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...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 vapours.

- 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 (1½") horn antenna is ideally suited for small vessels. Additionally, it provides an accuracy of ±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 on-site 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 ind 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 200 °C (392 °F), up to 400 °C (752 °F) 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/00/en

Endress+Hauser

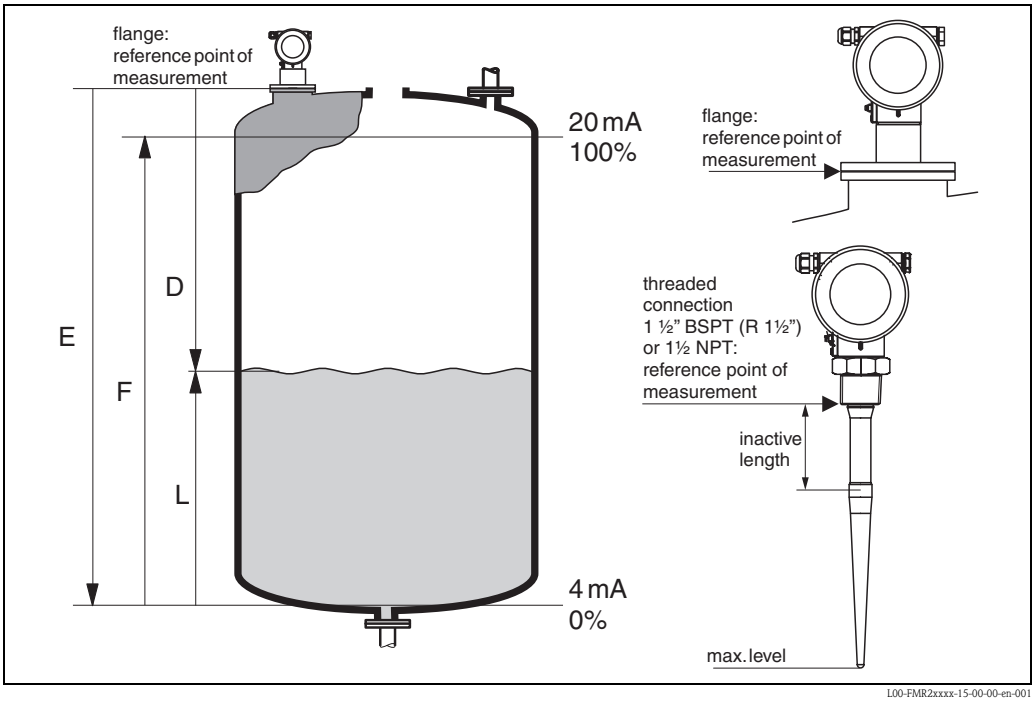
People for Process Automation

# Table of contents

# 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 max. 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.

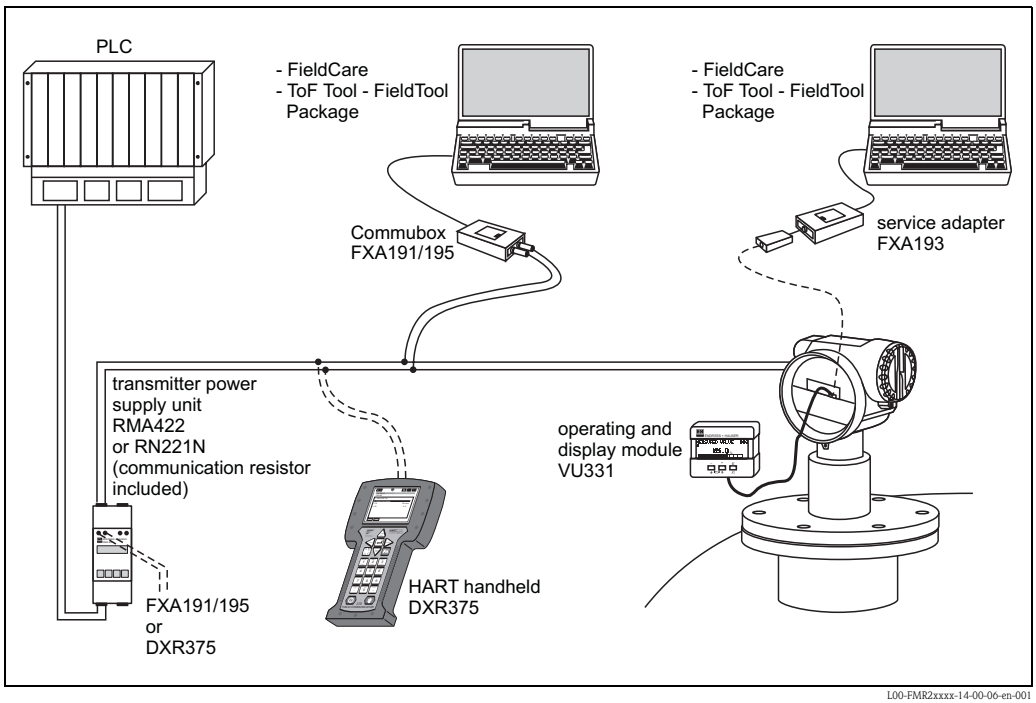
## Equipment architecture

### 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…20 mA output with HART protocol, or PROFIBUS PA respectively FOUNDATION Fieldbus communication.

### 4…20 mA output with HART protocol.

The complete measuring system consists of:




L00-FMR2xxxx-14-00-06-en-001

### On-site operation

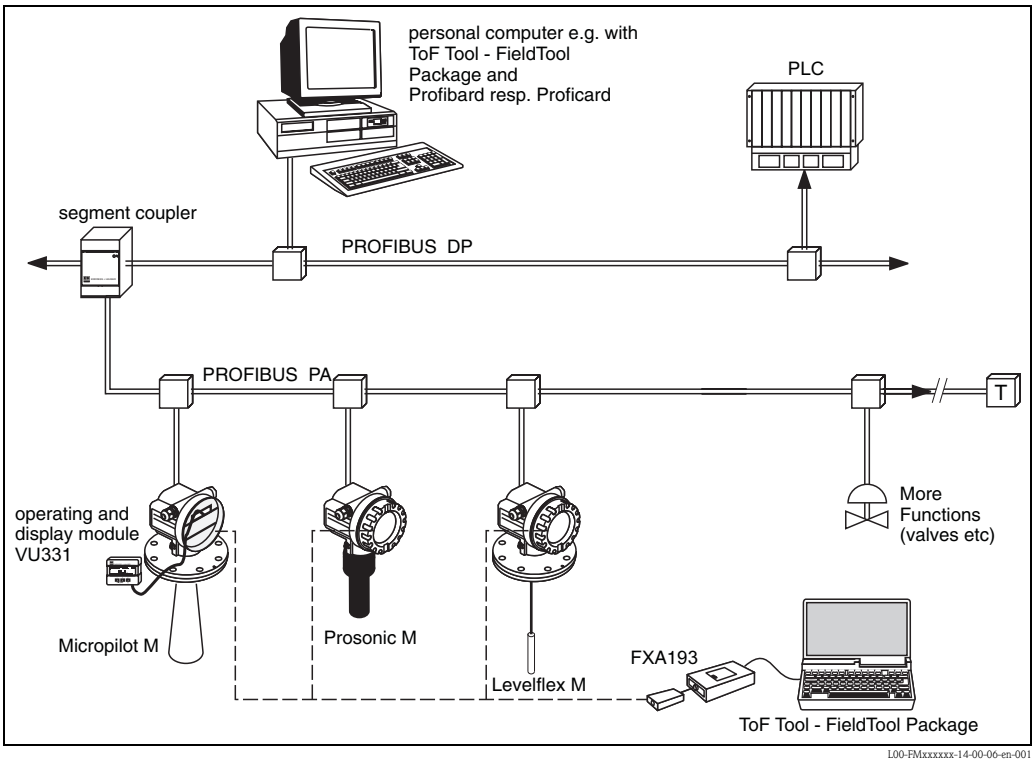
- with display and operating module VU331,
- with a Personal Computer, FXA193 and the operating software "ToF Tool – FieldTool Package" respectively "FieldCare".
  The ToF Tool is a graphical operating software for instruments from Endress+Hauser that operate based on the time-of-flight principle (radar, 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".

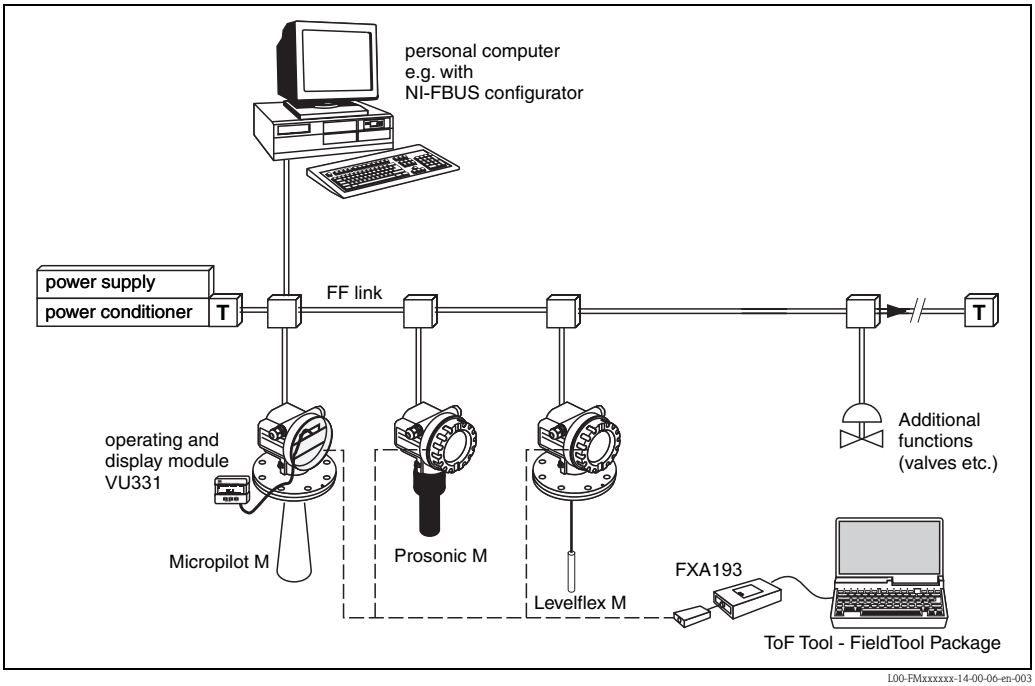
### System integration via PROFIBUS PA

A maximum of 32 transmitters (8 if mounted in an explosion hazardous location EEx ia IIC 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:



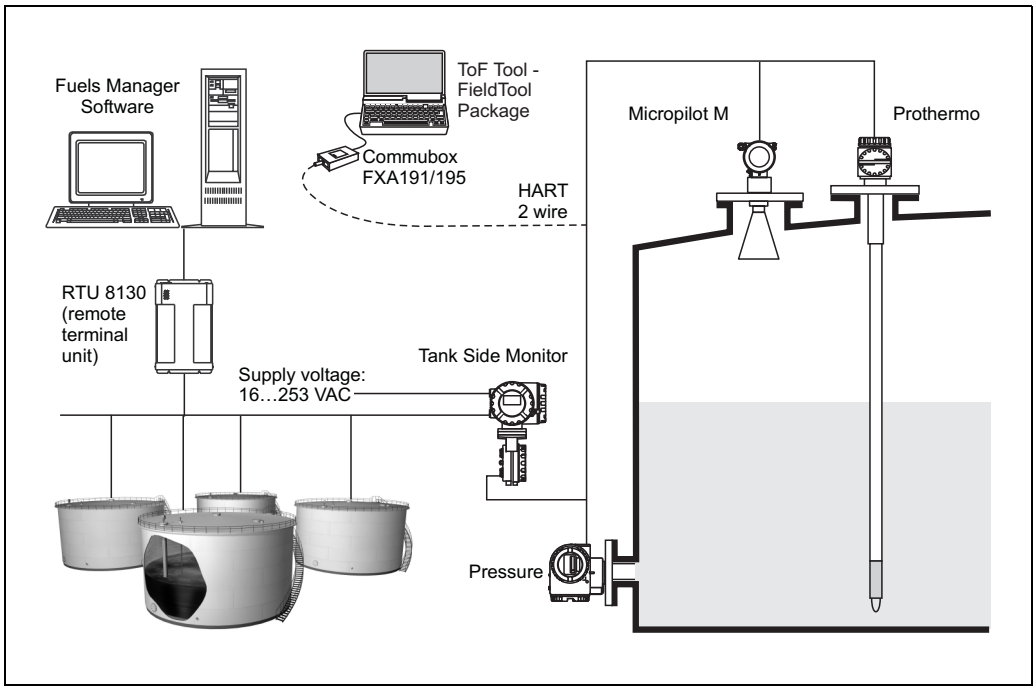

### System integration via FOUNDATION Fieldbus

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



**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...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.




L00-FMR2xxxx-14-00-06-en-030

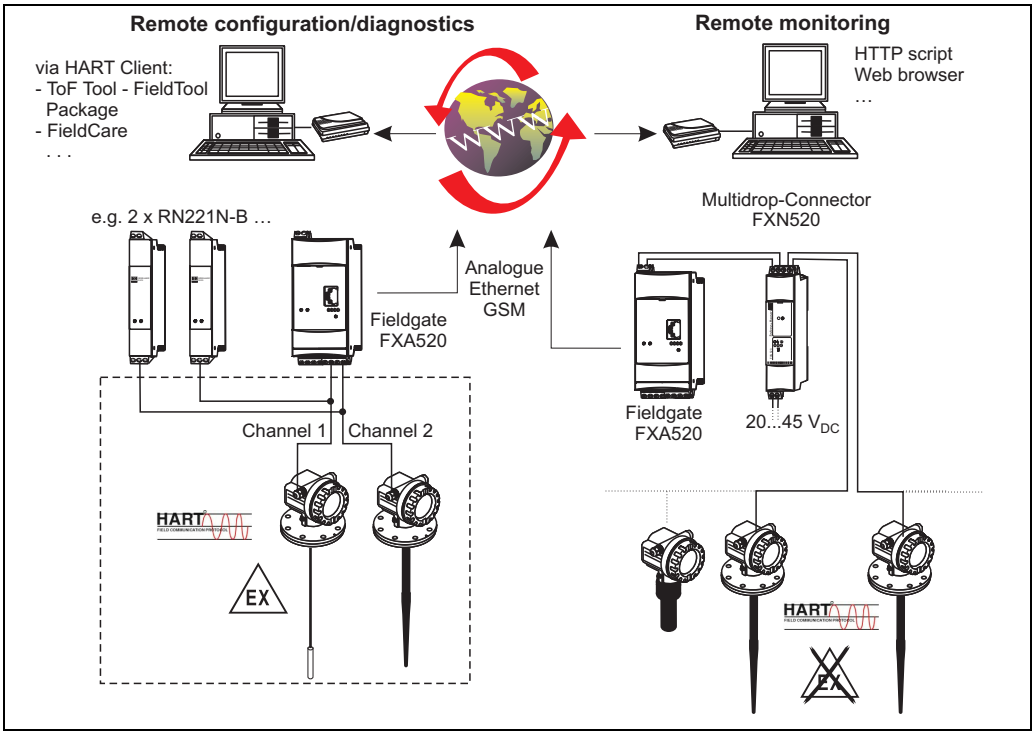
**System integration via Fieldgate**

*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 organisation 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.

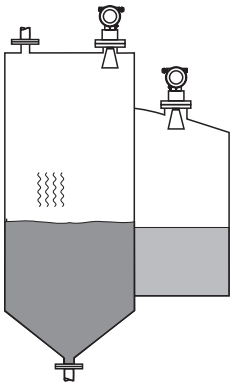
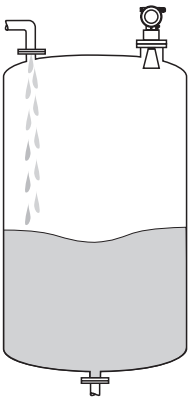
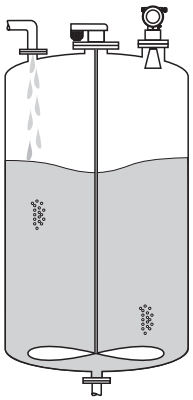
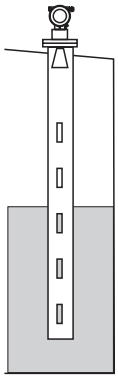
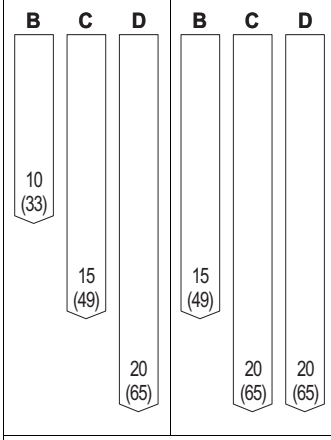
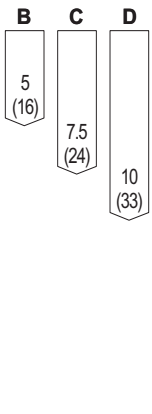
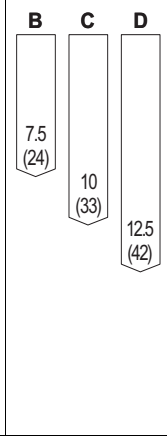
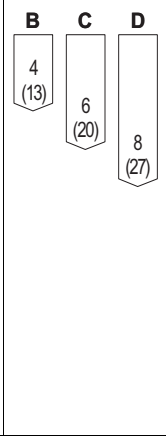
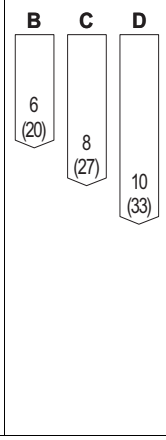
The maximum configurable range is:
- 20 m (65 ft) for Micropilot M FMR23x,
- 20 m (65 ft) for Micropilot M FMR24x,
  - 40 m (131 ft) for Micropilot M FMR24x with additional option D (E), see "ordering information",
  - 70 M (229 ft) for Micropilot M FMR24x with additional option F (G), see "ordering information",
- 70 m (229 ft) for Micropilot M FMR250 (further informations see TI390F/00/en).

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 (Εr) | Examples |
|---|---|---|
| **A** | 1,4...1,9 | non-conducting liquids, e.g. liquefied gas[1)] |
| **B** | 1,9...4 | non-conducting liquids, e.g. benzene, oil, toluene, … |
| **C** | 4...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**

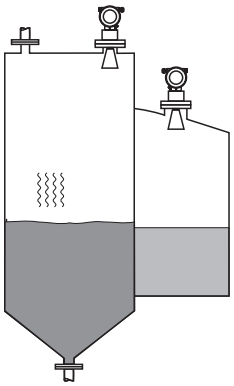
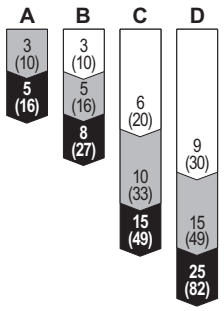
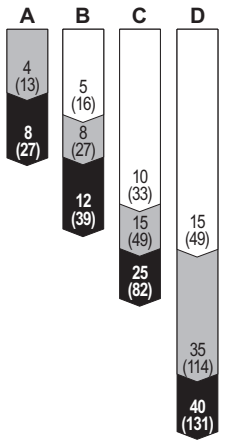
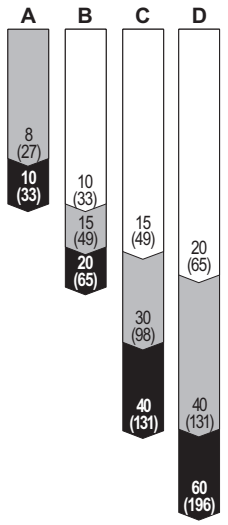
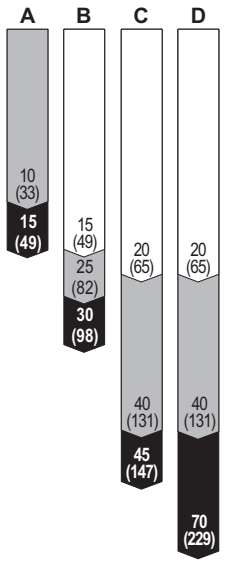
| | Storage tank [1] | | Buffer tank [1] | | Process tank with agitator [1] | | Stilling well | Bypass |
|---|---|---|---|---|---|---|---|---|
| |  Calm product surface (e.g. intermittent filling, filling from bottom, immersion tubes). | |  Moving surfaces (e.g. continuous filling, from above, mixing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

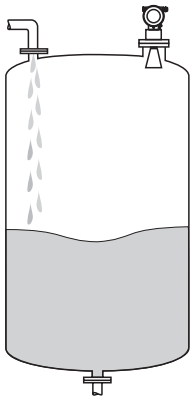
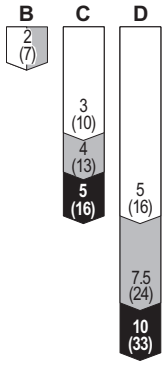
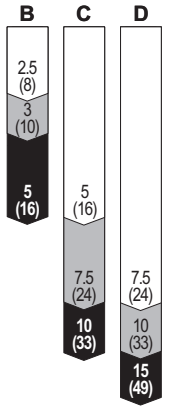
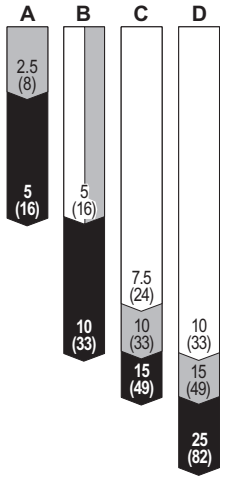
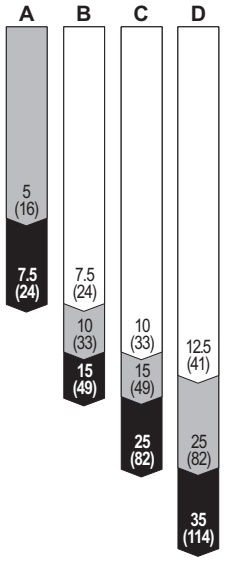
1) For media group A to use a stilling well (20 m / 65 ft).

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:<br>max. measuring range = 20 m (65 ft) | With additional option D (E):<br>max. measuring range = 40 m (131 ft) | With additional option F (G):<br>max. measuring range = 70 m (229 ft)<br>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**<br>  <br>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**<br>  <br>Moving surfaces (e.g. continuous filling, from above, mixing jets). |  |  |  |  |
| | **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") | — |
| **Process tank with agitator** | **B** 1 (3) / **C** 1.5 (5), 2 (7) / **D** 2 (7), 3 (10), **5 (16)** | **B** 1.5 (5), 2 (7) / **C** 2 (7), 3 (10), **7.5 (24)** / **D** 3 (10), 5 (16), **10 (33)** | **B** 2 (7), 2.5 (8) / **C** 3 (10), 5 (16), **12 (39)** / **D** 5 (16), 8 (27), **15 (49)** | **B** 3 (10), 4 (13), **5 (16)** / **C** 5 (16), 8 (27), **15 (49)** / **D** 7 (23), 10 (33), **20 (65)** |
| Turbulent surface. Single stage agitator <60 RPM. | | | | |
| | **Measuring range [m (ft)]** | | | |

| | |
|---|---|
| **FMR240:** | 40 mm ... 100 mm (1½" ... 4") |
| **FMR244:** | 40 mm (1½") |
| **FMR245:** | 50 mm ... 80 mm (2" ... 3") |
| **Stilling well** | **A, B, C, D**: 20 (65) |
| | **Measuring range [m (ft)]** |

| | |
|---|---|
| **FMR240:** | 40 mm ... 100 mm (1½" ... 4") |
| **FMR244:** | — |
| **FMR245:** | 50 mm ... 80 mm (2" ... 3") |
| **Bypass** | **C, D**: 20 (65) |
| | **Measuring range [m (ft)]** 1) |

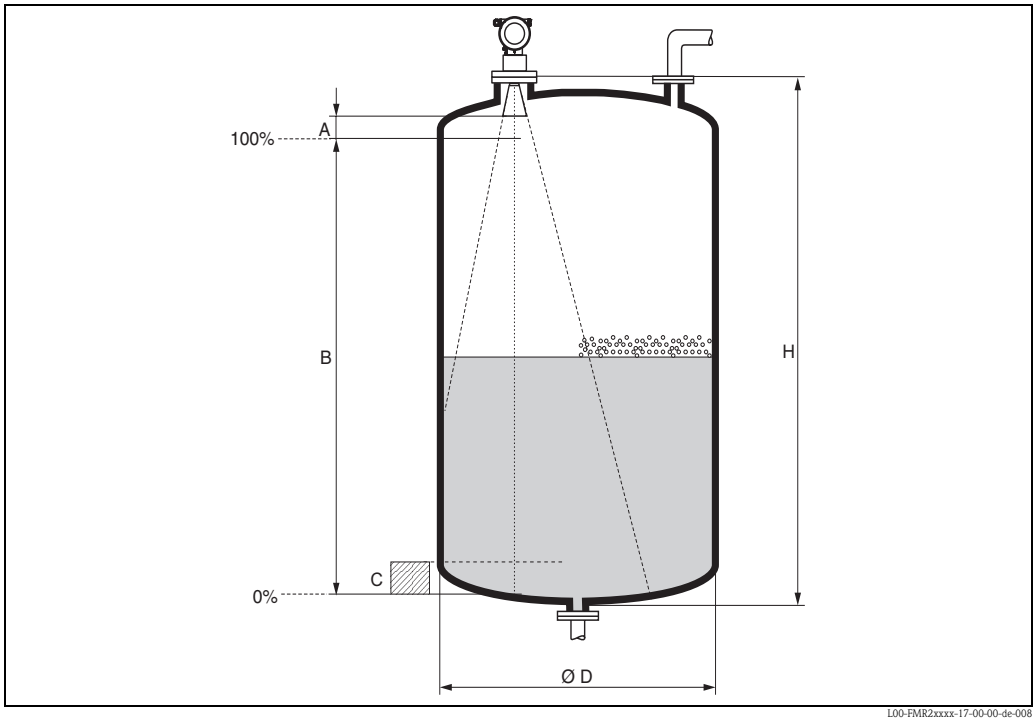
1) For media group A and B to use a Levelflex M with koax probe

## 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.




L00-FMR2xxxx-17-00-00-de-008

- 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...300 (6...12) | > 1 (> 40) | > 1,5 (> 60) |
| **FMR240** | 50 (2) | > 0.2 (> 8) | 50...250 / 2...10 | > 0.2 (> 8) | > 0.3 (> 12) |
| **FMR244** | 150 (6) | > 0.2 (> 8) | 50...250 / 2...10 | > 0.2 (> 8) | > 0.3 (> 12) |
| **FMR245** | 200 (8) | > 0.2 (> 8) | 50...250 / 2...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 | < 4 nW/cm$^2$ |
| 5 m | < 0,16 nW/cm$^2$ |

# Output

**Output signal**

- 4...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.

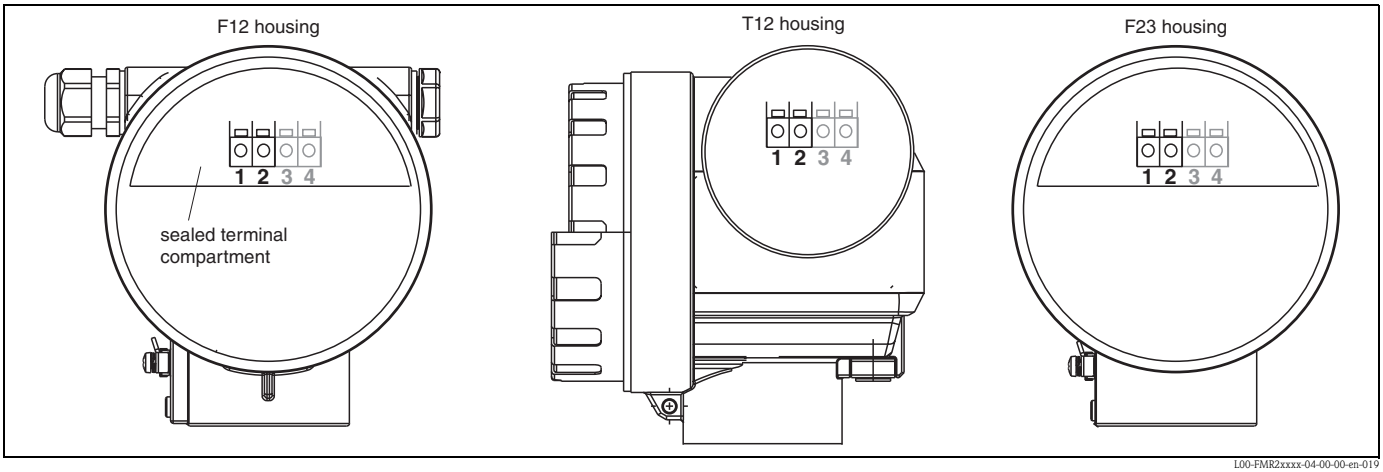
# Auxiliary energy

**Electrical connection**

**Terminal compartment**

Three housings are available:
- Aluminium housing F12 with additionally sealed terminal compartment for:
  - standard,
  - EEx ia.
- Aluminium housing T12 with separate terminal compartment for:
  - standard,
  - EEx e,
  - EEx d,
  - EEx ia (with overvoltage protection, see Page 17).
- 316L housing F23 for:
  - standard,
  - 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...10 mm |
| EEx em, EEx nA | Metal M20x1.5 | 7...10.5 mm |

**Terminals**

for wire cross-sections of 0.5...2.5 $mm^2$

**Terminal assignment**

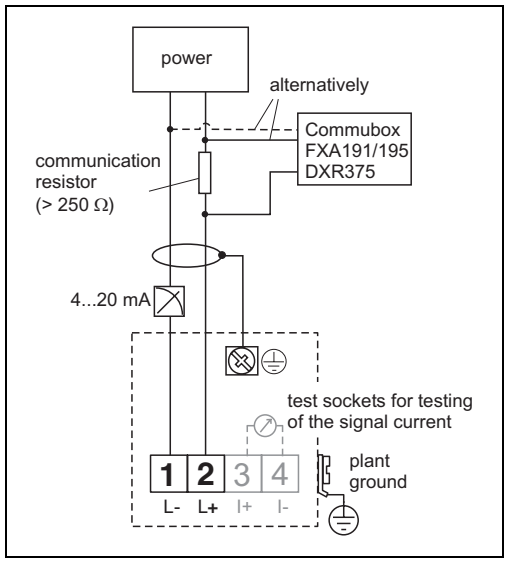
### 2-wire, 4…20 mA with HART

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 analogue signal is used. Use a screened 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.

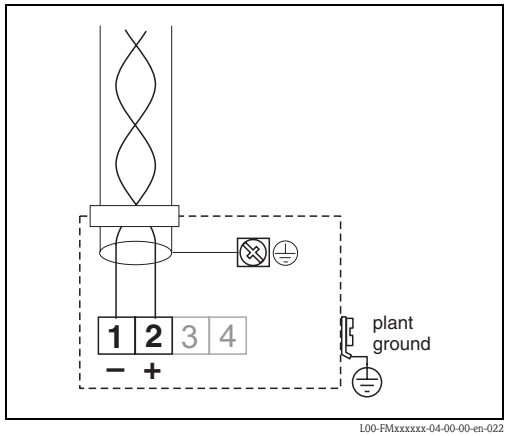



L00-FMxxxxxx-04-00-00-en-015

### 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, screened two-wire cable, preferably cable type A



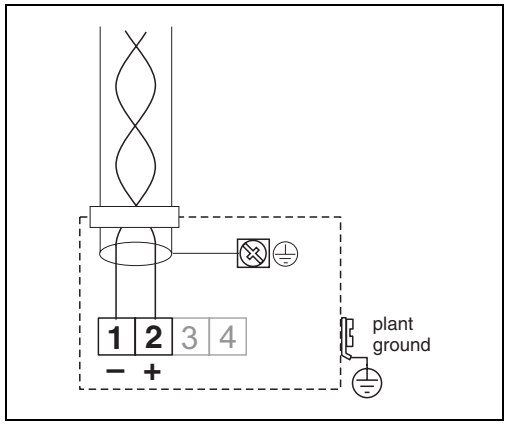

L00-FMxxxxxx-04-00-00-en-022

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, screened two-wire cable, preferably cable type A



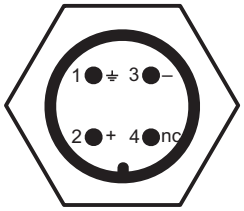

L00-FMxxxxxx-04-00-00-en-022

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.

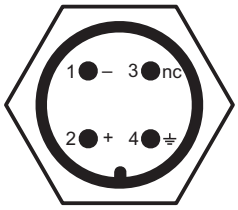
**Pin assignment of the M12 plug connector (PROFIBUS PA plug)**



L00-FMxxxxxx-04-00-00-yy-016

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

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



L00-FMxxxxxx-04-00-00-yy-017

| 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 | |
|---|---|---|---|---|
| | | | minimal | maximal |
| HART | standard | 4 mA | 16 V | 36 V |
| | | 20 mA | 7.5 V | 36 V |
| | EEx ia | 4 mA | 16 V | 30 V |
| | | 20 mA | 7.5 V | 30 V |
| | EEx em EEx d | 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 |
| | EEx ia | 11 mA | 10 V | 30 V |
| Fixed current for HART Multidrop mode | standard | 4 mA[1)] | 16 V | 36 V |
| | EEx ia | 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**

min. 60 mW, max. 900 mW

**Current consumption**

| Communication | Current consumption |
|---|---|
| HART | 3,6...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...125 Hz: Uss = 200 mV (at 500 Ω)

**Max. noise HART**

500 Hz...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 51-62) 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 screen 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: ± 10 mm
- ex 10 m: ± 0.1 % of measuring range

**FMR240, FMR244, FMR245:**
- **not** for max. measuring range = 70 m (229 ft)
  - to 1 m: ± 10 mm
- for max. measuring range = 20 m ( 65 ft) and 40 m (131 ft)
  - to 10 m: ± 3 mm
  - ex 10 m: ± 0.03 % of measuring range, whatever is larger
- for max. measuring range = 70 m (229 ft)
  - to 1m: ± 30 mm
  - ex 1 m: ± 15 mm or 0.04 % of measuring range, whatever is larger

**Resolution**

Digital / analog in % 4...20 mA
- FMR230: 1mm / 0.03 % of measuring range
- FMR231: 1mm / 0.03 % of measuring range
- FMR240: 1mm / 0.03 % of measuring range
- FMR244: 1mm / 0.03 % of measuring range
- FMR245: 1mm / 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 ambiente 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, max. 5 mm over the entire temperature range -40 °C...+80 °C
  - **FMR230**
    average $T_K$: 3 mm/10 K, max. 10 mm over the entire temperature range -40 °C...+80 °C
  - **FMR231**
    average $T_K$: 5 mm/10 K, max. 15 mm over the entire temperature range -40 °C...+80 °C
- 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 °C...+80 °C
  - **Span (20 mA)**
    average $T_K$: 0,09 %/10 K, max. 0,95 % over the entire temperature range -40 °C...+80 °C

**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 bigger 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<br>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<br>(saturated<br>steam) | 100 | 212 | 0.20 % | — | — | — | — |
| | 180 | 356 | — | 2.1 % | — | — | — |
| | 263 | 505.4 | — | — | 8.6 % | — | — |
| | 310 | 590 | — | — | — | 22 % | — |
| | 364 | 687.2 | — | — | — | — | 41.8 % |

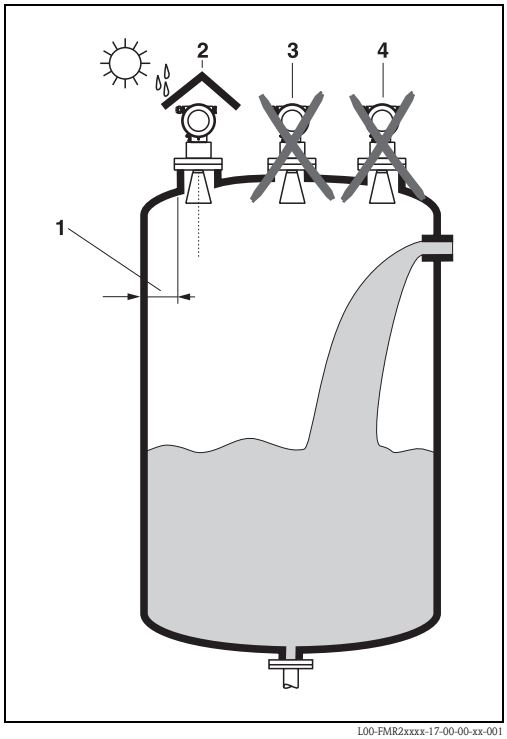
Note!
When the pressure is known and constant, this measured error can, for example, be compensated by means of linearization.

# 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 centre (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 Accessorieson Seite 63).




L00-FMR2xxxx-17-00-00-xx-001

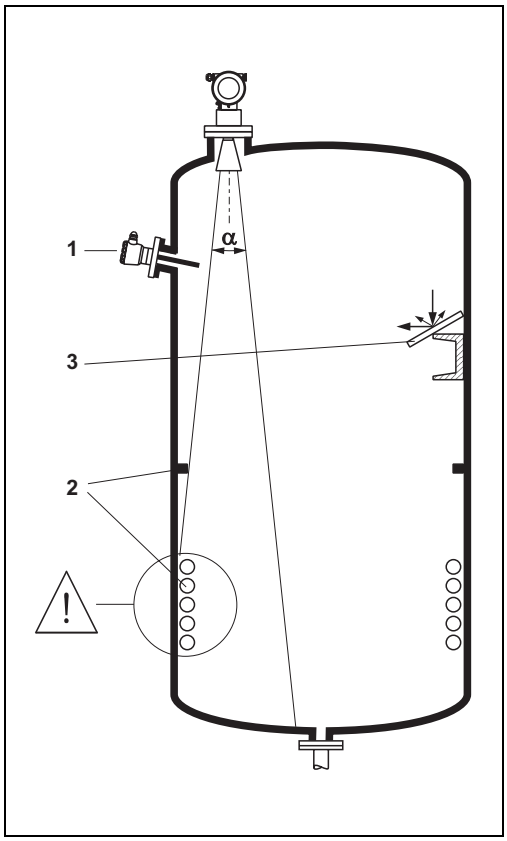
### Tank installations

- 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.

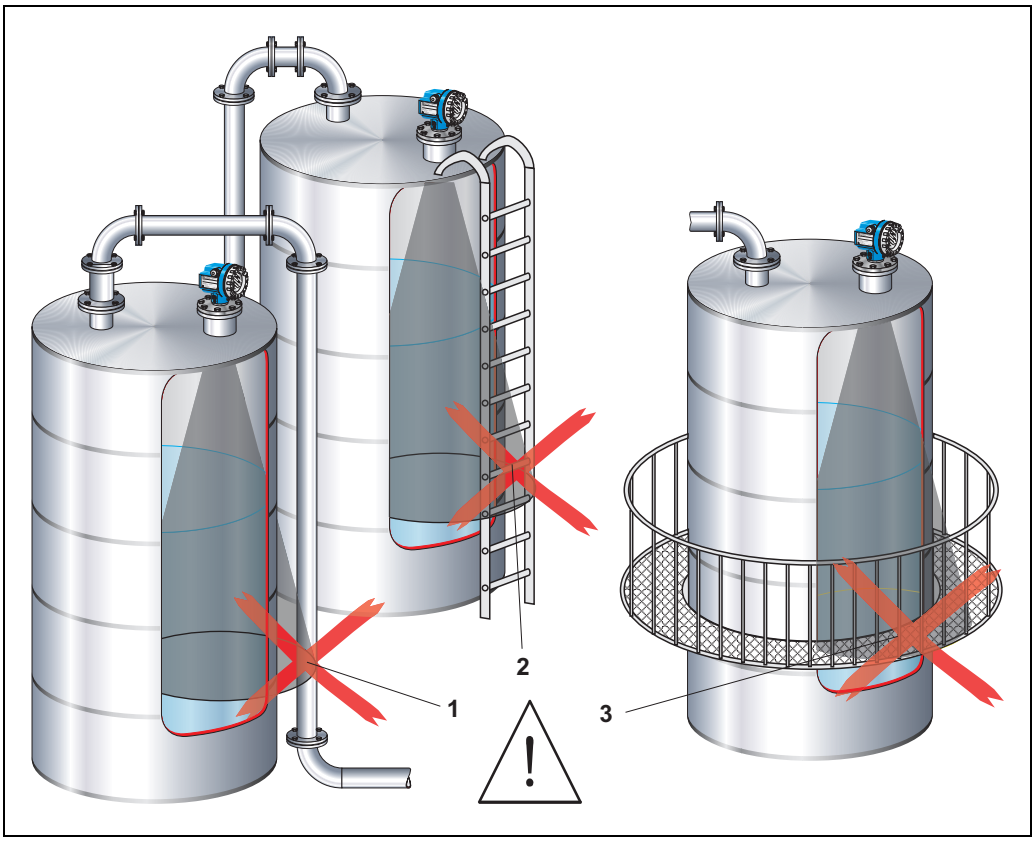
Please contact Endress+Hauser for further information.




L00-FMR2xxxx-17-00-00-xx-002

### 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.




L00-FMR2xxxx-17-00-00-xx-013

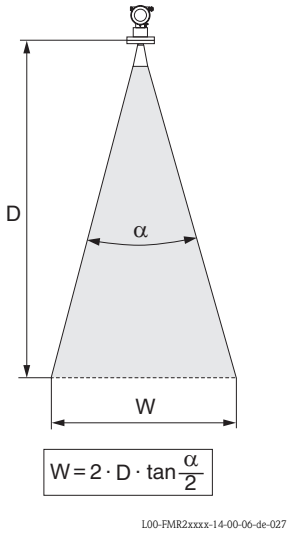
Please contact Endress+Hauser for further information.

**Beam angle**

The beam angle is defined as the angle a 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) |

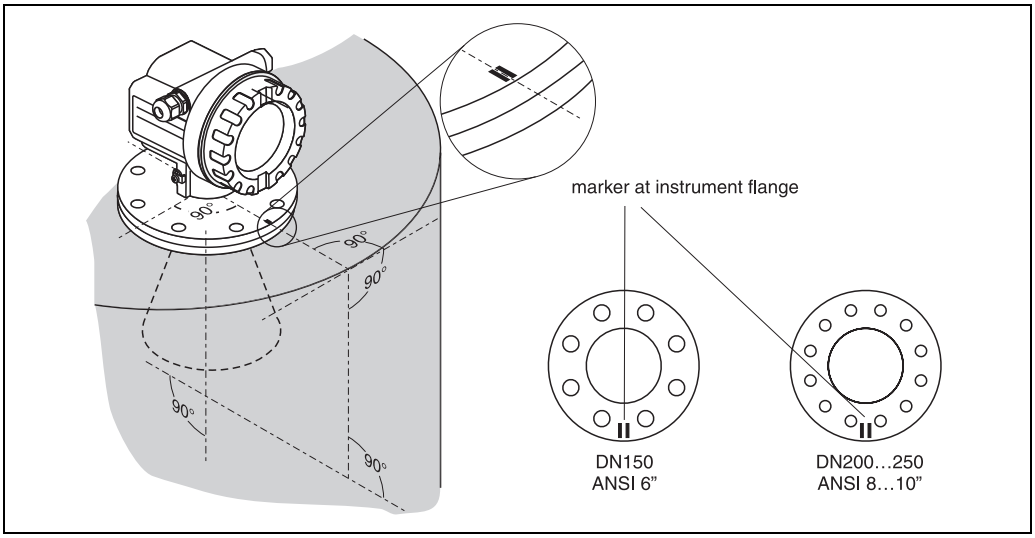



| Antenna size (horn diameter) | | | | | |
|---|---|---|---|---|---|
| | **FMR240** | 40 mm (1½") | 50 mm (2") | 80 mm (3") | 100 mm (4") |
| | **FMR244** | 40 mm (1½") | — | — | — |
| | **FMR245** | — | 50 mm (2") | 80 mm (3") | — |
| **Beam angle α** | | 23° | 18° | 10° | 8° |

| 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**

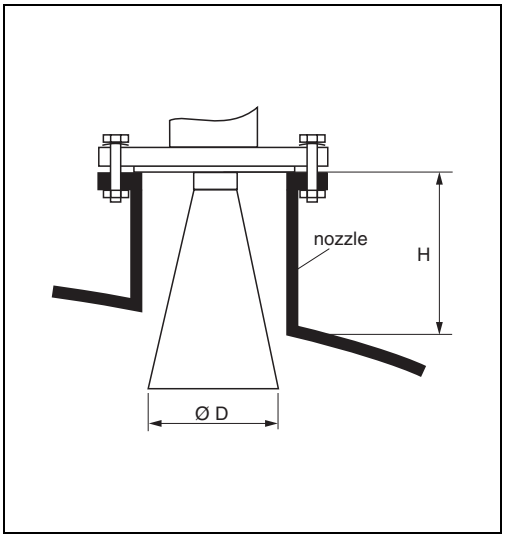
**Optimum mounting position**




L00-FMR230xx-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.
- 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.

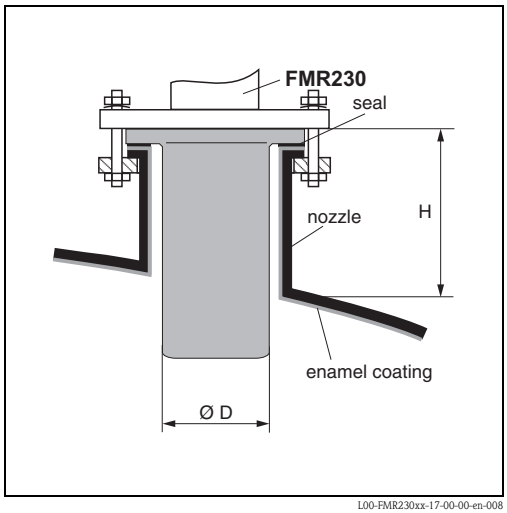



L00-FMR230xx-17-00-00-en-002

| **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.

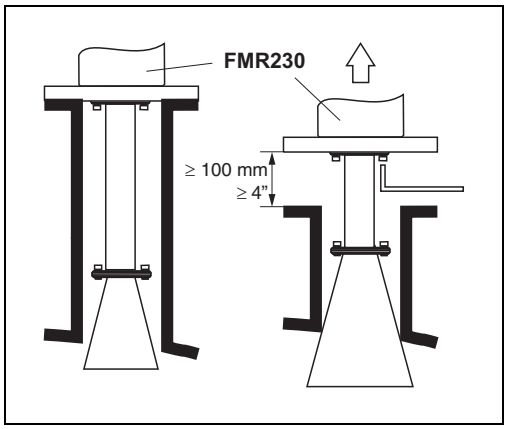



L00-FMR230xx-17-00-00-en-008

| 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.

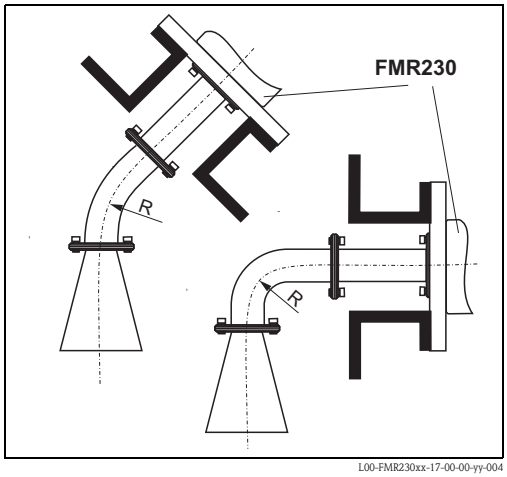



L00-FMR230xx-17-00-00-en-003

**Special extensions**

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

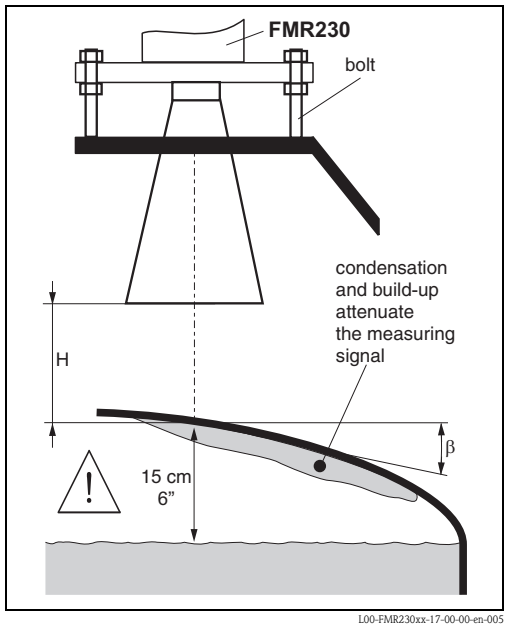
Please contact Endress+Hauser for further information.




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°…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.

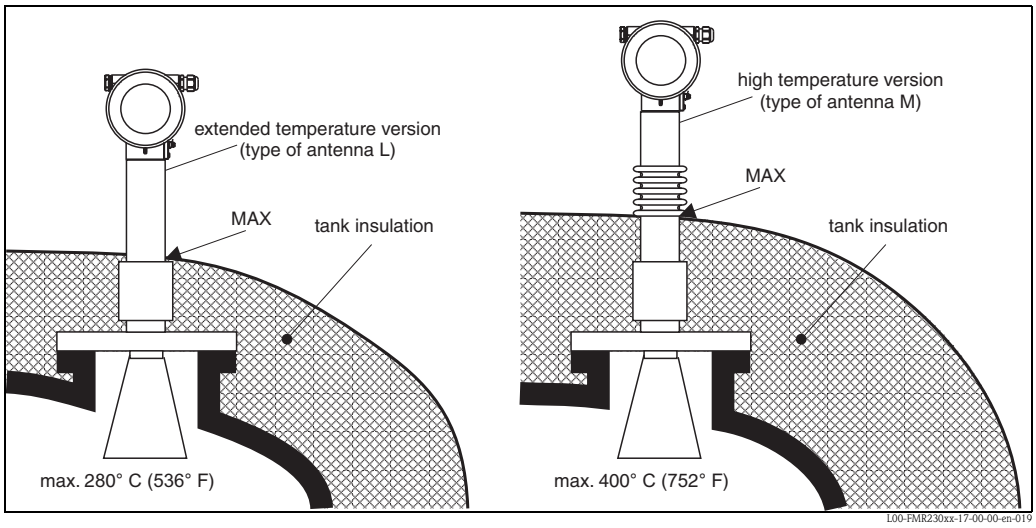



L00-FMR230xx-17-00-00-en-005

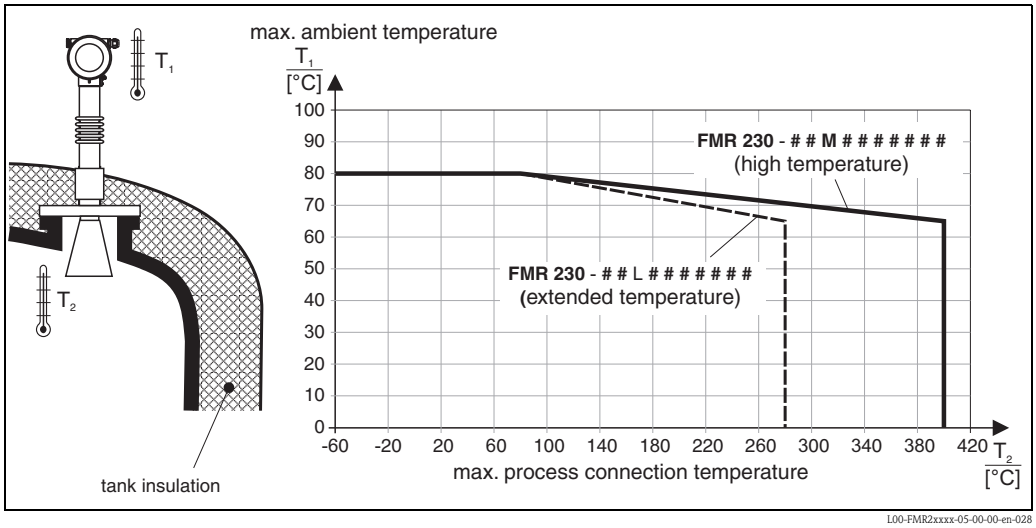
| **Penetrated material** | PE | PTFE | PP | Perspex |
|---|---|---|---|---|
| **DK / $\varepsilon r$** | 2.3 | 2.1 | 2.3 | 3.1 |
| **Optimum thickness [mm / inch]**[1)] | 15.7 / 0.62 | 16.4 / 0.65 | 15.7 / 0.62 | 13.5 / 0.53 |

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**



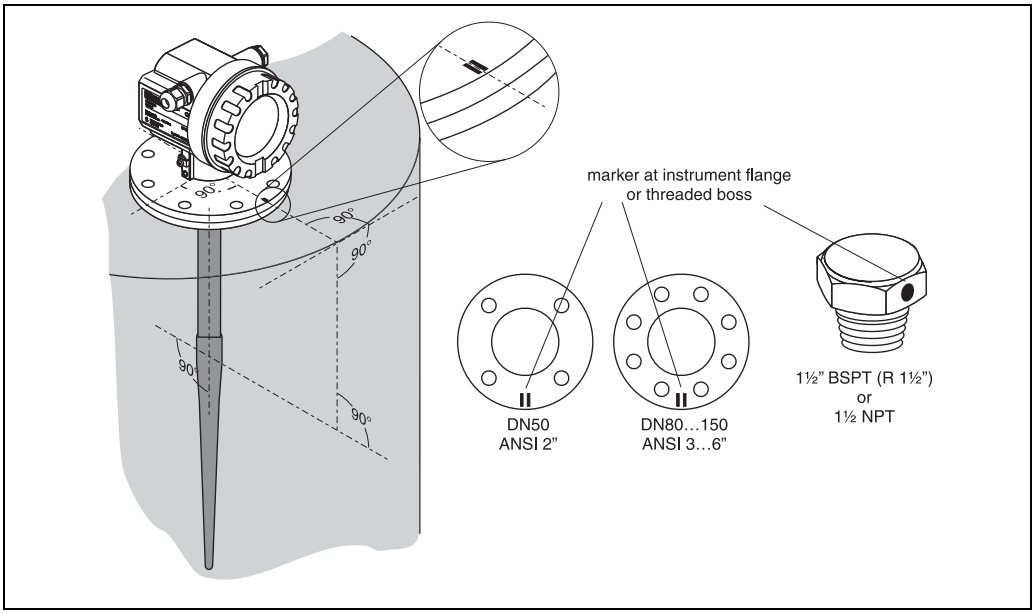

- To avoid the electronics heating up as a result of heat radiation or convection, the FMR230 must be incorporated into the tank insulation at high process temperature (≥ 200° C/392 °F).
- The isolation should nod exceed the points marked with "**MAX**" within the scetch.




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

**Installation in tank (free space) FMR231**

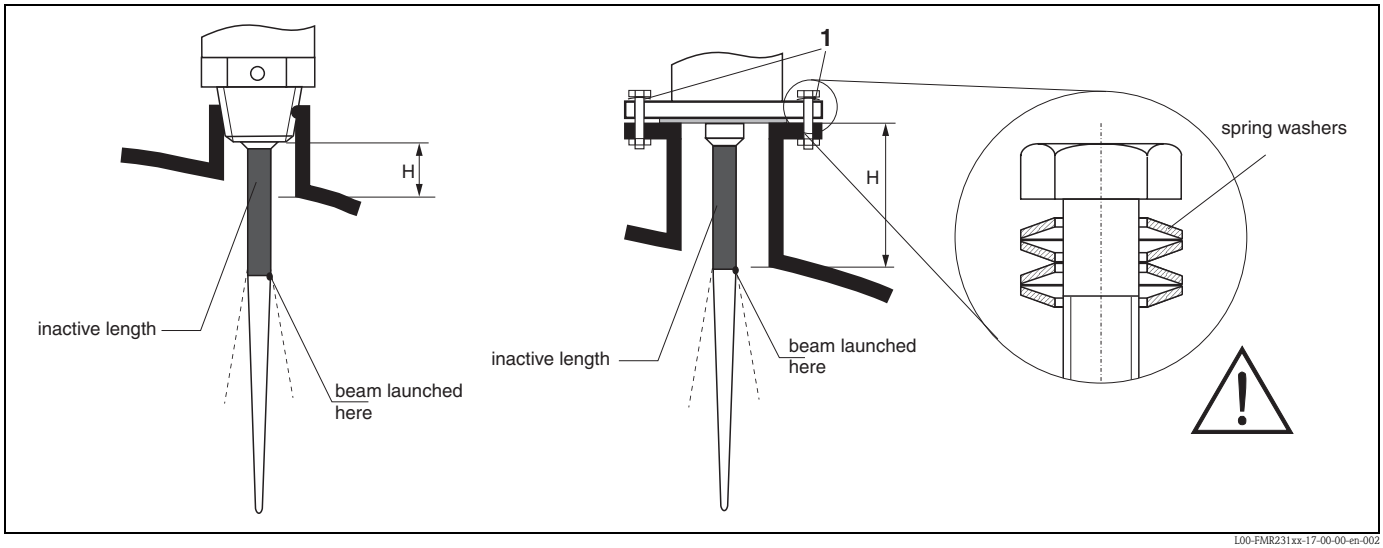
**Optimum mounting position**




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...100 Nm.
- 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.

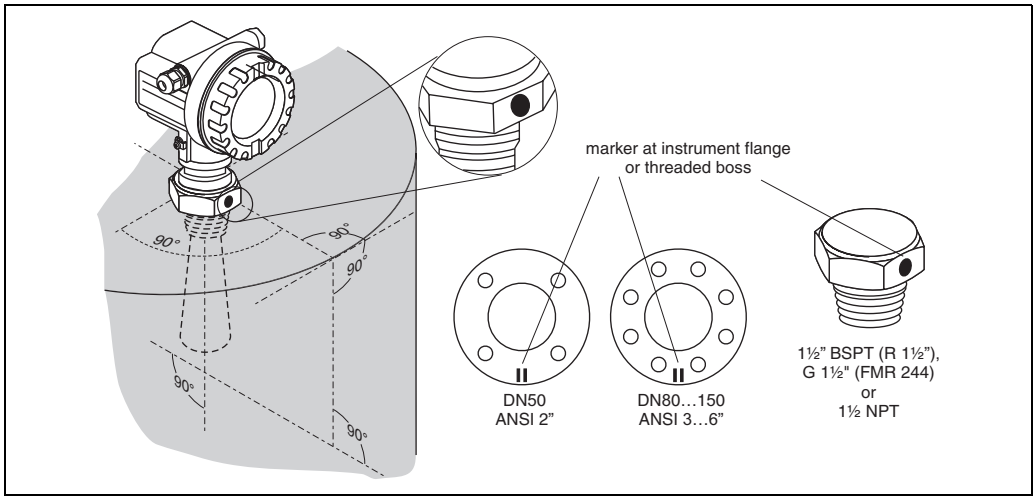



L00-FMR231xx-17-00-00-en-002

| 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**

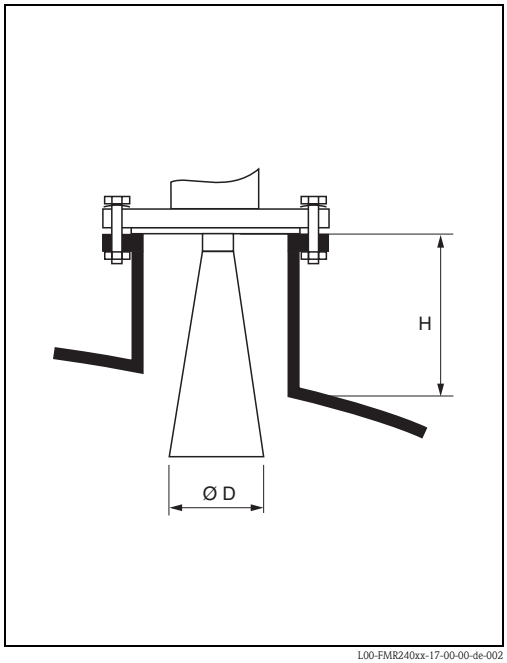
### Optimum mounting position




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 antenna extension if necessary (→ Page 40).
  Nozzle heights up to 500 mm can be accepted if this should not be possible due to mechanical reasons.
  Note!
  Please contact Endress+Hauser for application with higher nozzle.
- **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 / 1½" | 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

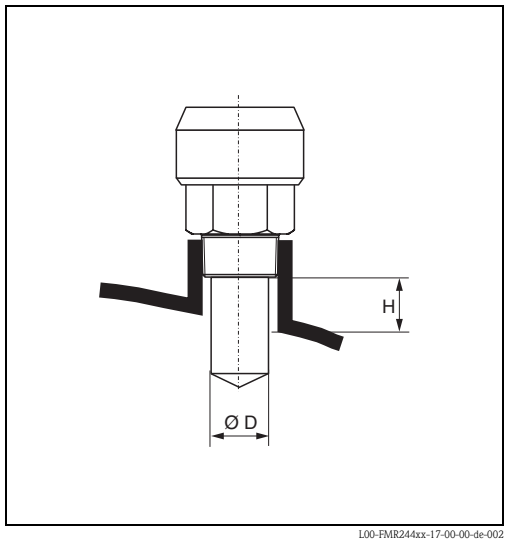
- Observe instructions on Page 20.
- If possible, use an antenna 100 mm / 4".

| **Penetrated material** | PE | PTFE | PP | Perspex |
|---|---|---|---|---|
| **DK / $\varepsilon_r$** | 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.
- 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 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.

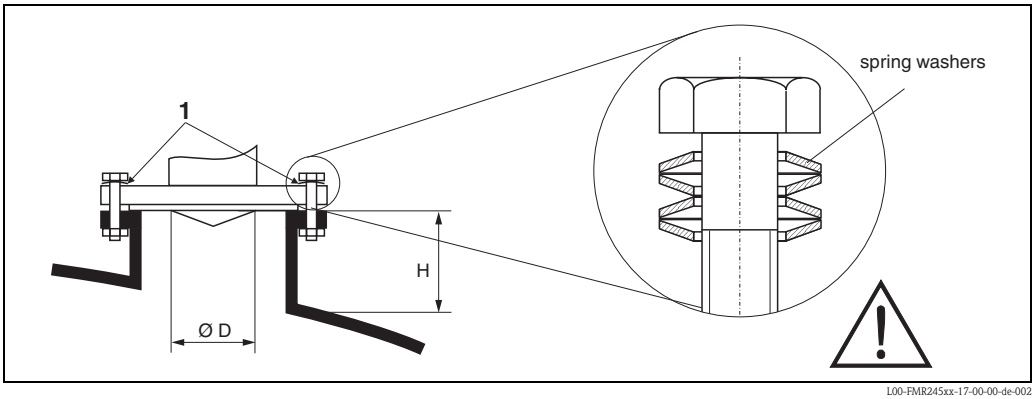



L00-FMR244xx-17-00-00-de-002

| Antenna size | 1½" / 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...100 Nm.
- 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.



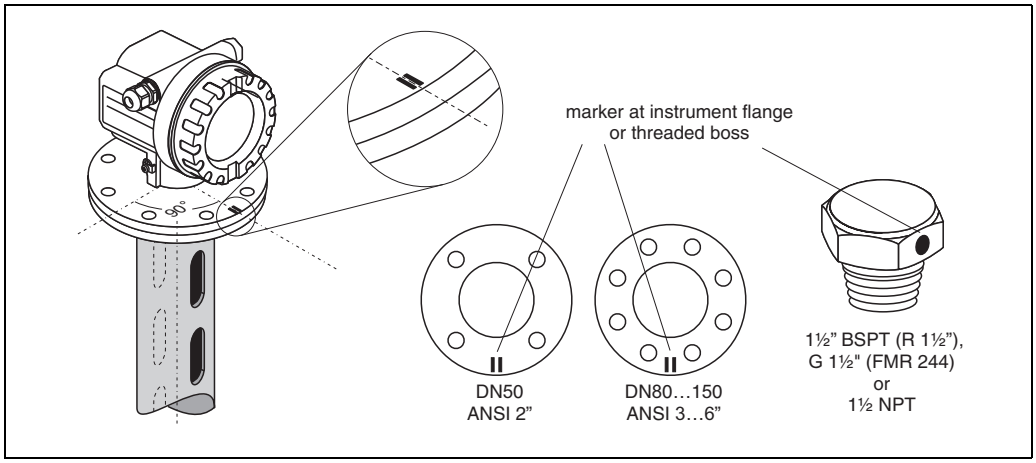

L00-FMR245xx-17-00-00-de-002

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**




L00-FMR230xx-17-00-00-en-006

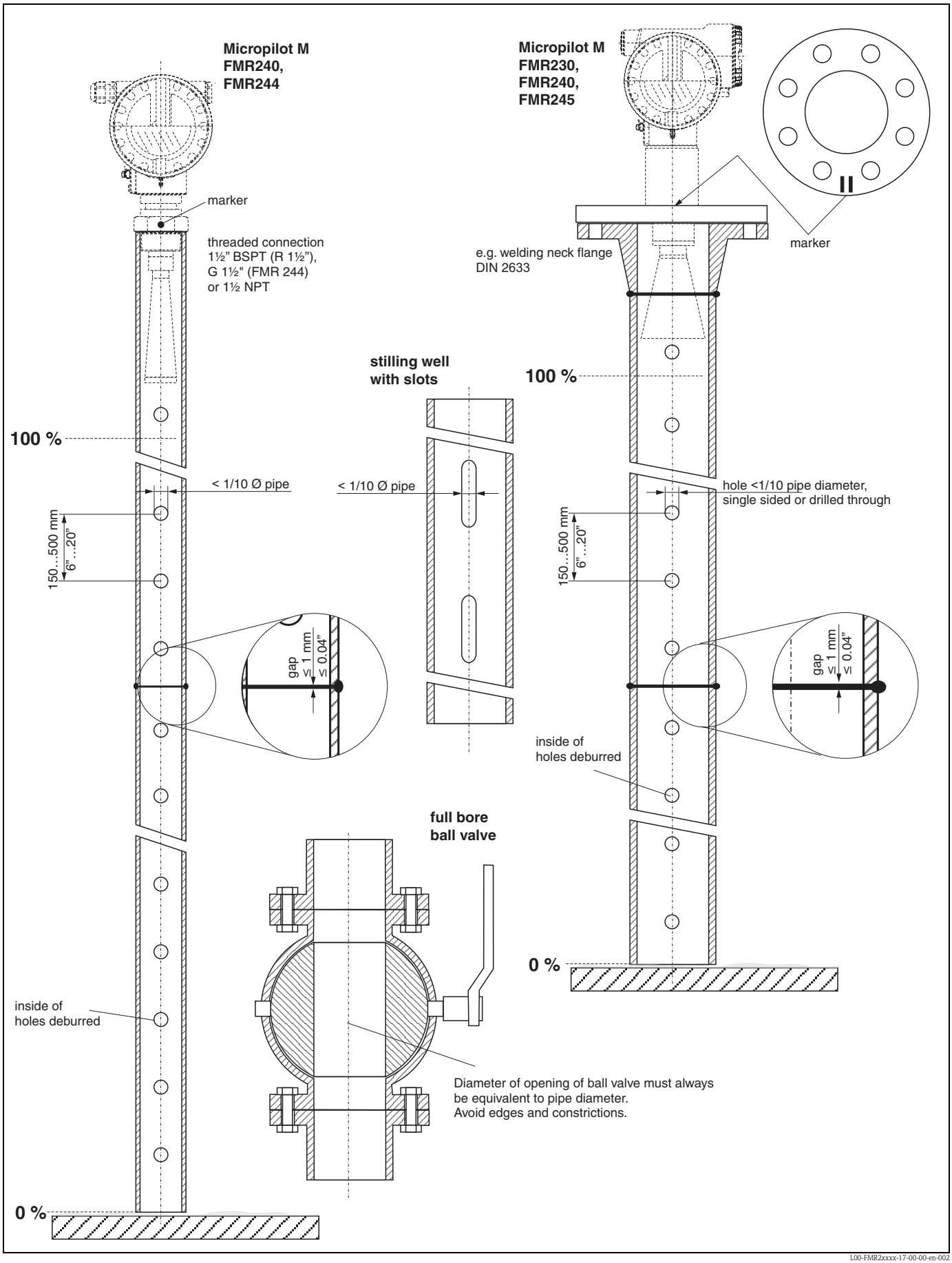
**Standard installation**

- 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) 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).

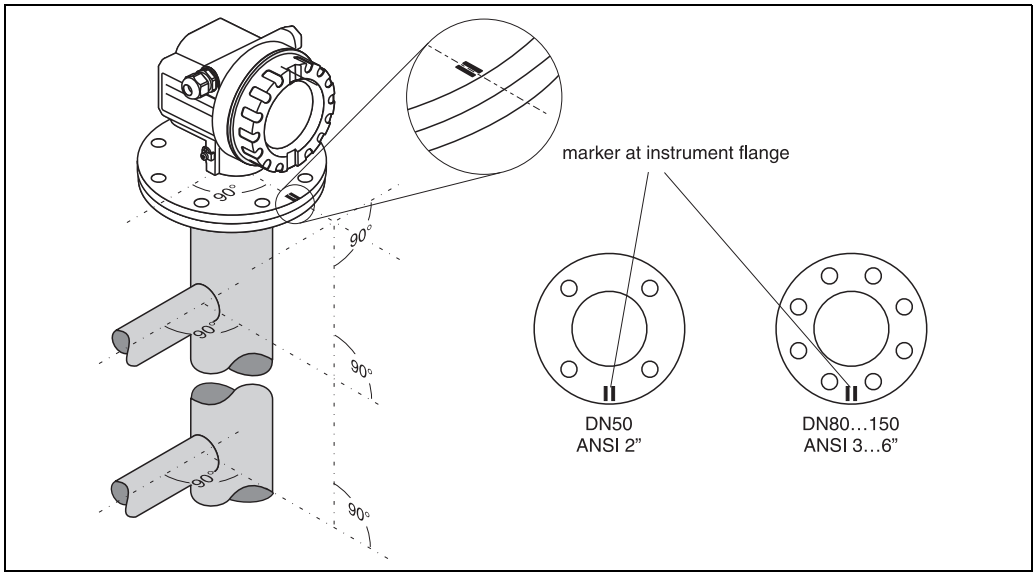
**Examples for the construction of stilling wells**




L00-FMR2xxxx-17-00-00-en-002

**Installation in bypass FMR230, FMR240, FMR245**

**Optimum mounting position**




L00-FMR230xx-17-00-00-en-007

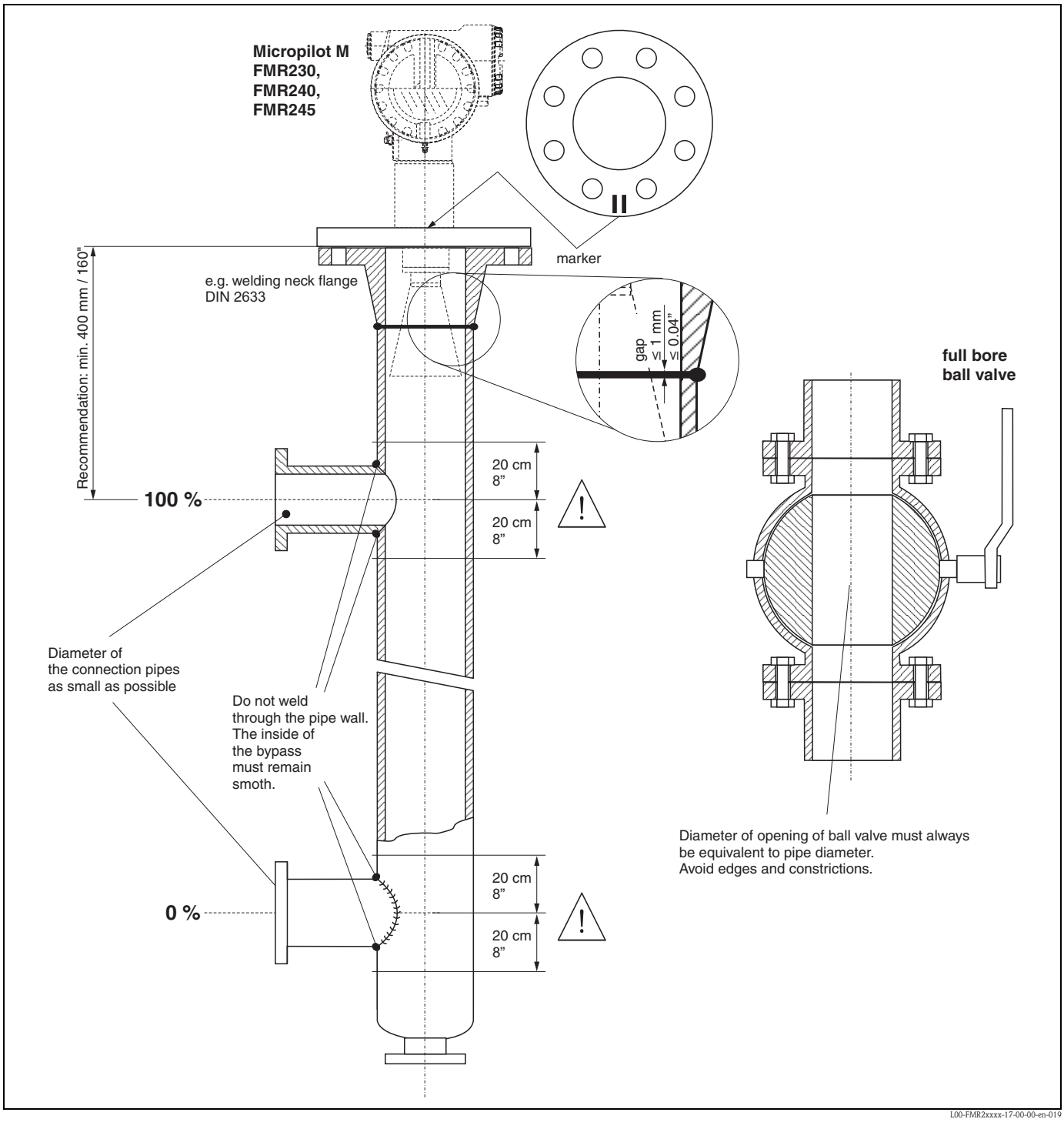
**Standard installation**

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

**Storage temperature**

-40 °C … +80 °C (-40 °F … +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…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 $\varepsilon r$. 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 analogue signal is used. Use a screened 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 ... +200 °C [1] (-40 °F ... -392 °F) | -1 ... 64 bar (... 928 psi) | PTFE, seal, 316L/1.4435 resp. Alloy C4 |
| | **E** | Standard | EPDM | -40 °C ... +150 °C (-40 °F ... +302 °F) | | |
| | **K** | Standard | Kalrez (Spectrum 6375) | -20 °C ... +200 °C [1] (-4 °F ... +392 °F) | | |
| | **L** | Extended temperature | Graphit | -60 °C ... +280 °C (-76 °F ... +536 °F) | -1 ... 100 bar (... 1450 psi) | Ceramic ($Al_2O_3$: 99,7%), Graphit, 316L/1.4435 |
| | **M** | High temperature | Graphit | -60 °C ... +400 °C (-76 °F ... +752 °F) | -1 ... 160 bar (... 2320 psi) | |
| | **H** | Enamel | PTFE | -40 °C ... +200 °C (-40 °F ... +392 °F) | -1 ... 16 bar (... 232 psi) | PTFE, Enamel |

↑

Ordering information see Page 51

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

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

↑

Ordering information see Page 54

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 ... +150 °C (–4 °F ... +302 °F) | –1 ... 40 bar (... 580 psi) | PTFE, seal, 316L/1.4435 resp. Alloy C22 |
| | **E** | Standard | FKM Viton GLT | –40 °C ... +150 °C (–40 °F ... +302 °F) | | |
| | **K** | Standard | Kalrez (Spectrum 6375) | –20 °C ... +150 °C (–4 °F ... +302 °F) | | |

↑

Ordering information see Page 57

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

↑

Ordering information see Page 59

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

↑

Ordering information see Page 61

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

2) meets USP Class VI conformity

**Dielectric constant**

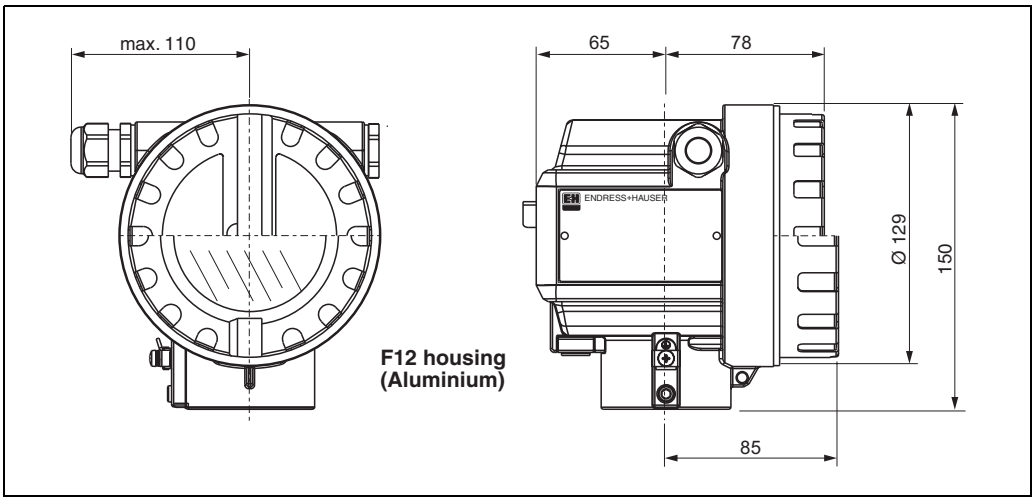
- in a stilling well: $\varepsilon r \geq 1{,}4$
- in free space: $\varepsilon r \geq 1{,}9$

# Mechanical construction

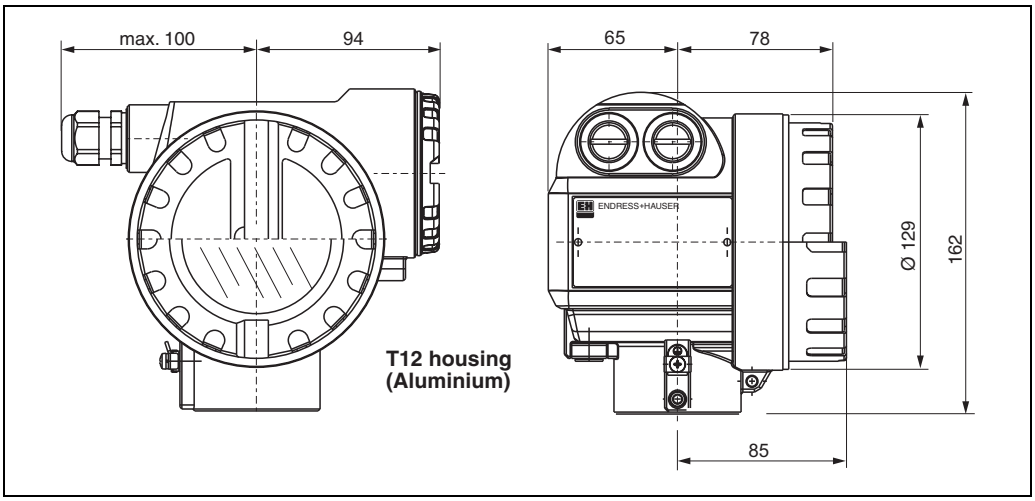
**Design, dimensions**

## Housing dimensions

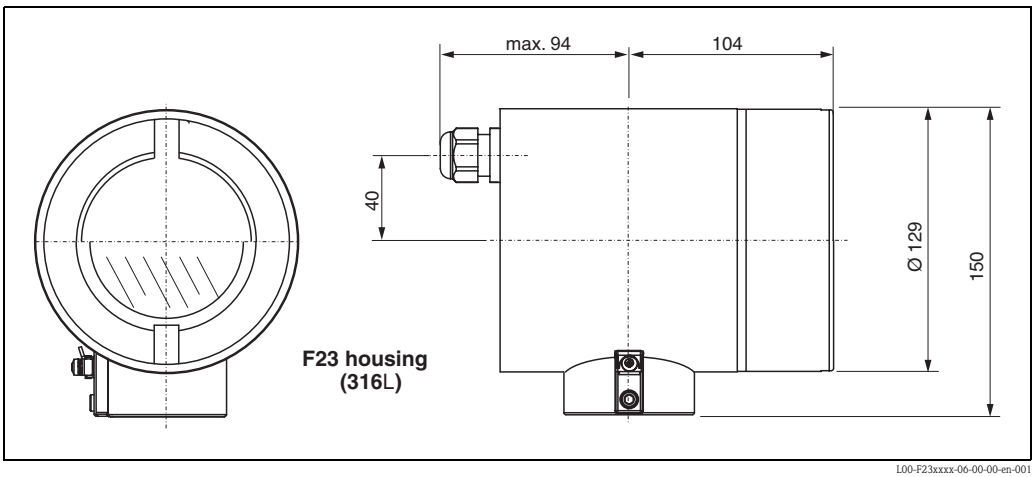
Dimensions for process connection and type of antenne see Page 38–42.




L00-F12xxxx-06-00-00-en-001



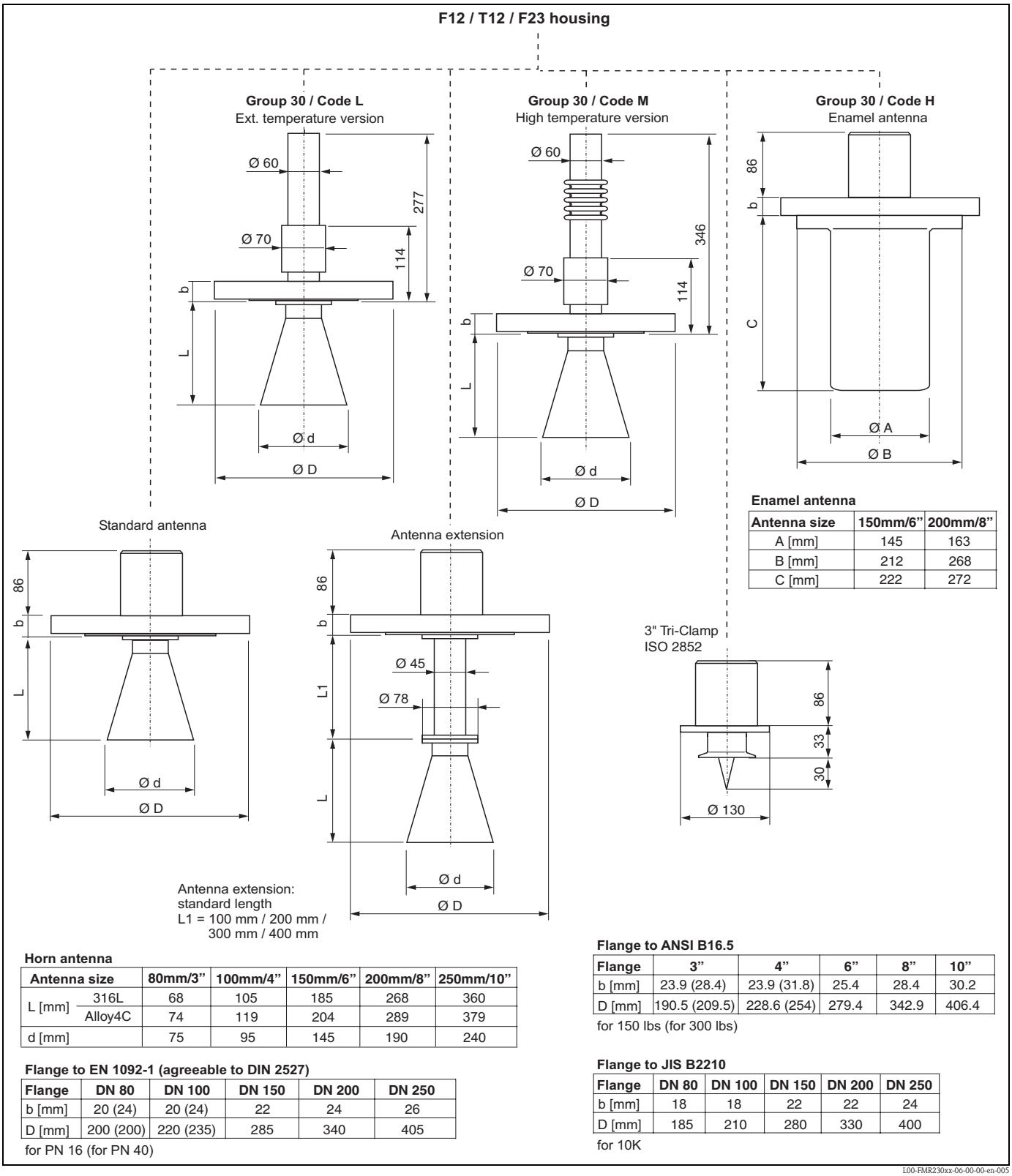

L00-T12xxxx-06-00-00-en-001




L00-F23xxxx-06-00-00-en-001

**Micropilot M FMR230 - process connection, type of antenna**

Housing dimensions see Page 37.




**Enamel antenna**

| Antenna size | 150mm/6" | 200mm/8" |
|---|---|---|
| A [mm] | 145 | 163 |
| B [mm] | 212 | 268 |
| C [mm] | 222 | 272 |

**Horn antenna**

| Antenna size | | 80mm/3" | 100mm/4" | 150mm/6" | 200mm/8" | 250mm/10" |
|---|---|---|---|---|---|---|
| L [mm] | 316L | 68 | 105 | 185 | 268 | 360 |
| | Alloy4C | 74 | 119 | 204 | 289 | 379 |
| d [mm] | | 75 | 95 | 145 | 190 | 240 |

**Flange to EN 1092-1 (agreeable to DIN 2527)**

| Flange | DN 80 | DN 100 | DN 150 | DN 200 | DN 250 |
|---|---|---|---|---|---|
| b [mm] | 20 (24) | 20 (24) | 22 | 24 | 26 |
| D [mm] | 200 (200) | 220 (235) | 285 | 340 | 405 |

for PN 16 (for PN 40)

**Flange to ANSI B16.5**

| Flange | 3" | 4" | 6" | 8" | 10" |
|---|---|---|---|---|---|
| b [mm] | 23.9 (28.4) | 23.9 (31.8) | 25.4 | 28.4 | 30.2 |
| D [mm] | 190.5 (209.5) | 228.6 (254) | 279.4 | 342.9 | 406.4 |

for 150 lbs (for 300 lbs)

**Flange to JIS B2210**

| Flange | DN 80 | DN 100 | DN 150 | DN 200 | DN 250 |
|---|---|---|---|---|---|
| b [mm] | 18 | 18 | 22 | 22 | 24 |
| D [mm] | 185 | 210 | 280 | 330 | 400 |

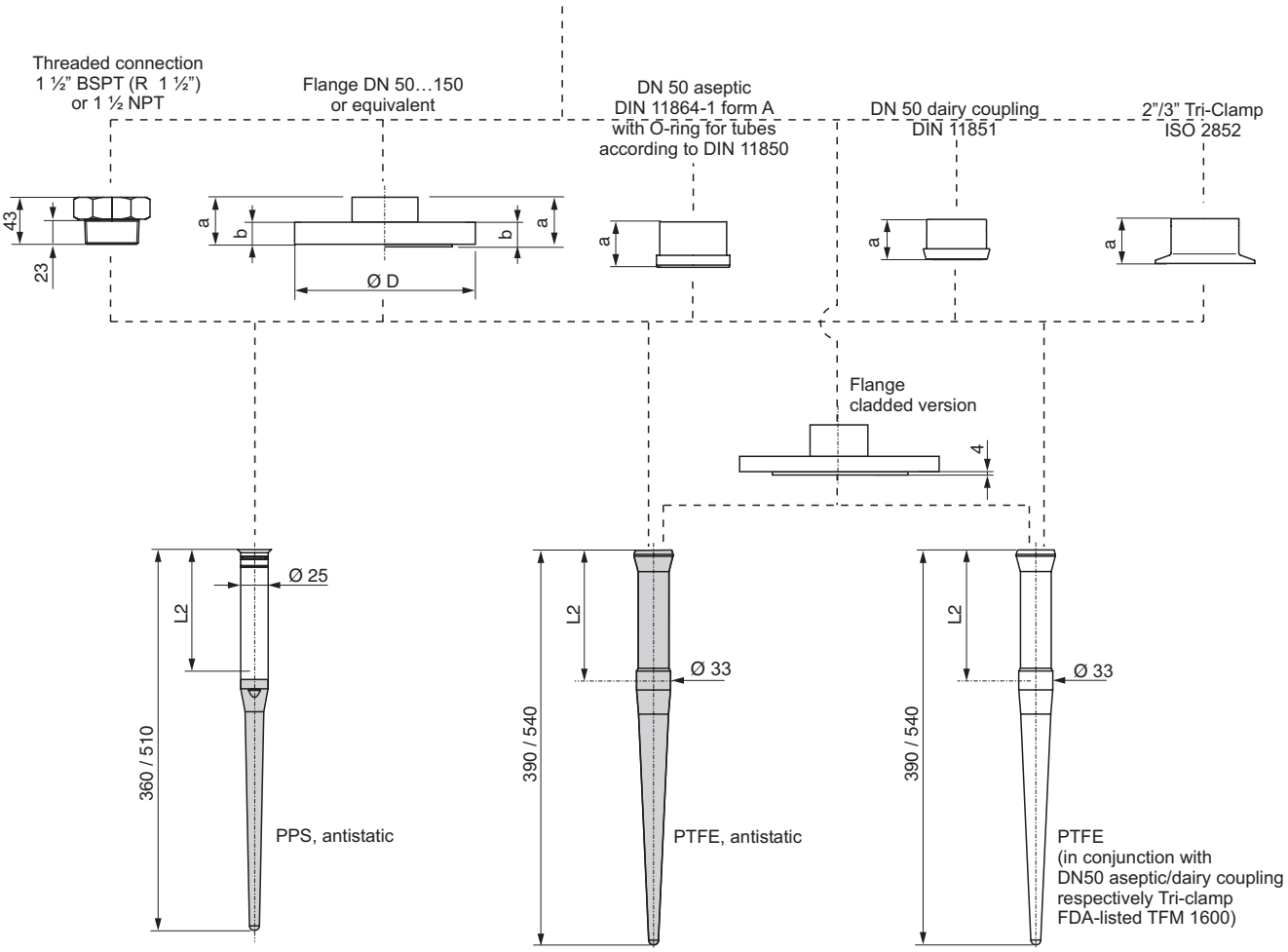
for 10K

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 EN 1092-1 (agreeable to DIN 2527)**

| Flange | DN 50 | DN 80 | DN 100 | DN 150 |
|---|---|---|---|---|
| b [mm] | 20 | 20 (24) | 20 | 22 |
| D [mm] | 165 | 200 (200) | 220 | 285 |

for PN 16 (for PN 40)

Inactive length, equivalent
to max. nozzle height
L2 = 100 mm / 250 mm

**Flange to ANSI B16.5**

| Flange | 2" | 3" | 4" | 6" |
|---|---|---|---|---|
| b [mm] | 19.1 | 23.9 (28.4) | 23.9 (31.8) | 25.4 |
| D [mm] | 152.4 | 190.5 (209.5) | 228.6 (254) | 279.4 |

for 150 lbs (for 300 lbs)

| Process connection | Flange DN 50…150 | DN 50 aseptic coupling | DN 50 diary coupling | 2"/3" Tri-Clamp |
|---|---|---|---|---|
| a [mm] without gastight feedthrough | 41 | 44.5 | 41 | 41 |
| a [mm] with gastight feedthrough | 77 | 80.5 | 77 | 77 |

**Flange to JIS B2220**

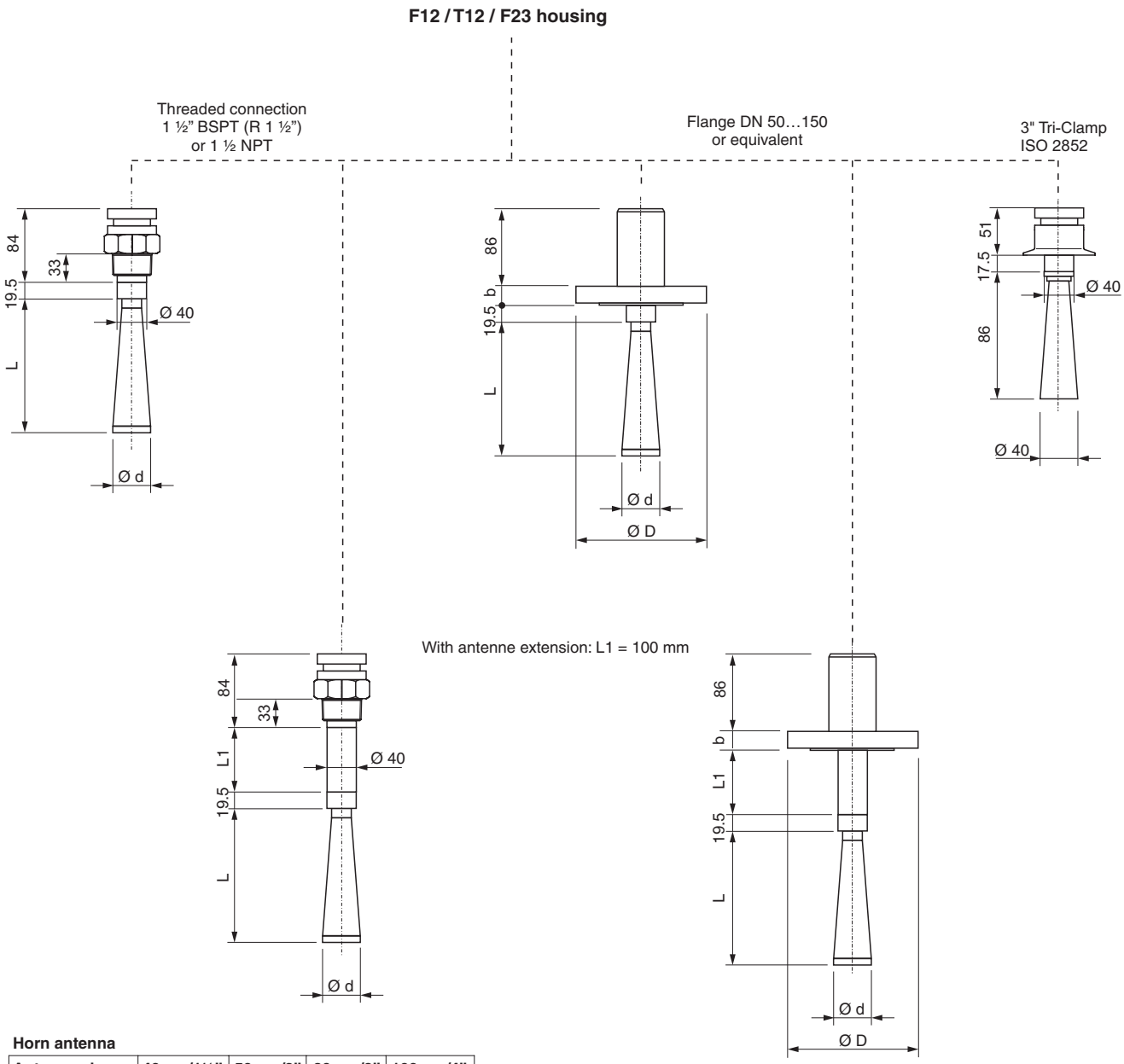
| Flange | DN 50 | DN 80 | DN 100 | DN 150 |
|---|---|---|---|---|
| b [mm] | 16 | 18 | 18 | 22 |
| D [mm] | 155 | 185 | 210 | 280 |

for 10K

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

**Micropilot M FMR240 - process connection, type of antenna**

Housing dimensions see Page 37.




**Horn antenna**

| Antenna size | 40mm/1½" | 50mm/2" | 80mm/3" | 100mm/4" |
|---|---|---|---|---|
| L [mm] | 86 | 115 | 211 | 282 |
| d [mm] | 40 | 48 | 75 | 95 |

**Flange to EN 1092-1 (agreeable to DIN 2527)**

| Flange | DN 50 | DN 80 | DN 100 | DN 150 |
|---|---|---|---|---|
| b [mm] | 18 (20) | 20 (24) | 20 (24) | 22 |
| D [mm] | 165 (165) | 200 (200) | 220 (235) | 285 |

for PN 16 (for PN 40)

**Flange to ANSI B16.5**

| Flange | 2" | 3" | 4" | 6" |
|---|---|---|---|---|
| b [mm] | 19.1 (22.4) | 23.9 (28.4) | 23.9 (31.8) | 25.4 |
| D [mm] | 152.4 (165.1) | 190.5 (209.5) | 228.6 (254) | 279.4 |

for 150 lbs (for 300 lbs)

**Flange to JIS B2220**

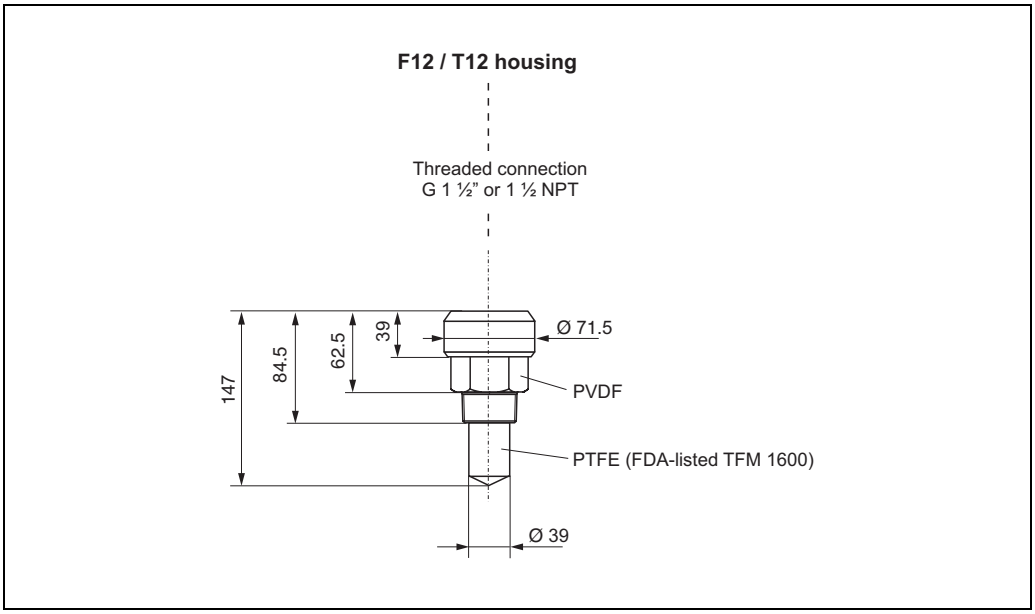
| Flange | DN 50 | DN 80 | DN 100 | DN 150 |
|---|---|---|---|---|
| b [mm] | 16 | 18 | 18 | 22 |
| D [mm] | 155 | 185 | 210 | 280 |

for 10K

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

**Micropilot M FMR244 - process connection, type of antenna**

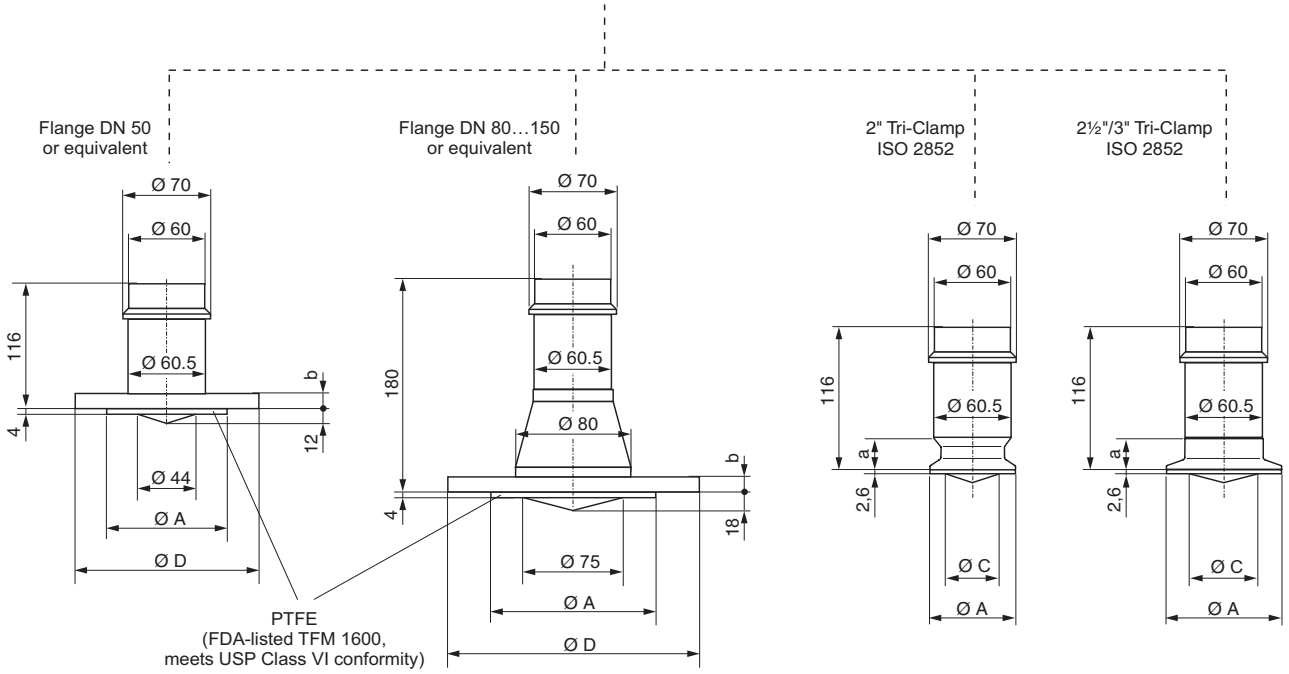
Housing dimensions see Page 37.



**Micropilot M FMR245 - process connection, type of antenna**

Housing dimensions see Page 37.

**F12 / T12 / F23 housing**




**Flange to EN 1092-1 (agreeable to DIN 2527)**

| Flange | DN 50 | DN 80 | DN 100 | DN 150 |
|---|---|---|---|---|
| b [mm] | 18 | 20 | 20 | 22 |
| D [mm] | 165 | 200 | 220 | 285 |
| A [mm] | 102 | 138 | 158 | 212 |

for PN 16

**Flange to ANSI B16.5**

| Flange | 2" | 3" | 4" | 6" |
|---|---|---|---|---|
| b [mm] | 19.1 | 23.9 | 23.9 | 25.4 |
| D [mm] | 152.4 | 190.5 | 228.6 | 279.4 |
| A [mm] | 92 | 127 | 158 | 212 |

for 150 lbs

**Process connection**

| Tri-Clamp | 2" | 2½" | 3" |
|---|---|---|---|
| a [mm] | 18 | 18 | 18 |
| A [mm] | 64 | 77.5 | 91 |
| C [mm] | 46 | 58 | 70 |

**Flange to JIS B2220**

| Flange | DN 50 | DN 80 | DN 100 | DN 150 |
|---|---|---|---|---|
| b [mm] | 16 | 18 | 18 | 22 |
| D [mm] | 155 | 185 | 210 | 280 |
| A [mm] | 96 | 127 | 151 | 212 |

for 10K

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

**Weight**

| Micropilot M | FMR230 | FMR231 | FMR240 | FMR244 | FMR245 |
|---|---|---|---|---|---|
| Weight for F12 or T12 housing | Approx. 6 kg + weight of flange | Approx. 4 kg + weight of flange | Approx. 4 kg + weight of flange | Approx. 2.5 kg | Approx. 4 kg + weight of flange |
| Weight for F23 housing | Approx. 9.4 kg + weight of flange | Approx. 7.4 kg + weight of flange | Approx. 7.4 kg + weight of flange | Approx. 5.9 kg | Approx. 7.4 kg + weight of flange |

**Material**

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

**Process connection**

See "Ordering information" on Page 51-62.

**Seal**

See "Ordering information" on Page 51-62.

**Antenna**

See "Ordering information" on Page 51-62.

# Human interface

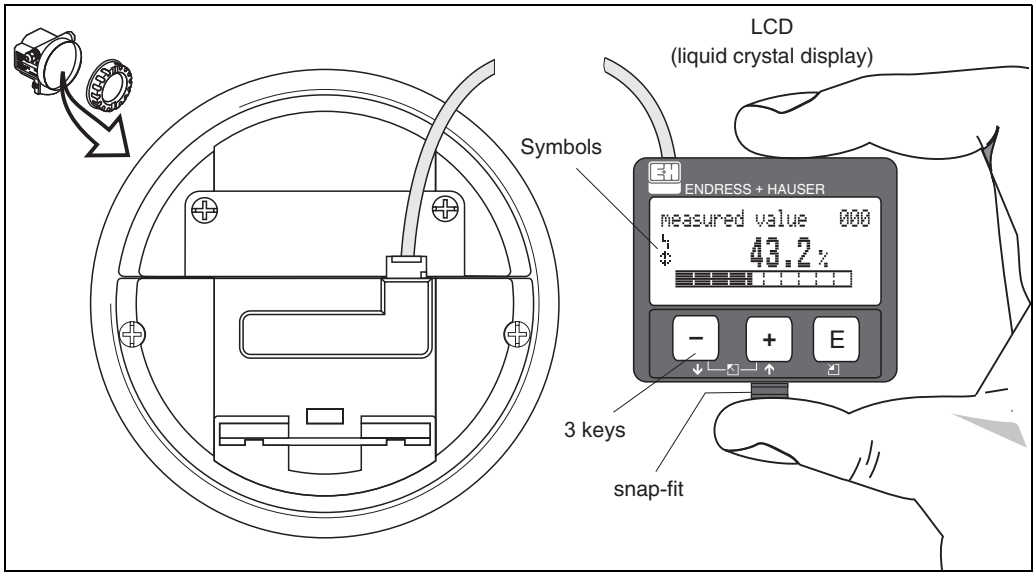
**Operation concept**

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 cable.

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

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

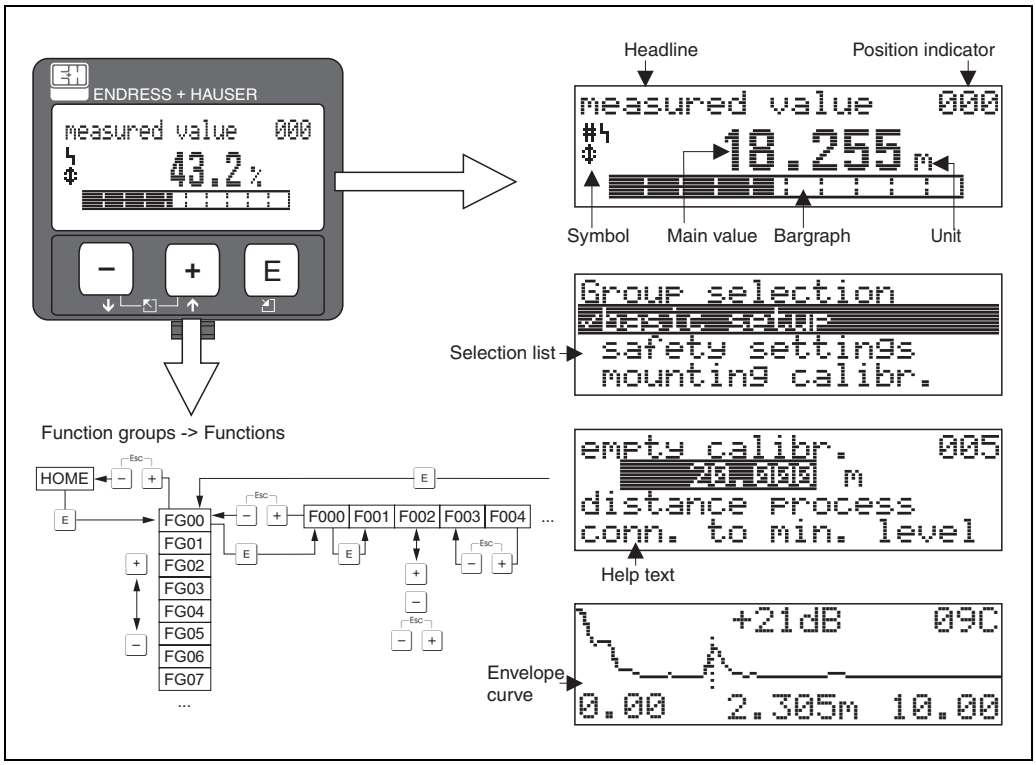
**Function of the keys**

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

## On-site operation

### Operation with VU331

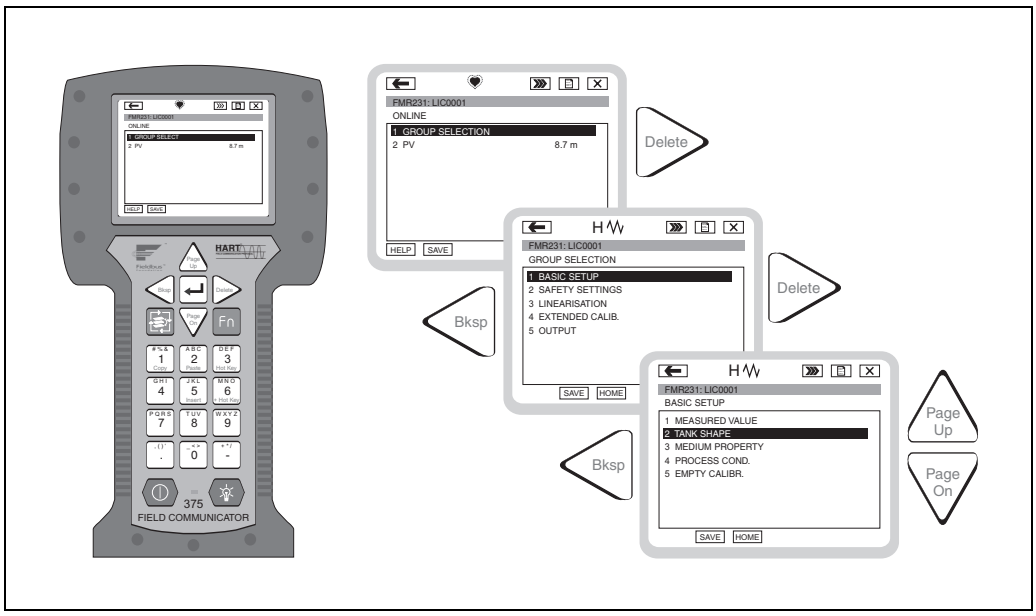
The LC-Display VU331 allows configuration via 3 keys directly at the instrument. All device functions can be set through a menu system. The menu consists of function groups and functions. Within a function, application parameters can be read or adjusted. The user is guided through a complete configuration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

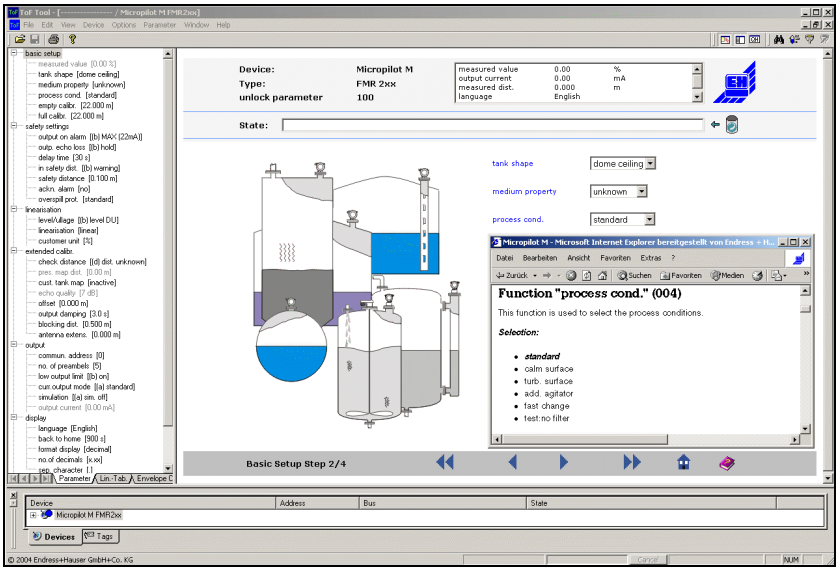
The Micropilot M can be remotely operated via HART, PROFIBUS PA and FOUNDATION Fieldbus. On-site adjustments are also possible.

### 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.

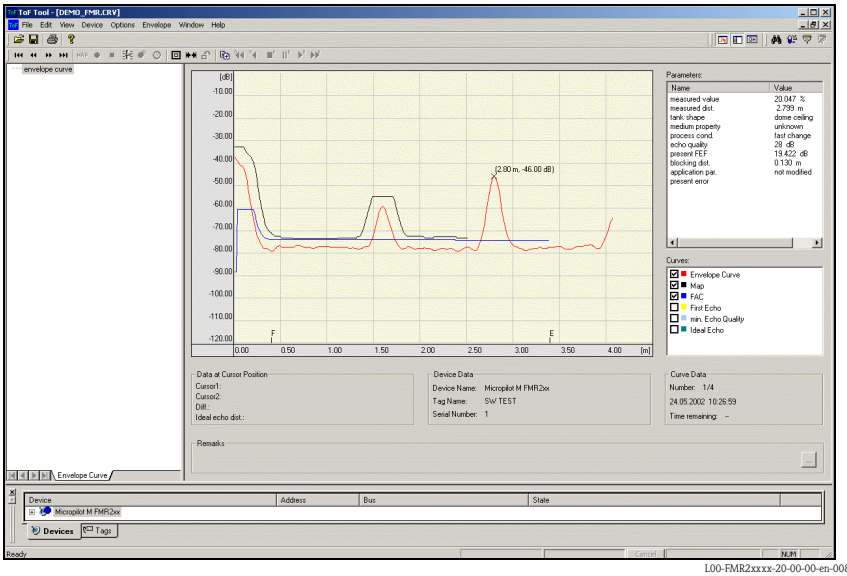
The ToF Tool supports the following functions:
- Online configuration of transmitters
- Signal analysis via envelope curve
- Linearisation table (create, edit, import and export)
- Loading and saving of instrument data (Upload/Download)
- Documentation of measuring point

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

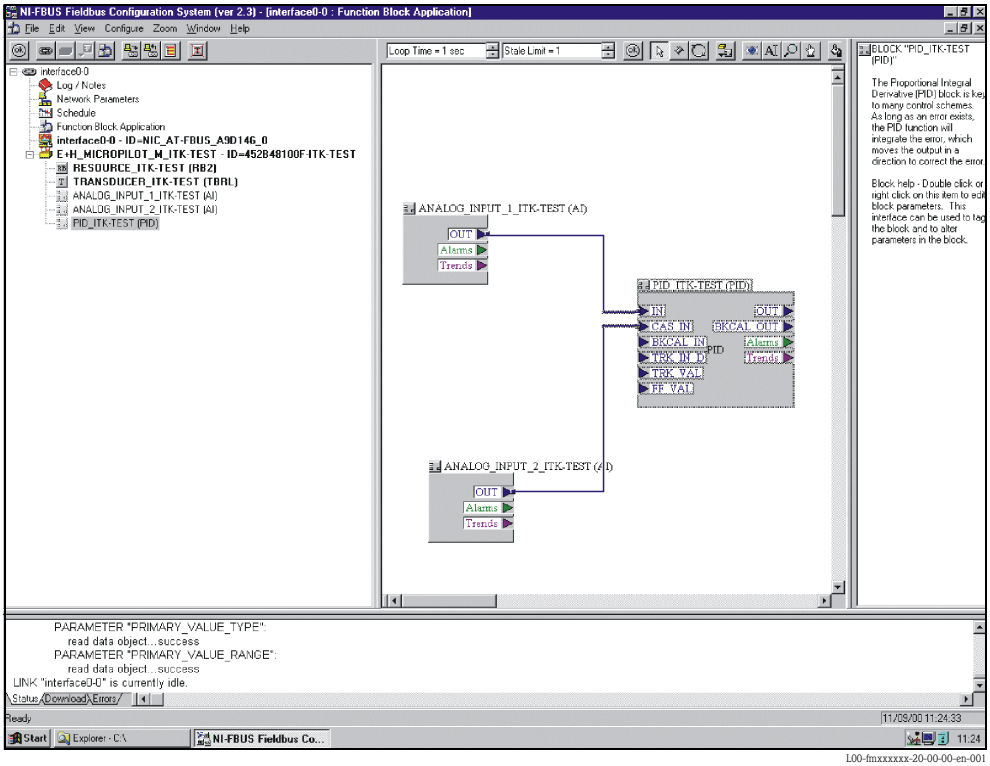
FieldCare is the Endress+Hauser FDT based Plant Asset Management Tool. It can configure all intelligent field devices in your plant and supports you in managing them. By using status information, it also provides a simple but effective means of checking their health.

- 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.

**Ex approval**

See "Ordering information" on Page 51-62.

**Sanitary compatibility**

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

FMR245 with flange cladding made of FDA-listed TFM 1600
- 3A/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 51-62 (see ZE244F/00/de).
SIL 2, for 4...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**

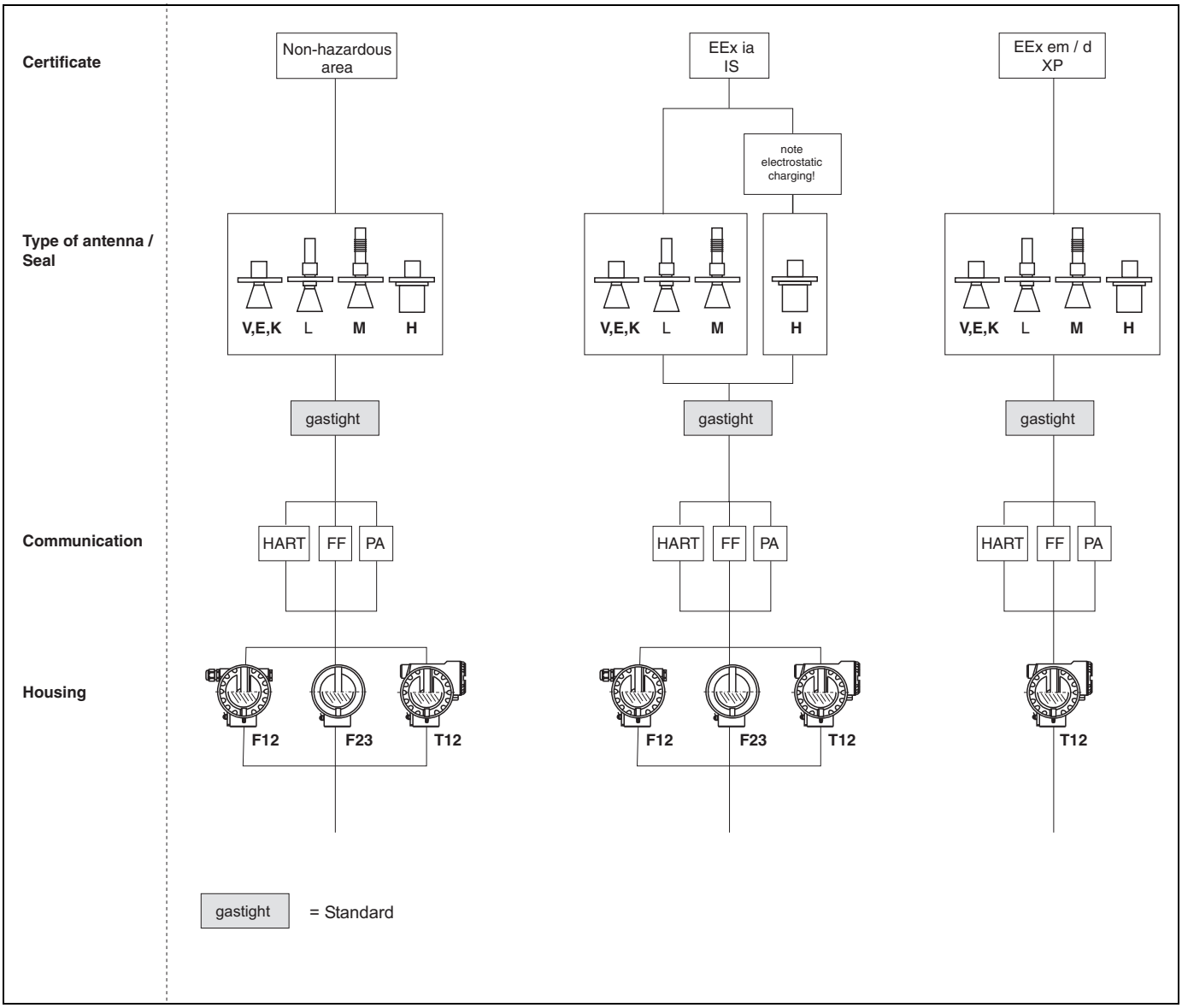
R&TTE, FCC

**Pressure measuring device guideline**

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

# Ordering information

**Micropilot M FMR230** **Instrument selection**



## 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<br>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<br>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…200°C/-40°F…392°F, conductive media max 150°C/302°F |
| | E | EPDM; -40°C…150°C/-40°F…302°F |
| | K | Kalrez; -20°C…200°C/-4°F…392°F, conductive media max 150°C/302°F |
| | L | Graphit; -60°C…280°C/-76°F…536°F |
| | M | Graphit; -60°C…400°C/-76°F…752°F |
| | H | Enamel; PTFE -40°C…200°C/-40°F…392°F |
| | Y | Special version |

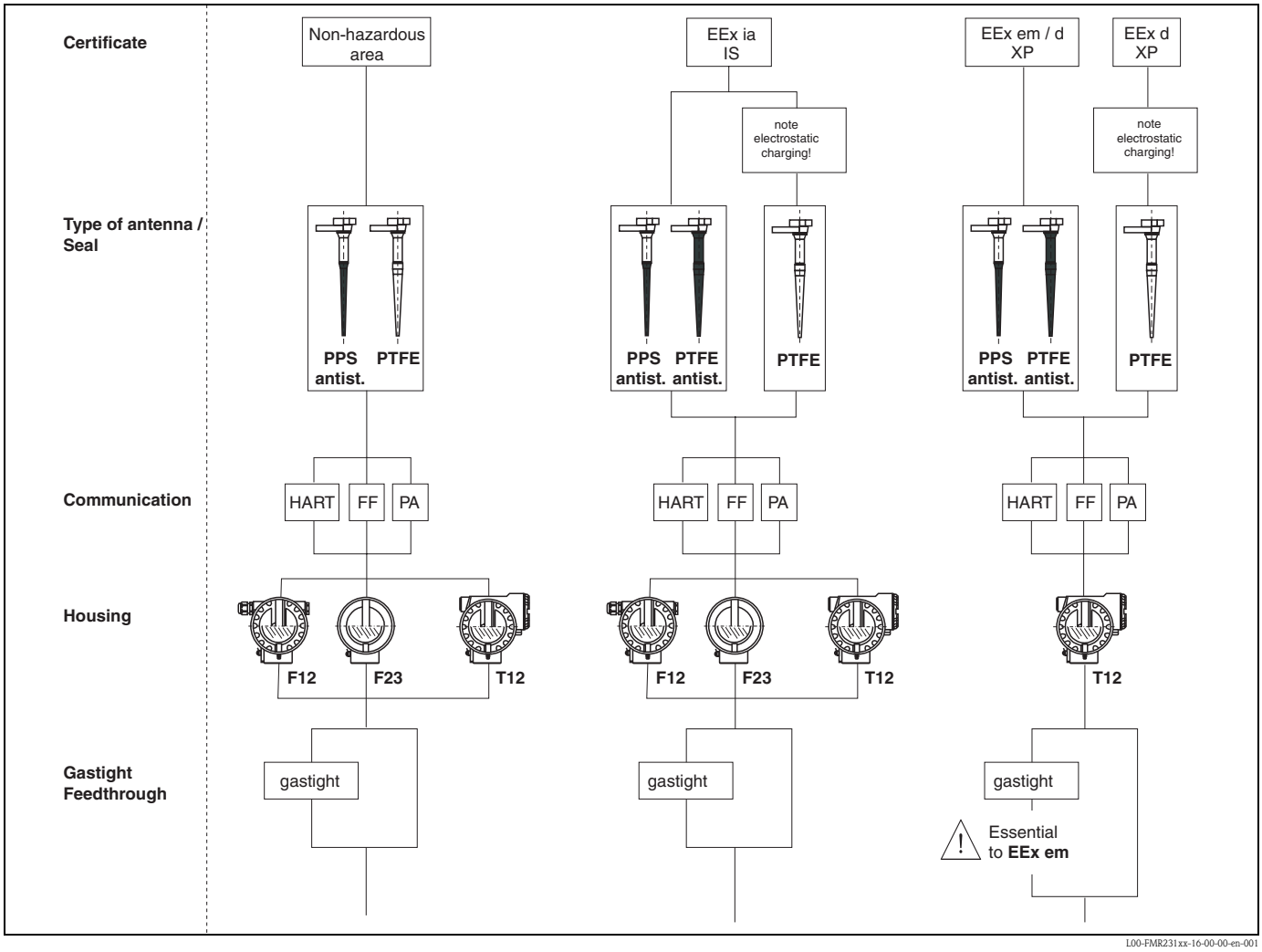
| | | |
|---|---|---|
| **40** | **Process connection:** | |
| | CMJ | DN80 PN16 B1, 316L flange EN1092-1 (DIN2527 C) |
| | CNJ | DN80 PN40 B1, 316L flange EN1092-1 (DIN2527 C) |
| | CQJ | DN100 PN16 B1, 316L flange EN1092-1 (DIN2527 C) |
| | CQ5 | DN100 PN10/16, AlloyC4>316Ti flange EN1092-1 (DIN2527 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 NPT1/2 | |
| | | | | | | | 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<br>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<br>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,<br>fully insutalted antenna: Note safety instruction (XA) (electrostatic charging)! | | |
| | H | ATEX II 1/2G EEx ia IIC T6, ATEX II 3D, XA,<br>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 1½" |
| | | | GNS | NPT 1½" |
| | | | 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)<br>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<br>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<br>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 |

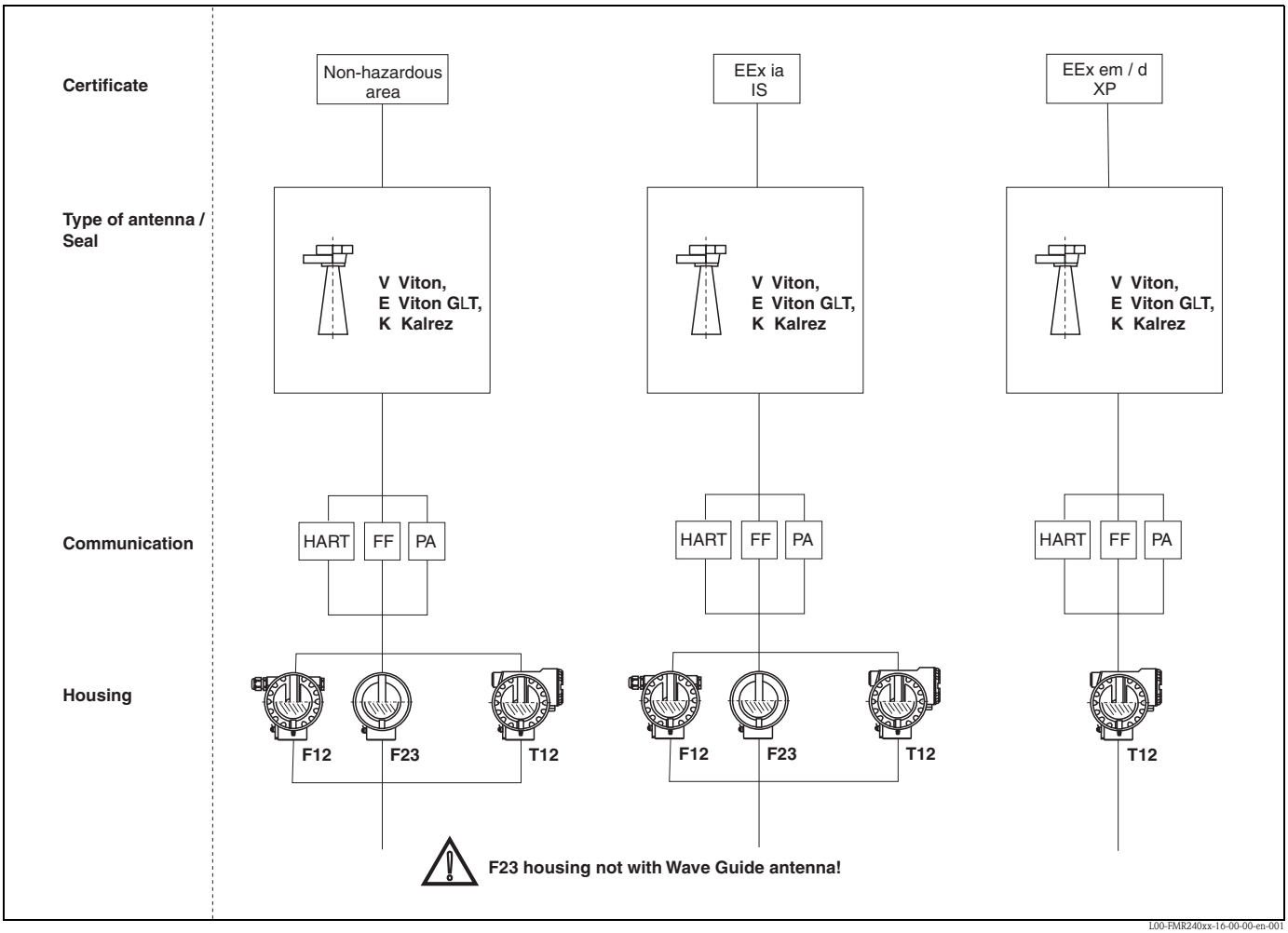
| | | |
|---|---|---|
| **60** | **Cable entry:** | |
| | 2 | Gland M20 (EEx d > thread M20) |
| | 3 | Thread G1/2 |
| | 4 | Thread NPT1/2 |
| | 5 | Plug M12 |
| | 6 | Plug 7/8" |
| | 9 | Special version |

| | | |
|---|---|---|
| **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…150°C/-4°F…302°F | | | | | | | | |
| | | E | FKM Viton GLT; -40°C…150°C/-40°F…302°F | | | | | | | | |
| | | K | Kalrez; -20°C…150°C/-4°F…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 |

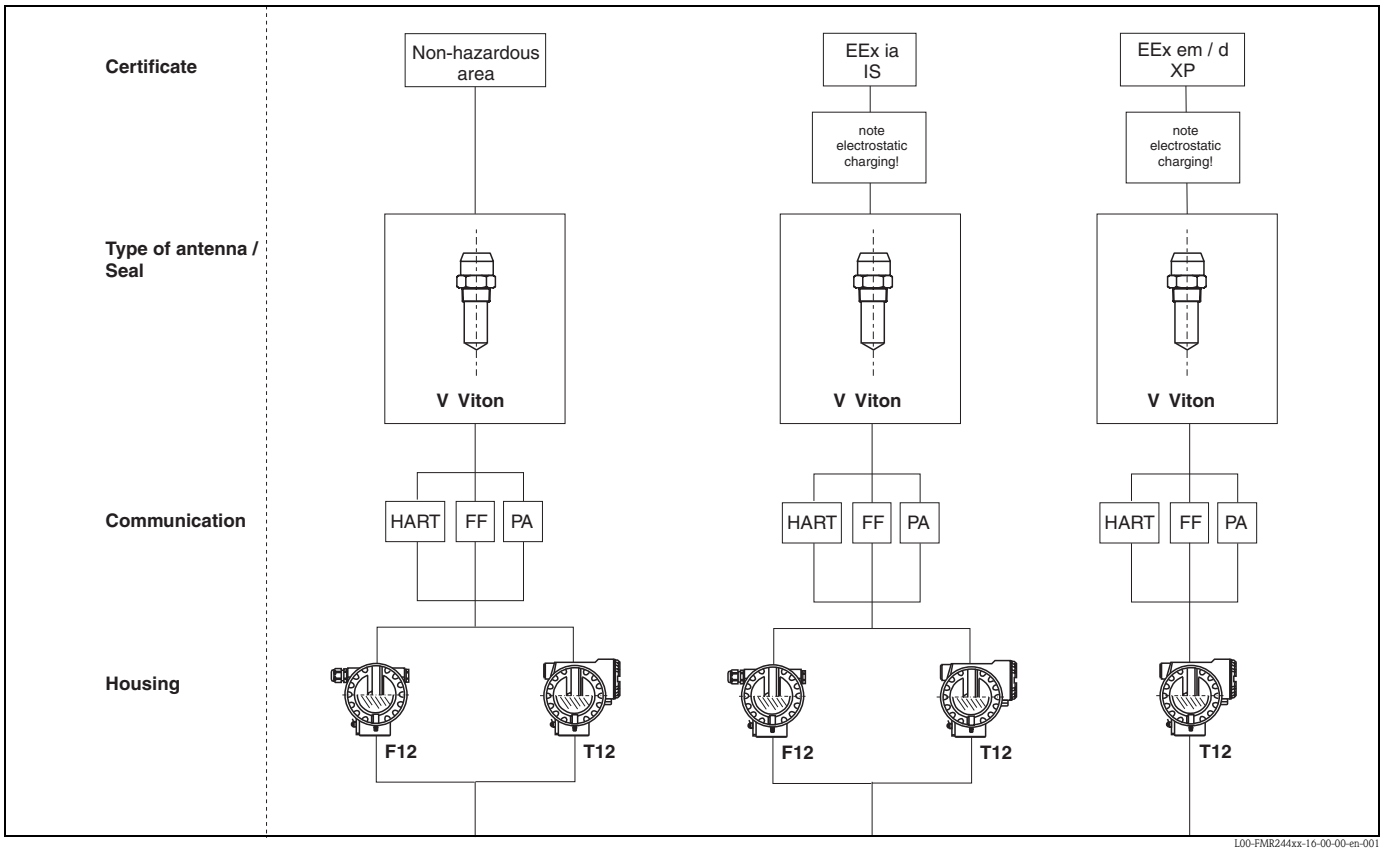
| | | |
|---|---|---|
| **70** | **Housing:** | |
| | A | F12 Alu, coated IP65 NEMA4X |
| | B | F23 316L IP65 NEMA4X |
| | C | T12 Alu, coated IP65 NEMA4X, separate conn. compartment |
| | D | T12 Alu, coated IP65 NEMA4X+OVP, separate conn. compartment, OVP=overvoltage protection |
| | Y | Special version |

| | | |
|---|---|---|
| **80** | **Cable entry:** | |
| | 2 | Gland M20 (EEx d > thread M20) |
| | 3 | Thread G1/2 |
| | 4 | Thread NPT1/2 |
| | 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 |

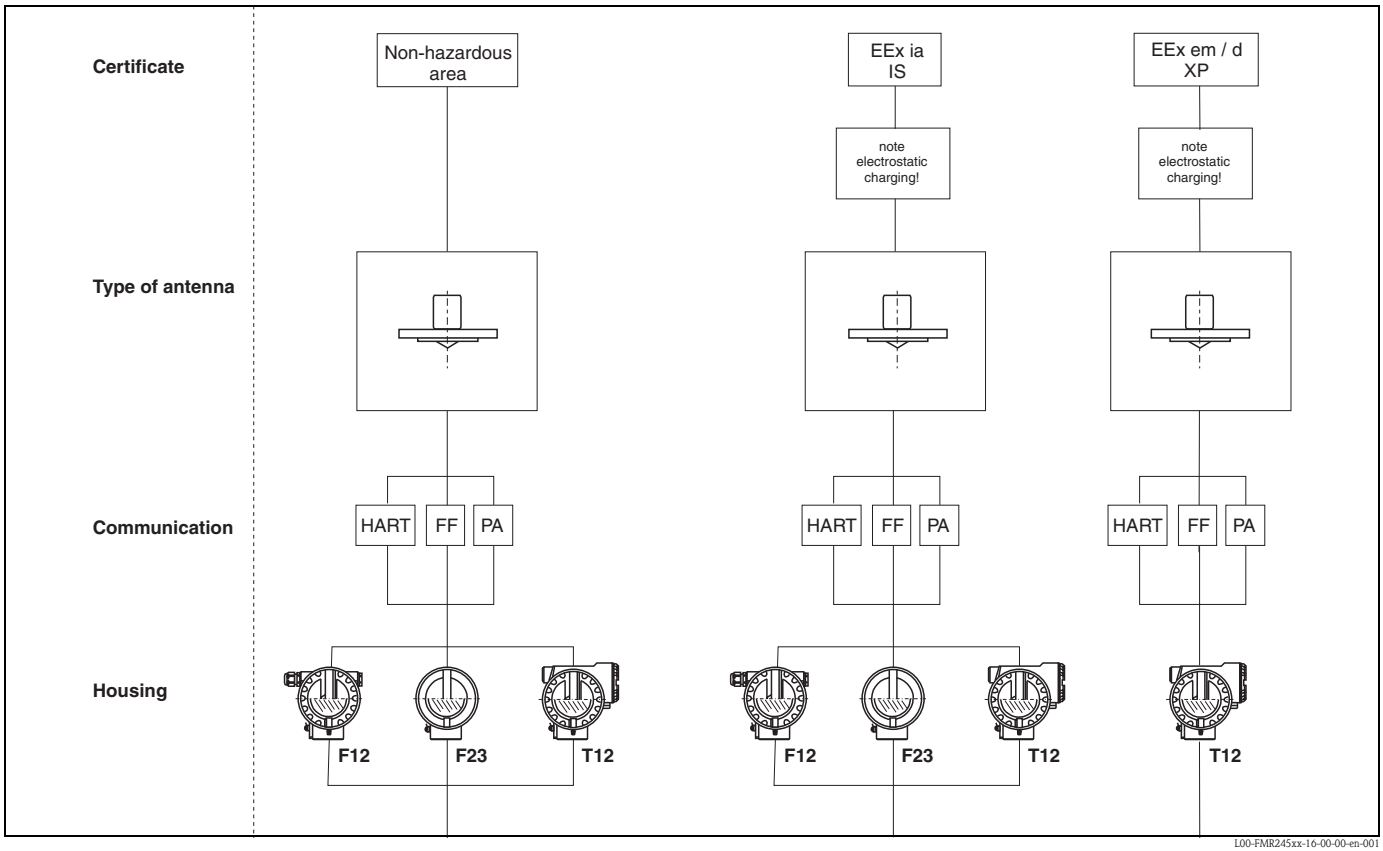
| 30 | | Antenna seal; Temperature: |
|---|---|---|
| | V | FKM Viton GLT; -40°C…130°C/-40°F…266°F |
| | Y | Special version |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 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 NPT1-1/2, 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 NPT1/2 | |
| | | | | | | | 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 NPT1/2 |
| 5 | Plug M12 |
| 6 | Plug 7/8" |
| 9 | Special version |

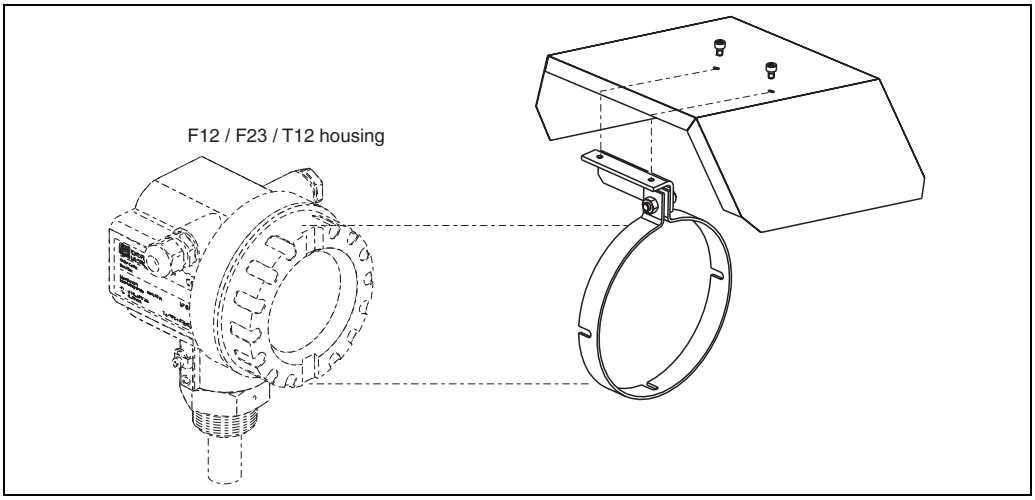
| 70 | Additional option: |
|---|---|
| A | Basic version |
| D | Advanced dynamics (max MB=40m) (SIL on request) MB=measuring range |
| F | Advanced dynamics (max MB=70m) (SIL on request) MB=measuring range |
| S | GL/ABS/NK marine certificate |
| Y | Special version |

| | |
|---|---|
| **FMR245-** | Complete product designation |

# Accessories

**Weather protection cover**

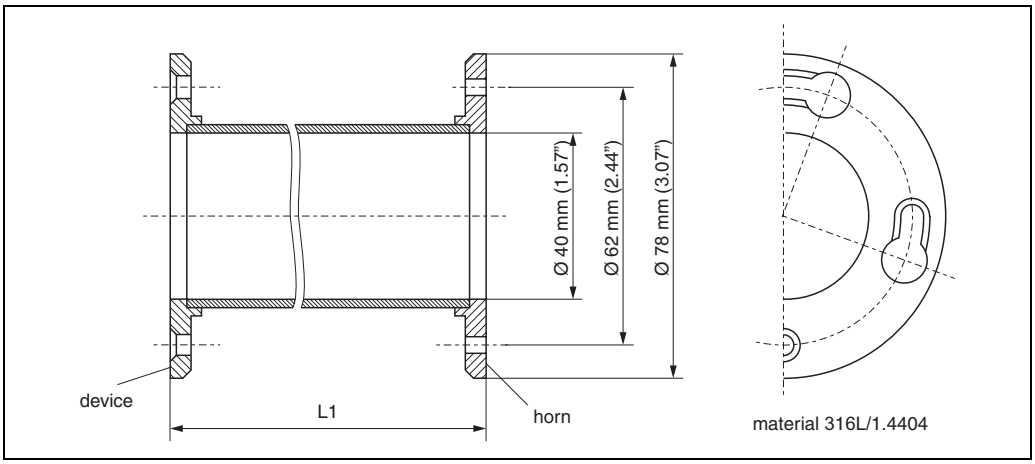
A Weather protection cover made of stainless steel is recommended for outdoor mounting (order code: 543199-0001). The shipment includes the protective cover and tension clamp.




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

**Antenna extension FAR10 (for FMR230)**

**Dimensions**

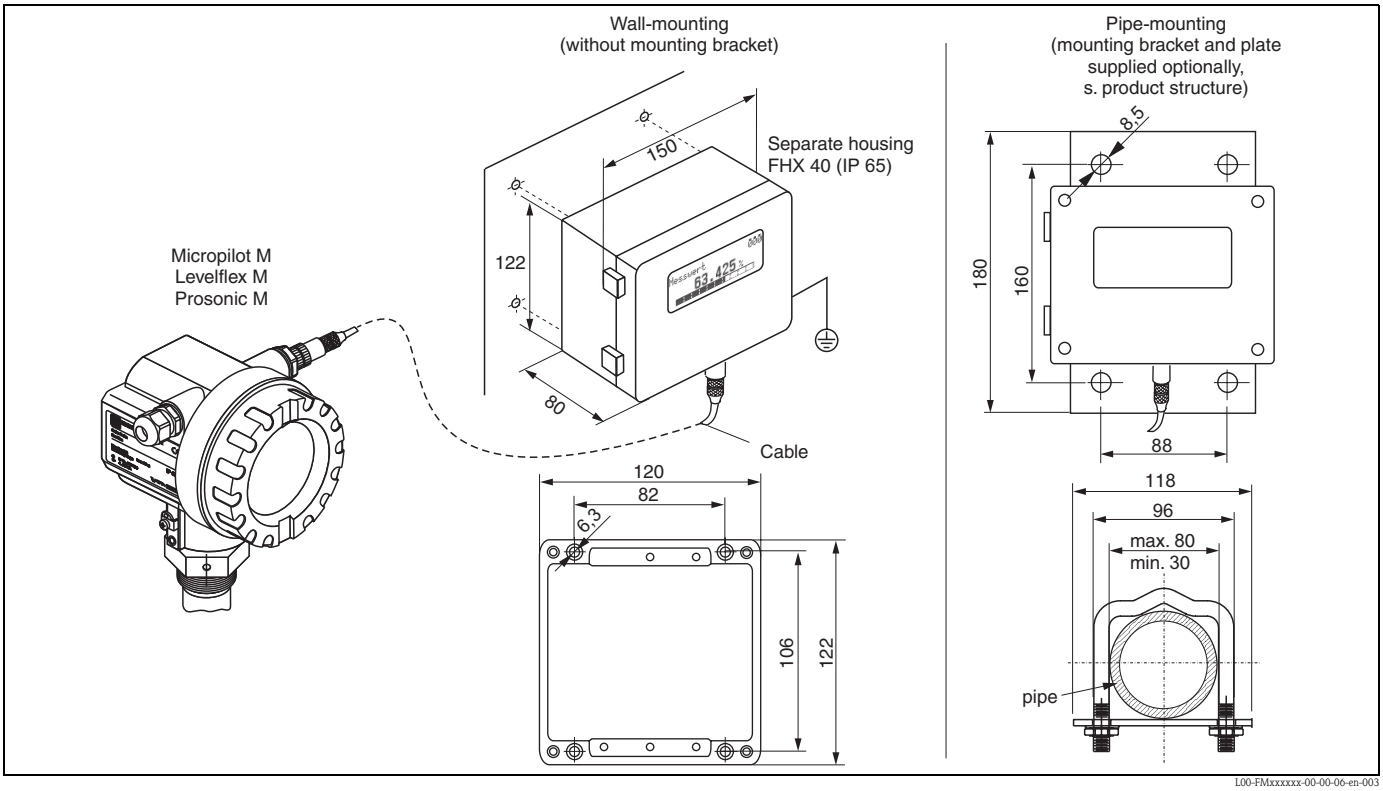



L00-FMRxxxxx-00-00-06-en-002

**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...+70 °C (–22 °F...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) / 4.8x5.9x3.2 |

| | | | | |
|---|---|---|---|---|
| | **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 FMU860/861/862
- 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 FMU860/861/862
- 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

**International Head Quarter**

Endress+Hauser
GmbH+Co. KG
Instruments International
Colmarer Str. 6
79576 Weil am Rhein
Deutschland

Tel. +49 76 21 9 75 02
Fax +49 76 21 9 75 34 5
www.endress.com
info@ii.endress.com

Endress+Hauser
People for Process Automation

TI345F/00/en/08.06
FM+SGML 6.0 ProMoDo