Operating Instructions

TDR sensor for continuous level measurement of bulk solids

GWR-2000

Four-wire Modbus

Converter version in second chamber

Rod and cable probe

Document ID: 41833

Contents

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Safety instructions for Ex areas

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

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1   About this document

1.1   Function

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

1.2   Target group

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

1.3   Symbols used

Information, tip, note
This symbol indicates helpful additional information.

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

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

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

Ex applications
This symbol indicates special instructions for Ex applications.

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

→ **Action**
This arrow indicates a single action.

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

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

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2   For your safety

2.1   Authorised personnel

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

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

2.2   Appropriate use

VEGAFLEX 82 is a sensor for continuous level measurement.

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

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

2.3   Warning about incorrect use

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

2.4   General safety instructions

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

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

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

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

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

2.5   CE conformity

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

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

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

2.6 NAMUR recommendations

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

The device 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 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

Type label

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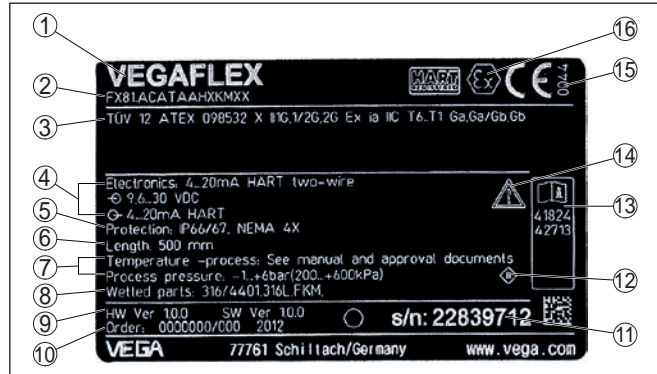

Fig. 1: Layout of the type label (example)

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

Serial number - Instrument search

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

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

Go to www.vega.com "*VEGA Tools*" and "*Instrument search*".

Enter the serial number.

Alternatively, you can access the data via your smartphone:

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

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- Scan the Data Matrix code on the type label of the instrument 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
- The sensor electronics for the actual measuring tasks
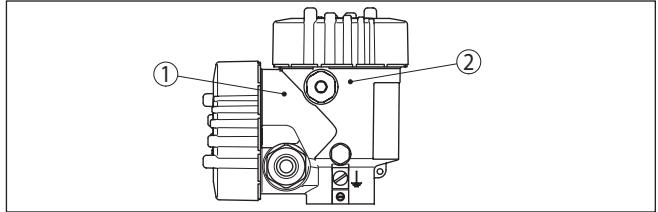
Fig. 2: Position of Modbus and sensor electronics

1 Modbus electronics
2 Sensor electronics

Scope of this operating instructions manual

This operating instructions manual applies to the following instrument versions:

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

Versions

This electronics version can be determined via the product code on the type label as well as on the electronics.

- Standard electronics: Type FX80HK.-

Scope of delivery

The scope of delivery encompasses:

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

3.2 Principle of operation

Application area

The VEGAFLEX 82 is a level sensor with cable or rod probe for continuous level measurement, suitable for applications in bulk solids.

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Functional principle - level measurement

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

Probe end tracking

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

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

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

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

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

Transport

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

Transport inspection

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

Storage

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

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

- Not in the open
- Dry and dust free
- Not exposed to corrosive media
- Protected against solar radiation
- Avoiding mechanical shock and vibration

Storage and transport temperature

- Storage and transport temperature see chapter "*Supplement - Technical data - Ambient conditions*"
- Relative humidity 20 … 85 %

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3.4   Accessories and replacement parts

PLICSCOM

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

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

VEGACONNECT

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

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

VEGADIS 81

The VEGADIS 81 is an external display and adjustment unit for VEGA plics® sensors.

For sensors with double chamber housing the interface adapter "*DISADAPT*" is also required for VEGADIS 81.

You can find further information in the operating instructions "*VEGADIS 81*" (Document-ID 43814).

DISADAPT

The adapter "*DISADAPT*" is an accessory part for sensors with double chamber housings. It enables the connection of VEGADIS 81 to the sensor housing via an M12 x 1 plug.

You can find further information in the supplementary instructions "*Adapter DISADAPT*" (Document-ID 45250).

PLICSMOBILE T61

PLICSMOBILE T61 is an external GSM/GPRS radio unit for transmission of measured values and for remote parameter adjustment of plics® sensors. Adjustment is carried out via PACTware/DTM and the integrated USB connection.

You can find further information in the supplementary instructions "*PLICSMOBILE T61*" (Document-ID 37700).

Protective cap

The protective cover protects the sensor housing against soiling and intense heat from solar radiation.

You will find additional information in the supplementary instructions manual "*Protective cover*" (Document-ID 34296).

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.

You can find additional information in the supplementary instructions manual "*Flanges according to DIN-EN-ASME-JIS*".

Electronics module

The electronics module VEGAFLEX series 80 is a replacement part for TDR sensors of VEGAFLEX series 80. There is a different version available for each type of signal output.

You can find further information in the operating instructions manual "*Electronics module VEGAFLEX series 80*".

Electronics module, Modbus

The electronics module Modbus is a replacement part for TDR sensors of VEGAFLEX series 80.

You can find further information in the operating instructions manual "*Electronics module Modbus VEGAFLEX series 80*".

Display and adjustment module with heating

The display and adjustment module can be optionally replaced by a display and adjustment module with heating function.

You can use this display and adjustment module in an ambient temperature range of -40 … +70 °C.

You can find further information in the operating instructions "*Display and adjustment module with heating*" (Document-ID 31708).

External housing

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

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

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

Rod components

If you are using an instrument with rod version, you can extend the rod probe individually with curved segments and rod and cable extensions of different lengths.

All extensions used must not exceed a total length of 6 m (19.7 ft).

The extensions are available in the following lengths:

Rod: ø 16 mm (0.63 in)
- Basic segments: 20 … 5900 mm (0.79 … 232 in)
- Rod/cable segments: 20 … 5900 mm (0.79 … 232 in)
- Curved segments: 100 x 100 mm (3.94 … 3.94 in)

You can find further information in the operating instructions manual "*Rod and cable components VEGAFLEX 80 series*".

Centering

If you mount the VEGAFLEX 82 in a bypass tube or standpipe, you have to avoid contact to the bypass tube by using a spacer at the probe end.

You can find additional information in the operating instructions manual "*Centering*".

4   Mounting

4.1   General instructions

Screwing in

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

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

Protection against moisture

Protect your instrument against moisture ingress through the following measures:

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

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

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.

Suitability for the process conditions

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

These are mainly:

● Active measuring component
● Process fitting
● Process seal

Process conditions are particularly:

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

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

4.2   Mounting instructions

Installation position

Mount VEGAFLEX 82 in such a way that the distance to vessel installations or to the vessel wall is at least 300 mm (12 in). In non-metallic vessels, the distance to the vessel wall should be at least 500 mm (19.7 in).

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

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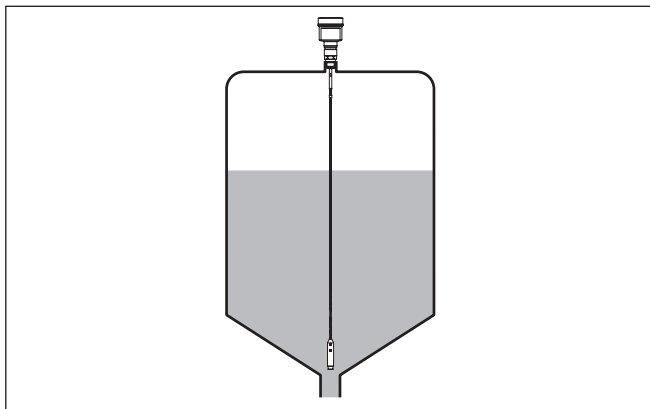

Fig. 3: Vessel with conical bottom

Type of vessel

Plastic vessel/Glass vessel
The guided microwave principle requires a metallic surface on the process fitting. Therefore, in plastic vessels, etc., use an instrument version with flange (from DN 50) or place a metal sheet (ø > 200 mm/8 in) beneath the process fitting when screwing it in.

Make sure that the plate has direct contact with the process fitting.

When installing the probes without metal vessel wall, e.g. in plastic vessels, the measured value can be influenced by strong electromagnetic fields (emitted interference according to EN 61326: class A).

Use a probe in coax version for applications in liquids.
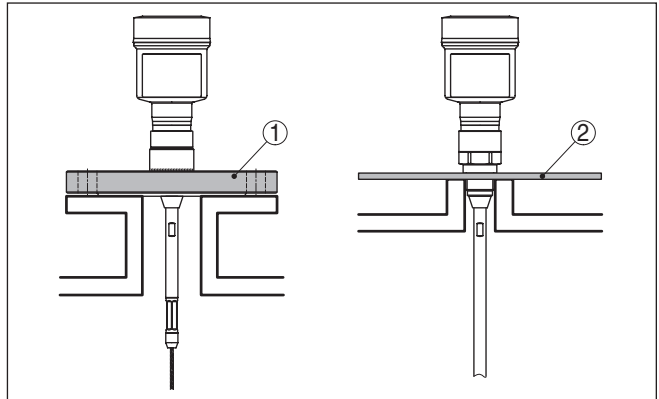
Fig. 4: Installation in non-metallic vessel

1   Flange
2   Metal sheet

Concrete vessel

When installed in thick concrete ceilings, VEGAFLEX 82 should be mounted front flush to the lower edge. In concrete silos, the distance to the wall should be at least 500 mm (20 in).

Fig. 5: Installation in concrete silo

Mounting socket

If possible, avoid sockets. Mount the sensor flush with the vessel top. If this is not possible, use short sockets with small diameter.

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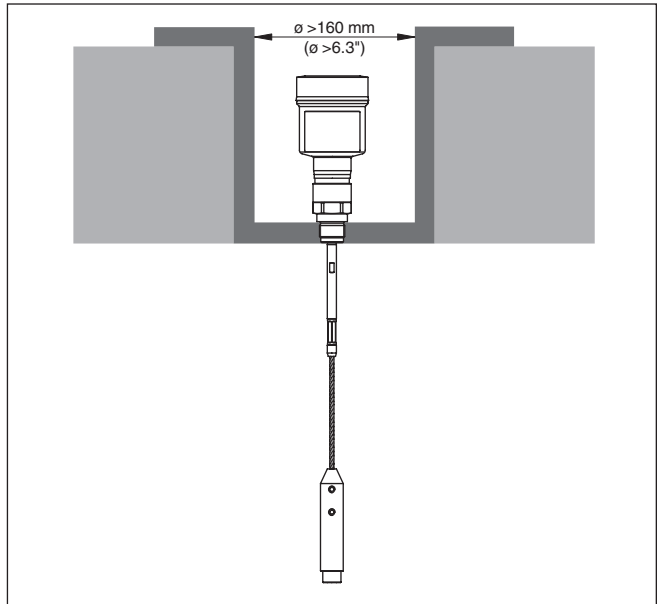Higher sockets or sockets with a bigger diameter can generally be used. They can, however, increase the upper blocking distance (dead band). Check if this is relevant for your measurement.

In such cases, always carry out a false signal suppression after installation. You can find further information under "*Setup procedure*".

d	h
DN25 ... DN150	≤ 150 mm (5.91")
> DN150 ... DN200	≤ 100 mm (3.94")
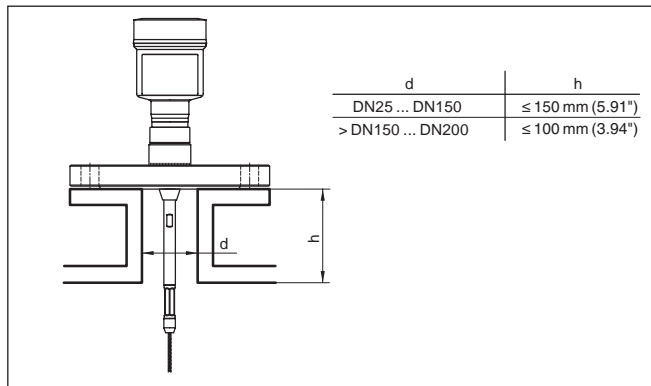
Fig. 6: Mounting socket

When welding the socket, make sure that the socket is flush with the vessel top.
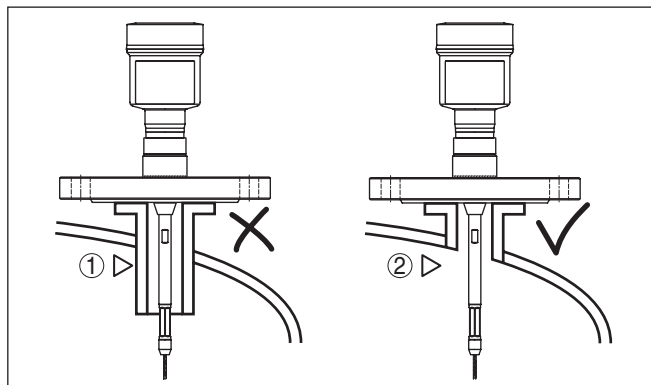
Fig. 7: Socket must be installed flush
1   Unfavourable installation
2   Socket flush - optimum installation

Welding work

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

Inflowing medium

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

Fig. 8: Mounting of the sensor with inflowing medium

Measuring range

The reference plane for the measuring range of the sensors is the sealing surface of the thread or flange.
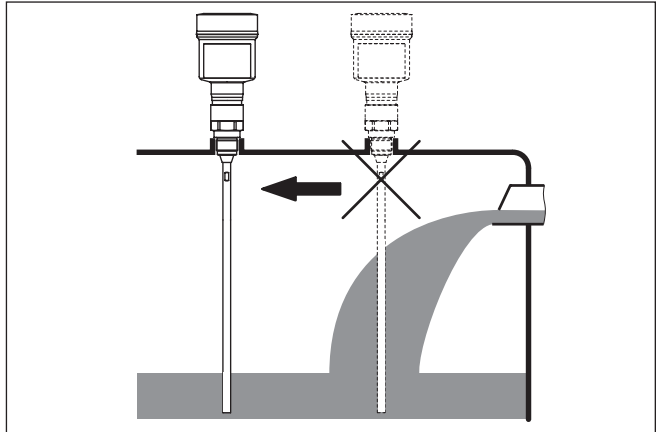
Keep in mind that a min. distance must be maintained below the reference plane and possibly also at the end of the probe - measurement in these areas is not possible (dead band). The length of the cable can be used all the way to the end only when measuring conductive products. These blocking distances for different mediums are listed in chapter "*Technical data*". Keep in mind for the adjustment that the default setting for the measuring range refers to water.

Pressure

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

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

Fasten

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

In the gravity weight there is an internal thread (M12), e.g. for an eye-bolt (optional) - (article no. 2.27423).

Make sure that the probe cable is not completely taut. Avoid tensile loads on the cable.

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

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

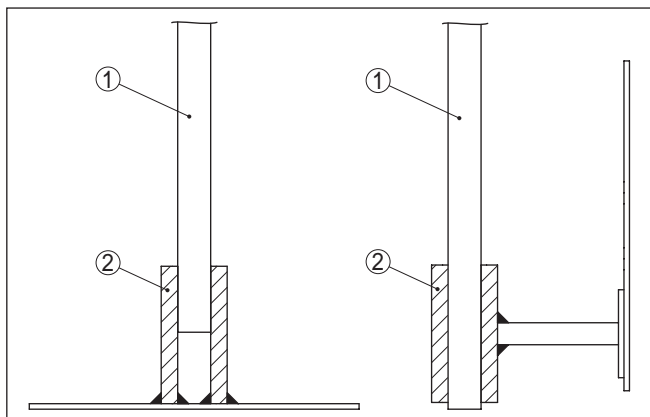Keep in mind that below the fastening, a measurement is not possible.

Fig. 9: Fasten the probe

1 Measuring probe
2 Retaining sleeve

Lateral installation

In case of difficult installation conditions in liquid applications, the probe can be also mounted laterally. For this purpose, adapt the rod with rod extensions or bow-shaped segments.

To compensate for the resulting changes in signal runtime, let the instrument determine the probe length automatically.

The determined probe length can deviate from the actual probe length when using curved or angled segments.

If internal installations such as struts, ladders, etc. are present on the vessel wall, the measuring probe should be mounted at least 300 mm (11.81 in) away from the vessel wall.

You can find further information in the supplementary instructions of the rod extension.

Rod extension

In case of difficult installation conditions, for example in a socket, the probe can be suitably adapted with a rod extension.

To compensate for the resulting changes in signal runtime, let the instrument determine the probe length automatically.

You can find further information in the supplementary instructions of the rod and cable components.

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5 Connecting to power supply and bus system

5.1 Preparing the connection

Safety instructions

Always keep in mind the following safety instructions:

⚠ **Warning:**
Connect only in the complete absence of line voltage.

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

Voltage supply

The instrument requires an operating voltage of 8 … 30 V DC. Operating voltage and digital bus signal are carried on separate two-wire connection cables.

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, screened cable should be used.

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

Use a cable gland fitting the cable diameter.

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.

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.

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

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

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

Cable screening and grounding

In systems with potential equalisation, connect the cable screen directly to ground potential at the power supply unit, in the connection

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box and at the sensor. The screen in the sensor must be connected directly to the internal ground terminal. The ground terminal outside on the housing must be connected to the potential equalisation (low impedance).

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

5.2   Connection

Connection technology

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

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

i **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

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

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

The electrical connection is finished.

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

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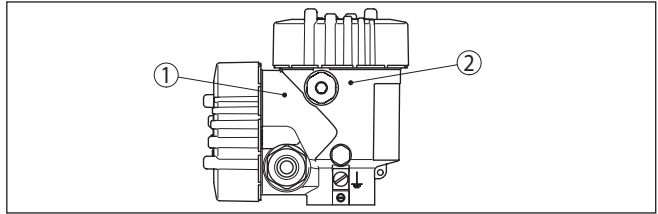
5.3   Wiring plan

Overview

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

1   Terminal compartment
2   Electronics compartment

Electronics compartment
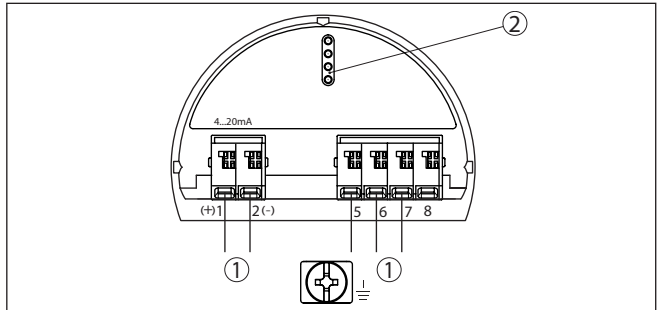
Fig. 12: Electronics compartment, double chamber housing

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

● **Information:**
ℹ The connection of an external display and adjustment unit is not possible with this double chamber housing.

Terminal compartment

Fig. 13: Terminal compartment
1   USB interface
2   Slide switch for integrated termination resistor (120 Ω)
3   Modbus signal
4   Voltage supply

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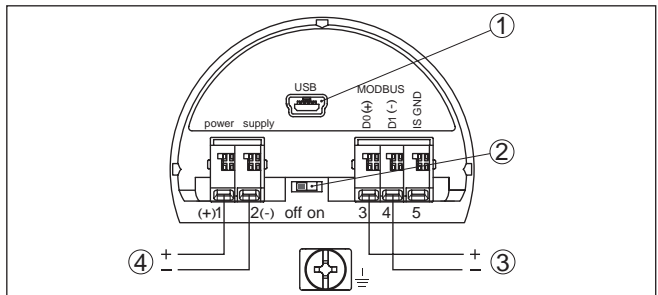| Terminal	Function	Polarity
1	Voltage supply	+
2	Voltage supply	-
3	Modbus signal D0	+
4	Modbus signal D1	-
5	Function ground when installing according to CSA (Canadian Standards Association)	

5.4 Double chamber housing with DISADAPT

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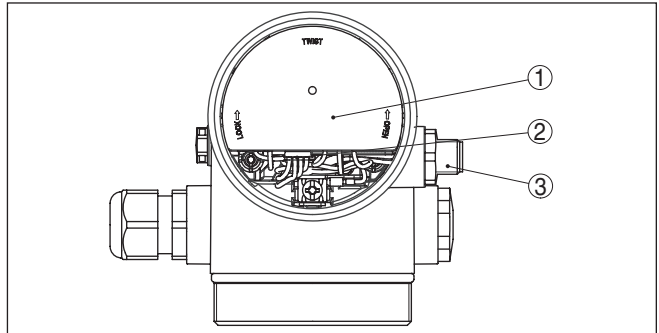
Fig. 14: View to the electronics compartment with DISADAPT for connection of the external display and adjustment unit

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

Assignment of the plug connector
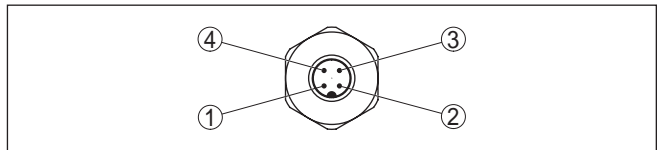
Fig. 15: View to the plug connector M12 x 1

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

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

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5.5 Supplementary electronics

Supplementary electronics - Additional current output

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

Both current outputs are passive and need a power supply.

Fig. 16: Terminal compartment, double chamber housing, supplementary electronics - additional current output
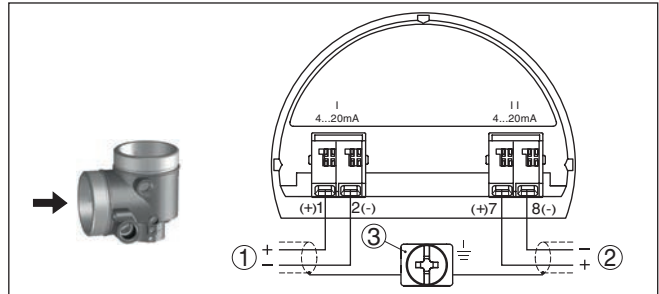
1   First current output (I) - Voltage supply and signal output (HART)
2   Second current output (II) - Voltage supply and signal output (without HART)
3   Ground terminal for connection of the cable screen

Supplementary electronics - Radio module PLICSMOBILE

The radio module PLICSMOBILE is an external GSM/GPRS radio unit for transmission of measured values and for remote parameter adjustment.
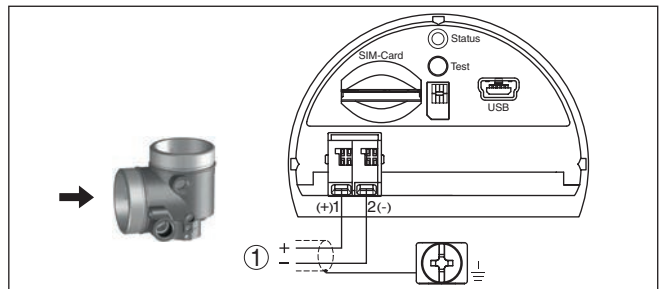
Fig. 17: Radio module PLICSMOBILE integrated in the connection compartment

1   Voltage supply

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

5.6 Switch-on phase

After VEGAFLEX 82 is connected to the bus system, the instrument carries out a self-test for approx. 30 seconds. The following steps are carried out:

● Internal check of the electronics
● Indication of the instrument type, hardware and software version, measurement loop name on the display or PC

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- Indication of the status message "*F 105 Determine measured value*" on the display or PC
- Status byte goes briefly to fault value

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

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. 18: 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.
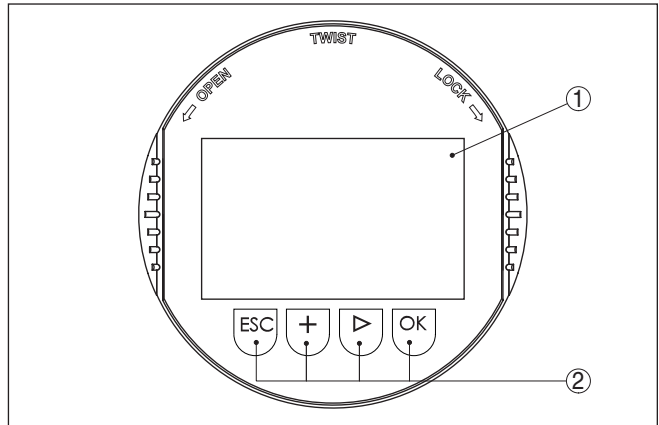
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6.3   Adjustment system

Fig. 19: 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

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

When the *[+]* and *[->]* keys are pressed quickly, the edited value, 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 82 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 indica-
tion**

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

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

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

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

6.4 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.
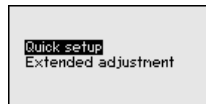
The following steps for the quick setup can be reached also in the "Extended adjustment".

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

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

6.5 Parameter adjustment - Extended adjustment

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

Quick setup
Extended adjustment
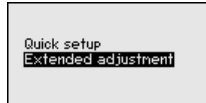
Main menu

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

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, pointer, measurement certainty, simulation, echo curve

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

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

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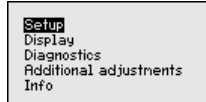For optimum adjustment of the measuring point, the individual submenu items in the main menu item "*Setup*" should be selected one after the other and provided with the correct parameters. If possible, go through the items in the given sequence.

The procedure is described below.

The following submenu points are available:

Setup	Setup	Setup
Measurement loop name	Adjustment interface	Linearization
Units	Damping	Current output
Probe length	**Linearization**	**False signal suppression**
Application	Current output	Lock adjustment
Adjustment level ▼	False signal suppression ▼	------------------- ▼
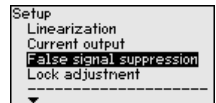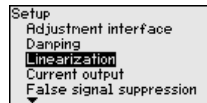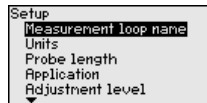
The submenu points described below.

Setup - Measurement loop name

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

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

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

Measurement loop name

TANK 04

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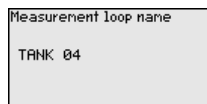
Setup - Units

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

Distance unit
mm ▼

Temperature unit
°C ▼

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

Setup - Probe length

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

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

Probe length
1000 mm

Probe length determine automatically?
Yes
No

Probe length
01000
mm
0   80000

Setup - Application - Type of medium

In this menu item you can select which type of medium you want to measure. You can choose between liquid or bulk solid.

Application
Type of medium
Application
Medium/Dielectric figure

Type of medium
Solid ▼

Type of medium
✓ Liquid
Solid

Setup - Application

In this menu item you can select the application. You can choose between metallic or non-metallic vessels.

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

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

Application
Product type
Application
Medium/Dielectric figure

Application
Level non-metal vessel ▼

Application
✓ Level metal vessel
Level non-metal vessel
Demonstration mode

Setup - Medium, dielectric constant

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

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

Application
Product type
Application
Medium/Dielectric figure

Medium/Dielectric constant
Granules,cement/1.5...3 ▼

Medium/Dielectric constant
Dust,wood shavings<1.5
✓ Granules,cement/1.5...3
Cereals, flour/>3

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You can choose between the following medium types:

Dielectric constant	Product type	Examples
> 3	Cereals, flour	All kind of cereals, wheat flour
1.5 … 3	Granules, cement	Lime, gypsum, cement
< 1.5	Dusts, wood chips	Wood chips, sawdust

Setup - Max. adjustment Level

In this menu item, you can enter the max. adjustment for the level.
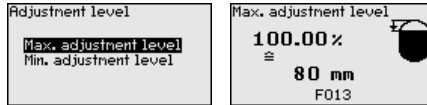
Adjust the requested percentage value with *[+]* and store with *[OK]*.
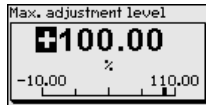
Enter the appropriate distance value in m (corresponding to the percentage value) for the full vessel. The distance refers to the sensor reference plane (seal surface of the process fitting). Keep in mind that the max. level must lie below the dead band.

Setup - Min. adjustment Level

In this menu item, you can enter the min. adjustment for the level.
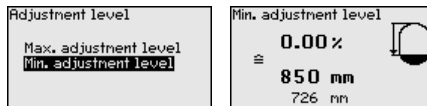
Adjust the requested percentage value with *[+]* and store with *[OK]*.
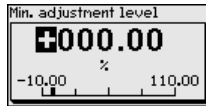
Enter the suitable distance value in m for the empty vessel (e.g. distance from the flange to the probe end) corresponding to the percentage value. The distance refers tot he sensor reference plane (seal surface of the process fitting).
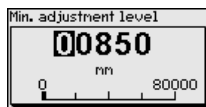
Setup - Damping

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

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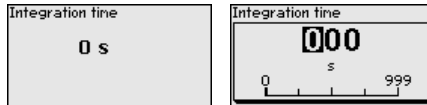
The default setting is a damping of 0 s.

Setup - Linearization

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

The linearization applies to the measured value indication and the current output. By activating the appropriate curve, the volume percentage of the vessel is displayed correctly. If the volume should not be displayed in percent but e.g. in l or kg, a scaling can be also set in the menu item "*Display*".
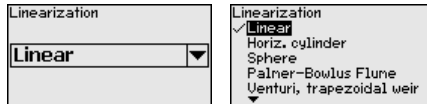
Warning:
If a linearisation curve is selected, the measuring signal is no longer necessarily linear to the filling height. This must be considered by the user especially when adjusting the switching point on the limit signal transmitter.

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

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

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

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

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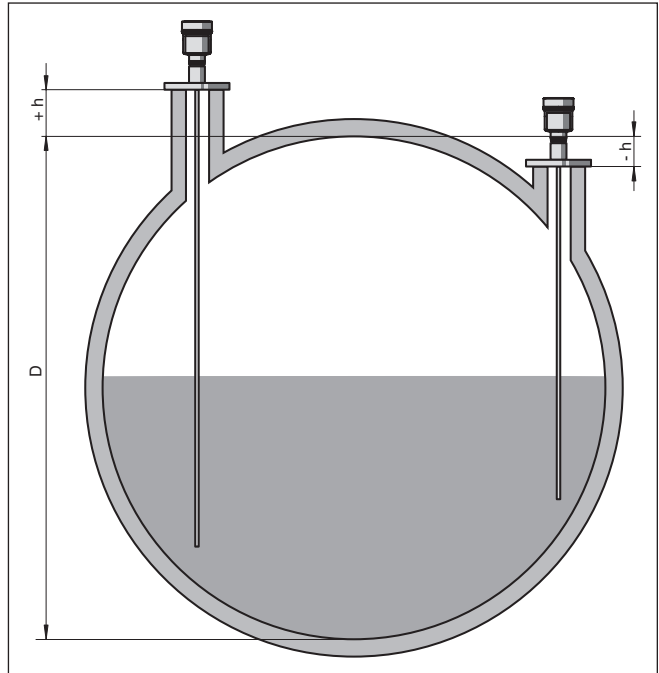
Fig. 20: Vessel height and socket correction value

D   Vessel height
+h   Positive socket correction value
-h   Negative socket correction value
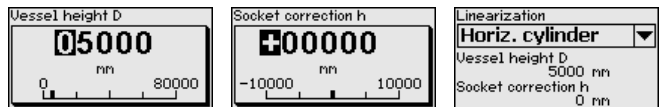
Setup - Current output mode

In the menu item "*Current output mode*" you determine the output characteristics and reaction of the current output in case of failure.
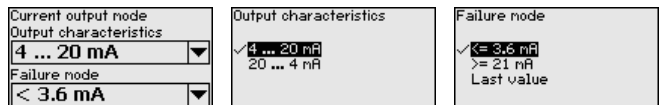
The default setting is output characteristics 4 … 20 mA, failure mode < 3.6 mA.

Setup - Current output Min./Max.

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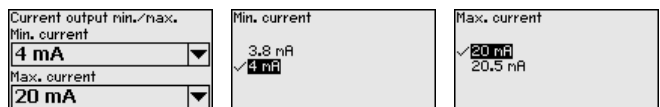
The default setting is min. current 3.8 mA and max. current 20.5 mA.

Setup - False signal suppression

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

● High sockets
● Vessel internals such as struts
● Deflectors, etc.

● **Note:**
ℹ A false signal suppression is only recommended with liquid applications.

A false signal suppression detects, marks and saves these false signals so that they are no longer taken into account in the level measurement.

This should be done with the lowest possible level so that all potential interfering reflections can be detected.

Proceed as follows:
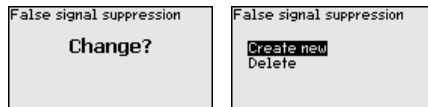
Enter the actual distance from the sensor to the product surface.
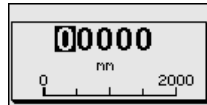
All interfering signals in this section are detected by the sensor and stored.

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

If a false signal suppression has already been created in the sensor, the following menu window appears when selecting "*False signal suppression*":
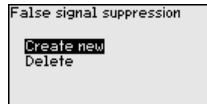
The instrument carries out an automatic false signal suppression as soon as the probe is uncovered. The false signal suppression is always updated.

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

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Lock/unlock setup - Adjustment

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

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

● Select menu items and show data
● Read data from the sensor into the display and adjustment module.
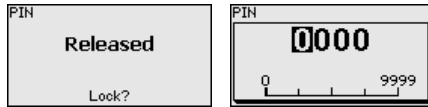
Caution:
With active PIN, adjustment via PACTware/DTM as well as other systems is also blocked.

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

Setup - Current output 2

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

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

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

Display

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

The following submenu points are available:
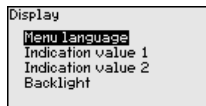
The submenu points described below.

Display - Menu language

This menu item enables the setting of the requested national language.
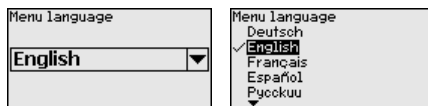
In the delivery status, the sensor is set to the ordered national language.

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Display - Displayed value 1

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

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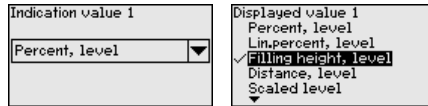
The default setting for the displayed value 1 is "*Filling height Level*".

Display - Displayed value 2

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

Displayed value 2	Displayed value 2
Electronics temperature ▼	Scaled level Meas. reliability, level ✓ Electronics temperature Dielectric constant Current ▼
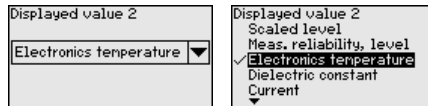
The default setting for the displayed value 2 is the electronics temperature.

Display - Backlight

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

Backlight	
Switched on	**Switch off?**

In delivery status, the lighting is switched on.

Diagnostics - Device status

In this menu item, the device status is displayed.

Diagnostics	Device status
Device status Peak values Distance Peak indicator, reliab. Peak values further Echo curve ▼	**OK**
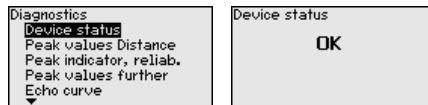
Diagnostics - Peak values Distance

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

Diagnostics	Distance to the level	
Device status Peak values Distance Peak indicator, reliab. Peak values further Echo curve ▼	Min. 68 Max. 265	mm mm

In another window you can reset the peak value.

Reset peak indicator
Distance to the level

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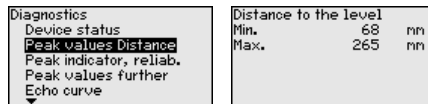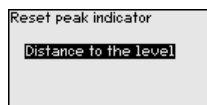
Diagnostics - Peak values Measurement certainty

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

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

```
Diagnostics              Meas. reliability, level
  Device status          Min.        100.0 %
  Peak values Distance   Max.        100.0 %
  Peak indicator, reliab.
  Peak values further
  Echo curve
```

In another window you can reset the peak value.

```
Reset peak indicator

  Meas. reliability, level
```
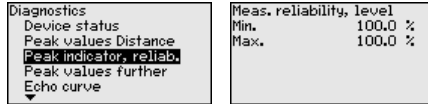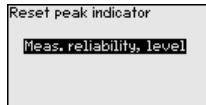
Diagnostics - Peak values Additional

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

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

```
Diagnostics              Electronics temperature
  Peak values Distance   Min.        27.28 ℃
  Peak indicator, reliab. Max.       28.84 ℃
  Peak values further    Dielectric constant
  Echo curve             Min.         1.00
  Simulation             Max.         1.00
```
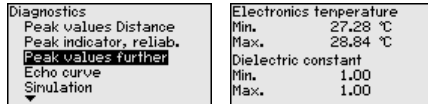
In another window you can carry out a reset of the two peak values separately.

```
Reset peak indicator

  Electronics temperature
  Dielectric constant
```
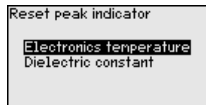
Diagnostics - Echo curve

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

```
Diagnostics              Echo curve
  Peak indicator, reliab.  0.15
  Peak values further     [v]
  Echo curve                0
  Simulation             -0.15
  Echo curve memory          0.0   'M'      1.4'
```
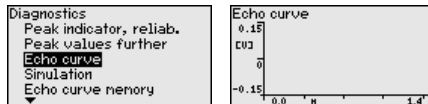
With the following functions you can zoom part sections of the echo curve.

- "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

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```
Echo curve              Y-Zoom
X-Zoom                  ✓ 1x
Y-Zoom                    2x
Unzoom                    5x
                          10x
```
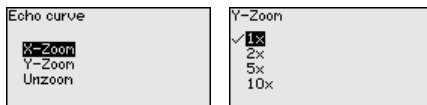
Diagnosis - Simulation

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

```
Diagnostics             Simulation
  Peak values further   Percent. level
  Echo curve            Lin.percent. level
  Simulation            Filling height. level
  Echo curve memory     Distance. level
 ─────────────────────  Meas. reliability. level
  ▼                       ▼
```
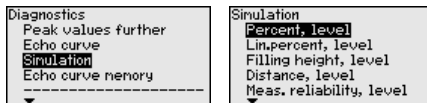
Select the requested simulation variable and set the requested value.

```
Simulation              Simulation running    Simulation running
                                              ⊞ 079.3
 Activate                  Percent                 %
 simulation?              79.4 %           -10.0        110.0
```
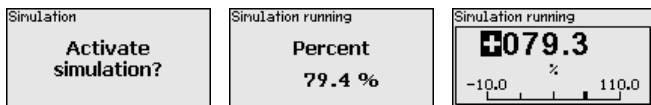
⚠ **Caution:**
During simulation, the simulated value is outputted as 4 … 20 mA current value and digital HART signal.

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

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

Diagnostics - Echo curve memory

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

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

```
Echo curve memory       Echo curve memory
                            Save
Setup                     echo curve
Echo curve memory         of the setup?
```
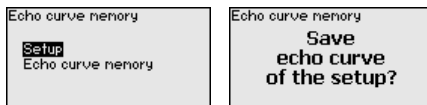
The function "*Echo curve memory*" enables storing echo curves of the measurement.

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.

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Diagnostics
Echo curve
Simulation
Echo curve memory

Device status

Echo curve memory

Setup
Echo curve memory

Echo curve memory
**Store actual
echo curve?**
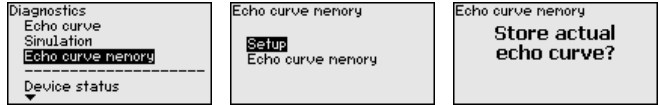
Additional adjustments - Date/Time

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

Date/Time
16:34
29.Nov 2012
Change now?

Format
√24 h
12 h

Date
05. Jun
2012
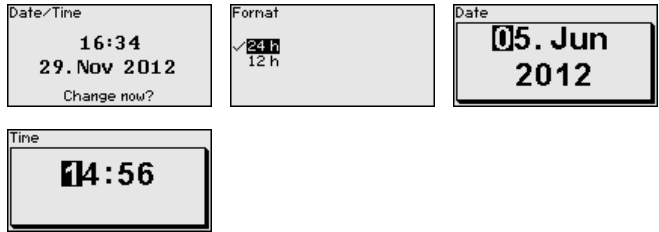
Time
14:56

Additional adjustments - Reset

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

Reset

Factory settings
Basic settings

The following reset functions are available:

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

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

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

Setup

Menu item	Default value	Modified value
Lock adjustment	Released	
Measurement loop name	Sensor	
Units	Distance unit: mm	
	Temperature unit: °C	
Probe length	Length of the probe Ex factory	
Type of medium	Bulk solid	
Application	Level in the metallic vessel	
Medium, dielectric constant	Granules, powder, cement / 1.5 … 3	
Superimposed gas phase	Yes	

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Menu item	Default value	Modified value
Dielectric constant, upper medium (TS)	1.5	
Tube inner diameter	200 mm	
Max. adjustment - Level	100 %	
Max. adjustment - Level	Distance: 0.000 m(d) - note blocking distances	
Min. adjustment - Level	0 %	
Min. adjustment - Level	Distance: Probe length - take dead band into account	
Accept adjustment of the level measurement?	No	
Max. adjustment - Interface	100 %	
Max. adjustment - Interface	Distance: 0.000 m(d) - note blocking distances	
Min. adjustment - Interface	0 %	
Min. adjustment - Interface	Distance: Probe length - take dead band into account	
Integration time - Level	0.0 s	
Integration time - Interface	0.0 s	
Linearization type	Linear	
Linearization - Socket correction	0 mm	
Linearization - Vessel height	Probe length	
Scaling size - Level	Volume in l	
Scaling unit - Level	Litres	
Scaling format - Level	Without decimal positions	
Scaling level - 100 % corresponds to	100	
Scaling level - 0 % corresponds to	0	
Accept scaling of the level measurement	Yes	
Scaling variable - Interface	Volume	
Scaling unit - Interface	Litres	
Scaling format - Interface	Without decimal positions	
Scaling interface - 100 % corresponds to	100	
Scaling interface - 0 % corresponds to	0	
Current output, output variable First HART variable (PV)	Lin. percent - Level	
Current output - Output characteristics	0 … 100 % correspond to 4 … 20 mA	
Current output - Reaction in case of failure	≤ 3.6 mA	
Current output - Min.	3.8 mA	
Current output - Max.	20.5 mA	

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Menu item	Default value	Modified value
Current output 2 - Output variable Second HART variable (SV)	Distance - Level	
Current output 2 - Output characteristics	0 … 100 % correspond to 4 … 20 mA	
Current output 2 - Reaction in case of failure	≤ 3.6 mA	
Current output - Min.	3.8 mA	
Current output - Max.	20.5 mA	
Third HART variable (TV)	Measurement certainty, level	
Fourth HART variable (QV)	Electronics temperature	

Display

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

Diagnostics

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

Additional adjustments

Menu item	Default value	Modified value
PIN	0000	

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

Additional adjustments - Copy instrument settings

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

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

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

- All data of the menu "*Setup*" and "*Display*"
- In the menu "*Additional adjustments*" the items "*Reset, Date/Time*"
- Special parameters
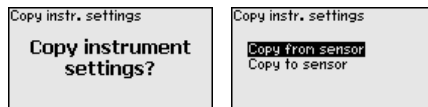
The copied data are permanently saved in an EEPROM memory in the display and adjustment module and remain there even in case of power failure. From there, they can be written into one or more sensors or kept as backup for a possible electronics exchange.

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

Additional settings - Scaling level

Since scaling is very extensive, scaling of the level value was divided into two menu items.
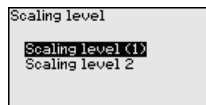
Additional settings - Scaling level 1

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

41833-EN-160517

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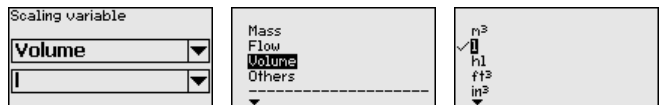
Additional settings - Scaling level 2

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

Scaling level	Scaling
Scaling level (1) **Scaling level 2**	100 % = 100 1 0 % = 0 1

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

Scaling format	Scaling 100 %	Scaling 0 %
✓XXXXX XXXX.X XXX.XX XX.XXX X.XXXX	⊞00100 1 -99999 99999	⊞00000 1 -99999 99999
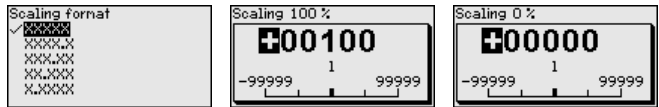
Additional settings - Current output, size

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

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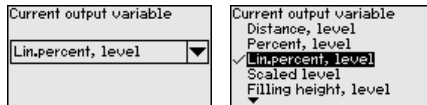
Additional settings - Current output, adjustment

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 0 % = 0.00 °C	⊞00000 1 -99999 99999	⊞00100 1 -99999 99999
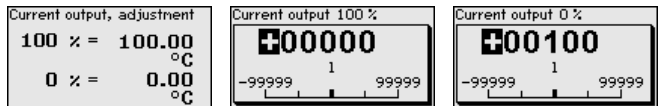
Additional adjustments - Probe type
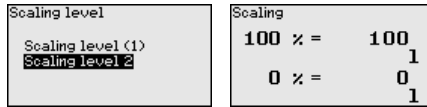
In this menu item you can select the type and size of your probe from a list of all possible probes. This is necessary to adapt the electronics optimally to the probe.

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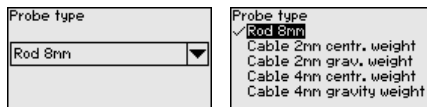
Additional adjustments - HART mode

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

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

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

In the mode "*Fixed current (4 mA)*" a fixed 4 mA signal is output independently of the actual level.
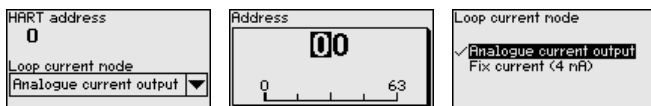
The default setting is "*Analogue current output*" and the address 00.

Additional adjustments - Special parameters

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

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

Info - Instrument name

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

Info - Instrument version

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

Info - Factory calibration date

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

Info - Sensor characteristics

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

6.6 Saving the parameter adjustment data

Backup on paper

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

Backup in the display and adjustment module

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

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

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

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

7 Setting up sensor and Modbus interface with PACTware

7.1 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. 21: 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. 22: 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.

Scope of the parameter adjustment:

● Sensor electronics
● Modbus electronics

Information:
For parameter adjustment, it is absolutely necessary to disconnect from the RTU.
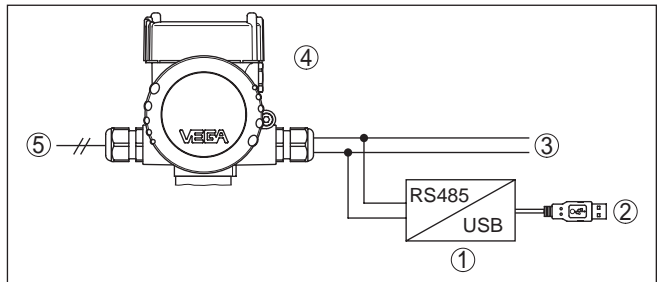
Fig. 23: Connection of the PC via the interface adapter to the RS 485 cable

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

7.2   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 Collec-

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tion. The DTMs can also be integrated into other frame applications according to FDT standard.

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

Further setup steps are described in the operating instructions manual "*DTM Collection/PACTware*" attached to each DTM Collection and which can also be downloaded from the Internet. Detailed descriptions are available in the online help of PACTware and the DTMs.
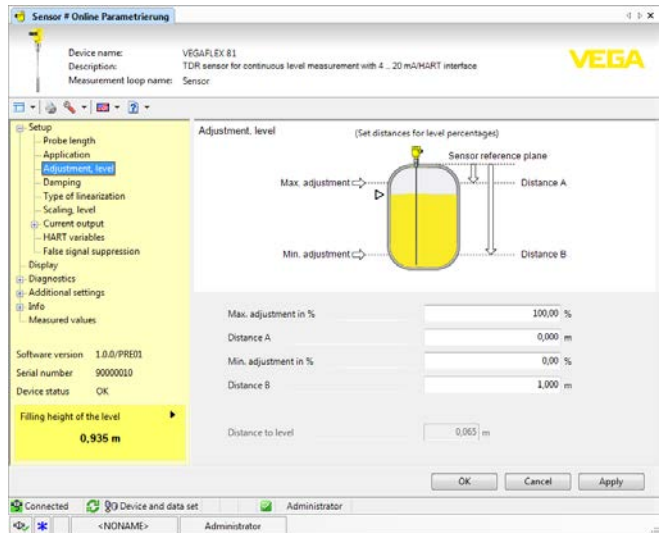
Fig. 24: Example of a DTM view

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.

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7.3   Set instrument address

The VEGAFLEX 82 requires an address for participating as a Slave 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:

● Mobus: 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.

7.4 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.
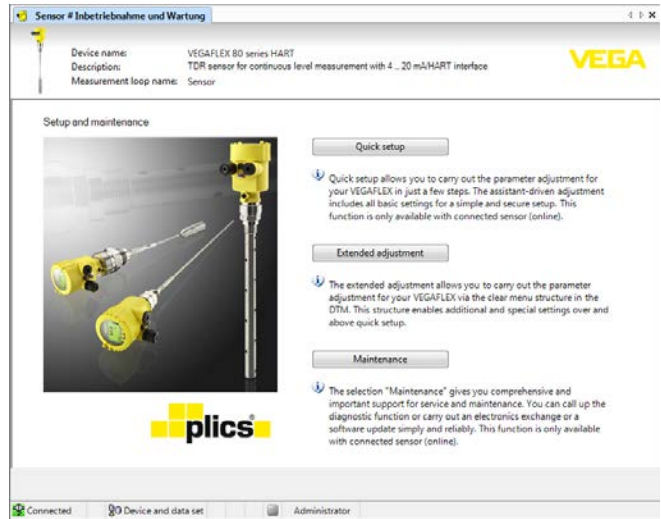
Fig. 25: Select quick setup

1 Quick setup
2 Extended adjustment
3 Maintenance

Quick setup

With quick setup you can carry out the parameter adjustment of VEGAFLEX 82 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.

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Start quick setup   Click to the button "*Quick setup*", to start the assistant-driven adjust-
ment for a simplified and reliable setup.

7.5   Saving the parameter adjustment data

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

8 Diagnostics and servicing

8.1 Maintenance

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

8.2 Diagnosis memory

The instrument has several memories which are 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
- Meas. certainty
- Electronics temperature

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

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

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

Event memory

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

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

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

Echo curve memory

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

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

- PC with PACTware/DTM

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- Control system with EDD
- Display and adjustment module

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

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

8.3 Status messages

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

Status messages

The status messages are divided into the following categories:

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

and explained by pictographs:
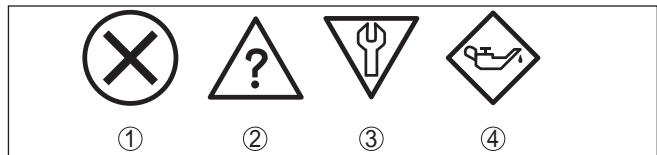
Fig. 26: Pictographs of the status messages

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

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

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

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

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

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

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

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

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

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

Failure (failure)

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

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 or correct installation 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	– Briefly separate operating voltage	Bit 5

Code Text message	Cause	Rectification	DevSpec Diagnosis Bits
F105 Measured value is determined	– The instrument is still in the start phase, the measured value could not yet be determined	– Wait for the end of the switch-on phase – Duration depending on the version and parameter adjustment up to approximately 3 min.	Bit 6
F113 Communication error	– Error in the internal instrument communication	– Briefly separate operating voltage – Send instrument for repair	-
F125 Impermissible electronics temperature	– Temperature of the electronics in the non-specified range	– Check ambient temperature – Isolate 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/Setup error	– Adjustment not within the vessel height/measuring range – Max. measuring range of the instrument not sufficient	– Check or correct installation 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 – Briefly separate operating voltage	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	-

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

Code Text message	Cause	Rectification	DevSpec 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"

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

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

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

Code Text message	Cause	Rectification	DevSpec State in CMD 48
M500 Error in the delivery status	– With the reset to delivery status, the data could not be restored	– Repeat reset – Load XML file with sensor data into the sensor	Bit 0 of Byte 14 … 24

Code Text message	Cause	Rectification	DevSpec State in CMD 48
M501 Error in the non-active linearization 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
M502 Error in the event memory	– Hardware error EEPROM	– Exchanging the electronics – Send instrument for repair	Bit 2 of Byte 14 … 24
M503 Meas. reliability too low	– Measurement certainty is too low for a reliable measurement – Process component or probe contaminated or defective	– Check installation and process conditions – Clean or exchange process component or probe	Bit 3 of Byte 14 … 24
M504 Error on an 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 installation 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/ Setup error	– Error during setup	– Check and correct installation 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

8.4   Rectify faults

Reaction when malfunction occurs

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

Procedure for fault rectification

The first measures are:

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

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

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Check the 4 … 20 mA signal

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

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

Treatment of measurement errors

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

- Constant level
- Filling
- Emptying

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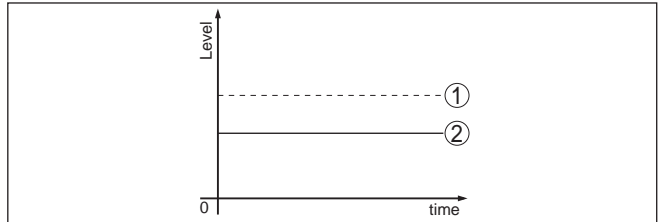

Fig. 27: The broken line 1 shows the real level, the continuous line 2 shows the level displayed by the sensor

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

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Measurement error with constant level

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

Measurement error during filling

Fault description	Error pattern	Cause	Rectification
3. Measured value remains in the area of the bottom during filling		– 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
4. Measured value remains momentarily unchanged during filling and then jumps to the correct level		– Turbulence on the product surface, quick filling	– Check parameters, change if necessary, e.g. in dosing vessel, reactor
5. Measured value jumps sporadically to 100 % during filling		– Changing condensation or contamination on the probe	– Carry out a false signal suppression
6. 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 outputted.	– Eliminate false signals in the close range – Check installation conditions – If possible, switch off the function "Overfill protection"

Measurement error during emptying

Fault description	Error pattern	Cause	Rectification
7. Measured value remains unchanged in the close range during emptying		– 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
8. 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.

8.5   Exchanging the electronics module

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

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

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

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

● In the factory
● Or on site by the user

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

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

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

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

8.6   Exchange or shorten cable/rod

Exchanging the cable/rod   The cable or rod (meas. part) of the probe can be shortened, if necessary. To loosen the rod or cable you need a fork spanner with spanner width 13.

1. Loosen the rod or cable by applying a fork spanner to the flat surfaces (SW 13), provide counterforce with another fork spanner (SW 13)
2. Unscrew the loosened rod or cable manually.
3. Place the enclosed new double washer onto the thread.

⚠ **Caution:**
Make sure that the two components of the double washer remain together.

4. Screw the new rod and the new cable manually to the thread on the process fitting.
5. Exert counterforce with the second fork spanner and tighten the measuring rod or cable on the flat surfaces with a torque of 20 Nm (15 lbf ft).
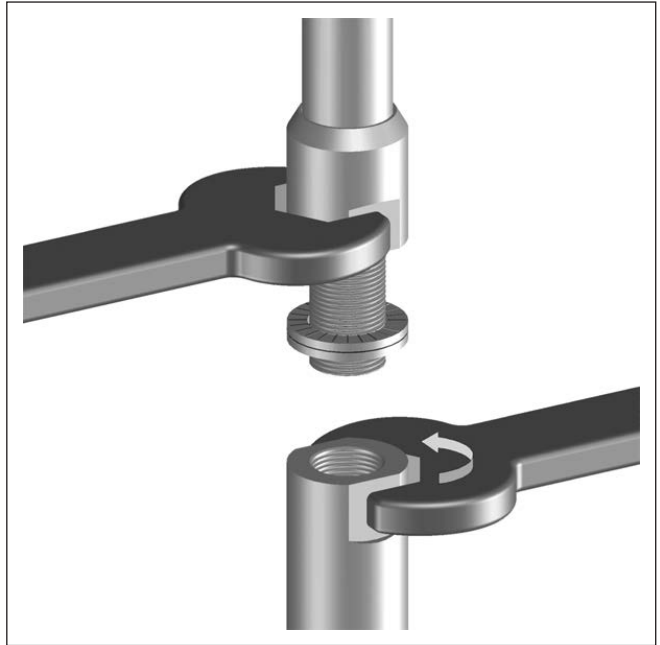
Fig. 36: Exchange cable or rod

> **Information:**
> Please maintain the specified torque so that the max. tensile strength of the connection remains.

6. Enter new probe length and if necessary the new probe type and then carry out a fresh adjustment (see "*Setup procedure, Carrying out min. adjustment - Carrying out max. adjustment*").

Shorten cable/rod

The rod or cable of the probe can be shortened individually.

1. Mark the requested length with mounted measuring rod.
2. Cable: Loosen the three pins on the gravity weight

   Cable ø 4: hexagon 3

   Cable ø 6, cable ø 8: hexagon 4
3. Cable: remove the pins
4. Cable: Pull the cable out of the gravity weight
5. Shorten the cable/rod with a cut-off wheel or metal saw at the marking. Take note of the specifications in the following illustration when shortening the cable.
6. Cable: shift the cable into the gravity weight (according to the drawing)

   Plastic coated cable: remove coating according drawing to 70 mm (2.76 in).

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7. Cable: Fasten the cable with three pins, torque 20 Nm (14.75 lbf in)

   Cable ø 4: 7 Nm (5.16 lbf ft)

   Cable ø 6, cable ø 8: 20 Nm (14.75 lbf ft)

8. Enter new probe length and then carry out a fresh adjustment (see "*Setup procedure, Carrying out min. adjustment - Carrying out max. adjustment*").
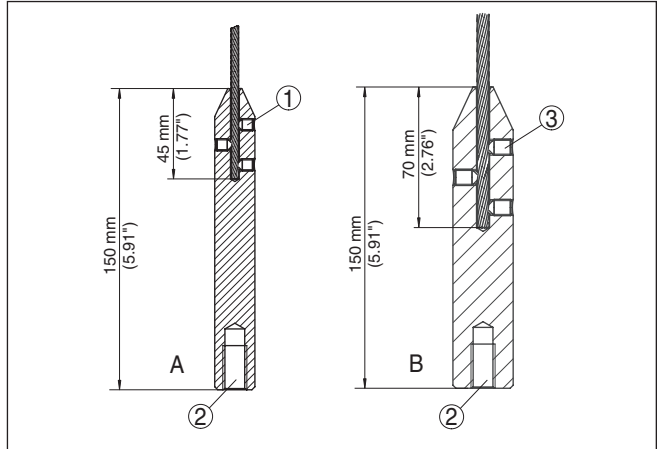
Fig. 37: Shortening the cable probe

A   Gravity weight - cable ø 4 mm
B   Gravity weight - cable ø 6 mm
1   Threaded pins
2   Thread M12 for eye-bolt
3   Threaded pins

8.7   Software update

The following components are required to update the instrument software:

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

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

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

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

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8.8   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: www.vega.com.

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

If a repair is necessary, please proceed as follows:

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

9   Dismount

9.1   Dismounting steps

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

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

9.2   Disposal

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

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

Materials: see chapter "*Technical data*"

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

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

10   Supplement

10.1   Technical data

General data

316L corresponds to 1.4404 or 1.4435

Materials, wetted parts

– Process fitting	316L and PPS GF 40, Alloy C22 (2.4602) and PPS GF 40
– Process seal on the instrument side (cable/rod leadthrough)	FKM (SHS FPM 70C3 GLT), FFKM (Kalrez 6375), EPDM (A+P 75.5/KW75F)
– Process seal	On site (instruments with thread: Klingersil C-4400 is attached)
– Inner conductor (up to the separation cable/rod)	316L
– Rod: ø 16 mm (0.63 in)	316L or Alloy C22 (2.4602)
– Cable: ø 4 mm (0.157 in)	316 (1.4401)
– Cable: ø 6 mm (0.236 in) - PA coated	Steel (galvanized), PA coated
– Cable: ø 6 mm (0.236 in)	316 (1.4401)
– Cable: ø 11 mm (0.433 in) - PA coated	Steel (galvanized), PA coated
– Gravity weight (optionally available)	316L

Materials, non-wetted parts

– Plastic housing	plastic PBT (Polyester)
– Aluminium die-casting housing	Aluminium die-casting AlSi10Mg, powder-coated - basis: Polyester
– Stainless steel housing - precision casting	316L
– Stainless steel housing, electropol-ished	316L
– Second Line of Defense (optional)[1]	Borosilicate glass GPC 540
– Seal between housing and housing lid	Silicone SI 850 R, NBR silicone-free
– Inspection window in housing cover (optional)	Polycarbonate (with Ex d version: glass)
– Ground terminal	316L
– Cable gland	PA, stainless steel, brass
– Sealing, cable gland	NBR
– Blind plug, cable gland	PA

Second Line of Defense (optional)[2]

– Supporting material	316L
– Glass potting	Borosilicate glass GPC 540
– Contacts	Alloy C22
– Helium leak rate	$< 10^{-6}$ mbar l/s

[1]   Only with Ex d version
[2]   Only with Ex d version

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– Pressure resistance	See process pressure of the sensor
Ohmic contact	Between ground terminal, process fitting and probe
Process fittings	
– Pipe thread, cylindrical (ISO 228 T1)	G¾, G1, G1½ according to DIN 3852-A
– American pipe thread, conical (ASME B1.20.1)	¾ NPT, 1 NPT, 1½ NPT
– Flanges	e.g. DIN from DN 25, ASME from 1"
Weight	
– Instrument weight (depending on process fitting)	approx. 0.8 … 8 kg (0.176 … 17.64 lbs)
– Rod: ø 16 mm (0.63 in)	approx. 1580 g/m (17 oz/ft)
– Cable: ø 4 mm (0.157 in)	approx. 78 g/m (0.84 oz/ft)
– Cable: ø 6 mm (0.236 in) - PA coated	approx. 180 g/m (1.9 oz/ft)
– Cable: ø 6 mm (0.236 in)	approx. 80 g/m (0.86 oz/ft)
– Cable: ø 11 mm (0.433 in) - PA coated	approx. 320 g/m (3.44 oz/ft)
– Gravity weight for cable ø 4 mm (0.157 in) and cable: ø 6 mm (0.236 in) - PA coated	325 g (11.46 oz)
– Gravity weight for cable ø 6 mm (0.236 in) and cable: ø 11 mm (0.433 in) - PA coated	780 g (27.51 oz)
Probe length L (from seal surface)	
– Rod: ø 16 mm (0.63 in)	up to 6 m (19.69 ft)
– Trimming accuracy - rod	±(1 mm + 0.05 % of the rod length)
– Cable: ø 4 mm (0.157 in)	up to 75 m (246.1 ft)
– Cable: ø 6 mm (0.236 in) - PA coated	up to 65 m (213.3 ft)
– Cable: ø 6 mm (0.236 in)	up to 75 m (246.1 ft)
– Cable: ø 11 mm (0.433 in) - PA coated	up to 65 m (213.3 ft)
– Trimming accuracy - cable	±(2 mm + 0.05 % of the cable length)
Lateral load with rod: ø 16 mm (0.63 in)	30 Nm (22.13 lbf ft)
Max. tensile load	
– Cable: ø 4 mm (0.157 in)	12 KN (2698 lbf)
– Cable: ø 6 mm (0.236 in) - PA coated	8 KN (1798 lbf)
– Cable: ø 6 mm (0.236 in)	30 KN (6744 lbf)
– Cable: ø 11 mm (0.433 in) - PA coated	30 KN (6744 lbf)

The tensile force of solids are subject of a normal fluctuation range. For this reason, the determined diagram value of the following diagrams must be multiplied with safety factor 2.
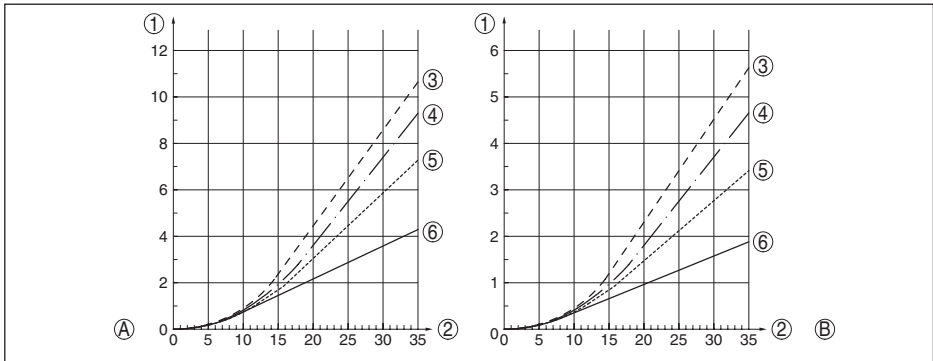
Fig. 38: Max. tensile load with cereals and plastic granules - Cable: ø 4 mm (0.157 in)

A   Cereals
B   Plastic granules
1   Tensile force in kN (the determined value must be multiplied with safety factor 2)
2   Cable length in m
3   Vessel diameter 12 m (39.37 ft)
4   Vessel diameter 9 m (29.53 ft)
5   Vessel diameter 6 m (19.69 ft)
6   Vessel diameter 3 m (9.843 ft)

Fig. 39: Max. tensile load with sand and cement - Cable: ø 4 mm (0.157 in)

C   Sand
D   Cement
1   Tensile force in kN (the determined value must be multiplied with safety factor 2)
2   Cable length in m
3   Vessel diameter 12 m (39.37 ft)
4   Vessel diameter 9 m (29.53 ft)
5   Vessel diameter 6 m (19.69 ft)
6   Vessel diameter 3 m (9.843 ft)

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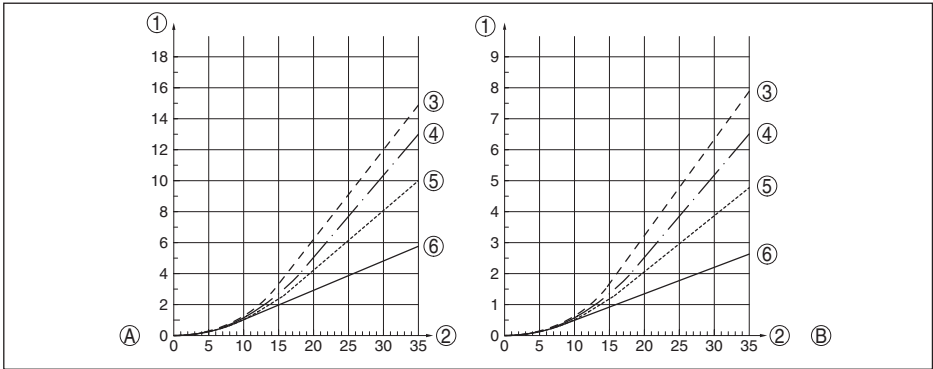
Fig. 40: Max. tensile load with cereals and plastic granules - Cable: ø 6 mm/ø 11 mm - PA coated

A   Cereals
B   Plastic granules
1   Tensile force in kN (the determined value must be multiplied with safety factor 2)
2   Cable length in m
3   Vessel diameter 12 m (39.37 ft)
4   Vessel diameter 9 m (29.53 ft)
5   Vessel diameter 6 m (19.69 ft)
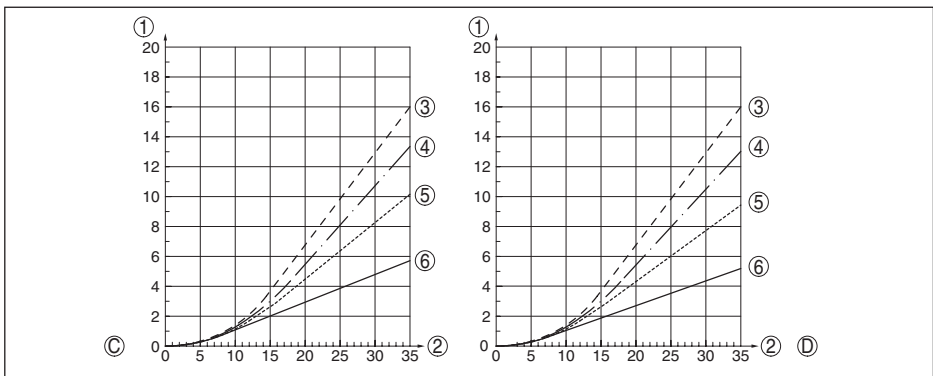6   Vessel diameter 3 m (9.843 ft)

Fig. 41: Max. tensile load with sand and cement - Cable: ø 6 mm/ø 11 mm - PA coated

C   Sand
D   Cement
1   Tensile force in kN (the determined value must be multiplied with safety factor 2)
2   Cable length in m
3   Vessel diameter 12 m (39.37 ft)
4   Vessel diameter 9 m (29.53 ft)
5   Vessel diameter 6 m (19.69 ft)
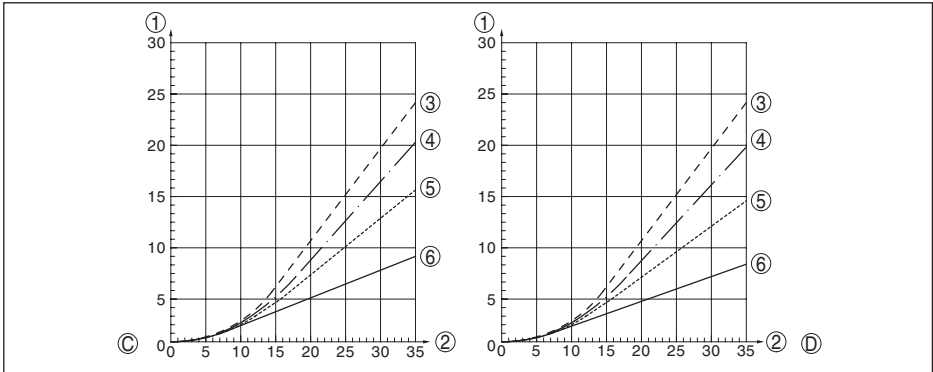6   Vessel diameter 3 m (9.843 ft)

Thread in gravity weight, e.g. for eye-bolt   M 12
(cable version)

Torque for exchangeable cable or rod probe (in the process fitting)

− Cable: ø 4 mm (0.157 in)   8 Nm (5.9 lbf ft)

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– Cable: ø 6 mm (0.236 in) - PA coated   8 Nm (5.9 lbf ft)

– Cable: ø 6 mm (0.236 in)   20 Nm (14.75 lbf ft)

– Cable: ø 11 mm (0.433 in) - PA coated   20 Nm (14.75 lbf ft)

– Rod: ø 16 mm (0.63 in)   20 Nm (14.75 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 solids
Min. dielectric constant of the medium	$\varepsilon_r \geq 1.5$

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

Accuracy (according to DIN EN 60770-1)

Process reference conditions according to DIN EN 61298-1

– Temperature   +18 … +30 °C (+64 … +86 °F)

– Relative humidity   45 … 75 %

– Air pressure   +860 … +1060 mbar/+86 … +106 kPa (+12.5 … +15.4 psig)

Installation reference conditions

– Min. distance to internal installations   > 500 mm (19.69 in)

– Vessel   metallic, ø 1 m (3.281 ft), centric installation, process fitting flush with the vessel ceiling

– Reflector   metallic, ø 1 m

– Medium   Bulk solids - cereals, flour, cement (dielectric constant ~2.0)

– Installation   Probe end does not touch the vessel bottom

Sensor parameter adjustment   No gating out of false signals carried out
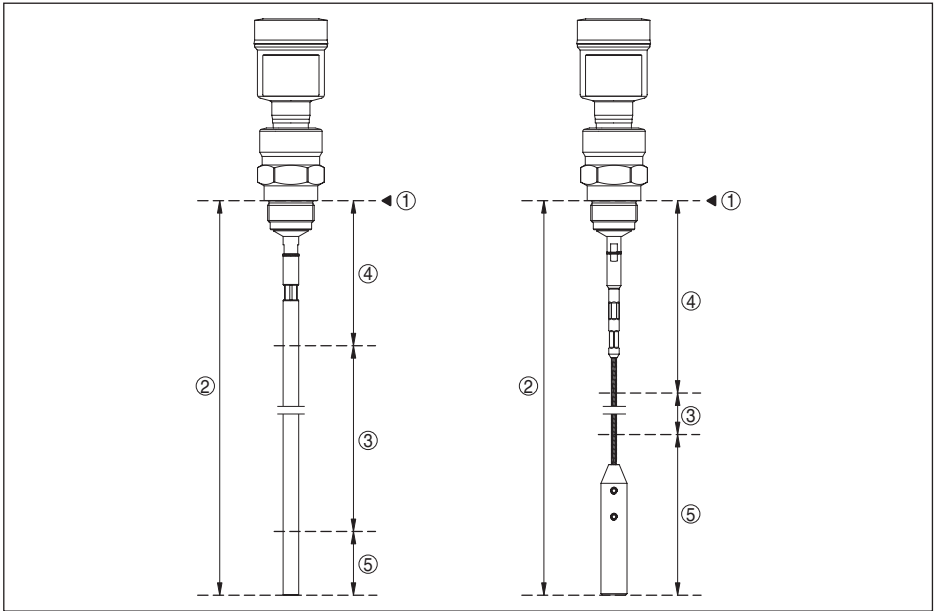
Fig. 42: Measuring ranges - VEGAFLEX 82

1   *Reference plane*
2   *Probe length L*
3   *Measuring range*
4   *Upper dead band (see following diagrams - grey section)*
5   *Lower dead band (see following diagrams - grey section)*

Typical deviation[3]   See following diagrams

Fig. 43: Deviation VEGAFLEX 82 in rod version
1   *Dead band - no measurement possible in this area*
L   *Probe length*

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

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Fig. 44: Deviation VEGAFLEX 82 in cable version in water

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

Repeatability   ≤ ±1 mm

Variables influencing measurement accuracy

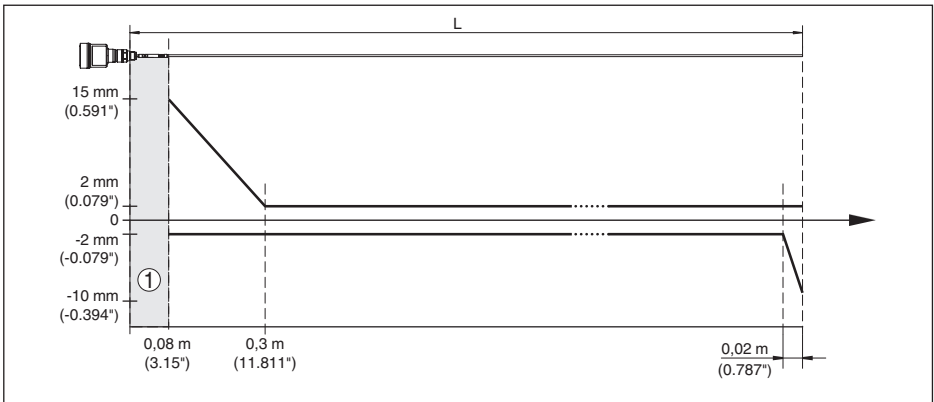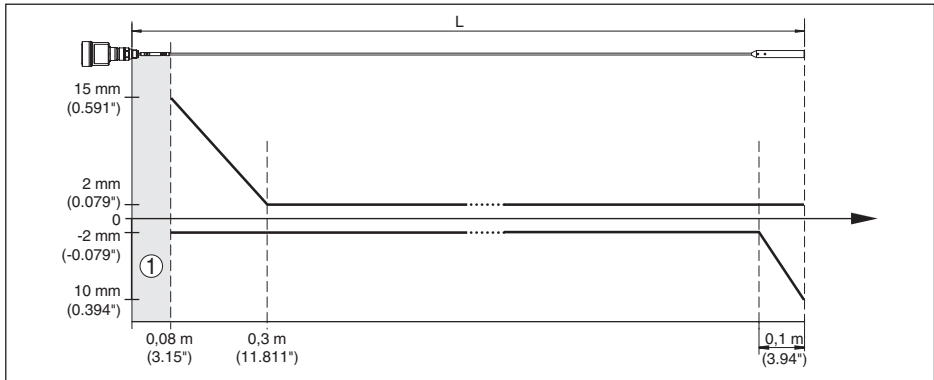| Temperature drift - Digital output	±3 mm/10 K relating to the max. measuring range or max. 10 mm (0.394 in)
Additional deviation through electromagnetic interference acc. to EN 61326	< ±10 mm (< ±0.394 in)

Influence of the superimposed gas and pressure to the accuracy

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

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 %	-	-
	180 °C (356 °F)	0.17 %	2.1 %	-
	264 °C (507 °F)	0.12 %	1.44 %	9.2 %
	366 °C (691 °F)	0.07 %	1.01 %	5.7 %

Characteristics and performance data

Measuring cycle time	< 500 ms
Step response time[4]	≤ 3 s
Max. filling/emptying speed	1 m/min
	Products with high dielectric constant (>10) up to 5 m/min.

Ambient conditions

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

Process conditions

For the process conditions, please also note the specifications on the type label. The lowest value always applies.

The measurement error through the process conditions in the specified pressure and temperature range is < 1 %.

Process pressure	-1 … +40 bar/-100 … +4000 kPa (-14.5 … +580 psig), depending on the process fitting
Vessel pressure relating to the flange nominal pressure stage	see supplementary instructions manual "*Flanges according to DIN-EN-ASME-JIS*"
Process temperature - Cable versions with PA coating	-40 … +80 °C (-40 … +176 °F)

Process temperature (thread or flange temperature) with process seals

– FKM (SHS FPM 70C3 GLT)	-40 … +150 °C (-40 … +302 °F)
– EPDM (A+P 75.5/KW75F)	-40 … +150 °C (-40 … +302 °F)
– FFKM (Kalrez 6375) - with temperature adapter	-20 … +200 °C (-4 … +392 °F)

[4] 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).

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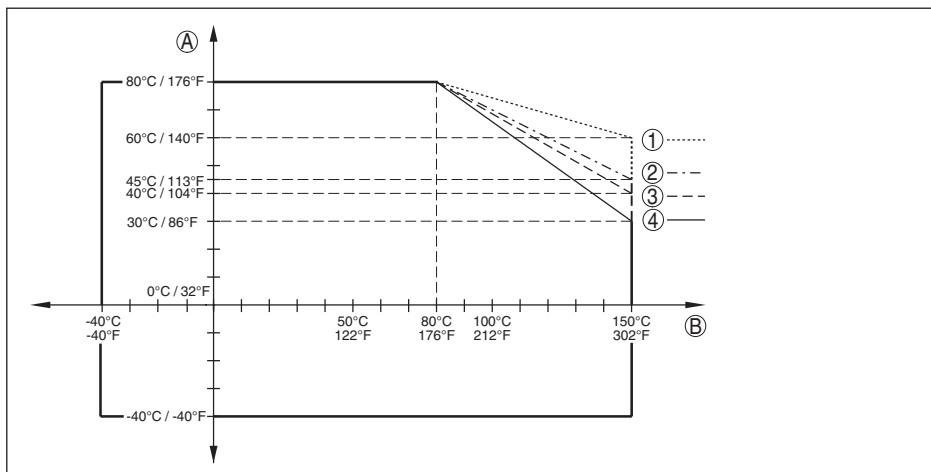
Fig. 45: Ambient temperature - process temperature, standard version

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
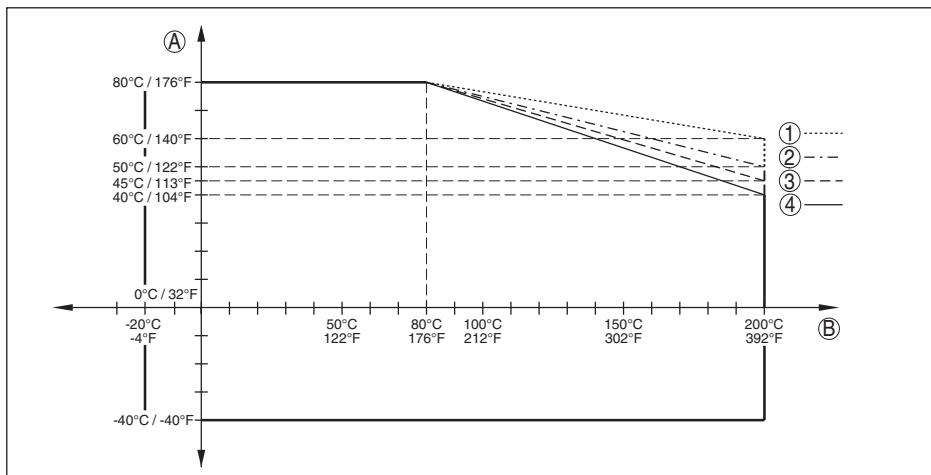

Fig. 46: Ambient temperature - process temperature, version with temperature adapter

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

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Vibration resistance

- Instrument housing   4 g at 5 … 200 Hz according to EN 60068-2-6 (vibration with resonance)
- Rod probe   1 g with 5 … 200 Hz according EN 60068-2-6 (vibration at resonance) with rod length 50 cm (19.69 in)

Shock resistance

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

Electromechanical data - version IP 66/IP 67

Cable gland	M20 x 1.5 or ½ NPT

Wire cross-section (spring-loaded terminals)

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

Display and adjustment module

Display element	Display with backlight

Measured value indication

- Number of digits   5
- Size of digits   W x H = 7 x 13 mm

Adjustment elements   4 keys

Protection rating

- unassembled   IP 20
- mounted in the housing without lid   IP 40

Materials

- Housing   ABS
- Inspection window   Polyester foil

Integrated clock

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

Additional output parameter - Electronics temperature

Output of the temperature values

- Analogue   Via the current output
- Digital   Via the digital output signal - depending on the electronics version

Range   -40 … +85 °C (-40 … +185 °F)

Resolution   < 0.1 K

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Accuracy	±3 K

Voltage supply	
Operating voltage	8 … 30 V DC
Power consumption	< 500 mW
Reverse voltage protection	Integrated

Electrical protective measures	
Protection, depending on housing version	
– Plastic housing	IP 66/IP 67 (NEMA Type 4X)
– Aluminium housing, stainless steel housing - investment casting, stainless steel housing - electro-polished	IP 66/IP 68 (0.2 bar), NEMA Type 6P[5]
Protection rating (IEC 61010-1)	III

Approvals

Instruments with approvals can have different technical specifications depending on the version.

For that reason the associated approval documents of these instruments have to be carefully noted. They are part of the delivery or can be downloaded under www.vega.com, "*VEGA Tools*" and "*Instrument search*" as well as in the download area.

10.2 Basics Modbus

Bus description

The Modbus protocol is a communication protocol for the communication between instruments. It is based on a Master/Slave or Client/Server architecture. By means of Modbus, a Master and several Slaves can be connected. Each bus participant has an unambiguous address and can send messages to the bus. This is initiated by the Master, the addressed Slave answers. For data transfer, the versions serial (EIA-485) as well as the mode RTU are available. In the RTU and ASCII mode interesting here, data will be transmitted in binary form. The telegram consists generally of the address, the function, the data as well as the transmission check.

Bus architecture

In the version Modbus RTU, up to 32 participants can be connected to the bus. The length of the twisted two-wire cable can be up to 1200 m. The bus must be terminated on both sides at the last bus participant with a terminating resistor of 120 Ohm. The resistor is already integrated in the VEGAFLEX 82 and is activated/deactivated via a slide switch.

[5] The prerequisites for maintaining the protection rating are a suitable cable as well as correct mounting.
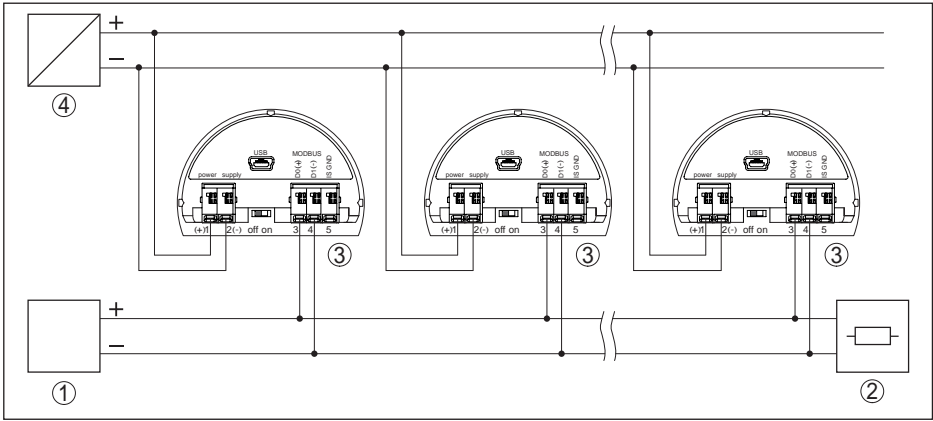
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Fig. 47: Bus architecture Modbus

1   RTU
2   Connection resistor
3   Bus participant
4   Voltage supply

Protocol description

The VEGAFLEX 82 is suitable for connection to the following RTUs with Modbus RTU or ASCII protocol.

RTU	Protocol
ABB Totalflow	Modbus RTU, ASCII
Bristol ControlWaveMicro	Modbus RTU, ASCII
Fisher ROC	Modbus RTU, ASCII
ScadaPack	Modbus RTU, ASCII
Thermo Electron Autopilot	Modbus RTU, ASCII

Parameters for the bus communication

The VEGAFLEX 82 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 Modbus	1 … 255	246

Start bits and data bits cannot be modified.

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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 82 which must be contacted for the variables and status information.

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

10.3 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	9600	-
Parity	202	Word	0 = None, 1 = Odd, 2 = Even	0	-
Stopbits	203	Word	1 = None, 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 out. Before each command, the address (1 byte) is sent, after each command a CRC (2 bytes) is sent.

PV, SV, TV and QV can be adjusted 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

Supplement is the chapter heading

Register Name	Register Number	Type	Note
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
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)

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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

10.4   Modbus RTU commands

FC3 Read Holding Register

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

Request:

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

Response:

Parameter	Length	Code/Data
Function Code	1 Byte	0x03
Start Address	2 Bytes	2*N
Register Value	N*2 Bytes	Data

FC4 Read Input Register

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

Request:

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

Response:

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

FC6 Write Single Register

With this function code an individual holding register can be written.

Request:

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

Response:

Parameter	Length	Code/Data
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 can be triggered or diagnostic values read out.

Request:

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

Response:

Parameter	Length	Code/Data
Function Code	1 Byte	0x08
Sub Function Code	2 Bytes	

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Parameter	Length	Code/Data
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

With this function code, several holding registers can be writen. Only registers can be written in an enquiry which are immediately consecutive. If there are gaps (registers do not exist) between the registers, then they cannot be written in a telegram.

Request:

Parameter	Length	Code/Data
Function Code	1 Byte	0x10
Start Address	2 Bytes	0x0000 to 0xFFFF
Register Value	2 Bytes	0x0001 to 0x007B
Byte Number	1 Byte	2*N
Register Value	N*2 Bytes	Data

Response:

Parameter	Length	Code/Data
Function Code	1 Byte	0x10
Sub Function Code	2 Bytes	0x0000 to 0xFFFF
Data	2 Bytes	0x01 to 0x7B

FC17 Report Slave ID

With this function code, the Slave ID can be queried.

Request:

Parameter	Length	Code/Data
Function Code	1 Byte	0x11

Response:

Parameter	Length	Code/Data
Function Code	1 Byte	0x11
Byte Number	1 Byte	
Slave ID	1 Byte	
Run Indicator Status	1 Byte	

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FC43 Sub 14, Read Device Identification

With this function code, the Device Identification can be queried.

Request:

Parameter	Length	Code/Data
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

Response:

Parameter	Length	Code/Data
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

10.5   Levelmaster commands

The VEGAFLEX 82 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 82 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

Parameter	Configurable Values	Default Value
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

Report Level (and Temperature)

Request:

Parameter	Length	Code/Data
Report Level (and Temperature)	4 characters ASCII	Uuu?

Response:

Parameter	Length	Code/Data
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

Request:

Parameter	Length	Code/Data
Report Unit Number	5 characters ASCII	U**N?

Response:

Parameter	Length	Code/Data
Report Level (and Temperature)	6 characters ASCII	UuuNnn

Assign Unit Number

Request:

Parameter	Length	Code/Data
Assign Unit Number	6 characters ASCII	UuuNnn

Response:

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

Set number of Floats

Request:

Parameter	Length	Code/Data
Set number of Floats	5 characters ASCII	UuuFn

Response:

Parameter	Length	Code/Data
Set number of Floats	6 characters ASCII	UuuFOK

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

Set Baud Rate

Request:

Parameter	Length	Code/Data
Set Baud Rate	8 (12) characters ASCII	UuuBbbbb[b][pds] Bbbbb[b] = 1200, 9600 (default) pds = parity, data length, stop bit (optional) parity: none = 81, even = 71 (default), odd = 71

Response:

Parameter	Length	Code/Data
Set Baud Rate	11 characters ASCII	

Example: U01B9600E71

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

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Set Receive to Transmit Delay

Request:

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

Response:

Parameter	Length	Code/Data
Set Receive to Transmit Delay	6 characters ASCII	UuuROK

Report Number of Floats

Request:

Parameter	Length	Code/Data
Set Receive to Transmit Delay	4 characters ASCII	UuuF

Response:

Parameter	Length	Code/Data
Set Receive to Transmit Delay	5 characters ASCII	UuuFn n = number of measurement values (0, 1 or 2)

Report Receive to Transmit Delay

Request:

Parameter	Length	Code/Data
Report Receive to Transmit Delay	4 characters ASCII	UuuR

Response:

Parameter	Length	Code/Data
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

10.6 Configuration of typical Modbus hosts

Fisher ROC 809

Wiring plan
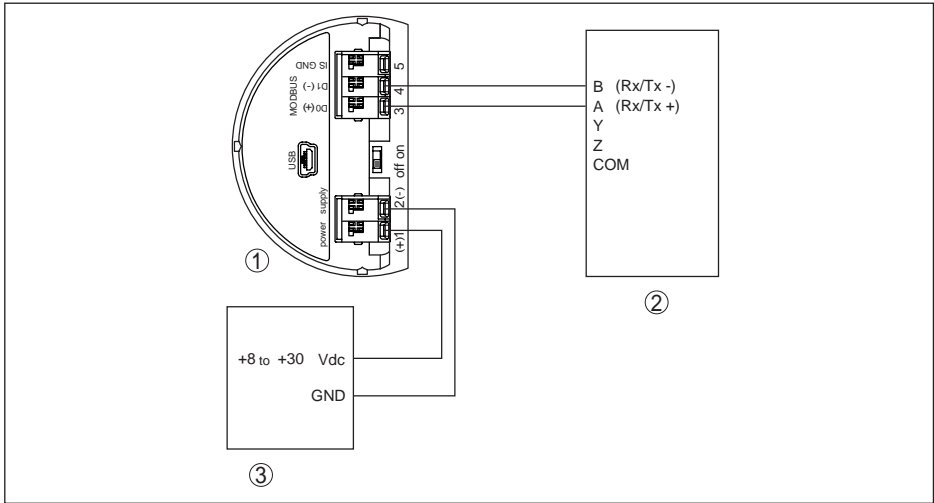
Fig. 48: Connection of VEGAFLEX 82 to RTU Fisher ROC 809

1   VEGAFLEX 82
2   RTU Fisher ROC 809
3   Voltage supply

Parameter

Parameter	Value
Baud Rate	9600
Floating Point Format Code	0
RTU Data Type	Conversion Code 66
Input Register Base Number	0

The basic number of the input registers is always added to the input register address of VEGAFLEX 82.

Address 1300 must hence be entered as register address for RTU Fisher ROC 809.

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ABB Total Flow

Wiring plan
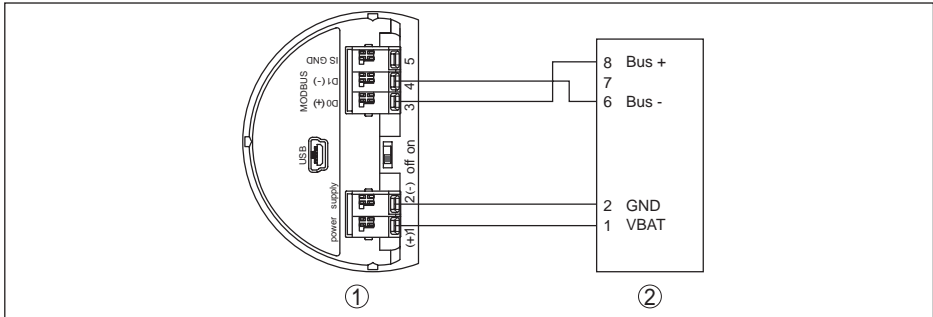
Fig. 49: Connection of VEGAFLEX 82 to RTU ABB Total Flow

1   VEGAFLEX 82
2   RTU ABB Total Flow

Parameter

Parameter	Value
Baud Rate	9600
Floating Point Format Code	0
RTU Data Type	16 Bit Modicon
Input Register Base Number	1

The basic number of the input registers is always added to the input register address of VEGAFLEX 82.

Address 1303 must hence be entered as register address for 1302 for RTU ABB Total Flow.

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Thermo Electron Autopilot

Wiring plan
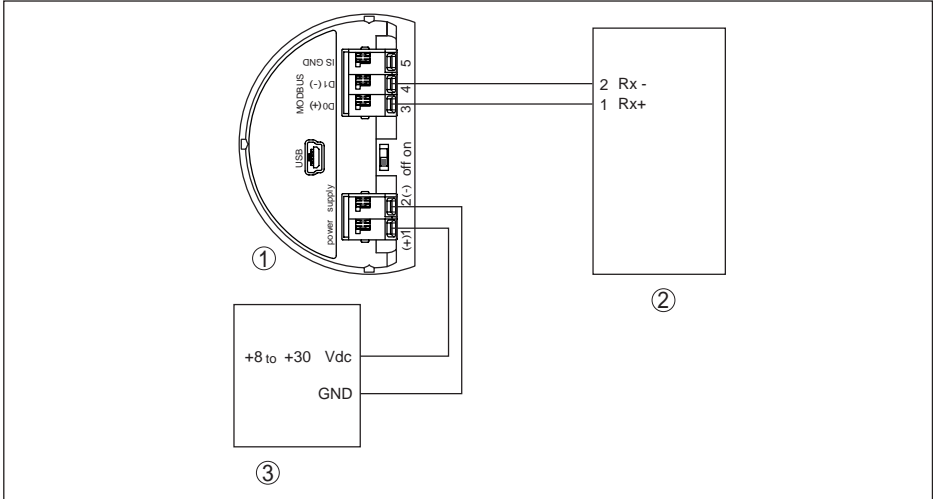
Fig. 50: Connection of VEGAFLEX 82 to RTU Thermo Electron Autopilot

1   VEGAFLEX 82
2   RTU Thermo Electron Autopilot
3   Voltage supply

Parameter

Parameter	Value
Baud Rate	9600
Floating Point Format Code	0
RTU Data Type	IEE Fit 2R
Input Register Base Number	0

The basic number of the input registers is always added to the input register address of VEGAFLEX 82.

For that reason, address 1300 must be entered as register address for 1300 for the RTU Thermo Electron Autopilot.

Bristol ControlWave Micro

Wiring plan
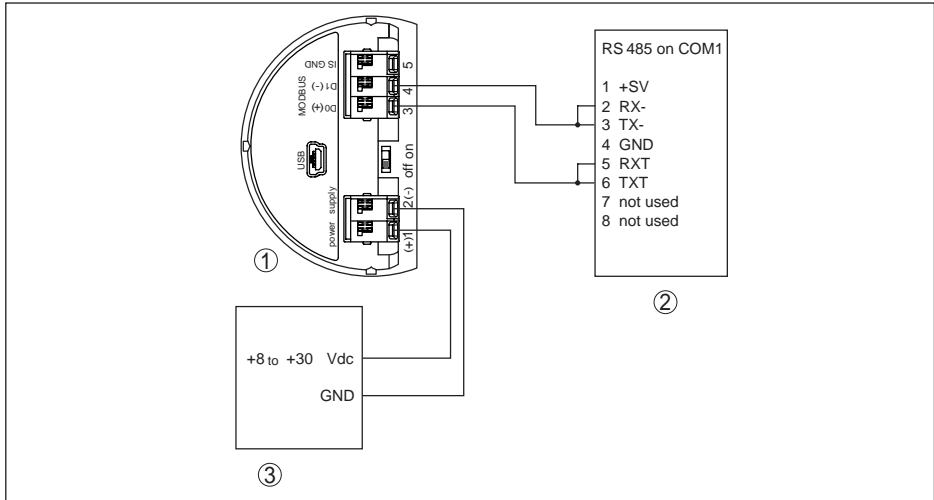
Fig. 51: Connection of VEGAFLEX 82 to RTU Bristol ControlWave Micro

1   VEGAFLEX 82
2   RTU Bristol ControlWave Micro
3   Voltage supply

Parameter

Parameter	Value
Baud Rate	9600
Floating Point Format Code	2 (FC4)
RTU Data Type	32-bit registers as 2 16-bit registers
Input Register Base Number	1

The basic number of the input registers is always added to the input register address of VEGAFLEX 82.

Address 1303 must hence be entered as register address for 1302 for RTU Bristol ControlWave Micro.

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ScadaPack

Wiring plan
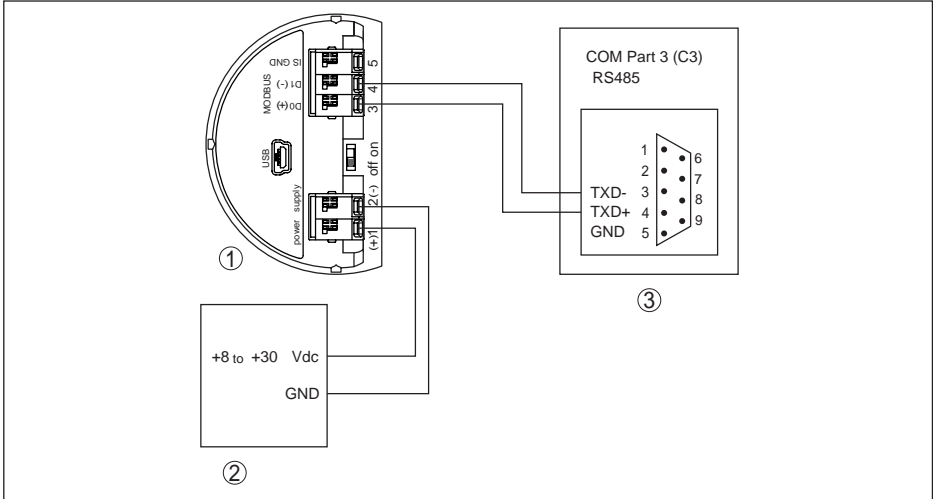
Fig. 52: Connection of VEGAFLEX 82 to RTU ScadaPack

1   VEGAFLEX 82
2   RTU ScadaPack
3   Voltage supply

Parameter

Parameter	Value
Baud Rate	9600
Floating Point Format Code	0
RTU Data Type	Floating Point
Input Register Base Number	30001

The basic number of the input registers is always added to the input register address of VEGAFLEX 82.

Address 31303 must hence be entered as register address for 1302 for RTU ScadaPack.

10.7   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
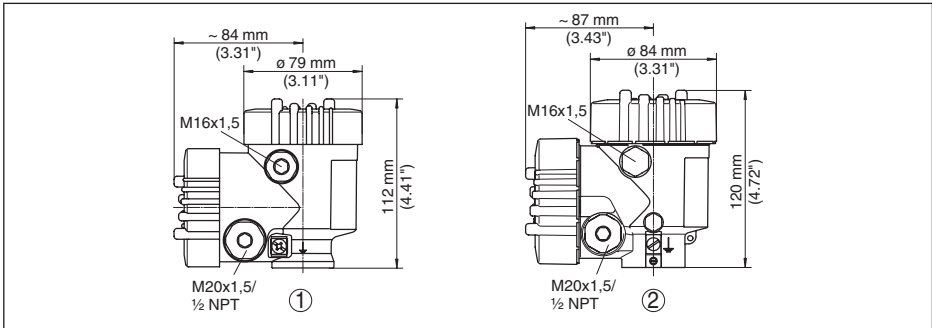
Fig. 53: Dimensions of housing - with integrated display and adjustment module the housing is 9 mm/0.35 inches higher

1   Plastic housing
2   Aluminium/Stainless steel housing

VEGAFLEX 82, cable version ø 4 mm (0.157 in)/ø 6 mm (0.236 in) - PA coated
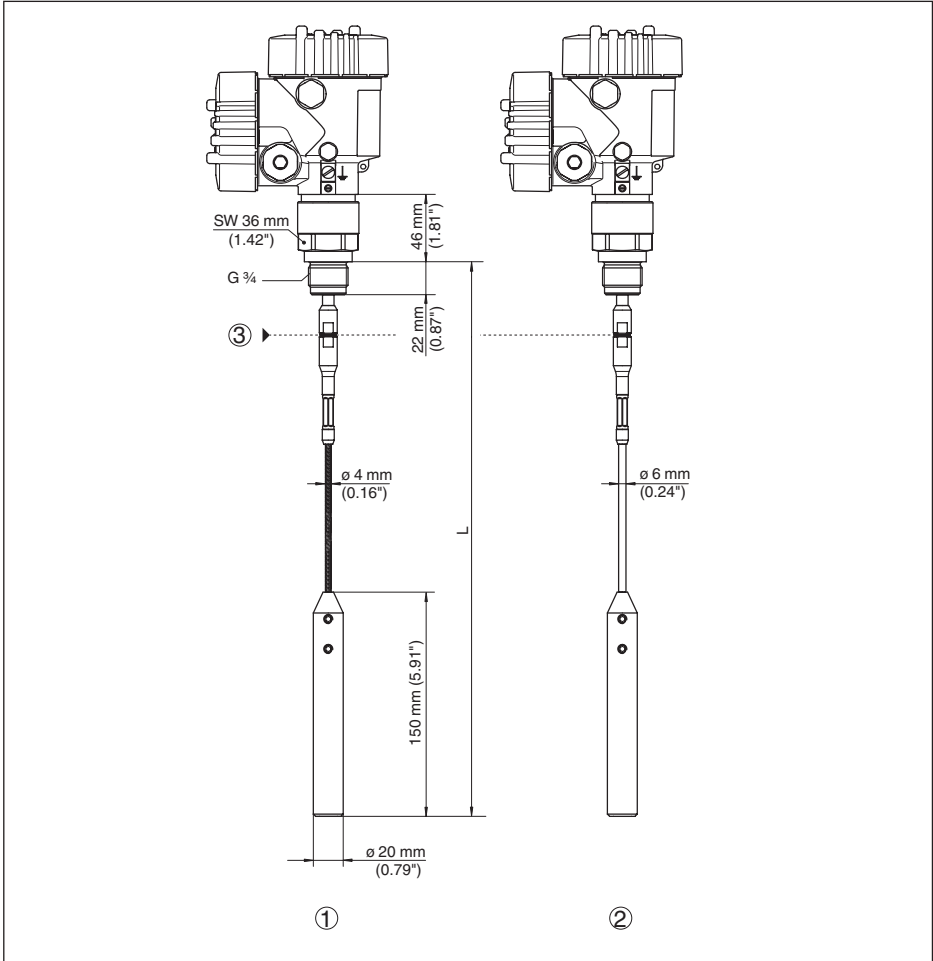
Fig. 54: VEGAFLEX 82, cable ø 4 mm (0.157 in)/ø 6 mm (0.236 in) threaded version with gravity weight (all gravity weights with thread M12 for eye-bolt)

L   Sensor length, see chapter "Technical data"
1   Cable ø 4 mm (0.157 in)
2   Cable ø 6 mm (0.236 in) - PA coated
3   Joint - cable

VEGAFLEX 82, cable version ø 6 mm (0.236 in)/ø 11 mm (0.433 in) - PA coated
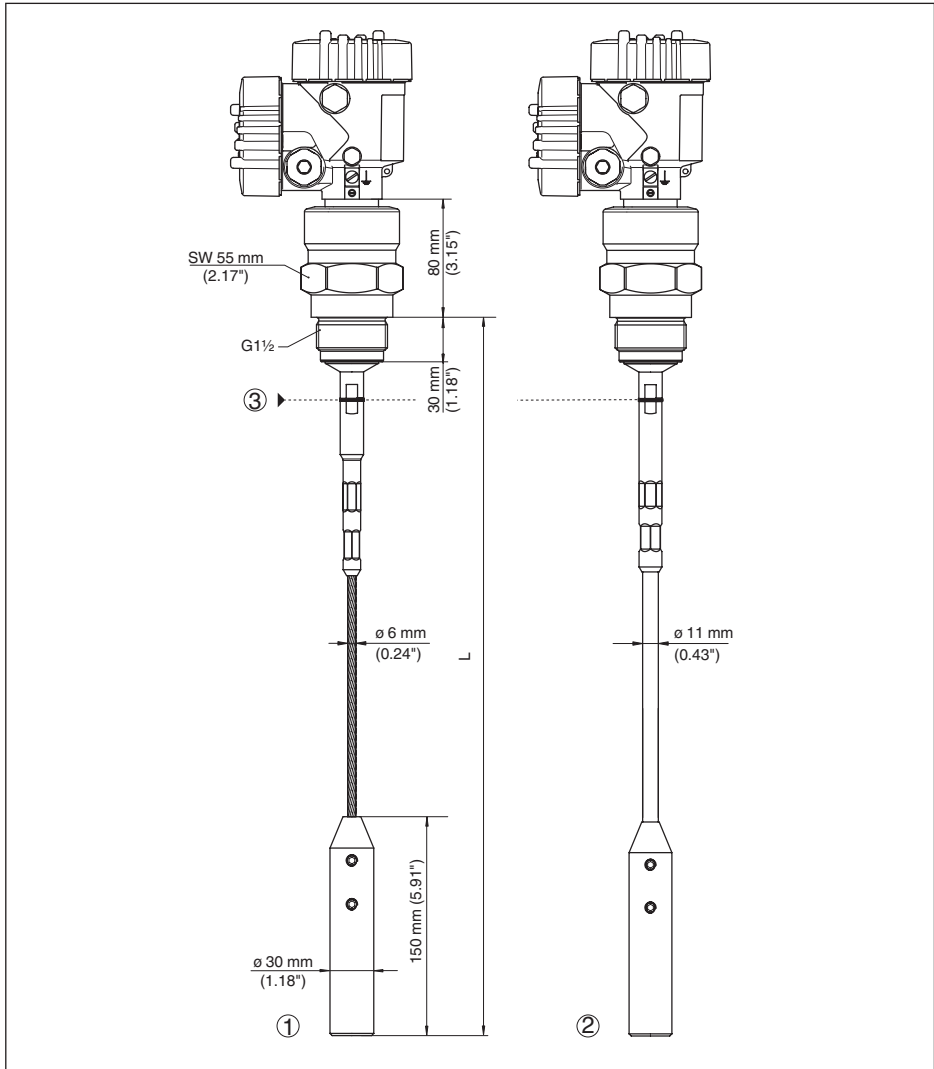
Fig. 55: VEGAFLEX 82, cable ø 6 mm (0.236 in)/ø 11 mm (0.433 in) threaded version with gravity weight (all gravity weights with thread M12 for eye-bolt)

L   Sensor length, see chapter "Technical data"
1   Cable ø 6 mm (0.236 in)
2   Cable ø 11 mm (0.433 in) - PA coated
3   Joint - cable

VEGAFLEX 82, rod version ø 16 mm (0.63 in)
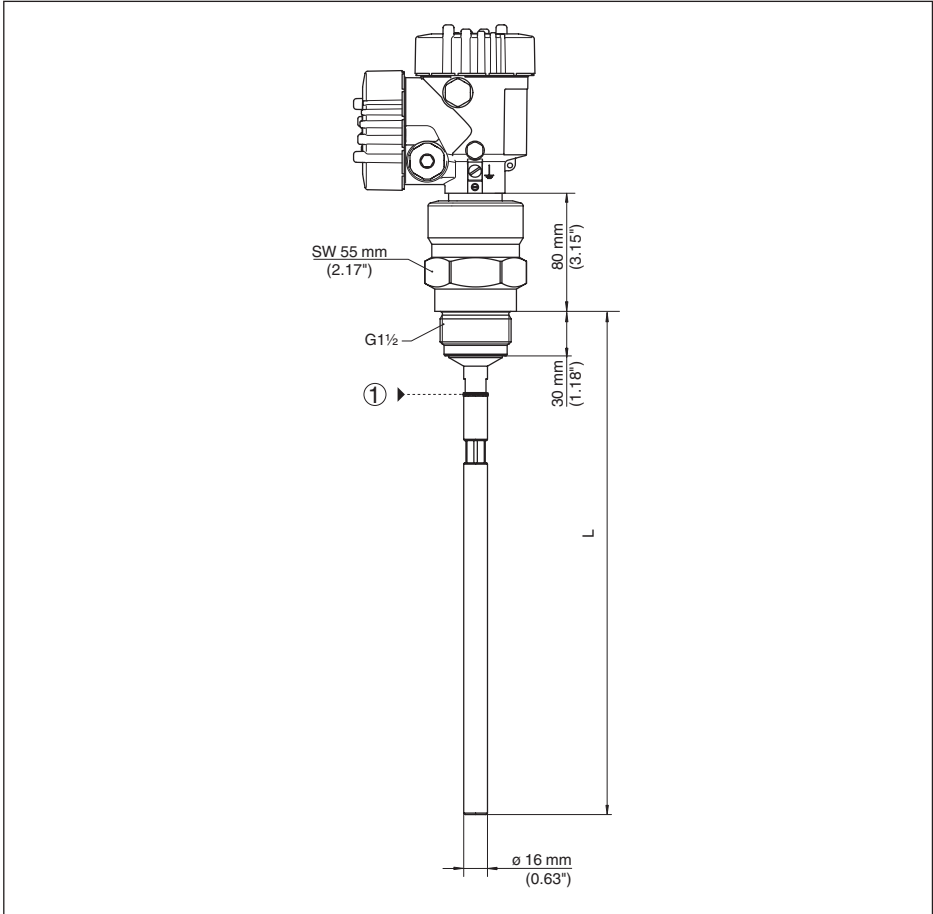
Fig. 56: VEGAFLEX 82, rod ø 16 mm (0.63 in), threaded version

L   Sensor length, see chapter "Technical data"
1   Joint - rod

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