# Operating Instructions

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

## VEGAFLEX 81

4 … 20 mA/HART - four-wire

Coax probe

Document ID: 42280

# Contents



42280-EN-171002

**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, fault rectification, the exchange of parts and the safety of the user. Please read this information before putting the instrument into operation and keep this manual accessible in the immediate vicinity of the device.

## 1.2 Target group

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

## 1.3 Symbols used

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

**Information, 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.

# 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 81 is a sensor for continuous level measurement.

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

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

## 2.3 Warning about incorrect use

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

## 2.4 General safety instructions

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

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. For safety reasons, only the accessory specified by the manufacturer must be used.

To avoid any danger, the safety approval markings and safety tips on the device must also be observed and their meaning looked up in this operating instructions manual.

## 2.5 EU conformity

The device fulfils the legal requirements of the applicable EU directives. By affixing the CE marking, we confirm the conformity of the instrument with these directives.

You can find the EU conformity declaration on our website under www.vega.com/downloads.

**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 43 – Signal level for fault information from measuring transducers
- NE 53 – Compatibility of field devices and display/adjustment components
- NE 107 - Self-monitoring and diagnosis of field devices

For further information see www.namur.de.

## 2.7 Installation and operation in the USA and Canada

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

Installations in the US shall comply with the relevant requirements of the National Electrical Code (ANSI/NFPA 70).

Installations in Canada shall comply with the relevant requirements of the Canadian Electrical Code

## 2.8 Environmental instructions

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

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

- Chapter "*Packaging, transport and storage*"

- Chapter "*Disposal*"

# 3 Product description

## 3.1 Configuration

**Type label**

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

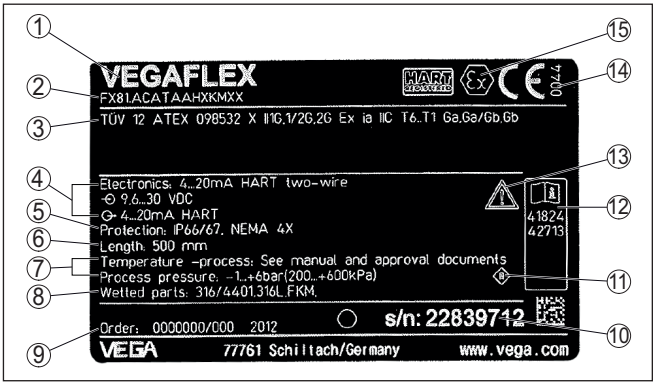


*Fig. 1: Layout of the type label (example)*

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", "*Instrument search (serial number)*". Enter the serial number.

Alternatively, you can access the data via your smartphone:

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

**Scope of this operating instructions manual**

This operating instructions manual applies to the following instrument versions:

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

**Versions**

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

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

**Scope of delivery**

The scope of delivery encompasses:

- Sensor
- Optional accessory
- Optionally integrated Bluetooth module
- Documentation
  - Quick setup guide VEGAFLEX 81
  - Instructions for optional instrument features
  - Ex-specific "*Safety instructions*" (with Ex versions)
  - If necessary, further certificates
- DVD "*DTM Collection*", included therein
  - PACTware
  - DTM Collection
  - Instrument master files (GSD) for Profibus PA
  - FDT certificates

**Information:**
In this operating instructions manual, the optional instrument features are described. The respective scope of delivery results from the order specification.

## 3.2 Principle of operation

**Application area**

The VEGAFLEX 81 is a level sensor with coax probe for continuous level or interface measurement, suitable for applications in liquids.

**Functional principle - level measurement**

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

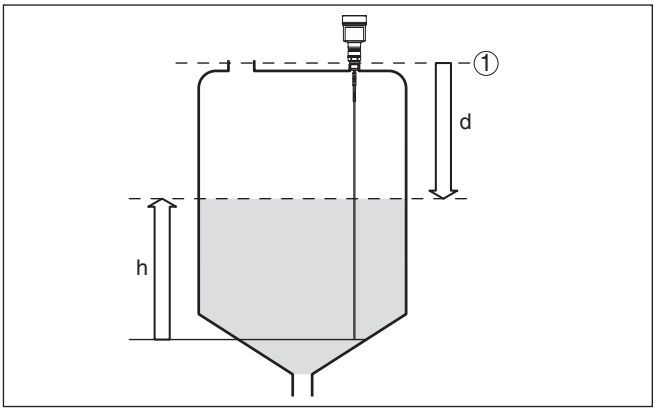


*Fig. 2: Level measurement*

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

**Functional principle - interface measurement**

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

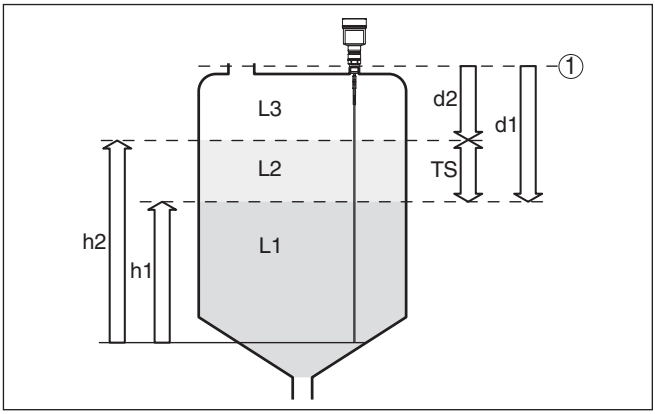


*Fig. 3: Interface measurement*

*1 Sensor reference plane (seal surface of the process fitting)*
*d1 Distance to the interface*
*d2 Distance to the level*
*TS Thickness of the upper medium (d1 - d2)*
*h1 Height - Interface*
*h2 Height - Level*
*L1 Lower medium*
*L2 Upper medium*
*L3 Gas phase*

**Prerequisites for interface measurement**

**Upper medium (L2)**

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

**Lower medium (L1)**

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

**Gas phase (L3)**

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

**Output signal**

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

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

## 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 %

**Lifting and carrying**

With an instrument weight of more than 18 kg (39.68 lbs) suitable and approved equipment must be used for lifting and carrying.

## 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 or the external display and adjustment unit and removed at any time.

The integrated Bluetooth module (optional) enables wireless adjustment via standard adjustment devices:[1)]

- Smartphone/tablet (iOS or Android operating system)
- PC/notebook with Bluetooth USB adapter (Windows operating system)

You can find further information in the operating instructions "*Display and adjustment module PLICSCOM*" (Document-ID 36433).

**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 "*VEGADIS adapter*" is also required for VEGADIS 81.

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

**VEGADIS adapter**

The VEGADIS adapter 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 "*VEGADIS adapter*" (Document-ID 45250).

[1)] Bluetooth function with VEGADIS 82 can only be used at a later date.

**VEGADIS 82**

VEGADIS 82 is suitable for measured value indication and adjustment of sensors with HART protocol. It is looped into the 4 … 20 mA/HART signal cable.

You can find further information in the operating instructions "*VEGADIS 82 4 … 20 mA/HART*" (Document-ID 45300).

**PLICSMOBILE T81**

PLICSMOBILE T81 is an external GSM/GPRS/UMTS radio unit for transmission of measured values and for remote parameter adjustment of HART sensors. The adjustment is carried out via a PC with PACTware and the corresponding DTM or via smartphone/tablet with the VEGA Tools app. The connection is made via the Bluetooth interface integrated in PLICSMOBILE.

You can find further information in the operating instructions "*PLICSMOBILE T81/B81/S81*" (Document-ID 55234).

**Protective cover**

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*".

**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).

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

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

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

Make sure that the degree of contamination specified in chapter "*Technical data*" meets the existing ambient conditions.

**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 before mounting that all parts of the instrument exposed to the process are suitable for the existing process conditions.

These are mainly:

- Active measuring component
- Process fitting
- Process seal

Process conditions in particular are:

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

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

**Suitability for the ambient conditions**

The instrument is suitable for standard and extended ambient conditions acc. to DIN/EN/IEC/ANSI/ISA/UL/CSA 61010-1.

## 4.2 Mounting instructions

**Installation position**

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

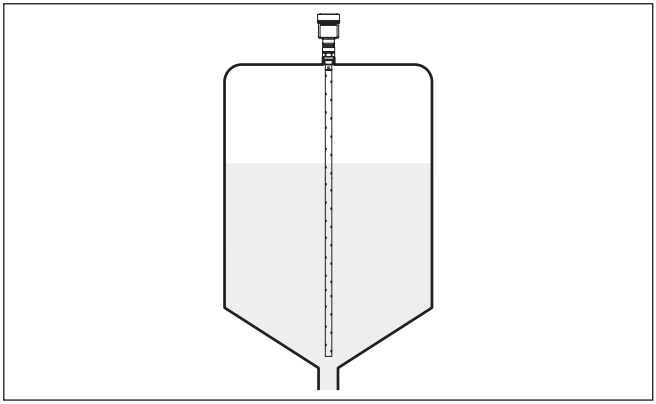

*Fig. 4: Vessel with conical bottom*

**Welding work**

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

**Inflowing medium**

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

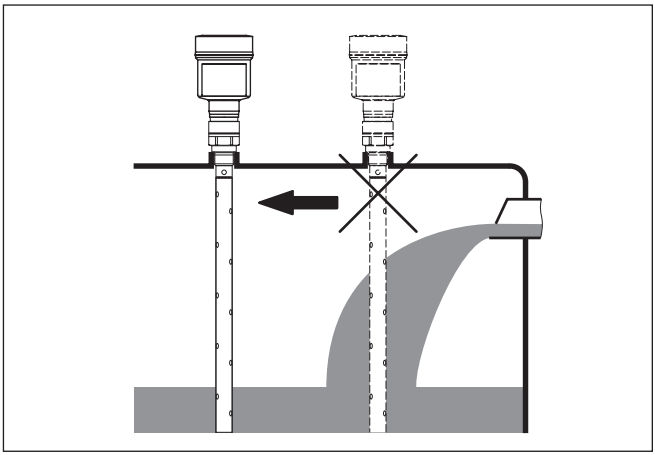

*Fig. 5: Mounting of the sensor with inflowing medium*

**Measuring range**

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

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

**Pressure**

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

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

**Fasten**

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

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

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

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

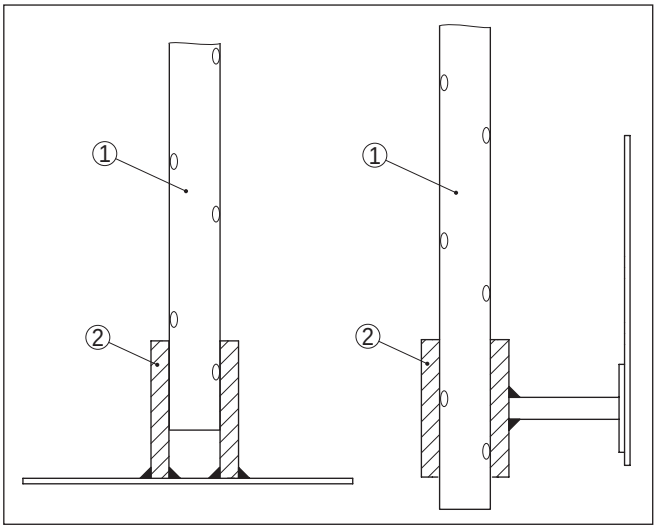


*Fig. 6: Fasten the probe*

*1 Coax probe*
*2 Retaining sleeve*

# 5 Connecting to power supply

## 5.1 Preparing the connection

**Safety instructions**

Always keep in mind the following safety instructions:

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

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

**Note:**
Install a separating facility for the instrument which is easy to access. The separating facility must be marked for the instrument (IEC/EN 61010).

**Voltage supply via mains voltage**

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

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

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

**Voltage supply via low voltage**

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

**Connection cable**

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

The 4 … 20 mA current output is connected with standard two-wire cable without screen. If electromagnetic interference is expected which is above the test values of EN 61326-1 for industrial areas, screened cable should be used.

Make sure that the cable used has the required temperature resistance and fire safety for max. occurring ambient temperature

Use a cable gland suitable for the cable diameter to ensure the seal effect of the cable gland (IP protection).

**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.

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**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.

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

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

**Cable screening and grounding**

If screened cable is required, we recommend connecting the cable screen on both ends to ground potential. In the sensor, the screen must be connected directly to the internal ground terminal. The ground terminal on the outside of the housing must be connected to the ground potential (low impedance).

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

In electroplating plants as well as plants for cathodic corrosion protection it must be taken into account that significant potential differences exist. This can lead to unacceptably high currents in the cable screen if it is grounded at both ends.

**Information:**

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

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

## 5.2 Connecting

**Connection technology**

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

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

**Information:**

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

**Connection procedure**

Proceed as follows:

1. Unscrew the housing lid
2. Loosen compression nut of the cable gland and remove blind plug

3. Remove approx. 10 cm (4 in) of the cable mantle (signal output), strip approx. 1 cm (0.4 in) insulation from the ends of the individual wires
4. Insert the cable into the sensor through the cable entry


*Fig. 7: Connection steps 5 and 6*

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

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

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

The electrical connection is finished.

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

## 5.3 Wiring plan, double chamber housing

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

**Electronics compartment**

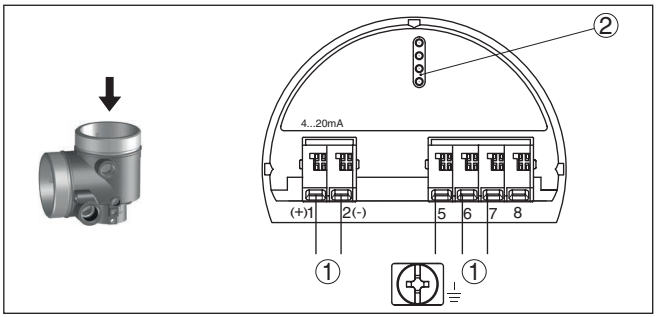


*Fig. 8: Electronics compartment - double chamber housing*

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

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

**Connection compartment with mains voltage**

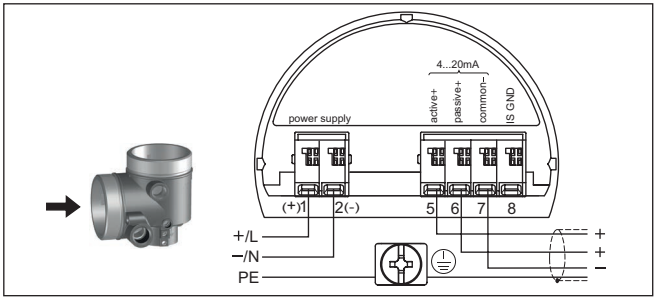


*Fig. 9: Connection compartment with double chamber housing with mains voltage*

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

### Connection compartment with low voltage

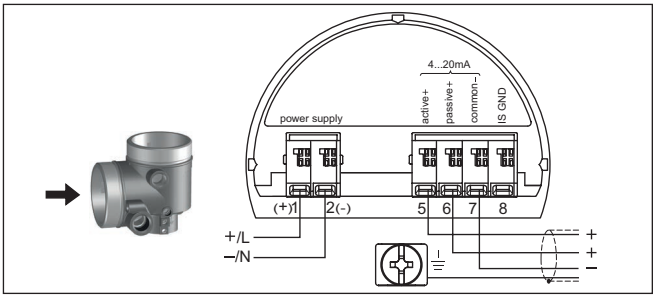


*Fig. 10: Connection compartment with double chamber housing with low voltage*

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

## 5.4 Double chamber housing with VEGADIS-Adapter

### Electronics compartment

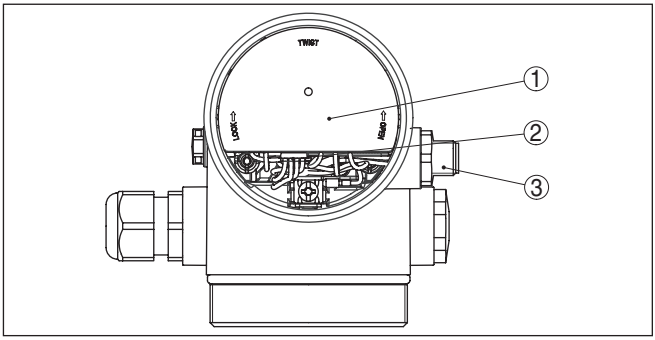


*Fig. 11: View to the electronics compartment with VEGADIS adapter for connection of the external display and adjustment unit*

1 *VEGADIS adapter*
2 *Internal plug connection*
3 *Plug connector M12 x 1*

**Assignment of the plug connector**

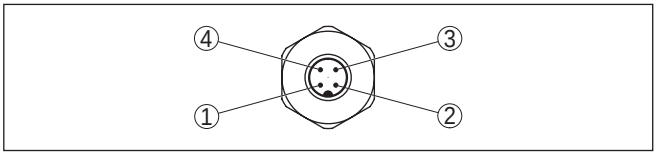


*Fig. 12: View to the plug connector M12 x 1*

*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 |

## 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.

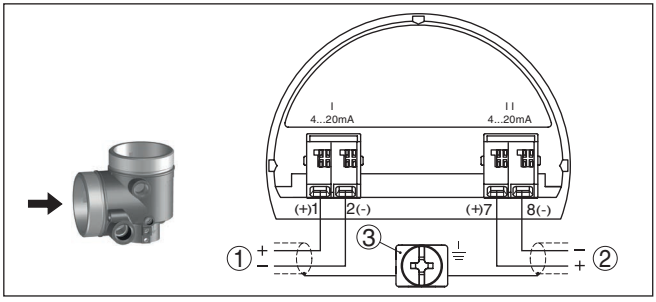


*Fig. 13: Terminal compartment, double chamber housing, supplementary electronics "Additional current output"*

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

## 5.6 Switch-on phase

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

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

- Indication of the status message "*F 105 Determine measured value*" on the display or PC
- The output signal jumps to the set fault current

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

# 6 Set up with the display and adjustment module

## 6.1 Insert display and adjustment module

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

Proceed as follows:

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

Disassembly is carried out in reverse order.

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


*Fig. 14: Installing the display and adjustment module in the electronics compartment of the single chamber housing*

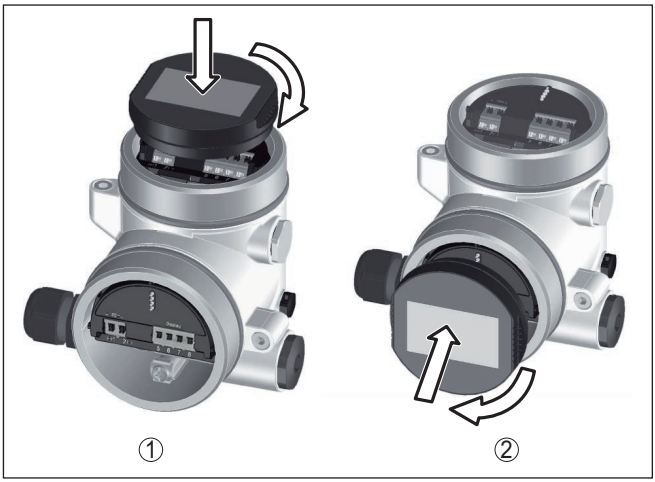


*Fig. 15: Installing the display and adjustment module in the double chamber housing*

*1 In the electronics compartment*
*2 In the terminal compartment*

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

## 6.2 Adjustment system

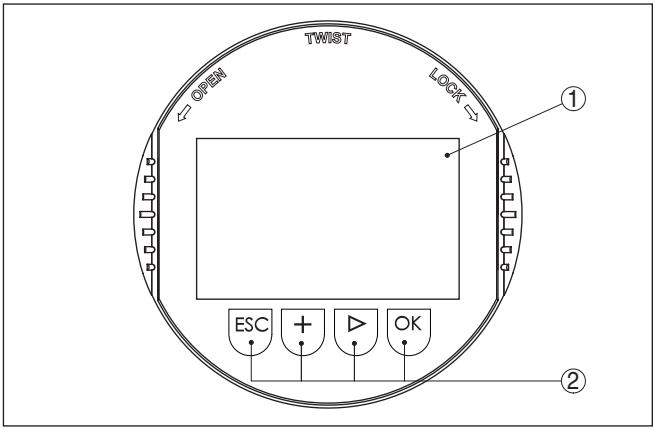


*Fig. 16: Display and adjustment elements*

*1 LC display*
*2 Adjustment keys*

**Key functions**

- ***[OK]*** key:

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

**Adjustment system**

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

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 81 carries out a short self-test where the device software is checked.

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

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

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

**Measured value indication**

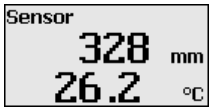
With the ***[->]*** key you can move between three different indication modes.

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

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

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

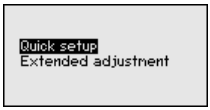





## 6.3 Parameter adjustment - Quick setup

**Quick setup**

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




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

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

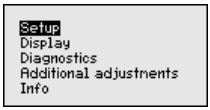
You can find the description of the individual menu items in the following chapter "*Parameter adjustment - Extended adjustment*".

## 6.4 Parameter adjustment - Extended adjustment

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


**Main menu**

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




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

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

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

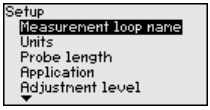
**Additional adjustments:** Reset, date/time, reset, copy function

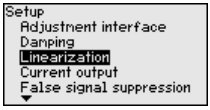
**Info:** Instrument name, hardware and software version, date of manufacture, instrument features

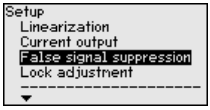
**Note:**
For optimum adjustment of the measuring point, the individual submenu items in the main menu item "*Setup*" should be selected one after the other and provided with the correct parameters. If possible, go through the items in the given sequence.

The procedure is described below.

The following submenu points are available:



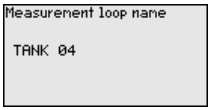

The submenu points are described below.

**Setup - Measurement loop name**

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

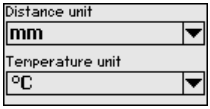
You can enter names with max. 19 characters. The character set comprises:

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




**Setup - Units**

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

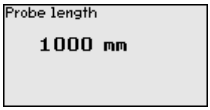


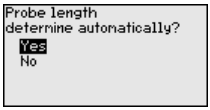

For the distance units you can choose between m, mm and ft and for the temperature units °C, °F and K.

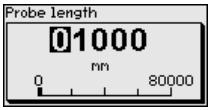
**Setup - Probe length**

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.

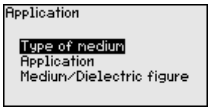


**Setup - Application - Type of medium**

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



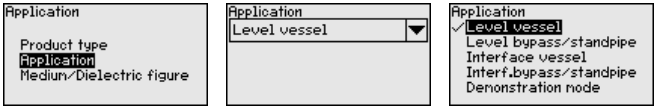

**Setup - Application - Application**

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

**Note:**

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

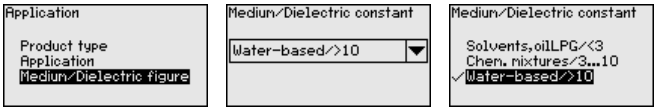
You have the option of choosing the demonstration mode. This mode is only suitable for test and demonstration purposes. In this mode, the sensor ignores the parameters of the application and reacts immediately to any change.




**Setup - Application - Medium, dielectric constant**

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

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



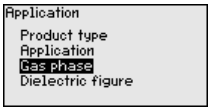

You can choose between the following medium types:

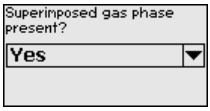
| Dielectric constant | Type of medium | Examples |
|---|---|---|
| > 10 | Water-based liquids | Acids, alcalis, water |
| 3 … 10 | Chemical mixtures | Chlorobenzene, nitro lacquer, aniline, isocyanate, chloroform |
| < 3 | Hydrocarbons | Solvents, oils, liquid gas |

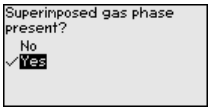
**Setup - Application - Gas phase**

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

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

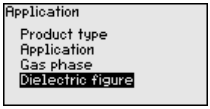


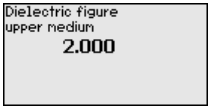



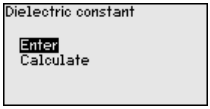




**Setup - Application - Dielectric constant**

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

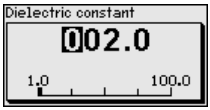


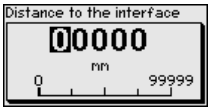




You can directly enter the dielectric constant of the upper medium or have the value determined by the instrument.

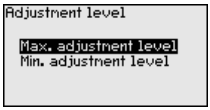
If you want the dielectric constant to be determined by the instrument, you have to enter the measured or known distance to the interface.

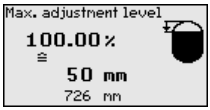


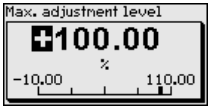

**Setup - Max. adjustment Level**

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

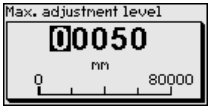



Adjust the requested percentage value with ***[+]*** and store with ***[OK]***.

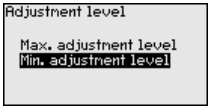


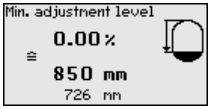

Enter the appropriate distance value in m (corresponding to the percentage value) for the full vessel. The distance refers to the sensor reference plane (seal surface of the process fitting). Keep in mind that the max. level must lie below the dead band.



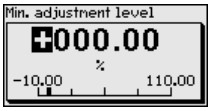

**Setup - Min. adjustment Level**

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

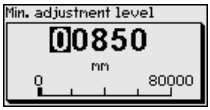



Adjust the requested percentage value with ***[+]*** and store with ***[OK]***.

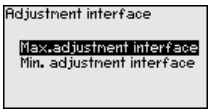


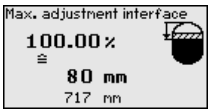

Enter the suitable distance value in m for the empty vessel (e.g. distance from the flange to the probe end) corresponding to the percentage value. The distance refers tot he sensor reference plane (seal surface of the process fitting).




**Setup - Max. adjustment - Interface**

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

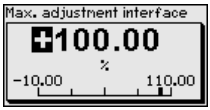


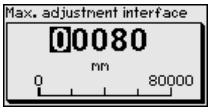




Enter the requested percentage value for the max. adjustment.

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

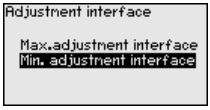
Enter the respective distance value in m for the surface of the upper medium corresponding to the percentage value.

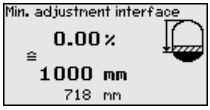



**Setup - Min. adjustment - Interface**

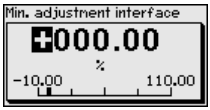
This menu item is only available if you have selected interface measurement under the menu item "*Application*".

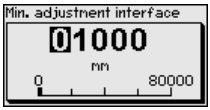



Enter the requested percentage value for the min. adjustment (interface).

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

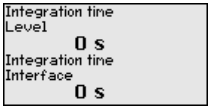


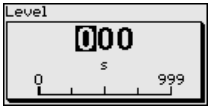



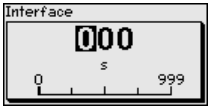

**Setup - Damping**

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

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



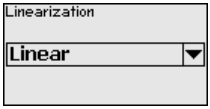



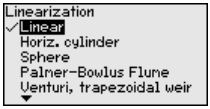

The default setting is a damping of 0 s.

**Setup - Linearisation**

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

The linearisation applies to the measured value indication and the 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 setting the switching point on the limit signal transmitter.

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

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

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

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

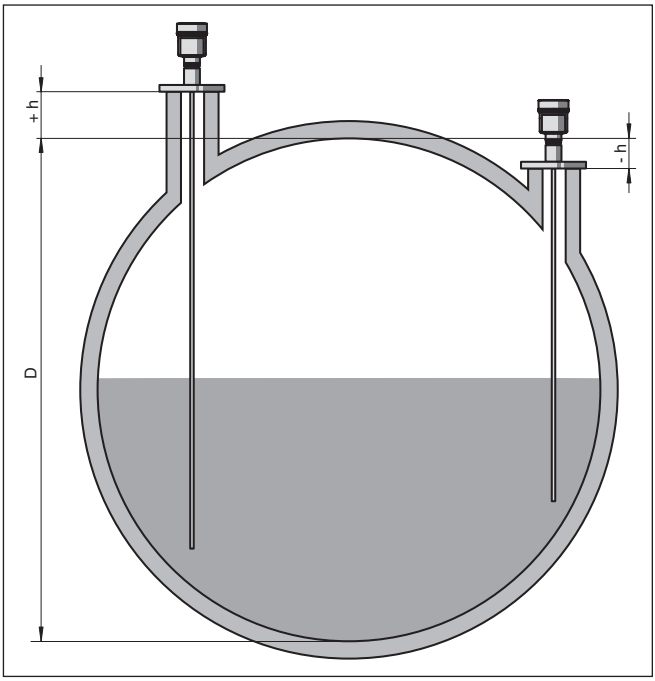
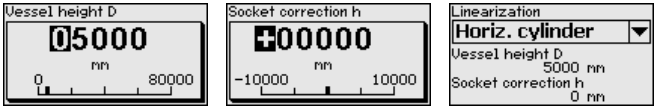


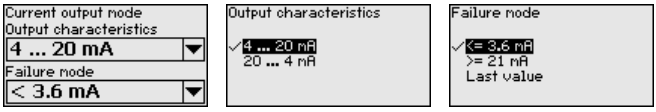

*Fig. 17: Vessel height and socket correction value*

*D Vessel height*
*+h Positive socket correction value*
*-h Negative socket correction value*




**Setup - Current output, mode**

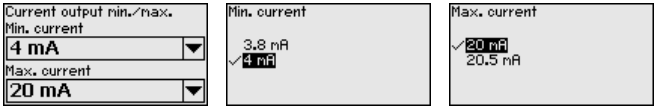
In the menu item "*Current output mode*" you determine the output characteristics and reaction of the current output in case of fault.




The default setting is output characteristics 4 … 20 mA, fault 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.

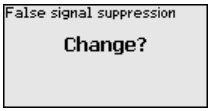
**Setup - False signal suppression**

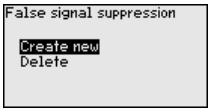
The following circumstances cause interfering reflections and can influence the measurement:

- High mounting sockets
- Vessel internals such as struts

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

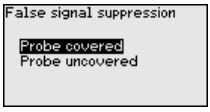
Proceed as follows:

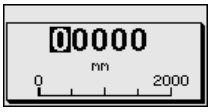



Select first if the probe is covered or uncovered.

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



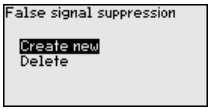




All interfering signals in this section are detected by the sensor and stored.

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

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

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




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

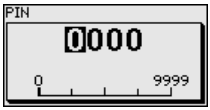
The menu item "*Delete*" is used to completely delete an already created false signal suppression. This is useful if the saved false signal suppression no longer matches the metrological conditions in the vessel.

**Lock/unlock setup - Adjustment**

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

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

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


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

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

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

**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.

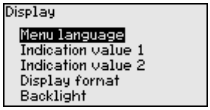
In menu item"*Current output 2*" you specify which measured value the additional current output refers to.

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 one after the other and provided with the correct parameters to ensure optimum adjustment of the display options. The procedure is described in the following.

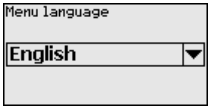
The following submenu points are available:

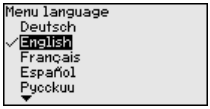



The submenu points are described below.

**Display - Menu language**

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

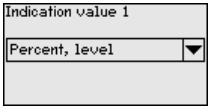



In delivery status, the sensor is set to English.

**Display - Displayed value 1**

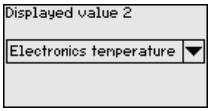
In this menu item, you define the indication of the measured value on the display. You can display two different measured values. In this menu item, you define measured value 1.




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

**Display - Displayed value 2**

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

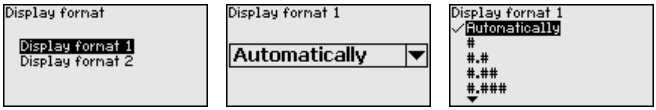



The default setting for the displayed value 2 is the electronics temperature.

**Display - Display format**

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

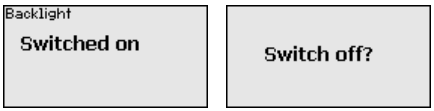
You can thus define the number of decimal positions the measured value is displayed with.




The default setting for the display format is "*Automatic*".

**Display - Backlight**

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

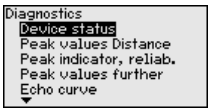



In delivery status, the lighting is switched on.

**Diagnostics - Device status**

In this menu item, the device status is displayed.

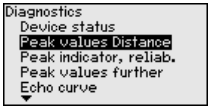
When the instrument displays a failure message, you can here get detailed information on the failure reason.

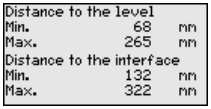


**Diagnostics - Peak values, Distance**

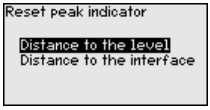
The respective min. and max. measured value is saved in the sensor. The two values are displayed in the menu item "*Peak values, distance*".

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




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

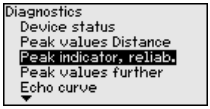


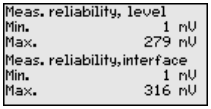

**Diagnostics - Peak values Measurement certainty**

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

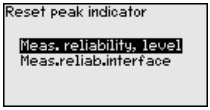
The measurement can be influenced by the process conditions. In this menu item, the measurement certainty of the level measurement is displayed in mV. The higher the value, the more reliable the measurement.

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



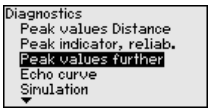

In another window you can carry out a reset of the two peak values separately.

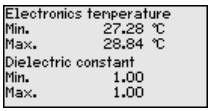



**Diagnostics - Peak values, Additional**

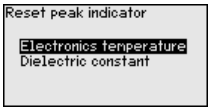
The respective min. and max. measured values are saved in the sensor. The values are displayed in the menu item "*Peak values Additional*".

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



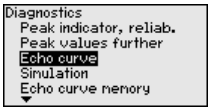
In another window you can carry out a reset of the two peak values separately.

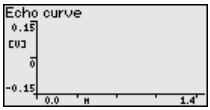



**Information:**
If one of the display values flashes, there is actually no valid value available.

**Diagnostics - Echo curve**

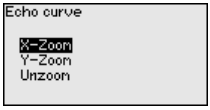
The menu item "*Echo curve*" shows the signal strength of the echoes over the measuring range in V. The signal strength enables an evaluation of the quality of the measurement.

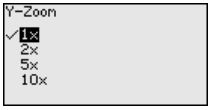



With the following functions you can zoom part sections of the echo curve.

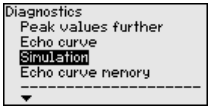
- "X-Zoom": Zoom function for the meas. distance
- "Y-Zoom": 1, 2, 5 and 10x signal magnification in "*V*"
- "Unzoom": Reset the presentation to the nominal measuring range without magnification

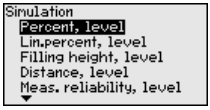


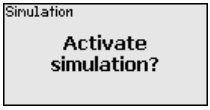

**Diagnosis - Simulation**

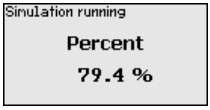
In this menu item you can simulate measured values via the current output. This allows the signal path to be tested, e.g. through downstream indicating instruments or the input card of the control system.

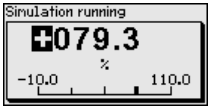



Select the requested simulation variable and set the requested value.




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

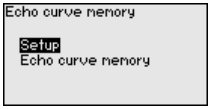
Push the ***[ESC]*** key to deactivate the simulation.

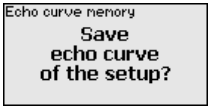
**Information:**
The simulation is terminated automatically 60 minutes after the activation of the simulation.

**Diagnostics - Echo curve memory**

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

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



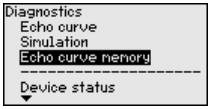



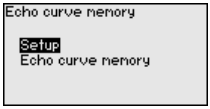

The function "*Echo curve memory*" enables storing echo curves of the measurement.

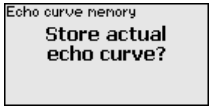
Under the sub-menu item "*Echo curve memory*" you can store the current echo curve.

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

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



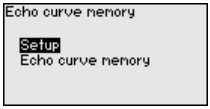



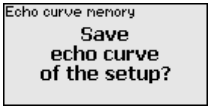




**Diagnostics - Echo curve memory**

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

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



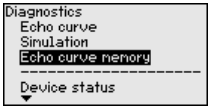



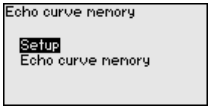

The function "*Echo curve memory*" enables storing echo curves of the measurement.

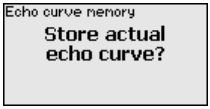
Under the sub-menu item "*Echo curve memory*" you can store the current echo curve.

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

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




**Additional settings - Reset**

After a reset, certain parameter adjustments made by the user are reset.

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


The following reset functions are available:

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

**Basic settings:** Restores the parameter settings, incl. special parameters, to the default values of the respective instrument. Any stored false signal suppression or user-programmed linearisation curve, as well as the measured value memory, are deleted.

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

**Menu - Setup**

| Menu | Menu item | Default value |
|---|---|---|
| Setup | Lock adjustment | Released |
| | Measurement loop name | Sensor |
| | Units | Distance unit: order-specific<br>Temperature unit: order-specific |
| | Probe length | Länge der Messsonde factory setting |
| | Type of medium | Liquid |
| | Application | Level, vessel |
| | Medium, dielectric constant | Water-based, > 10 |
| | Superimposed gas phase | Yes |
| | Dielectric constant, upper medium (TS) | 1.5 |
| | Tube inner diameter | 200 mm |

| Menu | Menu item | Default value |
|---|---|---|
| Setup | Max. adjustment - Level | 100 %<br>Distance: 0.000 m(d) - note blocking distances |
| | Min. adjustment - Level | 0 %<br>Distance: Probe length - take dead band into account |
| | Max. adjustment - Interface | 100 %<br>Distance: 0.000 m(d) - note blocking distances |
| | Min. adjustment - Interface | 0 %<br>Distance: Probe length - take dead band into account |
| Setup | Damping - Level | 0.0 s |
| | Damping - Interface | 0.0 s |
| Setup | Linearisation type | Linear |
| | Linearisation - Socket correction | 0 mm |
| | Linearisation - Vessel height | Probe length |
| Setup | Scaling variable - Level | Volume in l |
| | Scaling unit - Level | Litres |
| | Scaling format - Level | Without decimal positions |
| | Scaling level - 100 % corresponds to | 100 |
| | Scaling level - 0 % corresponds to | 0 |
| | Scaling variable - Interface | Volume |
| | Scaling unit - Interface | Litres |
| | Scaling format - Interface | Without decimal positions |
| | Scaling interface - 100 % corresponds to | 100 |
| | Scaling interface - 0 % corresponds to | 0 |
| Setup | Current output, output variable | Lin. percent - Level |
| | Current output - Output characteristics | 0 … 100 % correspond to 4 … 20 mA |
| | Current output - Reaction in case of fault | ≤ 3.6 mA |
| | Current output - Min. | 3.8 mA |
| | Current output - Max. | 20.5 mA |
| | Current output 2 - Output variable | Distance - Level |
| | Current output 2 - Output characteristics | 0 … 100 % correspond to 4 … 20 mA |
| | Current output 2 - Reaction in case of fault | ≤ 3.6 mA |
| | Current output 2 - Min. | 3.8 mA |
| | Current output 2 - Max. | 20.5 mA |

### Menu - Display

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

### Menu - Additional adjustments

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

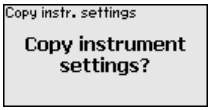
**Additional settings - Copy instrument settings**

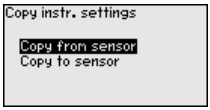
The instrument settings are copied with this function. The following functions are available:

- 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



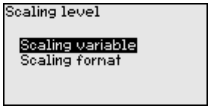

The copied data are permanently saved in an EEPROM memory in the display and adjustment module and remain there even in case of power failure. From there, they can be written into one or more sensors or kept as backup for a possible electronics exchange.

**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.

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

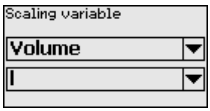
**Additional settings - Scaling level**

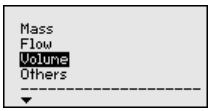
Since scaling is very extensive, scaling of the level value was divided into two menu items.




**Additional settings - Scaling level - Scaling variable**

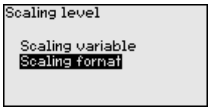
In menu item "*Scaling variable*" you define the scaling variable and the scaling unit for the level value on the display, e.g. volume in l.

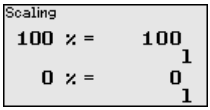


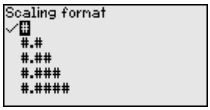


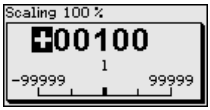
**Additional settings - Scaling level - Scaling format**

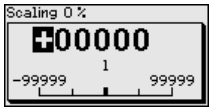



In menu item "*Scaling format*" you define the scaling format on the display and the scaling of the measured level value for 0 % and 100 %.

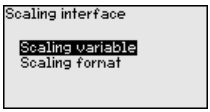


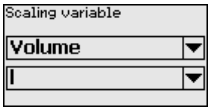

**Additional settings - Scaling interface**

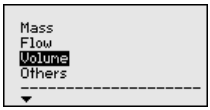
Since scaling is very extensive, scaling of the interface value was divided into two menu items.




**Additional settings - Scaling interface - Scaling variable**

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

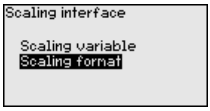


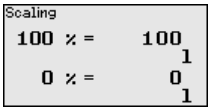



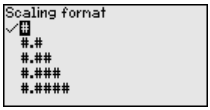


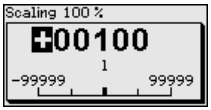
**Additional settings - Scaling interface - Scaling format**

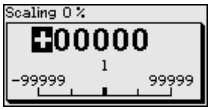
In menu item "*Scaling format*" you define the scaling format on the display and the scaling of the measured interface value for 0 % and 100 %.



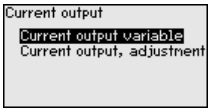



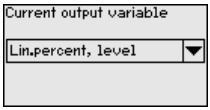

**Additional settings - Current output**

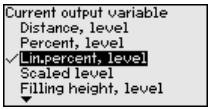
Since scaling is very extensive, scaling of the level value was divided into two menu items.




**Additional settings - Current output - Current output, meas. variable**

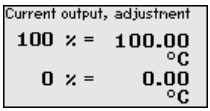
In menu item "*Current output, variable*" you specify which measured variable the current output refers to.

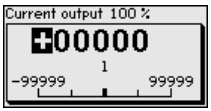


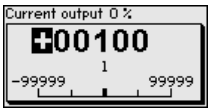




**Additional settings - Current output - Current output, adjustment**

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

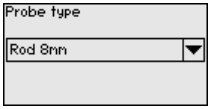


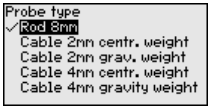




**Additional settings - Probe type**

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



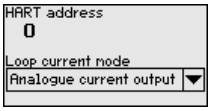

**Additional settings - HART mode**

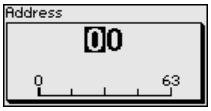
The sensor offers the HART modes "*Analogue current output*" and "*Fix current (4 mA)*". In this menu item you determine the HART mode and enter the address with Multidrop mode.

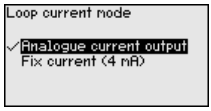
In the mode "*Fixed current output*" up to 63 sensors can be operated on one two-wire cable (Multidrop operation). An address between 0 and 63 must be assigned to each sensor.

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 settings - 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.

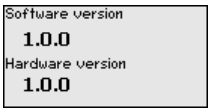
Change the settings of the special parameters only after having contacted our service staff.


**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.

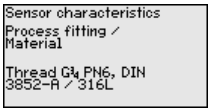


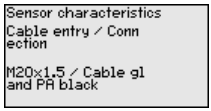

**Info - Factory calibration date**

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.


Example for displayed sensor features.

## 6.5 Saving the parameterisation data

**Backup on paper**

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

**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 menu item "*Copy device settings*" in the menu "*Additional settings*". 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*"
- The items "*Sensor-specific units, temperature unit and linearisation*" in the menu "*Additional settings*".
- The values of the user-programmable linearisation 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 device settings*".

# 7 Setup with PACTware

## 7.1 Connect the PC

**Via the interface adapter directly on the sensor**

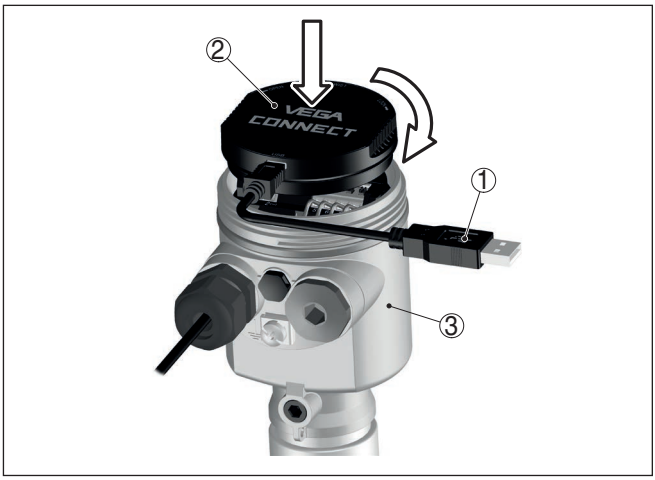



*Fig. 18: Connection of the PC directly to the sensor via the interface adapter*

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

**Connection via HART**

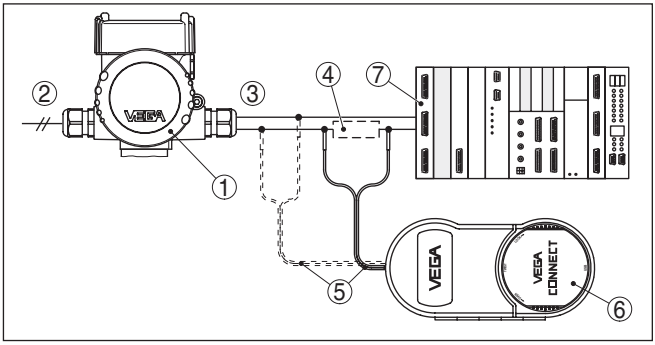



*Fig. 19: Connecting the PC via HART to the signal cable*

*1 VEGAFLEX 81*
*2 Voltage supply*
*3 4 … 20 mA signal output*
*4 HART resistance approx. 250 Ω (optional depending on processing)*
*5 Connection cable with 2 mm pins and terminals*
*6 VEGACONNECT*
*7 Processing system/PLC*

Necessary components:

- VEGAFLEX 81

- PC with PACTware and suitable VEGA DTM
- VEGACONNECT
- HART resistance approx. 250 Ω
- Processing system/PLC

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

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

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

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

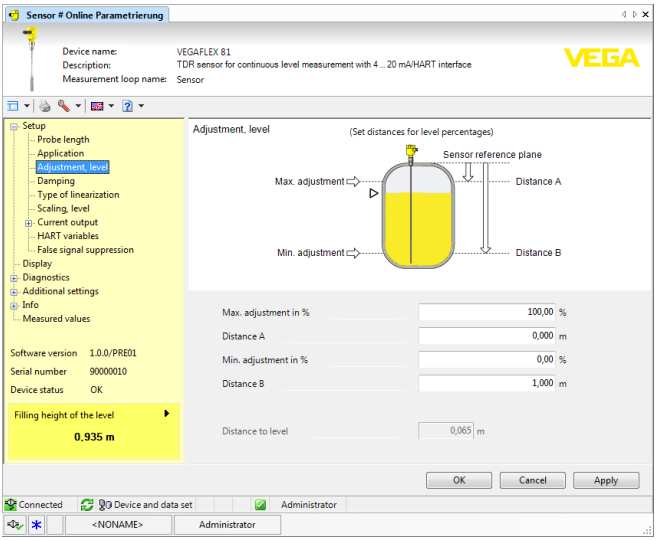



*Fig. 20: Example of a DTM view*

**Standard/Full version**

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

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

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

## 7.3 Set up with the quick setup

**General information**

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

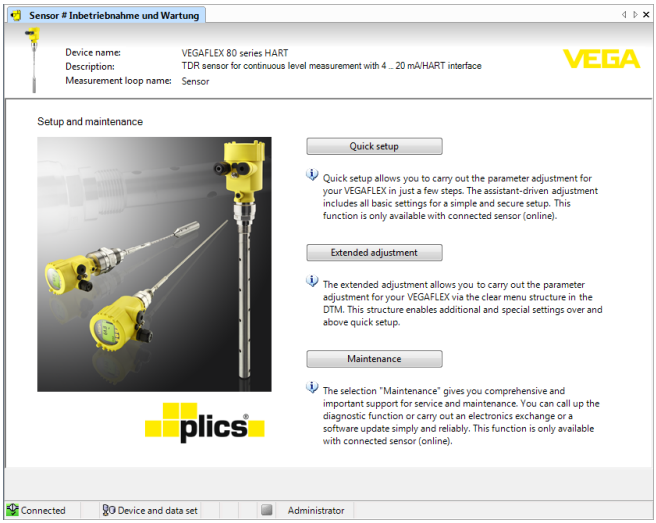



*Fig. 21: Select quick setup*

*1 Quick setup*
*2 Extended adjustment*
*3 Maintenance*

**Quick setup**
With quick setup you can carry out the parameter adjustment of VEGAFLEX 81 for your application in just a few simple steps. The assistant-driven adjustment includes the basic settings for simple, reliable setup and commissioning.

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

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

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

**Start quick setup**

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

## 7.4 Saving the parameterisation data

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

# 8 Set up with other systems

## 8.1 DD adjustment programs

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

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

## 8.2 Field Communicator 375, 475

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

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

# 9 Diagnostics and servicing

## 9.1 Maintenance

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

## 9.2 Diagnosis memory

The instrument has several memories available for diagnostic purposes. The data remain there even in case of voltage interruption.

**Measured value memory**

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

- Distance
- Filling height
- Percentage value
- Lin. percent
- Scaled
- Current value
- 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
- Control system with EDD

- Display and adjustment module

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

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

## 9.3 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:

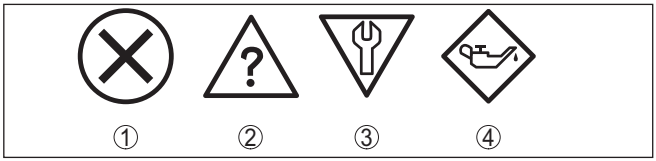



*Fig. 22: Pictographs of the status messages*

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

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

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

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

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

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

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

**Maintenance:** Due to external influences, the instrument function is limited. The measurement is affected, but the measured value is still valid. Plan in maintenance for the instrument because a failure is expected in the near future (e.g. due to buildup).

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

**Failure**

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

| Code<br>Text message | Cause | Rectification | DevSpec State in CMD 48 |
|---|---|---|---|
| F013<br>no measured value available | ● Sensor does not detect an echo during operation<br>● Process component or probe contaminated or defective | ● Check for correct mounting and/or parameter settings<br>● Clean or exchange process component or probe | Bit 0 of Byte 0 … 5 |
| F017<br>Adjustment span too small | ● Adjustment not within specification | ● Change adjustment according to the limit values (difference between min. and max. ≥ 10 mm) | Bit 1 of Byte 0 … 5 |
| F025<br>Error in the linearization table | ● Index markers are not continuously rising, for example illogical value pairs | ● Check values of the linearization table<br>● Delete/create a new linearization table | Bit 2 of Byte 0 … 5 |
| F036<br>No operable software | ● Failed or interrupted software update | ● Repeat software update<br>● Check electronics version<br>● Exchanging the electronics<br>● Send instrument for repair | Bit 3 of Byte 0 … 5 |
| F040<br>Error in the electronics | ● Hardware defect | ● Exchanging the electronics<br>● Send instrument for repair | Bit 4 of Byte 0 … 5 |
| F041<br>Probe loss | ● Probe mechanically defective | ● Check probe and exchange, if necessary | Bit 13 of Byte 0 … 5 |
| F080<br>General software error | ● General software error | ● Disconnect operating voltage briefly | Bit 5 of Byte 0 … 5 |
| F105<br>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<br>● Duration depending on the version and parameter adjustment max. 5 min. | Bit 6 of Byte 0 … 5 |
| F113<br>Communication error | ● EMC interference<br>● Transmission error during external communication with 4-wire power supply unit | ● Remove EMC influences<br>● Exchange 4-wire power supply unit or electronics | Bit 12 of Byte 0 … 5 |
| F260<br>Error in the calibration | ● Error in the calibration carried out in the factory<br>● Error in the EEPROM | ● Exchanging the electronics<br>● Send instrument for repair | Bit 8 of Byte 0 … 5 |
| F261<br>Error in the instrument settings | ● Error during setup<br>● Error when carrying out a reset<br>● False signal suppression faulty | ● Carry out a reset<br>● Repeat setup | Bit 9 of Byte 0 … 5 |

| Code<br>Text message | Cause | Rectification | DevSpec State in CMD 48 |
|---|---|---|---|
| F264<br>Installation/ Setup error | ● Error during setup | ● Check for correct mounting and/or parameter settings<br>● Check probe length | Bit 10 of Byte 0 … 5 |
| F265<br>Measurement function disturbed | ● Sensor no longer carries out a measurement | ● Carry out a reset<br>● Disconnect operating voltage briefly | Bit 11 of Byte 0 … 5 |
| F267<br>No executable sensor software | ● Sensor cannot start | ● Exchanging the electronics<br>● Send instrument for repair | No communication possible |

**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<br>Text message | Cause | Rectification | DevSpec<br>State in CMD 48 |
|---|---|---|---|
| C700<br>Simulation active | ● A simulation is active | ● Finish simulation<br>● 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<br>Text message | Cause | Rectification | DevSpec State in CMD 48 |
|---|---|---|---|
| S600<br>Impermissible electronics temperature | ● Temperature of the processing electronics in the non-specified section | ● Check ambient temperature<br>● Insulate electronics<br>● Use instrument with higher temperature range | Bit 8 of Byte 14 … 24 |
| S601<br>Overfilling | ● Level echo in the close range not available | ● Reduce level<br>● 100 % adjustment: Increase value<br>● Check mounting socket<br>● Remove possible interfering signals in the close range<br>● Use coaxial probe | Bit 9 of Byte 14 … 24 |
| S602<br>Level within the search range, compensation echo | ● Compensation echo superimposed by medium | ● 100 % adjustment: Increase value | Bit 10 of Byte 14 … 24 |

| Code<br>Text message | Cause | Rectification | DevSpec State in CMD 48 |
|---|---|---|---|
| S603<br>Impermissible operating voltage | ● Operating voltage below specified range | ● Check electrical connection<br>● 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<br>Text message | Cause | Rectification | DevSpec State in CMD 48 |
|---|---|---|---|
| M500<br>Error in the delivery status | ● The data could not be restored during the reset to delivery status | ● Repeat reset<br>● Load XML file with sensor data into the sensor | Bit 0 of Byte 14 … 24 |
| M501<br>Error in the non-active linearisation table | ● Index markers are not continuously rising, for example illogical value pairs | ● Check linearisation table<br>● Delete table/Create new | Bit 1 of Byte 14 … 24 |
| M504<br>Error at a device interface | ● Hardware defect | ● Exchanging the electronics<br>● Send instrument for repair | Bit 4 of Byte 14 … 24 |
| M505<br>no measured value available | ● Sensor does not detect an echo during operation | ● Check and correct mounting and/or parameter adjustment | Bit 5 of Byte 14 … 24 |
| | ● Process component or probe contaminated or defective | ● Clean or exchange process component or probe | |
| M506<br>Installation/ Setup error | ● Error during setup | ● Check and correct mounting and/or parameter adjustment<br>● Check probe length | Bit 6 of Byte 14 … 24 |
| M507<br>Error in the instrument settings | ● Error during setup<br>● Error when carrying out a reset<br>● False signal suppression faulty | ● Carry out reset and repeat setup | Bit 7 of Byte 14 … 24 |

## 9.4 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 via the adjustment device
- Checking the output signal
- Treatment of measurement errors

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

### Check the 4 … 20 mA signal

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

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

### Treatment of measurement errors

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

- Constant level
- Filling
- Emptying

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

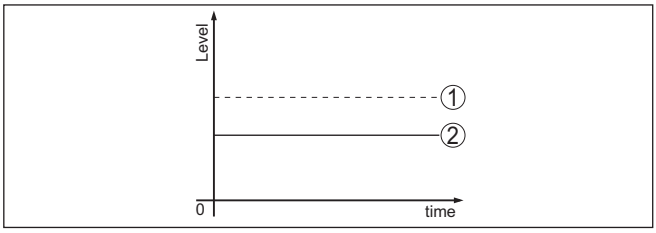
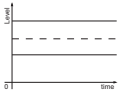
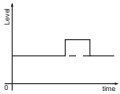



*Fig. 23: The broken line 1 shows the real level, the continuous line 2 shows the level displayed by the sensor*

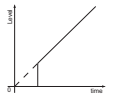
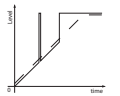
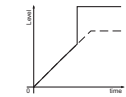
**Note:**

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

### Measurement error with constant level

| Fault description | Error pattern | Cause | Rectification |
|---|---|---|---|
| 1. Measured value shows a too low or too high level |  | ● Min./max. adjustment not correct | ● Adapt min./max. adjustment |
| | | ● Incorrect linearisation curve | ● Adapt linearisation 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<br>● 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 $\varepsilon_r < 2.5$ 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<br>● Check installation conditions<br>● 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<br>● Level echo too small | ● Eliminate false signals in the close range<br>● Remove contamination on the probe. After having removed the source of the false signals, the false signal suppression must be deleted.<br>● 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<br>● Carry out a new false signal suppression |

**Reaction after fault rectification**

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

**24 hour service hotline**

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

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

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

## 9.5 Exchanging the electronics module

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

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

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

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

- In the factory
- Or on site by the user

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

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

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

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

## 9.6 Software update

The following components are required to update the instrument software:

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

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

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

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

## 9.7 How to proceed if a repair is necessary

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

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

If a repair is necessary, please proceed as follows:

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

# 10 Dismount

## 10.1 Dismounting steps

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

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

## 10.2 Disposal

The instrument consists of materials which can be recycled by specialised recycling companies. We use recyclable materials and have designed the electronics 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 2012/19/EU**
This instrument is not subject to the WEEE directive 2012/19/EU and the respective national laws. Pass the instrument directly on to a specialised recycling company and do not use the municipal collecting points. These may be used only for privately used products according to the WEEE directive.

# 11 Supplement

## 11.1 Technical data

**General data**

| | |
|---|---|
| 316L corresponds to 1.4404 or 1.4435 | |
| Materials, wetted parts | |
| – Process fitting | 316L and PEEK, Alloy C22 (2.4602) and PEEK |
| – Process seal on the instrument side (rod leadthrough) | FKM (SHS FPM 70C3 GLT), FFKM (Kalrez 6375), EPDM (A+P 75.5/KW75F), silicone FEP coated (A+P FEP-O-SEAL) |
| – Process fitting - for volatile substances such as e.g. Ammonia | 316L |
| – Process seal (process side) - for volatile substances such as e.g. Ammonia | Borosilicate glass GPC 540 with 316L and Alloy C22 (2.4602)[2)] |
| – Process seal | On site (instruments with thread: Klingersil C-4400 is enclosed) |
| – Inner conductor (up to the separation rod) | 316L |
| – Spacers | PFA |
| – Tube: ø 21.3 mm (0.839 in) | 316L, Alloy C22 (2.4602), 304L |
| – Tube: ø 42.2 mm (1.661 in) | 316L, Alloy C22 (2.4602), 304L |
| Materials, non-wetted parts | |
| – Plastic housing | plastic PBT (Polyester) |
| – Aluminium die-cast housing | Aluminium die-casting AlSi10Mg, powder-coated - basis: Polyester |
| – Stainless steel housing (precision casting) | 316L |
| – Stainless steel housing (electropolished) | 316L |
| – Second Line of Defense (optional) | Borosilicate glass GPC 540 with 316L and Alloy C22 (2.4602) |
| – Seal between housing and housing lid | Silicone SI 850 R |
| – 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 |

[2)] Not suitable for hot steam applications.

| | |
|---|---|
| Second Line of Defense (optional) | |
| – The Second Line of Defense (SLOD) is a second level of the process separation in the form of a gas-tight feedthrough in the lower part of the housing, preventing product from penetrating into the housing. | |
| – Supporting material | 316L |
| – Glass potting | Borosilicate glass GPC 540 |
| – Contacts | Alloy C22 (2.4602) |
| – Helium leak rate | < $10^{-6}$ mbar l/s |
| – Pressure resistance | See process pressure of the sensor |
| Conductive connection | Between ground terminal, process fitting and probe |
| Process fittings - tube: ø 21.3 mm (0.839 in) | |
| – Pipe thread, cylindrical (ISO 228 T1) | G¾, G1, G1½ according to DIN 3852-A |
| – Pipe thread, conical (ASME B1.20.1) | ¾ NPT, 1 NPT, 1½ NPT |
| – Flanges | DIN from DN 25, ASME from 1" |
| Process fittings - tube: ø 42.2 mm (1.661 in) | |
| – Pipe thread, cylindrical (ISO 228 T1) | G1½ according to DIN 3852-A |
| – Pipe thread, conical (ASME B1.20.1) | 1½ NPT |
| – Flanges | DIN from DN 50, ASME from 2" |
| Weight | |
| – Instrument weight (depending on process fitting) | approx. 0.8 … 8 kg (0.176 … 17.64 lbs) |
| – Tube: ø 21.3 mm (0.839 in) | approx. 1110 g/m (11.9 oz/ft) |
| – Tube: ø 42.2 mm (1.661 in) | approx. 3100 g/m (33.3 oz/ft) |
| Probe length L (from seal surface) | |
| – Tube: ø 21.3 mm (0.839 in) | up to 6 m (19.69 ft) |
| – Tube: ø 42.2 mm (1.661 in) | up to 6 m (19.69 ft) |
| – Trimming accuracy - tube | ±1 mm |
| Lateral load | |
| – Tube: ø 21.3 mm (0.839 in) | 60 Nm (44 lbf ft) |
| – Tube: ø 42.2 mm (1.661 in) | 300 Nm (221 lbf ft) |
| Torque for NPT cable glands and Conduit tubes | |
| – Plastic housing | max. 10 Nm (7.376 lbf ft) |
| – Aluminium/Stainless steel housing | max. 50 Nm (36.88 lbf ft) |

**Input variable**

| | |
|---|---|
| Measured variable | Level of liquids |
| Min. dielectric constant of the medium | $\varepsilon_r \geq 1.4$ |

**Output variable**

| | |
|---|---|
| Output signals | 4 … 20 mA/HART - active; 4 … 20 mA/HART - passive |

| | |
|---|---|
| Range of the output signal | 3.8 … 20.5 mA/HART (default setting) |
| Terminal voltage passive | 9 … 30 V DC |
| Shortcircuit protection | Available |
| Potential separation | Available |
| Signal resolution | 0.3 µA |
| Fault signal, current output (adjustable) | Last valid measured value, ≥ 21.0 mA, ≤ 3.6 mA |
| Max. output current | 21 mA |
| Starting current | ≤ 3.6 mA |
| Load (4 … 20 mA/HART - active) | < 500 Ω |
| Damping (63 % of the input variable) | 0 … 999 s, adjustable |
| HART output values according to HART 7 (default setting)[3] | |
| – First HART value (PV) | Linearised percentage value, level |
| – Second HART value (SV) | Distance to the level |
| – Third HART value (TV) | Measurement certainty, level |
| – Fourth HART value (QV) | Electronics temperature |
| Indication value - Display and adjustment module[4] | |
| – Displayed value 1 | Filling height - Level |
| – Displayed value 2 | Electronics temperature |
| Resolution, digital | < 1 mm (0.039 in) |

**Accuracy (according to DIN EN 60770-1)**

| | |
|---|---|
| Process reference conditions according to DIN EN 61298-1 | |
| – Temperature | +18 … +30 °C (+64 … +86 °F) |
| – Relative humidity | 45 … 75 % |
| – Air pressure | +860 … +1060 mbar/+86 … +106 kPa (+12.5 … +15.4 psig) |
| Mounting, reference conditions | |
| – Min. distance to internal installations | > 500 mm (19.69 in) |
| – Vessel | metallic, ø 1 m (3.281 ft), centric mounting, process fitting flush with the vessel ceiling |
| – Medium | Water/Oil (dielectric constant ~2.0)[5] |
| – Mounting | Probe end does not touch the vessel bottom |
| Sensor parameter adjustment | No gating out of false signals carried out |

[3] The output values can be assigned individually.
[4] The indication values can be assigned individually.
[5] With interface measurement = 2.0.

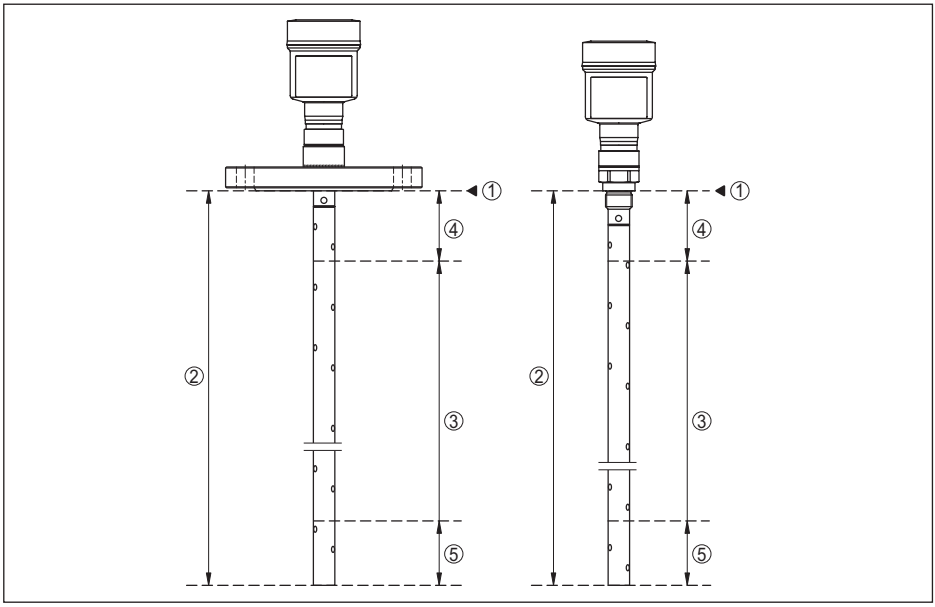



*Fig. 32: Measuring ranges - VEGAFLEX 81*

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

| | |
|---|---|
| Typical deviation - Interface measurement | ± 5 mm (0.197 in) |
| Typical deviation - Total level interface measurement | ± 5 mm (0.197 in) |
| Typical deviation - Level measurement[6)7)] | See following diagrams |

6) Depending on the mounting conditions, deviations can occur which can be rectified by adapting the adjustment or changing the measured value offset in the DTM service mode.
7) The dead bands can be optimized via a false signal suppression.

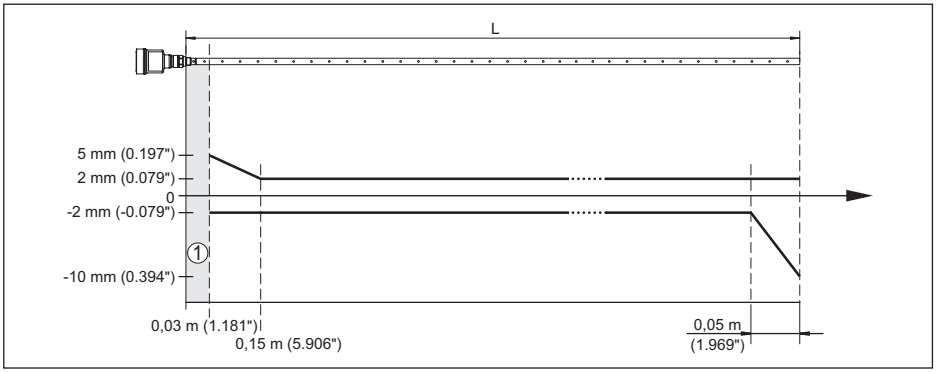



*Fig. 33: Deviation VEGAFLEX 81 in coaxial version in water*

*1 Dead band (no measurement possible in this area)*
*L Probe length*

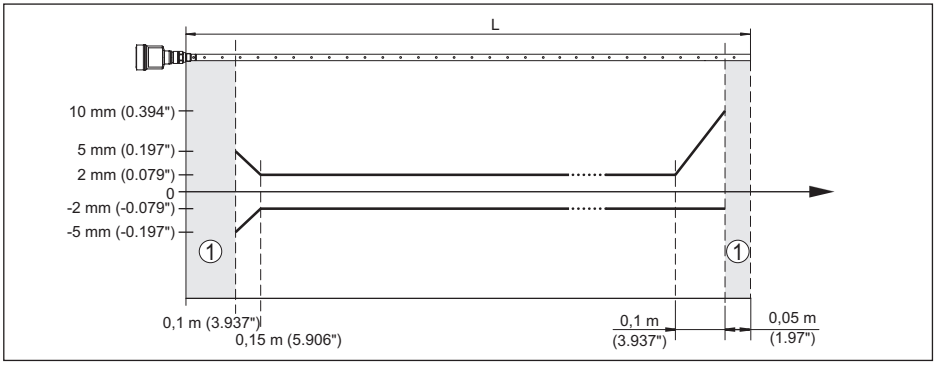



*Fig. 34: Deviation VEGAFLEX 81 in coaxial version in oil*

*1 Dead band (no measurement possible in this area)*
*L Probe length*

| | |
|---|---|
| Repeatability | ≤ ±1 mm |

## Variables influencing measurement accuracy

### Specifications for the digital measured value

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

### Specifications apply also to the current output[8)]

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

Deviation in the current output due to digital/analogue conversion

| | |
|---|---|
| – Non-Ex and Ex-ia version | < ±15 µA |
| – Ex-d-ia version | < ±40 µA |

[8)] Also for the additional current output (optional).

| | |
|---|---|
| Additional deviation through electromagnetic interference acc. to EN 61326 | < ±150 µA |

## Influence of the superimposed gas and pressure on measurement accuracy

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

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

| Gas phase | Temperature | Pressure | | |
|---|---|---|---|---|
| | | 1 bar (14.5 psig) | 10 bar (145 psig) | 50 bar (725 psig) |
| Air | 20 °C (68 °F) | 0 % | 0.22 % | 1.2 % |
| | 200 °C (392 °F) | -0.01 % | 0.13 % | 0.74 % |
| | 400 °C (752 °F) | -0.02 % | 0.08 % | 0.52 % |
| Hydrogen | 20 °C (68 °F) | -0.01 % | 0.1 % | 0.61 % |
| | 200 °C (392 °F) | -0.02 % | 0.05 % | 0.37 % |
| | 400 °C (752 °F) | -0.02 % | 0.03 % | 0.25 % |
| Steam (saturated steam) | 100 °C (212 °F) | 0.26 % | - | - |
| | 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[9] | ≤ 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

| | |
|---|---|
| – Standard version | -1 … +40 bar/-100 … +4000 kPa (-14.5 … +580 psig), depending on the process fitting |

[9] 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).

| | |
|---|---|
| – with borosilicate glass leadthrough | -1 … +100 bar/-100 … +10000 kPa (-14.5 … +1450 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 (thread or flange temperature)

| | |
|---|---|
| – 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) | -20 … +150 °C (-4 … +302 °F) |
| – FFKM (Kalrez 6375) | -20 … +200 °C (-4 … +392 °F) |
| – with borosilicate glass leadthrough | -60 … +150 °C (-76 … +302 °F) |

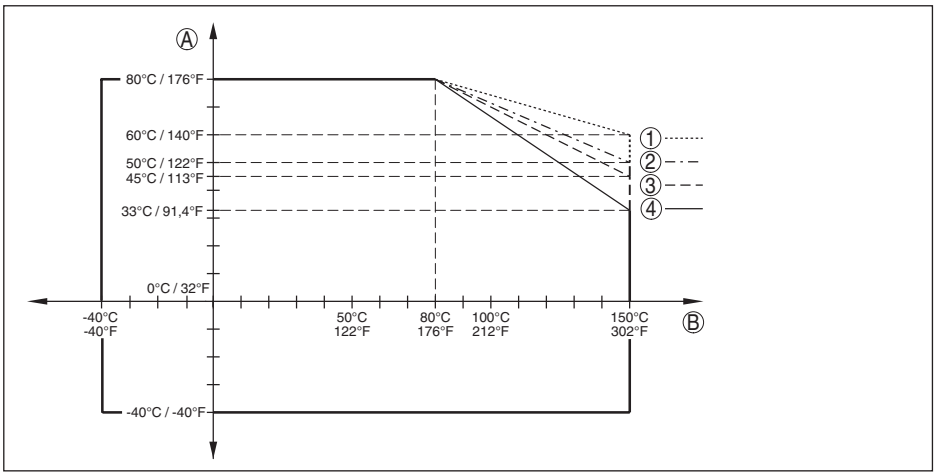



*Fig. 35: Ambient temperature - process temperature, standard version*

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

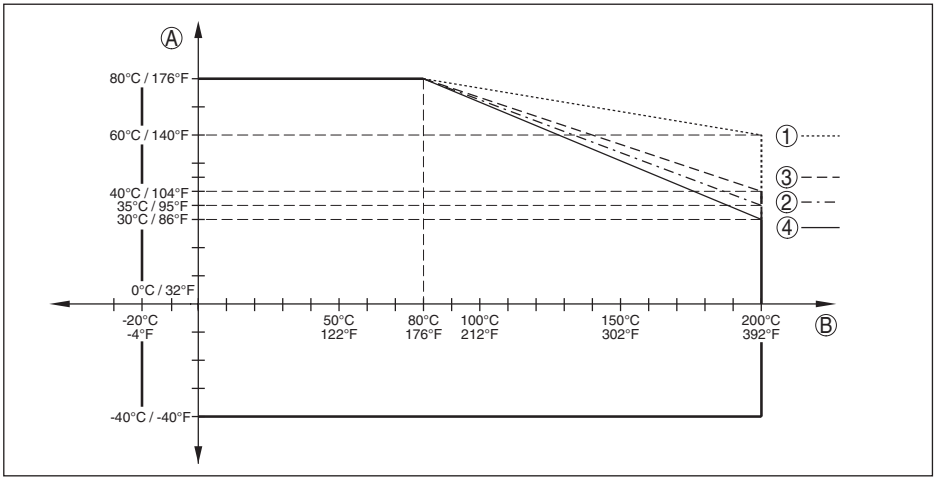



*Fig. 36: Ambient temperature - process temperature, version with temperature adapter*

*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)*

| | |
|---|---|
| Viscosity - dynamic | 0.1 … 500 mPa s (requirement: with density 1) |
| Vibration resistance | |
| – Coax probe | 1 g with 5 … 200 Hz according EN 60068-2-6 (vibration at resonance) with tube length 50 cm (19.69 in) |
| Shock resistance | |
| – Coax probe | 25 g, 6 ms according to EN 60068-2-27 (mechanical shock) with tube length 50 cm (19.69 in) |

**Electromechanical data - version IP 66/IP 67**

| | |
|---|---|
| Cable gland | M20 x 1.5 or ½ NPT |
| Wire cross-section (spring-loaded terminals) | |
| – Massive wire, stranded wire | 0.2 … 2.5 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 | ***[OK]***, ***[->]***, ***[+]***, ***[ESC]*** |
| – Switch | Bluetooth On/Off |

| | |
|---|---|
| Bluetooth interface | |
| – Standard | Bluetooth smart |
| – Effective range | 25 m (82.02 ft) |
| Protection rating | |
| – unassembled | IP 20 |
| – mounted in the housing without lid | IP 40 |
| Materials | |
| – Housing | ABS |
| – Inspection window | Polyester foil |
| Functional safety | SIL non-reactive |

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

| **Additional output parameter - Electronics temperature** | |
|---|---|
| Output of the values | |
| – Indication | Via the display and adjustment module |
| – 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 |
| Accuracy | ±3 K |

| **Bluetooth interface (optional)** | |
|---|---|
| Standard | Bluetooth smart |
| Effective range | 25 m (82.02 ft) |

| **Voltage supply** | |
|---|---|
| Operating voltage | |
| – Version for low voltage | 9.6 … 48 V DC, 20 … 42 V AC, 50/60 Hz |
| – Version for mains voltage | 90 … 253 V AC, 50/60 Hz |
| Reverse voltage protection | Integrated |
| Max. power consumption | 4 VA; 2.1 W |

| **Potential connections and electrical separating measures in the instrument** | |
|---|---|
| Electronics | Not non-floating |
| Ground terminal | Galvanically connected with the metal process fitting |
| Galvanic separation between electronics and metal housing parts | |
| – Reference voltage | 500 V AC |

| Electrical protective measures | |
|---|---|
| Protection, depending on housing version | |
| – Plastic housing | IEC 60529 IP 66/IP 67 (NEMA Type 4X) |
| – Aluminium housing; stainless steel housing - Precision casting | IEC 60529 IP 66/IP 68 (0.2 bar), NEMA Type 6P[10] |
| Overvoltage category (IEC 61010-1) - Version with low voltage | |
| Connection of the feeding power supply unit to networks of overvoltage category | III |
| Overvoltage category (IEC 61010-1) - Version with mains voltage | |
| – Altitude up to 2000 m (6562 ft) above sea level | III |
| – Altitude up to 5000 m (16404 ft) above sea level | III - Only with connected overvoltage protection |
| – Altitude up to 5000 m (16404 ft) above sea level | II |
| Pollution degree[11] | 4 |
| Protection rating (IEC 61010-1) | I |

**Approvals**

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

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

## 11.2 Dimensions

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

**Housing**

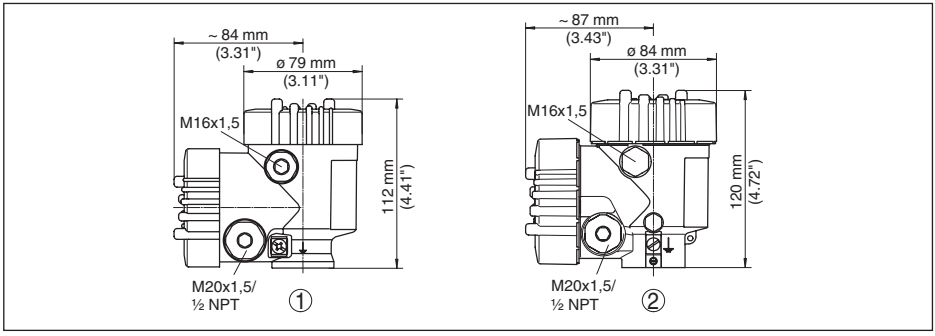



*Fig. 37: Dimensions of housing - with integrated display and adjustment module the housing is 9 mm/0.35 inches higher*

*1 Plastic double chamber*
*2 Aluminium/Stainless steel double chamber*

[10] The prerequisites for maintaining the protection rating are a suitable cable as well as correct mounting.
[11] When used with fulfilled housing protection.

**VEGAFLEX 81, coax version**

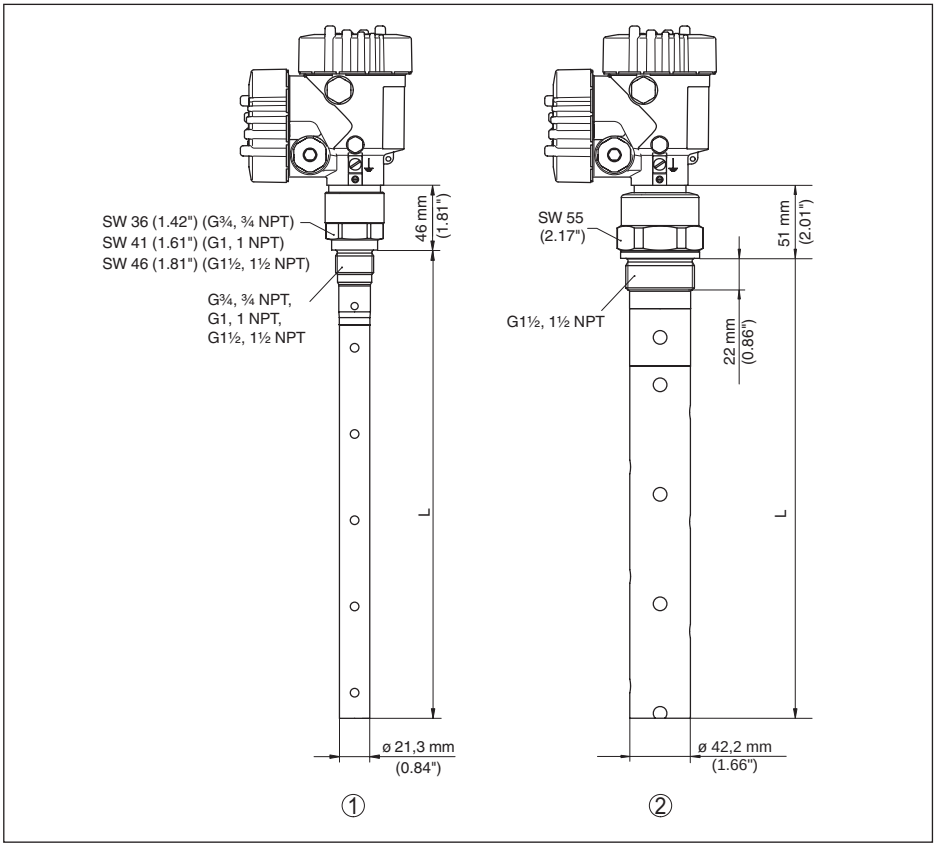



*Fig. 38: VEGAFLEX 81, threaded version*

*L Sensor length, see chapter "Technical data"*
*1 Coaxial version ø 21.3 mm (0.839 in)*
*2 Coaxial version ø 42.2 mm (1.661 in)*

## 11.3 Industrial property rights

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