



Level



Pressure



Flow



Temperature



Liquid  
Analysis



Registration



Systems  
Components



Services



Solutions

## Technical Information

# Waterpilot FMX167

Hydrostatic level measurement

Reliable and robust level probe with ceramic measuring cell

Compact device for level measurement in fresh water, wastewater and saltwater



### Application

The Waterpilot FMX167 is a pressure sensor for hydrostatic level measurement.

Three versions of FMX167 are available at Endress+Hauser:

- FMX167 with a stainless steel housing, outer diameter of 22 mm (0.87 inch): Standard version suitable for drinking water applications and for use in bore holes and wells with small diameters
- FMX167 with a stainless steel housing, outer diameter of 42 mm (1.66 inch): Heavy duty version, easy clean flush-mounted process diaphragm. Ideally suited to wastewater and sewage treatment plants
- FMX167 with a coated housing, outer diameter of 29 mm (1.15 inch): Corrosion resistant version generally for use in saltwater, particularly for ship ballast water tanks.

### Your benefits





- High mechanical resistance to overload and aggressive media
- High-precision, robust ceramic measuring cell with long-term stability
- Climate proofed sensor thanks to completely potted electronics and 2-filter pressure compensation system
- 4 to 20 mA output signal with integrated overvoltage protection
- Simultaneous measurement of level and temperature with optionally integrated Pt100 temperature sensor
- Drinking water approvals: KTW, NSF, ACS
- Approvals: ATEX, FM and CSA
- Marine certificate: GL, ABS
- Extensive range of accessories provides complete measuring point solutions

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## Function and system design

### Device selection

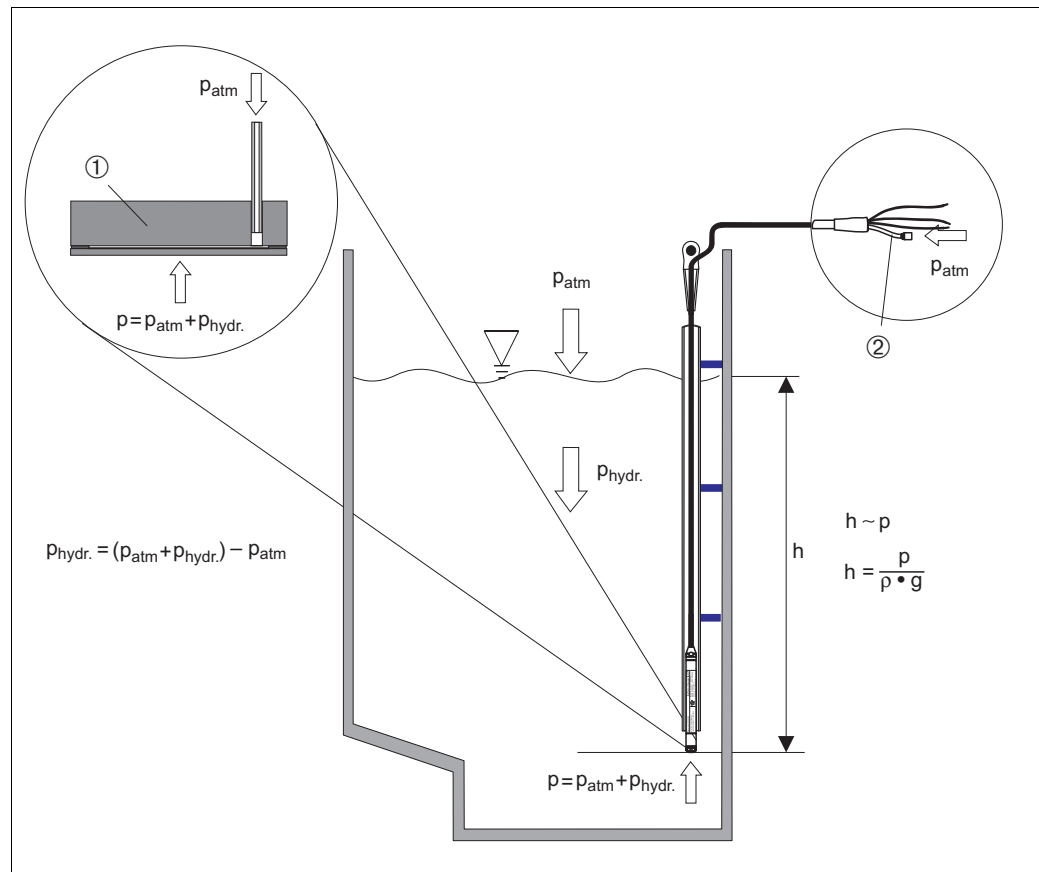
<b>Waterpilot FMX167</b>	 P01-FMX167xx-16-xx-xx-xx-002	 P01-FMX167xx-16-xx-xx-xx-003	 P01-FMX167xx-16-xx-xx-xx-004
Field of application	Hydrostatic level measurement in deep wells e.g. drinking water	Hydrostatic level measurement in wastewater	Hydrostatic level measurement in saltwater
	<p>  <b>Caution!</b>            The Waterpilot is not suitable for use in biogas plants since the gases can diffuse through the elastomers (seals, extension cable). Endress+Hauser offers the Deltapilot level transmitter for biogas applications.         </p>		
Process connection	<ul style="list-style-type: none"> <li>– Mounting clamp</li> <li>– Extension cable mounting screw with G1 1/2 A or 1 1/2 NPT thread</li> </ul>		
Outer diameter	22 mm	42 mm	Max. 29 mm
Extension cable	<ul style="list-style-type: none"> <li>– PE extension cable</li> <li>– PUR extension cable</li> <li>– FEP extension cable</li> </ul>		
Seals	<ul style="list-style-type: none"> <li>– FKM Viton</li> <li>– EPDM <sup>1)</sup></li> </ul>	<ul style="list-style-type: none"> <li>– FKM Viton</li> </ul>	<ul style="list-style-type: none"> <li>– FKM Viton</li> <li>– EPDM</li> </ul>
Measuring ranges	<ul style="list-style-type: none"> <li>– Nine fixed pressure measuring ranges in bar, mH<sub>2</sub>O, psi and ftH<sub>2</sub>O, from 0 to 0.1 bar to 0 to 20 bar (0 to 1 mH<sub>2</sub>O to 0 to 200 mH<sub>2</sub>O/ 0 to 1.5 psi to 0 to 300 psi/0 to 3 ftH<sub>2</sub>O to 0 to 600 ftH<sub>2</sub>O)</li> <li>– Customer-specific measuring ranges; factory-calibrated</li> </ul>		<ul style="list-style-type: none"> <li>– Seven fixed pressure measuring ranges in bar, mH<sub>2</sub>O, psi and ftH<sub>2</sub>O, from 0 to 0.1 bar to 0 to 4 bar (0 to 1 mH<sub>2</sub>O to 0 to 40 mH<sub>2</sub>O/ 0 to 1.5 psi to 0 to 60 psi/ 0 to 3 ftH<sub>2</sub>O to 0 to 150 ftH<sub>2</sub>O)</li> <li>– Customer-specific measuring ranges; factory-calibrated</li> </ul>
Overload	Up to 40 bar (580 psi)		Up to 25 bar (362 psi)
Process temperature	–10 to +70 °C		0 to +50 °C
Ambient temperature range	–10 to +70 °C		0 to +50 °C
Maximum measured error	±0.2 % of upper range value (URV)		
Supply voltage	10 to 30 V DC		
Output	4 to 20 mA		
Options	<ul style="list-style-type: none"> <li>– Drinking water approval</li> <li>– Integrated Pt100 temperature sensor</li> <li>– Integrated Pt100 temperature sensor and TMT181 temperature head transmitter (4 to 20 mA/HART)</li> <li>– Marine approval</li> </ul>		
Specialties	<ul style="list-style-type: none"> <li>– Large selection of approvals, including ATEX II 2 G, FM and CSA</li> <li>– High-precision, robust ceramic measuring cell with long-term stability</li> <li>– Customer-specific cable marking</li> </ul>		

1) Recommended for drinking water applications, not suitable for use in hazardous areas

## Measuring principle

The ceramic measuring cell is a dry measuring cell, i.e. pressure acts directly on the robust ceramic process isolating diaphragm of the Waterpilot.

Any changes in the air pressure are routed through the extension cable, via a pressure compensation tube, to the rear of the ceramic process isolating diaphragm and compensated for. A pressure-dependent change in capacitance caused by the movement of the process isolating diaphragm is measured at the electrodes of the ceramic carrier. The electronics convert the movement into a pressure-proportional signal which is linear to the medium level.



### Measuring principle

- 1 Ceramic measuring cell
- 2 Pressure compensation tube
- $h$  Level height
- $p$  Total pressure = hydrostatic pressure + atmospheric pressure
- $\rho$  Density of the medium
- $g$  Gravitational acceleration
- $p_{hydr.}$  Hydrostatic pressure
- $p_{atm}$  Atmospheric pressure

### Temperature measurement with optional Pt100<sup>1)</sup>

Endress+Hauser also offers the Waterpilot FMX167 with an optional 4-wire Pt100 resistance thermometer to measure level and temperature simultaneously. The Pt100 belongs to Accuracy Class B in accordance with DIN EN 60751, see also → [22](#), Sect. "Accessories".

### Temperature measurement with optional Pt100 and TMT181 temperature head transmitter

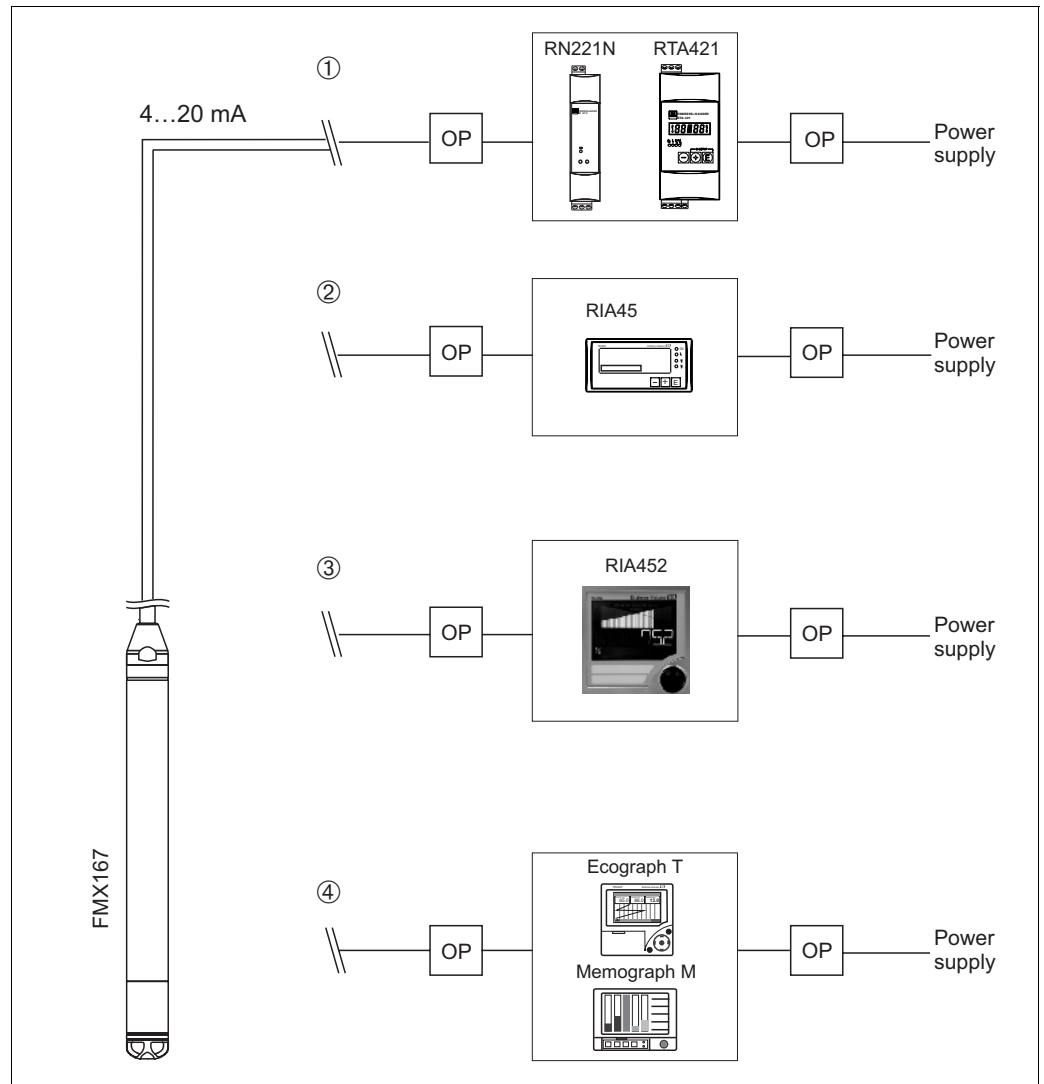
To convert the Pt100 signal to a 4 to 20 mA signal, Endress+Hauser also offers the TMT181 temperature transmitter.

1) Not for use in hazardous areas.

**Measuring system**

The complete standard measuring system consists of Waterpilot and a transmitter power supply unit with supply voltage of 10 to 30 V DC.

Possible measuring point solutions with a transmitter and evaluation units from Endress+Hauser:

*Application examples with FMX167*

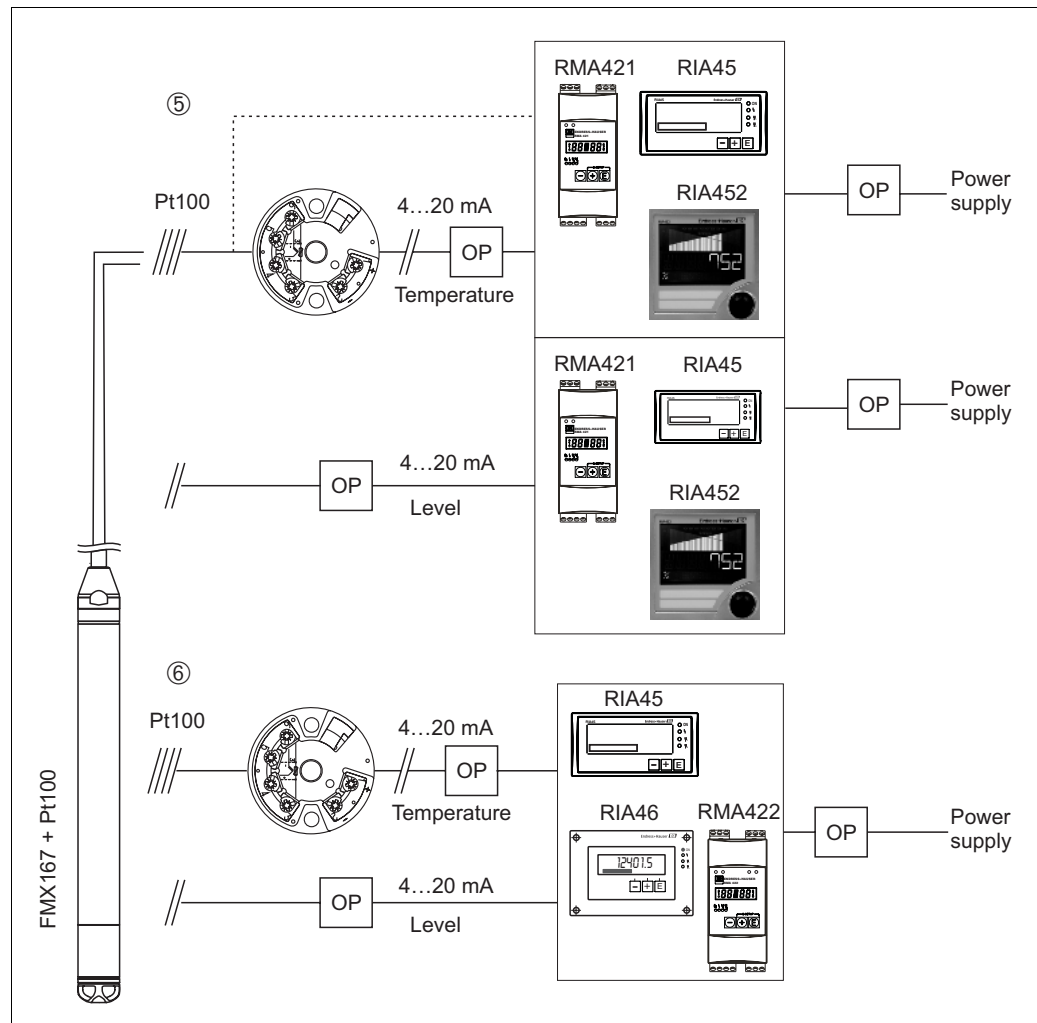
*OVP = Overvoltage protection e.g. HAW from Endress+Hauser (not for use in hazardous areas)*

*- OVP on the sensor side for field installation: HAW569/for top-hat rail/DINrail: HAW562*

*- OVP on the supply side for top-hat rail/DINrail: HAW561 (115/230 V) and HAW561K (24/48 V AC/DC)*

*Option dependent on supply voltage.*

1. Simple cost-effective measuring point solution: Power supply of Waterpilot in hazardous and non-hazardous areas using RN221N active barrier.  
Power supply and additional control of two consumers, e.g. pumps, via limit switch RTA421 with onsite display.
2. Evaluation unit RIA45 (for panel mounting) provides a power supply system, an onsite display and two switch outputs.
3. If several pumps are used, the pump service life can be prolonged by alternate switching. With alternating pump control, the pump which was out of service for the longest period of time is switched on. The evaluation unit RIA452 (for panel mounting) provides this option in addition to several other functions.
4. State-of-the-art recording technology with graphic display recorders from Endress+Hauser, such as Ecograph T, Memograph M, or paper recorders such as Alphalog for documenting, monitoring, visualizing and archiving purposes.



P01-FMX167xx-14-xx-xx-xx-005

#### Application examples with FMX167

OVP = Overvoltage protection e.g. HAW from Endress+Hauser (not for use in hazardous areas)

- OVP on the sensor side for field installation: HAW569/for top-hat rail/DINrail: HAW562

- OVP on the supply side for top-hat rail/DINrail: HAW561 (115/230 V) and HAW561K (24/48 V AC/DC)

Option dependent on supply voltage.

5. If you want to measure, display and evaluate the temperature as well as the level, e.g. to monitor temperature in fresh water to detect temperature limits for germ formation, you have the following options:  
The optional TMT181 temperature head transmitter can convert the Pt100 signal to a 4 to 20 mA HART signal and transfer it to any common evaluation unit. The RMA421, RIA45 and RIA452 evaluation units also offer a direct input for the Pt100 signal.
6. If you want to record and evaluate the level and temperature measured value with one device, use the RMA422, RIA45 and RIA46 evaluation units with two inputs. It is even possible to mathematically link the input signals with this unit. These evaluation units are not HART-compatible.

#### System integration

The device can be fitted with a tag name, see → 21 ff, "Ordering information", feature 995 "Marking" version "1".

## Input

<b>Measured variable</b>	<b>FMX167 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ Hydrostatic pressure of a liquid</li> <li>■ Pt100: Temperature of a liquid</li> </ul>	<b>TMT181 temperature head transmitter (optional)</b> <ul style="list-style-type: none"> <li>■ Temperature</li> </ul>
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<b>Measuring range</b>	<ul style="list-style-type: none"> <li>■ Nine fixed pressure measuring ranges in bar, mH<sub>2</sub>O, psi and ftH<sub>2</sub>O; → 21, "Ordering information" Section</li> <li>■ Customer-specific measuring ranges; factory-calibrated</li> <li>■ Temperature measurement from -10 to +70 °C (optional with Pt100)</li> </ul>
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Sensor measuring range [bar]	Lowest span that can be calibrated [bar]	Maximum overload/OPL <sup>1)</sup> [bar]	Vacuum resistance [bar <sub>abs</sub> ]
0.1	0.01	5.0	0.3
0.2	0.02	5.0	0.3
0.4	0.04	7.0	0
0.6	0.06	10.0	0
1.0	0.1	10.0	0
2.0	0.2	18.0	0
4.0	0.4	25.0	0
10.0 <sup>2)</sup>	1.0	40.0	0
20.0 <sup>2)</sup>	2.0	40.0	0

1) OPL: overpressure limit, depending on the weakest element, in terms of pressure, of the selected components

2) These measuring ranges are not offered for the probe version with a coated housing, outer diameter 29 mm.

<b>Input signal</b>	<b>FMX167 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ Change in capacitance</li> <li>■ Pt100: change in resistance</li> </ul>	<b>TMT181 temperature head transmitter (optional)</b> <ul style="list-style-type: none"> <li>■ Pt100 resistance signal, 4-wire</li> </ul>
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## Output

### Output signal

#### FMX167 + Pt100 (optional)

- FMX167: 4 to 20 mA for hydrostatic pressure measured value, two-wire
- Pt100: Temperature-dependent resistance value of the Pt100

#### TMT181 temperature head transmitter (optional)

- 4 to 20 mA for temperature measured value, two-wire

### Load

#### FMX167 + Pt100 (optional)

$$R_{\text{tot}} \leq \frac{U_b - 10 \text{ V}}{0.0225 \text{ A}} - 2 \cdot 0.09 \frac{\Omega}{\text{m}} \cdot l - R_{\text{add}}$$

P01-FMX167xx-16-xx-xx-xx-000

#### TMT181 temperature head transmitter (optional)

$$R_{\text{tot}} \leq \frac{U_b - 8 \text{ V}}{0.025 \text{ A}} - R_{\text{add}}$$

P01-FMX167xx-16-xx-xx-xx-001

$R_{\text{ges}}$  = Max. load resistance [ $\Omega$ ]

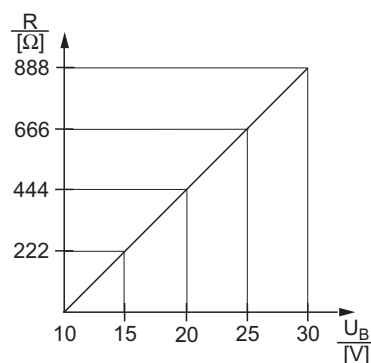
$R_{\text{add}}$  = additional resistances such as resistance of evaluation unit and/or display unit, cable resistance [ $\Omega$ ]

$U_b$  = Supply voltage [V]

$l$  = Simple length of extension cable [m] (cable resistance per wire  $\leq 0.09 \text{ } \Omega/\text{m}$ )

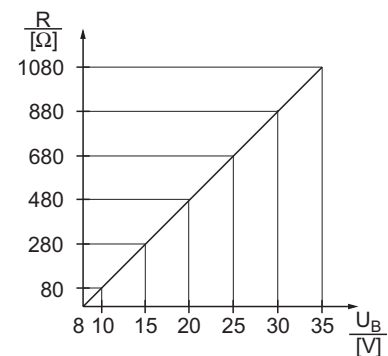
#### Note!

When using the measuring device in hazardous areas, installation must comply with the applicable national standards and regulations and the Safety Instructions or Installation or Control Drawings.



P01-FMX167xx-05-xx-xx-xx-001

FMX167 load chart for estimating the load resistance. Additional resistances, such as the resistance of the extension cable, have to be subtracted from the value calculated as shown in the equation.



P01-FMX167xx-05-xx-xx-xx-003

Temperature head transmitter load chart for estimating the load resistance. Additional resistances have to be subtracted from the value calculated as shown in the equation.



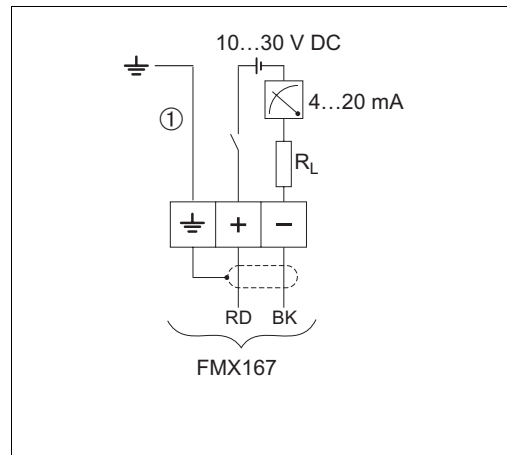
## Power supply

### Measuring unit electrical connection

Note!

- When using the measuring device in hazardous areas, installation must comply with the applicable national standards and regulations and the Safety Instructions (XAs) or the Installation or Control Drawings (ZDs), see also → 23, Sect. "Safety instructions", "Installation/Control Drawings".
- Reverse polarity protection is integrated in the Waterpilot FMX167 and in the temperature head transmitter TMT181. Changing the polarities will not result in the destruction of the devices.
- The cable must end in a dry room or a suitable terminal box. For installation outside, use the terminal box (IP 66/IP 67) with a GORE-TEX® filter from Endress+Hauser. The terminal box can be ordered using the order code of the FMX167 (→ 21, Sect. "Ordering information") or as an accessory (order number: 52006252).

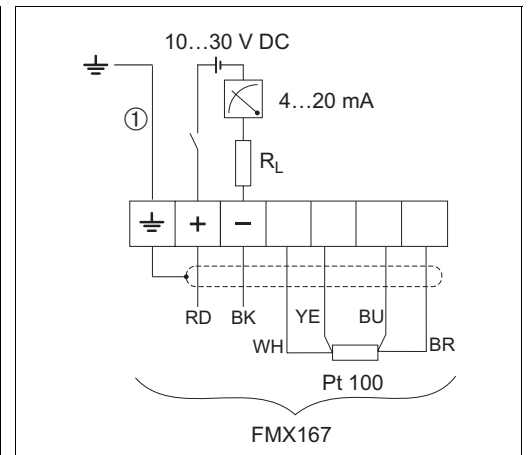
#### Waterpilot FMX167, standard



P01-FMX167xx-04-xx-xx-xx-008

FMX167 electrical connection, versions "7" or "3" for Feature 70 "Additional options" in the order code (→ 21).

#### Waterpilot FMX167 with Pt100

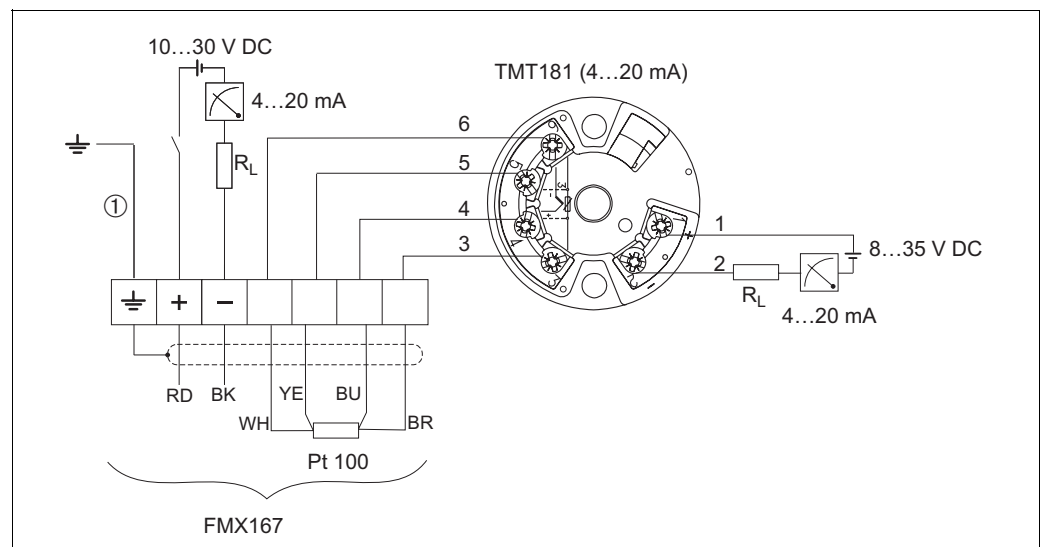


P01-FMX167xx-04-xx-xx-xx-006

FMX167 electrical connection with Pt100, versions "1" or "4" for Feature 70 "Additional options" in the order code (→ 21).

① Not for FMX167 with outer diameter 29 mm (1.15 in)

#### Waterpilot FMX167 with Pt100 and TMT181 temperature head transmitter TMT181) (4 to 20 mA)



P01-FMX167xxx-04-xx-xx-xx-007

FMX167 with Pt100 and TMT181 temperature head transmitter (4 to 20 mA), version "5" for Feature 70 in the order code (→ 21).

① Not for FMX167 with outer diameter 29 mm (1.15 in)

Wire colors: RD = red, BK = black, WH = white, YE = yellow, BU = blue, BR = brown

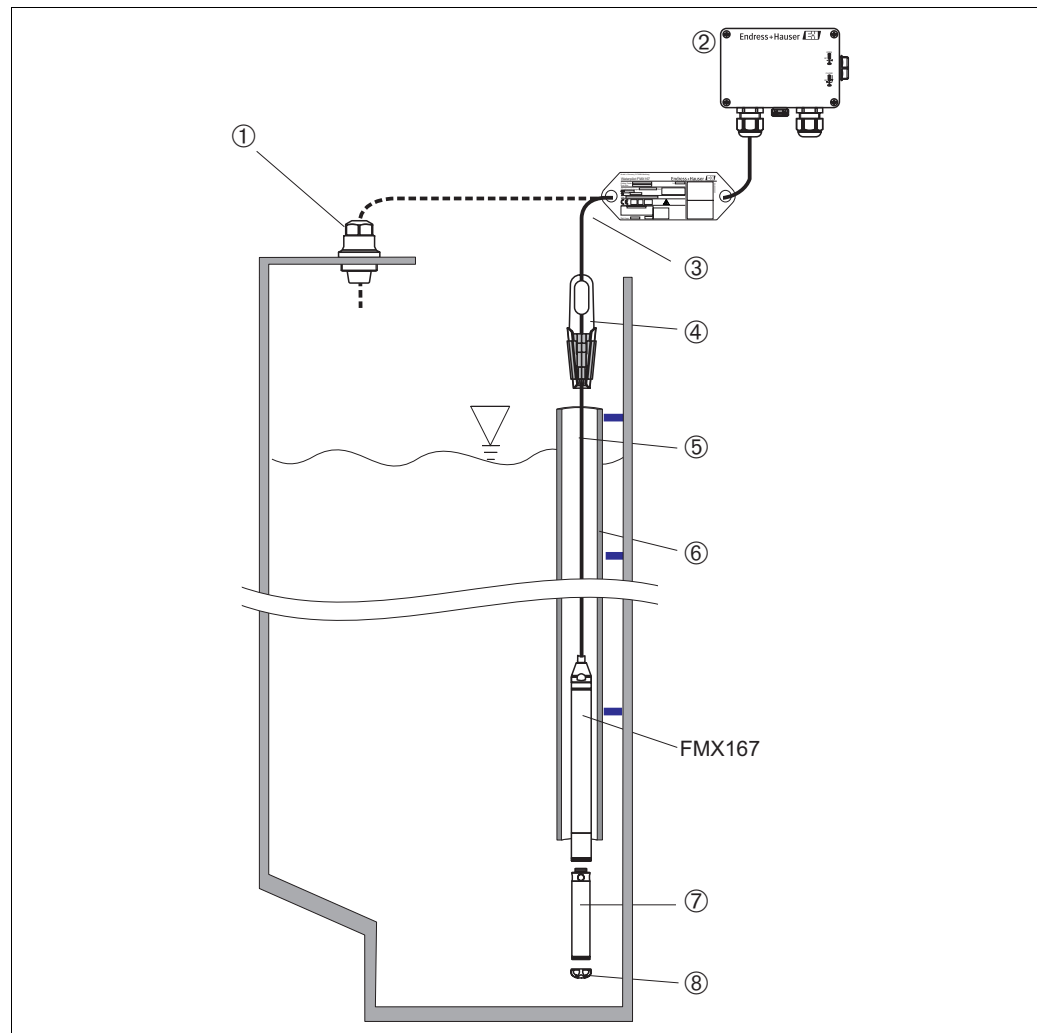
<b>Supply voltage</b>	<p>Note!</p> <p>When using the measuring device in hazardous areas, installation must comply with the applicable national standards and regulations and the Safety Instructions (XAs) or the Installation or Control Drawings (ZDs).  → 23, Sect. "Safety instructions", "Installation/Control Drawings".</p>	<b>TMT181 temperature head transmitter (optional)</b>
	<b>FMX167 + Pt100 (optional)</b>	<ul style="list-style-type: none"> <li>■ 8 to 35 V DC</li> </ul>
	<ul style="list-style-type: none"> <li>■ FMX167: 10 to 30 V DC</li> <li>■ Pt100: 10 to 30 V DC</li> </ul>	
<b>Cable specifications</b>	<p><b>FMX167 + Pt100 (optional)</b></p> <ul style="list-style-type: none"> <li>■ Commercially available instrument cable</li> <li>■ Terminals in terminal housing FMX167: 0.08 to 2.5 mm<sup>2</sup></li> <li>■ If the Pt100 signal is directly connected to a display and/or evaluation unit, Endress+Hauser recommends using a shielded cable.</li> </ul>	<p><b>TMT181 temperature head transmitter (optional)</b></p> <ul style="list-style-type: none"> <li>■ Commercially available instrument cable</li> <li>■ Terminals in terminal housing FMX167: 0.08 to 2.5 mm<sup>2</sup></li> <li>■ Transmitter connection: max. 1.75 mm<sup>2</sup></li> </ul>
<b>Power consumption</b>	<p><b>FMX167 + Pt100 (optional)</b></p> <p>≤ 0.675 W at 30 V DC</p>	<p><b>TMT181 temperature head transmitter (optional)</b></p> <p>≤ 0.875 W at 35 V DC</p>
<b>Current consumption</b>	<p><b>FMX167 + Pt100 (optional)</b></p> <ul style="list-style-type: none"> <li>■ Max. current consumption: ≤ 22.5 mA</li> <li>Min. current consumption: ≥ 3.5 mA</li> <li>■ Pt100: ≤ 0.6 mA</li> </ul>	<p><b>TMT181 temperature head transmitter (optional)</b></p> <ul style="list-style-type: none"> <li>■ Max. current consumption: ≤ 25 mA</li> <li>Min. current consumption: ≥ 3.5 mA</li> <li>■ Pt100 via temperature head transmitter: ≤ 0.6 mA</li> </ul>
<b>Residual ripple</b>	<p><b>FMX167 + Pt100 (optional)</b></p> <p>No effect for 4 to 20 mA signal up to ±5 % residual ripple within permissible range</p>	<p><b>TMT181 temperature head transmitter (optional)</b></p> <p><math>U_{ss} \geq 5 \text{ V}</math> at <math>U_B \geq 13 \text{ V}</math>, <math>f_{max.} = 1 \text{ kHz}</math></p>

## Accuracy

<b>Reference operating conditions</b>	<b>FMX167 + Pt100 (optional)</b> DIN EN 60770 $T_U = 25\text{ °C}$ (77°F)	<b>TMT181 temperature head transmitter (optional)</b> Calibration temperature $23\text{ °C} \pm 5\text{ K}$ (73°F $\pm 5\text{ K}$ )
<b>Maximum measured error</b>	<b>FMX167 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ Non-linearity including hysteresis and non-repeatability as per DIN EN 60770: <math>\pm 0.2\%</math> of upper range value (URV)</li> <li>■ Pt100: max. <math>\pm 0.7\text{ K}</math> (Class B to DIN EN 60751)</li> </ul>	<b>TMT181 temperature head transmitter (optional)</b> <ul style="list-style-type: none"> <li>■ <math>\pm 0.2\text{ K}</math></li> <li>■ With Pt100: max. <math>\pm 0.9\text{ K}</math></li> </ul>
<b>Long-term stability</b>	<b>FMX167 + Pt100 (optional)</b> $\pm 0.1\%$ of the upper range limit (URL) per year	<b>TMT181 temperature head transmitter (optional)</b> $\leq 0.1\text{ K}$ per year
<b>Influence of medium temperature</b>	<ul style="list-style-type: none"> <li>■ Thermal change in zero signal and output span for typical application temperature range <math>0\text{ to }+30\text{ °C}</math> (<math>+32\text{ to }+86\text{ °F}</math>): <math>\pm 0.4\%</math> (<math>\pm 0.5\%</math>)* of the upper range limit (URL)</li> <li>■ Thermal change in zero signal and output span for the entire medium temperature range <math>-10\text{ to }+70\text{ °C}</math> (<math>+14\text{ to }+158\text{ °F}</math>): <math>\pm 1.0\%</math> (<math>\pm 1.5\%</math>)* of the upper range limit (URL)</li> <li>■ Temperature coefficient (<math>\kappa</math>) of zero signal and output span: <math>0.15\%/10\text{ K}</math> (<math>0.3\%/10\text{ K}</math>)* of the upper range limit (URL)</li> </ul> <p style="text-align: center;">* Specifications for sensors 0.1 bar (1 mH<sub>2</sub>O, 1.5 psi, 3 ftH<sub>2</sub>O) and 0.6 bar (6 mH<sub>2</sub>O, 10 psi, 20 ftH<sub>2</sub>O)</p>	
<b>Warm-up period</b>	<b>FMX167 + Pt100 (optional)</b> 20 ms	<b>TMT181 temperature head transmitter (optional)</b> 4 s
<b>Rise time</b>	<b>FMX167 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ FMX167: 80 ms</li> <li>■ Pt100: 160 s</li> </ul>	–
<b>Settling time</b>	<b>FMX167 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ FMX167: 150 ms</li> <li>■ Pt100: 300 s</li> </ul>	–

## Installation conditions

### Installation instructions



P01-FMX167xx-11-xx-xx-xx-003

Installation examples, here shown with FMX167 with an outer diameter 22 mm

- 1 Extension cable mounting screw can be ordered via order code or as an accessory, → 21 ff
- 2 Terminal housing can be ordered using the order code or as an accessory → 21
- 3 Extension cable bending radius > 120 mm
- 4 Mounting clamp can be ordered via order code or as an accessory, → 21 ff
- 5 Extension cable, cable length → 18
- 6 Guide pipe
- 7 Additional weight can be ordered as an accessory with an outer diameter of 22 mm and 29 mm, → 22
- 8 Protection cap

#### Note!

- Sideways movement of the level probe can result in measuring errors. For this reason, install the probe at a point free from flow and turbulence, or use a guide tube. The internal diameter of the guide tube should be at least 1 mm larger than the outer diameter of the selected FMX167.
- The cable must end in a dry room or a suitable terminal box. The terminal box from Endress+Hauser provides optimum humidity and climatic protection and is suitable for outdoor installation.
- Protection cap: The device is provided with a protection cap to prevent mechanical damage to the measuring cell. This cap should not be removed during the transportation and installation process.
- Endress+Hauser recommends using twisted, shielded cables for any further wiring.

## Environment

<b>Ambient temperature range</b>	<b>FMX167 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ FMX167 with outer diameter of 22 mm and 42 mm: -10 to +70 °C (= medium temperature)</li> <li>■ FMX167 with outer diameter of 29 mm: 0 to +50 °C (= medium temperature)</li> </ul> <b>Terminal box</b>  -40 to +80 °C	<b>TMT181 temperature head transmitter (optional)</b>  -40 to +85 °C
<b>Storage temperature range</b>	<b>FMX167 + Pt100 (optional)</b>  -40 to +80 °C  <b>Terminal box</b>  -40 to +80 °C	<b>TMT181 temperature head transmitter (optional)</b>  -40 to +100 °C
<b>Degree of protection</b>	<b>FMX167 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ IP 68, permanently hermetically sealed</li> <li>■ Optional terminal box: IP 66/IP 67</li> </ul>	<b>TMT181 temperature head transmitter (optional)</b> <ul style="list-style-type: none"> <li>■ IP 00, moisture condensation permissible</li> <li>■ When mounted in the optional terminal boxes: IP 66/IP67</li> </ul>
<b>Electromagnetic compatibility (EMC)</b>	<b>FMX167 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ Interference emission to EN 61326 Class B equipment, interference immunity to EN 61326 Appendix A (Industrial)</li> <li>■ Maximum deviation &lt; 0.5 % of the span.</li> </ul>	<b>TMT181 temperature head transmitter (optional)</b> <ul style="list-style-type: none"> <li>■ Interference emission to EN 61326 Class B equipment, interference immunity to EN 61326 Appendix A (Industrial)</li> </ul>
<b>Overvoltage protection</b>	<b>FMX167 + Pt100 (optional)</b>  Integrated overvoltage protection to EN 61000-4-5 (500 V symmetrical/1000 asymmetrical) Install overvoltage protection ≥ 1.0 kV, external if necessary	<b>TMT181 temperature head transmitter (optional)</b>  Install overvoltage protection, external if necessary.

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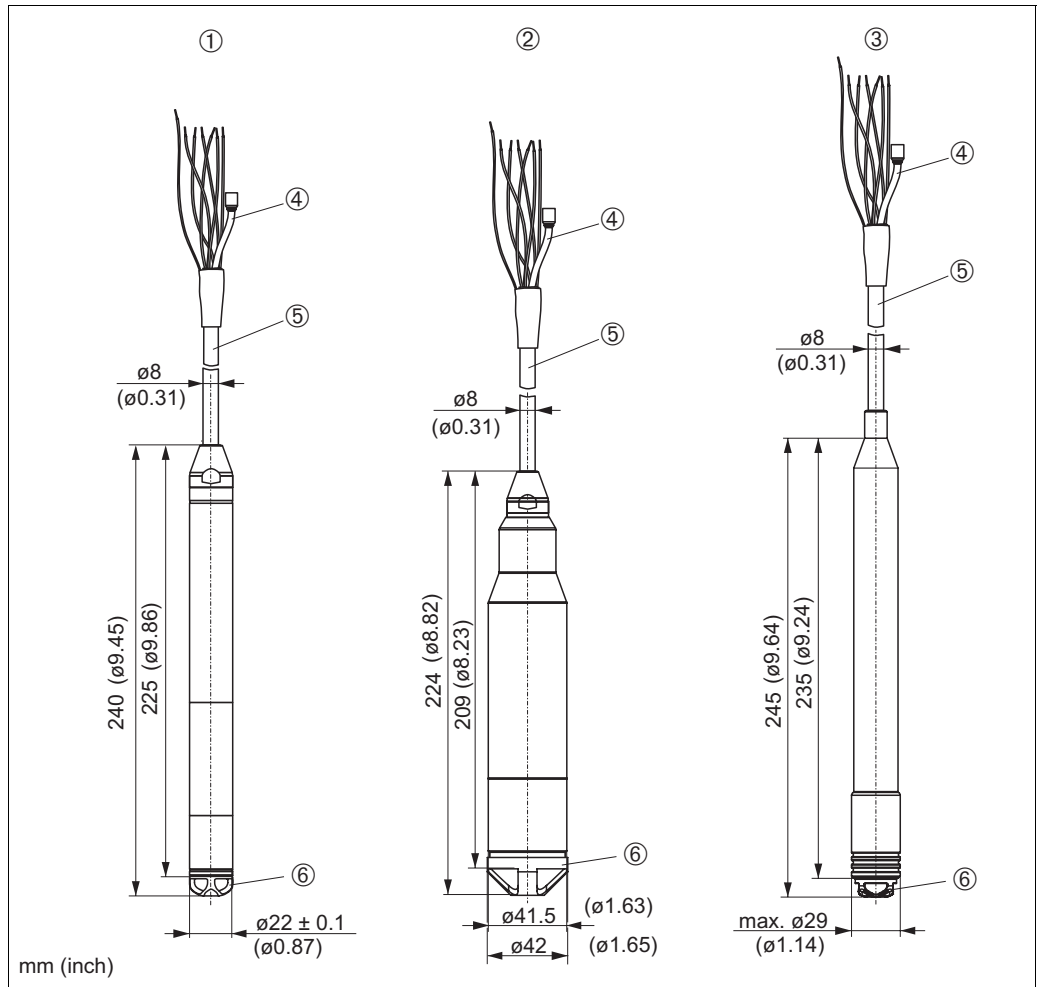
## Process conditions

---

<b>Medium temperature range</b>	<b>FMX167 + Pt100 (optional)</b> <ul style="list-style-type: none"><li>■ FMX167 with outer diameter of 22 mm and 42 mm: -10 to +70 °C</li><li>■ FMX167 with outer diameter of 29 mm: 0 to +50 °C</li></ul>	<b>TMT181 temperature head transmitter (optional)</b> <p>-40 to +85 °C (-40 to +185°F) (= ambient temperature), install temperature head transmitter outside medium.</p>
<b>Medium temperature limits</b>	<b>FMX167 + Pt100 (optional)</b> <ul style="list-style-type: none"><li>■ FMX167 with outer diameter of 22 mm and 42 mm: -20 to +70 °C</li><li>■ FMX167 with outer diameter of 29 mm: 0 to +50 °C</li></ul> <p>(You may operate the FMX167 in this temperature range. The specification can then be exceeded, e.g. measuring accuracy).</p>	

## Mechanical construction

### Dimensions of the level probe

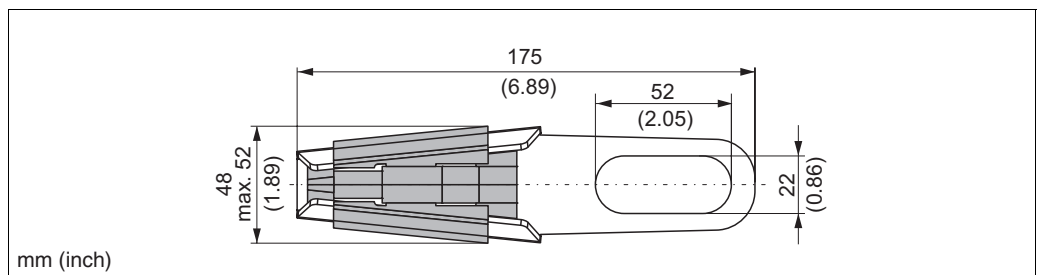


P01-FMX167xx-06-xx-xx-xx-006

### Versions of FMX167

- 1 FMX167, version "A" or "D" for Feature 30 "Probe tube" in the order code (→ 21)
- 2 FMX167, version "B" for Feature 30 "Probe tube" in the order code (→ 21)
- 3 FMX167, version "C" for Feature 30 "Probe tube" in the order code (→ 21)
- 4 Pressure compensation tube
- 5 Extension cable
- 6 Protection cap

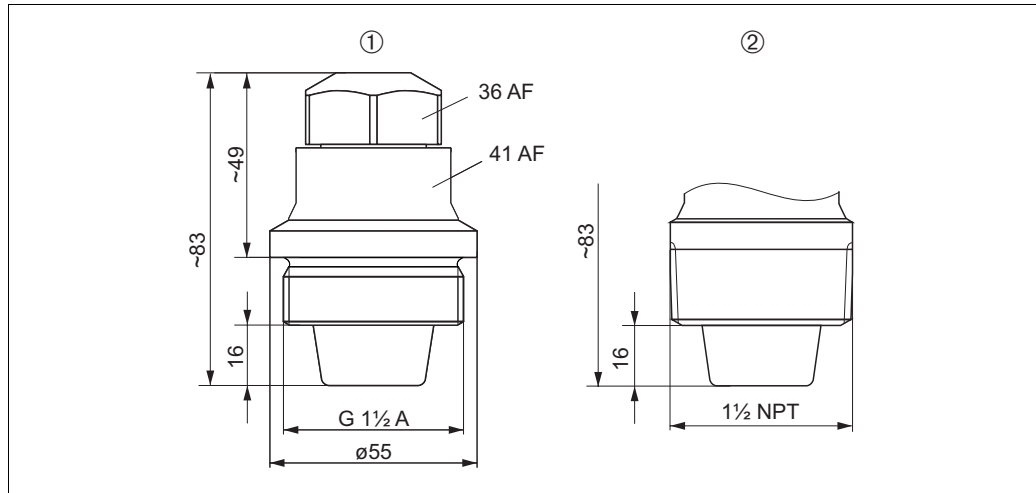
### Dimensions of the mounting clamp



P01-FMXxxxx-06-xx-xx-xx-010

Mounting clamp, version "2" for Feature 20 "Connection" in the order code (→ 21)

**Dimensions of the extension cable mounting screws**

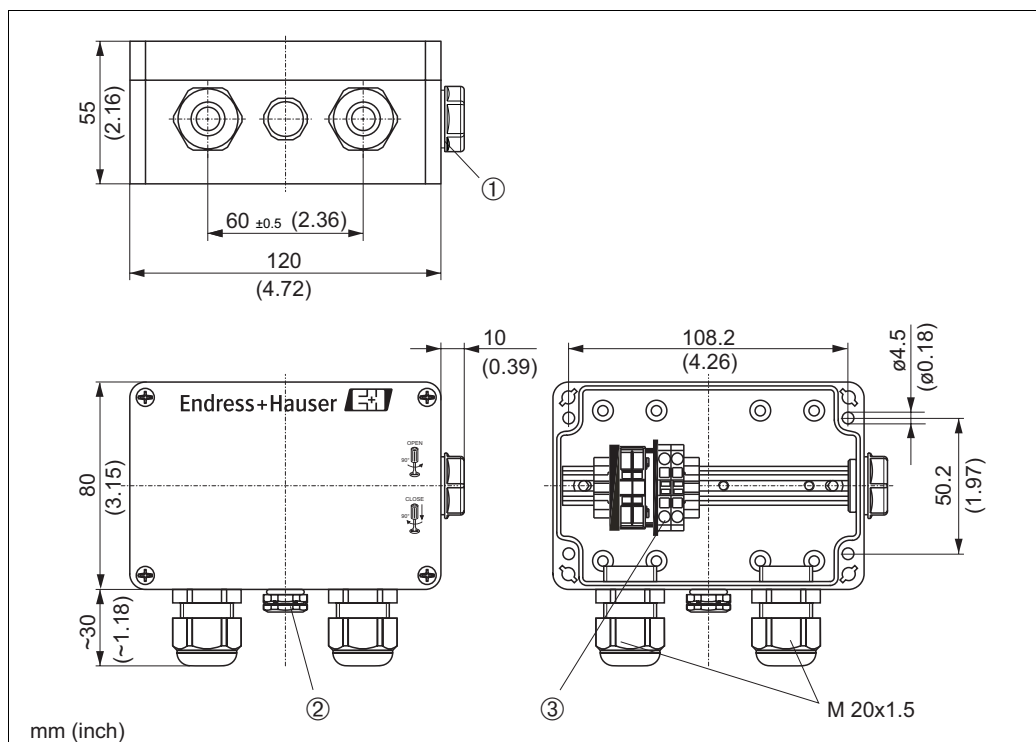


Extension cable mounting screws

- 1 Extension cable mounting screw G1 1/2 A, version "3" for Feature 20 "Connection" in the order code (→ 21)
- 2 Extension cable mounting screw 1 1/2 NPT, version "4" for Feature 20 "Connection" in the order code (→ 21)

Note!  
Application in unpressurized containers only.

**Dimensions of the terminal box IP 66/IP 67 with filter**



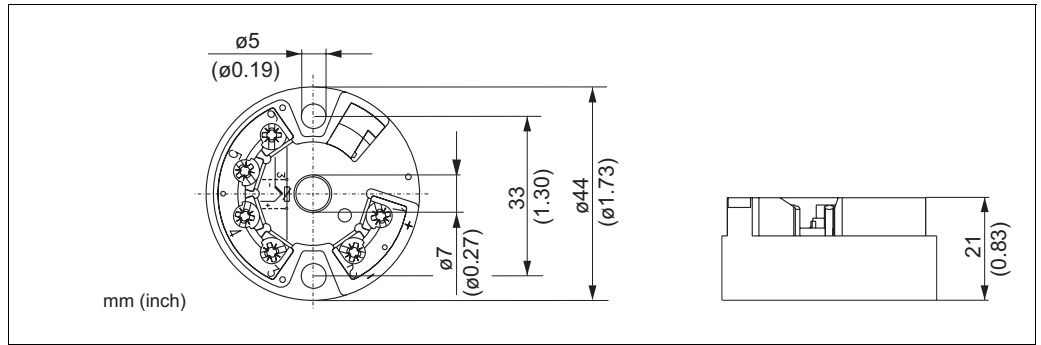
Terminal box

Version "3", "4" or "5" for Feature 70 "Additional options" in the order code (→ 21)

- 1 Dummy plug M 20x1.5
- 2 GORE-TEX® filter
- 3 Terminals for 0.08 to 2.5 mm²



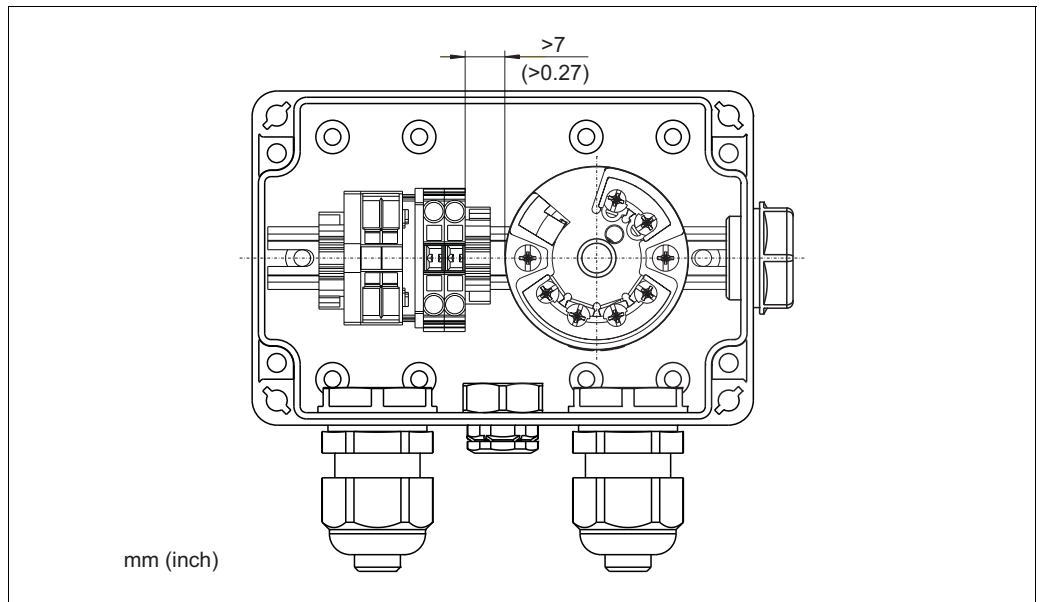
**Dimensions of the TMT181 temperature head transmitter**



TMT181 temperature head transmitter (4 to 20 mA)

Version "5" for Feature 70 "Additional options" in the order code (→ 21). The temperature head transmitter can be used in non-hazardous areas and for EEx nA.

**Terminal box with integrated TMT181 temperature head transmitter**



**Note!**

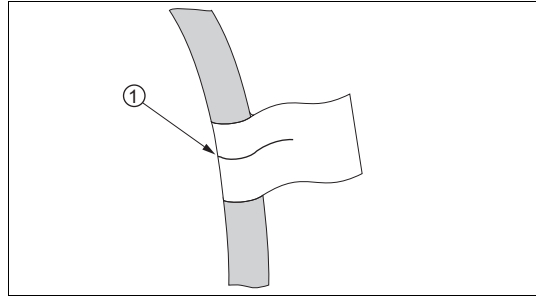
A distance of >7 mm must be maintained between the terminal strip and the TMT181 temperature head transmitter.

**Weight**

- Level probe, outer diameter 22 mm: 290 g
- Level probe, outer diameter 42 mm: 1150 g
- Level probe, outer diameter 29 mm: 340 g
- PE extension cable: 52 g/m
- PUR extension cable: 60 g/m
- FEP extension cable: 108 g/m
- Mounting clamp: 170 g
- Extension cable mounting screw G 1 ½ A: 770 g
- Extension cable mounting screw 1 ½ NPT: 724 g
- Terminal box: 235 g
- Temperature head transmitter TMT181: 40 g
- Additional weight: 300 g
- Testing adapter: 39 g

<b>Material</b>	<p>Level probe</p> <ul style="list-style-type: none"> <li>■ Level probe, outer diameter 22 mm: 1.4435 (AISI 316L)</li> <li>■ Level probe, outer diameter 42 mm: 1.4435 (AISI 316L)</li> <li>■ Level probe, outer diameter 29 mm: 1.4435 (AISI 316L) <ul style="list-style-type: none"> <li>– Sensor sleeve: PPS (polyphenylene sulfide)</li> <li>– Heat-shrink sleeve/cover: Polyolefin</li> </ul> </li> </ul> <p>Metal does not come into contact with the medium.</p> <ul style="list-style-type: none"> <li>■ Process ceramic: Al<sub>2</sub>O<sub>3</sub> aluminum oxide ceramic</li> <li>■ Seal (internal): EPDM or Viton</li> <li>■ Protection cap: <ul style="list-style-type: none"> <li>– PE-HD (high-density polyethylene) for FMX167 with outer diameter 22 mm and 29 mm.</li> <li>– PFA (perfluoroalkoxy) for FMX167 with outer diameter 42 mm.</li> </ul> </li> <li>■ Extension cable insulation: Either PE-LD (low-density polyethylene), FEP (fluorinated ethylene propylene) or PUR (polyurethane). For more information, see → <a href="#">18</a>, "Extension cable"</li> <li>■ Mounting clamp: 1.4404 (AISI 316L) and fiberglass reinforced PA (polyamide)</li> <li>■ Extension cable mounting screw G 1 ½A: 1.4301 (AISI 304)</li> <li>■ Extension cable mounting screw 1 ½NPT: 1.4301 (AISI 304)</li> <li>■ Terminal box: PC (polycarbonate)</li> <li>■ Temperature head transmitter TMT181: PC housing (polycarbonate)</li> </ul>
<b>Extension cable</b>	<p><b>PE extension cable</b></p> <ul style="list-style-type: none"> <li>■ Abrasion-resistant extension cable with Dynema strain-relief members; shielded with aluminum-coated film; insulated with polyethylene (PE), black; copper wires, twisted</li> <li>■ Pressure compensation tube with Teflon filter</li> </ul> <p><b>PUR extension cable</b></p> <ul style="list-style-type: none"> <li>■ Abrasion-resistant extension cable with Dynema strain-relief members; shielded with aluminum-coated film; insulated with polyurethane (PUR), black; copper wires, twisted</li> <li>■ Pressure compensation tube with Teflon filter</li> </ul> <p><b>FEP extension cable</b></p> <ul style="list-style-type: none"> <li>■ Abrasion-resistant extension cable; shielded with galvanized steel wire netting; insulated with fluorinated ethylene propylene (FEP), black; copper wires, twisted</li> <li>■ Pressure compensation tube with Teflon filter</li> </ul> <p><b>Cross-section of PE/PUR/FEP extension cable</b></p> <ul style="list-style-type: none"> <li>■ Total outer diameter: 8.0 mm ± 0.25 mm</li> <li>■ FMX167: 3 x 0.227 mm<sup>2</sup> + pressure compensation tube with Teflon filter</li> <li>■ FMX167 with Pt100 (optional): 7 x 0.227 mm<sup>2</sup> + pressure compensation tube with Teflon filter</li> <li>■ Pressure compensation tube with Teflon filter: <ul style="list-style-type: none"> <li>Outer diameter 2.5 mm (0.098 inch), internal diameter 1.5 mm (0.059 inch)</li> </ul> </li> </ul> <p><b>Cable resistance of PE/PUR/FEP extension cable</b></p> <ul style="list-style-type: none"> <li>■ Cable resistance per wire: ≤ 0.09 Ω/m</li> </ul> <p><b>Cable length of PE/PUR/FEP extension cable</b></p> <ul style="list-style-type: none"> <li>■ Please refer also to → <a href="#">8</a>, Sect. "Load".</li> <li>■ Cable length that can be ordered <ul style="list-style-type: none"> <li>– Customer-specific length in meters or feet (→ <a href="#">21</a>, "Ordering information")</li> <li>– Limited cable length when performing installation with freely suspended device with extension cable mounting screw or mounting clamp, as well as for Ex approval: max. 300 m/984 ft.</li> </ul> </li> <li>■ When using the measuring device in hazardous areas, installation must comply with the applicable national standards and regulations and the Safety Instructions (XAs) or the Installation or Control Drawings (ZDs). See also → <a href="#">23</a>, "Safety instructions" and "Installation/Control Drawings" Sections.</li> </ul> <p><b>Further technical data of PE /PUR/FEP extension cable</b></p> <ul style="list-style-type: none"> <li>■ Minimum bending radius: 120 mm</li> <li>■ Tensile strength: max. 950 N</li> <li>■ Cable extraction force: typical ≥ 450 N (FE, FEP) / typical ≥ 150 N (PUR) (The extension cable could be extracted from the level probe with a appropriate tensile force.)</li> <li>■ Resistance to UV light</li> <li>■ PE: Approved for use with drinking water</li> </ul>
<b>Terminals</b>	<ul style="list-style-type: none"> <li>■ Three terminals as standard in the terminal box</li> <li>■ 4-terminal strip can be ordered as an accessory, Order No: 52008938 Conductor cross-section 0.08 to 2.5 mm<sup>2</sup></li> </ul>

**Installation tool –  
indicating the customer-  
specific length on the cable**



P01-FMX21xxx-11-xxx-xxx-xxx-002

*1 cable marking, distance to the lower end of the cable probe*

- To make installation easier, Endress+Hauser offers a mark on the extension cable for a customer-specific length, see also → [21](#), "Ordering information".
- Mark tolerance: up to  $\pm 50$  mm (the mark tolerance corresponds to a measured error from up to  $\pm 50$  mm)
- Material: PET
- Adhesive: acrylic
- Immunity to temperature change:  $-30$  to  $+100$  °C

**Note!**

- The mark is for installation purposes only.  
It must be thoroughly removed without trace in the case of devices with drinking water approval. The extension cable must not be damaged in the process.
- Not for use in hazardous areas.

## Certificates and approvals

<b>CE mark</b>	The device meets the legal requirements of the applicable EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
<b>Ex approval, type of protection</b>	<ul style="list-style-type: none"> <li>■ ATEX II 2 G EEx ia IIC T6<sup>1)</sup></li> <li>■ ATEX II 3 G EEx nA II T6<sup>1)</sup></li> <li>■ FM: IS, Class I, Division 1, Groups A–D<sup>1)</sup></li> <li>■ CSA: IS, Class I, Division 1, Groups A–D<sup>1)</sup></li> </ul> <p><sup>1)</sup> Only for Waterpilot FMX167 without Pt100 and TMT181</p> <p>Note!</p> <ul style="list-style-type: none"> <li>■ Waterpilot FMX167 is only available for use in hazardous areas with the FKM Viton seal.</li> <li>■ The cable marking cannot be ordered with the Ex approvals listed due to a potential electrostatic charge (see → 21, "Ordering information").</li> <li>■ All explosion-protection data are given in a separate documentation which is available upon request. The Ex documentation is provided with all Ex-systems as standards, see also → 23, Sect. "Additional documentation", "Safety instructions" and "Installation/Control Drawings".</li> </ul>
<b>Drinking water approval (for FMX167 with Outer diameter 22 mm (0.87 in))</b>	<ul style="list-style-type: none"> <li>■ KTW certificate</li> <li>■ NSF 61 approval</li> <li>■ ACS approval</li> </ul>
<b>Marine approval</b>	<ul style="list-style-type: none"> <li>■ GL approval</li> <li>■ ABS approval</li> </ul>
<b>Standards and guidelines applied</b>	<p>The European standards and guidelines that have been applied are listed in the associated EC Declarations of Conformity. In addition, the following standards were also applied for the Waterpilot FMX167:</p> <p>DIN EN 60770 (IEC 60770): Transmitters for use in industrial process control systems Part 1: Methods for performance evaluation</p> <p>DIN 16086: Electrical pressure measuring instruments, pressure sensors, pressure transmitters, pressure measuring instruments, concepts, specifications on data sheets</p> <p>EN 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements</p>

## Ordering information

### FMX167

You can enter the versions for the specific feature in the following table. The versions entered make up the complete order code. Options which are mutually exclusive are not marked.

<b>10</b>	<b>Approval</b>			
	A	Non-hazardous area		
	B	ATEX II 2 G EEx ia IIC T6		
	C	ATEX II 3 G EEx nA II T6		
	D	FM IS, Class I, Division 1, Groups A – D		
	E	CSA IS, Class I, Division 1, Groups A – D		
	F	CSA General Purpose		
<b>20</b>	<b>Connection</b>			
	1	Probe cable		
	2	Mounting clamp, AISI 316L		
	3	Cable mounting screw G1-1/2, AISI 304		
	4	Cable mounting screw NPT 1-1/2, AISI 304		
<b>30</b>	<b>Probe tube:</b>			
	A	Outer diameter d = 22 mm, AISI 316L		
	B	Outer diameter d = 42 mm, flush-mounted, AISI 316L		
	C	Outer diameter d = 29 mm (1.15 in), AISI 316L with heat-shrink sleeve PPS/polyolefin for saltwater applications		
	D	Outer diameter d = 22 mm (0.87 in), AISI 316L + drinking water approval (can only be selected in conjunction with EPDM seal and PE probe cable)		
<b>40</b>	<b>Measuring range:</b>			
		<b>Measuring range</b>	<b>Measuring range</b>	
	BA	0 to 0.1 bar	MA	0 to 1 mH <sub>2</sub> O
	BB	0 to 0.2 bar	MB	0 to 2 mH <sub>2</sub> O
	BC	0 to 0.4 bar	MC	0 to 4 mH <sub>2</sub> O
	BD	0 to 0.6 bar	MD	0 to 6 mH <sub>2</sub> O
	BE	0 to 1.0 bar	ME	0 to 10 mH <sub>2</sub> O
	BF	0 to 2.0 bar	MF	0 to 20 mH <sub>2</sub> O
	BG	0 to 4.0 bar	MG	0 to 40 mH <sub>2</sub> O
	BH	0 to 10.0 bar	MH	0 to 100 mH <sub>2</sub> O
	BK	0 to 20.0 bar	MK	0 to 200 mH <sub>2</sub> O
	PA	0 to 1.5 psi	FA	0 to 3 ftH <sub>2</sub> O
	PB	0 to 3 psi	FB	0 to 6 ftH <sub>2</sub> O
	PC	0 to 6 psi	FC	0 to 15 ftH <sub>2</sub> O
	PD	0 to 10 psi	FD	0 to 20 ftH <sub>2</sub> O
	PE	0 to 15 psi	FE	0 to 30 ftH <sub>2</sub> O
	PF	0 to 30 psi	FF	0 to 60 ftH <sub>2</sub> O
	PG	0 to 60 psi	FG	0 to 150 ftH <sub>2</sub> O
	PH	0 to 150 psi	FH	0 to 300 ftH <sub>2</sub> O
	PK	0 to 300 psi	FK	0 to 600 ftH <sub>2</sub> O
	VV	Adjusted to customer specifications from 0 to ____ (upper range value) in ____ (unit), upper range value: 0.1 bar (1 mH <sub>2</sub> O, 1.5 psi, 3 ftH <sub>2</sub> O) to 20 bar (200 m <sub>2</sub> HO, 300 psi, 600 ft <sub>2</sub> HO)		
<b>50</b>	<b>Sensor seal:</b>			
	1	FKM Viton		
	2	EPDM		
<b>60</b>	<b>Probe cable:</b>			
	A	... m, shortable, PE		
	B	10 m, shortable, PE		
	C	20 m, shortable, PE		
	E	30 ft, shortable, PE		
	F	60 ft, shortable, PE		
	G	... ft, shortable, PE		
	I	... m, shortable, FEP		
	K	10 m, shortable, FEP		
	L	20 m, shortable, FEP		
	M	30 ft, shortable, FEP		
	N	60 ft, shortable, FEP		
	P	... ft, shortable, FEP		
FMX167				Order code
→ Ordering information for FMX167 continued on next page.				

## FMX167 (continued)

<b>60</b>	<b>Probe cable:</b>
	R ... m cable, shortable, PUR
	S 10 m cable, shortable, PUR
	T 20 m cable, shortable, PUR
	U ... m cable, shortable, PUR
	V 30 ft cable, shortable, PUR
	W 60 ft cable, shortable, PUR
<b>70</b>	<b>Additional option:</b>
	7 Basic version
	1 Pt100, 4-wire
	5 Pt100 + temperature head transmitter TMT181, 2-wire, 4 to 20 mA = -20 to +80 °C (-4 to +176°F) <sup>1)</sup>
	3 Terminal box IP66/67
	4 Terminal box IP66/67 + Pt, 4-wire
	A m cable marking>installation
	B ft cable marking>installation
	C m cable marking, terminal box, cable marking>installation, terminal box IP66/67
	D ft cable marking, terminal box, cable marking>installation, terminal box IP66/67
	S GL/ABS marine certificate
<b>995</b>	<b>Marking</b>
	1 Measuring point (TAG)
FMX167	Complete order code

<sup>1)</sup> incl. terminal box, see feature "3" or "4"

## Accessories

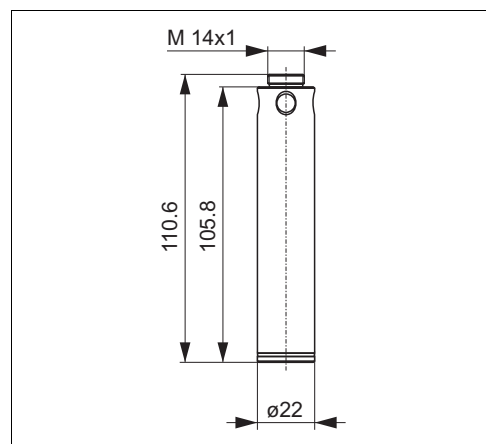
### Mounting clamp

- Endress+Hauser offers a mounting clamp for simple FMX167 mounting → [15](#)
- Material: 1.4404 (AISI 316L) and fiberglass reinforced PA (polyamide)
- Order number: 52006151  
See also → [21](#), "Ordering information"

### Terminal box

- Terminal box IP 66/IP 67 with GORE-TEX®-filter incl. 3 installed terminals.  
The terminal box is also suitable for installing a temperature head transmitter (Order No. 52008794) or for four additional terminals (Order No. 52008938) → [23](#).
- Order number: 52006152

### Additional weight (for FMX167 with an outer diameter of 22 mm and 29 mm)



P01-FMX167xx-06-xx-xx-xx-014

- Endress+Hauser offers additional weights to prevent sideways movement that results in measuring errors, or to make it easier to lower the device in a guide tube.  
You can screw several weights together. The weights are then attached directly to the FMX167. For FMX167 with outer diameter 29 mm (1.15 in), a maximum of 5 weights may be screwed on to FMX167.
- Material: 1.4435 (AISI 316L)
- Weight: 300 g
- Order number: 52006153

### TMT181 temperature head transmitter

- 2-wire temperature head transmitter, configured for a measuring range from -20 to +80 °C.  
This setting offers a temperature range of 100 K which can be easily mapped. Please note that the Pt100 resistance thermometer is designed for a temperature range from -10 to +70 °C → [22](#).
- Order number: 52008794

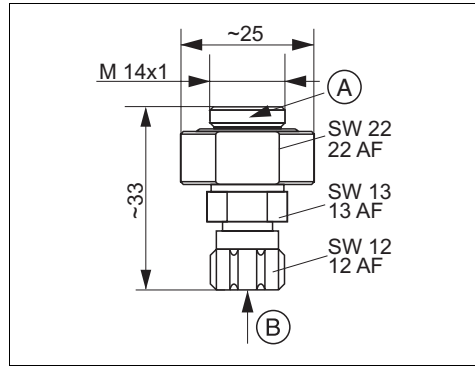
**Extension cable mounting screw**

- Endress+Hauser offers extension cable mounting screws to simplify the installation of the FMX167 and to close the measuring open → 16.
- Material: 1.4301 (AISI 304)
- Order number for extension cable mounting screw with G 1 ½ A thread: 52008264
- Order number for extension cable mounting screw with 1 ½ NPT thread: 52009311

**Terminals**

- Four terminals in strip for FMX167 terminal box, suitable for wire cross-section of 0.08 to 2.5 mm<sup>2</sup>
- Order number: 52008938

**Test adapter  
(for FMX167 with an outer diameter of 22 mm and 29 mm)**



- Endress+Hauser offers a testing adapter to ease function-testing of the level probes.
- Observe the maximum pressure for the compressed air hose and the maximum overload for the level probe → 7.
- Maximum pressure of the quick coupling piece supplied: 10 bar
- Adapter material: 1.4301 (AISI 304)
- Quick coupling piece material: anodized aluminum
- Adapter weight: 39 g
- Order number: 52011868

Testing adapter

- A FMX167 level probe connection
- B Compressed air hose connection, internal diameter of quick coupling piece 4 mm

## Additional documentation

**Field of activities**

- Pressure measurement: FA004P/00/EN
- Recording technology: FA014R/09/EN
- System components: FA016K/09/EN

**Technical Information**

- Technical Information Waterpilot FMX21 with 4 to 20 mA with HART output signal: TI431P/00/EN
- Technical Information Deltapilot M: TI437P/00/EN
- Temperature Head Transmitter iTEMP PCP TMT181: TI070R/09/EN

**Operating Instructions**

- Waterpilot FMX167: BA231P/00/EN

**Safety instructions**

- ATEX II 2 G Ex ia IIC T6: XA131P/00/A3
- ATEX II 3 G Ex nA II T6: XA132P/00/A3

**Installation/Control Drawings**

- FM IS Class I, Div. 1, Groups A – D: ZD063P/00/EN
- CSA IS Class I, Div. 1, Groups A – D: ZD064P/00/EN

**Drinking water approval**

- SD126P/00/A3

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