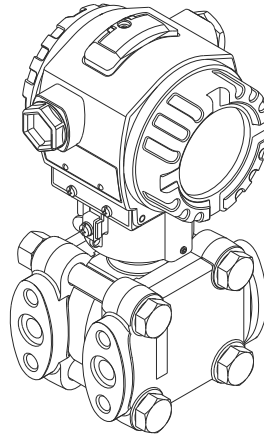


Brief Operating Instructions

Deltabar S

PMD75, FMD77, FMD78

Differential pressure measurement

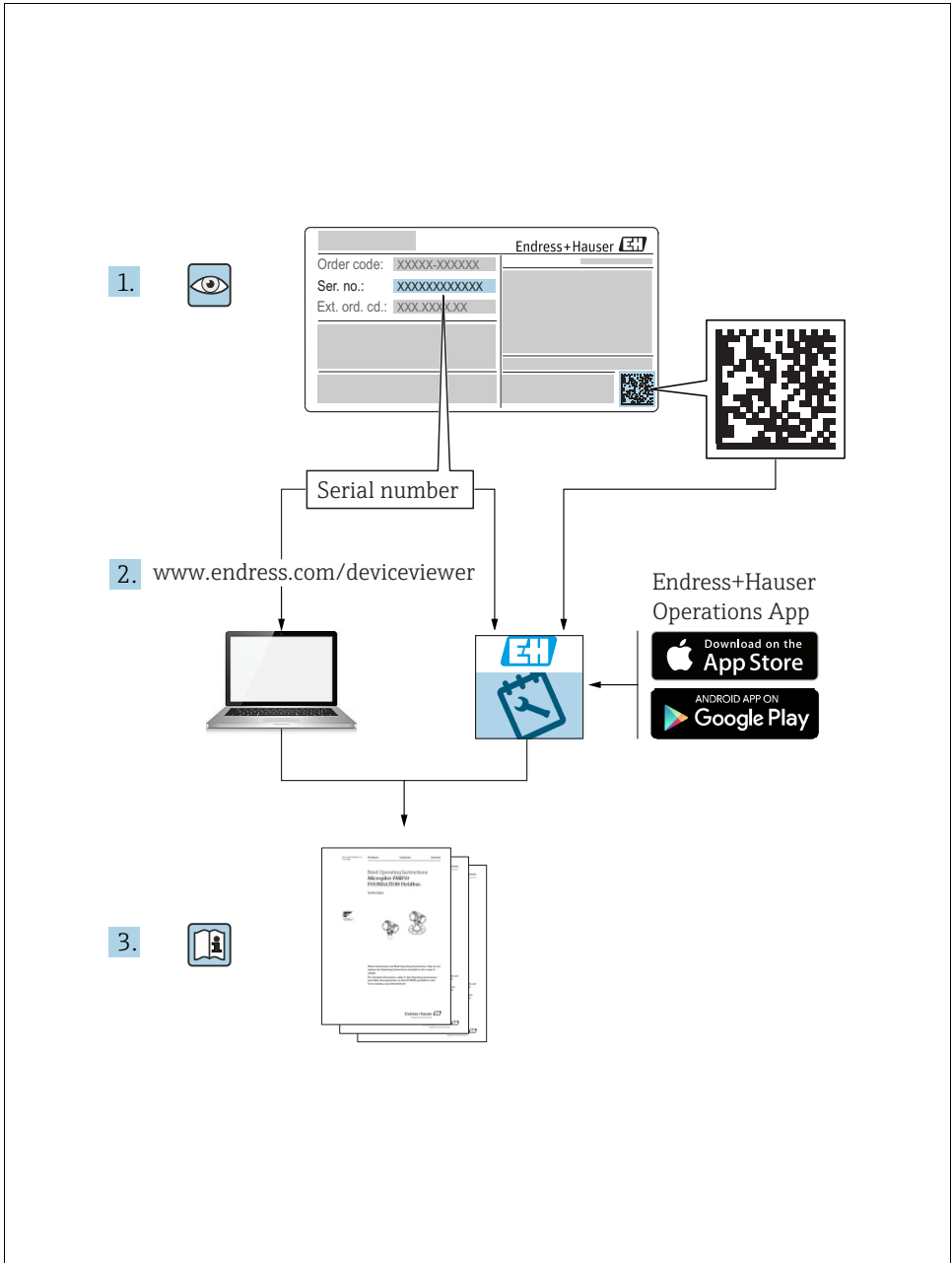


These Instructions are Brief Operating Instructions; they are not a substitute for the Operating Instructions pertaining to the device.

Detailed information about the device can be found in the Operating Instructions and the other documentation:

Available for all device versions via:

- Internet: www.endress.com/deviceviewer
- Smart phone/tablet: *Endress+Hauser Operations App*



A0023555

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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 serious or fatal injury.
 A0011190-DE	WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
 A0011191-DE	CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
 A0011192-DE	NOTICE! This symbol contains information on procedures and other facts which do not result in personal injury.







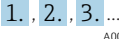


1.2.2 Electrical symbols

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.

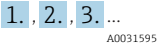
1.2.3 Tool symbols

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
 A0031595	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
	Series of steps
A, B, C, D, ...	Views

1.2.6 Symbols at the device

Symbol	Meaning
	Safety instructions Observe the safety instructions contained in the associated Operating Instructions.

1.3 Registered trademarks

KALREZ, VITON, TEFLON

Registered trademarks of E.I. Du Pont de Nemours & Co., Wilmington, USA

TRI-CLAMP

Registered trademark of Ladish & Co., Inc., Kenosha, USA

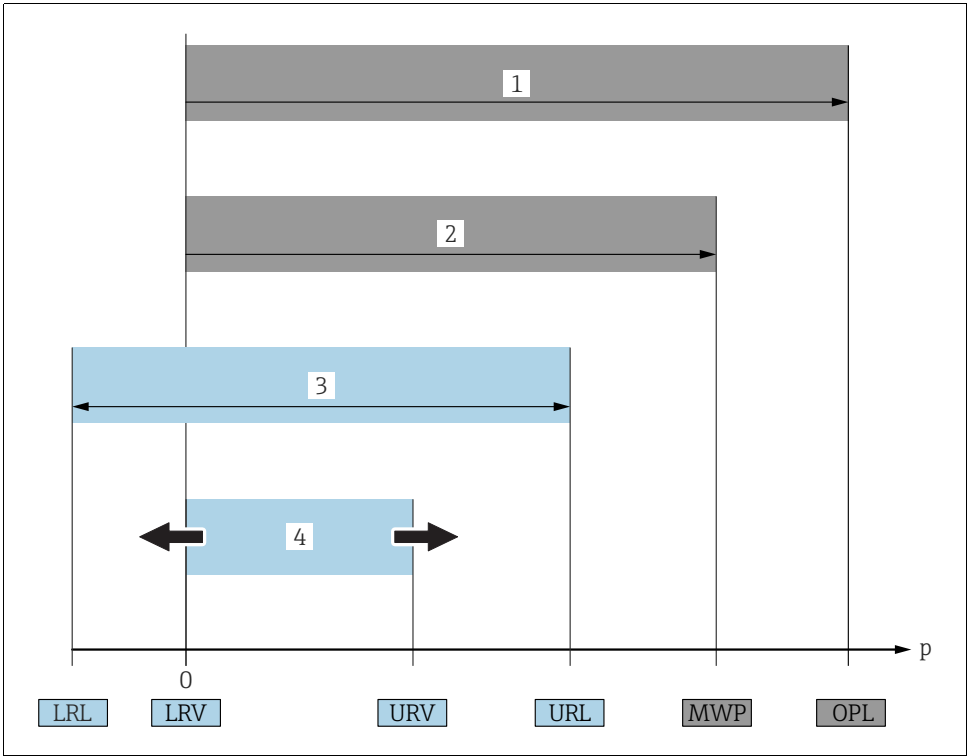
PROFIBUS PA®

Trademark of the PROFIBUS User Organization, Karlsruhe, Germany

GORE-TEX®

Registered trademarks of W.L. Gore & Associates, Inc., USA

1.4 Terms and abbreviations

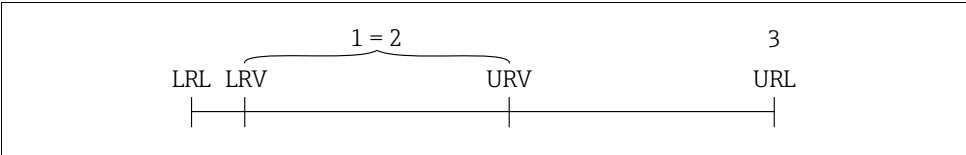


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Position	Term/Abbreviation	Explanation
1	OPL	The OPL (over pressure limit = sensor overload limit) for the sensors depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection must be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the relevant standards and additional notes, see technical information. The OPL may be applied for a limited time period.
2	MWP	The MWP (maximum working pressure) for the sensors depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the relevant standards and additional notes, see technical information. The MWP may be applied for an unlimited time.
3	Maximum sensor measuring range	Range between LRL and URL. This span is the maximum calibratable/adjustable measuring span.

Position	Term/Abbreviation	Explanation
4	Calibrated/Adjusted measuring span	Range between LRV and URV Factory setting: 0...URL Other calibrated spans can be ordered with customised settings.
p	-	Pressure
-	LRL	Lower range limit
-	URL	Upper range limit
-	LRV	Lower range value
-	URV	Upper range value
-	TD	Turn down

1.5 Turn down calculation



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Fig. 1:

- 1 Calibrated/Adjusted measuring span
- 2 Zero-based span
- 3 Upper range limit

Example	
<ul style="list-style-type: none"> ▪ Sensor: 10 bar (150 psi) ▪ Upper range limit (URL) = 10 bar (150 psi) <p>Turn down (TD):</p> $TD = \frac{URL}{ URV - LRV }$ $TD = \frac{10 \text{ bar (150 psi)}}{ 5 \text{ bar (75 psi)} - 0 \text{ bar (0 psi)} } = 2$ <p>In this example, the TD is thus 2:1. This span is based on the zero point.</p>	<ul style="list-style-type: none"> ▪ Calibrated/Adjusted measuring span: 0...5 bar (0...75 psi) ▪ Lower range value (LRV) = 0 bar ▪ Upper range value (URV) = 5 bar (75 psi)

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 Deltabar S is a differential pressure transmitter for measuring differential pressure, flow and level.

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.

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.

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 Nameplate

- The MWP (maximum working pressure) is specified on the nameplate. This value refers to a reference temperature of +20 °C (68°F) and may be applied to the device for an unlimited time. Observe temperature dependency of the MWP. The pressure values permitted at higher temperatures can be found in the standards EN 1092-1: 2001 Tab. 18 (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.), ASME B 16.5a – 1998 Tab. 2-2.2 F316, ASME B 16.5a – 1998 Tab. 2.3.8 N10276, JIS B 2220.
- For PMD75, the MWP applies for the temperature ranges specified in the Technical Information TI00382P in the "Ambient temperature range" and "Process temperature limits" sections.
- The test pressure corresponds to the over pressure limit (OPL) of the device = MWP x 1.5.
- The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP (maximum working pressure) of the measuring device.

3.2.2 Identifying the sensor type

See parameter "Sensor Meas.Type" in Operating Instruction BA00296P.

3.3 Scope of delivery

The scope of delivery comprises:

- Deltabar S differential pressure transmitter
- For PMD75 with side flanges made of AISI 316L or C22.8: additional 2 vent valves, AISI 316L
- PMD75 with side flanges made of AISI 316L or C22.8 and side vent: additional 4 locking screws, AISI 316L
- Operating program FieldCare with DTM
- Optional accessories

Documentation supplied:

- The Operating Instructions BA00294P and BA00296P are available via the Internet.
→ See: www.endress.com → Download.
- Brief Operating Instructions KA01021P
- Leporello KA00244P
- Final inspection report
- Also Safety Instructions with ATEX, IECEx and NEPSI devices
- Optional: factory calibration form, test certificates

3.4 CE mark, declaration of conformity

The device is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. The device complies with the applicable

standards and regulations as listed in the EC declaration of conformity and thus complies with the statutory requirements of the EC Directives. Endress+Hauser confirms the successful testing of the device by affixing to it the CE mark.

3.5 Registered trademarks

KALREZ, VITON, TEFLON

Registered trademarks of E.I. Du Pont de Nemours & Co., Wilmington, USA

TRI-CLAMP

Registered trademark of Ladish & Co., Inc., Kenosha, USA

PROFIBUS

Registered trademark of the PROFIBUS Trade Organization, Karlsruhe, D

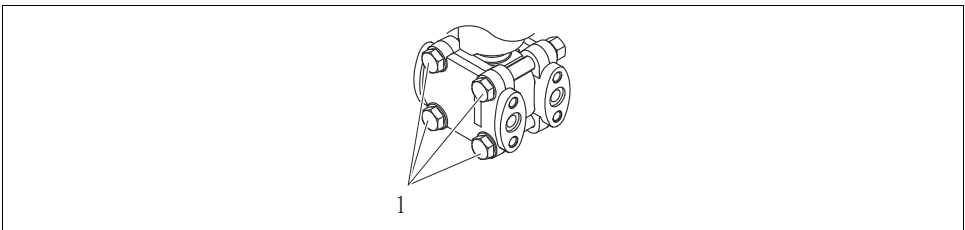
4 Installation

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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4.1 Incoming acceptance and storage

4.1.1 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.

4.1.2 Transport

▲ WARNING

Incorrect transport

Housing and diaphragm may be 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 (with secure transport protection for the diaphragm).
- ▶ Follow the safety instructions and transport conditions for devices of more than 18 kg (39.69 lbs).
- ▶ Do not use capillaries as a carrying aid for the diaphragm seals.

4.1.3 Storage

The device must be stored in a dry, clean area and protected against impact (EN 837-2).

Storage temperature range:






- -40...+90°C (-40 to +194°F)
- Onsite display: -40 to +85°C (-40 to +185°F)
- Separate housing: -40 to +60°C (-40 to +140°F)


4.2 Installation conditions

4.2.1 Dimensions

→ For dimensions, please refer to the Technical Information for Deltabar S TI00382P, "Mechanical construction" section.

4.3 Installation instructions

- Due to the orientation of the Deltabar S, there may be a shift in the measured value, i.e. when the container is empty, the measured value does not display zero. You can correct this zero point shift either via the "zero" key on the electronic insert, or on the outside of the device or via the onsite display. →  28, Kap. 6.2.1 "Position of operating elements", →  29, Kap. 6.2.2 "Function of operating elements – onsite display not connected" and →  39, Kap. 7.5 "Position adjustment".
- For FMD77 and FMD78, please refer to the section on →  16, Kap. 4.3.4 "Installation instructions for devices with diaphragm seals (FMD78)".
- 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%.
- To ensure optimal readability of the onsite display, it is possible to rotate the housing up to 380°. →  20, Kap. 4.3.9 "Rotating the housing".

- Endress+Hauser offers a mounting bracket for installing on pipes or walls.
→  18, Kap. 4.3.7 "Wall and pipe-mounting (optional)".

4.3.1 Installation for flow measurement

Flow measurement in gases with PMD75

- Mount the Deltabar S above the measuring point so that the condensate can run off into the process piping.

Flow measurement in steam with PMD75

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

Flow measurement in liquids with PMD75


- Mount the Deltabar S 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.

4.3.2 Installation for level measurement

Level measurement in an open container with PMD75

- Mount the Deltabar S below the lower measuring connection so that the impulse piping is always filled with liquid.
- The negative side is open to atmosphere 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 an open container with FMD77

- Mount the Deltabar S direct on the container. →  17, Kap. 4.3.5 "Seal for flange mounting".
- The negative side is open to atmosphere pressure.

Level measurement in a closed container with PMD75


- Mount the Deltabar S below the lower measuring connection so that the impulse piping is always filled with liquid.
- Always connect the impulse piping of negative 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 FMD77

- Mount the Deltabar S direct on the container. →  17, Kap. 4.3.5 "Seal for flange mounting".

- Always connect the impulse piping of negative 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 FMD78


- Mount the Deltabar S below the lower diaphragm seal. →  16, Kap. 4.3.4 "Installation instructions for devices with diaphragm seals (FMD78)".
- The ambient temperature should be the same for both capillaries.

Level measurement is only ensured between the upper edge of the lower diaphragm seal and the lower edge of the upper diaphragm seal.

Level measurement in a closed container with superimposed steam with PMD 70/PMD75

- Mount the Deltabar S below the lower measuring connection so that the impulse piping is always filled with liquid.
- Always connect the impulse piping of negative side above the maximum level.
- A condensate trap ensures constant pressure on the negative side.
- 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 with FMD77

- Mount the Deltabar S direct on the container. →  17, Kap. 4.3.5 "Seal for flange mounting".
- Always connect the impulse piping of negative side above the maximum level.
- A condensate trap ensures constant pressure on the negative side.
- When measuring in media with solid parts, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment.

4.3.3 Installation for differential pressure measurement

Differential pressure measurement in gases and steam with PMD75


- Mount the Deltabar S above the measuring point so that the condensate can run off into the process piping.

Differential pressure measurement in liquids with PMD75

- Mount the Deltabar S 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.

Differential pressure measurement in gases, steam and liquids with FMD78

- Mount the diaphragm seal with capillaries at the top or on the side on the piping.

- For vacuum applications: mount the Deltabar S below the measuring point. → See also →  16, Kap. 4.3.4 "Installation instructions for devices with diaphragm seals (FMD78)", "Vacuum application" section.
- The ambient temperature should be the same for both capillaries.

4.3.4 Installation instructions for devices with diaphragm seals (FMD78)

- 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!

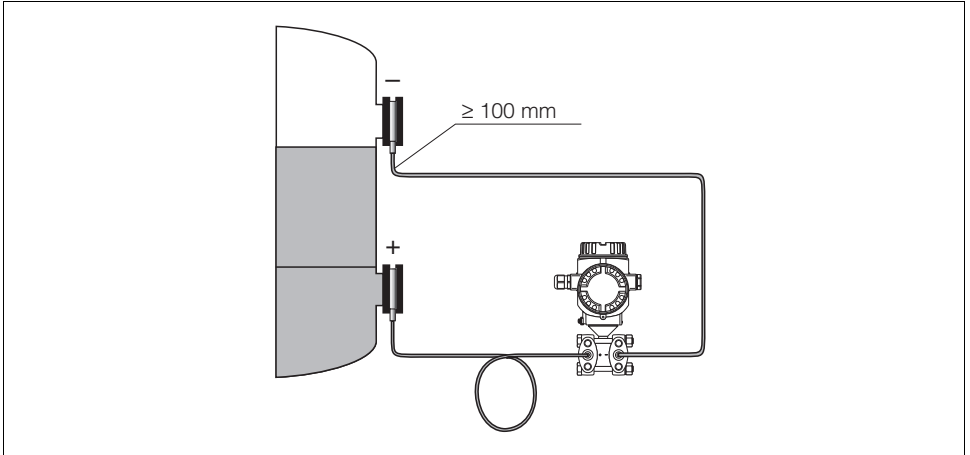
Damage to the device!

- ▶ 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 Deltabar S TI00382P, "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!
- ▶ The ambient temperature and length of both capillaries should be the same when using two-sided diaphragm seal systems.
- ▶ Two diaphragm seals which are the same (e.g. with regard to diameter, material, etc.) should always be used for the negative and positive side (standard delivery).



P01-FMD78xxx-11-xx-xx-xx-005

Fig. 2: Mounting Deltabar S, FMD78 with diaphragm seals and capillary, recommended mounting for vacuum applications: mount pressure transmitter below the lowest diaphragm seal!

Vacuum application (FMD78)

See operating instructions.

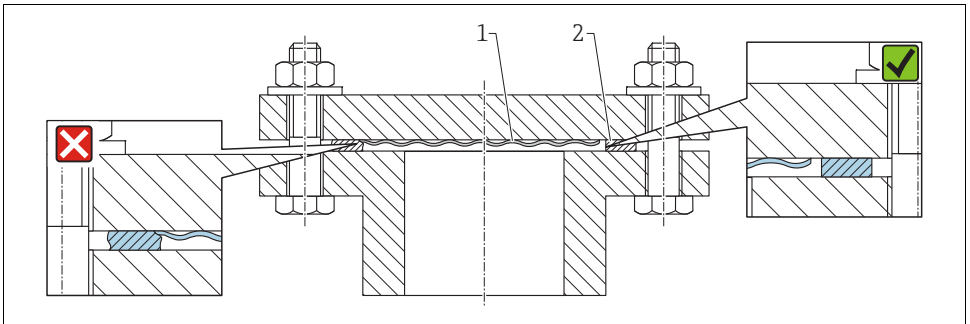
4.3.5 Seal for flange mounting

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.



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Fig. 3:

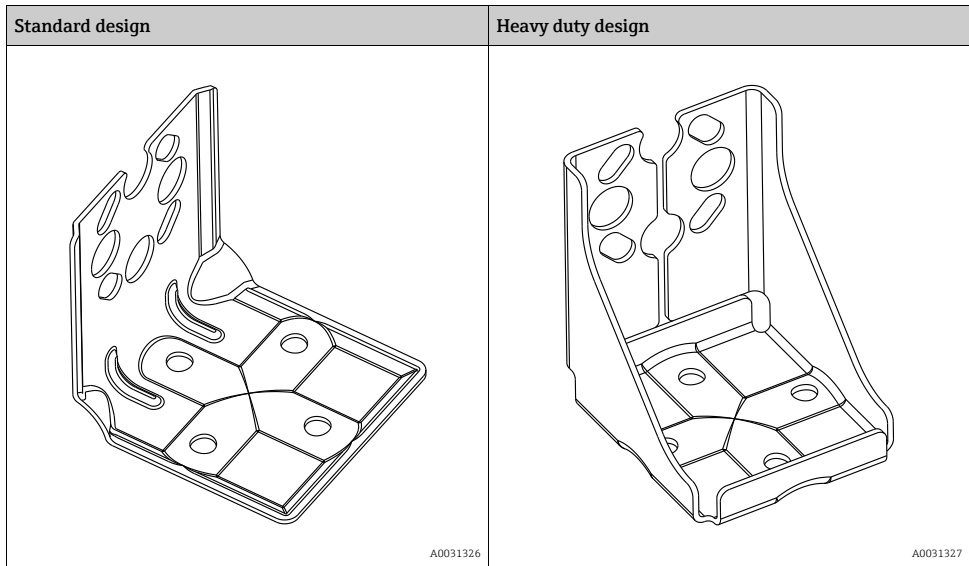
- 1 Process isolating diaphragm
- 2 Seal

4.3.6 Heat insulation – FMD77

See operating instructions.

4.3.7 Wall and pipe-mounting (optional)

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



The standard mounting bracket version is not suitable for use in an application subject to vibrations.

The vibration resistance of the reinforced version of the mounting bracket has been tested according to IEC 61298-3, see the "Vibration resistance" section in the technical documentation TI00382P.



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 SDO1553P/00/EN.

Please note the following when mounting:

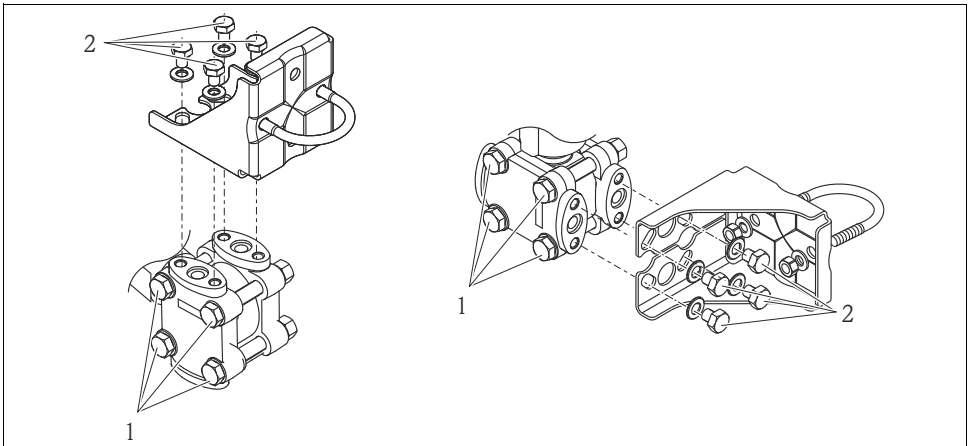
- To prevent the mounting screws from scoring, lubricate them with a multi-purpose grease prior to mounting.

- 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.



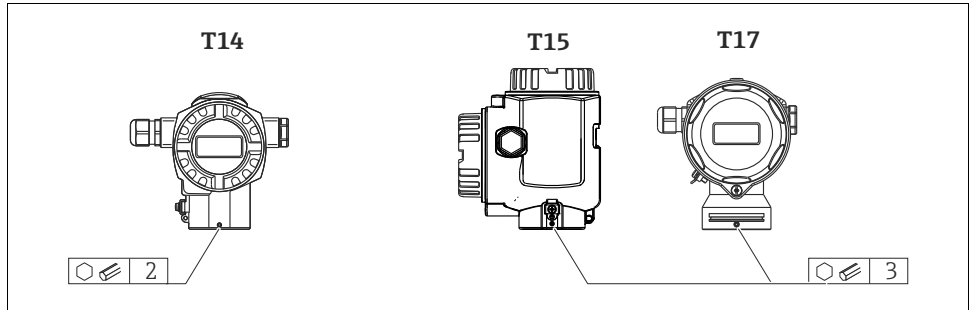
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4.3.8 Assembling and mounting the "separate housing" version

See operating instructions.

4.3.9 Rotating the housing

The housing can be rotated up to 380° by loosening the Allen screw.



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1. T14 housing: Loosen setscrew with a 2 mm (0.08 in) Allen key.
T15 and T17 housing: Loosen setscrew with a 3 mm (0.12 in) Allen key.
2. Rotate housing (max. up to 380°).
3. Retighten setscrew with 1 Nm (0,74 lbf ft).

4.3.10 Closing the housing covers

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.

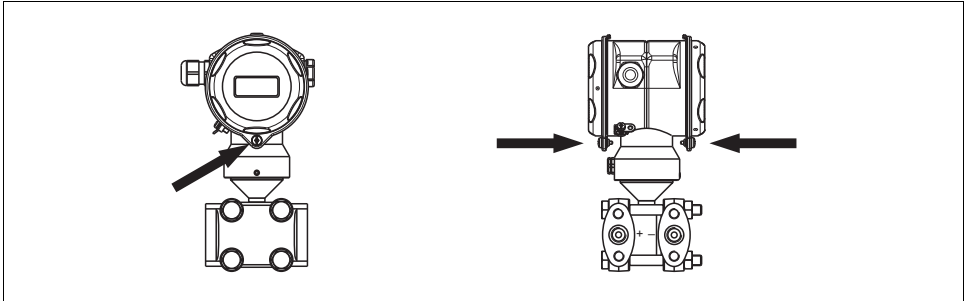
NOTICE

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.

Closing the cover on a hygienic stainless steel housing (T17)



P01-PM075xxx-17-xx-xx-xx-000

Fig. 4: Closing the cover

The covers for the terminal and electronics compartment are hooked into the casing and closed with a screw. These screws should be finger-tightened (2 Nm (1.48 lbf ft)) to the stop to ensure that the covers sit tightly.

4.4 Post-installation check

After installing the device, carry out the following checks:

- Are all screws firmly tightened?
- Are the housing covers screwed down tight?
- Are all locking screws and vent valves firmly tightened?

5 Wiring

5.1 Connecting the device

▲ WARNING

Risk of electric shock!

If the operating voltage is > 35 VDC: Dangerous contact voltage at terminals.

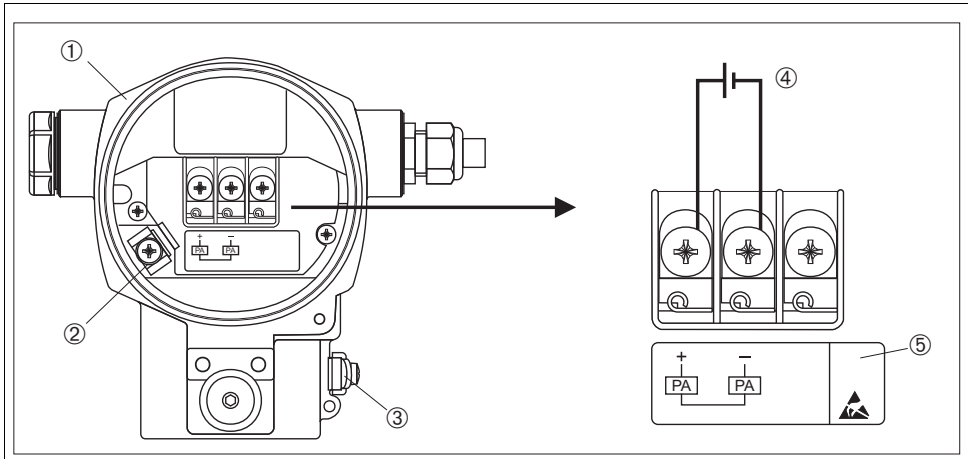
- ▶ In a wet environment, do not open the cover if voltage is present.

▲ WARNING

Limitation of electrical safety due to incorrect connection!

- Risk of electric shock and/or explosion in hazardous areas! In a wet environment, do not open the cover if voltage is present.
- 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.

- Devices with integrated overvoltage protection must be earthed.
- Protective circuits against reverse polarity, HF influences and overvoltage peaks are installed.
- The supply voltage must match the supply voltage on the nameplate. (→ 11, Kap. 3.2.1 "Nameplate".)
- Switch off the supply voltage before connecting the device.
- Remove housing cover of the terminal compartment.
- Guide cable through the gland. → For cable specification → 24, Kap. 5.2.4.
- Connect device in accordance with the following diagram.
- Screw down housing cover.
- Switch on supply voltage.

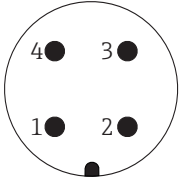


P01-x/Mx7xxxx-04-xx-xx-xx-008

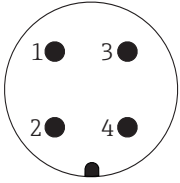
Fig. 5: Electrical connection of PROFIBUS PA
→ Please refer also to Section 4.2.1 "Supply voltage", Page 23.

- 1 Housing
- 2 Internal earth terminal
- 3 External earth terminal
- 4 Supply voltage, for version in non-hazardous area = 9...32 V DC
- 5 Devices with integrated overvoltage protection are labeled OVP (overvoltage protection) here.

5.1.1 Connecting devices with an M12 connector

PIN assignment for M12 connector	PIN	Meaning
 <p style="text-align: right; font-size: small;">A0011175</p>	1	Signal +
	2	Not assigned
	3	Signal -
	4	Earth

5.1.2 Connecting devices with 7/8" plug

PIN assignment for 7/8" connector	PIN	Meaning
 <p style="text-align: right; font-size: small;">A0011176</p>	PIN	Meaning
	1	Signal -
	2	Signal +
	3	Shield
	4	Not assigned

5.2 Connecting the measuring unit

For further information on the network structure and earthing and for further bus system components such as bus cables, see the relevant documentation, e.g. Operating Instructions BA00034S "Guidelines for planning and commissioning PROFIBUS DP/PA" and the PNO Guideline.

5.2.1 Supply voltage

Version for non-hazardous area: 9...32 V DC

⚠ WARNING

Supply voltage might be connected!

Risk of electric shock and/or explosion!

- ▶ 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.
- ▶ All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas.

5.2.2 Current consumption

Up to HW Version 1.10: 11 mA \pm 1 mA, switch-on current corresponds to IEC 61158-2, Clause 21.

As of HW Version 02.00: 13 mA \pm 1 mA, switch-on current corresponds to IEC 61158-2, Clause 21.

As of Hardware Version 1.10, you will find a label in the device on the electronic insert.

5.2.3 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)

5.2.4 Cable specification

- Use a twisted, screened two-wire cable, preferably cable type A.
- Outer cable diameter: 5 to 9 mm (0.2 to 0.35 in)

For further information on the cable specifications, see Operating Instructions BA00034S "Guidelines for planning and commissioning PROFIBUS DP/PA", PNO Guideline 2.092 "PROFIBUS PA User and Installation Guideline" and IEC 61158-2 (MBP).

5.2.5 Earthing and screening

Deltabar S must be earthed, for example by means of the external earth terminal.

Different earthing and screening installation methods are available for PROFIBUS PA networks such as:

- Isolated installation (see also IEC 61158-2)
- Installation with multiple earthing
- Capacitive installation

5.3 Overvoltage protection (optional)

See operating instructions.

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 connected as per Section 4.1?
- 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 onsite display lights up.

6 Operation

Feature 20 "Output; operation" in the order code provides you with information on the operating options available to you.

Versions in the order code		Operation
M	PROFIBUS PA; external and LCD	Via onsite display and 1 key on the exterior of the device
N	PROFIBUS PA; internal and LCD	Via onsite display and 1 key on the inside of the device
O	PROFIBUS PA; internal	Without onsite display, 1 key on the inside of the device


6.1 Onsite display (optional)

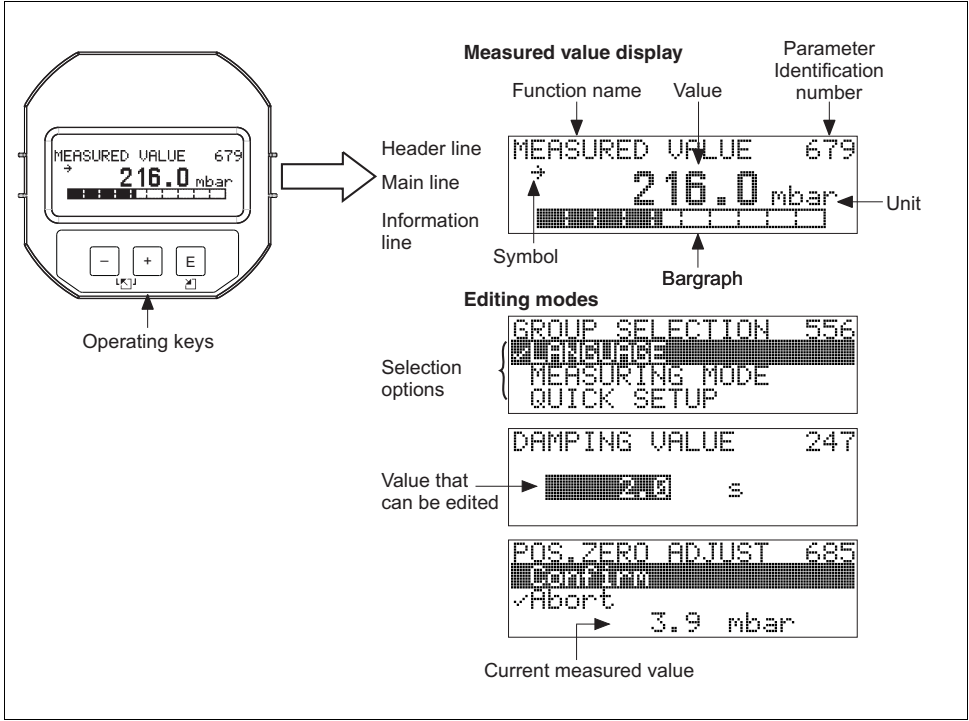
A 4-line liquid crystal display (LCD) is used for display and operation. The onsite display shows measured values, fault messages and notice messages.

The display of the device can be turned in 90° steps.

Depending on the installation position of the device, this makes it easy to operate the device and read the measured values.





Functions:

- 8-digit measured value display including sign and decimal point, unit display
- Bar graph as graphic display of the standardized value of the Analog Input Block (→ see also →  53, Kap. 7.9 "Scaling the OUT value", graphic)
- Simple and complete menu guidance thanks to separation of the parameters into several levels and groups
- Menu guidance in 8 languages (de, en, fr, es, it, nl, jp, ch)
- Each parameter is given a 3-digit ID number for easy navigation
- Option for configuring the display according to individual requirements and desires, such as language, alternating display, contrast setting, display of other measured values such as sensor temperature
- Comprehensive diagnostic functions (fault and warning message)
- rapid and safe commissioning with the Quick Setup menus



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

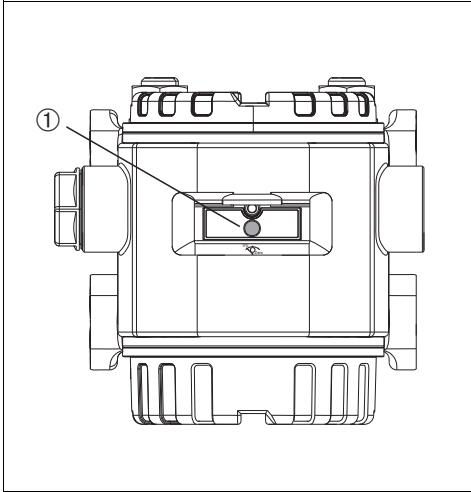
Symbol	Meaning
	<p>Alarm symbol</p> <ul style="list-style-type: none"> - Symbol flashing: warning, device continues measuring. - Symbol permanently lit: error, device does not continue measuring. <p>Note: The alarm symbol may overlie the tendency symbol.</p>
	<p>Lock symbol</p> <p>The operation of the device is locked. To unlock the device, → 36, Kap. 6.7 "Locking/unlocking operation".</p>
	<p>Communication symbol</p> <p>Data transfer via communication</p>

Symbol	Meaning
	Square root symbol Active measuring mode "Flow measurement" The square root flow signal is used for the digital output value of the Analog Input Block OUT.
	Tendency symbol (increasing) The primary value of the Transducer Block is increasing.
	Tendency symbol (decreasing) The primary value of the Transducer Block is decreasing.
	Tendency symbol (constant) The primary value of the Transducer Block has remained constant over the past few minutes.

6.2 Operating elements

6.2.1 Position of operating elements

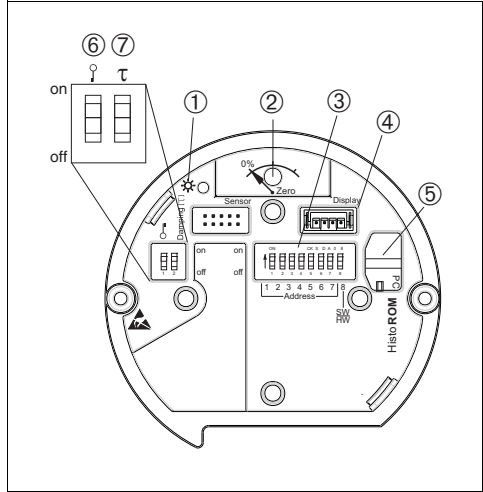
With regard to aluminum housings (T14/T15) and stainless steel housing (T14), the operating key is located either outside the device under the protection cap or inside on the electronic insert. In hygienic stainless housings (T17), the operating key is always located inside on the electronic insert. Additionally, three operating keys are located on the optional onsite display.



P01-xMD7xxxx-19-xx-xx-xx-074

Fig. 6: Operating key external, under the protective flap

- 1 Operating key for position adjustment (zero point correction) and total reset

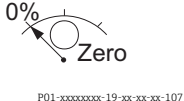
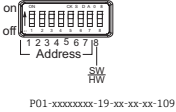
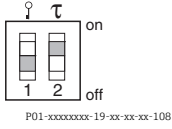


P01-xxxxxxx-19-xx-xx-xx-105

Fig. 7: Operating key and operating elements, internal

- 1 Green LED to indicate value is accepted
- 2 Operating key for position adjustment (zero point correction) and total reset
- 3 DIP switch for hardware address
- 4 Slot for optional display
- 5 Slot for optional HistoROM®/M-DAT
- 6 DIP-switch for locking/unlocking measured-value-relevant parameters
- 7 DIP-switch for damping on/off

6.2.2 Function of operating elements – onsite display not connected

Operating elements	Meaning
 <p>P01-xxxxxxx-19-xx-xx-xx-107</p>	<ul style="list-style-type: none"> Position adjustment (zero point correction): Press key for at least 3 seconds. If the LED on the electronic insert lights up briefly, the pressure applied has been accepted for position adjustment. See also the following section "Performing position adjustment onsite". Total reset: Press key for at least 12 seconds. If the LED on the electronic insert lights up briefly, the reset is being carried out.
 <p>P01-xxxxxxx-19-xx-xx-xx-109</p>	Set address in the bus. → 31, Kap. 6.3.1 "Device identification and addressing".
 <p>P01-xxxxxxx-19-xx-xx-xx-108</p>	<ul style="list-style-type: none"> DIP-switch 1: for locking/unlocking measured-value-relevant parameters Factory setting: off (unlocked) → See also Page 36, Section 5.7 "Locking/unlocking operation". DIP switch 2: damping on/off Factory setting: on (damping on)




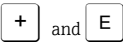
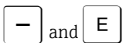
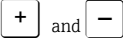
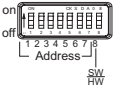
Performing position adjustment onsite

- The operation must be unlocked. → 36, Kap. 6.7 "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. → 38, Kap. 7.4 "Selecting language and measuring mode".
- The pressure applied must be within the nominal pressure limits of the sensor. See information on the nameplate.

Carry out position adjustment:

1. Pressure is present at device.
2. Press key for at least 3 seconds.
3. If the LED on the electronic insert lights up briefly, the pressure applied has been accepted for position adjustment.
If the LED does not light up, the pressure applied was not accepted. Observe the input limits. → For error messages see operating instructions.

6.2.3 Function of the operating elements – onsite display connected

Operating key(s)	Meaning
	<ul style="list-style-type: none"> - Navigate upwards in the picklist - Edit the numerical values and characters within a function
	<ul style="list-style-type: none"> - Navigate downwards in the picklist - Edit the numerical values and characters within a function
	<ul style="list-style-type: none"> - Confirm entry - Jump to the next item
	<p>Contrast setting of onsite display: darker</p>
	<p>Contrast setting of onsite display: brighter</p>
	<p>ESC functions:</p> <ul style="list-style-type: none"> - Exit edit mode without saving the changed value. - You are in a menu within a function group. The first time you press the keys simultaneously, you go back a parameter within the function group. Each time you press the keys simultaneously after that, you go up a level in the menu. - You are in a menu at a selection level. Each time you press the keys simultaneously, you go up a level in the menu. <p><i>Note:</i> The terms function group, level and selection level are explained in → 33, "General structure of the operating menu".</p>
 <p>P01-xxxxxxxx-19-xx-xx-xx-109</p>	<p>Set address in the bus. → See also → 31, Kap. 6.3.1 "Device identification and addressing".</p>

6.3 PROFIBUS PA communication protocol

See operating instructions.

6.3.1 Device identification and addressing

Note the following points:

- An address must be assigned to every PROFIBUS PA device. Only when the address is configured correctly will the device be recognized by the control system/master.
- Each address may only be assigned once in each PROFIBUS PA network.
- Valid device addresses are in the range from 0 to 125.
- The address 126 set at the factory can be used to check the function of the device and to connect to a PROFIBUS PA network already in operation. This address then has to be changed in order to integrate additional devices.
- All devices have the address 126 and software addressing on leaving the factory.
- The FieldCare operating program is delivered with the address 0 (default setting).

There are two ways of assigning the device address to Deltabar S:

- Using a DP Class 2 master operating program, such as FieldCare or
- Onsite using the DIP switches

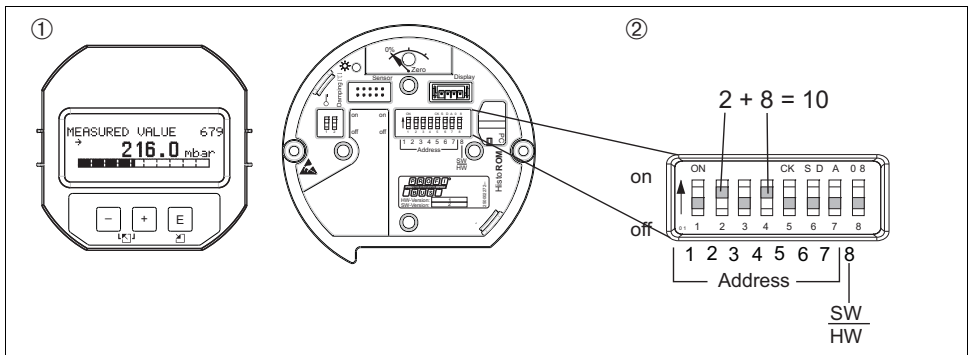


Fig. 8: Configuring the device address using the DIP switches

P01-xxxxxxx-19-xx-xx-xx-112

- 1 If necessary, remove onsite display (optional)
- 2 Set the hardware address via the DIP switches

Hardware addressing

Hardware addressing is configured as follows:

1. Set DIP switch 8 (SW/HW) to "Off".
2. Configure the address with DIP switches 1 to 7 (see graphic above).
3. You have to wait 10 seconds for a change in address to take effect. The device is restarted.

DIP-switch	1	2	3	4	5	6	7
Weighting in "On" position	1	2	4	8	16	32	64
Weighting in "Off" position	0	0	0	0	0	0	0

Software addressing

Software addressing is configured as follows:

1. Set DIP switch 8 (SW/HW) to "On" (factory setting).
2. The device is restarted.
3. The device reports its current address. Factory setting: 126
4. Configure the address via the configuration program.
See the following section for entering a new address using the FieldCare.
For other operating programs, please refer to the relevant Operating Instructions.

Configuring the new address using the FieldCare. DIP switch 8 (SW/HW) is set to "On" (SW):

1. Using the "Device Operation" menu, select the "Connect" option. The "Open Connection Wizard" screen is displayed.
2. The device reports its current address. Factory setting: 126 ¹⁾
3. The device has to be disconnected from the bus before you can assign the device a new address. For this purpose, select the "Disconnect" option in the → "Device Operation" menu.
4. Using the "Device Operation" menu, select → "Device Functions" → "Additional Functions" → "Set Device Station Address". The "PROFIdtm DPV1 (Set Device Station address)" screen is displayed.
5. Enter the new address and confirm with "Set".
6. The new address is assigned to the device.

1) The address 126 is not adjustable via the menu. After a reset (code 2712) the address is stored as a default address in the device.

6.4 Onsite operation – onsite display connected

If the onsite display is connected, the three operating keys are used to navigate through the operating menu, → 30, Kap. 6.2.3 "Function of the operating elements – onsite display connected".

6.4.1 General structure of the operating menu

The menu is split into four levels. The three upper levels are used to navigate while you use the bottom level to enter numerical values, select options and save settings. The entire menu is illustrated in Section 10.1 "Menu".

The structure of the OPERATING MENU depends on the measuring mode selected, e.g. if the "Pressure" measuring mode is selected, only the functions necessary for this mode are displayed.

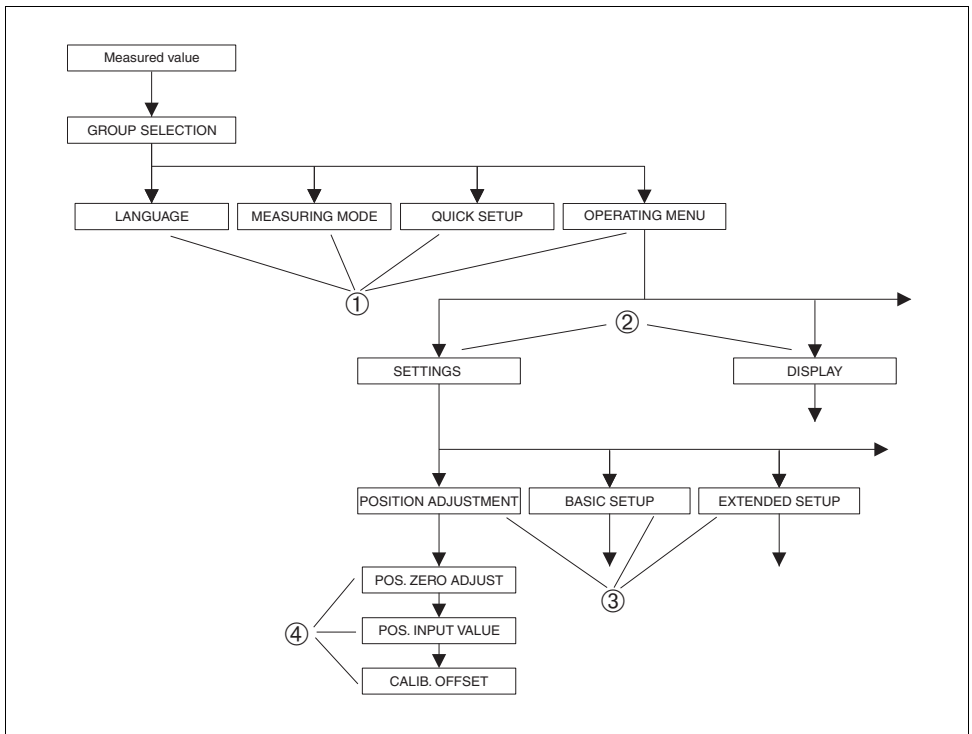


Fig. 9: General structure of the operating menu

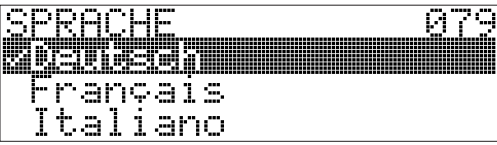
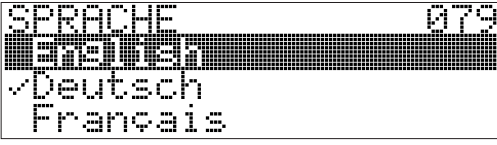
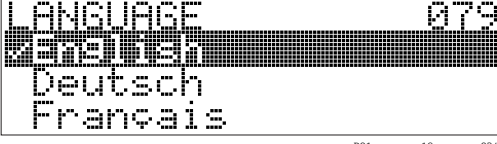
P01-xxxxxxx-19-xx-xx-en-145

- 1 1. Selection level
- 2 2. Selection level
- 3 Function groups
- 4 Parameter

The LANGUAGE and MEASURING MODE parameters are only displayed via the onsite display on the 1st selection level. In the digital communication, the LANGUAGE parameter is displayed in the DISPLAY group and the MEASURING MODE parameter is displayed in the QUICK SETUP menus or in the BASIC SETUP function group.


6.4.2 Selecting an option

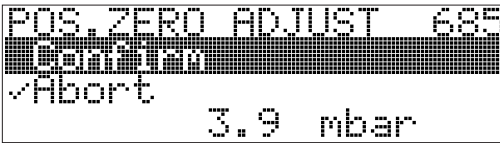
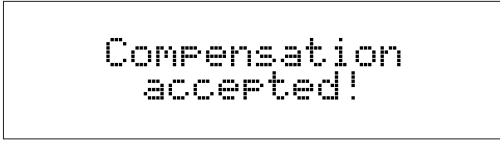

Example: select "English" as the language of the menu.

Onsite display	Operation
 <p>SPRACHE 079 ✓ Deutsch Français Italiano</p> <p style="text-align: right; font-size: small;">P01-xxxxxxxx-19-xx-xx-xx-017</p>	<p>German is selected as the language. A 3 in front of the menu text indicates the active option.</p>
 <p>SPRACHE 079 ✓ Englisch ✓ Deutsch Français</p> <p style="text-align: right; font-size: small;">P01-xxxxxxxx-19-xx-xx-xx-033</p>	<p>Select English with "+" or "-".</p>
 <p>LANGUAGE 079 ✓ Englisch Deutsch Français</p> <p style="text-align: right; font-size: small;">P01-xxxxxxxx-19-xx-xx-xx-034</p>	<ol style="list-style-type: none"> 1. Confirm your choice with 'E'. A 3 in front of the menu text indicates the active option. (English is now selected as the menu language.) 2. Jump to the next item with 'E'.

6.4.3 Taking pressure applied at device as value

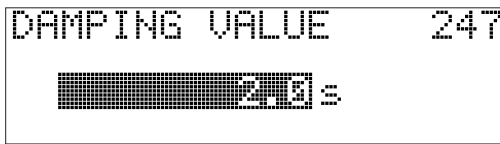
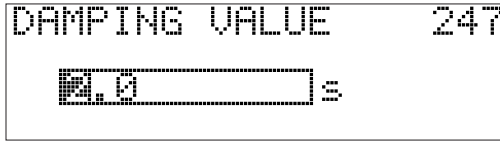
Example: performing position adjustment.

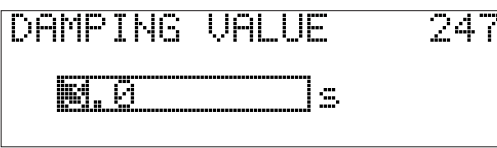
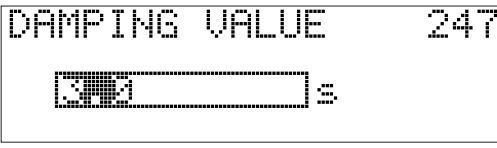
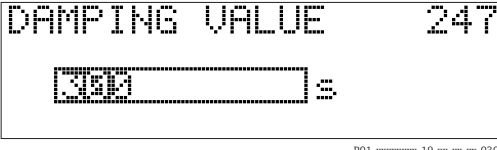
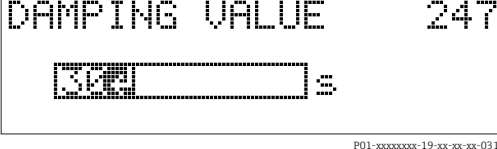

Onsite display	Operation
 <p>POS. ZERO ADJUST 685 ✓ 3.9 mbar Confirm</p> <p style="text-align: right; font-size: small;">P01-xxxxxxxx-19-xx-xx-xx-158</p>	<p>The bottom line on the onsite display displays the pressure present, here 3.9 mbar.</p>

Onsite display	Operation
 <p style="text-align: center; font-size: small;">P01-xxxxxxxx-19-xx-xx-xx-159</p>	<p>Use "+" or "-" to switch to the "Confirm" option. The active selection is highlighted in black.</p>
 <p style="text-align: center; font-size: small;">P01-xxxxxxxx-19-xx-xx-xx-037</p>	<p>Use "E" to assign the value (3.9 mbar) to the POS.ZERO ADJUST parameter. The device confirms the calibration and jumps back to the parameter, here POS.ZERO ADJUST (see next graphic).</p>
 <p style="text-align: center; font-size: small;">P01-xxxxxxxx-19-xx-xx-xx-160</p>	<p>Switch to the next parameter with "E".</p>

6.4.4 Editing a value

Example: adjusting DAMPING VALUE function from 2.0 s to 30.0 s. → [30, Kap. 6.2.3](#)
 "Function of the operating elements – onsite display connected".

Onsite display	Operation
 <p style="text-align: center; font-size: small;">P01-xxxxxxxx-19-xx-xx-xx-023</p>	<p>The onsite display shows the parameter to be changed. The value highlighted in black can be changed. The "s" unit is fixed and cannot be changed.</p>
 <p style="text-align: center; font-size: small;">P01-xxxxxxxx-19-xx-xx-xx-027</p>	<ol style="list-style-type: none"> 1. Press "+" or "-" to get to the editing mode. 2. The first digit is highlighted in black.

Onsite display	Operation
 <p style="text-align: right; font-size: small;">P01-xxxxxxxx-19-xx-xx-xx-028</p>	<ol style="list-style-type: none"> 1. Use "+" to change "2" to "3". 2. Confirm "3" with "E". The cursor jumps to the next position (highlighted in black).
 <p style="text-align: right; font-size: small;">P01-xxxxxxxx-19-xx-xx-xx-029</p>	<p>The decimal point is highlighted in black, i.e. you can now edit it.</p>
 <p style="text-align: right; font-size: small;">P01-xxxxxxxx-19-xx-xx-xx-030</p>	<ol style="list-style-type: none"> 1. Keep pressing "+" or "-" until "0" is displayed. 2. Confirm "0" with "E". The cursor jumps to the next position. "↓" is displayed and is highlighted in black. → See next graphic.
 <p style="text-align: right; font-size: small;">P01-xxxxxxxx-19-xx-xx-xx-031</p>	<p>Use "E" to save the new value and exit the editing mode. → See next graphic.</p>
 <p style="text-align: right; font-size: small;">P01-xxxxxxxx-19-xx-xx-xx-032</p>	<p>The new value for the damping is now 30.0 s.</p> <ul style="list-style-type: none"> - Jump to the next parameter with "E". - You can get back to the editing mode with "+" or "-".

6.5 HistoROM®/M-DAT (optional)

See operating instructions.

6.6 FieldCare

See operating instructions.

6.7 Locking/unlocking operation

See operating instructions.

6.8 Factory setting (reset)

See operating instructions.

7 Commissioning

The device is configured for the Pressure measuring mode as standard. 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 greater than the maximum permitted pressure is present at the device, the messages "E115 Sensor overpressure" and "E727 Sensor pressure error - overrange" are output in succession! 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 is present at the device, the messages "E120 Sensor low pressure" and "E727 Sensor pressure error - overrange" are output in succession! Use the device only within the sensor range limits

7.1 Configuring messages

- Messages E727, E115 and E120 are "Error"-type messages and can be configured as a "Warning" or an "Alarm". These messages are configured as "Warning" messages at the factory. This setting prevents the current output from assuming the set alarm current value for applications (e.g. cascade measurement) where the user is consciously aware of the fact that the sensor range can be exceeded
- We recommend setting messages E727, E115 and E120 to "Alarm" in the following instances:
 - The sensor range does not have to be exceeded for the measuring application.
 - Position adjustment has to be carried out that has to correct a large measured error as a result of the orientation of the device (e.g. devices with a diaphragm seal).

The device is configured for the Pressure measuring mode as standard. The measuring range and the unit in which the measured value is transmitted, as well as the digital output value of the Analog Input Block OUT, correspond to the data on the nameplate. Following a reset with code 1, 40864 or 33333 the OUT Value may have to be rescaled (→ [53](#), Kap. 7.9 "Scaling the OUT value" and → [53](#), Kap. 7.10 "System units (SET UNIT TO BUS)").

7.2 Function check

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


- "Post-installation check" checklist → see Section Kap. 4.4.
- "Post-connection check" checklist → see Section Kap. 5.4.

7.3 Commissioning via Class 2 master (FieldCare)

See operating instructions.

7.4 Selecting language and measuring mode

7.4.1 Local operation

The LANGUAGE and MEASURING MODE parameters are located on the top menu level.
→  33, Kap. 6.4.1 "General structure of the operating menu".

The following languages are available:

- Deutsch
- English
- Français
- Italiano
- Español
- Nederlands
- Chinese (CHS)
- Japanese (JPN)

The following measuring modes are available:

- Pressure
- Level
- Flow

7.4.2 Digital communication

The MEASURING MODE parameter is displayed in the digital communication in the QUICK SETUP menus and in the BASIC SETUP function group (OPERATING MENU → SETTINGS → BASIC SETUP).

The following measuring modes are available:

- Pressure
- Level
- Flow

The LANGUAGE parameter is arranged in the DISPLAY group (OPERATING MENU DISPLAY).

- Use the LANGUAGE parameter to select the menu language for the onsite display.

- Select the menu language for FieldCare by means of the "Language Button" in the configuration window. Select the menu language for the FieldCare frame via the "Extra" menu → "Options" → "Display" → "Language".

The following languages are available:

- Deutsch
- English
- Français
- Italiano
- Español
- Nederlands
- Chinese (CHS)
- Japanese (JPN)

7.5 Position adjustment

Due to the orientation of the device, there may be a shift in the measured value, i.e. when the container is empty or partly filled, the measured value parameter does not display zero. There are three options to choose from when performing position adjustment.

- Menu path onsite display: GROUP SELECTION ® OPERATING MENU ® SETTINGS ® POSITION ADJUSTMENT
- Menu path FieldCare: MANUFACTOR VIEW ® OPERATING MENU ® SETTINGS ® POSITION ADJUSTMENT

Parameter name	Description
POS. ZERO ADJUST Entry	<p>Position adjustment – the pressure difference between zero (set point) and the measured pressure need not be known.</p> <p>Example:</p> <ul style="list-style-type: none"> – MEASURED VALUE = 2.2 mbar (0.032 psi) – 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 <p>The CALIB. OFFSET parameter displays the resulting pressure difference (offset) by which the MEASURED VALUE was corrected.</p> <p>Factory setting: 0.0</p>

Parameter name	Description
POS. INPUT VALUE Entry	<p>Position adjustment – the pressure difference between zero (set point) and the measured pressure need not be known. To correct the pressure difference, you need a reference measurement value (e. g. from a reference device).</p> <p>Example:</p> <ul style="list-style-type: none"> – MEASURED VALUE = 0.5 mbar (0.0073 psi) – For the POS. INPUT VALUE parameter, specify the desired set point for the MEASURED VALUE, e.g. 2.0 mbar. (0.029 psi) ($\text{MEASURED VALUE}_{\text{new}} = \text{POS. INPUT VALUE}$) – MEASURED VALUE (after entry for POS. INPUT VALUE) = 2.0 mbar (0.029 psi) – The CALIB. OFFSET parameter displays the resulting pressure difference (offset) by which the MEASURED VALUE was corrected. $\text{CALIB. OFFSET} = \text{MEASURED VALUE}_{\text{old}} - \text{POS. INPUT VALUE}$, here: $\text{CALIB. OFFSET} = 0.5 \text{ mbar (0.0073 psi)} - 2.0 \text{ mbar (0.029 psi)} = -1.5 \text{ mbar (0.022 psi)}$ <p>Factory setting: 0.0</p>
CALIB. OFFSET Entry	<p>Position adjustment – the pressure difference between zero (set point) and the measured pressure is known.</p> <p>Example:</p> <ul style="list-style-type: none"> – MEASURED VALUE = 2.2 mbar (0.032 psi) – Via the CALIB. OFFSET parameter, enter the value by which the MEASURED VALUE should be corrected. To correct the MEASURED VALUE to 0.0 mbar, you must enter the value 2.2 here. ($\text{MEASURED VALUE}_{\text{new}} = \text{MEASURED VALUE}_{\text{old}} - \text{CALIB. OFFSET}$) – MEASURED VALUE (after entry for calib. offset) = 0.0 mbar <p>Factory setting: 0.0</p>

7.6 Flow measurement

7.6.1 Preparatory steps

- The Deltabar S PMD75 is usually used for flow measurement.
- Before calibrating the Deltabar S, 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 negative side.		
	Open 3.	Balance positive and negative side.		
	Open 6 and 7 briefly, then close them again.	Fill device completely with fluid and remove air.		
5	Carry out pos. zero adjustment 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. → 43, Kap. 7.6.3 and → 39, Kap. 7.5. 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 positive side from negative side.		
	Open 4.	Connect negative 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 pos. zero adjustment if the flow can be blocked off. In this case, step 5 is not applicable. → See → 43, Kap. 7.6.3 and → 39, Kap. 7.5.			
8	Carry out calibration. → See → 43, Kap. 7.6.2.			

Fig. 10: Above: preferred installation for gases
Below: preferred installation for liquids


- I Deltabar S PMD75
- II Three-valve manifold
- III Separator
- 1, 5 Drain valves
- 2, 4 Inlet valves
- 3 Equalizing valve
- 6, 7 Vent valves on Deltabar S
- A, B Shut-off valves

1) for arrangement with 5 valves

7.6.2 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 devices such as pitot tubes or orifice plates and depends on the volume or mass flow. Four flow measuring modes are available: volume flow, norm volume flow (European norm conditions), standard volume flow (American standard conditions) and mass flow.

In addition, the Deltabar S 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) totalizes the flow from commissioning onwards and cannot be reset.

- There is a Quick Setup menu for each of the measuring modes Pressure, Level and Flow which guides you through the most important basic functions. With the setting in the MEASURING MODE parameter, you specify which Quick Setup menu should be displayed. →  38, Kap. 7.4 "Selecting language and measuring mode".
- For a detailed description of the parameters see the Operating Instructions BA00296P "Cerabar S/Deltabar S/Deltapilot S, Description of device functions"
 - Table 6, POSITION ADJUSTMENT
 - Table 14, BASIC SETUP
 - Table 17, EXTENDED SETUP
 - Table 20, TOTALIZER SETUP.
- For flow measurement, select the "Flow" option by means of the MEASURING MODE parameter. The operating menu is structured appropriately.

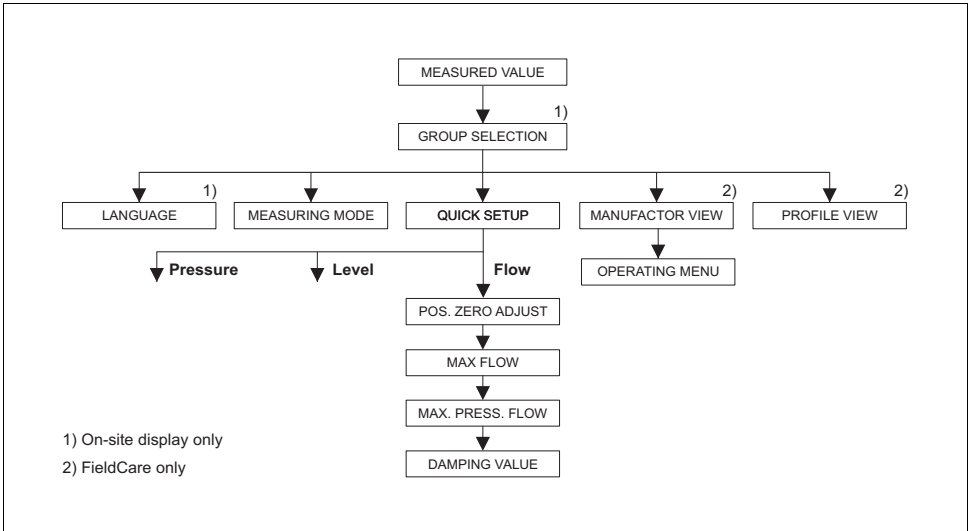
WARNING

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 in the "Calibration" → "Basic Setup" operating menu and, if necessary, reconfigured!

7.6.3 Quick Setup menu for the Flow measuring mode





P01-xxxxxxx-19-xx-xx-xx-166

Fig. 11: Quick Setup menu for the Flow measuring mode

Local operation	FieldCare
Measured value display Onsite display: Switch from the measured value display to GROUP SELECTION with F.	Measured value display Select QUICK SETUP menu.
GROUP SELECTION Select MEASURING MODE.	MEASURING MODE Select "Flow" option.
MEASURING MODE Select "Flow" option.	
GROUP SELECTION Select QUICK SETUP menu.	
POS.ZERO ADJUST Due to orientation of the device, there may be a shift in the measured value. You correct the MEASURED VALUE via the POS. ZERO ADJUST parameter with the "Confirm" option, i. e. you assign the value 0.0 to the pressure present.	POS.ZERO ADJUST Due to orientation of the device, there may be a shift in the measured value. You correct the MEASURED VALUE via the POS. ZERO ADJUST parameter with the "Confirm" option, i. e. you assign the value 0.0 to the pressure present.
MAX. FLOW Enter maximum flow of primary device. (→ See also layout sheet of primary device).	MAX. FLOW Enter maximum flow of primary device. (→ See also layout sheet of primary device).
MAX PRESS. FLOW Enter maximum pressure of primary device. (→ See also layout sheet of primary device).	MAX PRESS. FLOW Enter maximum pressure of primary device. (→ See also layout sheet of primary device).

Local operation	FieldCare
<p>DAMPING VALUE Enter damping time (time constant τ). The damping affects the speed at which all subsequent elements, such as the onsite display, measured value and OUT value of the Analog Input Block react to a change in the pressure.</p>	<p>DAMPING VALUE Enter damping time (time constant τ). The damping affects the speed at which all subsequent elements, such as the onsite display, measured value and OUT value of the Analog Input Block react to a change in the pressure.</p>

For onsite operation, see also →  30, Kap. 6.2.3 "Function of the operating elements – onsite display connected" and →  33, Kap. 6.4 "Onsite operation – onsite display connected".

7.7 Level measurement

7.7.1 Preparatory steps

Open container



- The Deltabar S PMD75, and FMD77 are suitable for level measurement in an open container.
- FMD77: the device is ready for calibration immediately after opening a shut-off valve (may or may not be present).
- PMD75: 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.		<p style="text-align: right; font-size: small;">P01-xMD7/xxxx-11-xx-xx-xx-003</p>
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. → See Page 48, Section 6.6.2.		

Fig. 12: Open container

- I* Deltabar S PMD75
- II* Separator
- 6* Vent valves on Deltabar S
- A* Shut-off valve
- B* Drain valve

Closed container



- All Deltabar S versions are suitable for level measurement in closed containers.
- FMD77: the device is ready for calibration immediately after opening the shut-off valves (may or may not be present).
- FMD78: the device is ready for calibration immediately.
- PMD75: 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 positive side from negative side.	
	Open A and B.	Open shut-off valves.	
3		Vent positive side (empty negative side if necessary).	
	Open 2 and 4.	Introduce fluid on positive side.	
	Open 6 and 7 briefly, then close them again.	Fill positive side completely with fluid and remove air.	
4		Set measuring point in operation.	<p style="text-align: right; font-size: small;">P01-xMD7xxx-11-xx-xx-xx-004</p>
	Now - 3, 6 and 7 are closed. - 2, 4, A and B are open.		
5		Carry out calibration. → See Page 48, Section 6.6.2.	

Fig. 13: Closed container

- I Deltabar S PMD75
- II Three-valve manifold
- III Separator
- 1, 2 Drain valves
- 2, 4 Inlet valves
- 3 Equalizing valve
- 6, 7 Vent valve on Deltabar S
- A, B Shut-off valve

Closed container with superimposed steam



- All Deltabar S versions are suitable for level measurement in containers with superimposed steam.
- FMD77: the device is ready for calibration immediately after opening the shut-off valves (may or may not be present).
- FMD78: the device is ready for calibration immediately.
- PMD75: 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 negative side.	
	Open 3.	Balance positive and negative side.	
	Open 6 and 7 briefly, then close them again.	Fill device completely with fluid and remove air.	
4		Set measuring point in operation.	<p style="text-align: right; font-size: small;">P01-xzMD7xxxx-11-xx-xx-xx-005</p>
	Close 3.	Shut off positive side from negative side.	
	Open 4.	Connect negative side.	
	Now - 3, 6 and 7 are closed. - 2, 4, A and B are open.		
5		Carry out calibration. → See Page 48, Section 6.6.2.	<p><i>I</i> Deltabar S PMD75 <i>II</i> Three-valve manifold <i>III</i> Separator 1, 5 Drain valves 2, 4 Inlet valves 3 Equalizing valve 6, 7 Vent valves on Deltabar S A, B Shut-off valves</p>

Fig. 14: Closed container with superimposed steam

7.7.2 Information on level measurement



- The Flow, Level and Pressure operating modes each have a quick setup menu which guides you through the most important basic functions. → See Page 48 for the "Level" quick setup menu.
- Furthermore, the three level modes "Level Easy Pressure", "Level Easy Height" and "Level Standard" are available to you for level measurement. You can select from the "Linear", "Pressure linearized" and "Height linearized" level types for the "Level Standard" level mode. The table in the "Overview of level measurement" section below provides an overview of the various measuring tasks.
 - In the "Level Easy Pressure" and "Level Easy Height" level modes, the values entered are not tested as extensively as in the "Level Standard" level mode. The values entered for EMPTY CALIB./FULL CALIB., EMPTY PRESSURE/FULL PRESSURE and EMPTY HEIGHT/FULL must have a minimum interval of 1% for the "Level Easy Pressure" and "Level Easy Height" level modes. The value will be rejected with a warning message 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 so that the measuring device can measure correctly.
 - The "Level Easy Pressure" and "Level Easy Height" level modes encompass fewer parameters than the "Level Standard" mode and are used for quick and easy configuration of a level application.
 - Customer-specific units of fill level, volume and mass or a linearization table may only be entered in the "Level Standard" level mode.
- For a detailed description of the parameters and configuration examples, see Operating Instructions BA00296P "Cerabar S/Deltabar S/Deltapilot S, Description of Device Functions.

⚠ 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 in the "Calibration" → "Basic Setup" operating menu and, if necessary, reconfigured!

7.7.3 Overview of level measurement

See operating instructions.

7.7.4 Quick Setup menu for the Level measuring mode

- Some parameters are only displayed if other parameters are appropriately configured. For example, the EMPTY CALIB. parameter is only displayed in the following cases:
 - LEVEL SELECTION "Level Easy Pressure" and CALIBRATION MODE "Wet"
 - LEVEL SELECTION "Level Standard", LEVEL MODE "Linear" and CALIBRATION MODE "WET"
 You can find the LEVEL MODE parameter in the BASIC SETTINGS function group.
- The following parameters are set to the following values in the factory:
 - LEVEL SELECTION: Level Easy Pressure
 - CALIBRATION MODE: Wet

- OUTPUT UNIT or LIN. MEASURAND: %
- EMPTY CALIB.: 0.0
- FULL CALIB.: 100.0
- The quick setup is suitable for simple and quick commissioning. If you wish to make more complex settings, e.g. change the unit from "%" to "m", you will have to calibrate using the BASIC SETTINGS group. → See Operating Instructions BA00296P.

⚠ 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 in the "Calibration" → "Basic Setup" operating menu and, if necessary, reconfigured!

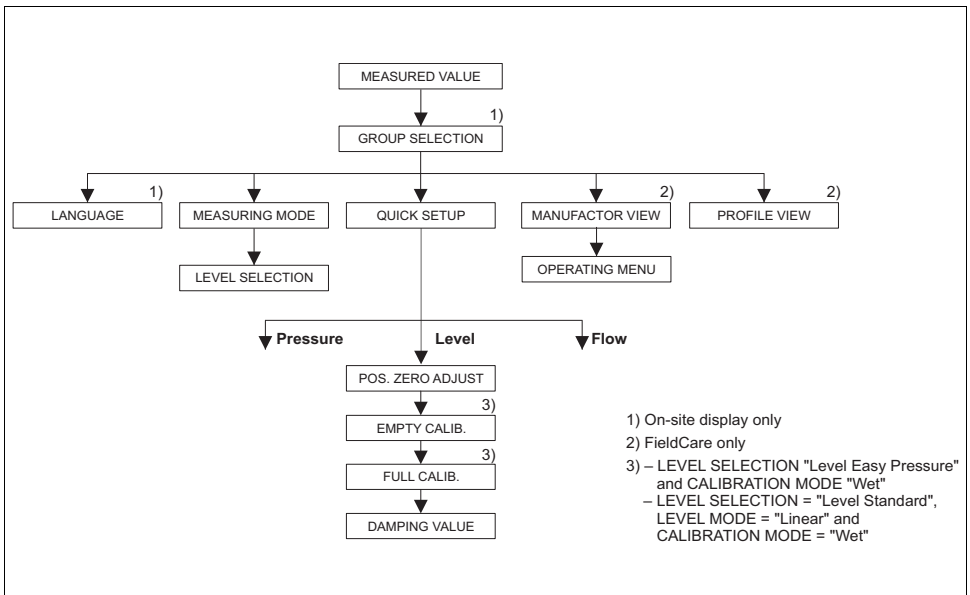


Fig. 15: Quick Setup menu for the "Level" measuring mode"

P01-xMD7xxxx-19-xx-xx-xx-079

Local operation	FieldCare
<p>Measured value display Onsite display: Switch from the measured value display to GROUP SELECTION with F.</p>	<p>Measured value display Select QUICK SETUP menu.</p>
<p>GROUP SELECTION Select MEASURING MODE.</p>	<p>MEASURING MODE Select "Level" option.</p>
<p>MEASURING MODE Select "Level" option.</p>	

Local operation	FieldCare
LEVEL SELECTION Select level mode. For an overview see Page 48.	LEVEL SELECTION Select level mode. For an overview see Page 48.
GROUP SELECTION Select QUICK SETUP menu.	
POS. ZERO ADJUST Due to orientation of the device, there may be a shift in the measured value. You correct the MEASURED VALUE via the POS. ZERO ADJUST parameter with the "Confirm" option, i. e. you assign the value 0.0 to the pressure present.	POS.ZERO ADJUST Due to orientation of the device, there may be a shift in the measured value. You correct the MEASURED VALUE via the POS. ZERO ADJUST parameter with the "Confirm" option, i. e. you assign the value 0.0 to the pressure present.
EMPTY CALIB. ¹⁾ Enter level for the lower calibration point. For this parameter, enter a level value which is assigned to the pressure present at the device.	EMPTY CALIB. ¹⁾ Enter level for the lower calibration point. For this parameter, enter a level value which is assigned to the pressure present at the device.
FULL CALIB. ¹⁾ Enter level for the upper calibration point. For this parameter, enter a level value which is assigned to the pressure present at the device.	FULL CALIB. ¹⁾ Enter level for the upper calibration point. For this parameter, enter a level value which is assigned to the pressure present at the device.
DAMPING VALUE Enter damping time (time constant τ). The damping affects the speed at which all subsequent elements, such as the onsite display, measured value and OUT value of the Analog Input Block react to a change in the pressure.	DAMPING VALUE Enter damping time (time constant τ). The damping affects the speed at which all subsequent elements, such as the onsite display, measured value and OUT value of the Analog Input Block react to a change in the pressure.

- 1) – LEVEL SELECTION "Level Easy Pressure" and CALIBRATION MODE "Wet"
 – LEVEL SELECTION "Level Standard", LEVEL MODE "Linear" and CALIBRATION MODE "Wet"

For onsite operation, see also Page 30, Section 5.2.3 "Function of the operating elements" and Page 28, Section 5.4 "Onsite operation".

7.8 Differential pressure measurement

7.8.1 Preparatory steps



- The Deltabar S PMD75 and FMD78 are usually used for differential pressure measurement.
- FMD78: the device is ready for calibration immediately.
- PMD75: 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 negative side.		
	Open 3.	Balance positive and negative 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 positive side from negative side.		
	Open 4.	Connect negative 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 52, Section 6.7.2.			

Fig. 16: Above: preferred installation for gases
Below: preferred installation for liquids

- I Deltabar S PMD75
- II Three-valve manifold
- III Separator
- 1, 5 Drain valves
- 2, 4 Inlet valves
- 3 Equalizing valve
- 6, 7 Vent valves on Deltabar S
- A, B Shut-off valve

1) for arrangement with 5 valves

7.8.2 Information on differential pressure measurement



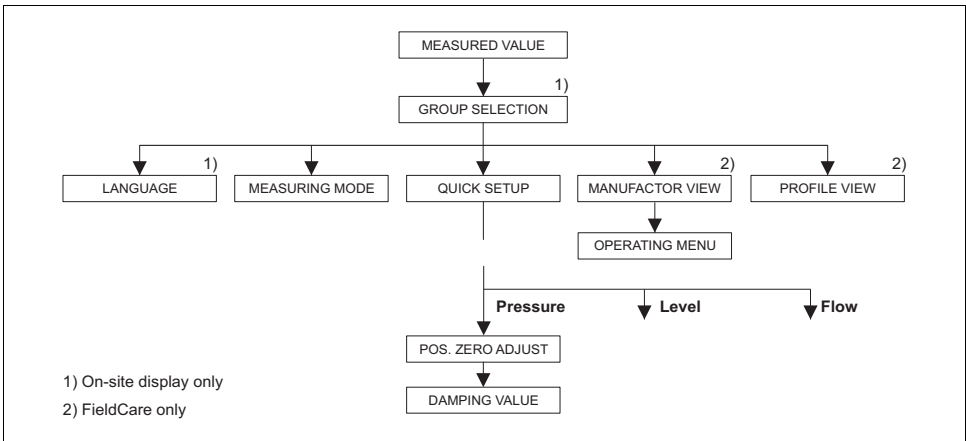
- There is a Quick Setup menu for each of the measuring modes Pressure, Level and Flow which guides you through the most important basic functions. With the setting in the MEASURING MODE parameter, you specify which Quick Setup menu should be displayed. → See also Page 38, Section 6.3 "Selecting language and measuring mode".
- For a detailed description of the parameters see the Operating Instructions BA00296P "Cerabar S/Deltabar S/Deltapilot S, Description of device functions"
 - Table 6, POSITION ADJUSTMENT
 - Table 7, BASIC SETUP
 - Table 16, EXTENDED SETUP
- For differential pressure measurement, select the "Pressure" option by means of the MEASURING MODE parameter. The operating menu is structured appropriately. → See also Section 10.1.

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 in the "Calibration" → "Basic Setup" operating menu and, if necessary, reconfigured!

7.8.3 Quick Setup menu for the Pressure measuring mode



P01-x1MD/xxxx-19-xx-xx-xx-080

Fig. 17: Quick Setup menu for the "Pressure" measuring mode

Local operation	FieldCare
Measured value display Onsite display: Switch from the measured value display to GROUP SELECTION with F.	Measured value display Select QUICK SETUP menu.

Local operation	FieldCare
GROUP SELECTION Select MEASURING MODE.	MEASURING MODE Select "Pressure" option.
MEASURING MODE Select "Pressure" option.	
GROUP SELECTION Select QUICK SETUP menu.	POS.ZERO ADJUST Due to orientation of the device, there may be a shift in the measured value. You correct the MEASURED VALUE via the POS. ZERO ADJUST parameter with the "Confirm" option, i. e. you assign the value 0.0 to the pressure present.
POS.ZERO ADJUST Due to orientation of the device, there may be a shift in the measured value. You correct the MEASURED VALUE via the POS. ZERO ADJUST parameter with the "Confirm" option, i. e. you assign the value 0.0 to the pressure present.	
DAMPING VALUE Enter damping time (time constant τ). The damping affects the speed at which all subsequent elements, such as the onsite display, measured value and OUT value of the Analog Input Block react to a change in the pressure.	
	DAMPING VALUE Enter damping time (time constant τ). The damping affects the speed at which all subsequent elements, such as the onsite display, measured value and OUT value of the Analog Input Block react to a change in the pressure.



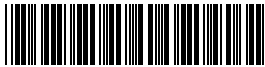
For onsite operation, see also Page 30, Section 5.2.3 "Function of the operating elements" and Page 28, Section 5.4 "Onsite operation".

7.9 Scaling the OUT value

See operating instructions.

7.10 System units (SET UNIT TO BUS)

See operating instructions.



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