Operating Instructions

Pressure transmitter with metallic measuring cell

VEGABAR 83

Secondary Device for electronic differential pressure

Document ID: 45051

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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, safety and the exchange of parts. 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 instruction 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.

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2 For your safety

2.1 Authorised personnel

All operations described in this documentation must be carried out only by trained and authorized personnel.

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

2.2 Intended use

As Secondary Device, the VEGABAR 83 is part of an electronic differential pressure meaasurement.

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 operating company 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 operating company 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.

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 us. Arbitrary conversions or modifications are explicitly forbidden. For safety reasons, only the accessory specified by us must be used.

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

2.5 Conformity

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

The corresponding conformity declarations can be found on our homepage.

Due to the design of its process fittings, the device does not subject of EU pressure device directive if it is operated at process pressures ≤ 200 bar.[1)]

2.6 NAMUR recommendations

As a Secondary Device, the device is part of an electronic differential pressure measurement. It fulfils the requirements of the NAMUR recommendations of the respective Primary Devices.

2.7 Installation and operation in the USA and Canada

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

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

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

2.8 Environmental instructions

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

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

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

[1)] Exception: Versions with measuring ranges from 250 bar. These are subject of the EU Pressure Device Directive.

3 Product description

3.1 Configuration

Scope of delivery

The scope of delivery encompasses:

- Pressure transmitter VEGABAR 83 - Secondary Device
- Ready-made connection cable, unassembled cable gland

The further scope of delivery encompasses:

- Documentation
  - Quick setup guide
  - 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. The respective scope of delivery results from the order specification.

Type label

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

- Instrument type
- Information about approvals
- Configuration information
- Technical data
- Serial number of the instrument
- QR code for device identification
- Numerical code for Bluetooth access (optional)
- Manufacturer information

Documents and software

To find order data, documents or software related to your device, you have the following options:

- Move to "www.vega.com" and enter in the search field the serial number of your instrument.
- Scan the QR code on the type label.
- Open the VEGA Tools app and enter the serial number under "***Documentation***".

RFID tag

An RFID tag with safety instructions relevant to explosion protection is supplied as an option. A wire and a seal for fastening are included.

The RFID tag is available in two versions:

RFID tag write-protected	RFID tag writable
● Recognisable by the DDCC RFID logo ● Written with identification link in accordance with IEC 61406, DIN Spec 91406 (syntax: sn.vega.com/12345678)	● Recognisable by the NFC logo ● Written with measurement loop identification

3.2 Principle of operation

Application area

VEGABAR 83 is suitable for applications in virtually all industries. It is used for the measurement of the following pressure types.

- Gauge pressure
- Absolute pressure
- Vacuum

Measured products

Measured products are gases, vapours and liquids.

The device is especially suitable for applications with higher temperatures and high pressures.

Measured variables

The electronic differential pressure measurement is suitable for the measurement of the following process variables:

- Level
- Flow
- Differential pressure
- Density
- Interface
- Level, density-compensated

Electronic differential pressure

The VEGABAR 83 Secondary Device is combined with a suitable sensor from the same device series to an electronic differential pressure measurement. The differential pressure measurement consists then of the Primary Device and Secondary Device.

Information:
The sensor versions "*Relative pressure climate-compensated*" as well as "*Double chamber housing*" are not suitable for connection of a Secondary Device.

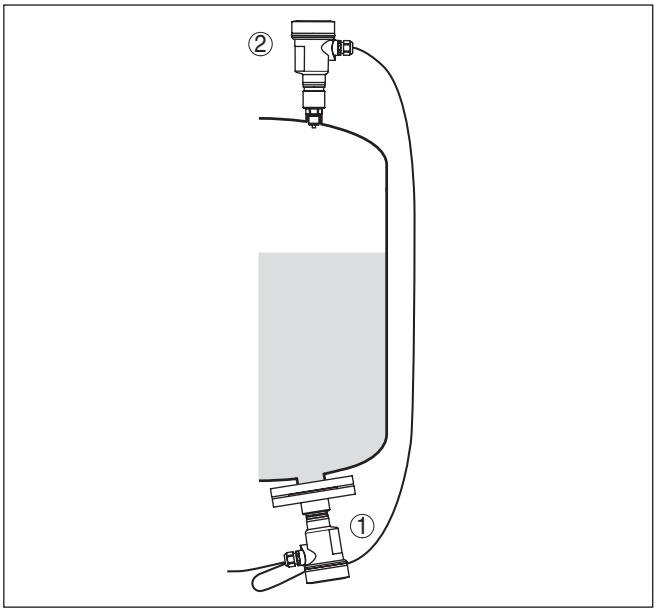

Fig. 1: Example, electronic differential pressure for level measurement in pressurized vessel

1 VEGABAR 83
2 VEGABAR 83, Secondary Device

The sensors are connected via a shielded four-wire cable. The measured value from the Secondary Device is read in and factored into the calculations. Power supply and parameter adjustment are carried out through the Primary Device.

You can find further information in chapter "*Combination Primary - Secondary* " of this operating instructions.

Pressure types

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.

Seal concept

The measuring system is completely welded and thus sealed against the process.

The process fitting is sealed against the process by a suitable seal. It must be provided by the customer, depending on the process fitting also included in the scope of delivery, see chapter "*Technical data*", "*Materials and weights*".

3.3 Supplementary cleaning procedures

The VEGABAR 83 is also available in the version "*Oil, grease and silicone-free*". These instruments have passed through a special cleaning procedure to remove oil, grease and paint-wetting impairment substances (PWIS).

The cleaning is carried out on all wetted parts as well as on surfaces accessible from outside. To keep the purity level, the instruments are immediately packed in plastic foil after the cleaning process. The purity level remains as long as the instrument is kept in the closed original packaging.

Caution:
The VEGABAR 83 in this version may not be used in oxygen applications. For this purpose, instruments are available in the special version "*Oil, grease and silicone-free for oxygen applications*".

3.4 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 "*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.

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3.5 Accessories

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

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 by "MWP" (Maximum Working Pressure) on the type label, see chapter "*Structure*". The MWP takes the element of the measuring cell and processing fitting combination with the weakest pressure into consideration and may applied permanently. The specification refers to a reference temperature of +20 °C (+68 °F). It also applies when a measuring cell with a higher measuring range than the permissible pressure range of the process fitting is installed order-related.

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.

Note:
In order to prevent damage to the device, a test pressure may only exceed the specified MWP briefly by 1.5 times at reference temperature. The pressure stage of the process fitting as well as the overload resistance of the measuring cell are taken into consideration here (see chapter "*Technical Data*").

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.

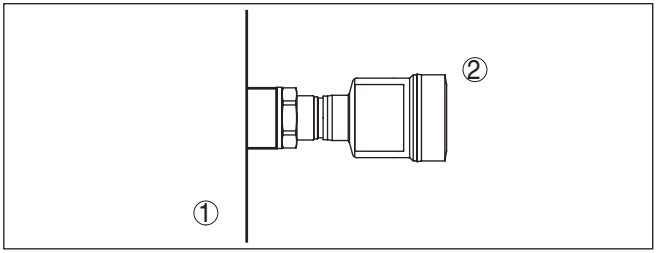

Fig. 2: Temperature ranges

1 Process temperature
2 Ambient temperature

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

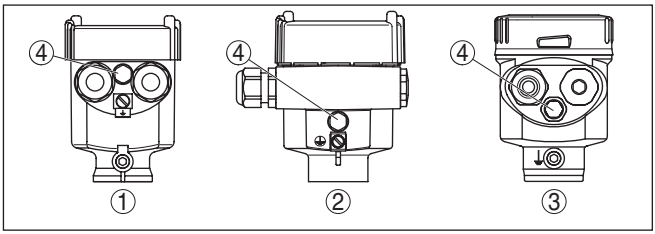

Fig. 3: Position of the filter element - non-Ex, Ex ia version

1 Plastic, stainless steel housing (precision casting)
2 Aluminium housing
3 Stainless steel housing (electropolished)
4 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.

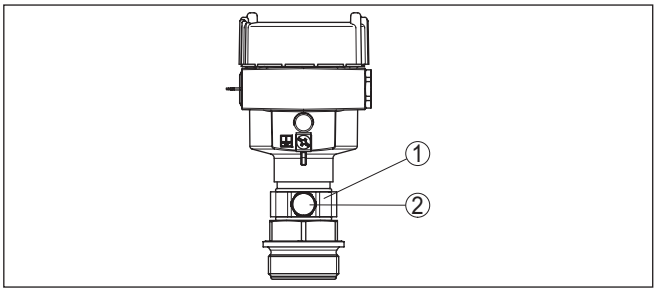

Fig. 4: Position of the filter element - Ex d version

1 Rotatable metal ring
2 Filter element

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

Instruments with Second Line of Defense

The process assembly of instruments with Second Line of Defense (gastight leadthrough) is completely encapsulated. An absolute pressure measuring cell is used so that no ventilation is required.

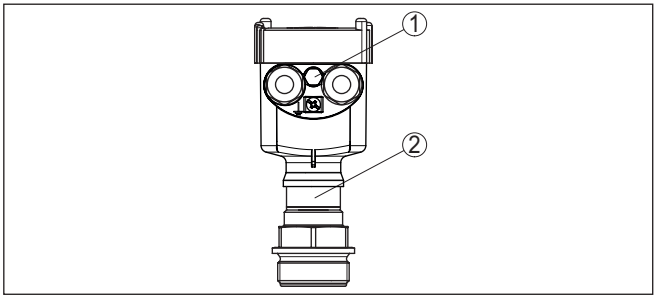

Fig. 5: Position of the filter element - gastight leadthrough

1 Filter element

Filter element - Position IP69 version

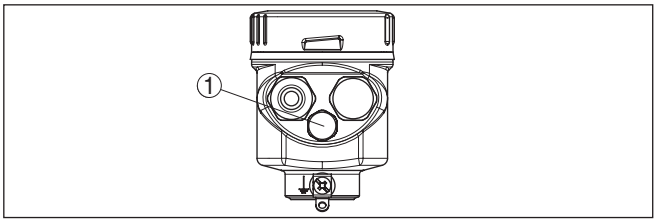

Fig. 6: Position of the filter element - IP69 version

1 Filter element

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

4.3 Combination Primary - Secondary

In principle, any sensor combination within the instrument series is allowed. The following requirements must be fulfilled:

- Configuration of the sensor suitable for electronic differential pressure
- Pressure type is identical for both sensors, i.e. relative pressure/ relative pressure or absolute pressure/absolute pressure
- Primary Device measures the higher pressure
- Measurement setup as shown in the following chapters

The measuring range of each sensor is selected such that it fits the measuring loop. For this, the max. recommended turn down must be noted. See chapter "*Technical data*". It is absolutely necessary the the measuring ranges of Primary and Secondary Device correspond.

Measurement result = Measured value of Primary (total pressure) - measured value of Secondary (static pressure)

Depending on the application, individual combinations can result, see following examples:

Example - large vessel

Data
Application: Level measurement

Medium: Water

Vessel height: 12 m, hydrostatic pressure = 12 m x 1000 kg/m³ x 9.81 m/s² = 117.7 kPa = 1.18 bar

Superimposed pressure: 1 bar

Total pressure: 1.18 bar + 1 bar = 2.18 bar

Instrument selection
Nominal measuring range Primary: 2.5 bar

Nominal measuring range Secondary: 1 bar

Turn Down: 2.5 bar/1.18 bar = 2.1 : 1

Example - small vessel

Data
Application: Level measurement

Medium: Water

Vessel height: 500 mm, hydrostatic pressure = 0.50 m x 1000 kg/m³ x 9.81 m/s² = 4.9 kPa = 0.049 bar

Superimposed pressure: 350 mbar = 0.35 bar

Total pressure: 0.049 bar + 0.35 bar = 0.399 bar

Instrument selection
Nominal measuring range Primary: 0.4 bar

Nominal measuring range Secondary: 0.4 bar

Turn Down: 0.4 bar /0.049 bar = 8.2 : 1

Example - orifice in pipeline

Data
Application: Differential pressure measurement

Medium: Gas

Static pressure: 0.8 bar

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Differential pressure on orifice: 50 mbar = 0.050 bar

Total pressure: 0.8 bar + 0.05 bar = 0.85 bar

Instrument selection

Nominal measuring range Primary: 1 bar

Nominal measuring range Secondary: 1 bar

Turn Down: 1 bar/0.050 bar = 20 : 1

Output measured values

The measuring result (level, pressure difference) as well as measured value Secondary (static or superimposed pressure) are output by the sensor. Depending on the instrument version, output as 4 … 20 mA signal or digitally via HART, Profibus PA or Foundation Fieldbus.

4.4 Level measurement

Measurement setup

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

- Mount the Primary Device below the min. level
- Mount primary device away from emptying
- Mount the Primary Device so that it is protected against pressure shocks from the stirrer
- Mount the Secondary Device above the max. level
- Mount secondary device away from filling stream

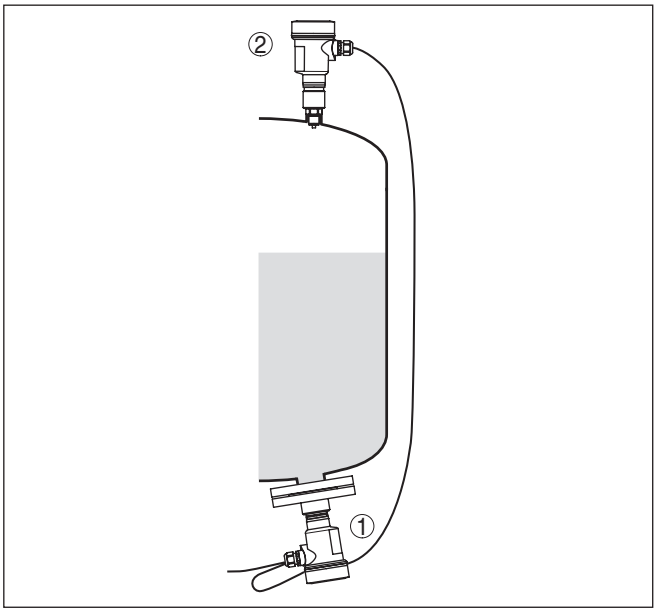

Fig. 7: Measurement setup, level measurement in pressurized vessel

1 VEGABAR 83, Primary Device
2 VEGABAR 83, Secondary Device

4.5 Differential pressure measurement

Measurement setup

Take note of the following instructions for the measurement setup, for example in gases:

- Mount the instruments above the measuring point

Possible condensation can then drain off into the process line.

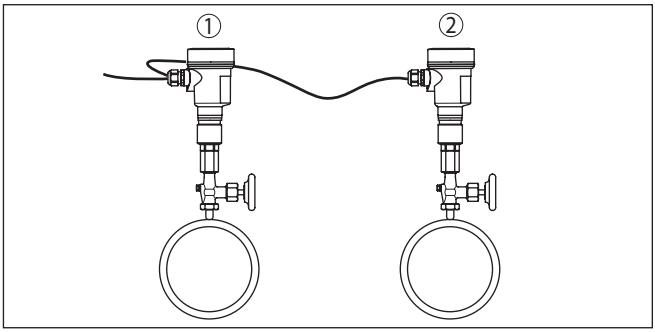

Fig. 8: Measurement setup for differential pressure measurement of gases in pipelines

1 VEGABAR 83, Primary Device
2 VEGABAR 83, Secondary Device

4.6 Interface measurement

Measurement setup

Requirements for a functioning measurement are:

- Vessel with changing level
- Products with steady density
- Interface always between the measurement points
- Total level always above the upper measurement point

The mounting distance "*h*" of the two sensors should be at least 10 %, better 20 %, of the final value of the sensor measuring range. A bigger distance increases the accuracy of the interface measurement.

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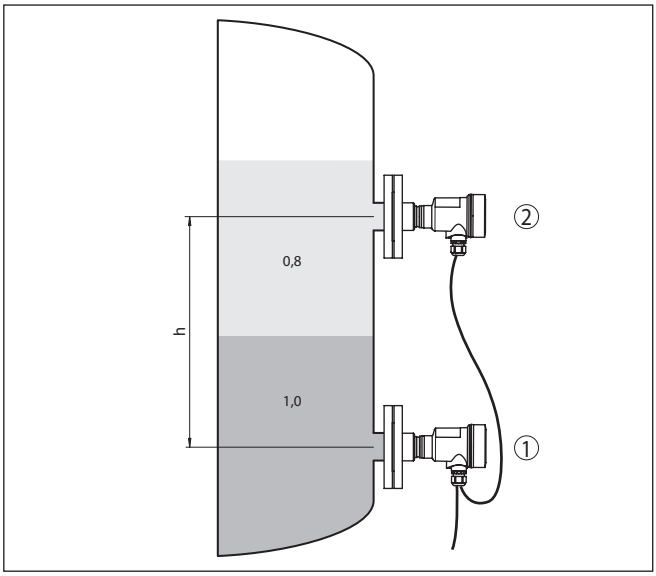


Fig. 9: Measurement setup with interface measurement, h = distance between the two measuring points

1 VEGABAR 83, Primary Device
2 VEGABAR 83, Secondary Device

Note:
The interface measurement is possible in open as well as in closed vessels.

4.7 Density measurement

Measurement setup

Requirements for a functioning measurement are:

- Vessel with changing level
- Distance between the measurement points as large as possible
- Level always above the upper measuring point

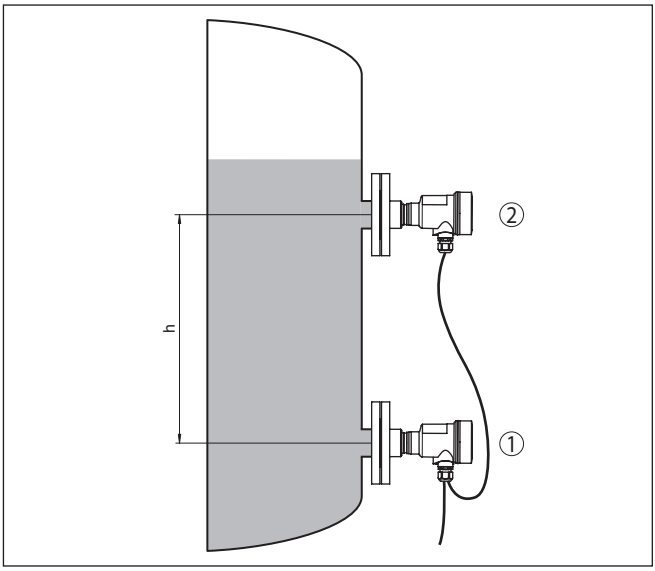


Fig. 10: Measurement setup for density measurement, h = distance between the two measuring points

1 VEGABAR 83, Primary Device
2 VEGABAR 83, Secondary Device

The mounting distance "*h*" of the two sensors should be at least 10 %, better 20 %, of the final value of the sensor measuring range. A bigger distance increases the accuracy of the density measurement.

Slight density changes cause only slight changes of the measured differential pressure. The measuring range must hence be selected accordingly.

Note:
The density measurement is possible in open as well as in closed vessels.

4.8 Density-compensated level measurement

Measurement setup

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

- Mount the Primary Device below the min. level
- Mount the Secondary Device above the Primary Devices
- Mount both sensors away from the filling stream and emptying and protected against pressure shocks from the stirrer

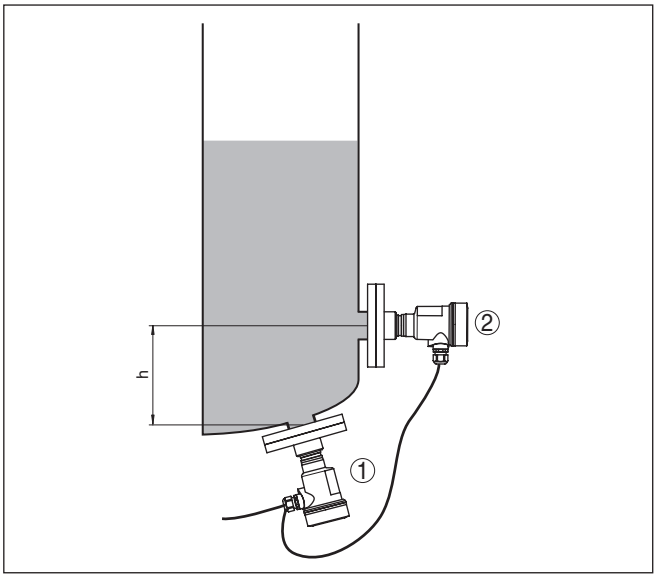


Fig. 11: Measurement setup for density-compensated level measurement, h = distance between the two measuring points

1 VEGABAR 83, Primary Device
2 VEGABAR 83, Secondary Device

The mounting distance "*h*" of the two sensors should be at least 10 %, better 20 %, of the final value of the sensor measuring range. A bigger distance increases the accuracy of the density compensation.

The density-compensated level measurement starts with the stored density 1 kg/dm³. As soon as both sensors are covered (the upper sensor with at least 20 mbar), this value will be replaced by the calculated density. Density compensation means that the level value in height units and the adjustment values do not change in case of a fluctuating density.

Note:
The density-compensated level measurement is only possible in open, i.e. unpressurized vessels.

4.9 External housing

Configuration

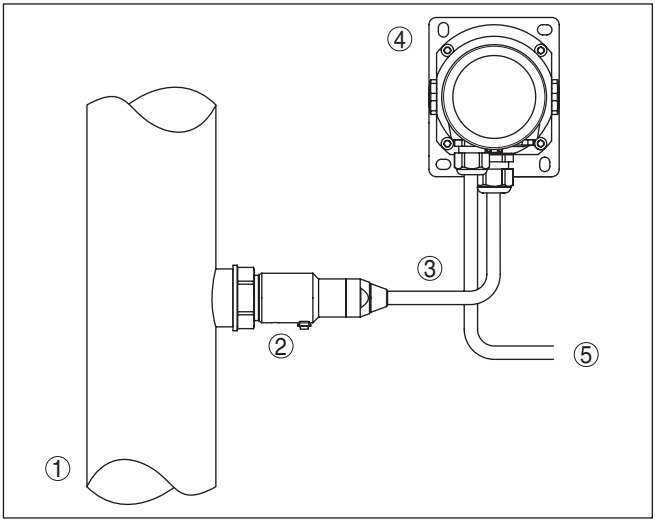


Fig. 12: Configuration, process module, external housing

1 *Pipeline*
2 *Process module*
3 *Connection cable process assembly - External housing*
4 *External housing*
5 *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

The voltage supply and the signal transmission are carried out via the four-wire, shielded connection cable from the Primary Device.

You can find the data for this signal circuit in chapter "*Technical data*".

Connection cable

The device is connected via the supplied four-wire, shielded cable or a similar cable provided by the customer. You can find detailed information of the connection cable in chapter "*Technical data*".

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

Cable screening and grounding

The shielding of the cable between Primary and Secondary Device must be connected on both ends to ground potential. In the sensor, the shielding is 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).

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 connection to the Primary Device is carried out through spring-loaded terminals in the respective housing. For this, use the supplied, confectioned cable. Solid cores as well as flexible cores with cable 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.

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.

You can find further information on the max. wire cross-section under "*Technical data - Electromechanical data*".

Connection procedure

Proceed as follows:

1. Unscrew the housing lid
2. Loosen compression nut of the cable gland and remove blind plug
3. Remove approx. 10 cm (4 in) of the cable mantle, strip approx. 1 cm (0.4 in) insulation from the individual wires or use supplied connection cable
4. Insert the cable into the sensor through the cable entry

Fig. 13: Connection steps 5 and 6

5. Insert the wire ends into the terminals according to the wiring plan
6. Check the hold of the wires in the terminals by lightly pulling on them
7. Connect the shielding to the internal ground terminal, connect the external ground terminal to potential equalisation

8. Tighten the compression nut of the cable entry gland. The seal ring must completely encircle the cable
9. Unscrew the blind plug on the Primary, screw in the supplied cable gland
10. Connection cable to Primary, see steps 3 to 8
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 ia version.

Electronics and connection compartment

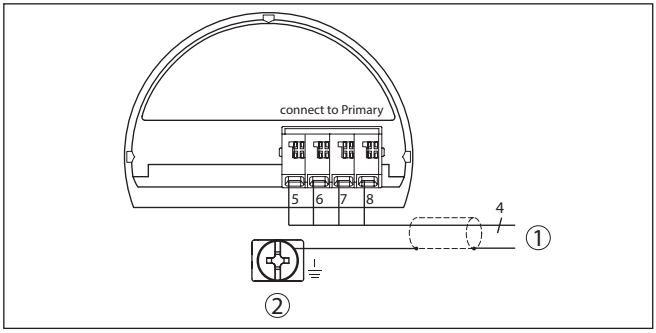


Fig. 14: Wiring plan VEGABAR 83 Secondary Device

1 To the Primary Device
2 Ground terminal for connection of the cable screening[2)]

[2)] Connect shielding here. Connect ground terminal on the outside of the housing to ground as prescribed. The two terminals are galvanically connected.

5.4 External housing with version IP68 (25 bar)

Overview

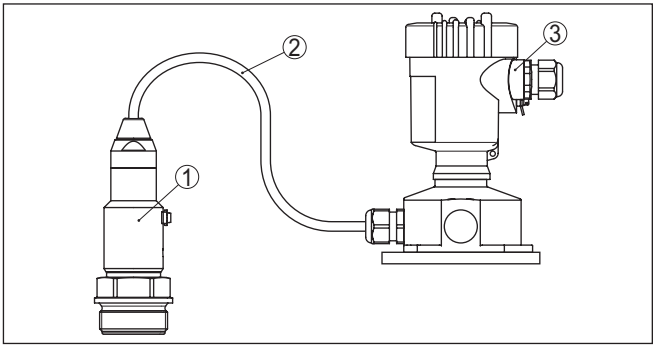


Fig. 15: VEGABAR 83 in IP68 version 25 bar with axial cable outlet, external housing

1 Transmitter
2 Connection cable
3 External housing

Electronics and connection compartment for power supply

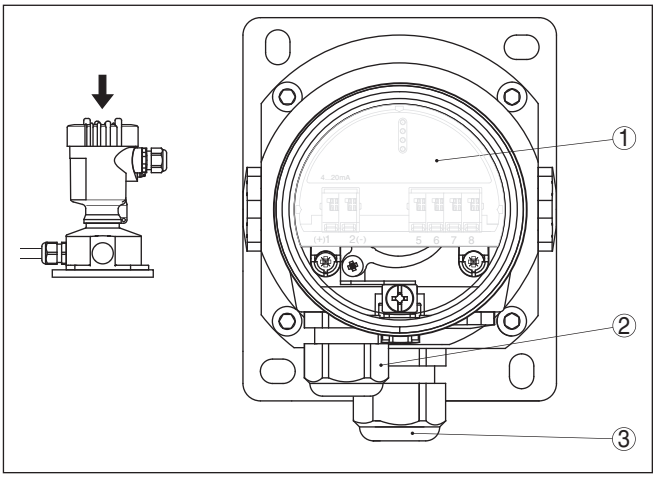


Fig. 16: Electronics and connection compartment

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

Terminal compartment, housing socket

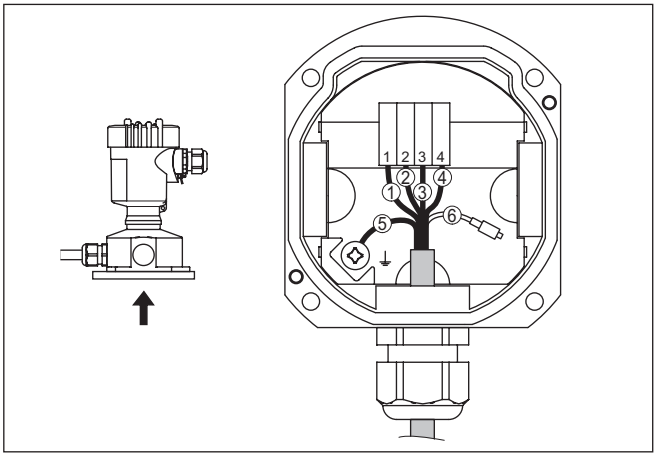


Fig. 17: Connection of the process component in the housing base

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

Electronics and connection compartment

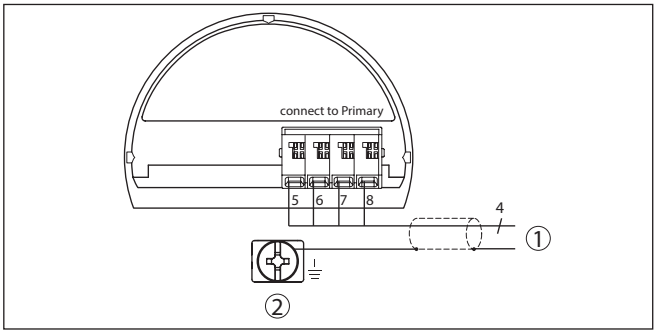


Fig. 18: Wiring plan VEGABAR 83 Secondary Device

1 *To the Primary Device*
2 *Ground terminal for connection of the cable screening*[3)]

[3)] Connect shielding here. Connect ground terminal on the outside of the housing to ground as prescribed. The two terminals are galvanically connected.

5.5 Connection example

Connection example, electronic differential pressure

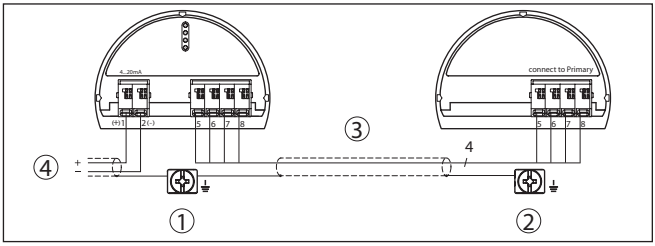


Fig. 19: Connection example, electronic differential pressure

1 Primary Device
2 Secondary Device
3 Connection cable
4 Supply and signal circuit Primary Device

The connection between Primary and Secondary Device is carried out acc. to the table:

Primary Device	Secondary Device
Terminal 5	Terminal 5
Terminal 6	Terminal 6
Terminal 7	Terminal 7
Terminal 8	Terminal 8

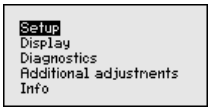
6 Set up with the display and adjustment module

6.1 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

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

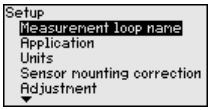
Diagnosis: Information, e.g. on instrument status, peak indicator, measurement reliability, simulation

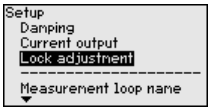
Additional adjustments: PIN, date/time, reset, copy function

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

In the main menu item "*Setup*", the individual submenu items should be selected one after the other and provided with the correct parameter values.

The following submenu points are available:





In the following section, the menu items from the menu "*Setup*" for electronic differential pressure measurement are described in detail. Depending on the selected application, different sections are relevant.

Information:
Further menu items of the menu "*Setup*" as well as the complete menus "*Display*", "*Diagnosis*", "*Additional adjustments*" and "*Info*" are described in the operating instructions of the respective Primary Device.

6.1.1 Setup

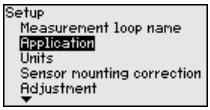
Application

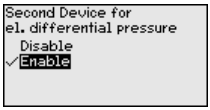
In this menu item you activate/deactivate the Secondary Device for electronic differential pressure and select the application.

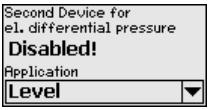
The VEGABAR 83 in conjunction with a Secondary Device can be used for flow, differential pressure, density and interface measurement. The default setting is differential pressure measurement. Switchover is carried out in the adjustment menu.

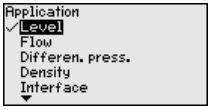
If you have connected **a** Secondary Device, you confirm this with "*Activate*".

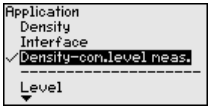
Note:
It is absolutely necessary to activate the Secondary Device to have the applications displayed in the electronic differential pressure measurement menus.







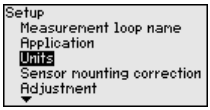


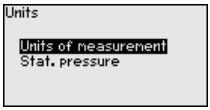


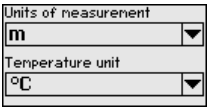
Enter the requested parameters via the appropriate keys, save your settings with ***[OK]*** and jump to the next menu item with the ***[ESC]*** and the ***[->]*** key.

Units

In this menu item, you determine the units for the "*Min. adjustment/Zero*" and "*Max. adjustment/Span*" as well as the static pressure.







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 unit is determined in the menu item "*Peak indicator temperature*".

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

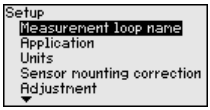
Especially with chemical seal systems, the installation position of the instrument can shift (offset) the measured value. Position correction compensates this offset. In the process, the actual measured value is taken over automatically. With relative pressure measuring cells a manual offset can also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

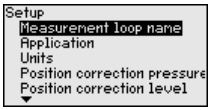
There are the following possibilities for a position correction with a Primary/Secondary combination

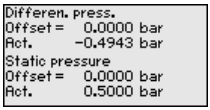
- Automatic correction for both sensors
- Manual correction for the Primary (differential pressure)
- Manual correction for the Secondary (static pressure)

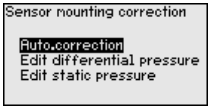
With a Primary/Secondary combination in the application "*Density-compensated level measurement*" there are the following additional options for the position correction

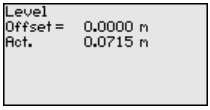
- Automatic correction, Primary (level)
- Manual correction for the Primary (level)

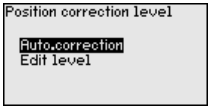


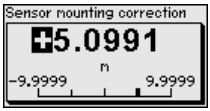












During an automatic position correction, the current measured value is accepted as the correction value. This value must not be influenced/corrupted by product coverage or static pressure.

In case of a manual position correction, the offset value is 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 any number of times.

Adjustment

VEGABAR 83 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).

When using the application "*Level*", the hydrostatic pressure, e.g. with full and empty vessel, is entered as adjustment value. A superimposed pressure is detected by the Secondary Device and automatically compensated. See the following example:

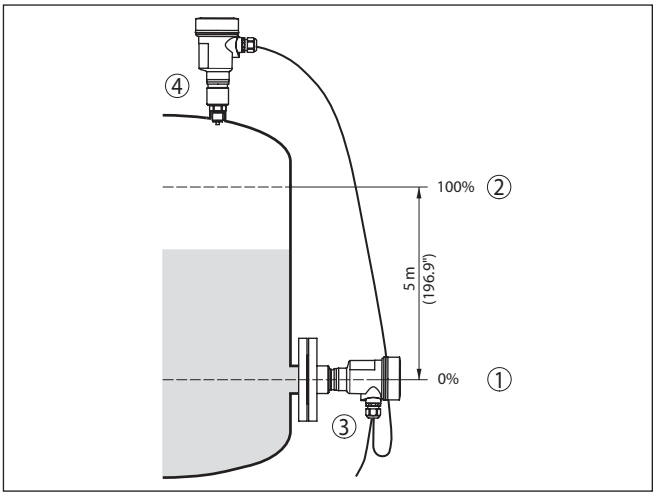


Fig. 20: Parameter adjustment example Min./max. adjustment, level measurement

1 *Min. level = 0 % corresponds to 0.0 mbar*
2 *Max. level = 100 % corresponds to 490.5 mbar*
3 *VEGABAR 83, Primary Device*
4 *VEGABAR 83, Secondary Device*

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.

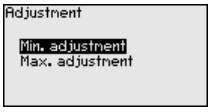
Note:
If the adjustment ranges are exceeded, the entered value will not be accepted. Editing can be interrupted with ***[ESC]*** or corrected to a value within the adjustment ranges.

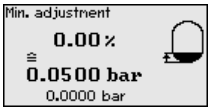
For the other process variables such as e.g. process pressure, differential pressure or flow, the adjustment is performed in like manner.

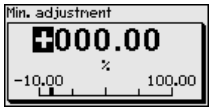
Min. adjustment - Level

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.

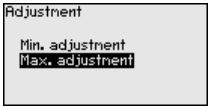
The min. adjustment is finished.

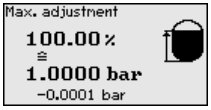
For an adjustment with filling, simply enter the actual measured value indicated at the bottom of the display.

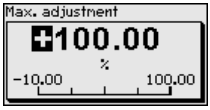
Max. adjustment - Level

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]***

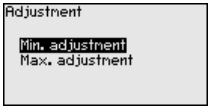
The max. adjustment is finished.

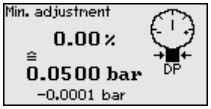
For an adjustment with filling, simply enter the actual measured value indicated at the bottom of the display.

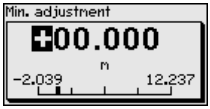
Min. adjustment flow

Proceed as follows:

1. Select the menu item "*Setup*" with ***[->]*** and confirm with ***[OK]***. Now select with ***[->]*** the menu item "*Min. 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. Change with ***[ESC]*** and ***[->]*** to the span adjustment

With flow in two directions (bidirectional) a negative differential pressure is also possible. The maximum negative pressure must then be entered for the min. adjustment. For linearization, select "*bidirectional*" or "*bidirectional-extracted by root*" accordingly, see menu item "*Linearization*".

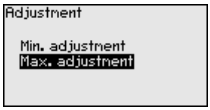
The min. adjustment is finished.

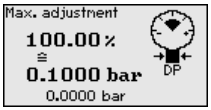
For an adjustment with pressure, simply enter the actual measured value indicated at the bottom of the display.

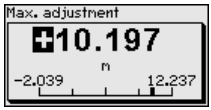
Max. adjustment flow

Proceed as follows:

1. Select with ***[->]*** the menu item Max. 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]***.

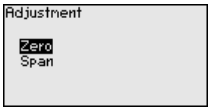
The max. adjustment is finished.

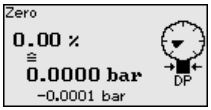
For an adjustment with pressure, simply enter the actual measured value indicated at the bottom of the display.

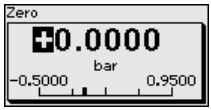
Zero adjustment differential pressure

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. Change with ***[ESC]*** and ***[->]*** to the span adjustment

The zero adjustment is finished.

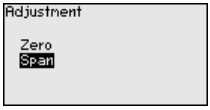
Information:
The Zero adjustment shifts the value of the span adjustment. The span, i.e. the difference between these values, however, remains unchanged.

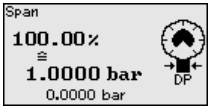
For an adjustment with pressure, simply enter the actual measured value indicated at the bottom of the display.

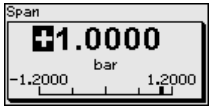
Span adjustment differential pressure

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]***.

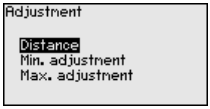
The span adjustment is finished.

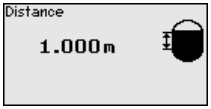
For an adjustment with pressure, simply enter the actual measured value indicated at the bottom of the display.

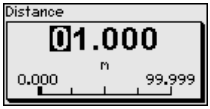
Distance density

Proceed as follows:

. Select in the menu item "*Setup*" with ***[->]*** "*Adjustment*" and confirm with ***[OK]***. Now confirm the menu item "*Distance*" with ***[OK]***.







. Edit the sensor distance with ***[OK]*** and set the cursor to the requested position with ***[->]***.

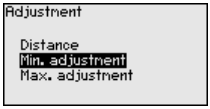
. Set the distance with ***[+]*** and save with ***[OK]***.

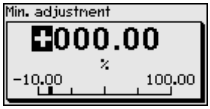
The adjustment of the distance is hence finished.

Min. adjustment density

Proceed as follows:

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





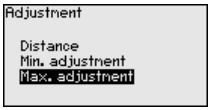
2. Edit the percentage value with ***[OK]*** and set the cursor to the requested position with ***[->]***.
3. Set the requested percentage value with ***[+]*** and save with ***[OK]***. The cursor jumps now to the density value.
4. Enter the min. density corresponding to the percentage value.
5. Save settings with ***[OK]*** and move with ***[ESC]*** and ***[->]*** to the max. adjustment.

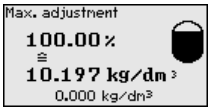
The min. adjustment for density is finished.

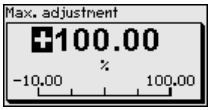
Max. adjustment density

Proceed as follows:

1. Select the menu item "*Setup*" with ***[->]*** and confirm with ***[OK]***. Now 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 with ***[+]*** and save with ***[OK]***. The cursor jumps now to the density value.

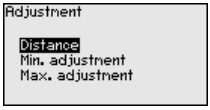
4. Enter the max. density value corresponding to the percentage value.

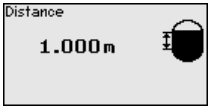
The max. adjustment for density is finished.

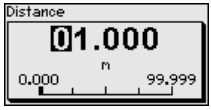
Distance interface

Proceed as follows:

1. Select in the menu item "*Setup*" with ***[->]*** "*Adjustment*" and confirm with ***[OK]***. Now confirm the menu item "*Distance*" with ***[OK]***.







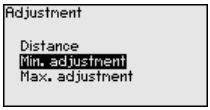
2. Edit the sensor distance with ***[OK]*** and set the cursor to the requested position with ***[->]***.
3. Set the distance with ***[+]*** and save with ***[OK]***.

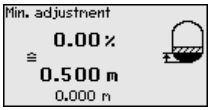
The adjustment of the distance is hence finished.

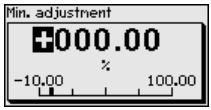
Min. adjustment interface

Proceed as follows:

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







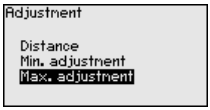
2. Edit the percentage value with ***[OK]*** and set the cursor to the requested position with ***[->]***.
3. Set the requested percentage value with ***[+]*** and save with ***[OK]***. The cursor jumps now to the height value.
4. Enter the min. height of the interface corresponding to the percentage value.
5. Save settings with ***[OK]*** and move with ***[ESC]*** and ***[->]*** to the max. adjustment.

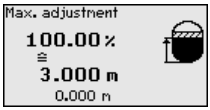
The min. adjustment for interface is thus finished.

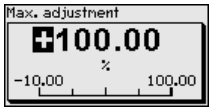
Max. adjustment interface

Proceed as follows:

1. Select the menu item "*Setup*" with ***[->]*** and confirm with ***[OK]***. Now 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 with ***[+]*** and save with ***[OK]***. The cursor jumps now to the height value.

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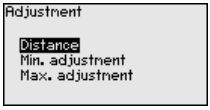
4. Enter the max. height of the interface corresponding to the percentage value.

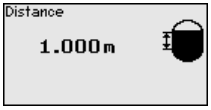
The max. adjustment for interface is finished.

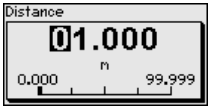
Distance level density-compensated

Proceed as follows:

. Select in the menu item "*Setup*" with ***[->]*** "*Adjustment*" and confirm with ***[OK]***. Now confirm the menu item "*Distance*" with ***[OK]***.







. Edit the sensor distance with ***[OK]*** and set the cursor to the requested position with ***[->]***.

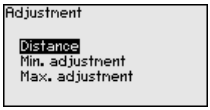
. Set the distance with ***[+]*** and save with ***[OK]***.

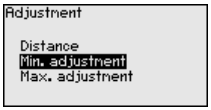
The adjustment of the distance is hence finished.

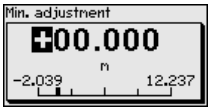
Min. adjustment level density-compensated

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. 0 %) with ***[+]*** and save with ***[OK]***. The cursor jumps now to the pressure value.
4. Enter the value corresponding to the min. level (e.g. 0 m).
5. Save settings with ***[OK]*** and move with ***[ESC]*** and ***[->]*** to the max. adjustment.

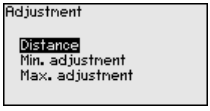
The min. adjustment is finished.

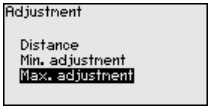
For an adjustment with filling, simply enter the actual measured value indicated at the bottom of the display.

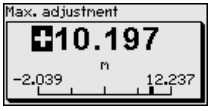
Max. adjustment level density-compensated

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. 100 %) with ***[+]*** and save with ***[OK]***. The cursor jumps now to the pressure value.

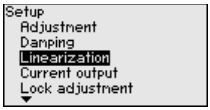
4. Enter the value for the full vessel (e.g. 10 m) corresponding to the percentage value.
5. Save settings with ***[OK]***

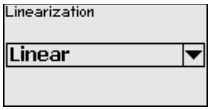
The max. adjustment is finished.

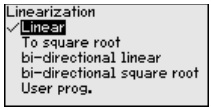
For an adjustment with filling, simply enter the actual measured value indicated at the bottom of the display.

Linearisation

A linearization is necessary for all applications in which the measured process variable does not increase linearly with the measured value. This applies for example to the flow measured via the differential pressure or the vessel volume measured via the level. Corresponding linearization curves are preprogrammed for such cases. They represent the correlation between the measured value percentage and process variable. 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**".[4)]

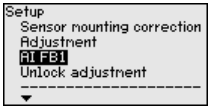
With flow in two directions (bidirectional) a negative differential pressure is also possible. This must already be taken into account in menu item "*Min. adjustment flow*".

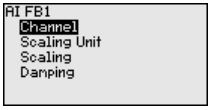
Caution:
Note the following, if the respective sensor is used as part of an overfill protection system according to WHG:

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.

AI FB1

Since the parameter adjustment of the Function Block 1 (FB1) is very comprehensive, it was divided into various submenu items.



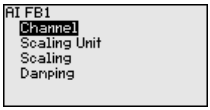


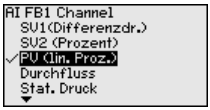
AI FB1 - Channel

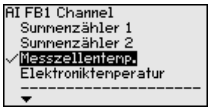
In menu item "*Channel*" you determine the input signal for further processing in AI FB 1.

[4)] The device assumes an approximately constant temperature and static pressure and calculates the flow rate from the measured differential pressure using the characteristic curve extracted by root.

As input signals, the output values of Transducer Block (TB) can be selected.



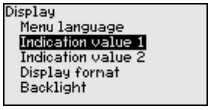


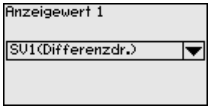


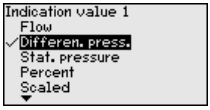
6.1.2 Display

Display value 1 and 2 - 4 … 20 mA

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



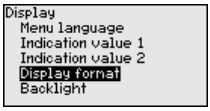


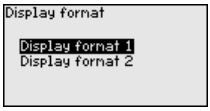


The default setting for the displayed value is "*Differential pressure*".

Display format 1 and 2

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

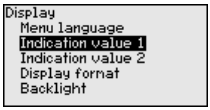


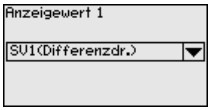


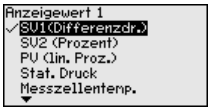
The default setting for the display format is "*Automatic*".

Display value 1 and 2 - bus systems

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



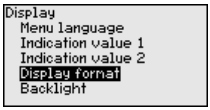


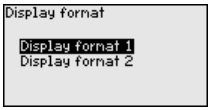


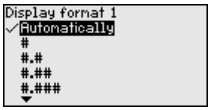
The default setting for the displayed value is "*Differential pressure*".

Display format 1 and 2

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







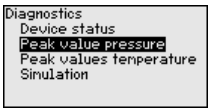
The default setting for the display format is "*Automatic*".

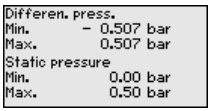
6.1.3 Diagnostics

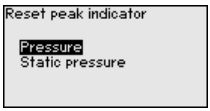
Peak indicator, pressure

The respective min. and max. measured values for the differential pressure and static pressure are stored in the sensor. In menu item "*Peak indicator, pressure*", both values are displayed.

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

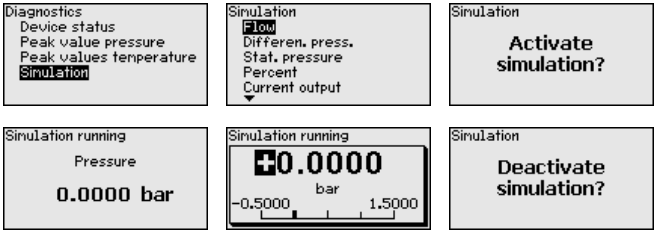






Simulation 4 … 20 mA/ HART

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.

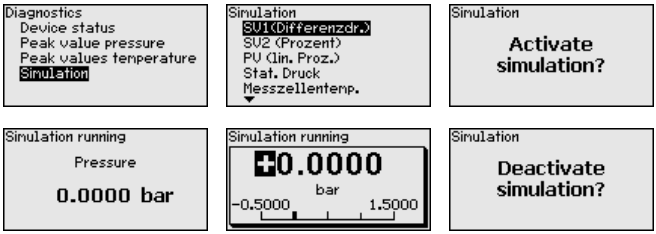
To deactivate the simulation, you have to push the ***[ESC]*** key and confirm the message "*Deactivate simulation*" with the ***[OK]*** key.

Caution:
During simulation, the simulated value is output as 4 … 20 mA current value and 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.

Simulation bus systems

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 digital signal. The status message along with the Asset Management function is "*Maintenance*".

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

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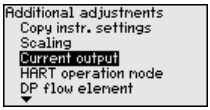
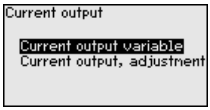
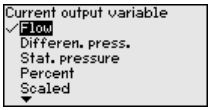
6.1.4 Additional adjustments

Current output 1 and 2 (size)

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





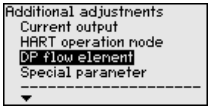


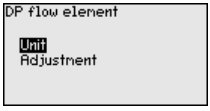
The following selection is possible depending on the selected application:

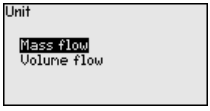
- Flow
- Height - Interface
- Density
- Differential pressure
- Static pressure
- Percent
- Scaled
- Percent linearized
- Measuring cell temperature (ceramic measuring cell)
- Electronics temperature

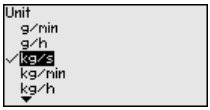
Characteristics values DP flow element

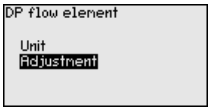
In this menu item, the units for the DP flow element are determined and the selection of mass or volume flow is carried out.

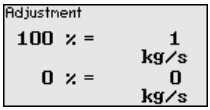












Furthermore the adjustment for the volume or mass flow at 0 % or 100 % is carried out.

The device automatically adds the flow in the selected unit. With appropriate adjustment and bidirectional linearization, the flow rate is counted both positively and negatively.

6.2 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.

Note:
You can find further menu items in the operating instructions of the respective Primary Device.

Setup

Menu item	Parameter	Default setting
Measurement loop name	19 alphanumeric characters/special characters	Sensor
Application	Application	Level
	Secondary Device for electronic differential pressure	Deactivated
Units	Unit of measurement	mbar (with nominal measuring range ≤ 400 mbar) bar (with nominal measuring ranges ≥ 1 bar)
	Static pressure	bar
Position correction		0.00 bar
Adjustment	Distance (with density and interface)	1.00 m
	Zero/Min. adjustment	0.00 bar 0.00 %
	Span/Max. adjustment	Nominal measuring range in bar 100.00 %
Damping	Integration time	0.0 s
Linearisation	Linear, cylindrical tank, … user-defined	Linear
Current output	Current output - Mode	Output characteristics 4 … 20 mA Reaction when malfunctions occur ≤ 3.6 mA
	Current output - Min./Max.	3.8 mA 20.5 mA
Lock adjustment	Blocked, released	Last setting

Display

Menu item	Default setting
Menu language	Order-specific
Displayed value 1	Current output in %
Displayed value 2	Ceramic measuring cell: Measuring cell temperature in °C Metallic measuring cell: Electronics temperature in °C
Display format	Number of positions after the decimal point, automatically

Menu item	Default setting
Backlight	Switched on

Diagnostics

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

Additional adjustments

Menu item	Parameter	Default setting
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 100 % corresponds to 0 l
Current output	Current output - Meas. variable	Lin. percent - Level
	Current output - Adjustment	0 … 100 % correspond to 4 … 20 mA
HART mode		Address 0
DP flow element	Unit	m^3/s
	Adjustment	0.00 % correspond to 0.00 m^3/s 100.00 %, 1 m^3/s
Special parameters	Service-Login	No reset

Info

Menu item	Parameter
Device name	VEGABAR 83
Instrument version	Hardware and software version
Factory calibration date	Date
Sensor characteristics	Order-specific characteristics

7 Diagnosis, asset management and service

7.1 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

7.2 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.

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.

7.3 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.

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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

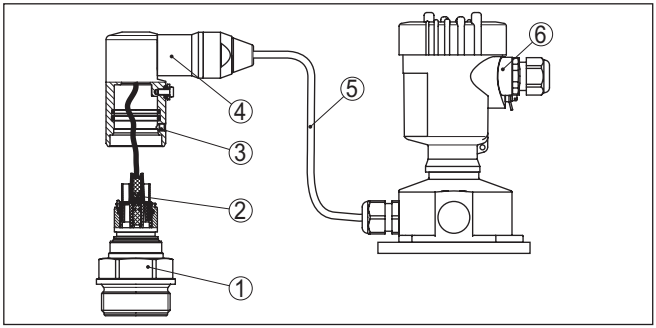

Fig. 21: VEGABAR 83 in IP68 version, 25 bar and lateral cable outlet, external housing

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.

7.4 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.

If there is no electronics module available on site, one can be ordered from the agency serving you.

7.5 How to proceed if a repair is necessary

On our homepage you will find detailed information on how to proceed in the event of a repair.

So that we can carry out the repair quickly and without queries, generate a instrument return form there with the data of your device.

The following is required:

- The serial number of the instrument
- A short description of the fault
- Details of the medium, if applicable

Print the generated instrument return form.

Clean the instrument and pack it damage-proof.

Send the printed instrument return form and possibly a safety data sheet together with the device.

You will find the address for the return on the generated instrument return form.

8 Dismount

8.1 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.

8.2 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.

9 Supplement

9.1 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 (piezoresistive/strain gauge measuring cell)	
Process fitting	316L
Diaphragm standard	316L
Diaphragm from measuring range 25 bar, with not flush version	Elgiloy (2.4711)
Seal ring, O-ring	FKM (VP2/A), EPDM (A+P 70.10-02), FFKM (Perlast G74S), FEPM (Fluoraz SD890)
Seal for process fitting (in the scope of delivery)	
– Thread G½ (EN 837)	Klingersil C-4400
Materials, wetted (ceramic/metallic measuring cell)	
Process fitting	316L
Diaphragm	Alloy C276 (2.4819), gold-coated 20 µ, gold/rhodium-coated 5 µ/1 µ[5]
Seal for process fitting (in the scope of delivery)	
– Thread G1½ (DIN 3852-A)	Klingersil C-4400
– Thread M44 x 1.25 (DIN 13)	FKM, FFKM, EPDM
Materials for applications in foodstuffs	
Surface quality, hygienic process fittings, typ.	R_a < 0.8 µm
Seal below wall mounting plate with 3A approval	EPDM
Materials, non-wetted parts	
Type label support on connection cable	PE hard
Isolating liquid ceramic/metallic measuring cell	KN 92 medical white oil (FDA conform)

[5] Not on instruments with SIL qualification.

Isolating liquid piezoresistive measuring cell	Synthetic oil, Halocarbon oil[6)7)]
Housing	
– Plastic housing	Plastic PBT (Polyester)
– Aluminium die-cast housing	Aluminium die-casting AlSi10Mg, powder-coated (Basis: Polyester)
– Stainless steel housing	316L
– Cable gland	PA, stainless steel, brass
– Sealing, cable gland	NBR
– Blind plug, cable gland	PA
– Seal between housing and housing lid	Silicone SI 850 R, NBR silicone-free
– Inspection window housing cover	Polycarbonate (UL-746-C listed), glass[8)]
– Ground terminal	316L
External housing	
– Housing	Plastic PBT (Polyester), 316L
– Socket, wall mounting plate	Plastic PBT (Polyester), 316L
– Seal between base and wall mounting plate	EPDM (fixed connected)
Inspection window in housing cover	Polycarbonate, UL746-C listed (with Ex d version: glass)
Seal, housing lid	Silicone SI 850 R, NBR silicone-free
Ground terminal	316Ti/316L
Connection cable to Primary Device	PE, PUR
Weights	
Total weight VEGABAR 83	approx. 0.8 … 8 kg (1.764 … 17.64 lbs), depending on process fitting and housing

Torques	
Max. torque, metric process fittings	
– G¼, G½	50 Nm (36.88 lbf ft)
– G½ front-flush, G1 front-flush	40 Nm (29.50 lbf ft)
– G1½ front-flush (piezoresistive measuring cell)	40 Nm (29.50 lbf ft)
– G1½ front-flush (ceramic/metallic measuring cell)	200 Nm (147.5 lbf ft)

6) Synthetic oil for measuring ranges up to 40 bar, FDA listed for the food processing industry. For measuring ranges up to 100 bar dry measuring cell.
7) Halocarbon oil: Generally in oxygen applications, not with vacuum measuring ranges, not with absolute measuring ranges < 1 bar_{abs}.
8) Glass with Aluminium and stainless steel (precision casting) housing

Max. torque, non-metric process fittings

- ½ NPT, inside ¼ NPT ≤ 40 bar/500 psig — 50 Nm (36.88 lbf ft)
- ½ NPT, inside ¼ NPT > 40 bar/500 psig — 200 Nm (147.5 lbf ft)
- 7/16 NPT for tube ¼" — 40 Nm (29.50 lbf ft)
- 9/16 NPT for tube 3/8" — 50 Nm (36.88 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 - Piezoresistive/Strain gauge measuring cell

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.[9)]

Nominal measuring ranges and overload capability in bar/kPa

Nominal range	Overload capability	
	Maximum pressure	Minimum pressure
Gauge pressure		
0 … +0.4 bar/0 … +40 kPa	+1.2 bar/+120 kPa	-1 bar/-100 kPa
0 … +1 bar/0 … +100 kPa	+3 bar/+300 kPa	-1 bar/-100 kPa
0 … +2.5 bar/0 … +250 kPa	+7.5 bar/+750 kPa	-1 bar/-100 kPa
0 … +5 bar/0 … +250 kPa	+15 bar/+1500 kPa	-1 bar/-100 kPa
0 … +10 bar/0 … +1000 kPa	+30 bar/+3000 kPa	-1 bar/-100 kPa
0 … +16 bar/0 … +1600 kPa	+48 bar/+5000 kPa	-1 bar/-100 kPa
0 … +25 bar/0 … +2500 kPa	+75 bar/+7500 kPa	-1 bar/-100 kPa
0 … +40 bar/0 … +4000 kPa	+120 bar/+12 MPa	-1 bar/-100 kPa
0 … +60 bar/0 … +6000 kPa	+180 bar/+18 MPa	-1 bar/-100 kPa
0 … +100 bar/0 … +10 MPa	+200 bar/+20 MPa	-1 bar/-100 kPa
0 … +160 bar/0 … +10 MPa	+320 bar/+20 MPa	-1 bar/-100 kPa
0 … +250 bar/0 … +25 MPa	+500 bar/+20 MPa	-1 bar/-100 kPa
0 … +400 bar/0 … +40 MPa	+800 bar/+80 MPa	-1 bar/-100 kPa
0 … +600 bar/0 … +60 MPa	+1200 bar/+120 MPa	-1 bar/-100 kPa
0 … +1000 bar/0 … +100 MPa	+1500 bar/+150 MPa	-1 bar/-100 kPa
-1 … 0 bar/-100 … 0 kPa	+3 bar/+300 kPa	-1 bar/-100 kPa
-1 … +1.5 bar/-100 … +150 kPa	+7.5 bar/+750 kPa	-1 bar/-100 kPa
-1 … +5 bar/-100 … +500 kPa	+15 bar/+1500 kPa	-1 bar/-100 kPa
-1 … +10 bar/-100 … +1000 kPa	+30 bar/+3000 kPa	-1 bar/-100 kPa

[9)] Data on overload capability apply for reference temperature.

Nominal range	Overload capability	
	Maximum pressure	Minimum pressure
-1 … +25 bar/-100 … +2500 kPa	+75 bar/+7500 kPa	-1 bar/-100 kPa
-1 … +40 bar/-100 … +4000 kPa	+120 bar/+12 MPa	-1 bar/-100 kPa
-0.2 … +0.2 bar/-20 … +20 kPa	+1.2 bar/+120 kPa	-1 bar/-100 kPa
-0.5 … +0.5 bar/-50 … +50 kPa	+3 bar/+300 kPa	-1 bar/-100 kPa
Absolute pressure		
0 … 1 bar/0 … 100 kPa	3 bar/300 kPa	0 bar abs.
0 … 2.5 bar/0 … 250 kPa	7.5 bar/750 kPa	0 bar abs.
0 … 5 bar/0 … 500 kPa	15 bar/1500 kPa	0 bar abs.
0 … 10 bar/0 … 1000 kPa	30 bar/3000 kPa	0 bar abs.
0 … 16 bar/0 … 1600 kPa	50 bar/5000 kPa	0 bar abs.
0 … 25 bar/0 … 2500 kPa	75 bar/+7500 kPa	0 bar abs.
0 … 40 bar/0 … 4000 kPa	120 bar/+12 MPa	0 bar abs.

Input variable - Ceramic/metallic measuring cell

The specifications are only an overview and refer to the measuring cell. Limitations due to the material and version of the process fitting are possible. The specifications on the nameplate apply.[10)]

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	+30 bar/+3000 kPa	-1 bar/-100 kPa
0 … +1 bar/0 … +100 kPa	+35 bar/+3500 kPa	-1 bar/-100 kPa
0 … +2.5 bar/0 … +250 kPa	+50 bar/+5000 kPa	-1 bar/-100 kPa
0 … +5 bar/0 … +500 kPa	+50 bar/+5000 kPa	-1 bar/-100 kPa
0 … +10 bar/0 … +1000 kPa	+50 bar/+5000 kPa	-1 bar/-100 kPa
0 … +25 bar/0 … +2500 kPa	+50 bar/+5000 kPa	-1 bar/-100 kPa
-1 … 0 bar/-100 … 0 kPa	+35 bar/+3500 kPa	-1 bar/-100 kPa
-1 … +1.5 bar/-100 … +150 kPa	+50 bar/+5000 kPa	-1 bar/-100 kPa
-1 … +5 bar/-100 … +500 kPa	+50 bar/+6500 kPa	-1 bar/-100 kPa
-1 … +10 bar/-100 … +1000 kPa	+50 bar/+5000 kPa	-1 bar/-100 kPa
-1 … +25 bar/-100 … +2500 kPa	+50 bar/+5000 kPa	-1 bar/-100 kPa
-0.05 … +0.05 bar/-5 … +5 kPa	+10 bar/+1000 kPa	-1 bar/-100 kPa
-0.2 … +0.2 bar/-20 … +20 kPa	+20 bar/+2000 kPa	-1 bar/-100 kPa
-0.5 … +0.5 bar/-50 … +50 kPa	+35 bar/+3500 kPa	-1 bar/-100 kPa

[10)] Data on overload capability apply for reference temperature.

Nominal range	Overload capability	
	Maximum pressure	Minimum pressure
Absolute pressure		
0 … 1 bar/0 … 100 kPa	35 bar/3500 kPa	0 bar abs.
0 … 2.5 bar/0 … 250 kPa	50 bar/5000 kPa	0 bar abs.
0 … 10 bar/0 … 1000 kPa	50 bar/5000 kPa	0 bar abs.
0 … 25 bar/0 … 2500 kPa	50 bar/5000 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	-14.5 psig
0 … +5 psig	+375 psig	-14.5 psig
0 … +15 psig	+525 psig	-14.5 psig
0 … +30 psig	+720 psig	-14.5 psig
0 … +75 psig	+720 psig	-14.5 psig
0 … +150 psig	+720 psig	-14.5 psig
0 … +300 psig	+720 psig	-14.5 psig
-14.5 … 0 psig	+510 psig	-14.5 psig
-14.5 … +20 psig	+720 psig	-14.5 psig
-14.5 … +75 psig	+975 psig	-14.51 psig
-14.5 … +150 psig	+725 psig	-14.5 psig
-14.5 … +300 psig	+725 psig	-14.5 psig
-0.7 … +0.7 psig	+225 psi	-14.5 psig
-3 … +3 psig	+190 psi	-14.5 psig
-7 … +7 psig	+525 psig	-14.5 psig
Absolute pressure		
0 … 15 psi	525 psi	0 psi
0 … 30 psi	+720 psig	0 psi
0 … 150 psi	+720 psig	0 psi
0 … 300 psi	+720 psig	0 psi

Adjustment ranges

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

Level (min./max. adjustment)

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

Flow (min./max. adjustment)	
– Percentage value	0 or 100 % fix
– Pressure value	-120 … 120 %
Differential pressure (zero/span adjustment)	
– Zero	-95 … +95 %
– Span	-120 … +120 %
Density (min./max. adjustment)	
– Percentage value	-10 … 100 %
– Density value	according to the measuring ranges in kg/dm³
Interface (min./max. adjustment)	
– Percentage value	-10 … 100 %
– Level value	according to the measuring ranges in m
Max. permissible Turn Down	Unlimited (recommended 20 : 1)

Dynamic behaviour output

Dynamic characteristics depending on medium and temperature

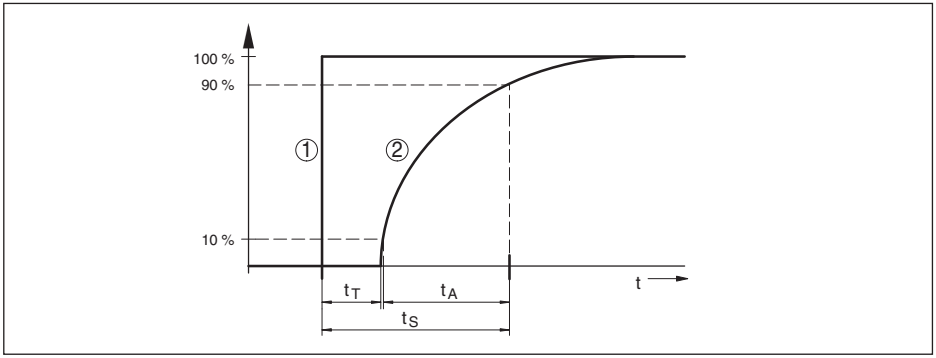

Fig. 22: Behaviour in case of sudden change of the process variable. t_T: dead time; t_A: rise time; t_S: jump response time

1 Process variable
2 Output signal

	VEGABAR 83	VEGABAR 83, IP68 (25 bar), connection cable > 25 m (82.01 ft)
Dead time	≤ 25 ms	≤ 50 ms
Rise time (10 … 90 %)	≤ 55 ms	≤ 150 ms
Step response time (ti: 0 s, 10 … 90 %)	≤ 80 ms	≤ 200 ms

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 +18 … +30 °C (+64 … +86 °F)

– Relative humidity	45 … 75 %
– Air pressure	860 … 1060 mbar/86 … 106 kPa (12.5 … 15.4 psi)
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	
– Piezoresistive/strain gauge measuring cell	depending on the process fitting and the chemical seal
– Ceramic/metallic measuring cell	< 5 mbar/0.5 kPa (0.07 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)

Specifications refer to the set span. Turn down (TD) is the ratio: nominal measuring range/set span.

Accuracy class	Non-linearity, hysteresis and repeatability with TD 1 : 1 up to 5 : 1	Non-linearity, hysteresis and repeatability at TD > 5 : 1
0.075 %	< 0.075 %	< 0.015 % x TD
0.1 %	< 0.1 %	< 0.02 % x TD
0.2 %	< 0.2 %	< 0.04 % x TD

Influence of the product temperature

Thermal change zero signal and output span

Turn down (TD) is the relation nominal measuring range/adjusted 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)*".

Piezoresistive/strain gauge measuring cell

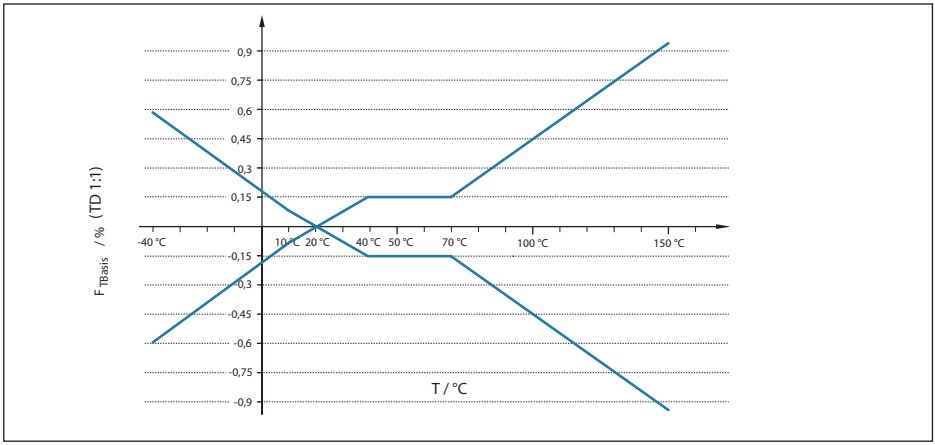

Fig. 23: Basic temperature error F_{TBasis} at TD 1 : 1

The basic temperature error in % from the above graphic can increase due to the additional factors such as accuracy class (factor FMZ) and Turn Down (factor FTD). The additional factors are listed in the following tables.

Additional factor through accuracy class

Accuracy class	0.075 %, 0.1 %	0.2 %
Factor FMZ	1	3

Additional factor through Turn Down

The additional factor F_{TD} 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 : 1	TD 10 : 1	TD 20 : 1
Factor FTD	1	1.75	3	5.5	10.5

Ceramic/Metal measuring cell - Standard

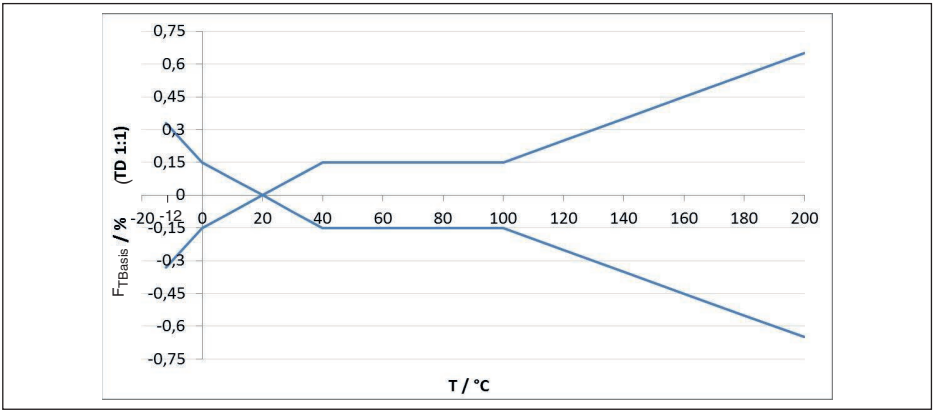

Fig. 24: Basic temperature error F_{TBasis} at TD 1 : 1

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	
	0.075 %, 0.1 %	0.2 %
Factor FMZ	1	3

Additional factor through Turn Down

The additional factor F_{TD} 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

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.[11)]

Long-term stability zero signal and output span - ceramic/metallic measuring cell

Time period	
One year	< 0.05 % x TD
Five years	< 0.1 % x TD
Ten years	< 0.15 % x TD

Long-term stability zero signal and output span - Piezoresistive/Strain gauge measuring cell

Measuring range/Version	Piezoresistive measuring cell	Strain gauge measuring cell
Measuring ranges > 1 bar	< 0.1 % x TD/year	
Measuring ranges > 1 bar, isolating liquid, synthetic oil, diaphragm Alloy C276	< 0.15 % x TD/year	–
Measuring range 1 bar		
Measuring range 0.4 bar	< 0.35 % x TD/year	

Long-term drift (according to IEC 61298-2) in hydrogen applications

When used in hydrogen applications, diffusion into the sensor structures over time can cause a signal drift. The extent of the drift depends essentially on factors such as the temperature of the hydrogen, the percentage of hydrogen in the measuring medium as well as the used diaphragm thickness of the pressure sensor. It is recommended to test the suitability of the selected product version accordingly.

Typical long-term drift ≤ 1 % x TD/year

Maximum long-term drift ≤ 3 % x TD/year

Process conditions - Piezoresistive/Strain gauge measuring cell

Process temperature

[11)] With ceramic/metallic measuring cell with gold-coated diaphragm, the values must be multiplied with factor 3.

Seal	Sensor version				
	Standard	Extended temperature range	Hygienic fittings		Version for oxygen applications
	p_{abs} ≥ 1 mbar		p_{abs} ≥ 1 mbar	p_{abs} ≥ 10 mbar	p_{abs} ≥ 10 mbar
Without consideration of the seal[12)]	-20/-40 … +105 °C (-4/-40 … +221 °F)	–	–	–	-20 … +60 °C (-4 … +140 °F)
FKM (VP2/A)	-20 … +105 °C (-4 … +221 °F)	-20 … +150 °C (-4 … +302 °F)	-20 … +85 °C (-4 … +185 °F)	-20 … +150 °C (-4 … +302 °F)	
EPDM (A+P 70.10-02)					
FFKM (Perlast G74S)	-15 … +105 °C (+5 … +221 °F)	-15 … +150 °C (+5 … +302 °F)	-15 … +85 °C (+5 … +185 °F)	-15 … +150 °C (+5 … +302 °F)	-15 … +60 °C (+5 … +140 °F)
FEPM (Fluoraz SD890)	-5 … +105 °C (+23 … +221 °F)	–	–	–	-5 … +60 °C (+23 … +140 °F)

Temperature derating

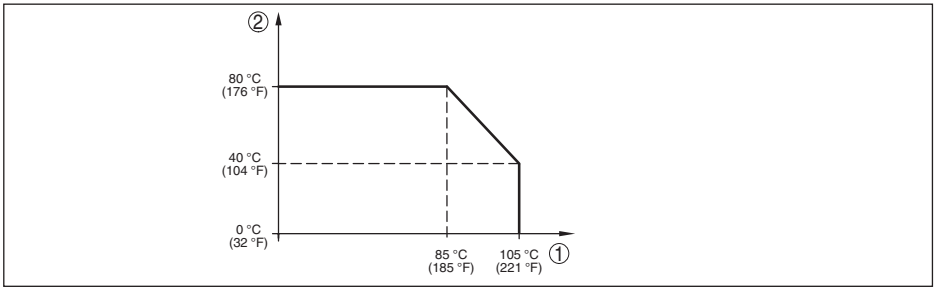

Fig. 25: Temperature derating VEGABAR 83, version up to +105 °C (+221 °F)

1 Process temperature
2 Ambient temperature

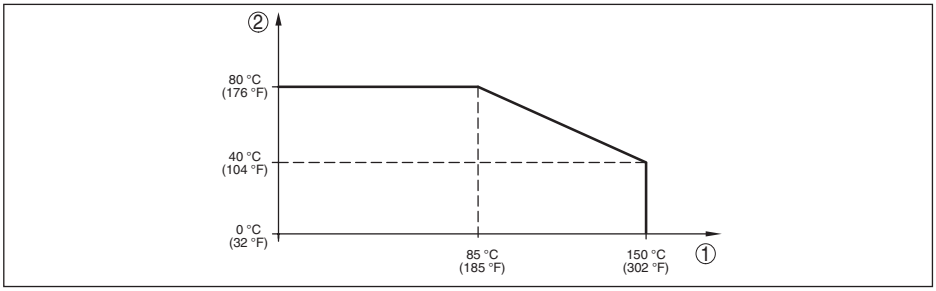

Fig. 26: Temperature derating VEGABAR 83, version up to +150 °C (+302 °F)

1 Process temperature
2 Ambient temperature

SIP process temperature (SIP = Sterilization in place)

12) Process fittings acc. to DIN 3852-A, EN 837

Vapour stratification for 2 h[13] +150 °C (+302 °F)

Process pressure

Permissible process pressure see specification "*Process pressure*" on the type label

Mechanical stress

Version	Without cooling zone		With cooling zone	
	All housing versions	Stainless steel double chamber	All housing versions	Stainless steel double chamber
Vibration resistance 1 to 4 g at 5 … 200 Hz according to EN 60068-2-6 (vibration with resonance)	4 g (GL characteristics 2)	0.7 g (GL characteristics 1)	4 g (GL characteristics 2)	0.7 g (GL characteristics 1)
Shock resistance 2.3 ms according to EN 60068-2-27 (mechanical shock)	50 g		50 g	20 g

Process conditions - Ceramic/metallic measuring cell

Process temperature

Version	Temperature ranges		
	p_{abs} ≥ 50 mbar	p_{abs} ≥ 10 mbar	p_{abs} ≥ 1 mbar
Standard	-12 … +150 °C (+10 … +284 °F)		-12 … +120 °C (+10 … +248 °F)
Extended temperature range	-12 … +180 °C (+10 … +356 °F)	-12 … +160 °C (+10 … +320 °F)	
	-12 … +200 °C (+10 … +392 °F)		

Temperature derating

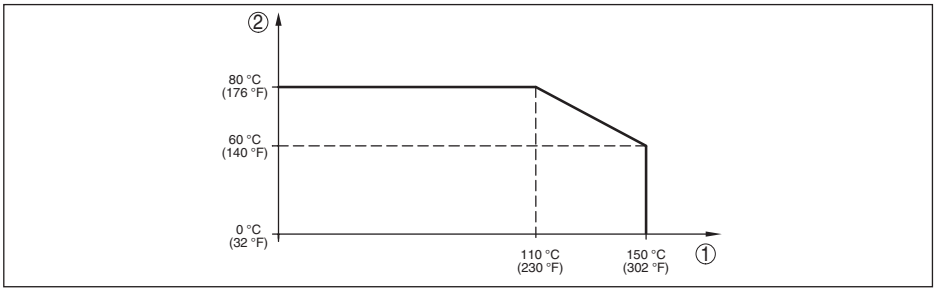

Fig. 27: Temperature derating VEGABAR 83, version up to +150 °C (+302 °F)

1 Process temperature
2 Ambient temperature

[13] Instrument configuration suitable for vapour

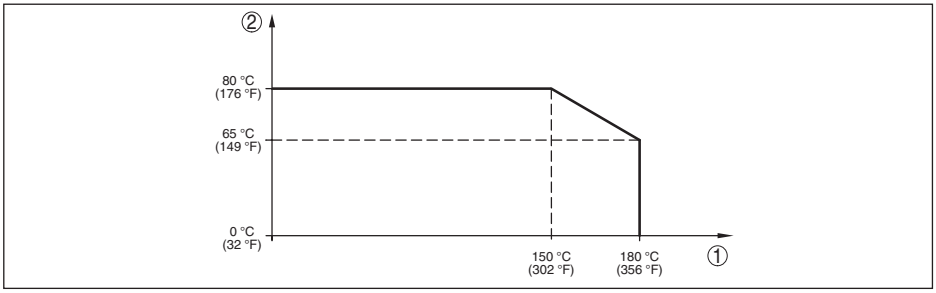

Fig. 28: Temperature derating VEGABAR 83, version up to +180 °C (+356 °F)

1 Process temperature
2 Ambient temperature

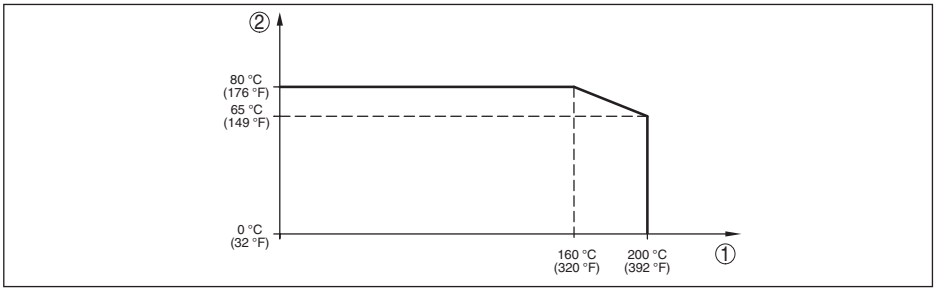

Fig. 29: Temperature derating VEGABAR 83, version up to +200 °C (+392 °F)

1 Process temperature
2 Ambient temperature

Process pressure

Permissible process pressure	see specification "*Process pressure*" on the type label

Mechanical stress[14]

Vibration resistance 1 to 4 g at 5 … 200 Hz according to EN 60068-2-6 (vibration with resonance)	4 g
Shock resistance	50 g, 2.3 ms according to EN 60068-2-27 (mechanical shock)[15]

Ambient conditions

Version	Ambient temperature	Storage and transport temperature
Standard version	-40 … +80 °C (-40 … +176 °F)	-60 … +80 °C (-76 … +176 °F)
Version IP66/IP68 (1 bar)	-20 … +80 °C (-4 … +176 °F)	-20 … +80 °C (-4 … +176 °F)
Version IP68 (25 bar), with connection cable PUR	-20 … +80 °C (-4 … +176 °F)	-20 … +80 °C (-4 … +176 °F)

[14] Depending on the instrument version
[15] 2 g with housing version stainless steel double chamber

Version	Ambient temperature	Storage and transport temperature
Version IP68 (25 bar), connection cable PE	-20 … +60 °C (-4 … +140 °F)	-20 … +60 °C (-4 … +140 °F)

Electromechanical data - version IP66/IP67 and IP66/IP68 (0.2 bar)[16]

Options of the cable entry

- Cable entry: M20 x 1.5; ½ NPT
- Cable gland: M20 x 1.5; ½ NPT (cable diameter 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
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[17]
- 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

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)

Interface to the Primary Device

Data transmission: Digital (I²C-Bus)

Connection cable Secondary - Primary, mechanical data

- Configuration: Cores, strain relief, braided, metal foil, jacket
- Standard length: 5 m (16.40 ft)

[16] IP66/IP68 (0.2 bar), only with absolute pressure.
[17] Breather capillaries not with Ex d version.

- Max. length: 70 m (229.7 ft)
- Min. bending radius (at 25 °C/77 °F): 25 mm (0.985 in)
- Diameter: approx. 8 mm (0.315 in), approx. 6 mm (0.236 in)
- Material: PE, PUR
- Colour: Black, blue

Connection cable Secondary - Primary, electrical data

- Wire cross-section: 0.34 mm² (AWG 22)
- Wire resistance: < 0.05 Ω/m (0.015 Ω/ft)

Voltage supply for the complete system through Primary Device

Operating voltage

- $U_{B\,min}$: 12 V DC
- $U_{B\,min}$ with lighting switched on: 16 V DC
- $U_{B\,max}$: Depending on the signal output and version of the Primary Devices

Potential connections and electrical separating measures in the instrument

Electronics: Non-floating

Galvanic separation

- between electronics and metallic parts of the device: Reference voltage 500 V AC

Conductive connection: Between ground terminal and metallic process fitting

Electrical protective measures[18)]

Housing material	Version	Protection acc. to IEC 60529	Protection acc. to NEMA
Plastic	Single chamber	IP66/IP67	Type 4X
Aluminium	Single chamber	IP66/IP67	
		IP66/IP68 (0.2 bar) IP66/IP68 (1 bar)	Type 6P
Stainless steel (electro-polished)	Single chamber	IP66/IP67 IP69	Type 4X
Stainless steel (precision casting)	Single chamber	IP66/IP67	Type 4X
		IP66/IP68 (0.2 bar) IP66/IP68 (1 bar)	Type 6P
Stainless steel	Transmitter, version with external housing	IP68 (25 bar)	-

Altitude above sea level

- by default: up to 2000 m (6562 ft)

18) Protection rating IP66/IP68 (0.2 bar) only in conjunction with absolute pressure, as no air compensation is possible when the sensor is completely flooded

– with connected overvoltage protection on the Primary Device	up to 5000 m (16404 ft)
Pollution degree[19)]	4
Protection rating (IEC 61010-1)	II

9.2 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
- F_{stab}: Long-term stability
- F_T: Thermal change of zero signal and output span (temperature error)
- F_{KI}: Deviation
- F_a: Thermal change of the current output
- FMZ: Additional factor measuring cell version
- FTD: Additional factor Turn down

9.3 Calculation of the total deviation - Practical example

Data

Level measurement in large vessel, height 12 m, medium water with 40 °C, correspond to 1.18 bar (118 KPa), static pressure 0.5 bar (50 KPa), total pressure 1.68 bar (168 KPa)

VEGABAR 83 Primary Device with nominal measuring range 2.5 bar (250 KPa), Secondary Device with nominal measuring range 1 bar (100 KPa), deviation < 0.1 %, process fitting G1½ (ceramic/metallic measuring cell)

The required values for the temperature error F_T, deviation F_{KI} and long-term stability F_{stab} are available in the technical data.

[19)] When used with fulfilled protection.

1. Calculation of the Turn down

TD = 2.5 bar/1.68 bar, TD = 1.49 : 1 (Primary)

TD = 1 bar/0.5 bar, TD = 2 : 1 (Secondary)

2. Determination temperature error F_T

The temperature error F_T consists of the basic temperature error F_{TBasis} , the additional factor measuring cell F_{MZ} and the additional factor Turn Down F_{TD}.

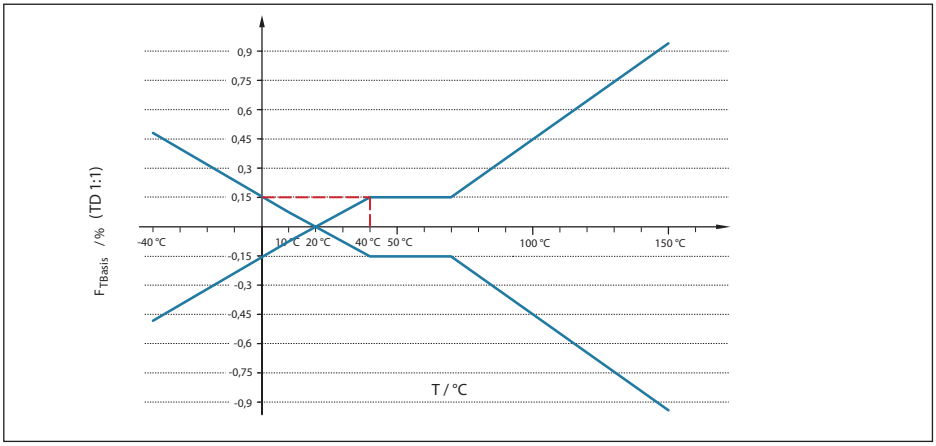

Fig. 30: Determination of the basic temperature error for the above example: F_{TBasis} = 0.15 %

Accuracy class	0.075 %, 0.1 %	0.2 %
Factor FMZ	1	3

Tab. 25: Determination of the additional factor measuring cell for above example: F_{MZ} = 1

The additional factor F_{TD} through Turn down is calculated according to the following formula:

F_{TD} = 0.5 x TD + 0.5 with TD = 1.49 of above calculation (Primary)

F_{TD} = 0.5 x 1.49 + 0.5 = 1.25 (Primary)

F_{TD} = 0.5 x TD + 0.5 with TD = 2 from above calculation (Secondary)

F_{TD} = 0.5 x 2 + 0.5 = 1.5 (Secondary)

Determination of the temperature error Primary Device:

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

F_{TP} = 0.15 % x 1 x 1.25

F_{TP} = 0.19 %

Determination of the temperature error Secondary Device:

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

F_{TS} = 0.15 % x 1 x 1.5

F_{TS} = 0.23 %

Determination of the total temperature error:

$F_T = \sqrt{((F_{TP})^2 + (F_{TS})^2)}$

$F_T = \sqrt{((0,19)^2 + (0,23)^2)}$

$F_T = 0,3\ \%$

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:

Deviation

Accuracy class	Non-linearity, hysteresis and non-repeatability	
	TD ≤ 5 : 1	TD > 5 : 1
0.075 %	< 0.075 %	< 0.015 % x TD
0.1 %	< 0.1 %	< 0.02 % x TD
0.2 %	< 0.2 %	< 0.04 % x TD

Tab. 26: Determination of the deviation from the table: F_{KI} = 0.1 % (Primary and Secondary Device)

Long-term stability

Time period	
One year	< 0.05 % x TD
Five years	< 0.1 % x TD
Ten years	< 0.15 % x TD

Tab. 27: Determination of the long-term stability from the table, consideration for one year: F_{stab} = 0.05 % x TD (Primary and Secondary Device)

Calculation of the long-term stability

$F_{stabP} = 0.05\ \% \times 1.49 = 0.075\ \%$ (Primary)

$F_{stabS} = 0.05\ \% \times 2 = 0.1\ \%$ (Secondary)

Calculation of the total long-term stability:

$F_{stab} = \sqrt{((F_{stabP})^2 + (F_{stabS})^2)}$

$F_{stab} = \sqrt{((0,075)^2 + (0,1)^2)}$

$F_{stab} = 0,13\ \%$

4. Calculation of the total deviation

- 1. step: Basic accuracy F_{perf}

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

$F_T = 0.3\ \%$

$F_{KI} = 0.1\ \%$ (determination of above table)

$F_{perf} = \sqrt{(0.3\ \%)^2 + (0.1\ \%)^2)}$

$F_{perf} = 0.32\ \%$

- 2. step: Total deviation F_{total}

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

$F_{perf} = 0.32\ \%$ (result of step 1)

$F_{stab} = 0.13\ \%$ (from top)

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

The total deviation of the sensors is hence 0.45 %.

5. Calculation of the total deviation of the measuring system

To the calculation of the total deviation of the measuring system, the thermal error of the analogue current output is added:

$F_{total} = \sqrt{(F_{total})^2 + (F_a)^2}$

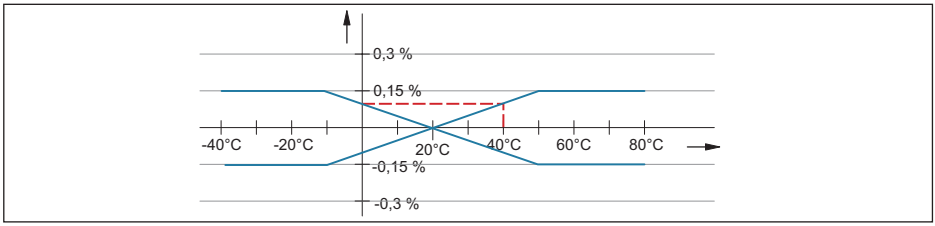

Fig. 31: F_a through thermal change current output, in this example = 0.1 %

$F_{total} = \sqrt{(0.45\ \%)^2 + (0.1\ \%)^2} = 0.46\ \%$

The total deviation of the measuring system is hence 0.46 %.

Deviation in mm: 0.46 % of 12000 mm = 55 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 nearly small.

9.4 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

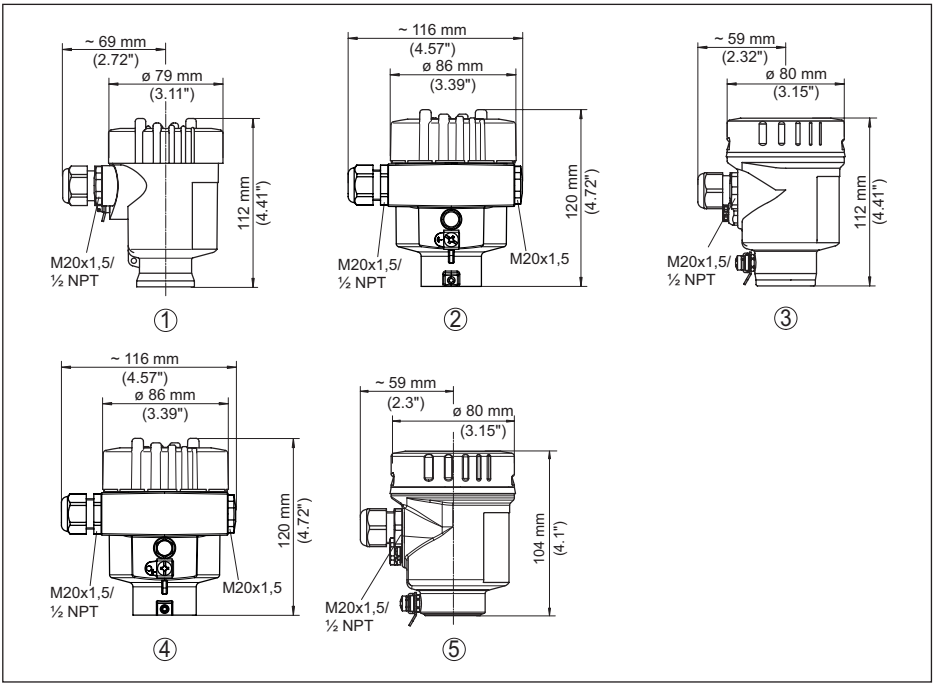

Fig. 32: Housing versions in protection rating IP66/IP67 and IP66/IP68 (0.2 bar), (with integrated display and adjustment module the housing is 9 mm/0.35 in or 18 mm/0.71 in higher)

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) IP69*

External housing on IP68 version

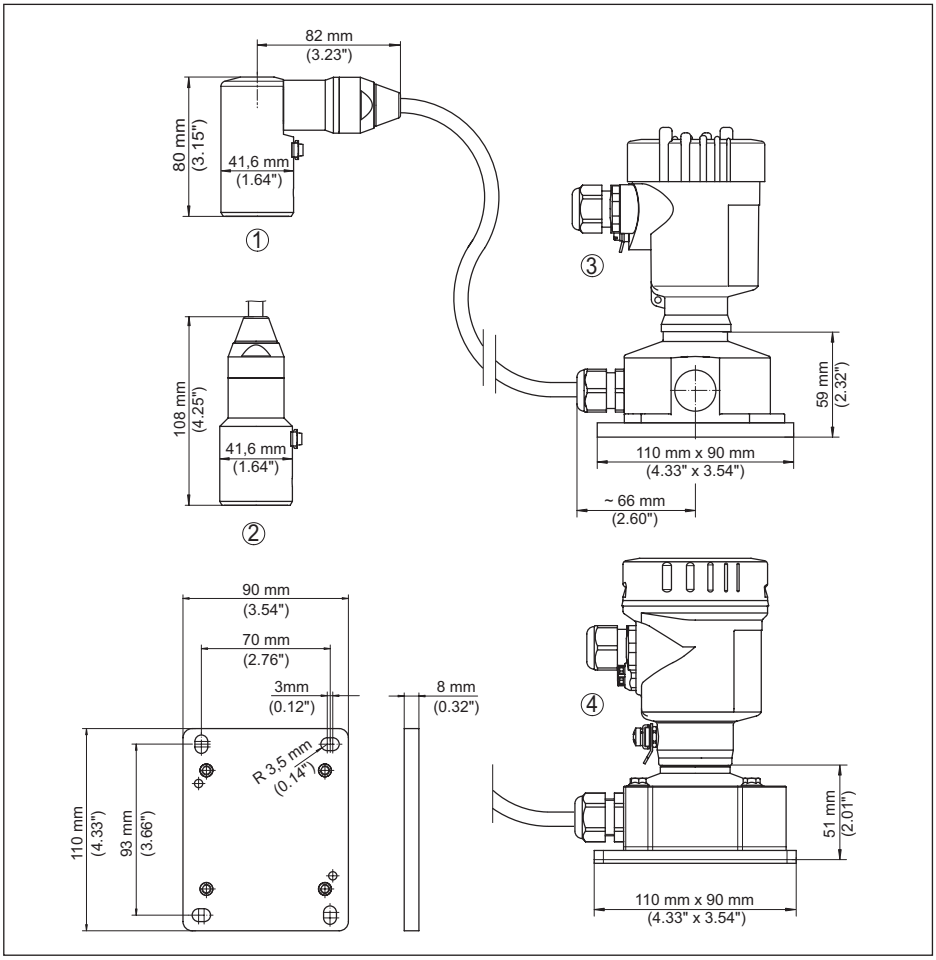

Fig. 33: VEGABAR 83, IP68 version with external housing

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 83, threaded fitting not front-flush

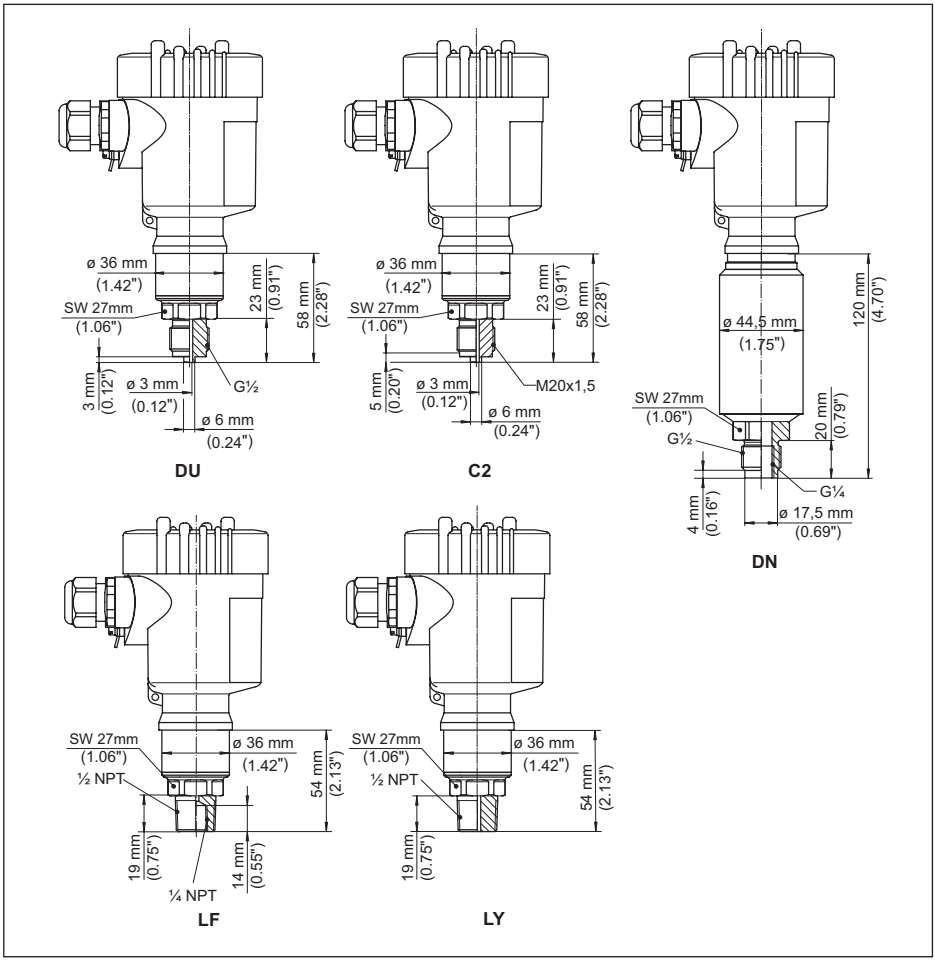

Fig. 34: VEGABAR 83, threaded fitting not front-flush

DU G½ (EN 837); manometer connection
C2 M20 x 1.5 (EN 837); manometer connection
DN G½, inside G¼ (ISO 228-1)
LF ½ NPT, inside ¼ NPT (ASME B1.20.1)
LY ½ NPT PN 1000

VEGABAR 83, threaded fitting front-flush

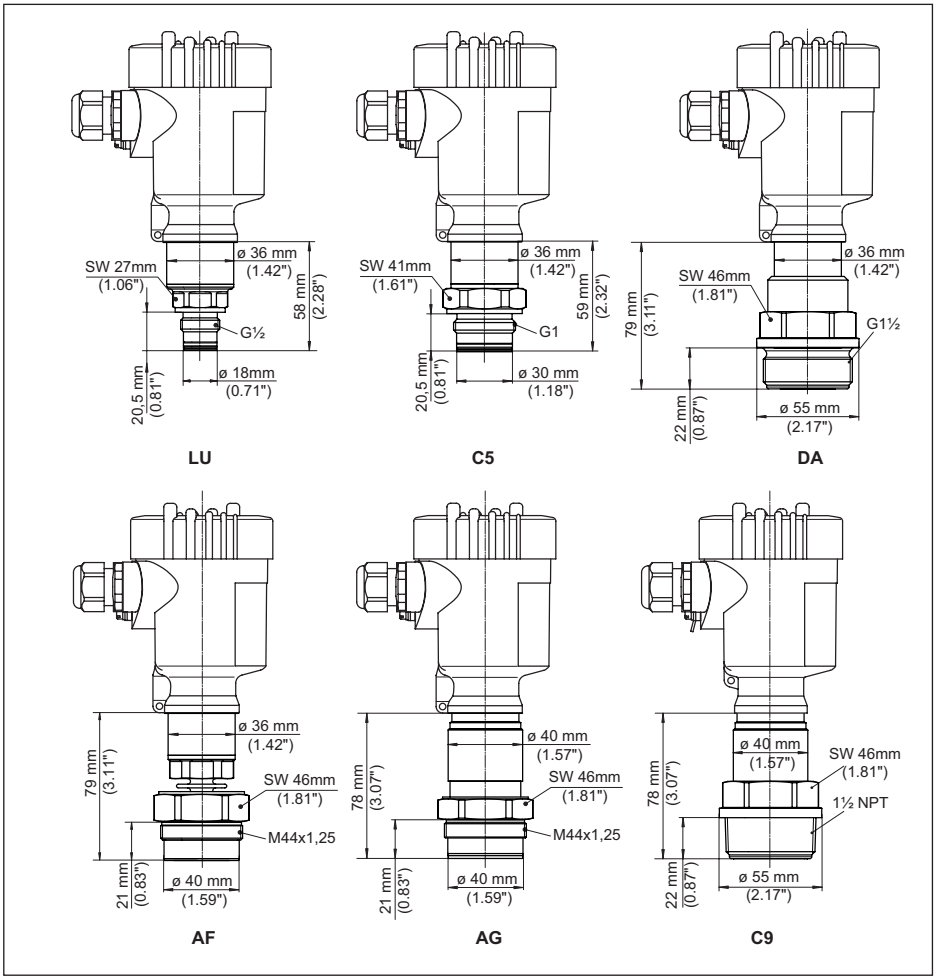

Fig. 35: VEGABAR 83, threaded fitting front-flush

LU G½ (ISO 228-1); front-flush; with O-ring
C5 G1 (ISO 228-1)
DA G1½ (DIN 3852-A)
AF M44 x 1.25 (DIN 13); pressure screw: Aluminium
AG M44 x 1.25 (DIN 13); pressure screw: 316L
AF/AG/DA with temperature adapter and screen sheet for +180 °C/+200 °C
C9 1½ NPT (ASME B1.20.1)

For the version with "*Second Line of Defense*", the measure of length increases by 17 mm (0.67 in).

VEGABAR 83, thread for hygienic adapter

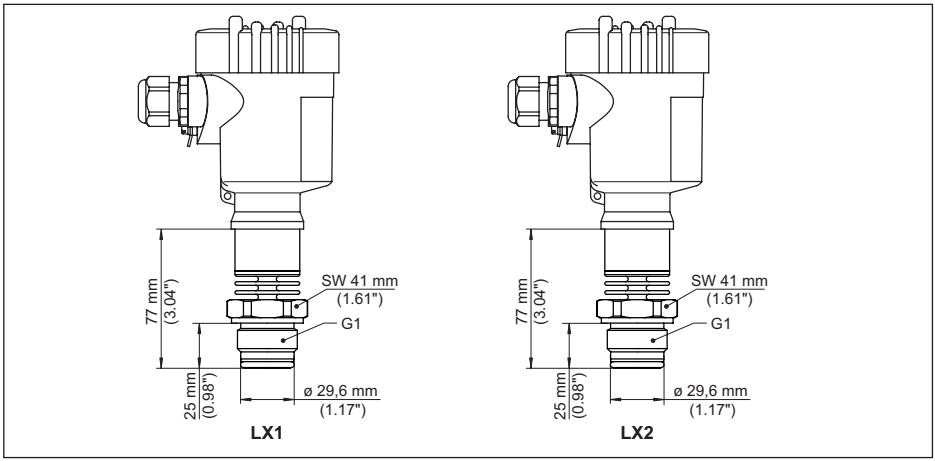

Fig. 36: VEGABAR 83, thread for hygienic adapter

LX G1 (ISO 228-1) for hygienic adapter sealing with O-ring

VEGABAR 83, hygienic fitting +150 °C (piezoresistive/strain gauge measuring cell)

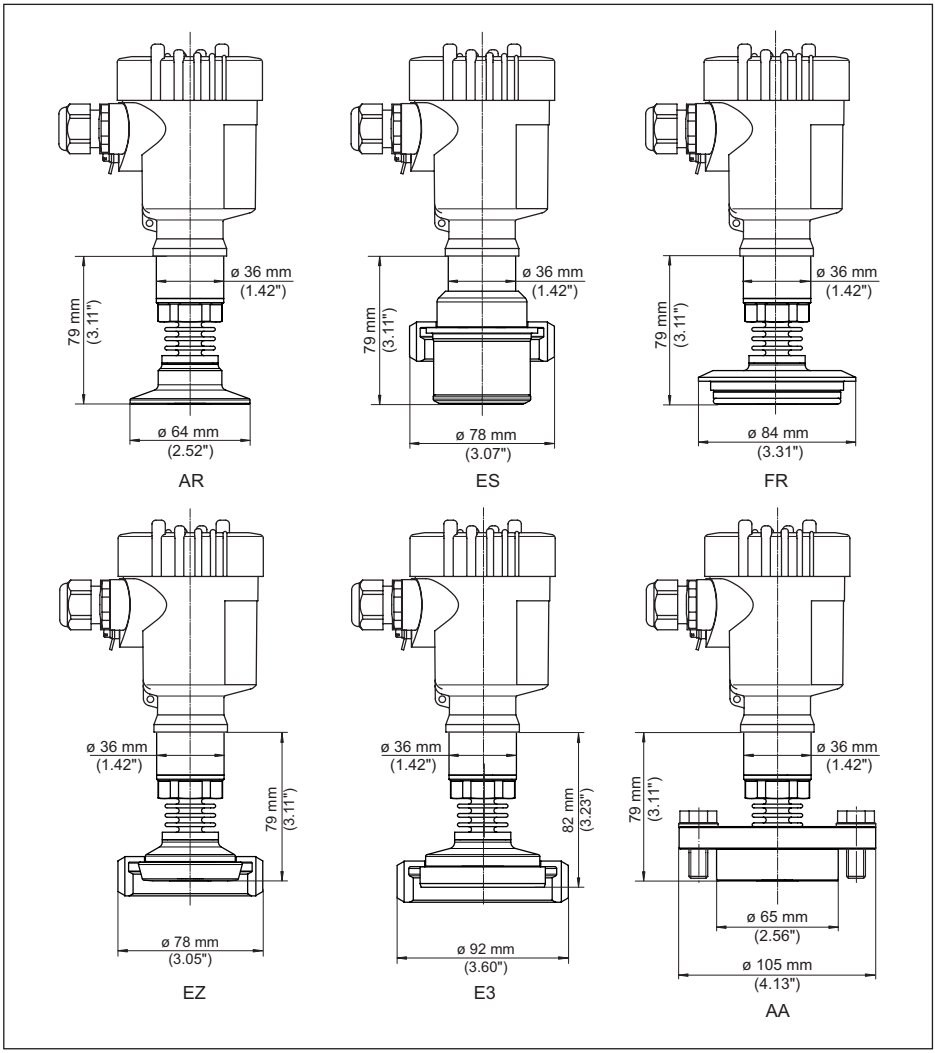

Fig. 37: VEGABAR 83, hygienic fitting +150 °C (piezoresistive/strain gauge measuring cell)

AR Clamp 2" PN 16 (ø 64 mm), (DIN 32676, ISO 2852)
ES Hygienic connection with compression nut F40 PN 25
FR Varivent N50-40 PN 25
EZ Collar socket DN 40 PN 40 (DIN 11851)
E3 Collar socket DN 50 PN 25 Form A (DIN 11864); for tube 53 x 1.5
AA DRD PN 40

For the version with "*Second Line of Defense*", the measure of length increases by 17 mm (0.67 in).

VEGABAR 83, hygienic fitting +150 °C (METEC® measuring cell)

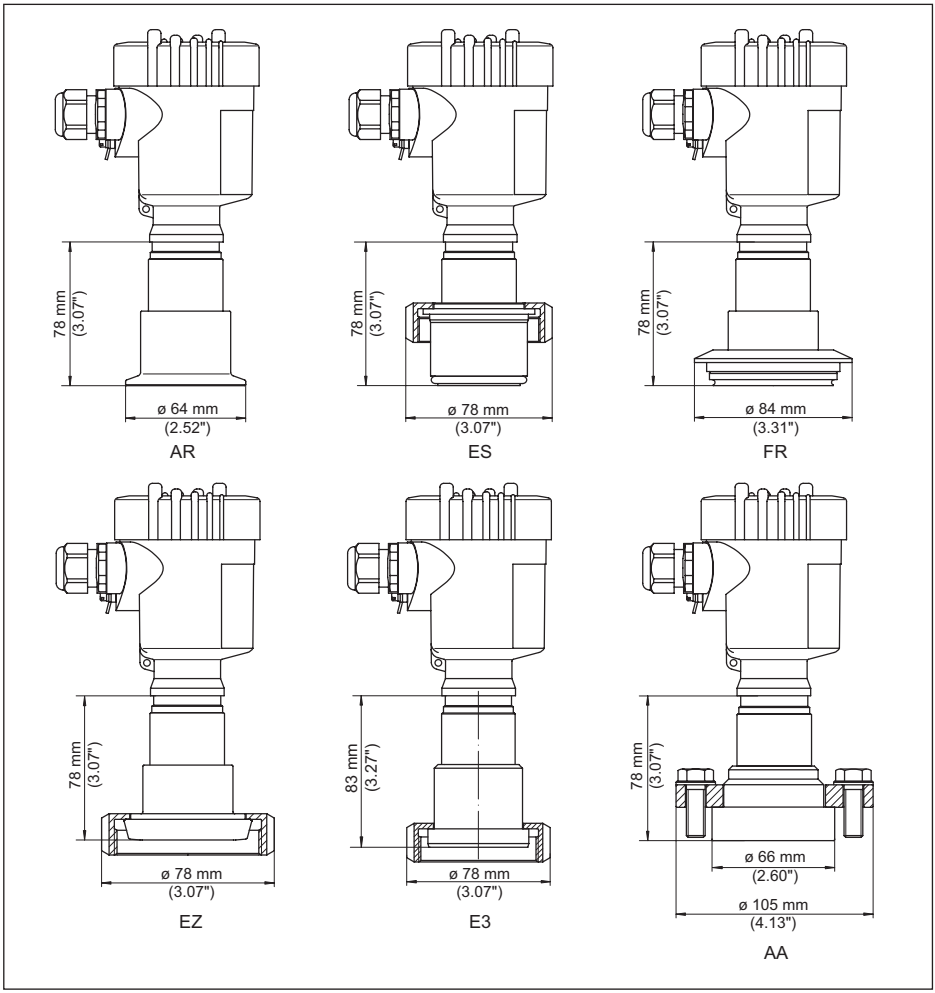

Fig. 38: VEGABAR 83, hygienic fitting +150 °C (METEC® measuring cell)

AR Clamp 2" PN 16 (ø 64 mm), (DIN 32676, ISO 2852)
ES Hygienic fitting with compression nut F40 PN 25
FR Varivent N50-40 PN 25
EZ Collar socket DN 40 PN 40, DIN 11851
E3 Collar socket DN 50 PN 25 Form A (DIN 11864); for tube 53 x 1.5
AA DRD PN 40

For the version with "*Second Line of Defense*", the measure of length increases by 17 mm (0.67 in).

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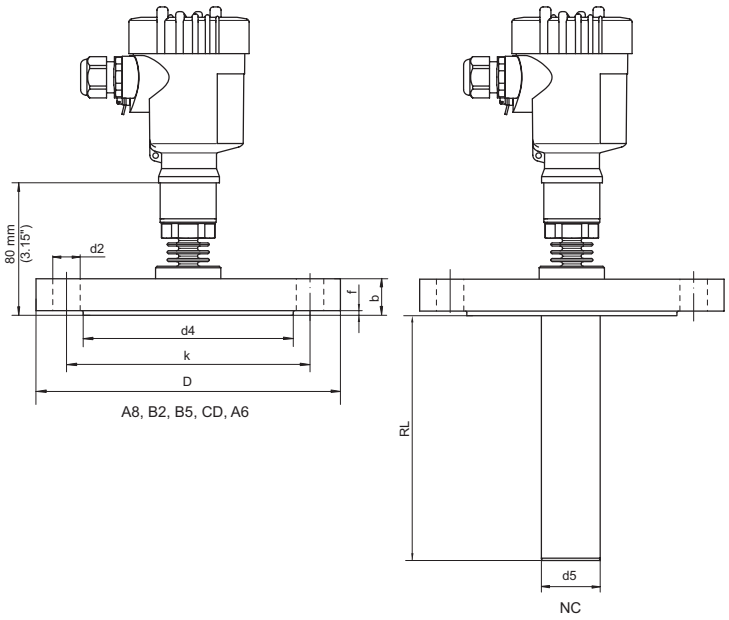
VEGABAR 83, flange connection +150 °C (piezoresistive/strain gauge measuring cell)



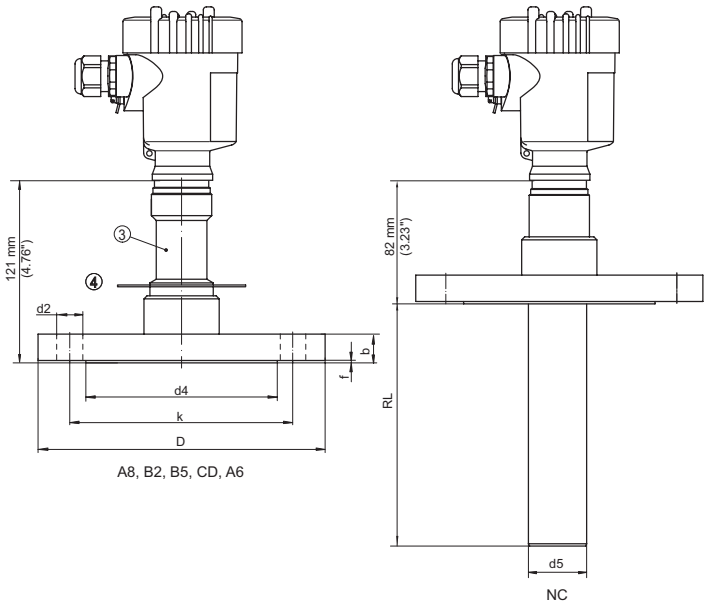
①	mm	DN	PN	D	b	k	d2	d4	f	RL	d5
	A8	40	40	150	18	110	4xø18	88	3	-	-
	B2	50	40	165	20	125	4xø18	102	3	-	-
	B5	80	40	200	24	160	8xø18	138	3	-	-
	CD	100	40	235	24	190	8xø22	162	3	-	-
	A6	150	16	285	22	240	8xø22	212	3	-	-
	NC	50	40	165	20	125	4xø18	102	3	③	④
	inch										
	A8	40	40	5.91"	0.71"	4.33"	4xø 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	40	9.25"	0.95"	7.48"	8xø 0.87"	6.38"	0.12"	-	-
	A6	150	16	11.22"	0.87"	9.45"	8xø 0.87"	8.35"	0.12"	-	-
	NC	50	40	6.50"	0.79"	4.92"	4xø 0.71"	4.02"	0.12"	③	④
②											
	CA	2“ 150 lbs		6.00"	0.75"	4.75"	4xø 0.75"	3.62"	0.06"	-	-
	CB	3“ 150 lbs		7.50"	0.94"	6“	4xø 0.75"	5“	0.06"	-	-

Fig. 39: VEGABAR 83, flange connection +150 °C (piezoresistive/strain gauge measuring cell)

1 Flange connection according to DIN 2501
2 Flange connection according to ASME B16.5
3 Order-specific
4 Order-specific

For the version with "*Second Line of Defense*", the measure of length increases by 17 mm (0.67 in).

VEGABAR 83, flange connection +180 °C/+200 °C (METEC® measuring cell)



① mm	DN	PN	D	b	k	d2	d4	f	RL	d5
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	40	235	24	190	8xø22	162	3	-	-
A6	150	16	300	28	250	8xø26	218	3	-	-
NC	50	40	165	20	125	4xø18	102	3	⑤	⑥
inch										
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	40	9.25"	0.95"	7.48"	8xø 0.87"	6.38"	0.12"	-	-
A6	150	16	11.81"	1.10"	9.84"	8xø 1.02"	8.58"	0.12"	-	-
NC	50	40	6.50"	0.79"	4.92"	4xø 0.71"	4.02"	0.12"	⑤	⑥
②										
CA	2“ 150 lbs		5.91"	0.77"	4.75"	4xø 0.75"	3.62"	0.12"	-	-
CB	3“ 150 lbs		7.48"	0.96"	6“	4xø 0.75"	5“	0.12"	-	-

Fig. 40: VEGABAR 83, flange connection +180 °C/+200 °C (METEC® measuring cell)

1 *Flange connection according to DIN 2501*
2 *Flange connection according to ASME B16.5*
3 *Temperature adapter up to +180 °C*
4 *Temperature screen sheet up to +200 °C*
5 *Order-specific*
6 *Order-specific*

For the version with "*Second Line of Defense*", the measure of length increases by 17 mm (0.67 in).

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