

Technical Information

Micropilot M FMR230/231/240/244/245

Level-Radar

Continuous and non-contact level measurement.

Cost-effective 4 to 20 mA 2-wire technology.

Suitable for hazardous locations.



Application

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

- The FMR230 is especially suited for measurement in buffer and process tanks.
- The FMR231 has its strengths wherever high chemical compatibility is required.
- The FMR240 with the small 40 mm (1½") horn antenna is ideally suited for small vessels. Additionally, it provides an accuracy of ± 3 mm (± 0.12 in).
- The FMR244 combines the advantages of the horn antenna with high chemical resistance. The 80 mm (3") horn antenna is used additionally in solids.
- 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 in the K-band: No compromises, the right frequency for every application.
- HART or PROFIBUS PA respectively FOUNDATION Fieldbus protocol.
- High temperatures: Suitable for process temperatures up to 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 IEC61508 / IEC61511-1.
- Option: gas-tight feedthrough for FMR230/231/240/245 to improve the process safety.

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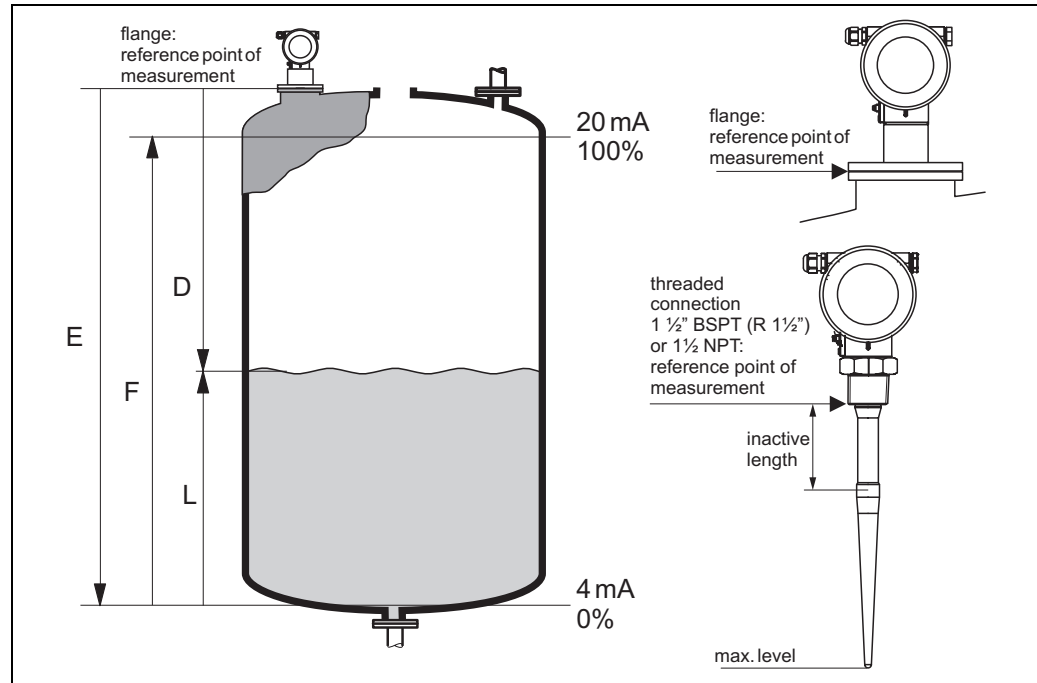
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Function and system design

Measuring principle

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



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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 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 4 mA and 20 mA for instruments with current output. They correspond with 0 % and 100 % for digital outputs and the display module.

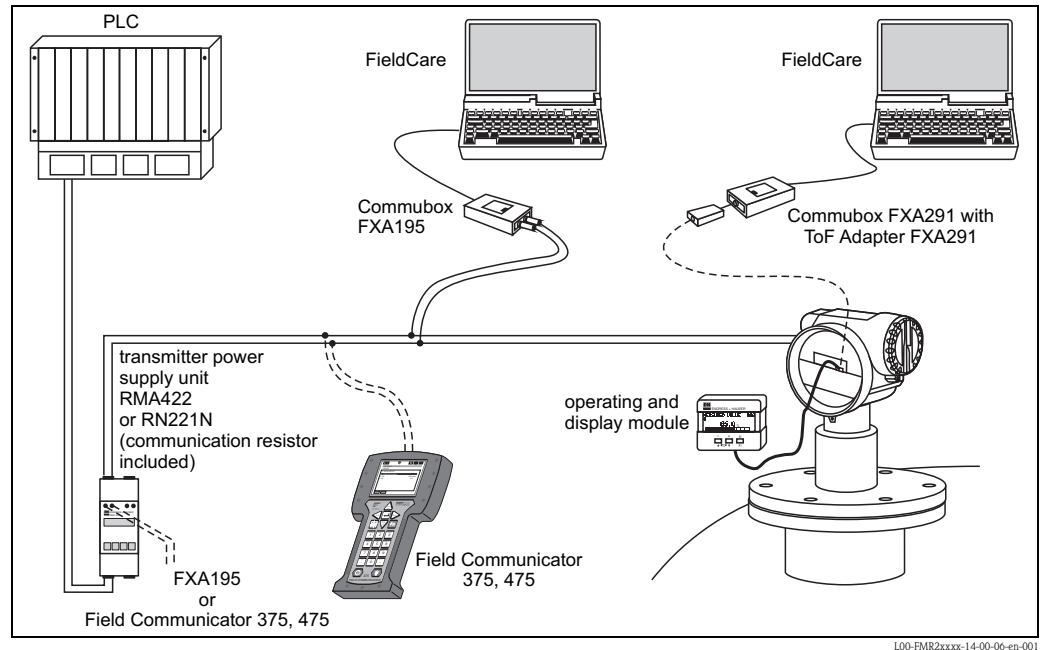
A linearization with max. 32 points, based on a table entered either manually or semi-automatically, can be activated locally or remotely. This function provides a measurement in engineering units and a linear output signal for spheres, horizontal cylindrical tanks and vessels with conical outlet.

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

4 to 20 mA output with HART protocol.

The complete measuring system consists of:

**On-site operation**

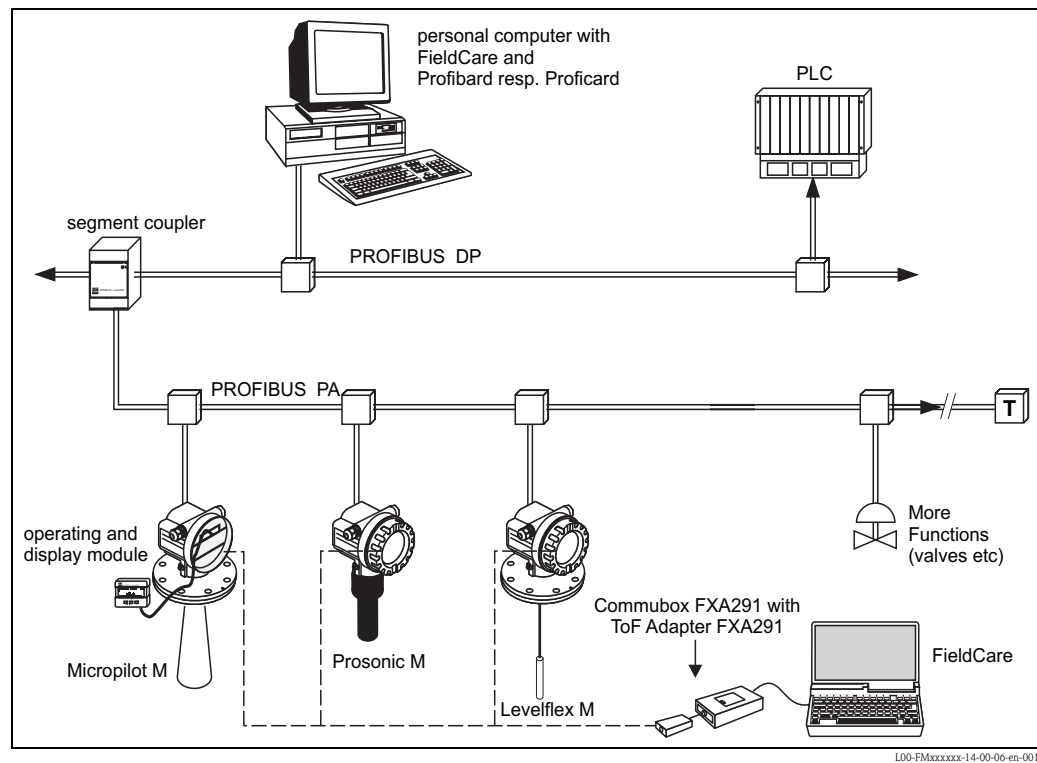
- with display and operating module,
- with a Personal Computer, FXA291 with ToF Adapter FXA291 (USB) and the operating software "FieldCare". FieldCare is a graphical operating software for instruments from Endress+Hauser (radar, ultrasonic, guided microimpulse). It assists with commissioning, securing data, signal analysis and documentation of the measuring point.

Remote operation

- with Field Communicator 375, 475,
- with a Personal Computer, Commubox 195 and the operating software "FieldCare".

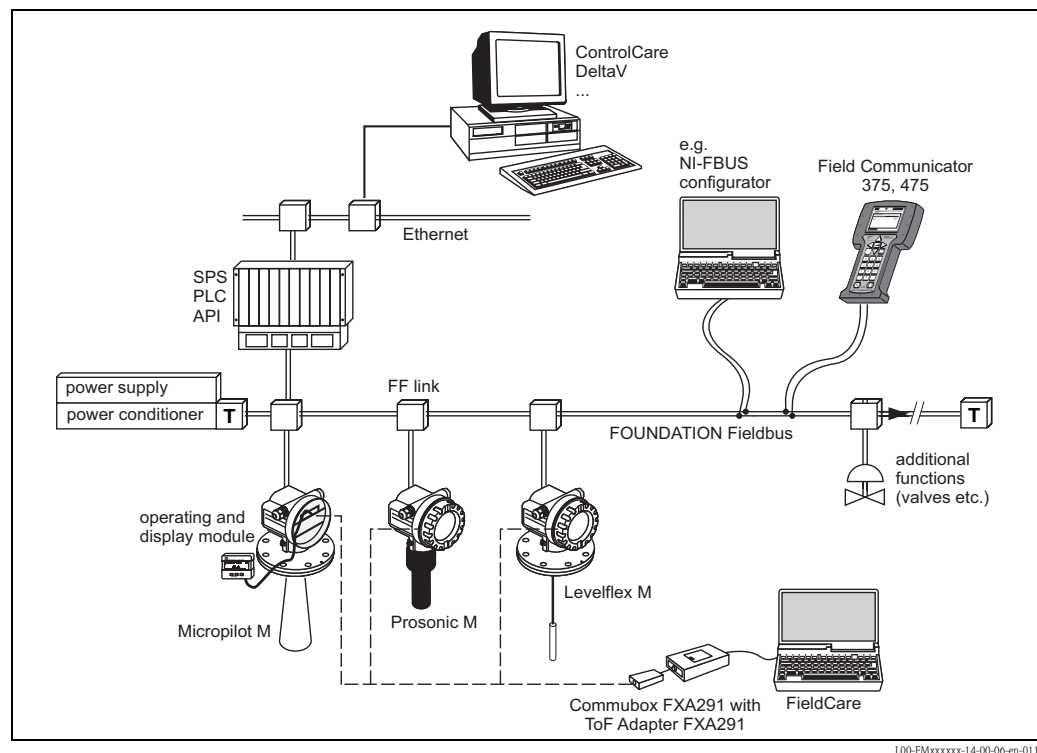
System integration via PROFIBUS PA

A maximum of 32 transmitters (8 if mounted in an explosion hazardous location Ex 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:



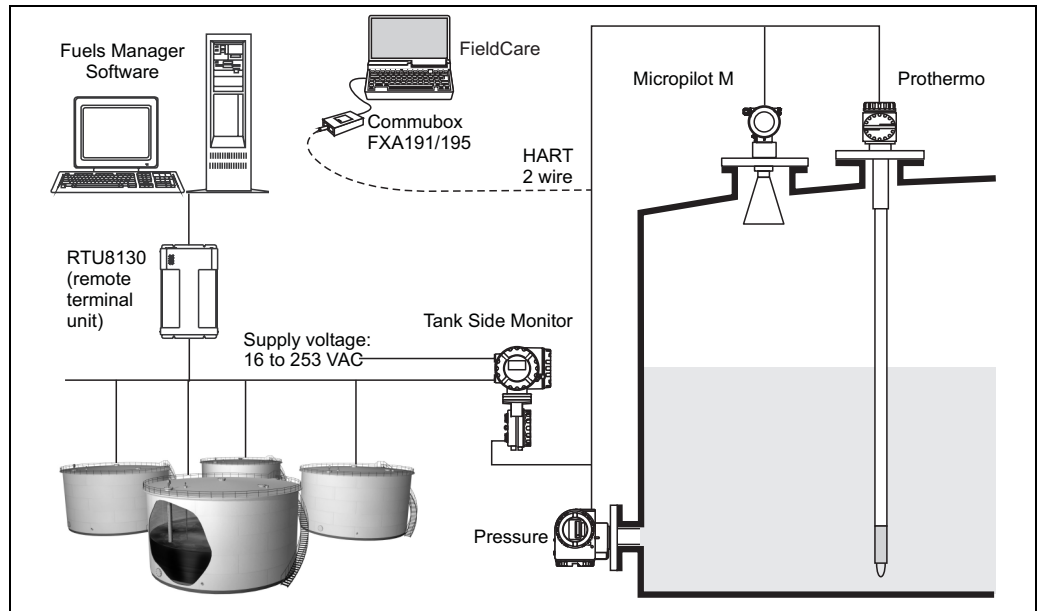
System integration via FOUNDATION Fieldbus

A maximum of 32 transmitters (standard, Ex em or Ex d) can be connected to the bus. For protection class Ex ia IIC: the max. number of transmitters depends on the established rules and standards for intrinsically safe circuits (EN60079-14, 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 to 20 mA sensors, digital I/O and analog output simplify full tank sensor integration. Use of the proven concept of the intrinsically safe HART bus for all on-tank sensors yields extremely low wiring costs, while at the same time providing maximum safety, reliability and data availability.



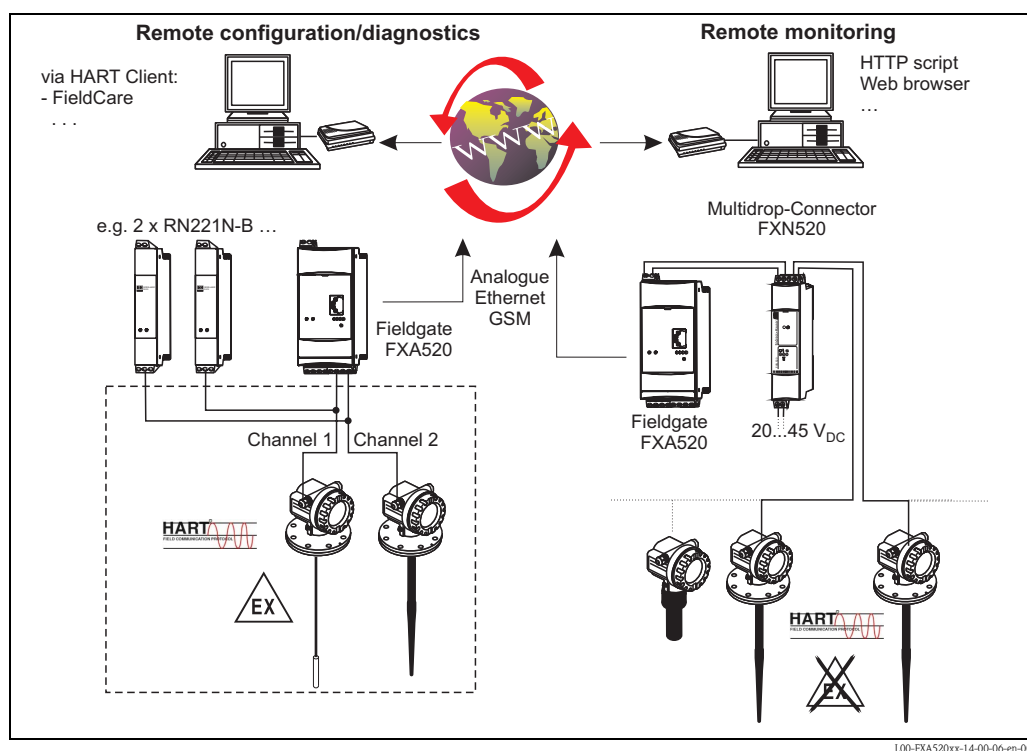
System integration via Fieldgate

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. 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.



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Note!

The number of instruments which can be connected in multidrop mode can be calculated by the "FieldNetCalc" program. A description of this program can be found in Technical Information TI400F/00/EN (Multidrop Connector FXN520). The program is available from your Endress+Hauser sales organisation or in the internet at: www.endress.com → Select your country → Download → Search: Fieldnetcalc.

Input

Measured variable The measured variable is the distance between a reference point (→  4) 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 in liquids 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 (66 ft) for Micropilot M FMR23x,
- 40 m (131 ft) for Micropilot M FMR24x (basic version),
- 70 m (230 ft) for Micropilot M FMR24x (with additional option F (G), see "ordering information")

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

1) Treat Ammonia NH₃ as a medium of group A, i.e. use FMR230 in a stilling well.

Measuring range in solids The FMR244 with 80 mm (3") antenna or FMR240 with 100 mm (4") horn antenna and additional option "F" (= advanced dynamics) is also suited for solid applications. The usable measuring range depends on the reflection properties of the medium, the mounting position and interference reflections which may be present. The maximum configurable measuring range for the FMR240 with 100 mm (4") horn antenna and additional option "F" (= advanced dynamics) is 30 m (98 ft) in solid applications. It is recommended to use the variable flange seal for alignment (→  78).

Reduction of the max. possible measuring range through:

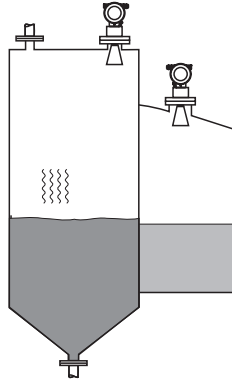
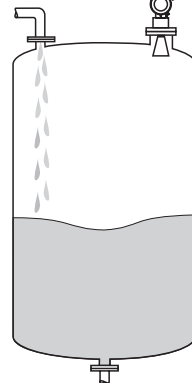
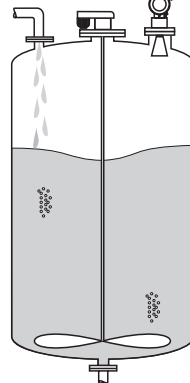
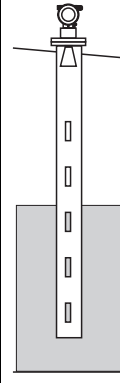
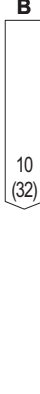
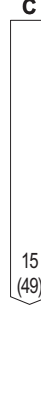
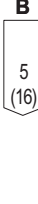
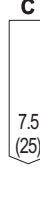
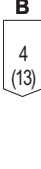
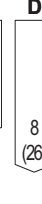
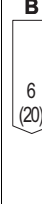
- Media with poor reflection properties (= small DC). For examples refer to table below.
- Angle of repose.
- Extremely loose surfaces of bulk solids, e.g. bulk solids with low bulk weight for pneumatic filling.
- Build-up, above all of moist products.

The following table describes the media groups and the dielectric constant ϵ_r .

Media group	DC (ϵ_r)	Examples	Signal attenuation
A	1.6 to 1.9	– Plastic granulate – White lime, special cement – Sugar	19 to 16 dB
B	1.9 to 2.5	– Portland cement, plaster	16 to 13 dB
C	2.5 to 4	– Grain, seeds – Ground stones – Sand	13 to 10 dB
D	4 to 7	– Naturally moist (ground) stones, ores – Salt	10 to 7 dB
E	> 7	– Metallic powder – Carbon black – Coal	< 7 dB

The respective lower group applies for very loose or loosened bulk solids.

Measuring range depending on vessel type, conditions and product for 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 to 250 mm (3 to 10")	80 to 250 mm (3 to 10") ²⁾							
FMR231:	Rod antenna	—		Rod antenna	—		Rod antenna	—	—	—							
	B 	C 	D 	B 	C 	D 	B 	C 	D 	B 	C 	D 	B 	C 	D 	A, B, C, D 	C, D 
Measuring range [m (ft)]																	

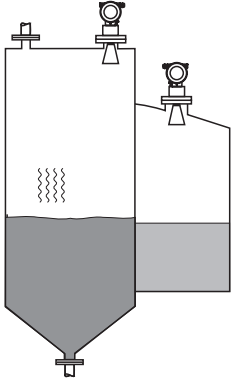
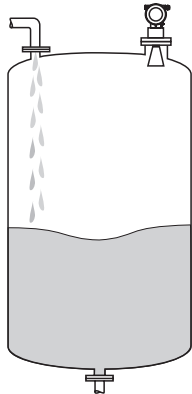
1) For media group A to use a stilling well (20 m (66 ft)).

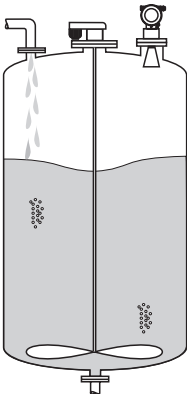
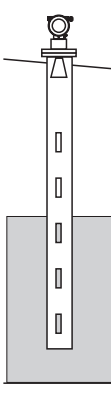
2) For media group A and B possible, i.e. with stilling well in bypass.

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

	Standard: max. measuring range = 40 m (131 ft)		With additional option "F" ("G"): max. measuring range = 70 m (230 ft)
* Max. recommended measuring range = 20 m (66 ft) for FMR244 with 80 mm (3") antenna, in solids 15 m (49 ft). ^{1) 2)} The recommended measuring range for FMR240 with 100 mm (4") horn antenna in solids is 30 m (98 ft).			

- 1) Larger measuring range in solids available on request.
- 2) In solids with additional option F (= advanced dynamic), and variable flange seal (→  78).

	Storage tank				Buffer tank			
	 Calm product surface (e.g. intermittent filling, filling from bottom, immersion tubes).				 Moving surfaces (e.g. continuous filling, from above, mixing jets).			
FMR240	40 mm (1½")	50 mm (2")	80 mm (3")	100 mm (4")	40 mm (1½")	50 mm (2")	80 mm (3")	100 mm (4")
FMR244	40 mm (1½")	-	* 80 mm (3")	-	40 mm (1½")	-	* 80 mm (3")	-
FMR245	-	50 mm (2")	80 mm (3")	-	-	50 mm (2")	80 mm (3")	-
	A 3 (9.9) 5 (16) B 5 (16) 8 (26) C 10 (32) 15 (49) D 15 (49) 25 (82)	A 4 (13) 8 (26) B 8 (26) 12 (39) C 15 (49) 25 (82) D 35 (110) 40 (131)	A 8 (26) 10 (32) B 15 (49) 20 (65) C 30 (98) 40 (131) 40 (131) D 60 (197)	A 10 (32) 15 (49) B 25 (82) 30 (99) C 40 (131) 45 (148) D 70 (229)	B 2 (6.6) C 4 (13) 5 (16) D 7.5 (24) 10 (32)	B 3 (9.9) 5 (16) C 7.5 (24) 10 (32) D 10 (32) 15 (49)	A 2.5 (8) 5 (16) B 5 (16) 10 (32) C 10 (32) 15 (49) D 15 (49) 25 (82)	A 5 (16) 7.5 (24) B 10 (32) 15 (49) C 15 (49) 25 (82) D 25 (82) 35 (110)
Measuring range [m (ft)]								

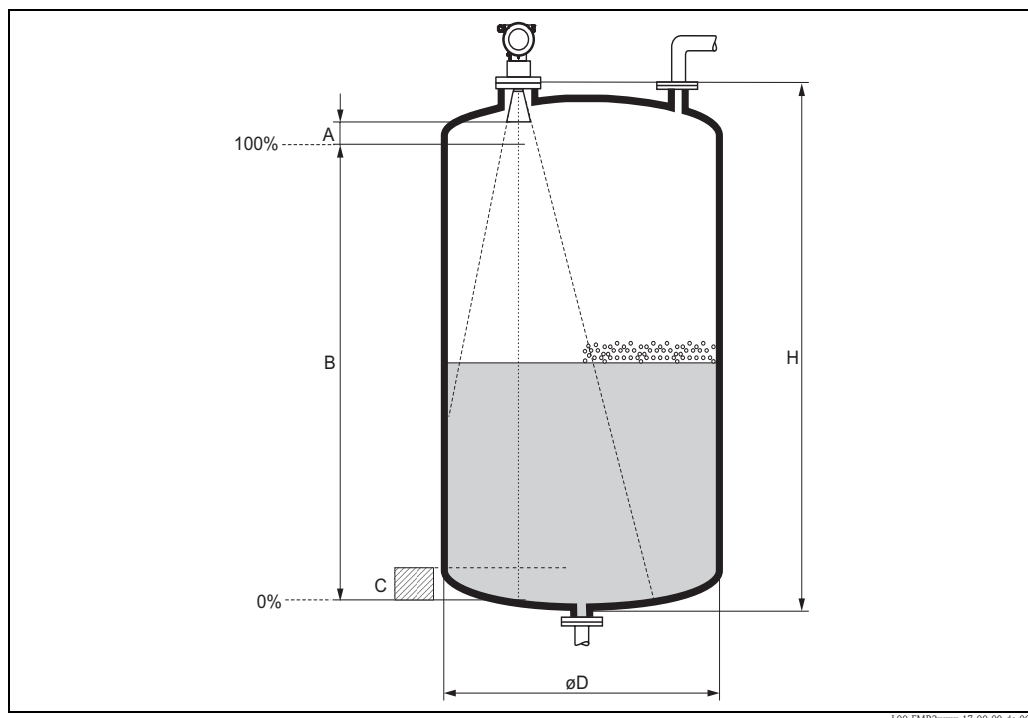
	Process tank with agitator				Stilling well ¹⁾	Bypass ²⁾								
														
	Turbulent surface. Single stage agitator < 60 RPM.													
FMR240	40 mm (1½")	50 mm (2")	80 mm (3")	100 mm (4")	40 to 100 mm (1½" to 4")	40 to 100 mm (1½" to 4")								
FMR244	40 mm (1½")	-	80 mm (3")	-	40 to 100 mm (1½" to 4")	-								
FMR245	-	50 mm (2")	80 mm (3")	-	50 to 80 mm (2" to 3")	50 to 80 mm (2" to 3")								
	B 	C 	D 	B 	C 	D 	B 	C 	D 	A, B, C, D 	C, D 	A, B, C, D 	A, B, C, D 	C, D 
Measuring range [m (ft)]														

1) Larger measuring range on request.
2) For media group A and B to use a Levelflex M with coax probe.

Measuring conditions in liquids

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 (→ 62).
- 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 NH₃** or some **fluorocarbons** ¹⁾, please use FMR230 in a stilling well.



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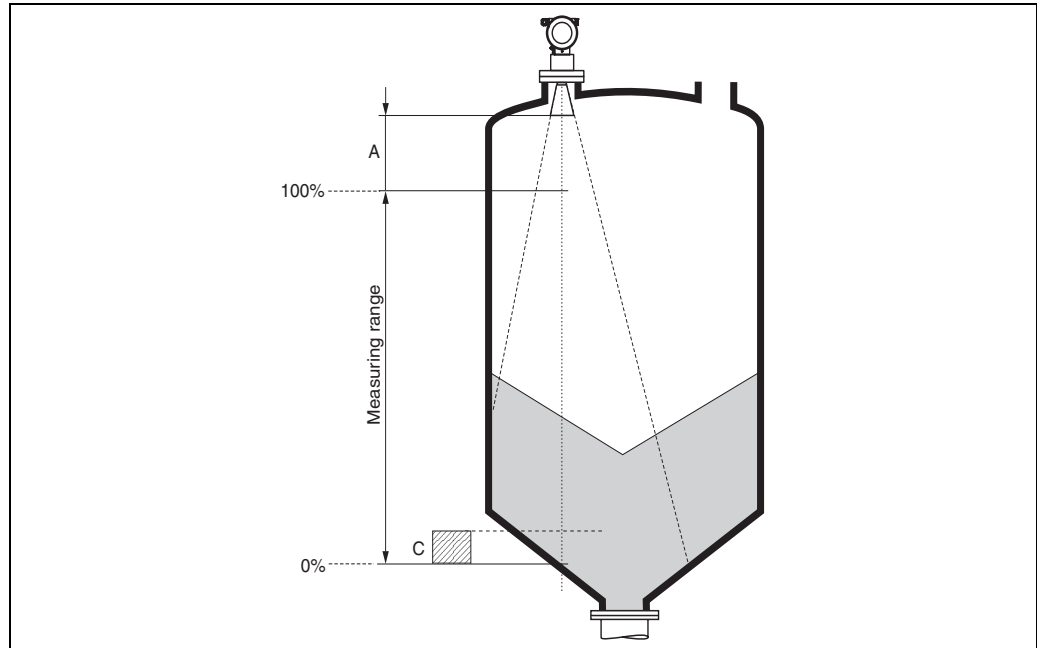
- The measuring range begins, where the beam hits the tank bottom. Particularly with dish bottoms or conical outlets the level cannot be detected below this point.
- In case of media with a low dielectric constant (groups A and B), the tank bottom can be visible through the medium at low levels (low 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 (in)]	B [m (ft)]	C [mm (in)]	D [m (ft)]	H [m (ft)]
FMR230/231	50 (1.97)	> 0,5 (> 1.6)	150 to 300 (5.91 to 11.8)	> 1 (> 3.3)	> 1,5 (> 4.9)
FMR240	50 (1.97)	> 0,2 (> 0.7)	50 to 250 (1.97 to 9.84)	> 0,2 (> 0.7)	> 0,3 (> 1)
FMR244	150 (5.91)	> 0,2 (> 0.7)	50 to 250 (1.97 to 9.84)	> 0,2 (> 0.7)	> 0,3 (> 1)
FMR245	200 (7.87)	> 0,2 (> 0.7)	50 to 250 (1.97 to 9.84)	> 0,2 (> 0.7)	> 0,3 (> 1)

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

Measuring conditions in solids

- The measuring range begins, where the beam hits the bottom. Particularly with conical outlets the level cannot be detected below this point. The maximum measuring range can be increased in such applications by using a top target positioner (→ 77).
- In case of media with a low dielectric constant (groups A and B), the bottom can be visible through the medium at low levels. In order to guarantee the required accuracy in these cases, it is recommended to position the zero-point at a distance **C** above the bottom (see Fig.).
- In principle it is possible to measure up to the tip of the antenna with the Micropilot M. However, due to considerations regarding abrasion and build-up and depending on the orientation of the product surface (angel of repose), the end of the measuring range should be at a distance of **A** (see Fig.). If required, and if some conditions (high DC value, flat angle of repose) are met, shorter distances can be achieved.



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A [mm (in)]	C [mm (in)]
approx. 400 (15.7)	50 to 150 (1.97 to 5.91)

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

Distance	Average energy density in beam direction	
	max. measuring range = 20 m (66 ft) / 40 m (131 ft)	measuring range = 70 m (230 ft)
1 m (3.3 ft)	< 12 nW/cm ²	< 64 nW/cm ²
5 m (16 ft)	< 0.4 nW/cm ²	< 2.5 nW/cm ²

Output

Output signal**HART**

Signal coding	FSK ± 0.5 mA over currency signal
Data transmission rate	1200 Baud
Galvanic isolation	Yes (IO-Module)

PROFIBUS PA

Signal coding	Manchester Bus Powered (MBP)
Data transmission rate	31.25 KBit/s, voltage mode
Galvanic isolation	Yes (IO-Module)

FOUNDATION Fieldbus

Signal coding	Manchester Bus Powered (MBP)
Data transmission rate	31.25 KBit/s, voltage mode
Galvanic isolation	Yes (IO-Module)

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 NE43).
- 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.

Protocol specific data**HART**

Manufacturer ID	000011 hex	
Device Type Code	000F hex (for FMR230/231)	001E hex (for FMR240/244/245)
Transmitter specific revision	04 hex (for FMR230/231)	05 hex (for FMR240/244/245)
HART specification	5.0	
DD-Files	Information and files can be found: ■ www.endress.com ■ www.hartcomm.org	
Load HART	Min. 250 Ω	
Device variables	Primary value: level or volume ¹⁾	
Features supported	■ Burst mode ■ Additional Transmitter Status	

1) according to configuration

PROFIBUS PA

Manufacturer ID	000011 hex
Ident number	1522 hex
Profile Version	3.0
GSD file	Information and files can be found: ■ www.endress.com ■ www.hartcom.com
GSD file version	
Output values	Primary value: measured value Secondary value: distance
Input values	Display value of PLC
Features supported	■ I&M ■ Identification & Maintenance (for FMR240/244/245 of software version 01.05.00)

FOUNDATION Fieldbus

	FMR230/231 only	FMR240/244/245 only
Manufacturer ID	452B48	
Device Type	100F hex	100F hex
Device Revision	04 hex	05 hex
DD Revision	Information and files can be found: ■ www.endress.com ■ www.feldbus.org	
CFF Revision		
Devise Tester Version (ITK Version)	4.61	5.00
ITK Test Campaign Number	IT035500	IT042000
Link Master (LAS) Capable	yes	
Link Master / Basic Device Selection	yes, default: Basic Device	
Node Address	Default: 247	
Features supported	Following methods are supported: ■ Basic setup ■ Safety settings ■ Acknowledge alarm ■ Linearisation ■ Extended calibration ■ Output ■ System parameters ■ Lock TB Manufacturer parameters	

Virtual Communication Relationship (VCRs)

Number of VCRs	24
Number of Link Objects in VFD	24
Permanent entries	1
Client VCRs	0
Server VCRs	24
Source VCRs	23
Sink VCRs	0
Subscriber VCRs	23
Publisher VCRs	23

Devise Link Capabilities

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 measurement	■ level or volume¹⁾ (channel 1) ■ distance (channel 2)
Diagnosic 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	Number of blocks	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.	1	—	enhanced
Analog Input 1	The AI block takes the manufacturer's input data, selected by channel number, and makes it available to other function blocks at its output.	2	30 ms	standard
Analog Input 2			30 ms	
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.	1	80 ms	standard
Arithmetic Function 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.	1	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.	1	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.	1	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.	1	60 ms	standard

Additional Function Block Information	
Instantiable Function Blocks	No
Number of instanciable blocks	—

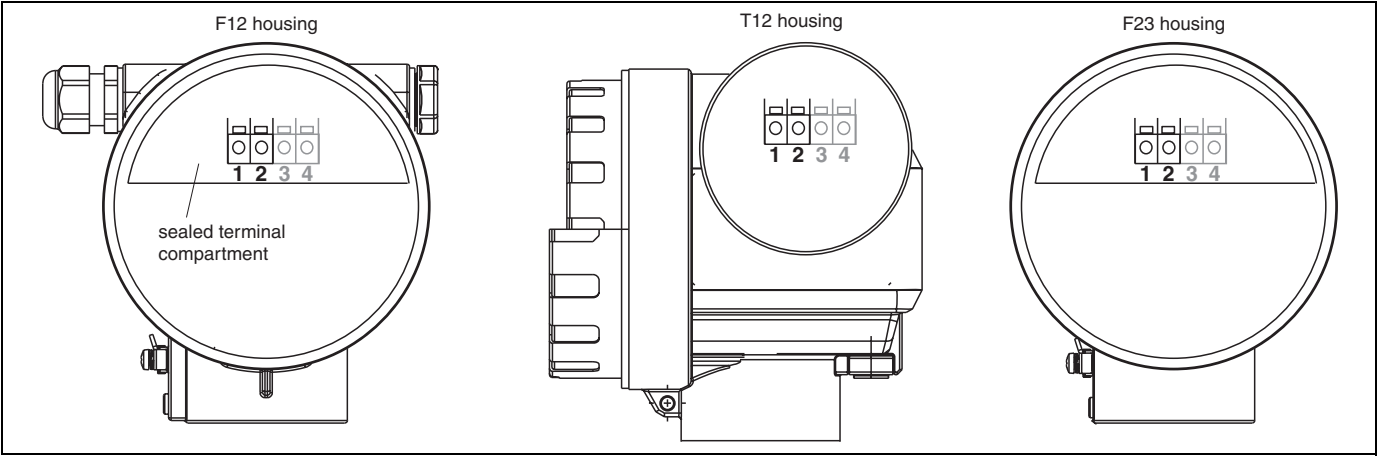
Auxiliary energy

Electrical connection

Terminal compartment

- Three housings are available:
- Aluminium housing F12 with additionally sealed terminal compartment for:
 - standard,
 - Ex ia.
 - Aluminium housing T12 with separate terminal compartment for:
 - standard,
 - Ex e,
 - Ex d,
 - Ex ia (with overvoltage protection, → 23)
 - 316L housing F23 for:
 - standard,
 - Ex ia.

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



Cable gland

	Type	Clamping area
Standard, Ex ia, IS	Plastic M20x1.5	5 to 10 mm (0.2 to 0.39 in)
Ex em, Ex nA	Metal M20x1.5	7 to 10.5 mm (0.28 to 0.41 in)

Terminals

for wire cross-sections of 0.5 to 2.5 mm² (20 to 14 AWG)

Terminal assignment**2-wire, 4 to 20 mA with HART**

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

Cable specification:

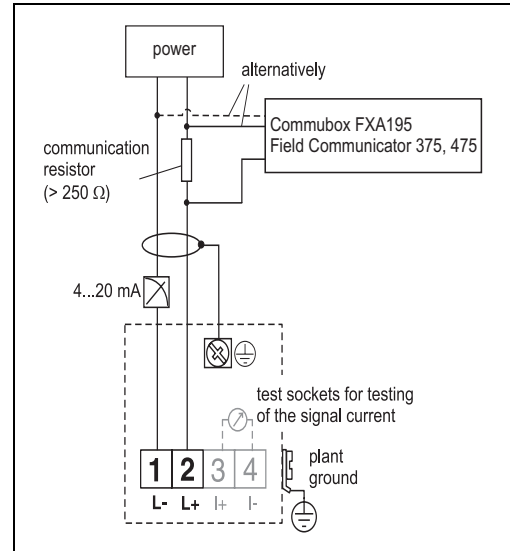
- A standard installation cable is sufficient if only the analogue signal is used. Use a screened cable when working with a superimposed communications signal (HART).

Note!

Protective circuitry against reverse polarity, RFI, and over-voltage peaks is built into the device (refer to TI241F/00/EN "basics for EMC-tests").

Note!

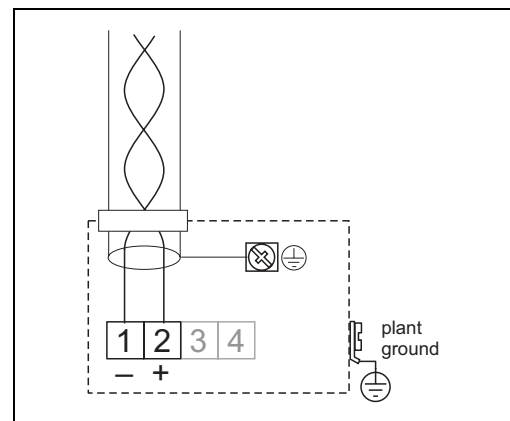
See TI402F/00/EN for connection to Tank Side Monitor NRF590.

**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/04/EN "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.



Note!

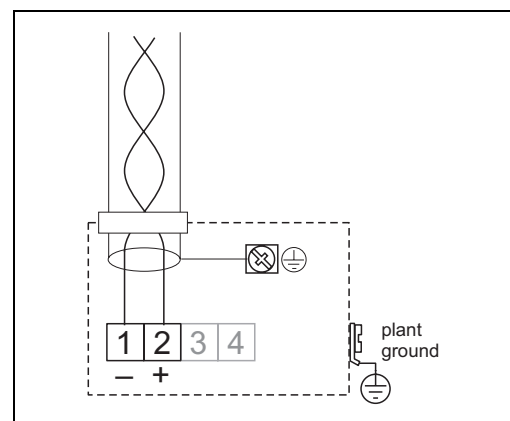
For further information on the cable specifications, see Operating Instructions BA034S/04/EN "Guidelines for planning and commissioning PROFIBUS DP/PA", PNO Guideline 2.092 "PROFIBUS PA User and Installation Guideline" and IEC61158-2 (MBP).

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/04/EN "FOUNDATION Fieldbus Overview" and the FOUNDATION Fieldbus Guideline.

Cable specification:

- Use a twisted, screened two-wire cable, preferably cable type A.



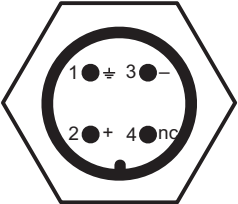
Note!

For further information on the cable specifications, see Operating Instructions BA013S/04/EN "FOUNDATION Fieldbus Overview", FOUNDATION Fieldbus Guideline and IEC61158-2 (MBP).

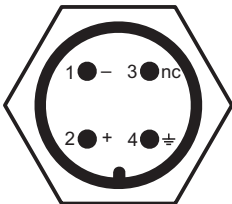
Fieldbus plug connectors

For the versions with fieldbus plug connector, the signal line can be connected without opening the housing.

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

 L00-FMxxxxxx-04-00-00-yy-016	Pin	Meaning
	1	Ground
	2	Signal +
	3	Signal -
	4	not connected

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

 L00-FMxxxxxx-04-00-00-yy-017	Pin	Meaning
	1	Signal -
	2	Signal +
	3	not connected
	4	ground

Load HART

Minimum load for HART communication: 250 Ω

Supply voltage

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
	Ex ia	4 mA	16 V	30 V
		20 mA	7.5 V	30 V
	Ex 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
	Ex ia	11 mA	10 V ¹⁾	30 V
Fixed current for HART Multidrop mode	standard	4 mA ²⁾	16 V	36 V
	Ex ia	4 mA ²⁾	16 V	30 V

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

2) Start up current 11 mA.

PROFIBUS PA

Supply voltage	9 V to 30 V (Ex) ¹⁾ 9 V to 32 V (non-Ex) max. voltage 35 V
Polarity sensitive	No
FISCO/FNICO compliant in accordance to IEC 60079-27	Yes

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

FOUNDATION Fieldbus

Supply voltage	9 V to 30 V (Ex) ¹⁾ 9 V to 32 V (non-Ex) max. voltage 35 V
Device (Lift off) minimum voltage	9 V
Polarity sensitive	No
FISCO/FNICO compliant	Yes

- 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 Ex d: cable entry)
- Cable entry: G½ or ½NPT
- PROFIBUS PA M12 plug
- FOUNDATION Fieldbus 7/8" plug

Power consumption

min. 60 mW, max. 900 mW

Current consumption**HART**

Device basic current	3.6 to 22 mA, for HART Multidrop: start up current is 11 mA
Breakdown signal (NAMUR NE43)	adjustable

PROFIBUS PA

Device basic current	max. 13 mA
Error current FDE (Fault Disconnection Electronic)	0 mA

FOUNDATION Fieldbus

Device basic current	15 mA
Device In-rush current	≤ 15 mA
Error current FDE (Fault Disconnection Electronic)	0 mA

FISCO

U _i	17.5 V
I _i	500 mA; with surge arrester 273 mA
P _i	5.5 W; with surge arrester 1.2 W
C _i	5 nF
L _i	0,01 mH

Ripple HART	47 to 125 Hz: $U_{ss} = 200 \text{ mV}$ (at 500Ω)
Max. noise HART	500 Hz to 10 kHz: $U_{eff} = 2.2 \text{ mV}$ (at 500Ω)
Overvoltage protector	The level transmitter Micropilot M with T12-housing (housing version "D", see ordering information, → 62ff.) is equipped with an internal overvoltage protector (600 V surge arrester) according to DIN EN 60079-14 or IEC 60060-1 (impulse current test $8/20 \mu\text{s}$, $\hat{I} = 10 \text{ kA}$, 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 = $+20 \text{ °C} \pm 5 \text{ °C}$ ($+68 \text{ °F} \pm 41 \text{ °F}$) ■ pressure = $1013 \text{ mbar abs.} \pm 20 \text{ mbar}$ ($15.19 \text{ psi} \pm 0.3 \text{ psi}$) ■ relative humidity (air) = $65 \% \pm 20 \%$ ■ ideal reflector ■ no major interference reflections inside the signal beam
Maximum measured error	Typical statements for reference conditions, include linearity, repeatability, and hysteresis: FMR230, FMR231: ■ to 10 m (33 ft): $\pm 10 \text{ mm}$ ($\pm 0.39 \text{ in}$) ■ ex 10 m (33 ft): $\pm 0.1 \%$ of measuring range FMR240, FMR244, FMR245: ■ not for max. measuring range = 70 m (230 ft) – to 1 m: $\pm 10 \text{ mm}$ ($\pm 0.39 \text{ in}$) ■ for max. measuring range = 40 m (131 ft) – to 10 m (33 ft): $\pm 3 \text{ mm}$ ($\pm 0.12 \text{ in}$) – ex 10 m (33 ft): $\pm 0.03 \%$ of measuring range ■ for max. measuring range = 70 m (230 ft) – to 1 m (3.3 ft): $\pm 30 \text{ mm}$ ($\pm 1.18 \text{ in}$) – ex 1 m (3.3 ft): $\pm 15 \text{ mm}$ ($\pm 0.59 \text{ in}$) or 0.04% of measuring range, whatever is larger
Resolution	Digital / analog in % 4 to 20 mA: 1 mm (0.04 in)/ 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 EN61298-3: ■ digital output (HART, PROFIBUS PA, FOUNDATION Fieldbus): – FMR24x average T_K: 2 mm (0.08 in) /10 K, max. 5 mm (0.2 in) over the entire temperature range -40 °C to $+80 \text{ °C}$ (-40 °F to $+176 \text{ °F}$). – FMR230 average T_K: 3 mm (0.12 in) /10 K, max. 10 mm (0.39 in) over the entire temperature range -40 °C to $+80 \text{ °C}$ (-40 °F to $+176 \text{ °F}$). – FMR231 average T_K: 5 mm (0.2 in) /10 K, max. 15 mm (0.59 in) over the entire temperature range -40 °C to $+80 \text{ °C}$ (-40 °F to $+176 \text{ °F}$). ■ Current output (additional error, in reference to the span of 16 mA): – Zero point (4 mA) average T_K: 0,03 %/10 K, max. 0,45 % over the entire temperature range -40 °C to $+80 \text{ °C}$ (-40 °F to $+176 \text{ °F}$). – Span (20 mA) average T_K: 0,09 %/10 K, max. 0,95 % over the entire temperature range -40 °C to $+80 \text{ °C}$ (-40 °F to $+176 \text{ °F}$).

Effect of gas phase

High pressures reduce the propagation velocity of the measuring signals in the gas/vapor above the fluid. This effect depends on the gas/vapor and is particularly large for low temperatures. This results in a measuring error that gets 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 %
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!

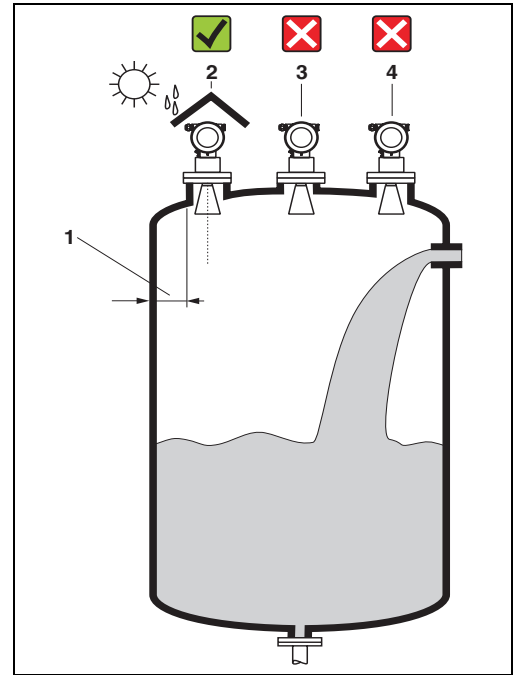
When the pressure is known and constant, this measured error can, for example, be compensated by means of linearization.

Operating conditions: Installation

Installation instructions

Orientation

- Recommended distance (1) wall – **outer edge** of nozzle: $\sim 1/6$ of tank diameter. Nevertheless the device should not be installed closer than
 - 30 cm (11.8 in) (FMR230/231)
 - 15 cm (5.91 in) (FMR240/244/245)
 to the tank wall.
- 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 ($\rightarrow$ 77, "Accessories").



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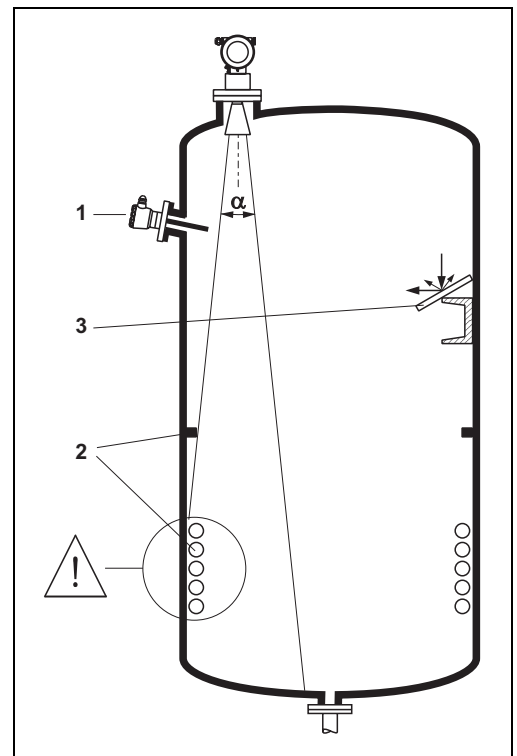
Tank installations

- Avoid any installations (1), like limit switches, temperature sensors, etc., inside the signal beam ($\rightarrow$ 27, "Beam angle").
- 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", $\rightarrow$ 28.
- Stilling well: a stilling well can always be used to avoid interference.
- Metallic screens (3) mounted at a slope spread the radar signals and can, therefore, reduce interference echoes.

Please contact Endress+Hauser for further information.

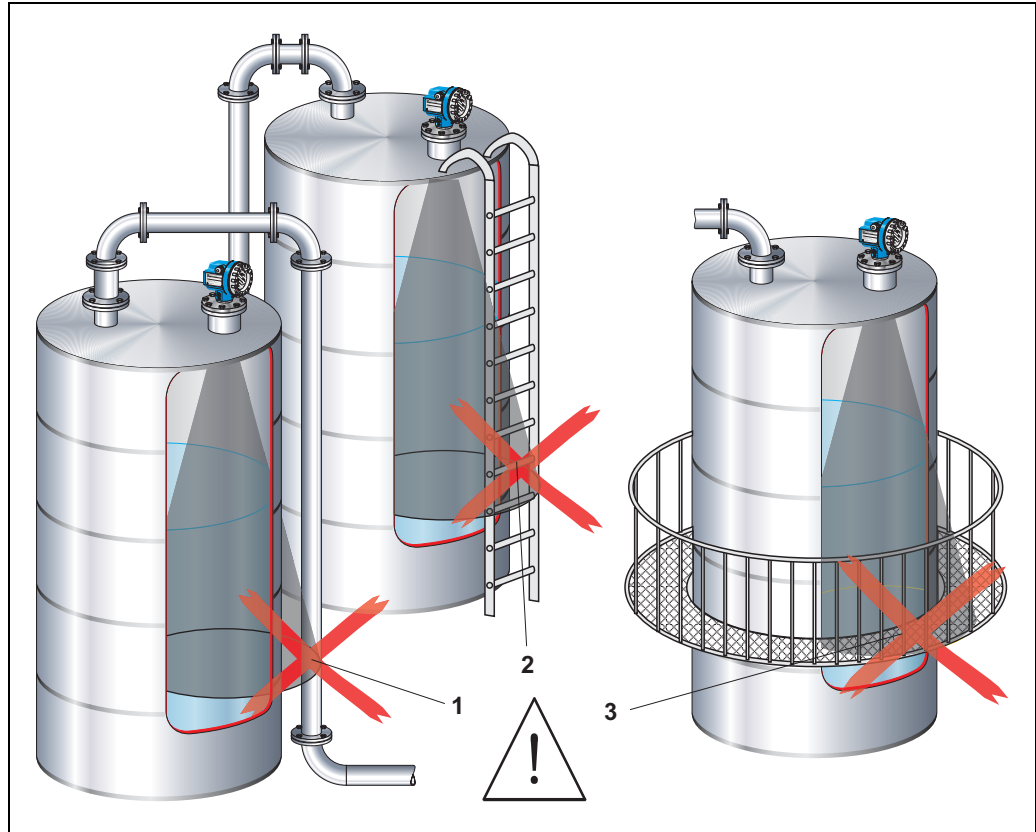


L00-FMR2xxxx-17-00-00-xx-002

Measurement in a plastic tank

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

Please contact Endress+Hauser for further information.



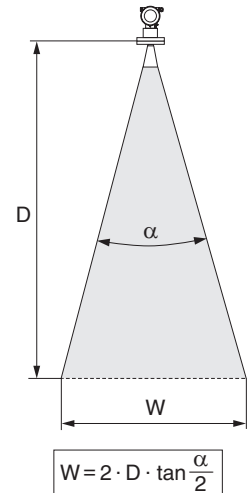
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Beam angle

The beam angle is defined as the angle α 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 (9.8 ft)	1,22 m (4 ft)	1,00 m (3.3 ft)	0,79 m (2.6 ft)	1,61 m (5.3 ft)
6 m (20 ft)	2,44 m (8 ft)	2,01 m (6.6 ft)	1,58 m (5.2 ft)	3,22m (11 ft)
9 m (30 ft)	3,66 m (12 ft)	3,01 m (9.9 ft)	2,37 m (7.8 ft)	4,82 m (16 ft)
12 m (39 ft)	4,88 m (16 ft)	4,02 m (13 ft)	3,16 m (10 ft)	6,43 m (21 ft)
15 m (49 ft)	6,10 m (20 ft)	5,02 m (16 ft)	3,95 m (13 ft)	8,04 m (26 ft)
20 m (66 ft)	8,14 m (27 ft)	6,69 m (22 ft)	5,27 m (17 ft)	10,72 m (35 ft)



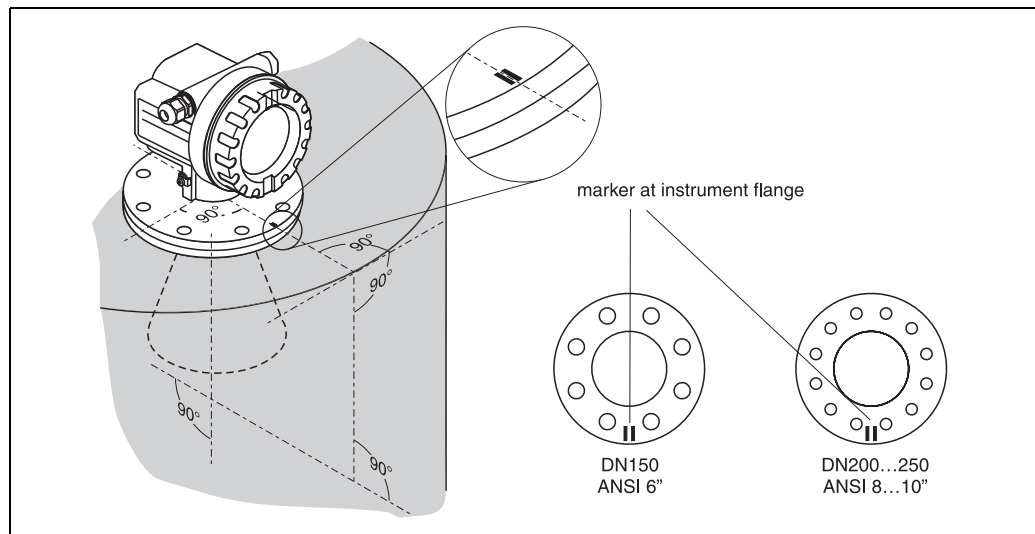
L00-FMR2xxxx-14-00-06-de-027

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 (9.8 ft)	1,22 m (4 ft)	0,95 m (3.1 ft)	0,53 m (1.7 ft)	0,42 m (1.4 ft)
6 m (20 ft)	2,44 m (8 ft)	1,90 m (6.2 ft)	1,05 m (3.4 ft)	0,84 m (2.8 ft)
9 m (30 ft)	3,66 m (12 ft)	2,85 m (9.4 ft)	1,58 m (5.2 ft)	1,26 m (4.1 ft)
12 m (39 ft)	4,88 m (16 ft)	3,80 m (12 ft)	2,10 m (6.9 ft)	1,68 m (5.5 ft)
15 m (49 ft)	6,10 m (20 ft)	4,75 m (16 ft)	2,63 m (8.6 ft)	2,10 m (6.9 ft)
20 m (66 ft)	8,14 m (27 ft)	6,34 m (21 ft)	3,50 m (11 ft)	2,80 m (9.2 ft)
25 m (82 ft)	10,17 m (33 ft)	7,92 m (26 ft)	4,37 m (14 ft)	3,50 m (11 ft)
30 m (98 ft)	—	9,50 m (31 ft)	5,25 m (17 ft)	4,20 m (14 ft)
35 m (115 ft)	—	11,09 m (36 ft)	6,12 m (20 ft)	4,89 m (16 ft)
40 m (131 ft)	—	12,67 m (42 ft)	7,00 m (23 ft)	5,59 m (18 ft)
45 m (148 ft)	—	—	7,87 m (26 ft)	6,29 m (21 ft)
60 m (197 ft)	—	—	10,50 m (34 ft)	8,39 m (28 ft)
70 m (230 ft)	—	—	—	9,79 m (32 ft)

Installation in tank (free space) FMR230

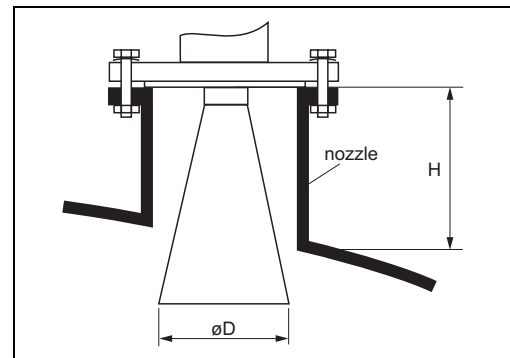
Optimum mounting position



100-FMR230xx-17-00-00-es-001

Standard installation

- Observe installation instructions, → 25.
- 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.

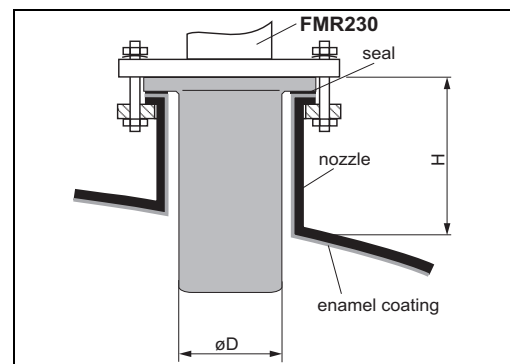


100-FMR230xx-17-00-00-es-002

Antenna size	150 mm (6")	200 mm (8")	250 mm (10")
D [mm (in)]	146 (5.75)	191 (7.52)	241 (9.49)
H [mm (in)]	< 205 (< 8.07)	< 290 (< 11.4)	< 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.

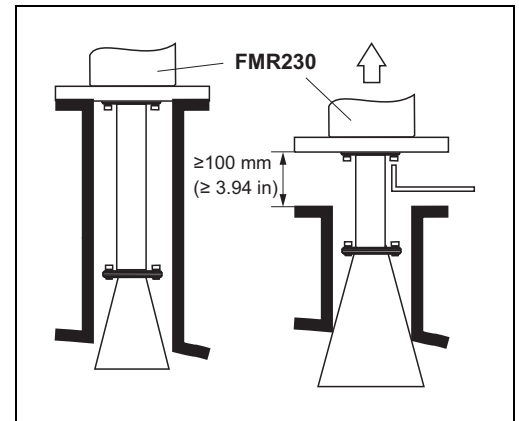


100-FMR230xx-17-00-00-es-008

Antenna size	150 mm (6")	200 mm (8")
D [mm (in)]	145 (5.71)	163 (6.42)
H [mm (in)]	< 222 (< 8.74)	< 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 (3.94 in).
- Recommended torque: 10 Nm (7.37 lbf ft).

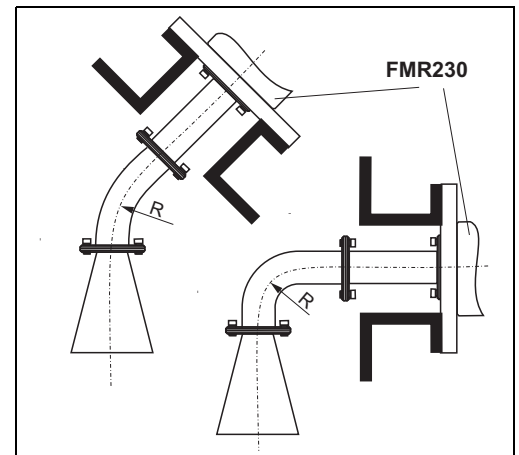


100-FMR230xx-17-00-00-xx-001

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 (11.8 in).

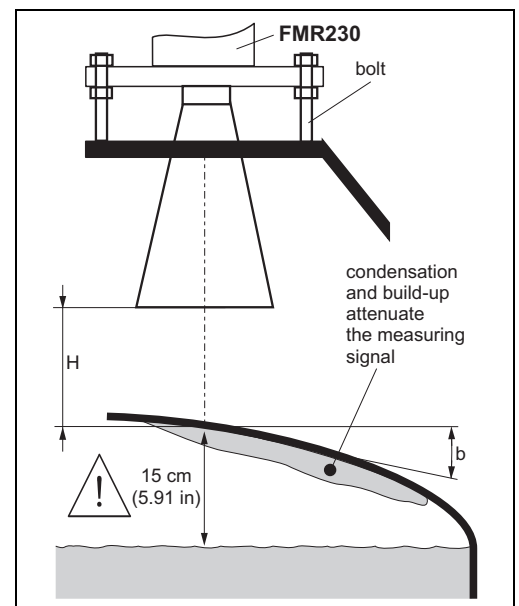
Please contact Endress+Hauser for further information.



100-FMR230xx-17-00-00-yy-001

Measurement from the outside through plastic walls

- Medium with dielectric constant $\epsilon_r > 10$.
- Maximum level 15 cm (5.91 in) below tank ceiling.
- Distance H greater than 100 mm (3.94 in).
- Preferred mounting by means of stand-offs for adjustment of the ideal distance H.
- If possible, **avoid mounting location where condensation or build-up might occur.** In case of outdoor mounting, the space between antenna and vessel has to be protected from the elements.
- Optimum angle β between 15° to 20°
- Select vessel construction material with low dielectric constant and corresponding thickness. No conductive (black) plastics (refer to table).
- If possible, use an antenna DN250 (10").
- Do not mount any potential reflectors (i.e. pipes) outside the tank in the signal beam.

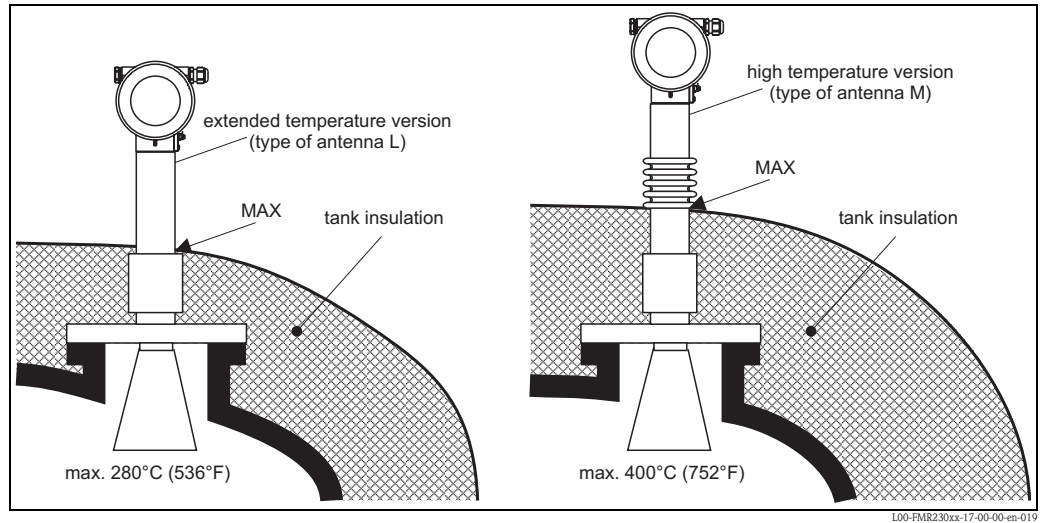


100-FMR230xx-17-00-00-en-005

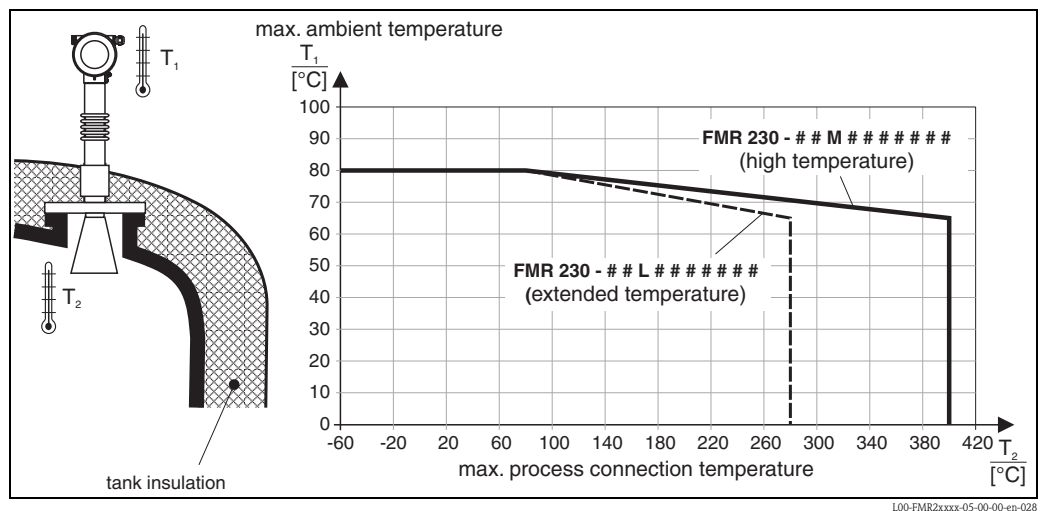
Penetrated material	PE	PTFE	PP	Perspex
DK / ϵ_r	2.3	2.1	2.3	3.1
Optimum thickness [mm (in)] ¹⁾	15,7 (0.62)	16,4 (0.65)	15,7 (0.62)	13,5 (0.53)

1) Other possible values for the thickness are multiples of the values listed (i.e. E: 31,4 mm (1.24 in), 47,1 mm (1.85 in), ...)

Installation FMR230 with heat insulation



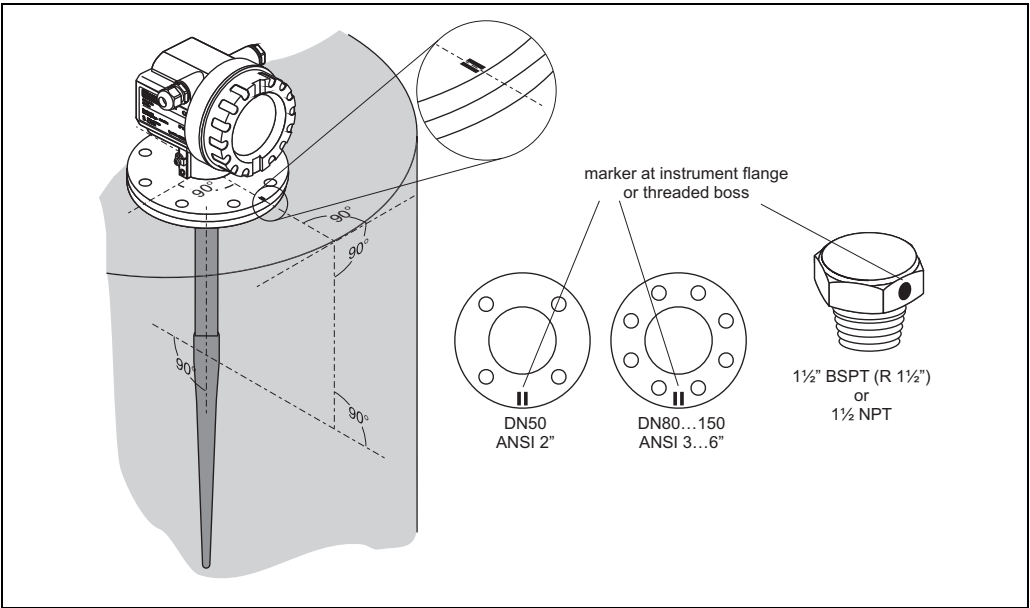
- To avoid the electronics heating up as a result of heat radiation or convection, the FMR230 must be incorporated into the tank insulation at high process temperature ($\geq 200\text{ °C}$ ($\geq 392\text{ °F}$)).
- The isolation should not exceed the points marked with "MAX" within the sketch.



For process connection temperatures (T_2) above 80 °C (176 °F), the allowed ambient temperature (T_1) 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

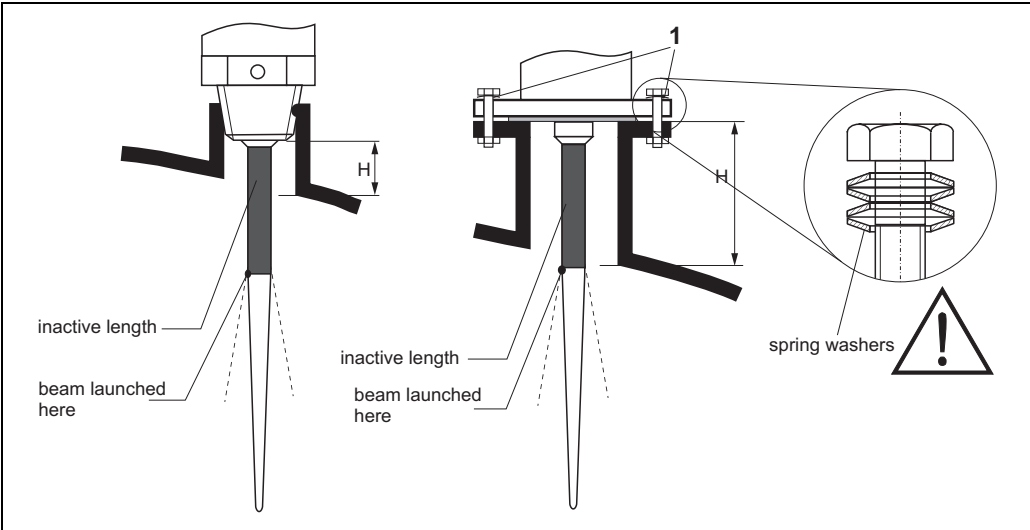
Standard installation

- Observe installation instructions, → 25.
- Marker is aligned towards tank wall.
- The marker is always exactly in the middle between two bolt-holes in the flange.
- Use spring washers (1) (see Fig.).

Note!

It is recommended to retighten the flange bolts periodically, depending on process temperature and pressure. Recommended torque: 60 to 100 Nm (44.24 to 73.75 lbf ft).

- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.
- The inactive part of the rod antenna must extend below the nozzle.
- The rod antenna must be aligned vertically.

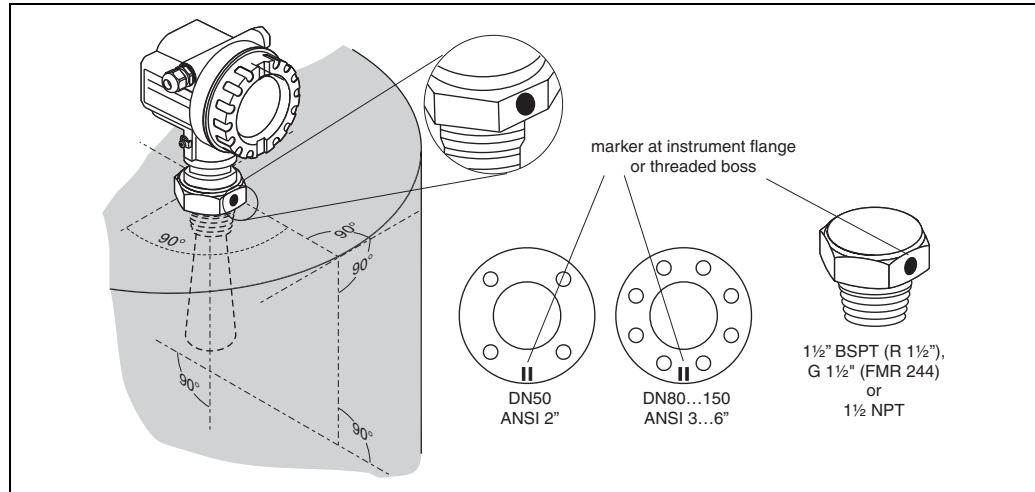


L00-FMR231xx-17-00-00-en-002

Material	PPS		PTFE	
Antenna length [mm (in)]	360 (14.2)	510 (20.1)	390 (15.4)	540 (21.3)
H [mm (in)]	< 100 (< 3.94)	< 250 (< 9.84)	< 100 (< 3.94)	< 250 (< 9.84)

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

Optimum mounting position



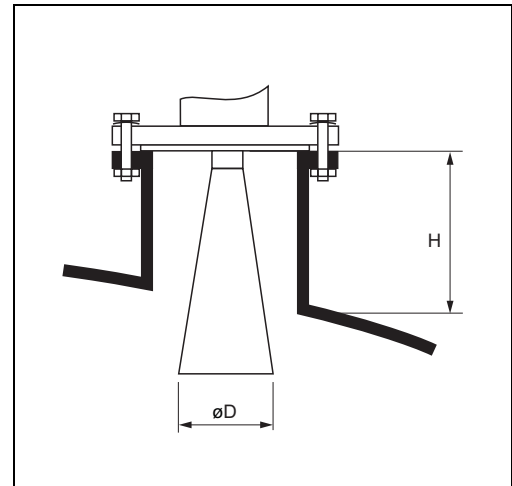
100-FMR240xx-17-00-00-es-001

Standard installation FMR240

- Observe installation instructions, → 25.
- 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 (3.94 in) antenna extension if necessary. Nozzle heights up to 500 mm (19.7 in) can be accepted if this should not be possible due to mechanical reasons.

Note!

Please contact Endress+Hauser for application with higher nozzle.



100-FMR240xx-17-00-00-de-002

- **The horn antenna must be aligned vertically.**

Caution!

The maximum range may be reduced, if the horn antenna is not vertically aligned.

- For mounting in solid applications use the variable flange seal to align the device towards the product surface (→ 77, "Accessories").

Antenna size	40 mm (1½")	50 mm (2")	80 mm (3")	100 mm (4")
D [mm (in)]	40 (1.57)	48 (1.85)	75 (2.95)	95 (3.74)
H [mm (in)]	< 85 (< 3.35)	< 115 (< 4.53)	< 210 (< 8.27)	< 280 (< 11)

Measurement from the outside through plastic walls

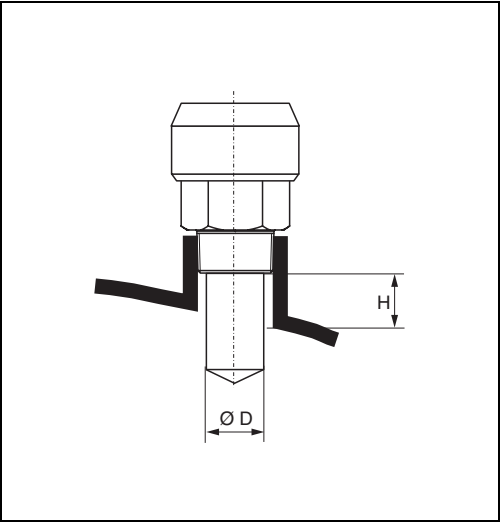
- Observe instructions, → 25.
- If possible, use an antenna 100 mm (4").

Penetrated material	PE	PTFE	PP	Perspex
DK / ε _r	2,3	2,1	2,3	3,1
Optimum thickness [mm (in)] 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: 7,6 mm (0.3 in), 11,4 mm (0.45 in), ...)

Standard installation FMR244 - 40 mm (1½") antenna

- Observe installation instructions, → 25.
- Marker is aligned towards tank wall.
- Install the device using the threaded boss (AF60) only. Observe the max. torque of 20 Nm (14.75 lbf ft).
- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.
- For optimum measurement, the tip of the antenna should extend below the nozzle. Nozzle heights up to 500 mm (19.7 in) 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.

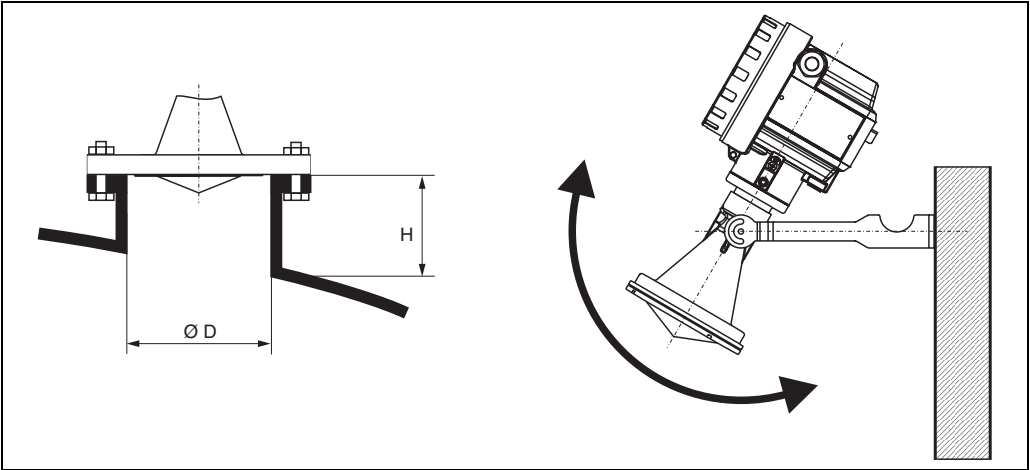


100-FMR244xx-17-00-00-de-002

Antenna size	40 mm (1½")
D [mm (in)]	39 (1.54)
H [mm (in)]	< 85 (3.35)

Standard installation FMR244 - 80 mm (3") antenna

- Observe installation instructions, → 25.
- 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 (→ 77, "Accessories") can be used to align the device (solid applications).
- If using a mounting bracket (→ 77, "Accessories"), 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.



100-FMR244xx-17-00-00-xx-011

Antenna size	80 mm (3")		
D [mm (in)]	80 (3.15)	100 (3.94)	150 (5.91)
H [mm (in)]	< 500 (< 19.7)	< 500 (< 19.7)	< 500 (< 19.7)

Standard installation FMR245

- Observe installation instructions, → 25.
- Marker is aligned towards tank wall.
- The marker is always exactly in the middle between two bolt-holes in the flange.
- Use spring washers (1) (see Fig.).

Note!

It is recommended to retighten the flange bolts periodically, depending on process temperature and pressure.
Recommended torque: 60 to 100 Nm (44.25 to 73.75 lbf ft).

- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.
- **The antenna must be aligned vertically.**

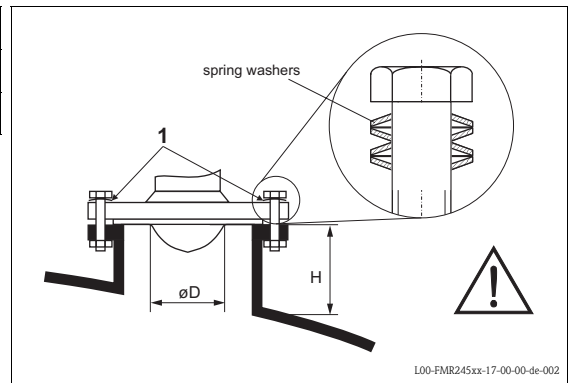
Caution!

The maximum range may be reduced, if the antenna is not vertically aligned.

Note!

Please contact Endress+Hauser for application with higher nozzle.

Antenna size	50 mm (2")	80 mm (3")
D [mm (in)]	48 (1.89)	75 (2.95)
H [mm (in)]	< 500 (< 19.7)	< 500 (< 19.7)

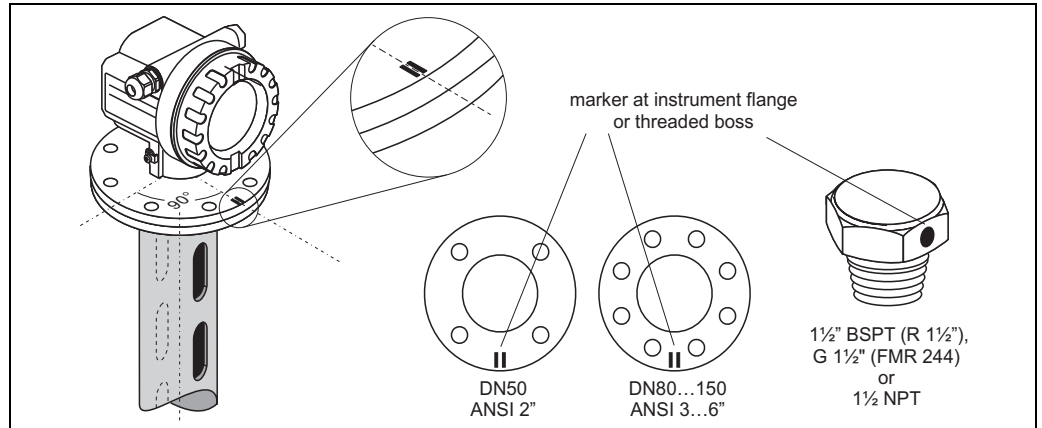


Note!

The PTFE plating of the FMR245 is used for sealing to the process. Usually no other sealing is necessary.

Installation in stilling well
FMR230, FMR240,
FMR244, FMR245

Optimum mounting position



100-FMR230xx-17-00-00-en-006

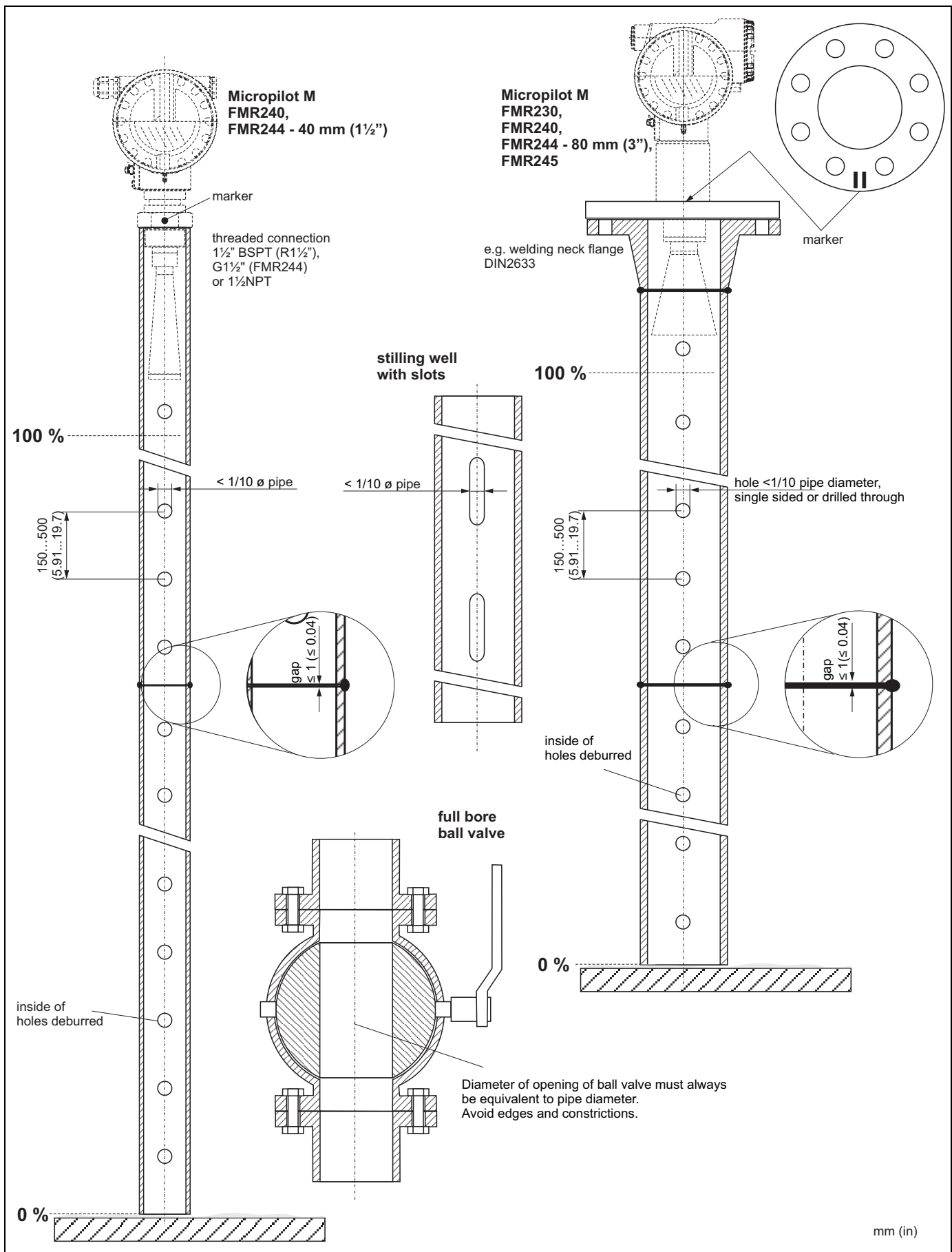
Standard installation

- 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, → 25.

Recommendations for the stilling well

- Metal (no enamel coating, plastic on request).
- Constant diameter.
- Diameter of stilling well not larger than antenna diameter.
- Weld seam as smooth as possible and on the same axis as the slots.
- Slots offset 180° (not 90°).
- Slot width respectively diameter of holes max. 1/10 of pipe diameter, de-burred. Length and number do not have any influence on the measurement.
- Select horn antenna as big as possible. For intermediate sizes (i.e. 180 mm (7")) 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 stilling well must be smooth on the inside (average roughness $R_z \leq 6.3 \mu\text{m}$ ($\leq 248 \mu\text{in}$)). 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 smoothed. 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).

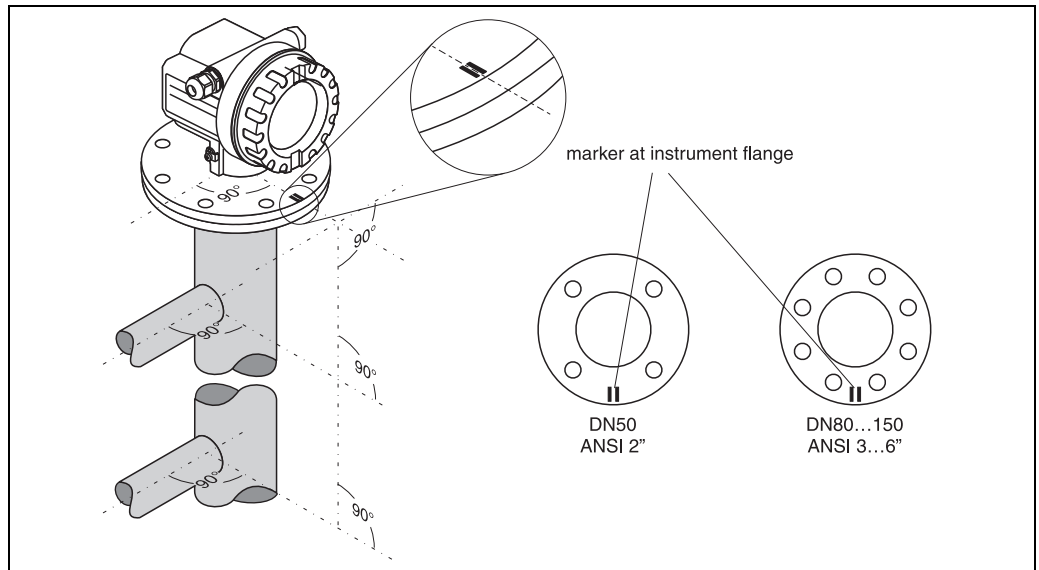
Examples for the construction of stilling wells



100-FMR2xxxx-17-00-00-en-002

Installation in bypass FMR230, FMR240, FMR245

Optimum mounting position



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

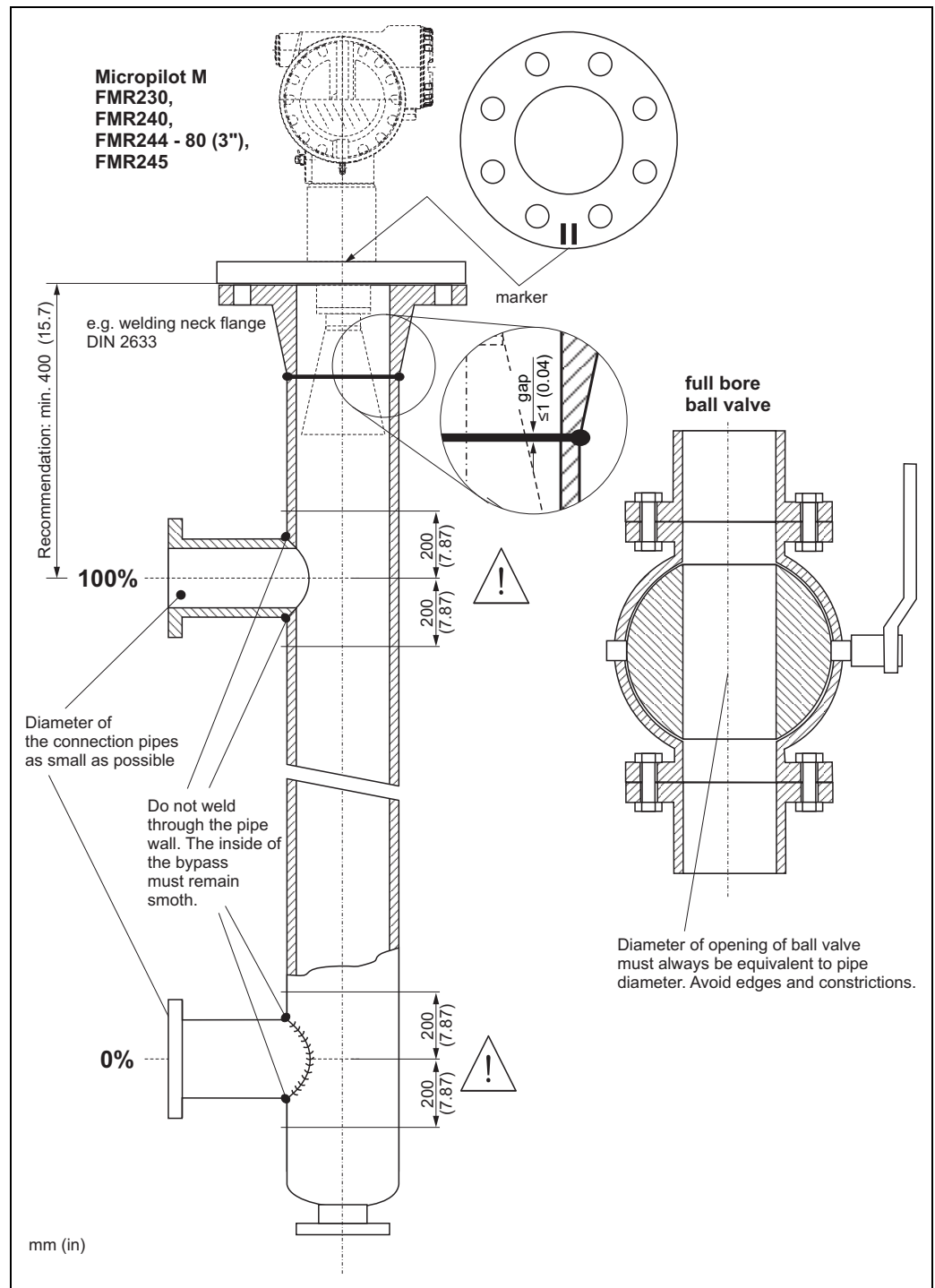
Standard installation

- 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, → 25.

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 (3.5")) 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).
- In the area of the tank connections ($\sim \pm 20$ cm (± 7.87 in)) a reduced accuracy of the measurement has to be expected.

Example for the construction of a bypass.



100-FMR2xxx-17-00-00-en-019

Operating conditions: Environment

Ambient temperature range	Ambient temperature for the transmitter: -40 °C to +80 °C (-40 °F to +176 °F) or -50 °C to +80 °C (-58 °F to +176 °F). The functionality of the LCD display may be limited for temperatures $T_a < -20$ °C (-4 °F) and $T_a > +60$ °C (+140 °F). A weather protection cover should be used for outdoor operation if the instrument is exposed to direct sunlight.
Storage temperature	-40 °C to +80 °C (-40 °F to +176 °F) or -50 °C to +80 °C (-58 °F to +176 °F).
Climate class	DIN EN 60068-2-38 (test Z/AD)
Degree of protection	■ with closed housing: IP65, NEMA4X (higher degree of protection e.g. IP68 on request) ■ with open housing: IP20, NEMA1 (also ingress protection of the display) ■ antenna: IP68 (NEMA6P)
Vibration resistance	DIN EN 60068-2-64 / IEC 68-2-64: ■ 20 to 2000 Hz, 1 (m/s²)²/Hz (FMR230/231; FMR240; FMR245; FMR244 with 40 mm (1½") antenna) ■ 20 to 2000 Hz, 0.5 (m/s²)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 ϵ_r. If the medium tends to cause contamination and deposits, cleaning on a regular basis is recommended. Care has to be taken not to damage the antenna in the process of a mechanical or hose-down cleaning (eventually connection for cleaning liquid). The material compatibility has to be considered if cleaning agents are used! The maximum permitted temperature at the flange should not be exceeded.
Electromagnetic compatibility (EMC)	■ Electromagnetic compatibility in accordance with all the relevant requirements of the EN 61326 series and NAMUR recommendation (NE21). For details refer to the Declaration of Conformity. Maximum deviation < 0.5 % of the span. ■ 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 range may be reduced by the selected process connection. The pressure rating (PN) specified on the flanges refers to a reference temperature of 20 °C (68 °F), 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 1.4404 and 1.4435 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

FMR230					
Type of antenna		Seal	Temperature	Pressure	Wetted parts
V	Standard	FKM Viton GLT	-40 °C to +200 °C ¹⁾ (-40 °F to +392 °F)	-1 bar to 64 bar (-14.5 psi to 928 psi)	PTFE, seal, 316L resp. Alloy C4
	Standard	EPDM	-40 °C to +150 °C (-40 °F to +302 °F)		
	Standard	Kalrez (Spectrum 6375)	-20 °C to +200 °C ¹⁾ (-4 °F to +392 °F)		
L	Extended temperature	Graphit	-60 °C to +280 °C (-76 °F to +536 °F)	-1 bar to 100 bar (-14.5 psi to 1450 psi)	Ceramic (Al ₂ O ₃ : 99,7%), Graphit, 316L
M	High temperature	Graphit	-60 °C to +400 °C (-76 °F to +752 °F)	-1 bar to 160 bar (-14.5 psi to 2320 psi)	
H	Enamel	PTFE	-40 °C to +200 °C (-40 °F to +392 °F)	-1 bar to 16 bar (-14.5 psi to 232 psi)	PTFE, Enamel

↑ Ordering information, → 63

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

FMR231					
Type of antenna		Process connection	Temperature	Pressure	Wetted parts
A, B	PPS	—	-20 °C to +120 °C (-4 °F to +248 °F)	-1 bar to 16 bar (-14.5 psi to 232 psi)	316L, Viton, PPS
E, F	PTFE (TFM1600)	PVDF threaded connection	-40 °C to +80 °C (-40 °F to +176 °F)	-1 bar to 3 bar (-14.5 psi to 43.5 psi)	PVDF, PTFE
		Metal threaded connection		-1 bar to 40 bar (-14.5 psi to 302 °F)	316L, PTFE (TFM1600)
		Flange unclad			
		Flange clad ²⁾		-1 bar to 16 bar (-14.5 psi to 232 psi)	PTFE (TFM1600)
		Tri-Clamp 2"		-1 bar to 16 bar (-14.5 psi to 232 psi)	316L, PTFE (TFM1600) ¹⁾
		Tri-Clamp 3"		-1 bar to 10 bar (-14.5 psi to 145 psi)	
		Aseptic, Dairy		-1 bar to 25 bar (-14.5 psi to 362.5 psi)	

FMR231					
Type of antenna		Process connection	Temperature	Pressure	Wetted parts
H, J	PTFE antistatic (TFM4220, 2% conductive additives)	Metal threaded connection	-40 °C to +150 °C (-40 °F to +302 °F)	-1 bar to 40 bar (-14.5 psi to 302 °F)	316L, PTFE (TFM4220)
		Flange unclad			
		Flange clad ²⁾		-1 bar to 16 bar (-14.5 psi to 232 psi)	PTFE (TFM4220)

↑ Ordering information, → 66

- 1) FDA-listed material, meets USP Class VI conformity.
- 2) On DN150, 6" ANSI, JIS 150A the disc is made of antistatic PTFE (=black).

FMR240					
Type of antenna		Seal	Temperature	Pressure	Wetted parts
V	Standard	FKM Viton	-20 °C to +150 °C (-4 °F to +302 °F)	-1 bar to 40 bar (-14.5 psi to 580 psi)	PTFE, seal, 316L resp. Alloy C22
E	Standard	FKM Viton GLT	-40 °C to +150 °C (-40 °F to +302 °F)		
K	Standard	Kalrez (Spectrum 6375)	-20 °C to +150 °C (-4 °F to +302 °F)		

↑ Ordering information, → 68

FMR244					
Type of antenna		Seal	Temperature	Pressure	Wetted parts
V	Standard, completely PTFE encapsulated	FKM Viton GLT	-40 °C to +130 °C (-40 °F to +266 °F)	-1 bar to 3 bar (-14.5 psi to 43.5 psi)	PTFE (TFM1600), Viton, PVDF
S	Standard, PP clad	Silicone	-40 °C to +80 °C (-40 °F to +176 °F)		PP, Silicone, PBT

↑ Ordering information, → 72

FMR245					
Type of antenna		Seal	Temperature	Pressure	Wetted parts
B, C, F, G	Standard, PTFE clad	none	-40 °C to +200 °C (-40 °F to +392 °F)	-1 bar to 16 bar (-14.5 psi to 232 psi)	PTFE (TFM1600, FDA-listed) ^{1) 2)}

↑ Ordering information, → 75

- 1) 3A-, EHEDG approval for Tri-Clamp process connection.
- 2) Meets USP Class VI conformity.

Dielectric constant

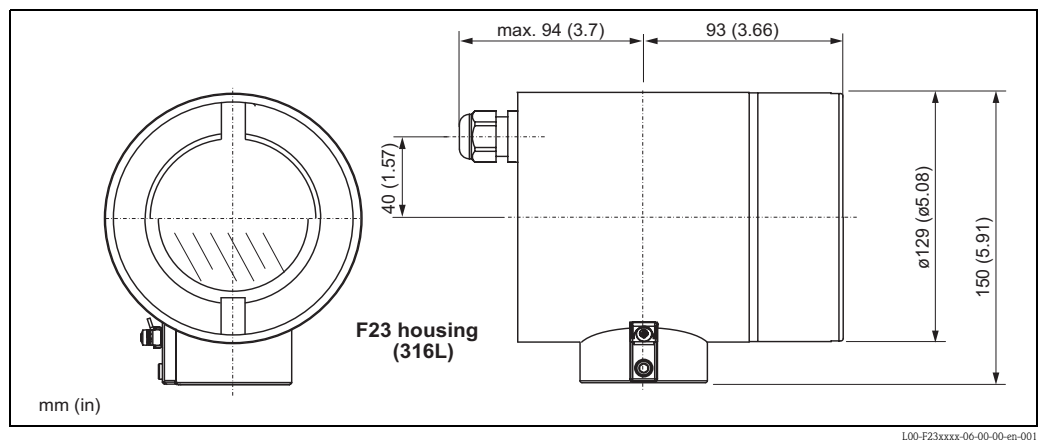
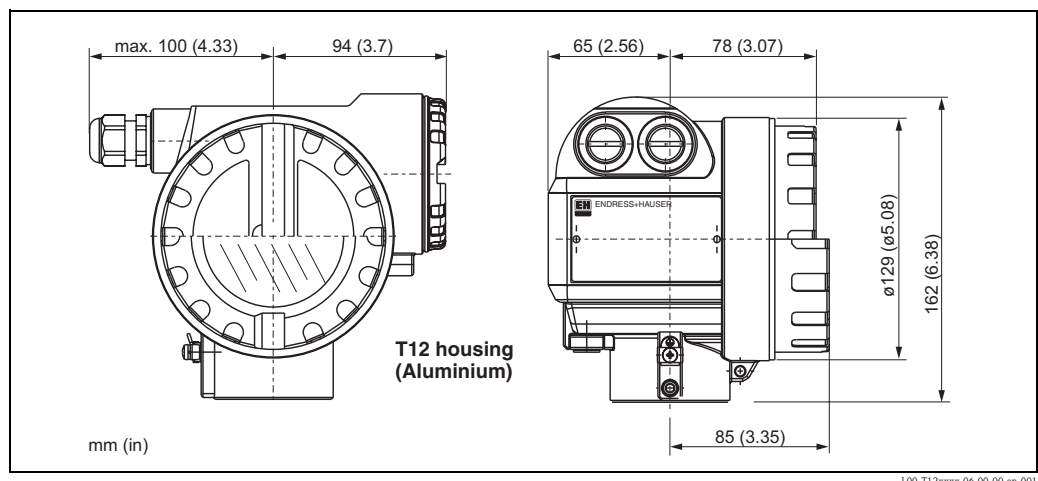
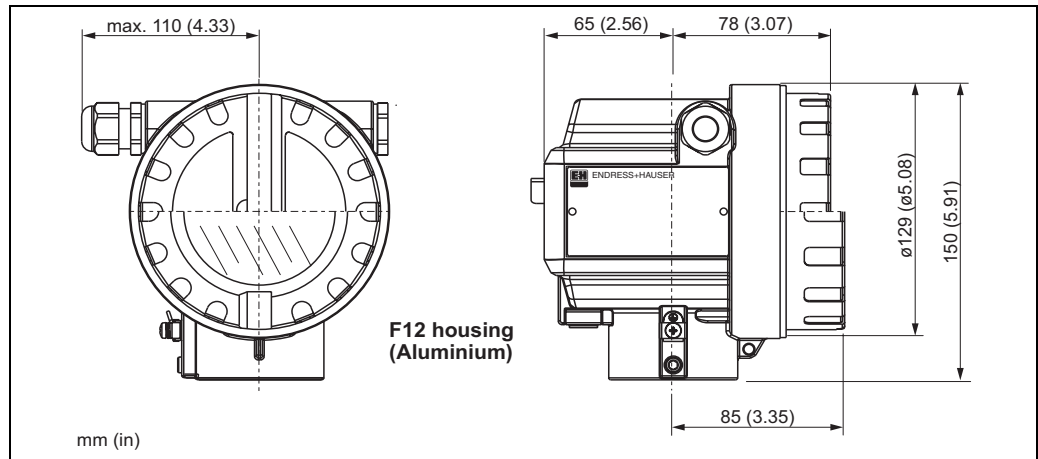
- in a stilling well: $\epsilon_r \geq 1,4$
- in free space: $\epsilon_r \geq 1,9$

Mechanical construction

Design, dimensions

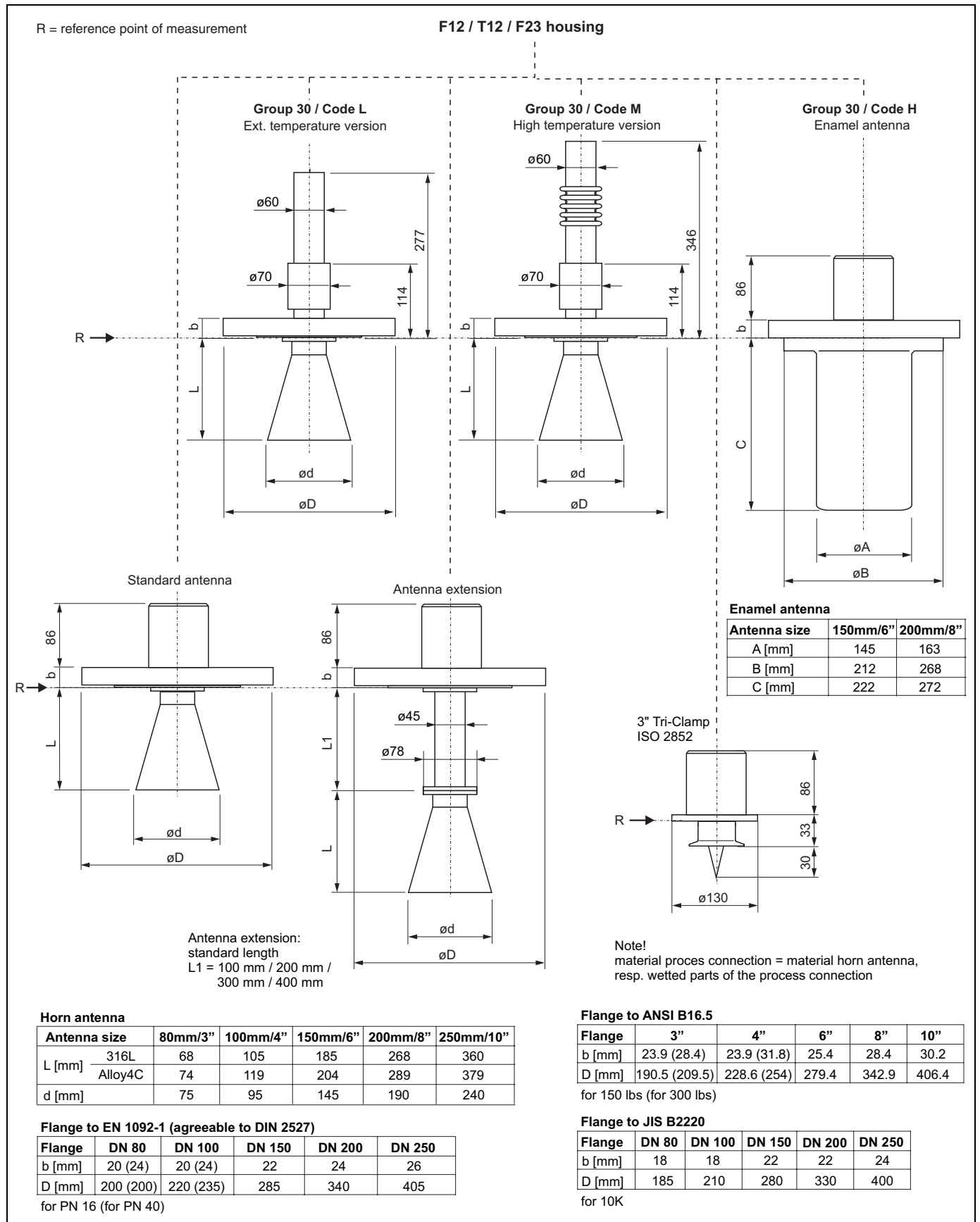
Housing dimensions

Dimensions for process connection and type of antennae, → 42.



Micropilot M FMR230 - Process connection and antenna

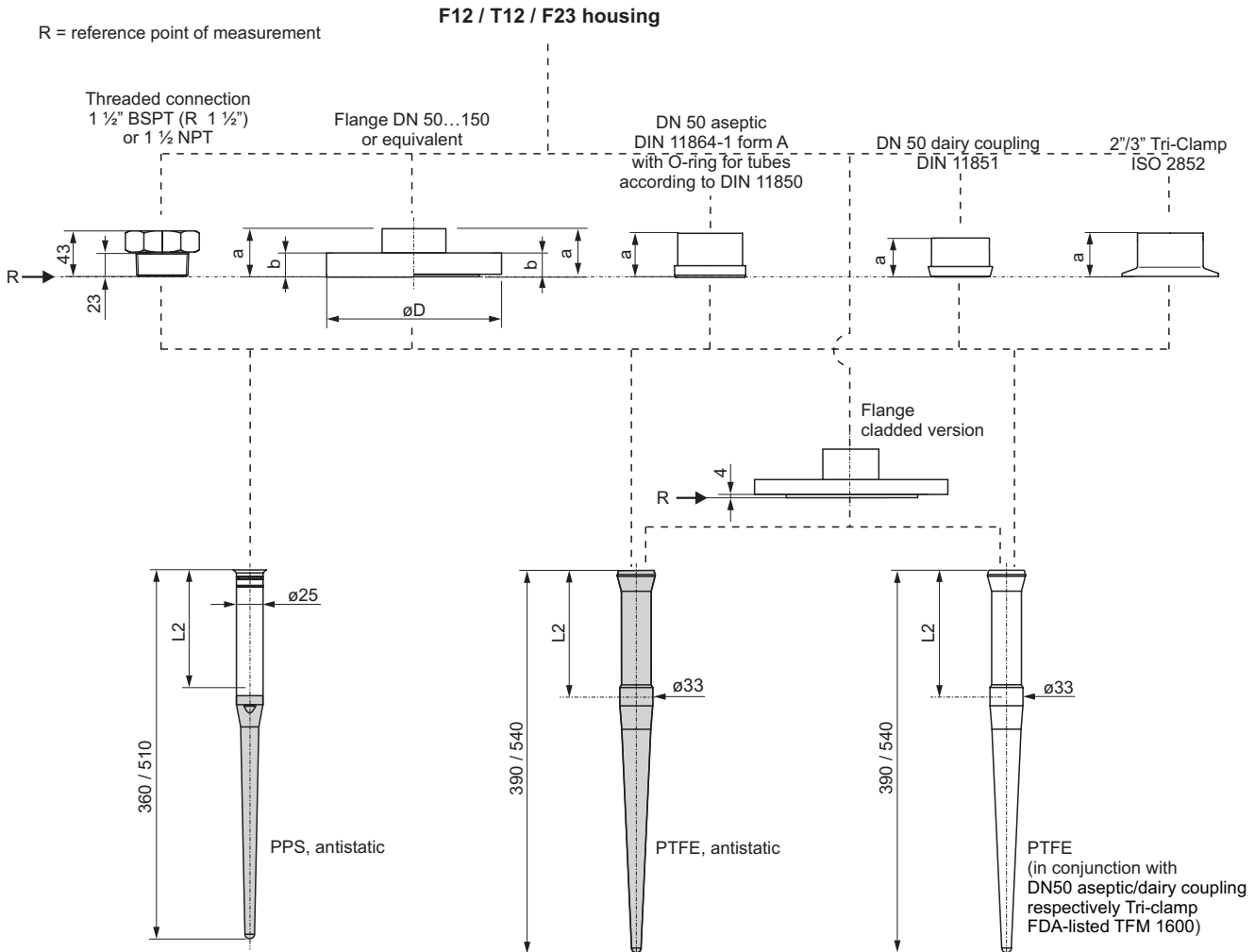
Housing dimensions, → 42.



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

Micropilot M FMR231 - Process connection and antenna

Housing dimensions, → 42.



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)

Flange to JIS B2220

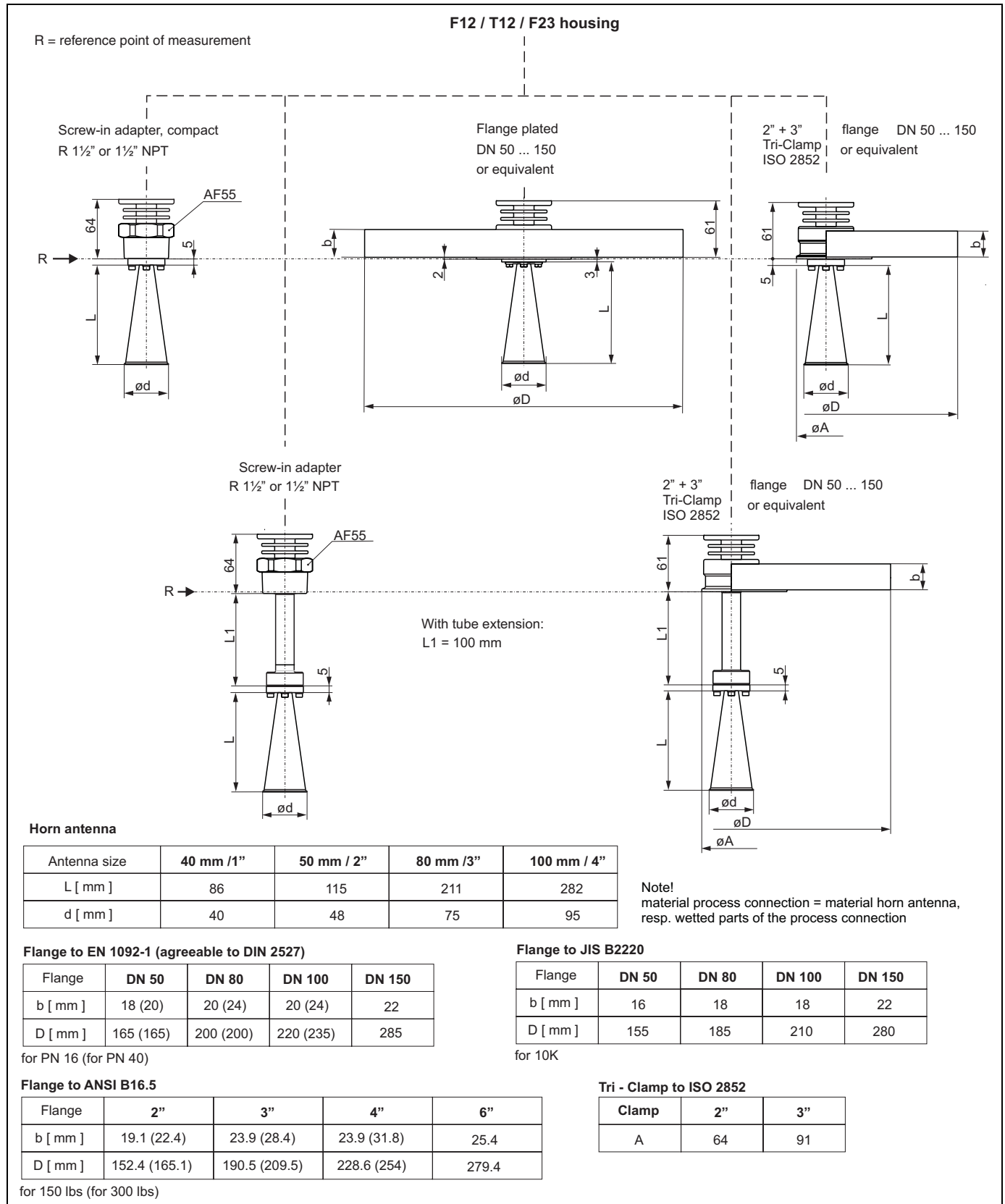
Flange	DN 50	DN 80	DN 100	DN 150
b [mm]	16	18	18	22
D [mm]	155	185	210	280

for 10K

Process connection	Flange DN 50...150	DN 50 aseptic coupling	DN 50 dairy 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

Micropilot M FMR240 - Process connection and antenna

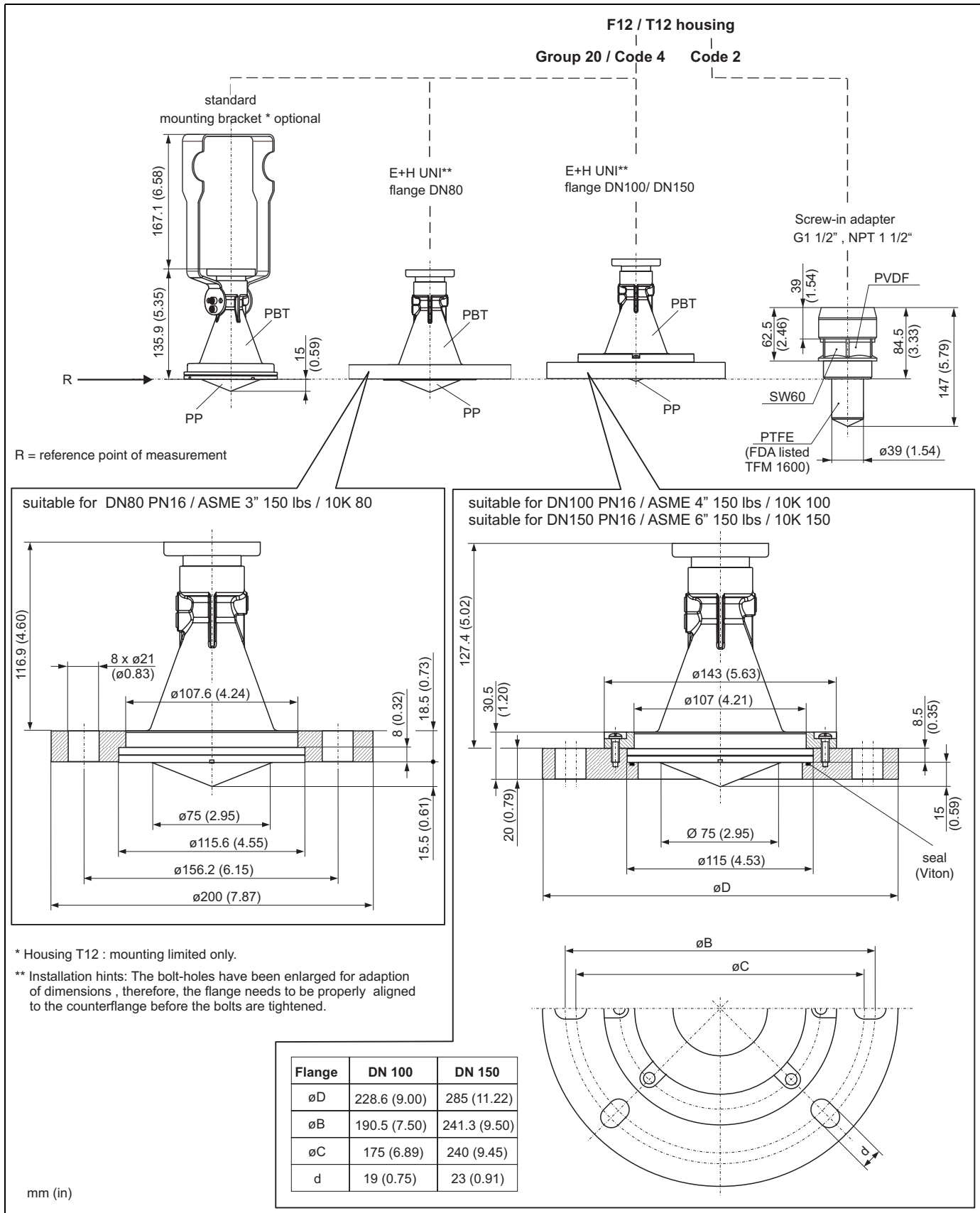
Housing dimensions, → 42.



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

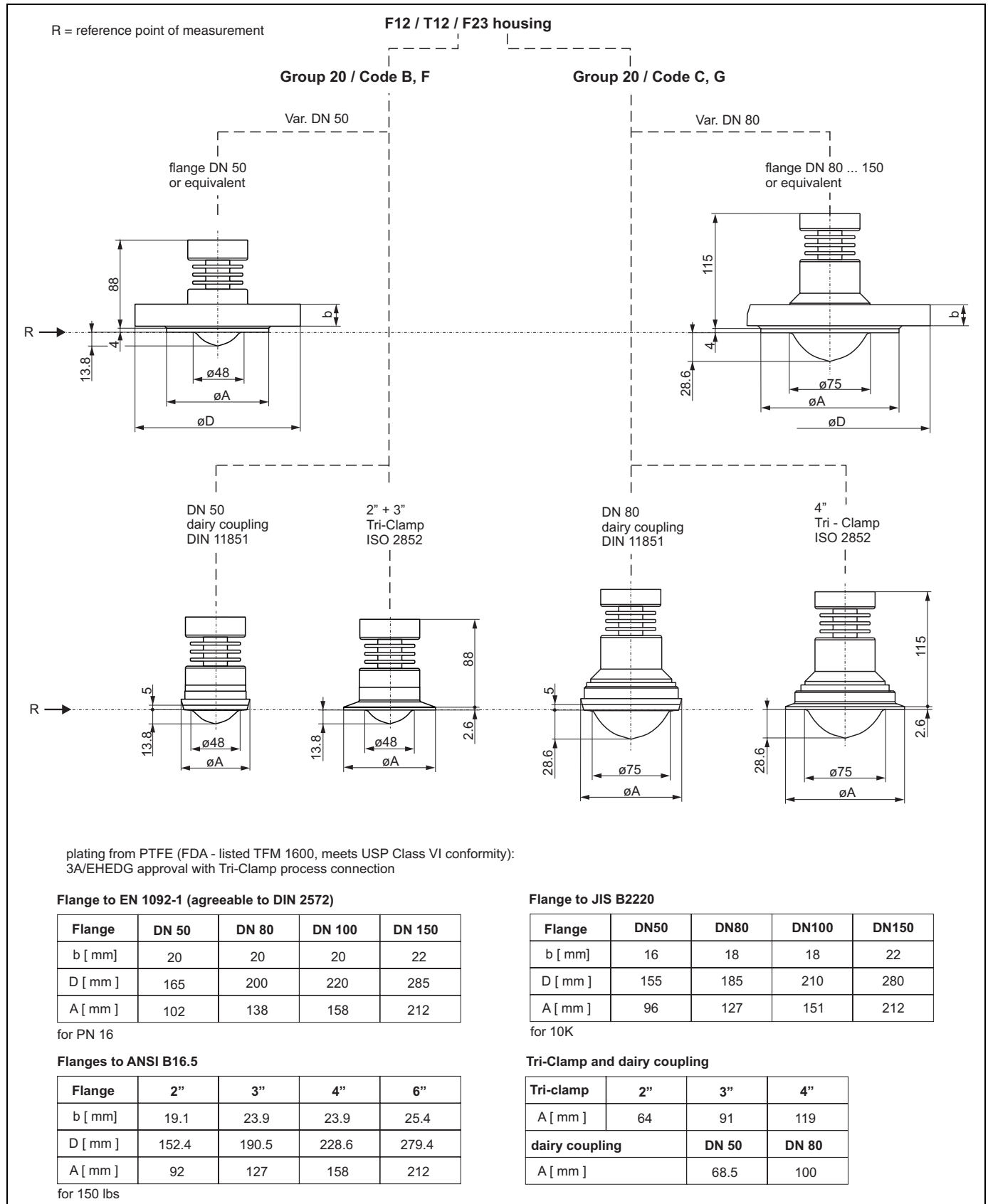
Micropilot M FMR244 - Process connection and antenna

Housing dimensions, → 42.



Micropilot M FMR245 - Process connection and antenna

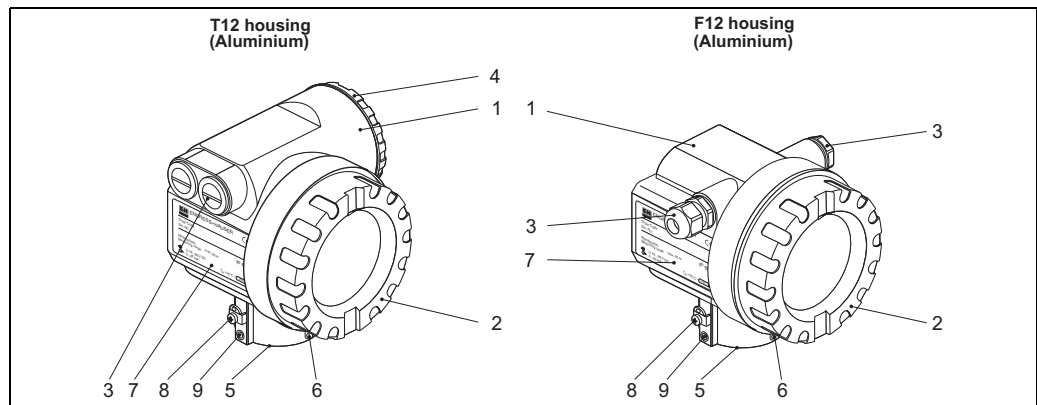
Housing dimensions, → 42.



100-FMR245xx-06-00-00-en-006

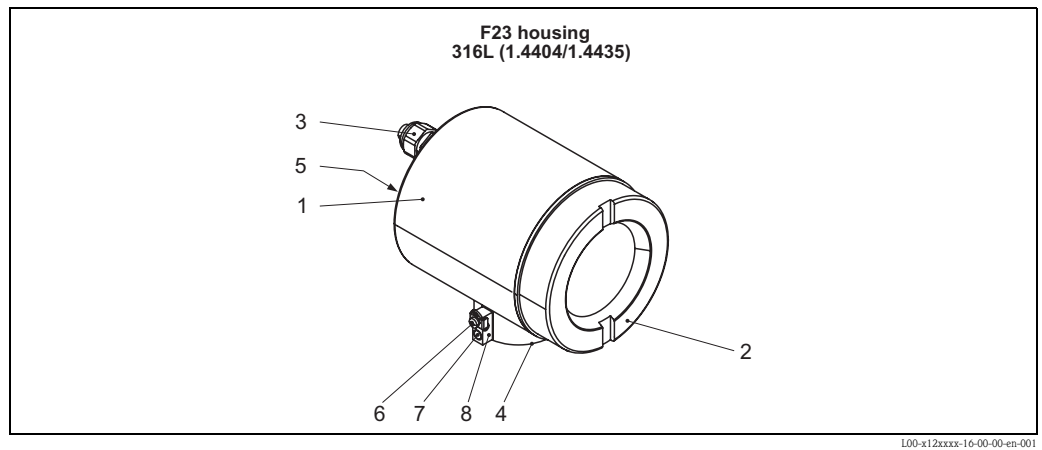
Weight

Micropilot M	FMR230	FMR231	FMR240	FMR244	FMR245
Weight for F12 or T12 housing	Approx. 6 kg (13.23 lbs) + weight of flange	Approx. 4 kg (8.82 lbs) + weight of flange	Approx. 4 kg (8.82 lbs) + weight of flange	Approx. 2,5 kg (5.51 lbs)	Approx. 4 kg (8.82 lbs) + weight of flange
Weight for F23 housing	Approx. 9,4 kg (20.73 lbs) + weight of flange	Approx. 7,4 kg (16.32 lbs) + weight of flange	Approx. 7,4 kg (16.32 lbs) + weight of flange	-	Approx. 7,4 kg (16.32 lbs) + weight of flange

**Material
(not in contact with process)****Materials of T12 and F12 housing (seawater-resistant, powder-coated)**

100-x12xxxx-16-00-00-en-001

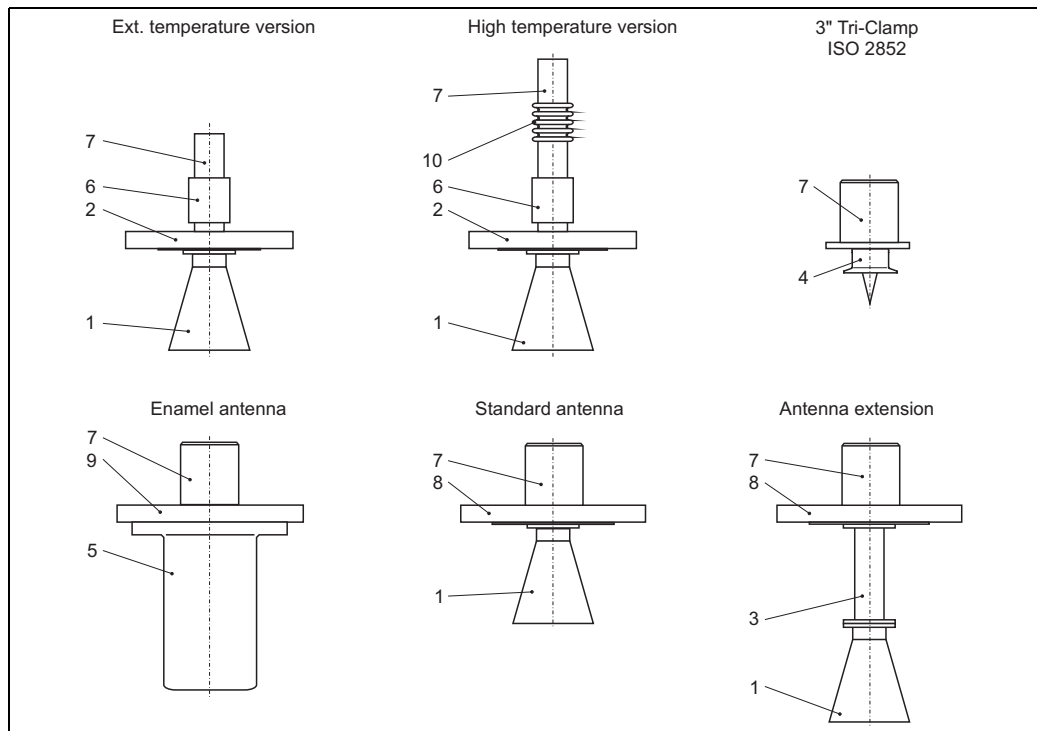
Pos.	Part	Material	
1	T12 and F12 housing	AlSi10Mg	
2	Cover (Display)	AlSi10Mg	
	Sealing	Fa. SHS: EPDM 70pW FKN	
	Window	ESG-K-Glass (Toughened safety glass)	
	Sealing of the glass	Silicone sealing compound Gomastit 402	
3	Sealing	Fa. SHS: EPDM 70 pW FKN	Trelleborg: EPDM E7502
	Cable gland	Polyamid (PA), CuZn nickel-plated	
	Plug	PBT-GF30	1.0718 galvanized
		PE	3.1655
4	Adapter	316L (1.4435)	AlMgSiPb (anodized)
	Cover (Connection compartment)	AlSi10Mg	
	Sealing	Fa. SHS: EPDM 70pW FKN	Trelleborg: EPDM E7502/E7515
5	Clamp	Screws: A4; Clamp: Ms nickel-plated; Spring washer: A4	
	Sealing ring	Fa. SHS: EPDM 70pW FKN	Trelleborg: EPDM E7502/E7515
6	Retaining ring for tag	VA	
	Rope	VA	
	Crimp sleeve	Aluminium	
7	Nameplate	1.4301	
	Groove pin	A2	
8	Ground terminal:	Screws: A2; Spring washer: A4; Clamp: 1.4301 Holder: 1.4310	
9	Screws	A2-70	

Materials of F23 housing (corrosion-resistant)

Pos.	Part	Material	
1	F23 housing	Housing body: 1.4404; Sensor neck: 1.4435; earth connection block: 1.4435	
2	Cover	1.4404	
	Sealing	Fa. SHS: EPDM 70pW FKN	
	Window	ESG-K-Glass (Toughened safety glass)	
	Sealing of the glass	Silicone sealing compound Gomastit 402	
3	Sealing	Fa. SHS: EPDM 70pW FKN	Trelleborg: EPDM E7502
	Cable gland	Polyamid (PA), CuZn nickel-plated	
	Plug	PBT-GF30	1.0718 galvanized
		PE	3.1655
	Adapter	316L (1.4435)	
4	Sealing ring	Fa. SHS: EPDM 70pW FKN	Trelleborg: EPDM E7502
5	Nameplate	1.4301	
6	Grounding terminal:	Screws: A2; Spring washer: A4; Clamp: 1.4301; Holder: 1.4310	
7	Screw	A2-70	
8	Retaining ring for tag	VA	
	Rope	VA	
	Crimp sleeve	Aluminium	

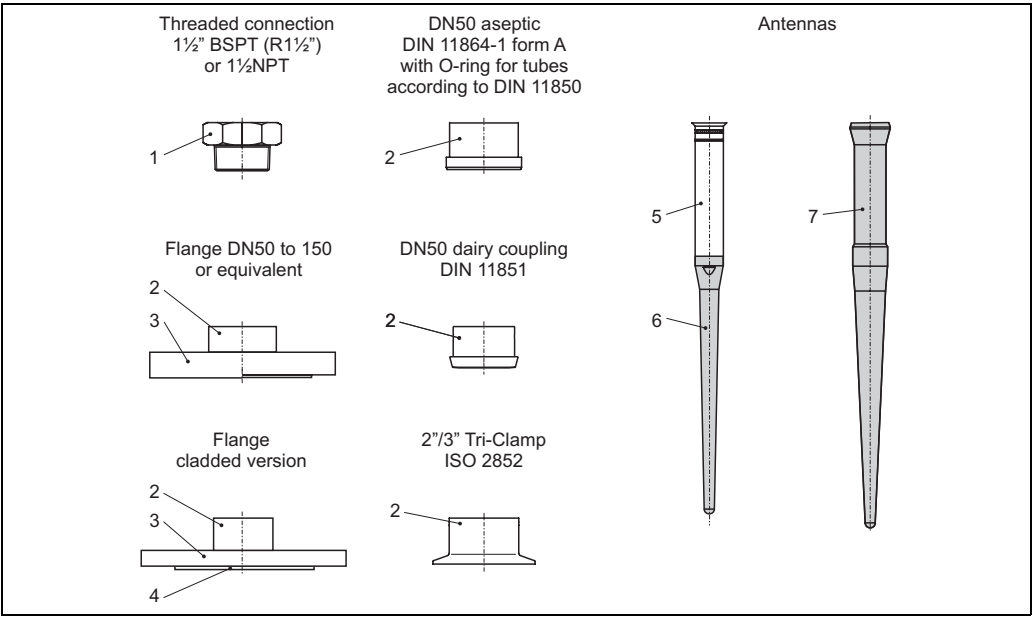
Material
(in contact with process)

Materials FMR230



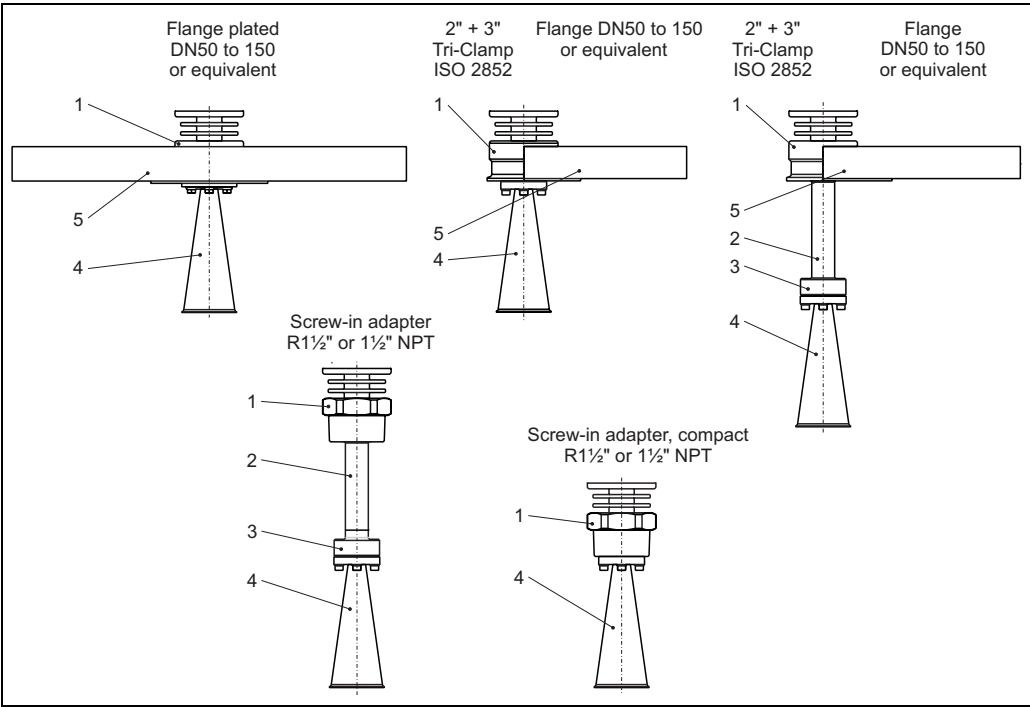
Pos.	Part	Material	
1	Horn antenna	316L (1.4404)	Hastelloy
	Screw	A4	Hastelloy
	Spring washer	A4	
2	Flange	316L (1.4404/1.4435)	
3	Antenna extension	316L (1.4435)	Hastelloy
	Screws	A4	Hastelloy
	Spring washer	A4	
4	Process connection (e.g. Tri-Clamp)	316L (1.4435)	
	Coupling		
5	Horn antenna	Enamel	
6	Process separation	316L (1.4404)	
7	Housing adapter	304 (1.4301)	
8	Flange	316L (1.4404) optional Hastelloy plated	
	Coupling	316L (1.4435)	Hastelloy
9	Flange	316L (1.4404)	
	Screws	A2 - 1.4301	
10	Temperature reduction	304 (1.4301)	

Materials FMR231



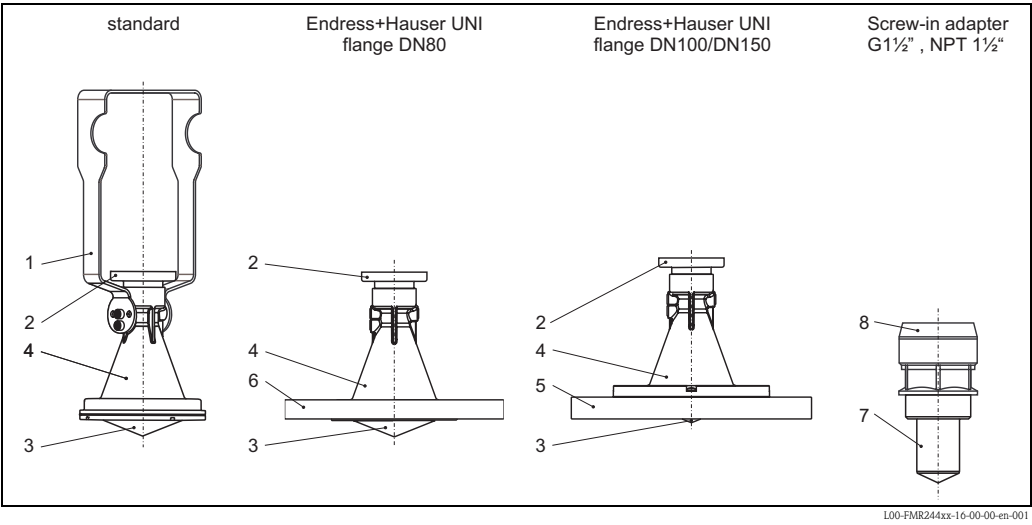
Pos.	Bauteil	Werkstoff
1	Adapter	316L (1.4435)
		PVDF
2	Adapter	316L (1.4435)
3	Flange	316L (1.4404/1.4435)
4	Plating	PTFE
5	Pipe	316L (1.4435)
6	Rod antenna	PPS, antistatic
7	Rod antenna	PTFE, antistatic
		PTFE (in conjunction with flange, DN50 aseptic / dairy coupling respectively Tri-clamp FDA-listed TFM1600)

Materials FMR240

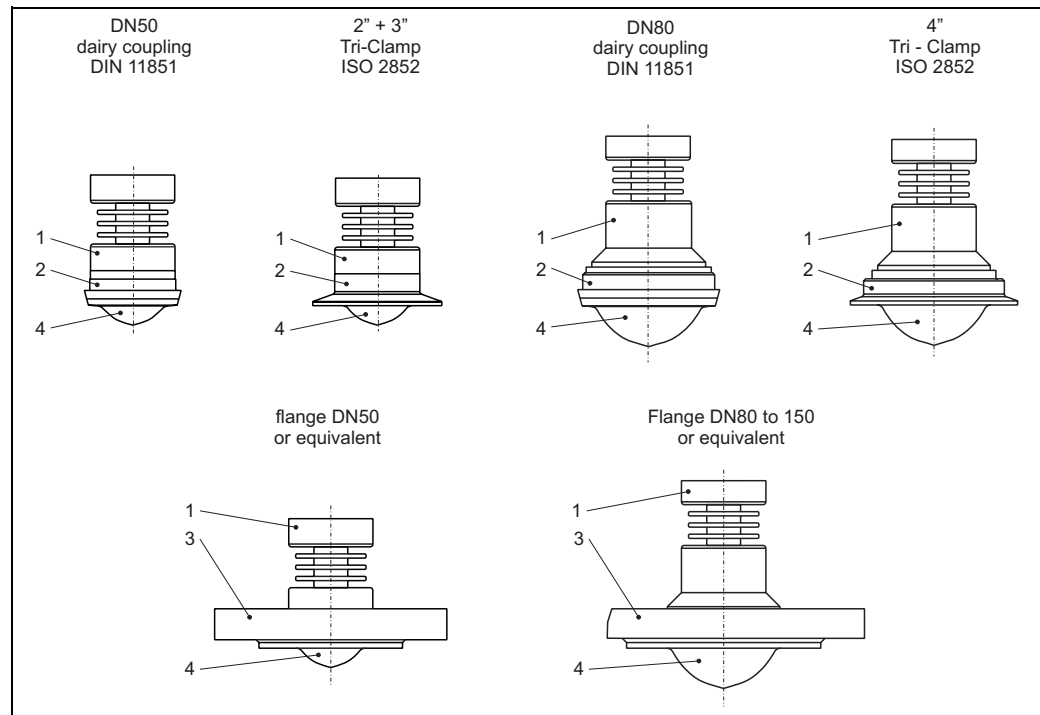


Pos.	Part	Material	
1	Adapter	316L (1.4404)	
	Mounting plate		
2	Pipe extension	316L (1.4404)	
3	Process adapter extension	316L (1.4404)	
	Mounting plate		
4	Horn	316L (1.4404)	Hastelloy C22
	Screws	A4	Hastelloy C22
	Spring washer	A4	
5	Flange	316L (1.4404) optional Hastelloy C22 plated	

Materials FMR244



Pos.	Part	Material
1	Mounting bracket	304 (1.4301)
	Screws	A2
	Nordlock disk	A4
2	Adapter	304 (1.4301)
3	Focusing refractor	PP
	Sealing	Silicone
4	Horn	PBT
5	Flange + adapter ring	PP
	Screws	A2
	Sealing	Viton
6	Collar flange	PP
7	Sleeve	PTFE (FDA listed TFM1600)
	Sealing	Viton
8	Adapter	PVDF

Materials FMR245

Pos.	Part	Material
1	Adapter	304 (1.4301)
2	Process connection	316L (1.4435)
3	Flange	316L (1.4404 / 1.4435)
4	Plating	PTFE (FDA listed TFM1600)

Flange

Endress+Hauser supplies DIN/EN flanges made of stainless steel AISI 316L with the material number 1.4404 or 1.4435. With regard to their temperature stability properties, the materials 1.4404 and 1.4435 are grouped under 13E0 in EN1092-1 Tab. 18. The chemical composition of the two materials can be identical.

Process connection

See "Ordering information", → 63ff.

Note!

Material process connection = material horn antenna, resp. wetted parts of the process connection.

Seal

See "Ordering information", → 63ff.

Antenna

See "Ordering information", → 63ff.

Note!

Material process connection = material horn antenna, resp. wetted parts of the process connection.

Human interface

Operation concept

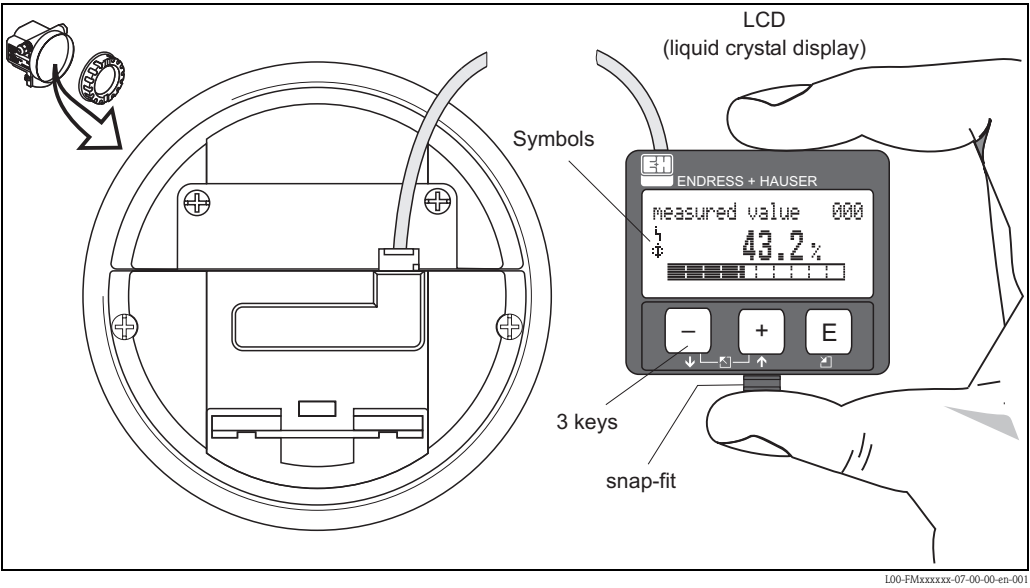
The display of the process value and the configuration of the Micropilot occur locally by means of a large 4-line alphanumeric display with plain text information. The guided menu system with integrated help texts ensures a quick and safe commissioning. To access the display the cover of the electronic 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 FieldCare, the graphical operating software for Endress+Hauser time-of-flight systems.

Display elements

Liquid crystal display (LCD):

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



The 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 (19.7 in) 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.

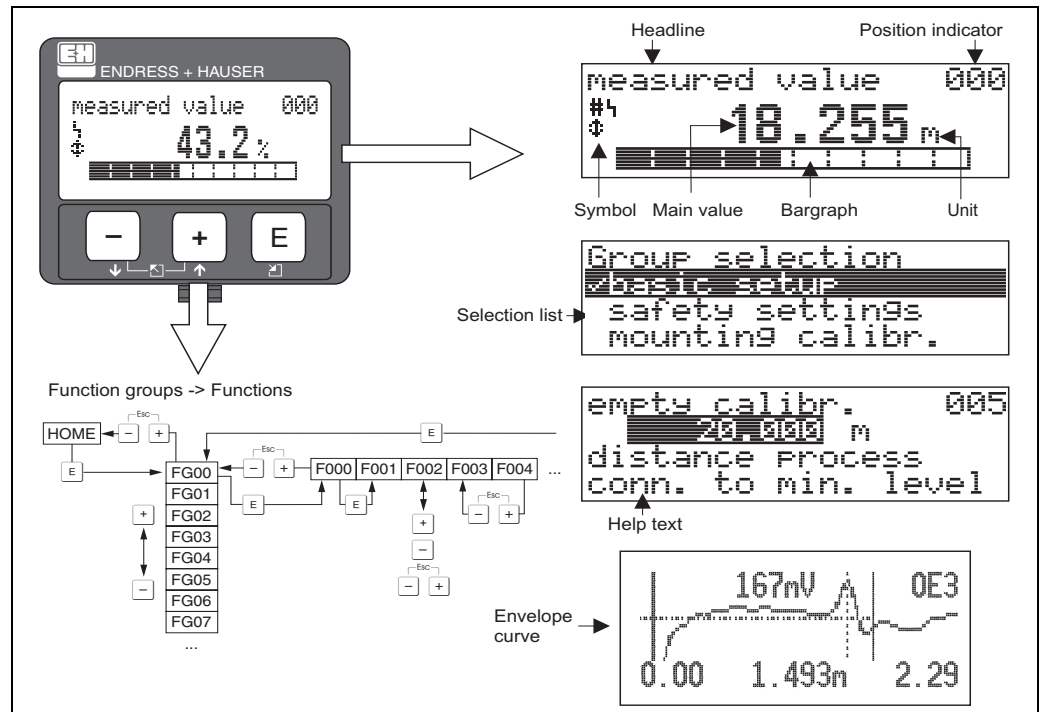
Function of the keys

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.
 or 	Navigate to the left within a function group.
	Navigate to the right within a function group, confirmation.
 and  or  and 	Contrast settings of the LCD.
 and  and 	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 device display

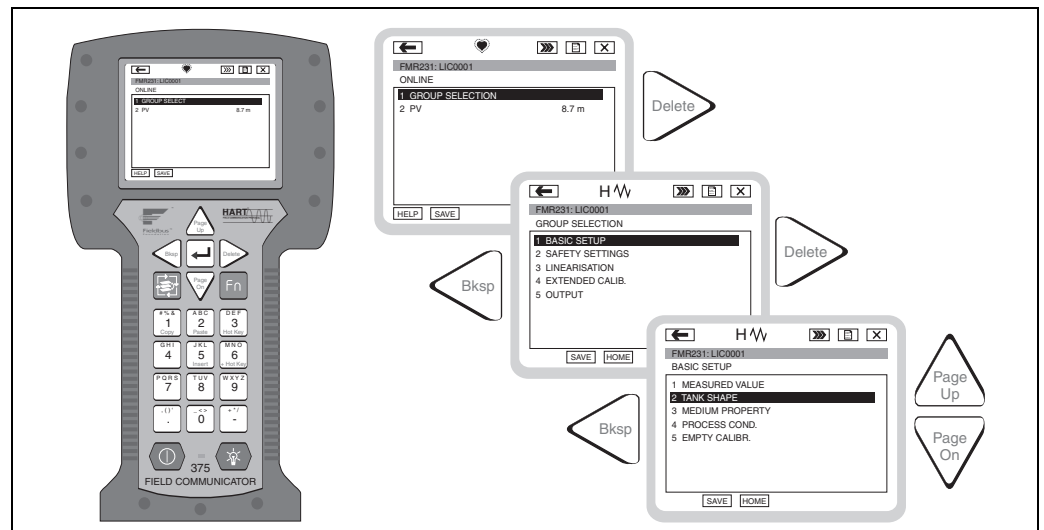
The LC-Display allows configuration via 3 keys directly at the instrument. All device functions can be set through a menu system. The menu consists of function groups and functions. Within a function, application parameters can be read or adjusted. The user is guided through a complete configuration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



100-FMRxxxx-07-00-00-en-002

Operation with the Field Communicator 375, 475

All device functions can be adjusted via a menu operation with the Field Communicator 375, 475.



100-FMRxxxx-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 Field Communicator 375, 475.

Remote operation

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

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. Hardware and software requirements you can find on the internet:

www.endress.com → select your country → search: FieldCare → FieldCare → Technical Data.

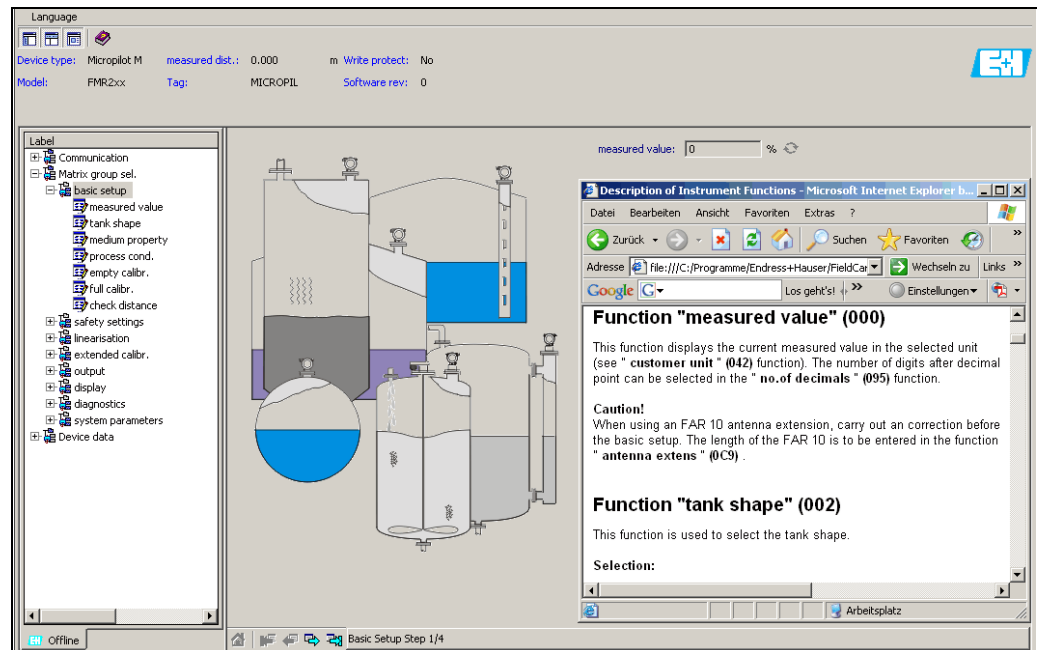
FieldCare supports the following functions:

- 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:

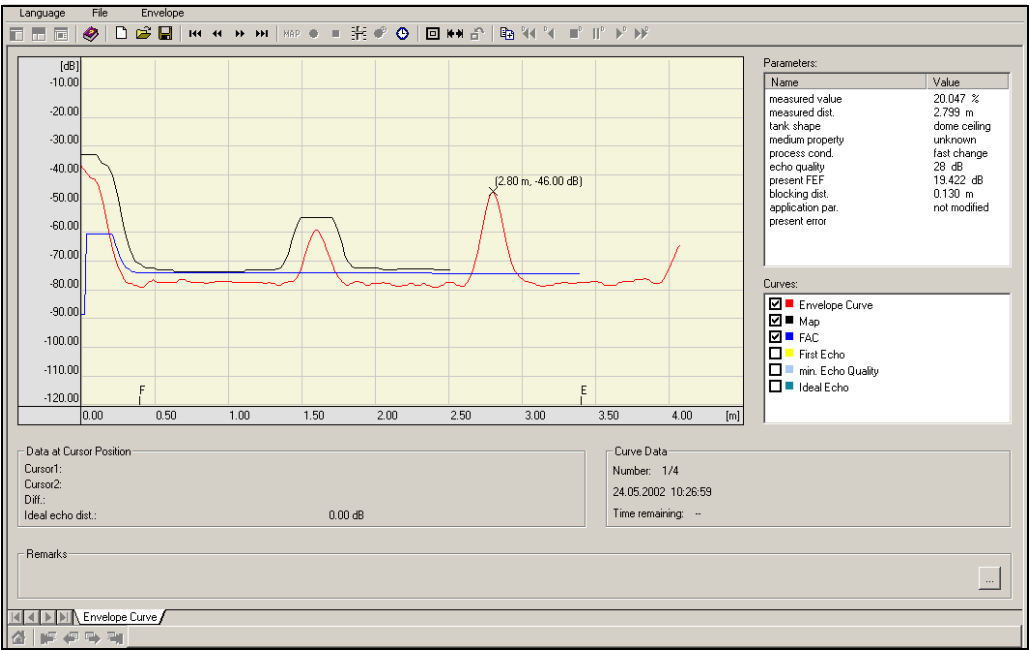
- HART via Commubox FXA195 and the USB port on a computer
- PROFIBUS PA via segment coupler and PROFIBUS interface card
- Commubox FXA291 with ToF Adapter FXA291 (USB) via service interface

Menu-guided commissioning



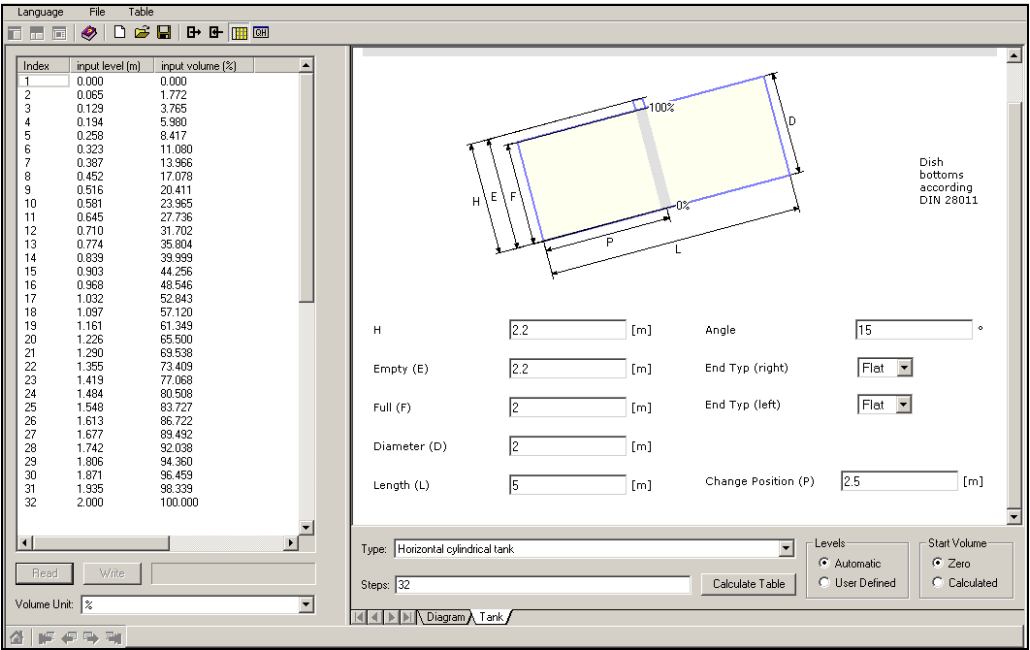
MicropilotM-en-305

Signal analysis via envelope curve



MicropilotM-en-300

Tank linearisation



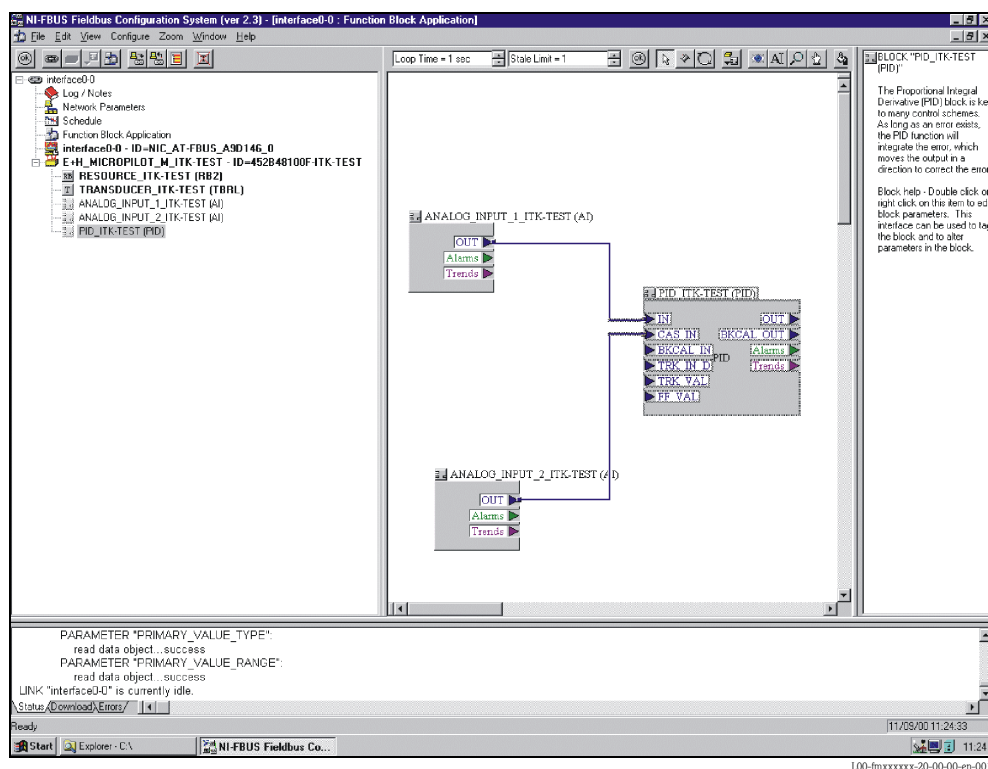
MicropilotM-en-307

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



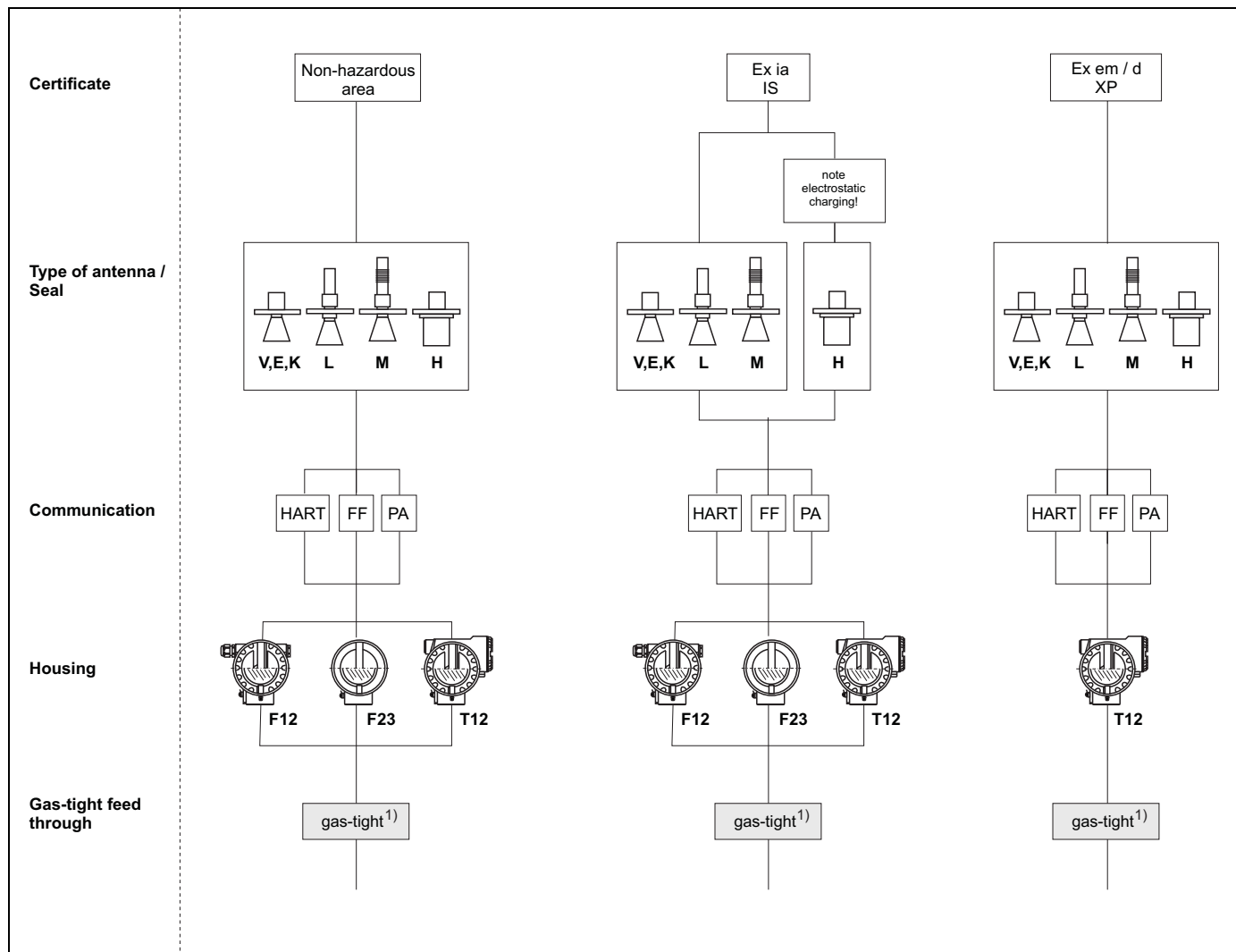
Certificates and approvals

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", → 63ff.
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", → 63ff. (see ZE244F/00/DE). SIL 2, for 4 to 20 mA output signal (see SD150F/00/EN "Functional Safety Manual").
Marine certificate	GL (Germanisch Lloyd), ABS, NK – HART, PROFIBUS PA – not HT antenna
External standards and guidelines	EN 60529 Protection class of housing (IP-code). EN 61010 Safety regulations for electrical devices for measurement, control, regulation and laboratory use. EN 61326-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 scope of the EC Directive 97/23/EC (Pressure Measuring Device Guideline).

Ordering information

Micropilot M FMR230

Instrument selection



gas-tight¹⁾ = Standard

L00-FMR230xx-16-00-00-es-001

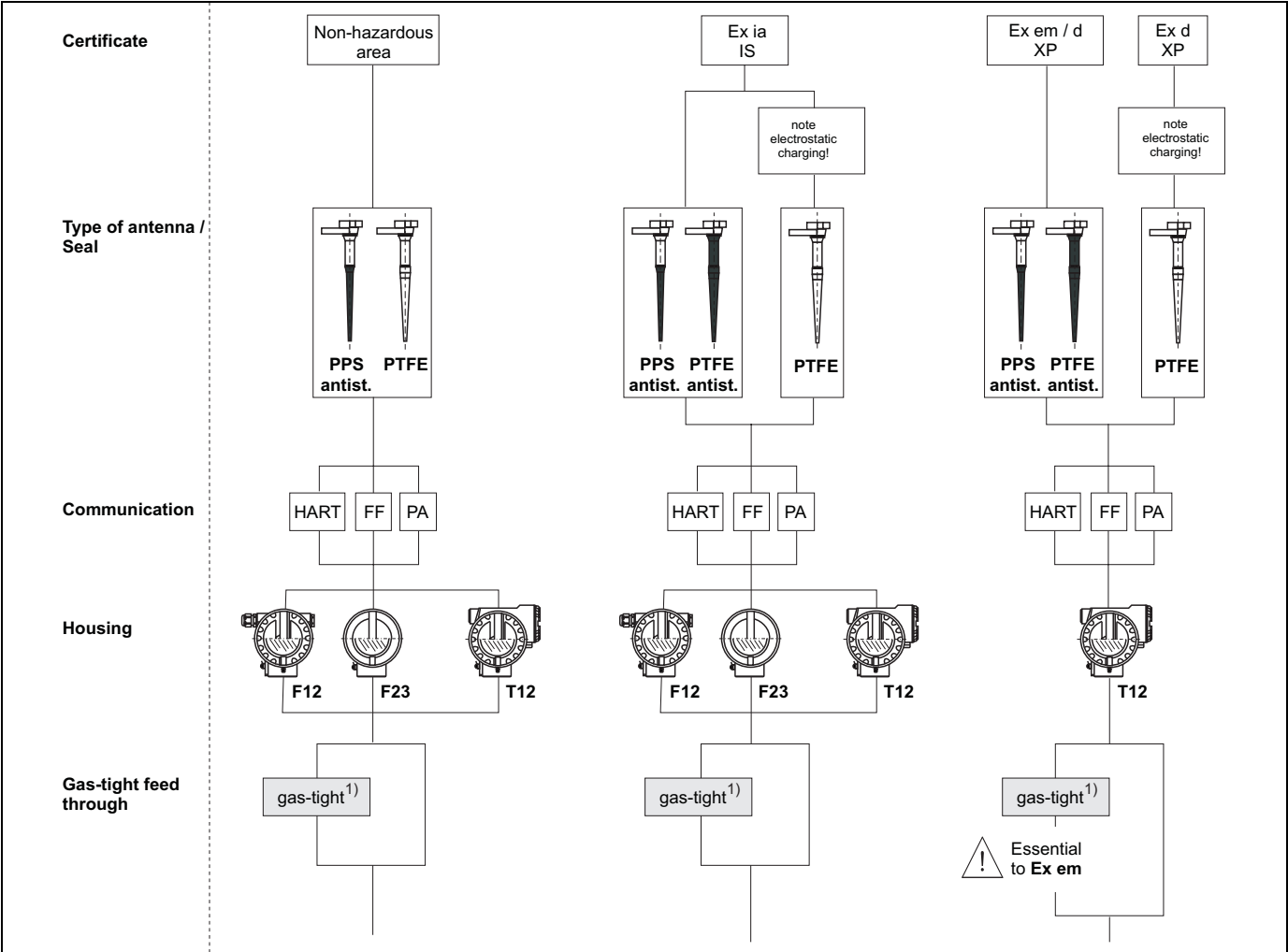
- 1) The gas-tight feedthrough of the device improves the process safety between the seal coupling the antenna to the process and the electronics compartment (connection compartment of the device).

Ordering structure Micropilot M FMR230

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

40		Process Connection:											
												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, purge flange ANSI B16.5 NUS
												YY9	Special version
50		Output; Operation:											
												A	4-20mA SIL HART; 4-line display VU331, envelope curve display on site
												B	4-20mA SIL HART; w/o display, via communication
												K	4-20mA SIL HART; Prepared for FHX40, remote display (Accessory)
												C	PROFIBUS PA; 4-line display VU331, envelope curve display on site
												D	PROFIBUS PA; w/o display, via communication
												L	PROFIBUS PA; Prepared for FHX40, remote display (Accessory)
												E	FOUNDATION Fieldbus; 4-line display, envelope curve display on site
												F	FOUNDATION Fieldbus; w/o display, via communication
												M	FOUNDATION Fieldbus; Prepared for FHX40, remote display (Accessory)
												Y	Special version
60		Housing:											
												A	F12 Alu, coated IP65 NEMA4X
												B	F23 316L IP65 NEMA4X
												C	T12 Alu, coated IP65 NEMA4X, separate conn. compartment
												D	T12 Alu, coated IP65 NEMA4X+OVP, separate conn. compartment, OVP=overvoltage protection
												Y	Special version
70		Cable Entry:											
												2	Gland M20 (EEx d > thread M20)
												3	Thread G1/2
												4	Thread NPT1/2
												5	Plug M12
												6	Plug 7/8"
												9	Special version
80		Additional Option:											
												A	Basic version
												B	EN10204-3.1 material, wattted parts (316L wetted parts) inspection certificate
												H	5-point linearity protocol, see additional spec.
												J	5-point, 3.1, NACE, 5-point linearity protocol, see additional spec., EN10204-3.1 material, NACE MR0175, (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
995		Marking:											
												1	Tagging (TAG)
												2	Bus adress
FMR230-													Complete product designation

Micropilot M FMR231 Instrument selection



gas-tight¹⁾ = 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).

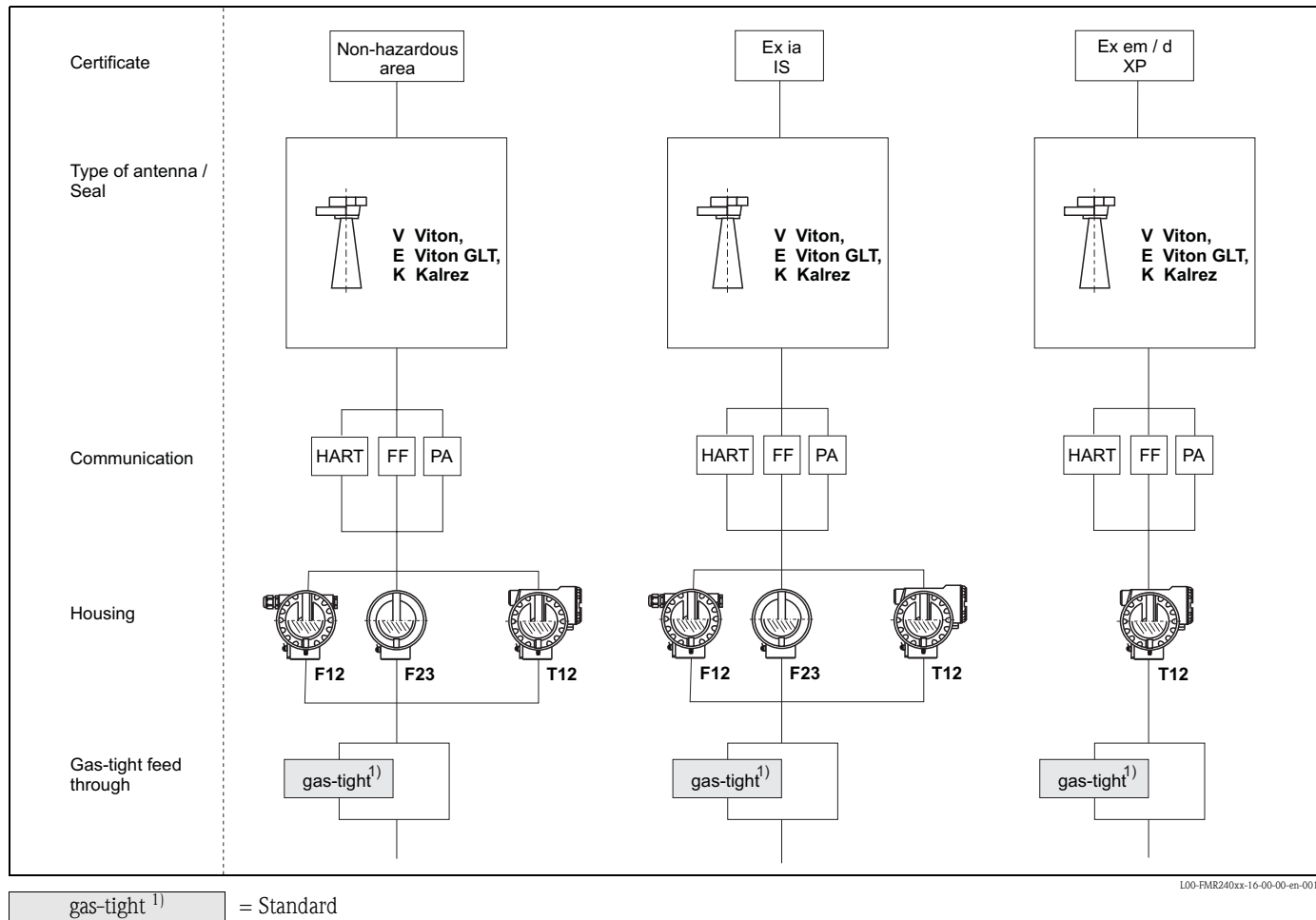
Ordering structure Micropilot M FMR231

10	Approval:	
	A	Non-hazardous area
	F	Non-hazardous area, WHG
	1	ATEX II 1/2 G EEx ia IIC T6, IECEx Zone 0/1
	2	ATEX II 1/2 G EEx ia IIC T6, XA, IECEx Zone 0/1 Note safety instruction (XA) (electrostatic charging)!
	5	ATEX II 1/2 G EEx d (ia) IIC T6, XA, IECEx Zone 0/1 Note safety instruction (XA) (electrostatic charging)!
	6	ATEX II 1/2 G EEx ia IIC T6, WHG, IECEx Zone 0/1
	7	ATEX II 1/2 G EEx ia IIC T6, WHG, XA, IECEx Zone 0/1 Note safety instruction (XA) (electrostatic charging)!
	3	ATEX II 1/2 G EEx em (ia) IIC T6
	8	ATEX II 1/2 G EEx em (ia) IIC T6, WHG
	4	ATEX II 1/2 G EEx d (ia) IIC T, IECEx Zone 0/16
	G	ATEX II 3 G EEx nA II T6, XA, fully insulalted antenna: Note safety instruction (XA) (electrostatic charging)!
	H	ATEX II 1/2G EEx ia IIC T6, ATEX II 3D, XA, fully insulalted antenna: Note safety instruction (XA) (electrostatic charging)!
	S	FM IS - Cl.I Div.1 Gr. A-D, zone 0, 1, 2
	T	FM XP - Cl.I Div.1 Group A-D, zone 1, 2
	N	CSA General Purpose
	U	CSA IS - Cl.I Div.1 Group A-D, zone 0, 1, 2
	V	CSA XP - Cl.I Div.1 Group A-D, zonw 1, 2
	L	TIIS EEx d [ia] IIC T4
	I	NEPSI Ex ia IIC T6
	J	NEPSI Ex d (ia) ia IIC T6
	R	NEPSI Ex nAL IIC T6
	Y	Special version
20	Antenna; Inactive Length:	
	A	PPS antistatic 360mm/14", Viton, 316L; nozzle height max 100mm/4"
	B	PPS antistatic 510mm/20", Viton, 316L; nozzle height max 250mm/10"
	E	PTFE 390mm/15", fully insulated; nozzle height max 100mm/4"
	F	PTFE 540mm/21", fully insulated; nozzle height max 250mm/10"
	H	PTFE antistatic 390mm/15", fully insul.; nozzle height max 100mm/4"
	J	PTFE antistatic 540mm/21", fully insul.; nozzle height max 250mm/10"
	Y	Special version
30	Process Connection:	
	GGJ	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, slotted-nut, 316L
	HFJ	DIN11864-1 A DN50 Tube DIN11850, slotted-nut, 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)
	BOJ	DN100 PN10/16 A, 316L flange EN1092-1 (DIN2527 B)
	COJ	DN100 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
	COK	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
	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

30										Process Connection:									
										ALK 3" 150lbs, PTFE > 316/316L flange ANSI B16.5									
										APJ 4" 150lbs RF, 316/316L flange ANSI B16.5									
										AQJ 4" 300lbs RF, 316/316L flange ANSI B16.5									
										APK 4" 150lbs, PTFE > 316/316L flange ANSI B16.5									
										AVJ 6" 150lbs RF, 316/316L flange ANSI B16.5									
										AVK 6" 150lbs, PTFE (black) > 316/316L flange ANSI B16.5									
										PTFE (black) = conductive cladding									
										KEJ 10K 50A RF, 316L flange JIS B2220									
										KEK 10K 50A, PTFE > 316L flange JIS B2220									
										KLJ 10K 80A RF, 316L flange JIS B2220									
										KLK 10K 80A, PTFE > 316L flange JIS B2220									
										KPJ 10K 100A RF, 316L flange JIS B2220									
										KPK 10K 100A, PTFE > 316L flange JIS B2220									
										KVJ 10K 150A RF, 316L flange JIS B2220									
										KVK 10K 150A, PTFE (black) > 316L flange JIS B2220									
										PTFE (black) = conductive cladding									
										YY9 Special version									
40										Output; Operation:									
										A 4-20mA SIL HART; 4-line display VU331, envelope curve display on site									
										B 4-20mA SIL HART; w/o display, via communication									
										K 4-20mA SIL HART; Prepared for FHX40, remote display (Accessory)									
										C PROFIBUS PA; 4-line display VU331, envelope curve display on site									
										D PROFIBUS PA; w/o display, via communication									
										L PROFIBUS PA; Prepared for FHX40, remote display (Accessory)									
										E FOUNDATION Fieldbus; 4-line display, envelope curve display on site									
										F FOUNDATION Fieldbus; w/o display, via communication									
										M FOUNDATION Fieldbus; Prepared for FHX40, remote display (Accessory)									
										Y Special version									
50										Housing:									
										A F12 Alu, coated IP65 NEMA4X									
										B F23 316L IP65 NEMA4X									
										C T12 Alu, coated IP65 NEMA4X, separate conn. compartment									
										D T12 Alu, coated IP65 NEMA4X+OVP, separate conn. compartment, OVP=overvoltage protection									
										Y Special version									
60										Cable Entry:									
										2 Gland M20 (EEx d > thread M20)									
										3 Thread G1/2									
										4 Thread NPT1/2									
										5 Plug M12									
										6 Plug 7/8"									
										9 Special version, TSP-no. to be spec.									
70										Gas-Tight Feed Through:									
										A Not selected									
										C Selected									
80										Additional Option:									
										A Basic version									
										B EN10204-3.1 material, wattet parts, (316L wetted parts) inspection certificate									
										C EN10204-3.1 material, pressurized, (316/316L pressurized) inspection certificate									
										H 5-point linearity protocol, see additional spec.									
										J 5-point, 3.1, wetted parts 5-point linearity protocol, see additional spec., EN10204-3.1 material, wetted parts, (316L wetted parts) inspection certificate									
										K 5-point, 3.1, pressurized, 5-point linearity protocol, see additional spec., EN10204-3.1 material, pressurized, (316/316L pressurized) inspection certificate									
										S GL/ABS/NK marine certificate									
										Y Special version									
995										Marking:									
										1 Tagging (TAG)									
										2 Bus adress									
FMR231-										Complete product designation									

Micropilot M FMR240

Instrument selection



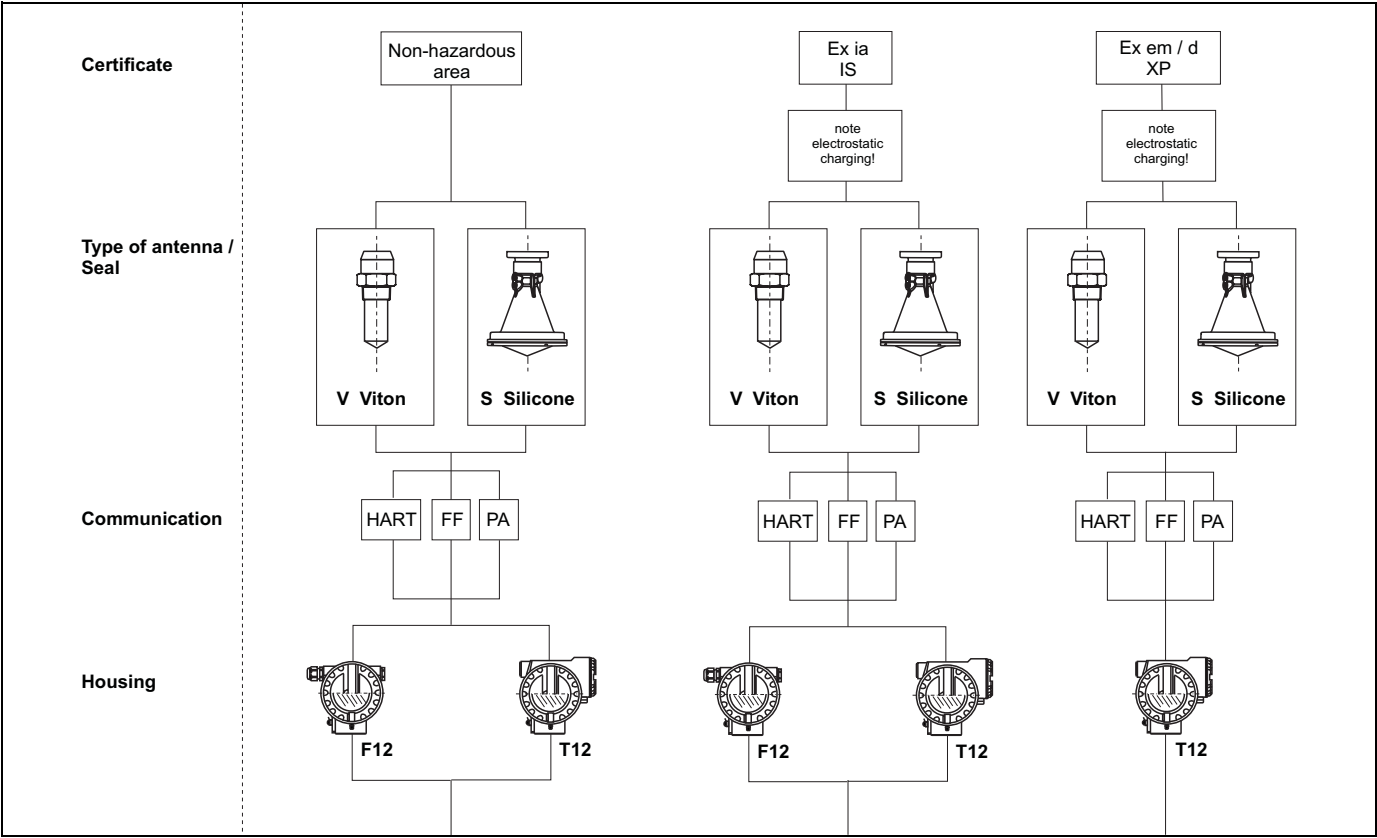
- 1) The gas-tight feedthrough of the device improves the process safety between the seal coupling the antenna to the process and the electronics compartment (connection compartment of the device).

Ordering structure Micropilot M FMR240

10	Approval:			
	A	Non-hazardous area		
	F	Non-hazardous area, WHG		
	1	ATEX II 1/2G EEx ia IIC T6		
	6	ATEX II 1/2G EEx ia IIC T6, WHG		
	3	ATEX II 1/2G EEx em (ia) IIC T6		
	8	ATEX II 1/2G EEx em (ia) IIC T6, WHG		
	4	ATEX II 1/2G EEx d (ia) IIC T6		
	B	ATEX II 1/2G, II 1/2D, Alu blind cover, ATEX II 1/2G EEx ia IIC T6, ATEX II 1/2D		
	H	ATEX II 1/2G EEx ia IIC T6, ATEX II 3D		
	G	ATEX II 3G EEx nA II T6		
	S	FM IS - Cl.I Div.1 Gr. A-D, zone 0, 1, 2		
	T	FM XP - Cl.I Div.1 Group A-D, zone 1, 2		
	N	CSA General Purpose		
	U	CSA IS - Cl.I Div.1 Group A-D, zone 0, 1, 2		
	V	CSA XP - Cl.I Div.1 Group A-D, zone 1, 2		
	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) ia IIC T6		
	R	NEPSI Ex nAL IIC T6		
	Y	Special version		
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		
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		
40	Antenna Extension			
	1	Not selected		
	2	100 mm/4"		
	9	Special version		
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		

Micropilot M FMR244

Instrument selection



L00-FMR244cx-16-00-00-en-001

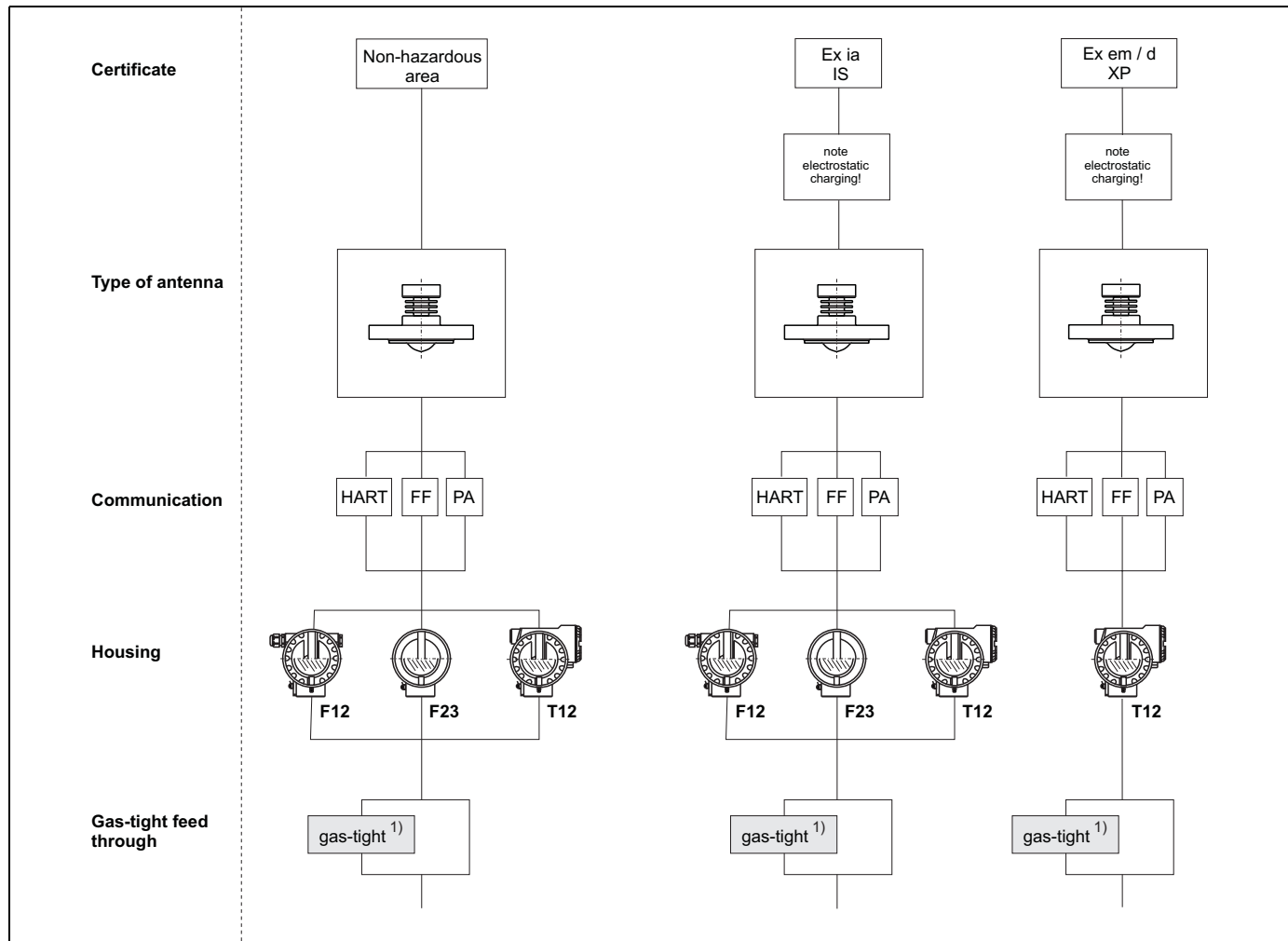
Ordering structure Micropilot M FMR244

10	Approval:			
	A	Non-hazardous area		
	F	Non-hazardous area, WHG		
	2	ATEX II 1/2G EEx ia IIC T6, XA note safety instruction (XA) (electrostatic charging)!		
	7	ATEX II 1/2G EEx ia IIC T6, WHG, XA note safety instruction (XA) (electrostatic charging)!		
	5	ATEX II 1/2G EEx d [ia] IIC T6, XA note safety instruction (XA) (electrostatic charging)!		
	H	ATEX II 1/2G EEx ia IIC T6, ATEX 3D, XA note safety instruction (XA) (electrostatic charging)!		
	B	ATEX II 1/2D, Alu blind cover, XA		
	C	ATEX II 1/3D, XA		
	G	ATEX II 3G EEx nA II T6		
	S	FM IS - Cl.I Div.1 Gr. A-D, zone 0, 1, 2		
	T	FM XP - Cl.I Div.1 Group A-D, zone 1, 2		
	N	CSA General Purpose		
	U	CSA IS - Cl.I Div.1 Group A-D, zone 0, 1, 2		
	V	CSA XP - Cl.I Div.1 Group A-D, zone 1, 2		
	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) ia IIC T6		
	R	NEPSI Ex nAL IIC T6		
	Y	Special version		
20	Antenna:			
	2	40mm/1-1/2", PTFE encapsulated		
	4	80mm/3", PP cladded		
	9	Special version		
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		
40	Process Connection:			
	GGS	Thread ISO228 G1-1/2, PVDF		
	GNS	Thread ANSI NPT1-1/2, PVDF		
	XME	Mounting bracket, 304		
	XXR	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		
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, envelope curve display on site		
	F	FOUNDATION Fieldbus; w/o display, via communication		
	M	FOUNDATION Fieldbus; Prepared for FHX40, remote display (Accessory)		
	Y	Special version		
60	Housing:			
	A	F12 Alu, coated IP65 NEMA4X		
	C	T12 Alu, coated IP65 NEMA4X, separate conn. compartment		
	D	T12 Alu, coated IP65 NEMA4X, separate conn. compartment, OVP=overvoltage protection		
	Y	Special version		
70	Cable entry:			
	2	Gland M20 (EEx d > thread M20)		
	3	Thread G1/2		
	4	Thread NPT1/2		
	5	Plug M12		
	6	Plug 7/8"		
	9	Special version		

[illegible]

Micropilot M FMR245

Instrument selection



100-FMR245xx-1-0-00-00-en-001

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

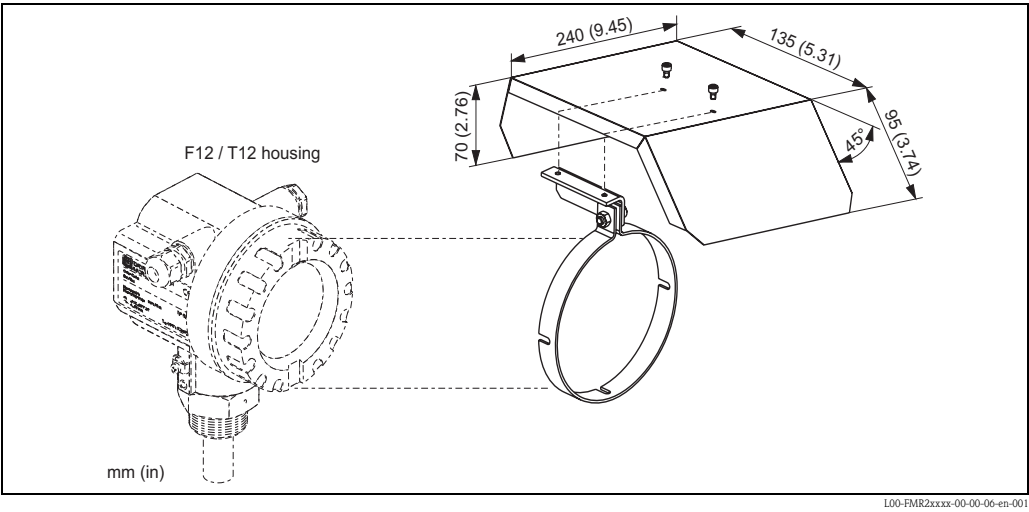
10	Approval:		
	A	Non-hazardous area	
	F	Non-hazardous area, WHG	
	2	ATEX II 1/2G EEx ia IIC T6, XA, Note safety instruction (XA) (electrostatic charging)!	
	7	ATEX II 1/2G EEx ia IIC T6, WHG, XA, Note safety instruction (XA) (electrostatic charging)!	
	5	ATEX II 1/2G EEx d [ia] IIC T6, XA, Note safety instruction (XA) (electrostatic charging)!	
	H	ATEX II 1/2G EEx ia IIC T6, ATEX 3D, XA, Note safety instruction (XA) (electrostatic charging)!	
	B	ATEX II 1/2G, ATEX II 1/2D, XA, Alu blind cover	
		ATEX II 1/2G EEx ia IIC T6, ATEX II 1/2D, Note safety instruction (XA) (electrostatic charging)!	
	G	ATEX II 3G EEx nA II T6, Note safety instruction (XA) (electrostatic charging)!	
	S	FM IS - Cl.I Div.1 Gr. A-D, zone 0, 1, 2	
	T	FM XP - Cl.I Div.1 Group A-D, zone 1, 2	
	N	CSA General Purpose	
	U	CSA IS - Cl.I Div.1 Group A-D, zone 0, 1, 2	
	V	CSA XP - Cl.I Div.1 Group A-D, zone 1, 2	
	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) ia IIC T6	
	R	NEPSI Ex nAL IIC T6	
	Y	Special version	
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	
	9	Special version	
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, slotted-nut, PTFE > 316L	
	MTK	DIN11851 DN80 PN25, slotted-nut, PTFE > 316L	
	TDK	Tri-Clamp ISO2852 DN51 (2"), PTFE > 316L, 3A	
	TFK	Tri-Clamp ISO2852 DN76.1 (3"), PTFE > 316L, 3A	
	THK	Tri-Clamp ISO2852 DN101.6 (4"),PTFE > 316L, 3A	
	YY9	Special version	
40	Output; Operation:		
	A	4-20mA SIL HART; 4-line display VU331, envelope curve display on site	
	B	4-20mA SIL HART; w/o display, via communication	
	K	4-20mA SIL HART; Prepared for FHX40, remote display (Accessory)	
	C	PROFIBUS PA; 4-line display VU331, envelope curve display on site	
	D	PROFIBUS PA; w/o display, via communication	
	L	PROFIBUS PA; Prepared for FHX40, remote display (Accessory)	
	E	FOUNDATION Fieldbus; 4-line display, envelope curve display on site	
	F	FOUNDATION Fieldbus; w/o display, via communication	
	M	FOUNDATION Fieldbus; Prepared for FHX40, remote display (Accessory)	
	Y	Special version	

50									Housing:
									A F12 Alu, coated IP65 NEMA4X
									B F23 316L IP65 NEMA4X
									C T12 Alu, coated IP65 NEMA4X, separate conn. compartment
									D T12 Alu, coated IP65 NEMA4X+OVP, separate conn. compartment, OVP=overvoltage protection
									Y Special version
60									Cable Entry:
									2 Gland M20 (EEx d > thread M20)
									3 Thread G1/2
									4 Thread NPT1/2
									5 Plug M12
									6 Plug 7/8"
									9 Special version
70									Additional Option:
									A Basic version
									C EN10204-3.1 material, pressurized, (316/316L pressurized) inspection certificate
									F Advanced dynamics, max. MB=70m liquids, MB=measuring range
									G Advanced dynamics, 3.1, max. MB=70m liquids, MB=measuring range, EN10204-3.1 material (316L pressurized) inspection certificate
									H 5-point linearity protocol, see additional spec.
									K 5-point, 3.1, pressurized, 5-point linearity protocol, see additional spec., EN10204-3.1 material, pressurized, (316/316L pressurized) inspection certificate
									L 5-point, advanced dynamics, 3.1, 5-point linearity protocol, see additional spec., Advanced dynamics, 3.1 material, max MB=70m liquids, MB=measuring range EN10204-3.1 material, (316L wetted parts) inspection certificate
									S GL/ABS/NK marine certificate
									Y Special version
995									Marking:
									1 Tagging (TAG)
									2 Bus address
FMR245-									Complete product designation

Accessories

Weather protection cover

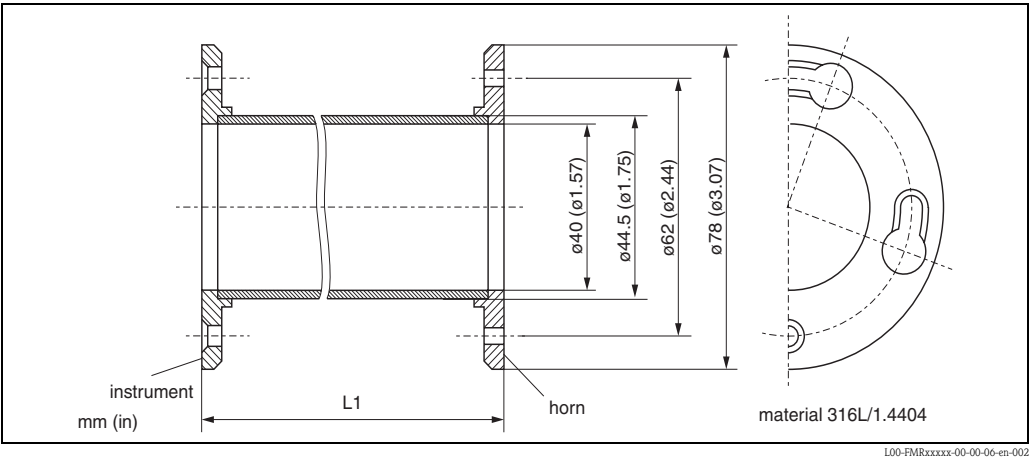
A Weather protection cover made of stainless steel is recommended for outdoor mounting (order code: 543199-0001). The shipment includes the protective cover and tension clamp.



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

Antenna extension FAR10
(for FMR230)

Dimensions



L00-FMRxxxx-00-00-06-en-002

Ordering information:

10	Material:	
	6	316L
	7	316L + EN10204-3.1, NACE MR1075 (316L wetted parts) inspection certificate
	4	AlloyB2
	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 version
FAR10-		Complete product designation

**Variable flange seal for
FMR244 - 80 mm (3") antenna
and FMR240 - 100 mm (4")
horn antenna**

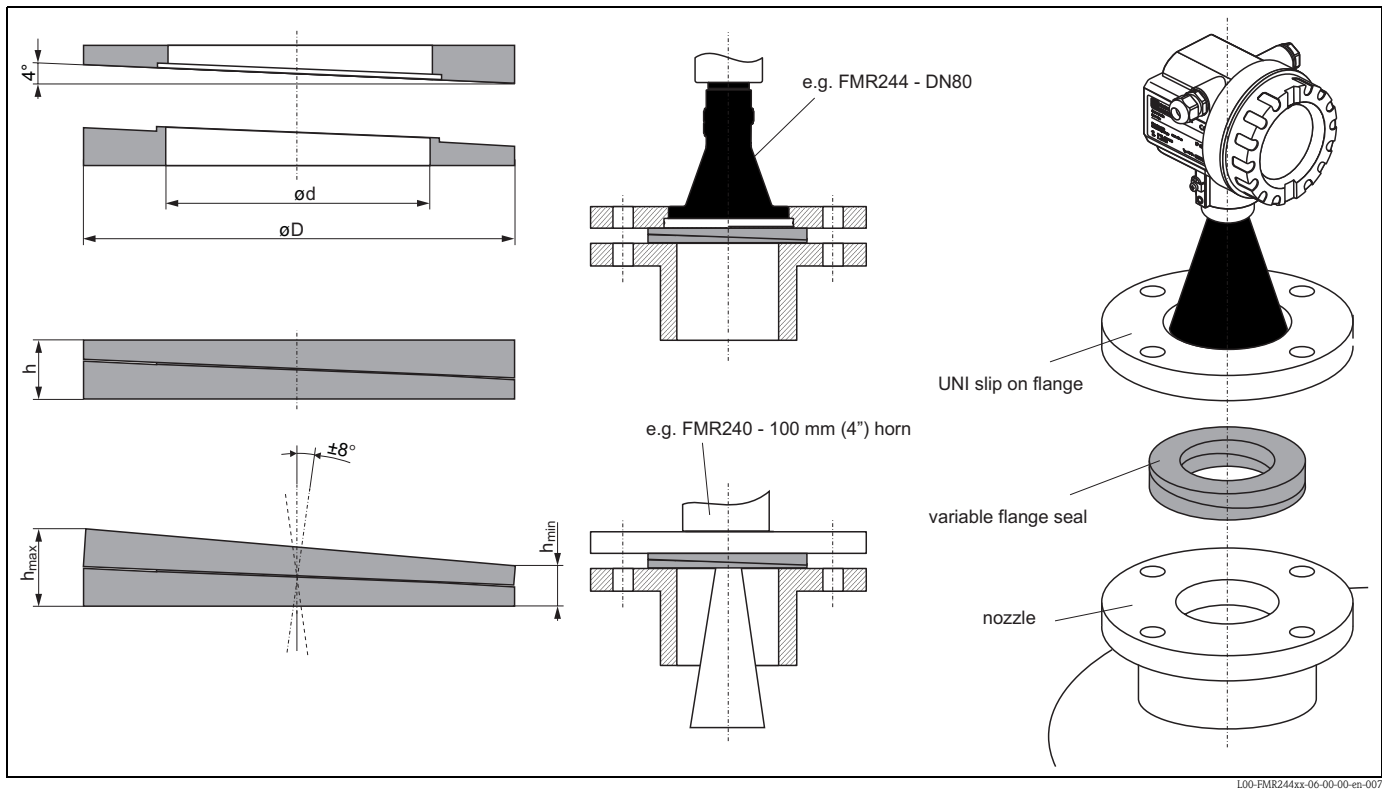
Technical data and ordering information

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 to 0.1 bar (-1.45 psi to 1.45 psi)		
Process temperature	-40 °C to +80 °C (-40 °F to +176 °F)		
Order code	71074263	71074264	71074265

Note for Ex-applications:

The material and process conditions of the adjustable flange seal must fit the process properties (temperature, pressure, resistance).

Dimensions



100-FMR244cx-06-00-00-en-007

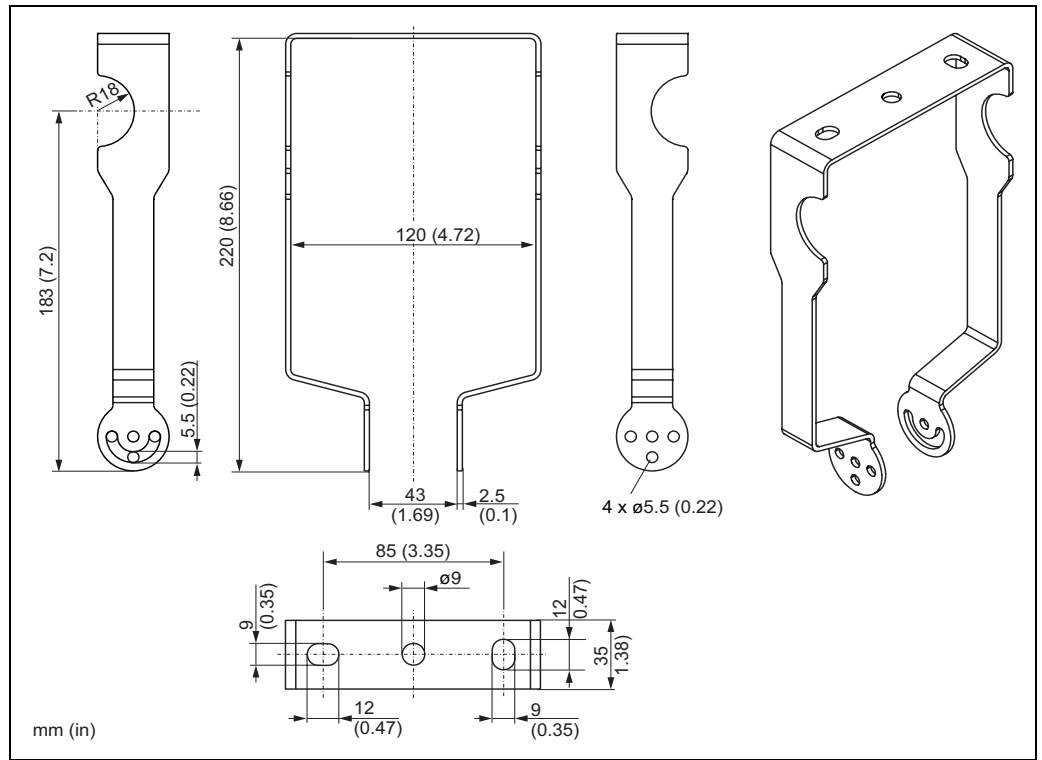
Variable flange seal	DN80 ¹⁾	DN100 ^{1) 2)}	DN150 ^{1) 2)}
D [mm (in)]	142 (5.59)	162 (6.38)	218 (8.58)
d [mm (in)]	89 (3.5)	115 (4.53)	169 (6.65)
h [mm (in)]	22 (0.87)	23.5 (0.93)	26.5 (1.04)
h _{min} [mm (in)]	14 (0.55)	14 (0.55)	14 (0.55)
h _{max} [mm (in)]	30 (1.18)	33 (1.3)	39 (1.54)

1) For FMR244 with process connection XVG, XXG or X1G (UNI slip on flange).

2) For FMR240 with 100 mm (4") horn antenna and flange mounting process connection.

Mounting bracket for FMR244 Dimensions

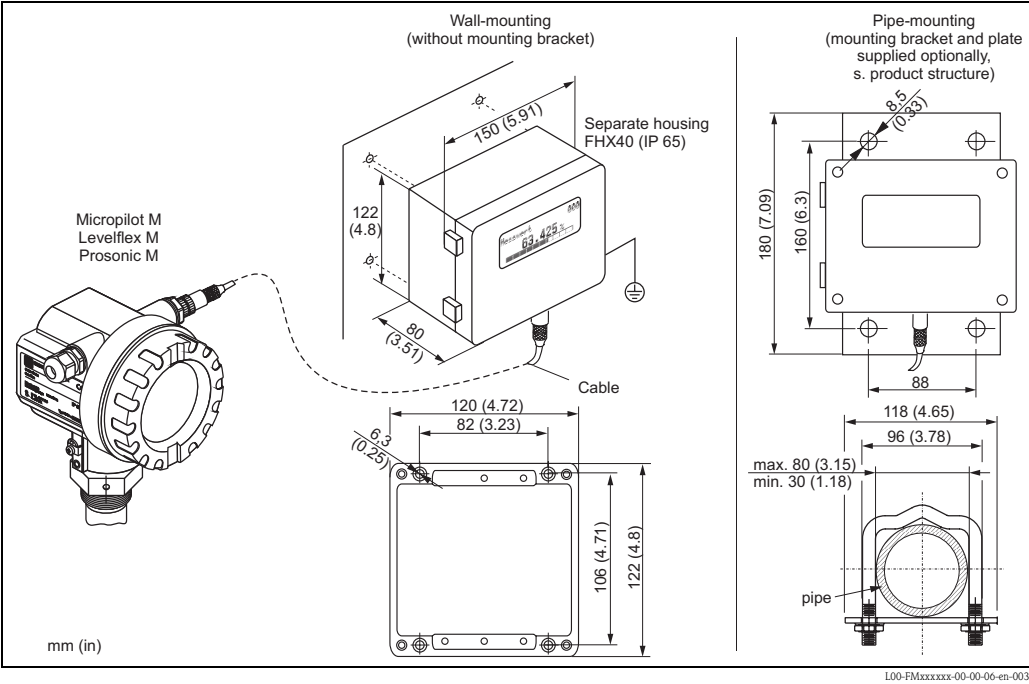
Mounting bracket to the alignment of FMR244 in solid applications uses (order code: 71091643).



Note!

With T12 housing it's not possible to mount the device direct at the ceiling.

Remote display FHX40



Technical data (cable and housing) and product structure:

Max. cable length	20 m (66 ft)
Temperature range	-30 °C to +70 °C (-22 °F to +158 °F)
Degree of protection	IP65/67 (housing); IP68 (cable) acc. to IEC 60529
Materials	Housing: AlSi12; cable glands: nickle plated brass
Dimensions [mm (in)]	122x150x80 (4.8x5.91x3.15) / HxWxD

	Approval:
A	Non-hazardous area
I	ATEX II 2 G EEx ia IIC T6, ATEX II 3D
S	FM IS Cl.I Div.1 Gr.A-D, zone0
U	CSA IS Cl.I Div.1 Gr.A-D, zone0
N	CSA General Purpose
K	TIIS Ex ia IIC T6
C	NEPSI Ex ia IIC T6/T5
G	IECEx zone1 Ex ia IIC T6/T5
K	TIIS ia IIC T6 (in preparation)
Y	Special version
	Cable:
1	20m/65ft; for HART
5	20m/65ft; for PROFIBUS PA/FOUNDATION Fieldbus
9	Special version
	Additional option:
A	Basic version
B	Mounting bracket, pipe 1" / 2"
Y	Special version
	Marking:
1	Messstelle (TAG)
FHX40 -	Complete product designation

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

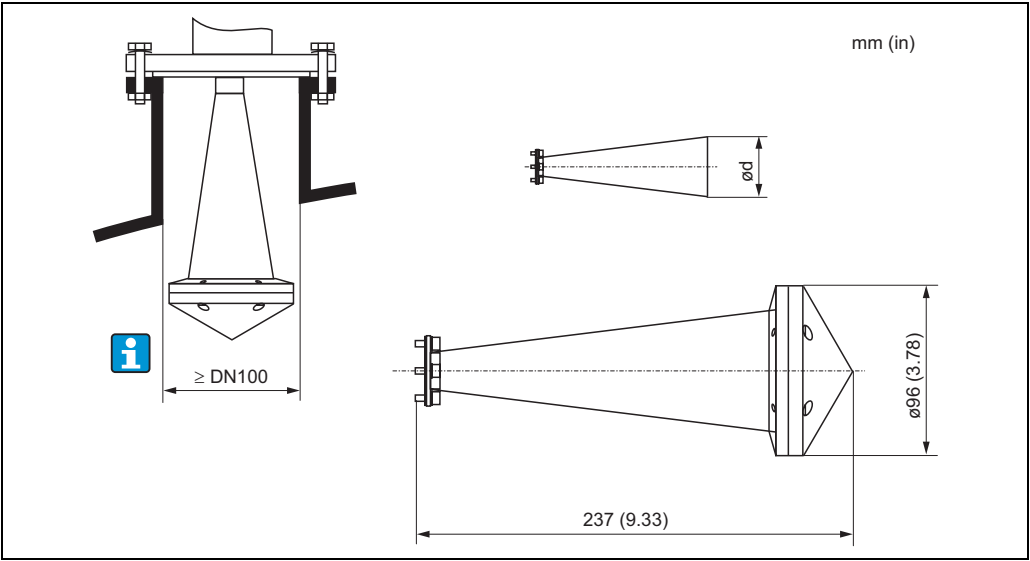
**Horn cover for
80 mm (3") and 100 mm (4")
horn antenna**

Technical data

Materials	
Horn cover	PTFE
Screws	316L
Holding ring	316L
Contact ring	316L
O-ring seal	Silicone
Flat seal	PTFE

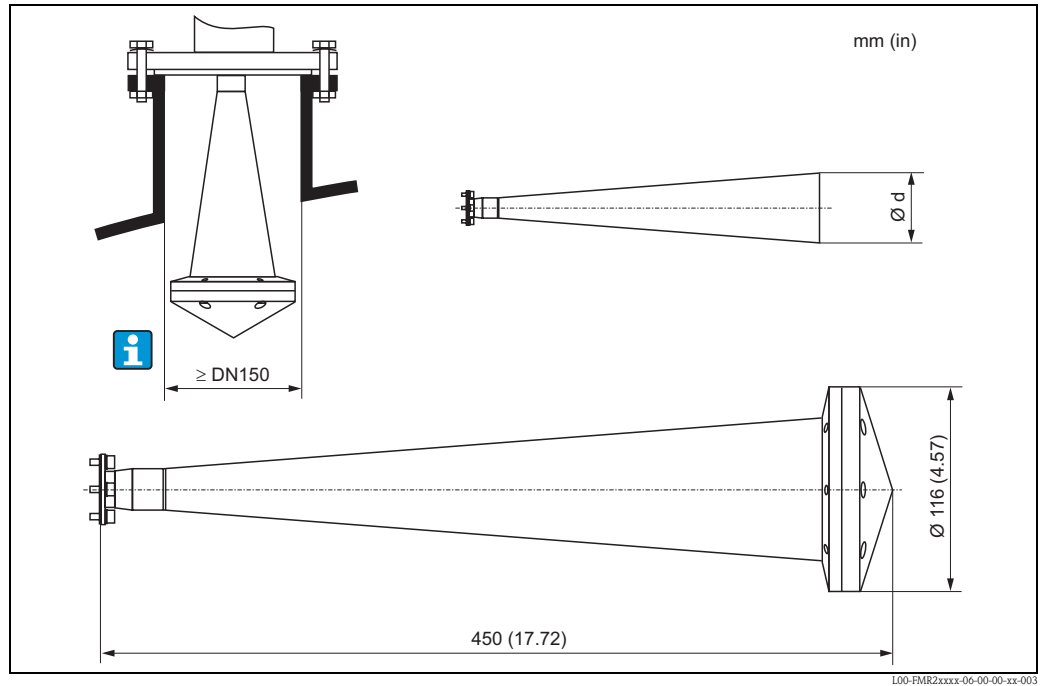
Process conditions	
Vessel pressure max.	0.5 bar (7.252 psi)
Process temperature max.	130 °C (266 °F)

Dimensions



Horn cover for horn antenna 80 mm (3")
– for antenna diameter $d = 75$ mm (2.95 in)
– for FMR240: antenna variant G, 4
– for FMR250: antenna variant D

Note!
The horn cover is not allowed to use in areas, where explosion proofed equipment is necessary.



Horn cover for horn antenna 100 mm (4")
 – for antenna diameter $d = 95$ mm (3.74 in)
 – for FMR240: antenna variant H, S
 – for FMR250: antenna variant E

Note!

The horn cover is not allowed to use in areas, where explosion proofed equipment is necessary.

Ordering information

Horn antenna	80 mm (3")	100 mm (4")
Order code	71105890	71105889

Commubox FXA195 HART For intrinsically safe communication with 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 instrument you need the "ToF Adapter FXA291" as an additional accessory.

ToF Adapter FXA291 The ToF Adapter FXA291 connects the Commubox FXA291 via the USB interface of a personal computer or a notebook to the instrument. 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.

Correlation of safety instructions (XA, XC) and certificates (ZD, ZE) to the instrument:

FMR230:

[illegible]

- 1) German WHG only in combination with certificate ZE244F/00/EN.
- 2) Note safety instructions (XA) (electrostatic charging)!
- 3) Envelope curve display on site.
- 4) Via communication
- 5) Separate conn. compartment.
- 6) OVP = overvoltage protection.

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- 1) German WHG only in combination with certificate ZE244F/00/EN.
- 1) Fully insulated antenna; note safety instructions (XA) (electrostatic charging)!
- 2) Note safety instructions (XA) (electrostatic charging)!
- 3) Envelope curve display on site.
- 4) Via communication.
- 5) Separate conn. compartment.
- 6) OVP = overvoltage protection.

[illegible]

- 1) German WHG only in combination with certificate ZE244F/00/EN.
- 2) Envelope curve display on site.
- 3) Via communication.
- 4) Separate conn. compartment.

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- * In preparation
- 1) Note safety instructions (XA) (electrostatic charging)!
- 2) German WHG only in combination with certificate ZE244F/00/EN.
- 2) Envelope curve display on site.
- 3) Via communication.
- 4) Separate conn. compartment.
- 5) OVP = overvoltage protection.

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

- US 5,387,918 $\cong$ EP 0 535 196
- US 5,689,265 $\cong$ EP 0 626 063
- US 5,659,321
- US 5,614,911 $\cong$ EP 0 670 048
- US 5,594,449 $\cong$ 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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