TI00437P/00/EN/22.21
71536630
2021-07-01



# Technical Information
# **Deltapilot M FMB50, FMB51, FMB52, FMB53**

Hydrostatic level measurement

## Pressure sensor with CONTITE™ measuring cell (condensate-resistant)

### Application

The device is used for the following measuring tasks:
- Hydrostatic pressure measurement in liquids and paste-like media in all areas of process engineering, process measuring technology, pharmaceuticals and the food industry
- Level, volume or mass measurement in liquids

### Your benefits

- Very good reproducibility and long-term stability
- Maximum plant safety provided by one-of-a-kind, condensate-resistant CONTITE measuring cell
- High reference accuracy: ±0.2 %
  optionally ±0.1 %
- Turn down up to 100:1
- Uniform platform for differential pressure, hydrostatics and pressure (Deltabar M – Deltapilot M – Cerabar M)
- Simple, fast commissioning through a user interface designed for real-world applications
- Used for process pressure monitoring up to SIL 2, certified to IEC 61508 Edition 2.0 and IEC 61511 by TÜV NORD
- Usage in drinking water: KTW, NSF

Endress+Hauser
People for Process Automation

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# Document information

**Document function**

The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.

**Symbols used**

## Safety symbols

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

## Electrical symbols

| Symbol | Meaning | Symbol | Meaning |
|---|---|---|---|
| | **Protective ground connection**<br>A terminal which must be connected to ground prior to establishing any other connections. | | **Ground connection**<br>A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system. |

## Symbols for certain types of information

| Symbol | Meaning |
|---|---|
| | **Permitted**<br>Procedures, processes or actions that are permitted. |
| | **Preferred**<br>Procedures, processes or actions that are preferred. |
| | **Forbidden**<br>Procedures, processes or actions that are forbidden. |
| | **Tip**<br>Indicates additional information. |
| | Reference to documentation |
| | Reference to page |
| | Reference to graphic |
| | Visual inspection |

## Symbols in graphics

| Symbol | Meaning |
|---|---|
| 1, 2, 3 ... | Item numbers |
| 1. , 2. , 3. ... | Series of steps |

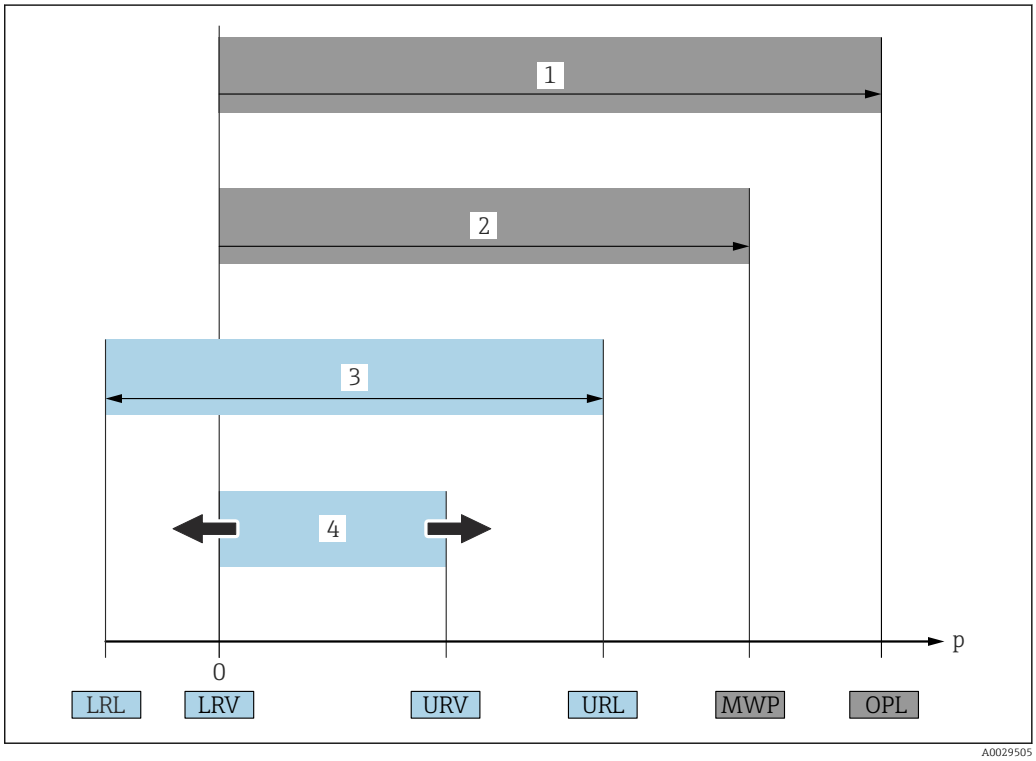
| Symbol | Meaning |
|---|---|
| **A, B, C, ...** | Views |
| **A-A, B-B, C-C, ...** | Sections |

**Documentation**

See chapter "Additional documentation" → 78

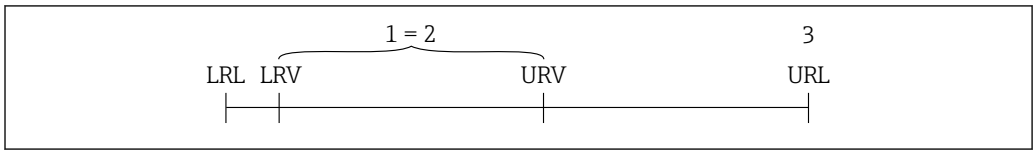
The document types listed are available:
In the Download Area of the Endress+Hauser Internet site: www.endress.com → Download

**Terms and abbreviations**




| Item | Term/abbreviation | Explanation |
|---|---|---|
| 1 | OPL | OPL: The OPL (over pressure limit = sensor overload limit) for the measuring device depends on the lowest-rated element, with regard to pressure, of the selected components, i.e., the process connection has to be taken into consideration in addition to the measuring cell. Observe pressure-temperature dependency. |
| 2 | MWP | MWP: The MWP (maximum working pressure) for the sensors depends on the lowest-rated element, with regard to pressure, of the selected components, i.e., the process connection has to be taken into consideration in addition to the measuring cell. Observe pressure-temperature dependency. The MWP may be applied at the device for an unlimited period of time. The MWP can be found on the nameplate. |
| 3 | Maximum sensor measuring range | Span between LRL and URL<br>This sensor measuring range is equivalent to the maximum calibratable/adjustable span. |
| 4 | Calibrated/adjusted span | Span between LRV and URV<br>Factory setting: 0 to URL<br>Other calibrated spans can be ordered as customized spans. |
| p | - | Pressure |
| - | LRL | Lower range limit |
| - | URL | Upper range limit |
| - | LRV | Lower range value |
| - | URV | Upper range value |
| - | TD (Turn down) | Turn down<br>Example - see the following section. |

## Turn down calculation




*1 Calibrated/adjusted span*
*2 Zero point-based span*
*3 Upper range limit*

**Example**

- Sensor: 10 bar (150 psi)
- Upper range limit (URL) = 10 bar (150 psi)
- Calibrated/adjusted span: 0 to 5 bar (0 to 75 psi)
- Lower range value (LRV) = 0 bar (0 psi)
- Upper range value (URV) = 5 bar (75 psi)

Turn down (TD):

$$TD = \frac{URL}{|URV - LRV|}$$

$$TD = \frac{10\ \text{bar (150 psi)}}{|5\ \text{bar (75 psi)} - 0\ \text{bar (0 psi)}|} = 2$$

In this example, the TD is 2:1.
This span is based on the zero point.

# Function and system design

**Device features**

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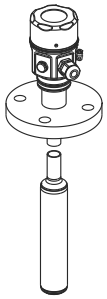
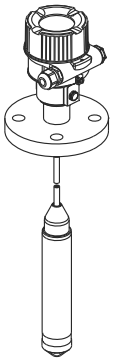
FMB50 Compact version



A0023538

FMB51 Rod version



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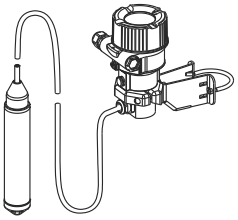
FMB52 Cable version



A0023540

FMB53 Rope version with mounting bracket

### Field of application

- Level measurement
- Pressure measurement

### Industries

- FMB50: Food, pharmaceuticals, chemicals, power plants, automotive, etc.
- FMB51: Food, pharmaceuticals, chemicals, power plants, automotive, etc.
- FMB52: Food, pharmaceuticals, chemicals, power plants, automotive, etc.
- FMB53: Environment (freshwater and wastewater)

**Process connections**

FMB50
- Thread
- Flanges
- Flush hygienic connections

FMB51
- Thread
- Flanges

FMB52
- Thread
- Flanges

FMB53
Suspension clamp

**Measuring ranges**

From −0.1 to +0.1 bar (-1.5 to +1.5 psi) to −1 to +10 bar (-15 to 150 psi)

**OPL**

Max. 40 bar (600 psi)

**Process temperature range**

FMB50
−10 to +100 °C (+14 to +212 °F) (+135 °C (+275 °F) for a maximum of 30 minutes)

FMB51
−10 to +85 °C (+14 to +185 °F)

FMB52
With PE cable (stationary): −10 to +70 °C (+14 to +158 °F)
With FEP cable (stationary): −10 to +80 °C (+14 to +176 °F)

FMB53
With PE cable (stationary): −10 to +70 °C (+14 to +158 °F)
With FEP cable (stationary): −10 to +80 °C (+14 to +176 °F)

**Operating temperature range**

- Without LCD display: −40 to +85 °C (−40 to +185 °F) (−25 to +85 °C (−13 to +185 °F) under static conditions with IO-Link)
- Without LCD in the case of IO-Link **with** current output: +70 °C (+158 °F)
- Without LCD in the case of IO-Link **without** current output: +80 °C (+176 °F)
- With LCD display: −20 to +70 °C (−4 to +158 °F)
  Extended temperature application range (−40 to +85 °C (−40 to +185 °F)) with restrictions in optical properties such as display speed and contrast
- With separate housing: −20 to +60 °C (−4 to +140 °F)
  (installation without insulation)

**Reference accuracy**

0.2 % (0.1% optionally) depending on the measuring range

**Supply voltage**

- 11.5 to 45 $V_{DC}$ (versions with plug-in connector 35 $V_{DC}$)
- For intrinsically safe device versions: 11.5 to 30 $V_{DC}$
- IO-Link communication: 18 $V_{DC}$ required at least (11.5 to 30 $V_{DC}$ if IO-Link is not used but rather the current output)

**Output**

4 to 20 mA with superimposed HART protocol, IO-Link, PROFIBUS PA or FOUNDATION Fieldbus

**Options**

- Gold-rhodium coated process membrane
- 3.1 inspection certificate
- 3A approval and EHEDG approval for FMB50

- Specific firmware versions
- Initial device settings can be ordered
- Separate housing

### Specialties

- Absolutely resistant to condensate thanks to hermetically sealed CONTITE™ cell
- Maximum flexibility thanks to modular design
- Special cleaning of the transmitter to remove paint-wetting impairment substances, for use in paint shops

### FMB50, FMB51, FMB52 universal application

- Modular probe program to ensure optimum process adaptation
- FMB50 compact version: installation in the tank from below or from the side
- FMB51, FMB52 rod and cable extension: installation from above, i.e. easy to retrofit ground tanks, no additional opening in the vessel floor

### FMB50 optimized for hygienic applications

- All typical flush-mounted process connections can be supplied
- Welding flanges
- Stainless steel housing
- All the sanitary process connections are gap-free and can be cleaned so that the unit is free of residue, e.g. CIP cleaning
- USDA/H1-approved transfer liquid as per FDA Directive
- 3A approval or EHEDG approvals

A0024005

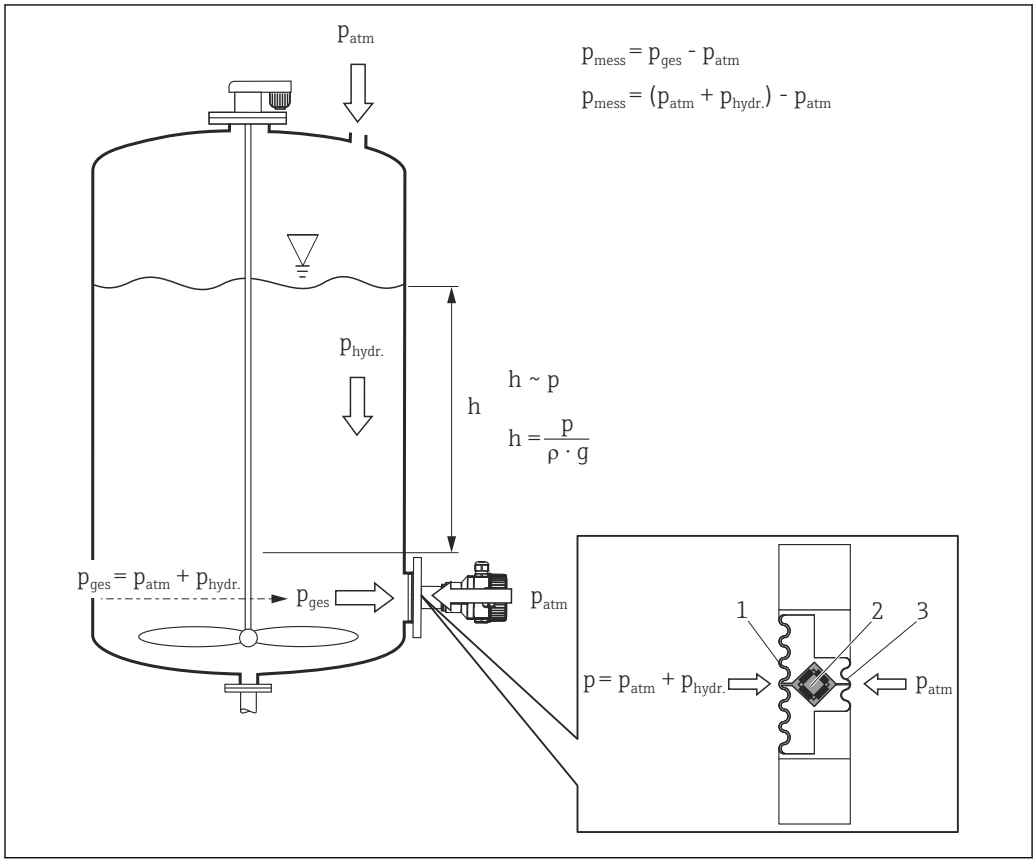
A0020029

### FMB53 for level measurement in water and wastewater

- The housing with the electronic insert is mounted outside shafts and vessels in such a way that it is protected from flooding. The extension cable is secured with a suspension clamp.
- The measuring cell tube made of stainless steel (AISI 316L) and the Alloy process isolating diaphragm allow use in aggressive media such as wastewater for example.
- Extension cable 500 to 300 000 mm (20 to 11 810 in) in length (up to 100 m (328 ft) in the hazardous area) without strain relief
- Special measuring cell with gold/rhodium coating for applications in which severe hydrogen formation can occur (e.g. digested sludge); → 35
- Special measuring cell with gold/platinum coating for acids, alkalis or sea water; → 35

**Measuring principle**

**Hydrostatic level measurement**




*1 Process isolating diaphragm*
*2 Measuring element*
*3 Rear isolating membrane of the CONTITE™ measuring cell*
*g Gravitational acceleration*
*h Level height*
*$P_{ges}$ Total pressure = hydrostatic pressure + atmospheric pressure*
*$P_{atm}$ Atmospheric pressure*
*$P_{hydr.}$ Hydrostatic pressure*
*$P_{mess}$ Measured pressure in the measuring cell = hydrostatic pressure*
*ρ Density of the medium*

Due to its weight, a liquid column creates hydrostatic pressure. If the density is constant, the hydrostatic pressure depends solely on the height h of the liquid column.

The CONTITE™ measuring cell, which works on the principle of the gauge pressure sensor, constitutes the core of Deltapilot M. In contrast to conventional gauge pressure sensors, the precision measuring element (2) in the CONTITE™ measuring cell is absolutely protected, situated between the process isolating diaphragm (1) and the rear isolating membrane (3). Thanks to this hermetic sealing of the measuring element, the CONTITE™ measuring cell is absolutely insensitive to condensate/ condensation and aggressive gases. The pressure applied is transferred from the process isolating diaphragm to the measuring element by means of an oil without any loss in pressure.

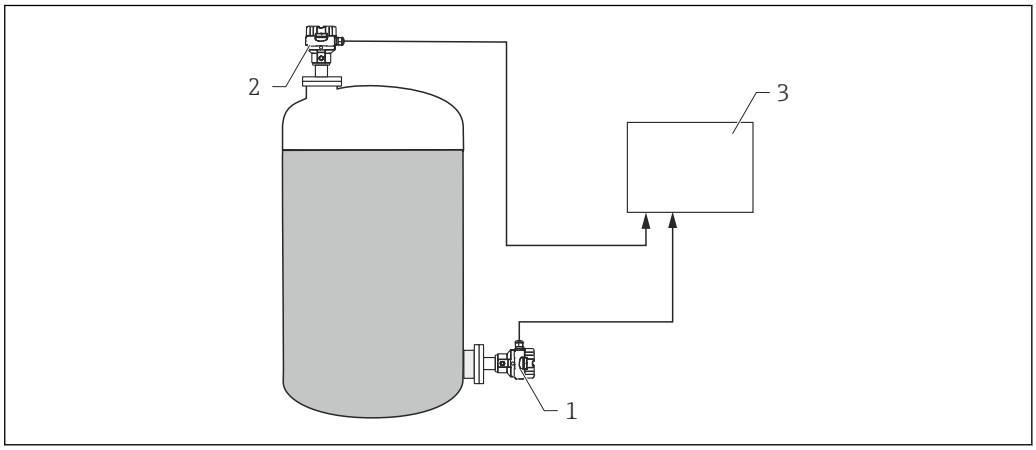
Any measured errors due to fluctuations in temperature are compensated for in the electronics unit by means of the sensor temperature.

A linearization function with max. 32 points, based on a table entered either manually or semi-automatically, can be activated locally or remotely. This function facilitates measurement in engineering units, and provides a linear output signal for spherical and horizontal cylindrical vessels, and vessels with a conical outlet.

**Level measurement in closed tanks with pressure overlay**

You can determine the differential pressure in tanks with pressure overlay using two Deltapilot M. The pressure measured values of the two probes are sent to a signal processing unit such as Endress

+Hauser RMA or a PLC. The signal processing unit or PLC determines the difference in pressure and uses this to calculate the level and the density where necessary.




*1 Deltapilot 1 measures the total pressure (hydrostatic pressure and top pressure)*
*2 Deltapilot 2 measures the top pressure*
*3 Signal processing unit determines the difference in pressure and uses this to calculate the level*

NOTICE

**Measured errors can occur.**
Large measured errors can occur if the ratio of the level to the top pressure is >1:6. This does not affect reproducibility.
- ▶ When selecting the measuring cell, make sure you select measuring ranges that are sufficiently wide (see example).

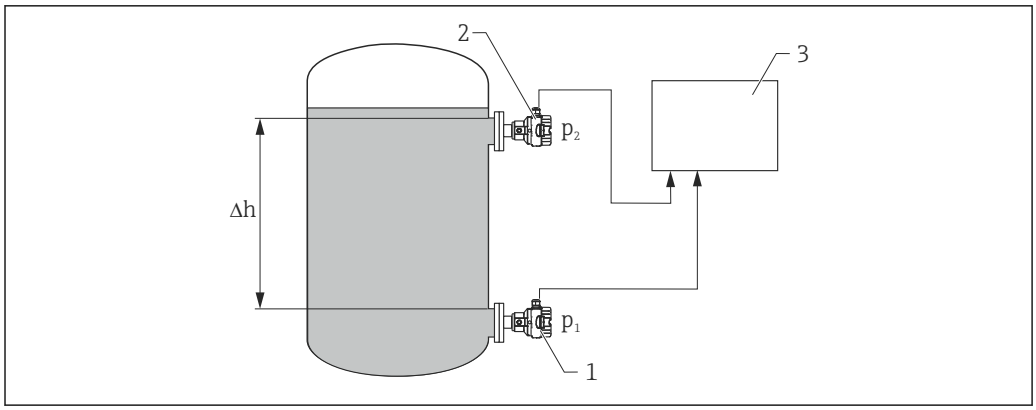
Example:
- Max. hydrostatic pressure = 600 mbar (9 psi)
- Max. top pressure (Deltapilot 2):
  300 mbar (4.5 psi)
- Max. total pressure, measured with Deltapilot 1:
  300 mbar (4.5 psi) + 600 mbar (9 psi) = 900 mbar (13.5 psi) measuring cell to be selected:
  0 to 1 200 mbar (0 to 18 psi)
- Max. pressure, measured with Deltapilot 2:
  300 mbar (4.5 psi) → measuring cell to be selected: 0 to 400 mbar (0 to 6 psi)

NOTICE

**Possibility of probe 2 flooding during differential pressure measurement.**
Measured errors can occur.
- ▶ When installing, make sure that probe 2 cannot be flooded.

**Density measurement**

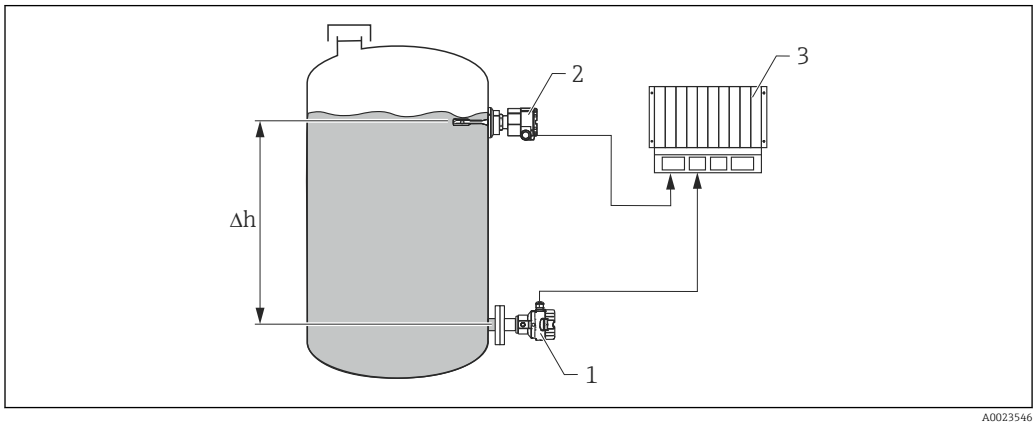
You can measure the density in tanks with pressure overlay using two Deltapilot M and a signal processing unit or a PLC. The signal processing unit or the PLC calculates the density from the known distance between the two Deltapilot M devices Δh and the two measured values $p_1$ and $p_2$.




1 *Deltapilot 1 determines pressure measured value $p_1$*
2 *Deltapilot 2 determines pressure measured value $p_2$*
3 *Signal processing unit determines the density from the two measured values $p_1$ and $p_2$ and the distance Δh*

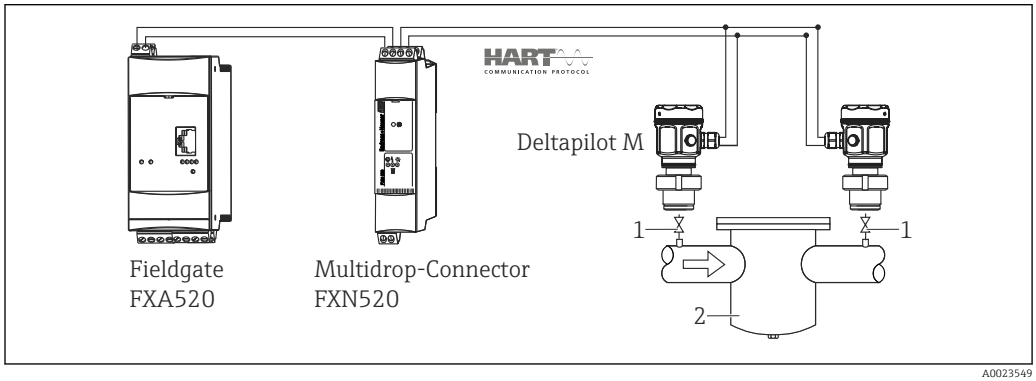
**Level measurement with automatic density correction (with media changing in the tank)**

Level measurement with automatic density correction is possible in conjunction with a limit switch such as Liquiphant and a PLC. The limit switch always switches at the same level. In the switch point, the signal processing unit determines the corrected density from the pressure of the Deltapilot M currently measured and the known distance between Deltapilot M and the limit switch. The signal processing unit then calculates the level from the new density and the measured pressure of the Deltapilot M.




1 *Deltapilot M*
2 *Liquiphant*
3 *PLC*

**Electrical differential pressure measurement with gauge pressure sensors**




1 *Shut-off valves*
2 *e.g. filter*

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

**⚠ WARNING**

**Risk of explosion!**

- ▶ If using intrinsically safe devices, strict compliance with the rules for interconnecting intrinsically safe circuits as stipulated in IEC60079-14 (proof of intrinsic safety) is mandatory.

**Communication protocol**

- 4 to 20 mA with HART communication protocol
- 4 to 20 mA with IO-Link communication protocol
- PROFIBUS PA
  - The Endress+Hauser devices meet the requirements of the FISCO model.
  - Due to a low current consumption of 11 mA ± 1 mA, the following number of devices can be operated on one bus segment if installing as per FISCO: up to 8 devices for Ex ia, CSA IS and FM IS applications or up to 31 devices for all other applications, e.g., in non-hazardous areas, Ex nA etc. Further information on PROFIBUS PA can be found in Operating Instructions BA00034S "PROFIBUS DP/PA: Guidelines for planning and commissioning" and in the PNO Guideline.
- FOUNDATION Fieldbus
  - The Endress+Hauser devices meet the requirements of the FISCO model.
  - Due to a low current consumption of 16 mA ± 1 mA, the following number of devices can be operated on one bus segment if installing as per FISCO: up to 6 devices for Ex ia, CSA IS and FM IS applications or up to 22 devices for all other applications, e.g., in non-hazardous areas, Ex nA etc. Further information on FOUNDATION Fieldbus, such as requirements for bus system components, can be found in Operating Instructions BA00013S "FOUNDATION Fieldbus Overview".

# Input

## Measured variable

**Measured process variables**

Hydrostatic pressure

## Measuring range

| Sensor | Maximum sensor measuring range | | Smallest calibratable measuring span (preset at the factory) [1] | MWP | OPL | Vacuum resistance [2] | Option [3] |
|---|---|---|---|---|---|---|---|
| | lower (LRL) [4] | upper (URL) | | | | Synthetic oil/ Inert oil | |
| [bar (psi)] | [bar (psi)] | [bar (psi)] | [bar (psi)] | [bar (psi)] | [bar (psi)] | [$bar_{abs}$ ($psi_{abs}$)] | |
| 0.1 (1.5) | −0.1 (-1.5) | +0.1 (+1.5) | 0.01 (0.15) | 2.7 (40.5) | 4 (60) | 0.01/0.04 (0.145/0.6) | 1C |
| 0.4 (6) | −0.4 (-6) | +0.4 (+6) | 0.02 (0.3) | 5.3 (79.5) | 8 (120) | | 1F |
| 1.2 (18) | −1 (-15) | +1.2 (+18) | 0.06 (1) | 16 (240) | 24 (360) | | 1H |
| 4 (60) | −1 (-15) | +4 (+60) | 0.2 (3) | 16 (240) | 24 (360) | | 1M |
| 10 (150) | −1 (-15) | +10 (+150) | 0.5 (7.5) | 27 (405) | 40 (600) | | 1P |

1) Factory calibration Turn down: Max 20:1, higher on request.
2) The vacuum resistance applies to the measuring cell at reference conditions.
3) Product Configurator, "Sensor range" ordering feature
4) By default, the device is set to a lower range limit of 0 bar. Please specify in the order if the lower range limit is to be set to a different default value.

# Output

**Output signal**

- 4 to 20 mA with superimposed digital communication protocol HART 6.0, 2-wire
- Digital communication signal IO-Link, 3-wire
- Digital communication signal PROFIBUS PA (Profile 3.02)
- Digital communication signal FOUNDATION Fieldbus

| Output | Optional [1] |
|---|---|
| 4 to 20mA HART | 2 |
| 4 to 20mA, IO-Link | 7 |
| PROFIBUS PA | 3 |
| FOUNDATION Fieldbus | 4 |

1) Product Configurator, "Output" ordering feature

**Signal range 4 to 20 mA**

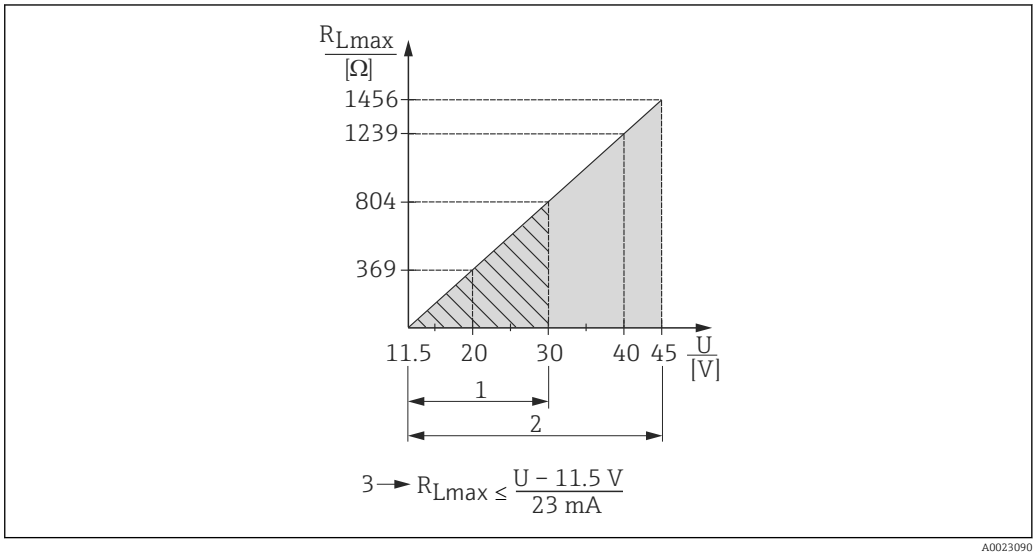
4 to 20 mA HART and IO-Link: 3.8 to 20.5 mA

**Signal on alarm**

As per NAMUR NE 43

- 4 to 20 mA HART:
  Options:
  - Max. alarm: can be set from 21 to 23 mA (factory setting: 22 mA)
  - Hold measured value: last measured value is held
  - Min. alarm: 3.6 mA
- IO-Link:
  - Max. alarm: permanently set to 22 mA
  - Min. alarm: 3.6 mA
  - Hold measured value: last measured value is held
- PROFIBUS PA: can be set in the Analog Input block
  Options: Last Valid Out Value (factory setting), Fail-safe Value, Status Bad
- FOUNDATION Fieldbus: can be set in the Analog Input block
  Options: Last Good Value, Fail-safe Value (factory setting), Wrong Value

**Load - 4...20 mA HART**



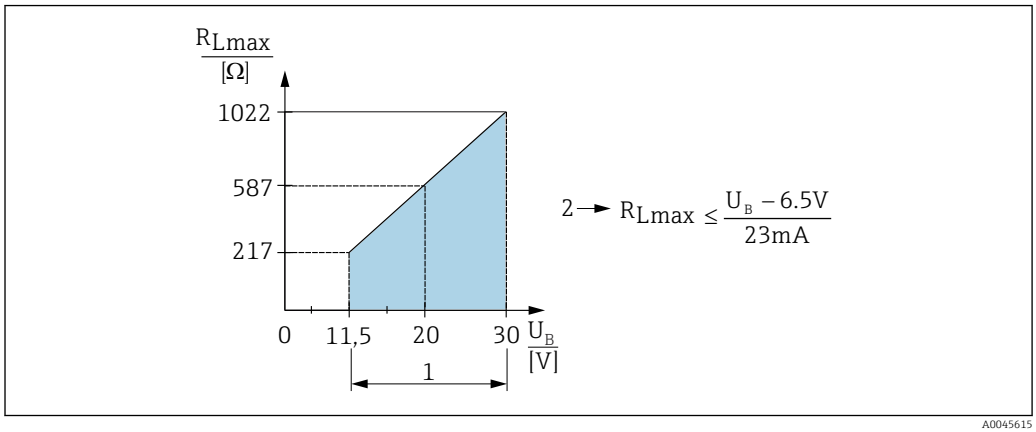

A0023090

*1 Supply voltage 11.5 to 30 V DC for intrinsically safe device versions (not for analog)*
*2 Supply voltage 11.5 to 45 V DC (versions with plug-in connector 35 V DC) for other types of protection and for uncertified device versions*
*3 $R_{Lmax}$ Maximum load resistance*
*U Supply voltage*

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

**Load for current output in the case of an IO-Link device**

In order to guarantee sufficient terminal voltage, a maximum load resistance $R_L$ (including line resistance) must not be exceeded depending on the supply voltage $U_B$ of the supply unit.

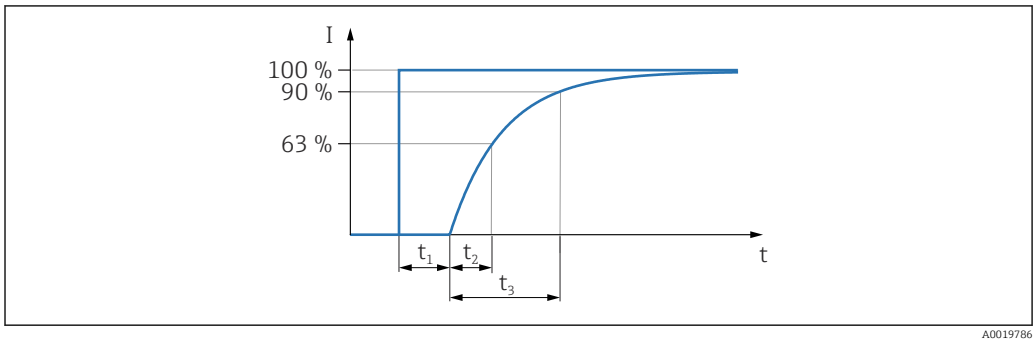



*1 Power supply 11.5 to 30 $V_{DC}$*
*2 $R_{Lmax}$ maximum load resistance*
*$U_B$ Supply voltage*

- Output of failure current and display of "M803" (Output: MIN alarm current)
- Periodic checking to establish if it is possible to quit fault state

**Dead time, time constant**

Presentation of the dead time and the time constant:




**Dynamic behavior, current output (HART electronics)**

| | Device | Dead time ($t_1$) [ms] | Time constant T63 (= $t_2$) [ms] | Time constant T90 (= $t_3$) [ms] |
|---|---|---|---|---|
| Max. | FMB50 | 60 | 90 | 210 |
| Max. | FMB51<br>FMB52<br>FMB53 | 500 | 250 | - |

**Dynamic behavior, digital output (HART electronics)**

| | Device | Dead time ($t_1$) [ms] | Dead time ($t_1$) [ms] + Time constant T63 (= $t_2$) [ms] | Dead time ($t_1$) [ms] + Time constant T90 (= $t_3$) [ms] |
|---|---|---|---|---|
| Min. | FMB50 | 220 | 310 | 370 |
| Max. | | 1020 | 1110 | 1170 |
| Min. | FMB51<br>FMB52<br>FMB53 | 660 | 910 | - |
| Max. | | 1460 | 1710 | - |

**Reading cycle**

- Acyclic: max. 3/s, typically 1/s (depends on command # and number of preambles)
- Cyclic (Burst): max. 3/s, typically 2/s

The device commands the BURST MODE function for cyclic value transmission via the HART communication protocol.

### Cycle time (update time)

Cyclic (Burst): min. 300 ms

### Response time

When recording step responses, it is important to bear in mind that the response times of the sensor might be added to the specified times.

- Acyclic: min. 330 ms, typically 590 ms (depending on command # and number of preambles)
- Cyclic (Burst): min. 160 ms, typically 350 ms (depending on command # and number of preambles)

## Dynamic behavior, PROFIBUS PA

| | Device | Dead time ($t_1$) [ms] | Dead time ($t_1$) [ms] + Time constant T63 (= $t_2$) [ms] | Dead time ($t_1$) [ms] + Time constant T90 (= $t_3$) [ms] |
|---|---|---|---|---|
| Min. | FMB50 | 95 | 185 | 245 |
| Max. | | 1195 | 1285 | 1345 |
| Min. | FMB51 FMB52 FMB53 | 535 | 785 | - |
| Max. | | 1635 | 1885 | - |

### Reading cycle (SPS)

- Acyclic: typically 25/s
- Cyclic: typically 30/s (dependent on the number and type of function blocks used in a closed-control loop)

### Cycle time (update time)

Min. 100 ms

The cycle time in a bus segment in cyclic data communication depends on the number of devices, on the segment coupler used and on the internal PLC cycle time.

### Response time

- Acyclic: approx. 23 ms to 35 ms (depending on Min. Slave Interval)
- Cyclic: approx. 8 ms to 13 ms (depending on Min. Slave Interval)

## Dynamic behavior, FOUNDATION Fieldbus

| | Device | Dead time ($t_1$) [ms] | Dead time ($t_1$) [ms] + Time constant T63 (= $t_2$) [ms] | Dead time ($t_1$) [ms] + Time constant T90 (= $t_3$) [ms] |
|---|---|---|---|---|
| Min. | FMB50 | 105 | 195 | 255 |
| Max. | | 1105 | 1195 | 1255 |
| Min. | FMB51 FMB52 FMB53 | 545 | 795 | - |
| Max. | | 1545 | 1795 | - |

### Reading cycle

- Acyclic: typically 5/s
- Cyclic: max. 10/s (dependent on the number and type of function blocks used in a closed-control loop)

### Cycle time (update time)

Cyclic: min. 100 ms

### Response time

- Acyclic: typically 70 ms (for standard bus parameter settings)
- Cyclic: max. 20 ms (for standard bus parameter settings)

## IO-Link

| | Dead time ($t_1$) [ms] | Time constant (T63), $t_2$ [ms] | Time constant (T90), $t_3$ [ms] |
|---|---|---|---|
| Min. | 60 ms + cycle time | 90 ms + cycle time | 210 ms + cycle time |

### Reading cycle

- Acyclic: cyclic/n where n is dependent on the size of the acyclic data
- Cyclic: min. 100/s

### Cycle time (update time)

Cyclic: min. 10 ms

### Response time

Cyclic: < 10 ms at 38.4 kbps

When recording step responses, it is important to bear in mind that the response times of the sensor might be added to the specified times.

## Damping

A damping affects all outputs (output signal, display):
- Via onsite display (not analog), handheld terminal or PC with operating program, continuous from 0 to 999 s
- Via DIP switch on the electronic insert (not IO-Link), "on" (= set value) and "off" (= damping switched off)
- Factory setting: 2 s

## Firmware version

| Designation | Option [1] |
|---|---|
| 01.00.zz, FF, DevRev01 | 76 |
| 01.00.zz, PROFIBUS PA, DevRev01 | 77 |
| 01.00.zz, HART, DevRev01 | 78 |

1) Product Configurator, "Firmware version" ordering feature

## Galvanic isolation

The following devices have a galvanic isolation between electronic and probe:
- FMB51, FMB52, FMB53
- FMB50 with separate housing

## HART protocol-specific data

| | |
|---|---|
| Manufacturer ID | 17 (11 hex) |
| Device type ID | 35 (23 hex) |
| Device revision | 01 (01 hex) - SW version 01.00.zz |
| HART specification | 6 |
| DD revision | ▪ 01 (Dutch))<br>▪ 02 (Russian)) |
| Device description files (DTM, DD) | Information and files under:<br>▪ www.endress.com<br>▪ www.fieldcommgroup.org/registered-products |
| HART load | Min. 250 Ω |

| | |
|---|---|
| HART device variables | The following measured values are assigned to the device variables:<br>**Measured values for PV (primary variable)**<br>▪ Pressure<br>▪ Level<br>▪ Tank content<br>**Measured values for SV, TV (second and third variable)**<br>▪ Pressure<br>▪ Level<br>**Measured values for QV (fourth device variable)**<br>Temperature |
| Supported functions | ▪ Burst mode<br>▪ Additional transmitter status<br>▪ Device locking<br>▪ Alternative modes of operation |

## Wireless HART data

| | |
|---|---|
| Minimum starting voltage | 11.5 V [1] |
| Start-up current | 12 mA (default) or 22 mA (customer setting) |
| Starting time | 5 s or 7 s for rod/cable version |
| Minimum operating voltage | 11.5 V [1] |
| Multidrop current | 4 mA |
| Time for connection setup | 1 s |

1) Or higher if operating near ambient temperature limits (−40 to +85 °C (−40 to +185))

## IO-Link protocol-specific data

IO-Link is a point-to-point connection for communication between the device and an IO-Link master. The IO-Link communication interface enables direct access to the process and diagnostic data. It also provides the option of configuring the device while in operation.

*The device supports the following features:*

| | |
|---|---|
| IO-Link specification | Version 1.1 |
| IO-Link Smart Sensor Profile 2nd Edition | Supported:<br>▪ Identification<br>▪ Diagnosis<br>▪ Digital measuring sensor (as per SSP 4.3.3) |
| IO-Link transfer rate | COM2; 38.4 kBaud |
| Minimum cycle time | 10 ms |
| Process data width | 4 bytes process data<br>2 bytes diagnostic data |
| IO-Link data storage | Yes |
| Block configuration according to V1.1 | Yes |
| Device operational | 5 s after the supply voltage is applied, the device is operational (first valid measured value after 2 s) |

### Device description

In order to integrate field devices into a digital communication system, the IO-Link system requires a description of the device parameters such as output data, input data, data format, quantity of data and supported IO-Link transfer rate.

These data are contained in the device description (IODD [1]) which is made available to the IO-Link master via generic modules during commissioning of the communication system.

The IODD can be downloaded as follows:
- Endress+Hauser: www.endress.com
- IODDfinder: https://ioddfinder.io-link.com/#/

## Protocol-specific data PROFIBUS PA

| | |
|---|---|
| Manufacturer ID | 17 (11 hex) |
| Ident number | 1554 hex |
| Profile Version | 3.02<br>SW Version 01.00.zz |
| GSD Revision | 5 |
| DD Revision | 1 |
| GSD File<br>DD Files | Information and files can be found:<br>▪ www.endress.com<br>▪ www.profibus.org |
| Output values | **Measured values for PV (via Analog Input Function Block)**<br>▪ Pressure<br>▪ Level<br>▪ Tank content<br>**Measured values for SV**<br>▪ Pressure<br>▪ Temperature |
| Input values | Input value sent from PLC, can be shown on display |
| Supported functions | ▪ Identification & Maintenance<br>Simple device identification via control system and nameplate<br>▪ Condensed status<br>▪ Automatic ident number adaptation and switchable to following ident numbers:<br>▪ 9700: Profile-specific transmitter identification number with the "Classic" or "Condensed" status.<br>▪ 1503: 1503: Compatibility mode for the old Deltapilot M (DB50, DB50L, DB51, DB52, DB53).<br>▪ 1555: Identification number for the new Deltapilot M (FMB50, FMB51, FMB52, FMB53).<br>▪ Device locking: The device can be locked by hardware or software. |

## FOUNDATION Fieldbus protocol-specific data

| | |
|---|---|
| Device type | 0x1023 |
| Device revision | 01 (hex) |
| DD revision | 0x01021 |
| Device description files (DTM, DD) | Information and files under:<br>▪ www.endress.com<br>▪ www.fieldcommgroup.org/registered-products |
| CFF revision | 0x000102 |
| ITK version | 5.2.0 |
| ITK certification driver no. | IT067500 |
| Link Master functionality supported (LAS) | Yes |
| Link Master/Basic Device selectable | Yes; Factory setting: Basic Device |
| Number of VCRs | 44 |
| Number of link objects in VFD | 50 |
| Number of FB schedule objects | 40 |

1) IO Device Description

### Virtual communication references (VCRs)

| | |
|---|---|
| Permanent entries | 44 |
| Client VCRs | 0 |
| Server VCRs | 5 |
| Source VCRs | 8 |
| Sink VCRs | 0 |
| Subscriber VCRs | 12 |
| Publisher VCRs | 19 |

### Link settings

| | |
|---|---|
| Slot time | 4 |
| Min. inter PDU delay | 12 |
| Max. response delay | 40 |

### Transducer Blocks

| Block | Content | Output values |
|---|---|---|
| TRD1 Block | Contains all parameters related to the measurement | ▪ Pressure or level (channel 1)<br>▪ Process temperature (channel 2)<br>▪ Measured pressure value (channel 3)<br>▪ Max. pressure (channel 4)<br>▪ Level before linearization (channel 5) |
| Diagnostic Block | Contains diagnostic information | Error code via DI channels (channel 10 to 15) |
| Display Block | Contains parameters to configure the onsite display | No output values |

### Function blocks

| Block | Content | Number of blocks | Execution time | Functionality |
|---|---|---|---|---|
| Resource Block | The Resource Block contains all the data that uniquely identify the device. It is an electronic version of a nameplate of the device. | 1 | | Enhanced |
| Analog Input Block 1<br>Analog Input Block 2 | The AI Block receives the measuring data from the Sensor Block, (selectable via a channel number) and makes the data available to other function blocks at its output. Enhancement: digital outputs for process alarms, fail safe mode. | 2 | 25 ms | Enhanced |
| Digital Input Block | This block contains the discrete data of the Diagnostic Block (selectable via a channel number 10 to 15) and provides them for other blocks at the output. | 1 | 20 ms | Standard |
| Digital Output Block | This block converts the discrete input and thus initiates an action (selectable via a channel number) in the DP Flow Block or in the TRD1 Block. Channel 20 resets the counter for max. pressure transgressions value. | 1 | 20 ms | Standard |
| PID Block | The PID Block serves as a proportional-integral-derivative controller and is used almost universally for closed-loop-control in the field including cascade and feedforward. Input IN can be indicated on the display. The selection is performed in the Display Block (DISPLAY_MAIN_LINE_CONTENT). | 1 | 40 ms | Standard |
| Arithmetic Block | This block is designed to permit simple use of popular measurement math functions. The user does not have to know how to write equations. The math algorithm is selected by name, chosen by the user for the function to be performed. | 1 | 35 ms | Standard |

| Block | Content | Number of blocks | Execution time | Functionality |
|---|---|---|---|---|
| Input Selector Block | The Input Selector Block facilitates the selection of up to four inputs and generates an output based on the configured action. This block normally receives its inputs from AI Blocks. The block performs maximum, minimum, average and 'first good' signal selection. Inputs IN1 to IN4 can be indicated on the display. The selection is performed in the Display Block (DISPLAY_MAIN_LINE_1_CONTENT). | 1 | 30 ms | Standard |
| Signal Characterizer Block | The Signal Characterizer Block has two sections, each with an output that is a non-linear function of the respective input. The non-linear function is generated by a single look-up table with 21 arbitrary x-y pairs. | 1 | 40 ms | Standard |
| Integrator Block | The Integrator Block integrates a variable as a function of the time or accumulates the counts from a Pulse Input Block. The block may be used as a totalizer that counts up until reset or as a batch totalizer that has a setpoint, where the integrated value or accumulated value is compared to pre-trip and trip settings, generating a binary signal when the setpoint is reached. | 1 | 35 ms | Standard |

*Additional function block information:*

| | |
|---|---|
| Instantiate function blocks | Yes |
| Number of additional instantiate function blocks | 20 |

# Power supply

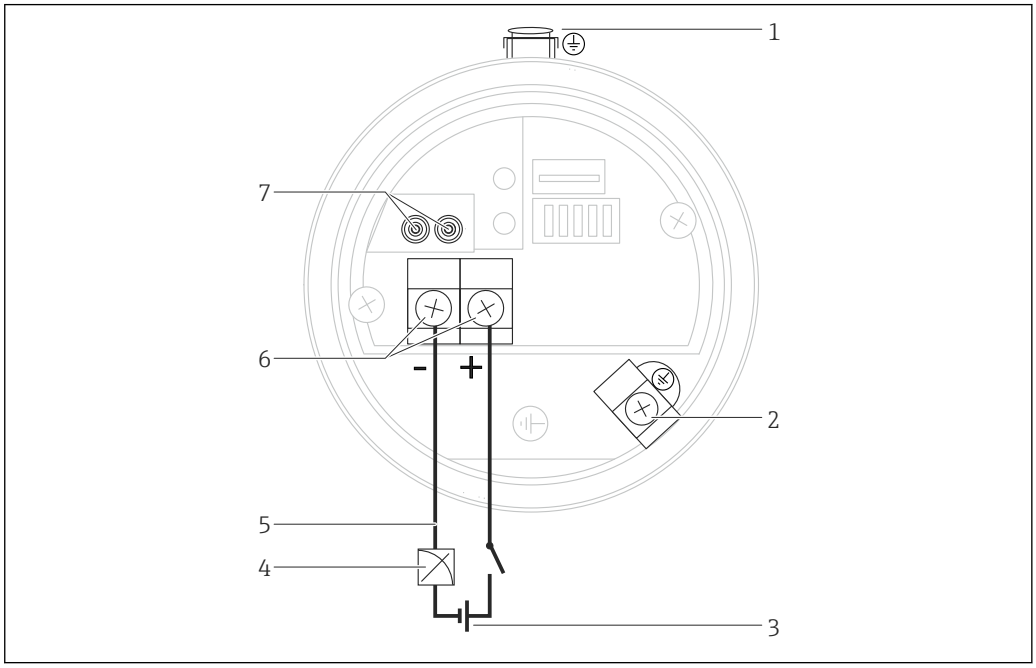
**⚠ WARNING**

**Limitation of electrical safety due to incorrect connection!**

- When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings .
- All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all Ex devices .
- In accordance with IEC/EN61010 a suitable circuit breaker must be provided for the device.
- HART: Overvoltage protection HAW569-DA2B for the non-hazardous area, ATEX II 2 (1) Ex ia IIC and IEC Ex ia can be ordered as an option (see "Ordering information" section).
- Protective circuits against reverse polarity, HF influences and overvoltage peaks are integrated.

## Terminal assignment

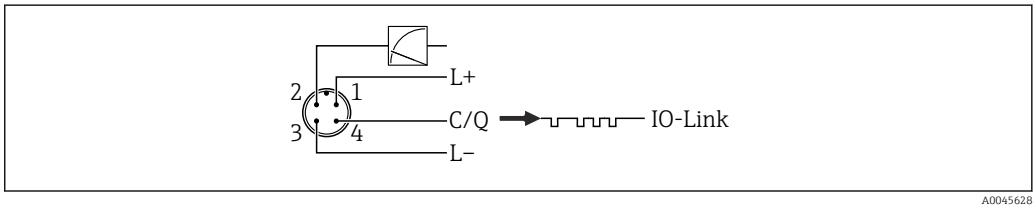
### HART, PROFIBUS PA, FOUNDATION Fieldbus




A0023505

1 *External ground terminal (only for devices with certain approvals or if "Measuring point" (TAG) is ordered)*
2 *Internal ground terminal*
3 *Supply voltage → 24*
4 *4 to 20 mA for HART devices*
5 *For HART and FOUNDATION Fieldbus devices: With a handheld terminal, all the parameters can be configured anywhere along the bus line via menu operation.*
6 *Terminals*
7 *For HART devices: test terminals, see section "Taking 4 to 20 mA test signal" → 24*

### IO-Link




A0045628

1 *Supply voltage +*
2 *4-20 mA*
3 *Supply voltage -*
4 *C/Q (IO-Link communication)*

## Supply voltage

### 4 to 20 mA HART

| Type of protection | Supply voltage |
|---|---|
| Intrinsically safe | 11.5 to 30 V DC |
| ▪ Other types of protection<br>▪ Devices without certificate | 11.5 to 45 V DC<br>(versions with plug-in connector 35 V DC) |

*Taking 4 to 20 mA test signal*

A 4 to 20 mA test signal may be measured via the test terminals without interrupting the measurement.

### IO-Link

- 11.5 to 30 V DC if only the analog output is used
- 18 to 30 V DC if IO-Link is used

### PROFIBUS PA

Version for non-hazardous areas: 9 to 32 V DC

### FOUNDATION Fieldbus

Version for non-hazardous areas: 9 to 32 V DC

## Current consumption

- IO-Link < 60 mA
- PROFIBUS PA: 11 mA ±1 mA, switch-on current corresponds to IEC 61158-2, Clause 21
- FOUNDATION Fieldbus: 16 mA ±1 mA, switch-on current corresponds to IEC 61158-2, Clause 21

## Electrical connection

| Cable entry | Degree of protection | Option [1] |
|---|---|---|
| M20 gland | IP66/68 NEMA 4X/6P | A |
| G ½" thread | IP66/68 NEMA 4X/6P | C |
| NPT ½" thread | IP66/68 NEMA 4X/6P | D |
| M12 plug | IP66/67 NEMA 4X/6P | I |
| 7/8" plug | IP66/68 NEMA 4X/6P | M |
| HAN7D plug 90 deg. | IP65 | P |
| PE cable 5m<br>(Only for FMB50) | IP66/68 NEMA4X/6P + pressure compensation via cable | S |
| M16 valve connector | IP64 | V |

1) Product Configurator, "Electrical connection" ordering feature

### PROFIBUS PA

The digital communication signal is transmitted to the bus via a twin-core connecting cable. The bus line also provides the power supply. For further information on the network structure and grounding, and for further bus system components such as bus cables, see the relevant documentation, e.g., Operating Instructions BA00034S "PROFIBUS DP/PA: Guidelines for planning and commissioning" and the PNO Guideline.

### FOUNDATION Fieldbus

The digital communication signal is transmitted to the bus via a twin-core connecting cable. The bus line also provides the power supply. For further information on the network structure and grounding and for further bus system components such as bus cables, see the relevant documentation, e.g., Operating Instructions BA00013S "FOUNDATION Fieldbus Overview" and the FOUNDATION Fieldbus Guideline.

## Terminals

- Supply voltage and internal ground terminal: 0.5 to 2.5 $mm^2$ (20 to 14 AWG)
- External ground terminal: 0.5 to 4 $mm^2$ (20 to 12 AWG)

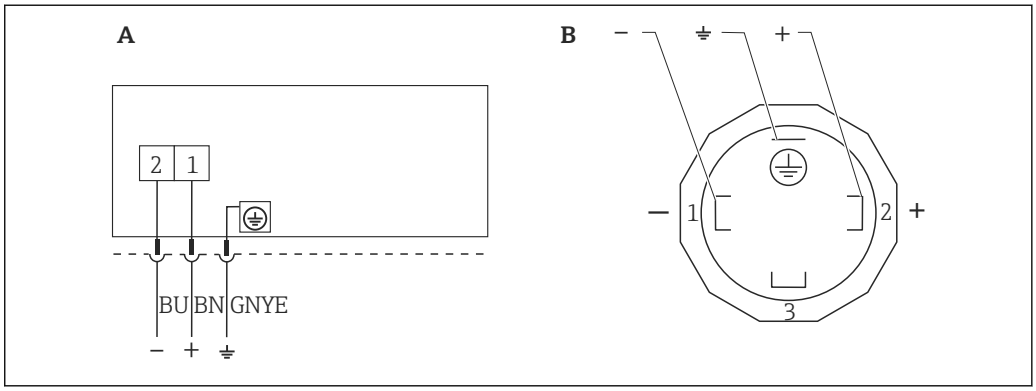
**Cable entry**

| Approval | Type | Clamping area |
|---|---|---|
| Standard, CSA GP<br>FM/ CSA IS | Plastic M20x1.5 | 5 to 10 mm (0.2 to 0.39 in) |
| ATEX II1/2D Ex t, II1/2GD Ex ia,<br>II3G Ex nA,<br>IEC Ex t Da/Db | Metal M20x1.5 (Ex e) | 7 to 10.5 mm (0.28 to 0.41 in) |

For other technical data, see the housing section → 39

**Connector**

**Devices with valve connector (HART)**

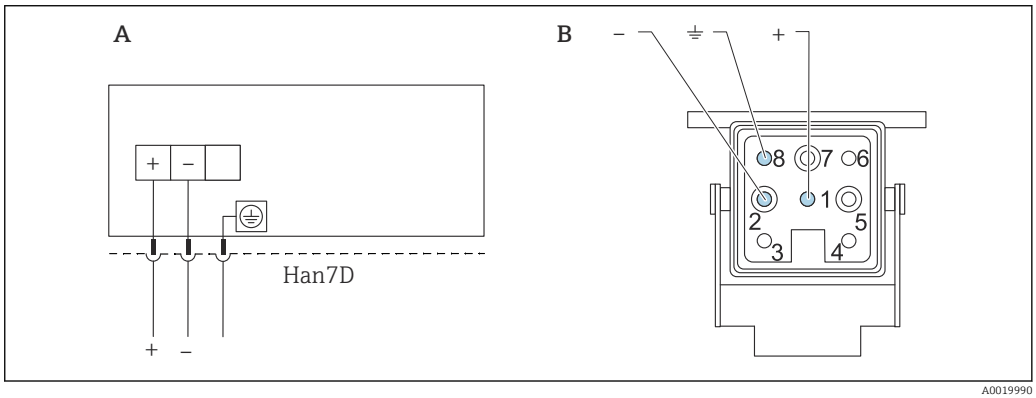



1 *BN = brown, BU = blue, GNYE = green*

*A Electrical connection for devices with valve connector*
*B View of the plug connector at the device*

Material: PA 6.6

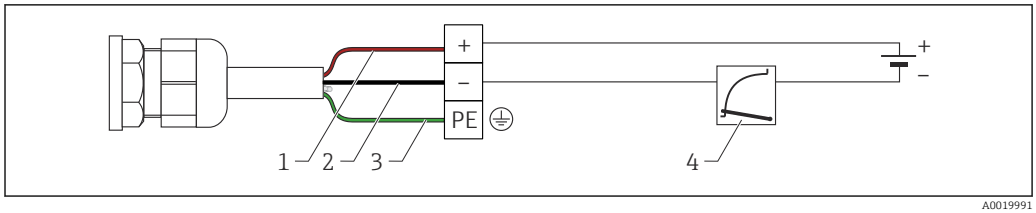
**Connecting devices with Harting plug Han7D (HART)**




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

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

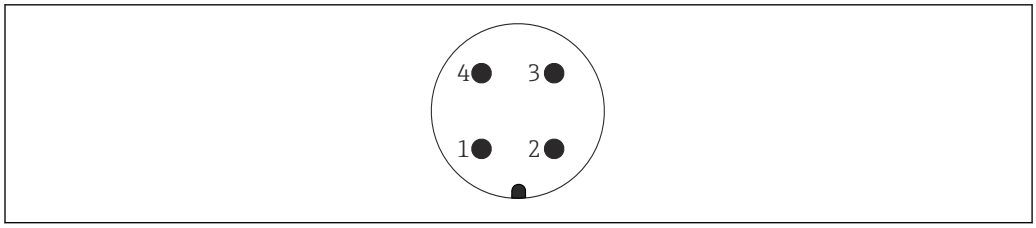
### Connecting the cable version (FMB50 only)




A0019991

1 *RD = red*
2 *BK = black*
3 *GNYE = green*
4 *4 to 20 mA*

### Connecting devices with M12 plug (HART, PROFIBUS PA)




A0011175

1 *Signal +*
2 *Not assigned*
3 *Signal –*
4 *Earth*

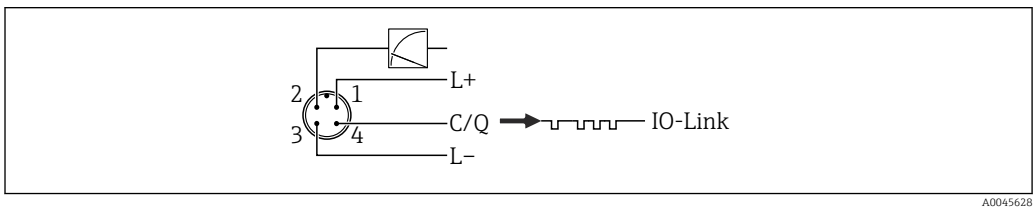
Endress+Hauser offers the following accessories for devices with an M12 plug:

Plug-in jack M 12x1, straight
- Material: body PA; coupling nut CuZn, nickel-plated
- Degree of protection (fully locked): IP66/67
- Order number: 52006263

Plug-in jack M 12x1, elbowed
- Material: body PBT/PA; coupling nut GD-Zn, nickel-plated
- Degree of protection (fully locked): IP66/67
- Order number: 71114212

Cable 4 x 0.34 mm$^2$ (20 AWG) with M12 socket, elbowed, screw plug, length 5 m (16 ft)
- Material: body PUR; coupling nut CuSn/Ni; cable PVC
- Degree of protection (fully locked): IP66/67
- Order number: 52010285

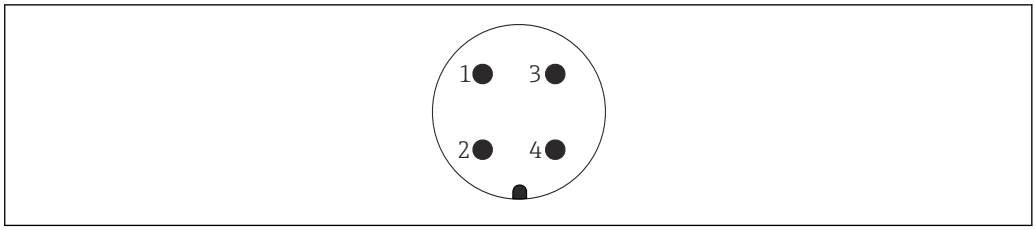
### Connecting devices with M12 plug (IO-Link)




A0045628

1 *Supply voltage +*
2 *4-20 mA*
3 *Supply voltage -*
4 *C/Q (IO-Link communication)*

**Connecting devices with 7/8" plug (HART, FOUNDATION Fieldbus)**




A0011176

*1 Signal -*
*2 Signal +*
*3 Shield*
*4 Not assigned*

External thread: 7/8 - 16 UNC
- Material: 316L (1.4401)
- Degree of protection: IP66/68

**Cable specification**

**HART**

- Endress+Hauser recommends using twisted, shielded twin-core cables.
- The cable outer diameter depends on the cable entry used.

**IO-Link**

Endress+Hauser recommends using twisted, four-core cable.

**PROFIBUS PA**

Endress+Hauser recommends using twisted, shielded twin-core cable, preferably cable type A.

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

**FOUNDATION Fieldbus**

Use a twisted, shielded twin-core cable, preferably cable type A.

For further information on the cable specifications, see Operating Instructions BA00013S "FOUNDATION Fieldbus Overview", FOUNDATION Fieldbus Guideline and IEC 61158-2 (MBP).

**Start-up current**

- 12 mA or 22 mA (selectable)
- IO-Link: 12 mA

**Residual ripple**

No influence on 4 to 20 mA signal up to ±5 % residual ripple within the permitted voltage range [according to HART hardware specification HCF_SPEC-54 (DIN IEC 60381-1)].

**Influence of power supply**

≤0.001 % of URL/V

**Overvoltage protection (optional)**

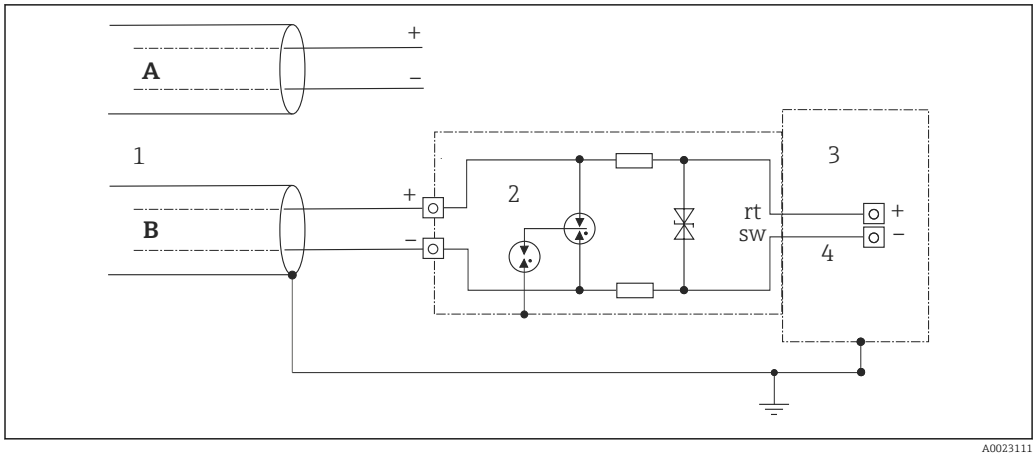
The device can be fitted with overvoltage protection. The overvoltage protection is mounted at the factory on the housing thread (M20x1.5) for the cable gland and is approx. 70 mm (2.76 in) in length (take additional length into account when installing). The device is connected as illustrated in the following graphic.

For details refer to TI01013KDE, XA01003KA3 and BA00304KA2.

Ordering information:

Product Configurator, "Mounted accessories" ordering feature, option NA

**Wiring**




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

# Performance characteristics of metallic process membrane

**Reference operating conditions**

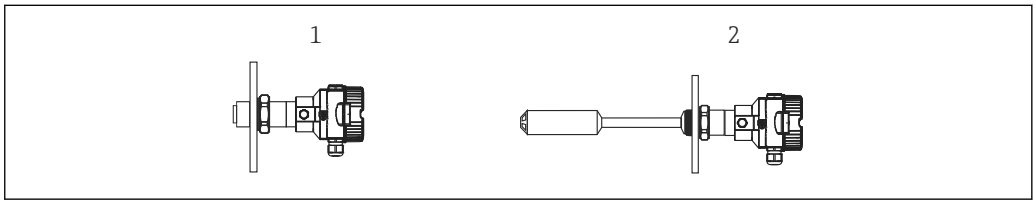
- As per IEC 60770
- Ambient temperature $T_A$ = constant, in the range of: +21 to +33 °C (+70 to +91 °F)
- Humidity φ= constant, in the range of: 5 to 80 % rH
- Ambient pressure $p_A$ = constant, in the range of: 860 to 1 060 mbar (12.47 to 15.37 psi)
- Position of the measuring cell = constant, in the range of:
  FMB50: ±1° horizontally
  FMB51/FMB52/FMB53: ±1° vertically
- Input of LOW SENSOR TRIM and HIGH SENSOR TRIM for lower range value and upper range value
- Span based on zero point
- Material of the process membrane: Alloy C276 (2.4819) and Alloy C276 (2.4819) with coating (AuRh or AuPt)
- Measuring cell material (meter body): Alloy C276 (2.4819), 316L (1.4435)
- Fill fluid: synthetic oil (FDA)/inert oil
- Supply voltage: 24 V DC ±3 V DC
- Load for HART: 250 Ω

**Influence of the orientation**

- < 2.3 mbar (0.0345 psi) if synthetic oil is used (FDA).
- < 5 mbar (0.075 psi) if inert oil is used.

Position-dependent zero shift can be corrected → 32.

**Calibration position**




A0023545

*1 FMB50*
*2 FMB51, FMB52, FMB53*

To minimize the effect of the orientation (e.g., in the case of vertical device installation), position offset is preset at the factory.

**Resolution**

- Current output: 1 µA
- Display: can be set (factory setting: presentation of the maximum accuracy of the transmitter)

**Reference accuracy**

The reference accuracy comprises the non-linearity according to limit point setting, hysteresis and non-reproducibility as per IEC 60770. The data refer to the calibrated span.

| Measuring cell | Reference accuracy in % of the calibrated span | | |
|---|---|---|---|
| | TD | Option "Standard" [1] | Option "Platinum" [1] |
| 100 mbar (1.5 psi) | ▪ TD 1:1 to TD 2:1<br>▪ TD > 2:1 to TD 4:1 | ▪ ±0.2<br>▪ ±0.1 x TD | ▪ ±0.15<br>▪ ±0.075 x TD |
| 400 mbar (6 psi) | ▪ TD 1:1 to TD 4:1<br>▪ TD > 4:1 to TD 10:1 | ▪ ±0.2<br>▪ ±0.05 x TD | ▪ ±0.15<br>▪ ±0.0375 x TD |
| 1.2 bar (18 psi) | ▪ TD 1:1 to TD 2:1<br>▪ TD > 2:1 to TD 12:1 | ▪ ±0.2<br>▪ ±0.1 x TD | ▪ ±0.1<br>▪ ±0.05 x TD |
| 4 bar (60 psi) | ▪ TD 1:1 to TD 4:1<br>▪ TD > 4:1 to TD 20:1 | ▪ ±0.2<br>▪ ±0.05 x TD | ▪ ±0.1<br>▪ ±0.025 x TD |
| 10 bar (150 psi) | ▪ TD 1:1 to TD 2.5:1<br>▪ TD > 2.5:1 to TD 20:1 | ▪ ±0.2<br>▪ ±0.08 x TD | ▪ ±0.1<br>▪ ±0.04 x TD |

1) Product Configurator, "Reference accuracy" ordering feature

### Thermal change in the zero output and the output span

| Version | Measuring cell | −10 to +60 °C (+14 to +140 °F) | +60 to +85 °C (+140 to +185 °F) | FMB50 only: +85 to +100 °C (+185 to +212 °F) |
|---|---|---|---|---|
| | | % of the calibrated span | | |
| FMB50<br>FMB51/52/53<br>snap-on | 100 mbar<br>(1.5 psi) | < (0.32 + 0.30 x TD) | < (0.34 + 0.40 x TD) | < (0.34 + 0.55 x TD) |
| FMB51/52/53<br>welded | 100 mbar<br>(1.5 psi) | < (0.32 + 0.50 x TD) | < (0.34 + 0.60 x TD) | - |
| FMB50/51/52/53 | 400 mbar<br>(6 psi) | < (0.31 + 0.25 x TD) | < (0.32 + 0.30 x TD) | - |
| | 1.2 bar<br>(18 psi),<br>4 bar (60 psi),<br>10 bar<br>(150 psi) | < (0.31 + 0.10 x TD) | < (0.32 + 0.15 x TD) | < (0.33 + 0.20 x TD) |

### Total performance

The "Total performance" specification comprises the non-linearity including hysteresis, non-reproducibility as well as the thermal change in the zero point.

| Total performance in % of the URL | | | | |
|---|---|---|---|---|
| Version | Measuring cell | −10 to +60 °C (+14 to +140 °F) | +60 to +85 °C (+140 to +185 °F) | FMB50 only: +85 to +100 °C (+185 to +212 °F) |
| FMB50<br>FMB51/52/53<br>snap-on | 100 mbar<br>(1.5 psi) | < 0.35 | < 0.45 | < 0.6 |
| FMB51/52/53<br>welded | 100 mbar<br>(1.5 psi) | < 0.8 | < 1 | - |
| FMB50/51/52/53 | 400 mbar<br>(6 psi) | < 0.35 | < 0.45 | < 0.6 |
| | 1.2 bar<br>(18 psi),<br>4 bar (60 psi),<br>10 bar<br>(150 psi) | < 0.15 | < 0.2 | < 0.25 |

### Long-term stability

| Measuring cell | Long-term stability [%] |
|---|---|
| 100 mbar (1.5 psi) | ▪ < 0.18 of the upper range limit (URL)/year<br>▪ < 0.45 of the upper range limit (URL)/5 years |
| 400 mbar (6 psi),<br>1.2 bar (18 psi) | ▪ < 0.1 of the upper range limit (URL)/year<br>▪ < 0.25 of the upper range limit (URL)/5 years |
| 4 bar (60 psi),<br>10 bar (150 psi) | ▪ < 0.05 of the upper range limit (URL)/year<br>▪ < 0.125 of the upper range limit (URL)/5 years |

### Total error

The total error comprises the long-term stability and the total performance:

| Measuring cell | % of the URL/year (in the permitted temperature range) |
|---|---|
| 100 mbar (1.5 psi) | ▪ Snap-on: ±0.63<br>▪ Welded: ±1.0 |
| 400 mbar (6 psi), | ±0.61 |
| 1.2 bar (18 psi) | ±0.27 |
| 4 bar (60 psi),<br>10 bar (150 psi) | ±0.25 |

**Warm-up time**

- 4 to 20 mA HART:
  - FMB50 = ≤ 5 s
  - FMB51/FMB52/FMB53 = ≤ 8 s
- IO-Link: < 1 s
- PROFIBUS PA: ≤ 8 s
- FOUNDATION Fieldbus: ≤ 20 s (≤ 45 s after a TOTAL reset)

# Mounting

**General installation instructions**

The position-dependent zero point shift can be corrected:
- directly at the device via operating keys on the electronic insert
- directly at the device via operating keys on the display
- via digital communication if the cover is not open.

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

**FMB50**

**Level measurement**

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

**Pressure measurement in gases**

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

**Pressure measurement in steams**

Use a siphon if measuring pressure in steams.

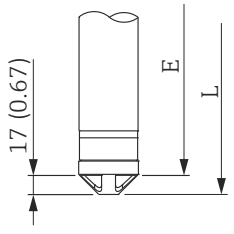
The siphon reduces the temperature to almost the ambient temperature.

**Pressure measurement in liquids**

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

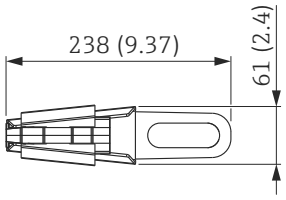
**FMB51/FMB52/FMB53**

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




Engineering unit mm (in)

Suspension clamp (required for FMB53)
Material:→ 🖹 61
Ordering information:
Order number: 52010869
Product Configurator, "Accessory enclosed" ordering feature, option "PO". A0023566




Engineering unit mm (in)

**Supplementary installation instructions**

**PE cable length > 300 m (984 ft)**

Two suspension clamps must be used for PE cables longer than300 m (984 ft).

**Cable length tolerances**

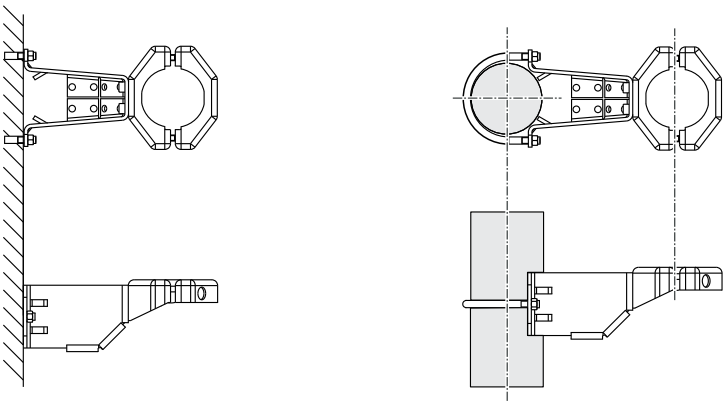
- FMB52
  - Cable length < 5 m (16 ft): up to −35 mm (−1.38 in)
  - Cable length 5 to 10 m (16 to 33 ft): up to −75 mm (−2.95 in)
  - Cable length 10 to 100 m (33 to 328 ft): up to −100 mm (−3.94 in)
- FMB53
  - Cable length < 5 m (16 ft): up to ±17.5 mm (0.69 in)
  - Cable length 5 to 10 m (16 to 33 ft): up to ±37.5 mm (1.48 in)
  - Cable length 10 to 100 m (33 to 328 ft): up to ±50 mm (1.97 in)

**Rod length tolerances**

FMB51: Rod length < 4 000 mm (157 in): up to −4 mm (−0.16 in)

**Wall and pipe mounting, transmitter (optional)**

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




Ordering information:
- included in the delivery for the FMB50/51/52 with a separate housing (available for order via feature "Separate housing") and for the FMB53
- available for order as a separate accessory (Part No.: 71102216).

Further details→ 55.

**"Separate housing" version**

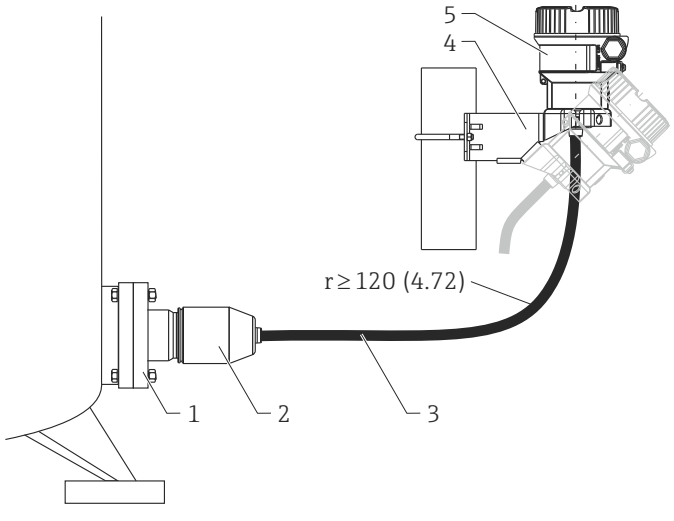
With the "separate housing" version, you are able to mount the housing with the electronics insert at a distance from the measuring point. This allows for trouble-free measurement:
- Under particularly difficult measuring conditions (at installation locations that are cramped or difficult to access)
- If rapid cleaning of the measuring point is required
- If the measuring point is exposed to vibrations

You can choose between different cable versions:
- PE: 2 m (6.6 ft), 5 m (16 ft) and 10 m (33 ft)
- FEP: 5 m (16 ft).

Ordering information:
- Product Configurator, "Separate housing" ordering feature
- Product Configurator, "Enclosed accessories" ordering feature, option PA

For the dimensions → 🖹 55

In the case of the "separate housing" version, the sensor is delivered with the process connection and cable ready mounted. The housing and a mounting bracket are enclosed as separate units. The cable is provided with a socket at both ends. These sockets are simply connected to the housing and the sensor.




*1 Process connection with sensor - see the following section for the degrees of protection*
*2 Process connection adapter (weight 0.93 kg (2.05 lb))*
*3 Cable (weight 0.05 kg/Meter (0.11 lb)), both ends are fitted with a socket*
*4 Mounting bracket provided, suitable for pipe and wall mounting (for pipes from 1 1/4" up to 2" diameter)*
*5 Housing with electronic insert - degrees of protection → 🖹 36*

Engineering unit mm (in)

Degree of protection for the process connection and sensor with the use of
- FEP-cabel:
  - IP 69 [2)]
  - IP 66 NEMA 4/6P
  - IP 68 (1,83 m$H_2O$ für 24 h) NEMA 4/6P
- PE-cabel:
  - IP 66 NEMA 4/6P
  - IP 68 (1,83 m$H_2O$ für 24 h) NEMA 4/6P

Technical data of the PE and FEP cable:
- Minimum bending radius: 120 mm (4.72 in)
- Cable extraction force: max.450 N (101.16 lbf)
- Resistance to UV light

2) Identification of IP protection category according to DIN EN 60529. The earlier designation “IP69K” according to DIN 40050 Part 9 is no longer valid (the standard was withdrawn on November 1, 2012). The tests required for both standards are identical.

Use in hazardous area:
- Intrinsically safe installations (Ex ia/IS)
- FM/CSA IS: for Div.1 installation only

**Oxygen applications**

Oxygen and other gases can react explosively to oils, grease and plastics, such that, among other things, the following precautions must be taken:
- All components of the system, such as measuring devices, must be cleaned in accordance with the BAM (DIN 19247) requirements.
- Depending on the materials used, a certain maximum temperature and a maximum pressure must not be exceeded for oxygen applications.
  The maximum temperature $T_{max}$ for oxygen applications is 60 °C (140 °F).

The devices suitable for gaseous oxygen applications are listed in the following table with the specification $p_{max}$.

| Order code for devices [1], cleaned for oxygen applications | $p_{max}$ for oxygen applications |
|---|---|
| FMB50 [2] | ▪ Depends on the lowest-rated element, with regard to pressure, of the selected components: over pressure limit (OPL) of the sensor, process connection (1.5 x PN) [3]<br>▪ Depends on the fill fluid [4] |
| FMB51 [2] | ▪ Depends on the lowest-rated element, with regard to pressure, of the selected components: over pressure limit (OPL) of the sensor or process connection (1.5 x PN) [3]<br>▪ Depends on the fill fluid [4]<br>▪ Depends on seal material |

1) Device only, not accessory or enclosed accessory
2) Product Configurator, "Service" ordering feature, option "HB"
3) → 🖹 14, "Measuring range" section and → 🖹 41, "Mechanical construction" section
4) Oxygen applications possible with FKM seal and inert oil.

**PWIS cleaning**

Special cleaning of the transmitter to remove paint-wetting substances, for use in paint shops, for instance.

Ordering information:

Ordering information: Product Configurator, "Service" ordering feature, option HC

The stability of the materials used must be checked before using them in the medium.

The protective cap of the process isolating diaphragm must be removed if necessary (FMB51/ FMB52/ FMB53).

**Applications with hydrogen**

A**gold-plated** metal process isolating diaphragm offers universal protection against hydrogen diffusion, both in gas applications and in applications with aqueous solutions.

**Applications with hydrogen in aqueous solutions**

A**gold/rhodium-plated** metal process isolating diaphragm (AU/Rh) offers effective protection against hydrogen diffusion.

**Special measuring cells for acids, alkalis or sea water (not FMB50)**

For acids, alkalis or sea water, Endress+Hauser offers process isolating diaphragms with a gold/ platinum coating.

With temperature exposure (up to85 °C (185 °F)) there is an additional zero point deviation of1.1 mbar (0.0165 psi).

Ordering information:

Product Configurator, "Process isolating diaphragm material" ordering feature, option N

# Environment

**Operating temperature range**

**Device**

- Without LCD display: −40 to +85 °C (−40 to +185 °F) (−25 to +85 °C (−13 to +185 °F) under static conditions with IO-Link)
- Without LCD in the case of IO-Link **with** current output: +70 °C (+158 °F)
- Without LCD in the case of IO-Link **without** current output: +80 °C (+176 °F)
- With LCD display: −20 to +70 °C (−4 to +158 °F)
  Extended temperature application range (−40 to +85 °C (−40 to +185 °F)) with restrictions in optical properties such as display speed and contrast
- With separate housing (not for diaphragm seal): −20 to +60 °C (−4 to +140 °F)
  (installation without insulation)

For applications with very high temperatures, a diaphragm seal with a temperature isolator can be used. Use a mounting bracket!

If vibrations also occur in the application, Endress+Hauser recommends you use a diaphragm seal with a capillary.

**Optional, enclosed accessories**

M12 plug-in jack, 90 deg. elbowed and 5-meter cable: −25 to +70 °C (−13 to +158 °F)

**Ambient temperature limits**

| Version | FMB50 | FMB51 | FMB52 | FMB53 |
|---|---|---|---|---|
| Without LCD display | −40 to +85 °C (−40 to +185 °F) | | With PE cable: −40 to +70 °C (−40 to +158 °F)<br>With FEP cable: −40 to +80 °C (−40 to +176 °F) | |
| With LCD display [1)] | −20 to +70 °C (−4 to +158 °F) | | | |
| With M12 plug , elbowed | −25 to +85 °C (−13 to +185 °F) | | With PE cable: −25 to +70 °C (−13 to +158 °F)<br>With FEP cable: −25 to +80 °C (−13 to +176 °F) | |
| With separate housing (PE and FEP cable) | −20 to +60 °C (−4 to +140 °F) | | | |

1) Extended temperature application range (−40 to +85 °C (−40 to +185 °F)) with restrictions in optical properties such as display speed and contrast

**Storage temperature range**

| Version | FMB50 | FMB51 | FMB52 | FMB53 |
|---|---|---|---|---|
| Without LCD display | −40 to +90 °C (−40 to +194 °F) | | With PE cable: −40 to +70 °C (−40 to +158 °F)<br>With FEP cable: −40 to +80 °C (−40 to +176 °F) | |
| With LCD display [1)] | −40 to +85 °C (−40 to +185 °F) | | | |
| With M12 plug, elbowed | −25 to +70 °C (−13 to +158 °F) | | With PE cable: −25 to +70 °C (−13 to +158 °F)<br>With FEP cable: −25 to +70 °C (−13 to +158 °F) | |
| With separate housing and FEP cable | −20 to +60 °C (−4 to +140 °F) | | | |

1) Extended temperature application range (−40 to +85 °C (−40 to +185 °F)) with restrictions in optical properties such as display speed and contrast

**Climate class**

Class 4K4H (air temperature: −20 to +55 °C (−4 to +131 °F), relative humidity: 4 to 100%) satisfied as per DIN EN 60721-3-4 (condensation possible)

**Degree of protection**

Depending on the used electrical connection → 🖹 24
F31 housing: IP 68 (1,83 mH2O for 24 h)
Ordering information:
Product Configurator, "Electrical connection" ordering feature

**Vibration resistance**

| Device/accessory | Test standard | Vibration resistance |
|---|---|---|
| FMB50, FMB52, FMB53 | GL VI-7-2<br>▪ Part 7: Guidelines for the Performance of Type Approvals<br>▪ Chapter 2: Test Requirements for Electrical / Electronic Equipment and Systems | Guaranteed for:<br>5 to 25 Hz: ±1.6 mm (0.06 in);<br>25 to 100 Hz:<br>4 g in all 3 axes |
| FMB50, FMB52, FMB53 with mounting bracket | IEC 61298-3 | Guaranteed for:<br>10 to 60 Hz: ±0.15 mm (0.01 in);<br>60 to 500 Hz:<br>2 g in all 3 axes |
| FMB51 | IEC 60068-2-6 | Guaranteed for:<br>10 to 60 Hz: ±0.075 mm (0.003 in)<br>60 to 150 Hz 1g in all 3 axes |

**Electromagnetic compatibility**

- Electromagnetic compatibility as per all the relevant requirements of the EN 61326 series and NAMUR Recommendation EMC (NE21).
- Max. deviation during EMC-tests : < 0.5 % of the span
- All tests were performed with full measurement range (TD 1:1).

Further details can be found in the manufacturer declaration.

# Process

**Process temperature range**

<table>
<tr><th>FMB50</th><th>FMB51</th><th>FMB52</th><th>FMB53</th></tr>
<tr><td rowspan="2">−10 to +100 °C (+14 to +212 °F)<br>135 °C (275 °F) for 30 min. maximum</td><td>−10 to +85 °C (+14 to +185 °F)</td><td colspan="2">With PE cable: −10 to +70 °C (+14 to +158 °F)<br>With FEP cable: −10 to +80 °C (+14 to +176 °F)</td></tr>
<tr><td></td><td colspan="2">Min. process temperature when using the KALREZ seal: −3 °C (+27 °F)</td></tr>
</table>

**Lateral load FMB51 (static)**

≤30 Nm (22.13 lbf ft)

**Pressure specifications**

**⚠ WARNING**

**The maximum pressure for the measuring device depends on the lowest-rated element with regard to pressure (components are: process connection, optional mounted parts or accessories).**

- Only operate the measuring device within the prescribed limits of the components!
- MWP (maximum working pressure): The MWP is specified on the nameplate. This value refers to a reference temperature of +20 °C (+68 °F) and may be applied to the device for an unlimited time. Note temperature dependence of MWP. For flanges, refer to the following standards for the permitted pressure values at higher temperatures: EN 1092-1 (with regard to their stability/ temperature property, the materials 1.4435 and 1.4404 are grouped together under EN 1092-1; the chemical composition of the two materials can be identical.), ASME B 16.5a, JIS B 2220 (the latest version of the standard applies in each case). MWP data that deviate from this are provided in the relevant sections of the Technical Information.
- The test pressure corresponds to the overpressure limit (OPL) of the overall system. This value refers to a reference temperature of +20 °C (+68 °F).
- The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP (maximum working pressure) of the measuring device.
- In the case of sensor range and process connections where the over pressure limit (OPL) of the process connection is smaller than the nominal value of the sensor, the device is set at the factory, at the very maximum, to the OPL value of the process connection. If you want to use the entire sensor range, select a process connection with a higher OPL value.
- Oxygen applications: In oxygen applications, the values for "$p_{max}$ and $T_{max}$ for oxygen applications may not be exceeded.

# Mechanical construction

For the dimensions, see the Product Configurator: www.endress.com

Search for product → click "Configuration" to the right of the product image → after configuration click "CAD"

The following dimensions are rounded values. For this reason, they may deviate slightly from the dimensions given on www.endress.com.

## Device height

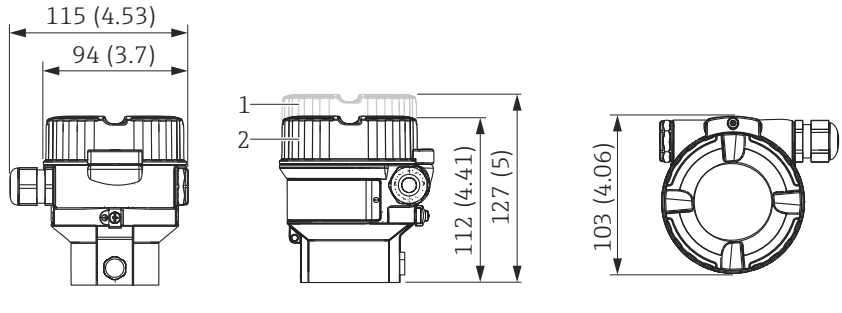
**The device height is calculated from**

- the height of the housing
- the height of the relevant process connection.

The individual heights of the components can be found in the following sections. To calculate the device height, simply add up the individual heights of the components. If necessary, the installation space (the space used to install the device) must also be taken into account. You can use the following table for this:

| Section | Page | Height |
|---|---|---|
| Housing height | → 39 | |
| Process connections | → 41 | |
| Installation distance | - | |
| Device height | | |

## F31 housing, aluminum



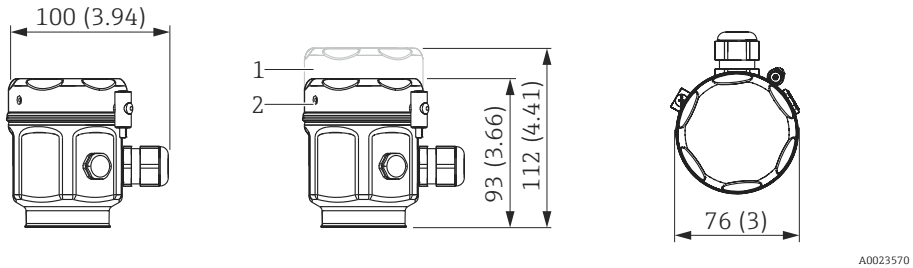

*1 Cover with viewing window*
*2 Cover without viewing window*

Engineering unit mm (in). Front view, left-hand side view, top view

| Material | Weight kg (lbs) | | Option [1] |
|---|---|---|---|
| | With display | Without display | |
| Aluminium [2] | 1.1 (2.43) | 1.0 (2.21) | I |
| Aluminum with glass viewing window [2] | | | J |

1) Product Configurator, "Housing" ordering feature
2) Degree of protection dependent on cable entry used → 36

**F15 housing, stainless steel (hygienic)**




*1 Cover with viewing window*
*2 Cover without viewing window*

Engineering unit mm (in). Front view, left-hand side view, top view
Thread depth of cable gland 10 mm (0.39 in) max.

| Material | Weight kg (lbs) | | Option [1] |
|---|---|---|---|
| | With display | Without display | |
| Stainless steel [2] | 1.1 (2.43) | 1.0 (2.21) | Q |
| Stainless steel with glass viewing window [2] | | | R |
| Stainless steel with plastic viewing window [2] | | | S |

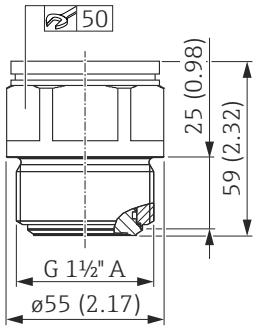
1) Product Configurator, "Housing" ordering feature
2) Degree of protection depends on the cable entry used → 🖹 36

**Diameter of the process membrane**

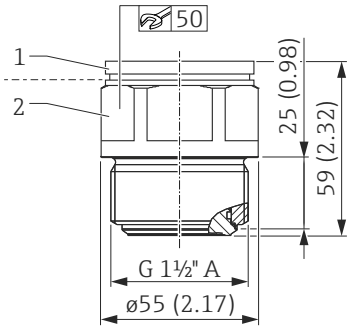
35.8 mm (1.41 in)

**Process connections FMB50, FMB51, FMB52** **ISO 228 G and NPT threaded connection**

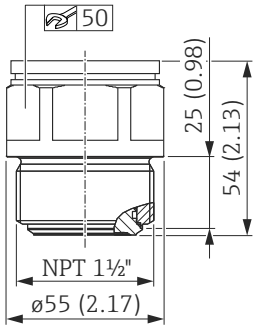
A




B




C



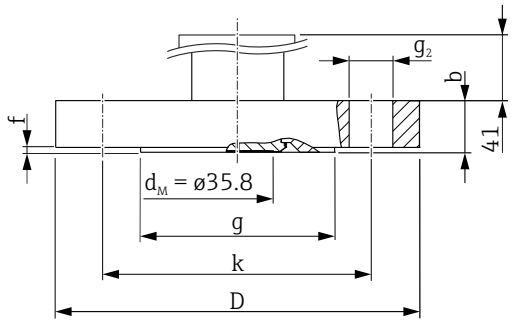

Engineering unit mm (in)

| Item | Designation | Material | Weight | Approval | Option [1] |
|---|---|---|---|---|---|
| | | | kg (lb) | | |
| A | Thread ISO 228 G 1 ½" A | AISI 316L (1.4435) | 0,8 (1.76) | - | GGJ |
| B | Thread ISO 228 G 1 ½" A | ▪ 1: top section AISI 316L (1.4435)<br>▪ 2: bottom section Alloy C276 (2.4819) | 0,8 (1.76) | - | GGC |
| C | Thread ANSI 1 ½" MNPT | AISI 316L (1.4435) | 0,8 (1.76) | CRN | RGJ |

1) Product Configurator, "Process connection" section

**Process connections FMB50, FMB51, FMB52**

**EN flanges, connection dimensions as per EN 1092-1**



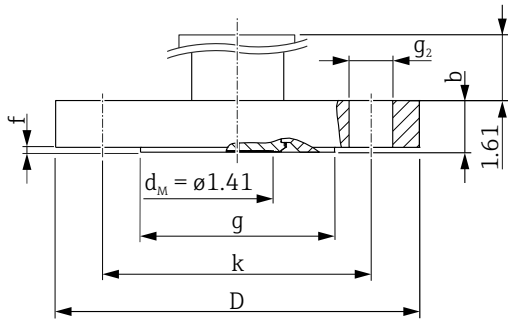

*D* *Diameter of flange*
*b* *Thickness*
*g* *Raised face*
*f* *Height of raised face*
*k* *Hole circle*
*$g_2$* *Diameter of hole*

Engineering unit mm

| Flange [1] [2] | | | | | | | Boltholes | | | Weight | Option [3] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal diameter | Nominal pressure | Shape | D | b | g | f | Quantity | $g_2$ | k | | |
| | | | [mm] | [mm] | [mm] | [mm] | | [mm] | [mm] | [kg (lb)] | |
| DN 40 | PN 10/16 | B1 | 150 | 18 | 88 | 2 | 4 | 18 | 110 | 3.05 (6.72) | CEJ |
| DN 50 | PN 10/16 | B1 | 165 | 18 | 102 | 2 | 4 | 18 | 125 | 3.75 (8.27) | CFJ |
| DN 80 | PN 10/16 | B1 | 200 | 20 | 138 | 2 | 8 | 18 | 160 | 5.55 (12.24) | CGJ |
| DN 100 | PN 10/16 | B1 | 220 | 20 | 158 | 2 | 8 | 18 | 180 | 6.75 (14.88) | CHJ |

1) The roughness of the surface in contact with the medium including the raised face of the flange (all standards) is $R_a$10 to 12.5 µm (394 to 492 µin). Lower surface roughness available on request.
2) Material AISI 316L: Endress+Hauser supplies DIN/EN stainless steel flanges as per AISI 316L (DIN/EN material number 1.4404 or 14435). With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are grouped together under 13EO in EN 1092-1: 2001 Tab. 18. The chemical composition of the two materials can be identical.
3) Product Configurator, "Process connection" ordering feature

### ASME flanges, connection dimensions as per ASME B 16.5, raised face RF



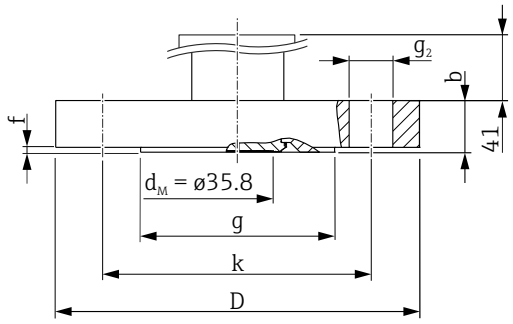

*D* *Diameter of flange*
*b* *Thickness*
*g* *Raised face*
*f* *Height of raised face*
*k* *Hole circle*
*$g_2$* *Diameter of hole*

Engineering unit mm

| Flange [1] [2] | | | | | | Boltholes | | | Weight | Approval | Option [3] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal diameter | Class | D | b | g | f | Quantity | $g_2$ | k | | | |
| [in] | [lb./sq in] | [in] | [in] | [in] | [in] | | [in] | [in] | [kg (lb)] | | |
| 1 ½ | 150 | 5 | 0.69 | 2.88 | 0.06 | 4 | 0.62 | 3.88 | 2.55 (5.62) | CRN | AEJ<br>(not FMB51/52) |
| 2 | 150 | 6 | 0.75 | 3.62 | 0.06 | 4 | 0.75 | 4.75 | 3.45 (7.61) | CRN | AFJ |
| 3 | 150 | 7.5 | 0.94 | 5 | 0.06 | 4 | 0.75 | 6 | 6.15 (13.56) | CRN | AGJ |
| 4 | 150 | 9 | 0.94 | 6.19 | 0.06 | 8 | 0.75 | 7.5 | 8.25 (18.19) | CRN | AHJ |

1) The roughness of the surface in contact with the medium including the raised face of the flange (all standards) is $R_a$3.2 to 6.3 µm (125 to 250 µin). Lower surface roughness available on request.
2) Material AISI 316/316L: Combination of AISI 316 for required pressure resistance and AISI 316L for required chemical resistance (dual rated).
3) Product Configurator, "Process connection" ordering feature

### JIS flanges, connection dimensions as per JIS B 2220 BL, raised face RF



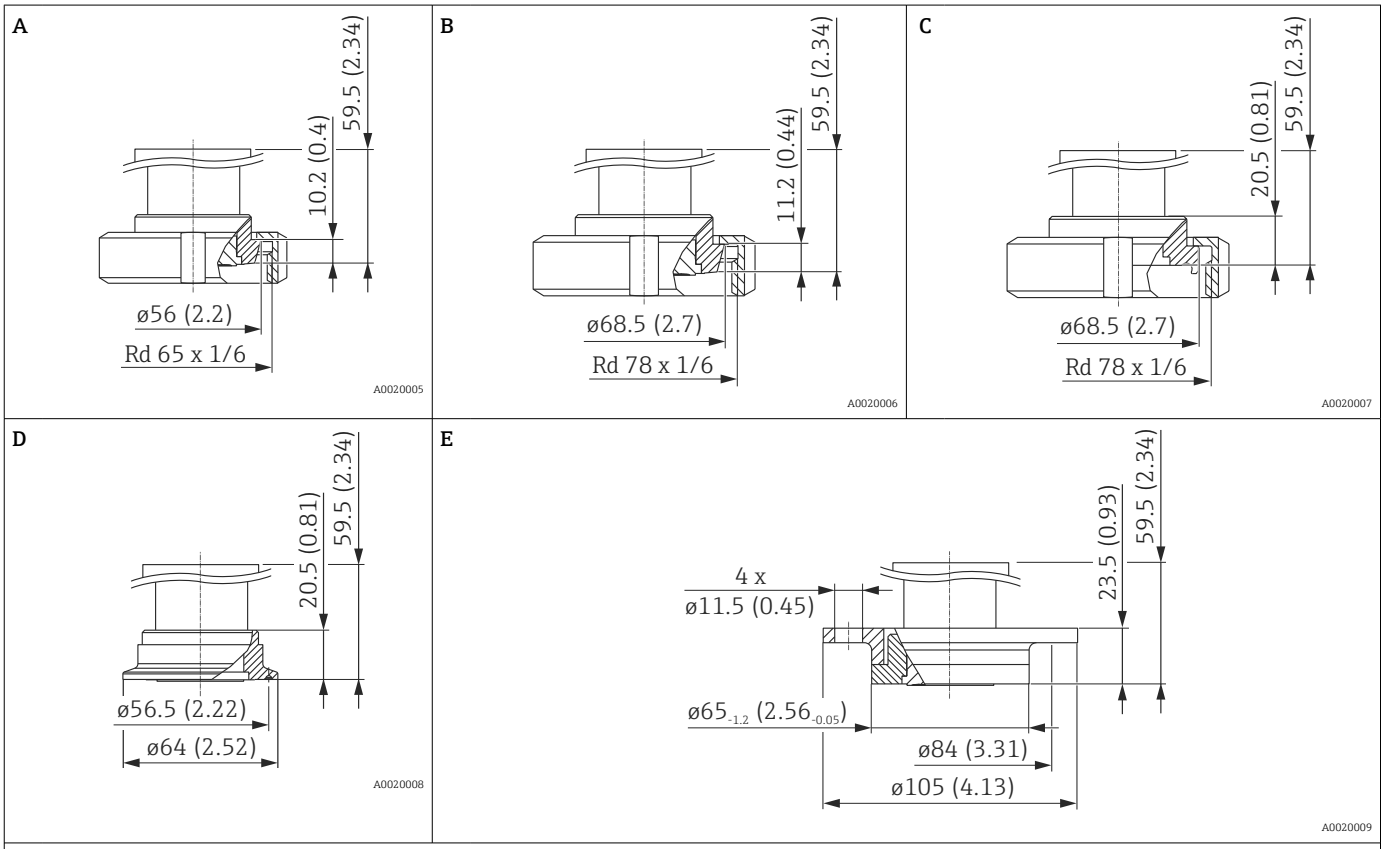

*D Diameter of flange*
*b Thickness*
*g Raised face*
*f Height of raised face*
*k Hole circle*
*$g_2$ Diameter of hole*

Engineering unit mm

| Flange [1] [2] | | | | | | Boltholes | | | Weight | Option [3] |
|---|---|---|---|---|---|---|---|---|---|---|
| Nominal diameter | Nominal pressure | D | b | g | f | Quantity | $g_2$ | k | | |
| | | [mm] | [mm] | [mm] | [mm] | | [mm] | [mm] | [kg (lb)] | |
| 40 A | 10 K | 140 | 16 | 81 | 2 | 4 | 19 | 105 | 2.55 (5.62) | KEJ |
| 50 A | 10 K | 155 | 16 | 96 | 2 | 4 | 19 | 120 | 2.95 (6.50) | KFJ |
| 80 A | 10 K | 185 | 18 | 126 | 2 | 8 | 19 | 150 | 4.25 (9.37) | KGJ |
| 100 A | 10 K | 210 | 18 | 151 | 2 | 8 | 19 | 175 | 5.35 (11.79) | KHJ |

1) The roughness of the surface in contact with the medium including the raised face of the flange (all standards) is $R_a$3.2 to 6.3 µm (125 to 250 µin). Lower surface roughness available on request.
2) Material AISI 316L (1.4435)
3) Product Configurator, "Process connection" ordering feature

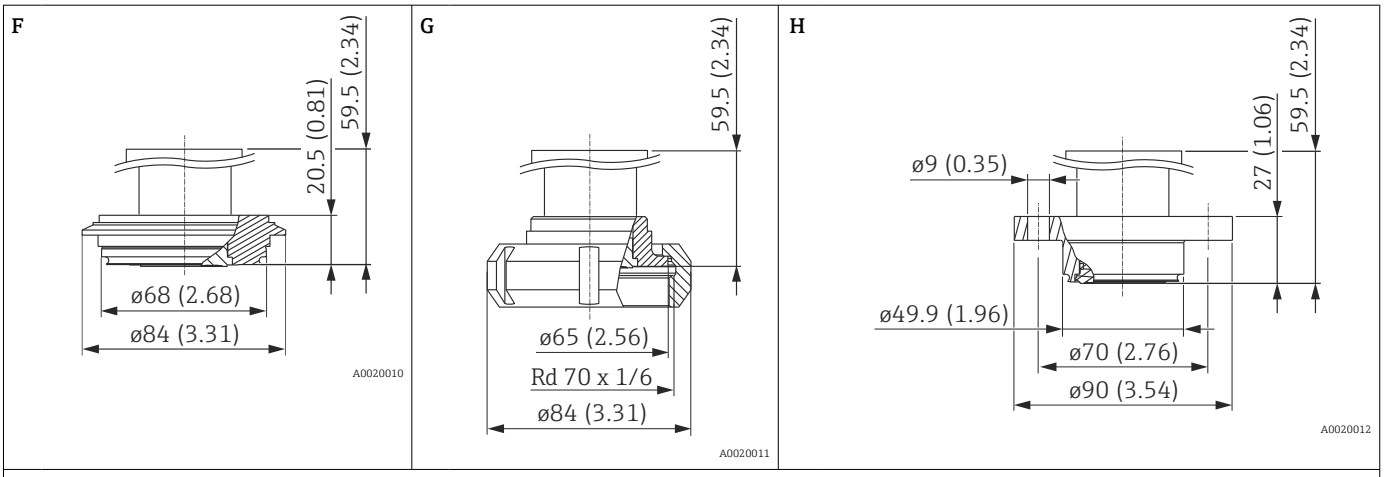
**Process connections FMB50 Hygienic connections**




Engineering unit mm (in)

| Item [1] | Designation | Nominal pressure | Material | Weight | Approval | Option [2] |
|---|---|---|---|---|---|---|
| | | | | kg (lb) | | |
| A | DIN 11851 DN 40 | PN 25 | AISI 316L (1.4435) | 0.7 (1.54) | EHEDG, 3A, CRN | MZJ [3] |
| B | DIN 11851 DN 50 | PN 25 | | 0.9 (1.98) | EHEDG, 3A, CRN | MRJ [3] |
| C | DIN 11864-1 A DN 50<br>DIN 11866-A pipe, slotted nut, 316L | PN 16 | | 1 (2.21) | EHEDG, 3A | NDJ [3] |
| D | Tri-Clamp ISO 2852 DN 40 – DN 51 (2"),<br>DIN 32676 DN 50 | - | | 0.7 (1.54) | EHEDG, 3A, CRN | TDJ |
| E | DRD DN 50 (65 mm), slip-on flange AISI 304 (1.4301) | PN 25 | | 1.1 (1.98) | - | TIJ |

1) Roughness of the surface in contact with the medium is $R_a$ < 0.76 µm (30 µin) as standard. Lower surface roughness available on request.
2) Product Configurator, "Process connection" ordering feature
3) Endress+Hauser supplies these slotted nuts in stainless steel AISI 304 (DIN/EN material number 1.4301) or in AISI 304L (DIN/EN material number 1.4307).



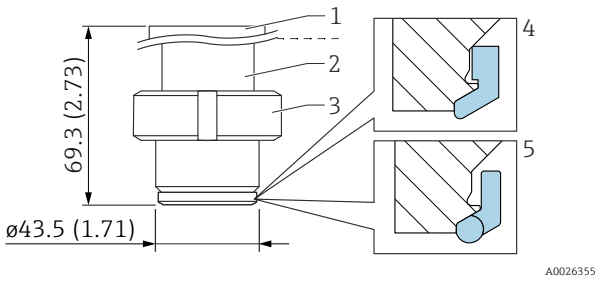

Engineering unit mm (in)

| Item [1] | Designation | Nominal pressure | Material | Weight | Approval | Option [2] |
|---|---|---|---|---|---|---|
| | | | | kg (lb) | | |
| F | Varivent type N for pipes 40 – 162 | PN 40 | AISI 316L (1.4435) | | EHEDG, 3A, CRN | TRJ |
| G | SMS 2" | PN 25 | | 1 (2.21) | 3A | TXJ [3] |
| H | NEUMO, D50 | PN 16 | | 0.7 (1.54) | 3A | S4J |

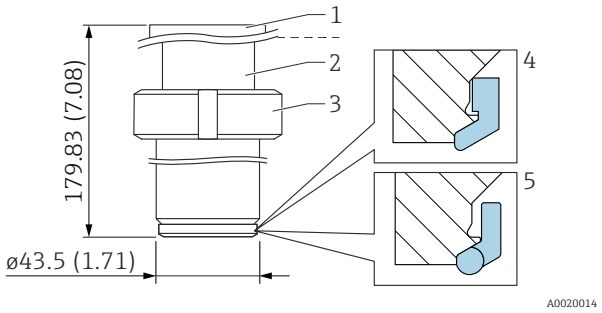
1) Roughness of the surface in contact with the medium is $R_a$ < 0.76 µm (30 µin) as standard. Lower surface roughness available on request.
2) Product Configurator, "Process connection" ordering feature
3) Endress+Hauser supplies these slotted nuts in stainless steel AISI 304 (DIN/EN material number 1.4301) or in AISI 304L (DIN/EN material number 1.4307).

**Universal process adapter**

A




B




1 *Top section: AISI 316L (1.4404)*
2 *Bottom section: AISI 316L (1.4435)*
3 *Slotted nut: AISI 304 (1.4301) or AISI 304L (1.4307)*
4 *Molded seal: silicone or EPDM*
5 *EPDM O-ring with AISI 316L (1.4404) support ring*

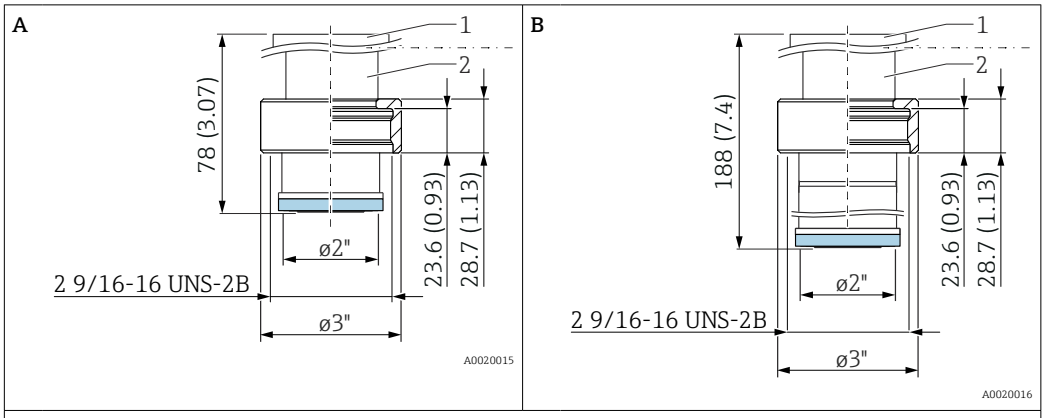
Engineering unit mm (in)

- Roughness of the surface in contact with the medium is $R_a$ < 0.76 µm (30 µin) as standard. Surface finish $R_a$ < 0.38 µm (15 µin) electropolished (wetted), ordering information: Product Configurator, "Service" ordering feature, option "HK"
- Silicone molded seal:
  FDA 21CFR177.2600/USP Class VI, order number: 52023572
- EPDM molded seal:
  FDA (177.2600), USP Class VI; 5 pcs, order number: 71100719
- EPDM O-ring with AISI 316L (1.4404) support ring:
  FDA (177.2600), USP Class VI; 1 pc, order number: 71431380

| Item | Designation | Nominal pressure | Weight | Approval [1), 2)] | Option [3)] |
|---|---|---|---|---|---|
| | | bar (psi) | kg (lb) | | |
| A | Universal process adapter<br>Molded seal made of silicone (4) | 10 (145) | 0.8 (1.76) | CRN | UPJ |
| | Universal process adapter<br>Molded seal made of EPDM (4) | | | - | URJ |
| | Universal process adapter<br>EPDM O-ring with support ring (5) [4)] | | | CRN | UNJ |
| B | Universal process adapter<br>6-inch extension<br>Molded seal made of silicone (4) | | 1.7 (3.75) | CRN | UQJ |
| | Universal process adapter<br>6-inch extension<br>EPDM O-ring with support ring (5) [4)] | | | CRN | UOJ |

1) CSA approval: Product Configurator, "Approval" ordering feature
2) See Product Configurator for additional approvals.
3) Product Configurator, "Process connection" ordering feature
4) With EHEDG approval.

### Anderson process adapter



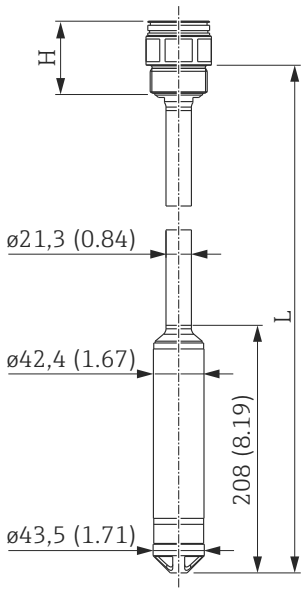

Engineering unit mm (in)

| Item [1] | Designation | Nominal pressure | Material | Weight | Approval | Option [2] |
|---|---|---|---|---|---|---|
| | | bar (psi) | | kg (lb) | | |
| A | Anderson short process adapter 2-3/16", 316L, incl. silicone molded seal FDA 21CFR177.2600 | 3.5 (50) | ▪ 1: Top section AISI 316L (1.4404)<br>▪ 2: Bottom section AISI 316L (1.4435)<br>▪ Slotted nut AISI 316L (1.4404) | 1.5 (3.31) | 3A | USJ |
| B | Anderson long process adapter 6-1/2", 316L, incl. silicone molded seal FDA 21CFR177.2600 | | | 2.9 (6.39) | 3A | UTJ |

1) Roughness of the surface in contact with the medium is $R_a$ < 0.76 µm (30 µin) as standard. Lower surface roughness available on request.
2) Product Configurator, "Process connection" ordering feature

**Process connections FMB51 (rod version)**

**Threaded connection ISO 228 and NPT**

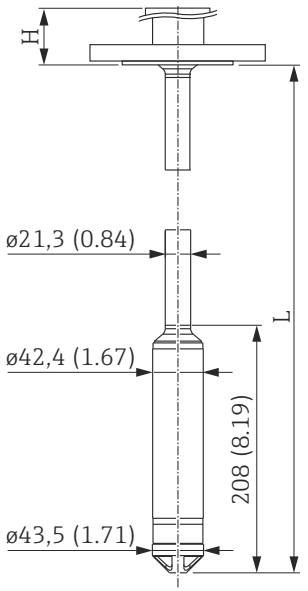



*H For dimensions of process connections → 🖹 41*
*L Probe length L = 0.4 to 4 m (1.3 to 13 ft) - see Product Configurator, "Probe connection" section*

Engineering unit mm (in)

| Process connection incl. sensor | Weight |
|---|---|
| Housing weight | → 🖹 39 |
| Process connection weight | → 🖹 41 |
| Pipe incl. cable | 0.77 kg/m (1.70 lbs/3.3 ft) |
| Threaded connection incl. measuring cell tube and sensor | 1.65 kg (3.64 lb) |
| Flange connection incl. measuring cell tube and sensor, without a flange | - |
| | |
| Total weight of device | |

### EN/DIN-, ANSI- and JIS flanges



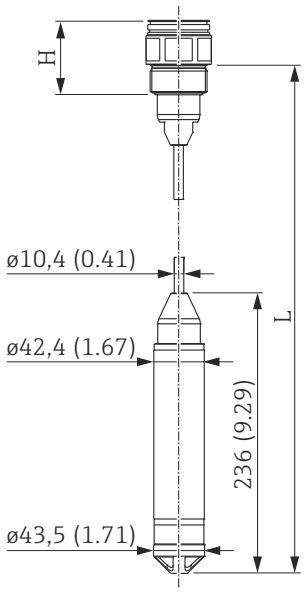

*H For dimensions of process connections*
*L Probe length L = 0.4 to 4 m (1.3 to 13 ft) - see Product Configurator, "Probe connection" section*

Engineering unit mm (in)

| Process connection incl. sensor | Weight |
|---|---|
| Housing weight | → 39 |
| Process connection weight | → 41 |
| Pipe incl. cable | 0.77 kg/m (1.70 lbs/3.3 ft) |
| Threaded connection incl. measuring cell tube and sensor | - |
| Flange connection incl. measuring cell tube and sensor, without a flange | 1.30 kg (2.87 lb) |
| | |
| Total weight of device | |

**Process connections FMB52 (cable version)**

**Threaded connection ISO 228 and NPT**

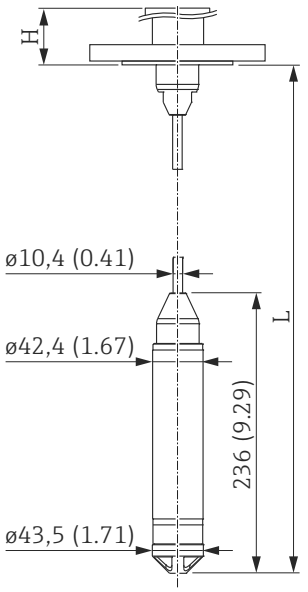



*H For dimensions of process connections → 🖹 41*
*L Probe length L = 500 to 300 000 mm (20 to 11 810 in) - see Product Configurator, order code for "Probe connection"*

Engineering unit mm (in)

| Process connection incl. sensor | Weight |
|---|---|
| Housing weight | → 🖹 39 |
| Process connection weight | → 🖹 41 |
| PE cable | 0.13 kg/m (0.28 lbs/3.3 ft) |
| FEP cable | 0.18 kg/m (0.40 lbs/3.3 ft) |
| Threaded connection incl. measuring cell tube and sensor | 1.65 kg (3.64 lb) |
| Flange connection incl. measuring cell tube and sensor, without a flange | - |
| | |
| Total weight of device | |

### EN/DIN, ANSI and JIS flanges

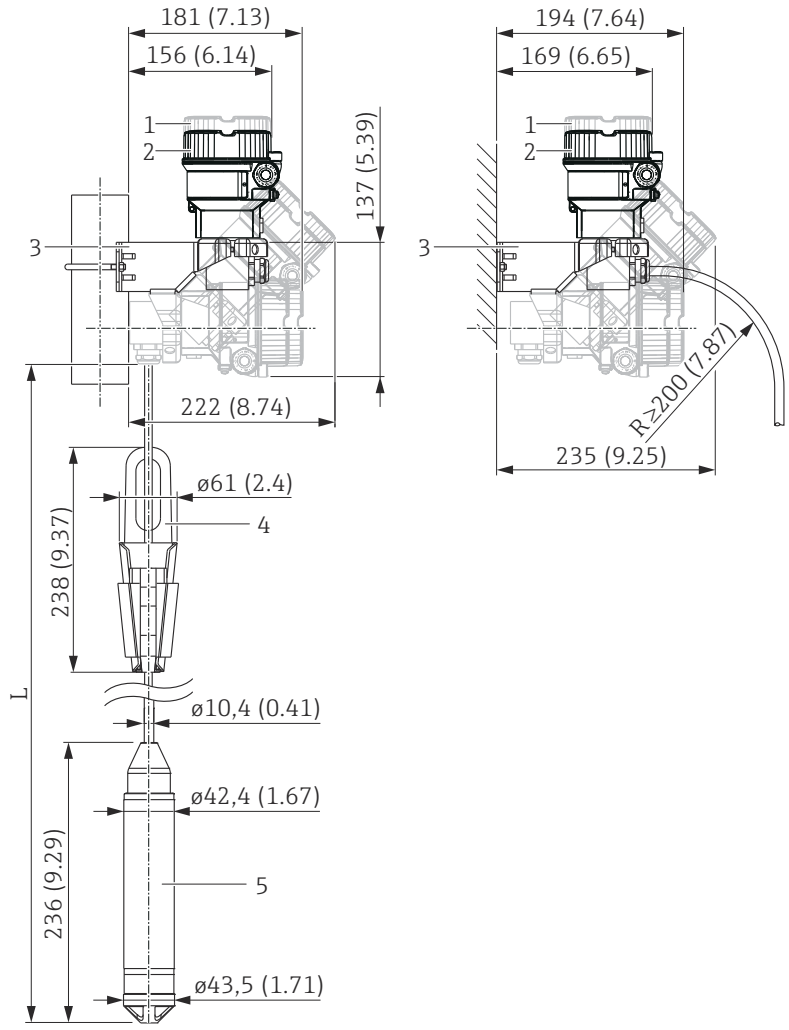



*H For dimensions of process connections*
*L Probe length L = 500 to 300 000 mm (20 to 11 810 in) - see Product Configurator, order code for "Probe connection"*

Engineering unit mm (in)

| Process connection incl. sensor | Weight |
|---|---|
| Housing weight | → 39 |
| Process connection weight | → 41 |
| PE cable | 0.13 kg/m (0.28 lbs/3.3 ft) |
| FEP cable | 0.18 kg/m (0.40 lbs/3.3 ft) |
| Flange connection incl. measuring cell tube and sensor, without a flange | 1.30 kg (2.87 lb) |
| | |
| Total weight of device | |

**Dimensions of FMB53 with F31 housing, suspension clamp and mounting bracket**

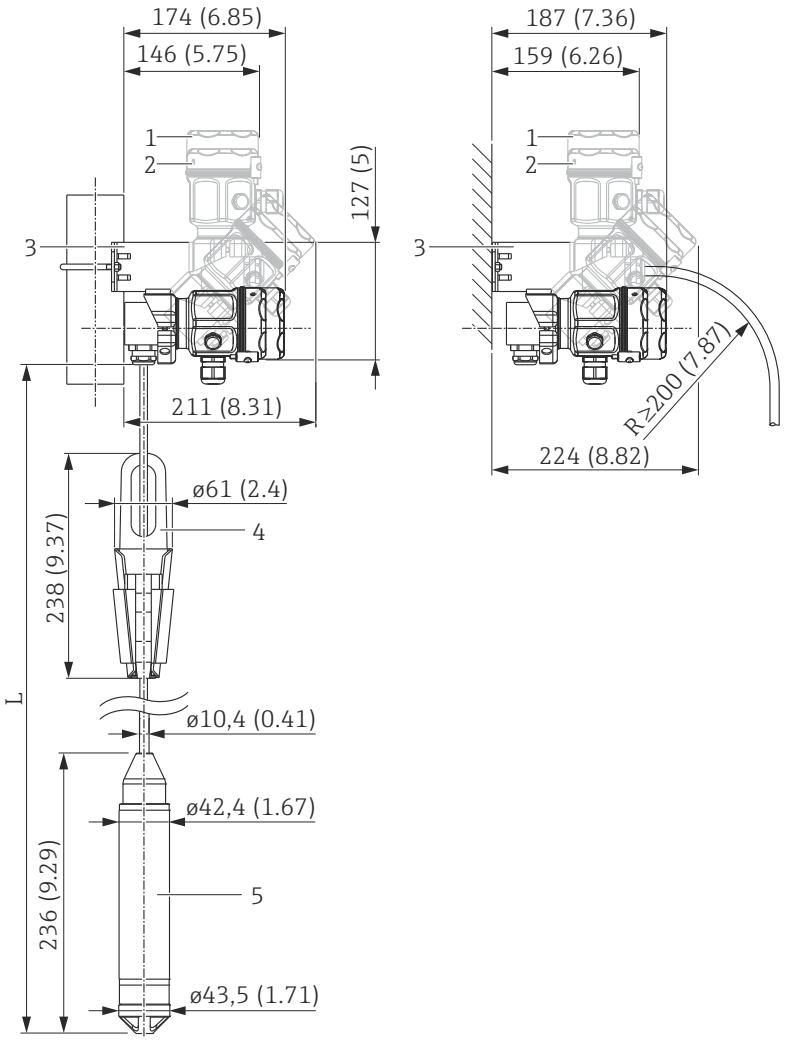



*1 Dimensions for housing covers with a viewing window.*
*2 Housing covers without a viewing window are approx. 15 mm (0.59 in) lower.*
*3 Mounting bracket for pipe and wall mounting (for pipes from 1 ¼" up to 2" diameter)*
*4 Suspension clamp*
*5 Measuring cell tube*
*L Probe length L = 500 to 300 000 mm (20 to 11 810 in) - see Product Configurator, order code for "Probe connection"*

FMB53 with suspension clamp and mounting bracket (mounting bracket without marine approval)
Engineering unit mm (in)

| Process connection incl. sensor | Weight |
|---|---|
| Housing weight | → 🖹 39 |
| PE cable (cable length > 120 m (394 ft) = Delivery on cable reel) | 0.13 kg/m (0.28 lbs/3.3 ft) |
| FEP cable (cable length > 120 m (394 ft) = Delivery on cable reel) | 0.18 kg/m (0.40 lbs/3.3 ft) |
| Mounting bracket | 0.2 kg (0.44 lb) |
| Pipe bend incl. cable entry | 0.65 kg (1.43 lb) |
| Suspension clamp | 0.4 kg (0.88 lb) |
| Measuring cell tube incl. sensor | 1.0 kg (2.21 lb) |
| | |
| Total weight of device | |

**Dimensions of FMB53 with F15 housing, suspension clamp and mounting bracket**

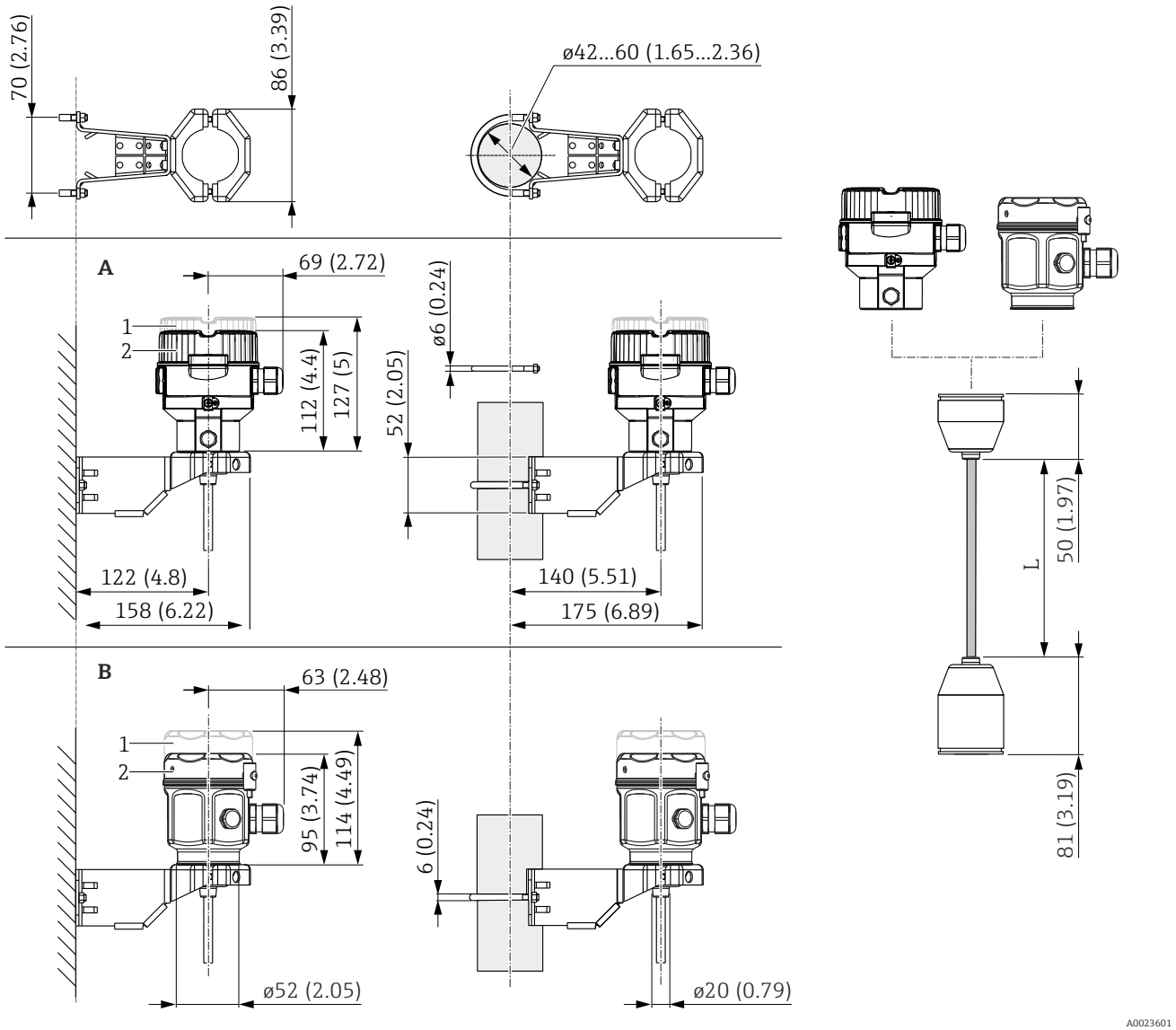



*1 Dimensions for housing covers with a viewing window.*
*2 Housing covers without a viewing window are approx. 15 mm (0.59 in) lower.*
*3 Mounting bracket for pipe and wall mounting (for pipes from 1 ¼" up to 2" diameter)*
*4 Suspension clamp*
*5 Measuring cell tube*
*L Probe length L = 500 to 300 000 mm (20 to 11 810 in) - see Product Configurator, order code for "Probe connection"*

FMB53 with suspension clamp and mounting bracket (mounting bracket without marine approval)
Engineering unit mm (in)

| Process connection incl. sensor | Weight |
|---|---|
| Housing weight | → 🖹 40 |
| PE cable (cable length > 120 m (394 ft) = Delivery on cable reel) | 0.13 kg/m (0.28 lbs/3.3 ft) |
| FEP cable (cable length > 120 m (394 ft) = Delivery on cable reel) | 0.18 kg/m (0.40 lbs/3.3 ft) |
| Mounting bracket | 0.2 kg (0.44 lb) |
| Pipe bend incl. cable entry | 0.65 kg (1.43 lb) |
| Suspension clamp | 0.4 kg (0.88 lb) |
| Measuring cell tube incl. sensor | 1.0 kg (2.21 lb) |
| | |
| Total weight of device | |

**Wall and pipe mounting with mounting bracket**




*1 Housing cover with viewing window*
*2 Housing cover without viewing window*
*L PE: 2 m (6.6 ft), 5 m (16 ft) and 10 m (33 ft), FEP: 5 m (16 ft).*
*L1 FMB50 = 91 mm (3.58 in); FMB51 and FMB52 = 81 mm (3.19 in)*

Engineering unit mm (in)

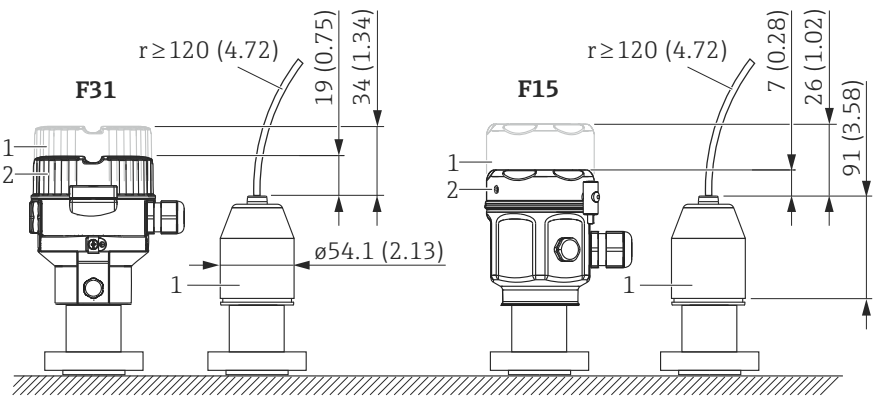
| Item | Designation | Weight (kg (lb)) | | Option [1] |
|---|---|---|---|---|
| | | Housing (F31 or F15) | Mounting bracket | |
| A | Dimensions with F31 housing | → 39 | 0.5 (1.10) | U |
| B | Dimensions with F15 housing | | | |

1) Product Configurator, "Separate housing" ordering feature

Also available for order as a separate accessory: Part number 71102216

**FMB50: Reduction in installation height**

If the separate housing is used, the mounting height of the process connection is reduced compared to the dimensions of the standard version.

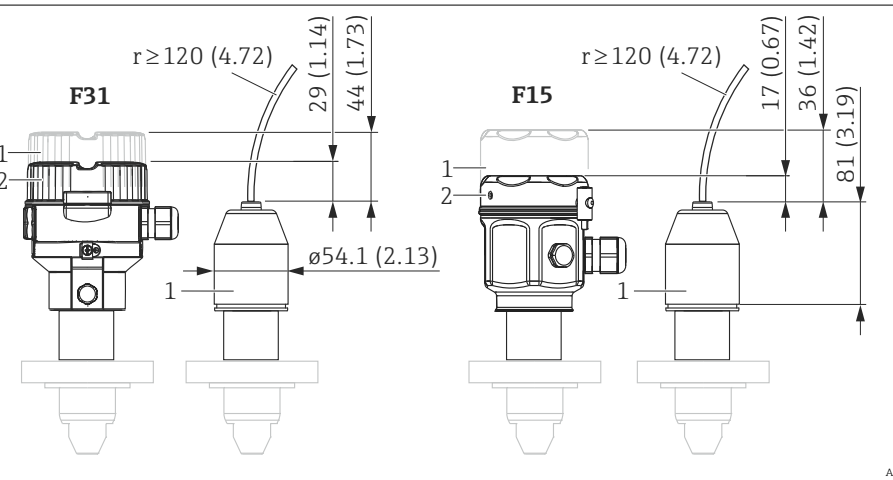



*1 Process connection adapter*

Engineering unit mm (in)

**FMB51, FMB52: Reduction in installation height**

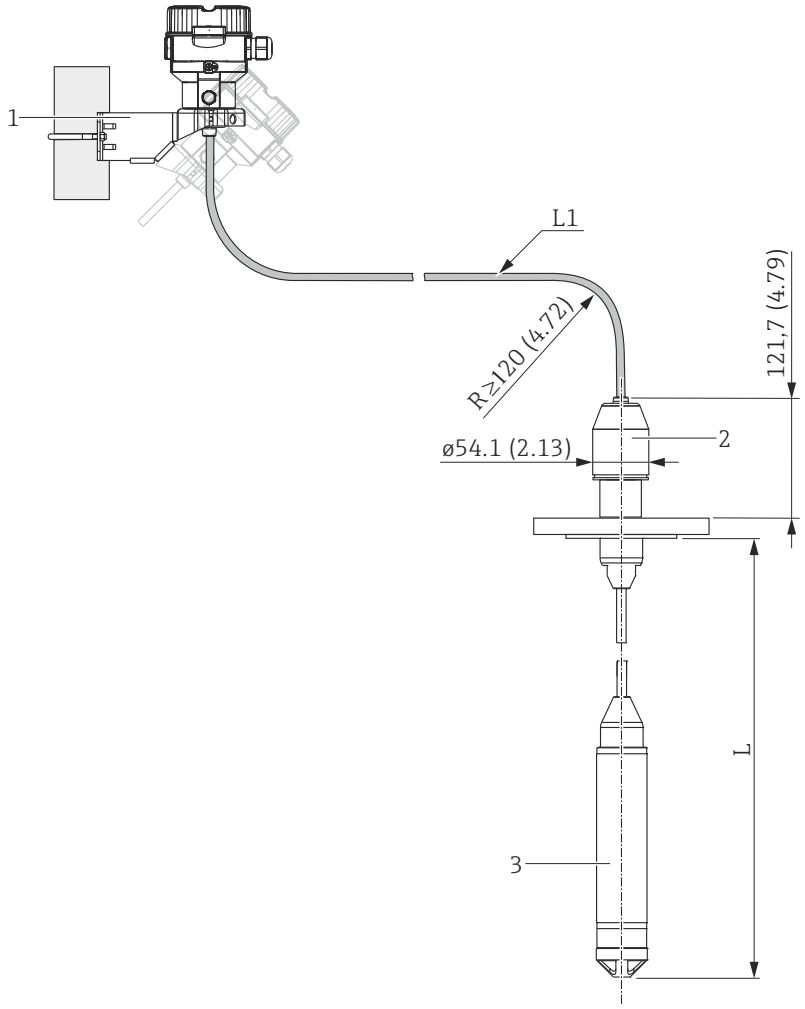
If the separate housing is used, the mounting height of the process connection is reduced compared to the dimensions of the standard version.




*1 Process connection adapter*

Engineering unit mm (in)

**Example for a "Separate housing version"**




*1 Mounting bracket for pipe and wall mounting (for pipes from 1 ¼" up to 2" diameter)*
*2 Process connection adapter*
*3 Measuring cell tube*
*L1 PE: 2 m (6.6 ft), 5 m (16 ft) and 10 m (33 ft); FEP: 5 m (16 ft)*
*L Probe length = 500 to 300 000 mm (20 to 11 810 in)*

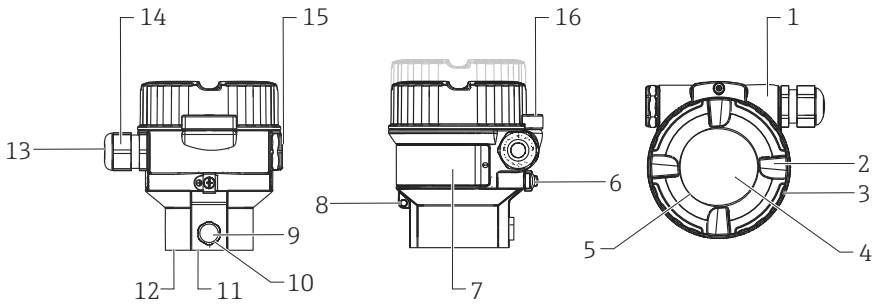
Connecting cable with process connection adapter and mounting bracket, depicted here with a FMB52
Engineering unit mm (in)

| Process connection incl. sensor | Weight |
|---|---|
| Separate housing for FMB50 | Weight of housing → 🖹 39 + 0.5 kg (1.10 lb) |
| Separate housing for FMB51 and FMB52 | Weight of housing → 🖹 39 + 0.65 kg (1.43 lb) |
| Process connection adapter | 0.4 kg (0.88 lb) |
| Mounting bracket | 0.2 kg (0.44 lb) |
| Pipe bend incl. cable entry | 0.65 kg (1.43 lb) |
| PE cable 2 m (6.6 ft) | 0.16 kg (0.35 lb) |
| PE cable 5 m (16 ft) | 0.32 kg (0.71 lb) |
| | |
| Total weight of device | |

Ordering information for FMB50, FMB51, FMB52: Product Configurator, order code for "Separate housing".

## Materials not in contact with process

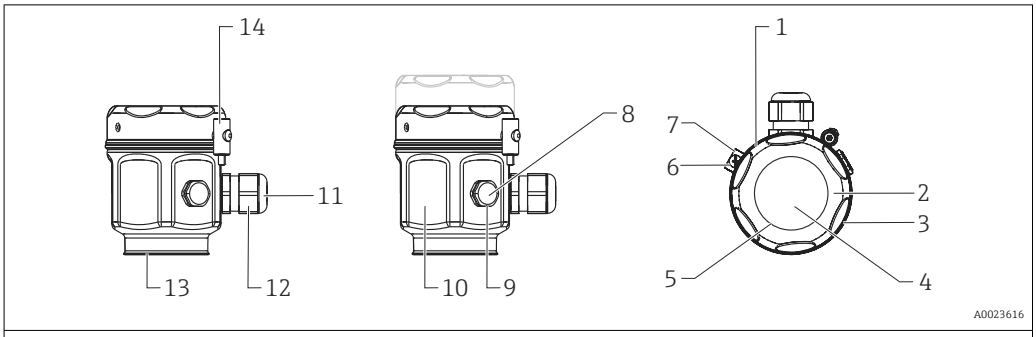
### F31 housing




Front view, left-hand side view, top view

| Item number | Component part | Material |
|---|---|---|
| 1 | F31 housing, RAL 5012 (blue) | Die-cast aluminum with protective powder-coating on polyester base |
| 2 | Cover, RAL 7035 (gray) | Die-cast aluminum with protective powder-coating on polyester base |
| 3 | Cover seal | EPDM |
| 4 | Sight glass | Mineral glass |
| 5 | Sight glass seal | Silicone (VMQ) |
| 6 | External ground terminal | AISI 304 (1.4301) |
| 7 | Nameplates | Plastic film |
| 8 | Fastening for wired-on tag plate | AISI 304 (1.4301)/AISI 316 (1.4401) |
| 9 | Pressure compensation filter | AISI 316L (1.4404) and PBT-FR |
| 10 | Pressure compensation filter, O-ring | VMQ or EPDM |
| 11 | Sealing ring | EPDM |
| 12 | Snap ring | PC Plastic |
| 13 | Seal of cable gland and blind plug | EPDM/NBR |
| 14 | Cable gland | Polyamide (PA), for dust ignition-proof: CuZn nickel-plated |
| 15 | Blind plug | PBT-GF30 FR |
| | | for dust ignition-proof, Ex d, FM XP and CSA XP: AISI 316L (1.4435) |
| 16 | Cover clamp | Clamp AISI 316L (1.4435), screw A4 |

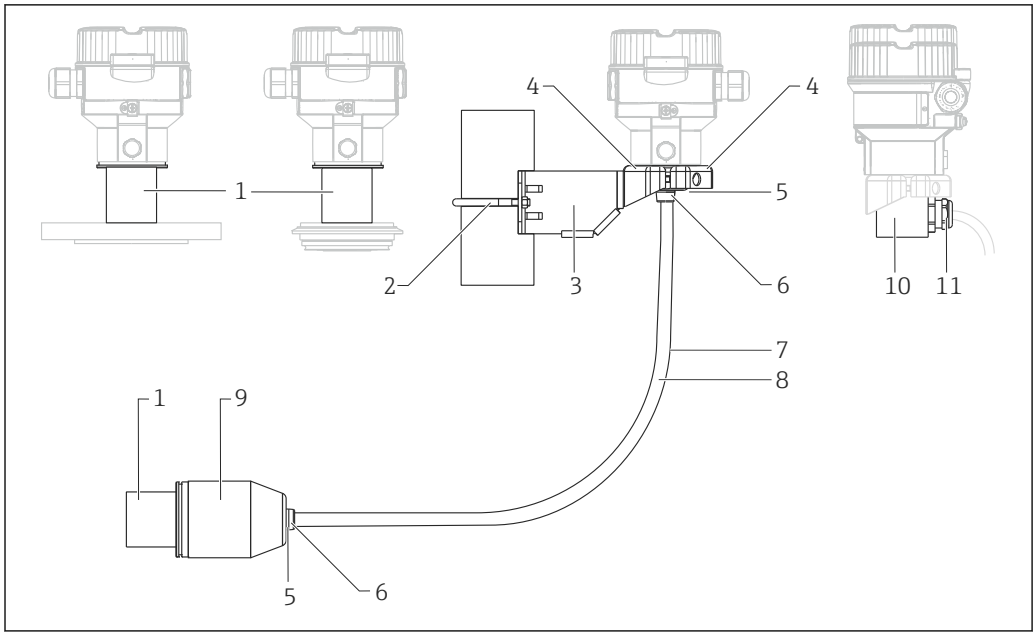
**F15 housing**




Front view, left-hand side view, top view

| Item number | Component part | Material |
|---|---|---|
| 1 | F15 housing | AISI 316L (1.4404) |
| 2 | Cover | |
| 3 | Cover seal | Silicone with PTFE coating |
| 4 | Sight glass for non-hazardous area, ATEX Ex ia, NEPSI Zone 0/1 Ex ia, IECEx Zone 0/1 Ex ia, FM NI, FM IS, CSA IS | Polycarbonate (PC) |
| 4 | Sight glass for ATEX 1/2 D, ATEX 1/3 D, ATEX 1 GD, ATEX 1/2 GD, ATEX 3 G, FM DIP, CSA dust ignition-proof | Mineral glass |
| 5 | Sight glass seal | Silicone (VMQ) |
| 6 | External ground terminal | AISI 304 (1.4301) |
| 7 | Fastening for wired-on tag plate | AISI 304 (1.4301)/AISI 316 (1.4401) |
| 8 | Pressure compensation filter | AISI 316L (1.4404) and PBT-FR |
| 9 | Pressure compensation filter, O-ring | VMQ or EPDM |
| 10 | Nameplates | Lasered on |
| 11 | Cable gland | Polyamide (PA), for dust ignition-proof: CuZn nickel-plated |
| 12 | Seal of cable gland and blind plug | NBR/Silicone/EPDM |
| 13 | Sealing ring | EPDM |
| 14 | Screw | A4-50 |

### Connecting parts




A0023617

| Item number | Component part | Material |
|---|---|---|
| 1 | Connection between the housing and process connection | AISI 316L (1.4404) |
| 2 | Mounting bracket | Bracket AISI 316L (1.4404) |
| 3 | | Screw and nuts A4-70 |
| 4 | | Half-shells: AISI 316L (1.4404) |
| 5 | Seal for cable from separate housing | FKM, EPDM |
| 6 | ▪ Gland for cable from separate housing:<br>▪ Screws: | ▪ AISI 316L (1.4404)<br>▪ A2 |
| 7 | PE cable for separate housing | Abrasion-proof cable with strain-relief Dynema members; shielded using aluminum-coated film; insulated with polyethylene (PE-LD), black; copper wires, twisted, UV-resistant |
| 8 | FEP cable for separate housing | Abrasion-proof cable; shielded using galvanized steel wire netting; insulated with fluorinated ethylene propylene (FEP), black; copper wires, twisted, UV-resistant |
| 9 | Process connection adapter for separate housing | AISI 316L (1.4404) |
| 10 | Housing adapter | FMB50, FMB51, FMB52: AISI 316L (1.4404)<br>FMB53: AISI 304 (1.4301) |
| 11 | Cable gland:<br>Sealing insert:<br>O-ring: | CuZn nickel-plated<br>TPE-V<br>NBR |

### Fill fluid

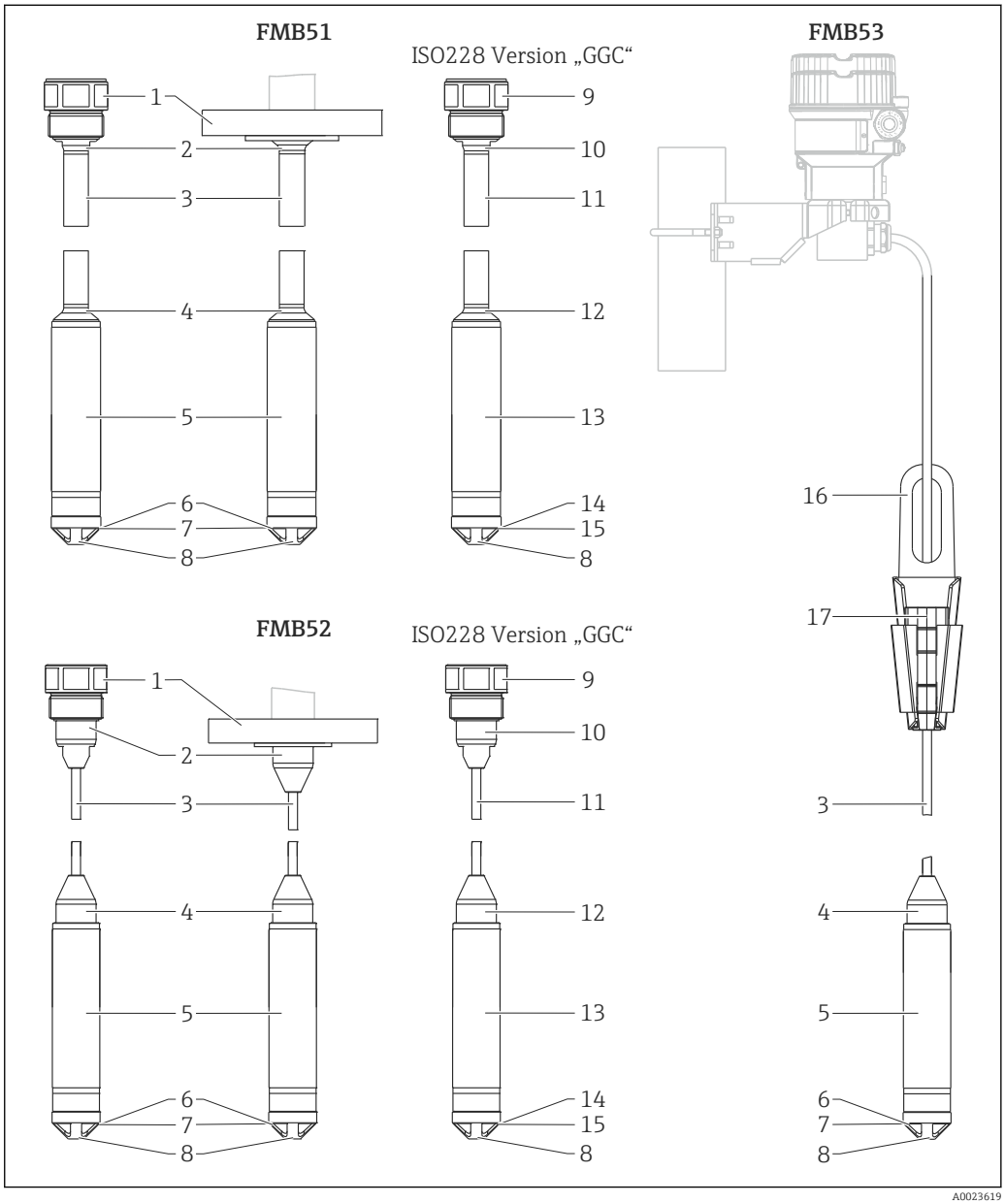
| Designation | Option [1] |
|---|---|
| Inert oil | 2 |
| Synthetic oil polyalphaolefin FDA 21 CFR 178.3620, NSF H1 | 3 |

1) Product Configurator, order code for "Fill fluid"

### Materials in contact with process

NOTICE

- Device components in contact with the process are listed in the "Mechanical construction" → 39 and "Ordering information" → 75 sections.




A0023619

| Item number | Component | Material |
|---|---|---|
| 1 | Process connection | → 41 |
| 2 | Socket | AISI 316L (1.4404) |
| 3 | Rod | AISI 316L (1.4404) |

| Item number | Component | Material |
|---|---|---|
| | PE cable | Abrasion-proof cable; shielded using galvanized steel wire netting and aluminum-coated film; insulated with polyethylene (PE-LD), black/blue; copper wires, twisted, UV-resistant |
| | PE cable<br>(Usage in drinking water) | Abrasion-proof cable; shielded using galvanized steel wire netting and aluminum-coated film; insulated with polyethylene (PE-LD), black; copper wires, twisted, UV-resistant |
| 3 | FEP cable | Abrasion-proof cable; shielded using galvanized steel wire netting and aluminum-coated film; insulated with fluorinated ethylene propylene (FEP), black; copper wires, twisted, UV-resistant |
| 4 | Socket | AISI 316L (1.4404) |
| 5 | Probe tube | AISI 316L (1.4404) |
| 6 | Process membrane and meter body | → 🖹 62 |
| 7 | Seals | → 🖹 63 |
| 8 | Protection cap | POM |
| 9 | Process connection | Alloy C276 (2.4819) |
| 10 | Socket | Alloy C4 (2.4610) |
| 11 | Rod | Alloy C4 (2.4610) |
| 12 | Socket | Alloy C4 (2.4610) |
| 13 | Probe tube | Alloy C22 (2.4602) |
| 14 | Process membrane and meter body | → 🖹 62 |
| 15 | Seals | → 🖹 63 |
| 16 | Suspension clamp | AISI 316L (1.4404) |
| 17 | Clamping jaw | PA-GF |

### DIN/EN flanges

Endress+Hauser supplies DIN/EN flanges made of stainless steel AISI 316L as per material numbers 1.4435 or 1.4404. With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are grouped together under 13EO in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.

### Process membrane

| Process membrane | Coating | Meter body | FMB50 | FMB51 | FMB52 | Option [1] |
|---|---|---|---|---|---|---|
| Alloy C276 (2.4819) | - | 316L (1.4435) or Alloy C276 (2.4819) [2] | ✔ | ✔ | ✔ | B |
| Alloy C276 (2.4819) | Gold-rhodium | Alloy C276 (2.4819) | ✔ | ✔ | ✔ | L |
| Alloy C276 (2.4819) | Gold-platinum | Alloy C276 (2.4819) | — | ✔ | ✔ | N |

1) Product Configurator, "Material of the process membrane" ordering feature
2) The material of the meter body corresponds to the material of the selected process connection.

| Process membrane | Coating | Meter body | FMB53 | Option [1] |
|---|---|---|---|---|
| Alloy C276 (2.4819) | - | 316L (1.4435) | ✔ | B |
| Alloy C276 (2.4819) | Gold-rhodium | Alloy C276 (2.4819) | ✔ | L |
| Alloy C276 (2.4819) | Gold-platinum | Alloy C276 (2.4819) | ✔ | N |

1) Product Configurator, "Material of the process membrane" ordering feature

### Seals

| Designation | Option [1] |
|---|---|
| FKM Viton | A [2] |
| EPDM | J [2] |
| Kalrez 6375 | L [2] |
| None, welded cell | U |

1) Product Configurator, "Seal" ordering feature
2) Not FMB50

### TSE Certificate of Suitability (Transmissible Spongiform Encephalopathy)

The following applies to all device components in contact with the process:

- They do not contain any materials derived from animals.
- No additives or operating materials derived from animals are used in production or processing.

# Operability

## Operating concept

### Operator-oriented menu structure for user-specific tasks

- Commissioning
- Operation
- Diagnostics
- Expert level

### Quick and safe commissioning

Guided menus for applications

### Reliable operation

- Onsite operation possible in several languages
- Standardized operation at the device and in the operating tools
- Parameters can be locked/unlocked using the device's write protection switch (not IO-Link), using the device software or via remote control

### Efficient diagnostics increase measurement reliability

- Remedial measures are integrated in plain text
- Diverse simulation options

## Onsite operation

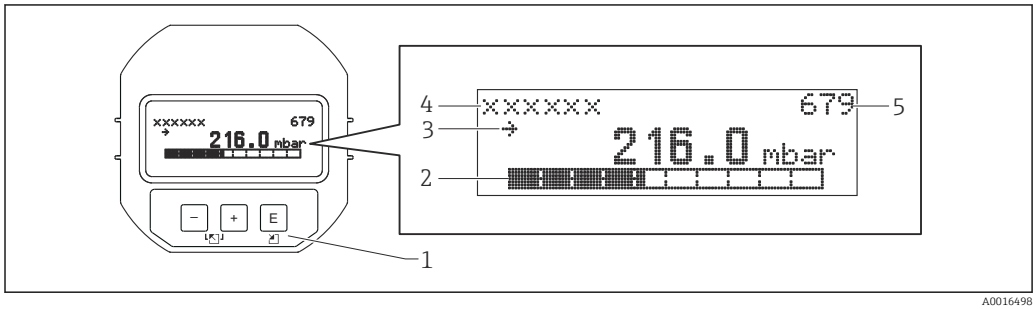
### Onsite display (optional)

A 4-line liquid crystal display (LCD) is used for display and operation. The onsite display shows measured values, dialog text as well as fault and notice messages in plain text, thereby supporting the user in every stage of operation. The liquid crystal display of the device can be turned in 90° stages. Depending on the orientation of the device, this makes it easy to operate the device and read the measured values.

Functions:

- 8-digit measured value display incl. sign and decimal point in relation to the set pressure range.
  - Bar graph for 4 to 20 mA HART as current display
  - Bar graph for IO-Link as current display
  - Bar graph for PROFIBUS PA as graphic display of the standardized value of the AI block
  - Bar graph for FOUNDATION Fieldbus as graphic display of the transducer output
- Simple and complete menu guidance as parameters are split 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 preferences, such as language, alternating display, display of other measured values such as sensor temperature, contrast setting
- Comprehensive diagnostic functions (fault and warning message, peak-hold indicators, etc.)

*Overview*




A0016498

*1 Operating keys*
*2 Bar graph*
*3 Symbol*
*4 Header*
*5 Parameter ID number*

Ordering information: Product Configurator, "Output, Operation" ordering feature

| Function | Operation via display | | | |
|---|---|---|---|---|
| | HART | IO-Link | PROFIBUS PA | FOUNDATION Fieldbus |
| Position adjustment (zero point correction) | ✔ | ✔ | ✔ | ✔ |
| Setting lower range value and upper range value - reference pressure present at the device | ✔ | ✔ | ✔ | ✔ |
| Device reset | ✔ | ✔ | ✔ | ✔ |
| Locking and unlocking parameters relevant to the measured value | ✔ | ✔ | ✔ | ✔ |
| Switching damping on and off | ✔ | ✔ | ✔ | ✔ |

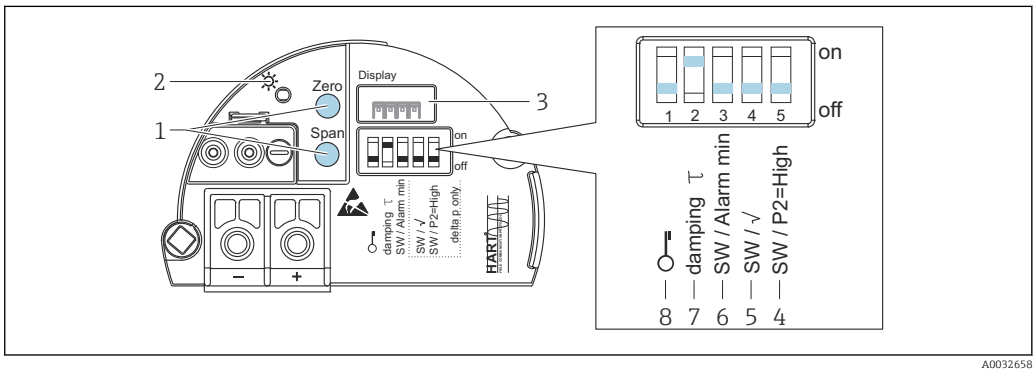
**Operating keys and elements located internally on the electronic insert**

| Function | Operation with operating keys and elements on the electronic insert | | | |
|---|---|---|---|---|
| | HART | IO-Link | PROFIBUS PA | FOUNDATION Fieldbus |
| Position adjustment (zero point correction) | ✔ | ✔ | ✔ | ✔ |
| Setting lower range value and upper range value - reference pressure present at the device | ✔ | ✔ | – | – |
| Device reset | ✔ | ✔ | ✔ | ✔ |
| Locking and unlocking parameters relevant to the measured value | ✔ | – | ✔ | ✔ |
| Value acceptance indicated by the green LED | ✔ | ✔ | ✔ | ✔ |
| Switching damping on and off | ✔ | – | ✔ | ✔ |

Ordering information:

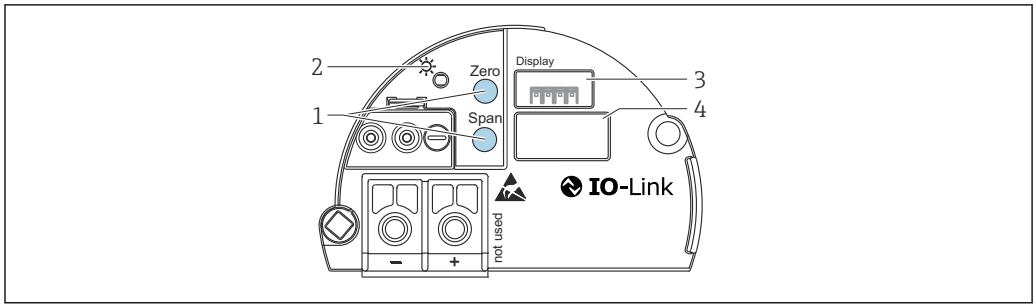
Product Configurator, "Output, Operation" ordering feature

*HART*




*1 Operating keys for lower range value (zero) and upper range value (span)*
*2 Green LED to indicate successful operation*
*3 Slot for optional local display*
*4 DIP switch only for Deltabar M*
*5 DIP switch only for Deltabar M*
*6 DIP switch for alarm current SW / Alarm Min (3.6 mA)*
*7 DIP switch for switching damping on/off*
*8 DIP switch for locking/unlocking parameters relevant to the measured value*

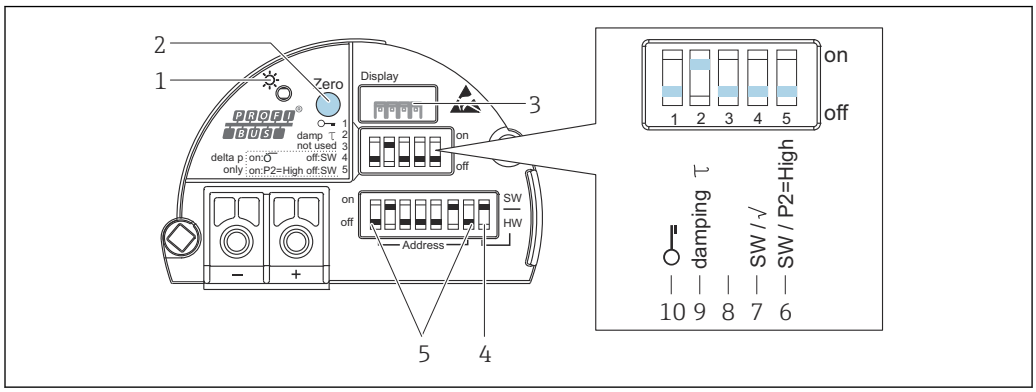
*IO-Link*




A0045576

1 *Operating keys for lower range value (zero) and upper range value (span)*
2 *Green LED to indicate successful operation*
3 *Slot for optional onsite display*
4 *Slot for M12 plug*

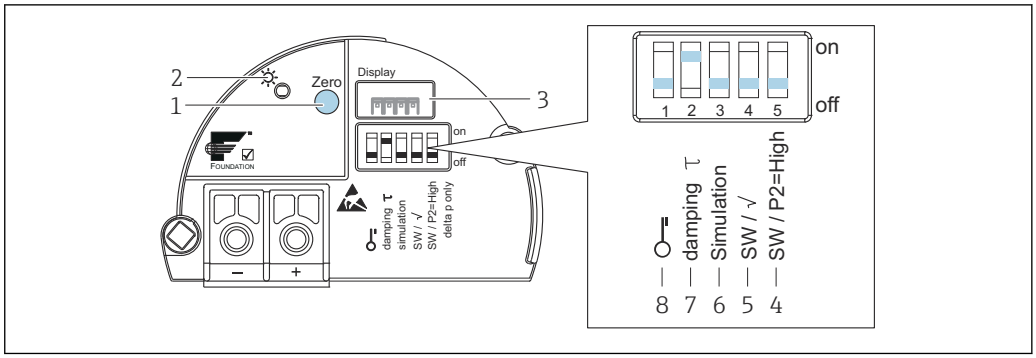
*PROFIBUS PA*




A0032659

1 *Green LED to indicate successful operation*
2 *Operating key for position zero adjustment (Zero) or reset*
3 *Slot for optional local display*
4 *DIP-switch for bus address SW / HW*
5 *DIP-switch for hardware address*
6 *DIP switch only for Deltabar M*
7 *DIP switch only for Deltabar M*
8 *Not used*
9 *DIP switch for switching damping on/off*
10 *DIP switch for locking/unlocking parameters relevant to the measured value*

*FOUNDATION Fieldbus*




*1 Operating key for position zero adjustment (Zero) or reset*
*2 Green LED to indicate successful operation*
*3 Slot for optional local display*
*4 DIP switch only for Deltabar M*
*5 DIP switch only for Deltabar M*
*6 DIP-switch for simulation mode*
*7 DIP switch for switching damping on/off*
*8 DIP switch for locking/unlocking parameters relevant to the measured value*

**Operating languages**

You can also choose another language in addition to the standard language "English":

| Designation | Option [1] |
|---|---|
| English | AA |
| German | AB |
| French | AC |
| Spanish | AD |
| Italian | AE |
| Dutch | AF |
| Chinese | AK |
| Japanese | AL |

1) Product Configurator "Additional Operation Language" ordering feature

**Remote operation**

Depending on the position of the write protection switch on the device, all software parameters are accessible.

| Hardware and software for remote operation | HART | IO-Link | PROFIBUS PA | FOUNDATION Fieldbus |
|---|---|---|---|---|
| FieldCare → 🖹 67 | ✔ [1] | ✔ [2] | ✔ [3] | ✔ |
| FieldXpert SFX100 → 🖹 68 | ✔ | – | – | ✔ |
| NI-FBUS Configurator → 🖹 68 | – | – | – | ✔ |
| Field Xpert SMT70, SMT77→ 🖹 68 | ✔ [1] | ✔ [2] | – | ✔ |

1) Commubox FXA195 required
2) SFP20 required
3) Profiboard or Proficard required

### FieldCare

FieldCare is an Endress+Hauser asset management tool based on FDT technology. With FieldCare, you can configure all Endress+Hauser devices as well as devices from other manufacturers that support the FDT standard.

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

Connection options:
- HART via Commubox FXA195 and the USB port on a computer
- IO-Link with FieldPort SFP20 and the USB interface of a computer and IO-Link IODD Interpreter DTM
- PROFIBUS PA via segment coupler and PROFIBUS interface card

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

**Field Xpert SFX100**

Field Xpert is an industrial PDA with integrated 3.5" touchscreen from Endress+Hauser based on Windows Mobile. It offers wireless communication via the optional VIATOR Bluetooth modem from Endress+Hauser. Field Xpert also works as a stand-alone device for asset management applications. For details refer to BA00060S/04/DE.

**Field Xpert SMT70, SMT77**

The Field Xpert SMT70 tablet PC for device configuration enables mobile plant asset management in hazardous (Ex Zone 2) and non-hazardous areas. It is suitable for commissioning and maintenance staff. It manages Endress+Hauser and third-party field instruments with a digital communication interface and documents the progress of the work. The SMT70 is designed as a complete solution. It comes with a pre-installed driver library and is an easy-to-use, touch-enabled tool for managing field devices throughout their entire life cycle.

The Field Xpert SMT77 for device configuration enables mobile plant asset management in areas categorized as Ex Zone 1. It is suitable for commissioning and maintenance staff for easy management of field instruments with a digital communication interface. The touch-enabled tablet PC is designed as a complete solution. It comes with comprehensive pre-installed driver libraries and offers users a modern software user interface to manage field instruments throughout the entire life cycle.

Required tool: "IO-Link IODD Interpreter DTM"

**FieldPort SFP20**

The FieldPort SFP20 is a USB interface for the configuration of Endress+Hauser IO-Link devices, and also of devices from other vendors. Combined with the IO-Link CommDTM and the IODD Interpreter, the FieldPort SFP20 complies with the FDT/DTM standards.

**Commubox FXA195**

For intrinsically safe HART communication with FieldCare via the USB interface. For details refer to TI00404F/00/EN.

**Profiboard**

For connecting a PC to PROFIBUS.

**Proficard**

For connecting a laptop to PROFIBUS.

**FF configuration program**

FF configuration program, such as NI-FBUS Configurator, to
- connect devices with "FOUNDATION Fieldbus signal" to an FF-network
- set FF-specific parameters

*Remote operation via NI-FBUS Configurator:*

The NI-FBUS Configurator is an easy-to-use graphical environment for creating linkages, field-based control loops and a schedule based on the FOUNDATION Fieldbus concept.

You can use the NI-FBUS Configurator to configure a fieldbus network as follows:
- Set function block and device tags
- Set device addresses
- Create and edit field-based control systems and control loops

- Configure sensor-specific parameters
- Create and edit schedules
- Read and write to control systems and control loops
- Execute methods that are listed in the manufacturer-specific device description (DD) (e.g., device basic settings)
- Display DD menus (e.g., tab for calibration data)
- Save the device and network configuration
- Verify a configuration and compare it to a saved configuration
- Monitor a saved configuration
- Replace a virtual device by a real device
- Save and print a configuration

**System integration**

The device can be given a tag name (max. 8 alphanumeric characters).

| Designation | Option [1] |
|---|---|
| Measuring point (TAG), see additional spec. | Z1 |
| Bus address, see additional spec. | Z2 |

1) Product Configurator, "Identification" ordering feature

IO-Link Smart Sensor Profile 2nd Edition

Supports
- Identification
- Diagnosis
- Digital Measuring Sensor (as per SSP 4.3.3)

**IO-Link (optional)**

*Operating concept for devices with IO-Link*

- Operator-oriented menu structure for user-specific tasks
- Quick and safe commissioning

*Efficient diagnostics increase measurement reliability*

- Remedial measures
- Simulation options

*IO-Link information*

IO-Link is a point-to-point connection for communication between the measuring device and an IO-Link master. The measuring device features an IO-Link communication interface type 2 (pin 4) with a second IO function on pin 2. This requires an IO-Link-compatible assembly (IO-Link master) for operation. The IO-Link communication interface enables direct access to the process and diagnostic data. It also provides the option of configuring the measuring device while in operation.

Characteristics of the IO-Link interface:
- IO-Link specification: Version 1.1
- IO-Link Smart Sensor Profile 2nd Edition
- Speed: COM2; 38.4 kBaud
- Minimum cycle time: 10 ms
- Process data width: 14 Byte
- IO-Link data storage: Yes
- Block configuration: Yes
- Device operational: The measuring device is operational 5 seconds after the supply voltage is applied

*IO-Link download*

**http://www.endress.com/download**
- Select "Software" as the media type
- Select "Device Driver" as the software type
  Select IO-Link (IODD)
  IODD for Deltapilot FMB50
- In the "Text Search" field enter the device name.

https://ioddfinder.io-link.com/
Search by
- Manufacturer
- Article number
- Product type

**Device Search (IO-Link)**

The Device Search parameter is used to uniquely identify the device during installation.

# Certificates and approvals

**CE mark**

The device meets the legal requirements of the relevant EC directives. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.

**RoHS**

The measuring system complies with the substance restrictions of the Restriction on Hazardous Substances Directive 2011/65/EU (RoHS 2).

**RCM marking**

The supplied product or measuring system meets the ACMA (Australian Communications and Media Authority) requirements for network integrity, interoperability, performance characteristics as well as health and safety regulations. Here, especially the regulatory arrangements for electromagnetic compatibility are met. The products bear the RCM marking on the nameplate.

A0029561

**Ex approvals**

- ATEX
- IECEx
- FM
- CSA
- NEPSI
- Combinations of different approvals also

All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all Ex devices .

**EAC conformity**

The measuring system meets the legal requirements of the applicable EAC guidelines. These are listed in the corresponding EAC Declaration of Conformity together with the standards applied.

The manufacturer confirms successful testing of the device by affixing to it the EAC mark.

**Suitable for hygiene applications**

For information on installation and approvals, see documentation SD02503F "Hygiene approvals".

For information on 3-A and EHEDG-tested adapters, see documentation TI00426F "Weld-in adapter, process adapter and flanges".

**Certificate of current Good Manufacturing Practices (cGMP)**

Product Configurator, order code for "Test, Certificate" option "JG"

- The certificate is only available in English
- Materials of construction of product wetted parts
- TSE compliance
- Polishing and surface finish
- Material/ compound compliance table (USP Class VI, FDA conformity)

**Certificate of Compliance ASME BPE 2012 (only FMB50)**

Ordering information:

Product Configurator, "Additional approval" ordering feature, option "LW"

**Functional safety SIL**

The Deltapilot M with 4 to 20 mA output signal has been developed to assessed and certified by TÜV NORD CERT as per IEC 61508 Edition 2.0 and IEC 61511. These devices can be used to monitor the process level and pressure up to SIL 2. For a detailed description of the safety functions with Deltapilot M, settings and functional safety data, see the "Functional safety manual - Deltapilot M" SD00347P.

Ordering information:

Product Configurator, "Additional approval" ordering feature, option "LA"

**CRN approval**

Some device versions have CRN approval. A CRN-approved process connection with a CSA approval must be ordered for a CRN-approved device. These devices are fitted with a separate plate bearing the registration number 0F14101.5.

Ordering information:

Product Configurator, “Process connection” ordering feature and

Product Configurator, "Approval" ordering feature

**Overfill protection**

WHG (FMB50, FMB51, FMB52): see document ZE00275P

Ordering information:

Product Configurator, "Additional approval" ordering feature, option "LC".

**Other standards and guidelines**

The applicable European guidelines and standards can be found in the relevant EU Declarations of Conformity. The following standards were also applied:

**IEC 62828-1 and IEC 62828-2:**

Transmitters for use in industrial-process control systems. Part 1: Methods for performance evaluation

**DIN 16086:**

Electrical pressure measuring instruments, pressure sensors, pressure transmitters, pressure measuring instruments, concepts, specifications in data sheets

**EN 61326 series:**

EMC product family standard for electrical equipment for measurement, control, regulation and laboratory procedures.

**EN 60529:**

Degrees of protection provided by enclosures (IP code)

**AD2000**

The pressure retaining material 316L (1.4435/1.4404) corresponds to AD2000 - W2/W10.

**Pressure Equipment Directive 2014/68/EU (PED)**

**Pressure equipment with allowable pressure ≤ 200 bar (2 900 psi)**

Pressure equipment (with a maximum allowable pressure PS ≤ 200 bar (2 900 psi)) can be classified as pressure accessories in accordance with Pressure Equipment Directive 2014/68/EU. If the maximum allowable pressure is ≤ 200 bar (2 900 psi) and the pressurized volume of the pressure equipment is ≤ 0.1 l, the pressure equipment is subject to the Pressure Equipment Directive (cf. Pressure Equipment Directive 2014/68/EU, Article 4, point 3). The Pressure Equipment Directive only requires that the pressure equipment shall be designed and manufactured in accordance with the "sound engineering practice of a Member State".

*Reasons:*

- Pressure Equipment Directive (PED) 2014/68/EU Article 4, point 3
- Pressure equipment directive 2014/68/EU, Commission´s Working Group "Pressure", Guideline A-05 + A-06

*Note:*

A partial examination shall be performed for pressure instruments that are part of safety equipment for the protection of a pipe or vessel from exceeding allowable limits (safety accessory in accordance with Pressure Equipment Directive 2014/68/EU, Article 2, point 4).

**Manufacturer declaration**

Depending on the desired configuration, the following documents can be ordered additionally with the device:

- TSE-free, materials free from animal origin
- Regulation (EC) No. 2023/2006 (GMP)
- Regulation (EC) No. 1935/2004 on materials and articles intended to come into contact with food

**Downloading the Declaration of Conformity**

www.endress.com → Download

### Marine approval

| Designation | FMB50 | FMB51 | FMB52 | FMB53 | Option [1] |
|---|---|---|---|---|---|
| GL | ✔ | – | ✔ | ✔ | LE |
| ABS | ✔ | – | ✔ | ✔ | LF |
| LR | ✔ | – | ✔ | ✔ | LG |
| BV | ✔ | – | ✔ | ✔ | LH |
| DNV | ✔ | – | ✔ | ✔ | LI |

1) Product Configurator, "Additional options 1" and "Additional options 2" ordering feature

### Drinking water approval

| Designation | Option [1] |
|---|---|
| KTW | LQ |
| NSF61 | LR |
| ACS (under development) | LS |

1) Product Configurator, "Additional options 1" and "Additional options 2" ordering feature

### Classification of process sealing between electrical systems and (flammable or combustible) process fluids in accordance with ANSI/ ISA 12.27.01

Endress+Hauser instruments are designed according to ANSI/ISA 12.27.01 either as single seal or dual seal devices with annunciation, allowing the user to waive the use and save the cost of installing external secondary process seals in the conduit as required by the process sealing sections of ANSI/ NFPA 70 (NEC) and CSA 22.1 (CEC). These instruments comply with the North-American installation practice and provide a very safe and cost-saving installation for pressurized applications with hazardous fluids.

Further information can be found in the control drawings of the relevant devices.

### Inspection certificate

| Designation | FMB50 | FMB51 | FMB52 | FMB53 | Option [1] |
|---|---|---|---|---|---|
| 3.1 Material certificate, wetted metallic parts, EN10204-3.1 inspection certificate | ✔ | ✔ | ✔ | ✔ | JA [2] |
| Conformity to NACE MR0175, wetted metallic parts | ✔ | ✔ | ✔ | ✔ | JB [2] |
| Conformity to NACE MR0103, wetted metallic parts | ✔ | ✔ | ✔ | ✔ | JE [2] |
| Conformity to AD2000, wetted metallic parts, excepting process membrane | ✔ | – | – | – | JF |
| Surface finish measurement ISO4287/Ra, wetted metallic parts, Inspection certificate | ✔ | – | – | – | KB |
| Helium leak test, internal procedure, inspection certificate | ✔ | ✔ | ✔ | ✔ | KD |
| Pressure test, internal procedure, inspection certificate | ✔ | ✔ | ✔ | – | KE |
| 3.1 Material certificate+Delta-Ferrit measurement, internal procedure, wetted metallic parts, EN10204-3.1 inspection certificate | ✔ | – | – | – | KF |
| 3.1 Material certificate+PMI test (XRF), internal procedure, wetted metallic parts, EN10204-3.1 inspection certificate | ✔ | ✔ | ✔ | ✔ | KG |

1) Product Configurator, "Test, certificate" ordering feature
2) The selection of this feature for coated process isolating diaphragm / process connections refers to the metallic base material.

### Calibration; unit

| Designation | Option [1] |
|---|---|
| Sensor range; % | A |
| Sensor range; mbar/bar | B |
| Sensor range; kPa/MPa | C |
| Sensor range; mm/mH2O | D |
| Sensor range; inH2O/ftH2O | E |

| Designation | Option [1] |
|---|---|
| Sensor range; psi | F |
| Customized pressure; see additional specification | J |
| Customized level; see additional specification | K |

1) Product Configurator, "Calibration; unit" ordering feature

## Calibration

| Designation | Option [1] |
|---|---|
| Factory calib. certificate 5-point | F1 |
| DKD/DAkkS calib. certificate 10-point [2] | F2 |

1) Product Configurator "Calibration" ordering feature
2) Only for FMB50

## Service

| Designation | Option [1] |
|---|---|
| Cleaned from oil+grease [2] | HA |
| Cleaned for oxygen service [2] | HB |
| Cleaned from PWIS (PWIS = paint wetting impairment substances) [2] | HC |
| Adjusted min alarm current | IA |
| Adjusted HART Burst Mode PV | IB |

1) Product Configurator "Service" ordering feature
2) Only device, not accessory or enclosed accessory

# Ordering information

Detailed ordering information is available as follows:
- In the Product Configurator on the Endress+Hauser website:www.endress.com → Click "Corporate" → Select your country → Click "Products" → Select the product using the filters and search field → Open product page → The "Configure" button to the right of the product image opens the Product Configurator.
- From your Endress+Hauser Sales Center:www.addresses.endress.com

**Product Configurator - the tool for individual product configuration**
- Up-to-the-minute configuration data
- Depending on the device: direct input of information specific to the measuring point, such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic generation of the order code with its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

## Special device versions

Endress+Hauser offers special device versions as **T**echnical **S**pecial **P**roducts (TSP).

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

## Scope of delivery

- Device
- Optional accessories
- Brief Operating Instruction
- Calibration certificates
- Optional certificates

## Measuring point (TAG)

| | |
|---|---|
| **Order code for** | 895: Marking |
| **Option** | Z1: Tagging (TAG), see additional spec. |
| **Location of measuring point identification** | To be selected in the additional specification:<br>▪ Tie-on label, stainless steel<br>▪ Adhesive paper label<br>▪ Label provided<br>▪ RFID TAG<br>▪ RFID TAG + tie-on label, stainless steel<br>▪ RFID TAG + adhesive paper label<br>▪ RFID TAG + label provided |
| **Definition of measuring point identification** | To be specified in additional specification:<br>3 lines each with a maximum of 18 characters<br>The measuring point designation appears on the selected label and/or the RFID TAG. |
| **Identification on electronic nameplate (ENP)** | 32 characters |
| **Identification on display module** | 10 characters |

## Configuration data sheet

IO-Link: The following data can only be selected for cyclic data and not for acyclic data.

### Pressure

If the option "J" was selected for the order code for "Calibration; Unit" in the Product Configurator, the following configuration data sheet must be completed and included with the order.

**Pressure unit**

| | | | |
|---|---|---|---|
| ❑ mbar | ❑ $mmH_2O$ | ❑ mmHg | ❑ Pa |
| ❑ bar | ❑ $mH_2O$ | ❑ $kgf/cm^2$ | ❑ kPa |
| ❑ psi | ❑ $ftH_2O$ | | ❑ MPa |
| | ❑ $inH_2O$ | | |

**Calibration Range / Output**

| | | |
|---|---|---|
| Low range value (LRV): | _____ | [Pressure engineering unit] |
| Upper range value (URV): | _____ | [Pressure engineering unit] |

**Display**

| 1st Value Display [1] | 2nd Value Display [1] |
|---|---|
| ❑ Main Value | ❑ None (Default) |
| | ❑ Main Value [%] |
| | ❑ Pressure |
| | ❑ Current [mA] (HART only) |
| | ❑ Temperature |

1) Depending on sensor and communication version

**Damping**

Damping: _____ sec (Default 2 sec)

Lowest calibratable span (preset at factory) → 🖹 14

### Level

If the option "K" was selected for the order code for "Calibration; Unit" in the Product Configurator, the following configuration data sheet must be completed and included with the order.

**Pressure unit**

❑ mbar ❑ $mmH_2O$ ❑ mmHg ❑ Pa
❑ bar ❑ $mH_2O$ ❑ $kgf/cm^2$ ❑ kPa
❑ psi ❑ $ftH_2O$ ❑ MPa
❑ $inH_2O$

**Output unit (scaled unit)**

| Mass | Lengths | Volume | Volume | Percent |
|---|---|---|---|---|
| ❑ kg | ❑ m | ❑ l | ❑ gal | ❑ % |
| ❑ t | ❑ dm | ❑ hl | ❑ Igal | |
| ❑ lb | ❑ cm | ❑ $m^3$ | | |
| | ❑ mm | ❑ $ft^3$ | | |
| | ❑ ft | ❑ $in^3$ | | |
| | ❑ inch | | | |

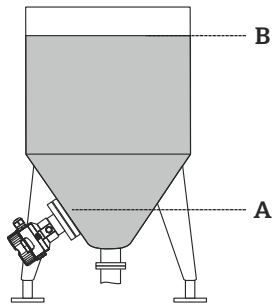
Empty pressure [a]: Low pressure value (empty) _____ [Pressure engineering unit]

Empty calibration [a]: Low level value (empty) _____ [Scaled unit]

Full pressure [b]: High pressure value (full) _____ [Pressure engineering unit]

Full calibration [b]: High level value (full) _____ [Scaled unit]

**Example**




*A 0 mbar / 0m*
*B 300 mbar (4.5 psi) / 3 m (9.8 ft)*

**Display**

1st Value Display [1)]

❑ Main Value

2nd Value Display

❑ None (Default)
❑ Main Value [%]
❑ Pressure
❑ Current [mA] (HART only)
❑ Temperature

1) Depending on sensor and communication version

**Damping**

Damping: _____ sec (Default 2 sec)

# Supplementary documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2D matrix code (QR code) on the nameplate

**Standard documentation**

- Technical Information: planning guide
  The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device
- Brief Operating Instructions: takes you quickly to the 1st measured value
  The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning
- Operating Instructions: reference manual
  The Operating Instructions contain all the information that is required in the various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal

**Supplementary device-dependent documentation**

Additional documents are supplied depending on the device version ordered: Always comply strictly with the instructions in the supplementary documentation. The supplementary documentation is an integral part of the device documentation.

**Field of Activities**

Pressure measurement, powerful instruments for process pressure, differential pressure, level and flow:

FA00004P/00/EN

**Safety instructions**

See Download area of the website.

**Special Documentation**

Document SD01553P

Mechanical accessories for pressure measuring devices

The documentation provides an overview of available manifolds, oval flange adapters, pressure gauge valves, shutoff valves, siphons, condensate pots, cable shortening kits, test adapters, flushing rings, block-and-bleed valves and protective roofs.

# Accessories

**Weld-in adapter, Process adapter and Flanges**

See technical information TI00426F/00.

**Mounting bracket for wall and pipe mounting**

→ 🖹 33

**Suspension clamp (FMB53 only)**

→ 🖹 33

**Extension cable shortening kit (FMB53 only)**

See Product Configurator, "Accessory enclosed" ordering feature, option "PW" or can be ordered as a separate accessory (part no. 71125862).

For details refer to SD00553P/00/A2.

**M12 connector**

→ 🖹 25

**Adapter Uni for FMB50**

For dimensions and technical data, see Technical Information TI00426F.

| Designation | FMB50 | FMB51 | FMB52 | FMB53 | Option [1] |
|---|---|---|---|---|---|
| Weld-in adapter G1-1/2, 316L | ✔ | ✔ | ✔ | - | QJ |
| Weld-in tool adapter Uni D65/D85, Brass | ✔ | - | - | - | Q1 |
| Weld-in adapter Uni D85, 316L | ✔ | - | - | - | Q2 |
| Weld-in adapter Uni D85, 316L, 3.1 EN10204-3.1 material, inspection certificate | ✔ | - | - | - | Q3 |
| Weld-in adapter Uni 6" D85, 316L | ✔ | - | - | - | Q5 |
| Weld-in adapter Uni 6" D85, 316L, 3.1 EN10204-3.1 material, inspection certificate | ✔ | - | - | - | Q6 |
| Welding jig adapter Uni 6" D85, brass | ✔ | - | - | - | Q7 |
| Weld-in adapter G1-1/2, 316L, 3.1 EN10204-3.1 material, inspection certificate | ✔ | ✔ | ✔ | - | QK |
| Weld-in tool adapter G1-1/2, Brass | ✔ | ✔ | ✔ | - | QL |
| Weld-in flange DRD DN50 65mm, 316L | ✔ | - | - | - | QP |
| Weld-in fl. DRD DN50 65mm, 316L 3.1 EN10204-3.1 material, inspection certificate | ✔ | - | - | - | QR |
| Weld-in tool flange DRD DN50 65mm, Brass | ✔ | - | - | - | QS |
| Weld-in adapter Uni D65, 316L | ✔ | - | - | - | QT |
| Weld-in adapter Uni D65, 316L, 3.1 EN10204-3.1 material, inspection certificate | ✔ | - | - | - | QU |
| Adapter Uni > DIN11851 DN40, 316L, 3.1, slotted-nut, EN10204-3.1 material, inspection certificate | ✔ | - | - | - | R1 |
| Adapter Uni > DIN11851 DN50, 316L, 3.1, slotted-nut, EN10204-3.1 material, inspection certificate | ✔ | - | - | - | R2 |
| Adapter Uni > DRD DN50 65mm, 316L, 3.1 EN10204-3.1 material, inspection certificate | ✔ | - | - | - | R3 |
| Adapter Uni > Clamp 2", 316L, 3.1 EN10204-3.1 material, inspection certificate | ✔ | - | - | - | R4 |
| Adapter Uni > Clamp 3", 316L, 3.1 EN10204-3.1 material, inspection certificate | ✔ | - | - | - | R5 |
| Adapter Uni > Varivent, 316L, 3.1 EN10204-3.1 material, inspection certificate | ✔ | - | - | - | R6 |
| Adapter Uni > DIN11851 DN40, 316L, slotted-nut | ✔ | - | - | - | RA |

| Designation | FMB50 | FMB51 | FMB52 | FMB53 | Option [1] |
|---|---|---|---|---|---|
| Adapter Uni > DIN11851 DN50, 316L, slotted-nut | ✔ | - | - | - | RB |
| Adapter Uni > DRD DN50 65mm, 316L | ✔ | - | - | - | RC |
| Adapter Uni > Clamp 2", 316L | ✔ | - | - | - | RD |
| Adapter Uni > Clamp 3", 316L | ✔ | - | - | - | RE |
| Adapter Uni > Varivent N, 316L | ✔ | - | - | - | RF |

1) Product Configurator, "Enclosed accessories" section

## Service-specific accessories

| Accessories | Description |
|---|---|
| DeviceCare SFE100 | Configuration tool for HART, PROFIBUS and FOUNDATION Fieldbus field devices<br>Technical Information TI01134S<br>DeviceCare is available to download at www.software-products.endress.com. You need to register in the Endress+Hauser software portal to download the application. |
| FieldCare SFE500 | FDT-based plant asset management tool<br>FieldCare can configure all smart field units in your plant and helps you manage them. By using the status information, FieldCare is also a simple but effective way of checking the status and condition of the field devices.<br>Technical Information TI00028S |
| FieldPort SFP20 | **Mobile configuration tool for all IO-Link devices:**<br>▪ Pre-installed device and communication DTMs in FieldCare<br>▪ Pre-installed device and communication DTMs in FieldXpert<br>▪ M12 connection for IO-Link field devices |
| Field Xpert SMT70, SMT77 | The Field Xpert SMT70 tablet PC for device configuration enables mobile plant asset management in hazardous (Ex Zone 2) and non-hazardous areas. It is suitable for commissioning and maintenance staff. It manages Endress+Hauser and third-party field instruments with a digital communication interface and documents the progress of the work. The SMT70 is designed as a complete solution. It comes with a pre-installed driver library and is an easy-to-use, touch-enabled tool for managing field devices throughout their entire life cycle.<br>The Field Xpert SMT77 for device configuration enables mobile plant asset management in areas categorized as Ex Zone 1. It is suitable for commissioning and maintenance staff for easy management of field instruments with a digital communication interface. The touch-enabled tablet PC is designed as a complete solution. It comes with comprehensive pre-installed driver libraries and offers users a modern software user interface to manage field instruments throughout the entire life cycle. |

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