Technical Information
Waterpilot FMX21

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

Reliable and robust level probe with ceramic measuring cell

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 in): 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 (1.65 in): Heavy duty version, easy clean flush-mounted process diaphragm. Ideally suited for wastewater and sewage treatment plants.
- FMX21 with a plastic insulation, outer diameter of 29 mm (1.14 in): 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 ±0.2 %
  - PLATINUM version ±0.1 %
- Automatic density compensation to increase accuracy
- Usage in drinking water: KTW, NSF, ACS
- Approvals: ATEX, FM, CSA
- Marine certificate: GL, ABS, LR, BV, DNV
- Extensive range of accessories provides complete measuring point solutions

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Document information

Document conventions

Safety symbols

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

Electrical symbols

Symbol	Meaning
⎓	**Direct current** A terminal to which DC voltage is applied or through which direct current flows.
~	**Alternating currrent** A terminal to which alternating voltage is applied or through which alternating current flows.
⎓ ~	**Direct current and alternating current** • A terminal to which alternating voltage or DC voltage is applied. • A terminal through which alternating current or direct current flows.
⏚	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
⊜	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.
⏚	**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of praxis.

Symbols for certain types of information

Symbol	Meaning
	Tip Indicates additional information.
	Reference to page Refers to the corresponding page number.

Symbols in graphics

Symbol	Meaning
1, 2, 3, 4, ...	Item numbers
A, B, C, D, ...	Views

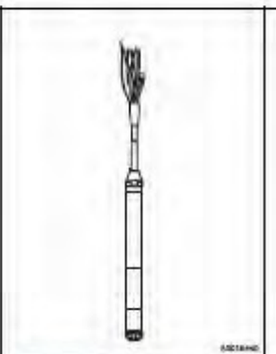
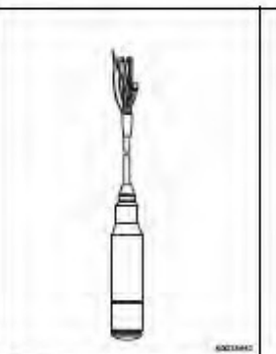
	**Hazardous area** Indicates a hazardous area.
	Safe area (non-hazardous area) Indicates a non-hazardous location.

Symbols at the device

Symbol	Meaning
	**Connecting cable immunity to temperature change** Indicates that the connecting cables must be able to withstand temperatures of at least 85 °C (185 °F).

Function and system design

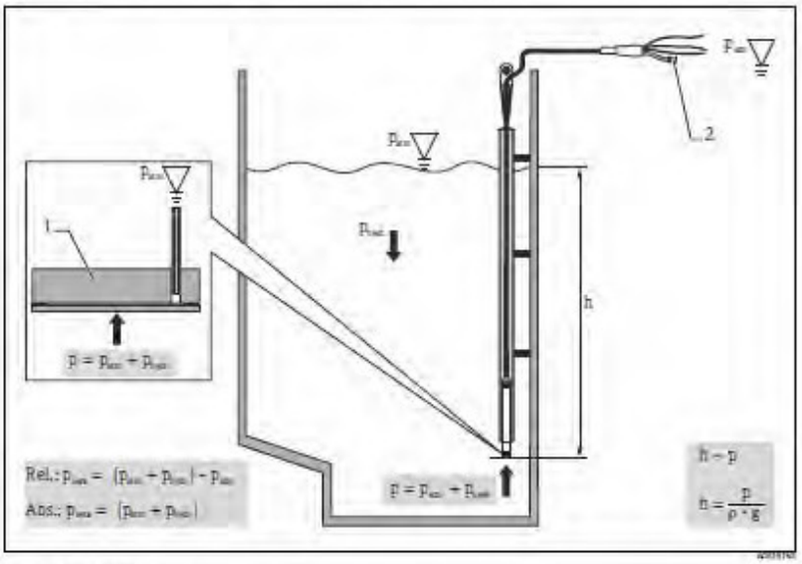
Device selection

Waterpilot FMX21			
Field of application	Hydrostatic level measurement in deep wells e.g. drinking water	Hydrostatic level measurement in wastewater	Hydrostatic level measurement in saltwater
	NOTICE **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 G 1½" A or NPT 1½" thread		
Outer diameter	22 mm (0.87 in)	42 mm (1.65 in)	max. 29 mm (1.14 in)
Extension cable	PE, PUR, FEP (→ 25)		
Seals	▪ FKM Viton ▪ EPDM [1]	FKM Viton	▪ FKM Viton ▪ EPDM [1]
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_2O, mH_2O, inH_2O, ftH_2O, psi and numerous level units.		
Overload	Up to 40 bar (600 psi)		Up to 25 bar (375 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		
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) ▪ Marine certificate		
Specialties	▪ High-precision, robust ceramic measuring cell with long-term stability ▪ Automatic density compensation ▪ Customer specific cable marking ▪ Absolute pressure measuring cell		

1) Recommended for drinking water applications and not 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 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.



1 *Ceramic measuring cell*
2 *Pressure compensation tube*

h *Level height*
p *Total pressure = atmospheric pressure + hydrostatic pressure*
ρ *Density of the medium*
g *Gravitational acceleration*
$p_{hydr.}$ *Hydrostatic pressure*
$p_{atm.}$ *Atmospheric pressure*
$p_{sens.}$ *Pressure displayed on the sensor*

Temperature measurement with optional Pt100 resistance thermometer [1)]

Endress+Hauser also offers the Waterpilot FMX21 with an optional 4-wire Pt100 resistance thermometer to measure level and temperature simultaneously (→ 30). The Pt100 belongs to Accuracy Class B in accordance with DIN EN 60751.

Temperature measurement with optional Pt100 and TMT182 temperature head transmitter [1)]

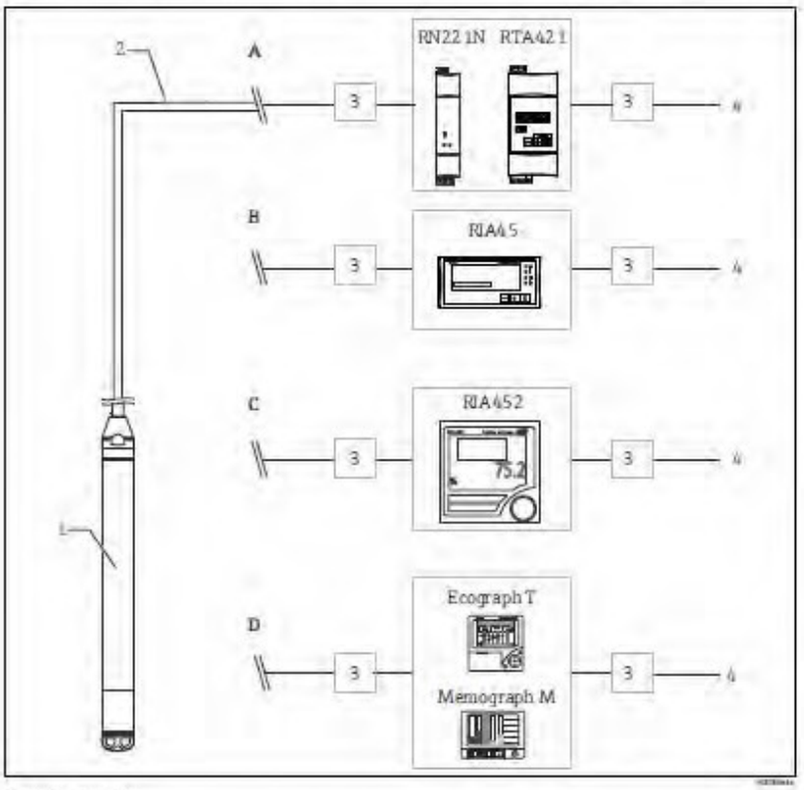
Endress+Hauser also offers the TMT182 temperature head transmitter with the HART protocol to convert the temperature signal to an analog, scalable 4 to 20 mA output signal superimposed with HART 6.0.
See also: "Density compensation with Pt100 temperature sensor" (→ 9); "Ordering information" (→ 28); "Accessories" (→ 30) 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:



Application examples

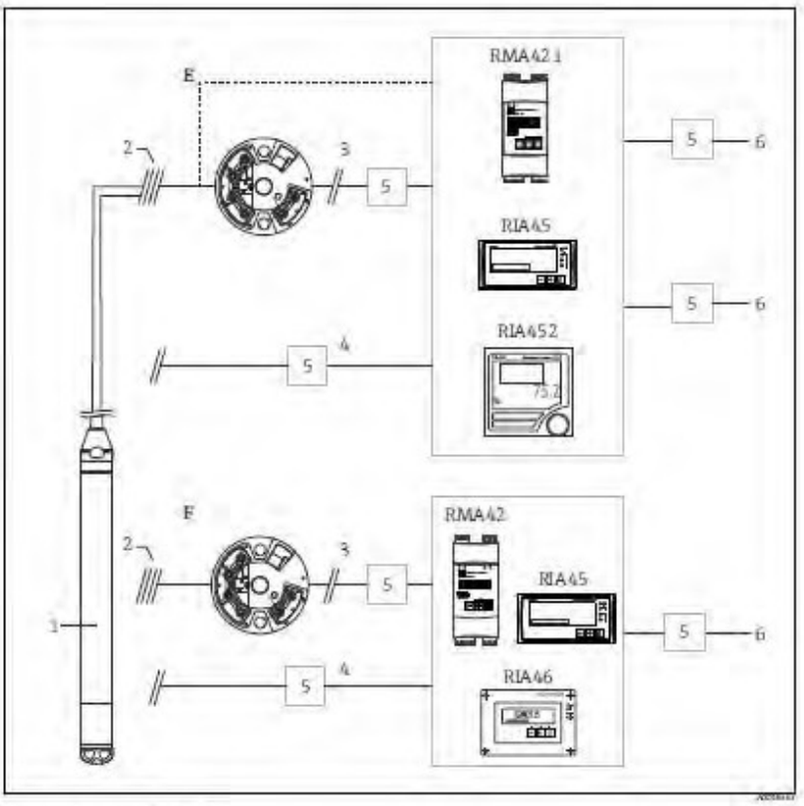
1 *Waterpilot FMX21 HART*
2 *4 to 20 mA HART*
3 *Overvoltage protection (OP), e.g. HAW from Endress+Hauser (not for use in hazardous areas)*
- OP on the sensor side for field installation: HAW569; for top-hat rail/DINrail: HAW562 /intrinsically safe HAW562Z
- OP on the supply side for top-hat rail/DINrail: HAW561 (115/230 V) and HAW561K (24/48 V AC/DC)
The overvoltage protection selected must be appropriate for the supply voltage.
4 *Power supply*

A 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.

B Evaluation unit RIA45 (for panel mounting) provides a power supply system, an onsite display and two switch outputs.

C 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.

D 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.



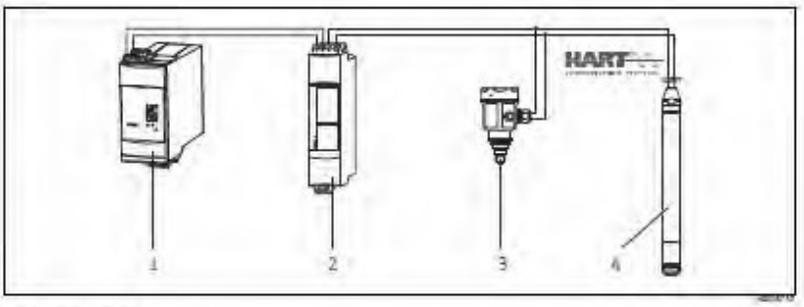
Application examples with Pt100

1 *Waterpilot FMX21 HART*
2 *Connection for integrated Pt100 temperature sensor in the FMX21*
3 *4 to 20 mA HART (Temperature)*
4 *4 to 20 mA HART (Level)*
5 *Overvoltage protection (OP), e.g. HAW from Endress+Hauser (not for use in hazardous areas)*
- OP on the sensor side for field installation: HAW569; for top-hat rail/DINrail: HAW562/intrinsically safe HAW562Z
- OP on the supply side for top-hat rail/DINrail: HAW561 (115/230 V) and HAW561K (24/48 V AC/DC)
The overvoltage protection selected must be appropriate for the supply voltage.
6 *Power supply*

E 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.

F If you want to record and evaluate the level and temperature measured value with one device, use the RMA42, 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.

Level measurement with absolute pressure probe and external pressure signal



1 *Fieldgate FXA520*
2 *Multidrop-Connector FXN520*
3 *Cerabar*
4 *Waterpilot FMX21*

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 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.

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

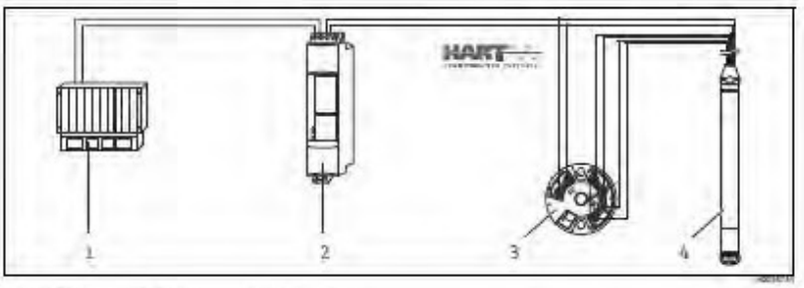
The Waterpilot FMX21 can correct measured errors that result from fluctuations in the density of the water caused by temperature. Users can choose from the following options:

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 signals are 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).

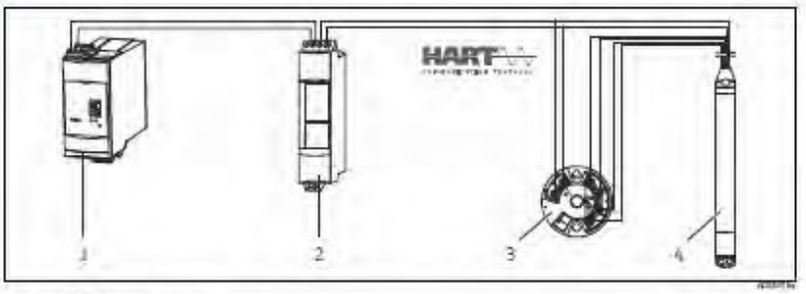


1 *HART Master, e.g. PLC (programmable logic controller)*
2 *FXN520 Multidrop-Connector*
3 *TMT182 Temperature head transmitter*
4 *Waterpilot FMX21*

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.

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



1 *Fieldgate FXA520*
2 *Multidrop-Connector FXN520*
3 *TMT182 Temperature head transmitter*
4 *Waterpilot FMX21*

Without additional compensation due to the anomaly of water, errors of up to 4 % may 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).

For further information please refer to the appropriate Technical documentation:
- TI00078R: TMT182 temperature head transmitter (4 to 20 mA/HART)
- TI00369F: FXA520 Fieldgate
- TI00400F: FXN520 multidrop connector

Communication protocol	4 to 20 mA HART with communication protocol
System integration	The device can be fitted with a tag name. "Ordering information", feature 895 "Marking" version "Z1" (→ 🗎 38).

Input

Measured variable

FMX21 + Pt100 (optional)

- Hydrostatic pressure of a liquid
- Pt100: temperature

TMT182 temperature head transmitter (optional)

Temperature

Measuring range

- Customer-specific measuring ranges or factory calibration
- Temperature measurement from −10 to +70 °C (+14 to +158 °F) with Pt100 (optional)

Sensor measuring range [bar (psi)]	Smallest span that can be calibrated [1] [bar (psi)]	Vacuum resistance [bar_{abs} (psi_{abs})]	Version in the order code [2]
Gauge pressure			
0.1 (1.5)	0.01 (0.15)	0.3 (4.5)	1C
0.2 (3.0)	0.02 (0.3)	0.3 (4.5)	1D
0.4 (6.0)	0.04 (1.0)	0	1F
0.6 (9.0)	0.06 (1.0)	0	1G
1.0 (15.0)	0.1 (1.5)	0	1H
2.0 (30.0)	0.2 (3.0)	0	1K
4.0 (60.0)	0.4 (6.0)	0	1M
10.0 (150) [3]	1.0 (15)	0	1P
20.0 (300) [3]	2.0 (30)	0	1Q
Absolute pressure			
2.0 (30.0)	0.2 (3.0)	0	2K
4.0 (60.0)	0.4 (6.0)	0	2M
10.0 (150) [3]	1.0 (15)	0	2P
20.0 (300) [3]	2.0 (30)	0	2Q

1) Recommended Turn down: Max 100:1
Factory calibration Turn down: Max 20:1, higher on request.

2) Ordering information (→ 28)

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

Input signal

FMX21 + Pt100 (optional)

- Change in capacitance
- Pt100: change in resistance

TMT182 temperature head transmitter (optional)

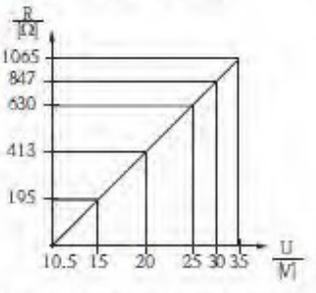
Pt100 resistance signal, 4-wire

Output

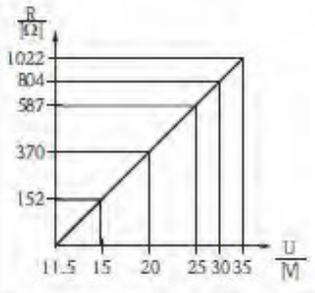
Output signal	**FMX21 + Pt100 (optional)** ▪ 4 to 20 mA with overlying digital HART 6.0 communication protocol, 2-wire for hydrostatic pressure measured value ▪ Pt100: Temperature-dependent resistance values	**TMT182 temperature head transmitter (optional)** 4 to 20 mA with overlying digital HART 5.0 communication protocol for temperature measured value, 2-wire
Signal range	3.8 to 20.5 mA	
Signal on alarm	**FMX21 + Pt100 (optional)** 4 to 20 mA HART Options: ▪ Max. alarm (factory setting 22mA): can be set from 21 to 23 mA ▪ Hold measured value: last measured value is held ▪ Min. alarm: 3.6 mA	**TMT182 temperature head transmitter (optional)** Options: ▪ Max. alarm ≥ 21.0 mA ▪ Min. alarm ≤ 3.6 mA
Load	**FMX21** $R_{L\,max} \leq \frac{U - 10.5\ V}{23\ mA} - 2 \cdot 0.09\ \frac{\Omega}{m} \cdot l - R_{add}$	**TMT182 temperature head transmitter (optional)** $R_{L\,max} \leq \frac{U - 11.5\ V}{0.023\ A} - R_{add}$

$R_{L\,max}$ = *Max. load resistance [Ω]*
R_{add} = *Additional resistances such as resistance of evaluation unit and/or display unit, cable resistance [Ω]*
U = *Supply voltage [V]*
l = *Simple length of extension cable [m]. (cable resistance per wire ≤ 0.09 Ω /m)*

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



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 TMT182 load chart for estimating the load resistance. Additional resistances have to be subtracted from the value calculated as shown in the equation.

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

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

Power supply

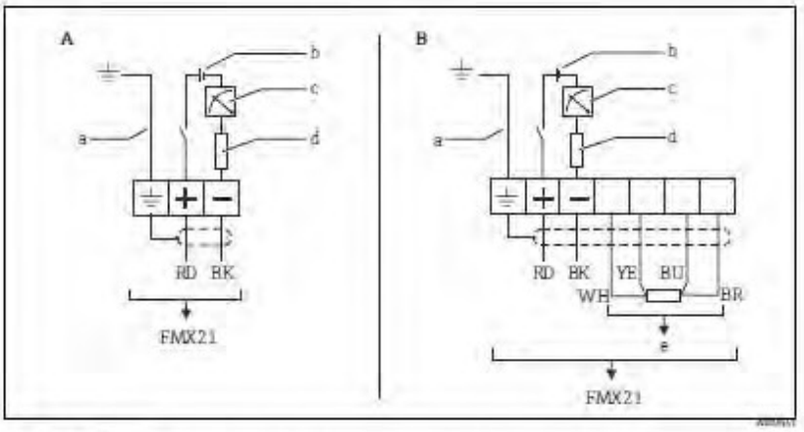
When using the measuring device in hazardous areas, installation must comply with the applicable national standards and regulations and the Safety Instructions (XAs) and the Installation or Control Drawings (ZDs). All explosion-protection data are given in a separate documentation which is available upon request. This documentation is provided with the devices as standard (→ 32).

Supply voltage	**FMX21 + Pt100 (optional)** • 10.5 to 35 V (non-hazardous area) • 10.5 to 30 V (hazardous area)	**TMT182 temperature head transmitter (optional)** 11.5 to 35 V DC
Power consumption	**FMX21 + Pt100 (optional)** • ≤ 0.805 W at 35 V DC (non-hazardous area) • ≤ 0.690 W at 30 V DC (hazardous area)	**TMT182 temperature head transmitter (optional)** ≤ 0.805 W at 35 V DC
Current consumption	**FMX21 + Pt100 (optional)** • Max. current consumption: ≤ 23 mA Min. current consumption: ≥ 3.6 mA • Pt100: ≤ 0.6 mA	**TMT182 temperature head transmitter (optional)** • Max. current consumption: ≤ 23 mA Min. current consumption: ≥ 3.5 mA • Pt100 via temperature head transmitter: ≤ 0.6 mA

Measuring unit electrical connection

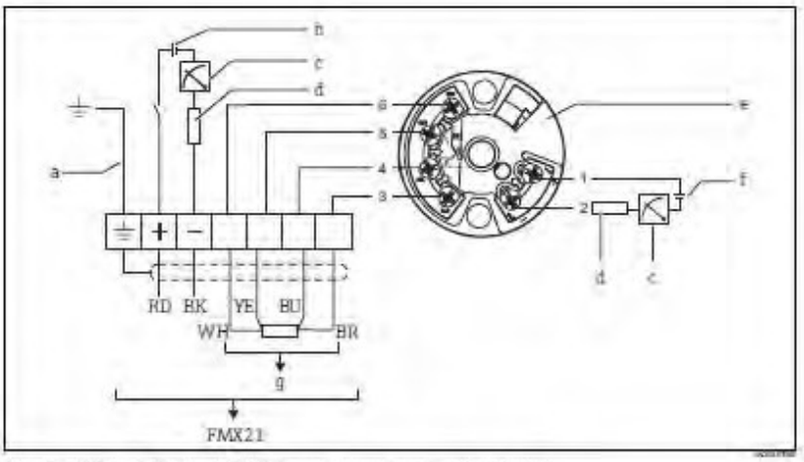
- Reverse polarity protection is integrated in the Waterpilot FMX21 and in the TMT182 temperature head transmitter. Changing the polarities will not damage the devices.
- The cable must end in a dry room or a suitable terminal box. The terminal box (IP66/IP67) with a GORE-TEX® filter from Endress+Hauser is suitable for outdoor installations. The terminal box can be ordered as an accessory using the order code for FMX21 version 'PS' for feature 620 (→ 28).

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).



A *Waterpilot FMX21*
B *Waterpilot FMX21 with Pt100 (→ Version "NB" for feature 610 "Accessories" in the order code (→ 28)*

a *Not for FMX21 with an outer diameter of 29 mm (1.14 in)*
b *10.5 to 30 V DC (Ex), 10.5 to 35 V DC*
c *4 to 20 mA*
d *Resistance (R_L)*
e *Pt100*



Waterpilot FMX21 with Pt100 and TMT182 temperature head transmitter (4 to 20 mA) (→ versions "NB" and "PT", feature 610 and 620 in the order code (→ 28)

a *Not for FMX21 with an outer diameter of 29 mm (1.14 in)*
b *10.5 to 35 V DC*
c *4 to 20 mA*
d *Resistance (R_L)*
e *TMT182 temperature head transmitter (4 to 20 mA)*
f *11.5 to 35 V DC*
g *Pt100*

1) Not for use in hazardous areas.

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

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

Cable specifications

FMX21 + Pt100 (optional)

- Commercially available instrument cable
- Terminal, terminal box: 0.08 to 2.5 mm² (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.

TMT182 temperature head transmitter (optional)

- Commercially available instrument cable
- Terminal, terminal box: 0.08 to 2.5 mm² (28 to 14 AWG)
- Transmitter connection: max. 1.75 mm² (15 AWG)

Residual ripple

FMX21 + Pt100 (optional)

No impact on the 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))

TMT182 temperature head transmitter (optional)

$U_{ss} \geq 3$ V at $U \geq 13$ V, $f_{max.} = 1$ kHz

Performance characteristics

Reference operating conditions

FMX21 + Pt100 (optional)

- As per IEC 60770
- Ambient temperature T_A = constant, in range: +21 to +33 °C (+70 °F to +91 °F)
- Humidity φ = constant, in range: 20 to 80 % RH
- Ambient pressure p_A = constant, in range: 860 to 1060 mbar (13 to 16 psi)
- Position of the measuring cell = constant, in range, vertical: ±1°
- Supply voltage constant: 21 V DC to 27 V DC
- Load with HART: 250 Ω
- Pt100: DIN EN 60770 T_A = 25 °C (77 °F)

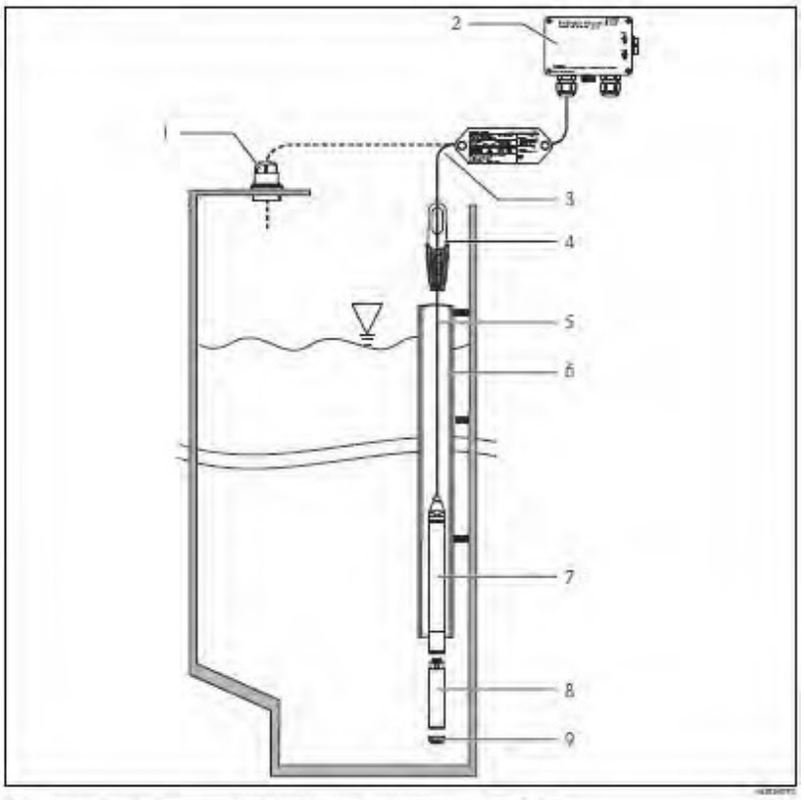
TMT182 temperature head transmitter (optional)

Calibration temperature 25 °C (77 °F) ±5 K

Reference accuracy	**FMX21 + Pt100 (optional)** The reference accuracy comprises the non-linearity after limit point configuration, hysteresis and non-repeatability in accordance with IEC 60770. ▪ Setting ±0.2 % – to TD 5:1: < 0.2 % of the set span – from TD 5:1 to TD 10:1 ±(0.02 x TD+0.1) PLATINUM version: ▪ Setting ±0.1 % (optional) – to TD 5:1: < 0.1 % of the set span – from TD 5:1 to TD 10:1 ±(0.02 x TD) ▪ Class B to DIN EN 60751 – Pt100: max. ±1 K	**TMT182 temperature head transmitter (optional)** ▪ ±0.2 K ▪ With Pt100: max. ±0.9 K
Resolution	Current output: 1 µA **Read cycle** HART commands: 2 to 3 per second on average	
Long-term stability	**FMX21 + Pt100 (optional)** ▪ ≤ 0.1 % of URL/year ▪ ≤ 0.25 % of URL/5 years	**TMT182 temperature head transmitter (optional)** ≤ 0.1 K per year
Influence of medium temperature	▪ Thermal change in the zero output and the output span 0 to +30 °C (+32 to +86 °F): <(0.15 + 0.15 x TD)% –10 to +70 °C (+14 to +158 °F): <(0.4 + 0.4 x TD)% ▪ Temperature coefficient (T_K) of the zero output and output span –10 to +70 °C (+14 to +158 °F): 0.1 % / 10 K URL	
Warm-up period	**FMX21 + Pt100 (optional)** ▪ FMX21: < 6 s ▪ Pt100: 20 ms	**TMT182 temperature head transmitter (optional)** 4 s
Step response time	**FMX21 + Pt100 (optional)** ▪ FMX21: 400 ms (T90 time), 500 ms (T99 time) ▪ Pt100: 160 s (T90 time), 300 s (T99 time)	—

Installation

Installation instructions



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 (→ 28)*
2 *Terminal box can be ordered via order code or as an accessory (→ 28)*
3 *Extension cable bending radius > 120 mm (4.72 in)*
4 *Mounting clamp can be ordered via order code or as an accessory (→ 28)*
5 *Extension cable, length (→ 25)*
6 *Guide pipe*
7 *Waterpilot FMX21*
8 *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)*
9 *Protection cap*

Additional installation instruction

- 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 device is provided with a protection cap to prevent mechanical damage to the measuring cell.
- 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 (→ 30).
- Rod length tolerances: < 5 m (16 ft): ±17.5 mm (0.69 in); > 5 m (16 ft): ±0.2 % (→ 31)
- 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 → 28 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).

Environment

Ambient temperature range	**FMX21 + 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) **Cable** (fixed installation) ▪ PE: −30 to +70 °C (−22 to +158 °F) ▪ FEP: −40 to +70 °C (−40 to +158 °F) ▪ PUR: −40 to +70 °C (−40 to +158 °F) **Terminal box** −40 to +80 °C (−40 to +176 °F)	**TMT182 temperature head transmitter (optional)** −40 to +85 °C (−40 to +185 °F)
Storage temperature range	**FMX21 + Pt100 (optional)** −40 to +80 °C (−40 to +176 °F) **Cable** (fixed installation) ▪ PE: −30 to +70 °C (−22 to +158 °F) ▪ FEP: −30 to +80 °C (−22 to +176 °F) ▪ PUR: −40 to +80 °C (−40 to +176 °F) **Terminal box** −40 to +80 °C (−40 to +176 °F)	**TMT182 temperature head transmitter (optional)** −40 to +100 °C (−40 to +212 °F)
Degree of protection	**FMX21 + Pt100 (optional)** IP68, permanently hermetically sealed at 20 bar (290 psi) (~ 200 m H_2O) **Terminal box (optional)** IP66, IP67	**TMT182 temperature head transmitter (optional)** IP00, condensation permitted
Geometric height according to IEC61010-1 Ed.3	Up to 2 000 m (6 600 ft) above MSL.	
Electromagnetic compatibility (EMC)	**FMX21 + Pt100 (optional)** ▪ EMC in accordance with all the relevant requirements of the EN 61326 series. Details are provided in the Declaration of Conformity. ▪ Maximum deviation < 0.5 % of the span.	**TMT182 temperature head transmitter (optional)** EMC in accordance with all the relevant requirements of the EN 61326 series. Details are provided in the Declaration of Conformity.

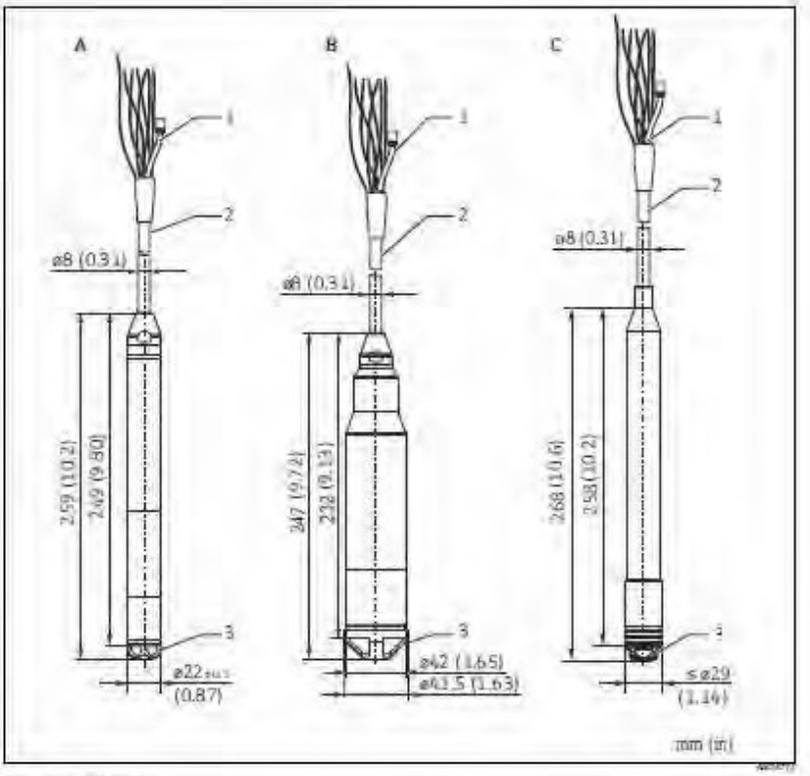
Overvoltage protection	**FMX21 + Pt100 (optional)** • Integrated overvoltage protection to EN 61000-4-5 (500 V symmetrical/1000 V asymmetrical) • Install overvoltage protection ≥ 1.0 kV, external if necessary	**TMT182 temperature head transmitter (optional)** Install overvoltage protection, external if necessary.

Process

Medium temperature range	**FMX21 + 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) • With outer diameter of 29 mm (1.14 in): 0 to +50 °C (+32 to +122 °F)	**TMT182 temperature head transmitter (optional)** —
Medium temperature limits	**FMX21 + 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) 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) The FMX21 can be operated in this temperature range. The specification can then be exceeded, e.g. measuring accuracy.	—

Mechanical construction

Dimensions of the level probe

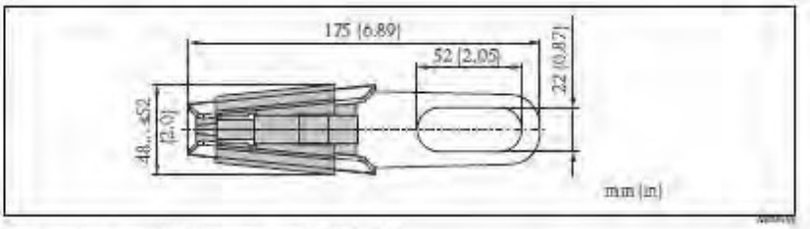


Versions of the FMX21

A *In the order code: feature 45 "Probe tube", version "1" or "Accessories" (→ 128)*
B *In the order code: feature 45 "Probe tube", version "2" (→ 128)*
C *In the order code: feature 45 "Probe tube", version "5" (→ 128)*

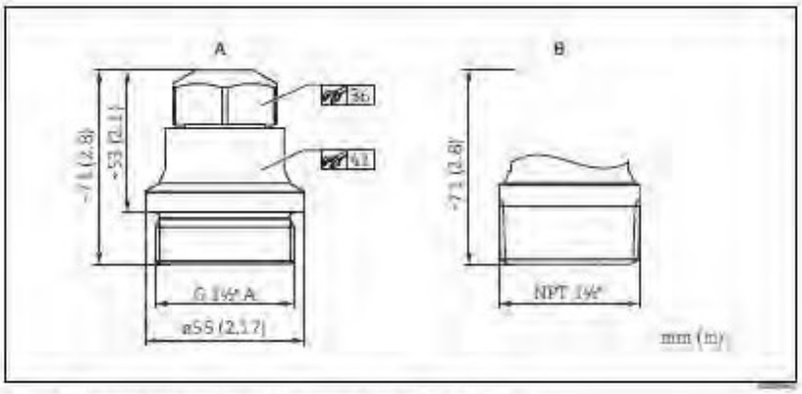
1 *Pressure compensation tube*
2 *Extension cable (Length: see → 125)*
3 *Protection cap*

Dimensions of the mounting clamp



In the order code: feature 620 "Accessories", version "PQ" (→ 128)

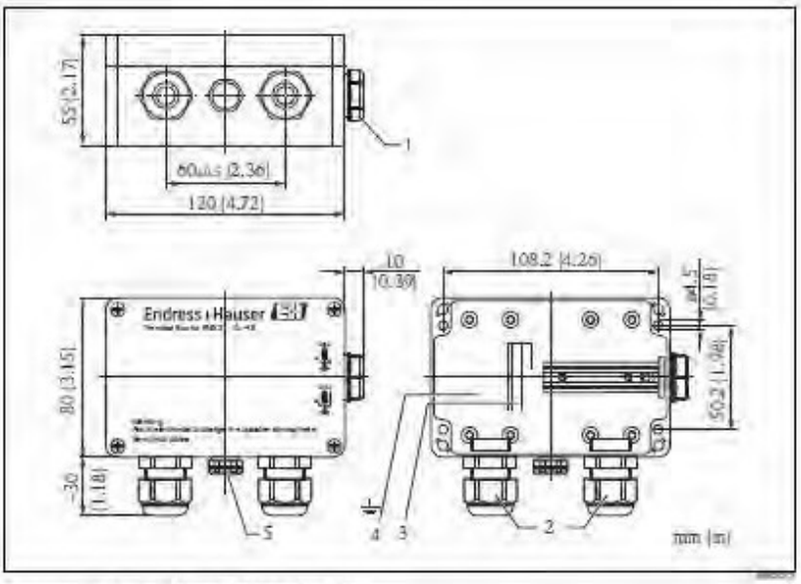
Dimensions of the extension cable mounting screws



A *G 1½" A, in the order code: feature 620 "Accessories", version "PQ" (→ 🖹 28)*
B *NPT 1½", in the order code: feature 620 "Accessories", version "PR" (→ 🖹 28)*

Application in unpressurized containers only.

Dimensions of the IP66, IP67 terminal boxes with filters



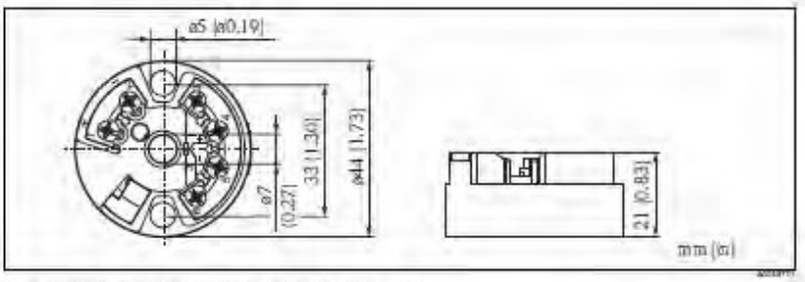
In the order code: feature 620, version "PS" or "PT" (→ 🖹 28)

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

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

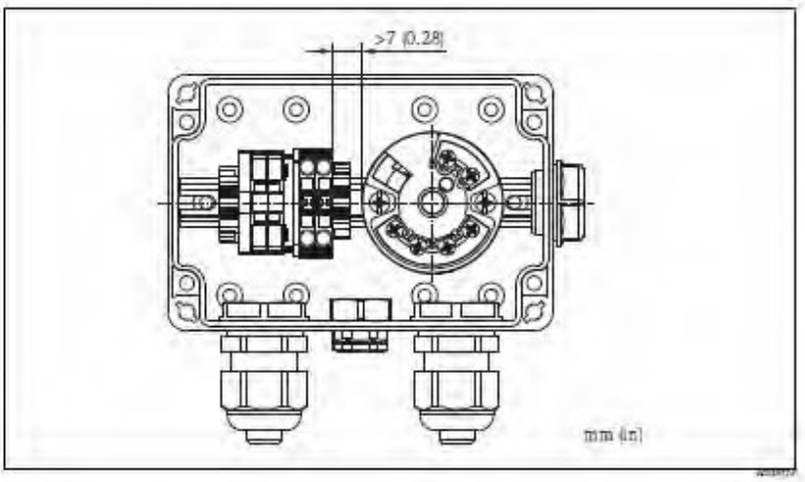
The 4-terminal strip is not intended for use in hazardous areas incl. CSA GP.

Dimensions of the TMT182 temperature head transmitter



In the order code: feature 620 'Accessories', version 'PT' for (→ 🖹 18).

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

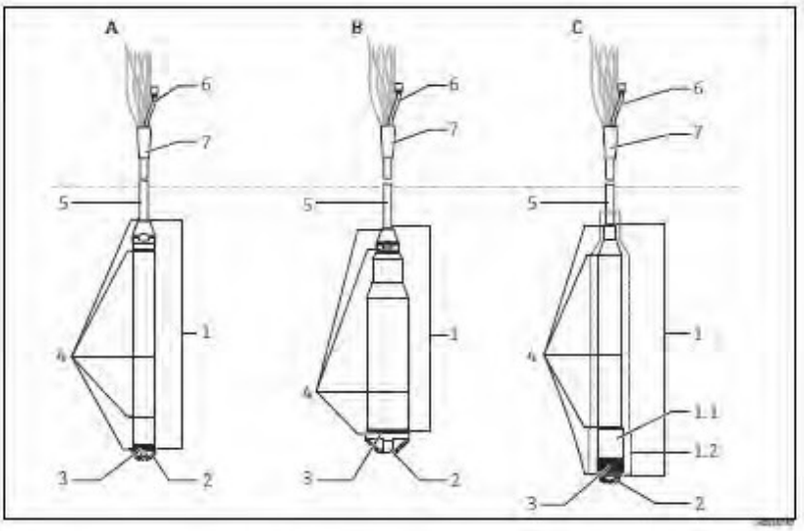


A distance of > 7 mm (> 0.28 in mm) must be maintained between the terminal strip and the TMT182 temperature head transmitter.

Weight

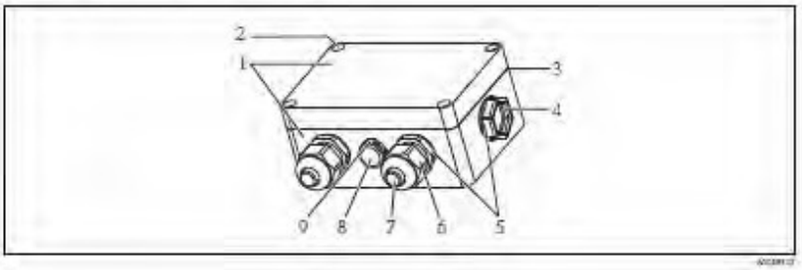
Component part		Weight
Level probe, outer diameter 22 mm (0.87 in)		344 g (12.133 oz)
Level probe, outer diameter 42 mm (1.65 in)		1376 g (48.532 oz)
Level probe, outer diameter 29 mm (1.14 in)		394 g (13.896 oz)
Extension cable	• PE • PUR • PEP	• 51 g/m (0.035 lbs/1 ft) • 60 g/m (0.040 lbs/1 ft) • 108 g/m (0.072 lbs/1 ft
Mounting clamp		170 g (5.996 oz)
Extension cable mounting screw G 1½" A		770 g (27.158 oz
Extension cable mounting screw NPT 1½"		724 g (25.535 oz)
Terminal box		235 g (8.288 oz)
Temperature head transmitter TMT182		40 g (1.411 oz)
Additional weight		300 g (10.581 oz)
Testing adapter		39 g (1.376 oz)

Material



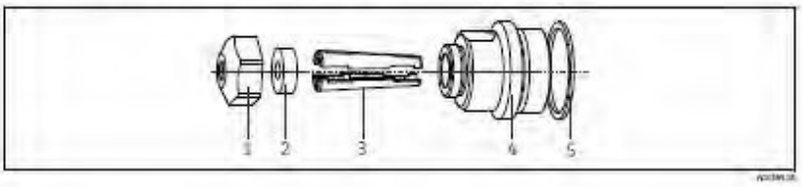
Material in contact with process		
Position number	**Component part**	**Material**
1	**A**: Level probe, outer diameter 22 mm (0.87 in) **B**: Level probe, outer diameter 42 mm (1.65 in) **C**: Level probe, outer diameter max. 29 mm (1.14 in)	316L (1.4404/1.4435)
1.1	Sensor sleeve	PPS (polyphenylene sulfide)
1.2	Heat-shrink sleeve The heat-shrink sleeve at the level probe acts as an insulation. It prevents electrical contact between the probe and the tank. Electrochemical corrosion is thus avoided.	Polyolefin and hot-melt adhesive
2	Protection cap ▪ **A** and **C**: with outer diameter 22 mm (0.87 in) and 29 mm (1.14 in) ▪ **B**: with outer diameter 42 mm (1.65 in)	▪ PPO (Polyphenylenoxid) ▪ PFA (Perfluoralkoxy)
3	Process ceramic	Al_2O_3 (aluminum oxide ceramic)
4	Seal	EPDM or FKM Viton
5	Extension cable insulation For more information → 🖹 25	Either: ▪ PE-LD (low-density polyethylene) ▪ FEP (fluorinated ethylene propylene) ▪ PUR (polyurethane)
Material not in contact with process		
6	Pressure compensation tube	PA
7	Heat-shrink sleeve	Polyolefin

Terminal box (not in contact with process)



Position number	Component part	Material
1	Housing	PC
2	Mounting screws (4 x)	A2
3	Seal	CR (Chloropren-Unvulcanized rubber)
4	Dummy plug M20x1.5	PBT-GF30
5	Cable gland M20x1.5	PE-HD
6		PA6
7		PA6-GF30
8	Pressure compensation tube	PA6-GF10, ePTFE
9	Pressure compensation tube O-ring	Silicone (VMQ)

Cable mounting screw (not in contact with process)

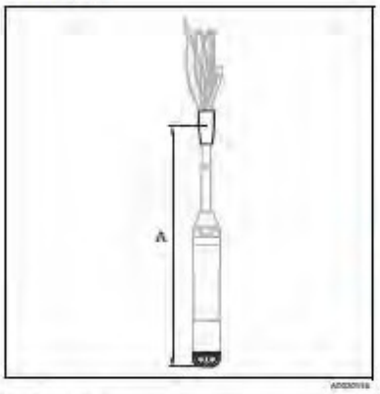


Position number	Component part	Material
1	Cover cable gland	304 (1.4301)
2	Seal	NBR
3	Klemmhülsen	PA66-GF35
4	Anschlussstück cable gland G 1½" A, NPT 1½"	304 (1.4301)
5	Seal → only for G 1½" A	EPDM

Extension cable

PE	PUR	FEP
▪ 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	▪ 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	▪ 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

Cable length



A Cable length

- Please refer also to "Load" (→ 🖹 12).
- Cable lengths that can be ordered
  - Customer-specific length in meters or feet (→ 🖹 28, "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) "Documentation"

Cross-section
- Total outer diameter: 8.0 mm (0.31 in) ±0.25 mm (±0.01 in)
- FMX21: 3 x 0.227 mm^2 (3 x 26 AWG) + pressure compensation tube with Teflon filter
- FMX21 with Pt100 (optional): 7 x 0.227 mm^2 (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
per wire: ≤ 0.09 Ω/m

Further technical data
- Minimum bending radius: 120 mm (4.72 in)
- Tensile strength: max. 950 N (213.56 lbf)
- Cable extraction force (= necessary tensile force to extract the cable from the level probe):
  - PE, FEP: typical ≥ 400 N (89.92 lbf), PUR: typical ≥ 150 N (33.72 lbf)
  - for use in hazardous areas: ≥ 100 N (73.75 lbf)
- Resistance to UV light
- PE: Usage in 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)

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

Operability

FieldCare	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. FieldCare supports the following functions: • Configuration of transmitters in offline and online mode • Loading and saving device data (upload/download) • Documentation of the measuring point Connection options: • Via Commubox FXA195 and the USB port of a computer • Via Fieldgate FXA520 For further information and free download of FieldCare see → www.endress.com → Download → Search: FieldCare
Field Xpert SFX	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.

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.

Ex approval

- ATEX
- CSA C/US
- FM
- IEC
- NEPSI
- INMETRO

- The approvals to apply only for Waterpilot FMX21 without Pt100 and without TMT182.
- Waterpilot FMX21 is only available for use in hazardous areas with the FKM Viton seal.
- All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas (→ 32).

Drinking water approval

For FMX21 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)
- LR (Lloyds Register)
- BV (Bureau Veritas)
- DNV (Det Norske Veritas)

Standards and guidelines

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:

- 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
- IEC 60529:
  Degrees of protection provided by enclosures

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.

10	**Approval:**										
	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/CI. I Division 1, Groups A – D, Ex ia, zone 1									
	CD	CSA General Purpose									
	IC	IEC Ex ia IIC T6 Gb									
	MA	INMETRO Ex ia IIC T6									
	NA	NEPSI Ex ia IIC T6									
20		**Output:**									
		2	4-20 mA HART								
45			**Probe tube:**								
			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							
70				**Sensor range:**							
				Measuring range							
				1C	100 mbar/10 kPa/1.5 psi gauge, 1 m H_2O/3 ft H_2O/40 in H_2O						
				1D	200 mbar/20 kPa/3 psi gauge, 2 m H_2O/6 ft H_2O/80 in H_2O						
				1F	400 mbar/40 kPa/6 psi gauge, 4 m H_2O/13 ft H_2O/160 in H_2O						
				1G	600 mbar/60 kPa/9 psi gauge, 6 m H_2O/20 ft H_2O/240 in H_2O						
				1H	1 bar/100 kPa/15 psi gauge, 10 m H_2O/33 ft H_2O/400 in H_2O						
				1K	2 bar/200 kPa/30 psi gauge, 20 m H_2O/67 ft H_2O/800 in H_2O						
				1M	4 bar/400 kPa/60 psi gauge, 40 m H_2O/133 ft H_2O/1600 in H_2O						
				1P	10 bar/1 MPa/150 psi gauge, 100 m H_2O/333 ft H_2O/4000 in H_2O						
				1Q	20 bar/2 MPa/300 psi gauge, 200 m H_2O/667 ft H_2O/8000 in H_2O						
				2K	2 bar/200 kPa/30 psi absolute, 20 m H_2O/67 ft H_2O/800 in H_2O						
				2M	4 bar/400 kPa/60 psi absolute, 40 m H_2O/133 ft H_2O/1600 in H_2O						
				2P	10 bar/1 MPa/150 psi absolute, 100 m H_2O/333 ft H_2O/4000 in H_2O						
				2Q	20 bar/2 MPa/300 psi absolute, 200 m H_2O/667 ft H_2O/8000 in H_2O						
80						**Reference accuracy:**					
						D	Platinum				
						O	Standard				
90							**Calibration, unit:**				
							0	Sensor range; %			
							B	Sensor range; mbar/bar			
							C	Sensor range; kPa/MPa			
							D	Sensor range; mm/mH_2O			
							F	Sensor range; in H_2O/ft H_2O			
							P	Sensor range; psi			
							J	Customized pressure; see additional specification			
							K	Customized level; see additional specification			
FMX21											Order code

→ Ordering information for continued on next page

FMX21 (continued)

100		**Probe connection:**
	10	10 m cable, shortable, PE
	11	20 m cable, shortable, PE
	15	..... m cable, shortable, PE
	20	30 ft cable, shortable, PE
	21	60 ft cable, shortable, PE
	25	..... ft cable, shortable, PE
	30	10 m cable, shortable, FEP
	31	20 m cable, shortable, FEP
	35	..... m cable, shortable, FEP
	40	30 ft cable, shortable, FEP
	41	60 ft cable, shortable, FEP
	45	..... ft cable, shortable, FEP
	50	10 m cable, shortable, PUR
	51	20 m cable, shortable, PUR
	55	..... m cable, shortable, PUR
	60	30 ft cable, shortable, PUR
	61	60 ft cable, shortable, PUR
	65	..... ft cable, shortable, PUR
190		**Seal:**
	A	FKM Viton
	H	EPDM
FMX21-		Order code

Additional ordering information (optional)

550		**Calibration**
	F1	Works calib. certificate 5-point
570		**Service**
	IA	Adjusted min alarm current
	IB	Adjusted HART Burst Mode PV
	IR	... m cable marking>installation
	IS	... ft cable marking>installation
	Y9	Special version
590		**Additional approval**
	LE	GL Marine certificate
	LF	ABS Marine certificate
	LG	LR Marine certificate
	LH	BV Marine certificate
	LI	DNV Marine certificate
	LQ	KTW potable water approval
	LR	NSF potable water approval
	LS	ACS potable water approval
610		**Accessories mounted**
	NB	Temperature sensor Pt100, 4-wire
620		**Accessories enclosed**
	PD	Suspension clamp, 316L
	PQ	Cable mounting screw G1 W', 304
	PR	Cable mounting screw NPT1 W', 304
	PS	Terminal box IP66/67
	PT	Temperature head transmitter TMT182, 2-wire, 4-20 mA, -20 to 80 °C
	PU	Additional weight, 316L
	PV	Adapter, function test
	PW	Shortening kit, extension cable
895		**Marking**
	Z1	Tagging (TAG)
FMX21-		Order code

Accessories

Mounting clamp

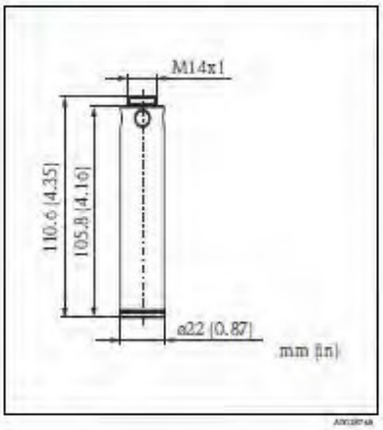
- Endress+Hauser offers a mounting clamp for easy FMX21 mounting (→ 20).
- Material: 316L (1.4404) and fiberglass reinforced PA (polyamide)
- Order number 52006151, "Ordering information" (→ 28)

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) → 21, "Ordering information" (→ 28).

The terminal box is not intended for the FMX21 with Ex nA explosion protection in the hazardous area. When using the terminal box in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings.

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 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: 316L (1.4435)
- Weight: 300 g (10.581 oz)
- Order number 52006153, "Ordering information" (→ 28)

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) → 22.
- Order number: 51001023, Ordering information (→ 28)

The TMT182 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 (→ 21).

- Order number for extension cable mounting screw:
  - 52008264 (G 1½" A)
  - 52009311 (NPT 1½")
- Material (→ 23)

Terminals

- Four terminals in strip for terminal box, suitable for wire cross-section: 0.08 to 2.5 mm² (28 to 14 AWG)
- Order number: 52008938

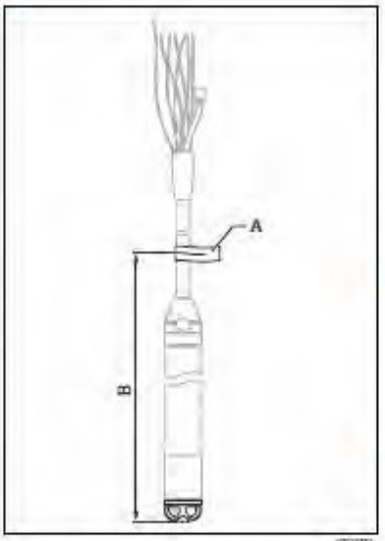
The 4-terminal strip is not intended for use in hazardous areas incl. CSA GP.

Cable shortening kit

- The cable shortening kit is used to easily and professionally shorten a cable.
- Order Number: 71222671, "Ordering information" and the documentation SD00552P/00/A6 (→ 28)

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

Cable marking



A Cable marking
B Cable marking tolerance

- To make installation easier, Endress+Hauser offers a mark on the extension cable for a customer-specific length, see also → 28, "Ordering information".
- Cable marking tolerance (distance to the lower end of the cable probe):
  Cable length < 5 m (16 ft): ±17.5 mm (0.69 in)
  Cable length > 5 m (16 ft): ±0.2 %
- Material: PET, Adhesive: acrylic
- Immunity to temperature change: −30 to +100 °C (-22 to +212 °F)

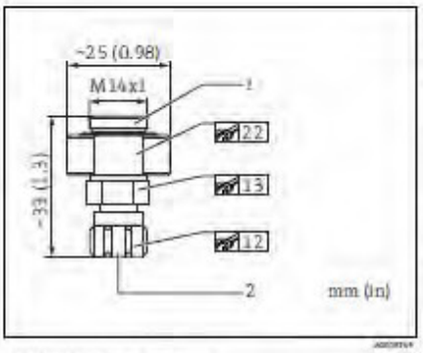
NOTICE

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.

Testing adapter



1 FMX21 level probe connection
2 Compressed air hose connection, internal diameter of quick coupling piece 4 mm (0.16 in)

For FMX21 with outer diameter of 22 mm (0.87 in) and 29 mm (1.14 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 (→ 11).
- Maximum pressure of the quick coupling piece supplied: 10 bar (145 psi)
- Adapter material: 304 (1.4301)
- Quick coupling piece material: anodized aluminum
- Adapter weight: 39 g (1.376 oz)
- Order number 52011868 (→ 28)

Documentation

The following document types are also available in the Download Area of the Endress+Hauser website: www.endress.com → Download

Field of activities
- Pressure measurement: FA00004P/00/EN
- Recording technology: FA00014R/09/EN
- System components: FA00016K/09/EN

Technical Information
- Waterpilot FMX167 with 4 to 20 mA analog output: TI00351P/00/EN
- Deltapilot M: TI00437P/00/EN
- Temperature head transmitter iTEMP HART TMT182: TI00078R/09/EN

Operating Instructions
- Waterpilot FMX21: BA00380P/00/EN
- Cable shortening kit: SD00552P/00/A6
- Field Xpert: BA01211S/04/EN

Safety instructions

Safety Instructions (XA) are supplied with the device depending on the approval. These instructions are anintegral part of the Operating Instructions.

Approval	Feature in Order code	Types of protection	Category	Documentation
ATEX	BD	Ex ia IIC	II 2 G	XA00454P
ATEX	BE	Ex nA IIC	II 3 G	XA00485P
IECEx	IC	Ex ia IIC	n/a	XA00455P
CSA C/US	CE	Ex ia IIC	n/a	ZD232P (960008976)
FM	FE	AEx ia IIC	n/a	ZD231P (960008975)
NEPSI	NA	Ex ia IIC	n/a	XA00456P
INMETRO	MA	Ex ia IIC	n/a	XA01066P

The nameplate provides information on the Safety Instructions (XA) that are relevant for the device.

Drinking water approval
- SD00289P/00/A3 (NSF)
- SD00319P/00/A3 (KTW)
- SD00320P/00/A3 (ACS)

Patents

This product is protected by at least one of the following patents. Further patents are pending.
- US 6,427,129 B1 ≙ EP 0 892 249 B1
- US 6,703,943 A1
- DE 203 13 744.2 U1

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	☐ mmH_2O	☐ mmHg	☐ hPa
☐ bar	☐ mH_2O		☐ kPa
	☐ ftH_2O		☐ MPa
☐ psi	☐ inH_2O	☐ kgf/cm^2	

Output Unit (Scaled unit)

Mass	Length	Volume	Volume	Percent
☐ kg	☐ m	☐ l	☐ gal	☐ %
☐ t	☐ dm	☐ hl	☐ Igal	
☐ lb	☐ cm			
	☐ mm	☐ m^3		
		☐ ft^3		
	☐ ft	☐ in^3		
	☐ inch			

Empty calibration [a]:
low pressure value (empty) _____ [pres.eng.unit]

Empty calibration [a]:
low level value (empty) _____ [scaled unit]

Full calibration [b]:
high pressure value (full) _____ [pres.eng.unit]

Full calibration [b]:
high level value (full) _____ [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

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

Calibration Range / Output

Low range value (LRV) _____ [pressure engineering unit]
Upper range value (URV): _____ [pressure engineering unit]

Damping

Damping: _____ sec

Endress+Hauser SE+Co.
2340 Endress Place
Greenwood, In. 46143-9772

Final Inspection Report /Endprüfprotokoll

The manufacturer confirms that all measuring equipment used to assure the quality of the products has been calibrated and is traceable to national (e.g. DKD/DAkkS, NIST, NABL...) or international standards.

Der Hersteller bestätigt, dass die zu Qualitätsprüfungen des Erzeugnisses eingesetzten Messmittel gültig kalibriert waren und auf nationale (z.B. DKD/DAkkS, NIST, NABL...) bzw. internationale Normale rückführbar sind.

Waterpilot HART

TAG number — Messstellen-Nummer

Order code	Bestellcode	FMX21-6FF0/0
Serial number	Seriennummer	NB00D915122
Extended order code	Erweiterter Bestellcode	FMX21-FE211HGE25A+PO
Sensor range	Sensor-Messbereich	0...400 inH2O
Adjusted measuring range	Eingestellter Messbereich	0...400 inH2O
Maximum permissible error	Max. zulässige Messabweichung	± 0.2 %
Output type	Ausgang	4-20 mA HART
Software version	Softwareversion	01.00
Output mode	Ausgangsmodus	linear

HAMPTON ROADS SANITATION DISTRICT HRSD

Customer order number	Auftragsnummer des Kunden	34884
E+H sales order number	E+H Auftragsnummer	3019367181000010
Internal order number	Interne Auftragsnummer	3003840583/0010

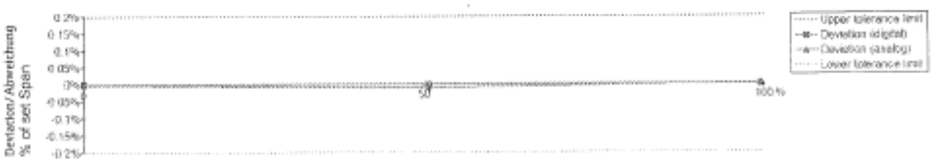
Ambient temperature	Umgebungs-Temperatur	22.2°C (± 1 °C)
Ambient humidity	Umgebungs-Luftfeuchte	27.9 %rel.F (± 10 %rel.F)
Ambient pressure	Umgebungs-Luftdruck	980.6 mbar (± 0.2 mbar)

Calibrated according to fix point method IEC 60770. Prüfung nach Grenzpunktmethode gemäß IEC 60770.

Measuring results / Messergebnisse

Calibration point / Kalibrierpunkt	Nominal value ($p_{Ref.}$) / Sollwert ($p_{Ref.}$)	Measured value (digital readout) / Istwert (Digitaler Wert)	Deviation (digital) / Abweichung (digital)	Nominal value (i_{Out} calculated) / Sollwert (i_{Out} berechnet)	Current output (analog) / Istwert Stromausgang (analog)	Rel. deviation (analog) / Rel. Abweichung (analog)
%	inH2O	inH2O	% of Span	mA	mA	%
0	0.00000	0.00040	0.00010	4.00000	3.99994	-0.00036
51	202.402	202.394	-0.00197	12.09608	12.09430	-0.01115
99	397.588	397.586	-0.00055	19.90352	19.90399	0.00295

Calibration orientation
Kalibrierlage



Calibration carried out in output mode linear/
Kalibration erfolgte im Ausgangsmodus linear.

Measuring point in % of adjusted measuring range/
Messpunkt in % vom eingestellten Messbereich

We confirm that all tests, according to the Quality Plan (QP), have been performed successfully. At the time of verification, the measuring points of the device indicated above were in compliance to the published valid technical specification (TI).

Wir bestätigen, dass alle Tests aus dem Qualitätsplan (QP) erfolgreich durchgeführt wurden. Das Gerät entsprach zum Zeitpunkt der Prüfung an den aufgeführten Messpunkten den gültigen technischen Spezifikationen (TI).

TI 431P

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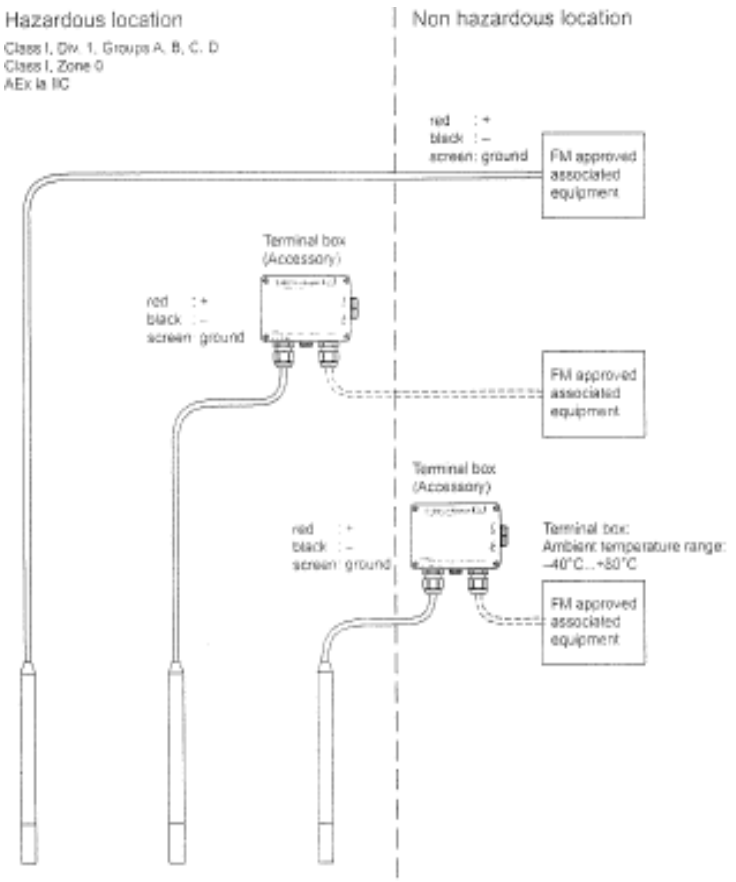
Endress+Hauser
People for Process Automation

Date of inspection/ Prüfdatum 26. Nov 2018



Intrinsically safe (entity), Class I, Div. 1, Groups A, B, C, D or Zone 0, IIC Hazardous Location Installations

1. FM approved apparatus must be installed in accordance with manufacturer instructions.
2. Control room equipment must not use or generate over 250 V.
3. The installation must be in accordance with the National Electric Code ANSI / NFPA 70 and ANSI / ISA-RP 12.06.01.
4. Sensor entity parameters: Vmax = 30 V DC, Imax = 133 mA, Pmax = 1 W Ci and Li per following table:

Length of sensor cable	Ci (10.3 nF + 180 pF/m)	Li (1 µH/m)
5 m	11.3 nF	5 µH
10 m	12.2 nF	10 µH
20 m	14.0 nF	20 µH
30 m	15.8 nF	30 µH
50 m	19.4 nF	50 µH
100 m	28.4 nF	100 µH
200 m	46.4 nF	200 µH
300 m	64.4 nF	300 µH

5. FM approved associated equipment must meet following conditions: Voc or Vt ≤ Vmax; Isc or Io ≤ Imax; Po ≤ Pmax; Ca ≥ Ci + Ccable; La ≥ Li + Lcable. Install associated equipment in accordance with the manufacturer instructions.
6. Use supply wires suitable for 5°C above surrounding ambient.
7. Avoid friction and impact sparks. Anchor sensor if necessary, secure against swinging.
8. WARNING: Avoid electrostatic charging of plastic surfaces. Do not rub. Do not use in media or environments which may generate electrostatic charges on plastic surfaces.
9. WARNING: Substitution of components may impair intrinsic safety.
10. Do not remove or move terminal blocks, fastening elements or insulation plate of the terminal box. Do not build in additional components.
11. Connect cable screen to earth ground of the installation.

Sensor

Temperature class	Ambient temperature range
T4	–10°C ≤ Ta ≤ +70°C
T5	–10°C ≤ Ta ≤ +55°C
T6	–10°C ≤ Ta ≤ +40°C

Terminal box

Temperature class	Ambient temperature range
T6	–40°C ≤ Ta ≤ +80°C

Terminal box (Accessory):