# Operating Instructions

**Submersible pressure transmitter with metal measuring cell**

## VEGABAR 87

4 … 20 mA

Document ID: 45507

# Contents



45507-EN-220624

**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.

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# 1 About this document

## 1.1 Function

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

## 1.2 Target group

This operating instructions manual is directed to trained personnel. The contents of this manual must be made available to the qualified personnel and implemented.

## 1.3 Symbols used

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

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

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

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

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

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

**Ex applications**
This symbol indicates special instructions for Ex applications.

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

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

**Disposal**
This symbol indicates special instructions for disposal.

# 2 For your safety

## 2.1 Authorised personnel

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

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

## 2.2 Appropriate use

Model VEGABAR 87 is a pressure transmitter for level and gauge measurement.

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

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

## 2.3 Warning about incorrect use

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

## 2.4 General safety instructions

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

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

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

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

## 2.5 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.

The EU conformity declaration can be found on our homepage.

## 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

A Class 2 power supply unit has to be used for the installation in the USA and Canada.

## 2.8 Environmental instructions

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

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

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

# 3 Product description

## 3.1 Configuration

**Scope of delivery**

The scope of delivery encompasses:

- VEGABAR 87 pressure transmitter
- Ventilation valves, closing screws – depending on version (see chapter " *Dimensions*")

The further scope of delivery encompasses:

- Documentation
  - Quick setup guide VEGABAR 87
  - Test certificate for pressure transmitters
  - Instructions for optional instrument features
  - Ex-specific " *Safety instructions*" (with Ex versions)
  - If necessary, further certificates

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

**Scope of this operating instructions**

This operating instructions manual applies to the following instrument versions:

- Hardware from 1.0.0
- Software from 1.3.7

**Note:**
You can find the hardware and software version of the instrument as follows:

- On the type plate of the electronics module
- In the adjustment menu under " *Info*"

**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 *Product code*
2 *Field for approvals*
3 *Technical data*
4 *Serial number of the instrument*
5 *QR code*
6 *Symbol of the device protection class*
7 *ID numbers, instrument documentation*

**Serial number - Instrument search**

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

- Product code (HTML)
- Delivery date (HTML)
- Order-specific instrument features (HTML)
- Operating instructions and quick setup guide at the time of shipment (PDF)
- Test certificate (PDF) - optional

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

Alternatively, you can access the data via your smartphone:

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

## 3.2 Principle of operation

**Application area**

The VEGABAR 87 is a pressure transmitter for pressure and level measurements of liquids with higher temperatures in the chemical, food processing and pharmaceutical industry.

**Measured products**

Measured products are liquids.

Depending on the instrument version and the measurement setup, the measured products can be also viscous.

**Measured variables**

The VEGABAR 87 is suitable for the measurement of the following process variables:

- Level

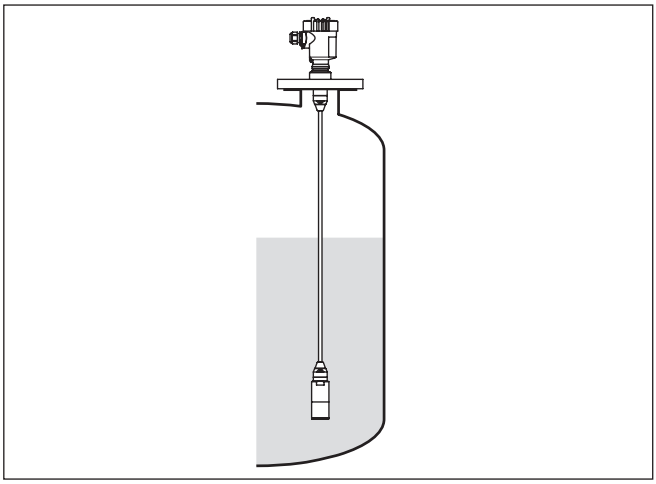


*Fig. 2: Level measurement with VEGABAR 87*

**Electronic differential pressure**

Depending on the version, the VEGABAR 87 is also suitable for electronic differential pressure measurement. For this, the instrument is combined with a Secondary Device.

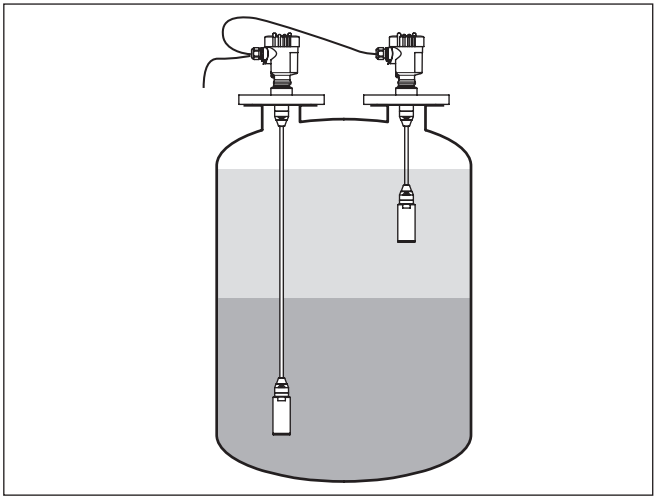


*Fig. 3: Electronic differential pressure measurement via a Primary/Secondary combination*

You can find detailed information in the operating instructions of the respective Secondary Device.

**Measuring system**

The process pressure acts on the sensor element via the stainless steel diaphragm and an internal transmission liquid. The process

pressure causes a resistance change which is converted into a corresponding output signal and output as measured value.

The METEC® measuring cell is the measuring unit. It consists of the ceramic-capacitive CERTEC® measuring cell and a special, temperature-compensated isolating system.

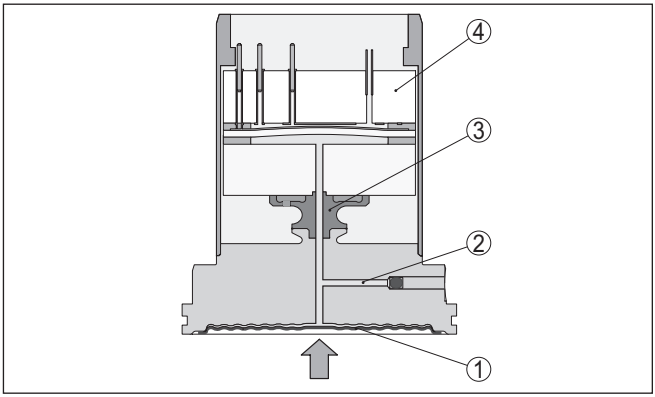



*Fig. 4: Configuration of the METEC® measuring cell with VEGABAR 87*

*1 Process diaphragm*
*2 Isolating liquid*
*3 FeNi adapter*
*4 CERTEC® measuring cell*

**Measuring system temperature**

Temperature sensors in the ceramic diaphragm and the ceramic base of the CERTEC® measuring cell detect the actual process temperature. The temperature value is output via:

- The display and adjustment module
- The current output or the additional current output
- The digital signal output

**Pressure types**

The measuring cell design depends on the selected pressure type.

**Relative pressure**: the measuring cell is open to the atmosphere. The ambient pressure is detected in the measuring cell and compensated. It thus has no influence on the measured value.

**Absolute pressure**: the measuring cell contains vacuum and is encapsulated. The ambient pressure is not compensated and does hence influence the measured value.

**Relative pressure, climate-compensated**: the measuring cell is evacuated and encapsulated. The ambient pressure is detected through a reference sensor in the electronics and compensated. It thus has no influence on the measured value.

**Seal concept**

The measuring system is completely welded and hence sealed against the process. The sealing of the process fitting against the process is carried out by a seal provided on site.

## 3.3 Packaging, transport and storage

**Packaging**

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

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

**Transport**

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

**Transport inspection**

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

**Storage**

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

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

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

**Storage and transport temperature**

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

**Lifting and carrying**

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

## 3.4 Accessories

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

**Display and adjustment module**

The display and adjustment module is used for measured value indication, adjustment and diagnosis.

The integrated Bluetooth module (optional) enables wireless adjustment via standard adjustment devices.

**VEGACONNECT**

The interface adapter VEGACONNECT enables the connection of communication-capable instruments to the USB interface of a PC.

**VEGADIS 82**

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

**Overvoltage protection**

The overvoltage arrester B81-35 is used instead of the terminals in the single or double chamber housing.

**Protective cover**

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

**Flanges**

Screwed flanges are available in different versions according to the following standards: DIN 2501, EN 1092-1, BS 10, ASME B 16.5, JIS B 2210-1984, GOST 12821-80.

**Welded socket, threaded and hygienic adapter**

Welded sockets are used to connect the devices to the process.

Threaded and hygienic adapters enable simple adaptation of devices with standard threaded fittings to process-side hygiene connections.

# 4 Mounting

## 4.1 General instructions

**Process conditions**

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

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

These are mainly:

- Active measuring component
- Process fitting
- Process seal

Process conditions in particular are:

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

**Protection against moisture**

Protect your instrument against moisture ingress through the following measures:

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

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

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

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

**Screwing in**

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

See chapter " *Dimensions*" for wrench size.

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

**Vibrations**

Avoid damages on the device by lateral forces, for example by vibrations. It is thus recommended to fix the devices with process fitting

thread G½ of plastic at the installation site via a suitable measuring instrument holder.

If there is strong vibration at the mounting location, the instrument version with external housing should be used. See chapter " *External housing*".

**Permissible process pressure (MWP) - Device**

The permissible process pressure range is specified on the type label with "MWP" (Maximum Working Pressure), see chapter " *Configuration*". This applies even if a measuring cell with a measuring range (order-related) higher than the permissible pressure range of the process fitting is installed.

In addition, a temperature derating of the process fitting, e. g. with flanges, can limit the permissible process pressure range according to the respective standard.

**Permissible process pressure (MWP) - Mounting accessory**

The permissible process pressure range is stated on the type label. The instrument should only be operated with these pressures if the mounting accessory used also fulfils these values. This should be ensured by suitable flanges, welded sockets, tension rings with Clamp connections, sealings, etc.

**Temperature limits**

Higher process temperatures often mean also higher ambient temperatures. Make sure that the upper temperature limits stated in chapter " *Technical data*" for the environment of the electronics housing and connection cable are not exceeded.

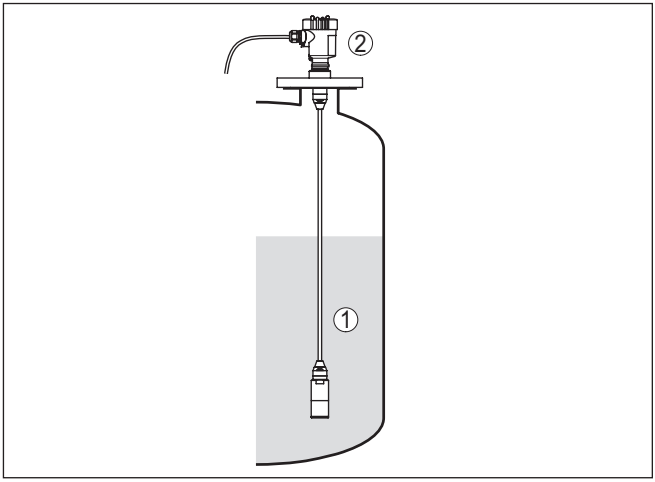



*Fig. 5: Temperature ranges*

*1 Process temperature*
*2 Ambient temperature*

**Transport and mounting protection**

Depending on the transmitter, the VEGABAR 87 is supplied with a protective cap or a transport and mounting protection.

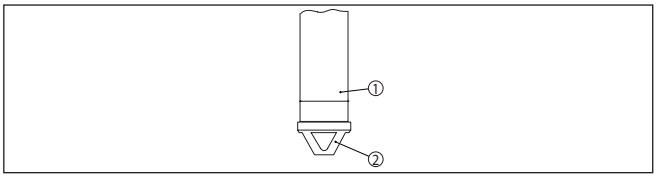



*Fig. 6: VEGABAR 87, transport and mounting protection*

*1 Transmitter*
*2 Transport and mounting protection*

Remove this protection after mounting and before setting up the instrument.

In case of slightly contaminated measured media, the transport and mounting protection can remain on the instrument as an impact protection during operation.

## 4.2 Ventilation and pressure compensation

**Filter element - Function**

The filter element in the electronics housing has the following functions:

- Ventilation of the electronics housing
- Atmospheric pressure compensation (with relative pressure measuring ranges)

**Caution:**
The filter element causes a time-delayed pressure compensation. When quickly opening/closing the housing cover, the measured value can change for approx. 5 s by up to 15 mbar.

For an effective ventilation, the filter element must be always free from buildup. In case of horizontal mounting, turn the housing so that the filter element points downward after the instrument is installed. This provides better protection against buildup.

**Caution:**
Do not use a high-pressure cleaner. The filter element could be damaged, which would allow moisture into the housing.

The following paragraphs describe how the filter element is arranged in the different instrument versions.

**Filter element - Position**

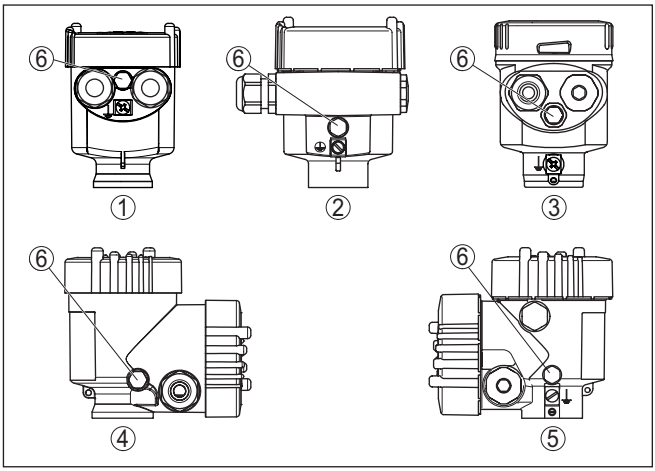



*Fig. 7: Position of the filter element*

*1 Plastic, stainless steel single chamber (precision casting)*
*2 Aluminium - single chamber*
*3 Stainless steel single chamber (electropolished)*
*4 Plastic double chamber*
*5 Aluminium, stainless steel double chamber housing (precision casting)*
*6 Filter element*

With the following instruments a blind plug is installed instead of the filter element:

- Instruments in protection IP66/IP68 (1 bar) - ventilation via capillaries in non-detachable cable
- Instruments with absolute pressure

**Filter element - Position Ex-d version**

→ Turn the metal ring in such a way that the filter element points downward after installation of the instrument. This provides better protection against buildup.

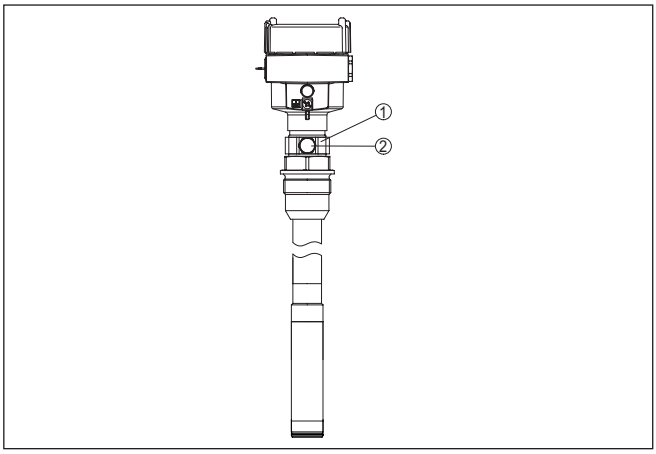



*Fig. 8: Position of the filter element - Ex-d version*

*1 Rotatable metal ring*
*2 Filter element*

With absolute pressure measuring ranges, a blind plug is used instead of the filter element.

**Filter element - Position Second Line of Defense**

The Second Line of Defense (SLOD) is a second level of the process separation in form of a gas-tight leadthrough in the housing neck, preventing products from penetrating into the housing.

With these instruments, the process assembly is completely encapsulated. An absolute pressure measuring cell is used so that no ventilation is required.

With relative pressure measuring ranges, the ambient pressure is detected and compensated by a reference sensor in the electronics.

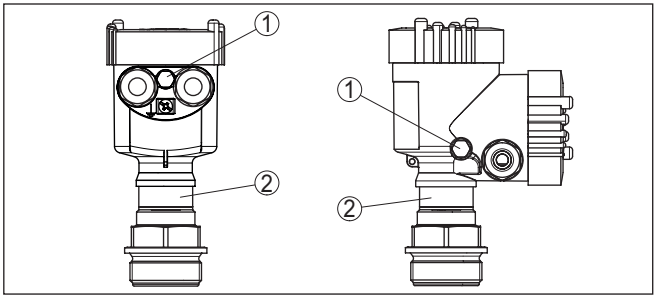



*Fig. 9: Position of the filter element - gastight leadthrough*

*1 Filter element*
*2 Gas-tight leadthrough*

**Filter element - Position IP69K version**

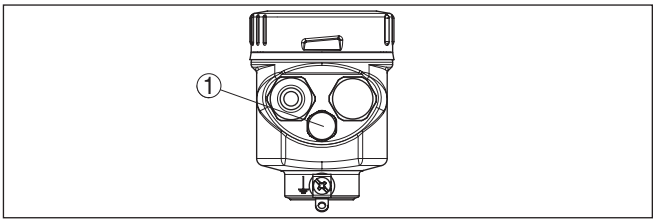



*Fig. 10: Position of the filter element - IP69K version*

*1 Filter element*

Instruments with absolute pressure have a blind plug mounted instead of the filter element.

## 4.3 Level measurement

**Measurement setup**

Keep the following in mind when setting up the measuring system:

- Do not mount the instrument close to the filling stream or emptying area
- Mount the instrument so that it is protected against pressure shocks from the stirrer

## 4.4 External housing

**Configuration**

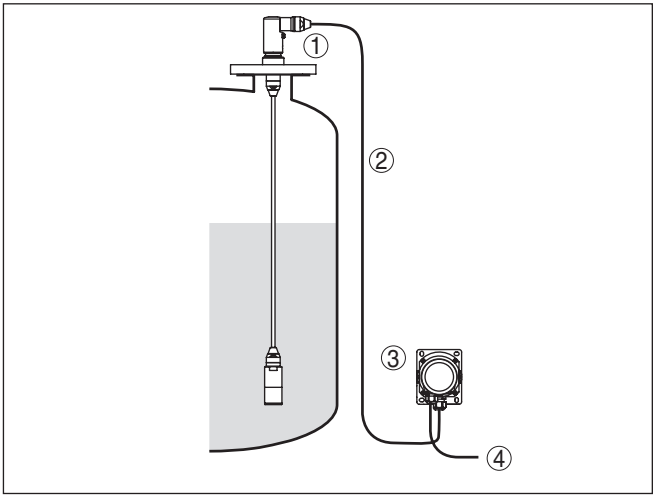



*Fig. 11: Arrangement measurement loop, external housing*

*1 Sensor*
*2 Connection cable sensor, external housing*
*3 External housing*
*4 Signal cable*

# 5 Connecting to power supply

## 5.1 Preparing the connection

**Safety instructions**

Always keep in mind the following safety instructions:

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

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

**Voltage supply**

Power supply and current signal are carried on the same two-wire cable. The operating voltage can differ depending on the instrument version.

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

Provide a reliable separation between the supply circuit and the mains circuits according to DIN EN 61140 VDE 0140-1.

Power the instrument via an energy-limited circuit acc. to IEC 61010-1, e.g. via Class 2 power supply unit.

Keep in mind the following additional factors that influence the operating voltage:

- Lower output voltage of the power supply unit under nominal load (e.g. with a sensor current of 20.5 mA or 22 mA in case of fault signal)
- Influence of additional instruments in the circuit (see load values in chapter " *Technical data*")

**Connection cable**

The instrument is connected with standard two-wire cable without shielding. If electromagnetic interference is expected which is above the test values of EN 61326-1 for industrial areas, shielded cable should be used.

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

**Cable screening and grounding**

If shielded cable is required, we recommend connecting the cable screening on both ends to ground potential. In the sensor, the cable screening 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.

**Note:**
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*".

**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.

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

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

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

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

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

## 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. If a display and adjustment module is installed, remove it by turning it slightly to the left
3. Loosen compression nut of the cable gland and remove blind plug
4. Remove approx. 10 cm (4 in) of the cable mantle, strip approx. 1 cm (0.4 in) of insulation from the ends of the individual wires

5. Insert the cable into the sensor through the cable entry

*Fig. 12: Connection steps 5 and 6 - Single chamber housing*

6. 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.

7. Check the hold of the wires in the terminals by lightly pulling on them
8. Connect the shielding to the internal ground terminal, connect the external ground terminal to potential equalisation
9. Tighten the compression nut of the cable entry gland. The seal ring must completely encircle the cable
10. Reinsert the display and adjustment module, if one was installed
11. Screw the housing lid back on

The electrical connection is finished.

## 5.3 Single chamber housing

The following illustration applies to the non-Ex, Ex-ia and Ex-d version.

**Electronics and connection compartment**

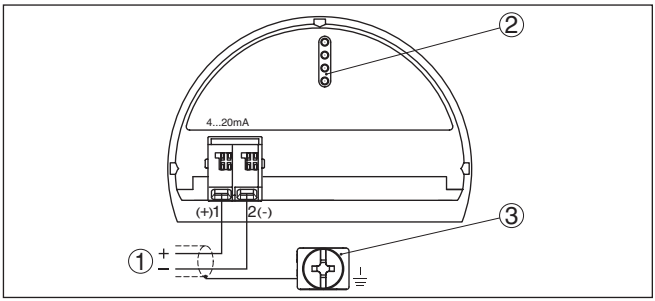



*Fig. 13: Electronics and connection compartment - single chamber housing*

*1 Voltage supply, signal output*
*2 For display and adjustment module or interface adapter*
*3 Ground terminal for connection of the cable screening*

## 5.4 Housing IP66/IP68 (1 bar)

**Wire assignment, connection cable**

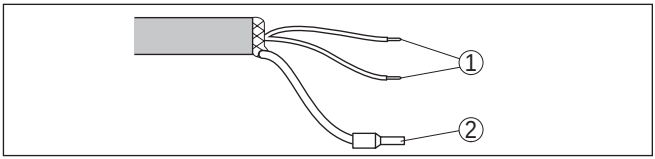



*Fig. 14: Wire assignment in permanently connected connection cable*

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

## 5.5 External housing

**Terminal compartment, housing socket**

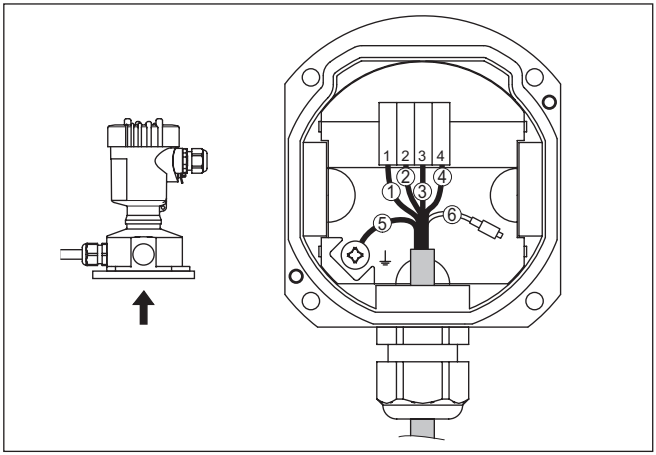



*Fig. 15: Connection of the process component in the housing base*

*1 Yellow*
*2 White*
*3 Red*
*4 Black*
*5 Shielding*
*6 Breather capillaries*

**Electronics and connection compartment for power supply**

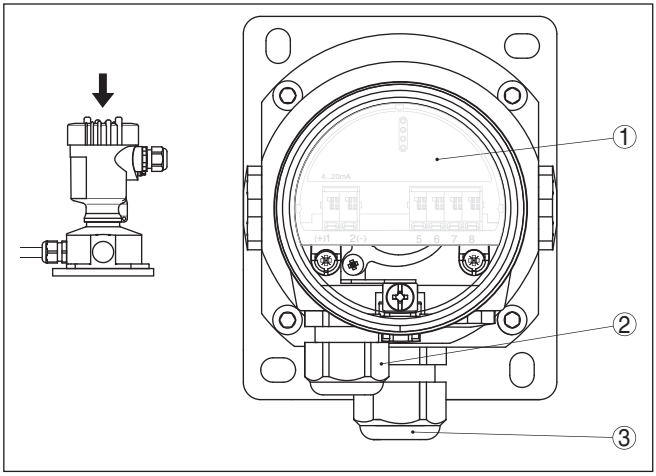



*Fig. 16: Electronics and connection compartment*

*1 Electronics module*
*2 Cable gland for voltage supply*
*3 Cable gland for connection cable, transmitter*

**Electronics and connection compartment**

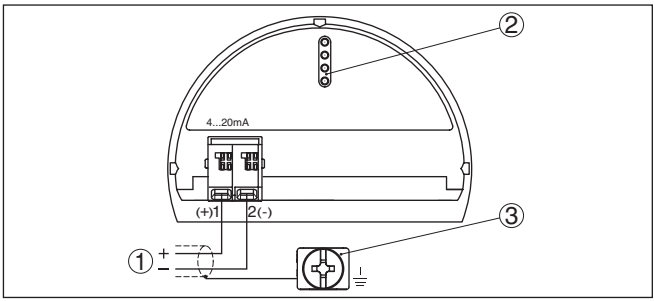



*Fig. 17: Electronics and connection compartment - single chamber housing*

*1 Voltage supply, signal output*
*2 For display and adjustment module or interface adapter*
*3 Ground terminal for connection of the cable screening*

## 5.6 Switch-on phase

After connecting the instrument to power supply or after a voltage recurrence, the instrument carries out a self-check:

- Internal check of the electronics
- Indication of a status message on the display or PC
- The output signal jumps to the set fault current

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

# 6 Set up 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. 18: Installing the display and adjustment module in the electronics compartment of the single chamber housing*

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

## 6.2 Adjustment system

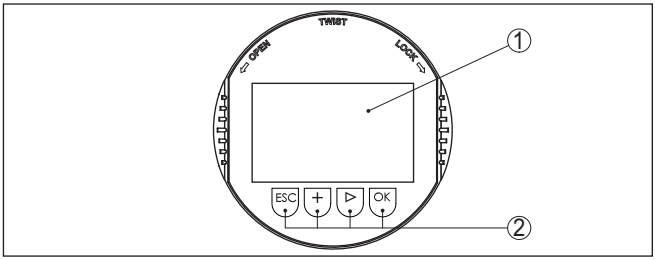



*Fig. 19: Display and adjustment elements*

*1 LC display*
*2 Adjustment keys*

**Key functions**

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

**Adjustment system**

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

**Adjustment system - keys via magnetic pen**

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

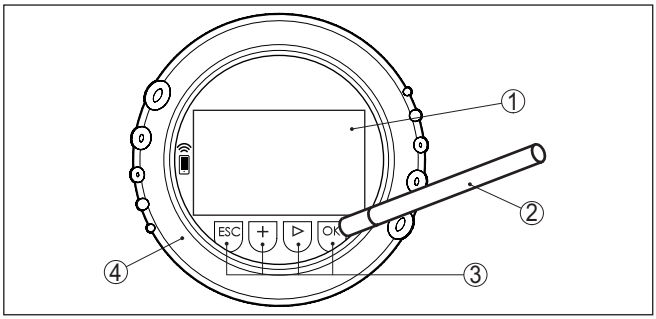



*Fig. 20: Display and adjustment elements - with adjustment via magnetic pen*

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

**Time functions**

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

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

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

## 6.3 Measured value indication

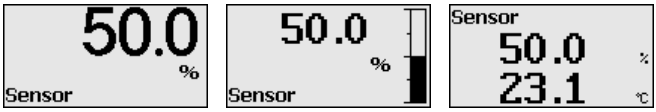
**Measured value indication**

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 respective bargraph presentation are displayed.

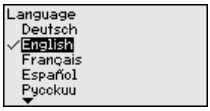
In the third view, the selected measured value as well as a second selectable value, e.g. the temperature, are displayed.




With the " ***OK***" key you move (during the initial setup of the instrument) to the selection menu " *Language*".

**Selection language**

In this menu item, you can select the national language for further parameterization.

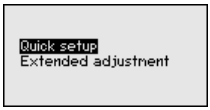



With the " ***[->]***" button, you can select the requested language, with " ***OK***" you confirm the selection and move to the main menu.

You can change your selection afterwards with the menu item " *Setup - Display, Menu language*".

## 6.4 Parameter adjustment - 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.




Select the individual steps with the ***[->]*** key.

After the last step, " *Quick setup terminated successfully*" is displayed briefly.

The return to the measured value indication is carried out through the ***[->]*** or ***[ESC]*** keys or automatically after 3 s

**Note:**
You can find a description of the individual steps in the quick setup guide of the sensor.

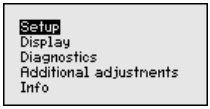
You can find " *Extended adjustment*" in the next sub-chapter.

## 6.5 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. for measurement loop name, application, units, position correction, adjustment, signal output, disable/enable operation

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

**Diagnosis:** Information, for example, of device status, peak value, simulation

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

**Info:** Instrument name, hardware and software version, calibration date, sensor features

**Note:**
For optimum setting 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 submenu points are described below.

### 6.5.1 Setup

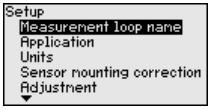
**Measurement loop name**

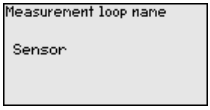
In the menu item "*Sensor TAG*" you edit a twelve-digit measurement loop designation.

You can enter an unambiguous designation for the sensor, e.g. the measurement loop name or the tank or product designation. In digital systems and in the documentation of larger plants, a singular designation must be entered for exact identification of individual measuring points.

The available digits include:

- Letters from A … Z
- Numbers from 0 … 9
- Special characters +, -, /, -



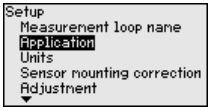

**Application**

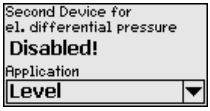
In this menu item you activate/deactivate the Secondary Device for electronic differential pressure and select the application.

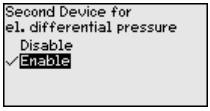
VEGABAR 87 can be used for process pressure and level measurement. The setting in the delivery status is process pressure measurement. The mode can be changed in this adjustment menu.

If you have connected **no** Secondary Device, you confirm this with "*Deactivate*".

Depending on the selected application, different subchapters in the following adjustment steps are important. There you can find the individual adjustment steps.



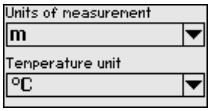




Enter the requested parameters via the appropriate keys, save your settings with ***[OK]*** and jump to the next menu item with the ***[ESC]*** and the ***[->]*** key.

**Units**

In this menu item, the adjustment units of the instrument are determined. The selection determines the unit displayed in the menu items " *Min. adjustment (Zero)*" and " *Max. adjustment (Span)*".

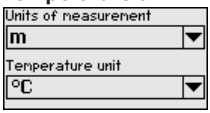
**Unit of measurement:**




If the level should be adjusted in a height unit, the density of the medium must also be entered later during the adjustment.

In addition, the temperature unit of the instrument is specified. The selection determines the unit displayed in menu items " *Peak value, temperature*" and "in the variables of the digital output signal".

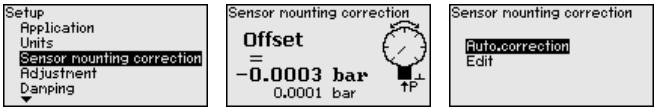
**Temperature unit:**




Enter the requested parameters via the appropriate keys, save your settings with ***[OK]*** and jump to the next menu item with the ***[ESC]*** and the ***[->]*** key.

**Position correction**

Especially with chemical seal systems, the installation position of the instrument can shift (offset) the measured value. Position correction compensates this offset. In the process, the actual measured value is taken over automatically. With relative pressure measuring cells a manual offset can also be carried out.




**Note:**
If the current measured value is automatically accepted, it must not be falsified by medium coverage or static pressure.

With the manual position correction, the offset value can be determined by the user. Select for this purpose the function " *Edit*" and enter the requested value.

Save your settings with ***[OK]*** and move with ***[ESC]*** and ***[->]*** to the next menu item.

After the position correction is carried out, the actual measured value is corrected to 0. The corrective value appears with an inverse sign as offset value in the display.

The position correction can be repeated as often as necessary. However, if the sum of the corrective values exceeds 20 % of the nominal measuring range, then no position correction is possible.

**Adjustment**

VEGABAR 87 always measures pressure independently of the process variable selected in the menu item " *Application*". To output the

selected process variable correctly, an allocation of the output signal to 0 % and 100 % must be carried out (adjustment).

With the application " *Level*", the hydrostatic pressure, e.g. with full and empty vessel, is entered for adjustment. See following example:

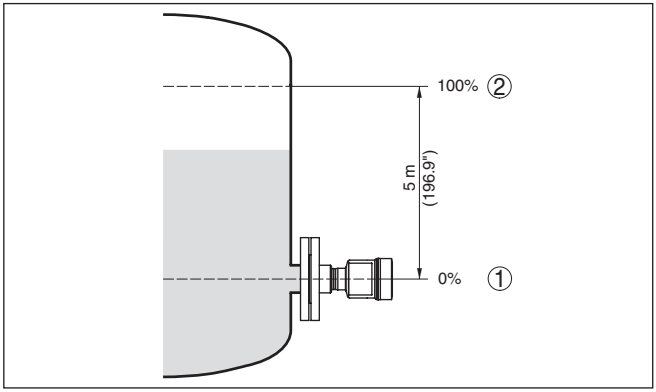



*Fig. 21: Parameter adjustment example Min./max. adjustment, level measurement*

*1 Min. level = 0 % corresponds to 0.0 mbar*
*2 Max. level = 100 % corresponds to 490.5 mbar*

If these values are not known, an adjustment with filling levels of e.g. 10 % and 90 % is also possible. By means of these settings, the real filling height is then calculated.

The actual product level during this adjustment is not important, because the min./max. adjustment is always carried out without changing the product level. These settings can be made ahead of time without the instrument having to be installed.

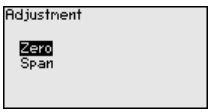
**Note:**
If the adjustment ranges are exceeded, the entered value will not be accepted. Editing can be interrupted with ***[ESC]*** or corrected to a value within the adjustment ranges.

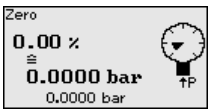
For the other process variables such as e.g. process pressure, differential pressure or flow, the adjustment is performed in like manner.

**Zero adjustment**

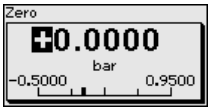
Proceed as follows:

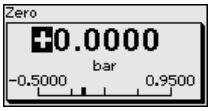
1. Select the menu item " *Setup*" with ***[->]*** and confirm with ***[OK]***. Now select with ***[->]*** the menu item " *Zero adjustment*" and confirm with ***[OK]***.




2. Edit the mbar value with ***[OK]*** and set the cursor to the requested position with ***[->]***.






3. Set the requested mbar value with ***[+]*** and store with ***[OK]***.
4. Go with ***[ESC]*** and ***[->]*** to the span adjustment

The zero adjustment is finished.

**Information:**
The Zero adjustment shifts the value of the span adjustment. The span, i.e. the difference between these values, however, remains unchanged.

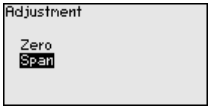
For an adjustment with pressure, simply enter the actual measured value indicated at the bottom of the display.

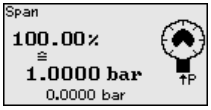
If the adjustment ranges are exceeded, the message " *Outside parameter limits*" appears. The editing procedure can be aborted with ***[ESC]*** or the displayed limit value can be accepted with ***[OK]***.

**Span adjustment**

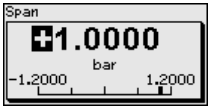
Proceed as follows:

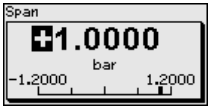
1. Select with ***[->]*** the menu item Span adjustment and confirm with ***[OK]***.






2. Edit the mbar value with ***[OK]*** and set the cursor to the requested position with ***[->]***.






3. Set the requested mbar value with ***[+]*** and store with ***[OK]***.

For an adjustment with pressure, simply enter the actual measured value indicated at the bottom of the display.

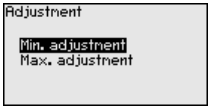
If the adjustment ranges are exceeded, the message " *Outside parameter limits*" appears. The editing procedure can be aborted with ***[ESC]*** or the displayed limit value can be accepted with ***[OK]***.

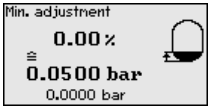
The span adjustment is finished.

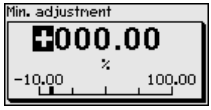
**Min. adjustment - Level**

Proceed as follows:

1. Select the menu item " *Setup*" with ***[->]*** and confirm with ***[OK]***. Now select with ***[->]*** the menu item " *Adjustment*", then " *Min. adjustment*" and confirm with ***[OK]***.







2. Edit the percentage value with ***[OK]*** and set the cursor to the requested position with ***[->]***.
3. Set the requested percentage value (e.g. 10 %) with ***[+]*** and save with ***[OK]***. The cursor jumps now to the pressure value.
4. Enter the pressure value corresponding to the min. level (e.g. 0 mbar).
5. Save settings with ***[OK]*** and move with ***[ESC]*** and ***[->]*** to the max. adjustment.

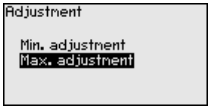
The min. adjustment is finished.

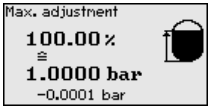
For an adjustment with filling, simply enter the actual measured value indicated at the bottom of the display.

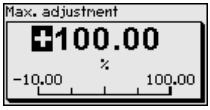
**Max. adjustment - Level**

Proceed as follows:

1. Select with ***[->]*** the menu item Max. adjustment and confirm with ***[OK]***.



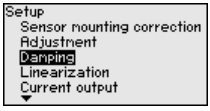

2. Edit the percentage value with ***[OK]*** and set the cursor to the requested position with ***[->]***.
3. Set the requested percentage value (e.g. 90 %) with ***[+]*** and save with ***[OK]***. The cursor jumps now to the pressure value.
4. Enter the pressure value for the full vessel (e.g. 900 mbar) corresponding to the percentage value.
5. Save settings with ***[OK]***

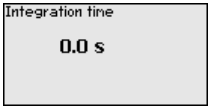
The max. adjustment is finished.

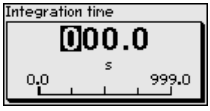
For an adjustment with filling, simply enter the actual measured value indicated at the bottom of the display.

**Damping**

To damp process-dependent measured value fluctuations, set an integration time of 0 … 999 s in this menu item. The increment is 0.1 s.



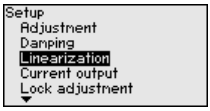



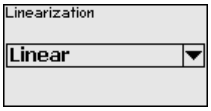



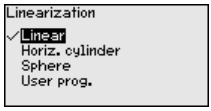

The default setting is a damping of 0 s.

**Linearisation**

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




With flow measurement and selection " *Linear*" display and output (percentage/current) are linear to " **Differential pressure**". This can be used, for example, to feed a flow computer.

With flow measurement and selection " *Extraction by root*"display and output (percentage/current) are linear to " **Flow**". [1)]

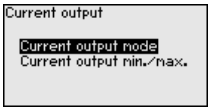
With flow in two directions (bidirectional) a negative differential pressure is also possible. This must already be taken into account in menu item " *Min. adjustment flow*".

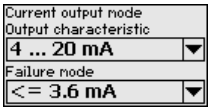
**Caution:**
Note the following, if the respective sensor is used as part of an overfill protection system according to WHG:

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.

**Current output (mode)**

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

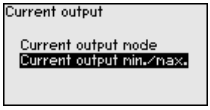


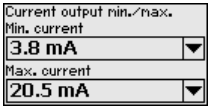




The default setting is output characteristics 4 … 20 mA, fault mode < 3.6 mA.

**Current output (min./ max.)**

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



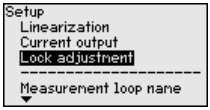



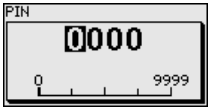

The default setting is min. current 3.8 mA and max. current 20.5 mA.

**Lock/Unlock adjustment**

In the menu item " *Lock/unlock adjustment*" you safeguard the sensor parameters against unauthorized or unintentional modifications.

This is done by entering a four-digit PIN.





[1)] The device assumes an approximately constant temperature and static pressure and converts the differential pressure into the flow rate via the characteristic curve extracted by root.

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

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

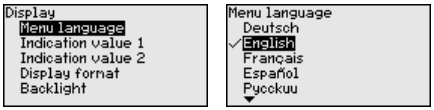
Releasing the sensor adjustment is also possible in any menu item by entering the PIN.

**Caution:**
With active PIN, adjustment via PACTware/DTM and other systems is also blocked.

### 6.5.2 Display

**Language**

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



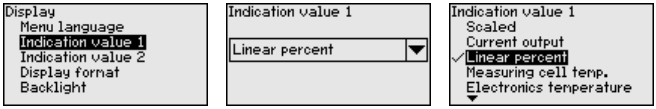

The following languages are available:

- German
- English
- French
- Spanish
- Russian
- Italian
- Dutch
- Portuguese
- Japanese
- Chinese
- Polish
- Czech
- Turkish

In delivery status, the VEGABAR 87 is set to English.

**Display value 1 and 2**

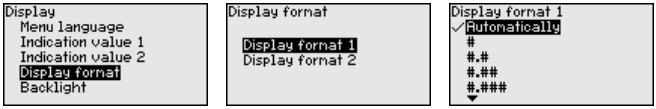
In this menu item, you define which measured value is displayed.




The setting in the delivery status for the display value is " *Lin. percent*".

**Display format 1 and 2**

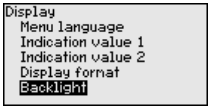
In this menu item you define the number of decimal positions with which the measured value is displayed.




The setting in the delivery status for the display format is " *Automatic*".

**Backlight**

The display and adjustment module has a backlight for the display. In this menu item you can switch on the lighting. You can find the required operating voltage in chapter " *Technical data*".



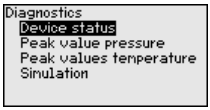


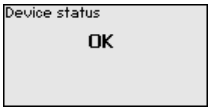
In delivery status, the lighting is switched on.

### 6.5.3 Diagnostics

**Device status**

In this menu item, the device status is displayed.



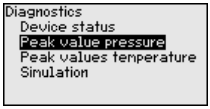



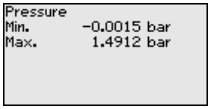

In case of error, e.g. the error code F017, e.g. the error description " *Adjustment span too small*" and a four digit figure are displayed for service purposes. You can find the error codes with description, reason as well as rectification in chapter " *Asset Management*".

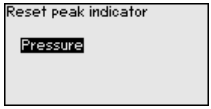
**Peak value, pressure**

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

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



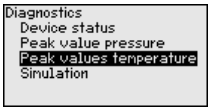



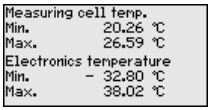



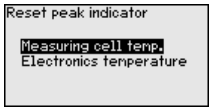

**Peak value, temperature**

The respective min. and max. measured values of the measuring cell and the electronics temperature are stored in the sensor. In menu item " *Peak value, temperature*", both values are displayed.

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

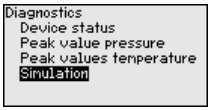


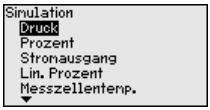



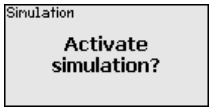



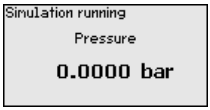

**Simulation**

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

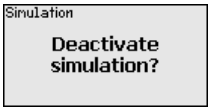









Select the requested simulation variable and set the requested value.

To deactivate the simulation, you have to push the ***[ESC]*** key and confirm the message " *Deactivate simulation*" with the ***[OK]*** key.

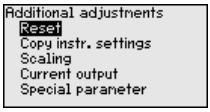
**Caution:**
During simulation, the simulated value is output as 4 … 20 mA current value and with instruments 4 … 20 mA/HART in addition as digital HART signal. The status message within the context of the asset management function is " *Maintenance*".

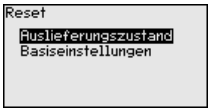
**Note:**
Without manual deactivation, the sensor terminates the simulation automatically after 60 minutes.

### 6.5.4 Additional adjustments

**Reset**

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




The following reset functions are available:

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

**Basic settings:** Resetting of the parameter settings incl. special parameters to the default values of the respective instrument. Any user programmable linearization curve as well as the measured value memory are deleted.

**Note:**
You can find the default values of the device in chapter " *Menu overview*".

**Copy instrument settings**

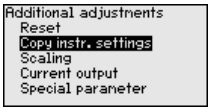
The instrument settings are copied with this function. The following functions are available:

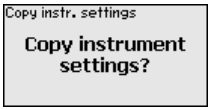
- **Read from sensor:** Read data from sensor and store into the display and adjustment module
- **Write into sensor:** Store data from the display and adjustment module back into the sensor

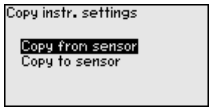
The following data or settings for adjustment of the display and adjustment module are saved:

- All data of the menu " *Setup*" and " *Display*"

- In the menu " *Additional adjustments*" the items " *Reset, Date/ Time*"
- The user-programmable linearization curve



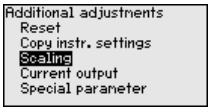



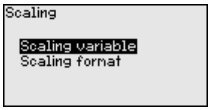

The copied data are permanently saved in an EEPROM memory in the display and adjustment module and remain there even in case of power failure. From there, they can be written into one or more sensors or kept as backup for a possible electronics exchange.

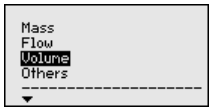
**Note:**
Before the data are saved in the sensor, a safety check is carried out to determine if the data match the sensor. In the process the sensor type of the source data as well as the target sensor are displayed. If the data do not match, a fault message is outputted or the function is blocked. The data are saved only after release.

**Scaling (1)**

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

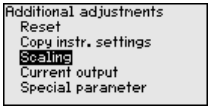


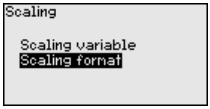



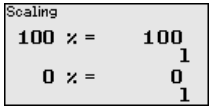




**Scaling (2)**

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

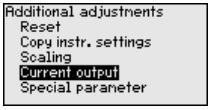


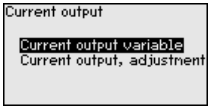



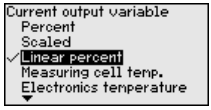




**Current output (meas. variable)**

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

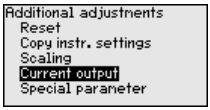


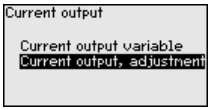



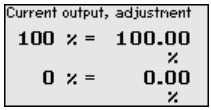




**Current output (adjustment)**

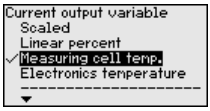
Depending on the selected measured variable, you assign in the menu item " *Current output, adjustment*" the measured values that 4 mA (0 %) and 20 mA (100 %) of the current output refer to.

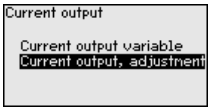


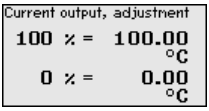




If the measuring cell temperature is selected as measured variable, then e.g. 0 °C refers to 4 mA and 100 °C to 20 mA.



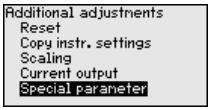




**Special parameters**

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.

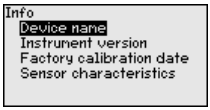




### 6.5.5 Info

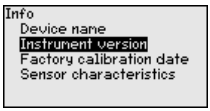
**Device name**

In this menu item, you can read out the instrument name and the instrument serial number:



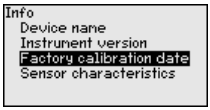

**Instrument version**

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



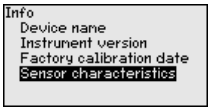

**Factory calibration date**

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.




**Sensor characteristics**

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



## 6.6 Menu overview

The following tables show the adjustment menu of the instrument. Depending on the instrument version or application, all menu items may not be available or some may be differently assigned.

### Setup

| Menu item | Parameter | Default value |
|---|---|---|
| Measurement loop name | 19 alphanumeric characters/special characters | Sensor |
| Application | Level, process pressure | Level |
| Units | Adjustment unit (m, bar, Pa, psi … user-defined) | mbar (with nominal measuring range ≤ 400 mbar)<br>bar (with nominal measuring ranges ≥ 1 bar) |
| | Temperature unit (°C, °F) | °C |
| Position correction | Offset | 0.00 bar |
| Adjustment | Zero/Min. adjustment | 0.00 bar<br>0.00 % |
| | Span/Max. adjustment | Nominal measuring range in bar<br>100.00 % |
| Damping | Integration time | 1 s |
| Linearisation | Linear, cylindrical tank, … user-defined | Linear |
| Current output | Current output - Mode | |
| | Output characteristics: 4 … 20 mA, 20 … 4 mA | 4 … 20 mA |
| | Failure mode: ≤ 3.6 mA, ≥ 20 mA, last measured value | ≤ 3.6 mA |
| | Current output - Min./Max. | |
| | Min. current: 3.8 mA, 4 mA | 3.8 mA |
| | Max. current: 20 mA, 20.5 mA | 20.5 mA |
| Lock adjustment | Blocked, released | Released |

### Display

| Menu item | Default value |
|---|---|
| Menu language | Selected language |
| Displayed value 1 | Pressure |
| Displayed value 2 | Ceramic measuring cell: Measuring cell temperature in °C<br>Metallic measuring cell: Electronics temperature in °C |
| Display format | Number of positions after the decimal point, automatically |
| Backlight | Switched on |

### Diagnostics

| Menu item | Parameter | Default value |
|---|---|---|
| Device status | | - |
| Peak value | Pressure | Current pressure measured value |
| Pointer function temp. | Temperature | Actual measuring cell and electronic temperature |
| Simulation | Pressure, percent, current output, linearized percent, measuring cell temperature, electronics temperature | Pressure |

### Additional adjustments

| Menu item | Parameter | Default value |
|---|---|---|
| Date/Time | | Actual date/Actual time |
| Reset | Delivery status, basic settings | |
| Copy instrument settings | Read from sensor, write into sensor | |
| Scaling | Scaling size | Volume in l |
| | Scaling format | 0 % corresponds to 0 l<br>100 % corresponds to 100 l |
| Current output | Current output - Meas. variable | Lin. percent - Level |
| | Current output - Adjustment | 0 … 100 % correspond to 4 … 20 mA |
| Current output 2 | Current output - Meas. variable | Measuring cell temperature (ceramic measuring cell) |
| | Current output - Adjustment | 0 … 100 °C correspond to 4 … 20 mA |
| Special parameters | Service-Login | No reset |

### Info

| Menu item | Parameter |
|---|---|
| Device name | VEGABAR 87 |
| Instrument version | Hardware and software version |
| Factory calibration date | Date |
| Sensor characteristics | Order-specific characteristics |

## 6.7 Save parameter adjustment data

**On paper**

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

**In the display and adjustment module**

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

# 7 Setup with PACTware

## 7.1 Connect the PC

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

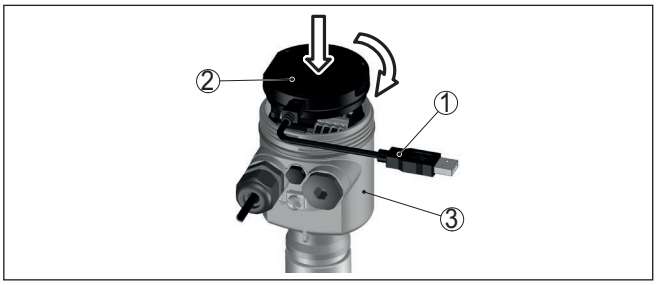



*Fig. 22: Connection of the PC directly to the sensor via the interface adapter*

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

## 7.2 Parameterization

**Prerequisites**

For parameter adjustment of the instrument via a Windows PC, the configuration software PACTware and a suitable instrument driver (DTM) according to FDT standard are required. The latest 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.

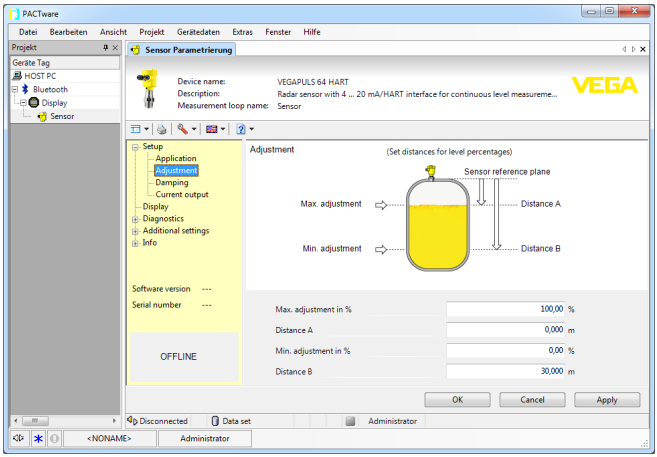



*Fig. 23: Example of a DTM view*

**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 Save parameter adjustment data

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

# 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

**Maintenance**

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

**Precaution measures against buildup**

In some applications, product buildup on the diaphragm can influence the measuring result. Depending on the sensor and application, take precautions to ensure that heavy buildup, and especially a hardening thereof, is avoided.

**Cleaning**

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

Take note of the following:

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

## 9.2 Diagnosis function

**Failure**

| Code<br>Text message | Cause | Rectification |
|---|---|---|
| F013<br>No valid measured value available | Gauge pressure or low pressure<br>Measuring cell defective | Exchange measuring cell<br>Send instrument for repair |
| F017<br>Adjustment span too small | Adjustment not within specification | Change the adjustment according to the limit values |
| F025<br>Error in the linearization table | Index markers are not continuously rising, for example illogical value pairs | Check linearization table<br>Delete table/Create new |
| F036<br>no operable sensor software | Failed or interrupted software update | Repeat software update<br>Check electronics version<br>Exchanging the electronics<br>Send instrument for repair |
| F040<br>Error in the electronics | Hardware defect | Exchanging the electronics<br>Send instrument for repair |
| F041<br>Communication error | No connection to the sensor electronics | Check connection between sensor and main electronics (with separate version) |
| F080<br>General software error | General software error | Disconnect operating voltage briefly |
| F105<br>Measured value is determined | The instrument is still in the switch-on phase, the measured value could not yet be determined | Wait for the end of the switch-on phase |

| Code<br>Text message | Cause | Rectification |
|---|---|---|
| F113<br>Communication error | Error in the internal instrument communication | Disconnect operating voltage briefly<br>Send instrument for repair |
| 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 |
| F261<br>Error in the instrument settings | Error during setup<br>Error when carrying out a reset | Repeat setup<br>Repeat reset |
| F264<br>Installation/Setup error | Inconsistent settings (e.g.: distance, adjustment units with application process pressure) for selected application<br>Invalid sensor configuration (e.g.: application electronic differential pressure with connected differential pressure measuring cell) | Modify settings<br>Modify connected sensor configuration or application |
| F265<br>Measurement function disturbed | Sensor no longer carries out a measurement | Carry out a reset<br>Disconnect operating voltage briefly |

### Function check

| Code<br>Text message | Cause | Rectification |
|---|---|---|
| C700<br>Simulation active | A simulation is active | Finish simulation<br>Wait for the automatic end after 60 mins. |

### Out of specification

| Code<br>Text message | Cause | Rectification |
|---|---|---|
| S600<br>Impermissible electronics temperature | Temperature of the electronics in the non-specified range | Check ambient temperature<br>Insulate electronics<br>Use instrument with higher temperature range |
| S603<br>Impermissible operating voltage | Operating voltage below specified range | Check electrical connection<br>If necessary, increase operating voltage |
| S605<br>Impermissible pressure value | Measured process pressure below or above the adjustment range | Check nominal measuring range of the instrument<br>If necessary, use an instrument with a higher measuring range |

**Maintenance**

| Code<br>Text message | Cause | Rectification |
|---|---|---|
| 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 |
| M501<br>Error in the non-active linearisation table | Index markers are not continuously rising, for example illogical value pairs | Check linearization table<br>Delete table/Create new |
| M502<br>Error in the event memory | Hardware error EEPROM | Exchanging the electronics<br>Send instrument for repair |
| M504<br>Error at a device interface | Hardware defect | Exchanging the electronics<br>Send instrument for repair |
| M507<br>Error in the instrument settings | Error during setup<br>Error when carrying out a reset | Carry out reset and repeat setup |

## 9.3 Rectify faults

**Reaction when malfunction occurs**

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

**Fault rectification**

The first measures are:

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

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

**4 … 20 mA signal**

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

| Error | Cause | Rectification |
|---|---|---|
| 4 … 20 mA signal not stable | Fluctuating measured value | Set damping |
| 4 … 20 mA signal missing | Electrical connection faulty | Check connection, correct, if necessary |
| | Voltage supply missing | Check cables for breaks; repair if necessary |
| | Operating voltage too low, load resistance too high | Check, adapt if necessary |
| Current signal greater than 22 mA, less than 3.6 mA | Sensor electronics defective | Replace device or send in for repair depending on device version |

**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.

## 9.4 Exchange process module on version IP68 (25 bar)

On version IP68 (25 bar), the user can exchange the process module on site. Connection cable and external housing can be kept.

Required tools:

- Hexagon key wrench, size 2

**Caution:**
The exchange may only be carried out in the complete absence of line voltage.

In Ex applications, only a replacement part with appropriate Ex approval may be used.

**Caution:**
During exchange, protect the inner side of the parts against contamination and moisture.

Proceed as follows when carrying out the exchange:

1. Losen the fixing screw with the hexagon key wrench
2. Carefully detach the cable assembly from the process module

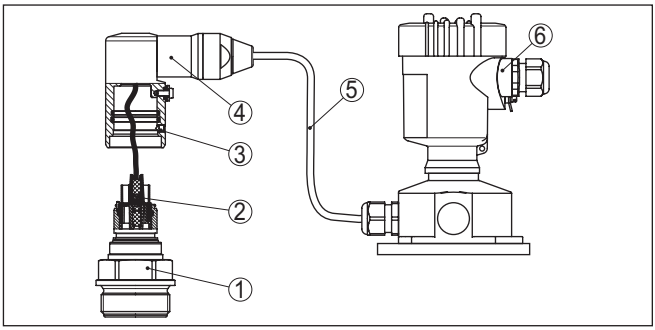



*Fig. 24: VEGABAR 87 in IP68 version, 25 bar and lateral cable outlet, external housing*

*1 Process module*
*2 Plug connector*
*3 Fixing screw*
*4 Cable assembly*
*5 Connection cable*
*6 External housing*

3. Loosen the plug connector
4. Mount the new process module on the measuring point
5. Plug the connector back in
6. Mount the cable assembly on the process module and turn it to the desired position
7. Tighten the fixing screw with the hexagon key wrench

The exchange is finished.

## 9.5 Exchanging the electronics module

In case of a defect, the user can replace the electronics module with another one of identical type.

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

You can find detailed information you need to carry out an electronics exchange in the handbook of the electronics module.

## 9.6 Software update

The following components are required to update the instrument software:

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

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

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

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

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

## 9.7 How to proceed if a repair is necessary

You can find an instrument return form as well as detailed information about the procedure in the download area of our homepage. By doing this you help us carry out the repair quickly and without having to call back for needed information.

Proceed as follows in case of repair:

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

# 10 Dismount

## 10.1 Dismounting steps

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

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

## 10.2 Disposal

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

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

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

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

# 11 Supplement

## 11.1 Technical data

**Note for approved instruments**

The technical data in the respective safety instructions which are included in delivery are valid for approved instruments (e.g. with Ex approval). These data can differ from the data listed herein, for example regarding the process conditions or the voltage supply.

All approval documents can be downloaded from our homepage.

**Materials and weights**

| | |
|---|---|
| **Materials, wetted parts** | |
| Process fitting | 316L |
| Transmitter | 316L |
| Suspension cable | FEP |
| Seal, suspension cable | FKM, FEP |
| Connection tube | 316L |
| Diaphragm | Alloy C276 (2.4819) |
| Protective cap | PFA |
| Seal for process fitting (in the scope of delivery) | |
| – Thread G1½ (DIN 3852-A) | Klingersil C-4400 |
| – Threaded fitting | Klingersil C-4400 |
| **Materials, non-wetted parts** | |
| Isolating liquid | Essomarcal (medical white oil, FDA-approved) |
| Straining clamp | 1.4301 |
| Screw connection for suspension cable | 316L |
| Sensor housing | |
| – Housing | Plastic PBT (Polyester), Aluminium AlSi10Mg (powder-coated, basis: Polyester), 316L |
| – Cable gland | PA, stainless steel, brass |
| – Cable gland: Seal, closure | NBR, PA |
| – Seal, housing lid | Silicone SI 850 R, NBR silicone-free |
| – Inspection window housing cover | Polycarbonate (UL-746-C listed), glass [2] |
| – Ground terminal | 316L |
| External housing - deviating materials | |
| – Housing and socket | Plastic PBT (Polyester), 316L |
| – Socket seal | EPDM |
| – Seal below wall mounting plate [3] | EPDM |
| – Inspection window housing cover | Polycarbonate (UL-746-C listed) |
| Ground terminal | 316Ti/316L |

[2] Glass with Aluminium and stainless steel precision casting housing
[3] Only for 316L with 3A approval

| | |
|---|---|
| Connection cable with IP68 (25 bar) version [4] | |
| – Cable cover | PE, PUR |
| – Type label support on cable | PE hard |
| **Materials, transmitter protection** | |
| Transport and mounting protection | PFA |
| transport protection net | PE |
| **Weights** | |
| Basic weight | 0.7 kg (1.543 lbs) |
| Suspension cable | 0.1 kg/m (0.07 lbs/ft) |
| Connection tube | 1.5 kg/m (1 lbs/ft) |
| Straining clamp | 0.2 kg (0.441 lbs) |
| Threaded fitting | 0.4 kg (0.882 lbs) |

## Torques

| | |
|---|---|
| Max. torque for process fitting | |
| – G1½ | 200 Nm (147.5 lbf ft) |
| Max. torque for NPT cable glands and Conduit tubes | |
| – Plastic housing | 10 Nm (7.376 lbf ft) |
| – Aluminium/Stainless steel housing | 50 Nm (36.88 lbf ft) |

## Input variable

The specifications are only an overview and refer to the measuring cell. Limitations due to the material and version of the process fitting as well as the selected pressure type are possible. The specifications on the nameplate apply. [5]

### Nominal measuring ranges and overload capability in bar/kPa

| Nominal range | Overload capability | |
|---|---|---|
| | Maximum pressure | Minimum pressure |
| Gauge pressure | | |
| 0 … +0.1 bar/0 … +10 kPa | +15 bar/+1500 kPa | -1 bar/-100 kPa |
| 0 … +0.4 bar/0 … +40 kPa | +25 bar/+2500 kPa | -1 bar/-100 kPa |
| 0 … +1 bar/0 … +100 kPa | +25 bar/+2500 kPa | -1 bar/-100 kPa |
| 0 … +2.5 bar/0 … +250 kPa | +25 bar/+2500 kPa | -1 bar/-100 kPa |
| 0 … +10 bar/0 … +1000 kPa | +25 bar/+2500 kPa | -1 bar/-100 kPa |
| 0 … +25 bar/0 … +2500 kPa | +25 bar/+2500 kPa | -1 bar/-100 kPa |
| Absolute pressure | | |
| 0 … 1 bar/0 … 100 kPa | 25 bar/+2500 kPa | 0 bar abs. |
| 0 … 2.5 bar/0 … 250 kPa | 25 bar/+2500 kPa | 0 bar abs. |
| 0 … 10 bar/0 … 1000 kPa | 25 bar/+2500 kPa | 0 bar abs. |

[4] Between transmitter and external electronics housing.
[5] Data on overload capability apply for reference temperature.

| Nominal range | Overload capability | |
|---|---|---|
| | Maximum pressure | Minimum pressure |
| 0 … 25 bar/0 … 2500 kPa | 25 bar/+2500 kPa | 0 bar abs. |

### Nominal measuring ranges and overload capacity in psi

| Nominal range | Overload capability | |
|---|---|---|
| | Maximum pressure | Minimum pressure |
| Gauge pressure | | |
| 0 … +1.5 psig | +225 psig | -14.51 psig |
| 0 … +5 psig | +360 psig | -14.51 psig |
| 0 … +15 psig | +360 psig | -14.51 psig |
| 0 … +30 psig | +360 psig | -14.51 psig |
| 0 … +150 psig | +360 psig | -14.51 psig |
| 0 … +300 psig | +360 psig | -14.51 psig |
| Absolute pressure | | |
| 0 … 15 psi | 360 psi | 0 psi |
| 0 … 30 psi | 360 psi | 0 psi |
| 0 … 150 psi | 360 psi | 0 psi |
| 0 … 300 psi | 360 psi | 0 psi |

## Adjustment ranges

Specifications refer to the nominal measuring range, pressure values lower than -1 bar cannot be set

Min./Max. adjustment:

- Percentage value: -10 … 110 %
- Pressure value: -20 … 120 %

Zero/Span adjustment:

- Zero: -20 … +95 %
- Span: -120 … +120 %
- Difference between zero and span: max. 120 % of the nominal range

Max. permissible Turn Down: Unlimited (recommended 20 : 1)

## Switch-on phase

Start-up time with operating voltage $U_B$

- ≥ 12 V DC: ≤ 9 s
- < 12 V DC: ≤ 22 s

Starting current (for run-up time): ≤ 3.6 mA

## Output variable

Output signal: 4 … 20 mA - passive

| | |
|---|---|
| Connection technology | Two-wire |
| Range of the output signal | 3.8 … 20.5 mA (default setting) |
| Signal resolution | 0.3 µA |
| Fault signal, current output (adjustable) | ≤ 3.6 mA, ≥ 21 mA, last measured value |
| Max. output current | 21.5 mA |
| Load | See load resistance under Power supply |
| Damping (63 % of the input variable), adjustable | 0 … 999 s |

**Output variable - Additional current output**

For details on the operating voltage see chapter "Voltage supply"

| | |
|---|---|
| Output signal | 4 … 20 mA (passive) |
| Range of the output signal | 3.8 … 20.5 mA (default setting) |
| Signal resolution | 0.3 µA |
| Fault signal, current output (adjustable) | Last valid measured value, ≥ 21 mA, ≤ 3.6 mA |
| Max. output current | 21.5 mA |
| Starting current | ≤ 10 mA for 5 ms after switching on, ≤ 3.6 mA |
| Load | Load resistor, see chapter "Voltage supply" |
| Damping (63 % of the input variable), adjustable | 0 … 999 s |

**Dynamic behaviour output**

Dynamic characteristics depending on medium and temperature

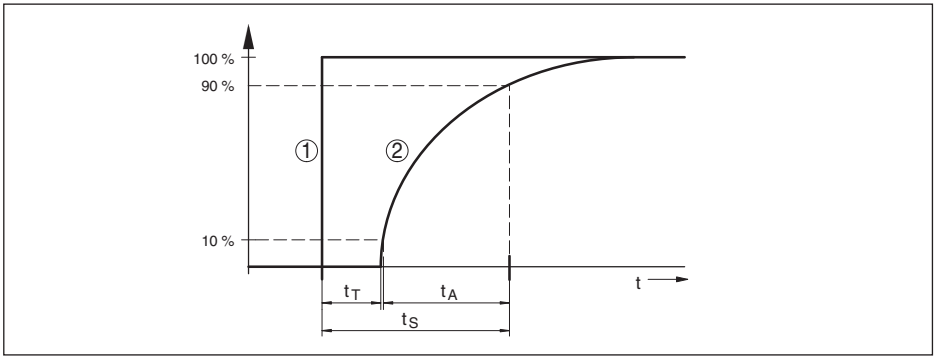



*Fig. 25: Behaviour in case of sudden change of the process variable. $t_T$: dead time; $t_A$: rise time; $t_S$: jump response time*

*1 Process variable*
*2 Output signal*

| | |
|---|---|
| Dead time | ≤ 50 ms |
| Rise time | ≤ 150 ms |
| Step response time | ≤ 200 ms (ti: 0 s, 10 … 90 %) |
| Damping (63 % of the input variable) | 0 … 999 s, adjustable via menu item " *Damping*" |

## Reference conditions and influencing variables (according to DIN EN 60770-1)

| | |
|---|---|
| Reference conditions according to DIN EN 61298-1 | |
| – Temperature | +15 … +25 °C (+59 … +77 °F) |
| – Relative humidity | 45 … 75 % |
| – Air pressure | 860 … 1060 mbar/86 … 106 kPa (12.5 … 15.4 psig) |
| Determination of characteristics | Limit point adjustment according to IEC 61298-2 |
| Characteristic curve | Linear |
| Reference installation position | upright, diaphragm points downward |
| Influence of the installation position | < 0.2 mbar/20 Pa (0.003 psig) |
| Deviation in the current output due to strong, high-frequency electromagnetic fields acc. to EN 61326-1 | < ±150 µA |

## Deviation (according to IEC 60770-1)

Applies to the **digital** signal output (HART, Profibus PA, Foundation Fieldbus) as well as to the **analogue** current output 4 … 20 mA and refers to the set span. Turn down (TD) is the ratio "nominal measuring range/set span".

The specified values correspond to the value $F_{KI}$ in chapter " *Calculation of the total deviation*".

| Accuracy class | Non-linearity, hysteresis and repeatability with TD 1 : 1 up to 5 : 1 | Non-linearity, hysteresis and repeatability with 5 : 1 |
|---|---|---|
| 0.1 % | < 0.1 % | < 0.02 % x TD |

## Influence of the medium or ambient temperature

### Thermal change zero signal and output span through product temperature

Applies to the **digital** signal output (HART, Profibus PA, Foundation Fieldbus) as well as to the **analogue** current output 4 … 20 mA and refers to the set span. Turn down (TD) is the ratio "nominal measuring range/set span".

The thermal change of the zero signal and output span corresponds to the value $F_T$ in chapter " *Calculation of the total deviation (according to DIN 16086)*".

### Ceramic/Metal measuring cell - Standard

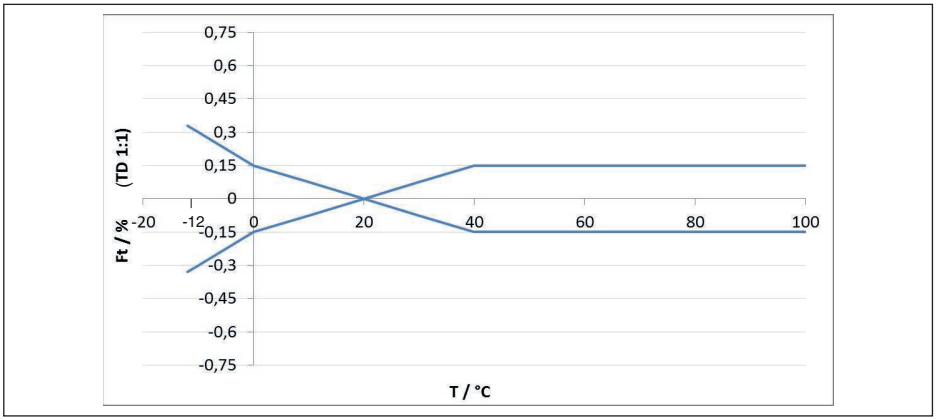



*Fig. 26: Basic temperature error $F_{TBasis}$ at TD 1 : 1*

The basic temperature error in % from the above graphic can increase due to the additional factors, depending on the measuring cell version (factor FMZ) and the Turn Down (factor FTD). The additional factors are listed in the following tables.

### Additional factor through measuring cell version

| Measuring cell version | Measuring cell - Standard | Measuring cell climate-compensated, depending on measuring range | | |
|---|---|---|---|---|
| | 0.1 % | 10 bar, 25 bar | 1 bar, 2.5 bar | 0.4 bar |
| Factor FMZ | 1 | 1 | 2 | 3 |

### Additional factor through Turn Down

The additional factor FTD through Turn down is calculated according to the following formula:

$F_{TD} = 0.5 \times TD + 0.5$

In the table, example values for typical Turn downs are listed.

| Turn Down | TD 1 : 1 | TD 2.5 : 1 | TD 5 : 1 | TD 10 : 1 | TD 20 : 1 |
|---|---|---|---|---|---|
| Factor FTD | 1 | 1.75 | 3 | 5.5 | 10.5 |

### Thermal change current output through ambient temperature

Applies also to the **analogue** 4 … 20 mA current output and refers to the set span.

Thermal change, current output < 0.05 %/10 K, max. < 0.15 %, each with -40 … +80 °C (-40 … +176 °F)

The thermal change of the current output corresponds to the value $F_a$ in chapter "*Calculation of the total deviation (according to DIN 16086)*".

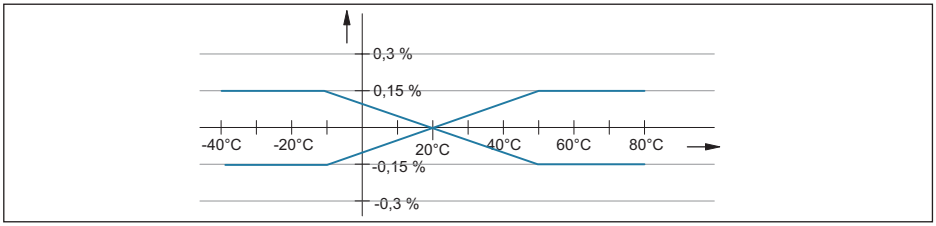



*Fig. 27: Thermal change, current output*

## Long-term stability (according to DIN 16086)

Applies to the respective **digital** signal output (e.g. HART, Profibus PA) as well as to **analogue** current output 4 … 20 mA under reference conditions. Specifications refer to the set span. Turn down (TD) is the ratio nominal measuring range/set span.

### Long-term stability zero signal and output span

| Time period | All measuring ranges | Measuring range<br>0 … +0.025 bar/0 … +2.5 kPa |
|---|---|---|
| One year | < 0.05 % x TD | < 0.1 % x TD |
| Five years | < 0.1 % x TD | < 0.2 % x TD |
| Ten years | < 0.2 % x TD | < 0.4 % x TD |

### Long-term stability zero signal and output span - version climate-compensated

| Nominal measuring range in bar/kPa | Nominal measuring range in psig | |
|---|---|---|
| 0 … 10 bar/0 … 1000 kPa | 0 … 150 psig | < (0.1 % x TD)/year |
| 0 … 25 bar/0 … 2500 kPa | 0 … 350 psig | |
| 0 … 1 bar/0 … 100 kPa | 0 … 15 psig | < (0.25 % x TD)/year |
| 0 … 2.5 bar/0 … 250 kPa | 0 … 35 psig | |
| 0 … 0.4 bar/0 … 40 kPa | 0 … 6 psig | < (1 % x TD)/year |

## Ambient conditions

| Version | Ambient temperature | Storage and transport temperature |
|---|---|---|
| Version with connection tube | -40 … +80 °C (-40 … +176 °F) | -60 … +80 °C (-76 … +176 °F) |
| Version with FEP suspension cable | -20 … +80 °C (-4 … +176 °F) | -20 … +80 °C (-4 … +176 °F) |
| Version IP68 (1 bar) with connection cable PE | -20 … +60 °C (-4 … +140 °F) | -20 … +60 °C (-4 … +140 °F) |

## Process conditions

### Process temperature

Process temperature

– Suspension cable -12 … +100 °C (+10 … +212 °F)

| | |
|---|---|
| – Connection tube | -12 … +100 °C (+10 … +212 °F) |
| **Process pressure** | |
| Permissible process pressure | see specification " *process pressure*" on the type label |
| **Mechanical stress**[6] | |
| Vibration resistance | |
| – Suspension cable | 4 g at 5 … 200 Hz according to EN 60068-2-6 (vibration with resonance) |
| – Connection tube | 1 g (with lengths > 0.5 m (1.64 ft), the tube must be supported in addition) |
| Shock resistance | 50 g, 2.3 ms according to EN 60068-2-27 (mechanical shock) [7] |

## Electromechanical data - version IP66/IP67 and IP66/IP68 (0.2 bar) [8]

| | |
|---|---|
| Options of the cable entry | |
| – Cable entry | M20 x 1.5; ½ NPT |
| – Cable gland | M20 x 1.5, ½ NPT (cable ø see below table) |
| – Blind plug | M20 x 1.5; ½ NPT |
| – Closing cap | ½ NPT |

| Material cable gland/Seal insert | Cable diameter | | | |
|---|---|---|---|---|
| | 5 … 9 mm | 6 … 12 mm | 7 … 12 mm | 10 … 14 mm |
| PA/NBR | ● | ● | – | ● |
| Brass, nickel-plated/NBR | ● | ● | – | – |
| Stainless steel/NBR | – | – | ● | – |

| | |
|---|---|
| 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) |

## Electromechanical data - version IP68 (25 bar)

| | |
|---|---|
| Connection cable transmitter - external housing, mechanical data | |
| – Configuration | Wires, strain relief, breather capillaries, screen braiding, metal foil, mantle [9] |
| – Standard length | 5 m (16.40 ft) |
| – Max. length | 180 m (590.5 ft) |
| – Min. bending radius at 25 °C/77 °F | 25 mm (0.985 in) |
| – Diameter | approx. 8 mm (0.315 in) |
| – Material | PE, PUR |
| – Colour | Black, blue |

[6] Depending on the instrument version.
[7] 2 g with housing version stainless steel double chamber.
[8] IP66/IP68 (0.2 bar), only with absolute pressure.
[9] Breather capillaries not with Ex-d version.

| | |
|---|---|
| Connection cable transmitter - external housing, electrical data | |
| – Wire cross-section | 0.5 mm² (AWG 20) |
| – Wire resistance | 0.037 Ω/m (0.012 Ω/ft) |

**Electromechanical data - version suspension cable IP68 (25 bar)**

| | |
|---|---|
| Suspension cable, mechanical data | |
| – Configuration | Wires, strain relief, breather capillaries, screen braiding, metal foil, mantle |
| – Standard length | 5 m (16.40 ft) |
| – Max. length | 250 m (820.2 ft) |
| – Min. bending radius (at 25 °C/77 °F) | 25 mm (0.985 in) |
| – Diameter | approx. 8 mm (0.315 in) |
| – Colour, suspension cable PE | Black, blue |
| – Colour, suspension cable PUR/FEP | Blue |
| Suspension cable, electrical data | |
| – Wire cross-section | 0.5 mm² (AWG 20) |
| – Wire resistance R' | 0.037 Ω/m (0.012 Ω/ft) |

**Additional output parameter - Electronics temperature**

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

**Voltage supply**

| | |
|---|---|
| Operating voltage $U_B$ | 9.6 … 35 V DC |
| Operating voltage $U_B$ with lighting switched on | 16 … 35 V DC |
| Reverse voltage protection | Integrated |
| Permissible residual ripple | |
| – for $U_N$ 12 V DC (9.6 V < $U_B$ < 14 V) | ≤ 0.7 $V_{eff}$ (16 … 400 Hz) |
| – for $U_N$ 24 V DC (18 V < $U_B$ < 35 V) | ≤ 1.0 $V_{eff}$ (16 … 400 Hz) |
| Load resistor | |
| – Calculation | ($U_B$ - $U_{min}$)/0.022 A |
| – Example - with $U_B$ = 24 V DC | (24 V - 9.6 V)/0.022 A = 655 Ω |

**Potential connections and electrical separating measures in the instrument**

| | |
|---|---|
| Electronics | Not non-floating |
| Reference voltage [10] | 500 V AC |

[10] Galvanic separation between electronics and metal housing parts

| | |
|---|---|
| Conductive connection | Between ground terminal and metallic process fitting |

**Electrical protective measures**

| Housing material | Version | Protection acc. to IEC 60529 | Protection acc. to NEMA |
|---|---|---|---|
| Plastic | Single chamber | IP66/IP67 | Type 4x |
| Aluminium | | IP66/IP67<br>IP66/IP68 (0.2 bar) | Type 4x<br>Type 6P |
| Stainless steel (electro-polished) | | IP66/IP67<br>IP69K | Type 4x<br>- |
| Stainless steel (precision casting) | | IP66/IP67<br>IP66/IP68 (0.2 bar) | Type 4x<br>Type 6P |
| Stainless steel | Transmitter for external housing | IP68 (25 bar) | - |

| | |
|---|---|
| Altitude above sea level | |
| – by default | up to 2000 m (6562 ft) |
| – with connected overvoltage protection on the Primary Device | up to 5000 m (16404 ft) |
| Pollution degree [11] | 4 |
| Protection rating (IEC 61010-1) | II |

## 11.2 Calculation of the total deviation

The total deviation of a pressure transmitter indicates the maximum measurement error to be expected in practice. It is also called maximum practical deviation or operational error.

According to DIN 16086, the total deviation $F_{total}$ is the sum of the basic deviation $F_{perf}$ and the long-term stability $F_{stab}$:

$$F_{total} = F_{perf} + F_{stab}$$

The basic deviation $F_{perf}$ in turn consists of the thermal change of the zero signal and the output span $F_T$ (temperature error) as well as the deviation $F_{KI}$:

$$F_{perf} = \sqrt{((F_T)^2 + (F_{KI})^2)}$$

The thermal change of zero signal and output span $F_T$ is specified in chapter " *Technical data*". The basic temperature error $F_T$ is shown in a graphic. Depending on the measuring cell version and Turn down, this value must be multiplied with the additional factors FMZ and FTD:

$F_T$ x FMZ x FTD

Also these values are specified in chapter " *Technical data*".

This applies initially to the digital signal output through HART, Profibus PA, Foundation Fieldbus or Modbus.

With 4 … 20 mA output, the thermal change of the current output $F_a$ must be added:

$$F_{perf} = \sqrt{((F_T)^2 + (F_{KI})^2 + (F_a)^2)}$$

To provide a better overview, the formula symbols are listed together below:

- $F_{total}$: Total deviation
- $F_{perf}$: Basic deviation

[11] When used with fulfilled housing protection.

- $F_{stab}$: Long-term stability
- $F_T$: Thermal change of zero signal and output span (temperature error)
- $F_{Kl}$: Deviation
- $F_a$: Thermal change of the current output
- FMZ: Additional factor measuring cell version
- FTD: Additional factor Turn down

## 11.3 Practical example

**Data**

Level measurement in a water reservoir, 1,600 mm height corresponds to 0.157 bar (157 kPa), medium temperature 50 °C

VEGABAR 87 with measuring range 0.4 bar, deviation < 0.1 %, meas. cell ø 28 mm

**1. Calculation of the Turn down**

TD = 0.4 bar/0.157 bar, TD = 2.6 : 1

**2. Determination temperature error $F_T$**

The necessary values are taken from the technical data:

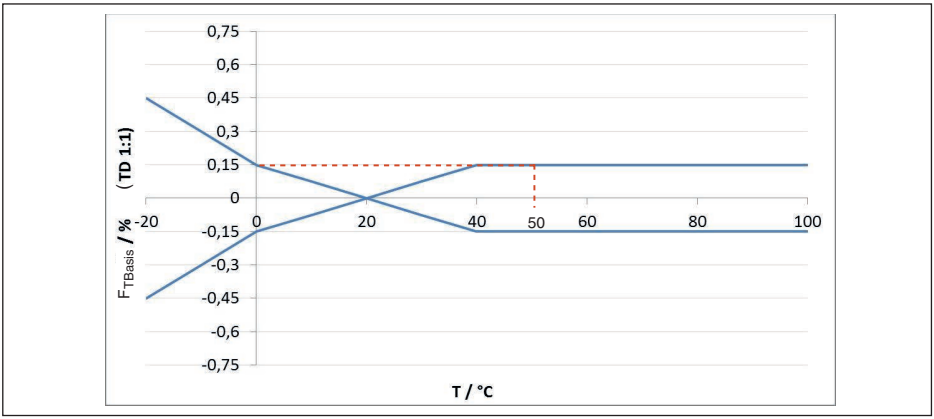



*Fig. 28: Determination of the basic temperature error for the above example: $F_{TBasis}$ = 0.15 %*

| Measuring cell version | Measuring cell - Standard | Measuring cell climate-compensated, depending on measuring range | | |
|---|---|---|---|---|
| | 0.1 % | 10 bar, 25 bar | 1 bar, 2.5 bar | 0.4 bar |
| Factor FMZ | 1 | 1 | 2 | 3 |

*Tab. 21: Determination of the additional factor measuring cell for above example: $F_{MZ}$ = 1*

| Turn Down | TD 1 : 1 | TD 2.5 : 1 | TD 5 : 1 | TD 10 : 1 | TD 20 : 1 |
|---|---|---|---|---|---|
| Factor FTD | 1 | 1.75 | 3 | 5.5 | 10.5 |

*Tab. 22: Determination of the additional factor "turn down" for the above example: $F_{TD}$ = 1.75*

$F_T = F_{TBasis} \times F_{MZ} \times F_{TD}$

$F_T = 0.15\ \% \times 1 \times 1.75$

$F_T$ = 0.26 %

### 3. Determination of deviation and long-term stability

The required values for deviation $F_{KI}$ and long-term stability $F_{stab}$ are available in the technical data:

| Accuracy class | Non-linearity, hysteresis and non-repeatability | |
|---|---|---|
| | TD ≤ 5 : 1 | TD > 5 : 1 |
| 0.1 % | < 0.1 % | < 0.02 % x TD |

*Tab. 23: Determination of the deviation from table: $F_{KI}$ = 0.1 %*

### VEGABAR 86

| Time period | Measuring cell ø 28 mm | | Measuring cell ø 17.5 mm |
|---|---|---|---|
| | All measuring ranges | Measuring range 0 … +0.025 bar/0 … +2.5 kPa | |
| One year | < 0.05 % x TD | < 0.1 % x TD | < 0.1 % x TD |
| Five years | < 0.1 % x TD | < 0.2 % x TD | < 0.2 % x TD |
| Ten years | < 0.2 % x TD | < 0.4 % x TD | < 0.4 % x TD |

### VEGABAR 87

| Time period | All measuring ranges | Measuring range 0 … +0.025 bar/0 … +2.5 kPa |
|---|---|---|
| One year | < 0.05 % x TD | < 0.1 % x TD |
| Five years | < 0.1 % x TD | < 0.2 % x TD |
| Ten years | < 0.2 % x TD | < 0.4 % x TD |

*Tab. 24: Determination of the long-term stability from the table, consideration for one year: $F_{stab}$0.05 % x TD = 0.05 % x 2.6 = 0.13 %*

### 4. Calculation of the total deviation - 4 … 20 mA signal

**- 1. step: Basic accuracy $F_{perf}$**

$F_{perf} = \sqrt{((F_T)^2 + (F_{KI})^2 + (F_a)^2)}$

$F_T$ = 0.26 %

$F_{KI}$ = 0.2 %

$F_a$ = 0.15 %

$F_{perf} = \sqrt{(0.26\ \%)^2)^2 + (0.1\ \%)^2) + (0.15\ \%)^2)}$

$F_{perf}$ = 0.32 %

**- 2. step: Total deviation $F_{total}$**

$F_{total} = F_{perf} + F_{stab}$

$F_{stab}$ = (0.05 % x TD)

$F_{stab}$ = (0.05 % x 2.5)

$F_{stab}$ = 0.13 %

$F_{total}$ = 0.32 % + 0.13 % = 0.45 %

The total deviation of the measuring system is hence 0.45 %.

Deviation in mm: 0.45 % of 1600 mm = 7 mm

The example shows that the measurement error in practice can be considerably higher than the basic accuracy. Reasons are temperature influence and Turn down.

The thermal change of the current output is in this example is negligible.

## 11.4 Dimensions

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

### Housing

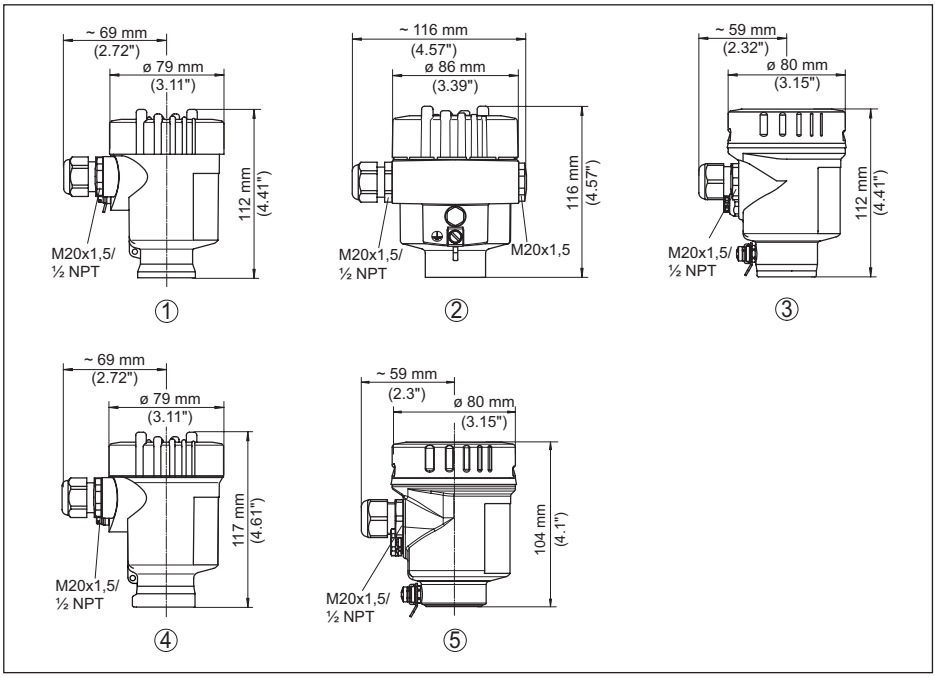



*Fig. 29: Housing versions in protection rating IP66/IP67 and IP66/IP68 (0.2 bar), (with integrated display and adjustment module the housing is 9 mm/0.35 in or 18 mm/0.71 in higher)*

1 *Plastic single chamber (IP66/IP67)*
2 *Aluminium - single chamber*
3 *Stainless steel single chamber (electropolished)*
4 *Stainless steel single chamber (precision casting)*
5 *Stainless steel single chamber (electropolished) IP69K*

## External housing on IP68 version

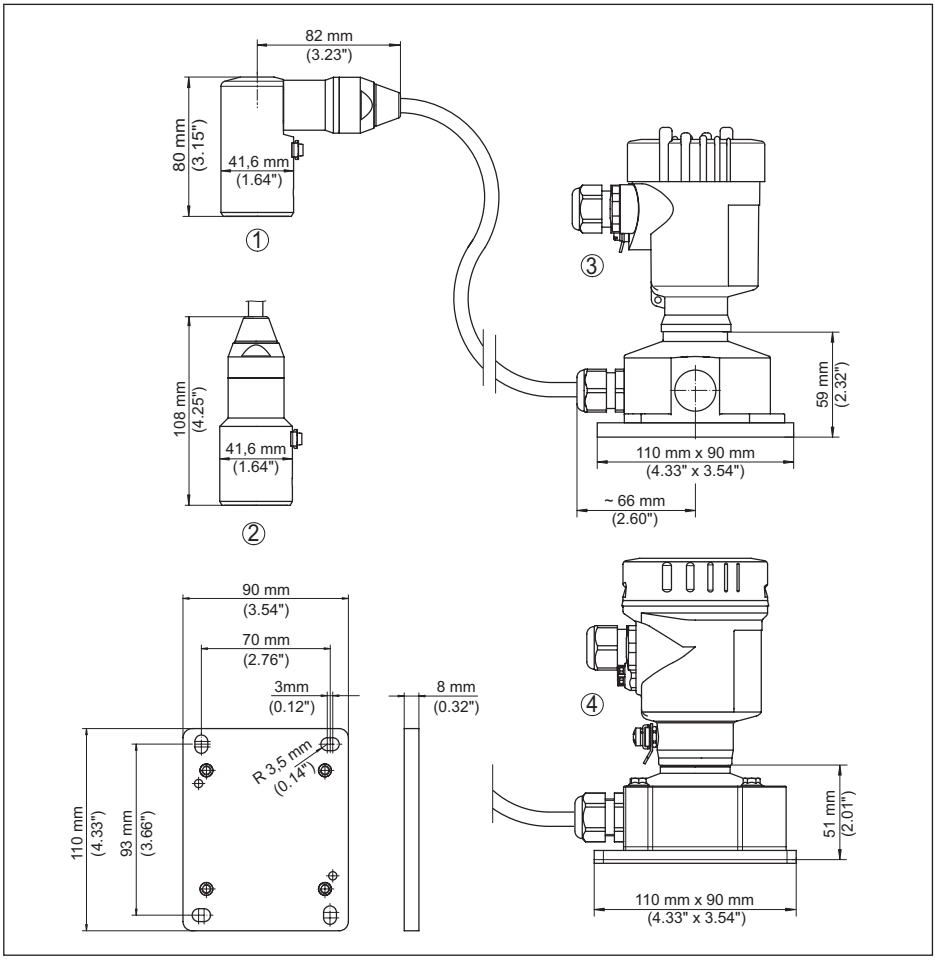



*Fig. 30: VEGABAR 87, IP68 version with external housing*

1 *Lateral cable outlet*
2 *Axial cable outlet*
3 *Plastic single chamber*
4 *Stainless steel single chamber*
5 *Seal 2 mm (0.079 in), (only with 3A approval)*

**VEGABAR 87**

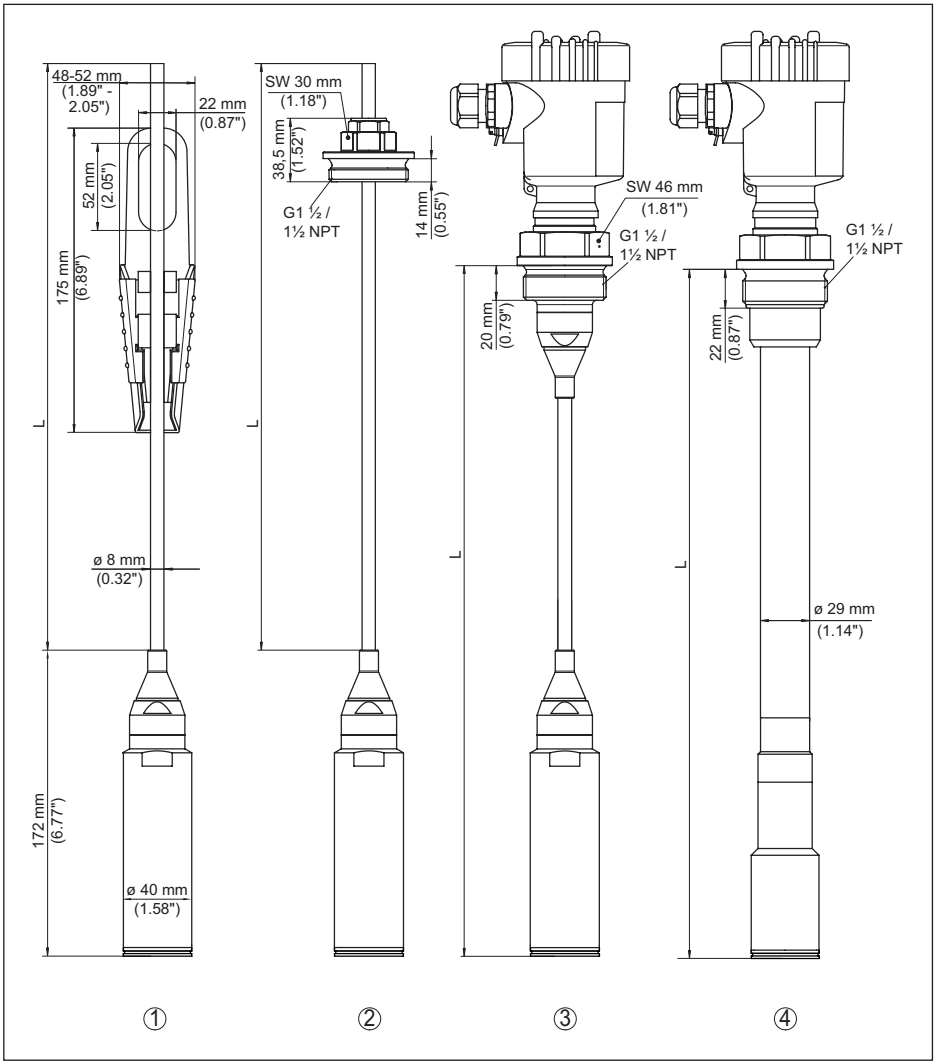
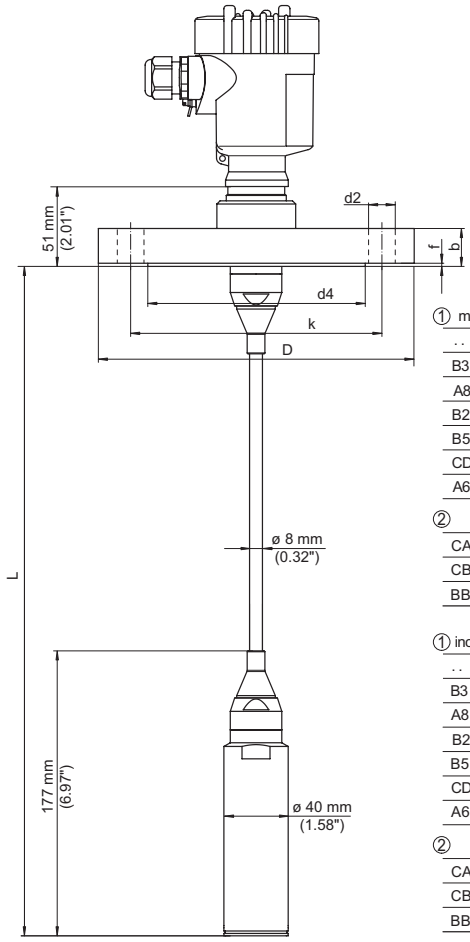



*Fig. 31: VEGABAR 87, standard fittings*

*1 Straining clamp*
*2 Threaded fitting*
*3 Thread G1½*
*4 Thread 1½ NPT*
*L Total length from configurator*

## VEGABAR 87, flange connection




| ① mm | DN | PN | D | b | k | d2 | d4 | f |
|---|---|---|---|---|---|---|---|---|
| .. | 25 | 40 | 115 | 18 | 85 | 4xø14 | 68 | 2 |
| B3 | 32 | 40 | 140 | 18 | 100 | 4xø18 | 78 | 2 |
| A8 | 40 | 40 | 150 | 18 | 110 | 4xø18 | 88 | 3 |
| B2 | 50 | 40 | 165 | 20 | 125 | 4xø18 | 102 | 3 |
| B5 | 80 | 40 | 200 | 24 | 160 | 8xø18 | 138 | 3 |
| CD | 100 | 16 | 220 | 20 | 180 | 8xø18 | 158 | 3 |
| A6 | 150 | 16 | 285 | 22 | 240 | 8xø22 | 162 | 3 |

| ② | " | lbs | D | b | k | d2 | d4 | f |
|---|---|---|---|---|---|---|---|---|
| CA | 2" | 150 | 152,5 | 19 | 120,5 | 4xø16 | 92 | 3 |
| CB | 3" | 150 | 190.5 | 19 | 152,5 | 4xø16 | 152 | 3 |
| BB | 4" | 300 | 254 | 30.5 | 200 | 8xø16 | 157 | 3 |

| ① inch | DN | PN | D | b | k | d2 | d4 | f |
|---|---|---|---|---|---|---|---|---|
| .. | 25 | 40 | 4.53" | 0.71" | 3.35" | 4xø 0.55" | 2.68" | 0.08" |
| B3 | 32 | 40 | 5.51" | 0.71" | 3.94" | 4xø 0.71" | 3.07" | 0.08" |
| A8 | 40 | 40 | 5.91" | 0.71" | 4.33" | 4xø 0.71" | 3.47" | 0.12" |
| B2 | 50 | 40 | 6.50" | 0.79" | 4.92" | 4xø 0.71" | 4.02" | 0.12" |
| B5 | 80 | 40 | 7.87" | 0.95" | 6.30" | 8xø 0.71" | 5.43" | 0.12" |
| CD | 100 | 16 | 8.66" | 0.79" | 7.09" | 8xø 0.71" | 6.22" | 0.12" |
| A6 | 150 | 16 | 11.22" | 0.87" | 9.45" | 8xø 0.87" | 6.38" | 0.12" |

| ② | " | lbs | D | b | k | d2 | d4 | f |
|---|---|---|---|---|---|---|---|---|
| CA | 2" | 150 | 6" | 0.75" | 4.75" | 4xø0.63" | 3.63" | 0.12" |
| CB | 3" | 150 | 7.50" | 0.75" | 6" | 4xø0.63" | 6" | 0.12" |
| BB | 4" | 300 | 10" | 1.25" | 7.87" | 8xø0.63" | 6.19" | 0.12" |

*Fig. 32: VEGABAR 87, flange connection*

*1 Flanges according to DIN 2501*
*2 Flanges according to ASME B16.5*
*L Total length from configurator*

## VEGABAR 87, hygienic fitting

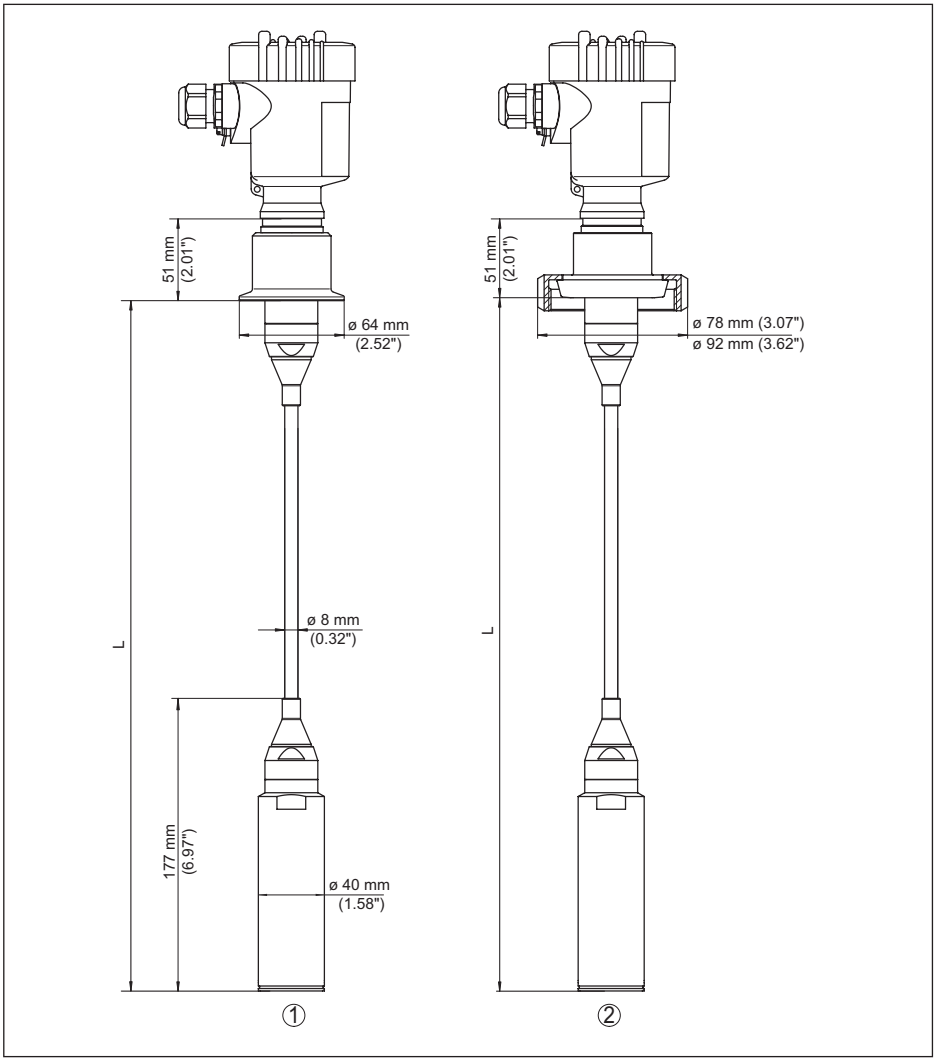



*Fig. 33: VEGABAR 87, hygienic fittings*

*1 Clamp 2" PN 16 (ø 64 mm) DIN 32676, ISO 2852*
*2 Slotted nut DN 50*
*L Total length from configurator*

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VEGA Grieshaber KG
Am Hohenstein 113
77761 Schiltach
Germany

Phone +49 7836 50-0
E-mail: info.de@vega.com
www.vega.com