

Operating Instructions

Deltabar S FMD77, FMD78, PMD75

Differential pressure measurement,
pressure measurement
HART



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 this manual.

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1 About this document

1.1 Document function







These Operating Instructions contain all the information that is required in the 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



1.2.1 Safety symbols

Symbol	Meaning
 A0011189-EN	DANGER! This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
 A0011190-EN	WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
 A0011191-EN	CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
 A0011192-EN	NOTICE! This symbol contains information on procedures and other circumstances that do not result in personal injury.







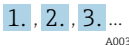


1.2.2 Electrical symbols

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 that must be connected to the 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.

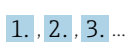
1.2.3 Tool symbols

Symbol	Meaning
 A0011221	Allen key
 A0011222	Open-ended wrench



1.2.4 Symbols for certain types of Information

Symbol	Meaning
 A0011182	Permitted Indicates procedures, processes or actions that are allowed.
 A0011184	Not permitted Indicates procedures, processes or actions that are forbidden.
 A0011193	Tip Indicates additional information.
 A0028658	Reference to documentation
 A0028659	Reference to page.
 A0028660	Reference to graphic
 A0031595	Series of steps
 A0018343	Result of a series of actions
 A0028673	Visual inspection

1.2.5 Symbols in graphics

Symbol	Meaning
1, 2, 3, 4 etc.	Numbering of main items
 A0031595	Series of steps
A, B, C, D etc.	Views

1.2.6 Symbols on device

Symbol	Meaning
 →  A0019159	Safety notice Observe the safety instructions contained in the associated operating instructions.

1.3 Registered trademarks

KALREZ®

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®

Trademark of W.L. Gore & Associates, Inc., USA

2 Basic safety instructions

2.1 Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfil the following requirements:

- Trained, qualified specialists must have a relevant qualification for this specific function and task
- Are authorized by the plant operator
- Are familiar with national regulations
- Before beginning work, the specialist staff must have read and understood the instructions in the manuals and supplementary documentation as well as in the certificates (depending on the application)
- Follow instructions and basic conditions

The operating personnel must fulfil the following requirements:

- Are instructed and authorized according to the requirements of the task by the facility's owner-operator
- They must follow the instructions in this manual

2.2 Intended use

The Deltabar S is a differential pressure/pressure transmitter for measuring flow, level, pressure or differential pressure.

2.2.1 Incorrect use

The manufacturer is not liable for damage caused by improper or unintended use.

Clarification for borderline cases:

In the case of special fluids and fluids used for cleaning, Endress+Hauser is glad to provide assistance in clarifying the corrosion resistance of wetted materials, but does not accept any warranty or liability.

2.3 Workplace safety

When working on and with the device:

- Wear the required personal protective equipment as per national regulations.
- Switch off the supply voltage before connecting the device.

2.4 Operational safety

Risk of injury!

- ▶ Operate the device only if it is in proper technical condition, free from errors and faults.
- ▶ The operator is responsible for trouble-free operation of the device.

Modifications 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 the repair of an electrical device.
- ▶ Use original spare parts and accessories from Endress+Hauser only.

2.5 Hazardous area

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

- Check the nameplate to determine whether the ordered device can be used for the intended application in the hazardous area.
- Comply with the instructions in the separate supplementary documentation, which is an integral part of this manual.

2.6 Product security

This measuring instrument 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 it is safe to operate. It meets general safety standards and legal requirements. It also conforms to the EC directives listed in the device-specific EC Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.

2.7 Functional safety SIL3 (optional)

The Functional Safety Manual must be strictly observed for devices that are used in functional safety applications.

3 Identification

3.1 Product identification

The following options are available for identification of the measuring instrument:

- Nameplate specifications
- Order code with breakdown of the device features on the delivery note
- Enter the serial number from the nameplates in W@M Device Viewer (www.endress.com/deviceviewer): All the information about the measuring instrument is displayed.

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

3.1.1 Manufacturer address

Endress+Hauser SE+Co. KG
Hauptstraße 1
79689 Maulburg, Germany
Address of the manufacturing plant: See nameplate

3.2 Device designation

3.2.1 Nameplate

Different nameplates are used depending on the device version.

The nameplates contain the following information:

- Manufacturer name and device name
- Address of the certificate holder and country of manufacture
- Order code and serial number
- Technical data
- Approval-specific information

Compare the data on the nameplate with your order.

3.2.2 Identification of sensor type

See "Sensor Meas.Type" parameter in Operating Instructions BA00274P.

3.3 Scope of delivery

The scope of delivery comprises:

- Deltabar S differential pressure transmitter
- For devices with the "HistoROM/M-DAT" option:
CD-ROM with Endress+Hauser operating program
- Optional accessories

Documentation supplied:

- The BA00270P and BA00274P Operating Instructions are available on the Internet. → See: www.endress.com → Download.
- Brief Operating Instructions KA01018P
- Leporello KA00218P
- Final inspection report
- Additional Safety Instructions with ATEX, IECEx and NEPSI devices
- Optional: factory calibration certificate, 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 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.

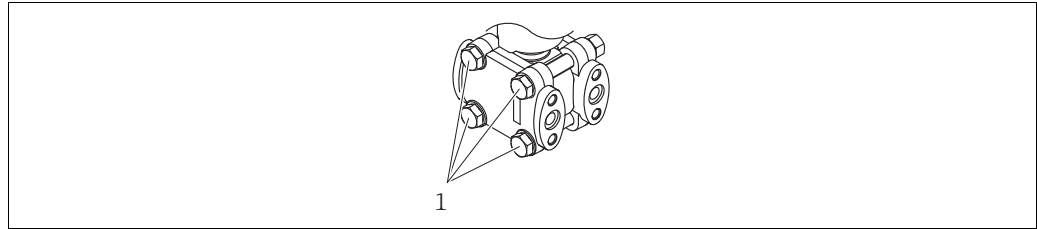
4 Mounting

NOTICE

Incorrect handling!

Damage to the device!

- ▶ The removal of the screws with item number (1) is not permissible under any circumstances and will void the warranty.



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4.1 Incoming acceptance, storage

4.1.1 Incoming acceptance

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

4.1.2 Transportation to measuring point

▲ WARNING

Incorrect transportation

Housing, membrane and capillary may become damaged, and there is a risk of injury!

- ▶ Transport the measuring instrument to the measuring point in its original packaging or by the process connection (with secure transport protection for the membrane).
- ▶ 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.

4.1.3 Storage

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

Storage temperature range:






- -40 to +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 Installation dimensions

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

4.3 Installation

- Due to the orientation of the Deltabar S, a zero point shift may occur, i.e. when the container is empty, the measured value does not display zero. You can correct this zero point shift either directly on the device via the  button or via remote operation. →  34, "Function of operating elements – onsite display not connected" or Section 7.4 "Position adjustment".
- For FMD77 and FMD78, please refer to Section 4.3.5 "Installation instructions for devices with diaphragm seals (FMD78)", →  19.
- 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 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 optimum readability of the onsite display, it is possible to rotate the housing by up to 380°. →  24, Section 4.3.10 "Rotating the housing".
- Endress+Hauser offers a mounting bracket for installing on pipes or walls. →  21, Section 4.3.8 "Wall and pipe mounting (optional)".

4.3.1 Installation for flow measurement

Flow measurement in gases with PMD75

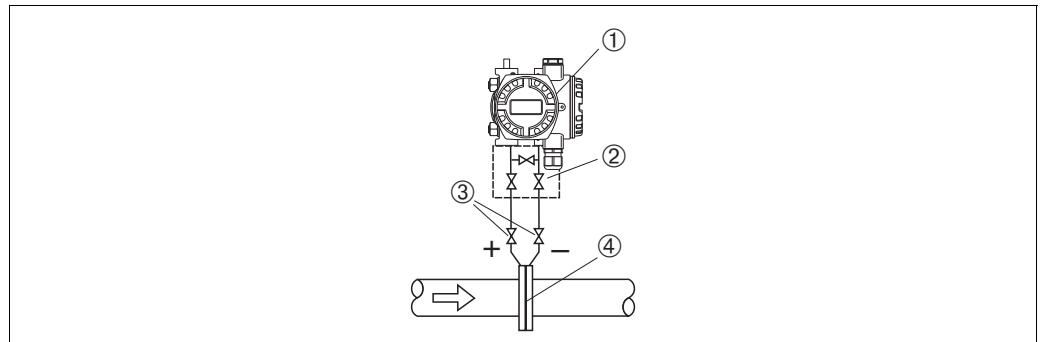
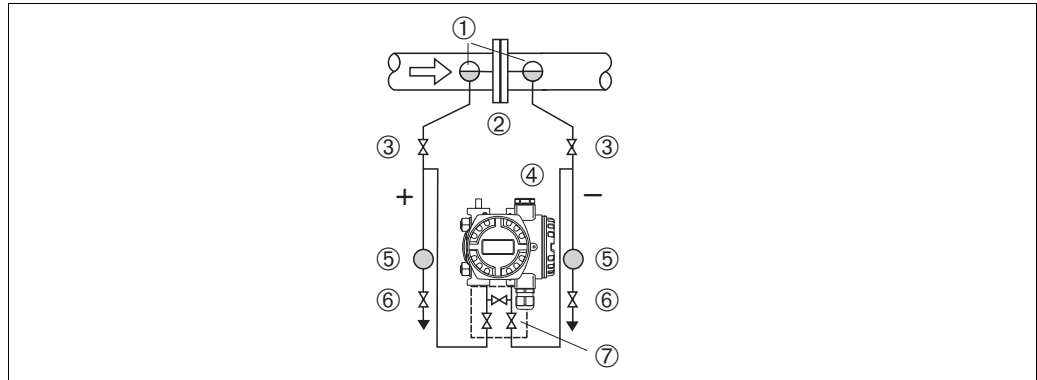


Fig. 1: Measuring layout for flow measurement in gases with PMD75

- 1 Deltabar S, PMD75 here
- 2 Three-valve manifold
- 3 Shut-off valves
- 4 Orifice plate or pitot tube

- Mount the Deltabar S above the measuring point so that the condensate can drain into the process pipe.

Flow measurement in steam with PMD75



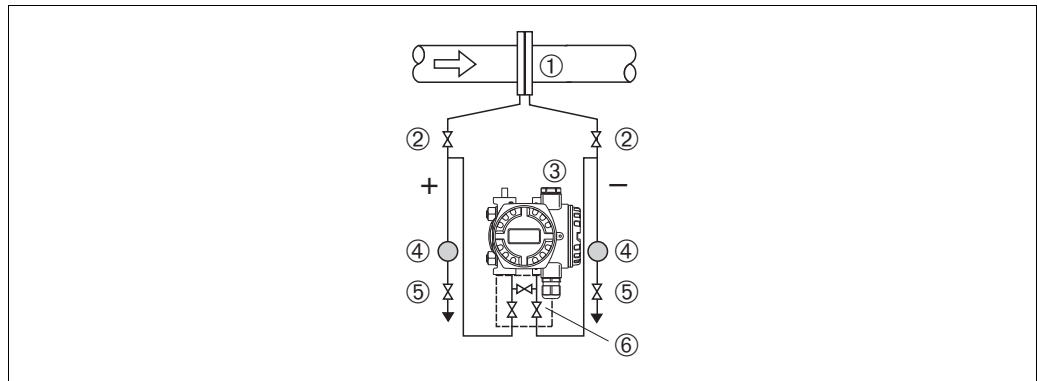
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Fig. 2: Measuring layout for flow measurement in steam with PMD75

- 1 Condensate traps
- 2 Orifice plate or pitot tube
- 3 Shut-off valves
- 4 Deltabar S, PMD75 here
- 5 Separator
- 6 Drain valves
- 7 Three-valve manifold

- 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



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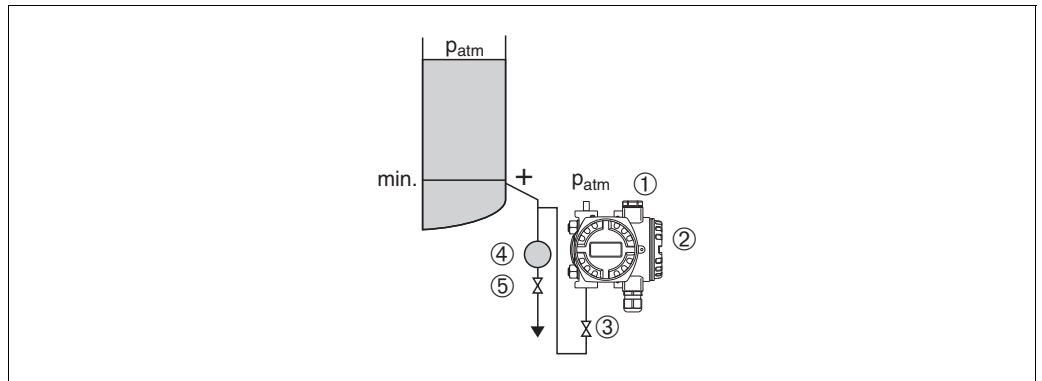
Fig. 3: Measuring layout for flow measurement in liquids with PMD75

- 1 Orifice plate or pitot tube
- 2 Shut-off valves
- 3 Deltabar S, PMD75 here
- 4 Separator
- 5 Drain valves
- 6 Three-valve manifold

- 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



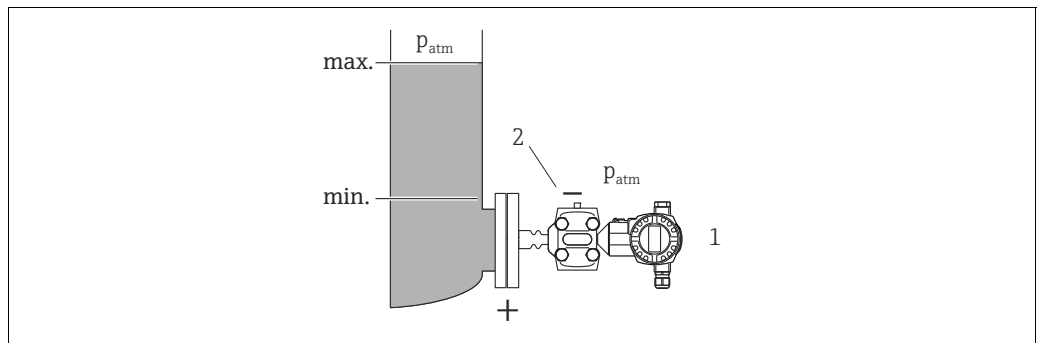
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Fig. 4: Measuring layout for level measurement in an open container with PMD75

- 1 The negative side is open to atmospheric pressure
- 2 Deltabar S, PMD75 here
- 3 Shut-off valve
- 4 Separator
- 5 Drain valve

- 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 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 an open container with FMD77



A0024164

Fig. 5: Measuring layout for level measurement in an open container with FMD77

- 1 Deltabar S, FMD77 here
- 2 The negative side is open to atmospheric pressure

- Mount the Deltabar S directly on the vessel. → 20, Section 4.3.6 "Seal for flange mounting".
- The negative side is open to atmospheric pressure.

Level measurement in a closed container with PMD75

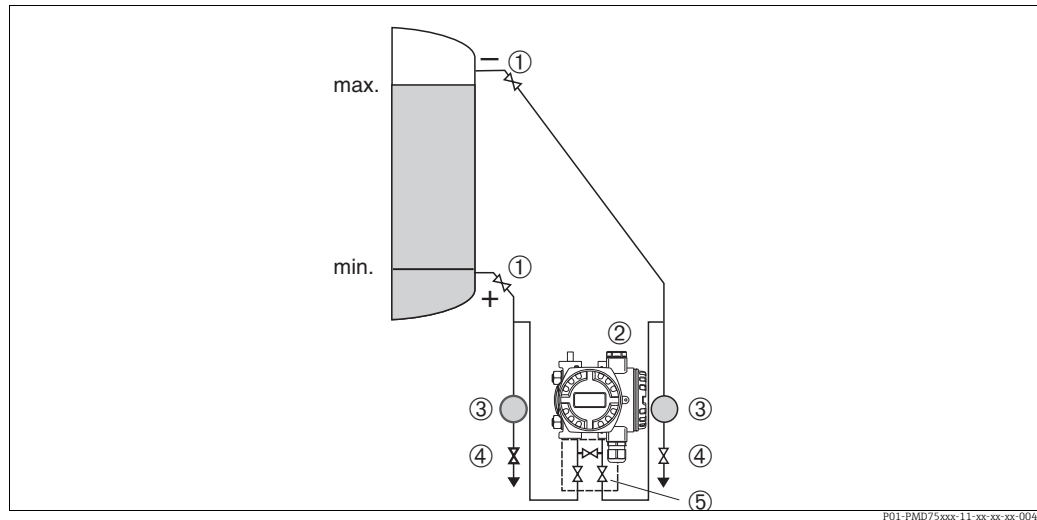


Fig. 6: Measuring layout for level measurement in a closed container with PMD75

- 1 Shut-off valves
- 2 Deltabar S, PMD75
- 3 Separator
- 4 Drain valves
- 5 Three-valve manifold

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

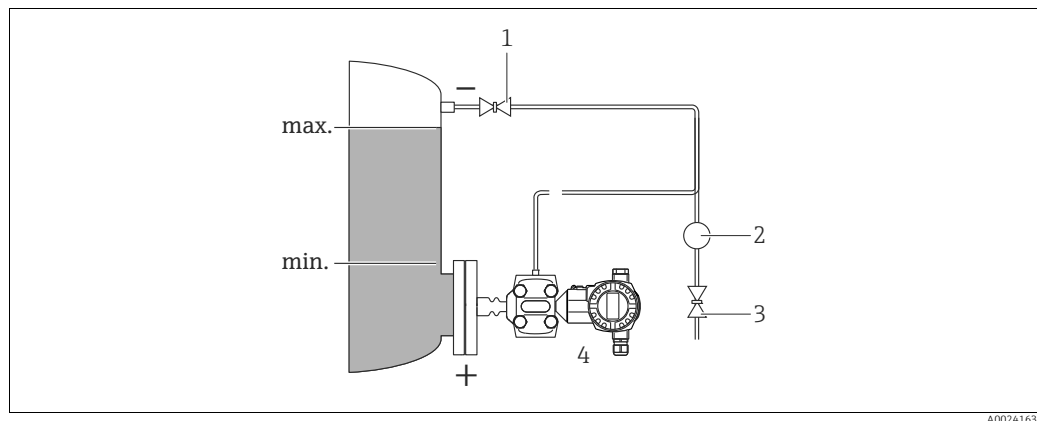


Fig. 7: Measuring layout for level measurement in a closed container with FMD77

- 1 Shut-off valve
- 2 Separator
- 3 Drain valve
- 4 Deltabar S, FMD77 here

- Mount the Deltabar S directly on the vessel. → 20, Section 4.3.6 "Seal for flange mounting".
- Always connect the impulse piping on the 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

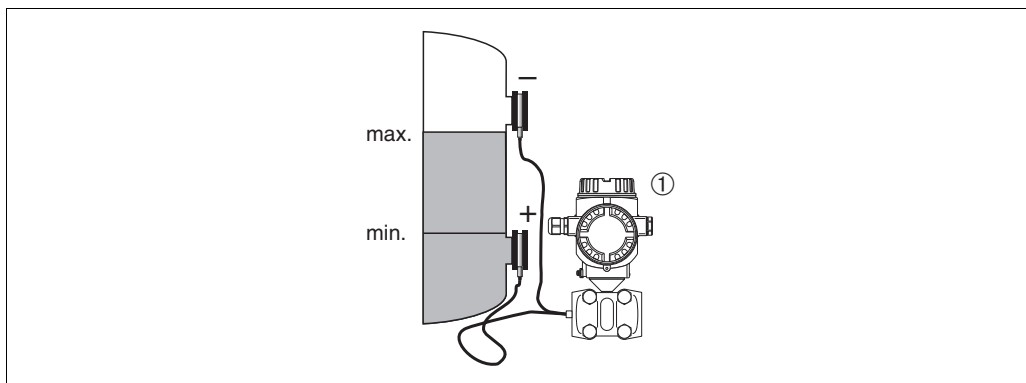


Fig. 8: Measuring layout for level measurement in a closed container with FMD78

1 Deltabar S, FMD78 here

- Mount the Deltabar S below the lower diaphragm seal. → 19, Section 4.3.5 "Installation instructions for devices with diaphragm seals (FMD78)".
- The ambient temperature should be the same for both capillaries.

Level measurement is only guaranteed 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 PMD75

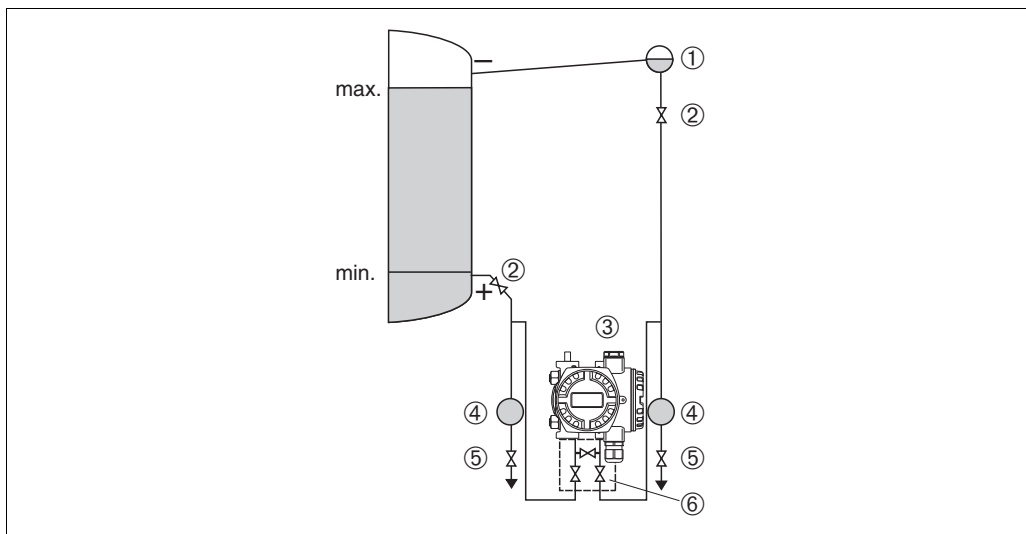


Fig. 9: Measuring layout for level measurement in a container with superimposed steam with PMD75

- 1 Condensate trap
- 2 Shut-off valves
- 3 Deltabar S, PMD75 here
- 4 Separator
- 5 Drain valves
- 6 Three-valve manifold

- Mount the Deltabar S below the lower measuring connection so that the impulse piping is always filled with liquid.
- Always connect the impulse piping on the negative side above the maximum level.
- The 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

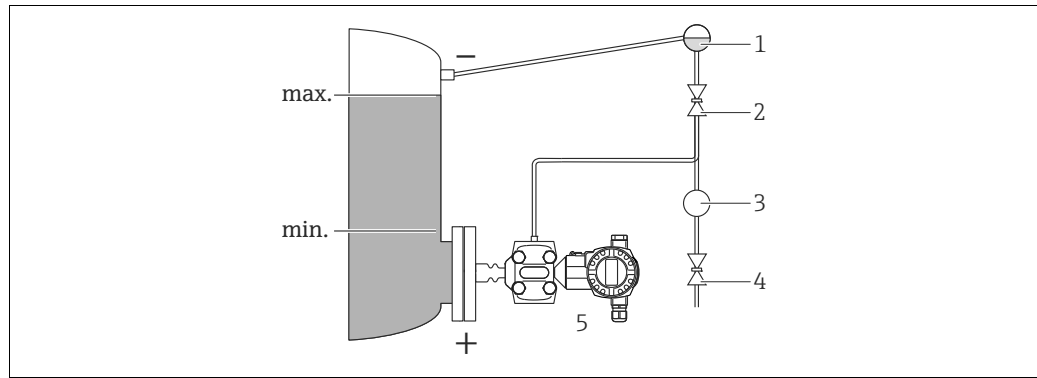


Fig. 10: Measuring layout for level measurement in a container with superimposed steam with FMD77

- 1 Condensate trap
- 2 Shut-off valve
- 3 Separator
- 4 Drain valve
- 5 Deltabar S, FMD77 here

- Mount the Deltabar S directly on the vessel. → 20, Section 4.3.6 "Seal for flange mounting".
- Always connect the impulse piping on the negative side above the maximum level.
- The 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 pressure measurement (160 bar (2400 psi) and 250 bar (3750 psi) measuring cell)

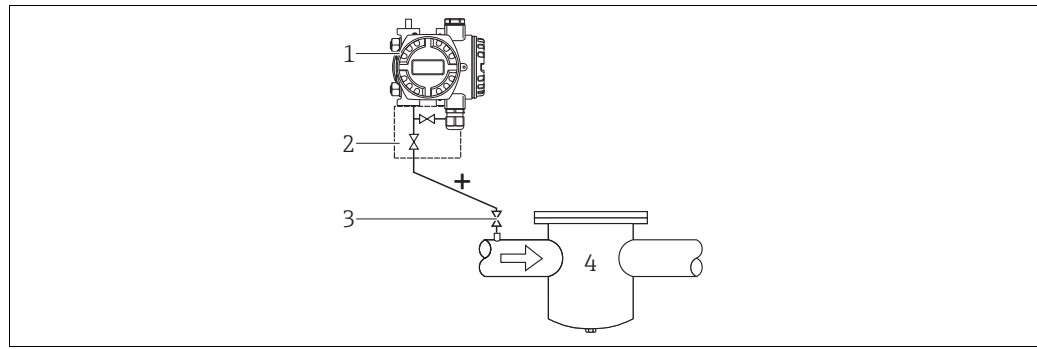


Fig. 11: Measuring layout for pressure measurement in gases and steams with PMD75 with blind flange on LP side

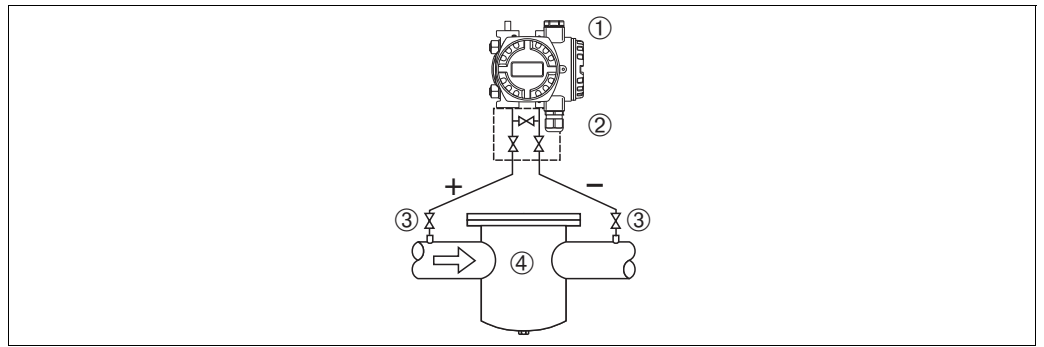
- 1 Deltabar S, PMD75 here
- 2 Two-valve manifold
- 3 Shut-off valve
- 4 Pressurized container

The negative side is open to atmospheric pressure via the reference air filters screwed into the LP side flange.

- Mount the Deltabar S above the measuring point so that the condensate can drain into the process pipe.

4.3.4 Installation for differential pressure measurement

Differential pressure measurement in gases and steam with PMD75



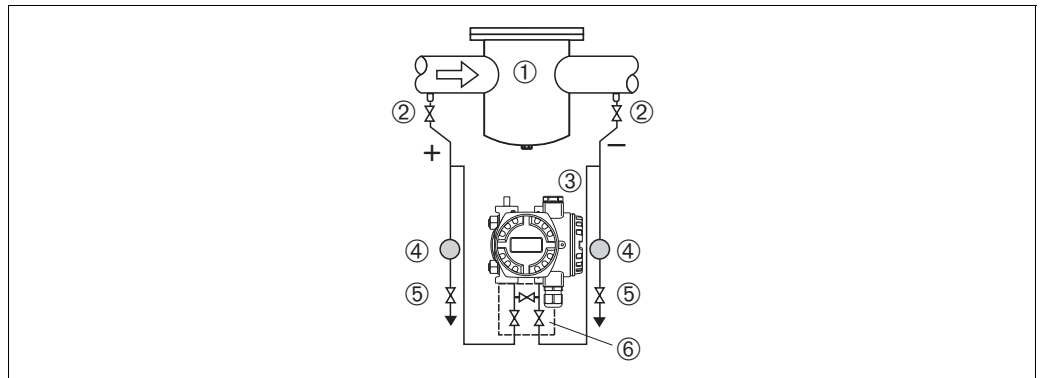
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Fig. 12: Measuring layout for differential pressure measurement in gases and steam with PMD75

- 1 Deltabar S, PMD75 here
- 2 Three-valve manifold
- 3 Shut-off valves
- 4 e.g. filter

- Mount the Deltabar S above the measuring point so that the condensate can drain into the process pipe.

Differential pressure measurement in liquids with PMD75



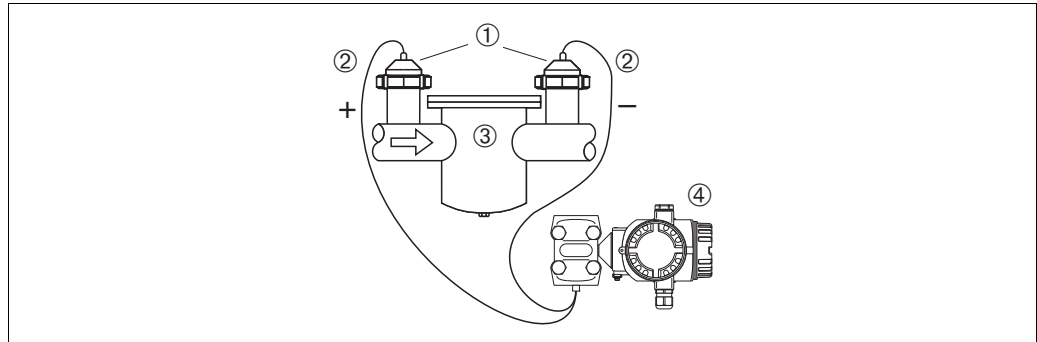
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Fig. 13: Measuring layout for differential pressure measurement in liquids with PMD75

- 1 e.g. filter
- 2 Shut-off valves
- 3 Deltabar S, PMD75 here
- 4 Separator
- 5 Drain valves
- 6 Three-valve manifold

- 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



P01-FMD78xxx-11-xx-xx-xx-000

Fig. 14: Measuring layout for differential pressure measurement in gases, steam and liquids, FMD78

- 1 Diaphragm seal
- 2 Capillary
- 3 e.g. filter
- 4 Deltabar S, FMD78 here

- Mount diaphragm seals with capillaries on pipes at the top or side.
- For vacuum applications: mount the Deltabar S below the measuring point. → 19, Section 4.3.5 "Installation instructions for devices with diaphragm seals (FMD78)", "Vacuum application" section.
- The ambient temperature should be the same for both capillaries.

4.3.5 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 membrane of the diaphragm seal with hard or pointed objects.
- Do not remove the protection on the process membrane until just before installation.

NOTICE

Incorrect handling!

Damage to the device!

- ▶ A diaphragm seal and the pressure transmitter together form a closed, calibrated system that has been filled through openings in the diaphragm seal and in the pressure transmitter's measurement system. These openings are sealed and must 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 mm (3.94 in)).
- ▶ Please observe the application limits of the diaphragm seal fill fluid 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:

- ▶ Mount capillaries vibration-free (in order to avoid additional pressure fluctuations)
- ▶ Do not mount in the vicinity of heating or cooling lines
- ▶ Insulate the capillaries 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!
- ▶ In the case of two-sided diaphragm seal systems, the ambient temperature and the length of both capillaries should be identical.
- ▶ 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).

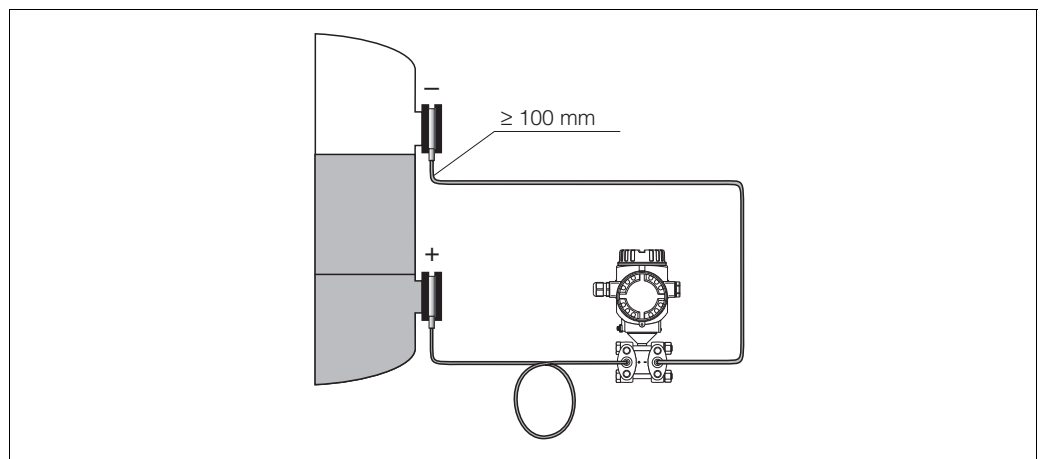


Fig. 15: Mounting Deltabar S, FMD78 with diaphragm seals and capillary, recommended mounting for vacuum applications: mount pressure transmitter below the lowest diaphragm seal!

Vacuum application

See Technical Information.

4.3.6 Seal for flange mounting

NOTICE

Incorrect measurement results.

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

- ▶ Ensure that the seal is not touching the process membrane.

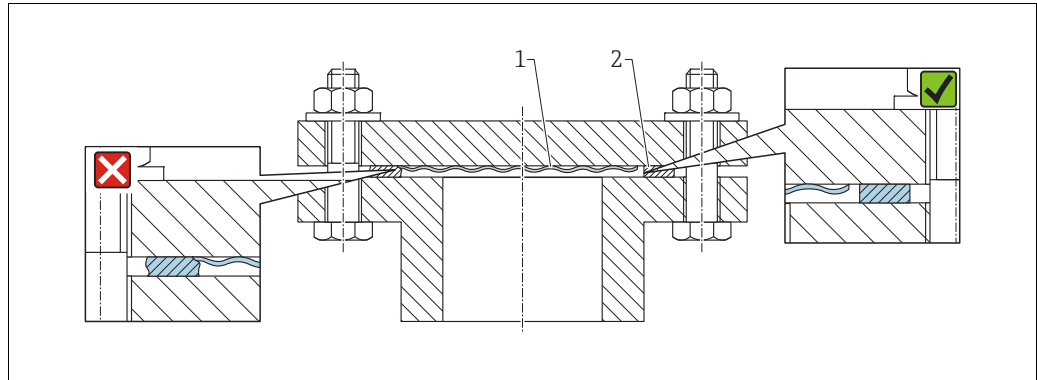


Fig. 16:
1 Process membrane
2 Seal

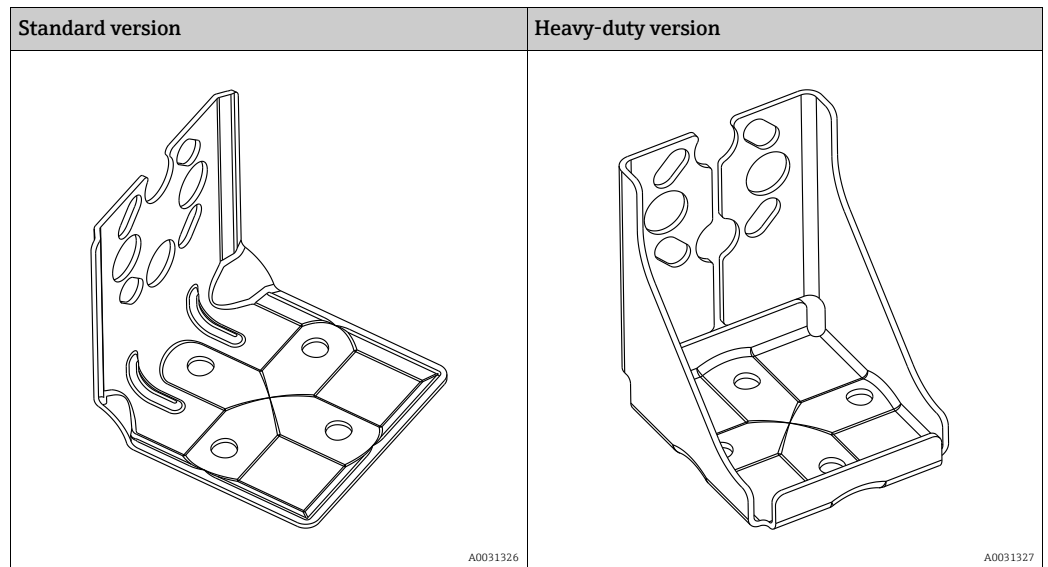
A0017743

4.3.7 Heat insulation – FMD77

See Technical Information.

4.3.8 Wall and pipe mounting (optional)

Endress+Hauser offers the following mounting brackets to install the device on pipes or walls:



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

The heavy-duty version of the mounting bracket has been tested for vibration resistance according to IEC 61298-3, see the "Vibration resistance" section of Technical Information TI00382P.



If a valve manifold is used, its dimensions should also be taken into consideration. Bracket for wall and pipe mounting including retaining bracket for pipe mounting and two nuts. The material of the screws used to secure the device depend on the order code. For the technical data (such as the dimensions or order numbers for screws), see the accessory document SD01553P.

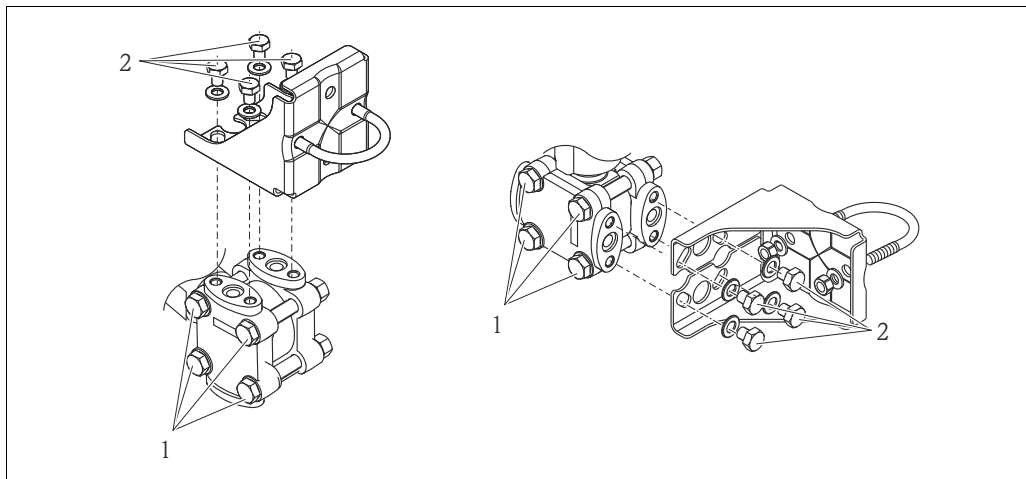
Please note the following when mounting:

- To prevent the mounting screws from scoring, they must be lubricated with a multi-purpose grease before mounting.
- For pipe mounting, the nuts on the retainer 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!**

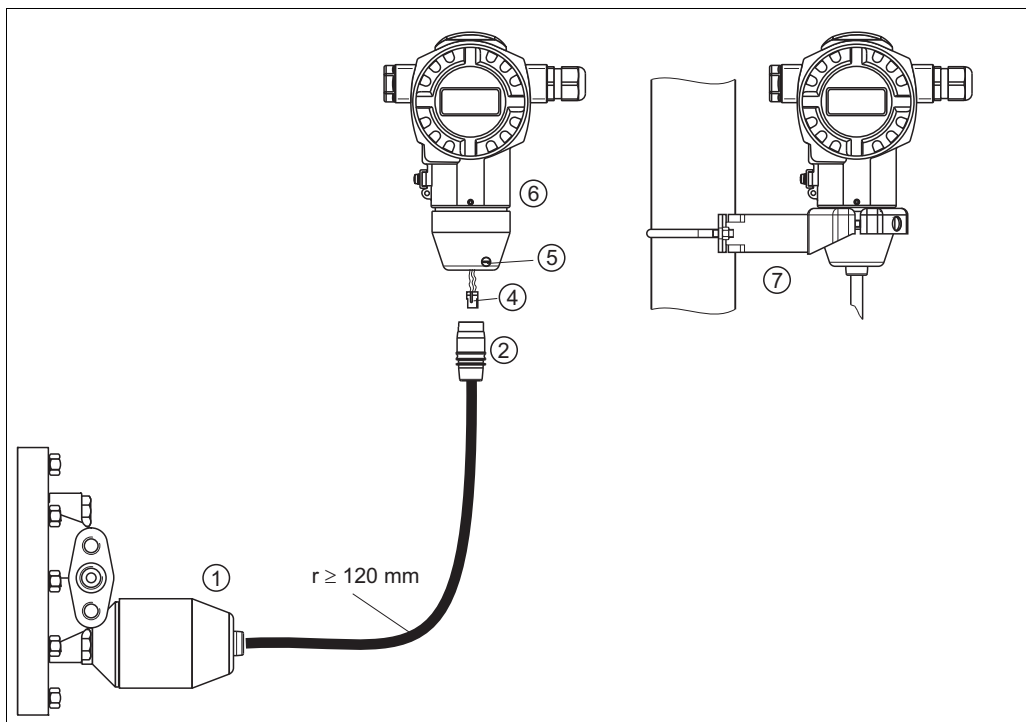
Damage to the device!

- The removal of the screws with item number (1) is not permissible under any circumstances and will void the warranty.



A0025335

4.3.9 Assembling and mounting the "separate housing" version



P01-xMD7/xxxx-11-xx-xx-xx-011

Fig. 17: "Separate housing" version

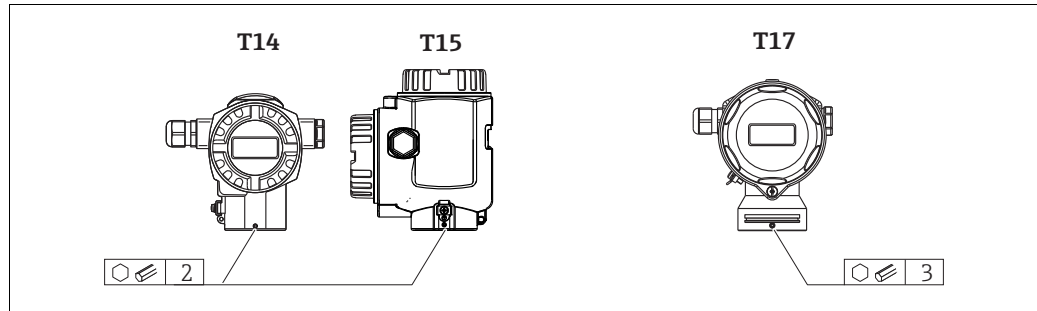
- 1 In the "remote housing" version, the sensor is supplied with process connection and cable fitted.
- 2 Cable with connection jack
- 4 Connector
- 5 Locking screw
- 6 Housing mounted with housing adapter, included
- 7 Mounting bracket suitable for wall and pipe mounting, included

Assembly and mounting

1. Connect plug (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) \geq 120 mm (4.72 in).

4.3.10 Rotating the housing

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



A0019996

1. T14 and T15 housing: loosen setscrew with a 2 mm (0.08 in) Allen key.
T17 housing: loosen the setscrew with a 3 mm (0.12 in) Allen key.
2. Rotate the housing (max. up to 380°).
3. Retighten the setscrew with 1 Nm (0.74 lbf ft).

4.3.11 Closing the housing covers

NOTICE

Devices with EPDM cover seal - leaking transmitter!

Mineral-, animal- or plant-based lubricants cause the EPDM cover seal to swell and the transmitter to leak as a result.

- It is not necessary to grease the thread due to the coating applied to the thread at the factory.

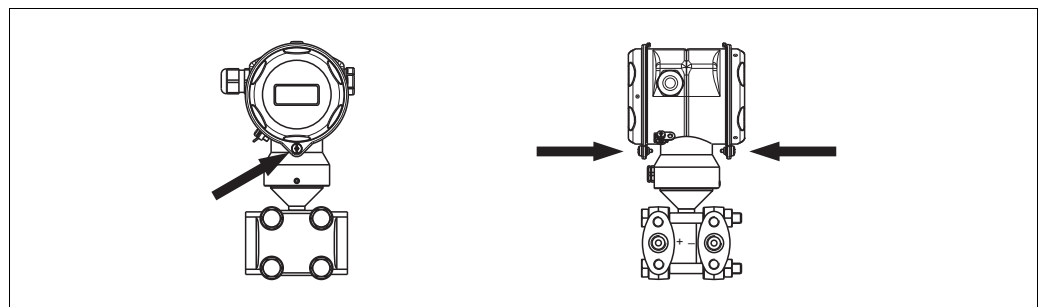
NOTICE

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 encounter resistance when closing the covers, then check the threads again for dirt or fouling.

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



P01-PMD75xxx-17-xx-xx-xx-000

Abb. 18: Closing the cover

The covers for the terminal compartment and electronics compartment are hooked into the housing and closed with a screw in each case. These screws must be tightened finger-tight (2 Nm (1.48 lbf ft)) to the stop to ensure that the covers are securely seated and leak-tight.

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

Electrical safety is compromised by an incorrect connection!

- Risk of electric shock and/or explosion! Switch off the supply voltage before connecting the device.
- When using the measuring instrument in hazardous areas, installation must also comply with the applicable national standards and regulations and the Safety Instructions or Installation or Control Drawings.
- Devices with integrated overvoltage protection must be grounded.
- Protective circuits against reverse polarity, HF influences, and overvoltage peaks are integrated.
- The supply voltage must match the supply voltage on the nameplate. → 8 ff, Section 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. Preferably use twisted, shielded two-wire cable. Tighten the cable glands or cable entries so that they are leak-tight. Counter-tighten the housing entry. Use a suitable tool with width across flats SW24/25 (8 Nm (5.9 lbf ft) for the M20 cable gland.
- Connect the device as indicated in the following diagram.
- Screw down housing cover.
- Switch on the supply voltage.

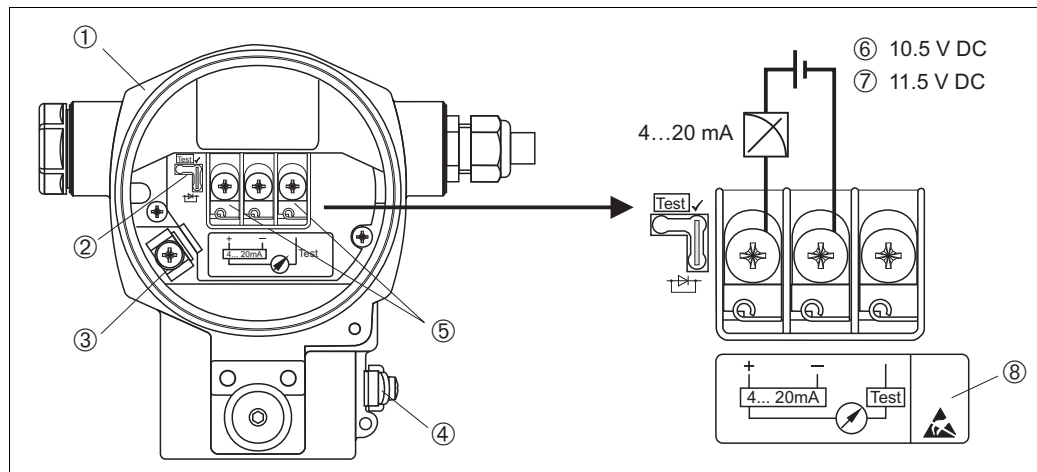


Fig. 19: Electrical connection 4 to 20 mA HART
→ Observe also Section 5.2.1 "Section 5.2.1", → 28.

- 1 Housing
- 2 Jumper for 4 to 20 mA test signal.
→ 28, Section 5.2.1 "Measuring a 4 to 20 mA test signal" section.
- 3 Internal ground terminal
- 4 External ground terminal
- 5 4 to 20 mA test signal between positive and test terminal
- 6 Minimum supply voltage = 10.5 V DC, jumper is inserted in accordance with the illustration.
- 7 Minimum supply voltage = 11.5 V DC, jumper is inserted in "Test" position.
- 8 Devices with integrated overvoltage protection are labeled OVP (overvoltage protection) here.

5.1.1 Connection of devices with Harting plug Han7D

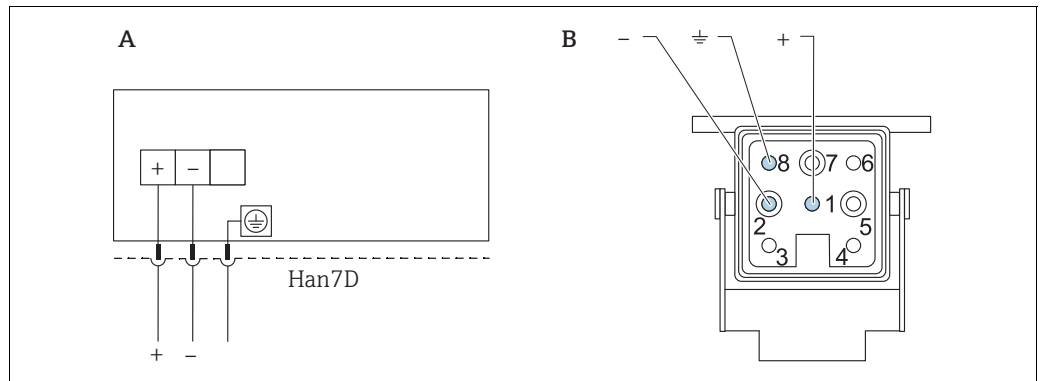


Fig. 20:

- A Electrical connection for devices with Harting plug Han7D
- B View of the connection on the device
- Brown
-) Green/yellow
- + Blue

5.1.2 Connection of devices with M12 plug

PIN assignment for M12 connector	PIN	Meaning
	1	Signal +
	2	Not used
	3	Signal -
	4	Earth

5.2 Connecting the measuring unit

5.2.1 Supply voltage

⚠ WARNING

Supply voltage might be connected!



Risk of electric shock and/or explosion!

- ▶ When using the measuring instrument in hazardous areas, installation must also comply with the applicable national standards and regulations and the Safety Instructions or Installation or Control Drawings.
- ▶ All explosion protection data are provided in separate Ex documentation, which is available on request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas.

Electronic version	Jumper for 4 to 20 mA test signal in "Test" position (order configuration)	Jumper for 4 to 20 mA test signal in "Non-Test" position
4 to 20 mA HART, version for non-hazardous areas	11.5 to 45 V DC	10.5 to 45 V DC

Taking 4 to 20 mA test signal

A 4 to 20 mA test signal may be measured via the positive and test terminal without interrupting the measurement. The minimum supply voltage of the measuring instrument can be reduced by simply changing the position of the jumper. As a result, operation with lower supply voltages is also possible. To keep the corresponding measurement error below 0.1 %, the current measuring instrument should exhibit an internal resistance of $< 0.7 \Omega$. Observe the position of the jumper in accordance with the following table.

Jumper position for test signal	Description
	<ul style="list-style-type: none"> - Measuring 4 to 20 mA test signal via the positive and test terminal: possible. (Thus, the output current can be measured without interruption via the diode.) - Delivery status - Minimum supply voltage: 11.5 V DC
	<ul style="list-style-type: none"> - Measuring 4 to 20 mA test signal via the positive and test terminal: not possible. - Minimum supply voltage: 10.5 V DC

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.
- Outer cable diameter: 5 to 9 mm (0.2 to 0.35 in)

5.2.4 Load

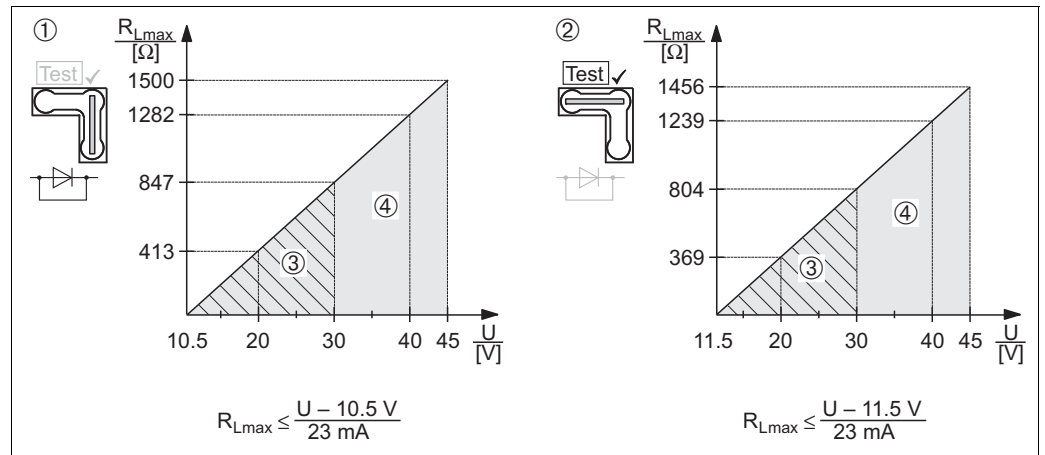


Fig. 21: Load diagram, observe the position of the jumper and the explosion protection (→ §28, "Measuring a 4 to 20 mA test signal" section.)

- 1 Jumper for the 4 to 20 mA test signal inserted in "Non-Test" position
- 2 Jumper for the 4 to 20 mA test signal inserted in "Test" position
- 3 Power supply 10.5 (11.5) to 30 V DC for 1/2 G, 1 GD, 1/2 GD, FM IS, CSA IS, IECEx ia, NEPSI Ex ia
- 4 Power supply 10.5 (11.5) to 45 V DC for device for non-hazardous areas, 1/2 D, 1/3 D, 2 G Ex d, 3 G Ex nA, FM XP, FM DIP, FM NI, CSA XP, CSA dust ignition proof, NEPSI Ex d

R_{Lmax} Maximum load resistance

U Supply voltage



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

5.2.5 Shielding/potential equalization

- You achieve optimum shielding against interference influences if the shielding is connected on both sides (in the cabinet and at the device). If potential equalization currents are expected in the plant, only ground the shielding on one side, preferably at the transmitter.
- 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.

5.2.6 Connecting Field Xpert SFX100

Compact, flexible and robust industry handheld terminal for remote configuration and for obtaining measured values via the HART current output (4-20 mA).

For details, see Operating Instructions BA00060S.

5.2.7 Commubox FXA195 connection

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 via the USB port. The Commubox is also suitable for connecting to intrinsically safe circuits. → See Technical Information TI00404F for further information.

5.2.8 Connecting Commubox FXA291/ToF adapter FXA291 for operation via FieldCareFieldCare

Connecting the Commubox FXA291

The Commubox FXA291 connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) to the USB interface of a personal computer or a notebook. For details, see TI00405C.

For the following Endress+Hauser devices, you also need the "ToF adapter FXA291" accessory:

- Cerabar S PMC71, PMP7x
- Deltabar S PMD7x, FMD7x
- Deltapilot S FMB70

Connecting the ToF adapter FXA291

The ToF adapter FXA291 connects the Commubox FXA291 via the USB port of a personal computer or a laptop to the following Endress+Hauser devices:

- Cerabar S PMC71, PMP7x
- Deltabar S PMD7x, FMD7x
- Deltapilot S FMB70

For details, see KA00271F.

5.3 Potential equalization

Ex applications: Connect all devices to the local potential equalization system. Observe the applicable regulations.

5.4 Overvoltage protection (optional)

NOTICE

Device could be destroyed!

Devices with integrated overvoltage protection must be grounded.

Devices showing version "M" in feature 100 "Additional options 1" or feature 110 "Additional options 2" in the order code are equipped with overvoltage protection (→ see also Technical Information TI00416P "Ordering information").

- Overvoltage protection:
 - Nominal functioning DC voltage: 600 V
 - Nominal discharge current: 10 kA
- Surge current check $\hat{i} = 20$ kA satisfied as per DIN EN 60079-14: 8/20 μ s
- Arrester AC current check $I = 10$ A satisfied

5.5 Post-connection check

Perform the following checks after completing the electrical installation of the device:

- Does the supply voltage match the specification on the nameplate?
- Is the device connected as per 5.1?
- 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.

6.1 Onsite display (optional)

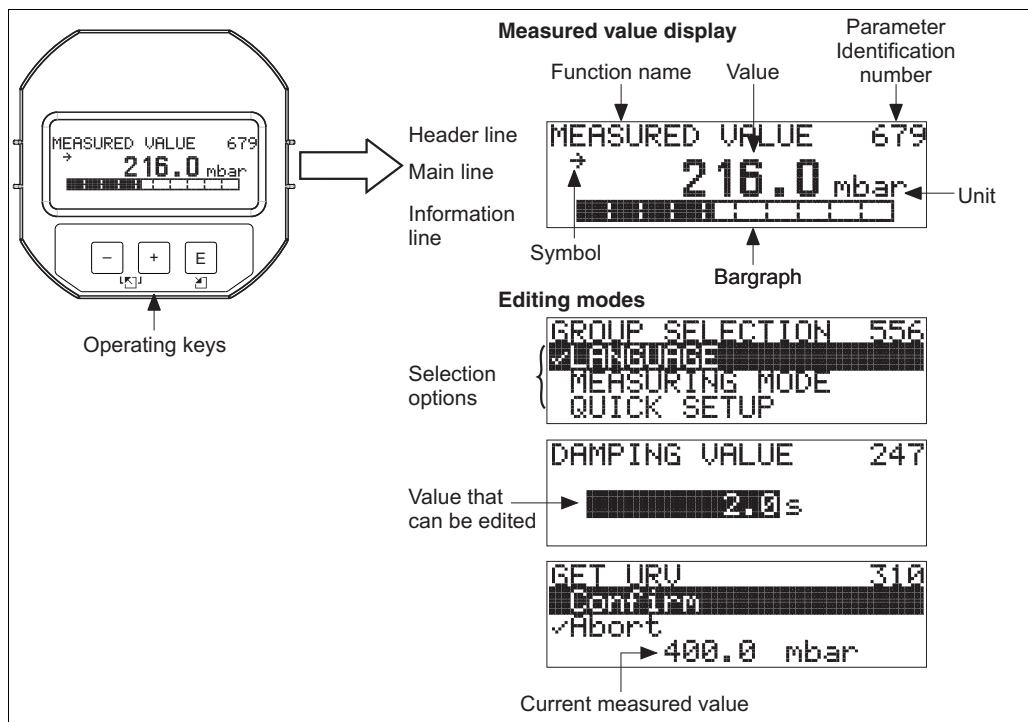
A 4-line liquid crystal display (LCD) is used for display and operation. The onsite display shows measured values, dialog texts, fault messages and notice messages.

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

Depending on the orientation 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 for displaying current
- Simple and complete menu guidance due to breakdown of parameters into several levels and groups
- Each parameter is assigned 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, maximum/minimum indicators, etc.)
- Rapid and safe commissioning using Quick Setup menus



P01-xMx7xxxx-07-xx-xx-xx-001

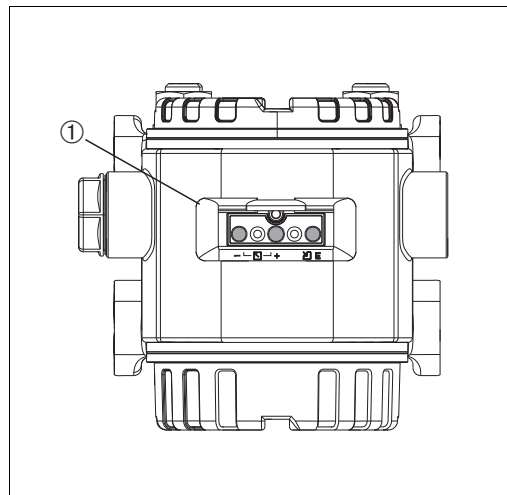
The following table illustrates the symbols that can appear on the onsite display. Four symbols may appear at the same time.

Symbol	Meaning
	Alarm symbol – Symbol flashing: warning, device continues measuring. – Symbol permanently lit: error, device does not continue measuring. <i>Note:</i> The alarm symbol may overlie the tendency symbol.
	Lock symbol The operation of the device is locked. Unlock the device, →  46.
	Communication symbol Data transfer via communication
	Square root symbol Active measuring mode "Flow measurement" The root flow signal is used for the current output.
	Tendency symbol (increasing) The measured value increases.
	Tendency symbol (decreasing) The measured value decreases.
	Tendency symbol (constant) The measured value has remained constant throughout the last few minutes.

6.2 Operating elements

6.2.1 Position of operating elements

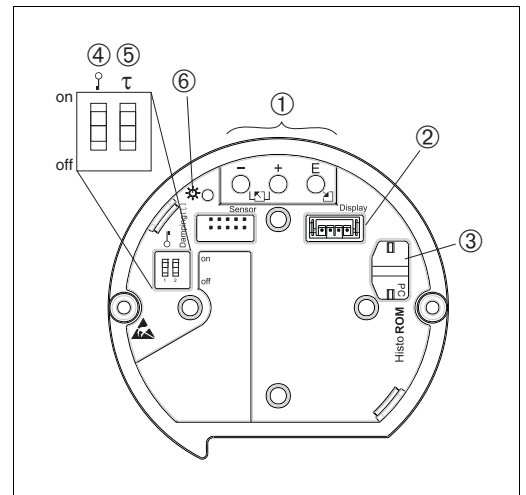
In the case of the aluminum housing (T14/T15) and stainless steel housing (T14), the operating keys are located either under the protective cap on the outside of the device or inside on the electronic insert. In the case of the hygienic stainless steel housing (T17), the operating keys are always inside on the electronic insert. In addition, there are operating keys on the optional onsite display.



P01-xxxxxxxx-19-xx-xx-xx-056

Fig. 22: Operating keys, external

- 1 Operating keys on the outside of the device under the protective flap













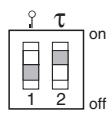
P01-xxxxxxxx-19-xx-xx-xx-104

Fig. 23: Operating keys, internal











- 1 Operating keys
- 2 Slot for optional display
- 3 Slot for optional HistoROM®/M-DAT module
- 4 DIP switch for locking/unlocking parameters relevant to the measured values
- 5 DIP switch for damping on/off
- 6 Green LED to indicate value being accepted

6.2.2 Function of operating elements – onsite display not connected

Press and hold the key or the key combination for at least 3 seconds to execute the corresponding function. Press the key combination for at least 6 seconds for a reset.

Operating key(s)	Meaning
	Adopt lower range value. A reference pressure is present at the device. → For a detailed description, also see → 36 , Section 6.3.1 "Pressure measuring mode", → 37 , Section 6.3.2 "Level measuring mode" or → 39 , Section 6.3.3 "Flow measuring mode (not for 160 bar and 250 bar)".
	Adopt upper range value. A reference pressure is present at the device. → For a detailed description, also see → 36 , Section 6.3.1 "Pressure measuring mode", → 37 , Section 6.3.2 "Level measuring mode" or → 39 , Section 6.3.3 "Flow measuring mode (not for 160 bar and 250 bar)".
	Position adjustment
 and  and 	Reset all parameters. The reset via operating keys corresponds to the software reset code 7864.
 and 	Copy the configuration data from the optional HistoROM®/M-DAT module to the device.
 and 	Copy the configuration data from the device to the optional HistoROM®/M-DAT module.
 <small>P01-xxxxxxxx-19-xx-xx-xx-057</small>	<ul style="list-style-type: none"> - DIP switch 1: for locking/unlocking measured value-relevant parameters. Factory setting: off (unlocked) - DIP switch 2: damping on/off, factory setting: on (damping on)

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 or characters within a function
	<ul style="list-style-type: none"> - Navigate downwards in the picklist - Edit the numerical values or characters within a function
	<ul style="list-style-type: none"> - Confirm entry - Jump to the next item
 and 	Contrast setting of onsite display: darker
 and 	Contrast setting of onsite display: brighter
 and 	<p>ESC functions:</p> <ul style="list-style-type: none"> - Exit the editing mode without saving the modified 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 the 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 →  40, Section 6.4.1 "".</p>

6.3 Onsite operation – onsite display not connected

To operate the device with a HistoROM®/M-DAT module, see → 43, Section 6.5.

6.3.1 Pressure measuring mode

If no onsite display is connected, the following functions are possible by means of the three keys on the electronic insert or on the exterior of the device:




- Position adjustment (zero point correction)
- Setting the lower range value and upper range value
- Device reset, → 34, Section 6.2.2 "Function of operating elements – onsite display not connected", table.
- Operation must be unlocked. → 46, Section 6.8 "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. → 49, Section 7.3 "Selecting language and 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 can affect the calibration data!

This situation can result in product overflow.

- ▶ Check the calibration data if the measuring mode is changed.

Carrying out position adjustment ¹⁾		Setting lower range value.		Setting upper range value.	
Pressure is present at the device.		The desired pressure for the lower range value is present at the device.		The desired pressure for the upper range value is present at the device.	
↓		↓		↓	
Press  for at least 3 s.		Press  for at least 3 s.		Press  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
↓	↓	↓	↓	↓	↓
Pressure present for position adjustment has been accepted.	Pressure present for position adjustment has not been accepted. Observe the input limits.	Pressure present for lower range value has been accepted.	Pressure present for lower range value has not been accepted. Observe the input limits.	Pressure present for upper range value has been accepted.	Pressure present for upper range value has not been accepted. Observe the input limits.

1) Observe warning on → 49 Section 7, "Commissioning".

6.3.2 Level measuring mode

If no onsite display is connected, the following functions are possible by means of the three keys on the electronic insert or on the exterior of the device:

- Position adjustment (zero point correction)
- Assignment of the lower and upper pressure value to the lower or upper level value
- Device reset, → [34](#), Section 6.2.2 "Function of operating elements – onsite display not connected", table.
- The "-" and \boxplus keys only have a function in the following cases:
 - LEVEL SELECTION "Level Easy Pressure", CALIBRATION MODE "Wet"
 - LEVEL SELECTION "Level Standard", LEVEL MODE "Linear", CALIBRATION MODE "Wet"

In other settings, the keys do not have a function.

- The device is configured for the "Pressure" measuring mode as standard. You can change the measuring mode by means of the MEASURING MODE parameter. → [49](#), Section 7.3 "Selecting language and measuring mode".

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.
- SET LRV: 0.0 (corresponds to 4 mA value)
- SET URV: 100.0 (corresponds to 20 mA value)

These parameters can be changed only via the onsite display or remote control, such as FieldCare.




- Operation must be unlocked. → [46](#), Section 6.8 "Locking/unlocking operation".
- The pressure applied must be within the nominal pressure limits of the sensor. See information on the nameplate.
- → [55](#), Section 7.6 "Level measurement". For a description of the parameters see Operating Instructions BA00274P.
- LEVEL SELECTION, CALIBRATION MODE, LEVEL MODE, EMPTY CALIB., FULL CALIB., SET LRV and SET URV are parameter names that are used for the onsite display or remote operation, such as FieldCare.


▲ WARNING

Changing the measuring mode can affect the calibration data!

This situation can result in product overflow.

- ▶ Check the calibration data if the measuring mode is changed.

Carrying out position adjustment ¹⁾		Setting lower pressure value.		Setting upper pressure value.	
Pressure is present at the device.		Desired pressure for lower pressure value (EMPTY PRESSURE ²⁾) is present at the device.		Desired pressure for upper pressure value (FULL PRESSURE ¹⁾) is present at device.	
↓		↓		↓	
Press  for at least 3 s.		Press  for at least 3 s.		Press  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
↓	↓	↓	↓	↓	↓
Pressure present for position adjustment has been accepted.	Pressure present for position adjustment has not been accepted. Observe the input limits.	The pressure present was saved as the lower pressure value (EMPTY PRESSURE ²⁾) and assigned to the lower level value (EMPTY CALIB. ²⁾ .	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 ²⁾) and assigned to the upper level value (FULL CALIB. ²⁾ .	The pressure present was not saved as the upper pressure value. Observe the input limits.

- 1) Observe warning on →  49, Section 7 "Commissioning".
- 2) Parameter name used for the onsite display or remote control, such as FieldCare.

6.3.3 Flow measuring mode (not for 160 bar and 250 bar)

If no onsite display is connected, the following functions are possible by means of the three keys on the electronic insert or on the exterior of the device:

- Position adjustment (zero point correction)
- Assign the maximum pressure value to the maximum flow value
- Device reset, → 34, Section 6.2.2 "Function of operating elements – onsite display not connected", table.
- Operation must be unlocked. → 46, Section 6.8 "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. → 49, Section 7.3 "Selecting language and measuring mode".
- The "-" key does not have any function.
- The pressure applied must be within the nominal pressure limits of the sensor. See information on the nameplate.
- → 54, Section 7.5.3 "Quick Setup menu for the Flow measuring mode" and Operating Instructions BA00274P, parameter descriptions MAX. PRESS. FLOW, MAX. FLOW, SET LRV – Flow and LINEAR/SQROOT.

▲ WARNING

Changing the measuring mode can affect the calibration data!


This situation can result in product overflow.

- ▶ Check the calibration data if the measuring mode is changed.

Carrying out position adjustment ¹⁾		Setting maximum pressure value.	
Pressure is present at the device.		Desired pressure for the maximum pressure value (MAX. PRESS. FLOW ²⁾) is present at device.	
↓		↓	
Press [OK] for at least 3 s.		Press [OK] 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?	
Yes	No	Yes	No
↓	↓	↓	↓
Pressure present for position adjustment has been accepted.	Pressure present for position adjustment has not been accepted. Observe the input limits.	The pressure present was saved as the maximum pressure value (MAX. PRESS FLOW ²⁾) and assigned to the maximum flow value (MAX. FLOW ²⁾ .	The pressure present was not saved as the maximum pressure value. Observe the input limits.

- 1) Observe warning on → 49, Section 7 "Commissioning".
- 2) Parameter name used for the onsite display or remote control, such as FieldCare.

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 and to input parameters, →  35, Section 6.2.3 "Function of the operating elements – onsite display connected".

6.4.1 Menu structure

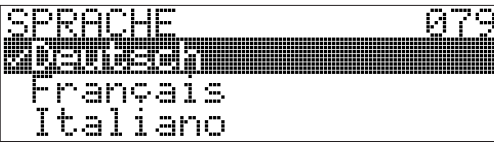
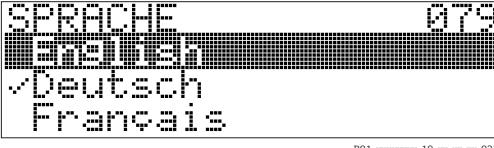


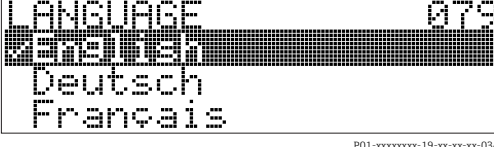


The menu is split into four levels. The three upper levels are used to navigate while you use the bottom level to enter numerical values, select options and save settings.

The entire operating menu is shown in the operating instructions BA00274P "Cerabar S/ Deltabar S/Deltapilot S, Description of device functions".

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.

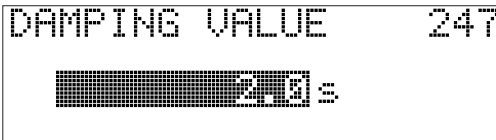
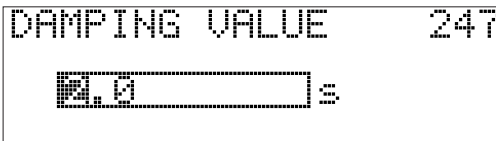
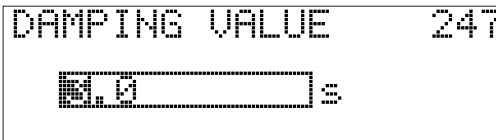
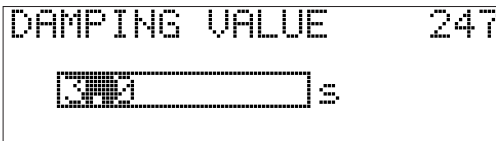
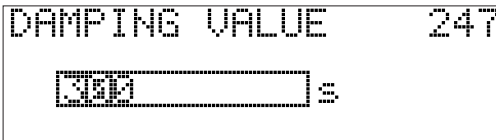
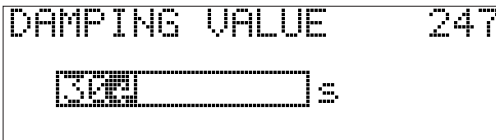
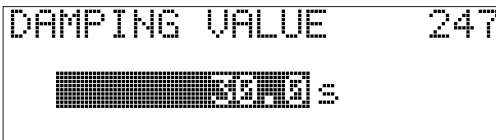
6.4.2 Selecting an option

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

Onsite display	Operation
 <p style="text-align: right; font-size: small;">P01-xxxxxxxx-19-xx-xx-xx-017</p>	<p>"German" has been selected as the menu language. A ✓ in front of the menu text indicates the active option.</p>
 <p style="text-align: right; font-size: small;">P01-xxxxxxxx-19-xx-xx-xx-033</p>	<p>Select English with  or .</p>
 <p style="text-align: right; font-size: small;">P01-xxxxxxxx-19-xx-xx-xx-034</p>	<ol style="list-style-type: none"> 1. Select  to confirm. A ✓ 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 .

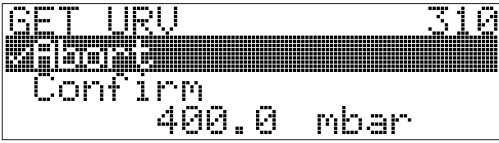
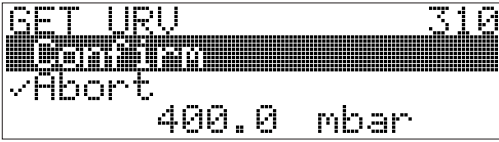
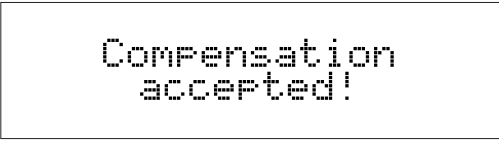
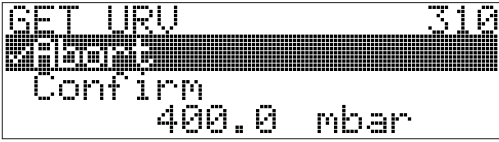
6.4.3 Editing a value

Example: adjusting DAMPING VALUE function from 2.0 s to 30.0 s. → 34, Section 6.2.2 "Function of operating elements – onsite display not connected".

Onsite display	Operation
 <p style="text-align: right; 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: right; font-size: small;">P01-xxxxxxxx-19-xx-xx-xx-027</p>	<ol style="list-style-type: none"> 1. Press \leftarrow or \rightarrow to enter the editing mode. 2. The first digit is highlighted in black.
 <p style="text-align: right; font-size: small;">P01-xxxxxxxx-19-xx-xx-xx-028</p>	<ol style="list-style-type: none"> 1. Use the \rightarrow key to change "2" to "3". 2. Press the \rightarrow key to confirm "3". 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 \leftarrow or \rightarrow until "0" is displayed. 2. Press the \rightarrow key to confirm "0". The cursor jumps to the next position. \downarrow 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 \rightarrow to save the new value and exit 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 \rightarrow. - Use \leftarrow or \rightarrow to return to editing mode.

6.4.4 Taking pressure applied at device as value

Example: configuring upper range value – assigning 20 mA to the pressure value 400 mbar.

Onsite display	Operation
 <p>GET URV 310 Abort Confirm 400.0 mbar</p> <p style="text-align: right; font-size: small;">P01-xxxxxxx-19-xx-xx-xx-035</p>	<p>The bottom line on the onsite display displays the pressure present, 400 mbar here.</p>
 <p>GET URV 310 Confirm ✓Abort 400.0 mbar</p> <p style="text-align: right; font-size: small;">P01-xxxxxxx-19-xx-xx-xx-036</p>	<p>Use <input type="checkbox"/> or <input checked="" type="checkbox"/> to switch to the "Confirm" option. The active selection is highlighted in black.</p>
 <p style="text-align: center;">Compensation accepted!</p> <p style="text-align: right; font-size: small;">P01-xxxxxxx-19-xx-xx-xx-037</p>	<p>Use <input type="checkbox"/> to assign the value (400 mbar) to the GET URV parameter. The device confirms the calibration and jumps back to the parameter, here GET URV (see next graphic).</p>
 <p>GET URV 310 Abort Confirm 400.0 mbar</p> <p style="text-align: right; font-size: small;">P01-xxxxxxx-19-xx-xx-xx-035</p>	<p>Switch to the next parameter with <input type="checkbox"/>.</p>


6.5 HistoROM[®]/M-DAT (optional)

NOTICE

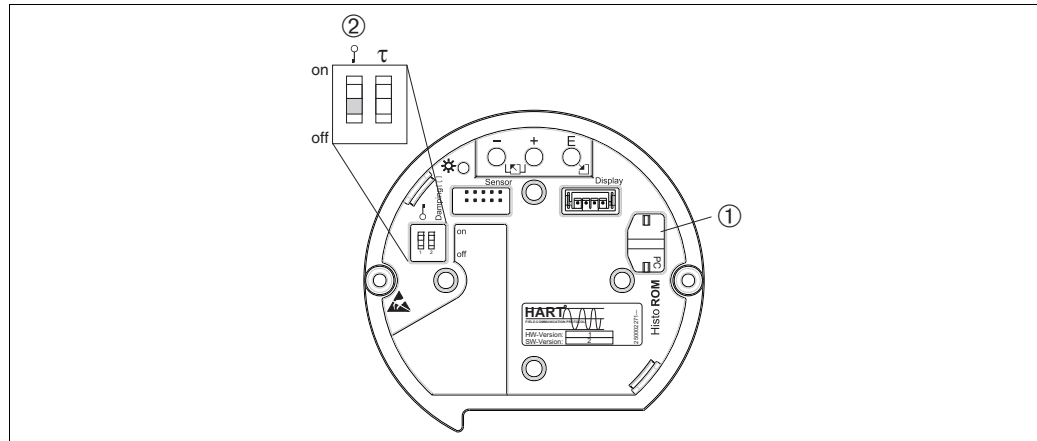
Device could be destroyed!

Detach HistoROM[®]/M-DAT module from the electronic insert or attach it to the insert in a deenergized state only.

HistoROM[®]/M-DAT is a memory module, which is attached to the electronic insert and fulfils the following functions:

- Back-up copy of configuration data
- Copying configuration data of a transmitter into another transmitter
- Cyclic recording of pressure and sensor temperature measured values
- Recording diverse events, such as alarms, configuration changes, counters for measuring range undershooting and exceeding for pressure and temperature, exceeding and undershooting the user limits for pressure and temperature, etc.
- The HistoROM[®]/M-DAT can be retrofitted at any stage (order number: 52027785).
- The HistoROM data and the data in the device are analyzed once a HistoROM[®]/M-DAT is attached to the electronic insert and power is reestablished to the device. During the analysis, the messages "W702, HistoROM data not consistent" and "W706, Configuration in HistoROM and device not identical" can occur. For measures →  65, Section 9.1 "Messages."

6.5.1 Copying configuration data



Electronic insert with optional HistoROM®/M-DAT memory module

P01-xxxxxxx-19-xx-xx-xx-098

- 1 Optional HistoROM®/M-DAT
- 2 To copy configuration data from the HistoROM®/M-DAT to a device or from a device to a HistoROM®/M-DAT, operation must be unlocked (DIP switch 1, position "Off", parameter INSERT PIN No = 100). Please refer also to → 46, Section 6.8 "Locking/unlocking operation".

Onsite operation – onsite display not connected

Copying configuration data from a device to a HistoROM®/M-DAT module:

Operation must be unlocked.

1. Disconnect the device from the supply voltage.
2. Attach the HistoROM®/M-DAT module to the electronic insert.
3. Reestablish the supply voltage to the device.
4. Press the \square and "-" keys (for at least 3 seconds) until the LED on the electronic insert lights up.
5. Wait approx. 20 seconds. Configuration data are loaded from the HistoROM®/M-DAT to the device. The device is not restarted.
6. Before removing the HistoROM®/M-DAT again from the electronic insert, disconnect the device from the supply voltage.

Copying configuration data from a HistoROM®/M-DAT to a device:

Operation must be unlocked.

1. Disconnect the device from the supply voltage.
2. Attach the HistoROM®/M-DAT module to the electronic insert. Configuration data from another device are stored in the HistoROM®/M-DAT.
3. Reestablish the supply voltage to the device.
4. Press the \square and "+" keys (for at least 3 seconds) until the LED on the electronic insert lights up.
5. Wait approx. 20 seconds. All parameters except DEVICE SERIAL No., DEVICE DESIGN., CUST. TAG NUMBER, LONG TAG NUMBER, DESCRIPTION, BUS ADDRESS, CURRENT MODE and the parameters in the POSITION ADJUSTMENT and PROCESS CONNECTION group are loaded into the device by the HistoROM®/M-DAT. The device is restarted.
6. Before removing the HistoROM®/M-DAT again from the electronic insert, disconnect the device from the supply voltage.

Onsite operation via onsite display (optional) or remote operation**Copying configuration data from a device to a HistoROM®/M-DAT module:**

Operation must be unlocked.

1. Disconnect the device from the supply voltage.
2. Attach the HistoROM®/M-DAT to the electronic insert.
3. Reestablish the supply voltage to the device.
4. Using the HistoROM CONTROL parameter, select the option "Device → HistoROM" as the data transfer direction (menu path: (GROUP SELECTION →) OPERATING MENU → OPERATION).
The DOWNLOAD SELECT. parameter setting has no influence on uploading from the device to HistoROM.
5. Wait approx. 20 seconds. Configuration data are loaded from the device to the HistoROM®/M-DAT module. The device is not restarted.
6. Before removing the HistoROM®/M-DAT again from the electronic insert, disconnect the device from the supply voltage.

Copying configuration data from a HistoROM®/M-DAT to a device:

Operation must be unlocked.

1. Disconnect the device from the supply voltage.
2. Attach the HistoROM®/M-DAT module to the electronic insert. Configuration data from another device are stored in the HistoROM®/M-DAT.
3. Reestablish the supply voltage to the device.
4. Use the DOWNLOAD SELECT. parameter to select which parameters are to be overwritten (menu path: (GROUP SELECTION →) OPERATING MENU → OPERATION).
The following parameters are overwritten according to the selection:
 - **Configuration copy (factory setting):**
all parameters except DEVICE SERIAL No., DEVICE DESIGN., CUST. TAG NUMBER, LONG TAG NUMBER, DESCRIPTION, BUS ADDRESS, CURRENT MODE and the parameters in the POSITION ADJUSTMENT, PROCESS CONNECTION, CURR. TRIM (SERVICE/SYSTEM 2), SENSOR TRIM and SENSOR DATA group.
 - **Device replacement:**
all parameters except DEVICE SERIAL No., DEVICE DESIGN. and the parameters in the POSITION ADJUSTMENT, PROCESS CONNECTION, CURR. TRIM (SERVICE/SYSTEM 2), SENSOR TRIM and SENSOR DATA group.
 - **Electronics replacement:**
all parameters except the parameters in the CURR. TRIM (SERVICE/SYSTEM 2) and SENSOR DATA group.
 Factory setting: Configuration copy
5. Using the HistoROM CONTROL parameter, select the option "HistoROM → Device" as the data transfer direction.
(Menu path: (GROUP SELECTION →) OPERATING MENU → OPERATION)
6. Wait approx. 20 seconds. Configuration data are loaded from the HistoROM®/M-DAT to the device. The device is restarted.
7. Before removing the HistoROM®/M-DAT again from the electronic insert, disconnect the device from the supply voltage.

6.6 Operation via SFX100

Compact, flexible and robust industry handheld terminal for remote configuration and for obtaining measured values via the HART current output (4-20 mA).
For details, see Operating Instructions BA00060S.


6.7 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. You can find hardware and software requirements on the Internet: www.endress.com → Search: FieldCare → FieldCare → Technical Data.

FieldCare supports the following functions:

- Configuration of transmitters in online operation
- Loading and saving of device data (upload/download)
- HistoROM[®]/M-DAT analysis
- Documentation of the measuring point

Connection options:


- HART via Commubox FXA195 and the USB port of a computer
- HART via Fieldgate FXA520
- Service interface with Commubox FXA291 and ToF adapter FXA291.
- →  29, Section 5.2.7 "Commubox FXA195 connection".
- In the "Level Standard" measuring mode, the configuration data that were loaded via FDT upload cannot be written again (FDT download). These data are only used to document the measuring point.
- Further information on FieldCare can be found on the Internet (<http://www.endress.com>, Download, → Search for: FieldCare).

6.8 Locking/unlocking operation

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

You have the following possibilities for locking/unlocking operation:

- Via the DIP switch on the electronic insert, locally at the device.
- Via the onsite display (optional)
- Via communication, e.g. FieldCare and HART handheld device.

The  symbol on the onsite display indicates that operation is locked. 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 onsite display or remote operation, e.g. FieldCare, you can unlock operation either using the onsite display or remote operation.

The table provides an overview of the locking functions:

Locking via	View/read parameters	Modify/write via ¹⁾		Unlocking via		
		Onsite display	Remote operation	DIP switch	Onsite display	Remote operation
DIP switch	Yes	No	No	Yes	No	No
Onsite display	Yes	No	No	No	Yes	Yes
Remote operation	Yes	No	No	No	Yes	Yes

1) Parameters which refer to how the display appears, e.g. LANGUAGE and DISPLAY CONTRAST, can still be altered.

6.8.1 Locking/unlocking operation locally via DIP switch

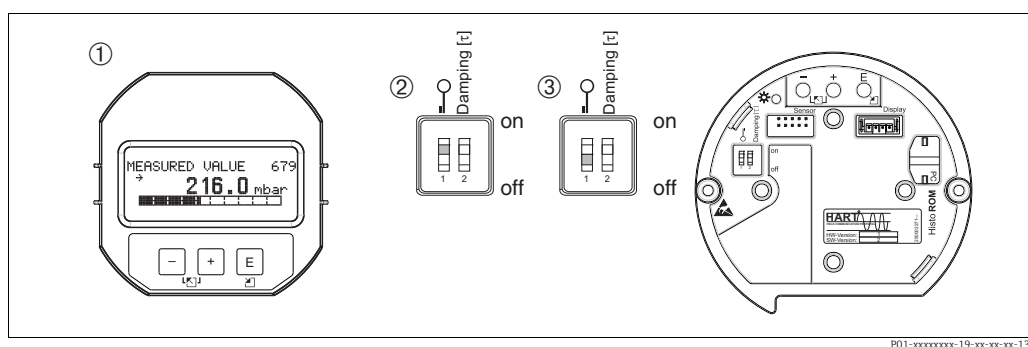


Fig. 24: DIP switch position "Hardware locking" on the electronic insert

- 1 Remove the (optional) onsite display
- 2 DIP switch is at "on": operation is locked.
- 3 DIP switch is at "off": operation is unlocked (operation possible)

6.8.2 Locking/unlocking operation via onsite display or remote operation

	Description
Locking operation	<ol style="list-style-type: none"> 1. Select INSERT PIN NO. parameter, menu path: OPERATING MENU → OPERATION → INSERT PIN NO. 2. To lock operation, enter a number for this parameter between 0 and 9999 that is ≠100.
Unlocking operation	<ol style="list-style-type: none"> 1. Select INSERT PIN No. parameter. 2. To unlock operation, enter "100" for the parameter.

6.9 Factory setting (reset)

By entering a certain code, you can completely, or partially, reset the entries for the parameters to the factory settings. (→ For factory settings, refer to the Operating Instructions BA00274P "Cerabar S/Deltabar S/Deltapilot S, Description of device functions".) Enter the code by means of the ENTER RESET CODE parameter (menu path: (GROUP SELECTION →) OPERATING MENU → OPERATION).

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 (→ 46, Section 6.8).



Any customer-specific configuration carried out at the factory is not affected by a reset (customer-specific configuration remains). If, after a reset, you wish the parameters to be reset to the factory settings, please contact Endress+Hauser Service.

Reset code	Description and effect
1846	Display reset <ul style="list-style-type: none"> - This reset resets all parameters related to how the display appears (DISPLAY group). - Any simulation running is terminated. - The device is restarted.
62	PowerUp reset (warm start) <ul style="list-style-type: none"> - This reset resets all the parameters in the RAM. Data are read back anew from the EEPROM (processor is initialized again). - Any simulation running is terminated. - The device is restarted.
2710	Measuring mode level reset <ul style="list-style-type: none"> - Depending on the settings for the LEVEL MODE, LIN MEASURAND, LIND MEASURAND or COMB. MEASURAND parameters, the parameters needed for this measuring task will be reset. - Any simulation running is terminated. - The device is restarted. <p>Example LEVEL MODE = linear and LIN. MEASURAND = level</p> <ul style="list-style-type: none"> ■ HEIGHT UNIT = m ■ CALIBRATION MODE = wet ■ EMPTY CALIB. = 0 ■ FULL CALIB. = Sensor end value converted to mH₂O, e.g. 5.099 mH₂O for a 500 mbar (7.5 psi) sensor
333	User reset <ul style="list-style-type: none"> - This reset resets the following parameters: <ul style="list-style-type: none"> - POSITION ADJUSTMENT function group - BASIC SETUP function group, apart from customer-specific units - EXTENDED SETUP function group - TOTALIZER SETUP function group - OUTPUT group - HART DATA function group: CURRENT MODE, BUS ADDRESS and PREAMBLE NUMBER - Any simulation running is terminated. - The device is restarted.
7864	Total reset <ul style="list-style-type: none"> - This reset resets the following parameters: <ul style="list-style-type: none"> - POSITION ADJUSTMENT function group - BASIC SETUP function group - EXTENDED SETUP function group - LINEARIZATION function group (an existing linearization table is deleted) - TOTALIZER SETUP function group - OUTPUT group - Function group HART DATA - MESSAGES function group - All configurable messages ("Error" type) are reset to the factory setting. → See also → 65, Section 9.1 "Messages" and → 73, Section 9.2 "Response of outputs to errors". - USER LIMITS function group - SYSTEM 2 function group - Any simulation running is terminated. - The device is restarted.
8888	HistoROM reset <p>The measured value and event buffers are deleted. During the reset, the HistoROM has to be attached to the electronic insert.</p>

7 Commissioning

The device is configured for the "Pressure" measuring mode at the factory. The measuring range and the unit in which the measured value is transmitted correspond to the data on the nameplate.

▲ WARNING

The permitted process pressure is exceeded!

Risk of injury due to bursting of parts!

- ▶ Only use the device within the sensor range limits!

NOTICE

Permitted differential pressure undershot/exceeded!

Output of messages if differential pressure is too high or too low.

- ▶ If a differential pressure that is lower than the minimum permitted differential pressure is present at the device, messages "E120 sensor low pressure" and "E727 sensor pressure error - overrange" are output in succession.
Only use the device within the sensor range limits!
- ▶ If a differential pressure that is greater than the maximum permitted differential pressure is present at the device, messages "E115 sensor overpressure" and "E727 sensor pressure error - overrange" are output in succession.
Only use the device within the sensor range limits!

7.1 Configuring messages

- Messages E727, E115 and E120 are "Error" 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:
 - It is not necessary to go outside the sensor range for the measuring application.
 - A position adjustment must be carried out that has to correct a large measurement error as a result of the orientation of the device (e.g. devices with diaphragm seal).

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 4.4
- "Post-connection check" checklist → see Section 5.5

7.3 Selecting language and measuring mode

7.3.1 Onsite operation

The LANGUAGE and MEASURING MODE parameters are on the 1st selection level.

The following measuring modes are available:

- Pressure
- Level
- Flow (not for 160 bar and 250 bar)

7.3.2 Digital communication

The following measuring modes are available:

- Pressure
- Level
- Flow (not for 160 bar and 250 bar)

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 using the "Language" button in the configuration window. Select the menu language for the FieldCare frame using the "Extras" menu → "Options" → "Display" → "Language".

7.4 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, the measured value does not display zero. There are three options to choose from when performing position adjustment.

(Menu path: (GROUP SELECTION →) OPERATING MENU → SETTINGS → POSITION ADJUSTMENT)

Parameter name	Description
POS. ZERO ADJUST (685) 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 using 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. <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>
POS. INPUT VALUE (563) Entry	<p>Position adjustment – the pressure difference between zero (set point) and the measured pressure need not be known. To correct the pressure difference, a reference measurement value (e.g. from a reference device) is required.</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 mbar (0.022 psi) – The current value is also corrected. <p>Factory setting: 0.0</p>

Parameter name	Description
CALIB. OFFSET (319) 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- The current value is also corrected. <p>Factory setting: 0.0</p>

7.5 Flow measurement

7.5.1 Preliminaries



- 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	Initial situation: All valves closed		
2	Open 3		
3	Open A and B		
4	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.		
	Open 1 and 5. ¹	Blow out/rinse out impulse piping.	
	Close 1 and 5. ¹	Close valves after cleaning.	
5	Open 2	Introduce fluid.	
6	Open 6 and 7 briefly	Vent device.	
7	Close 2; open 4		
8	Open 6 and 7 briefly	Vent device again	
9	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 11. → 54, Section 7.5.3 and → 50, Section 7.4. Conditions: – The flow cannot be blocked off. – The tapping points (A and B) are at the same geodetic height.		
10	Close 3; open 2	Set measuring point to operation.	
11	Carry out pos. zero adjustment if the flow can be blocked off. In this case, step 9 is not applicable. → 54, Section 7.5.3 and → 50, Section 7.4.		

Fig. 25: 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

7.5.2 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 provides 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. You specify which Quick Setup menu should be displayed with the setting in the MEASURING MODE parameter. →  49, Section 7.3 "Selecting language and measuring mode".
- For a detailed parameter description, see the Operating Instructions BA00274P "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 then structured according to the measuring mode that is selected.


WARNING



Changing the measuring mode can affect the calibration data!

This situation can result in product overflow.

- ▶ Check the calibration data if the measuring mode is changed.

7.5.3 Quick Setup menu for the Flow measuring mode

Onsite operation	Digital communication
Measured value display Switch from the measured value display to the GROUP SELECTION with  .	See BA00274P.
GROUP SELECTION Select the MEASURING MODE parameter.	
MEASURING MODE Select "Flow" option.	
GROUP SELECTION Select the QUICK SETUP menu.	
POS. ZERO ADJUST Due to the 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. PRESS. FLOW Enter maximum pressure of primary device. (→ See also layout sheet of primary 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 current output, react to a change in the pressure.	

For onsite operation, see also →  35, Section 6.2.3 "Function of the operating elements – onsite display connected" and →  40, Section 6.4 "Onsite operation – onsite display connected".

7.6 Level measurement

7.6.1 Preliminaries

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 the container to a level above the lower tap.		
2	Clean impulse piping if necessary.		
	Close A.	Block off device.	
	Open B.	Rinse out impulse piping.	
	Close B.	Close valve after cleaning.	
3	Fill measuring system with fluid.		
	Open A.	Open shut-off valve.	
4	Vent device.		
	Open 6 briefly, then close again.	Fill measuring instrument completely with fluid and remove air.	
5	Set measuring point to operation.		
	Now:		
	- B and 6 are closed.		
	- A is open.		
6	Carry out calibration.		
	→ 58, Section 7.6.2.		

Fig. 26: 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). Before calibrating the device, the impulse piping must be cleaned and filled with fluid.
- 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 the container to a level above the lower tap. Negative impulse piping filled with gas.	
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 (drain 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 to operation.	
	Now:	<ul style="list-style-type: none"> - 3, 6 and 7 are closed. - 2, 4, A and B are open. 	
5		Carry out calibration. → 58, Section 7.6.2.	<p>Fig. 27: Closed container</p> <p>I Deltabar S PMD75 II Three-valve manifold III Separator 1, 5 Drain valves 2, 4 Inlet valves 3 Equalizing valve 6, 7 Vent valve on Deltabar S A, B Shut-off valve</p>

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). Before calibrating the device, the impulse piping must be cleaned and filled with fluid.
- 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	Initial situation: All valves closed		
2	Open A and B Fill the impulse piping of negative side to the height of the condensate trap.		
3	Open 3.		
4	Open 2	Introduce fluid.	
5	Open 6 and 7 briefly	Vent device.	
6	Close 2; open 4		
7	Open 6 and 7 briefly	Vent device again	
8	Set measuring point to operation. Close 3. Open 2. If necessary, rinse out lines via 1 and 5.		

Fig. 28: Closed container with superimposed steam

- 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

7.6.2 Information on level measurement



- The Flow, Level and Pressure measuring modes each have a quick setup menu which guides you through the most important basic functions. → For the "Level" quick setup menu, see → 60 Section 7.6.4.
- 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. In the "Level Easy Pressure" and "Level Easy Height" level modes, the values entered for EMPTY CALIBRATION/FULL CALIBRATION, EMPTY PRESSURE/FULL PRESSURE, EMPTY HEIGHT/FULL HEIGHT and GET LRV/SET URV must be at least 1% apart. The value will be rejected, and a 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 measuring instrument to be able to 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.
 - Where the device is intended for use as a subsystem in a safety function (SIL), a "device configuration with enhanced parameter security" (SAFETY CONFIRM.) is only possible for the "Level" measuring mode in the "Level Easy Pressure" level mode. All the parameters previously entered are checked after a password is entered. Once the "Level Easy Height" or "Level Standard" mode has been selected, the configuration first has to be reset to the factory setting using the RESET parameter (menu path: (GROUP SELECTION →) OPERATING MENU → OPERATION) with the reset code "7864".
→ For further information, see the Functional Safety Manual Deltabar S.
- For a detailed parameter description and examples of parameters, see the Operating Instructions BA00274P "Cerabar S/Deltabar S/Deltapilot S, Description of device functions".

WARNING

Changing the measuring mode can affect the calibration data!

This situation can result in product overflow.

- ▶ Check the calibration data if the measuring mode is changed.

7.6.3 Overview of level measurement

Measuring task	LEVEL SELECTION/ LEVEL MODE	Measured variable options	Description	Note	Measured value display
The measured variable is in direct proportion to the measured pressure. Calibration is performed by entering two pressure-level value pairs.	LEVEL SELECTION: Level Easy Pressure	Via OUTPUT UNIT parameter: %, level, volume or mass units.	<ul style="list-style-type: none"> - Calibration with reference pressure – wet calibration, see Operating Instructions BA00274P. - Calibration without reference pressure – dry calibration, see Operating Instructions BA00274P. 	<ul style="list-style-type: none"> - Incorrect entries are possible - SIL mode possible - Customized units are not possible 	The measured value display and the LEVEL BEFORE LIN parameter show the measured value.
The measured variable is in direct proportion to the measured pressure. Calibration is performed by entering the density and two height-level value pairs.	LEVEL SELECTION: Level Easy Height	Via OUTPUT UNIT parameter: %, level, volume or mass units.	<ul style="list-style-type: none"> - Calibration with reference pressure – wet calibration, see Operating Instructions BA00274P. - Calibration without reference pressure – dry calibration, see Operating Instructions BA00274P. 	<ul style="list-style-type: none"> - Incorrect entries are possible - SIL mode not possible - Customized units are not possible 	The measured value display and the LEVEL BEFORE LIN parameter show the measured value.
The measured variable is in direct proportion to the measured pressure.	LEVEL SELECTION: Level standard/ LEVEL MODE: Linear	Via the LINEAR MEASURAND parameter: <ul style="list-style-type: none"> - % (level) - Level - Volume - Mass 	<ul style="list-style-type: none"> - Calibration with reference pressure – wet calibration, see Operating Instructions BA00274P. - Calibration without reference pressure – dry calibration, see Operating Instructions BA00274P. 	<ul style="list-style-type: none"> - Incorrect entries are rejected by the device - SIL mode not possible - Customized level, volume and mass units are possible 	The measured value display and the LEVEL BEFORE LIN parameter show the measured value.
The measured variable is not in direct proportion to the measured pressure as, for example, with containers with a conical outlet. A linearization table must be entered for the calibration.	LEVEL SELECTION: Level standard/ LEVEL MODE: Pressure linearized	Via LINd MEASURAND parameter: <ul style="list-style-type: none"> - Pressure + % - Pressure + volume - Pressure + mass 	<ul style="list-style-type: none"> - Calibration with reference pressure: semiautomatic entry of linearization table, see Operating Instructions BA00274P. - Calibration without reference pressure: manual entry of linearization table, see Operating Instructions BA00274P. 	<ul style="list-style-type: none"> - Incorrect entries are rejected by the device - SIL mode not possible - Customized level, volume and mass units are possible 	The measured value display and the TANK CONTENT parameter show the measured value.
<ul style="list-style-type: none"> - Two measured variables are required or - The container shape is given by value pairs, such as height and volume. <p>The 1st measured variable %-height or height must be in direct proportion to the measured pressure. The 2nd measured variable volume, mass or % must not be in direct proportion to the measured pressure. A linearization table must be entered for the 2nd measured variable. The 2nd measured variable is assigned to the 1st measured variable by means of this table.</p>	LEVEL SELECTION: Level standard/ LEVEL MODE: Height linearized	Via COMB. MEASURAND parameter: <ul style="list-style-type: none"> - Height + volume - Height + mass - Height + % - %-Height + volume - %-Height + mass - %-Height + % 	<ul style="list-style-type: none"> - Calibration with reference pressure: wet calibration and semiautomatic entry of linearization table, see Operating Instructions BA00274P. - Calibration without reference pressure: dry calibration and manual entry of linearization table, see Operating Instructions BA00274P. 	<ul style="list-style-type: none"> - Incorrect entries are rejected by the device - SIL mode not possible - Customized level, volume and mass units are possible 	<p>The measured value display and the TANK CONTENT parameter display the 2nd measured value (volume, mass or %).</p> <p>The LEVEL BEFORE LIN parameter displays the 1st measured value (%-height or height).</p>

7.6.4 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 and CALIBRATION MODE parameters in the BASIC SETTINGS function group,
 (menu path: (GROUP SELECTION →) OPERATING MENU → SETTINGS → BASIC SETTINGS).
- 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
 - SET LRV (BASIC SETTINGS group): 0.0 (corresponds to 4 mA value)
 - SET URV (BASIC SETTINGS group): 100.0 (corresponds to 20 mA value).
- 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 BA00274P.

⚠ WARNING



Changing the measuring mode can affect the calibration data!

This situation can result in product overflow.

- ▶ Check the calibration data if the measuring mode is changed.

Onsite operation	Digital communication
Measured value display Switch from the measured value display to the GROUP SELECTION with  .	See BA00274P.
GROUP SELECTION Select MEASURING MODE.	
MEASURING MODE Select "Level" option.	
LEVEL SELECTION Select level mode. For an overview →  59.	
GROUP SELECTION Select the QUICK SETUP menu.	
POS. ZERO ADJUST Due to the 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 CALIBRATION ¹⁾ (set the corresponding level) Enter level value for the lower calibration point. For this parameter, enter a level value which is assigned to the pressure present at the device.	
FULL CALIBRATION ¹⁾ (set the corresponding level) Enter level value 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 current output, 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 →  35, Section 6.2.3 "Function of the operating elements – onsite display connected" and →  40, Section 6.4 "Onsite operation – onsite display connected".

7.7 Differential pressure measurement

7.7.1 Preliminaries



- 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	Initial situation: All valves closed		
2	Open 3		
3	Open A and B		
4	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.		
	Open 1 and 5. ¹	Blow out/rinse out impulse piping.	
	Close 1 and 5. ¹	Close valves after cleaning.	
5	Open 2	Introduce fluid.	
6	Open 6 and 7 briefly	Vent device.	
7	Close 2; open 4		
8	Open 6 and 7 briefly	Vent device again	
9	Set measuring point to operation.		
	Close 3.		
	Open 2.		

Fig. 29: 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

7.7.2 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. You specify which Quick Setup menu should be displayed with the setting in the MEASURING MODE parameter. Select → 49 Section 7.3 Selecting language and measuring mode.
- For a detailed parameter description, see the Operating Instructions BA00274P "Cerabar S/Deltabar S/Deltapilot S, Description of device functions"
 - Table 6, POSITION ADJUSTMENT
 - Table 7, BASIC SETUP
 - Table 15, EXTENDED SETUP
- For differential pressure measurement, select the "Pressure" option by means of the MEASURING MODE parameter. The operating menu is then structured according to the measuring mode that is selected.

▲ WARNING

Changing the measuring mode can affect the calibration data!

This situation can result in product overflow.

- ▶ Check the calibration data if the measuring mode is changed.

7.7.3 Quick Setup menu for the "Pressure" measuring mode

Onsite operation	Digital communication
<p>Measured value display Switch from the measured value display to the GROUP SELECTION with </p>	See BA00274P.
<p>GROUP SELECTION Select the MEASURING MODE parameter.</p>	
<p>MEASURING MODE Select "Pressure" option.</p>	
<p>GROUP SELECTION Select the QUICK SETUP menu.</p>	
<p>POS. ZERO ADJUST Due to the 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.</p>	
<p>SET LRV Set the measuring range (enter 4 mA value). Enter the pressure value for the lower current value (4 mA value). No reference pressure must be present at the device.</p>	
<p>SET URV Set the measuring range (enter 20 mA value). Enter the pressure value for the upper current value (20 mA value). No reference pressure must be present at the device.</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 current output, react to a change in the pressure.</p>	

For onsite operation, see also → 35, Section 6.2.3 "Function of the operating elements – onsite display connected" and → 40, Section 6.4 "Onsite operation – onsite display connected".

8 Maintenance

Deltabar S requires no maintenance.

8.1 Cleaning instructions

Endress+Hauser provides flushing rings as an accessory to enable cleaning of the process membrane without removing the transmitter from the process.


For further information, please contact your local Endress+Hauser Sales Center.

8.1.1 Deltabar FMD77, FMD78

Frequent use of SIP cleaning increases the stress and strain on the process membrane. Under unfavorable conditions, frequent changes of temperature can lead to process membrane material fatigue and potentially leaks over the long term.

8.2 External cleaning

Please note the following points when cleaning the measuring instrument:

- The cleaning agents used should not corrode the surface and the seals.
- Mechanical damage to the process membrane, e.g. due to pointed objects, must be avoided.
- Observe the degree of protection of the device. See the nameplate if necessary (→  8).

9 Troubleshooting

9.1 Messages

The following table lists all the possible messages that can occur.

The device differentiates between the error types "Alarm", "Warning" and "Error". You may specify whether the device should react as if for an "Alarm" or "Warning" for "Error" messages. → See "Message type/NA 64" column and Section 9.2 "Response of outputs to errors".

In addition, the "Message type/NA 64" column classifies the messages in accordance with NAMUR Recommendation NA 64:

- Breakdown: indicated with "B"
- Maintenance needed: indicated with "C" (check request)
- Function check: indicated with "T" (in service)

Error message display on the onsite display:

- The measured value display shows the message with the highest priority. → See the "Priority" column.
- The ALARM STATUS parameter shows all the messages present in descending order of priority. You can scroll through all the messages pending using the \boxplus or \boxminus key.

Message display via digital communication:

- The ALARM STATUS parameter shows the message with the highest priority. → See the "Priority" column.



- If the device detects a defect in the onsite display during initialization, special error messages are generated. → For the error messages → 72, Section 9.1.1 "Onsite display error messages".
- For support and further information, please contact Endress+Hauser Service.
- → See also Section 9.4 ff.

Code	Error type/ NA 64	Corre- sponds to NE 107	Message/description	Cause	Measure	Pri- ority
101 (A101)	Alarm B	Failure (F)	B>Sensor electronic EEPROM error	<ul style="list-style-type: none"> - Electromagnetic effects are greater than specifications in the technical data. (→ See Section 10.) This message normally only appears briefly. - Sensor defect. 	<ul style="list-style-type: none"> - Wait a few minutes. - Restart the device. Perform reset (Code 62). - Block off electromagnetic effects or eliminate source of disturbance. - Replace sensor. 	17
102 (W102)	Warning C	Mainte- nance required (M)	C>Checksum error in EEPROM: peakhold segment	<ul style="list-style-type: none"> - Main electronics defect. Correct measurement can continue as long as you do not need the peak hold indicator function. 	<ul style="list-style-type: none"> - Replace main electronics. 	53
106 (W106)	Warning C	Function check (C)	C>Downloading - please wait	<ul style="list-style-type: none"> - Downloading. 	<ul style="list-style-type: none"> - Wait for download to complete. 	52
110 (A110)	Alarm B	Failure (F)	B>Checksum error in EEPROM: configura- tion segment	<ul style="list-style-type: none"> - The supply voltage is discon- nected when writing. - Electromagnetic effects are greater than specifications in the technical data. (→ See Section 10.) - Main electronics defect. 	<ul style="list-style-type: none"> - Reestablish supply voltage. If necessary, perform reset (code 7864) and recalibrate the device. - Block off electromagnetic effects or eliminate sources of disturbance. - Replace main electronics. 	6

Code	Error type/ NA 64	Corre- sponds to NE 107	Message/description	Cause	Measure	Pri- ority
113 (A113)	Alarm B	Failure (F)	B>ROM failure in transmitter electronic.	- Main electronics defect.	- Replace main electronics.	1
115 (E115)	Error B Factory setting: Warning C	Out of specification (S)	B>Sensor overpressure	- Overpressure present. - Sensor defect.	- Reduce pressure until message disappears. - Replace sensor.	29
116 (W116)	Warning C	Maintenance required (M)	C>Download error, repeat download	- The file is corrupt. - During the download, the data are not correctly transmitted to the processor, e.g. due to open cable connections, spikes (ripple) on the supply voltage or electromagnetic effects.	- Use another file. - Check cable connection PC – transmitter. - Block off electromagnetic effects or eliminate sources of disturbance. - Perform reset (code 7864) and recalibrate the device. - Repeat download.	36
120 (E120)	Error B Factory setting: Warning C	Out of specification (S)	B>Sensor low pressure	- Pressure too low. - Sensor defect.	- Increase pressure until message disappears. - Replace sensor.	30
121 (A121)	Alarm B	Failure (F)	B>Checksum error in factory segment of EEPROM	- Main electronics defect.	- Replace main electronics.	5
122 (A122)	Alarm B	Failure (F)	B>Sensor not connected	- Cable connection sensor –main electronics disconnected. - Electromagnetic effects are greater than specifications in the technical data. (→ See Section 10.) - Main electronics defect. - Sensor defect.	- Check cable connection and repair if necessary. - Block off electromagnetic effects or eliminate source of disturbance. - Replace main electronics. - Replace sensor.	13
130 (A130)	Alarm B	Failure (F)	B>EEPROM is defective.	- Main electronics defect.	- Replace main electronics.	10
131 (A131)	Alarm B	Failure (F)	B>Checksum error in EEPROM: min/max segment	- Main electronics defect.	- Replace main electronics.	9
132 (A132)	Alarm B	Failure (F)	B>Checksum error in totalizer EEPROM	- Main electronics defect.	- Replace main electronics.	7
133 (A133)	Alarm B	Failure (F)	B>Checksum error in History EEPROM	- An error occurred when writing. - Main electronics defect.	- Perform reset (code 7864) and recalibrate the device. - Replace main electronics.	8
602 (W602)	Warning C	Function check (C)	C>Linearization curve not monotone	- The linearization table is not monotonically increasing or decreasing.	- Add to or correct linearization table. Then accept linearization table again.	57

Code	Error type/ NA 64	Corre- sponds to NE 107	Message/description	Cause	Measure	Pri- ority
604 (W604)	Warning C	Function check (C)	C>Linearization table not valid. Less than 2 points or points too close	From software version "02.10.xx" onwards, there is no min. span for the Y-points. <ul style="list-style-type: none"> - The linearization table consists of less than 2 points. - At least 2 points in the linearization table are too close together. A minimum gap of 0.5 % of the distance between two points must be maintained. Spans for the "Pressure linearized" option: HYDR. PRESS MAX. - HYDR. PRESS MIN.; TANK CONTENT MAX. - TANK CONTENT MIN. Spans for the "Height linearized" option: LEVEL MAX - LEVEL MIN; TANK CONTENT MAX. - TANK CONTENT MIN. 	<ul style="list-style-type: none"> - Add to linearization table. Accept linearization table again if necessary. - Correct linearization table and accept again. 	58
613 (W613)	Warning I	Function check (C)	I>Simulation is active	<ul style="list-style-type: none"> - Simulation is switched on, i.e. the device is not measuring at present. 	<ul style="list-style-type: none"> - Switch off simulation. 	60
620 (E620)	Error C Factory set- ting: Warning C	Out of spec- ification (S)	C>Current output out of range	The current is outside the permitted range from 3.8 to 20.5 mA. <ul style="list-style-type: none"> - The pressure value is outside the configured measuring range (but may be within the sensor range). - Loose connection at sensor cable 	<ul style="list-style-type: none"> - Check pressure applied, reconfigure measuring range if necessary. (→ See Operating Instructions BA00274P) - Perform reset (code 7864) and recalibrate the device. - Wait a short period of time and tighten the connection, or avoid loose connection. 	49
700 (W700)	Warning C	Mainte- nance required (M)	C>Last configuration not stored	<ul style="list-style-type: none"> - An error occurred when writing or reading configuration data or the power supply was disconnected. - Main electronics defect. 	<ul style="list-style-type: none"> - Perform reset (code 7864) and recalibrate the device. - Replace main electronics. 	54
701 (W701)	Warning C	Function check (C)	C>Measuring chain config. exceeds sensor range	<ul style="list-style-type: none"> - The calibration carried out would cause the sensor nominal range to be exceeded or undershot. 	<ul style="list-style-type: none"> - Carry out calibration again. 	50
702 (W702)	Warning C	Mainte- nance required (M)	C>HistoROM data not consistent	<ul style="list-style-type: none"> - Data were not written correctly to the HistoROM, e.g. if the HistoROM was detached during the writing process. - HistoROM does not have any data. 	<ul style="list-style-type: none"> - Repeat upload. - Perform reset (code 7864) and recalibrate the device. - Copy suitable data to the HistoROM. (→ See also → 44, Section 6.5.1 "Copying configuration data".) 	55
703 (A703)	Alarm B	Failure (F)	B>Measurement error	<ul style="list-style-type: none"> - Fault in the main electronics. - Main electronics defect. 	<ul style="list-style-type: none"> - Briefly disconnect device from the power supply. - Replace main electronics. 	22
704 (A704)	Alarm B	Function check (C)	B>Measurement error	<ul style="list-style-type: none"> - Fault in the main electronics. - Main electronics defect. 	<ul style="list-style-type: none"> - Briefly disconnect device from the power supply. - Replace main electronics. 	12
705 (A705)	Alarm B	Failure (F)	B>Measurement error	<ul style="list-style-type: none"> - Fault in the main electronics. - Main electronics defect. 	<ul style="list-style-type: none"> - Briefly disconnect device from the power supply. - Replace main electronics. 	21

Code	Error type/ NA 64	Corre- sponds to NE 107	Message/description	Cause	Measure	Pri- ority
706 (W706)	Warning C	Mainte- nance required (M)	C>Configuration in HistoROM and device not identical.	<ul style="list-style-type: none"> - Configuration (parameters) in the HistoROM and in the device is not identical. 	<ul style="list-style-type: none"> - Copy data from the device to the HistoROM. (→ 44, Section 6.5.1 "Copying configuration data".) - Copy data from the HistoROM to the device. (→ 44Section 6.5.1 "Copying configuration data") The message remains if the HistoROM and the device have different software versions. The message goes out if you copy the data from the device to the HistoROM. - Device reset codes such as 7864 do not have any effect on the HistoROM. That means that if you perform a reset, the configurations in the HistoROM and in the device may not be the same. 	59
707 (A707)	Alarm B	Function check (C)	B>X-VAL. of lin. table out of edit limits	<ul style="list-style-type: none"> - At least one X-VALUE in the linearization table is either below the value for HYDR. PRESS MIN. or MIN. LEVEL or above the value for HYDR. PRESS. MAX. or LEVEL MAX. 	<ul style="list-style-type: none"> - Carry out calibration again. (→ See Operating Instructions BA00274P) 	38
710 (W710)	Warning C	Function check (C)	B>Set span too small. Not allowed	<ul style="list-style-type: none"> - Values for calibration (e.g. lower range value and upper range value) are too close together. - The sensor was replaced and the customer-specific configuration does not suit the sensor. - Unsuitable download carried out. 	<ul style="list-style-type: none"> - Adjust calibration to suit sensor. (→ See also Operating Instructions BA00274P, parameter description MINIMUM SPAN) - Adjust calibration to suit sensor. - Replace sensor with a suitable sensor. - Check configuration and perform download again. 	51
711 (A711)	Alarm B	Function check (C)	B>LRV or URV out of edit limits	<ul style="list-style-type: none"> - Lower range value and/or upper range value exceed or fall below the sensor range limits. - The sensor was replaced and the customer-specific configuration does not suit the sensor. - Unsuitable download carried out. 	<ul style="list-style-type: none"> - Reconfigure lower range value and/or upper range value to suit the sensor. Pay attention to position adjustment. - Reconfigure lower range value and/or upper range value to suit the sensor. Pay attention to position adjustment. - Replace sensor with a suitable sensor. - Check configuration and perform download again. 	37
713 (A713)	Alarm B	Function check (C)	B>100% POINT level out of edit limits	<ul style="list-style-type: none"> - The sensor was replaced. 	<ul style="list-style-type: none"> - Carry out calibration again. 	39
715 (E715)	Error C Factory set- ting: Warning C	Out of spec- ification (S)	C>Sensor over temperature	<ul style="list-style-type: none"> - The temperature measured in the sensor is higher than the upper nominal temperature of the sensor. (→ See also Operating Instructions BA00274P, Tmax SENSOR parameter description) - Unsuitable download carried out. 	<ul style="list-style-type: none"> - Reduce process temperature/ ambient temperature. - Check configuration and perform download again. 	32

Code	Error type/ NA 64	Corre- sponds to NE 107	Message/description	Cause	Measure	Pri- ority
716 (E716)	Error B Factory set- ting: Alarm B	Failure (F)	B>Process membrane broken	– Sensor defect.	– Replace sensor. – Reduce the pressure.	24
717 (E717)	Error C Factory set- ting: Warning C	Out of spec- ification (S)	C>Transmitter over temperature	– The temperature measured in the electronics is greater than the upper nominal temperature of the electronics (+88 °C (+190 °F)). – Unsuitable download carried out.	– Reduce ambient temperature. – Check configuration and perform download again.	34
718 (E718)	Error C Factory set- ting: Warning C	Out of spec- ification (S)	C>Transmitter under temperature	– The temperature measured in the electronics is less than the lower nominal temperature of the elec- tronics (–43 °C (–45 °F)). – Unsuitable download carried out.	– Increase ambient temperature. Insulate device if necessary. – Check configuration and perform download again.	35
719 (A719)	Alarm B	Function check (C)	B>Y-VAL of lin. table out of edit limits	– At least one Y-VALUE in the lin- earization table is below the MIN. TANK CONTENT or above the MAX. TANK CONTENT.	– Carry out calibration again. (→ See Operating Instructions BA00274P)	40
720 (E720)	Error C Factory set- ting: Warning C	Out of spec- ification (S)	C>Sensor under tem- perature	– The temperature measured in the sensor is less than the lower nominal temperature of the sensor. (→ See also Operating Instructions BA00274P, parameter description Tmin SENSOR) – Unsuitable download carried out. – Loose connection at sensor cable	– Increase process temperature/ ambient temperature. – Check configuration and perform download again. – Wait a short period of time and tighten the connection, or avoid loose connection.	33
721 (A721)	Alarm B	Function check (C)	B>ZERO POSITION level out of edit limits	– LEVEL MIN or LEVEL MAX has been changed.	– Perform reset (code 2710) and recalibrate the device.	41
722 (A722)	Alarm B	Function check (C)	B>EMPTY CALIB. or FULL CALIB. out of edit limits	– LEVEL MIN or LEVEL MAX has been changed.	– Perform reset (code 2710) and recalibrate the device.	42
723 (A723)	Alarm B	Function check (C)	B>MAX. FLOW out of edit limits	– FLOW-MEAS. TYPE has been changed.	– Carry out calibration again.	43
725 (A725)	Alarm B	Failure (F)	B>Sensor connection error, cycle disturbance	– Electromagnetic effects are greater than specifications in the technical data. (→ See Section 10.) – Setscrew loose. – Sensor or main electronics defect.	– Block off electromagnetic effects or eliminate source of disturbance. – Retighten setscrew with 1 Nm (0.74 lbf ft) (see Section 4.3.10). – Replace sensor or main elec- tronics.	25

Code	Error type/ NA 64	Corre- sponds to NE 107	Message/description	Cause	Measure	Pri- ority
726 (E726)	Error C Factory set- ting: Alarm C	Out of spec- ification (S)	C>Sensor temperature error - overrange	<ul style="list-style-type: none"> - Electromagnetic effects are greater than specifications in the technical data. (→ See Section 10.) - Process temperature is outside permitted range. - Sensor defect. 	<ul style="list-style-type: none"> - Block off electromagnetic effects or eliminate source of disturbance. - Check temperature present, reduce or increase if necessary. - If the process temperature is within the permitted range, replace sensor. 	31
727 (E727)	Error C Factory set- ting: Warning C	Out of spec- ification (S)	C>Sensor pressure error - overrange	<ul style="list-style-type: none"> - Electromagnetic effects are greater than specifications in the technical data. (→ See Section 10.) - Pressure is outside permitted range. - Sensor defect. 	<ul style="list-style-type: none"> - Block off electromagnetic effects or eliminate source of disturbance. - Check pressure present, reduce or increase if necessary. - If the pressure is within the permitted range, replace sensor. 	28
728 (A728)	Alarm B	Failure (F)	B>RAM error	<ul style="list-style-type: none"> - Fault in the main electronics. - Main electronics defect. 	<ul style="list-style-type: none"> - Briefly disconnect device from the power supply. - Replace main electronics. 	2
729 (A729)	Alarm B	Failure (F)	B>RAM error	<ul style="list-style-type: none"> - Fault in the main electronics. - Main electronics defect. 	<ul style="list-style-type: none"> - Briefly disconnect device from the power supply. - Replace main electronics. 	3
730 (E730)	Error C Factory set- ting: Warning C	Out of spec- ification (S)	C>LRV user limits exceeded	<ul style="list-style-type: none"> - Pressure measured value has undershot the value specified for the Pmin ALARM WINDOW parameter. - Loose connection at sensor cable 	<ul style="list-style-type: none"> - Check system/pressure measured value. - Change value for Pmin ALARM WINDOW if necessary. (→ See also Operating Instructions BA00274P, parameter description Pmin ALARM WINDOW) - Wait a short period of time and tighten the connection, or avoid loose connection. 	46
731 (E731)	Error C Factory set- ting: Warning C	Out of spec- ification (S)	C>URV user limits exceeded	<ul style="list-style-type: none"> - Pressure measured value has overshoot the value specified for the Pmax ALARM WINDOW parameter. 	<ul style="list-style-type: none"> - Check system/pressure measured value. - Change value for Pmax ALARM WINDOW if necessary. (→ See also Operating Instructions BA00274P, parameter description Pmax ALARM WINDOW) 	45
732 (E732)	Error C Factory set- ting: Warning C	Out of spec- ification (S)	C>LRV Temp. User limits exceeded	<ul style="list-style-type: none"> - Temperature measured value has undershot the value specified for the Tmin ALARM WINDOW parameter. - Loose connection at sensor cable 	<ul style="list-style-type: none"> - Check system/temperature measured value. - Change value for Tmin ALARM WINDOW if necessary. (→ See also Operating Instructions BA00274P, parameter description Tmin ALARM WINDOW) - Wait a short period of time and tighten the connection, or avoid loose connection. 	48
733 (E733)	Error C Factory set- ting: Warning C	Out of spec- ification (S)	C>URV Temp. User lim- its exceeded	<ul style="list-style-type: none"> - Temperature measured value has overshoot the value specified for the Tmax ALARM WINDOW parameter. 	<ul style="list-style-type: none"> - Check system/temperature measured value. - Change value for Tmax ALARM WINDOW if necessary. (→ See also Operating Instructions BA00274P, parameter description Tmax ALARM WINDOW) 	47

Code	Error type/ NA 64	Corre- sponds to NE 107	Message/description	Cause	Measure	Pri- ority
736 (A736)	Alarm B	Failure (F)	B>RAM error	<ul style="list-style-type: none"> - Fault in the main electronics. - Main electronics defect. 	<ul style="list-style-type: none"> - Briefly disconnect device from the power supply. - Replace main electronics. 	4
737 (A737)	Alarm B	Failure (F)	B>Measurement error	<ul style="list-style-type: none"> - Fault in the main electronics. - Main electronics defect. 	<ul style="list-style-type: none"> - Briefly disconnect device from the power supply. - Replace main electronics. 	20
738 (A738)	Alarm B	Failure (F)	B>Measurement error	<ul style="list-style-type: none"> - Fault in the main electronics. - Main electronics defect. 	<ul style="list-style-type: none"> - Briefly disconnect device from the power supply. - Replace main electronics. 	19
739 (A739)	Alarm B	Failure (F)	B>Measurement error	<ul style="list-style-type: none"> - Fault in the main electronics. - Main electronics defect. 	<ul style="list-style-type: none"> - Briefly disconnect device from the power supply. - Replace main electronics. 	23
740 (E740)	Error C Factory set- ting: Warning C	Mainte- nance required (M)	C>Calculation over- flow, bad configura- tion, hardware defect	<ul style="list-style-type: none"> - Level measuring mode: the mea- sured pressure has undershot the value for HYDR. PRESS. MIN. or overshot the value for HYDR. PRESS. MAX. - Level measuring mode: the mea- sured level did not reach the LEVEL MIN value or exceeded the LEVEL MAX value. - Flow measuring mode: the mea- sured pressure has undershot the value for MAX. PRESS FLOW. 	<ul style="list-style-type: none"> - Check configuration and carry out calibration again if neces- sary. - Select a device with a suitable measuring range. - Check configuration and carry out calibration again if neces- sary. (→ See also Operating Instructions BA00274P, parameter description LEVEL MIN.) - Check configuration and carry out calibration again if neces- sary. - Select a device with a suitable measuring range. 	27
741 (A741)	Alarm B	Function check (C)	B>TANKHEIGHT out of edit limits	<ul style="list-style-type: none"> - LEVEL MIN or LEVEL MAX has been changed. 	<ul style="list-style-type: none"> - Perform reset (code 2710) and recalibrate the device. 	44
742 (A742)	Alarm B	Failure (F)	B>Sensor connection error (upload)	<ul style="list-style-type: none"> - Electromagnetic effects are greater than specifications in the technical data. (→ See Section 10.) This message normally only appears briefly. - Cable connection sensor –main electronics disconnected. - Sensor defect. 	<ul style="list-style-type: none"> - Wait a few minutes. - Perform reset (code 7864) and recalibrate the device. - Check cable connection and repair if necessary. - Replace sensor. 	18
743 (A743)	Alarm B	Failure (F)	B>Electronic PCB error during initialization	<ul style="list-style-type: none"> - Electromagnetic effects are greater than specifications in the technical data. (→ See Section 10.) This message normally only appears briefly. - Main electronics defect. 	<ul style="list-style-type: none"> - Wait a few minutes. - Restart the device. Perform reset (Code 62). - Replace main electronics. 	14
744 (A744)	Alarm B	Failure (F)	B>Main electronic PCB error	<ul style="list-style-type: none"> - Electromagnetic effects are greater than specifications in the technical data. (→ See Section 10.) - Main electronics defect. 	<ul style="list-style-type: none"> - Restart the device. Perform reset (Code 62). - Block off electromagnetic effects or eliminate source of disturbance. - Replace main electronics. 	11
745 (W745)	Warning C	Mainte- nance required (M)	C>Sensor data unknown	<ul style="list-style-type: none"> - Sensor does not suit the device (electronic sensor nameplate). Device continues measuring. 	<ul style="list-style-type: none"> - Replace sensor with a suitable sensor. 	56

Code	Error type/ NA 64	Corre- sponds to NE 107	Message/description	Cause	Measure	Pri- ority
746 (W746)	Warning C	Function check (C)	C>Sensor connection error - initializing	<ul style="list-style-type: none"> - Electromagnetic effects are greater than specifications in the technical data. (→ See Section 10.) This message normally only appears briefly. - Overpressure or negative pressure present. 	<ul style="list-style-type: none"> - Wait a few minutes. - Restart the device. Perform reset (Code 7864). - Block off electromagnetic effects or eliminate source of disturbance. - Reduce or increase pressure. 	26
747 (A747)	Alarm B	Failure (F)	B>Sensor software not compatible to electronics	<ul style="list-style-type: none"> - Sensor does not suit the device (electronic sensor nameplate). 	<ul style="list-style-type: none"> - Replace sensor with a suitable sensor. 	16
748 (A748)	Alarm B	Failure (F)	B>Memory failure in signal processor	<ul style="list-style-type: none"> - Electromagnetic effects are greater than specifications in the technical data. (→ See Section 10.) - Main electronics defect. 	<ul style="list-style-type: none"> - Block off electromagnetic effects or eliminate source of disturbance. - Replace main electronics. 	15



9.1.1 Onsite display error messages

If the device detects a defect in the onsite display during initialization, the following error messages can be displayed:

Message	Measure
Initialization, VU Electr. Defect A110	Replace onsite display.
Initialization, VU Electr. Defect A114	
Initialization, VU Electr. Defect A281	
Initialization, VU Checksum Err. A110	
Initialization, VU Checksum Err. A112	
Initialization, VU Checksum Err. A171	
Initialization	Supply voltage too low. Set supply voltage to the correct value.

9.2 Response of outputs to errors

The device differentiates between the message types "Alarm", "Warning" and "Error".
 → See the following table and → 65, Section 9.1 "Messages".

Output	A (Alarm)	W (Warning)	E (Error: Alarm/Warning)
Current output	<ul style="list-style-type: none"> - Device does not continue measuring. - The current output assumes the value specified via the OUTPUT FAIL MODE¹⁾, ALT. CURR. OUTPUT¹⁾ and SET MAX. ALARM.¹⁾. → See also the following section "Configuring current output for an alarm". 	Device continues measuring.	For this error, you can enter whether the device should react as in the event of an alarm or as in the event of a warning. See corresponding "Alarm" or "Warning" column. (→ See also Operating Instructions BA00274P, parameter description SELECT ALARM TYPE)
Bar graph (onsite display)	The bar graph adopts the value defined by the OUTPUT FAIL MODE ¹⁾ parameter.	The bar graph adopts the value which corresponds to the current value.	See this table, "Alarm" or "Warning" column, depending on the option selected.
Onsite display	<ul style="list-style-type: none"> - The measured value and message are displayed alternately - Measured value display:  -symbol is permanently displayed. Message display <ul style="list-style-type: none"> - 3-digit number such as A122 and description 	<ul style="list-style-type: none"> - The measured value and message are displayed alternately - Measured value display:  -symbol flashes. Message display: <ul style="list-style-type: none"> - 3-digit number such as W613 and description 	<ul style="list-style-type: none"> - The measured value and message are displayed alternately - Measured value display: see corresponding "Alarm" or "Warning" column Message display: <ul style="list-style-type: none"> - 3-digit number such as E731 and description
Remote operation (digital communication)	In the case of an alarm, the ALARM STATUS ²⁾ parameter displays a 3-digit number such as 122 for "Sensor connection error, incorrect data."	In the case of a warning, the ALARM STATUS ²⁾ parameter displays a 3-digit number such as 613 for "Simulation is active".	In the case of an error, the ALARM STATUS ²⁾ parameter displays a 3-digit number such as 731 for "Pmax ALARM WINDOW undershot".

- 1) Menu path: (GROUP SELECTION → OPERATING MENU → OUTPUT
- 2) Menu path: (GROUP SELECTION →) OPERATING MENU → MESSAGES

9.2.1 Configuring current output for an alarm

You can configure the current output for the event of an alarm by means of the OUTPUT FAIL MODE, ALT. CURR. OUTPUT and SET MAX. ALARM parameters. These parameters are displayed in the OUTPUT group ((GROUP SELECTION →) OPERATING MENU → OUTPUT).

In the event of an alarm, the current and the bar graph assume the value entered with the OUTPUT FAIL MODE parameter.

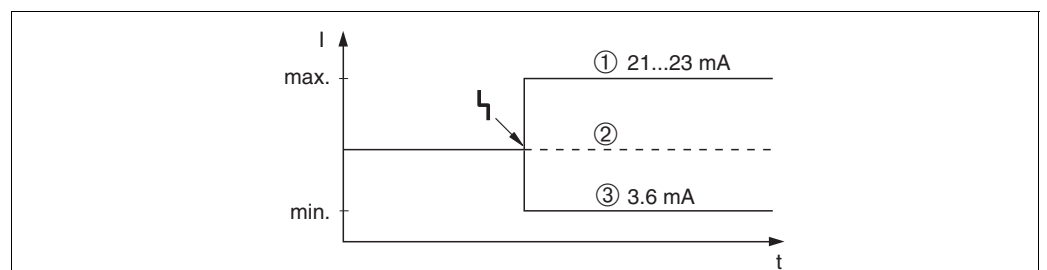


Fig. 30: Current output in the event of an alarm

Options:

- 1 Max. alarm (110%): can be set between 21 and 23 mA via the SET MAX. ALARM parameter
- 2 Hold meas. value: last measured value is kept
- 3 Min. Alarm (-10%): 3.6 mA

Factory setting:

- OUTPUT FAIL MODE = max. alarm (110%)
- SET MAX. ALARM = 22 mA

Use the ALT. CURR. OUTPUT parameter to set the current output value for the error messages E 120 "Sensor low pressure" and E 115 "Sensor overpressure". You have the following options:

- Normal/NE43: the current output assumes the value set via the OUTPUT FAIL MODE and SET MAX. ALARM parameters.
- Special
 - Lower sensor limit undershot (E 120 "Sensor low pressure"): 3.6 mA
 - Upper sensor limit overshoot (E 115 "Sensor overpressure"): current output assumes the value set via the SET MAX ALARM parameter.

Note:

When using the case "special", the behavior is limited to an over/underpressure in a range LRL -10% up to LRL -30% and URL +10% up to URL +30%.

Factory setting:

- ALT. CURR. OUTPUT: Normal/NE43



9.3 Confirming messages

Depending on the settings for the ALARM DISPL. TIME and ACK. ALARM MODE parameters, the following measures should be taken to clear a message:

Settings ¹⁾	Measures
<ul style="list-style-type: none"> - ALARM DISPLAY TIME = 0 s - ACK. ALARM MODE = off 	<ul style="list-style-type: none"> - Rectify cause of the message (see also Section 9.1).
<ul style="list-style-type: none"> - ALARM DISPL. TIME > 0 s - ACK. ALARM MODE = off 	<ul style="list-style-type: none"> - Rectify cause of the message (see also Section 9.1). - Wait for the alarm display time to elapse.
<ul style="list-style-type: none"> - ALARM DISPLAY TIME = 0 s - ACK. ALARM MODE = on 	<ul style="list-style-type: none"> - Rectify cause of the message (see also Section 9.1). - Confirm message using ACK. ALARM parameter.
<ul style="list-style-type: none"> - ALARM DISPL. TIME > 0 s - ACK. ALARM MODE = on 	<ul style="list-style-type: none"> - Rectify cause of the message (see also Section 9.1). - Confirm message using ACK. ALARM parameter. - Wait for the alarm display time to elapse. If a message appears and the alarm display time elapses before the message has been acknowledged, the message will be cleared once it has been acknowledged.


1) Menu path for ALARM DISPL. TIME and ACK. ALARM MODE:
(GROUP SELECTION →) OPERATING MENU → DIAGNOSTICS → MESSAGES

If the onsite display displays a message, you can suppress it with the  key.

If there are several messages, the onsite display shows the message which has the highest priority (Section 9.1). Once you have suppressed this message using the  key, the message with the next highest priority is displayed. You can use the  key to suppress each message, one after the other.

The ALARM STATUS parameter continues to display all the messages present.

9.4 Repair

The Endress+Hauser repair concept provides for measuring instruments to have a modular design and that the customer can also carry out repairs (→  75 "Spare parts").

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

9.5 Repairs to Ex-approved devices

WARNING

Incorrect repair can compromise electrical safety!

Explosion hazard!

When repairing Ex-certified devices, please note the following:

- Repairs to Ex-certified devices must be carried out by Endress+Hauser Service or by specialist personnel according to national regulations.
- 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. Only replace parts with identical parts.
- Electronic inserts or sensors already in use in a standard instrument may not be used as spare parts for a certified device.
- Carry out repairs according to the instructions. After repairs, the device must fulfill the requirements of the specified individual tests.
- A certified device may only be converted into another certified variant by Endress+Hauser.

9.6 Spare parts

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



Measuring instrument serial number:

- Located on the device and spare part nameplate.
- Can be read out via the "DEVICE SERIAL NO." parameter in the "TRANSMITTER DATA" submenu.

9.7 Return

The measuring instrument must be returned if it is in need of repair or a factory calibration, or if the wrong measuring instrument has been delivered or ordered. Legal specifications require Endress+Hauser, as an ISO-certified company, to follow certain procedures when handling products that are in contact with the medium.

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.

9.8 Disposal

When disposing, ensure that the materials of the device components are separated and processed accordingly.

9.9 Software history

Date	Software version	Changes to the software
11.2003	01.00.zz	Original software. Compatible with: <ul style="list-style-type: none"> - ToF Tool Field Tool Package, version 1.04.00 or higher - Commuwin II version 2.08.-1, Update G or higher - HART Communicator DXR375 with Device Rev.: 10, DD Rev.: 1
06.2004	02.00.zz	<ul style="list-style-type: none"> - Number of parameters in the Quick Setup menus has been reduced. - Onsite operation: LANGUAGE and MEASURING MODE parameters have been moved to the top level. - New SAFETY CONFIRM. group implemented for SIL. → See also Safety Manual Deltabar S. - MEASURING MODE "Level", LEVEL MODE "Linear": AREA UNIT and TANK SECTION parameters have been replaced with the TANK VOLUME and TANK HEIGHT parameters. - Function of the UNIT FLOW parameter has been split across four parameters. - Function of the SIMULATED VALUE parameter has been split across six parameters. - SENSOR TRIM and CURRENT TRIM groups have been removed. - Sensor adapt reset, code 1209 and sensor calibration reset, code 2509 have been removed. - Quick Setup menus are available via ToF Tool Compatible with: <ul style="list-style-type: none"> - ToF Tool Field Tool Package version 2.00.00 or higher - Commuwin II version 2.08.-1, Update G or higher - HART Communicator DXR375/475 with Device Rev.: 20, DD Rev.: 1
06.2005	02.01.zz	<ul style="list-style-type: none"> - Operating keys also integrated on the optional onsite display. - Chinese and Japanese are available as the menu language on request. Compatible with: <ul style="list-style-type: none"> - ToF Tool Field Tool Package version 3.00.00 or higher - FieldCare Version 2.01.00, DTM Library Version 2.06.00, DTM: Deltabar S/MD7x/VO2.00 V 1.4.98.74* - HART Communicator DXR375/475 with Device Rev.: 20, DD Rev.: 1* * Menu languages Chinese and Japanese not selectable
06.2006	02.10.zz	<ul style="list-style-type: none"> - New "Level easy pressure" and "Level easy height" level modes implemented. New LEVEL SELECTION parameter implemented. - DOWNLOAD FUNCTION parameter added to OPERATION group. - SAFETY CONFIRM group extended for the "Level" measuring mode in the "Level Easy Pressure" level selection. → See also Safety Manual Deltabar S. - Factory setting for the "Error" messages redefined. - Chinese and Japanese included as menu languages by default. Compatible with: <ul style="list-style-type: none"> - ToF Tool Field Tool Package version 4.0 - FieldCare version 2.02.00 - HART Communicator DXR375/475 with Device Rev.: 21, DD Rev.: 1
01.2013	02.11.zz	"Russian" is included as a menu language by default. The menu language "Nederlands" is no longer supported.
06.2014	02.20.zz	HART7 protocol revision has been implemented.
10.2017	02.30.zz	Improvement of safety confirmation and menus in FieldCare and HART handheld terminal.

10 Technical data

For technical data, please refer to Technical Information Deltabar S TI00382P.

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