BA00382P/00/EN/20.16
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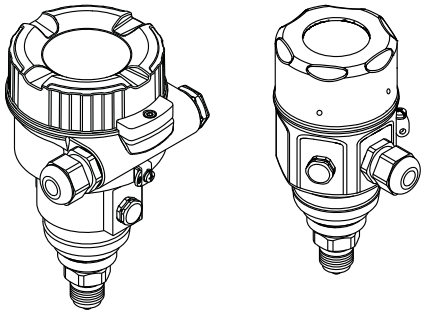
Valid from software version:
01.00.zz

Operating Instructions
Cerabar M
Deltabar M
Deltapilot M

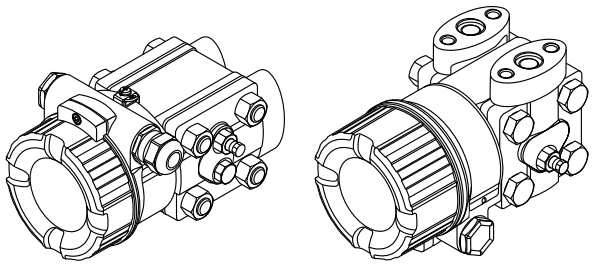
Process pressure / Differential pressure, Flow / Hydrostatic

HART COMMUNICATION PROTOCOL

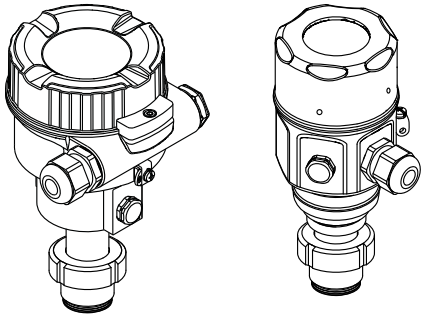
Cerabar M



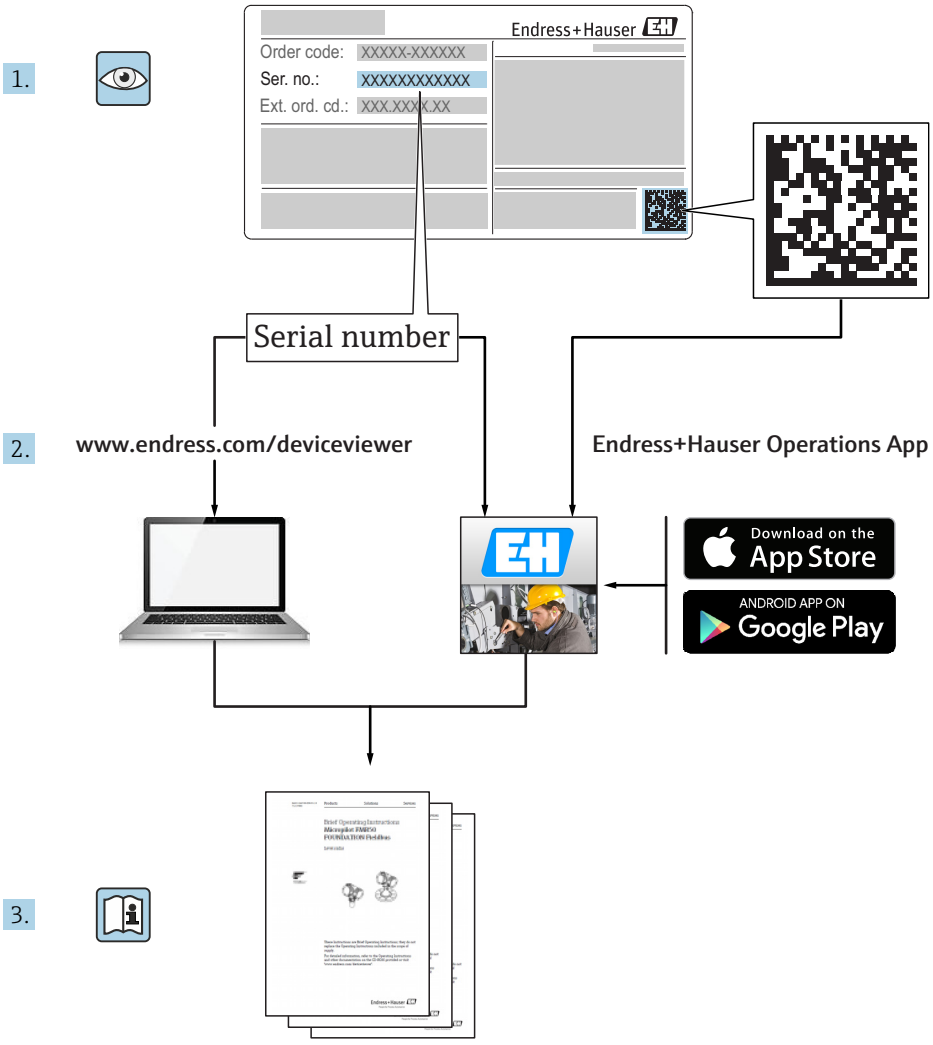
Deltabar M



Deltapilot M



Endress+Hauser
People for Process Automation



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Make sure the document is stored in a safe place such that it is always available when working on or with the device.
To avoid danger to individuals or the facility, read the "Basic safety instructions" section carefully, as well as all other safety instructions in the document that are specific to working procedures.
The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser distributor will supply you with current information and updates to these Instructions.

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1 Document information

1.1 Document function

These Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

1.2 Symbols used

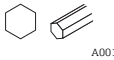
1.2.1 Safety symbols

Symbol	Meaning
A0011189-DE	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in seriousor fatal injury.
A0011190-DE	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in seriousor fatal injury.
A0011191-DE	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minoror medium injury.
A0011192-DE	**NOTICE!** This symbol contains information on procedures and other facts which do not result in personalinjury.

1.2.2 Electrical symbols

Symbol	Meaning	Symbol	Meaning
	Direct current		Alternating current
	Direct current and alternating current		**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	Protective ground connection A terminal which must be connected to ground prior to establishing any other connections.		**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

1.2.3 Tool symbols

Symbol	Meaning
 A0011221	Allen key
A0011222	Hexagon wrench

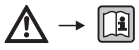
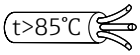
1.2.4 Symbols for certain types of information

Symbol	Meaning
A0011182	**Permitted** Indicates procedures, processes or actions that are permitted.
A0011184	**Forbidden** Indicates procedures, processes or actions that are forbidden.
A0011193	**Tip** Indicates additional information.
A0015482	Reference to documentation
A0015484	Reference to page
A0015487	Reference to graphic
1. , 2. , ...	Series of steps
A0018343	Result of a sequence of actions
A0015502	Visual inspection

1.2.5 Symbols in graphics

Symbol	Meaning
1, 2, 3, 4, ...	Item numbers
1. , 2. , ...	Series of steps
A, **B**, **C**, **D**, ...	Views

1.2.6 Symbols at the device

Symbol	Meaning
 A0019159	**Safety instructions** Observe the safety instructions contained in the associated Operating Instructions.
	**Connecting cable immunity to temperature change** Indicates that the connecting cables have to withstand a temperature of 85°C at least.

1.2.7 Registered trademarks

KALREZ®, VITON®, TEFLON®
Registered label of E.I. Du Pont de Nemours & Co., Wilmington, USA

TRI-CLAMP®
Registered label of Ladish & Co., Inc., Kenosha, USA

HART®
Registered trademark of the FieldComm Group, Austin, USA

GORE-TEX®
Registered label of W.L. Gore & Associates, Inc., USA

2 Basic safety instructions

2.1 Requirements concerning the staff

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:
- Trained, qualified specialists: must have a relevant qualification for this specific function and task
- Are authorized by the plant owner/operator
- Are familiar with federal/national regulations
- Before beginning work, the specialist staff must have read and understood the instructions in the Operating Instructions and supplementary documentation as well as in the certificates (depending on the application)
- Following instructions and basic conditions

The operating personnel must fulfill the following requirements:
- Being instructed and authorized according to the requirements of the task by the facility's owner-operator
- Following the instructions in these Operating Instructions

2.2 Designated use

The **Cerabar M** is a pressure transmitter for measuring level and pressure.
The **Deltabar M** is a differential pressure transmitter for measuring differential pressure, flow and level.
The **Deltapilot M** is a hydrostatic pressure sensor for measuring level and pressure.

2.2.1 Incorrect use

The manufacturer is not liable for damage caused by improper or non-designated use.
Verification for borderline cases:
For special fluids and fluids for cleaning, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of fluid-wetted materials, but does not accept any warranty or liability.

2.3 Workplace safety

For work on and with the device:
- Wear the required personal protective equipment according to federal/national regulations.
- Switch off the supply voltage before connecting the device.

2.4 Operational safety

Risk of injury!
- ▶ Operate the device in proper technical condition and fail-safe condition only.
- ▶ The operator is responsible for interference-free operation of the device.
- ▶ Only disassemble the device in pressurless condition!

Conversions to the device
Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers:
- ▶ If, despite this, modifications are required, consult with Endress+Hauser.

Repair
To ensure continued operational safety and reliability,

- ▶ Carry out repairs on the device only if they are expressly permitted.
- ▶ Observe federal/national regulations pertaining to repair of an electrical device.
- ▶ Use original spare parts and accessories from Endress+Hauser only.

2.5 Hazardous area

To eliminate a danger for persons or for the facility when the device is used in the hazardous area (e.g. explosion protection, pressure vessel safety):

- Based on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area.
- Observe the specifications in the separate supplementary documentation that is an integral part of these Instructions.

2.6 Product safety

This measuring device is designed in accordance with good engineering practice to meet state-of-the- art safety requirements, has been tested, and left the factory in a condition in which they are safe to operate. It fulfills general safety requirements and legal requirements. It also conforms to the EC directives listed in the device-specific EC declaration of conformity. Endress+Hauser confirms this fact by applying the CE mark.

2.7 Functional Safety SIL (optional)

If using devices for applications with safety integrity, the Functional Safety Manual (SD00347P/00/EN) must be observed thoroughly.

3 Identification

3.1 Product identification

The following options are available for identification of the measuring device:
- Nameplate specifications
- Order code with breakdown of the device features on the delivery note
- Enter serial numbers from nameplates in W@M Device Viewer (www.endress.com/deviceviewer): All information about the measuring device is displayed.

For an overview of the technical documentation provided, enter the serial number from the nameplates in the W@M Device Viewer (www.endress.com/deviceviewer).

3.2 Device designation

3.2.1 Device identification via the nameplate

- The MWP (maximum working pressure) is specified on the nameplate. This value refers to a reference temperature of 20°C (68°F) or 100°F (38 °C) for ANSI flanges.
- The pressure values permitted at higher temperatures can be found in the following standards:
  – EN 1092-1: 2001 Tab. 18 [1)]
  – ASME B 16.5a – 1998 Tab. 2-2.2 F316
  – ASME B 16.5a – 1998 Tab. 2.3.8 N10276
  – JIS B 2220
- The test pressure corresponds to the over pressure limit (OPL) of the device = MWP x 1.5 [2)].
- The Pressure Equipment Directive (EC Directive 97/23/EC) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP (maximum working pressure) of the measuring device.

1) With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are grouped together under 13EO in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.
2) The equation does not apply for PMP51 and PMP55 with a 40 bar (600 psi) or a 100 bar (1500 psi) measuring cell.

Aluminum housing

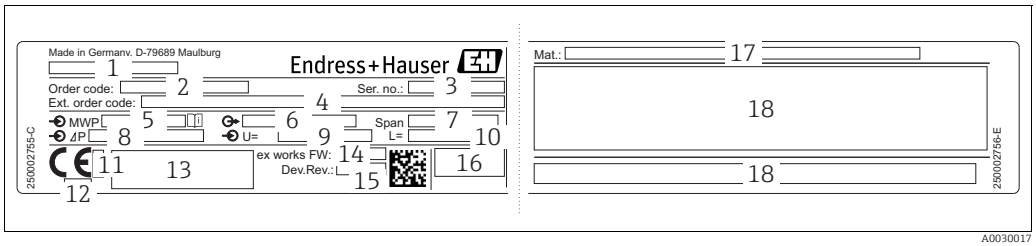


Fig. 1: Nameplate

1 Device name
2 Order code (for re-orders)
3 Serial number (for identification)
4 Extended order code (complete)
5 MWP (maximum working pressure)
6 Electronic version (output signal)
7 Min./max. span
8 Nominal measuring range
9 Supply voltage
10 Unit of length
11 ID number of notified body with regard to ATEX (optional)
12 ID number of notified body with regard to Pressure Equipment Directive (optional)
13 Approvals
14 Device version
15 Software version
16 Degree of protection
17 Wetted materials
18 Approval-specific information

Devices suitable for oxygen applications are fitted with an additional nameplate.

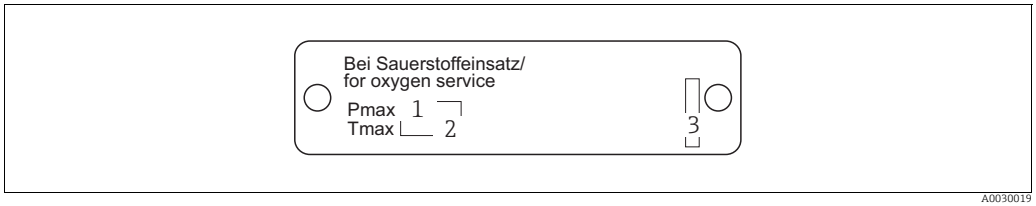


Fig. 2: Additional nameplate for devices suitable for oxygen applications

1 Maximum pressure for oxygen applications
2 Maximum temperature for oxygen applications
3 Layout identification of the nameplate

Stainless steel housing, hygienic

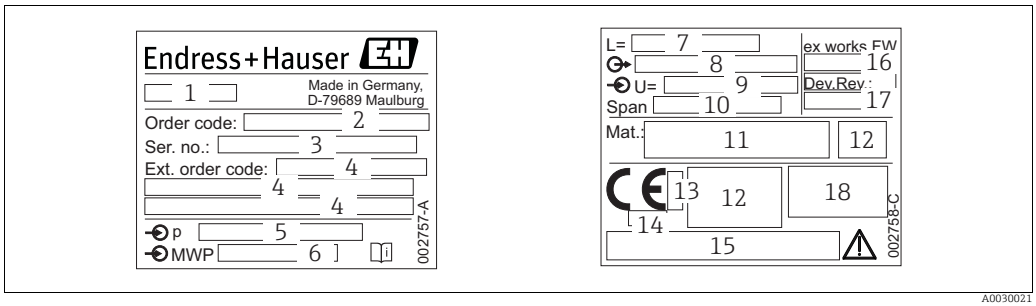


Fig. 3: Nameplate for Cerabar M and Deltapilot M

1 Device name
2 Order code (for re-orders)
3 Serial number (for identification)
4 Extended order code (complete)
5 Nominal measuring range
6 MWP (maximum working pressure)
7 Length data
8 Electronic version (output signal)
9 Supply voltage
10 Min./max. span
11 Wetted materials
12 Approval-specific information
13 ID number of notified body with regard to ATEX (optional)
14 ID number of notified body with regard to Pressure Equipment Directive (optional)
15 Approvals
16 Software version
17 Device version
18 Degree of protection

Devices with certificates are fitted with an additional plate.

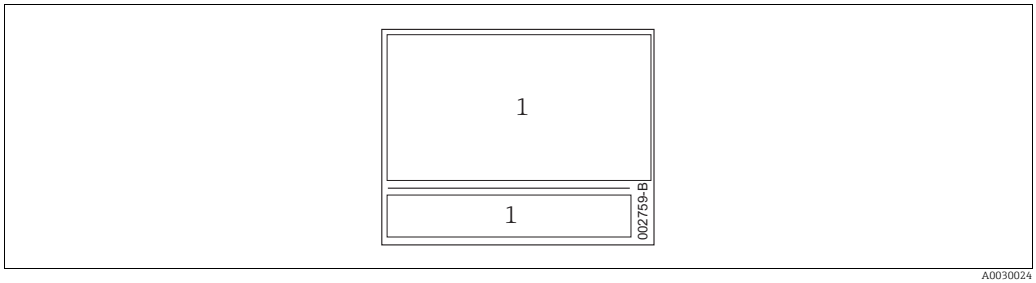


Fig. 4: Additional nameplate for devices with certificates

1 Approval-specific information

3.2.2 Identifying the sensor type

In the case of gauge pressure sensors, the "Pos. zero adjust" parameter appears in the operating menu ("Setup" -> "Pos. zero adjust").
In the case of absolute pressure sensors, the "Calib. offset" parameter appears in the operating menu ("Setup" -> "Calib. offset").

3.3 Scope of delivery

The scope of delivery comprises:
- Device
- Optional accessories

Documentation supplied:
- Operating Instruction BA00382P is available on the Internet.
  → See: www.endress.com → Download
- Brief Operating Instruction: KA01030P Cerabar M / KA01027P Deltabar M / KA01033P Deltapilot M
- Final inspection report
- Additional Safety Instructions for ATEX, IECEx and NEPSI devices
- Optional: factory calibration form, test certificates

3.4 CE mark, Declaration of Conformity

The devices are designed to meet state-of-the-art safety requirements, have been tested and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations as listed in the EC Declaration of Conformity and thus comply with the statutory requirements of the EC Directives. Endress+Hauser confirms the conformity of the device by affixing to it the CE mark.

4 Installation

4.1 Incoming acceptance

- Check the packaging and the contents for damage.
- Check the shipment, make sure nothing is missing and that the scope of supply matches your order.

4.2 Storage and transport

4.2.1 Storage

The device must be stored in a dry, clean area and protected against damage from impact (EN 837-2).
Storage temperature range:
See Technical Information for Cerabar M TI00436P / Deltabar M TI00434P / Deltapilot M TI00437P.

4.2.2 Transport

⚠ WARNING
Incorrect transportation
Housing, diaphragm and capillaries may become damaged, and there is a risk of injury!
- ▶ Transport the measuring device to the measuring point in its original packaging or by the process connection.
- ▶ Follow the safety instructions and transport conditions for devices weighing more than 18 kg (39.6 lbs).
- ▶ Do not use capillaries as a carrying aid for the diaphragm seals.

4.3 Installation conditions

4.3.1 Dimensions

→ For dimensions, please refer to the Technical Information for Cerabar M TI00436P / Deltabar M TI00434P / Deltapilot M TI00437P, "Mechanical construction" section.

4.4 General installation instructions

- Devices with a G 1 1/2 thread:
  When screwing the device into the tank, the flat seal has to be positioned on the sealing surface
  of the process connection. To avoid additional strain on the process isolating diaphragm, the thread should never be sealed with hemp or similar materials.
- Devices with NPT threads:
  – Wrap Teflon tape around the thread to seal it.
  – Tighten the device at the hexagonal bolt only. Do not turn at the housing.
  – Do not overtighten the thread when screwing. Max. torque: 20 to 30 Nm (14.75 to 22.13 lbf ft)

4.4.1 Mounting sensor modules with PVDF thread

⚠ WARNING

Risk of damage to process connection!

Risk of injury!

▶ Sensor modules with PVDF process connections with threaded connection must be installed with the mounting bracket provided!

⚠ WARNING

Material fatigue from pressure and temperature!

Risk of injury if parts burst! The thread can become loose if exposed to high pressure and temperatures.

▶ The integrity of the thread must be checked regularly and the thread may need to be re-tightened with the maximum tightening torque of 7 Nm (5.16 lbf ft). Teflon tape is recommended for sealing the ½" NPT thread.

4.5 Installing Cerabar M

- Due to the orientation of the Cerabar M, there may be a shift in the zero point, i.e. when the container is empty or partially full, the measured value does not display zero. You can correct this zero point shift → 47, Section "Function of the operating elements" or → 64, Section 8.4 "Position zero adjustment".
- For PMP55, please refer to Section 4.5.2 "Installation instructions for devices with diaphragm seals – PMP55", → 17.
- Endress+Hauser offers a mounting bracket for installing on pipes or walls. → 21, Section 4.5.5 "Wall and pipe mounting (optional)".

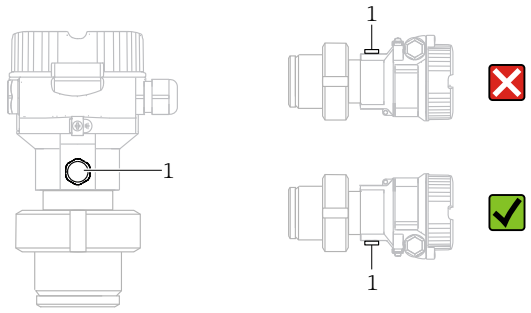
4.5.1 Installation instructions for devices without diaphragm seals – PMP51, PMC51

NOTICE

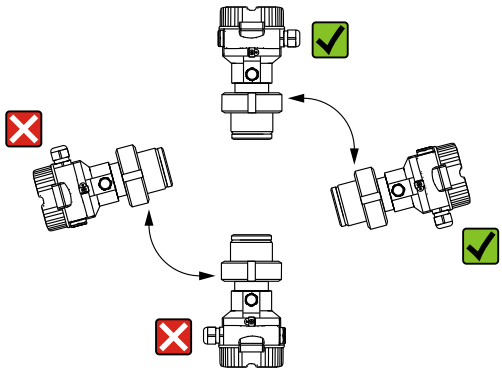
Damage to the device!

If a heated Cerabar M is cooled during the cleaning process (e.g. by cold water), a vacuum develops for a short time, whereby moisture can penetrate the sensor through the pressure compensation (1).

▶ If this is the case, mount the Cerabar M with the pressure compensation (1) pointing downwards.



- Keep the pressure compensation and GORE-TEX® filter (1) free from contamination.
- Cerabar M transmitters without diaphragm seals are mounted as per the norms for a manometer (DIN EN 837-2). We recommend the use of shutoff devices and siphons. The orientation depends on the measuring application.
- Do not clean or touch process isolating diaphragms with hard or pointed objects.
- The device must be installed as follows in order to comply with the cleanability requirements of the ASME-BPE (Part SD Cleanability):



Pressure measurement in gases

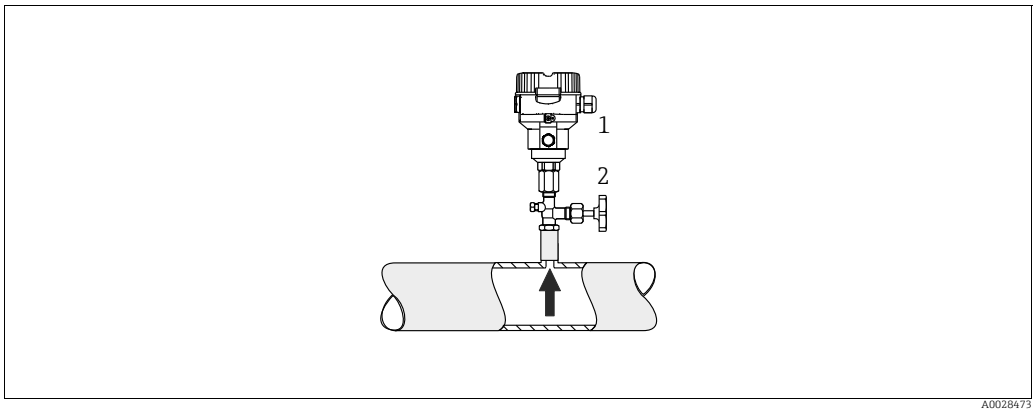


Fig. 5: Measuring arrangement for pressure measurement in gases

1 Cerabar M
2 Shutoff device

Mount the Cerabar M with the shutoff device above the tapping point so that any condensate can flow into the process.

Pressure measurement in steams

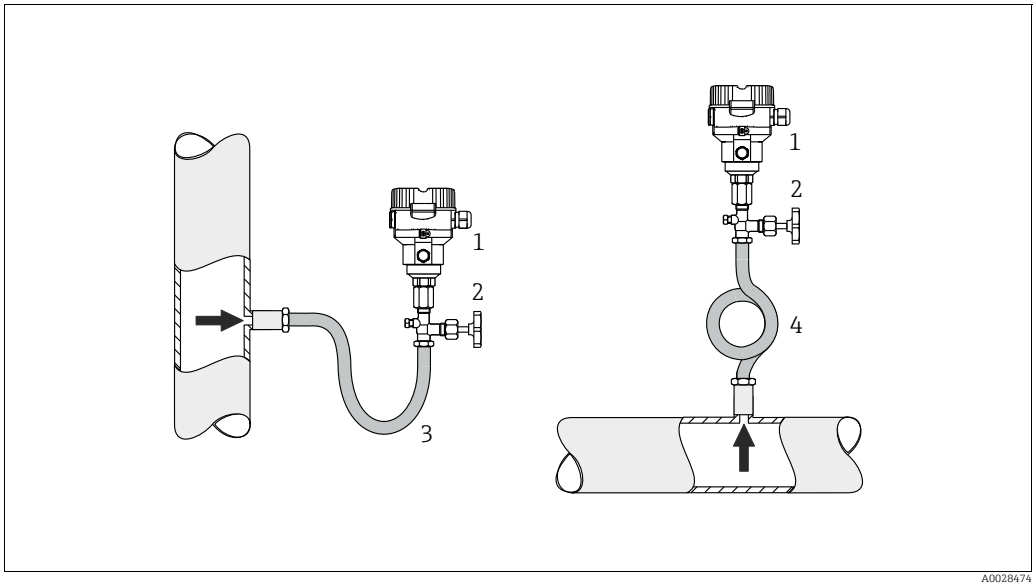


Fig. 6: Measuring arrangement for pressure measurement in steams

1 Cerabar M
2 Shutoff device
3 U-shaped siphon
4 Circular siphon

- Mount Cerabar M with siphon above the tapping point.
- Fill the siphon with liquid before commissioning.
  The siphon reduces the temperature to almost the ambient temperature.

Pressure measurement in liquids

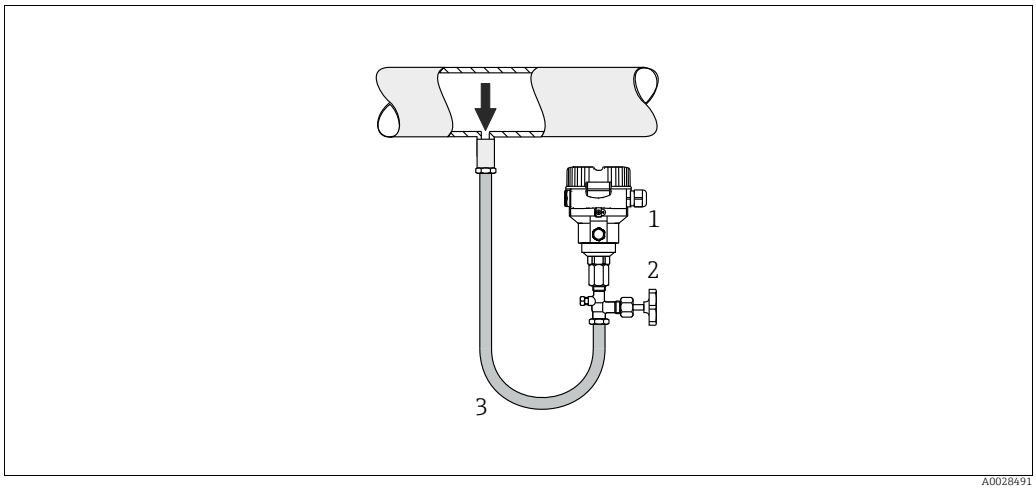


Fig. 7: Measuring arrangement for pressure measurement in liquids

1 Cerabar M
2 Shutoff device

- Mount Cerabar M with shutoff device below or at the same level as the tapping point.

Level measurement

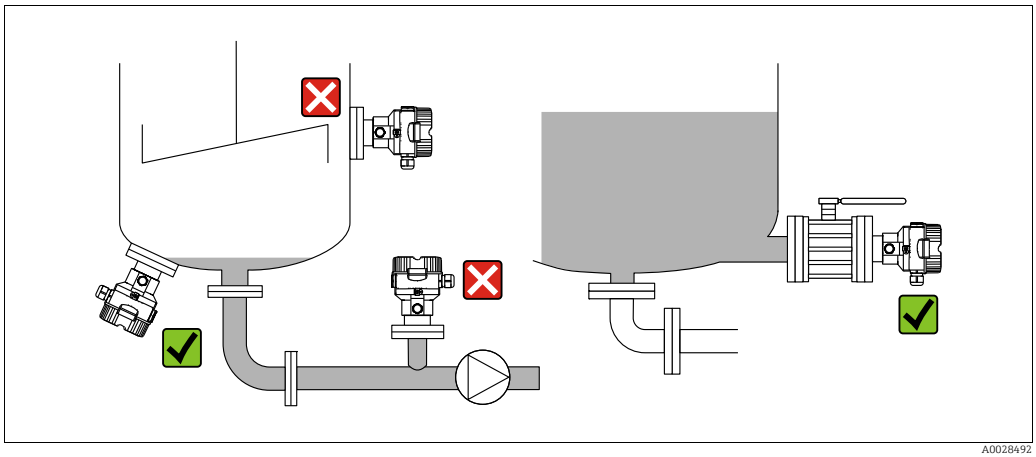


Fig. 8: Measuring arrangement for level

- Always install the Cerabar M below the lowest measuring point.
- Do not mount the device in the filling curtain or at a point in the tank which could be affected by pressure pulses from an agitator.
- Do not mount the device in the suction area of a pump.
- The calibration and functional test can be carried out more easily if you mount the device downstream of a shutoff device.

4.5.2 Installation instructions for devices with diaphragm seals – PMP55

- Cerabar M devices with diaphragm seals are screwed in, flanged or clamped, depending on the type of diaphragm seal.
- Please note that the hydrostatic pressure of the liquid columns in the capillaries can cause zero point shift. The zero point shift can be corrected.
- Do not clean or touch the process isolating diaphragm of the diaphragm seal with hard or pointed objects.
- Do not remove process isolating diaphragm protection until shortly before installation.

NOTICE

Improper handling!

Damage to the device!

- ▶ A diaphragm seal and the pressure transmitter together form a closed, oil-filled calibrated system. The fill fluid hole is sealed and may not be opened.
- ▶ When using a mounting bracket, sufficient strain relief must be ensured for the capillaries in order to prevent the capillary bending down (bending radius ≥ 100 (3.94 in)).
- ▶ Please observe the application limits of the diaphragm seal filling oil as detailed in the Technical Information for Cerabar M TI00436P, "Planning instructions for diaphragm seal systems" section.

NOTICE

In order to obtain more precise measurement results and to avoid a defect in the device, mount the capillaries as follows:

- ▶ Vibration-free (in order to avoid additional pressure fluctuations)
- ▶ Not in the vicinity of heating or cooling lines
- ▶ Insulate if the ambient temperature is below or above the reference temperature
- ▶ With a bending radius of ≥ 100 mm (3.94 in).
- ▶ Do not use the capillaries as a carrying aid for the diaphragm seals!

Vacuum application

For applications under vacuum, Endress+Hauser recommends mounting the pressure transmitter below the diaphragm seal. This prevents vacuum loading of the diaphragm seal caused by the presence of fill fluid in the capillary.

When the pressure transmitter is mounted above the diaphragm seal, the maximum height difference H1 in accordance with the illustrations below must not be exceeded.

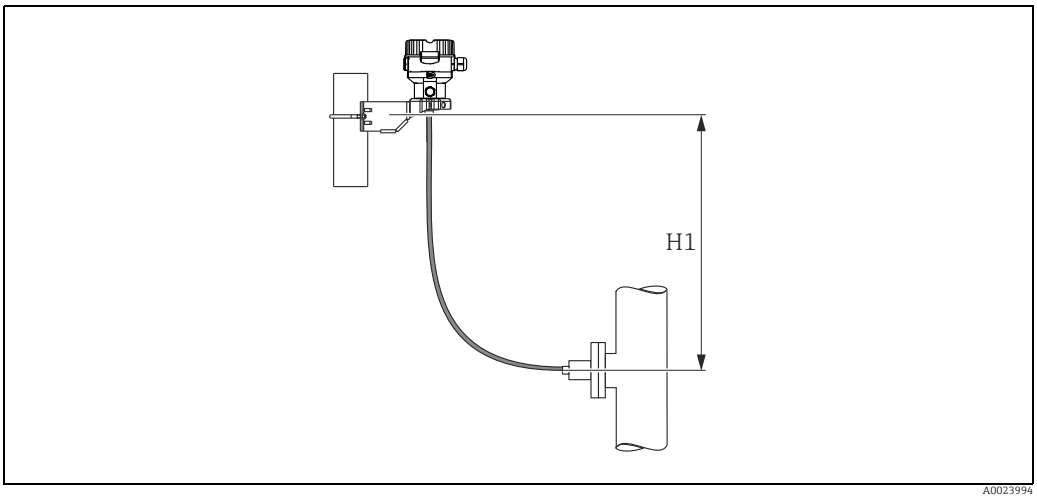


Fig. 9: Installation above the lower diaphragm seal

The maximum height difference depends on the density of the filling oil and the smallest ever pressure that is permitted to occur at the diaphragm seal (empty vessel), see illustration below:

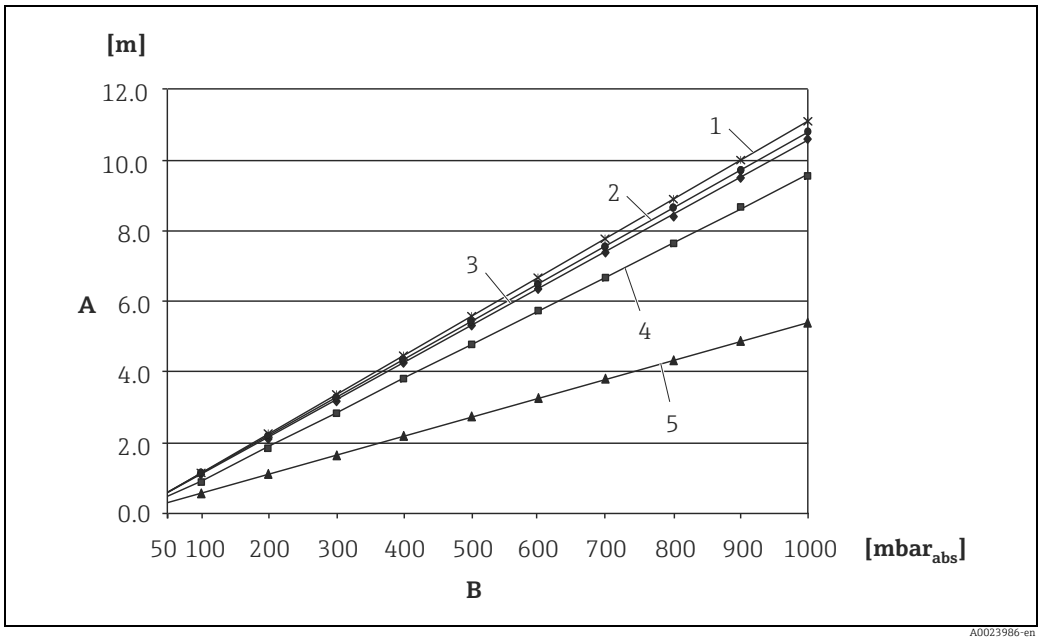


Fig. 10: Diagram of maximum installation height above the lower diaphragm seal for vacuum applications depending on the pressure at the diaphragm seal on the positive side

A Height difference H1
B Pressure at diaphragm seal
1 Low temperature oil
2 Vegetable oil
3 Silicone oil
4 High-temperature oil
5 Inert oil

Mounting with temperature isolator

Endress+Hauser recommends the use of temperature isolators in the event of constant extreme medium temperatures which lead to the maximum permissible electronics temperature of +85 °C (+185°F) being exceeded.
Depending on the filling oil used, diaphragm seal systems with temperature isolators can be used for maximum temperatures of up to 400 °C (+752 °F). → For the temperature application limits, see technical Information, "Diaphragm seal filling oils" section.
To minimize the influence of rising heat, Endress+Hauser recommends the device be mounted horizontally or with the housing pointing downwards. The additional installation height also brings about a maximum zero point shift of 21 mbar (0.315 psi) due to the hydrostatic column in the temperature isolator. You can correct this zero point shift at the device.
The temperature restrictions are lowest with an insulation height of 30 mm (1.18 inch). Full insulation exhibits virtually the same behavior as no insulation!
The temperature limits with an insulation height of 30 mm (1.18 inch) are illustrated in the following graphic.

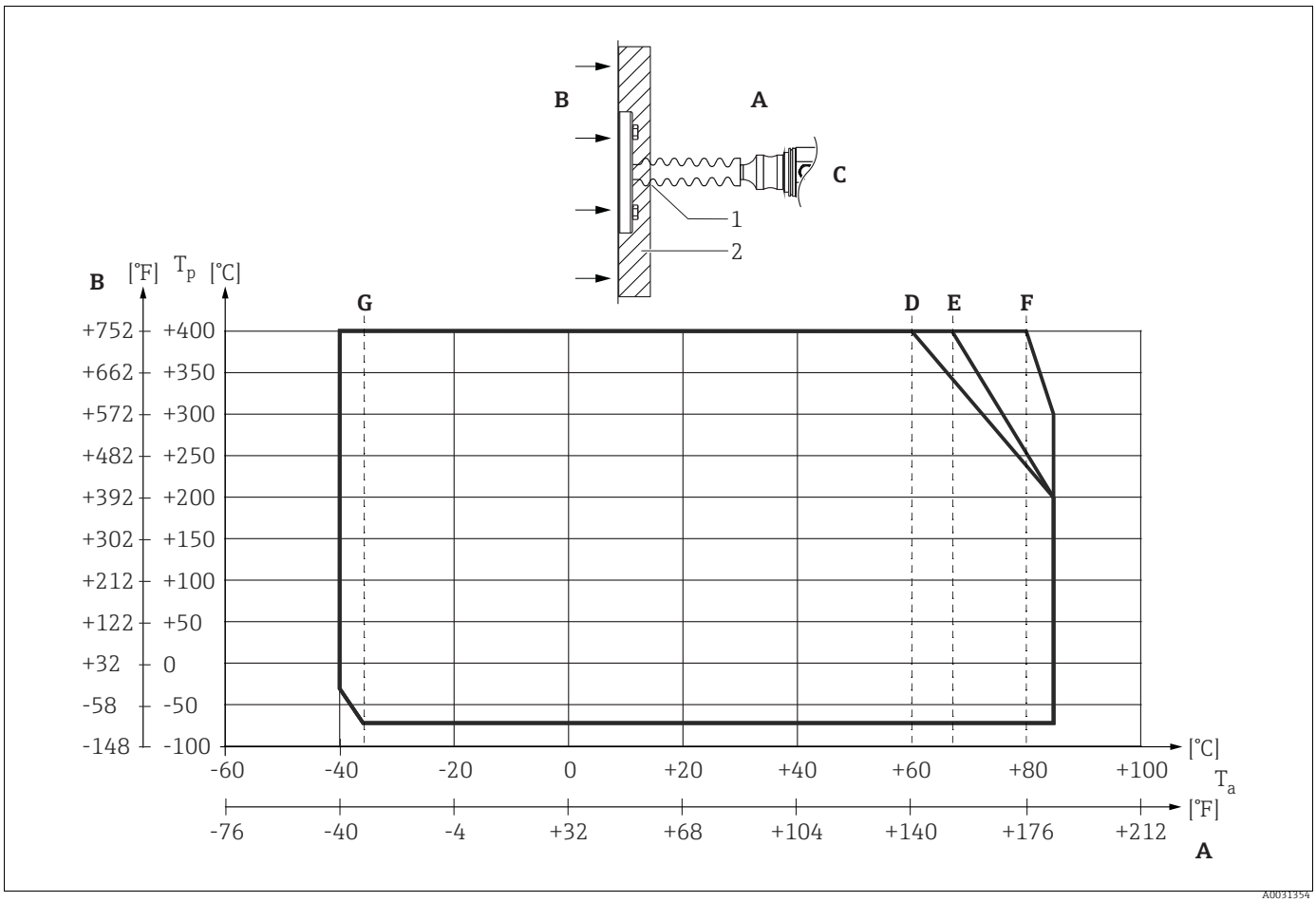


Fig. 11:

A Ambient temperature: ≤ 85 °C (185 °F)
B Process temperature: max. 400 °C (752 °F), depending on the filling oil used
C Device with temperature isolator, material 316L (1.4404)
D Without isolation
E Maximum isolation
F 30 mm (1.18. inch) isolation
G Without isolation, maximum isolation, 30 mm (1.18. inch) isolation
1 Isolation heigth 30 mm (1.18. inch)
2 Isolation material

4.5.3 Seal for flange mounting

NOTICE

Corrupted measurement results.

The seal is not allowed to press against the process isolating diaphragm as this could affect the measurement result.

▶ Ensure that the seal is not touching the process isolating diaphragm.

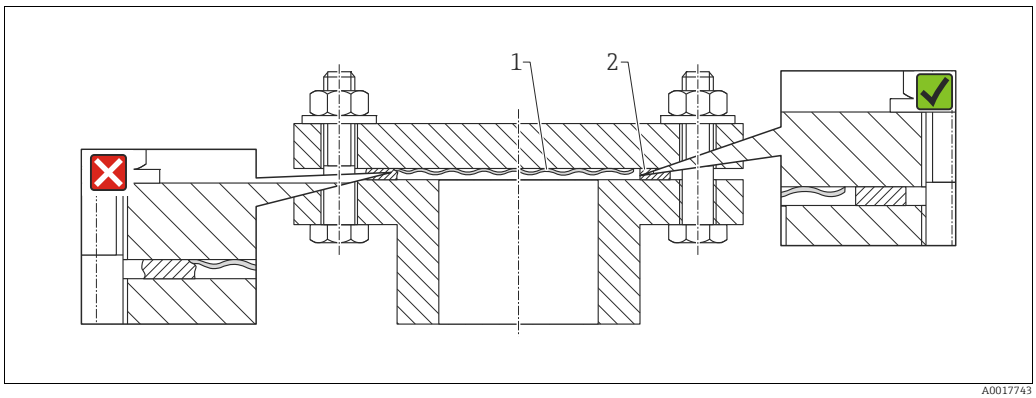


Fig. 12:
1 Process isolating diaphragm
2 Seal

4.5.4 Thermal insulation – PMP55

The PMP55 may only be insulated up to a certain height. The maximum permitted insulation height is indicated on the devices and applies to an insulation material with a heat conductivity ≤ 0.04 W/(m x K) and to the maximum permitted ambient and process temperature. The data were determined under the most critical application "quiescent air".

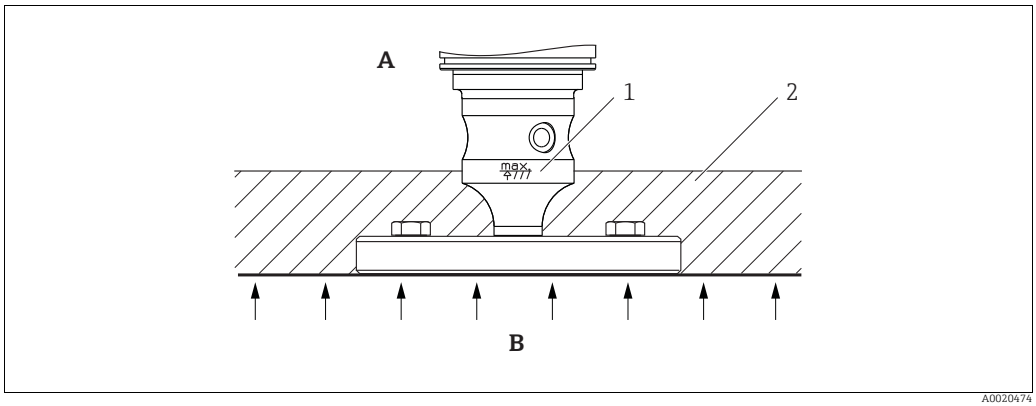
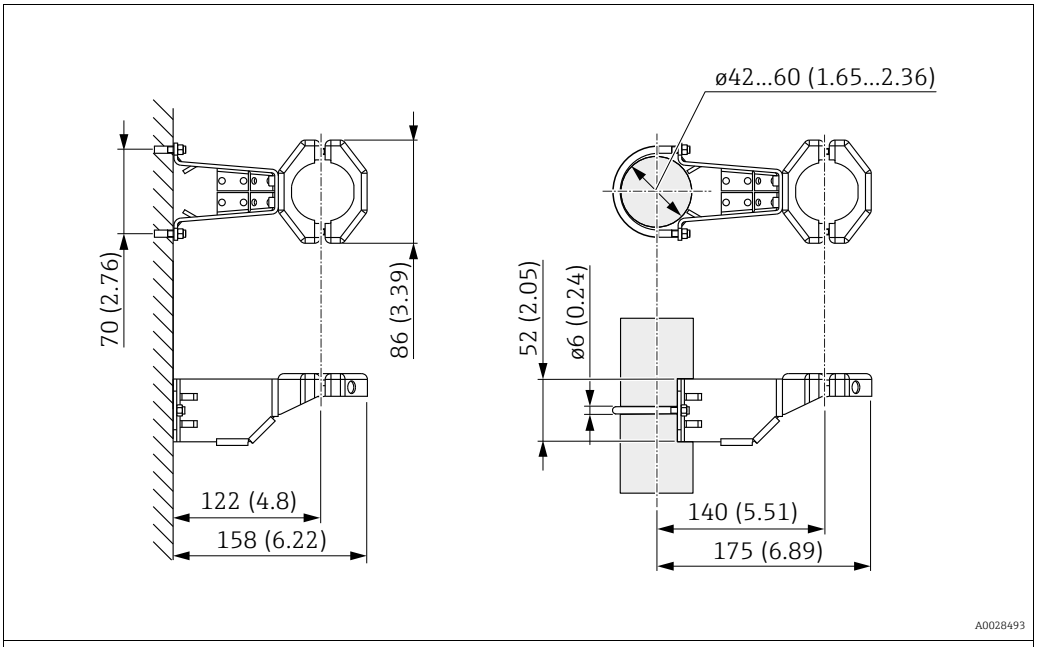


Fig. 13: Maximum permitted insulation height, here indicated on a PMP55 with a flange

A Ambient temperature: ≤ 70 °C (158°F)
B Process temperature: max. 400 °C (752°F), depending on the diaphragm seal filling oil used
1 Maximum permitted insulation height
2 Insulation material

4.5.5 Wall and pipe mounting (optional)

Endress+Hauser offers a mounting bracket for installation on pipes or walls (for pipe diameters from 1 ¼" to 2").



Engineering unit mm (in)

Please note the following when mounting:
- Devices with capillary tubes: mount capillaries with a bending radius ≥ 100 mm (3.94 in).
- When mounting on a pipe, tighten the nuts on the bracket uniformly with a torque of at least 5 Nm (3.69 lbs ft).

4.5.6 Assembling and mounting the "separate housing" version

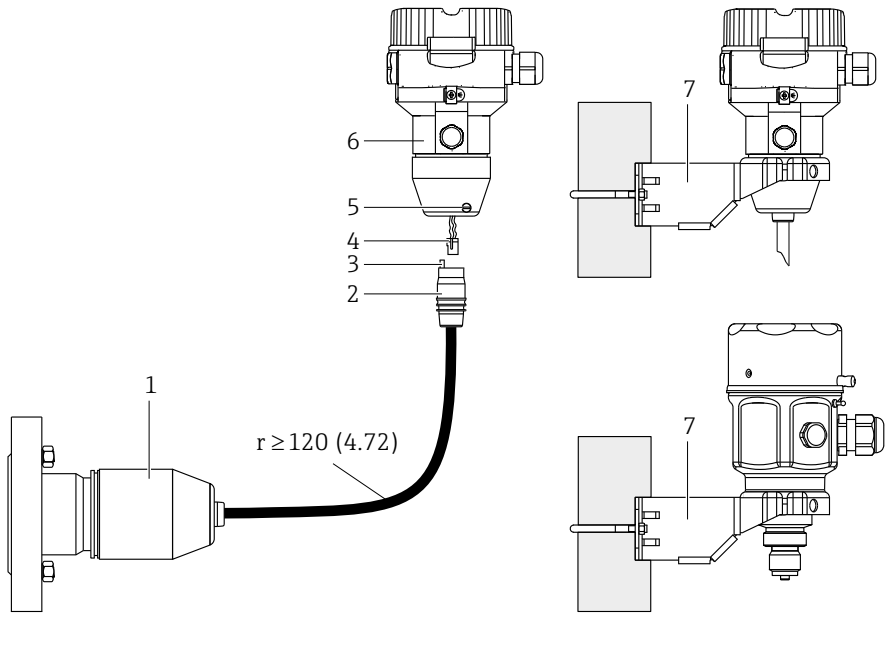


Fig. 14: "Separate housing" version

1 In the case of the "separate housing" version, the sensor is delivered with the process connection and cable ready mounted.
2 Cable with connection jack
3 Pressure compensation
4 Connector
5 Locking screw
6 Housing mounted with housing adapter, included
7 Mounting bracket provided, suitable for pipe and wall mounting (for pipe diameters from 1 ¼" up to 2")

Engineering unit mm (in)

Assembly and mounting

1. Insert the connector (item 4) into the corresponding connection jack of the cable (item 2).
2. Plug the cable into the housing adapter (item 6).
3. Tighten the locking screw (item 5).
4. Mount the housing on a wall or pipe using the mounting bracket (item 7).
   When mounting on a pipe, tighten the nuts on the bracket uniformly with a torque of at least 5 Nm (3.69 lbs ft).
   Mount the cable with a bending radius (r) ≥ 120 mm (4.72 in).

Routing the cable (e.g. through a pipe)

You require the cable shortening kit.
Order number: 71093286
For details on mounting, see SD00553P/00/A6.

4.5.7 PMP51, version prepared for diaphragm seal mount – welding recommendation

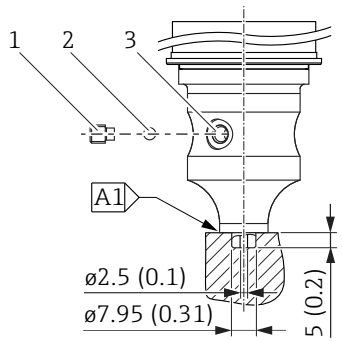
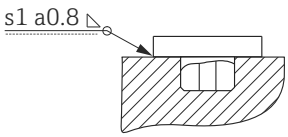


Fig. 15: Version XSJ: prepared for diaphragm seal mount

1 Hole for fill fluid
2 Bearing
3 Setscrew
A1 See the "Welding recommendation" table below

Engineering unit mm (in)

Endress+Hauser recommends welding on the diaphragm seal as follows for the "XSJ - Prepared for diaphragm seal mount" version in feature 110 "Process connections" in the order code up to, and including, 40 bar (600 psi) sensors: the total welding depth of the fillet weld is 1 mm (0.04 in) with an outer diameter of 16 mm (0.63 in). Welding is performed according to the WIG method.

Consecutive seam no.	Sketch/welding groove shape, dimension as per DIN 8551	Base material matching	Welding method DIN EN ISO 24063	Welding position	Inert gas, additives
A1 for sensors ≤ 40 bar (600 psi)		Adapter made of AISI 316L (1.4435) to be welded to diaphragm seal made of AISI 316L (1.4435 or 1.4404)	141	PB	Inert gas Ar/H 95/5 Additive: ER 316L Si (1.4430)

Information on filling

The diaphragm seal must be filled as soon as it has been welded on.

- After welded into the process connection, the sensor assembly must be properly filled with a filling oil and sealed gas-tight with a sealing ball and lock screw.
  Once the diaphragm seal has been filled, at the zero point the device display should not exceed 10% of the full scale value of the cell measuring range. The internal pressure of the diaphragm seal must be corrected accordingly.
- Adjustment / calibration:
  - The device is operational once it has been fully assembled.
  - Perform a reset. The device must then be calibrated to the process measuring range as described in the Operating Instructions.

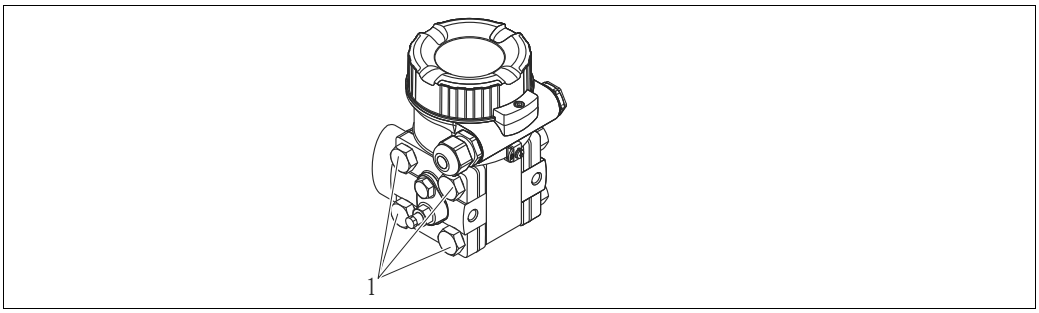
4.6 Installing Deltabar M

NOTICE

Incorrect handling!

Damage of the device!

▶ Disassembly of the screws with item number (1) is not permissible under any circumstances and will result in loss of warranty.



4.6.1 Installation position

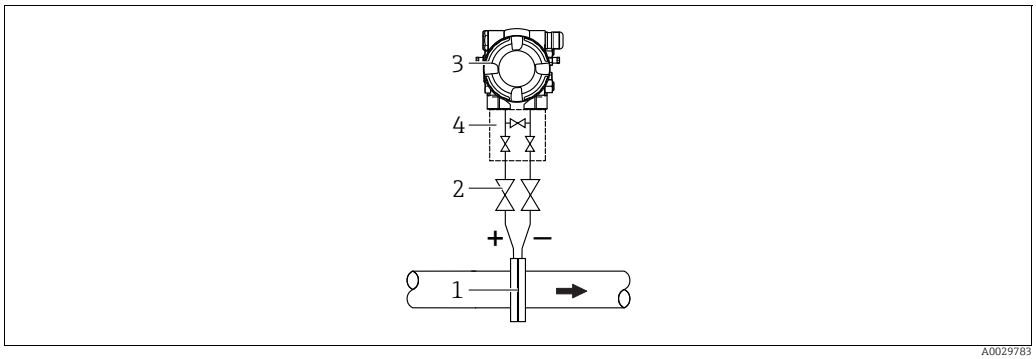
- Due to the orientation of the Deltabar M, there may be a shift in the measured value, i.e. when the container is empty, the measured value does not display zero. You may correct this zero point shift by a position adjustment in one of the following ways:
  - via the operation keys on the electronics module (→ 47, "Function of the operating elements")
  - via the operating menu (→ 64, "Position zero adjustment")
- General recommendations for routing the impulse piping can be found in DIN 19210 "Methods for measurement of fluid flow; differential piping for flow measurement devices" or the corresponding national or international standards.
- Using a three-valve or five-valve manifold allows for easy commissioning, installation and maintenance without interrupting the process.
- When routing the impulse piping outdoors, ensure that sufficient anti-freeze protection is used, e.g. by using pipe heat tracing.
- Install the impulse piping with a monotonic gradient of at least 10%.
- Endress+Hauser offers a mounting bracket for installing on pipes or walls (→ 29, "Wall and pipe-mounting (option)").

Installation position for flow measurement

For more information about differential pressure flow measurement refer to following documents:

- Differential pressure flow measurements with orifices: Technical Information TI00422P
- Differential pressure flow measurement with Pitot tubes: Technical Information TI00425P

Flow measurement in gases

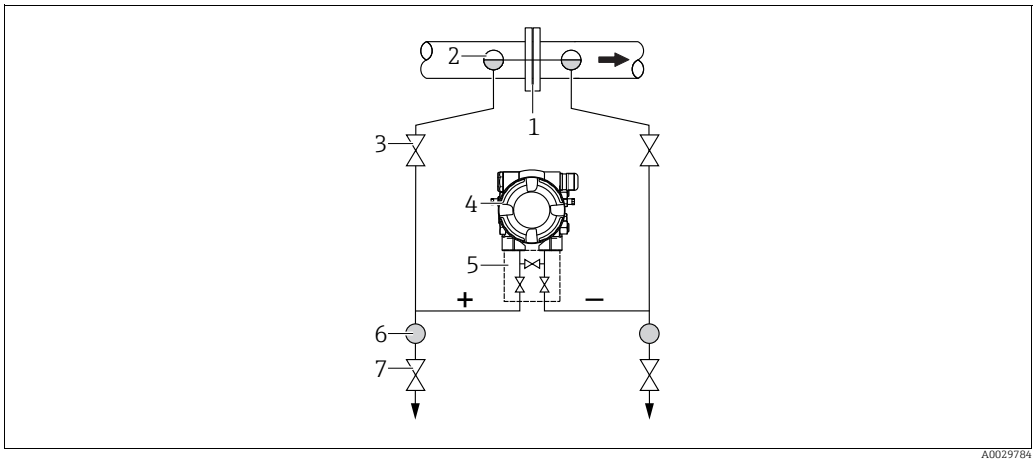


Measuring layout for flow measurement in gases

1 Orifice plate or pitot tube
2 Shut-off valves
3 Deltabar M
4 Three-valve manifold

- Mount the Deltabar M above the measuring point so that the condensate which may be present, can run off into the process piping.

Flow measurement in steam

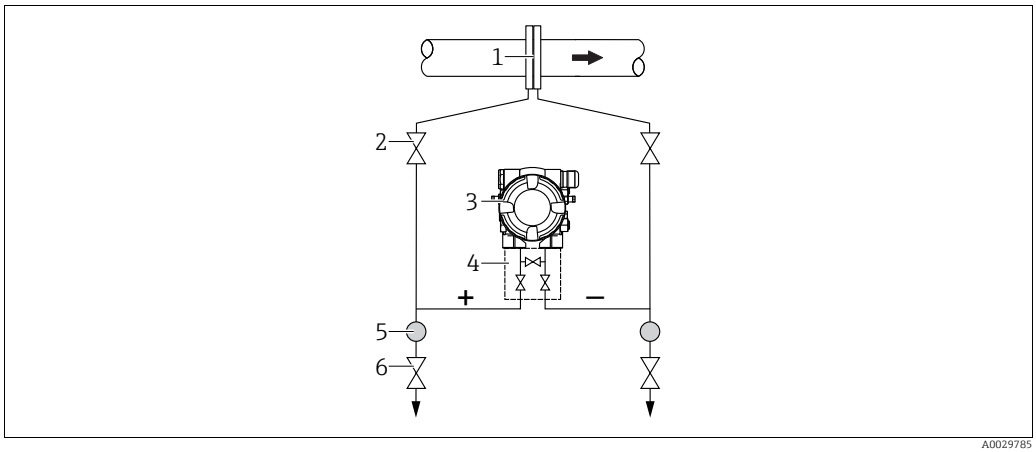


Measuring layout for flow measurement in steam

1 Orifice plate or pitot tube
2 Condensate traps
3 Shut-off valves
4 Deltabar M
5 Three-valve manifold
6 Separator
7 Drain valves

- Mount the Deltabar M below the measuring point.
- Mount the condensate traps at the same level as the tapping points and at the same distance to the Deltabar M.
- Prior to commissioning, fill the impulse piping to the height of the condensate traps.

Flow measurement in liquids



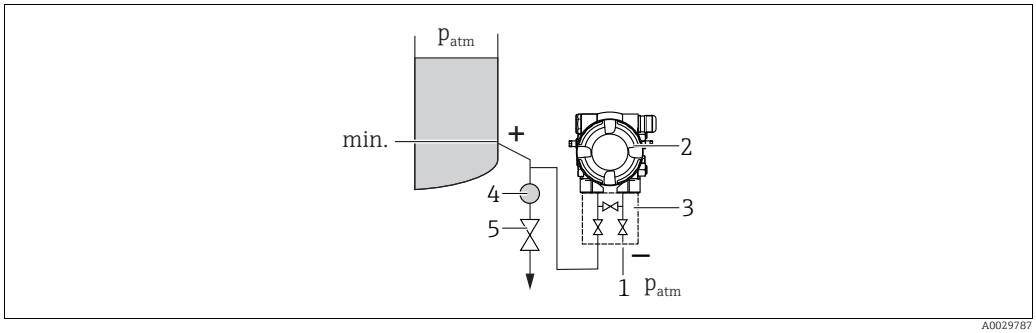
Measuring layout for flow measurement in liquids

1 Orifice plate or pitot tube
2 Shut-off valves
3 Deltabar M
4 Three-valve manifold
5 Separator
6 Drain valves

- Mount the Deltabar M below the measuring point so that the impulse piping is always filled with liquid and gas bubbles can run back into the process piping.
- When measuring in media with solid parts, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment.

Installation position for level measurement

Level measurement in an open container

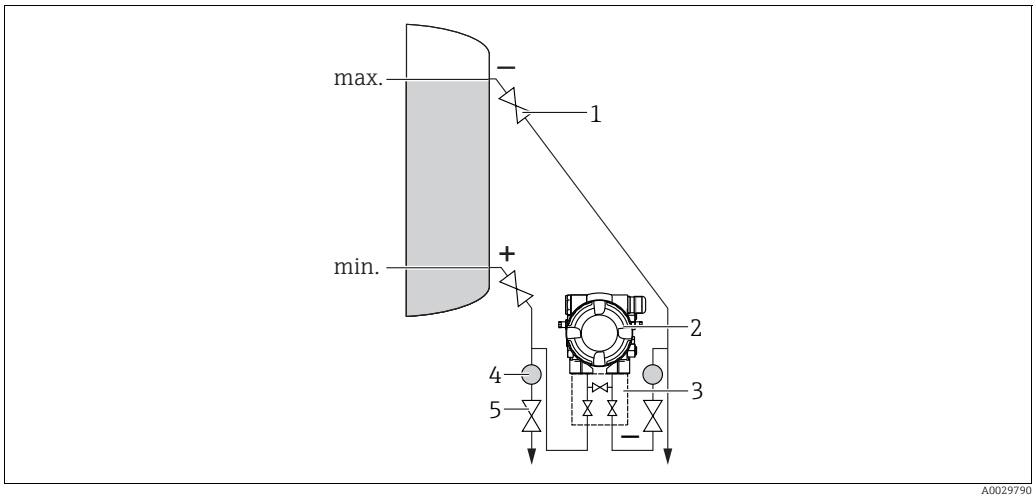


Measuring layout for level measurement in open containers

1 The low-pressure side is open to atmospheric pressure
2 Deltabar M
3 Three-valve manifold
4 Separator
5 Drain valve

- Mount the Deltabar M below the lower measuring connection so that the impulse piping is always filled with liquid.
- The low-pressure side is open to atmospheric pressure.
- When measuring in media with solid parts, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment.

Level measurement in a closed container

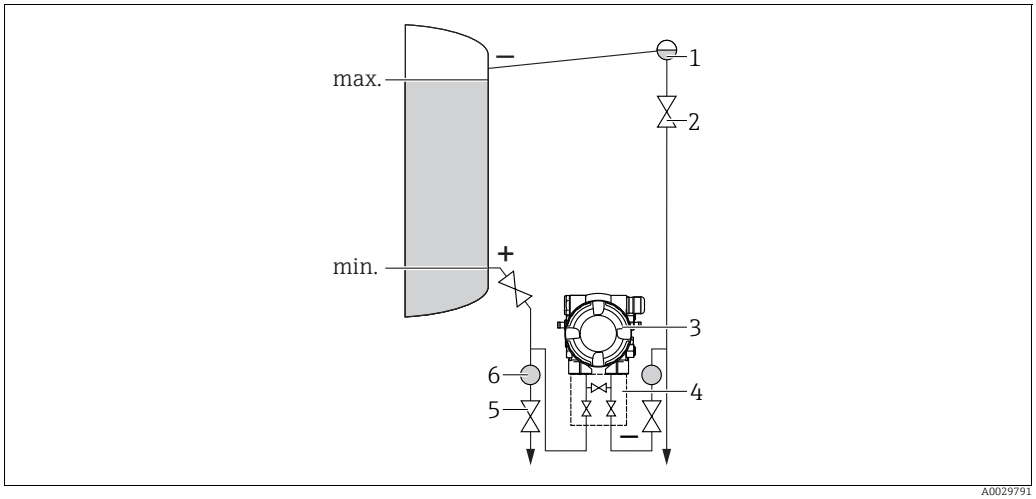


Measuring layout for level measurement in a closed container

1 Shut-off valves
2 Deltabar M
3 Three-valve manifold
4 Separator
5 Drain valves

- Mount the Deltabar M below the lower measuring connection so that the impulse piping is always filled with liquid.
- Always connect the low-pressure side above the maximum level.
- When measuring in media with solid parts, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment.

Level measurement in a closed container with superimposed steam



Measuring layout for level measurement in a container with superimposed steam

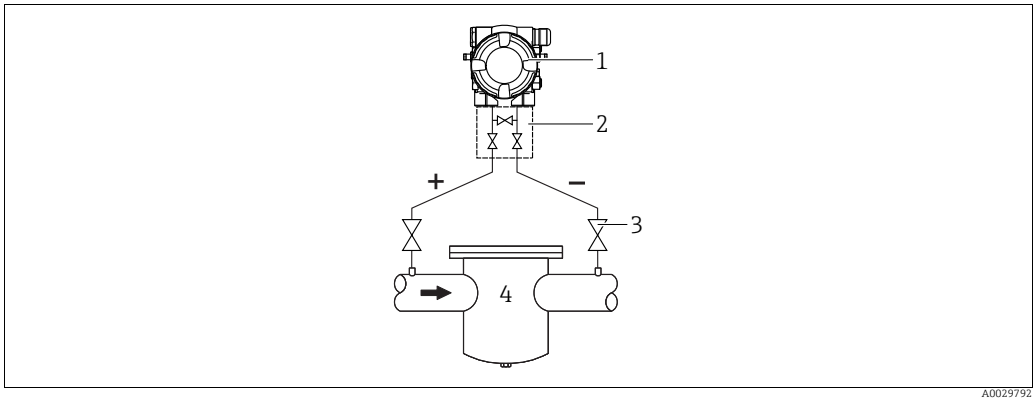
1 Condensate trap
2 Shut-off valves
3 Deltabar M
4 Three-valve manifold
5 Separator
6 Drain valves

- Mount the Deltabar M below the lower measuring connection so that the impulse piping is always filled with liquid.
- Always connect the low-pressure side above the maximum level.
- A condensate trap ensures constant pressure on the low-pressure side.

- When measuring in media with solid parts, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment.

Installation position for differential pressure measurement

Differential pressure measurement in gases and steam

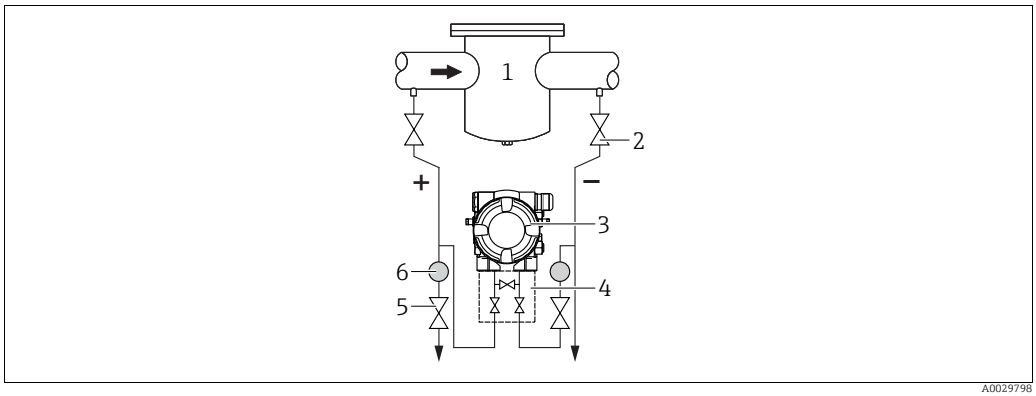


Measuring layout for differential pressure measurement in gases and steam

1 Deltabar M
2 Three-valve manifold
3 Shut-off valves
4 e.g. filter

- Mount the Deltabar M above the measuring point so that the condensate which may be present, can run off into the process piping.

Differential pressure measurement in liquids



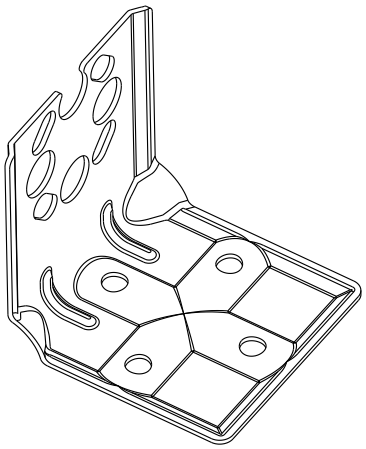
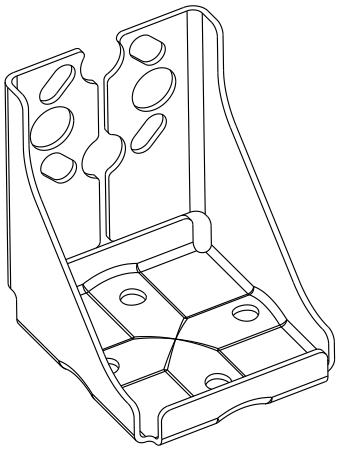
Measuring layout for differential pressure measurement in liquids

1 e.g. filter
2 Shut-off valves
3 Deltabar M
4 Three-valve manifold
5 Separator
6 Drain valves

- Mount the Deltabar M below the measuring point so that the impulse piping is always filled with liquid and gas bubbles can run back into the process piping.
- When measuring in media with solid parts, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment.

4.6.2 Wall and pipe-mounting (option)

Endress+Hauser offers the following mounting brackets for installing the device on pipes or walls:

Standard design	Heavy duty design
 A0031326	 A0031327

When using a valve block, the block's dimensions must be taken into account.
Bracket for wall and pipe mounting including retaining bracket for pipe mounting and two nuts.
material of the screws used to secure the device depend on the order code.
Technical data (e.g. dimensions or order numbers for screws) see accessory document SD01553P/00/EN.

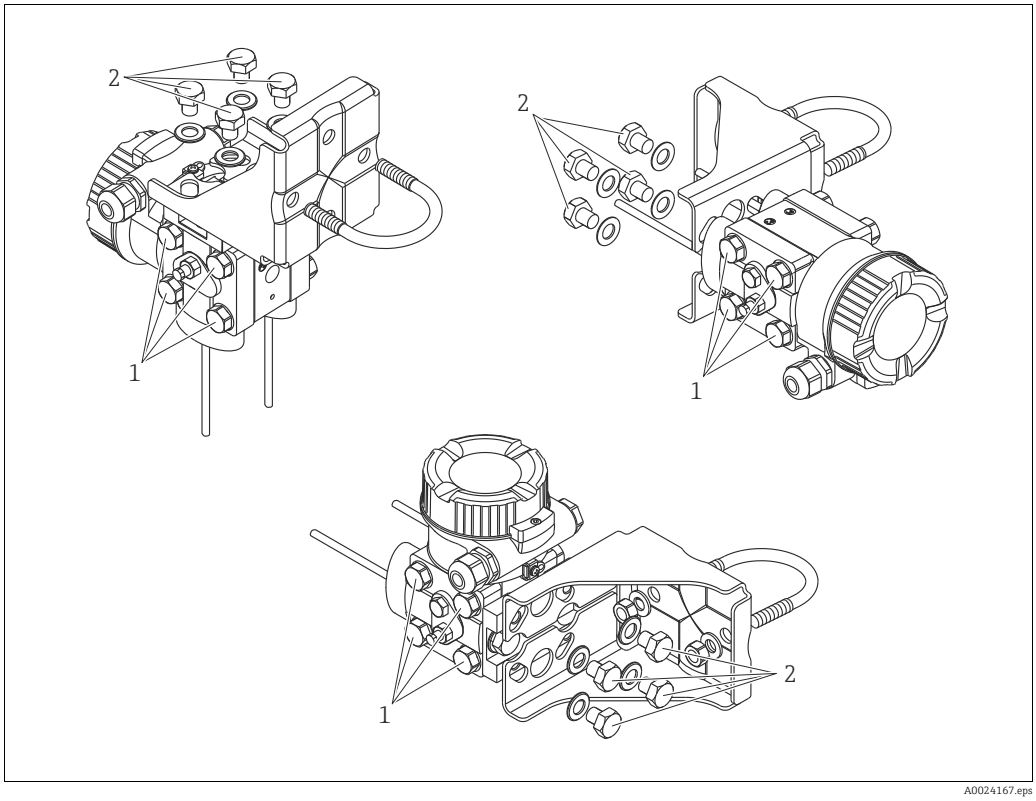
Please note the following when mounting:
- To prevent the mounting screws from scoring, lubricate them with a multi-purpose grease prior to mounting.
- In the case of pipe mounting, the nuts on the bracket must be tightened uniformly with a torque of at least 30 Nm (22.13 lbf ft).
- For installation purposes, only use the screws with item number (2) (see the following diagram).

NOTICE

Incorrect handling!

Damage of the device!

- Disassembly of the screws with item number (1) is not permissible under any circumstances and will result in loss of warranty.



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Typical installation arrangements

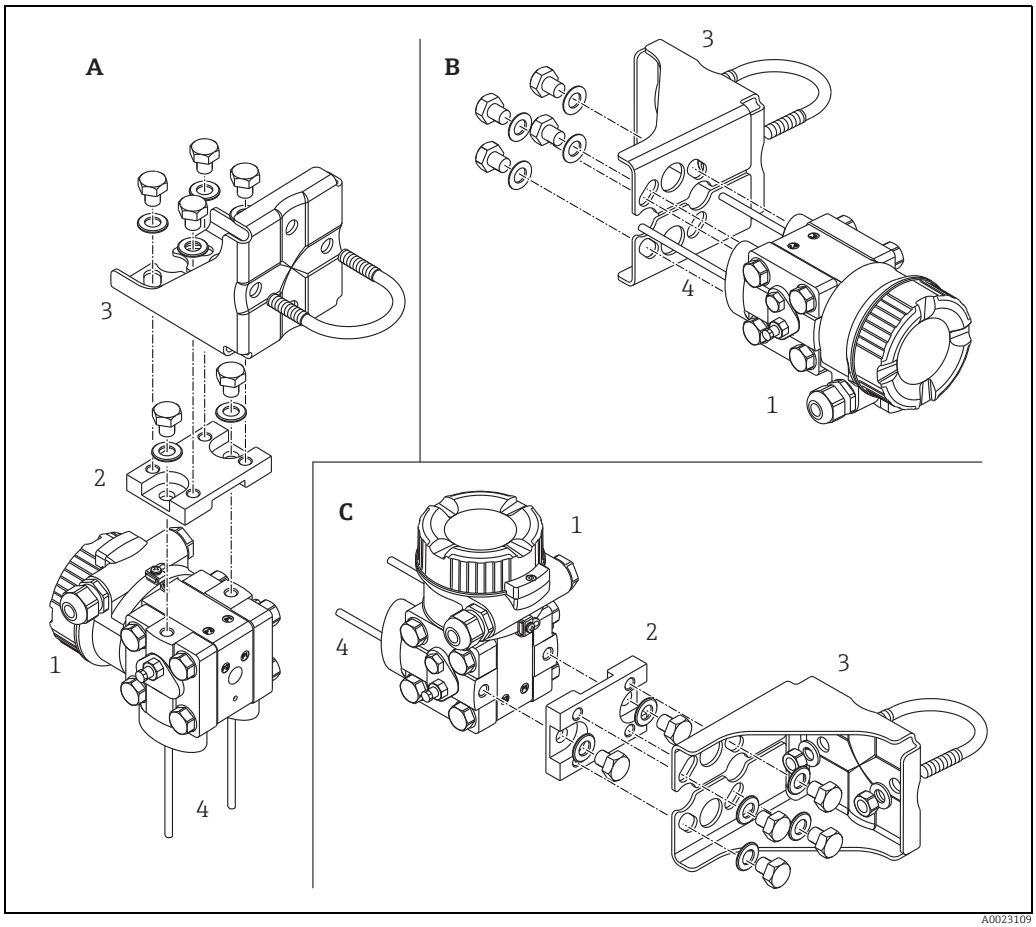


Abb. 16:

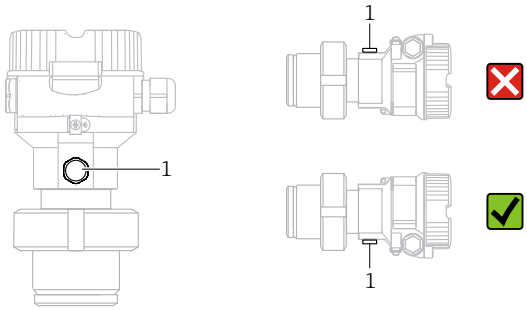
A Impulse line vertical, version V1, alignment 90°
B Impulse line horizontal, version H1, alignment 180°
C Impulse line horizontal, version H2, alignment 90°
1 Deltabar M
2 Adapter plate
3 Mounting bracket
4 Pressure line

4.7 Installing Deltapilot M

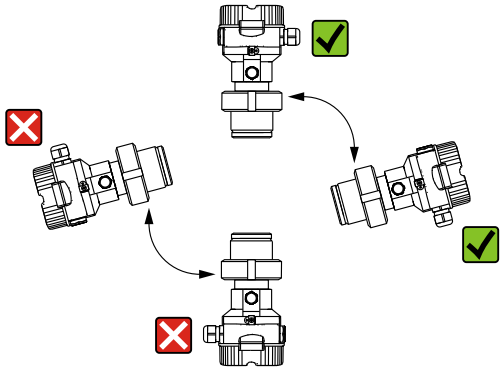
- Due to the orientation of the Deltapilot M, there may be a shift in the zero point, i.e. when the container is empty or partially full, the measured value does not display zero. You can correct this zero point shift → 47, Section "Function of the operating elements" or → 64, Section 8.4 "Position zero adjustment".
- The local display can be rotated in 90° stages.
- Endress+Hauser offers a mounting bracket for installing on pipes or walls. → 21, Section 4.5.5 "Wall and pipe mounting (optional)".

4.7.1 General installation instructions

- Do not clean or touch process isolating diaphragms with hard or pointed objects.
- The process isolating diaphragm in the rod and cable version is protected against mechanical damage by a plastic cap.
- If a heated Deltapilot M is cooled during the cleaning process (e.g. by cold water), a vacuum develops for a short time, whereby moisture can penetrate the sensor through the pressure compensation (1). If this is the case, mount the Deltapilot M with the pressure compensation (1) pointing downwards.



- Keep the pressure compensation and GORE-TEX® filter (1) free from contamination.
- The device must be installed as follows in order to comply with the cleanability requirements of the ASME-BPE (Part SD Cleanibility).:



4.7.2 FMB50

Level measurement

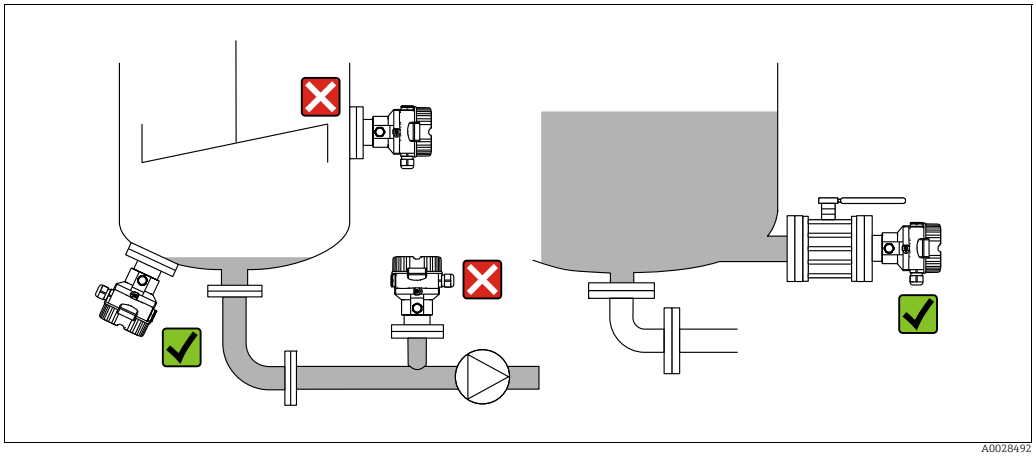


Fig. 17: Measuring arrangement for level

- Always install the device below the lowest measuring point.
- Do not install the device at the following positions:
  - in the filling curtain
  - in the tank outflow
  - in the suction area of a pump
  - or at a point in the tank that can be affected by pressure pulses from the agitator
- The calibration and functional test can be carried out more easily if you mount the device downstream of a shutoff device.
- Deltapilot M must be included in the insulation for media that can harden when cold.

Pressure measurement in gases

- Mount Deltapilot M with shutoff device above the tapping point so that any condensate can flow into the process.

Pressure measurement in steams

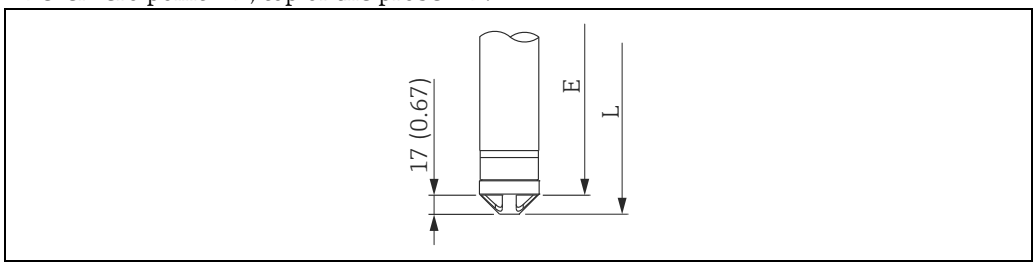
- Mount Deltapilot M with siphon above the tapping point.
- Fill the siphon with liquid before commissioning.
  The siphon reduces the temperature to almost the ambient temperature.

Pressure measurement in liquids

- Mount Deltapilot M with the shutoff device below or at the same level as the tapping point.

4.7.3 FMB51/FMB52/FMB53

- When mounting rod and cable versions, make sure that the probe head is located at a point as free as possible from flow. To protect the probe from impact resulting from lateral movement, mount the probe in a guide tube (preferably made of plastic) or secure it with a clamping fixture.
- In the case of devices for hazardous areas, comply strictly with the safety instructions when the housing cover is open.
- The length of the extension cable or the probe rod is based on the planned level zero point. The height of the protective cap must be taken into consideration when designing the layout of the measuring point. The level zero point (E) corresponds to the position of the process isolating diaphragm.
  Level zero point = E; top of the probe = L.



4.7.4 Mounting the FMB53 with a suspension clamp

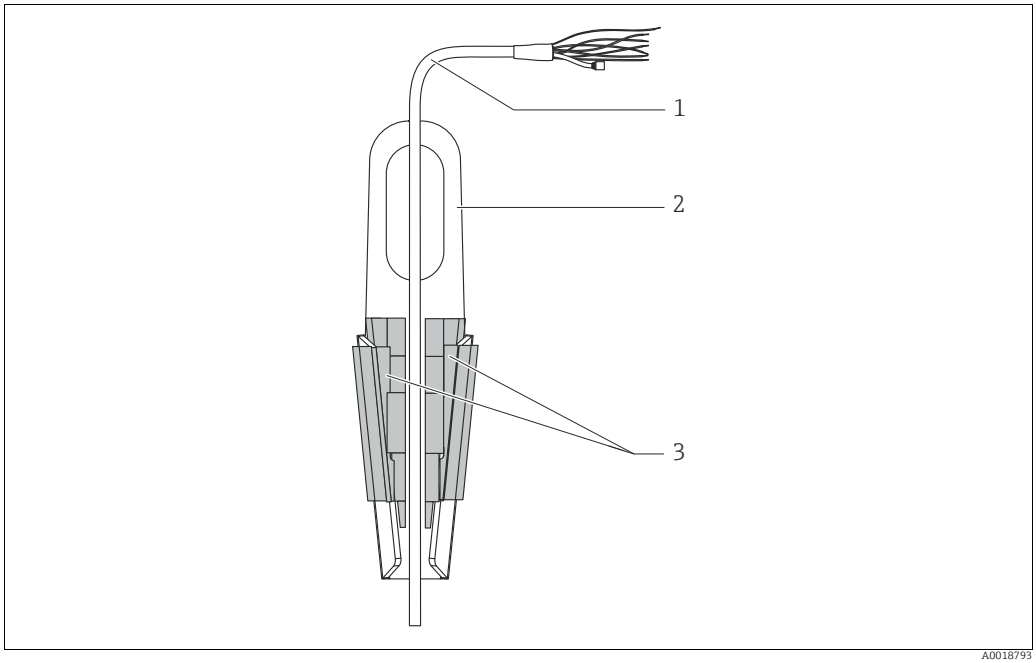


Fig. 18: Mounting with a suspension clamp

1 Extension cable
2 Suspension clamp
3 Clamping jaws

Mounting the suspension clamp:

1. Mount the suspension clamp (item 2). When selecting the place to fix the unit, take the weight of the extension cable (item 1) and the device into account.
2. Raise the clamping jaws (item 3). Position the extension cable (item 1) between the clamping jaws as illustrated in Figure.
3. Hold the extension cable in position (item 1) and push the clamping jaws (item 3) back down.
   Tap the clamping jaws gently from above to fix them in place.

4.7.5 Seal for flange mounting

NOTICE

Distorted measurement results.

The seal is not allowed to press on the process isolating diaphragm as this could affect the measurement result.

▶ Ensure that the seal is not touching the process isolating diaphragm.

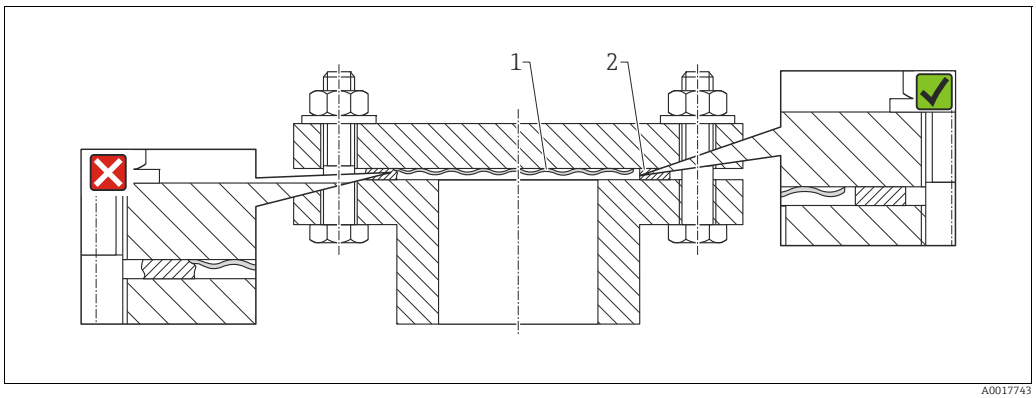
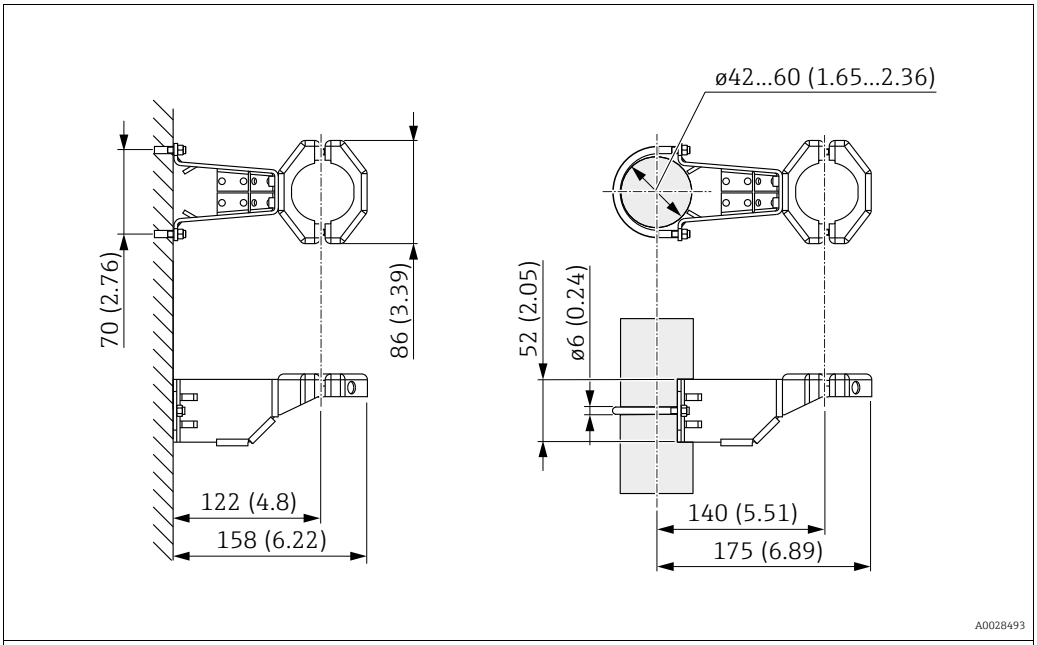


Fig. 19:
1 Process isolating diaphragm
2 Seal

4.7.6 Wall and pipe mounting (optional)

Mounting bracket

Endress+Hauser offers a mounting bracket for installing on pipes or walls (for pipes from 1 1/4" up to 2" diameter).



Maßeinheit mm (in)

In the case of pipe mounting, the nuts on the bracket must be tightened uniformly with a torque of at least 5 Nm (3.69 lbf ft).

4.7.7 Assembling and mounting the "separate housing" version

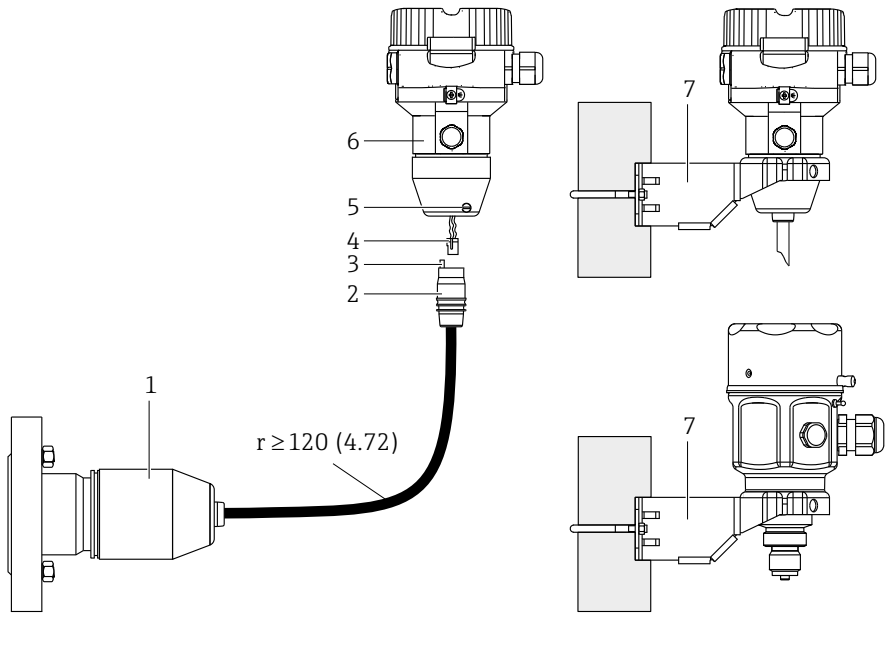


Fig. 20: "Separate housing" version

1 In the case of the "separate housing" version, the sensor is delivered with the process connection and cable ready mounted.
2 Cable with connection jack
3 Pressure compensation
4 Connector
5 Locking screw
6 Housing mounted with housing adapter, included
7 Mounting bracket provided, suitable for pipe and wall mounting (for pipes from 1 1/4" up to 2" diameter)

Maßeinheit mm (in)

Assembly and mounting

1. Insert the connector (item 4) into the corresponding connection jack of the cable (item 2).
2. Plug the cable into the housing adapter (item 6).
3. Tighten the locking screw (item 5).
4. Mount the housing on a wall or pipe using the mounting bracket (item 7).
   When mounting on a pipe, tighten the nuts on the bracket uniformly with a torque of at least 5 Nm (3.69 lbf ft).
   Mount the cable with a bending radius (r) ≥ 120 mm (4.72 in).

Routing the cable (e.g. through a pipe)

You require the cable shortening kit.
Order number: 71093286
For details on mounting, see SD00553P/00/A6.

4.7.8 Supplementary installation instructions

Sealing the probe housing

- Moisture must not penetrate the housing when mounting the device, establishing the electrical connection and during operation.
- Always firmly tighten the housing cover and the cable entries.

4.8 Mounting of the profile seal for universal process mounting adapter

For details on mounting, see KA00096F/00/A3.

4.9 Closing the housing cover

NOTICE

Devices with EPDM cover seal - transmitter leakiness!

Mineral-based, animal-based or vegetable-based lubricants cause the EPDM cover seal to swell and the transmitter to become leaky.

▶ The thread is coated at the factory and therefore does not require any lubrication.

NOTICE

The housing cover can no longer be closed.

Damaged thread!

▶ When closing the housing cover, please ensure that the thread of the cover and housing are free from dirt, e.g. sand.If you feel any resistance when closing the cover, check the thread on both again to ensure that they are free from dirt.

4.9.1 Closing the cover on the stainless steel housing

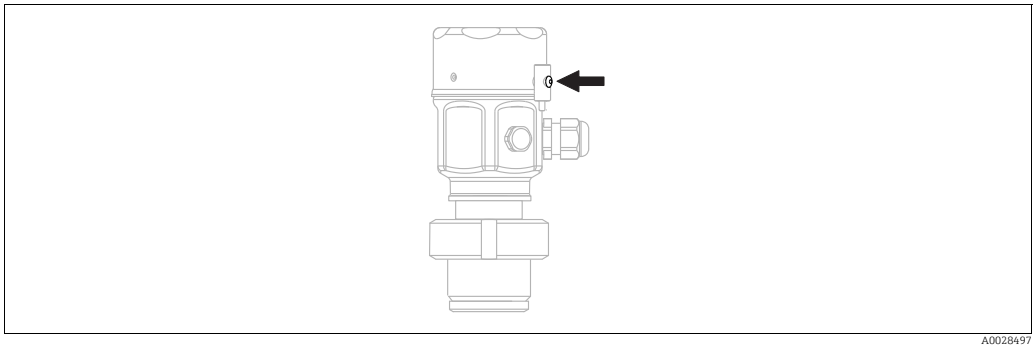


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Fig. 21: Closing the cover

The cover for the electronics compartment is tightened by hand at the housing until the stop. The screw serves as DustEx protection (only available for devices with DustEx approval).

4.10 Post-installation check

O	Is the device undamaged (visual inspection)?
O	Does the device comply with the measuring point specifications? For example: ▪ Process temperature ▪ Process pressure ▪ Ambient temperature range ▪ Measuring range
O	Are the measuring point identification and labeling correct (visual inspection)?
O	Is the device adequately protected against precipitation and direct sunlight?
O	Are the securing screw and securing clamp tightened securely?

5 Electrical connection

5.1 Connecting the device

⚠ WARNING

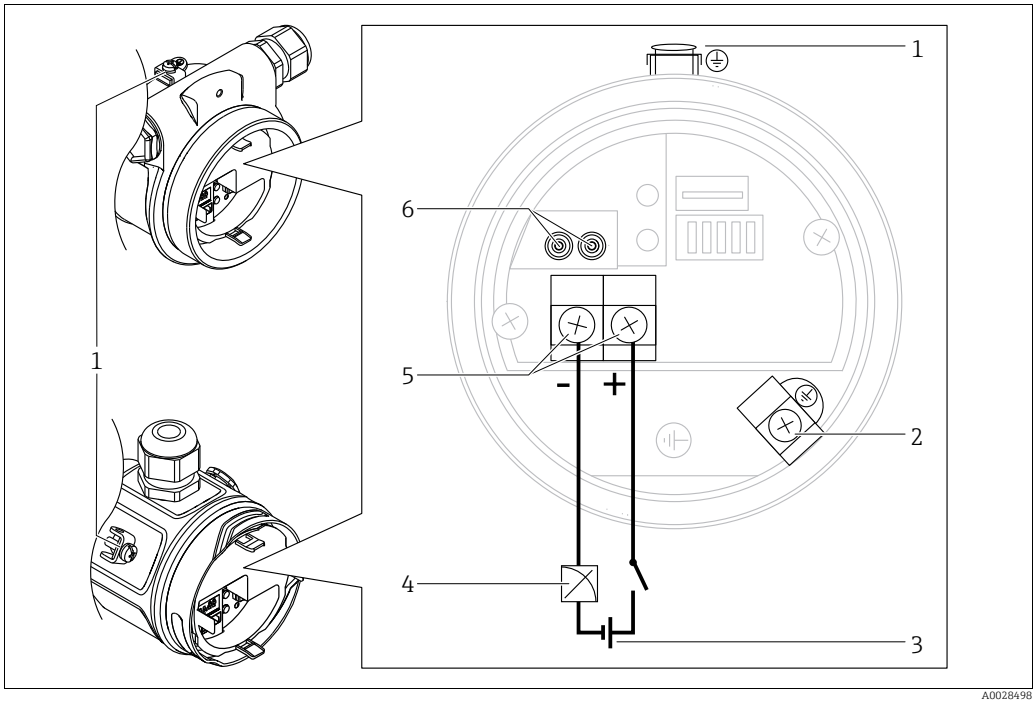
Supply voltage might be connected!

Risk of electric shock and/or explosion!

- Ensure that no uncontrolles processes are activated in the system.
- Switch off the supply voltage before connecting the device.
- When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings.
- A suitable circuit breaker must be provided for the device in accordance with IEC/EN61010.
- Devices with integrated overvoltage protection must be grounded.
- Protective circuits against reverse polarity, HF influences and overvoltage peaks are integrated.

Connect the device in the following order:

1. Check that the supply voltage corresponds to the supply voltage indicated on the nameplate.
2. Switch off the supply voltage before connecting the device.
3. Remove housing cover.
4. Guide the cable through the gland. Preferably use a twisted, shielded two-wire cable.
5. Connect the device in accordance with the following diagram.
6. Screw down the housing cover.
7. Switch on the supply voltage.



Electrical connection 4...20 mA HART

1 *External ground terminal*
2 *Grounding terminal*
3 *Supply voltage: 11,5 ... 45 VDC (versions with plug connectors: 35 V DC)*
4 *4 to 20 mA*
5 *Terminals for supply voltage and signal*
6 *Test terminals*

5.1.1 Connecting devices with a Harting connector Han7D

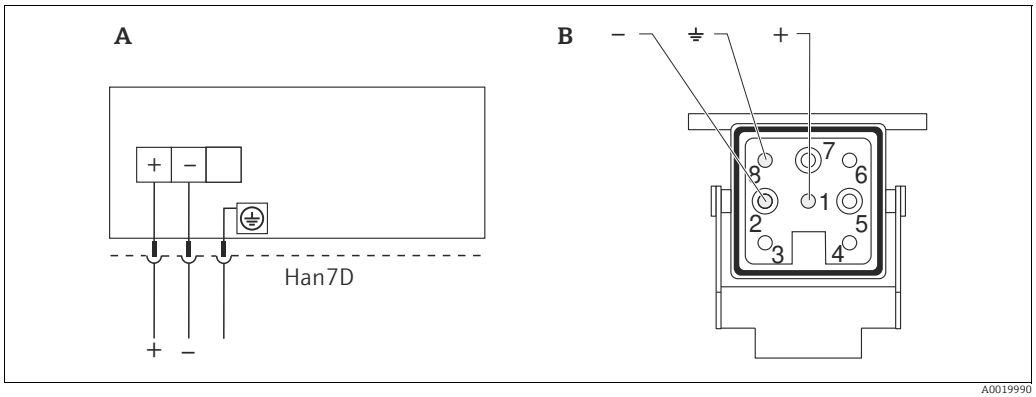


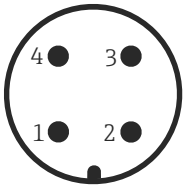
Fig. 22:

A Electrical connection for devices with Harting plug Han7D
B View of the connection on the device

Material: CuZn, gold-plated contacts of plug-in jack and connector

5.1.2 Connecting devices with an M12 connector

PIN assignment for M12 connector

PIN assignment for M12 connector	PIN	Meaning
	1	Signal +
	2	Not assigned
	3	Signal –
	4	Earth

5.1.3 Devices with valve connector

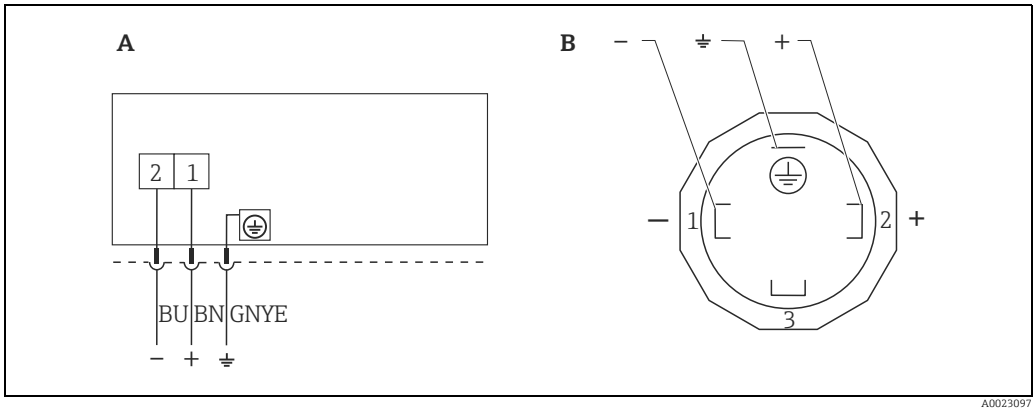


Fig. 23: BN = brown, BU = blue, GNYE = green/yellow

A Electrical connection for devices with valve connector
B View of the connection on the device

Material: PA 6.6

5.2 Connecting the measuring unit

5.2.1 Supply voltage

Electronic version	
4 to 20 mA HART, for non-hazardous areas	11.5 to 45 V DC (versions with plug-in connector 35 V DC)

Taking 4 to 20 mA test signal

A 4 to 20 mA test signal may be measured via the test terminals without interrupting the measurement. To keep the corresponding measured error below 0.1%, the current measuring device should exhibit an internal resistance of < 0.7 Ω.

5.2.2 Terminals

- Supply voltage and internal ground terminal: 0.5 to 2.5 mm² (20 to 14 AWG)
- External ground terminal: 0.5 to 4 mm² (20 to 12 AWG)

5.2.3 Cable specification

- Endress+Hauser recommends using twisted, shielded two-wire cables.
- Cable outer diameter: 5 to 9 mm (0.2 to 0.35 in) depends on the used cable gland (see technical information)

5.2.4 Load

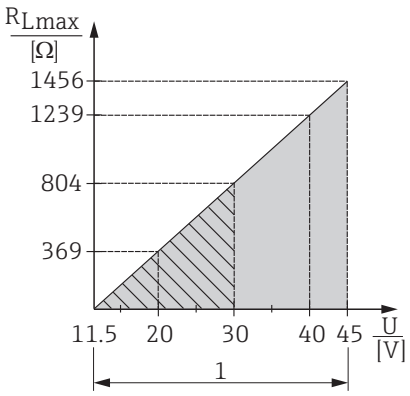


Fig. 24: Load diagram

1 Supply voltage 11.5 to 45 V DC (versions with plug-in connector 35 V DC) for other types of protection and for uncertified device versions
2 R_{Lmax} Maximum load resistance
U Supply voltage

When operating via a handheld terminal or via a PC with an operating program, a minimum communication resistance of 250 Ω must be taken into account.

5.2.5 Shielding/potential equalization

- A normal device cable suffices if only the analog signal is used. A shielded cable is recommended if using the HART protocol. Observe grounding concept of the plant.
- When using in hazardous areas, you must observe the applicable regulations. Separate Ex documentation with additional technical data and instructions is included with all Ex systems as standard. Connect all devices to the local potential equalization.

5.2.6 Connecting Field Xpert SFX100

Compact, flexible and robust industry handheld terminal for remote parametrization and measured value inspection via the HART current output (4 to 20mA).
For details refer to Operating Instructions BA00060S/04/EN.

5.2.7 Connecting Commubox FXA195

The Commubox FXA195 connects intrinsically safe transmitters with the HART protocol to a computer's USB port. This allows remote operation of the transmitter using Endress+Hauser's FieldCare operating program. Power is supplied to the Commubox through the USB port. The Commubox is also suitable for connection to intrinsically safe circuits. → See Technical Information TI00404F for further information.

5.3 Overvoltage protection (optional)

Devices showing version "NA" in feature 610 "Accessory mounted" in the order code are equipped with a surge arrester (see Technical Information "Ordering information" section). The surge arrester is mounted at the factory on the housing thread for the cable gland and is approx. 70 mm (2.76 in) in length (take additional length into account when installing). The device is connected as specified in the following graphic. For details refer to TI001013KEN, XA01003KA3 and BA00304KA2.

5.3.1 Wiring

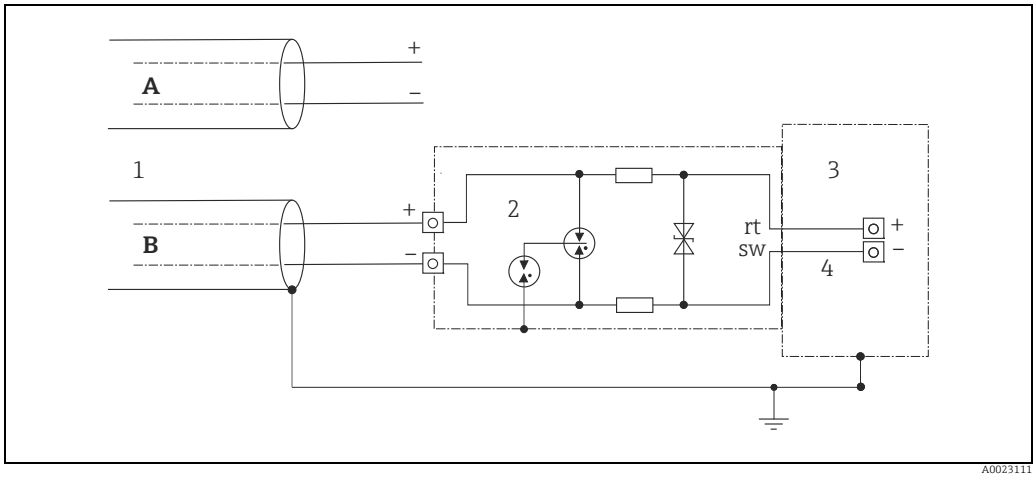


Fig. 25:

A Without direct shield grounding
B With direct shield grounding
1 Incoming connection cable
2 HAW569-DA2B
3 Unit to be protected
4 Connection cable

5.3.2 Installation

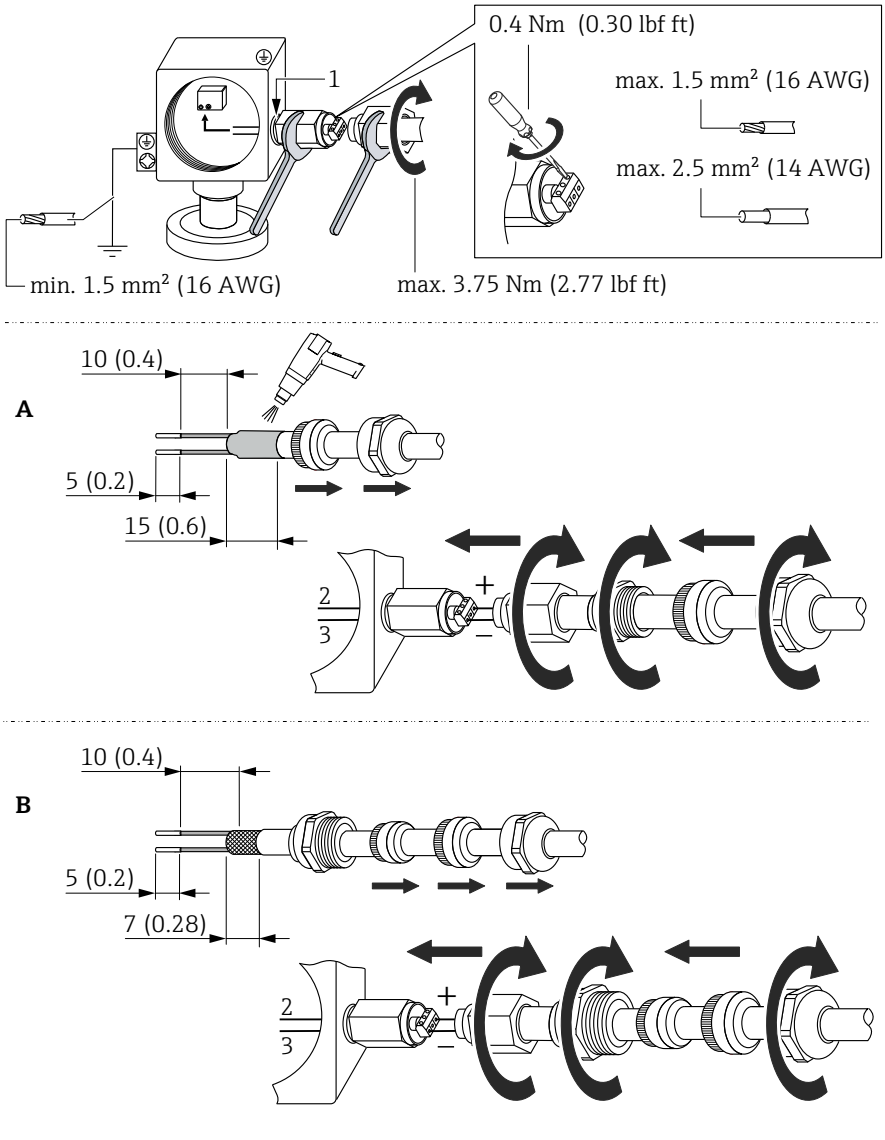


Fig. 26:

A Without shield grounding
B With shield grounding
1 See NOTICE below
2 Red
3 Black

Engineering unit mm (in)

NOTICE

Screw connection glued at factory!

Damage to the device and/or surge arrester!

- When releasing/tightening the union nut use a wrench to hold the screw steady so it does not turn.

5.4 Post-connection check

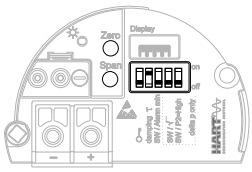
Perform the following checks after completing electrical installation of the device:
- Does the supply voltage match the specifications on the nameplate?
- Is the device properly connected?
- Are all screws firmly tightened?
- Are the housing covers screwed down tight?

As soon as voltage is applied to the device, the green LED on the electronic insert lights up for a few seconds or the connected local display lights up.

6 Operation

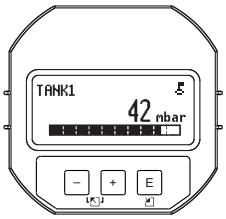
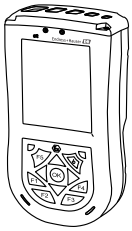
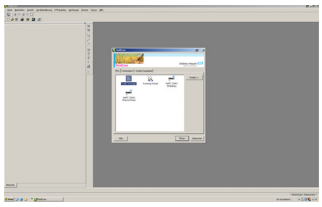
6.1 Operating options

6.1.1 Operation without operating menu

Operating options	Explanation	Graphic illustration	Description
Local operation without device display	The device is operated using the operating keys and DIP switches on the electronic insert.		→ 46

6.1.2 Operation with operating menu

Operation with an operating menu is based on an operation concept with "user roles" → 48.

Operating options	Explanation	Graphic illustration	Description
Local operation with device display	The device is operated using the operating keys on the device display.		→ 50
Remote operation via HART handheld terminal	The device is operated using the HART handheld terminal (e.g. SFX100).		→ 54
Remote operation via FieldCare	The device is operated using the FieldCare operating tool.		→ 54

6.2 Operation without operating menu

6.2.1 Position of operating elements

The operating keys and DIP switches are located on the electronic insert in the device.

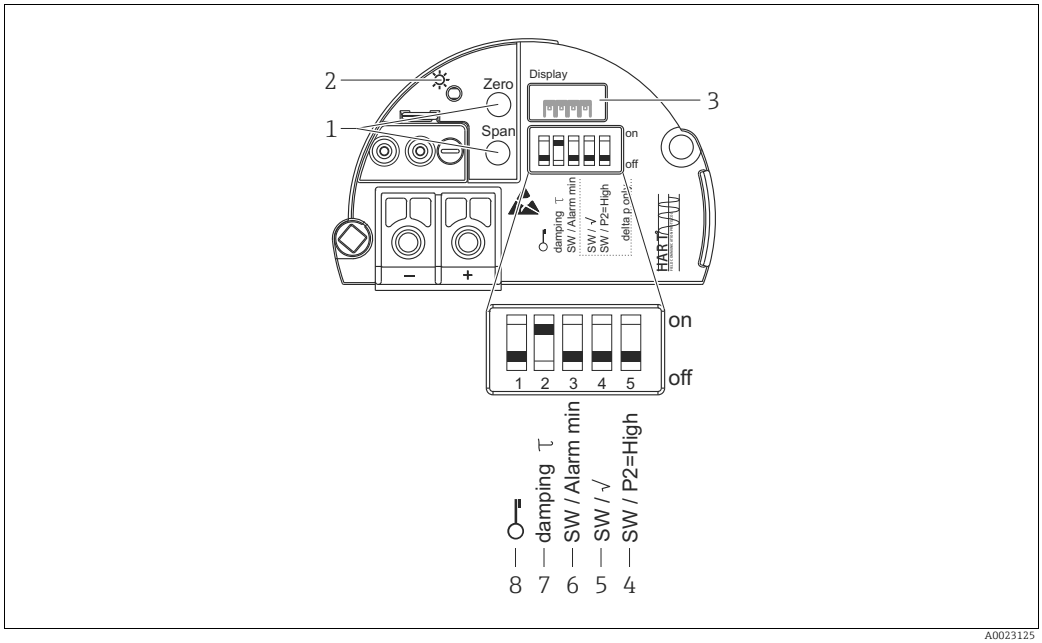


Fig. 27: HART electronic insert

1 Operating keys for lower range value (zero) and upper range value (span)
2 Green LED to indicate successful operation
3 Slot for optional local display
4+5 DIP switch only for Deltabar M
Switch 5: "SW/Square root"; used to control the output characteristics
Switch 4: "SW/P2-High"; used to determine the high-pressure side
6 DIP switch for alarm current SW / Alarm Min (3.6 mA)
7 DIP switch for switching damping on/off
8 DIP switch for locking/unlocking parameters relevant to the measured value

Function of the DIP switches

Switches	Symbol/ labeling	Switch position	
		"off"	"on"
1		The device is unlocked. Parameters relevant to the measured value can be modified.	The device is locked. Parameters relevant to the measured value cannot be modified.
2	damping τ	Damping is switched off. The output signal follows measured value changes without any delay.	Damping is switched on. The output signal follows measured value changes with the delay time τ.[1)]
3	SW/Alarm min	The alarm current is defined by the setting in the operating menu. ("Setup" -> "Extended setup" -> "Curr. output" -> "Output fail mode")	The alarm current is 3.6 mA regardless of the setting in the operating menu.
The following switches only for Deltabar M:			
4	SW/√	The output characteristics is defined by the setting in the operating menu. ▪ "Setup" -> "Measuring mode" ▪ "Setup" -> "Extended Setup" -> "Current output" -> "Linear/Sqroot"	The measuring mode is "flow" and the output characterisitcs is "Square root" regardless of the settings in the operating menu.

Switches	Symbol/ labeling	Switch position	
		"off"	"on"
5	SW/P2= High	The high-pressure side is defined by the setting in the operating menu. ("Setup" -> "High Press. Side")	The high-pressure side is allocated to the P2 pressure connection regardless of the setting in the operating menu.

1) The value for the delay time can be configured via the operating menu ("Setup" -> "Damping"). Factory setting: τ = 2 s or as per order specifications.

Function of the operating elements

Operating key(s)	Meaning
"Zero" pressed for at least 3 seconds	**Get LRV** ▪ **"Pressure" measuring mode** The pressure present is accepted as the lower range value (LRV). ▪ **"Level" measuring mode, "In pressure" level selection, "Wet" calibration mode** The pressure present is assigned to the lower level value ("Empty calibration"). No function is assigned to the key if level selection = "In height" and/or calibration mode = "Dry" ▪ **"Flow" measuring mode** There is no function allocated to the "Zero" key.
"Span" pressed for at least 3 seconds	**Get URV** ▪ **"Pressure" measuring mode** The pressure present is accepted as the upper range value (URV). ▪ **"Level" measuring mode, "In pressure" level selection, "Wet" calibration mode** The pressure present is assigned to the upper level value ("Full calibration"). No function is assigned to the key if level selection = "In height" and/or calibration mode = "Dry" ▪ **"Flow" measuring mode** The pressure present is accepted as the maximum pressure ("Max. pressure flow") and allocated to the maximum flow ("max. flow").
"Zero" and **"Span"** pressed simultaneously for at least 3 seconds	**Position adjustment** The sensor characteristic curve is shifted such that the pressure present becomes the zero value.
"Zero" and **"Span"** pressed simultaneously for at least 12 seconds	**Reset** All parameters are reset to the order configuration.

6.2.2 Locking/unlocking operation

Once you have entered all the parameters, you can lock your entries against unauthorized and undesired access.

If operation is locked by means of the DIP switch, you can only unlock operation again by means of the DIP switch. If operation is locked by means of the operating menu, you can only unlock operation again using the operating menu.

Locking/unlocking via DIP switches

DIP switch 1 on the electronic insert is used to lock/unlock operation.
→ 46, "Function of the DIP switches".

6.3 Operation with an operating menu

6.3.1 Operation concept

The operation concept makes a distinction between the following user roles:

User role	Meaning
Operator	Operators are responsible for the devices during normal "operation". This is usually limited to reading process values either directly at the device or in a control room. If the work with the devices extends beyond value read-off tasks, the tasks involve simple, application-specific functions that are used in operation. Should an error occur, these users simple forward the information on the errors but do not intervene themselves.
Service engineer/ technician	Service engineers usually work with the devices in the phases following device commissioning. They are primarily involved in maintenance and troubleshooting activities for which simple settings have to be made at the device. Technicians work with the devices over the entire life cycle of the product. Thus, commissioning and advanced settings and configurations are some of the tasks they have to carry out.
Expert	Experts work with the devices over the entire product life cycle, but their device requirements are often extremely high. Individual parameters/functions from the overall functionality of the devices are required for this purpose time and again. In addition to technical, process-oriented tasks, experts can also perform administrative tasks (e.g. user administration). "Experts" can avail of the entire parameter set.

6.3.2 Structure of the operating menu

User role	Submenu	Meaning/use
Operator	Language	Only consists of the "Language" parameter (000) where the operating language for the device is specified. The language can always be changed even if the device is locked.
Operator	Display/operat.	Contains parameters that are needed to configure the measured value display (selecting the values displayed, display format, display contrast, etc.). With this submenu, users can change the measured value display without affecting the actual measurement.
Service engineer/ technician	Setup	Contains all the parameters that are needed to commission measuring operations. This submenu has the following structure: ▪ **Standard setup parameters** A wide range of parameters, which can be used to configure a typical application, is available at the start. The measuring mode selected determines which parameters are available. After making settings for all these parameters, the measuring operation should be completely configured in the majority of cases. ▪ **"Extended setup" submenu** The "Setup" submenu contains additional parameters for more in-depth configuration of the measurement operation to convert the measured value and to scale the output signal. This menu is split into additional submenus depending on the measuring mode selected.

User role	Submenu	Meaning/use
Service engineer/ technician	Diagnosis	Contains all the parameters that are needed to detect and analyze operating errors. This submenu has the following structure: ▪ **Diagnostic list** Contains up to 10 error messages currently pending. ▪ **Event logbook** Contains the last 10 error messages (no longer pending). ▪ **Instrument info** Contains information on the device identification. ▪ **Measured values** Contains all the current measured values ▪ **Simulation** Is used to simulate pressure, level, flow, current and alarm/warning. ▪ **Reset**
Expert	Expert	Contains all the parameters of the device (including those in one of the submenus). The "Expert" submenu is structured by the function blocks of the device. It thus contains the following submenus: ▪ **System** Contains all the device parameters that neither affect measurement nor integration into a distributed control system. ▪ **Measurement** Contains all the parameters for configuring the measurement. ▪ **Output** Contains all the parameters for configuring the current output. ▪ **Communication** Contains all the parameters for configuring the HART interface. ▪ **Application** Contains all the parameters for configuring the functions that go beyond the actual measurement (e.g. totalizer). ▪ **Diagnosis** Contains all the parameters that are needed to detect and analyze operating errors.

For an overview of the entire operating menu: → 108 ff.

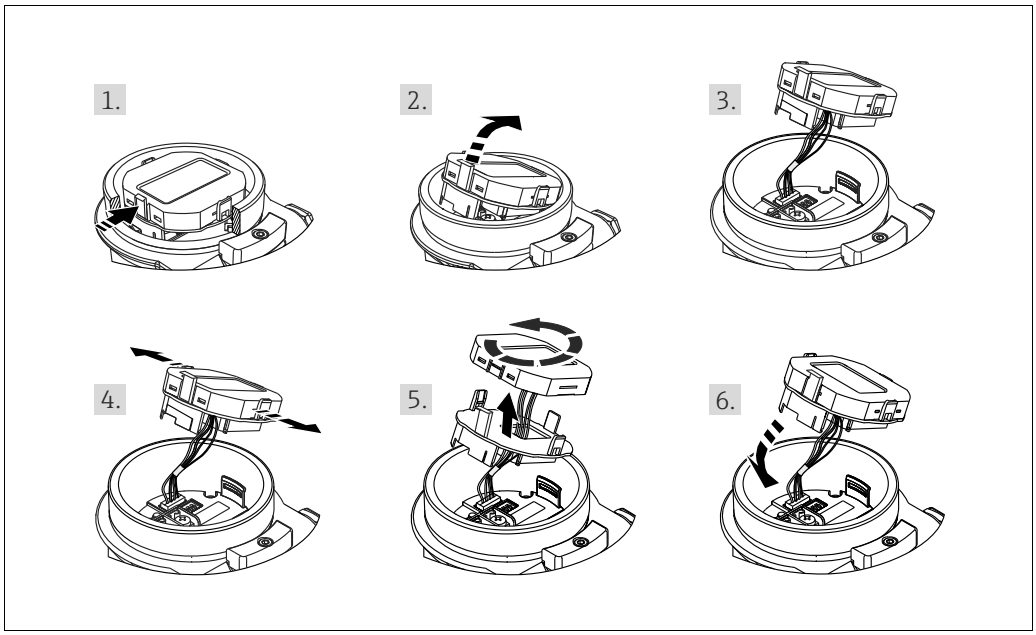
Direct access to parameters

The parameters can only be accessed directly via the "Expert" user role.

Parameter name	Description
Direct access (119) Entry Menu path: Expert → Direct access	Enter the direct access code to go directly to a parameter. **Options:** ▪ Enter the desired parameter code. **Factory setting:** 0 **Note:** For direct access, it is not necessary to enter leading zeros.

6.3.3 Operation with a device display (optional)

A 4-line liquid crystal display (LCD) is used for display and operation. The local display shows measured values, dialog texts, fault messages and notice messages.
For easy operation the display can be taken out of the housing (see figure steps 1 to 3). It is connected to the device through a 90 mm (3.54 in) cable.
The display of the device can be turned in 90° stages (see figure steps 4 to 6).
Depending on the orientation of the device, this makes it easy to operate the device and read the measured values.



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Functions:
- 8-digit measured value display including sign and decimal point, bargraph for 4 to 20 mA HART as current display
- Three keys for operation
- Simple and complete menu guidance as parameters are split into several levels and groups
- Each parameter is given a 3-digit parameter code for easy navigation
- Possibility of configuring the display to suit individual requirements and preferences, such as language, alternating display, contrast setting, display of other measured values such as sensor temperature etc.
- Comprehensive diagnostic functions (fault and warning message etc.)

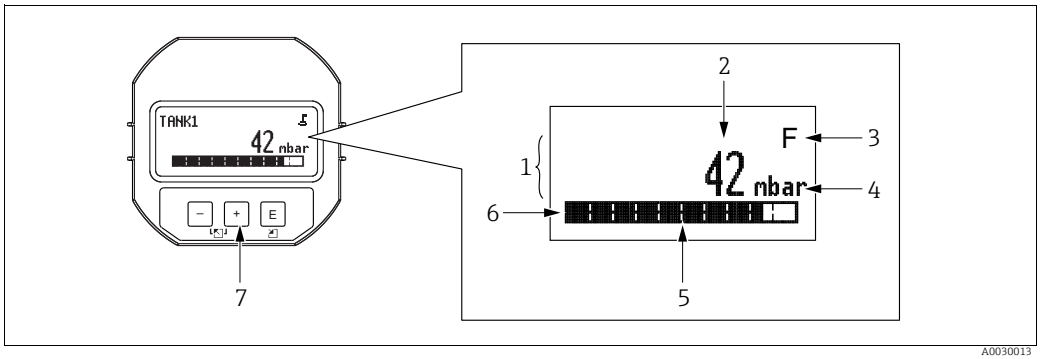


Fig. 28: Display

1 Main line
2 Value
3 Symbol
4 Unit
5 Bar graph
6 Information line
7 Operating keys

The following table illustrates the symbols that can appear on the local display. Four symbols can occur at one time.

Symbol	Meaning
	Lock symbol The operation of the device is locked. To unlock the device, → 55, Locking/ unlocking operation.
	Communication symbol Data transfer via communication
	Square root symbol Active measuring mode "Flow measurement" The root flow signal is used for the current output.
S	**Error message "Out of specification"** The device is being operated outside its technical specifications (e.g. during warmup or cleaning processes).
C	**Error message "Service mode"** The device is in the service mode (during a simulation, for example).
M	**Error message "Maintenance required"** Maintenance is required. The measured value remains valid.
F	**Error message "Failure detected"** An operating error has occurred. The measured value is no longer valid.

Operating keys on the display and operating module

Operating key(s)	Meaning
+	– Navigate downwards in the picklist – Edit the numerical values and characters within a function
−	– Navigate upwards in the picklist – Edit the numerical values and characters within a function
E	– Confirm entry – Jump to the next item – Selection of a menu item and activation of the editing mode
+ and E	Contrast setting of local display: darker
− and E	Contrast setting of local display: brighter
+ and −	ESC functions: – Exit the edit mode for a parameter without saving the changed value. – You are in a menu at a selection level. Each time you press the keys simultaneously, you go up a level in the menu.

Operating example: Parameters with a picklist

Example: selecting "Deutsch" as the language of the menu.

	Language 000	Operation
1	✔ English Deutsch	"English" is set as the menu language (default value). A ✔ in front of the menu text indicates the active option.
2	Deutsch ✔ English	Select "Deutsch" with ⊞ or ⊟.
3	✔ Deutsch English	1. Confirm your choice with Ⓔ. A ✔ in front of the menu text indicates the active option ("Deutsch" is now selected as the menu language). 2. Exit the edit mode for the parameter with Ⓔ.

Operating example: User-definable parameters

Example: setting "Set URV" parameter from 100 mbar (1.5 psi) to 50 mbar (0.75 psi).

	Set URV 014	Operation
1	1 0 0 . 0 0 0 mbar	The local display shows the parameter to be changed. The value highlighted in black can be changed. The "mbar" unit is specified in another parameter and cannot be modified here.
2	**1** 0 0 . 0 0 0 mbar	1. Press ⊞ or ⊟ to get to the editing mode. 2. The first digit is highlighted in black.
3	**5** 0 0 . 0 0 0 mbar	1. Use ⊞ to change "1" to "5". 2. Confirm "5" with Ⓔ. The cursor jumps to the next position (highlighted in black). 3. Confirm "0" with Ⓔ (second position).
4	5 0 **0** . 0 0 0 mbar	The third position is highlighted in black and can now be edited.
5	5 0 ↵ . 0 0 0 mbar	1. Switch to the "↵" symbol with the ⊟ key. 2. Use Ⓔ to save the new value and exit the editing mode. → See next graphic.
6	5 **0** . 0 0 0 mbar	The new value for the upper range value is 50.0 mbar (0.75 psi). – You exit the edit mode for the parameter with Ⓔ. – You can get back to the editing mode with ⊞ or ⊟.

Operating example: Accepting the pressure present

Example: setting position adjustment

	Pos. zero adjust 007	Operation
1	✔ Abort Confirm	The pressure for position adjustment is present at the device.
2	Confirm ✔ Abort	Use ⊞ or ⊟ to switch to the "Confirm" option. The active option is highlighted in black.
3	Compensation accepted!	Accept the pressure present as position adjustment with the Ⓔ key. The device confirms the adjustment and goes back to the "Pos. zero adjust" parameter.
4	✔ Abort Confirm	Exit the edit mode for the parameter with Ⓔ.

6.3.4 Operation via SFX100

Compact, flexible and robust industry handheld terminal for remote parametrization and measured value inspection via the HART current output (4 to 20mA).
For details refer to Operating Instructions BA00060S/04/EN.

6.3.5 Operation via FieldCare

FieldCare is an Endress+Hauser asset management tool based on FDT technology. With FieldCare, you can configure all Endress+Hauser devices as well as devices from other manufacturers that support the FDT standard. Hardware and software requirements you can find on the internet: www.endress.com → select your country → Search: FieldCare → FieldCare → Technical Data.

FieldCare supports the following functions:
- Configuration of transmitters in online/offline mode
- Loading and saving device data (upload/download)
- Documentation of the measuring point
- Offline parametrization of transmitters

Connection options:
- HART via Commubox FXA195 and the USB port of a computer
- HART via Fieldgate FXA520

- → 41, Section 5.2.7 "Connecting Commubox FXA195".
- In "Level expert" measuring mode, the configuration data which were generated by FDT upload cannot be saved back again (FDT download); they are used solely to document the configuration.
- Further information on FieldCare can be found on the Internet (http://www.endress.com, Download → Search for: FieldCare).
- As not all internal device dependencies can be mapped in offline operation, the consistency of the parameters must be checked before the parameters are transmitted to the device.

6.3.6 Locking/unlocking operation

Once you have entered all the parameters, you can lock your entries against unauthorized and undesired access.
Locked operation is indicated as follows:
- By the symbol on the onsite display
- The parameters are grayed out in FieldCare and the HART handheld terminal, which means they cannot be edited. Indicated in the corresponding "Locking" parameter.

Parameters which refer to how the display appears, e.g. "Language" and "Display contrast", can still be altered.

If operation is locked by means of the DIP switch, you can only unlock operation again by means of the DIP switch. If operation is locked by means of the operating menu, you can only unlock operation again using the operating menu.

The "Operator code" parameter is used to lock and unlock the device.

Parameter name	Description
Operator code (021) Entry Menu path: Setup → Extended setup → Operator code	Use this function to enter a code to lock or unlock operation. **User input:** ▪ To lock: Enter a number ≠ the release code (value range: 1 to 9999). ▪ To unlock: Enter the release code. The release code is "0" in the order configuration. Another release code can be defined in the "Code definition" parameter. If the user has forgotten the release code, the release code can be visible by entering the number "5864". **Factory setting:** 0

The release code is defined in the "Code definition" parameter.

Parameter name	Description
Code definition (023) Entry Menu path: Setup → Extended setup → Code definition	Use this function to enter a release code with which the device can be unlocked. **User input:** ▪ A number between 0 and 999 **Factory setting:** 0

6.3.7 Resetting to factory settings (reset)

By entering a certain code, you can completely, or partially, reset the entries for the parameters to the factory settings[1]. Enter the code by means of the "Enter reset code" parameter (menu path: "Diagnosis" → "Reset" → "Enter reset code").
There are various reset codes for the device. The following table illustrates which parameters are reset by the particular reset codes. Operation must be unlocked to reset parameters (→ 55).

Any customer-specific configuration carried out at the factory is not affected by a reset (customer-specific configuration remains). If you want to change the customer-specific configuration carried out at the factory, please contact Endress+Hauser Service.
As no separate service level is provided, the order code and serial number may be changed without a specific unblocking code (e.g. after replacing the electronics).

Reset code[1]	Description and effect
62	**PowerUp reset (warm start)** ▶ The device is restarted. ▶ Data are read back anew from the EEPROM (processor is initialized again). ▶ Any simulation which may be running is ended.
333	**User reset** ▶ This code resets all the parameters apart from: – Device tag (022) – Linearization table – Operating hours (162) – Event logbook – Current trim 4mA (135) – Current trim 20mA (136) – Lo trim sensor (131) – Hi trim sensor (132) ▶ Any simulation which may be running is ended. ▶ The device is restarted.
7864	**Total reset** ▶ This code resets all the parameters apart from: – Operating hours (162) – Event logbook – Lo trim sensor (131) – Hi trim sensor (132) ▶ Any simulation which may be running is ended. ▶ The device is restarted.

1) To be entered in "Diagnosis" → "Reset" → "Enter reset code" (124)

After a "Total reset" in FieldCare you have to press the "refresh" button in order to ensure that the measuring units are also reset.

1) The default value for the individual parameters is indicated in the parameter description (→ 116 ff)

7 Integrating transmitter using HART® protocol

Version data for the device

Firmware version	01.00.zz	▪ On the title page of the Operating instructions ▪ On nameplate ▪ **Firmware Version** parameter Diagnostics → Instrument info → Firmware-Version
Manufacturer ID	17 (0x11)	Parameter **Manufacturer Id** Diagnostics → Instrument info → Manufacturer ID
Device type ID	Cerabar M: 25 (0x19) Deltabar M: 33 (0x21) Deltapilot M: 35 (0x23)	Parameter **Device ID** Diagnostics → Instrument info → Device ID
HART protocol revision	6.0	---
Device revision	1	▪ On transmitter nameplate ▪ **Device revision** parameter Diagnostics → Instrument info → Device revision

The suitable device description file (DD) for the individual operating tools is listed in the table below, along with information on where the file can be acquired.

Operating tools

Operating tool	Reference sources for device descriptions (DD and DTM)
FieldCare	▪ www.endress.com → Download-Area ▪ CD-ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)
AMS Device Manager (Emerson Process Management)	www.endress.com → Download-Area
SIMATIC PDM (Siemens)	www.endress.com → Download-Area
Field Communicator 375, 475 (Emerson Process Management)	Use update function of handheld terminal

7.1 HART process variables and measured values

The following numbers are assigned to the process variables in the factory:

Process variable	Pressure	Flow (Deltabar only)		Level	
		Linear	Square root	Linear	Table active
First process variable (Primary Variable)	0 - Measured pressure	0 - Measured pressure	5 - Flow	8 - Level before linearization	9- Tank content
Second process variable (Secondary Variable)	2 - Druck n. Lagekor	5 - Flow	0 - Measured pressure	0 - Measured pressure	8 - Level before linearization
Third process variable (Tertiary Variable)	3 - Sensor pressure	6 - Totalizer 1	6 - Totalizer 1	2 - Corrected press.	0 - Measured pressure
Fourth process variable (Quaternary Variable)	Deltabar M: 251 - None Apart from Deltabar M: Sensor temp.				

The assignment of the device variables to the process variable is displayed in the **Expert → Communication → HART output** menu.
The assignment of the device variables to the process variable can be changed using HART command 51. An overview of the possible device variables can be found in the following section.

7.2 Device variables and measured values

The following measured values are assigned to the individual device variables:

Device-Variable Code	Device variable	Measured value	Operating mode	Devices
0	PRESSURE_1_FINAL_VALUE	Meas. pressure	all	all
1	PRESSURE_1_AFTER_DAMPING	Pressure af. damp	all	all
2	PRESSURE_1_AFTER_CALIBRATION	Corrected press.	all	all
3	PRESSURE_1_AFTER_SENSOR	Sensor pressure	all	all
4	MEASURED_TEMPERATURE_1	Sensor temp.	all	Not Deltabar M
5	FLOW_AFTER_SUPPRESSION	Flow	Flow only	Not Deltabar M
6	TOTALIZER_1_FLOAT	Totalizer 1	Flow only	Not Deltabar M
7	TOTALIZER_2_FLOAT	Totalizer 2	Flow only	Not Deltabar M
8	MEASURED_LEVEL_AFTER_ SIMULATION	Level before Lin.	Level only	all [1]
9	MEASURED_TANK_CONTENT_AFTER_ SIMULATION	Tank content	Level only	all [1]
10	CORRECTED_MEASUREMENT_ DENSITY	Process density	Level only	all [1]
11	MEASURED_TEMPERATURE_3	Electronics Temp	all	Not Deltabar M
12	HART_INPUT_VALUE	HART Input Value	Not selectable as output	
251	None (no device variable is mapped)		all (but only allowed for Quaternary)	

1) Cerabar M: with Level measurement option

The device variables can be queried from a HART® master using HART® command 9 or 33.

8 Commissioning

The device is configured at the factory for the Pressure measuring mode (Cerabar, Deltabar) or Level measuring mode (Deltapilot). The measuring range and the unit in which the measured value is transmitted correspond to the specifications on the nameplate.

⚠ WARNING

Exceeding the maximum allowable working pressure!

Risk of injury due to bursting of parts! Warning messages are generated if pressure is too high.

- If a pressure smaller than the minimum permitted pressure or greater than the maximum permitted pressure is present at the device, the following messages are output in succession (depending on the setting in the "Alarm behavior" (050) parameter):
  "S140 Working range P" or "F140 Working range P"
  "S841 Sensor range" or "F841 Sensor range"
  "S971 Adjustment"
  Use the device only within the sensor range limits.

NOTICE

Shortfall of the allowable working pressure!

Output of messages if pressure is too low.

- If a pressure smaller than the minimum permitted pressure or greater than the maximum permitted pressure is present at the device, the following messages are output in succession (depending on the setting in the "Alarm behavior" (050) parameter):
  "S140 Working range P" or "F140 Working range P"
  "S841 Sensor range" or "F841 Sensor range"
  "S971 Adjustment"
  Use the device only within the sensor range limits.

8.1 Function check

Carry out a post-installation and a post-connection check as per the checklist before commissioning the device.

- "Post-installation check" checklist → Chap. 4.10
- "Post-connection check" checklist → Chap. 5.4

8.2 Commissioning without an operating menu

8.2.1 Pressure measuring mode

If no local display is connected, the following functions are possible by means of the keys on the electronic insert:
- Position adjustment (zero point correction)
- Setting lower range value and upper range value
- Device reset → 47

- Operation must be unlocked. → 55, "Locking/unlocking operation"
- The device is configured for the "Pressure" measuring mode as standard. You can switch measuring modes by means of the "Measuring mode" parameter. → 63, "Measuring mode selection"
- The pressure applied must be within the nominal pressure limits of the sensor. See information on the nameplate.

⚠ WARNING

Changing the measuring mode affects the span (URV)!

This situation can result in product overflow.

▶ If the measuring mode is changed, the span setting (URV) must be verified and, if necessary, reconfigured!

Carrying out position adjustment.[1]	
Pressure is present at device.	
↓	
Press the "Zero" and "Span" keys simultaneously for at least 3 s.	
↓	
Does the LED on the electronic insert light up briefly?	
Yes	No
↓	↓
Applied pressure for position adjustment has been accepted.	Applied pressure for position adjustment has not been accepted. Observe the input limits.

Setting lower range value.	
Desired pressure for lower range value is present at device.	
↓	
Press the "Zero" key for at least 3 s.	
↓	
Does the LED on the electronic insert light up briefly?	
Yes	No
↓	↓
Applied pressure for lower range value has been accepted.	Applied pressure for lower range value has not been accepted. Observe the input limits.

Setting upper range value.	
Desired pressure for upper range value is present at device.	
↓	
Press the "Span" key for at least 3 s.	
↓	
Does the LED on the electronic insert light up briefly?	
Yes	No
↓	↓
Applied pressure for upper range value has been accepted.	Applied pressure for upper range value has not been accepted. Observe the input limits.

1) Observe warning on commissioning (→ 59)

8.2.2 Level measuring mode

The following functions are possible by means of the keys on the electronic insert:
- Position adjustment (zero point correction)
- Setting the lower and upper pressure value and assigning to the lower and upper level value
- Device reset → 47

- The "Zero" and "Span" keys only have a function with the following setting:
  – "Level selection" = "In pressure", "Calibration mode" = "Wet"
  The keys have no function in other settings.
- The device is configured for the "Pressure" measuring mode as standard. You can switch measuring modes by means of the "Measuring mode" parameter. → 63, "Measuring mode selection"
  The following parameters are set to the following values at the factory:
  – "Level selection" = "In pressure"
  – "Calibration mode": wet
  – "Unit before lin": %
  – "Empty calib.": 0.0
  – "Full calib.": 100.0
  – "Set LRV": 0.0 (corresponds to 4 mA value)
  – "Set URV": 100.0 (corresponds to 20 mA value)
- Operation must be unlocked. → 55, "Locking/unlocking operation".
- The pressure applied must be within the nominal pressure limits of the sensor. See information on the nameplate.

⚠ WARNING

Changing the measuring mode affects the span (URV)!

This situation can result in product overflow.

▶ If the measuring mode is changed, the span setting (URV) must be verified and, if necessary, reconfigured!

Carrying out position adjustment.[1]		**Setting lower pressure value.**		**Setting upper pressure value.**	
Pressure is present at device.		Desired pressure for lower pressure value ("empty pressure") is present at device.		Desired pressure for upper pressure value ("full pressure") is present at device.	
↓		↓		↓	
Press the "Zero" and "Span" keys simultaneously for at least 3 s.		Press the "Zero" key for at least 3 s.		Press the "Span" key for at least 3 s.	
↓		↓		↓	
Does the LED on the electronic insert light up briefly?		Does the LED on the electronic insert light up briefly?		Does the LED on the electronic insert light up briefly?	
Yes	No	Yes	No	Yes	No
↓	↓	↓	↓	↓	↓
Applied pressure for position adjustment has been accepted.	Applied pressure for position adjustment has not been accepted. Observe the input limits.	The pressure present was saved as the lower pressure value ("empty pressure") and assigned to the lower level value ("empty calibration").	The pressure present was not saved as the lower pressure value. Observe the input limits.	The pressure present was saved as the upper pressure value ("full pressure") and assigned to the upper level value ("full calibration").	The pressure present was not saved as the upper pressure value. Observe the input limits.

1) Observe warning on commissioning (→ 59)

8.2.3 Flow measuring mode (Deltabar M only)

The following functions are possible by means of the keys on the electronic insert:
- Position adjustment (zero point correction)
- Set the maximum pressure value and assign it to the maximum flow value
- Device reset → 47

- The operation must be unlocked. → 47, "Locking/unlocking operation".
- The device is configured for the "Pressure" measuring mode as standard. You can switch measuring modes by means of the "Measuring mode" parameter. → 63, "Selecting the language, measuring mode and pressure unit".
- DIP switch 4 (SW/√) on the electronics insert can be used to switch to the "Flow" measuring mode. In this case, the "Measuring mode" parameter is adjusted automatically.
- The "Zero"- key does not have any function in the "Flow" measuring mode.
- The pressure applied must be within the nominal pressure limits of the sensor. See information on the nameplate.

⚠ WARNING

Changing the measuring mode affects the span (URV)!

This situation can result in product overflow.

▶ If the measuring mode is changed, the span setting (URV) must be verified and, if necessary, reconfigured!

Carry out position adjustment.[1]	
Pressure is present at device.	
↓	
Press the "Zero" and "Span" keys simultaneously for at least 3 s.	
↓	
Does the LED on the electronic insert light up briefly?	
Yes	No
↓	↓
Applied pressure for position adjustment has been accepted.	Applied pressure for position adjustment has not been accepted. Observe the input limits.

Setting maximum pressure value.	
Desired pressure for the maximum pressure value ("Max. Press. Flow") is present at device.	
↓	
Press the "Span" key for at least 3 s.	
↓	
Does the LED on the electronic insert light up briefly?	
Yes	No
↓	↓
The pressure present was saved as the maximum pressure value ("Max. Press. Flow") and assigned to the maximum flow value ("Max. Flow").	The pressure present was not saved as the maximum pressure value. Observe the input limits.

1) Observe warning concerning the commissioning (page → 59).

8.3 Commissioning with an operating menu

Commissioning comprises the following steps:
1. Function check (→ 59)
2. Selecting the language, measuring mode and pressure unit (→ 63)
3. Position adjustment (→ 64)
4. Configuring measurement:
   – Pressure measurement (→ 79 ff)
   – Level measurement (→ 65 ff)
   – Flow measurement (→ 65 ff)

8.3.1 Selecting the language, measuring mode and pressure unit

Language selection

Parameter name	Description
Language (000) Selection Menu path: Main menu → Language	Select the menu language for the local display. **Options:** ▪ English ▪ Another language (as selected when ordering the device) ▪ Possibly a third language (language of the manufacturing plant) **Factory setting**: English

Measuring mode selection

Parameter name	Description
Measuring mode (005) Selection Menu path: Setup → Measuring mode	Select the measuring mode. The operating menu is structured differently depending on the measuring mode selected. **⚠ WARNING** **Changing the measuring mode affects the span (URV)!** This situation can result in product overflow. ▶ If the measuring mode is changed, the span setting (URV) must be verified and, if necessary, reconfigured! **Options:** ▪ Pressure ▪ Level ▪ Flow **Factory setting:** Pressure

Pressure unit selection

Parameter name	Description
Press. eng. unit (125) Selection Menu path: Setup → Press. eng. unit	Select the pressure unit. If a new pressure unit is selected, all pressure-specific parameters are converted and displayed with the new unit. **Options:** ▪ mbar, bar ▪ mmH2O, mH2O, inH2O ▪ ftH2O ▪ Pa, kPa, MPa ▪ psi ▪ mmHg, inHg ▪ kgf/cm^2 **Factory setting:** mbar or bar depending on the sensor nominal measuring range, or as per order specifications

8.4 Position zero adjustment

The pressure resulting from the orientation of the device can be corrected here.

Parameter name	Description
Corrected press. (172) Display Menu path: Setup → Corrected press.	Displays the measured pressure after sensor trim and position adjustment. If this value is not equal to "0", it can be corrected to "0" by the position adjustment.
Pos. zero adjust (007) (Deltabar M and gauge pressure sensor) Selection Menu path: Setup → Pos. zero adjust	Position zero adjustment – the pressure difference between zero (set point) and the measured pressure need not be known. **Example:** – Measured value = 2.2 mbar (0.033 psi) – You correct the measured value via the "Pos. zero adjust" parameter with the "Confirm" option. This means that you assign the value 0.0 to the pressure present. – Measured value (after pos. zero adjust) = 0.0 mbar – The current value is also corrected. **Options** ▪ Confirm ▪ Abort **Factory setting:** Abort
Calib. offset (192) / (008) (absolute pressure sensor) Entry	Position adjustment – the pressure difference between set point and the measured pressure must be known. **Example:** – Measured value = 982.2 mbar (14.73 psi) – You correct the measured value with the value entered (e.g. 2.2 mbar (0.033 psi)) via the "Calib. offset" parameter. This means that you are assigning the value 980.0 (14.7 psi) to the pressure present. – Measured value (after calib. offset) = 980.0 mbar (14.7 psi) – The current value is also corrected. **Factory setting:** 0.0

8.5 Level measurement (Cerabar M and Deltapilot M)

8.5.1 Information on level measurement

- The limit values are not checked, i.e. the values entered must be appropriate for the sensor and the measuring task for the device to be able to measure correctly.
- Customer-specific units are not possible.
- There is no unit conversion.
- The values entered for "Empty calib./Full calib.", "Empty pressure/Full pressure", "Empty height/Full height" and "Set LRV/Set URV" must be at least 1% apart. The value will be rejected, and a warning message displayed, if the values are too close together.

You have a choice of two methods for calculating the level: "In pressure" and "In height". The table in the "Overview of level measurement" section that follows provides you with an overview of these two measuring tasks.

8.5.2 Overview of level measurement

Measuring task	Level selection	Measured variable selection	Description	Measured value display
Calibration is performed by entering two pressure-level value pairs.	"In pressure"	Via the "Unit before lin" parameter: %, level, volume or mass units.	– Calibration with reference pressure (wet calibration), see → 66 – Calibration without reference pressure (dry calibration), see → 68	The measured value display and the "Level before lin" parameter display the measured value.
Calibration is performed by entering the density and two height-level value pairs.	"In height"		– Calibration with reference pressure (wet calibration), see → 70 – Calibration without reference pressure (dry calibration), see → 72	

8.5.3 "In pressure" level selection Calibration with reference pressure (wet calibration)

Example:
In this example, the level in a tank should be measured in "m". The maximum level is 3 m (9.8 ft). The pressure range is set to 0 to 300 mbar (4.5 psi).

Prerequisite:
- The measured variable is in direct proportion to the pressure.
- The tank can be filled and emptied.

The values entered for "Empty calib./Full calib." and" Set LRV/Set URV" and the pressures present at the device must be at least 1% apart. The value will be rejected, and a warning message displayed, if the values are too close together. Further limit values are not checked, i.e. the values entered must be appropriate for the sensor and the measuring task for the measuring device to be able to measure correctly.

	Description
1	Perform "position adjustment".→ 64
2	Select the "Level" measuring mode via the "**Measuring mode (005)**" parameter. Menu path: Setup → Measuring mode
3	Select the "In pressure" level mode via the "Level selection" parameter. Menu path: Setup → Extended setup → Level → Level selection.
4	Select a pressure unit via the "Press eng. unit" parameter, here "mbar" for example. Menu path: Setup → Press. eng. unit

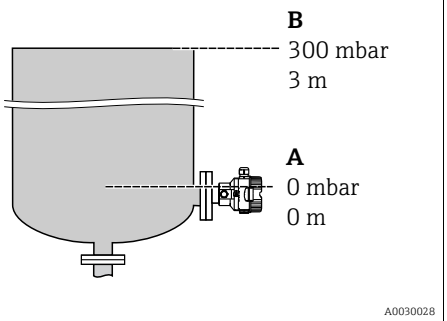
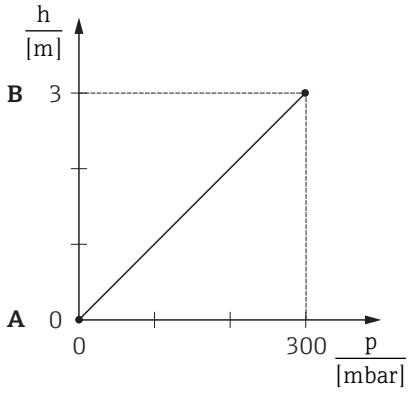


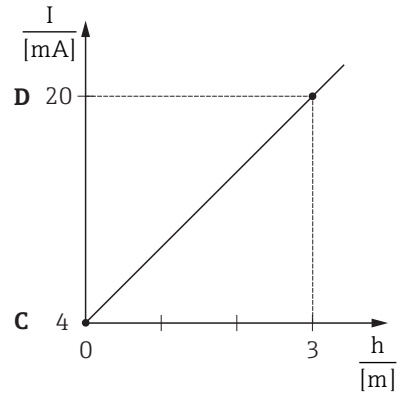
Fig. 29: Calibration with reference pressure – wet calibration

A See Table, Step 8.
B See Table, Step 9.

	Description
5	Select a level unit via the "Unit before lin" parameter, here "m" for example. Menu path: Setup → Extended setup → Level → Unit before lin
6	Select the "Wet" option via the "Calibration mode" parameter. Menu path: Setup → Extended setup → Level → Calibration mode
7	If calibration is performed with a medium other than the process medium, enter the density of the calibration medium in the "Adjust density" parameter. Menu path: Setup → Extended setup → Level → Adjust density
8	The pressure for the lower calibration point is present at the device, here 0 mbar for example.
	Select the "Empty calib." parameter. Menu path: Setup → Extended setup → Level → Empty calib.
	Enter the level value, here 0 m for example. The pressure value present is assigned to the lower level value by confirming the value.
9	The pressure for the upper calibration point is present at the device, here 300 mbar (4.5 psi) for example.
	Select the "Full calib." parameter. Menu path: Setup → Extended setup → Level → Full calib.
	Enter the level value, here 3 m (9.8 ft) for example. The pressure value present is assigned to the upper level value by confirming the value.
10	Set the level value for the lower current value (4 mA) by means of "Set LRV". Menu path: Setup → Extended setup → Current output → Set LRV
11	Set the level value for the upper current value (20 mA) by means of "Set URV". Menu path: Setup → Extended setup → Current output → Set URV
12	If calibration was performed with a medium other than the process medium, specify the density of the process medium in the "Process density" parameter. Menu path: Setup → Extended setup → Level → Process density
13	Result: The measuring range is set for 0 to 3 m (9.8 ft).



A0017658



A0031063

Fig. 30: Calibration with reference pressure – wet calibration

A See Table, Step 8.
B See Table, Step 9.
C See Table, Step 10.
D See Table, Step 11.

The measured variables %, level, volume and mass are available for this level mode. See → 123 "**Unit before lin (025)**".

8.5.4 "In pressure" level selection Calibration without reference pressure (dry calibration)

Example:
In this example, the volume in a tank should be measured in liters. The maximum volume of 1000 liters (264 US gal) corresponds to a pressure of 450 mbar (6.75 psi). The minimum volume of 0 liters corresponds to a pressure of 50 mbar (0.75 psi) since the device is mounted below the start of the level measuring range.

Prerequisite:
- The measured variable is in direct proportion to the pressure.
- This is a theoretical calibration i.e. the pressure and volume values for the lower and upper calibration point must be known.

- The values entered for "Empty calib./Full calib.", "Empty pressure/Full pressure" and "Set LRV/Set URV" must be at least 1% apart. The value will be rejected, and a warning message displayed, if the values are too close together. Further limit values are not checked, i.e. the values entered must be appropriate for the sensor and the measuring task for the measuring device to be able to measure correctly.
- Due to the orientation of the device, there may be pressure shifts in the measured value, i.e. when the container is empty or partly filled, the measured value is not zero. For information on how to perform position adjustment, see → 64, "Position zero adjustment".

	Description
1	Select the "Level" measuring mode via the "Measuring mode" parameter. Menu path: Setup → Measuring mode
2	Select the "In pressure" level mode via the "Level selection" parameter. Menu path: Setup → Extended setup → Level → Level selection
3	Select a pressure unit via the "Press eng. unit" parameter, here "mbar" for example. Menu path: Setup → Press. eng. unit
4	Select a level unit via the "Unit before lin" parameter, here "l" (liters) for example. Menu path: Setup → Extended setup → Level → Unit before lin

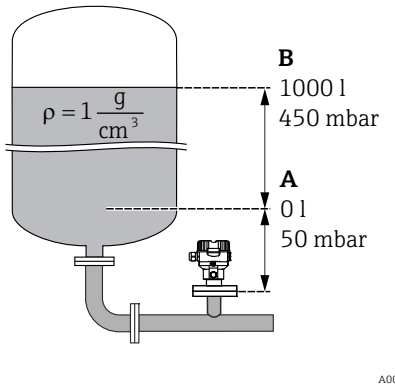
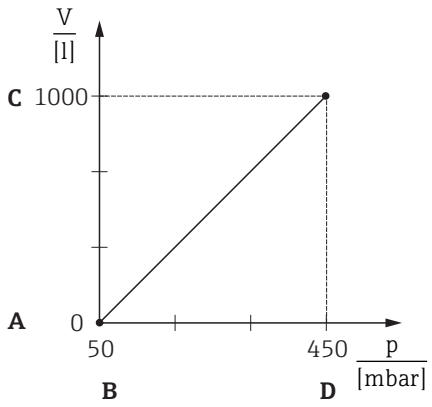


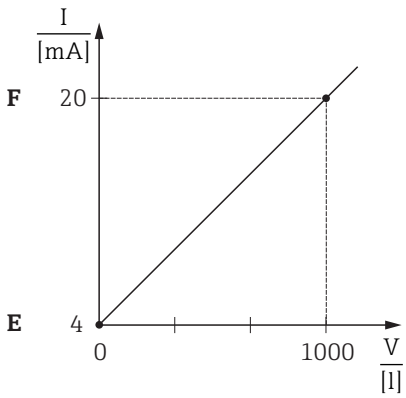
Fig. 31: Calibration without reference pressure – dry calibration

A See Table, Steps 6 and 7.
B See Table, Steps 8 and 9.

	Description
5	Select the "Dry" option via the "Calibration mode" parameter. Menu path: Setup → Extended setup → Level → Calibration mode
6	Enter the volume value for the lower calibration point via the "Empty calib." parameter, here 0 liters for example. Menu path: Setup → Extended setup → Level → Empty calib.
7	Enter the pressure value for the lower calibration point via the "Empty pressure" parameter, here 50 mbar (0.75 psi) for example. Menu path: Setup → Extended setup → Level → Empty pressure
8	Enter the volume value for the upper calibration point via the "Full calib." parameter, here 1000 liters (264 US gal) for example. Menu path: Setup → Extended setup → Level → Full calib.
9	Enter the pressure value for the upper calibration point via the "Full pressure" parameter, here 450 mbar (6,75 psi) for example. Menu path: Setup → Extended setup → Level → Full pressure
10	"Adjust density" contains the factory setting 1.0 but this value can be changed if required. The value pairs subsequently entered must correspond to this density. Menu path: Setup → Extended setup → Level → Adjust density
11	Set the volume value for the lower current value (4 mA) via the "Set LRV" parameter. Menu path: Setup → Extended setup → Current output → Set LRV
12	Set the volume value for the upper current value (20 mA) via the "Set URV" parameter. Menu path: Setup → Extended setup → Current output → Set URV
13	If calibration was performed with a medium other than the process medium, specify the density of the process medium in the "Process density" parameter. Menu path: Setup → Extended setup → Level → Process density
14	Result: The measuring range is set for 0 to 1000 l (264 US gal).



A0031028



A0031064

Fig. 32: Calibration with reference pressure – wet calibration

A See Table, Step 6.
B See Table, Step 7.
C See Table, Step 8.
D See Table, Step 9.
E See Table, Step 11.
F See Table, Step 12.

The measured variables %, level, volume and mass are available for this level mode. See → 123 "**Unit before lin (025)**".

8.5.5 "In height" level selection Calibration with reference pressure (wet calibration)

Example:
In this example, the volume in a tank should be measured in liters. The maximum volume of 1000 liters (264 US gal) corresponds to a level of 4.5 m (15 ft). The minimum volume of 0 liters corresponds to a level of 0.5 m (1.6 ft) since the device is mounted below the start of the level measuring range.
The density of the medium is 1 g/cm³ (1 SGU).

Prerequisite:
- The measured variable is in direct proportion to the pressure.
- The tank can be filled and emptied.

The values entered for "Empty calib./Full calib.", " Set LRV/Set URV" and the pressures present at the device must be at least 1% apart. The value will be rejected, and a warning message displayed, if the values are too close together. Other limit values are not checked, i.e. the values entered must be appropriate for the sensor and the measuring task for the device to be able to measure correctly.

	Description
1	Perform position adjustment. See → 64.
2	Select the "Level" measuring mode via the "Measuring mode" parameter. Menu path: Setup → Measuring mode
3	Select the "In height" level mode via the "Level selection" parameter. Menu path: Setup → Extended setup → Level → Level selection
4	Select a pressure unit via the "Press eng. unit" parameter, here mbar for example. Menu path: Setup → Press. eng. unit
5	Select a level unit via the "Unit before lin" parameter, here "l" (liters) for example. Menu path: Setup → Extended setup → Level → Unit before lin

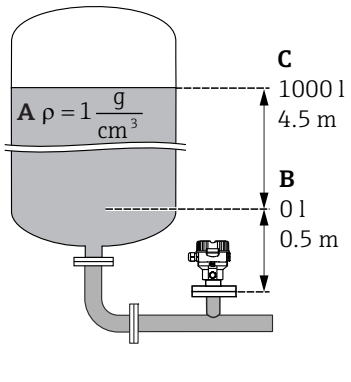


Fig. 33: Calibration with reference pressure – wet calibration

A See Table, Step 10.
B See Table, Step 8.
C See Table, Step 9.

	Description
6	Select a level unit via the "Height unit" parameter, here "m" for example. Menu path: Setup → Extended setup → Level → Height unit
7	Select the "Wet" option via the "Calibration mode" parameter. Menu path: Setup → Extended setup → Level → Calibration mode
8	The pressure for the lower calibration point is present at the device, here "50 mbar" (0.75 psi) for example.
	Enter the volume value for the lower calibration point via the "Empty calib." parameter, here 0 liters for example. (The pressure currently measured is displayed as the height, here 0.5 m (1.6 ft) for example.) Menu path: Setup → Extended setup → Level → Empty calib.
9	The pressure for the upper calibration point is present at the device, here "450 mbar" (6.75 psi) for example.
	Enter the volume value for the upper calibration point via the "Full calib." parameter, here "1000 liters" (264 US gal) for example. The pressure currently measured is displayed as the height, here "4.5 m" (15 ft) for example. Menu path: Setup → Extended setup → Level → Full calib.
8	If calibration is performed with a medium other than the process medium, enter the density of the calibration medium in the "Adjust density" parameter, here "1 g/cm³" (1 SGU) for example. Menu path: Setup → Extended setup → Level → Adjust density
11	Set the volume value for the lower current value (4 mA) via the "Set LRV" parameter. Menu path: Setup → Extended setup → Current output → Set LRV
12	Set the volume value for the upper current value (20 mA) via the "Set URV" parameter. Menu path: Setup → Extended setup → Current output → Set URV
13	If calibration was performed with a medium other than the process medium, specify the density of the process medium in the "Process density" parameter. Menu path: Setup → Extended setup → Level → Process density
14	Result: The measuring range is set for 0 to 1000 l (264 US gal).

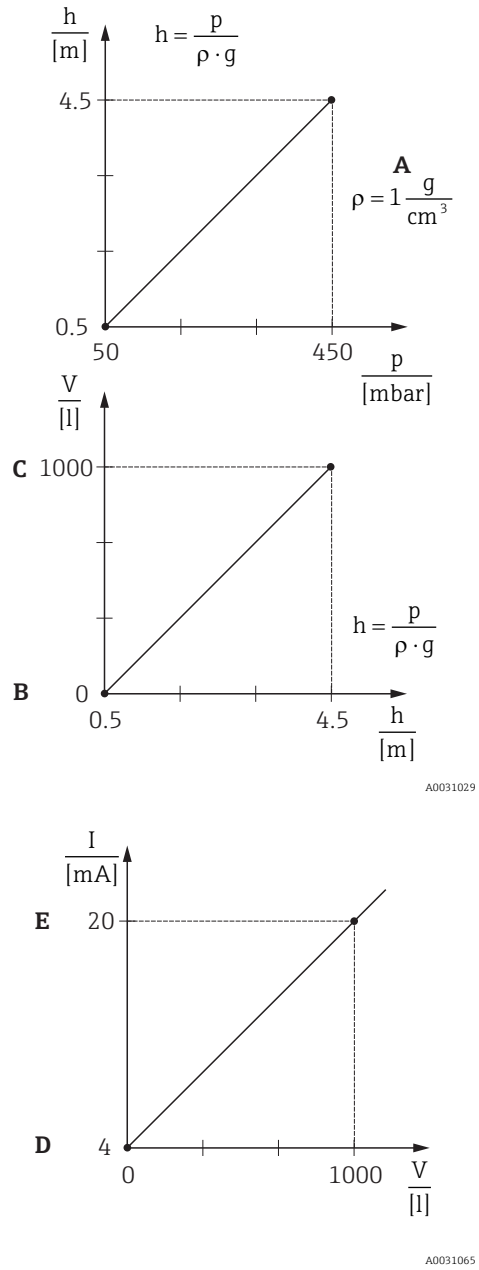


Fig. 34: Calibration with reference pressure – wet calibration

E See Table, Step 10.
F See Table, Step 8.
G See Table, Step 9.
H See Table, Step 11
I See Table, Step 12.

The measured variables %, level, volume and mass are available for this level mode → 123 "**Unit before lin (025)**".

8.5.6 "In height" level selection Calibration without reference pressure (dry calibration)

Example:
In this example, the volume in a tank should be measured in liters. The maximum volume of 1000 liters (264 US gal) corresponds to a level of 4.5 m (15 ft). The minimum volume of 0 liters corresponds to a level of 0.5 m (1.6 ft) since the device is mounted below the start of the level measuring range.

Prerequisite:
- The measured variable is in direct proportion to the pressure.
- This is a theoretical calibration i.e. the height and volume values for the lower and upper calibration point must be known.

- The values for "Empty calib./Full calib.", "Empty height/Full height" and" Set LRV/Set URV" must be at least 1% apart. The value will be rejected, and a warning message displayed, if the values are too close together. Further limit values are not checked, i.e. the values entered must be appropriate for the sensor and the measuring task for the measuring device to be able to measure correctly.
- Due to the orientation of the device, there may be pressure shifts in the measured value, i.e. when the container is empty or partly filled, the measured value is not zero. For information on how to perform position adjustment, see → 64, "Position zero adjustment".

	Description
1	Select the "Level" measuring mode via the "Measuring mode" parameter. Menu path: Setup → Measuring mode
2	Select a pressure unit via the "Press eng. unit" parameter, here "mbar" for example. Menu path: Setup → Press. eng. unit
3	Select the "In height" level mode via the "Level selection" parameter. Menu path: Setup → Extended setup → Level → Level selection
4	Select a level unit via the "Unit before lin" parameter, here "l" (liters) for example. Menu path: Setup → Extended setup → Level → Unit before lin
5	Select a level unit via the "Height unit" parameter, here "m" for example. Menu path: Setup → Extended setup → Level → Height unit
6	Select the "Dry" option via the "Calibration mode" parameter. Menu path: Setup → Extended setup → Level → Calibration mode

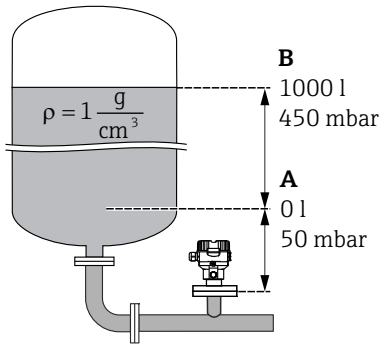


Fig. 35: Calibration without reference pressure – dry calibration

A See Table, Step 11.
B See Table, Steps 7 and 8.
D See Table, Steps 9 and 10.

	Description
7	Enter the volume value for the lower calibration point via the "Empty calib." parameter, here 0 liters for example. Menu path: Setup → Extended setup → Level → Empty calib.
8	Enter the height value for the lower calibration point via the "Empty height" parameter, here 0.5 m (1.6 ft) for example. Menu path: Setup → Extended setup → Level → Empty height
9	Enter the volume value for the upper calibration point via the "Full calib." parameter, here 1000 liters (264 US gal) for example. Menu path: Setup → Extended setup → Level → Full calib.
10	Enter the height value for the upper calibration point via the "Full height" parameter, here 4.5 m (15 ft) for example. Menu path: Setup → Extended setup → Level → Full height
11	Enter the density of the medium via the "Adjust density" parameter, here "1 g/cm³" (1 SGU) for example. Menu path: Setup → Extended setup → Level → Adjust density
12	Set the volume value for the lower current value (4 mA) via the "Set LRV" parameter. Menu path: Setup → Extended setup → Current output → Set LRV
13	Set the volume value for the upper current value (20 mA) via the "Set URV" parameter. Menu path: Setup → Extended setup → Current output → Set URV
14	If the process uses a medium other than that on which the calibration was based, the new density has to be specified in the "Process density" parameter. Menu path: Setup → Extended setup → Level → Process density
15	Result: The measuring range is set for 0 to 1000 l (264 US gal).

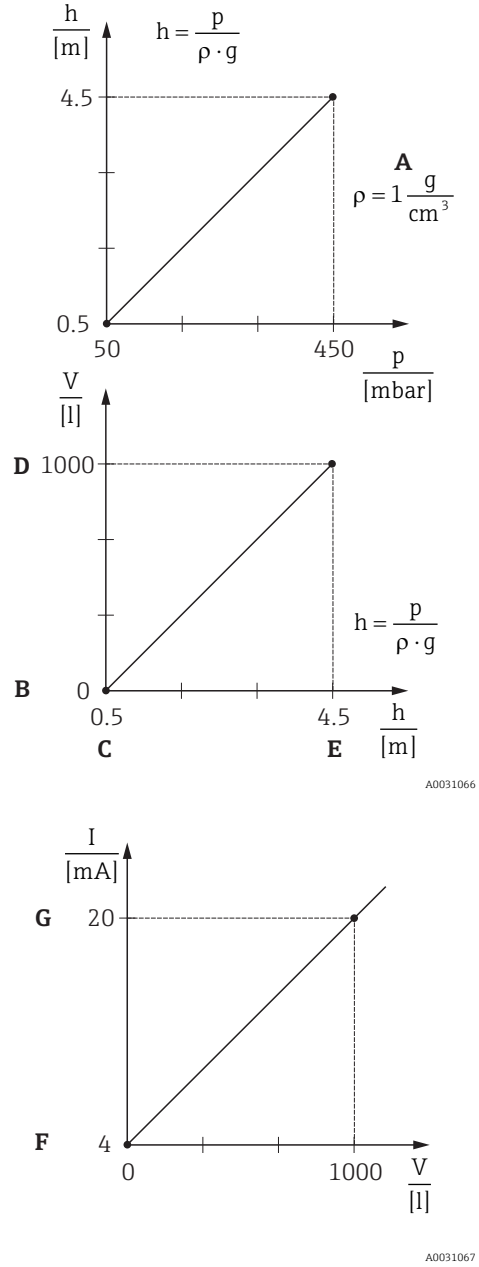


Fig. 36: Calibration with reference pressure – wet calibration

A See Table, Step 11.
B See Table, Step 7.
C See Table, Step 8.
D See Table, Step 9.
E See Table, Step 10.
F See Table, Step 12.
G See Table, Step 13.

The measured variables %, level, volume and mass are available for this level mode → 123 "**Unit before lin (025)**".

8.5.7 Calibration with partially-filled tank (wet calibration)

Example:
In this example a wet calibration is shown when it is not possible to empty the vessel and then fill it up to 100%. Here a 20% filling is used as “Empty” and a “25%” filling is used as “Full” calibration point. The calibration is then extended to 0% ... 100% and LRV / URV are adjusted accordingly.

Prerequisite:
The default value in the level mode for calibration mode is “Wet”.
However, it can be changed via: Setup → Extended Setup → Level → Calibration mode

	Description
1	Select the "Level" measuring mode via the "**Measuring mode (005)**" parameter. Menu path: Setup → **Measuring mode (005)**
2	Set value for "Empty calib." with acting pressure for Level e.g. 20%. Menu path: Setup → Extended Setup → Level → Empty calibration
3	Set value for "Full calib." with acting pressure for Level e.g. 25%. Menu path: Setup → Extended Setup → Level → Full calibration
4	The values for full and empty pressure are measured automatically at adjustment. As the transmitter automatically sets the pressure values that suit to empty and full calibration to min and max pressure that cause the output current, it is necessary to set the right upper range value (URV) and lower range value (LRV).

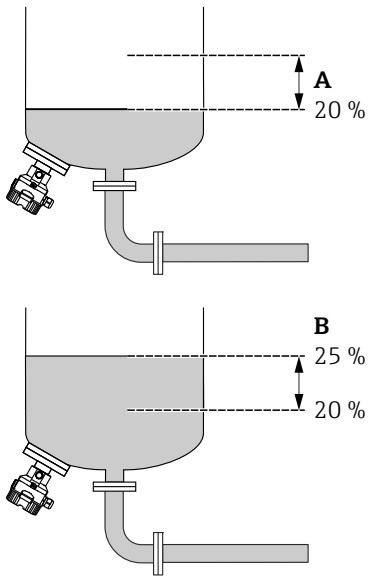


Abb. 37: Calibration with partially-filled tank

A See Table, Step 2
B See Table, Step 3

It is also possible to use different liquids (e.g. water) for the adjustment. In this case you have to enter the different densities at following menu path:
- Setup → Ext. Setup → Level → **Adjust density (034)** (e.g. 1.0 kg/l for water)
- Setup → Ext. Setup → Level → **Process density (035)** (e.g. 0.8 kg/l for oil)

8.6 Linearization

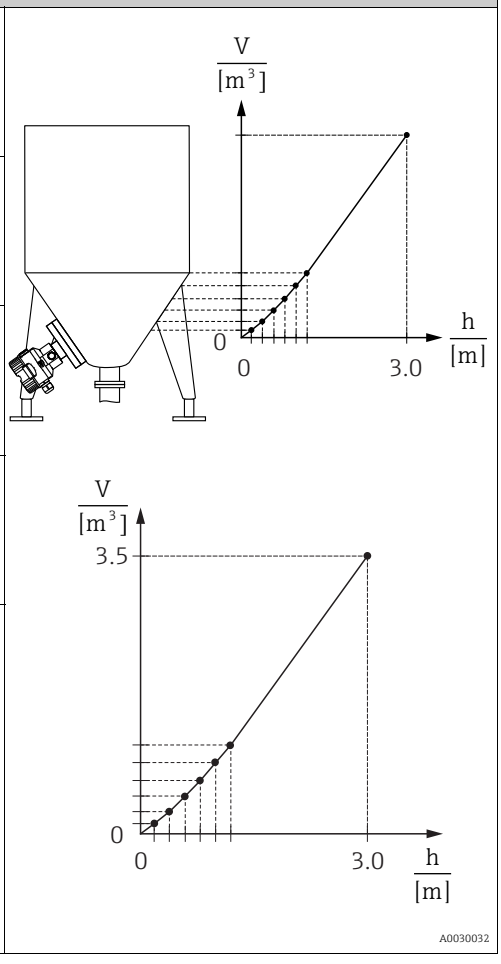
8.6.1 Manual entry of the linearization table

Example:
In this example, the volume in a tank with a conical outlet should be measured in m^3.

Prerequisite:

- This is a theoretical calibration, i.e. the points for the linearization table are known.
- A level calibration has been performed.

For a description of the parameters mentioned, → Chap. 12.2 "Description of parameters".

	Description	
1	Select the "Manual entry" option via the "Lin. mode" parameter. Menu path: Setup → Extended setup → Linearization → Lin. mode	
2	Select the volume/mass unit via the "Unit after lin." parameter, e.g. m^3. Menu path: Setup → Extended setup → Linearization → Unit after lin.	
3	Enter the number of the point in the table via the "Line-numb." parameter. Menu path: Setup → Extended setup → Linearization → Line-numb	
	The level (e.g. 0 m) is entered via the "X-value" parameter. Confirm your entry. Menu path: Setup → Extended setup → Linearization → X-value	
	Using the "Y-value" parameter, enter the associated volume value, here 0 m^3 for example, and confirm the value. Menu path: Setup → Extended setup → Linearization → Y-value	

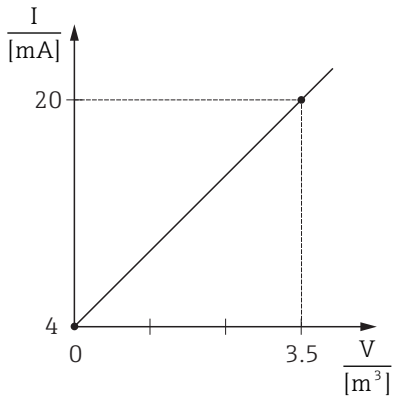
	Description	
4	To enter another point in the table, select the "Next point" option via the "Edit table" parameter. Enter the next point as explained in Step 3. Menu path: Setup → Extended setup → Linearization → Edit table	
5	Once all the points have been entered in the table, select the "Activate table" option via the "Lin. mode" parameter. Menu path: Setup → Extended setup → Linearization → Lin. mode	
6	Result: The measured value after linearization is displayed.	

Fig. 38: Manual entry of the linearization table

1. Error message F510 "Linearization" and alarm current as long as the table is being entered and until the table is activated.
2. The 0% value (= 4 mA) is defined by the smallest point in the table.
   The 100% value (= 20 mA) is defined by the biggest point in the table.
3. You can change the allocation of the volume or mass values to the current values using the "Set LRV" and "Set URV" parameters.

8.6.2 Manual entry of the linearization table via the operating tool

With an operating tool based on FDT technology (e.g. FieldCare), it is possible to enter linearization via a module that has been specially designed for this. In doing so, you gain an overview of the selected linearization even while making the entry. Additionally, it is possible to call up pre-programmed tank shapes.

The linearization table can also be entered manually point for point in the menu of the operating tool (see → Chap. 8.6.1 "Manual entry of the linearization table".

8.6.3 Semi-automatic entry of the linearization table

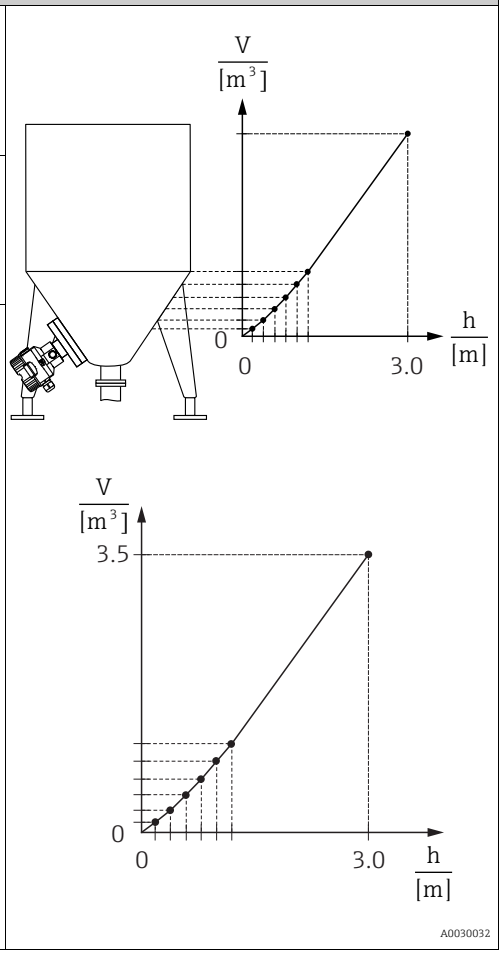
Example:
In this example, the volume in a tank with a conical outlet should be measured in m^3.

Prerequisite:

- The tank can be filled or emptied. The linearization characteristic must rise continuously.
- A level calibration has been performed.

For a description of the parameters mentioned → Chap. 12.2 "Description of parameters".

	Description
1	Select the "Semi-auto. entry" option via the "Lin. mode" parameter. Menu path: Setup → Extended setup → Linearization → Lin. mode
2	Select the volume unit/mass unit via the "Unit after lin." parameter, e.g. m^3. Menu path: Setup → Extended setup → Linearization → Unit after lin.
3	Fill the tank to the height of the 1st point.



	Description
4	Enter the number of the point in the table via the "Line-numb." parameter. Menu path: Setup → Extended setup → Linearization → Line-numb
	The actual level is displayed via the "X-value" parameter. Menu path: Setup → Extended setup → Linearization → X-value
	Using the "Y-value" parameter, enter the associated volume value, here 0 m^3 for example, and confirm the value. Menu path: Setup → Extended setup → Linearization → Y-value
5	To enter another point in the table, select the "Next point" option via the "Edit table" parameter. Enter the next point as explained in Step 4. Menu path: Setup → Extended setup → Linearization → Edit table
6	Once all the points have been entered in the table, select the "Activate table" option via the "Lin. mode" parameter. Menu path: Setup → Extended setup → Linearization → Lin. mode
7	Result: The measured value after linearization is displayed.

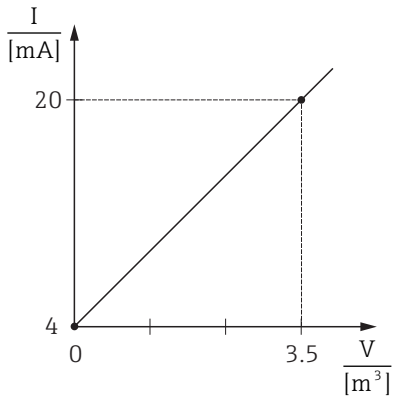


Fig. 39: Semi-automatic entry of the linearization table

1. Error message F510 "Linearization" and alarm current as long as the table is being entered and until the table is activated.
2. The 0% value (= 4 mA) is defined by the smallest point in the table.
   The 100% value (= 20 mA) is defined by the biggest point in the table.
3. You can change the allocation of the volume or mass values to the current values using the "Set LRV" and "Set URV" parameters.

8.7 Pressure measurement

8.7.1 Calibration without reference pressure (dry calibration)

Example:
In this example, a device with a 400 mbar (6 psi) sensor is configured for the 0 to +300 mbar (4.5 psi) measuring range, i.e. 0 mbar is assigned to the 4 mA value and 300 mbar (4.5 psi) to the 20 mA value.

Prerequisite:
This is a theoretical calibration, i.e. the pressure values for the lower and upper range are known.

Due to the orientation of the device, there may be pressure shifts in the measured value, i.e. the measured value is not zero in a pressureless condition. For information on how to perform position adjustment, see → 64.

	Description
1	Select the "Pressure" measuring mode via the "Measuring mode" parameter. Menu path: Setup → Measuring mode
2	Select a pressure unit via the "Press eng. unit" parameter, here "mbar" for example. Menu path: Setup → Press. eng. unit
3	Select the "Set LRV" parameter. Menu path: Setup → Set LRV
	Enter the value for the "Set LRV" parameter (here 0 mbar) and confirm. This pressure value is assigned to the lower current value (4 mA).
4	Select the "Set URV" parameter. Menu path: Setup → Set URV
	Enter the value for the "Set URV" parameter (here 300 mbar (4.5 psi)) and confirm. This pressure value is assigned to the upper current value (20 mA).
5	Result: The measuring range is configured for 0 to +300 mbar (4.5 psi).

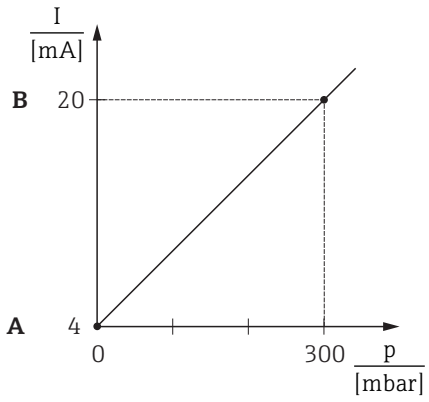


Fig. 40: Calibration without reference pressure

A See Table, Step 3.
B See Table, Step 4.

8.7.2 Calibration with reference pressure (wet calibration)

Example:
In this example, a device with a 400 mbar (6 psi) sensor is configured for the 0 to +300 mbar (4.5 psi) measuring range, i.e. 0 mbar is assigned to the 4 mA value and 300 mbar (4.5 psi) to the 20 mA value.

Prerequisite:
The pressure values 0 mbar and 300 mbar (4.5 psi) can be specified. The device is already mounted, for example.

For a description of the parameters mentioned, see Section 12.2 "Description of parameters".

	Description
1	Perform position adjustment → 64.
2	Select the "Pressure" measuring mode via the "Measuring mode" parameter. Menu path: Setup → Measuring mode
3	Select a pressure unit via the "Press eng. unit" parameter, here "mbar" for example. Menu path: Setup → Press. eng. unit
4	The pressure for the lower-range value (4 mA value) is present at the device, here 0 mbar for example.
	Select the "Get LRV" parameter. Menu path: Setup → Extended setup → Current output → Get LRV.
	Confirm the value present by selecting "Confirm". The pressure value present is assigned to the lower current value (4 mA).
5	The pressure for the upper-range value (20 mA value) is present at the device, here 300 mbar (4.5 psi) for example.
	Select the "Get URV" parameter. Menu path: Setup → Extended setup → Current output → Get URV.
	Confirm the value present by selecting "Confirm". The pressure value present is assigned to the upper current value (20 mA).
6	Result: The measuring range is configured for 0 to +300 mbar (4.5 psi).

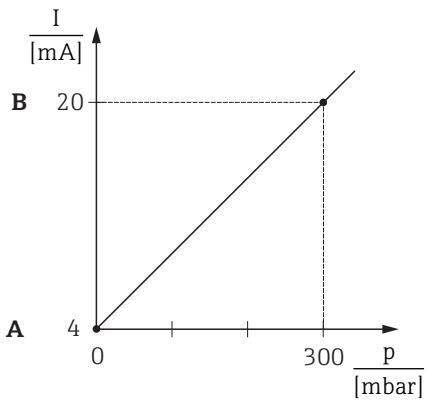


Fig. 41: Calibration with reference pressure

A See Table, Step 4.
B See Table, Step 5.

8.8 Electrical differential pressure measurement with gauge pressure sensors (Cerabar M or Deltapilot M)

Example:
In the example given, two Cerabar M or Deltapilot M devices (each with a gauge pressure sensor) are interconnected. The pressure difference can thus be measured using two independent Cerabar M or Deltapilot M devices.

For a description of the parameters mentioned → Chap. 12.2 "Description of parameters".

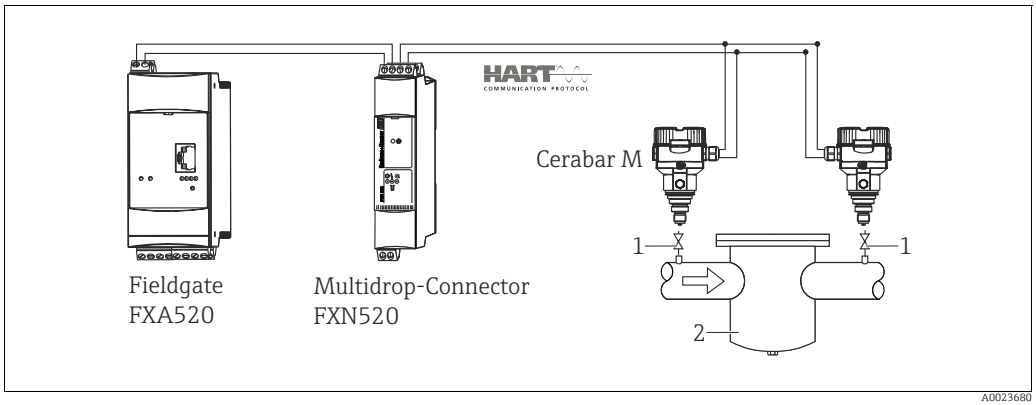


Fig. 42:
1 Shut-off valves
2 e.g. filter

	Description Adjustment of the Cerabar M/Deltapilot M on the high pressure side
1	Select the "Pressure" measuring mode via the "Measuring mode" parameter. **⚠ WARNING** **Changing the measuring mode affects the span (URV)!** This situation can result in product overflow. ▶ If the measuring mode is changed, the span setting (URV) must be verified and, if necessary, reconfigured! Menu path: Setup → Measuring mode
2	Select a pressure unit via the "Press eng. unit" parameter, here "mbar" for example. Menu path: Setup → Press. eng. unit
3	The Cerabar M/Deltapilot M is unpressurized, perform position adjustment, see → 64.
4	Switch on burst mode via the "Burst mode" parameter Menu path: Expert → Communication → HART Config.
5	Set the output current to "Fixed" 4.0 mA via the "Current mode" parameter. Menu path: Expert → Communication → HART Config
6	Configure an address ≠ 0 via the "Bus address" parameter, e.g. bus address = 1 (HART 5.0 master: Range 0 to 15, where address = 0 calls up the "Signaling" setting; HART 6.0 master: range 0 to 63) Menu path: Expert → Communication → HART Config.

	Description **Adjustment of the Cerabar M/Deltapilot M on the low pressure side (the differential is generated in this device)**
1	Select the "Pressure" measuring mode via the "Measuring mode" parameter. **⚠ WARNING** **Changing the measuring mode affects the span (URV)!** This situation can result in product overflow. ▶ If the measuring mode is changed, the span setting (URV) must be verified and, if necessary, reconfigured! Menu path: Setup → Measuring mode
2	Select a pressure unit via the "Press eng. unit" parameter, here "mbar" for example. Menu path: Setup → Press. eng. unit
3	The Cerabar M/Deltapilot M is unpressurized, perform position adjustment , see → 64.
4	Set the output current to "Fixed" 4.0mA via the "Current mode" parameter. Menu path: Expert → Communication → HART Config.
5	Configure an address <> 0 via the "Bus address" parameter, e.g. bus address = 2 (HART 5.0 master: Range 0 to 15, where address = 0 calls up the "Signaling" setting; HART 6.0 master: range 0 to 63) Menu path: Expert → Communication → HART Config.
6	Activate the reading of a value sent externally in burst mode via the "Electr. Delta P" parameter. Menu path: Expert → Application
7	Result: The measured value output by the Cerabar M/Deltapilot M on the low pressure side equals the differential: high pressure - low pressure, and can be read out by means of a HART request of the address of the Cerabar M/Deltapilot M on the low pressure side.

⚠ WARNING

Settings can result in non-permitted use of the "Electr. Delta P" function.

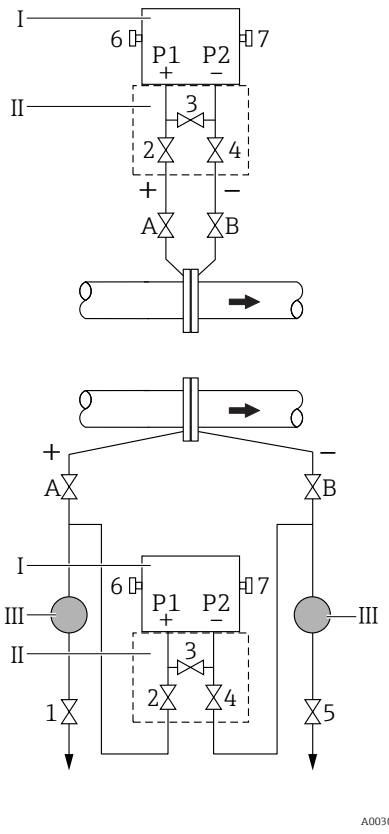
The measured value of the transmitting device (via burst) must always be greater than the measured value of the receiving device (via the "Electr. Delta P" function).
Adjustments that result in an offset of the pressure values (e.g. position adjustment, trim) must always be performed in accordance with the individual sensor and its orientation, irrespective of the "Electr. Delta P" application. Other settings result in non-permitted use of the "Electr. Delta P" function and can lead to incorrect measured values.

▶ It is not permitted to reverse the assignment of the measuring points to the direction of communication.

8.9 Differential pressure measurement (Deltabar M)

8.9.1 Preparatory steps

Before calibrating the device, the impulse piping must be cleaned and filled with fluid. → See the following table.

	Valves	Meaning	Preferred installation
1	Close 3.		
2	Fill measuring system with fluid.		
	Open A, B, 2, 4.	Fluid flows in.	
3	Clean impulse piping if necessary:[1)] – by blowing out with compressed air in the case of gases – by rinsing out in the case of liquids.		
	Close 2 and 4.	Block off device.	
	Open 1 and 5.[1]	Blow out/rinse out impulse piping.	
	Close 1 and 5.[1]	Close valves after cleaning.	
4	Vent device.		
	Open 2 and 4.	Introduce fluid.	
	Close 4.	Close low-pressure side.	
	Open 3.	Balance positive and low-pressure side.	
	Open 6 and 7 briefly, then close them again.	Fill device completely with fluid and remove air.	
5	Set measuring point in operation.		
	Close 3.	Shut off high-pressure side from low-pressure side.	
	Open 4.	Connect low-pressure side.	
	Now – 1[1], 3, 5[1], 6 and 7 are closed. – 2 and 4 are open. – A and B open (if present).		
6	Carry out calibration if necessary. → See also page 84, section 6.6.2.		

Above: preferred installation for gases
Below: preferred installation for liquids

I Deltabar M
II Three-valve manifold
III Separator
1, 5 Drain valves
2, 4 Inlet valves
3 Equalising valve
6, 7 Vent valves on Deltabar M
A, B Shut-off valve

1) for arrangement with 5 valves

8.9.2 Setup menu for Pressure measuring mode

Parameter name	Description	see page
Measuring mode (005) Selection	Select the "Pressure" measuring mode.	118
Switch P1/P2 (163) Display	Indicates whether the "SW/P2High" DIP switch (DIP switch 5) is switched on.	120
High pressure side (006) (183) Selection/Display	Determines, which pressure input corresponds to the high-pressure side. This setting is only valid if the "SW/P2High" DIP switch is in the OFF position (see the "Pressure side switch" (163) parameter). Otherwise P2 corresponds to the high-pressure side in any case.	120
Press. eng. unit (125) Selection	Select the pressure unit. If a new pressure unit is selected, all pressure-specific parameters are converted and displayed with the new unit.	119
Corrected press. (172) Display	Displays the measured pressure after sensor trim and position adjustment.	122
Pos. zero adjust (007) Selection	Position adjustment – the pressure difference between zero (set point) and the measured pressure need not be known. **Example:** – Measured value = 2.2 mbar (0.033 psi) – You correct the measured value via the "Pos. zero adjust" parameter with the "Confirm" option. This means that you assign the value 0.0 to the pressure present. – Measured value (after pos. zero adjust) = 0.0 mbar – The current value is also corrected.	119
Set LRV (056) Entry	Set the pressure value for the lower current value (4 mA).	130
Set URV (057) Entry	Set the pressure value for the upper current value (20 mA).	130
Damping switch (164) Display	Displays the status of DIP switch 2 ("damping τ"), which is used to switch the damping of the output signal on and off.	119
Damping value (017) Entry/Display	Enter damping time (time constant τ). The damping affects the speed at which the measured value reacts to changes in pressure. The damping is only active if DIP switch 2 ("damping τ") is in the ON position.	119
Pressure after damping (111) Display	Displays the measured pressure after sensor trim, position adjustment and damping.	122

8.10 Flow measurement (Deltabar M)

8.10.1 Information on flow measurement

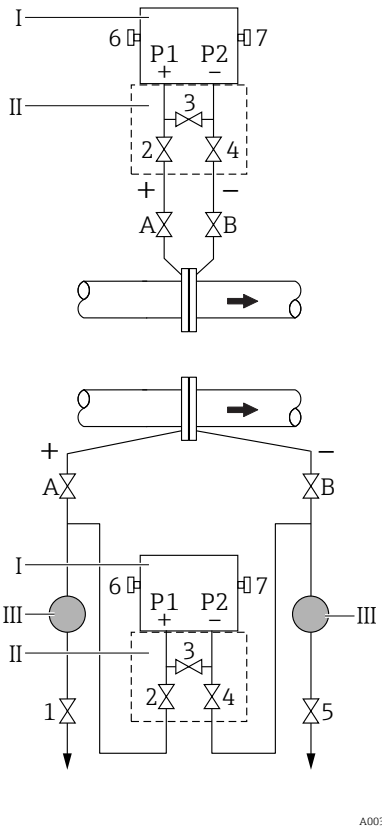
In the "Flow" measuring mode, the device determines a volume or mass flow value from the differential pressure measured. The differential pressure is generated by means of primary elements such as pitot tubes or orifice plates and depends on the volume or mass flow. Four flow types are available: volume flow, norm volume flow (European norm conditions), standard volume flow (American standard conditions), mass flow and flow in %.

In addition, the Deltabar M software is equipped with two totalizers as standard. The totalizers add up the volume or the mass flow. The counting function and the unit can be set separately for both totalizers. The first totalizer (totalizer 1) can be reset to zero at any time while the second (totalizer 2) totalises the flow from commissioning onwards and cannot be reset.

The totalizers are not available for the "Flow in %" flow type.

8.10.2 Preparatory steps

Before calibrating the Deltabar M, the impulse piping must be cleaned and filled with fluid.
→ See the following table.

	Valves	Meaning	Preferred installation
1	Close 3.		
2	Fill measuring system with fluid.		
	Open A, B, 2, 4.	Fluid flows in.	
3	Clean impulse piping if necessary[1)]: – by blowing out with compressed air in the case of gases – by rinsing out in the case of liquids.		
	Close 2 and 4.	Block off device.	
	Open 1 and 5.[1]	Blow out/rinse out impulse piping.	
	Close 1 and 5.[1]	Close valves after cleaning.	
4	Vent device.		
	Open 2 and 4.	Introduce fluid.	
	Close 4.	Close low-pressure side.	
	Open 3.	Balance positive and low-pressure side.	
	Open 6 and 7 briefly, then close them again.	Fill device completely with fluid and remove air.	
5	Carry out position zero adjustment (→ 64) if the following conditions are met. If the conditions are not met, then do not carry out the pos. zero adjustment until after step 6. Conditions: – The process cannot be blocked off. – The tapping points (A and B) are at the same geodetic height.		
6	Set measuring point in operation.		
	Close 3.	Shut off high-pressure side from low-pressure side.	
	Open 4.	Connect low-pressure side.	
	Now – 1[1], 3, 5[1], 6 and 7 are closed. – 2 and 4 are open. – A and B open (if present).		
7	Carry out position zero adjustment (→ 64) if the flow can be blocked off. In this case, step 5 is not applicable.		
8	Carry out calibration. → See page 87, → Chap. 8.10.3.		

Above: preferred installation for gases
Below: preferred installation for liquids

I Deltabar M
II Three-valve manifold
III Separator
1, 5 Drain valves
2, 4 Inlet valves
3 Equalising valve
6, 7 Vent valves on Deltabar M
A, B Shut-off valves

1) for arrangement with 5 valves

8.10.3 Setup menu for the "Flow" measuring mode

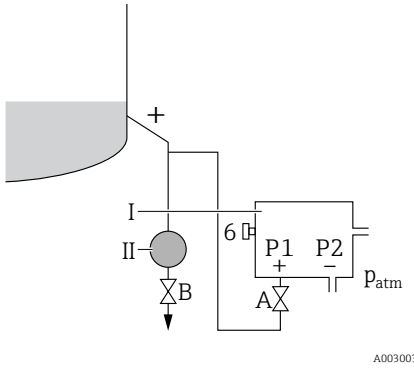
Parameter name	Description	see page
Lin./SQRT switch (133) Display	Displays the status of DIP switch 4 on the electronic insert, which is used to define the output characteristics of the current output.	130
Measuring mode (005) Selection	Select the "Flow" measuring mode.	118
Pressure side switch (163) Display	Indicates whether the "SW/P2High" DIP switch (DIP switch 5) is switched on.	120
High pressure side (006) (183) Selection	Determines, which pressure input corresponds to the high-pressure side. This setting is only valid if the "SW/P2High" DIP switch is in the OFF position (see the "Pressure side switch" (163) parameter). Otherwise P2 corresponds to the high-pressure side in any case.	120
Press. eng. unit (125) Selection	Select the pressure unit. If a new pressure unit is selected, all pressure-specific parameters are converted and displayed with the new unit.	119
Corrected press. (172) Display	Displays the measured pressure after sensor trim and position adjustment.	122
Pos. zero adjust (007) Selection	Position adjustment – the pressure difference between zero (set point) and the measured pressure need not be known. **Example:** – Measured value = 2.2 mbar (0.033 psi) – You correct the measured value via the "Pos. zero adjust" parameter with the "Confirm" option. This means that you assign the value 0.0 to the pressure present. – Measured value (after pos. zero adjust) = 0.0 mbar – The current value is also corrected.	119
Max. flow (009) Entry	Enter maximum flow of primary element. See also layout sheet of primary element. The maximum flow is assigned to the maximum pressure which you enter via the "Max. pressure flow" (010) parameter.	128
Max. pressure flow (010) Entry	Enter maximum pressure of primry element. → See layout sheet of primary element. This pressure is assigned to the flow defined in the "Max. flow" (009) parameter.	128
Damping switch (164) Display	Displays the status of DIP switch 2 "damping τ", which is used to switch the damping of the output signal on and off.	119
Damping value (017) Entry/Display	Enter damping time (time constant τ). The damping affects the speed at which the measured value reacts to changes in pressure. The damping is only active if DIP switch 2 "damping τ" is in the ON position.	119
Flow (018) Display	Displays the present flow value.	128
Pressure after damping (111) Display	Displays the measured pressure after sensor trim, position adjustment and damping.	122

8.11 Level measurement (Deltabar M)

8.11.1 Preparatory steps

Open container

Before calibrating the device, the impulse piping must be cleaned and filled with fluid. → See the following table.

	Valves	Meaning	Installation
1	Fill container to a level above the lower tap.		
2	Fill measuring system with fluid.		
	Open A.	Open shut-off valve.	
3	Vent device.		
	Open 6 briefly, then close it again.	Fill device completely with fluid and remove air.	
4	Set measuring point in operation.		
	Now – B and 6 are closed. – A is open.		
5	Carry out calibration according to one of the following methods: ▪ "in pressure" - with reference pressure (→ 92) ▪ "in pressure" - without reference pressure (→ 66) ▪ "in heigth" - with reference pressure (→ 98) ▪ "in height" - without reference pressure (→ 98)		

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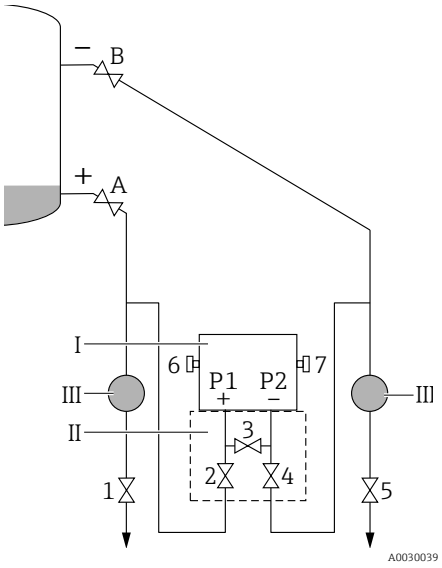
Open container

I *Deltabar M*
II *Separator*
6 *Vent valves on Deltabar M*
A *Shut-off valve*
B *Drain valve*

Closed container

Before calibrating the device, the impulse piping must be cleaned and filled with fluid. → See the following table.

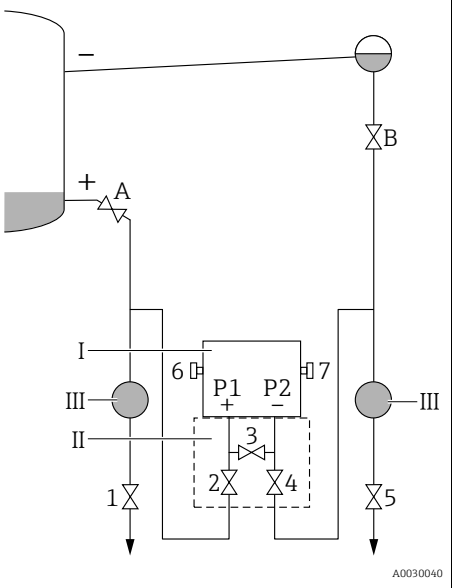
	Valves	Meaning	Installation
1	Fill container to a level above the lower tap.		
2	Fill measuring system with fluid.		
	Close 3.	Shut off high-pressure side from low-pressure side.	
	Open A and B.	Open shut-off valves.	
3	Vent high-pressure side (empty low-pressure side if necessary).		
	Open 2 and 4.	Introduce fluid on high-pressure side.	
	Open 6 and 7 briefly, then close them again.	Fill high-pressure side completely with fluid and remove air.	
4	Set measuring point in operation.		
	Now – 3, 6 and 7 are closed. – 2, 4, A and B are open.		
5	Carry out calibration according to one of the following methods: ▪ "in pressure" - with reference pressure (→ 92) ▪ "in pressure" - without reference pressure (→ 68) ▪ "in heigth" - with reference pressure (→ 98) ▪ "in height" - without reference pressure (→ 98)		

Closed container

I	*Deltabar M*
II	*Three-valve manifold*
III	*Separator*
1, 2	*Drain valves*
2, 4	*Inlet valves*
3	*Equalizing valve*
6, 7	*Vent valve on Deltabar M*
A, B	*Shut-off valve*

Closed container with superimposed steam

Before calibrating the device, the impulse piping must be cleaned and filled with fluid. → See the following table.

	Valves	Meaning	Installation
1	Fill container to a level above the lower tap.		
2	Fill measuring system with fluid.		
	Open A and B.	Open shut-off valves.	
	Fill the negative impulse piping to the level of the condensate trap.		
3	Vent device.		
	Open 2 and 4.	Introduce fluid.	
	Close 4.	Close low-pressure side.	
	Open 3.	Balance positive and low-pressure side.	
	Open 6 and 7 briefly, then close them again.	Fill device completely with fluid and remove air.	
4	Set measuring point in operation.		
	Close 3.	Shut off high-pressure side from low-pressure side.	
	Open 4.	Connect low-pressure side.	
	Now – 3, 6 and 7 are closed. – 2, 4, A and B are open.		
5	Carry out calibration according to one of the following methods: ▪ "in pressure" - with reference pressure (→ 92) ▪ "in pressure" - without reference pressure (→ 68) ▪ "in heigth" - with reference pressure (→ 98) ▪ "in height" - without reference pressure (→ 98)		

Closed container with superimposed steam

I *Deltabar M*
II *Three-valve manifold*
III *Separator*
1, 5 *Drain valves*
2, 4 *Inlet valves*
3 *Equalising valve*
6, 7 *Vent valves on Deltabar M*
A, B *Shut-off valves*

8.11.2 Information on level measurement

You have a choice of two methods for calculating the level: "In pressure" and "In height". The table in the "Overview of level measurement" section that follows provides you with an overview of these two measuring tasks.

- The limit values are not checked, i.e. the values entered must be appropriate for the sensor and the measuring task for the device to be able to measure correctly.
- Customer-specific units are not possible.
- The values entered for "Empty calib./Full calib.", "Empty pressure/Full pressure", "Empty height/Full height" and "Set LRV/Set URV" must be at least 1% apart. The value will be rejected, and a message output, if the values are too close together.

8.11.3 Overview of level measurement

Measuring task	Level selection	Measured variable options	Description	Measured value display
Calibration takes place by entering two pressure/level value pairs.	"In pressure"	Via the "Unit before lin" parameter: %, level, volume or mass units.	▪ Calibration with reference pressure (wet calibration), → 92 ▪ Calibration without reference pressure (dry calibration) → 68	The measured value display and the "Level before lin" parameter display the measured value.
Calibration takes place by entering the density and two height/level value pairs.	"In height"		▪ Calibration with reference pressure (wet calibration), → 98 ▪ Calibration without reference pressure (dry calibration) → 96	

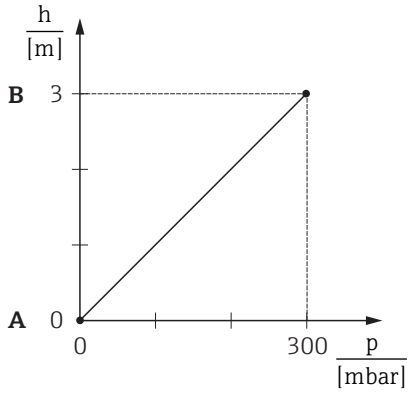
8.11.4 Level selection "in pressure" Calibration with reference pressure (wet calibration)

Example:
In this example, the level in a tank should be measured in "m". The maximum level is 3 m (9.8 ft). The pressure range is set to 0 to 300 mbar (4.5 psi).

Prerequisite:
- The measured variable is in direct proportion to the pressure.
- The tank can be filled and emptied.

The values entered for "Empty calib./Full calib." and" Set LRV/Set URV" must be at least 1% apart. The value will be rejected, and a message output, if the values are too close together. Other limit values are not checked, i.e. the values entered must be appropriate for the sensor and the measuring task for the device to be able to measure correctly.

	Description	
1	Perform "position zero adjustment" → 64.	
2	Select the "Level" measuring mode via the "**Measuring mode (005)**" parameter (→ 63). Menu path: Setup → Measuring mode	
3	Select a pressure unit via the "Press eng. unit" parameter (→ 87), here "mbar" for example. Menu path: Setup → Press. eng. unit	
4	Select the "In pressure" level mode via the "Level selection" parameter (→ 123). Menu path: Setup → Extended setup → Level → Level selection	
5	Select a level unit via the "Unit before lin" parameter (→ 123), here "m" for example. Menu path: Setup → Extended setup → Level → Unit before lin	
6	Select the "Wet" option via the "Calibration mode" parameter (→ 123). Menu path: Setup → Extended setup → Level → Calibration mode	

	Description	
7	a. The pressure for the lower calibration point is present at the device, here "0 mbar" for example. b. Select the "Empty calib." parameter (→ 124). c. Enter the level value, here "0 m" for example. Confirming the value means you assign the pressure value present to the lower level value. Menu path: Setup → Extended setup → Level → Empty calib.	 A0017658 *Calibration with reference pressure (wet calibration)* *A See Table, Step 7* *B See Table, Step 8*
8	a. The pressure for the upper calibration point is present at the device, here "300 mbar" (4.5 psi) for example. b. Select the "Full calib." parameter (→ 124). c. Enter the level value, here "3 m" for example. Confirming the value means you assign the pressure value present to the upper level value. Menu path: Setup → Extended setup → Level → Full calib.	
9	Result: The measuring range is set for 0 to 3 m (9.8 ft). 0 m corresponds to an output current of 4 mA. 3 m (9.8 ft) corresponds to an output current of 20 mA.	

8.11.5 Level selection "in pressure" Calibration without reference pressure (dry calibration)

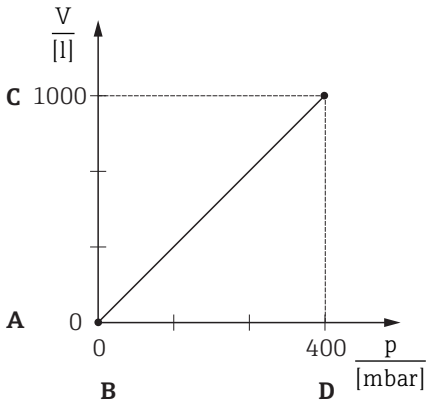
Example:
In this example, the volume in a tank should be measured in liters. The maximum volume of 1000 liters (264 US gal) corresponds to a pressure of 400 mbar (6 psi). The minimum volume of 0 liters corresponds to a pressure of 0 mbar.

Prerequisite:
- The measured variable is in direct proportion to the pressure.
- This is a theoretical calibration i.e. the pressure and volume values for the lower and upper calibration point must be known.

The values entered for "Empty calib./Full calib." and" Set LRV/Set URV" must be at least 1% apart. The value will be rejected, and a message output, if the values are too close together. Other limit values are not checked, i.e. the values entered must be appropriate for the sensor and the measuring task for the device to be able to measure correctly.

	Description	
1	Perform "position zero adjustment" → 64.	
2	Select the "Level" measuring mode via the "**Measuring mode (005)**" parameter (→ 63). Menu path: Setup → Measuring mode	
3	Select a pressure unit via the "Press eng. unit" parameter (→ 64), here "mbar" for example. Menu path: Setup → Press. eng. unit	
4	Select the "In pressure" level mode via the "Level selection" parameter (→ 123). Menu path: Setup → Extended setup → Level → Level selection	
5	Select a level unit via the "Unit before lin" parameter (→ 123), here "l" for example. Menu path: Setup → Extended setup → Level → Unit before lin	
6	Select the "Dry" option via the "Calibration mode" parameter (→ 123). Menu path: Setup → Extended setup → Level → Calibration mode	

	Description
7	Enter the volume value for the lower calibration point via the "Empty calib." parameter (→ 124), here "0 liter" for example. Menu path: Setup → Extended setup → Level → Empty calib.
8	Enter the pressure value for the lower calibration point via the "Empty pressure" parameter (→ 124), here "0 mbar" for example. Menu path: Setup → Extended setup → Level → Empty pressure
9	Enter the volume value for the upper calibration point via the "Full calib." parameter (→ 124), here "1000 liter" (264 US gal) for example. Menu path: Setup → Extended setup → Level → Full calib.
10	Enter the pressure value for the upper calibration point via the "Full pressure" parameter (→ 124), here "400 mbar" (6 psi) for example. Menu path: Setup → Extended setup → Level → Full pressure
11	Result: The measuring range is set for 0 to 1000 l (264 US gal). 0 l corresponds to an output current of 4 mA. 1000 l (264 US gal) corresponds to an output current of 20 mA.



Calibration without reference pressure (dry calibration)

A See Table, Step 7.
B See Table, Step 8.
C See Table, Step 9.
D See Table, Step 10.

8.11.6 Level selection "in height" Calibration without reference pressure (dry calibration)

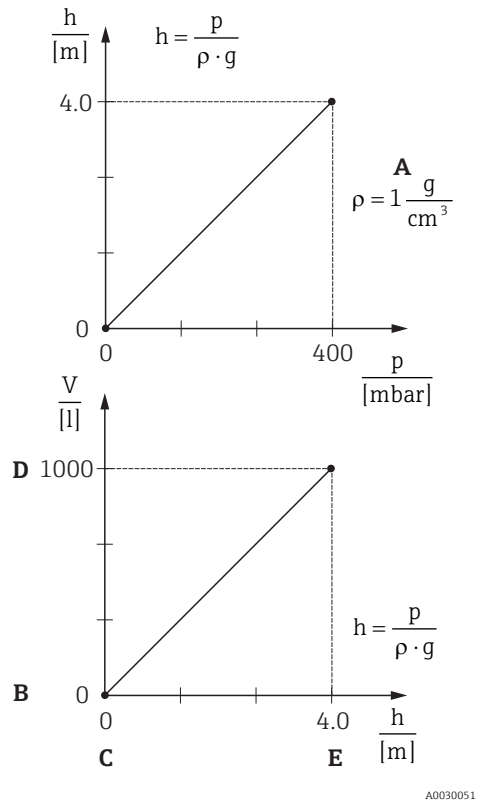
Example:
In this example, the volume in a tank should be measured in liters. The maximum volume of 1000 liters (264 US gal) corresponds to a level of 4 m (13 ft). The minimum volume of 0 liters corresponds to a level of 0 m. The density of the medium is 1 g/cm^3 (1 SGU).

Prerequisite:
- The measured variable is in direct proportion to the pressure.
- This is a theoretical calibration i.e. the pressure and volume values for the lower and upper calibration point must be known.

The values entered for "Empty calib./Full calib." and " Set LRV/Set URV" must be at least 1% apart. The value will be rejected, and a message output, if the values are too close together. Other limit values are not checked, i.e. the values entered must be appropriate for the sensor and the measuring task for the device to be able to measure correctly.

	Description	
1	Perform "position zero adjustment" → 64.	
2	Select the "Level" measuring mode via the "**Measuring mode (005)**" parameter (→ 63). Menu path: Setup → Measuring mode	
3	Select a pressure unit via the "Press eng. unit" parameter (→ 64), here "mbar" for example. Menu path: Setup → Press. eng. unit	
4	Select the "In height" level mode via the "Level selection" parameter (→ 123). Menu path: Setup → Extended setup → Level → Level selection	
5	Select a level unit via the "Unit before lin" parameter (→ 123), here "l" for example. Menu path: Setup → Extended setup → Level → Unit before lin	
6	Select a level unit via the "Height unit" parameter (→ 123), here "m" for example. Menu path: Setup → Extended setup → Level → Height unit	
7	Select the "Wet" option via the "Calibration mode" parameter (→ 123). Menu path: Setup → Extended setup → Level → Calibration mode	

	Description
8	Enter the height value for the lower calibration point via the "Empty height" parameter (→ 124), here "0 m" for example. Menu path: Setup → Extended setup → Level → Empty height
9	Enter the volume value for the upper calibration point via the "Full calib." parameter (→ 124), here "1000 liter" (264 US gal) for example. Menu path: Setup → Extended setup → Level → Full calib.
10	Enter the volume value for the lower calibration point via the "Empty calib." parameter (→ 124), here "0 liter" for example. Menu path: Setup → Extended setup → Level → Empty calib.
11	Enter the height value for the upper calibration point via the "Full height" parameter (→ 124), here "4 m" (13 ft) for example. Menu path: Setup → Extended setup → Level → Full height
12	Enter the density of the medium, using the "Adjust density" parameter (→ 125), here 1 g/cm³ (1 SGU) for example. Menu path: Setup → Extended setup → Level → Adjust density
13	Result: The measuring range is set for 0 to 1000 l (264 US gal). 0 l corresponds to an output current of 4 mA. 1000 l (264 US gal) corresponds to an output current of 20 mA.



Calibration without reference pressure (dry calibration)

A See table, Step 12.
B See table, Step 8.
C See table, Step 9.
D See table, Step 10.
E See table, Step 11.

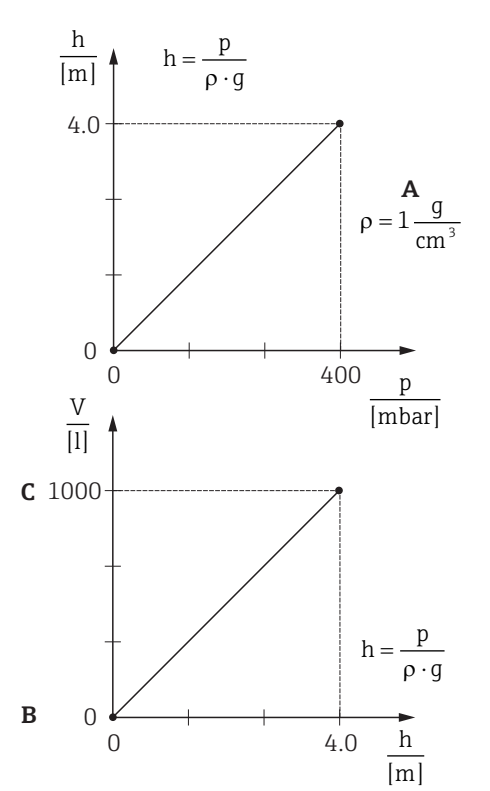
8.11.7 Level selection "in height" Calibration with reference pressure (wet calibration)

Example:
In this example, the volume in a tank should be measured in liters. The maximum volume of 1000 liters (264 US gal) corresponds to a level of 4 m (13 ft). The minimum volume of 0 liters corresponds to a level of 0 m. The density of the medium is 1 g/cm^3 (1 SGU).

Prerequisite:
- The measured variable is in direct proportion to the pressure.
- The tank can be filled and emptied.

The values entered for "Empty calib./Full calib." and" Set LRV/Set URV" must be at least 1% apart. The value will be rejected, and a message output, if the values are too close together. Other limit values are not checked, i.e. the values entered must be appropriate for the sensor and the measuring task for the device to be able to measure correctly.

	Description	
1	Perform "position zero adjustment" → 64.	
2	Select the "Level" measuring mode via the "**Measuring mode (005)**" parameter (→ 63). Menu path: Setup → Measuring mode	
3	Select a pressure unit via the "Press eng. unit" parameter (→ 64), here "mbar" for example. Menu path: Setup → Press. eng. unit	
4	Select the "In height" level mode via the "Level selection" parameter (→ 123). Menu path: Setup → Extended setup → Level → Level selection	
5	Select a level unit via the "Unit before lin" parameter (→ 123), here "l" for example. Menu path: Setup → Extended setup → Level → Unit before lin	
6	Select a level unit via the "Height unit" parameter (→ 123), here "m" for example. Menu path: Setup → Extended setup → Level → Height unit	
7	Select the "Wet" option via the "Calibration mode" parameter (→ 123). Menu path: Setup → Extended setup → Level → Calibration mode	

	Description	
8	a. The pressure for the lower calibration point is present at the device, here "0 mbar" for example. b. Select the "Empty calib." parameter (→ 124). c. Enter the volume value, here "0 l" for example. Menu path: Setup → Extended setup → Level → Empty calib.	
9	a. The pressure for the upper calibration point is present at the device, here "400 mbar" (6 psi) for example. b. Select the "Full calib." parameter (→ 124). c. Enter the volume value, here "1000 l" (264 US gal) for example. Menu path: Setup → Extended setup → Level → Full calib.	
10	Enter the density of the medium, using the "Adjust density" parameter (→ 125), here 1 g/cm³ (1 SGU) for example. Menu path: Setup → Extended setup → Level → Adjust density	
11	If the process uses a medium other than the medium on which the calibration was based, the new density must be specified in the "Process density" parameter (→ 125). Menu path: Setup → Extended Setup → Level → Density process	
12	Result: The measuring range is set for 0 to 1000 l (264 US gal). 0 l corresponds to an output current of 4 mA. 1000 l (264 US gal) corresponds to an output current of 20 mA.	

Calibration with reference pressure (wet calibration)

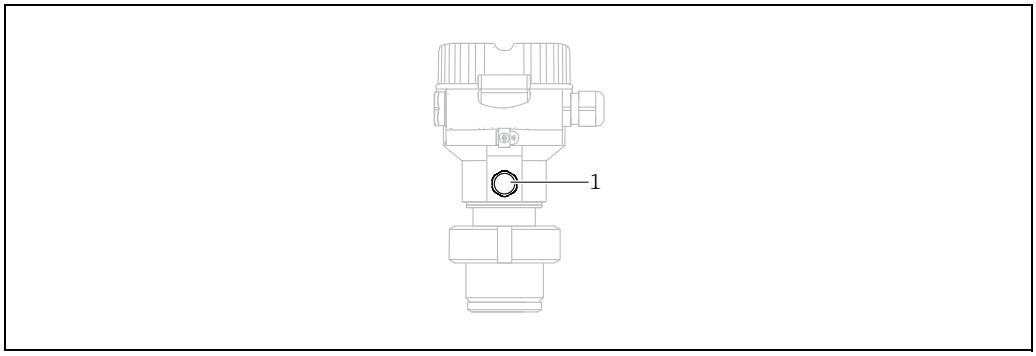
A See table, Step 8.
B See table, Step 9.

8.12 Backup or duplicate device data

The device has no memory module. With an operating tool based on FDT technology (e.g. FieldCare), you have the following options:
- Saving/rescuing configuration data
- Duplicating instrument configurations
- Transferring all relevant parameters when replacing electronic inserts.

9 Maintenance

Deltabar M requires no maintenance.
For Cerabar M and Deltapilot M keep the pressure compensation and GORE-TEX® filter (1) free from contamination.



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9.1 Cleaning instructions

Endress+Hauser offer flushing rings as accessories to clean process isolating diaphragms without taking the transmitters out of the process.
For further information please contact your local Endress+Hauser Sales Center.

9.1.1 Cerabar M PMP55

We recommend you perform CIP (cleaning in place (hot water)) before SIP (sterilization in place (steam)) for pipe diaphragm seals. A frequent use of sterilization in place (SIP) will increase the stress on the process isolating diaphragm. Under unfavorable circumstances in the long term view we cannot exclude that a frequent temperature change could lead to a material fatigue of the process isolating diaphragm and possibly to a leakage.

9.2 Exterior cleaning

Please note the following points when cleaning the device:
- The cleaning agents used should not corrode the surface and the seals.
- Mechanical damage to the process isolating diaphragm, e.g. due to pointed objects, must be avoided.
- Observe the degree of protection of the device. See the nameplate if necessary (→ 8 ff).

10 Troubleshooting

10.1 Messages

The following table lists the messages that can occur. The Diagnostic code parameter shows the message with the highest priority. The device has four different status information codes according to NAMUR NE107:

- F = failure
- M (warning) = maintenance required
- C (warning) = function check
- S (warning) = out of specification (deviations from the permitted ambient or process conditions determined by the device with the self-monitoring function, or errors in the device itself indicate that the measuring uncertainty is greater than what would be expected under normal operating conditions).

Diagnostic code	Error message	Cause	Measure
0	No error	–	–
C412	Backup in prog.	Downloading.	1. Wait for download to complete
C482	Current simul.	Current output simulation is switched on, i.e. the device is not measuring at present.	1. End the simulation
C484	Error simul.	Fault state simulation is switched on, i.e. the device is not measuring at present.	1. End the simulation
C485	Measure simul.	Simulation is switched on, i.e. the device is not measuring at present.	1. End the simulation
C824	Process pressure	– Overpressure or low pressure present. This message normally only appears briefly. – Electromagnetic effects are greater than specifications in the technical data.	1. Check the pressure value 2. Restart the device 3. Perform a reset
F002	Sens. unknown	Sensor does not suit the device (electronic sensor nameplate).	1. Contact Endress+Hauser Service
F062	Sensor conn.	– Cable connection between sensor and main electronics disconnected. – Sensor defective. – Electromagnetic effects are greater than specifications in the technical data. This message normally only appears briefly.	1. Check sensor cable 2. Replace electr. 3. Contact Endress+Hauser Service 4. Replace sensor (snap-on Version)
F081	Initialization	– Cable connection between sensor and main electronics disconnected. – Sensor defective. – Electromagnetic effects are greater than specifications in the technical data. This message normally only appears briefly.	1. Perform a reset 2. Check sensor cable 3. Contact Endress+Hauser Service
F083	Permanent mem.	– Sensor defective. – Electromagnetic effects are greater than specifications in the technical data. This message normally only appears briefly.	1. Restart the device 2. Contact Endress+Hauser Service
F140	Working range P	– Overpressure or low pressure present. – Electromagnetic effects are greater than specified in the technical data. – Sensor defective.	1. Check the process pressure 2. Check the sensor range
F261	Electronics	– Main electronics defective. – Fault in the main electronics.	1. Restart the device 2. Replace electr.
F282	Data memory	– Fault in the main electronics. – Main electronics defective.	1. Restart the device 2. Replace electr.

Diagnostic code	Error message	Cause	Measure
F283	Permanent mem.	– Main electronics defective. – Electromagnetic effects are greater than specifications in the technical data. – The supply voltage is disconnected when writing. – An error occurred when writing.	1. Perform a reset 2. Replace electr.
F411	Up-/download	– The file is defective. – During the download, the data are not correctly transmitted to the processor, e.g. because of open cable connections, voltage peaks (ripple) on the supply voltage or electromagnetic effects.	1. Download again 2. Use another file 3. Perform a reset
F510	Linearization	– The linearization table is being edited.	1. Conclude entries 2. Select "linear"
F511	Linearization	– The linearization table consists of less than 2 points.	1. Table too small 2. Corr. table 3. Accept the table
F512	Linearization	– The linearization table is not monotonic increasing or decreasing.	1. Tab. not monotonic 2. Corr. table 3. Accept the table
F841	Sensor range	– Overpressure or low pressure present. – Sensor defective.	1. Check the pressure value 2. Contact Endress+Hauser Service
F882	Input signal	– External measured value is not received or displays a failure status.	1. Check the bus 2. Check source device 3. Check setting
M002	Sens. unknown	– Sensor does not suit the device (electronic sensor nameplate). Device continues measuring.	1. Contact Endress+Hauser Service
M283	Permanent mem.	– Cause as indicated for F283. – Correct measurement can continue as long as you do not need the peakhold indicator function.	1. Perform a reset 2. Replace electr.
M431	Adjustment	– The pressure applied is outside the set measuring range (but within the sensor range). – The calibration carried out would result in the sensor nominal operating range being undershot or overshot.	1. Check the measuring range 2. Check position adjustment 3. Check the setting
M434	Scaling	– Values for calibration (e.g. lower range value and upper range value) are too close together. – Lower range value and/or upper range value undershoot or overshoot the sensor range limits. – The sensor was replaced and the customer-specific configuration does not suit the sensor. – Unsuitable download carried out.	1. Check the measuring range 2. Check the setting 3. Contact Endress+Hauser Service
M438	Data record	– The supply voltage is disconnected when writing. – An error occurred when writing.	1. Check setting 2. Restart the device 3. Replace electr.
M515	Configuration Flow	– Max. flow out of nominal range of sensor	1. Recalibrate the device 2. Restart the device
M882	Input signal	External measured value displays a warning status.	1. Check the bus 2. Check source device 3. Check setting
S110	Working range T	– Electromagnetic effects are greater than specifications in the technical data. – Sensor defective. – Overtemperature or low temperature present.	1. Check proc. temp. 2. Check temperature range
S140	Working range P	– Electromagnetic effects are greater than specifications in the technical data. – Sensor defective. – Overpressure or low pressure present.	1. Check proc. pressure 2. Check sensor range

Diagnostic code	Error message	Cause	Measure
S822	Process temp.	– The temperature measured in the sensor is greater than the upper nominal temperature of the sensor. – The temperature measured in the sensor is lower than the lower nominal temperature of the sensor. – Loose connection at the sensor cable.	1. Check the temperature 2. Check the setting
S841	Sensor range	– Overpressure or low pressure present. – Sensor defective.	1. Check the pressure value 2. Contact Endress+Hauser Service
S971	Adjustment	– The current is outside the permitted range 3.8 to 20.5 mA. – The pressure applied is outside the set measuring range (but within the sensor range).	1. Check the pressure value 2. Check the measuring range 3. Check the setting

10.2 Response of output to errors

The response of the current output to errors is defined in the following parameters:
- "Alarm behavior" (050) → 129
- "Output fail mode (190) → 129
- "High alarm current" (052) → 129

10.3 Repair

The Endress+Hauser repair concept provides for measuring devices to have a modular design and that the customer can also carry out repairs (see → 104, → Chap. 10.5 "Spare Parts").

- For certified devices, please see the "Repair of Ex-certified devices" section.
- For more information on service and spare parts, contact Endress+Hauser Service. → See www.endress.com/worldwide.

10.4 Repair of Ex-certified devices

⚠ WARNING

Limitation of electrical safety due to incorrect connection!
Risk of explosion!

When repairing Ex-certified devices, please note the following:
- Only specialist personnel or Endress+Hauser may repair certified devices.
- Relevant standards, national hazardous area regulations and safety instructions and certificates must be observed.
- Only genuine Endress+Hauser spare parts may be used.
- When ordering spare parts, please check the device designation on the nameplate. Identical parts may only be used as replacements.
- Electronic inserts or sensors already in use in a standard device may not be used as spare parts for a certified device.
- Carry out repairs according to the instructions. Following a repair, the device must fulfill the requirements of the specified individual tests.
- A certified device may only be converted to another certified device version by Endress+Hauser.
- All repairs and modifications must be documented.

10.5 Spare Parts

- Some replaceable measuring device components are identified by means of a spare part nameplate. This contains information about the spare part.
- All the spare parts for the measuring device along with the order code are listed In the W@M Device Viewer (www.endress.com/deviceviewer) and can be ordered. If available, users can also download the associated Installation Instructions.

Measuring device serial number:
- Located on the device and spare part nameplate.
- Can be read out via the "Serial number" parameter in the "Instrument info" submenu.

10.6 Return

The measuring device must be returned if repairs or a factory calibration are required, or if the wrong measuring device has been ordered or delivered. According to legal regulations, Endress+Hauser, as a ISO-certified company, is required to follow certain procedures when handling returned products that are in contact with process fluids.
To ensure swift, safe and professional device returns, please read the return procedures and conditions on the Endress+Hauser website at www.services.endress.com/return-material.

10.7 Disposal

When disposing, separate and recycle the device components based on the materials.

10.8 Software history

Device	Date	Softwareversion	Software modifications	Operating Instruction
Cerabar	09.2009	01.00.zz	Original software. Compatible with: – FieldCare from version 2.02.00 – Field Communicator DXR375 with Device Rev.: 1, DD Rev.: 1	BA382P/00/EN/08.09 71089556
				BA382P/00/EN/10.09 71104504
				BA00382P/00/EN/13.10 71123275
				BA00382P/00/EN/14.11 71134588
				BA00382P/00/EN/15.11 71134880
				BA00382P/00/EN/16.12 71157182
				BA00382P/00/EN/17.12 71191304
				BA00382P/00/EN/18.14 71241501
				BA00382P/00/EN/19.14 71270330
				BA00382P/00/EN/20.16 71316868

Device	Date	Softwareversion	Software modifications	Operating Instruction
Deltabar	08.2009	01.00.zz	Original software. Compatible with: – FieldCare from version 2.02.00 – Field Communicator DXR375 with Device Rev.: 1, DD Rev.: 1	BA382P/00/EN/08.09 71089556
				BA382P/00/EN/10.09 71104504
				BA00382P/00/EN/13.10 71123275
				BA00382P/00/EN/14.11 71134588
				BA00382P/00/EN/15.11 71134880
				BA00382P/00/EN/16.12 71157182
				BA00382P/00/EN/17.12 71191304
				BA00382P/00/EN/18.14 71241501
				BA00382P/00/EN/19.14 71270330
				BA00382P/00/EN/20.16 71316868

Device	Date	Softwareversion	Software modifications	Operating Instruction
Deltapilot	10.2009	01.00.zz	Original software. Compatible with: – FieldCare from version 2.02.00 – Field Communicator DXR375 with Device Rev.: 1, DD Rev.: 1	BA382P/00/EN/10.09 71104504
				BA00382P/00/EN/13.10 71123275
				BA00382P/00/EN/14.11 71134588
				BA00382P/00/EN/15.11 71134880
				BA00382P/00/EN/16.12 71157182
				BA00382P/00/EN/17.12 71191304
				BA00382P/00/EN/18.14 71241501
				BA00382P/00/EN/19.14 71270330
				BA00382P/00/EN/20.16 71316868

11 Technical data

For the technical data, please refer to the Technical Information for Cerabar M TI436P / Deltabar M TI434P / Deltapilot M TI437P.

12 Appendix

12.1 Overview of operating menu

All the parameters are listed in the following table. The page number refers to where a description of the parameter can be found.

Level 1	Level 2	Level 3	Level 4	Direct access	Page
Parameters in italics are read-only parameters and cannot be edited. Specific settings, such as the measuring mode, dry or wet calibration, or hardware locking, determine whether these parameters are displayed.					
Language				000	117
Display/operat.	Display mode			001	117
	Add. disp. value			002	117
	Format 1st value			004	118
Setup	Lin./SQRT switch (Deltabar)			133	118
	Measuring mode *Measuring mode (read only)*			005 *182*	118
	Switch P1/P2 (Deltabar)			163	120
	High pressure side (Deltabar) *High pressure side (read only)*			006 *183*	120
	Press. eng. unit			125	119
	Corrected press.			172	122
	Pos. zero adjust (Deltabar M and gauge pressure sensors) Calib. offset (absolute pressure sensor)			007 192	119 119
	Max. flow ("Flow" measuring mode) (Deltabar)			009	128
	Max. pressure flow ("Flow" measuring mode) (Deltabar)			010	128
	Empty calib. (Level measuring mode and "Calibration mode" = wet)			011	124
	Full calib. (Level measuring mode and "Calibration mode" = wet)			012	124
	Set LRV (Pressure measuring mode and flow linear)			013	130
	Set URV (Pressure measuring mode and flow linear)			014	130
	Damping switch (read only)			164	119
	Damping *Damping (read only)*			017 *184*	119
	Flow ("Flow" measuring mode) (Deltabar)			018	128
	Level before lin (Level measuring mode)			019	125
	Pressure af. damp			111	122
	Extended setup	Code definition		023	116
		Device tag		022	117
		Operator code		021	116
		Level (Level measuring mode)	Level selection	024	123
			Unit before lin	025	123
			Height unit	026	123
			Calibration mode	027	123

Level 1	Level 2	Level 3	Level 4	Direct access	Page
...	...	...	Empty calib. *Empty calib.*	028 011	124
... Setup	**... Extended setup**	**... Level** (Level measuring mode)	Empty pressure *Empty pressure (read only)*	029 *185*	124
			Empty height *Empty height (read only)*	030 *186*	124
			Full calib. *Full calib.*	031 012	124
			Full pressure *Full pressure (read only)*	032 *187*	124
			Full height *Full height (read only)*	033 *188*	124
			Adjust density	034	125
			Process density	035	125
			Level before lin	019	125
		Linearization	Lin. mode	037	125
			Unit after lin.	038	125
			Line-numb.:	039	125
			X-value:	040	126
			Y-value:	041	126
			Edit table	042	126
			Tank description	173	126
			Tank content	043	126
		Flow ("Flow" measuring mode) (Deltabar)	Flow type	044	126
			Mass flow unit	045	127
			Norm. flow unit	046	127
			Std. flow unit	047	127
			Flow unit	048	127
			Max. flow	009	128
			Max. pressure flow	010	128
			Set low-flow cut-off	049	128
			Flow	018	128
		Current output	Alarm behavior P	050	129
			Alarm cur. switch	165	129
			Output fail mode	190	129
			High alarm curr.	052	129
			Set min. current	053	130
			Output current	054	129
			Linear/Sqroot (Deltabar) *Linear/Sqroot (read only)*	055 *191*	130
			Get LRV (Pressure measuring mode)	015	130
			Set LRV	013	130
			Get URV (pressure)	016	130
			Set URV	014	130

Level 1	Level 2	Level 3	Level 4	Direct access	Page
...	...	**Totalizer 1** (Deltabar)	Eng. unit totalizer 1	058 059 060 061	135
... Setup	**... Extended setup**	**... Totalizer 1** (Deltabar)	Totalizer 1 mode	175	135
			Totalizer 1 failsafe	176	135
			Reset totalizer 1	062	135
			Totalizer 1	063	135
			Totalizer 1 overflow	064	135
		Totalizer 2 (Deltabar)	Eng. unit totalizer 2	065 066 067 068	136
			Totalizer 2 mode	177	136
			Totalizer 2 failsafe	178	136
			Totalizer 2	069	136
			Totalizer 2 overflow	070	136
Diagnosis	Diagnostic code			071	137
	Last diag. code			072	137
	Min. meas. press.			073	137
	Max. meas. press.			074	137
	Diagnostic list	Diagnostic 1		075	137
		Diagnostic 2		076	137
		Diagnostic 3		077	137
		Diagnostic 4		078	137
		Diagnostic 5		079	137
		Diagnostic 6		080	137
		Diagnostic 7		081	137
		Diagnostic 8		082	137
		Diagnostic 9		083	137
		Diagnostic 10		084	137
	Event logbook	Last diag. 1		085	138
		Last diag. 2		086	138
		Last diag. 3		087	138
		Last diag. 4		088	138
		Last diag. 5		089	138
		Last diag. 6		090	138
		Last diag. 7		091	138
		Last diag. 8		092	138
		Last diag. 9		093	138
		Last diag. 10		094	138
	Instrument info	Firmware version		095	117
		Serial number		096	117
		Ext. order code		097	117
		Order identifier		098	117

Level 1	Level 2	Level 3	Level 4	Direct access	Page
		Cust. tag number		254	117
		Device tag		022	117
...	...	ENP version		099	117
... Diagnosis	... Instrument Info	Config. counter		100	137
		LRL sensor		101	128
		URL sensor		102	128
		Manufacturer ID		103	132
		Device type code		105	132
		Device revision		108	132
	Measured values	Flow (Deltabar)		018	128
		Level before lin		019	125
		Tank content		043	125
		Meas. pressure		020	121
		Sensor pressure		109	122
		Corrected press.		172	122
		Sensor temp. (Cerabar/Deltapilot)		110	120
		Pressure af. damp		111	122
	Simulation	Simulation mode		112	138
		Sim. pressure		113	139
		Sim. flow (Deltabar)		114	139
		Sim. level		115	139
		Sim. tank cont.		116	139
		Sim. current		117	139
		Sim. error no.		118	139
	Reset	Enter reset code		124	118
Expert	Direct access			119	116
	System	Code definition		023	116
		Lock switch		120	116
		Operator code		021	116
		Instrument info	Cust. tag number	254	116
			Device tag	022	117
			Serial number	096	117
			Firmware version	095	117
			Ext. order code	097	117
			Order identifier	098	117
			ENP version	099	117
			Electr. serial no.	121	117
			Sensor serial no.	122	117
		Display	Language	000	117
			Display mode	001	117
			Add. disp. value	002	117
			Format 1st value	004	118
		Management	Enter reset code	124	118

Level 1	Level 2	Level 3	Level 4	Direct access	Page
	Measurement	Lin./SQRT switch (Deltabar)		133	118
		Measuring mode *Measuring mode (read only)*		005 *182*	118
...	...				
... Expert	**... Measurement**	**Basic setup**	Pos. zero adjust (Deltabar and gauge pressure sensors) Calib. offset (absolute pressure sensor)	007 008	119
			Damping switch (read only)	164	119
			Damping *Damping (read only)*	017 *184*	119
			Press. eng. unit	125	119
			Temp. eng. unit (Cerabar/ Deltapilot)	126	120
			Sensor temp. (Cerabar/Deltapilot)	110	120
		Pressure	Switch P1/P2 (Deltabar)	163	120
			High pressure side (Deltabar) *High pressure side (read only)*	006 *183*	120
			Set LRV	013	120
			Set URV	014	120
			Meas. pressure	020	121
			Sensor pressure	109	122
			Corrected press.	172	122
			Pressure af. damp	111	122
		Level	Level selection	024	123
			Unit before lin	025	123
			Height unit	026	123
			Calibration mode	027	123
			Empty calib. *Empty calib.*	028 011	124
			Empty pressure *Empty pressure (read only)*	029 *185*	124
			Empty height *Empty height (read only)*	030 *186*	124
			Full calib. *Full calib.*	031 012	124
			Full pressure *Full pressure (read only)*	032 *187*	124
			Full height *Full height (read only)*	033 *188*	124
			Density unit	127	124
			Adjust density *Adjust density (read only)*	034 *189*	125
			Process density *Process density (read only)*	035 *181*	125
			Level before lin	019	125
		Linearization	Lin. mode	037	125
			Unit after lin.	038	125
			Line-numb.:	039	125

Level 1	Level 2	Level 3	Level 4	Direct access	Page
			X-value:	040	126
			Y-value:	041	126
			Edit table	042	126
...	...	...	Tank description	173	126
... Expert	... Measurement	... Linearization	Tank content	043	126
		Flow (Deltabar)	Flow type	044	126
			Mass flow unit	045	127
			Norm. flow unit	046	127
			Std. flow unit	047	127
			Flow unit	048	127
			Max. flow	009	128
			Max. pressure flow	010	128
			Set low-flow cut-off	049	128
			Flow	018	128
		Sensor limits	LRL sensor	101	128
			URL sensor	102	128
		Sensor trim	Lo trim measured	129	129
			Hi trim measured	130	129
			Lo trim sensor	131	129
			Hi trim sensor	132	129
	Output	**Current output**	Output current (read only)	054	129
			Alarm behavior P	050	129
			Alarm cur. switch (read only)	165	129
			Output fail mode *Output fail mode (read only)*	190 *051*	129
			High alarm curr.	052	129
			Set min. current	053	130
			Lin./SQRT switch (Deltabar)	133	130
			Linear/Sqroot (Deltabar)	055	130
			Get LRV (Pressure measuring mode)	015	130
			Set LRV	056 013 166 168	130
			Get URV (Pressure measuring mode)	016	130
			Set URV	057 014 067 169	130
			Start current	134	130
			Curr. trim 4mA	135	131
			Curr. trim 20mA	136	131
			Offset trim 4mA	137	131
			Offset trim 20 mA	138	131

Level 1	Level 2	Level 3	Level 4	Direct access	Page
	Communication	**HART config**	Burst mode	142	132
			Burst option	143	132
			Current mode	144	132
			Bus address	145	132
...	...		Preamble number	146	132
... Expert	**... Communication**	HART info	Device type code	105	132
			Device revision	108	132
			Manufacturer ID	103	132
			Hart version	180	132
			Descriptor	139	132
			HART message	140	132
			HART date	141	133
		HART output	Primary value is	147	133
			Primary value	148	133
			Secondary val. is	149	133
			Secondary value	150	133
			Third value is	151	133
			Third value	152	133
			4th value is	153	133
			4th value	154	133
		HART input	HART input value	155	133
			HART input stat.	179	133
			HART input unit	156	134
			HART input form.	157	134
	Application	Electr. delta P (Cerabar/Deltapilot)		158	134
		Fixed ext. value (Cerabar/Deltapilot)		174	134
		Totalizer 1 (Deltabar)	Eng. unit totalizer 1	058 059 060 061	135
			Totalizer 1 mode	175	135
			Totalizer 1 failsafe	176	135
			Reset totalizer 1	062	135
			Totalizer 1	063	135
			Totalizer 1 overflow	064	135
		Totalizer 2 (Deltabar)	Eng. unit totalizer 2	065 066 067 068	136
			Totalizer 2 mode	177	136
			Totalizer 2 failsafe	178	136
			Totalizer 2	069	136
			Totalizer 2 overflow	070	136
	Diagnosis	Diagnostic code		071	137
		Last diag. code		072	137

Level 1	Level 2	Level 3	Level 4	Direct access	Page
		Reset logbook		159	137
		Min. meas. press.		073	137
		Max. meas. press.		074	137
		Reset peakhold		161	137
...	...	Operating hours		162	137
... Expert	... Diagnosis	Config. counter		100	137
		Diagnostic list	Diagnostic 1	075	137
			Diagnostic 2	076	137
			Diagnostic 3	077	137
			Diagnostic 4	078	137
			Diagnostic 5	079	137
			Diagnostic 6	080	137
			Diagnostic 7	081	137
			Diagnostic 8	082	137
			Diagnostic 9	083	137
			Diagnostic 10	084	137
		Event logbook	Last diag. 1	085	138
			Last diag. 2	086	138
			Last diag. 3	087	138
			Last diag. 4	088	138
			Last diag. 5	089	138
			Last diag. 6	090	138
			Last diag. 7	091	138
			Last diag. 8	092	138
			Last diag. 9	093	138
			Last diag. 10	094	138
		Simulation	Simulation mode	112	138
			Sim. pressure	113	139
			Sim. flow (Deltabar)	114	139
			Sim. level	115	139
			Sim. tank cont.	116	139
			Sim. current	117	139
			Sim. error no.	118	139

12.2 Description of parameters

This section describes the parameters in the order they are arranged in the "Expert" operating menu. Parameters (or parameter numbers) in italics are read-only parameters and cannot be edited. Specific settings, such as the measuring mode, dry or wet calibration, or hardware locking, determine whether these parameters are displayed.

Expert

Parameter name	Description
Direct access (119) Entry	Enter the direct access code to go directly to a parameter. **Options:** ▪ A number between 0 and 999 (only valid entries are recognized) **Factory setting:** 0 **Note:** For direct access, it is not necessary to enter leading zeros.

12.2.1 System

Expert → System

Parameter name	Description
Code definition (023) Entry	Use this function to enter a release code with which the device can be unlocked. **Options:** ▪ A number between 0 and 9999 **Factory setting:** 0
Lock switch (120) Display	Displays the status of DIP switch 1 on the electronic insert. You can lock or unlock parameters relevant to the measured value with DIP switch 1. If operation is locked by means of the **"Operator code" (021)** parameter, you can only unlock operation again by means of this parameter. **Display:** ▪ On (locking switched on) ▪ Off (locking switched off) **Factory setting:** Off (locking switched off)
Operator code (021) Entry	Use this function to enter a code to lock or unlock operation. **Options:** ▪ To lock operation: enter a number between 1 and 9999 provided the release code = 0; then a number ≠ release code. ▪ To unlock operation: enter the number 0. The release code is "0" in the order configuration. Another release code can be defined in the "Code definition" parameter. If the user has forgotten the release code, it can be made visible again by entering the number sequence "5864". **Factory setting:** 0

Expert → System → Instrument info

Parameter name	Description
Cust. tag number (254) Entry	Enter device tag e.g. TAG number (max. 8 alphanumeric characters). **Factory setting:** no entry or as per order specifications
Device tag (022) Entry	Enter device tag e.g. TAG number (max. 32 alphanumeric characters). **Factory setting:** no entry or as per order specifications
Serial number (096) Display	Displays the serial number of the device (11 alphanumeric characters).
Firmware version (095) Display	Displays the firmware version.
Ext. order code (097) Display	Enter the extended order code. **Factory setting:** As per order specifications
Order identifier (098) Entry	Enter the order identifier. **Factory setting:** As per order specifications
ENP version (099) Display	Displays the ENP version (ENP = electronic nameplate)
Electr. serial no. (121) Display	Displays the serial number of the main electronics (11 alphanumeric characters).
Sensor serial no. (122) Display	Displays the serial number of the sensor (11 alphanumeric characters).

Expert → System → Display

Parameter name	Description
Language (000) Selection	Select the menu language for the local display. **Options:** ▪ English ▪ Optionally one further language (as selected when ordering the device) ▪ One further language (language of the producing factory) **Factory setting**: English
Display mode (001) Selection	Specify the contents for the first line of the local display in the measuring mode. **Options:** ▪ Primary value (PV) ▪ External value ▪ All alternating **Factory setting:** Primary value (PV)
Add. disp. value (002) Selection	Specify the contents for the second line of the local display in the measuring mode. **Options:** ▪ No value ▪ Pressure ▪ Main value (%) ▪ Current ▪ Temperature ▪ Totalizer 1 ▪ Totalizer 2 The options depend on the measuring mode chosen. **Factory setting:** No value

Parameter name	Description
Format 1st value (004) Selection	Specify the number of places after the decimal point for the value displayed in the main line. **Options:** ▪ Auto ▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx ▪ x.xxxxx **Factory setting:** Auto

Expert → System → Management

Parameter name	Description
Enter reset code (124) Entry	Reset parameters completely or partially to the factory values or order configuration, → Page 56, "Resetting to factory settings (reset)". **Factory setting:** 0

12.2.2 Measurement

Expert → Measurement

Parameter name	Description
Lin./SQRT switch (133) Display	Displays the status of DIP switch 4 on the electronic insert, which is used to define the output characteristics of the current output. **Display:** ▪ SW setting The output characteristics is defined by the "Linear/Sqroot" (055) parameter. ▪ Square root The square root signal is used, independent of the setting in the "Linear/Sqroot" (055) parameter. **Factory setting** SW setting
Measuring mode (005) Selection	Select the measuring mode. The operating menu is structured differently depending on the measuring mode selected. **⚠ WARNING** **Changing the measuring mode affects the span (URV)!** This situation can result in product overflow. ▶ If the measuring mode is changed, the span setting (URV) must be verified and, if necessary, reconfigured! **Options:** ▪ Pressure ▪ Level ▪ Flow (Deltabar M only) **Factory setting** Pressure or as per order specifications

Expert → Measurement → Basic setup

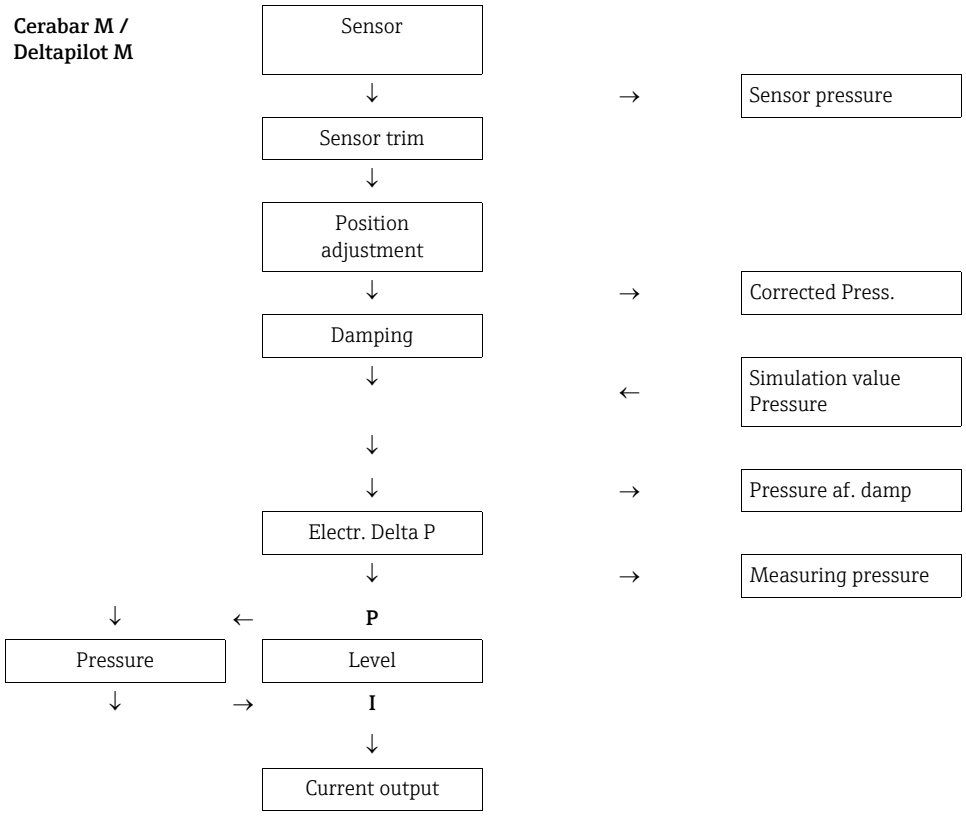
Parameter name	Description
Pos. zero adjust (007) (Deltabar M and gauge pressure sensor) Selection	Position adjustment – the pressure difference between zero (set point) and the measured pressure need not be known. **Example:** – Measured value = 2.2 mbar (0.033 psi) – You correct the measured value via the "Pos. zero adjust" parameter with the "Confirm" option. This means that you are assigning the value 0.0 to the pressure present. – Measured value (after pos. zero adjust) = 0.0 mbar – The current value is also corrected. **Factory setting:** Abort
Calib. offset (192) / (008) (absolute pressure sensor) Selection	Position adjustment – the pressure difference between the set point and the measured pressure must be known. **Example:** – Measured value = 982.2 mbar (14.73 psi) – You correct the measured value with the value entered (e.g. 2.2 mbar (0.033 psi)) via the "Calib. offset" parameter. This means that you are assigning the value 980.0 (14.7 psi) to the pressure present. – Measured value (after pos. zero adjust) = 980.0 mbar (14.7 psi) – The current value is also corrected. **Factory setting:** 0.0
Damping switch (164) Display	Displays the switch position of DIP switch 4 which is used to switch the damping of the output signal on and off. **Display:** ▪ Off The output signal is not damped. ▪ On The output signal is damped. The attenuation constant is specified in the "Damping value" parameter (017) (184) **Factory setting** On
Damping value (017) Entry	Enter the damping time (time constant τ). The damping affects the speed at which the measured value reacts to changes in pressure. **Input range:** 0.0 to 999.0 s **Factory setting:** 2.0 or as per order specifications
Press. eng. unit (125) Selection	Select the pressure unit. If a new pressure unit is selected, all pressure-specific parameters are converted and displayed with the new unit. **Options:** ▪ mbar, bar ▪ mmH2O, mH2O, inH2O ▪ ftH2O ▪ Pa, kPa, MPa ▪ psi ▪ mmHg, inHg ▪ kgf/cm^2 **Factory setting:** mbar or bar depending on the sensor nominal measuring range, or as per order specifications

Parameter name	Description
Temp. eng. unit (126) (only for Cerabar M and Deltapilot M) Selection	Select the unit for the temperature measured values. The setting affects the unit for the "Sensor temp." parameter. **Options:** ▪ ℃ ▪ ℉ ▪ K **Factory setting:** ℃
Sensor temp. (110) (only for Cerabar M and Deltapilot M) Display	Displays the temperature currently measured in the sensor. This can deviate from the process temperature.

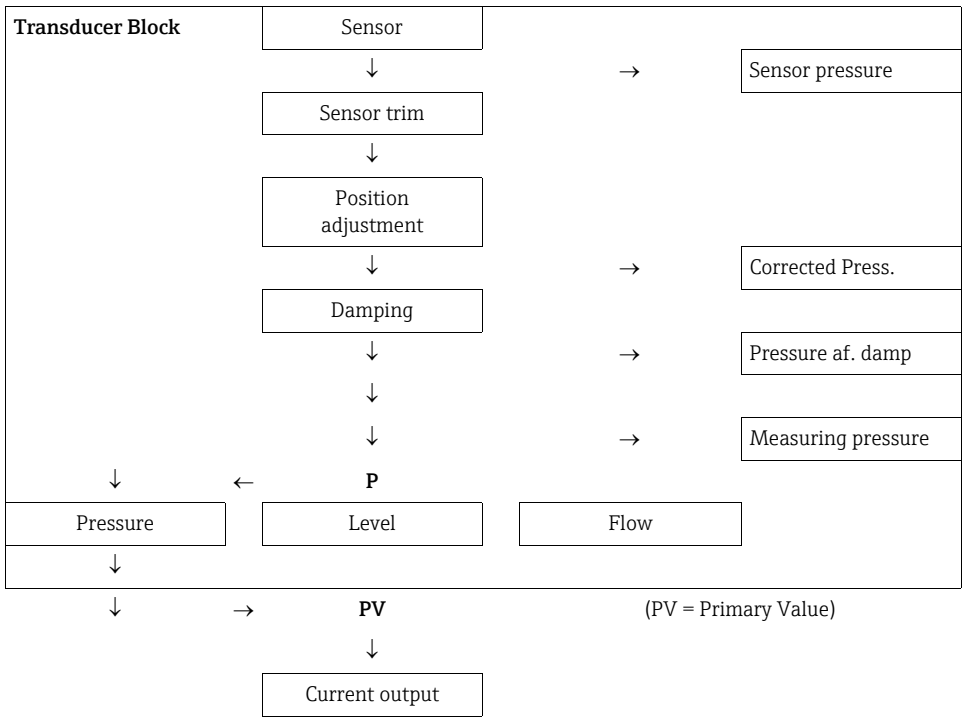
Expert → Measurement → Pressure

Parameter name	Description
Switch P1/P2 (163) Display	Indicates whether the "SW/P2High" DIP switch (DIP switch 5) is switched on. The "SW/P2High" DIP switch determines which pressure input corresponds to the high-pressure side. **Display:** ▪ SW setting "SW/P2 High" is switche off: The "High pressure side" (006) parameter determines which pressure input corresponds to the high-pressure side. ▪ P2 High "SW/P2 High" is switched on: Pressure input P2 corresponds to the high-pressure side, independent of the setting in the "High pressure side" (006) parameter. **Factory setting:** SW setting
High pressure side (006) (183) Selection	Determines, which pressure input corresponds to the high-pressure side. This setting is only valid if the "SW/P2High" DIP switch is in the OFF position (see the "Pressure side switch" (163) parameter). Otherwise P2 corresponds to the high-pressure side in any case. **Selection:** ▪ P1 High Pressure input P1 is the high-pressure side. ▪ P2 High Pressure input P2 is the high-pressure side. **Factory setting** P1 High
Set LRV (013) Display	Set the lower-range value – without reference pressure. Enter the pressure value for the lower current value (4 mA). **Factory setting:** 0.0 or as per order specifications
Set URV (014) Display	Set the upper-range value – without reference pressure. Enter the pressure value for the upper current value (20 mA). **Factory setting:** Upper range limit sensor or as per order specifications.

Parameter name	Description
Meas. pressure (020) Display	Displays the measured pressure after sensor recalibration, position adjustment and damping.



Deltabar M



Parameter name	Description
Sensor pressure (109) Display	Displays the measured pressure before the sensor trim and position adjustment.
Corrected press. (172) Display	Displays the measured pressure after sensor trim and position adjustment.
Pressure af. damp (111) Display	Displays the measured pressure after sensor trim, position adjustment and damping.

Expert → Measurement → Level

Parameter name	Description
Level selection (024) Selection	Select the method for calculating the level **Options:** ▪ In pressure If this option is selected, specify two pressure/level value pairs. The level value is displayed directly in the unit that you select via the "Unit before lin" parameter. ▪ In height If this option is selected, specify two height/level value pairs. From the measured pressure, the device first calculates the height using the density. This information is then used to calculate the level in the "Unit before lin" selected using the two value pairs specified. **Factory setting:** In pressure
Unit before lin (025) Selection	Select the unit for the measured value display for the level before linearization. The unit selected is only used to describe the measured value. This means that the measured value is not converted when a new output unit is selected. Example: ▪ Current measured value: 0.3 ft ▪ New output unit: m ▪ New measured value: 0.3 m **Options** ▪ % ▪ mm, cm, dm, m ▪ ft, inch ▪ m^3, in^3 ▪ l, hl ▪ ft^3 ▪ gal, Igal ▪ kg, t ▪ lb **Factory setting:** %
Height unit (026) Selection	Select the height unit. The measured pressure is converted to the selected height unit using the "Adjust density" parameter. **Prerequisite** "Level selection" = "In height" **Options** ▪ mm ▪ m ▪ inch ▪ ft **Factory setting:** m
Calibration mode (027) Selection	Select the calibration mode. **Options:** ▪ Wet Wet calibration takes place by filling and emptying the container. With two different levels, the level, volume, mass or percentage value entered is assigned to the pressure measured at this point in time ("Empty calibration" and "Full calibration" parameters). ▪ Dry Dry calibration is a theoretical calibration. For this calibration, you specify two pressure/level value pairs via the following parameters: "Empty calib.", "Empty pressure", "Full calib.", "Full pressure". **Factory setting:** Wet

Parameter name	Description
Empty calib. (028) **Empty calib. (011)** Entry	Enter the output value for the lower calibration point (container empty). The unit defined in "Unit before lin" must be used. ▪ In the case of wet calibration, the level (container empty) must actually be available. The associated pressure is then automatically recorded by the device. ▪ In the case of dry calibration, the level (container empty) does not have to be available. The associated pressure has to be entered in the "**Empty pressure (029)**" parameter for the "In pressure" level selection. The associated height has to be entered in the "Empty height (030)" parameter for the "In height" level selection. **Factory setting:** 0.0
Empty pressure (029) Entry/display	Enter the pressure value for the lower calibration point (container empty). → See also "**Empty calib. (028)**". **Prerequisite** ▪ "Level selection" = In pressure "Calibration mode" = Wet (display only), Dry (entry) **Factory setting:** 0.0
Empty height (030) Entry/display	Enter the height value for the lower calibration point (container empty). Select the unit via the "**Height unit (026)**" parameter. **Prerequisite:** ▪ "Level selection" = in height and "Calibration mode" = wet (display only) , Dry (entry) **Factory setting:** 0.0
Full calib. (031) **Full calib. (012)** Entry	Enter the output value for the upper calibration point (container full). The unit defined in "Unit before lin" must be used. ▪ In the case of wet calibration, the level (container full) must actually be available. The associated pressure is then automatically recorded by the device. ▪ In the case of dry calibration, the level (container full) does not have to be available. The associated pressure has to be entered in the "Full pressure (030)" parameter for the "In pressure" level mode. The associated height has to be entered in the "Empty height" parameter for the "In height" level selection. **Factory setting:** 100.0
Full pressure (032) Entry/display	Enter the pressure value for the upper calibration point (container full). → See also "Full calib.". **Prerequisite** ▪ "Level selection" = in pressure and "Calibration mode" = wet (display only), Dry (entry) **Factory setting:** Upper-range limit (URL) of the sensor
Full height (033) Entry/display	Enter the height value for the upper calibration point (container full). You select the unit via the "Height unit" parameter. **Prerequisite:** ▪ "Level selection" = in height and "Calibration mode" = wet (display only), Dry (entry) **Factory setting:** Upper-range limit (URL) is converted to a height unit
Density unit (127) Display	Displays the density unit. The measured pressure is converted to a height using the "Height unit", "Density unit" and "Adjust density" parameters. **Factory setting:** ▪ g/cm^3

Parameter name	Description
Adjust density (034) Entry	Enter the density of the medium. The measured pressure is converted to a height using the "Height unit" and "Adjust density" parameters. **Factory setting:** 1.0
Process density (035) Entry	Enter a new density value for density correction. The calibration was carried out with water as the medium, for example. Now the container is to be used for another medium with another density. The calibration is corrected appropriately by entering the new density value in the "Process density" parameter. If you change to dry calibration after a wet calibration using the "Calibration mode" parameter, the density for the "Adjust density" and "Process density" parameters must be entered correctly before changing the calibration mode. If the pressure falls with increasing levels, such as in the case of residual volume measurement, a negative value must be entered for this parameter. **Factory setting:** 1.0
Level before lin. (019) Display	Displays the level value prior to linearization.

Expert → Measurement → Linearization

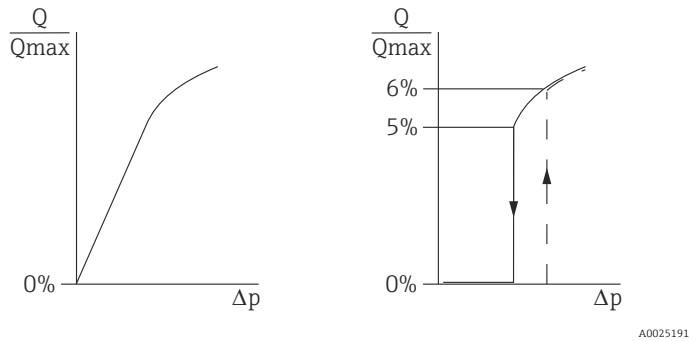
Parameter name	Description
Lin. mode (037) Selection	Select the linearization mode. **Options:** ▪ Linear The level is output without being converted beforehand. "Level before lin." is output. ▪ Erase table The existing linearization table is deleted. ▪ Manual entry (sets the table to the edit mode, an alarm is output): The value pairs of the table (X-value and Y-value) are entered manually. ▪ Semiautomatic entry (sets the table to the edit mode, an alarm is output): The container is emptied or filled in stages in this entry mode. The device automatically records the level value (X-value). The associated volume, mass or %-value is entered manually (Y-value). ▪ Activate table The table entered is activated and checked with this option. The device shows the level after linearization. **Factory setting:** Linear
Unit after lin. (038) Selection	Select the volume unit (unit of the Y-value). **Options:** ▪ % ▪ cm, dm, m, mm ▪ hl ▪ in^3, ft^3, m^3 ▪ l ▪ in, ft ▪ kg, t ▪ lb ▪ gal ▪ Igal **Factory setting:** %
Line numb. (039) Entry	Enter the number of the current point in the table. The subsequent entries for "X-value" and "Y-value" refer to this point. **Input range:** ▪ 1 to 32

Parameter name	Description
X-value (193/040) Display/Entry	Enter the level value for the specific point in the table and confirm. ▪ If "Lin. mode" = "Manual", the level value has to be entered. ▪ If "Lin. mode" = "Semiautomatic", the level value is displayed and has to be confirmed by entering the associated Y-value.
Y-value (041) Entry	Enter the output value for the specific point in the table. The unit is determined by "Unit after lin.". The linearization table must be monotonic (increasing or decreasing).
Edit table (042) Selection	Select the function for entering the table. **Options:** ▪ Next point: enter the next point. ▪ Current point: stay on the current point to correct a mistake for example. ▪ Previous point: skip back to the previous point to correct a mistake for example. ▪ Insert point: insert an additional point (see example below). ▪ Delete point: delete the current point (see example below). **Example:** Add a point - in this case between the 4th and 5th point for example – Select point 5 via the "Line-numb." parameter. – Select the "Insert point" option via the "Edit table" parameter. – Point 5 is displayed for the "Line-numb" parameter. Enter new values for the "X-value" and "Y-value" parameters. **Example:** Delete a point - in this case the 5th point for example – Select point 5 via the "Line-numb." parameter. – Select the "Delete point" option via the "Edit table" parameter. – The 5th point is deleted. All of the subsequent points are moved up one number i.e. following deletion, the 6th point becomes Point 5. **Factory setting:** Current point
Tank description (173) Entry	Enter the tank description (max. 32 alphanumeric characters)
Tank content (043) Display	Displays the level value after linearization.

Expert → Measurement → Flow (Deltabar M)

Parameter name	Description
Flow type (044) Selection	Select the flow type. **Options:** ▪ Volume process cond. (volume under operating conditions) ▪ Volume norm. cond. (norm volume under norm conditions in Europe: 1013,25 mbar and 273,15 K (0 °C)) ▪ Volume std. cond. (standard volume under standard conditions in the USA: 1013,25 mbar (14,7 psi) and 288,15 K (15 °C/59 °F)) ▪ Mass (mass under operating conditions) ▪ Flow in % **Factory setting:** Flow in %

Parameter name	Description
Mass flow unit (045) Selection	Select mass flow unit. When a new flow unit is selected, all flow-specific parameters are converted and displayed with the new unit within a flow type. When the flow type is changed, conversion is not possible. **Prerequisite:** ▪ "Flow type" (044) = Mass **Options:** ▪ g/s, kg/s, kg/min, kg/h ▪ t/s, t/min, t/h, t/d ▪ oz/s, oz/min ▪ lb/s, lb/min, lb/h ▪ ton/s, ton/min, ton/h, ton/d **Factory setting:** kg/s
Norm. flow unit (046) Selection	Select norm flow unit. When a new flow unit is selected, all flow-specific parameters are converted and displayed with the new unit within a flow type. When the flow type is changed, conversion is not possible. **Prerequisite:** ▪ "Flow type" (044) = Volume norm. cond. **Options:** ▪ Nm3/s, Nm3/min, Nm3/h, Nm3/d **Factory setting:** Nm^3/s
Std. flow unit (047) Selection	Select standard flow unit. When a new flow unit is selected, all flow-specific parameters are converted and displayed with the new unit within a flow type. When the flow type is changed, conversion is not possible. **Prerequiste:** ▪ "Flwo type" (044) = Volume std. cond. **Options:** ▪ Sm3/s, Sm3/min, Sm3/h, Sm3/d ▪ SCFS, SCFM, SCFH, SCFD **Factory setting:** Sm^3/s
Flow unit (048) Selection	Select volume flow unit. When a new flow unit is selected, all flow-specific parameters are converted and displayed with the new unit within a flow type. When the flow type is changed, conversion is not possible. **Prerequisite:** ▪ "Flow type" (044) = Volume process cond. **Options:** ▪ dm3/s, dm3/min, dm3/h ▪ m3/s, m3/min, m3/h, m3/d ▪ l/s, l/min, l/h ▪ hl/s, hl/min, hl/d ▪ ft3/s, ft3/min, ft3/h, ft3/d ▪ ACFS, ACFM, ACFH, ACFD ▪ ozf/s, ozf/min ▪ Gal/s, Gal/min, Gal/h, Gal/day, MGal/d ▪ I. Gal/s, I. Gal/min, I. Gal/h ▪ bbl/s, bbl/min, bbl/h, bbl/d **Factory setting:** m^3/s

Parameter name	Description
Max. flow (009) Entry	Enter maximum flow of primary element. See also layout sheet of primary element. The maximum flow is assigned to the maximum pressure which you enter via the "Max. pressure flow" (010) parameter. Use the "**Linear/Sqroot**" **(055)** parameter to specify the current signal for the "Flow" measuring mode. The following applies for the "square root" setting: If you enter a new value for "**Max. flow**" **(009)**, the value for "**Set URV**" **(057)** is also changed. Use the "**Set URV**" **(057)** parameter to assign a flow to the upper current value. If you want to assign the upper current value a value other than that for "**Max. flow**" **(009)**, you must enter the desired value for "**Set URV**" **(057)**. **Factory setting:** 100.0
Max. pressure flow (010) Entry	Enter maximum pressure of primry element. → See layout sheet of primary element. This pressure is assigned to the flow defined in the "**Max. flow**" **(009)** parameter. Use the "**Lienar/Sqroot**" **(055)** parameter to specify the current signal for the "Flow" measuring mode. The following applies for the "linear" setting: If you enter a new value for "**Max. pressure flow**" **(010)**, the value for "**Set URV**" **(014)** is also changed. Use the "**Set URV**" **(014)** parameter to assign a presure value to the upper current value. If you want to assign the upper current value a value other than that for "Max. press. flow" (010), you must enter the desired value for "**Set URV**" **(014)**. **Factory setting:** Upper range limit (URL) of the sensor
Set low-flow cut-off (049) Entry	Enter switch-on point of the flow-flow cut-off. Thje hysteresis between the switch-on point and the switch-off point is always 1 % of the maximum flow value. **Input range:** 0…50 % of the end flow value t (**"Max. flow" (009)**).  **Factory setting:** 5 % (of the maximum flow value)
Flow (018) Display	Displays the present flow value.

Expert → Measurement → Sensor limits

Parameter name	Description
LRL sensor (101) Display	Displays the lower-range limit of the sensor.
URL sensor (102) Display	Displays the upper-range limit of the sensor.

Expert → Measurement → Sensor trim

Parameter name	Description
Lo trim measured (129) Display	Displays the reference pressure present to be accepted for the lower calibration point.
Hi trim measured (130) Display	Displays the reference pressure present to be accepted for the upper calibration point.
Lo trim sensor (131) Display	Sensor recalibration by entering a target pressure while simultaneously and automatically accepting a reference pressure present for the lower calibration point.
Hi trim sensor (132) Display	Sensor recalibration by entering a target pressure while simultaneously and automatically accepting a reference pressure present for the upper calibration point.

12.2.3 Output

Expert → Output → Current output

Parameter name	Description
Output current (054) Display	Displays the current value of the current.
Alarm behav. P (050) Selection	Configure the current output for when the sensor limits are undershot or overshot. **Options:** ▪ Warning The device continues measuring. An error message is displayed. ▪ Alarm The output signal assumes a value that can be specified by the "Output fail mode" function. ▪ NAMUR – Lower sensor limit undershot: Current output = 3.6 mA – Upper sensor limit overshot: Current output assumes value of 21 to 23 mA, depending on the setting of the "**High alarm curr." (052) parameter**. **Factory setting:** Warning
Alarm cur. switch (165)	Displays the switch status of DIP switch 3 "SW/alarm min." **Display** ▪ AF The alarm current has the value defined in the **"Output fail mode" (190)**. ▪ Alarm min. The alarm current is 3.6 mA regardless of the software setting.
Output fail mode (190) Selection	Select the output fail mode. In the event of an alarm, the current assumes the current value specified with this parameter. **Options:** ▪ Max. (110%): can be set from 21 to 23 mA Max: can be set from 21 to 23 mA → see also "**High alarm curr. (052)**" ▪ Hold: last measured value is held ▪ Min. (–10%): 3.6 mA **Factory setting:** Max. alarm 110% (22 mA)
High alarm curr. (052) Entry	Enter the current value for the high alarm current. → See also "Output fail mode". **Input range:** 21 to 23 mA **Factory setting:** 22 mA

Parameter name	Description
Set min. current (053) Entry	Enter the lower current limiting value. Some switching units do not accept current values lower than 4.0 mA. **Options:** ▪ 3.8 mA ▪ 4.0 mA **Factory setting:** 3.8 mA
Lin./SQRT switch (133) Display	Displays the state of DIP switch 4 "SW/SQRT". **Display** ▪ SW The output characteristics is defined in the "Linear/Sqroot" (055) parameter ▪ Square root The output characteristics follows a square root function, independent of the software setting. This characteristics is needed for differential pressure flow measurement.
Linear/Sqroot (055) Selection	Specify current signal for the "Flow" measuring mode. See also: "Set LRV" (056) and "Set URV" (057). **Prerequisite:** ▪ "Measuring mode" (005) = Flow **Options:** ▪ Linear The linear pressure signal is used for the current output. The flow must be calculated in the evaluation unit. ▪ Flow (square root) The root flow signal is used for the current output. The "Flow (square root)" current signal is indicated on the on-site display with a root symbol. **Factory setting:** Square root
Get LRV (015) Entry (only in pressure measuring mode)	Set the lower-range value – reference pressure is present at the device. The pressure for the lower current value (4 mA) is present at the device. With the "Confirm" option, you assign the lower current value to the pressure value present. **Options:** ▪ Abort ▪ Confirm
Set LRV (056, 013, 166, 168) Entry	Set the pressure value for the lower current value (4 mA). **Factory setting:** 0.0 % in the level measuring mode; 0.0 or in accordance with ordering specifications in the pressure measuring mode 0.0 m^3/h in the flow measureing mode
Get URV (016) Entry (only in pressure measuring mode)	Set the upper-range value – reference pressure is present at the device. The pressure for the upper current value (20 mA) is present at the device. With the "Confirm" option, you assign the upper current value to the pressure value present. **Options:** ▪ Abort ▪ Confirm
Set URV (057, 014, 167, 169) Entry	Set the pressure value for the upper current value (20 mA). **Factory setting:** 100.0 % in the level measuring mode; URL sensor or in accordance with ordering information in the pressure measuring mode; 3600 m^3/h in the flow measuring mode
Startcurrent (134) Entry	Use this function to enter the start current. This setting is also effective in the HART multidrop mode. **Options:** ▪ 12 mA ▪ Max Alarm (22 mA, non-adjustable) **Factory setting:** 12 mA

Parameter name	Description
Curr. trim 4mA (135) Entry	Enter the current value for the lower point (4 mA) of the current linear regression line. You can adapt the current output to the transmission conditions with this parameter and "Curr. trim 20mA". Perform the current trim for the lower point as follows: 1. Select the "Current" option in the "Simulation mode" parameter. 2. Set the 4mA value in the "Sim. current" parameter. 3. Enter the current value measured with the switching unit in the "Curr. trim 4mA" parameter. **Input range:** Measured current ±0.2 mA **Factory setting:** 4 mA
Curr. trim 20mA (136) Entry	Enter the current value for the upper point (20 mA) of the current linear regression line. You can adapt the current output to the transmission conditions with this parameter and "Curr. trim 4mA". Perform the current trim for the lower point as follows: 1. Select the "Current" option in the "Simulation mode" parameter. 2. Enter the "20 mA" value in the "Sim. current" parameter. 3. Enter the current value measured with the switching unit in the "Curr. trim 20mA" parameter. **Input range:** Measured current ±0.2 mA **Factory setting:** 20 mA
Offset trim 4mA (137) Display	Displays the difference between 4 mA and the value entered for the "Curr. trim 4mA" parameter. **Factory setting:** 0
Offset trim 20mA (138) Display	Displays the difference between 20 mA and the value entered for the "Curr. trim 20mA" parameter. **Factory setting:** 0

12.2.4 Communication

Expert → Communication → HART config

Parameter name	Description
Burst mode (142) Selection	Switch the burst mode on and off. **Options:** ▪ On ▪ Off
Burst option (143) Entry	Use this parameter to specify what HART command is sent to the master. **Options:** ▪ 1 (HART command 1) ▪ 2 (HART command 2) ▪ 3 (HART command 3) ▪ 9 (HART command 9) ▪ 33 (HART command 33) **Factory setting:** 1 (HART command 1)
Current mode (144) Selection	Configure the current mode for HART communication. **Options:** ▪ Signaling Measured value transmitted by the current value ▪ Fixed Fixed current 4.0 mA (multidrop mode) (measured value only transmitted via HART digital communication) **Factory setting** Signaling
Bus address (145) Entry	Enter the address for exchanging data via the HART protocol. (HART 5.0 master: Range 0 to 15, where address = 0 calls up the "Signaling" setting; HART 6.0 master: range 0 to 63) **Factory setting:** 0
Preamble number (146) Entry	Enter the number of preambles in the HART protocol. (Synchronization of the modem modules along a transmission path, each modem module could "swallow" one byte; at least 2 bytes must be preambles.) **Input range:** 2 to 20 **Factory setting:** 5

Expert → Communication → HART info

Parameter name	Description
Device type code (105) Display	Displays the numeric ID of the device. For Deltabar M: 33 For Deltapilot: 35 For Cerabar: 25
Device revision (108) Display	Displays the device revision. e.g.: 1
Manufacturer ID (103) Display	Displays the manufacturer number in decimal numerical format. Here: 17 Endress+Hauser
HART revision (180) Display	Displays the HART revision. Here: 6
Descriptor (139) Entry	Enter the tag description (max. 16 alphanumeric characters).
HART message (140) Entry	Enter a message (max. 32 alphanumeric characters). This message is sent via the HART protocol at the request of the master.

Parameter name	Description
HART date (141) Entry	Enter the date of the last change in configuration. **Factory setting:** DD/MM/YY (date of the final test)

Expert → Communication → HART output

Parameter name	Description
Primary value is (147) Display	Indicates which measured variable is transmitted as the primary process value via the HART protocol. The variable displayed depends on the "measuring mode" selected: – "Pressure" measuring mode: "Meas. pressure" – "Level" measuring mode, "Linear" lin. mode: "Level before lin." – "Level" measuring mode, "Activate table" lin. mode: "Tank content"
Primary value (148) Display	Displays the primary process value. → See also "Primary value is"
Secondary val. is (149) Display	Secondary value. Displays the assignment. The following process values can be displayed depending on the measuring mode selected: – "Meas. pressure" – "Sensor pressure" – "Corrected press." – "Pressure af. damp" – "Sensor temp." – "Level before lin." – "Tank content" – "Flow" – Totalizer 1 – Totalizer 2
Secondary value (150) Display	Displays the secondary process value. → See also "Secondary val. is"
Third value is (151) Display	Third process value. Displays the assignment. → See also "Secondary val. is"
Third value (152) Display	Displays the third process value. → See also "Third val. is"
4th value is (153) Display	4th process value. Displays the assignment. → See also "Secondary val. is"
4th value (154) Display	Displays the 4th process value. → See also "4th value is"

Expert → Communication → HART input

Parameter name	Description
HART input value (155) Display	Displays the HART input value.
HART input stat. (179) Display	Displays the HART input status Bad / Uncertain / Good

Parameter name	Description
HART input unit (156) Selection	Select the HART input value. **Options:** ▪ Unknown ▪ mbar, bar ▪ mmH2O, ftH2O, inH2O ▪ Pa, hPa, kPa, MPa ▪ psi ▪ mmHg, inHg ▪ Torr ▪ g/cm^2, kg/cm^2 ▪ lb/ft^2 ▪ atm ▪ °C, °F, K, R **Factory setting:** Unknown
HART input form. (157) Selection	Specify the format for displaying the HART input value. **Options:** ▪ x.x (default) ▪ x.xx ▪ x.xxx ▪ x.xxxx ▪ x.xxxxx **Factory setting:** x.x

12.2.5 Application

Expert → Application (Cerabar M and Deltapilot M)

Parameter name	Description
Electr. delta P (158) Entry	For switching the electr. delta P application on or off with an external or constant value. **Options:** Off External value Constant **Factory setting:** Off
Fixed ext. value (174) Entry	Use this function to enter the constant value. The value refers to "HART input unit". **Factory setting:** 0.0

Expert → Application → Totalizer 1 (Deltabar M)

With the "Flow in %" flow type setting, the totalizer is not avaialble and is not displayed at this position.

Parameter name	Description
Eng. unit totalizer 1 (058) (059) (060) (061) Selection	Select unit for totalizer 1. **Options** Depending on the settinbg in the "Flow meas. type" (044) parameter this parameter offers a list of volume, norm volume, standard volume and mass units. When a new volume or mass unit is selected, totalizuer-specific parameters are converted and displayed with the new unit within a unit group. When the flow mode is change, the totalizer value is not converted. The Direct Access Code depends on the selection in the "Flow meas. type" (044) parameter: – (058): Flow. meas. type "Mass" – (059): Flow. meas. type "Volume norm. cond." – (060): Flow. meas. type "Volume std. cond." – (061): Flow. meas. type "Volume process cond." **Factory setting:** m^3
Totalizer 1 mode (175)	Define the behavior of the totalizer. **Options:** ▪ Balanced: Integration of all measured flows (positive and negative) ▪ Pos. flow only: only positive flows are integrated. ▪ Neg. flow only: only negative flows are integrated. ▪ Hold: No flow is integrated. The totalizer keeps its current value. **Factory setting:** Pos. flow only
Totalizer 1 failsafe (176)	Define the behavior of the totalizer in the case of an error. **Options:** ▪ Run: Totalizing is continued. ▪ Hold: The totalizer is stopped and keeps its current value.
Reset Totalizer 1 (062) Selection	You reset totalizer 1 to zero with this parameter. **Selection:** ▪ Abort (do not reset) ▪ Reset **Factory setting:** Abort
Totalizer 1 (063) Display	Displays the total flow value of totalizer 1. You can reset the value with the "Reset totalizer 1" (062) parameter. The "Totalizer 1 overflow" (064) parameter displays the overflow. **Example:** The value123456789 m^3 is indicated as follows: – Totalizer 1: 3456789 m^3 – Totalizer 1 overflow: 12 E7 m^3
Totalizer 1 overflow (064) Display	Displays the overflow value of totalizer 1. → See also **"Totalizer 1" (063)**.

Expert → Application → Totalizer 2 (Deltabar M)

With the "Flow in %" flow type setting, the totalizer is not avaialble and is not displayed at this position.

Parameter name	Description
Eng. unit totalizer 2 (065) (066) (067) (068) Selection	Select the unit for totalizer 2. → See also "Eng. unit totalizer 1". The Direct Access Code depends on the selection in the "Flow meas. type" (044) parameter: – (065): Flow. meas. type "Mass" – (066): Flow. meas. type "Gas norm. cond." – (067): Flow. meas. type "Gas. std. cond." – (068): Flow. meas. type "Volume process cond." **Factory setting:** m^3
Totalizer 2 mode (177)	Define the behavior of the totalizer. **Options:** ▪ Balanced: Integration of all measured flows (positive and negative) ▪ Pos. flow only: only positive flows are integrated. ▪ Neg. flow only: only negative flows are integrated. ▪ Hold: No flow is integrated. The totalizer keeps its current value. **Factory setting:** Pos. flow only
Totalizer 2 failsafe (178)	Define the behavior of the totalizer in the case of an error. **Options:** ▪ Run: Totalizing is continued. ▪ Hold: The totalizer is stopped and keeps its current value.
Totalizer 2 (069) Display	Displays the total flow value of totalizer 2. The "Totalizer 2overflow" (070) parameter displays the overflow. See the example for "Totalizer 1"
Totalizer 2 overflow (070) Display	Displays the overflow value of totalizer 2. See the example for "Totalizer 1".

12.2.6 Diagnosis

Expert → Diagnosis

Parameter name	Description
Diagnostic code (071) Display	Displays the diagnostic message with the highest priority currently present.
Last diag. code (072) Display	Displays the last diagnostic message that occurred and was rectified. ▪ Digital communication: the last message is displayed. ▪ The messages listed in the "Last diag. code" parameter can be deleted via the "Reset logbook" parameter.
Reset logbook (159) Selection	With this parameter, you reset all the messages of the "Last diag. code" parameter and the "Last diag. 1" to "Last diag. 10" event log. **Options:** ▪ Abort ▪ Confirm **Factory setting:** Abort
Min. meas. press. (073) Display	Displays the lowest pressure value measured (peakhold indicator). You can reset this indicator by means of the "Reset peakhold" parameter.
Max. meas. press. (074) Display	Displays the highest pressure value measured (peakhold indicator). You can reset this indicator by means of the "Reset peakhold" parameter.
Reset peakhold (161) Selection	You can reset the "Min. meas. press." and "Max. meas. press." indicators with this parameter. **Options:** ▪ Abort ▪ Confirm **Factory setting:** Abort
Operating hours (162) Display	Displays the hours of operation. This parameter cannot be reset.
Config. counter (100) Display	Displays the configuration counter. This counter is increased by one every time a parameter or group is changed. The counter counts up to 65535 and then starts again at zero.

Expert → Diagnosis → Diagnostic list

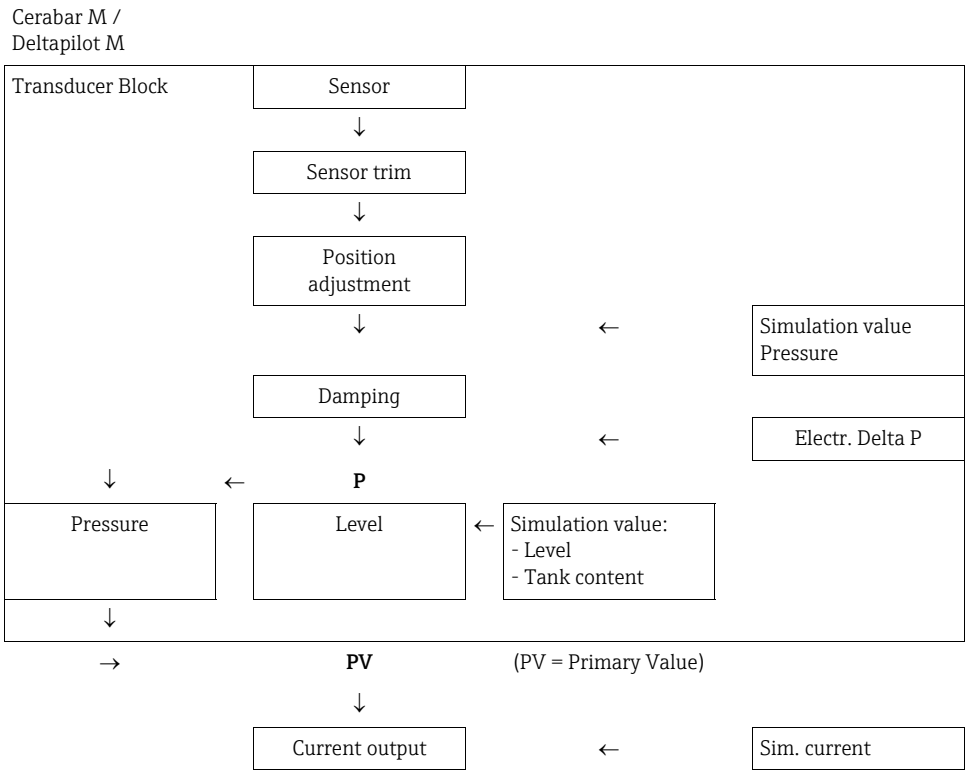
Parameter name	Description
Diagnostic 1 (075) Diagnostic 2 (076) Diagnostic 3 (077) Diagnostic 4 (078) Diagnostic 5 (079) Diagnostic 6 (080) Diagnostic 7 (081) Diagnostic 8 (082) Diagnostic 9 (083) Diagnostic 10 (084)	These parameters contain up to ten diagnosis messages that are currently pending, arranged in order of priority.

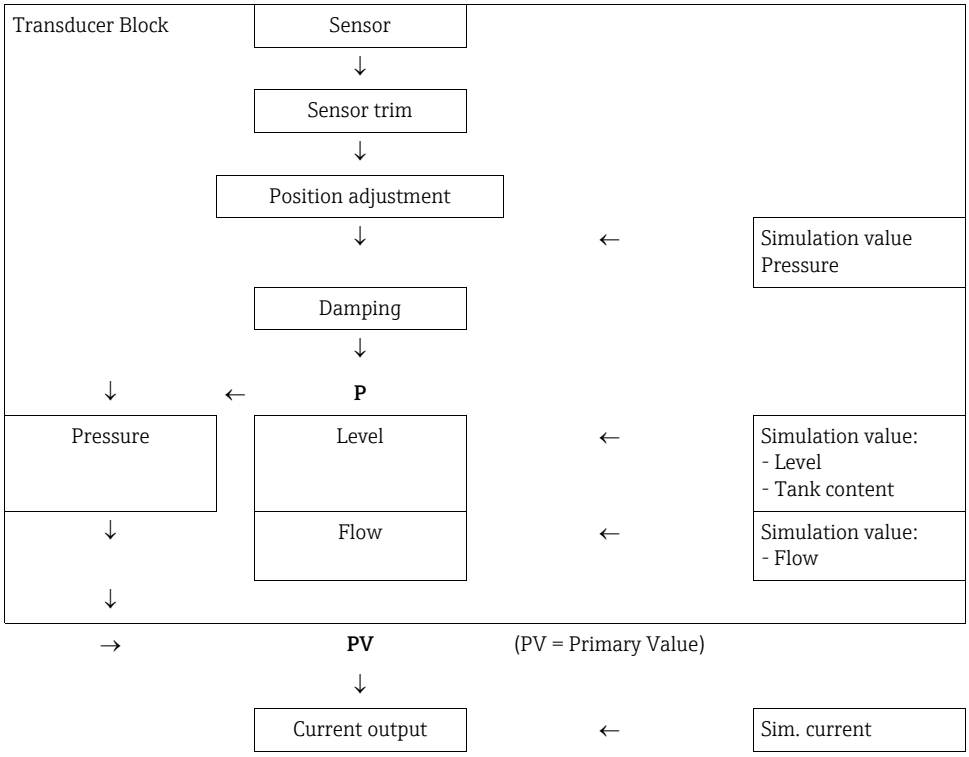
Expert → Diagnosis → Event logbook

Parameter name	Description
Last diag. 1 (085) Last diag. 2 (086) Last diag. 3 (087) Last diag. 4 (088) Last diag. 5 (089) Last diag. 6 (090) Last diag. 7 (091) Last diag. 8 (092) Last diag. 9 (093) Last diag. 10 (094)	These parameters contain the last 10 diagnosis messages to occur and be rectified. They can be reset with the "Reset logbook" parameter. Errors which have occurred multiple times are displayed once only.

Expert → Diagnosis → Simulation

Parameter name	Description
Simulation mode (112) Selection	Switch on simulation and select the simulation mode. Any simulation running is switched off if the measuring mode or level type (Lin. mode (037)) is changed. **Options**: ▪ None ▪ Pressure, → see also this table, "Sim. pressure" parameter ▪ Level, → see this table, "Sim. level" parameter ▪ Flow, → see this table, "Sim. flow" parameter ▪ Tank content, → see this table, "Sim. tank cont." parameter ▪ Current, → see this table, "Sim. current" parameter ▪ Alarm/warning, → see this table, "Sim. error no." parameter **Factory setting:** None



Parameter name	Description
	Deltabar M 
Sim. pressure (113) Entry	Enter the simulation value. → See also "Simulation mode". **Prerequisite:** ▪ "Simulation mode" = Pressure **Switch on value:** Current pressure measured value
Sim. flow (114) Entry	Enter the simulation value. → See also "**Simulation mode (112)**". **Prerequisite:** ▪ "Meas. mode" = Flow and "Simulation Mode" = Flow
Sim. level (115) Entry	Enter the simulation value. → See also "Simulation mode". **Prerequisite:** ▪ "Measuring mode" = Level and "Simulation mode" = Level
Sim. tank cont. (116) Entry	Enter the simulation value. → See also "Simulation mode". **Prerequisites:** ▪ "Measuring mode" = Level, "Activate table" lin. mode and "Simulation mode" = Tank content.
Sim. current (117) Entry	Enter the simulation value. → See also "Simulation mode". **Prerequisite:** ▪ "Simulation mode"= Current value **Factory setting:** Current value of the current
Sim. error no. (118) Entry	Enter the diagnostic message number. → See also "Simulation mode". **Prerequisite:** ▪ "Simulation mode"= Alarm/warning **Switch on value:** 484 (simulation active)

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