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, slurries, and solids. 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 up to 200 °C (392 °F) and 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 Endress+Hauser operating software.
- 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.
- Option: gas-tight feedthrough for FMR230/231/240/245 to improve the process safety.

TI345F/00/en

Endress+Hauser

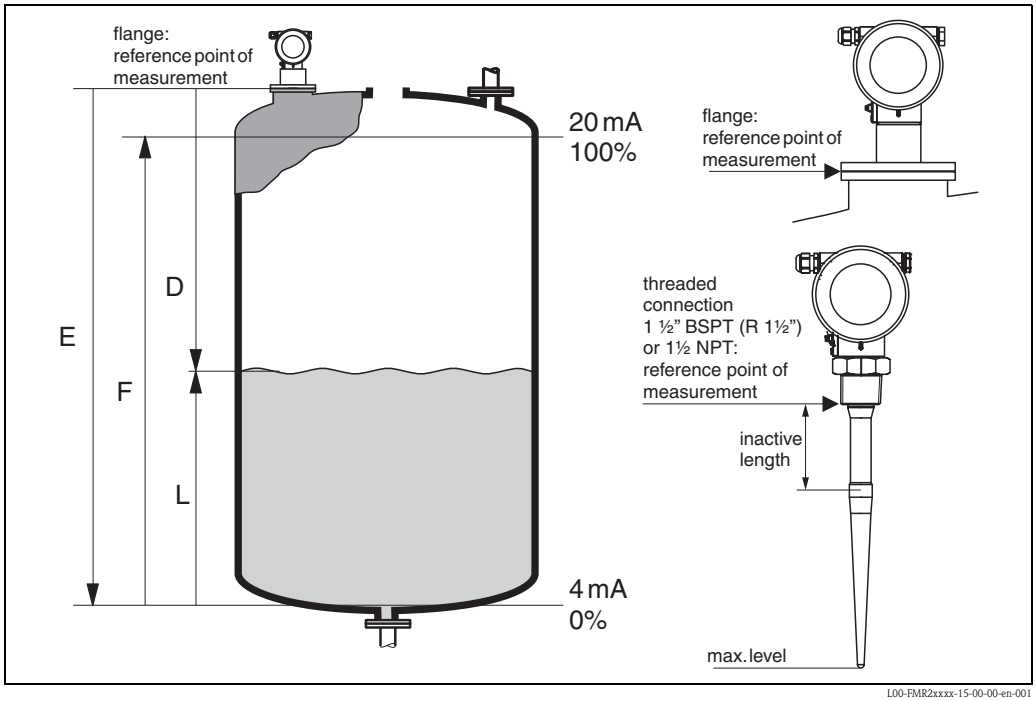
People for Process Automation

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.

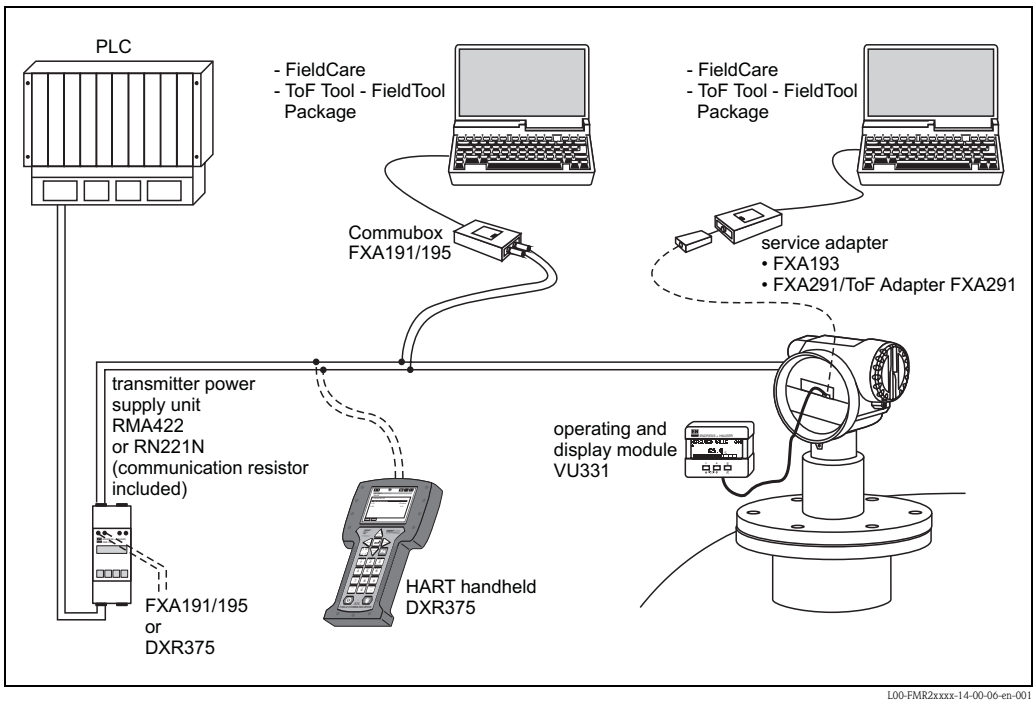
Equipment architecture

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:



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On-site operation

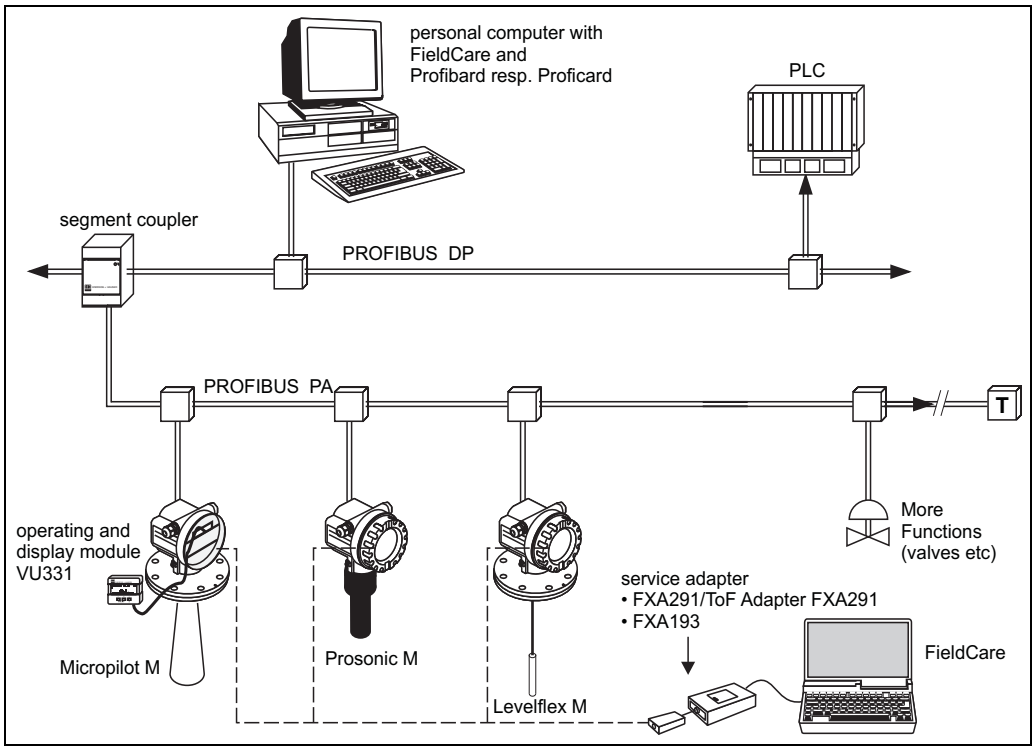
- with display and operating module VU331,
- with a Personal Computer, FXA193 and the operating software "ToF Tool – FieldTool Package" respectively "FieldCare". The ToF Tool is a graphical operating software for instruments from Endress+Hauser that operate based on the time-of-flight principle (radar,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

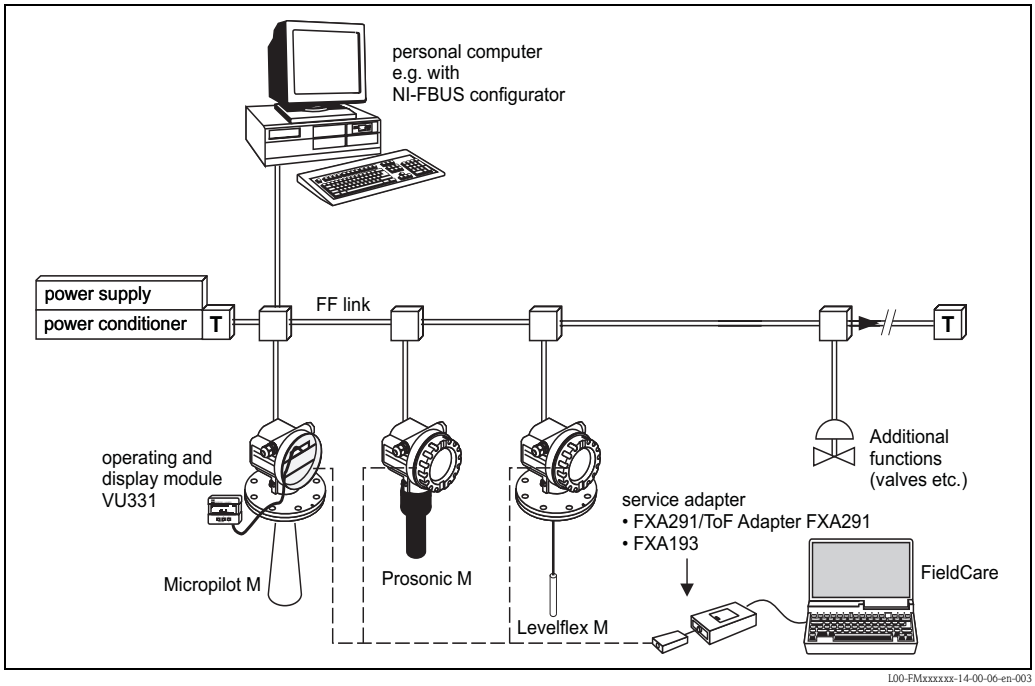
System integration via PROFIBUS PA

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:



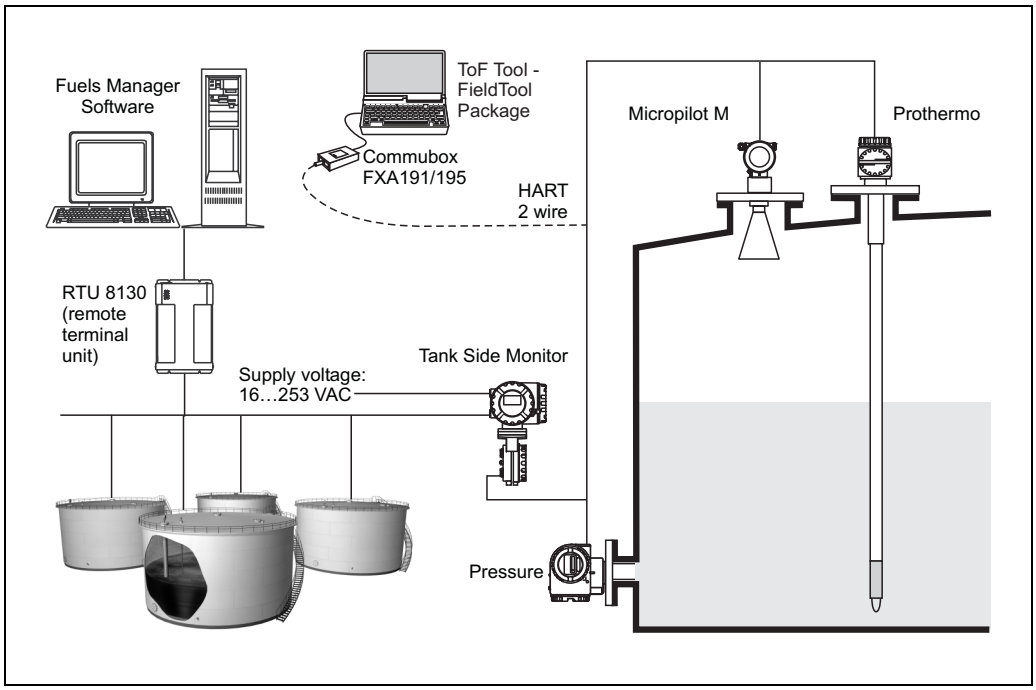
System integration via FOUNDATION Fieldbus

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.



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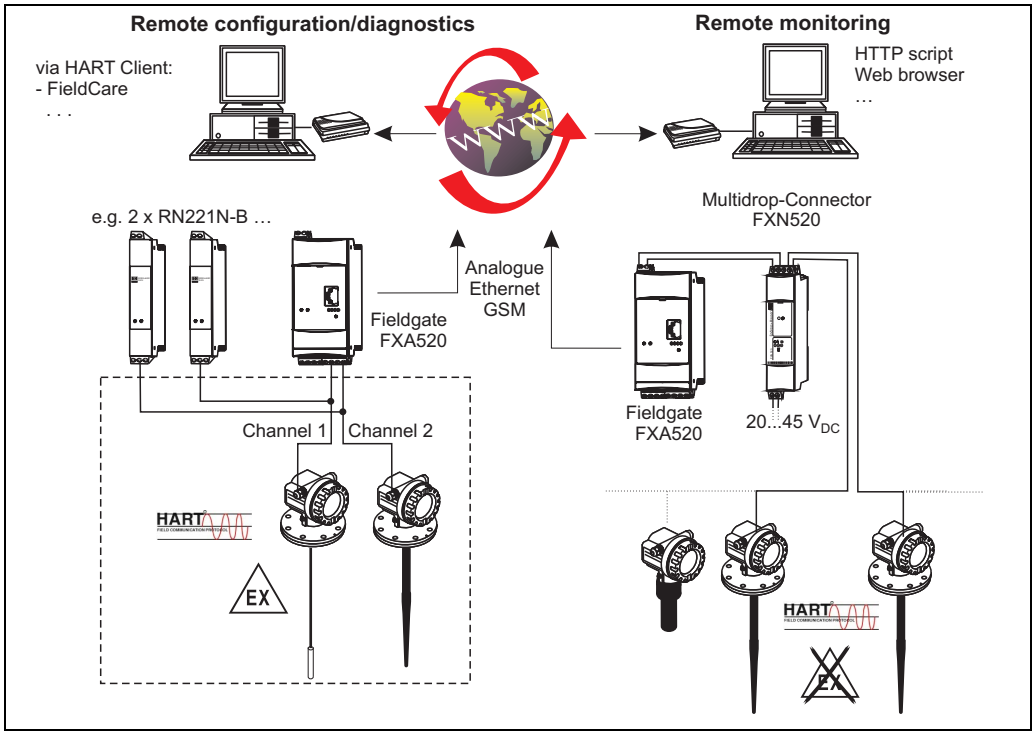
System integration via Fieldgate

Vendor Managed Inventory

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

Remote maintenance of measuring equipment

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



Note!
The number of instruments which can be connected in mutidrop mode can be calculated by the "FieldNetCalc" program. A description of this program can be found in Technical Information TI 400F (Multidrop Conncector FXN520). The program is available form your Endress+Hauser sales 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.

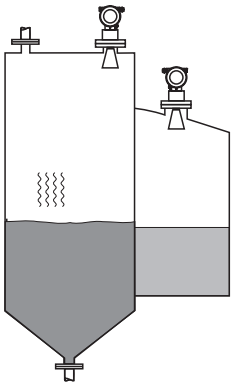
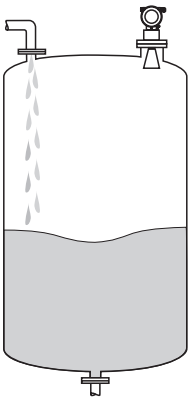
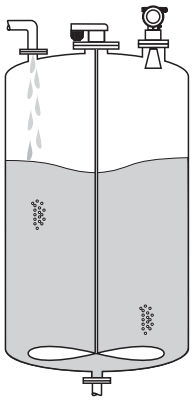
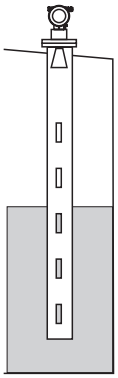
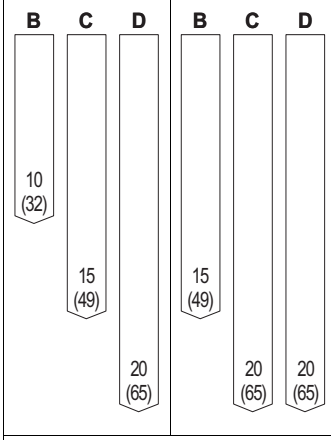
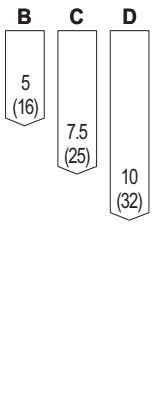
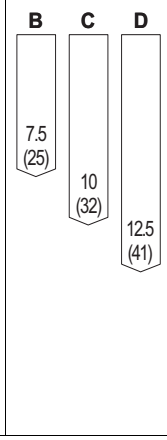
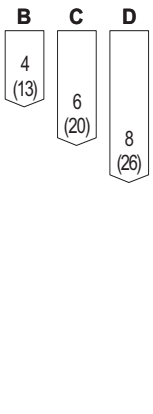
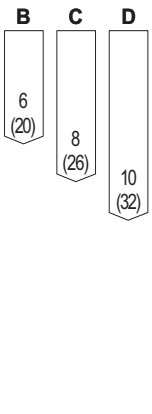
The maximum configurable range is:
- 20 m (65 ft) for Micropilot M FMR23x,
- 40 m (131 ft) for Micropilot M FMR24x (basic version),
  70 M (229 ft) for Micropilot M FMR24x (with additional option F (G), see "ordering information"),
- 70 m (229 ft) for Micropilot M FMR250 (further informations see TI390F/00/en).

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 (Er)	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)]							

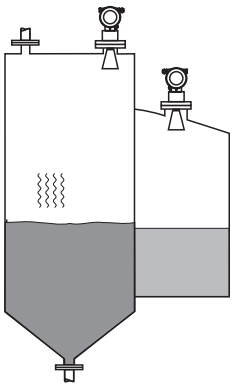
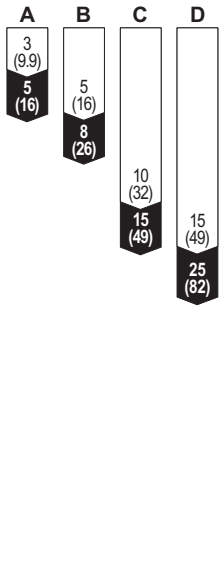
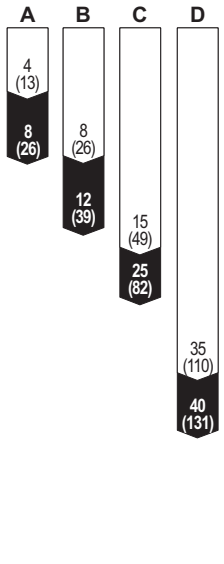
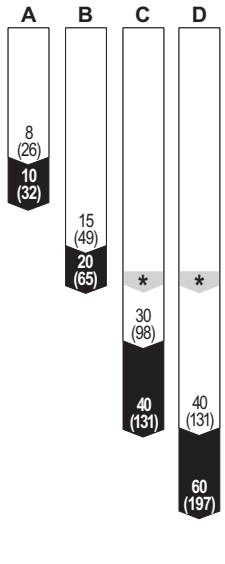
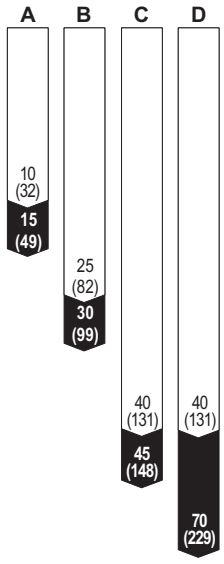
1) For media group A to use a stilling well (20 m / 65 ft).

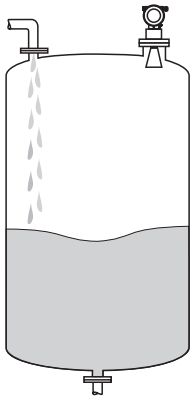
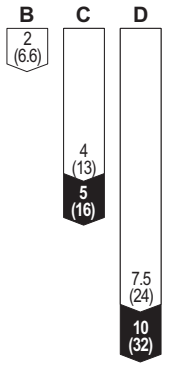
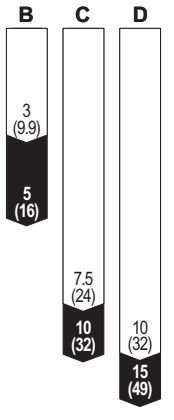
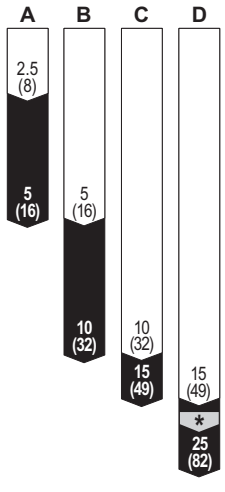
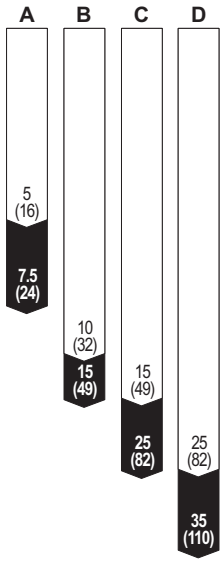
2) For media group A and B possible, i.e. with stilling well in bypass.

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

Standard: max. measuring range = 40 m (131 ft)	With additional option F (G): max. measuring range = 70 m (229 ft) min. measuring range = 5 m (16 ft)
* max. recommended measuring range = 20 m (65 ft) for FMR244 with 60 mm (3") antenna, in solids 15 m (49 ft) [1]	

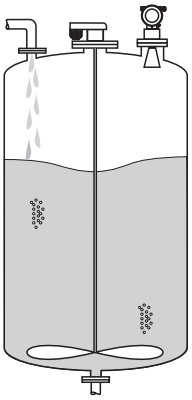
1) Larger measuring range in solids available on request.

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

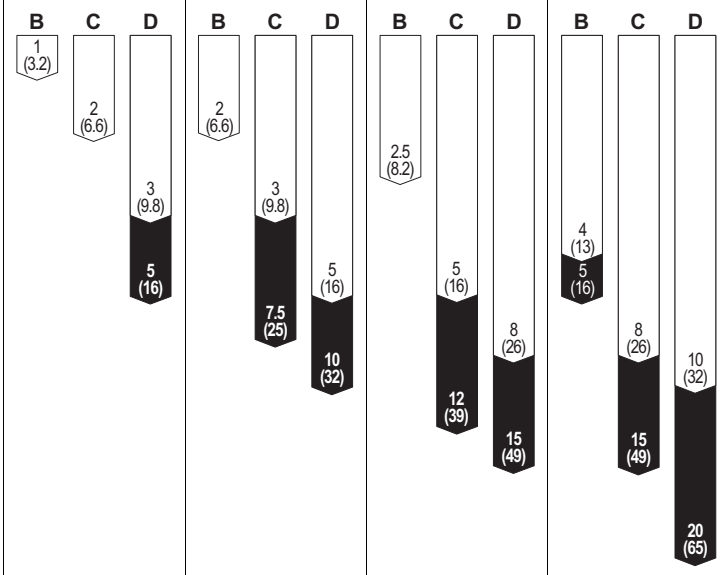
FMR240:	40 mm (1½")	50 mm (2")	80 mm (3")	100 mm (4")
FMR244:	40 mm (1½")	—	* 80 mm (3")	—
FMR245:	—	50 mm (2")	80 mm (3")	—
Buffer tank  Moving surfaces (e.g. continuous filling, from above, mixing jets).				
	Measuring range [m (ft)]			

FMR240:	40 mm (1½")	50 mm (2")	80 mm (3")	100 mm (4")
FMR244:	40 mm (1½")	—	80 mm (3")	—
FMR245:	—	50 mm (2")	80 mm (3")	—

Process tank with agitator



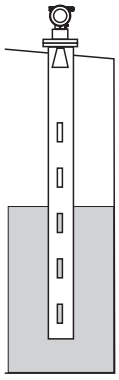
Turbulent surface.
Single stage agitator <60 RPM.



Measuring range [m (ft)]

FMR240:	40 mm ... 100 mm (1½" ... 4")
FMR244:	40 mm ... 80 mm (1½" ... 3")
FMR245:	50 mm ... 80 mm (2" ... 3")

Stilling well



Measuring range [m (ft)]

FMR240:	40 mm ... 100 mm (1½" ... 4")
FMR244:	—
FMR245:	50 mm ... 80 mm (2" ... 3")

Bypass

Measuring range [m (ft)] 1)

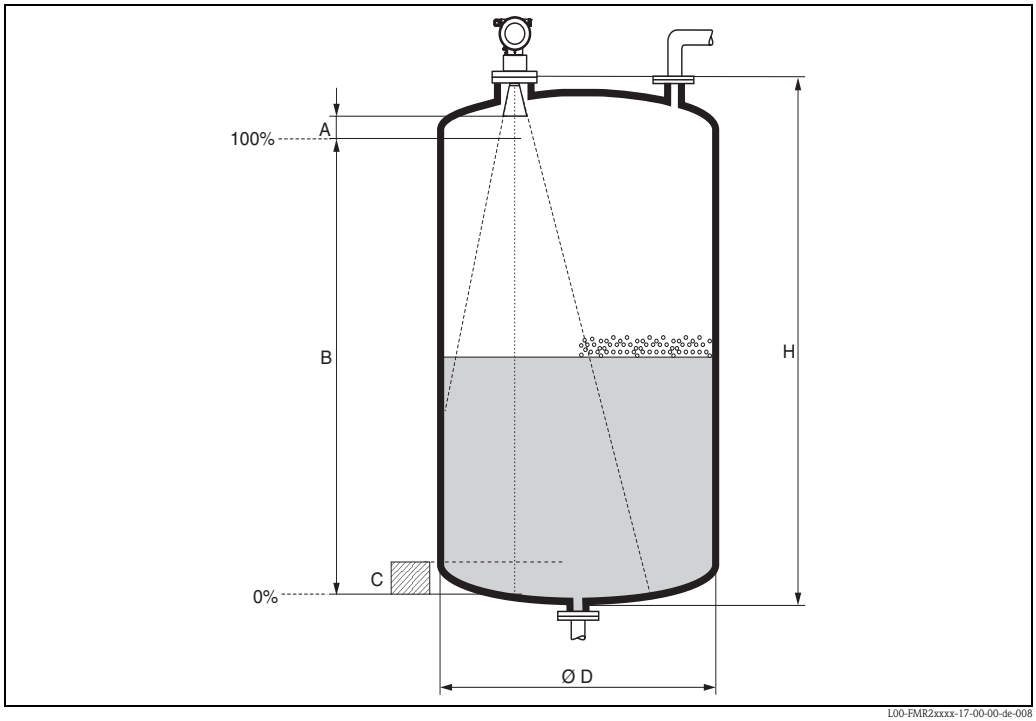
1) For media group A and B to use a Levelflex M with koax probe

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 F (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.



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- 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	
	max. measuring range = 20 m (65 ft) / 40 m (131 ft)	measuring range = 70 m (229 ft)
1 m	< 12 nW/cm^2	< 64 nW/cm^2
5 m	< 0.4 nW/cm^2	< 2.5 nW/cm^2

Output

Output signal

- 4…20 mA with HART protocol
- PROFIBUS PA
  - signal coding: Manchester Bus Powered (MBP); Manchester II
  - data transmission rate: 31.25 KBit/s, voltage mode
- FOUNDATION Fieldbus (H1)
  - signal coding: Manchester Bus Powered (MBP); Manchester II
  - data transmission rate: 31.25 KBit/s, voltage mode

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.

Data of the FOUNDATION Fieldbus interface

Basic Data (FMR230/231 only)

Device Type	100F (hex)
Device Revision	04 (hex)
DD Revision	01 (hex)
CFF Revision	01 (hex)
ITK Version	4.61
ITK-Certification Driver-No.	IT035500
Link Master (LAS) cabable	yes
Link Master / Basic Device selectable	yes; Default: Basic Device
Number VCRs	24
Number of Link-Objects in VFD	24

Basic Data (FMR240/244/245 only)

Device Type	100F (hex)
Device Revision	05 (hex)
DD Revision	01 (hex)
CFF Revision	01 (hex)
ITK Version	5.0
ITK-Certification Driver-No.	IT042000
Link Master (LAS) cabable	yes
Link Master / Basic Device selectable	yes; Default: Basic Device
Number VCRs	24
Number of Link-Objects in VFD	24

Virtual communication references (VCRs)

Permanent Entries	1
Client VCRs	0
Server VCRs	24
Source VCRs	23
Sink VCRs	0
Subscriber VCRs	23
Publisher VCRs	23

Link Settings

Slot time	4
Min. Inter PDU delay	4
Max. response delay	10

Transducer Blocks

Block	Content	Output values
Sensor Block	contains all parameters related to the mesurement	■ level or volume[1)] (channel 1) ■ distance (channel 2)
Diagnsotic Block	contains diagnostic information	no output values
Display Block	contains parameters to configure the local display	no output values

1) je nach Konfiguration des Sensor-Blocks

Function Blocks

Block	Content	Execution time	Functionality
Resource Block	The Resource Block contains all the data that uniquely identifies the field device. It is an electronic version of a nameplate of the device.		enhanced
Analog Input Block 1 Analog Input Block 2	The AI block takes the manufacturer's input data, selected by channel number, and makes it available to other function blocks at its output.	30 ms	standard
PID Block	The PID block serves as proportional-integral-derivative controller and is used almost universally to do closed-loop-control in the field including cascade and feedforward.	80 ms	standard
Arithmetic Block	This block is designed to permit simple use of popular measurement math functions. The user does not have to know how to write equations. The math algorithm is selected by name, chosen by the user for the function to be done.	50 ms	standard
Input Selector Block	The input selector block provides selection of up to four inputs and generates an output based on the configured action. This block normally receives its inputs from AI blocks. The block performs maximum, minimum, middle, average and 'first good' signal selection.	30 ms	standard
Signal Characterizer Block	The signal characterizer block has two sections, each with an output that is a non-linear function of the respective input. The non-linear function is determined by a single look-up table with 21 arbitrary x-y pairs.	40 ms	standard
Integrator Block	The Integrator Function Block integrates a variable as a function of the time or accumulates the counts from a Pulse Input block. The block may be used as a totalizer that counts up until reset or as a batch totalizer that has a setpoint, where the integrated or accumulated value is compared to pre-trip and trip settings, generating discrete signals when these settings are reached.	60 ms	standard

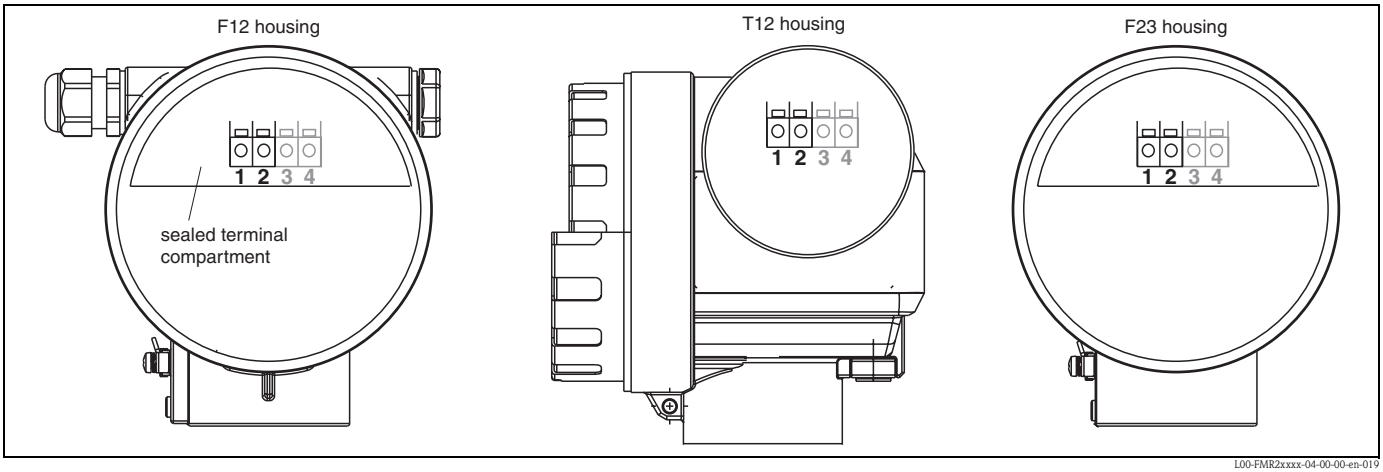
Auxiliary energy

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 19).
- 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

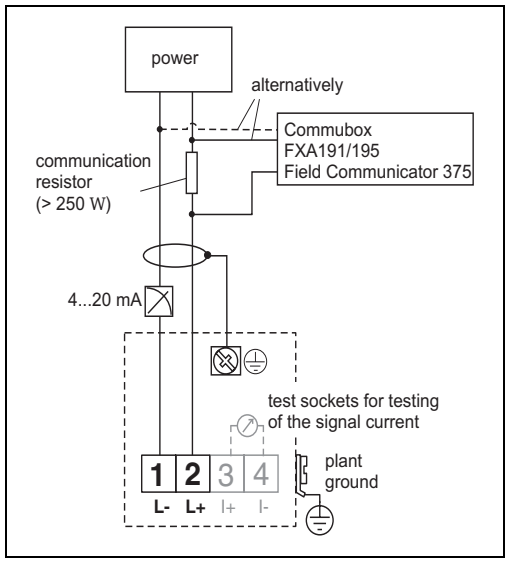
2-wire, 4…20 mA with HART

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.



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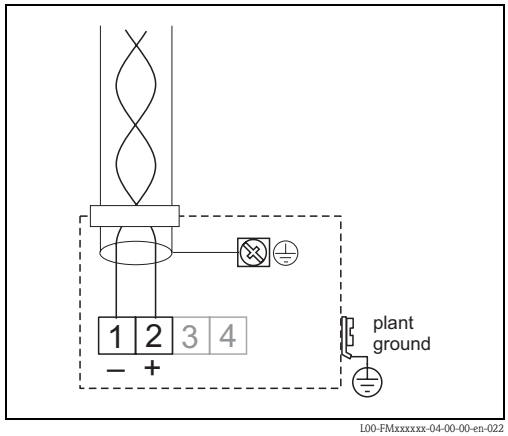
PROFIBUS PA

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

Cable specification:
- Use a twisted, screened two-wire cable, preferably cable type A



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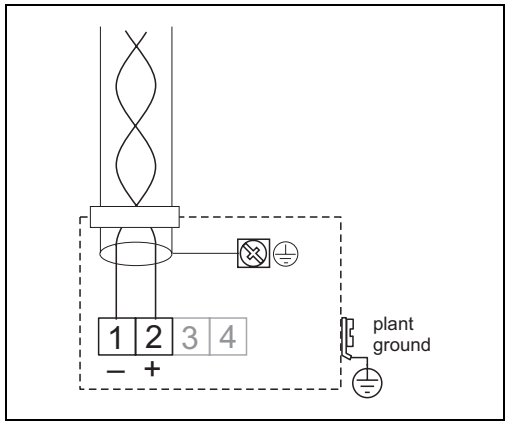
Note!
For further information on the cable specifications, see Operating Instructions BA034S "Guidelines for planning and commissioning PROFIBUS DP/PA", PNO Guideline 2.092 "PROFIBUS PA User and Installation Guideline" and IEC 61158-2 (MBP).

FOUNDATION Fieldbus

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

Cable specification:
- Use a twisted, screened two-wire cable, preferably cable type A



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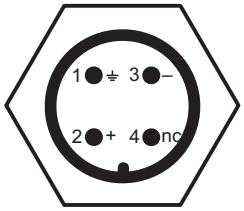
Note!
For further information on the cable specifications, see Operating Instructions BA013S "FOUNDATION Fieldbus Overview", FONDATION Fieldbus Guideline and IEC 61158-2 (MBP).

Fieldbus plug connectors

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

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



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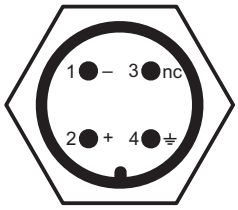
Pin	Meaning
1	Ground
2	Signal +
3	Signal –
4	not connected

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



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

Load HART

Minimum load for HART communication: 250 Ω

Supply voltage

HART

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 d	4 mA	16 V	30 V
		20 mA	11 V	30 V
	dust Ex	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 [1)]	36 V
	EEx ia	11 mA	10 V [1)]	30 V
Fixed current for HART Multidrop mode	standard	4 mA [2)]	16 V	36 V
	EEx ia	4 mA [2)]	16 V	30 V

1) Short-term min. start-up voltage: 11.4 V

2) Start-up current 11 mA.

FOUNDATION Fieldbus

Supply voltage	9 V ... 32 V [1]
Lift-off voltage	9 V

1) There may be additional restrictions for devices with an explosion protection certificate. Refer to the notes in the appropriate safety instructions (XA).

Cable entry

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

Power consumption

min. 60 mW, max. 900 mW

Current consumption

HART

3,6 ... 22 mA. For HART Multidrop: start up current is 11 mA.

PROFIBUS PA

Max. 13 mA.

FOUNDATION Fieldbus

Basic current	15 mA
In-rush current	≤ 15 mA
Error current	0 mA
FISCO/FNICO compliant	yes
Polarity sensitive	no

FISCO

U_i	17,5 V
I_i	500 mA; with surge arrester 273 mA
P_i	5,5 W; with surge arrester1, 2 W
C_i	5 nF
L_i	0,01 mH

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 59-71) 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 = 40 m (131 ft)
  - to 10 m: ± 3 mm
  - ex 10 m: ± 0.03 % of measuring range
- 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):
  - **FMR24x**
    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 Nitrogen	20	68	0.00 %	0.22 %	1.2 %	2.4 %	3.89 %
	200	392	-0.01 %	0.13 %	0.74 %	1.5 %	2.42 %
	400	752	-0.02 %	0.08 %	0.52 %	1.1 %	1.70 %
Hydrogen	20	68	-0.01 %	0.10 %	0.61 %	1.2 %	2.00 %
	200	392	-0.02 %	0.05 %	0.37 %	0.76 %	1.23 %
	400	752	-0.02 %	0.03 %	0.25 %	0.53 %	0.86 %

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

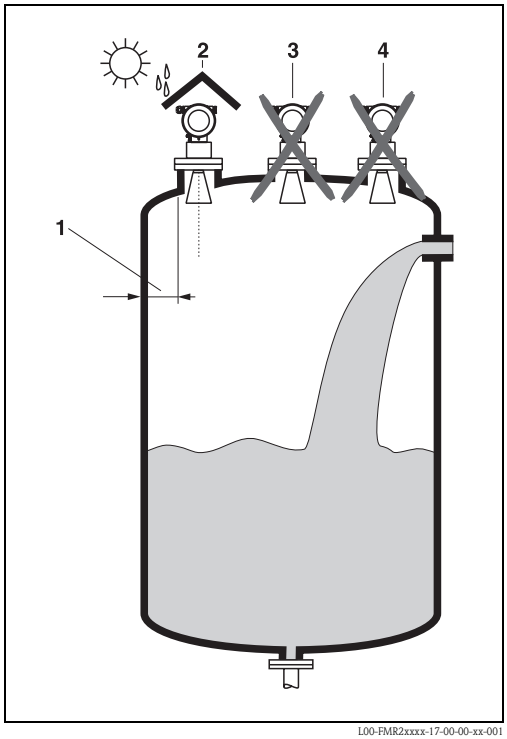
Note!
When the pressure is known and constant, this measured error can, for example, be compensated by means of linearization.

Operating conditions: Installation

Installation instructions

Orientation

- Recommended distance (1) wall – **outer edge** of nozzle: ~1/6 of tank diameter. Nevertheless the device should not be installed closer than 30 cm/ 12“ (FMR230/231) resp. 15 cm/6“ (FMR240/ 244/245) to the tankwall.
- Not in the 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 72).



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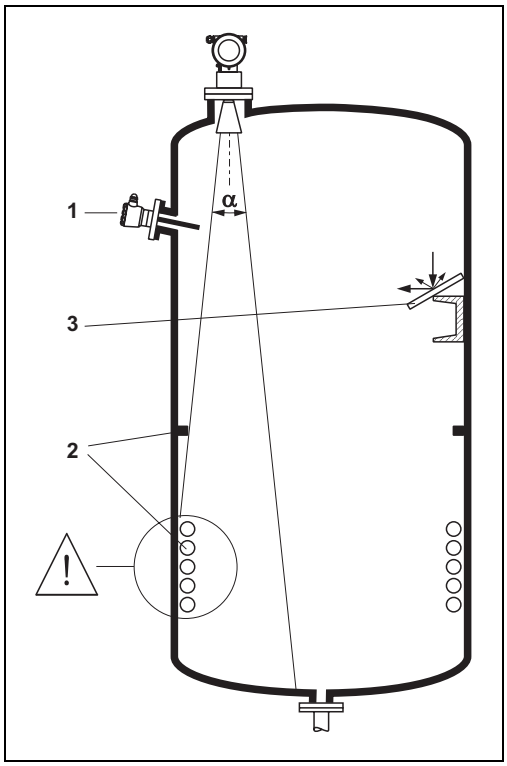
Tank installations

- Avoid any installations (1), like limit switches, temperature sensors, etc., inside the signal beam (see Beam angle on Page 24).
- Symmetrical installations (2), i.e. vacuum rings, heating coils, baffles, etc., can also interfere with the measurement.

Optimization options

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

Please contact Endress+Hauser for further information.



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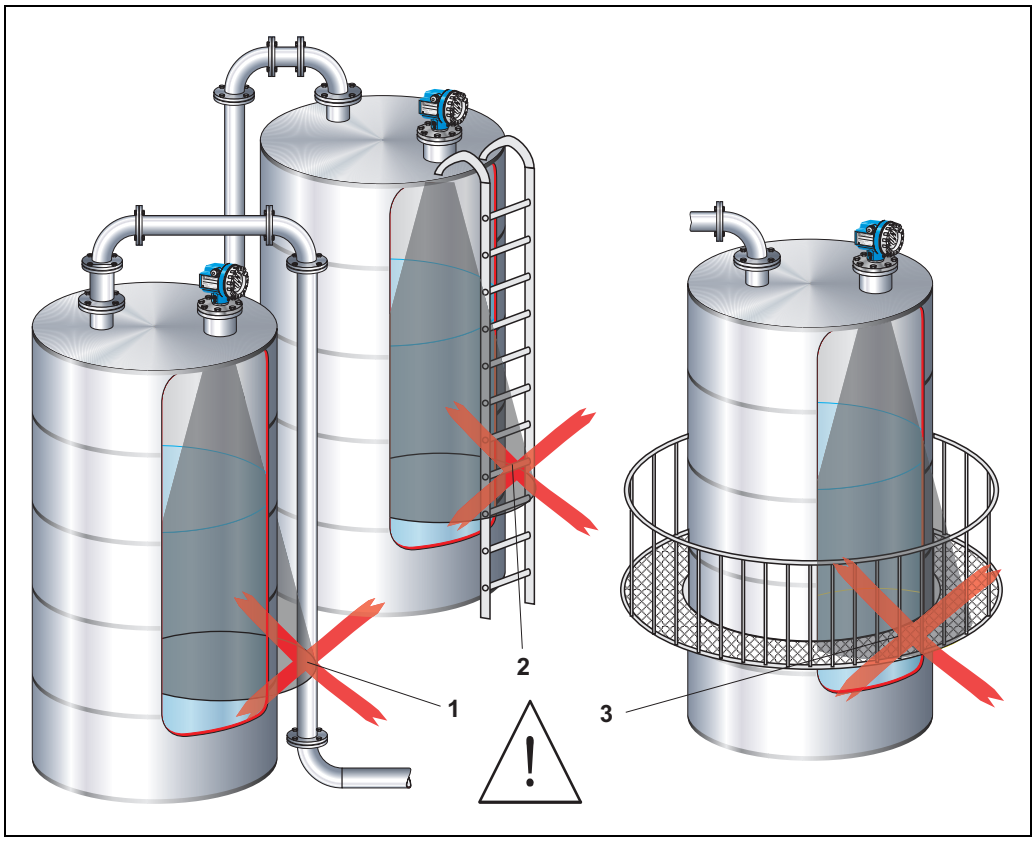
Measurement in a plastic tank

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



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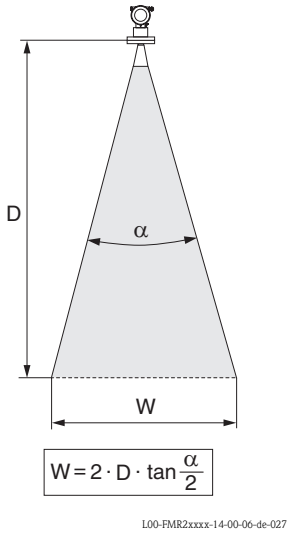
Please contact Endress+Hauser for further information.

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)



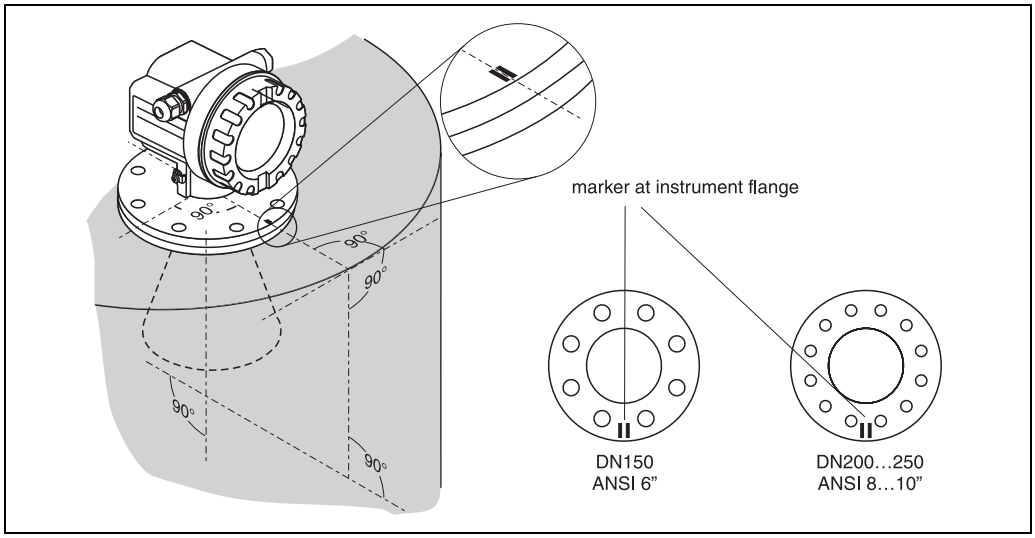
L00-FMR2xxxx-14-00-06-de-027

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

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

Installation in tank (free space) FMR230

Optimum mounting position



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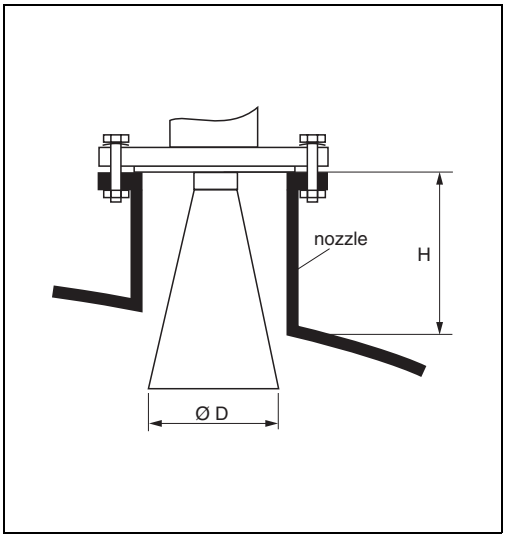
Standard installation

- Observe installation instructions on Page 22.
- 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.

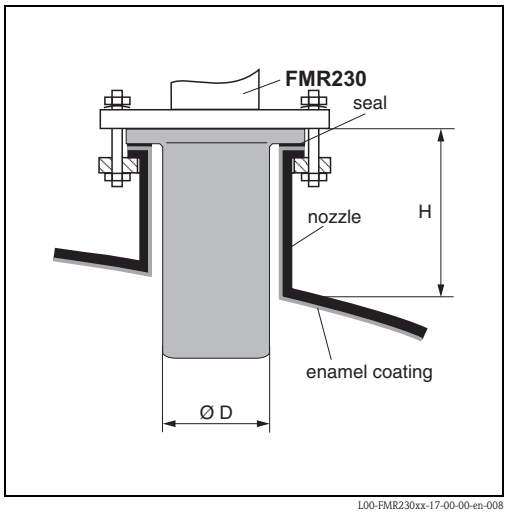


L00-FMR230xx-17-00-00-en-002

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.

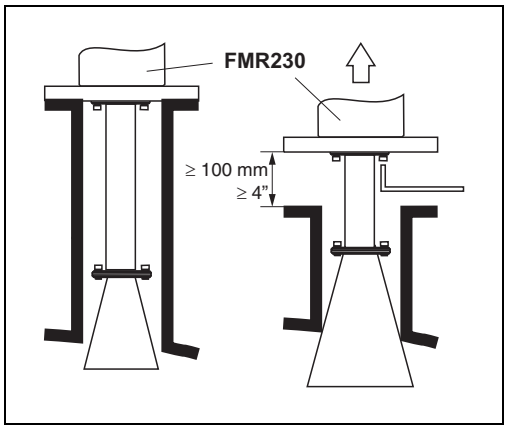


L00-FMR230xx-17-00-00-en-008

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.

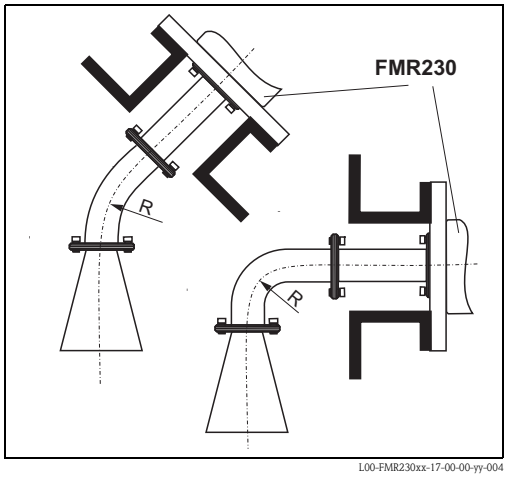


L00-FMR230xx-17-00-00-en-003

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").

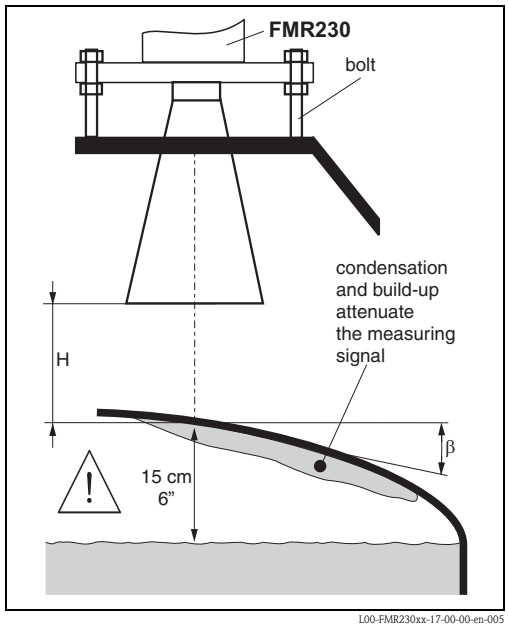
Please contact Endress+Hauser for further information.



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.

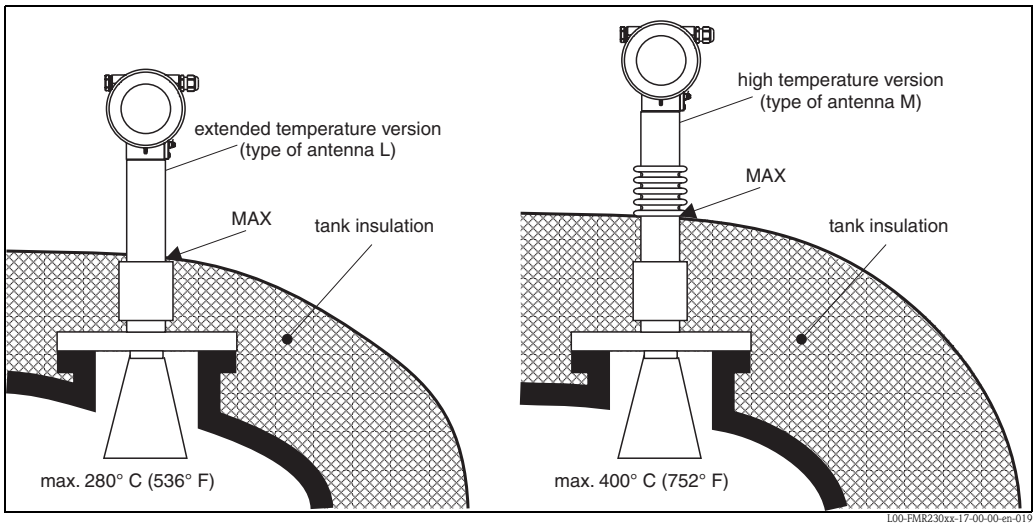


L00-FMR230xx-17-00-00-en-005

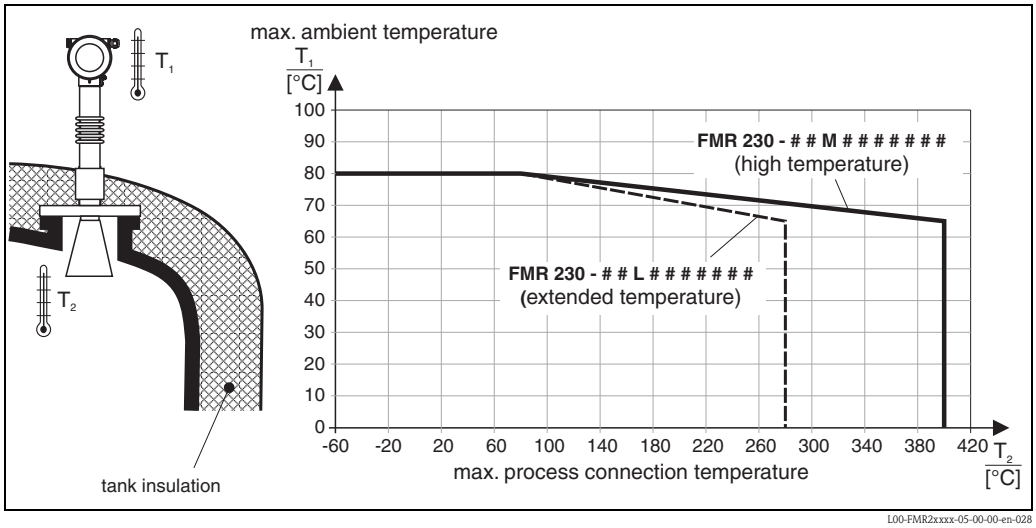
Penetrated material	PE	PTFE	PP	Perspex
DK / εr	2.3	2.1	2.3	3.1
Optimum thickness [mm (inch)][1)]	15.7 (0.62)	16.4 (0.65)	15.7 (0.62)	13.5 (0.53)

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

Installation FMR230 with heat insulation



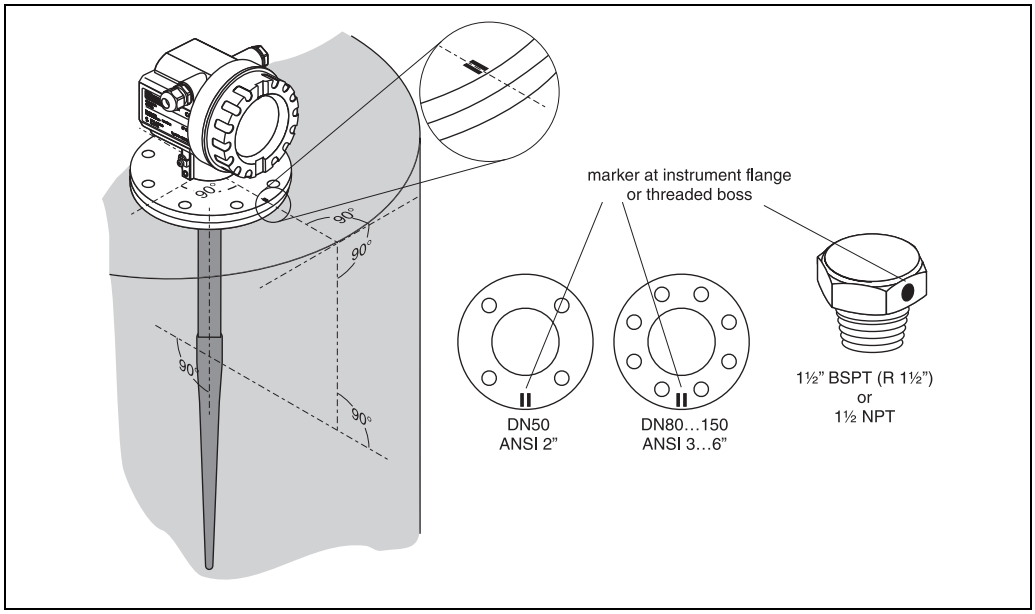
- To avoid the electronics heating up as a result of heat radiation or convection, the FMR230 must be incorporated into the tank insulation at high process temperature (≥ 200° C (≥ 392 °F)).
- The isolation should nod exceed the points marked with "**MAX**" within the scetch.



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

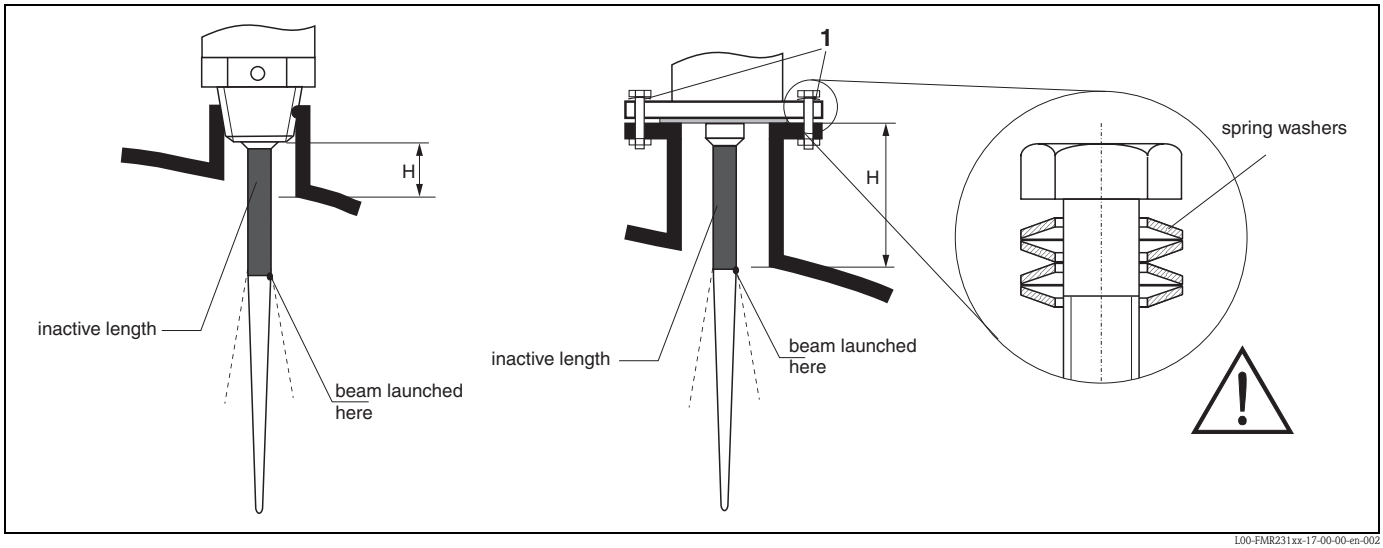
Optimum mounting position



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

Standard installation

- Observe installation instructions on Page 22.
- 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.

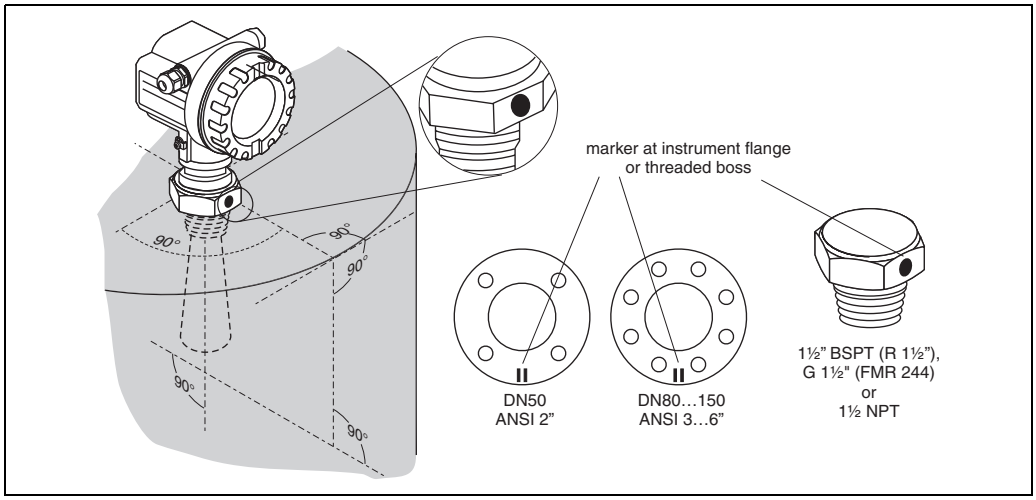


L00-FMR231xx-17-00-00-en-002

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

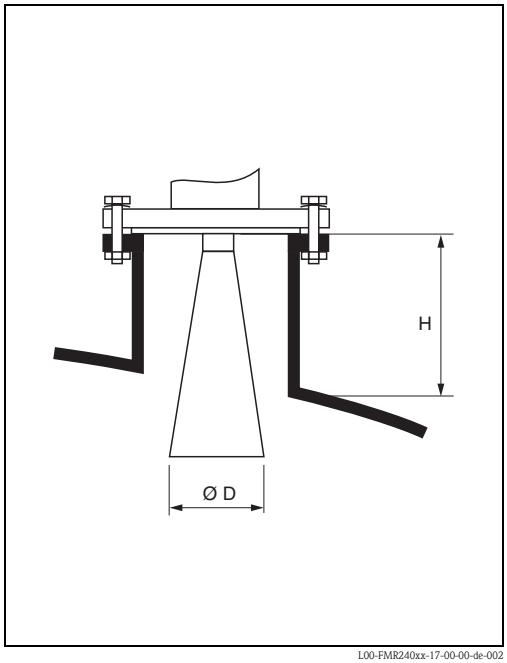
Optimum mounting position



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

Standard installation FMR240

- Observe installation instructions on Page 22.
- 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 (). Nozzle heights up to 500 mm (20")can be accepted if this should not be possible due to mechanical reasons.
  Note!
  Please contact Endress+Hauser for application with higher nozzle.
- **The 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

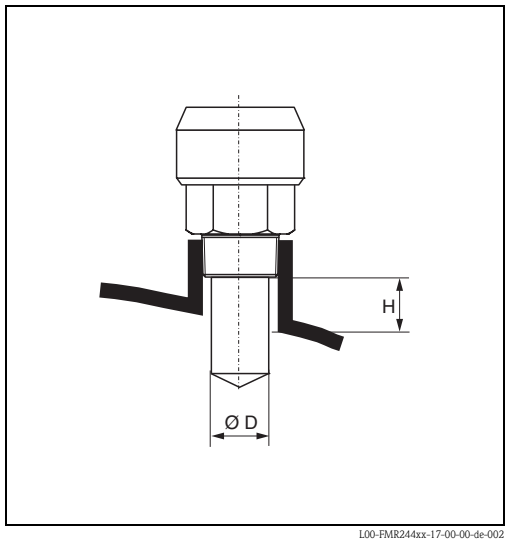
- Observe instructions on Page 22.
- If possible, use an antenna 100 mm (4").

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

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

Standard installation FMR244 - 40 mm / 1½" antenna

- Observe installation instructions on Page 22.
- 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 (20") can be accepted if this should not be possible due to mechanical reasons.
  Note!
  Please contact Endress+Hauser for application with higher nozzle.
- The antenna must be aligned vertically.

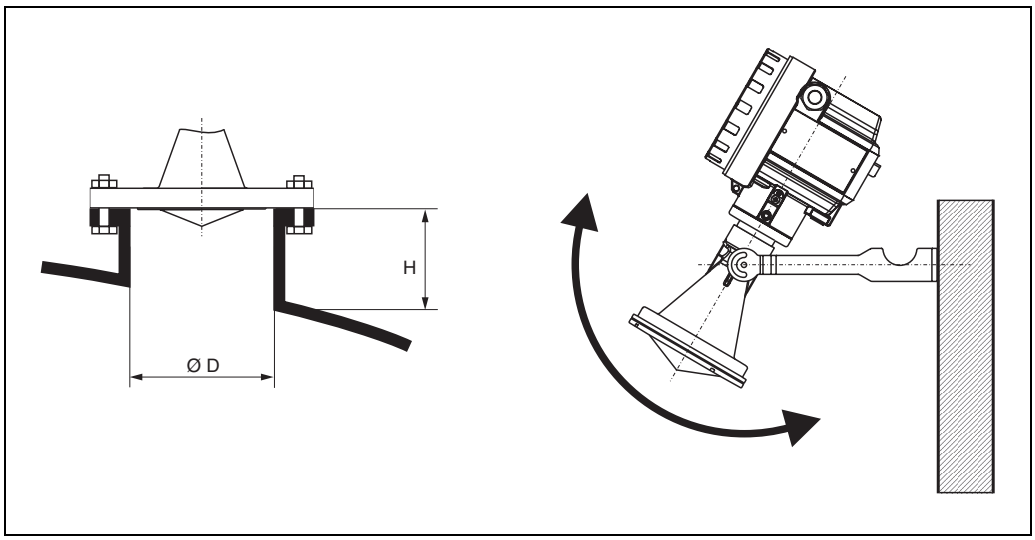


L00-FMR244xx-17-00-00-de-002

Antenna size	40 mm (1½")
D [mm (inch)]	39 (1.5)
H [mm (inch)]	< 85 (< 3.4)

Standard installation FMR244 - 80 mm / 3" antenna

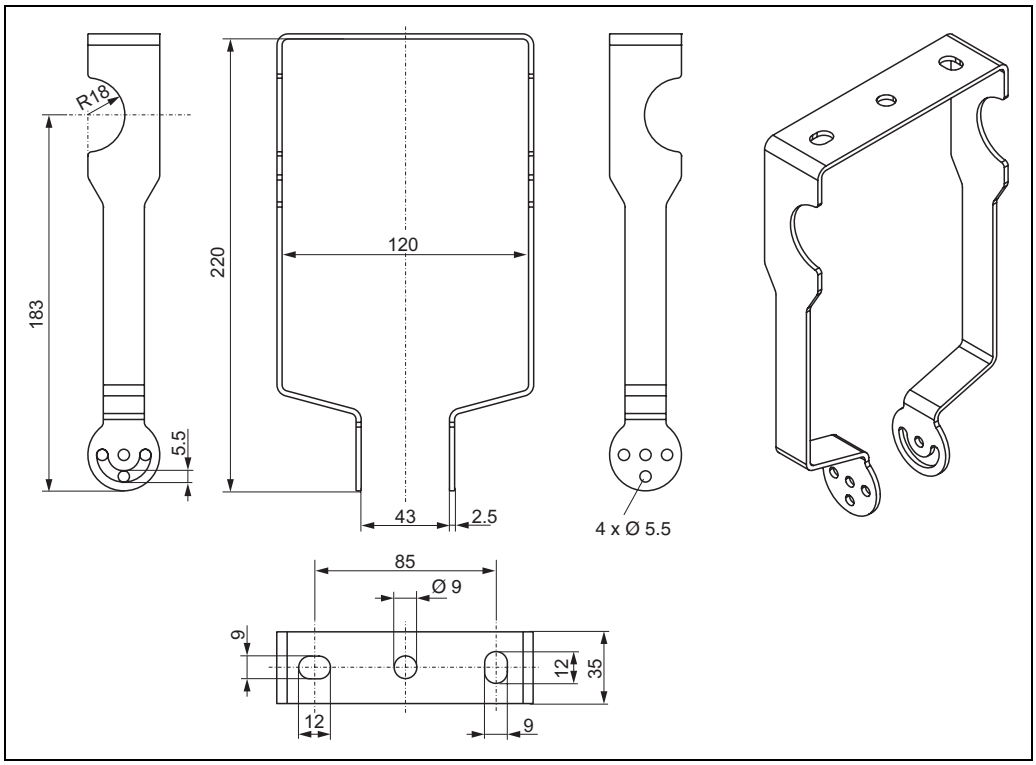
- Observe installation instructions on Page 22.
- Marker is aligned towards tank wall.
- The marker is located directly below the housing neck on the stainless steel feedthrough.
- As an option for flange mounting, a variable flange seal ("see Accessories") can be used to align the device (solid applications).
- If using a mounting bracket, the device can be aligned at the bracket (solid applications).
- After mounting (flange), the housing can be turned 350° in order to simplify access to the display and the terminal compartment.



L00-FMR244xx-17-00-00-xx-011

Antenna size	80 mm (3")		
D [mm (inch)]	80 (3)	100 (4)	150 (6)
H [mm (inch)]	< 500 (< 20)	< 500 (< 20)	< 500 (< 20)

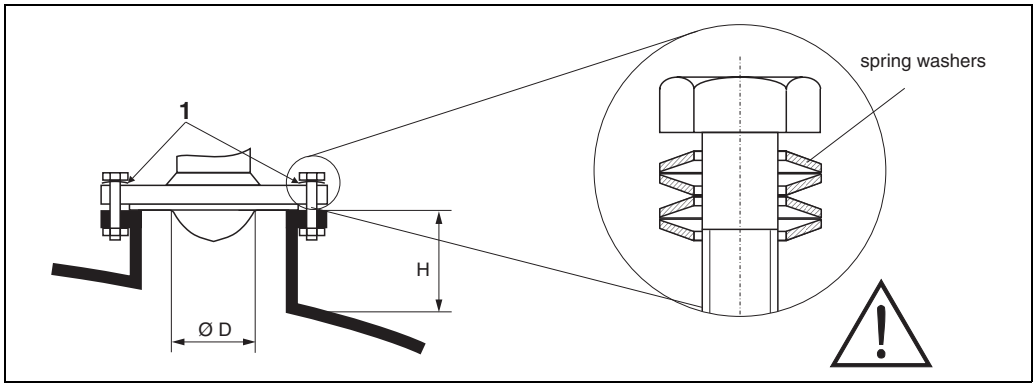
Mounting bracket
Dimensions:



Note!
T12 housing mounting limited only.

Standard installation FMR245

- Observe installation instructions on Page 22.
- 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.



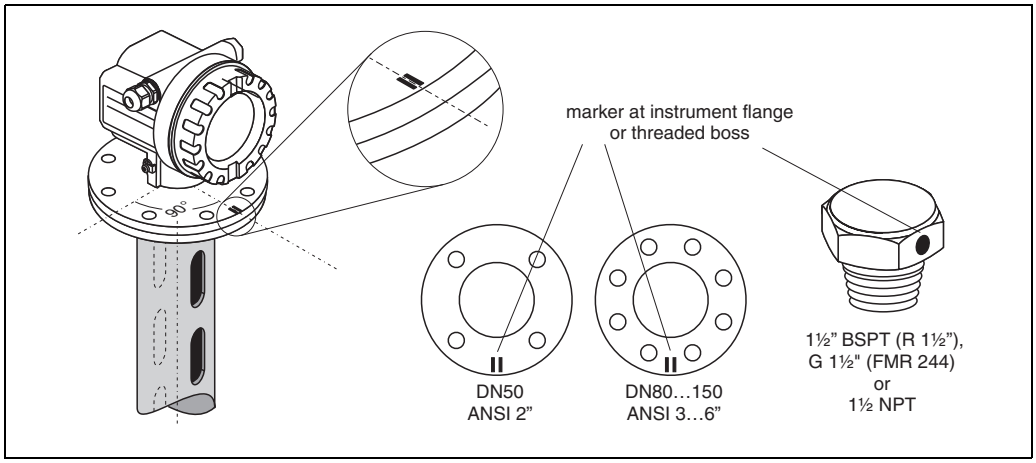
L00-FMR245xx-17-00-00-de-002

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

Antenna size	50 mm (2")	80 mm (3")
D [mm (inch)]	48 (1.9)	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

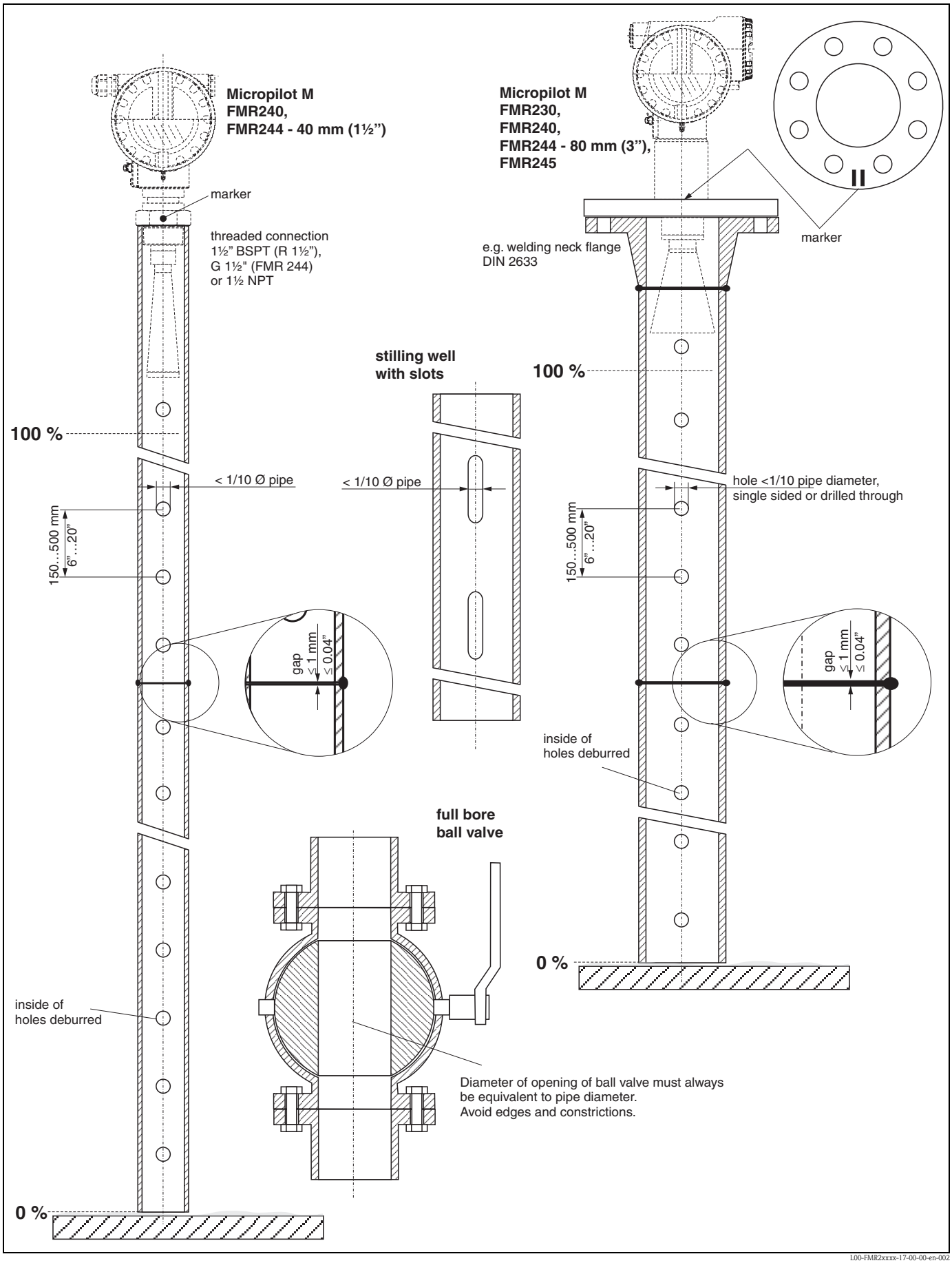
Standard installation

- 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 22.

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 ≤ 6.3 µm). 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).

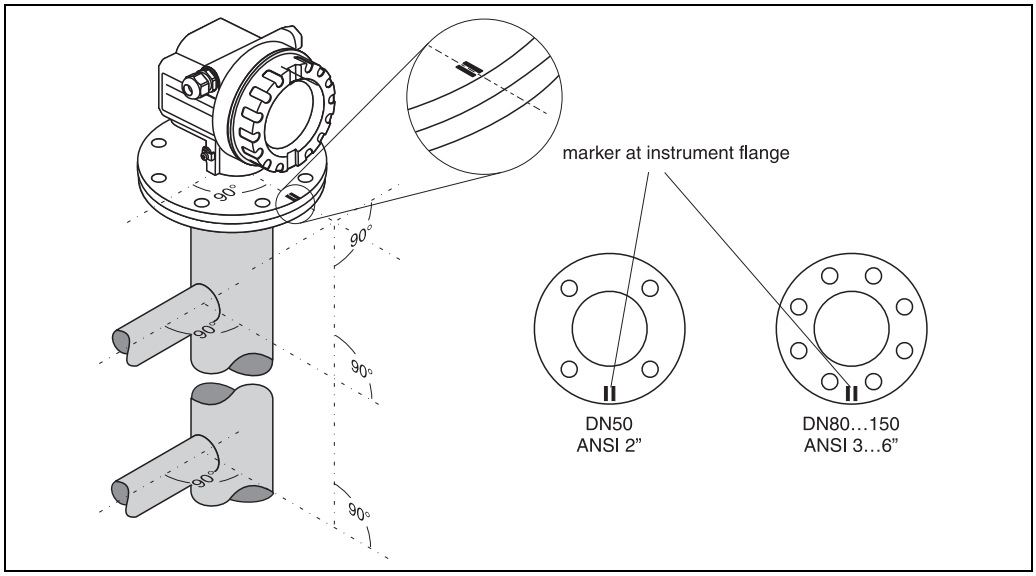
Examples for the construction of stilling wells



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

Installation in bypass FMR230, FMR240, FMR245

Optimum mounting position



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

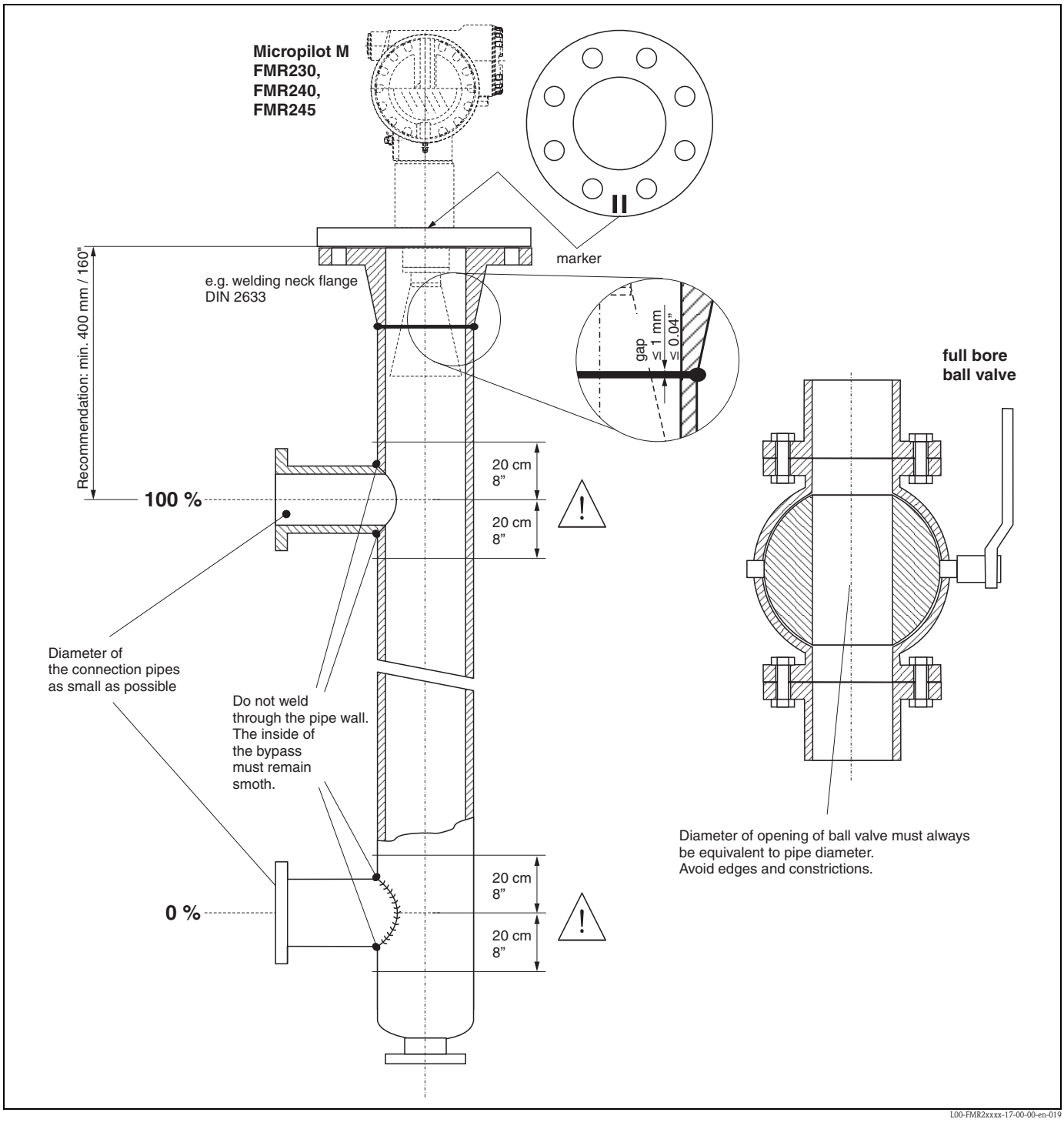
Standard installation

- 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 22.

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 $(m/s^2)^2/Hz$ (FMR230/231; FMR240; FMR245; FMR244 with 40 mm (1½") antenna)
- 20…2000 Hz, 0.5 $(m/s^2)^2/Hz$ (FMR244 with 80 mm (3") antenna)

Cleaning of the antenna

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

Electromagnetic compatibility (EMC)

- Electromagnetic compatibility to EN 61326 and NAMUR recommendation EMC (NE 21). For details refer to the declaration of conformity.
- 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

Note!
The specified rage may be reduced by the selected process connection. The pressure rating (PN) specified on the flanges refers to a reference temperature of 20 °C, for ASME flanges to 100 °F. Observe pressure-temperature dependency.
The pressure values permitted at higher temperatures can be found in the following standards:
- EN 1092-1: 2001 Tab. 18
  With regard to their temperature stability properties, the materials 1.4435 and 1.4404 are grouped under 13E0 in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.
- ASME B 16.5a - 1998 Tab. 2-2.2 F316
- ASME B 16.5a - 1998 Tab. 2.3.8 N10276
- JIS B 2220

	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 59

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 62

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 65

	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
	S	Standard, PP clad	Silicone	–40 °C ... +80 °C (–40 °F ... +176 °F)		PP, Silicone, PBT

↑

Ordering information see Page 67

	Type of antenna		Seal	Temperature	Pressure	Wetted parts
FMR245	**3, 4**	Standard, PTFE clad	none	–40 °C ... +200 °C (–40 °F ... +392 °F)	–1 ... 16 bar (...232 psi)	PTFE (TFM1600, FDA-listed) [1) 2)]

↑

Ordering information see Page 70

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

2) meets USP Class VI conformity

Dielectric constant

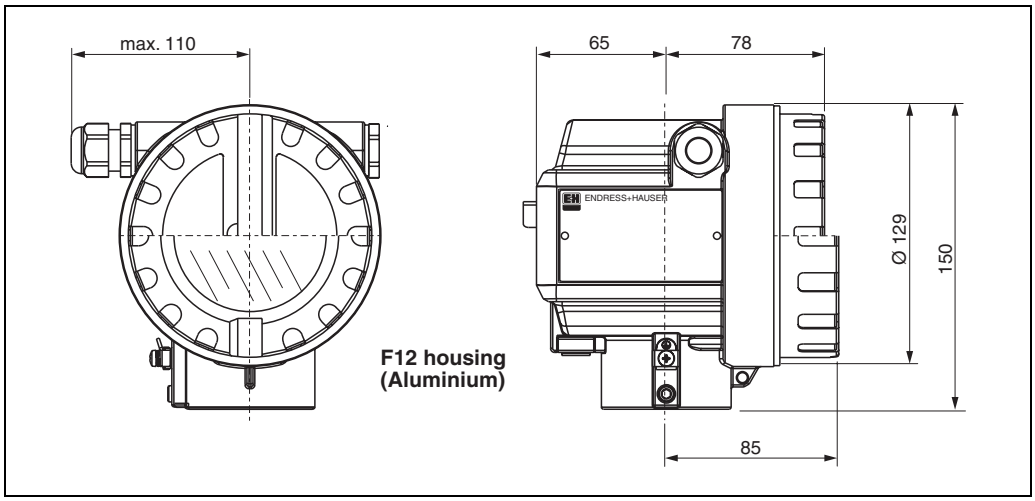
- in a stilling well: $\varepsilon r \geq 1{,}4$
- in free space: $\varepsilon r \geq 1{,}9$

Mechanical construction

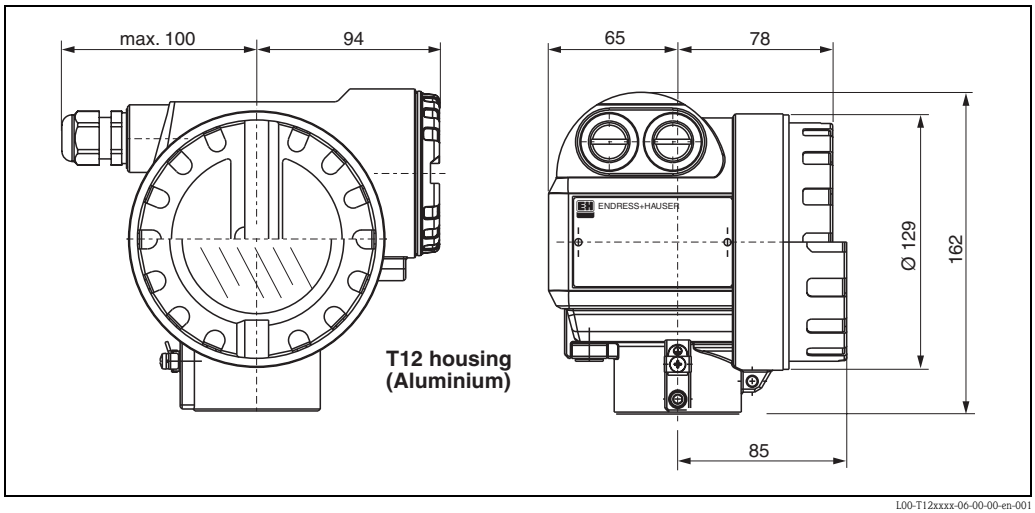
Design, dimensions

Housing dimensions

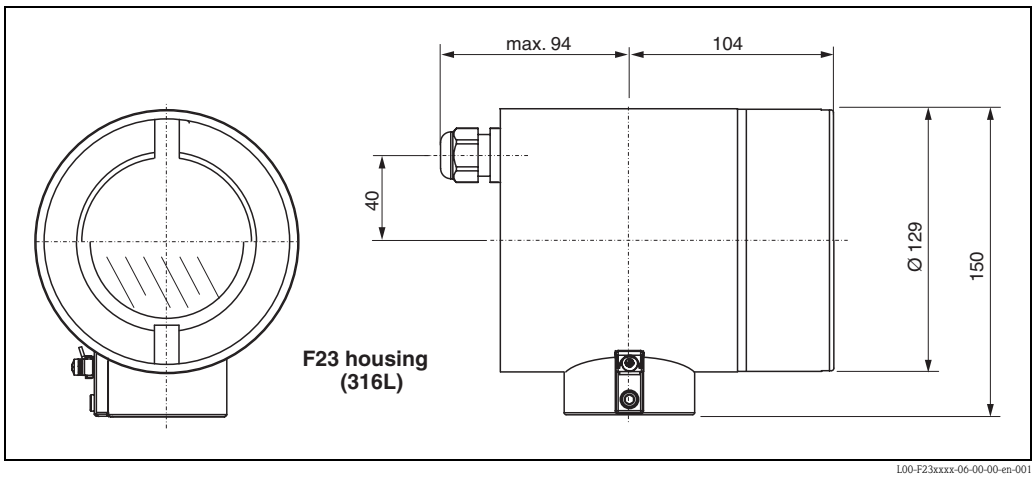
Dimensions for process connection and type of antenne –.



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



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

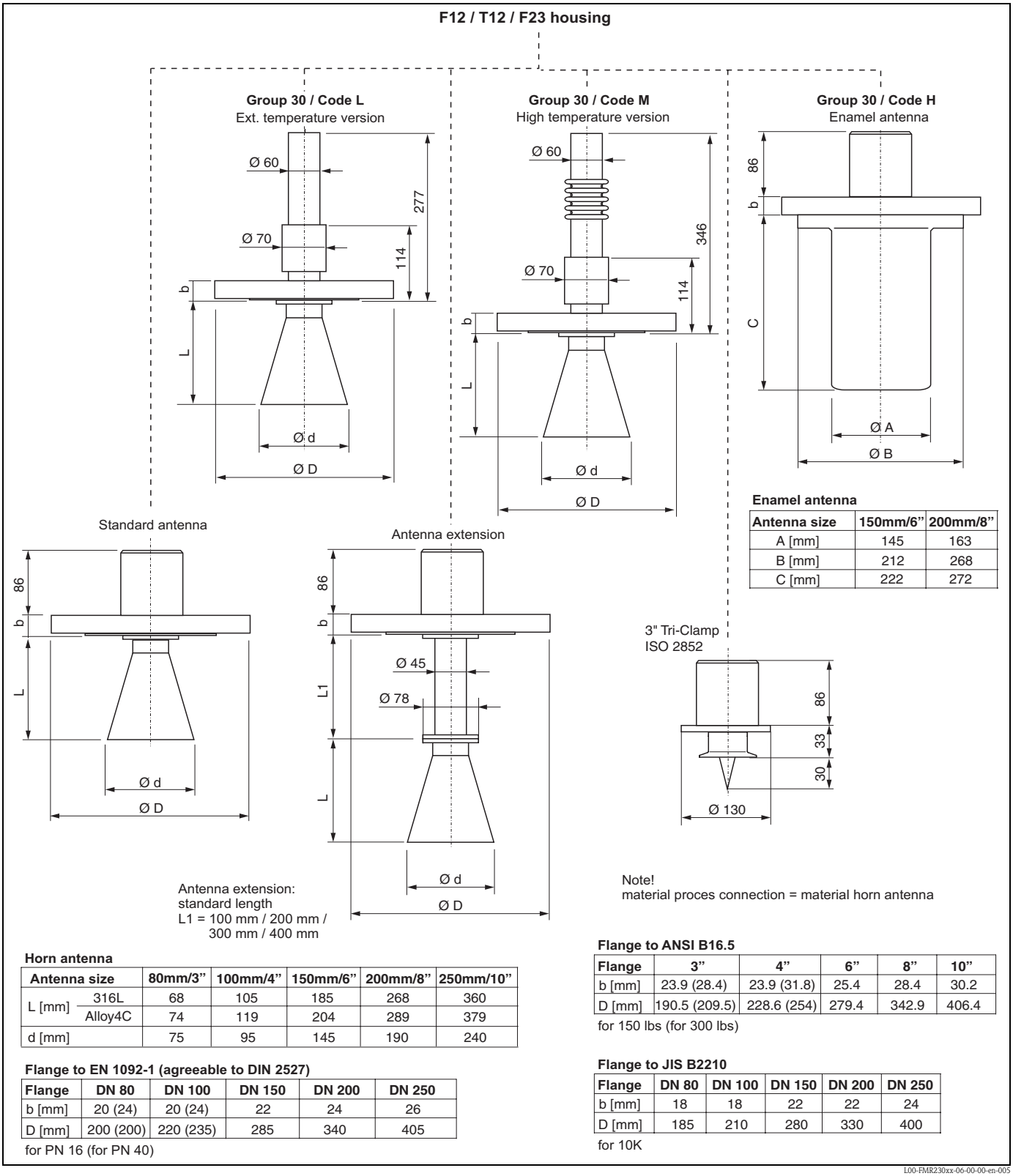


L00-F23xxxx-06-00-00-en-001

Micropilot M FMR230 - process connection, type of antenna

Housing dimensions see Page 41.

F12 / T12 / F23 housing



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

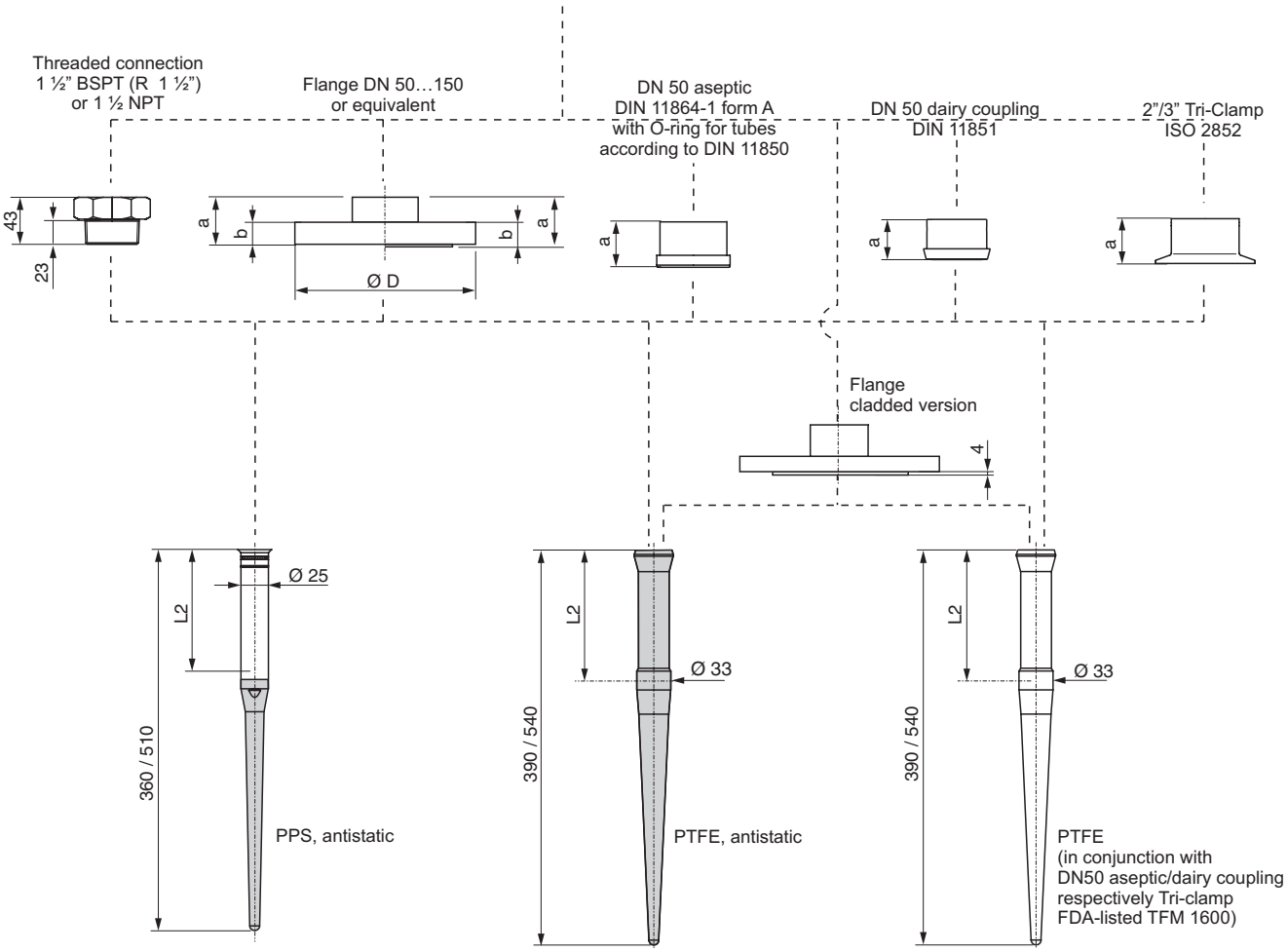
for 10K

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

Micropilot M FMR231 - process connection, type of antenna

Housing dimensions see Page 41.

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

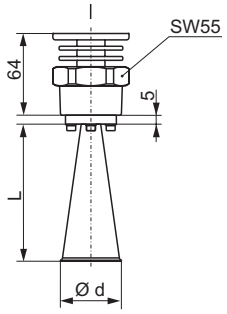
Micropilot M FMR240 - process connection, new type of antenna

Housing dimensions see Page 41.

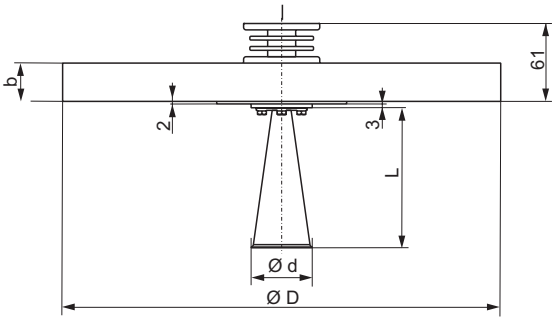
F12 / T12 / F23 housing

Group 20 / Code E, F, G, H - not for Group 10 / Code L, D, E, I, J, R

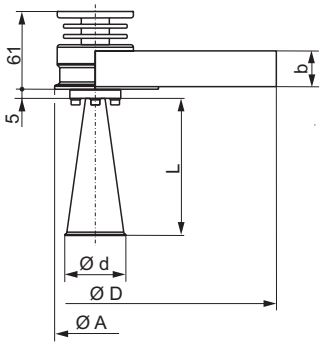
Screw-in adapter, compact
R 1½" or 1½" NPT



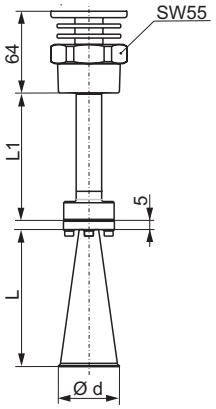
Flange plated
DN 50 ... 150
or equivalent



2" + 3"
Tri-Clamp
ISO 2852
flange DN 50 ... 150
or equivalent

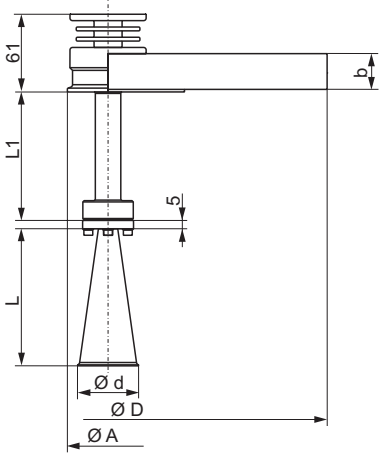


Screw-in adapter
R 1½" or 1½" NPT



With tube extension:
L1 = 100 mm

2" + 3"
Tri-Clamp
ISO 2852
flange DN 50 ... 150
or equivalent



Horn antenna

Antenna size	**40 mm /1"**	**50 mm / 2"**	**80 mm /3"**	**100 mm / 4"**
L [mm]	86	115	211	282
d [mm]	40	48	75	95

Note!
material proces connection = material horn antenna

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 (für PN 40)

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

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)

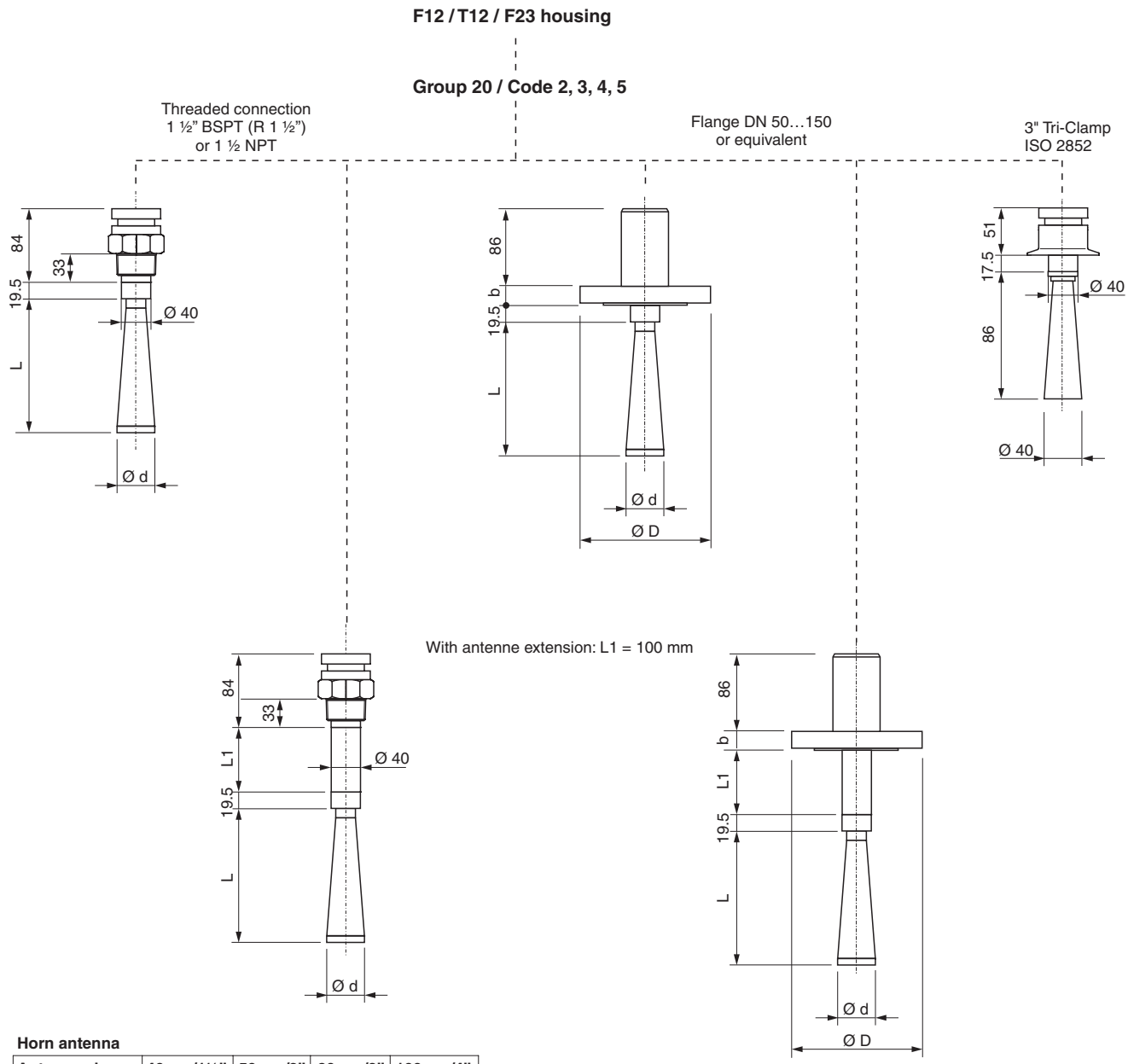
Tri - Clamp to ISO 2852

Clamp	**2"**	**3"**
A	64	91

L00-FMR240xx-06-00-00-en-006

Micropilot M FMR240 - process connection, old type of antenna

Housing dimensions see Page 41.



Horn antenna

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

Note!
material proces connection = material horn antenna

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

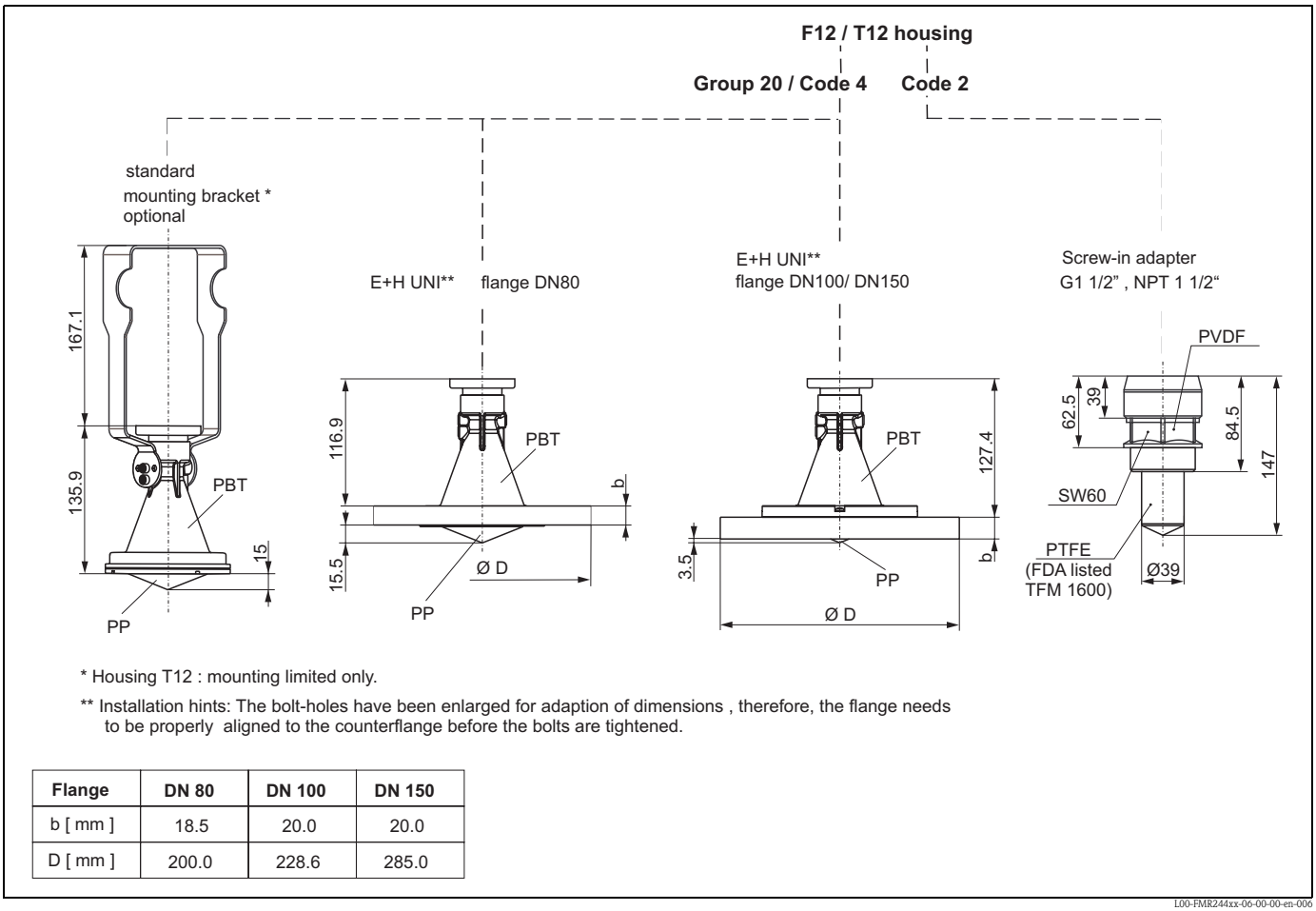
Flange	DN 50	DN 80	DN 100	DN 150
b [mm]	16	18	18	22
D [mm]	155	185	210	280

for 10K

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

Micropilot M FMR244 - process connection, new type of antenna

Housing dimensions see Page 41.



* Housing T12 : mounting limited only.

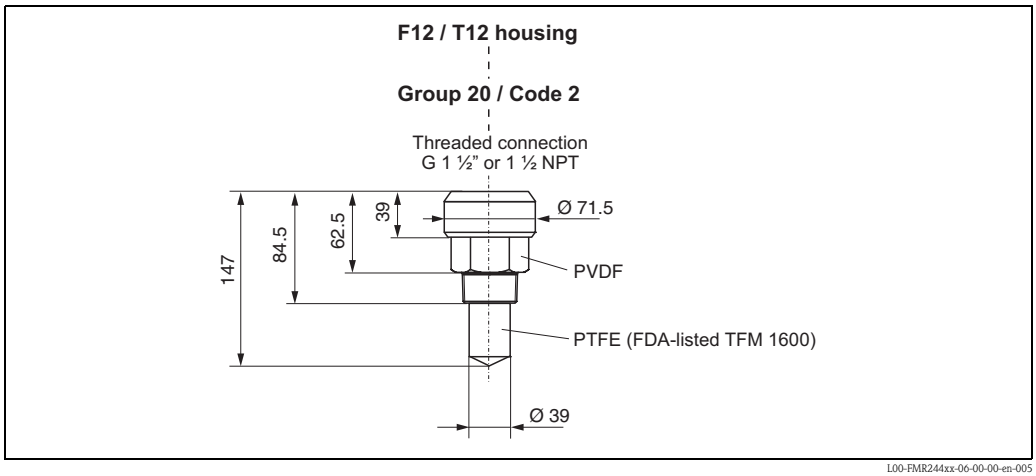
** Installation hints: The bolt-holes have been enlarged for adaption of dimensions , therefore, the flange needs to be properly aligned to the counterflange before the bolts are tightened.

Flange	DN 80	DN 100	DN 150
b [mm]	18.5	20.0	20.0
D [mm]	200.0	228.6	285.0

L00-FMR244xx-06-00-00-en-006

Micropilot M FMR244 - process connection, old type of antenna

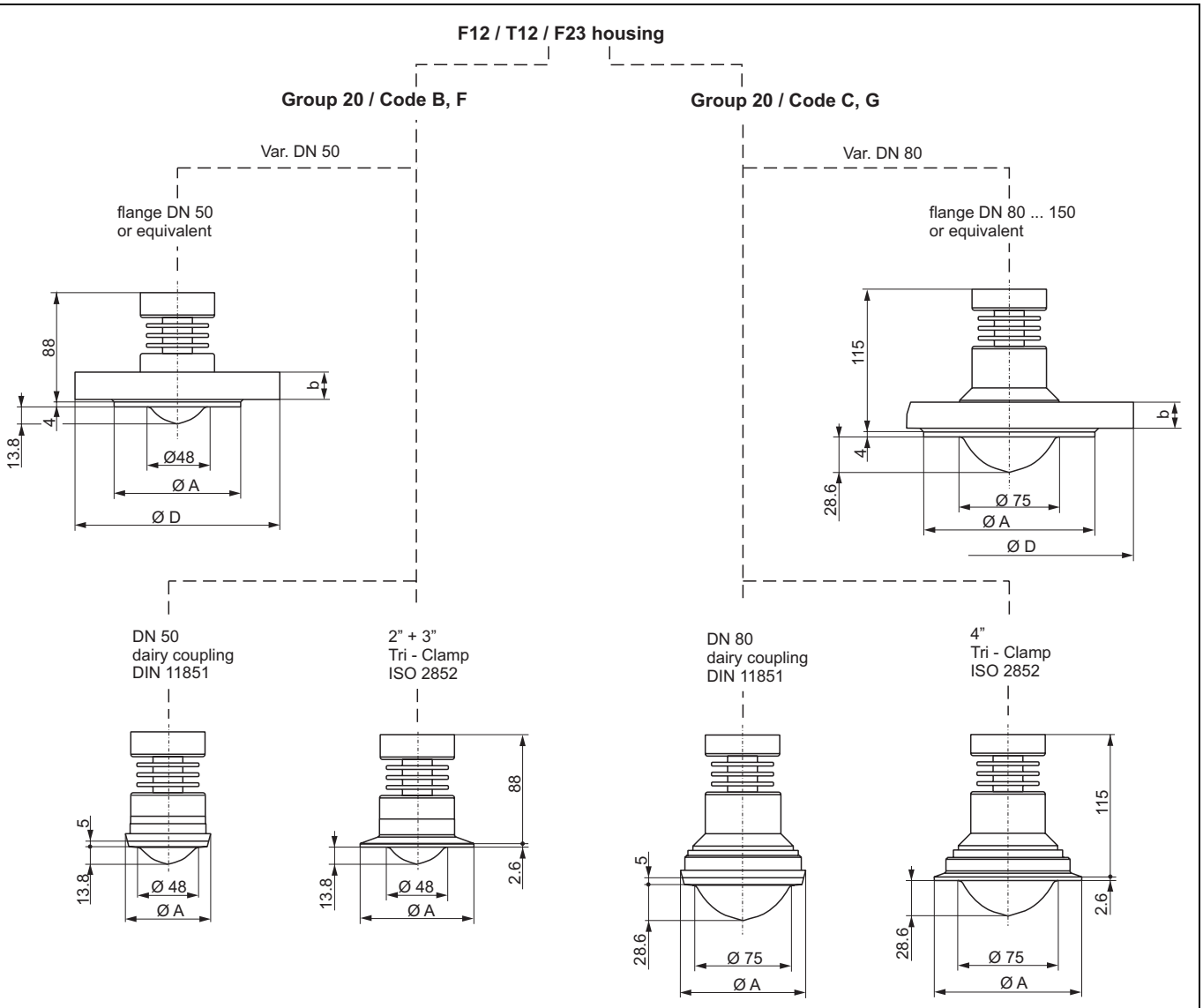
Housing dimensions see Page 41.



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

Micropilot M FMR245 - process connection, new type of antenna

Housing dimensions see Page 41.



plating from PTFE (FDA - listed TFM 1600, meets USP Class VI conformity)

Flange to EN 1092-1 (agreeable to DIN 2572)

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

for PN 16

Flange to JIS B2220

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 10K

Flanges 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

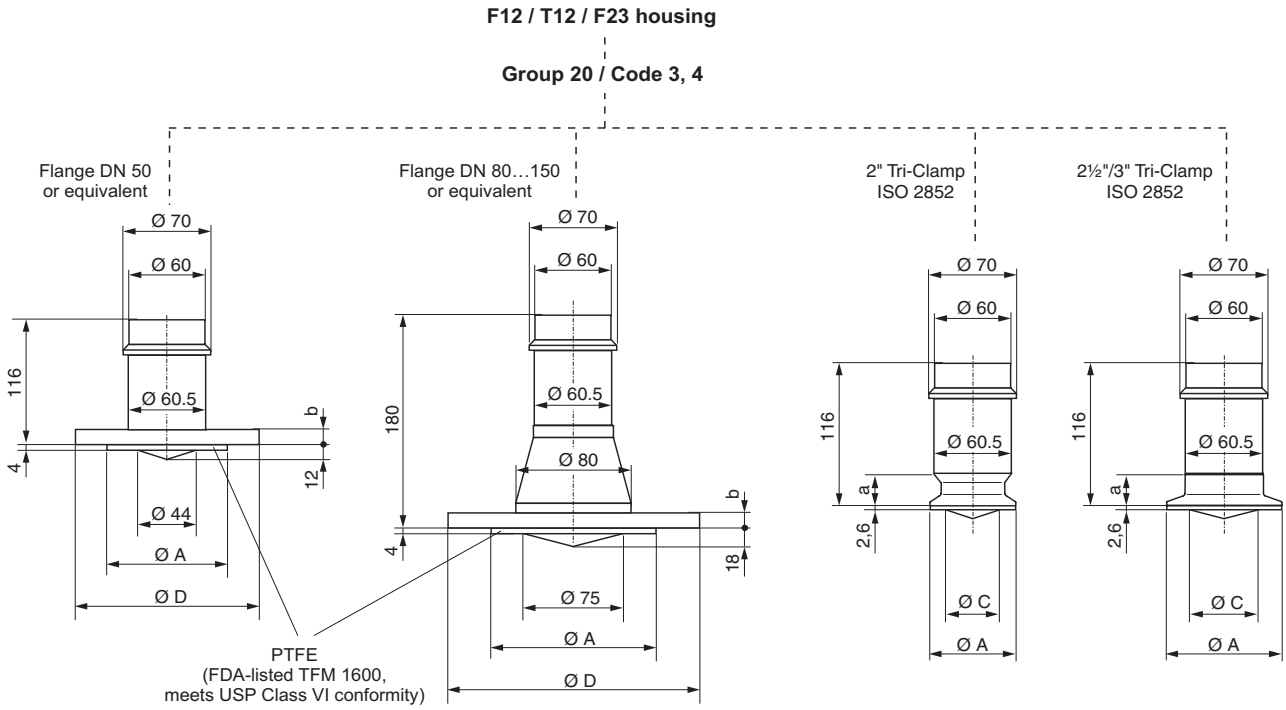
Tri - Clamp and dairy coupling

Tri-clamp	2"	3"	4"
A [mm]	64	91	119
dairy coupling		**DN 50**	**DN 80**
A [mm]		68.5	100

L00-FMR245xx-06-00-00-en-006

Micropilot M FMR245 - process connection, old type of antenna

Housing dimensions see Page 41.



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, powder-coated
  - housing F23: 316L, corrosion-resistant steel
- Sight window: glass
- Flange:
  Endress+Hauser supplies DIN/EN flanges made of stainless steel AISI 316L with the material number 1.4435 or 1.4404. With regard to their temperature stability properties, the materials 1.4435 and 1.4404 are grouped under 13E0 in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.

Process connection

See "Ordering information" on Page 59-71.

Seal

See "Ordering information" on Page 59-71.

Antenna

See "Ordering information" on Page 59-71.

Human interface

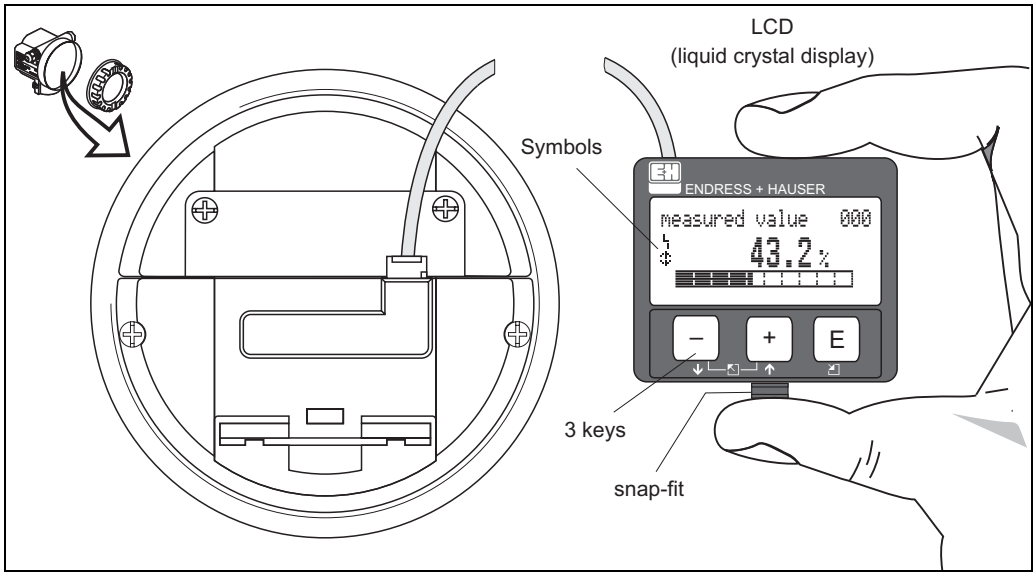
Operation concept

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

Operating elements

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

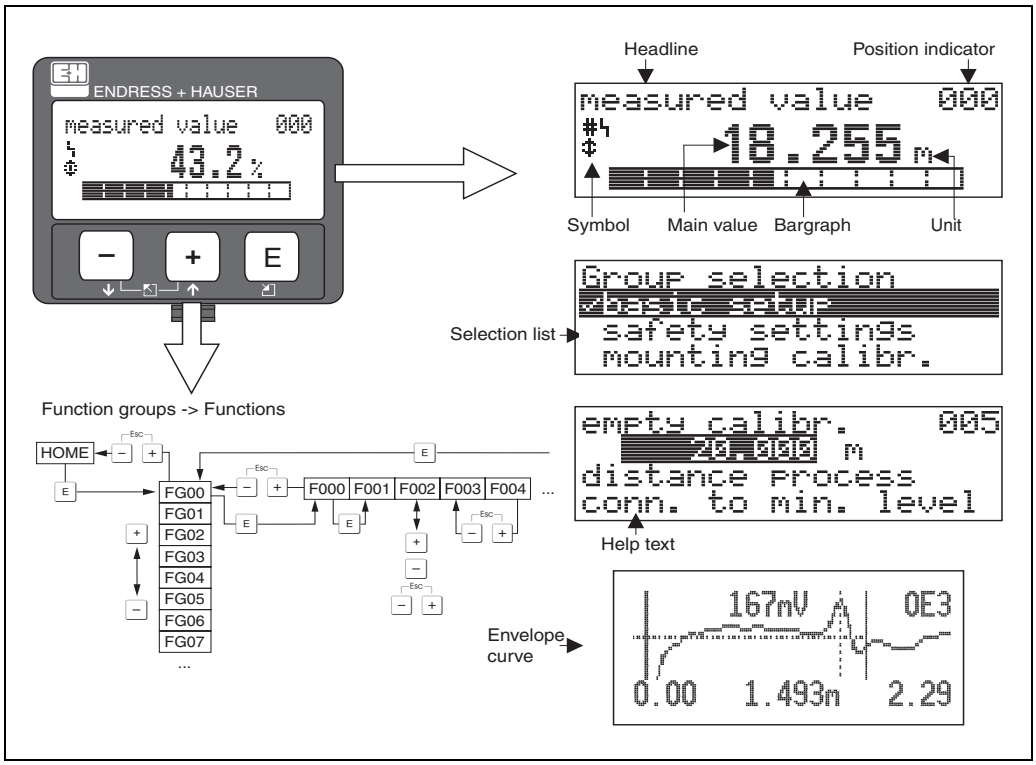
Function of the keys

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

On-site operation

Operation with VU331

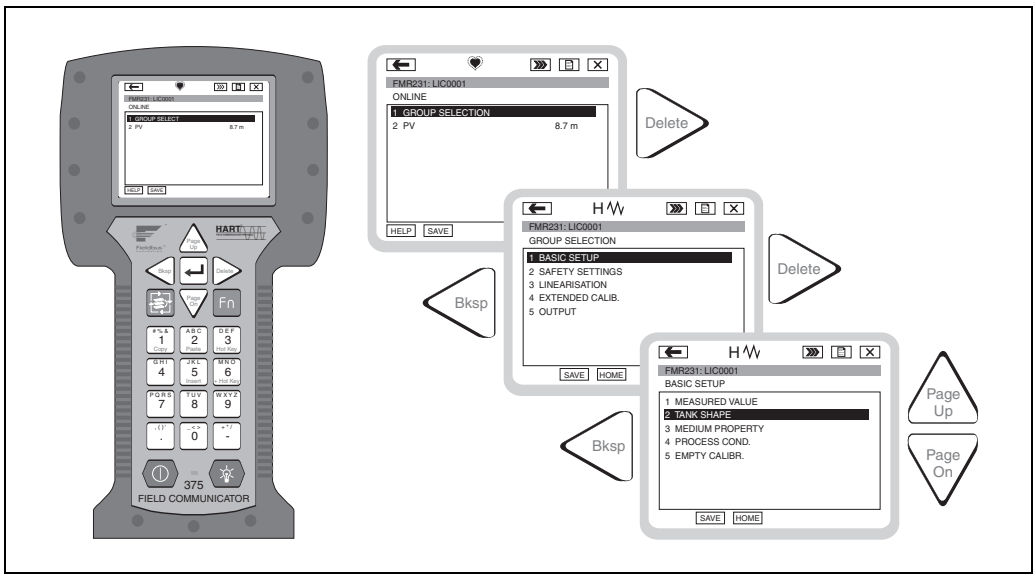
The LC-Display VU331 allows configuration via 3 keys directly at the instrument. All device functions can be set through a menu system. The menu consists of function groups and functions. Within a function, application parameters can be read or adjusted. The user is guided through a complete configuration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

ToF Tool – Fieldtool Package

The ToF Tool is a graphic and menu-guided operating program for measuring devices from Endress+Hauser. It is used for the commissioning, data storage, signal analysis and documentation of the devices. The following operating systems are supported: WinNT4.0, Win2000 and Windows XP. You can set all parameters via the ToF Tool.

The ToF Tool supports the following functions:
- Configuration of transmitters in online operation
- Singal analysis via envelope curve
- Tank linearisation
- Loading and saving device data (upload/download)
- Documentation of the measuring point

Connection options:
- HART via Commubox FXA191 and the RS 232 C serial interface of a computer
- HART via Commubox FXA195 and the USB port on a computer
- PROFIBUS PA via segment coupler and PROFIBUS interface card
- FOUNDATION Fieldbus, PROFIBUS PA and HART via the FXA193/FXA291 service interface

Note!
You can use the ToF Tool to configure the Endress+Hauser parameters for devices with "FOUNDATION Fieldbus signal". You need an FF configuration program to be able to configure all the FF-specific parameters and to integrate the device into an FF network.

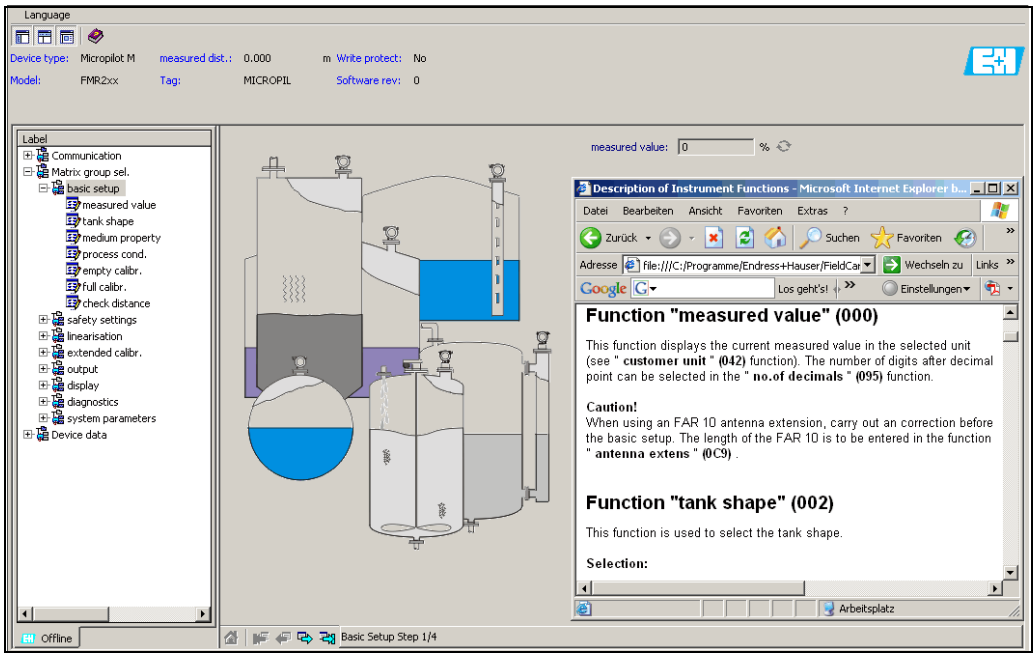
FieldCare

FieldCare is an Endress+Hauser asset management tool based on FDT technology. With FieldCare, you can configure all Endress+Hauser devices as well as devices from other manufacturers that support the FDT standard. The following operating systems are supported: WinNT4.0, Win2000 and Windows XP.

FieldCare supports the following functions:
- Configuration of transmitters in online operation
- Singal analysis via envelope curve
- Tank linearisation
- Loading and saving device data (upload/download)
- Documentation of the measuring point

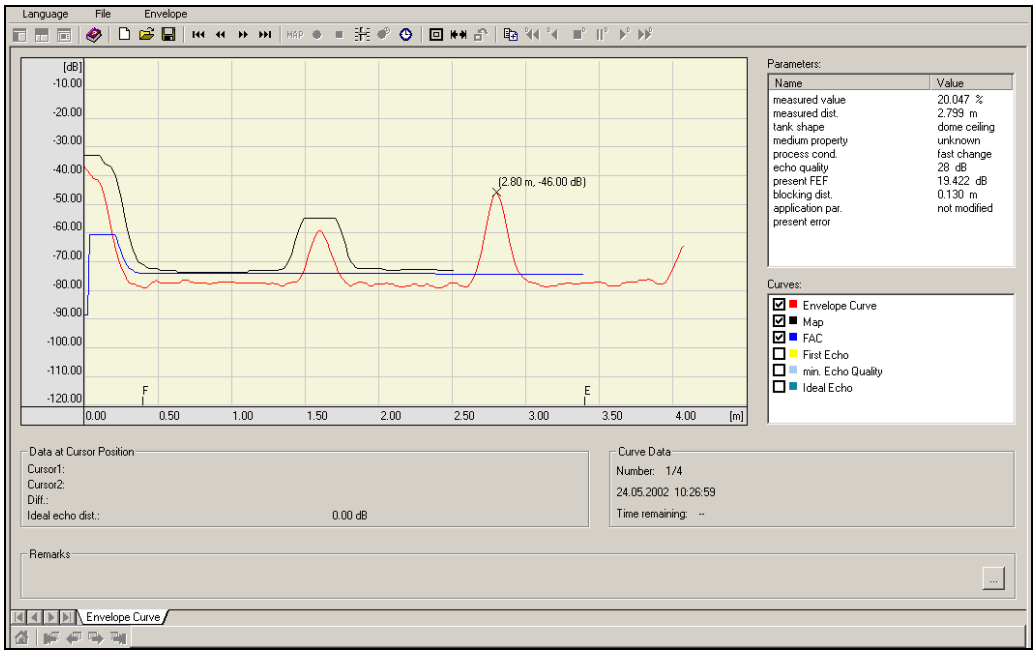
Connection options:
- HART via Commubox FXA191 and the RS 232 C serial interface of a computer
- HART via Commubox FXA195 and the USB port on a computer
- PROFIBUS PA via segment coupler and PROFIBUS interface card

Menu-guided commissioning



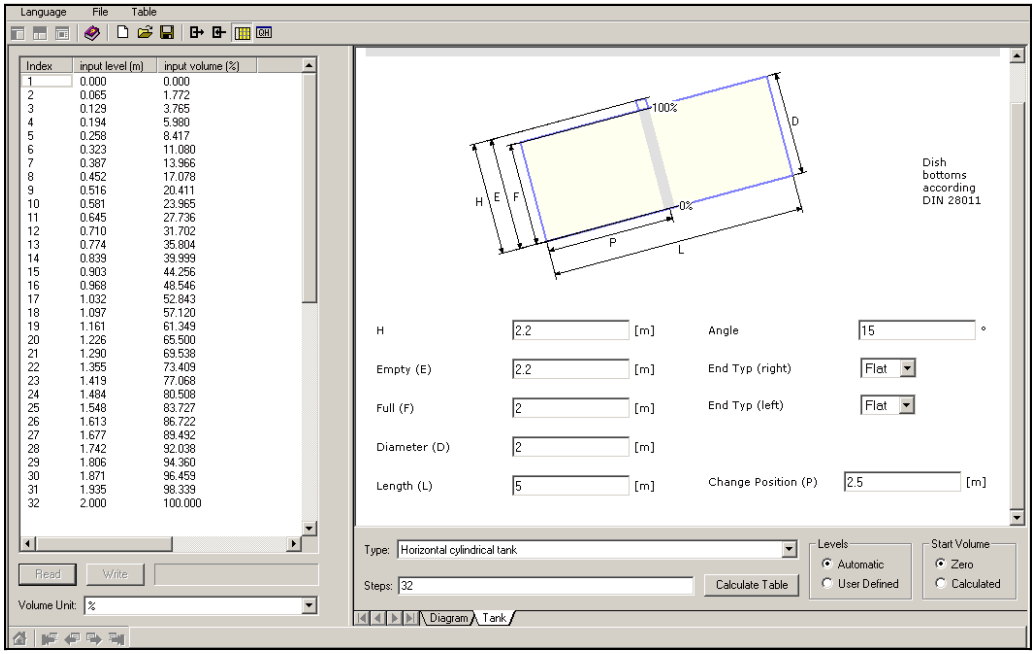
MicropilotM-en-305

Signal analysis via envelope curve



MicropilotM-en-306

Tank linearisation

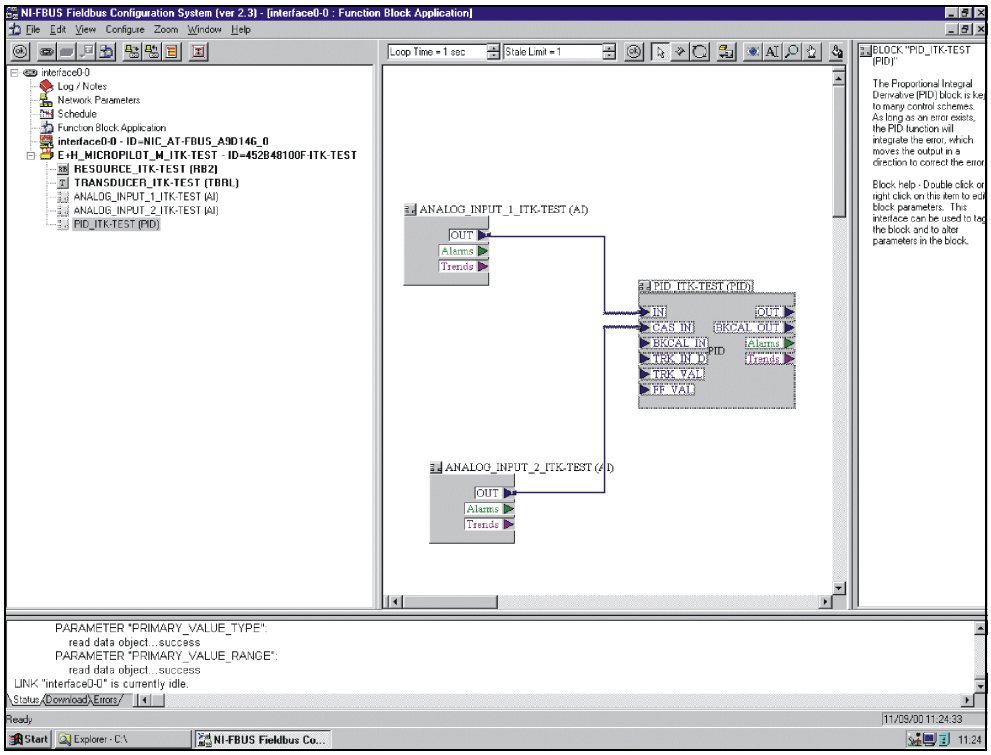


MicropilotM-en-307

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 59-71.

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 59-71 (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-X

EMC product family standard for electrical equipment for measurement, control and laboratory use.

NAMUR

User association for automation technology in process industries.

RF approvals

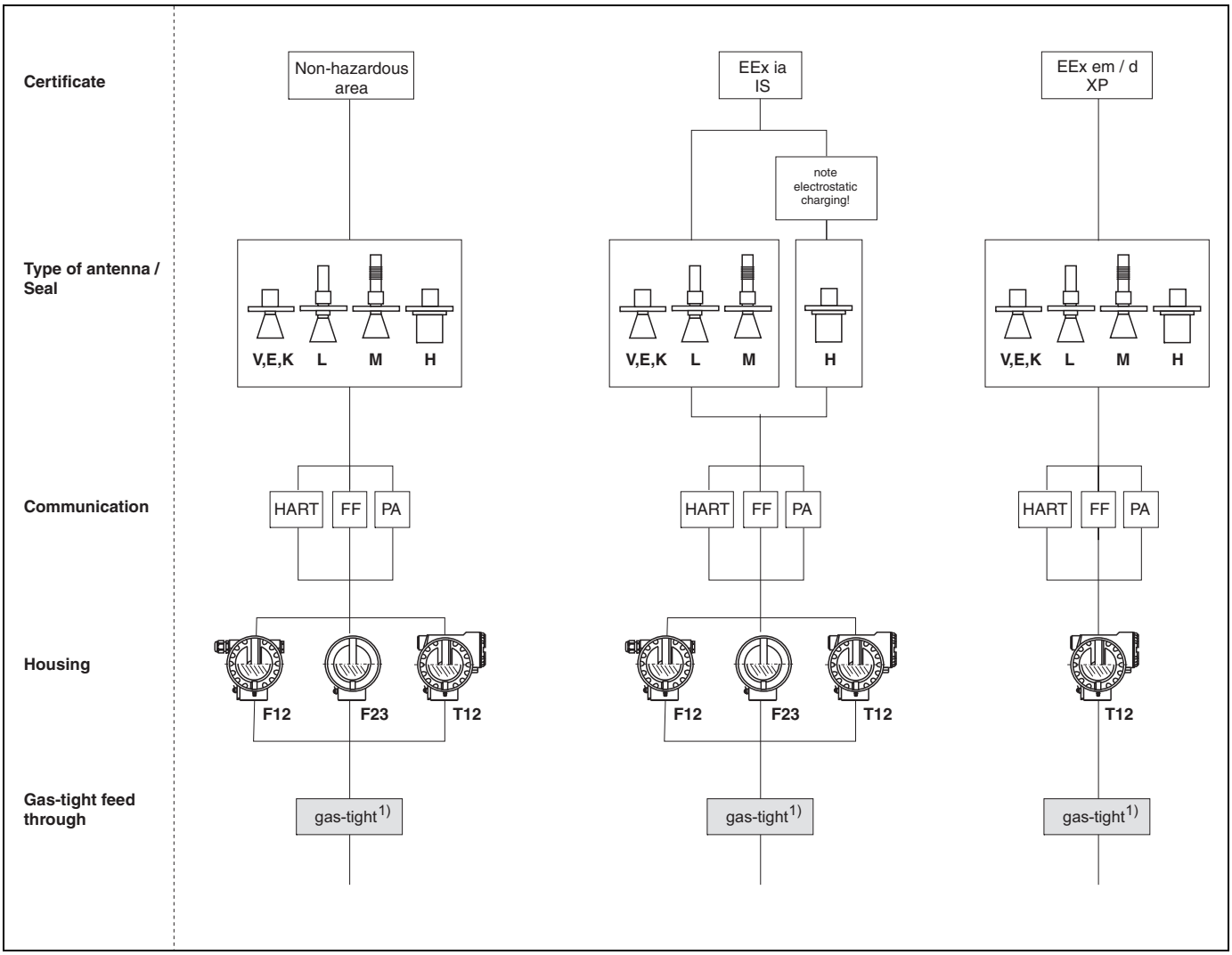
R&TTE, FCC

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**



gas-tight 1) = Standard

1) The gas-tight feedthrough of the device improves the process safety between the seal coupling the antenna to the process and the electronics compartment (connection compartment of the device).

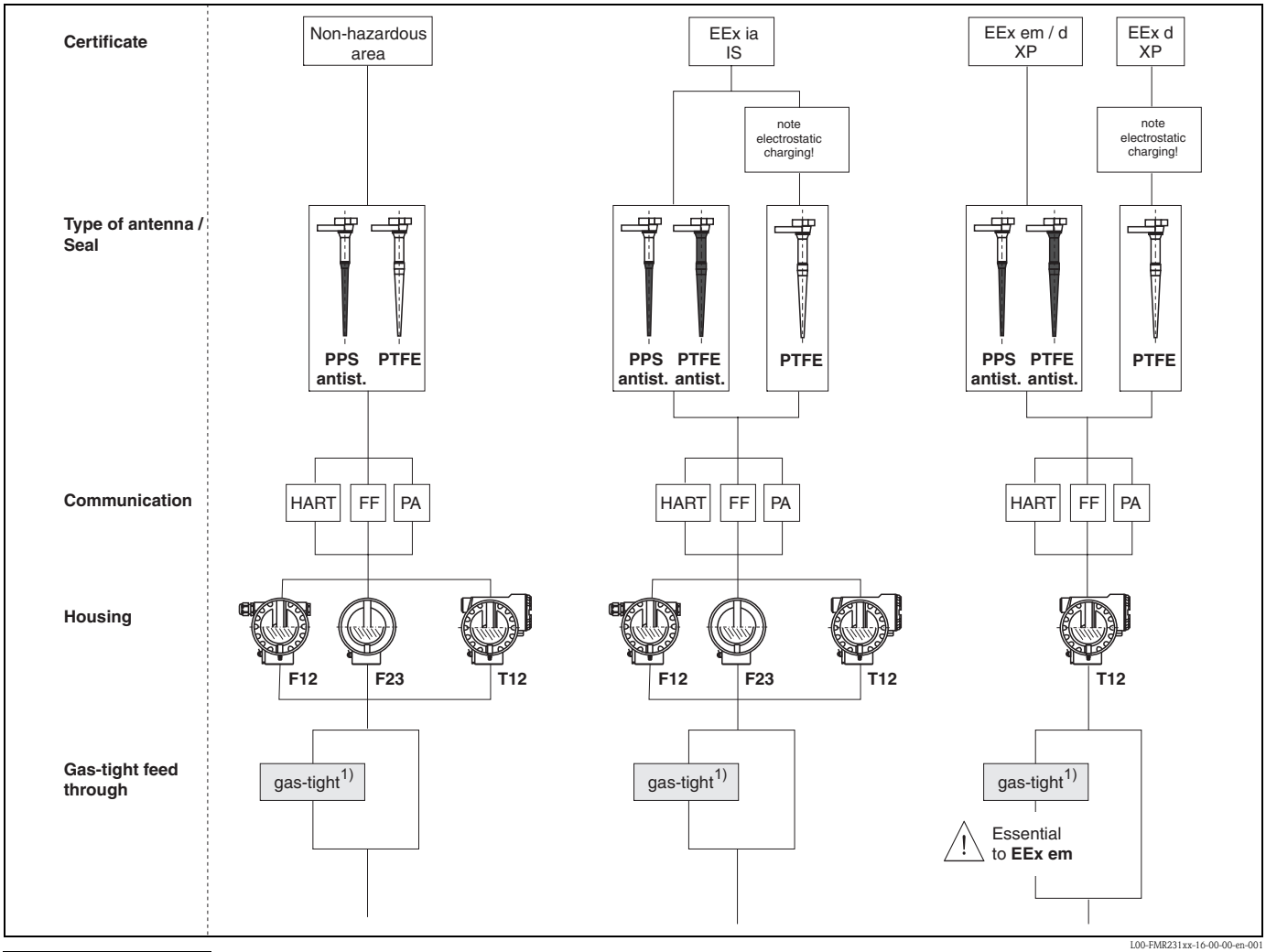
Ordering structure Micropilot M FMR230

10	**Approval:**								
	A	Non-hazardous area							
	F	Non-hazardous area, WHG							
	1	ATEX II 1/2 G Ex ia IIC T6, IECEx Zone 0/1							
	2	ATEX II 1/2 G Ex ia IIC T6, XA, IECEx Zone 0/1 Note safety instruction (XA) (electrostatic charging)!							
	3	ATEX II 1/2 G Ex em [ia] IIC T6, IECEx Zone 0/1							
	4	ATEX II 1/2 G Ex d [ia] IIC T6, IECEx Zone 0/1							
	6	ATEX II 1/2 G Ex ia IIC T6, WHG, IECEx Zone 0/1							
	7	ATEX II 1/2 G Ex ia IIC T6, WHG, XA, IECEx Zone 0/1 Note safety instruction (XA) (electrostatic charging)!							
	8	ATEX II 1/2 G Ex 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							
	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							
	Y	Special version, to be specified							
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, to be specified					
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:**					
				UKJ	2" 300lbs RF, 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				
				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				
				UV6	6" 150lbs FF, AlloyC4, Spülanschl. Flansch ANSI B16.5 NUS				
				YY9	Special version, to be specified				
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, to be specified			
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, to be specified		
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, to be specified	
80								**Additional Option:**	
								A	Basic version
								B	EN10204-3.1 material, watted parts (316L wetted parts) inspection certificate
								N	EN10204-3.1, material, NACE MR0175 (316L wetted parts) inspection certificate
								S	GL/ABS/NK marine certificate
								Y	Special version, to be specified
FMR230-									Complete product designation

Micropilot M FMR231 **Instrument selection**



gas-tight [1] = Standard

1) The gas-tight feedthrough of the device improves the process safety between the seal coupling the antenna to the process and the electronics compartment (connection compartment of the device).

Ordering structure Micropilot M FMR231

10	**Approval:**			
	A	Non-hazardous area		
	F	Non-hazardous area, WHG		
	1	ATEX II 1/2 G Ex ia IIC T6, IECEx Zone 0/1		
	2	ATEX II 1/2 G Ex ia IIC T6, XA, IECEx Zone 0/1 Note safety instruction (XA) (electrostatic charging)!		
	5	ATEX II 1/2 G Ex d (ia) IIC T6, XA, IECEx Zone 0/1 Note safety instruction (XA) (electrostatic charging)!		
	6	ATEX II 1/2 G Ex ia IIC T6, WHG, IECEx Zone 0/1		
	7	ATEX II 1/2 G Ex ia IIC T6, WHG, XA, IECEx Zone 0/1 Note safety instruction (XA) (electrostatic charging)!		
	3	ATEX II 1/2 G Ex em [ia] IIC T6, IECEx Zone 0/1		
	8	ATEX II 1/2 G Ex em [ia] IIC T6, WHG, IECEx Zone 0/1		
	4	ATEX II 1/2 G Ex d [ia] IIC T, IECEx Zone 0/16		
	G	ATEX II 3 G Ex nA II T6, XA, fully insutalted antenna: Note safety instruction (XA) (electrostatic charging)!		
	H	ATEX II 1/2G Ex ia IIC T6, ATEX II 3D, XA, fully insutalted antenna: Note safety instruction (XA) (electrostatic charging)!		
	S	FM IS - Cl.I Div.1 Gr. A-D		
	T	FM XP - Cl.I Div.1 Group A-D		
	N	CSA General Purpose		
	U	CSA IS - Cl.I Div.1 Group A-D		
	V	CSA XP - Cl.I Div.1 Group A-D		
	L	TIIS EEx d [ia] IIC T4		
	I	NEPSI Ex ia IIC T6		
	J	NEPSI Ex d (ia) IIC T6		
	R	NEPSI Ex nAL IIC T6		
	Y	Special version, to be specified		
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, to be specified	
30			**Process Connection:**	
			GGJ	Thread EN10226 R1-1/2, 316L
			GGS	Thread EN10226 R1-1/2, PVDF
			GNJ	Thread ANSI NPT1-1/2, 316L
			GNS	Thread ANSI NPT1-1/2; PVDF
			TEJ	Tri-Clamp ISO2852 DN40-51 (2"), 316L
			TLJ	Tri-Clamp ISO2852 DN70-76.1 (3"), 316L
			MFJ	DIN11851 DN50 PN40, 316L
			HFJ	DIN11864-1 A DN50 Tube DIN11850, 316L
			BFJ	DN50 PN10/16 A, 316L flange EN1092-1 (DIN2527 B)
			CFJ	DN50 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
			CFK	DN50 PN10/16, PTFE>316L flange EN1092-1 (DIN2527)
			BMJ	DN80 PN10/16 A, 316L flange EN1092-1 (DIN2527 B)
			CMJ	DN80 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
			BNJ	DN80 PN25/40 A, 316L flange EN1092-1 (DIN2527 B)
			CNJ	DN80 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C)
			CMK	DN80 PN10/16, PTFE>316L flange EN1092-1 (DIN2527)
			BQJ	DN100 PN10/16 A, 316L flange EN1092-1 (DIN2527 B)
			CQJ	DN100 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
			CQK	DN100 PN10/16, PTFE>316L flange EN1092-1 (DIN2527)
			BWJ	DN150 PN10/16 A, 316L flange EN1092-1 (DIN2527 B)
			CWJ	DN150 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
			CWK	DN150 PN10/16, PTFE(black)>316L flange EN1092-1 (DIN2527)
				PTFE(black) = conductive cladding
FMR231-				Product designation (part 1)

Ordering structure Micropilot M FMR231 (continued)

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

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, to be specified

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, to be specified

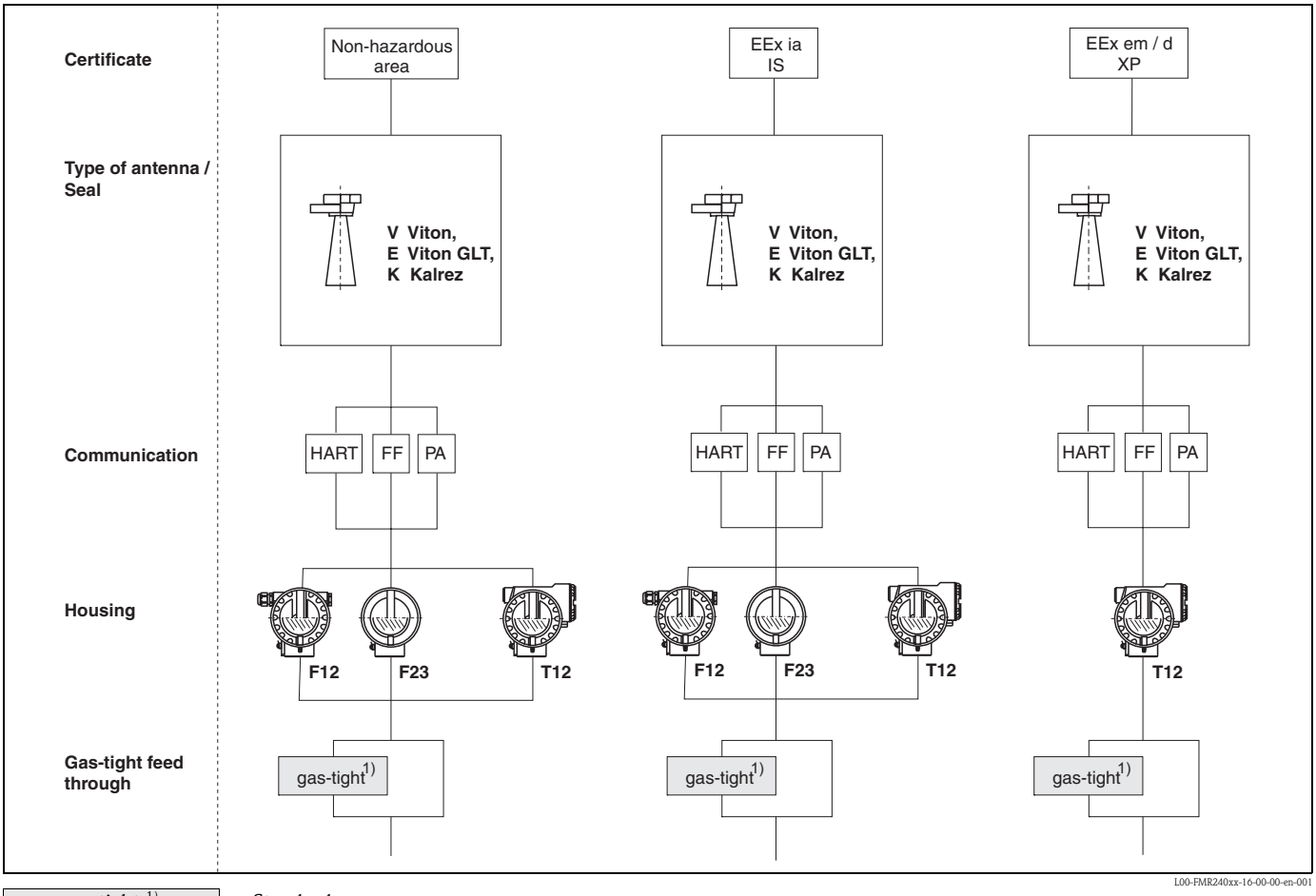
60		**Cable Entry:**
	2	Gland M20 (EEx d > thread M20)
	3	Thread G1/2
	4	Thread NPT1/2
	5	Plug M12
	6	Plug 7/8"
	9	Special version, to be specified

70		**Gas-Tight Feed Through:**
	A	Not selected
	C	Selected

80		**Additional Option:**
	A	Basic version
	B	EN10204-3.1 material, watted parts, (316L wetted parts) inspection certificate
	C	EN10204-3.1 material, pressurized, (316/316L pressurized) inspection certificate
	S	GL/ABS/NK marine certificate
	Y	Special version, to be specified

FMR231-	Complete product designation

Micropilot M FMR240 **Instrument selection**



gas-tight [1] = Standard

1) The gas-tight feedthrough of the device improves the process safety between the seal coupling the antenna to the process and the electronics compartment (connection compartment of the device).

Ordering structure Micropilot M FMR240

10	Approval:	
	A	Non-hazardous area
	F	Non-hazardous area, WHG
	1	ATEX II 1/2G Ex ia IIC T6
	6	ATEX II 1/2G Ex ia IIC T6, WHG
	3	ATEX II 1/2G Ex em [ia] IIC T6
	8	ATEX II 1/2G Ex em [ia] IIC T6, WHG
	4	ATEX II 1/2G Ex d [ia] IIC T6
	B	ATEX II 1/2G Ex ia IIC T6, ATEX II 1/2D
	H	ATEX II 1/2G Ex ia IIC T6, ATEX II 3D
	G	ATEX II 3G Ex nA II T6
	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
	L	TIIS EEx d [ia] IIC T4
	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, to be specified

FMR240-										Product designation (part 1)

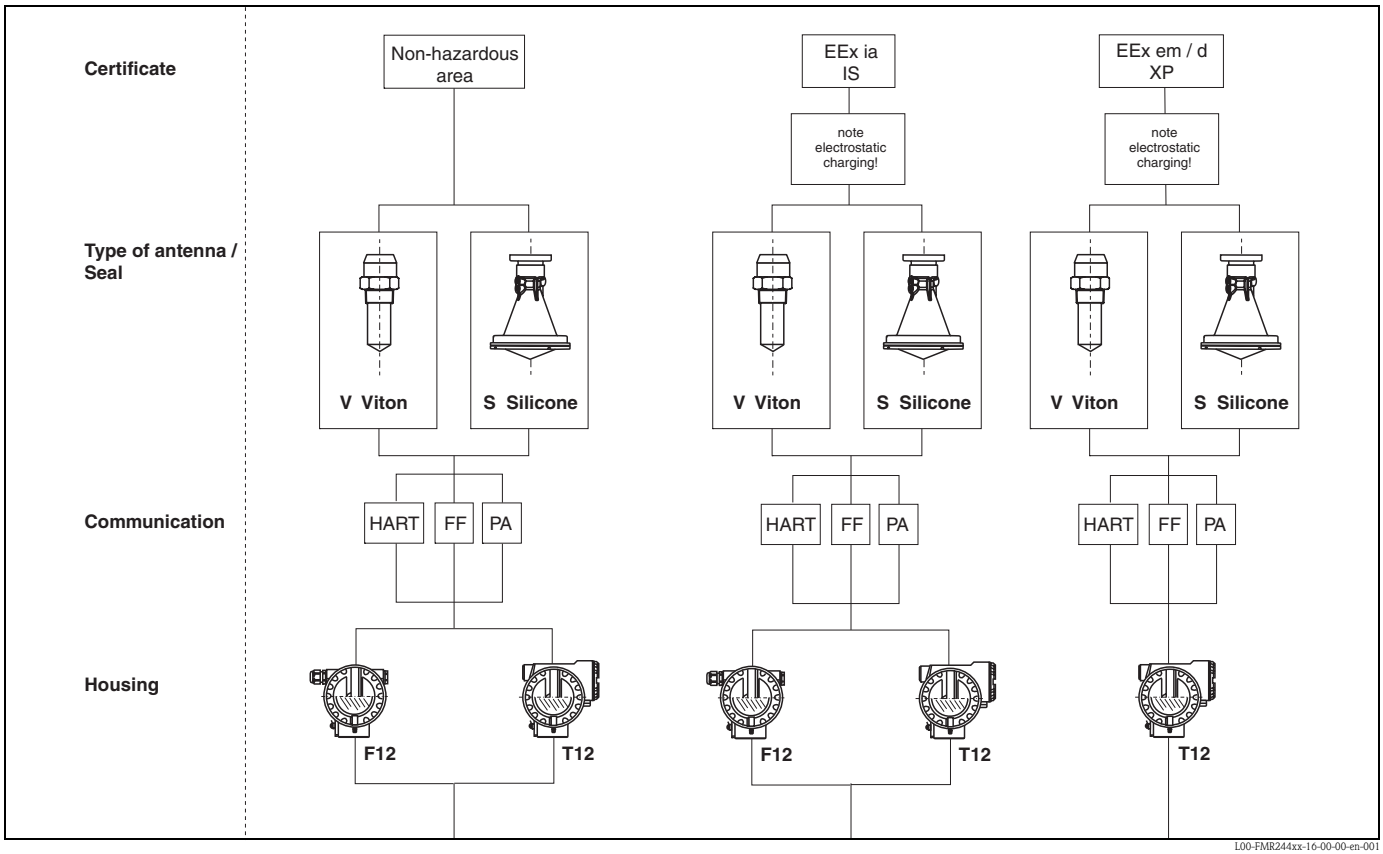
Ordering structure Micropilot M FMR240 (continued)

20		**Antenna:**									
		E	40mm/1-1/2", gas-tight feed through								
		F	50mm/2", gas-tight feed through								
		G	80mm/3", gas-tight feed through								
		H	100mm/4", gas-tight feed through								
		2	40mm/1-1/2"								
		3	50mm/2"								
		4	80mm/3"								
		5	100mm/4"								
		9	Special version, to be specified								
30			**Antenna Seal; Temperature:**								
			V	FKM Viton; -20…150°C/-4…302°F							
			E	FKM Viton GLT; -40…150°C/-40…302°F							
			K	Kalrez; -20…150°C/-4…302°F							
			Y	Special version, to be specified							
40					**Antenna Extension**						
					1	Not selected					
					2	100 mm/4"					
					9	Special version, to be specified					
50					**Process Connection:**						
					GGJ	Thread EN10226 R1-1/2, 316L					
					GNJ	Thread ANSI NPT1-1/2, 316L					
					TDJ	Tri-Clamp ISO2852 DN40-51 (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, to be specified
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, to be specified
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, to be specified
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, to be specified
90	**Additional Option:**	
	A	Basic version
	B	EN10204-3.1B material, wetted parts, (316L wetted parts) inspection certificate
	F	Advanced dynamics (max MB=70m) MB=measuring range
	G	Advanced dynamics (max MB=70m), EN10204-3.1, NACE MR0175 (316L wetted parts) inspection certificate MB=measuring range
	N	EN10204-3.1B material, NACE MR0175 (316L wetted parts) inspection certificate
	S	GL/ABS/NK marine certificate
	Y	Special version, to be specified
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 1/2G Ex ia IIC T6, XA note safety instruction (XA) (electrostatic charging)!
	7	ATEX II 1/2G Ex ia IIC T6, WHG, XA note safety instruction (XA) (electrostatic charging)!
	5	ATEX II 1/2G Ex d [ia] IIC T6, XA note safety instruction (XA) (electrostatic charging)!
	H	ATEX II 1/2G Ex ia IIC T6, ATEX 3D, XA note safety instruction (XA) (electrostatic charging)!
	B	ATEX II 1/2D, Alu blind cover, XA note safety instruction (XA) (electrostatic charging)!
	C	ATEX II 1/3D, XA note safety instruction (XA) (electrostatic charging)!
	G	ATEX II 3G Ex nA II T6
	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, to be specified

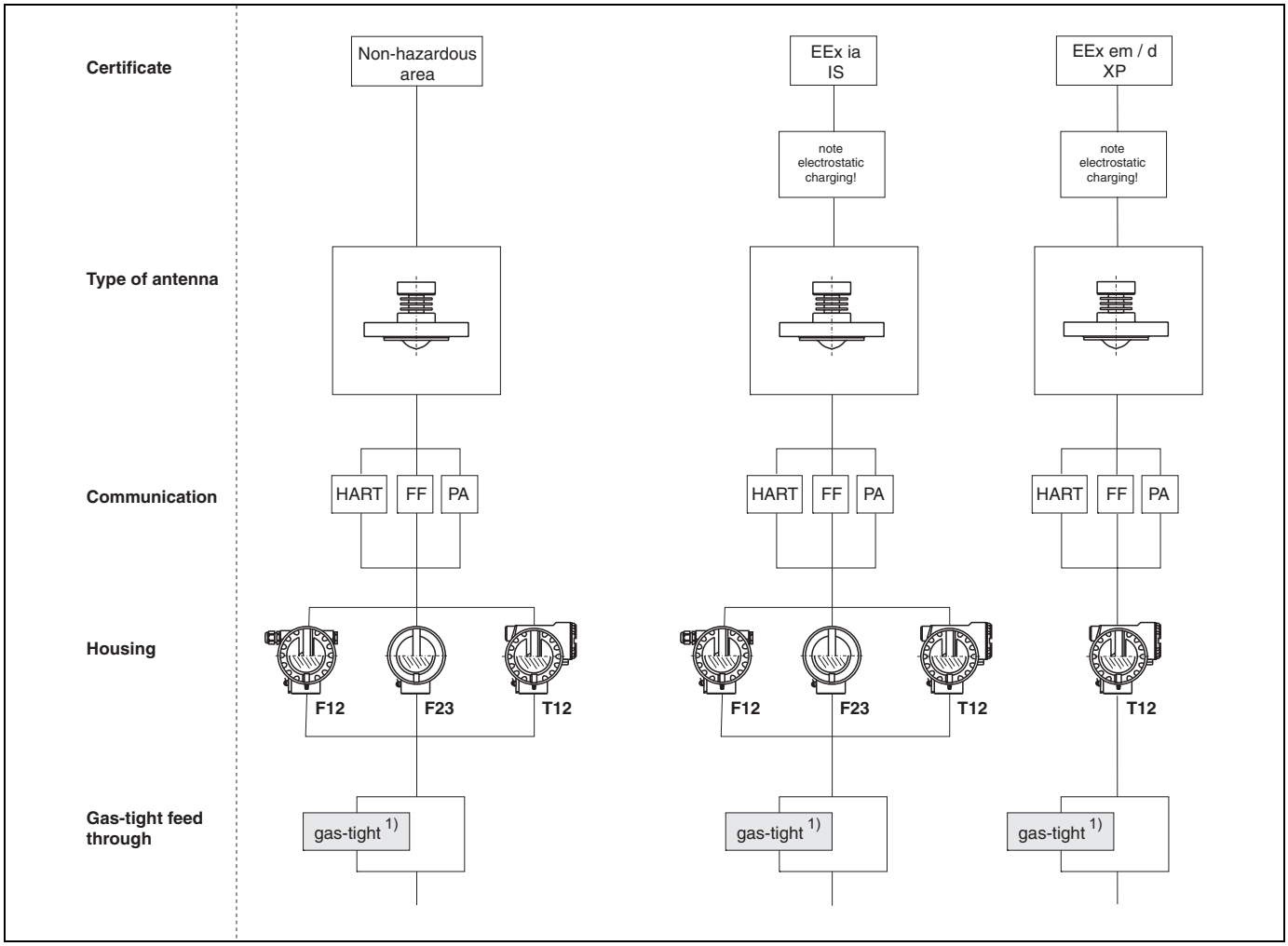
20		Antenna:
	2	40mm/1-1/2", PTFE encapsulated
	4	80mm/3", PP cladded
	9	Special version, to be specified

FMR244-										Product designation (part 1)

Ordering structure Micropilot M FMR244 (continued)

30			**Antenna Seal; Temperature:**						
			S	Silicone; -40...80°C/-40…176°F					
			V	FKM Viton GLT; -40…130°C/-40…266°F					
			Y	Special version, to be specified					
40				**Process Connection:**					
				GGS	Thread ISO228 G1-1/2, PVDF				
				GNS	Thread ANSI NPT1-1/2, PVDF				
				XME	Mounting bracket, 304				
				XRX	W/o slip on flange/mounting bracket customer side connection				
				XVG	UNI slip on flange 3"/DN80/80, PP max 4bar abs/58psia, suitable for 3" 150lbs / DN80 PN16 / 10K 80				
				XXG	UNI slip on flange 4"/DN100/100, PP max 4bar abs/58psia, suitable for 4" 150lbs / DN100 PN16 / 10K 100				
				X1G	UNI slip on flange 6"/DN150/150, PP max 4bar abs/58psia, suitable for 6" 150lbs / DN150 PN16 / 10K 150				
				YY9	Special version, to be specified				
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, to be specified		
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, to be specified	
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, to be specified
80									**Additional option:**
									A Basic version
									F Advanced dynamics (max MB=70m) (SIL on request) MB=measuring range
									S GL/ABS/NK marine certificate
									Y Special version, to be specified
FMR244-									Complete product designation

Micropilot M FMR245 **Instrument selection**



gas-tight 1) = Standard

1) The gas-tight feedthrough of the device improves the process safety between the seal coupling the antenna to the process and the electronics compartment (connection compartment of the device).

Ordering structure Micropilot M FMR245

10	**Approval:**	
	A	Non-hazardous area
	F	Non-hazardous area, WHG
	2	ATEX II 1/2G Ex ia IIC T6, XA, Note safety instruction (XA) (electrostatic charging)!
	7	ATEX II 1/2G Ex ia IIC T6, WHG, XA, Note safety instruction (XA) (electrostatic charging)!
	5	ATEX II 1/2G Ex d [ia] IIC T6, XA, Note safety instruction (XA) (electrostatic charging)!
	H	ATEX II 1/2G Ex ia IIC T6, ATEX 3D, XA, Note safety instruction (XA) (electrostatic charging)!
	B	ATEX II 1/2G, ATEX II 1/2D, XA ATEX II 1/2G Ex ia IIC T6 Note safety instruction (XA) (electrostatic charging)!
	G	ATEX II 3G Ex nA II T6
	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, to be specified

20		**Antenna:**	
	B	50mm/2", -40...200°C/-40...392°F	
	C	80mm/3", -40...200°C/-40...392°F	
	F	50mm/2", -40...200°C/-40...392°F, gas-tight feed through	
	G	80mm/3", -40...200°C/-40...392°F, gas-tight feed through	
	3	50mm/2", -40...150°C/-40...302°F	
	4	80mm/3", -40...150°C/-40...302°F	
	9	Special version, to be specified	

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
			MRK	DIN11851 DN50 PN25, PTFE>316L
			MTK	DIN11851 DN80 PN25, PTFE>316L
			TDK	Tri-Clamp ISO2852 DN51 (2"), PTFE>316L
			TFK	Tri-Clamp ISO2852 DN76.1 (3"), PTFE>316L
			THK	Tri-Clamp ISO2852 DN101.6 (4"),PTFE>316L
			YY9	Special version, to be specified

FMR245-								Product designation (part 1)

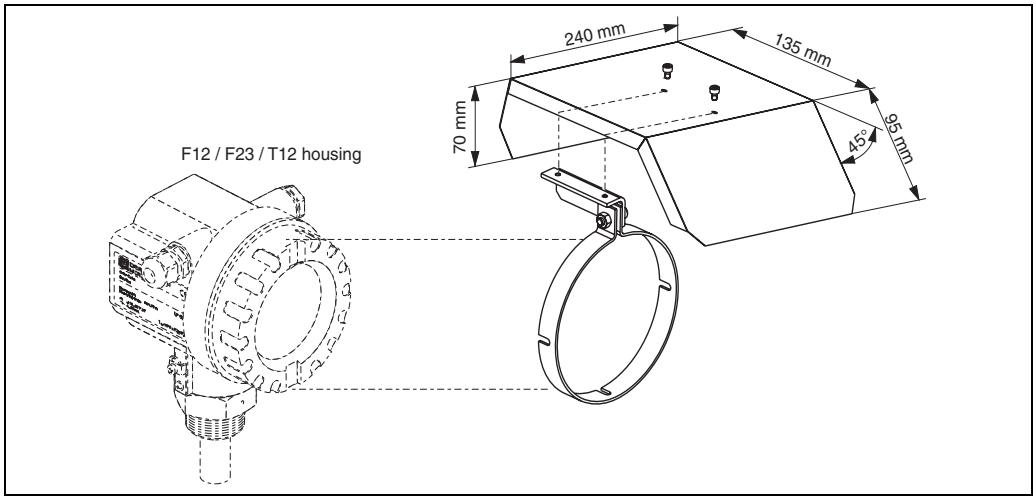
Ordering structure Micropilot M FMR245 (continued)

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, to be specified
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, to be specified
60								**Cable Entry:**
						2		Gland M20
						3		Thread G1/2
						4		Thread NPT1/2
						5		Plug M12
						6		Plug 7/8"
						9		Special version, to be specified
70								**Additional Option:**
							A	Basic version
							C	EN10204-3.1 material, pressurized, (316/316L pressurized) inspection certificate
							F	Advanced dynamics (max MB=70m) MB=measuring range
							G	Advanced dynamics (max MB=70m), EN10204-3.1 (316L pressurized) inspection certificate MB=measuring range
							S	GL/ABS/NK marine certificate
							Y	Special version, to be specified
FMR245-								Complete product designation

Accessories

Weather protection cover

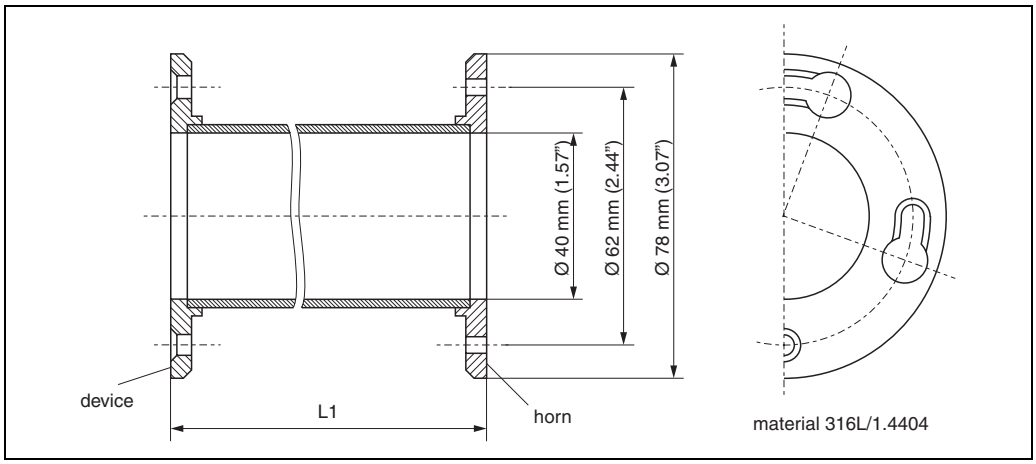
A Weather protection cover made of stainless steel is recommended for outdoor mounting (order code: 543199-0001). The shipment includes the protective cover and tension clamp.



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

Antenna extension FAR10 (for FMR230)

Dimensions



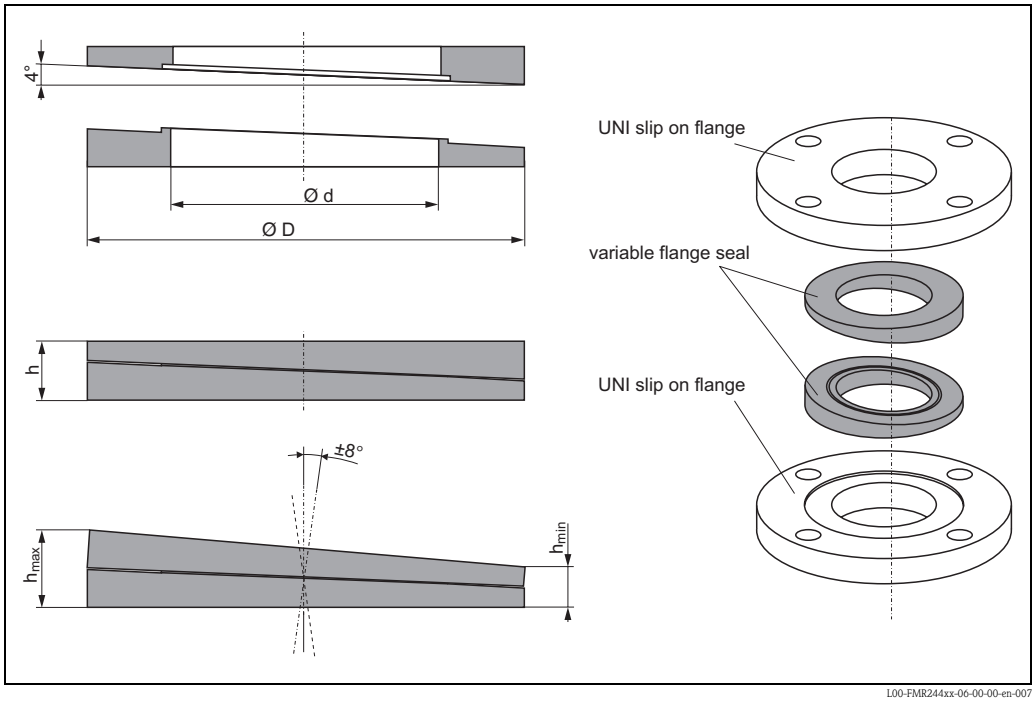
L00-FMRxxxxx-00-00-06-en-002

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

Variable flange seal for FMR244 - 80 mm (3") antenna

Domensions



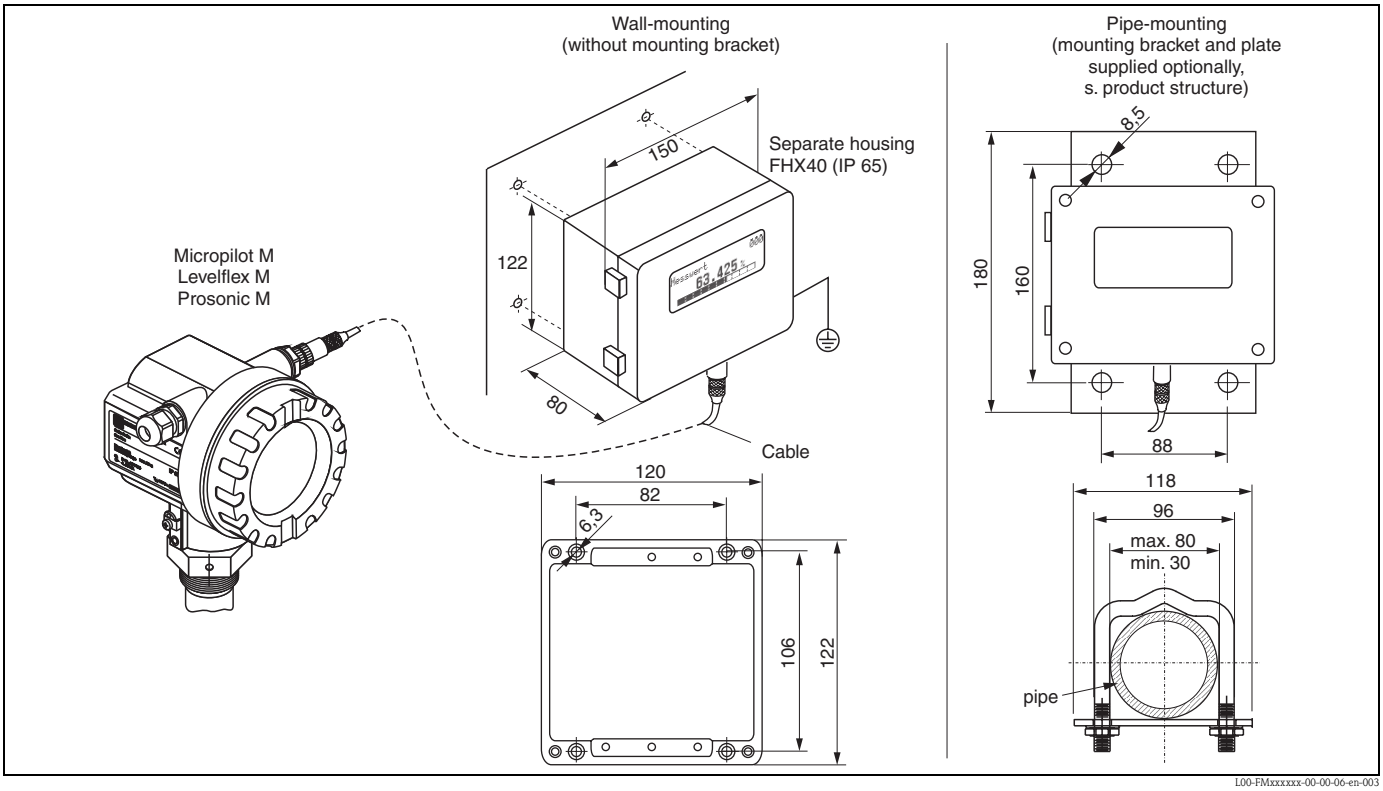
L00-FMR244xx-06-00-00-en-007

Variable flange seal	DN80	DN100	DN150
D [mm (inch)]	142 (5.59)	162 (6.38)	218 (8.58)
d [mm (inch)]	89 (3.50)	115 (4.53)	169 (6.65)
h [mm (inch)]	22 (0.87)	23.5 (0.93)	26.5 (1.04)
h_{min} [mm (inch)]	14 (0.55)	14 (0.55)	14 (0.55)
h_{max} [mm (inch)]	30 (1.18)	33 (1.30)	39 (1.54)

Technical data and ordering information

Variable flange seal	DN80	DN100	DN150
compatible with	DN80 PN10-40 ANSI 3" 150lbs JIS 10K 80A	DN100 PN10-40 ANSI 4" 150lbs JIS 10K 100A	DN150 PN10-40 ANSI 6" 150lbs JIS 10K 150A
Material	EPDM		
Process pressure	-0.1 bar ... 0.1 bar (-1.45 psi ... 1.45 psi)		
Process temperature	-40 °C ... +80 °C (-40 °F ... +176 °F)		
Order code	71074263	71074264	71074265

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)
- Prosonic S FMU9x

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)
- Prosonic S FMU9x

For details refer to KA271F/00/a2.

Documentation

Special Documentation

Continuous level measurement in liquids

Selection and engineering guide for the process industry, CP023F/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, K	HART	BA218F/00/en	BA221F/00/en	KA159F/00/a2
	C, D, L	PROFIBUS PA	BA225F/00/en	BA221F/00/en	KA159F/00/a2
	E, F, M	FOUNDATION Fieldbus	BA228F/00/en	BA221F/00/en	KA159F/00/a2
FMR231	A, B, K	HART	BA219F/00/en	BA221F/00/en	KA159F/00/a2
	C, D, L	PROFIBUS PA	BA226F/00/en	BA221F/00/en	KA159F/00/a2
	E, F, M	FOUNDATION Fieldbus	BA229F/00/en	BA221F/00/en	KA159F/00/a2
FMR240	A, B, K	HART	BA220F/00/en	BA291F/00/en	KA235F/00/a2
	C, D, L	PROFIBUS PA	BA227F/00/en	BA291F/00/en	KA235F/00/a2
	E, F, M	FOUNDATION Fieldbus	BA230F/00/en	BA291F/00/en	KA235F/00/a2
FMR244	A, B, K	HART	BA248F/00/en	BA291F/00/en	KA235F/00/a2
	C, D, L	PROFIBUS PA	BA249F/00/en	BA291F/00/en	KA235F/00/a2
	E, F, M	FOUNDATION Fieldbus	BA250F/00/en	BA291F/00/en	KA235F/00/a2
FMR245	A, B, K	HART	BA251F/00/en	BA291F/00/en	KA235F/00/a2
	C, D, L	PROFIBUS PA	BA252F/00/en	BA291F/00/en	KA235F/00/a2
	E, F, M	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 1/2G Ex ia IIC T6,	A, B, K	HART	A	2118	XA099F	ZE 44F/00/de
					B	2118	XA203F	ZE244F/00/de
	6	ATEX II 1/2G Ex ia IIC T6, + 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 1/2G Ex ia IIC T6, special conditions	A, B, K	HART	A	2117 X	XA103F	ZE244F/00/de
					B	2117 X	XA205F	ZE244F/00/de
	7	ATEX II 1/2G Ex ia IIC T6, special conditions + 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, FMR240	3	ATEX II 1/2G Ex em [ia] IIC T6,	A, B	HART	C	2118	XA100F	ZE244F/00/de
			C, D	PROFIBUS PA	C	2118	XA100F	ZE244F/00/de
	8	ATEX II 1/2G Ex em [ia] IIC T6, + WHG[1)]	E, F	FOUNDATION Fieldbus	C	2118	XA100F	—
FMR230, FMR231, FMR240	4	ATEX II 1/2G Ex d [ia] IIC T6,	A, B, C, D, E, F	HART, PROFIBUS PA, FOUNDATION Fieldbus	C	2118	XA101F	—
FMR231, FMR244, FMR245	5	ATEX II 1/2G Ex d [ia] IIC T6, special conditions	A, B, C, D, E, F	HART, PROFIBUS PA, FOUNDATION Fieldbus	C	2117 X	XA105F	—
FMR230, FMR231, FMR240, FMR244, FMR245	G	ATEX II 3G Ex 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 1/2G Ex ia IIC T6, ATEX II 3D	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.

Instrument	Certificate	Explosion protection	Output	Communication	Housing	PTB 00 ATEX	XA	German WHG
FMR240	B	ATEX II 1/2G Ex ia IIC T6, ATEX II 1/2D	A, B, C, D, E, F, K, L, M	HART, PROFIBUS PA, FOUNDATION Fieldbus	A, B, D	2118	XA406F	—
FMR244	B C	ATEX II 1/2D special conditions ATEX II 1/3D special conditions	A, B, C, D, E, F, K, L, M	HART, PROFIBUS PA, FOUNDATION Fieldbus	A, B, C, D	2117 X	XA408F	—
FMR245	B	ATEX II 1/2G Ex ia IIC T6, ATEX II 1/2D special conditions	A, B, C, D, E, F, K, L, M	HART, PROFIBUS PA, FOUNDATION Fieldbus	A, B, C, D	2117 X	XA407F	—

Instrument	Certificate	Explosion protection	Output	Communication	Housing	IECEx PTB 04.	XA
FMR230, FMR231, FMR240	1	IECEx Zone 0/1 Ex ia IIC T6,	A, B, K	HART	A	0015 X	XA354F
					B	0015 X	XA366F
			A, B	HART	D	0015 X	XA368F
			C, D, L	PROFIBUS PA	A	0015 X	XA357F
					B	0015 X	XA362F
			C, D	PROFIBUS PA	D	0015 X	XA364F
			E, F, M	FOUNDATION Fieldbus	A	0015 X	XA357F
					B	0015 X	XA362F
			E, F	FOUNDATION Fieldbus	D	0015 X	XA364F
FMR230, FMR231, FMR244, FMR245	D	IECEx Zone 0/1 Ex ia IIC T6, special conditions	A, B, K	HART	A	0015 X	XA358F
					B	0015 X	XA367F
			A, B	HART	D	0015 X	XA369F
			C, D, L	PROFIBUS PA	A	0015 X	XA361F
					B	0015 X	XA363F
			C, D	PROFIBUS PA	D	0015 X	XA365F
			E, F, M	FOUNDATION Fieldbus	A	0015 X	XA361F
					B	0015 X	XA363F
			E, F	FOUNDATION Fieldbus	D	0015 X	XA365F
FMR230, FMR231, FMR240	E	IECEx Zone 0/1 Ex d [ia] IIC T6,	A, B, C, D, E, F, K, L, M	HART, PROFIBUS PA, FOUNDATION Fieldbus	C	0015 X	XA356F
FMR230, FMR231, FMR244, FMR245	E	IECEx Zone 0/1 Ex d [ia] IIC T6, special conditions	A, B, C, D, E, F, K, L, M	HART, PROFIBUS PA, FOUNDATION Fieldbus	C	0015 X	XA360F

Instrument	Certificate	Explosion protection	Antenna	Output	Communication	Housing	NEPSI GYJ...	XA
FMR230, FMR231, FMR240	I	Ex ia IIC T6...T1	A, B, H, J	A, B, K	HART	A	...071295	XA370F
				C, D, L	PROFIBUS PA	A	...071295	XA373F
				E, F, M	FOUNDATION Fieldbus	A	...071295	XA373F
FMR230, FMR231, FMR244, FMR245	I	Ex ia IIC T1...T6	E, F	A, B, K	HART	A	...071295	XA372F
				C, D, L	PROFIBUS PA	A	...071295	XA375F
				E, F, M	FOUNDATION Fieldbus	A	...071295	XA375F

Instrument	Certificate	Explosion protection	Antenna	Output	Communication	Housing	NEPSI GYJ...	XA
FMR230, FMR231, FMR240	J	Ex d [ia] IIC T1...T6	A, B, H, J	A, B, C, D, E, F, K, L, M	HART, PROFIBUS PA, FOUNDATION Fieldbus	C	...071296	XA371F
FMR230, FMR231, FMR244, FMR245	J	Ex d [ia] IIC T1...T6	E, F	A, B, C, D, E, F, K, L, M	HART, PROFIBUS PA, FOUNDATION Fieldbus	C	...071296	XA374F
FMR230, FMR231, FMR240, FMR244, FMR245	R	Ex nAL IIC T1...T6	A, B, E, F, H, J	A, B, C, D, E, F, K, L, M	HART, PROFIBUS PA, FOUNDATION Fieldbus	A, B, D	...04357 X	XC007F

Correlation of Control Drawings (ZD) to the instrument:

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

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

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

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

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TI345F/00/en/05.08
71074300
FM+SGML 6.0 ProMoDo

71074300