Operating Instructions

Differential pressure transmitter with metallic measuring diaphragm

VEGADIF 85

4 … 20 mA/HART

Document ID: 53567

Contents

1 About this document ... 4

1.1 Function ... 4
1.2 Target group ... 4
1.3 Symbols used ... 4

2 For your safety ... 5

2.1 Authorised personnel ... 5
2.2 Appropriate use ... 5
2.3 Warning about incorrect use ... 5
2.4 General safety instructions ... 5
2.5 EU conformity ... 5
2.6 NAMUR recommendations ... 6
2.7 Installation and operation in the USA and Canada ... 6
2.8 Environmental instructions ... 6

3 Product description ... 7

3.1 Configuration ... 7
3.2 Principle of operation ... 8
3.3 Supplementary cleaning procedures ... 11
3.4 Packaging, transport and storage ... 12
3.5 Accessories ... 12

4 Mounting ... 14

4.1 General instructions ... 14
4.2 Instructions for oxygen applications ... 16
4.3 Connection to the process ... 16
4.4 Mounting and connection instructions ... 17
4.5 Measurement setups ... 19

5 Connecting to power supply ... 28

5.1 Preparing the connection ... 28
5.2 Connecting ... 29
5.3 Wiring plans ... 30
5.4 Connection example ... 36
5.5 Switch-on phase ... 37

6 Set up the sensor with the display and adjustment module ... 38

6.1 Insert display and adjustment module ... 38
6.2 Adjustment system ... 39
6.3 Measured value indication ... 40
6.4 Parameter adjustment - Quick setup ... 41
6.5 Parameter adjustment - Extended adjustment ... 41
6.6 Save parameter adjustment data ... 58

7 Set up sensor with PACTware ... 59

7.1 Connect the PC ... 59
7.2 Parameterization ... 59
7.3 Save parameter adjustment data ... 61

8 Set up sensor with other systems ... 62

8.1 DD adjustment programs ... 62
8.2 Field Communicator 375, 475 ... 62

9 Set up measuring system ... 63
9.1 Level measurement ... 63
9.2 Flow measurement ... 65

10 Diagnosis, asset management and service ... 67
10.1 Maintenance ... 67
10.2 Diagnosis memory ... 67
10.3 Asset Management function ... 68
10.4 Rectify faults ... 71
10.5 Replace process flanges ... 72
10.6 Exchange process module on version IP68 (25 bar) ... 73
10.7 Exchanging the electronics module ... 74
10.8 Software update ... 74
10.9 How to proceed if a repair is necessary ... 74

11 Dismount ... 75
11.1 Dismounting steps ... 75
11.2 Disposal ... 75

12 Supplement ... 76
12.1 Technical data ... 76
12.2 Calculation of the total deviation ... 87
12.3 Calculation of the total deviation - Practical example ... 88
12.4 Dimensions, versions process component ... 89
12.5 Industrial property rights ... 95
12.6 Trademark ... 95

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.

Editing status: 2022-06-10

1 About this document

1.1 Function

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

1.2 Target group

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

1.3 Symbols used

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

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

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

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

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

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

Ex applications
This symbol indicates special instructions for Ex applications.

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

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

Disposal
This symbol indicates special instructions for disposal.

2 For your safety

2.1 Authorised personnel

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

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

2.2 Appropriate use

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 operator is responsible for the trouble-free operation of the instrument. When measuring aggressive or corrosive media that can cause a dangerous situation if the instrument malfunctions, the operator has to implement suitable measures to make sure the instrument is functioning properly.

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

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

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

2.5 EU conformity

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

The EU conformity declaration can be found on our homepage.

2.6 NAMUR recommendations

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

The device fulfils the requirements of the following NAMUR recommendations:

- NE 21 – Electromagnetic compatibility of equipment
- NE 43 – Signal level for fault information from measuring transducers
- NE 53 – Compatibility of field devices and display/adjustment components
- NE 107 – Self-monitoring and diagnosis of field devices

For further information see www.namur.de.

2.7 Installation and operation in the USA and Canada

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

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

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

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

2.8 Environmental instructions

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

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

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

3 Product description

3.1 Configuration

Scope of delivery

The scope of delivery encompasses:

- 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:

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

1. *Instrument type*
2. *Product code*
3. *Field for approvals*
4. *Technical data*
5. *Serial number of the instrument*
6. *Data matrix code for VEGA Tools app*
7. *Reminder to observe the instrument documentation*

Serial number - Instrument search

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

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

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

Alternatively, you can access the data via your smartphone:

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

3.2 Principle of operation

Application area

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.

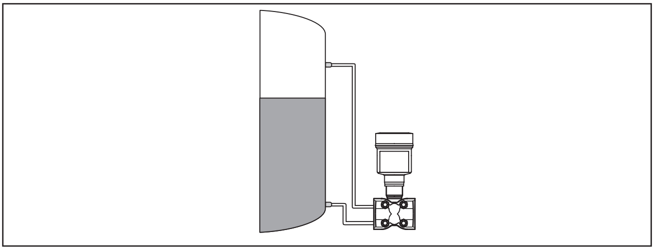


Fig. 2: Level measurement with VEGADIF 85 in a pressurized vessel

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.

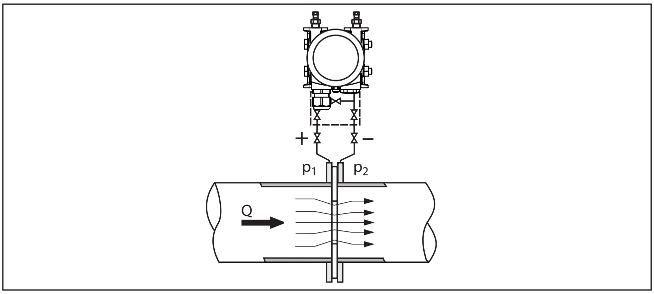


Fig. 3: Flow measurement with VEGADIF 85 and orifice, Q = flow, differential pressure $\Delta p = p_1 - p_2$

Differential pressure measurement

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

53567-EN-220620

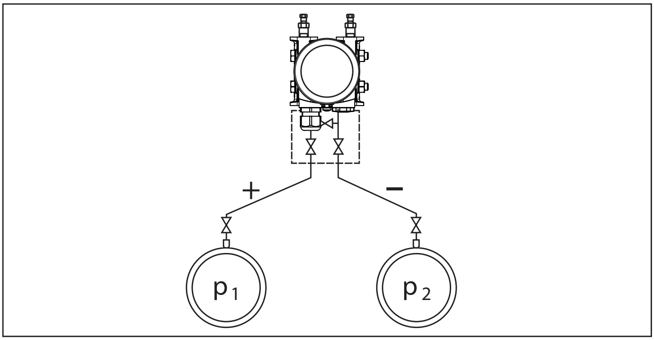


Fig. 4: Measurement of the differential pressure in pipelines with VEGADIF 85, differential pressure $\Delta p = p_1 - p_2$

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.

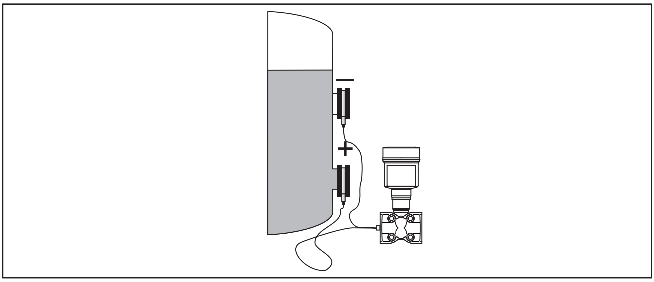


Fig. 5: Density measurement with VEGADIF 85

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.

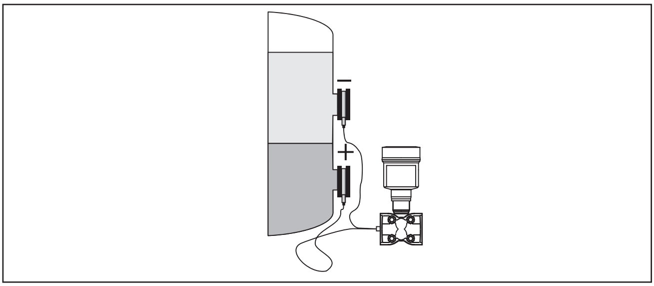


Fig. 6: Interface measurement with VEGADIF 85

53567-EN-220620

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.

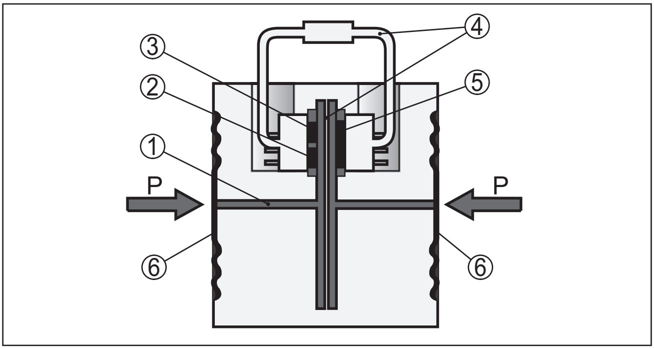


Fig. 7: Configuration metallic measuring cell

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*".

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.

VEGADIS 81

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

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.

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.

53567-EN-220620

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.

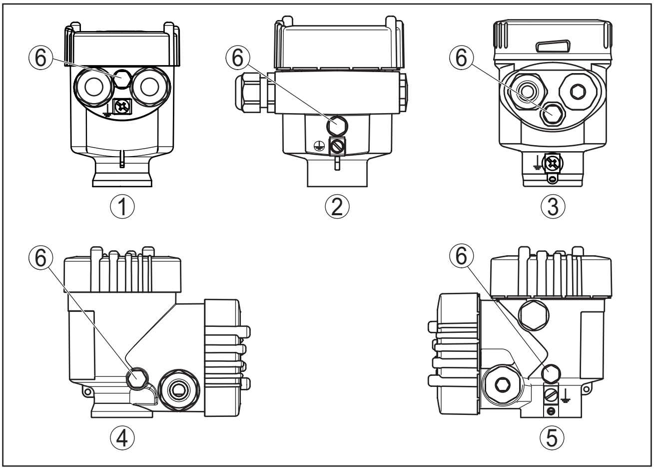


Fig. 8: Position of the filter element - non-Ex, Ex-ia and Ex-d-ia version

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.

Vibrations

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

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.

53567-EN-220620

4.2 Instructions for oxygen applications

Oxygen applications

Oxygen and other gases can be explosive when brought into contact with oils, grease and plastics, so the following measures must also be taken:

- All components of the system, e.g. 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*"

Danger:
Instruments for oxygen applications must be unpacked just before mounting. After removing the protective cover of the process fitting, the label "O_2" will be visible on the process fitting. Penetration of oil, grease and dirt should be avoided. Danger of explosion!

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**".

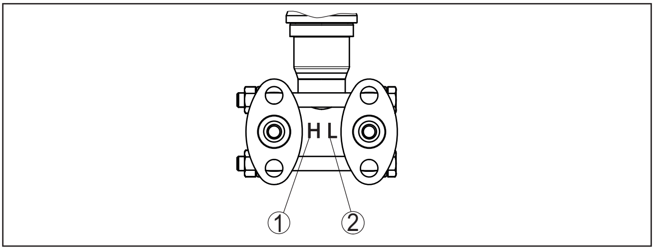


Fig. 9: Marking for high/low pressure side on the process component

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.

3-fold valve block

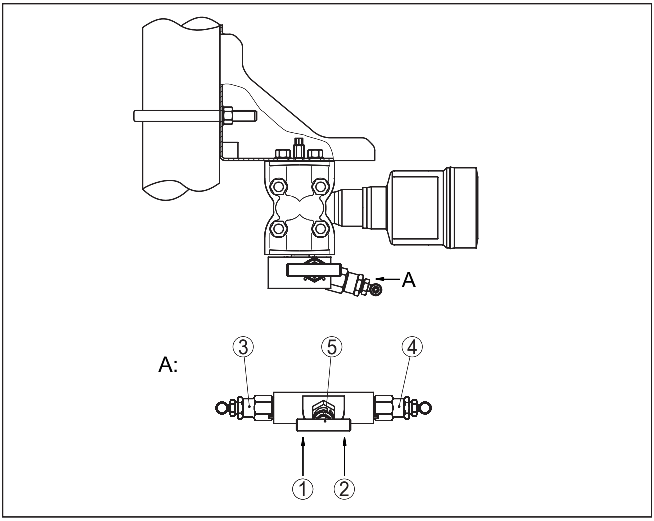


Fig. 10: Connection of a 3-fold valve block

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

3-fold valve block, flanging on both sides

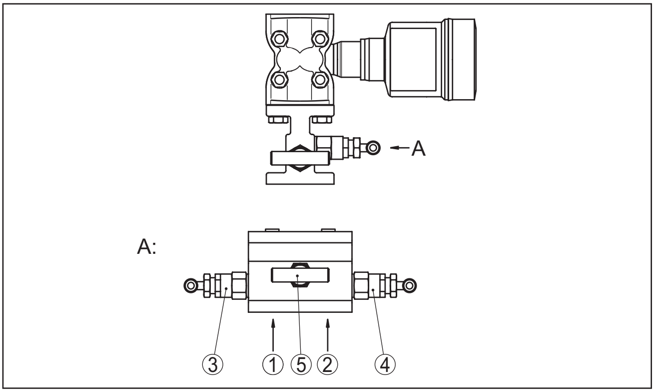


Fig. 11: Connection of a 3-fold valve block, flanging on both sides

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

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

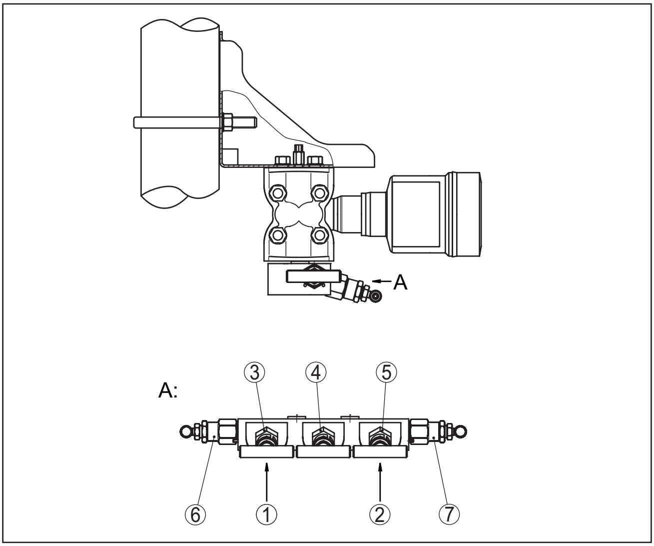


Fig. 12: Connection of a 5-fold valve block

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

53567-EN-220620

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.

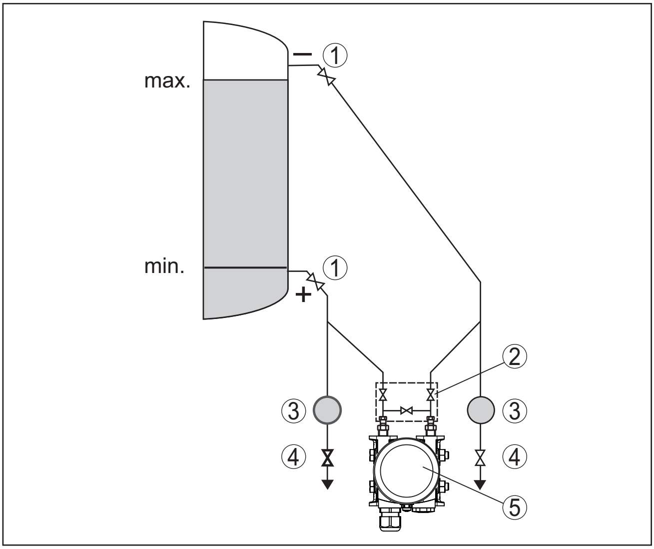


Fig. 13: Measurement setup, level measurement in closed vessel

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.

53567-EN-220620

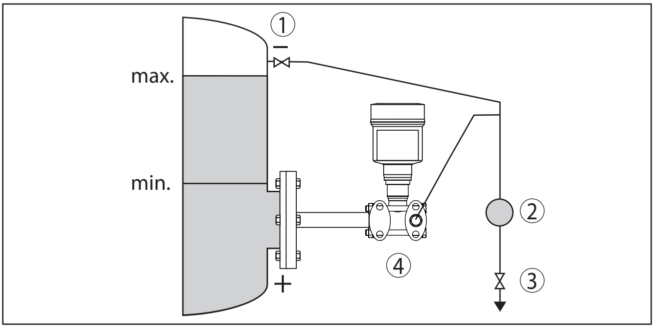


Fig. 14: Measurement setup, level measurement in closed vessel

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.

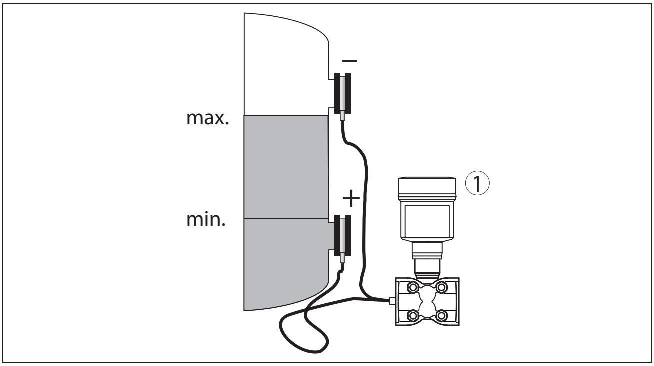


Fig. 15: Measurement setup, level measurement in closed vessel

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.

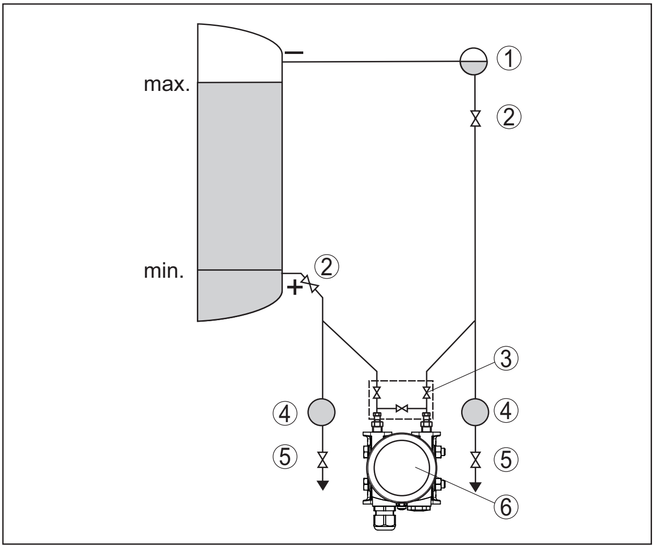


Fig. 16: Measurement setup in closed vessel with superimposed steam

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

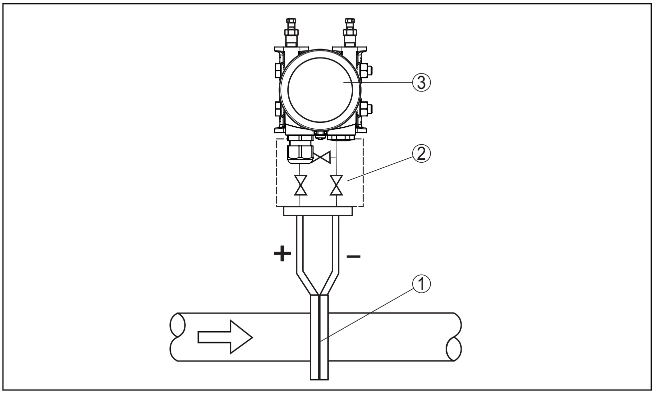


Fig. 17: Measurement setup with flow measurement of gases, connection via 3-fold valve block, flanging on both sides

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

53567-EN-220620

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

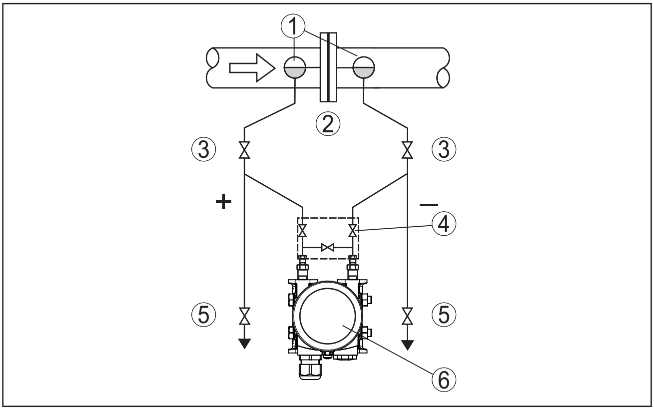


Fig. 18: Measurement setup, flow measurement in vapours

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

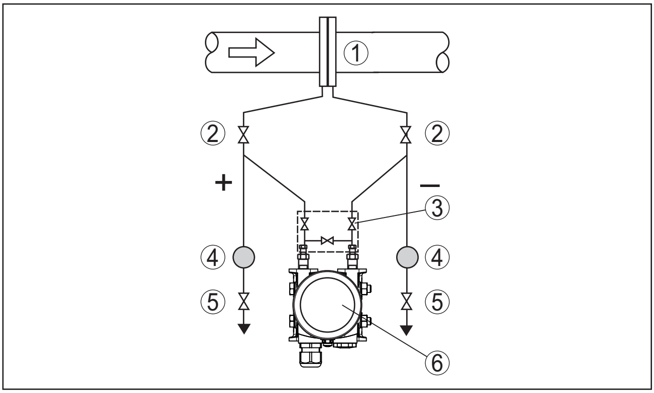


Fig. 19: Measurement setup, flow measurement in liquids

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.

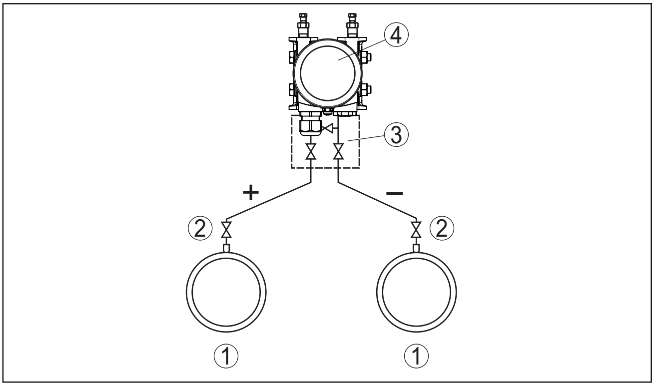


Fig. 20: Measurement setup with differential pressure measurement between two pipelines in gases and vapours

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.

53567-EN-220620

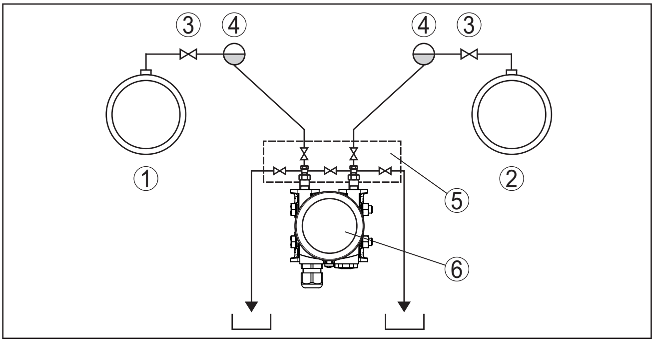


Fig. 21: Measurement setup with differential pressure measurement between a vapour and a condensate cable

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.

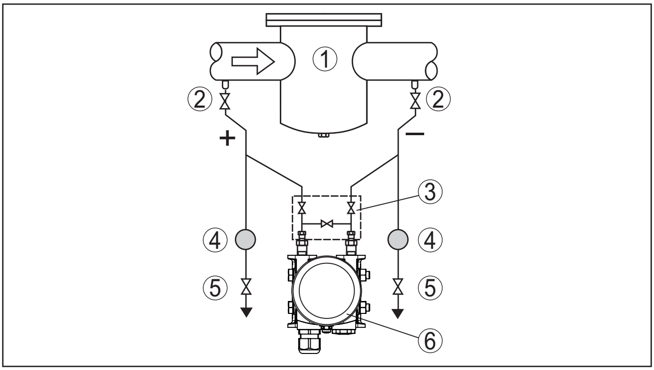


Fig. 22: Measurement setup with differential pressure measurement in liquids

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

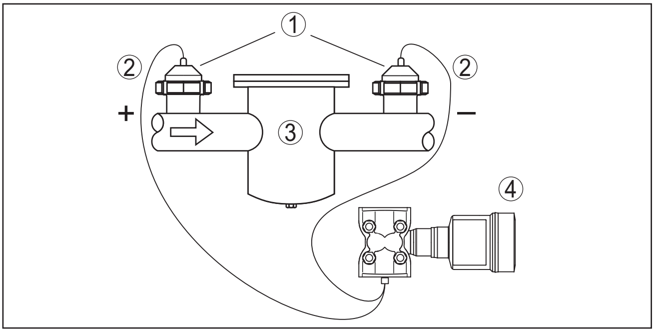


Fig. 23: Measurement setup, differential pressure measurement in gases, vapours and liquids

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

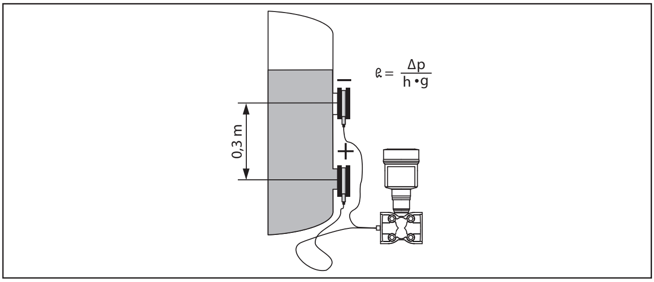


Fig. 24: Measurement setup for density measurement

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/m^3, max. density 1200 kg/m^3

53567-EN-220620

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

$\Delta p = \rho \bullet g \bullet h$

$= 1000\ kg/m^3 \bullet 9.81\ m/s^2 \bullet 0{,}3\ m$

$= 2943\ Pa = 29.43\ mbar$

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

$\Delta p = \rho \bullet g \bullet h$

$= 1200\ kg/m^3 \bullet 9.81\ m/s^2 \bullet 0.3\ m$

$= 3531\ Pa = 35.31\ mbar$

4.5.6 Interface

Interface measurement

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

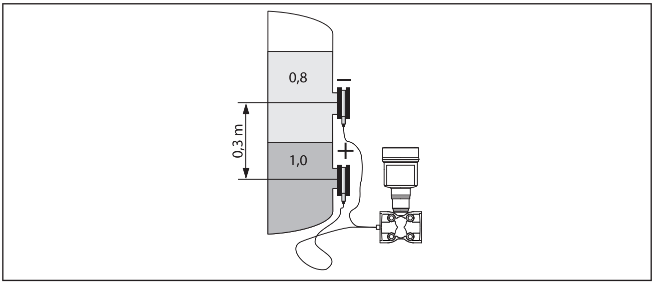


Fig. 25: Measurement setup with interface measurement

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:

$\Delta p = \rho \bullet g \bullet h$

$= 800\ kg/m^3 \bullet 9.81\ m/s \bullet 0.3\ m$

$= 2354\ Pa = 23.54\ mbar$

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

$\Delta p = \rho \bullet g \bullet h$

$= 1000\ kg/m^3 \bullet 9.81\ m/s \bullet 0.3\ m$

$= 2943\ Pa = 29.43\ mbar$

5 Connecting to power supply

5.1 Preparing the connection

Safety instructions

Always keep in mind the following safety instructions:

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

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

Voltage supply

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

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

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

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

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

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

Connection cable

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

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

We generally recommend the use of shielded cable for HART multidrop mode.

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

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

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

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

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

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

5.2 Connecting

Connection technology

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

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

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

Connection procedure

Proceed as follows:

1. Unscrew the housing lid
2. If a display and adjustment module is installed, remove it by turning it slightly to the left
3. Loosen compression nut of the cable gland and remove blind plug

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

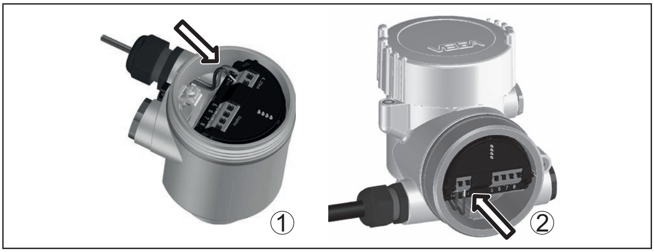


Fig. 26: Connection steps 5 and 6

1 Single chamber housing
2 Double chamber housing

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

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

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

The electrical connection is finished.

5.3 Wiring plans

5.3.1 Single chamber housing

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

Electronics and connection compartment

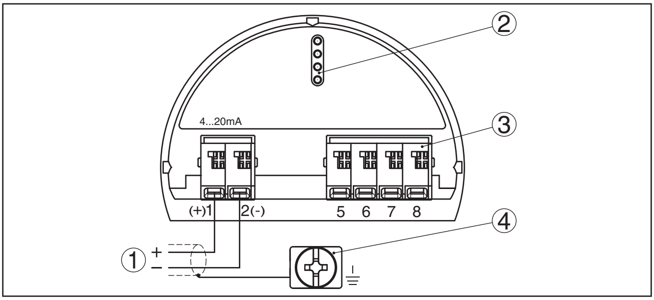


Fig. 27: Electronics and connection compartment - single chamber housing

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

5.3.2 Double chamber housing

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

Electronics compartment

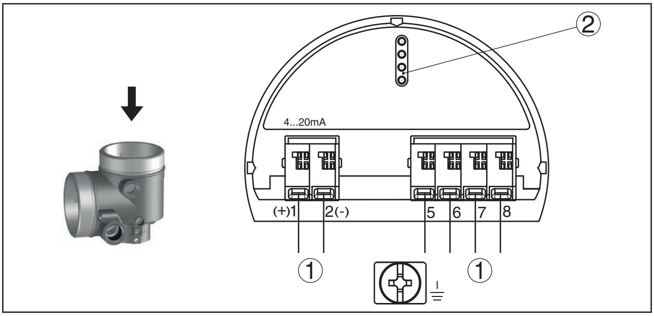


Fig. 28: Electronics compartment - double chamber housing

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

53567-EN-220620

Connection compartment

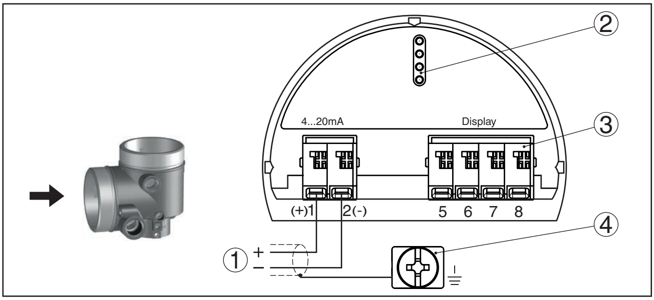


Fig. 29: Connection compartment - double chamber housing

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

Supplementary electronics - Additional current output

To make a second measured value available for use, you can use the supplementary electronics " *Additional current output*".

Both current outputs are passive and need a power supply.

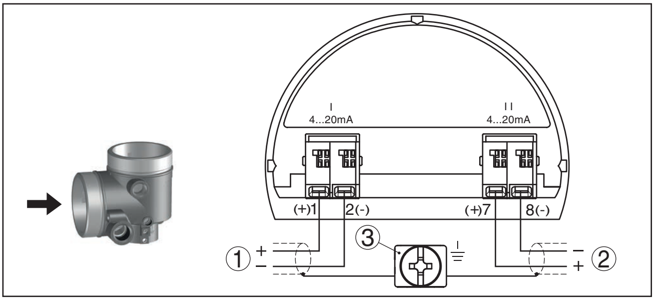


Fig. 30: Terminal compartment, double chamber housing, supplementary electronics " Additional current output"

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

53567-EN-220620

Connection compartment - Radio module PLICSMOBILE 81

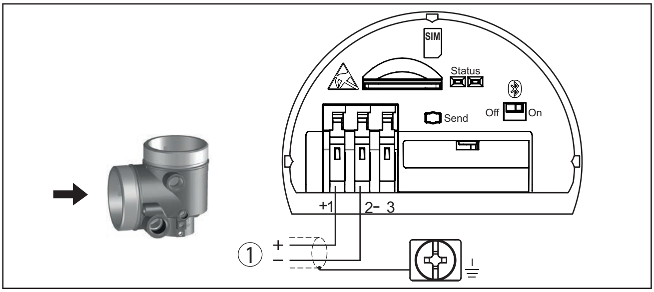


Fig. 31: Connection compartment - Radio module PLICSMOBILE 81

1 Voltage supply

You can find detailed information for connection in the operating instructions " *PLICSMOBILE*".

5.3.3 Ex-d double chamber housing

Electronics compartment

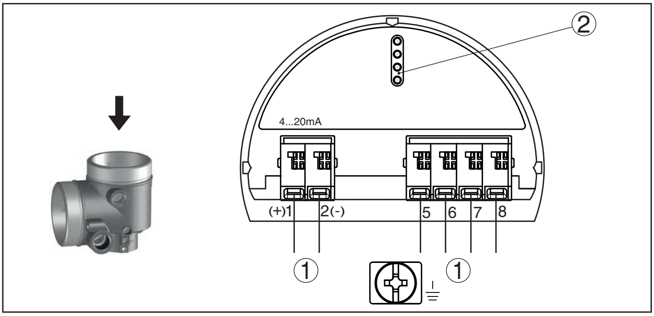


Fig. 32: Electronics compartment - Ex-d double chamber housing

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

Connection compartment

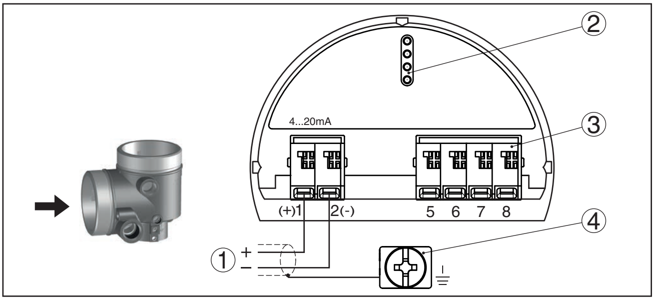


Fig. 33: Connection compartment - double chamber housing

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

5.3.4 Housing IP66/IP68 (1 bar)

Wire assignment, connection cable

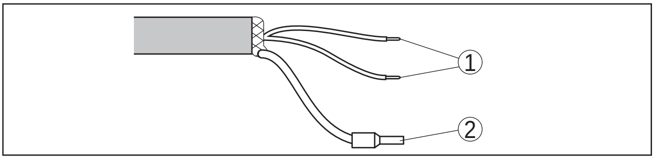


Fig. 34: Wire assignment in permanently connected connection cable

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

53567-EN-220620

5.3.5 External housing with version IP68 (25 bar)

Electronics and connection compartment for power supply

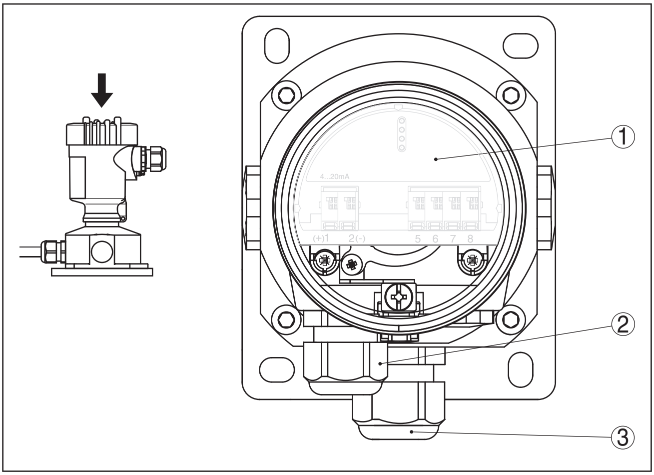


Fig. 35: Electronics and connection compartment

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

Terminal compartment, housing socket

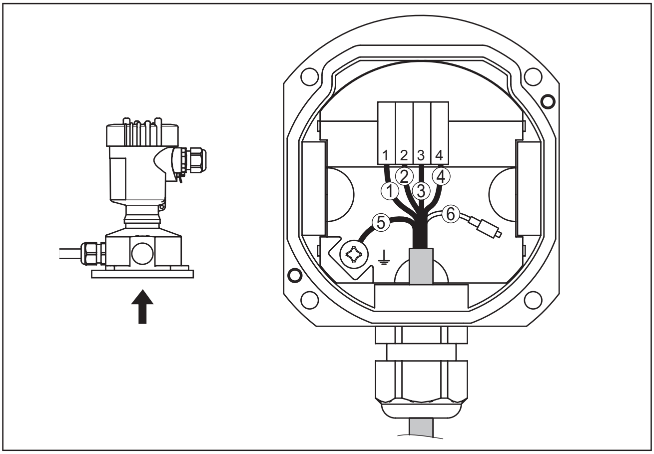


Fig. 36: Connection of the process component in the housing base

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

53567-EN-220620

Electronics and connection compartment

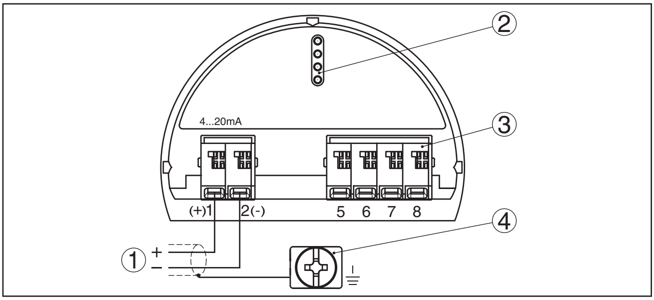


Fig. 37: Electronics and connection compartment - single chamber housing

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

5.4 Connection example

Connection example, additional current output

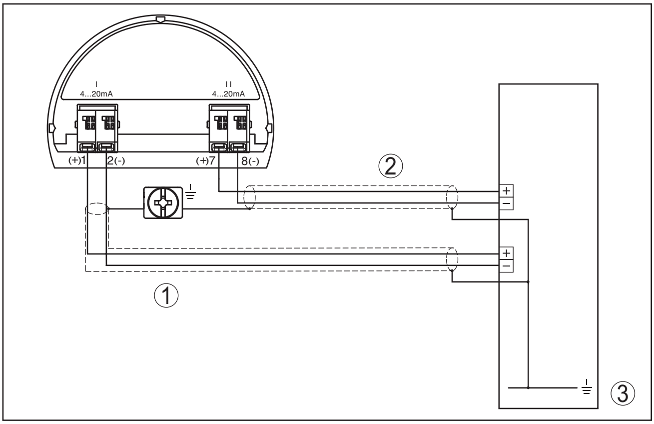


Fig. 38: Connection example VEGADIF 85 additional current output

1 Supply and signal circuit, sensor
2 Signal circuit, additional current output
3 Input card PLC

Sensor	Circuit	Input card PLC
Terminal 1 (+) passive	Supply and signal circuit, sensor	Input 1 terminal (+) active
Terminal 2 (-) passive	Supply and signal circuit, sensor	Input 1 terminal (-) active
Terminal 7 (+) passive	Signal circuit, additional current output	Input 2 terminal (+) active
Terminal 8 (-) passive	Signal circuit, additional current output	Input 2 terminal (-) active

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
- The output signal jumps to the set fault current

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

6 Set up 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. 39: Installing the display and adjustment module in the electronics compartment of the single chamber housing

53567-EN-220620

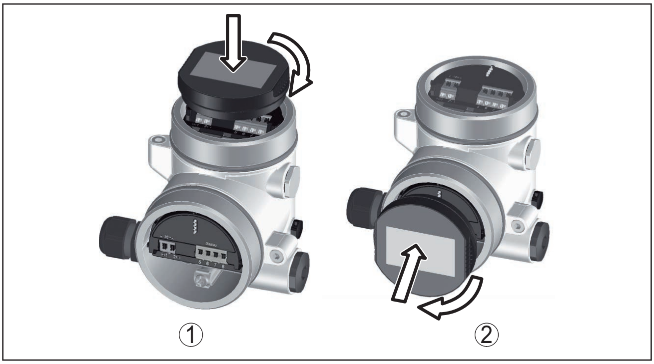


Fig. 40: Installing the display and adjustment module in the double chamber housing

1 *In the electronics compartment*
2 *In the connection compartment*

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

6.2 Adjustment system

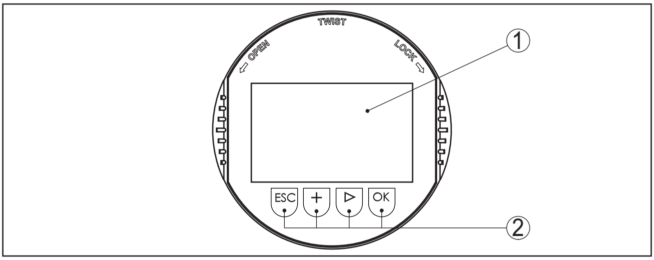


Fig. 41: Display and adjustment elements

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.

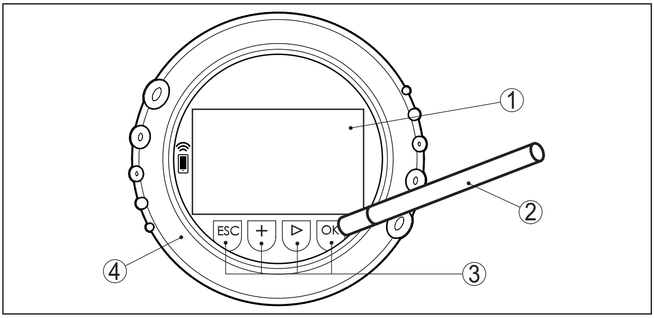


Fig. 42: Display and adjustment elements - with adjustment via magnetic pen

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

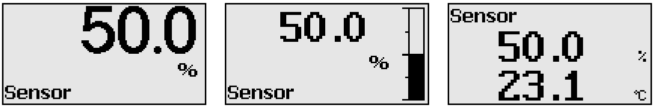
With the ***[->]*** key you can move between three different indication modes.

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.

53567-EN-220620

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

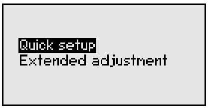
In this menu item, you can select the national language for further parameterization.

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.

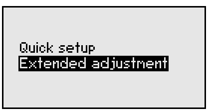
The return to the measured value indication is carried out through the ***[->]*** or ***[ESC]*** keys or automatically after 3 s

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
Display
Diagnostics
Additional adjustments
Info
```

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

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

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

Additional adjustments: date/time, reset, copy function

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

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

The submenu points are described below.

6.5.1 Setup

Measurement loop name

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

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

The available digits include:

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

```
Setup
  Measurement loop name
  Application
  Units
  Sensor mounting correction
  Adjustment
```

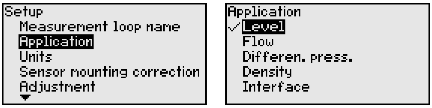
```
Measurement loop name

 Sensor
```

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.

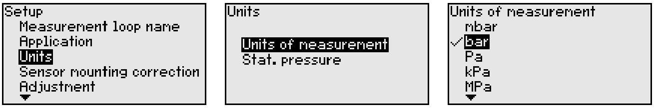


Enter the requested parameters via the appropriate keys, save your settings with ***[OK]*** and jump to the next menu item with the ***[ESC]*** and the ***[->]*** key.

Units

Unit of measurement:

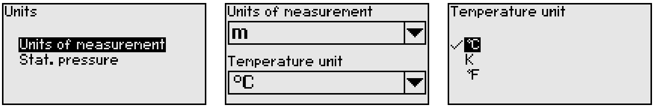
In this menu item, the adjustment units of the instrument are determined. The selection determines the unit displayed in the menu items " *Min. adjustment (Zero)*" and " *Max. adjustment (Span)*".



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

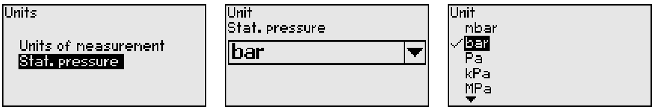
Temperature unit:

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



Unit, static pressure:

The unit "Static pressure" is also set here.



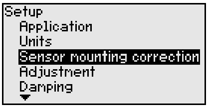
Enter the requested parameters via the appropriate keys, save your settings with ***[OK]*** and jump to the next menu item with the ***[ESC]*** and the ***[->]*** key.

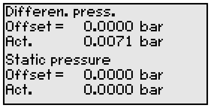
Position correction

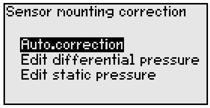
The installation position of the instrument can shift the measured value (offset). The position correction function compensates this offset. In the process the current measured value can be accepted automatically.

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 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:

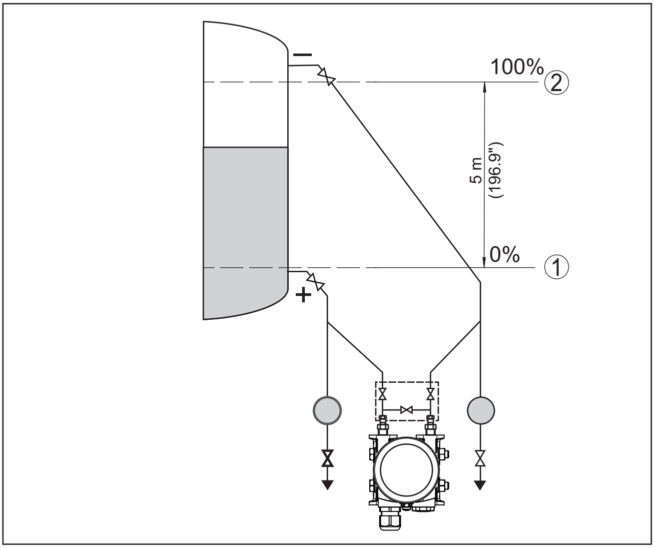


Fig. 43: Parameter adjustment example Min./max. adjustment, level measurement

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

53567-EN-220620

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

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

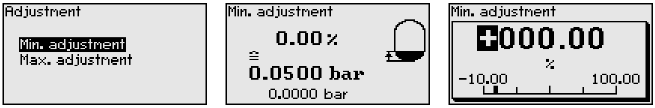
Note:
If the adjustment ranges are exceeded, the entered value will not be accepted. Editing can be interrupted with ***[ESC]*** or corrected to a value within the adjustment ranges.

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

Min. adjustment - Level

Proceed as follows:

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



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

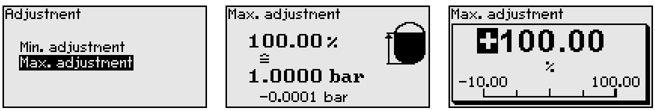
The min. adjustment is finished.

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

Max. adjustment - Level

Proceed as follows:

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



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

5. Save settings with ***[OK]***

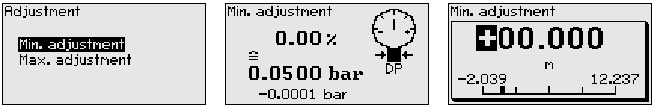
The max. adjustment is finished.

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

Min. adjustment flow

Proceed as follows:

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



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

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

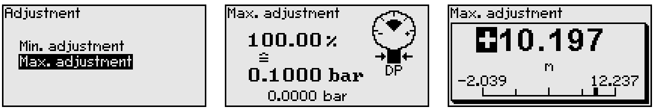
The min. adjustment is finished.

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:

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

53567-EN-220620

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

The zero adjustment is finished.

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

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

Span adjustment differential pressure

Proceed as follows:

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

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

The span adjustment is finished.

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

Distance density

Proceed as follows:

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

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

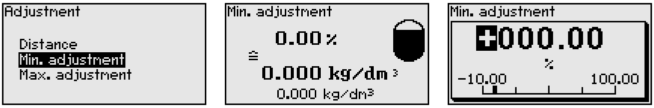
. Set the distance with ***[+]*** and save with ***[OK]***.

The adjustment of the distance is hence finished.

Min. adjustment density

Proceed as follows:

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



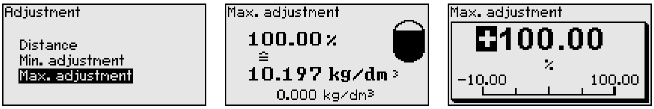
2. Edit the percentage value with ***[OK]*** and set the cursor to the requested position with ***[->]***.
3. Set the requested percentage value with ***[+]*** and save with ***[OK]***. The cursor jumps now to the density value.
4. Enter the min. density corresponding to the percentage value.
5. Save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

The min. adjustment for density is finished.

Max. adjustment density

Proceed as follows:

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



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

The max. adjustment for density is finished.

Distance interface

Proceed as follows:

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

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

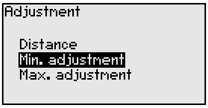
The adjustment of the distance is hence finished.

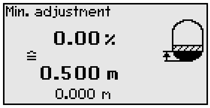
Min. adjustment interface

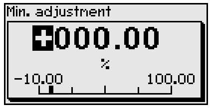
Proceed as follows:

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

53567-EN-220620







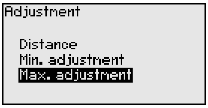
2. Edit the percentage value with ***[OK]*** and set the cursor to the requested position with ***[->]***.
3. Set the requested percentage value with ***[+]*** and save with ***[OK]***. The cursor jumps now to the height value.
4. Enter the min. height of the interface corresponding to the percentage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

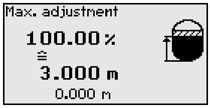
The min. adjustment for interface is thus finished.

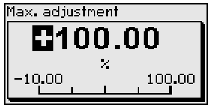
Max. adjustment interface

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]***.







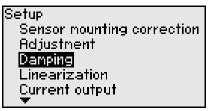
2. Edit the percentage value with ***[OK]*** and set the cursor to the requested position with ***[->]***.
3. Set the requested percentage value with ***[+]*** and save with ***[OK]***. The cursor jumps now to the height value.
4. Enter the max. height of the interface corresponding to the percentage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

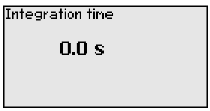
The max. adjustment for interface is finished.

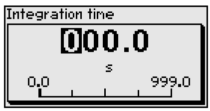
Damping

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 adjusted integration time is effective for all applications of the differential pressure measurement.



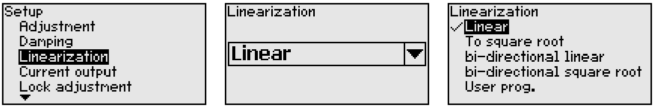




The default setting is a damping of 0 s.

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.

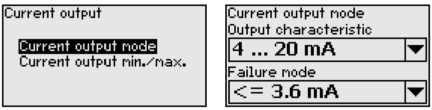
Current output

In the menu items " *Current output*" you determine the properties of the current output.

On instruments with integrated additional current output, the properties for each current output are adjusted individually. The following descriptions apply to both current outputs.

Current output (mode)

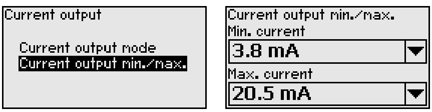
In the menu item " *Current output mode*" you determine the output characteristics and reaction of the current output in case of fault.



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

Current output (min./ max.)

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



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

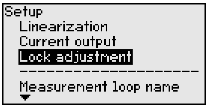
Lock/Unlock adjustment

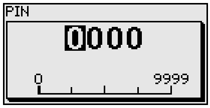
In the menu item " *Lock/unlock adjustment*" you safeguard the sensor parameters against unauthorized or unintentional modifications.

[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.

53567-EN-220620

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

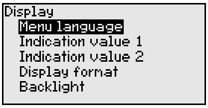
Releasing the sensor adjustment is also possible in any menu item by entering the PIN.

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.



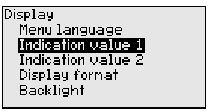
The following languages are available:

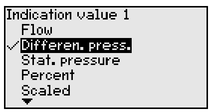
- German
- English
- French
- Spanish
- Russian
- Italian
- Dutch
- Portuguese
- Japanese
- Chinese
- Polish
- Czech
- Turkish

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.

```
Display
  Menu language
  Indication value 1
  Indication value 2
  Display format
  Backlight
```

```
Display format

  Display format 1
  Display format 2
```

```
Display format 1
✓Automatically
  #
  #.#
  #.##
  #.###
```

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*".

```
Display
  Menu language
  Indication value 1
  Indication value 2
  Display format
  Backlight
```

```
Backlight

  Switched on
```

In delivery status, the lighting is switched on.

6.5.3 Diagnostics

Device status

In this menu item, the device status is displayed.

```
Diagnostics
  Device status
  Peak value pressure
  Peak values temperature
  Simulation
```

```
Device status

        OK
```

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

Peak value, pressure

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

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

```
Diagnostics
  Device status
  Peak value pressure
  Peak values temperature
  Simulation
```

```
Differen. press.
Min.          - 0.507 bar
Max.            0.507 bar
Static pressure
Min.             0.00 bar
Max.             0.50 bar
```

```
Reset peak indicator

  Pressure
  Static pressure
```

Peak value, temperature

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

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

```
Diagnostics
  Device status
  Peak value pressure
  Peak values temperature
  Simulation
```

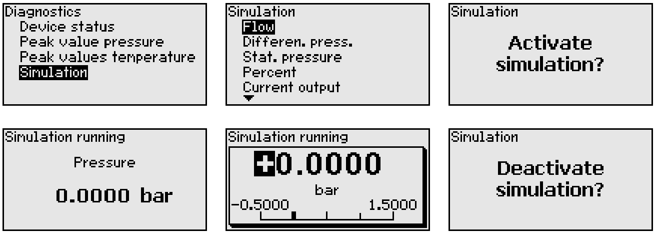
```
Measuring cell temp.
Min.          20.26 °C
Max.          26.59 °C
Electronics temperature
Min.        - 32.80 °C
Max.          38.02 °C
```

```
Reset peak indicator

  Measuring cell temp.
  Electronics temperature
```

Simulation 4 … 20 mA/ HART

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



Select the requested simulation variable and set the requested value.

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

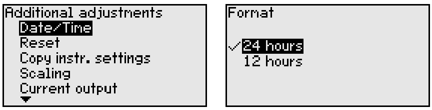
Caution:
During simulation, the simulated value is output as 4 … 20 mA current value and as digital HART signal. The status message within the context of the asset management function is " *Maintenance*".

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

6.5.4 Additional adjustments

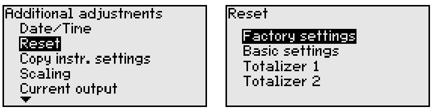
Date/Time

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

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 ≤ 500 mbar) bar (with nominal measuring ranges ≥ 3 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
Linearisation		Linear
Current output	Current output - Mode	Output characteristics 4 … 20 mA Reaction when malfunctions occur ≤ 3.6 mA
	Current output - Min./Max.	3.8 mA 20.5 mA
Lock adjustment		Released

Display

Menu item	Default value
Menu language	Order-specific
Displayed value 1	Current output in %
Displayed value 2	Measuring cell temperature in °C 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 value	Pressure	Actual measured value
	Temperature	Actual temperature values from measuring cell, electronics
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
Current output 1	Current output - Meas. variable	Lin. percent - Level
	Current output - Adjustment	0 … 100 % correspond to 4 … 20 mA
Current output 2	Current output - Meas. variable	Measuring cell temperature
	Current output - Adjustment	0 … 100 °C correspond to 4 … 20 mA
HART mode		Address 0

Copy instrument settings

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

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

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

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

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

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

Scaling (1)

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

```
Additional adjustments
  Reset
  Copy instr. settings
  Scaling
  Current output
  HART operation mode
```

```
Scaling

  Scaling variable
  Scaling format
```

```
  Mass
  Flow
  Volume
  Others
  ---------------------
```

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 %.

```
Additional adjustments
  Reset
  Copy instr. settings
  Scaling
  Current output
  HART operation mode
```

```
Scaling

  Scaling variable
  Scaling format
```

```
Scaling
 100 % =      100
                l
   0 % =        0
                l
```

Current output

In the menu items " *Current output*" you determine the properties of the current output.

On instruments with integrated additional current output, the properties for each current output are adjusted individually. The following descriptions apply to both current outputs.

Current output 1 and 2 (size)

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

```
Additional adjustments
  Copy instr. settings
  Scaling
  Current output
  HART operation mode
  DP flow element
```

```
Current output

  Current output variable
  Current output, adjustment
```

```
Current output variable
✓ Flow
  Differen. press.
  Stat. pressure
  Percent
  Scaled
```

The following selection is possible depending on the selected application:

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

Current output (adjustment)

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

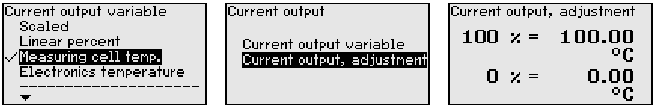
```
Additional adjustments
  Special parameter
  Scaling
  Current output
  HART mode
  ---------------------
```

```
Current output

  Current output variable
  Current output, adjustment
```

```
Current output, adjustment
 100 % =   100.00
               %
   0 % =     0.00
               %
```

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



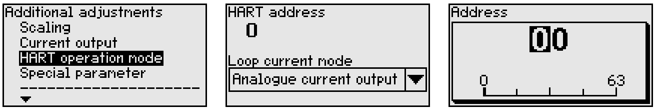
HART mode

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

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

If you select the function " *Analogue current output*" and also enter an address number, you can output a 4 … 20 mA signal in Multidrop mode.

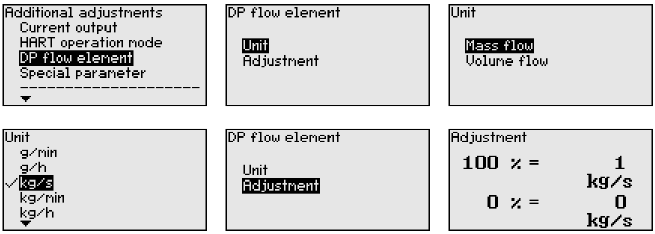
In the mode " *Fixed current (4 mA)*" a fixed 4 mA signal is output independently of the actual level.



The setting in the delivery status is " *Analogue current output*" and the address 00.

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.

```
Additional adjustments
  HART operation mode
  DP flow element
  Special parameter
  --------------------
  Date/Time
```

```
Service login
```

6.5.5 Info

Device name

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

```
Info
  Device name
  Instrument version
  Factory calibration date
  Sensor characteristics
```

Instrument version

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

```
Info
  Device name
  Instrument version
  Factory calibration date
  Sensor characteristics
```

Factory calibration date

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

```
Info
  Device name
  Instrument version
  Factory calibration date
  Sensor characteristics
```

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.

```
Info
  Device name
  Instrument version
  Factory calibration date
  Sensor characteristics
```

6.6 Save parameter adjustment data

On paper

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

In the display and adjustment module

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

53567-EN-220620

7 Set up sensor with PACTware

7.1 Connect the PC

Via the interface adapter directly on the sensor

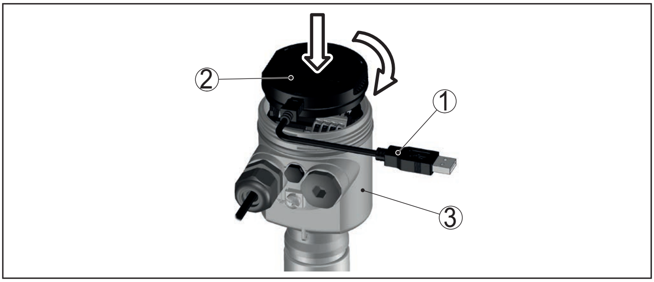


Fig. 44: Connection of the PC directly to the sensor via the interface adapter

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

Via the interface adapter and HART

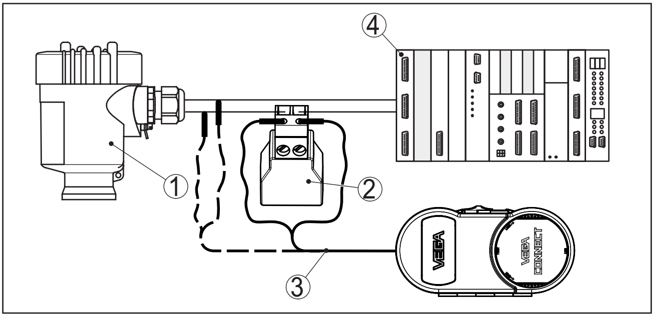


Fig. 45: Connecting the PC via HART to the signal cable

1 Sensor
2 HART resistance 250 Ω (optional depending on evaluation)
3 Connection cable with 2 mm pins and terminals
4 Processing system/PLC/Voltage supply
5 Interface adapter, for example VEGACONNECT 4

Note:
With power supply units with integrated HART resistance (internal resistance approx. 250 Ω), an additional external resistance is not necessary. This applies, e.g. to the VEGA instruments VEGATRENN 149A, VEGAMET 381, VEGAMET 391. Common Ex separators are also usually equipped with a sufficient current limiting resistance. In such cases, the interface adapter can be connected parallel to the 4 … 20 mA cable (dashed line in the previous illustration).

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.

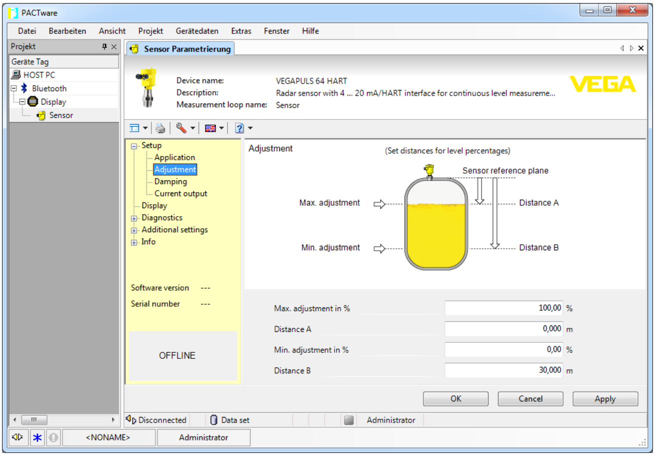


Fig. 46: Example of a DTM view

Standard/Full version

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

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

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

7.3 Save parameter adjustment data

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

8 Set up sensor with other systems

8.1 DD adjustment programs

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

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

8.2 Field Communicator 375, 475

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

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

In the HART communication, the Universal Commands and a part of the Common Practice Commands are supported.

9 Set up measuring system

9.1 Level measurement

Closed vessel

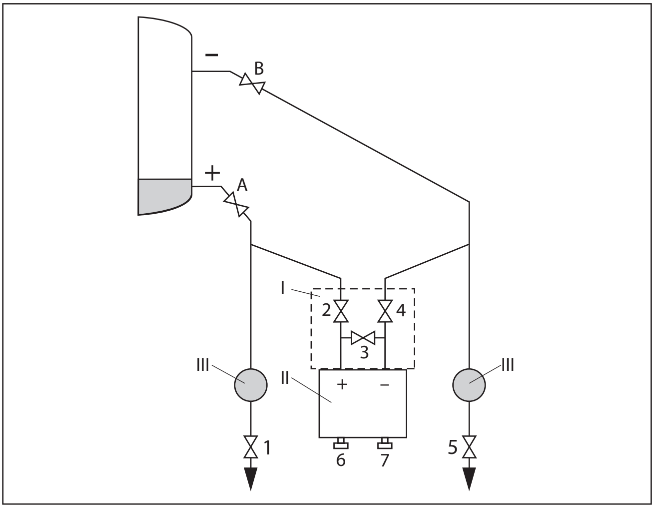


Fig. 47: Preferred measurement setup for closed vessels

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

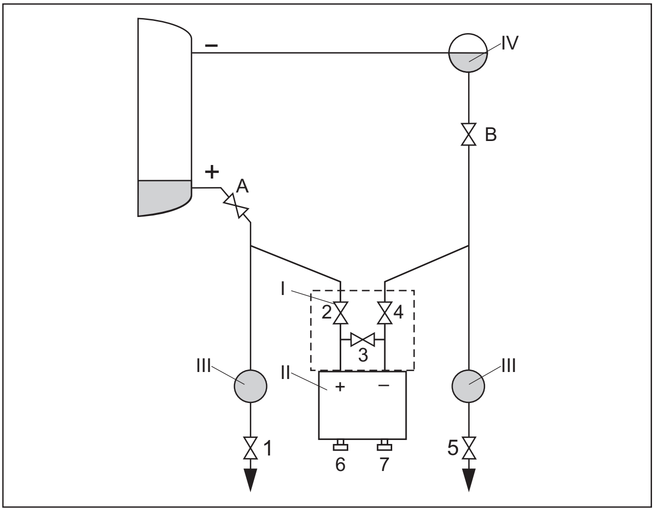


Fig. 48: Preferred measurement setup for closed vessels with steam overlay

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.

53567-EN-220620

9.2 Flow measurement

Gases

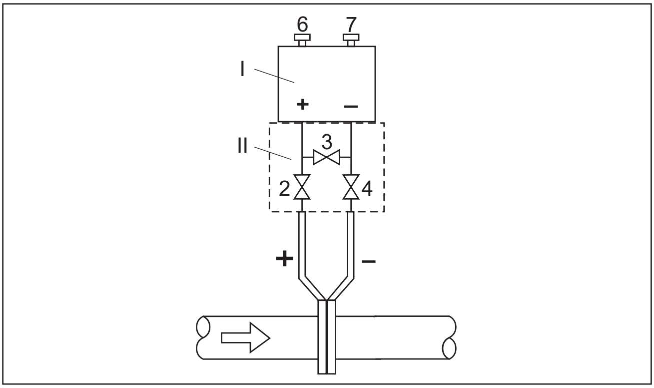


Fig. 49: Prefered measurement setup for gases, connection via 3-fold valve block, flanging on both sides

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

Liquids

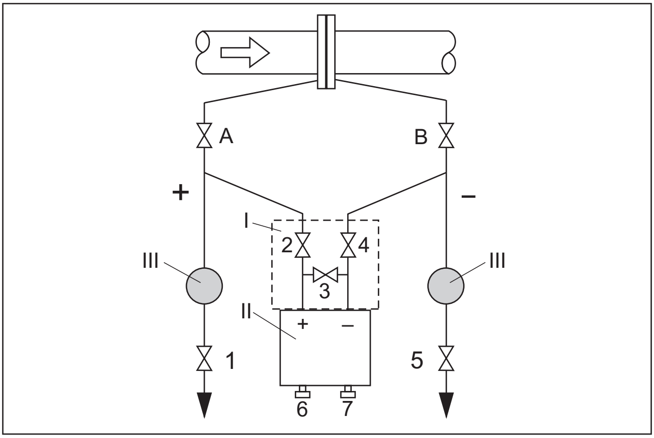


Fig. 50: Preferred measurement setup for liquids

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:

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.

10 Diagnosis, asset management and service

10.1 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

10.2 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.

10.3 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:

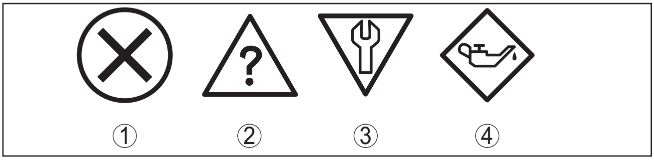


Fig. 51: Pictographs of the status messages

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

53567-EN-220620

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. 6: 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. 7: 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

10.4 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.

4 … 20 mA signal

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

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

Reaction after fault rectification

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

24 hour service hotline

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

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

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

10.5 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.

10.6 Exchange process module on version IP68 (25 bar)

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

Required tools:

- Hexagon key wrench, size 2

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

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

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

Proceed as follows when carrying out the exchange:

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

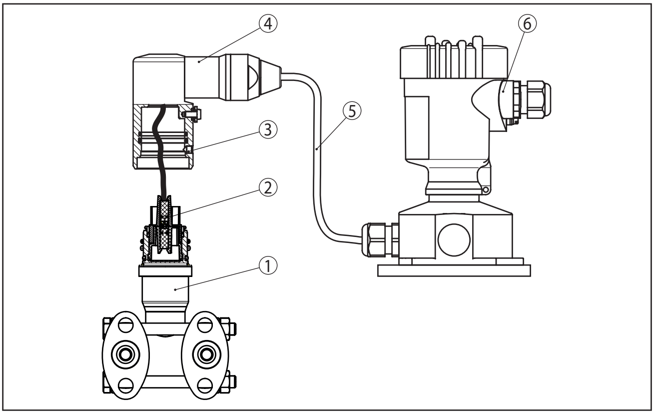


Fig. 52: VEGADIF 85 in IP68 version, 25 bar and lateral cable outlet, external housing

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

53567-EN-220620

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.

10.7 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.

10.8 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.

10.9 How to proceed if a repair is necessary

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

Proceed as follows in case of repair:

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

11 Dismount

11.1 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.

11.2 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.

12 Supplement

12.1 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 A2-70, hexagon nut DIN 934 M8 A2-70
– 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

53567-EN-220620

– 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

Pressure ranges in bar/Pa

Nominal range	Lower measurement limit	Upper measuring limit
10 mbar (1 kPa)	-10 mbar (-3 kPa)	+10 mbar (+3 kPa)
30 mbar (3 kPa)	-30 mbar (-3 kPa)	+30 mbar (+3 kPa)
100 mbar (10 kPa)	-100 mbar (-10 kPa)	+100 mbar (+10 kPa)
500 mbar (50 kPa)	-500 mbar (-50 kPa)	+500 mbar (+50 kPa)
3 bar (300 kPa)	-3 bar (-300 kPa)	+3 bar (+300 kPa)
16 bar (1600 kPa)	-16 bar (-1600 kPa)	+16 bar (+1600 kPa)
40 bar (4000 kPa)	-40 bar (-4000 kPa)	+40 bar (+4000 kPa)

Pressure ranges in psi

Nominal range	Lower measurement limit	Upper measuring limit
0.15 psig	-0.15 psig	+0.15 psig
0.45 psig	-0.45 psig	+0.45 psig
1.5 psig	-1.5 psig	+1.5 psig
7.5 psig	-7.5 psig	+7.5 psig
45 psig	-45 psig	-45 psig
240 psig	-240 psig	+240 psig
580 psig	-580 psig	+580 psig

[7)] 4 layers PTFE

Adjustment ranges [8)]

Maximum permissible Turn Down	Unlimited (recommended up to 20 : 1)
Adjustment differential pressure	
Zero/Span adjustment:	
– Pressure value zero	-120 … +120 %
– Pressure value span	Zero + (-240 … +240 %)
Adjustment level	
Min./Max. adjustment:	
– Percentage value	-10 … +110 %
– Pressure value	-120 … +120 %
Adjustment flow	
Zero/Span adjustment:	
– Pressure value zero	-120 … +120 %
– Pressure value span	-120 … +120 %

Switch-on phase

Start-up time with operating voltage U_B	
– ≥ 12 V DC	≤ 9 s
– < 12 V DC	≤ 22 s
Starting current (for run-up time)	≤ 3.6 mA

Output variable

Output signal	4 … 20 mA/HART
Range of the output signal	3.8 … 20.5 mA/HART (default setting)
Fulfilled HART specification	7.3
Signal resolution	0.3 µA
Fault signal, current output (adjustable)	≤ 3.6 mA, ≥ 21 mA, last measured value [9)]
Max. output current	21.5 mA
Load	See load resistance under Power supply
Starting current	≤ 10 mA for 5 ms after switching on, ≤ 3.6 mA
Damping (63 % of the input variable), adjustable	0 … 999 s
HART output values according to HART 7 (default setting) [10)]	
– First HART value (PV)	Linear percentage value
– Second HART value (SV)	Static pressure
– Third HART value (TV)	Differential pressure
– Fourth HART value (QV)	Electronics temperature

Output variable - Additional current output

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

[8)] The specifications refer to the nominal measuring range.
[9)] Last measured value not possible with SIL.
[10)] The output values can be assigned individually.

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

Dynamic behaviour output

Dynamic characteristics depending on medium and temperature

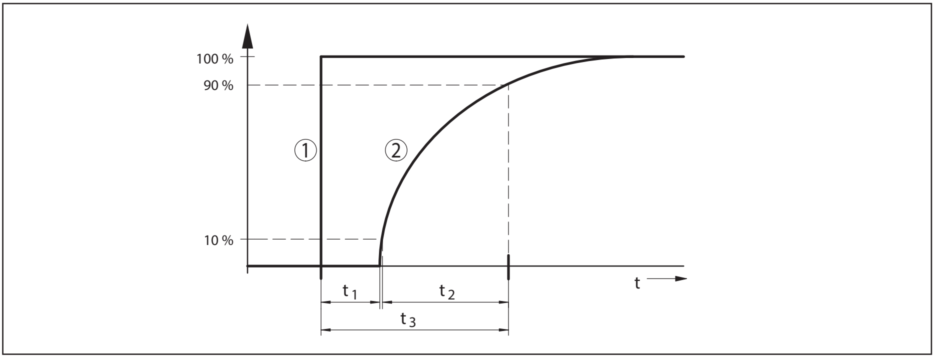


Fig. 53: Behaviour in case of sudden change of the process variable. t_1: dead time; t_2: rise time; t_3: jump response time

1 Process variable
2 Output signal

Version, nominal measuring range	Dead time t_1	Rise time t_2	Step response time t_3
Basic version 10 bar and 30 bar	160 ms	115 ms	275 ms
Basic version 100 mbar	130 ms	95 ms	225 ms
Basic version 500 mbar		75 ms	205 ms
Basic version, 3 bar		60 ms	190 ms
Basic version, 16 bar			
Chemical seal version, all nominal measuring ranges	Dependent on the chemical seal	Dependent on the chemical seal	Dependent on the chemical seal
Version IP68 (25 bar)	additionally 50 ms	additionally 150 ms	additionally 200 ms

Damping (63 % of the input variable)	0 … 999 s, adjustable via menu item " *Damping*"

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

<table>
<tr><th>Measuring range</th><th>TD ≤ 5 : 1</th><th>TD > 5 : 1</th><th>TD > 10 : 1</th></tr>
<tr><td>10 mbar (1 kPa)/0.145 psi</td><td rowspan="2">< ±0.1 %</td><td colspan="2" rowspan="2">< ±0.02 % x TD</td></tr>
<tr><td>30 mbar (3 kPa)/0.44 psi</td></tr>
<tr><td>100 mbar (10 kPa)/1.5 psi</td><td colspan="2" rowspan="4">< ±0.065 %</td><td rowspan="2">< ±0.035 % + 0.01 % x TD</td></tr>
<tr><td>500 mbar (50 kPa)/7.3 psi</td></tr>
<tr><td>3 bar (300 kPa)/43.51 psi</td><td>< ±0.015 % + 0.005 % x TD</td></tr>
<tr><td>16 bar (1600 kPa)/232.1 psi</td><td>< ±0.035 % + 0.01 % x TD</td></tr>
</table>

Static pressure

<table>
<tr><th>Measuring range</th><th>Up to nominal pressure [11]</th><th>TD 1:1</th></tr>
<tr><td>10 mbar (1 kPa)/0.145 psi</td><td rowspan="2">40 bar (4000 kPa)</td><td rowspan="6">< ±0.1 %</td></tr>
<tr><td>30 mbar (3 kPa)/0.44 psi</td></tr>
<tr><td>100 mbar (10 kPa)/1.5 psi</td><td rowspan="4">160 bar (16000 kPa)
resp.
400 bar (40000 kPa)</td></tr>
<tr><td>500 mbar (50 kPa)/7.3 psi</td></tr>
<tr><td>3 bar (300 kPa)/43.51 psi</td></tr>
<tr><td>16 bar (1600 kPa)/232.1 psi</td></tr>
</table>

Flow > 50 %[12]

<table>
<tr><th>Measuring range</th><th>TD ≤ 5 : 1</th><th>TD > 5 : 1</th><th>TD > 10 : 1</th></tr>
<tr><td>10 mbar (1 kPa)/0.145 psi</td><td rowspan="2">< ±0.1 %</td><td rowspan="2" colspan="2">< ±0.02 % x TD</td></tr>
<tr><td>30 mbar (3 kPa)/0.44 psi</td></tr>
<tr><td>100 mbar (10 kPa)/1.5 psi</td><td rowspan="4" colspan="2">< ±0.065 %</td><td>< ±0.035 % + 0.01 % x TD</td></tr>
<tr><td>500 mbar (50 kPa)/7.3 psi</td><td rowspan="2">< ±0.015 % + 0.005 % 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>< ±0.035 % + 0.01 % x TD</td></tr>
</table>

25 % < Flow ≤ 50 %[13]

<table>
<tr><th>Measuring range</th><th>TD ≤ 5 : 1</th><th>TD > 5 : 1</th><th>TD > 10 : 1</th></tr>
<tr><td>10 mbar (1 kPa)/0.145 psi</td><td rowspan="2">< ±0.2 %</td><td rowspan="2" colspan="2">< ±0.04 % x TD</td></tr>
<tr><td>30 mbar (3 kPa)/0.44 psi</td></tr>
<tr><td>100 mbar (10 kPa)/1.5 psi</td><td rowspan="4" colspan="2">< ±0.13 %</td><td>< ±0.07 % + 0.02 % x TD</td></tr>
<tr><td>500 mbar (50 kPa)/7.3 psi</td><td rowspan="2">< ±0.03 % + 0.01 % 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>< ±0.07 % + 0.02 % x TD</td></tr>
</table>

Influence of the medium or ambient temperature

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

Thermal change zero signal and output span, differential pressure[14]

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

[11] Measuring range end, absolute pressure
[12] Root characteristic
[13] Root characteristic
[14] Relating to the adjusted span.

Measuring range	-10 … +60 °C / +14 … +140 °F	-40 … -10 °C / -40 … +14 °F und +60 … +85 °C /+140 … +185 °F
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[15)]

Measuring range	Up to nominal pressure [16)]	-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		

Thermal change current output through ambient temperature

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

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

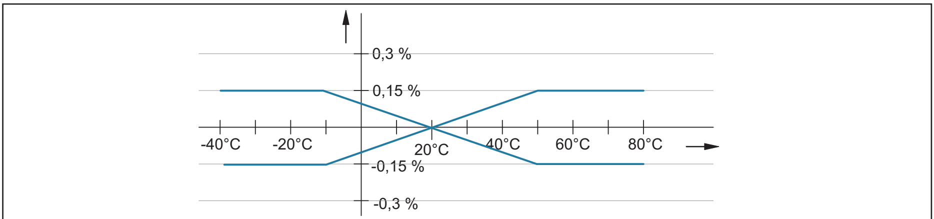


Fig. 54: Thermal change, current output

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 [17)]	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)			

15) Relating to the measuring range end value.
16) Measuring range end, absolute pressure.
17) Measuring range end, absolute pressure.

<table>
<tr><th>Nominal range</th><th>Up to nominal pressure [17]</th><th>Influence on the zero point</th><th>Influence on the span</th></tr>
<tr><td>100 mbar (10 kPa), (1.5 psi)</td><td rowspan="4">160 bar (16000 kPa), (2400 psi)
400 bar (4000 kPa), (5800 psi)</td><td rowspan="4">160 bar (16000 kPa), (2400 psi):
< ±0.10 % x TD
400 bar(4000 kPa), (5800 psi):
≤ 0.25 % x TD</td><td rowspan="4">160 bar(16000 kPa), (2400 psi):
< ±0.10 %
400 bar(4000 kPa), (5800 psi):
≤ 0.25 %</td></tr>
<tr><td>500 mbar (50 kPa), (7.3 psi)</td></tr>
<tr><td>3 bar (300 kPa), (43.51 psi)</td></tr>
<tr><td>16 bar (1600 kPa), (232.1 psi)</td></tr>
</table>

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 [1]	< 0.065 % x TD	< 0.1 % x TD	< 0.15 % x TD
Static pressure [1]	< ±0.065 %	< ±0.1 %	< ±0.15 %

Process conditions

Process temperature [1]

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)
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 [1]

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) [1]

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) [1]

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

53567-EN-220620

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 IP66/IP68 (1 bar)

Connection cable, mechanical data

- Configuration: Wires, strain relief, breather capillaries, screen braiding, metal foil, mantle
- Standard length: 5 m (16.4 ft)
- Min. bending radius (at 25 °C/77 °F): 25 mm (0.984 in)
- Diameter: approx. 8 mm (0.315 in)
- Colour - version PE: Black
- Colour - version PUR: Blue

Connection cable, electrical data

- Wire cross-section: 0.5 mm² (AWG 20)
- Wire resistance R´: 0.037 Ω/m (0.012 Ω/ft)

Electromechanical data - version IP68 (25 bar)

Connection cable, mechanical data

- Configuration: Wires, strain relief, breather capillaries, screen braiding, metal foil, mantle
- Standard length: 5 m (16.40 ft)
- Max. length: 25 m (82.02 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)

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 U_B	11 … 35 V DC
Operating voltage U_B with lighting switched on	16 … 35 V DC
Reverse voltage protection	Integrated
Permissible residual ripple	
– for U_N 12 V DC (11 V < U_B < 14 V)	≤ 0.7 V_{eff} (16 … 400 Hz)
– for U_N 24 V DC (18 V < U_B < 35 V)	≤ 1.0 V_{eff} (16 … 400 Hz)
Load resistor	
– Calculation	$(U_B - U_{min})$/0.022 A
– Example - U_B= 24 V DC	(24 V - 11 V)/0.022 A = 591 Ω

Potential connections and electrical separating measures in the instrument

Electronics	Not non-floating
Reference voltage [1]	500 V AC
Conductive connection	Between ground terminal and metallic process fitting

Electrical protective measures [1]

Housing material	Version	Protection acc. to IEC 60529	Protection acc. to NEMA
Plastic	Single chamber	IP66/IP67	Type 4X
	Double chamber		

53567-EN-220620

Housing material	Version	Protection acc. to IEC 60529	Protection acc. to NEMA
Aluminium	Single chamber	IP66/IP67 IP66/IP68 (0.2 bar) IP68 (1 bar)	Type 4X Type 6P -
	Double chamber	IP66/IP67 IP66/IP68 (0.2 bar)	Type 4X Type 6P
Stainless steel (electro-polished)	Single chamber	IP66/IP67 IP69K	Type 4X
Stainless steel (precision casting)	Single chamber	IP66/IP67 IP66/IP68 (0.2 bar) IP68 (1 bar)	Type 4X Type 6P -
	Double chamber	IP66/IP67 IP66/IP68 (0.2 bar)	Type 4X Type 6P
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 [1)]	2
Protection rating (IEC/EN 61010-1)	II

12.2 Calculation of the total deviation

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

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

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

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

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

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)

53567-EN-220620

- F_{Kl}: Deviation
- F_a: Thermal change of the current output
- FMZ: Additional factor measuring cell version
- FTD: Additional factor Turn down

12.3 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 % + 0.20 % 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

<table>
<tr><th>Measuring range</th><th>TD 1 : 1 up to 5 : 1</th><th>TD > 5 : 1</th><th>TD > 10 : 1</th></tr>
<tr><td>10 mbar (1 kPa)/0.145 psi</td><td rowspan="2">< ±0.1 %</td><td rowspan="2" colspan="2">< ±0.02 % x TD</td></tr>
<tr><td>30 mbar (3 kPa)/0.44 psi</td></tr>
<tr><td>100 mbar (10 kPa)/1.5 psi</td><td rowspan="4" colspan="2">< ±0.065 %</td><td rowspan="2">< ±(0.035 % + 0.01 %) x TD</td></tr>
<tr><td>500 mbar (50 kPa)/7.3 psi</td></tr>
<tr><td>3 bar (300 kPa)/43.51 psi</td><td>< ±(0.015 % + 0.005 %) x TD</td></tr>
<tr><td>16 bar (1600 kPa)/232.1 psi</td><td>< ±(0.035 % + 0.01 %) x TD</td></tr>
</table>

Long-term stability

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

4. Calculation of the total deviation - digital output signal

- 1. step: Basic deviation 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)

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

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

$F_{stab} = 0.13\ \%$

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

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

- 1. step: Basic deviation F_{perf}

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

$F_T = 0.25\ \%$

$F_{Kl} = 0.065\ \%$

$F_a = 0.15\ \%$

$F_{perf} = \sqrt{(0.25\ \%)^2 + (0.065\ \%)^2 + (0.15\ \%)^2)}$

$F_{perf} = 0.3\ \%$

- 2. step: Total deviation F_{total}

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

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

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

$F_{stab} = 0.13\ \%$

$F_{total} = 0.3\ \% + 0.13\ \% = 0.43\ \%$

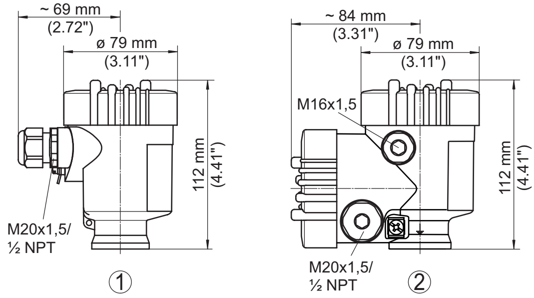
The total percentage deviation of the measurement is thus 0.43 %. The absolute total deviation is 0.43 % of 250 mbar = 1.1 mbar

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.

12.4 Dimensions, versions process component

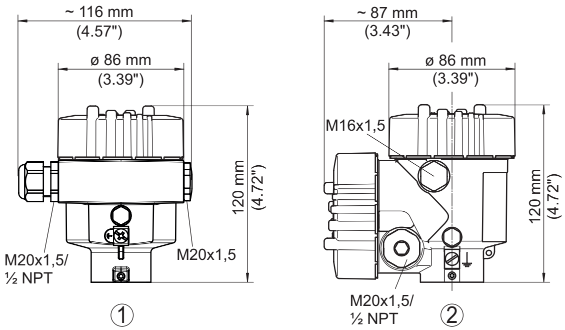
The following dimensional drawings represent only an extract of the possible versions. Detailed dimensional drawings can be downloaded at www.vega.com under " *Downloads*" and " *Drawings*".

Plastic housing



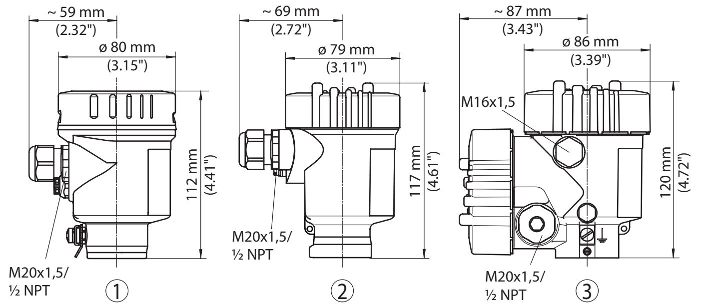
1 *Plastic single chamber*
2 *Plastic double chamber*

Aluminium housing



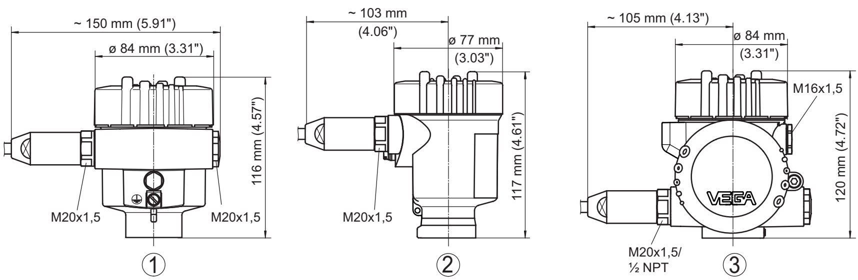
1 *Aluminium - single chamber*
2 *Aluminium - double chamber*

Stainless steel housing



1 *Stainless steel single chamber (electropolished)*
2 *Stainless steel single chamber (precision casting)*
3 *Stainless steel double chamber housing (precision casting)*

Aluminium and stainless steel housing in protection IP66/IP68 (1 bar)



1 *Aluminium - single chamber*
2 *Stainless steel single chamber (precision casting)*
3 *Aluminium double chamber, stainless steel double chamber (precision casting)*

External housing with IP68 (25 bar) version

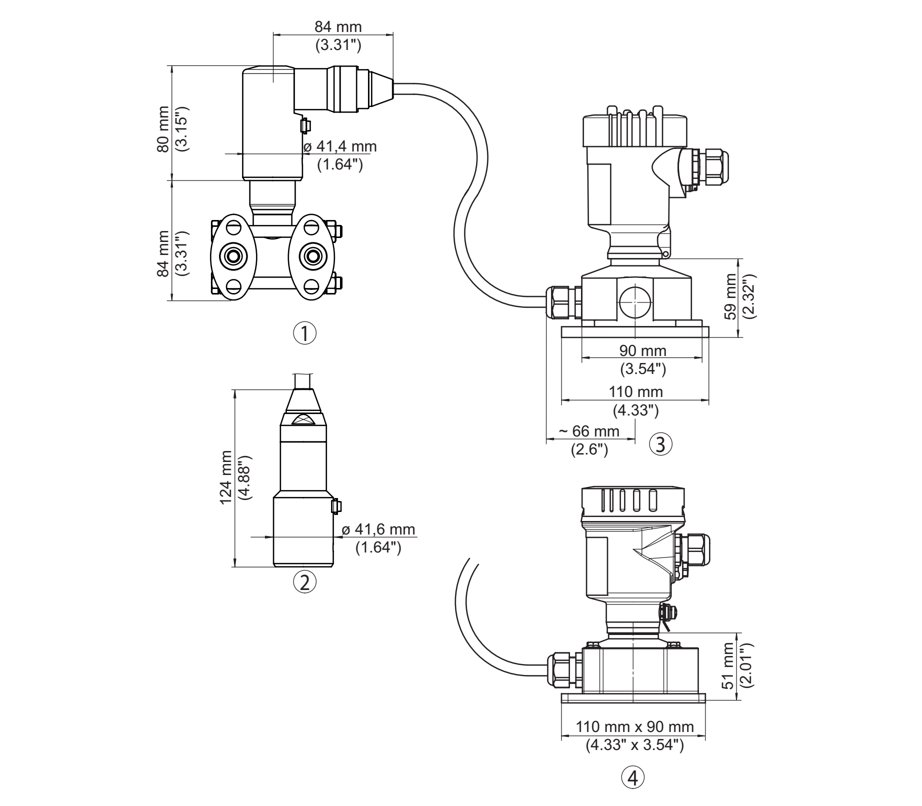


Fig. 55: External housing

1 *Lateral cable outlet*
2 *Cable outlet axial*
3 *Plastic single chamber*
4 *Stainless steel single chamber*

53567-EN-220620

Ventilation on process axis

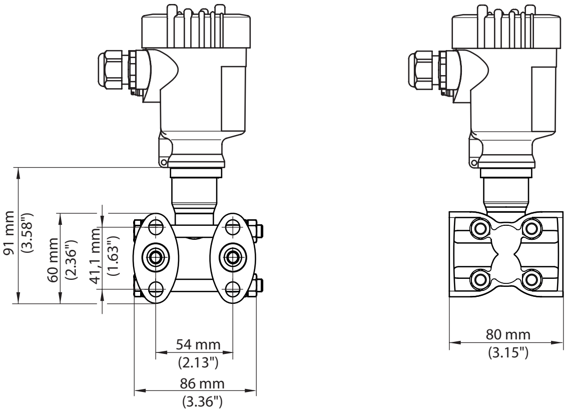


Fig. 56: VEGADIF 85, ventilation on process axis

Connection	Fastening	Material	Scope of delivery
¼-18 NPT, IEC 61518	7/16-20 UNF	316L	incl. 2 vent valves 316L
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)	

Lateral ventilation

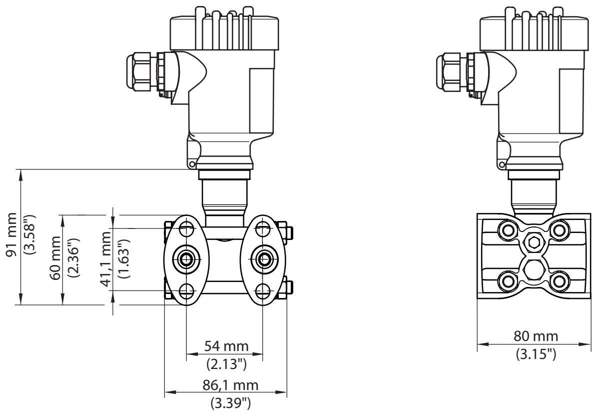


Fig. 57: VEGADIF 85, lateral ventialtion

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

Oval flange, prepared for chemical seal connection

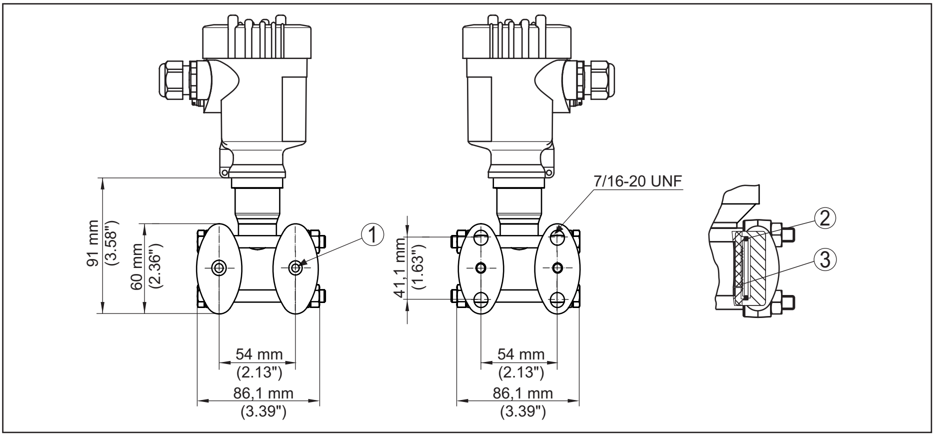


Fig. 58: left: Process fitting VEGADIF 85 prepared for chemical seal assembly. right: Position of the copper ring seal

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

53567-EN-220620

12.5 Industrial property rights

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