



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services

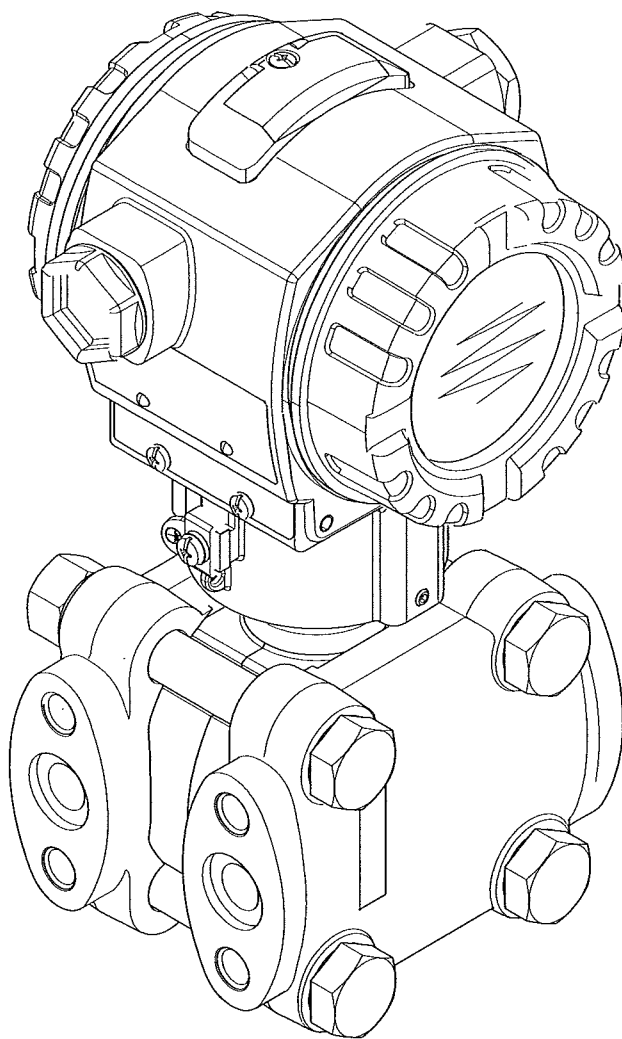


Solutions

Operating Instructions

Deltabar S FMD76/77/78, PMD70/75

Differential pressure transmitter



BA270P/00/en/05.04
52022793
valid from
Software version 02.00
Hardware version 02.00

Endress+Hauser 
People for Process Automation

Overview documentation

Device	Documentation	Content	Bemerkung
Deltabar S 4...20 mA HART	Technical Information TI382P	Technical data	The documentation is available on the ToF Tool CD. The CD is supplied with any device ordered with the "HistoROM module" option. See: www.endress.com → Download
	Operating Instructions BA270P	<ul style="list-style-type: none"> – Identification – Installation – Wiring – Operation – Commissioning, Description of Quick Setup menus – Maintenance – Trouble-shooting and spare parts – Appendix: Illustration of menu 	The documentation is supplied with the device. See: www.endress.com → Download
	Operating Instructions BA274P	<ul style="list-style-type: none"> – Examples of configuration for pressure, level and flow measurement – Description of parameters – Trouble-shooting – Appendix: Illustration of menu 	→ See: www.endress.com → Download
	Brief Operating Instructions KA218P	<ul style="list-style-type: none"> – Wiring – Operation without on-site display – Description of Quick Setup menus – Operation HistoROM®/M-DAT 	The documentation is supplied with the device. See cover of the terminal compartment.
	Functional Safety Manual SD189P	<ul style="list-style-type: none"> – Safety function with Deltabar S – Behaviour in operation and failure – Commissioning and iterative tests – Settings – Technical safety characteristic quantities – Management Summary 	The documentation is supplied with the devices showing version "E" in feature 100 "Additional options 1" or in feature 110 "Additional options 2". → See also Technical Information TI382P, chapter "Ordering information".

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1 Safety instructions

1.1 Designated use

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

The manufacturer accepts no liability for damages resulting from incorrect use or use other than that designated.

1.2 Installation, commissioning and operation

The device has been designed to operate safely in accordance with current technical, safety and EU standards. If installed incorrectly or used for applications for which it is not intended, however, it is possible that application-related dangers may arise, e.g. product overflow due to incorrect installation or calibration. For this reason, the instrument must be installed, connected, operated and maintained according to the instructions in this manual: personnel must be authorised and suitably qualified. The manual must have been read and understood, and the instructions followed. Modifications and repairs to the device are permissible only when they are expressly approved in the manual. Pay particular attention to the technical data on the nameplate.

1.3 Operational safety




1.3.1 Hazardous areas




If the device is to be installed in an explosion hazardous area, then the specifications in the certificate as well as all national and local regulations must be observed. A separate Ex documentation is enclosed with the device and is an integral part of this documentation. The installation regulations, connection values and Safety Instructions listed in this document must be observed.






- Ensure that all personnel are suitably qualified.

1.4 Notes on safety conventions and icons

In order to highlight safety-relevant or alternative operating procedures in the manual, the following conventions have been used, each indicated by a corresponding icon in the margin.

Symbol	Meaning
	Warning! A warning highlights actions or procedures which, if not performed correctly, will lead to personal injury, a safety hazard or destruction of the instrument.
	Caution! Caution highlights actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the instrument.
	Note! A note highlights actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an instrument response which is not planned.

	Device certified for use in explosion hazardous area If the device has this symbol embossed on its nameplate, it can be installed in an explosion hazardous area or a non-explosion hazardous area, according to the approval.
	Explosion hazardous area Symbol used in drawings to indicate explosion hazardous areas. – Devices used in hazardous areas must possess an appropriate type of protection.
	Safe area (non-explosion hazardous area) Symbol used in drawings to indicate, if necessary, non-explosion hazardous areas. – Devices used in hazardous areas must possess an appropriate type of protection. Lines used in hazardous areas must meet the necessary safety-related characteristic quantities.

	Direct voltage A terminal to which or from which a direct current or voltage may be applied or supplied.
	Alternating voltage A terminal to which or from which an alternating (sine-wave) current or voltage may be applied or supplied.
	Grounded terminal A grounded terminal, which as far as the operator is concerned, is already grounded by means of an earth grounding system.
	Protective grounding (earth) terminal A terminal which must be connected to earth ground prior to making any other connection to the equipment.
	Equipotential connection (earth bonding) A connection made to the plant grounding system which may be of type e.g. neutral star or equipotential line according to national or company practice.

2 Identification

2.1 Device designation

2.1.1 Nameplate

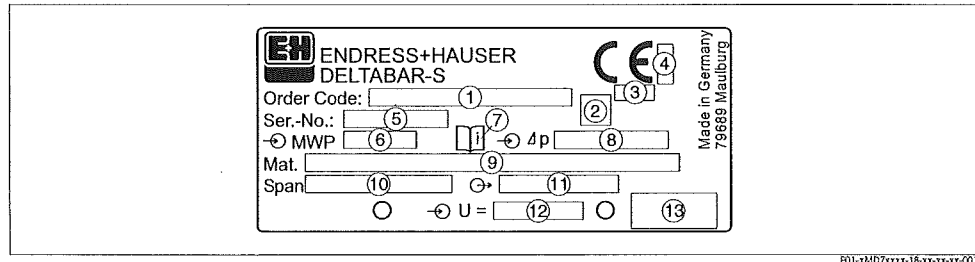


Fig. 1: Nameplate for Deltabar S

- 1 Order code
See the specifications on the order confirmation for the meanings of the individual letters and digits.
- 2 GL-symbol for GL marine certificate (optional)
- 3 ID number of notified body with regard to Pressure Equipment Directive (optional)
- 4 ID number of notified body with regard to ATEX (optional)
- 5 Serial number
- 6 MWP (Maximum working pressure)
- 7 Symbol: Note: pay particular attention to the data in the "Technical Information"
- 8 Nominal measuring range
- 9 Wetted materials
- 10 Minimum/maximum span
- 11 Electronic version (output signal)
- 12 Supply voltage
- 13 Degree of protection

Devices for use in hazardous areas are fitted with an additional nameplate.

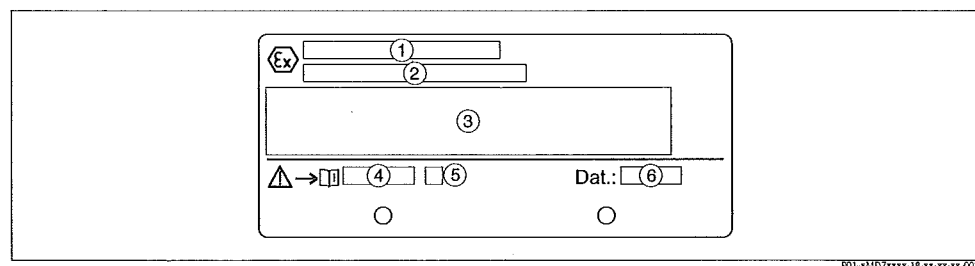


Fig. 2: Additional nameplate for devices for hazardous areas

- 1 EC type examination certificate number
- 2 Type of protection e.g. II 1/2 G EEx ia IIC T4/T6
- 3 Electrical data
- 4 Safety Instructions number e.g. XA235P
- 5 Safety Instructions index e.g. A
- 6 Device manufacture data (month and year)

**Note!**

- The MWP (maximum working pressure) is specified on the nameplate. This value refers to a reference temperature of 20°C (68°F) or 100°F for ANSI flanges.
- The test pressure (Over pressure limit OPL) = MWP (nameplate) x 1.5.
- The pressure values permitted at higher temperatures can be found in the following standards:
 - EN 1092-1: 2001 Tab. 18 ¹
 - ASME B 16.5a – 1998 Tab. 2-2.2 F316
 - ASME B 16.5a – 1998 Tab. 2.3.8 N10276
 - JIS B2210/B2238

- 1) With regard to its stability-temperature property, the material 1.4435 is identical to 1.4404 which is grouped under 13EO in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.

2.2 Scope of delivery

The scope of delivery comprises:

- Deltabar S differential pressure transmitter (for PMD70 and PMD75 with side flanges made of AISI 316L: additional locking screws, AISI 316L)
- For devices with the "HistoROM module" option:
CD-ROM with ToF Tool operating program and documentation
- Optional accessories

Documentation supplied:

- Operating Instructions BA270P (this document)
- Brief Operating Instructions KA218P
- Final inspection report
- Optional: factory calibration form
- Devices which are suitable for use in hazardous areas:
additional documentation such as Safety Instructions (XA...), Control or Installation Drawings (ZD...)

Additional documentation available with devices with the "HistoROM module" option:

- Technical Information TI382P

2.3 CE mark, declaration of conformity

The devices are designed to meet state-of-the-art safety requirements, have been tested and left the factory in a condition in which they are safe to operate.

The devices comply with the applicable standards and regulations in accordance with DIN EN 61010 "Safety requirements for electrical equipment for measurement, control and laboratory use".

The measuring system described in these Operating Instructions thus complies with the statutory requirements of the EC Directives. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.

2.4 Registered trademarks

KALREZ, VITON, TEFLON

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

TRI-CLAMP

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

HART

Registered trademark of the HART Communication Foundation, Austin, USA.

3 Installation

3.1 Incoming acceptance and storage

3.1.1 Incoming acceptance

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

3.1.2 Storage

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

Storage temperature range:

- $-40...+100^{\circ}\text{C}$ ($-40...+212^{\circ}\text{F}$)
- On-site display: $-40...+85^{\circ}\text{C}$ ($-40...+185^{\circ}\text{F}$)

3.2 Installation conditions

3.2.1 Dimensions

→ For dimensions, please refer to the Technical Information for Deltabar S TI382P, "Mechanical construction" section. See page 2, "Overview documentation".

3.3 Installation instructions



Note!

- Due to the orientation of the Deltabar S, there may be a shift in the measured value, i.e. when the container is empty, the measured value does not display zero. This zero point shift can be corrected. → See page 44, section 6.3 "Position adjustment".
- For FMD77 and FMD78, please refer to section 3.3.4. "Installation instructions for devices with diaphragm seals", page 15.
- General recommendations for routing the impulse piping can be found in DIN 19210 "Methods for measurement of fluid flow; differential piping for flow measurement devices" or the corresponding national or international standards.
- Using a three-valve or five-valve manifold allows for easy commissioning, installation and maintenance without interrupting the process.
- When routing the impulse piping outdoors, ensure that sufficient anti-freeze protection is used, e.g. by using pipe heat tracing.
- Install the impulse piping with a monotonic gradient of at least 10%.
- To ensure optimal readability of the on-site display, it is possible to rotate the housing up to 380° . → See page 18, section 3.3.7 "Rotating the housing".
- Endress+Hauser offers a mounting bracket for installing on pipes or walls. → See page 17, section 3.3.6 "Wall and pipe mounting".

3.3.1 Installation for flow measurement



Note!

For more information about flow measurement with the Deltabar S differential pressure transmitter and orifice plate or pitot tube, see also Technical Information TI297P Deltatop/Deltaset.

Flow measurement in gases with PMD70/PMD75

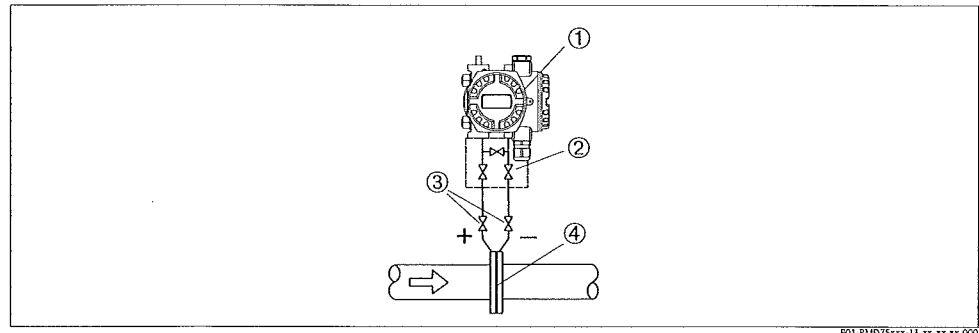


Fig. 3: Measuring layout for flow measurement in gases with PMD75

- 1 Deltabar S, here PMD75
- 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 run off into the process piping.

Flow measurement in steam with PMD70/PMD75

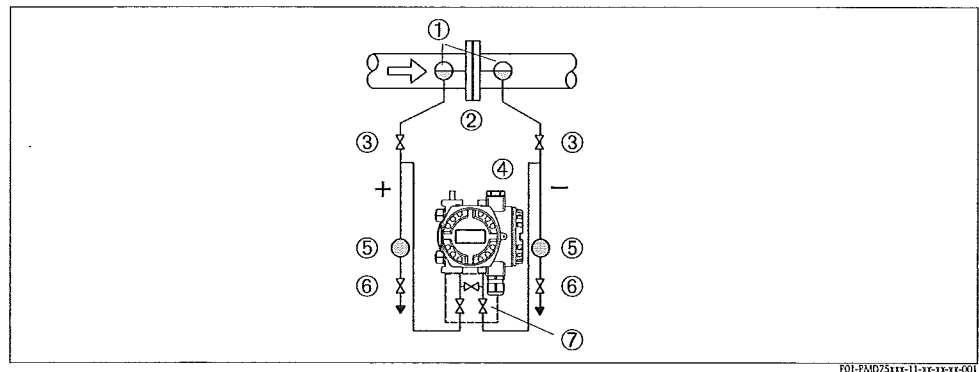


Fig. 4: Measuring layout for flow measurement in steam with PMD75

- 1 Condensate traps
- 2 Orifice plate or pitot tube
- 3 Shut-off valves
- 4 Deltabar S, here PMD75
- 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 PMD70/PMD75

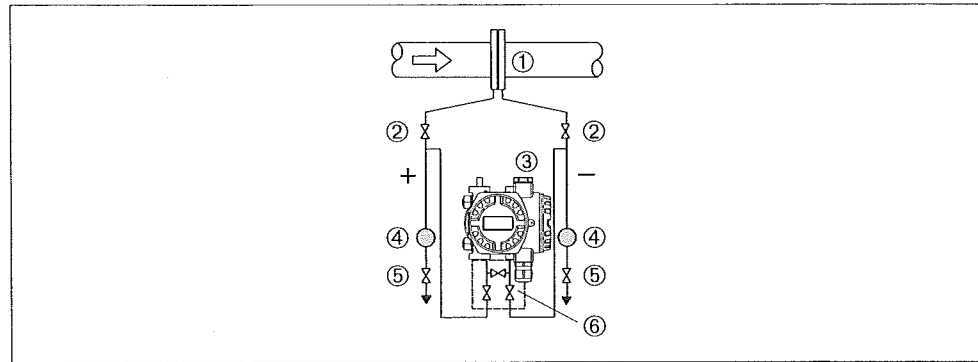


Fig. 5: Measuring layout for flow measurement in liquids with PMD75

- 1 Orifice plate or pitot tube
- 2 Shut-off valves
- 3 Deltabar S, here PMD75
- 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.

3.3.2 Installation for level measurement

Level measurement in an open container with PMD70/PMD75

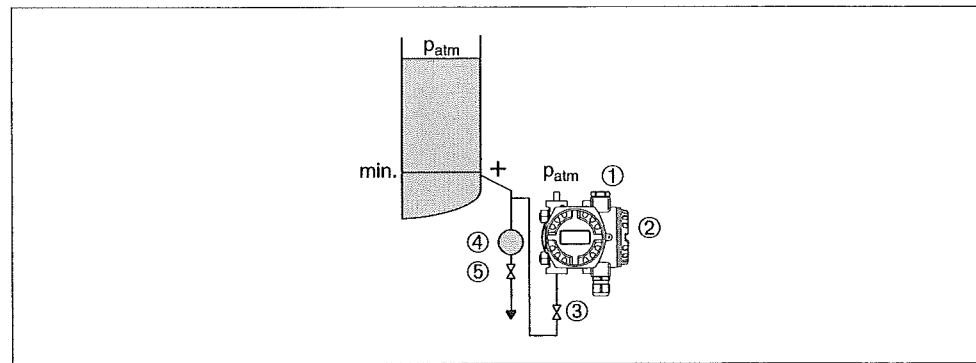


Fig. 6: Measuring layout for level measurement in open containers with PMD75

- 1 The negative side is open to atmospheric pressure
- 2 Deltabar S, here PMD75
- 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 atmosphere pressure.
- When measuring in media with solid parts, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment.

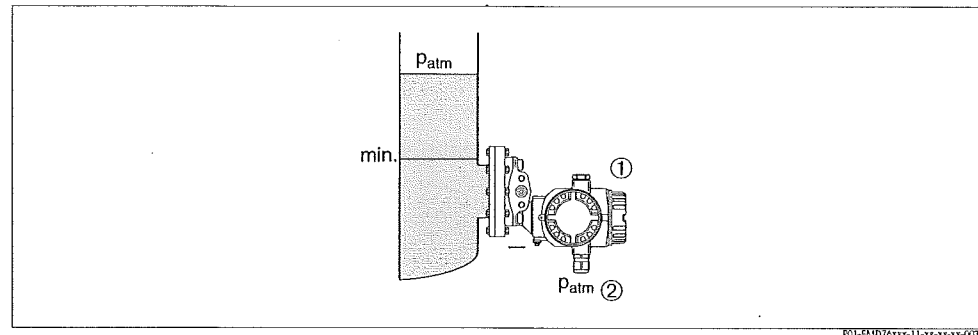
Level measurement in an open container with FMD76/FMD77

Fig. 7: Measuring layout for level measurement in open containers with FMD76

- 1 Deltabar S, here FMD76
- 2 The negative side is open to atmospheric pressure

- Mount the Deltabar S direct on the container. → See also page 17, section 3.3.5 "Seal for flange mounting".
- The negative side is open to atmosphere pressure.

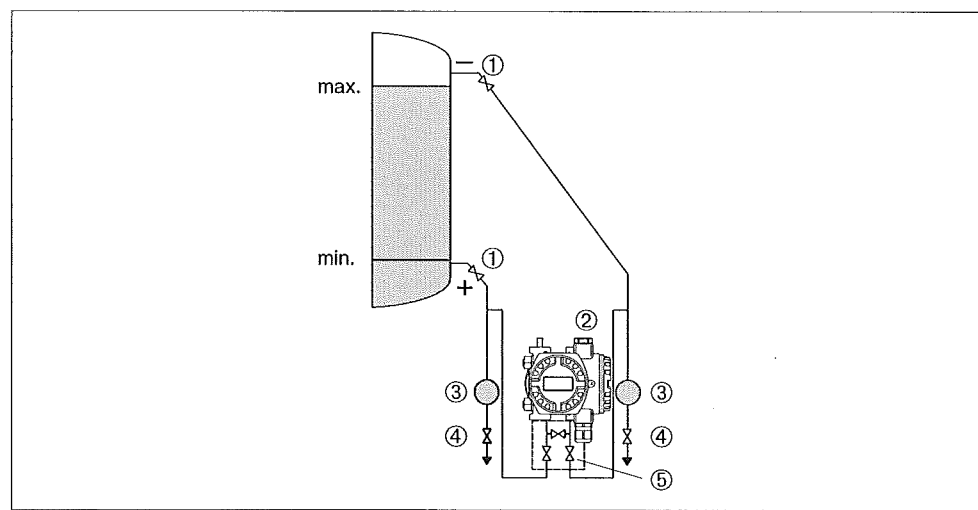
Level measurement in a closed container with PMD70/PMD75

Fig. 8: 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 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 FMD76/FMD77

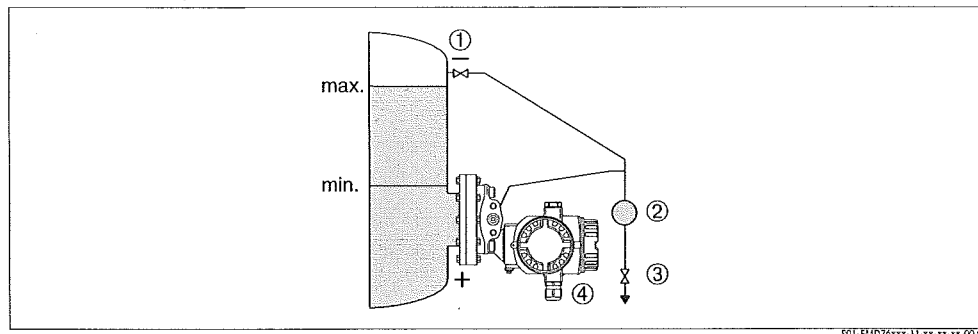


Fig. 9: Measuring layout for level measurement in a closed container with FMD76

- 1 Shut-off valve
- 2 Separator
- 3 Drain valve
- 4 Deltabar S, here FMD76

- Mount the Deltabar S direct on the container. → See also page 17, section 3.3.5 "Seal for flange mounting".
- Always connect 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

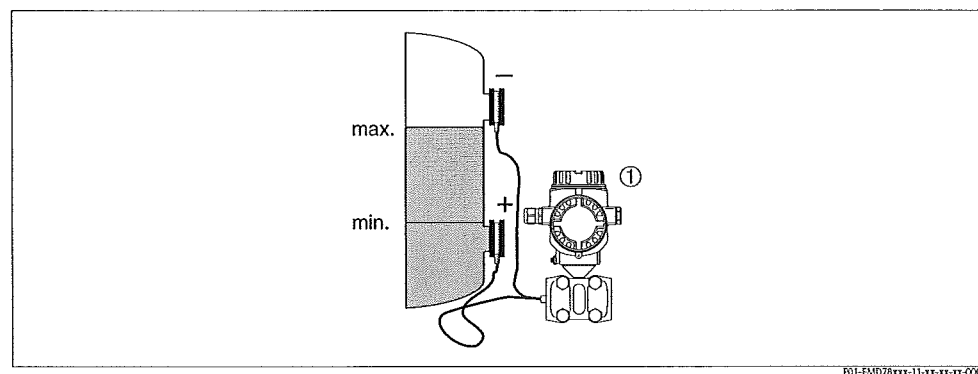


Fig. 10: Measuring layout for level measurement in a closed container with FMD78

- 1 Deltabar S, here FMD78

- Mount the Deltabar S below the lower diaphragm seal. → See also page 15, section 3.3.4 "Installation instructions for devices with diaphragm seals".
- The ambient temperature should be the same for both capillaries.



Note!

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

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

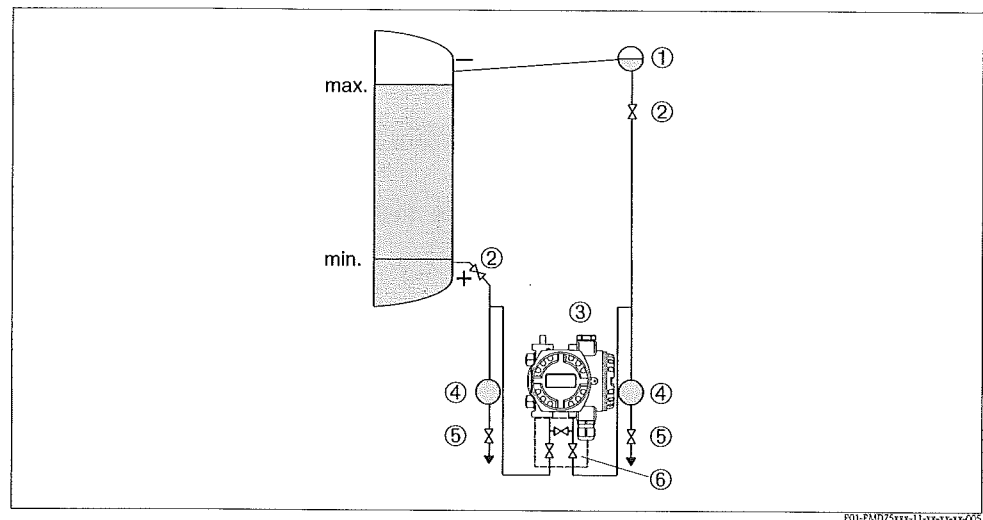


Fig. 11: Measuring layout for level measurement in a container with superimposed steam with PMD75

- 1 Condensate trap
- 2 Shut-off valves
- 3 Deltabar S, here PMD75
- 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 negative side above the maximum level.
- A condensate trap ensures constant pressure on the negative side.
- When measuring in media with solid parts, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment.

Level measurement in a closed container with superimposed steam with FMD 76/ FMD77

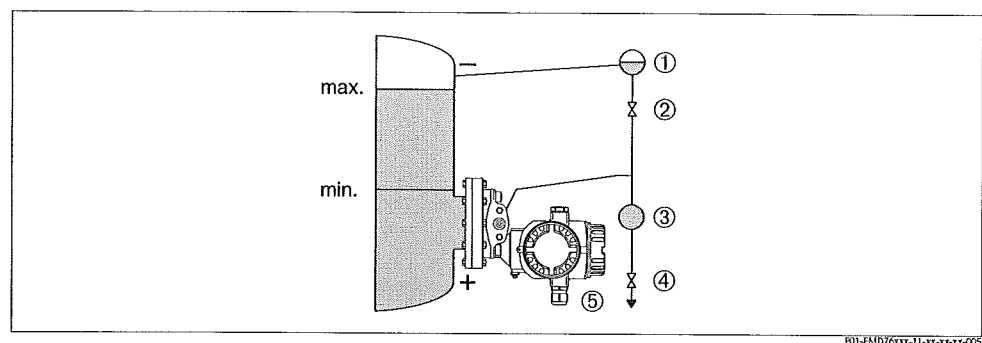


Fig. 12: Measuring layout for level measurement in a container with superimposed steam with FMD76

- 1 Condensate trap
- 2 Shut-off valve
- 3 Separator
- 4 Drain valve
- 5 Deltabar S, here FMD76

- Mount the Deltabar S direct on the container. → See also page 17, section 3.3.5 "Seal for flange mounting".
- Always connect the negative side above the maximum level.
- A condensate trap ensures constant pressure on the negative side.
- When measuring in media with solid parts, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment.

3.3.3 Installation for differential pressure measurement

Differential pressure measurement in gases and steam with PMD70/PMD75

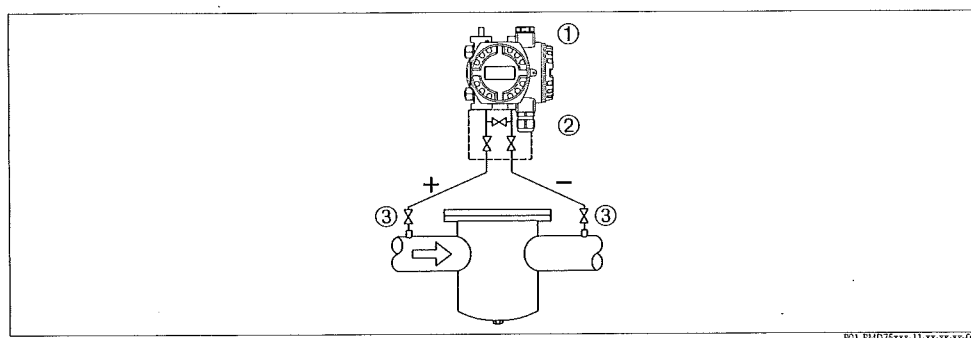


Fig. 13: Measuring layout for differential pressure measurement in gases and steam with PMD75

- 1 Deltabar S, here PMD75
- 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 run off into the process piping.

Differential pressure measurement in liquids with PMD70/PMD75

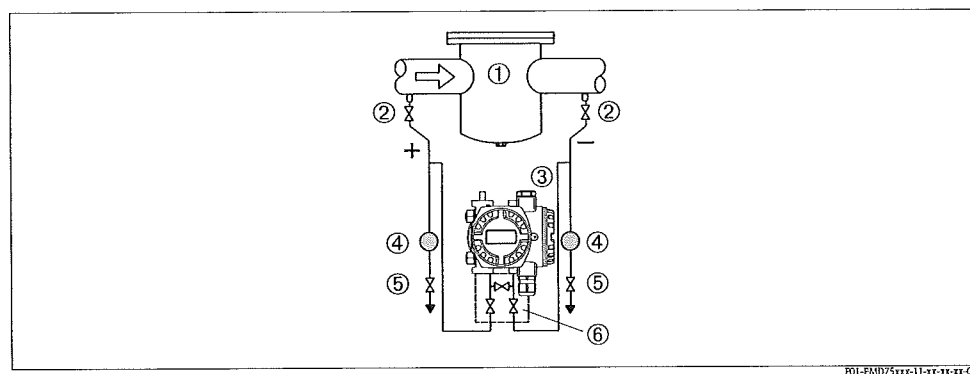


Fig. 14: Measuring layout for differential pressure measurement in liquids with PMD75

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

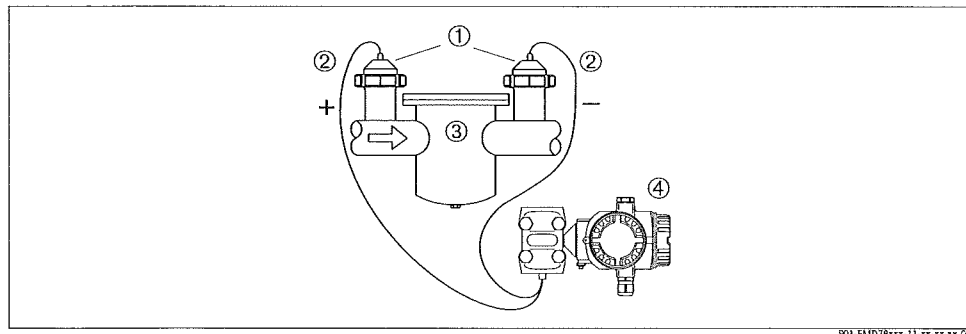


Fig. 15: Measuring layout for differential pressure measurement in gases, steam and liquids with FMD78

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

- Mount the diaphragm seal with capillaries at the top or on the side on the piping.
- For vacuum applications: mount the Deltabar S below the measuring point. → See page 15, section 3.3.4 "Installation instructions for devices with diaphragm seals", "Vacuum application" part.
- The ambient temperature should be the same for both capillaries.

3.3.4 Installation instructions for devices with diaphragm seals



Note!

- The diaphragm seal, together with the pressure transmitter, forms a closed, calibrated system, which is filled through openings in the diaphragm seal and in the measurement system of the pressure transmitter. These openings are sealed and must not be opened.
- Do not clean or touch diaphragm seals with hard or pointed objects.
- Do not remove membrane protection until shortly before installation.
- 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).
- 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. → See also page 44, section 6.3 "Position adjustment".
- Please note the application limits of the diaphragm seal filling oil as detailed in the Technical Information for Deltabar S TI382P, Section "Planning instructions for diaphragm seal systems". → See also page 2, "Overview documentation".

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

- vibration-free (in order to avoid additional pressure fluctuations)
- not in the vicinity of heating or cooling lines
- insulate in the event of colder or warmer ambient conditions
- with a bending radius of ≥ 100 mm.
- The ambient temperature and length of both capillaries should be the same when using two-sided diaphragm seal systems.
- Two diaphragm seals which are the same (e.g. with regard to diameter, material, etc.) should always be used for the negative and positive side (standard delivery).

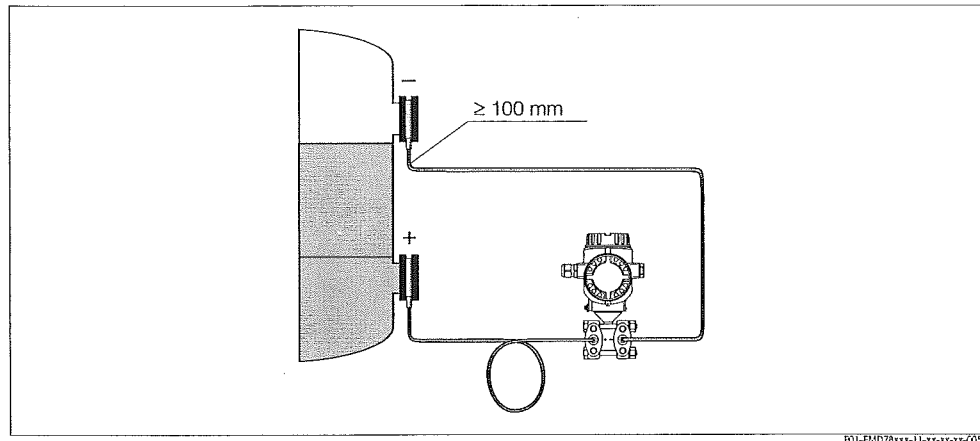


Fig. 16: Mounting Deltabar S, FMD78 with diaphragm seals and capillary, recommended mounting for vacuum applications: mount pressure transmitter below the lowest diaphragm seal!

Vacuum application

For applications under vacuum, Endress+Hauser recommends mounting the pressure transmitter underneath the lower diaphragm seal. A vacuum load of the diaphragm seal caused by the presence of filling oil in the capillaries is hereby prevented.

When the pressure transmitter is mounted above the lower diaphragm seal, the maximum height difference H_1 in accordance with the illustration below on the left must not be exceeded. The maximum height difference is dependent on the density of the filling oil and the smallest ever pressure that is permitted to occur at the diaphragm seal on the positive side (empty container), see illustration below, on the right.

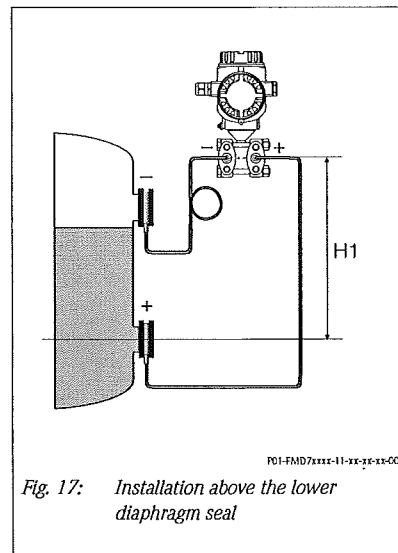


Fig. 17: Installation above the lower diaphragm seal

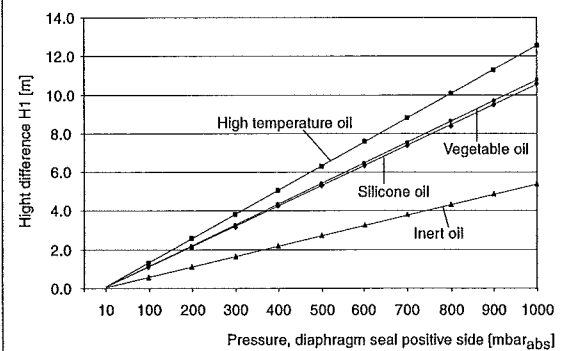


Fig. 18: Diagram of maximum installation height above the lower diaphragm seal for vacuum applications dependent on the pressure at the diaphragm seal on the positive side

3.3.5 Seal for flange mounting

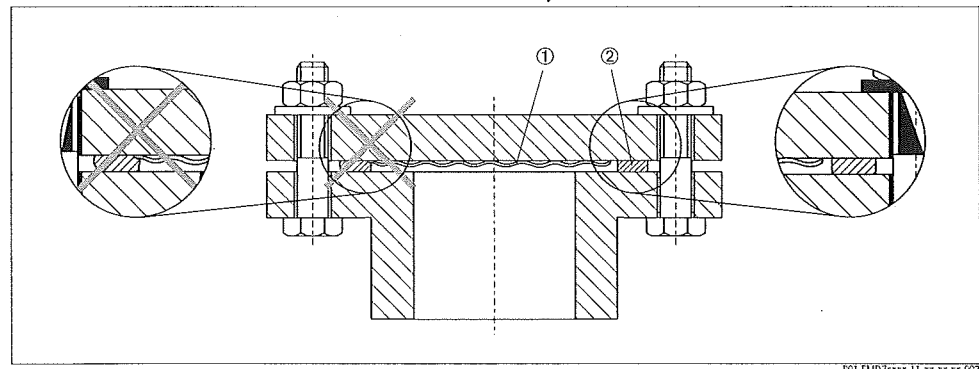


Fig. 19: Mounting the versions with flange or diaphragm seal

- 1 Diaphragm
2 Seal



Warning!

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

3.3.6 Wall and pipe-mounting (optional)

Endress+Hauser offers a mounting bracket for installing on pipes or walls.



Note!

If a valve block is used, its dimensions should be taken into consideration.

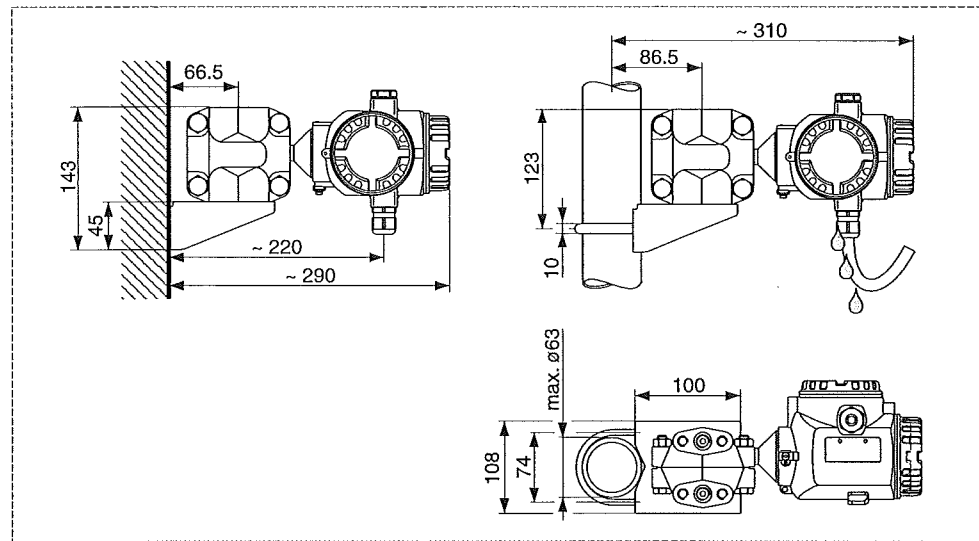


Fig. 20: Left: wall mounting with mounting bracket, right: pipe mounting with mounting bracket

Please note the following when mounting:

- The cable entry should always point downwards so that moisture on the connecting cable can drain off and not penetrate the housing.
- Devices with capillary lines: mount capillaries with a bending radius of ≥ 100 mm.

3.3.7 Rotating the housing

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

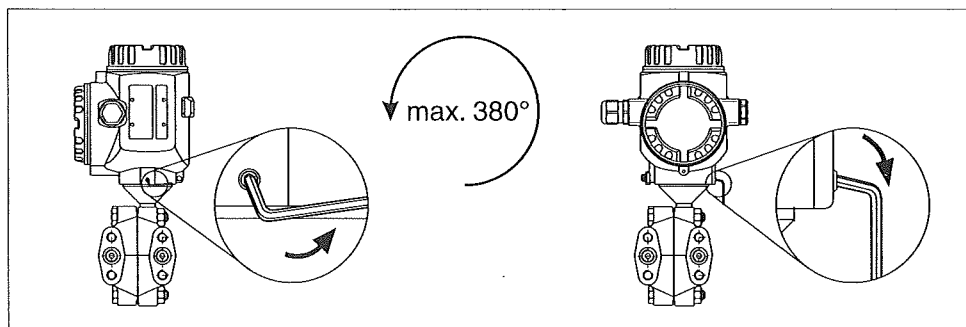


Fig. 21: Aligning the housing

- Loosen setscrew with a 2 mm Allen key.
- Rotate housing (max. up to 380°).
- Retighten setscrew.

3.4 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?

4 Wiring

4.1 Connecting the device



Note!

- When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions (XAs) or Installation or Control Drawings (ZDs).
- Protective circuits against reverse polarity, HF influences and overvoltage peaks are installed.
- The supply voltage must match the supply voltage on the nameplate. (→ See also page 6, section 2.1.1 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, screened two-wire cable.
- Connect device in accordance with the following diagram.
- Screw down housing cover.
- Switch on supply voltage.

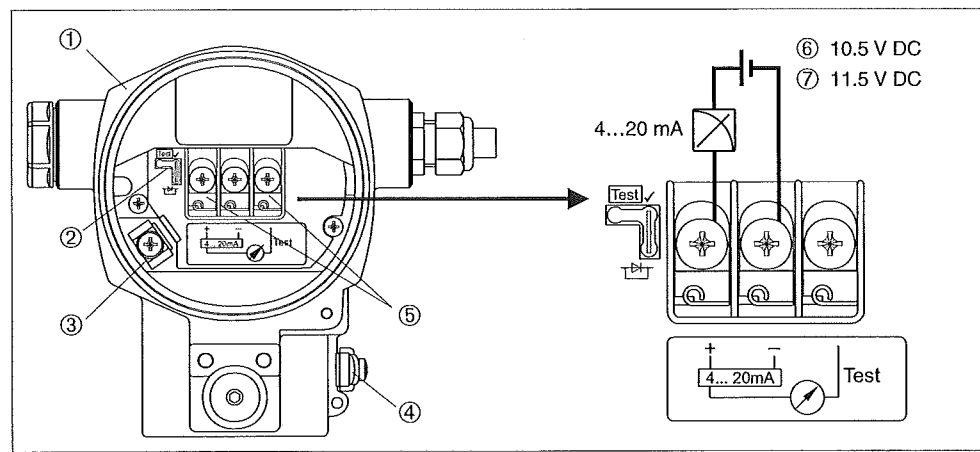


Fig. 22: Electrical connection 4...20 mA HART
→ Observe also section 4.2.1 "Supply voltage", page 21.

- 1 Housing
- 2 Jumper for 4...20 mA test signal.
→ See also page 21, section 4.2.1, "Taking 4...20 mA test signal" part.
- 3 Internal earth terminal
- 4 External earth terminal
- 5 4...20 mA test signal between plus 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.

4.1.1 Connecting devices with Harting plug Han7D

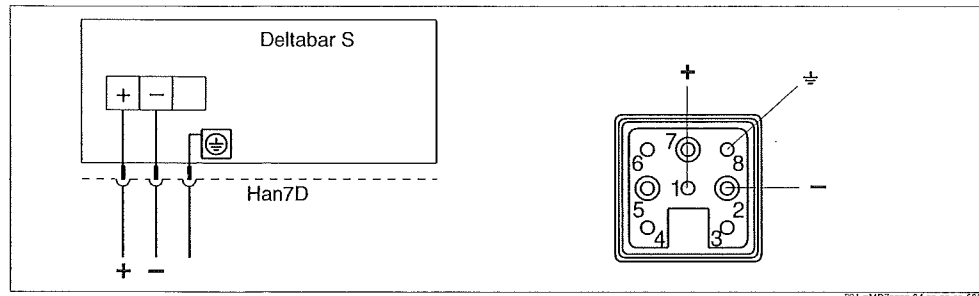


Fig. 23: Left: electrical connection for devices with Harting plug Han7D
Right: view of the plug at the device

4.1.2 Connection devices with M12 plug

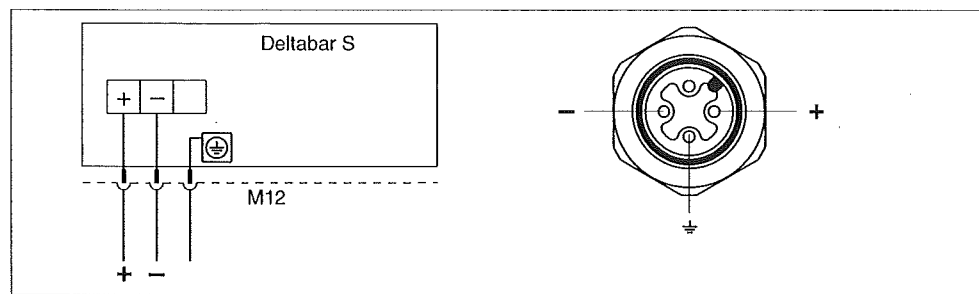


Fig. 24: Left: electrical connection for devices with M12 plug
Right: view of the plug at the device

4.1.3 Connection devices with 7/8" plug

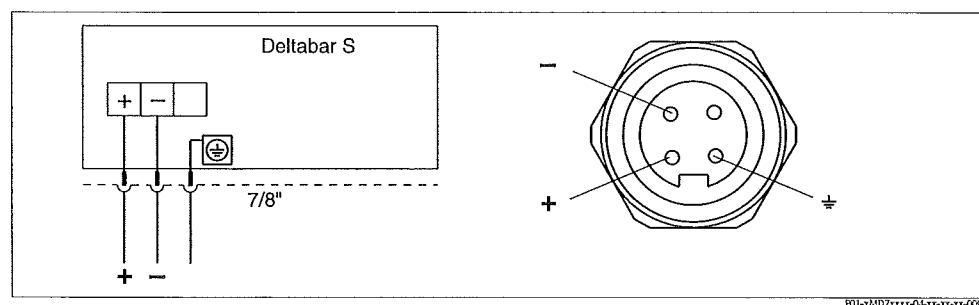


Fig. 25: Left: electrical connection for devices with 7/8" plug
Right: view of the plug at the device

4.2 Connecting the measuring unit

4.2.1 Supply voltage



Note!

- All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas.
- When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions (XAs) or Installation or Control Drawings (ZDs).

Electronic version	Jumper for 4...20 mA test signal in "Standard" position	Jumper for 4...20 mA test signal in "Test" position
4...20 mA HART, for non-hazardous areas	10.5...45 V DC	11.5...45 V DC

Taking 4...20 mA test signal

A 4...20 mA signal may be measured via the positive and test terminal without interrupting the measurement. The minimum supply voltage of the device can be reduced by simply changing the position of the jumper. As a result, operation is also possible with lower voltage sources. To keep the measured error below 0.1%, the current measuring device should display 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"> – Taking 4...20 mA test signal via plus and test terminal: not possible. – minimum supply voltage: 10.5 V DC
	<ul style="list-style-type: none"> – Taking 4...20 mA test signal via plus 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

4.2.2 Cable specification

- Endress+Hauser recommends using twisted, screened two-wire cables.
- Terminals for wire cross-sections 0.5...2.5 mm²
- Cable external diameter: 5...10 mm

4.2.3 Load

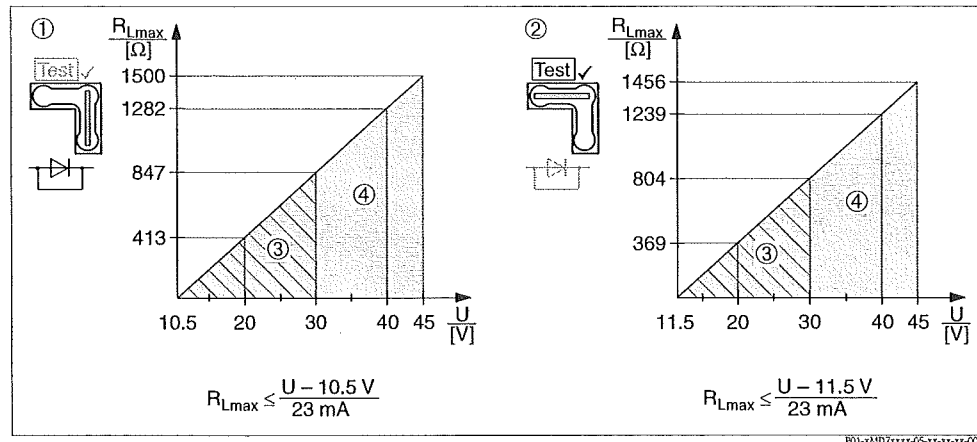


Fig. 26: Load diagram, observe the position of the jumper and the explosion protection (→ See also page 21, "Taking 4...20 mA test signal" part.)

- 1 Jumper for 4...20 mA test signal inserted in "Standard" position
- 2 Jumper for 4...20 mA test signal inserted in "Test" position
- 3 Supply voltage 10,5 (11,5)...30 V DC for EEx ia, 1/2 D, 1 GD, 1/2 GD, FM IS and CSA IS
- 4 Supply voltage 10,5 (11,5)...45 V DC for device for non-hazardous areas, 1/3 D, EEx d, EEx nA, FM XP, FM DIP, FM NI, CSA XP and CSA Dust-Ex

R_{Lmax} Maximum load resistance

U Supply voltage



Note!

When operating via a handheld terminal or via PC with an operating program, a minimum communication resistance of 250 Ω must exist within the loop.

4.2.4 Screening/potential matching

- You achieve optimum screening against disturbances if the screening is connected on both sides (in the cabinet and on the device). If you have to reckon with potential equalisation currents in the plant, only earth screening 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.
- Ex applications: set up potential matching inside and outside the hazardous area. Connect all devices to the local potential matching.

4.2.5 Connecting HART handheld terminal

With a HART handheld terminal you can set and check the transmitter and avail of additional functions all along the 4...20 mA line.

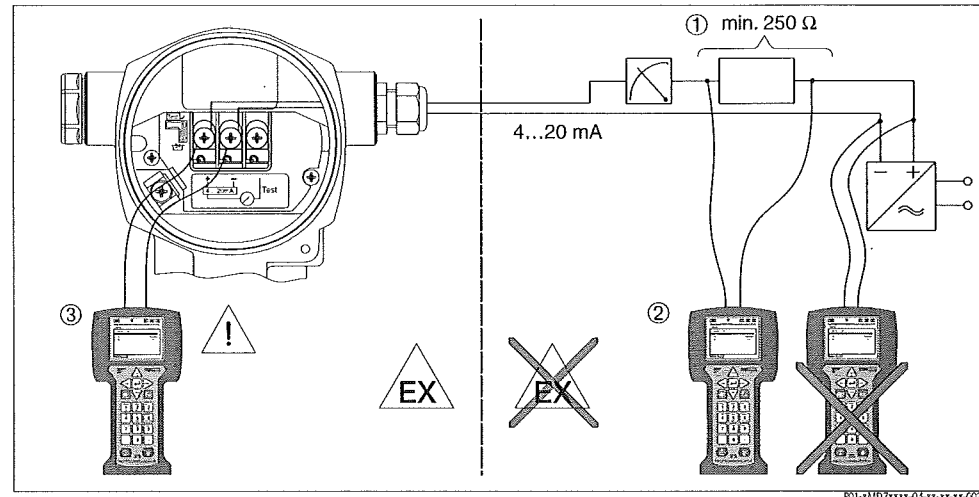


Fig. 27: Connecting an HART handheld terminal, e.g. Field Communicator DXR 375

- 1 Necessary communication resistor $\geq 250 \Omega$
- 2 HART handheld terminal
- 3 HART handheld terminal, directly connected to the device even in the Ex i-area



Warning!

- In the case of Ex d type of protection, do not connect the handheld terminal in the hazardous area.
- Do not replace the battery of the handheld terminal in the hazardous area.
- For devices with FM or CSA certificates, establish electrical connection as per Installation or Control Drawing (ZD...) supplied.

4.2.6 Connecting Commubox FXA 191 for operation via ToF Tool or Commuwin II

The Commubox FXA 191 connects Smart Transmitters with HART protocol to the serial interface (RS 232) of a computer. This makes it possible to remotely operate the transmitters with the aid of the Endress+Hauser operating programs ToF Tool or Commuwin II. The Commubox is also suitable for use in intrinsically safe circuits.

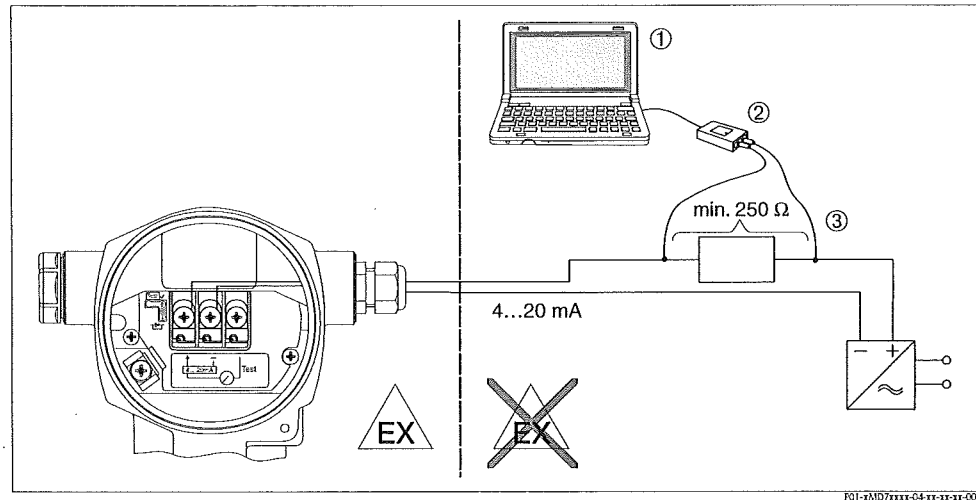


Fig. 28: Connecting PC with operating programs ToF Tool or Commuwin II via Commubox FXA 191

- 1 Computer with operating program ToF Tool or Commuwin II
- 2 Commubox FXA 191
- 3 Necessary communication resistor $\geq 250 \Omega$

4.3 Potential matching

Potential matching does not have to be set up.

4.4 Post-connection check

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

- Does the supply voltage match the specifications on the nameplate?
- Is the device connected as per section 4.1?
- Are all screws firmly tightened?
- Are the housing covers screwed down tight?

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

5 Operation

Feature 20 "Electronics, communication, display, operation" in the order code provides you with information on the operating options available to you.

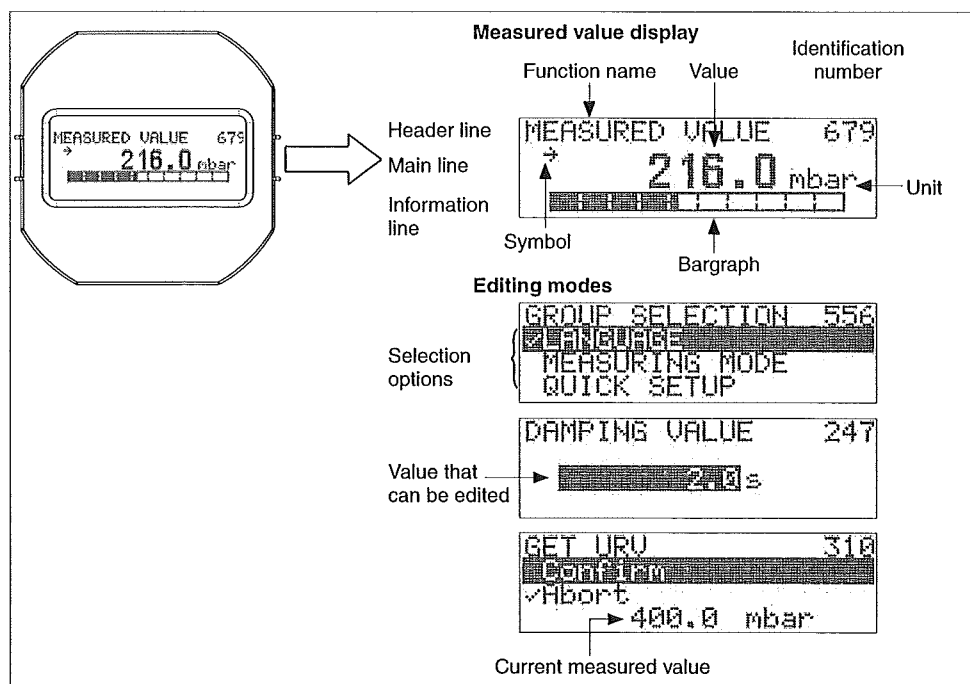
Versions in the order code		Operation
A	4...20 mA, HART, LCD, operation external	via on-site display and 3 keys on the exterior of the device
B	4...20 mA, HART, LCD	via on-site display and 3 keys on the inside of the device
C	4...20 mA HART	without on-site display, 3 keys on the inside of the device

5.1 On-site display (optional)

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

Functions:

- 8-digit measured value display including sign and decimal point, bargraph for current display
- simple and complete menu guidance thanks to separation of the parameters into several levels and groups
- each parameter is given a 3-digit ID number for easy navigation
- option for configuring the display according to individual requirements and desires, such as language, alternating display, contrast setting, display of other measured values such as sensor temperature
- comprehensive diagnostic functions (fault and warning message, peak-hold indicators, etc.)
- rapid and safe commissioning with the Quick Setup menus



P01-7MD71111-07-11-11-11-000

The following table illustrates the symbols that can appear on the on-site display. Four symbols can occur at one 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 device, → see section 5.9.
	Communication symbol Data transfer via communication <i>Note:</i> The alarm symbol may overlie the communication symbol.
	Square root symbol Active measuring mode "Flow measurement" The root flow signal is used for the current output.
	Tendency symbol (increasing) The measured value is increasing.
	Tendency symbol (decreasing) The measured value is decreasing.
	Tendency symbol (constant) The measured value has remained constant over the past few minutes.

5.2 Operating elements

5.2.1 Position of operating elements

The operating keys are located either under the protective cap on the exterior of the device or inside on the electronic insert.

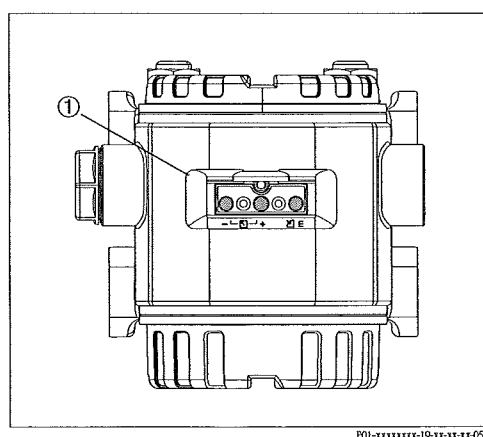


Fig. 29: Operating keys, external

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

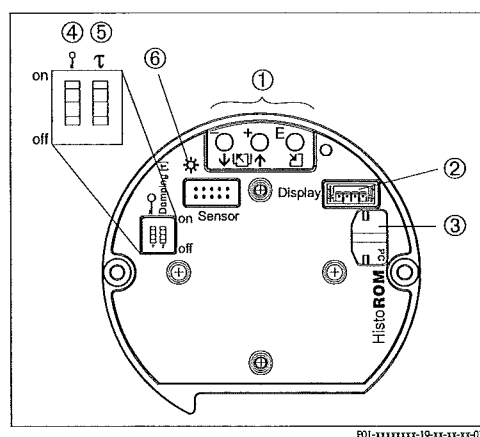














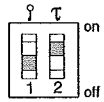


Fig. 30: Operating keys, internal

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










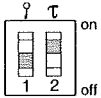
5.2.2 Function of the operating elements – on-site display not connected

Operating key(s)	Meaning
	<p> Note!</p> <ul style="list-style-type: none"> ■ The device is configured for the pressure measuring mode as standard. You can switch measuring modes by means of the MEASURING MODE parameter. → See page 43, section 6.2 "Selecting language and measuring mode". ■ Press the key for at least 3 seconds to accept the pressure value applied.
	<p>MEASURING MODE "Pressure":</p> <ul style="list-style-type: none"> ■ The pressure applied is assigned to the lower current value (SET LRV – pressure ¹).
	<p> Note!</p> <ul style="list-style-type: none"> ■ MEASURING MODE "Level": The factory settings for the LEVEL MODE, CALIBRATION MODE, LIN. MEASURAND, EMPTY CALIB. and FULL CALIB. parameters are as follows: <ul style="list-style-type: none"> – LEVEL MODE = Linear – CALIBRATION MODE = wet – LIN. MEASURAND = % – EMPTY CALIB. = 0 % – FULL CALIB. = 100 %. These parameters can only be modified by means of the on-site display or remote operation such as the ToF Tool.
	<p>MEASURING MODE "Level", CALIBRATION MODE "wet":</p> <ul style="list-style-type: none"> ■ FÜLLSTANDSSTYP "Linear": <ul style="list-style-type: none"> – The pressure applied is saved as the lower pressure value (EMPTY PRESSURE ¹) and assigned to the lower level value (EMPTY CALIB. ¹). The lower level and current values (SET LRV – level ¹) remain unchanged. These values can only be modified by means of the on-site display or remote operation such as the ToF Tool. → See also page 51, section 6.5.3 "Quick Setup menu for Level measuring mode" and Operating Instructions BA274P, parameter descriptions LEVEL MODE, CALIBRATION MODE, EMPTY CALIB., EMPTY PRESSURE and SET LRV – Level. ■ LEVEL MODE "Pressure Linearized" or "Height Linearized": <ul style="list-style-type: none"> – The key does not have any function.
	<p>MEASURING MODE "Level", CALIBRATION MODE "dry":</p> <ul style="list-style-type: none"> ■ The key does not have any function.
	<p>MEASURING MODE "Flow":</p> <ul style="list-style-type: none"> ■ The key does not have any function.

Operating key(s)	Meaning
	<p> Note!</p> <ul style="list-style-type: none"> The device is configured for the pressure measuring mode as standard. You can switch measuring modes by means of the MEASURING MODE parameter. → See page 43, section 6.2 "Selecting language and measuring mode". Press the key for at least 3 seconds to accept the pressure value applied. <p>MEASURING MODE "Pressure":</p> <ul style="list-style-type: none"> The pressure applied is assigned to the upper current value (SET URV – pressure¹). <p> Note!</p> <ul style="list-style-type: none"> MEASURING MODE "Level": The factory settings for the LEVEL MODE, CALIBRATION MODE, LIN. MEASURAND, EMPTY CALIB. and FULL CALIB. parameters are as follows: <ul style="list-style-type: none"> – LEVEL MODE = Linear – CALIBRATION MODE = wet – LIN. MEASURAND = % – EMPTY CALIB. = 0 % – FULL CALIB. = 100 %. These parameters can only be modified by means of the on-site display or remote operation such as the ToF Tool. <p>MEASURING MODE "Level", CALIBRATION MODE "wet":</p> <ul style="list-style-type: none"> LEVEL MODE "Linear": <ul style="list-style-type: none"> – The pressure applied is saved as the upper pressure value (FULL PRESSURE¹) and assigned to the upper level value (FULL CALIB.¹). The upper level and current values (SET URV – level¹) remain unchanged. These values can only be modified by means of the on-site display or remote operation such as the ToF Tool. → See also page 51, section 6.5.3 "Quick Setup menu for Level measuring mode" and Operating Instructions BA274P, parameter descriptions LEVEL MODE, CALIBRATION MODE, FULL CALIB., FULL PRESSURE, and SET URV – Level. LEVEL MODE "Pressure Linearized" or "Height Linearized": <ul style="list-style-type: none"> – The key does not have any function. <p>MEASURING MODE "Level", CALIBRATION MODE "dry":</p> <ul style="list-style-type: none"> The key does not have any function. <p>MEASURING MODE "Flow":</p> <ul style="list-style-type: none"> The pressure applied is saved as the maximum pressure value (MAX. PRESS. FLOW¹) and assigned to the maximum flow value (MAX. FLOW¹). The maximum flow value and upper current value (SET URV – flow¹) remain unchanged. These values can only be modified by means of the on-site display or remote operation such as the ToF Tool. → See also page 47, section 6.4.3 "Quick Setup menu for Flow measuring mode" and Operating Instructions BA274P, parameter descriptions MAX. PRESS. FLOW, MAX. FLOW, SET LRV – Flow and LINEAR/SQROOT.
	Position adjustment (Press key for at least 3s.)
 and  and 	Reset all parameters. The reset via operating keys corresponds to the software reset code 7864. (Press key for at least 6s.)
 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.
	<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)

1) Parameter name used for the on-site display or remote operation such as the ToF Tool.

5.2.3 Function of the operating elements – on-site display connected

Operating key(s)	Meaning
	<ul style="list-style-type: none"> – Navigate upwards in the picklist – Edit the numerical values and characters within a function
	<ul style="list-style-type: none"> – Navigate downwards in the picklist – Edit the numerical values and characters within a function
	<ul style="list-style-type: none"> – Confirm entry – Jump to the next item
 and 	Contrast setting of on-site display: darker
 and 	Contrast setting of on-site display: brighter
 and 	<p>ESC functions:</p> <ul style="list-style-type: none"> – Exit edit mode without saving the changed value. – You are in a menu within a function group. The first time you press the keys simultaneously, you go back a parameter within the function group. Each time you press the keys simultaneously after that, you go up a level in the menu. – You are in a menu at a selection level. Each time you press the keys simultaneously, you go up a level in the menu. <p><i>Note:</i> The terms function group, level and selection level are explained in section 5.4.1, page 33.</p>
 <small>FD1-xxxxxxx-10-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)

5.3 On-site operation – on-site display not connected



Note!

To operate the device with a HistoROM®/M-DAT module see page 35, Section 5.5 "HistoROM®/M-DAT module".

5.3.1 Pressure measuring mode

If no on-site 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 lower range value and upper range value
- Device reset, → see also page 27, section 5.2.2 "Function of the operating elements", Table.



Note!

- The operation must be unlocked. → See page 40, section 5.9 "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. → See page 43, section 6.2 "Selecting language and measuring mode".
- The pressure applied must be within the nominal pressure limits of the sensor. See information on the nameplate.

Carry out position adjustment.		Setting lower range value.		Setting upper range value.	
Pressure is present at device.		Desired pressure for lower range value is present at device.		Desired pressure for upper range value is present at device.	
↓		↓		↓	
Press "E"-key for 3 s.		Press "-"-key for 3 s.		Press "+"-key for 3 s.	
↓		↓		↓	
Does the LED on the electronic insert light up briefly?		Does the LED on the electronic insert light up briefly?		Does the LED on the electronic insert light up briefly?	
Yes	No	Yes	No	Yes	No
↓	↓	↓	↓	↓	↓
Applied pressure for position adjustment has been accepted.	Applied pressure for position adjustment has not been accepted. Observe the input limits.	Applied pressure for lower range value has been accepted.	Applied pressure for lower range value has not been accepted. Observe the input limits.	Applied pressure for upper range value has been accepted.	Applied pressure for upper range value has not been accepted. Observe the input limits.

5.3.2 Level measuring mode



Note!

If no on-site 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)
 - Set the lower and upper pressure value and assign to the lower and upper level value
 - Device reset, → see also page 27, section 5.2.2 "Function of the operating elements", Table.
-
- The operation must be unlocked. → See page 40, section 5.9 "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. → See page 43, section 6.2 "Selecting language and measuring mode".
 - The \square and \square keys do not have any function if the LEVEL MODE "Pressure linearized" or "Height linearized" or the CALIBRATION MODE "dry" was selected.
 - The factory settings for the LEVEL MODE, CALIBRATION MODE, LIN. MEASURAND, EMPTY CALIB. and FULL CALIB. parameters are as follows:
 - LEVEL MODE = Linear
 - CALIBRATION MODE = wet
 - LIN. MEASURAND = %
 - EMPTY CALIB. = 0 %
 - FULL CALIB. = 100 %.
 These parameters can only be modified by means of the on-site display or remote operation such as the ToF Tool.
 - The pressure applied must be within the nominal pressure limits of the sensor. See information on the nameplate.
 - → See also page 51, section 6.5.3 "Quick Setup menu for Level measuring mode" and Operating Instructions BA274P, parameter descriptions LEVEL MODE, CALIBRATION MODE, EMPTY CALIB., FULL CALIB., EMPTY PRESSURE, FULL PRESSURE, SET LRV – Level and SET URV – Level.

Carry out position adjustment.		Setting lower pressure value.		Setting upper pressure value.	
Pressure is present at device.		Desired pressure for lower pressure value (EMPTY PRESSURE ¹⁾ is present at device.		Desired pressure for upper pressure value (FULL PRESSURE ¹⁾ is present at device.	
↓		↓		↓	
Press "E"-key for 3 s.		Press "-"-key for 3 s.		Press "+"-key for 3 s.	
↓		↓		↓	
Does the LED on the electronic insert light up briefly?		Does the LED on the electronic insert light up briefly?		Does the LED on the electronic insert light up briefly?	
Yes	No	Yes	No	Yes	No
↓	↓	↓	↓	↓	↓
Applied pressure for position adjustment has been accepted.	Applied pressure for position adjustment has not been accepted. Observe the input limits.	The pressure present was saved as the lower pressure value (EMPTY PRESSURE ¹⁾ and assigned to the lower level value (EMPTY CALIB. ¹).	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 ¹⁾ and assigned to the upper level value (FULL CALIB. ¹).	The pressure present was not saved as the upper pressure value. Observe the input limits.

1) Parameter name used for the on-site display or remote operation such as the ToF Tool.


5.3.3 Flow measuring mode

If no on-site 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)
- Set the maximum pressure value and assign it to the maximum flow value
- Device reset, → see also page 27, section 5.2.2 "Function of the operating elements", Table.



Note!

- The operation must be unlocked. → See page 40, section 5.9 "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. → See page 43, section 6.2 "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.
- → See also page 47, section 6.4.3 "Quick Setup menu for Level measuring mode" and Operating Instructions BA274P, parameter descriptions MAX. PRESS. FLOW, MAX. FLOW, SET LRV – Flow and LINEAR/SQROOT.

Carry out position adjustment.		Setting maximum pressure value.	
Pressure is present at device.		Desired pressure for the maximum pressure value (MAX. FLOW ¹⁾ is present at device.	
↓		↓	
Press "E"-key for 3 s.		Press "+"-key for 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
↓	↓	↓	↓
Applied pressure for position adjustment has been accepted.	Applied pressure for position adjustment has not been accepted. Observe the input limits.	The pressure present was saved as the maximum pressure value (MAX. PRESS FLOW ¹⁾ and assigned to the maximum flow value (MAX. FLOW ¹⁾ .	The pressure present was not saved as the maximum pressure value. Observe the input limits.

- 1) Parameter name used for the on-site display or remote operation such as the ToF Tool.

5.4 On-site operation – on-site display connected

If the on-site display is connected, the three operating keys are used to navigate through the operating menu, → see page 29, section 5.2.3 "Function of the operating elements".

5.4.1 General structure of the operating menu

The menu is split into four levels. The three upper levels are used to navigate while you use the bottom level to enter numerical values, select options and save settings. The entire menu is illustrated in section 10.1 "Menu for on-site display, ToF Tool and HART handheld terminal". The structure of the OPERATING MENU depends on the measuring mode selected, e.g. if the "Pressure" measuring mode is selected, only the functions necessary for this mode are displayed.

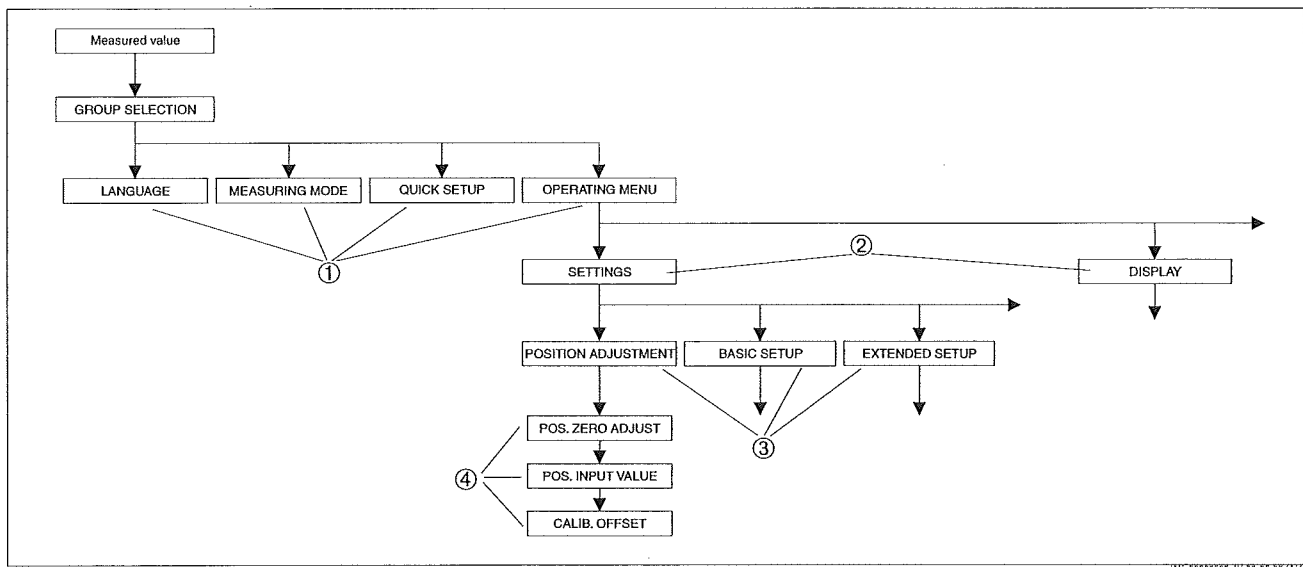


Fig. 31: Structure of the operating menu

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

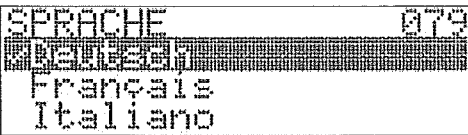
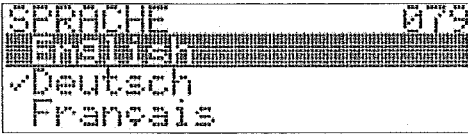
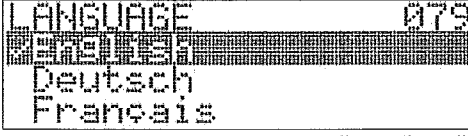


Note!

The LANGUAGE and MEASURING MODE parameters are only displayed via the on-site display on the 1st selection level. In the ToF Tool or HART handheld terminal, the LANGUAGE parameter is displayed in the DISPLAY group and the MEASURING MODE parameter is displayed in the QUICK SETUP menus or in the BASIC SETUP function group. → See also section 10.1 "Operating menu for on-site display, ToF Tool and HART handheld terminal".

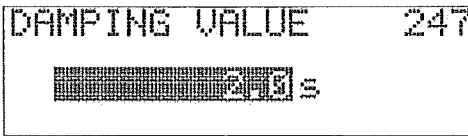
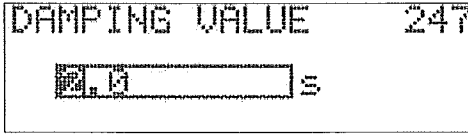
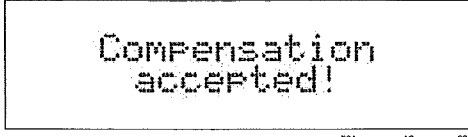
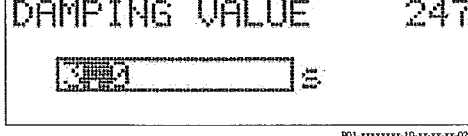
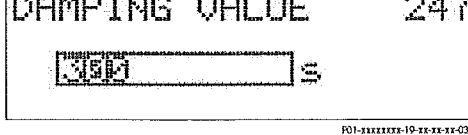
5.4.2 Selecting an option

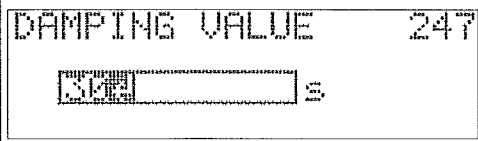
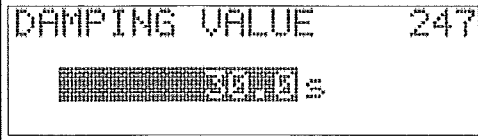
Example: select "English" as the language of the menu.

On-site display	Operation
 <p>P01-XXXXXXXX-10-XX-XX-XX-017</p>	German is selected as the language. A ✓ in front of the menu text indicates the active option.
 <p>P01-XXXXXXXX-10-XX-XX-XX-033</p>	Select English with "+" or "-".
 <p>P01-XXXXXXXX-10-XX-XX-XX-034</p>	<ol style="list-style-type: none"> 1. Confirm your choice with "E". 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 "E".

5.4.3 Editing a value

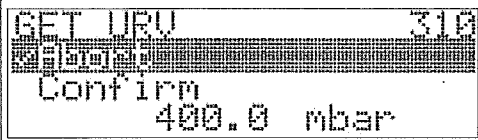
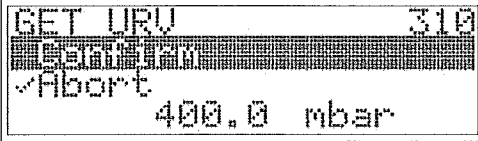
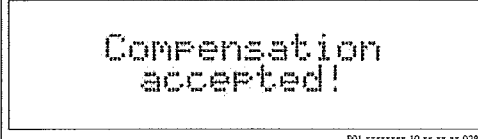
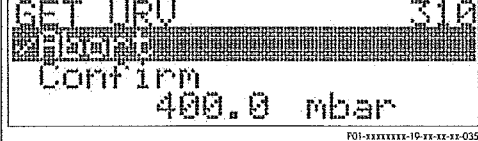
Example: adjusting DAMPING VALUE function from 2.0 s to 30.0 s. → See also page 29, section 5.2.3 "Function of the operating elements".

On-site display	Operation
 <p>P01-XXXXXXXX-10-XX-XX-XX-023</p>	The on-site 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>P01-XXXXXXXX-10-XX-XX-XX-027</p>	<ol style="list-style-type: none"> 1. Press "+" or "-" to get to the editing mode. 2. The first digit is highlighted in black.
 <p>P01-XXXXXXXX-10-XX-XX-XX-028</p>	<ol style="list-style-type: none"> 1. Use "+" to change "2" to "3". 2. Confirm "3" with "E". The cursor jumps to the next position (highlighted in black).
 <p>P01-XXXXXXXX-10-XX-XX-XX-029</p>	The decimal point is highlighted in black, i.e. you can now edit it.
 <p>P01-XXXXXXXX-10-XX-XX-XX-030</p>	<ol style="list-style-type: none"> 1. Keep pressing "+" or "-" until "0" is displayed. 2. Confirm "0" with "E". The cursor jumps to the next position. ↵ is displayed and is highlighted in black. → See next graphic.

On-site display	Operation
 <p>F01-XXXXXXXX-19-XX-XX-XX-031</p>	Use "E" to save the new value and exit the editing mode. → See next graphic.
 <p>F01-XXXXXXXX-19-XX-XX-XX-032</p>	The new value for the damping is now 30.0 s. – Jump to the next parameter with "E". – You can get back to the editing mode with "+" or "-".

5.4.4 Taking pressure applied at device as value

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

On-site display	Operation
 <p>F01-XXXXXXXX-19-XX-XX-XX-035</p>	The bottom line on the on-site display displays the pressure present, here 400 mbar.
 <p>F01-XXXXXXXX-19-XX-XX-XX-036</p>	Use "+" or "-" to switch to the "Confirm" option. The active selection is highlighted in black.
 <p>F01-XXXXXXXX-19-XX-XX-XX-038</p>	Use "E" 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>F01-XXXXXXXX-19-XX-XX-XX-035</p>	Switch to the next parameter with "E".

5.5 HistoROM®/M-DAT (optional)

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

- 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.



Warning!

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

**Note!**

- The HistoROM®/M-DAT module may be retrofitted at any time (Order No.: 52020797).
- The HistoROM data and the data in the device are analysed 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, see page 55, section 8.1 "Messages."

5.5.1 Copying configuration data

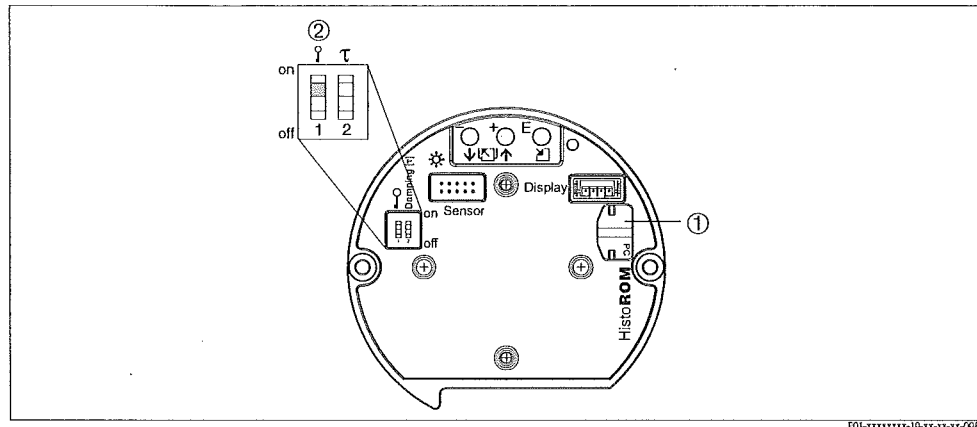


Abb. 32: Electronic insert with optional HistoROM®/M-DAT memory module

- 1 optional HistoROM®/M-DAT
- 2 To copy configuration data from the HistoROM®/M-DAT module to a device, the operation must be unlocked DIP-switch 1, Position "off", Parameter INSERT PIN NO. = 100). To copy configuration data from a device to a HistoROM®/M-DAT module, the operation may be locked or unlocked. Observe page 40, section 5.9 "Locking/unlocking operation".

On-site operation – on-site display not connected

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

1. Disconnect device from supply voltage.
2. Attach the HistoROM®/M-DAT module to the electronic insert.
3. Reestablish supply voltage to the device.
4. Press \square and \square -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 device to the HistoROM®/M-DAT.
6. Disconnect device from the supply voltage again.
7. Detach memory module.
8. Reestablish supply voltage to the device.

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

The operation must be unlocked. → See also page 40, section 5.9 "Locking/unlocking operation".

1. Disconnect device from 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 supply voltage to the device.
4. Press 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 device to the HistoROM®/M-DAT.
6. Before removing the HistoROM®/M-DAT again from the electronic insert, disconnect the device from supply voltage.

On-site operation via on-site display (optional) or remote operation**Copying configuration data from a device to a HistoROM®/M-DAT:**

1. Disconnect device from supply voltage.
2. Attach the HistoROM®/M-DAT module to the electronic insert.
3. Reestablish supply voltage to the device.
4. Using the HistoROM CONTROL parameter select the option "Device → HistoROM" as the data transfer direction.
(Menu path: (GROUPSELECTION →) OPERATING MENU → OPERATION)
5. Wait approx. 20 seconds. Configuration data are loaded from the device to the HistoROM®/M-DAT.
6. Disconnect device from the supply voltage again.
7. Detach memory module.
8. Reestablish supply voltage to the device.

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

The operation must be unlocked. → See also page 40, section 5.9 "Locking/unlocking operation".

1. Disconnect device from 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 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)
5. Wait approx. 20 seconds. Configuration data are loaded from the device to the HistoROM®/M-DAT. The device is restarted.
6. Before removing the HistoROM®/M-DAT again from the electronic insert, disconnect the device from supply voltage.

5.6 ToF Tool operating program

The ToF Tool is a graphic and menu-guided operating program for measuring devices from Endress+Hauser. It is used for supporting the commissioning, data storage, signal analysis and documentation of the devices. The following operating systems are supported: WinNT4.0, Win2000 and Windows XP. You can set all parameters via the ToF Tool.

The ToF Tool supports the following functions:

- Configuration of transmitters in online operation
- Loading and saving device data (upload/download)
- HistoROM®/M-DAT analysis
- Documentation of the measuring point
- Calculation of tank characteristics for the level measuring mode

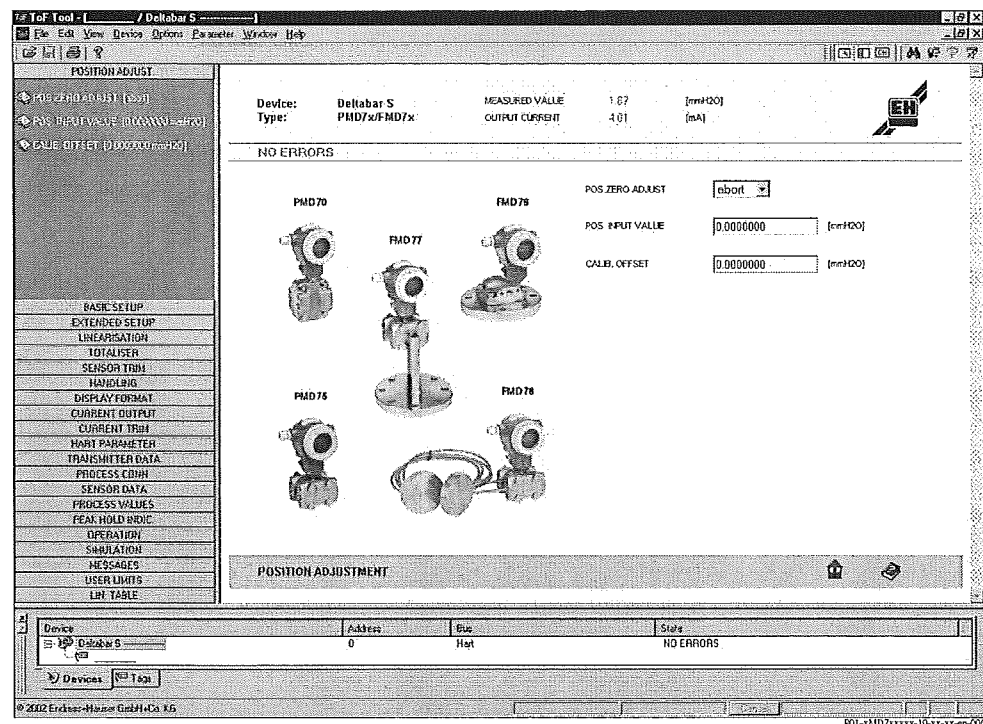


Fig. 33: ToF Tool operating program, the configuration is performed via a menu

Connection options:

- HART via Commubox FXA 191 and the serial interface RS 232 C of a computer
- Service interface with adapter FXA 193



Note!

- → See also page 24, section 4.2.6 "Connecting Commubox FXA 191 for operation via TOF Tool or Commuwin II".
- Further information on the ToF Tool can be found on the ToF Tool CD-ROM on the Internet (<http://www.endress.com>, Download → Search for: ToF Tool). The CD is supplied with any device ordered with the "HistoROM module" option.

5.7 Operation via HART handheld terminal

Use the HART handheld terminal to set all parameters all the way along the 4...20 mA cable via menu operation.

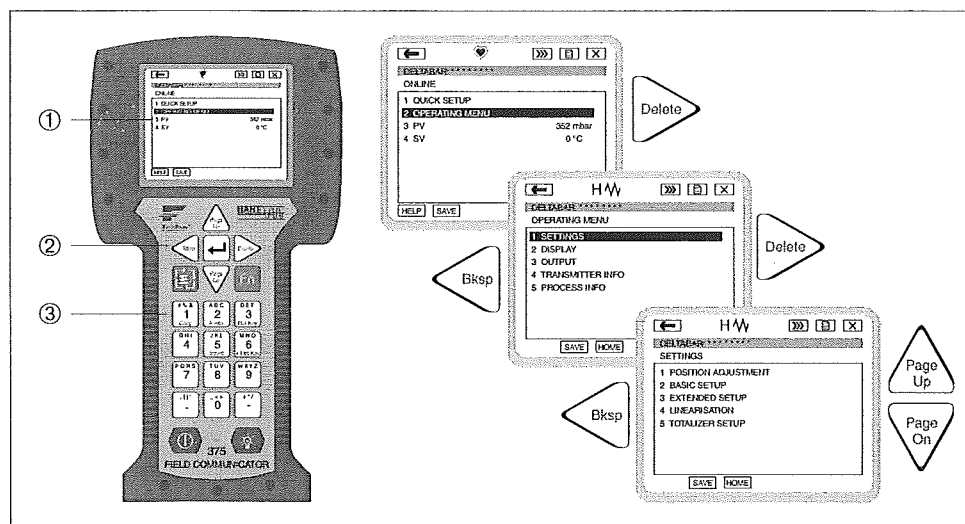


Fig. 34: HART handheld terminal, here e.g. Field Communicator DXR 375 and menu guidance

- 1 LC display with menu text
- 2 Keys for menu selection
- 3 Keys for parameter entry



Note!

- → See also page 23, section 4.2.5 "Connecting HART handheld terminal".
- For further information, please refer to the Operating Instructions for the handheld terminal. The Operating Instructions are supplied with the handheld terminal.

5.8 Commuwin II operating program

Commuwin II is a graphically supported operating program for intelligent measuring devices with the HART and PROFIBUS PA communication protocols. The following operating systems are supported: Win3.1/3.11, Win95, Win98, WinNT4.0 and Win2000. Commuwin II shows the most important parameters (→ see also section 10.2 "Operating matrix HART Commuwin II").

Commuwin II supports the following functions:

- Configuration of measuring devices in on-line operation via matrix operation
- Loading and saving device data (upload/download)
- Visualisation of measured and limit values
- Presentation and recording of measured values with a line recorder.



Note!


- For further information, please refer to the Operating Instructions BA 124F "Commuwin II FXS 113".
- You can obtain the current device description (DD) either from your local Endress+Hauser Sales Office or via the Internet (<http://www.endress.com>).

5.9 Locking/unlocking operation

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

You have the following possibilities for locking/unlocking the operation:

- Via a DIP-switch on the electronic insert, locally on the display.
- Via the on-site display (optional)
- Via communication e.g. ToF Tool, Commuwin II and HART handheld terminal.

The -symbol on the on-site display indicates that operation is locked. Parameters which refer to how the display appears, e.g. LANGUAGE and DISPLAY CONTRAST can still be altered.

Note!

- 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 on-site display or remote operation e.g. ToF Tool, you can only unlock operation again by means of the on-site display or remote operation.
- If the operation is locked, any change to the "Damping on/off" DIP switch will not have any impact on the damping time. Any change will not take effect until the operation has been unlocked again.

The table provides an overview of the locking functions:

Locking via	View/read parameter	Modify/write via ¹		Unlocking via		
		On-site display	Remote operation	DIP-switch	On-site display	Remote operation
DIP-switch	Yes	No	No	Yes	No	No
On-site 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.

5.9.1 Locking/unlocking operation locally via DIP-switch

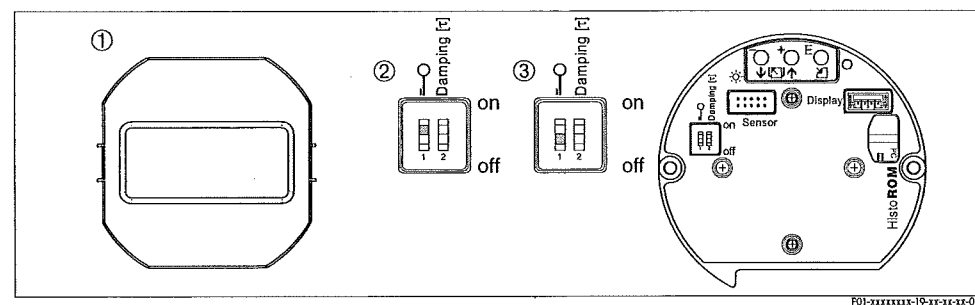


Fig. 35: DIP-switch position "Hardware locking" on the electronic insert

- 1 If necessary, remove on-site display (optional)
- 2 DIP-switch is at "on": operation is locked.
- 3 DIP-switch is at "off": operation is unlocked (operation possible)

5.9.2 Locking/unlocking operation via on-site 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...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.

5.10 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 BA274P "Cerabar S/ Deltabar S, Description of device functions". See also page 2, "Overview documentation".)

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 (→ see page 40, section 5.9).



Note!

Any customer-specific configuration carried out by 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 which have to do with how the display appears (DISPLAY group). – Any simulation which may be running is ended. – 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 initialised again). – Any simulation which may be running is ended. – 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, LINdMEASURAND or COMB. MEASURAND parameters, the parameters needed for this measuring task will be reset. – Any simulation which may be running is ended. – The device is restarted. <p>Example LEVEL MODE = linear and LIN. MEASURAND = Height</p> <ul style="list-style-type: none"> ■ HEIGHT UNIT = m ■ CALIBRATION MODE = wet ■ EMPTY CALIB. = 0 ■ FULL CALIB. = Sensor end value converted to H₂O, e.g. 50.99 mH₂O for a 500 mbar sensor
333	User reset <ul style="list-style-type: none"> – Affects the following parameters: <ul style="list-style-type: none"> – Function group POSITION ADJUSTMENT – Function group BASIC SETUP, except for the customer-specific units – Function group EXTENDED SETUP – Function group TOTALIZER SETUP – Group OUTPUT – Function group HART DATA: BUS ADDRESS and PREAMBLE NUMBER – Any simulation which may be running is ended. – The device is restarted.

Reset code	Description and effect
7864	Total reset <ul style="list-style-type: none">– Affects the following parameters:<ul style="list-style-type: none">– Function group POSITION ADJUSTMENT– Function group BASIC SETUP– Function group EXTENDED SETUP– Function group LINEARISATION (an existing linearisation table is erased)– Function group TOTALIZER SETUP– Group OUTPUT– Function group PEAK HOLD INDICATOR– Function group HART DATA– All configurable messages ("Error" type) are set to "Warning".<ul style="list-style-type: none">→ See also page 55, section 8.1 "Messages" and page 62, 8.2 "Response of outputs to errors".– Function group USER LIMITS– Any simulation which may be running is ended.– The device is restarted.
8888	HistoROM reset <p>The measured value memory and event memory are cleared. During the reset, the HistoROM must be attached to the electronic insert.</p>

6 Commissioning



Note!

The device is configured for the Pressure measuring mode as standard. The measuring range and the unit in which the measured value is transmitted correspond to the specifications on the nameplate.

6.1 Function check

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

- "Post-installation check" checklist → see section 3.4
- "Post-connection check" checklist → see section 4.4

6.2 Selecting language and measuring mode

6.2.1 On-site operation

The LANGUAGE and MEASURING MODE parameters are located on the top menu level. → See also page, section 5.4.1 "General structure of the operating menu".

The following languages are available:

- Deutsch
- English
- Français
- Italiano
- Español
- Nederlands

The following measuring modes are available:

- Pressure
- Level
- Flow

6.2.2 ToF Tool or HART handheld terminal

The MEASURING MODE parameter is displayed in the ToF Tool and in the HART handheld terminal in the QUICK SETUP menus and in the BASIC SETUP function group (OPERATING MENU → SETTINGS → BASIC SETUP).

The following measuring modes are available:

- Pressure
- Level
- Flow

The LANGUAGE parameter is arranged in the ToF Tool and in the HART handheld terminal in the DISPLAY group (OPERATING MENU → DISPLAY).

Use the LANGUAGE parameter to select the menu language for the on-site display. Select the menu language for the ToF Tool via the "Options" menu → "Settings" → "Language" tab → "ToF Tool language" field.

The following languages are available:

- Deutsch
- English
- Français
- Italiano
- Español
- Nederlands

6.3 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 parameter 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. (A reference pressure is present at the device.)</p> <p>Example:</p> <ul style="list-style-type: none"> – MEASURED VALUE = 2.2 mbar – Correct the MEASURED VALUE via the POS. ZERO ADJUST parameter with the "Confirm" option. This means that you are assigning the value 0.0 to the pressure present. – MEASURED VALUE (after pos. zero adjust) = 0.0 mbar – The current value is also corrected. <p>The CALIB. OFFSET parameter displays the resulting pressure difference (offset) by which the MEASURED VALUE was corrected.</p> <p>Factory setting: 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. (A reference pressure is present at the device.)</p> <p>Example:</p> <ul style="list-style-type: none"> – MEASURED VALUE = 0.5 mbar – For the POS. INPUT VALUE parameter, specify the desired set point for the MEASURED VALUE, e.g. 2 mbar. ($\text{MEASURED VALUE}_{\text{new}} = \text{POS. INPUT VALUE}$) – MEASURED VALUE (after entry for POS. INPUT VALUE) = 2.0 mbar – 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: $\text{CALIB. OFFSET} = 0.5 \text{ mbar} - 2.0 \text{ mbar} = -1.5 \text{ mbar}$ – The current value is also corrected. <p>Factory setting: 0</p>
CALIB. OFFSET (319) Entry	<p>Position adjustment – the pressure difference between zero (set point) and the measured pressure is known. (A reference pressure is not present at the device.)</p> <p>Example:</p> <ul style="list-style-type: none"> – MEASURED VALUE = 2.2 mbar – 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</p>

6.4 Flow measurement

6.4.1 Preparatory steps



Note!

- The Deltabar S PMD70 or PMD75 is usually used for flow measurement.
- Before calibrating the Deltabar S, the impulse piping must be cleaned and the device filled with fluid. → See the following table.

	Valves	Meaning	Preferred installation
1	Close 3.		
2	Fill measuring system with fluid.		
	Open A, B, 2, 4.	Fluid flows in.	
3	Clean impulse piping if necessary ¹⁾ : – by blowing out with compressed air in the case of gases – by rinsing out in the case of liquids.		
	Close 2 and 4.	Block off device.	
	Open 1 and 5. ¹⁾	Blow out/rinse out impulse piping.	
	Close 1 and 5. ¹⁾	Close valves after cleaning.	
4	Vent device.		
	Open 2 and 4.	Introduce fluid.	
	Close 4.	Close negative side.	
	Open 3.	Balance positive and negative side.	
	Open 6 and 7 briefly, then close them again.	Fill device completely with fluid and remove air.	
5	Carry out pos. zero adjustment if the following conditions are met. If the conditions are not met, then do not carry out the pos. zero adjustment until after step 6. → See page 47, section 6.4.3 and page 44, section 6.3. Conditions: – The process cannot be blocked off. – The tapping points (A and B) are at the same geodetic height.		
6	Set measuring point in operation.		
	Close 3.	Shut off positive side from negative side.	
	Open 4.	Connect negative side.	
	Now – 1 ¹⁾ , 3, 5 ¹⁾ , 6 and 7 are closed. – 2 and 4 are open. – A and B open (if present).		
7	Carry out pos. zero adjustment if the flow can be blocked off. In this case, step 5 is not applicable. → See page 47, section 6.4.3. and 44, section 6.3		
8	Carry out calibration. → See page 46, section 6.4.2.		

Fig. 36: Above: preferred installation for gases
Below: preferred installation for liquids

- I Deltabar S, PMD70 or PMD75
II Three-valve manifold
Separator
1, 5 Drain valves
2, 4 Inlet valves
3 Equalising valve
6, 7 Vent valves on Deltabar S
A, B Shut-off valves

1) for arrangement with 5 valves

6.4.2 Information on flow measurement

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

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



Note!

- There is a Quick Setup menu for each of the measuring modes Pressure, Level and Flow which guides you through the most important basic functions. With the setting in the MEASURING MODE parameter, you specify which Quick Setup menu should be displayed. → See also page 43, section 6.2 "Selecting language and measuring mode".
- For a detailed description of the parameters see the Operating Instructions BA274P "Cerabar S/ Deltabar S, Description of device functions"
 - Table 6, POSITION ADJUSTMENT
 - Table 12, BASIC SETUP
 - Table 15, EXTENDED SETUP
 - Table 18, TOTALIZER SETUP.→ See also page 2, section "Overview documentation".
- For flow measurement, select the "Flow" option by means of the MEASURING MODE parameter. The operating menu is structured appropriately. → See also section 10.1.

6.4.3 Quick Setup menu for the Flow measuring mode

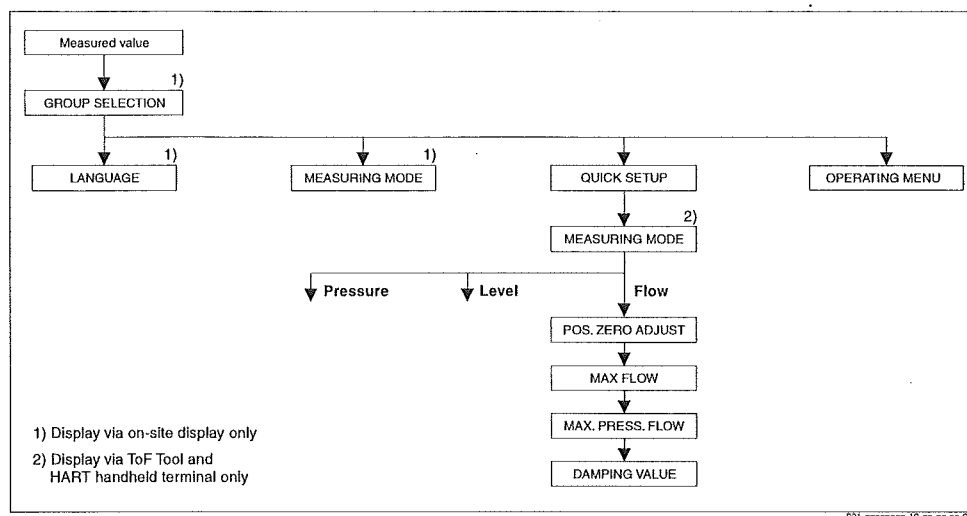


Fig. 37: Quick Setup menu for the Flow measuring mode

On-site operation
Measured value display On-site display: Switch from the measured value display to GROUP SELECTION with
GROUP SELECTION Select MEASURING MODE.
MEASURING MODE Select "Flow" option.
GROUP SELECTION Select QUICK SETUP menu.
POS. ZERO ADJUST Due to orientation of the device, there may be a shift in the measured value. You correct the MEASURED VALUE via the POS. ZERO ADJUST parameter with the "Confirm" option, i. e. you assign the value 0.0 to the pressure present.
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 TIME Enter damping time (time constant τ). The damping affects the speed at which all subsequent elements, such as the on-site display, measured value and current output react to a change in the pressure.

ToF Tool and HART handheld terminal
Measured value display Select QUICK SETUP menu.
MEASURING MODE Select "Flow" option.
POS. ZERO ADJUST Due to orientation of the device, there may be a shift in the measured value. You correct the MEASURED VALUE via the POS. ZERO ADJUST parameter with the "Confirm" option, i. e. you assign the value 0.0 to the pressure present.
MAX. FLOW Enter maximum flow of primary device. (→ See also layout sheet of primary device).
MAX. PRESS FLOW Enter maximum pressure of primary device. (→ See also layout sheet of primary device).
DAMPING TIME Enter damping time (time constant τ). The damping affects the speed at which all subsequent elements, such as the on-site display, measured value and current output react to a change in the pressure.



Note!

For on-site operation, see also page 29, section 5.2.3 "Function of the operating elements" and page 33, section 5.4 "On-site operation".

6.5 Level measurement

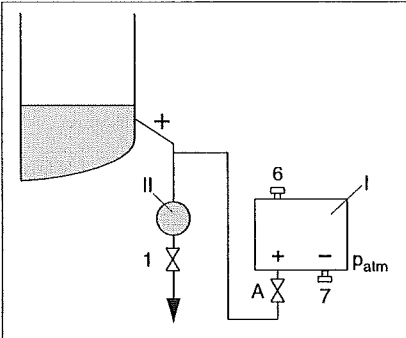
6.5.1 Preparatory steps

Open container



Note!

- The Deltabar S PMD70, PMD75, FMD76 and FMD77 are usually used for level measurement in an open container.
- FMD76 and FMD77: the device is ready for calibration immediately after opening a shut-off valve (may or may not be present).
- PMD70 and PMD75: before calibrating the device, the impulse piping must be cleaned and the device filled with fluid. → See the following table.

	Valves	Meaning	Installation
1	Fill container to a level above the lower tap.		
2	Fill measuring system with fluid.		
	Open A.	Open shut-off valve.	
3	Vent device.		
	Open 6 briefly, then close it again.	Fill device completely with fluid and remove air.	
4	Set measuring point in operation.		<p>Fig. 38: Open container</p> <p>I Deltabar S, PMD70 or PMD75</p> <p>II Separator</p> <p>1 Drain valve</p> <p>6, 7 Vent valves on Deltabar S</p> <p>A Shut-off valve</p>
	Now		
	– A and 6 are closed.		
	– B is open.		
5	Carry out calibration. → See page 50, section 6.5.2.		

Closed container



Note!

- All Deltabar S versions are suitable for level measurement in closed containers.
- FMD76 and FMD77: the device is ready for calibration immediately after opening a shut-off valve (may or may not be present).
- FMD78: the device is ready for calibration immediately.
- PMD70 and PMD75: before calibrating the device, the impulse piping must be cleaned and the device filled with fluid. → See the following table.

	Valves	Meaning	Installation
1	Fill container to a level above the lower tap.		<p style="text-align: right; font-size: small;">P01-20MD7/TEXT-11-XX-XX-XX-XX-XX</p>
2	Fill measuring system with fluid.		
	Close 3.	Shut off positive side from negative side.	
	Open A and B.	Open shut-off valves.	
3	Vent positive side (empty negative side if necessary).		
	Open 2 and 4.	Introduce fluid on positive side.	
	Open 6 and 7 briefly, then close them again.	Fill positive side completely with fluid and remove air.	
4	Set measuring point in operation.		
	Now		
	– 3, 6 and 7 are closed.		
	– 2, 4, A and B are open.		
5	Carry out calibration. → See page 50, section 6.5.2.		

Fig. 39: Closed container

I Deltabar S, PMD70 and PMD75
 II Three-valve manifold
 III Separator
 1, 2 Drain valves
 2, 4 Inlet valves
 3 Equalising valve
 6, 7 Vent valve on Deltabar S
 A, B Shut-off valve

Containers with superimposed steam



Note!

- All Deltabar S versions are suitable for level measurement in containers with superimposed steam.
- FMD76 and FMD77: the device is ready for calibration immediately after opening a shut-off valve (may or may not be present).
- FMD78: the device is ready for calibration immediately.
- PMD70 and PMD75: before calibrating the device, the impulse piping must be cleaned and the device filled with fluid. → See the following table.

	Valves	Meaning	Installation
1	Fill container to a level above the lower tap.		<p style="text-align: right; font-size: small;">FO1-2MD71111-11-11-11-11-005</p>
2	Fill measuring system with fluid.		
	Open A and B.	Open shut-off valves.	
	Fill the negative impulse piping to the level of the condensate trap.		
3	Vent device.		
	Open 2 and 4.	Introduce fluid.	
	Open 3.	Balance positive and negative side.	
	Open 6 and 7 briefly, then close them again.	Fill device completely with fluid and remove air.	
4	Set measuring point in operation.		
	Close 3.	Shut off positive side from negative side.	
	Open 4.	Connect negative side.	
	Now – 3, 6 and 7 are closed. – 2, 4, A and B are open.		
5	Carry out calibration. → See page 50, section 6.5.2.		

Fig. 40: Closed container with superimposed steam

- I Deltabar S, PMD70 and PMD75
 II Three-valve manifold
 III Separator
 1, 5 Drain valves
 2, 4 Inlet valves
 3 Equalising valve
 6, 7 Vent valves on Deltabar S
 A, B Shut-off valves

6.5.2 Information on level measurement

Three level types are available for level measurement, namely: "Linear", "Pressure Linearized" and "Height Linearized".

- Linear: select this level type if the measured variable is in direct proportion to the measured pressure. You can choose between Height, Volume, Mass or % as the measured variable.
- Pressure Linearized: select this level type if the measured variable is not in direct proportion to the measured pressure such as in the case of containers with a conical outlet. You can choose between Volume, Mass or % as the measured variable.
- Height Linearized: Select this level type if you need two measured variables or the container shape is given in value pairs such as height and volume. The following combinations are possible: "Height + Volume", "Height + Mass", "Height + %", "%-Height + Volume", "%-Height + Mass" or "%-Height + %". Perform two calibrations for this level type. First for the measured variable Height or %-Height like for the "Linear" level type and then for the measured variable Volume, Mass or % like for the "Pressure Linearized" level type.

For the level types "Linear" and "Height Linearized", the calibration modes "wet" and "dry" are available.

- Wet: wet calibration takes place by filling and emptying the container. Two pressure-level value pairs have to be entered for this calibration mode. In the case of two different levels, the level value is entered and the pressure measured at this moment is assigned to the level value.
- Dry: dry calibration is a theoretical calibration which you can carry out even if the device is not mounted or the container is empty. Depending on the measured variable selected, values for the parameters needed for the calculation are queried. For example, the density of the fluid must be entered for the "Level" measured variable.

For the "Pressure Linearized" and "Height Linearized" level type, enter a linearisation table. The entry modes "Manual" and "Semiautomatic" are available here.

- Manual: the container neither has to be filled nor emptied for this entry mode. Enter the appropriate value points for the linearisation table.
- Semiautomatic: the container is filled or emptied in stages in this entry mode. The device automatically records the hydrostatic pressure. Enter the associated volume, mass or %-value.



Note!

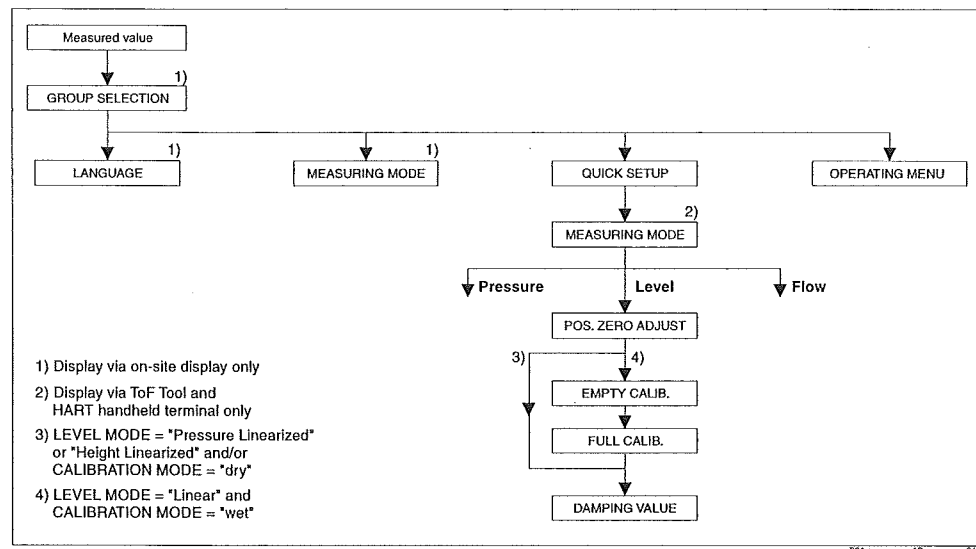
- There is a Quick Setup menu for each of the measuring modes Pressure, Level and Flow which guides you through the most important basic functions. With the setting in the MEASURING MODE parameter, you specify which Quick Setup menu should be displayed. → See also page 43, section 6.2 "Selecting language and measuring mode".
- For a detailed description of the parameters see the Operating Instructions BA274P "Cerabar S/ Deltabar S, Description of device functions"
 - Table 6, POSITION ADJUSTMENT
 - Table 8 to 11, BASIC SETUP
 - Table 14, EXTENDED SETUP
 - Table 16, LINEARISATION – On-site operation
 - Table 17, LINEARISATION – ToF Tool and HART handheld terminal
 - See also page 2, section "Overview documentation".
- For level measurement, select the "Level" option by means of the MEASURING MODE parameter. The operating menu is structured appropriately. → See also section 10.1. The factory settings for the LEVEL MODE, CALIBRATION MODE, LIN. MEASURAND, EMPTY CALIB. and FULL CALIB. parameters are as follows:
 - LEVEL MODE = Linear
 - CALIBRATION MODE = wet
 - LIN. MEASURAND = %
 - EMPTY CALIB. = 0 %
 - FULL CALIB. = 100 %.

6.5.3 Quick Setup menu for Level measuring mode



Note!

Some parameters of the "Level" measuring mode are only displayed if other parameters are appropriately configured. For example, the EMPTY PRESSURE parameter is not displayed unless the "Linear" option was selected for the LEVEL MODE parameter and the "wet" option was selected for the CALIBRATION MODE parameter (see following figure). You can find the LEVEL MODE parameter in the BASIC SETTINGS function group (menu path: (GROUP SELECTION →) OPERATING MENU → SETTINGS → BASIC SETTINGS).



6.6 Differential pressure measurement

6.6.1 Preparatory steps



Note!

- The Deltabar S PMD70, PMD75 and FMD78 are usually used for differential pressure measurement.
- FMD78: the device is ready for calibration immediately.
- PMD70 and PMD75: before calibrating the device, the impulse piping must be cleaned and the device filled with fluid. → See the following table.

Valves	Meaning	Preferred installation
1	Close 3.	
2	Fill measuring system with fluid.	
	Open A, B, 2, 4.	
3	Clean impulse piping if necessary: ¹ – by blowing out with compressed air in the case of gases – by rinsing out in the case of liquids.	
	Close 2 and 4.	
	Block off device.	
	Open 1 and 5. ¹	
	Blow out/rinse out impulse piping.	
	Close 1 and 5. ¹	
	Close valves after cleaning.	
4	Vent device.	
	Open 2 and 4.	
	Introduce fluid.	
	Close 4.	
	Close negative side.	
	Open 3.	
	Balance positive and negative side.	
	Open 6 and 7 briefly, then close them again.	
	Fill device completely with fluid and remove air.	
5	Set measuring point in operation.	
	Close 3.	
	Shut off positive side from negative side.	
	Open 4.	
	Connect negative side.	
	Now – 1 ¹ , 3, 5 ¹ , 6 and 7 are closed. – 2 and 4 are open. – A and B open (if present).	
6	Carry out calibration if necessary. → See also page 54, section 6.6.2.	<p>Fig. 42: Above: preferred installation for gases Below: preferred installation for liquids</p> <p>I Deltabar S, PMD70 or PMD75 II Three-valve manifold III Separator 1, 5 Drain valves 2, 4 Inlet valves 3 Equalising valve 6, 7 Vent valves on Deltabar S A, B Shut-off valve</p>

1) for arrangement with 5 valves

6.6.2 Information on differential pressure measurement



Note!

- There is a Quick Setup menu for each of the measuring modes Pressure, Level and Flow which guides you through the most important basic functions. With the setting in the MEASURING MODE parameter, you specify which Quick Setup menu should be displayed. → See also page 43, section 6.2 "Selecting language and measuring mode".
- For a detailed description of the parameters see the Operating Instructions BA274P "Cerabar S/ Deltabar S, Description of device functions"
 - Table 6, POSITION ADJUSTMENT
 - Table 7, BASIC SETUP
 - Table 13, EXTENDED SETUP
 → See also page 2, section "Overview documentation".
- For differential pressure measurement, select the "Pressure" option by means of the MEASURING MODE parameter. The operating menu is structured appropriately. → See also section 10.1.

6.6.3 Quick Setup menu for Pressure measuring mode

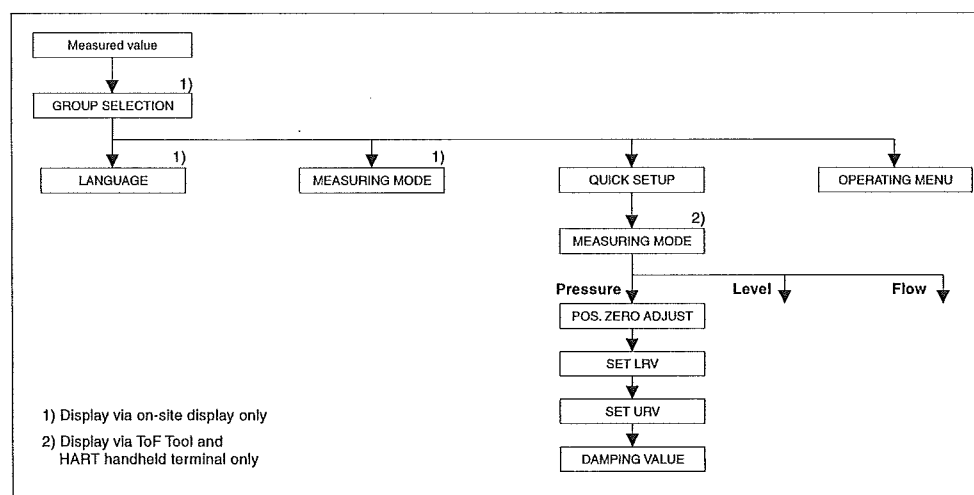


Fig. 43: Quick Setup menu for Pressure measuring mode

On-site operation	ToF Tool and HART handheld terminal
Measured value display On-site display: Switch from the measured value display to GROUP SELECTION with .	Measured value display Select QUICK SETUP menu.
GROUP SELECTION Select MEASURING MODE.	MEASURING MODE Select "Pressure" option.
MEASURING MODE Select "Pressure" option.	
GROUP SELECTION Select QUICK SETUP menu.	
POS. ZERO ADJUST Due to orientation of the device, there may be a shift in the measured value. You correct the MEASURED VALUE via the POS. ZERO ADJUST parameter with the "Confirm" option, i. e. you assign the value 0.0 to the pressure present.	POS. ZERO ADJUST Due to orientation of the device, there may be a shift in the measured value. You correct the MEASURED VALUE via the POS. ZERO ADJUST parameter with the "Confirm" option, i. e. you assign the value 0.0 to the pressure present.
SET LRV Set the measuring range (enter 4 mA value). Specify a pressure value for the lower current value (4 mA value). A reference pressure does not have to be present at the device.	SET LRV Set the measuring range (enter 4 mA value). Specify a pressure value for the lower current value (4 mA value). A reference pressure does not have to be present at the device.

On-site operation	ToF Tool and HART handheld terminal
GET LRV Set the measuring range (enter 4 mA value). The pressure for the lower current value (4 mA value) is present at device. With the "Confirm" option, you assign the lower current value to the pressure value present.	GET LRV Set the measuring range (enter 4 mA value). The pressure for the lower current value (4 mA value) is present at device. With the "Confirm" option, you assign the lower current value to the pressure value present.
DAMPING TIME Enter damping time (time constant τ). The damping affects the speed at which all subsequent elements, such as the on-site display, measured value and current output react to a change in the pressure.	DAMPING TIME Enter damping time (time constant τ). The damping affects the speed at which all subsequent elements, such as the on-site display, measured value and current output react to a change in the pressure.

**Note!**

For on-site operation, see also page 29, section 5.2.3 "Function of the operating elements" and page 33, section 5.4 "On-site operation".

7 Maintenance

Deltabar S requires no maintenance.

7.1 Exterior cleaning

Please note the following points when cleaning the device:

- The cleaning agents used should not attack the surface and the seals.
- Mechanical damage to the membrane, e.g. due to pointed objects, must be avoided.

8 Trouble-shooting

8.1 Messages

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

The device differentiates between the error types "Alarm", "Warning" and "Error". At the factory, all "Error" type messages are set to "Warning".

→ See "Error type/NA 64" column and section 8.2 "Response of outputs to errors".

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

- Break down: indicated with "B"
- Maintenance need: indicated with "C" (check request)
- Function check: indicated with "I" (in service)

Error message display on the on-site display:

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

Message display via the ToF Tool, HART handheld terminal and Commuwin II:

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

**Note!**

- For support and further information, please contact Endress+Hauser Service.
- → See also section 8.4, 8.5 and 8.6.

Code	Error type/ NA 64	Message/description	Cause	Measure	Priority
101 (A101)	Alarm B	B>Sensor electronic EEPROM error	<ul style="list-style-type: none"> Electromagnetic effects are greater than specifications in the technical data. (→ See section 9.) 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	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	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	B>Checksum error in EEPROM: configuration segment	<ul style="list-style-type: none"> The supply voltage is disconnected when writing. Electromagnetic effects are greater than specifications in the technical data. (→ See section 9.) Main electronics defect. 	<ul style="list-style-type: none"> Reestablish supply voltage. Perform reset (Code 7864) if necessary. Carry out calibration again. Block off electromagnetic effects or eliminate sources of disturbance. Replace main electronics. 	6
113 (A113)	Alarm B	B>ROM failure in transmitter electronic	<ul style="list-style-type: none"> Main electronics defect. 	<ul style="list-style-type: none"> Replace main electronics. 	1
115 (E115)	Error C	C>Sensor overpressure	<ul style="list-style-type: none"> Overpressure present. Sensor defect. 	<ul style="list-style-type: none"> Reduce pressure until message disappears. Replace sensor. 	29
116 (W116)	Warning C	C>Download error, repeat download	<ul style="list-style-type: none"> The file is defect. During the download, the data are not correctly transmitted to the processor, e.g. because of open cable connections, spikes (ripple) on the supply voltage or electromagnetic effects. 	<ul style="list-style-type: none"> Use another file. Check cable connection PC – transmitter. Block off electromagnetic effects or eliminate sources of disturbance. Perform reset (Code 7864) and carry out calibration again. Repeat download. 	36
120 (E120)	Error C	C>Sensor low pressure	<ul style="list-style-type: none"> Pressure too low. Sensor defect. 	<ul style="list-style-type: none"> Increase pressure until message disappears. Replace sensor. 	30
121 (A121)	Alarm B	B>Checksum error in factory segment of EEPROM	<ul style="list-style-type: none"> Main electronics defect. 	<ul style="list-style-type: none"> Replace main electronics. 	5
122 (A122)	Alarm B	B>Sensor not connected	<ul style="list-style-type: none"> Cable connection sensor – main electronics disconnected. Electromagnetic effects are greater than specifications in the technical data. (→ See section 9.) Main electronics defect. Sensor defect. 	<ul style="list-style-type: none"> 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	B>EEPROM is defect.	<ul style="list-style-type: none"> Main electronics defect. 	<ul style="list-style-type: none"> Replace main electronics. 	10
131 (A131)	Alarm B	B>Checksum error in EEPROM: min/max segment	<ul style="list-style-type: none"> Main electronics defect. 	<ul style="list-style-type: none"> Replace main electronics. 	9
132 (A132)	Alarm B	B>Checksum error in totalizer EEPROM	<ul style="list-style-type: none"> Main electronics defect. 	<ul style="list-style-type: none"> Replace main electronics. 	7

Code	Error type/ NA 64	Message/description	Cause	Measure	Priority
133 (A133)	Alarm B	B>Checksum error in History EEPROM	<ul style="list-style-type: none"> – An error occurred when writing. – Main electronics defect. 	<ul style="list-style-type: none"> – Perform reset (Code 7864) and carry out calibration again. – Replace electronics. 	8
602 (W602)	Warning C	C>Linearisation curve not monoton	<ul style="list-style-type: none"> – The linearisation table is not monotonic increasing. 	<ul style="list-style-type: none"> – Add to linearisation table or perform linearisation again. 	57
604 (W604)	Warning C	C>Linearisation table not valid. At least 2 points	<ul style="list-style-type: none"> – The linearisation table consists of less than 2 points. 	<ul style="list-style-type: none"> – Add to linearisation table. If necessary, perform linearisation again. 	58
613 (W613)	Warning I	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	C>Current output out of range	<ul style="list-style-type: none"> – The current is outside the permitted range 3.8...20.5 mA. – The pressure applied is outside the set measuring range (but within the sensor range). 	<ul style="list-style-type: none"> – Check pressure applied, reconfigure measuring range if necessary (→ See also Operating Instructions BA274P, chapter 4 to 6 or these Operating Instructions, page 2.) – Perform reset (Code 7864) and carry out calibration again. 	49
700 (W700)	Warning C	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 carry out calibration again. – Replace main electronics. 	54
701 (W701)	Warning C	C>Measuring chain config. exceeds sensor range	<ul style="list-style-type: none"> – The calibration carried out would result in the sensor nominal operating range being undershot or overshot. 	<ul style="list-style-type: none"> – Carry out calibration again. 	51
702 (W702)	Warning C	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 carry out calibration again. – Copy suitable data to the HistoROM. (→ See also page 36, section 5.5.1 "Copying configuration data".) 	55
703 (A703)	Alarm B	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	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	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
706 (W706)	Warning C	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. (→ See also page 36, section 5.5.1 "Copying configuration data".) – Copy data from the HistoROM to the device. (→ See also page 36, section 5.5.1 "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. 	59

Code	Error type/ NA 64	Message/description	Cause	Measure	Priority
707 (A707)	Alarm B	B>X-VAL. of lin. table out of edit limits.	<ul style="list-style-type: none"> At least one X-VALUE in the linearisation 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 also Operating Instructions BA274P, chapter 5 or these Operating Instructions, page 2.) 	38
710 (W710)	Warning 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 BA274P, parameter description MINIMUM SPAN or these Operating Instructions, page 2.) Adjust calibration to suit sensor. Replace sensor with a suitable sensor. Check configuration and perform download again. 	51
711 (A711)	Alarm B	B>LRV or URV out of edit limits	<ul style="list-style-type: none"> Lower range value and/or upper range value undershoot or overshoot the sensor range limits. The sensor was replaced and the customer-specific configuration does not suit the sensor. Unsuitable download carried out. 	<ul style="list-style-type: none"> Reconfigure lower range value and/or upper range value to suit the sensor. Pay attention to position factor. Reconfigure lower range value and/or upper range value to suit the sensor. Pay attention to position factor. Replace sensor with a suitable sensor. Check configuration and perform download again. 	37
713 (A713)	Alarm B	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	C>Sensor over temperature	<ul style="list-style-type: none"> The temperature measured in the sensor is greater than the upper nominal temperature of the sensor. (→ See also Operating Instructions BA274P, parameter description Tmax SENSOR or these Operating Instructions, page 2.) Unsuitable download carried out. 	<ul style="list-style-type: none"> Reduce process temperature/ambient temperature. Check configuration and perform download again. 	32
716 (A716)	Alarm B	B>Sensor diaphragm broken	<ul style="list-style-type: none"> Sensor defect. 	<ul style="list-style-type: none"> Replace sensor. 	24
717 (E717)	Error C	C>Transmitter over temperature	<ul style="list-style-type: none"> The temperature measured in the electronics is greater than the upper nominal temperature of the electronics (+88 °C). Unsuitable download carried out. 	<ul style="list-style-type: none"> Reduce ambient temperature. Check configuration and perform download again. 	34
718 (E718)	Error C	C>Transmitter under temperature	<ul style="list-style-type: none"> The temperature measured in the electronics is smaller than the lower nominal temperature of the electronics (-43 °C). Unsuitable download carried out. 	<ul style="list-style-type: none"> Increase ambient temperature. Insulate device if necessary. Check configuration and perform download again. 	35
719 (A719)	Alarm B	B>Y-VAL of lin. table out of edit limits	<ul style="list-style-type: none"> At least on Y-VALUE in the linearisation table is below the MIN. TANK CONTENT or above the MAX. TANK CONTENT. 	<ul style="list-style-type: none"> Carry out calibration again. (→ See also Operating Instructions BA274P, chapter 5 or these Operating Instructions, page 2.) 	40

Code	Error type/ NA 64	Message/description	Cause	Measure	Priority
720 (E720)	Error C	C>Sensor under temperature	<ul style="list-style-type: none"> – The temperature measured in the sensor is smaller than the lower nominal temperature of the sensor. (→ See also Operating Instructions BA274P, parameter description Tmin SENSOR or Operating Instructions, page 2.) – Unsuitable download carried out. 	<ul style="list-style-type: none"> – Increase process temperature/ambient temperature. – Check configuration and perform download again. 	33
721 (A721)	Alarm B	B>ZERO POSITION level 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 carry out calibration again. 	41
722 (A722)	Alarm B	B>EMPTY CALIB. or FULL CALIB. 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 carry out calibration again. 	42
723 (A723)	Alarm B	B>MAX. FLOW out of edit limits	<ul style="list-style-type: none"> – FLOW-MEAS. TYPE has been changed. 	<ul style="list-style-type: none"> – Carry out calibration again. 	43
725 (A725)	Alarm B	B>Sensor connection error, cycle disturbance	<ul style="list-style-type: none"> – Electromagnetic effects are greater than specifications in the technical data. (→ See section 9.) – Sensor or main electronics defect. 	<ul style="list-style-type: none"> – Block off electromagnetic effects or eliminate source of disturbance. – Replace sensor or main electronics. 	25
726 (E726)	Error C	C>Sensor temperature error - overrange	<ul style="list-style-type: none"> – Electromagnetic effects are greater than specifications in the technical data. (→ See section 9.) – 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	C>Sensor pressure error - overrange	<ul style="list-style-type: none"> – Electromagnetic effects are greater than specifications in the technical data. (→ See section 9.) – 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	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	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	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. 	<ul style="list-style-type: none"> – Check system/pressure measured value. – Change value for Pmin ALARM WINDOW if necessary. (→ See also Operating Instructions BA274P, parameter description Pmin ALARM WINDOW or these Operating Instructions, page 2.) 	46

Code	Error type/ NA 64	Message/description	Cause	Measure	Priority
731 (E731)	Error C	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 BA274P, parameter description Pmax ALARM WINDOW or these Operating Instructions, page 2.) 	45
732 (E732)	Error C	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. 	<ul style="list-style-type: none"> Check system/temperature measured value. Change value for Tmin ALARM WINDOW if necessary. (→ See also Operating Instructions BA274P, parameter description Tmin ALARM WINDOW or these Operating Instructions, page 2.) 	48
733 (E733)	Error C	C>URV Temp. User limits 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 BA274P, parameter description Tmax ALARM WINDOW or these Operating Instructions, page 2.) 	47
736 (A736)	Alarm B	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	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	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	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	C>Calculation overflow, bad configuration	<ul style="list-style-type: none"> Level measuring mode: the measured pressure has undershot the value for HYDR. PRESS. MIN. or overshoot the value for HYDR. PRESS. MAX. Flow measuring mode: the measured pressure has undershot the value for MAX. PRESS FLOW. 	<ul style="list-style-type: none"> Check configuration and carry out calibration again if necessary. Select a device with a suitable measuring range. Check configuration and carry out calibration again if necessary. Select a device with a suitable measuring range. 	27
741 (A741)	Alarm B	B>TANK HEIGHT 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 carry out calibration again. 	44
742 (A742)	Alarm B	B>Sensor connection error (upload)	<ul style="list-style-type: none"> Electromagnetic effects are greater than specifications in the technical data. (→ See section 9.) 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 carry out calibration again. Check cable connection and repair if necessary. Replace sensor. 	18

Code	Error type/ NA 64	Message/description	Cause	Measure	Priority
743 (E743)	Alarm B	B>Electronic PCB error during initialisation	<ul style="list-style-type: none"> – 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	B>Main electronic PCB error	<ul style="list-style-type: none"> – Electromagnetic effects are greater than specifications in the technical data. (→ See section 9.) – 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	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
746 (W746)	Warning C	C>Sensor connection error - initialising	<ul style="list-style-type: none"> – Electromagnetic effects are greater than specifications in the technical data. (→ See section 9.) This message normally only appears briefly. – Overpressure or low pressure present. 	<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. – Reduce or increase pressure. 	26
747 (A747)	Alarm B	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	B>Memory failure in signal processor	<ul style="list-style-type: none"> – Electromagnetic effects are greater than specifications in the technical data. (→ See section 9.) – Main electronics defect. 	<ul style="list-style-type: none"> – Block off electromagnetic effects or eliminate source of disturbance. – Replace main electronics. 	15

8.2 Response of outputs to errors

The device differentiates between the error types Alarm, Warning and Error.

→ See the following table and page 55, section 8.1 "Messages".

Output	A (Alarm)	W (Warning)	E (Error: Alarm/Warning)
Current output	Assumes the value specified via the OUTPUT FAIL MODE ¹ , ALT. CURR. OUTPUT ¹ and SET MAX. ALARM ¹ parameter. → 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 BA274P, parameter description SELECT ALARM TYPE or these Operating Instructions, page 2.)
Bar graph (on-site display)	→ See this table, current output.	→ See this table, current output.	→ See this table, current output.
On-site display	<ul style="list-style-type: none"> The measured value and message are displayed alternately Measured value display: $\frac{1}{2}$ -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: $\frac{1}{2}$ -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 (ToF Tool, HART handheld terminal or Commuwin II)	In the case of an alarm, the ALARM STATUS ² parameter displays a 3-digit number such as 122 for "Sensor not connected".	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 "URV user limits exceeded".

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

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

8.2.1 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. The parameters are displayed in the OUTPUT group. ((GROUP SELECTION →) OPERATING MENU → OUTPUT).

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

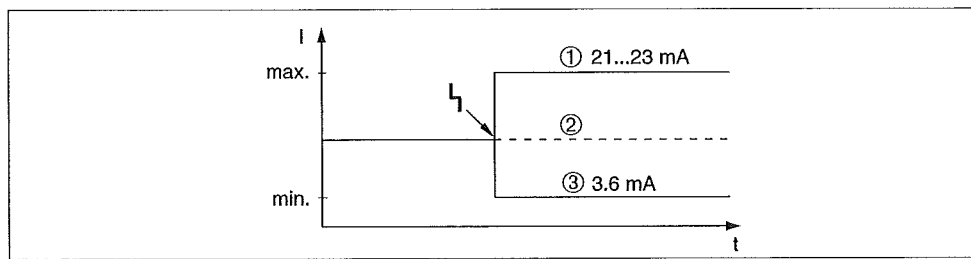


Fig. 44: Current output in the event of an alarm

Options:

- 1 Max. alarm (110%): can be set between 21...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., 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: the current output assumes the value set via the OUTPUT FAIL MODE and SET MAX. ALARM parameters.
- NAMUR
 - Lower sensor limit undershot (E 120 "Sensor low pressure"): 3.6 mA
 - Upper sensor limit overshoot (E 115 "Sensor overpressure") overshoot: current output assumes the value set via the SET MAX ALARM parameter.


Factory setting: ALT. CURR. OUTPUT = normal



8.3 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
– ALARM DISPL. TIME = 0 s – ACK. ALARM MODE = off	– Rectify cause of the message (see also Section 8.1).
– ALARM DISPL. TIME > 0 s – ACK. ALARM MODE = off	– Rectify cause of the message (see also Section 8.1). – Wait for the alarm display time to elapse.
– ALARM DISPL. TIME = 0 s – ACK. ALARM MODE = on	– Rectify cause of the message (see also Section 8.1). – Confirm message using ACK. ALARM parameter.
– ALARM DISPL. TIME > 0 s – ACK. ALARM MODE = on	– Rectify cause of the message (see also Section 8.1). – 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 on-site display displays a message, you can delete it with the -key.

If there are several messages, the on-site display shows the message which has the highest priority (see also Section 8.1). Once you have deleted this message using the -key, the message with the next highest priority is displayed. You can use the -key to delete each message, one after the other.

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

8.4 Repair

The Endress+Hauser repairs concept provides for measuring devices to have a modular design and also the customer may carry out repairs.

section "Spare parts" contains all the spare parts listed with their order numbers. You can order them from Endress+Hauser for repairs on your Deltabar S. As far as necessary, the spare parts also include replacement instructions.



Note!

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

8.5 Repair of Ex-certified devices



Warning!

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

- Only specialist personnel or Endress+Hauser may undertake repairs of certified devices.
- Relevant standards, national hazardous area regulations and Safety Instructions (XA...) and Certificates must be observed.
- Only genuine Endress+Hauser spare parts may be used.
- When ordering spare parts, please check the device designation on the nameplate. Identical parts may only be used as replacements.
- Electronic inserts or sensors already in use in a standard instrument may not be used as spare parts for a certified device.
- Carry out repairs according to the instructions. After repairs, the device must fulfil the requirements of the specified individual tests.
- A certified device may only be converted into another certified variant by Endress+Hauser.
- All repairs and modifications must be documented.

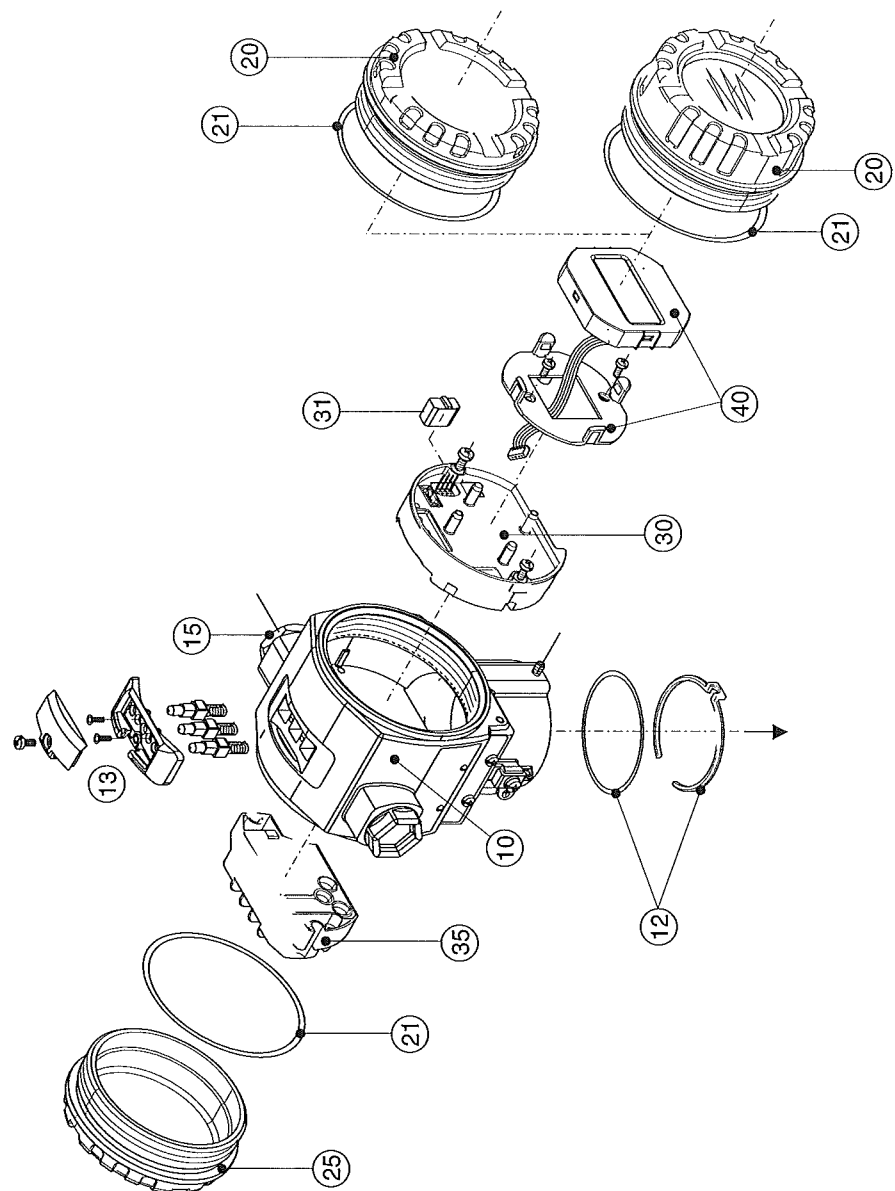
8.6 Spare Parts

The following pages list all the spare parts with order numbers which you can order from Endress+Hauser to repair the Deltabar S.

When ordering spare parts, always quote the serial number indicated on the nameplate. The spare parts number is embossed on every spare part. As far as necessary, the spare parts also include replacement instructions.

8.6.1 Spare parts for PMD70, PMD75, FMD76, FMD77, FMD78

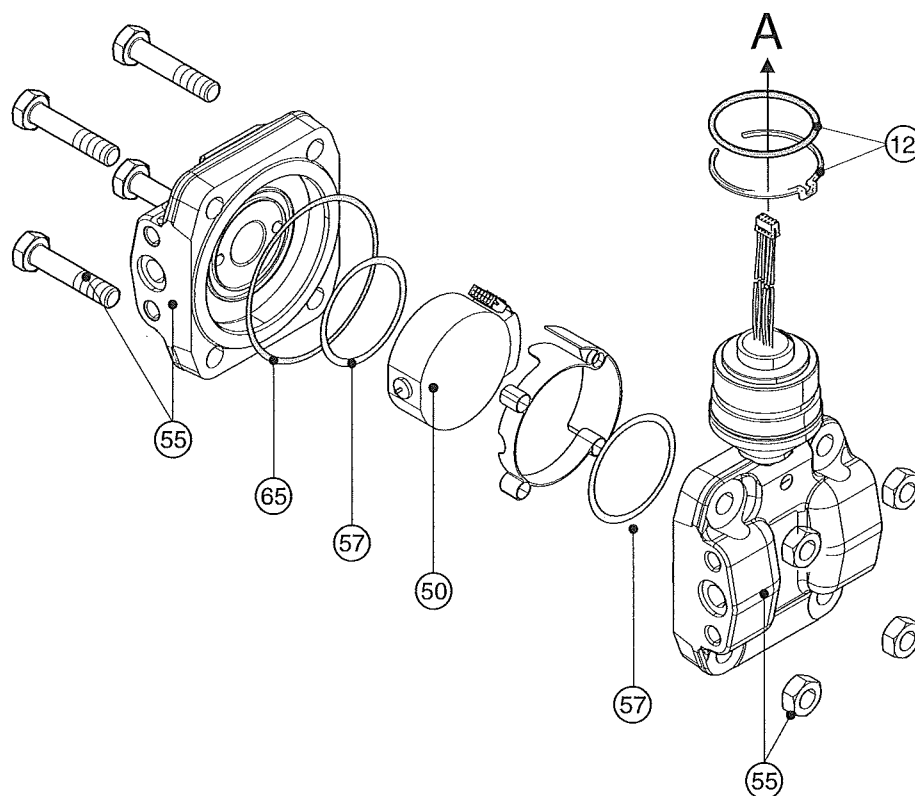
See the following pages for flanges and sensors.



P01-PM711111-09-11-11-11-000

10	Housing (with retaining ring and housing seal, without cover)
52020430	Aluminium T14 housing, M20x1.5, not for EEx d/XP
52020488	Aluminium T14 housing, M20x1.5, HART, with 3 push buttons external, not for EEx d/XP
52020489	Aluminium T14 housing, M20x1.5, PROFIBUS PA/Foundation Fieldbus, with push button external, not for EEx d/XP
52020431	Aluminium T14 housing, 1/2 NPT, not for EEx d/XP
52020490	Aluminium T14 housing, 1/2 NPT, HART, with 3 push buttons external, not for EEx d/XP
52020491	Aluminium T14 housing, 1/2 NPT, PROFIBUS PA/Foundation Fieldbus, with push button external, not for EEx d/XP
12	Mounting set housing/sensor
52020440	Mounting set housing/sensor consists of: 2 O-rings 45.69x2.62 EPDM + retaining ring
13	Push buttons housing, HART
52024110	Push buttons, consists of: push buttons, cover and screws (version 2.0)
15	Cable entry/Cable gland
52020760	Cable gland M20x1.5, gasket
52020761	Cable entry G 1/2, gasket, adapter
52020762	Plug 2/ pole, Han7D, gasket
52020763	Plug 3 pole, M12, gasket
20	Cover
52020432	Cover for Aluminium T14 housing incl. gasket, not for Ex d/XP
52020433	Cover for Aluminium T14- housing incl. gasket, for Ex d/XP
52020494	Cover for Aluminium T14 housing with sight glass incl. gasket, for Ex-free area
52020492	Cover for Aluminium T14 housing with sight glass incl. gasket, not for Ex d/XP
52020493	Cover for Aluminium T14 housing with sight glass incl. gasket, for Ex d/XP
21	Sealing for cover
52020429	Sealing set EPDM for cover Aluminium T14 housing (5 pieces)
25	Cover for terminal compartment
52020432	Cover for Aluminium T14 housing incl. gasket, not for Ex d/XP
52020433	Cover for Aluminium T14 housing incl. gasket, for Ex d/XP
30	Electronics
52024400	Electronics 4...20 mA, HART, Ex, version 2.0, push button on electronics
52024111	Electronics 4...20 mA, HART, Ex, version 2.0, push button on housing
31	HistoROM module
52020797	HistoROM module, ToF Tool-CD included
35	Terminal block
52020434	Terminal 3 pole, RFI-filter 4...20 mA HART Ex ia
52020436	Terminal 3 pole, RFI-filter 4...20 mA HART Ex d
40	Display module
52024112	Display module VU 333 with holder (version 2.0)

8.6.2 Spare parts for PMD70



P01-PMD70-09-xx-xx-001

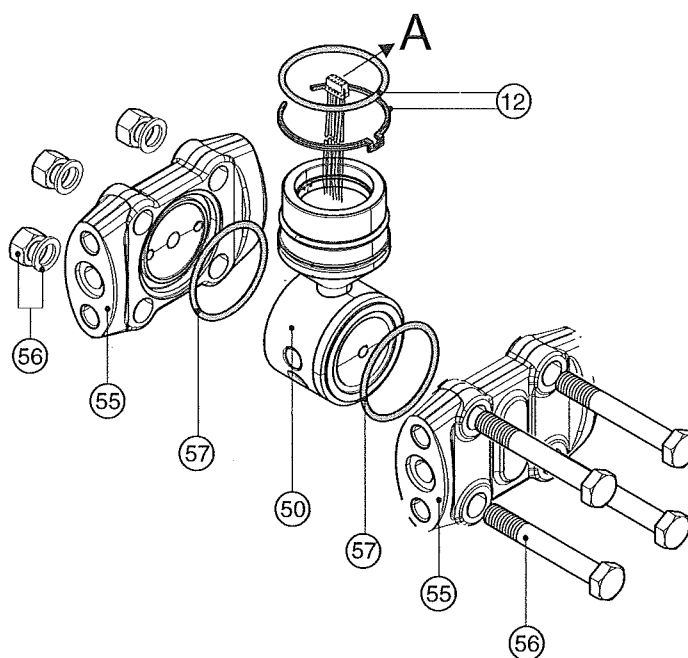
55	Flanges for PMD70
52020495	Flange 1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, C22.8 (2 pieces)
52020496	Flange 1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, AISI 316L (2 pieces)
52020497	Flange 1/4 – 18 NPT, mounting: M10, C22.8 (2 pieces)
52020498	Flange 1/4 – 18 NPT, mounting: M10, AISI 316L (2 pieces)
57	Process gasket
52020444	O-ring 48.9x2.62 EPDM 70 (4 pieces)
52020445	O-ring 48.9x2.62 FFKM Kalrez 70 (1 piece)
52020446	O-ring 48.9x2.62 FKM-Viton 70 (4 pieces)
52020447	O-ring 48.9x2.62 FKM-Viton 70, oil and grease free (4 pieces)
52020448	O-ring 48.9x2.62 FFKM 75 Chemraz (1 piece)
65	Sealing kit
52020779	O-ring 78.0x1.5 NBR 70 (4 pieces)

Sensor module for Deltabar S PMD70 (Position 50)

Certificates					
A					For non-hazardous areas
1					ATEX II 1/2 G EEx ia IIC T6
6					ATEX II 1/2 G EEx ia IIC T6, overspill protection WHG
2					ATEX II 1/2 D
3					ATEX II 1/2 GD EEx ia IIC T6
4					ATEX II 1/3 D
7					ATEX II 3 G EEx nA II T6
S					FM IS, Class I, II, III Division 1, Groups A – G; NI Class I Division 2, Groups A – D; AEx ia
Q					FM DIP, Class II, III Division 1, Groups E – G
R					FM NI, Class I, Division 2, Groups A – D
U					CSA IS, Class I, II, III Division 1, Groups A – G; Class I Division 2, Groups A – D, Ex ia
W					CSA Class II, III Division 1, Groups E – G (Dust-Ex)
Measuring cell, nominal operating range, PN					
7B					25 mbar measuring cell, PN 10 (2.5 kPa/250 mmH ₂ O/10 inH ₂ O/0.375 psi)
7D					100 mbar measuring cell, PN 16 (10 kPa/1 mH ₂ O/40 inH ₂ O/1.5 psi)
7F					500 mbar measuring cell, PN 100 (50 kPa/5 mH ₂ O/200 inH ₂ O/7.5 psi)
7H					3 bar measuring cell, PN 100 (300 kPa/30 mH ₂ O/1200 inH ₂ O/45 psi)
Process connection, material					
B					1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, C22.8
D					1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, AISI 316L
F					1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, Alloy C
G					1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, PVDF
U					RC 1/4 mounting: 7/16 – 20 UNF, AISI 316L
1					1/4 – 18 NPT, mounting: PN 160: M10, C22.8
2					1/4 – 18 NPT, mounting: PN 160: M10, AISI 316L
3					1/4 – 18 NPT, mounting: PN 160: M10, Alloy C
0					without process connection
Gasket material					
A					FKM Viton cell seal
B					EPDM cell seal
D					Kalrez cell seal
E					Chemraz cell seal
1					FKM Viton cell seal, degreased
Additional options 1					
A					Additional options 1 not selected
B					Material test certificate for wetted components, inspection certificate as per EN 10204 3.1.B acc. to specification 52005759
S					GL (German Lloyd) marine certificate
2					Test report acc. to EN10204 2.2
3					Routine test with certificate, inspection certificate as per EN 10204 3.1.B
4					Overpressure test with certificate, inspection certificate as per EN 10204 3.1.B
Additional options 2					
A					Additional options 2 not selected
K					Vent valves (2 pieces), Alloy C
S					GL (German Lloyd) marine certificate
U					Mounting bracket for wall and pipe, AISI 316L
2					Test report acc. to EN10204 2.2
3					Routine test with certificate, inspection certificate as per EN 10204 3.1.B
4					Overpressure test with certificate, inspection certificate as per EN 10204 3.1.B
5					Helium leak test EN 1518 with test certificate, inspection certificate as per EN 10204 3.1.B
PMD70X					order code sensor module with process connection
PMD70X			0	A A	order code sensor module without process connection

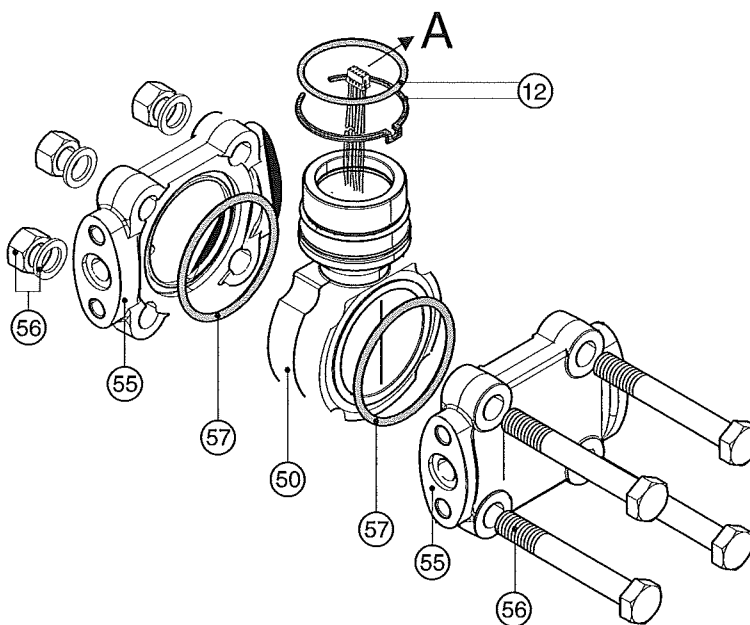
8.6.3 Spare parts for PMD75

Measuring ranges 100 mbar, 500 mbar, 3 bar, 16 bar, 40 bar



P01-2MD751111-09-11-11-002

Measuring ranges 10 mbar and 30 mbar



P01-2MD751111-09-11-11-002

55	Flanges for measuring ranges 100 mbar, 500 mbar, 3 bar, 16 bar, 40 bar
52020667	Flange 1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, C22.8 (2 pieces)
52020668	Flange 1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, AISI 316L (2 pieces)
52020669	Flange 1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, AISI 316L (2 pieces), with PTFE gasket (2 pieces)
52020670	Flange 1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, AISI 316L, side vent (2 pieces) incl. 4 locking screws, with PTFE gasket (2 pieces)
52020671	Flange 1/4 – 18 NPT, IEC 61518, mounting: 7/16 – 20 UNF, C22.8, side vent (2 pieces) incl. 4 locking screws
52020672	Flange 1/4 – 18 NPT, IEC 61518, mounting: 7/16 – 20 UNF, AISI 316L, side vent (2 pieces) incl. 4 locking screws
52020673	Flange 1/4 – 18 NPT, PN 160, mounting: M10, AISI 316L (2 pieces), with PTFE gasket (2 pieces)
52020674	Flange 1/4 – 18 NPT, PN 160, mounting: M10, C22.8 (2 pieces)
52020675	Flange 1/4 – 18 NPT, PN 160, mounting: M10, AISI 316L (2 pieces)
52020676	Flange 1/4 – 18 NPT, PN 420, mounting: M12, AISI 316L (2 pieces)
52020677	Flange 1/4 – 18 NPT, PN 420, mounting: M12, AISI 316L (2 pieces), with PTFE gasket (2 pieces)
52020678	Flange 1/4 – 18 NPT, PN 420, mounting: M12, C22.8 (2 pieces)
52020679	Flange RC 1/4, mounting: 7/16 – 20 UNF, AISI 316L (2 pieces), with PTFE gasket (2 pieces)
52020680	Flange RC 1/4, mounting: 7/16 – 20 UNF, AISI 316L (2 pieces)
52020681	Flange RC 1/4, mounting: 7/16 – 20 UNF, AISI 316L, side vent (2 pieces) incl. 4 locking screws, with PTFE gasket (2 pieces)
52020682	Flange RC 1/4, mounting: 7/16 – 20 UNF, AISI 316L, side vent (2 pieces) incl. 4 locking screws
55	Flanges for measuring ranges 10 mbar and 30 mbar
52020683	Flange 1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, C22.8 (2 pieces)
52020684	Flange 1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, AISI 316L (2 pieces), with PTFE gasket (2 pieces)
52020685	Flange 1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, AISI 316L (2 pieces)
52020686	Flange 1/4 – 18 NPT, PN 160, mounting: M10, C22.8 (2 pieces)
52020688	Flange 1/4 – 18 NPT, PN 160, mounting: M10, AISI 316L (2 pieces)
52020689	Flange 1/4 – 18 NPT, PN 160, mounting: M10, AISI 316L (2 pieces), with PTFE gasket (2 pieces)
52020690	Flange RC 1/4, mounting: 7/16 – 20 UNF, AISI 316L (2 pieces)
52020691	Flange RC 1/4, mounting: 7/16 – 20 UNF, AISI 316L (2 pieces), with PTFE gasket (2 pieces)
52020692	Flange 1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, C22.8, side vent (2 pieces) incl. 4 locking screws
52020694	Flange 1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, AISI 316L, side vent (2 pieces) incl. 4 locking screws, with PTFE gasket (2 pieces)
52020695	Flange 1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, AISI 316L, side vent (2 pieces) incl. 4 locking screws
52020696	Flange RC 1/4, mounting: 7/16 – 20 UNF, AISI 316L, side vent (2 pieces) incl. 4 locking screws
52020697	Flange RC 1/4, mounting: 7/16 – 20 UNF, AISI 316L, side vent (2 pieces) incl. 4 locking screws, with PTFE gasket (2 pieces)
56	Mounting set flanges
52020687	Mounting set flange, PN 420, steel, for gasket NBR, Viton, consists of: 4 hexagonal screws M12x90 and 4 hexagonal nuts
52020693	Mounting set flange, PN 420, steel, for gasket PTFE, copper, consists of: 4 hexagonal screws M12x90, 4 hexagonal nuts and 4 lock washers
52020758	Mounting set flange, PN 160, stainless steel, for gasket NBR, Viton, consists of: 4 hexagonal screws M12x90 and 4 hexagonal nuts
52020759	Mounting set flange, PN 160, stainless steel, for gasket PTFE, copper, consists of: 4 hexagonal screws M12x90, 4 hexagonal nuts and 4 lock washers
57	Process gasket for measuring range 100 mbar, 500 mbar, 3 bar, 16 bar, 40 bar
52020731	Gasket PTFE (4 pieces)
52020732	O-ring 44.0 x 3.0 FKM Viton 90 (4 pieces)
52020733	O-ring 44.0 x 3.0 FKM Viton 70 (4 pieces)
52020734	O-ring 44.0 x 3.0 NBR 70 (4 pieces)
57	Process gasket for measuring range 30 mbar and 30 mbar
52020735	Gasket PTFE (4 pieces)
52020736	O-ring 58.0 x 3.0 FKM Viton 83 (4 pieces)
52020737	O-ring 58.0 x 3.0 NBR 90 (4 pieces)

Sensor module for Deltabar S PMD75 (Position 50)

Certificates							
A							For non-hazardous areas
1							ATEX II 1/2 G EEx ia IIC T6
6							ATEX II 1/2 G EEx ia IIC T6, overspill protection WHG
2							ATEX II 1/2 D
3							ATEX II 1/2 GD EEx ia IIC T6
4							ATEX II 1/3 D
5							ATEX II 2 G EEx d IIC T6
7							ATEX II 3 G EEx nA II T6
S							FM IS, Class I, II, III Division 1, Groups A – G; NI Class I Division 2, Groups A – D; AEx ia
T							FM XP, Class I Division 1, Groups A – D; AEx d
Q							FM DIP, Class II, III Division 1, Groups E – G
R							FM NI, Class I, Division 2, Groups A – D
U							CSA IS, Class I, II, III Division 1, Groups A – G; Class I Division 2, Groups A – D, Ex ia
V							CSA XP, Class I, Division 1, Groups B – D, Ex d
W							CSA Class II, III Division 1, Groups E – G (Dust-Ex)
3							Combi-certificate: ATEX II 1/2 GD EEx ia IIC T6
C							Combi-certificate: FM IS and XP Class I Division 1, Groups A – D
D							Combi-certificate: CSA IS and XP Class I Division 1, Groups A – D
E							Combi-certificate: FM/CSA IS and XP Class I Division 1, Groups A – D
Measuring cell, nominal operating range, PN							
7B							10 mbar measuring cell, PN 160 (1 kPa/100 mmH ₂ O/4 inH ₂ O/0.15 psi)
7C							30 mbar measuring cell, PN 160 (3 kPa/300 mmH ₂ O/12 inH ₂ O/0.45 psi)
7D							100 mbar measuring cell, PN 160 (10 kPa/1 mH ₂ O/40 inH ₂ O/1.5 psi)
7F							500 mbar measuring cell, PN 160 (50 kPa/5 mH ₂ O/200 inH ₂ O/7.5 psi)
7H							3 bar measuring cell, PN 160 (300 kPa/30 mH ₂ O/1200 inH ₂ O/45 psi)
7L							16 bar measuring cell, PN 160 (1.6 MPa/160 mH ₂ O/528 ftH ₂ O/240 psi)
7M							40 bar measuring cell, PN 160 (4 MPa/400 mH ₂ O/1320 ftH ₂ O/600 psi)
8F							500 mbar measuring cell, PN 420 (50 kPa/5 mH ₂ O/200 inH ₂ O/7.5 psi)
8H							3 bar measuring cell, PN 420 (300 kPa/30 mH ₂ O/1200 inH ₂ O/45 psi)
8L							16 bar measuring cell, PN 420 (1.6 MPa/160 mH ₂ O/528 ftH ₂ O/240 psi)
8M							40 bar measuring cell, PN 420 (4 MPa/400 mH ₂ O/1320 ftH ₂ O/600 psi)
78							Prepared mounting DELTATOP/DELTASET, PN 160
88							Prepared mounting DELTATOP/DELTASET, PN 420
Material diaphragm							
1							AISI 316L
2							Alloy C
3							Monel
5							Tantalum
6							Alloy C276 with Rhodium-Gold coating
Process connection, material							
B							1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, C22.8
C							1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, C22.8, side vent, including 4 fastening bolt connections (AISI 316L) mounted
D							1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, AISI 316L
E							1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, AISI 316L, side vent, including 4 fastening bolt connections (AISI 316L) mounted
F							1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, Alloy C, without screws/vents
H							1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, Alloy C, side vent, without screws/vent
U							RC 1/4 mounting: 7/16 – 20 UNF, AISI 316L
V							RC 1/4 mounting: 7/16 – 20 UNF, C22.8, side vent, including 4 fastening bolt connections (AISI 316L) mounted
1							1/4 – 18 NPT, mounting: PN 160: M10, PN 420: M12, C22.8
2							1/4 – 18 NPT, mounting: PN 160: M10, PN 420: M12, AISI 316L
3							1/4 – 18 NPT, mounting: PN 160: M10, PN 420: M12, Alloy C
0							without process connection
PMD75X							order code sensor module with process connection
PMD75X				0	A	A	order code sensor module without process connection

→ For continuation of ordering information of sensor module, see following page.

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8.7 Returning the device

Before you send in a device for repairs or checking:

- Remove all signs of fluids, paying particular attention to seal grooves and gaps in which fluid can become lodged. This is especially important if the fluid is hazardous to health. Please refer also to the "Declaration of Contamination".

Please enclose the following when returning the device:

- Please fill out completely and sign the "Declaration of Contamination".
It is only then possible for Endress+Hauser to inspect or repair the returned device.
- The chemical and physical properties of the fluid.
- A description of the application.
- A description of the error which occurred.
- Special instructions on handling, if necessary, e.g. safety data sheet as per EN 91/155/EEC.

8.8 Disposal

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

8.9 Software history

Software version/ valid as of	Changes software	Changes documentation
01.00/01.10.2003	Original software. Compatible with: – ToF Tool Field Tool Package, version 1.04.00 or higher – Commuwin II version 2.08.-1, Update G or higher – HART Communicator DXR 375 (from OS 4.6) with Device Rev.: 10, DD Rev.: 1	
02.00/05.2004	<ul style="list-style-type: none"> – Number of parameters in the Quick Setup menus has been reduced. – On-site operation: LANGUAGE and MEASURING MODE parameters have been moved to the top level. – New SAFETY CONFIRM. group implemented for SIL. → See also SDI89P 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: – ToF Tool Field Tool Package version 2.00.00 or higher – Commuwin II version 2.08.-1, Update > G – HART Communicator DXR 375 (from OS 4.6) with Device Rev.: 20, DD Rev.: 1	<ul style="list-style-type: none"> – Documentation changed to reflect changes to the software. – The "Description of Parameters" Section has been moved to the Operating Instructions BA274P.

9 Technical data

For technical data, please refer to the Technical Information TI382P for Deltabar S.
→ See also page 2, section "Overview documentation".

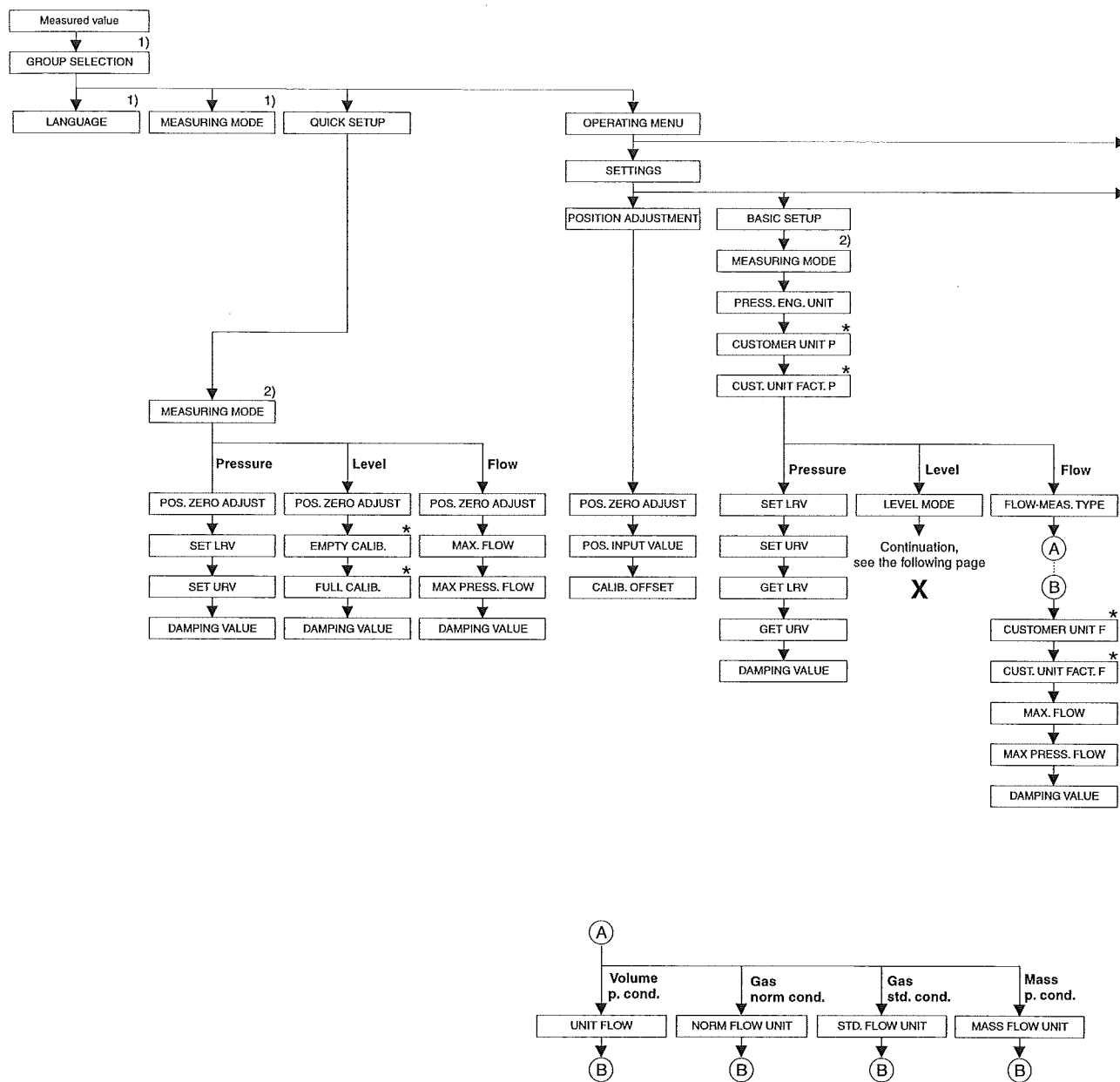
10 Appendix

10.1 Operating menu for on-site display, ToF Tool and HART handheld terminal



Note!

- The entire menu is depicted on the following pages.
- The menu has a different structure depending on the measuring mode selected. This means that some function groups are only displayed for one measuring mode, e.g. "LINEARISATION" function group for the Level measuring mode.
- In addition, there are also parameters that are only displayed if other parameters are appropriately configured. For example the Customer Unit P parameter is only displayed if the "User unit" option was selected for the PRESS. ENG. UNIT parameter. These parameters are indicated with a "**".
- For a description of the parameters, please refer to Operating Instructions BA274P "Description of device functions". The exact dependency of individual parameters on one another is explained here. See also page 2, section "Overview documentation".



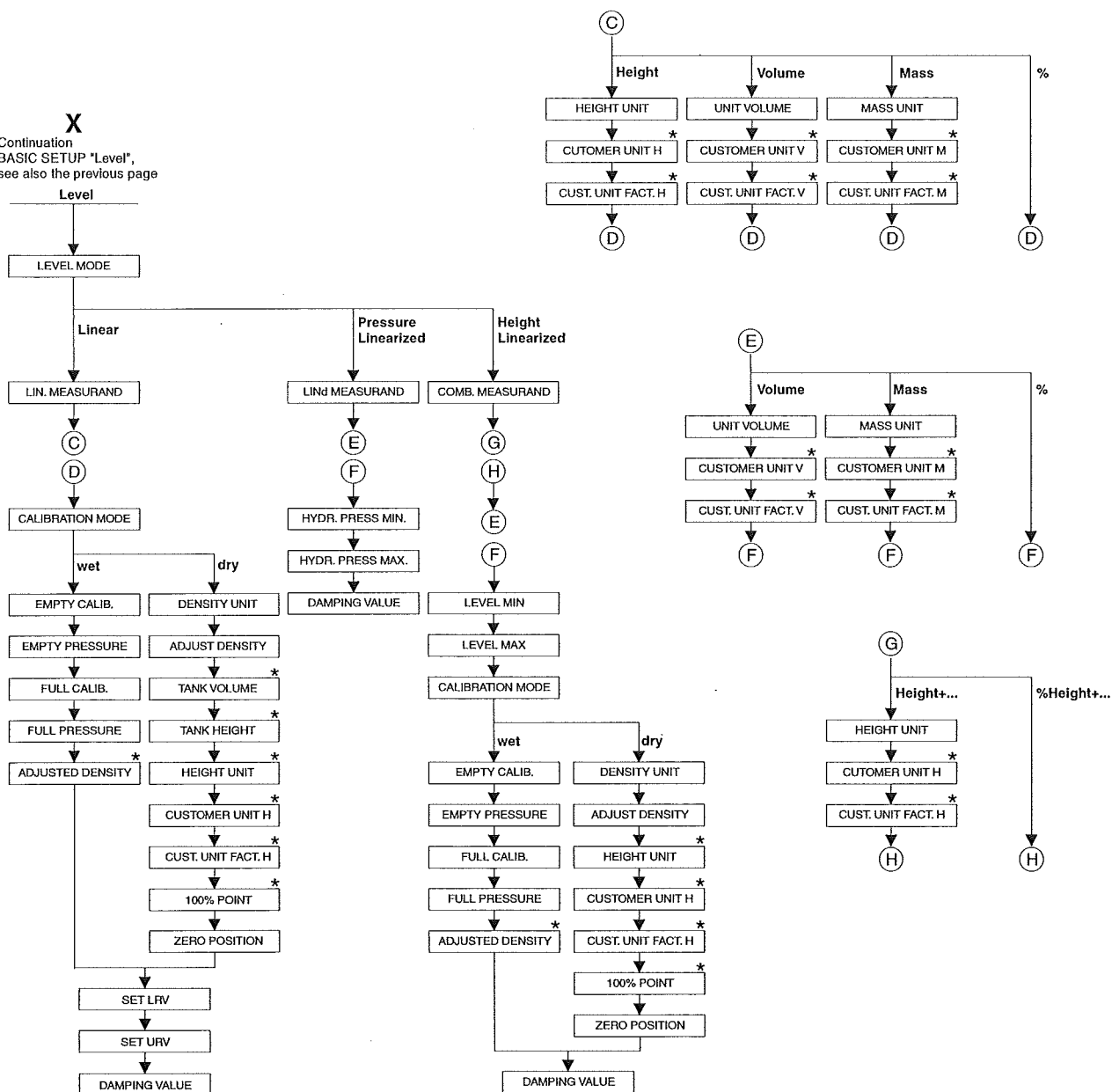
1) Display via on-site display only

2) Display via ToF Tool and
HART Handheld terminal only

* There are parameters that are only displayed if other parameters are appropriately configured.
For example the CUSTOMER UNIT P parameter is only displayed if the "User unit" option was selected for the PRESS. ENG. UNIT parameter.
These parameters are indicated with a ***.

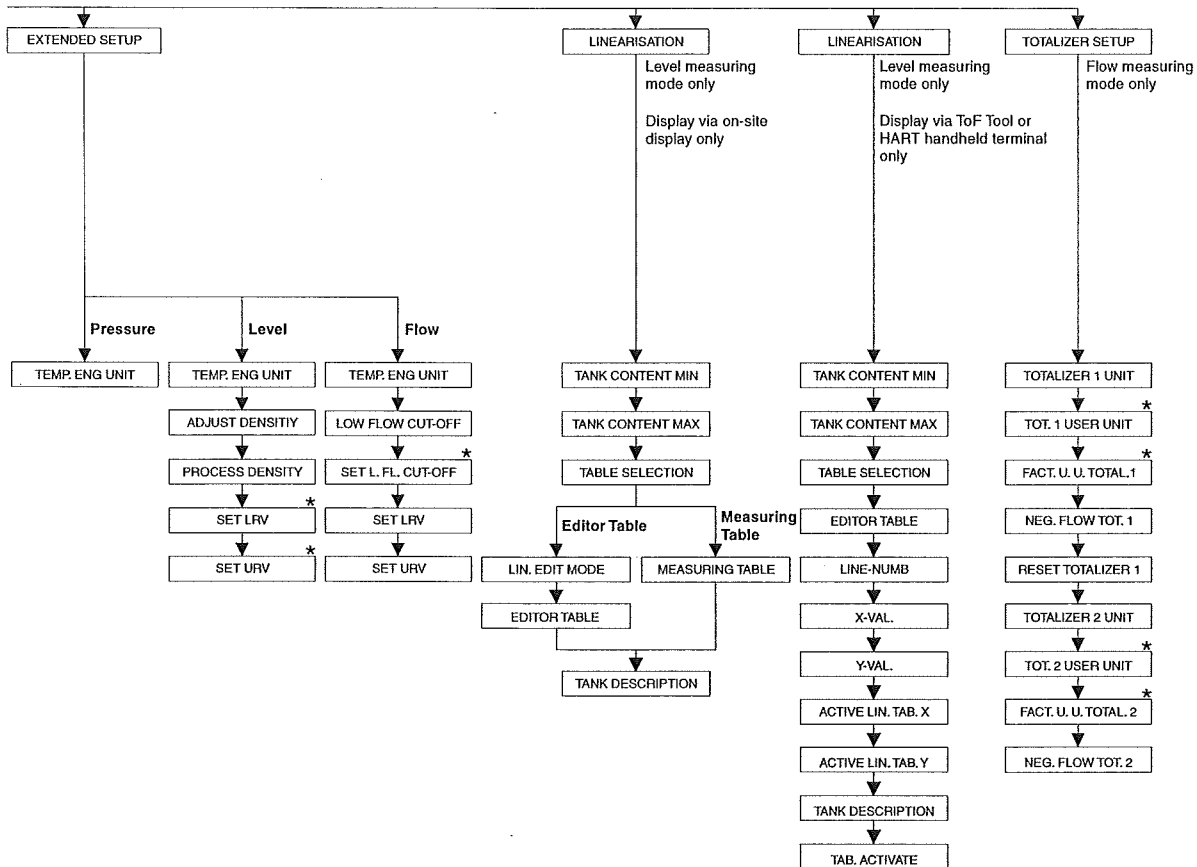
P01-111111-10-11-11-004

X
Continuation
BASIC SETUP "Level",
see also the previous page



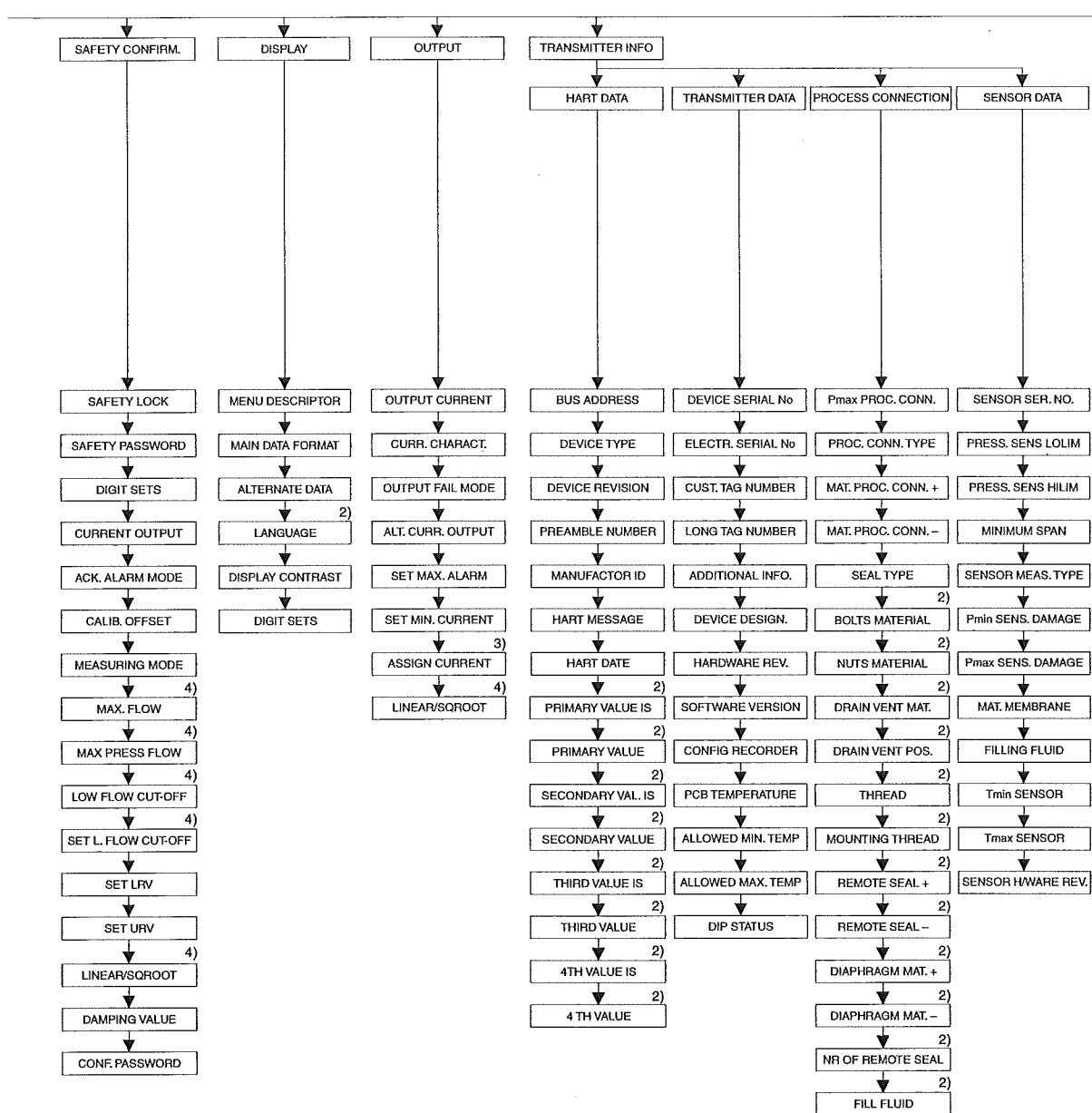
* There are parameters that are only displayed if other parameters are appropriately configured.
For example the CUST. UNIT FACT. H parameter is only displayed if the "User unit" option was selected for the HEIGHT UNIT parameter.
These parameters are indicated with a "*".

FCI-3711111-19-11-11-11-069



* There are parameters that are only displayed if other parameters are appropriately configured.
For example the TOT. 1 USER UNIT parameter is only displayed if the "User unit" option was selected for the TOTALIZER 1 UNIT parameter.
These parameters are indicated with a "*".

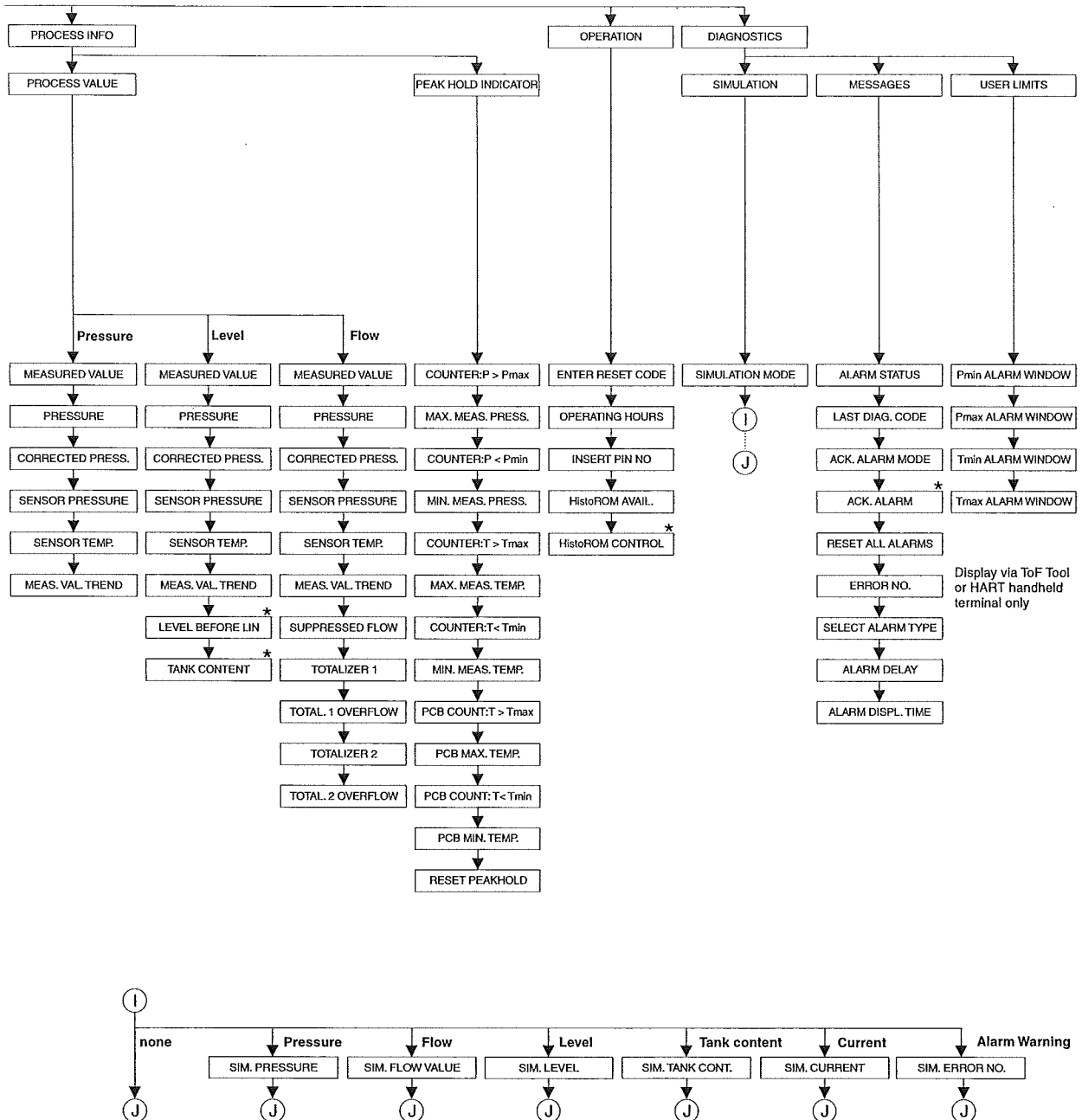
P01-xxxxxx-10-xx-xx-xx-070



2) Display via ToF Tool and HART handheld terminal only

3) Level measuring mode only

4) Flow measuring mode only



* There are parameters that are only displayed if other parameters are appropriately configured.
 These parameters are indicated with a **.

10.2 Operating matrix HART Commuwin II



Note!

All parameters are displayed via the ToF Tool, the HART handheld terminal and the on-site display (→ see section 10.1). Commuwin II only displays the parameters listed below.

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 Basic setup	Measured value	Set LRV	Set URV	Get LRV	Get URV	Calib. offset	Pos. zero adjust	Damping value	Output fail mode	Press. eng. unit
V1 Peak hold indic.	Min. meas. press.	Max. meas. pressure	Pos. input value	Sensor temp.	Min. meas. temp.	Max. meas. temp.	PCB temperature	PCB min. temp.	PCB max. temp.	Temp. eng. unit
V2 Transmitter info	Counter: P < Pmin	Counter: P > Pmax	Safety lockstate		Counter: T < Tmin	Counter: T > Tmax	Reset peakhold	HistoROM avail.	HistoROM control	Table selection
V3 Linearisation	Measuring mode	Level mode	Measurand	Tank content unit	Editor table	Lin. edit mode	Tab. activate	Line-numb	X-Val.	Y-Val.
V4 Level	Eng. unit level	Level min./Hydr. press. min.	Level max./Hydr. press. max.	Tank content min.	Tank content max.	Calibration mode	Empty calib.	Empty pressure	Full calib.	Full pressure
V5 Flow	Unit flow	Flow-meas. type	Max. pressure flow	Max flow	Low flow cut-off	Set l. fl. cut-off	Reset totalizer 1	Neg. flow tot. 1	Totalizer 1	Totalizer 1 unit
V6 Process info	Pmin Alarm window	Pmax Alarm window	Tmin Alarm window	Tmax alarm window	Proc. conn. type	Mat. proc. conn. +	Mat. proc. conn. -	Seal type	Filling fluid	Sensor meas. type
V7 Output	Output current	Set min. current	Set max. current	Linear/sqroot.	Assing current	Low sensor trim	High sensor trim	Press. sens. LOLIM	Press. sens. HILIM	Sensor pressure
V8 Additional function	Simulation mode	Simulated value	Main line format	Menu descriptor	Density unit	Adjust density	Zero position	100% point	DIP status	Damp switch
V9 Service	Alarm status	Last diag. code	Ack. alarm	Ack. alarm mode	Alarm delay	Alarm displ. time	Operating hours	Revision count	Enter reset code	Insert PIN no
VA User info	Cust. tag number	Additional info.	Device serial no	Sensor ser. no.	Electr. serial no	Device design.	Software version	Cust. unit flow	Flow unit scale	

10.3 Patents

This product may be protected by at least one of the following patents. Further patents are pending.

- DE 203 11 320 U1
- US 6,631,644 A1 ≙ EP 1 299 701 B1
- US 5,670,063 A1 ≙ EP 0 516 579 B1
- US 5,539,611 A1
- US 5,050,034 A1 ≙ EP 0 445 382 B1
- US 5,097,712 A1 ≙ EP 0 420 105 B1
- US 5,050,035 A1 ≙ EP 0 414 871 B1
- US 5,005,421 A1 ≙ EP 0 351 701 B1
- EP 0 414 871 B1
- US 5,334,344 A1 ≙ EP 0 490 807 B1
- US 6,703,943 A1
- US 5,499,539 A1 ≙ EP 0 613 552 B1

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Declaration of contamination

Dear customer,

Because of legal determinations and for the safety of our employees and operating equipment, we need this "Declaration of contamination" with your signature before your order can be handled. Please, include the completely filled in declaration with the device and the shipping documents in any case. Add also safety sheets and / or specific handling instructions if necessary.

Type of device / sensor:	_____	Serial no.:	_____
Medium / concentration:	_____	Temperature:	_____ Pressure: _____
Cleaned with:	_____	Conductivity:	_____ Viscosity: _____

Warning hints for medium used (mark the appropriate hints)

☐

radioactive

☐

explosive

☐

caustic

☐

poisonous

☐

harmful to
health

☐

biologically
hazardous

☐

inflammable

☐

safe

Reason for return

Company data

Company:	_____	Contact person:	_____
	_____		_____
	_____	Department:	_____
Address:	_____	Phone:	_____
	_____	Fax / e-mail:	_____
	_____	Your order no.:	_____

I hereby certify that the returned equipment has been cleaned and decontaminated acc. to good industrial practices and is in compliance with all regulations. This equipment poses no health or safety risks due to contamination.

(Place, date)

(Company stamp and legally binding signature)

More information about services and repairs:
www.services.endress.com

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