Operating Instructions

Pressure transmitter with chemical seal

VEGABAR 81

Modbus and Levelmaster protocol

Document ID: 46293

Contents

46293-EN-230914

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

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1 About this document

1.1 Function

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

1.3 Symbols used

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

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

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

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

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

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

Ex applications
This symbol indicates special instructions for Ex applications.

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

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

Disposal
This symbol indicates special instructions for disposal.

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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 Appropriate use

The VEGABAR 81 is a pressure transmitter for process pressure and hydrostatic level measurement.

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

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

2.3 Warning about incorrect use

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

2.4 General safety instructions

This is a state-of-the-art instrument complying with all prevailing regulations and directives. The instrument must only be operated in a technically flawless and reliable condition. The 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

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

The device fulfils the requirements of the following NAMUR recommendations:

- NE 21 – Electromagnetic compatibility of equipment
- NE 53 – Compatibility of field devices and display/adjustment components
- NE 107 – Self-monitoring and diagnosis of field devices

For further information see www.namur.de.

2.7 Installation and operation in the USA and Canada

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

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

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

- VEGABAR 81 pressure transmitter

The further scope of delivery encompasses:

- Documentation
  - Quick setup guide VEGABAR 81
  - Test certificate for pressure transmitters
  - Instructions for optional instrument features
  - Ex-specific " *Safety instructions*" (with Ex versions)
  - If necessary, further certificates

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

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***".

Electronics design

The instrument contains two different electronics in its housing chambers:

- The Modbus electronics for power supply and communication with the Modbus-RTU
- The sensor electronics for the actual measuring tasks

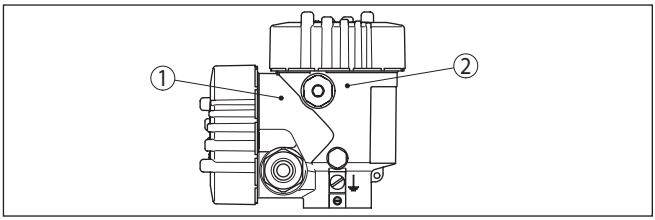

Fig. 1: Position of Modbus and sensor electronics

1 Modbus electronics
2 Sensor electronics

3.2 Principle of operation

Application area

VEGABAR 81 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 chemical seal systems of VEGABAR 81, which are optimally adapted to the process, also allow measurement of highly corrosive and hot products.

Measured variables

The VEGABAR 81 is suitable for the measurement of the following process variables:

- Process pressure
- Level

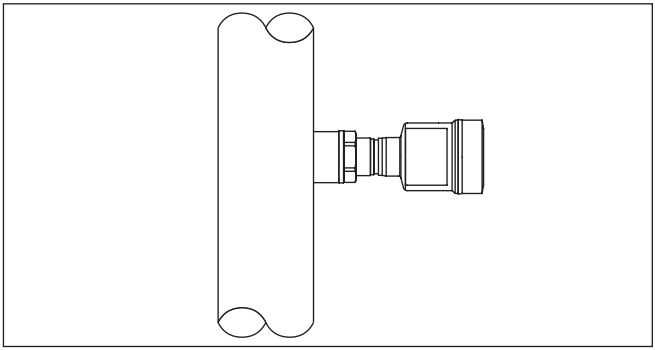

Fig. 2: Process pressure measurement VEGABAR 81

Chemical seal

The VEGABAR 81 is equipped with a chemical seal. It consists of a stainless steel diaphragm and an isolating liquid.

A chemical seal has two tasks:

- Separation of the sensor element from the medium

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- Transmission of the process pressure to the sensor element

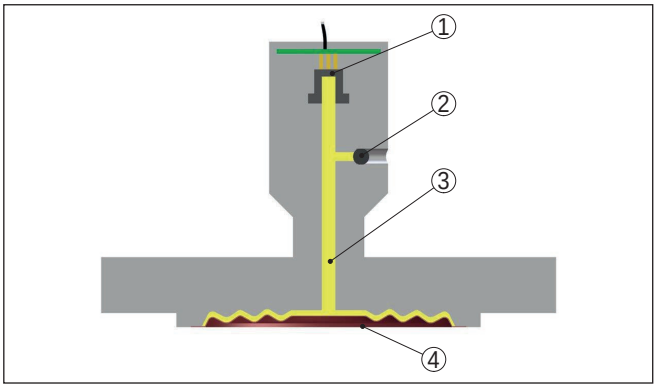

Fig. 3: Configuration of a chemical seal

1 Sensor element
2 Sealed screw
3 Isolating liquid
4 Stainless steel diaphragm

The chemical seal is available in different versions, see chapter "*Dimensions*".

Measuring system

The process pressure acts on the sensor element via the isolating diaphragm. The process pressure causes a resistance change which is converted into a corresponding output signal and output as measured value.

Measuring ranges up to 40 bar: piezoresistive sensor element with a transmission liquid, measuring ranges from 100 bar: a dry strain gauge (DMS) sensor element.

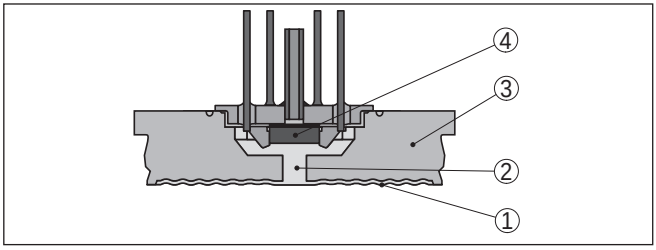

Fig. 4: Configuration of the measuring system with piezoresistive sensor element

1 Diaphragm
2 Isolating liquid
3 Base element
4 Sensor element

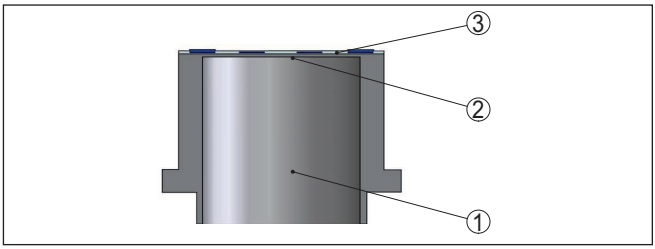

Fig. 5: Configuration of the measuring system with strain gauge (DMS) sensor element

1 Pressure cylinder
2 Process diaphragm
3 Sensor element

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 81 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 81 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 " *Supplement - Technical data - Ambient conditions*"
- Relative moisture 20 … 85 %

Lifting and carrying

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

3.5 Accessories

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

Display and adjustment module

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

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

VEGACONNECT

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

Secondary sensors

Secondary sensors of VEGABAR series 80 enable in conjunction with VEGABAR 81 an electronic differential pressure measurement.

VEGADIS 81

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

VEGADIS adapter

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

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.

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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.

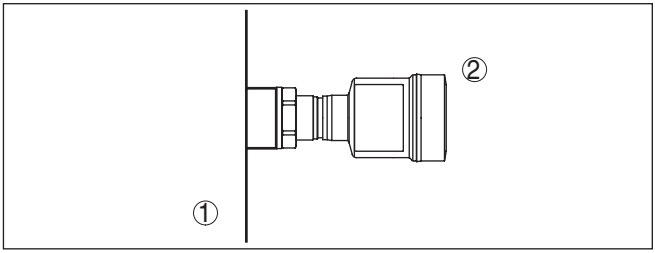


Fig. 6: Temperature ranges

1 Process temperature
2 Ambient temperature

4.2 Instructions for oxygen applications

Warning:
As an oxidising agent, oxygen can cause or intensify fires. Oils, grease, some plastics and dirt can burn explosively on contact with oxygen. There is a risk of serious personal injury or damage to property.

Therefore, to avoid this, take the following precautions, for example:

- All components of the system - measuring instruments - must be cleaned in accordance with the requirements of recognized regulations or standards
- Depending on the seal material, certain temperatures and pressures must not be exceeded in oxygen applications, see chapter "*Technical data*"
- Devices for oxygen applications may only be unpacked from the PE foil just before assembly.
- Check whether the marking "O2" is visible on the process fitting after removing the protection for the process fitting
- Avoid any ingress of oil, grease and dirt

4.3 Ventilation and pressure compensation

Filter element - Function

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

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

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

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

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

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

Filter element - Position

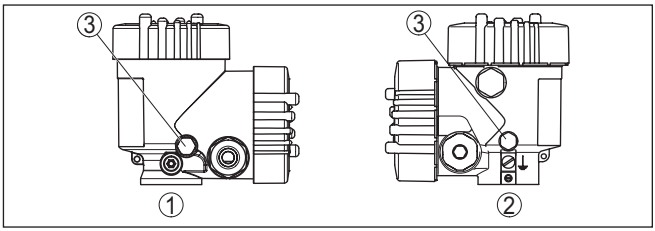


Fig. 7: Position of the filter element

1 Plastic double chamber housing
2 Aluminium, stainless steel (precision casting) double chamber
3 Filter element

4.4 Process pressure measurement

Measurement setup in gases

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

- Mount the instrument above the measuring point

Possible condensation can then drain off into the process line.

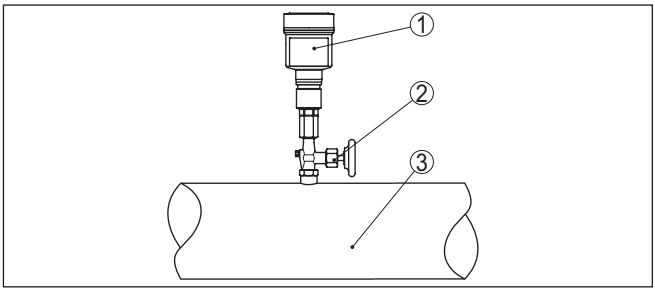


Fig. 8: Measurement setup for process pressure measurement of gases in pipelines

1 VEGABAR 81
2 Blocking valve
3 Pipeline

Measurement setup in vapours

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

- Connect via a siphon
- Do not insulate the siphon
- Fill the siphon with water before setup

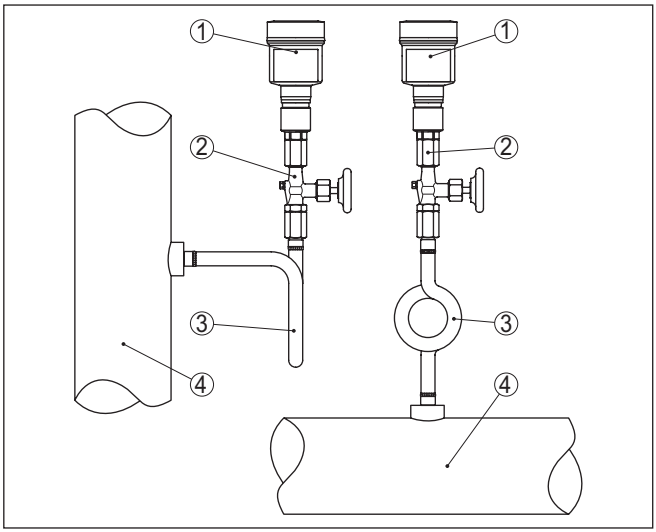


Fig. 9: Measurement setup for process pressure measurement of gases in pipelines

1 VEGABAR 81
2 Blocking valve
3 Siphon in U or circular form
4 Pipeline

A protective accumulation of water is formed through condensation in the pipe bends. Even in applications with hot steam, a medium temperature < 100 °C on the transmitter is ensured.

Measurement setup in liquids

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

- Mount the instrument below the measuring point

The effective pressure line is always filled with liquid and gas bubbles can bubble up to the process line.

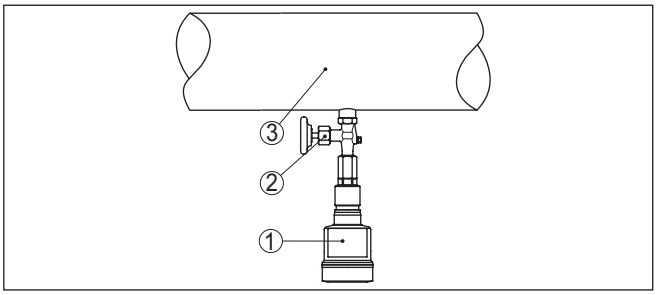


Fig. 10: Measurement setup for process pressure measurement of liquids in pipelines

1 VEGABAR 81
2 Blocking valve
3 Pipeline

4.5 Level measurement

Measurement setup

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

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

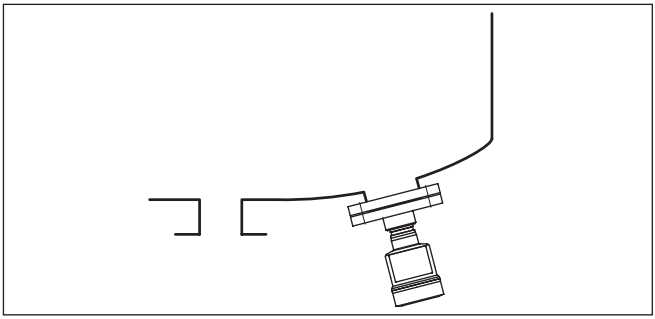


Fig. 11: Measurement setup for level measurement

4.6 External housing

Configuration

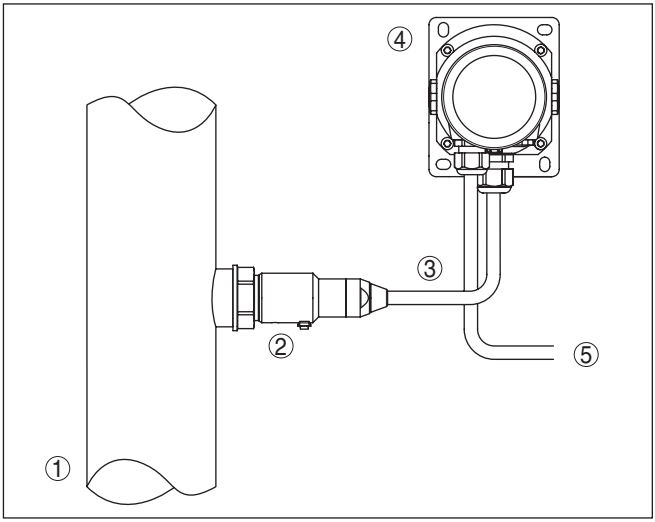


Fig. 12: Configuration, process module, external housing

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

5 Connecting to power supply and bus system

5.1 Preparing the connection

Safety instructions

Always keep in mind the following safety instructions:

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

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

Voltage supply

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

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

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

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

Connection cable

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

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

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

Cable screening and grounding

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

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

Cable glands

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

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

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

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

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

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

5.2 Connecting

Connection technology

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

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

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

Connection procedure

Proceed as follows:

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

Fig. 13: Connection steps 5 and 6

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

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

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

The electrical connection is finished.

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

5.3 Wiring plan

Overview

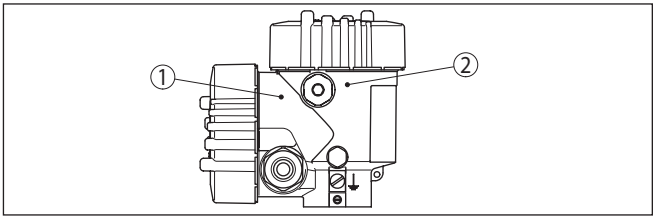


Fig. 14: Position of connection compartment (Modbus electronics) and electronics compartment (sensor electronics)

1 Connection compartment
2 Electronics compartment

Electronics compartment

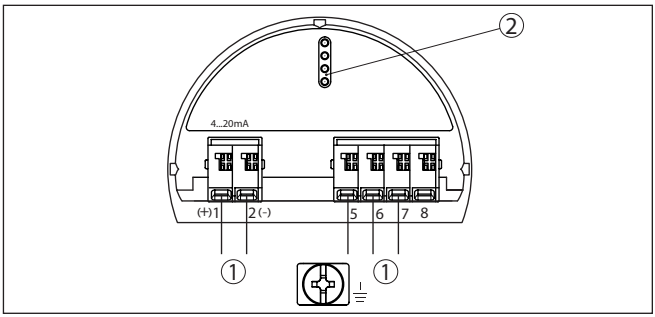


Fig. 15: Electronics compartment - double chamber housing

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

Connection compartment

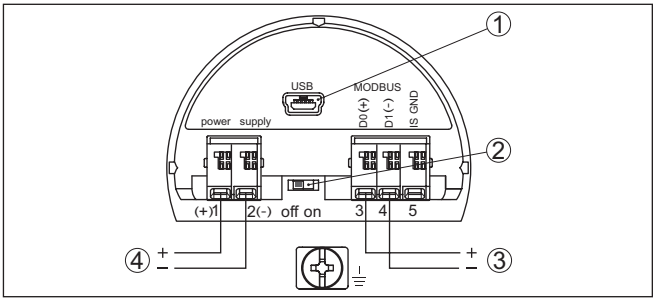


Fig. 16: Connection compartment

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

Terminal	Function	Polarity
1	Voltage supply	+

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

5.4 External housing with version IP68 (25 bar)

Overview

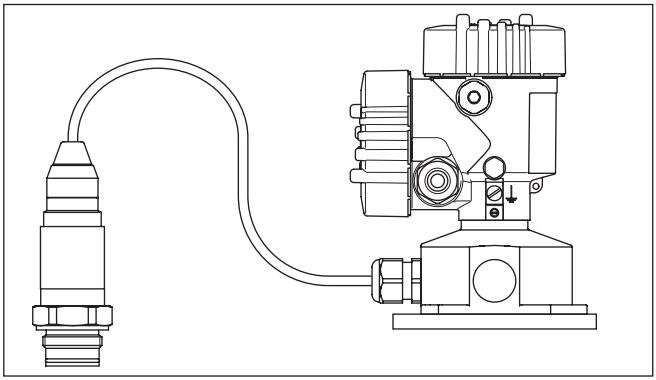


Fig. 17: VEGABAR 81 in IP68 version 25 bar with axial cable outlet, external housing

Electronics and connection compartment for power supply

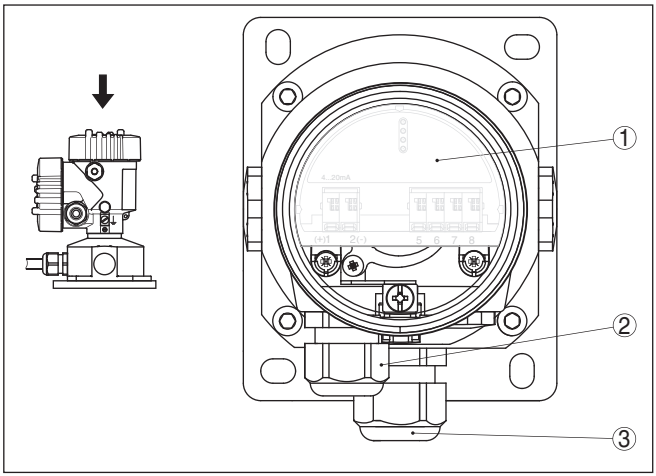


Fig. 18: Electronics and connection compartment

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

Terminal compartment, housing socket

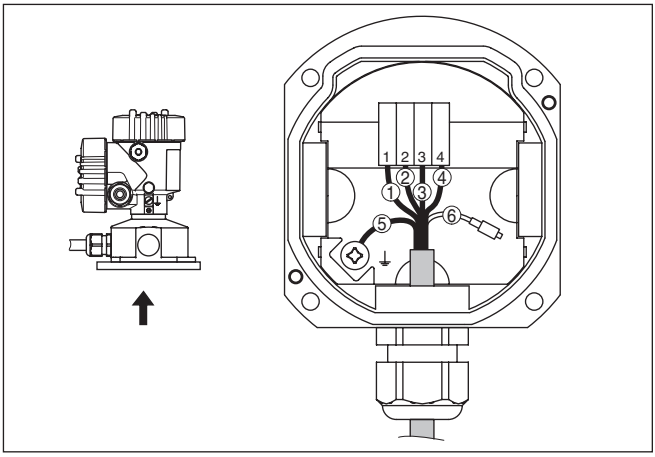


Fig. 19: Connection of the sensor in the housing base

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

Connection compartment

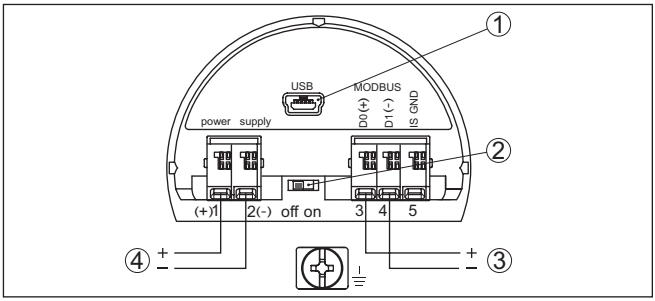


Fig. 20: Connection compartment

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

Terminal	Function	Polarity
1	Voltage supply	+
2	Voltage supply	-
3	Modbus signal D0	+
4	Modbus signal D1	-

Terminal	Function	Polarity
5	Function ground when installing according to CSA (Canadian Standards Association)	

5.5 Switch-on phase

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

- Internal check of the electronics
- Indication of a status message on the display or PC

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

6 Set up the sensor with the display and adjustment module

6.1 Insert display and adjustment module

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

Proceed as follows:

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

Disassembly is carried out in reverse order.

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

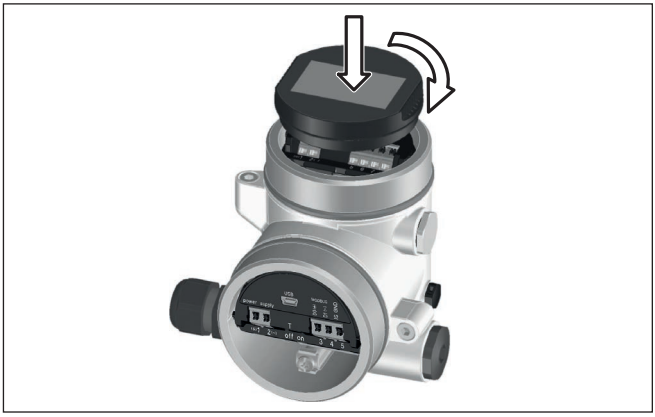


Fig. 21: Insertion of the display and adjustment module

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

6.2 Adjustment system

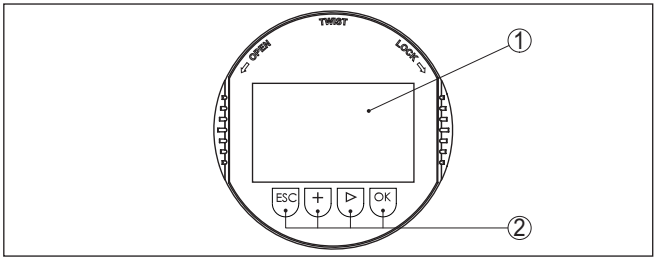


Fig. 22: Display and adjustment elements

1 LC display
2 Adjustment keys

Key functions

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

Adjustment system

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

Adjustment system - keys via magnetic pen

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

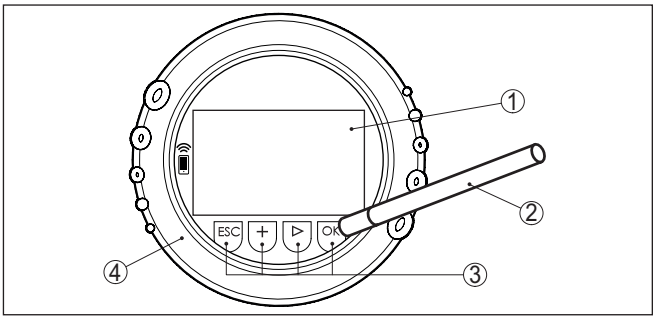


Fig. 23: Display and adjustment elements - with adjustment via magnetic pen

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

Time functions

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

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

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

6.3 Measured value indication

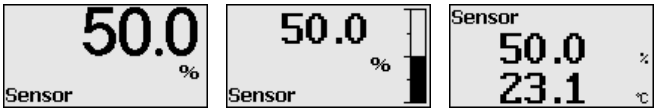
Measured value indication

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

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

In the second view, the selected measured value and a respective bargraph presentation are displayed.

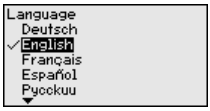
In the third view, the selected measured value as well as a second selectable value, e.g. the temperature, are displayed.



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

Selection language

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

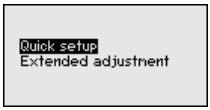


With the " ***[->]***" button, you can select the requested language, with " ***OK***" you confirm the selection and move to the main menu.

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

6.4 Parameter adjustment - Quick setup

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



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

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

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

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

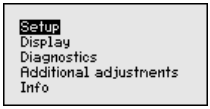
You can find " *Extended adjustment*" in the next sub-chapter.

6.5 Parameter adjustment - Extended adjustment

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

Main menu

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



Setup: Settings e. g. for measurement loop name, application, units, position correction, adjustment, signal output, disable/enable operation

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

Diagnosis: Information, for example, of device status, peak indicator, simulation

Additional adjustments: date/time, reset, copy function

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

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

The submenu points are described below.

6.5.1 Setup

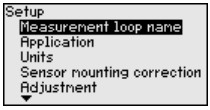
Measurement loop name

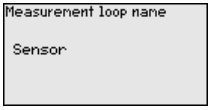
In the menu item "*Sensor TAG*" you edit a twelve-digit measurement loop designation.

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

The available digits include:

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





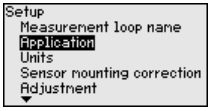
Application

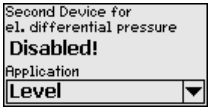
In this menu item you activate/deactivate the Secondary Device for electronic differential pressure and select the application.

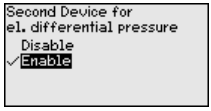
VEGABAR 81 can be used for process pressure and level measurement. The setting in the delivery status is "*Level*". The mode can be changed in this adjustment menu.

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

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





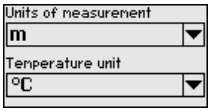


Enter the requested parameters via the appropriate keys, save your settings with ***[OK]*** and jump to the next menu item with the ***[ESC]*** and the ***[->]*** key.

Units

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

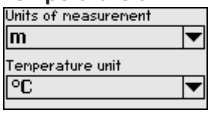
Unit of measurement:



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

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

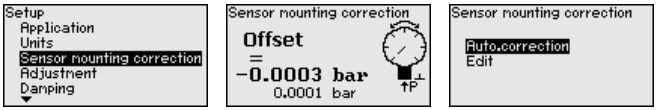
Temperature unit:



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

Position correction

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



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

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

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

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

The position correction can be repeated as often as necessary. However, if the sum of the corrective values exceeds ±50 % of the nominal measuring range, then no position correction is possible.

Adjustment

VEGABAR 81 always measures pressure independently of the process variable selected in the menu item " *Application*". To output the

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

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

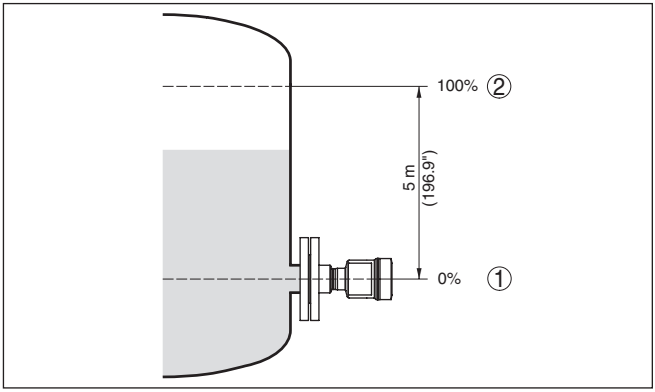


Fig. 24: Parameter adjustment example Min./max. adjustment, level measurement

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

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

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

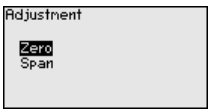
Note:
If the adjustment ranges are exceeded, the entered value will not be accepted. Editing can be interrupted with ***[ESC]*** or corrected to a value within the adjustment ranges.

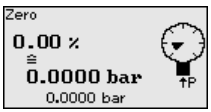
For the other process variables such as e.g. process pressure, differential pressure or flow, the adjustment is performed in like manner.

Zero adjustment

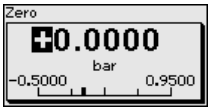
Proceed as follows:

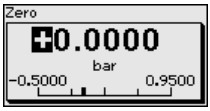
1. Select the menu item " *Setup*" with ***[->]*** and confirm with ***[OK]***. Now select with ***[->]*** the menu item " *Zero adjustment*" and confirm with ***[OK]***.





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





3. Set the requested mbar value with ***[+]*** and store with ***[OK]***.
4. 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.

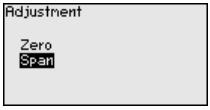
For an adjustment with pressure, simply enter the actual measured value indicated at the bottom of the display.

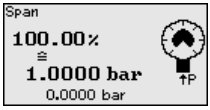
If the adjustment ranges are exceeded, the message " *Outside parameter limits*" appears. The editing procedure can be aborted with ***[ESC]*** or the displayed limit value can be accepted with ***[OK]***.

Span adjustment

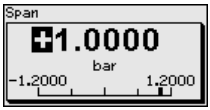
Proceed as follows:

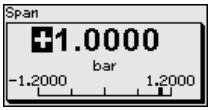
1. Select with ***[->]*** the menu item " *Span adjustment*" and confirm with ***[OK]***.





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





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

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

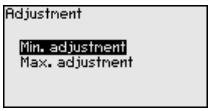
If the adjustment ranges are exceeded, the message " *Outside parameter limits*" appears. The editing procedure can be aborted with ***[ESC]*** or the displayed limit value can be accepted with ***[OK]***.

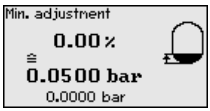
The span adjustment is finished.

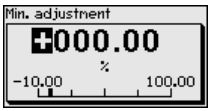
Min. adjustment - Level

Proceed as follows:

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







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

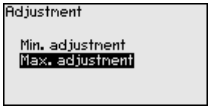
The min. adjustment is finished.

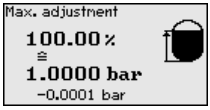
For an adjustment with filling, simply enter the actual measured value indicated at the bottom of the display.

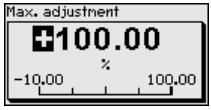
Max. adjustment - Level

Proceed as follows:

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







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

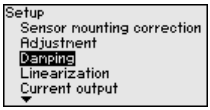
The max. adjustment is finished.

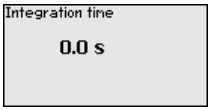
For an adjustment with filling, simply enter the actual measured value indicated at the bottom of the display.

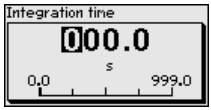
Damping

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

The set damping is effective for level and process pressure measurement as well as for all applications of electronic differential pressure measurement.



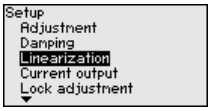


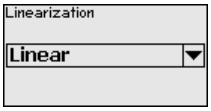


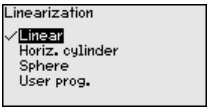
The default setting is a damping of 0 s.

Linearisation

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







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

With flow measurement and selection " *Extraction by root*"display and output (percentage/current) are linear to " **Flow**". [2)]

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*".

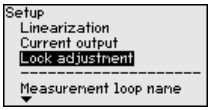
Caution:
Note the following, if the respective sensor is used as part of an overfill protection system according to WHG:

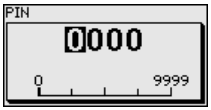
If a linearisation curve is selected, the measuring signal is no longer necessarily linear to the filling height. This must be considered by the user especially when setting the switching point on the limit signal transmitter.

Lock/Unlock adjustment

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

This is done by entering a four-digit PIN.





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

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

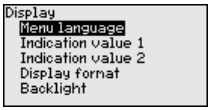
Releasing the sensor adjustment is also possible in any menu item by entering the PIN.

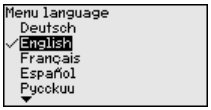
Caution:
With active PIN, adjustment via PACTware/DTM and other systems is also blocked.

6.5.2 Display

Language

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





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

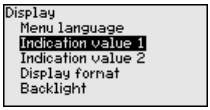
The following languages are available:

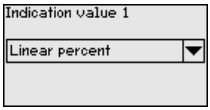
- German
- English
- French
- Spanish
- Russian
- Italian
- Dutch
- Portuguese
- Japanese
- Chinese
- Polish
- Czech
- Turkish

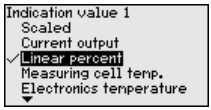
In delivery status, the VEGABAR 81 is set to English.

Display value 1 and 2

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



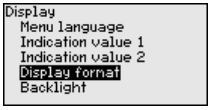


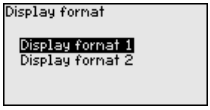


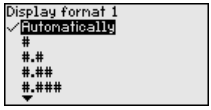
The setting in the delivery status for the display value is " *Lin. percent*".

Display format 1 and 2

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



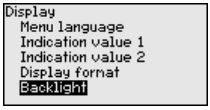




The setting in the delivery status for the display format is " *Automatic*".

Backlight

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

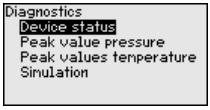


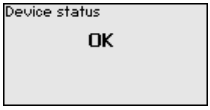
In delivery status, the lighting is switched on.

6.5.3 Diagnostics

Device status

In this menu item, the device status is displayed.





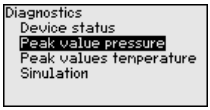
In case of error, e.g. the error code F017, e.g. the error description " *Adjustment span too small*" and a four digit figure are displayed for

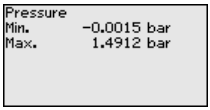
service purposes. You can find the error codes with description, reason as well as rectification in chapter " *Asset Management*".

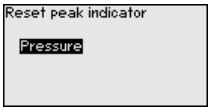
Peak indicator, pressure

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

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



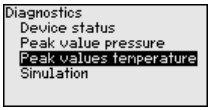


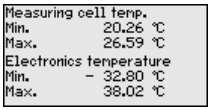


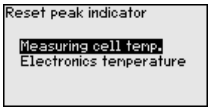
Peak indicator, temperature

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

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

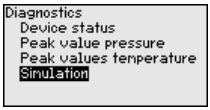


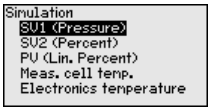


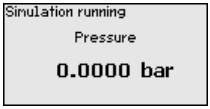


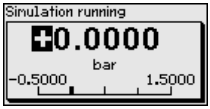
Simulation

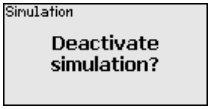
In this menu item you simulate measured values. Hence, the signal path can be tested via the bus system to the input card of the control system.











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.

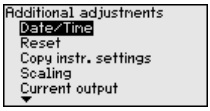
Caution:
During simulation, the simulated value is output as digital signal. The status message along with the Asset Management function is " *Maintenance*".

Information:
The sensor terminates the simulation automatically after 60 minutes.

6.5.4 Additional adjustments

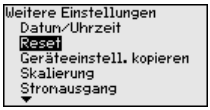
Date/Time

In this menu item, you adjust the internal clock of the sensor. There is no adjustment for summer/winter (daylight saving) time.



Reset

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



The following reset functions are available:

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

Basic settings: Resets the parameter settings, incl. special parameters, to the default values of the respective instrument. Any programmed linearisation curve as well as the measured value memory are deleted.

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

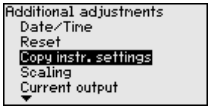
Copy instrument settings

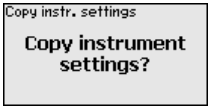
The instrument settings are copied with this function. The following functions are available:

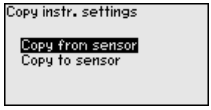
- **Read from sensor:** Read data from sensor and store into the display and adjustment module
- **Write into sensor:** Store data from the display and adjustment module back into the sensor

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

- All data of the menu " *Setup*" and " *Display*"
- In the menu " *Additional adjustments*" the items " *Reset, Date/Time*"
- The user-programmable linearization curve







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

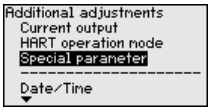
Note:
Before the data are saved in the sensor, a safety check is carried out to determine if the data match the sensor. In the process the sensor

type of the source data as well as the target sensor are displayed. If the data do not match, a fault message is outputted or the function is blocked. The data are saved only after release.

Special parameters

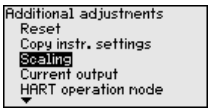
In this menu item you gain access to the protected area where you can enter special parameters. In exceptional cases, individual parameters can be modified in order to adapt the sensor to special requirements.

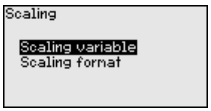
Change the settings of the special parameters only after having contacted our service staff.

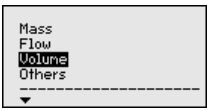


Scaling (1)

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

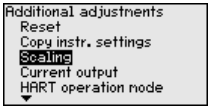


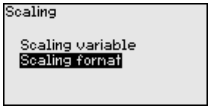


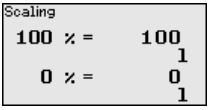


Scaling (2)

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



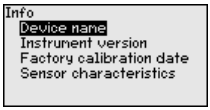




6.5.5 Info

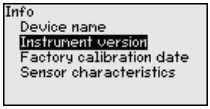
Device name

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



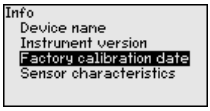
Instrument version

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



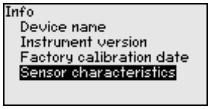
Factory calibration date

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



Sensor characteristics

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



6.6 Menu overview

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

Setup

Menu item	Parameter	Default value
Measurement loop name		Sensor
Application	Application	Level
	Secondary sensor for electronic differential pressure	Deactivated
Units	Unit of measurement	mbar (with nominal measuring range ≤ 400 mbar) bar (with nominal measuring ranges ≥ 1 bar)
	Temperature unit	°C
Position correction		0.00 bar
Adjustment	Zero/Min. adjustment	0.00 bar 0.00 %
	Span/Max. adjustment	Nominal measuring range in bar 100.00 %
Damping	Integration time	1 s
Lock adjustment	Blocked, released	Released

Display

Menu item	Default value
Menu language	Selected language
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 value
Backlight	Switched on

Diagnostics

Menu item	Parameter	Default value
Device status		-
Peak indicator	Pressure	Current pressure measured value
Peak indicator temp.	Temperature	Actual measuring cell and electronic temperature
Simulation		Process pressure

Additional adjustments

Menu item	Parameter	Default value
Date/Time		Actual date/Actual time
Reset	Delivery status, basic settings	
Copy instrument settings	Read from sensor, write into sensor	
Scaling	Scaling size	Volume in l
	Scaling format	0 % corresponds to 0 l 100 % corresponds to 100 l
Special parameters	Service-Login	No reset

Info

Menu item	Parameter
Device name	VEGABAR 81
Instrument version	Hardware and software version
Factory calibration date	Date
Sensor characteristics	Order-specific characteristics

6.7 Save parameter adjustment data

On paper

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

In the display and adjustment module

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

7 Setting up sensor and Modbus interface with PACTware

7.1 Connect the PC

To the sensor electronics

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

Scope of the parameter adjustment:

- Sensor electronics

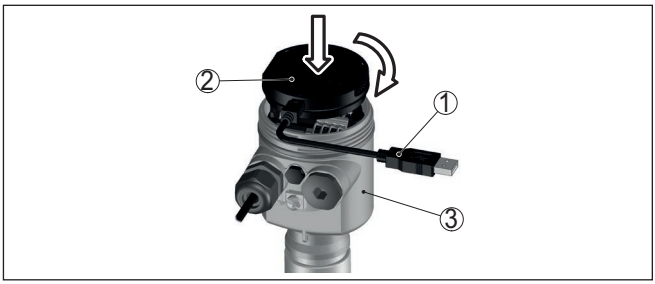


Fig. 25: Connection of the PC directly to the sensor via the interface adapter

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

To the Modbus electronics

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

Scope of the parameter adjustment:

- Sensor electronics
- Modbus electronics

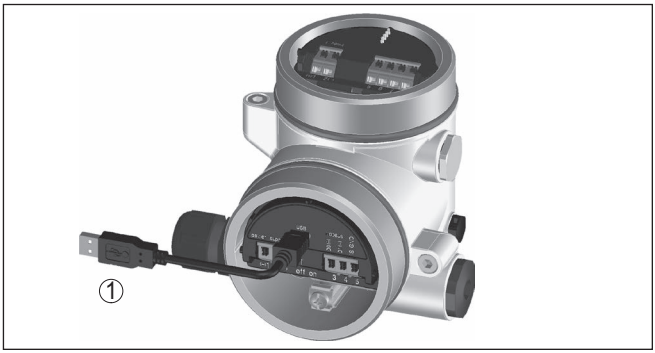


Fig. 26: Connecting the PC via USB to the Modbus electronics

1 USB cable to the PC

To the RS 485 cable

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

46293-EN-230914

Scope of the parameter adjustment:

- Sensor electronics
- Modbus electronics

Information:
For parameter adjustment, it is absolutely necessary to disconnect from the RTU.

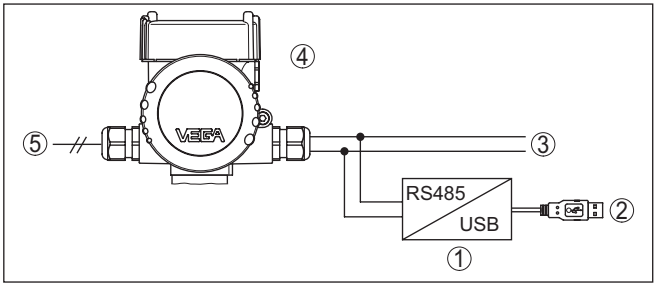


Fig. 27: Connection of the PC via the interface adapter to the RS 485 cable

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

7.2 Parameterization

Prerequisites

For parameter adjustment of the instrument via a Windows PC, the configuration software PACTware and a suitable instrument driver (DTM) according to FDT standard are required. The latest PACTware version as well as all available DTMs are compiled in a DTM Collection. The DTMs can also be integrated into other frame applications according to FDT standard.

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

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

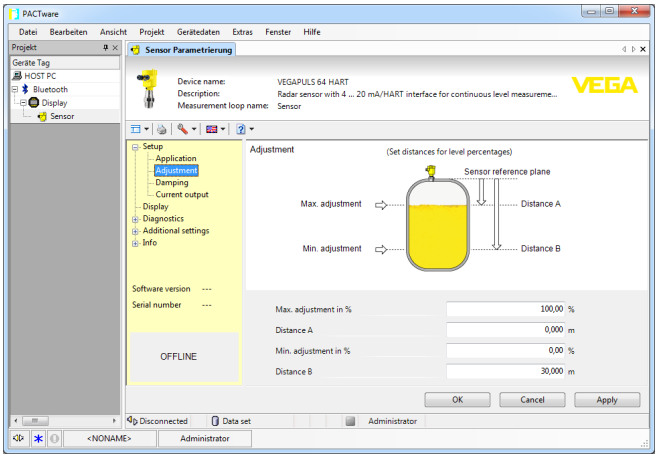


Fig. 28: Example of a DTM view

7.3 Set instrument address

The VEGABAR 81 requires an address for participating as a sensor in the Modbus communication. The addess setting is carried out via a PC with PACTware/DTM or Modbus RTU.

The default settings for the address are:

- Modbus: 246
- Levelmaster: 31

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

Via PC through Modbus electronics

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

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

Via PC through RS 485 cable

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

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

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

right mouse key " *Parameter*", then " *Online parameter setting*" and start the DTM for the Modbus electronics.

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

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

Via Modbus-RTU

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

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

7.4 Save parameter adjustment data

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

8 Diagnosis, asset management and service

8.1 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

8.2 Diagnosis memory

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

Measured value memory

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

Depending on the instrument version, values that can be stored are for example:

- Level
- Process pressure
- Differential pressure
- Static pressure
- Percentage value
- Scaled values
- Current output
- Lin. percent
- Measuring cell temperature
- Electronics temperature

When the instrument is shipped, the measured value memory is active and stores pressure value and measuring cell temperature every 10 s, with electronic differential pressure also the static pressure.

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

Event memory

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

Event types are for example:

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

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

8.3 Asset Management function

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

Status messages

The status messages are divided into the following categories:

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

and explained by pictographs:

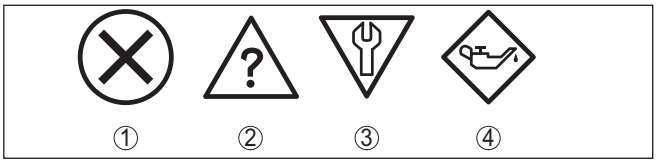


Fig. 29: Pictographs of the status messages

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

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

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

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

This status message is inactive by default.

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

This status message is inactive by default.

Maintenance required:
Due to external influences, the instrument function is limited. The measurement is affected, but the measured value is still valid. Plan in

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

This status message is inactive by default.

Failure

Code Text message	Cause	Rectification
F013 No valid measured value available	Gauge pressure or low pressure Measuring cell defective	Exchange measuring cell Send instrument for repair
F017 Adjustment span too small	Adjustment not within specification	Change the adjustment according to the limit values
F025 Error in the linearization table	Index markers are not continuously rising, for example illogical value pairs	Check linearization table Delete table/Create new
F036 no operable sensor software	Failed or interrupted software update	Repeat software update Check electronics version Exchanging the electronics Send instrument for repair
F040 Error in the electronics	Hardware defect	Exchanging the electronics Send instrument for repair
F041 Communication error	No connection to the sensor electronics	Check connection between sensor and main electronics (with separate version)
F080 General software error	General software error	Disconnect operating voltage briefly
F105 Measured value is determined	The instrument is still in the switch-on phase, the measured value could not yet be determined	Wait for the end of the switch-on phase
F113 Communication error	Error in the internal instrument communication	Disconnect operating voltage briefly Send instrument for repair
F260 Error in the calibration	Error in the calibration carried out in the factory Error in the EEPROM	Exchanging the electronics Send instrument for repair
F261 Error in the instrument settings	Error during setup Error when carrying out a reset	Repeat setup Repeat reset
F264 Installation/Setup error	Inconsistent settings (e.g.: distance, adjustment units with application process pressure) for selected application Invalid sensor configuration (e.g.: application electronic differential pressure with connected differential pressure measuring cell)	Modify settings Modify connected sensor configuration or application
F265 Measurement function disturbed	Sensor no longer carries out a measurement	Carry out a reset Disconnect operating voltage briefly

Function check

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

Out of specification

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

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

Maintenance

Code Text message	Cause	Rectification	DevSpec State in CMD 48
M500 Error in the delivery status	The data could not be restored during the reset to delivery status	Repeat reset Load XML file with sensor data into the sensor	Bit 0 of Byte 14 … 24
M501 Error in the non-active linearisation table	Index markers are not continuously rising, for example illogical value pairs	Check linearization table Delete table/Create new	Bit 1 of Byte 14 … 24
M502 Error in the event memory	Hardware error EEPROM	Exchanging the electronics Send instrument for repair	Bit 2 of Byte 14 … 24
M504 Error at a device interface	Hardware defect	Exchanging the electronics Send instrument for repair	Bit 3 of Byte 14 … 24
M507 Error in the instrument settings	Error during setup Error when carrying out a reset	Carry out reset and repeat setup	Bit 4 of Byte 14 … 24

8.4 Rectify faults

Reaction when malfunction occurs

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

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.

8.5 Exchanging the electronics module

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

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

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

8.6 Exchange process module on version IP68 (25 bar)

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

Required tools:

- Hexagon key wrench, size 2

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

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

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

Proceed as follows when carrying out the exchange:

1. Losen the fixing screw with the hexagon key wrench

2. Carefully detach the cable assembly from the process module

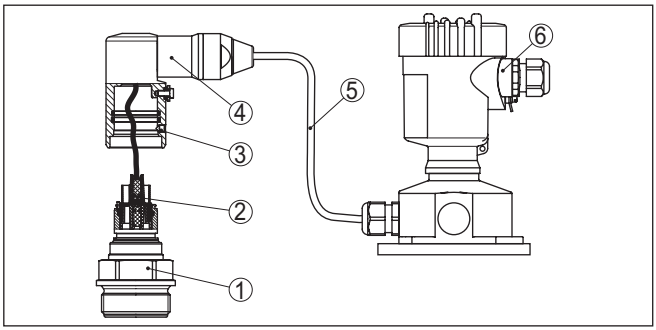


Fig. 30: VEGABAR 81 in IP68 version, 25 bar and lateral cable outlet, external housing

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.

8.7 Software update

The following components are required to update the instrument software:

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

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

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

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

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

8.8 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.

You will need:

- The serial number of the instrument
- A short description of the problem
- Details of the medium

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.

9 Dismount

9.1 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.

9.2 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.

10 Supplement

10.1 Technical data

Note for approved instruments

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

All approval documents can be downloaded from our homepage.

Materials and weights

Materials, wetted parts

Process fitting	316L
Diaphragm	316L, Alloy C276 (2.4819), Alloy C22 (2.4602), Alloy 400 (2.4360), Tantalum, Titanium, 316L ECTFE coated, 1.4435 with gold coating (25 µm), 316L with 0.25 mm PTFE coating [3]
Seal for process fitting (in the scope of delivery)	
– Thread G½ (EN 837), G1½ (DIN 3852-A)	Klingersil C-4400
Surface quality, hygienic process fittings, typ.	R_a < 0.8 µm

Materials, non-wetted parts

Sensor housing	
– Housing	Plastic PBT (Polyester), Aluminium AlSi10Mg (powder-coated, basis: Polyester), 316L
– Cable gland	PA, stainless steel, brass
– Cable gland: Seal, closure	NBR, PA
– Seal, housing lid	Silicone SI 850 R, NBR silicone-free
– Inspection window housing cover	Polycarbonate (UL-746-C listed), glass [4]
– Ground terminal	316L
External housing - deviating materials	
– Housing and socket	Plastic PBT (Polyester), 316L
– Socket seal	EPDM
– Seal below wall mounting plate [5]	EPDM
– Inspection window housing cover	Polycarbonate (UL-746-C listed), glass [6]
Ground terminal	316Ti/316L
Connection cable with IP68 (25 bar) version [7]	
– Cable cover	PE, PUR

[3] Plastic coatings (e.g. PTFE, PFA, ECTFE) are not used for corrosion protection, but are only suitable as abrasion protection or non-stick coating.
[4] Glass with Aluminium and stainless steel (precision casting) and Ex d housing
[5] Only for 316L with 3A approval
[6] Glass with Aluminium and stainless steel (precision casting) housing
[7] Between transmitter and external electronics housing.

– Type label support on cable	PE hard
Connection cable with IP68 (1 bar) version [8]	PE, PUR

Weights

Total weight	approx. 0.8 … 8 kg (1.764 … 17.64 lbs), depending on process fitting and housing

Torques

Max. torque for process fitting with thread	40 Nm (29.50 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

[8] Fix connected to the sensor.
[9] Data on overload capability apply for reference temperature.

Nominal range	Overload capability	
	Maximum pressure	Minimum pressure
-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
-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.

Adjustment ranges

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

Min./Max. adjustment:

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

Zero/Span adjustment:

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

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

Switch-on phase

Run-up time approx.: 23 s

Output variable

Output

- Physical layer: Digital output signal according to standard EIA-485
- Bus specifications: Modbus Application Protocol V1.1b3, Modbus over serial line V1.02
- Data protocols: Modbus RTU, Modbus ASCII, Levelmaster

Max. transmission rate: 57.6 Kbit/s

Dynamic behaviour output

Dynamic characteristics depending on medium and temperature

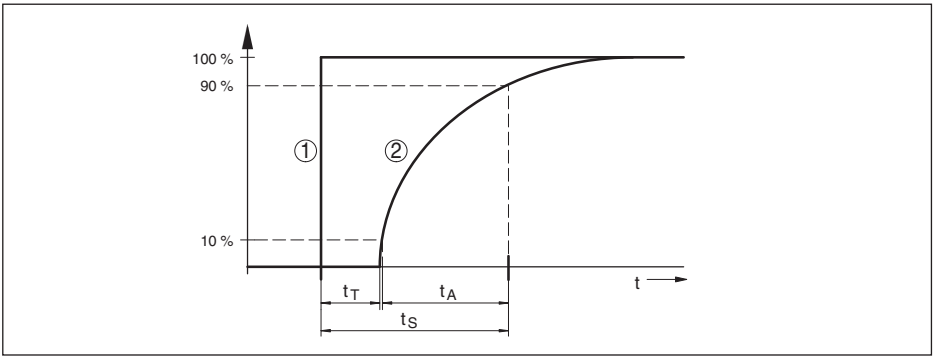


Fig. 31: Sudden change of the process variable. t_T: dead time; t_A: rise time; t_S: jump response time

1 Process variable
2 Output signal

	VEGABAR 81	VEGABAR 81, 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

To this amounts the reaction time of the isolatng system. This time varies from values < 1 s with compact chemical seals to several seconds with capillary systems.

Example: Flange-type chemical seal DN 80, filling silicone oil KN 2.2, capillary length 10 m, measuring range 1 bar

Process temperature	Reaction time
+40 °C (+104 °F)	approx. 1.5 s
+20 °C (+58 °F)	approx. 3 s
-20 °C (-4 °F)	approx. 11 s

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 depending on the chemical seal version

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)

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

Accuracy class	Non-linearity, hysteresis and repeatability with TD 1 : 1 up to 5 : 1	Non-linearity, hysteresis and repeatability with 5 : 1
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.

Average temperature coefficient	In the compensated temperature range 10 … +70 °C (+50 … +158 °F)	Outside the compensated temperature range
Turn down 1 : 1	< 0.05 %/10 K	typ. < 0.05 %/10 K
Turn down 1 : 1 up to 5 : 1	< 0.1 %/10 K	-
Turn down up to 10 : 1	< 0.15 %/10 K	-

Additional temperature influence through chemical seal

The specifications refer to diaphragm material 316L as well as isolating liquid silicone oil. They are only used for estimation. The actual values depend on the diameter, material and strength of the diaphragm as well as the isolating liquid. They are available on request.

Temperature coefficient of the chemical seal in mbar/10 K with

- Flange DN 50 PN 40, Form C, DIN 2501 1.2 mbar/10 K
- Flange DN 80 PN 40, Form C, DIN 2501 0.25 mbar/10 K
- Flange DN 80 PN 40, Form C, DIN 2501 with extension 50 mm 1.34 mbar/10 K
- Flange 2" 150 lbs RF, ASME B16.5 1.2 mbar/10 K
- Flange 3" 150 lbs RF, ASME B16.5 0.25 mbar/10 K
- Flange 3" 150 lbs RF, ASME B16.5 with extension 2" 1.34 mbar/10 K

Temperature coefficient of a cooling element, depending on the diaphragm-ø 0.1 … 1.5 mbar/10 K

Temperature coefficient of a 1 m long capillary line, depending on the diaphragm-ø 0.1 … 15 mbar/10 K

Long-term stability (according to DIN 16086)

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

Long-term stability zero signal and output < (0.1 % x TD)/year
span [10)]

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

Process conditions

Process temperature

The table shows the process temperature for p_{abs} ≥ 1 bar/14.5 psi. Process temperature for p_{abs} < 1 bar/14.5 psi see chapter "Chemical seal for vacuum applications".

Isolating liquid	Version	p_{abs} >= 1 bar/14.5 psi
Silicone oil VE 2, KN 2	Standard	-40 … +150 °C (-40 … +302 °F)
	with cooling element	-40 … +250 °C (-40 … +482 °F)
	with capillaries	
Silicone oil KN 17	with cooling element	-90 … +200 °C (-130 … +392 °F
	with capillaries	
High temperature oil VE 32, KN 32	with cooling element	-10 … +320 °C (+14 … +752 °F) up to 10 h: -10 … +400 °C (+14 … +608 °F)
	with capillaries	
Halocarbon oil KN 21	Standard	-40 … +150 °C (-40 … +302 °F)
	For oxygen applications	-40 … +60 °C (-40 … +140 °F)
Silicone-free liquid KN 70 [11)]		-40 … +70 °C (-40 … +158 °F)
Medical white oil (FDA) VE 92, KN 92	Standard	-10 … +150 °C (+14 … +302 °F)
	with cooling element	-10 … +250 °C (+14 … +482 °F)
Neobee KN 59		-20 … +150 °C (+14 … +302 °F)

Process pressure

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

Permissible process pressure for fittings PN 160 in Alloy 400 (2.4360), see following temperature derating:

10) Depending on which chemical seal is used, the values can also be higher.
11) no vacuum

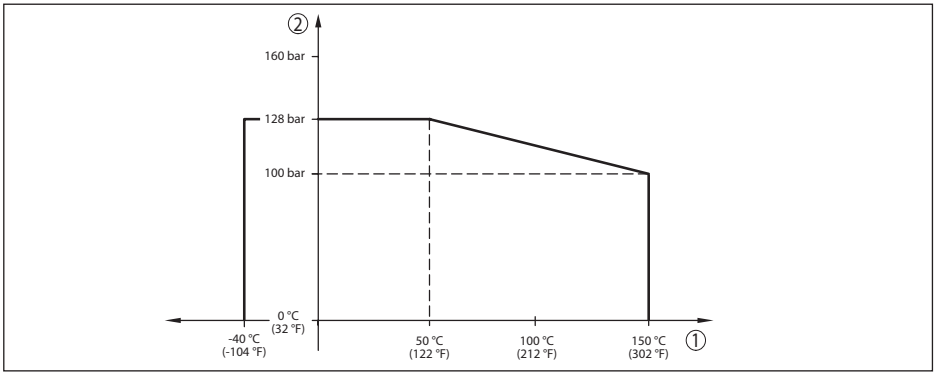


Fig. 32: Temperature derating VEGABAR 81, process fittings Alloy 400 (2.4360)

1 Process temperature
2 Process pressure

Mechanical stress[12)]

Vibration resistance

– Standard versions	1 to 4 g at 5 … 200 Hz according to EN 60068-2-6 (vibration with resonance)
– Version with cooling element and metal housing	0.5 g at 5 … 200 Hz according to EN 60068-2-6 (vibration with resonance)

Shock resistance

– Standard versions	50 g, 2.3 ms according to EN 60068-2-27 (mechanical shock)
– Version with stainless steel double chamber housing	2 g, 2.3 ms according to EN 60068-2-27 (mechanical shock)

Electromechanical data - version IP66/IP67 and IP66/IP68 (0.2 bar) [13)]

Options of the cable entry

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

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

Wire cross-section (spring-loaded terminals)

– Massive wire, stranded wire	0.2 … 2.5 mm² (AWG 24 … 14)

[12)] Depending on the instrument version.
[13)] IP66/IP68 (0.2 bar), only with absolute pressure.

– Stranded wire with end sleeve	0.2 … 1.5 mm² (AWG 24 … 16)

Electromechanical data - version IP66/IP68 (1 bar)

Connection cable, mechanical data	
– Configuration	Wires, strain relief, breather capillaries, screen braiding, metal foil, mantle
– Standard length	5 m (16.4 ft)
– Min. bending radius (at 25 °C/77 °F)	25 mm (0.984 in)
– Diameter	approx. 8 mm (0.315 in)
– Colour - version PE	Black
– Colour - version PUR	Blue
Connection cable, electrical data	
– Wire cross-section	0.5 mm² (AWG 20)
– Wire resistance R'	0.037 Ω/m (0.012 Ω/ft)

Electromechanical data - version IP68 (25 bar)

Connection cable transmitter - external housing, mechanical data	
– Configuration	Wires, strain relief, breather capillaries, screen braiding, metal foil, mantle [14]
– 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 external display and adjustment unit

Data transmission	Digital (I²C-Bus)
Connection cable	Four-wire

Sensor version	Configuration, connection cable		
	Cable length	Standard cable	Shielded
4 … 20 mA/HART Modbus	50 m	●	–
Profibus PA, Foundation Fieldbus	25 m	–	●

Interface to the Secondary sensor

Data transmission	Digital (I²C-Bus)
Configuration, connection cable	4-wire, shielded

[14] Breather capillaries not with Ex d version.

Max. cable length	70 m (229.7 ft)

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

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

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

Potential connections and electrical separating measures in the instrument	
Electronics	Non-floating
Galvanic separation	
– between electronics and metallic parts of the device	Reference voltage 500 V AC
– between voltage supply and Modbus communication cables	Reference voltage 500 V AC
Conductive connection	Between ground terminal and metallic process fitting

Electrical protective measures [15)]

Housing material	Version	Protection acc. to IEC 60529	Protection acc. to NEMA
Plastic	Double chamber	IP66/IP67	Type 4x
Aluminium		IP66/IP68 (0.2 bar)	Type 6P
Stainless steel, precision casting			
Stainless steel (transmitter, version with external housing)		IP68 (25 bar)	-

Connection of the feeding power supply unit	Networks of overvoltage category III

[15)] 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

Altitude above sea level	
– by default	up to 2000 m (6562 ft)
– with connected overvoltage protection	up to 5000 m (16404 ft)
Pollution degree [16]	4
Protection rating (IEC 61010-1)	II

10.2 Chemical seal with vacuum applications

A chemical seal is closed to the medium with a metallic diaphragm. The inner space between the diaphragm and the sensor element is completely filled with a pressure transmission fluid.

As the pressure decreases, the boiling temperature of the pressure transmission liquid drops. Thus, at pressure values < 1 bar_{abs}, depending on the temperature, gas particles can be released which are dissolved in the pressure transmission fluid. This makes it compressible, which leads to faulty measured values.

For that reason, chemical seal systems can only be used to a limited extent in a vacuum, depending on the pressure transmission liquid, process temperature and pressure. To extend the area of application, we offer a so-called vacuum service as an option.

The following graphics show typical areas of application for different pressure transmission liquids. The characteristic curves are exemplary and can also deviate depending on the process fitting and diaphragm material.

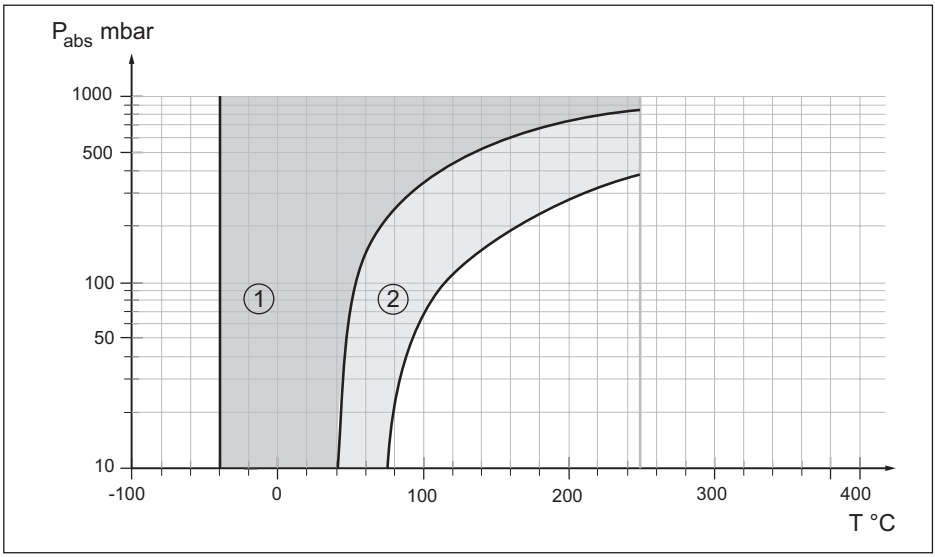


Fig. 33: Area of application for silicone oil VE 2.2, KN 2.2

1 Standard chemical seal
2 Chemical seal with vacuum service

[16] When used with fulfilled housing protection.

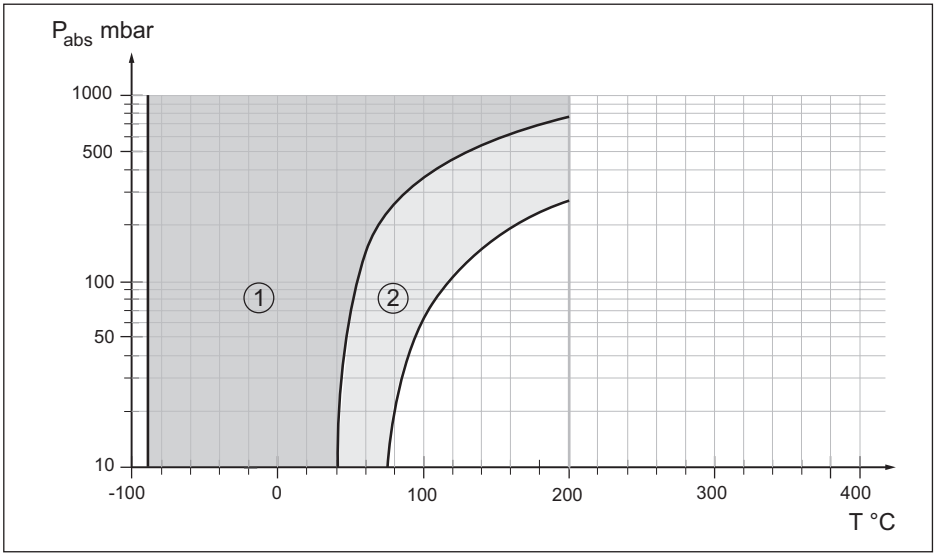


Fig. 34: Area of application for silicone oil KN 17

1 Standard chemical seal
2 Chemical seal with vacuum service

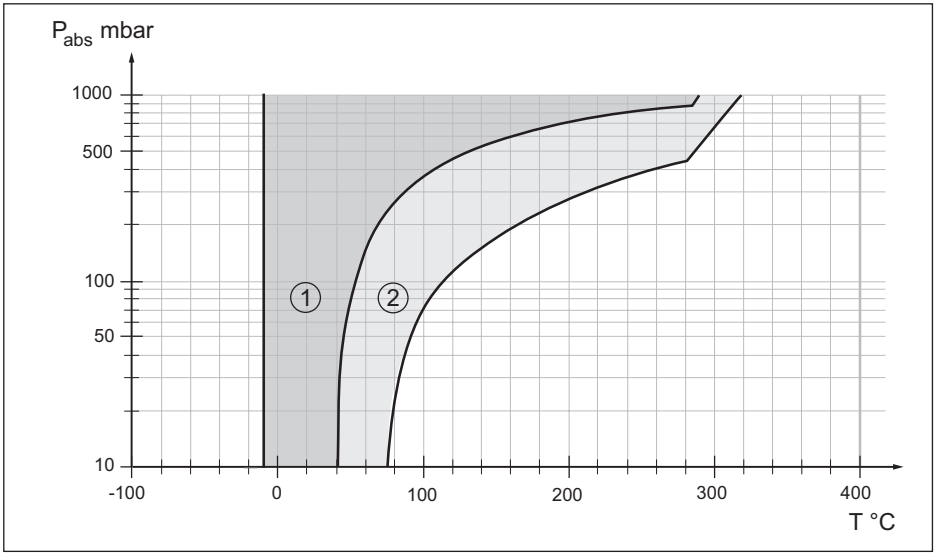


Fig. 35: Area of application for high temperature oil VE 32, KN 32

1 Standard chemical seal
2 Chemical seal with vacuum service

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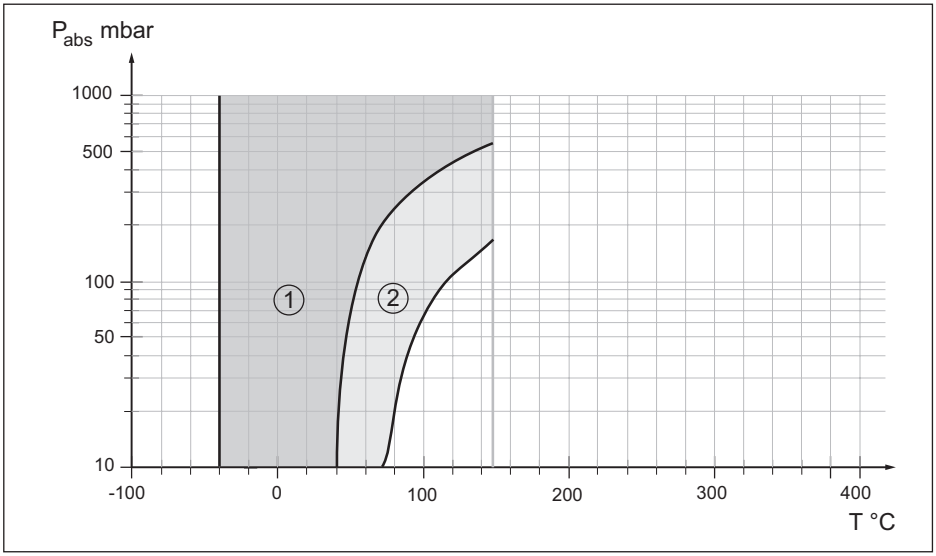

Fig. 36: Area of application for Halocarbon oil KN 21

1 Standard chemical seal
2 Chemical seal with vacuum service

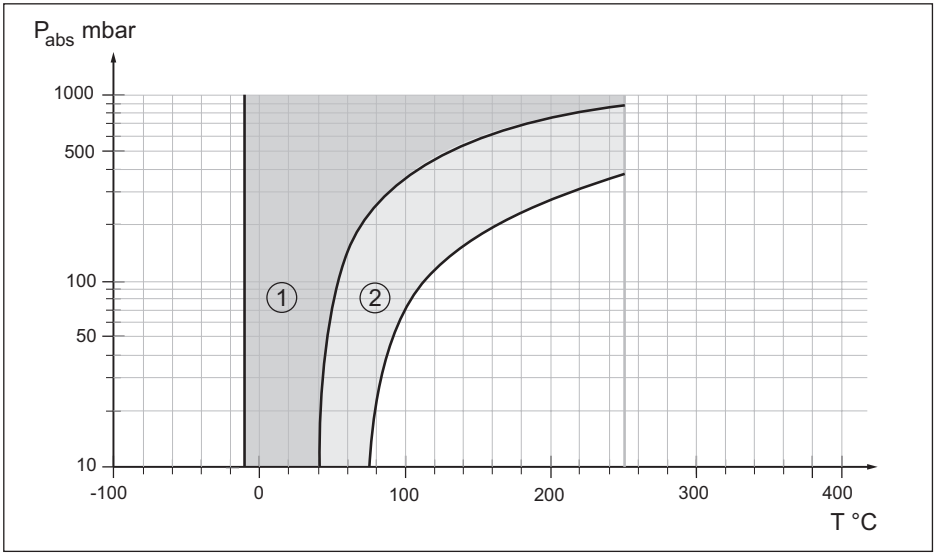

Fig. 37: Application area for medical white oil KN 92

1 Standard chemical seal
2 Chemical seal with vacuum service

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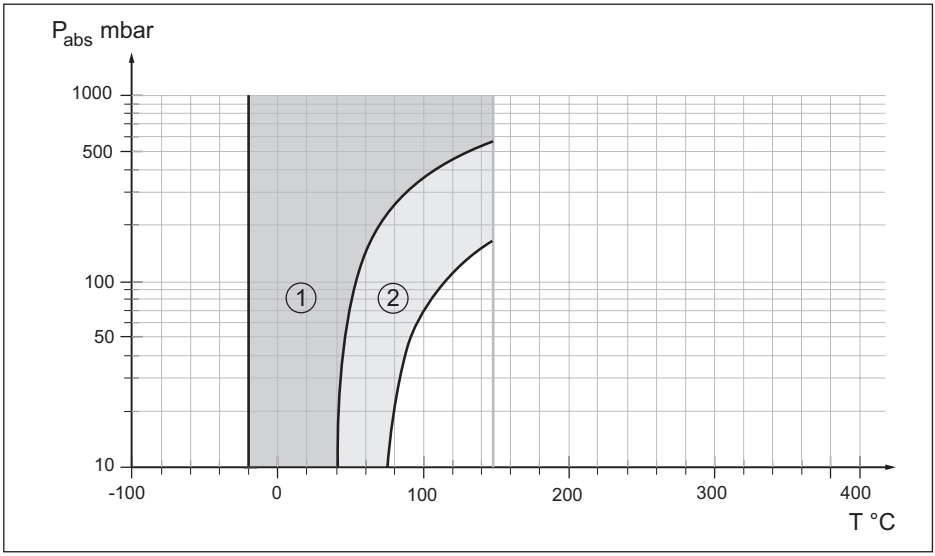

Fig. 38: Area of application for Neobee M-20 KN 59

1 Standard chemical seal
2 Chemical seal with vacuum service

10.3 Device communication Modbus

In the following, the necessary device-specific details are shown. You can find further information of Modbus on www.modbus.org.

Parameters for the bus communication

The VEGABAR 81 is preset with the following default values:

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

Start bits and data bits cannot be modified.

General configuration of the host

The data exchange with status and variables between field device and host is carried out via register. For this, a configuration in the host is required. Floating point numbers with short prevision (4 bytes) according to IEEE 754 are transmitted with individually selectable order of the data bytes (byte transmission order). This " *Byte transmission order*" is determined in the parameter " *Format Code*". Hence the RTU knows the registers of the VEGABAR 81 which must be contacted for the

variables and status information.

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

10.4 Modbus register

Holding Register

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

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

Input register

The input registers consist of 16 bits. They can only be read out. Before each command, the address (1 byte) is sent, after each command a CRC (2 bytes) is sent.

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

Register Name	Register Number	Type	Note
Status	100	DWord	Bit 0: Invalid Measurement Value PV Bit 1: Invalid Measurement Value SV Bit 2: Invalid Measurement Value TV Bit 3: Invalid Measurement Value QV
PV Unit	104	DWord	Unit Code
PV	106		Primary Variable in Byte Order CDAB
SV Unit	108	DWord	Unit Code
SV	110		Secondary Variable in Byte Order CDAB
TV Unit	112	DWord	Unit Code
TV	114		Third Variable in Byte Order CDAB
QV Unit	116	DWord	Unit Code

Register Name	Register Number	Type	Note
QV	118		Quarternary Variable in Byte Order CDAB
Status	1300	DWord	See Register 100
PV	1302		Primary Variable in Byte Order of Register 3000
SV	1304		Secondary Variable in Byte Order of Register 3000
TV	1306		Third Variable in Byte Order of Register 3000
QV	1308		Quarternary Variable in Byte Order of Register 3000
Status	1400	DWord	See Register 100
PV	1402		Primary Variable in Byte Order CDAB
Status	1412	DWord	See Register 100
SV	1414		Secondary Variable in Byte Order CDAB
Status	1424	DWord	See Register 100
TV	1426		Third Variable in Byte Order CDAB
Status	1436	DWord	See Register 100
QV	1438		Quarternary Variable in Byte Order CDAB
Status	2000	DWord	See Register 100
PV	2002	DWord	Primary Variable in Byte Order ABCD (Big Endian)
SV	2004	DWord	Secondary Variable in Byte Order ABCD (Big Endian)
TV	2006	DWord	Third Variable in Byte Order ABCD (Big Endian)
QV	2008	DWord	Quarternary Variable in Byte Order ABCD (Big Endian)
Status	2100	DWord	See Register 100
PV	2102	DWord	Primary Variable in Byte Order DCBA (Little Endian)
SV	2104	DWord	Secondary Variable in Byte Order DCBA (Little Endian)
TV	2106	DWord	Third Variable in Byte Order ABCD DCBA (Little Endian)
QV	2108	DWord	Quarternary Variable in Byte Order DCBA (Little Endian)
Status	2200	DWord	See Register 100
PV	2202	DWord	Primary Variable in Byte Order BACD (Middle Endian)
SV	2204	DWord	Secondary Variable in Byte Order BACD (Middle Endian)
TV	2206	DWord	Third Variable in Byte Order BACD (Middle Endian)
QV	2208	DWord	Quarternary Variable in Byte Order BACD (Middle Endian)

Unit Codes for Register 104, 108, 112, 116

Unit Code	Measurement Unit
1	in H2O

Unit Code	Measurement Unit
2	in Hg
3	ft H2O
4	mm H2O
5	mm Hg
6	psi
7	bar
8	mbar
11	Pa
12	kPa
13	torr
32	°C
33	°F
40	US liq. gal.
41	L
42	Imp. Gal.
43	m3
44	ft
45	m
46	bbl
47	in
48	cm
49	mm
111	cyd
112	cft
113	cuin
237	MPa

10.5 Modbus RTU commands

FC3 Read Holding Register

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

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

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

FC4 Read Input Register

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

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

FC6 Write Single Register

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

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

FC8 Diagnostics

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

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

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Implemented function codes:

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

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

FC16 Write Multiple Register

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

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

FC17 Report Sensor ID

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

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

FC43 Sub 14, Read Device Identification

With this function code, the Device Identification is queried.

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

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

10.6 Levelmaster commands

The VEGABAR 81 is also suitable for connection to the following RTUs with Levelmaster protocol. The Levelmaster protocol is often called " *Siemens*" " *Tank protocol*".

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

Parameters for the bus communication

The VEGABAR 81 is preset with the default values:

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

The Levelmaster commands are based on the following syntax:

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

Report Level (and Temperature)

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

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

Information:

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

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

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

Report Unit Number

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

Assign Unit Number

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

Set number of Floats

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

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

Set Baud Rate

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

Example: U01B9600E71

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

Set Receive to Transmit Delay

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

Report Number of Floats

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

Report Receive to Transmit Delay

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

Error codes

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

10.7 Configuration of typical Modbus hosts

Fisher ROC 809

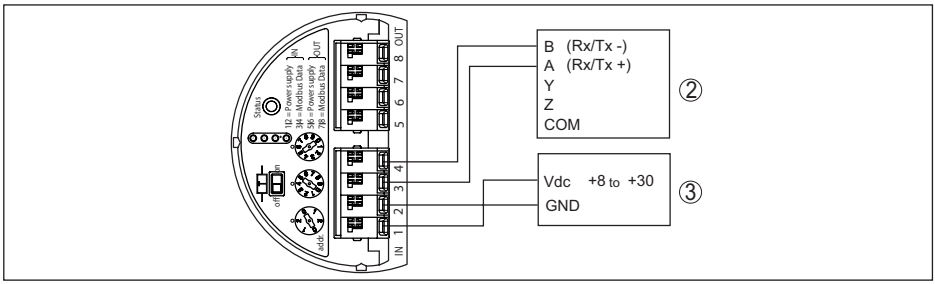


Fig. 39: Connection of VEGABAR 81 to RTU Fisher ROC 809

1 VEGABAR 81
2 RTU Fisher ROC 809
3 Voltage supply

Parameters for Modbus Hosts

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

The basic number of the input registers is always added to the input register address of VEGABAR 81.

This results in the following constellations:

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

10.8 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*".

The instrument versions are shown with single chamber housing, however are designed with the following double chamber housings:

Housing

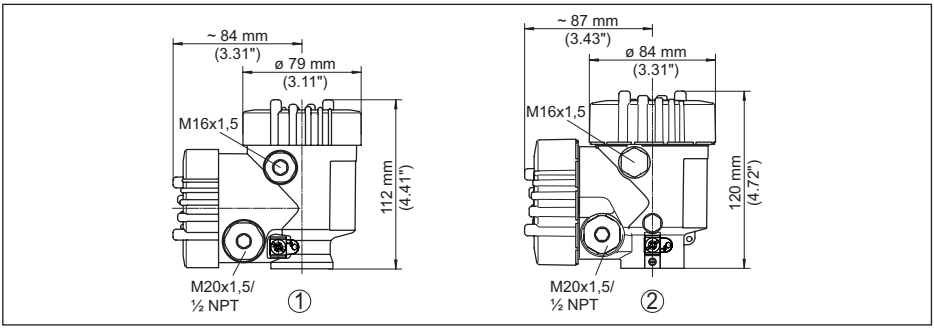


Fig. 40: Dimensions of housing (with integrated display and adjustment module the housing is 9 mm/0.35 inches or 18 mm/0.71 in higher)

1 Plastic double chamber
2 Aluminium/Stainless steel double chamber

External housing on IP68 version

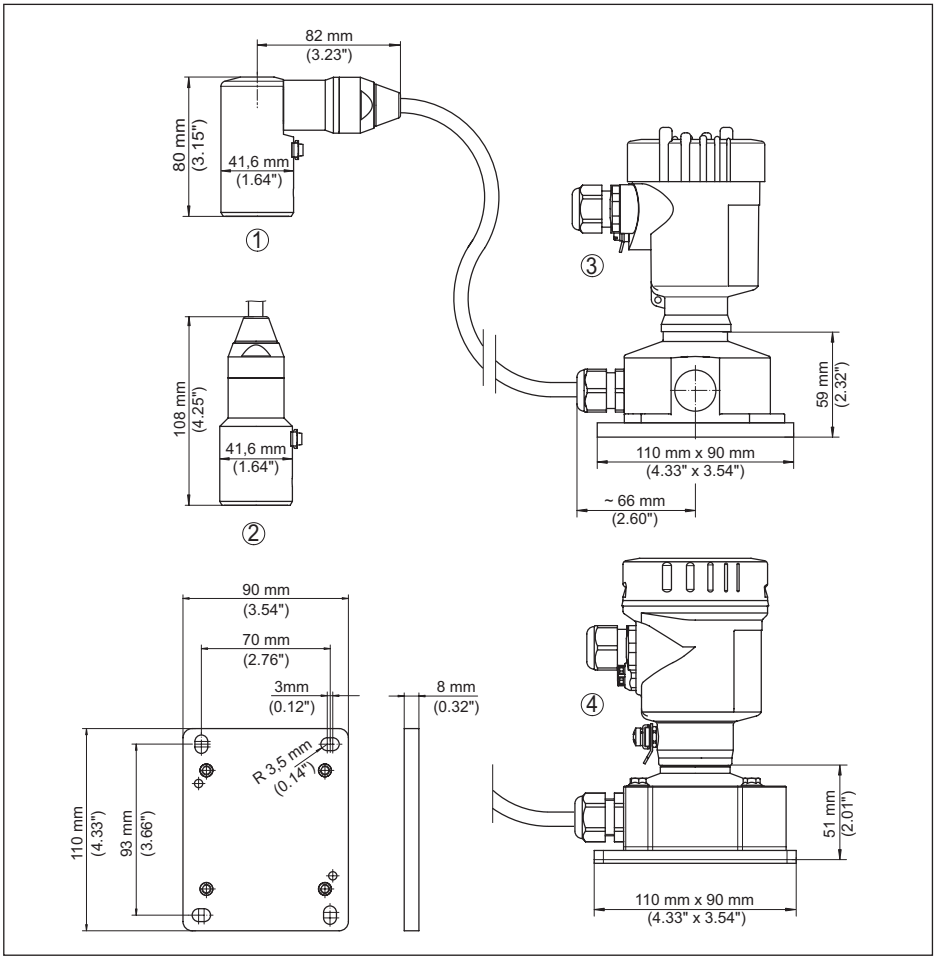


Fig. 41: VEGABAR 81, IP68 version with external housing

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 81, threaded fitting

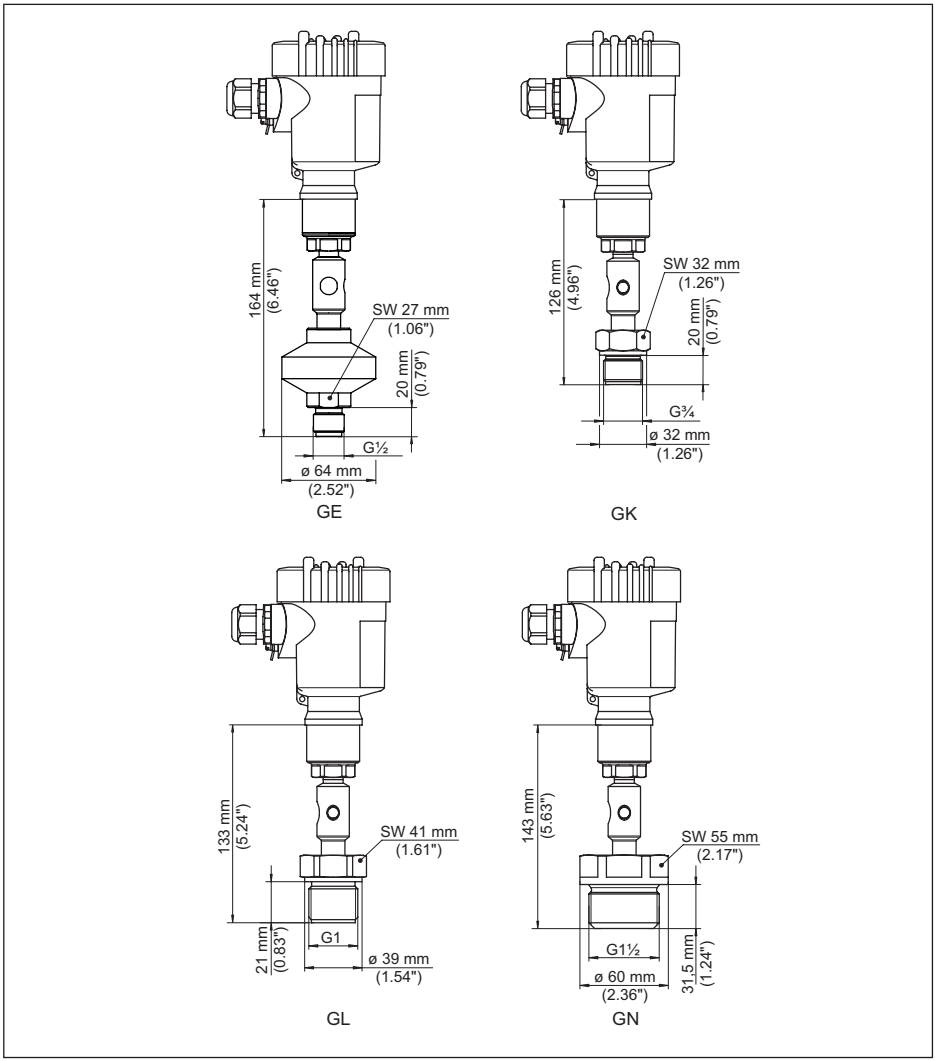
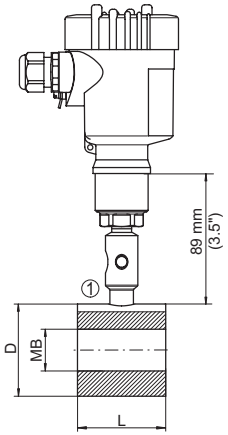
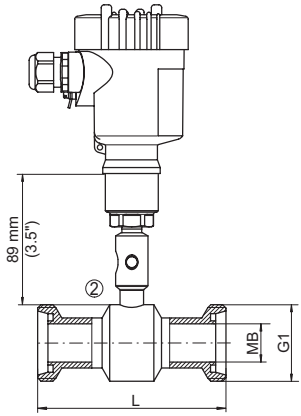


Fig. 42: VEGABAR 81, threaded fitting

GE G½ A outside PN 160 (ISO 228-1); diaphragm: inside; > 105 °C with temperature adapter
GK G¾ A outside PN 600 (DIN 3852-E); diaphragm: front-flush
GL G1 A outside PN 600 (ISO 228-1); diaphragm: front-flush
GN G1½ PN 600 (DIN 3852-A); diaphragm: front-flush

VEGABAR 81, tube isolating diaphragm





mm

DN	PN	D	Mb	L
25	6…100	63	28,5	60
40	6…100	85	43	60
50	6…100	95	54,5	60

H3

mm

DN	PN	G1	L	Mb
25	40	Rd52x1/6"	128	26
32	40	Rd58x1/6"	140	32
50	25	Rd78x1/6"	156	50

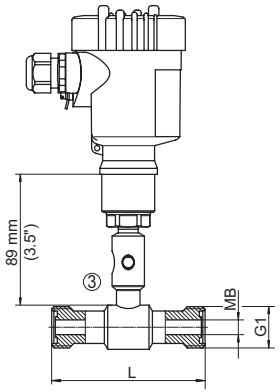
H7

inch

DN	PN	D	Mb	L
25	6…100	2.48"	1.12"	2.36"
40	6…100	3.35"	1.69"	2.36"
50	6…100	3.74"	2.15"	2.36"

inch

DN	PN	G1	L	Mb
25	40	Rd52x1/6"	5.04"	1.02"
32	40	Rd58x1/6"	5.51"	1.26"
50	25	Rd78x1/6"	6.14"	1.97"



mm

DN	PN	G1	L	Mb
20	40	RD44x1/6"	104	20

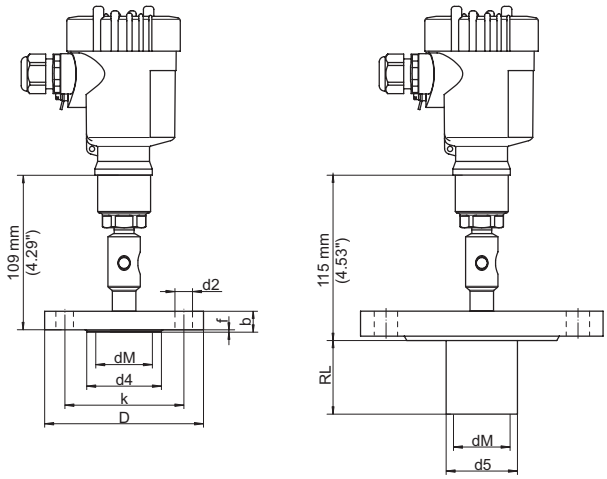
inch

DN	PN	G1	D	d
20	40	RD44x1/6"	4.09"	0.79"

Fig. 43: VEGABAR 81, tube isolating diaphragm

1 *Tube isolating diaphragm for mounting between flanges*
2 *Tube isolating diaphragm according to DIN 11851*
3 *Tube isolating diaphragm according to DIN 11864-1*

VEGABAR 81, flange connection, dimensions in mm



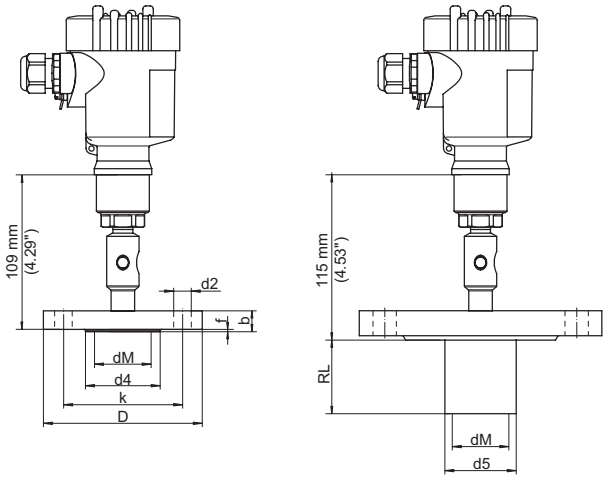
①	DN	PN	D	b	k	d2	d4	f	③	d5	④
	20	40	105	18	75	4 x ø14	58	2	-	-	-
HU	25	40	115	18	85	4 x ø14	68	2	-	-	32
NE	32	40	140	18	100	4 x ø18	78	2	-	-	-
I2	40	40	170	26	125	4 x ø22	88	2	-	-	45
I5	50	40	165	20	125	4 x ø18	102	2	-	-	60
NC	50	40	165	20	125	4 x ø18	102	2	50	48,3	45
ID	80	40	200	24	160	8 x ø18	138	2	-	-	90
IE	80	40	200	24	160	8 x ø18	138	2	200	76	72

②	"	lbs	D	b	k	d2	d4	f	③	d5	④
BW	1"	150	110	14,7	79,4	4 x ø16	51	2	-	-	-
CA	2"	150	150	19,5	120,7	4 x ø19	92	2	-	-	-
F3	2"	150	150	19,5	120,7	4 x ø20	92	2	50	48,3	47
CB	3"	150	190	24,3	152,4	4 x ø19	127	2	-	-	-

Fig. 44: VEGABAR 81, flange connection, dimensions in mm

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

VEGABAR 81, flange connection, dimensions in inch



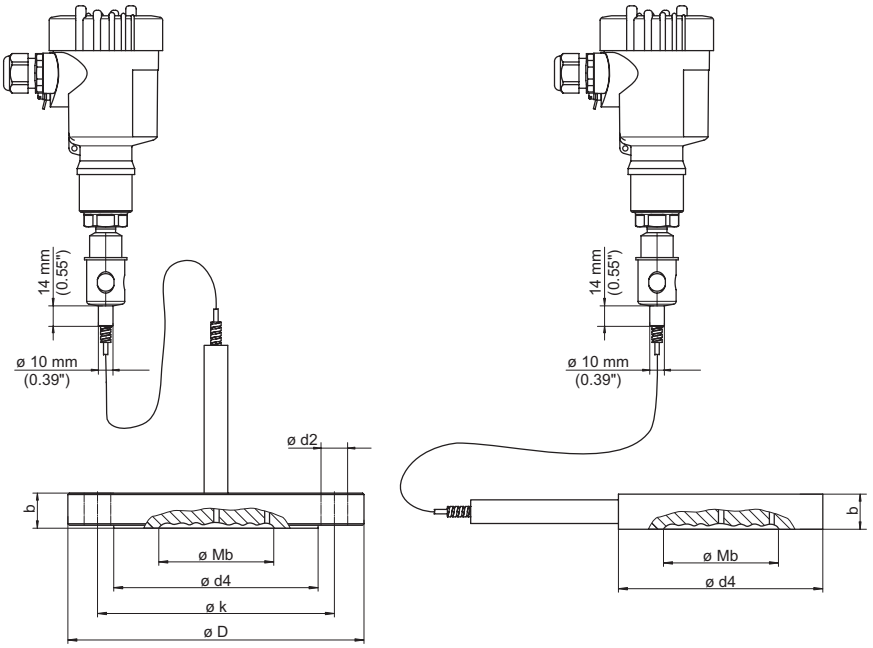
①	DN	PN	D	b	k	d2	d4	f	③	d5	④
	20	40	4.13"	0.71"	2.95"	4 x ø0.55"	2.28"	0.08"	-	-	-
HU	25	40	4.53"	0.71"	3.35"	4 x ø0.55"	2.68"	0.08"	-	-	1.26"
NE	32	40	5.51"	0.71"	3.94"	4 x ø0.71"	3.07"	0.08"	-	-	-
I2	40	40	6.69"	1.02"	4.92"	4 x ø0.87"	3.47"	0.08"	-	-	1.77"
I5	50	40	6.5"	0.79"	4.92"	4 x ø0.71"	4.02"	0.08"	-	-	2.36"
NC	50	40	6.5"	0.79"	4.92"	4 x ø0.71"	4.02"	0.08"	1.97"	1,9"	1.77"
ID	80	40	7.87"	0.95"	6.3"	8 x ø0.71"	5.43"	0.08"	-	-	3.54"
IE	80	40	7.87"	0.95"	6.3"	8 x ø0.71"	5.43"	0.08"	7.87"	2.99"	2.84"

②	"	lbs	D	b	k	d2	d4	f	③	d5	④
BW	1"	150	4.33"	0.58"	3.13"	4 x ø0.63"	2.01"	0.08"	-	-	-
CA	2"	150	5.91"	0.77"	4.75"	4 x ø0.75"	3.62"	0.08"	-	-	-
F3	2"	150	5.91"	0.77"	4.75"	4 x ø0.79"	3.62"	0.08"	2"	1.9"	1.85"
CB	3"	150	7.48"	0.96"	6"	4 x ø0.75"	5"	0.08"	-	-	-

Fig. 45: VEGABAR 81, flange connection, dimensions in inch

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

VEGABAR 81, flange and cell isolating diaphragm with capillary line



mm

DN	PN	D	b	d4	k	d2	Mb
25	40	115	18	68	85	14	32
40	40	150	18	88	110	18	45
50	40	165	20	102	125	18	59
80	40	200	20	138	160	18	89

inch

DN	PN	D	b	d4	k	d2	Mb
25	40	4.53"	0.71"	2.68"	3.35"	0.55"	1.26"
40	40	5.91"	0.71"	3.47"	4.33"	0.71"	1.77"
50	40	6.5"	0.79"	4.02"	4.92"	0.71"	2.32"
80	40	7.87"	0.79"	5.43"	6.3"	0.71"	3.5"

mm

DN	PN	b	d4	Mb
25	16....100	18	68	32
40	16....100	18	88	45
50	16....100	20	102	59
80	16....100	20	138	89

inch

DN	PN	b	d4	Mb
25	16....100	0.71"	2.68"	1.26"
40	16....100	0.71"	3.47"	1.77"
50	16....100	0.79"	4.02"	2.32"
80	16....100	0.79"	5.43"	3.5"

Fig. 46: VEGABAR 81, flange and cell isolating diaphragm with capillary line

1 Flange isolating diaphragm with capillary line
2 Cell isolating diaphragm with capillary line

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