Quick setup guide

Radar sensor for continuous level measurement of liquids and bulk solids

VEGAPULS 6X

Two-wire 4 … 20 mA/HART

plus second current output 4 … 20 mA

Document ID: 66445

Contents

Information:
This quick setup guide enables quick setup and commissioning of your instrument.

You can find supplementary information in the corresponding, more detailed Operating Instructions Manual as well as the Safety Manual that comes with instruments with SIL qualification. These manuals are available on our homepage.

Operating instructions VEGAPULS 6X - Two-wire 4 … 20 mA/HART plus second current output 4 … 20 mA: Document-ID 66443
Editing status of the quick setup guide: 2023-05-16

66445-EN-230524

1 For your safety

1.1 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.

1.2 Appropriate use

VEGAPULS 6X 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.

1.3 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.

1.4 General safety instructions

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

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

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

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

The low transmitting power of the radar sensor is far below the internationally approved limits. No health impairments are to be expected with intended use. The band range of the measuring frequency can be found in chapter " *Technical data*".

1.5 Mode of operation - Radar signal

Country specific settings for the radar signals are determined via the mode. The operating mode must be set in the operating menu via the respective operating tool at the beginning of the setup.

Caution:
Operating the device without selecting the relevant mode constitutes a violation of the regulations of the radio approvals of the respective country.

1.6 Installation and operation in the USA and Canada

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

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

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

A Class 2 power supply unit has to be used for the installation in the USA and Canada.

2 Product description

2.1 Configuration

Type label

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

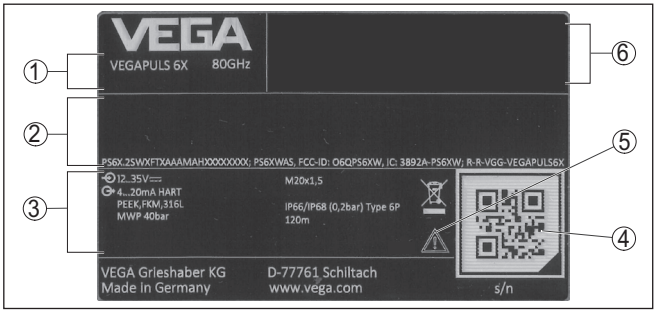


Fig. 1: Layout of the type label (example)

1 *Device type, order code, radar frequency*
2 *Field for approvals, product code*
3 *Technical data*
4 *QR-code for VEGA Tools app*
5 *Reminder to observe the instrument documentation*
6 *Field for conformity logos*

Serial number - Instrument search

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

- Product information
- Device configuration
- Related documentation
- Further documents

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

Alternatively, you can access the data via your smartphone:

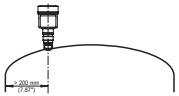
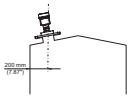
- Download the VEGA Tools app from the " *Apple App Store*" or the " *Google Play Store*"
- Scan the QR-code on the type label of the device or
- Enter the serial number manually in the app

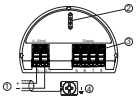
3 Setup – the most important steps

Prepare

What?	How?
Identify sensor 	Scan QR code on type label, check sensor data

Mount and connect sensor

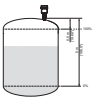
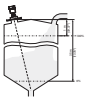
Liquids	Bulk solids
	

Connection technology	Wiring plan
	

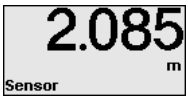
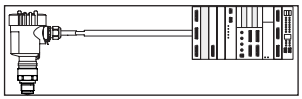
Select adjustment

Display and adjustment module	VEGA Tools app [1]
	

Parameterize sensor

Liquids	Bulk solids
Enter medium type, application, vessel height, adjustment and mode	
	

Check measured value

Indicators	Output
	

[1] Download via Apple App Store, Google Play Store, Baidu Store

4 Mounting

4.1 Mounting instructions

Polarisation

Radar sensors for level measurement emit electromagnetic waves. The polarisation is the direction of the electrical share of these waves. It is identifiable by a mark on the housing, see the following drawing:

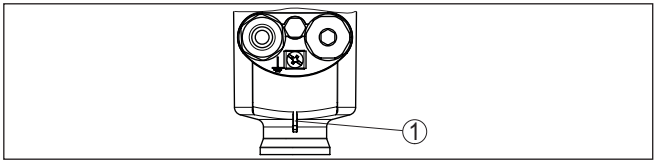


Fig. 2: Position of the polarisation

1 Nose for marking the direction of polarisation

Turning the housing changes the polarisation and thus also the effect of false echoes on the measured value.

Note:
Therefore, pay attention to the position of the polarisation when mounting or when making subsequent changes. Fix the housing to prevent a change in the metrological properties (see chapter " *Housing features*").

Mounting position - liquids

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

Note:
If you cannot maintain this distance, you should carry out a false signal suppression during setup. This applies especially if buildup on the vessel wall is to be expected. [2)]

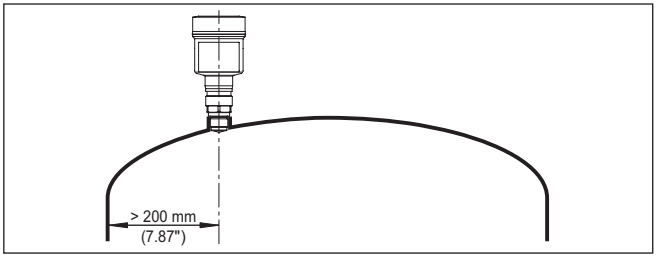


Fig. 3: Mounting of the radar sensor on round vessel tops

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

[2)] In this case, it is recommended to repeat the false signal suppression at a later time with existing buildup.

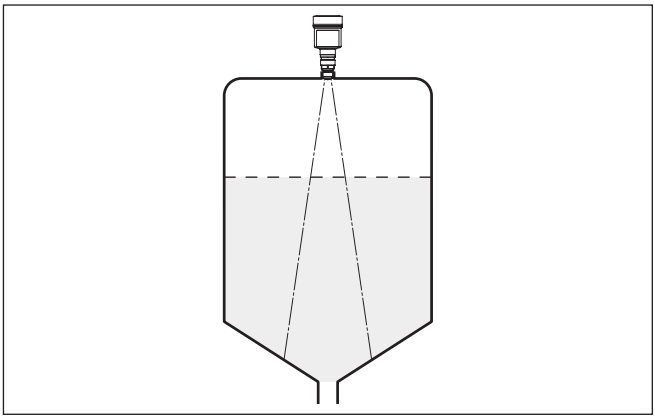


Fig. 4: Mounting of the radar sensor on vessels with conical bottom

Mounting position - bulk solids

Mount the instrument at least 200 mm (7.874 in) away from the vessel wall.

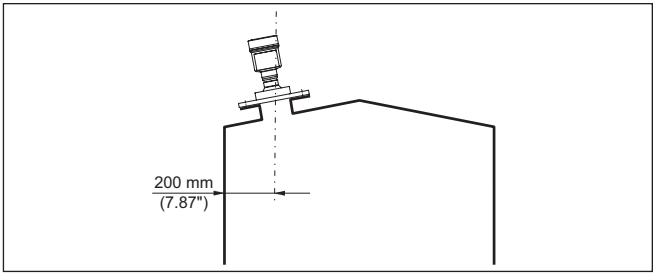


Fig. 5: Mounting the radar sensor on the vessel top

Note:
If you cannot maintain this distance, you should carry out a false signal suppression during setup. This applies especially if buildup on the vessel wall is to be expected. [3)]

[3)] In this case, it is recommended to repeat the false signal suppression at a later time with existing buildup.

5 Connecting to power supply

5.1 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.

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

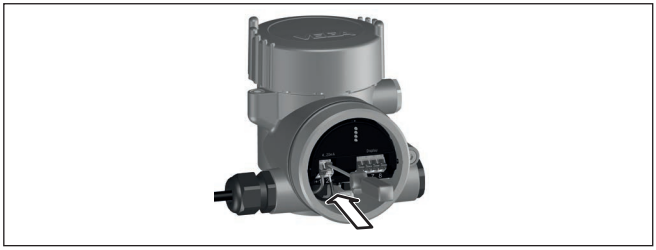


Fig. 6: Connection steps 5 and 6

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

Note:
Fixed conductors and flexible conductors with ferrules can be inserted directly into the terminal openings. In the case of flexible conductors for opening the terminals, use a screwdriver (3 mm blade width) to push the actuator lever away from the terminal opening. When released, the terminals are closed again.

7. Check the hold of the wires in the terminals by lightly pulling on them
8. Connect the shielding 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.

5.2 Wiring plan, double chamber housing

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

Electronics compartment

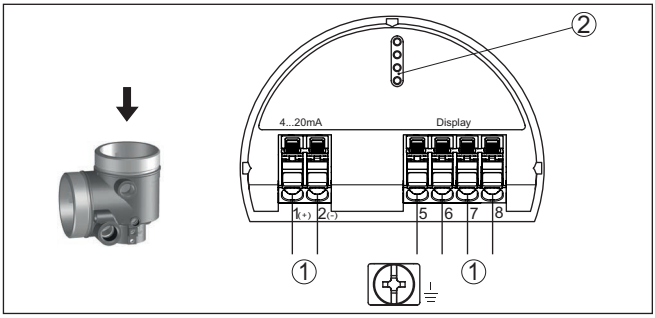


Fig. 7: Electronics compartment - double chamber housing

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

Connection compartment

Both current outputs are passive and need a power supply.

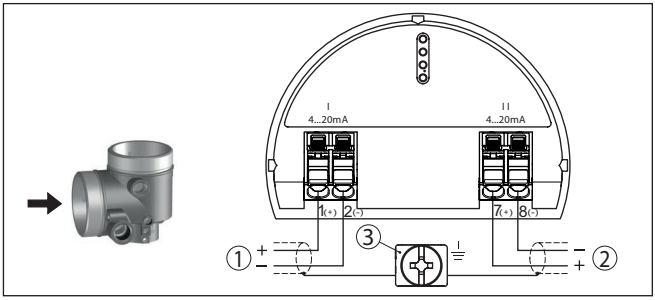


Fig. 8: Connection compartment, double chamber housing

1 Current output (I) - Voltage supply sensor and signal output 4 … 20 mA/ HART
2 Second current output (II) - Signal output 4 … 20 mA
3 Ground terminal for connection of the cable screening

5.3 Switch-on phase

After connection to the power supply, the device carries out a self-test:

- Internal check of the electronics
- Output signal is set to failure

The current measured value is then output on the signal cable.

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.

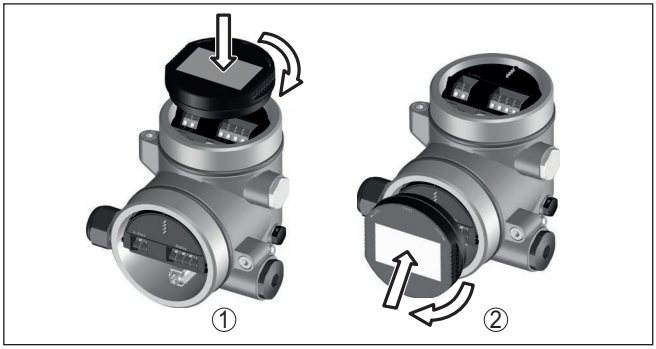


Fig. 9: Installing the display and adjustment module in the double chamber housing

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.

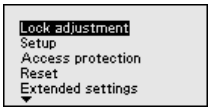
6.2 Parameterization

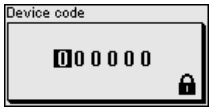
6.2.1 Lock/Unlock adjustment

Lock/Unlock adjustment (non-SIL)

In this menu item you safeguard the sensor parameters against unauthorized or unintentional modifications.

Information:
The non-SIL version of the device is delivered without activated access protection. If necessary, the access protection can be activated and the device locked.





When the adjustment is blocked, only the following adjustment functions are possible without entering the device code:

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

Caution:
When the adjustment is blocked, the adjustment via PACTware/DTM and other systems is also blocked.

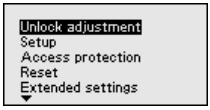
Releasing the sensor adjustment is also possible in any menu item by entering the device code.

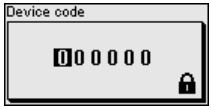
Lock/Unlock adjustment (SIL)

In this menu item you safeguard the sensor parameters against unauthorized or unintentional modifications.

Information:
The SIL version of the device is delivered in locket state.

Safe parameterization:
To avoid possible errors during parameterization in a non-safe user environment, a verification procedure is used that makes it possible to detect parameterization errors reliably. For this, safety-relevant parameters must be verified before they are stored in the device. In normal operating condition, the instrument is also locked against parameter changes through unauthorized access.



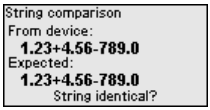


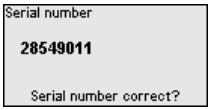
Information:
If the device code has been changed and forgotten, the enclosed information sheet "*Access Protection*" provides an emergency device code.

Character string comparison and serial number:
You first have to carry out the character string comparison. This is used to check the character respresentation.

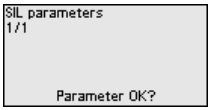
Confirm if the two character strings are identical. The verification texts are provided in German and in the case of all other menu languages, in English.

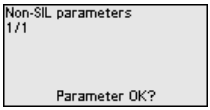
Afterwards you confirm that the serial number of your instrument was carried over correctly. This is used to check device communication.





In the next step, the instrument checks the data of the measurement and decides by means of the evaluation results if a functions test is required. If a function test is necessary, the following message is displayed.



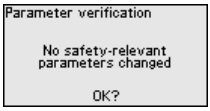


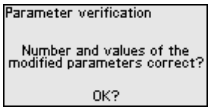
In this case, you have to carry out a function test.

Function test:
During a function test, you have to test the safety function of the instrument in the vessel with the original medium.

SIL You can find the detailed sequence of the function test in chapter "*Functional safety (SIL)*" of the operating instructions.

Verify parameter:
All safety-relevant parameters must be verified after a change. After the function test, all modified, safety-relevant parameters will be listed. Confirm the modified values one after the other.





If the described process of parameter adjustment was run through completely and correctly, the instrument will be locked and hence ready for operation.

Otherwise the instrument remains in the released and hence unsafe condition.

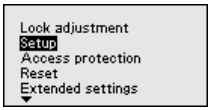
Note:
When the adjustment is blocked, the adjustment via PACTware/DTM and other systems is also blocked.

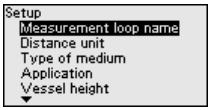
6.2.2 Setup

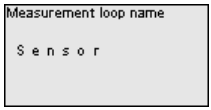
Measurement loop name Here you can assign a suitable measurement loop name.

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

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

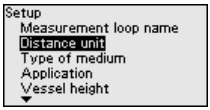


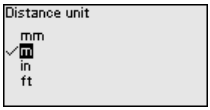




Distance unit

In this menu item you select the distance unit of the device.

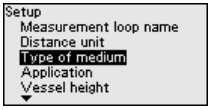


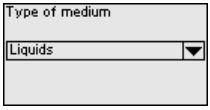


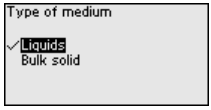
Type of medium

This menu item allows you to adapt the sensor to the different measuring conditions of the media " *Liquid*" or " *Bulk solid*".

The corresponding application is selected in the following menu item " *Application*".

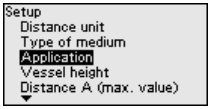


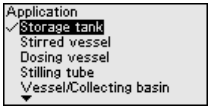


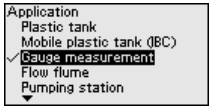


Application - liquid

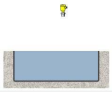
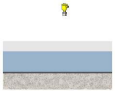
With " *Liquid*", the applications are based on the following features, to which the measuring characteristic of the sensor is adjusted in particular:

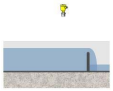
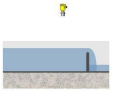






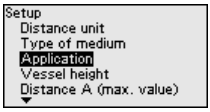
Application	Vessel	Process/measurement conditions	Further recommendations
Storage tank 	Large volume Upright cylindrical, horizontal round	Slow filling and emptying Smooth medium surface Multiple reflections from dished vessel ceiling Condensation	-
Stirrer vessel 	Large agitator blades of metal Installations like flow breakers, heating spirals Nozzle	Frequent, fast to slow filling and emptying Strongly agitated surface, foam and strong vortex generation Multiple reflections through dished vessel ceiling Condensation, buildup on the sensor	False signal suppression with running agitator

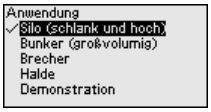
Application	Vessel	Process/measurement conditions	Further recommendations
Dosing vessel 	Small vessels	Frequent and fast filling/emptying Tight installation situation Multiple reflections through dished vessel ceiling Product buildup, condensate and foam generation	-
Standpipe 	Standpipe in the vessel	Tubes with different diameters and openings for product mixing Welded connections or mechanical joints with very long tubes	Orientation of the polarisation direction False signal suppression
Bypass 	Bypass tube outside the vessel Typical lengths: up to 6 m	Tubes with different diameters Lateral connections to the vessel	Orientation of the polarisation direction False signal suppression
Vessel/Collecting basin 	Large volume Upright cylindrical or rectangular	Slow filling and emptying Smooth medium surface Condensation	-
Plastic tank (measurement through the vessel top) 		Measurement through the tank top, if appropriate to the application Condensation on the plastic ceiling In outdoor facilities, water and snow on vessel top possible	When measuring through the tank top: False signal suppression When measuring through the tank top (outdoor areas): Protective roof for the measuring point
Transportable plastic tank (IBC) 	Small vessels	Material and thickness different Measurement through the vessel top, if appropriate to the application Changed reflection conditions as well as jumps in measured values when changing vessels	When measuring through the tank top: False signal suppression When measuring through the tank top (outdoor areas): Protective roof for the measuring point
Gauge measurement, waters 		Slow gauge change Extreme damping of output signal in case of wave generation Ice and condensation on the antenna possible Floating debris sporadically on the water surface	-

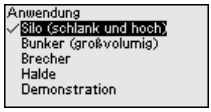
Application	Vessel	Process/measurement conditions	Further recommendations
Flow measurement flume/Overfall 		Slow gauge change Smooth to agitated water surface Measurement often from a short distance with the demand for accurate measurement results Ice and condensation on the antenna possible	-
Pumping station/ Pump shaft 		Partly strongly agitated surface Installations such as pumps and ladders Multiple reflections through flat vessel ceiling Dirt and grease deposits on shaft wall and sensor Condensation on the sensor	False signal suppression
Overflow basin (RÜB) 	Large volume Partly installed underground	Partly strongly agitated surface Multiple reflections through flat vessel ceiling Condensation, dirt deposits on the sensor Flooding of the sensor antenna	-
Demonstration 	Applications for non-typical level measurements, e.g. device tests	Instrument demonstration Object recognition/monitoring Fast position changes of a measuring plate during functional test	-

Application - bulk solid

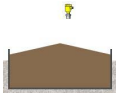
With " *Bulk solid*", the applications are based on the following features, to which the measuring characteristic of the sensor is adjusted in particular:





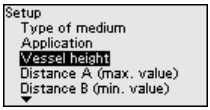


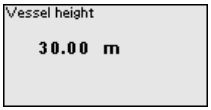
Application	Vessel	Process/measurement conditions	Further recommendations
Silo 	Slim and high Upright cylindrical	Interfering reflections due to weld seams on the vessel Multiple echoes/diffuse reflections due to unfavourable pouring positions with fine grain Varying pouring positions due to outlet funnel and filling cone	False signal suppression Alignment of the measurement to the silo outlet

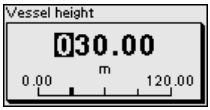
Application	Vessel	Process/measurement conditions	Further recommendations
Bunker 	Large volume	Large distance to the medium Steep angles of repose, unfavourable pouring positions due to outlet funnel and filling cone Diffuse reflections due to structured vessel walls or internals Multiple echoes/diffuse reflections due to unfavourable pouring positions with fine grain Changing signal conditions when large amounts of material slip off	False signal suppression
Crusher 		Measured value jumps and varying pouring positions, e.g. due to truck filling Fast reaction time Large distance to the medium Interfering reflections from fixtures or protective devices	False signal suppression
Heap 	Large volume Upright cylindrical or rectangular	Measured value jumps, e.g. through heap profile and traverses Large angles of repose, varying pouring positions Measurement near the filling stream Sensor mounting on movable conveyor belts	-
Demonstration 	Applications that are not typical level measurements, e.g. device tests	Instrument demonstration Object recognition/monitoring Measured value verification with higher measuring accuracy with reflection without bulk solids, e.g. via a measuring plate	-

Vessel height

Through this selection the operating range of the sensor is adapted to the vessel height. Hence the measurement reliability is increased considerably under different basic conditions.







Note:
Regardless of this, the min. adjustment must also be carried out (see following section).

Adjustment

Since the radar sensor is a distance measuring instrument, it is the distance from the sensor to the medium surface that is measured. To indicate the actual level, the measured distance must be assigned to a certain height percentage (min./max. adjustment).

During adjustment, enter the respective measuring distance when the vessel is full and empty (see the following examples):

Liquids:

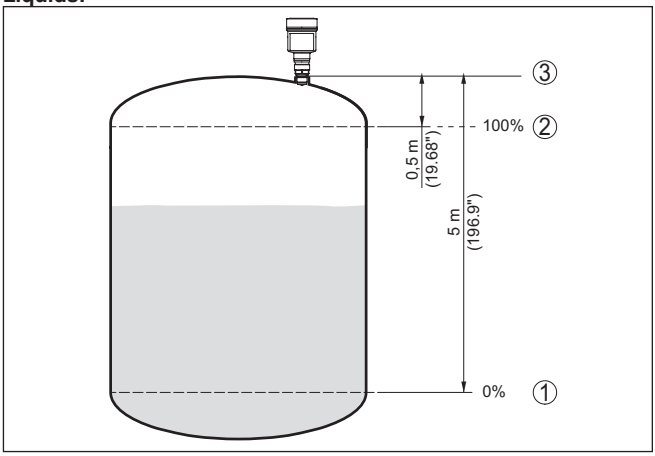


Fig. 10: Parameterisation example min./max. adjustment - liquids

1 Min. level = max. meas. distance (distance B)
2 Max. level = min. meas. distance (distance A)
3 Reference plane

Bulk solids:

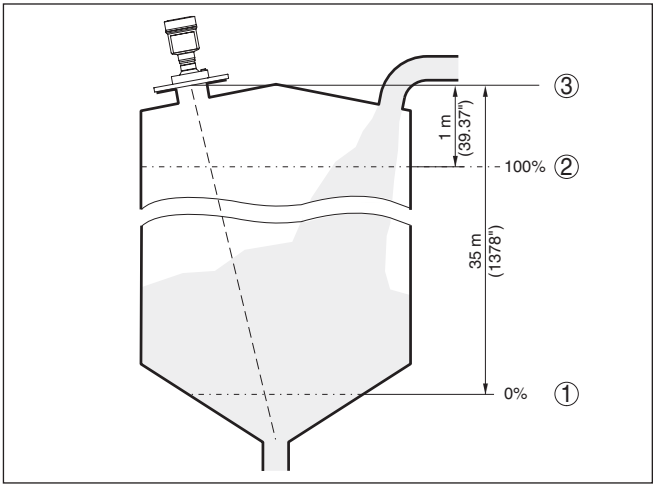


Fig. 11: Parameterisation example min./max. adjustment - bulk solids

1 Min. level = max. meas. distance (distance B)
2 Max. level = min. meas. distance (distance A)
3 Reference plane

If these values are not known, and adjustment can for example be carried out with the distances of 10 % and 90 %.

The starting point for these distance specifications is always the reference plane, e.g. the sealing surface of the thread or flange. Informa-

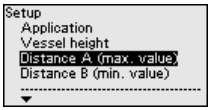
tion on the reference plane can be found in the chapters " *Mounting instructions*" resp. " *Technical data*". The actual filling height is then calculated on the basis of these entries.

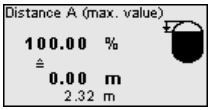
The actual product level during this adjustment is not important, because the min./max. adjustment is always carried out without changing the product level. These settings can be made ahead of time without the instrument having to be installed.

Distance A (max. value)

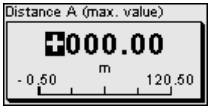
Proceed as follows:

1. Select with ***[->]*** the menu item Distance A (max. value) and confirm with ***[OK]***.





2. Edit the distance value with ***[OK]*** and set the cursor to the requested position with ***[->]***.
3. Adjust the requested distance value for 100 % with ***[+]*** and store with ***[OK]***.

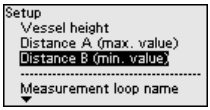


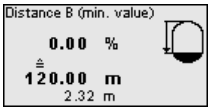
4. Move with ***[ESC]*** and ***[->]*** to the min. adjustment

Distance B (min. value)

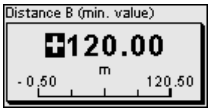
Proceed as follows:

1. Select with ***[->]*** the menu item " *Distance B (min. value)*" and confirm with ***[OK]***.





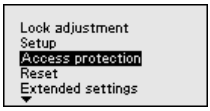
2. Edit the distance value with ***[OK]*** and set the cursor to the requested position with ***[->]***.
3. Set the requested distance value for 0 % (e.g. distance from the sensor up to the vessel bottom) with ***[+]*** and save with ***[OK]***. The cursor now jumps to the distance value.

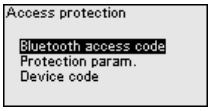


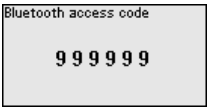
6.2.3 Access protection

Bluetooth access code

This menu item enables to change the factory-preset Bluetooth access code to your personal Bluetooth access code.





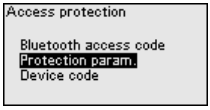


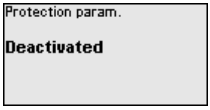
Note:
You can find the individual factory Bluetooth access code of the device on the information sheet supplied " *PINs and Codes*".

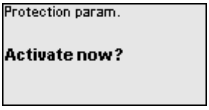
Protection of the parameterization

This menu item allows you to protect the sensor parameters from unwanted or unintended changes. To activate the protection, you must define and enter a 6-digit device code.

Note:
For SIL devices, the protection of the parameterisation is activated ex works. These devices have an individual device code. You will find it in the information sheet supplied " *PINs and Codes*".







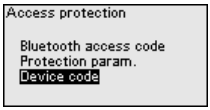
When protection is activated, the individual menu items can still be selected and displayed. However, the parameters can no longer be changed.

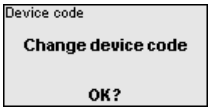
Releasing the sensor adjustment is also possible in any menu item by entering the device code.

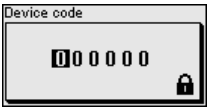
Note:
With protected parameter adjustment, adjustment via the adjustment app as well as PACTware/DTM and other systems is also blocked.

Device code

This menu item allows you to change the device code. It is only displayed if the parameterisation protection has been activated beforehand.





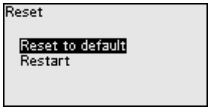


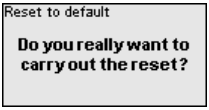
Note:
The changed device code is also effective for adjustment via the adjustment app, PACTware/DTM and other systems.

6.2.4 Reset

Reset

During a reset, parameter settings made by the user are reset to the values of the factory settings. You can fined the values in chapter " *Menu overview*".





Information:
The language and Bluetooth access code are not reset, a currently running simulation however is aborted.

Reset - Factory settings:

- Restoring the factory and order-specific parameter settings
- Resetting a user-set measuring range to the recommended measuring range (see chapter " *Technical data*")
- Deleting a created false signal suppression, a user-programmable linearisation curve as well as the measured value and echo curve memory [4)]

Reset - Restart:
Is used to restart the device without switching off the operating voltage.

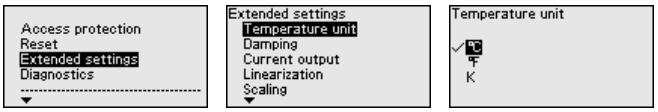
Note:
For the duration of the reset, the device changes its behaviour from the normal measuring operation. Therefore, observe the following for downstream systems:

- The current output outputs the set false signal
- The Asset-Management function outputs the message " *Maintenance*" aus

6.2.5 Extended settings

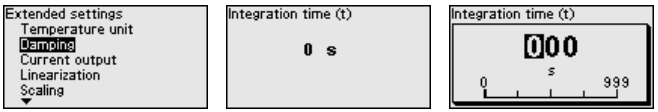
Temperature unit

In this menu item you select the temperature unit of the device.



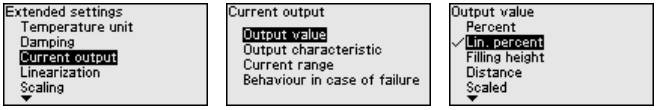
Damping

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



Current output - Output value

In this menu item you determine which measured value is output via the respective current output:



The following selection possibilities are available:

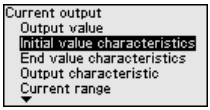
- Percent
- Linearized percent
- Filling height
- Distance

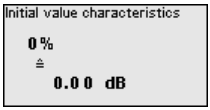
[4)] The event and parameter change memories are maintained.

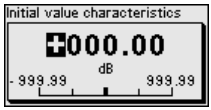
- Scaled
- Measurement reliability
- Electronics temperature
- Measuring rate
- Operating voltage

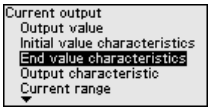
Current output - Initial/Final value characteristics

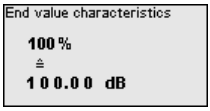
Here you determine which heights of the output value belong to the current values 4 mA and 20 mA .

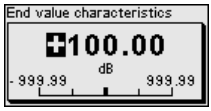










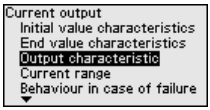


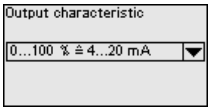
Note:
This menu item is only available if one of the following output values was selected for the current output:

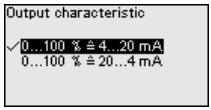
- Measurement reliability
- Electronics temperature
- Measuring rate
- Operating voltage

Current output - Output characteristics

In the menu item " *Current output - Output characteristic*" you select for 0 … 100 % output value if the characteristic of the current output rises (4 … 20 mA) or falls (20 … 4 mA).

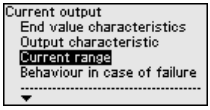


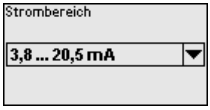


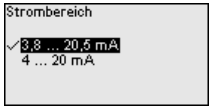


Current output - Current range

In the menu item " *Current output - Current range*" you determine the range of the current output as 4 … 20 mA or 3.8 … 20.5 mA.

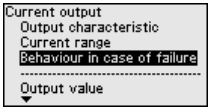


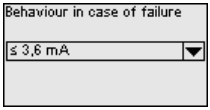


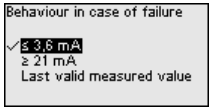


Current output - Reaction in case of fault

In the menu item " *Current output - Behaviour in case of failure*" you set the behaviour of the current output in case of failures as ≤ 3.6 mA or ≥ 21 mA resp. the last measured value.



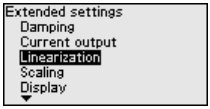


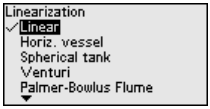


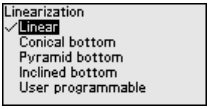
Linearisation

Linearisation is required for all vessels where the vessel volume does not increase linearly with the level and the display or output of the volume is desired. The same applies to flow measuring constructions and the relationship between flow and level.

Corresponding linearisation curves are stored for these measurement situations. They indicate the relationship between the percentage level and the vessel volume or flow rate. The selection depends on the selected linerarisation type liquid or bulk solid.





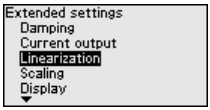


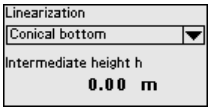
Note:
The selected linearisation applies to the measured value indication and the signal output.

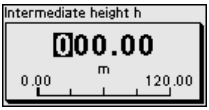
Depending on the medium and the vessel bottom, the intermediate height is also entered, see next menu item.

Linearization - Intermediate height

The intermediate height is the beginning of the cylindrical area, e.g. for vessels with conical bottoms.

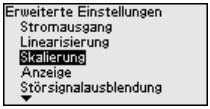


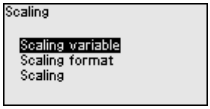


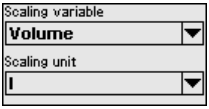


Scaling

In the menu item " *Scaling*" you define the scaling variable and unit as well as the scaling format. By doing so, it is for example the indication of the level measured value for 0 % and 100 % on the display as volume in l is possible.

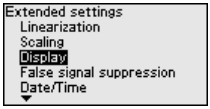


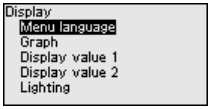


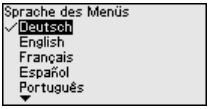


Display - Menu language

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







The following languages are available:

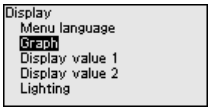
- German
- English
- French
- Spanish
- Portuguese
- Italian
- Dutch
- Russian

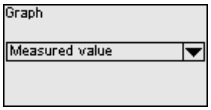
- Chinese
- Japanese
- Polish
- Czech
- Turkish

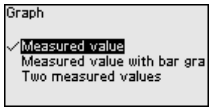
Display - Presentation

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

- Measured value in large font
- Measured value and corresponding bargraph presentation
- Measured value as well as second selectable value, e.g. electronics temperature



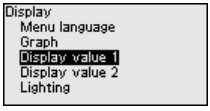


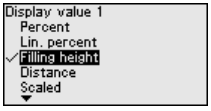


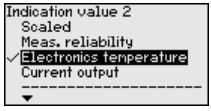
During the initial setup of an instrument shipped with factory settings, use the " ***OK***" key to get to the menu " *National language*".

Display - Displayed value 1, 2

In this menu item, you determine which measured values is displayed.

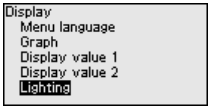


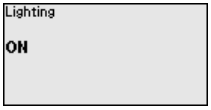




Display - Lighting

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





Note:
If the power supply is currently insufficient, the lighting is temporarily switched off (maintaining the device function).

False signal suppression

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

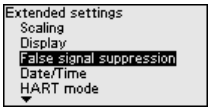
- High mounting nozzles
- Vessel internals such as struts
- Agitators
- Buildup or welded joints on vessel walls

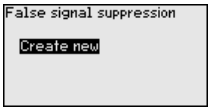
A false signal suppression detects, marks and saves these false signals to ensure that they are ignored in the level measurement.

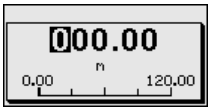
Note:
The false signal suppression should be done with the lowest possible level so that all potential interfering reflections can be detected.

Create new:
Proceed as follows:

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



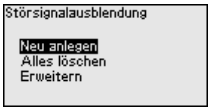




2. Confirm 2-times with ***[OK]*** and enter the actual distance from the sensor to the product surface.
3. All interfering signals in this range are detected by the sensor and stored after being confirmed with ***[OK]***.

Note:
Check the distance to the medium 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 all:
An false signal suppression that has already been created is completely deleted.

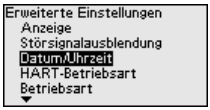
→ This is useful if the applied false signal suppression no longer matches the metrological conditions of the vessel.

Extend:
A false signal suppression that has already been created is extended. The distance to the medium 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 area.

→ This is useful if a false signal suppression was carried out when the level was too high and thus not all false signals could be detected.

Date/Time

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



Note:
The device is set to CET (Central European Time) at the factory.

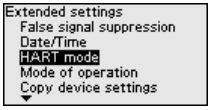
HART mode

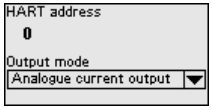
In this menu item you specify the HART mode and enter the address for multidrop mode.

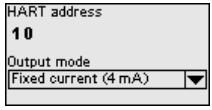
HART address 0:
In the menu item " *Output mode*" the " *Analogue current output*" is displayed and a 4 … 20 mA signal output.

HART address deviation from 0:
In the menu item " *Output mode*" " *Fixed current (4 mA)*" is displayed and independent of the actual level a fixed 4 mA signal output. The level is output digitally via the HART signal.

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



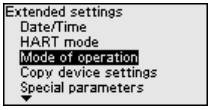


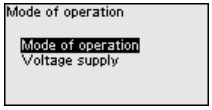


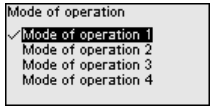
Mode

This menu item contains operational settings of the sensor.

Mode:
Country specific settings for the radar signals are determined via the operating mode.



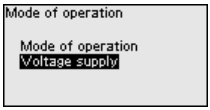


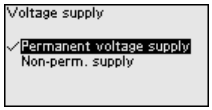


- Mode 1: EU, Albania, Andorra, Azerbaijan, Australia, Belarus, Bosnia and Herzegovina, Canada, Liechtenstein, Moldavia, Monaco, Montenegro, New Zealand, Northern Macedonia, Norway, San Marino, Saudi Arabia, Serbia, Switzerland, Turkey, Ukraine, United Kingdom, USA
- Mode of operation 2: Brazil, Japan, South Korea, Taiwan, Thailand
- Mode of operation 3: India, Malaysia, South Africa
- Mode of operation 4: Russia, Kazakhstan

Note:
Depending on the operating mode, metrological properties of the device can change (see chapter " *Technical data, input variable*").

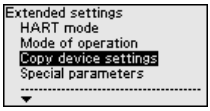
Voltage supply:
The power supply determines whether the sensor is in operation permanently or only in accordance with certain requirements.

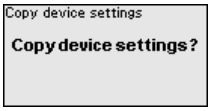


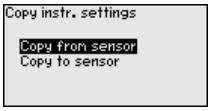


Copy instrument settings

The following functions are available:







Load from sensor:
Store data from sensor in the display and adjustment module.

Write to sensor:
Store data from display and adjustment module in the sensor

The following device settings are copied:

- Measurement loop name
- Application
- Units
- Adjustment
- Damping
- Current output
- Linearisation
- Scaling
- Indication
- PV adjustment
- Mode
- Diagnostic behaviour

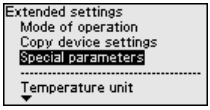
The copied data are permanently saved in an EEPROM memory in the display and adjustment module and remain there even in case of power failure. From there, they can be written into one or more sensors or kept as backup for a possible electronics exchange.

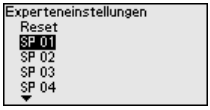
Note:
Before the data are saved in the sensor, a safety check is carried out to determine if the data match the sensor. In the process the sensor type of the source data as well as the target sensor are displayed. If the data do not match, a fault message is outputted or the function is blocked. The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

Special parameters

Special parameters are used to adapt the sensor to special requirements. However, this is only necessary in rare cases.

However, only change the special parameters after consulting our service staff.





The special parameters can be reset to factory settings with " *Reset*".

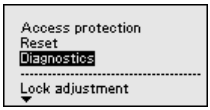
Note:
The special parameters are described in a separate section at the end of the chapter " *Parameter adjustment*".

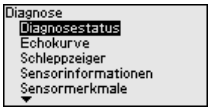
6.2.6 Diagnostics

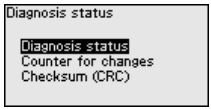
Diagnosis status

The following is displayed in this menu item:

- Diagnosis status (device status OK or error messages)
- Change counter (number of the parameter changes)
- Current checksum CRC (checksum for plausibility of the set parameters) with date of the last change
- Checksum (CRC) of the last SIL locking with date

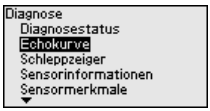


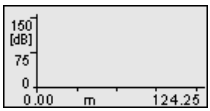


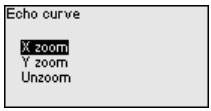


Echo curve

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







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

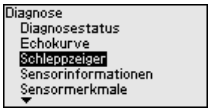
- "X-Zoom": Zoom function for the meas. distance
- "Y-Zoom": 1, 2, 5 and 10x signal magnification in " *dB*"
- "Unzoom": Reset the presentation to the nominal measuring range without magnification

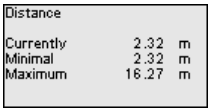
Measured values/peak indicator

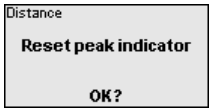
The following min./max. values saved by the sensor are displayed in the menu item " *Measured values/Peak indicator*":

- Distance
- Measurement reliability
- Measuring rate
- Electronics temperature
- Operating voltage

The ***[OK]*** key opens a reset function in the respective peak indicator window:



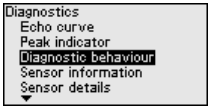


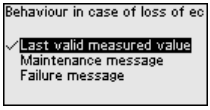


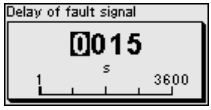
With the ***[OK]*** key, the peak indicator are reset to the actual measured values.

Diagnostic behaviour

In this menu item, you define what the signal output outputs in the event of an echo loss. For this purpose, the time after an echo loss until a fault message is selected.







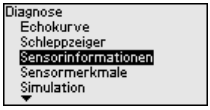
Sensor information

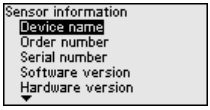
In this menu item the following information of the instrument can be read out:

- Device name
- Order and serial number
- Hardware and software version
- Device Revision
- Factory calibration date

as well as additionally depending on the device version:

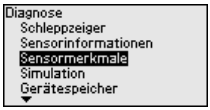
- Instrument address
- Loop Current Mode
- Fieldbus Profile Rev.
- Expanded Device Type
- Sensor acc. to SIL
- Sensor acc. to WHG
- Bustype ID





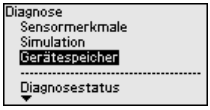
Sensor characteristics

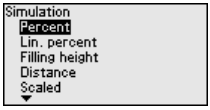
The menu item " *Sensor characteristics*" delivers sensor characteristics such as approval, process fitting, seal, measuring range etc.

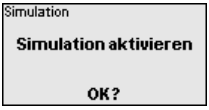


Simulation

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





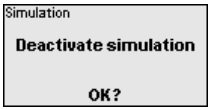


Select the requested simulation variable and set the requested value.

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

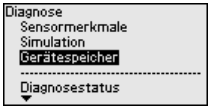
Note:
The sensor terminates the simulation automatically after 60 minutes.

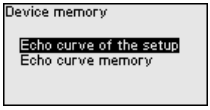
To deactivate the simulation manually in advance, you have to push the ***[ESC]*** key and confirm the message with the ***[OK]*** key.

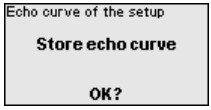


Device memory

The menu item Device memory offers the following functions:







Echo curve of the setup:
With the function " *Echo curve of the setup*" it is possible to store the echo curve at the time of the setup. Storage should be carried out at the lowest possible level.

Note:
This is generally recommended, even mandatory, for using the asset management functionality.

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

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

6.2.7 Special parameters

SP01 - Activate measuring range start limiting

Measuring range start limiting is activated here. The appropriate distance value is set in the special parameter SP02.

→ Jumps in the measured value to a changing false signal in the close range can thus be prevented.

Note:
However, activation also means that the sensor no longer accepts the level echo in the event of overfilling above the measuring range begin. A measured value jump to a multiple echo may occur here.

SP02 - Manual limitation of the measuring range begin

Here, an individual limitation of the measuring range begin takes place independent of the 100 % adjustment. The entered distance value in " *m*" must always be between the sensor reference point and the maximum level.

→ Echoes between the sensor reference point and this value will not be detected.

SP03 - Reliability on the vessel bottom resp. the measuring range

This is an additional distance value " *m*" that is added to the special parameter SP24 to reliably detect the zero point in case of insufficient reflections at the bottom of the vessel.

→ The echo detection below the 0 % adjustment is intended to support the reliable detection of an echo when the vessel is completely empty.

SP04 - Correction of the propagation speed

This parameter in " %" is used for correction of a running time shift or a modified spreading speed of the radar signal.

→ This compensates for measurement deviations due to longer distances in standpipes or a higher permittivity of the atmosphere in the vessel (e.g. for gases and vapours especially at high pressures).

SP05/06 - Factor for noise averaging rising/falling

The noise averaging is a temporal, floating average value formation of all signals received by the sensor. The set factor determines the number of averaged echo curves as a Basis 2 exponent (example: factor 2 corresponds to the averaging of 2^2 [= 4] echo curves).

→ Used for false signals caused by sporadic echoes, e.g. from agitator blades. The false signals are given a lower relevance or amplitude by a larger value of SP05. They are thus more strongly suppressed in their evaluation.

→ Use for level echoes with changing amplitude, e.g. due to a turbulent medium surface. The level echoes receive a greater relevance or constant amplitude through a larger value of SP06. They are thus increased in their evaluation.

Note:
A higher factor for noise averaging can lead to a longer reaction time or a delay of the measured value update.

SP07 - Deactivate filter function "Smooth raw value curve"

This parameter is always switched on ex-factory. It acts as a digital filter over the raw value curve depending on the selected application.

→ In principle, it causes an improvement in measurement reliability.

Note:
Therefore, switching off only makes sense in very special applications that need to be clarified.

SP08 - Offset detection curve for echo analysis

The detection curve runs above the echo curve with a defined distance (offset). Only the echoes that exceed the detection curve are detected and processed.

This special parameter in " *dB*" influences the sensitivity of the device against all echoes in the measuring range.

→ An increase of the dB value reduces the sensitivity of the echo detection and signal analysis.

Note:
This affects the level echo to the same extent. Therefore, the application is only used with very strong false signals and simultaneously good reflection properties of the medium.

SP09 - Minimum measurement reliability for level echo selection

The measurement reliability is the difference between echo amplitude and detection curve. This parameter defines the required min. measurement reliability in " *dB*" an echo must have within the focussing range to be accepted as level echo.

→ By entering a minimum measurement reliability, false signals below this value are not accepted as a level echo.

SP10 - Additional reliability of false signal storage

This parameter increases the already created false signal suppression by the input value in " *dB*" over the entire, stored false signal range. It is used when it is expected that false signals such as those from product buildup, condensate formation or agitators will increase in amplitude.

→ An increase of the value avoids that such a false signal is accepted as level echo.

Note:
An increase is useful for very heavily fluctuating or amplitude-increasing false signals. It is advised against reducing the value of the default setting.

SP12 - Activate "Summarize echoes" function

This function is used to activate and select the function " *Summarize echoes*". It consists of the individual parameters " *SP13 - Amplitude difference with function "Summarize echoes""* and " *SP14 - Echo distance for function "Summarize echoes""*.

→ This helps to suppress measured value jumps resulting from material cones or emptying hoppers in bulk solids applications when filling and emptying.

SP13 - Amplitude difference in "Summarize echoes" function

This parameter in " *dB*" determines how great the maximum amplitude difference between two adjacent echoes may be in order to summarize them.

SP14 - Echo distance for "Summarize echoes" function

This parameter in " *m*" entered here determines how great the distance between the end of the first echo and the start of the second echo may be at the maximum in order for them to be summarized.

SP15 - Activate "First large echo" function

When this parameter is activated, the first echo not saved as a false echo with sufficiently great amplitude is selected as a product echo.

→ This is useful for very large multiple reflections by e.g. a round vessel lid.

SP16 - Minimum amplitude "First large echo"

This parameter in " *dB*" determines how much smaller the useful echo amplitude may be compared to the largest echo so that it is evaluated as the first large echo and thus as a product echo

→ Up to this value, a relatively weak reflection signal of the medium is thus output as a measured value.

SP17 - Wide focussing range

This parameter determines the measuring window width " *m*" around the currently measured level echo. Only within this focusing range are changes (location, amplitude, number of echoes) accepted for evaluating the current level.

→ If this value is increased, very rapid level changes, e.g. due to collapsing material heaps or surge-like filling/emptying, are accepted even in an extended range.

SP18 - Minimum measurement reliability outside focussing range

The measurement reliability is the difference in " *dB*" between echo amplitude and detection curve. This parameter defines the required

	min. measurement reliability an echo must have outside the focussing range to be accepted as useful echo. → This is useful to obtain the measured value also in case of sporadic loss of the level signal, e. g. with foam generation.
SP19 - Time for opening the focussing range	If no more reflection can be detected within the focussing range, a measuring window opens. This parameter defines the time in " *s*" until it opens. This can be the case, for example, in the event of a level change without an evaluable reflection signal or in the event of an echo outside the focussing range with a greater useful echo probability. → As a result, on reaching this echo with high useful echo probability, this is evaluated as a useful echo and output as the current level.
SP22 - Measured value offset	The reference plane for the measurement with radar sensors is the lower edge of the flange or the sealing surface of the thread. The sensors are calibrated to this reference plane at the factory. This parameter enables an adaptation of this factory setting, e.g. to subsequently attached mounting facilities such as adapter flanges, threaded adapters, etc. → A possible offset error (constant error of the measured distance over the entire measuring range) is compensated for by this input.
SP24 - Factor for additional reliability at the measuring range end	This value in " %" is additional safety below the 0 % adjustment related to the measuring range. → It supports the detection of an echo when the vessel is completely empty, even with unfavourable vessel bottom shapes.
SP HART - HART signal	This parameter serves to activate/deaxctivate the HART signal in the output.
SP SIL - Safety Integrity Level function	This parameter serves to activate/deactivate the Safety Integrity Level function.

7 Setup with smartphone/tablet (Bluetooth)

7.1 Preparations

System requirements

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

- Operating system: iOS 8 or newer
- Operating system: Android 5.1 or newer
- Bluetooth 4.0 LE or newer

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

Make sure that the Bluetooth function of the display and adjustment module is activated. For this, the switch on the bottom side must be set to " *On*".

Factory setting is " **On**".

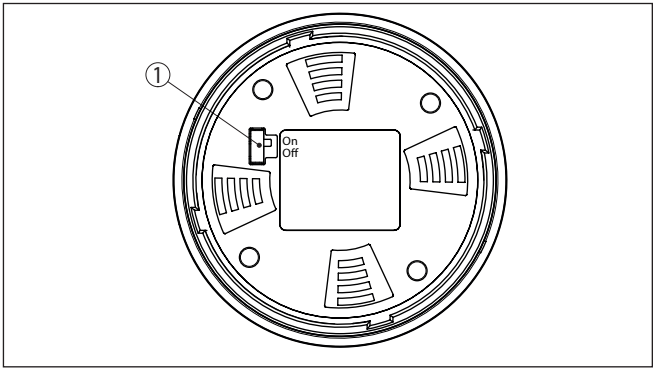


Fig. 12: Activate Bluetooth

1 Switch
On = Bluetooth active
Off = Bluetooth not active

7.2 Connecting

Connecting

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

The message " *Connecting …*" is displayed.

The devices found are listed and the search is automatically continued.

Select the requested instrument in the device list.

Authenticate

When establishing the connection for the first time, the operating tool and the sensor must authenticate each other. After the first correct authentication, each subsequent connection is made without a new authentication query.

Enter Bluetooth access code

For authentication, enter the 6-digit Bluetooth access code in the next menu window. You can find the code on the information sheet " *Pins and Codes*" in the device packaging.

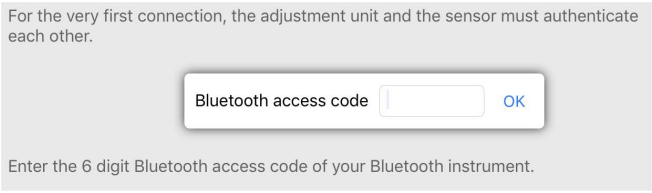


Fig. 13: Enter Bluetooth access code

Note:
If an incorrect code is entered, the code 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 tool.

If the Bluetooth connection is interrupted, e.g. due to a too large distance between the two devices, this is displayed on the adjustment tool. The message disappears when the connection is restored.

Change device code

Parameter adjustment of the device is only possible if the parameter protection is deactivated or the adjustment released. When delivered, parameter protection is deactivated by default and can be activated at any time.

It is recommended to enter a personal 6-digit device code. To do this, go to menu " *Extended functions*", " *Access protection*", menu item " *Protection of the parameter adjustment*".

7.3 Parameterization

Enter parameters

The sensor adjustment menu is divided into two areas, which are arranged next to each other or one below the other, depending on the adjustment tool.

- Navigation section
- Menu item display

The selected menu item can be recognized by the colour change.

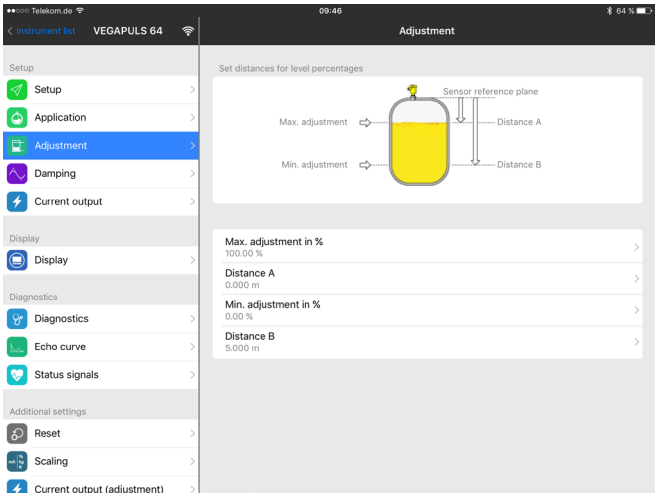


Fig. 14: Example of an app view - Setup measured values

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.

8 Menu overview

8.1 Display and adjustment module

Setup

Menu item	Parameter	Selection	Default setting
Measurement loop name			Sensor
Distance unit	Distance unit	mm, m, in, ft	m
Type of medium	Type of medium	Liquid	Liquid [5]
		Bulk solid	Bulk solid [6]
Application	Application - liquid	Storage tank, agitator tank, dosing tank, standpipe, tank/collection basin, plastic tank (measurement through tank top), mobile plastic tank (IBC), level measurement in waters, flow measurement flume/overflow, pump station/pump shaft, combined sewer overflow, demonstration	Storage tank [7]
	Application - bulk solid	Silo, bunker, crusher, heap, demonstration	Silo [8]
Vessel height			Recommended meas. range, see chapter " *Technical data*"
Distance A (max. value)	Max. value		Max. adjustment 100 % corresponds to 0,000 m
Distance B (min. value)	Min. value		Min. adjustment 0 % corresponds to 120,000 m

Extended settings

Menu item	Parameter	Selection	Basic setting
Temperature unit		°C, °F, K	°C
Damping (SIL)	Integration time	0 … 999 s	1 s

[5] Plastic horn antenna, thread with integrated antenna system, flange with encapsulated antenna system
[6] Flange with lens antenna
[7] Plastic horn antenna, thread with integrated antenna system, flange with encapsulated antenna system
[8] Flange with lens antenna

Menu item	Parameter	Selection	Basic setting
Current output (SIL)	Output value	Percent, linearized percent, filling height, distance, scaled, measurement reliability, electronics temperature, measuring rate, operating voltage	Percent
	Initial value characteristics	Initial value - characteristics (4 mA)	4 mA correspond to
	Final value characteristics	End value - characteristics (20 mA)	20 mA correspond to
	Output characteristics	0 … 100 % correspond to 4 … 20 mA	0 … 100 % correspond to 4 … 20 mA
		0 … 100 % correspond to 20 … 4 mA	
	Current range	4 … 20 mA	4 … 20 mA
		3.8 … 20.5 mA	
	Reaction when malfunctions occur	≤ 3.6 mA, ≥ 21 mA, last valid measured value	≤ 3.6 mA
	Reaction in case of fault (SIL)	≤ 3.6 mA, ≥ 21 mA	≤ 3.6 mA
Current output 2	Output value	Percent, linearized percent, filling height, distance, scaled, measurement reliability, electronics temperature, measuring rate, operating voltage	Percent
	Initial value characteristics	Initial value - characteristics (4 mA)	4 mA correspond to
	Final value characteristics	End value - characteristics (20 mA)	20 mA correspond to
	Output characteristics	0 … 100 % correspond to 4 … 20 mA	0 … 100 % correspond to 4 … 20 mA
		0 … 100 % correspond to 20 … 4 mA	
	Current range	4 … 20 mA	4 … 20 mA
		3.8 … 20.5 mA	
	Reaction when malfunctions occur	≤ 3.6 mA, ≥ 21 mA, last valid measured value	≤ 3.6 mA
Linearisation	Linearization type - liquid	Linear, cylindrical tank, spherical tank, Venturi, trapezoidal weir, rectangular weir, Palmer-Bowlus flume, V-Notch, triangular overfall	Linear
	Linearization type - bulk solids	Linear, conical bottom, pyramid bottom, sloping bottom	Linear
	Intermediate height "h"		
Scaling	Scaling size	Scaling size (dimensionless, mass, volume, height, pressure, flow, others)	Dimensionless
		Scaling unit (unit selection depending on scaling size, user-defined)	-
	Scaling format	#, #.#, #.##, #.###, #.####	#
	Scaling	Scaling	100 % correspond to 0 % correspond to

66445-EN-230524

Menu item	Parameter	Selection	Basic setting
Indication	Menu language	German, English, French, Spanish, Portuguese, Italian, Dutch, Russian, Chinese, Japanese, Turkish, Polish	Order-specific
	Presentation	One measured value, measured value and bargraph, two measured values	One measured value
	Displayed values 1, 2	Percent, linearized percent, filling height, distance, scaled, measurement reliability, electronics temperature, current output, current output 2	Percent
	Backlight	On, Off	On
False signal suppression (SIL)	False signal suppression	Create new, expand, delete all	-
Date/Time	Date/Time	Date	Actual date
		Format: 24 h, 12 h	24 h
		Time	Actual time
HART mode	HART address	0 … 63	0
	Output mode	Analogue current output with HART, fix current (4 mA) with HART	Analogue current output with HART
Mode	Mode	Mode 1: EU, Albania, Andorra, Azerbaijan, Australia, Belarus, Bosnia and Herzegovina, Canada, Liechtenstein, Moldavia, Monaco, Montenegro, New Zealand, Northern Macedonia, Norway, San Marino, Saudi Arabia, Serbia, Switzerland, Turkey, Ukraine, United Kingdom, USA Mode of operation 2: Brazil, Japan, South Korea, Taiwan, Thailand Mode of operation 3: India, Malaysia, South Africa Mode 4: Russia	Mode 1
	Energy supply	Permanent voltage supply	Permanent voltage supply
		Not permanent voltage supply	
Copy instrument settings		Read from sensor, store in sensor	-

Reset

Menu item	Parameter	Selection	Default setting
Reset	Reset	Reset to factory settings, Restart	-

9 Supplement

9.1 Technical data

Note for approved instruments

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

All approval documents can be downloaded from our homepage.

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

Options of the cable entry

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

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

Wire cross-section (spring-loaded terminals)

- Massive wire, stranded wire — 0.2 … 2.5 mm² (AWG 24 … 14)
- Stranded wire with end sleeve — 0.2 … 1.5 mm² (AWG 24 … 16)

Output variable - Second current output

Output signal	4 … 20 mA (passive)
Range of the output signal	3.8 … 20.5 mA (default setting)
Signal resolution	0.3 µA
Fault signal, current output (adjustable)	≤ 3.6 mA, ≥ 21 mA, last valid measured value
Max. output current	22 mA
Starting current	≤ 3.6 mA; ≤ 10 mA for 5 ms after switching on
Load	see load diagram under Power supply
Damping (63 % of the input variable), adjustable	0 … 999 s

Voltage supply, sensor

Operating voltage U_B	12 … 35 V DC
Operating voltage U_B with lighting switched on	18 … 35 V DC
Reverse voltage protection	Integrated

Permissible residual ripple	
– for 12 V < U_B < 18 V	≤ 0.7 V_{eff} (16 … 400 Hz)
– for 18 V < U_B < 35 V	≤ 1 V_{eff} (16 … 400 Hz)
Load resistor	
– Calculation	(U_B - U_{min})/0.022 A
– Example - U_B= 24 V DC	(24 V - 12 V)/0.022 A = 545 Ω

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