Operating Instructions

TDR sensor for continuous level and interface measurement of liquids

VEGAFLEX 86

Modbus and Levelmaster protocol

Converter version in second chamber

Coax probe

-196 … +280 °C

-196 … +450 °C

Document ID: 42288

Contents

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.

Editing status: 2023-05-23

1 About this document

1.1 Function

This instruction provides all the information you need for mounting, connection and setup as well as important instructions for maintenance, fault rectification, the exchange of parts and the safety of the user. 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 personnel. The contents of this manual must be made available to the qualified personnel and implemented.

1.3 Symbols used

Document ID
This symbol on the front page of this instruction refers to the Document ID. By entering the Document ID on www.vega.com you will reach the document download.

Information, note, tip: This symbol indicates helpful additional information and tips for successful work.

Note: This symbol indicates notes to prevent failures, malfunctions, damage to devices or plants.

Caution: Non-observance of the information marked with this symbol may result in personal injury.

Warning: Non-observance of the information marked with this symbol may result in serious or fatal personal injury.

Danger: Non-observance of the information marked with this symbol results in serious or fatal personal injury.

Ex applications
This symbol indicates special instructions for Ex applications.

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

1 Sequence of actions
Numbers set in front indicate successive steps in a procedure.

Disposal
This symbol indicates special instructions for disposal.

2 For your safety

2.1 Authorised personnel

All operations described in this documentation must be carried out only by trained, qualified personnel authorised by the plant operator.

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

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 this product can give rise to application-specific hazards, e.g. vessel overfill through incorrect mounting or adjustment. Damage to property and persons or environmental contamination can result. Also, the protective characteristics of the instrument can be impaired.

2.4 General safety instructions

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

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

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

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

2.5 Conformity

The device complies with the legal requirements of the applicable country-specific directives or technical regulations. We confirm conformity with the corresponding labelling.

The corresponding conformity declarations can be found on 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 fulfils the requirements of the following NAMUR recommendations:

- NE 21 – Electromagnetic compatibility of equipment
- 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 Installation and operation in the USA and Canada

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

Installations in the US shall comply with the relevant requirements of the National Electrical Code (NEC - NFPA 70) (USA).

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

2.8 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 fulfil this obligation by observing the environmental instructions in this manual:

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

3   Product description

3.1   Configuration

Scope of delivery

The scope of delivery encompasses:

● Sensor VEGAFLEX 86
● Optional accessory
● Optionally integrated Bluetooth module

The further scope of delivery encompasses:

● Documentation
   – Quick setup guide VEGAFLEX 86
   – Instructions for optional instrument features
   – Ex-specific " *Safety instructions*" (with Ex versions)
   – If necessary, further certificates

> ● **Information:**
> **ℹ** Optional instrument features are also described in this operating
> instructions manual. The respective scope of delivery results from the
> order specification.

Scope of this operating instructions

This operating instructions manual applies to the following instrument versions:

● Hardware from 1.0.0
● Software from 1.3.0
● Only for instrument versions without SIL qualification

Type label

The type label contains the most important data for identification and use of the instrument:
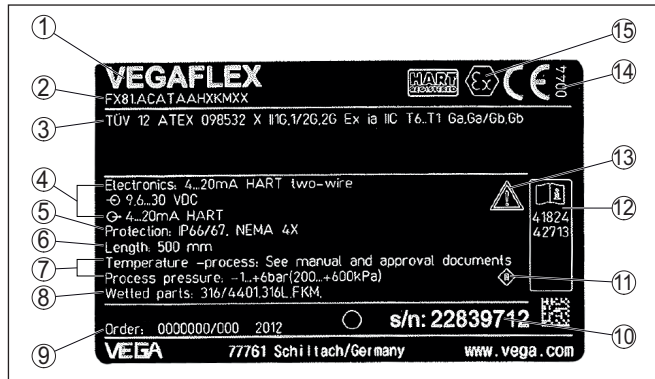
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Fig. 1: Layout of the type label (example)

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

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

Alternatively, you can access the data via your smartphone:

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

Electronics design

The instrument contains two different electronics in its housing chambers:

● The Modbus electronics for power supply and communication with the Modbus-RTU

VEGAFLEX 86 • Modbus and Levelmaster protocol

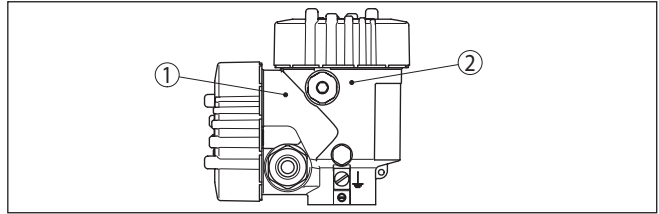● The sensor electronics for the actual measuring tasks

Fig. 2: Position of Modbus and sensor electronics

1 Modbus electronics
2 Sensor electronics

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 medium surface, the microwave pulses are reflected. The running time is evaluated by the instrument and output as level.
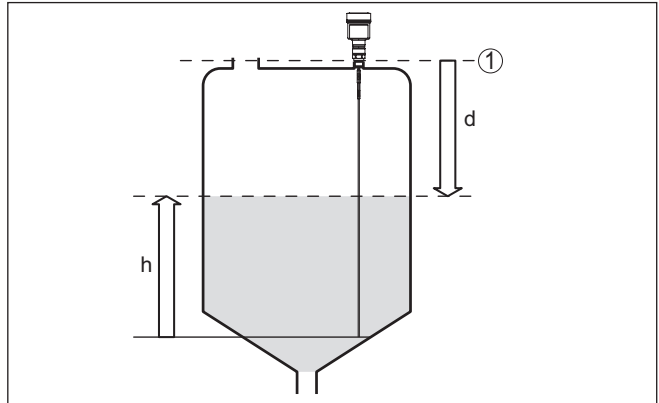
Fig. 3: Level measurement

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

Functional principle - interface measurement

High frequency microwave impulses are guided along a steel cable or rod. Upon reaching the medium surface, a part of the microwave impulses is reflected. The other part passes through the upper product and is reflected by the interface. The running times to the two product layers are processed by the instrument.
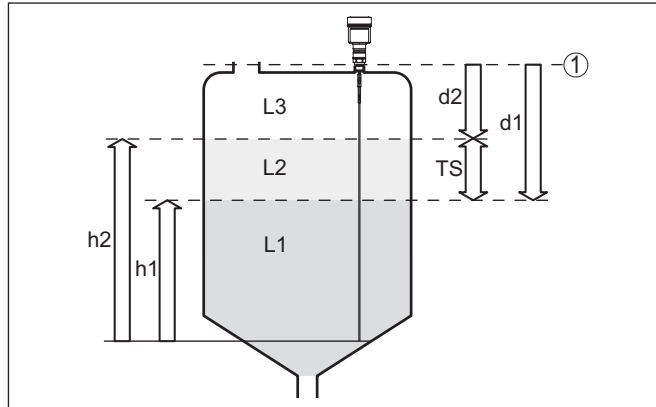
Fig. 4: Interface measurement

1   Sensor reference plane (seal surface of the process fitting)
d1 Distance to the interface
d2 Distance to the level
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.
● 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.

3.3 Packaging, transport and storage

Packaging	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 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	● Storage and transport temperature see chapter " *Supplement - Technical data - Ambient conditions*"
	● Relative moisture 20 … 85 %
Lifting and carrying	With instrument weights of more than 18 kg (39.68 lbs) suitable and approved equipment must be used for lifting and carrying.

3.4 Accessories

The instructions for the listed accessories can be found in the download area on our homepage.

Display and adjustment module	The display and adjustment module is used for measured value indication, adjustment and diagnosis.
	The integrated Bluetooth module (optional) enables wireless adjustment via standard adjustment devices.
VEGACONNECT	The interface adapter VEGACONNECT enables the connection of communication-capable instruments to the USB interface of a PC.

VEGADIS 81	The VEGADIS 81 is an external display and adjustment unit for VEGA plics® sensors.
VEGADIS adapter	The VEGADIS adapter is an accessory part for sensors with double chamber housing. It enables the connection of VEGADIS 81 to the sensor housing via an M12 x 1 plug.
VEGADIS 82	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.
Protective cover	The protective cover protects the sensor housing against soiling and intense heat from solar radiation.
Flanges	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.
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 (32.8 ft) to the sensor by using a connection cable.

4 Mounting

4.1 General instructions

Screwing in

Devices with threaded fitting are screwed into the process fitting with a suitable wrench via the hexagon.

See chapter " *Dimensions*" for wrench size.

⚠ **Warning:**
The housing or the electrical connection may not be used for screwing in! Depending on the device version, tightening can cause damage, e. g. to the rotation mechanism of the housing.

Protection against moisture

Protect your instrument against moisture ingress through the following measures:

● Use a suitable connection cable (see chapter " *Connecting to power supply*")
● Tighten the cable gland or plug connector
● Lead the connection cable downward in front of the cable entry or plug connector

This applies mainly to outdoor installations, in areas where high humidity is expected (e.g. through cleaning processes) and on cooled or heated vessels.

⚠ **Note:**
Make sure that during installation or maintenance no moisture or dirt can get inside the instrument.

To maintain the housing protection, make sure that the housing lid is closed during operation and locked, if necessary.

Cable glands

Metric threads
In the case of instrument housings with metric thread, the cable glands are screwed in at the factory. They are sealed with plastic plugs as transport protection.

You have to remove these plugs before electrical connection.

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. The dust protection caps do not provide sufficient protection against moisture.

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

Process conditions

⚠ **Note:**
For safety reasons, the instrument must only be operated within the permissible process conditions. You can find detailed information on the process conditions in chapter " *Technical data*" of the operating instructions or on the type label.

Hence make sure before mounting 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 in particular are:

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

4.2 Mounting instructions

Installation position

In vessels with conical bottom it can be advantageous to mount the device 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 blocking distance) is stated in chapter " *Technical data*".
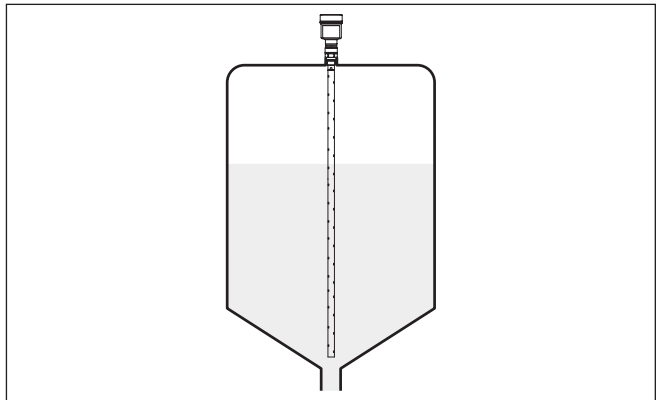

Fig. 5: Vessel with conical bottom

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 medium surface, not the inflowing product.
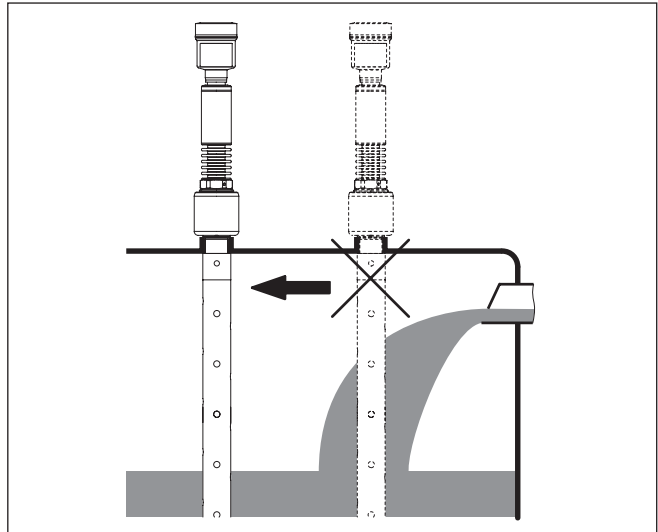
Fig. 6: Mounting of the sensor with inflowing medium

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 (blocking distance). These blocking distances 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 sealing 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.

In case of strong external vibrations or 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 measurement is not possible below the fastening point.
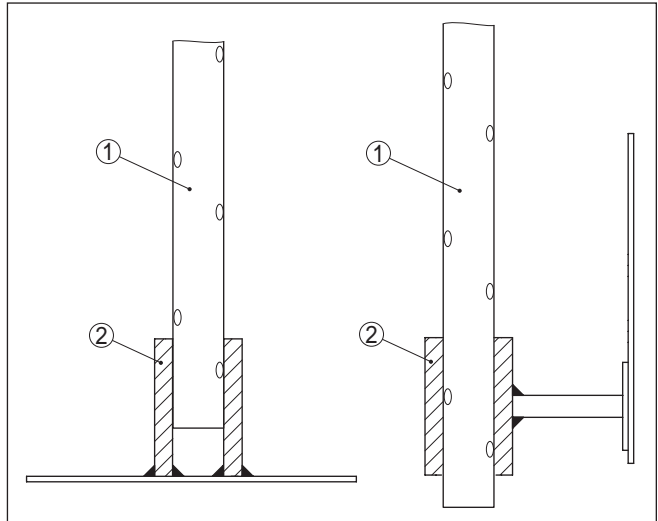
Fig. 7: Fasten the probe

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. Ths 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 (1.97 in). Only then is a reliable temperature decoupling guaranteed.

Fig. 8: Mounting the instrument on insulated vessels.

1   Temperature insulation
2   Ambient temperature on the housing

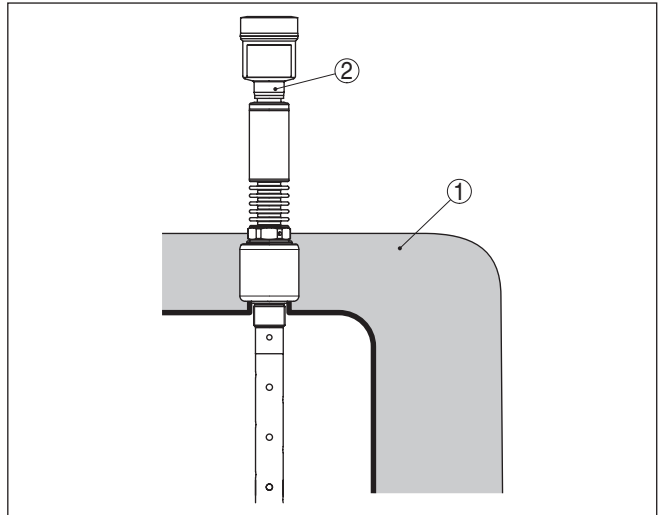**Steam boiler applications**   Vapours, superimposed gases, high pressures and temperature differences can change the spreading speed of radar impulses.

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 measurement 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.

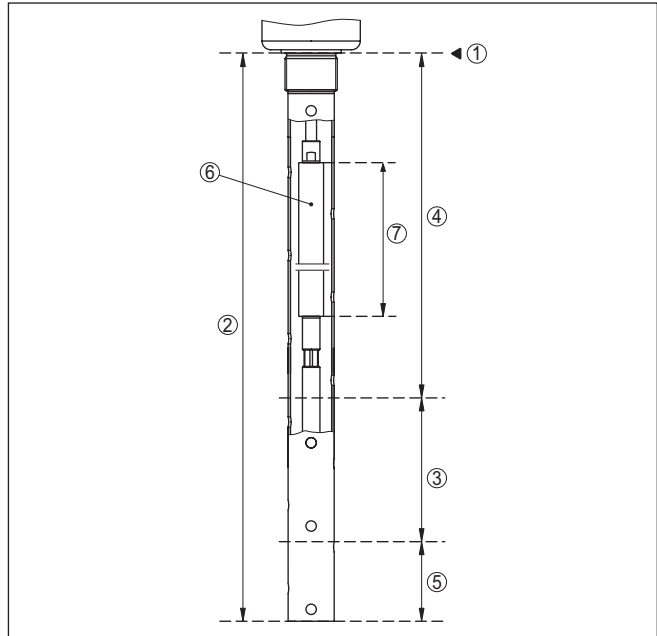| Length - Reference distance (7)	Length - blocking distance (4)	Probe length min. (2)	Deviation max.
260 mm (10.24 in)	450 mm (17.72 in)	> 1000 mm (39.37 in)	± 10 %
500 mm (19.69 in)	690 mm (27.17 in)	> 1250 mm (49.21 in)	± 5 %
750 mm (29.53 in)	940 mm (37.01 in)	> 1500 mm (59.06 in)	± 3 %

Fig. 9: 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 blocking distance*
6   *Reference measurement distance to steam compensation*
7   *Length of the reference measuring distance*

5 Connecting to power supply and bus system

5.1 Preparing the connection

Safety instructions

Always keep in mind the following safety instructions:

- Carry out electrical connection by trained, qualified personnel authorised by the plant operator
- If overvoltage surges are expected, overvoltage arresters should be installed

⚠️ **Warning:**
Only connect or disconnect in de-energized state.

Voltage supply

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

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

⚠️ **Note:**
Power the instrument via an energy-limited circuit (power max. 100 W) acc. to IEC 61010-1, e.g.

- Class 2 power supply unit (acc. to UL1310)
- SELV power supply unit (safety extra-low voltage) with suitable internal or external limitation of the output current

Connection cable

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

Use cable with round cross section for instruments with housing and cable gland. Use a cable gland suitable for the cable diameter to ensure the seal effect of the cable gland (IP protection rating).

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

Cable glands

Metric threads:
In the case of instrument housings with metric thread, the cable glands are screwed in at the factory. They are sealed with plastic plugs as transport protection.

ℹ️ **Note:**
You have to remove these plugs before electrical connection.

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.

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

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

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

Cable screening and grounding

Make sure that the cable screen and grounding are carried out according to Fieldbus specification. We recommend to connect the cable screening to ground potential on both ends.

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

5.2 Connecting

Connection technology

The voltage supply and signal output are connected via the spring-loaded terminals in the housing.

Connection to the display and adjustment module or to the interface adapter is carried out via contact pins in the housing.

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 nut of the cable gland and remove blind plug

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. 10: Connection steps 5 and 6

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

● **Information:**
ℹ️ Solid cores as well as flexible cores with wire end sleeves are insert-
ed 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 cable screening to the internal ground terminal, con-
nect the outer ground terminal to potential equalisation in case of
power supply via low voltage

8. Connect the lead cable for voltage supply in the same way ac-
cording to the wiring plan, in addition connect the ground conduc-
tor to the inner ground terminal when powered with mains voltage.

9. Tighten the compression nut of the cable entry gland. The seal
ring must completely encircle the cable

10. Screw the housing lid back on

The electrical connection is finished.

● **Information:**
ℹ️ The terminal blocks are pluggable and can be removed from the
housing insert. To do this, lift the terminal block with a small screwdriv-
er and pull it out. When inserting the terminal block again, you should
hear it snap in.
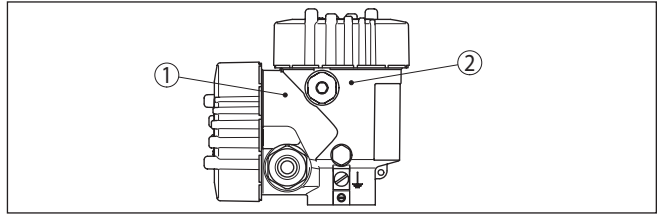
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5.3 Wiring plan

Overview

Fig. 11: Position of connection compartment (Modbus electronics) and electronics compartment (sensor electronics)

1 Connection compartment
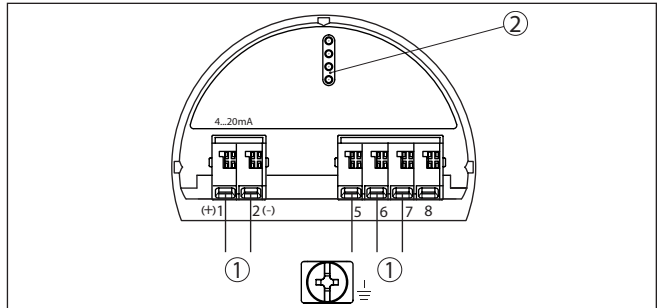*2 Electronics compartment*

Electronics compartment

Fig. 12: Electronics compartment - double chamber housing

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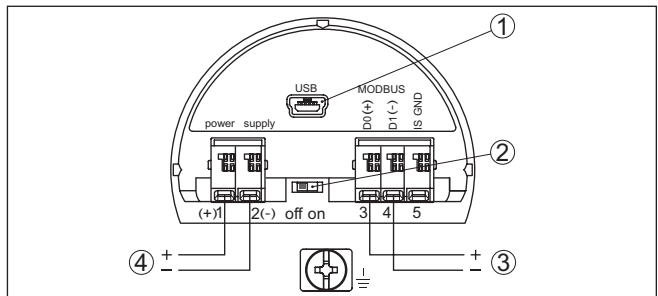
Connection compartment

Fig. 13: Connection compartment

1 USB interface
2 Slide switch for integrated termination resistor (120 Ω)
3 Modbus signal
4 Voltage supply

Terminal	Function	Polarity
1	Voltage supply	+

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Terminal	Function	Polarity
2	Voltage supply	-
3	Modbus signal D0	+
4	Modbus signal D1	-
5	Function ground when installing according to CSA (Canadian Standards Association)	

5.4 Double chamber housing with VEGADIS-Adapter
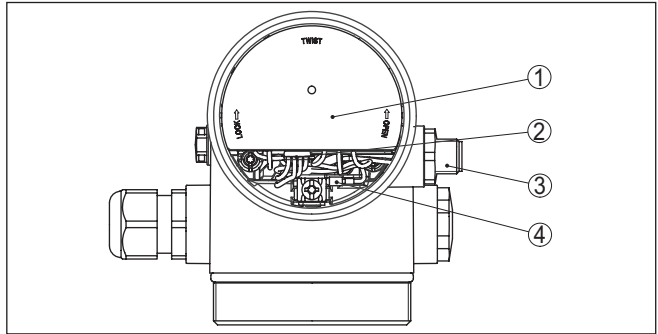
Electronics compartment

Fig. 14: View to the electronics compartment with VEGADIS adapter for connection of the external display and adjustment unit

1 VEGADIS adapter
2 Internal plug connection
3 M12 x 1 plug connector
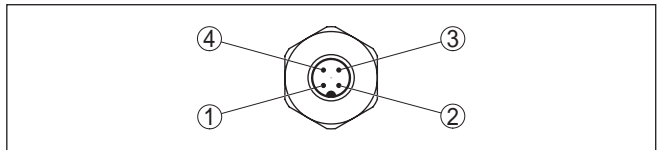
Assignment of the plug connector

Fig. 15: Top view of the M12 x 1 plug connector

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

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5.5 Switch-on phase

After connecting VEGAFLEX 86 to the bus system, the device first performs a self-test:

● Internal check of the electronics
● Indication of the status message " *F 105 Determine measured value*" on the display or PC
● Status byte goes to fault value

Then the actual measured value is output to the signal cable. The value takes into account settings that have already been carried out, e.g. default setting.

6 Set up the sensor with the display and adjustment module

6.1 Adjustment volume

The display and adjustment module is only used for parameter adjustment of the sensor, i.e. for adaptation to the measurement task.

The parameter adjustment of the Modbus interface is carried out via a PC with PACTware. You can find the procedure in chapter " *Set up sensor and Modbus interface with PACTware*".

6.2 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. 16: Insertion of the display and adjustment module

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.

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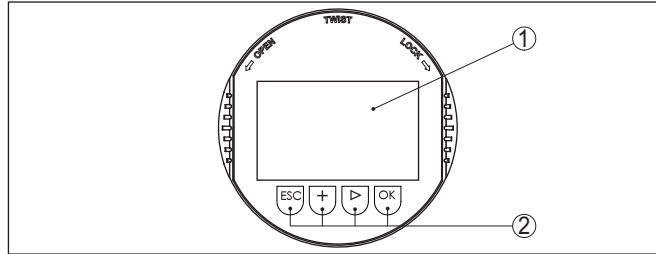## 6.3 Adjustment system

Fig. 17: 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:
– Change measured value presentation
– Select list entry
– Select editing position

● *[+]* key:
– Change value of the parameter

● *[ESC]* key:
– Interrupt input
– Jump to next higher menu

Adjustment system

The instrument is operated via the four keys of the display and adjustment module. The individual menu items are shown on the LC display. You can find the function of the individual keys in the previous illustration.

Adjustment system - keys via magnetic pen

With the Bluetooth version of the display and adjustment module you can also adjust the instrument with the magnetic pen. The pen operates the four keys of the display and adjustment module right through the closed lid (with inspection window) of the sensor housing.
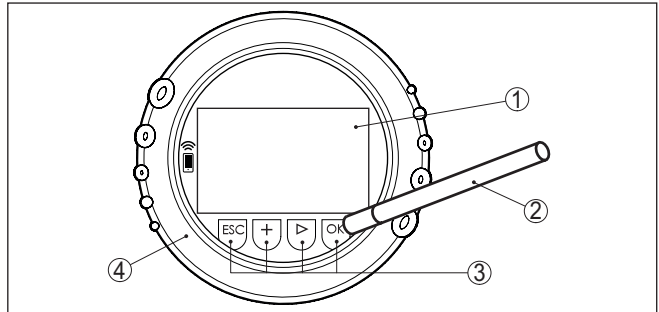
Fig. 18: Display and adjustment elements - with adjustment via magnetic pen

1   LC display
2   Magnetic pen
3   Adjustment keys
4   Lid with inspection window

Time functions

When the *[+]* and *[->]* keys are pressed quickly, the edited value, or the cursor, changes one value or position at a time. If the key is pressed longer than 1 s, the value or position changes 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 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 respective bargraph presentation are displayed.

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

6.4 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.

Quick setup
Extended adjustment

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
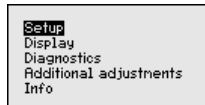● Min. adjustment
● False signal suppression

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

6.5 Parameter adjustment - Extended adjustment

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

Quick setup
Extended adjustment

Main menu

The main menu is divided into five sections with the following func-tions:

Setup
Display
Diagnostics
Additional adjustments
Info

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

Diagnosis: Information, e.g. on instrument status, peak indicator, measurement reliability, simulation, echo curve

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

**Info:** Instrument name, hardware and software version, date of manu-facture, instrument features

Note:
For optimum setting of the measuring point, the individual submenu items in the main menu item " *Setup*" should be selected one after

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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:
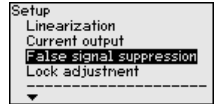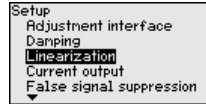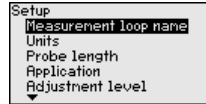
The submenu points are described below.

6.5.1 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
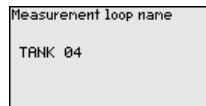
Units

In this menu item you select the distance unit and the temperature unit.
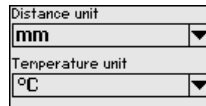
For the distance units you can choose between m, mm and ft and for the temperature units °C, °F and K.

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.
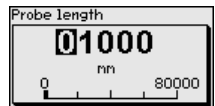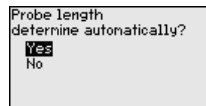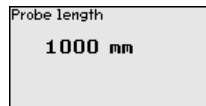
Application - Medium type

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

VEGA

Application	Type of medium
Type of medium	**Liquid** ▼
Application	
Medium/Dielectric figure	

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.

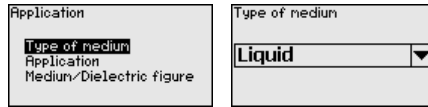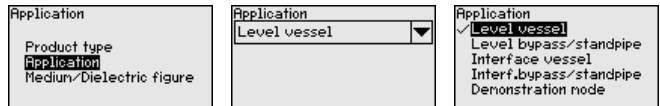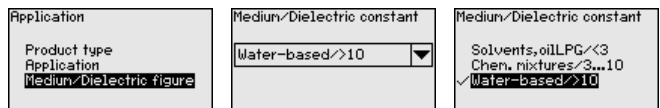| Application	Application	Application
	Level vessel ▼	✓Level vessel
Product type		Level bypass/standpipe
Application		Interface vessel
Medium/Dielectric figure		Interf.bypass/standpipe
		Demonstration mode

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	Medium/Dielectric constant	Medium/Dielectric constant
	Water-based/>10 ▼	Solvents,oilLPG/<3
Product type		Chem. mixtures/3...10
Application		✓Water-based/>10
Medium/Dielectric figure		

You can choose between the following medium types:

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

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	Superimposed gas phase present?	Superimposed gas phase present?
Product type	Yes ▼	No
Application		✓Yes
Gas phase		
Dielectric figure		
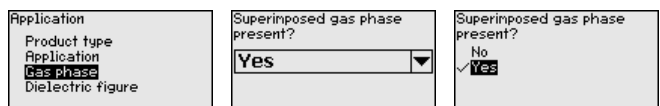
Application - Dielectric constant

This menu item is only available if you have selected interface measurement under the menu item "*Application*". In this menu item you can enter the dielectric constant of the upper medium.

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

You can directly enter the dielectric constant of the upper medium or have the value determined by the instrument.

If you want the dielectric constant to be determined by the instrument, you have to enter the measured or known distance to the interface.
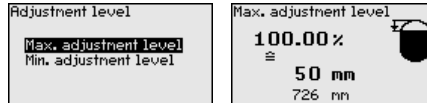
● **Note:**
ℹ The dielectric constant can only be reliably determined if two different media and a sufficiently large interface are present.

Dielectric constant	Distance to the interface
002.0	00000
	mm
1.0 100.0	0 99999
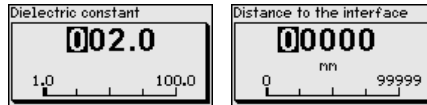
Max. adjustment level

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
Max. adjustment level	100.00 %
Min. adjustment level	≙
	50 mm
	726 mm

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

Max. adjustment level
⊞100.00
%
-10.00   110.00

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 blocking distance.
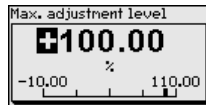
Max. adjustment level
00050
mm
0   80000

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.

Adjustment level	Min. adjustment level
Max. adjustment level	0.00 %
Min. adjustment level	≙
	850 mm
	726 mm

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

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Min. adjustment level

000.00
%
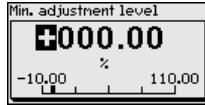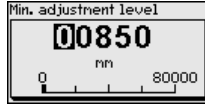-10.00   110.00
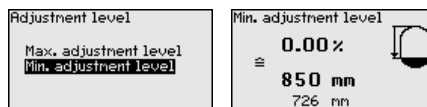
Enter the suitable distance value in m for the empty vessel (e.g. distance from the flange to the probe end) corresponding to the percentage value. The distance refers tot he sensor reference plane (seal surface of the process fitting).
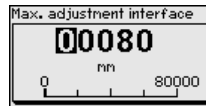
Min. adjustment level

00850
mm
0   80000

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

Adjustment interface

Max.adjustment interface
Min. adjustment interface

Max. adjustment interface

100.00 %
≙
80 mm
717 mm
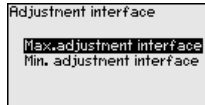
Enter the requested percentage value for the max. adjustment.

As an alternative, you have the possibility taking over the adjustment of the level measurement also for the interface.

Enter the respective distance value in m for the surface of the upper medium corresponding to the percentage value.
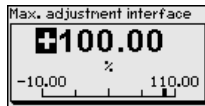
Max. adjustment interface

100.00
%
-10.00   110.00

Max. adjustment interface

00080
mm
0   80000

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

Adjustment interface

Max.adjustment interface
Min. adjustment interface

Min. adjustment interface

0.00 %
≙
1000 mm
718 mm
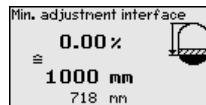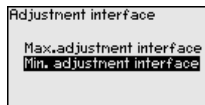
Enter the requested percentage value for the min. adjustment (interface).

Enter the respective distance value in m for the interface corresponding to the percentage value of the interface.

Min. adjustment interface

000.00
%
-10.00   110.00

Min. adjustment interface

01000
mm
0   80000
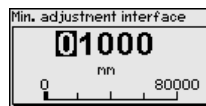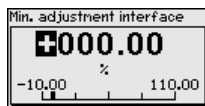
Damping   To damp process-dependent measured value fluctuations, set an integration time of 0 … 999 s in this menu item.

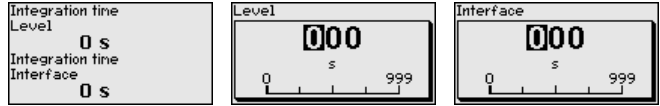If you have selected interface measurement under the menu item "*Application*", you can adjust the damping for the level and the interface separately.

The default setting is a damping of 0 s.

Linearisation   A linearisation 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 linearisation curves are preprogrammed for these vessels. They represent the correlation between the level percentage and vessel volume.

The linearisation applies to the measured value indication and the 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*".
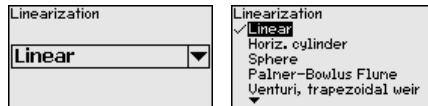
⚠ **Warning:**
If a linearisation curve is selected, the measuring signal is no longer necessarily linear to the filling height. This must be considered by the user especially when setting the switching point on the limit signal transmitter.

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 nozzle correction you have to enter the height of the nozzle above the upper edge of the vessel. If the nozzle is lower than the upper edge of the vessel, this value can also be negative.
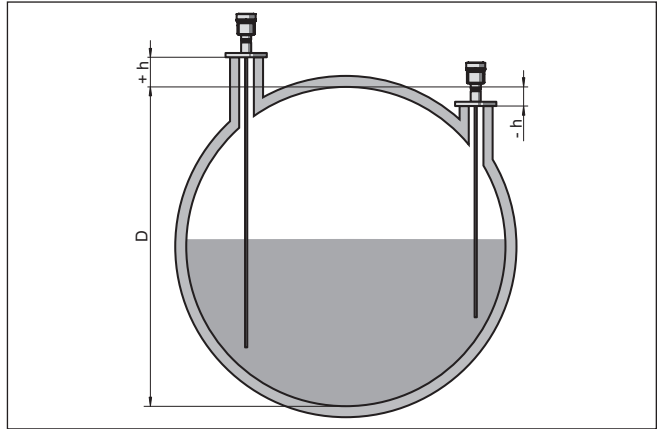
Fig. 19: Vessel height and socket correction value

D   Vessel height
+h Positive socket correction value
-h   Negative socket correction value
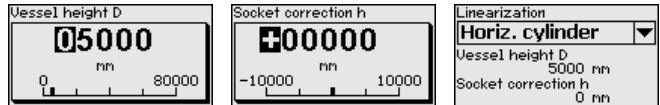
Current output mode   In the menu item " *Current output mode*" you determine the output characteristics and reaction of the current output in case of fault.
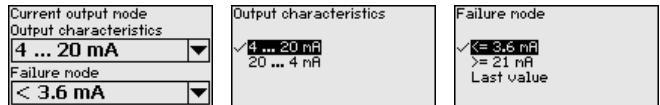
The default setting is output characteristics 4 … 20 mA, fault mode < 3.6 mA.

Current output, min./max.   In the menu item " *Current output Min./Max.*", you determine the reaction of the current output during operation.
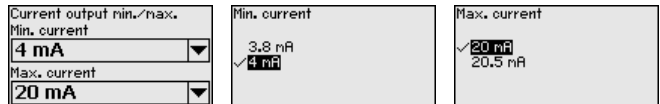
The default setting is min. current 3.8 mA and max. current 20.5 mA.

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

- High mounting nozzles
- Vessel internals 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:

False signal suppression	False signal suppression
Change?	Create new Delete
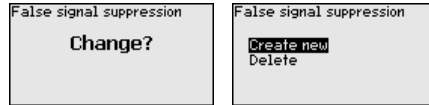
Select first if the probe is covered or uncovered.

If the probe is covered, enter the actual distance from the sensor to the product surface.

False signal suppression	
Probe covered Probe uncovered	00000 mm 0 2000
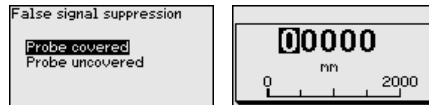
All interfering signals in this section are detected by the sensor and stored.

Keep in mind that with covered probe only false signals in the uncovered area of the probe are detected.

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

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

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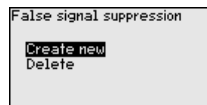
The instrument carries out an automatic false signal suppression as soon as the probe is uncovered. The false signal suppression is always updated.

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 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:

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

```
Bedienung

    Gesperrt

    Freigeben?
```

```
PIN
      0000

  0           9999
```
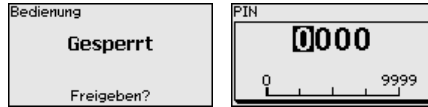
⚠ **Caution:**
When the PIN is active, adjustment via PACTware/DTM as well as other systems is also blocked.

In delivery status, the PIN is **0000**.

Call our service department if you have modified and forgotten the PIN.

6.5.2 Display

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

The following submenu points are available:

```
Display
 Menu language
 Indication value 1
 Indication value 2
 Display format
 Backlight
```
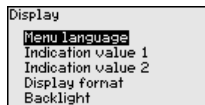
The submenu points are described below.

Menu language

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

```
Menu language

 English              ▼
```

```
Menu language
   Deutsch
 ✓English
   Français
   Español
   Pycckuu
   ▼
```
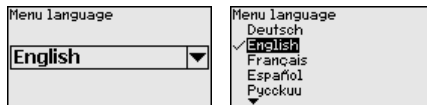
In delivery status, the sensor is set to English.

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.

```
Indication value 1

 Percent, level       ▼
```

```
Displayed value 1
   Percent, level
   Lin.percent, level
 ✓Filling height, level
   Distance, level
   Scaled level
   ▼
```
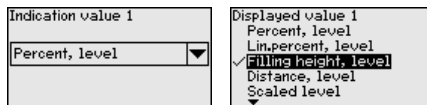
The default setting for the displayed value 1 is " *Filling height Level*".

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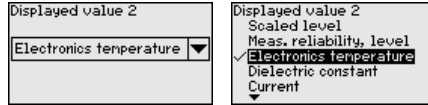
The default setting for the displayed value 2 is the electronics temperature.

Display format

In this menu item, you define the display format of the measured value on the display. You can define different display formats for the two measured values.

You can thus define the number of decimal positions the measured value is displayed with.
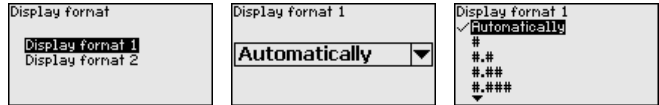
The default setting for the display format is " *Automatic*".

Backlight

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

To maintain the function of the device, the lighting is temporarily switched off if the power supply is insufficient.

In delivery status, the lighting is switched on.

6.5.3 Diagnostics

Device status

In this menu item, the device status is displayed.

When the instrument displays a fault signal, you can here get detailed information on the failure reason.
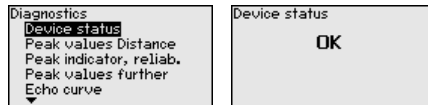
Peak indicator, distance

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

```
Reset peak indicator

Distance to the level
Distance to the interface
```
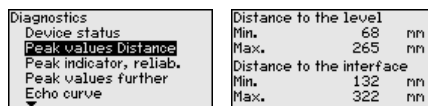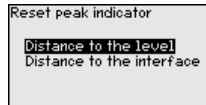
Peak indicator, measurement reliability

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

The measurement can be influenced by the process conditions. In this menu item, the measurement reliability of the level measurement is displayed in mV. The higher the value, the more reliable the 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.

```
Diagnostics              Meas. reliability, level
  Device status          Min.             1 mV
  Peak values Distance   Max.           279 mV
  Peak indicator, reliab. Meas. reliability,interface
  Peak values further    Min.             1 mV
  Echo curve             Max.           316 mV
```

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

```
Reset peak indicator

Meas. reliability, level
Meas.reliab.interface
```
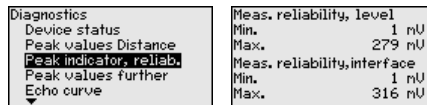
Peak indicator, additional

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

This menu item displays the peak values of the electronics temperature as well as the dielectric constant.
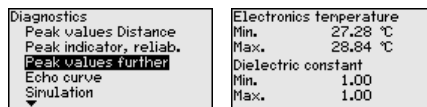
```
Diagnostics              Electronics temperature
  Peak values Distance   Min.          27.28 °C
  Peak indicator, reliab. Max.          28.84 °C
  Peak values further    Dielectric constant
  Echo curve             Min.            1.00
  Simulation             Max.            1.00
```

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

```
Reset peak indicator

Electronics temperature
Dielectric constant
```
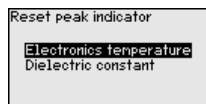
● **Information:**
ℹ If one of the display values flashes, there is actually no valid value available.

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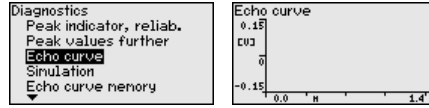
With the following functions you can zoom part sections of the echo curve.

● "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
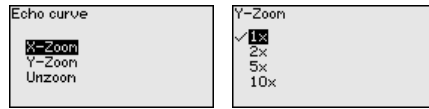
Simulation

In this menu item you can simulate measured values via the current output. This allows the signal path to be tested, e.g. through downstream indicating instruments or the input card of the control system.
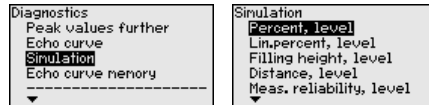
Select the requested simulation variable and set the requested value.
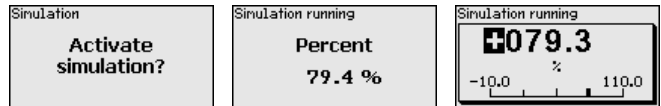
⚠️ **Caution:**
During simulation, the simulated value is output as 4 … 20 mA current value and digital HART signal.

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

ℹ️ **Information:**
The simulation is terminated automatically 60 minutes after the activation of the simulation.

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.

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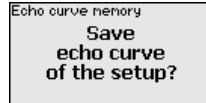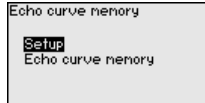
The function " *Echo curve memory*" enables storing echo curves of the measurement.

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.
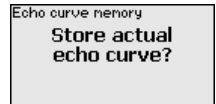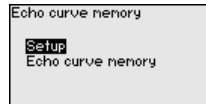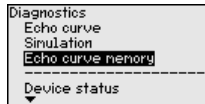
6.5.4 Additional adjustments

Date/Time   In this menu item, the internal clock of the sensor is set.
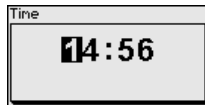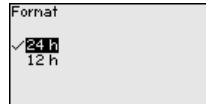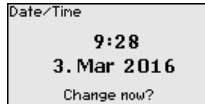
Reset   After a reset, certain parameter adjustments made by the user are reset.

● **Note:**
ℹ After this menu window, the reset process is carried out. No further safety inquiry follows.

The following reset functions are available:

Delivery status: Restores the parameter settings at the time of shipment from the factory, incl. order-specific settings. Any stored false signal suppression or user-programmed linearisation curve, as well as the measured value memory, are deleted.

Basic settings: Restores the parameter settings, incl. special parameters, to the default values of the respective instrument. Any stored

false signal suppression or user-programmed linearisation curve, as well as the measured value memory, are 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:

Menu - Setup

Menu item	Default value
Lock adjustment	Released
Measurement loop name	Sensor
Units	Distance unit: order-specific
	Temperature unit: order-specific
Probe length	Länge der Messsonde factory setting
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 %
	Distance: 0.000 m(d) - note blocking distances
Min. adjustment - Level	0 %
	Distance: Probe length - take dead band into account
Max. adjustment - Interface	100 %
	Distance: 0.000 m(d) - note blocking distances
Min. adjustment - Interface	0 %
	Distance: Probe length - take dead band into account
Damping - Level	0.0 s
Damping - Interface	0.0 s
Linearization type	Linear
Linearisation - Socket correction	0 mm
Linearisation - Vessel height	Probe length
Scaling variable - 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
Scaling variable - Interface	Volume
Scaling unit - Interface	Litres

Menu item	Default value
Scaling format - Interface	Without decimal positions
Scaling interface - 100 % corresponds to	100
Scaling interface - 0 % corresponds to	0
Current output, output variable	Lin. percent - Level
Current output - Output characteristics	0 … 100 % correspond to 4 … 20 mA
Current output - Reaction in case of fault	≤ 3.6 mA
Current output - Min.	3.8 mA
Current output - Max.	20.5 mA

Menu - Display

Menu item	Default value
Language	Selected language
Displayed value 1	Filling height
Displayed value 2	Electronics temperature
Display format 1	Automatically
Display format 2	Automatically
Backlight	Switched on

Menu - Additional adjustments

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

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

- **Read from sensor:** Read data from sensor and store into the display and adjustment module
- **Write into sensor:** Store 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
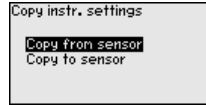
Prerequisites

The following requirements must be met for a successful transmission:

● The data can only be transferred to the same device type, e.g. VEGAFLEX 86
● It must be the same probe type, e.g. rod probe
● The firmware of both devices is identical

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 number this sensor had.

Tip:
We recommend to save the instrument adjustments. In case of an electronics exchange the saved parameter adjustment data relieve this process.

Scaling level

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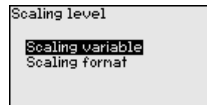
Scaling level - Scaling prime

In menu item " *Scaling variable*" you define the scaling variable and the scaling unit for the level value on the display, e.g. volume in l.
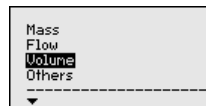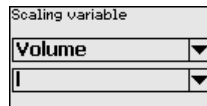
Scaling level - Scaling format
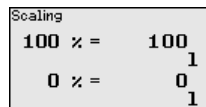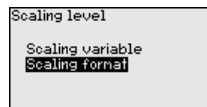
In menu item " *Scaling format*" you define the scaling format on the display and the scaling of the measured level value for 0 % and 100 %.

VEGA

Scaling format	Scaling 100 %	Scaling 0 %
✓▪	⊞00100	⊞00000
#.#	1	1
#.##	-99999 99999	-99999 99999
#.###		
#.####		
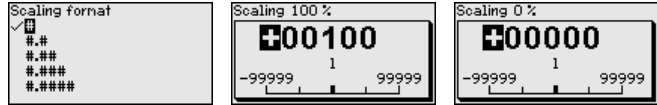
Scaling interface

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

Scaling interface

Scaling variable
Scaling format
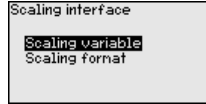
Scaling interface - Scaling size

In menu item " *Scaling variable*" you define the scaling variable and the scaling unit for the interface value on the display, e.g. volume in l.

Scaling variable	Mass	m³
Volume ▼	Flow	✓l
l ▼	**Volume**	hl
	Others	ft³
	------------------	in³
	▼	▼
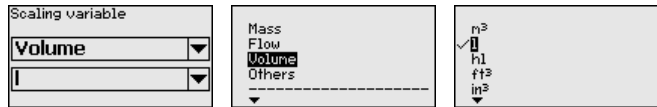
Scaling interface - Scaling format

In menu item " *Scaling format*" you define the scaling format on the display and the scaling of the measured interface value for 0 % and 100 %.

Scaling interface	Scaling
Scaling variable	100 % = 100
Scaling format	1
	0 % = 0
	1

Scaling format	Scaling 100 %	Scaling 0 %
✓▪	⊞00100	⊞00000
#.#	1	1
#.##	-99999 99999	-99999 99999
#.###		
#.####		
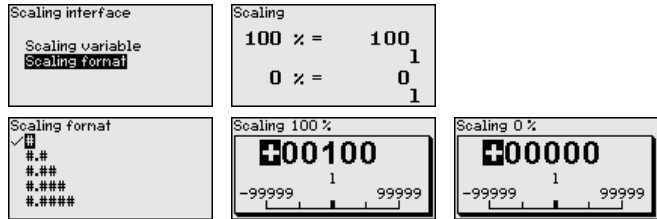
Current output

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

Current output

Current output variable
Current output, adjustment
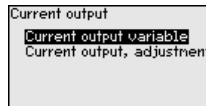
Current output - Current output size

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

Current output variable	Current output variable
	Distance, level
Lin.percent, level ▼	Percent, level
	✓Lin.percent, level
	Scaled level
	Filling height, level
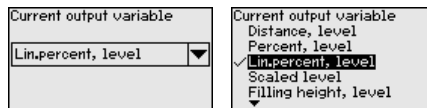
Current output - Current output adjustment

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

Current output, adjustment	Current output 100 %	Current output 0 %
100 % = 100.00 °C	⊞00000	⊞00100
0 % = 0.00 °C	1 -99999 99999	1 -99999 99999
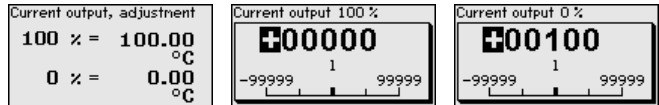
Probe type

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.

Probe type	Probe type
Rod 8mm ▼	✓Rod 8mm Cable 2mm centr. weight Cable 2mm grav. weight Cable 4mm centr. weight Cable 4mm gravity weight
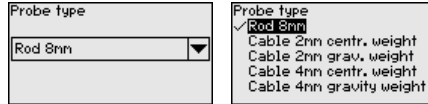
HART mode

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.

HART address	Address	Loop current mode
0	0̲0	✓Analogue current output Fix current (4 mA)
Loop current mode Analogue current output ▼	0 63	
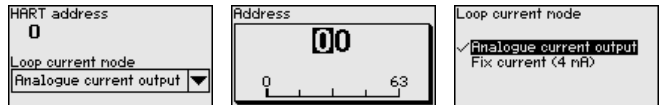
The default setting is " *Analogue current output*" and the address 00.

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.

Service login
⊞A
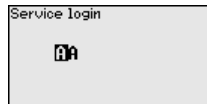
6.5.5 Info

Device name

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

Instrument version

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

VEGA

```
Software version
   1.0.0
Hardware version
   1.0.0
```

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.

```
Factory calibration date
   3. Aug    2012
Last change
  29. Nov    2012
```

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.

```
Sensor characteristics

    Display
     now?
```
```
Sensor characteristics
Process fitting /
Material

Thread G¾ PN6, DIN
3852-A / 316L
```
```
Sensor characteristics
Cable entry / Conn
ection

M20x1.5 / Cable gl
and PA black
```

Example for displayed sensor features.

6.6   Save parameter adjustment data

On paper

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

In the display and adjustment module

If the instrument is equipped with a display and adjustment module, the parameter adjustment data can be saved therein. The procedure is described in menu item " *Copy device settings*".

7 Set up with smartphone/tablet/PC/ notebook via Bluetooth

7.1 Preparations

Make sure that the Bluetooth function of the display and adjustment module is activated. For this, the switch on the bottom side must be set to " *On*".
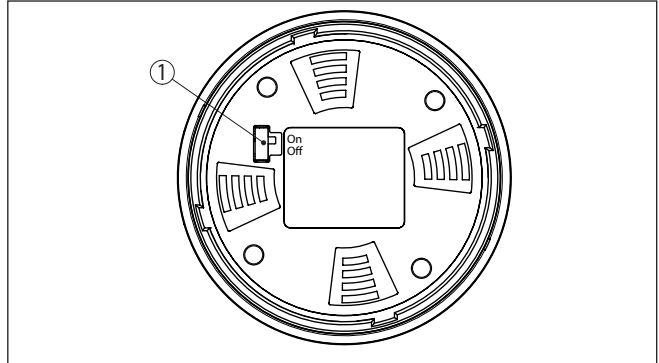
Fig. 20: Activate Bluetooth

1 Bluetooth switch
On Bluetooth active
Off Bluetooth not active

Change sensor PIN

The security concept of Bluetooth operation absolutely requires that the default setting of the sensor PIN be changed. This prevents unauthorized access to the sensor.

The default setting of the sensor PIN is " **0000**". First of all you have to change the sensor PIN in the adjustment menu of the respective sensor, e.g. to " **1111**".

Use " *OK*" to switch to the input menu.

VEGA

```
PIN

     0000
```

Change the PIN, e.g. to " **1111**".

```
PIN

     1111
```

```
PIN

     Deactivated
```
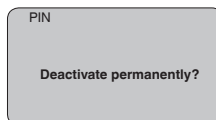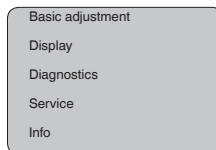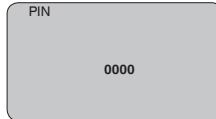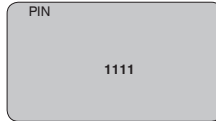
This permanently deactivates the PIN.

The display immediately changes to PIN activation.

Press " *ESC*" to cancel the activation of the PIN.

With " *OK*" you can enter and activate a PIN.

```
PIN

     Enable?
```

```
PIN

     Activated
```
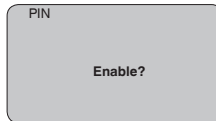
After the sensor PIN has been changed, sensor adjustment can be enabled again. For access (authentication) with Bluetooth, the modified PIN is still effective.

● **Information:**
ℹ Bluetooth communication functions only if the actual sensor PIN differs from the default setting " **0000**".

7.2 Connecting

Preparations

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

PC/Notebook
Start PACTware and the VEGA project assistant. Select the device search via Bluetooth and start the search function. The device automatically searches for Bluetooth-capable devices in the vicinity.

Connecting

The message "*Searching …*" is displayed.

All found instruments will be listed in the adjustment window. The search is continued automatically.

Select the requested instrument in the device list.

The message "*Connecting …*" is displayed.

Authenticate

For the first connection, the operating device and the sensor must authenticate each other. After successful authentication, the next connection functions without authentication.

For authentication, enter in the next menu window the 4-digit sensor PIN.

7.3   Sensor parameter adjustment

The sensor parameterization is carried out via the adjustment app on the smartphone/tablet or the DTM on the PC/notebook.

App view
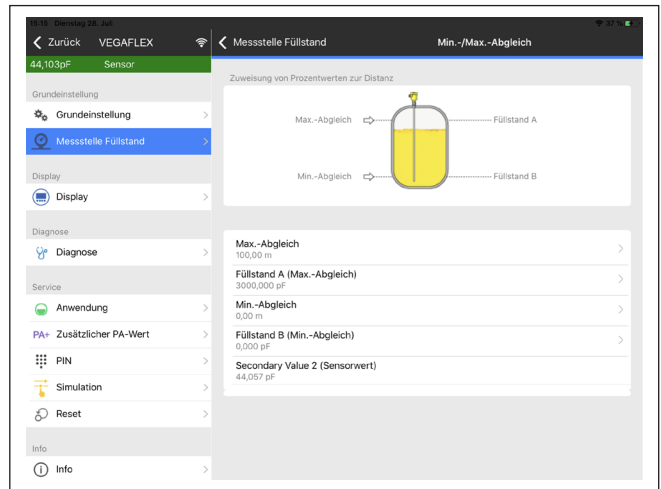
Fig. 21: Example of an app view - Setup sensor adjustment

8 Setting up sensor and Modbus interface with PACTware

8.1 Connect the PC

To the sensor electronics Connection of the PC to the sensor electronics is carried out via the interface adapter VEGACONNECT.

Scope of the parameter adjustment:

● Sensor electronics
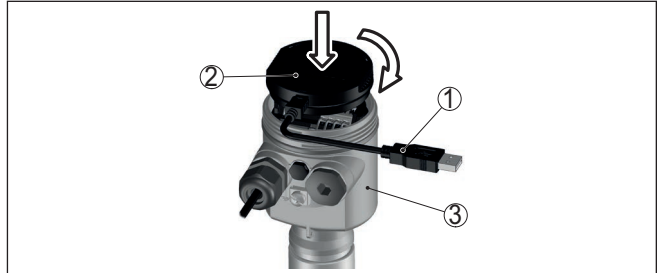
Fig. 22: Connection of the PC directly to the sensor via the interface adapter

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

To the Modbus electronics Connection of the PC to the Modbus electronics is carried out via a USB cable.

Scope of the parameter adjustment:

● Sensor electronics
● Modbus electronics

Fig. 23: Connecting the PC via USB to the Modbus electronics

1   USB cable to the PC

To the RS 485 cable Connection of the PC to the RS 485 cable is carried out via a standard interface adapter RS 485/USB.

VEGAFLEX 86 • Modbus and Levelmaster protocol

Scope of the parameter adjustment:

● Sensor electronics
● Modbus electronics

Information:
ℹ For parameter adjustment, it is absolutely necessary to disconnect from the RTU.
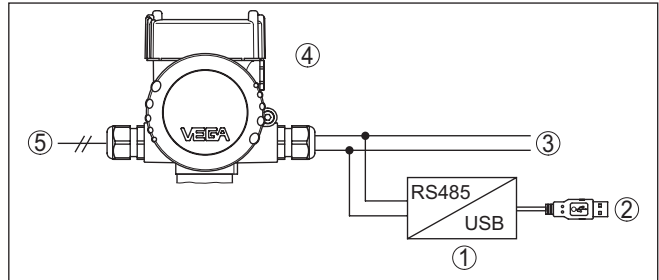
Fig. 24: Connection of the PC via the interface adapter to the RS 485 cable

1 Interface adapter RS 485/USB
2 USB cable to the PC
3 RS 485 cable
4 Sensor
5 Voltage supply

8.2 Parameter adjustment with PACTware

Prerequisites

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:
ℹ 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.
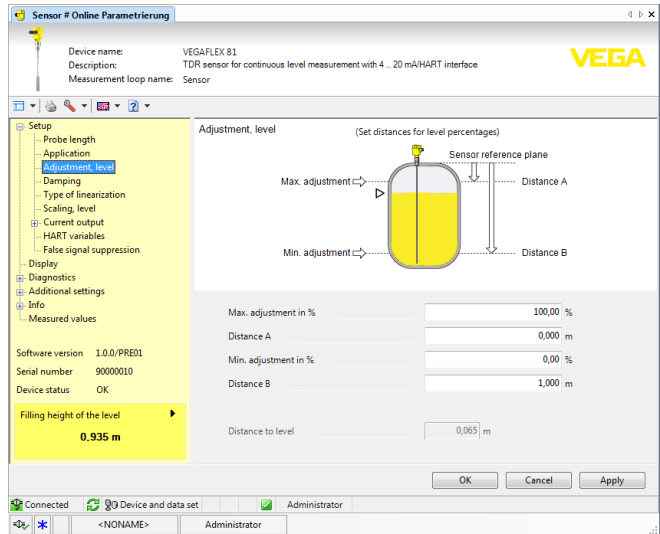
Fig. 25: Example of a DTM view

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.

8.3 Set instrument address

The VEGAFLEX 86 requires an address for participating as a sensor in the Modbus communication. The addess setting is carried out via a PC with PACTware/DTM or Modbus RTU.

The default settings for the address are:

● Modbus: 246
● Levelmaster: 31

Note:
The setting of the instrument address can only be carried out online.

Via PC through Modbus electronics

Start the project assistant and wait until the project tree has been set up. Then, in the project tree, go to the symbol for the Modbus gateway. Select with the right mouse key " *Parameter*", then " *Online parameter adjustment*" and start the DTM for the Modbus electronics.

In the menu bar of the DTM, go to the list arrow next to the symbol for " *Screwdriver*". Select the menu item " *Change address in the instrument*" and set the requested address.

Via PC through RS 485 cable

In the device catalogue, select the option " *Modbus Serial*" under " *Driver*". Double click on this driver and integrate it into the project tree.

Open the device manager on your PC and find out which COM interface the USB/RS 485 adapter is located on. Then go to the symbol " *Modbus COM.*" in the project tree. Select " *Parameter*" with the right mouse key and start the DTM for the USB/RS 485 adapter. Enter the COM interface no. from the device manager under " *Basic settings*".

Select with the right mouse key " *Additional functions*" and " *Instrument search*". The DTM then searches for the connected Modbus participants and integrates them into the project tree. Now, in the project tree, go to the symbol for the Modbus gateway. Select with the right mouse key " *Parameter*", then " *Online parameter setting*" and start the DTM for the Modbus electronics.

In the menu bar of the DTM, go to the list arrow next to the symbol for " *Screwdriver*". Select the menu item " *Change address in the instrument*" and set the requested address.

Then move again to the symbol " *Modbus COM.*" in the project tree. Select with the right mouse key " *Additional functions*" and " *Change DTM addresses*". Enter here the modified address of the Modbus gateway.

Via Modbus-RTU

The instrument address is set in register no. 200 of the Holding Register (see chapter " *Modbus register* " in this operating instructions manual).

The procedure depends on the respective Modbus-RTU and the configuration tool.

8.4   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.
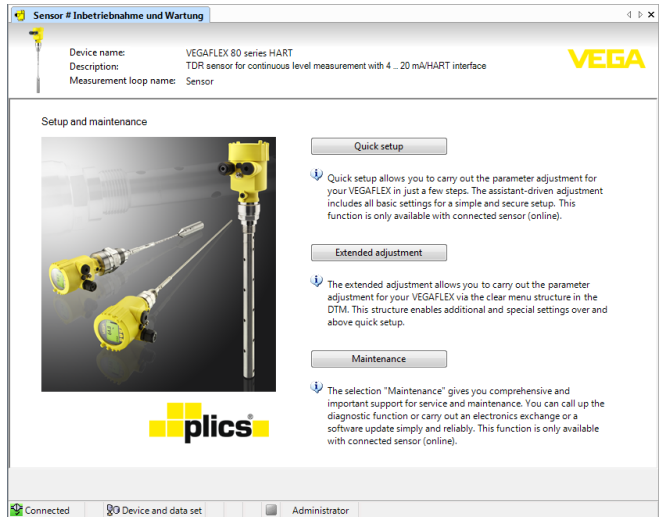
Fig. 26: Select quick setup

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.

8.5   Save parameter adjustment data

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

9 Diagnosis, asset management and service

9.1 Maintenance

Maintenance

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

Cleaning

The cleaning helps that the type label and markings on the instrument are visible.

Take note of the following:

- Use only cleaning agents which do not corrode the housings, type label and seals
- Use only cleaning methods corresponding to the housing protection rating

9.2 Measured value and event memory

The instrument has several memories available for diagnostic purposes. The data remain there even in case of 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
- Measurement reliability
- Electronics temperature

When the instrument is shipped, the measured value memory is active and stores distance, measurement reliability 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. Additional echo curves are stored via:

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

9.3 Asset Management function

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 there are more detailed error messages available under the menu item " *Diagnostics*" via the respective adjustment module.

Status messages

The status messages are divided into the following categories:

● Failure
● Function check
● Out of specification
● Maintenance required

and explained by pictographs:
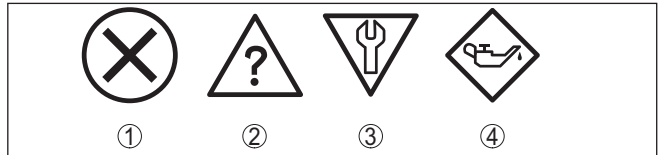
Fig. 27: Pictographs of the status messages

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

Malfunction (Failure):
Due to a malfunction in the instrument, a fault signal is output.

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

Function check:
The instrument is being worked on, the measured value is temporarily invalid (for example during simulation).

This status message is inactive by default.

Out of specification:

The measured value is unreliable because an instrument specification was exceeded (e.g. electronics temperature).

This status message is inactive by default.

Maintenance required:

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.

Failure (failure)

| Code
Text message | Cause | Rectification | DevSpec
Diagnosis Bits |
|---|---|---|---|
| F013
no measured value available | Sensor does not detect an echo during operation
Antenna system dirty or defective | Check for correct mounting and/or parameter adjustment
Clean or exchange process component or antenna | Bit 0 |
| F017
Adjustment span too small | Adjustment not within specification | Change adjustment according to the limit values (difference between min. and max. ≥ 10 mm) | Bit 1 |
| F025
Error in the linearization table | Index markers are not continuously rising, for example illogical value pairs | Check linearization table
Delete table/Create new | Bit 2 |
| F036
No operable software | Failed or interrupted software update | Repeat software update
Check electronics version
Exchanging the electronics
Send instrument for repair | Bit 3 |
| F040
Error in the electronics | Hardware defect | Exchanging the electronics
Send instrument for repair | Bit 4 |
| F041
Probe loss | Cable probe broken or rod probe defective | Check probe and exchange, if necessary | Bit 13 |
| F080
General software error | General software error | Disconnect operating voltage briefly | Bit 5 |
| F105
Measured value is determined | The instrument is still in the switch-on phase, the measured value could not yet be determined | Wait for the end of the switch-on phase
Duration up to approx. 3 minutes depending on the version and parameter settings | Bit 6 |
| F113
Communication error | Error in the internal instrument communication | Disconnect operating voltage briefly
Send instrument for repair | - |

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| Code | Cause | Rectification | DevSpec |
Text message			Diagnosis Bits
F125 Impermissible electronics temperature	Temperature of the electronics in the non-specified range	Check ambient temperature Insulate electronics Use instrument with higher temperature range	Bit 7
F260 Error in the calibration	Error in the calibration carried out in the factory Error in the EEPROM	Exchanging the electronics Send instrument for repair	Bit 8
F261 Error in the instrument settings	Error during setup False signal suppression faulty Error when carrying out a reset	Repeat setup Repeat reset	Bit 9
F264 Installation/Set-up error	Adjustment not within the vessel height/measuring range Max. measuring range of the instrument not sufficient	Check for correct mounting and/or parameter adjustment Use an instrument with bigger measuring range	Bit 10
F265 Measurement function disturbed	Sensor no longer carries out a measurement Operating voltage too low	Check operating voltage Carry out a reset Disconnect operating voltage briefly	Bit 11
F266 Impermissible operating voltage	Wrong operating voltage	Check operating voltage Check connection cables	Bit 14
F267 No executable sensor software	Sensor cannot start	Exchanging the electronics Send instrument for repair	-

Tab. 8: Error codes and text messages, information on causes as well as corrective measures

Function check

| Code | Cause | Rectification | DevSpec |
Text message			State in CMD 48
C700 Simulation active	A simulation is active	Finish simulation Wait for the automatic end after 60 mins.	"Simulation Active" in "Standardized Status 0"

Tab. 9: Error codes and text messages, information on causes as well as corrective measures

Out of specification

| Code | Cause | Rectification | DevSpec |
Text message			State in CMD 48
S600 Impermissible electronics temperature	Temperature of the processing electronics in the non-specified section	Check ambient temperature Insulate electronics Use instrument with higher temperature range	Bit 8 of Byte 14 … 24

| Code | Cause | Rectification | DevSpec |
Text message			State in CMD 48
S601 Overfilling	Level echo in the close range not available	Reduce level 100 % adjustment: Increase value Check mounting socket Remove possible interfering signals in the close range Use coaxial probe	Bit 9 of Byte 14 … 24
S602 Level within the search range, compensation echo	Compensation echo superimposed by medium	100 % adjustment: Increase value	Bit 10 of Byte 14 … 24
S603 Impermissible operating voltage	Operating voltage below specified range	Check electrical connection If necessary, increase operating voltage	Bit 11 of Byte 14 … 24

Tab. 10: Error codes and text messages, information on causes as well as corrective measures

Maintenance

| Code | Cause | Rectification | DevSpec |
Text message			State in CMD 48
M500 Error in the delivery status	The data could not be restored during the reset to delivery status	Repeat reset Load XML file with sensor data into the sensor	Bit 0 of Byte 14 … 24
M501 Error in the non-active linearisation table	Index markers are not continuously rising, for example illogical value pairs	Check linearization table Delete table/Create new	Bit 1 of Byte 14 … 24
M504 Error at a device interface	Hardware defect	Exchanging the electronics Send instrument for repair	Bit 4 of Byte 14 … 24
M505 no measured value available	Sensor does not detect an echo during operation	Check and correct mounting and/or parameter adjustment	Bit 5 of Byte 14 … 24
	Process component or probe contaminated or defective	Clean or exchange process component or probe	
M506 Installation/Set-up error	Error during setup	Check and correct mounting and/or parameter adjustment Check probe length	Bit 6 of Byte 14 … 24
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	Bit 7 of Byte 14 … 24

Tab. 11: Error codes and text messages, information on causes as well as corrective measures

9.4 Rectify faults

Reaction when malfunction occurs

The operator of the system is responsible for taking suitable measures to rectify faults.

Fault rectification

The first measures are:

● Evaluation of fault messages
● Checking the output signal
● Treatment of measurement errors

A smartphone/tablet with the adjustment app or a PC/notebook with the software PACTware and the suitable DTM offer you further comprehensive diagnostic possibilities. In many cases, the causes can be determined in this way and the faults eliminated.

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	Fluctuating measured value	Set damping
4 … 20 mA signal missing	Electrical connection faulty	Check connection, correct, if necessary
	Voltage supply missing	Check cables for breaks; repair if necessary
	Operating voltage too low, load resistance too high	Check, adapt if necessary
Current signal greater than 22 mA, less than 3.6 mA	Sensor electronics defective	Replace device or send in for repair depending on device version

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.
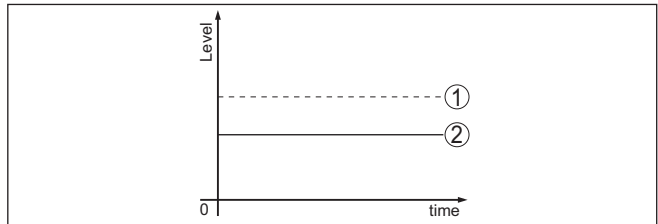
Fig. 28: The broken line 1 shows the real level, the continuous line 2 shows the level displayed by the sensor
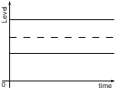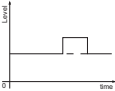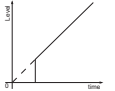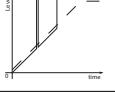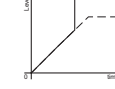
ℹ Note:
If the output level is constant, the cause could also be the fault setting of the output to " *Hold value*".

If the level is too low, the reason could be a line resistance that is too high

Measurement error with constant level

Fault description	Cause	Rectification
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
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	Cause	Rectification
Measured value remains in the area of the bottom during filling	Echo from the probe end larger than the product echo, for example, with products with ε_r < 2.5 oil-based, solvents, etc.	Check parameter "Medium" and "Vessel height", adapt if necessary
Measured value remains momentarily unchanged during filling and then jumps to the correct level	Turbulence on the medium surface, quick filling	Check parameters, change if necessary, e.g. in dosing vessel, reactor
Measured value jumps sporadically to 100 % during filling	Changing condensation or contamination on the probe	Carry out a false signal suppression
Measured value jumps to ≥ 100 % or 0 m distance	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 output.	Eliminate false signals in the close range Check installation conditions If possible, switch off the function "Overfill protection"

Measurement error during emptying

Fault description	Cause	Rectification
Measured value remains unchanged in the close range during emptying	False signal larger than the level echo Level echo too small	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
Measured value remains reproducible in one position during emptying	Stored false signals in this position are larger than the level echo	Delete false signal suppression 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, the order data must first be downloaded from the Internet (see operating instructions " *Electronics module*").

Information:
All application-specific settings must be entered again. That's why you have to carry out a fresh setup after exchanging the electronics.

If you saved the parameter settings during the first setup of the sensor, you can transfer them to the replacement electronics module. A fresh setup is then not 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.

You can find information about the installation in the download file.

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 about the procedure in the download area of our homepage. By doing this you help us carry out the repair quickly and without having to call back for needed information.

Proceed as follows in case of repair:

● 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
● Ask the agency serving you to get the address for the return shipment. You can find the agency on our homepage.

10 Dismount

10.1 Dismounting steps

To remove the device, carry out the steps in chapters " *Mounting*" and " *Connecting to power suplly*" in reverse.

Warning:
When dismounting, pay attention to the process conditions in vessels or pipelines. There is a risk of injury, e.g. due to high pressures or temperatures as well as aggressive or toxic media. Avoid this by taking appropriate protective measures.

10.2 Disposal

Pass the instrument on to a specialised recycling company and do not use the municipal collecting points.

Remove any batteries in advance, if they can be removed from the device, and dispose of them separately.

If personal data is stored on the old device to be disposed of, delete it before disposal.

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

11 Supplement

11.1 Technical data

General data

Material 316L corresponds to 1.4404 or 1.4435

Materials, wetted parts

− Process fitting - rod version	316L, 904L (1.4539), Alloy C22 (2.4602) and Aluminium oxide-ceramic 99.7 % (Al2O3) or Alloy C22 (2.4602) and Aluminium oxide-ceramic 99.7 % (Al2O3)
− Tube: ø 42.2 mm (1.661 in)	316L or Alloy C22 (2.4602)
− Process seal on the instrument side (cable/rod leadthrough)	Aluminium oxide-ceramic 99.5 % (Al2O3) 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-cast housing	Aluminium die-casting AlSi10Mg, powder-coated (Basis: Polyester)
− Stainless steel housing (precision casting)	316L
	Optional anti-corrosion coating with Novolak epoxy resin according to Norsok 6C
− Stainless steel housing (electropol-ished)	316L
− Second Line of Defense	Borosilicate glass GPC 540
− Seal between housing and housing lid	Silicone SI 850 R
− Inspection window in housing cover (optional)	Plastic housing: Polycarbonate (UL746-C listed)
	Metal housing: Glass [1]
− Ground terminal	316L
− Cable gland	PA, stainless steel, brass
− Sealing, cable gland	NBR
− Blind plug, cable gland	PA

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

[1] Aluminium, stainless steel precision casting and Ex d housing

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– Contacts	Alloy C22 (2.4602)
– Helium leak rate	< 10^{-6} mbar l/s
– Pressure resistance	See process pressure of the sensor
Process fittings	
– Pipe thread, cylindrical (ISO 228 T1)	G1½ (DIN 3852-A)
– Pipe thread, conical (ASME B1.20.1)	1½ NPT
– Flanges	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	≥ 1.4

Output variable

Output	
– Physical layer	Digital output signal according to standard EIA-485
– Bus specifications	Modbus Application Protocol V1.1b3, Modbus over serial line V1.02
– Data protocols	Modbus RTU, Modbus ASCII, Levelmaster
Max. transmission rate	57.6 Kbit/s

Measurement 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)

Mounting, reference conditions

–	Min. distance to internal installations	> 500 mm (19.69 in)
–	Vessel	metallic, ø 1 m (3.281 ft), centric mounting, process fitting flush with the vessel ceiling
–	Medium	Water/Oil (dielectric constant ~2.0) [2]
–	Mounting	Probe end does not touch the vessel bottom
	Sensor parameter adjustment	No gating out of false signals carried out
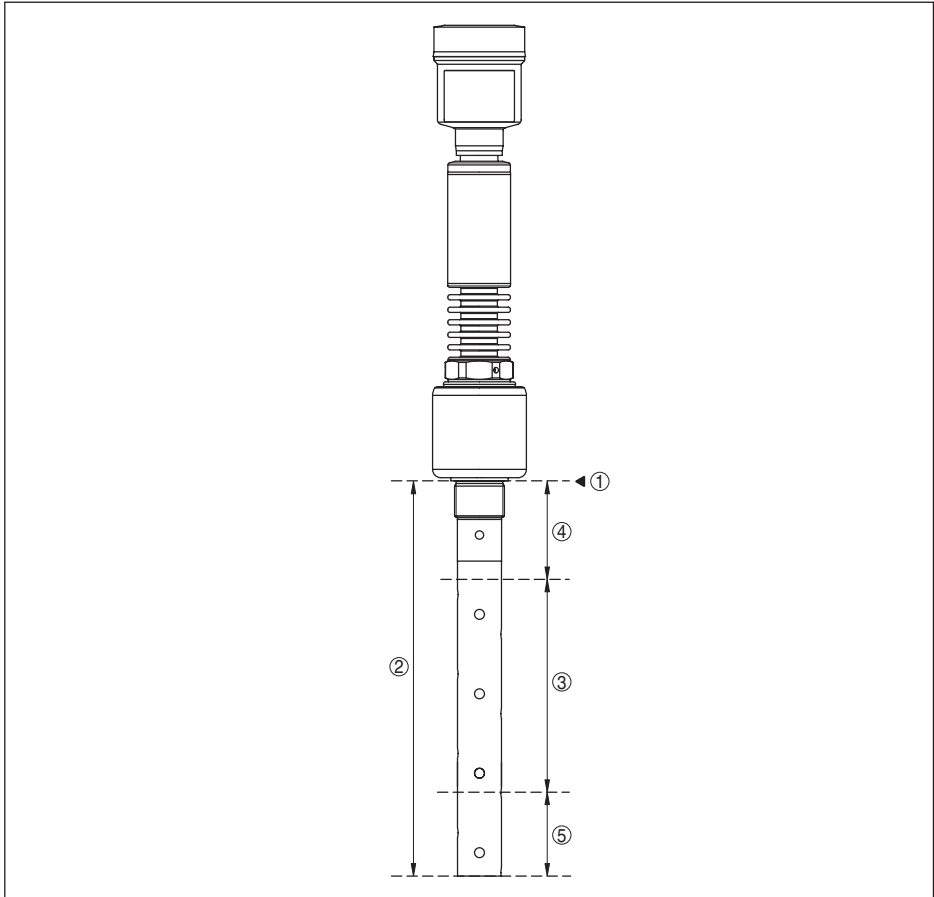
Fig. 29: Measuring ranges - VEGAFLEX 86

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

[2]   With interface measurement = 2.0

Typical deviation - Interface measurement	± 5 mm (0.197 in)
Typical deviation - Total level interface measurement	See following diagrams
Typical deviation - Level measurement [3][4]	See following diagrams
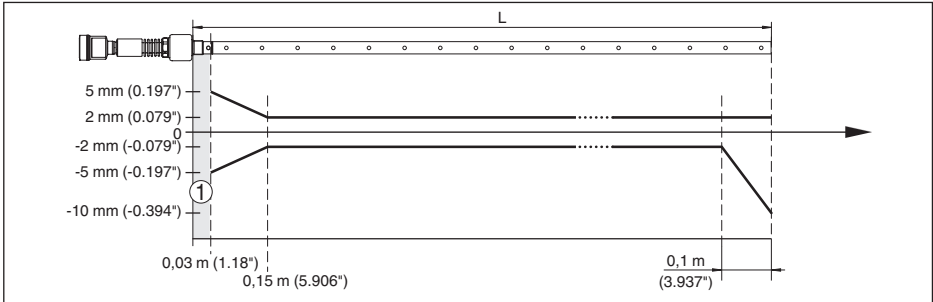
Fig. 30: Deviation VEGAFLEX 86 in coax version in water (measurement length up to 1.5 m/4.92 ft)

1   Blocking distance (no measurement possible in this area)
L   Probe length
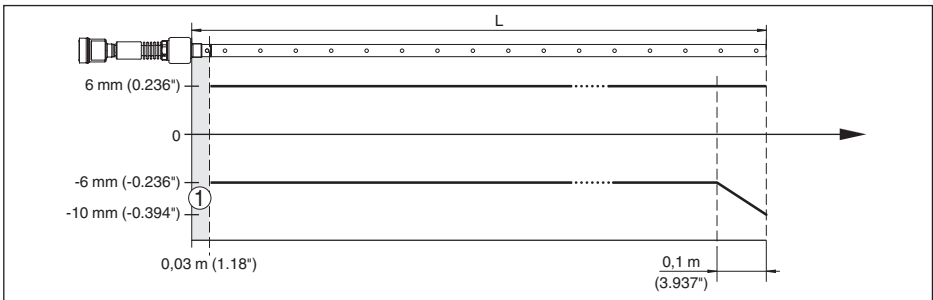
Fig. 31: Deviation VEGAFLEX 86 in coax version in water (measurement length up to 6 m/19.69 ft)

1   Blocking distance (no measurement possible in this area)
L   Probe length

[3]   Depending on the mounting conditions, deviations can occur which can be rectified by adapting the adjustment or changing the measured value offset in the DTM service mode.
[4]   The blocking distances can be optimized via a false signal suppression.
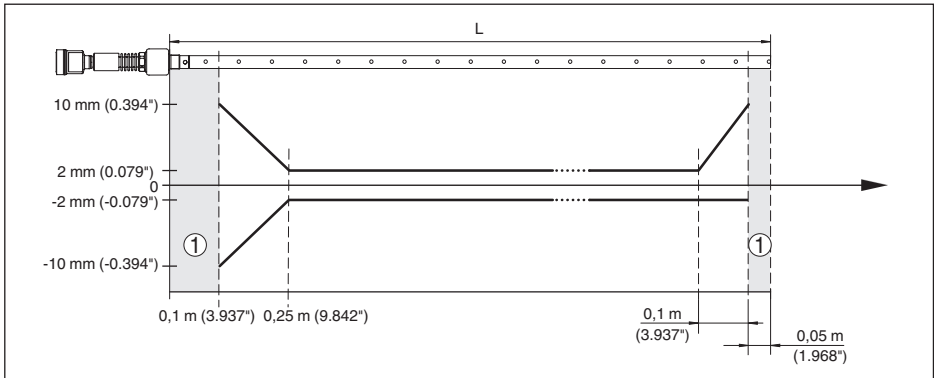
VEGA

Fig. 32: Deviation VEGAFLEX 86 in coax version in oil (measurement length up to 1.5 m/4.92 ft)

1   Blocking distance (no measurement possible in this area)
L   Probe length
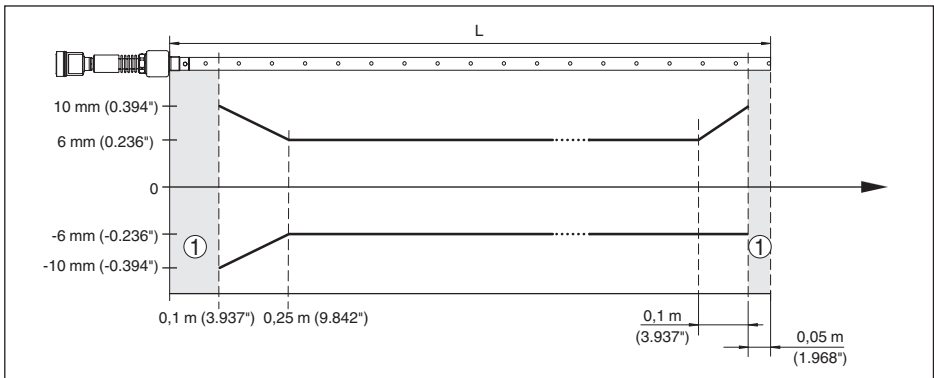
Fig. 33: Deviation VEGAFLEX 86 in coax version in oil (measurement length up to 6 m/19.69 ft)

1   Blocking distance (no measurement possible in this area)
L   Probe length

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

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 %

Non-repeatability   ≤ ±1 mm

Variables influencing measurement accuracy

Temperature drift - Digital output	±3 mm/10 K relating to the max. measuring range or max. 10 mm (0.394 in)
Additional deviation through electromagnetic interference acc. to EN 61326	< ±10 mm (< ±0.394 in)

Influence of the superimposed gas and pressure on measurement 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.

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		
		1 bar (14.5 psig)	10 bar (145 psig)	50 bar (725 psig)
Air	20 °C (68 °F)	0 %	0.22 %	1.2 %
	200 °C (392 °F)	-0.01 %	0.13 %	0.74 %
	400 °C (752 °F)	-0.02 %	0.08 %	0.52 %
Hydrogen	20 °C (68 °F)	-0.01 %	0.1 %	0.61 %
	200 °C (392 °F)	-0.02 %	0.05 %	0.37 %
	400 °C (752 °F)	-0.02 %	0.03 %	0.25 %
Steam (saturated steam)	100 °C (212 °F)	0.26 %	-	-
	150 °C (302 °F)	0.17 %	2.1 %	-

Characteristics and performance data

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

Ambient conditions

Ambient, storage and transport temperature

– Standard	-40 … +80 °C (-40 … +176 °F)
– CSA, Ordinary Location	-40 … +60 °C (-40 … +140 °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

[5] 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).

Vessel pressure relating to the flange nominal pressure stage	see supplementary instructions manual " *Flanges according to DIN-EN-ASME-JIS*"
Process temperature	-196 … +280 °C (-321 … +536 °F)
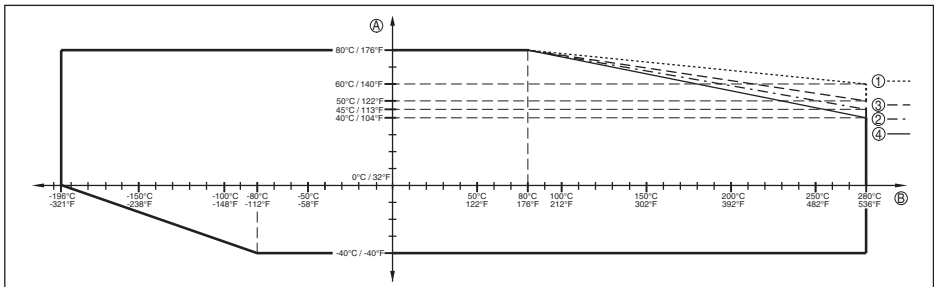
Fig. 34: Ambient temperature - process temperature, standard version

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 %.
with anti-corrosion coating - Novolak epoxy resin according to Norsok 6C (optional)	max. +150 °C (+302 °F) on the flange surface
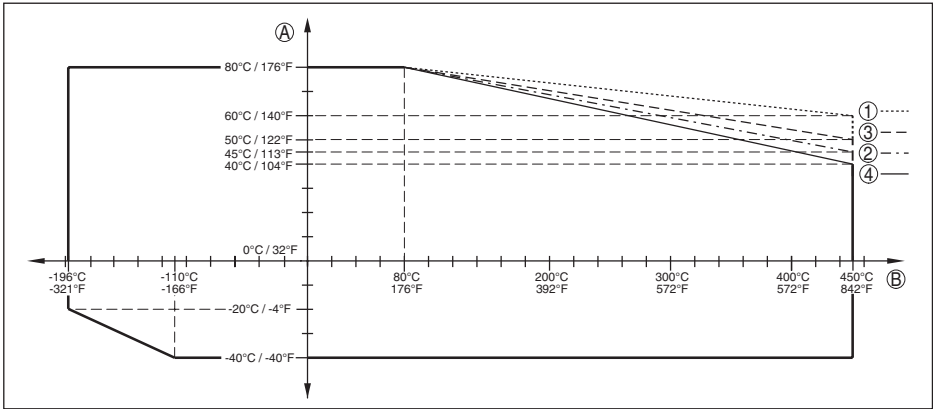
Fig. 35: Ambient temperature - process temperature, standard version

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)
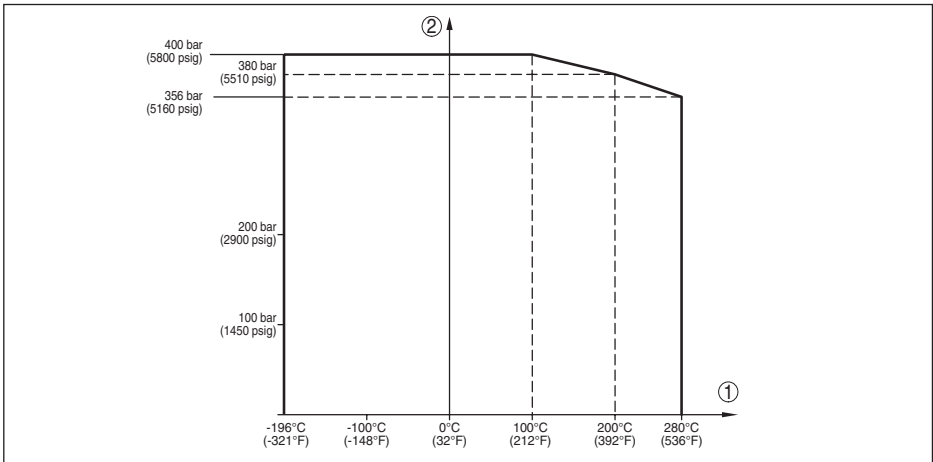
Fig. 36: Process pressure - process temperature (version -196 … +280 °C/-321 … +536 °F)

1   Process temperature (depending on the seal material)
2   Process pressure
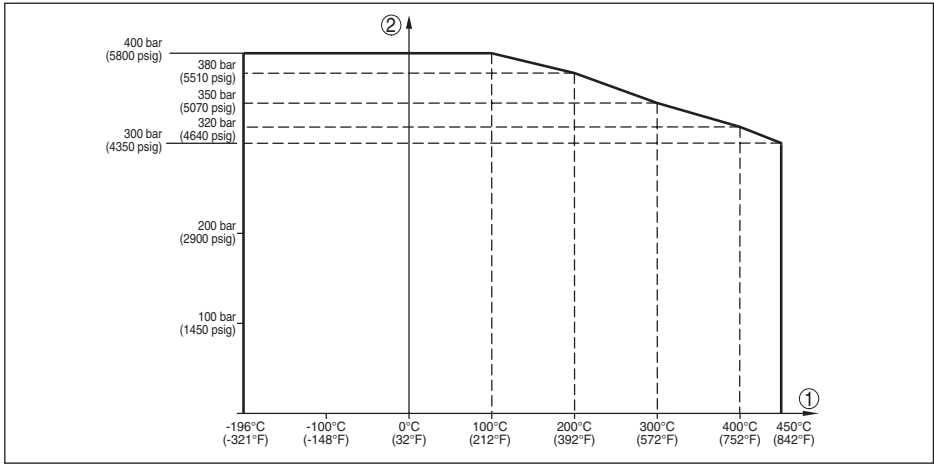
Fig. 37: Process pressure - process temperature (version -196 … +450 °C/-321 … +842 °F)

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

	Flanges of 904L (1.4539): see ASME B16.5-2013, Table 2-3.11, permissible temperature range: -60 … +400 °C (-76 … 752 °F)
Viscosity - dynamic	0.1 … 500 mPa s (requirement: with density 1)
Vibration resistance	
Ɩ 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	
Ɩ 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 IP67

Options of the cable entry

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

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

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Wire cross-section (spring-loaded terminals)

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

Integrated clock

Date format	Day.Month.Year
Time format	12 h/24 h
Time zone, factory setting	CET
Max. rate deviation	10.5 min/year

Additional output parameter - Electronics temperature

Range	-40 … +85 °C (-40 … +185 °F)
Resolution	< 0.1 K
Deviation	± 3 K
Availability of the temperature values	
– Indication	Via the display and adjustment module
– Output	Via the respective output signal

Voltage supply

Operating voltage	8 … 30 V DC
Max. power consumption	520 mW
Reverse voltage protection	Integrated

Potential connections and electrical separating measures in the instrument

Electronics	Non-floating
Galvanic separation	
– between electronics and metallic parts of the device	Reference voltage 500 V AC
Conductive connection	Between ground terminal and metallic process fitting

Electrical protective measures

Protection, depending on housing version	
– Plastic housing	IP67 acc. to IEC 60529, Type 4X acc. to NEMA
– Aluminium housing; stainless steel housing - precision casting	IP68 (0.2 bar) acc. to IEC 60529, Type 6P acc. to NEMA
Connection of the feeding power supply unit to networks of overvoltage category	III
Pollution degree [6]	4
Protection rating (IEC 61010-1)	III

11.2 Device communication Modbus

In the following, the necessary device-specific details are shown. You can find further information of

[6] When used with fulfilled housing protection

Modbus on www.modbus.org.

Parameters for the bus communication

The VEGAFLEX 86 is preset with the following default values:

Parameter	Configurable Values	Default Value
Baud Rate	1200, 2400, 4800, 9600, 19200	9600
Start Bits	1	1
Data Bits	7, 8	8
Parity	None, Odd, Even	None
Stop Bits	1, 2	1
Address range Modbus	1 … 255	246

Start bits and data bits cannot be modified.

General configuration of the host

The data exchange with status and variables between field device and host is carried out via register. For this, a configuration in the host is required. Floating point numbers with short prevision (4 bytes) according to IEEE 754 are transmitted with individually selectable order of the data bytes (byte transmission order). This " *Byte transmission order*" is determined in the parameter " *Format Code*". Hence the RTU knows the registers of the VEGAFLEX 86 which must be contacted for the variables and status information.

Format Code	Byte transmission order
0	ABCD
1	CDAB
2	DCBA
3	BADC

11.3 Modbus register

Holding Register

The Holding registers consist of 16 bit. They can be read and written. Before each command, the address (1 byte), after each command, a CRC (2 byte) is sent.

Register Name	Register Number	Type	Configurable Values	Default Value	Unit
Address	200	Word	1 … 255	246	–
Baud Rate	201	Word	1200, 2400, 4800, 9600, 19200, 38400, 57600	9600	–
Parity	202	Word	0 = None, 1 = Odd, 2 = Even	0	–
Stopbits	203	Word	1 = One, 2 = Two	1	–
Delay Time	206	Word	10 … 250	50	ms
Byte Oder (Floating point format)	3000	Word	0, 1, 2, 3	0	–

Input register

The input registers consist of 16 bits. They can only be read. The address (1 byte) is sent before each command, a CRC (2 bytes) after each command. PV, SV, TV and QV can be set via the sensor DTM.

Register Name	Register Number	Type	Note
Status	100	DWord	Bit 0: Invalid Measurement Value PV
			Bit 1: Invalid Measurement Value SV
			Bit 2: Invalid Measurement Value TV
			Bit 3: Invalid Measurement Value QV
PV Unit	104	DWord	Unit Code
PV	106		Primary Variable in Byte Order CDAB
SV Unit	108	DWord	Unit Code
SV	110		Secondary Variable in Byte Order CDAB
TV Unit	112	DWord	Unit Code
TV	114		Third Variable in Byte Order CDAB
QV Unit	116	DWord	Unit Code
QV	118		Quarternary Variable in Byte Order CDAB
Status	1300	DWord	See Register 100
PV	1302		Primary Variable in Byte Order of Register 3000
SV	1304		Secondary Variable in Byte Order of Register 3000
TV	1306		Third Variable in Byte Order of Register 3000
QV	1308		Quarternary Variable in Byte Order of Register 3000
Status	1400	DWord	See Register 100
PV	1402		Primary Variable in Byte Order CDAB
Status	1412	DWord	See Register 100
SV	1414		Secondary Variable in Byte Order CDAB
Status	1424	DWord	See Register 100
TV	1426		Third Variable in Byte Order CDAB
Status	1436	DWord	See Register 100
QV	1438		Quarternary Variable in Byte Order CDAB
Status	2000	DWord	See Register 100
PV	2002	DWord	Primary Variable in Byte Order ABCD (Big Endian)
SV	2004	DWord	Secondary Variable in Byte Order ABCD (Big Endian)
TV	2006	DWord	Third Variable in Byte Order ABCD (Big Endian)
QV	2008	DWord	Quarternary Variable in Byte Order ABCD (Big Endian)
Status	2100	DWord	See Register 100

Register Name	Register Number	Type	Note
PV	2102	DWord	Primary Variable in Byte Order DCBA (Little Endian)
SV	2104	DWord	Secondary Variable in Byte Order DCBA (Little Endian)
TV	2106	DWord	Third Variable in Byte Order ABCD DCBA (Little Endian)
QV	2108	DWord	Quarternary Variable in Byte Order DCBA (Little Endian)
Status	2200	DWord	See Register 100
PV	2202	DWord	Primary Variable in Byte Order BACD (Middle Endian)
SV	2204	DWord	Secondary Variable in Byte Order BACD (Middle Endian)
TV	2206	DWord	Third Variable in Byte Order BACD (Middle Endian)
QV	2208	DWord	Quarternary Variable in Byte Order BACD (Middle Endian)

Unit Codes for Register 104, 108, 112, 116

Unit Code	Measurement Unit
32	Degree Celsius
33	Degree Fahrenheit
40	US Gallon
41	Liters
42	Imperial Gallons
43	Cubic Meters
44	Feet
45	Meters
46	Barrels
47	Inches
48	Centimeters
49	Millimeters
111	Cubic Yards
112	Cubic Feet
113	Cubic Inches

11.4 Modbus RTU commands

FC3 Read Holding Register

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

	Parameter	Length	Code/Data
Request:	Function Code	1 Byte	0x03
	Start Address	2 Bytes	0x0000 to 0xFFFF
	Number of Registers	2 Bytes	1 to 127 (0x7D)

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	Parameter	Length	Code/Data
Response:	Function Code	1 Byte	0x03
	Byte Count	2 Bytes	2*N
	Register Value	N*2 Bytes	Data

FC4 Read Input Register

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

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

FC6 Write Single Register

This function code is used to write to a single Holding Register.

	Parameter	Length	Code/Data
Request:	Function Code	1 Byte	0x06
	Start Address	2 Bytes	0x0000 to 0xFFFF
	Number of Registers	2 Bytes	Data
Response:	Function Code	1 Byte	0x04
	Start Address	2 Bytes	2*N
	Register Value	2 Bytes	Data

FC8 Diagnostics

With this function code different diagnostic functions are triggered or diagnostic values read out.

	Parameter	Length	Code/Data
Request:	Function Code	1 Byte	0x08
	Sub Function Code	2 Bytes	
	Data	N*2 Bytes	Data
Response:	Function Code	1 Byte	0x08
	Sub Function Code	2 Bytes	
	Data	N*2 Bytes	Data

Implemented function codes:

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

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

FC16 Write Multiple Register

This function code is used to write to several Holding Registers. In a request, it can only be written to registers that are in direct succession.

	Parameter	Length	Code/Data
Request:	Function Code	1 Byte	0x10
	Start Address	2 Bytes	0x0000 to 0xFFFF
	Number of Registers	2 Bytes	0x0001 to 0x007B
	Byte Count	1 Byte	2*N
	Register Value	N*2 Bytes	Data
Response:	Function Code	1 Byte	0x10
	Start Address	2 Bytes	0x0000 to 0xFFFF
	Number of Registers	2 Bytes	0x01 to 0x7B

FC17 Report Sensor ID

With this function code, the sensor ID on Modbus is queried.

	Parameter	Length	Code/Data
Request:	Function Code	1 Byte	0x11
Response:	Function Code	1 Byte	0x11
	Byte Number	1 Byte	
	Sensor ID	1 Byte	
	Run Indicator Status	1 Byte	

FC43 Sub 14, Read Device Identification

With this function code, the Device Identification is queried.

	Parameter	Length	Code/Data
Request:	Function Code	1 Byte	0x2B
	MEI Type	1 Byte	0x0E
	Read Device ID Code	1 Byte	0x01 to 0x04
	Object ID	1 Byte	0x00 to 0xFF

	Parameter	Length	Code/Data
Response:	Function Code	1 Byte	0x2B
	MEI Type	1 Byte	0x0E
	Read Device ID Code	1 Byte	0x01 to 0x04
	Confirmity Level	1 Byte	0x01, 0x02, 0x03, 0x81, 0x82, 0x83
	More follows	1 Byte	00/FF
	Next Object ID	1 Byte	Object ID number
	Number of Objects	1 Byte	
	List of Object ID	1 Byte	
	List of Object length	1 Byte	
	List of Object value	1 Byte	Depending on the Object ID

11.5 Levelmaster commands

The VEGAFLEX 86 is also suitable for connection to the following RTUs with Levelmaster protocol. The Levelmaster protocol is often called " *Siemens*" " *Tank protocol*".

RTU	Protocol
ABB Totalflow	Levelmaster
Kimray DACC 2000/3000	Levelmaster
Thermo Electron Autopilot	Levelmaster

Parameters for the bus communication

The VEGAFLEX 86 is preset with the default values:

Parameter	Configurable Values	Default Value
Baud Rate	1200, 2400, 4800, 9600, 19200	9600
Start Bits	1	1
Data Bits	7, 8	8
Parity	None, Odd, Even	None
Stop Bits	1, 2	1
Address range Levelmaster	32	32

The Levelmaster commands are based on the following syntax:

- Capital letters are at the beginning of certain data fields
- Small letters stand for data fields
- All commands are terminated with " *<cr>*" (carriage return)
- All commands start with " *Uuu*", whereby " *uu*" stands for the address (00-31)
- " ***" can be used as a joker for any position in the address. The sensor always converts this in its address. In case of more than one sensor, the joker must not be used, because otherwise several slaves will answer
- Commands that modify the instrument return the command with " *OK*". " *EE-ERROR*" replaces " *OK*" if there was a problem changing the configuration

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Report Level (and Temperature)

	Parameter	Length	Code/Data
Request:	Report Level (and Temperature)	4 characters ASCII	Uuu?
Response:	Report Level (and Temperature)	24 characters ASCII	UuuDlll.llFtttEeeeeWwwww uu = Address lll.ll = PV in inches ttt = Temperature in Fahrenheit eeee = Error number (0 no error, 1 level data not readable) wwww = Warning number (0 no warning)

PV in inches will be repeated if " *Set number of floats*" is set to 2. Hence 2 measured values can be transmitted. PV value is transmitted as first measured value, SV as seconed measured value.

Information:
The max. value for the PV to be transmitted is 999.99 inches (corresponds to approx. 25.4 m).

If the temperature should be transmitted in the Levelmaster protocol, then TV must be set in the sensor to temperature.

PV, SV and TV can be adjusted via the sensor DTM.

Report Unit Number

	Parameter	Length	Code/Data
Request:	Report Unit Number	5 characters ASCII	U**N?
Response:	Report Level (and Temperature)	6 characters ASCII	UuuNnn

Assign Unit Number

	Parameter	Length	Code/Data
Request:	Assign Unit Number	6 characters ASCII	UuuNnn
Response:	Assign Unit Number	6 characters ASCII	UuuNOK uu = new Address

Set number of Floats

	Parameter	Length	Code/Data
Request:	Set number of Floats	5 characters ASCII	UuuFn
Response:	Set number of Floats	6 characters ASCII	UuuFOK

If the number is set to 0, no level is returned

Set Baud Rate

	Parameter	Length	Code/Data
Request:	Set Baud Rate	8 (12) characters ASCII	UuuBbbbb[b][pds] Bbbbb[b] = 1200, 9600 (default) pds = parity, data length, stop bit (optional) parity: none = N, even = E (default), odd = O
Response:	Set Baud Rate	11 characters ASCII	

Example: U01B9600E71

Change instrument on address 1 to baudrate 9600, parity even, 7 data bits, 1 stop bit

Set Receive to Transmit Delay

	Parameter	Length	Code/Data
Request:	Set Receive to Transmit Delay	7 characters ASCII	UuuRmmm mmm = milliseconds (50 up to 250), default = 127 ms
Response:	Set Receive to Transmit Delay	6 characters ASCII	UuuROK

Report Number of Floats

	Parameter	Length	Code/Data
Request:	Report Number of Floats	4 characters ASCII	UuuF
Response:	Report Number of Floats	5 characters ASCII	UuuFn n = number of measurement values (0, 1 or 2)

Report Receive to Transmit Delay

	Parameter	Length	Code/Data
Request:	Report Receive to Transmit Delay	4 characters ASCII	UuuR
Response:	Report Receive to Transmit Delay	7 characters ASCII	UuuRmmm mmm = milliseconds (50 up to 250), default = 127 ms

Error codes

Error Code	Name
EE-Error	Error While Storing Data in EEPROM
FR-Error	Erorr in Frame (too short, too long, wrong data)
LV-Error	Value out of limits

11.6 Configuration of typical Modbus hosts
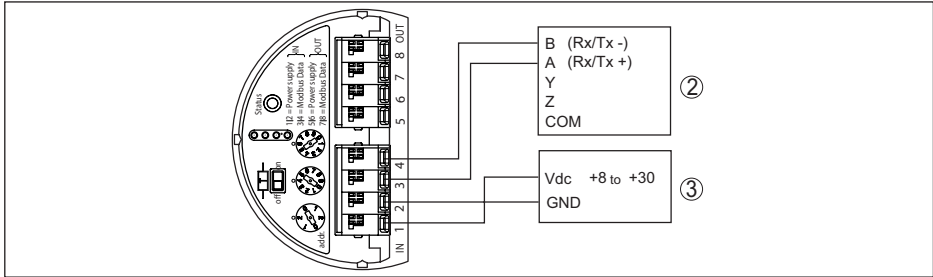
Fisher ROC 809

Fig. 38: Connection of VEGAFLEX 86 to RTU Fisher ROC 809

1   VEGAFLEX 86
2   RTU Fisher ROC 809
3   Voltage supply

Parameters for Modbus Hosts

Parameter	Value Fisher ROC 809	Value ABB Total Flow	Value Fisher Thermo Electron Autopilot	Value Fisher Bristol Control-Wave Micro	Value Scada-Pack
Baud Rate	9600	9600	9600	9600	9600
Floating Point Format Code	0	0	0	2 (FC4)	0
RTU Data Type	Conversion Code 66	16 Bit Modicon	IEE Fit 2R	32-bit registers as 2 16-bit registers	Floating Point
Input Register Base Number	0	1	0	1	30001

The basic number of the input registers is always added to the input register address of VEGAFLEX 86.

This results in the following constellations:

● Fisher ROC 809 - Register address for 1300 is address 1300
● ABB Total Flow - Register address for 1302 is address 1303
● Thermo Electron Autopilot - Register address for 1300 is address 1300
● Bristol ControlWave Micro - Register address for 1302 is address 1303
● ScadaPack - Register address for 1302 is address 31303

11.7 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*".
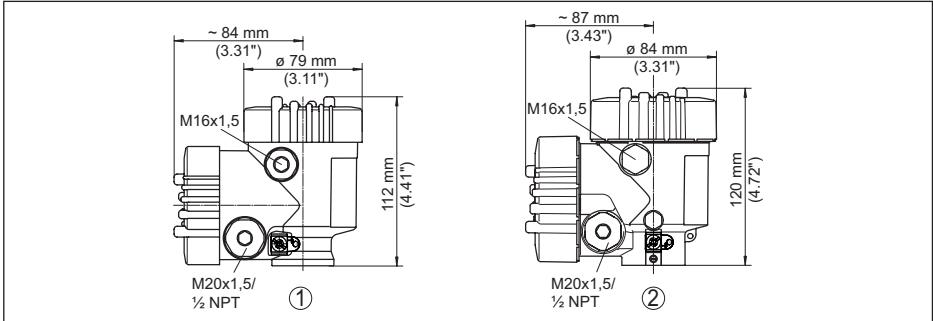
Housing

Fig. 39: Dimensions housing (with integrated display and adjustment module the housing is 9 mm/0.35 in higher)

1   Plastic double chamber
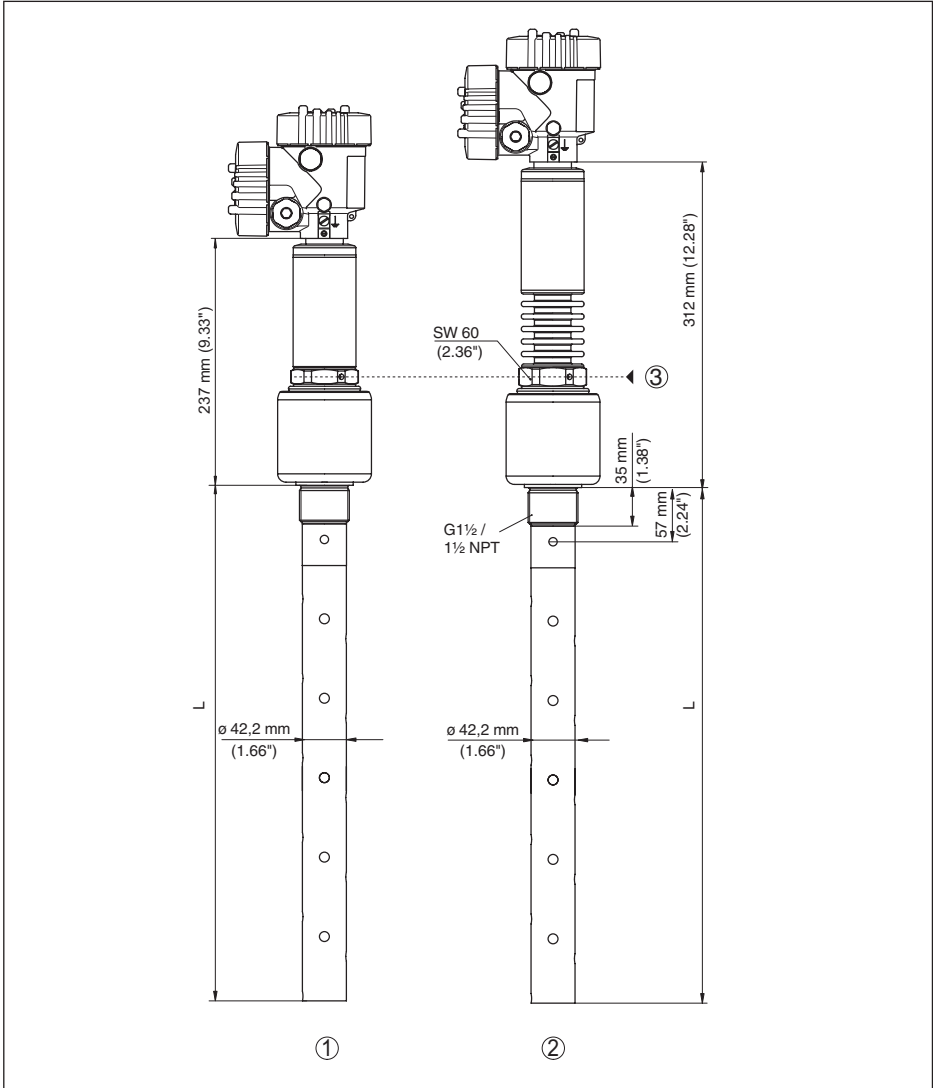2   Aluminium/Stainless steel double chamber

VEGAFLEX 86, coax version

Fig. 40: 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

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