



Level



Pressure



Flow



Temperature

Liquid  
Analysis

Registration

Systems  
Components

Services



Solutions

## Technical Information

# Waterpilot FMX21

Hydrostatic level measurement

Reliable and robust level probe with ceramic measuring cell

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



### Application

The Waterpilot FMX21 is a pressure sensor for hydrostatic level measurement.

Endress+Hauser offers three different versions of the FMX21 sensor:

- FMX21 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.
- FMX21 with a stainless steel housing, outer diameter of 42 mm (1.66 inch): Heavy duty version, easy clean flush-mounted process diaphragm. Ideally suited for wastewater and sewage treatment plants.
- FMX21 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 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 with superimposed HART 6.0 output signal
- Simultaneous measurement of level and temperature with optionally integrated Pt100 temperature sensor
- Accuracy
  - Reference accuracy  $\pm 0.2\%$
  - PLATINUM version  $\pm 0.1\%$
- Automatic density compensation to increase accuracy
- Usage in drinking water: KTW, NSF, ACS
- Approvals: ATEX, FM, CSA
- Marine certificate: GL, ABS, LR, DNV
- Extensive range of accessories provides complete measuring point solutions

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## Function and system design

### Device selection

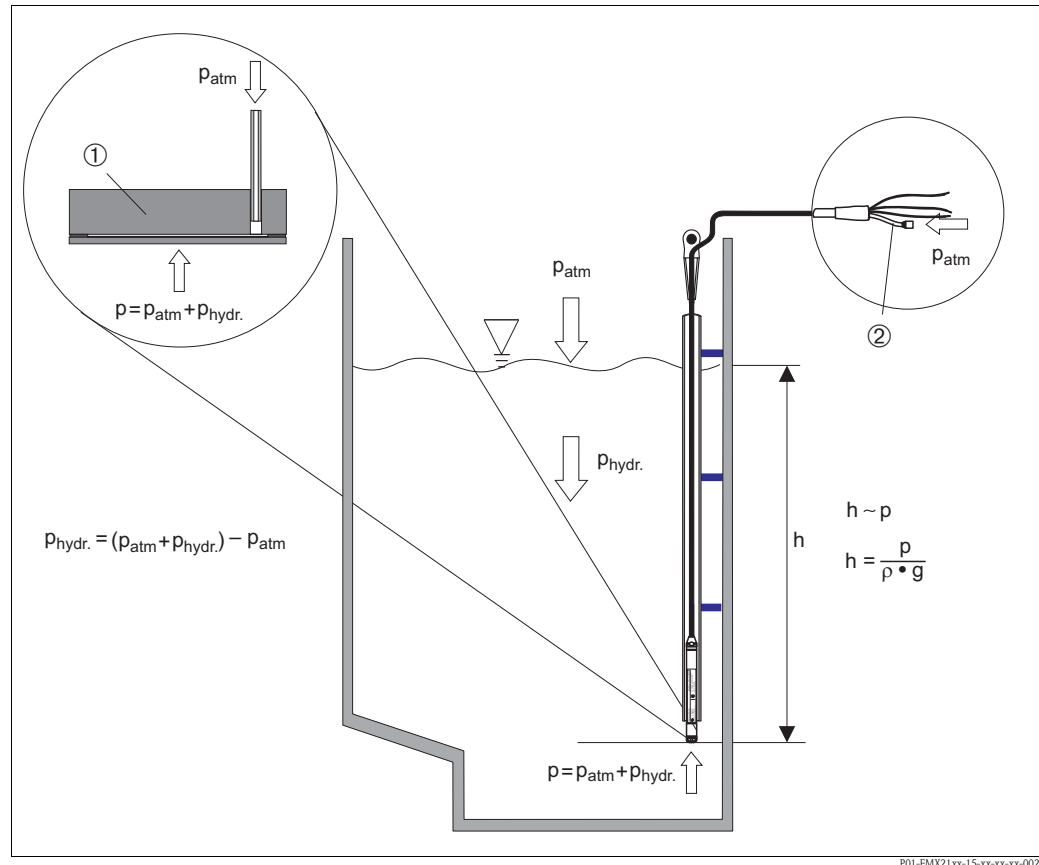
Waterpilot FMX21	 P01-FMX21xxx-16-xx-xx-xx-002	 P01-FMX21xx-16-xx-xx-xx-003	 P01-FMX21xxx-16-xx-xx-xx-004
Field of application	Hydrostatic level measurement in deep wells e.g. drinking water	Hydrostatic level measurement in wastewater	Hydrostatic level measurement in saltwater
	Caution! The Waterpilot is not suitable for use in biogas plants since the gases can diffuse through the elastomers (seals, extension cable). For applications with biogas Endress+Hauser offers the level transmitter Deltapilot.		
Process connection	– Mounting clamp – Extension cable mounting screw with G1 ½ A or 1 ½ NPT thread		
Outer diameter	22 mm (0.87 in)	42 mm (1.65 in)	max. 29 mm (1.14 in)
Extension cable	– PE extension cable – PUR extension cable – FEP extension cable		
Seals	– FKM Viton – EPDM <sup>1)</sup>	– FKM Viton	– FKM Viton – EPDM <sup>1)</sup>
Measuring ranges	– Gauge pressure: from 0 to 0.1 bar to 0 to 20 bar (0 to 1.5 psi to 0 to 300 psi) – Absolute pressure: from 0 to 2 bar to 0 to 20 bar (0 to 30 psi to 0 to 300 psi)		– Gauge pressure: from 0 to 0.1 bar to 0 to 4 bar (0 to 1.5 psi bis 0 to 60 psi) – Absolute pressure: from 0 to 2 bar to 0 to 4 bar (0 to 1.5 psi bis 0 to 60 psi)
	– Customer-specific measuring ranges; factory-calibrated – The following output units can be configured: %, mbar, bar, kPa, MPa, mmH <sub>2</sub> O, mH <sub>2</sub> O, inH <sub>2</sub> O, ftH <sub>2</sub> O, psi and numerous level units.		
Overload	Up to 40 bar (580 psi)		Up to 25 bar (362 psi)
Process temperature range	–10 to +70 °C (+14 to +158 °F)		0 to +50 °C (+32 to +122 °F)
Reference accuracy	– ±0.2 % of the set span – Optional: ±0.1 % of set span (PLATINUM version)		
Supply voltage	10.5 to 35 V DC, Ex: 10.5 to 30 V DC		
Output	4 to 20 mA (invertible) with superimposed digital communication protocol HART 6.0, 2-wire (invertible)		
Options	– Drinking water approval		
	– Large selection of approvals, including ATEX, FM, CSA – Broad range of accessories – Integrated Pt100 temperature sensor and TMT182 temperature head transmitter (4 to 20 mA/HART)		
Specialties	– High-precision, robust ceramic measuring cell with long-term stability – Automatic density compensation – Customer specific cable marking – Absolute pressure cell		

1) Recommended for drinking water applications.

## 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 FMX21.

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 then convert this into a signal which is proportional to the pressure and is linear to the level of the medium.



### 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 FMX21 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 → 26 "Accessories".

### Temperature measurement with optional Pt100 and TMT182 temperature head transmitter <sup>1)</sup>

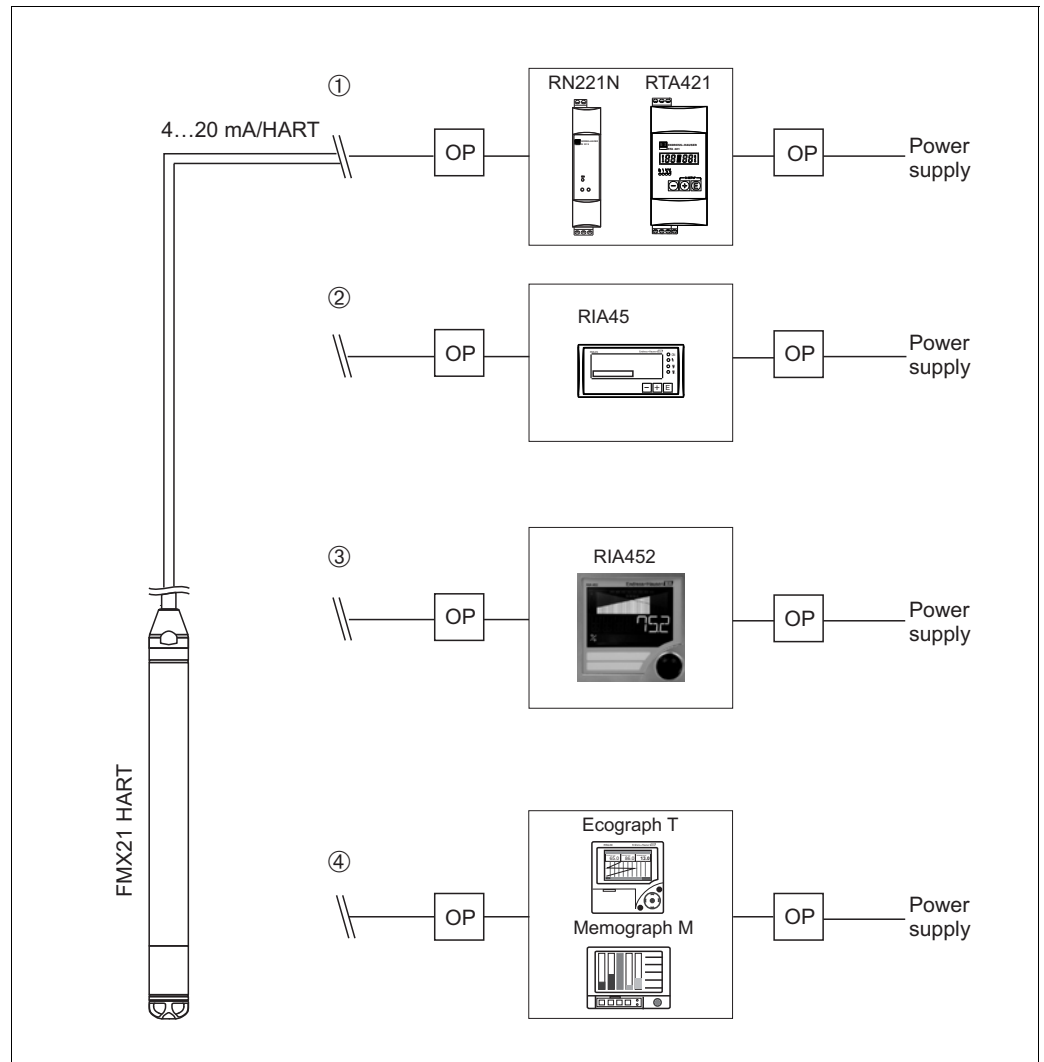
Endress+Hauser also offers the TMT182 temperature head transmitter with the HART protocol to convert the temperature signal to an analog, scalable 4 to 20 mA output signal superimposed with HART 6.0, see also → 7 "Density compensation with Pt100 temperature sensor" → 24 "Ordering information" → 26 Chap. "Accessories" and Technical Information TI00078R.

1) Not for use in hazardous areas.

## Measuring system

As standard, the complete measuring system consists of a Waterpilot FMX21 and a transmitter power supply unit with a supply voltage of 10.5 to 30 V DC (hazardous areas) or 10.5 to 35 V DC (non-hazardous areas).

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



P01-FMX21-xx-14-xx-xx-en-004

### Sample applications with FMX21

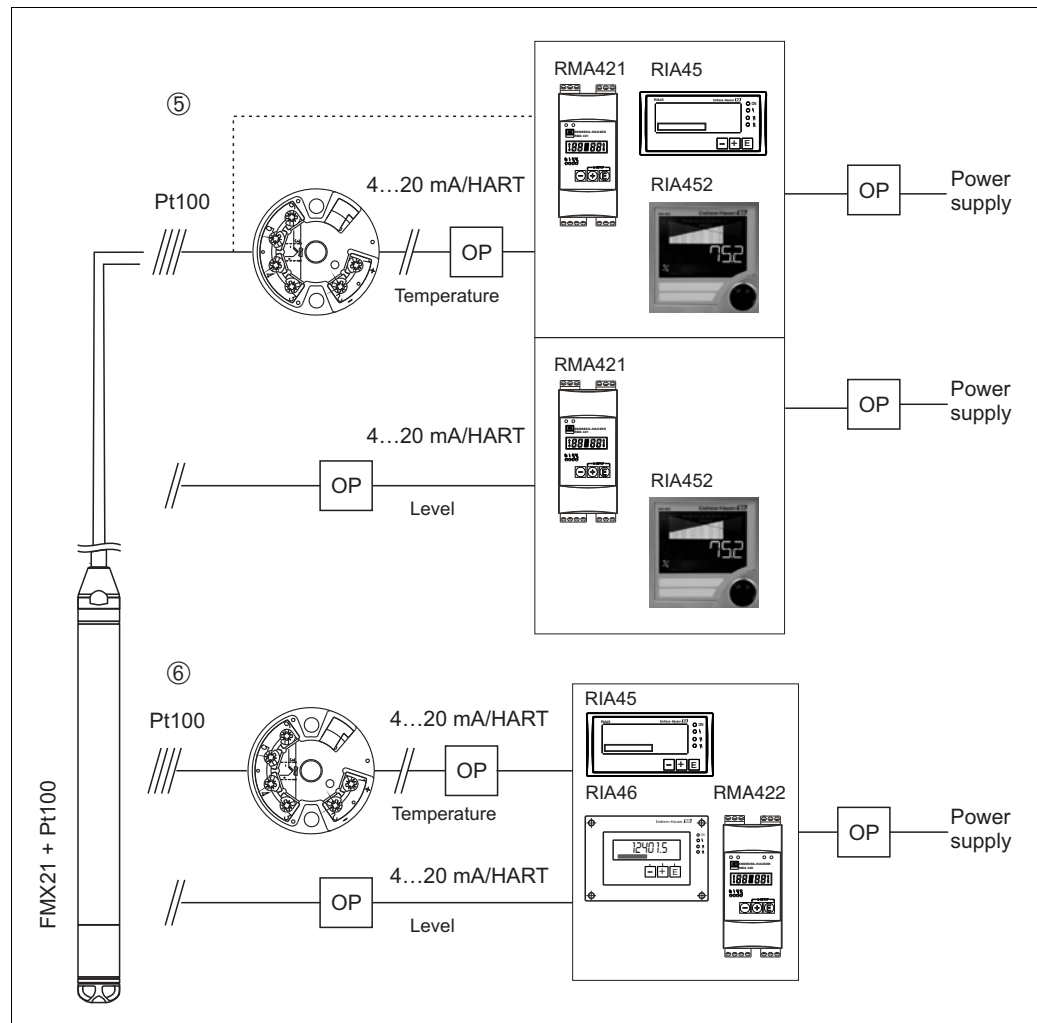
OP = Overvoltage protection, e.g. HAW from Endress+Hauser (not for use in hazardous areas)

- OP on sensor side for field installation: HAW569/for top-hat/DIN rail: HAW562/intrinsically safe HAW562Z

- OP on power supply side for top-hat/DIN rail: HAW561 (115/230 V) and HAW561K (24/48 V AC/DC)

The overvoltage protection selected must be appropriate for the supply voltage.

1. Easy and cost-effective measuring point solution: power supplied to the Waterpilot in hazardous and non-hazardous areas via the RN221N active barrier. Power supply and additional control of two appliances, such as pumps, by means of the RTA421 limit value switch with onsite display.
2. The RIA45 units (for panel mounting) offer power supply, an onsite display, two switch outputs and signal adjustment (turndown).
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) provide 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 for documenting, monitoring, visualizing and archiving purposes.



P01-FMX21xx-14-xx-xx-en-005

#### Sample applications with FMX21 with Pt100

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

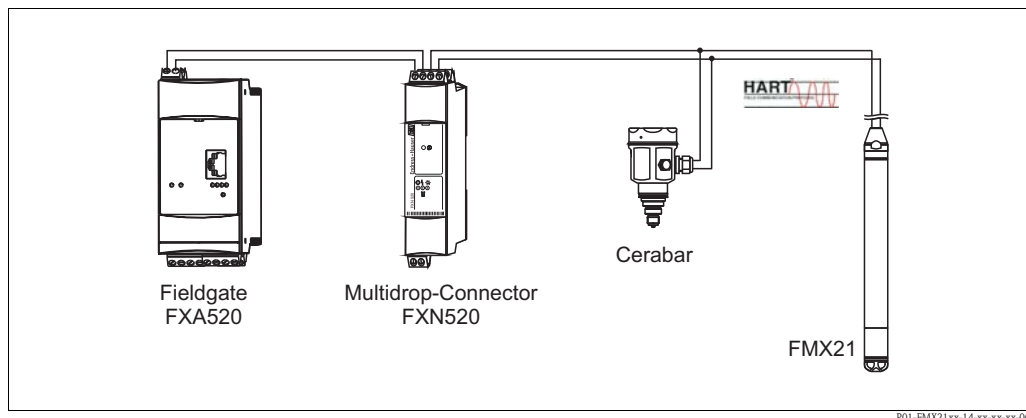
- OP on sensor side for field installation: HAW569/for top-hat/DIN rail: HAW562/intrinsically safe HAW562Z

- OP on power supply side for top-hat/DIN rail: HAW561 (115/230 V) and HAW561K (24/48 V AC/DC)

The overvoltage protection selected must be appropriate for the 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 TMT182 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 unit with two inputs. It is even possible to mathematically link the input signals with this unit. These evaluation are not HART permeable.

### Level measurement with absolute pressure probe and external pressure signal



It is advisable to use an absolute pressure probe for applications in which condensation can occur. In the case of level measurement with an absolute pressure probe, the measured value is affected by fluctuations in the ambient air pressure. To correct the resulting measured error, you can connect an external absolute pressure sensor (e.g. Cerabar) to the HART signal cable, switch the waterpilot to the burst mode and the Cerabar to operate in mode "Electr. Delta P".

The external absolute pressure sensor then calculates the difference between the two pressure signals and can thus determine the level precisely.

Only one level measured value can be corrected in this way.

Caution!

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.

### Density compensation with Pt100 temperature sensor

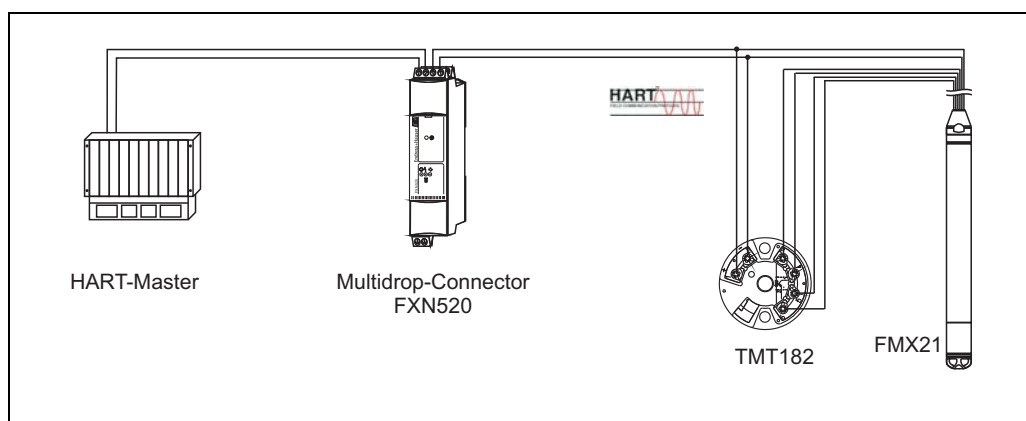
The Waterpilot FMX21 can correct measured errors that result from fluctuations in the density of the water caused by temperature. Users can choose from the following options:

**Use the internally measured sensor temperature of the FMX21**

The internally measured sensor temperature is calculated in the Waterpilot FMX21 for density compensation. The level signal is thus corrected according to the density characteristic line of the water.

Use the optional internal temperature sensor for density compensation in a suitable HART master (e.g. PLC)

The Waterpilot FMX21 is available with an optional Pt100 temperature sensor. Endress+Hauser additionally offers the TMT182 temperature head transmitter to convert the Pt100 signal to a 4 to 20 mA HART signal. The temperature and pressure signal is transmitted to the HART master (e.g. PLC) where a corrected level value can be generated using a stored linearization table or the density function (of a chosen medium).

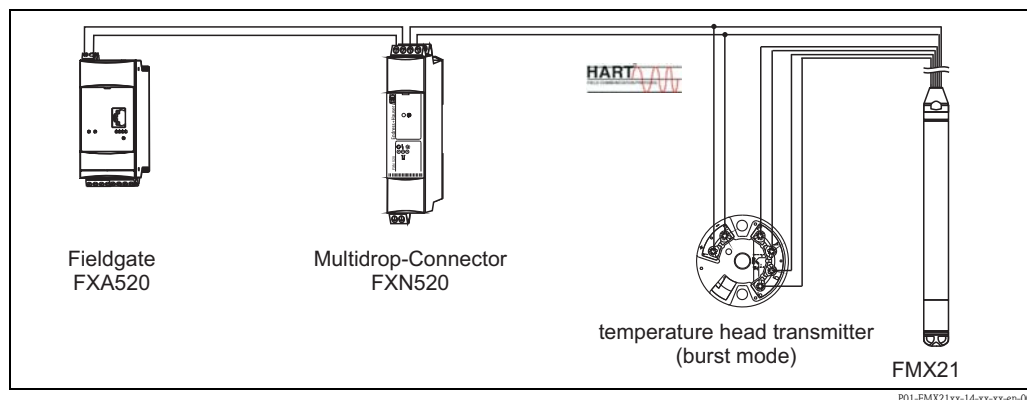


### Use an external temperature signal which is transmitted to the FMX21 via HART burst mode

The Waterpilot FMX21 is available with an optional Pt100 temperature sensor. In this case, the signal of the Pt100 is analyzed using a HART-compliant (at least HART 5.0) temperature transmitter that supports BURST mode. The temperature signal can thus be transmitted to the FMX21. The FMX21 uses this signal for the density correction of the level signal.

Note!

The TMT182 temperature head transmitter is not suitable for this configuration.



P01-FMX21xx-14-xx-xx-en-007

Without compensation additional errors of up to 4 % can occur at a temperature of 70 °C (158 °F) for example. With density compensation, this error can be decreased to 0.5% in the entire temperature range from 0 to 70 °C (32 to 158 °F).

Note!

For further information on the devices, please refer to the appropriate Technical Information:

- TI00078R: TMT182 temperature head transmitter (4 to 20 mA/HART)
- TI00369F: FXA520 Fieldgate
- TI00400F: FXN520 multidrop connector

<b>Communication protocol</b>	4 to 20 mA HART with communication protocol
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<b>System integration</b>	The device can be fitted with a tag name, see → 24 ff "Ordering information", feature 895 "Marking" version "Z1".
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## Input

Measured variable	FMX21 + Pt100 (optional)	TMT182 temperature head transmitter (optional)
	<ul style="list-style-type: none"> <li>Hydrostatic pressure of a liquid</li> <li>Pt100: temperature</li> </ul>	Temperature

Measuring range	<ul style="list-style-type: none"> <li>Customer-specific measuring ranges; factory-calibrated</li> <li>Temperature measurement from –10 to +70 °C (+14 to +158 °F) with Pt100 (optional)</li> <li>A sensor measuring range turndown (TD) of up to 10:1 can be set at the factory or directly by the customer.</li> </ul>
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Sensor measuring range	Smallest span that can be calibrated	Maximum overload/ OPL <sup>1)</sup>	Vacuum resistance	Version in the order code <sup>2)</sup>
[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar <sub>abs</sub> (psi <sub>abs</sub> )]	
<b>Gauge pressure</b>				
0.1 (1.5)	0.01 (0.15)	5.0 (75.0)	0.3 (4.5)	1C
0.2 (3.0)	0.02 (0.3)	5.0 (75.0)	0.3 (4.5)	1D
0.4 (6.0)	0.04 (1.0)	6.0 (90.0)	0	1F
0.6 (9.0)	0.06 (1.0)	10.0 (150)	0	1G
1.0 (15.0)	0.1 (1.5)	10.0 (150)	0	1H
2.0 (30.0)	0.2 (3.0)	15.0 (225)	0	1K
4.0 (60.0)	0.4 (6.0)	25.0 (375)	0	1M
10.0 (150) <sup>3)</sup>	1.0 (15)	40.0 (600)	0	1P
20.0 (300) <sup>3)</sup>	2.0 (30)	40.0 (600)	0	1Q
<b>Absolute pressure</b>				
2.0 (30.0)	0.2 (3.0)	15.0 (225)	0	2K
4.0 (60.0)	0.4 (6.0)	25.0 (375)	0	2M
10.0 (150) <sup>3)</sup>	1.0 (15)	40.0 (600)	0	2P
20.0 (300) <sup>3)</sup>	2.0 (30)	40.0 (600)	0	2Q

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

2) See →  24 "Ordering information"

3) These measuring ranges are not offered for the probe version with a coated housing, outer diameter 29 mm (1.14 in) .

Input signal	FMX21 + Pt100 (optional)	TMT182 temperature head transmitter (optional)
	<ul style="list-style-type: none"> <li>Change in capacitance</li> <li>Pt100: change in resistance</li> </ul>	Pt100 resistance signal, 4-wire

# Output

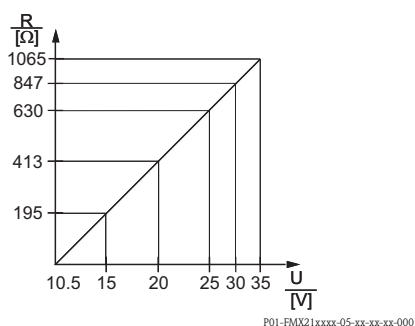
<b>Output signal</b>	<b>FMX21 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>4 to 20 mA with overlying digital HART 6.0 communication protocol, 2-wire for hydrostatic pressure measured value</li> <li>Pt100: Temperature-dependent resistance values</li> </ul>	<b>TMT182 temperature head transmitter (optional)</b> <p>4 to 20 mA with overlying digital HART 5.0 communication protocol for temperature measured value, 2-wire</p>
<b>Signal range</b>	<ul style="list-style-type: none"> <li>3.8 to 20.5 mA</li> </ul>	
<b>Signal on alarm</b>	<b>FMX21 + Pt100 (optional)</b> <p>4 to 20 mA/HART Options:</p> <ul style="list-style-type: none"> <li>Max. alarm (factory setting 22mA): can be set from 21 to 23 mA</li> <li>Hold measured value: last measured value is held</li> <li>Min. alarm: 3.6 mA</li> </ul>	<b>TMT182 temperature head transmitter (optional)</b> <p>Options:</p> <ul style="list-style-type: none"> <li>Max. alarm <math>\geq 21.0</math> mA</li> <li>Min. alarm <math>\leq 3.6</math> mA</li> </ul>

<b>Load</b>	<b>FMX21</b> $R_{Lmax} \leq \frac{U - 10.5 \text{ V}}{23 \text{ mA}} - 2 \cdot 0.9 \frac{\Omega}{\text{m}} \cdot l - R_{add}$ <p style="text-align: right; font-size: small;">P01-FMX21xx-16-xx-xx-en-000</p>	<b>TMT182 temperature head transmitter (optional)</b> $R_{tot} \leq \frac{U - 11.5 \text{ V}}{0.023 \text{ A}} - R_{add}$ <p style="text-align: right; font-size: small;">P01-FMX21xx-16-xx-xx-en-001</p>
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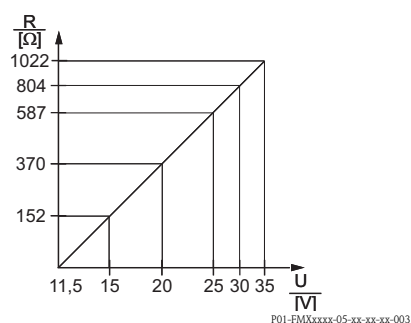
$R_{Lmax}$  = Max. load resistance [ $\Omega$ ]  
 $R_{add}$  = Additional resistances such as resistance of evaluation unit and/or display unit, cable resistance [ $\Omega$ ]  
 $U$  = Supply voltage [V]  
 $l$  = Simple length of extension cable [m] (cable resistance per wire  $\leq 0.09 \Omega/\text{m}$ )

## 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.



FMX21 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.



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.

## Note!

When operating using a HART handheld terminal or a PC with an operating program, a minimum communication resistance of 250  $\Omega$  has to be taken into account.

**Resolution**Current output: 1  $\mu$ A**Read cycle**

HART commands: 2 to 3 per second on average

**Damping**

- Continuously 0 to 999 s via HART handheld terminal or PC with operating program
- Factory setting: 2 s

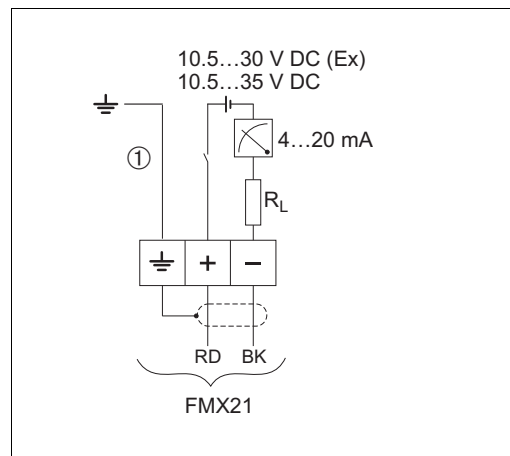
## Power supply

**Measuring unit electrical connection**

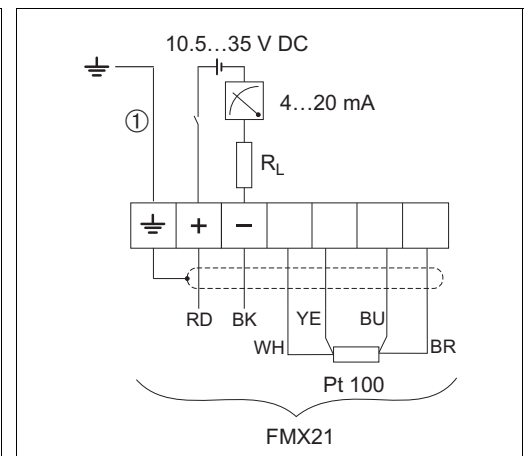
Note!

- When using the measuring device in hazardous areas, installation must comply with the applicable national standards and regulations and the Safety Instructions (XAs) and the Installation or Control Drawings (ZDs).  
→ 28 "Additional documentation", "Safety instructions" and "Installation/Control Drawings".
- Reverse polarity protection is integrated in the Waterpilot FMX21 and in the TMT182 temperature head transmitter. Changing the polarities will not damage the devices.
- The cable must end in a dry room or a suitable terminal box. The terminal box (IP66/IP67) with a GORE-TEX® filter from Endress+Hauser is suitable for outdoor installations. The terminal box can be ordered as an accessory using the order code for FMX21 → 24 version "PS" for feature 620.

The electrical connection is made with the corresponding wires of the probe cable and with the optional use of the terminal box (Commubox FXA) or an active barrier (e.g. RN221N).

**FMX21**

Electrical connection

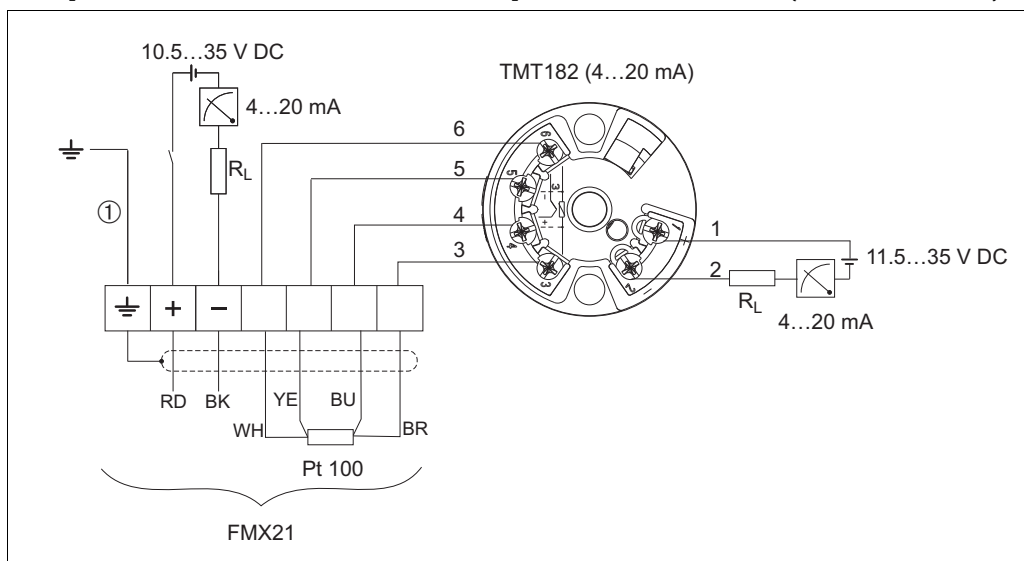
**FMX21 with Pt100<sup>1)</sup>**

Electrical connection

Version "NB" for feature 610 "Accessories" in the order code → 24 ff.

① Not for FMX21 with an outer diameter of 29 mm (1.14 in).

<sup>1)</sup> Not for use in hazardous areas.

**Waterpilot FMX21 with Pt100 and TMT182 temperature head transmitter (4 to 20 mA/HART) <sup>1)</sup>**


FMX21 with Pt100 and TMT182 temperature head transmitter  
versions "NB" and "PT" for the features 610 and 620 in the order code → 24 ff.

① Not for FMX21 with an outer diameter of 29 mm (1.14 in).

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


<sup>1)</sup> Not for use in hazardous areas.

Connection classification as per IEC 61010-1:

- Overvoltage category 1
- Pollution degree 1

**Connection data in the hazardous area**

4 to 20 mA	Ex ia IIC T4 to T6
Ui	30 V DC
Ii	133 mA
Pi	1.0 W
Ci	10.3 nF (sensor)/180 pF/m (cable)
Li	0 µH (sensor)/1 µH/m (cable)
Ta	−10 °C (+14 °F) ≤ Ta ≤ +70 °C (+158 °F) for T4; −10 °C (+14 °F) ≤ Ta ≤ +40 °C (+104 °F) for T6

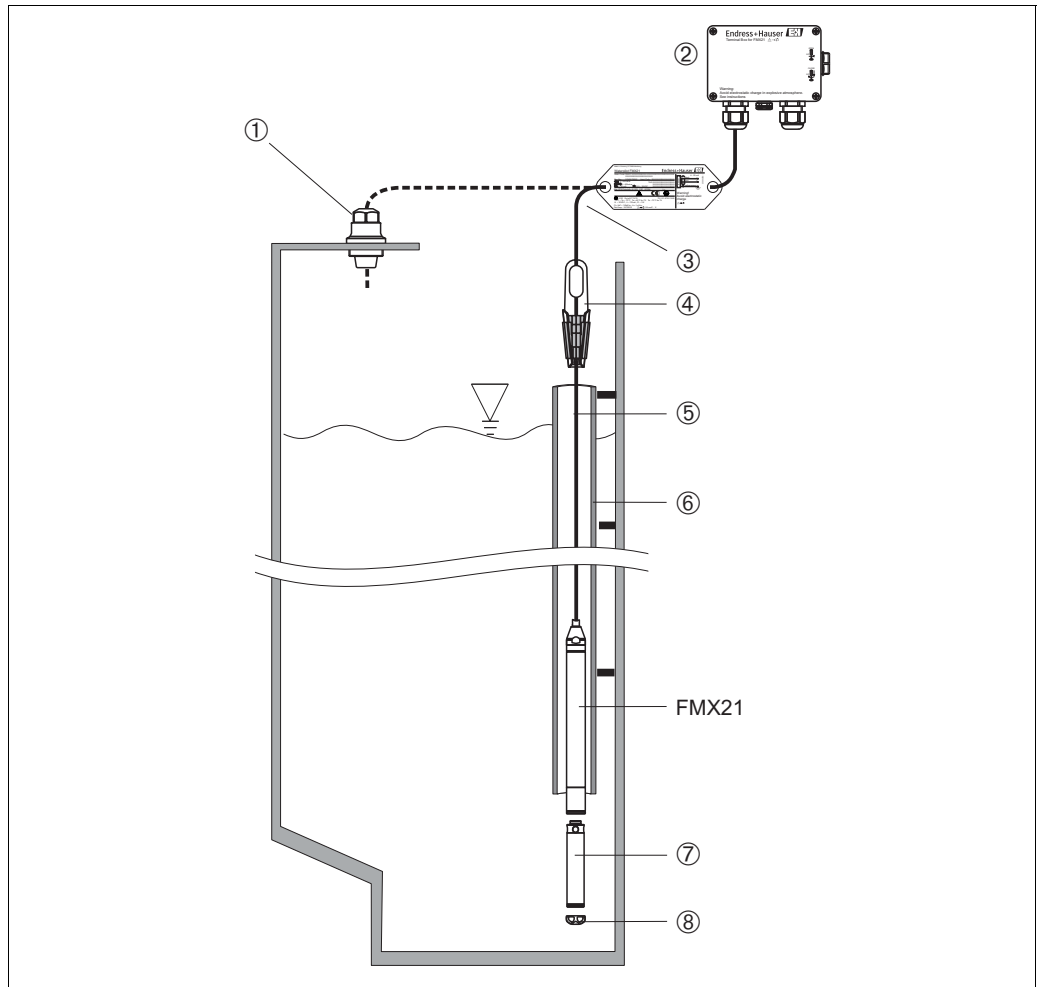
<b>Supply voltage</b>	<p>Note!</p> <ul style="list-style-type: none"> <li>■ When using the measuring device in hazardous areas, installation must comply with the applicable national standards and regulations and the Safety Instructions (XAs) and the Installation or Control Drawings (ZDs). All explosion-protection data are given in a separate documentation which is available upon request. This documentation is provided with the devices as standard, see also →  28 "Additional documentation".</li> </ul> <div> <div> <b>FMX21 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ 10.5 to 35 V (non-hazardous area)</li> <li>■ 10.5 to 30 V (hazardous area)</li> </ul> </div> <div> <b>TMT182 temperature head transmitter (optional)</b> <p>11.5 to 35 V DC</p> </div> </div>
<b>Cable specifications</b>	<div> <div> <b>FMX21 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ Commercially available shielded instrument cable</li> <li>■ Terminal, terminal box: 0.08 to 2.5 mm<sup>2</sup> (28 to 14 AWG)</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> </div> <div> <b>TMT182 temperature head transmitter (optional)</b> <ul style="list-style-type: none"> <li>■ Commercially available shielded instrument cable</li> <li>■ Terminal, terminal box: 0.08 to 2.5 mm<sup>2</sup> (28 to 14 AWG)</li> <li>■ Transmitter connection: max. 1.75 mm<sup>2</sup> (15 AWG)</li> </ul> </div> </div>
<b>Power consumption</b>	<div> <div> <b>FMX21 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ ≤ 0.805 W at 35 V DC (non-hazardous area)</li> <li>■ ≤ 0.690 W at 30 V DC (hazardous area)</li> </ul> </div> <div> <b>TMT182 temperature head transmitter (optional)</b> <p>≤ 0.805 W at 35 V DC</p> </div> </div>
<b>Current consumption</b>	<div> <div> <b>FMX21 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ Max. current consumption: ≤ 23 mA</li> <li>Min. current consumption: ≥ 3.6 mA</li> <li>■ Pt100: ≤ 0.6 mA</li> </ul> </div> <div> <b>TMT182 temperature head transmitter (optional)</b> <ul style="list-style-type: none"> <li>■ Max. current consumption: ≤ 23 mA</li> <li>Min. current consumption: ≥ 3.5 mA</li> <li>■ Pt100 via temperature head transmitter: ≤ 0.6 mA</li> </ul> </div> </div>
<b>Residual ripple</b>	<div> <div> <b>FMX21 + Pt100 (optional)</b> <p>No impact on 4 to 20 mA signal to ±5 % residual ripple within the permitted voltage range (according to HART Hardware Specification HCF_SPEC-54 (DIN IEC 60381-1)).</p> </div> <div> <b>TMT182 temperature head transmitter (optional)</b> <p><math>U_{ss} \geq 3 \text{ V}</math> at <math>U_b \geq 13 \text{ V}</math>, <math>f_{max.} = 1 \text{ kHz}</math></p> </div> </div>

## Performance characteristics

<b>Reference operating conditions</b>	<b>FMX21 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ As per IEC 60770</li> <li>■ Ambient temperature <math>T_A</math> = constant, in range: +21 to +33 °C (+70 °F to +91 °F)</li> <li>■ Humidity <math>\phi</math> = constant, in range: 20 to 80 % RH</li> <li>■ Ambient pressure <math>p_A</math> = constant, in range: 860 to 1060 mbar (12.47 to 15.37 psi)</li> <li>■ Position of the measuring cell = constant, in range: vertical: <math>\pm 1^\circ</math></li> <li>■ Supply voltage constant: 21 V DC to 27 V DC</li> <li>■ Load with HART: 250 <math>\Omega</math></li> <li>■ Pt100: DIN EN 60770 <math>T_A = 25^\circ\text{C}</math> (77 °F)</li> </ul>	<b>TMT182 temperature head transmitter (optional)</b> <p>Calibration temperature <math>25^\circ\text{C}</math> (77 °F) <math>\pm 5\text{ K}</math></p>
<b>Reference accuracy</b>	<b>FMX21 + Pt100 (optional)</b> <p>The reference accuracy comprises the non-linearity after limit point configuration, hysteresis and non-repeatability in accordance with IEC 60770.</p> <ul style="list-style-type: none"> <li>■ Setting <math>\pm 0.2\%</math> <ul style="list-style-type: none"> <li>– to TD 5:1: <math>&lt; 0.2\%</math> of the set span</li> <li>– from TD 5:1 to TD 10:1 <math>\pm(0.02 \times \text{TD} + 0.1)</math></li> </ul> </li> <li>■ PLATINUM version: <ul style="list-style-type: none"> <li>■ Setting <math>\pm 0.1\%</math> (optional) <ul style="list-style-type: none"> <li>– to TD 5:1: <math>&lt; 0.1\%</math> of the set span</li> <li>– from TD 5:1 to TD 10:1 <math>\pm(0.02 \times \text{TD})</math></li> </ul> </li> <li>■ Class B to DIN EN 60751 <ul style="list-style-type: none"> <li>– Pt100: max. <math>\pm 1\text{ K}</math></li> </ul> </li> </ul> </li> </ul>	<b>TMT182 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>FMX21 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ <math>\leq 0.1\%</math> of URL/year</li> <li>■ <math>\leq 0.25\%</math> of URL/5 years</li> </ul>	<b>TMT182 temperature head transmitter (optional)</b> <p><math>\leq 0.1\text{ K}</math> per year</p>
<b>Influence of medium temperature</b>	<ul style="list-style-type: none"> <li>■ Thermal change in the zero output and the output span  0 to +30 °C (+32 to +86 °F): <math>&lt;(0.15 + 0.15 \times \text{TD})\%</math>  –10 to +70 °C (+14 to +158 °F): <math>&lt;(0.4 + 0.4 \times \text{TD})\%</math></li> <li>■ Temperature coefficient (<math>T_K</math>) of the zero output and output span  –10 to +70 °C (+14 to +158 °F): <math>0.1\% / 10\text{ K URL}</math></li> </ul>	
<b>Warm-up period</b>	<b>FMX21 + Pt100 (optional)</b> <p>FMX21: <math>&lt; 6\text{ s}</math>  Pt100: 20 ms</p>	<b>TMT182 temperature head transmitter (optional)</b> <p>4 s</p>
<b>Step response time</b>	<b>FMX21 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ FMX21: 400 ms (<math>T_{90}</math> time), 500 ms (<math>T_{99}</math> time)</li> <li>■ Pt100: 160 s (<math>T_{90}</math> time), 300 s (<math>T_{99}</math> time)</li> </ul>	–

# Installation

## Installation instructions



P01-FMX21-xx-11-xx-xx-xx-003

Installation examples, here illustrated with FMX21 with an outer diameter of 22 mm (0.87 in)

- 1 Extension cable mounting screw can be ordered via order code or as an accessory → 24 ff
- 2 Terminal box can be ordered via order code or as an accessory → 24 ff
- 3 Extension cable bending radius > 120 mm (4.72 in)
- 4 Mounting clamp can be ordered via order code or as an accessory → 24 ff
- 5 Extension cable, length → 21
- 6 Guide pipe
- 7 Additional weight can be ordered as an accessory for FMX21 with an outer diameter of 22 mm (0.87 in) and 29 mm (1.14 in) → 26
- 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 (0.04 in) bigger than the outer diameter of the selected FMX21.
- 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.
- If the cable is shortened, the filter at the pressure compensation tube has to be reattached. Endress+Hauser offers a cable shortening kit for this purpose → 24 ff (SD00552P/00/A6).
- Endress+Hauser recommends using twisted, shielded cables.
- Note for ship building applications: Measures for limitation of the propagation of fire along cable bundles are required (fire stops).

## Ambient conditions

<b>Ambient temperature range</b>	<b>FMX21 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ FMX21 with outer diameter of 22 mm (0.87 in) and 42 mm (1.65 in): –10 to +70 °C (+14 to +158 °F) (= medium temperature)</li> <li>■ FMX21 with outer diameter of 29 mm (1.14 in): 0 to +50 °C (+32 to +122 °F) (= medium temperature)</li> </ul> <b>Terminal box</b> –40 to +80 °C (–40 to +176 °F)	<b>TMT182 temperature head transmitter (optional)</b> –40 to +85 °C (–40 to +185 °F)
<b>Storage temperature range</b>	<b>FMX21 + Pt100 (optional)</b> –40 to +80 °C (–40 to +176 °F) <b>Terminal box</b> –40 to +80 °C (–40 to +176 °F)	<b>TMT182 temperature head transmitter (optional)</b> –40 to +100 °C (–40 to +212 °F)
<b>Degree of protection</b>	<b>FMX21 + Pt100 (optional)</b> IP68, permanently hermetically sealed at 40 bar (580 psi)(~400 m H <sub>2</sub> O) <b>Terminal box (optional)</b> IP66/IP67	<b>TMT182 temperature head transmitter (optional)</b> IP00, condensation permitted
<b>Electromagnetic compatibility (EMC)</b>	<b>FMX21 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ EMC in accordance with all the relevant requirements of the EN 61326 series. Details are provided in the Declaration of Conformity.</li> <li>■ Maximum deviation &lt;0.5 % of the span.</li> </ul>	<b>TMT182 temperature head transmitter (optional)</b> EMC in accordance with all the relevant requirements of the EN 61326 series. Details are provided in the Declaration of Conformity.
<b>Overvoltage protection</b>	<b>FMX21 + 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>TMT182 temperature head transmitter (optional)</b> Install overvoltage protection, external if necessary.

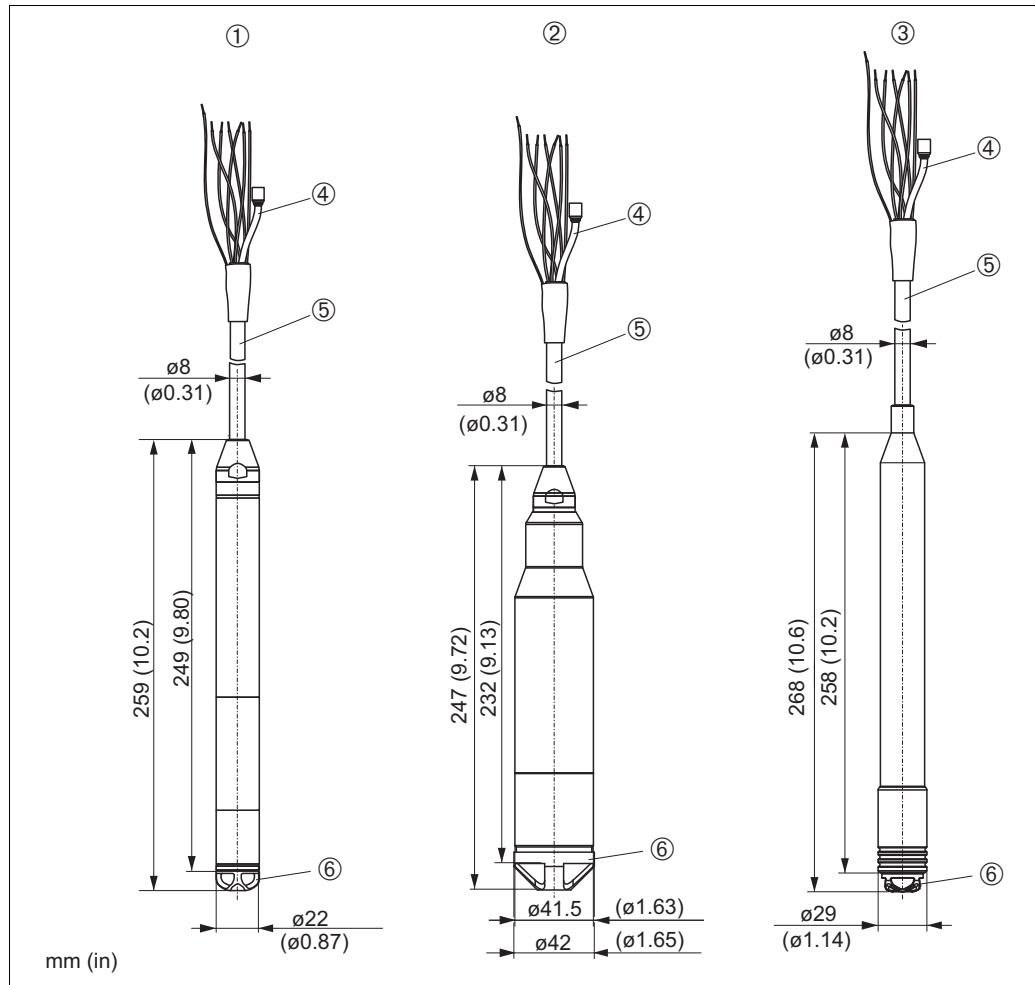


## Process conditions

<b>Medium temperature range</b>	<b>FMX21 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ FMX21 with outer diameter of 22 mm (0.87 in) and 42 mm (1.65 in): −10 to +70 °C (+14 to +158 °F)</li> <li>■ FMX21 with outer diameter of 29 mm (1.14 in): 0 to +50 °C (+32 to +122 °F)</li> </ul>	<b>TMT182 temperature head transmitter (optional)</b>  –
<b>Medium temperature limits</b>	<b>FMX21 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ FMX21 with outer diameter of 22 mm (0.87 in) and 42 mm (1.65 in): −20 to +70 °C (−4 to +158 °F)</li> </ul> <p>Note! In hazardous areas incl. CSA GP, the medium temperature limit is at −10 to +70 °C (+14 to +158 °F).</p> <ul style="list-style-type: none"> <li>■ FMX21 with outer diameter of 29 mm (1.14 in): 0 to +50 °C (+32 to +122 °F)</li> </ul> <p>(The FMX21 can be operated in this temperature range. The specification can then be exceeded, e.g. measuring accuracy.)</p>	–

# Mechanical construction

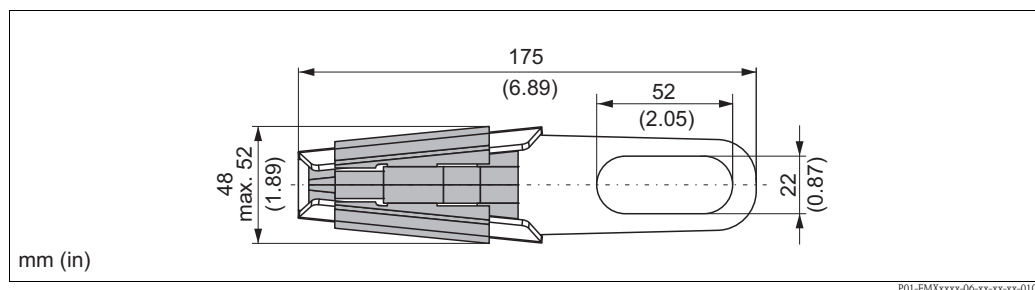
## Dimensions of the level probe



### Versions of the FMX21

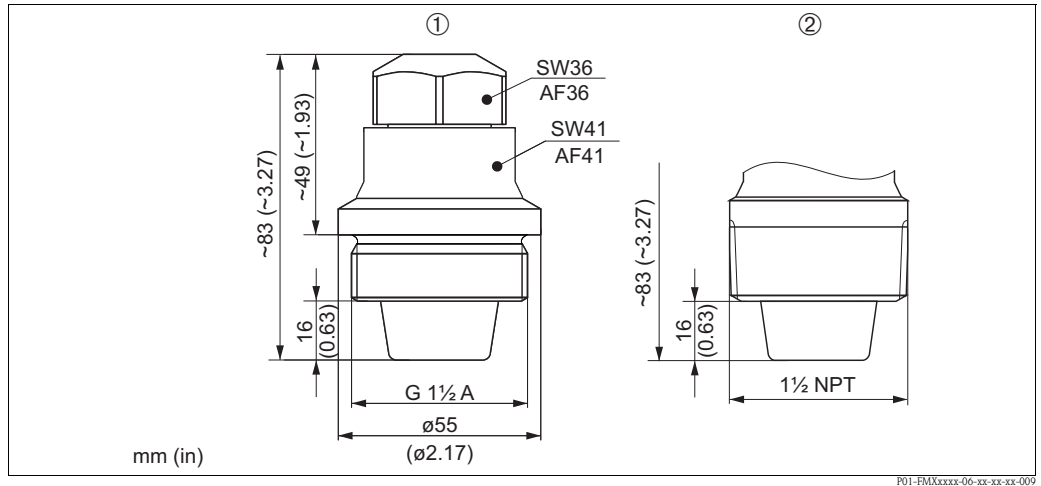
- 1 Version "1" for feature 45 "Probe tube" or "Accessories" in the order code → 24 ff
- 2 Version "2" for feature 45 "Probe tube" in the order code → 24 ff
- 3 Version "5" for feature 45 "Probe tube" in the order code → 24 ff
- 4 Pressure compensation tube
- 5 Extension cable
- 6 Protection cap

## Dimensions of the mounting clamp



Mounting clamp, version "PO" for feature 620 "Accessories" in the order code → 24 ff

### Dimensions of the extension cable mounting screws



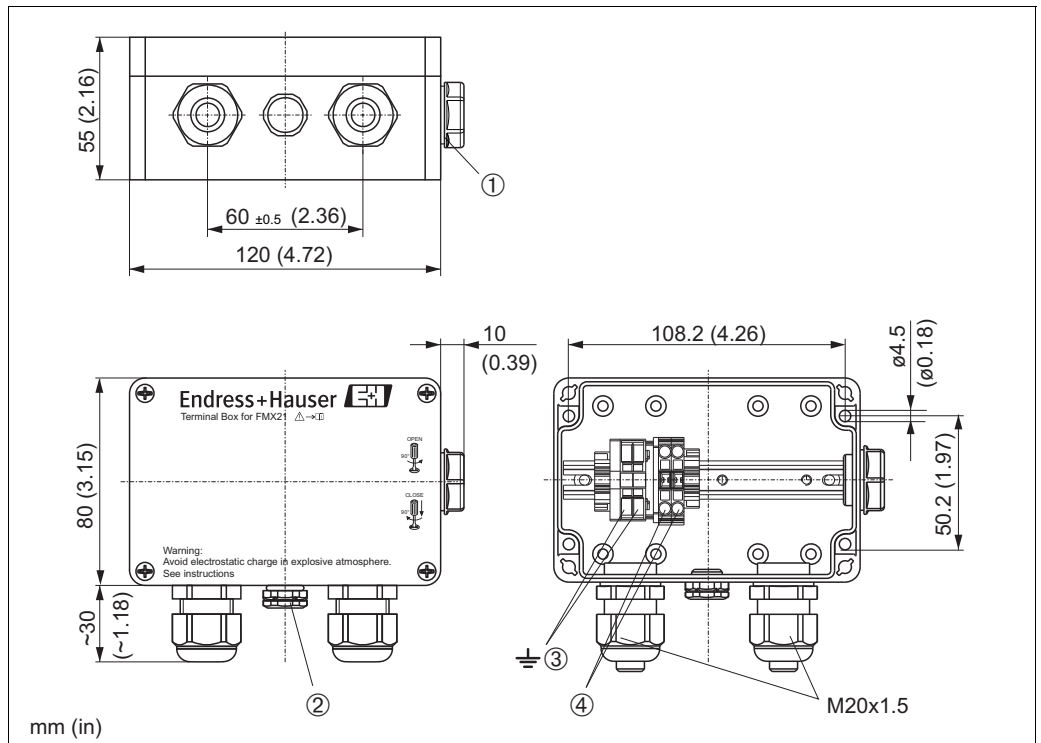
Extension cable mounting screws

- 1 Extension cable mounting screw G 1 1/2 A, version "PQ" for feature 620 "Accessories" in the order code → 24 ff
- 2 Extension cable mounting screw 1 1/2 NPT, version "PR" for feature 620 "Accessories" in the order code → 24 ff

Note!

Application in unpressurized containers only.

### Dimensions of the IP66/IP67 terminal boxes with filters



Terminal box / Version "PS" or "PT" for feature 620 "Accessories" in the order code → 24 ff

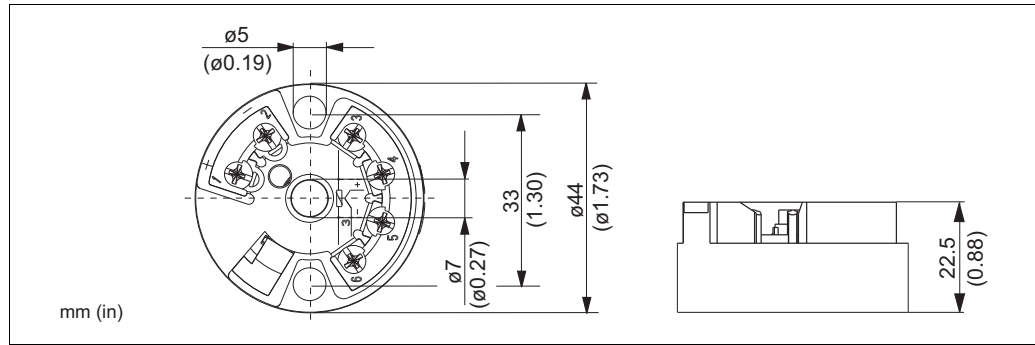
- 1 Dummy plug M20x1.5
- 2 GORE-TEX® filter
- 3 Ground connection / terminals for 0.08 to 2.5 mm² (28 to 14 AWG)
- 4 4 to 20 mA / terminals for 0.08 to 2.5 mm² (28 to 14 AWG)

If ordered together with FMX21 but without the optional TMT182 temperatur transmitter, the terminal box is incl. a 4-terminal strip.

Note!

The 4-terminal strip is not intended for use in hazardous areas incl. CSA GP.

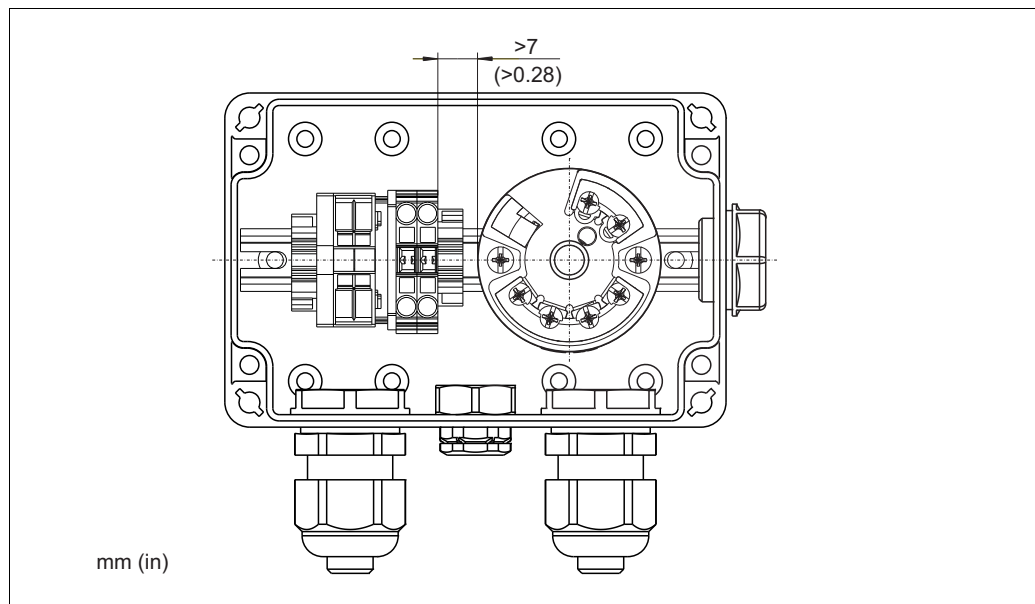
### Dimensions of the TMT182 temperature head transmitter



P01-FMX21xxx-06-xx-xx-xx-012

TMT182 temperature head transmitter (4 to 20 mA/HART), version "PT" for feature 620 "Accessories" in the order code  
→ 24 ff.

### Terminal box with integrated TMT182 temperature head transmitter (4 to 20 mA/HART)



P01-FMX21xxx-06-xx-xx-xx-022

#### Note!

A distance of >7 mm (>0.28 in mm) must be maintained between the terminal strip and the TMT182 temperature head transmitter.

### Weight

- Level probe, outer diameter 22 mm (0.87 in): 344 g (12.133 oz)
- Level probe, outer diameter 29 mm (1.14 in): 394 g (13.896 oz)
- Level probe, outer diameter 42 mm (1.65 in): 1376 g (48.532 oz)
- PE extension cable: 52 g/m (0.33 lbs/1 ft)
- FEP extension cable: 108 g/m (0.072 lbs/1 ft)
- PUR extension cable: 60 g/m (0.039 lbs/1 ft)
- Mounting clamp: 170 g (5.996 oz)
- Extension cable mounting screw G1 ½ A: 770 g (27.158 oz)
- Extension cable mounting screw 1½ NPT: 724 g (25.535 oz)
- Terminal box: 235 g (8.288 oz)
- Temperature head transmitter: 40 g (1.411 oz)
- Additional weight: 300 g (1.376 oz)
- Adapter weight: 39 g

## Material

- Level probe, outer diameter 22 mm (0.87 in): 1.4435 (AISI 316L)
- Level probe, outer diameter 29 mm (1.14 in): 1.4435 (AISI 316L)
  - Sensor sleeve: PPS (polyphenylene sulfide); heat-shrink tube/cover: polyolefin.
 The materials used ensure that metal does not come in contact with the medium.
- Level probe, outer diameter 42 mm (1.65 in): 1.4435 (AISI 316L)
- Process ceramic: Al<sub>2</sub>O<sub>3</sub> aluminum oxide ceramic
- Seal (internal): EPDM or Viton
- Protection cap: – PPO (polyphenylene oxide) for FMX21 with outer diameter 22 mm and 29 mm.
  - PFA (perfluoroalkoxy) for FMX21 with outer diameter 42 mm.
- Extension cable insulation: either PE-LD (low-density polyethylene), FEP (fluorinated ethylene propylene) or PUR (polyurethane), for further information, see → 21 "Extension cable".
- Mounting clamp: 1.4404 (AISI 316L) and fiberglass reinforced PA (polyamide)
- Extension cable mounting screw G1 ½ A: 1.4301 (AISI 304)
- Extension cable mounting screw 1 ½ NPT: 1.4301 (AISI 304)
- Terminal box: PC (polycarbonate)
- Temperature head transmitter: PC housing (polycarbonate)

## Extension cable

### PE extension cable

- Abrasion-resistant extension cable with Dynema strain-relief members; shielded with aluminum-coated film; insulated with polyethylene (PE), black; copper wires, twisted
- Pressure compensation tube with Teflon filter

### PUR extension cable

- Abrasion-resistant extension cable with Dynema strain-relief members; shielded with aluminum-coated film; insulated with polyurethane (PUR), black; copper wires, twisted
- Pressure compensation tube with Teflon filter

### FEP extension cable

- Abrasion-resistant extension cable; shielded with galvanized steel wire netting; insulated with fluorinated ethylene propylene (FEP), black; copper wires, twisted
- Pressure compensation tube with Teflon filter

### Cross-section of PE/PUR/FEP extension cable

- Total outer diameter: 8.0 mm (0.31 in) ±0.25 mm (±0.01 in)
- FMX21: 3 x 0.227 mm<sup>2</sup> (3 x 26 AWG) + pressure compensation tube with Teflon filter
- FMX21 with Pt100 (optional): 7x 0.227 mm<sup>2</sup> (7x 26 AWG) + pressure compensation tube with Teflon filter
- Pressure compensation tube with Teflon filter: outer diameter 2.5 mm (0.1 in), internal diameter 1.5 mm (0.06 in)

### Cable resistance of PE/PUR/FEP extension cable

- Cable resistance per wire: ≤ 0.09 Ω/m

### Cable length of PE/PUR/FEP extension cable

- Please refer also to → 10, Chap. "Load".
- Cable length that can be ordered
  - Customer-specific length in meters or feet (→ 24, "Ordering information")
  - Limited cable length when performing installation with freely suspended device with extension cable mounting screw or mounting clamp, as well as for hazardous areas: max. 300 m (984 ft).
- 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) "Additional documentation".

### Further technical data for PE/PUR/FEP extension cable

- Minimum bending radius: 120 mm (4.72 in)
- Tensile strength: max. 950 N (213.56 lbf)
- Cable extraction force: typical ≥400 N (89.92 lbf) PE, FEP / typical ≥150 N (33.72 lbf) PUR  
(The extension cable could be extracted from the level probe with a appropriate tensile force.)
- Resistance to UV light
- PE: Approved for use with drinking water

## Terminals

- Three terminals as standard in the terminal box
- 4-terminal strip can be ordered as an accessory, Order No: 52008938  
Conductor cross-section 0.08 to 2.5 mm<sup>2</sup> (28 to 14 AWG)

Note!

The 4-terminal strip is not intended for use in hazardous areas incl. CSA GP.

## Human interface

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<b>Field Xpert SFX100</b>	Field Xpert is an industrial PDA with integrated 3.5" touchscreen from Endress+Hauser based on Windows Mobile. It communicates via wireless with the optional VIATOR® Bluetooth® modem connected to a HART device point-to-point or wireless via WiFi and Endress+Hauser's Fieldgate FXA520. Field Xpert also works as a stand-alone device for asset management applications. For details refer to BA00060S/00/EN.
<b>Field Communicator 375, 475</b>	The Field Communicator 375, 475 handheld terminal can be used to set all the parameter via menu operation.
<b>FieldCare</b>	<p>FieldCare is Endress+Hauser's plant asset management tool based on FDT technology. You can use FieldCare to configure all Endress+Hauser devices as well as third-party devices which support the FDT standard.</p> <p>FieldCare supports the following functions:</p> <ul style="list-style-type: none"><li>■ Configuration of transmitters in offline and online mode</li><li>■ Loading and saving device data (upload/download)</li><li>■ Documentation of the measuring point</li></ul> <p>Connection options:</p> <ul style="list-style-type: none"><li>■ Via Commubox FXA195 and the USB port of a computer</li><li>■ Via Fieldgate FXA520</li></ul> <p>For further information and free download of FieldCare see → <a href="http://www.endress.com">www.endress.com</a> → Download → Search: FieldCare</p>

## 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>Approvals, types of protection</b>	<ul style="list-style-type: none"> <li>■ ATEX II 2 G Ex ia IIC T4/T6 Gb <sup>1) 2)</sup></li> <li>■ ATEX II 3 G Ex nA IIC T5/T6 <sup>1) 3)</sup></li> <li>■ FM: IS Cl. I, Div. 1 Gp. A-D; AEx ia Cl. I Zone 1 IIC <sup>1)</sup></li> <li>■ CSA C/US: IS Cl. I, Div. 1 Gp. A-D; Ex ia Cl. I Zone 1 IIC <sup>1)</sup></li> <li>■ CSA: General Purpose</li> <li>■ IEC Ex ia IIC T6 Gb <sup>1)</sup></li> <li>■ NEPSI Ex ia IIC T6</li> </ul> <p><sup>1)</sup> Only for Waterpilot FMX21 without Pt100 and TMT182</p> <p><sup>2)</sup> T4/T6:  Temperature class T4 at -10 °C (+14 °F) &lt; Ta &lt; +70 °C (+158 °F)  Temperature class T6 at -10 °C (+14 °F) &lt; Ta &lt; +40 °C (+104 °F)</p> <p><sup>3)</sup> T5/T6:  Temperature class T5 at -10 °C (+14 °F) &lt; Ta &lt; +70 °C (+158 °F)  Temperature class T6 at -10 °C (+14 °F) &lt; Ta &lt; +60 °C (+140 °F)</p> <p>Note!</p> <ul style="list-style-type: none"> <li>■ Waterpilot FMX21 is only available for use in hazardous areas with the FKM Viton seal.</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 → 28 "Additional documentation", "Safety instructions" and "Installation/Control Drawings".</li> </ul>
<b>Drinking water approval (for FMX21 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 certificate</b>	<ul style="list-style-type: none"> <li>■ GL (Germanischer Lloyd)</li> <li>■ ABS (American Bureau of Shipping)</li> <li>■ LR (Lloyds Register)</li> <li>■ DNV (Det Norske Veritas)</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 FMX21:</p> <ul style="list-style-type: none"> <li>■ DIN EN 60770 (IEC 60770): Transmitters for use in industrial process control systems Part 1: Methods for performance evaluation</li> <li>■ DIN 16086: Electrical pressure measuring instruments, pressure sensors, pressure transmitters, pressure measuring instruments, concepts, specifications on data sheets</li> <li>■ EN 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements</li> <li>■ EN 61010-1 (IEC 61010-1): Safety requirements for electrical equipment for measurement, control and laboratory use</li> <li>■ EN 60529: Degrees of protection provided by enclosures</li> </ul>

## Ordering information

### FMX21

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>	
	AA	Non-hazardous area	
	BE	ATEX II 2 G Ex ia IIC T6	
	BD	ATEX II 3 G Ex nA IIC T6	
	FE	FM IS, Cl. I Division 1, Groups A – D, AEx ia, zone 1	
	CE	CSA C/US IS Cl. I Division 1, Groups A – D, Ex ia, zone 1	
	CD	CSA General Purpose	
	IC	IEC Ex ia IIC T6 Gb	
	NA	NEPSI Ex ia IIC T6	
<b>20</b>		<b>Output:</b>	
	2	4-20 mA HART	
<b>45</b>		<b>Probe tube:</b>	
	1	Outer diameter d = 22 mm, AISI 316L	
	2	Outer diameter d = 42 mm, flush-mounted, AISI 316L	
	5	Outer diameter d = 29 mm, AISI 316L, PPS/polyolefin for saltwater applications	
<b>70</b>		<b>Sensor range:</b>	
		<b>Measuring range</b>	
	1C	100 mbar/10 kPa/1.5 psi gauge, 1mH <sub>2</sub> O/3ftH <sub>2</sub> O/40inH <sub>2</sub> O	
	1D	200 mbar/20 kPa/3 psi gauge, 2mH <sub>2</sub> O/6ftH <sub>2</sub> O/80inH <sub>2</sub> O	
	1F	400 mbar/40 kPa/6 psi gauge, 4mH <sub>2</sub> O/13ftH <sub>2</sub> O/160inH <sub>2</sub> O	
	1G	600 mbar/60 kPa/9 psi gauge, 6mH <sub>2</sub> O/20ftH <sub>2</sub> O/240inH <sub>2</sub> O	
	1H	1 bar/100 kPa/15 psi gauge, 10mH <sub>2</sub> O/33ftH <sub>2</sub> O/400inH <sub>2</sub> O	
	1K	2 bar/200 kPa/30 psi gauge, 20mH <sub>2</sub> O/67ftH <sub>2</sub> O/800inH <sub>2</sub> O	
	1M	4 bar/400 kPa/60 psi gauge, 40mH <sub>2</sub> O/133ftH <sub>2</sub> O/1600inH <sub>2</sub> O	
	1P	10 bar/1 MPa/150 psi gauge, 100mH <sub>2</sub> O/333ftH <sub>2</sub> O/4000inH <sub>2</sub> O	
	1Q	20 bar/2 MPa/300 psi gauge, 200mH <sub>2</sub> O/667ftH <sub>2</sub> O/8000inH <sub>2</sub> O	
	2K	2 bar/200 kPa/30 psi absolute, 20mH <sub>2</sub> O/67ftH <sub>2</sub> O/800inH <sub>2</sub> O	
	2M	4 bar/400 kPa/60 psi absolute, 40mH <sub>2</sub> O/133ftH <sub>2</sub> O/1600inH <sub>2</sub> O	
	2P	10 bar/1 MPa/150 psi absolute, 100mH <sub>2</sub> O/333ftH <sub>2</sub> O/4000inH <sub>2</sub> O	
	2Q	20 bar/2 MPa/300 psi absolute, 200mH <sub>2</sub> O/667ftH <sub>2</sub> O/8000inH <sub>2</sub> O	
<b>80</b>		<b>Reference accuracy:</b>	
	D	Platinum	
	G	Standard	
<b>90</b>		<b>Calibration, unit:</b>	
	A	Sensor range; %	
	B	Sensor range; mbar/bar	
	C	Sensor range; kPa/MPa	
	D	Sensor range; mm/mH <sub>2</sub> O	
	E	Sensor range; inH <sub>2</sub> O/ftH <sub>2</sub> O	
	F	Sensor range; psi	
	J	Customized pressure; see additional specification	
	K	Customized level; see additional specification	
FMX21-			Order code

→ Ordering information for FMX21 continued on next page.



## Endress+Hauser

## Accessories

### Mounting clamp

- Endress+Hauser offers a mounting clamp for easy FMX21 mounting → [18](#).
- Material: 1.4404 (AISI 316L) and fiberglass reinforced PA (polyamide)
- Order number 52006151, see also "Ordering information" → [24](#),

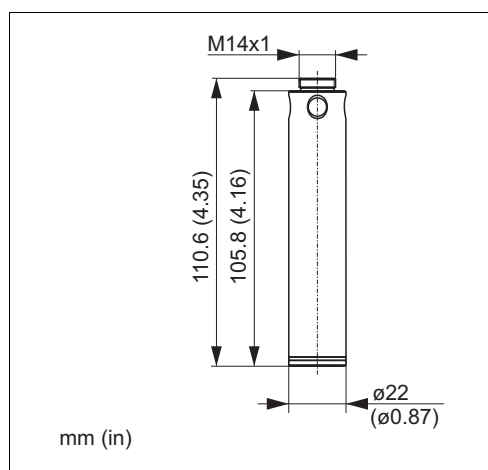
### Terminal box

- IP66/IP67 terminal boxes with GORE-TEX® filter incl. 3 integrated terminals.  
The terminal box is also suitable for installing a TMT182 temperature head transmitter or for four additional terminals (Order No. 52008938) → [19](#).
- "Ordering information" → [24](#)

Note!

The terminal box is not intended for the FMX21 with Ex nA explosion protection in the hazardous area.

### Additional weight (for FMX21 with outer diameter of 22 mm (0.87 in) or 29 mm (1.14 in))



- 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 FMX21. For FMX21 with an outer diameter of 29 mm (1.14 in) a maximum of 5 weights may be attached. In combination with the Ex nA approval, for FMX21 with an outer diameter of 29 mm (1.14 in) a maximum of 1 additional weight may be attached.
- Material: 1.4435 (AISI 316L)
- Weight: 300 g (10.581 oz)
- Order number 52006153, see also "Ordering information" → [24](#)

### TMT182 temperature head transmitter (4 to 20 mA/ HART)

- 2-wire temperature head transmitter, configured for a measuring range from -20 to +80 °C (-4 to +158 °F). 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 (-14 to +176 °F) → [20](#).
- "Ordering information" → [24](#),

Note!

The TM182 temperature head transmitter is not intended for use in hazardous areas incl. CSA GP.

### Extension cable mounting screw

- Endress+Hauser offers extension cable mounting screws to ease FMX21 mounting and to seal the measuring aperture → [19](#).
- Material: 1.4301 (AISI 304)
- order number 52008264 (G1½ A thread), order number 52009311 (NPT1½ thread), see also "Ordering information" → [24](#)

### Terminals

- Four terminals in strip for terminal box, suitable for wire cross-section: 0.08 to 2.5 mm<sup>2</sup> (28 to 14 AWG)
- Order number: 52008938

Note!

The 4-terminal strip is not intended for use in hazardous areas incl. CSA GP.

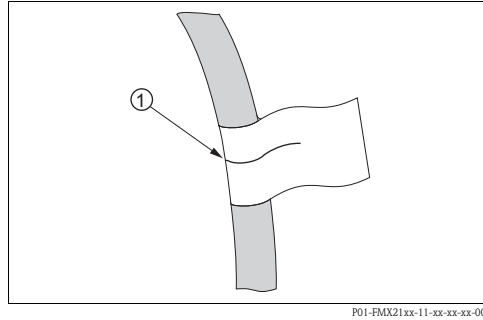
### Cable shortening kit

- The cable shortening kit is used to easily and professionally shorten a cable.
- → [24](#), "Ordering information" and the documentation SD00552P/00/A6.

Note!

The cable shortening kit is not intended for the FMX21 with FM/CSA approval.

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



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

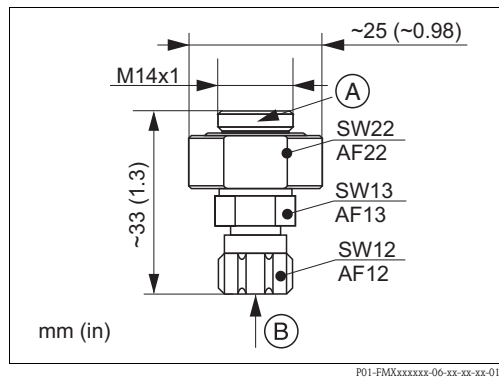
**Note!**

The mark is for installation purposes only.

The mark 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.

- To make installation easier, Endress+Hauser offers a mark on the extension cable for a customer-specific length, see also → 24 "Ordering information".
- Mark tolerance: up to  $\pm 50$  mm (1.97 in)  
(The mark tolerance corresponds to a measured error from up to  $\pm 50$  mm (1.97 in).
- Material: PET
- Adhesive: acrylic
- Immunity to temperature change:  
–30 to +100 °C (–22 to +212 °F)

**Testing adapter  
(for FMX21 with outer  
diameter of 22 mm (0.87 in)  
and 29 mm (1.14 in))**



Testing adapter

A FMX21 level probe connection

B Compressed air hose connection, internal diameter of quick coupling piece 4 mm (0.16 in)

- 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 → 24.
- Maximum pressure of the quick coupling piece supplied: 10 bar (145 psi)
- Adapter material: 1.4301 (AISI 304)
- Quick coupling piece material: anodized aluminum
- Adapter weight: 39 g (1.376 oz)
- Order number 52011868, see also → 24 "Ordering information".

## Additional documentation

<b>Field of activities</b>	<ul style="list-style-type: none"> <li>■ Pressure measurement: FA00004P/00/EN</li> <li>■ Recording technology: FA00014R/09/EN</li> <li>■ System components: FA00016K/09/EN</li> </ul>
<b>Technical Information</b>	<ul style="list-style-type: none"> <li>■ Technical Information Waterpilot FMX167 with 4 to 20 mA analog output: TI00351P/00/EN</li> <li>■ Technical Information Deltapilot M: TI00437P/00/EN</li> <li>■ Temperature head transmitter iTEMP HART TMT182: TI00078R/09/EN</li> </ul>
<b>Operating Instructions</b>	<ul style="list-style-type: none"> <li>■ Waterpilot FMX21: BA00380P/00/EN</li> <li>■ Cable shortening kit: SD00552P/00/A6</li> <li>■ Field Xpert: BA00060S/04/EN</li> </ul>
<b>Safety instructions</b>	<ul style="list-style-type: none"> <li>■ ATEX II 2 G: XA00454P/00/A3</li> <li>■ ATEX II 3 G: XA00485P/00/A3</li> <li>■ IECEx Ex ia IIC: XA00455P/00/EN</li> <li>■ NEPSI Ex ia IIC: XA00456P/00/B2</li> </ul>
<b>Installation/ Control Drawings</b>	<ul style="list-style-type: none"> <li>■ FM IS Cl. I, Div. 1, Gp. A – D / Cl. I Zone 1 IIC: ZD00231P/00/EN</li> <li>■ CSA C/US IS Cl. I, Div. 1, Gp. A – D / Cl. I Zone 1, IIC: ZD00232P/00/EN</li> </ul>
<b>Drinking water approval</b>	<ul style="list-style-type: none"> <li>■ SD00289P/00/A3 (NSF)</li> <li>■ SD00319P/00/A3 (KTW)</li> <li>■ SD00320P/00/A3 (ACS)</li> </ul>

# Configuration data sheet

Level

The following configuration data sheet has to be filled in and included with the order if the option "K: customized level" has been selected in feature "090: Calibration; unit" in the product structure.

Pressure engineering unit

☐ mbar

☐ bar

☐ psi

☐ mmHg

☐ kgf/cm2

☐ mmH2O

☐ mH2O

☐ ftH2O

☐ inH2O

☐ Pa

☐ kPa

☐ MPa

Output unit (Scaled unit)

☐ %

☐ m

☐ dm

☐ cm

☐ mm

☐ inch

☐ ft

☐ l

☐ hl

☐ m3

☐ gal

☐ lgal

☐ ft3

☐ in3

☐ kg

☐ t

☐ lb

Empty calibration (a)

(Empty) low pressure value \_\_\_\_\_  
(pres. eng. unit)

(Empty) low level value \_\_\_\_\_  
(scaled unit)

Full calibration (b)

(Full) high pressure value \_\_\_\_\_  
(pres. eng. unit)

(Full) high level value \_\_\_\_\_  
(scaled unit)

Damping

Damping: \_\_\_\_\_ sec

**Pressure**

The following configuration data sheet has to be filled in and included with the order if the option "J: customized pressure" has been selected in feature "090: Calibration; unit" in the product structure.

**Pressure Engineering Unit (a)**

- |                               |                                |                                  |                              |
|-------------------------------|--------------------------------|----------------------------------|------------------------------|
| <input type="checkbox"/> mbar | <input type="checkbox"/> mmH2O | <input type="checkbox"/> mmHg    | <input type="checkbox"/> Pa  |
| <input type="checkbox"/> bar  | <input type="checkbox"/> mH2O  |                                  | <input type="checkbox"/> kPa |
|                               | <input type="checkbox"/> ftH2O |                                  | <input type="checkbox"/> MPa |
| <input type="checkbox"/> psi  | <input type="checkbox"/> inH2O | <input type="checkbox"/> kgf/cm2 |                              |

**Calibration Range / Output**

LRV: \_\_\_\_\_ [pressure engineering unit]  
URV: \_\_\_\_\_ [pressure engineering unit]

**Damping**

Damping \_\_\_\_ sec



---

## Instruments International

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**Endress+Hauser**   
People for Process Automation







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 in): 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 in): 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 in): 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
- Usage in drinking water: 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

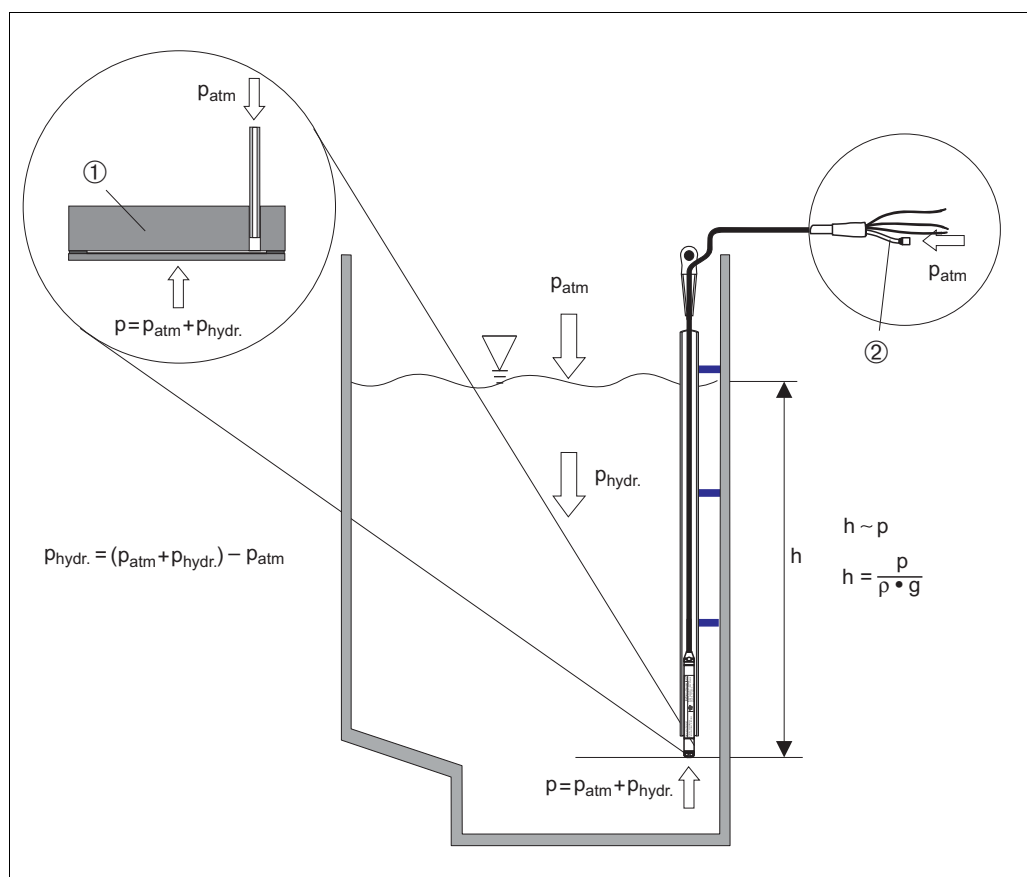
Waterpilot FMX167	 P01-FMX167xx-16-xx-xx-xx-002	 P01-FMX167xx-16-xx-xx-xx-003	 P01-FMX167xx-16-xx-xx-xx-004
Field of application	Hydrostatic level measurement in deep wells e.g. drinking water	Hydrostatic level measurement in wastewater	Hydrostatic level measurement in saltwater
	Caution! The Waterpilot 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.		
Process connection	– Mounting clamp – Extension cable mounting screw with G1 ½ A or 1 ½ NPT thread		
Outer diameter	22 mm (0.87 in)	42 mm (1.65 in)	max. 29 mm (max. 1.14 in)
Extension cable	– PE extension cable – PUR extension cable – FEP extension cable		
Seals	– FKM Viton – EPDM <sup>1)</sup>	– FKM Viton	– FKM Viton – EPDM <sup>1)</sup>
Measuring ranges	– 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) – Customer-specific measuring ranges; factory-calibrated		– 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) – Customer-specific measuring ranges; factory-calibrated
Overload	Up to 40 bar (580 psi)		Up to 25 bar (362 psi)
Process temperature	–10 to +70 °C (+14 to +158 °F)		0 to +50 °C (+32 to +122 °F)
Ambient temperature range	–10 to +70 °C (+14 to +158 °F)		0 to +50 °C (+32 to +122 °F)
Maximum measured error	±0.2 % of upper range value (URV)		
Supply voltage	10 to 30 V DC		
Output	4 to 20 mA (invertible)		
Options	– Drinking water approval		
	– Integrated Pt100 temperature sensor – Integrated Pt100 temperature sensor and TMT181 temperature head transmitter (4 to 20 mA HART) – Marine certificate		
Specialties	– Large selection of approvals, including ATEX II 2 G, FM and CSA – High-precision, robust ceramic measuring cell with long-term stability – Customer-specific cable marking		

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.



P01-FMX167xx-15-xx-xx-xx-002

### 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<sup>1)</sup>

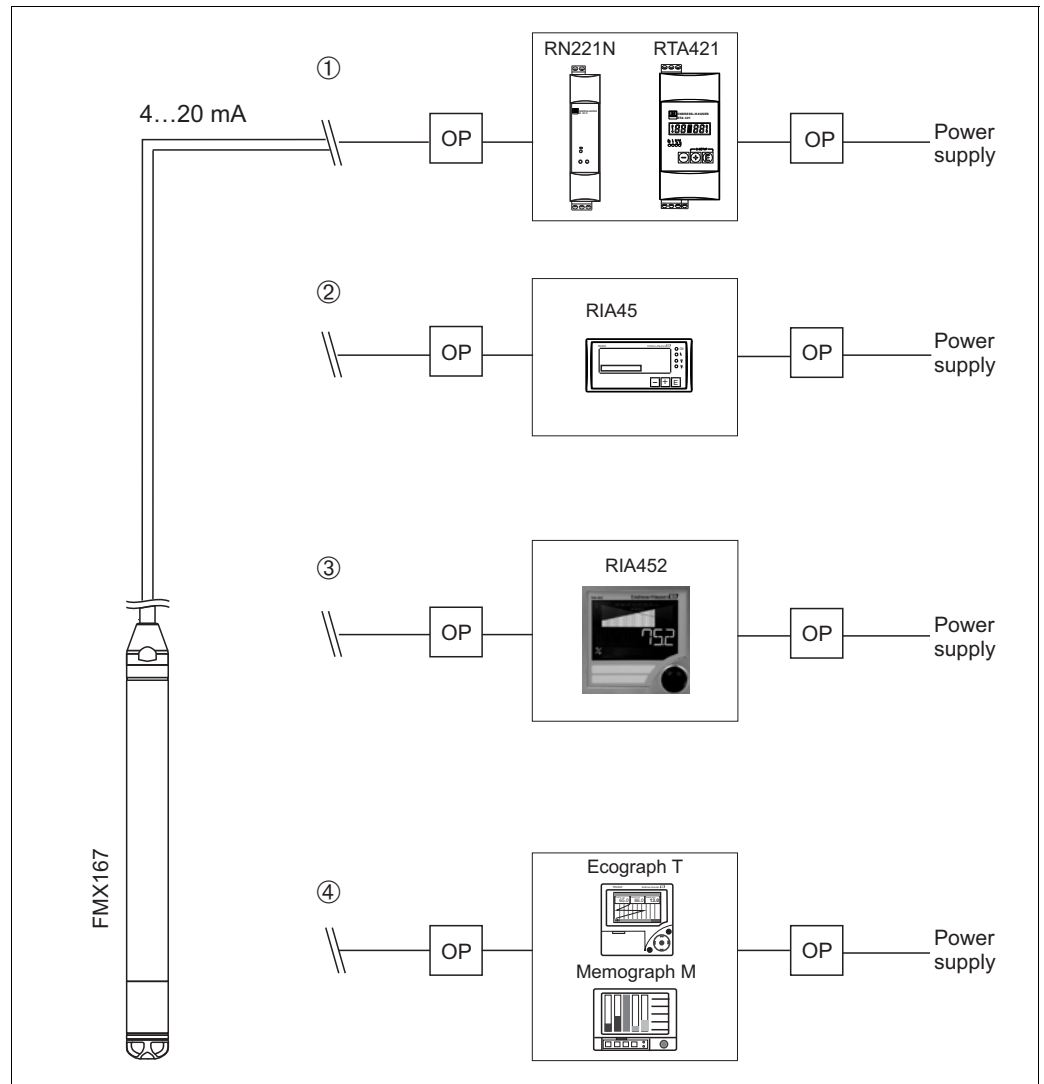
To convert the Pt100 signal to a 4 to 20 mA signal, Endress+Hauser also offers the TMT181 temperature head transmitter.

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:



F01-FMX167/xx-14-xx-xx-en-004

*Application examples with FMX167*

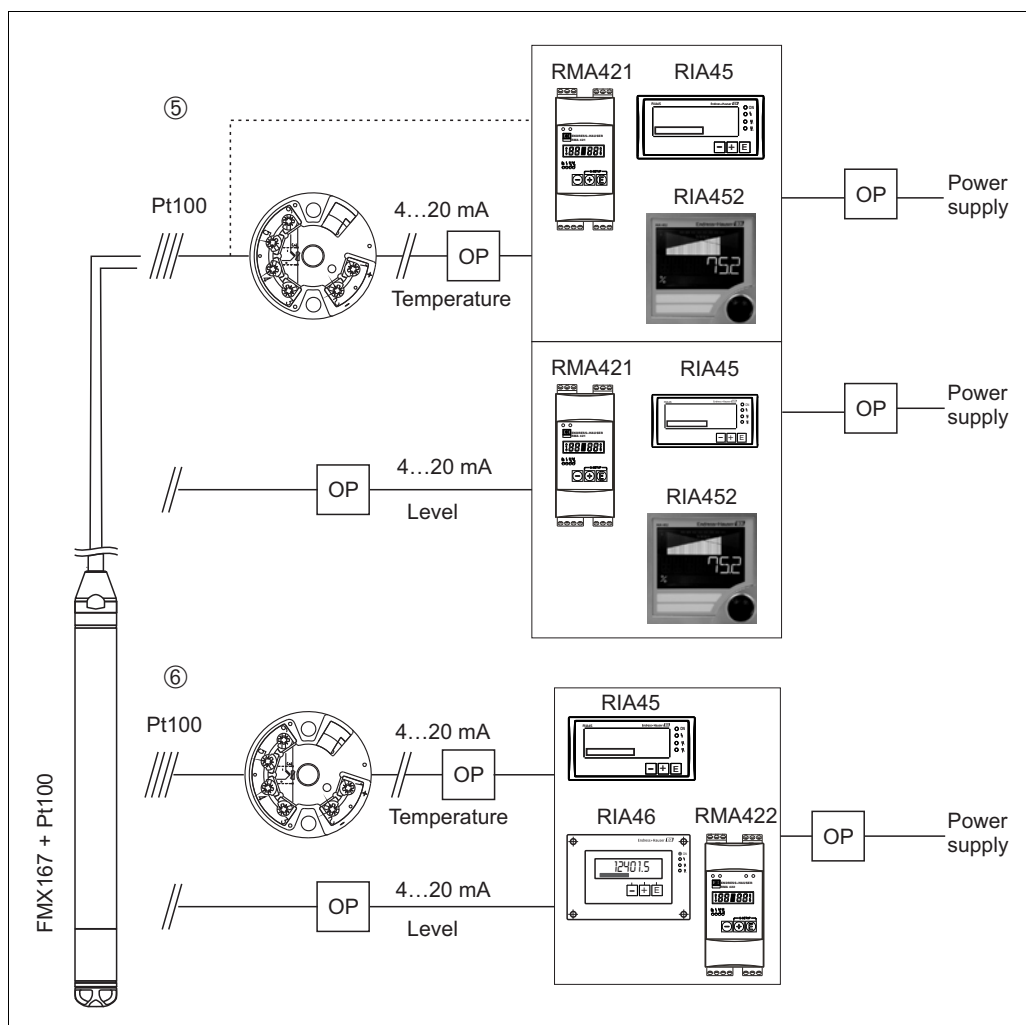
*OVP = Overvoltage protection e.g. HAW from Endress+Hauser (not for use in hazardous areas)*

*- 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-en-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> Temperature
--------------------------	---	--

<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"</li> <li>■ Customer-specific measuring ranges; factory-calibrated</li> <li>■ Temperature measurement from -10 to +70 °C (+14 to +158 °F) optional with Pt100</li> </ul>
------------------------	---

Sensor measuring range	Lowest span that can be calibrated	Maximum overload/OPL <sup>1)</sup>	Vacuum resistance
[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar <sub>abs</sub> (psi <sub>abs</sub> )]
0.1 (1.5)	0,01 (0.15)	5.0 (75.0)	0.3 (4.5)
0.2 (3.0)	0.02 (0.3)	5.0 (75.0)	0.3 (4.5)
0.4 (6.0)	0.04 (1.0)	7.0 (105)	0
0.6 (9.0)	0.06 (1.0)	10.0 (150)	0
1.0 (15.0)	0.1 (1.5)	10.0 (150)	0
2.0 (30.0)	0.2 (3.0)	18.0 (270)	0
4.0 (60.0)	0.4 (6.0)	25.0 (375)	0
10.0 (150) <sup>2)</sup>	1.0 (15)	40.0 (600)	0
20.0 (300) <sup>2)</sup>	2.0 (30)	40.0 (600)	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 (1.14 in).

<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> Pt100 resistance signal, 4-wire
---------------------	---	--

Output

Output signal	<div>FMX167 + Pt100 (optional)<div><div>■ FMX167: 4 to 20 mA for hydrostatic pressure measured value, two-wire</div><div>■ Pt100: Temperature-dependent resistance value of the Pt100</div></div></div> <div>TMT181 temperature head transmitter (optional)<div>4 to 20 mA for temperature measured value, two-wire</div></div>
---------------	---

Load	<div>FMX167 + Pt100 (optional)<div><math display="block">R_{tot} \leq \frac{U_b - 10\text{ V}}{0.0225\text{ A}} - 2 \cdot 0.09 \frac{\Omega}{\text{m}} \cdot l - R_{add}</math><div>P01-FMX167xx-16-xx-xx-xx-000</div></div></div> <div>TMT181 temperature head transmitter (optional)<div><math display="block">R_{tot} \leq \frac{U_b - 8\text{ V}}{0.025\text{ A}} - R_{add}</math><div>P01-FMX167xx-16-xx-xx-xx-001</div></div></div>
------	---

$R_{ges}$

=

Max. load resistance [Ω]

$R_{add}$

=

additional resistances such as resistance of evaluation unit and/or display unit, cable resistance [Ω]

$U_b$

=

Supply voltage [V]

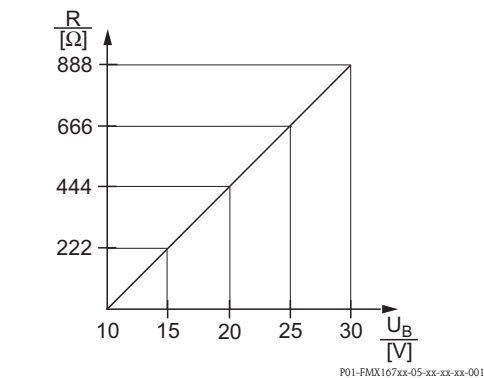
$l$

=

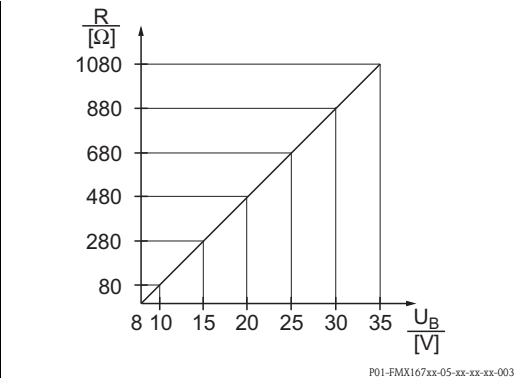
Simple length of extension cable [m] (cable resistance per wire ≤ 0.09 /Ωm)

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.



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.



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.



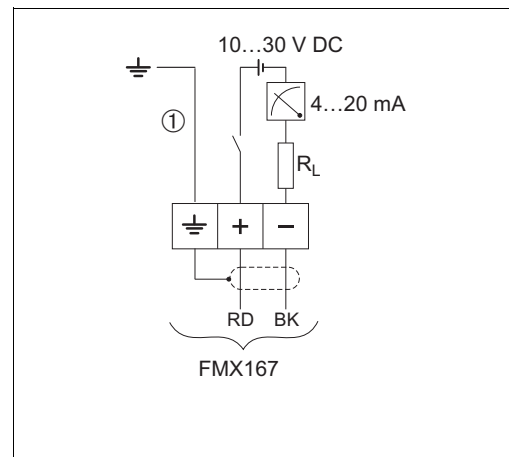
## Power supply

### Measuring unit electrical connection

Note!

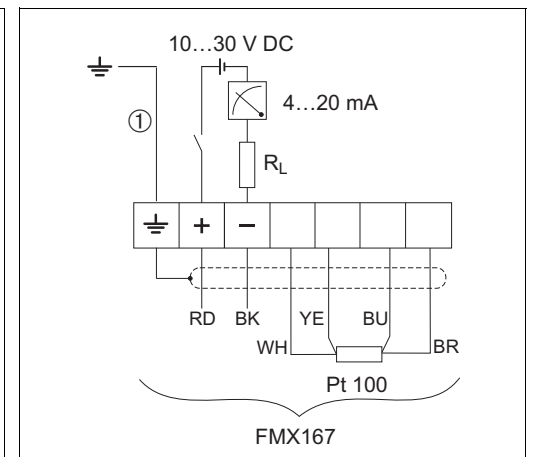
- When using the measuring device in hazardous areas, installation must comply with the applicable national standards and regulations and the Safety Instructions (XAs) or the Installation or Control Drawings (ZDs), see also → 24, "Safety instructions", "Installation/Control Drawings".
- Reverse polarity 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, "Ordering information") or as an accessory (order number: 52006252).

#### Waterpilot FMX167, standard



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

#### Waterpilot FMX167 with Pt100<sup>1)</sup>

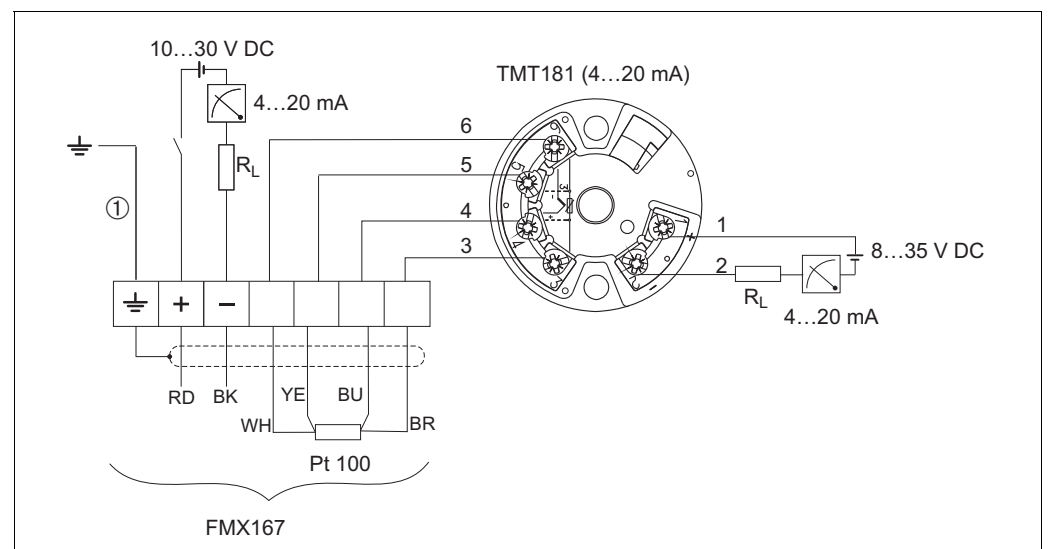


Electrical connection with Pt100, versions "1" or "4" for Feature 70 "Additional options" in the order code (→ 21).

① Not for FMX167 with outer diameter 29 mm (1.14 in).

<sup>1)</sup> Not for use in hazardous areas.

#### Waterpilot FMX167 with Pt100 and TMT181 temperature head transmitter TMT181 (4 to 20 mA)<sup>1)</sup>



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 (1.14 in)

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

<sup>1)</sup> Not for use in hazardous areas.

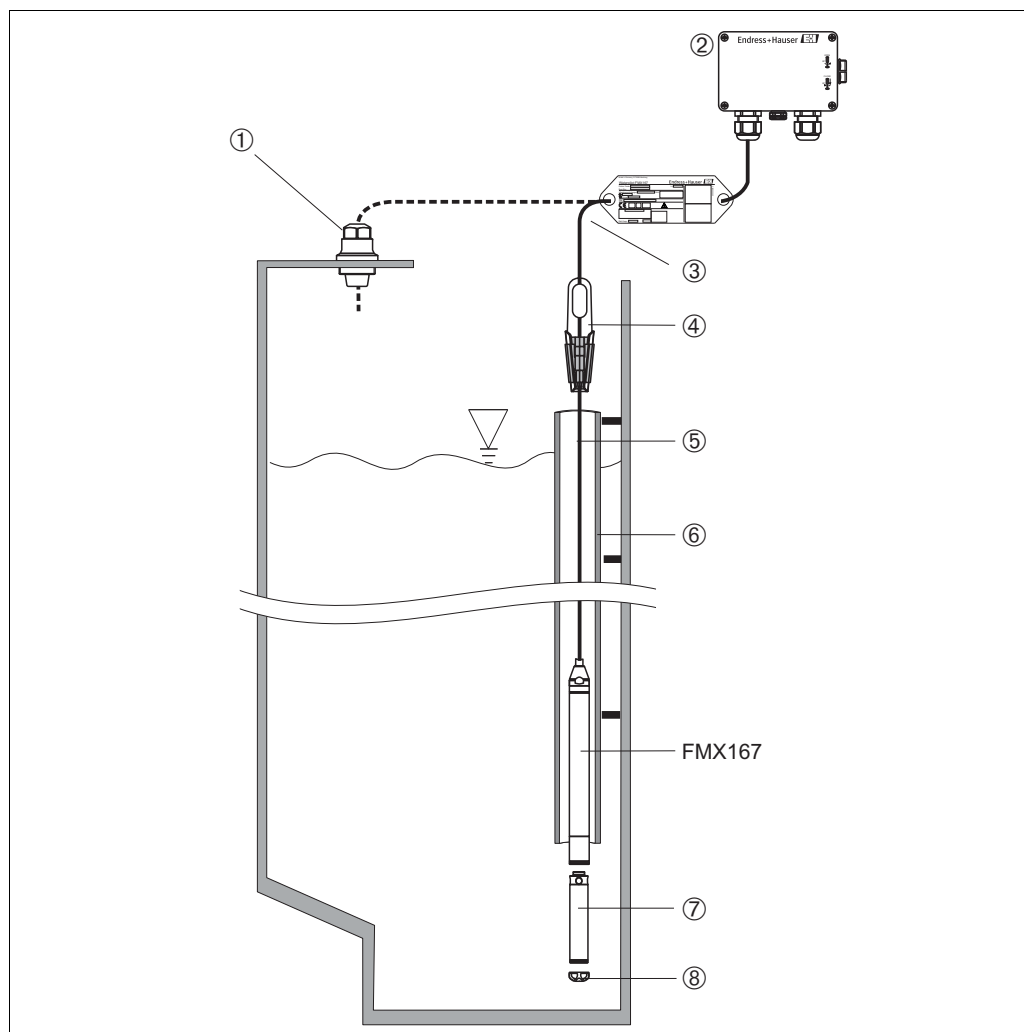
<b>Supply voltage</b>	<p>Note!</p> <p>When using the measuring device in hazardous areas, installation must comply with the applicable national standards and regulations and the Safety Instructions (XAs) or the Installation or Control Drawings (ZDs). → 24, Sect. "Safety instructions", "Installation/Control Drawings".</p> <div> <div> <b>FMX167 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ FMX167: 10 to 30 V DC</li> <li>■ Pt100: 10 to 30 V DC</li> </ul> </div> <div> <b>TMT181 temperature head transmitter (optional)</b> <p>8 to 35 V DC</p> </div> </div>
<b>Cable specification</b>	<div> <div> <b>FMX167 + Pt100 (optional)</b> <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> (28 to 14 AWG)</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> </div> <div> <b>TMT181 temperature head transmitter (optional)</b> <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> (28 to 14 AWG)</li> <li>■ Transmitter connection: max. 1.75 mm<sup>2</sup> (15 AWG)</li> </ul> </div> </div>
<b>Power consumption</b>	<div> <div> <b>FMX167 + Pt100 (optional)</b> <p>≤ 0.675 W at 30 V DC</p> </div> <div> <b>TMT181 temperature head transmitter (optional)</b> <p>≤ 0.875 W at 35 V DC</p> </div> </div>
<b>Current consumption</b>	<div> <div> <b>FMX167 + Pt100 (optional)</b> <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> </div> <div> <b>TMT181 temperature head transmitter (optional)</b> <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> </div> </div>
<b>Residual ripple</b>	<div> <div> <b>FMX167 + Pt100 (optional)</b> <p>No effect for 4 to 20 mA signal up to ±5 % residual ripple within permissible range</p> </div> <div> <b>TMT181 temperature head transmitter (optional)</b> <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> </div> </div>

## Performance characteristics

<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 $23\text{ °C}$ (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>* 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-FMX167xxx-11-xxx-xx-xx-003

Installation examples, here shown the FMX167 with an outer diameter 22 mm (0.87 in)

- 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 (4.72 in)
- 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 (0.87 in) and 29 mm (1.14 in) → 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 (0.04 in) 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.
- If the cable is shortened, the filter at the pressure compensation tube has to be reattached. Endress+Hauser offers a cable shortening kit for this purpose, see the documentation SD00552P/00/A6.
- Endress+Hauser recommends using twisted, shielded cables for any further wiring.
- Note for ship building applications: Measures for limitation of the propagation of fire along cable bundles are required (fire stops).

## Ambient conditions

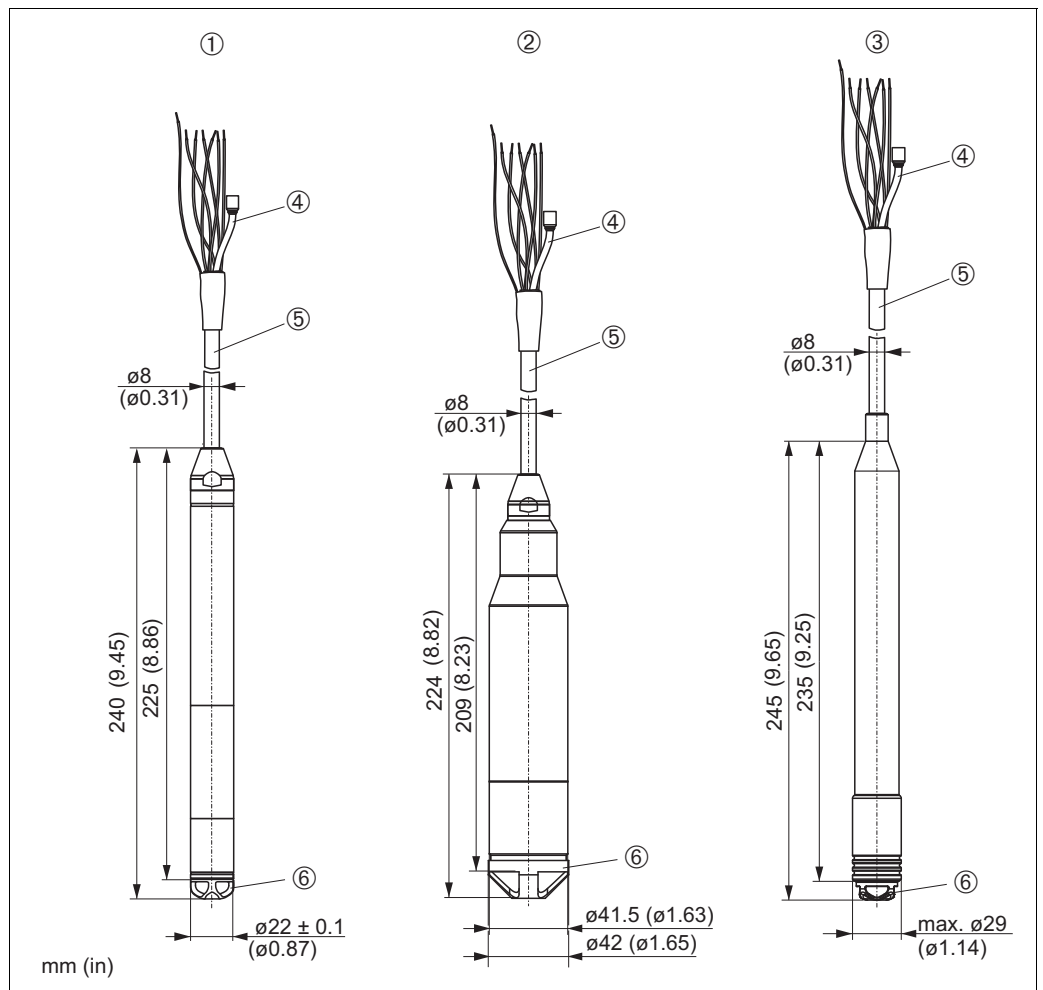
<b>Ambient temperature range</b>	<b>FMX167 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ with outer diameter of 22 mm (0.87 in) and 42 mm (1.65 in): –10 to +70 °C (14 to +158 °F) (= medium temperature)</li> <li>■ with outer diameter of 29 mm (1.14 in): 0 to +50 °C (+32 to +122 °F) (= medium temperature)</li> </ul> <b>Terminal box</b> –40 to +80 °C (–40 to +176 °F)	<b>TMT181 temperature head transmitter (optional)</b> –40 to +85 °C (–40 to +185 °F)
<b>Storage temperature range</b>	<b>FMX167 + Pt100 (optional)</b> –40 to +80 °C (–40 to +176 °F)  <b>Terminal box</b> –40 to +80 °C (–40 to +176 °F)	<b>TMT181 temperature head transmitter (optional)</b> –40 to +100 °C (–40 to +212 °F)
<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> Interference emission to EN 61326 Class B equipment, interference immunity to EN 61326 Appendix A (Industrial)
<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.

## Process conditions

<b>Medium temperature range</b>	<b>FMX167 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ with outer diameter of 22 mm (0.87 in) and 42 mm (1.65 in): –10 to +70 °C (–14 to +158 °F)</li> <li>■ FMX167 with outer diameter of 29 mm (1.14 in): 0 to +50 °C (+32 to 122 °F)</li> </ul>	<b>TMT181 temperature head transmitter (optional)</b>  –40 to +85 °C (–40 to +185°F) (= ambient temperature), install temperature head transmitter outside medium.
<b>Medium temperature limits</b>	<b>FMX167 + Pt100 (optional)</b> <ul style="list-style-type: none"> <li>■ with outer diameter of 22 mm (0.87 in) and 42 mm (1.65 in): –20 to +70 °C (–4 to +158 °F)</li> </ul> <p>Note! In hazardous areas incl. CSA GP, the medium temperature limit is at –10 to +70 °C (+14 to +158 °F).</p> <ul style="list-style-type: none"> <li>■ with outer diameter of 29 mm (1.14 in): 0 to +50 °C (+32 to +122 °F)</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

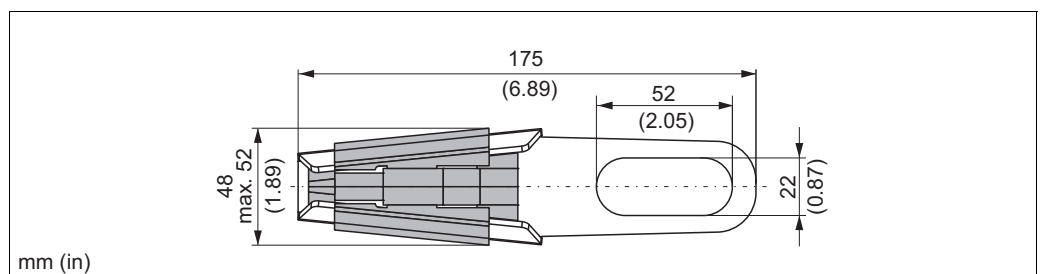


P01-FMX167xx-06-xx-xx-xx-006

#### Versions of FMX167

- 1 Version "A" or "D" for Feature 30 "Probe tube" in the order code ( $\rightarrow$  21)
- 2 Version "B" for Feature 30 "Probe tube" in the order code ( $\rightarrow$  21)
- 3 Version "C" for Feature 30 "Probe tube" in the order code ( $\rightarrow$  21)
- 4 Pressure compensation tube
- 5 Extension cable
- 6 Protection cap

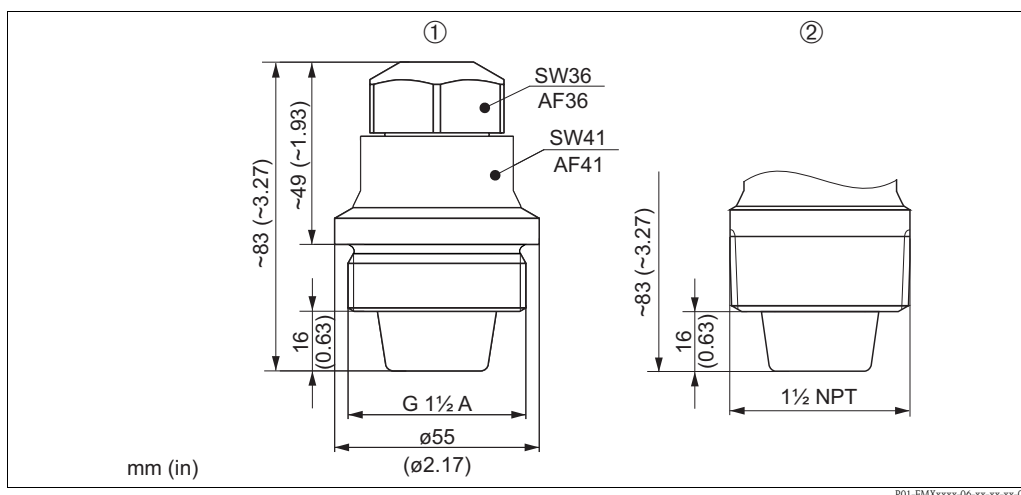
### Dimensions of the mounting clamp



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

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

### Dimensions of the extension cable mounting screws



P01-FMXxxx-06-xx-xx-xx-009

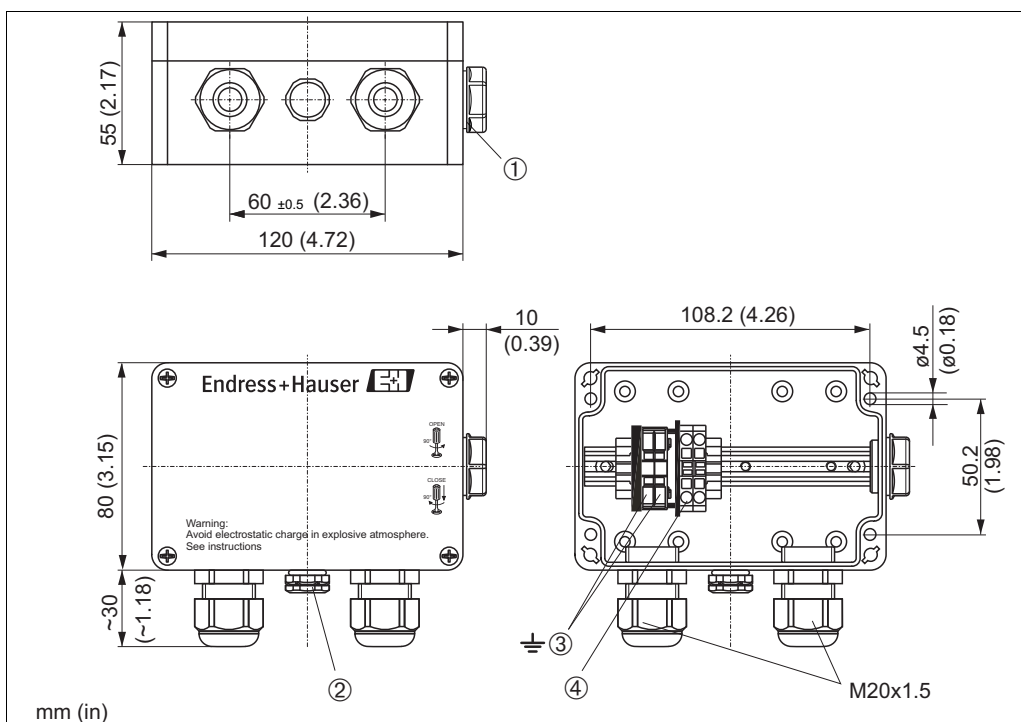
#### Extension cable mounting screws

- 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



P01-FMX167xx-06-xx-xx-xx-011

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

- 1 Dummy plug M20x1.5
- 2 GORE-TEX® filter
- 3 Ground connection / terminals for 0.08 to 2.5 mm<sup>2</sup> (28 to 14 AWG)
- 4 4 to 20 mA / terminals for 0.08 to 2.5 mm<sup>2</sup> (28 to 14 AWG)

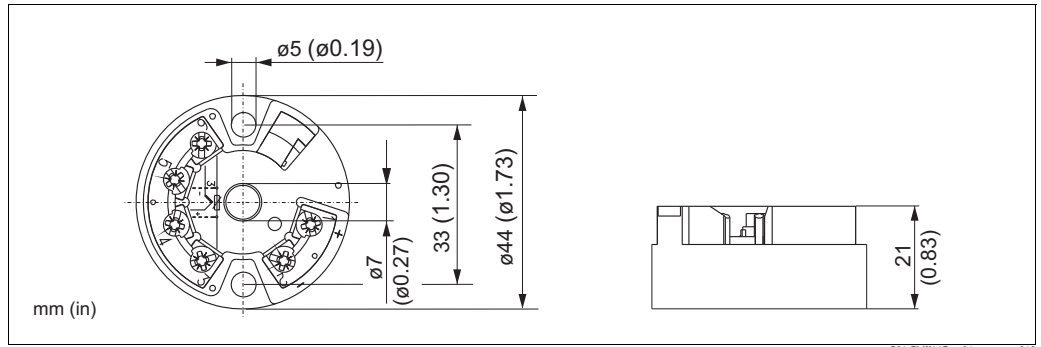
If ordered together with FMX167 but without the optional TMT181 temperatur transmitter, the terminal box is incl. a 4-terminal strip.

#### Note!

The 4-terminal strip is not intended for use in hazardous areas incl. CSA GP.



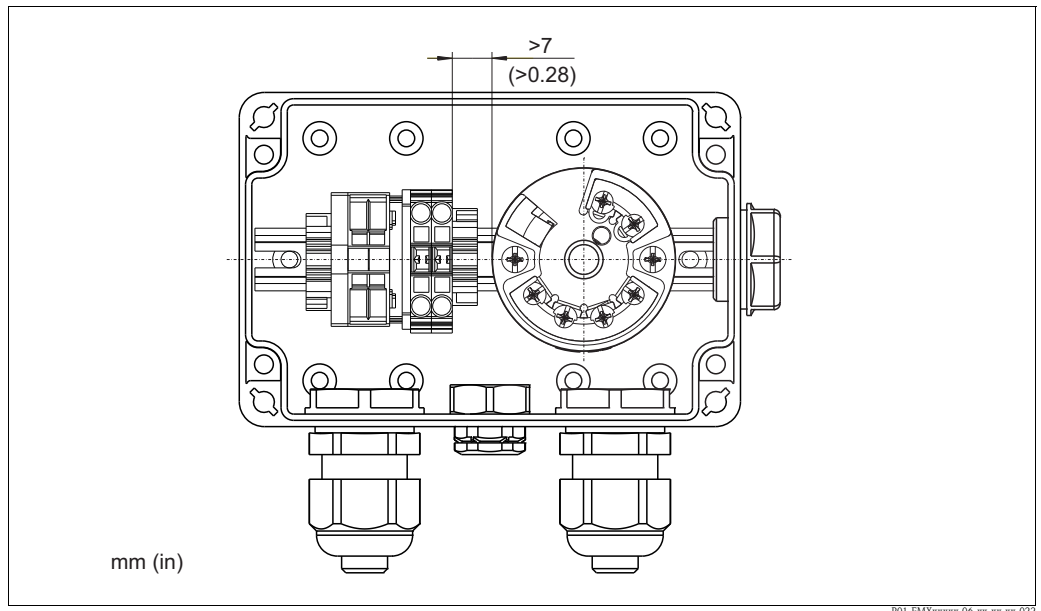
### Dimensions of the TMT181 temperature head transmitter



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.

### Terminal box with integrated TMT181 temperature head transmitter







#### Note!

A distance of >7 mm (>0.28 in) must be maintained between the terminal strip and the TMT181 temperature head transmitter.

### Weight

- Level probe, outer diameter 22 mm (0.87 in): 290 g (10.228 oz)
- Level probe, outer diameter 42 mm (1.65 in): 1150 g (40.561 oz)
- Level probe, outer diameter 29 mm (1.14 in): 340 g (11.992 oz)
- PE extension cable: 52 g/m (0.33 lbs/1 ft)
- PUR extension cable: 60 g/m (0.039 lbs/1 ft)
- FEP extension cable: 108 g/m (0.072 lbs/1 ft)
- Mounting clamp: 170 g (5.996 oz)
- Extension cable mounting screw G 1 ½ A: 770 g (27.158 oz)
- Extension cable mounting screw 1 ½ NPT: 724 g (25.535 oz)
- Terminal box: 235 g (8.288 oz)
- Temperature head transmitter TMT181: 40 g (1.411 oz)
- Additional weight: 300 g (10.581 oz)
- Testing adapter: 39 g (1.376 oz)

<b>Material</b>	<ul style="list-style-type: none"> <li>■ Level probe, outer diameter 22 mm (0.87 in): 1.4435 (AISI 316L)</li> <li>■ Level probe, outer diameter 42 mm (1.65 in): 1.4435 (AISI 316L)</li> <li>■ Level probe, outer diameter 29 mm (1.14 in): 1.4435 (AISI 316L) <ul style="list-style-type: none"> <li>– Sensor sleeve: PPS (polyphenylene sulfide), Heat-shrink sleeve/cover: Polyolefin</li> <li>Metal does not come into contact with the medium.</li> </ul> </li> <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: – PPO (polyphenylene oxide) for FMX167 with outer diameter 22 mm (0.87 in) and 29 mm (1.14 in). <ul style="list-style-type: none"> <li>– PFA (perfluoroalkoxy) for FMX167 with outer diameter 42 mm (1.65 in).</li> </ul> </li> <li>■ Extension cable insulation: Either PE-LD (low-density polyethylene), FEP (fluorinated ethylene propylene) or PUR (polyurethane). For more information, see →  18, "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>
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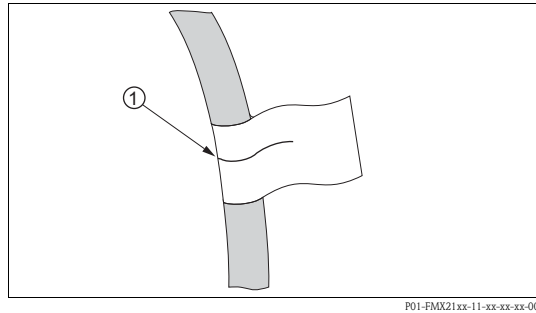
<b>Extension cable</b>	<p><b>PE extension cable</b></p> <ul style="list-style-type: none"> <li>■ Abrasion-resistant extension cable with Dynema strain-relief members; shielded with aluminum-coated film; insulated with polyethylene (PE), black; copper wires, twisted</li> <li>■ Pressure compensation tube 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 (0.31 in) ±0.25 mm (±0.01 in)</li> <li>■ FMX167: 3 x 0.227 mm<sup>2</sup> (3 x 26 AWG) + pressure compensation tube with Teflon filter</li> <li>■ FMX167 with Pt100 (optional): 7x0.227 mm<sup>2</sup> (7x26 AWG) + pressure compensation tube with Teflon filter</li> <li>■ Pressure compensation tube with Teflon filter: Outer diameter 2.5 mm (0.1 in), internal diameter 1.5 mm (0.06 in)</li> </ul> <p><b>Cable resistance of PE/PUR/FEP extension cable</b></p> <p>Cable resistance per wire: ≤ 0.09 Ω/m</p> <p><b>Cable length of PE/PUR/FEP extension cable</b></p> <ul style="list-style-type: none"> <li>■ Please refer also to →  8, Sect. "Load".</li> <li>■ Cable length that can be ordered <ul style="list-style-type: none"> <li>– Customer-specific length in meters or feet (→  21, "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 →  24, "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 (4.72 in)</li> <li>■ Tensile strength: max. 950 N (213.56 lbf)</li> <li>■ Cable extraction force: typical ≥ 400 N (89.92 lbf) PE, FEP / typical ≥ 150 N (33.72 lbf) 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>
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<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> (28 to 14 AWG)</li> </ul>
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Note!

The 4-terminal strip is not intended for use in hazardous areas incl. CSA GP.

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





*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 (1.97 in) (the mark tolerance corresponds to a measured error from up to  $\pm 50$  mm (1.97 in))
- Material: PET
- Adhesive: acrylic
- Immunity to temperature change:  $-30$  to  $+100$  °C ( $-22$  to  $212$  °F)

**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>	<p>The device meets the legal requirements of the applicable EC Directives.</p> <p>Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.</p>
<b>Approvals, types of protection</b>	<ul style="list-style-type: none"> <li>■ ATEX II 2 G Ex ia IIC T6 Gb <sup>1)</sup></li> <li>■ ATEX II 3 G Ex 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> <li>■ CSA: General Purpose</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 →  24, 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 certificate</b>	<ul style="list-style-type: none"> <li>■ GL (Germanischer Lloyd)</li> <li>■ ABS (American Bureau of Shipping)</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> <ul style="list-style-type: none"> <li>■ DIN EN 60770 (IEC 60770): Transmitters for use in industrial process control systems Part 1: Methods for performance evaluation</li> <li>■ DIN 16086: Electrical pressure measuring instruments, pressure sensors, pressure transmitters, pressure measuring instruments, concepts, specifications on data sheets</li> <li>■ EN 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements</li> <li>■ EN 61010-1 (IEC 61010-1): Safety requirements for electrical equipment for measurement, control and laboratory use</li> <li>■ EN 60529: Degrees of protection provided by enclosures</li> </ul>

## 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, AISI 316L with heat-shrink sleeve PPS/polyolefin for saltwater applications	
	D	Outer diameter d = 22 mm, AISI 316L + potable water approval KTW/NSF/ACS (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 mH <sub>2</sub> O, 300 psi, 600 ftH <sub>2</sub> O)	
<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)

60						<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
70						<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
995						<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"

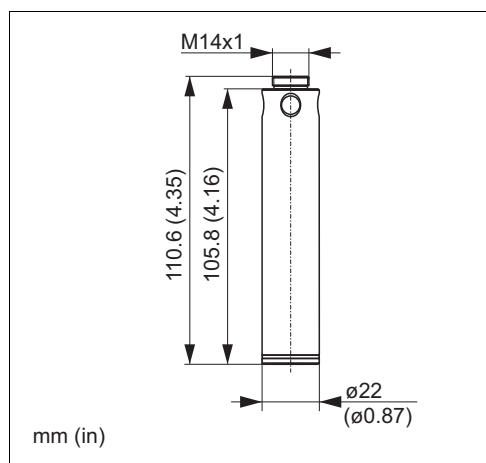
### Terminal box

- 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

Note!

The terminal box is not intended for the FMX167 with Ex nA explosion protection in the hazardous area.

### Additional weight (for FMX167 with an outer diameter of 22 mm (0.87) and 29 mm 1.14 in))



- 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 (1.14 in), a maximum of 5 weights may be screwed on to FMX167.
- Material: 1.4435 (AISI 316L)
- Weight: 300 g (10.581 oz)
- Order number: 52006153

### TMT181 temperature head transmitter

- 2-wire temperature head transmitter, configured for a measuring range from  $-20$  to  $+80$  °C ( $-4$  to  $176$  °F). 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 ( $-14$  to  $158$  °F) → 23.
- Order number: 52008794

Note!

The TM181 temperature head transmitter is not intended for use in hazardous areas incl. CSA GP.

### 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> (28...14 AWG)
- Order number: 52008938

Note!

The 4-terminal strip is not intended for use in hazardous areas incl. CSA GP.

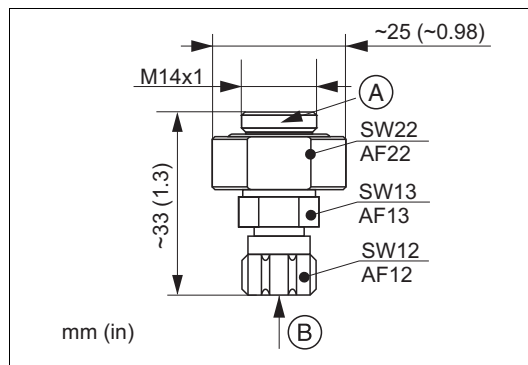
### Cable shortening kit

The cable shortening kit is used to easily and professionally shorten a cable, see SD00552P/00/A6.

Note!

The cable shortening kit is not intended for the FMX167 with FM/CSA approval.

### Test adapter (for FMX167 with an outer diameter of 22 mm (0.87) and 29 mm 1.14 in))



P01-FMXxxxxxx-06-xx-xx-xx-013

Testing adapter

A FMX167 level probe connection

B Compressed air hose connection, internal diameter of quick coupling piece 4 mm (0.16 in)

- 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 (145 psi)
- Adapter material: 1.4301 (AISI 304)
- Quick coupling piece material: anodized aluminum
- Adapter weight: 39 g (1.376 oz)
- Order number: 52011868

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## Additional documentation

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<b>Field of activities</b>	<ul style="list-style-type: none"><li>■ Pressure measurement: FA00004P/00/EN</li><li>■ Recording technology: FA00014R/09/EN</li><li>■ System components: FA00016K/09/EN</li></ul>
<b>Technical Information</b>	<ul style="list-style-type: none"><li>■ Technical Information Waterpilot FMX21 with 4 to 20 mA with HART output signal: TI00431P/00/EN</li><li>■ Technical Information Deltapilot M: TI00437P/00/EN</li><li>■ Temperature Head Transmitter iTEMP PCP TMT181: TI00070R/09/EN</li></ul>
<b>Operating Instructions</b>	<ul style="list-style-type: none"><li>■ Waterpilot FMX167: BA00231P/00/EN</li><li>■ Cable shortening kit: SD00552P/00/A6</li></ul>
<b>Safety instructions</b>	<ul style="list-style-type: none"><li>■ ATEX II 2 G: XA00131P/00/A3</li><li>■ ATEX II 3 G: XA00132P/00/A3</li></ul>
<b>Installation/Control Drawings</b>	<ul style="list-style-type: none"><li>■ FM IS Class I, Div. 1, Groups A – D: ZD00063P/00/EN</li><li>■ CSA IS Class I, Div. 1, Groups A – D: ZD00064P/00/EN</li></ul>
<b>Drinking water approval</b>	<ul style="list-style-type: none"><li>■ SD00289P/00/A3 (NSF)</li><li>■ SD00126P/00/A3 (KTW/ACS)</li></ul>

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