Product Information

Radar
Level measurement in liquids
VEGAPULS WL 61, 61, 62, 63, 65, 66
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**Take note of safety instructions for Ex applications**

Please note the Ex specific safety information which you can find on our homepage [www.vega.com](http://www.vega.com) under: "Downloads - Approvals" and which comes with every instrument. In hazardous areas you should take note of the corresponding 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.

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29019-EN-12016
1 Measuring principle

Measuring principle

Extremely short microwave pulses are emitted by the antenna system in the direction of the measured product, reflected by the product surface and received back again by the antenna system. They propagate at the speed of light. The time from emission to reception of the signals is proportional to the level in the vessel.

A special time stretching procedure allows reliable and precise measurement of the extremely short signal running times. The radar sensors operate with low transmission power in the C or K band frequency range. The proven ECHOFOX signal processing software selects the correct level echo out of a large number of interfering reflections. An adjustment with empty and full vessel is not necessary.

Applications in liquids

Two different emitting frequencies are available for these applications. The compact, high frequency K-band sensors are particularly suitable for applications where high accuracy is required. Excellent signal focusing is achieved even with small antennas.

Low frequency C-band sensors are able to penetrate foam and strong condensation and are thus suitable for very difficult process conditions. Completely unaffected by vapour, gas composition, pressure and temperature changes, the sensors reliably detect the surface of widely different products.

Input variable

The measured quantity is the distance between process fitting of the sensor and product surface. Depending on the sensor version, the reference plane is the seal surface on the hexagon or the lower side of the flange.

Fig. 1: Data of the input variable with VEGAPULS 62

1 Reference plane
2 Measured variable, max. measuring range
3 Antenna length
4 Useful measuring range
## 2 Type overview

<table>
<thead>
<tr>
<th>Applications</th>
<th>Water processing, pump stations, storm water overflow tank, flow measurement in open flumes and level monitoring</th>
<th>Corrosive liquids in small vessels under easy process conditions</th>
<th>Storage tanks and process vessels under extremely difficult process conditions</th>
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<tr>
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<td>35 m (114.8 ft)</td>
<td>35 m (114.8 ft)</td>
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<td>Thread G1½ A/PVDF, mounting strap/316L or flange/PP</td>
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<td>-40 … +80 °C (-40 … +176 °F)</td>
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<td>• PLICSCOM&lt;br&gt;• PACTware&lt;br&gt;• VEGADIS 61&lt;br&gt;• VEGADIS 62</td>
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<td>• ATEX&lt;br&gt;• IEC&lt;br&gt;• Shipbuilding&lt;br&gt;• Overfill protection&lt;br&gt;• FM&lt;br&gt;• CSA&lt;br&gt;• Gost</td>
<td>• ATEX&lt;br&gt;• IEC&lt;br&gt;• Shipbuilding&lt;br&gt;• Overfill protection&lt;br&gt;• FM&lt;br&gt;• CSA&lt;br&gt;• Gost</td>
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<td>Storage tanks and process vessels under extremely difficult process conditions</td>
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</table>

Radar – Level measurement in liquids
3 Instrument selection

Application areas

VEGAPULS WL 61
The radar sensor VEGAPULS WL 61 is particularly suitable for use in pump stations and storm water overflow tanks, for flow measurement in open flumes as well as for gauge measurement. The high housing protection rating of the instrument allows outdoor mounting.

VEGAPULS 61
VEGAPULS 61 is suitable for applications in liquids in smaller vessels under ordinary process conditions. There are application possibilities in nearly all areas of industry.

The version with encapsulated antenna system is particularly suitable for level measurement of aggressive liquids in small vessels. The version with plastic horn antenna is particularly suitable for flow measurement in open flumes or gauge measurement in waters.

VEGAPULS 62
VEGAPULS 62 is suitable for applications in liquids in storage tanks and process vessels under difficult process conditions. Application possibilities can be found in the chemical industry, in environmental and recycling technology as well as in the petrochemical industry.

The version with horn antenna is particularly suitable for storage tanks and process vessels for measurement of products like solvents, hydrocarbons and fuels. The version with parabolic antenna is particularly suitable for measurement of products with low εr value at large measuring distances.

VEGAPULS 63
The VEGAPULS 63 is suitable for the measurement of aggressive liquids or applications with special hygienic requirements. Application possibilities can be found in the chemical industry as well as in the food processing and pharmaceutical sector.

VEGAPULS 65
The VEGAPULS 65 is suitable for vessels with liquids under easy process conditions with small process fitting. The application possibilities are in virtually all industries.

VEGAPULS 66
The VEGAPULS 66 is suitable for the measurement of liquids under difficult and extreme process conditions such as buildup, condensation and foam generation as well as strong product movements. The application possibilities are in the chemical industry, in the environmental and recycling technology as well as in the petrochemistry.

Applications

Level measurement in vessels
For level measurement in vessels with conical bottom it can be advantageous to mount the sensor in the center of the vessel, as measurement is then possible down to the lowest point of the vessel bottom.

Measurement in a surge pipe
When using a surge pipe in a vessel, influences from vessel installations and turbulences can be excluded. Under these prerequisites, the measurement of products with low dielectric values (εr value ≥ 1.6) is possible. In very adhesive products, measurement in a surge pipe is not recommended.

Measurement in difficult applications
The electronics version with increased sensitivity enables use of the instrument also in applications with very poor reflective properties and products with low εr value.

Flow measurement
Flow measurement in open flumes with a defined constriction, such as e. g. a rectangular overflow, can be realized with a level measurement.
Fig. 4: Flow measurement with rectangular overflow: $d_{\text{min}}$, minimum distance of the sensor; $h_{\text{max}}$ = max. filling of the rectangular overflow

1. Overflow orifice (side view)
2. Headwater
3. Tail water
4. Overfall orifice (view from bottom water)
## 4 Selection criteria

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6 Mounting

Mounting examples
The following illustrations show mounting examples and measurement setups.

**Pump shaft**

The strongly focussed measuring signal of VEGAPULS WL 61 offers considerable advantages particularly in tight spaces. The sensor operates reliably even with foam and buildup on the shaft wall.

**Acid tank**

A non-contact measuring principle is particularly suitable for level measurement in acid tanks.

VEGAPULS 61 is characterised by a small process fitting and a PVDF encapsulated antenna. The sensor is insensitive to temperature fluctuations and gas phases.

**Reactor**

For the production of resins, different basic substances are mixed with solvents and a reaction is caused by adding process heat. Non-contact measurement with the radar sensor VEGAPULS 62 is ideal for use in the production of reaction products. Since the measurement is performed without direct contact to the medium, virtually no buildup forms on the sensor.

**Sugar evaporator**

The VEGAPULS 63 radar sensor is particularly suitable for level measurement in the sugar evaporator.

The PTFE encapsulated horn antenna is protected against contamination or adhesion by the juice. The instrument is gauge and low pressure resistant, even with dynamic pressure and suction.

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Fig. 5: Level measurement in the pump shaft with VEGAPULS WL 61

Fig. 6: Level measurement in an acid tank with VEGAPULS 61

Fig. 7: Level measurement in a reactor with VEGAPULS 62

Fig. 8: Level measurement in a sugar evaporator with VEGAPULS 63
7 Electronics - 4 … 20 mA/HART - two-wire

Configuration of the electronics
The pluggable electronics is mounted in the electronics compartment of the instrument and can be exchanged by the user when servicing is required. The electronics is completely encapsulated to protect against vibration and moisture.

The terminals for voltage supply as well as contact pins with \( \text{I}^2 \text{C} \) interface for parameter adjustment are located on the upper side of the electronics. With the double chamber housing, the terminals are located in the separate connection compartment.

Voltage supply
Depending on the version, the supply voltage and the current signal are carried on the same two-wire connection cable.

The VEGA power supply units VEGATRENN 149AEx, VEGASTAB 690, VEGADIS 371 as well as VEGAMET signal conditioning instruments are suitable for power supply. When one of these instruments is used, a reliable separation of the supply circuits from the mains circuits according to DIN VDE 0106 part 101 is realised for the sensor.

- Operating voltage
  - 9.6 … 36 V DC
- Permissible residual ripple - Non-Ex, Ex-ia instrument
  - for \( 9.6 \text{ V} < U_{\text{L}} < 14 \text{ V} \): ±0.7 \( V_{\text{eff}} \) (16 … 400 Hz)
  - for \( 18 \text{ V} < U_{\text{L}} < 36 \text{ V} \): ±1.0 \( V_{\text{eff}} \) (16 … 400 Hz)

Connection cable
The sensors are connected with standard cable without screen. An outer cable diameter of 5 … 9 mm ensures the seal effect of the cable entry.

If electromagnetic interference is expected which is above the test values of EN 61326 for industrial areas, screened cable should be used. In HART multidrop mode the use of screened cable is generally recommended.

Cable screening and grounding
If screened cable is necessary, the cable screen must be connected on both ends to ground potential. If potential equalisation currents are expected, the connection on the evaluation side must be made via a ceramic capacitor (e.g. 1 nF, 1500 V).

Connection single chamber housing

Connection double chamber housing

Wire assignment connection cable VEGAPULS WL 61

Fig. 9: Electronics and connection compartment, single chamber housing
1 Voltage supply/Signal output
2 For indicating and adjustment module or interface adapter
3 For external indicating and adjustment unit
4 Ground terminal for connection of the cable screen

Fig. 10: Connection compartment, double chamber housing
1 Voltage supply/Signal output
2 For indicating and adjustment module or interface adapter
3 Ground terminal for connection of the cable screen
8  **Electronics - 4 ... 20 mA/HART - four-wire**

**Configuration of the electronics**

The pluggable electronics is mounted in the electronics compartment of the instrument and can be exchanged by the user when servicing is required. The electronics is completely encapsulated to protect against vibration and moisture.

The contact pins with I²C interface for parameter adjustment are located on the upper side of the electronics. The terminals for the power supply are located in the separate connection compartment.

**Voltage supply**

If a reliable separation is required, the power supply and the current output are transmitted over separate two-wire connection cables.

- Operating voltage with version for low voltage
  - 9.6 ... 48 V DC, 20 ... 42 V AC, 50/60 Hz
- Operating voltage with version for mains voltage
  - 90 ... 253 V AC, 50/60 Hz

**Connection cable**

The 4 ... 20 mA current output is connected with standard two-wire cable without screen. If electromagnetic interference is expected which is above the test values of EN 61326 for industrial areas, screened cable should be used.

For power supply, an approved installation cable with PE conductor is required.

An outer cable diameter of 5 ... 9 mm ensures the seal effect of the respective cable entry.

**Cable screening and grounding**

If screened cable is necessary, the cable screen must be connected on both ends to ground potential. If potential equalisation currents are expected, the connection on the evaluation side must be made via a ceramic capacitor (e.g., 1 nF, 1500 V).

**Connection double chamber housing**

![Diagram](https://via.placeholder.com/150)

*Fig. 12: Connection compartment, double chamber housing*

1. Voltage supply
2. 4 ... 20 mA signal output active
3. 4 ... 20 mA signal output passive
9 Electronics - Profibus PA

Configuration of the electronics
The pluggable electronics is mounted in the electronics compartment of the instrument and can be exchanged by the user when servicing is required. The electronics is completely encapsulated to protect against vibration and moisture.

The terminals for voltage supply as well as the plug with I²C interface for parameter adjustment are located on the upper side of the electronics. With the double chamber housing, these connection elements are located in the separate connection compartment.

Voltage supply
Power supply via the H1 Fieldbus cable.

- Operating voltage
  - 9 ... 32 V DC
- Max. number of sensors with DP/PA segment coupler
  - 32
- Max. number of sensors with VEGALOG 571 EP input card
  - 10

Connection cable
Connection is made with screened cable according to Profibus specification. A cable diameter of 5 ... 9 mm ensures the seal effect of the cable gland.

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

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

In systems without potential equalisation, connect the cable screen directly to ground potential at the power supply unit and at the sensor. In the connection box or T-distributor, the screen of the short stub to the sensor must not be connected to ground potential or to another cable screen. The cable screens to the power supply unit and to the next distributor must be connected to each other and also connected to ground potential via a ceramic capacitor (e.g. 1 nF, 1500 V). Low-frequency potential equalisation currents are thus suppressed, but the protective effect against high frequency interference signals remains.

Connection single chamber housing

Wire assignment connection cable VEGAPULS WL 61

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

Connection double chamber housing

Fig. 14: Connection compartment, double chamber housing
1 Voltage supply/Signal output
2 For indicating and adjustment module or interface adapter
3 Ground terminal for connection of the cable screen

Fig. 15: Wire assignment fix-connected connection cable
1 Voltage supply/Signal output
2 For indicating and adjustment module or interface adapter
3 Selection switch for bus address
4 For external indicating and adjustment unit
5 Ground terminal for connection of the cable screen

Fig. 13: Electronics and connection compartment, single chamber housing
1 Voltage supply/Signal output
2 For indicating and adjustment module or interface adapter
3 Selection switch for bus address
4 For external indicating and adjustment unit
5 Ground terminal for connection of the cable screen
10 Electronics - Foundation Fieldbus

Configuration of the electronics
The pluggable electronics is mounted in the electronics compartment of the instrument and can be exchanged by the user when servicing is required. The electronics is completely encapsulated to protect against vibration and moisture.

The terminals for voltage supply as well as contact pins with I²C interface for parameter adjustment are located on the upper side of the electronics. With the double chamber housing, the terminals are located in the separate connection compartment.

Voltage supply
Power supply via the H1 Fieldbus cable.
- Operating voltage
  - 9 ... 32 V DC
- max. number of sensors
  - 32

Connection cable
Connection is made with screened cable according to Fieldbus specification. A cable diameter of 5 ... 9 mm ensures the seal effect of the cable gland.

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.

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

In systems without potential equalisation, connect the cable screen directly to ground potential at the power supply unit and at the sensor. In the connection box or T-distributor, the screen of the short stub to the sensor must not be connected to ground potential or to another cable screen. The cable screens to the power supply unit and to the next distributor must be connected to each other and also connected to ground potential via a ceramic capacitor (e.g. 1 nF, 1500 V). Low-frequency potential equalisation currents are thus suppressed, but the protective effect against high frequency interference signals remains.

Connection single chamber housing

Connection double chamber housing

Wire assignment connection cable VEGAPULS WL 61

1 Voltage supply/Signal output
2 For indicating and adjustment module or interface adapter
3 Ground terminal for connection of the cable screen

1 brown (+) and blue (-) to power supply or to the processing system
2 Shielding
11 Electronics, Modbus, Levelmaster protocol

Configuration of the electronics

The pluggable electronics is mounted in the electronics compartment of the instrument and can be exchanged by the user when servicing is required. The electronics is completely encapsulated to protect against vibration and moisture.

The contact pins with i²C interface for parameter adjustment are located on the upper side of the electronics. The terminals for the power supply are located in the separate connection compartment.

Voltage supply

Power supply via the Modbus host.

- Operating voltage
  - 8 ... 30 V DC
- max. number of sensors
  - 15

Connection cable

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

For power supply, a separate two-wire cable is required.

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.

An outer cable diameter of 5 ... 9 mm ensures the seal effect of the respective cable entry.

Cable screening and grounding

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

In systems without potential equalisation, connect the cable screen directly to ground potential at the power supply unit and at the sensor. In the connection box or T-distributor, the screen of the short stub to the sensor must not be connected to ground potential or to another cable screen. The cable screens to the power supply unit and to the next distributor must be connected to each other and also connected to ground potential via a ceramic capacitor (e.g. 1 nF, 1500 V). Low-frequency potential equalisation currents are thus suppressed, but the protective effect against high frequency interference signals remains.

Connection compartment

![Connection compartment diagram](image)

Fig. 19: Connection compartment

1. Modbus connection
2. Slide switch for integrated termination resistor (120 Ω)
3. USB connection
4. Voltage supply
12 Operation

12.1 Overview

The sensors can be adjusted with the following adjustment media:

- With indicating and adjustment module
- With external indicating and adjustment unit
- an adjustment software according to FDT/DTM standard, e.g. PACTware and PC

as well as via systems from other manufacturers, dependent on the signal output:

- A HART handheld (4 … 20 mA/HART)
- The adjustment program AMS (4 … 20 mA/HART and Foundation Fieldbus)
- The adjustment program PDM (Profinbus PA)
- A configuration tool (Foundation Fieldbus)

The entered parameters are generally saved in the sensor, optionally also in the indicating and adjustment module or in the adjustment program.

12.2 Indicating and adjustment module

PLICSCOM

The pluggable indicating and adjustment module is used for measured value indication, operation and diagnosis. It is equipped with an illuminated full dot matrix as well as four keys for adjustment.

![Fig. 20: Indicating and adjustment module PLICSCOM](image)

The indicating and adjustment module is integrated in the respective sensor housing or in the external indicating and adjustment unit. After mounting, the sensor as well as the indicating and adjustment module are splash-proof even without housing cover.

12.3 External indicating and adjustment unit

VEGADIS 62

VEGADIS 62 is suitable for measured value indication and adjustment of sensors with HART protocol. The instrument is looped into the 4 … 20 mA/HART signal cable.

![Fig. 21: External indicating and adjustment unit VEGADIS 62](image)

12.4 PACTware/DTM

As an alternative to the indicating and adjustment module, the sensor can also be configured via a Windows PC. To do this, the configuration software PACTware and a suitable instrument driver (DTM) according to the FDT standard are required. The current PACTware version as well as all available DTMs are compiled in a DTM Collection. The DTMs can also be integrated into other frame applications according to the FDT standard.

All device DTMs are available as a free-of-charge standard version and as a full version that must be purchased. In the standard version, all functions for complete setup are already included. An assistant for simple project configuration simplifies the adjustment considerably. Saving/printing the project as well as import/export functions are also part of the standard version.

In the full version there is also an extended print function for complete project documentation as well as a save function for measured value and echo curves. In addition, there is a tank calculation program as well as a multiviewer for display and analysis of the saved measured value and echo curves.

Connection of the PC via VEGACONNECT

The interface converter VEGACONNECT is required for connection of the PC. On the computer side, the connection is made via USB interface. The VEGACONNECT is placed instead of the indicating and adjustment module to the sensor, the connection to the sensor is made automatically. As an alternative the connection via the HART signal can be carried out on any position of the signal cable with 4 … 20 mA/HART sensors.

![Fig. 22: Connection via VEGACONNECT and USB](image)

Necessary components:

- VEGAPULS
- PC with PACTware and suitable DTM
- VEGACONNECT
- Voltage supply/Processing system

12.5 Alternative adjustment programs

PDM

For HART and Profinbus PA sensors, device descriptions are available as EDDs for the adjustment program PDM. The device descriptions are already included in the current version of the PDM. Newer instrument drivers that are not yet delivered with the PDM are available in the download section.

AMS

For HART and Foundation Fieldbus sensors, device descriptions are available as EDDs for the adjustment program AMS. The device descriptions are already included in the current version of the AMS. Newer instrument drivers that are not yet delivered with the AMS are available in the download section.
13 Dimensions

Plastic housing

1. Single chamber housing
2. Double chamber housing

Aluminium housing

1. Single chamber housing
2. Double chamber housing

Stainless steel housing

1. Single chamber housing electropolished
2. Single chamber housing precision casting
3. Double chamber housing precision casting

VEGAPULS WL 61

1. Mounting strap
2. Adapter flange

VEGAPULS 61

1. Version with encapsulated antenna system
2. Version with plastic horn antenna
3. Mounting strap
4. Adapter flange
Dimensions

**VEGAPULS 62**

1. Threaded version
2. Threaded version with temperature adapter up to 250 °C
3. Flange version

**VEGAPULS 63**

1. Flange version DN 50
2. Flange version DN 80
3. Tri-Clamp version 2"

**VEGAPULS 65**

1. Threaded version G1½ A
2. Flange version DN 80

**VEGAPULS 66**

1. Version with horn antenna ø 145 mm
2. Version with standpipe antenna

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18 Radar – Level measurement in liquids
The listed drawings are only an excerpt of the available process fittings. You can find further drawings on our homepage www.vega.com » Downloads » Drawings.
You can find at www.vega.com
- operating instructions manuals
- specification sheet
- Software
- drawings
- certificates
- approvals
and much, much more

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