



## Product information

### Radar

Level measurement in liquids and bulk solids

VEGAPULS C 11  
VEGAPULS C 21  
VEGAPULS C 22  
VEGAPULS C 23  
VEGAPULS 11  
VEGAPULS 21  
VEGAPULS 31



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### Take note of safety instructions for Ex applications



Please note the Ex specific safety information that you can find at [www.vega.com](http://www.vega.com) and that comes with each instrument. In hazardous areas you should take note of the appropriate regulations, conformity and type approval certificates of the sensors and power supply units. The sensors must only be operated on intrinsically safe circuits. The permissible electrical values are stated in the certificate.

# 1 Measuring principle

## Measuring principle

The devices emit a continuous radar signal through their antennas. The emitted signal is reflected by the medium and received as an echo by the antenna.

The frequency difference between the emitted and received signal is proportional to the distance and depends on the filling height. The determined filling height is converted into a respective output signal and output as measured value.

## 80 GHz technology

The 80 GHz technology used enables a unique focusing of the radar beam and a wide dynamic range of the radar sensors. The greater the dynamic range of a radar sensor, the wider its application spectrum and the higher its measurement reliability.

## Advantages

Non-contact radar technology is characterized by extremely high measurement accuracy. The measurement is influenced neither by fluctuating product features nor by changing process conditions such as temperature, pressure or strong dust generation. The user-friendly adjustment without vessel filling and emptying saves time.

## Input variable

The measured variable is the distance between the antenna edge of the sensor and the medium surface. The antenna edge is also the reference plane for the measurement.

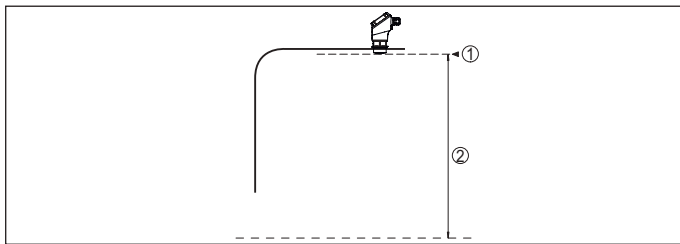


Fig. 1: Data of the input variable

- 1 Reference plane
- 2 Measured variable, max. measuring range

## 2 Type overview

VEGAPULS C 11



VEGAPULS C 21



VEGAPULS C 22



<b>Applications</b>	Water processing, pump stations, storm water overflow tank, level monitoring	Water processing, pump stations, storm water overflow tank, flow measurement in open flumes, level monitoring	Water processing, pump stations, storm water overflow tank, flow measurement in open flumes, level monitoring
<b>Max. measuring range</b>	8 m (26.25 ft)	15 m (49.21 ft)	15 m (49.21 ft)
<b>Antenna/Material</b>	Integrated antenna system/PVDF encapsulated	Integrated antenna system/PVDF encapsulated	Integrated antenna system/PVDF encapsulated
<b>Beam angle</b>	8°	8°	8°
<b>Process fitting</b>	G1½, 1½ NPT, R1½	G1½, 1½ NPT, R1½	G1½, 1½ NPT, R1½
<b>Material</b>	PVDF	PVDF	PVDF
<b>Connection for mounting strap</b>	G1, 1 NPT, R1	G1, 1 NPT, R1	G1½, 1½ NPT, R1½
<b>Process temperature</b>	-40 ... +60 °C (-40 ... +140 °F)	-40 ... +80 °C (-40 ... +176 °F)	-40 ... +80 °C (-40 ... +176 °F)
<b>Process pressure</b>	-1 ... +3 bar/-100 ... +300 kPa (-14.5 ... +43.51 psi)	-1 ... +3 bar/-100 ... +300 kPa (-14.5 ... +43.51 psi)	-1 ... +3 bar/-100 ... +300 kPa (-14.5 ... +43.51 psi)
<b>Deviation</b>	≤ 5 mm	≤ 2 mm	≤ 2 mm
<b>Frequency range</b>	W-band	W-band	W-band
<b>Signal output</b>	<ul style="list-style-type: none"> <li>Two-wire 4 ... 20 mA</li> </ul>	<ul style="list-style-type: none"> <li>Two-wire 4 ... 20 mA/HART</li> <li>SDI-12</li> <li>Modbus</li> </ul>	<ul style="list-style-type: none"> <li>Two-wire 4 ... 20 mA/HART</li> <li>SDI-12</li> <li>Modbus</li> </ul>
<b>Communication interface</b>	Bluetooth	Bluetooth	Bluetooth
<b>Indication/Adjustment</b>	-/Via app on smartphone or tablet and Bluetooth	-/Via app on smartphone or tablet and Bluetooth	-/Via app on smartphone or tablet and Bluetooth
<b>Approvals <sup>1)</sup></b>	-	<ul style="list-style-type: none"> <li>c-UL-us, EAC, RCM</li> <li>ATEX/IEC</li> <li>EAC/SEPRO</li> <li>NEPSI/CCOE/TIIS/KOSHA</li> <li>INMETRO/IA</li> </ul>	<ul style="list-style-type: none"> <li>c-UL-us, EAC, RCM</li> <li>ATEX/IEC</li> <li>EAC/SEPRO</li> <li>NEPSI/CCOE/TIIS/KOSHA</li> <li>INMETRO/IA</li> </ul>

<sup>1)</sup> Available or applied for

VEGAPULS C 23



VEGAPULS 11



VEGAPULS 21



VEGAPULS 31



Water processing, pump stations, storm water overflow tank, flow measurement in open flumes, level monitoring	Water treatment, storage tanks in all industrial areas, plastic tanks (measurement through the tank wall)	Water treatment, storage tanks in all industrial areas, plastic tanks (measurement through the tank wall)	Water treatment, storage tanks in all industrial areas, plastic tanks (measurement through the tank wall)
30 m (98.43 ft)	8 m (26.25 ft)	15 m (49.21 ft)	15 m (49.21 ft)
Integrated antenna system/PVDF encapsulated	Integrated antenna system/PVDF encapsulated	Integrated antenna system/PVDF encapsulated	Integrated antenna system/PVDF encapsulated
4°	8°	8°	8°
-	G1½, 1½ NPT, R1½ PVDF	G1½, 1½ NPT, R1½ PVDF	G1½, 1½ NPT, R1½ PVDF
G1, 1 NPT, R1	G1½, 1½ NPT, R1½	G1½, 1½ NPT, R1½	G1½, 1½ NPT, R1½
-40 ... +80 °C (-40 ... +176 °F)	-40 ... +60 °C (-40 ... +140 °F)	-40 ... +80 °C (-40 ... +176 °F)	-40 ... +80 °C (-40 ... +176 °F)
-1 ... +3 bar/-100 ... +300 kPa (-14.5 ... +43.51 psi)	-1 ... +3 bar/-100 ... +300 kPa (-14.5 ... +43.51 psi)	-1 ... +3 bar/-100 ... +300 kPa (-14.5 ... +43.51 psi)	-1 ... +3 bar/-100 ... +300 kPa (-14.5 ... +43.51 psi)
≤ 2 mm	≤ 5 mm	≤ 2 mm	≤ 2 mm
W-band	W-band	W-band	W-band
<ul style="list-style-type: none"> <li>Two-wire 4 ... 20 mA/HART</li> <li>SDI-12</li> <li>Modbus</li> </ul>	<ul style="list-style-type: none"> <li>Two-wire 4 ... 20 mA</li> </ul>	<ul style="list-style-type: none"> <li>Two-wire 4 ... 20 mA/HART</li> </ul>	<ul style="list-style-type: none"> <li>Two-wire 4 ... 20 mA/HART</li> </ul>
Bluetooth	Bluetooth	Bluetooth	Bluetooth
-/Via app on smartphone or tablet and Bluetooth	-/Via app on smartphone or tablet and Bluetooth	-/Via app on smartphone or tablet and Bluetooth	Integrated display and adjustment unit/ Via app on smartphone or tablet and Bluetooth
<ul style="list-style-type: none"> <li>c-UL-us, EAC, RCM</li> <li>ATEX/IEC</li> <li>EAC/SEPRO</li> <li>NEPSI/CCOE/TIIS/KOSHA</li> <li>INMETRO/IA</li> </ul>	-	<ul style="list-style-type: none"> <li>c-UL-us, EAC, RCM</li> <li>ATEX/IEC</li> <li>EAC/SEPRO</li> <li>NEPSI/CCOE/TIIS/KOSHA</li> <li>INMETRO/IA</li> </ul>	<ul style="list-style-type: none"> <li>c-UL-us, EAC, RCM</li> <li>ATEX/IEC</li> <li>EAC/SEPRO</li> <li>NEPSI/CCOE/TIIS/KOSHA</li> <li>INMETRO/IA</li> </ul>

### 3 Instrument selection

#### Application area

The radar sensors of the VEGAPULS 10, 20, 30 series described here are used for non-contact level measurement of liquids and bulk solids. They can be used in both simple and aggressive liquids. The sensors also measure light and heavy bulk solids absolutely reliably, both with strong dust and noise generation and independent of buildup or condensation.

#### Device overview

##### VEGAPULS C 11

VEGAPULS C 11 is the ideal sensor for non-contact level measurement in simple applications where a high degree of protection is required. It is particularly suitable for use in water treatment, pumping stations, rain overflow basins and level monitoring.

##### VEGAPULS C 21, C 22, C 23

VEGAPULS C 21, C 22, C 23 are the ideal sensors for non-contact level measurement in simple applications where a high degree of protection is required. They are particularly suitable for use in water treatment, pumping stations and rain overflow basins, for flow measurement in open channels and level monitoring.

##### VEGAPULS 11, 21, 31

VEGAPULS 11, 21, 31 are the ideal sensors for non-contact level measurement in simple applications. They are particularly suitable for use in water treatment, storage tanks with acids, lyes and additives in all industrial areas, or for measuring levels in plastic tanks from the outside through the tank wall.

#### Configuration and housing protection classes

The radar sensors of series VEGAPULS 10, 20, 30 are available in different designs, housing protection classes and connection techniques. The following illustrations show typical examples.

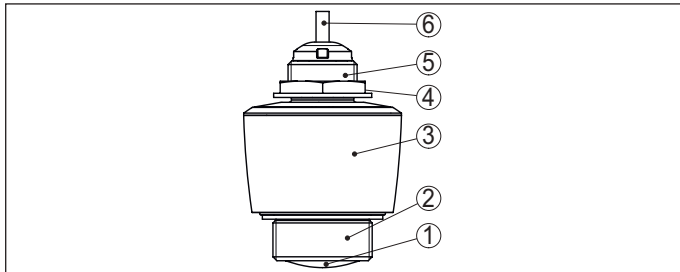


Fig. 2: VEGAPULS C 11 with direct cable outlet in protection rating IP66/IP68 (3 bar)

- 1 Radar antenna
- 2 Process fitting
- 3 Electronics housing
- 4 Counter nut
- 5 Mounting thread
- 6 Connection cable

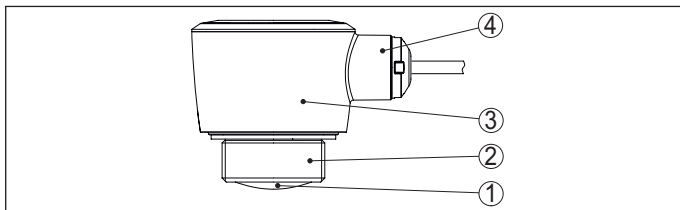


Fig. 3: VEGAPULS C 22 with direct cable outlet for ceil mounting in protection rating IP66/IP68 (3 bar)

- 1 Radar antenna
- 2 Process fitting
- 3 Electronics housing
- 4 Cable outlet

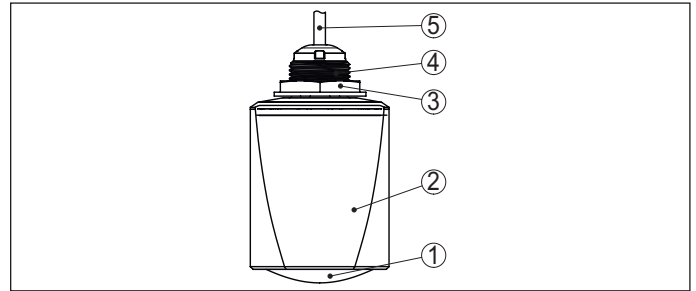


Fig. 4: VEGAPULS C 23 with direct cable outlet in protection rating IP66/IP68 (3 bar)

- 1 Radar antenna
- 2 Electronics housing
- 3 Counter nut
- 4 Mounting thread
- 5 Connection cable

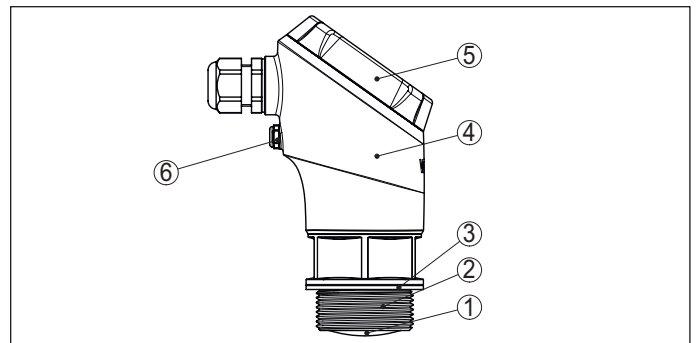


Fig. 5: VEGAPULS 31 in protection class IP66/IP67

- 1 Radar antenna
- 2 Process fitting
- 3 Process seal
- 4 Electronics housing
- 5 Display and adjustment unit
- 6 Ventilation/pressure compensation

## 4 Mounting

### Installation position

Mount the sensor in a position which is at least 200 mm (7.874 in) away from the vessel wall. If the sensor is installed in the center of dished or round vessel tops, multiple echoes can arise. However, these can be suppressed by an appropriate adjustment.

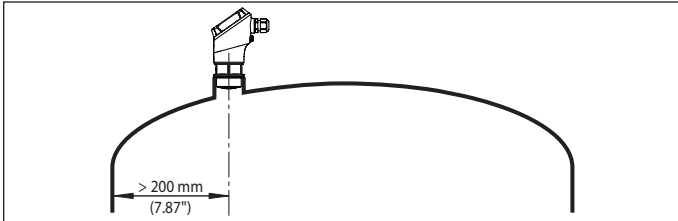


Fig. 6: Mounting of the radar sensor on round vessel tops

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

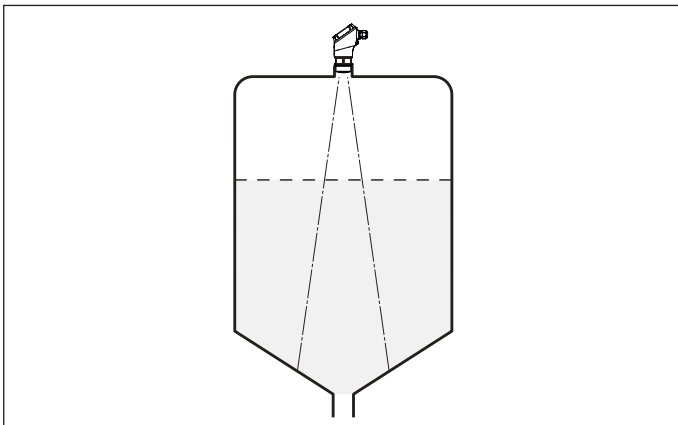


Fig. 7: Mounting of the radar sensor on vessels with conical bottom

### Mounting examples gauge measurement

The following illustrations show mounting examples and possible measurement setups.

#### River level

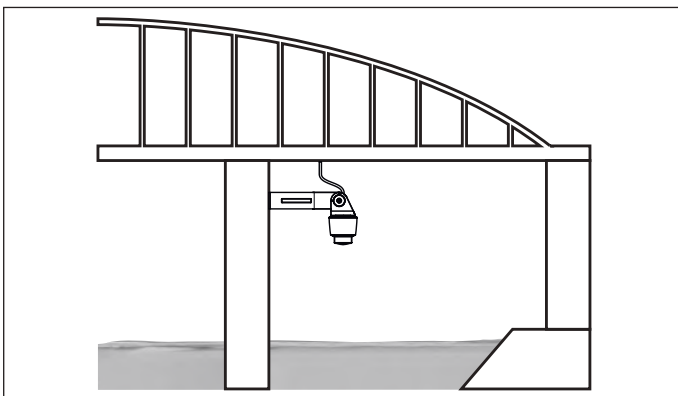


Fig. 8: Gauge measurement river, sensor mounting on bridge pier

### Deep well level

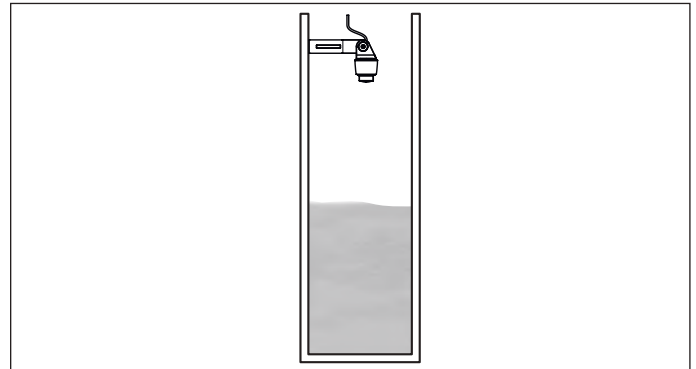


Fig. 9: Gauge measurement deep well, sensor mounting on lid

### Mounting examples flow measurement

The following illustrations show mounting examples and possible measurement setups.

#### Rectangular overflow

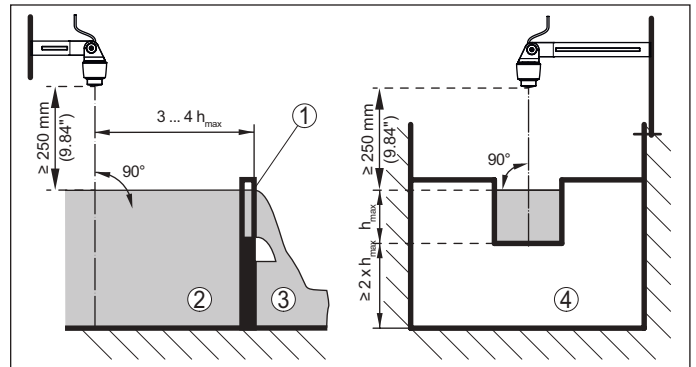


Fig. 10: Flow measurement with rectangular flume:  $h_{max}$  = max. filling of the rectangular flume

- 1 Overfall orifice (side view)
- 2 Upstream water
- 3 Tailwater
- 4 Overfall orifice (view from tailwater)

## Khafagi-Venturi flume

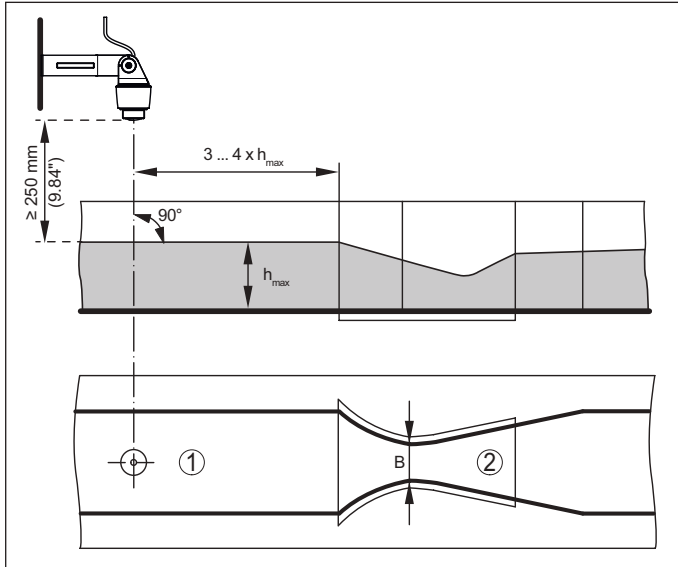


Fig. 11: Flow measurement with Khafagi-Venturi flume:  $h_{max}$  = max. filling of the flume; B = tightest constriction in the flume

- 1 Position sensor
- 2 Venturi flume



## 5 Electronics - Two-wire 4 ... 20 mA

### Voltage supply

Power the instrument via an energy-limited circuit (power max. 100 W) acc. to IEC 61010-1.

Specifications of the voltage supply:

- Operating voltage
  - 12 ... 35 V DC
- Permissible residual ripple
  - for  $U_N$  12 V DC ( $12\text{ V} < U_B < 18\text{ V}$ ):  $\leq 0,7\text{ V}_{\text{eff}}$  (16 ... 400 Hz)
  - for  $U_N$  24 V DC ( $18\text{ V} < U_B < 35\text{ V}$ ):  $\leq 1,0\text{ V}_{\text{eff}}$  (16 ... 400 Hz)

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

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

### Connection cable

The instrument is connected with standard two-wire cable.

### Connection

#### Direct cable outlet



Fig. 12: Wire assignment in permanently connected connection cable

	Wire colour	Function	Polarity
1	Brown	Voltage supply, signal output	+
2	Blue	Voltage supply, signal output	-

### Connection housing

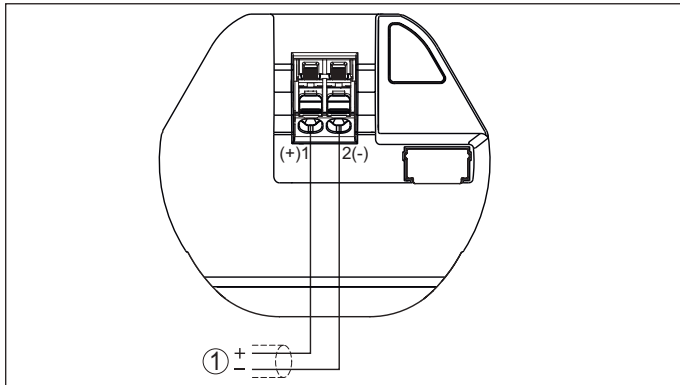


Fig. 13: Connection compartment VEGAPULS

1 Voltage supply, signal output

## 6 Electronics - Two-wire 4 ... 20 mA/HART

### Voltage supply

Power the instrument via an energy-limited circuit (power max. 100 W) acc. to IEC 61010-1.

Specifications of the voltage supply:

- Operating voltage
  - 12 ... 35 V DC
- Permissible residual ripple
  - for  $U_N$  12 V DC ( $12\text{ V} < U_B < 18\text{ V}$ ):  $\leq 0,7\text{ V}_{\text{eff}}$  (16 ... 400 Hz)
  - for  $U_N$  24 V DC ( $18\text{ V} < U_B < 35\text{ V}$ ):  $\leq 1,0\text{ V}_{\text{eff}}$  (16 ... 400 Hz)

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

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

### Connection cable

The instrument is connected with standard two-wire cable. If electromagnetic interference is expected which is above the test values of EN 61326-1 for industrial areas, shielded cable should be used.

Shielded cable generally necessary in HART multidrop mode.

### Connection

#### Direct cable outlet

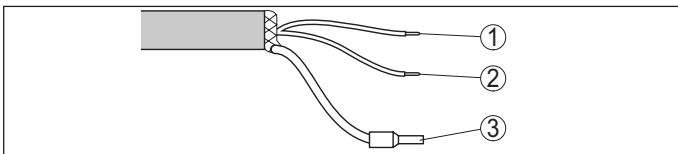


Fig. 14: Wire assignment in permanently connected connection cable

	Wire colour	Function	Polarity
1	Brown	Voltage supply, signal output	+
2	Blue	Voltage supply, signal output	-
3		Shielding	

### Connection housing

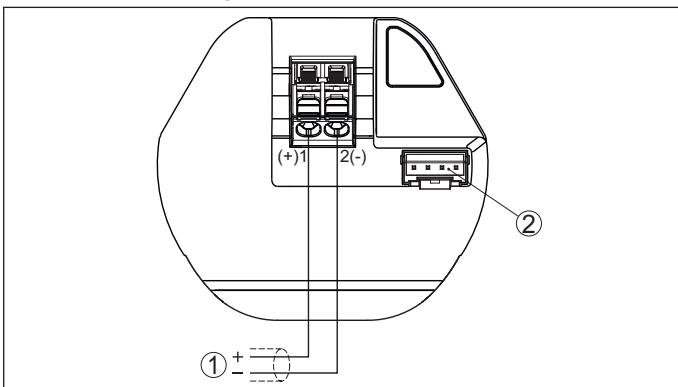


Fig. 15: Connection compartment VEGAPULS

- 1 Voltage supply, signal output
- 2 Plug connector for display and adjustment unit

7 Electronics - SDI-12

Voltage supply

The device is supplied with power via an SDI-12 datalogger.  
Power the instrument via an energy-limited circuit (power max. 100 W)  
acc. to IEC 61010-1.  
Specifications of the voltage supply:

- Operating voltage
  - 9 ... 32 V DC
- max. number of sensors
  - 32

Connection cable

The instrument is connected with standard three-wire cable without shielding. If electromagnetic interference is expected which is above the test values of EN 61326-1 for industrial areas, shielded cable should be used.

Connection

Direct cable outlet

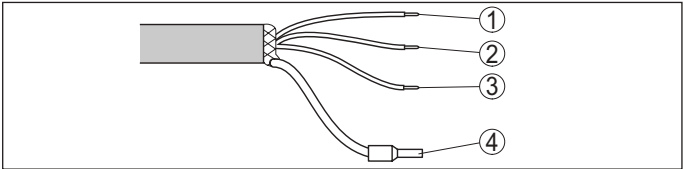


Fig. 16: Wire assignment in permanently connected connection cable

	Wire colour	Function	Polarity
1	Brown	Voltage supply	+
2	Blue	Voltage supply	-
3	White	SDI Data	+
4		Shielding	

8 Electronics - Modbus

Voltage supply

The operating voltage and the digital bus signal are routed via separate two-wire connection cables.

Power the instrument via an energy-limited circuit (power max. 100 W) acc. to IEC 61010-1.

Specifications of the voltage supply:

- Operating voltage
  - 8 ... 30 V DC
- max. number of sensors
  - 32

Connection cable

The instrument is connected with standard two-wire, twisted cable suitable for RS 485. If electromagnetic interference is expected which is above the test values of EN 61326 for industrial areas, shielded cable should be used.

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

Connection

Direct cable outlet

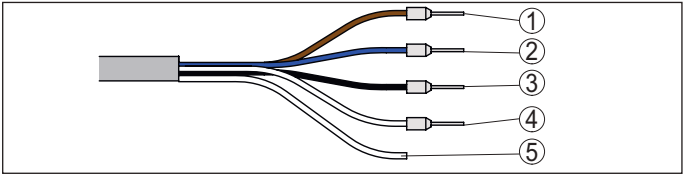


Fig. 17: Wire assignment in permanently connected connection cable

	Wire colour	Function	Polarity
1	Brown	Voltage supply	+
2	Blue	Voltage supply	-
3	Black	Modbus signal D0	+
4	White	Modbus signal D1	-
5		Shielding	

## 9 Adjustment

### 9.1 Wireless adjustment

Devices with integrated Bluetooth module can be adjusted wirelessly via standard adjustment tools:

- Smartphone/tablet (iOS or Android operating system)
- PC/notebook (Windows operating system)

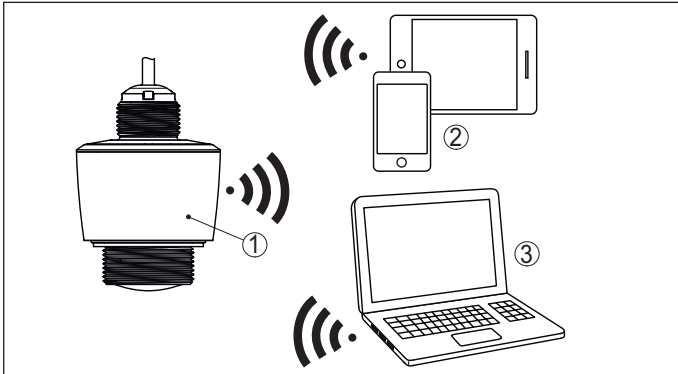


Fig. 18: Wireless connection to standard operating devices with integrated Bluetooth LE

- 1 Sensor
- 2 Smartphone/Tablet
- 3 PC/Notebook

### 9.2 Adjustment via the signal cable

Devices with signal output 4 ... 20 mA/HART can also be operated via a signal cable. This is done via an interface adapter and a PC/notebook using DTM/PACTware.

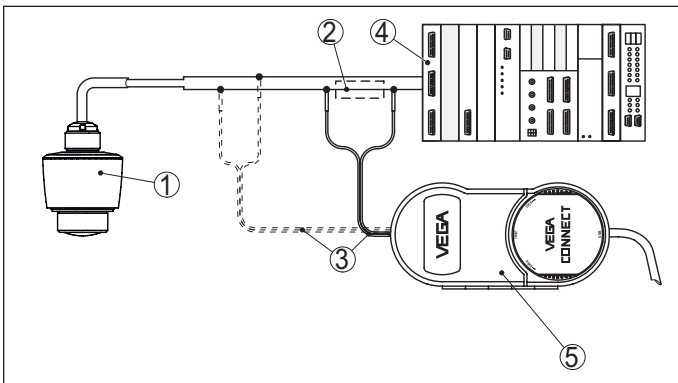


Fig. 19: Connecting the PC to the signal cable

- 1 Sensor
- 2 HART resistance 250  $\Omega$  (optional depending on evaluation)
- 3 Connection cable with 2 mm pins and terminals
- 4 Voltage supply
- 5 Interface adapter VEGA CONNECT

### 9.3 Local adjustment

The integrated display and adjustment unit is used for on-site adjustment of VEGAPULS 31

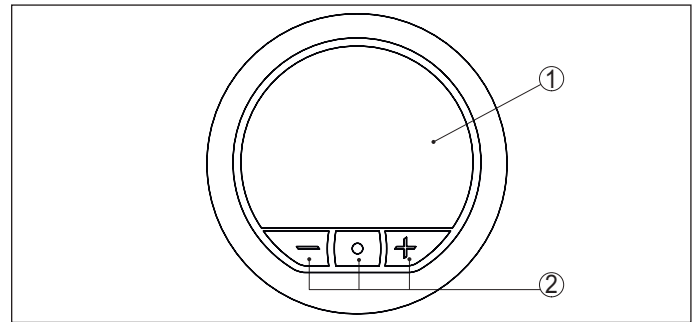


Fig. 20: Integrated display and adjustment unit

- 1 LC display
- 2 Adjustment keys

## 10 Dimensions

### VEGAPULS C 11

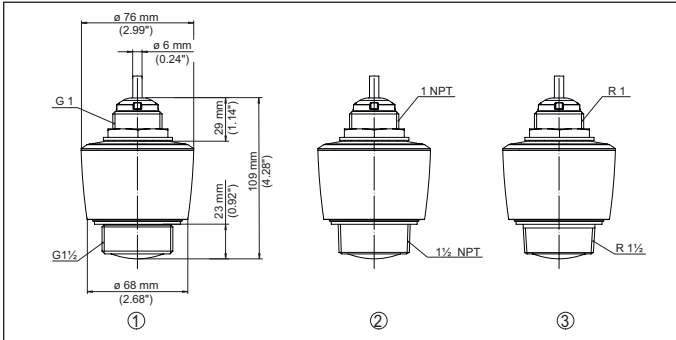


Fig. 21: Dimensions VEGAPULS C 11

- 1 Thread G1½
- 2 Thread 1½ NPT
- 3 Thread R1½

### VEGAPULS C 21

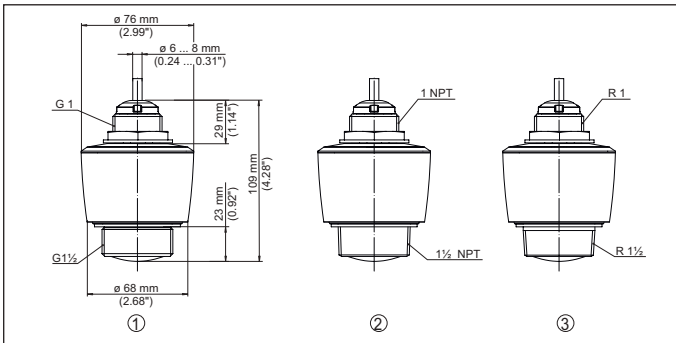


Fig. 22: Dimensions VEGAPULS C 21

- 1 Thread G1½
- 2 Thread 1½ NPT
- 3 Thread R1½

### VEGAPULS C 22

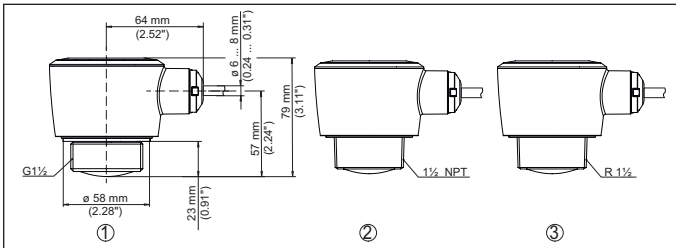


Fig. 23: Dimensions VEGAPULS C 22

- 1 Thread G1½
- 2 Thread 1½ NPT
- 3 Thread R1½

### VEGAPULS C 23

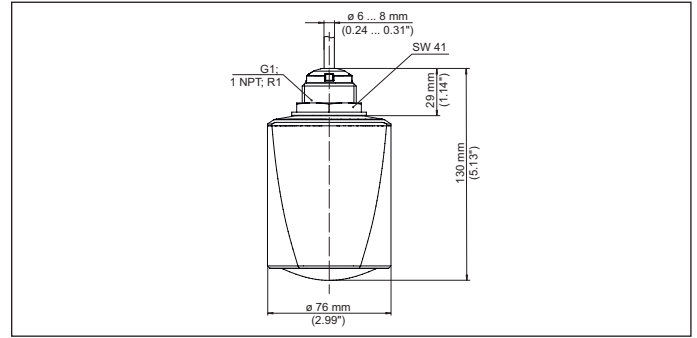


Fig. 24: Dimensions VEGAPULS C 23

### VEGAPULS 11, 21, 31

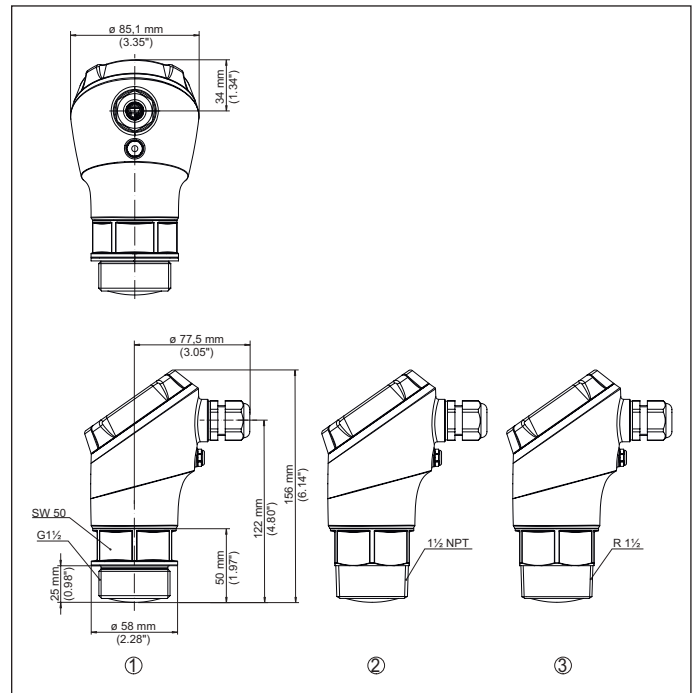


Fig. 25: Dimensions VEGAPULS 11, 21, 31

- 1 Thread G1½
- 2 Thread 1½ NPT
- 3 Thread R1½

### Mounting strap for ceiling mounting

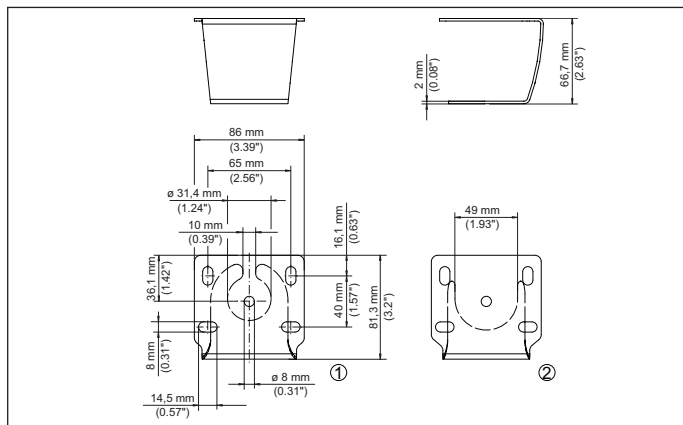


Fig. 26: Mounting strap for ceiling mounting

- 1 Sensor holder 1"
- 2 Sensor holder 1½"

### Mounting strap for wall mounting - bracket 200 mm

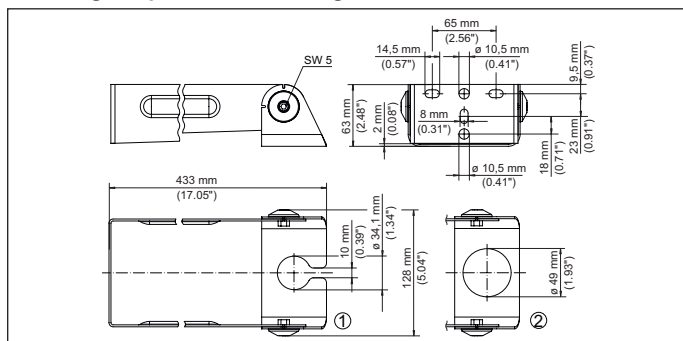


Fig. 27: Mounting strap for wall mounting - bracket 200 mm

- 1 Sensor holder 1"
- 2 Sensor holder 1½"

The listed drawings represent only an excerpt of the available versions and mounting possibilities. You can find more drawings at [www.vega.com/downloads](http://www.vega.com/downloads) under "Drawings".





All statements concerning scope of delivery, application, practical use and operating conditions of the sensors and processing systems correspond to the information available at the time of printing.  
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