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Operating Instructions

**TDR sensor for continuous level and
interface measurement of liquids**

VEGAFLEX 86

4 ... 20 mA/HART - four-wire

Coax probe

-196 ... +280 °C

-196 ... +450 °C



Document ID: 42285



VEGA

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Safety instructions for Ex areas

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

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1 About this document

1.1 Function

This operating instructions manual provides all the information you need for mounting, connection and setup as well as important instructions for maintenance and fault rectification. Please read this information before putting the instrument into operation and keep this manual accessible in the immediate vicinity of the device.

1.2 Target group

This operating instructions manual is directed to trained specialist personnel. The contents of this manual should be made available to these personnel and put into practice by them.

1.3 Symbols used



Information, tip, note

This symbol indicates helpful additional information.



Caution: If this warning is ignored, faults or malfunctions can result.



Warning: If this warning is ignored, injury to persons and/or serious damage to the instrument can result.



Danger: If this warning is ignored, serious injury to persons and/or destruction of the instrument can result.



Ex applications

This symbol indicates special instructions for Ex applications.



List

The dot set in front indicates a list with no implied sequence.



Action

This arrow indicates a single action.



Sequence of actions

Numbers set in front indicate successive steps in a procedure.



Battery disposal

This symbol indicates special information about the disposal of batteries and accumulators.

2 For your safety

2.1 Authorised personnel

All operations described in this operating instructions manual must be carried out only by trained specialist personnel authorised by the plant operator.

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

2.2 Appropriate use

VEGAFLEX 86 is a sensor for continuous level measurement.

You can find detailed information about the area of application in chapter "*Product description*".

Operational reliability is ensured only if the instrument is properly used according to the specifications in the operating instructions manual as well as possible supplementary instructions.

2.3 Warning about incorrect use

Inappropriate or incorrect use of the instrument can give rise to application-specific hazards, e.g. vessel overfill or damage to system components through incorrect mounting or adjustment. Also the protective characteristics of the instrument can be influenced.

2.4 General safety instructions

This is a state-of-the-art instrument complying with all prevailing regulations and guidelines. The instrument must only be operated in a technically flawless and reliable condition. The operator is responsible for the trouble-free operation of the instrument.

During the entire duration of use, the user is obliged to determine the compliance of the necessary occupational safety measures with the current valid rules and regulations and also take note of new regulations.

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

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

The safety approval markings and safety tips on the device must also be observed.

2.5 CE conformity

The device fulfills the legal requirements of the applicable EC guidelines. By affixing the CE marking, we confirm successful testing of the product.

You can find the CE Certificate of Conformity in the download section of our homepage.

Electromagnetic compatibility

Instruments in four-wire or Ex-d-ia version are designed for use in an industrial environment. Nevertheless, electromagnetic interference from electrical conductors and radiated emissions must be taken into account, as is usual with class A instruments according to EN 61326-1. If the instrument is used in a different environment, the electromagnetic compatibility to other instruments must be ensured by suitable measures.

2.6 NAMUR recommendations

NAMUR is the automation technology user association in the process industry in Germany. The published NAMUR recommendations are accepted as the standard in field instrumentation.

The device fulfills the requirements of the following NAMUR recommendations:

- NE 21 – Electromagnetic compatibility of equipment
- NE 43 – Signal level for malfunction information from measuring transducers
- NE 53 – Compatibility of field devices and display/adjustment components
- NE 107 – Self-monitoring and diagnosis of field devices

For further information see www.namur.de.

2.7 Environmental instructions

Protection of the environment is one of our most important duties. That is why we have introduced an environment management system with the goal of continuously improving company environmental protection. The environment management system is certified according to DIN EN ISO 14001.

Please help us fulfill this obligation by observing the environmental instructions in this manual:

- Chapter "*Packaging, transport and storage*"
- Chapter "*Disposal*"

3 Product description

3.1 Configuration

Type label

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



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

- 1 Instrument type
- 2 Product code
- 3 Approvals
- 4 Power supply and signal output, electronics
- 5 Protection rating
- 6 Probe length
- 7 Process and ambient temperature, process pressure
- 8 Material, wetted parts
- 9 Hardware and software version
- 10 Order number
- 11 Serial number of the instrument
- 12 Symbol of the device protection class
- 13 ID numbers, instrument documentation
- 14 Reminder to observe the instrument documentation
- 15 Notified authority for CE marking
- 16 Approval directives

Serial number - Instrument search

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

- Product code (HTML)
- Delivery date (HTML)
- Order-specific instrument features (HTML)
- Operating instructions and quick setup guide at the time of shipment (PDF)
- Order-specific sensor data for an electronics exchange (XML)
- Test certificate (PDF) - optional

Go to www.vega.com, "VEGA Tools" and "Instrument search". Enter the serial number.

Alternatively, you can access the data via your smartphone:

- Download the smartphone app "VEGA Tools" from the "Apple App Store" or the "Google Play Store"

- Scan the Data Matrix code on the type label of the instrument or
- Enter the serial number manually in the app

Scope of this operating instructions manual

This operating instructions manual applies to the following instrument versions:

- Hardware from 1.0.0
- Software from 1.2.0
- Only for instrument versions without SIL qualification

Versions

The instrument can be supplied in two different electronics versions. Each electronics version can be identified via the product code on the type label as well as on the electronics.

- Standard electronics with operating voltage 90 ... 253 V AC; 50/60 Hz: Typ FX80B.-
- Standard electronics with supply voltage 9.6 ... 48 V DC; 20 ... 42 V AC: Type FX80I.-

Scope of delivery

The scope of delivery encompasses:

- Sensor
- Documentation
 - Quick setup guide
 - Test certificate measuring accuracy (optional)
 - Supplementary instructions "*GSM/GPRS radio module*" (optional)
 - Supplementary instructions manual "*Heating for display and adjustment module*" (optional)
 - Supplementary instructions manual "*Plug connector for continuously measuring sensors*" (optional)
 - Ex-specific "*Safety instructions*" (with Ex versions)
 - If necessary, further certificates

3.2 Principle of operation

Application area

The VEGAFLEX 86 is a level sensor with coax probe for continuous level or interface measurement, suitable for applications in liquids with high temperatures up to 450 °C (842 °F).

Functional principle - level measurement

High frequency microwave pulses are guided along a steel cable or a rod. Upon reaching the product surface, the microwave pulses are reflected. The running time is evaluated by the instrument and outputted as level.

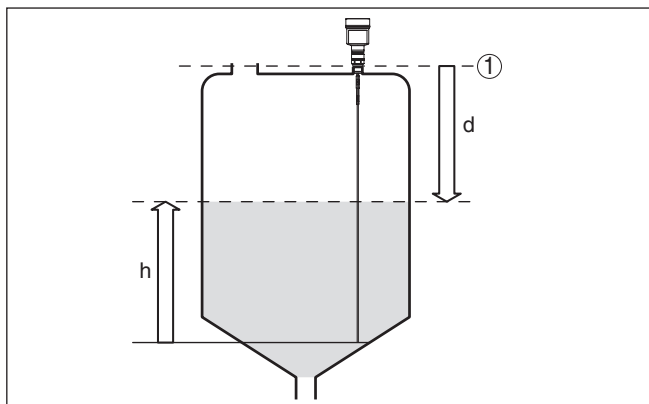


Fig. 2: Level measurement

- 1 Sensor reference plane (seal surface of the process fitting)
- d Distance to the level (HART value 1)
- h Height - Level

Probe end tracking

To increase sensitivity, the probe is equipped with probe end tracking. In products with a low dielectric constant, this function is very helpful. This is the case, for example, in plastic granules, packing chips or in vessels with fluidized products.

Between a dielectric constant of 1.5 and 3, the function switches on, if required. As soon as the level echo can no longer be detected, probe end tracking is automatically activated. The measurement is continued with the last calculated dielectric constant.

The accuracy thus depends on the stability of the dielectric constant.

If you measure a medium with a dielectric constant below 1.5, probe end tracking is always active. In this case, you have to enter the dielectric constant of the medium. A stable dielectric constant is very important here.

Functional principle - interface measurement

High frequency microwave impulses are guided along a steel cable or rod. Upon reaching the product surface, a part of the microwave impulses is reflected. The other part passes through the upper product layer and is reflected by the interface. The running times to the two product layers are processed by the instrument.

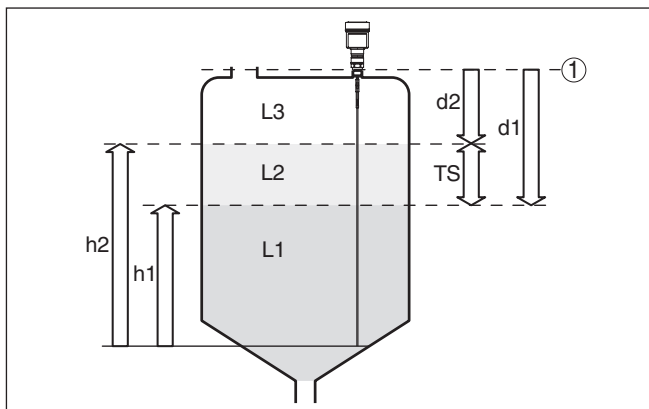


Fig. 3: Interface measurement

1 Sensor reference plane (seal surface of the process fitting)

d1 Distance to the interface (HART value 1)

d2 Distance to the level (HART value 3)

TS Thickness of the upper medium ($d1 - d2$)

h1 Height - Interface

h2 Height - Level

L1 Lower medium

L2 Upper medium

L3 Gas phase

Prerequisites for interface measurement

Upper medium (L2)

- The upper medium must not be conductive
- The dielectric constant of the upper medium or the actual distance to the interface must be known (input required). Min. dielectric constant: 1.6. You can find a list of dielectric constants on our home page: www.vega.com.
- The composition of the upper medium must be stable, no varying products or mixtures
- The upper medium must be homogeneous, no stratifications within the medium
- Min. thickness of the upper medium 50 mm (1.97 in)
- Clear separation from the lower medium, emulsion phase or detritus layer max. 50 mm (1.97 in)
- If possible, no foam on the surface

Lower medium (L1)

- The dielectric constant must be 10 higher than the dielectric constant of the upper medium, preferably electrically conductive. Example: upper medium dielectric constant 2, lower medium at least dielectric constant 12.

Gas phase (L3)

- Air or gas mixture
- Gas phase - dependent on the application, gas phase does not always exist ($d2 = 0$)

Output signal

The instrument is always preset to the application "*Level measurement*".

For the interface measurement, you can select the requested output signal with the setup.

Packaging

3.3 Packaging, transport and storage

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

The packaging of standard instruments consists of environment-friendly, recyclable cardboard. For special versions, PE foam or PE foil is also used. Dispose of the packaging material via specialised recycling companies.

Transport

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

Transport inspection

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

Storage

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

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

- Not in the open
 - Dry and dust free
 - Not exposed to corrosive media
 - Protected against solar radiation
 - Avoiding mechanical shock and vibration
- Storage and transport temperature see chapter "*Supplement - Technical data - Ambient conditions*"
 - Relative humidity 20 ... 85 %

Storage and transport temperature

3.4 Accessories and replacement parts

PLICSCOM

The display and adjustment module PLICSCOM is used for measured value indication, adjustment and diagnosis. It can be inserted into the sensor and removed at any time.

You can find further information in the operating instructions "*Display and adjustment module PLICSCOM*" (Document-ID 27835).

VEGACONNECT

The interface adapter VEGACONNECT enables the connection of communication-capable instruments to the USB interface of a PC. For parameter adjustment of these instruments, the adjustment software PACTware with VEGA-DTM is required.

You can find further information in the operating instructions "*Interface adapter VEGACONNECT*" (Document-ID 32628).

VEGADIS 81	<p>The VEGADIS 81 is an external display and adjustment unit for VEGA plics® sensors.</p> <p>For sensors with double chamber housing the interface adapter "<i>DISADAPT</i>" is also required for VEGADIS 81.</p> <p>You can find further information in the operating instructions "<i>VEGADIS 81</i>" (Document-ID 43814).</p>
DISADAPT	<p>The adapter "<i>DISADAPT</i>" is an accessory part for sensors with double chamber housings. It enables the connection of VEGADIS 81 to the sensor housing via an M12 x 1 plug.</p> <p>You can find further information in the supplementary instructions "<i>Adapter DISADAPT</i>" (Document-ID 45250).</p>
VEGADIS 82	<p>VEGADIS 82 is suitable for measured value indication and adjustment of sensors with HART protocol. It is looped into the 4 ... 20 mA/HART signal cable.</p> <p>You can find further information in the operating instructions "<i>VEGADIS 82</i>" (Document-ID 45300).</p>
PLICSMOBILE T61	<p>PLICSMOBILE T61 is an external GSM/GPRS radio unit for transmission of measured values and for remote parameter adjustment of plics® sensors. Adjustment is carried out via PACTware/DTM and the integrated USB connection.</p> <p>You can find further information in the supplementary instructions "<i>PLICSMOBILE T61</i>" (Document-ID 37700).</p>
Protective cap	<p>The protective cover protects the sensor housing against soiling and intense heat from solar radiation.</p> <p>You will find additional information in the supplementary instructions manual "<i>Protective cover</i>" (Document-ID 34296).</p>
Flanges	<p>Screwed flanges are available in different versions according to the following standards: DIN 2501, EN 1092-1, BS 10, ASME B 16.5, JIS B 2210-1984, GOST 12821-80.</p> <p>You can find additional information in the supplementary instructions manual "<i>Flanges according to DIN-EN-ASME-JIS</i>".</p>
Electronics module	<p>The electronics module VEGAFLEX series 80 is a replacement part for TDR sensors of VEGAFLEX series 80. There is a different version available for each type of signal output.</p> <p>You can find further information in the operating instructions manual "<i>Electronics module VEGAFLEX series 80</i>".</p>
Display and adjustment module with heating	<p>The display and adjustment module can be optionally replaced by a display and adjustment module with heating function.</p> <p>You can use this display and adjustment module in an ambient temperature range of -40 ... +70 °C.</p> <p>You can find further information in the operating instructions "<i>Display and adjustment module with heating</i>" (Document-ID 31708).</p>

External housing

If the standard sensor housing is too big or in case of strong vibrations, an external housing can be used.

Then the sensor housing is made of stainless steel. The electronics is located in the external housing which can be mounted in a distance of up to 10 m (147 ft) to the sensor by using a connection cable.

You can find additional information in the operating instructions manual "*External housing*" (Document-ID 46802).

4 Mounting

4.1 General instructions

Screwing in

On instruments with threaded process fitting, the hexagon must be tightened with a suitable wrench. For the proper wrench size see chapter "*Dimensions*".



Warning:

The housing must not be used to screw the instrument in! Applying tightening force can damage internal parts of the housing.

Protection against moisture

Protect your instrument against moisture ingress through the following measures:

- Use the recommended cable (see chapter "*Connecting to power supply*")
- Tighten the cable gland
- When mounting horizontally, turn the housing so that the cable gland points downward
- Loop the connection cable downward in front of the cable gland

This applies particularly to:

- Outdoor mounting
- Installations in areas where high humidity is expected (e.g. through cleaning processes)
- Installations on cooled or heated vessels

Cable entries - NPT thread

In the case of instrument housings with self-sealing NPT threads, it is not possible to have the cable entries screwed in at the factory. The free openings for the cable glands are therefore covered with red dust protection caps as transport protection.

Prior to setup you have to replace these protective caps with approved cable glands or close the openings with suitable blind plugs.

Suitability for the process conditions

Make sure that all parts of the instrument exposed to the process are suitable for the existing process conditions.

These are mainly:

- Active measuring component
- Process fitting
- Process seal

Process conditions are particularly:

- Process pressure
- Process temperature
- Chemical properties of the medium
- Abrasion and mechanical influences

You can find detailed information on the process conditions in chapter "*Technical data*" as well as on the type label.

4.2 Mounting instructions

Installation position

During operation, the probe must not touch any installations or the vessel wall. If necessary, fasten the probe end.

In vessels with conical bottom it can be advantageous to mount the sensor in the center of the vessel, as measurement is then possible nearly down to the lowest point of the bottom. Keep in mind that measurement all the way down to the tip of the probe may not be possible. The exact value of the min. distance (lower dead band) is stated in chapter "Technical data".

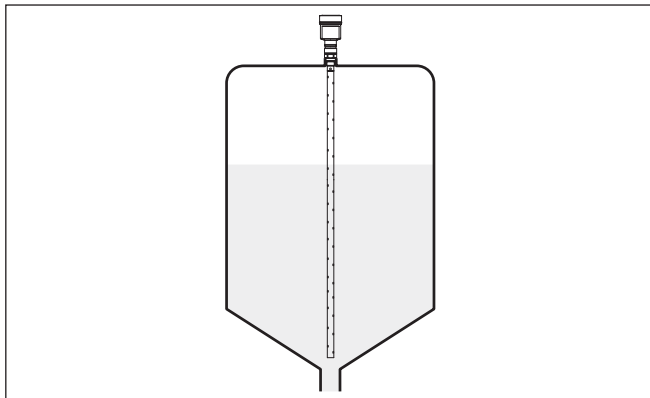


Fig. 4: Vessel with conical bottom

Welding work

Before beginning the welding work, remove the electronics module from the sensor. By doing this, you avoid damage to the electronics through inductive coupling.

Inflowing medium

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

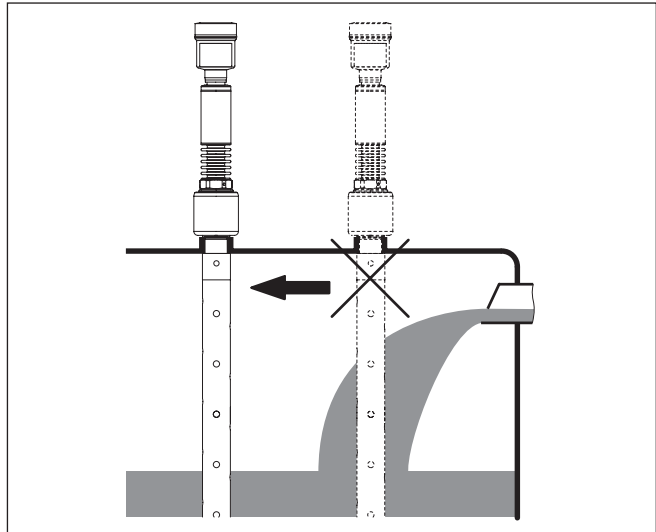


Fig. 5: Mounting of the sensor with inflowing medium

Measuring range

The reference plane for the measuring range of the sensors is the sealing surface of the thread or flange.

Keep in mind that a min. distance must be maintained below the reference plane and possibly also at the end of the probe - measurement in these areas is not possible (dead band). These dead bands are listed in chapter "*Technical data*". Keep in mind for the adjustment that the default setting for the measuring range refers to water.

Pressure

The process fitting must be sealed if there is gauge or low pressure in the vessel. Before use, check if the seal material is resistant against the measured product and the process temperature.

The max. permissible pressure is specified in chapter "*Technical data*" or on the type label of the sensor.

Fasten

If there is a risk of the coaxial probe touching the vessel wall during operation due to product movements or agitators, etc., the measuring probe should be securely fixed.

Avoid undefined vessel connections, i.e. the connection must be either grounded reliably or isolated reliably. Any undefined change of this condition can lead to measurement errors.

If there is a danger of the coaxial probe touching the vessel wall, then the probe must be fastened at the bottom end.

Keep in mind that below the fastening, a measurement is not possible.

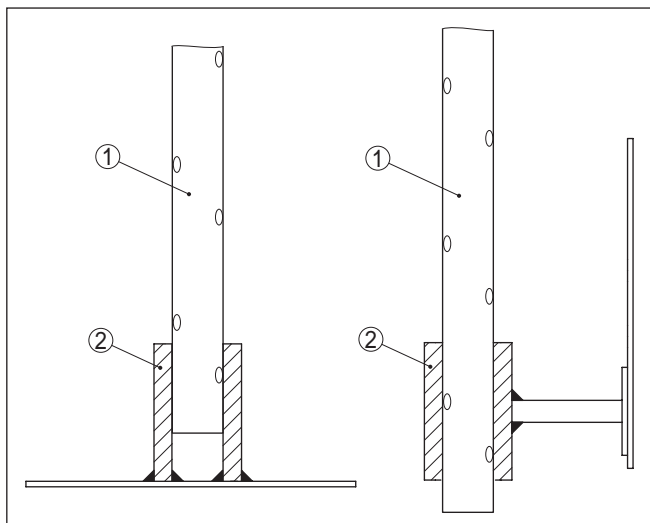


Fig. 6: Fasten the probe

- 1 Coax probe
- 2 Retaining sleeve

Mounting in the vessel insulation

Instruments for a temperature range up to +280 °C (536 °F) or up to +450 °C (842 °F) have a distance piece between process fitting and electronics housing. This distance piece is used for thermal decoupling of the electronics against high process temperatures.



Information:

The spacer may be incorporated in the vessel insulation up to max. 50 mm (2 in). Only then is a reliable temperature decoupling guaranteed.

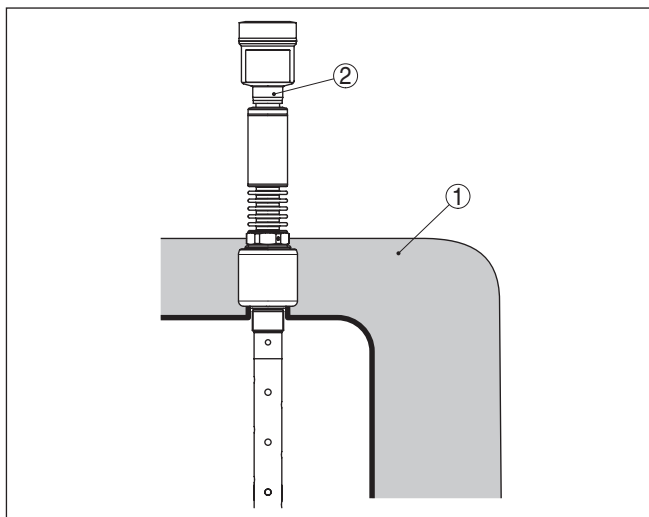


Fig. 7: Mounting the instrument on insulated vessels.

- 1 Temperature insulation
- 2 Ambient temperature on the housing

Steam boiler applications Vapours, superimposed gases, high pressures and temperature differences can change the spreading speed of radar impulses.

There are two possibilities to correct these deviations.

Corrective value in the process control system

In the technical data under "Influence of superimposed gas and pressure on accuracy" you can find a table with deviation values in some typical gases or in steam.

In the control system (DCS) you can correct the measurement results of the VEGAFLEX 86 with these values.

The prerequisite is constant temperature and pressure in the vessel.

Automatic correction via the reference distance

The VEGAFLEX 86 can be equipped optionally with a running time correction via reference distance. The probe can carry out an automatic running time correction with it.

The reference distance can be overfilled. Make sure that the last measured corrective value is used in case of overfilling.

Length - Reference distance (7)	Length - Blocking distance (4)	Probe length min. (2)	Deviation max.
260 mm (10.24 in)	450 mm (17.72 in)	> 1000 mm (39.37 in)	± 10 %
500 mm (19.69 in)	690 mm (27.17 in)	> 1250 mm (49.21 in)	± 5 %
750 mm (29.53 in)	940 mm (37.01 in)	> 1500 mm (59.06 in)	± 3 %

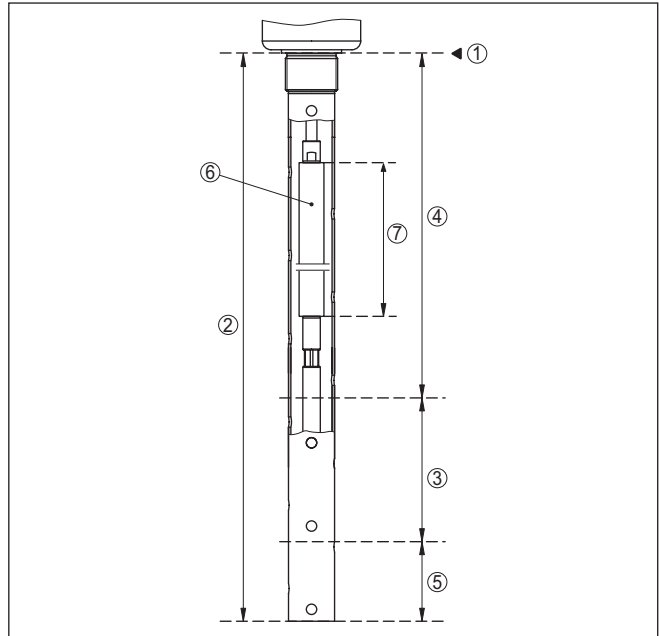


Fig. 8: Measuring ranges - VEGAFLEX 86 with steam compensation

- 1 Reference plane
- 2 Probe length L
- 3 Measuring range
- 4 Upper blocking distance with steam compensation
- 5 Lower dead band
- 6 Reference measurement distance to steam compensation
- 7 Length of the reference measuring distance

5 Connecting to power supply

5.1 Preparing the connection

Safety instructions

Always keep in mind the following safety instructions:



Warning:

Connect only in the complete absence of line voltage.

- The electrical connection must only be carried out by trained personnel authorised by the plant operator.
- If overvoltage surges are expected, overvoltage arresters should be installed.



Note:

Install a separating facility for the instrument which is easy to access. The separating facility must be marked for the instrument (IEC/EN61010).

Voltage supply via mains voltage

In this case, the instrument is designed in protection class I. To maintain this protection class, it is absolutely necessary that the ground conductor be connected to the internal ground terminal. Take note of the national installation regulations.

Supply voltage and current signal are carried on separate connection cables if reliable separation is required. The supply voltage range can differ depending on the instrument version.

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

Voltage supply via low voltage

In this case, the instrument is designed in protection class II. Generally connect the instrument to vessel ground (potential equalization) or with plastic vessels to the next ground potential. For this purpose, a ground terminal is located laterally on the instrument housing.

Connection cable

An approved, three-wire installation cable with PE conductor is required for voltage supply with mains voltage.

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 61326-1 for industrial areas, screened cable should be used.

For instruments with housing and cable gland, use cable with round cross-section. To ensure the seal effect of the cable gland (IP protection rating), you have to check for which cable outer diameter the cable gland is suitable.

Use a cable gland fitting the cable diameter.

Cable gland ½ NPT

With plastic housing, the NPT cable gland or the Conduit steel tube must be screwed without grease into the threaded insert.

Max. torque for all housings, see chapter "*Technical data*".

Cable screening and grounding

If screened cable is required, we recommend connecting the cable screen on both ends to ground potential. In the sensor, the screen must be connected directly to the internal ground terminal. The

ground terminal on the outside of the housing must be connected to the ground potential (low impedance).



In Ex systems, the grounding is carried out according to the installation regulations.

In electroplating and CCP systems (cathodic corrosion protection) it must be taken into account that significant potential differences exist. This can lead to unacceptably high currents in the cable screen if it is grounded at both ends.



Information:

The metallic parts of the instrument (process fitting, transmitter, concentric tube, etc.) are connected with the inner and outer ground terminal on the housing. This connection exists either directly via the conductive metallic parts or, in case of instruments with external electronics, via the screen of the special connection cable.

You can find specifications on the potential connections inside the instrument in chapter "*Technical data*".

5.2 Connection

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.



Information:

The terminal block is pluggable and can be removed from the electronics. To do this, lift the terminal block with a small screwdriver and pull it out. When reinserting the terminal block, you should hear it snap in.

Connection procedure

Proceed as follows:

1. Unscrew the housing lid
2. Loosen compression nuts of the cable glands
3. Remove approx. 10 cm (4 in) of the cable mantle (signal output), strip approx. 1 cm (0.4 in) insulation from the ends of the individual wires
4. Insert the cable into the sensor through the cable entry



Fig. 9: Connection steps 5 and 6

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

**Information:**

Solid cores as well as flexible cores with wire end sleeves are inserted directly into the terminal openings. In case of flexible cores without end sleeves, press the terminal from above with a small screwdriver, the terminal opening is then free. When the screwdriver is released, the terminal closes again.

6. Check the hold of the wires in the terminals by lightly pulling on them
7. Connect the screen to the internal ground terminal, connect the outer ground terminal to potential equalisation in case of power supply via low voltage
8. Connect the lead cable for power supply in the same way according to the wiring plan, in addition connect the ground conductor to the inner ground terminal when powered with mains voltage.
9. Tighten the compression nut of the cable glands. The seal ring must completely encircle the cables
10. Screw the housing lid back on

The electrical connection is finished.

**Information:**

The terminal blocks are pluggable and can be removed from the housing insert. To do this, lift the terminal block with a small screwdriver and pull it out. When inserting the terminal block again, you should hear it snap in.

5.3 Wiring plan, double chamber housing



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

Electronics compartment

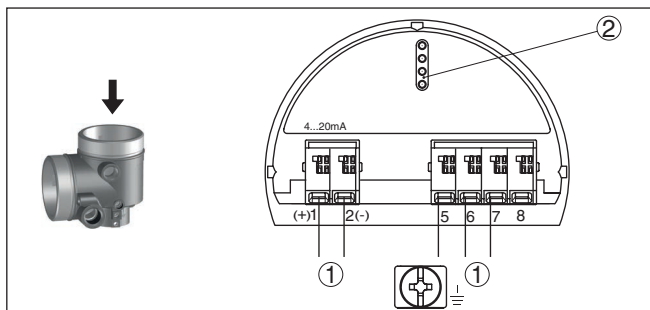


Fig. 10: Electronics compartment, double chamber housing

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



Information:

The connection of an external display and adjustment unit is not possible with the Ex-d-ia version.

Connection compartment with mains voltage

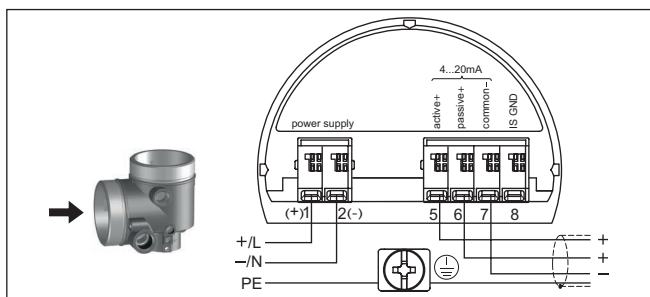


Fig. 11: Connection compartment with double chamber housing with mains voltage

Terminal	Function	Polarity
1	Voltage supply	+ / L
2	Voltage supply	- / N
5	4 ... 20 mA output (active)	+
6	4 ... 20 mA output (passive)	+
7	Mass - output	-
8	Function ground when installing according to CSA (Canadian Standards Association)	

Connection compartment with low voltage

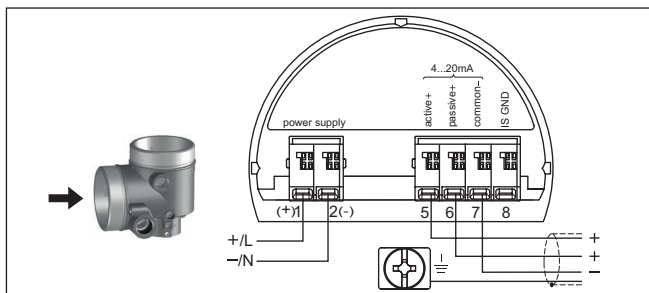


Fig. 12: Connection compartment with double chamber housing with low voltage

Terminal	Function	Polarity
1	Voltage supply	+/L
2	Voltage supply	-/N
5	4 ... 20 mA output (active)	+
6	4 ... 20 mA output (passive)	+
7	Mass - output	-
8	Function ground when installing according to CSA (Canadian Standards Association)	

5.4 Double chamber housing with DISADAPT

Electronics compartment

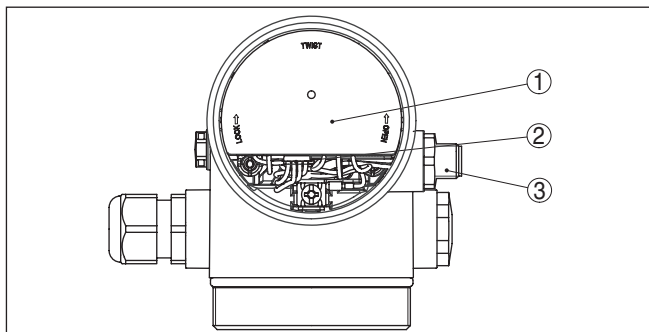


Fig. 13: View to the electronics compartment with DISADAPT for connection of the external display and adjustment unit

- 1 DISADAPT
- 2 Internal plug connection
- 3 Plug connector M12 x 1

Assignment of the plug connector

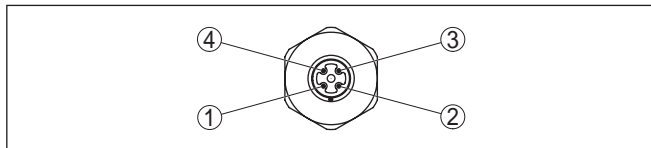


Fig. 14: View to the plug connector M12 x 1

- 1 Pin 1
- 2 Pin 2
- 3 Pin 3
- 4 Pin 4

Contact pin	Colour connection cable in the sensor	Terminal, electronics module
Pin 1	Brown	5
Pin 2	White	6
Pin 3	Blue	7
Pin 4	Black	8

Supplementary electronics - Additional current output

5.5 Supplementary electronics

To make a second measured value available for use, you can use the supplementary electronics - additional current output.

Both current outputs are passive and need a power supply.

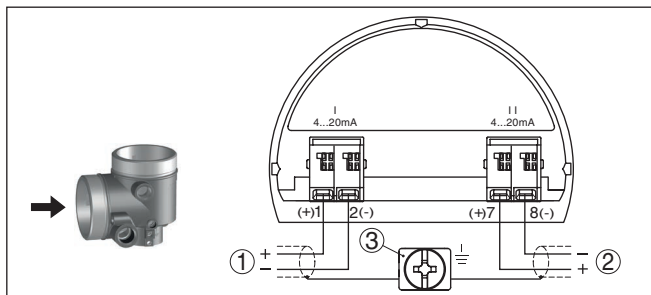


Fig. 15: Terminal compartment, double chamber housing, supplementary electronics - additional current output

- 1 First current output (I) - Voltage supply and signal output (HART)
- 2 Second current output (II) - Voltage supply and signal output (without HART)
- 3 Ground terminal for connection of the cable screen

Supplementary electronics - Radio module PLICSMOBILE

The radio module PLICSMOBILE is an external GSM/GPRS radio unit for transmission of measured values and for remote parameter adjustment.

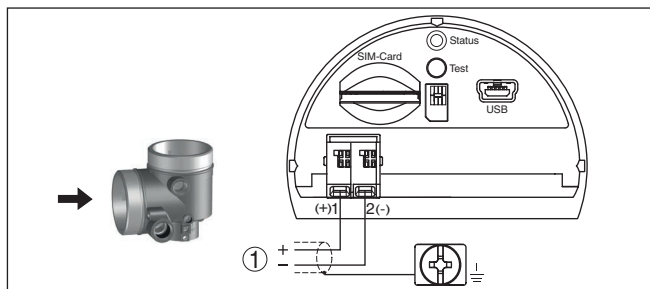


Fig. 16: Radio module PLICSMOBILE integrated in the connection compartment

1 Voltage supply

You can find detailed information on connection in the supplementary instructions "PLICSMOBILE GSM/GPRS radio module".

5.6 Switch-on phase

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

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

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

6 Set up with the display and adjustment module

6.1 Insert display and adjustment module

The display and adjustment module can be inserted into the sensor and removed again at any time. You can choose any one of four different positions - each displaced by 90°. It is not necessary to interrupt the power supply.

Proceed as follows:

1. Unscrew the housing lid
2. Place the display and adjustment module on the electronics in the desired position and turn it to the right until it snaps in.
3. Screw housing lid with inspection window tightly back on

Disassembly is carried out in reverse order.

The display and adjustment module is powered by the sensor, an additional connection is not necessary.



Fig. 17: Installing the display and adjustment module in the double chamber housing



Note:

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

6.2 Adjustment system

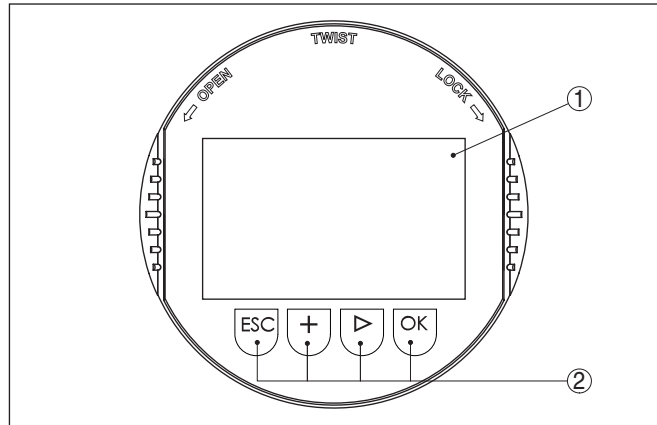


Fig. 18: Display and adjustment elements

- 1 LC display
- 2 Adjustment keys

Key functions

- **[OK]** key:
 - Move to the menu overview
 - Confirm selected menu
 - Edit parameter
 - Save value
- **[->]** key:
 - Presentation, change measured value
 - Select list entry
 - Select editing position
- **[+]** key:
 - Change value of the parameter
- **[ESC]** key:
 - Interrupt input
 - Jump to next higher menu

Adjustment system

You adjust the sensor via the four keys of the display and adjustment module. The individual menu items are shown on the LC display. You can find the functions of the individual keys in the previous illustration.

When the **[+]** and **[->]** keys are pressed quickly, the edited value, i.e. the cursor, moves by one position. When the keys are pressed longer than 1 s, the cursor moves continuously.

When the **[OK]** and **[ESC]** keys are pressed simultaneously for more than 5 s, the display returns to the main menu. The menu language is then switched over to "English".

Approx. 60 minutes after the last pressing of a key, an automatic reset to measured value indication is triggered. Any values not confirmed with **[OK]** will not be saved.

Switch-on phase

After switching on, the VEGAFLEX 86 carries out a short self-test where the device software is checked.

The output signal transmits a fault signal during the switch-on phase.

The following information is displayed on the display and adjustment module during the startup procedure:

- Instrument type
- Device name
- Software version (SW-Ver)
- Hardware version (HW-Ver)

Measured value indication

With the **[→]** key you can move between three different indication modes.

In the first view, the selected measured value is displayed in large digits.

In the second view, the selected measured value and a corresponding bar graph presentation are displayed.

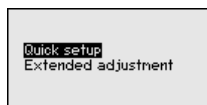
In the third view, the selected measured value as well as a second selectable value, e.g. the temperature, are displayed.



6.3 Parameter adjustment - Quick setup

Quick setup

To quickly and easily adapt the sensor to the application, select the menu item *"Quick setup"* in the start graphic on the display and adjustment module.



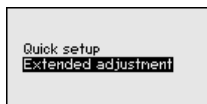
The following steps for the quick setup can be reached also in the *"Extended adjustment"*.

- Instrument address
- Measurement loop name
- Medium type (optional)
- Application
- Max. adjustment
- Min. adjustment
- False signal suppression

You can find the description of the individual menu items in the following chapter *"Parameter adjustment - Extended adjustment"*.

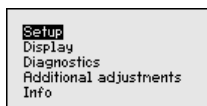
6.4 Parameter adjustment - Extended adjustment

For technically demanding measuring points, you can carry out extended settings in *"Extended adjustment"*.



Main menu

The main menu is divided into five sections with the following functions:



Setup: Settings, e.g. measurement loop name, medium, vessel, adjustment, signal output, device unit, false signal suppression, linearization curve

Display: Settings, e.g., for language, measured value display, lighting

Diagnostics: Information, e.g. on instrument status, pointer, measurement certainty, simulation, echo curve

Additional adjustments: Reset, date/time, reset, copy function

Info: Instrument name, hardware and software version, date of manufacture, instrument features

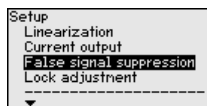
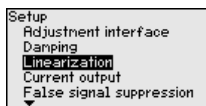
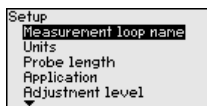


Note:

For optimum adjustment of the measuring point, the individual sub-menu items in the main menu item "Setup" should be selected one after the other and provided with the correct parameters. If possible, go through the items in the given sequence.

The procedure is described below.

The following submenu points are available:



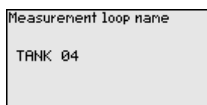
The submenu points described below.

Setup - Measurement loop name

Here you can assign a suitable measurement loop name. Push the "OK" key to start the editing. With the "+" key you change the sign and with the "->" key you jump to the next position.

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

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



Setup - Units

In this menu item you select the distance unit and the temperature unit.

Distance unit
mm ▼
Temperature unit
°C ▼

For the distance units you can choose between m, mm and ft and for the temperature units °C, °F and K.

Setup - Probe length

In this menu item you can enter the probe length or have the length determined automatically by the sensor system.

When choosing "Yes", then the probe length will be determined automatically. When choosing "No", you can enter the probe length manually.

Probe length
1000 mm

Probe length determine automatically?
Yes
No

Probe length
01000
mm
0 80000

Setup - Application - Type of medium

Coax probes can be only used in liquids. In this menu item, the fixed adjusted medium type "Liquid" is displayed.

Application
Type of medium
Liquid
Application
Medium/Dielectric figure

Type of medium
Liquid ▼

Setup - Application - Application

In this menu item, you can select the application. You can choose between level measurement and interface measurement. You can also choose between measurement in a vessel or in a bypass or standpipe.



Note:

The selection of the application has a considerable influence on all other menu items. Keep in mind that as you continue with the parameter adjustment, individual menu items are only optionally available.

You have the option of choosing the demonstration mode. This mode is only suitable for test and demonstration purposes. In this mode, the sensor ignores the parameters of the application and reacts immediately to any change.

Application
Product type
Application
Medium/Dielectric figure

Application
Level vessel ▼

Application
✓ Level vessel
Level bypass/standpipe
Interface vessel
Interf.bypass/standpipe
Demonstration mode

Setup - Application - Medium, dielectric constant

In this menu item, you can define the type of medium (product).

This menu item is only available if you have selected level measurement under the menu item "Application".

Application Product type Application Medium/Dielectric figure	Medium/Dielectric constant Water-based/>10	Medium/Dielectric constant Solvents,oilLPG/<3 Chem. mixtures/3...10 <input checked="" type="checkbox"/> Water-based/>10
---	---	--

You can choose between the following medium types:

Dielectric constant	Type of medium	Examples
> 10	Water-based liquids	Acids, alkalis, water
3 ... 10	Chemical mixtures	Chlorobenzene, nitro lacquer, aniline, isocyanate, chloroform
< 3	Hydrocarbons	Solvents, oils, liquid gas

Setup - Application - Gas phase

This menu item is only available, if you have chosen interface measurement under the menu item "Application". In this menu item you can enter if there is a superimposed gas phase in your application.

Only set the function to "Yes", if the gas phase is permanently present.

Application Product type Application Gas phase Dielectric figure	Superimposed gas phase present? Yes	Superimposed gas phase present? No <input checked="" type="checkbox"/> Yes
---	--	--

Setup - Application - Dielectric constant

This menu item is only available if you have selected interface measurement under the menu item "Application". In this menu item you can choose the type of medium of the upper medium.

Application Product type Application Gas phase Dielectric figure	Dielectric figure upper medium 2.000	Dielectric constant Enter Calculate
---	---	---

You can enter the dielectric constant of the upper medium directly or have the value determined by the instrument. To do this you have to enter the measured or known distance to the interface.

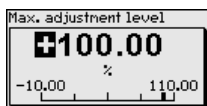
Dielectric constant 002.0 1.0 100.0	Distance to the interface 00000 mm 0 99999
---	---

Setup - Max. adjustment Level

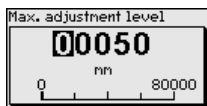
In this menu item you can enter the max. adjustment for the level. With interface measurement this is the maximum total level.

Adjustment level Max. adjustment level Min. adjustment level	Max. adjustment level 100.00 % 50 mm 726 mm
--	--

Adjust the requested percentage value with **[+]** and store with **[OK]**.

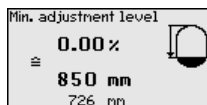
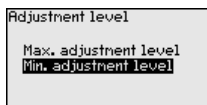


Enter the appropriate distance value in m (corresponding to the percentage value) for the full vessel. The distance refers to the sensor reference plane (seal surface of the process fitting). Keep in mind that the max. level must lie below the dead band.

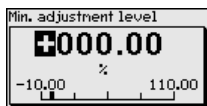


Setup - Min. adjustment Level

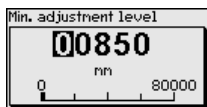
In this menu item you can enter the min. adjustment for the level. With interface measurement this is the minimum total level.



Adjust the requested percentage value with **[+]** and store with **[OK]**.

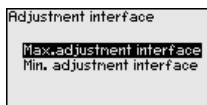


Enter the suitable distance value in m for the empty vessel (e.g. distance from the flange to the probe end) corresponding to the percentage value. The distance refers to the sensor reference plane (seal surface of the process fitting).

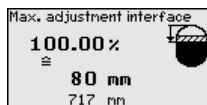
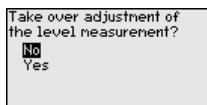


Setup - Max. adjustment - Interface

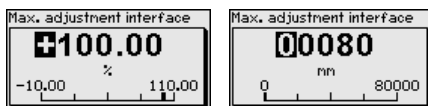
This menu item is only available if you have selected interface measurement under the menu item "Application".



You can accept the settings of the level measurement also for the interface measurement. If you select "Yes", the current setting will be displayed.



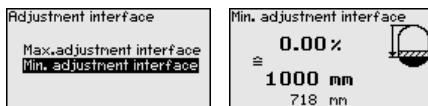
If you have selected "No", you can enter the adjustment for the interface separately. Enter the requested percentage value.



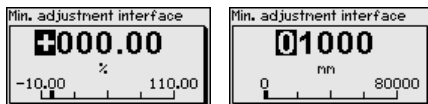
For the full vessel, enter the distance value in m matching the percentage value.

Setup - Min. adjustment - Interface

This menu item is only available if you have selected interface measurement under the menu item "Application". If you have selected "Yes" in the previous menu item (accept adjustment of the level measurement), the current setting will be displayed.



If you have selected "No", you can enter the adjustment for the interface measurement separately.

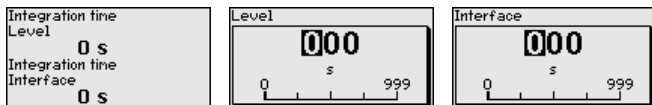


Enter the respective distance value in m for the empty vessel corresponding to the percentage value.

Setup - Damping

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

If you have selected interface measurement under the menu item "Application", you can adjust the damping for the level and the interface separately.

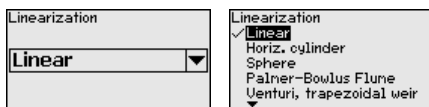


The default setting is a damping of 0 s.

Setup - Linearization

A linearization is necessary for all vessels in which the vessel volume does not increase linearly with the level - e.g. a horizontal cylindrical or spherical tank, when the indication or output of the volume is required. Corresponding linearization curves are preprogrammed for these vessels. They represent the correlation between the level percentage and vessel volume.

The linearization applies to the measured value indication and the current output. By activating the appropriate curve, the volume percentage of the vessel is displayed correctly. If the volume should not be displayed in percent but e.g. in l or kg, a scaling can be also set in the menu item "Display".



Warning:

If a linearisation curve is selected, the measuring signal is no longer necessarily linear to the filling height. This must be considered by the user especially when adjusting the switching point on the limit signal transmitter.

In the following, you have to enter the values for your vessel, for example the vessel height and the socket correction.

For non-linear vessel forms, enter the vessel height and the socket correction.

For the vessel height, you have to enter the total height of the vessel.

For the socket correction you have to enter the height of the socket above the upper edge of the vessel. If the socket is lower than the upper edge of the vessel, this value can also be negative.

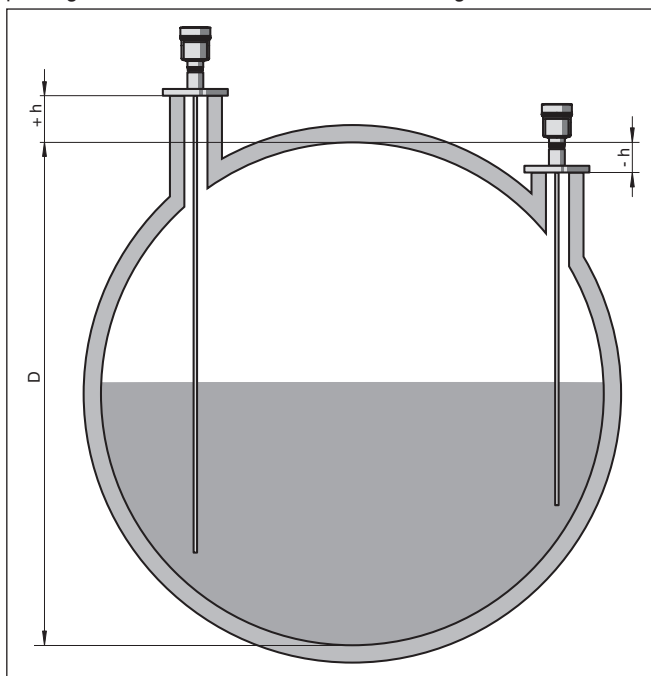
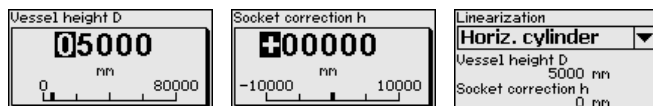


Fig. 19: Vessel height and socket correction value

D Vessel height

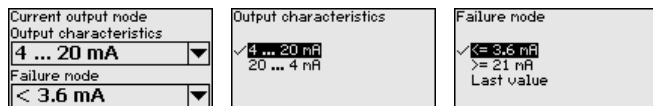
+h Positive socket correction value

-h Negative socket correction value



Setup - Current output mode

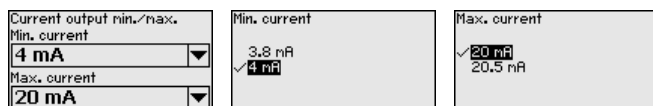
In the menu item "Current output mode" you determine the output characteristics and reaction of the current output in case of failure.



The default setting is output characteristics 4 ... 20 mA, failure mode < 3.6 mA.

Setup - Current output Min./Max.

In the menu item "Current output Min./Max.", you determine the reaction of the current output during operation.



The default setting is min. current 3.8 mA and max. current 20.5 mA.

Setup - False signal suppression

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

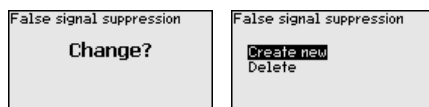
- High sockets
- Vessel installations such as struts



Note:

A false signal suppression detects, marks and saves these false signals so that they are no longer taken into account for the level and interface measurement. We generally recommend carrying out a false signal suppression to achieve the best possible accuracy. This should be done with the lowest possible level so that all potential interfering reflections can be detected.

Proceed as follows:



Enter the actual distance from the sensor to the product surface.



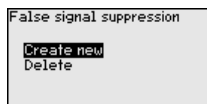
All interfering signals in this section are detected by the sensor and stored.



Note:

Check the distance to the product surface, because if an incorrect (too large) value is entered, the existing level will be saved as a false signal. The level would then no longer be detectable in this area.

If a false signal suppression has already been created in the sensor, the following menu window appears when selecting "*False signal suppression*":



The instrument carries out an automatic false signal suppression as soon as the probe is uncovered. The false signal suppression is always updated.

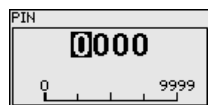
The menu item "*Delete*" is used to completely delete an already created false signal suppression. This is useful if the saved false signal suppression no longer matches the metrological conditions in the vessel.

Lock/unlock setup - Adjustment

In the menu item "*Lock/unlock adjustment*", you can protect the sensor parameters against unauthorized or inadvertent modification. The PIN is activated/deactivated permanently.

With active PIN, only the following adjustment functions are possible without entering a PIN:

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



Caution:

With active PIN, adjustment via PACTware/DTM as well as other systems is also blocked.

You can change the PIN number under "*Additional settings - PIN*".

Setup - Current output 2

If a supplementary electronics with an additional current output is installed in the instrument, you can adjust the additional current output separately.

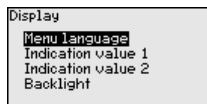
In menu item "*Current output 2*" you specify which measured value the additional current output refers to.

The procedure corresponds to the previous settings of the standard current output. See "*Setup - Current output*".

Display

In the main menu point "*Display*", the individual submenu points should be selected subsequently and provided with the correct parameters to ensure the optimum adjustment of the display options. The procedure is described in the following.

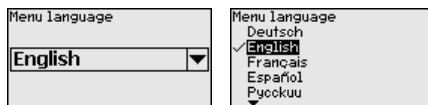
The following submenu points are available:



The submenu points described below.

Display - Menu language

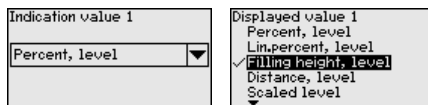
This menu item enables the setting of the requested national language.



In the delivery status, the sensor is set to the ordered national language.

Display - Displayed value 1

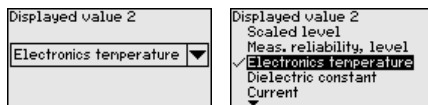
In this menu item, you define the indication of the measured value on the display. You can display two different measured values. In this menu item, you define measured value 1.



The default setting for the displayed value 1 is "Filling height Level".

Display - Displayed value 2

In this menu item, you define the indication of the measured value on the display. You can display two different measured values. In this menu item, you define measured value 2.



The default setting for the displayed value 2 is the electronics temperature.

Display - Backlight

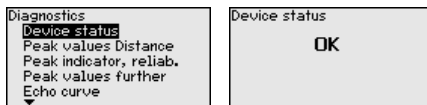
The integrated background lighting can be switched off via the adjustment menu. The function depends on the strength of the supply voltage, see "Technical data".



In delivery status, the lighting is switched on.

Diagnostics - Device status

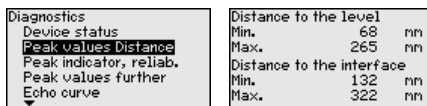
In this menu item, the device status is displayed.



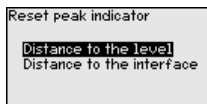
Diagnostics - Peak values Distance

The respective min. and max. measured value is saved in the sensor. The two values are displayed in the menu item "Peak values, distance".

If you have selected interface measurement under the menu item "Setup - Application", the peak values of the interface measurement are displayed in addition to the peak values of the level measurement.



In another window you can carry out a reset of the two peak values separately.

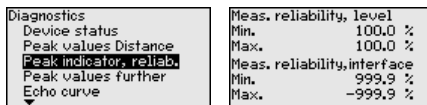


Diagnostics - Peak values Measurement certainty

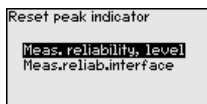
The respective min. and max. measured values are saved in the sensor. The two values are displayed in the menu item "Peak values, measurement certainty".

The measurement can be influenced by the process conditions. In this menu item, the measurement certainty of the level measurement is displayed as percentage value. The higher the value, the more reliable the measurement. Values > 90 % indicate reliable measurement.

If you have selected interface measurement under the menu item "Setup - Application", the peak values of the interface measurement are displayed in addition to the peak values of the level measurement.



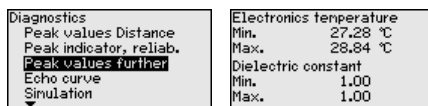
In another window you can carry out a reset of the two peak values separately.



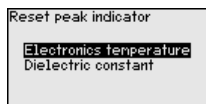
Diagnostics - Peak values Additional

The respective min. and max. measured values are saved in the sensor. The values are displayed in the menu item "Peak values Additional".

This menu item displays the peak values of the electronics temperature as well as the dielectric constant.

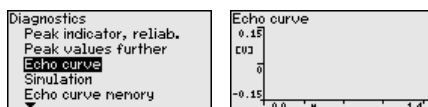


In another window you can carry out a reset of the two peak values separately.



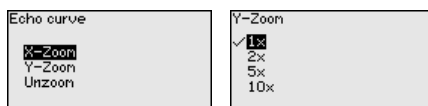
Diagnostics - Echo curve

The menu item "Echo curve" shows the signal strength of the echoes over the measuring range in V. The signal strength enables an evaluation of the quality of the measurement.



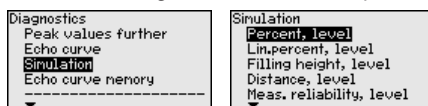
With the following functions you can zoom part sections of the echo curve.

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

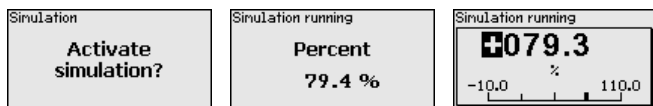


Diagnosis - Simulation

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



Select the requested simulation variable and set the requested value.



Caution:

During simulation, the simulated value is outputted as 4 ... 20 mA current value and digital HART signal.

Push the **[ESC]** key to deactivate the simulation.



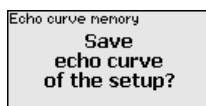
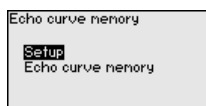
Information:

The simulation is terminated automatically 60 minutes after the activation of the simulation.

Diagnostics - Echo curve memory

With the menu item "Setup" the echo curve it is possible to save at the time of setup. This is generally recommended; for using the Asset Management functions it is necessary. If possible, the curve should be saved with a low level in the vessel.

With this, you can detect signal changes over the operating time. With the adjustment software PACTware and the PC, the high-resolution echo curve can be displayed and used to compare the echo curve of the setup with the actual echo curve.

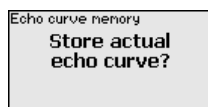
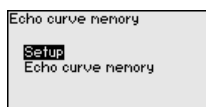
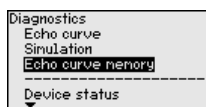


The function "Echo curve memory" enables storing echo curves of the measurement.

Under the sub-menu item "Echo curve memory" you can store the current echo curve.

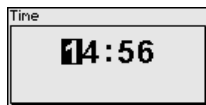
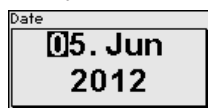
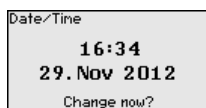
Parameter settings for recording the echo curve and the settings of the echo curve itself can be carried out in the adjustment software PACTware.

With the adjustment software PACTware and the PC the high-resolution echo curve can be displayed and used later on to assess the quality of the measurement.



Additional adjustments - Date Time

In this menu item, the internal clock of the sensor is adjusted.



Additional adjustments - Reset

With a reset, certain parameter adjustments carried out by the user are reset.



The following reset functions are available:

Delivery status: Restoring the parameter settings at the time of shipment from the factory incl. the order-specific settings. A created false signal suppression, user-programmable linearization curve as well as the measured value memory will be deleted.

Basic settings: Resetting of the parameter settings, incl. special parameters, to the default values of the respective instrument. Any stored false signal suppression or user programmable linearisation curve, as well as the measured value memory, is deleted.

The following table shows the default values of the instrument. Depending on the instrument version or application, all menu items may not be available or some may be differently assigned:

Setup

Menu item	Default value	Modified value
Lock adjustment	Released	
Measurement loop name	Sensor	
Units	Distance unit: mm Temperature unit: °C	
Probe length	Length of the probe Ex factory	
Type of medium	Liquid	
Application	Level, vessel	
Medium, dielectric constant	Water-based, > 10	
Superimposed gas phase	Yes	
Dielectric constant, upper medium (TS)	1.5	
Tube inner diameter	200 mm	
Max. adjustment - Level	100 %	
Max. adjustment - Level	Distance: 0.000 m(d) - note blocking distances	
Min. adjustment - Level	0 %	
Min. adjustment - Level	Distance: Probe length - take dead band into account	
Accept adjustment of the level measurement?	Yes	
Max. adjustment - Interface	100 %	
Max. adjustment - Interface	Distance: 0.000 m(d) - note blocking distances	
Min. adjustment - Interface	0 %	
Min. adjustment - Interface	Distance: Probe length - take dead band into account	
Integration time - Level	0.0 s	
Integration time - Interface	0.0 s	
Linearization type	Linear	
Linearization - Socket correction	0 mm	
Linearization - Vessel height	Probe length	

Menu item	Default value	Modified value
Scaling size - Level	Volume in l	
Scaling unit - Level	Litres	
Scaling format - Level	Without decimal positions	
Scaling level - 100 % corresponds to	100	
Scaling level - 0 % corresponds to	0	
Accept scaling of the level measurement	Yes	
Scaling variable - Interface	Volume	
Scaling unit - Interface	Litres	
Scaling format - Interface	Without decimal positions	
Scaling interface - 100 % corresponds to	100	
Scaling interface - 0 % corresponds to	0	
Current output, output variable First HART variable (PV)	Lin. percent - Level	
Current output - Output characteristics	0 ... 100 % correspond to 4 ... 20 mA	
Current output - Reaction in case of failure	≤ 3.6 mA	
Current output - Min.	3.8 mA	
Current output - Max.	20.5 mA	
Current output 2 - Output variable Second HART variable (SV)	Distance - Level	
Current output 2 - Output characteristics	0 ... 100 % correspond to 4 ... 20 mA	
Current output 2 - Reaction in case of failure	≤ 3.6 mA	
Current output - Min.	3.8 mA	
Current output - Max.	20.5 mA	
Third HART variable (TV)	Measurement certainty, level	
Fourth HART variable (QV)	Electronics temperature	

Display

Menu item	Default value	Modified value
Language	Order-specific	
Displayed value 1	Filling height Level	
Displayed value 2	Electronics temperature	
Backlight	Switched on	

Diagnostics

Menu item	Default value	Modified value
Status signals - Function control	Switched on	
Status signals - Out of specification	Switched off	

Menu item	Default value	Modified value
Status signals - Maintenance	Switched off	
Device memory - Echo curve memory	Stopped	
Device memory - Measured value memory	Started	
Device memory - Measured value memory - Measured values	Distance level, percentage value level, reliability level, electronics temperature	
Device memory - Measured value memory - Recording in time interval	3 min.	
Device memory - Measured value memory - Recording with measured value difference	15 %	
Device memory - Measured value memory - Start with measured value	Not active	
Device memory - Measured value memory - Stop with measured value	Not active	
Device memory - Measured value memory - Stop recording when memory is full	Not active	

Additional adjustments

Menu item	Default value	Modified value
PIN	0000	
Date	Actual date	
Time	Actual time	
Time - Format	24 hours	
Probe type	Device-specific	

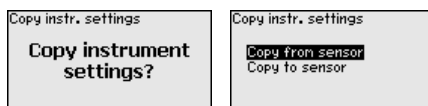
Additional adjustments - Copy instrument settings

The instrument settings are copied with this function. The following functions are available:

- Read from sensor: Read data from sensor and save in the display and adjustment module
- Write to sensor: Save data from the display and adjustment module back into the sensor

The following data or settings for adjustment of the display and adjustment module are saved:

- All data of the menu "Setup" and "Display"
- In the menu "Additional adjustments" the items "Reset, Date/Time"
- Special parameters



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

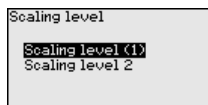


Note:

Before the data are stored in the sensor, a check is carried out to determine if the data fit the sensor. If the data do not fit, a fault signal is triggered or the function is blocked. When data are being written into the sensor, the display shows which instrument type the data originate from and which TAG-no. this sensor had.

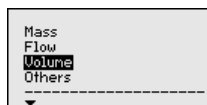
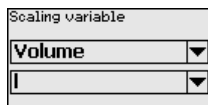
Additional settings - Scaling level

Since scaling is very extensive, scaling of the level value was divided into two menu items.



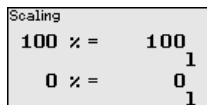
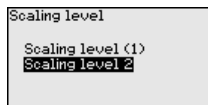
Additional settings - Scaling level 1

In menu item "Level 1" you define the scaling variable and the scaling unit for the level value on the display, e.g. volume in l.

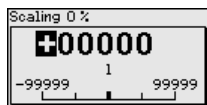
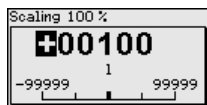
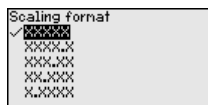


Additional settings - Scaling level 2

Since scaling is very extensive, scaling of the level value was divided into two menu items.



In menu item "Level 2" you define the scaling format on the display and the scaling of the measured level value for 0 % and 100 %.



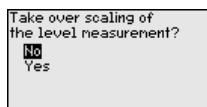
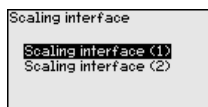
Additional settings - Scaling interface

Since scaling is very extensive, scaling of the interface value was divided into two menu items.

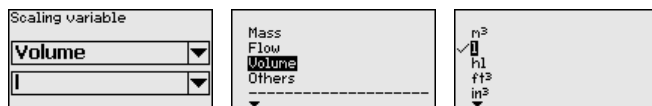
Additional settings - Scaling interface (1)

In menu item "Interface 1" you define the scaling size and the scaling unit for the interface value on the display, e.g. volume in l.

You can accept the scaling of the level measurement also for the interface measurement. If you select "Yes", the current setting is displayed.

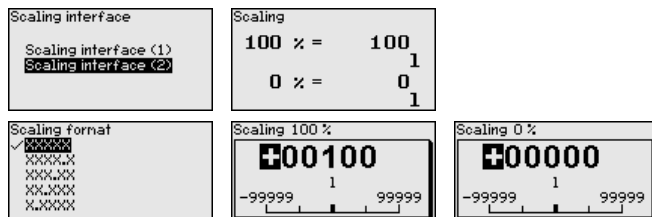


If you have selected "No", you can enter the scaling for the interface separately.



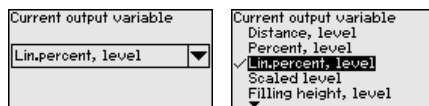
Additional settings - Scaling interface (2)

In menu item "Interface (2)" you define the scaling format on the display and the scaling of the interface measured value for 0 % and 100 %.



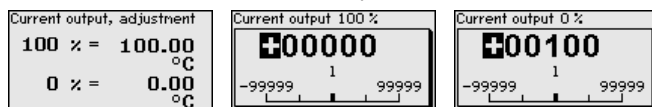
Additional settings - Current output, size

In menu item "Current output, variable" you specify which measured variable the current output refers to.



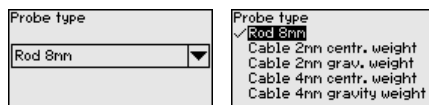
Additional settings - Current output, adjustment

In menu item "Current output, adjustment" you can assign a respective measured value to the current output.



Additional adjustments - Probe type

In this menu item you can select the type and size of your probe from a list of all possible probes. This is necessary to adapt the electronics optimally to the probe.



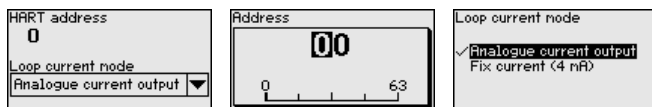
Additional adjustments - HART mode

The sensor offers the HART modes "Analogue current output" and "Fix current (4 mA)". In this menu item you determine the HART mode and enter the address with Multidrop mode.

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

If you select the function "Analogue current output" and also enter an address number, you can output a 4 ... 20 mA signal in Multidrop mode.

In the mode "Fixed current (4 mA)" a fixed 4 mA signal is output independently of the actual level.

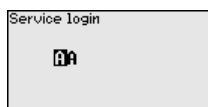


The default setting is "Analogue current output" and the address 00.

Additional adjustments - Special parameters

In this menu item you gain access to the protected area where you can enter special parameters. In exceptional cases, individual parameters can be modified in order to adapt the sensor to special requirements.

Change the settings of the special parameters only after having contacted our service staff.



Info - Instrument name

In this menu, you read out the instrument name and the instrument serial number.

Info - Instrument version

In this menu item, the hardware and software version of the sensor is displayed.



Info - Factory calibration date

In this menu item, the date of factory calibration of the sensor as well as the date of the last change of sensor parameters are displayed via the display and adjustment module or via the PC.



Info - Sensor characteristics

In this menu item, the features of the sensor such as approval, process fitting, seal, measuring range, electronics, housing and others are displayed.



6.5 Saving the parameter adjustment data

We recommended noting the adjusted data, e.g. in this operating instructions manual, and archiving them afterwards. They are thus available for multiple use or service purposes.

Backup on paper

Backup in the display and adjustment module

If the instrument is equipped with a display and adjustment module, the data in the sensor can be saved in the display and adjustment module. The procedure is described in the menu "*Additional adjustments*" in the menu item "*Copy sensor data*". The data remain there permanently even if the sensor power supply fails.

The following data or settings for adjustment of the display and adjustment module are saved:

- All data of the menu "*Setup*" and "*Display*"
- In the menu "*Additional settings*" the items "*Sensor-specific units, temperature unit and linearization*"
- The values of the user programmable linearization curve

The function can also be used to transfer settings from one instrument to another instrument of the same type. If it is necessary to exchange a sensor, the display and adjustment module is inserted into the replacement instrument and the data are likewise written into the sensor via the menu item "*Copy sensor data*".

7 Setup with PACTware

7.1 Connect the PC

Via the interface adapter directly on the sensor

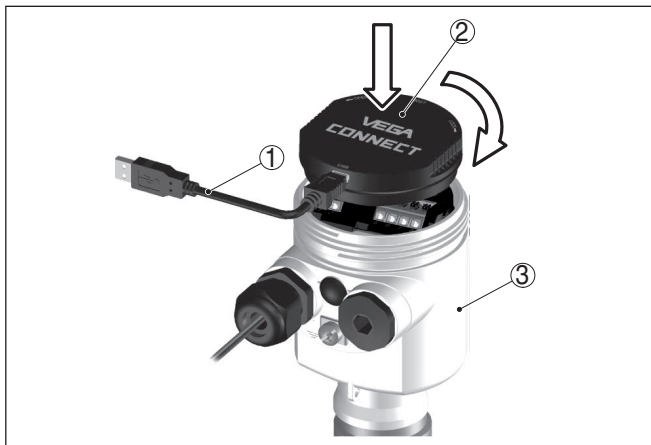


Fig. 20: Connection of the PC directly to the sensor via the interface adapter

- 1 USB cable to the PC
- 2 Interface adapter VEGACONNECT
- 3 Sensor

Connection via HART

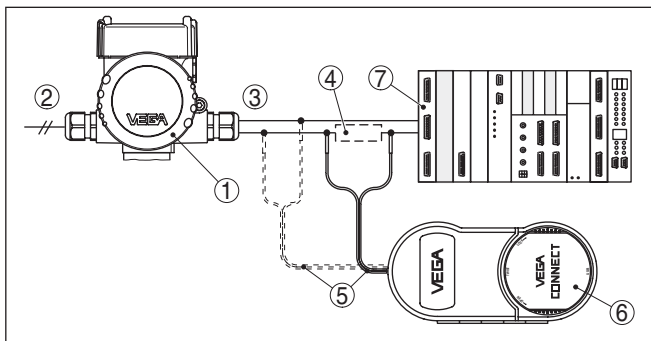


Fig. 21: Connecting the PC via HART to the signal cable

- 1 VEGAFLEX 86
- 2 Voltage supply
- 3 4 ... 20 mA signal output
- 4 HART resistance approx. 250 Ω (optional depending on processing)
- 5 Connection cable with 2 mm pins and terminals
- 6 VEGACONNECT
- 7 Processing system/PLC

Necessary components:

- VEGAFLEX 86
- PC with PACTware and suitable VEGA DTM

- VEGACONNECT
- HART resistance approx. 250 Ω
- Processing system/PLC

**Note:**

With power supply units with integrated HART resistance (internal resistance approx. 250 Ω), an additional external resistance is not necessary. This applies, e.g. to the VEGA instruments VEGATRENN 149A, VEGAMET 381 and VEGAMET 391). Commercially available Ex separators are also usually equipped with sufficient current limitation resistance. In such cases, VEGACONNECT can be connected parallel to the 4 ... 20 mA cable.

Prerequisites**7.2 Parameter adjustment with PACTware**

For parameter adjustment of the sensor via a Windows PC, the configuration software PACTware and a suitable instrument driver (DTM) according to FDT standard are required. The up-to-date PACTware version as well as all available DTMs are compiled in a DTM Collection. The DTMs can also be integrated into other frame applications according to FDT standard.

**Note:**

To ensure that all instrument functions are supported, you should always use the latest DTM Collection. Furthermore, not all described functions are included in older firmware versions. You can download the latest instrument software from our homepage. A description of the update procedure is also available in the Internet.

Further setup steps are described in the operating instructions manual "*DTM Collection/PACTware*" attached to each DTM Collection and which can also be downloaded from the Internet. Detailed descriptions are available in the online help of PACTware and the DTMs.

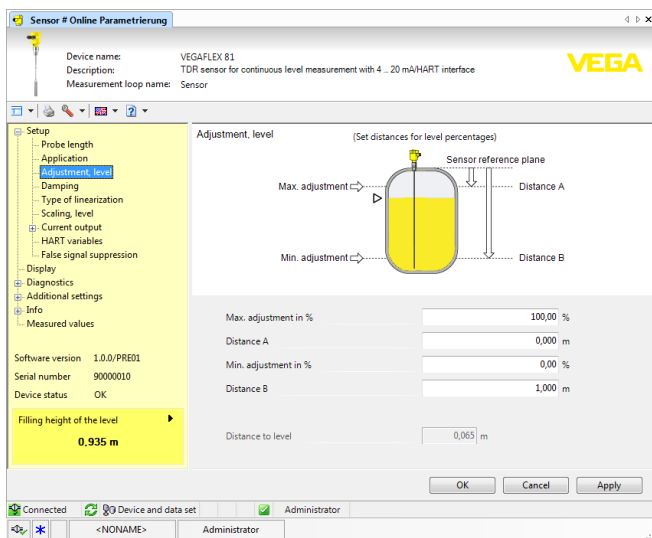


Fig. 22: Example of a DTM view

Standard/Full version

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.

The standard version is available as a download under www.vega.com/downloads and "Software". The full version is available on CD from the agency serving you.

7.3 Set up with the quick setup

General information

The quick setup is another option for parameter adjustment of the sensor. It allows fast, convenient adjustment of the most important parameters to adapt the sensor quickly to standard applications. To use it, select the function "Quick setup" in the start screen.

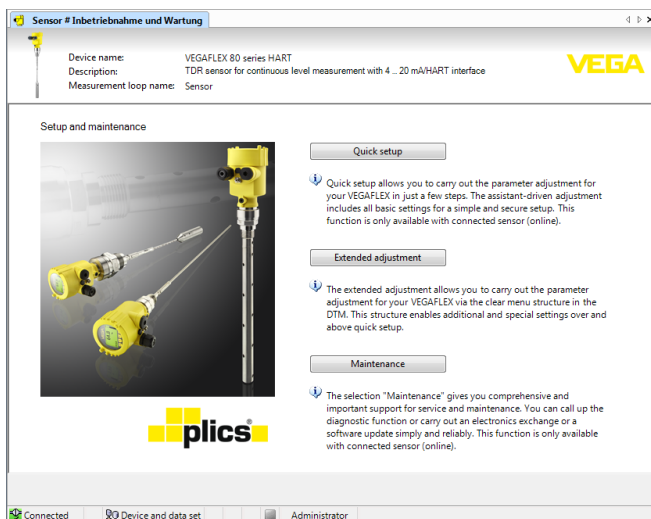


Fig. 23: Select quick setup

- 1 Quick setup
- 2 Extended adjustment
- 3 Maintenance

Quick setup

With quick setup you can carry out the parameter adjustment of VEGAFLEX 86 for your application in just a few simple steps. The assistant-driven adjustment includes the basic settings for simple, reliable setup and commissioning.



Information:

If the function is inactive, then possibly no instrument is connected. Check the connection to the instrument.

Extended adjustment

With the extended adjustment, you carry out the parameter adjustment for the instrument via the clear menu structure in the DTM (Device Type Manager). This enables additional and special settings over and above those offered by quick setup.

Maintenance

Under the menu item "Maintenance" you get comprehensive and important support for servicing and maintenance. You can call up diagnostic functions and carry out an electronics exchange or a software update.

Start quick setup

Click to the button "Quick setup", to start the assistant-driven adjustment for a simplified and reliable setup.

7.4 Saving the parameter adjustment data

We recommend documenting or saving the parameter adjustment data via PACTware. That way the data are available for multiple use or service purposes.

8 Set up with other systems

8.1 DD adjustment programs

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

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

8.2 Field Communicator 375, 475

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

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

9 Diagnostics and servicing

9.1 Maintenance

If the device is used correctly, no maintenance is required in normal operation.

9.2 Diagnosis memory

The instrument has several memories which are available for diagnosis purposes. The data remain even with voltage interruption.

Measured value memory

Up to 100,000 measured values can be stored in the sensor in a ring memory. Each entry contains date/time as well as the respective measured value. Storable values are for example:

- Distance
- Filling height
- Percentage value
- Lin. percent
- Scaled
- Current value
- Meas. reliability
- Electronics temperature

When the instrument is shipped, the measured value memory is active and stores distance, measurement certainty and electronics temperature every 3 minutes.

In "Extended adjustment" you can select the respective measured values.

The requested values and recording conditions are set via a PC with PACTware/DTM or the control system with EDD. Data are thus read out and also reset.

Event memory

Up to 500 events are automatically stored with a time stamp in the sensor (non-deletable). Each entry contains date/time, event type, event description and value. Event types are for example:

- Modification of a parameter
- Switch-on and switch-off times
- Status messages (according to NE 107)
- Error messages (according to NE 107)

The data are read out via a PC with PACTware/DTM or the control system with EDD.

Echo curve memory

The echo curves are stored with date and time and the corresponding echo data. The memory is divided into two sections:

Echo curve of the setup: This is used as reference echo curve for the measurement conditions during setup. Changes in the measurement conditions during operation or buildup on the sensor can thus be recognized. The echo curve of the setup is stored via:

- PC with PACTware/DTM
- Control system with EDD

- Display and adjustment module

Further echo curves: Up to 10 echo curves can be stored in a ring buffer in this memory section. Further echo curves are stored via:

- PC with PACTware/DTM
- Control system with EDD
- Display and adjustment module

9.3 Status messages

The instrument features self-monitoring and diagnostics according to NE 107 and VDI/VDE 2650. In addition to the status messages in the following tables, detailed error messages are available under menu item "Diagnostics" via the display and adjustment module, PACTware/DTM and EDD.

Status messages

The status messages are divided into the following categories:

- Failure
- Function check
- Out of specification
- Maintenance requirement

and explained by pictographs:

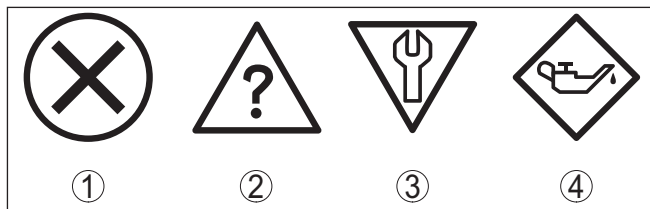


Fig. 24: Pictographs of the status messages

- 1 Failure - red
- 2 Out of specification - yellow
- 3 Function check - orange
- 4 Maintenance - blue

Failure: Due to a malfunction in the instrument, a failure message is outputted.

This status message is always active. It cannot be deactivated by the user.

Function check: The instrument is in operation, the measured value is temporarily invalid (for example during simulation).

This status message is inactive by default. It can be activated by the user via PACTware/DTM or EDD.

Out of specification: The measured value is unstable because the instrument specification is exceeded (e.g. electronics temperature).

This status message is inactive by default. It can be activated by the user via PACTware/DTM or EDD.

Maintenance: Due to external influences, the instrument function is limited. The measurement is affected, but the measured value is

still valid. Plan in maintenance for the instrument because a failure is expected in the near future (e.g. due to buildup).

This status message is inactive by default. It can be activated by the user via PACTware/DTM or EDD.

Failure

The following table shows the error codes in the status message "Failure" and gives information on the reason and rectification. Keep in mind that some information is only valid with four-wire instruments.

Code Text message	Cause	Rectification
F013 no measured value available	<ul style="list-style-type: none"> – Sensor does not detect an echo during operation – Process component or probe contaminated or defective 	<ul style="list-style-type: none"> – Check or correct installation and/or parameter adjustment – Clean or exchange process component or probe
F017 Adjustment span too small	<ul style="list-style-type: none"> – Adjustment not within specification 	<ul style="list-style-type: none"> – Change adjustment according to the limit values (difference between min. and max. ≥ 10 mm)
F025 Error in the linearization table	<ul style="list-style-type: none"> – Index markers are not continuously rising, for example illogical value pairs 	<ul style="list-style-type: none"> – Check values of the linearization table – Delete/create a new linearization table
F036 No operable software	<ul style="list-style-type: none"> – Failed or interrupted software update 	<ul style="list-style-type: none"> – Repeat software update – Check electronics version – Exchanging the electronics – Send instrument for repair
F040 Error in the electronics	<ul style="list-style-type: none"> – Hardware defect 	<ul style="list-style-type: none"> – Exchanging the electronics – Send instrument for repair
F041 Probe loss	<ul style="list-style-type: none"> – Probe mechanically defective 	<ul style="list-style-type: none"> – Check probe and exchange, if necessary
F080 General software error	<ul style="list-style-type: none"> – General software error 	<ul style="list-style-type: none"> – Disconnect operating voltage briefly
F105 Measured value is determined	<ul style="list-style-type: none"> – The instrument is still in the start phase, the measured value could not yet be determined 	<ul style="list-style-type: none"> – Wait for the end of the switch-on phase – Duration depending on the version and parameter adjustment max. 5 min.
F113 Communication error	<ul style="list-style-type: none"> – EMC interference – Transmission error with the external communication with 4-wire power supply unit 	<ul style="list-style-type: none"> – Remove EMC influences – Exchange 4-wire power supply unit or electronics
F260 Error in the calibration	<ul style="list-style-type: none"> – Error in the calibration carried out in the factory – Error in the EEPROM 	<ul style="list-style-type: none"> – Exchanging the electronics – Send instrument for repair

Code Text mes- sage	Cause	Rectification
F261 Error in the instrument settings	<ul style="list-style-type: none"> – Error during setup – Error when carrying out a reset – False signal suppression faulty 	<ul style="list-style-type: none"> – Carry out a reset – Repeat setup
F264 Installation/ Setup error	<ul style="list-style-type: none"> – Error during setup 	<ul style="list-style-type: none"> – Check or correct installation and/or parameter adjustment – Check probe length
F265 Measurement function dis- turbed	<ul style="list-style-type: none"> – Sensor no longer carries out a measurement 	<ul style="list-style-type: none"> – Carry out a reset – Disconnect operating voltage briefly
F267 No executable sensor soft- ware	<ul style="list-style-type: none"> – Sensor cannot start 	<ul style="list-style-type: none"> – Exchanging the electronics – Send instrument for repair

Function check

The following table shows the error codes and text messages in the status message "*Function check*" and provides information on causes as well as corrective measures.

Code Text mes- sage	Cause	Rectification
C700 Simulation ac- tive	<ul style="list-style-type: none"> – A simulation is active 	<ul style="list-style-type: none"> – Finish simulation – Wait for the automatic end after 60 mins.

Out of specification

The following table shows the error codes and text messages in the status message "*Out of specification*" and provides information on causes as well as corrective measures.

Code Text mes- sage	Cause	Rectification
S600 Impermissi- ble electronics temperature	<ul style="list-style-type: none"> – Temperature of the processing electronics in the non-specified section 	<ul style="list-style-type: none"> – Check ambient temperature – Isolate electronics – Use instrument with higher temperature range
S601 Overfilling	<ul style="list-style-type: none"> – Level echo in the close range not available 	<ul style="list-style-type: none"> – Reduce level – 100 % adjustment: Increase value – Check mounting socket – Remove possible interfering signals in the close range – Use coaxial probe

Code Text mes- sage	Cause	Rectification
S602 Level with- in the search range, com- pensation echo	– Compensation echo super- imposed by medium	– 100 % adjustment: Increase value
S603 Impermissi- ble operating voltage	– Operating voltage below specified range	– Check electrical connection – If necessary, increase operating voltage

Maintenance

The following table shows the error codes and text messages in the status message "Maintenance" and provides information on causes as well as corrective measures.

Code Text mes- sage	Cause	Rectification
M500 Error in the delivery sta- tus	– With the reset to delivery status, the data could not be restored	– Repeat reset – Load XML file with sensor data into the sensor
M501 Error in the non-active linearization table	– Index markers are not con- tinuously rising, for example illogical value pairs	– Check linearization table – Delete table/Create new
M502 Error in the event memory	– Hardware error EEPROM	– Exchanging the electronics – Send instrument for repair
M503 Meas. reliabil- ity too low	– Measurement certainty is too low for a reliable meas- urement – Process component or probe contaminated or defective	– Check installation and process conditions – Clean or exchange process component or probe
M504 Error on an device inter- face	– Hardware defect	– Exchanging the electronics – Send instrument for repair
M505 no measured value avail- able	– Sensor does not detect an echo during operation	– Check and correct instal- lation and/or parameter adjustment
	– Process component or probe contaminated or defective	– Clean or exchange process component or probe

Code Text mes- sage	Cause	Rectification
M506 Installation/ Setup error	– Error during setup	– Check and correct instal- lation and/or parameter adjustment – Check probe length
M507 Error in the instrument settings	– Error during setup – Error when carrying out a reset – False signal suppression faulty	– Carry out reset and repeat setup

9.4 Rectify faults

Reaction when malfunc- tion occurs

The operator of the system is responsible for taking suitable meas-
ures to rectify faults.

Procedure for fault recti- fication

The first measures are:

- Evaluation of fault messages, for example via the display and adjustment module
- Checking the output signal
- Treatment of measurement errors

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

Check the 4 ... 20 mA signal

Connect a multimeter in the suitable measuring range according to the wiring plan. The following table describes possible errors in the current signal and helps to eliminate them:

Error	Cause	Rectification
4 ... 20 mA signal not stable	– Fluctuations of the measured variable	– Set damping appropriate to the instrument via the display and adjustment module or PACTware/DTM
4 ... 20 mA signal missing	– Electrical connection faulty	– Check connection according to chapter "Connection steps" and if necessary, correct according to chapter "Wiring plan"
	– Voltage supply missing	– Check cables for breaks; repair if necessary
	– Operating voltage too low or load resistance too high	– Check, adapt if necessary
Current signal greater than 22 mA or less than 3.6 mA	– Electronics module in the sensor defective	– Exchange the instrument or send it in for repair

Treatment of measurement errors

The below tables show typical examples for application-relevant measurement errors. There are two measurement errors:

- Constant level
- Filling
- Emptying

The images in column "Error pattern" show the real level as a broken line and the level displayed by the sensor as a continuous line.

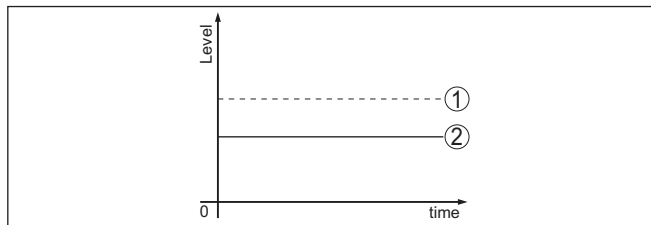


Fig. 25: The broken line 1 shows the real level, the continuous line 2 shows the level displayed by the sensor



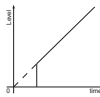
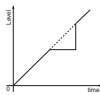
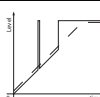
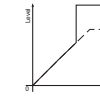
Note:

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

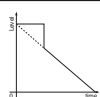

Measurement error with constant level

Fault description	Error pattern	Cause	Rectification
1. Measured value shows a too low or too high level		– Min./max. adjustment not correct	– Adapt min./max. adjustment
		– Incorrect linearization curve	– Adapt linearization curve
		– Running time error (small measurement error close to 100 %/serious error close to 0 %)	– Repeat setup
2. Measured value jumps towards 100 %		– Due to the process, the amplitude of the product echo decreases	– Carry out a false signal suppression
		– A false signal suppression was not carried out	
		– Amplitude or position of a false signal has changed (e.g. buildup); false signal suppression no longer matches	– Determine the reason for the changed false signals, carry out false signal suppression, e.g. with buildup

Measurement error during filling

Fault description	Error pattern	Cause	Rectification
3. Measured value remains in the area of the bottom during filling		<ul style="list-style-type: none"> Echo from the probe end larger than the product echo, for example, with products with $\epsilon_r < 2.5$ oil-based, solvents, etc. 	<ul style="list-style-type: none"> Check parameter "Medium" and "Vessel height", adapt if necessary
4. Measured value remains momentarily unchanged during filling and then jumps to the correct level		<ul style="list-style-type: none"> Turbulence on the product surface, quick filling 	<ul style="list-style-type: none"> Check parameters, change if necessary, e.g. in dosing vessel, reactor
5. Measured value jumps sporadically to 100 % during filling		<ul style="list-style-type: none"> Changing condensation or contamination on the probe 	<ul style="list-style-type: none"> Carry out a false signal suppression
6. Measured value jumps to ≥ 100 % or 0 m distance		<ul style="list-style-type: none"> Level echo is no longer detected in the close range due to false signals in the close range. The sensor goes into overfill protection mode. The max. level (0 m distance) as well as the status message "Overfill protection" are outputted. 	<ul style="list-style-type: none"> Eliminate false signals in the close range Check installation conditions If possible, switch off the function "Overfill protection"

Measurement error during emptying

Fault description	Error pattern	Cause	Rectification
7. Measured value remains unchanged in the close range during emptying		<ul style="list-style-type: none"> False signal larger than the level echo Level echo too small 	<ul style="list-style-type: none"> Eliminate false signals in the close range Remove contamination on the probe. After having removed the source of the false signals, the false signal suppression must be deleted. Carry out a new false signal suppression
8. Measured value remains reproducible in one position during emptying		<ul style="list-style-type: none"> Stored false signals in this position are larger than the level echo 	<ul style="list-style-type: none"> Delete false signal memory Carry out a new false signal suppression

Reaction after fault rectification

Depending on the reason for the fault and the measures taken, the steps described in chapter "Setup" must be carried out again or must be checked for plausibility and completeness.

24 hour service hotline

Should these measures not be successful, please call in urgent cases the VEGA service hotline under the phone no. **+49 1805 858550**.

The hotline is also available outside normal working hours, seven days a week around the clock.

Since we offer this service worldwide, the support is provided in English. The service itself is free of charge, the only costs involved are the normal call charges.

9.5 Exchanging the electronics module

If the electronics module is defective, it can be replaced by the user.



In Ex applications, only instruments and electronics modules with appropriate Ex approval may be used.

If there is no electronics module available on site, the electronics module can be ordered through the agency serving you. The electronics modules are adapted to the respective sensor and differ in signal output or voltage supply.

The new electronics module must be loaded with the default settings of the sensor. These are the options:

- In the factory
- Or on site by the user

In both cases, the serial number of the sensor is needed. The serial numbers are stated on the type label of the instrument, on the inside of the housing as well as on the delivery note.

When loading on site, first of all the order data must be downloaded from the Internet (see operating instructions manual "*Electronics module*").



Caution:

All user-specific settings must be entered again. Hence, you have to carry out a new setup after the electronics exchange.

If you have stored the data of the parameter adjustment during the first setup of the sensor, you can transfer these to the replacement electronics module. A new setup is no more necessary.

9.6 Software update

The following components are required to update the instrument software:

- Instrument
- Voltage supply
- Interface adapter VEGACONNECT
- PC with PACTware
- Current instrument software as file

You can find the current instrument software as well as detailed information on the procedure in the download area of our homepage: www.vega.com.



Caution:

Instruments with approvals can be bound to certain software versions. Therefore make sure that the approval is still effective after a software update is carried out.

You can find detailed information in the download area at www.vega.com.

9.7 How to proceed if a repair is necessary

You can find an instrument return form as well as detailed information of the procedure in the download area on our homepage: www.vega.com.

By doing this you help us carry out the repair quickly and without having to call back for needed information.

If a repair is necessary, please proceed as follows:

- Print and fill out one form per instrument
- Clean the instrument and pack it damage-proof
- Attach the completed form and, if need be, also a safety data sheet outside on the packaging
- Please contact the agency serving you to get the address for the return shipment. You can find the agency on our home page www.vega.com.

10 Dismount

10.1 Dismounting steps

**Warning:**

Before dismounting, be aware of dangerous process conditions such as e.g. pressure in the vessel or pipeline, high temperatures, corrosive or toxic products etc.

Take note of chapters "*Mounting*" and "*Connecting to power supply*" and carry out the listed steps in reverse order.

10.2 Disposal

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

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

Materials: see chapter "*Technical data*"

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

WEEE directive 2002/96/EG

This instrument is not subject to the WEEE directive 2002/96/EG and the respective national laws. Pass the instrument directly on to a specialised recycling company and do not use the municipal collecting points. These may be used only for privately used products according to the WEEE directive.

11 Supplement

11.1 Technical data

General data

Material 316L corresponds to 1.4404 or 1.4435

Materials, wetted parts

- | | |
|---|--|
| – Process fitting - coax version | 316L, Alloy C22 (2.4602) and Aluminium oxide-ceramic 99.7 % (Al_2O_3) or Alloy C22 (2.4602) and Aluminium oxide-ceramic 99.7 % (Al_2O_3) |
| – Tube: \varnothing 42.2 mm (1.661 in) | 316L or Alloy C22 (2.4602) |
| – Process seal on the instrument side (cable/rod leadthrough) | Aluminium oxide-ceramic 99.7 % (Al_2O_3) and graphite |
| – Process seal | On site |
| – Inner conductor (up to the separation rod) | Alloy C22 (2.4602) |
| – Spacer | Al_2O_3 |

Materials, non-wetted parts

- | | |
|---|--|
| – Plastic housing | plastic PBT (Polyester) |
| – Aluminium die-casting housing | Aluminium die-casting AlSi10Mg, powder-coated - basis: Polyester |
| – Stainless steel housing - precision casting | 316L |
| – Stainless steel housing, electropolished | 316L |
| – Second Line of Defense | Borosilicate glass GPC 540 |
| – Seal between housing and housing cover | NBR (stainless steel housing, precision casting), silicone (aluminium/plastic housing; stainless steel housing, electropolished) |
| – Inspection window in housing cover (optional) | Polycarbonate (with Ex d version: glass) |
| – Ground terminal | 316L |

Second Line of Defense

- | | |
|--|------------------------------------|
| – The Second Line of Defense (SLOD) is a second level of the process separation in the form of a gas-tight feedthrough in the lower part of the housing, preventing product from penetrating into the housing. | |
| – Supporting material | 316L |
| – Glass potting | Borosilicate glass GPC 540 |
| – Contacts | Alloy C22 |
| – Helium leak rate | $< 10^{-6}$ mbar l/s |
| – Pressure resistance | See process pressure of the sensor |

Process fittings

- Pipe thread, cylindrical (DIN 3852-A) G1½
- American pipe thread, conical (ASME B1.20.1) 1½ NPT
- Flanges e.g. DIN from DN 50, ASME from 2"

Weight

- Instrument weight (depending on process fitting) approx. 6 ... 12 kg (13.23 ... 26.46 lbs)
- Tube: ø 42.2 mm (1.661 in) approx. 3100 g/m (33.3 oz/ft)

Probe length L (from seal surface)

- Tube: ø 42.2 mm (1.661 in) up to 6 m (19.69 ft)
- Trimming accuracy - tube ±1 mm

Lateral load

- Tube: ø 42.2 mm (1.661 in) 300 Nm (221 lbf ft)

Torque for process fitting, thread

- -196 ... +280 °C (-321 ... +536 °F) max. 450 Nm (332 lbf ft)
- -196 ... +450 °C (-321 ... +842 °F) max. 400 Nm (295 lbf ft)

Torque for NPT cable glands and Conduit tubes

- Plastic housing max. 10 Nm (7.376 lbf ft)
- Aluminium/Stainless steel housing max. 50 Nm (36.88 lbf ft)

Input variable

Measured variable Level of liquids

Min. dielectric constant of the medium $\epsilon_r \geq 1.4$

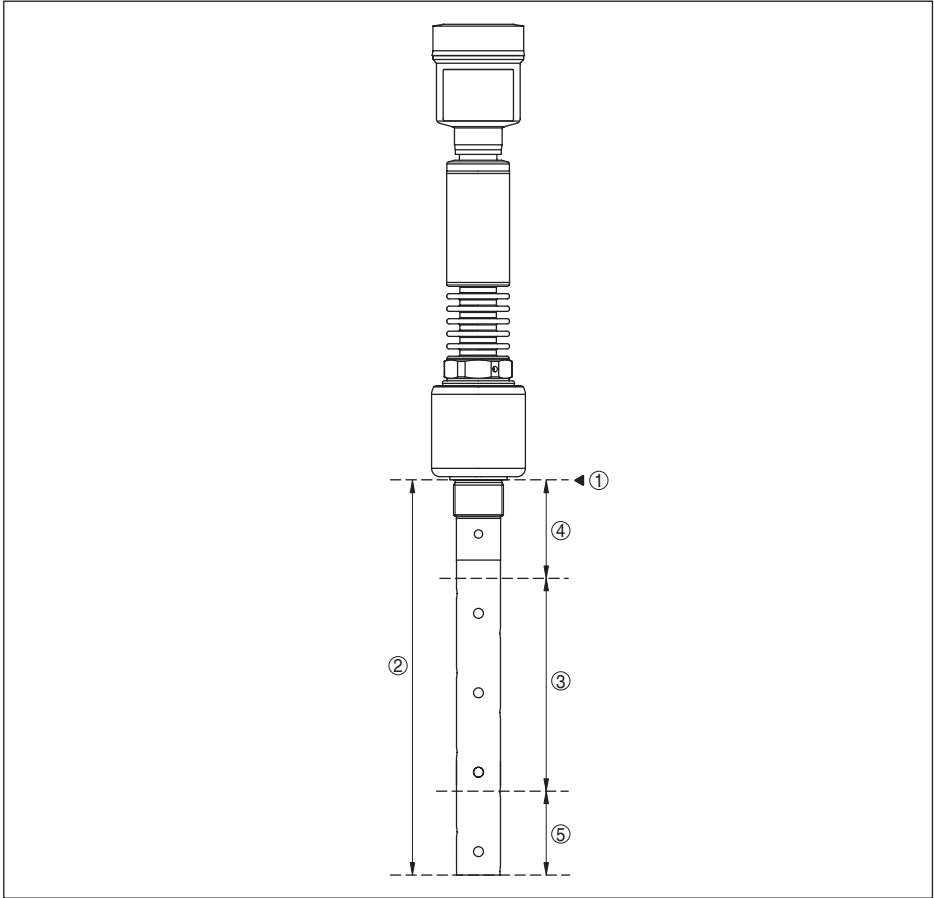


Fig. 34: Measuring ranges - VEGAFLEX 86

- 1 Reference plane
- 2 Probe length L
- 3 Measuring range (default setting refers to the measuring range in water)
- 4 Upper dead band (see diagrams under Accuracy - grey section)
- 5 Lower dead band (see diagrams under Accuracy - grey section)

Output variable

Output signals	4 ... 20 mA/HART - active; 4 ... 20 mA/HART - passive
Range of the output signal	3.8 ... 20.5 mA/HART (default setting)
Terminal voltage passive	9 ... 30 V DC
Shortcircuit protection	Available
Potential separation	Available
Signal resolution	0.3 μ A
Failure signal current output (adjustable)	Last valid measured value, ≥ 21.0 mA, ≤ 3.6 mA

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Max. output current	21 mA
Starting current	≤ 3.6 mA
Load (4 ... 20 mA/HART - active)	< 500 Ω
Damping (63 % of the input variable)	0 ... 999 s, adjustable
HART output values according to HART 7 (default setting) ¹⁾	
– First HART value (PV)	Linearised percentage value, level
– Second HART value (SV)	Distance to the level
– Third HART value (TV)	Measurement certainty, level
– Fourth HART value (QV)	Electronics temperature
Indication value - Display and adjustment module ²⁾	
– Displayed value 1	Filling height - Level
– Displayed value 2	Electronics temperature
Resolution, digital	< 1 mm (0.039 in)

Accuracy (according to DIN EN 60770-1)

Process reference conditions according to DIN EN 61298-1

– Temperature	+18 ... +30 °C (+64 ... +86 °F)
– Relative humidity	45 ... 75 %
– Air pressure	+860 ... +1060 mbar/+86 ... +106 kPa (+12.5 ... +15.4 psig)

Installation reference conditions

– Min. distance to internal installations	> 500 mm (19.69 in)
– Vessel	metallic, ø 1 m (3.281 ft), centric installation, process fitting flush with the vessel ceiling
– Medium	Water/Oil (dielectric constant ~2.0) ³⁾
– Installation	Probe end does not touch the vessel bottom

Sensor parameter adjustment No gating out of false signals carried out

Typical deviation - Interface measurement ± 5 mm (0.197 in)

Typical deviation - Total level interface measurement See following diagrams

Typical deviation - Level measurement⁴⁾⁵⁾ See following diagrams

¹⁾ The output values can be assigned individually

²⁾ The indication values can be assigned individually

³⁾ With interface measurement = 2.0

⁴⁾ Depending on the installation conditions, deviations can occur which can be rectified by adapting the adjustment or changing the measured value offset in the DTM service mode

⁵⁾ The dead bands can be optimized via a false signal suppression.

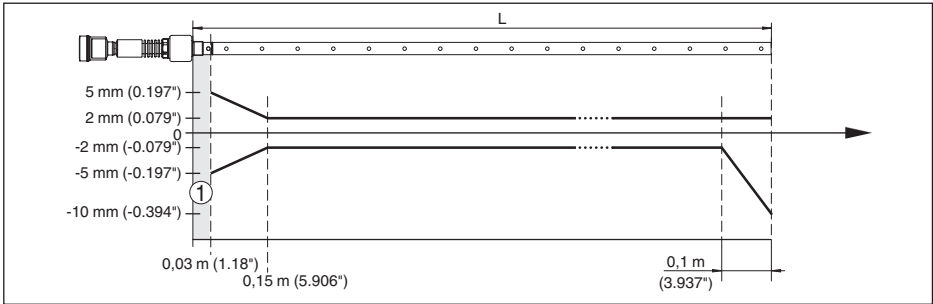


Fig. 35: Deviation VEGAFLEX 86 in coax version in water - measurement length up to 1.5 m (4.92 ft)

1 Dead band - no measurement possible in this area
L Probe length

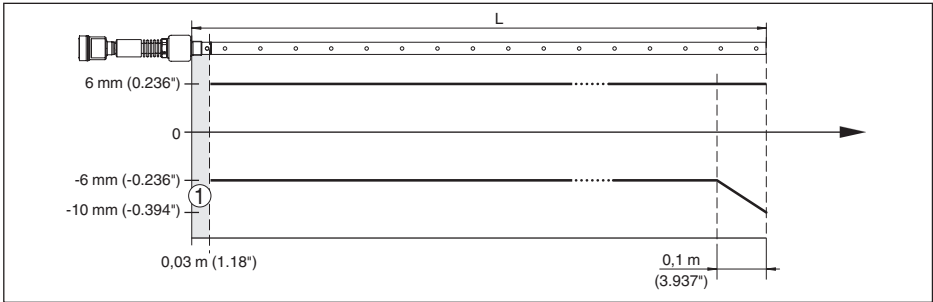


Fig. 36: Deviation VEGAFLEX 86 in coax version in water - measurement length up to 6 m (19.69 ft)

1 Dead band - no measurement possible in this area
L Probe length

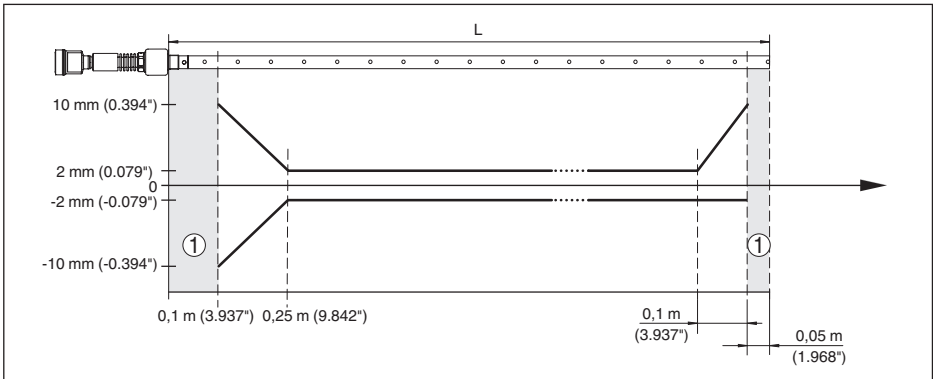


Fig. 37: Deviation VEGAFLEX 86 in coax version in oil - measurement length up to 1.5 m (4.92 ft)

1 Dead band - no measurement possible in this area
L Probe length

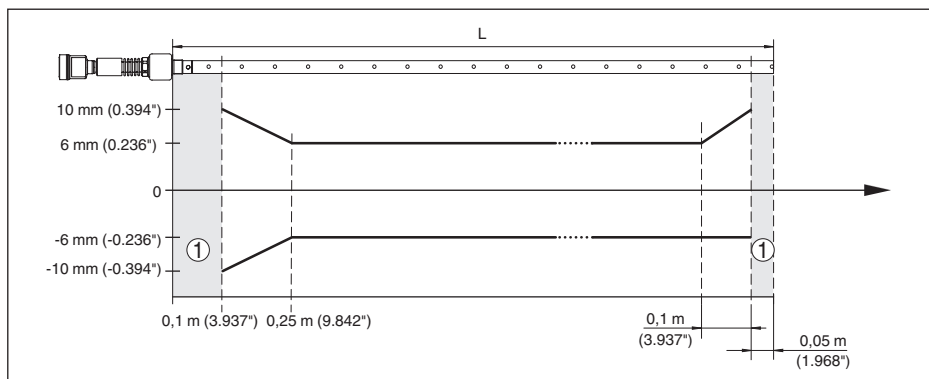


Fig. 38: Deviation VEGAFLEX 86 in coax version in oil - measurement length up to 6 m (19.69 ft)

1 Dead band - no measurement possible in this area
L Probe length

Max. deviation and max. deviating upper
blocking distance - version with refer-
ence distance

Length - Reference dis- tance (7)	Length - Blocking dis- tance (4)	Probe length min. (2)	Deviation max.
260 mm (10.24 in)	450 mm (17.72 in)	> 1000 mm (39.37 in)	± 10 %
500 mm (19.69 in)	690 mm (27.17 in)	> 1250 mm (49.21 in)	± 5 %
750 mm (29.53 in)	940 mm (37.01 in)	> 1500 mm (59.06 in)	± 3 %

Repeatability ≤ ±1 mm

Variables influencing measurement accuracy

Specifications for the digital measured value

Temperature drift - Digital output ±3 mm/10 K relating to the max. measuring range or
max. 10 mm (0.394 in)

Additional deviation through electromag- < ±10 mm (< ±0.394 in)
netic interference acc. to EN 61326

Specifications apply also to the current output⁶⁾

Temperature drift - Current output ±0.03 %/10 K relating to the 16 mA span max. ±0.3 %

Deviation on the current output through < ±15 µA
analogue/digital conversion

Additional deviation through electromag- < ±150 µA
netic interference acc. to EN 61326

Influence of the superimposed gas and pressure to the accuracy

The propagation speed of the radar impulses in gas or vapour above the medium is reduced by
high pressure. This effect depends on the superimposed gas or vapours.

⁶⁾ Also for the additional current output (optional)

The following table shows the resulting deviation for some typical gases and vapours. The specified values refer to the distance. Positive values mean that the measured distance is too large, negative values that the measured distance is too small.

Gas phase	Temperature	Pressure				
		10 bar (145 psig)	50 bar (725 psig)	100 bar (1450 psig)	200 bar (2900 psig)	400 bar (5800 psig)
Air	20 °C/68 °F	0.22 %	1.2 %	2.4 %	4.9 %	9.5 %
	200 °C/392 °F	0.13 %	0.74 %	1.5 %	3 %	6 %
	400 °C/752 °F	0.08 %	0.52 %	1.1 %	2.1 %	4.2 %
Hydrogen	20 °C/68 °F	0.10 %	0.61 %	1.2 %	2.5 %	4.9 %
	200 °C/392 °F	0.05 %	0.37 %	0.76 %	1.6 %	3.1 %
	400 °C/752 °F	0.03 %	0.25 %	0.53 %	1.1 %	2.2 %
Steam (saturated steam)	100 °C/212 °F	-	-	-	-	-
	180 °C/356 °F	2.1 %	-	-	-	-
	264 °C/507 °F	1.44 %	9.2 %	-	-	-
	366 °C/691 °F	1.01 %	5.7 %	13.2 %	76 %	-

Characteristics and performance data

Measuring cycle time	< 500 ms
Step response time ⁷⁾	≤ 3 s
Max. filling/emptying speed	1 m/min
	Products with high dielectric constant (>10) up to 5 m/min.

Ambient conditions

Ambient, storage and transport temperature	-40 ... +80 °C (-40 ... +176 °F)
--	----------------------------------

Process conditions

For the process conditions, please also note the specifications on the type label. The lowest value always applies.	
The measurement error through the process conditions in the specified pressure and temperature range is < 1 %.	
Process pressure	-1 ... +400 bar/-100 ... +40000 kPa (-14.5 ... +5800 psig), depending on the process fitting
Vessel pressure relating to the flange nominal pressure stage	see supplementary instructions manual " <i>Flanges according to DIN-EN-ASME-JIS</i> "
Process temperature	-196 ... +280 °C (-321 ... +536 °F)

⁷⁾ Time span after a sudden measuring distance change by max. 0.5 m in liquid applications, max 2 m with bulk solids applications, until the output signal has taken for the first time 90 % of the final value (IEC 61298-2).

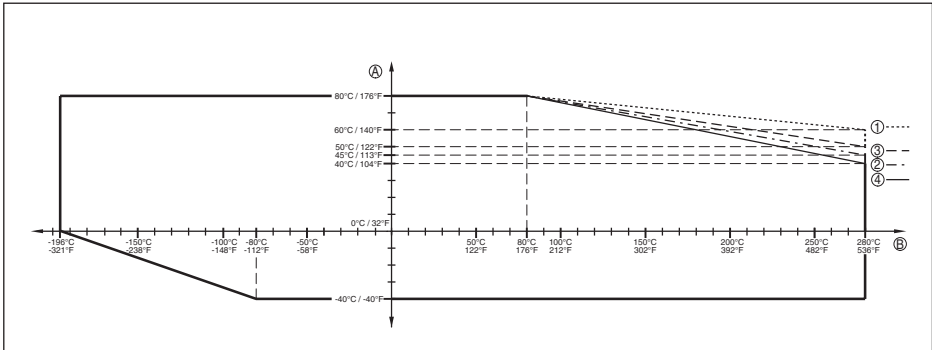


Fig. 39: Ambient temperature - process temperature, standard version

- A Ambient temperature
 B Process temperature (depending on the seal material)
 1 Aluminium housing
 2 Plastic housing
 3 Stainless steel housing, precision casting
 4 Stainless steel housing, electropolished

Process temperature

-196 ... +450 °C (-321 ... +842 °F)

The measurement error from the process conditions is in the specified pressure and temperature range of below 1 %.

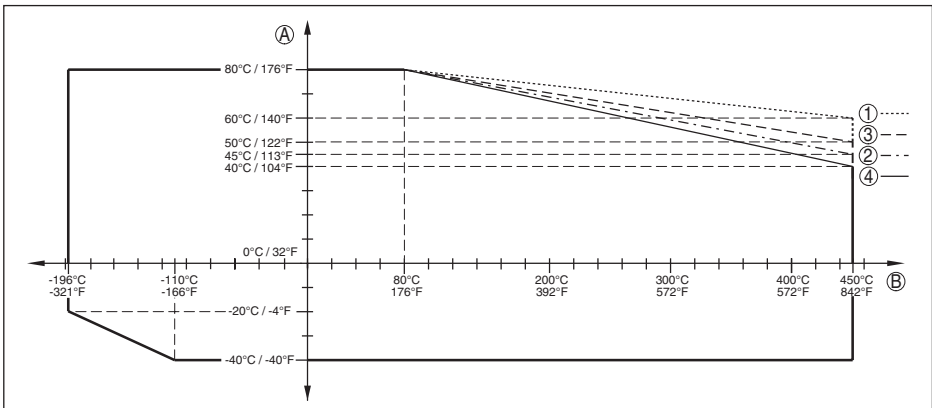


Fig. 40: Ambient temperature - process temperature, standard version

- A Ambient temperature
 B Process temperature (depending on the seal material)
 1 Aluminium housing
 2 Plastic housing
 3 Stainless steel housing, precision casting
 4 Stainless steel housing, electropolished

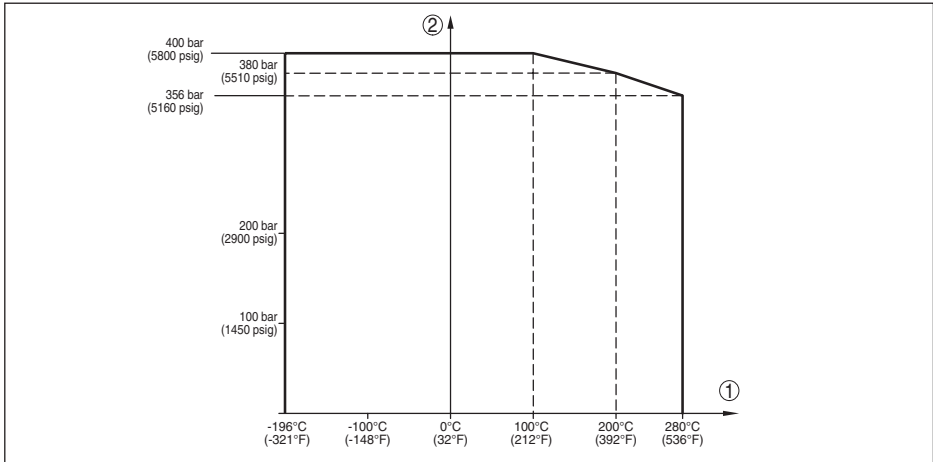


Fig. 41: Process pressure - process temperature (version -196 ... +280 °C/-321 ... +536 °F)

- 1 Process temperature (depending on the seal material)
2 Process pressure

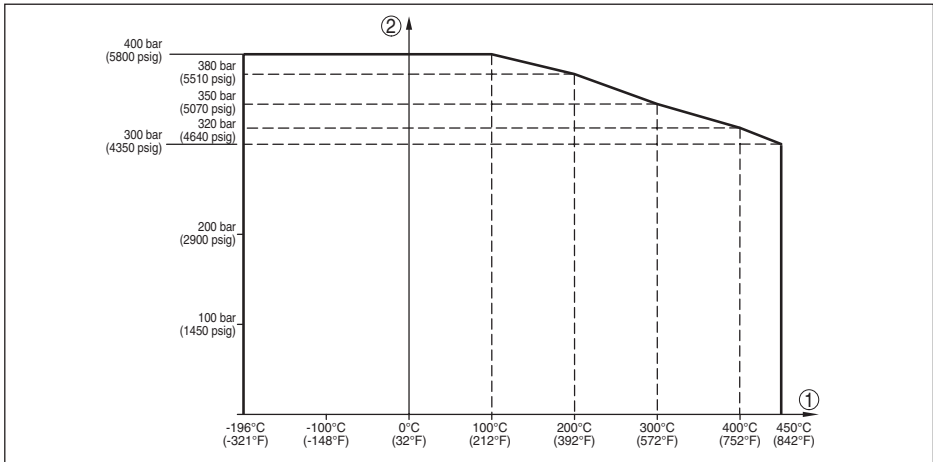


Fig. 42: Process pressure - process temperature (version -196 ... +450 °C/-321 ... +842 °F)

- 1 Process temperature (depending on the seal material)
2 Process pressure

Viscosity - dynamic

0.1 ... 500 mPa s (requirement: with density 1)

Vibration resistance

– Instrument housing

4 g at 5 ... 200 Hz according to EN 60068-2-6 (vibration with resonance)

– Coax probe

1 g with 5 ... 200 Hz according EN 60068-2-6 (vibration at resonance) with tube length 50 cm (19.69 in)

Shock resistance

- | | |
|----------------------|--|
| – Instrument housing | 100 g, 6 ms according to EN 60068-2-27 (mechanical shock) |
| – Coax probe | 25 g, 6 ms according to EN 60068-2-27 (mechanical shock) with tube length 50 cm (19.69 in) |

Electromechanical data - version IP 66/IP 67

- | | |
|--|---|
| Cable gland | M20 x 1.5 or ½ NPT |
| Wire cross-section (spring-loaded terminals) | |
| – Massive wire, stranded wire | 0.2 ... 2.5 mm ² (AWG 24 ... 14) |
| – Stranded wire with end sleeve | 0.2 ... 1.5 mm ² (AWG 24 ... 16) |

Display and adjustment module

- | | |
|--------------------------------------|------------------------|
| Display element | Display with backlight |
| Measured value indication | |
| – Number of digits | 5 |
| – Size of digits | W x H = 7 x 13 mm |
| Adjustment elements | 4 keys |
| Protection rating | |
| – unassembled | IP 20 |
| – mounted in the housing without lid | IP 40 |
| Materials | |
| – Housing | ABS |
| – Inspection window | Polyester foil |

Integrated clock

- | | |
|----------------------|----------------|
| Date format | Day.Month.Year |
| Time format | 12 h/24 h |
| Time zone Ex factory | CET |
| Rate deviation max. | 10.5 min/year |

Additional output parameter - Electronics temperature

- | | |
|----------------------------------|--|
| Output of the temperature values | |
| – Analogue | Via the additional current output |
| – Digital | Depending on the electronics version via the HART, Profibus PA, Foundation Fieldbus or Modbus signal |
| Range | -40 ... +85 °C (-40 ... +185 °F) |
| Resolution | < 0.1 K |
| Accuracy | ±3 K |

Voltage supply

- | | |
|---------------------------|---|
| Operating voltage | |
| – Version for low voltage | 9.6 ... 48 V DC, 20 ... 42 V AC, 50/60 Hz |

– Version for mains voltage	90 ... 253 V AC, 50/60 Hz
Reverse voltage protection	Integrated
Max. power consumption	4 VA; 2.1 W

Electrical protective measures

Protection rating	IP 66/IP 67 (NEMA 4X)
Overvoltage category (IEC 61010-1)	
– Version with low voltage	III
Overvoltage category (IEC 61010-1) - Version with mains voltage	
– up to 2000 m (6562 ft) above sea level	III
– up to 5000 m (16404 ft) above sea level	III - Only with connected overvoltage protection
– up to 5000 m (16404 ft) above sea level	II
Degree of soiling	3
Protection rating (IEC 61010-1)	I

Approvals

Instruments with approvals can have different technical specifications depending on the version. For that reason the associated approval documents of these instruments have to be carefully noted. They are part of the delivery or can be downloaded under www.vega.com, "VEGA Tools" and "Instrument search" as well as in the download area.

11.2 Dimensions

The following dimensional drawings represent only an extract of all possible versions. Detailed dimensional drawings can be downloaded at www.vega.com/downloads under "Drawings".

Housing

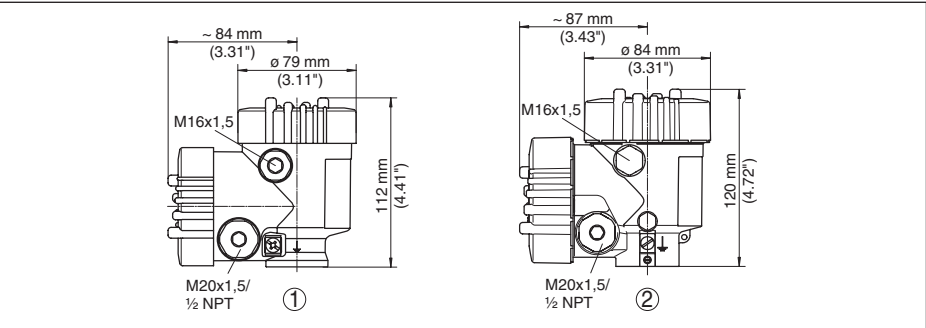


Fig. 43: Dimensions of housing - with integrated display and adjustment module the housing is 9 mm/0.35 inches higher

- 1 Plastic housing
- 2 Aluminium/Stainless steel housing

VEGAFLEX 86, coax version

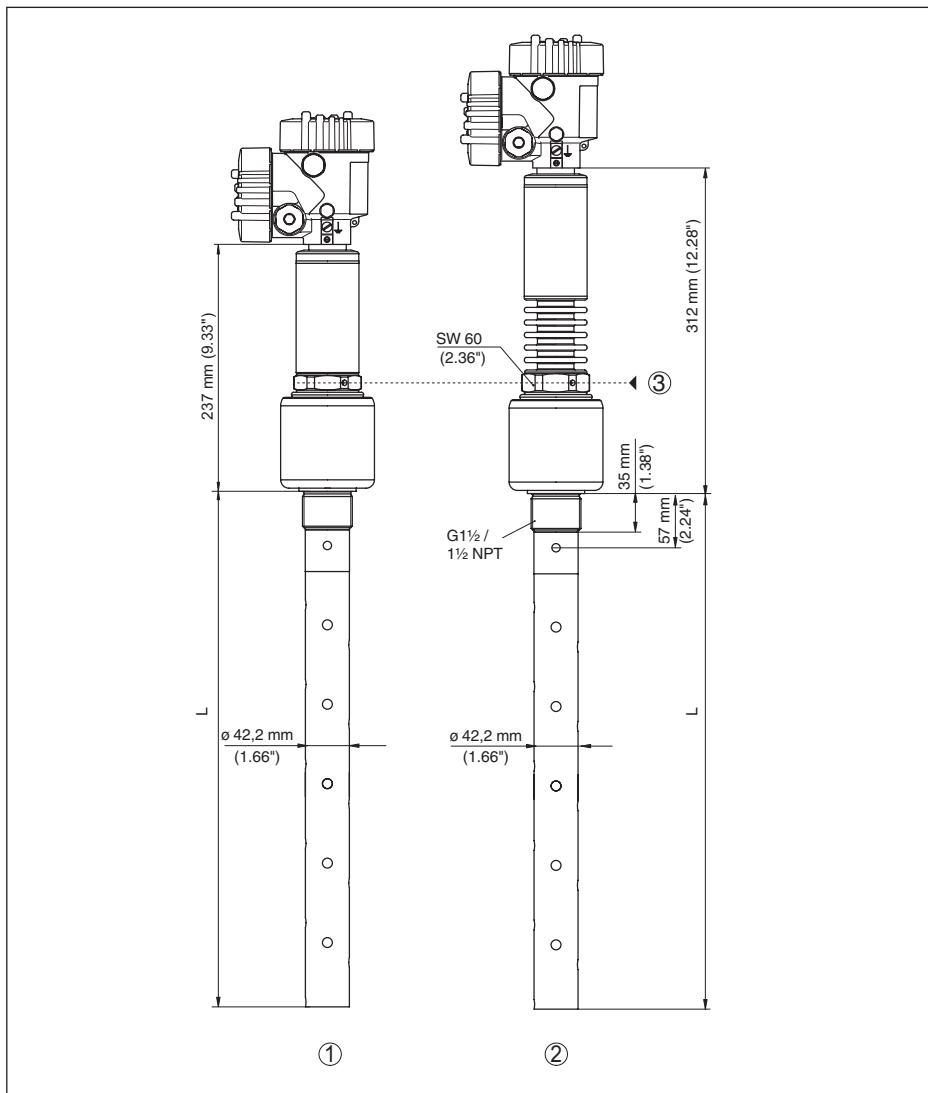


Fig. 44: VEGAFLEX 86, threaded version

- L Sensor length, see chapter "Technical data"
- 1 Temperature version -196 ... +280 °C (-321 ... 536 °F)
- 2 Temperature version -196 ... +450 °C (-321 ... 842 °F)
- 3 Max. height of the vessel insulation

11.3 Industrial property rights

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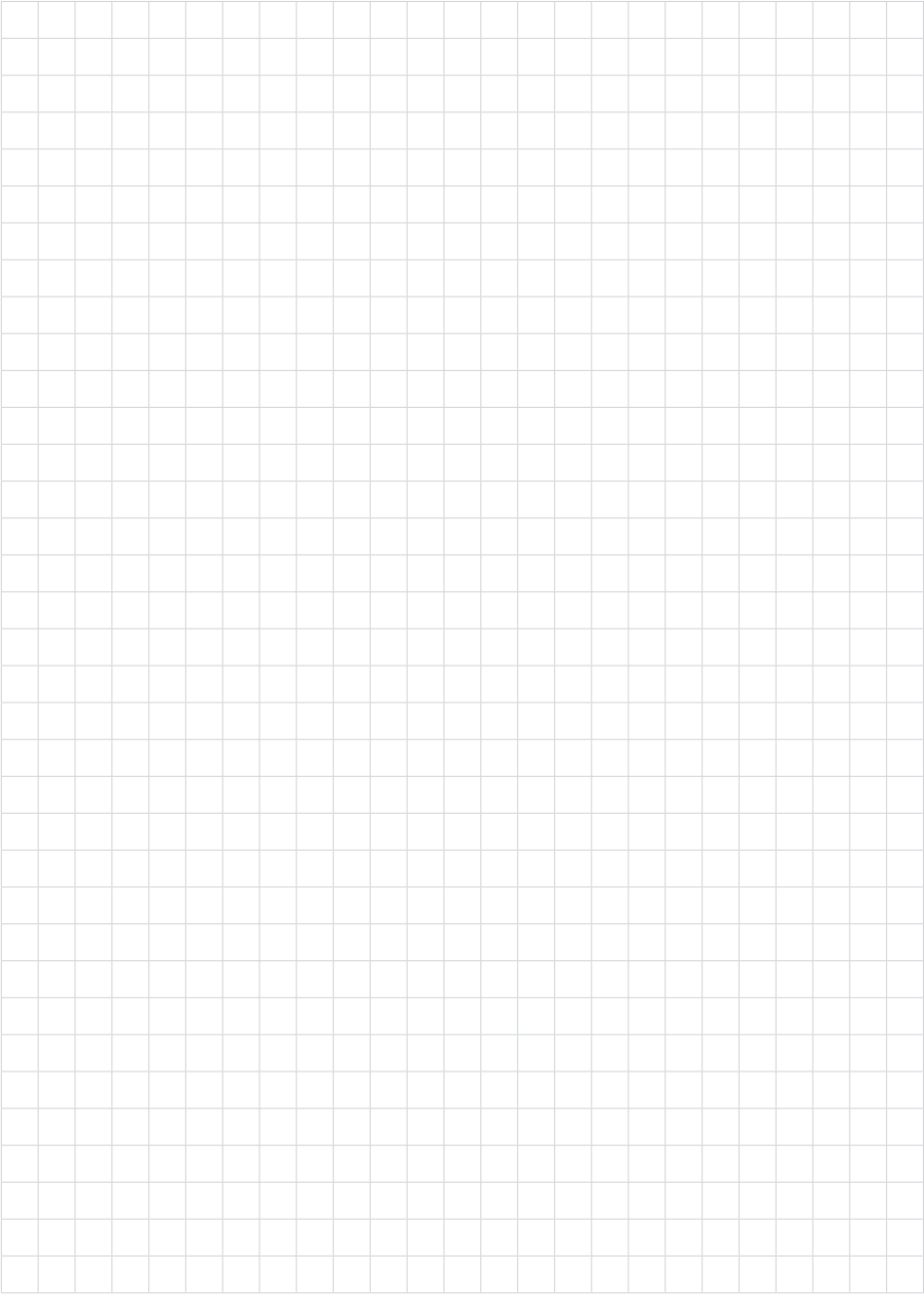
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