Quick setup guide

Radar sensor for continuous level measurement of liquids and bulk solids

VEGAPULS 6X

PROFINET, Modbus TCP, OPC UA (Ethernet-APL)

Document ID: 1048085

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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 - PROFINET, Modbus TCP, OPC UA (Ethernet-APL): Document-ID 1034189
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1 For your safety

1.1 Authorised personnel

All operations described in this documentation must be carried out only by trained and authorized personnel.

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 this document 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 operating company 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 operating company has to implement suitable measures to make sure the instrument is functioning properly.

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

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

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1.5 Mode of operation - Radar signal

Country or region 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 or region.

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 (NEC - NFPA 70) (USA).

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

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

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2 Product description

2.1 Configuration

Type label

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

- Instrument type
- Information about approvals
- Configuration information
- Technical data
- Serial number of the instrument
- QR code for device identification
- Numerical code for Bluetooth access (optional)
- Manufacturer information

Documents and software

To find order data, documents or software related to your device, you have the following options:

- Move to "www.vega.com" and enter in the search field the serial number of your instrument.
- Scan the QR code on the type label.
- Open the VEGA Tools app and enter the serial number under "***Documentation***".

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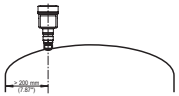
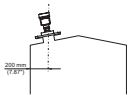
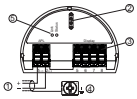
3 Setup - the most important steps

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
	

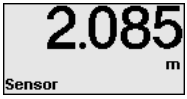
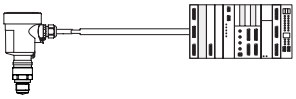
Select adjustment

Display and adjustment module	VEGA Tools app[1)]	Ethernet-APL, Browser, PACTware, FDI-Package
		

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:

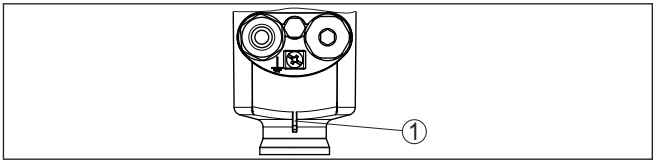


Fig. 1: Position of the polarisation

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.

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)]

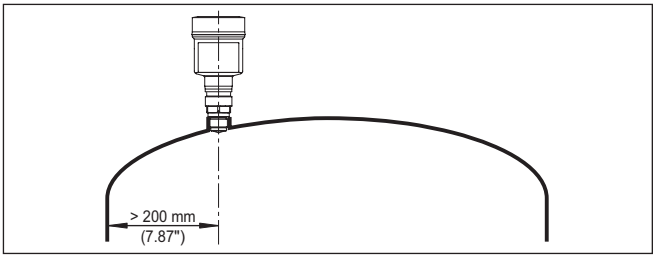


Fig. 2: Mounting of the radar sensor on round vessel tops

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.

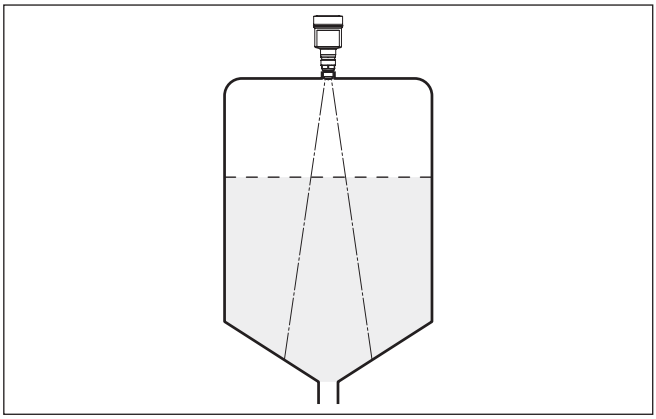


Fig. 3: Mounting of the radar sensor on vessels with conical bottom

Mounting position - bulk solids

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

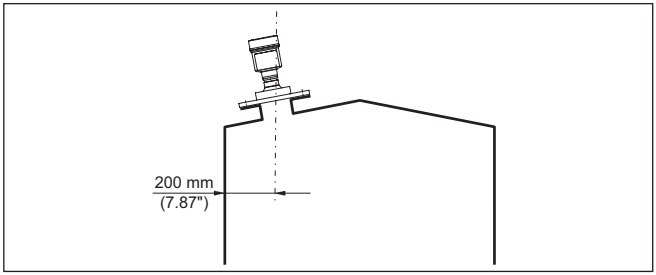


Fig. 4: Mounting the radar sensor on the vessel top

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

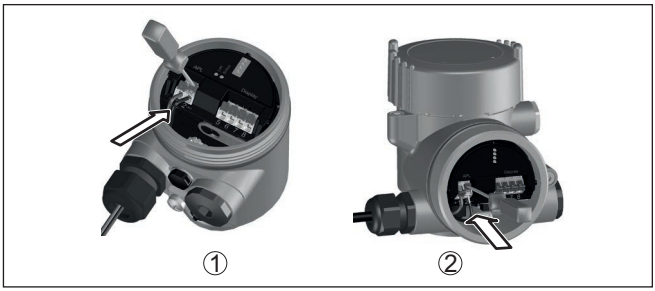


Fig. 5: Connection steps 5 and 6

1 Single chamber housing
2 Double chamber housing

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

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

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The electrical connection is finished.

5.2 Wiring plan, single chamber housing

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

Electronics and connection compartment

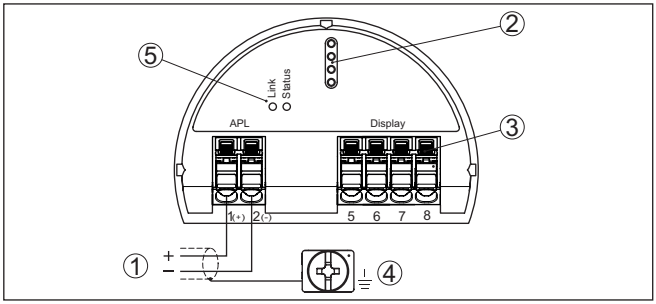

Fig. 6: Electronics and connection compartment - single chamber housing

1 *Voltage supply, signal output*
2 *For display and adjustment module or interface adapter*
3 *For external display and adjustment unit*
4 *Ground terminal for connection of the cable screening*
5 *APL status LEDs*

LED	Function
Link	Lights green: Connection established
	Flashes green: RX/TX activity
Status	Device status (according to NE 107) - flashes orange: PROFINET device localisation by means of DCP "*Service Identify*" active

5.3 Wiring plan, double chamber housing

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

Electronics compartment

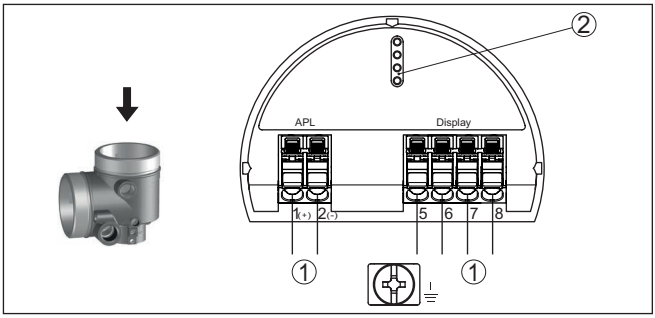

Fig. 7: Electronics compartment - double chamber housing

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

Connection compartment

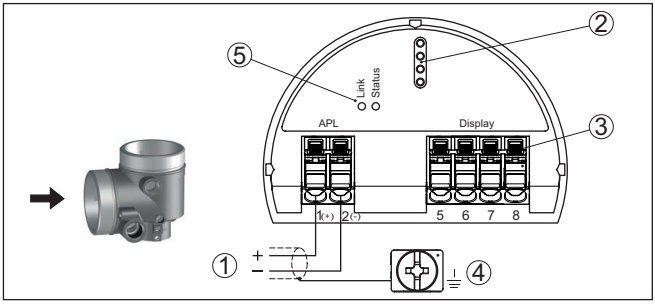

Fig. 8: Electronics and connection compartment - single chamber housing

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

LED	Function
Link	Lights green: Connection established
	Flashes green: RX/TX activity
Status	Device status (according to NE 107) - flashes orange: PROFINET device localisation by means of DCP "*Service Identify*" active

5.4 Switch-on phase

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

- Internal check of the electronics
- Status LED lights red
- Output signal is set to failure

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

6 Set up with web server

6.1 Preparations

System requirements

Supported browsers are:

- Chrome
- Edge
- Firefox
- Safari

Note:
The browser version must not be older than two years and JavaScript must be activated.

6.2 Connecting

Connecting

Start the browser and enter the IP address of the sensor.

The IP address is set to "*192.168.0.110*" and the subnet mask to "*255.255.255.0*" at the factory.

Information:
You can find the IP address in the display and adjustment module under the menu item "*LAN/Internet*".

Authenticate

The network access code must be entered the first time the connection is established.

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

Connected

Once the connection has been established, the user interface of the sensor appears in the browser.

6.3 Parameter adjustment

Enter parameters

The sensor adjustment menu is divided into three section:

- Header with status and current measured values
- Navigation section
- Menu item display

The selected menu item is indicated by the colour change in the navigation area.

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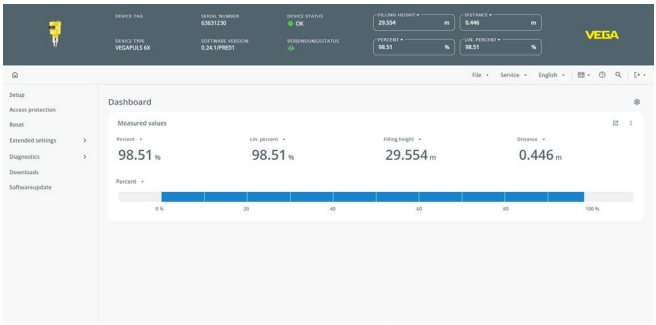


Fig. 9: Example of an adjustment menu view - Start page

Enter the desired parameters. Press the "*Accept*" button to transfer the entries to the sensor. The entries are now active in the sensor.

Close the browser to terminate connection.

7 Set up with the display and adjustment module

7.1 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.

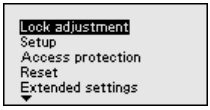
Note:
If you intend to retrofit the instrument with a display and adjustment module for continuous measured value indication, a higher lid with an inspection glass is required.

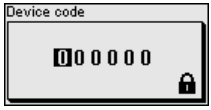
7.2 Parameter adjustment

7.2.1 Lock/Unlock adjustment

Lock/Unlock adjustment

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





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 other systems is also blocked.

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

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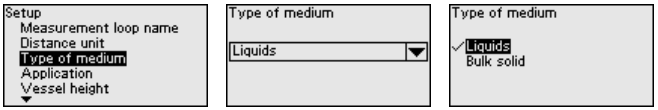
7.2.2 Setup

Type of medium

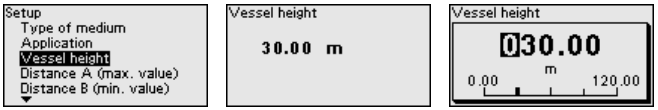
This menu item allows you to adapt the sensor to the different measuring conditions of the media "*Liquid*" or "*Bulk solid*".

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



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:

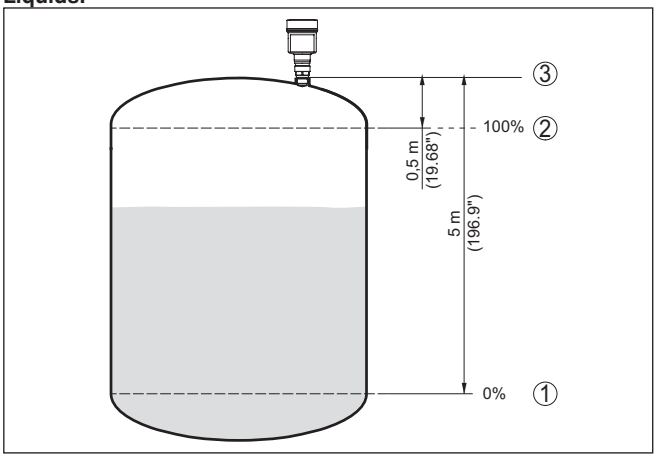


Fig. 10: Parameterisation example min./max. adjustment - liquids

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

Bulk solids:

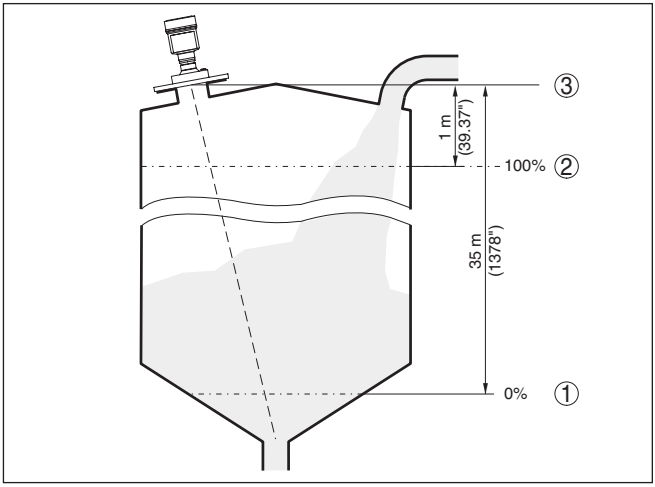


Fig. 11: Parameterisation example min./max. adjustment - bulk solids

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 %.

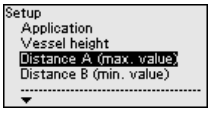
The starting point for these distance specifications is always the reference plane, e.g. the sealing surface of the thread or flange. Information on the reference plane can be found in the chapters "*Mounting instructions*" resp. "*Technical data*". The actual filling height is then calculated on the basis of these entries.

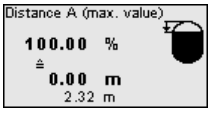
The actual product level during this adjustment is not important, because the min./max. adjustment is always carried out without changing the product level. These settings can be made ahead of time without the instrument having to be installed.

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]***.

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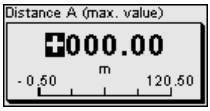
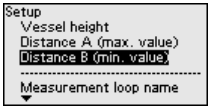


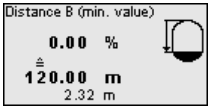
4. Move with ***[ESC]*** and ***[->]*** to the min. adjustment

Distance B (min. value)

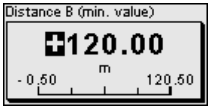
Proceed as follows:

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





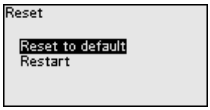
2. Edit the distance value with ***[OK]*** and set the cursor to the requested position with ***[->]***.
3. Set the requested distance value for 0 % (e.g. distance from the sensor up to the vessel bottom) with ***[+]*** and save with ***[OK]***. The cursor now jumps to the distance value.

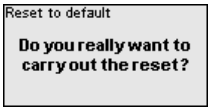


7.2.3 Reset

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.

4) The event and parameter change memories are maintained.

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

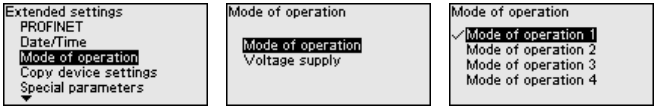
- The signal output outputs the set false signal.
- The Asset-Management function outputs the message "*Maintenance*" aus

7.2.4 Extended settings

Mode

This menu item contains operational settings of the sensor.

Mode:
Country or region-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, South-Africa, Switzerland, Turkey, Ukraine, United Kingdom, USA
- Mode of operation 2: Brazil, Japan, South Korea, Taiwan, Thailand
- Mode of operation 3: India, Malaysia
- 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*").

8 Set up with Smartphone/tablet

8.1 Preparations

System requirements

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

- Operating system: iOS 13 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**".

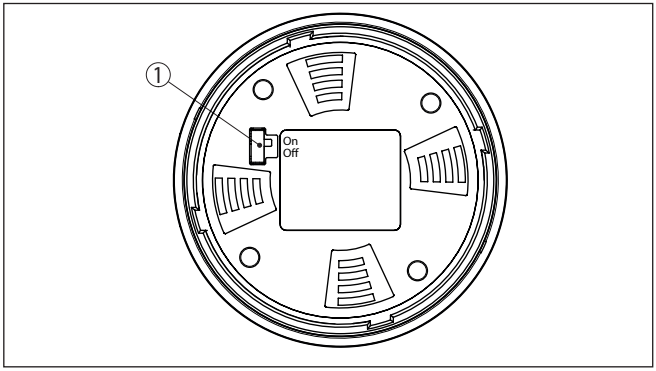


Fig. 12: Activate Bluetooth

1 Switch
On = Bluetooth active
Off = Bluetooth not active

8.2 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.

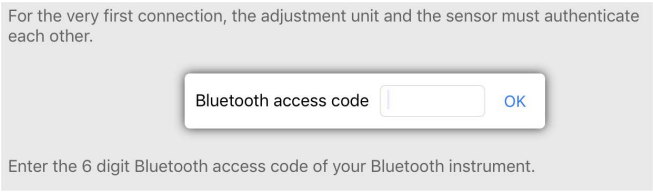


Fig. 13: Enter Bluetooth access code

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*".

8.3 Parameter adjustment

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.

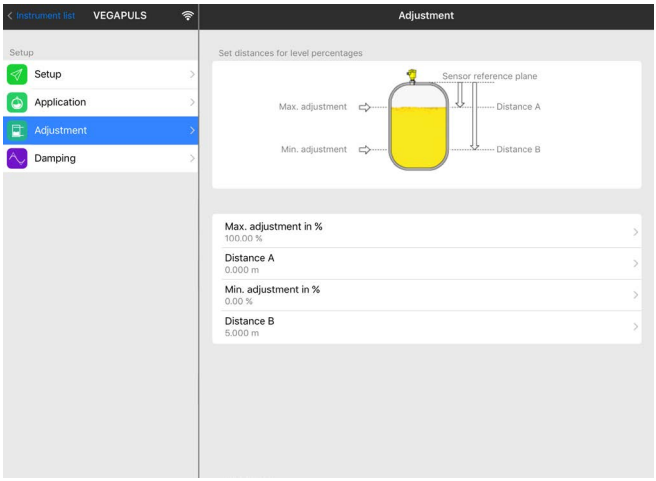


Fig. 14: Example of an app view - Setup measured values

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.

9 Menu overview

9.1 Functions and adjustment possibilities

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	Default setting
Temperature unit		°C, °F, K	°C
Damping	Integration time	0 … 999 s	0 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

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Menu item	Parameter	Selection	Default setting
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
Indication	Menu language	German, English, French, Spanish, Portuguese, Italian, Dutch, Russian, Chinese, Japanese, Turkish, Polish, Czech	Language is set with the first operation.
	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	Percent
	Backlight	On, Off	On
False signal suppression	False signal suppression	Create new, expand, delete all	-
LAN/Internet	Hostname	Hostname	-
	DHCP	OFF, ON	OFF
	IP address	-	192.168.0.110
	Subnet mask	-	255.255.255.0
	Standard gateway	-	0.0.0.0
Network services	Web server	OFF, ON	ON
	PROFINET	OFF, ON	ON
	MODBUS TCP	OFF, ON	ON
	OPC UA	OFF, ON	ON
	DTM over TCP	OFF, ON	ON
	ICMP	OFF, ON	ON
	Device Discovery	OFF, ON	ON
PROFINET	PROFINET-device name	-	-
Date/Time	Date/Time	Date	Actual date
		Format: 24 h, 12 h	24 h
		Time	Actual time

Menu item	Parameter	Selection	Default setting
Mode	Mode	Mode 1: EU, Albania, Andorra, Azerbaijan, Australia, Belarus, Bosnia and Herzegovina, Canada, Liechtenstein, Moldavia, Monaco, Montenegro, Morocco, New Zealand, Northern Macedonia, Norway, San Marino, Saudi Arabia, Serbia, South-Africa, Switzerland, Turkey, Ukraine, United Kingdom, USA Mode of operation 2: Brazil, Japan, South Korea, Taiwan, Thailand Mode of operation 3: India, Malaysia Mode 4: Russia	Mode 1
Copy instrument settings		Read from sensor, store in sensor	-
Special parameters	See separate menu overview at the end oc the chapter "*Menu overview*" of the operating instructions.		

Reset

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

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10 PROFINET system integration

10.1 Instrument master file (GSD)

For the configuration of a PROFINET controller (e.g. Siemens SPS) you require the manufacturer-specific PROFINET device master file (GSD file) of VEGAPULS 6X or the Profil-GSD file for LEVEL_RADAR.

VEGA GSD file

The manufacturer-specific GSD file can be downloaded directly from the VEGAPULS 6X using the integrated web server or via our download area.

File name (example): GSDML-V2.43-VEGA-VEGAPULS6X-20231220.xml

Manufacturer ID (VEGA): 0x0062 (=98)

Device ID (VEGAPULS 6X): 0x4754 (=18260)

Profil-GSD file

The Profil-GSD file for the "*PROFINET PA Profile LEVEL_RADAR*" can be downloaded directly from the PROFINET-International (PI) website if it is not pre-installed in the controller.

File name (example): GSDML-V2.43-PA_Profile_V4.02-B321-LEVEL_RADAR-20230217.xml

PROFIL-ID: 0xB321 (=45857)

10.2 Set the IP address in the device

The default setting for the IP address, Subnet mask and standard gateway is "*192.168.0.110/24*".

The IP address can be set in the device in different ways:

- Dynamic Configuration Protocol (DCP): The IP address is assigned to the sensor using a configuration tool that supports DCP, e.g. Siemens STEP 7 or Siemens PRONETA
- On-site adjustment with PLICSCOM: Menu item "*LAN/Internet*"
- Adjustment software VEGA Tools app, PACTware/DTM, web server: menu item "*LAN/Internet*"
- DHCP: The IP address is assigned by a DHCP server in the network (DHCP mode must be activated in the sensor)

Note:
The IP address is accepted immediately after a change!

10.3 PROFINET-device name

The PROFINET device name is used to uniquely identify a device in the PROFINET network. As a rule, the device name is often set when the device is first commissioned and then remains the same for the lifetime of the device in the network (in contrast to the IP address, which can be changed as required).

The factory setting for the PROFINET device name is "empty" (i.e. "not defined"). The PROFINET device name is assigned using the configuration tool of the PROFINET controller (e.g. Siemens STEP 7,

TIA or PRONETA). The set device name can be called up in on-site adjustment or the operating software (menu item "*Diagnosis*" > "*PROFINET information*").

10.4 Device identification with DCP

By means of the "*Discovery Configuration Protocol*" a PROFINET device can be identified with the "*Service Identify*".

If the identification is activated in VEGAPULS 6X (e.g. with Siemens PRONETA), the status LED flashes orange.

10.5 Cyclical data traffic

The sensor provides the controller with measured value data cyclically. The data is seen from the perspective of the controller (PLC), i.e. the sensor provides the controller with input data and the data is sent from the sensor to the controller. The sensor has no output data, i.e. the controller cannot send any cyclical data to the sensor.

Which modules are available depends on whether the manufacturer-specific GSD file or the LEVEL_RADAR Profil-GSD file (see chapter "*Device master file (GSD)*") is used.

Input data (modules) can be communicated cyclically:

AnalogInput	Slot	VEGA-GSD	PROFIL-GSD	Measured value
Level	1	√	√	Filling height
Distance	2	√	√	Distance value
Volume	3	√	√	Scaled value
Percent	11	√	-	Percentage value
Linearized percent	12	√	-	Linearised percentage value

Additional Measurement	Slot	VEGA-GSD	PROFIL-GSD	Measured value
Measurement Reliabiltiy	13	√	-	Measurement reliability
Electronic Temperature	14	√	-	Electronics temperature
Measurement Rate	15	√	-	Measuring rate
Operating Voltage	16	√	-	Operating voltage
APL-SNR	17	√	-	APL signal-to-noise-ratio

AnalogInput

The measured values in the module "*AnalogInput*" each consist of five bytes; in the first four bytes, the measured value is transmitted as a floating point number in the IEEE 754 standard. The fifth byte contains the corresponding status.

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Byte-No.	1	2	3	4	5
Format	IEEE-754-Floating point value				Status

Fig. 15: Module AnalogInput

Additional Measurement

The additional measured values in the module "*Additional Measurement*" each consist of seven bytes. In the first four bytes (Additional VALUE), the measured value is transmitted as a floating point number in the IEEE 754 standard. The fifth byte (Additional STATUS) contains the corresponding status. The unit is transmitted in bytes six and seven (Additional UNIT).

Coding: IEEE 754 format

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

Coding: Status byte

The status byte is coded acc. to profile 4.02 "<ph type="bold"><hervorhebung typ="kursiv"></ph>Profile for Process Control Devices<ph></hervorhebung></ph>". The status "*Measured value OK*" is coded as 80 (hex) (Bit7 = 1, Bit6 … 0 = 0).

Coding: Unit

The unit is coded acc. to profile 4.02 "*Profile for Process Control Devices*". The distance unit "m" corresponds for example to decimal value "*1010*".

10.6 I&M data

I&M data stands for "*Identification & Maintenance data*". This data can be read or written from the sensor using acyclic data exchange and helps to identify and maintain devices in a PROFINET network.

The VEGAPULS 6X supports the data "*I&M 0 … 3*" acc. to the profile 4.02 "*Profile for Process Control Devices*".

IM0	Main function	HW/FW version
IM1	TAG_FUNCTION TAG_LOCATION	Plant identifier Location identifier
IM2	INSTALLATION_DATE	Installation date
IM3	DESCRIPTOR	Comment

10.7 Startup parameter

Depending on the setting of the parameter "*Startup settings*", the startup parameters or only some of the startup parameters are written to the sensor by the controller (PLC) at startup.

Note:
By default, no startup parameters are written to the sensor.

10.8 System redundancy S2

PROFINET system redundancy S2 is a safety function in the PROFINET network that aims to increase the reliability and availability of automation systems. With this redundancy method, two identical control systems (PLCs) are operated in parallel. In the event of a failure or

error in one control system, the other system seamlessly takes over control of the connected devices and processes without any interruption or loss of process data. This type of redundancy is particularly important in critical applications where downtime must be minimised, such as in the process industry or in power plants.

Note:
The VEGAPULS 6X supports the PROFINET system redundanc S2, there are no additional settings in the sensor necessary.

11 MODBUS TCP

11.1 MODBUS in TCP/IP networks

MODBUS TCP is the extension of the MODBUS protocol for use in TCP/IP networks. It uses the TCP/IP protocol for the transmission of Modbus messages. This means that Modbus data is embedded in TCP packets and sent via IP networks. A Modbus TCP server is integrated in the VEGAPULS 6X, whose data can be read and accessed with a Modbus TCP host (e.g. PLC).

Note:
The MODBUS TCP server must be activated in the device (menu item "*Extended settings*" - "*Network services*"). In addition, a suitable IP address must be set for the network (see chapter "*Setting the IP address in the device*").

Note:
You can find further information to Modbus on www.modbus.org.

11.2 Function codes

The function codes (FC) are used by the Modbus TCP host to access the data of the Modbus TCP server (VEGAPULS 6X). The following function codes are supported:

- FC4 Read Input register (reading 16-bit registers)
- FC8 Diagnostics (reading of diagnosis values)

FC4 Read Input-Register With this command, any number (1-127) of input registers is read out. The start register, from which the readout should start, and the number of registers are transmitted.

	Parameter	Length	Code/Data
Request:	Function Code	1 Byte	0x04
	Start Address	2 Bytes	0x0000 to 0xFFFF
	Number of Registers	N*2 Bytes	1 to 127 (0x7D)
Response:	Function Code	1 Byte	0x04
	Byte count	1 Byte	2*N
	Register Value	N*2 Bytes	Data

FC8 Write Single-Register This function code is used to write to a single Holding Register.

	Parameter	Length	Code/Data
Request:	Function Code	1 Byte	0x06
	Start Address	2 Bytes	0x0000 to 0xFFFF
	Number of Registers	2 Bytes	Data

	Parameter	Length	Code/Data
Response:	Function Code	1 Byte	0x04
	Start Address	2 Bytes	2*N
	Register Value	2 Bytes	Data

Sub Function Code	Name
0x00	Return Data Request
0x0B	Return Message Counter

With sub function codes 0x00 only one 16 bit value can be written.

11.3 Input register

The following input registers of the sensor can be read out with the function code FC04 (reading 16-bit registers):

Value	Modbus register	Description
Device State	100	Device Namur State
Level (Filling height)		
Value	110, 111	IEEE 754 Format
Unit Level	112	Profibus Unit Codes
Status Level	113	VEGA-State
Distance		
Value	114, 115	IEEE 754 Format
Unit Distance	116	Profibus Unit Codes
Status Distance	117	VEGA-State
Scaled		
Value	118, 119	IEEE 754 Format
Unit Scaled	120	Profibus Unit Codes
Status Scaled	121	VEGA-State
Percent		
Value	122, 123	IEEE 754-Format
Unit Percent	124	Profibus Unit Codes
Status Percent	125	VEGA-State
Lin Percent		
Value	126, 127	IEEE 754 Format
Unit Lin Percent	128	Profibus Unit Codes
Status Lin Percent	129	VEGA-State
Measurement reliability		
Value	130, 131	IEEE 754 Format
Unit Measurement reliability	132	Profibus Unit Codes

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Value	Modbus register	Description
Status Measurement reliability	133	VEGA-State
Electronic temperature		
Value	134, 135	IEEE 754 Format
Unit Electronic temperature	136	Profibus Unit Codes
Status Electronic temperature	137	VEGA-State
Measurement rate		
Value	138, 139	IEEE 754 Format
Unit Measurement rate	140	Profibus Unit Codes
Status Measurement rate	141	VEGA-State
Operating voltage		
Value	142, 143	IEEE 754 Format
Unit Operating voltage	144	Profibus Unit Codes
Status Operating voltage	145	VEGA-State
APL-SNR		
Value	146, 147	IEEE 754 Format
Unit APL-SNR	148	Profibus Unit Codes
Status APL-SNR	149	VEGA-State

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12 OPC UA

An OPC UA (Open Platform Communications Unified Architecture) server is a software server that is used in industrial automation systems to provide device data. This data is then transmitted to OPC UA clients in a standardised format via the OPC UA protocol. The OPC UA standard enables secure, platform-independent and interoperable data transmission, making it ideal for modern industrial IoT applications.

The following data of the PA-DIM information model can be accessed:

Node Name (PADIM Type)	**Parameter**
AssetId	Sensor-TAG
DeviceHealth	Device Namur State
HardwareRevision	Device Hardware version
Manufacturer	„VEGA Grieshaber KG“
Model	Device Name
ProductCode	Device Ordernumber
SerialNumber	Device Serialnumber
SoftwareRevision	Device Software version
URI of Manufacturer	„http://www.vega.com“
URI of Product instance	Link to VEGA Serialnumbersearch

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13 Supplement

13.1 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.

PROFINET protocol	
Conformity class	Conformance Class B
Mains load class	Netload Class II
Cycle time	≥ 64 ms
System redundancy	System redundancy S2 (2 AR with 1 NAP)
Device profile	Profile 4.02 "Profile for Process Control Devices"
Manufacturer ID	0 x 62
Supported connections	2 x AR (IO Controller AR)
	1 x AR (IO-Supervisor Device AR connection allowed)
	1 x Input CR (Communication Relation)

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)

Voltage supply, sensor

Operating voltage U_B	9.6 … 15 V DC
Reverse voltage protection	Integrated

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