Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Micropilot M FMR230/231/240/244/245

Level-Radar

Smart transmitter for continuous and non-contact level measurement. Cost-effective 4 to 20 mA 2-wire technology. Suitable for hazardous locations.

Application

The Micropilot M is used for continuous, non-contact level measurement of liquids, pastes, and slurries. The measurement is not affected by changing media, temperature changes, gas blankets or vapors.

- The FMR230 is especially suited for measurement in buffer and process tanks.
- The FMR231 has its strengths wherever high chemical compatibility is required.
- The FMR240 with the small (1-½") horn antenna is ideally suited for small vessels. Additionally, it provides an accuracy of ± 0.12" (3 mm).
- The FMR244 combines the advantages of the horn antenna with high chemical resistance.
- The FMR245 – highly resistant, easy to clean.

Your benefits

- 2-wire technology, low price:
  A real alternative to differential pressure, floats and displacers. 2-wire technology reduces wiring costs and allows easy implementation into existing systems.
- Non-contact measurement:
  Measurement is almost independent from product properties.
- Easy local operation via menu-driven alphanumeric display.
- Easy commissioning, documentation and diagnostics via operating software (ToF Tool).
- 2 frequency ranges – FMR230/FMR231 in the C-band and FMR240/244/245 in the K-band: No compromises, the right frequency for every application.
- HART® or PROFIBUS® PA respectively FOUNDATION™ Fieldbus protocol.
- High temperatures:
  Suitable for process temperatures up to 392°F (200°C), up to 752°F (400°C) with high-temperature antenna.
- Rod antenna with inactive length:
  Reliable measurement in narrow nozzles, with condensation and build-up in the nozzle.
- Application in safety related systems (overspill protection) with requirements for functional safety up to SIL 2 in accordance to IEC 61508/IEC 61511-1.

TI345F/24/ae

Endress+Hauser

People for Process Automation

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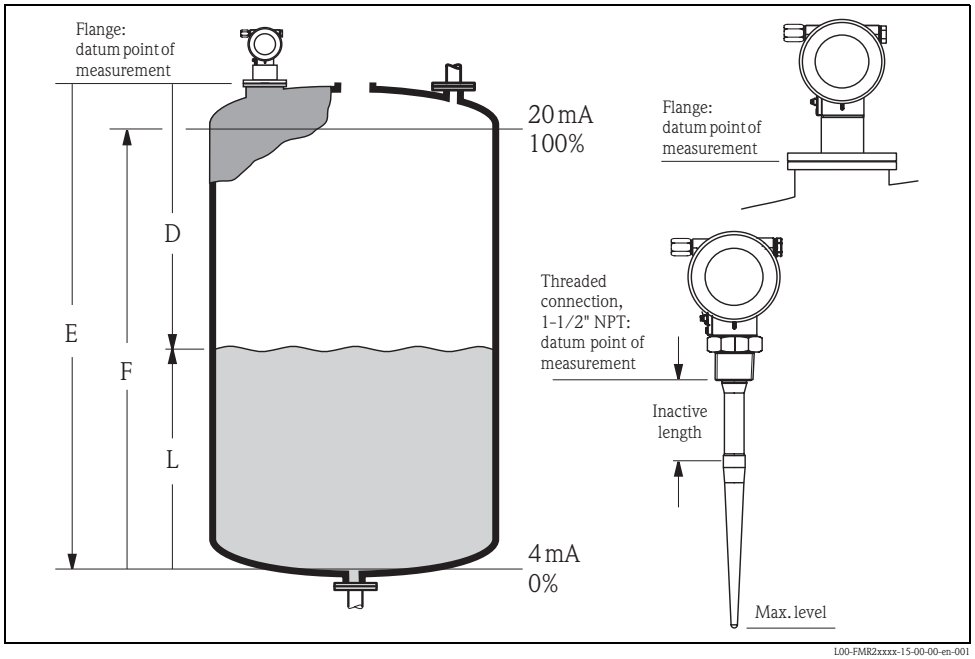
Function and system design

Measuring principle

The Micropilot is a "downward-looking" measuring system, operating based on the time-of-flight method. It measures the distance from the reference point (process connection) to the product surface. Radar impulses are emitted by an antenna, reflected off the product surface and received again by the radar system.



Input

The reflected radar impulses are received by the antenna and transmitted into the electronics. A microprocessor evaluates the signal and identifies the level echo caused by the reflection of the radar impulse at the product surface. The unambiguous signal identification is accomplished by the PulseMaster® eXact software, based on many years of experience with time-of-flight technology.
The mm-accuracy of the Micropilot S could be achieved with the patented algorithms of the PhaseMaster software.
The distance D to the product surface is proportional to the time of flight t of the impulse:

$D = c \cdot t/2$,
with c being the speed of light.

Based on the known empty distance E, the level L is calculated:

$L = E - D$

Refer to the above figure for the reference point for "E".

The Micropilot is equipped with functions to suppress interference echoes. The user can activate these functions. They ensure that interference echoes (i.e. from edges and weld seams) are not interpreted as level echo.

Output

The Micropilot is commissioned by entering an empty distance E (=zero), a full distance F (=span) and an application parameter. The application parameter automatically adapts the instrument to the process conditions. The data points “E” and “F” correspond with 4mA and 20mA for instruments with current output. They correspond with 0 % and 100 % for digital outputs and the display module.
A linearization with a maximum of 32 points, based on a table entered either manually or semi-automatically, can be activated locally or remotely. This function provides a measurement in engineering units and a linear output signal for spheres, horizontal cylindrical tanks and vessels with conical outlet.

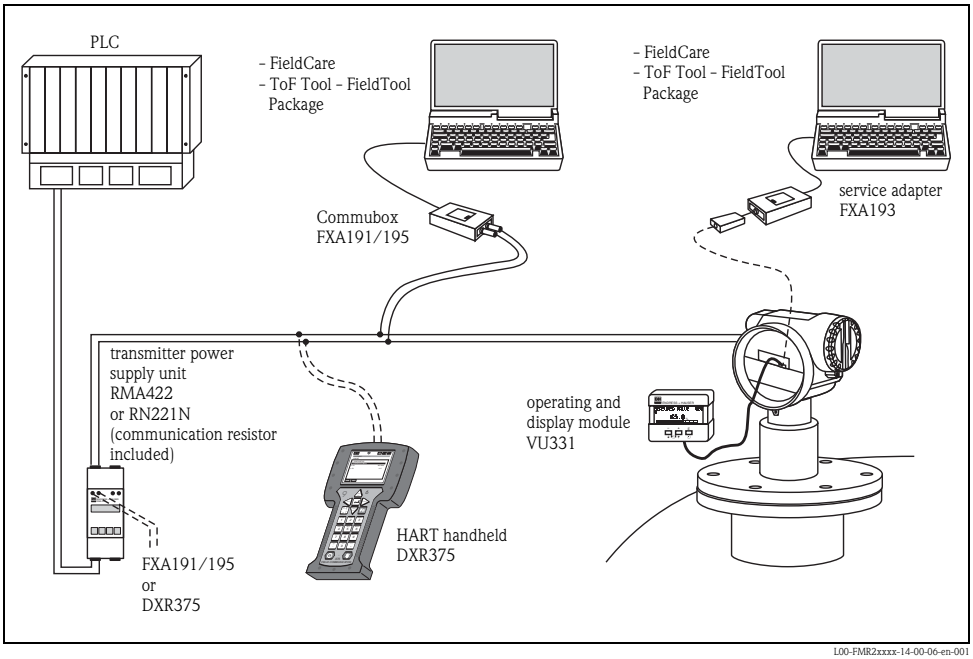
Equipment architecture

Stand-alone

The Micropilot M can be used for measurement in a stilling well / bypass as well as in free space.
The instrument provides a 4 to 20 mA output with HART protocol, or PROFIBUS PA respectively FOUNDATION Fieldbus communication.

4 to 20 mA output with HART protocol.

The complete measuring system consists of:



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Local operation

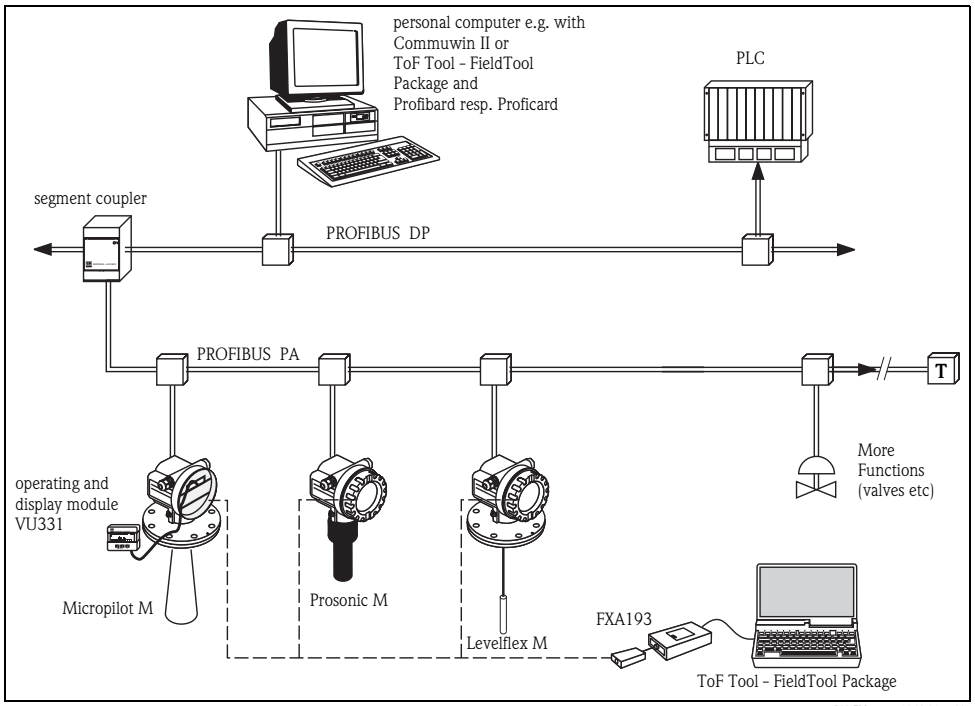
- With display and operating module VU331,
- With a Personal Computer, FXA193 and the operating software "ToF Tool - FieldTool Package" respectively "FieldCare".
  The ToF Tool is a graphical operating software for instruments from Endress+Hauser that operate based on the time-of-flight principle (radar, ultrasonic, guided micro-impulse). It assists with commissioning, securing data, signal analysis and documentation of the measuring point.

Remote operation

- With HART handheld DXR375,
- With a Personal Computer, Commubox FXA191/195 and the operating software "ToF Tool - FieldTool Package" respectively "FieldCare".

System integration via PROFIBUS PA

A maximum of 32 transmitters (8 if mounted in an intrinsically safe hazardous location according to FISCO-model) can be connected to the bus. The segment coupler provides the operating voltage to the bus. Both on-site as well as remote operation are possible.The complete measuring system consists of:



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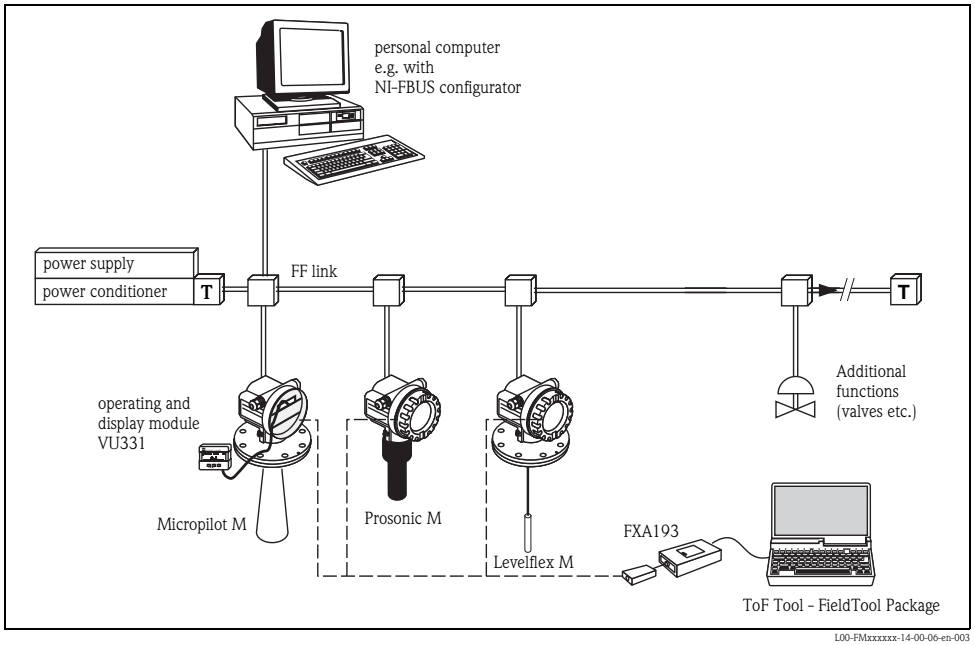
System integration via FOUNDATION Fieldbus

A maximum of 32 transmitters (standard, Explosion proof, EEx em or EEx d) can be connected to the bus. For protection class Intrinsically safe (EEx ia IIC): the maximum number of transmitters depends on the established rules and standards for intrinsically safe circuits (EN 60079-14), proof of intrinsically safety. Both local as well as remote operation are possible. The complete measuring system consists of:



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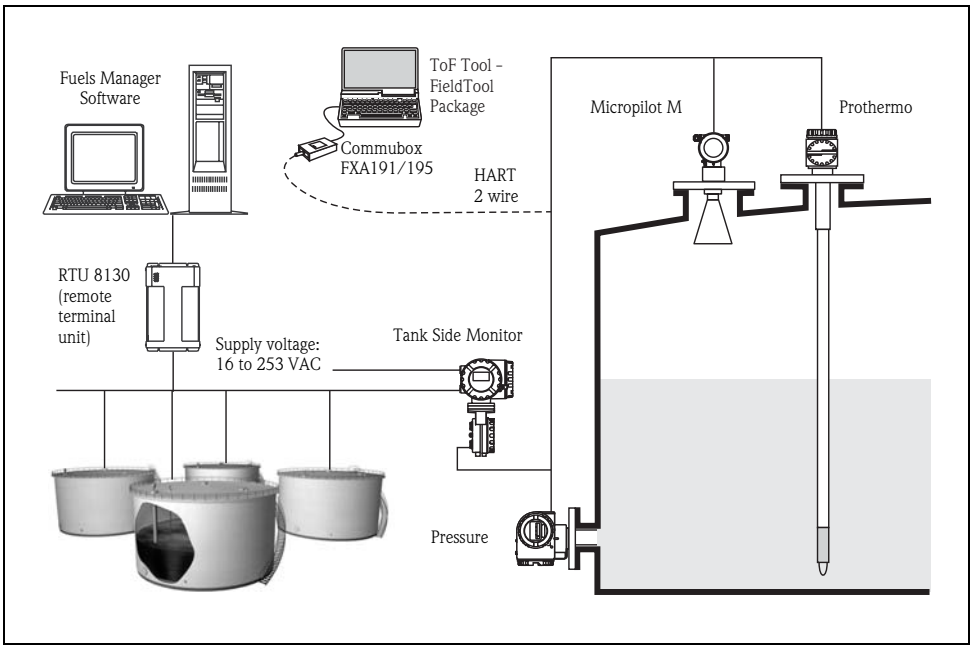
Integrated in tank gauging system

The Endress+Hauser Tank Side Monitor NRF590 provides integrated communications for sites with multiple tanks, each with one or more sensors on the tank, such as radar, spot or average temperature, capacitive probe for water detection and/or pressure sensors. Multiple protocols out of the Tank Side Monitor guarantee connectivity to nearly any of the existing industry standard tank gauging protocols. Optional connectivity of analog 4 to 20 mA sensors, digital I/O and analog output simplify full tank sensor integration. Use of the proven concept of the intrinsically safe HART bus for all on-tank sensors yields extremely low wiring costs, while at the same time providing maximum safety, reliability and data availability.



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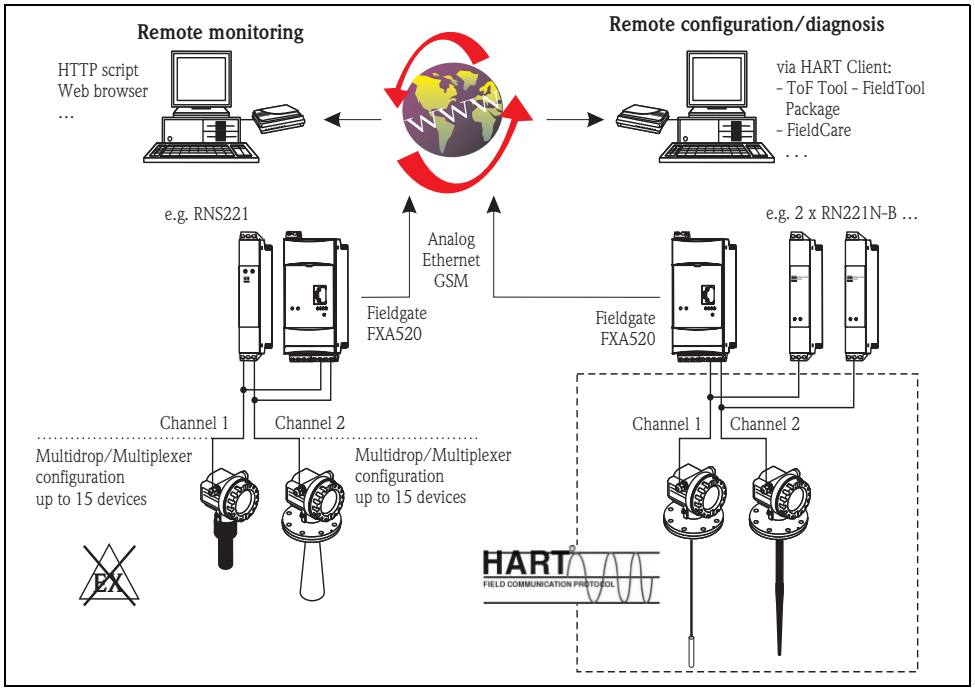
System integration via Fieldgate

Vendor Managed Inventory

By using Fieldgates to interrogate tank or silo levels remotely, suppliers of raw materials can provide their regular customers with information about the current supplies at any time and, for example, account for them in their own production planning. For their part, the Fieldgates monitor the configured level limits and, if required, automatically activate the next supply. The spectrum of options here ranges from a simple purchasing requisition via e-mail through to fully automatic order administration by coupling XML data into the planning systems on both sides.

Remote maintenance of measuring equipment

Fieldgates not only transfer the current measured values, they also alert the responsible standby personnel, if required, via e-mail or SMS. In the event of an alarm or also when performing routine checks, service technicians can diagnose and configure connected HART devices remotely. All that is required for this is the corresponding HART operating software (e.g. ToF Tool - FieldTool Package, FieldCare, ...) for the connected device. Fieldgate passes on the information transparently, so that all options for the respective operating software are available remotely. Some on-site service operations can be avoided by using remote diagnosis and remote configuration and all others can at least be better planned and prepared.



Note!
The number of instruments which can be connected in mutidrop mode can be calculated by the "FieldNetCalc" program. A description of this program can be found in Technical Information TI 400F (Multidrop Conncector FXN520). The program is available form your Endress+Hauser sales organization or in the internet at: "**www.endress.com Download**" (Text Search = "Fieldnetcalc").

Input

Measured variable

The measured variable is the distance between a reference point (refer to fig. on page 2) and a reflective surface (i.e. medium surface).
The level is calculated based on the tank height entered.The level can be converted into other units (volume, mass) by means of a linearization (32 points).

Measuring range

The usable measuring range depends on the size of the antenna, the reflectivity of the medium, the mounting location and eventual interference reflections.

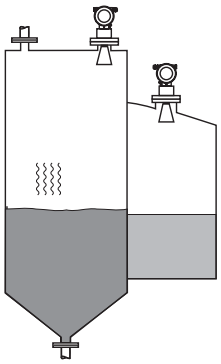
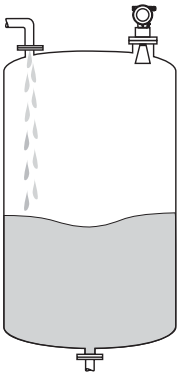
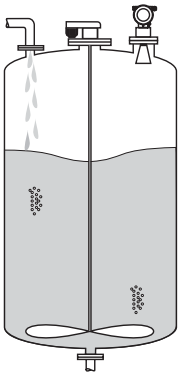
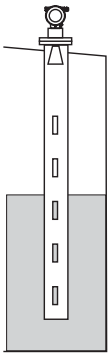
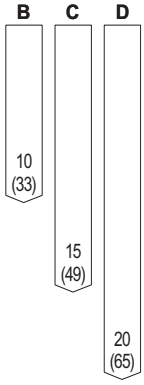
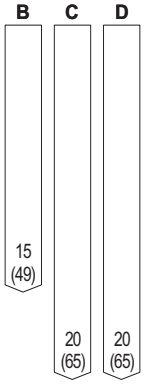
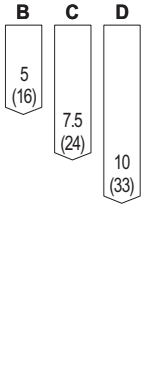
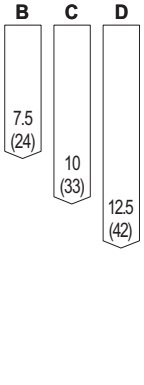
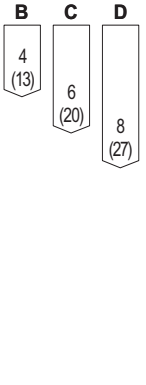
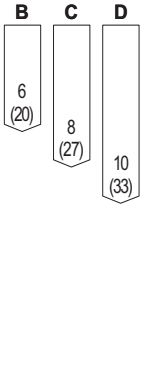
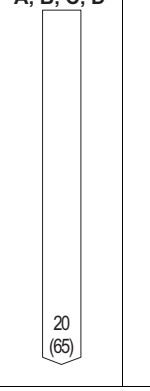
The maximum configurable range is:
- 65 ft (20 m) for Micropilot M FMR23x,
- 65 ft (20 m) for Micropilot M FMR24x,
  - 131 ft (40 m) for Micropilot M FMR24x with additional option D (E), see "ordering information",
  - 229 ft (70 m) for Micropilot M FMR24x with additional option F (G), see "ordering information",
- 229 ft (70 m) for Micropilot M FMR250 (further information, see TI390F/24/ae).

The following tables describe the groups of media as well as the achievable measuring range as a function of application and media group. If the dielectric constant of a medium is unknown, it is recommended to assume media group B to ensure a reliable measurement.

Media group	DC (Er)	Examples
A	1.4 o 1.9	non-conducting liquids, e.g. liquefied gas[1)]
B	1.9 to 4	non-conducting liquids, e.g. benzene, oil, toluene, …
C	4 to 10	e.g. concentrated acids, organic solvents, esters, aniline, alcohol, acetone, …
D	> 10	conducting liquids, e.g. aqueous solutions, dilute acids and alkalis

1) Treat Ammonia NH_3 as a medium of group A, i.e. use FMR230 in a stilling well.

Measuring range depending on vessel type, conditions and product for Micropilot M FMR230, FMR231

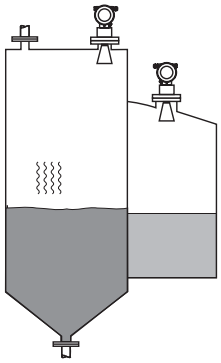
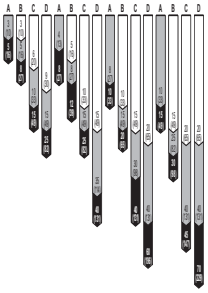
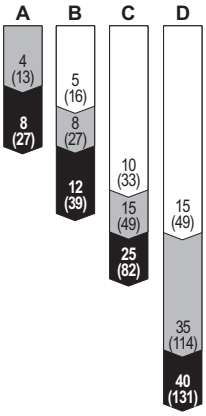
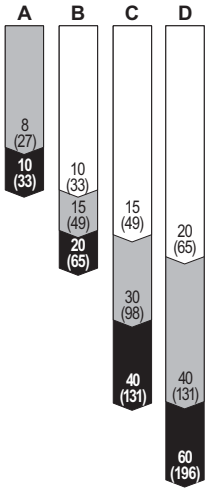
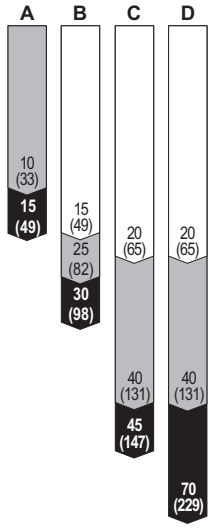
	Storage tank [1]		Buffer tank [1]		Process tank with agitator [1]		Stilling well	Bypass
	 Calm product surface (e.g. intermittent filling, filling from bottom, immersion tubes).		 Moving surfaces (e.g. continuous filling, from above, mixing jets).		 Turbulent surface. Single stage agitator < 60 RPM			
FMR230:	150 mm (6")	200 mm (8"), 250 mm (10")	150 mm (6")	200 mm (8"), 250 mm (10")	150 mm (6")	200 mm (8"), 250 mm (10")	80 to 250 mm (3 to 10")	80 to 250 mm (3 to 10") [2]
FMR231:	Rod antenna	—	Rod antenna	—	Rod antenna	—	—	—
								
	Measuring range m (ft)							

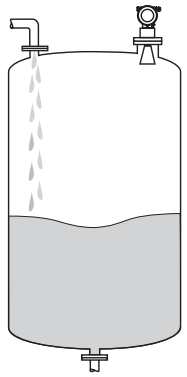
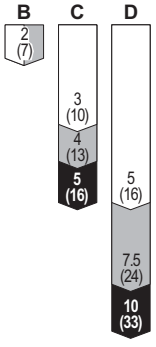
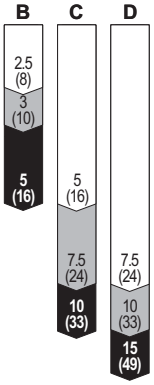
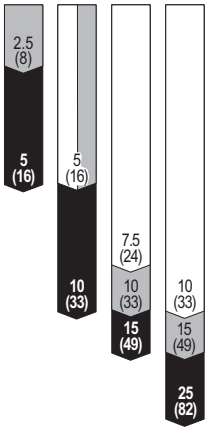
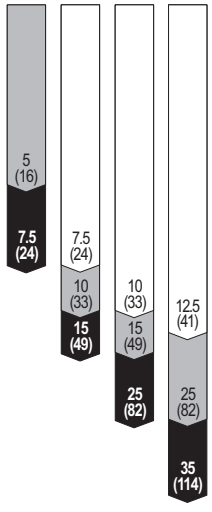
1) For media group A to use a stilling well (20 m / 65 ft).

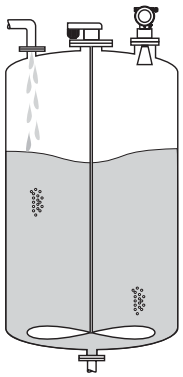
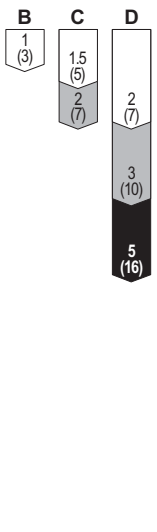
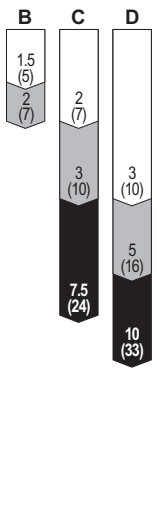
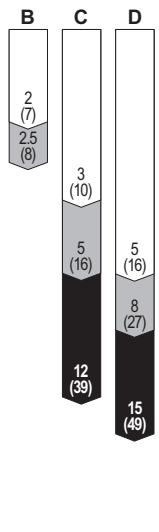
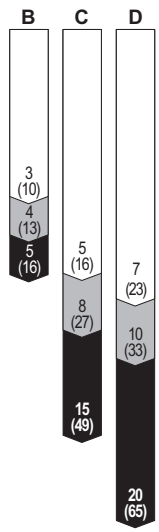
2) For media group A and B possible, i.e. with stilling well in bypass.

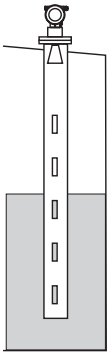
Measuring range depending on vessel type, conditions and product for Micropilot M FMR240, FMR244, FMR245

Standard: max. measuring range = 20 m (65 ft)	With additional option D (E): max. measuring range = 40 m (131 ft)	With additional option F (G): max. measuring range = 70 m (229 ft) min. measuring range = 5 m (16 ft)

FMR240:	40 mm (1½")	50 mm (2")	80 mm (3")	100 mm (4")
FMR244:	40 mm (1½")	—	—	—
FMR245:	—	50 mm (2")	80 mm (3")	—
Storage tank  Calm product surface (e.g. intermittent filling, filling from bottom, immersion tubes).				
	Measuring range m (ft)			

FMR240:	40 mm (1½")	50 mm (2")	80 mm (3")	100 mm (4")
FMR244:	40 mm (1½")	—	—	—
FMR245:	—	50 mm (2")	80 mm (3")	—
Buffer tank  Moving surfaces (e.g. continuous filling, from above, mixing jets).				
	Measuring range m (ft)			

FMR240:	40 mm (1-½")	50 mm (2")	80 mm (3")	100 mm (4")
FMR244:	40 mm (1-½")	—	—	—
FMR245:	—	50 mm (2")	80 mm (3")	—
Process tank with agitator  Turbulent surface. Single stage agitator <60 RPM.				
	Measuring range m (ft)			

FMR240:	40 mm to 100 mm (1-½" to 4")
FMR244:	40 mm (1-½")
FMR245:	50 mm to 80 mm (2" to 3")
Stilling well 	**A, B, C, D** 
	Measuring range m (ft)

FMR240:	40 mm to 100 mm (1-½" to 4")
FMR244:	—
FMR245:	50 mm to 80 mm (2" to 3")
Bypass 	**C, D** 
	Measuring range m (ft) [1)]

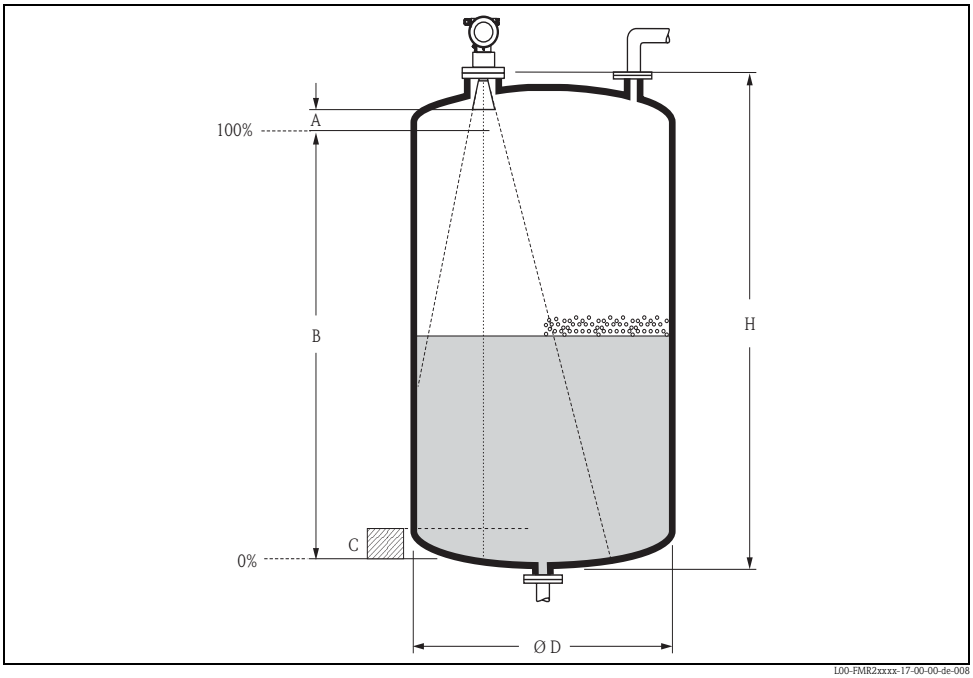
1) For media group A and B to use a Levelflex M with koax probe

Measuring conditions

Note!

- In case of **boiling surfaces, bubbling** or tendency for **foaming,** use FMR230 or FMR231. Depending on its consistence, foam can either absorb microwaves or reflect them off the foam surface. Measurement is possible under certain conditions. For FMR240/244/245, the additional option D, F (E, G) recommended (see ordering information).
- In case of heavy **steam development** or **condensate** the max. measuring range of FMR240 may decrease depending on density, temperature and composition of the steam → use FMR230 or FMR231.
- For the measurement of absorbing gases such as **ammonia NH_3** or some **fluorocarbons** [1)], please use FMR230 in a stilling well.

1) Affected compounds are e.g. R134a, R227, Dymel 152a.



- The measuring range begins, where the beam hits the tank bottom. Particularly with dish bottoms or conical outlets the level cannot be detected below this point.
- In case of media with a low dielectric constant (groups A and B), the tank bottom can be visible through the medium at low levels (low height **C**). Reduced accuracy has to be expected in this range. If this is not acceptable, we recommend positioning the zero point at a distance **C** (see Fig.) above the tank bottom in these applications.
- In principle it is possible to measure up to the tip of the antenna with FMR230/231/240. However, due to considerations regarding corrosion and build-up, the end of the measuring range should not be chosen any closer than **A** (see Fig.) to the tip of the antenna.
  For FMR244/245, the end of measuring range should not be chosen closer than **A** (see Fig.) to the tip of the antenna, especially if there is development of condensate.
- The smallest possible measuring range **B** depends on the antenna version (see Fig.).
- The tank diameter should be greater than **D** (see Fig.), the tank height at least **H** (see Fig.).

	A mm (inch)	B m (inch)	C mm (inch)	D m (inch)	H m (inch)
FMR230/231	50 (2)	> 0.5 (> 20)	150 to 300 (6 to 12)	> 1 (> 40)	> 1.5 (> 60)
FMR240	50 (2)	> 0.2 (> 8)	50 to 250 / 2 to 10	> 0.2 (> 8)	> 0.3 (> 12)
FMR244	150 (6)	> 0.2 (> 8)	50 to 250 / 2 to 10	> 0.2 (> 8)	> 0.3 (> 12)
FMR245	200 (8)	> 0.2 (> 8)	50 to 250 / 2 to 10	> 0.2 (> 8)	> 0.3 (> 12)

Operating frequency

- FMR230/231: C-band
- FMR240/244/245: K-band

Up to 8 Micropilot M transmitters can be installed in the same tank because the transmitter pulses are statistically coded.

Transmitting power

Average energy density in beam direction:

Distance	Average energy density
1 m (3 ft)	< 4 nW/cm^2
5 m (16 ft)	< 0.16 nW/cm^2

Output

Output signal

- 4 to 20 mA with HART protocol
- PROFIBUS PA
- FOUNDATION Fieldbus (FF)

Signal on alarm

Error information can be accessed via the following interfaces:
- Local display:
  - Error symbol
  - Plain text display
- Current output, signal on error can be selected (e.g. according to NAMUR recommendation NE 43).
- Digital interface

Linearization

The linearization function of the Micropilot M allows the conversion of the measured value into any unit of length or volume. Linearization tables for calculating the volume in cylindrical tanks are pre-programmed. Other tables of up to 32 value pairs can be entered manually or semi-automatically.

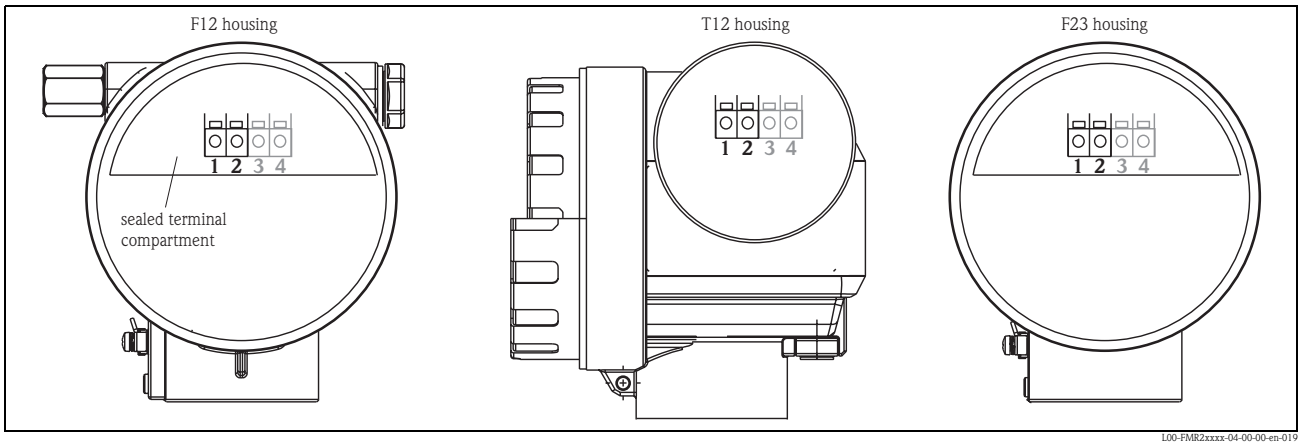
Auxiliary energy

Electrical connection

Terminal compartment

Three housings are available:
- Aluminum housing F12 with additionally sealed terminal compartment for:
  - standard,
  - Intrinsically safe (EEx ia).
- Aluminum housing T12 with separate terminal compartment for:
  - standard,
  - Explosion proof (EEx e / EEx d)
  - Intrinsically safe (EEx ia), with overvoltage protection, see Page 17.
- 316L SS housing F23 for:
  - standard,
  - Intrinsically safe (EEx ia).

The electronics and current output are galvanically isolated from the antenna circuit.



Cable gland

	Type	Clamping area
Standard, EEx ia, IS	Plastic M20x1.5	5 to 10 mm (0.2 to 0.4")
EEx em, EEx nA	Metal M20x1.5	7 to 10.5 mm (0.3 to 0.41")

Terminals

For wire cross-sections of 16 to 18 AWG (0.5 to 2.5 mm^2)

Terminal assignment

2-wire, 4 to 20 mA with HART

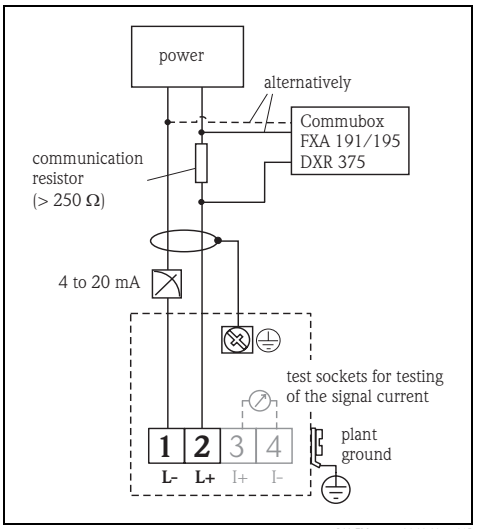
The 2-wire cable is connected to the screw terminals in the terminal compartment.

Cable specification:

- A standard installation cable is sufficient if only the analog signal is used. Use a shielded cable when working with a superimposed communications signal (HART).

Note!
Protective circuitry against reverse polarity, RFI, and over-voltage peaks is built into the device (refer to TI241F »basics for EMC-tests«).

Note!
See TI402F/00/en for connection to Tank Side Monitor NRF590.



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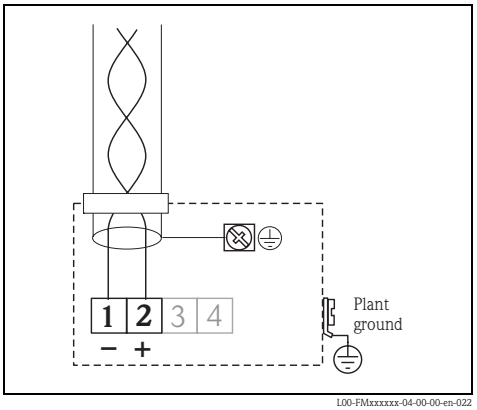
PROFIBUS PA

The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the auxiliary energy.
For further information on the network structure and earthing and for further bus system components such as bus cables, see the relevant documentation, e.g. Operating Instructions BA034S "Guidelines for planning and commissioning PROFIBUS DP/PA" and the PNO Guideline.

Cable specification:

- Use a twisted, shielded two-wire cable, preferably cable type A



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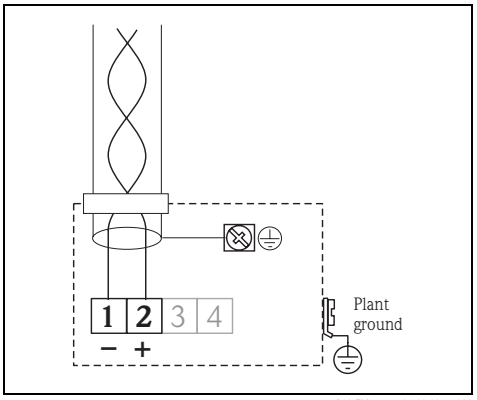
Note!
For further information on the cable specifications, see Operating Instructions BA034S "Guidelines for planning and commissioning PROFIBUS DP/PA", PNO Guideline 2.092 "PROFIBUS PA User and Installation Guideline" and IEC 61158-2 (MBP).

FOUNDATION Fieldbus

The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the auxiliary energy.
For further information on the network structure and earthing and for further bus system components such as bus cables, see the relevant documentation, e.g. Operating Instructions BA013S "FOUNDATION Fieldbus Overview" and the FONDATION Fieldbus Guideline.

Cable specification:

- Use a twisted, shielded two-wire cable, preferably cable type A



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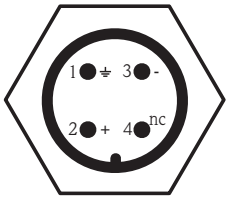
Note!
For further information on the cable specifications, see Operating Instructions BA013S "FOUNDATION Fieldbus Overview", FONDATION Fieldbus Guideline and IEC 61158-2 (MBP).

Fieldbus plug connectors

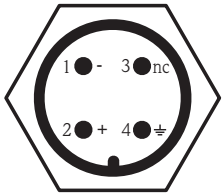
For the versions with fieldbus plug connector (M12 or 7/8"), the signal line can be connected without opening the housing.

Pin assignment of the M12 plug connector (PROFIBUS PA plug)



Pin	Meaning
1	Ground
2	Signal +
3	Signal –
4	not connected

Pin assignment of the 7/8" plug connector (FOUNDATION Fieldbus plug)



Pin	Meaning
1	Signal –
2	Signal +
3	not connected
4	ground

Load HART

Minimum load for HART communication: 250 Ω

Supply voltage

The following values are the voltages across the terminals directly at the instrument:

Communication		Current consumption	Terminal voltage	
			minimum	maximum
HART	standard	4 mA	16 V	36 V
		20 mA	7.5 V	36 V
	Intrinsically Safe	4 mA	16 V	30 V
		20 mA	7.5 V	30 V
	EEx em Explosion Proof	4 mA	16 V	30 V
		20 mA	11 V	30 V
Fixed current, adjustable e.g. for solar power operation (measured value transferred at HART)	standard	11 mA	10 V	36 V
	Intrinsically Safe	11 mA	10 V	30 V
Fixed current for HART Multidrop mode	standard	4 mA[1)]	16 V	36 V
	Intrinsically Safe	4 mA[1)]	16 V	30 V

1) Start up current 11 mA.

Cable entry

Cable gland: M20x1.5 (for EEx d: cable entry)
Cable entry: G ½ or ½" NPT
PROFIBUS PA M12 plug
Fieldbus Foundation 7/8" plug

Power consumption

Minimum 60 mW, max. 900 mW

Current consumption

Communication	Current consumption
HART	3.6 to 22 mA[1)]
PROFIBUS PA	max. 13 mA
FOUNDATION Fieldbus	max. 15 mA

1) for HART Multidrop: start up current is 11 mA.

Ripple HART

47 to 125 Hz: Uss = 200 mV (at 500 Ω)

Max. noise HART

500 Hz to 10 kHz: Ueff = 2.2 mV (at 500 Ω)

Overvoltage protector

The level transmitter Micropilot M with T12-housing (housing version "D", see ordering information on page 50-61) is equipped with an internal overvoltage protector (600 V surge arrester) according to DIN EN 60079-14 or IEC 60060-1 (impulse current test 8/20 µs, Î = 10 kA, 10 pulses). Connect the metallic housing of the Micropilot M to the tank wall or shield directly with an electrically conductive lead to ensure reliable potential matching.

Performance characteristics

Reference operating conditions

- Temperatur = +20°C (68°F) ±5 °C (9°F)
- Pressure = 1013 mbar abs. (14.7 psia) ±20 mbar (0.3 psi)
- Relative humidity (air) = 65 % ±20%
- Ideal reflector
- No major interference reflections inside the signal beam

Maximum measured error

Typical statements for reference conditions, include linearity, repeatability, and hysteresis:

FMR230, FMR231:
- To 10 m (33 ft): ± 10 mm (0.39")
- Over 10 m (33 ft): ± 0.1 % of measuring range

FMR240, FMR244, FMR245:
- **Not** for max. measuring range = 70 m (229 ft)
  - To 1 m (3 ft): ± 10 mm (0.39")
- For max. measuring range = 20 m (65 ft) and 40 m (131 ft)
  - To 10 m (33 ft): ± 3 mm (0.12")
  - Over 10 m (33 ft): ± 0.03 % of measuring range, whatever is larger
- For max. measuring range = 70 m (229 ft)
  - To 1 m (3 ft): ± 30 mm (1.18")
  - Over 1 m (3 ft): ± 15 mm (0.59") or 0.04 % of measuring range, whatever is larger

Resolution

Digital / analog in % 4 to 20 mA
- FMR230: 1 mm (0.04") / 0.03 % of measuring range
- FMR231: 1 mm (0.04") / 0.03 % of measuring range
- FMR240: 1 mm (0.04") / 0.03 % of measuring range
- FMR244: 1 mm (0.04") / 0.03 % of measuring range
- FMR245: 1 mm (0.04") / 0.03 % of measuring range

Reaction time

The reaction time depends on the parameter settings (min. 1 s). In case of fast level changes, the instrument needs the reaction time to indicate the new value.

Influence of ambient temperature

The measurements are carried out in accordance with EN 61298-3:
- digital output (HART, PROFIBUS PA, FOUNDATION Fieldbus):
  - **FMR240**
    average T_K: 2 mm/10 K (0.08"/10K), max. 5 mm (0.20") over the entire temperature range -40 to +80°C (-40 to +176°F)
  - **FMR230**
    average T_K: 3 mm/10 K (0.12"/10K), max. 10 mm (0.39") over the entire temperature range -40 to +80°C (-40 to +176°F)
  - **FMR231**
    average T_K: 5 mm/10 K (0.20"/10K), max. 15 mm (0.60") over the entire temperature range -40 to +80°C (-40 to +176°F)
- Current output (additional error, in reference to the span of 16 mA):
  - **Zero point (4 mA)**
    average T_K: 0.03 %/10 K, max. 0.45 % over the entire temperature range -40 to +80°C (-40 to +176°F)
  - **Span (20 mA)**
    average T_K: 0.09 %/10 K, max. 0.95 % over the entire temperature range -40 to +80°C (-40 to +176°F)

Effect of gas phase

High pressures reduce the propagation velocity of the measuring signals in the gas/vapor above the fluid. This effect depends on the gas/vapor and is particularly large for low temperatures. This results in a measuring error that gets larger as the distance increases between the device zero point (flange) and product surface. The following table illustrates this measured error for a few typical gases/vapors (with regard to the distance; a positive value means that too large a distance is being measured):

Gas phase	Temperature		Pressure				
	°C	°F	1 bar/14.5 psi	10 bar/145 psi	50 bar/725 psi	100 bar/1450 psi	160 bar/2320 psi
Air Nitrogen	20	68	0.00 %	0.22 %	1.2 %	2.4 %	3.89 %
	200	392	-0.01 %	0.13 %	0.74 %	1.5 %	2.42 %
	400	752	-0.02 %	0.08 %	0.52 %	1.1 %	1.70 %
Hydrogen	20	68	-0.01 %	0.10 %	0.61 %	1.2 %	2.00 %
	200	392	-0.02 %	0.05 %	0.37 %	0.76 %	1.23 %
	400	752	-0.02 %	0.03 %	0.25 %	0.53 %	0.86 %

Gas phase	Temperature		Pressure				
	°C	°F	1 bar/14.5 psi	10 bar/145 psi	50 bar/725 psi	100 bar/1450 psi	160 bar/2320 psi
Water (saturated steam)	100	212	0.20 %	—	—	—	—
	180	356	—	2.1 %	—	—	—
	263	505.4	—	—	8.6 %	—	—
	310	590	—	—	—	22 %	—
	364	687.2	—	—	—	—	41.8 %

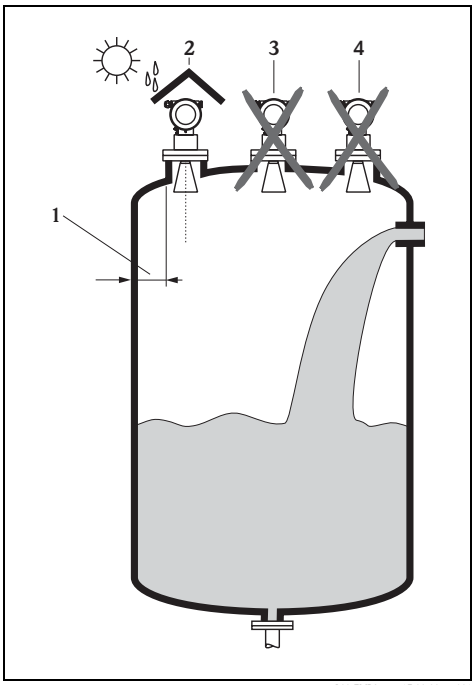
Note!
When the pressure is known and constant, this measured error can, for example, be compensated by means of linearization.

Operating conditions: Installation

Installation instructions

Orientation

- Recommended distance (1) wall – **outer edge** of nozzle: ~1/6 of tank diameter. Nevertheless the device should not be installed closer than 30 cm/ 12“ (FMR230/231) resp. 15 cm/6“ (FMR240/ 244/245) to the tankwall.
- Not in the center (3), interference can cause signal loss.
- Not above the fill stream (4).
- It is recommended to use a weather protection cover (2) in order to protect the transmitter from direct sun or rain. Assembly and disassembly is simply done by means of a tension clamp (see Accessories on Page 63).



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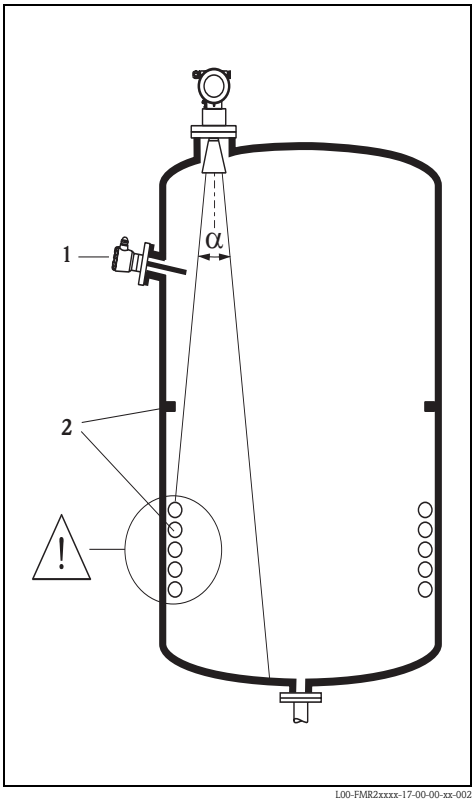
Tank installations

- Avoid any installations (1), like limit switches, temperature sensors, etc., inside the signal beam (see Beam angle on Page 22).
- Symmetrical installations (2), i.e. vacuum rings, heating coils, baffles, etc., can also interfere with the measurement.

Optimization options

- Antenna size: the bigger the antenna, the smaller the beam angle, the less interference echoes.
- Mapping: the measurement can be optimized by means of electronic suppression of interference echoes.
- Antenna alignment: refer to "optimum mounting position"
- Stilling well: a stilling well can always be used to avoid interference.
- Metallic screens (3) mounted at a slope spread the radar signals and can, therefore, reduce interference echoes.

Please contact Endress+Hauser for further information.



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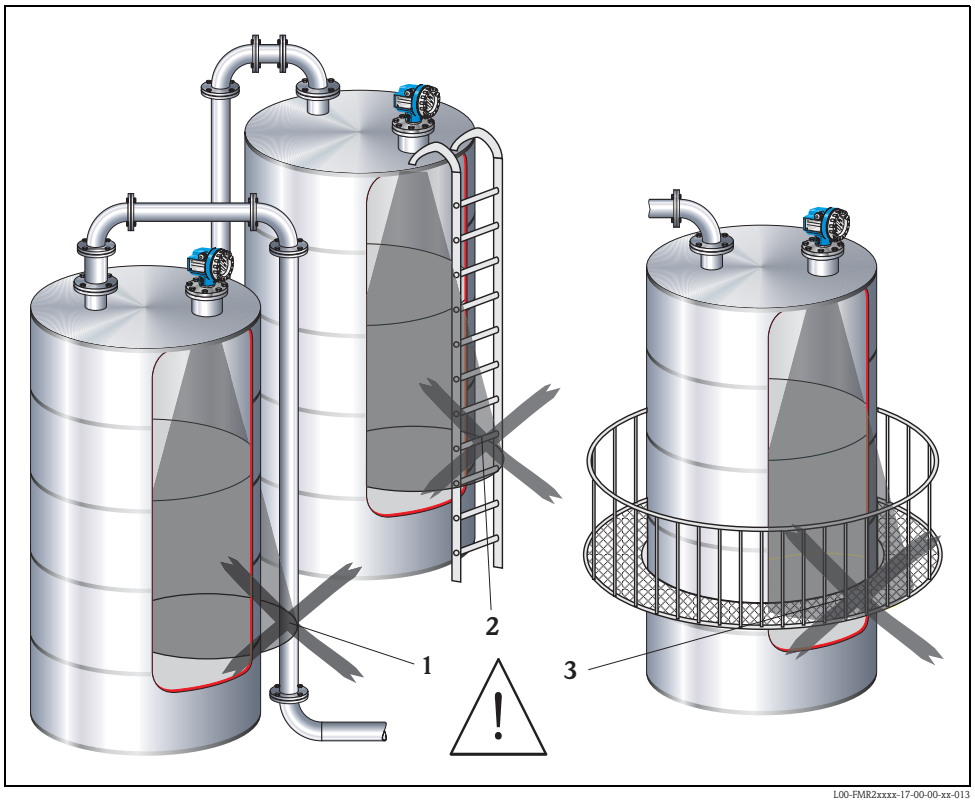
Measurement in a plastic tank

If the outer wall of the tank is made of a non-conductive material (e.g. GRP), microwaves can also be reflected off interfering installations outside the signal beam (e.g. metallic pipes (1), ladders (2), grates (3), ...). Therefore, there should be no such interfering installations in the signal beam.



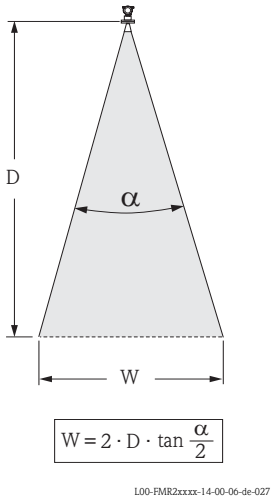
Please contact Endress+Hauser for further information.

Beam angle

The beam angle is defined as the angle at where the energy density of the radar waves reaches half the value of the maximum energy density (3dB-width). Microwaves are also emitted outside the signal beam and can be reflected off interfering installations. Beam diameter **W** as function of antenna type (beam angle α) and measuring distance **D**:

Antenna size (horn diameter)	FMR230			FMR231
	150 mm (6")	200 mm (8")	250 mm (10")	Rod
Beam angle α	23°	19°	15°	30°

Measuring distance (D)	Beamwidth diameter (W)			
	150 mm (6")	200 mm (8")	250 mm (10")	Rod
3 m (10 ft)	1.22 m (4.07 ft)	1.00 m (3.35 ft)	0.79 m (2.63 ft)	1.61 m (5.36 ft)
6 m (20 ft)	2.44 m (8.14 ft)	2.01 m (6.70 ft)	1.58 m (5.26 ft)	3.22m (10.72 ft)
9 m (30 ft)	3.66 m (12.21 ft)	3.01 m (10.05 ft)	2.37 m (7.90 ft)	4.82 m (16.08 ft)
12 m (40 ft)	4.88 m (16.28 ft)	4.02 m (13.40 ft)	3.16 m (10.53 ft)	6.43 m (21.44 ft)
15 m (49 ft)	6.10 m (19.94 ft)	5.02 m (16.40 ft)	3.95 m (12.90 ft)	8.04 m (26.26 ft)
20 m (65 ft)	8.14 m (26.45 ft)	6.69 m (21.75 ft)	5.27 m (17.11 ft)	10.72 m (34.83 ft)



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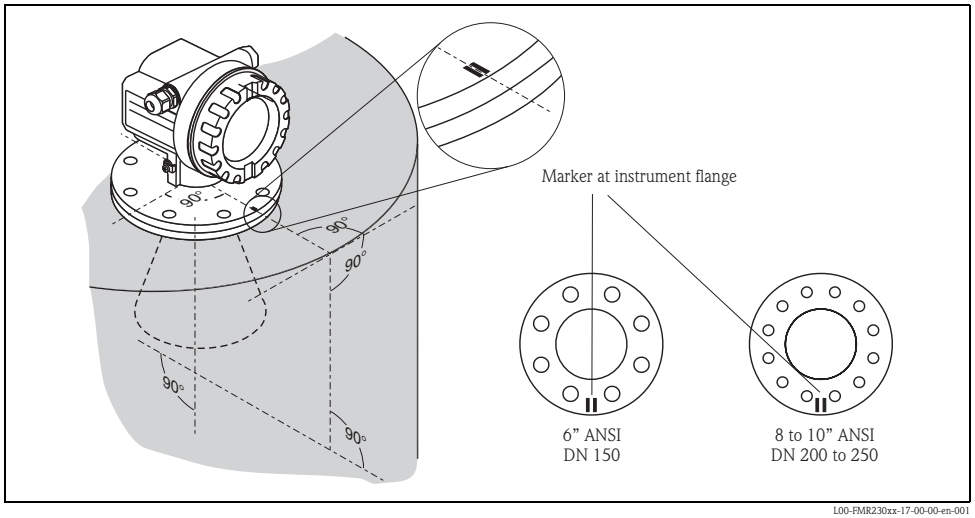
Antenna size (horn diameter)					
	FMR240	40 mm (1½")	50 mm (2")	80 mm (3")	100 mm (4")
	FMR244	40 mm (1½")	—	—	—
	FMR245	—	50 mm (2")	80 mm (3")	—
Beam angle α		23°	18°	10°	8°

Measuring distance (D)	Beamwidth diameter (W)			
	40 mm (1½")	50 mm (2")	80 mm (3")	100 mm (4")
3 m (10 ft)	1.22 m (4.07 ft)	0.95 m (3.17 ft)	0.53 m (1.75 ft)	0.42 m (1.40 ft)
6 m (20 ft)	2.44 m (8.14 ft)	1.90 m (6.34 ft)	1.05 m (3.50 ft)	0.84 m (2.80 ft)
9 m (30 ft)	3.66 m (12.21 ft)	2.85 m (9.50 ft)	1.58 m (5.25 ft)	1.26 m (4.20 ft)
12 m (40 ft)	4.88 m (16.28 ft)	3.80 m (12.67 ft)	2.10 m (7.00 ft)	1.68 m (5.59 ft)
15 m (49 ft)	6.10 m (19.94 ft)	4.75 m (15.52 ft)	2.63 m (8.57 ft)	2.10 m (6.85 ft)
20 m (65 ft)	8.14 m (26.45 ft)	6.34 m (20.59 ft)	3.50 m (11.37 ft)	2.80 m (9.09 ft)
25 m (82 ft)	10.17 m (33.37 ft)	7.92 m (25.98 ft)	4.37 m (14.35 ft)	3.50 m (11.47 ft)
30 m (98 ft)	—	9.50 m (31.04 ft)	5.25 m (17.15 ft)	4.20 m (13.71 ft)
35 m (114 ft)	—	11.09 m (36.11 ft)	6.12 m (19.95 ft)	4.89 m (15.94 ft)
40 m (131 ft)	—	12.67 m (41.50 ft)	7.00 m (22.92 ft)	5.59 m (18.32 ft)
45 m (147 ft)	—	—	7.87 m (25.72 ft)	6.29 m (20.56 ft)
60 m (196 ft)	—	—	10.50 m (34.30 ft)	8.39 m (27.41 ft)
70 m (229 ft)	—	—	—	9.79 m (32.03 ft)

Installation in tank (free space) FMR230

Optimum mounting position



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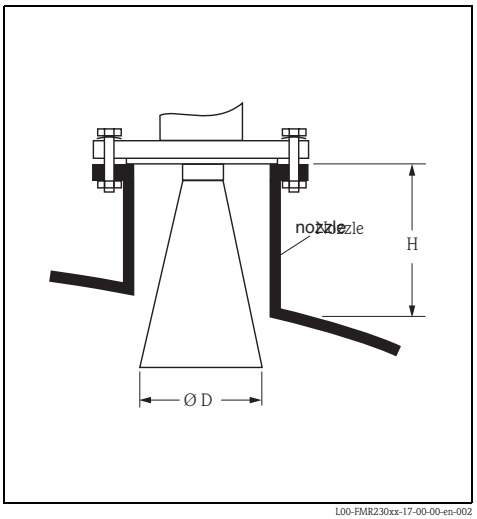
Standard installation

- Observe installation instructions on Page 20.
- Marker is aligned towards tank wall.
- The marker is always exactly in the middle between two bolt-holes in the flange.
- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.
- The horn antenna must extend below the nozzle, otherwise use antenna extension FAR10.
- Align horn antenna vertically.



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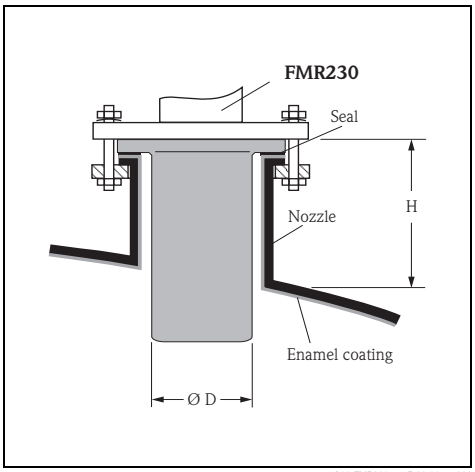
Antenna size	150 mm / 6"	200 mm / 8"	250 mm / 10"
D [mm / inch]	146 / 5.8	191 / 7.5	241 / 9.5
H [mm / inch]	< 205 / < 8.1	< 290 / < 11.5	< 380 / <15

Installation instructions for enamelled antenna

- Refer to standard installation.
- **Attention!**
  Do not hit or chip the enamelled antenna, the coating can be damaged.



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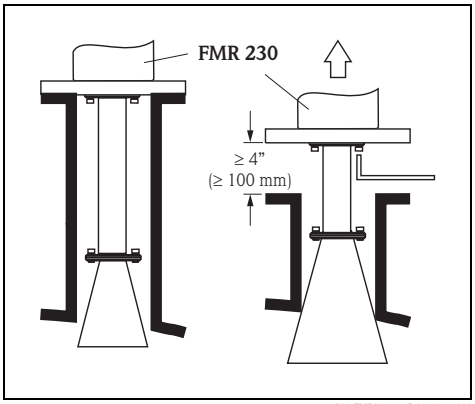
Antenna size	150 mm / 6"	200 mm / 8"
D [mm / inch]	145 / 5.7	163 / 6.4
H [mm / inch]	< 222 / 8.7	< 272 / 10.7

Antenna extension FAR10

- The antenna extension has to be selected such that the horn extends below the nozzle.
- If the horn diameter is greater than the nominal width of the nozzle, the antenna including the extension is mounted from inside the vessel. The bolts are tightened from outside, with the instrument lifted up. The extension has to be selected such that the instrument can be lifted by at least 100 mm (4").
- Recommended torque: 10 Nm (7.4 lbf ft).



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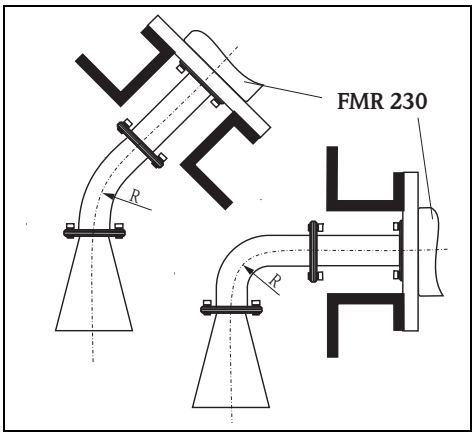
Special extensions

- If the antenna has to be mounted on a sloping or vertical vessel wall, an extension with a 45° or 90° bend is available.
- The smallest possible radius R for the bend is 300 mm (12").

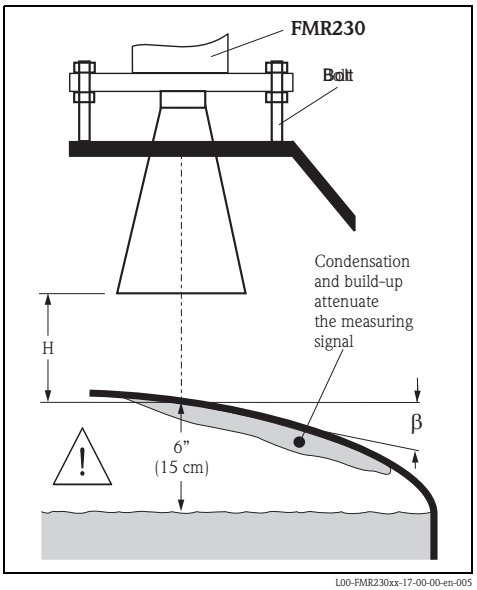
Please contact Endress+Hauser for further information.



L00-FMR230xx-17-00-00-yy-004

Measurement from the outside through plastic walls

- Medium with dielectric constant $\varepsilon r > 10$.
- Maximum level 15 cm (6") below tank ceiling.
- Distance H greater than 100 mm (4").
- Preferred mounting by means of stand-offs for adjustment of the ideal distance H.
- If possible, **avoid mounting location where condensation or build-up might occur**. In case of outdoor mounting, the space between antenna and vessel has to be protected from the elements.
- Optimum angle β between 15° to 20°
- Select vessel construction material with low dielectric constant and corresponding thickness. No conductive (black) plastics (refer to table).
- If possible, use an antenna DN250 / 10".
- Do not mount any potential reflectors (i.e. pipes) outside the tank in the signal beam.

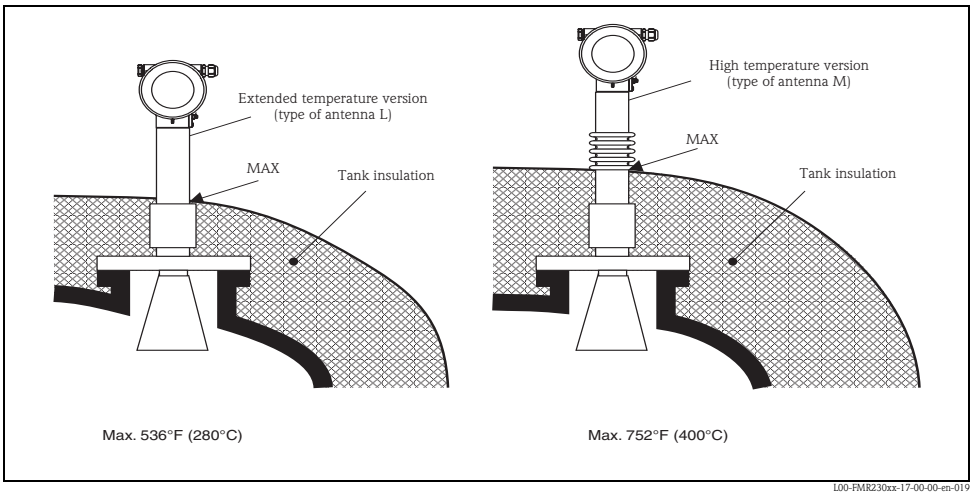


L00-FMR230xx-17-00-00-en-005

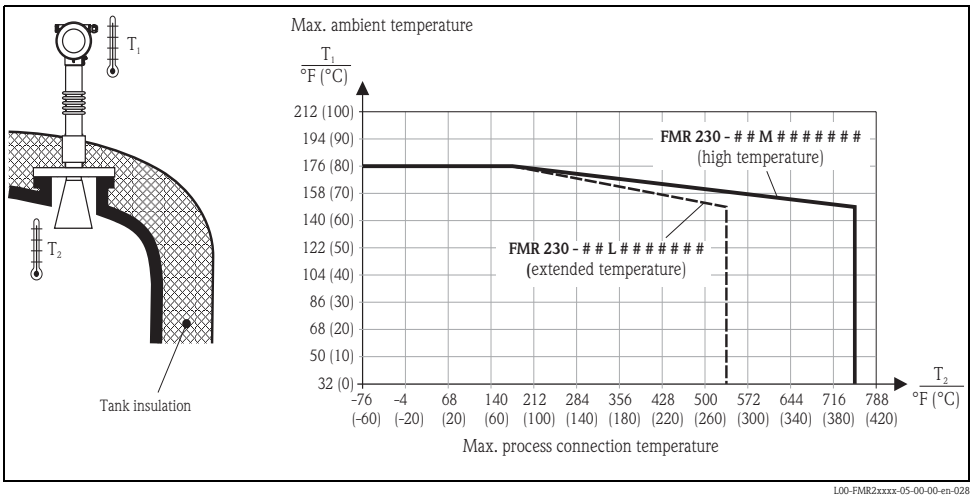
Penetrated material	PE	PTFE	PP	Perspex
DK / εr	2.3	2.1	2.3	3.1
Optimum thickness [mm / inch][1)]	15.7 / 0.62	16.4 / 0.65	15.7 / 0.62	13.5 / 0.53

1) Other possible values for the thickness are multiples of the values listed (i.e. E: 31.4 mm (1.24"), 47.1 mm (1.85"), ...)

Installation FMR230 with heat insulation



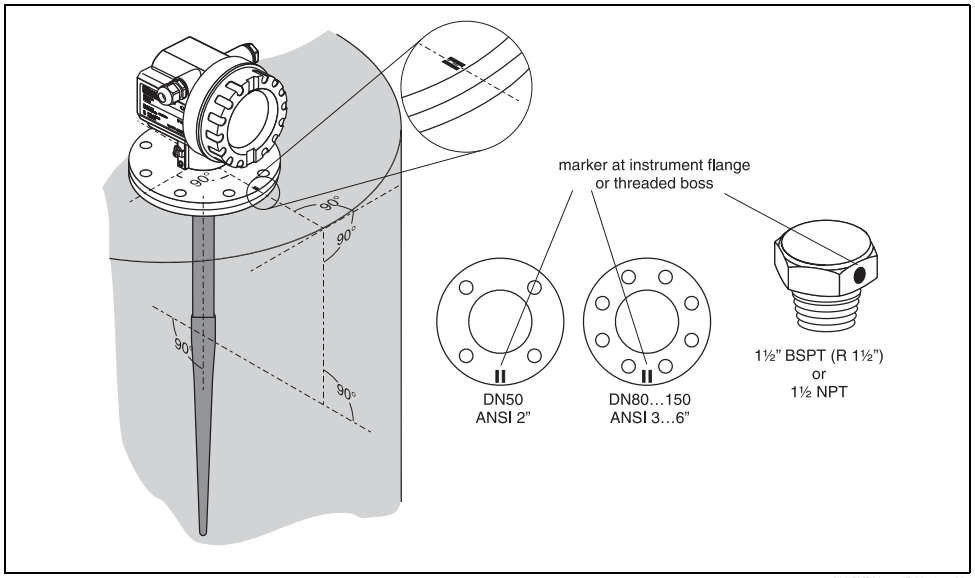
- To avoid the electronics heating up as a result of heat radiation or convection, the FMR230 must be incorporated into the tank insulation at high process temperature (≥ 200°C / 392°F).
- The isolation should nod exceed the points marked with "**MAX**" within the drawing above.



For process connection temperatures (T2) above 80°C (176°F), the allowed ambient temperature (T1) at the housing is reduced according to the above diagram.

Installation in tank (free space) FMR231

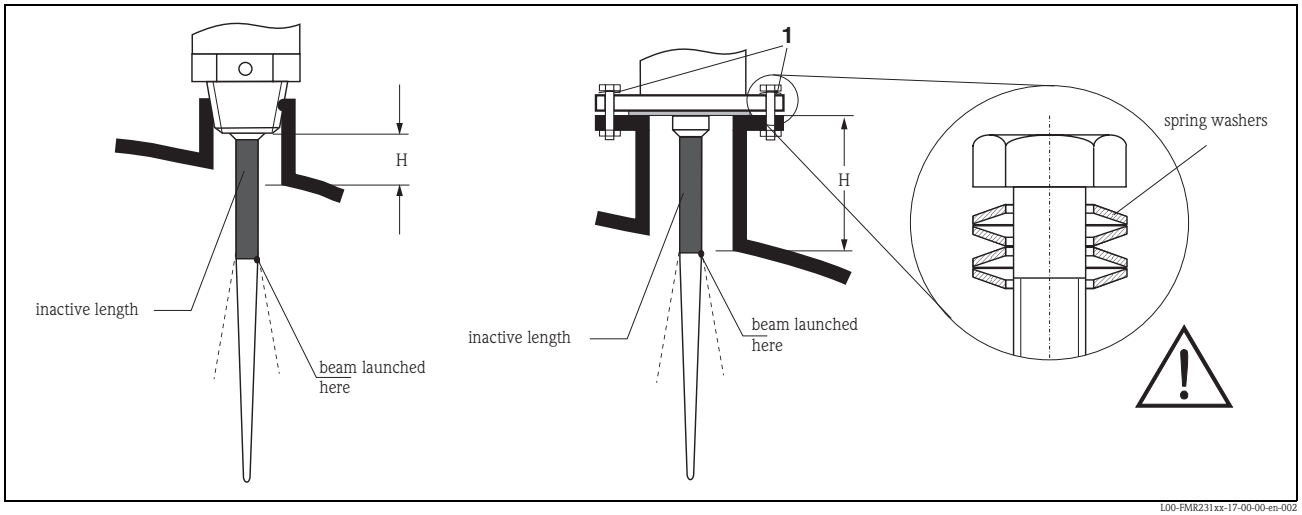
Optimum mounting position



L00-FMR231xx-17-00-00-en-001

Standard installation

- Observe installation instructions on Page 20.
- Marker is aligned towards tank wall.
- The marker is always exactly in the middle between two bolt-holes in the flange.
- Use spring washers (1) (see Fig.).
  Note!
  It is recommended to retighten the flange bolts periodically, depending on process temperature and pressure.
  Recommended torque: 60 to 100 Nm (44 to 74 lbf ft).
- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.
- The inactive part of the rod antenna must extend below the nozzle.
- The rod antenna must be aligned vertically.

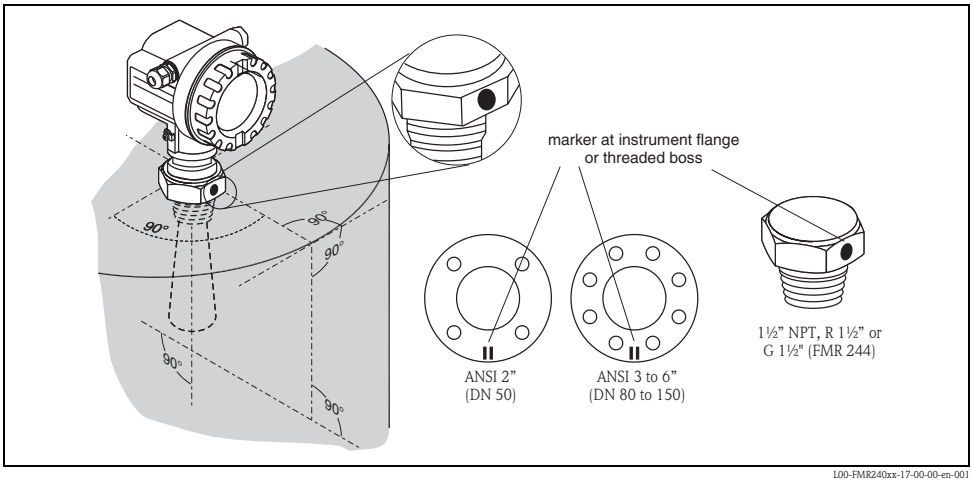


L00-FMR231xx-17-00-00-en-002

Material	PPS		PTFE	
Antenna length [mm / inch]	360 / 14	510 / 20	390 / 15	540 / 21
H [mm / inch]	< 100 / < 4	< 250 / < 10	< 100 / < 4	< 250 / < 10

Installation in tank (free space) FMR240, FMR244, FMR245

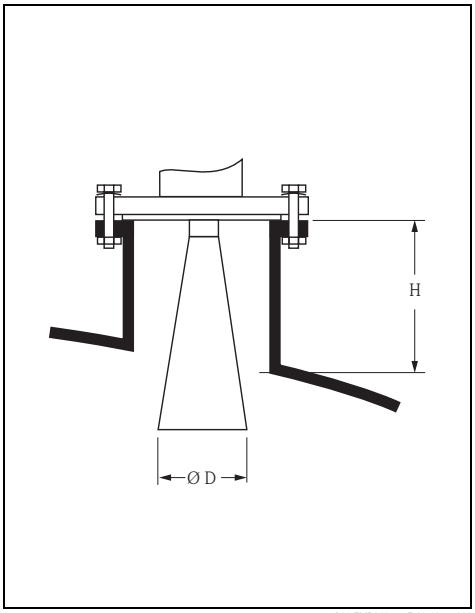
Optimum mounting position



L00-FMR240xx-17-00-00-en-001

Standard installation FMR240

- Observe installation instructions on Page 20.
- Marker is aligned towards tank wall.
- The marker is always exactly in the middle between two bolt-holes in the flange.
- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.
- For optimum measurement, the horn antenna should extend below the nozzle. Select version with 100 mm (4") antenna extension if necessary (→ Page 40).
  Nozzle heights up to 500 mm (20") can be accepted if this should not be possible due to mechanical reasons.
  Note!
  Please contact Endress+Hauser for application with higher nozzles.
- **The horn antenna must be aligned vertically.**
  Caution!
  The maximum range may be reduced if the horn antenna is not vertically aligned.



L00-FMR240xx-17-00-00-de-002

Antenna size	40 mm / 1-½"	50 mm / 2"	80 mm / 3"	100 mm / 4"
D [mm / inch]	40 / 1.5	48 / 1.9	75 / 3	95 / 3.7
H [mm / inch]	< 85 / < 3.4	< 115 / < 4.5	< 210 / < 8.3	< 280 / < 11

Measurement from the outside through plastic walls

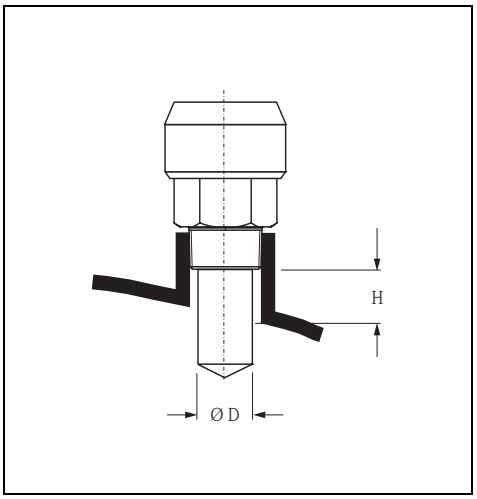
- Observe instructions on Page 20.
- If possible, use an antenna 100 mm / 4".

Penetrated material	PE	PTFE	PP	Perspex
DK / ε_r	2.3	2.1	2.3	3.1
Optimum thickness [mm / inch][1)]	3.8 / 0.15	4.0 / 0.16	3.8 / 0.15	3.3 / 0.13

1) Other possible values for the thickness are multiples of the values listed (i.e. E: 3.8 mm (0.30"), 11.4 mm (0.45"), …)

Standard installation FMR244

- Observe installation instructions on Page 20.
- Marker is aligned towards tank wall.
- Install the device using the threaded boss (AF 60) only. Observe the max. torque of 20 Nm (15 lbf ft).
- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.
- For optimum measurement, the tip of the antenna should extend below the nozzle. Nozzle heights up to 500 mm (20") can be accepted if this should not be possible due to mechanical reasons.
  Note!
  Please contact Endress+Hauser for application with higher nozzle.
- The antenna must be aligned vertically.

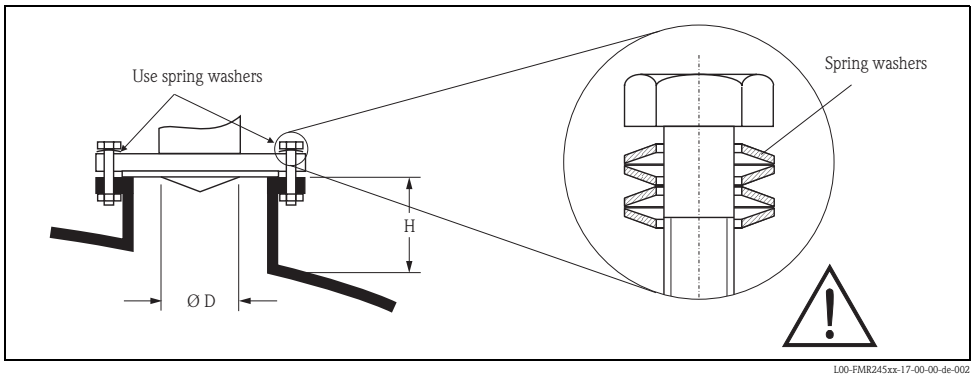


L00-FMR244xx-17-00-00-de-002

Antenna size	1-½" / 40 mm
D [mm / inch]	39 / 1.5
H [mm / inch]	< 85 / < 3.4

Standard installation FMR245

- Observe installation instructions on Page 20.
- Marker is aligned towards tank wall.
- The marker is always exactly in the middle between two bolt-holes in the flange.
- Use spring washers (1) (see Fig.).
  Note!
  It is recommended to retighten the flange bolts periodically, depending on process temperature and pressure.
  Recommended torque: 60 to 100 Nm (44 to 74 lbf ft).
- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.
- **The antenna must be aligned vertically.**
  Caution!
  The maximum range may be reduced, if the antenna is not vertically aligned.



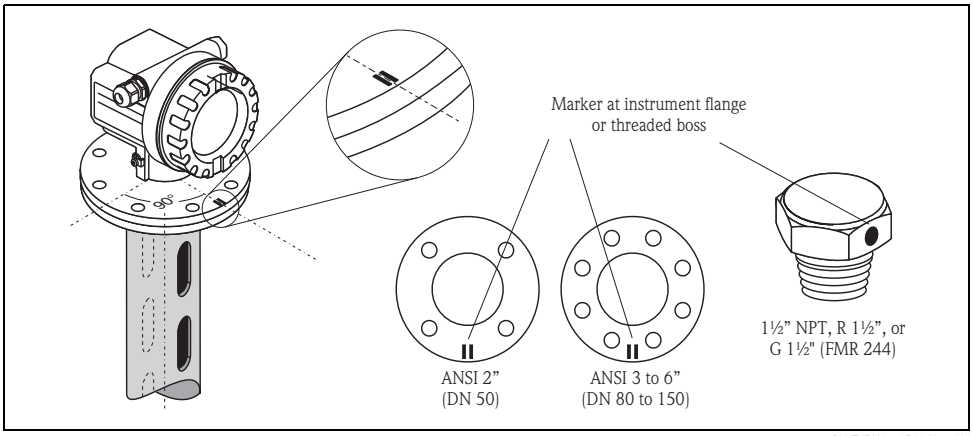
L00-FMR245xx-17-00-00-de-002

Note!
Please contact Endress+Hauser for application with higher nozzle.

Antenna size	50 mm / 2"	80 mm / 3"
D [mm / inch]	44 / 1.8	75 / 3
H [mm / inch]	< 500 / <20	< 500 / < 20

Installation in stilling well FMR230, FMR240, FMR244, FMR245

Optimum mounting position



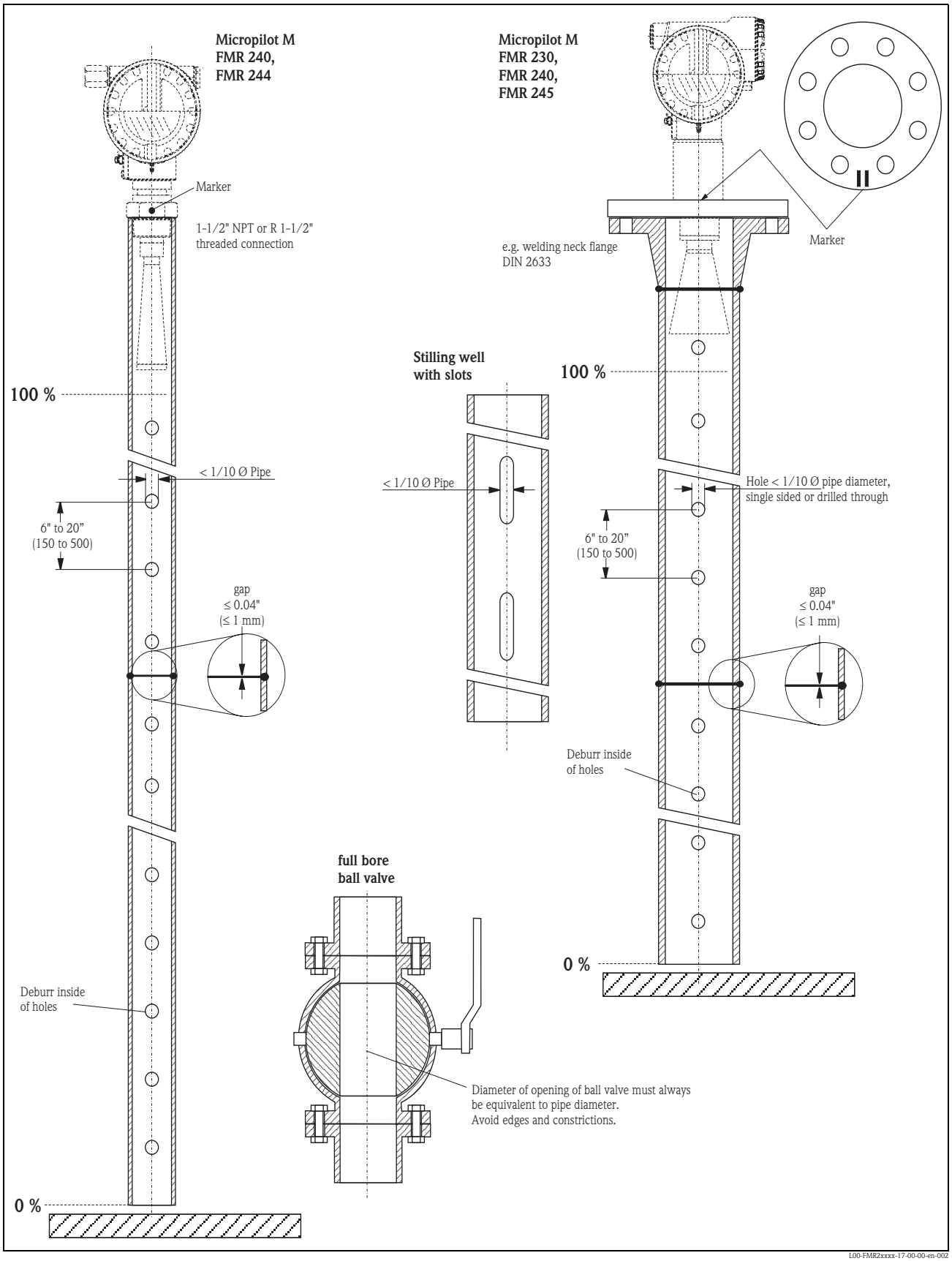
Standard installation

- Marker is aligned toward slots.
- The marker is always exactly in the middle between two bolt-holes in the flange.
- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.
- Measurements can be performed through an open full bore ball valve without any problems.
- Additional installation instructions on Page 20.

Recommendations for the stilling well

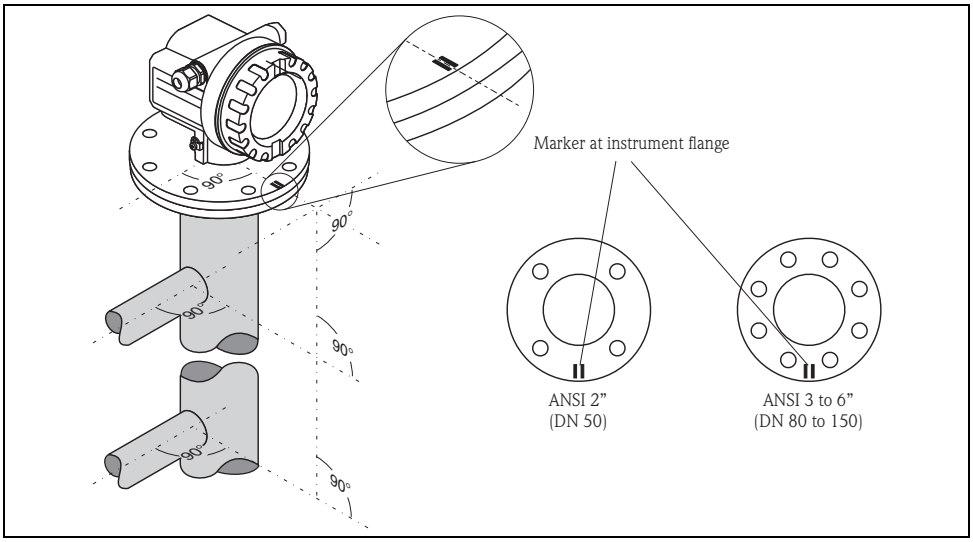
- Metal (no enamel coating, plastic on request).
- Constant diameter.
- Diameter of stilling well not larger than antenna diameter.
- Weld seam as smooth as possible and on the same axis as the slots.
- Slots offset 180° (not 90°).
- Slot width respectively diameter of holes max. 1/10 of pipe diameter, de-burred. Length and number do not have any influence on the measurement.
- Select horn antenna as big as possible. For intermediate sizes (i.e. 180 mm/7.1") select next larger antenna and adapt it mechanically (FMR230/FMR240 only).
- At any transition (i.e. when using a ball valve or mending pipe segments), no gap may be created exceeding 1 mm (0.04").
- The stilling well must be smooth on the inside (average roughness $Rz \leq 6.3\ \mu m$). Use extruded or parallel welded stainless steel pipe. An extension of the pipe is possible with welded flanges or pipe sleeves. Flange and pipe have to be properly aligned at the inside.
- Do not weld through the pipe wall. The inside of the stilling well must remain smooth. In case of unintentional welding through the pipe, the weld seam and any unevenness on the inside need to be carefully removed and smoothened. Otherwise, strong interference echoes will be generated and material build-up will be promoted.
- Particularly on smaller nominal widths it needs to be observed that flanges are welded to the pipe such that they allow for a correct orientation (marker aligned toward slots).

Examples for the construction of stilling wells



Installation in bypass FMR230, FMR240, FMR245

Optimum mounting position



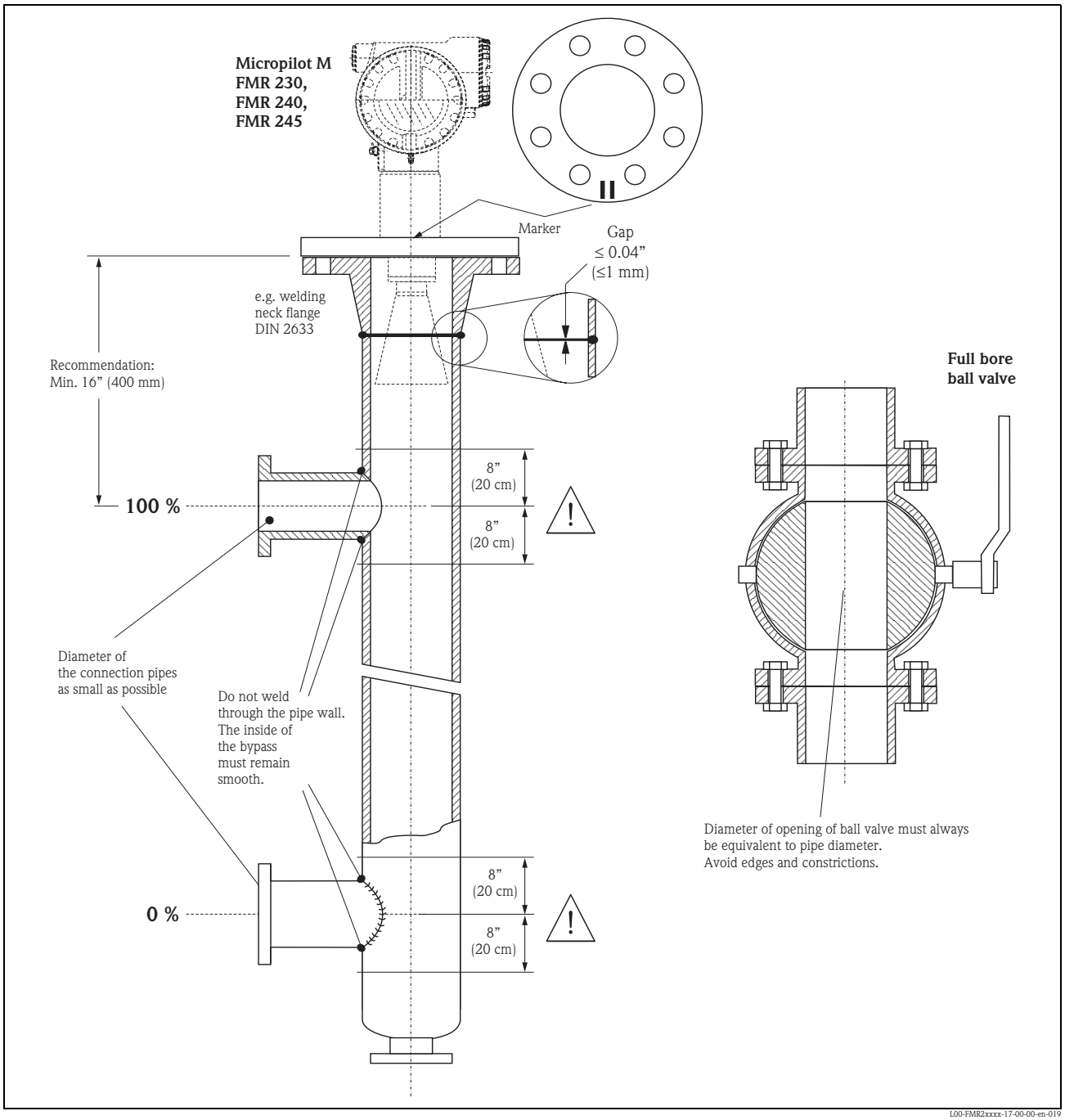
Standard installation

- Marker is aligned perpendicular (90°) to tank connectors.
- The marker is always exactly in the middle between two bolt-holes in the flange.
- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.
- The horn must be aligned vertically.
- Measurements can be performed through an open full bore ball valve without any problems.
- Additional installation instructions on Page 20.

Recommendations for the bypass pipe

- Metal (no plastic or enamel coating)
- Constant diameter
- Select horn antenna as big as possible. For intermediate sizes (i.e. 95 mm) select next larger antenna and adapt it mechanically (FMR230/FMR240 only).
- At any transition (i.e. when using a ball valve or mending pipe segments), no gap may be created exceeding 1 mm (0.04").
- In the area of the tank connections (~ ±20 cm / 8") a reduced accuracy of the measurement has to be expected.

Example for the construction of a bypass.



Operating conditions: Environment

Ambient temperature range

Ambient temperature for the transmitter: -40°C to +80°C (-40°F to +176°F), -50°C (-58°F) on request.
The functionality of the LCD display may be limited for temperatures T_a<-20°C (-68°F) and T_a>+60°C (+68°F).
A weather protection cover should be used for outdoor operation if the instrument is exposed to direct sunlight.

Storage temperature

-40°C to +80°C (-40°F to +176°F), -50°C (-58°F) on request.

Climate class

DIN EN 60068-2-38 (test Z/AD)

Degree of protection

- With closed housing: IP65, NEMA4X
- With open housing: IP20, NEMA1 (also ingress protection of the display)
- Antenna: IP68 (NEMA6P)

Vibration resistance

DIN EN 60068-2-64 / IEC 68-2-64: 20 to 2000 Hz, 1 $(m/s^2)^2/Hz$

Cleaning of the antenna

The antenna can get contaminated, depending on the application. The emission and reception of microwaves can thus eventually be hindered. The degree of contamination leading to an error depends on the medium and the reflectivity, mainly determined by the dielectric constant εr. If the medium tends to cause contamination and deposits, cleaning on a regular basis is recommended. Care has to be taken not to damage the antenna in the process of a mechanical or hose-down cleaning (eventually connection for cleaning liquid). The material compatibility has to be considered if cleaning agents are used!
The maximum permitted temperature at the flange should not be exceeded.

Electromagnetic compatibility

- Interference Emission to EN 61326, Electrical Equipment Class B
- Interference Immunity to EN 61326, Annex A (Industrial) and NAMUR Recommendation NE 21 (EMC)
- A standard installation cable is sufficient if only the analog signal is used. Use a shielded cable when working with a superimposed communications signal (HART).

Operating conditions: Process

Process temperature range/ Process pressure limits

	Type of antenna		Seal	Temperature	Pressure	Wetted parts
FMR230	**V**	Standard	FKM Viton GLT	-40°C to +200°C [1] (-40°F to +392°F)	-1 to 64 bar (-14 to 928 psi)	PTFE, seal, 316L SS/1.4435 resp. Alloy C4
	E	Standard	EPDM	-40°C to +150°C (-40°F to +302°F)		
	K	Standard	Kalrez (Spectrum 6375)	-20°C to +200°C [1] (-4°F to +392°F)		
	L	Extended temperature	Graphit	-60°C to +280°C (-76°F to +536°F)	-1 to 100 bar (-14 to 1450 psi)	Ceramic (Al_2O_3: 99,7%), Graphit, 316L SS/ 1.4435
	M	High temperature	Graphit	-60°C to +400°C (-76°F to +752°F)	-1 to 160 bar (-14 to 2320 psi)	
	H	Enamel	PTFE	-40°C to +200°C (-40°F to +392°F)	-1 to 16 bar (-14 to 232 psi)	PTFE, Enamel

↑

Ordering information see Page 50

1) max. +150°C (+302°F) for conductive media

	Type of antenna		Process connection	Temperature	Pressure	Wetted parts
FMR231	**A, B**	PPS	—	-20°C to +120°C (-4°F to +248°F)	-1 to 16 bar (-14 to 232 psi)	316L/1.4435, Viton, PPS
	C, D	PTFE (TFM1600)	PVDF threaded connection	-40°C to +80°C (-40°F to +176°F)	-1 to 3 bar (-14 to 43.5 psi)	PVDF, PTFE
			Metal threaded connection	-40°C to +150°C (-40°F to +302°F)	-1 to 40 bar (-14 to 580 psi)	316L/1.4435, PTFE (TFM1600)
			Flange unclad			
			Flange clad [2]		-1 to 16 bar (-14 to 232 psi)	PTFE (TFM1600)
			Tri-Clamp 2"		-1 to 16 bar (-14 to 232 psi)	316L/1.4435, PTFE (TFM1600) [1]
			Tri-Clamp 3"		-1 to 10 bar (-14 to 145 psi)	
			Aseptic, Dairy		-1 to 25 bar (-14 to 362 psi)	
	E, F	PTFE antistatc (TFM4220, 2% conductive additives)	Metal threaded connection	-40°C to +150°C (-40°F to +302°F)	-1 to 40 bar (-14 to 580 psi)	316L/1.4435, PTFE (TFM4220)
			Flange unclad			
			Flange clad [2]		-1 to 16 bar (-14 to 232 psi)	PTFE (TFM4220)

↑

Ordering information see Page 53

1) FDA-listed material, meets USP CLass VI conformity

2) on DN150, 6" ANSI, JIS 150A the disc is made of antistatic PTFE (=black)

	Type of antenna		Seal	Temperature	Pressure	Wetted parts
FMR240	**V**	Standard	FKM Viton	-20°C to +150°C (-4 °F ... +302°F)	-1 to 40 bar (-14 to 580 psi)	PTFE, seal, 316L/1.4435 resp. Alloy C22
	E	Standard	FKM Viton GLT	-40°C to +150°C (-40°F to +302°F)		
	K	Standard	Kalrez (Spectrum 6375)	-20°C to +150°C (-4°F to +302°F)		

↑

Ordering information see Page 56

	Type of antenna		Seal	Temperature	Pressure	Wetted parts
FMR244	**V**	Standard, completely PTFE encapsulated	FKM Viton GLT	-40°C to +130°C (-40°F to +266°F)	-1 to 3 bar (-14 to 43.5 psi)	PTFE (TFM1600), Viton, PVDF

↑

Ordering information see Page 58

	Type of antenna		Seal	Temperature	Pressure	Wetted parts
FMR245	**3, 4**	Standard, PTFE clad	none	-40°C to +150°C (-40°F to +302°F)	-1 to 16 bar (-14 to 232 psi)	PTFE (TFM1600, FDA-listed) [1) 2)]

↑

Ordering information see Page 60

1) 3-A, EHEDG approval for Tri-Clamp process connection.

2) Meets USP Class VI conformity

Dielectric constant

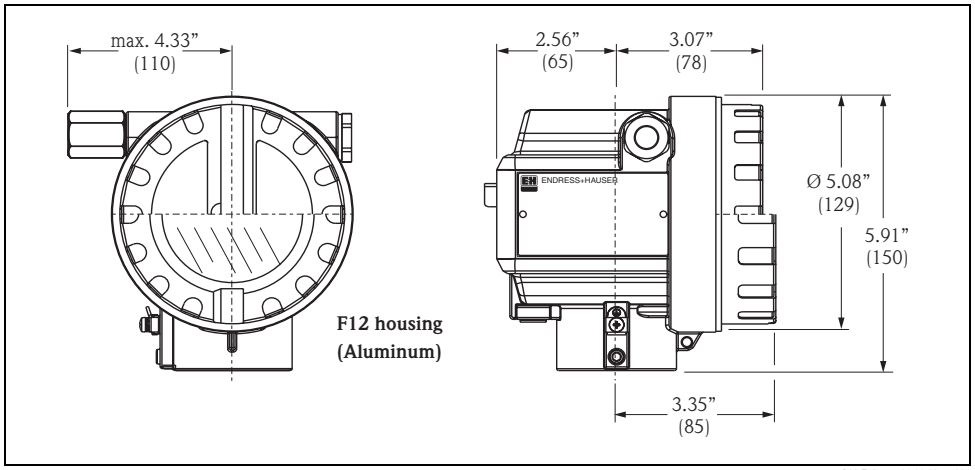
- In a stilling well: $\varepsilon r \geq 1.4$
- In free space: $\varepsilon r \geq 1.9$

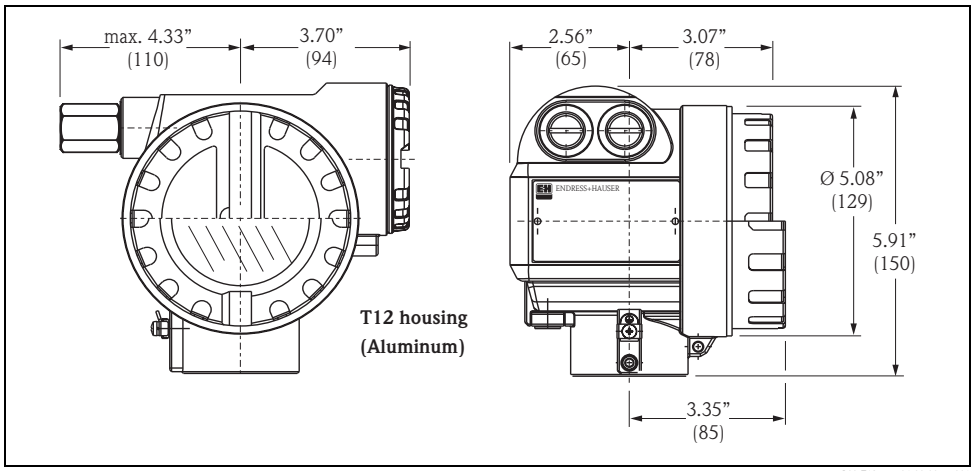
Mechanical construction

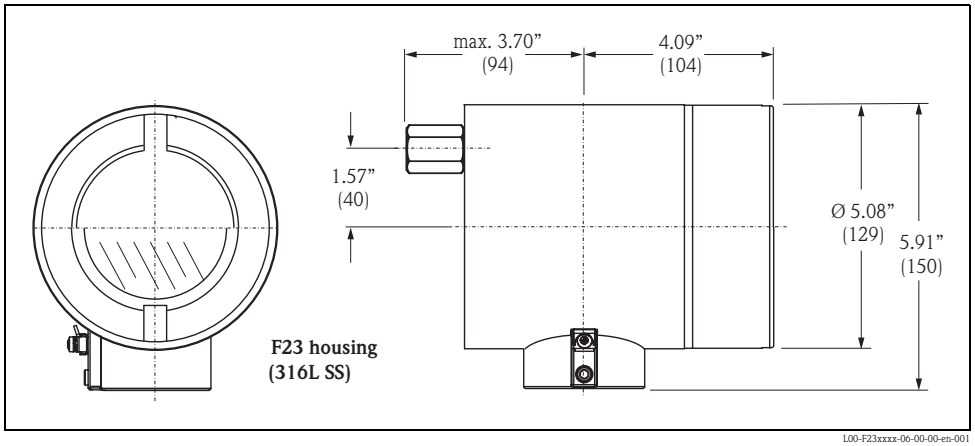
Design, dimensions

Housing dimensions

Dimensions for process connection and type of antenna see Page 38-41.



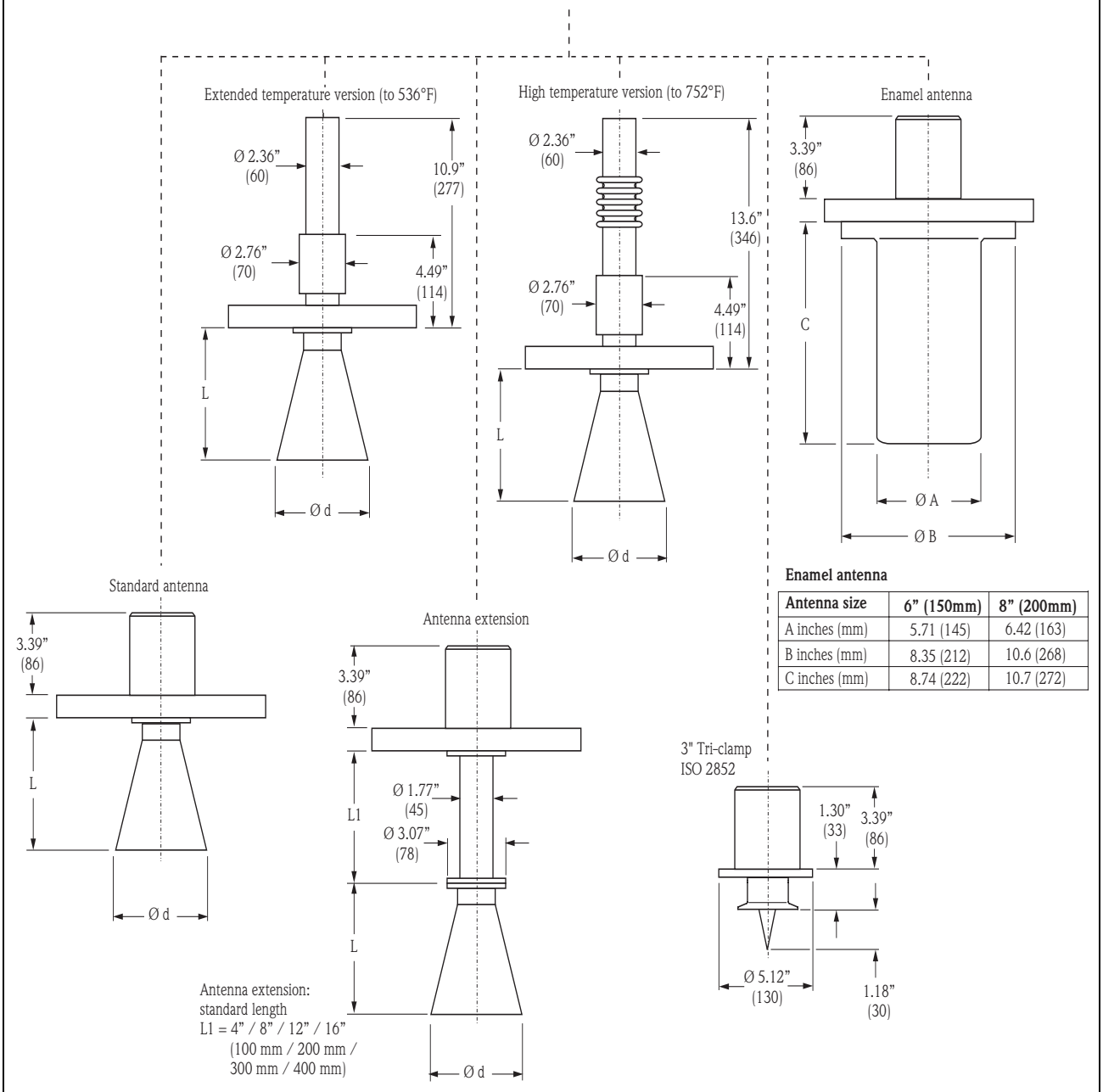




Micropilot M FMR230 - process connection, type of antenna

Housing dimensions see Page 37.

F12 / T12 / F23 housing



Enamel antenna

Antenna size	6" (150mm)	8" (200mm)
A inches (mm)	5.71 (145)	6.42 (163)
B inches (mm)	8.35 (212)	10.6 (268)
C inches (mm)	8.74 (222)	10.7 (272)

Horn antenna

Antenna size	3" (80mm)	4" (100mm)	6" (150mm)	8" (200mm)	10" (250mm)
L inches (mm)	2.91 (74)	4.69" (119)	8.03 (204)	11.4 (289)	14.9 (379)
d inches (mm)	2.99 (76)	3.78 96)	5.75 (146)	7.52 (191)	9.49 (241)

Standard ANSI B16.5 flanges available for FMR 230: 3", 4", 6", 8" and 10" in Class 150. Class 300 available for 3" and 4" only)

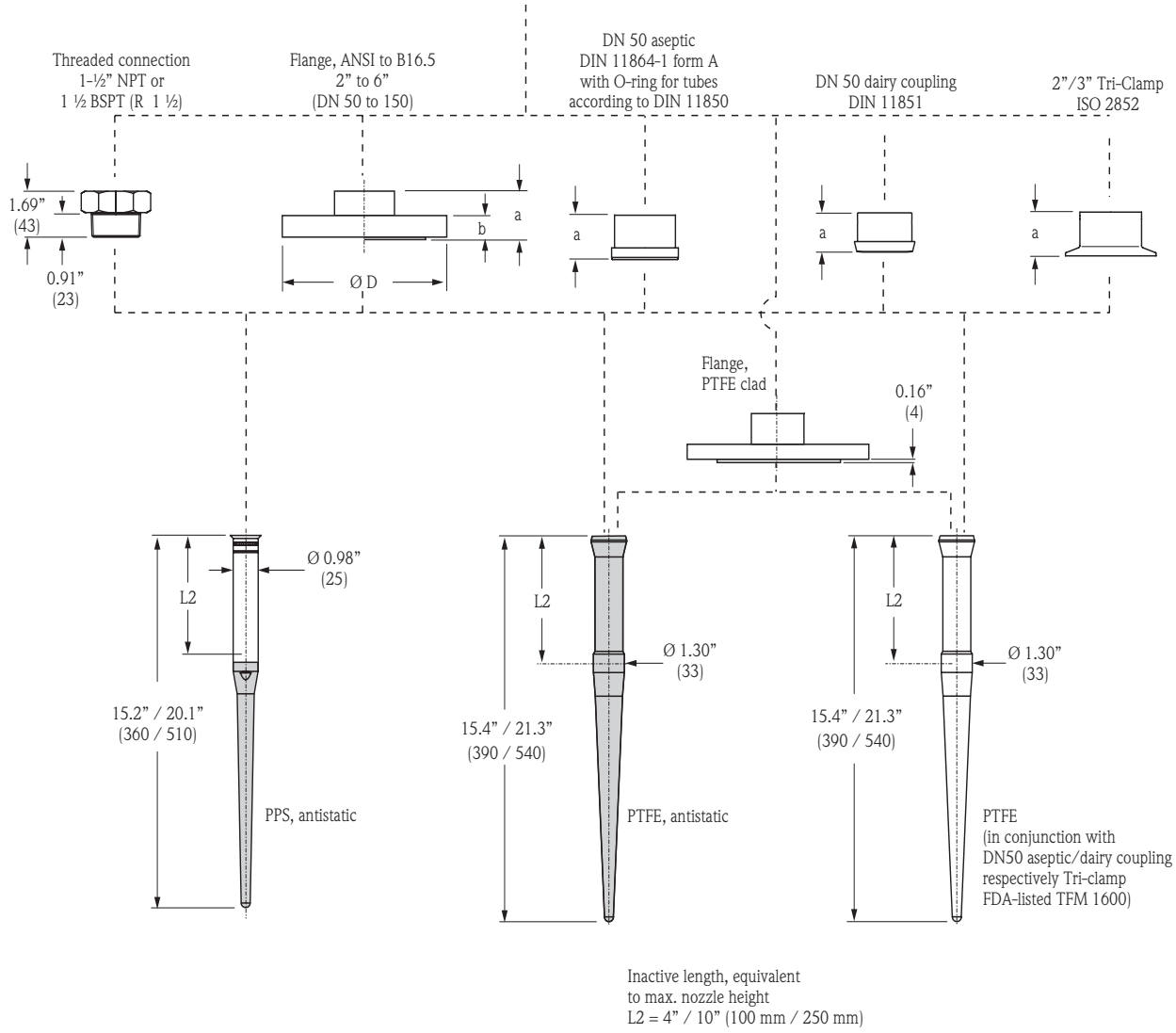
NOTE: DIN and JIS flanges available, please consult factory.

L00-FMR230xx-06-00-00-en-005

Micropilot M FMR231 - process connection, type of antenna

Housing dimensions see Page 37.

F12 / T12 / F23 housing



Flange to ANSI B16.5

Flange	2"	3"	4"	6"
b	0.75"	0.94" (1.12")	0.94" (1.25")	1.00"
D	6.0"	7.50" (8.25")	9.00" (10.0")	11.0"

for 150 lbs (for 300 lbs)

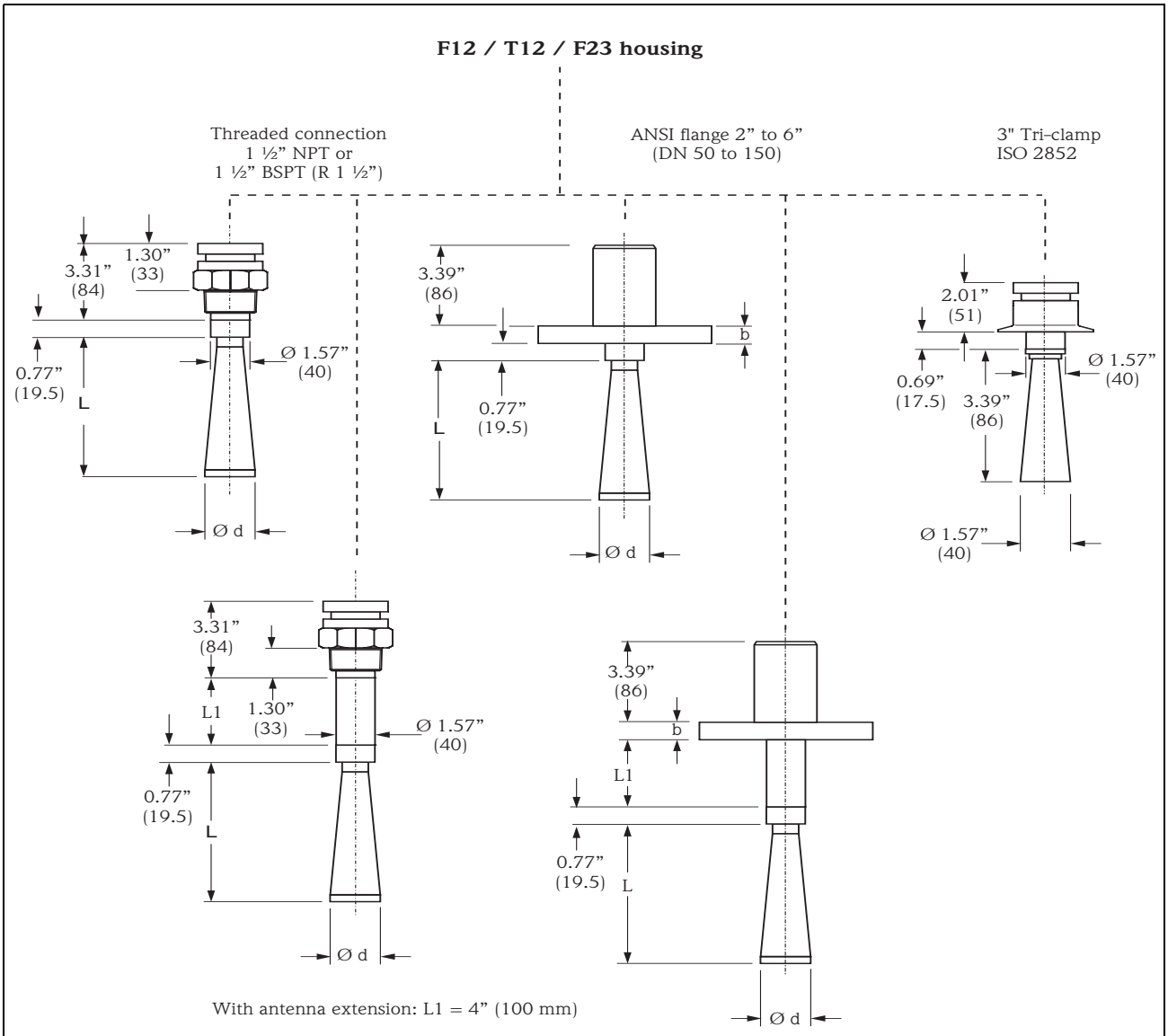
NOTE: Other process connections available for DIN or JIS, please consult Endress+Hauser.

Process connection	Flange 2" to 6"	DN 50 aseptic coupling	DN 50 diary coupling	2"/3" Tri-Clamp
a = inches (mm) without gastight feedthrough	1.61 (41)	1.75 (44.5)	1.61 (41)	1.61 (41)
a = inches (mm) with gastight feedthrough	3.03 (77)	3.17 (80.5)	3.03 (77)	3.03 (77)

L00-FMR231xx-06-00-00-en-005

Micropilot M FMR240 - process connection, type of antenna

Housing dimensions see Page 37.



Horn antenna

Antenna size	1½" (40mm)	2" (50mm)	3" (80mm)	4" (100mm)
L inches (mm)	3.39 (86)	4.53 (115)	8.31 (211)	11.1 (282)
Ød inches (mm)	1.57 (40)	1.89 (48)	2.95 (75)	3.74 (95)

ANSI flanges

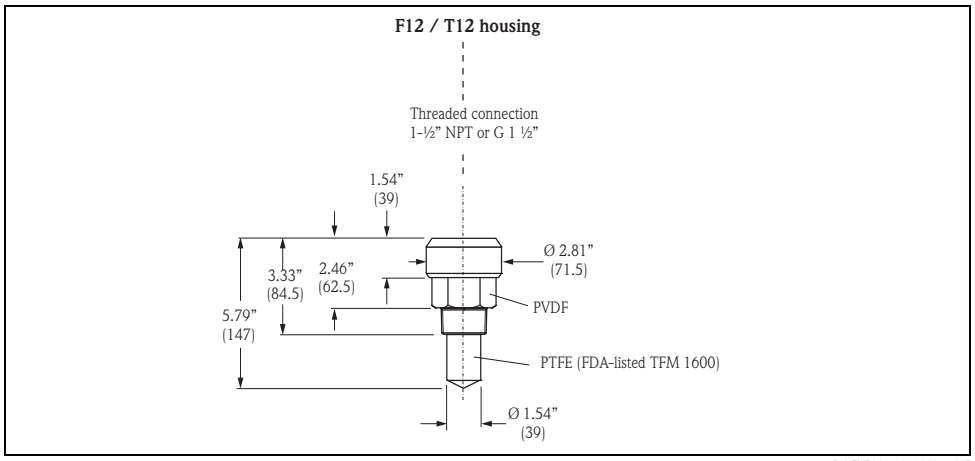
Flange	2"	3"	4"	6"
b (150 lb class)	0.75"	0.94"	0.94"	1"
b (300 lb class)	0.88"	1.12"	1.25"	N/A

NOTE: DIN and JIS flanges available, please consult factory.

L00-FMR240xx-06-00-00-en-005

Micropilot M FMR244 - process connection, type of antenna

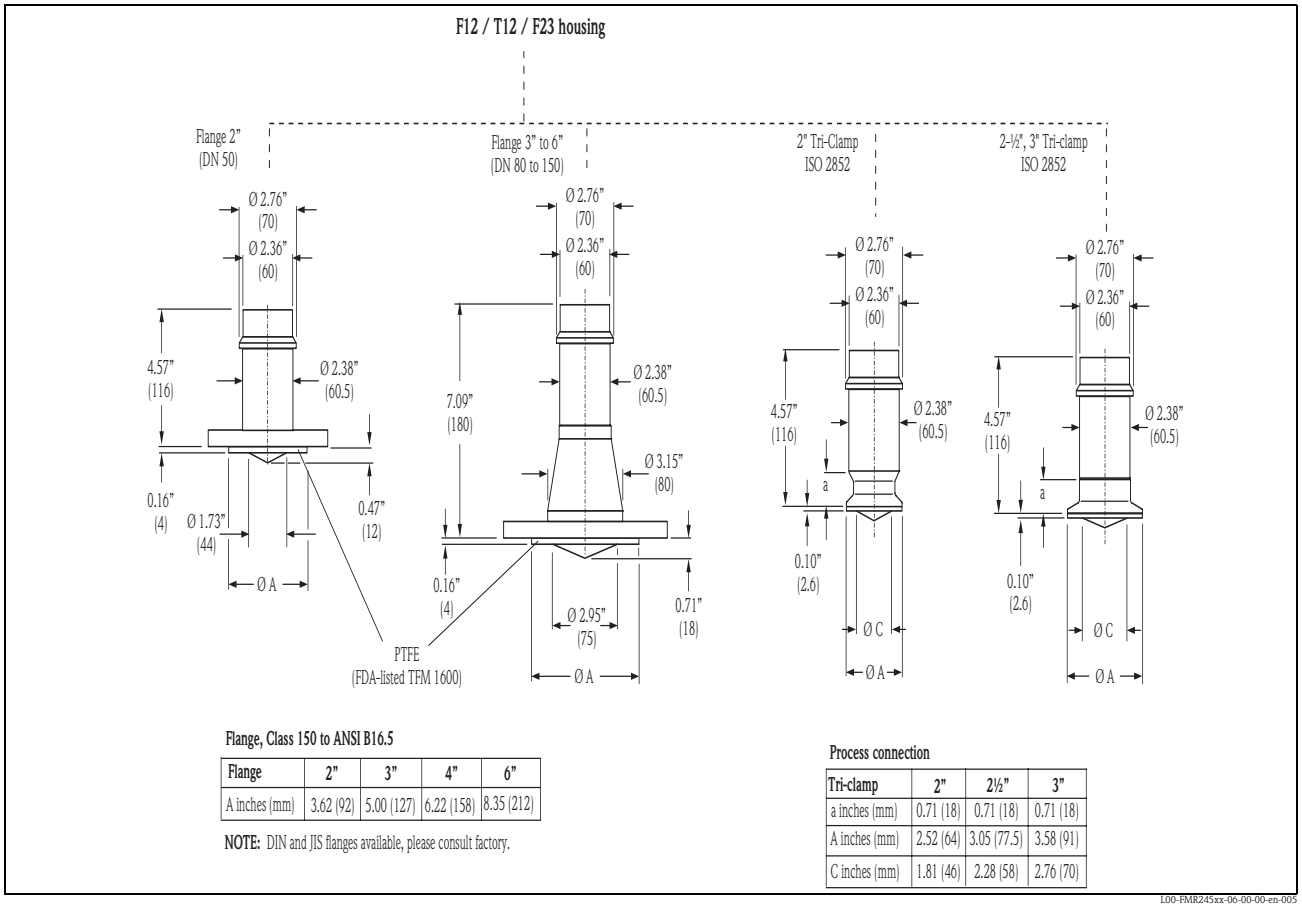
Housing dimensions see Page 37.



L00-FMR244xx-06-00-00-en-005

Micropilot M FMR245 - process connection, type of antenna

Housing dimensions see Page 37.



Flange, Class 150 to ANSI B16.5

Flange	2"	3"	4"	6"
A inches (mm)	3.62 (92)	5.00 (127)	6.22 (158)	8.35 (212)

NOTE: DIN and JIS flanges available, please consult factory.

Process connection

Tri-clamp	2"	2½"	3"
a inches (mm)	0.71 (18)	0.71 (18)	0.71 (18)
A inches (mm)	2.52 (64)	3.05 (77.5)	3.58 (91)
C inches (mm)	1.81 (46)	2.28 (58)	2.76 (70)

L00-FMR245xx-06-00-00-en-005

Weight

Micropilot M	FMR230	FMR231	FMR240	FMR244	FMR245
Weight for F12 or T12 housing	Approx. 13 lb (6 kg) + weight of flange	Approx. 9 lb (4 kg) + weight of flange	Approx. 9 lb (4 kg) + weight of flange	Approx. 5.5 lb (2.5 kg)	Approx. 9 lb (4 kg) + weight of flange
Weight for F23 housing	Approx. 21 lb (9.4 kg) + weight of flange	Approx. 16 lb (7.4 kg) + weight of flange	Approx. 16 lb (7.4 kg) + weight of flange	Approx. 13 lb (5.9 kg)	Approx. 16 lb (7.4 kg) + weight of flange

Material

- Housing:
  - housing F12/T12: aluminum (AlSi10Mg), seawater-resistant, chromated, powder-coated
  - housing F23: 316L SS, corrosion-resistant steel
- Sight window: glass

Process connection

See "Ordering information" on Page 50-61.

Seal

See "Ordering information" on Page 50-61.

Antenna

See "Ordering information" on Page 50-61.

Human interface

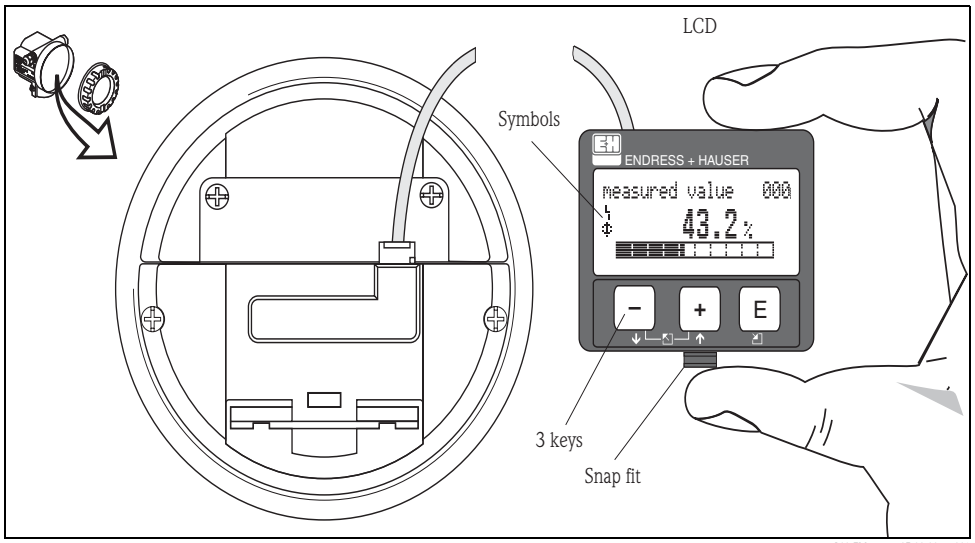
Operation concept

The display of the process value and the configuration of the Micropilot occur locally by means of a large 4-line alphanumeric display with plain text information. The guided menu system with integrated help texts ensures a quick and safe commissioning.
To access the display the cover of the electronic compartment may be removed even in hazardous area (IS and XP).
Remote commissioning, including documentation of the measuring point and in-depth analysis functions, is supported via the ToF Tool, the graphical operating software for E+H time-of-flight systems.

Display elements

Liquid crystal display (LCD):

Four lines with 20 characters each. Display contrast adjustable through key combination.



L00-FMxxxxxx-07-00-00-en-001

The VU331 LCD display can be removed to ease operation by simply pressing the snap-fit (see graphic above). It is connected to the device by means of a 500 mm (20") cable.

The following table describes the symbols that appear on the liquid crystal display:

Sybmol	Meaning
	ALARM_SYMBOL This alarm symbol appears when the instrument is in an alarm state. If the symbol flashes, this indicates a warning.
	LOCK_SYMBOL This lock symbol appears when the instrument is locked,i.e. if no input is possible.
	COM_SYMBOL This communication symbol appears when a data transmission via e.g. HART, PROFIBUS PA or FOUNDATION Fieldbus is in progress.
	SIMULATION_SWITCH_ENABLE This communication symbol appears when simulation in FOUNDATION Fieldbus is enabled via the DIP switch.

Operating elements

The operating elements are located inside the housing and are accessible for operation by opening the lid of the housing.

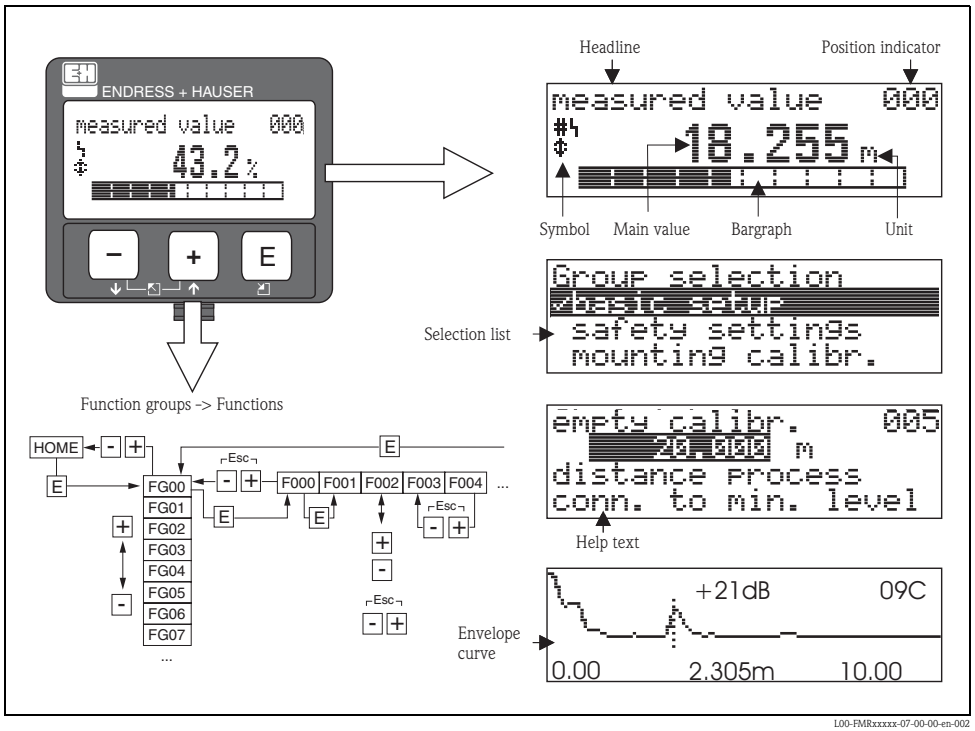
Function of the keys

Key(s)	Meaning
+ or ↑	Navigate upwards in the selection list Edit numeric value within a function
− or ↓	Navigate downwards in the selection list Edit numeric value within a function
Esc − + or ←	Navigate to the left within a function group
E	Navigate to the right within a function group, confirmation.
+ and E or − and E	Contrast settings of the LCD
+ and − and E	Hardware lock / unlock After a hardware lock, an operation of the instrument via display or communication is not possible! The hardware can only be unlocked via the display. An unlock parameter must be entered to do so.

Local operation

Operation with VU331

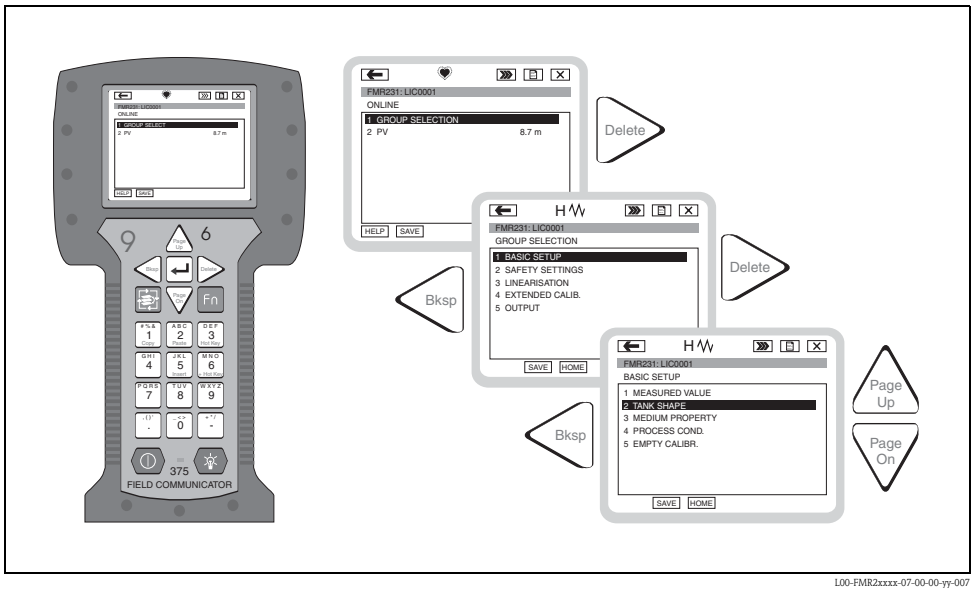
The LC-Display VU331 allows configuration via 3 keys directly at the instrument. All device functions can be set through a menu system. The menu consists of function groups and functions. Within a function, application parameters can be read or adjusted. The user is guided through a complete configuration procedure.



L00-FMRxxxxx-07-00-00-en-002

Operation with handheld unit Field Communicator DXR375

All device functions can be adjusted via a menu operation with the handheld unit DXR375.



L00-FMR2xxxx-07-00-00-yy-007

Note!
Further information on the handheld unit is given in the respective operating manual included in the transport bag of the DXR375.

Remote operation

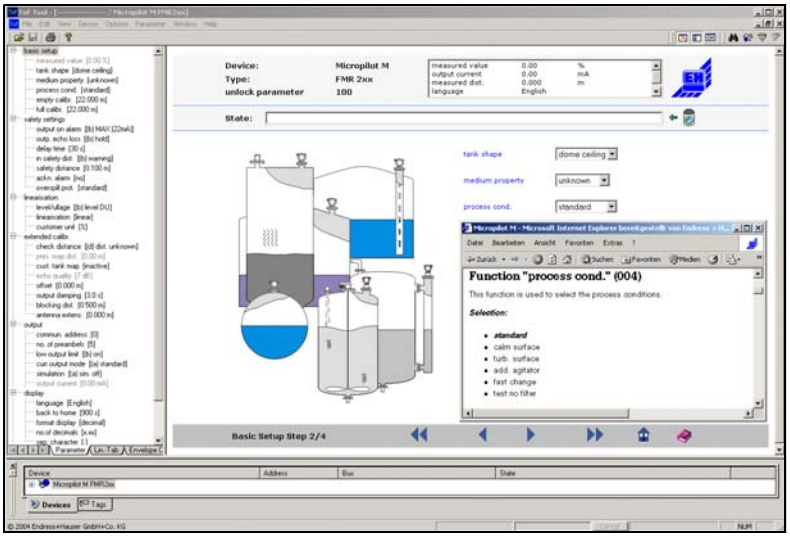
The Micropilot M can be remotely operated via HART, PROFIBUS PA and FOUNDATION Fieldbus. On-site adjustments are also possible.

Operation with ToF Tool

The ToF Tool is a graphical operation software for instruments from Endress+Hauser that operate based on the time-of-flight principle. It is used to support commissioning, securing of data, signal analysis and documentation of the instruments. It is compatible with the following operating systems: WinNT4.0, Win2000 and WinXP.

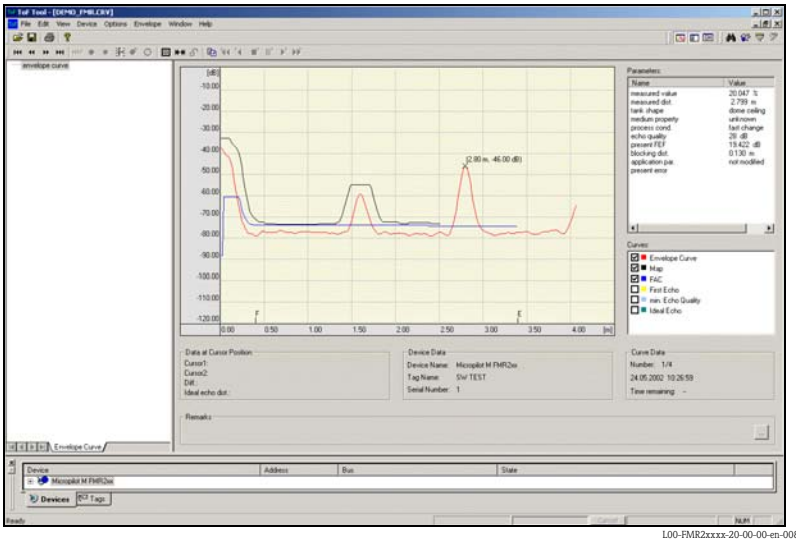
The ToF Tool supports the following functions:
- Online configuration of transmitters
- Signal analysis via envelope curve
- Linearisation table (create, edit, import and export)
- Loading and saving of instrument data (Upload/Download)
- Documentation of measuring point

Menu-guided commissioning:



L00-FMR2xxxx-20-00-00-en-002

Signal analysis via envelope curve:



L00-FMR2xxxx-20-00-00-en-008

Connection options:
- HART with Commubox FXA191/195
- PROFIBUS PA
- Service-interface with adapter FXA193

Operation with FieldCare

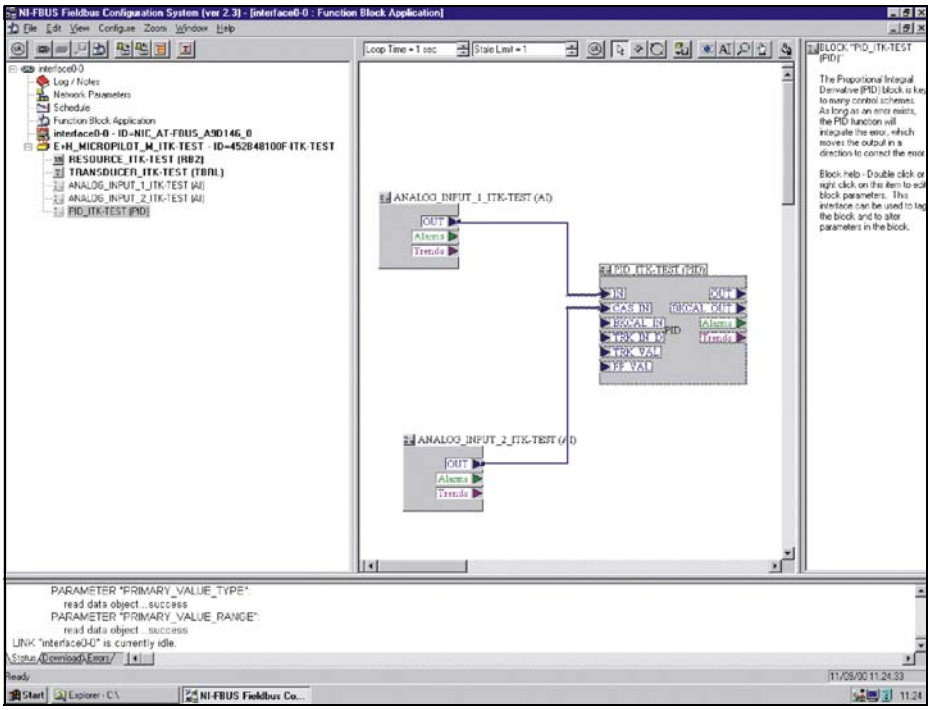
FieldCare is the Endress+Hauser FDT based Plant Asset Management Tool. It can configure all intelligent field devices in your plant and supports you in managing them. By using status information, it also provides a simple but effective means of checking their health.

- Supports Ethernet, HART, PROFIBUS, FOUNDATION Fieldbus etc.
- Operates all Endress+Hauser devices
- Operates all third-party actuators, I/O systems and sensors supporting the FDT standard
- Ensures full functionality for all devices with DTMs
- Offers generic profile operation for any third-party fieldbus device that does not have a vendor DTM

Operation with NI-FBUS configurator (only FOUNDATION Fieldbus)

The NI-FBUS Configurator is an easy-to-use graphical environment for creating linkages, loops, and a schedule based on the fieldbus concepts.

You can use the NI-FBUS Configurator to configure a fieldbus network as follows:
- Set block and device tags
- Set device addresses
- Create and edit function block control strategies (function block applications)
- Configure vendor-defined function and transducer blocks
- Create and edit schedules
- Read and write to function block control strategies (function block applications)
- Invoke Device Description (DD) methods
- Display DD menus
- Download a configuration
- Verify a configuration and compare it to a saved configuration
- Monitor a downloaded configuration
- Replace devices
- Log project download changes
- Save and print a configuration



L00-fmxxxxxx-20-00-00-en-001

Certificates and approvals

CE approval

The measuring system meets the legal requirements of the EC-guidelines. Endress+Hauser confirms the instrument passing the required tests by attaching the CE-mark.

Hazardous approvals

See "Ordering information" on Page 50-61.

Sanitary compatibility

FMR231 with PTFE-antenna made of FDA-listed TFM 1600.

FMR245 with flange cladding made of FDA-listed TFM 1600
– 3-A/EHEDG approval with Tri-clamp process connection.
– TFM 1600 meets USP Class VI conformity

Note!
The leak-tight connections can be cleaned with the cleaning methods usually used in this industry without leaving residues.

Overspill protection

German WHG. See "Ordering information" on Page 50-61 (see ZE244F/00/de).
SIL 2, for 4 to 20 mA output signal (see SD150F/00/en "Functional Safety Manual").

Marine certificate

GL (Germanisch Lloyd), ABS, NK
– HART, PROFIBUS PA
– not HT antenna

External standards and guidelines

EN 60529

Protection class of housing (IP-code)

EN 61010

Safety regulations for electrical devices for measurement, control, regulation and laboratory use.

EN 61326

Emissions (equipment class B), compatibility (appendix A – industrial area)

NAMUR

Standards committee for measurement and control in the chemical industry

RF approvals

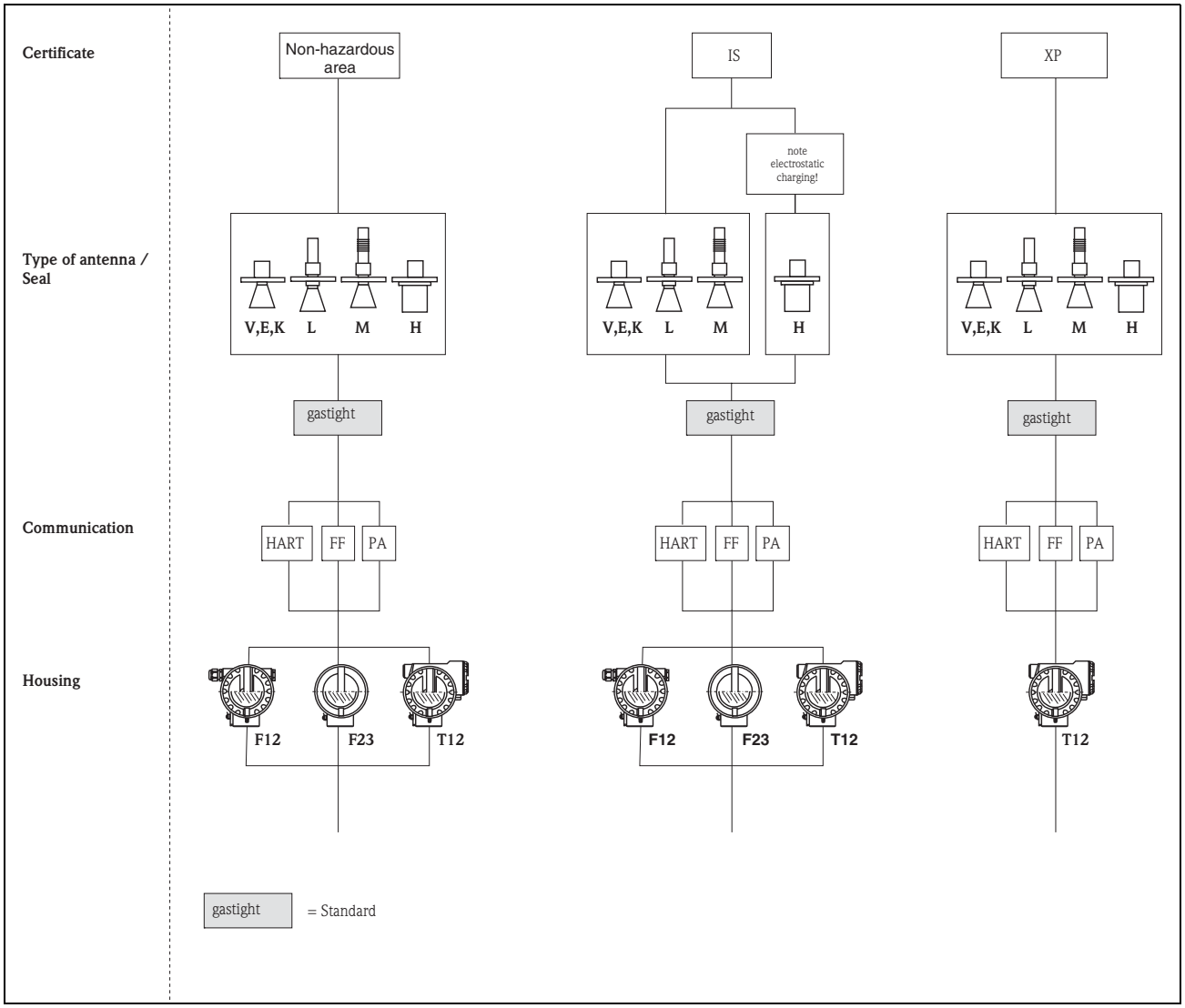
R&TTE, FCC

Pressure measuring device guideline

The instruments of the Micropilot M product family are not subject to the scope of the EC Directive 97/23/EC (Pressure Measuring Device Guideline).

Ordering information

Micropilot M FMR230 **Instrument selection**



L00-FMR230xx-16-00-00-en-001

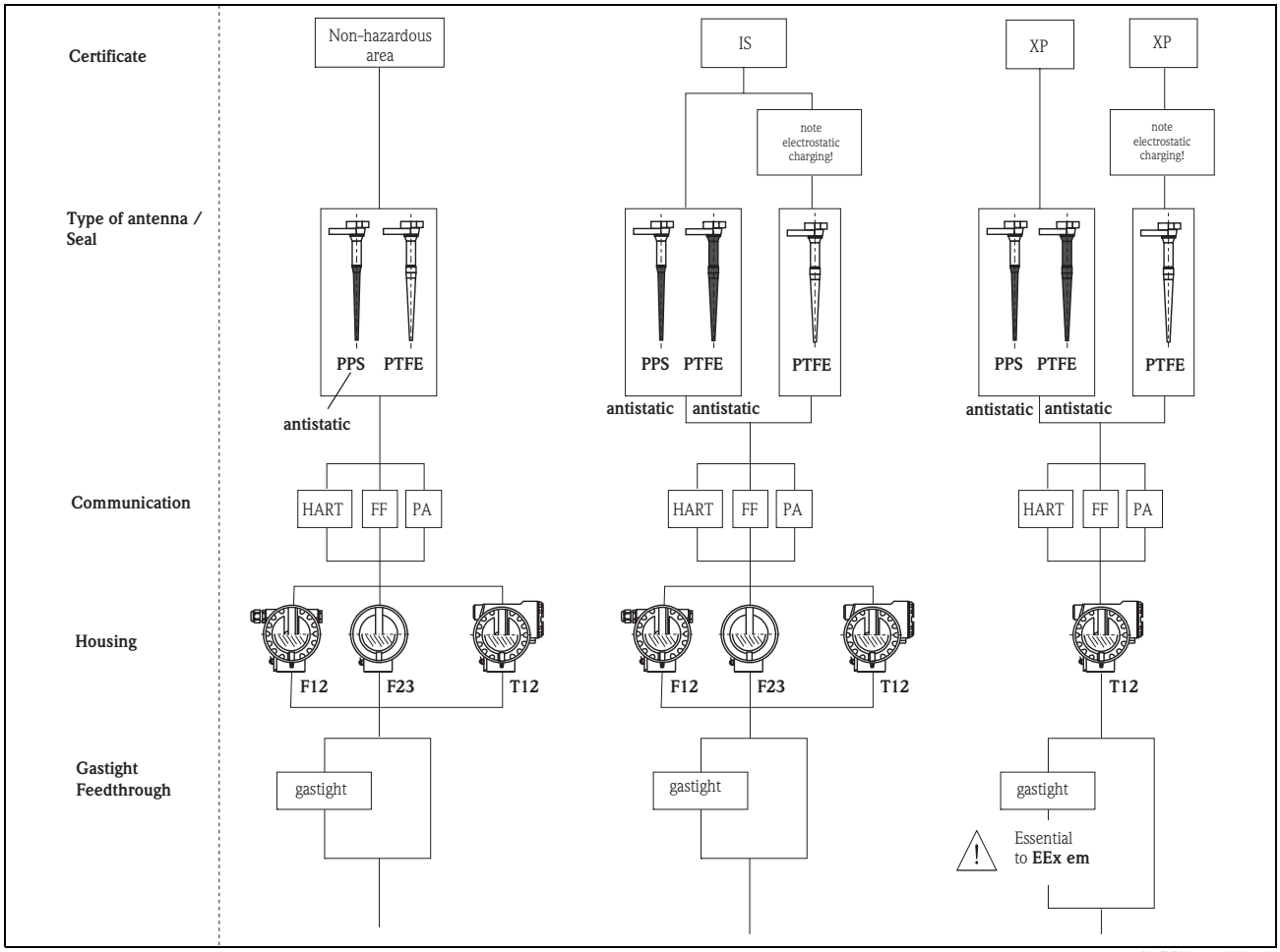
Ordering structure Micropilot M FMR230

10	**Approval:**									
	A	Non-hazardous area								
	F	Non-hazardous area, WHG								
	1	ATEX II 1/2 G EEx ia IIC T6, IECEx Zone 0/1								
	2	ATEX II 1/2 G EEx ia IIC T6, XA, IECEx Zone 0/1 Note safety instruction (XA) (electrostatic charging)!								
	3	ATEX II 1/2 G EEx em [ia] IIC T6, IECEx Zone 0/1								
	4	ATEX II 1/2 G EEx d [ia] IIC T6, IECEx Zone 0/1								
	6	ATEX II 1/2 G EEx ia IIC T6, WHG, IECEx Zone 0/1								
	7	ATEX II 1/2 G EEx ia IIC T6, WHG, XA, IECEx Zone 0/1 Note safety instruction (XA) (electrostatic charging)!								
	8	ATEX II 1/2 G EEx em [ia] IIC T6, WHG, IECEx Zone 0/1								
	G	ATEX II 3 G EEx nA II T6								
	H	ATEX II 1/2G EEx ia IIC T6, ATEX II 3D								
	S	FM IS - Cl.I Div.1 Gr. A-D								
	T	FM XP - Cl.I Div.1 Group A-D								
	N	CSA General Purpose								
	U	CSA IS - Cl.I Div.1 Group A-D								
	V	CSA XP - Cl.I Div.1 Group A-D								
	K	TIIS EEx ia IIC T4								
	L	TIIS EEx d [ia] IIC T4								
	M	TIIS EEx d [ia] IIC T1								
	I	NEPSI Ex ia IIC T6								
	J	NEPSI Ex d (ia) IIC T6								
	R	NEPSI Ex nAL IIC T6								
	W	AUS Ex ib IIC T6								
	Y	Special version								
20		**Antenna:**								
		1	w/o horn, for pipe installation							
		2	80mm/3"							
		3	100mm/4"							
		4	150mm/6"							
		5	200mm/8"							
		6	250mm/10"							
30			**Antenna seal; Temperature:**							
			V	FKM Viton; -40°C to 200°C/-40°F to 392°F, conductive media max 150°C/302°F						
			E	EPDM; -40°C to 150°C/-40°F to 302°F						
			K	Kalrez; -20°C to 200°C/-4°F to 392°F, conductive media max 150°C/302°F						
			L	Graphit; -60°C to 280°C/-76°F to 536°F						
			M	Graphit; -60°C to 400°C/-76°F to 752°F						
			H	Enamel; PTFE -40°C to 200°C/-40°F to 392°F						
			Y	Special version						
40				**Process connection:**						
				CMJ	DN80 PN16 B1, 316L flange EN1092-1 (DIN2527 C)					
				CNJ	DN80 PN40 B1, 316L flange EN1092-1 (DIN2527 C)					
				CQJ	DN100 PN16 B1, 316L flange EN1092-1 (DIN2527 C)					
				CQ5	DN100 PN10/16, AlloyC4>316Ti flange EN1092-1 (DIN2527 C)					
				CRJ	DN100 PN40 B1, 316L flange EN1092-1 (DIN2527 C)					
				CWJ	DN150 PN16 B1, 316L flange EN1092-1 (DIN2527 C)					
				CW5	DN150 PN10/16, AlloyC4>316Ti flange EN1092-1 (DIN2527)					
				EWT	DN150 PN16, Enamel>steel flange EN1092-1 (DIN2527)					
				CXJ	DN200 PN16 B1, 316L flange EN1092-1 (DIN2527 C)					
				EXT	DN200 PN16, Enamel>steel flange EN1092-1 (DIN2527)					
				C6J	DN250 PN16 B1, 316L flange EN1092-1 (DIN2527 C)					
				C65	DN200 PN16, AlloyC4>316Ti flange EN1092-1 (DIN2527)					
FMR230-										Product designation (part 1)

Ordering structure Micropilot M FMR230 (continued)

40				**Process connection:**					
				ALJ	3" 150lbs RF, 316/316L flange ANSI B16.5				
				AMJ	3" 300lbs RF, 316/316L flange ANSI B16.5				
				APJ	4" 150lbs RF, 316/316L flange ANSI B16.5				
				AQJ	4" 300lbs RF, 316/316L flange ANSI B16.5				
				AVJ	6" 150lbs RF, 316/316L flange ANSI B16.5				
				AV5	6" 150lbs, AlloyC4>316Ti flange ANSI B16.5				
				AVT	6" 150lbs, Enamel>steel flange ANSI B16.5				
				A3J	8" 150lbs RF, 316/316L flange ANSI B16.5				
				A35	8" 150lbs, AlloyC4>316Ti flange ANSI B16.5				
				A3T	8" 150lbs, Enamel>steel flange ANSI B16.5				
				A5J	10" 150lbs RF, 316/316L flange ANSI B16.5				
				A55	10" 150lbs, AlloyC4>316Ti flange ANSI B16.5				
				KA2	10K 80A RF, 316Ti flange JIS B2220				
				KH2	10K 100A RF, 316Ti flange JIS B2220				
				KV2	10K 150A RF, 316Ti flange JIS B2220				
				KD2	10K 200A RF, 316Ti flange JIS B2220				
				K52	10K 250A RF, 316Ti flange JIS B2220				
				TL2	Tri-Clamp ISO2852 DN70-76.1 (3"), 316Ti				
				YY9	Special version				
50					**Output; Operation:**				
					A	4-20mA SIL HART; 4-line display VU331, envelope curve display on site			
					B	4-20mA SIL HART; w/o display, via communication			
					K	4-20mA SIL HART; Prepared for FHX40, remote display (Accessory)			
					C	PROFIBUS PA; 4-line display VU331, envelope curve display on site			
					D	PROFIBUS PA; w/o display, via communication			
					L	PROFIBUS PA; Prepared for FHX40, remote display (Accessory)			
					E	FOUNDATION Fieldbus; 4-line display VU331, envelope curve display on site			
					F	FOUNDATION Fieldbus; w/o display, via communication			
					M	FOUNDATION Fieldbus; Prepared for FHX40, remote display (Accessory)			
					Y	Special version			
60						**Housing:**			
						A	F12 Alu, coated IP65 (NEMA4X)		
						B	F23 316L IP65 (NEMA4X)		
						C	T12 Alu, coated IP65 (NEMA4X), separate conn. compartment		
						D	T12 Alu, coated IP65 (NEMA4X)+OVP, separate conn. compartment, OVP=overvoltage protection		
						Y	Special version		
70							**Cable entry:**		
							2	Gland M20 (EEx d > thread M20)	
							3	Thread G1/2	
							4	Thread NPT 1/2"	
							5	Plug M12	
							6	Plug 7/8"	
							9	Special version	
80								**Additional option:**	
								A	Basic version
								B	EN10204-3.1B (316L wetted parts) inspection certificate
								N	EN10204-3.1B, NACE MR0175 (316L wetted parts) inspection certificate
								S	GL/ABS/NK marine certificate
								Y	Special version
FMR230-									Complete product designation

Micropilot M FMR231 **Instrument selection**



Ordering structure Micropilot M FMR231

10	**Approval:**			
	A	Non-hazardous area		
	F	Non-hazardous area, WHG		
	1	ATEX II 1/2 G EEx ia IIC T6, IECEx Zone 0/1		
	2	ATEX II 1/2 G EEx ia IIC T6, XA, IECEx Zone 0/1 Note safety instruction (XA) (electrostatic charging)!		
	6	ATEX II 1/2 G EEx ia IIC T6, WHG, IECEx Zone 0/1		
	7	ATEX II 1/2 G EEx ia IIC T6, WHG, XA, IECEx Zone 0/1 Note safety instruction (XA) (electrostatic charging)!		
	3	ATEX II 1/2 G EEx em [ia] IIC T6, IECEx Zone 0/1		
	8	ATEX II 1/2 G EEx em [ia] IIC T6, WHG, IECEx Zone 0/1		
	4	ATEX II 1/2 G EEx d [ia] IIC T, IECEx Zone 0/16		
	G	ATEX II 3 G EEx nA II T6, XA, fully insutalted antenna: Note safety instruction (XA) (electrostatic charging)!		
	H	ATEX II 1/2G EEx ia IIC T6, ATEX II 3D, XA, fully insutalted antenna: Note safety instruction (XA) (electrostatic charging)!		
	S	FM IS - Cl.I Div.1 Gr. A-D		
	T	FM XP - Cl.I Div.1 Group A-D		
	N	CSA General Purpose		
	U	CSA IS - Cl.I Div.1 Group A-D		
	V	CSA XP - Cl.I Div.1 Group A-D		
	K	TIIS EEx ia IIC T4		
	L	TIIS EEx d [ia] IIC T4		
	M	TIIS EEx d [ia] IIC T1		
	I	NEPSI Ex ia IIC T6		
	J	NEPSI Ex d (ia) IIC T6		
	R	NEPSI Ex nAL IIC T6		
	W	AUS Ex ib IIC T6		
	Y	Special version		
20		**Antenna; Inactive length:**		
	A	PPS antistatic 360mm/14", Viton, 316L; nozzle height max 100mm/4"		
	B	PPS antistatic 510mm/20", Viton, 316L; nozzle height max 250mm/10"		
	E	PTFE 390mm/15", fully insulated; nozzle height max 100mm/4"		
	F	PTFE 540mm/21", fully insulated; nozzle height max 250mm/10"		
	H	PTFE antistatic 390mm/15", fully insul.; nozzle height max 100mm/4"		
	J	PTFE antistatic 540mm/21", fully insul.; nozzle height max 250mm/10"		
	Y	Special version		
30			**Process connection:**	
		GGJ	1½" BSPT (R 1½")	
		GGS	1½" BSPT (R 1½")	
		GNJ	NPT 1-½"	
		GNS	NPT 1-½"	
		TEJ	Tri-Clamp ISO2852 DN40-51 (2"), 316L	
		TLJ	Tri-Clamp ISO2852 DN70-76.1 (3"), 316L	
		MFJ	DIN11851 DN50 PN40, 316L	
		HFJ	DIN11864-1 A DN50 Tube DIN11850, 316L	
		BFJ	DN50 PN10/16 A, 316L flange EN1092-1 (DIN2527 B)	
		CFJ	DN50 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)	
		CFK	DN50 PN10/16, PTFE>316L flange EN1092-1 (DIN2527)	
		BMJ	DN80 PN10/16 A, 316L flange EN1092-1 (DIN2527 B)	
		CMJ	DN80 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)	
		BNJ	DN80 PN25/40 A, 316L flange EN1092-1 (DIN2527 B)	
		CNJ	DN80 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C)	
		CMK	DN80 PN10/16, PTFE>316L flange EN1092-1 (DIN2527)	
		BQJ	DN100 PN10/16 A, 316L flange EN1092-1 (DIN2527 B)	
		CQJ	DN100 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)	
		CQK	DN100 PN10/16, PTFE>316L flange EN1092-1 (DIN2527)	
		BWJ	DN150 PN10/16 A, 316L flange EN1092-1 (DIN2527 B)	
		CWJ	DN150 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)	
		CWK	DN150 PN10/16, PTFE(black)>316L flange EN1092-1 (DIN2527)	
			PTFE(black) = conductive cladding	
FMR231-				Product designation (part 1)

Ordering structure Micropilot M FMR231 (continued)

30	**Process connection:**	
	AEJ	2" 150lbs RF, 316/316L flange ANSI B16.5
	AEK	2" 150lbs, PTFE>316/316L flange ANSI B16.5
	ALJ	3" 150lbs RF, 316/316L flange ANSI B16.5
	AMJ	3" 300lbs RF, 316/316L flange ANSI B16.5
	ALK	3" 150lbs, PTFE>316/316L flange ANSI B16.5
	APJ	4" 150lbs RF, 316/316L flange ANSI B16.5
	AQJ	4" 300lbs RF, 316/316L flange ANSI B16.5
	APK	4" 150lbs, PTFE>316/316L flange ANSI B16.5
	AVJ	6" 150lbs RF, 316/316L flange ANSI B16.5
	AVK	6" 150lbs, PTFE(black)>316/316L flange ANSI B16.5
		PTFE(black) = conductive cladding
	KEJ	10K 50A RF, 316L flange JIS B2220
	KEK	10K 50A, PTFE>316L flange JIS B2220
	KLJ	10K 80A RF, 316L flange JIS B2220
	KLK	10K 80A, PTFE>316L flange JIS B2220
	KPJ	10K 100A RF, 316L flange JIS B2220
	KPK	10K 100A, PTFE>316L flange JIS B2220
	KVJ	10K 150A RF, 316L flange JIS B2220
	KVK	10K 150A, PTFE(black)>316L flange JIS B2220
		PTFE(black) = conductive cladding
	YY9	Special version

40	**Output; Operation:**	
	A	4-20mA SIL HART; 4-line display VU331, envelope curve display on site
	B	4-20mA SIL HART; w/o display, via communication
	K	4-20mA SIL HART; Prepared for FHX40, remote display (Accessory)
	C	PROFIBUS PA; 4-line display VU331, envelope curve display on site
	D	PROFIBUS PA; w/o display, via communication
	L	PROFIBUS PA; Prepared for FHX40, remote display (Accessory)
	E	FOUNDATION Fieldbus; 4-line display VU331, envelope curve display on site
	F	FOUNDATION Fieldbus; w/o display, via communication
	M	FOUNDATION Fieldbus; Prepared for FHX40, remote display (Accessory)
	Y	Special version

50	**Housing:**	
	A	F12 Alu, coated IP65 (NEMA4X)
	B	F23 316L IP65 (NEMA4X)
	C	T12 Alu, coated IP65 (NEMA4X), separate conn. compartment
	D	T12 Alu, coated IP65 (NEMA4X)+OVP, separate conn. compartment, OVP=overvoltage protection
	Y	Special version

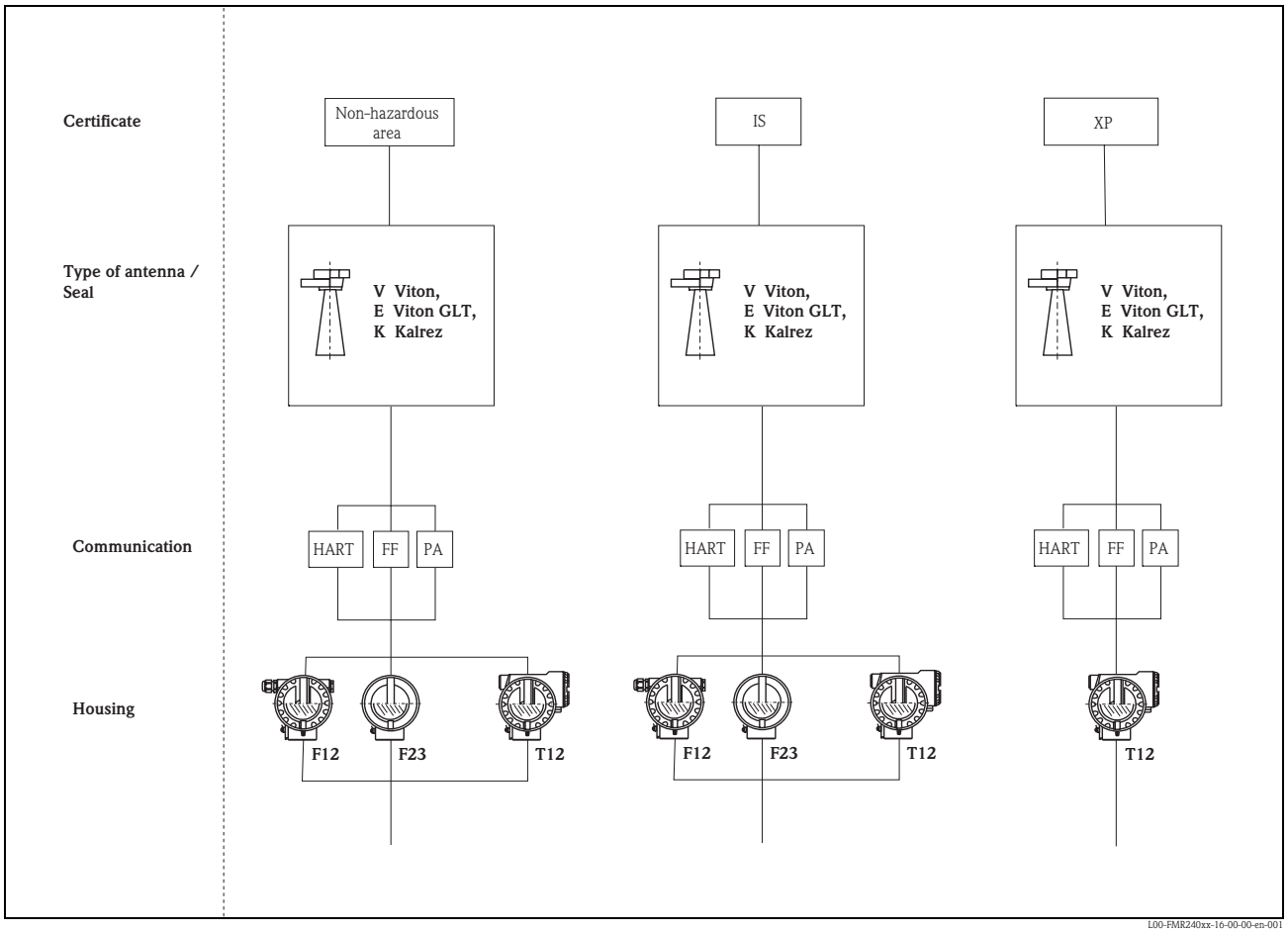
60	**Cable entry:**	
	2	Gland M20 (EEx d > thread M20)
	3	Thread G1/2
	4	Thread NPT 1/2"
	5	Plug M12
	6	Plug 7/8"
	9	Special version

70	**Gas-tight feed through:**	
	A	Not selected
	C	Selected

80	**Additional option:**	
	A	Basic version
	B	EN10204-3.1B (316L wetted parts) Inspection certificate
	S	GL/ABS/NK marine certificate
	Y	Special version

FMR231-	Complete product designation

Micropilot M FMR240 **Instrument selection**



Ordering structure Micropilot M FMR240

10	Approval:	
	A	Non-hazardous area
	F	Non-hazardous area, WHG
	1	ATEX II 1/2 G EEx ia IIC T6
	6	ATEX II 1/2 G EEx ia IIC T6, WHG
	3	ATEX II 1/2 G EEx em [ia] IIC T6
	8	ATEX II 1/2 G EEx em [ia] IIC T6, WHG
	4	ATEX II 1/2 G EEx d [ia] IIC T6
	G	ATEX II 3 G EEx nA II T6
	H	ATEX II 1/2G EEx ia IIC T6, ATEX II 3D
	S	FM IS - Cl.I Div.1 Gr. A-D
	T	FM XP - Cl.I Div.1 Group A-D
	N	CSA General Purpose
	U	CSA IS - Cl.I Div.1 Group A-D
	V	CSA XP - Cl.I Div.1 Group A-D
	K	TIIS EEx ia IIC T4
	L	TIIS EEx d [ia] IIC T4
	W	AUS Ex ib IIC T6
	D	IECEx Zone 0/1, Ex ia IIC T6
	E	IECEx Zone 0/1, Ex d (ia) IIC T6
	I	NEPSI Ex ia IIC T6
	J	NEPSI Ex d (ia) IIC T6
	R	NEPSI Ex nAL IIC T6
	Y	Special version

FMR240-											Product designation (part 1)

Ordering structure Micropilot M FMR240 (continued)

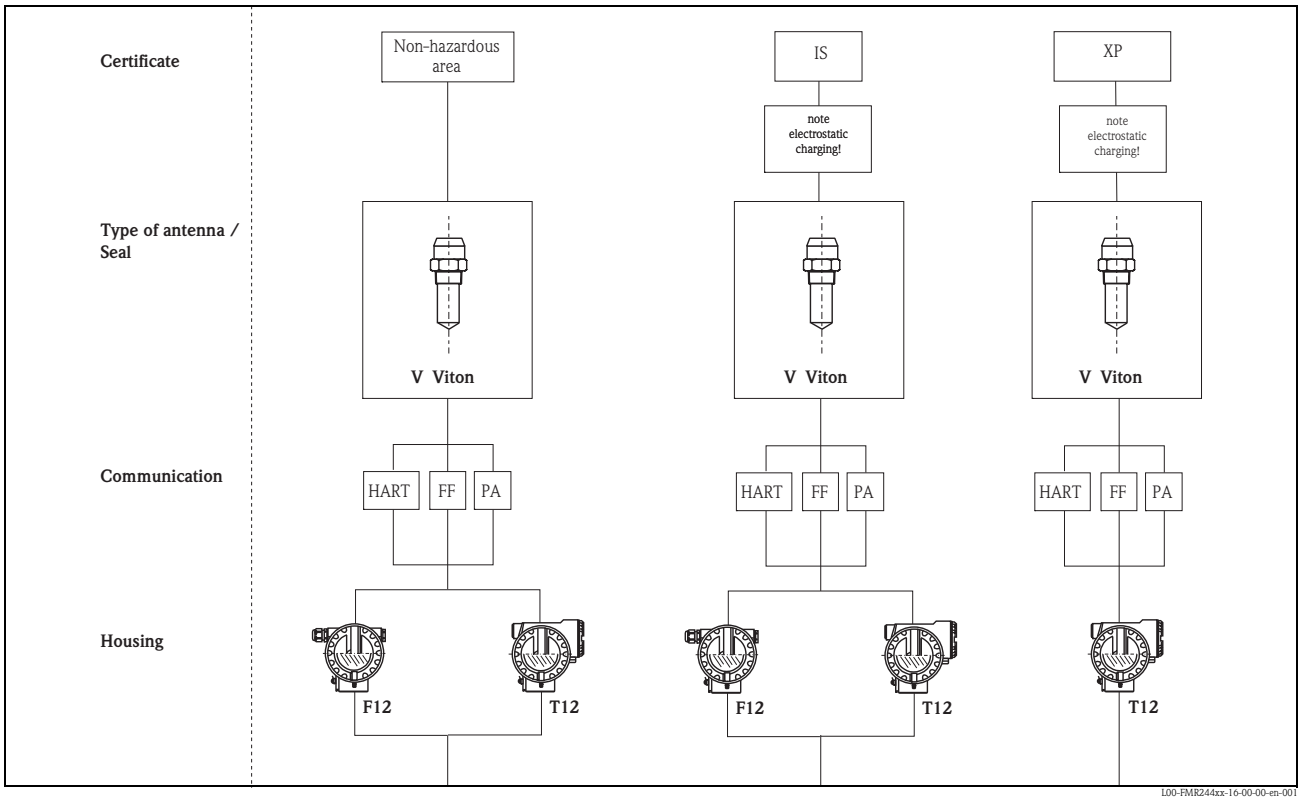
20	**Antenna:**	
	2	40mm/1-1/2"
	3	50mm/2"
	4	80mm/3"
	5	100mm/4"
30	**Antenna seal; Temperature:**	
	V	FKM Viton; -20°C to 150°C/-4°F to 302°F
	E	FKM Viton GLT; -40°C to 150°C/-40°F to 302°F
	K	Kalrez; -20°C to 150°C/-4°F to 302°F
40	**Antenna extension**	
	1	without antenna extension
	2	100 mm / 4" antenna extension
	9	Special version
50	**Process connection:**	
	GGJ	Thread DIN2999 R1-1/2, 316L
	GNJ	Thread ANSI NPT 1-1/2", 316L
	TLJ	Tri-Clamp ISO2852 DN70-76.1 (3"), 316L
	CFJ	DN50 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
	CGJ	DN50 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C)
	CFM	DN50 PN10/16, AlloyC22>316L flange EN1092-1 (DIN2527)
	CGM	DN50 PN25/40, AlloyC22>316L flange EN1092-1 (DIN2527)
	CMJ	DN80 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
	CNJ	DN80 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C)
	CMM	DN80 PN10/16, AlloyC22>316L flange EN1092-1 (DIN2527)
	CNM	DN80 PN25/40, AlloyC22>316L flange EN1092-1 (DIN2527)
	CQJ	DN100 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
	CRJ	DN100 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C)
	CQM	DN100 PN10/16, AlloyC22>316L flange EN1092-1 (DIN2527)
	CRM	DN100 PN25/40, AlloyC22>316L flange EN1092-1 (DIN2527)
	CWJ	DN150 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
	CWM	DN150 PN10/16, AlloyC22>316L flange EN1092-1 (DIN2527)
	AEJ	2" 150lbs RF, 316/316L flange ANSI B16.5
	AFJ	2" 300lbs RF, 316/316L flange ANSI B16.5
	AEM	2" 150lbs, AlloyC22>316/316L flange ANSI B16.5
	AFM	2" 300lbs, AlloyC22>316/316L flange ANSI B16.5
	ALJ	3" 150lbs RF, 316/316L flange ANSI B16.5
	AMJ	3" 300lbs RF, 316/316L flange ANSI B16.5
	ALM	3" 150lbs, AlloyC22>316/316L flange ANSI B16.5
	AMM	3" 300lbs, AlloyC22>316/316L flange ANSI B16.5
	APJ	4" 150lbs RF, 316/316L flange ANSI B16.5
	AQJ	4" 300lbs RF, 316/316L flange ANSI B16.5
	APM	4" 150lbs, AlloyC22>316/316L flange ANSI B16.5
	AQM	4" 300lbs, AlloyC22>316/316L flange ANSI B16.5
	AWJ	6" 150lbs RF, 316/316L flange ANSI B16.5
	AWM	6" 150lbs, AlloyC22>316/316L flange ANSI B16.5

FMR240-	Product designation (part 2)

Ordering structure Micropilot M FMR240 (continued)

50	**Process connection:**	
	KEJ	10K 50A RF, 316L flange JIS B2220
	KEM	10K 50A, AlloyC22>316L flange JIS B2220
	KLJ	10K 80A RF, 316L flange JIS B2220
	KLM	10K 80A, AlloyC22>316L flange JIS B2220
	KPJ	10K 100A RF, 316L flange JIS B2220
	KPM	10K 100A, AlloyC22>316L flange JIS B2220
	KWJ	10K 150A RF, 316L flange JIS B2220
	KWM	10K 150A, AlloyC22>316L flange JIS B2220
	YY9	Special version
60	**Output; Operation:**	
	A	4-20mA SIL HART; 4-line display VU331, envelope curve display on site
	B	4-20mA SIL HART; w/o display, via communication
	K	4-20mA SIL HART; Prepared for FHX40, remote display (Accessory)
	C	PROFIBUS PA; 4-line display VU331, envelope curve display on site
	D	PROFIBUS PA; w/o display, via communication
	L	PROFIBUS PA; Prepared for FHX40, remote display (Accessory)
	E	FOUNDATION Fieldbus; 4-line display VU331, envelope curve display on site
	F	FOUNDATION Fieldbus; w/o display, via communication
	M	FOUNDATION Fieldbus; Prepared for FHX40, remote display (Accessory)
	Y	Special version
70	**Housing:**	
	A	F12 Alu, coated IP65 (NEMA4X)
	B	F23 316L IP65 (NEMA4X)
	C	T12 Alu, coated IP65 (NEMA4X), separate conn. compartment
	D	T12 Alu, coated IP65 (NEMA4X) + OVP, separate conn. compartment, OVP=overvoltage protection
	Y	Special version
80	**Cable entry:**	
	2	Gland M20 (EEx d > thread M20)
	3	Thread G1/2
	4	Thread NPT 1/2"
	5	Plug M12
	6	Plug 7/8"
	9	Special version
90	**Additional option:**	
	A	Basic version
	B	EN10204-3.1B (316L wetted parts) Inspection certificate
	N	EN10204-3.1B, NACE MR0175 (316L wetted parts) Inspection certificate
	S	GL/ABS/NK marine certificate
	D	Advanced dynamics (max MB=40m) (SIL on request) MB=measuring range
	E	Advanced dynamics (max MB=40m), EN10204-3.1, NACE MR0175 (316L wetted parts) inspection certificate (SIL on request), MB=measuring range
	F	Advanced dynamics (max MB=70m) (SIL on request) MB=measuring range
	G	Advanced dynamics (max MB=70m), EN10204-3.1, NACE MR0175 (316L wetted parts) inspection certificate (SIL on request), MB=measuring range
	T	NUS marine certificate
	U	NUS marine certificate, adapter, 3" Tri-Clamp - NPT1-1/2, incl. clamp + seal FKM Viton
	V	NUS marine certificate, sample hatch, incl. clamp + seal FKM Viton
	Y	Special version
FMR240-		Complete product designation

Micropilot M FMR244 **Instrument selection**



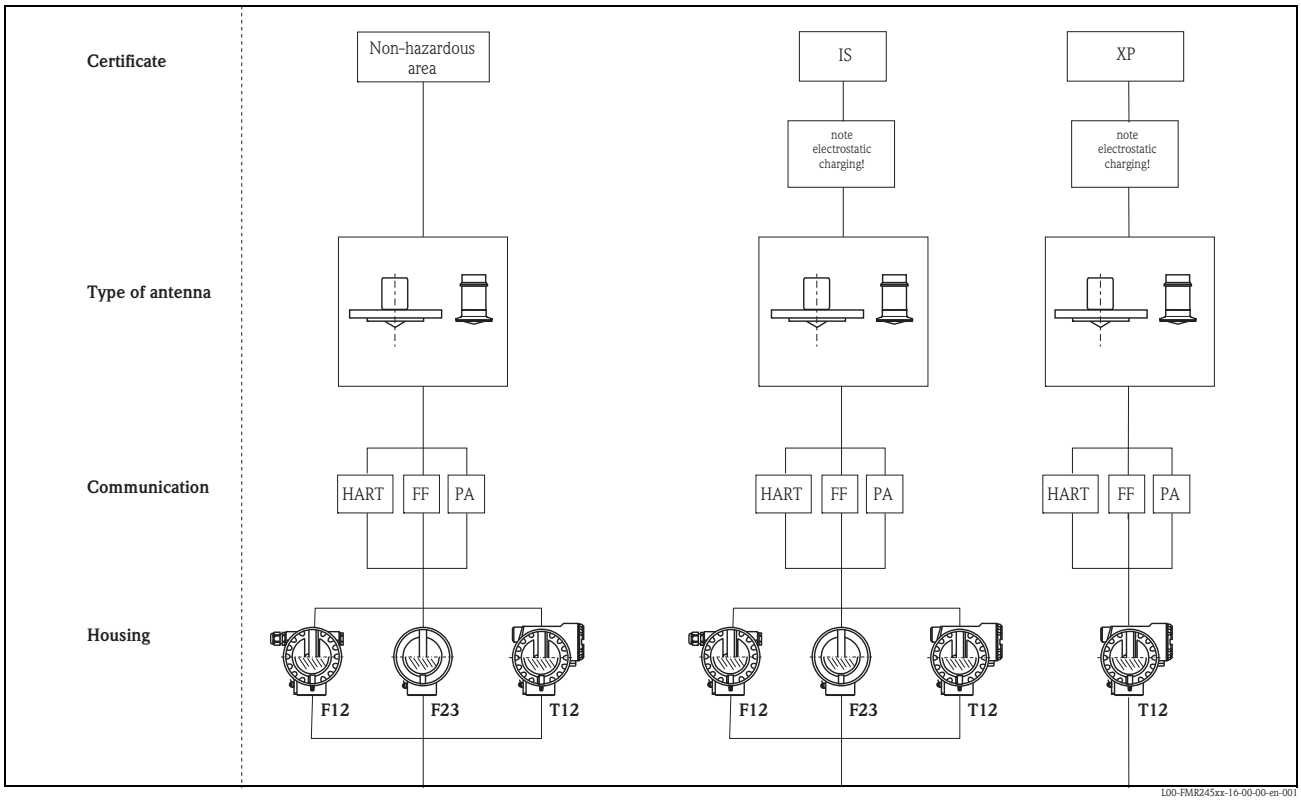
Ordering structure Micropilot M FMR244

10	**Approval:**								
	A	Non-hazardous area							
	F	Non-hazardous area, WHG							
	2	ATEX II 1/2 G EEx ia IIC T6, XA, Note safety instruction (XA) (electrostatic charging)!							
	7	ATEX II 1/2 G EEx ia IIC T6, WHG, XA, Note safety instruction (XA) (electrostatic charging)!							
	5	ATEX II 1/2 G EEx d [ia] IIC T6, XA, Note safety instruction (XA) (electrostatic charging)!							
	G	ATEX II 3 G EEx nA II T6							
	H	ATEX II 1/2G EEx ia IIC T6, ATEX 3D, XA, Note safety instruction (XA) (electrostatic charging)!							
	S	FM IS - Cl.I Div.1 Gr. A-D							
	T	FM XP - Cl.I Div.1 Group A-D							
	N	CSA General Purpose							
	U	CSA IS - Cl.I Div.1 Group A-D							
	V	CSA XP - Cl.I Div.1 Group A-D							
	K	TIIS EEx ia IIC T4							
	L	TIIS EEx d [ia] IIC T4							
	D	IECEx Zone 0/1, Ex ia IIC T6, XA, Note safety instruction (XA) (electrostatic charging)!							
	E	IECEx Zone 0/1, Ex d (ia) IIC T6, XA, Note safety instruction (XA) (electrostatic charging)!							
	I	NEPSI Ex ia IIC T6							
	J	NEPSI Ex d (ia) IIC T6							
	R	NEPSI Ex nAL IIC T6							
	Y	Special version							
20		**Antenna:**							
		2	40mm (1-1/2")						
		9	Special version						
30			**Antenna seal; Temperature:**						
			V	FKM Viton GLT; -40°C to 130°C/-40°F to 266°F					
			Y	Special version					
FMR244-									Product designation (part 1)

Ordering structure Micropilot M FMR244 (continued)

40				**Process connection:**					
					– Threaded boss –				
				GGS	Thread ISO228 G1-1/2, PVDF				
				GNS	Thread ANSI NPT 1-1/2", PVDF				
				YY9	Special version				
50					**Output; Operation:**				
					A	4-20mA SIL HART; 4-line display VU331, envelope curve display on site			
					B	4-20mA SIL HART; w/o display, via communication			
					K	4-20mA SIL HART; Prepared for FHX40, remote display (Accessory)			
					C	PROFIBUS PA; 4-line display VU331, envelope curve display on site			
					D	PROFIBUS PA; w/o display, via communication			
					L	PROFIBUS PA; Prepared for FHX40, remote display (Accessory)			
					E	FOUNDATION Fieldbus; 4-line display VU331, envelope curve display on site			
					F	FOUNDATION Fieldbus; w/o display, via communication			
					M	FOUNDATION Fieldbus; Prepared for FHX40, remote display (Accessory)			
					Y	Special version			
60						**Housing:**			
						A	F12 Alu, coated IP65 (NEMA4X)		
						C	T12 Alu, coated IP65 (NEMA4X), separate conn. compartment		
						D	T12 Alu, coated IP65 (NEMA4X), separate conn. compartment, OVP=overvoltage protection		
						Y	Special version		
70							**Cable entry:**		
							2	Gland M20 (EEx d > thread M20)	
							3	Thread G1/2	
							4	Thread NPT 1/2"	
							5	Plug M12	
							6	Plug 7/8"	
							9	Special version	
80								**Additional option:**	
								A	Basic version
								D	Advanced dynamics (max MB=40m) (SIL on request) MB=measuring range
								F	Advanced dynamics (max MB=70m) (SIL on request) MB=measuring range
								S	GL/ABS/NK marine certificate
								Y	Special version
FMR244-									Complete product designation

Micropilot M FMR245 **Instrument selection**



Ordering structure Micropilot M FMR245

10	**Approval:**	
	A	Non-hazardous area
	F	Non-hazardous area, WHG
	2	ATEX II 1/2 G EEx ia IIC T6, XA, Note safety instruction (XA) (electrostatic charging)!
	7	ATEX II 1/2 G EEx ia IIC T6, WHG, XA, Note safety instruction (XA) (electrostatic charging)!
	5	ATEX II 1/2 G EEx d [ia] IIC T6, XA, Note safety instruction (XA) (electrostatic charging)!
	G	ATEX II 3 G EEx nA II T6
	H	ATEX II 1/2G EEx ia IIC T6, ATEX 3D, XA, Note safety instruction (XA) (electrostatic charging)!
	S	FM IS - Cl.I Div.1 Gr. A-D
	T	FM XP - Cl.I Div.1 Group A-D
	N	CSA General Purpose
	U	CSA IS - Cl.I Div.1 Group A-D
	V	CSA XP - Cl.I Div.1 Group A-D
	K	TIIS EEx ia IIC T4
	L	TIIS EEx d [ia] IIC T4
	D	IECEx Zone 0/1, Ex ia IIC T6, XA, Note safety instruction (XA) (electrostatic charging)!
	E	IECEx Zone 0/1, Ex d (ia) IIC T6, XA, Note safety instruction (XA) (electrostatic charging)!
	I	NEPSI Ex ia IIC T6
	J	NEPSI Ex d (ia) IIC T6
	R	NEPSI Ex nAL IIC T6
	Y	Special version
20		**Antenna:**
	3	50mm/2"
	4	80mm/3"
	9	Special version

FMR245- Product designation (part 1)

Ordering structure Micropilot M FMR245 (continued)

30	**Process connection:**	
	CFK	DN50 PN10/16, PTFE>316L flange EN1092-1 (DIN2527)
	CMK	DN80 PN10/16, PTFE>316L flange EN1092-1 (DIN2527)
	CQK	DN100 PN10/16, PTFE>316L flange EN1092-1 (DIN2527)
	CWK	DN150 PN10/16, PTFE>316L flange EN1092-1 (DIN2527)
	AEK	2" 150lbs, PTFE>316L flange ANSI B16.5
	ALK	3" 150lbs, PTFE>316L flange ANSI B16.5
	APK	4" 150lbs, PTFE>316L flange ANSI B16.5
	AVK	6" 150lbs, PTFE>316L flange ANSI B16.5
	KEK	10K 50A, PTFE>316L flange JIS B2220
	KLK	10K 80A, PTFE>316L flange JIS B2220
	KPK	10K 100A, PTFE>316L flange JIS B2220
	KVK	10K 150A, PTFE>316L flange JIS B2220
	TDK	Tri-Clamp ISO2852 DN51 (2"), PTFE>316L
	TEK	Tri-Clamp ISO2852 DN63.5 (2-1/2"), PTFE>316L
	TFK	Tri-Clamp ISO2852 DN76.1 (3"), PTFE>316L
	YY9	Special version

40	**Output; Operation:**	
	A	4-20mA SIL HART; 4-line display VU331, envelope curve display on site
	B	4-20mA SIL HART; w/o display, via communication
	K	4-20mA SIL HART; Prepared for FHX40, remote display (Accessory)
	C	PROFIBUS PA; 4-line display VU331, envelope curve display on site
	D	PROFIBUS PA; w/o display, via communication
	L	PROFIBUS PA; Prepared for FHX40, remote display (Accessory)
	E	FOUNDATION Fieldbus; 4-line display VU331, envelope curve display on site
	F	FOUNDATION Fieldbus; w/o display, via communication
	M	FOUNDATION Fieldbus; Prepared for FHX40, remote display (Accessory)
	Y	Special version

50	**Housing:**	
	A	F12 Alu, coated IP65 (NEMA4X)
	B	F23 316L IP65 (NEMA4X)
	C	T12 Alu, coated IP65 (NEMA4X), separate conn. compartment
	D	T12 Alu, coated IP65 (NEMA4X) + OVP, separate conn. compartment, OVP=overvoltage protection
	Y	Special version

60	**Cable entry:**	
	2	Gland M20
	3	Thread G1/2
	4	Thread NPT 1/2"
	5	Plug M12
	6	Plug 7/8"
	9	Special version

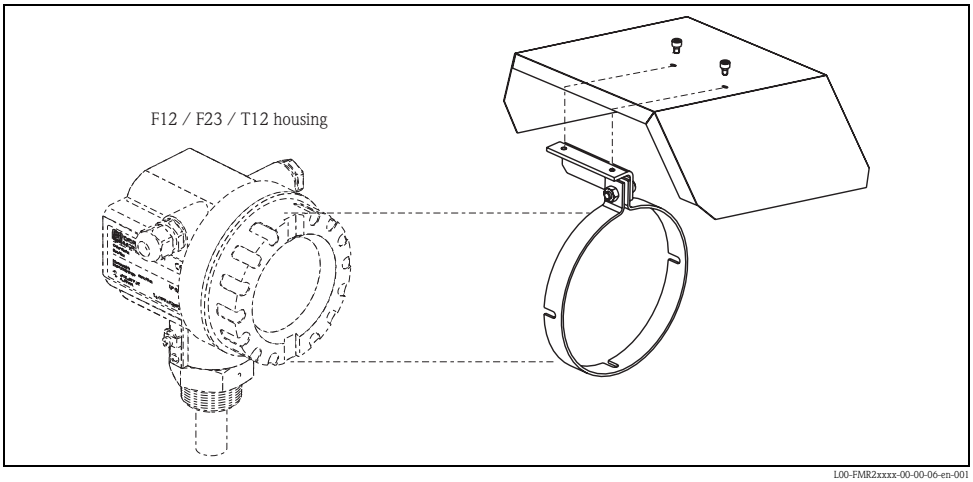
70	**Additional option:**	
	A	Basic version
	D	Advanced dynamics (max MB=40m) (SIL on request) MB=measuring range
	F	Advanced dynamics (max MB=70m) (SIL on request) MB=measuring range
	S	GL/ABS/NK marine certificate
	Y	Special version

FMR245-	Complete product designation

Accessories

Weather protection cover

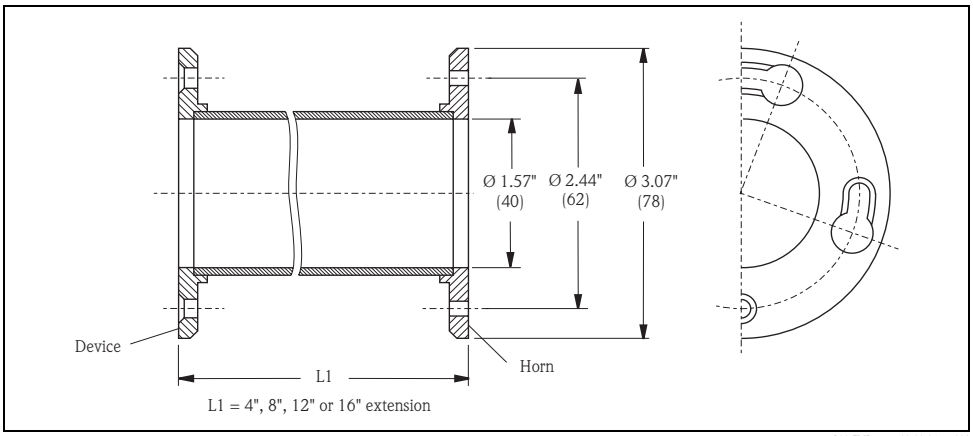
A Weather protection cover made of stainless steel is recommended for outdoor mounting (order code: 543199-0001). The shipment includes the protective cover and tension clamp.



L00-FMR2xxxx-00-00-06-en-001

Antenna extension FAR10 (for FMR230)

Dimensions

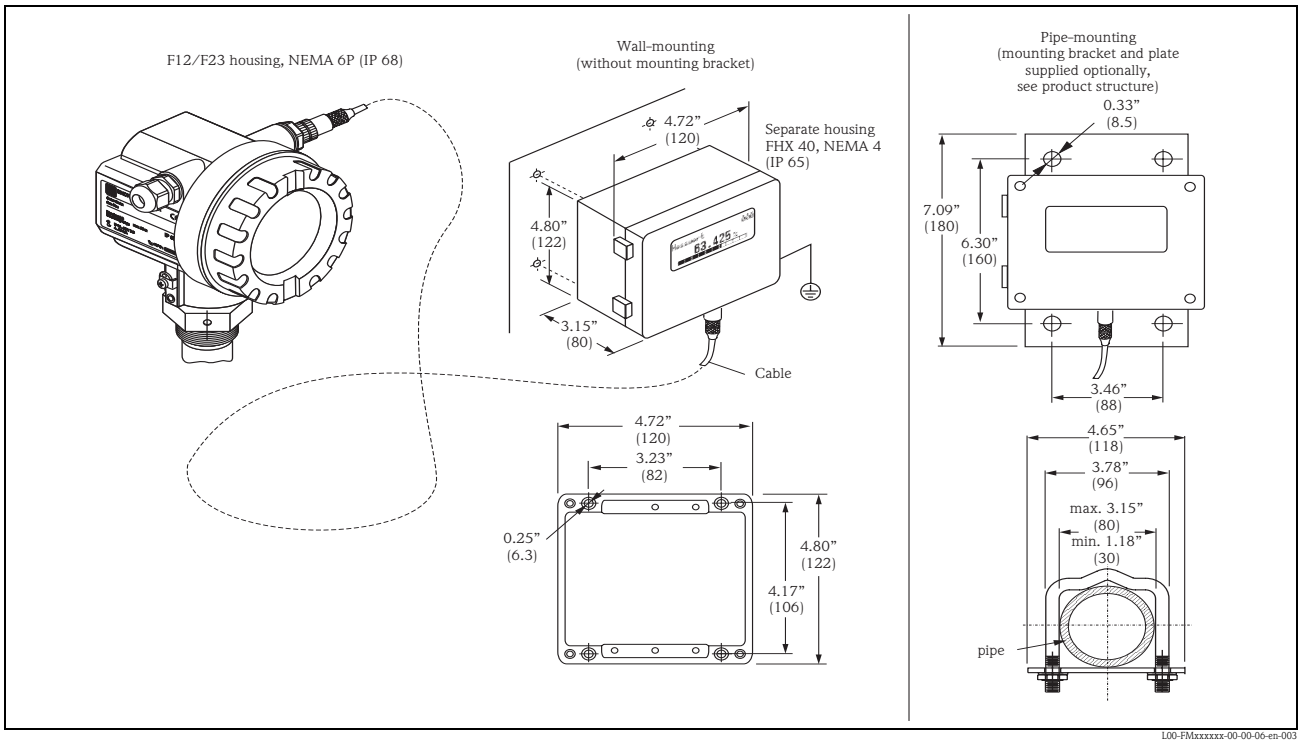


L00-FMRxxxxx-00-00-06-en-002

Ordering information:

10	**Material:**		
	6		316L
	7		316L + EN10204-3.1B, NACE MR1075 inspection certificate
	2		316Ti
	5		AlloyC4
	9		Special version
20		**Extension:**	
		A	100 mm / 4"
		B	200 mm / 8"
		C	300 mm / 12"
		D	400 mm / 16"
		Y	Special length
FAR10-			Complete product designation

Remote display FHX40



Technical data (cable and housing) and product structure:

Max. cable length	20 m (65 ft)
Temperature range	-30°C to +70°C (-22°F to 158°F)
Degree of protection	IP65 acc. to EN 60529 (NEMA 4)
Materials	Housing: AlSi12; cable glands: nickle plated brass
Dimensions mm / inch	122x150x80 (HxWxD) / 4.8 x 5.9 x 3.2

	Approval:				
	A				Nn-hazardous area
	1				ATEX II 2 G EEx ia IIC T6, ATEX II 3D
	S				FM IS Cl.I Div.1 Gr.A-D
	U				CSA IS Cl.I Div.1 Gr.A-D
	N				CSA General Purpose
	K				TIIS ia IIC T6 (in preparation)
		Cable:			
		1			20m/65ft; for HART
		5			20m/65ft; for PROFIBUS PA/FOUNDATION Fieldbus
			Additional option:		
			A		Basic version
			B		Mounting bracket, pipe 1"/ 2"
FHX40 -					Complete product designation

For connection of the remote display FHX40 use the cable which fits the communication version of the respective instrument.

Commubox FXA191 HART For intrinsically safe communication with ToF Tool/FieldCare via the RS232C interface. For details refer to TI237F/00/en.

Commubox FXA195 HART

For intrinsically safe communication with ToF Tool/FieldCare via the USB interface. For details refer to TI404F/00/en.

Commubox FXA291

The Commubox FXA291 connects Endress+Hauser field instruments with CDI interface (= Endress+Hauser Common Data Interface) to the USB interface of a personal computer or a notebook. For details refer to TI405C/07/en.

Note!
For the following Endress+Hauser instruments you need the "ToF Adapter FXA291" as an additional accessory:

- Cerabar S PMC71, PMP7x
- Deltabar S PMD7x, FMD7x
- Deltapilot S FMB70
- Gammapilot M FMG60
- Levelflex M FMP4x
- Micropilot FMR130/FMR131
- Micropilot M FMR2xx
- Micropilot S FMR53x, FMR540
- Prosonic S FMU90
- Prosonic M FMU4x
- Tank Side Monitor NRF590 (with additional adapter cable)

ToF Adapter FXA291

The ToF Adapter FXA291 connects the Commubox FXA291 via the USB interface of a personal computer or a notebook to the following Endress+Hauser instruments:

- Cerabar S PMC71, PMP7x
- Deltabar S PMD7x, FMD7x
- Deltapilot S FMB70
- Gammapilot M FMG60
- Levelflex M FMP4x
- Micropilot FMR130/FMR131
- Micropilot M FMR2xx
- Micropilot S FMR53x, FMR540
- Prosonic S FMU90
- Prosonic M FMU4x
- Tank Side Monitor NRF590 (with additional adapter cable)

For details refer to KA271F/00/a2.

Documentation

System Information

System Information for Micropilot, SI019F/00/en.

Special Documentation

Time of Flight Liquid Level Measurement

Selection and engineering for the process industry, SD157F/00/en.

Radar Tank Gauging brochure

For inventory control and custody transfer applications in tank farms and terminals, SD001V/00/en.

Technical Information

Tank Side Monitor NRF590

Technical Information for Tank Side Monitor NRF590, TI402F/00/en.

Fieldgate FXA520

Technical Information for Fieldgate FXA520, TI369F/00/en.

Operating Instructions

Micropilot M

Correlation of operating instructions to the instrument:

Instrument	Output	Communication	Operating Instructions	Description of Instrument Functions	Brief Operating Instructions (in the Instrument)
FMR230	A, B	HART	BA218F/00/en	BA221F/00/en	KA159F/00/a2
	C, D	PROFIBUS PA	BA225F/00/en	BA221F/00/en	KA159F/00/a2
	E, F	FOUNDATION Fieldbus	BA228F/00/en	BA221F/00/en	KA159F/00/a2
FMR231	A, B	HART	BA219F/00/en	BA221F/00/en	KA159F/00/a2
	C, D	PROFIBUS PA	BA226F/00/en	BA221F/00/en	KA159F/00/a2
	E, F	FOUNDATION Fieldbus	BA229F/00/en	BA221F/00/en	KA159F/00/a2
FMR240	A, B	HART	BA220F/00/en	BA291F/00/en	KA235F/00/a2
	C, D	PROFIBUS PA	BA227F/00/en	BA291F/00/en	KA235F/00/a2
	E, F	FOUNDATION Fieldbus	BA230F/00/en	BA291F/00/en	KA235F/00/a2
FMR244	A, B	HART	BA248F/00/en	BA291F/00/en	KA235F/00/a2
	C, D	PROFIBUS PA	BA249F/00/en	BA291F/00/en	KA235F/00/a2
	E, F	FOUNDATION Fieldbus	BA250F/00/en	BA291F/00/en	KA235F/00/a2
FMR245	A, B	HART	BA251F/00/en	BA291F/00/en	KA235F/00/a2
	C, D	PROFIBUS PA	BA252F/00/en	BA291F/00/en	KA235F/00/a2
	E, F	FOUNDATION Fieldbus	BA253F/00/en	BA291F/00/en	KA235F/00/a2

Tank Side Monitor NRF590

Operating Instructions for Tank Side Monitor NRF590, BA256F/00/en.
Description of Instrument Functions for Tank Side Monitor NRF590, BA257F/00/en.

Certificates Correlation of safety instructions (XA) and certificates (ZE) to the instrument:

Instrument	Certificate	Explosion protection	Output	Communication	Housing	PTB 00 ATEX	XA	German WHG
FMR230, FMR231, FMR240, FMR244, FMR245	A	non-ex	A, B, C, D, E, F, K, L, M	HART, PROFIBUS PA, FOUNDATION Fieldbus	—	—	—	—
	F	non-ex + WHG[1)]	A, B, C, D, K, L	HART, PROFIBUS PA	—	—	—	ZE244F/00/de
FMR230, FMR231, FMR240	1	ATEX II 1/2 G EEx ia IIC T6, IECEx Zone 0/1	A, B, K	HART	A	2118	XA099F	ZE 44F/00/de
					B	2118	XA203F	ZE244F/00/de
	6	ATEX II 1/2 G EEx ia IIC T6, IECEx Zone 0/1 + WHG[1)]	A, B	HART	D	2118	XA207F	ZE244F/00/de
			C, D, L	PROFIBUS PA	A	2118	XA102F	ZE244F/00/de
					B	2118	XA204F	ZE244F/00/de
			C, D	PROFIBUS PA	D	2118	XA208F	ZE244F/00/de
			E, F, M	FOUNDATION Fieldbus	A	2118	XA102F	—
					B	2118	XA204F	—
			E, F	FOUNDATION Fieldbus	D	2118	XA208F	—
FMR230, FMR231, FMR244, FMR245	2	ATEX II 1/2 G EEx ia IIC T6, IECEx Zone 0/1 with safety instruction	A, B, K	HART	A	2117 X	XA103F	ZE244F/00/de
					B	2117 X	XA205F	ZE244F/00/de
	7	ATEX II 1/2 G EEx ia IIC T6, IECEx Zone 0/1 with safety instruction + WHG[1)]	A, B	HART	D	2117 X	XA209F	ZE244F/00/de
			C, D, L	PROFIBUS PA	A	2117 X	XA106F	ZE244F/00/de
					B	2117 X	XA206F	ZE244F/00/de
			C, D	PROFIBUS PA	D	2117 X	XA210F	ZE244F/00/de
			E, F, M	FOUNDATION Fieldbus	A	2117 X	XA106F	—
					B	2117 X	XA206F	—
			E, F	FOUNDATION Fieldbus	D	2117 X	XA210F	—
FMR230, FMR231, FMR244, FMR245	3	ATEX II 1/2 G EEx em [ia] IIC T6, IECEx Zone 0/1	A, B	HART	C	2118	XA100F	ZE244F/00/de
			C, D	PROFIBUS PA	C	2118	XA100F	ZE244F/00/de
	8	ATEX II 1/2 G EEx em [ia] IIC T6, IECEx Zone 0/1 + WHG[1)]	E, F	FOUNDATION Fieldbus	C	2118	XA100F	—
FMR230, FMR231, FMR240	4	ATEX II 1/2 G EEx d [ia] IIC T6, IECEx Zone 0/1	A, B, C, D, E, F	HART, PROFIBUS PA, FOUNDATION Fieldbus	C	2118	XA101F	—
FMR230, FMR231, FMR244, FMR245	5	ATEX II 1/2 G EEx d [ia] IIC T6, IECEx Zone 0/1 with safety instruction	A, B, C, D, E, F	HART, PROFIBUS PA, FOUNDATION Fieldbus	C	2117 X	XA105F	—
FMR230, FMR231, FMR240, FMR244, FMR245	G	ATEX II 3 G EEx nA IIC T6	A, B, C, D, E, F, K, L, M	HART, PROFIBUS PA, FOUNDATION Fieldbus	—	—	XA233F	—
FMR230, FMR231, FMR240, FMR244, FMR245	H	ATEX II 1/2 G EEx ia IIC T6, ATEX II 3 D	A, B, C, D, E, F, K, L, M	HART, PROFIBUS PA, FOUNDATION Fieldbus	A, B	2118	XA277F	—

1) German WHG only in combination with certificate ZE244F/00/de.

Correlation of Control Drawings (ZD) to the instrument:

Instrument	Certificate	Explosion protection	Output	Communication	Housing	ZD
FMR230, FMR231, FMR240, FMR244, FMR245	S	FM IS	A, B, K	HART	A	ZD055F/00/en
					B	ZD126F/00/en
			A, B	HART	D	ZD127F/00/en
			C, D, L	PROFIBUS PA	A	ZD056F/00/en
					B	ZD128F/00/en
			C, D	PROFIBUS PA	D	ZD129F/00/en
			E, F, M	FOUNDATION Fieldbus	A	ZD057F/00/en
					B	ZD130F/00/en
			E, F	FOUNDATION Fieldbus	D	ZD131F/00/en
	T	FM XP	A, B, C, D, E, F, K, L, M	HART, PROFIBUS PA, FOUNDATION Fieldbus	C	ZD058F/00/en
FMR230, FMR231, FMR240, FMR244, FMR245	U	CSA IS	A, B, K	HART	A	ZD059F/00/en
					B	ZD132F/00/en
			A, B	HART	D	ZD133F/00/en
			C, D, L	PROFIBUS PA	A	ZD060F/00/en
					B	ZD134F/00/en
			C, D	PROFIBUS PA	D	ZD135F/00/en
			E, F, M	FOUNDATION Fieldbus	A	ZD061F/00/en
					B	ZD136F/00/en
			E, F	FOUNDATION Fieldbus	D	ZD137F/00/en
	V	CSA XP	A, B, C, D, E, F, K, L, M	HART, PROFIBUS PA, FOUNDATION Fieldbus	C	ZD062F/00/en

Safety Manual

Functional safety manual for Micropilot M, SD150F/00/en.

This product may be protected by at least one of the following patents.
Further patents are pending.

- US 5,387,918 ≙ EP 0 535 196
- US 5,689,265 ≙ EP 0 626 063
- US 5,659,321
- US 5,614,911 ≙ EP 0 670 048
- US 5,594,449 ≙ EP 0 676 037
- US 6,047,598
- US 5,880,698
- US 5,926,152
- US 5,969,666
- US 5,948,979
- US 6,054,946
- US 6,087,978
- US 6,014,100

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