Operating Instructions

Differential pressure transmitter with metallic measuring diaphragm

VEGADIF 85

Modbus and Levelmaster protocol

Document ID: 53571

Contents

53571-EN-230814

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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53571-EN-230814

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.

53571-EN-230814

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

VEGADIF 85 is an instrument for measurement of flow, level, differential pressure, density and interface.

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.

2.6 NAMUR recommendations

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

The device fulfils the requirements of the following NAMUR recommendations:

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

For further information see www.namur.de.

2.7 Environmental instructions

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

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

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

3 Product description

3.1 Configuration

Scope of delivery

The scope of delivery encompasses:

- VEGADIF 85 pressure transmitter
- Ventilation valves, closing screws – depending on version (see chapter " *Dimensions*")

The further scope of delivery encompasses:

- Documentation
  - Quick setup guide VEGADIF 85
  - Test certificate for pressure transmitters
  - Instructions for optional instrument features
  - Ex-specific " *Safety instructions*" (with Ex versions)
  - If necessary, further certificates

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

Scope of this operating instructions

This operating instructions manual applies to the following instrument versions:

- Hardware from 1.0.0
- Software from 1.3.4

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

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

Type label

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

- 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***".

3.2 Principle of operation

Application area

VEGADIF 85 is suitable universally for applications in virtually all industries. It is used for the measurement of the following pressure types:

- Differential pressure
- Static pressure

Measured products

Measured products are gases, vapours and liquids.

Measured variables

The differential pressure measurement enables the measurement of:

- Level
- Flow
- Differential pressure
- Density
- Interface

Level measurement

The instrument is suitable for level measurement in closed, superimposed pressure vessels. The static pressure is compensated by differential pressure measurement. It is available as a separate measured value for digital signal outputs.

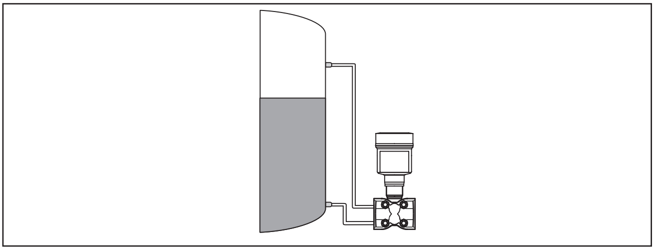


Fig. 1: Level measurement with VEGADIF 85 in a pressurized vessel

Flow measurement

The flow measurement is carried out via an effective pressure transmitter, such as an orifice plate or pitot tube. The device records the resulting pressure difference and converts the measured value into the flow. With digital signal outputs, the static pressure is available as a separate measured value.

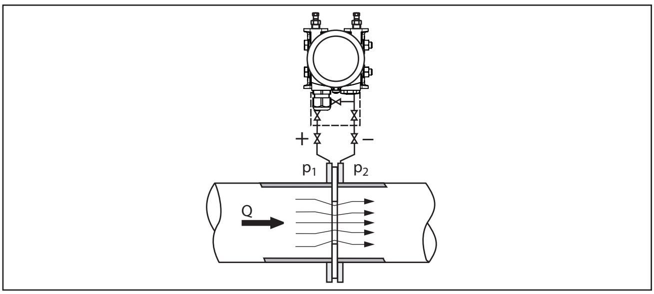


Fig. 2: Flow measurement with VEGADIF 85 and orifice, Q = flow, differential pressure $\Delta p = p_1 - p_2$

53571-EN-230814

Differential pressure measurement

The pressures in two different pipelines are acquired via effective pressure lines. The device determines the differential pressure.

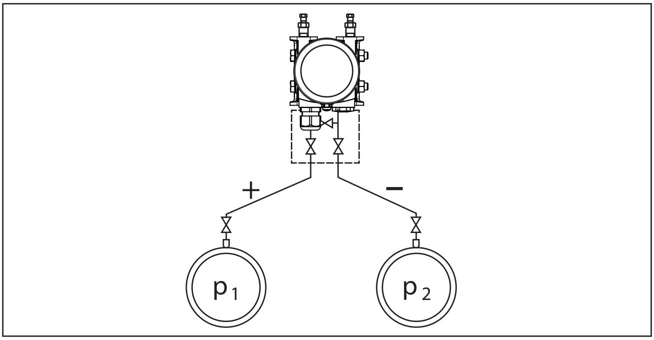


Fig. 3: Measurement of the differential pressure in pipelines with VEGADIF 85, differential pressure $\Delta p = p_1 - p_2$

Density measurement

With the help of the instrument, density measurement in a vessel with changing level and homogeneous density distribution can be easily realized. The instrument is connected to the vessel via a chemical seal at two different measuring points.

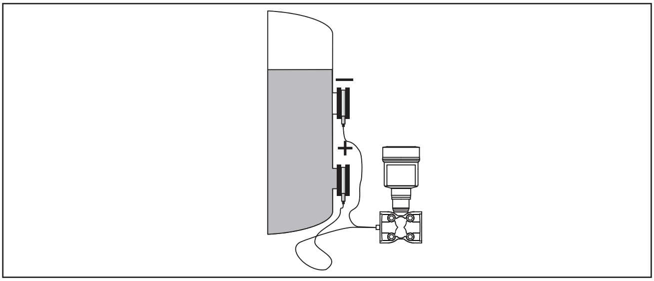


Fig. 4: Density measurement with VEGADIF 85

Interface measurement

The instrument can also be used for interface measurement in a vessel with changing level. The instrument is connected to the vessel via a chemical seal at two different measuring points.

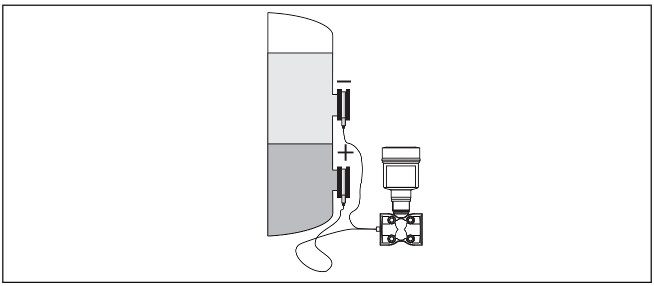


Fig. 5: Interface measurement with VEGADIF 85

Functional principle

A metallic measuring cell is used as sensor element. The process pressures are transmitted via the separating diaphragms and filling oils to a piezoresistive sensor element (resistance measuring bridge using semiconductor technology).

The difference between the acting pressures changes the bridge voltage. This change is measured, further processed and converted into a corresponding output signal.

When measurement limits are exceeded, an overload system protects the sensor element against damage.

In addition, the measuring cell temperature and the static pressure are measured on the low pressure side. The measuring signals are further processed and are available as additional output signals.

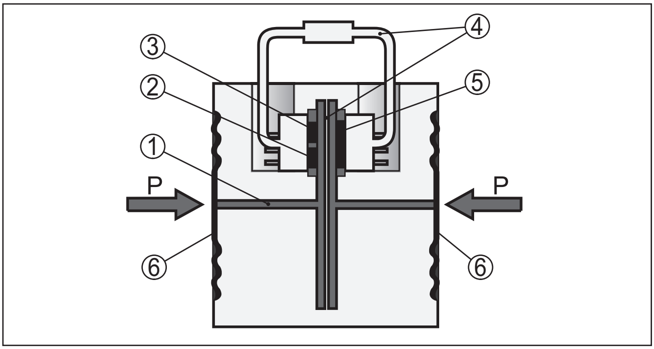


Fig. 6: Configuration metallic measuring cell

1 *Filling fluid*
2 *Temperature sensor*
3 *Absolute pressure sensor, static pressure*
4 *Overload system*
5 *Differential pressure sensor*
6 *Separating diaphragm*

3.3 Supplementary cleaning procedures

The VEGADIF 85 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 VEGADIF 85 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*".

53571-EN-230814

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.

Caution:
Instruments for oxygen applications are sealed in PE foil and provided with a label "Oxygen! Use no Oil". Remove this foil just before mounting the instrument! See instruction under " *Mounting*".

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.

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.

Mounting accessories

The suitable mounting accessories for VEGADIF 85 include oval flange adapters, valve blocks as well as mounting brackets.

Chemical seal

Through the use of chemical seals, VEGADIF 85 can also be used for corrosive, highly viscous or hot media.

53571-EN-230814

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

Permissible process pressure (MWP)

The permissible process pressure range is specified on the type label with "MWP" (Maximum Working Pressure), see chapter " *Configuration*". This specification refers to a reference temperature of +25 °C (+76 °F). The MWP may also be permanently applied on one side.

In order to prevent damage to the device, a test pressure acting on both sides 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*").

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

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.

Ventilation

The ventilation for the electronics housing is realised via a filter element in the vicinity of the cable glands.

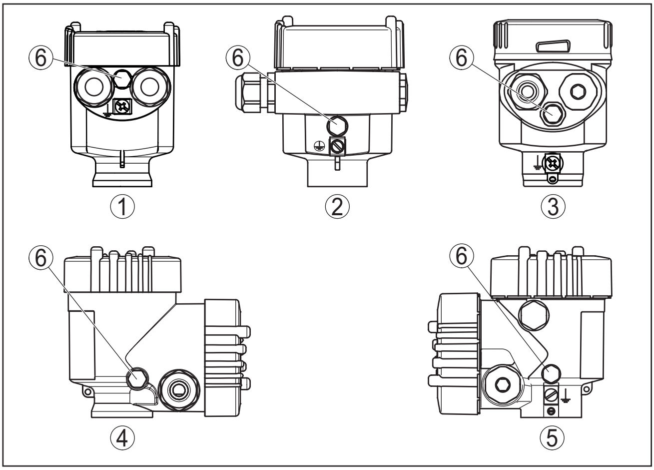


Fig. 7: Position of the filter element - non-Ex, Ex-ia and Ex-d-ia version

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

Information:
Make sure that the filter element is always free of buildup during operation. A high-pressure cleaner may not be used for cleaning.

Turning the housing

For better readability of the display or access to the wiring, the electronics housing can be rotated by 330°. A stop prevents the housing from being turned too far.

Depending on the version and housing material, the locking screw on the neck of the housing must be slightly loosened. The housing can then be turned to the correct position. As soon as the requested position is reached, tighten the locking screw.

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.

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 Connection to the process

DP flow element

DP flow elements are installations in pipelines which generate a flow-dependent pressure drop. The flow rate is measured via this differential pressure. Typical DP flow elements are Venturi tubes, orifice plates or impact pressure probes.

Instructions for mounting the DP flow elements are stated in the appropriate standards as well as in the documentation from the respective manufacturer.

Effective pressure lines

Effective pressure lines are pipelines with a small diameter. They are used to connect the differential pressure transmitter to the pressure tapping point or the DP flow element.

Principles
Effective pressure lines for gases must always remain completely dry and no condensate must collect. Effective pressure lines for liquids must always be completely filled and must not contain any gas bubbles. Therefore, suitable venting systems must be provided for liquids and suitable drainage systems for gases.

Wiring
Effective pressure lines must always run with a sufficient, strictly monotonous slope/gradient of at least 2 %, but better up to 10 %.

Recommendations for wiring of effective pressure lines are stated in the corresponding national and international standards.

Connection
Effective pressure lines are connected to the device via standard cutting ring screw connections with suitable thread.

Note:
Follow the mounting instructions of the respective manufacturer and seal the thread, e.g. with PTFE tape.

Valve blocks

Valve blocks are used for initial shut-off when connecting the differential pressure transmitter to the process. They are also used for pressure compensation of the measuring chambers during adjustment.

3-fold and 5-fold valve blocks are available (see chapter " *Mounting and connection instructions*").

Ventilation valves, closing screws

Free openings on the process assembly must be closed by ventilation valves or closing screws. Required torque see chapter " *Technical data*".

Note:
Use the supplied parts and seal the thread with four layers of PTFE tape.

4.4 Mounting and connection instructions

Connection high/low pressure side

When connecting VEGADIF 85 to the measuring point, take note of the high/low pressure side of the process component. [1].

The " **H**" identifies the high pressure side, the low pressure side due to an " **L**" on the process component next to the oval flanges.

Note:
The static pressure is measured on the low pressure side " **L**".

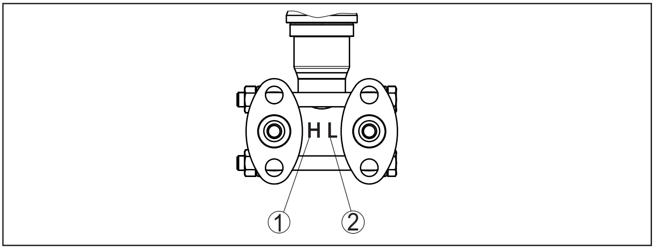


Fig. 8: Marking for high/low pressure side on the process component

1 H = High pressure side
2 L = Low pressure side

[1] The pressure effective on "H" is considered as positive, the pressure effective on "L" as negative in the calculation of the pressure difference.

53571-EN-230814

3-fold valve block

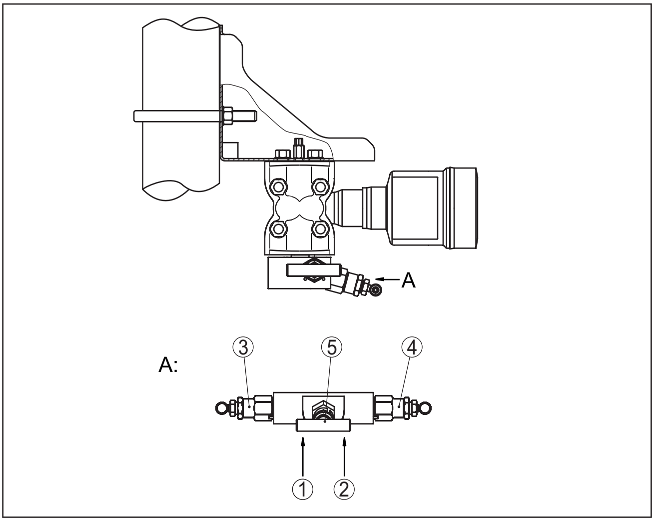


Fig. 9: Connection of a 3-fold valve block

1 Process fitting
2 Process fitting
3 Inlet valve
4 Inlet valve
5 Breather valve

3-fold valve block, flanging on both sides

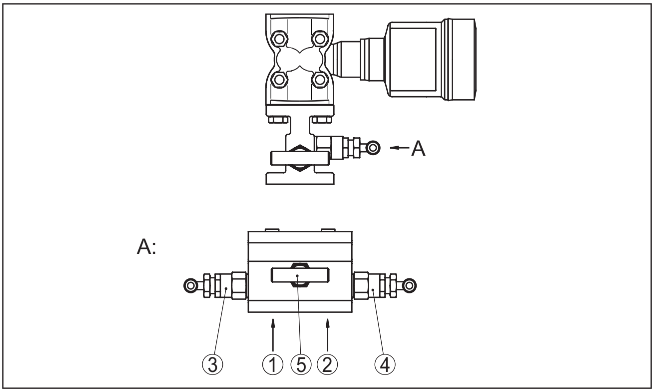


Fig. 10: Connection of a 3-fold valve block, flanging on both sides

1 Process fitting
2 Process fitting
3 Inlet valve
4 Inlet valve
5 Breather valve

53571-EN-230814

Note:
No mounting bracket is required for valve blocks that can be flange-mounted on both sides. The process side of the valve block is mounted directly to a DP flow element, e.g. an orifice plate.

5-fold valve block

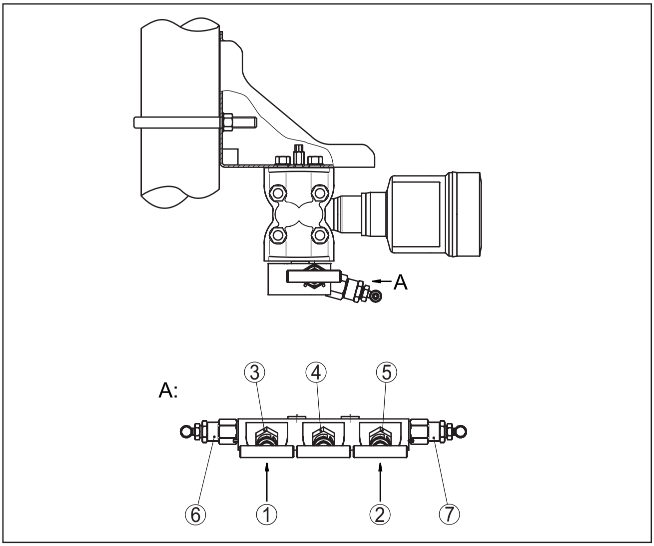


Fig. 11: Connection of a 5-fold valve block

1 *Process fitting*
2 *Process fitting*
3 *Inlet valve*
4 *Breather valve*
5 *Inlet valve*
6 *Valve for checking/ventilating*
7 *Valve for checking/ventilating*

4.5 Measurement setups

4.5.1 Overview

The following sections show common measurement setups:

- Level
- Flow
- Differential pressure
- Interface
- Density

Depending on the application, there may also be different arrangements.

Note:
For simplification, the effective pressure lines are partly shown with a horizontal course and sharp angles. For wiring, please observe the instructions in chapter " *Mounting*, *Connection to the process*" as well

53571-EN-230814

as the hook ups in the supplementary instructions " *Mounting accessory pressure technology*".

4.5.2 Level

In closed vessels with effective pressure lines

- Mount device below the lower measurement connection so that the effective pressure lines are always filled with liquid
- Always connect the low pressure side above the max. level in the vessel
- For measurement in products with solid content, such as e.g. dirty liquids, the installation of separators and drain valves is recommended. Debris and sediment can thus be collected and removed.

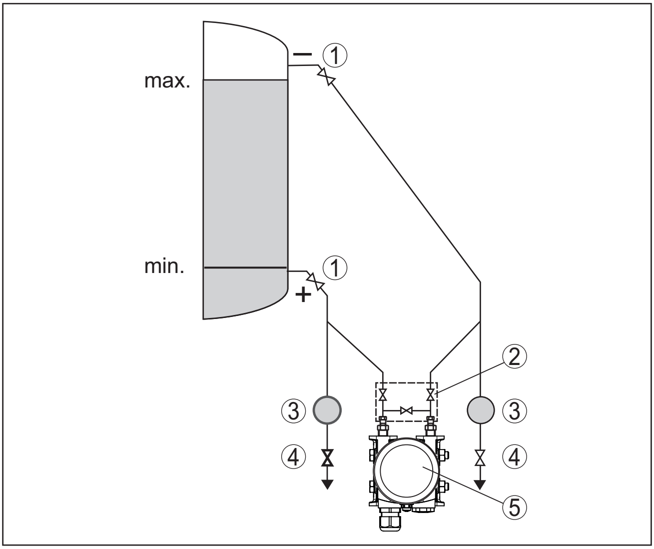


Fig. 12: Measurement setup, level measurement in closed vessel

1 *Blocking valves*
2 *3-fold valve block*
3 *Precipitator*
4 *Drain valves*
5 *VEGADIF 85*

In closed vessels with single chemical seal

- Mount device directly to the vessel
- Always connect the low pressure side above the max. level in the vessel
- For measurement in products with solid content, such as e.g. dirty liquids, the installation of separators and drain valves is recommended. Debris and sediment can thus be collected and removed.

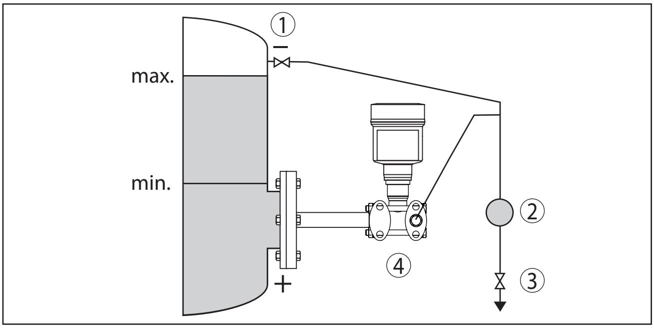


Fig. 13: Measurement setup, level measurement in closed vessel

1. *Blocking valve*
2. *Precipitator*
3. *Drain valve*
4. *VEGADIF 85*

In closed vessels with double chemical seal

- Mount device below the lower chemical seal
- The ambient temperature should be the same for both capillaries

Information:
Level measurement is only carried out between the upper edge of the lower and the lower edge of the upper chemical seal.

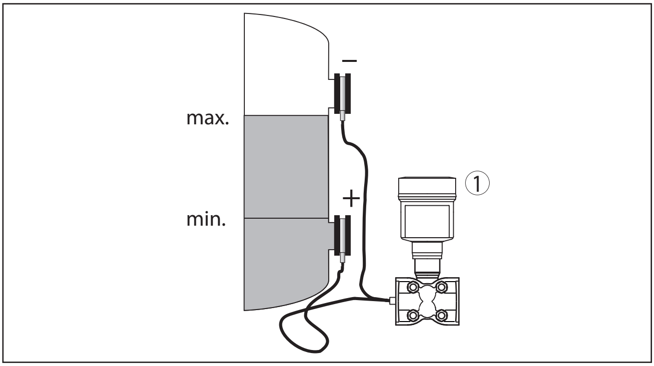


Fig. 14: Measurement setup, level measurement in closed vessel

1. *VEGADIF 85*

In closed vessels with steam layering with effective pressure line

- Mount device below the lower measurement connection so that the effective pressure lines are always filled with liquid
- Always connect the low pressure side above the max. level in the vessel
- The condensate vessel ensures a constant pressure on the low pressure side
- For measurement in products with solid content, such as e.g. dirty liquids, the installation of separators and drain valves is recommended. Debris and sediment can thus be collected and removed.

53571-EN-230814

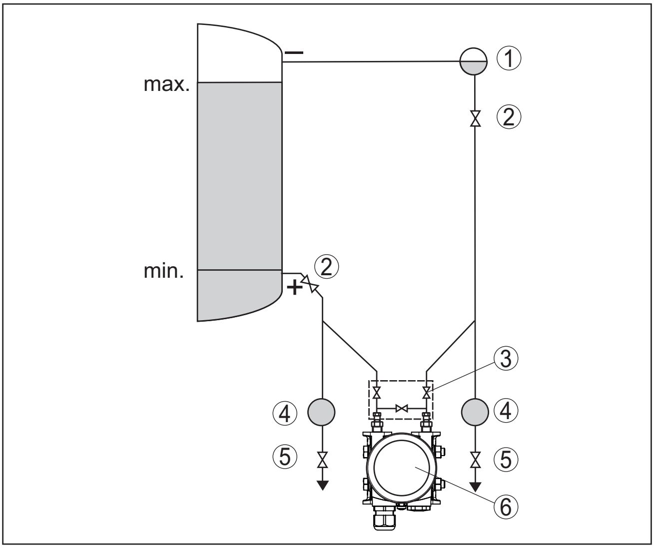


Fig. 15: Measurement setup in closed vessel with superimposed steam

1 Condensate vessel
2 Blocking valves
3 3-fold valve block
4 Precipitator
5 Drain valves
6 VEGADIF 85

4.5.3 Flow

In gases

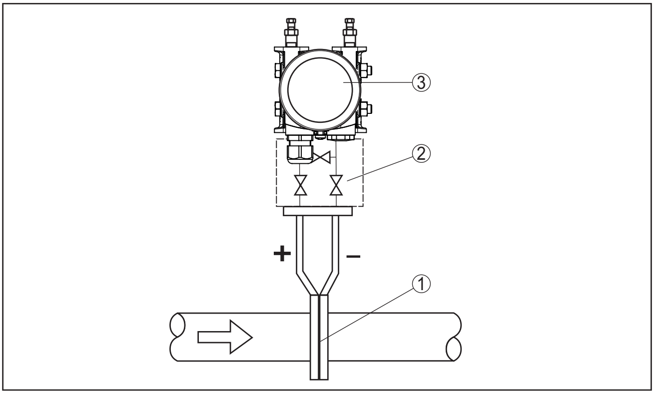


Fig. 16: Measurement setup with flow measurement of gases, connection via 3-fold valve block, flanging on both sides

1 Orifice or impact pressure probe
2 3-fold valve block, flanging on both sides
3 VEGADIF 85

In vapours

- Mount the instrument below the measuring point
- Mount condensate vessels at the same height with the discharge socket and at the same distance to the device
- Fill the effective pressure lines to the height of the condensate vessels before setup

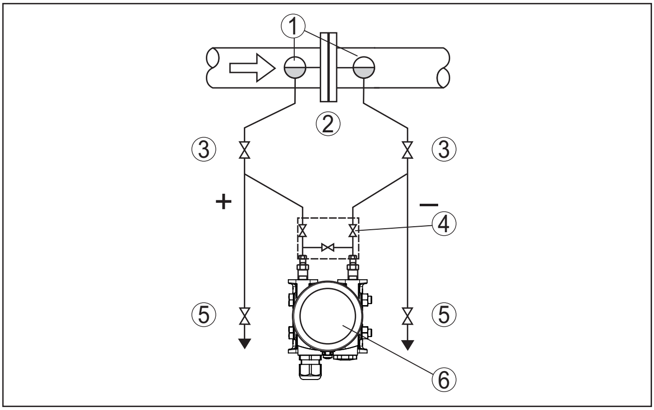


Fig. 17: Measurement setup, flow measurement in vapours

1 Condensate vessels
2 Orifice or impact pressure probe
3 Blocking valves
4 3-fold valve block
5 Drain or blow-off valves
6 VEGADIF 85

In liquids

- Mount device below the measurement loop so that the effective pressure lines are always filled with liquid and gas bubbles can bubble up to the process line
- For measurements in products with solid content such as e.g. dirty liquids, the installation of separators and drain valves is recommended to enable collection and removal of debris and sediment.
- Fill the effective pressure lines to the height of the condensate vessels before setup

53571-EN-230814

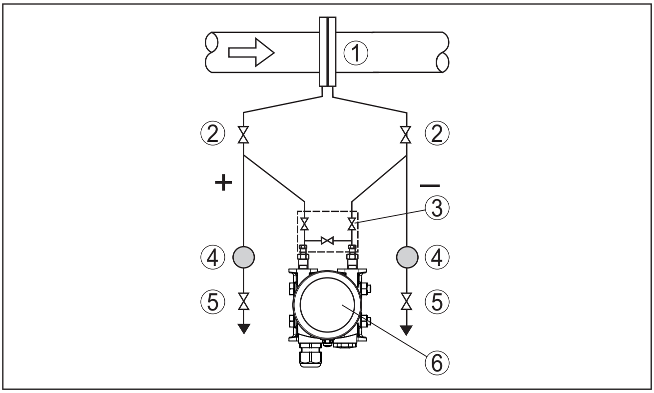


Fig. 18: Measurement setup, flow measurement in liquids

1 Orifice or impact pressure probe
2 Blocking valves
3 3-fold valve block
4 Precipitator
5 Drain valves
6 VEGADIF 85

4.5.4 Differential pressure

In gases and vapours

- Mount device above the measurement loop so that condensate can drain off in the process cable.

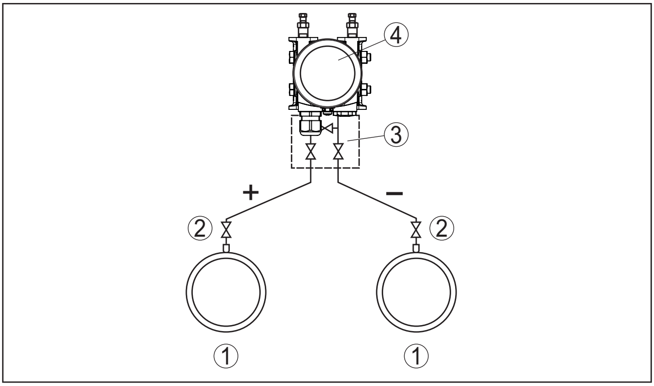


Fig. 19: Measurement setup with differential pressure measurement between two pipelines in gases and vapours

1 Pipelines
2 Blocking valves
3 3-fold valve block
4 VEGADIF 85

In vapour and condensate plants

- Mount device below the measurement loop so that some condensate can collect in the effective pressure lines.

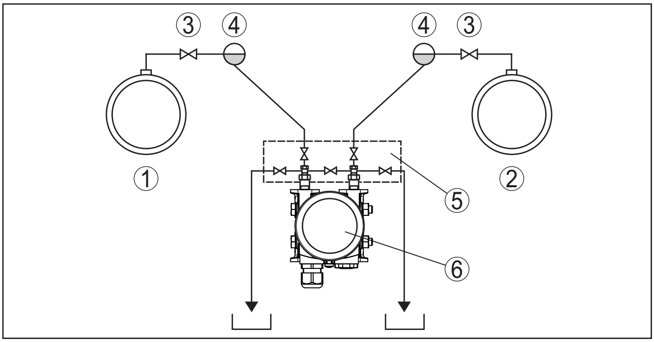


Fig. 20: Measurement setup with differential pressure measurement between a vapour and a condensate cable

1. *Vapour cable*
2. *Condensate cable*
3. *Blocking valves*
4. *Condensate vessels*
5. *5-fold valve block*
6. *VEGADIF 85*

In liquids

- Mount device below the measurement loop so that the effective pressure lines are always filled with liquid and gas bubbles can bubble up to the process line
- For measurement in products with solid content, such as e.g. dirty liquids, the installation of separators and drain valves is recommended. Debris and sediment can thus be collected and removed.

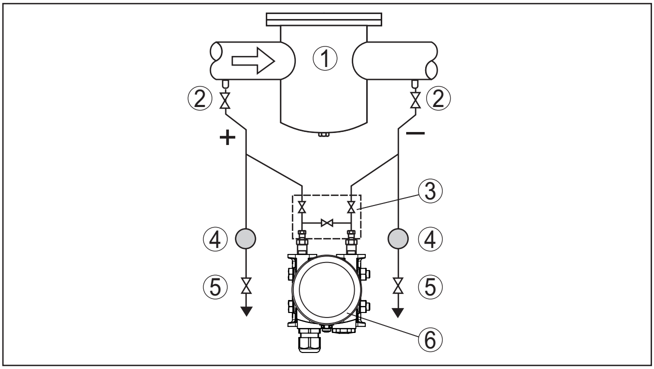


Fig. 21: Measurement setup with differential pressure measurement in liquids

1. *e.g. filter*
2. *Blocking valves*
3. *3-fold valve block*
4. *Precipitator*
5. *Drain valves*
6. *VEGADIF 85*

When chemical seal systems are used in all products

- Mount chemical seal with capillaries on top or laterally on the pipeline

- In vacuum applications: Mount VEGADIF 85 below the measurement loop
- The ambient temperature should be the same for both capillaries

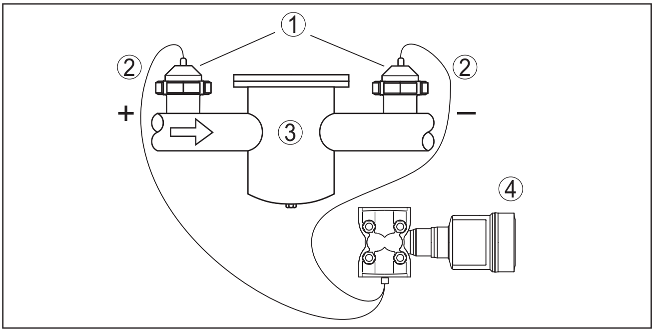


Fig. 22: Measurement setup, differential pressure measurement in gases, vapours and liquids

1 *Chemical seal with slotted nut*
2 *Capillaries*
3 *E.g. filter*
4 *VEGADIF 85*

4.5.5 Density

Density measurement

- Mount device below the lower chemical seal
- The distance between the two measurement points must be as large as possible to ensure a high measurement accuracy
- The ambient temperature should be the same for both capillaries

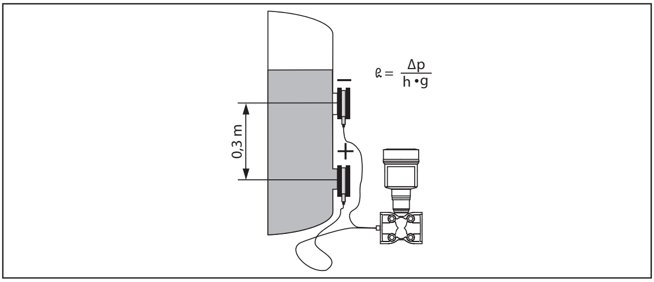


Fig. 23: Measurement setup for density measurement

Density measurement is only possible when the level remains above the upper measuring point. If the level falls below the upper measuring point, the measuring system continues to work with the last density value.

This density measurement functions with open as well as closed vessels. Make sure that small density changes cause only small changes to the measured differential pressure.

Example

Distance between the two measurement points 0.3 m, min. density 1000 kg/m³, max. density 1200 kg/m³

Carry out min. adjustment for the differential pressure measured with density 1.0:

Δp = ρ • g • h

= 1000 kg/m³ • 9.81 m/s² • 0,3 m

= 2943 Pa = 29.43 mbar

Carry out max. adjustment for the differential pressure measured with density 1.2:

Δp = ρ • g • h

= 1200 kg/m³ • 9.81 m/s² • 0.3 m

= 3531 Pa = 35.31 mbar

4.5.6 Interface

Interface measurement

- Mount device below the lower chemical seal
- The ambient temperature should be the same for both capillaries

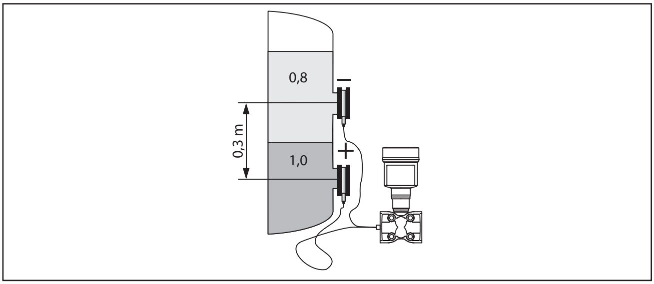


Fig. 24: Measurement setup with interface measurement

An interface measurement is only possible if the densities of the two media remain the same and the interface is between the two measurement points. The total level must be above the upper measurement point.

This density measurement functions with open but also with closed vessel.

Example

Distance between the two measurement points 0.3 m, min. density 800 kg/m³, max. density 1000 kg/m³

Carry out min. adjustment for the differential pressure which is measured at the height of the interface on the lower measurement point:

Δp = ρ • g • h

= 800 kg/m³ • 9.81 m/s • 0.3 m

= 2354 Pa = 23.54 mbar

Carry out max. adjustment for the differential pressure which is measured at the height of the interface on the upper measurement point:

Δp = ρ • g • h

= 1000 kg/m³ • 9.81 m/s • 0.3 m

= 2943 Pa = 29.43 mbar

53571-EN-230814

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 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*".

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).

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. 25: 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

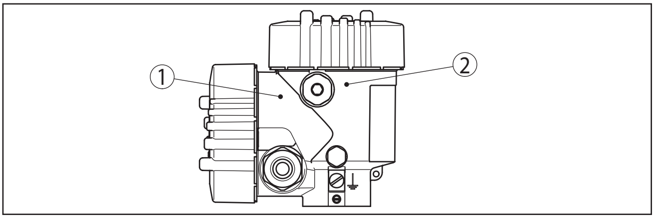


Fig. 26: Position of connection compartment (Modbus electronics) and electronics compartment (sensor electronics)

1 Connection compartment
2 Electronics compartment

Electronics compartment

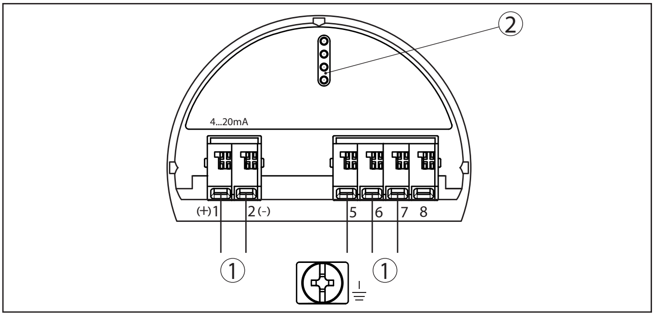


Fig. 27: Electronics compartment - double chamber housing

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

Connection compartment

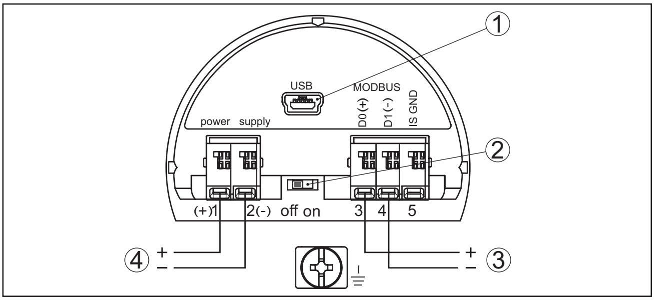


Fig. 28: Connection compartment

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

Terminal	Function	Polarity
1	Voltage supply	+

53571-EN-230814

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)

Electronics and connection compartment for power supply

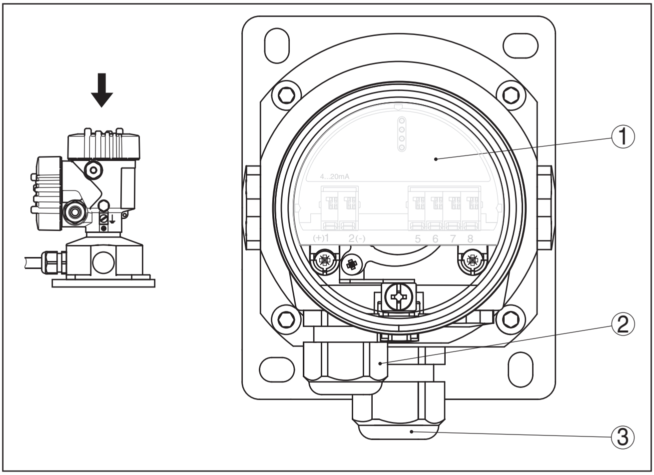


Fig. 29: Electronics and connection compartment

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

Terminal compartment, housing socket

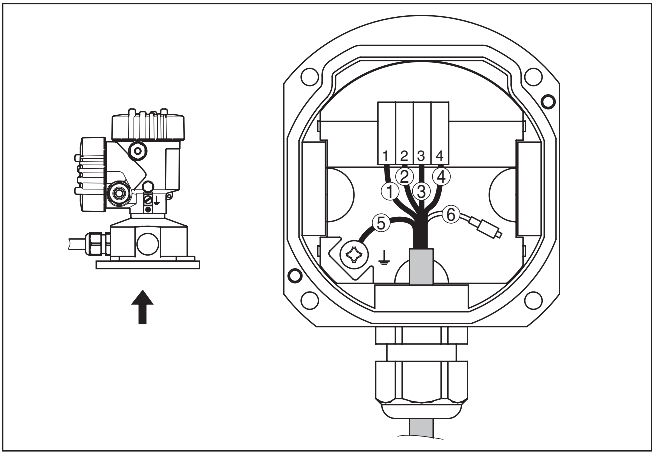


Fig. 30: Connection of the sensor in the housing base

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

Connection compartment

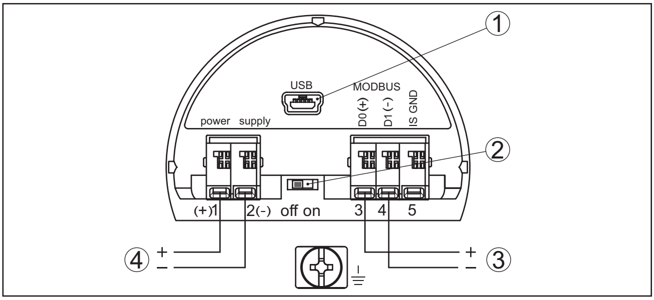


Fig. 31: Connection compartment

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	-

53571-EN-230814

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. 32: 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.

53571-EN-230814

6.2 Adjustment system

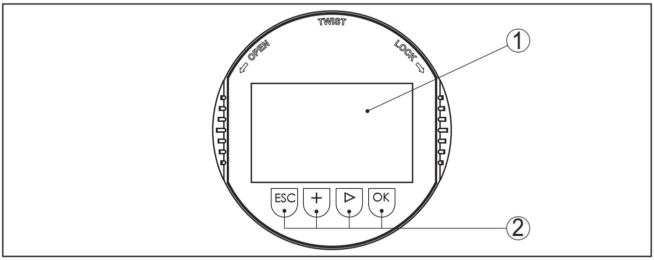


Fig. 33: Display and adjustment elements

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.

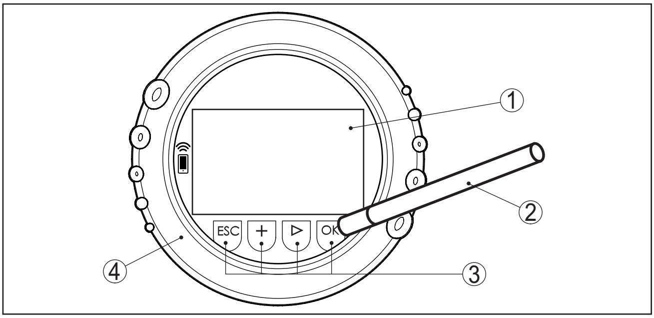


Fig. 34: Display and adjustment elements - with adjustment via magnetic pen

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

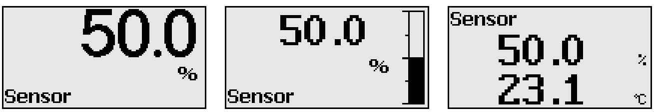
Measured value indication

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

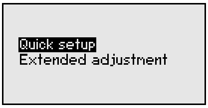
In this menu item, you can select the national language for further parameterization.

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.

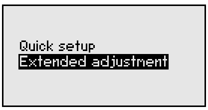
The return to the measured value indication is carried out through the ***[->]*** or ***[ESC]*** keys or automatically after 3 s

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

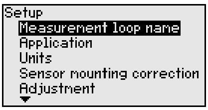
Measurement loop name

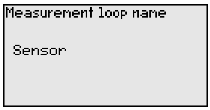
In the menu item " *Sensor TAG*" you edit a twelve-digit measurement loop designation.

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 +, -, /, -

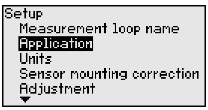


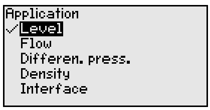


Application

The VEGADIF 85 can be used for flow, differential pressure, density and interface measurement. The default setting is differential pressure measurement. Switchover is carried out in the adjustment menu.

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

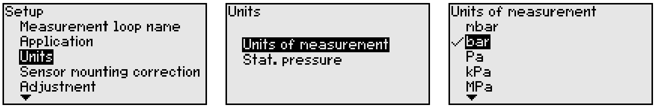




Enter the requested parameters via the appropriate keys, save your settings with ***[OK]*** and jump to the next menu item with the ***[ESC]*** and the ***[->]*** key.

Units

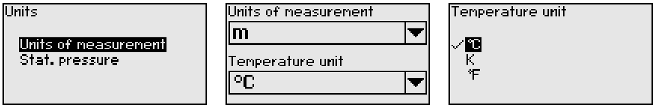
Unit of measurement:
In this menu item, the adjustment units of the instrument are determined. The selection determines the unit displayed in the menu items " *Min. adjustment (Zero)*" and " *Max. adjustment (Span)*".



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

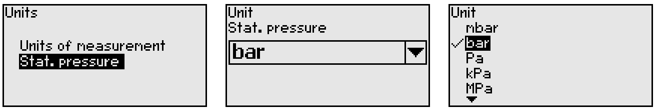
Temperature unit:

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".



Unit, static pressure:

The unit "Static pressure" is also set here.



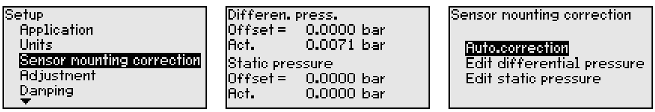
Enter the requested parameters via the appropriate keys, save your settings with ***[OK]*** and jump to the next menu item with the ***[ESC]*** and the ***[->]*** key.

Position correction

The installation position of the instrument can shift the measured value (offset). The position correction function compensates this offset. In the process the current measured value can be accepted automatically.

VEGADIF 85 has two separate sensor systems: one sensor for differential pressure and one sensor for static pressure. The following possibilities thus result for position correction:

- Automatic correction for both sensors
- Manual correction for differential pressure
- Manual correction for static pressure



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

In case of a manual position correction, the offset value is determined by the user. Select for this purpose the function " *Edit*" and enter the requested value.

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 correction value must be within the nominal measuring range, regardless of whether the correction value is determined automatically or entered manually. Depending on the correction value, the nominal measuring range apparently decreases or increases. However, this is only a consequence of the calculated offset. The actual nominal measuring range does not change. The following graphic illustrates this:

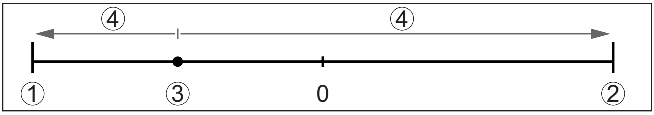


Fig. 35: Example correction value

1 *Lower limit of the nominal measuring range*
2 *Upper limit of the nominal measuring range*
3 *Correction value (example); shown as "0" on display*
4 *Apparently decreased/increased nominal measuring range*

The position correction can be repeated any number of times.

Adjustment

VEGADIF 85 always measures pressure independently of the process variable selected in the menu item " *Application*". To output the selected process variable correctly, an allocation of the output signal to 0 % and 100 % must be carried out (adjustment).

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

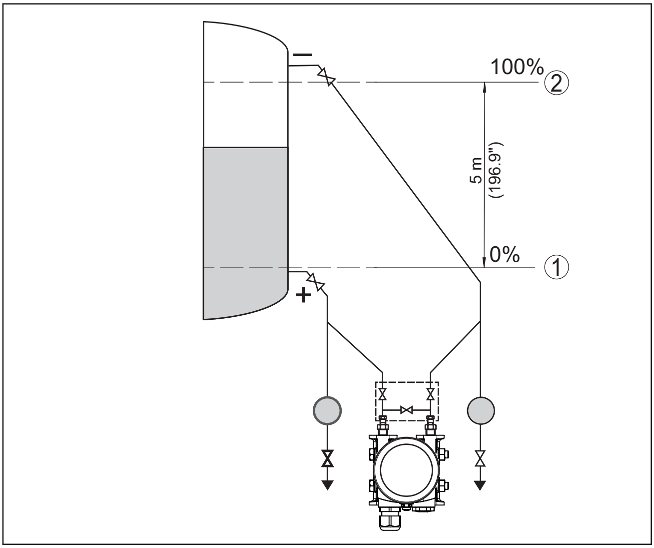


Fig. 36: Parameter adjustment example Min./max. adjustment, level measurement

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

53571-EN-230814

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.

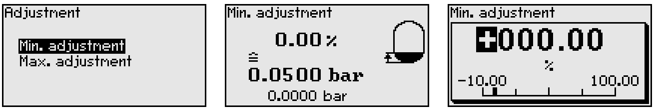
For the other process variables such as e.g. process pressure, differential pressure or flow, the adjustment is performed in like manner.

Information:
Depending on the vessel shape and adjustment, levels of -10 % … +110 % are displayed. This means that - within certain limits - "underfilling" and "overfilling" can also be displayed.

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.

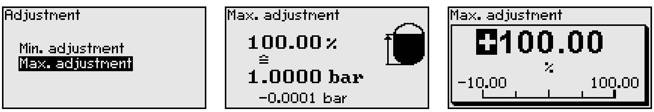
The min. adjustment is finished.

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 ***[->]***.

53571-EN-230814

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

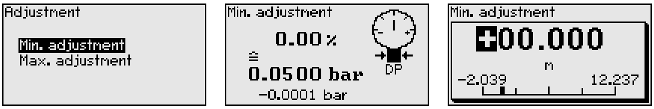
The max. adjustment is finished.

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

Min. adjustment flow

Proceed as follows:

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



2. Edit the mbar value with ***[OK]*** and set the cursor to the requested position with ***[->]***.
3. Set the requested mbar value with ***[+]*** and store with ***[OK]***.
4. Change with ***[ESC]*** and ***[->]*** to the span adjustment

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

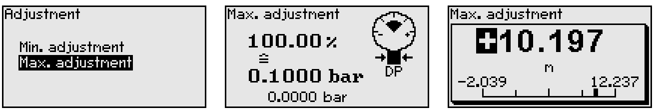
The min. adjustment is finished.

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

Max. adjustment flow

Proceed as follows:

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



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

The max. adjustment is finished.

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

Zero adjustment differential pressure

Proceed as follows:

53571-EN-230814

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

2. Edit the mbar value with ***[OK]*** and set the cursor to the requested position with ***[->]***.
3. Set the requested mbar value with ***[+]*** and store with ***[OK]***.
4. Change with ***[ESC]*** and ***[->]*** to the span adjustment

The zero adjustment is finished.

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

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

Span adjustment differential pressure

Proceed as follows:

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

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

The span adjustment is finished.

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

Distance density

Proceed as follows:

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

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

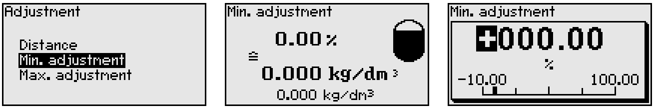
. Set the distance with ***[+]*** and save with ***[OK]***.

The adjustment of the distance is hence finished.

Min. adjustment density

Proceed as follows:

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



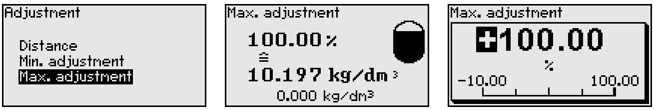
2. Edit the percentage value with ***[OK]*** and set the cursor to the requested position with ***[->]***.
3. Set the requested percentage value with ***[+]*** and save with ***[OK]***. The cursor jumps now to the density value.
4. Enter the min. density corresponding to the percentage value.
5. Save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

The min. adjustment for density is finished.

Max. adjustment density

Proceed as follows:

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



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

The max. adjustment for density is finished.

Distance interface

Proceed as follows:

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

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

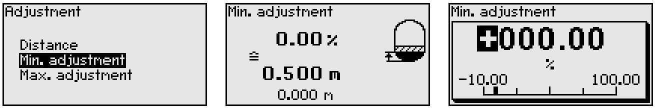
The adjustment of the distance is hence finished.

Min. adjustment interface

Proceed as follows:

53571-EN-230814

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



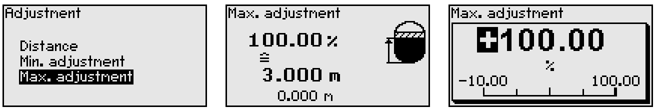
2. Edit the percentage value with ***[OK]*** and set the cursor to the requested position with ***[->]***.
3. Set the requested percentage value with ***[+]*** and save with ***[OK]***. The cursor jumps now to the height value.
4. Enter the min. height of the interface corresponding to the percentage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

The min. adjustment for interface is thus finished.

Max. adjustment interface

Proceed as follows:

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



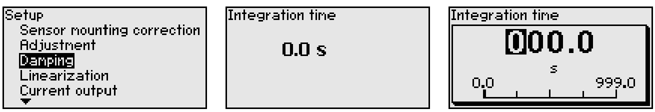
2. Edit the percentage value with ***[OK]*** and set the cursor to the requested position with ***[->]***.
3. Set the requested percentage value with ***[+]*** and save with ***[OK]***. The cursor jumps now to the height value.
4. Enter the max. height of the interface corresponding to the percentage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

The max. adjustment for interface is finished.

Damping

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

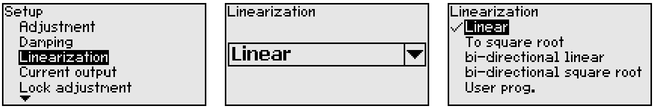
The set damping is effective for level and process pressure measurement as well as for all applications of electronic differential pressure measurement.



The default setting is a damping of 0 s.

Linearisation

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



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

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

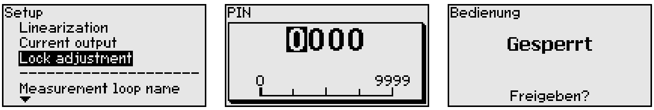
Caution:
Note the following, if the respective sensor is used as part of an overfill protection system according to WHG:

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.

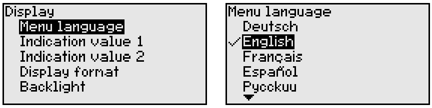
Caution:
With active PIN, adjustment via PACTware/DTM and other systems is also blocked.

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 calculates the flow rate from the measured differential pressure using the characteristic curve extracted by root.



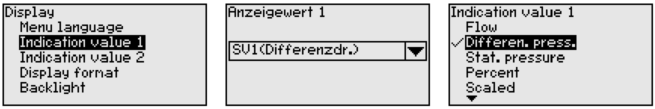
The following languages are available:

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

In delivery status, the VEGADIF 85 is set to English.

Display value 1 and 2 - 4 … 20 mA

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



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

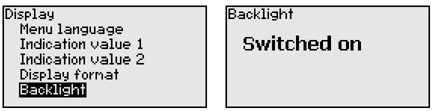
Display format 1 and 2

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

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

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*".

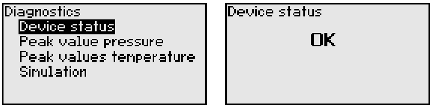


In delivery status, the lighting is switched on.

6.5.3 Diagnostics

Device status

In this menu item, the device status is displayed.

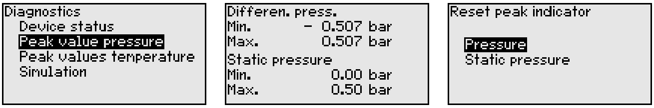


In case of error, e.g. the error code F017, e.g. the error description " *Adjustment span too small*" and a four digit figure are displayed for service purposes. You can find the error codes with description, reason as well as rectification in chapter " *Asset Management*".

Peak indicator, pressure

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

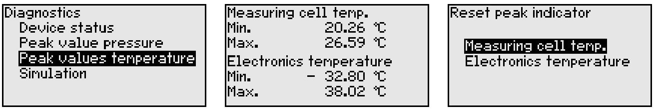
In another window you can carry out a reset of the peak values separately.



Peak indicator, temperature

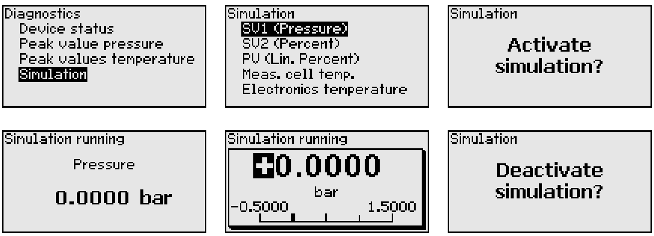
The respective min. and max. measured values of the measuring cell and the electronics temperature are stored in the sensor. In menu item " *Peak indicator, temperature*", both values are displayed.

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*".

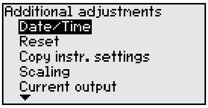
53571-EN-230814

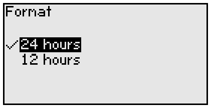
Information:
The sensor terminates the simulation automatically after 60 minutes.

6.5.4 Additional adjustments

Date/Time

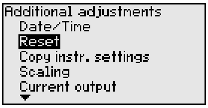
In this menu item, you adjust the internal clock of the sensor. There is no adjustment for summer/winter (daylight saving) time.

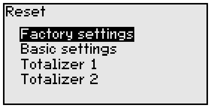




Reset

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.

Totalizer 1 and 2: Reset of the summarized flow volumes with application "Flow"

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

Setup

Menu item	Parameter	Default value
Measurement loop name		Sensor
Application	Application	Level
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

Menu item	Parameter	Default value
Linearisation		Linear
Lock adjustment		Released

Display

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

Diagnostics

Menu item	Parameter	Default value
Device status		-
Peak indicator	Pressure	Actual measured value
	Temperature	Actual temperature values from measuring cell, elec-tronics
Simulation		Process pressure

Additional adjustments

Menu item	Parameter	Default value
PIN		0000
Date/Time		Actual date/Actual time
Copy instrument settings		
Special parameters		No reset
Scaling	Scaling size	Volume in l
	Scaling format	0 % corresponds to 0 l 100 % corresponds to 0 l

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*"

53571-EN-230814

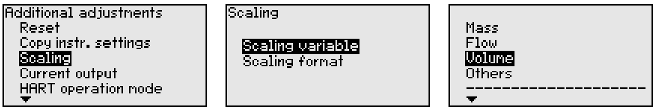
- In the menu " *Additional adjustments*" the items " *Reset, Date/ Time*"
- The user-programmable linearization curve

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

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

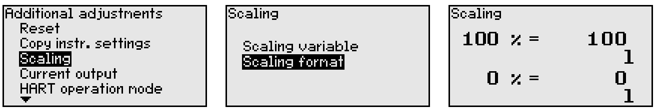
Scaling (1)

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



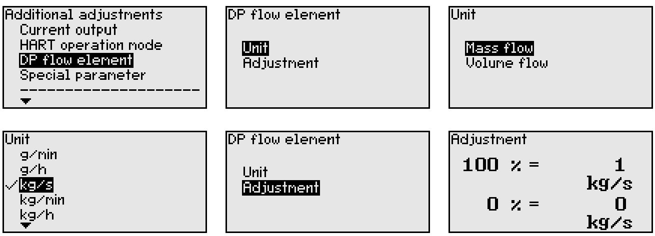
Scaling (2)

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



Characteristics values DP flow element

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



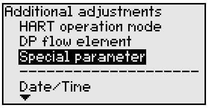
Furthermore the adjustment for the volume or mass flow at 0 % or 100 % is carried out.

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

Special parameters

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

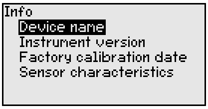
Change the settings of the special parameters only after having contacted our service staff.



6.5.5 Info

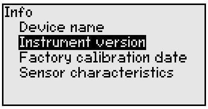
Device name

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



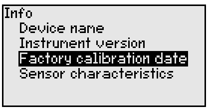
Instrument version

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



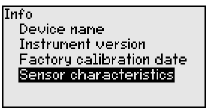
Factory calibration date

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



Sensor characteristics

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



53571-EN-230814

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

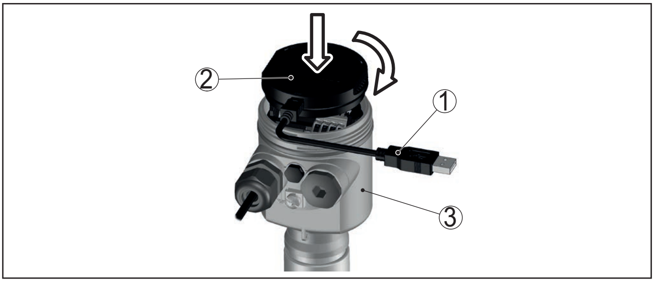


Fig. 37: Connection of the PC directly to the sensor via the interface adapter

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

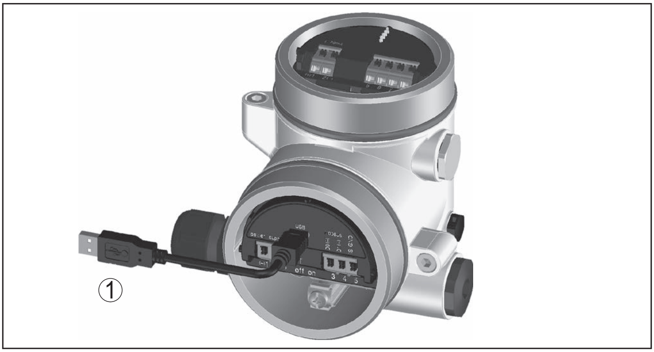


Fig. 38: Connecting the PC via USB to the Modbus electronics

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.

53571-EN-230814

Scope of the parameter adjustment:

- Sensor electronics
- Modbus electronics

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

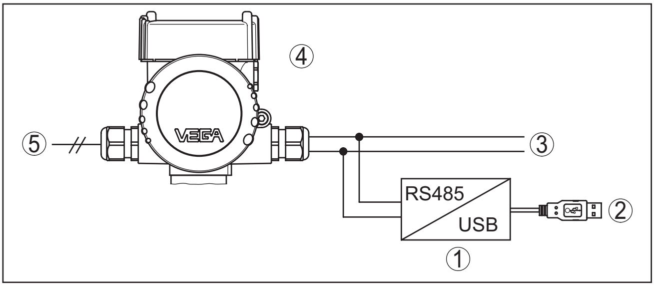


Fig. 39: Connection of the PC via the interface adapter to the RS 485 cable

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.

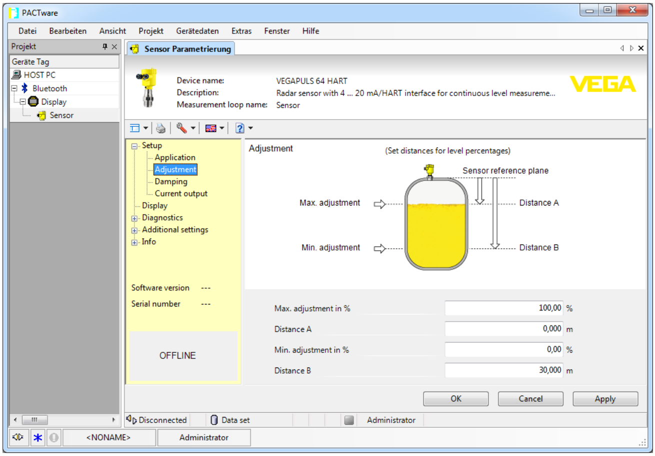


Fig. 40: Example of a DTM view

Standard/Full version

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

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

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

7.3 Set instrument address

The VEGADIF 85 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.

53571-EN-230814

8 Set up measuring system

8.1 Level measurement

Closed vessel

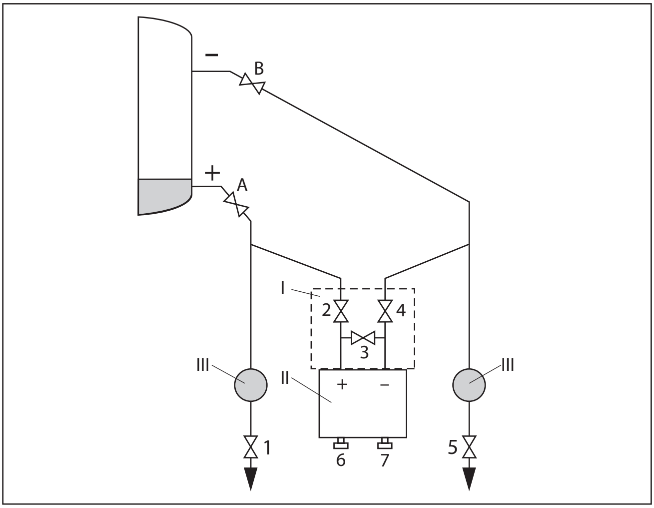


Fig. 41: Preferred measurement setup for closed vessels

I VEGADIF 85
II 3-fold valve block
III Precipitator
1, 5 Drain valves
2, 4 Inlet valves
3 Breather valve
6, 7 Vent valves on VEGADIF 85
A, B Blocking valves

Proceed as follows:

1. Fill the vessel to just above the lower tap
2. Fill measuring system with medium

   Close valve 3: Separate high/low pressure side

   Open valve A and B: Open block valves
3. Vent high pressure side (probably empty low pressure side)

   Open valve 2 and 4: Discharge medium on the high pressure side

   Briefly open valve 6 and 7, then close again: Fill the high pressure side completely with the medium and remove air.
4. Set measurement loop to operation

   Now:

   Valve 3, 6 and 7 are closed

   Valves 2, 4, A and B are open

Closed vessel with steam layer

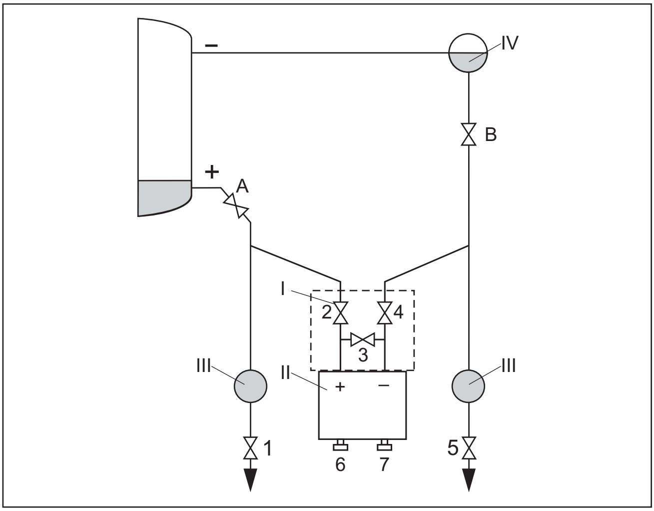


Fig. 42: Preferred measurement setup for closed vessels with steam overlay

I VEGADIF 85
II 3-fold valve block
III Precipitator
IV Condensate vessel
1, 5 Drain valves
2, 4 Inlet valves
3 Breather valve
6, 7 Vent valves on VEGADIF 85
A, B Blocking valves

Proceed as follows:

1. Fill the vessel to just above the lower tap
2. Fill measuring system with medium

   Open valve A and B: Open block valves

   Fill the low pressure effective pressure line on the height of the condensation pot
3. Remove air from instrument:

   Open valve 2 and 4: Discharge medium

   Open valve 3: Equalisation high and low pressure side

   Briefly open valve 6 and 7, then close again: Fill the measuring instrument completely with the medium and remove air
4. Put measurement loop into operation:

   Close valve 3: Separate high and low pressure side

   Open valve 4: Connect low pressure side

   Now:

   Valve 3, 6 and 7 are closed

   Valves 2, 4, A and B are open.

53571-EN-230814

8.2 Flow measurement

Gases

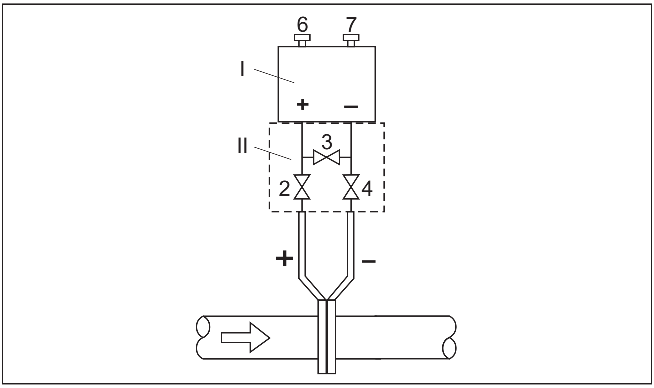


Fig. 43: Prefered measurement setup for gases, connection via 3-fold valve block, flanging on both sides

I VEGADIF 85
II 3-fold valve block
2, 4 Inlet valves
3 Breather valve
6, 7 Vent valves on VEGADIF 85

Liquids

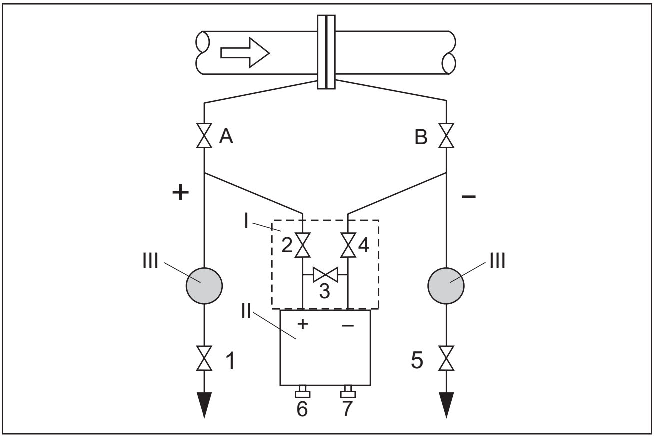


Fig. 44: Preferred measurement setup for liquids

I VEGADIF 85
II 3-fold valve block
III Precipitator
1, 5 Drain valves
2, 4 Inlet valves
3 Breather valve
6, 7 Vent valves on VEGADIF 85
A, B Blocking valves

Proceed as follows:

53571-EN-230814

1. Close valve 3
2. Fill measuring system with medium.

   For this purpose, open valves A, B (if available) as well as 2, 4: Medium flows in

   If necessary, clean the differential pressure lines: - with gases by blowing out with compressed air - with liquids by rinsing. [3]

   For this purpose close valve 2 and 4, i.e. block the instrument.

   Then open valve 1 and 5 so that the effective pressure lines blow out/rinse.

   Close valves 1 and 5 (if available) after cleaning
3. Remove air from instrument:

   Open valves 2 and 4: Medium flows in

   Close valve 4: Low pressure side is closed

   Open valve 3: Equalisation high and low pressure side

   Briefly open valve 6 and 7, then close again: Fill the measuring instrument completely with the medium and remove air
4. Carry out a position correction if the following conditions apply. If the conditions are not fulfilled, then carry out the position correction after step 6.

   Conditions:

   The process cannot be sealed off.

   The pressure extraction points (A and B) are at the same geodesic height.
5. Put measurement loop into operation:

   Close valve 3: Separate high and low pressure side

   Open valve 4: Connect low pressure side

   Now:

   Valves 1, 3, 5, 6 and 7 are closed [4]

   Valves 2 and 4 are open

   Valves A and B open
6. Carry out position correction, if flow can be blocked. In this case, step 5 is not required.

[3] Arrangement with 5 valves.
[4] Valves 1, 3, 5: Configuration with 5 valves.

53571-EN-230814

9 Diagnosis, asset management and service

9.1 Maintenance

Maintenance

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

Precaution measures against buildup

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

Cleaning

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

Take note of the following:

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

9.2 Diagnosis 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.

9.3 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:

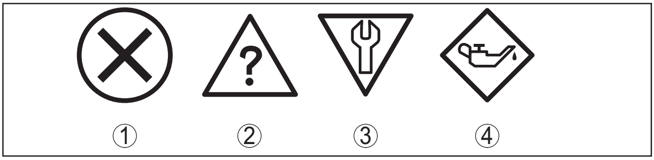


Fig. 45: Pictographs of the status messages

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

53571-EN-230814

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**	**DevSpec** **State in CMD 48**
F013 No valid measured value available	Gauge pressure or low pressure Measuring cell defective	Exchange measuring cell Send instrument for repair	Byte 5, Bit 0 of Byte 0 … 5
F017 Adjustment span too small	Adjustment not within specification	Change the adjustment according to the limit values	Byte 5, Bit 1 of Byte 0 … 5
F025 Error in the linearization table	Index markers are not continuously rising, for example illogical value pairs	Check linearization table Delete table/Create new	Byte 5, Bit 2 of Byte 0 … 5
F036 no operable sensor software	Failed or interrupted software update	Repeat software update Check electronics version Exchanging the electronics Send instrument for repair	Byte 5, Bit 3 of Byte 0 … 5
F040 Error in the electronics	Hardware defect	Exchanging the electronics Send instrument for repair	Byte 5, Bit 4 of Byte 0 … 5
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	Byte 5, Bit 5 of Byte 0 … 5
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	Byte 5, Bit 6 of Byte 0 … 5
F113 Communication error	Error in the internal instrument communication	Disconnect operating voltage briefly Send instrument for repair	Byte 4, Bit 4 of Byte 0 … 5
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	Byte 4, Bit 0 of Byte 0 … 5
F261 Error in the instrument settings	Error during setup Error when carrying out a reset	Repeat setup Repeat reset	Byte 4, Bit 1 of Byte 0 … 5

Code Text message	Cause	Rectification	DevSpec State in CMD 48
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	Byte 4, Bit 2 of Byte 0 … 5
F265 Measurement function disturbed	Sensor no longer carries out a measurement	Carry out a reset Disconnect operating voltage briefly	Byte 4, Bit 3 of Byte 0 … 5

Tab. 7: Error codes and text messages, information on causes as well as corrective measures

Function check

Code Text message	Cause	Rectification	DevSpec State in CMD 48
C700 Simulation active	A simulation is active	Finish simulation Wait for the automatic end after 60 mins.	"Simulation Active" in "Standardized Status 0"

Tab. 8: Error codes and text messages, information on causes as well as corrective measures

Out of specification

Code Text message	Cause	Rectification	DevSpec State in CMD 48
S600 Impermissible electronics temperature	Temperature of the electronics in the non-specified range	Check ambient temperature Insulate electronics	Byte 23, Bit 0 of Byte 14 … 24
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	-

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

Code Text message	Cause	Rectification	DevSpec State in CMD 48
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

9.4 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.

9.5 Replace process flanges

If required, the process flanges can be replaced by an identical type by the user.

Preparations

Required spare parts, depending on order specification:

- Process flanges
- Seals
- Screws, nuts

Required tools:

- Wrench SW 13

It is recommended that the work be carried out on a clean, level surface, e.g. a workbench.

Caution:
There is a risk of injury due to residues of process media in the process flanges. Take suitable protective measures against this.

Dismounting

Proceed as follows:

1. Loosen hexagon head screws crosswise with wrench
2. Carefully remove the process flanges without damaging the differential pressure measuring cell
3. Lift O-ring seals out of the grooves of the process flanges using a pointed tool
4. Clean O-ring grooves and separating diaphragms with a suitable cleaner and soft cloth

Note:
Note additional cleaning for oil and grease-free version

Mounting

Proceed as follows:

1. Insert new, undamaged O-ring seals into the grooves, check for correct position
2. Mount process flanges carefully on the differential pressure measuring cell, the seal must remain in the groove
3. Insert undamaged screws and nuts, screw together crosswise
4. First tighten with 8 Nm, then with 12 Nm
5. Finally tighten with 16 Nm at 160 bar, 18 Nm at 400 bar, 22 Nm for copper gaskets.

The process flanges are exchanged.

Note:
After installing the device in the measuring point, carry out a position correction again.

9.6 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.

53571-EN-230814

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

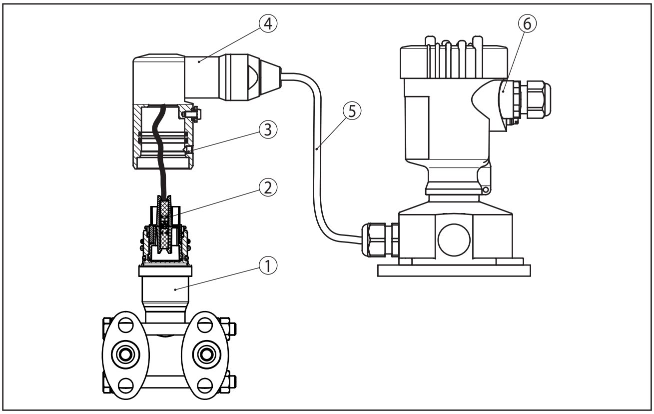


Fig. 46: VEGADIF 85 in IP68 version, 25 bar and lateral cable outlet, external housing

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.

The necessary serial number can be found on the type label of the instrument or on the delivery note.

9.7 Exchanging the electronics module

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

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

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

9.8 Software update

The following components are required to update the instrument software:

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

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

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

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

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

9.9 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.

10 Dismount

10.1 Dismounting steps

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

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

10.2 Disposal

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

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

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

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

11 Supplement

11.1 Technical data

Note for approved instruments

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

All approval documents can be downloaded from our homepage.

Materials and weights

Material 316L corresponds to stainless steel 1.4404 or 1.4435

Materials, wetted parts	
– Process fitting with lateral flanges	316L, Alloy C276 (2.4819), Superduplex (1.4410)
– Separating diaphragm	316L, Alloy C276 (2.4819), 316L/1.4404 6 µm gold coated
– Seal	FKM (ERIKS 514531), EPDM (ERIKS 55914)
– Seal for chemical seal assembly	Copper sealing ring
– Screw plugs	316L
– Ventilation valves	316L
Isolating liquid	
– Standard applications	Silicone oil
– Oxygen applications	Halocarbon oil [5]
Materials, non-wetted parts	
– Electronics housing	Plastic PBT (polyester), Alu die-casting, powder-coated, 316L
– Cable gland	PA, stainless steel, brass
– Sealing, cable gland	NBR
– Blind plug, cable gland	PA
– External housing	Plastic PBT (Polyester), 316L
– Socket, wall mounting plate external electronics housing	Plastic PBT (Polyester), 316L
– Seal between housing socket and wall mounting plate	TPE (fixed connected)
– Seal, housing lid	Silicone SI 850 R, NBR silicone-free
– Inspection window housing cover	Polycarbonate (UL-746-C listed), glass [6]
– Screws and nuts for lateral flange	PN 160 and PN 400: hexagon screw DIN 931 M8 x 85 A4-70 (1.4404/316L), hexagon nut DIN 934 M8 A4-70 (1.4404/316L)
– Ground terminal	316Ti/316L
– Connection between IP68 transmitter and external electronics housing	PE, PUR

[5] Note deviating process temperature limits
[6] Glass with Aluminium and stainless steel precision casting housing

53571-EN-230814

– Type label support with IP68 version on cable	PE hard
Weight	approx. 4.2 … 4.5 kg (9.26 … 9.92 lbs), depending on process fitting

Max. torques

Fixing nuts bracket for mounting angle	30 Nm (22.13 lbf ft)
Mounting screws for oval flange adapter, valve block and mounting bracket on the process assembly	25 Nm (18.44 lbf ft)
Ventilation valves, closing screws [7]	18 Nm (13.28 lbf ft)
Mounting screws for process assembly	
– 160 bar	16 Nm (11.80 lbf ft)
– 400 bar	18 Nm (13.28 lbf ft)
Socket screws, external housing	5 Nm (3.688 lbf ft)
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

Measuring ranges in bar

Measuring range	Nominal range	Max. adjustment range
10 mbar	-10 mbar … +10 mbar	-12 mbar … +12 mbar
30 mbar	-30 mbar … +30 mbar	-36 mbar … +36 mbar
100 mbar	-100 mbar … +100 mbar	-120 mbar … +120 mbar
500 mbar	-500 mbar … +500 mbar	-600 mbar … +600 mbar
3 bar	-3 bar … +3 bar	-3.6 bar … +3.6 bar
16 bar	-16 bar … +16 bar	-19.2 bar … +19.2 bar
40 bar	-40 bar … +40 bar	-48 bar … +48 bar

Measuring ranges in psi

Measuring range	Nominal range	Max. adjustment range
0.15 psig	-0.15 psig … +0.15 psig	-0.18 psig … +0.18 psig
0.45 psig	0.45 psig … +0.45 psig	-0.54 psig … +-0.54 psig
1.5 psig	-1.5 psig … +1.5 psig	-1.8 psig … +1.8 psig
7.5 psig	-7.5 psig … +7.5 psig	-9 psig … +9 psig
45 psig	-45 psig … +45 psig	-5.4 psig … +5.4 psig
240 psig	-240 psig … +240 psig	-288 psig … +288 psig
580 psig	-580 psig … +580 psig	-696 psig … +696 psig

[7] 4 layers PTFE

Measuring ranges in kPa

Measuring range	Nominal range	Max. adjustment range
1 kPa	-1 kPa … +1 kPa	-1.2 kPa … +1.2 kPa
3 kPa	-3 kPa … +3 kPa	-3.6 kPa … +3.6 kPa
10 kPa	-10 kPa … +10 kPa	-12 kPa … +12 kPa
50 kPa	-50 kPa … +50 kPa	-60 kPa … +60 kPa
300 kPa	-300 kPa. … +300 kPa	-360 kPa … +360 kPa
1600 kPa	-1600 kPa … +1600 kPa	-1920 kPa … +1920 kPa
4000 kPa	-4000 kPa … +4000 kPa	-4800 kPa … +4800 kPa

Turn Down

Maximum permissible Turn Down	Unlimited (recommended up to 20 : 1)

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

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

Additional output parameter - Measuring cell temperature

Range	-40 … +85 °C (-40 … +185 °F)
Measuring cell temperature	
– Resolution	1 K
– Deviation	±1 K
Output of the temperature values	
– Indication	Via the display and adjustment module
– Analogue	Via the current output, the additional current output
– Digital	Via the digital output signal (depending on the electronics version)

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 psig)
Determination of characteristics	Limit point adjustment according to IEC 61298-2

Characteristic curve	Linear
Calibration position of the measuring cell	Vertical, i.e. upright process component
Influence of the installation position	<0.35 mbar/20 Pa (0.003 psig) 10° inclination each around the transverse axis
Material, lateral flanges	316L

Deviation at the current output due to strong, high-frequency electromagnetic fields

– In accordance with EN 61326-1	< ±80 µA
– In accordance with IACS E10 (shipbuilding)/IEC 60945	<= ±160 µA

Deviation determined according to the limit point method according to IEC 60770 or IEC 61298

The measurement deviation includes the non-linearity, hysteresis and non-reproducibility.

The values apply to the **digital** signal output (HART, Profibus PA, Foundation Fieldbus) as well as to the **analogue** current output 4 … 20 mA. For differential pressure they refer to the set span, for static pressure to the measuring range final value. Turn down (TD) is the ratio of the nominal measuring range to the set span.

Differential pressure

Measuring range	TD ≤ 5 : 1	TD > 5 : 1	TD > 10 : 1
10 mbar (1 kPa)/0.145 psi	< ±0.1 %	< ±0.02 % x TD	
30 mbar (3 kPa)/0.44 psi			
100 mbar (10 kPa)/1.5 psi	< ±0.065 %		< ±0.035 % + 0.01 % x TD
500 mbar (50 kPa)/7.3 psi			
3 bar (300 kPa)/43.51 psi			< ±0.015 % + 0.005 % x TD
16 bar (1600 kPa)/232.1 psi			< ±0.035 % + 0.01 % x TD

Static pressure

Measuring range	Up to nominal pressure [8]	TD 1:1
10 mbar (1 kPa)/0.145 psi	40 bar (4000 kPa)	< ±0.1 %
30 mbar (3 kPa)/0.44 psi		
100 mbar (10 kPa)/1.5 psi	160 bar (16000 kPa) resp. 400 bar (40000 kPa)	
500 mbar (50 kPa)/7.3 psi		
3 bar (300 kPa)/43.51 psi		
16 bar (1600 kPa)/232.1 psi		

Flow > 50 %[9]

Measuring range	TD ≤ 5 : 1	TD > 5 : 1	TD > 10 : 1
10 mbar (1 kPa)/0.145 psi	< ±0.1 %	< ±0.02 % x TD	
30 mbar (3 kPa)/0.44 psi			

[8] Measuring range end, absolute pressure
[9] Root characteristic

Measuring range	TD ≤ 5 : 1	TD > 5 : 1	TD > 10 : 1
100 mbar (10 kPa)/1.5 psi	< ±0.065 %		< ±0.035 % + 0.01 % x TD
500 mbar (50 kPa)/7.3 psi			< ±0.015 % + 0.005 % x TD
3 bar (300 kPa)/43.51 psi			
16 bar (1600 kPa)/232.1 psi			< ±0.035 % + 0.01 % x TD

25 % < Flow ≤ 50 % [10)]

Measuring range	TD ≤ 5 : 1	TD > 5 : 1	TD > 10 : 1
10 mbar (1 kPa)/0.145 psi	< ±0.2 %	< ±0.04 % x TD	
30 mbar (3 kPa)/0.44 psi			
100 mbar (10 kPa)/1.5 psi	< ±0.13 %		< ±0.07 % + 0.02 % x TD
500 mbar (50 kPa)/7.3 psi			< ±0.03 % + 0.01 % x TD
3 bar (300 kPa)/43.51 psi			
16 bar (1600 kPa)/232.1 psi			< ±0.07 % + 0.02 % x TD

Influence of the medium or ambient temperature

Applies to instruments in basic version with **digital** signal output. Specifications refer to the set span. Turn down (TD) = nominal measuring range/set span.

Thermal change zero signal and output span, differential pressure [11)]

Measuring range	-10 … +60 °C / +14 … +140 °F	-40 … -10 °C / -40 … +14 °F und +60 … +85 °C /+140 … +185 °F
10 mbar (1 kPa)/0.145 psi	< ±0.15 % + 0.20 % x TD	< ±0.4 % + 0.3 % x TD
30 mbar (3 kPa)/0.44 psi	< ±0.15 % + 0.10 % x TD	< ±0.2 % + 0.15 % x TD
100 mbar (10 kPa)/1.5 psi	< ±0.15 % + 0.15 % x TD	< ±0.15 % + 0.20 % x TD
500 mbar (50 kPa)/7.3 psi	< ±0.15 % + 0.05 % x TD	< ±0.2 % + 0.06 % x TD
3 bar (300 kPa)/43.51 psi		
16 bar (1600 kPa)/232.1 psi	< ±0.15 % + 0.15 % x TD	< ±0.15 % + 0.20 % x TD

Thermal change zero signal and output span, static pressure [12)]

Measuring range	Up to nominal pressure [13)]	-40 … +80 °C / -40 … +176 °F
10 mbar (1 kPa)/0.145 psi	40 bar (4000 kPa)	< ±0.5 %
30 mbar (3 kPa)/0.44 psi		
100 mbar (10 kPa)/1.5 psi	160 bar (16000 kPa) resp. 400 bar (40000 kPa)	
500 mbar (50 kPa)/7.3 psi		
3 bar (300 kPa)/43.51 psi		
16 bar (1600 kPa)/232.1 psi		

10) Root characteristic
11) Relating to the adjusted span.
12) Relating to the measuring range end value.
13) Measuring range end, absolute pressure.

Influence of the static pressure

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

Change zero signal and output span

Nominal range	Up to nominal pressure [14]	Influence on the zero point	Influence on the span
10 mbar (1 kPa), (0.145 psi)	40 bar (4000 kPa), (600 psi)	< ±0.10 % x TD	< ±0.10 %
30 mbar (3 kPa), (0.44 psi)			
100 mbar (10 kPa), (1.5 psi)	160 bar (16000 kPa), (2400 psi) 400 bar (4000 kPa), (5800 psi)	160 bar (16000 kPa), (2400 psi): < ±0.10 % x TD 400 bar(4000 kPa), (5800 psi): ≤ 0.25 % x TD	160 bar(16000 kPa), (2400 psi): < ±0.10 % 400 bar(4000 kPa), (5800 psi): ≤ 0.25 %
500 mbar (50 kPa), (7.3 psi)			
3 bar (300 kPa), (43.51 psi)			
16 bar (1600 kPa), (232.1 psi)			

Long-term stability (according to DIN 16086)

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

The long-term stability of the zero signal and output span corresponds to the value F_{Stab} in chapter "*Calculation of the total deviation (according to DIN 16086)*".

Long-term stability zero signal and output span

Measured variable	Time range		
	1 year	5 years	10 years
Differential pressure [15]	< 0.065 % x TD	< 0.1 % x TD	< 0.15 % x TD
Static pressure [16]	< ±0.065 %	< ±0.1 %	< ±0.15 %

Process conditions

Process temperature [17]

Material seal	Filling oil	Temperature limits
FKM (ERIKS 514531)	Silicone oil	-20 … +105 °C (-4 … +221 °F)
	Halocarbon oil for oxygen applications	-10 … +60 °C (-4 … +140 °F)

53571-EN-230814

[14] Measuring range end, absolute pressure.
[15] Relating to the adjusted span.
[16] Relating to the measuring range end value.
[17] With entry into the process fitting, connection via valve block, brief venting, no permanent flow through the measuring chambers

Material seal	Filling oil	Temperature limits
PTFE	Silicone oil	-40 … +105 °C (-40 … +221 °F)
	Halocarbon oil for oxygen applications	-10 … +60 °C (-4 … +140 °F)
Copper	Silicone oil	-40 … +105 °C (-40 … +221 °F)
	Halocarbon oil for oxygen applications	-10 … +60 °C (-4 … +140 °F)
EPDM (ERIKS 55914)	Silicone oil	-40 … +105 °C (-40 … +221 °F)
	Halocarbon oil for oxygen applications	-10 … +60 °C (-4 … +140 °F)

Process pressure [18]

Nominal range	Max. permissible process pressure (MWP)	Overload unilateral (OPL)	Overload bilateral (OPL)	Min. permissible static pressure
10 mbar (1 kPa)	40 bar (4000 kPa)	40 bar (4000 kPa)	60 bar (6000 kPa)	1 mbar$_{abs}$ (100 Pa$_{abs}$)
30 mbar (3 kPa)				
100 mbar (10 kPa)	160 bar (16000 kPa)	160 bar (16000 kPa)	240 bar (24000 kPa)	
500 mbar (50 kPa)	160 bar (16000 kPa) 400 bar (40000 kPa)	160 bar (16000 kPa) 400 bar (40000 kPa)	240 bar (24000 kPa) 630 bar (63000 kPa)	
3 bar (300 kPa)				
16 bar (1600 kPa)				

Nominal range	Max. permissible process pressure (MWP)	Overload unilateral (OPL)	Overload bilateral (OPL)	Min. permissible static pressure
0.15 psig	580.1 psig	580.1 psig	870.2 psig	0.015 psi
0.45 psig				
1.5 psig	2320 psig	2320 psig	3481 psig	
7.5 psig	2320 psig 5802 psig	2320 psig 5802 psig	3481 psig 9137 psig	
45 psig				
240 psig				

Mechanical stress

Vibration resistance	4 g at 5 … 200 Hz according to EN 60068-2-6 (vibration with resonance)
Shock resistance	50 g, 2.3 ms according to EN 60068-2-27 (mechanical shock) [19]

[18] Reference temperature +25 °C (+77 °F).
[19] 2 g with housing version stainless steel double chamber

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)

Electromechanical data - version IP66/IP67 and IP66/IP68 (0.2 bar) [20)]

Options of the cable entry

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

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

Wire cross-section (spring-loaded terminals)

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

Electromechanical data - version IP68 (25 bar)

Connection cable, mechanical data

- Configuration Wires, strain relief, breather capillaries, screen braiding, metal foil, mantle
- Standard length 5 m (16.40 ft)
- Max. length 50 m (164.0 ft)
- Min. bending radius (at 25 °C/77 °F) 25 mm (0.985 in)
- Diameter approx. 8 mm (0.315 in)
- Colour PE Black
- Colour 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)

Interface to the external display and adjustment unit

Data transmission Digital (I²C-Bus)

20) IP66/IP68 (0.2 bar), only with absolute pressure.

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	–	●

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

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			

53571-EN-230814

Housing material	**Version**	**Protection acc. to IEC 60529**	**Protection acc. to NEMA**
Stainless steel (transmitter, version with external housing)		IP68 (25 bar)	-

Connection of the feeding power supply unit	Networks of overvoltage category III
Altitude above sea level	
– by default	up to 2000 m (6562 ft)
– with connected overvoltage protection	up to 5000 m (16404 ft)
Pollution degree [21]	4
Protection rating (IEC 61010-1)	II

11.2 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 VEGADIF 85 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 VEGADIF 85 which must be contacted for the variables and status information.

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

[21] When used with fulfilled housing protection.

11.3 Modbus register

Holding Register

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

Register Name	Register Number	Type	Configurable Values	Default Value	Unit
Address	200	Word	1 … 255	246	–
Baud Rate	201	Word	1200, 2400, 4800, 9600, 19200, 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
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

Register Name	Register Number	Type	Note
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
2	in Hg
3	ft H2O
4	mm H2O
5	mm Hg
6	psi
7	bar
8	mbar
11	Pa

Unit Code	Measurement Unit
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

11.4 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)
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

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
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

53571-EN-230814

11.5 Levelmaster commands

The VEGADIF 85 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 VEGADIF 85 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

11.6 Configuration of typical Modbus hosts

Fisher ROC 809

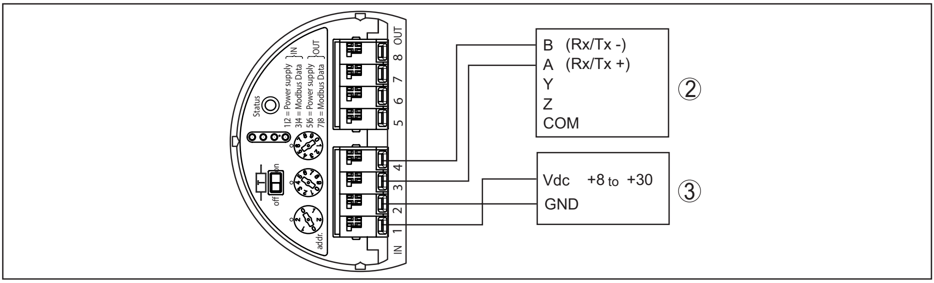


Fig. 47: Connection of VEGADIF 85 to RTU Fisher ROC 809

1 VEGADIF 85
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 ScadaPack
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 VEGADIF 85.

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

11.7 Calculation of the total deviation

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

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

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

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

53571-EN-230814

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

The thermal change of the zero signal and output span F_T is specified in chapter " *Technical data*".

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

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

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

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

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

11.8 Calculation of the total deviation - Practical example

Data

Differential pressure 250 mbar (25 KPa), medium temperature on the measuring cell 60 °C

VEGADIF 85 with measuring range 500 mbar

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

1. Calculation of the Turn down

TD = 500 mbar/250 mbar

TD = 2 : 1

2. Determination temperature error F_T

<table>
<tr><th>Measuring range</th><th>-10 … +60 °C / +14 … +140 °F</th><th>-40 … -10 °C / -40 … +14 °F und +60 … +85 °C /+140 … +185 °F</th></tr>
<tr><td>10 mbar (1 kPa)/0.145 psi</td><td>< ±0.15 % + 0.20 % x TD</td><td>< ±0.4 % + 0.3 % x TD</td></tr>
<tr><td>30 mbar (3 kPa)/0.44 psi</td><td>< ±0.15 % + 0.10 % x TD</td><td>< ±0.2 % + 0.15 % x TD</td></tr>
<tr><td>100 mbar (10 kPa)/1.5 psi</td><td>< ±0.15 % + 0.15 % x TD</td><td>< ±0.15 % + 0.2 % x TD</td></tr>
<tr><td>500 mbar (50 kPa)/7.3 psi</td><td rowspan="2">< ±0.15 % + 0.05 % x TD</td><td rowspan="2">< ±0.2 % + 0.06 % x TD</td></tr>
<tr><td>3 bar (300 kPa)/43.51 psi</td></tr>
<tr><td>16 bar (1600 kPa)/232.1 psi</td><td>< ±0.15 % + 0.15 % x TD</td><td>< ±0.15 % + 0.20 % x TD</td></tr>
</table>

F_T = 0.15 % + 0.05 % x TD

F_T = 0.15 % + 0.1 %

F_T = 0.25 %

3. Determination of deviation and long-term stability

Deviation

Measuring range	TD 1 : 1 up to 5 : 1	TD > 5 : 1	TD > 10 : 1
10 mbar (1 kPa)/0.145 psi	< ±0.1 %	< ±0.02 % x TD	
30 mbar (3 kPa)/0.44 psi			
100 mbar (10 kPa)/1.5 psi	< ±0.065 %		< ±(0.035 % + 0.01 %) x TD
500 mbar (50 kPa)/7.3 psi			
3 bar (300 kPa)/43.51 psi			< ±(0.015 % + 0.005 %) x TD
16 bar (1600 kPa)/232.1 psi			< ±(0.035 % + 0.01 %) x TD

Long-term stability

Measured variable	Time range		
	1 year	5 years	10 years
Differential pressure [22]	< 0.065 % x TD	< 0.1 % x TD	< 0.15 % x TD
Static pressure [23]	< ±0.065 %	< ±0.1 %	< ±0.15 %

4. Calculation of the total deviation - digital output signal

- 1. step: Basic accuracy F_{perf}

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

$F_T = 0.25\ \%$

$F_{Kl} = 0.065\ \%$

$F_{perf} = \sqrt{(0.25\ \%)^2 + (0.065\ \%)^2)}$

$F_{perf} = 0.26\ \%$

- 2. step: Total deviation F_{total}

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

$F_{perf} = 0.26\ \%$ (result of step 1)

$F_{stab} = 0.065\ \% \times TD$

$F_{stab} = 0.065\ \% \times 2$

$F_{stab} = 0.13\ \%$

$F_{total} = 0.26\ \% + 0.13\ \% = 0.39\ \%$

The total percentage deviation of the measurement is thus 0. 39%. The absolute total deviation is 0. 39% of 250 mbar = 1 mbar

The example shows that in practice the error of use can be significantly higher than the actual measurement error. The causes are temperature influence and turn down.

11.9 Dimensions, versions process component

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*".

[22] Relating to the adjusted span.
[23] Relating to the measuring range end value.

Housing

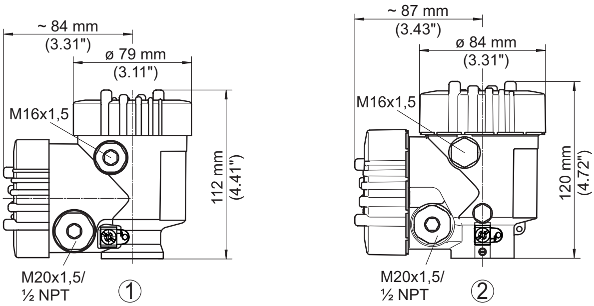


Fig. 48: Dimensions of housing - with integrated display and adjustment module the housing is 9 mm/0.35 inches or 18 mm/0.71 in higher

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

Ventilation on process axis

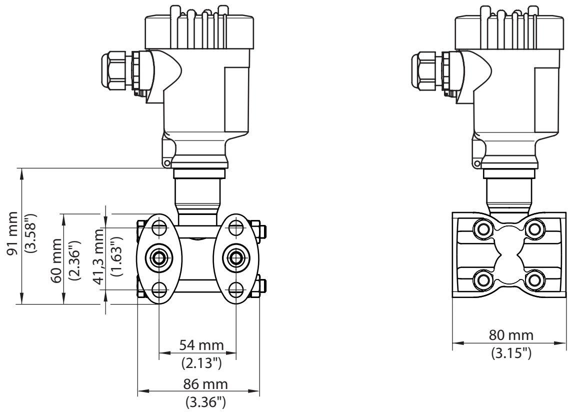


Fig. 49: VEGADIF 85, ventilation on process axis

Connection	Fastening	Material	Scope of delivery
¼-18 NPT, IEC 61518	7/16-20 UNF	316L	incl. 2 vent valves
¼-18 NPT, IEC 61518	7/16-20 UNF	Alloy C276 (2.4819)	
¼-18 NPT, IEC 61518	7/16-20 UNF	Super Duplex (2.4410)	without

53571-EN-230814

Lateral ventilation

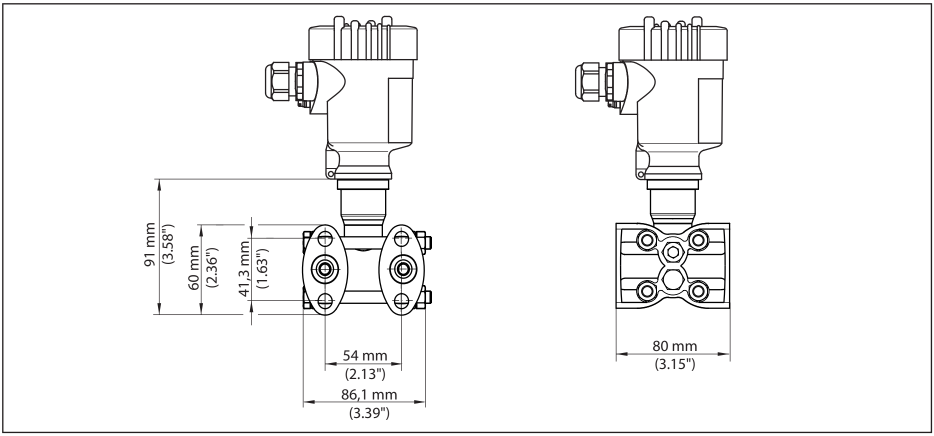


Fig. 50: VEGADIF 85, lateral ventialtion

Connection	Fastening	Material	Scope of delivery
¼-18 NPT, IEC 61518	7/16-20 UNF	316L	incl. 4 closing screws and 2 ventilation valves
¼-18 NPT, IEC 61518	7/16-20 UNF	Alloy C276 (2.4819)	

Oval flange, prepared for chemical seal connection

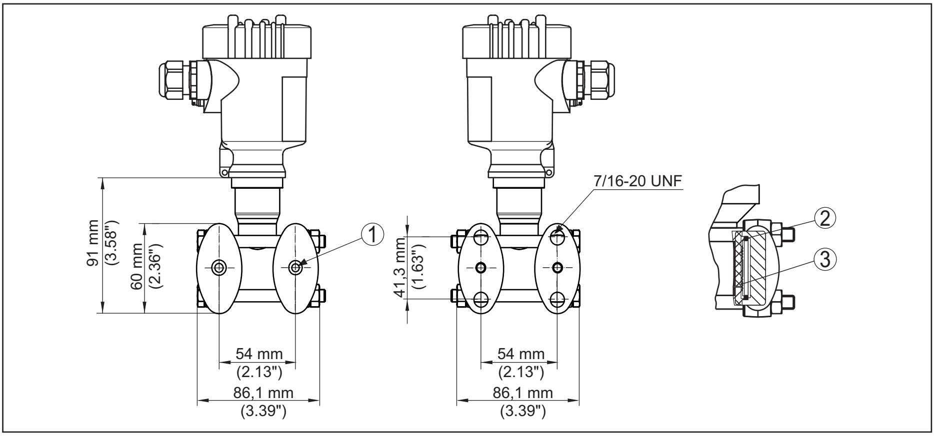


Fig. 51: left: Process fitting VEGADIF 85 prepared for chemical seal assembly. right: Position of the copper ring seal

1. *Chemical seal connection*
2. *Copper ring seal*
3. *Separating diaphragm*

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