Operating Instructions

Radar sensor for continuous level measurement of water and wastewater

VEGAPULS WL 61

Foundation Fieldbus

Document ID: 38063

Contents

38063-EN-180702

Safety instructions for Ex areas

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

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1 About this document

1.1 Function

This operating instructions manual provides all the information you need for mounting, connection and setup as well as important instructions for maintenance, 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 specialist personnel authorised by the plant operator.

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

2.2 Appropriate use

VEGAPULS WL 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.

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

For further information see www.namur.de.

2.7 Radio licenses for Europe

VEGAPULS WL 61

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

- EN 302372 - Tank Level Probing Radar
- EN 302729 - Level Probing Radar

It is hence approved for use inside and outside 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.

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

- The installation must be carried out by trained qualified personnel
- The instrument must be stationary mounted and the antenna directed vertically downward
- The mounting location must be at least 4 km away from radio astronomy stations, unless special permission was granted by the responsible national approval authority

- When installed within 4 to 40 km of a radio astronomy station, the instrument must not be mounted higher than 15 m above the ground.

You can find a list of the respective radio astronomy stations in chapter "*Supplement*".

Bluetooth radio module
The radio module used in the instrument for wireless Bluetooth communication was tested by the manufacturer according to the latest edition of the following standard:

- EN 300328 – Wideband transmission systems

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

2.8 Radio approval for USA

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

This device complies with Part 15 of the FCC Rules.

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 open air environments with the following limitations:

- 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.
- 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 approval for Canada

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

This device complies with Industry Canada's license-exempt RSS standard(s).

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 open air environments with the following limitations:

- 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.
- The installation of the LPR/TLPR device shall be done by trained installers, in strict compliance with the manufacturer'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 is, the user shall accept operations of high-powered radar 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.

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 environnements ouverts avec les restrictions suivantes :

- 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
- 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.

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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 Security concept, Bluetooth operation

Sensor adjustment via Bluetooth is based on a multi-stage security concept.

Authentication
When starting Bluetooth communication, an authentication is carried out between sensor and adjustment device by means of the sensor PIN. The sensor PIN is part of the respective sensor and must be entered in the adjustment device (smartphone/tablet). To increase adjustment convenience, this PIN is stored in the adjustment device. This process is secured via an algorithm acc. to standard SHA 256.

Protection against incorrect entries
In case of multiple incorrect PIN entries in the adjustment device, further entries are possible only after a certain amount of time has passed.

Encrypted Bluetooth communication
The sensor PIN as well as the sensor data are transmitted encrypted between sensor and adjustment device according to Bluetooth standard 4.0.

2.12 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

You can find the type label on the sensor housing as well as on the type label support on the connection cable.

It 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 (measurement reliability optional)*
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 number, instrument documentation*
15 *Reminder to observe the instrument documentation*
16 *Symbol for Bluetooth*

Sensor PIN

The 4-digit PIN is necessary for the Bluetooth connection to the sensor. The PIN is unique and is only valid of this sensor.

You can find the PIN as a label on a supplementary sheet in the sensor packaging and next to the type label.

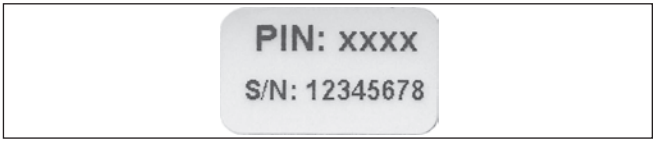


Fig. 2: Bluetooth PIN

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", "*Instrument search (serial number)*". 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 manual

This operating instructions manual applies to the following instrument versions:

- Hardware from 1.0.0
- Software from 4.4.0

Scope of delivery

The scope of delivery encompasses:

- Radar sensor
- Optionally integrated Bluetooth module
- Optional mounting accessory
- Documentation
  - Quick setup guide VEGAPULS WL 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 radar sensor VEGAPULS WL 61 is the ideal sensor for all applications in the water and waste water industry. It is particularly suitable for level measurement in water treatment, in pump stations as well as storm water overflow tanks, for flow measurement in open flumes and for gauge measurement.

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 Adjustment

Adjustment via the signal cable
As a standard feature, VEGAPULS WL 61 allows an adjustment via:

- DD adjustment programs
- Field Communicator 375, 475

Wireless adjustment
VEGAPULS WL 61 with integrated Bluetooth module enables the wireless adjustment via standard adjustment instruments:

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

Fig. 3: Wireless connection to standard operating devices

1 Display and adjustment module
2 Sensor
3 Smartphone/Tablet
4 Bluetooth USB adapter
5 PC/Notebook

3.4 Packaging, transport and storage

Packaging

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

The packaging of standard instruments consists of environment-friendly, recyclable cardboard. For special versions, PE foam or PE

foil is also used. Dispose of the packaging material via specialised recycling companies.

Transport

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

Transport inspection

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

Storage

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

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

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

Storage and transport temperature

- Storage and transport temperature see chapter "*Supplement - Technical data - Ambient conditions*"
- Relative 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.

4 Mounting

4.1 General instructions

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.

4.2 Mounting versions

Straining clamp

Most simply mount the instrument via the straining clamp. For this purpose, the connection cable is provided with a strain relief wire of Kevlar.

In order to avoid faulty measured values, make sure that the sensor does not oscillate.

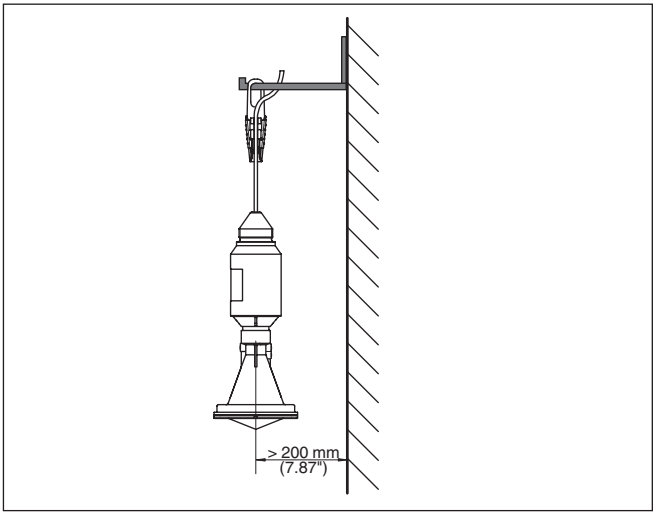


Fig. 4: Mounting via a straining clamp

Mounting bracket

For a rigid mounting, a mounting bracket with opening for thread G1½, e.g. from the VEGA product range, is recommended. The mounting of the sensor in the bracket is carried out via a G1½ counter nut of plastic. Take note of chapter "*Mounting instructions*" for the distance to the wall.

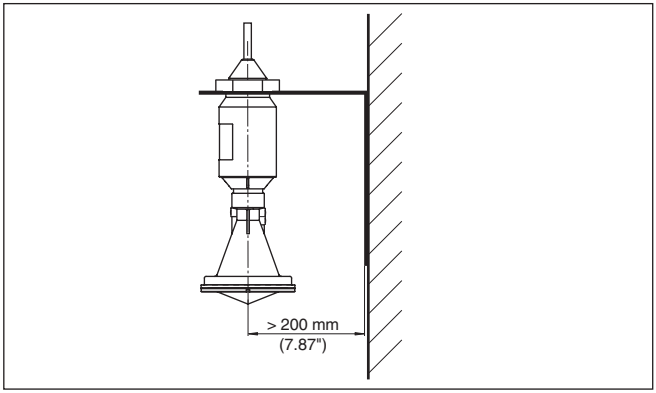


Fig. 5: Mounting via a mounting bracket

Mounting strap

The optional mounting strap enables sensor mounting on e.g. a ceiling, wall or bracket. It is available in the following versions:

- Length 300 mm for ceiling mounting
- Length 170 mm for wall mounting

Mounting strap - Ceiling mounting

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

This ensures swivelling of the sensor up to 180° for optimum orientation.

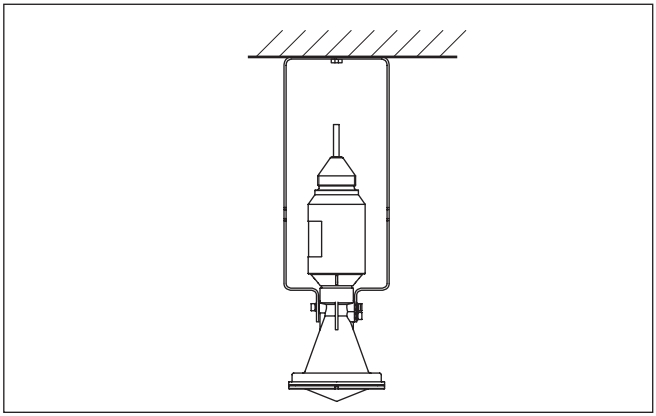


Fig. 6: Ceiling mounting via the mounting strap with length 300 mm

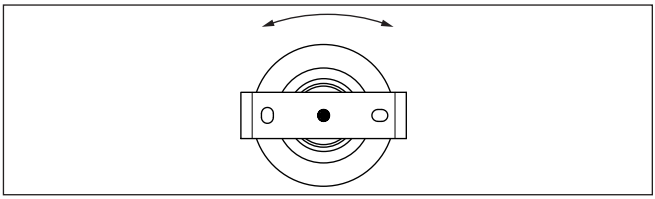


Fig. 7: Rotation in the centre with ceiling mounting

Mounting strap - Wall mounting

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

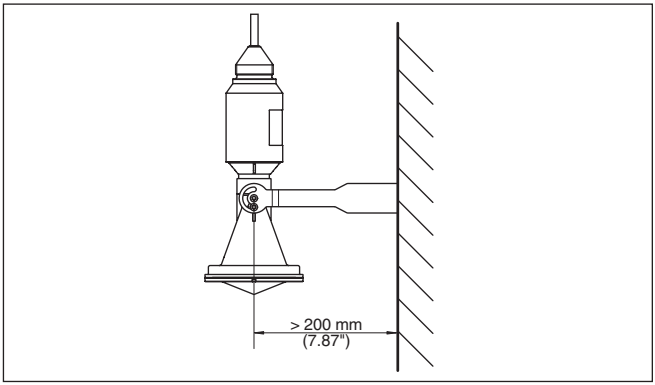


Fig. 8: Wall mounting via the mounting strap with length 170 mm

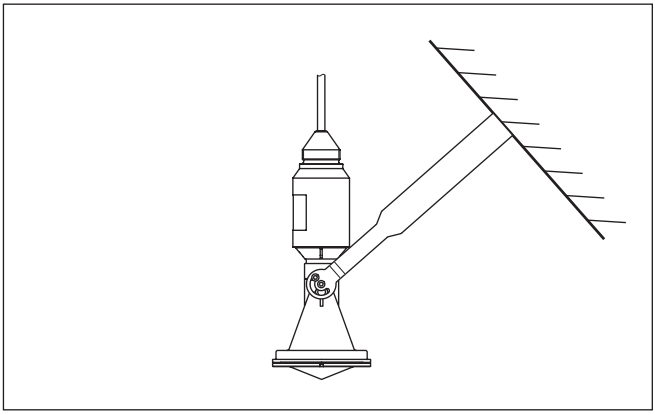


Fig. 9: Wall mounting with inclined wall via the mounting strap with length 300 mm

Flange mounting

For mounting the instrument on a socket or a manhole cover, an unassembled combi collar flange for DN 80 (ASME 3" or JIS 80) is optionally available also as retrofitting part.

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

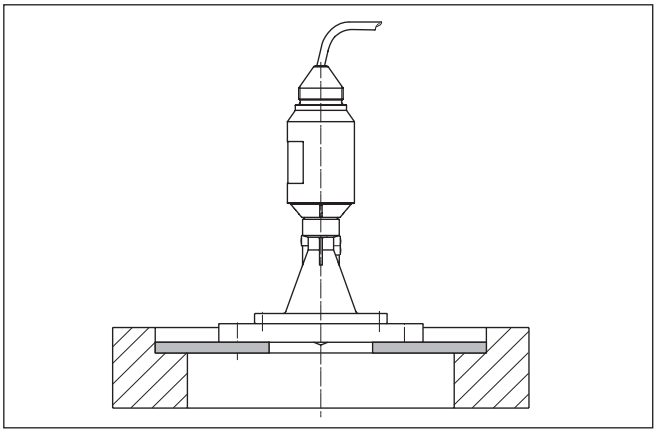


Fig. 10: Mounting by means of an adapter flange, for example, on a manhole lid.

4.3 Mounting preparations, mounting strap

The optional mounting strap is supplied unassembled. It must be screwed to the sensor before setup with the attached screws. Max. torque, see chapter "*Technical data*". Required tools: Allen wrench size 4.

There are two different variants of screwing the strap to the sensor. Depending on the selected variant, the sensor can be rotated in the strap infinitely variable through 180° or in three steps 0°, 90° and 180°.

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 strap, the polarisation can be used to reduce the effects of false echoes.

The position of the polarisation is marked by marking bars on the instrument.

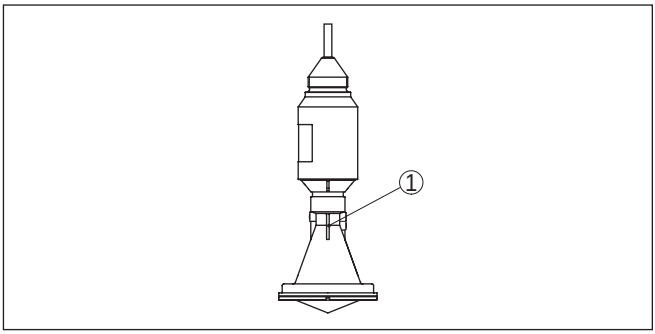


Fig. 11: Position of the polarisation, marked by marking bars on the instrument.

1 Marking bar

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.

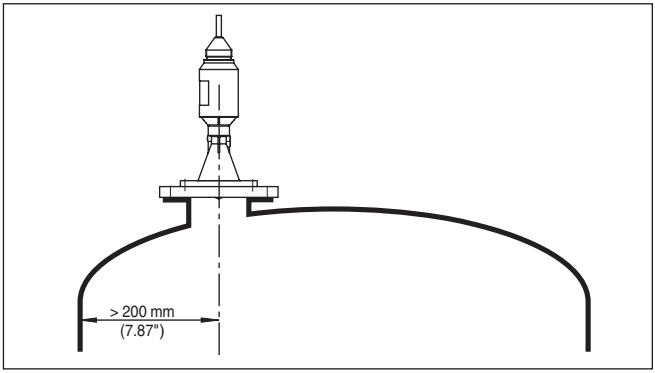


Fig. 12: Mounting of the radar sensor on round vessel tops

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.

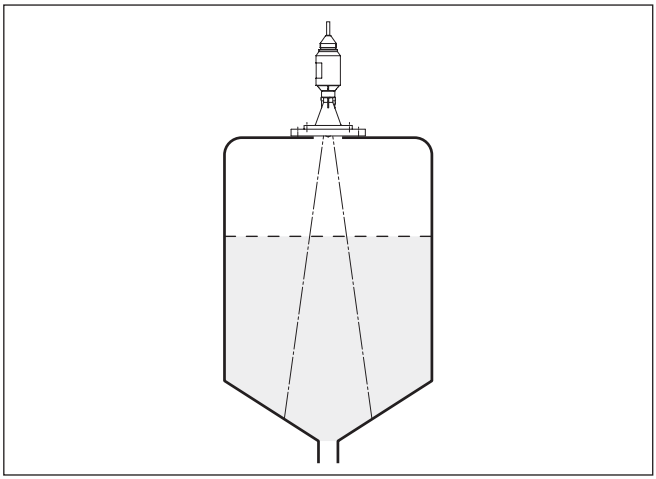


Fig. 13: Mounting of the radar sensor on vessels with conical bottom

Inflowing medium

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

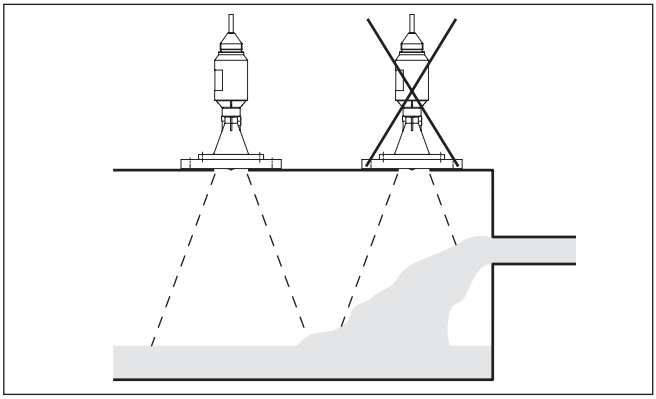


Fig. 14: Mounting of the radar sensor with inflowing medium

Mounting socket

Approximate values of the socket heights are shown in the following illustration. The socket end should be smooth and burr-free, if possible also rounded. After mounting, you have to carry out a false signal suppression during the parameter adjustment.

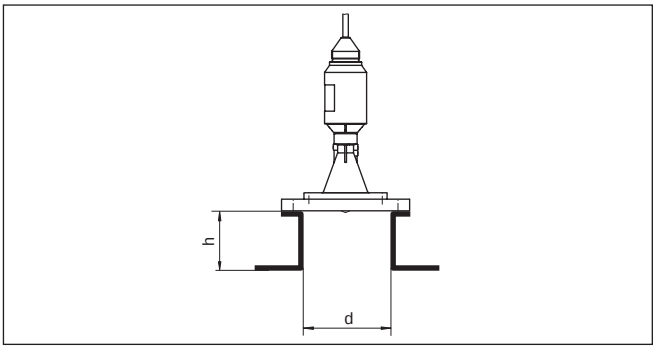


Fig. 15: Deviating socket dimensions

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

Socket diameter d	Socket length h
80 mm	≤ 300 mm
100 mm	≤ 400 mm
150 mm	≤ 500 mm

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

Sensor orientation

Direct the sensor as perpendicular as possible to the product surface to achieve optimum measurement results.

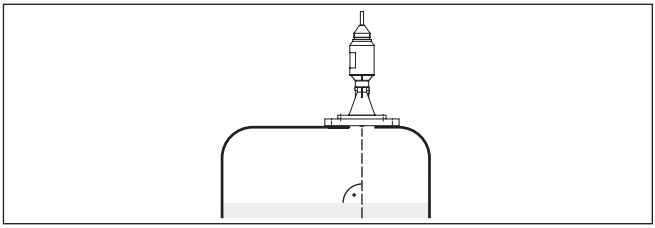


Fig. 16: Orientation of the sensor

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.

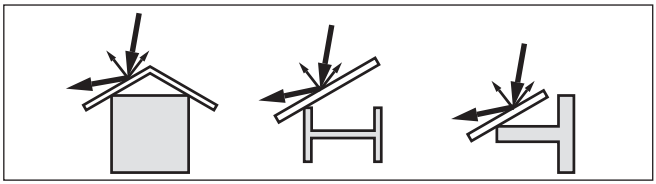


Fig. 17: Cover flat, large-area profiles with deflectors

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.

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.

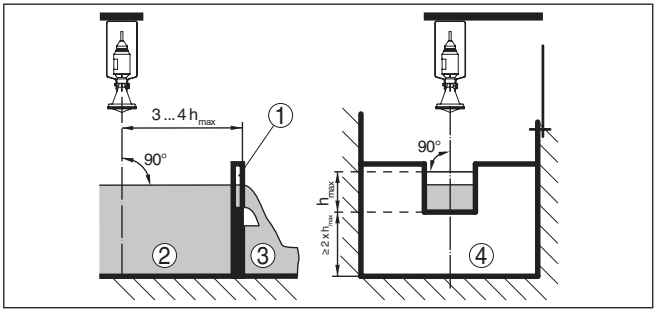


Fig. 18: Flow measurement with rectangular overfall: $d_{min.}$ = min. distance of the sensor (see chapter "Technical data"); $h_{max.}$ = max. filling of the rectangular spillway

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

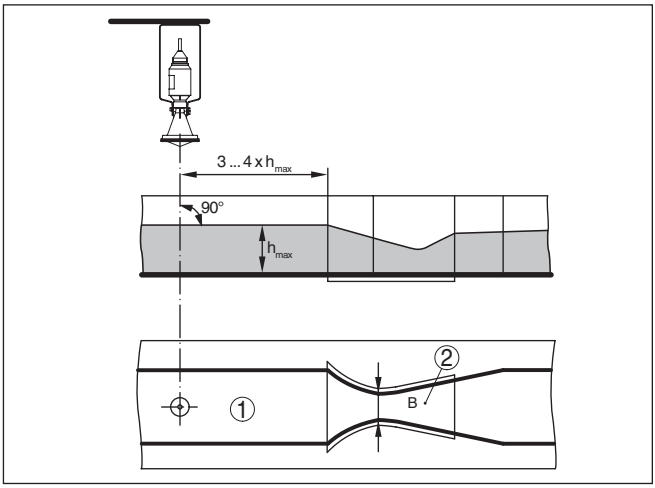


Fig. 19: Flow measurement with Khafagi-Venturi flume: $h_{max.}$ = max. filling of the flume; B = tightest constriction in the flume

1 Position sensor
2 Venturi flume

In general, the following points must be observed:

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

5 Connecting to power supply

5.1 Preparing the connection

Safety instructions

Always keep in mind the following safety instructions:

- Carry out electrical connection by trained 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

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

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

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

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

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

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

Connection cable

Connection is carried out with screened cable according to Fieldbus specification.

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.

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

Use a cable gland fitting the cable diameter.

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

5.2 Wiring plan - version IP 66/IP 68, 2 bar

Wire assignment, connection cable

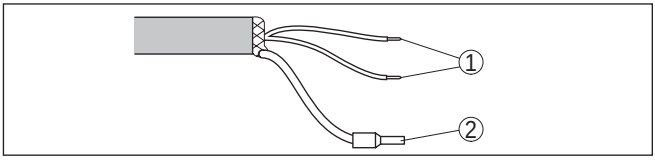


Fig. 20: Wire assignment in permanently connected connection cable

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

5.3 Switch-on phase

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

- Internal check of the electronics
- Indication of the instrument type, hardware and software version, measurement loop name on the display or PC
- Indication of the status message "*F 105 Determine measured value*" on the display or PC
- The output signal jumps to the set fault current

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

6 Setup with smartphone/tablet (Bluetooth)

6.1 Preparations

System requirements

Make sure that your smartphone/tablet meets the following system requirements:

- Operating system: iOS 8 or newer
- Operating system: Android 4.3 or newer
- Bluetooth Smart from 4.0

Download the app "VEGA Tools" from the Apple App Store or Google Play Store to your smartphone or tablet.

6.2 Connecting

Connecting …

Start the "VEGA Tools" app and select the function "Setup". The smartphone/tablet searches automatically for Bluetooth-capable instruments in the area.

The message "*Searching …*" is displayed.

The found instruments will be listed on the left side of the adjustment window. The search is continued automatically.

Select the requested instrument in the device list.

The message "*Connecting …*" is displayed.

Authenticate

For the first connection, the operating device and the sensor must authenticate each other. After successful authentication, the next connection functions without authentication.

iOS
During the pairing process, the following message is displayed: "*Pairing request (Bluetooth), e.g. 12345678 wants to pair with your iPad*". Press "Pair".

Android
The coupling passes through automatically.

Enter PIN

For authentication, enter in the next menu window the 4-digit PIN. You can find this PIN on:

- Type label support on sensor cable
- A supplementary sheet in the sensor packaging

Note:
If an incorrect sensor PIN is entered, the PIN can only be entered again after a delay time. This time gets longer after each incorrect entry.

The message "*Waiting for authentication*" is displayed on the smartphone/tablet.

Connected

After connection, the sensor adjustment menu is displayed on the respective adjustment instrument.

If the connection is interrupted, e.g. due to a too large distance between sensor and operating device, this is displayed on the operating device. The message disappears when the connection is restored.

Change sensor PIN

It is recommended to change the default setting of the sensor PIN to your own sensor PIN. To do this, go to the menu item "*Lock adjustment*".

After the sensor PIN has been changed, sensor adjustment can be enabled again. For access (authentication) with Bluetooth, the PIN is still effective.

6.3 Sensor parameter adjustment

Enter parameters

The sensor adjustment menu is divided into two halves:

On the left you'll find the navigation section with the menus "*Setup*", "*Display*", "*Diagnosis*" and others.

The selected menu item, recognisable by the colour change, is displayed in the right half.

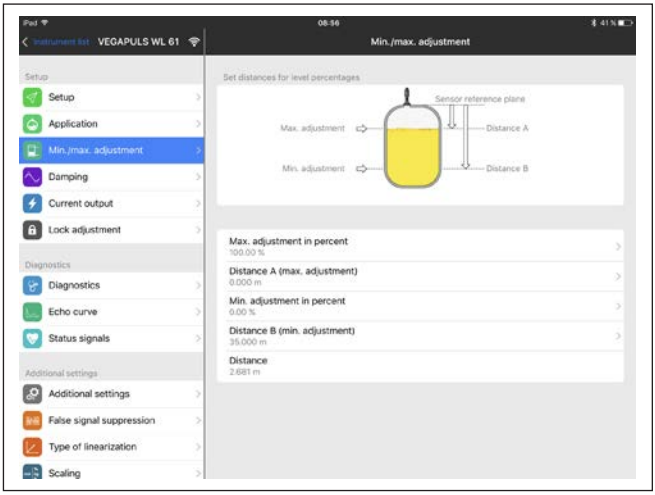


Fig. 22: Example of an app view - Setup sensor adjustment

Enter the requested parameters and confirm via the keyboard or the editing field. The settings are then active in the sensor.

Close the app to terminate connection.

7 Setup with PC/notebook (Bluetooth)

7.1 Preparations

System requirements

Make sure that your PC meets the following system requirements:

- Operating system Windows
- DTM Collection 10/2016 or higher
- USB 2.0 interface
- Bluetooth USB adapter

Activate Bluetooth USB adapter

Activate the Bluetooth USB adapter via the VEGA project assistant (see supplementary instructions "*Bluetooth USB adapter*"). Sensors with Bluetooth capable PLICSCOM will be found and a project tree created.

7.2 Connecting

Connecting …

Select the requested sensor for the online parameter adjustment in the project tree.

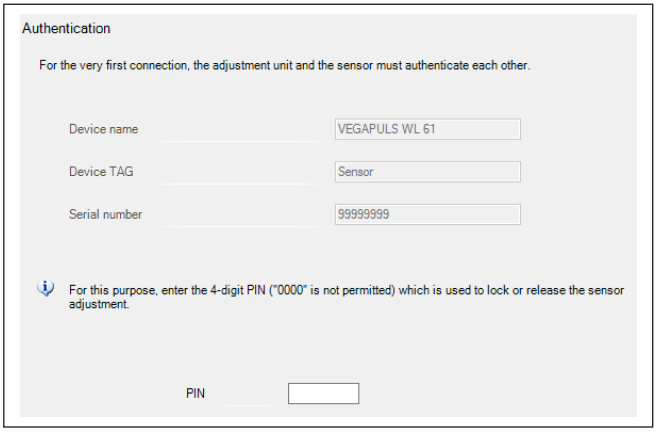
Authenticate

The window "*Authentication*" is displayed. For the first connection, the operating device and the sensor must authenticate each other. After successful authentication, the next connection functions without authentication.

Enter PIN

For authentication, enter in the next menu window the 4-digit PIN. You can find this PIN on:

- Type label support on sensor cable
- A supplementary sheet in the sensor packaging



Note:
If an incorrect sensor PIN is entered, the PIN can only be entered again after a delay time. This time gets longer after each incorrect entry.

Connected

After connection, the sensor DTM appears.

If the connection is interrupted, e.g. due to a too large distance between sensor and operating device, this is displayed on the operating device. The message disappears when the connection is restored.

Change sensor PIN

It is recommended to change the default setting of the sensor PIN to your own sensor PIN. To do this, go to the menu "*Additional adjustments*", menu item "*PIN*".

7.3 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.

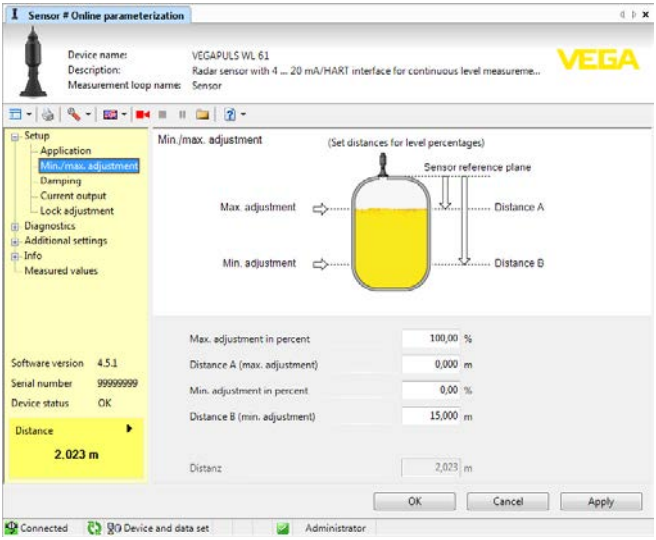


Fig. 24: Example of a DTM view - Setup, sensor adjustment

8 Set up with other systems

8.1 DD adjustment programs

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

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

8.2 Field Communicator 375, 475

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

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

9 Diagnosis, asset management and service

9.1 Maintenance

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:

38063-EN-180702

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:

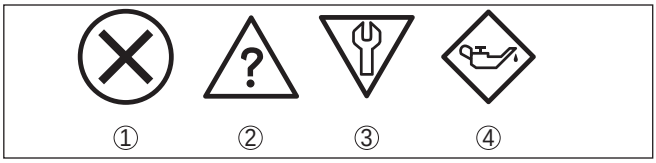


Fig. 25: Pictographs of the status messages

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 outputted.

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. 3: Error codes and text messages, information on cause and rectification (some specifications are only valid for four-wire instruments, the electronics of VEGAPULS WL 61 cannot be replaced by the user)

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. 4: 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. 5: 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. 6: 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

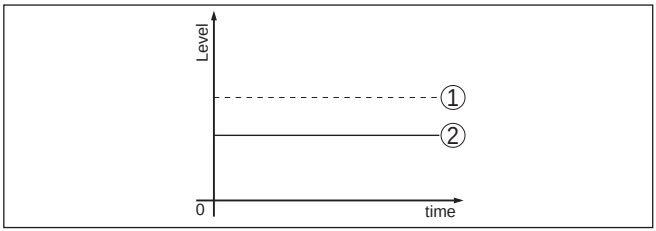
Further comprehensive diagnostics options are available with a PC with PACTware and the suitable DTM. In many cases, the reasons can be determined in this way and faults rectified.

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.

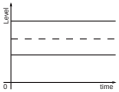
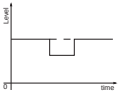
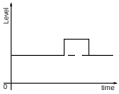


1 Real level
2 Level displayed by the sensor

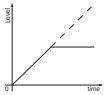
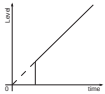
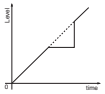
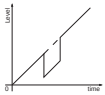
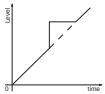
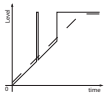
Notes:

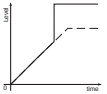
- Wherever the sensor displays a constant value, the reason could also be the fault setting of the current output to "*Hold value*"
- If the level indication is too low, the reason could be a line resistance that is too high

Measurement error with constant level

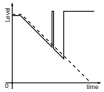
Fault description	Cause	Rectification
1. Measured value shows a too low or too high level 	● Min./max. adjustment not correct	● Adapt min./max. adjustment
	● Incorrect linearisation curve	● Adapt linearisation curve
	● Installation in a bypass tube or standpipe, hence running time error (small measurement 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 outputted.	● Check measuring site: Antenna must protrude out of the socket ● Remove contamination on the antenna ● Use a sensor with a more suitable antenna

Measurement error during emptying

Fault description	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 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 power supply*" and carry out the listed steps in reverse order.

10.2 Disposal

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

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

Materials: see chapter "*Technical data*"

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

WEEE directive 2012/19/EU
This instrument is not subject to the WEEE directive 2012/19/EU and the respective national laws. Pass the instrument directly on to a specialised recycling company and do not use the municipal collecting points. These may be used only for privately used products according to the WEEE directive.

11 Supplement

11.1 Technical data

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	
Materials, wetted parts	
– Adapter flange	PP-GF30 black
– Seal, adapter flange	FKM (COG VI500), EPDM (COG AP310)
– Focussing lense	PP
Materials, non-wetted parts	
– Antenna cone	PBT-GF 30
– Compression flange	PP-GF30 black
– Mounting strap	316L
– Fixing screws, mounting strap	316L
– Fixing screws, adapter flange	304
– Housing	Plastic PBT (Polyester)
– Connection cable	PUR
– Type label support on cable	PE hard
Instrument weight, depending on process fitting	0.7 … 3.4 kg (1.543 … 7.496 lbs)
Weight, connection cable	0.1 kg/m (0.07 lbs/ft)

Torques	
Max. torques	
– 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)

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 lower side of the flange.

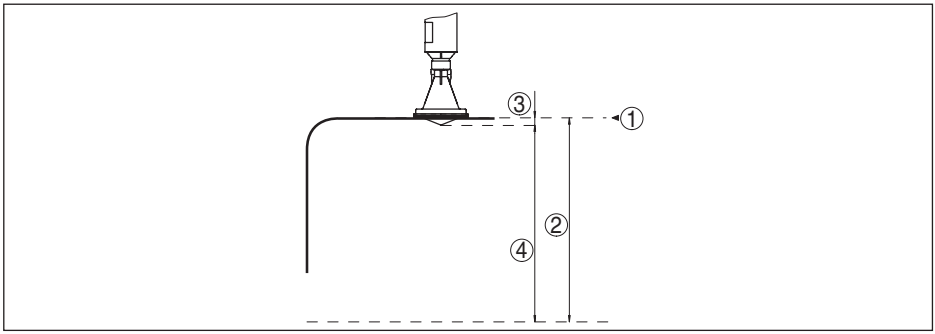


Fig. 40: Data of the input variable

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

Max. measuring range	15 m (49.21 ft)

Output variable

Output	
– Signal	digital output signal, Foundation Fieldbus protocol
– Physical layer	according to IEC 61158-2
Damping (63 % of the input variable)	0 … 999 s, adjustable
Channel Numbers	
– Channel 1	Process value
– Channel 8	Electronics temperature
– Channel 9	Count rate
Transmission rate	31.25 Kbit/s
Current value	
– Non-Ex and Ex ia instrument	10 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[1]	≤ 1 mm

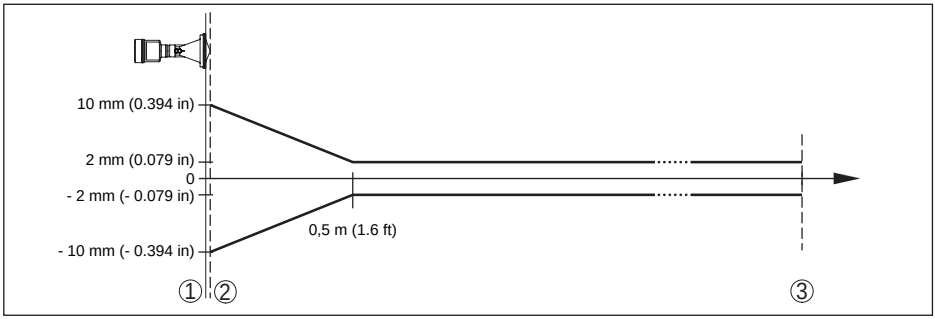


Fig. 41: Deviation under reference conditions

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	approx. 450 ms
Step response time[2]	≤ 3 s
Beam angle[3]	10°
Emitted HF power[4]	
– Average spectral transmission power density	-34 dBm/MHz EIRP
– Max. spectral transmission power density	+6 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.

[1] Already included in the meas. deviation
[2] Time span after a sudden distance change of max. 0.5 m until the output signal reaches for the first time 90% of the final value (IEC 61298-2).
[3] Outside the specified beam angle, the energy level of the radar signal is 50% (-3 dB) less.
[4] EIRP: Equivalent Isotropic Radiated Power

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Vessel pressure	-1 … 2 bar (-100 … 200 kPa/-14.5 … 29.0 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 68 (2 bar)

Cable entry	IP 68 cable gland
Connection cable	
– Configuration	two wires, one Kevlar cable, braiding, cover
– Standard length	6 m (19.69 ft)
– Max. length	550 m (1804 ft)
– Min. bending radius	25 mm (0.984 in) with 25 °C (77 °F)
– Diameter approx.	8 mm (0.315 in)
– Wire isolating and cable cover	PUR
– Colour	Black
– Fire protection classification	UL94-V0
Connection cable, electrical data	
– Wire cross-section	0.5 mm² (AWG 20)
– Wire resistance R'	0.037 Ω/m (0.012 Ω/ft)
– Inductance L_i'	0.6 µH/m (0.018 µH/ft)
– Capacitance Wire/Wire C_i'	133 pF/m (40 pF/ft)
– Capacitance Wire/Screen C_i'	215 pF/m (65 pF/ft)

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

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

Accuracy	±3 K

Bluetooth interface (optional)	
Standard	Bluetooth smart
Effective range	25 m (82.02 ft)

Voltage supply	
Operating voltage	
– 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
Operating voltage with 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
Power supply by/max. number of sensors	
– Fieldbus	max. 32 (max. 10 with Ex)

Potential connections and electrical separating measures in the instrument	
Electronics	Not non-floating
Reference voltage[5)]	500 V AC

Electrical protective measures	
Protection rating	IEC 60529 IP 66/IP 68 (2 bar), NEMA Type 6P
Protection rating (IEC 61010-1)	III

Approvals

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

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

11.2 Radio astronomy stations

Certain requirements for the use outside closed vessels result from the radio license for Europe of VEGAPULS WL 61. You can find the requirements in chapter "*Radio license for Europe*". Some of these requirements refer to radio astronomy stations. The following table states the geographic positions of radio astronomy stations in Europe:

5) Galvanic separation between electronics and metal housing parts

Country	Name of the Station	Geographic Latitude	Geographic Longitude
Finland	Metsähovi	60°13'04" N	24°23'37" E
	Tuorla	60°24'56" N	24°26'31" E
France	Plateau de Bure	44°38'01" N	05°54'26" E
	Floirac	44°50'10" N	00°31'37" W
Germany	Effelsberg	50°31'32" N	06°53'00" E
Hungary	Penc	47°47'22" N	19°16'53" E
Italy	Medicina	44°31'14" N	11°38'49" E
	Noto	36°52'34" N	14°59'21" E
	Sardinia	39°29'50" N	09°14'40" E
Poland	Krakow- Fort Skala	50°03'18" N	19°49'36" E
Russia	Dmitrov	56°26'00" N	37°27'00" E
	Kalyazin	57°13'22" N	37°54'01" E
	Pushchino	54°49'00" N	37°40'00" E
	Zelenchukskaya	43°49'53" N	41°35'32" E
Spain	Yebes	40°31'27" N	03°05'22" W
	Robledo	40°25'38" N	04°14'57" W
Switzerland	Bleien	47°20'26" N	08°06'44" E
Sweden	Onsala	57°23'45" N	11°55'35" E
UK	Cambridge	52°09'59" N	00°02'20" E
	Darnhall	53°09'22" N	02°32'03" W
	Jodrell Bank	53°14'10" N	02°18'26" W
	Knockin	52°47'24" N	02°59'45" W
	Pickmere	53°17'18" N	02°26'38" W

11.3 Supplementary information Foundation Fieldbus

The following table gives you an overview of the instrument versions and the corresponding device descriptions, the electrical characteristics of the bus system as well as the applied function blocks.

Revisions Data	DD-Revision	Rev_01
	CFF-File	010101.cff
	Device Revision	0101.ffo 0101.sym
	Cff-Revision	xx xx 01
	Device software revision	> 4.4.0
	ITK (Interoperability Test Kit) Number	5.2.0

Electricial Characteristics	Physicial Layer Type	Low-power signaling, bus-powered, FISCO I.S.
	Input Impedance	> 3000 Ohms between 7.8 KHz - 39 KHz
	Unbalanced Capacitance	< 250 pF to ground from either input terminal
	Output Amplitude	0.8 V P-P
	Electrical Connection	2 Wire
	Polarity Insensitive	Yes
	Max. Current Load	10 mA
	Device minimum operating voltage	9 V
Transmitter Function Blocks	Resource Block (RB)	1
	Transducer Block (TB)	1
	Standard Block (AI)	3
	Execution Time	30 mS
Advanced Function Blocks	Discret Input (DI)	Yes
	PID Control	Yes
	Output Splitter (OS)	Yes
	Signal Characterizer (SC)	Yes
	Integrator	Yes
	Input Selector (IS)	Yes
	Arithmetic (AR)	Yes
Diagnostics	Standard	Yes
	Advanced	Yes
	Performance	No
	Function Blocks Instantiable	No
General Information	LAS (Link Active Scheduler)	Yes
	Master Capable	Yes
	Number of VCRs (Virtual Communication Relationships)	24

Function blocks

Transducer Block (TB)

The Transducer Block "*Analog Input (AI)*" takes the original measured value (Secondary Value 2), carries out the min./max. adjustment (Secondary Value 1), carries out a linearization (Primary Value) and makes the values on its output available for further function blocks.

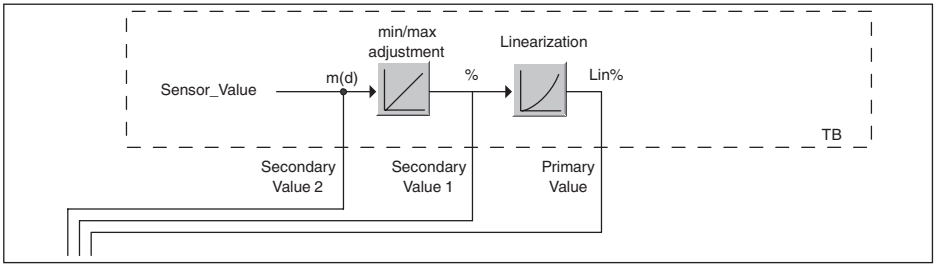

Fig. 42: Schematic presentation Transducer Block (TB)

Function block Analog Input (AI)

The function block "*Analog Input (AI)*" takes the original measured value selected by a Channel Number and makes it available to additional function blocks on its output.

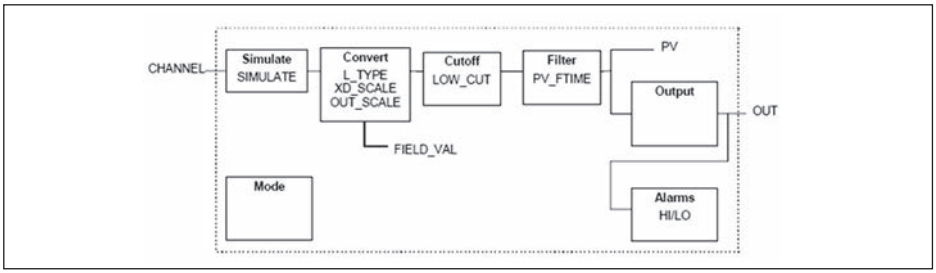

Fig. 43: Schematic presentation function block Analog Input (AI)

Function block Discret Input (DI)

The function block "*Discret Input (DI)*" takes the original measured value selected by a Channel Number and makes it available to additional function blocks on its output.

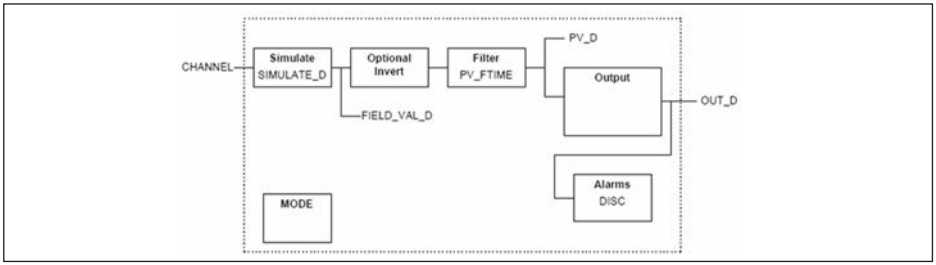

Fig. 44: Schematic presentation function block Discret Input (DI)

Function block PID Control

The function block "*PID Control* " is a key component for various tasks in the process automation and is used universally. PID blocks can be cascaded if this is necessary or requested due to different time constants with the primary and secondary process measurement.

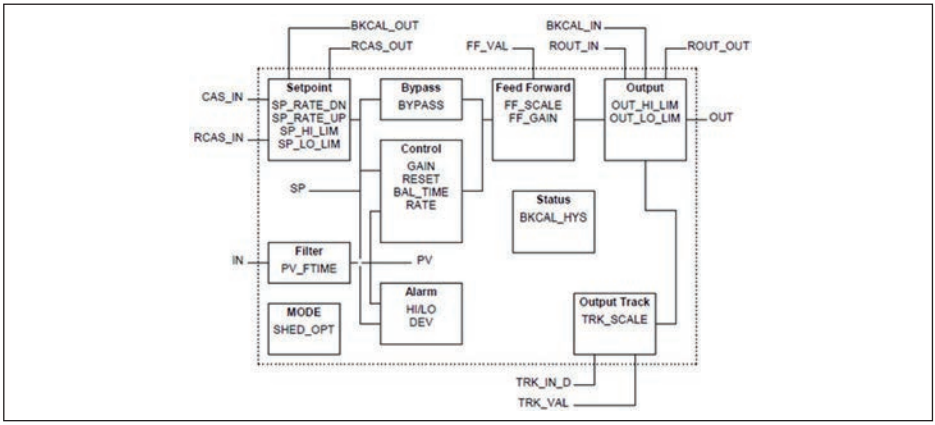

Fig. 45: Schematic presentation function block PID Control

Function block Output Splitter

The function block "*Output Splitter*" generates two control outputs out of one input. Each output is a linear image of a part of the input. A retrograde calculation function is realised by using the linear imaging function inversely. A cascading of several Output Splitters is supported by an integrated decision table for the combinability of inputs and outputs.

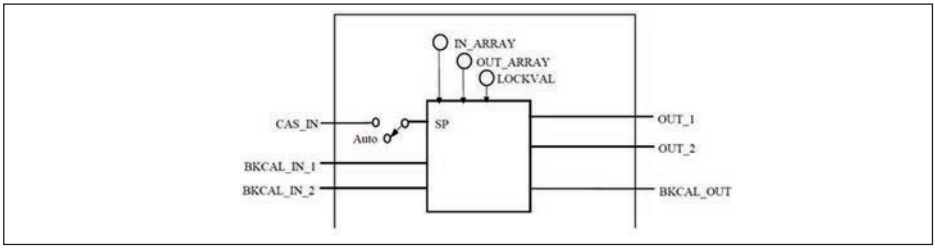

Fig. 46: Schematic presentation function block Output Splitter

Function block Signal Characterizer

The function block "*Signal Characterizer*" has two channels the outputs of which are not in linear relation with the respective input. The non-linear relation is defined by a look-up table with individually selectable x/y-pairs. The respective input signal is imaged on the corresponding output, hence this function block can be used in a control loop or signal path. Optionally the function axis can be exchanged in channel 2 so that the block can be also used in a reverse control loop.

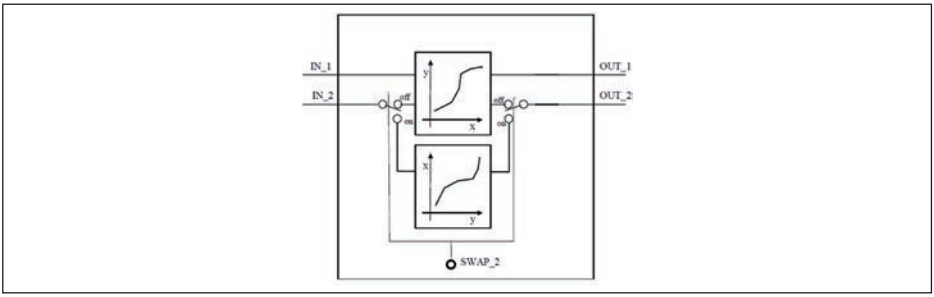

Fig. 47: Schematic presentation function block Signal Characterizer

Function block Integrator

The function block "*Integrator*" integrates a continuous input signal over the time and sums the results of an impulse input block. It is used as a totalizer up to a reset or as a subtotalizer up to a reference point at which the integrated and accumulated value is compared with the default values. When these default values are reached, digital output signals will be outputted. The integration function is carried out upwardly starting with zero and downwards with a default value. Two flow values are also available so that the net flow volume can be calculated and integrated. This can be used for calculation of volume and mass changes in the vessel or for optimisation of flow controls.

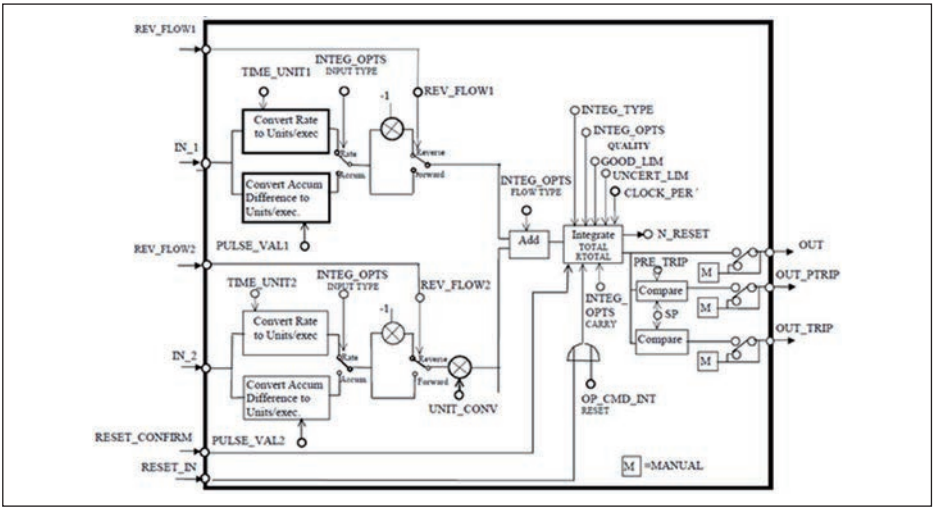

Fig. 48: Schematic presentation function block Integrator

Function block Input Selector

The function block "*Input Selector*" offers selection possibilities for up to four inputs and generates an output signal according to the selection criteria. Typical input signals are AI blocks. Selection possibilities are maximum, minimum, mean value, average value and first useful signal. Through parameter combination, the block can be used as rotary switch or as preselection switch for the first useful value. Switch information can be received by other input blocks or the user. Mean value selection is also supported.

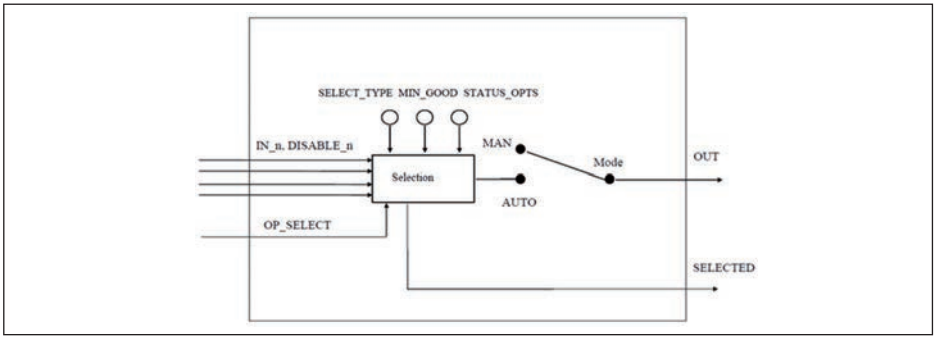

Fig. 49: Schematic presentation function block Input Selector

Function block Arithmetic

The function block "*Arithmetic*" allows the simple integration of usual metrological calculation functions. The user can select the requested measurement algortihm according to the name without known the formula.

The following algorithms are available:

- Flow compensation, linear
- Flow compensation, square root
- Flow compensation, approximate
- BTU flow
- Traditional Multiply Divide
- Average
- Traditional Summer
- Fourth order polynomial
- Simple HTG compensated level
- Fourth order Polynomial Based on PV

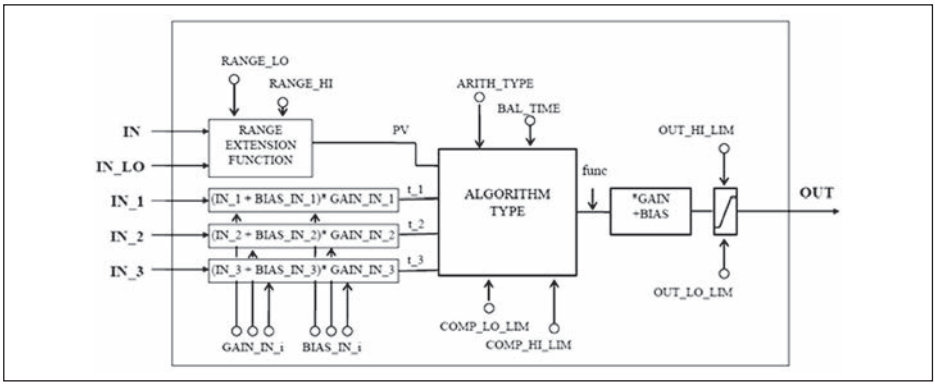

Fig. 50: Schematic presentation function block Arithmetic

Parameter list

The following table gives you an overview of the parameters used.

FF desciptor	Description	Unit
PRIMARY_VALUE	PRIMARY_VALUE (Linearized value). This is the process value after min/max adjustment and Linearization with the status of the transducer block. The unit is defined in "*PRIMARY_VALUE_UNIT*"	
PRIMARY_VALUE_UNIT	Selected unit code for "*PRIMARY_VALUE*"	
SECONDARY_VALUE_1	This is the measured value after min/max adjustment with the status of the transducer block. The unit is defined in "*SECONDARY_VALUE_1_UNIT*"	
SECONDARY_VALUE_1_ UNIT	Selected unit code for "*SECONDARY_VALUE_1*"	
SECONDARY_VALUE_2	This is the distance value ("*sensor_value*") with the status of the transducer block. The unit is defined in "*SECONDARY_VALUE_2_UNIT*"	
FILL_HEIGHT_VALUE	Filling height. The unit is defined in "*FILL_HEIGHT_VALUE_ UNIT*"	
FILL_HEIGHT_VALUE_UNIT	Filling height unit	
CONST_VALUE	Constant value	
SECONDARY_VALUE_1_ TYPE	Secondary value 1 type	
SECONDARY_VALUE_2_ TYPE	Secondary value 2 type	
FILL_HEIGHT_VALUE_Type	Filling height value type	
DIAGNOSIS	AITB Diagnosis	
DIAG_MASK_1		
DIAG_OUT_1		
DIAG_MASK_2		
DIAG_OUT_2		
DEVICE_IDENTIFICATION	Manufacturer ID, device type, bus type ID, measurement principle, serial number, DTM ID, device revision	
DEVICE_NAME	Device name	
IS-SPARE_ELECTRONICS	Device name	
DEVICE_VERSION_INFO	Hard- and software version for system, function and error	
CALIBRATION_DATE	Day, month and year	
FIRMWARE_VERSION_ASCII	Software version	
HW_VERSION_ASCII	Hardware version	
ADJUSTMENT_DATA	Min./max.-adjustment physical, percent and offset	
FIRMWARE_VERSION_MAIN	Firmware versions major, minor, revision and build	
PHYSICAL_VALUES	Distance, distance unit, distance status, level and status	
DEVICE_UNITS	Distance and temperature units of the instrument	
APPLICATION_CONFIG	Medium type, media, application type, vessel bottom, vessel height	
LINEARIZATION_TYPE_SEL	Type of linearization	

FF desciptor	Description	Unit
SIMULATION_PHYSCAL		
INTEGRATION_DATA	Physical offset and integration time	
DEVICE_CONFIG_PULS_ RADAR	Electronics variant, probe type, max. measuring range, antenna extension length, adjustment propagation antenna extension lprapproval configuration	
ADJUSTMENT_LIMITS_MIN	Min. range min.-/max.- values physical, percent, offset	
ADJUSTMENT_LIMITS_MAX	Max. range min.-/max.- values physical, percent, offset	%
FALSE_SIGNAL_COMMAND		%
FALSE_SIGNAL_CMD_CREATE_EXTEND		
FALSE_SIGNAL_CMD_DELET_REGION		
FALSE_SIGNAL_CMD_STATE	Busy, last command, errorcode	
FALSE_SIGNAL_CMD_CONFIGURATION1	Amplitude safety of the 0 % curve, safety of the false signal suppression, position of the 0 % and 100 % curve in near and far range	
FALSE_SIGNAL_CMD_CONFIGURATION2	Gradient of the manual sectors, safety at the end of false echo memory and depending on the import range gating out the false signals	
ECP_CURVE_AVARAGING_ CONFIG	Averaging factor on increasing and decreasing amplitude	
LEVEL_ECHO_MEASUREMENT	Function measured value filter	
ECHO_CURVE_STATUS		
PACKET_COUNT		
GU_ID_END		
ECHO_CURVE_READ	Echo curve data	
ECHO_EVALUATOR	Echo parameters, first large echo, amplitude threshold first large echo	
ECHO_DECIDER	Echo selection criteria, fault signal on loss of echo, delay on fault signal on loss of echo	
DISPLAY_SETTINGS	Indication value, menu language, lightning	
SIL_MODE		
EDENVELOPE_CURVE_FILTER	Parameters of envelope curve filter, activation of smooth raw value curve	
EDDETECTION_CURVE_FILTER	Parameters of the detection filter, offset threshold value curve	
EDECHO_COMBINATION	Parameters for echo combination, function combine echoes, amplitude difference of combined echoes, position difference of combined echoes	
LIN_TABLE_A … LIN_ TABLE_Q	32 couples of percentage and lin. percentage values	
ELECTRONICS_INFORMATION	Electronics version	

FF desciptor	Description	Unit
APPLICATION_CONFIG_ SERVICE	Limitation measuring range begin, safety of measuring range end	
LEVEL_ECHO_INFO	Level echo ID, amplitude, measurement safety	
DEVICE_STATUS	Device status	
FALSE_SIGNAL_LIMITS	False signal distance min./max.	
USER_PEAK_ELEC_TEMP	Min.-/max.- values of electronics temperature, date	
USER_MIN_MAX_PHYSI-CAL_VALUE	Min.-/max.- distance values, date	
RESET_PEAK_PHYSICAL_ VALUE		
RESET_LINEARIZATION_ CURVE		
DEVICE_STATUS_ASCII	Device status	
ECHO_CURVE_PLICSCOM_ REQUEST	Parameters as curve selection and resolution	
ECHO_CURVE_PLICSCOM_ LIMITS	Parameters as start and end	
APPROVAL_WHG	Sensor acc. to WHG	
DEVICE_STATE_CONFIG	Function check, maintenance required, out of specification	
ELECTRONIC_TEMPERA-TURE	Electronics temperature	
RESET_PEAK_ELECTRON-IC_TEMP		
FOCUS_RANGE_CONFIG	Width focusing range, time for opening the focusing range, min. measurement reliability in and outside the focusing range	
NOISE_DETECTION_INFO	Increase of the system noise	
NOISE_DETECTION_CON-FIG	System noise treatment	
ECHO_MEM_SAVE_CURVE_ TYPE		
ECHO_MEM_STATE	Busy, curve type, error code	

11.4 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*".

VEGAPULS WL 61, basic version

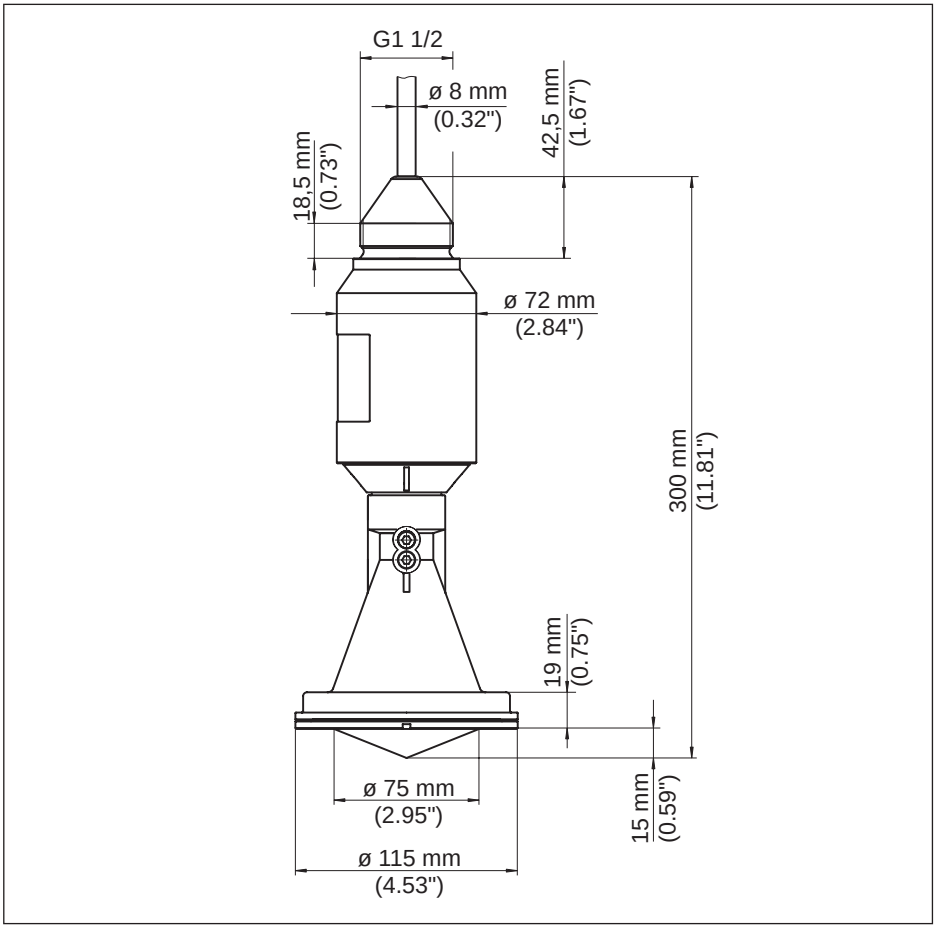

Fig. 51: VEGAPULS WL 61, basic version

VEGAPULS WL 61, version with mounting strap

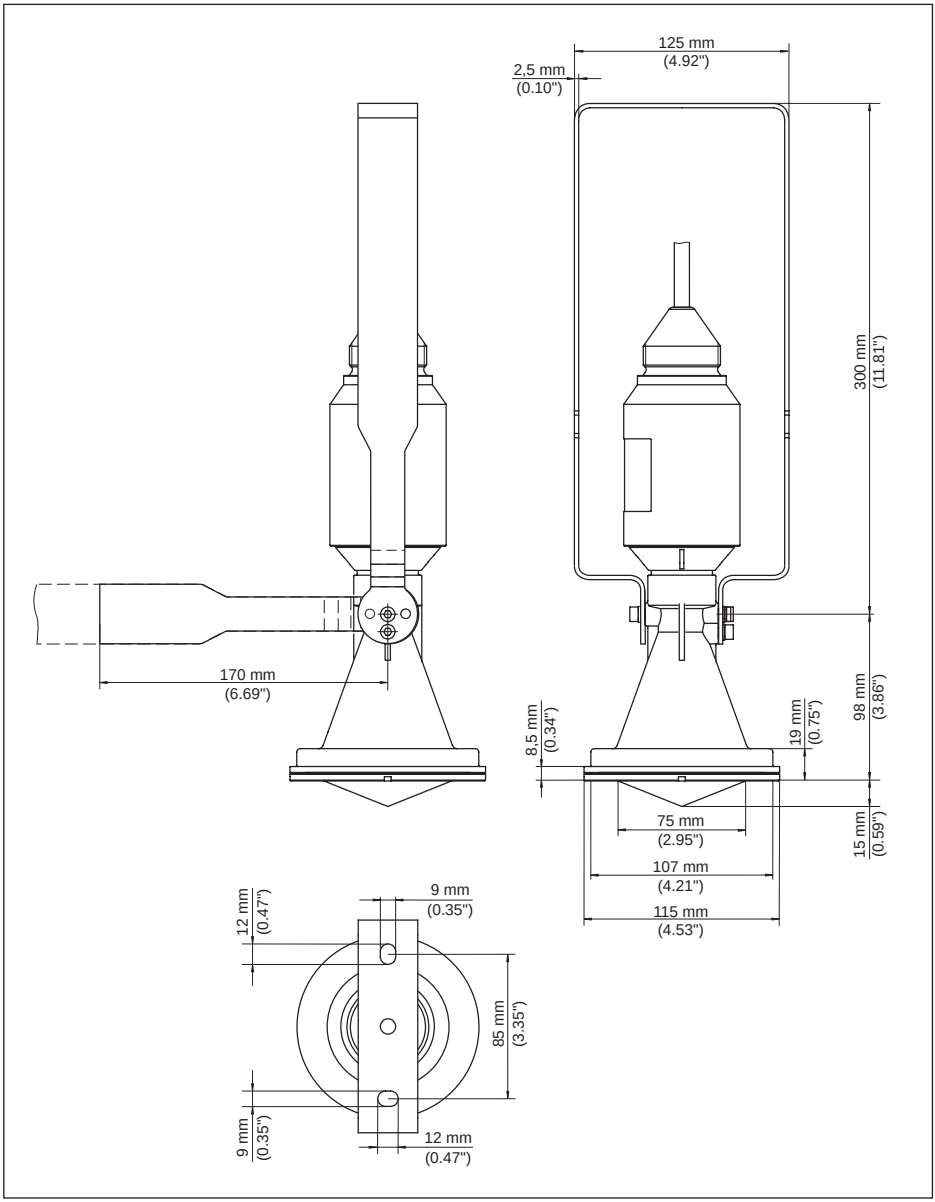

Fig. 52: VEGAPULS WL 61, version with mounting strap in 170 or 300 mm length

VEGAPULS WL 61, version with compression flange

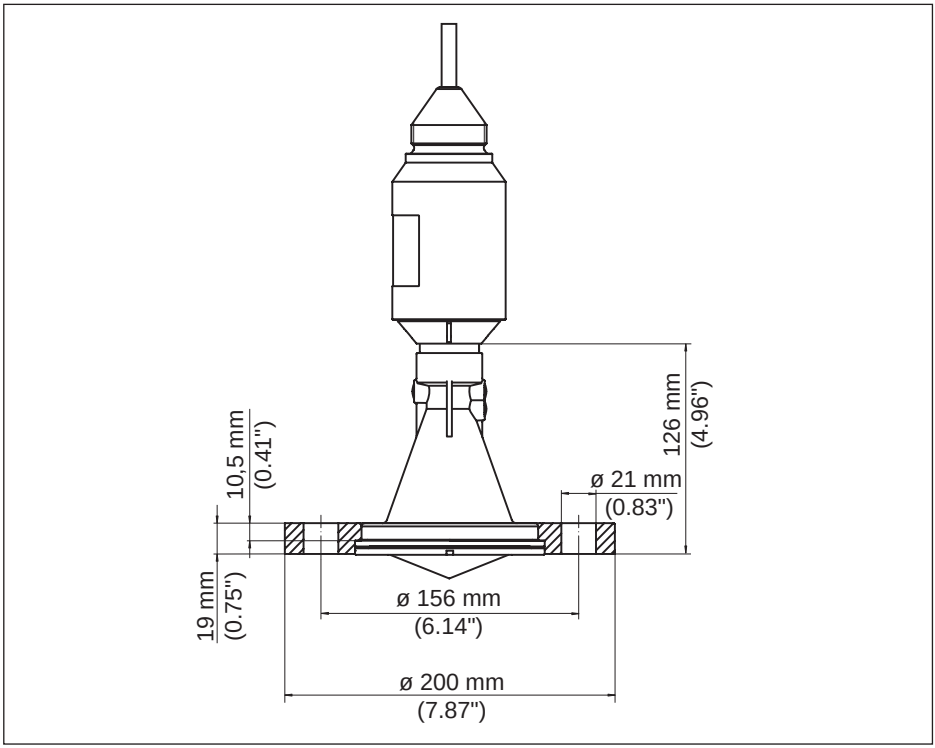

Fig. 53: VEGAPULS WL 61, compression flange DN 80/3"/JIS80

VEGAPULS WL 61, version with adapter flange

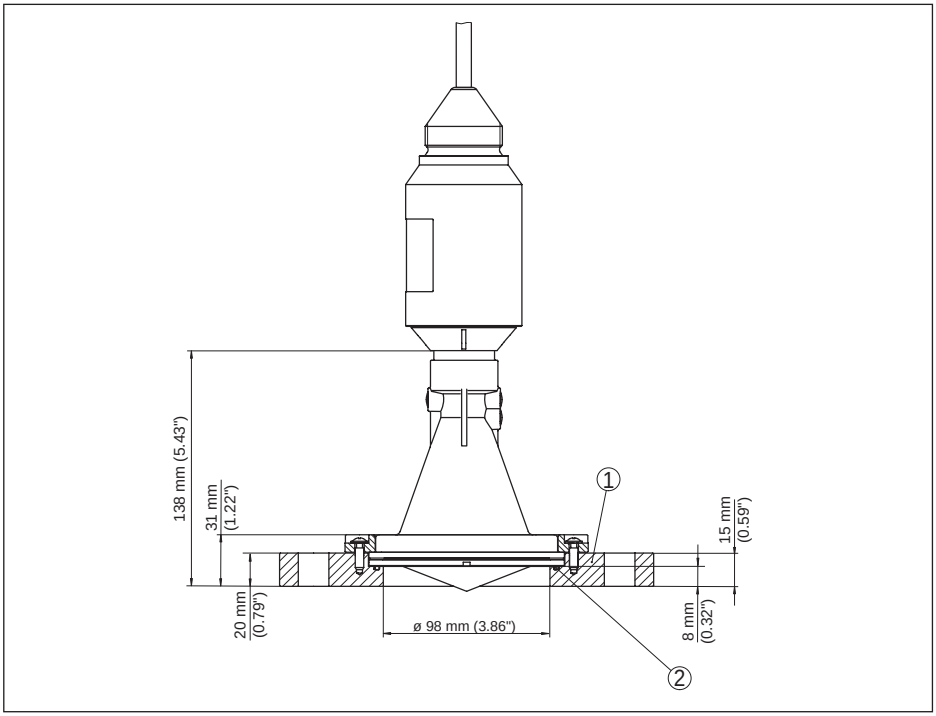

Fig. 54: VEGAPULS WL 61, adapter flange DN 100/4"/JIS 100 as well as DN 150/6"/JIS 150

1 Adapter flange
2 Seal

11.5 Industrial property rights

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11.6 Hash function acc. to mbed TLS

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11.7 Trademark

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