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

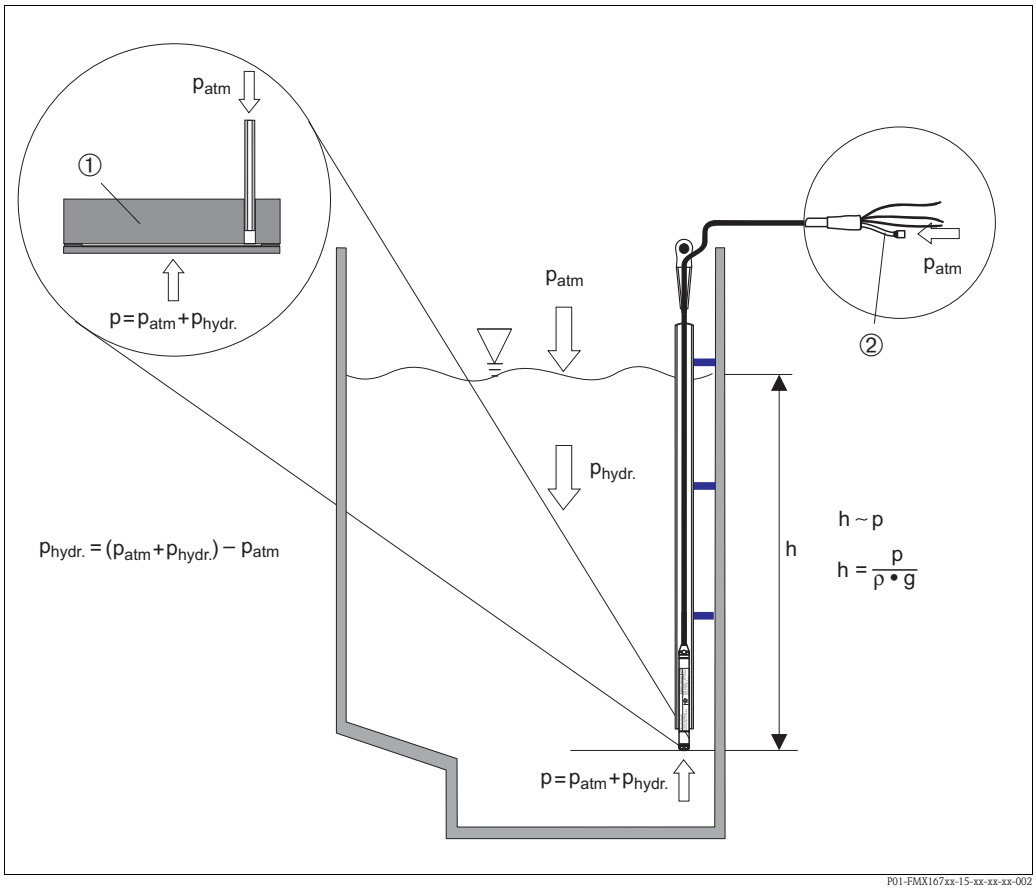
Device selection

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 [1]	– FKM Viton	– FKM Viton – EPDM [1]
Measuring ranges	– Nine fixed pressure measuring ranges in bar, mH_2O, psi and ftH_2O, from 0 to 0.1 bar to 0 to 20 bar (0 to 1 mH_2O to 0 to 200 mH_2O/ 0 to 1.5 psi to 0 to 300 psi/0 to 3 ftH_2O to 0 to 600 ftH_2O) – Customer-specific measuring ranges; factory-calibrated		– Seven fixed pressure measuring ranges in bar, mH_2O, psi and ftH_2O, from 0 to 0.1 bar to 0 to 4 bar (0 to 1 mH_2O to 0 to 40 mH_2O/ 0 to 1.5 psi to 0 to 60 psi/ 0 to 3 ftH_2O to 0 to 150 ftH_2O) – 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.



Measuring principle

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

Temperature measurement with optional Pt100[1)]

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 [1)]

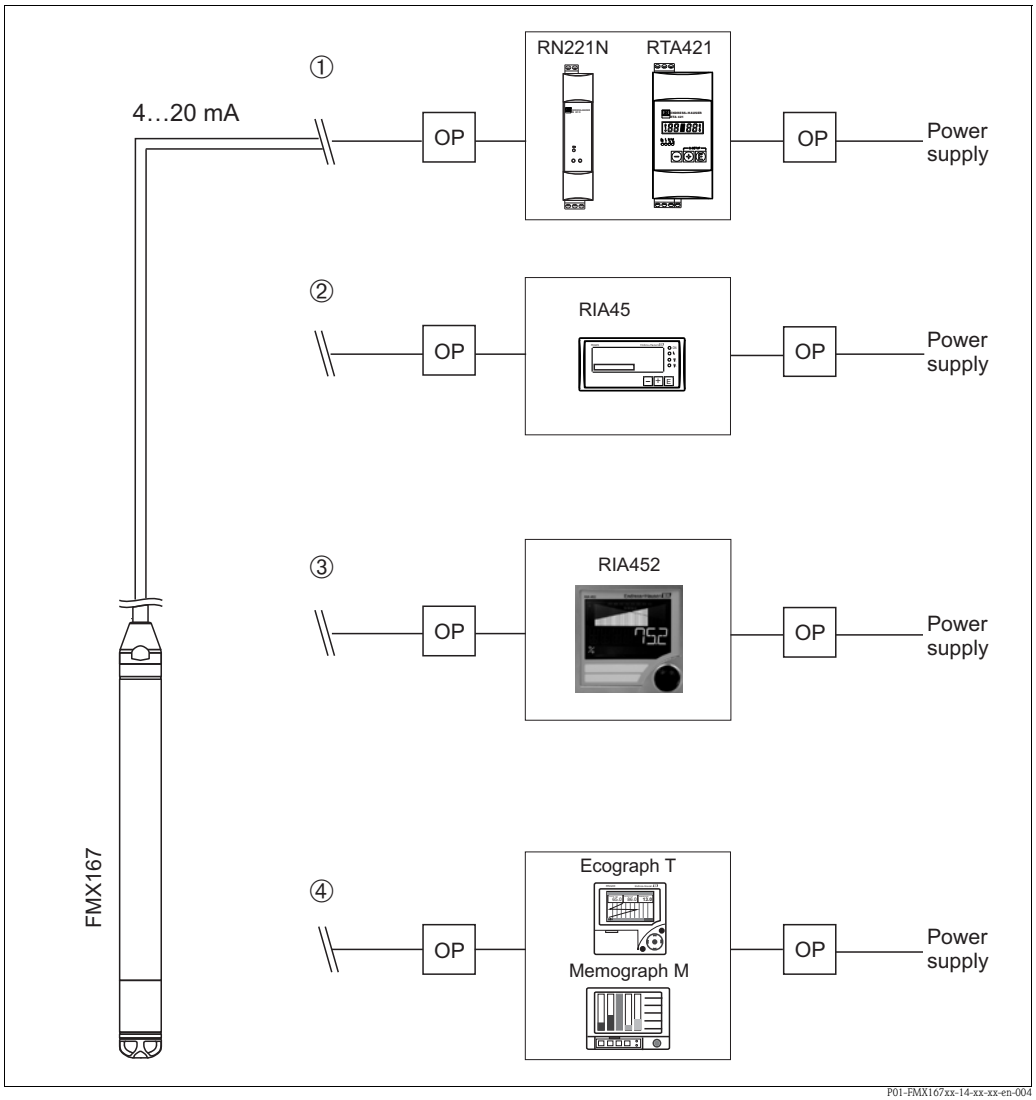
To convert the Pt100 signal to a 4 to 20 mA signal, Endress+Hauser also offers the TMT181 temperature transmitter.

1) Not for use in hazardous areas.

Measuring system

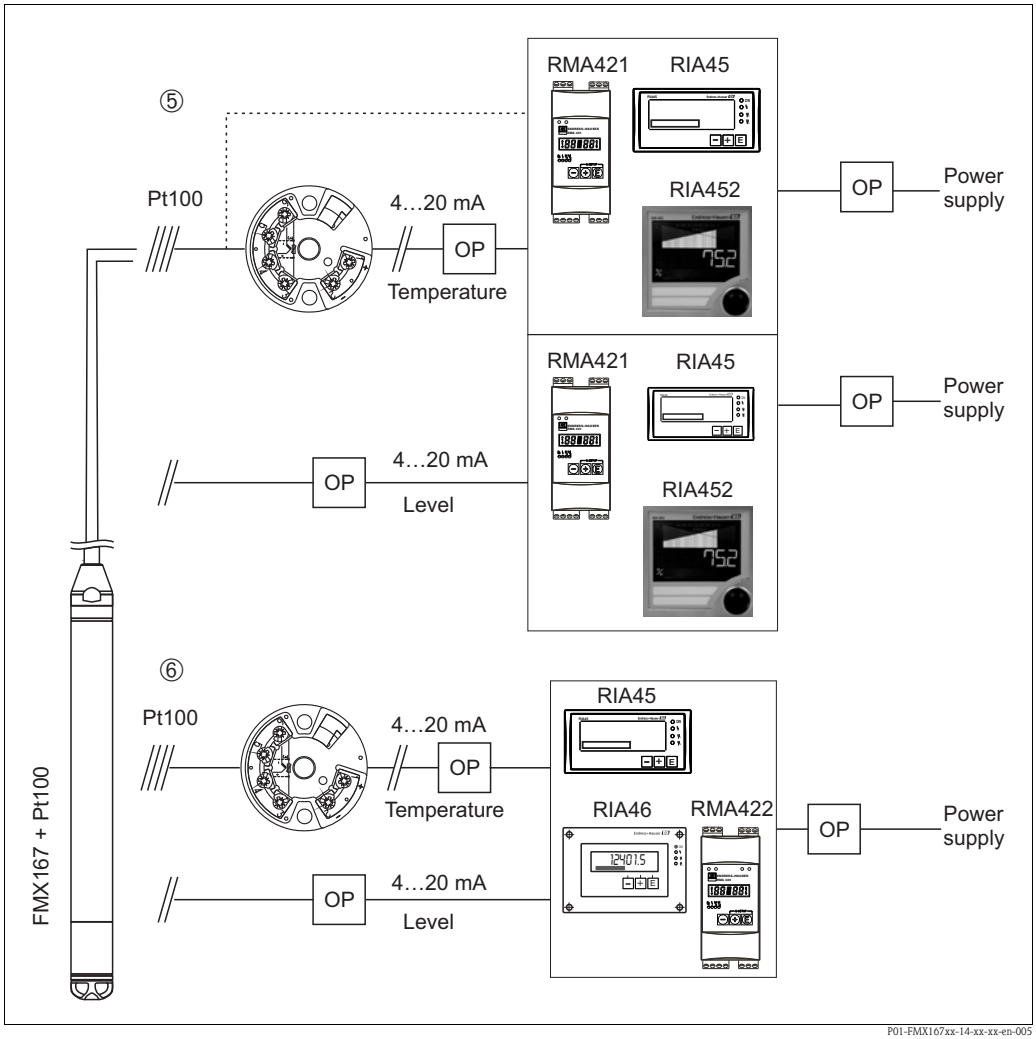
The complete standard measuring system consists of Waterpilot and a transmitter power supply unit with supply voltage of 10 to 30 V DC.

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



Application examples with FMX167
OVP = Overvoltage protection e.g. HAW from Endress+Hauser (not for use in hazardous areas)
- OVP on the sensor side for field installation: HAW569/for top-hat rail/DINrail: HAW562
- OVP on the supply side for top-hat rail/DINrail: HAW561 (115/230 V) and HAW561K (24/48 V AC/DC)
Option dependent on supply voltage.

1. Simple cost-effective measuring point solution: Power supply of Waterpilot in hazardous and non-hazardous areas using RN221N active barrier.
   Power supply and additional control of two consumers, e.g. pumps, via limit switch RTA421 with onsite display.
2. Evaluation unit RIA45 (for panel mounting) provides a power supply system, an onsite display and two switch outputs.
3. If several pumps are used, the pump service life can be prolonged by alternate switching. With alternating pump control, the pump which was out of service for the longest period of time is switched on. The evaluation unit RIA452 (for panel mounting) provides this option in additional 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.



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

Measured variable

FMX167 + Pt100 (optional)

- Hydrostatic pressure of a liquid
- Pt100: Temperature of a liquid

TMT181 temperature head transmitter (optional)

Temperature

Measuring range

- Nine fixed pressure measuring ranges in bar, mH_2O, psi and ftH_2O; → 21, "Ordering information"
- Customer-specific measuring ranges; factory-calibrated
- Temperature measurement from –10 to +70 °C (+14 to +158 °F) optional with Pt100

Sensor measuring range [bar (psi)]	Lowest span that can be calibrated [bar (psi)]	Maximum overload/OPL 1) [bar (psi)]	Vacuum resistance [bar_{abs}(psi_{abs})]
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) 2)	1.0 (15)	40.0 (600)	0
20.0 (300) 2)	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).

Input signal

FMX167 + Pt100 (optional)

- Change in capacitance
- Pt100: change in resistance

TMT181 temperature head transmitter (optional)

Pt100 resistance signal, 4-wire

Output

Output signal

FMX167 + Pt100 (optional)

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

TMT181 temperature head transmitter (optional)

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

Load

FMX167 + Pt100 (optional)

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

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

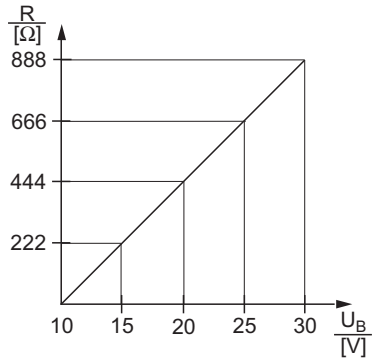
TMT181 temperature head transmitter (optional)

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

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

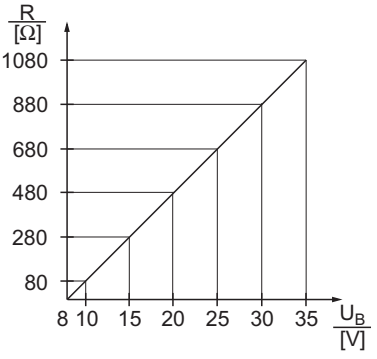
R_{ges} = *Max. load resistance [Ω]*
R_{add} = *additional resistances such as resistance of evaluation unit and/or display unit, cable resistance [Ω]*
U_b = *Supply voltage [V]*
l = *Simple length of extension cable [m] (cable resistance per wire ≤ 0.09 /Ωm)*

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.



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

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



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

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

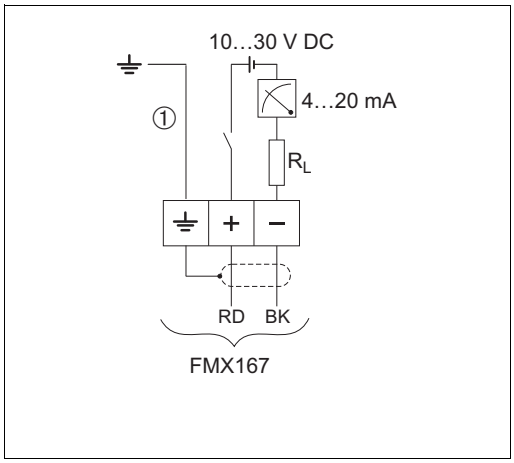
Power supply

Measuring unit electrical connection

Note!

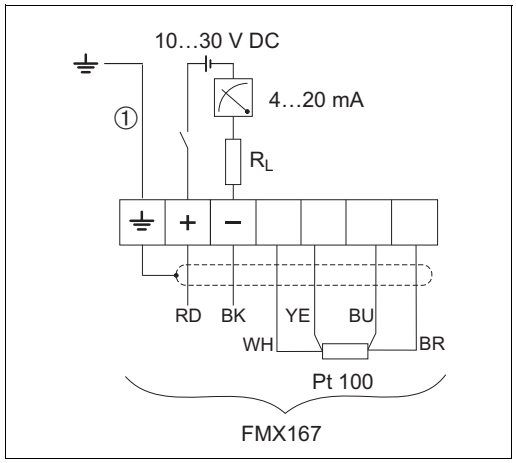
- When using the measuring device in hazardous areas, installation must comply with the applicable national standards and regulations and the Safety Instructions (XAs) or the Installation or Control Drawings (ZDs), see also → 🖹 24, "Safety instructions", "Installation/Control Drawings".
- Reverse polarity 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).

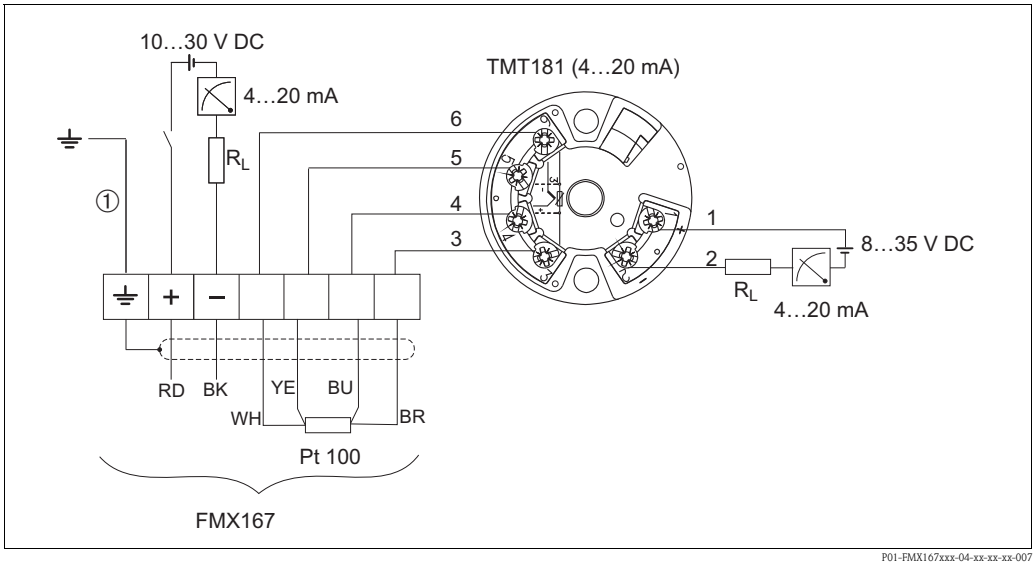
Waterpilot FMX167 with Pt100 [1)]



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).
1) Not for use in hazardous areas.

Waterpilot FMX167 with Pt100 and TMT181 temperature head transmitter TMT181 (4 to 20 mA) [1)]



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

1) Not for use in hazardous areas.

Supply voltage

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).
→ 24, Sect. "Safety instructions", "Installation/Control Drawings".

FMX167 + Pt100 (optional)

- FMX167: 10 to 30 V DC
- Pt100: 10 to 30 V DC

TMT181 temperature head transmitter (optional)

8 to 35 V DC

Cable specification

FMX167 + Pt100 (optional)

- Commercially available instrument cable
- Terminals in terminal housing FMX167: 0.08 to 2.5 mm^2 (28 to 14 AWG)
- If the Pt100 signal is directly connected to a display and/or evaluation unit, Endress+Hauser recommends using a shielded cable.

TMT181 temperature head transmitter (optional)

- Commercially available instrument cable
- Terminals in terminal housing FMX167: 0.08 to 2.5 mm^2 (28 to 14 AWG)
- Transmitter connection: max. 1.75 mm^2 (15 AWG)

Power consumption

FMX167 + Pt100 (optional)

≤ 0.675 W at 30 V DC

TMT181 temperature head transmitter (optional)

≤ 0.875 W at 35 V DC

Current consumption

FMX167 + Pt100 (optional)

- Max. current consumption: ≤ 22.5 mA
  Min. current consumption: ≥ 3.5 mA
- Pt100: ≤ 0.6 mA

TMT181 temperature head transmitter (optional)

- Max. current consumption: ≤ 25 mA
  Min. current consumption: ≥ 3.5 mA
- Pt100 via temperature head transmitter: ≤ 0.6 mA

Residual ripple

FMX167 + Pt100 (optional)

No effect for 4 to 20 mA signal up to ±5 % residual ripple within permissible range

TMT181 temperature head transmitter (optional)

$U_{ss} \geq 5$ V at $U_B \geq 13$ V, $f_{max.} = 1$ kHz

Performance characteristics

Reference operating conditions

FMX167 + Pt100 (optional)	TMT181 temperature head transmitter (optional)
DIN EN 60770 T_U = 25 °C (77 °F)	Calibration temperature 23 °C (73 °F) ±5 K

Maximum measured error

FMX167 + Pt100 (optional)	TMT181 temperature head transmitter (optional)
■ Non-linearity including hysteresis and non-repeatability as per DIN EN 60770: ±0.2 % of upper range value (URV) ■ Pt100: max. ±0.7 K (Class B to DIN EN 60751)	■ ±0.2 K ■ With Pt100: max. ±0.9 K

Long-term stability

FMX167 + Pt100 (optional)	TMT181 temperature head transmitter (optional)
±0.1 % of the upper range limit (URL) per year	≤ 0.1 K per year

Influence of medium temperature

- Thermal change in zero signal and output span for typical application temperature range 0 to +30 °C (+32 to +86°F): ±0.4 % (±0.5 %)* of the upper range limit (URL)
- Thermal change in zero signal and output span for the entire medium temperature range –10 to +70 °C (+14 to +158°F): ±1.0 % (±1.5 %)* of the upper range limit (URL)
- Temperature coefficient $_K$) of zero signal and output span: 0.15 %/10 K (0.3 %/10 K)* of the upper range limit (URL)

* Specifications for sensors 0.1 bar (1 mH_2O, 1.5 psi, 3 ftH_2O) and 0.6 bar (6 mH_2O, 10 psi, 20 ftH_2O)

Warm-up period

FMX167 + Pt100 (optional)	TMT181 temperature head transmitter (optional)
20 ms	4 s

Rise time

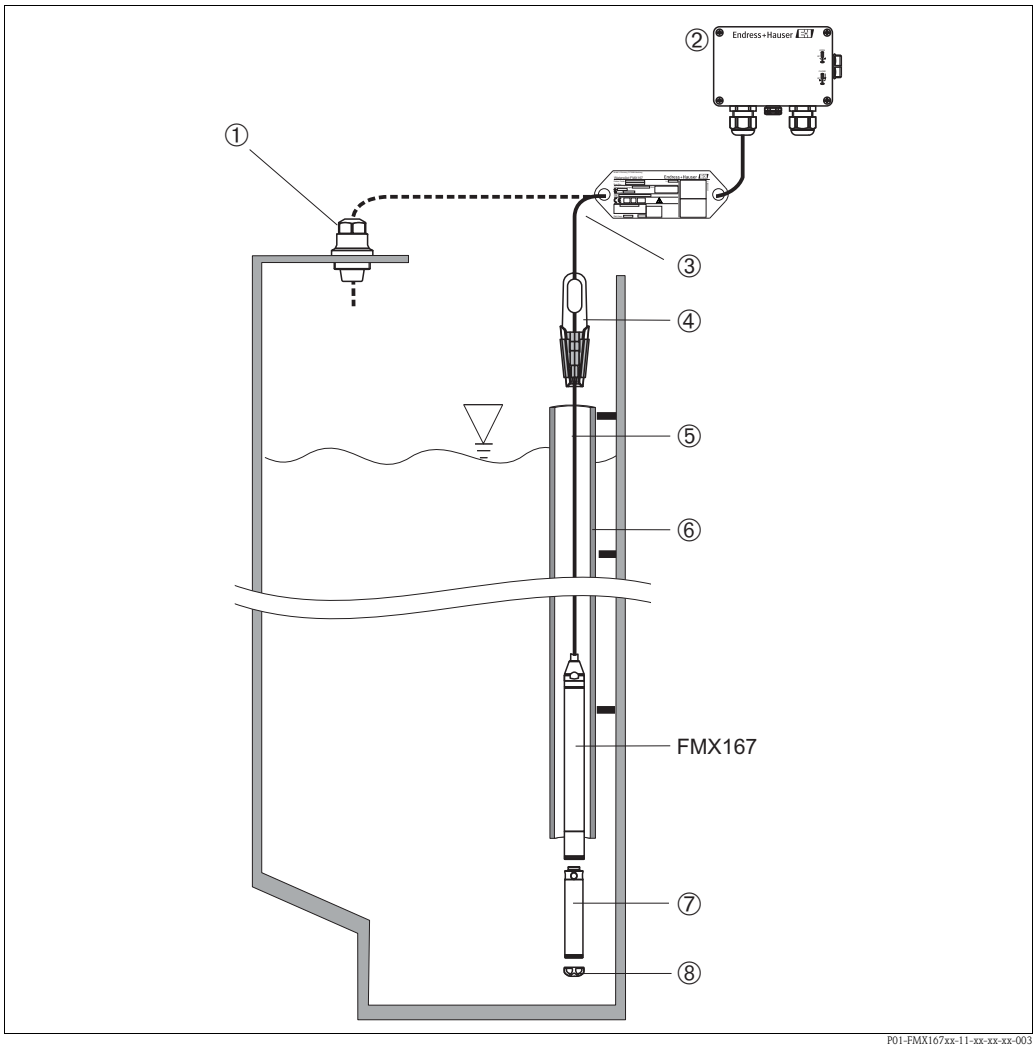
FMX167 + Pt100 (optional)	
■ FMX167: 80 ms ■ Pt100: 160 s	–

Settling time

FMX167 + Pt100 (optional)	
■ FMX167: 150 ms ■ Pt100: 300 s	–

Installation conditions

Installation instructions



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

Ambient temperature range

FMX167 + Pt100 (optional)

- 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)
- with outer diameter of 29 mm (1.14 in):
  0 to +50 °C (+32 to +122 °F)
  (= medium temperature)

Terminal box

–40 to +80 °C (–40 to +176 °F)

TMT181 temperature head transmitter (optional)

–40 to +85 °C (–40 to +185 °F)

Storage temperature range

FMX167 + Pt100 (optional)

–40 to +80 °C (–40 to +176 °F)

Terminal box

–40 to +80 °C (–40 to +176 °F)

TMT181 temperature head transmitter (optional)

–40 to +100 °C (–40 to +212 °F)

Degree of protection

FMX167 + Pt100 (optional)

- IP 68, permanently hermetically sealed
- Optional terminal box: IP 66/IP 67

TMT181 temperature head transmitter (optional)

- IP 00, moisture condensation permissible
- When mounted in the optional terminal boxes: IP 66/IP67

Electromagnetic compatibility (EMC)

FMX167 + Pt100 (optional)

- Interference emission to EN 61326 Class B equipment, interference immunity to EN 61326 Appendix A (Industrial)
- Maximum deviation <0.5 % of the span.

TMT181 temperature head transmitter (optional)

Interference emission to EN 61326 Class B equipment, interference immunity to EN 61326 Appendix A (Industrial)

Overvoltage protection

FMX167 + Pt100 (optional)

Integrated overvoltage protection to EN 61000-4-5 (500 V symmetrical/1000 asymmetrical)
Install overvoltage protection ≥1.0 kV, external if necessary

TMT181 temperature head transmitter (optional)

Install overvoltage protection, external if necessary.

Process conditions

Medium temperature range

FMX167 + Pt100 (optional)

- with outer diameter of 22 mm (0.87 in) and 42 mm (1.65 in):
  –10 to +70 °C (–14 to +158 °F)
- FMX167 with outer diameter of 29 mm (1.14 in):
  0 to +50 °C (+32 to 122 °F)

TMT181 temperature head transmitter (optional)

–40 to +85 °C (-40 to +185°F)
(= ambient temperature), install temperature head transmitter outside medium.

Medium temperature limits

FMX167 + Pt100 (optional)

- with outer diameter of 22 mm (0.87 in) and 42 mm (1.65 in):
  –20 to +70 °C (–4 to +158 °F)

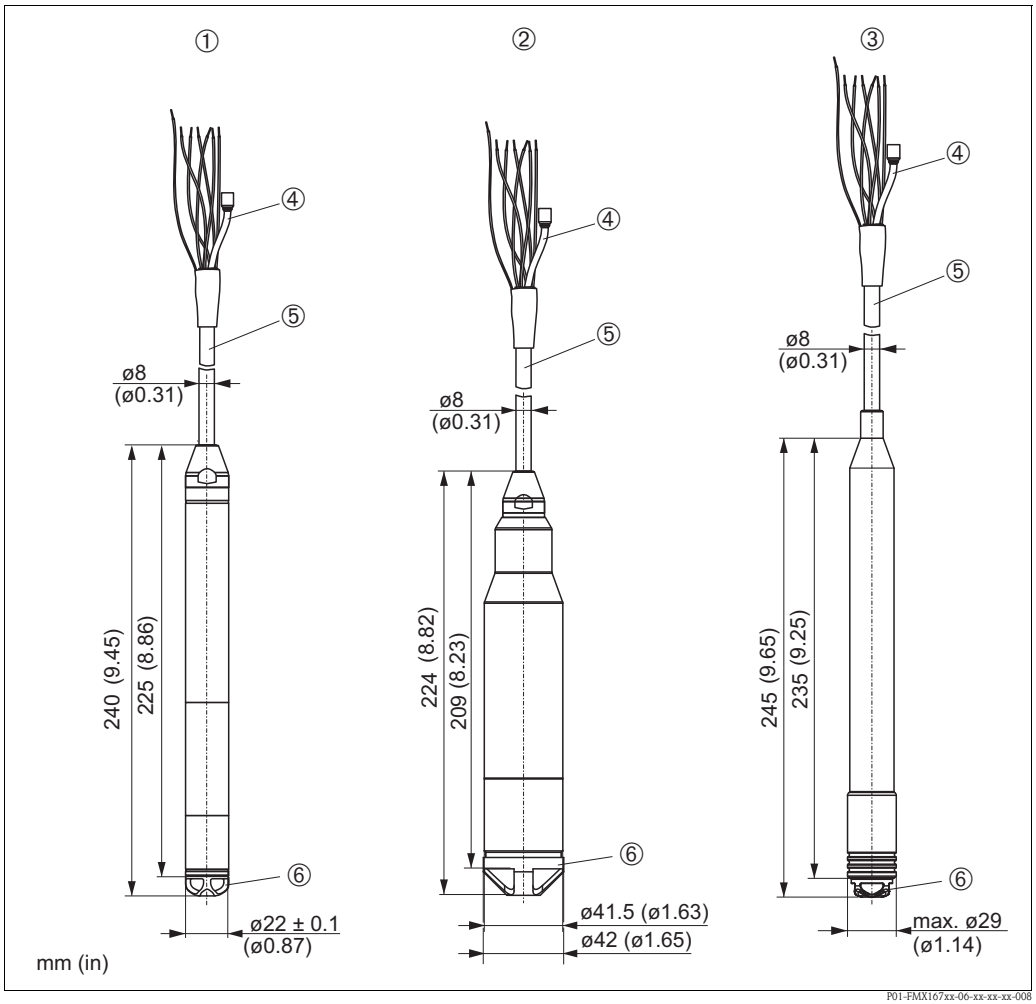
Note!
In hazardous areas incl. CSA GP, the medium temperature limit is at –10 to +70 °C (+14 to +158 °F).

- with outer diameter of 29 mm (1.14 in):
  0 to +50 °C (+32 to +122 °F)

(You may operate the FMX167 in this temperature range. The specification can then be exceeded, e.g. measuring accuracy).

Mechanical construction

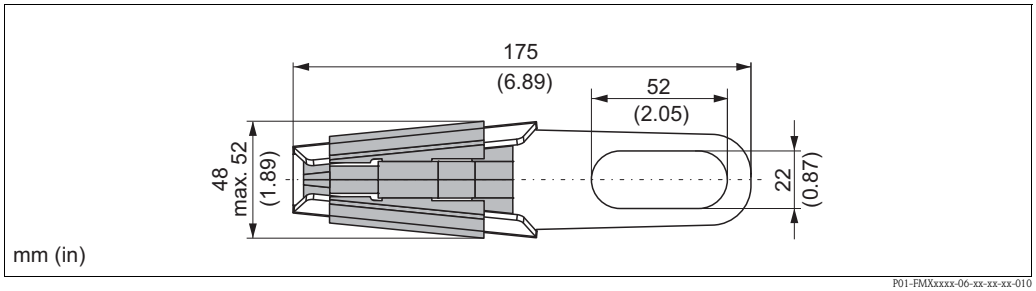
Dimensions of the level probe



Versions of FMX167

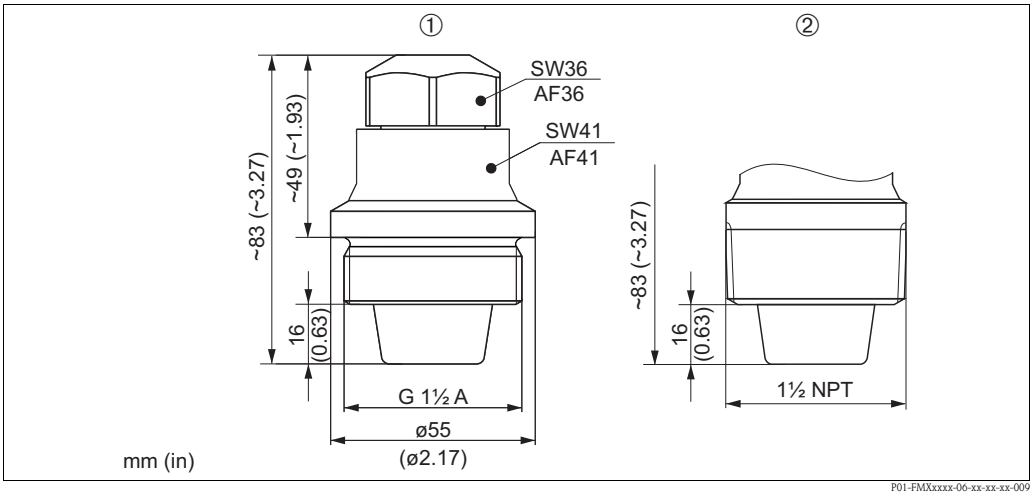
1 Version "A" or "D" for Feature 30 "Probe tube" in the order code (→ 🖹 21)
2 Version "B" for Feature 30 "Probe tube" in the order code (→ 🖹 21)
3 Version "C" for Feature 30 "Probe tube" in the order code (→ 🖹 21)
4 Pressure compensation tube
5 Extension cable
6 Protection cap

Dimensions of the mounting clamp



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

Dimensions of the extension cable mounting screws

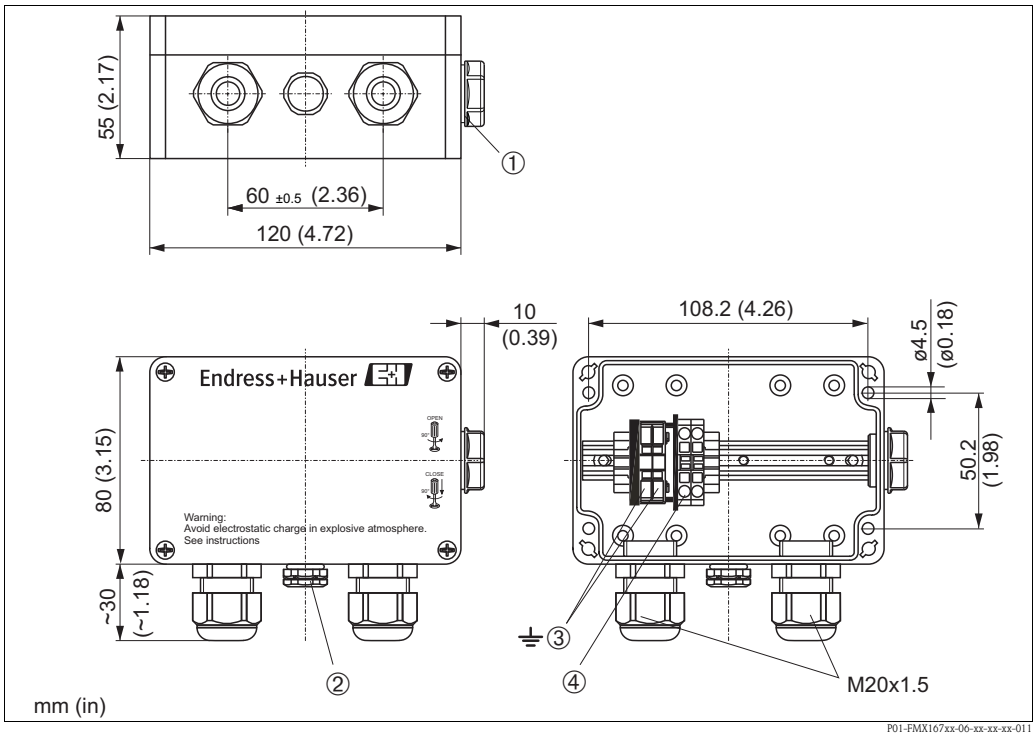


Extension cable mounting screws

1 Extension cable mounting screw G1 ½ A, version "3" for Feature 20 "Connection" in the order code (→ 🗎 21)
2 Extension cable mounting screw 1 ½ 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



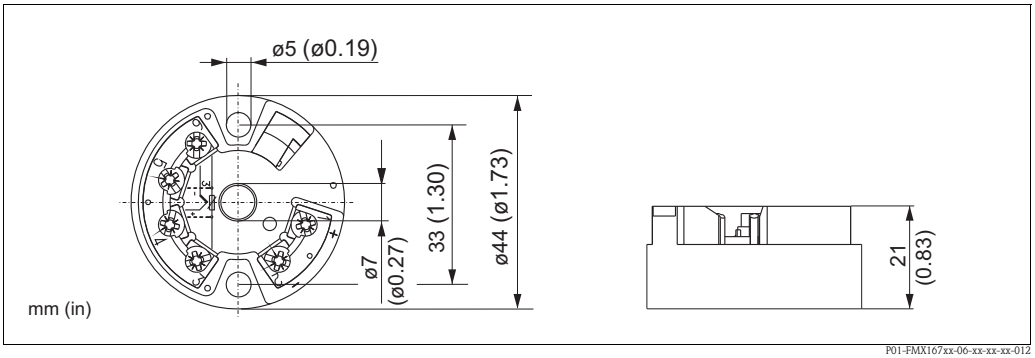
Version "3", "4" or "5" for Feature 70 "Additional options" in the order code (→ 🗎 21)

1 Dummy plug M20x1.5
2 GORE-TEX® filter
3 Ground connection / terminals for 0.08 to 2.5 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 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.

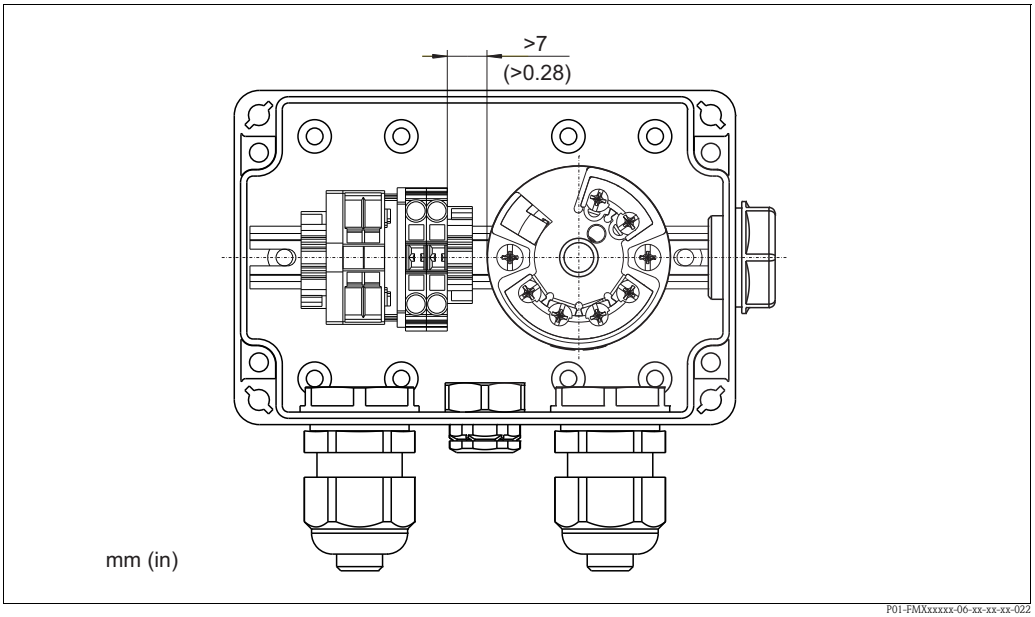
Dimensions of the TMT181 temperature head transmitter



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)

Material

- Level probe, outer diameter 22 mm (0.87 in): 1.4435 (AISI 316L)
- Level probe, outer diameter 42 mm (1.65 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 sleeve/cover: Polyolefin
  Metal does not come into contact with the medium.
- Process ceramic: Al_2O_3 aluminum oxide ceramic
- Seal (internal): EPDM or Viton
- Protection cap: – PPO (polyphenylene oxide) for FMX167 with outer diameter 22 mm (0.87 in) and 29 mm (1.14 in).
  – PFA (perfluoroalkoxy) for FMX167 with outer diameter 42 mm (1.65 in).
- Extension cable insulation: Either PE-LD (low-density polyethylene), FEP (fluorinated ethylene propylene) or PUR (polyurethane). For more information, see → 🖹 18, "Extension cable"
- Mounting clamp: 1.4404 (AISI 316L) and fiberglass reinforced PA (polyamide)
- Extension cable mounting screw G 1 ½A: 1.4301 (AISI 304)
- Extension cable mounting screw 1 ½NPT: 1.4301 (AISI 304)
- Terminal box: PC (polycarbonate)
- Temperature head transmitter TMT181: 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)
- FMX167: 3 x 0.227 mm^2 (3 x 26 AWG) + pressure compensation tube with Teflon filter
- FMX167 with Pt100 (optional): 7x0.227 mm^2 (7x26 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 → 🖹 8, Sect. "Load".
- Cable length that can be ordered
  – Customer-specific length in meters or feet (→ 🖹 21, "Ordering information")
  – 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).
- 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.

Further technical data of PE /PUR/FEP extension cable

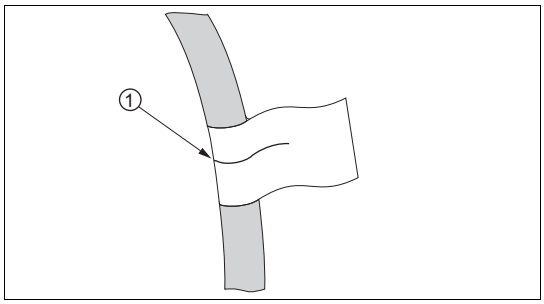
- Minimum bending radius: 120 mm (4.72 in)
- Tensile strength: max. 950 N (213.56 lbf)
- Cable extraction force: typical ≥ 400 N (89.92 lbf) PE, FEP / typical ≥ 150 N (33.72 lbf) PUR
  (The extension cable could be extracted from the level probe with a appropriate tensile force.)
- Resistance to UV light
- 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^2 (28 to 14 AWG)

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 ±50 mm (1.97 in) (the mark tolerance corresponds to a measured error from up to ±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

CE mark

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.

Approvals, types of protection

- ATEX II 2 G Ex ia IIC T6 Gb [1)]
- ATEX II 3 G Ex nA II T6[1)]
- FM: IS, Class I, Division 1, Groups A–D[1)]
- CSA: IS, Class I, Division 1, Groups A–D[1)]
- CSA: General Purpose

[1)] Only for Waterpilot FMX167 without Pt100 and TMT181

Note!

- Waterpilot FMX167 is only available for use in hazardous areas with the FKM Viton seal.
- The cable marking cannot be ordered with the Ex approvals listed due to a potential electrostatic charge (see → 21, "Ordering information").
- 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".

Drinking water approval (for FMX167 with Outer diameter 22 mm (0.87 in))

- KTW certificate
- NSF 61 approval
- ACS approval

Marine certificate

- GL (Germanischer Lloyd)
- ABS (American Bureau of Shipping)

Standards and guidelines applied

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:

- DIN EN 60770 (IEC 60770):
  Transmitters for use in industrial process control systems
  Part 1: Methods for performance evaluation
- DIN 16086:
  Electrical pressure measuring instruments,
  pressure sensors, pressure transmitters,
  pressure measuring instruments, concepts, specifications on data sheets
- EN 61326:
  Electrical equipment for measurement, control and laboratory use – EMC requirements
- EN 61010-1 (IEC 61010-1):
  Safety requirements for electrical equipment for measurement, control and laboratory use
- EN 60529:
  Degrees of protection provided by enclosures

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.

10 Approval

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

20 Connection

1	Probe cable
2	Mounting clamp, AISI 316L
3	Cable mounting screw G1-½, AISI 304
4	Cable mounting screw NPT 1-½, AISI 304

30 Probe tube:

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)

40 Measuring range:

Measuring range		Measuring range	
BA	0 to 0.1 bar	MA	0 to 1 mH_2O
BB	0 to 0.2 bar	MB	0 to 2 mH_2O
BC	0 to 0.4 bar	MC	0 to 4 mH_2O
BD	0 to 0.6 bar	MD	0 to 6 mH_2O
BE	0 to 1.0 bar	ME	0 to 10 mH_2O
BF	0 to 2.0 bar	MF	0 to 20 mH_2O
BG	0 to 4.0 bar	MG	0 to 40 mH_2O
BH	0 to 10.0 bar	MH	0 to 100 mH_2O
BK	0 to 20.0 bar	MK	0 to 200 mH_2O
PA	0 to 1.5 psi	FA	0 to 3 ftH_2O
PB	0 to 3 psi	FB	0 to 6 ftH_2O
PC	0 to 6 psi	FC	0 to 15 ftH_2O
PD	0 to 10 psi	FD	0 to 20 ftH_2O
PE	0 to 15 psi	FE	0 to 30 ftH_2O
PF	0 to 30 psi	FF	0 to 60 ftH_2O
PG	0 to 60 psi	FG	0 to 150 ftH_2O
PH	0 to 150 psi	FH	0 to 300 ftH_2O
PK	0 to 300 psi	FK	0 to 600 ftH_2O
VV	Adjusted to customer specifications from 0 to ___ (upper range value) in ___ (unit),upper range value: 0.1 bar (1 mH_2O, 1.5 psi, 3 ftH_2O) to 20 bar (200 m_2HO, 300 psi, 600 ft_2HO)		

50 Sensor seal:

1	FKM Viton
2	EPDM

60 Probe cable:

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		**Probe cable:**
	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		**Additional option:**
	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)[1)]
	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		**Marking**
	1	Measuring point (TAG)
FMX167		Complete order code

[1)] incl. terminal box, see feature "3" or "4"

Accessories

Mounting clamp

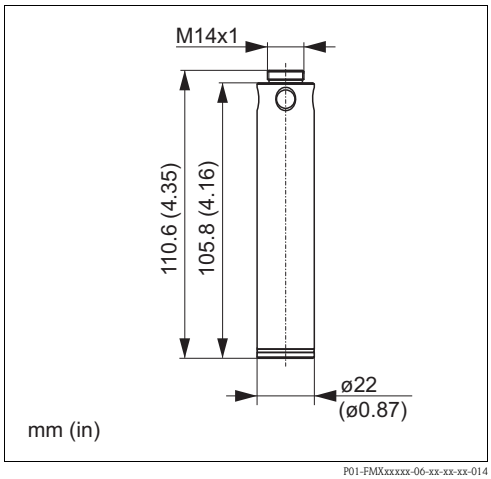
- Endress+Hauser offers a mounting clamp for simple FMX167 mounting → 🖹 15
- Material: 1.4404 (AISI 316L) and fiberglass reinforced PA (polyamide)
- Order number: 52006151
  See also → 🖹 21, "Ordering information"

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 ou inter 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 mm² (28...14 AWG)
- Order number: 52008938

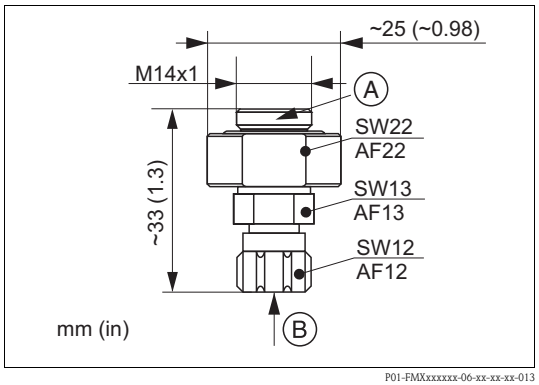
Note!
The 4-terminal strip is not intended for use in hazardous areas incl. CSA GP.

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))



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

Additional documentation

Field of activities	■ Pressure measurement: FA00004P/00/EN ■ Recording technology: FA00014R/09/EN ■ System components: FA00016K/09/EN
Technical Information	■ Technical Information Waterpilot FMX21 with 4 to 20 mA with HART output signal: TI00431P/00/EN ■ Technical Information Deltapilot M: TI00437P/00/EN ■ Temperature Head Transmitter iTEMP PCP TMT181: TI00070R/09/EN
Operating Instructions	■ Waterpilot FMX167: BA00231P/00/EN ■ Cable shortening kit: SD00552P/00/A6
Safety instructions	■ ATEX II 2 G: XA00131P/00/A3 ■ ATEX II 3 G: XA00132P/00/A3
Installation/Control Drawings	■ FM IS Class I, Div. 1, Groups A – D: ZD00063P/00/EN ■ CSA IS Class I, Div. 1, Groups A – D: ZD00064P/00/EN
Drinking water approval	■ SD00289P/00/A3 (NSF) ■ SD00126P/00/A3 (KTW/ACS)

Instruments International

Endress+Hauser
Instruments International AG
Kaegenstrasse 2
4153 Reinach
Switzerland

Tel. +41 61 715 81 00
Fax +41 61 715 25 00
www.endress.com
info@ii.endress.com

Endress+Hauser

People for Process Automation

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