used to extend an already created false signal suppression. This is useful if a false signal suppression was carried out with too high a level and not all false signals could be detected. When selecting "*Extend*", the distance to the product surface of the created false signal suppression is displayed. This value can now be changed and the false signal suppression can be extended to this range.

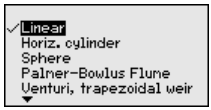
Additional settings - Linearization

A linearization is necessary for all vessels in which the vessel volume does not increase linearly with the level - e.g. a horizontal cylindrical or spherical tank - and the indication or output of the volume is required. Corresponding linearization curves are preprogrammed for these vessels. They represent the correlation between the level percentage and vessel volume.

By activating the appropriate curve, the volume percentage of the vessel is displayed correctly. If the volume should not be displayed in percent but e.g. in l or kg, a scaling can be also set in the menu item "*Display*".







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

Caution:
Note the following if instruments with appropriate approval are used as part of an overfill protection system according to WHG:

If a linearisation curve is selected, the measuring signal is no longer necessarily linear to the filling height. This must be considered by the user especially when setting the switching point on the limit signal transmitter.

Additional adjustments - Sensor address

In this menu item, the sensor address is adjusted on Profibus PA.

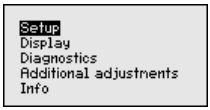
An address must be assigned to each Profibus PA instrument. The approved addresses are between 0 and 126. Each address must only be assigned once in the Profibus PA network. The sensor is only recognized by the control system if the address is set correctly.

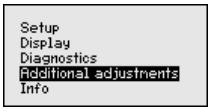
When the instrument is shipped, address 126 is set. This address can be used to test the function of the instrument and to connect it to a Profibus PA network. Then the address must be changed to integrate additional instruments.

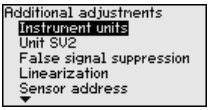
The address setting is carried out either via:

- The address selection switch in the electronics compartment of the instrument (address setting via hardware)
- The display and adjustment module (address setting via software)
- PACTware/DTM (address setting via software)

Note:
The software addressing is only possible if address 126 or higher is adjusted on the instrument with the address selection switches.

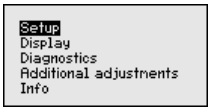


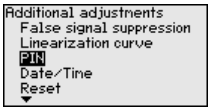


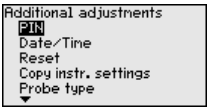


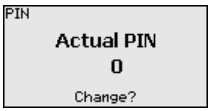
Additional settings - PIN

Entering a 4-digit PIN protects the sensor data against unauthorized access and unintentional modification. In this menu item, the PIN is displayed or edited and changed. However, this menu item is only available if adjustment is enabled in the menu "*Setup*".





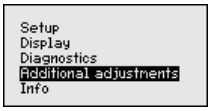


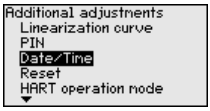


In delivery status, the PIN is "*0000*".

Additional settings - Date/ Time

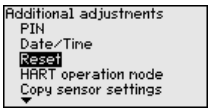
In this menu item, the internal clock of the sensor is set.

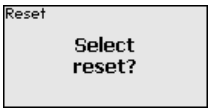


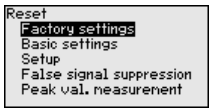


Additional settings - Reset

When a reset is carried out, all settings (with only a few exceptions) are reset. The exceptions are: PIN, language, lighting, SIL and HART mode.







The following reset functions are available:

- **Delivery status:** Restoring the parameter settings at the time of shipment from the factory incl. the order-specific settings. A created false signal suppression, user-programmable linearization curve, the measured value memory, echo curve memory as well as event memory will be deleted.
- **Basic settings:** Resetting of the parameter settings incl. special parameters to the default values of the respective instrument. Any created false signal suppression, user programmable linearization curve, measured value memory as well as event memory will be deleted.
- **Setup:** Resetting of the parameter settings to the default values of the respective instrument . Order-related settings remain but are not taken over into the current parameters. User-generated false signal suppression, user-programmed linearization curve, measured value memory, echo curve memory as well as event memory remain untouched. The linearization is set to linear.
- **False signal suppression:** Deletes a previously created false signal suppression. The false signal suppression created at the factory remains active.
- **Peak values, measured value:** Resets the measured min. and max. distances to the current measured value.

Select the requested reset function ***[->]*** and confirm with ***[OK]***.

The following table shows the default values of VEGAPULS 61:

Menu	Menu item	Default value
Setup	Measurement loop name	Sensor
	Medium	Liquid/Water Bulk solids/Crushed stones, gravel
	Application	Storage tank Silo
	Vessel form	Vessel bottom, dished form Vessel top, dished form
	Vessel height/Measuring range	Recommended measuring range, see "*Technical data*" in the supplement.
	Min. adjustment	Recommended measuring range, see "*Technical data*" in the supplement.
	Max. adjustment	0,000 m(d)
	AI FB1 Channnel	PV (lin. perc.)
	AI FB1 scaling unit	Height %
	AI FB1 scaling	0.00 lin %, 0.00 % 100.00 lin %, 100.00 %
	AI FB1 damping	0 s
	Lock adjustment	Released
Display	Language	Like order
	Displayed value	SV 1
	Backlight	Switched on
Additional adjustments	Distance unit	m
	Temperature unit	°C
	Unit SV2	m
	Probe length	Length of standpipe ex factory
	Linearisation curve	Linear
	Sensor address	126

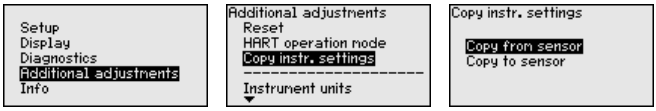
Additional settings - Copy instrument settings

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

- Store data from sensor in the display and adjustment module.
- Store data from display and adjustment module in 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*"
- In the menu "*Additional settings*" the items "*Distance unit, temperature unit and linearization*"
- The values of the user-programmable linearisation 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 sensor exchange.

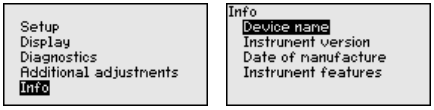
The type and the volume of the copied data depend on the respective sensor.

Note:

Before the data are stored in the sensor, a check is carried out to determine if the data fit the sensor. If the data do not fit, a fault signal is triggered or the function is blocked. When data are being written into the sensor, the display shows which instrument type the data originate from and which TAG-no. this sensor had.

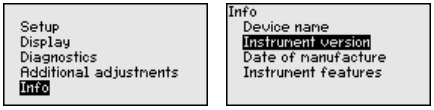
Info - Instrument name

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



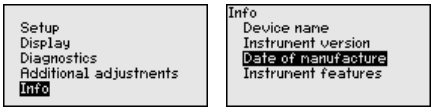
Info - Instrument version

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



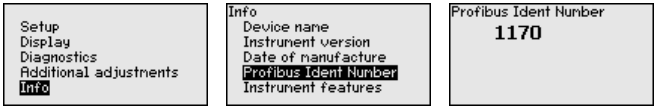
Info - Date of manufacture

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 - Profibus Ident Number

In this menu item, the Profibus ident number of the instrument is displayed.



Instrument features

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

6.5 Saving the parameterisation data

On paper

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

In the display and adjustment module

If the instrument is equipped with a display and adjustment module, the parameter adjustment data can be saved therein. The procedure is described in menu item "*Copy device settings*".

7 Setup with PACTware

7.1 Connect the PC

Via the interface adapter directly on the sensor

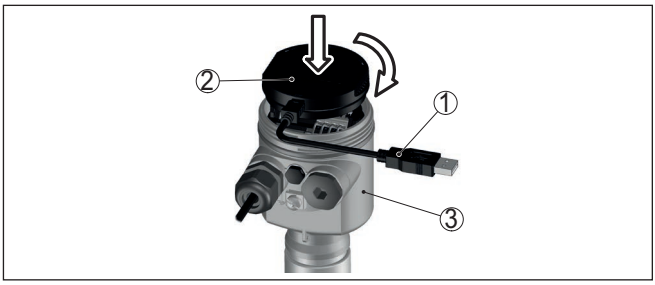


Fig. 37: Connection of the PC directly to the sensor via the interface adapter

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

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.

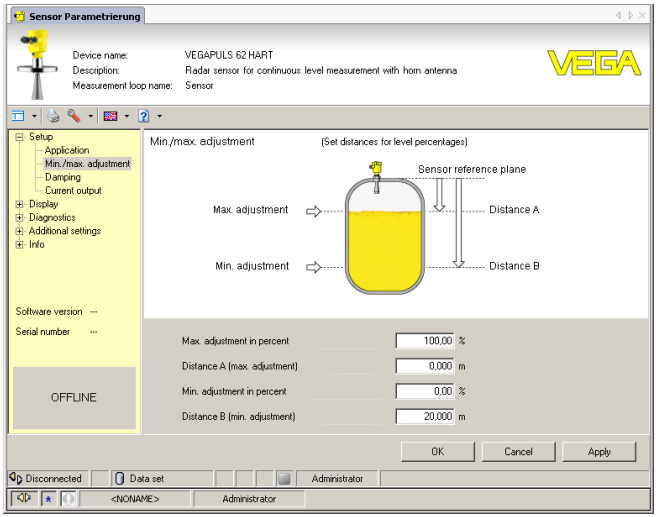


Fig. 38: Example of a DTM view

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 parameterisation data

We recommend documenting or saving the parameterisation 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*".

9 Diagnosis, asset management and service

9.1 Maintenance

Maintenance

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

Cleaning

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

Take note of the following:

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

9.2 Measured value and event memory

The instrument has several memories 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
- Measurement reliability
- Electronics temperature

When the instrument is shipped, the measured value memory is active and stores distance, measurement reliability 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. Additional 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:

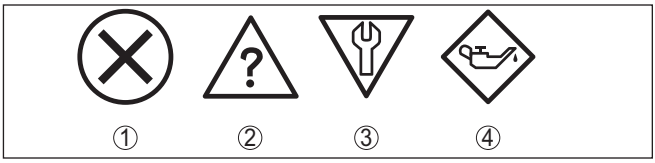


Fig. 39: Pictographs of the status messages

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

Failure: Due to a malfunction in the instrument, a fault message is output.

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

Function check: The instrument is being worked on, 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 unreliable because an instrument specification was 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 (failure)

Code Text message	Cause	Rectification	DevSpec Diagnosis Bits
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 settings ● Clean or exchange process component or antenna	Bit 0
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
F025 Error in the linearization table	● Index markers are not continuously rising, for example illogical value pairs	● Check linearisation table ● Delete table/Create new	Bit 2
F036 No operable software	● Failed or interrupted software update	● Repeat software update ● Check electronics version ● Exchanging the electronics ● Send instrument for repair	Bit 3
F040 Error in the electronics	● Hardware defect	● Exchanging the electronics ● Send instrument for repair	Bit 4
F080	● General software error	● Disconnect operating voltage briefly	Bit 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 up to approx. 3 min. depending on the version and parameter settings	Bit 6
F113 Communication error	● Error in the internal instrument communication	● Disconnect operating voltage briefly ● Send instrument for repair	Bit 12
F125 Impermissible electronics temperature	● Temperature of the electronics in the non-specified range	● Check ambient temperature ● Insulate electronics ● Use instrument with higher temperature range	Bit 7
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
F261 Error in the configuration	● Error during setup ● False signal suppression faulty ● Error when carrying out a reset	● Repeat setup ● Repeat reset	Bit 9

Code Text message	Cause	Rectification	DevSpec Diagnosis Bits
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 settings ● Use an instrument with bigger measuring range	Bit 10
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

Tab. 7: Error codes and text messages, information on causes as well as corrective measures

Function check

Code Text message	Cause	Rectification	DevSpec Diagnosis Bits
C700 Simulation active	● A simulation is active	● Finish simulation ● Wait for the automatic end after 60 mins.	Bit 19

Tab. 8: Error codes and text messages, information on causes as well as corrective measures

Out of specification

Code Text message	Cause	Rectification	DevSpec Diagnosis Bits
S600 Impermissible electronics temperature	● Temperature of the electronics in the non-specified range	● Check ambient temperature ● Insulate electronics ● Use instrument with higher temperature range	Bit 18
S601 Overfilling	● Danger of vessel overfilling	● Make sure that there is no further filling ● Check level in the vessel	Bit 20

Tab. 9: Error codes and text messages, information on causes as well as corrective measures

Maintenance

Code Text message	Cause	Rectification	DevSpec Diagnosis Bits
M500 Error during the reset "delivery status"	● The data could not be restored during the reset to delivery status	● Repeat reset ● Load XML file with sensor data into the sensor	Bit 13
M501 Error in the non-active linearisation table	● Hardware error EEPROM	● Exchanging the electronics ● Send instrument for repair	Bit 14
M502 Error in the diagnostics memory	● Hardware error EEPROM	● Exchanging the electronics ● Send instrument for repair	Bit 15

Code Text message	Cause	Rectification	DevSpec Diagnosis Bits
M503 Measurement reliability too low	● The echo/noise ratio is too small for reliable measurement	● Check installation and process conditions ● Clean the antenna ● Change polarisation direction ● Use instrument with higher sensitivity	Bit 16
M504 Error at a device interface	● Hardware defect	● Check connections ● Exchanging the electronics ● Send instrument for repair	Bit 17
M505 No echo available	● Level echo can no longer be detected	● Clean the antenna ● Use a more suitable antenna/ sensor ● Remove possible false echoes ● Optimize sensor position and orientation	Bit 21

Tab. 10: Error codes and text messages, information on causes as well as corrective measures

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 via the adjustment device
- Checking the output signal
- Treatment of measurement errors

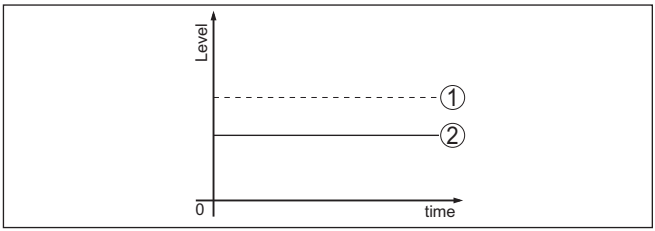
Further comprehensive diagnostics options are available with a PC with PACTware and the suitable DTM. In many cases, the reasons can be determined in this way and faults rectified.

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.

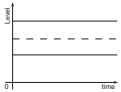
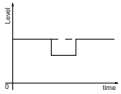
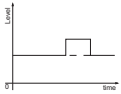


1 *Real level*
2 *Level displayed by the sensor*

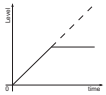
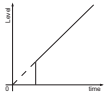
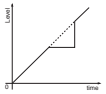
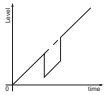
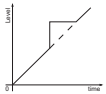
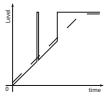
Notes:

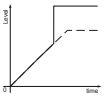
- Wherever the sensor displays a constant value, the reason could also be the fault setting of the current output to "*Hold value*"
- If the level indication is too low, the reason could be a line resistance that is too high

Measurement error with constant level

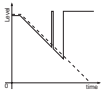
Fault description	Cause	Rectification
1. Measured value shows a too low or too high level 	● Min./max. adjustment not correct	● Adapt min./max. adjustment
	● Incorrect linearisation curve	● Adapt linearisation curve
	● Installation in a bypass tube or standpipe, hence running time error (small measurement 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	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

Fault description	Cause	Rectification
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 output.	● 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	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, the order data must first be downloaded from the Internet (see operating instructions "*Electronics module*").

Caution:
All application-specific settings must be entered again. That's why you have to carry out a fresh setup after exchanging the electronics.

If you saved the parameter settings during the first setup of the sensor, you can transfer them to the replacement electronics module. A fresh setup is then not necessary.

9.6 Software update

The device software can be updated in the following ways:

- Interface adapter VEGACONNECT
- HART signal
- Bluetooth

Depending on the method, the following components are required:

- Instrument
- Voltage supply
- Interface adapter VEGACONNECT
- Display and adjustment module PLICSCOM with Bluetooth function
- PC with PACTware/DTM and Bluetooth USB adapter
- 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 about the procedure in the download area of 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.

In case of repair, 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
- Ask 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 voltage 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 electronics to be easily separable.

WEEE directive
The instrument does not fall in the scope of the EU WEEE directive. Article 2 of this Directive exempts electrical and electronic equipment from this requirement if it is part of another instrument that does not fall in the scope of the Directive. These include stationary industrial plants.

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

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

11 Supplement

11.1 Technical data

Note for approved instruments

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

General data

316L corresponds to 1.4404 or 1.4435

Materials, wetted parts

Encapsulated antenna system	
– Process fitting	PVDF, 316L
– Process seal	FKM (IDG FKM 13-75)
– Antenna	PVDF
Plastic horn antenna	
– Adapter flange	PP-GF30 black
– Seal, adapter flange	FKM (COG VI500), EPDM (COG AP310)
– Focussing lense	PP
Rinsing connection	
– Flushing ring	PP-GFK
– O-ring seal, rinsing connection	FKM (SHS FPM 70C3 GLT), EPDM (COG AP310)
– Reflux valve	316 Ti
– Sealing, reflux valve	FKM (SHS FPM 70C3 GLT), EPDM (COG AP310)

Materials, non-wetted parts

Mounting parts	
– Antenna cone with plastic horn antenna	PBT-GF 30
– Compression flange	PP-GF30 black
– Mounting strap	316L
– Fixing screws, mounting strap	316L
– Fixing screws, adapter flange	304
Housing	
– Plastic housing	Plastic PBT (Polyester)
– Aluminium die-cast 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 housing cover	Polycarbonate (UL-746-C listed), glass[1)]
– Ground terminal	316L
Weight depending on process fitting and housing material	0.7 … 3.4 kg (1.543 … 7.496 lbs)

Torques

Max. torques, threaded version	
– G1½	7 Nm (5.163 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)
– Terminal screws, adapter flange - antenna	2.5 Nm (1.844 lbf ft)
– Flange screws, adapter flange DN 100	7 Nm (5.163 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.

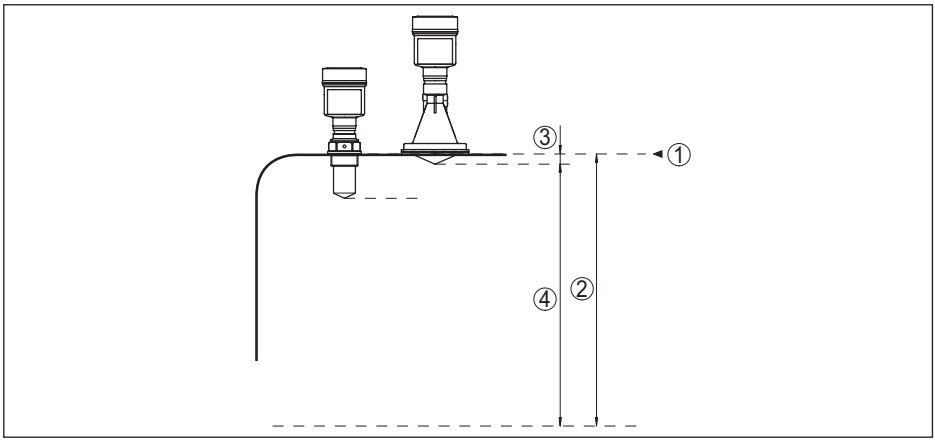


Fig. 54: Data of the input variable

1 Reference plane
2 Measured variable, max. measuring range
3 Antenna length
4 Utilisable measuring range

[1)] Glass with Aluminium and stainless steel precision casting housing

Standard electronics	
Max. measuring range	35 m (114.8 ft)
Recommended measuring range	
– Encapsulated antenna system	up to 10 m (32.81 ft)
– Plastic horn antenna	up to 20 m (65.62 ft)
Electronics with increased sensitivity	
Max. measuring range	35 m (114.8 ft)
Recommended measuring range	
– Encapsulated antenna system	up to 10 m (32.81 ft)
– Plastic horn antenna	up to 20 m (65.62 ft)

Output variable	
Output signal	digital output signal, format according to IEEE-754
Sensor address	126 (default setting)
Damping (63 % of the input variable)	0 … 999 s, adjustable
Profibus PA profile	3.02
Number of FBs with AI (function blocks with analogue input)	3
Default values	
– 1. FB	Primary Value (filling height linearized in %)
– 2. FB	Secondary Value 1 (filling height in %)
– 3. FB	Secondary Value 2 (distance value)
Current value	
– Non-Ex and Ex ia instrument	10 mA, ±0.5 mA
– Ex-d-ia instruments	16 mA, ±0.5 mA
Resolution, digital	< 1 mm (0.039 in)

Deviation (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	≤ 2 mm (meas. distance > 0.5 m/1.6 ft)
Non-repeatability[2)]	≤ 1 mm
Deviation with bulk solids	The values depend to a great extent on the application. Binding specifications are thus not possible.

[2)] Already included in the meas. deviation

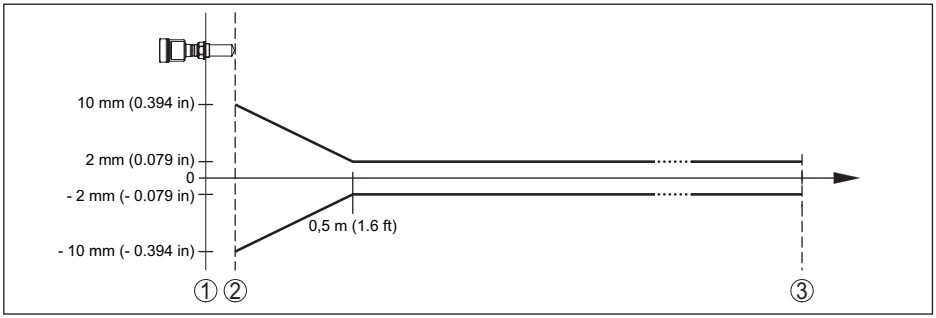


Fig. 55: Deviation under reference conditions - encapsulated antenna system

1 Reference plane
2 Antenna edge
3 Recommended measuring range

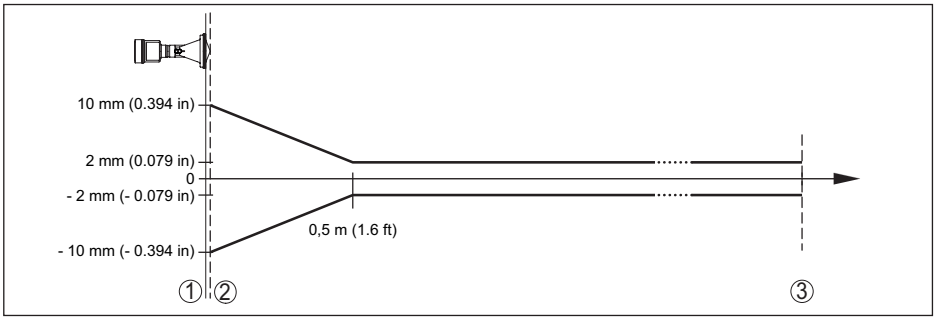


Fig. 56: Deviation under reference conditions - plastic horn antenna

1 Reference plane
2 Antenna edge
3 Recommended measuring range

Variables influencing measurement accuracy	
Temperature drift - Digital output	< 3 mm/10 K, max. 10 mm
Additional deviation through electromagnetic interference acc. to EN 61326	< 50 mm

Characteristics and performance data	
Measuring frequency	K-band (26 GHz technology)
Measuring cycle time	
– Standard electronics	approx. 450 ms
– Electronics with increased sensitivity	approx. 700 ms
Step response time[3)]	≤ 3 s

[3)] Time span after a sudden measuring distance change by max. 0.5 m in liquid applications, max 2 m with bulk solids applications, until the output signal has taken for the first time 90 % of the final value (IEC 61298-2).

Beam angle[4)]

- Encapsulated antenna system: 22°
- Plastic horn antenna: 10°

Emitted HF power (depending on the parameter setting)[5)]

- Average spectral transmission power density: -14 dBm/MHz EIRP
- Max. spectral transmission power density: +43 dBm/50 MHz EIRP
- Max. power density at a distance of 1 m: < 1 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 lower value always applies.

Vessel pressure

- Encapsulated antenna system: -1 … 3 bar (-100 … 300 kPa/-14.5 … 43.5 psi)
- Plastic horn antenna: -1 … 2 bar (-100 … 200 kPa/-14.5 … 29.0 psig)
- Version with adapter flange from DN100 PP or PP-GF 30: -1 … 1 bar (-100 … 100 kPa/-14.5 … 14.5 psig)

Process temperature (measured on the process fitting): -40 … +80 °C (-40 … +176 °F)

Vibration resistance

- 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)

Shock resistance: 100 g, 6 ms according to EN 60068-2-27 (mechanical shock)

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	–	●	●	–	●

[4)] Outside the specified beam angle, the energy level of the radar signal is 50% (-3 dB) less.
[5)] EIRP: Equivalent Isotropic Radiated Power.

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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
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

Adjustment elements

- 4 keys: ***[OK]***, ***[->]***, ***[+]***, ***[ESC]***
- Switch: Bluetooth On/Off

Bluetooth interface

- Standard: Bluetooth smart
- Effective range: 25 m (82.02 ft)

Protection rating

- unassembled: IP 20
- Mounted in the housing without lid: IP 40

Materials	
– Housing	ABS
– Inspection window	Polyester foil
Functional safety	SIL non-reactive

Interface to the external display and adjustment unit

Data transmission	Digital (I^2C-Bus)
Connection cable	Four-wire

Sensor version	Configuration, connection cable			
	Cable length	Standard cable	Special cable	Screened
4 … 20 mA/HART	50 m	●	–	–
Profibus PA, Foundation Fieldbus	25 m	–	●	●

Integrated clock

Date format	Day.Month.Year
Time format	12 h/24 h
Time zone, factory setting	CET
Max. rate deviation	10.5 min/year

Additional output parameter - Electronics temperature

Range	-40 … +85 °C (-40 … +185 °F)
Resolution	< 0.1 K
Deviation	±3 K
Output of the temperature values	
– Indication	Via the display and adjustment module
– Analogue	Via the current output, the additional current output
– Digital	Via the digital output signal (depending on the electronics version)

Voltage supply

Operating voltage U_B	
– Non-Ex instrument	9 … 32 V DC
– Ex-ia instrument - Power supply FISCO model	9 … 17.5 V DC
– Ex-ia instrument - Power supply ENTITY model	9 … 24 V DC
– Ex-d-ia instrument	16 … 32 V DC
Operating voltage U_B - illuminated display and adjustment module	
– Non-Ex instrument	13.5 … 32 V DC
– Ex-ia instrument - Power supply FISCO model	13.5 … 17.5 V DC

– Ex-ia instrument - Power supply ENTITY model	13.5 … 24 V DC
– Ex-d-ia instrument	No lighting possible (integrated ia barrier)
Number of sensors per DP/PA segment coupler, max.	
– Non-Ex	32
– Ex	10

Potential connections and electrical separating measures in the instrument

Electronics	Not non-floating
Reference voltage[6)]	500 V AC
Conductive connection	Between ground terminal and metallic process fitting

Overvoltage protection

Highest continuous operating voltage	35 V DC
Max. permissible input current	500 mA
Response voltage	> 500 V
Discharge current	< 10 kA (8/20 µs)

Electrical protective measures

Housing material	Version	Protection acc. to IEC 60529	Protection acc. to NEMA
Plastic	Single chamber	IP 66/IP 67	Type 4X
	Double chamber	IP 66/IP 67	Type 4X
Aluminium	Single chamber	IP 66/IP 68 (0.2 bar) IP 68 (1 bar)	Type 6P -
	Double chamber	IP 66/IP 68 (0.2 bar) IP 68 (1 bar)	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 -
	Double chamber	IP 66/IP 68 (0.2 bar) IP 68 (1 bar)	Type 6P -

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

6) Galvanic separation between electronics and metal housing parts

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, "*Instrument search (serial number)*" as well as in the download area.

11.2 Communication Profibus PA

Instrument master file

The instrument master file (GSD) contains the characteristic data of the Profibus PA instrument. These data are, e.g. the permissible transmission rates as well as information on diagnostics values and the format of the measured value output by the PA instrument.

A bitmap file is also provided for the Profibus network planning tool. This file is installed automatically when the GSD file is integrated. The bitmap file is used for symbolic indication of the PA instrument in the configuration tool.

ID number

Each Profibus instrument gets an unambiguous ident number (ID number) from the Profibus user organisation (PNO). This ID number is also included in the name of the GSD file. Optionally in addition to this manufacturer-specific GSD file, PNO also provides a general so-called profile-specific GSD file. If the general GSD file is used, the sensor must be set to the profile-specific ident number via the DTM software. By default, the sensor operates with the manufacturer-specific ID number. When using the instruments on a segment coupler SK-2 or SK-3, no special GSD files are required.

The following table shows the instrument ID and the GSD file names for VEGAPULS radar sensors.

Device name	Instrument ID		GSD file name	
	VEGA	Instrument class in profile 3.02	VEGA	Profile-specific
VEGAPULS WL 61	0x0CDB	0x9702	PSWL0CDB.GSD	PA139702.GSD
VEGAPULS 61	0x0BFC	0x9702	PS610BFC.GSD	PA139702.GSD
VEGAPULS 62	0x0BFD	0x9702	PS620BFD.GSD	PA139702.GSD
VEGAPULS 63	0x0BFE	0x9702	PS630BFE.GSD	PA139702.GSD
VEGAPULS 65	0x0BFF	0x9702	PS650BFF.GSD	PA139702.GSD
VEGAPULS 66	0x0C00	0x9702	PS660C00.GSD	PA139702.GSD
VEGAPULS 67	0x0C01	0x9702	PS670C01.GSD	PA139702.GSD
VEGAPULS SR 68	0x0CDC	0x9702	PSSR0CDC.GSD	PA139702.GSD
VEGAPULS 68	0x0C02	0x9702	PS680C02.GSD	PA139702.GSD
VEGAPULS 69	0x0BFA	0x9702	VE010BFA.GSD	PA139702.GSD

Cyclical data traffic

The master class 1 (e.g. PLC) cyclically reads out measured values from the sensor during operation. The below block diagram below shows which data can be accessed by the PLC.

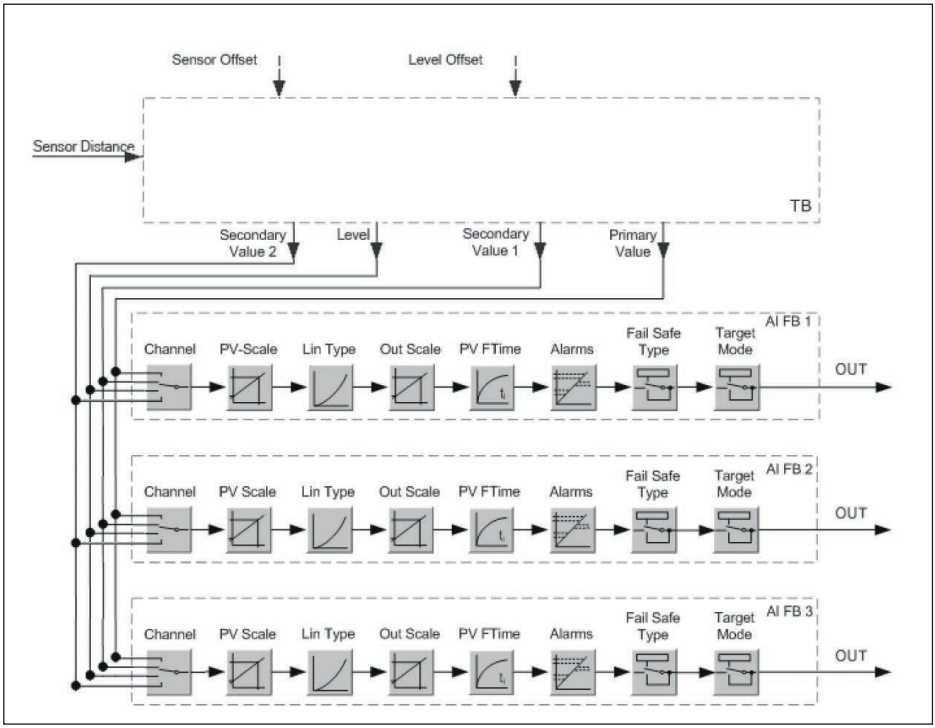

Fig. 57: VEGAPULS 61: Block diagram with AI FB 1 … AI FB 3 OUT values

TB Transducer Block
FB 1 … FB 3 Function Block

Module of the PA sensors

For the cyclic data traffic, VEGAPULS 61 provides the following modules:

- AI FB1 (OUT)
  - Out value of the AI FB1 after scaling
- AI FB2 (OUT)
  - Out value of the AI FB2 after scaling
- AI FB3 (OUT)
  - Out value of the AI FB3 after scaling
- Free Place
  - This module must be used if a value in the data telegram of the cyclical data traffic should not be used (e.g. replacement of temperature and Additional Cyclic Value)

A maximum of three modules can be active. By means of the configuration software of the Profibus master you can determine the configuration of the cyclical data telegram with these modules. The procedure depends on the respective configuration software.

Note:

The modules are available in two versions:

- Short for Profibus master supporting only one "Identifier Format" byte, e.g. Allen Bradley

- Long for Profibus master only supporting the "Identifier Format" byte, e.g. Siemens S7-300/400

Examples of telegram configuration

In the following you will see how the modules can be combined and how the appendant data telegram is structured.

Example 1

- AI FB1 (OUT)
- AI FB2 (OUT)
- AI FB3 (OUT)

Byte-No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Format	IEEE-754-Floating point value				Status	IEEE-754-Floating point value				Status	IEEE-754-Floating point value				Status
Value	AI FB1 (OUT)				AI FB1	AI FB2 (OUT)				AI FB2	AI FB3 (OUT)				AI FB3

Example 2

- AI FB1 (OUT)
- Free Place
- Free Place

Byte-No.	1	2	3	4	5
Format	IEEE-754-Floating point value				Status
Value	AI FB1 (OUT)				AI FB1

Note:

Bytes 6-15 are not used in this example.

Data format of the output signal

Byte4	Byte3	Byte2	Byte1	Byte0
Status	Value (IEEE-754)			

Fig. 58: Data format of the output signal

The status byte corresponds to profile 3.02 "Profibus PA Profile for Process Control Devices" coded. The status "Measured value OK" is coded as 80 (hex) (Bit7 = 1, Bit6 … 0 = 0).

The measured value is transferred as a 32 bit floating point number in the IEEE-754 format.

Byte n								Byte n+1								Byte n+2								Byte n+3							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
VZ	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	2^{-1}	2^{-2}	2^{-3}	2^{-4}	2^{-5}	2^{-6}	2^{-7}	2^{-8}	2^{-9}	2^{-10}	2^{-11}	2^{-12}	2^{-13}	2^{-14}	2^{-15}	2^{-16}	2^{-17}	2^{-18}	2^{-19}	2^{-20}	2^{-21}	2^{-22}	2^{-23}
Sign Bit	Exponent							Significant								Significant								Significant							

$$\text{Value} = (-1)^{VZ} \bullet 2^{(\text{Exponent} - 127)} \bullet (1 + \text{Significant})$$

Fig. 59: Data format of the measured value

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Coding of the status byte associated with the PA output value

You can find further information for the coding of the status byte in the Device Description 3.02 on www.profibus.com.

Status code	Description according to Profibus standard	Possible cause
0 x 00	bad - non-specific	Flash-Update active
0 x 04	bad - configuration error	● Adjustment error ● Configuration error with PV-Scale (PV-Span too small) ● Unit irregularity ● Error in the linearization table
0 x 0C	bad - sensor failure	● Hardware error ● Converter error ● Leakage pulse error ● Trigger error
0 x 10	bad - sensor failure	● Measured value generation error ● Temperature measurement error
0 x 1f	bad - out of service constant	"Out of Service" mode switched on
0 x 44	uncertain - last unstable value	Failsafe replacement value (Failsafe-Mode = "Last value" and already valid measured value since switching on)
0 x 48	uncertain substitute set	● Switch on simulation ● Failsafe replacement value (Failsafe-Mode = "Fsafe value")
0 x 4c	uncertain - initial value	Failsafe replacement value (Failsafe-Mode = "Last valid value" and no valid measured value since switching on)
0 x 51	uncertain - sensor; conversion not accurate - low limited	Sensor value < lower limit
0 x 52	uncertain - sensor; conversion not accurate - high limited	Sensor value > upper limit
0 x 80	good (non-cascade) - OK	OK
0 x 84	good (non-cascade) - active block alarm	Static revision (FB, TB) changed (10 sec. active, after the parameter of the static category has been written)
0 x 89	good (non-cascade) - active advisory alarm - low limited	Lo-Alarm
0 x 8a	good (non-cascade) - active advisory alarm - high limited	Hi-Alarm
0 x 8d	good (non-cascade) - active critical alarm - low limited	Lo-Lo-Alarm
0 x 8e	good (non-cascade) - active critical alarm - high limited	Hi-Hi-Alarm

11.3 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

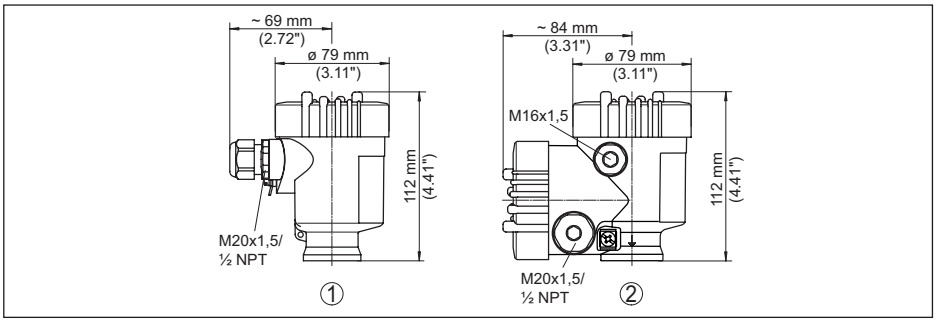

Fig. 60: Housing versions in protection IP 66/IP 67 (with integrated display and adjustment module the housing is 9 mm/0.35 in higher)

1 Plastic single chamber
2 Plastic double chamber

Aluminium housing

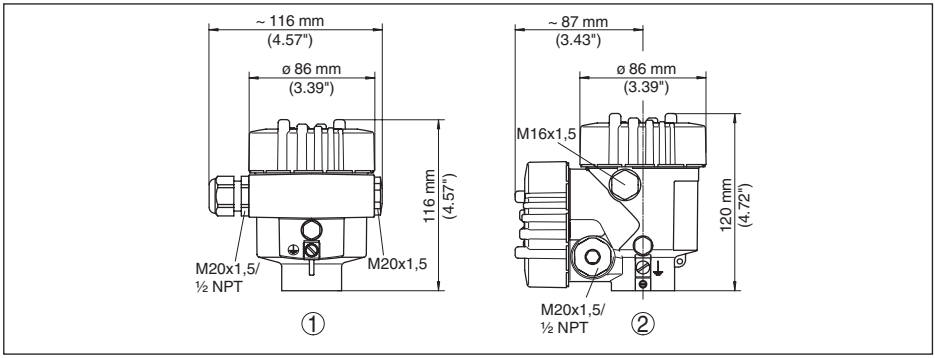

Fig. 61: Housing versions with protection rating IP 66/IP 68 (0.2 bar) (with integrated display and adjustment module the housing is 18 mm/0.71 in higher)

1 Aluminium - single chamber
2 Aluminium - double chamber

Aluminium housing with protection rating IP 66/IP 68, 1 bar

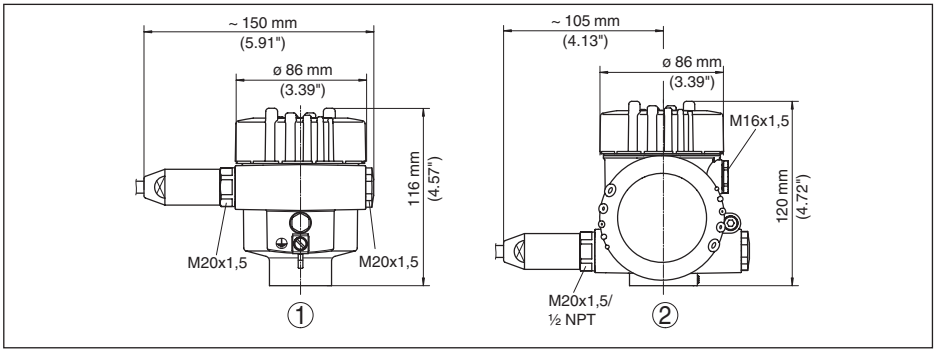

Fig. 62: Housing version with protection rating IP 66/IP 68 (1 bar), (with integrated display and adjustment module the housing is 18 mm/0.71 in higher)

1 Aluminium - single chamber
2 Aluminium - double chamber

Stainless steel housing

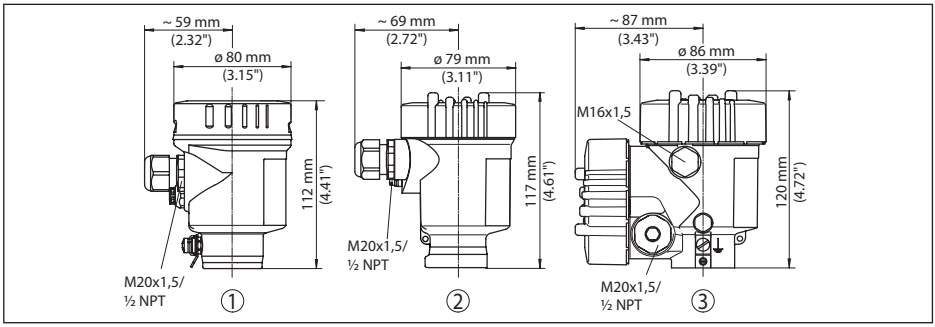

Fig. 63: Housing versions with protection rating IP 66/IP 68 (0.2 bar) (with integrated display and adjustment module the housing is 18 mm/0.71 in higher)

1 Stainless steel single chamber (electropolished)
2 Stainless steel single chamber (precision casting)
3 Stainless steel double chamber housing (precision casting)

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

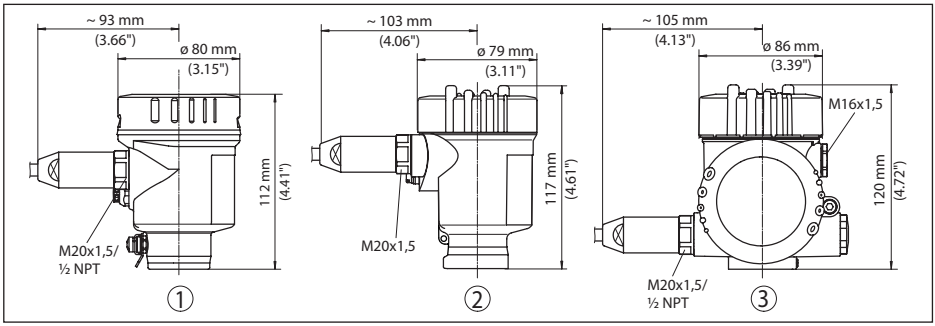

Fig. 64: Housing version with protection rating IP 66/IP 68 (1 bar), (with integrated display and adjustment module the housing is 18 mm/0.71 in higher)

1 Stainless steel single chamber (electropolished)
2 Stainless steel single chamber (precision casting)
3 Stainless steel double chamber housing (precision casting)

VEGAPULS 61, threaded version

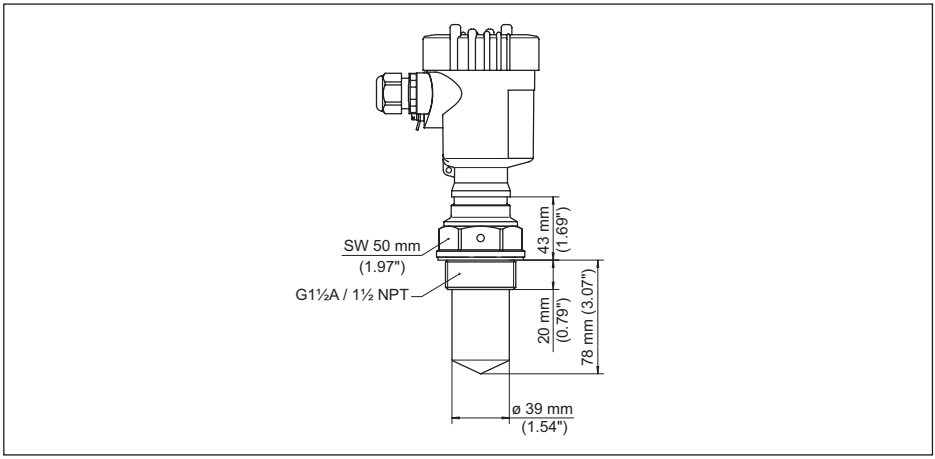

Fig. 65: VEGAPULS 61, Thread G1½, 1½ NPT

VEGAPULS 61, hygienic fitting

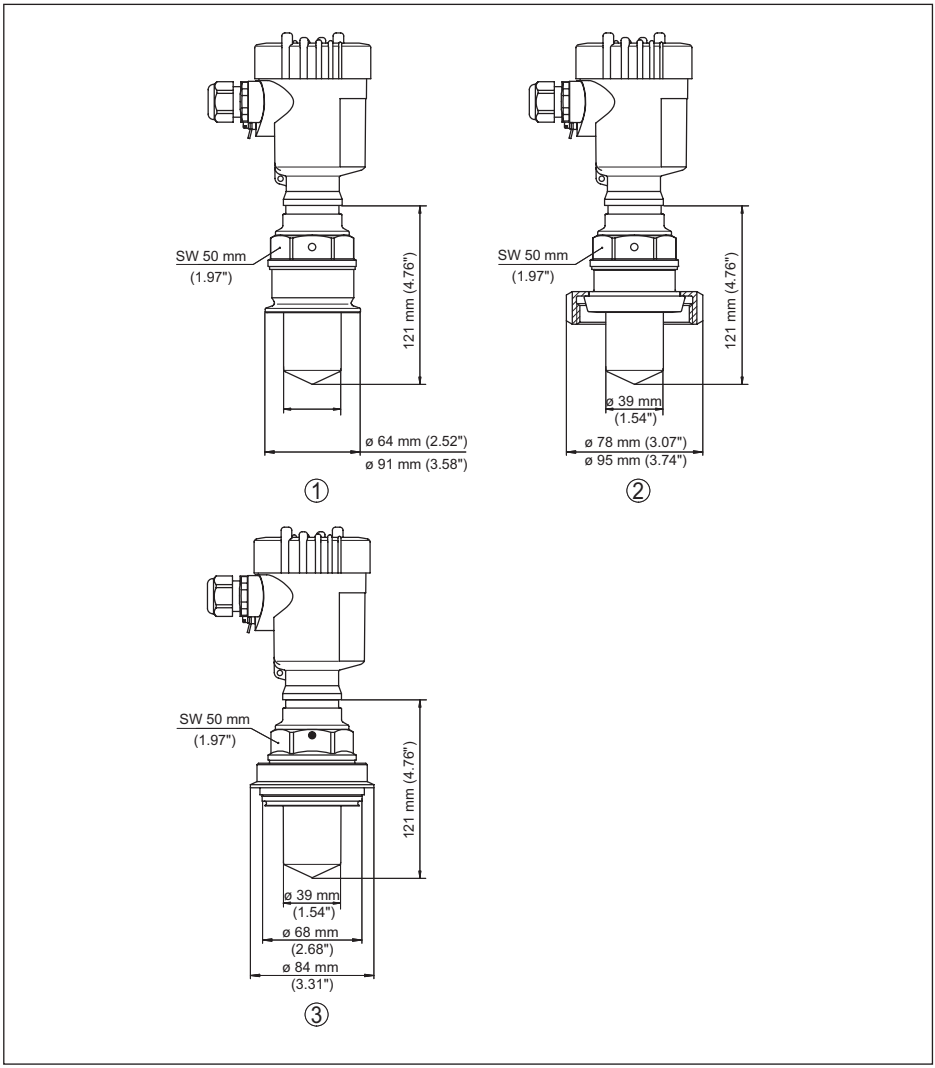

Fig. 66: VEGAPULS 61, hygienic fitting

1 *Clamp 2" PN 16 (ø 64 mm), 3" PN 16 (ø 91 mm), (DIN 32676, ISO 2852)*
2 *Slotted nut DN 50 PN 80 (DIN 11851)*
3 *Tuchenhagen Varivent DN 32*

VEGAPULS 61, version with mounting strap

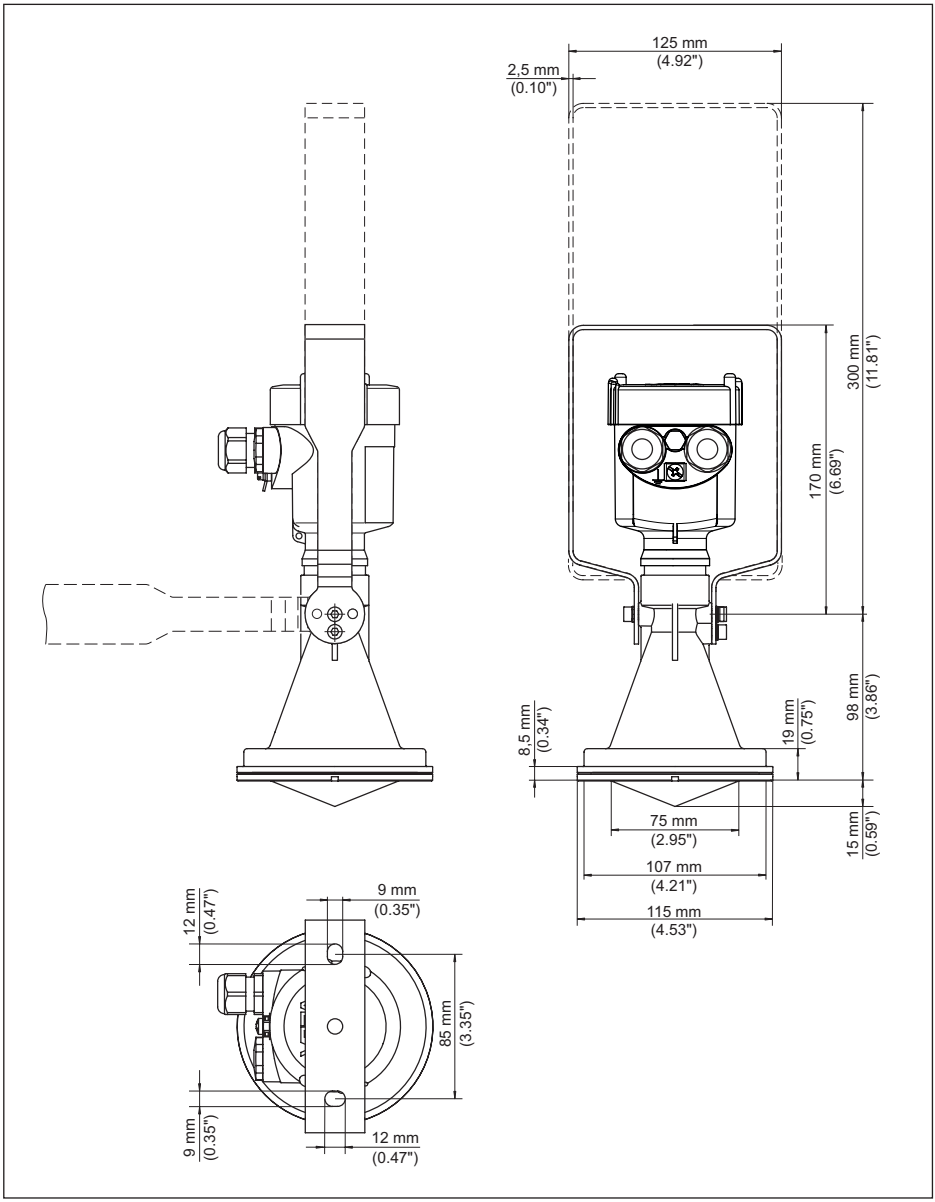

Fig. 67: VEGAPULS 61, mounting strap in 170 or 300 mm length

VEGAPULS 61, version with mounting strap and clamps

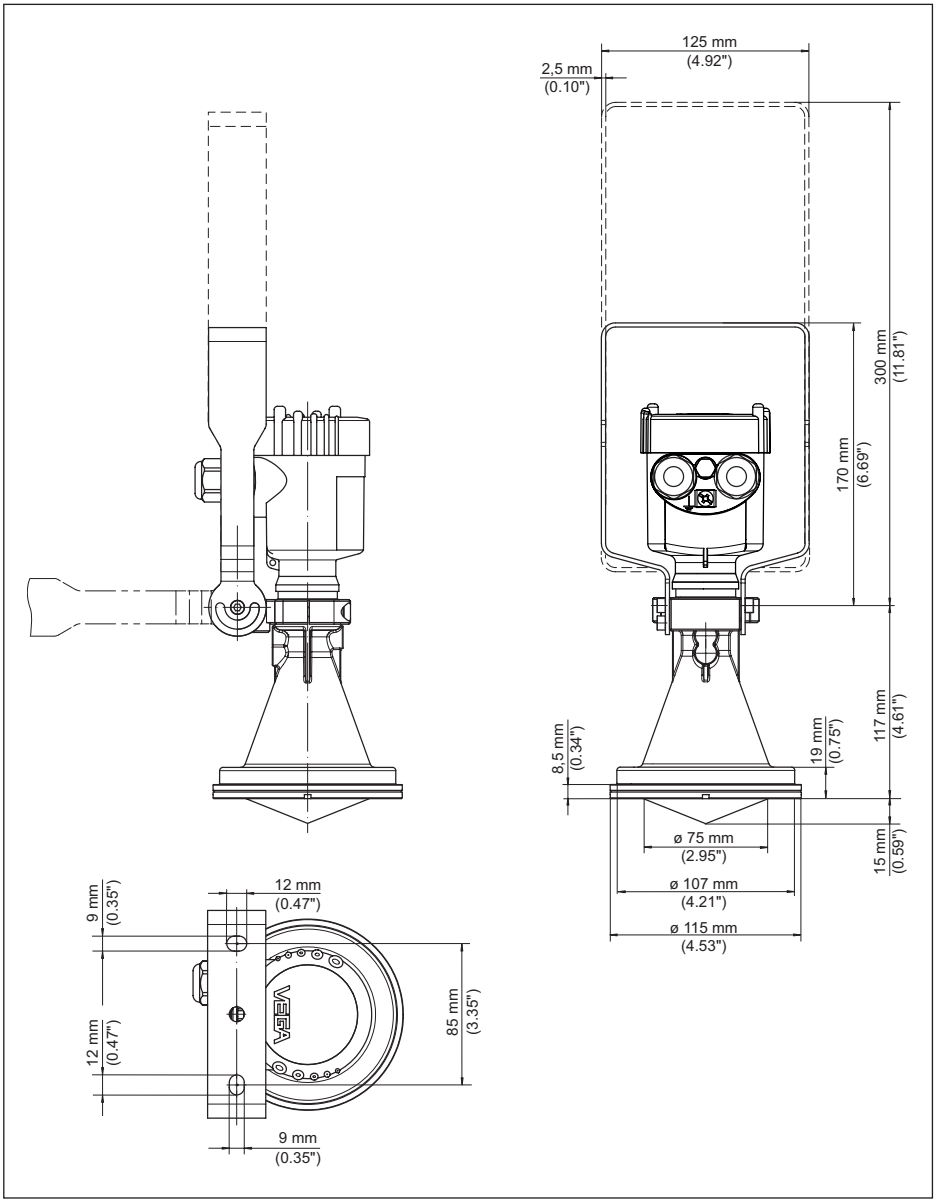

Fig. 68: VEGAPULS 61, mounting strap in 170 or 300 mm length

VEGAPULS 61, version with mounting strap and reflector

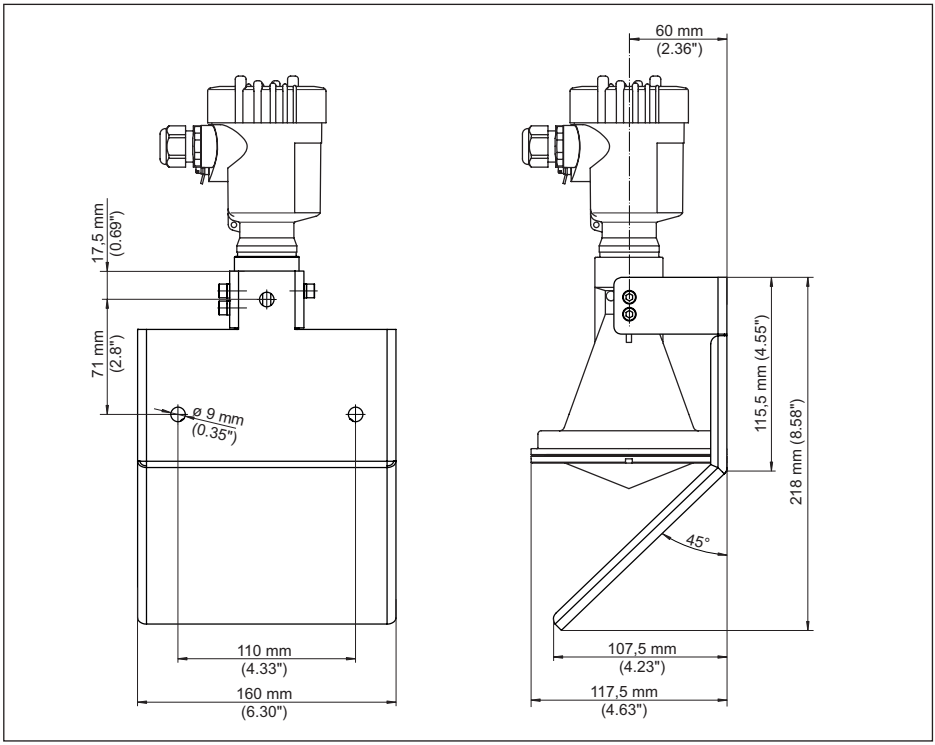

Fig. 69: VEGAPULS 61, mounting strap and reflector

VEGAPULS 61, version with compression flange

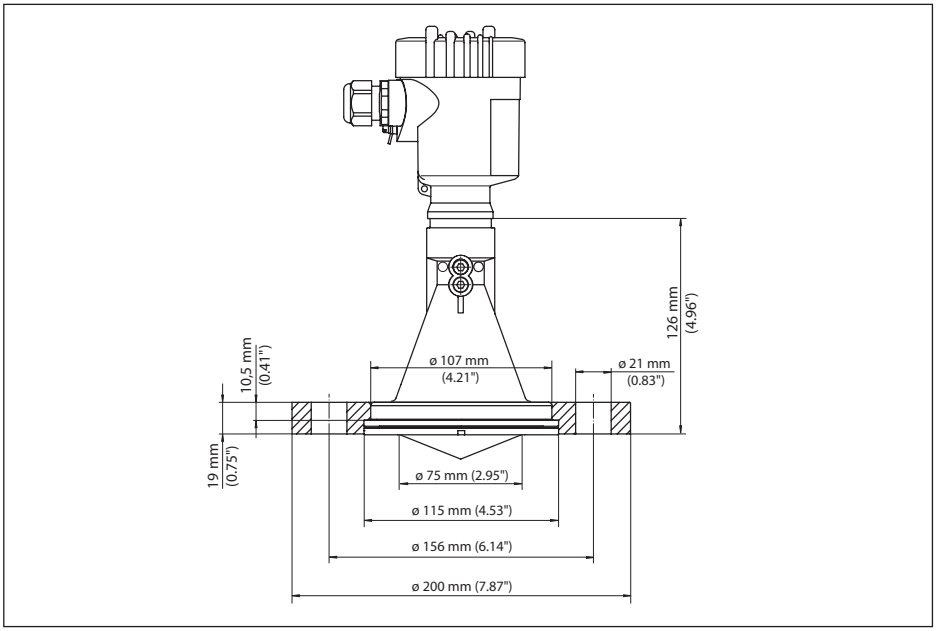

Fig. 70: VEGAPULS 61, compression flange suitable for DN 80 PN 16, ASME 3" 150lbs, JIS80 10K

VEGAPULS 61, version with compression flange and rinsing connection

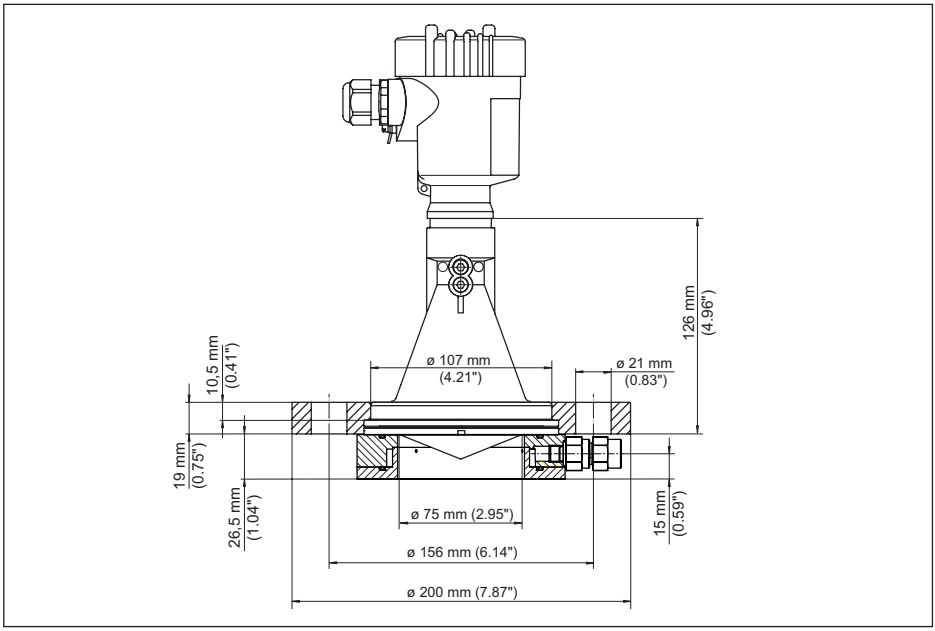

Fig. 71: VEGAPULS 61, compression flange with rinsing connection suitable for DN 80 PN 16, ASME 3" 150lbs, JIS80 10K

VEGAPULS 61, version with adapter flange

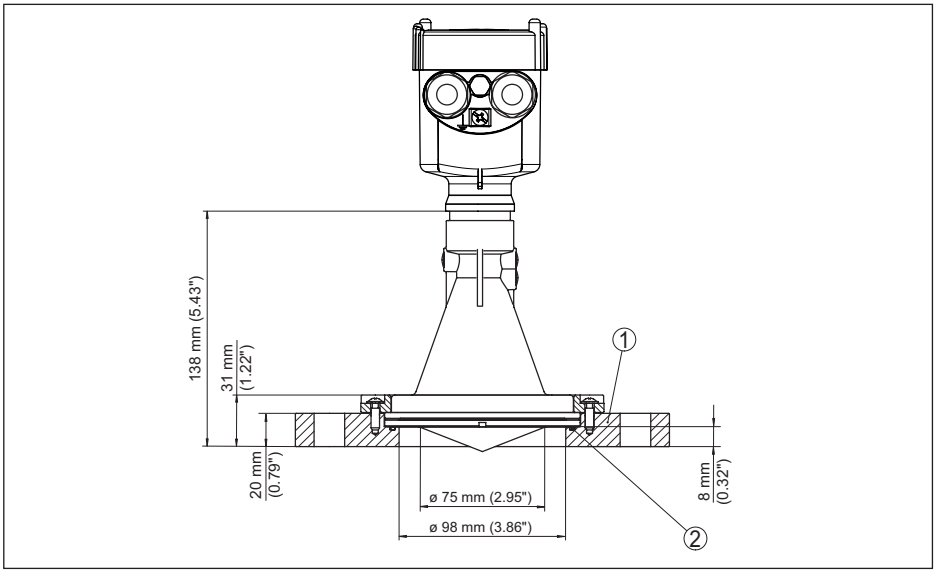

Fig. 72: VEGAPULS 61, adapter flange

1 Adapter flange
2 Seal

VEGAPULS 61, version with adapter flange and rinsing connection

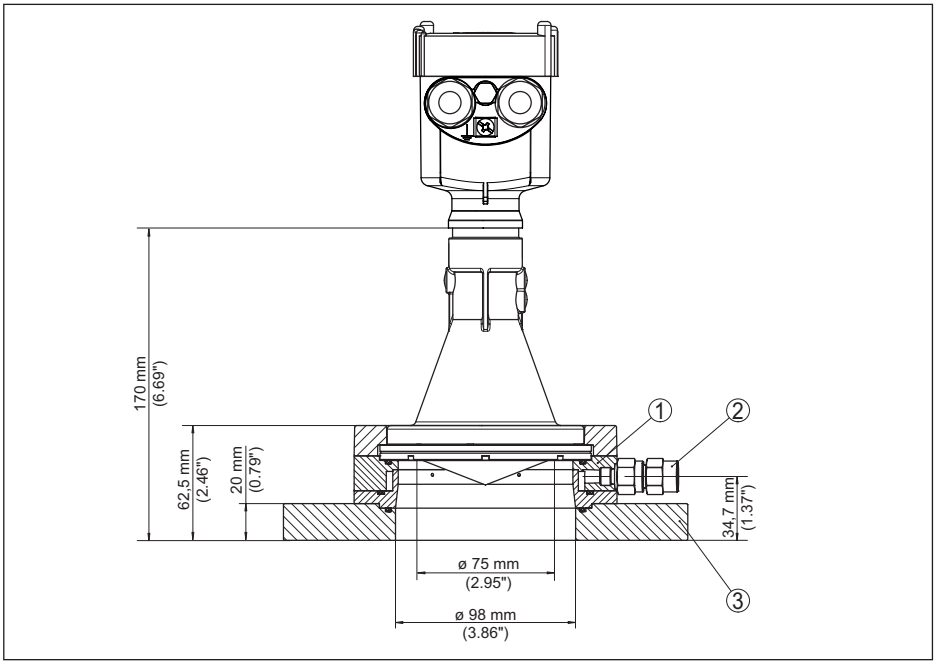

Fig. 73: VEGAPULS 61, adapter flange and air rinsing

1 Rinsing connection
2 Reflux valve
3 Adapter flange

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