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

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 ind the K-band: No compromises, the right frequency for every application.
- HART or PROFIBUS PA respectively FOUNDATION Fieldbus protocol.
- High temperatures: Suitable for process temperatures up to 200 °C (392 °F), up to 400 °C (752 °F) with high-temperature antenna.
- Rod antenna with inactive length:
  Reliable measurement in narrow nozzles, with condensation and build-up in the nozzle.
- Used for level monitoring (MIN, MAX) up to SIL 2 as per IEC 61508 / IEC 61511.
- Gas-tight feedthrough to improve the process safety for FMR230 standard, for FMR231/240/245 optionally.

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Endress+Hauser

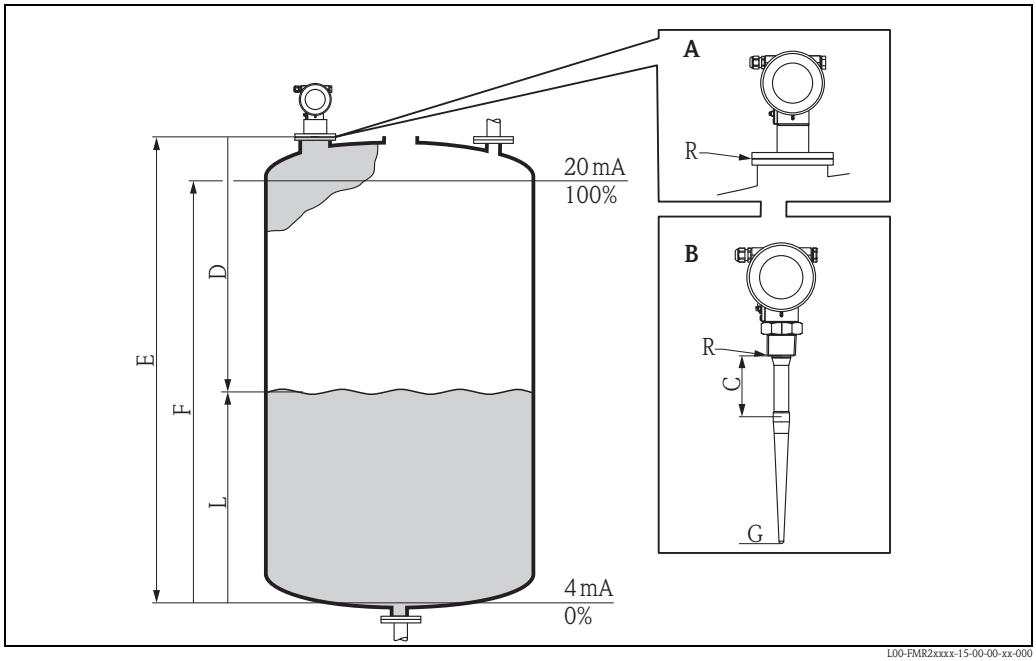
People for Process Automation

Table of contents

Function and system design

Measuring principle

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



A *Flange version*
B *Threaded connection R1½", 1½" NPT*
C *Inactive length*
G *Max. level*
R *Reference point*

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 device to the process conditions. For models with a current output, the factory adjustment for zero point "E" and span "F" is 4 mA and 20 mA. For digital outputs and the display module, the factory adjustment for zero point "E" and span "F" is 0% and 100%. 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.

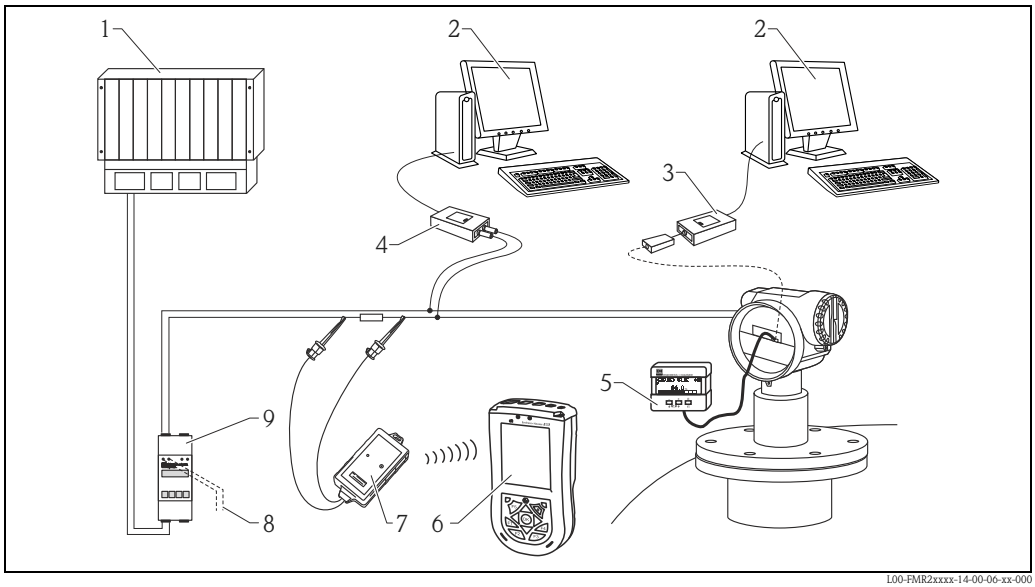
Equipment architecture

Stand-alone

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

4 to 20 mA output with HART protocol.

The complete measuring system consists of:



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1 PLC
2 FieldCare
3 Commubox FXA195 with ToF Adapter FXA291
4 Commubox FXA195
5 Operating and display module
6 Field Xpert SFX100
7 VIATOR Bluetooth modem with connecting cable
8 Connection for Commubox FXA195
9 Transmitter power supply unit RMA422 or RN221N (communication resistor included)

On-site operation

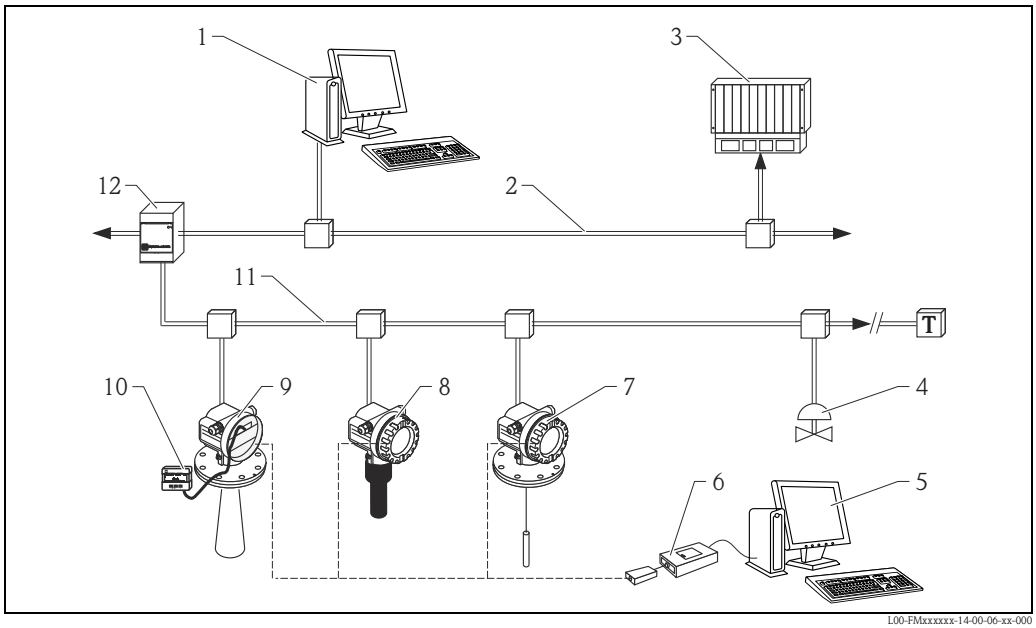
- With display and operating module,
- With a Personal Computer, FXA291 with ToF Adapter FXA291 (USB) and the operating software "FieldCare". FieldCare is a graphical operating software for devices from Endress+Hauser (radar, ultrasonic, guided microimpulse). It assists with commissioning, securing data,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

Remote operation

- With Field Xpert SFX100
- With a Personal Computer, Commubox FXA195 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:



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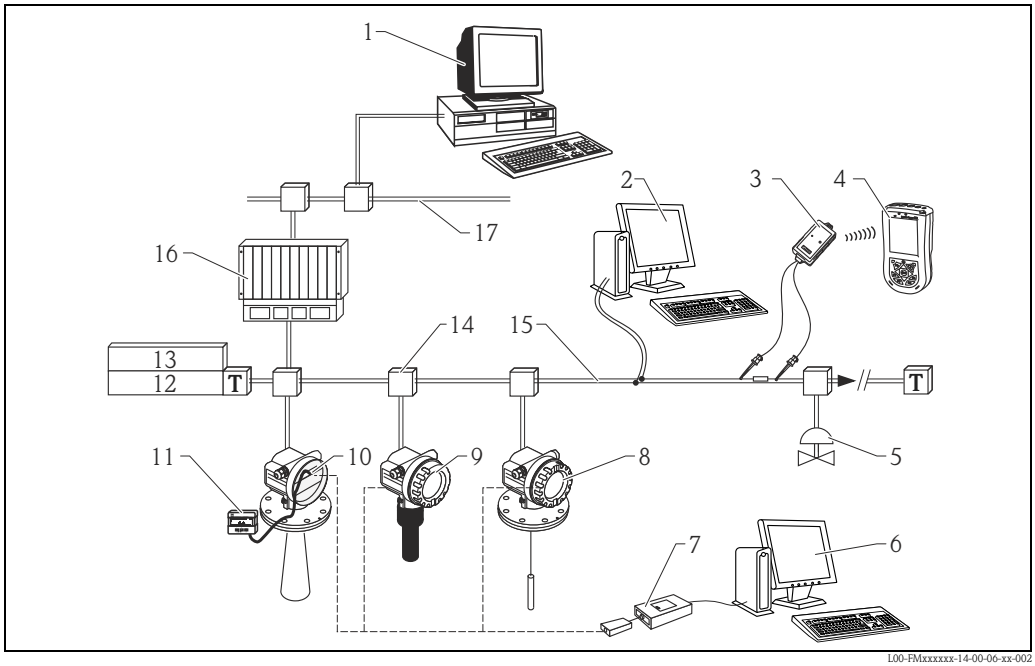
1	*PC with FieldCare and Profiboard resp. Proficard*	*7*	*Levelflex M*
2	*PROFIBUS DP*	*8*	*Prosonic M*
3	*PLC*	*9*	*Micropilot M*
4	*More Functions (valves etc.)*	*10*	*Operating and display module*
5	*FieldCare*	*11*	*PROFIBUS PA*
6	*Commubox FXA291 with ToF Adapter FXA291*	*12*	*Segment coupler*

System integration via FOUNDATION Fieldbus

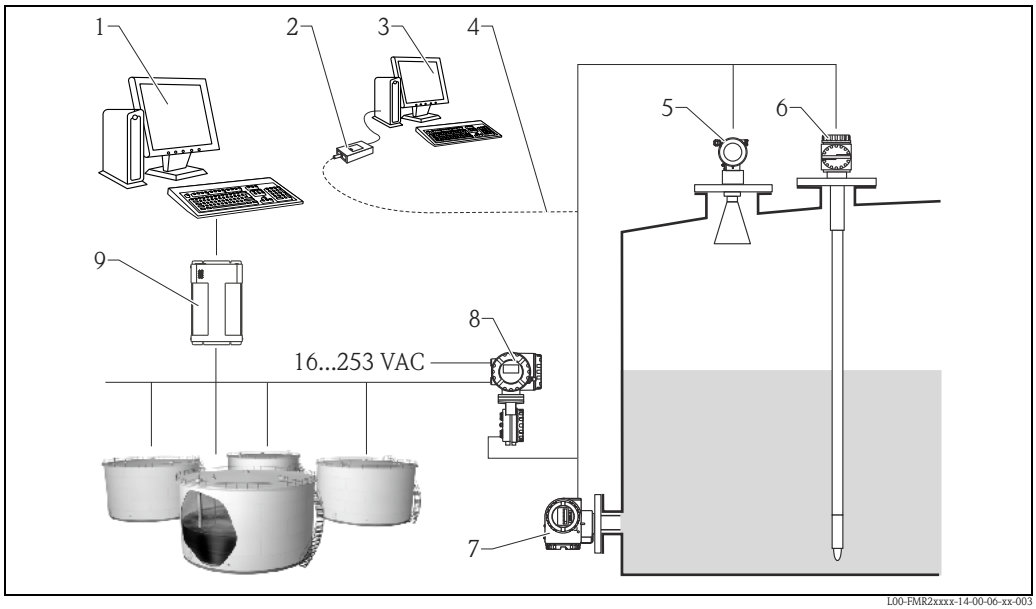
A maximum of 32 transmitters (standard, Ex em or Ex d) can be connected to the bus.
For protection class Ex ia IIC: the max. number of transmitters depends on the established rules and standards for intrinsically safe circuits (EN 60079-14, proof of intrinsically safety). Both on-site as well as remote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



1	*ControlCare Delta V...*	*10*	*Micropilot M*
2	*E.g. NI-FBUS configurator*	*11*	*Operating and display module*
3	*VIATOR Bluetooth modem with connecting cable*	*12*	*Power conditioner*
4	*Field Xpert SFX100*	*13*	*Power supply*
5	*More Functions (valves etc.)*	*14*	*FF Link*
6	*FieldCare*	*15*	*FOUNDATION Fieldbus*
7	*Commubox FXA291 with ToF Adapter FXA291*	*16*	*PLC*
8	*Levelflex M*	*17*	*Ethernet*
9	*Prosonic M*		

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.



1 Fuels Manager Software
2 Commubox FXA195
3 FieldCare
4 HART 2 wire
5 Micropilot M
6 Prothermo
7 Pressure
8 Tank Side Monitor
9 RTU8130 (remote terminal unit)

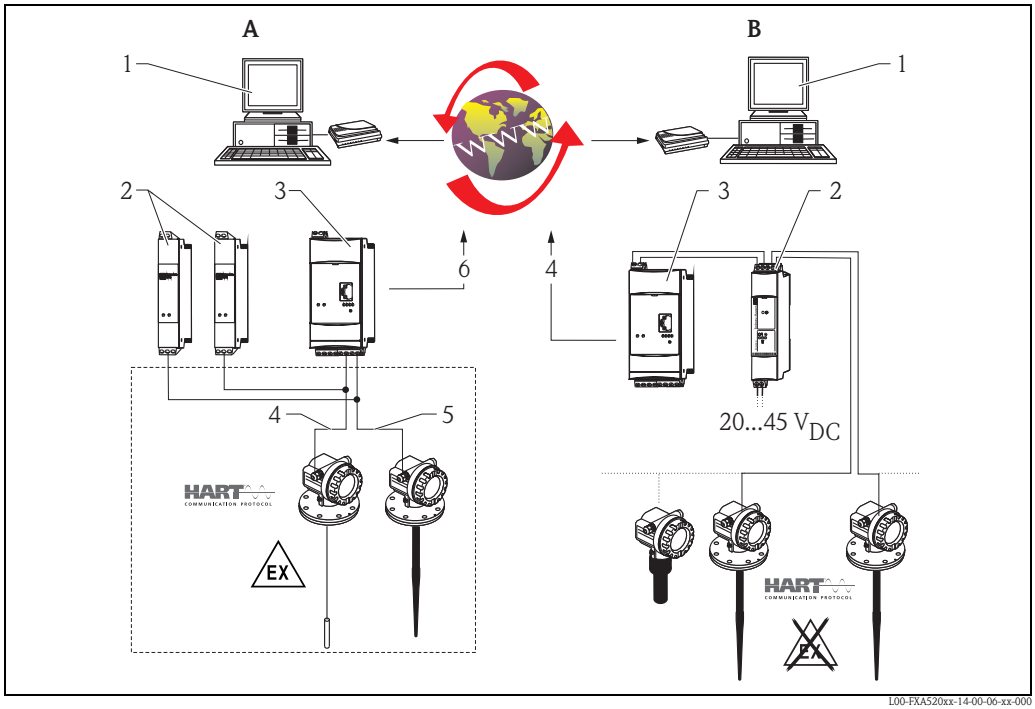
System integration via Fieldgate

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.



A *Remote configuration/diagnostics*
1 *Via HART Client: FieldCare*
2 *E.g. 2x RN221N-B...*
3 *Fieldgate FXA520*
4 *Channel 1*
5 *Channel 2*
6 *Analog; Ethernet; GSM*

B *Remote monitoring*
1 *HTTP script; Web browser*
2 *Multidrop-Connector FXN520*
3 *Fieldgate FXA520*
4 *Analog / Ethernet / GSM*

Note!
The number of devices which can be connected in mutidrop mode can be calculated by the "FieldNetCalc" program. A description of this program can be found in Technical Information TI00400F/00/EN (Multidrop Conncector FXN520). The program is available form 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 (Er)	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 NH_3 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 (→ 🖹 84).

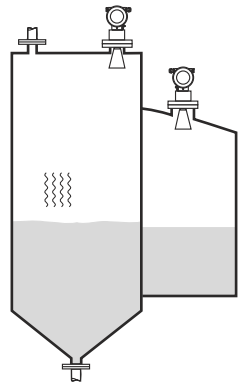
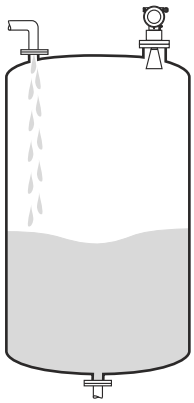
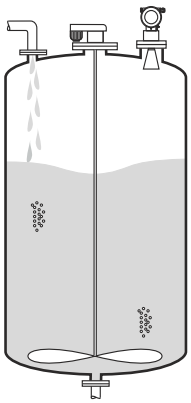
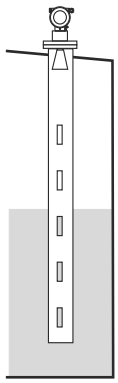
Reduction of the max. possible measuring range through:
- Media with poor reflection properties (= small DC). For examples refer to table below.
- Angle of repose.
- Extremely loose surfaces of bulk solids, e.g. bulk solids with low bulk weight for pneumatic filling.
- Build-up, above all of moist products.

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

Media group	DC (Er)	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 10 (32); **C** 15 (49); **D** 20 (65)	**B** 15 (49); **C** 20 (65); **D** 20 (65)	**B** 5 (16); **C** 7.5 (25); **D** 10 (32)	**B** 7.5 (25); **C** 10 (32); **D** 12.5 (41)	**B** 4 (13); **C** 6 (20); **D** 8 (26)	**B** 6 (20); **C** 8 (26); **D** 10 (32)	**A, B, C, D** 20 (65)	**C, D** 20 (65)
	Measuring range [m (ft)]							

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

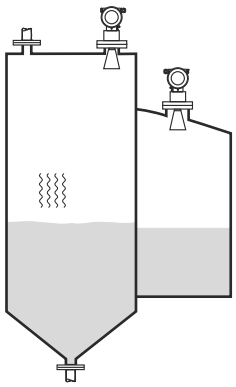
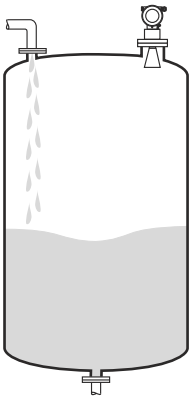
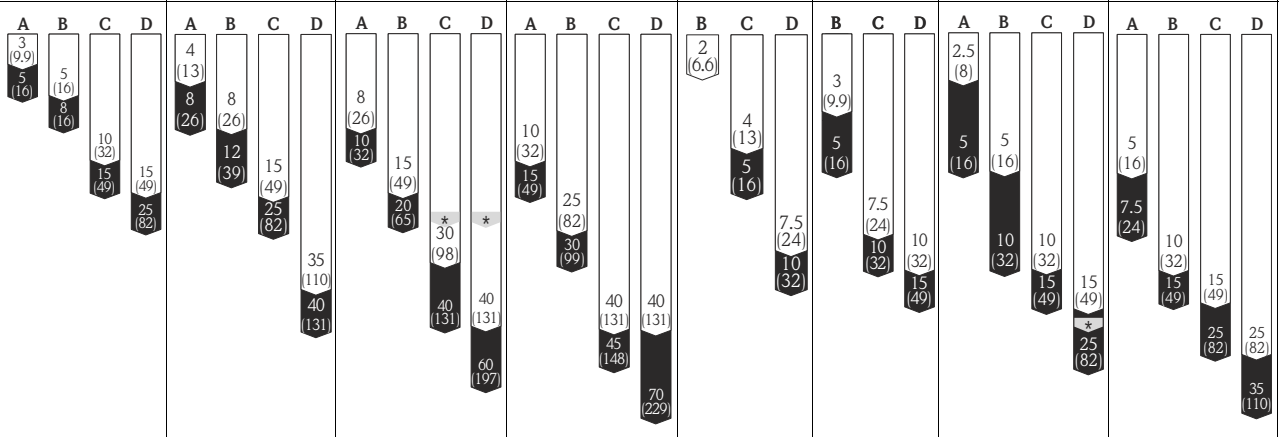
2) For media group A and B possible, i.e. with stilling well in bypass.

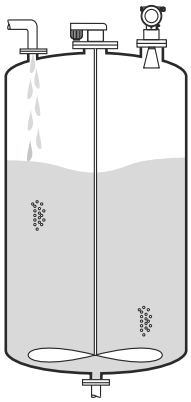
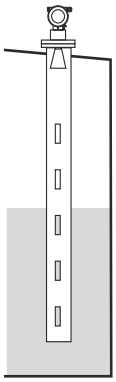
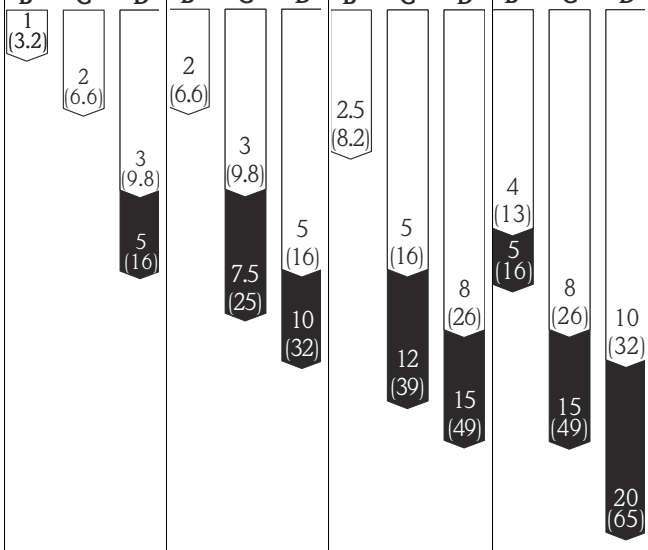
Measuring range depending on vessel type, conditions and product for FMR240, FMR244, FMR245

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 (→ 🖹 84).

	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")	-
								
	Measuring range [m (ft)]							

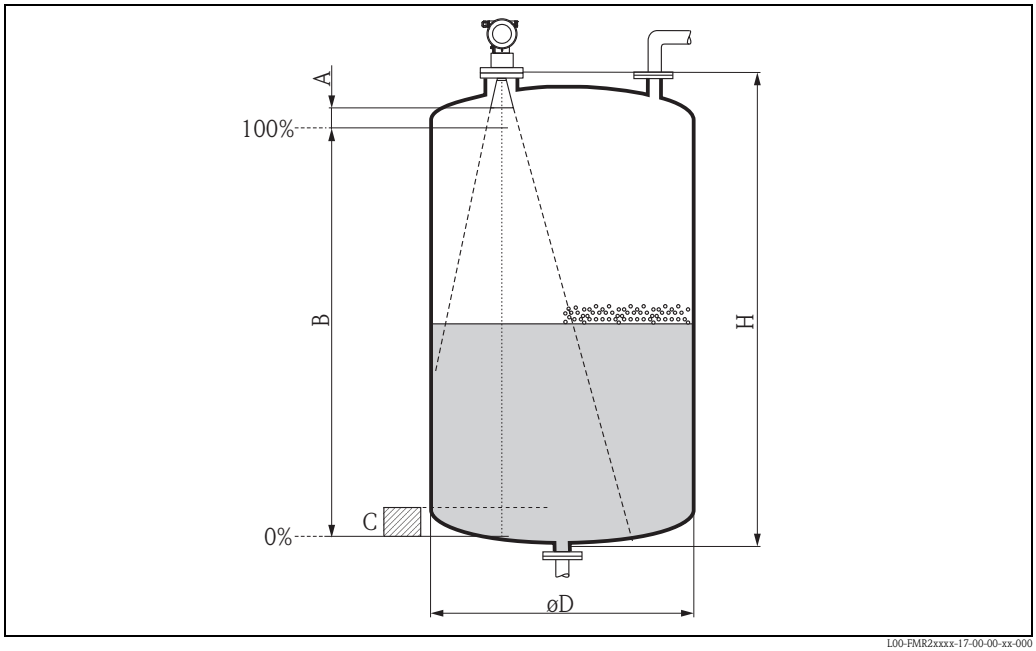
	Process tank with agitator				Stilling well[1]	Bypass[2]
	 Turbulent surface. Single stage agitator < 60 RPM.					
FMR240	40 mm (1½")	50 mm (2")	80 mm (3")	100 mm (4")	40 to 100 mm (1½" to 4")	40 to 100 mm (1½" to 4")
FMR244	40 mm (1½")	-	80 mm (3")	-	40 to 100 mm (1½" to 4"	-
FMR245	-	50 mm (2")	80 mm (3")	-	50 to 80 mm (2" to 3")	50 to 80 mm (2" to 3")
					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 (→ 67).
- In case of heavy **steam development** or **condensate** the max. measuring range of FMR240 may decrease depending on density, temperature and composition of the steam → use FMR230 or FMR231.
- For the measurement of absorbing gases such as **ammonia NH_3** or some **fluorocarbons** [1], please use FMR230 in a stilling well.



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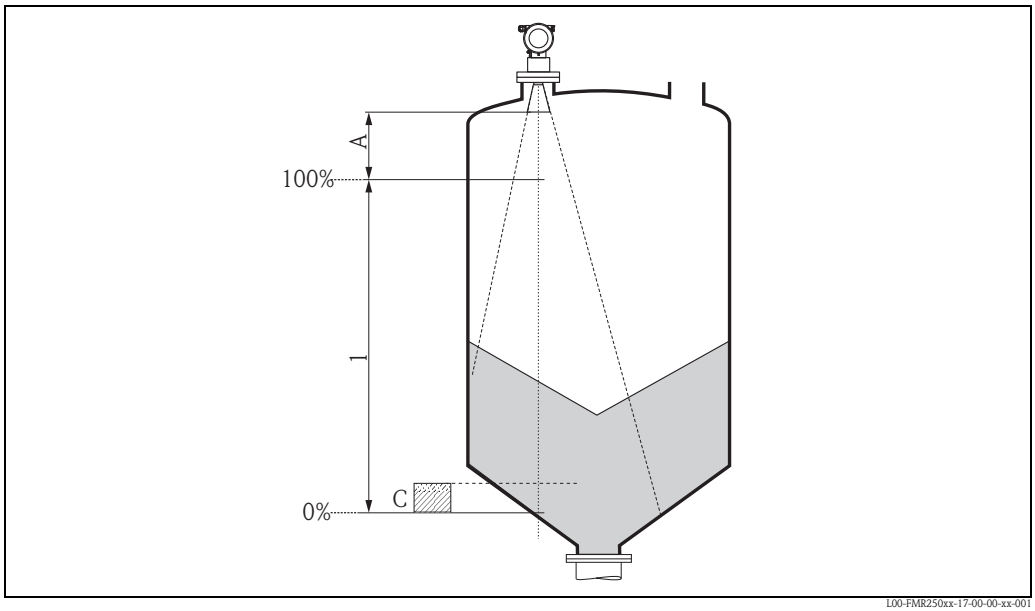
- The measuring range begins, where the beam hits the tank bottom. Particularly with dish bottoms or conical outlets the level cannot be detected below this point.
- In case of media with a low dielectric constant (groups A and B), the tank bottom can be visible through the medium at low levels (low 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 (→ 82).
- 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.



1 Measuring range

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 & Maitenance (for FMR240/244/245 of software version 01.05.00)

FOUNDATION Fieldbus

	FMR230/231	FMR240/244/245
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 Selectable	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 mesurement	■ Level or volume[1] (channel 1) ■ Distance (channel 2)
Diagnsotic Block	Contains diagnostic information	No output values
Display Block	Contains parameters to configure the local display	No output values

1) depending on the configuration of the sensor-block

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	—

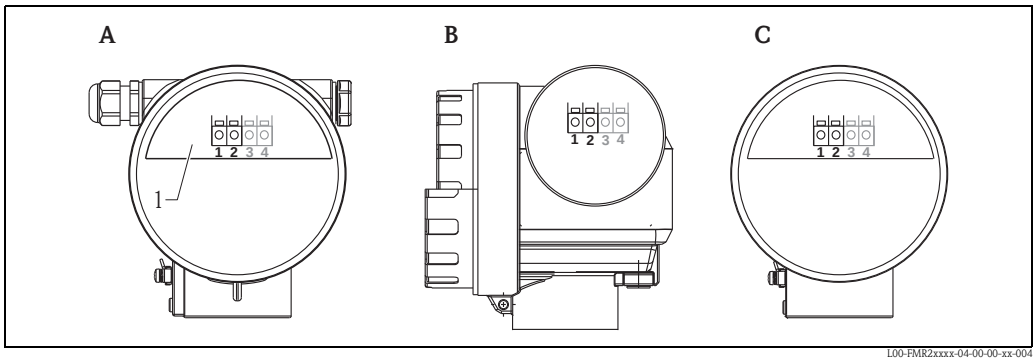
Auxiliary energy

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, → 24)
- 316L housing F23 for:
  - Standard,
  - Ex ia.

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



A *F12 housing*
B *T12 housing*
C *F23 housing*
1 *Sealed terminal compartment*

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 mm^2 (20 to 14 AWG)

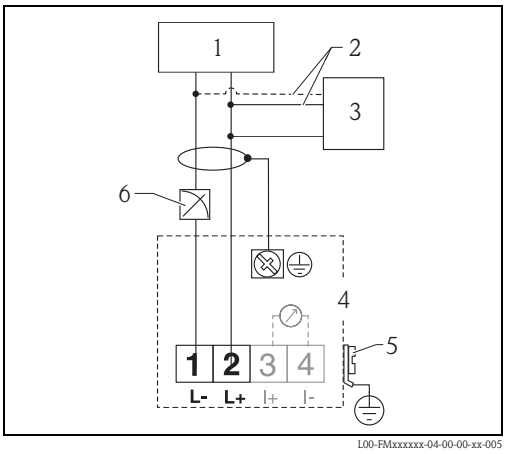
Terminal assignment

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 TI00241F/00/EN "basics for EMC-tests").
- See TI00402F/00/EN for connection to Tank Side Monitor NRF590.



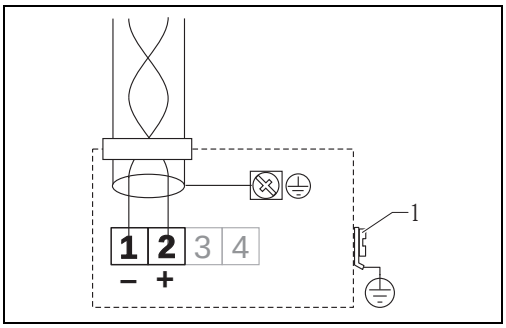
L00-FMxxxxxx-04-00-00-xx-005

1 Power
2 Alternatively
3 Commubox FXA195, Field Xpert SFX100
4 Test socket for testing of the signal current
5 Plant ground
6 4 to 20 mA

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. BA00034S/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.



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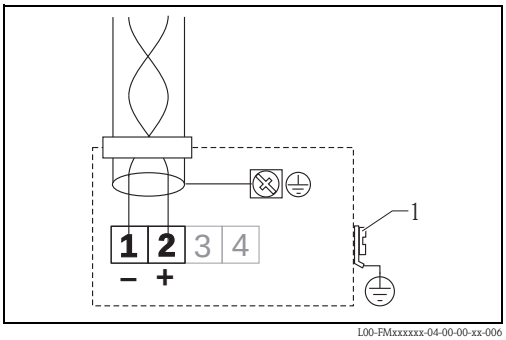
1 Plant ground

Note!
For further information on the cable specifications, see Operating Instructions BA00034S/04/EN "Guidelines for planning and commissioning PROFIBUS DP/PA", PNO Guideline 2.092 "PROFIBUS PA User and Installation Guideline" and IEC 61158-2 (MBP).

FOUNDATION Fieldbus

The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the auxiliary energy. For further information on the network structure and earthing and for further bus system components such as bus cables, see the relevant documentation, e.g. BA00013S/04/EN "FOUNDATION Fieldbus Overview" and the FONDATION Fieldbus Guideline.

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



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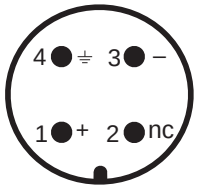
1 Plant ground

Note!
For further information on the cable specifications, see Operating Instructions BA00013S/04/EN "FOUNDATION Fieldbus Overview", FONDATION Fieldbus Guideline and IEC 61158-2 (MBP).

Fieldbus plug connectors

For the versions with a connector M12 or 7/8", the housing does not have to be opened for connecting the signal line.

Pin assignment of the M12 plug connector



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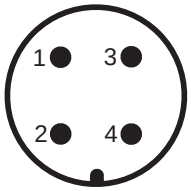
Pin	Meaning
1	Signal +
2	Not assigned
3	Signal –
4	Earth

Pin assignment of the 7/8" plug connector



A0011176

Pin	Meaning
1	Signal –
2	Signal +
3	Shield
4	Not assigned

Load HART

Minimum load for HART communication: 250 Ω

Supply voltage

HART

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

Communication		Current consumption	Terminal voltage
HART	standard	4 mA	16 to 36 V
		20 mA	7.5 to 36 V
	Ex ia	4 mA	16 to 30 V
		20 mA	7.5 to 30 V
	Ex d	4 mA	16 to 30 V
		20 mA	11 to 30 V
	dust Ex	4 mA	16 to 30 V
		20 mA	11 to 30 V
Fixed current, adjustable e.g. for solar power operation (measured value transferred at HART)	standard	11 mA	10[1)] to 36 V
	Ex ia	11 mA	10[1)] to 30 V
Fixed current for HART Multidrop mode	standard	4 mA [2)]	16 to 36 V
	Ex ia	4 mA [2)]	16 to 30 V

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

2) Start up current 11 mA.

PROFIBUS PA and FOUNDATION Fieldbus

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

Type	Terminal voltage
Supply voltage	9 to 30 V (Ex) [1] 9 to 32 V (non-Ex) max. voltage 35 V
Device (Lift off) minimum voltage	9 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).

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: Uss = 200 mV (at 500 Ω)

Max. noise HART

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

Overvoltage protector

The level transmitter Micropilot M with T12-housing (housing version "D", see Ordering information, → 67) is equipped with an internal overvoltage protector (600 V surge arrester) according to EN/IEC 60079-14 or EN/IEC 60060-1 (impulse current test 8/20 µs, Î = 10 kA, 10 pulses). Connect the metallic housing of the Micropilot M to the tank wall or screen directly with an electrically conductive lead to ensure reliable potential matching.

Performance characteristics

Reference operating conditions

- Temperatur = +20 °C ±5 °C (+68 °F ±41 °F)
- Pressure = 1013 mbar abs. ±20 mbar (15.19 psi ±0.3 psi)
- Relative humidity (air) = 65% ±20%
- Ideal reflector
- No major interference reflections inside the signal beam

Maximum measured error

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

FMR230, FMR231:
- to 10 m (33 ft): ±10 mm (0.39 in)
- ex 10 m (33 ft): ±0.1% of measuring range

FMR240, FMR244, FMR245:
- **Not** for max. measuring range = 70 m (230 ft)
  - to 1 m (3.3 ft): ±10 mm (0.39 in)
- For max. measuring range = 40 m (131 ft)
  - to 10 m (33 ft): ±3 mm (0.12 in)
  - ex 10 m (33 ft): ±0.03% of measuring range
- For max. measuring range = 70 m (230 ft)
  - to 1 m (3.3 ft): ±30 mm (1.18 in)
  - ex 1 m (3.3 ft): ±15 mm (0.59 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 device 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 to +80 °C (-40 to +176°F).
  - **FMR230**
    Average T_K: 3 mm (0.12 in) /10 K, max. 10 mm (0.39 in) over the entire temperature range -40 to +80 °C (-40 to +176°F).
  - **FMR231**
    Average T_K: 5 mm (0.2 in) /10 K, max. 15 mm (0.59 in) over the entire temperature range -40 to +80 °C (-40 to +176°F).
- Current output (additional error, in reference to the span of 16 mA):
  - **Zero point (4 mA)**
    Average T_K: 0,03%/10 K, max. 0,45% over the entire temperature range -40 to +80 °C (-40 to +176°F).
  - **Span (20 mA)**
    Average T_K: 0,09%/10 K, max. 0,95% over the entire temperature range -40 to +80 °C (-40 to +176°F).

Effect of gas phase

High pressures reduce the propagation velocity of the measuring signals in the gas/vapor above the fluid. This effect depends on the kind of gas/vapor and of its temperature. 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 in bar (psi)				
	°C (°F)	1 (14.5)	10 (145)	50 (725)	100 (1450)	160 (2320)
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%

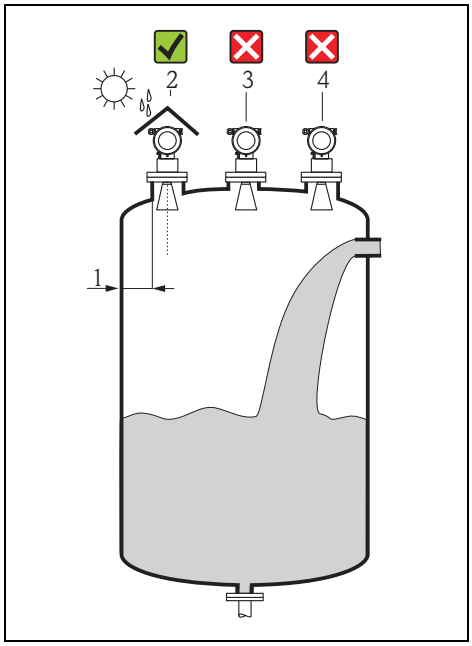
Note!
When the pressure is known and constant, this measured error can, for example, be compensated by means of linearization.

Operating conditions: Installation

Installation instructions

Orientation

- Recommended distance (1) wall – **outer edge** of nozzle: ~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 tankwall.
- Not in the centre (3), interference can cause signal loss.
- Not above the fill stream (4).
- It is recommended to use a weather protection cover (2) in order to protect the transmitter from direct sun or rain. Assembly and disassembly is simply done by means of a tension clamp (→ 82, "Accessories").



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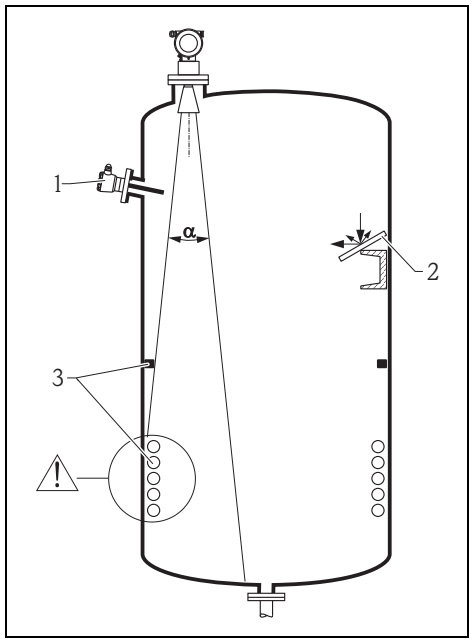
Tank installations

- Avoid any installations (1), like limit switches, temperature sensors, etc., inside the signal beam (→ 28, "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", → 29.
- Stilling well: a stilling well can always be used to avoid interference.
- Metallic screens (3) mounted at a slope spread the radar signals and can, therefore, reduce interference echoes.

Please contact Endress+Hauser for further information.



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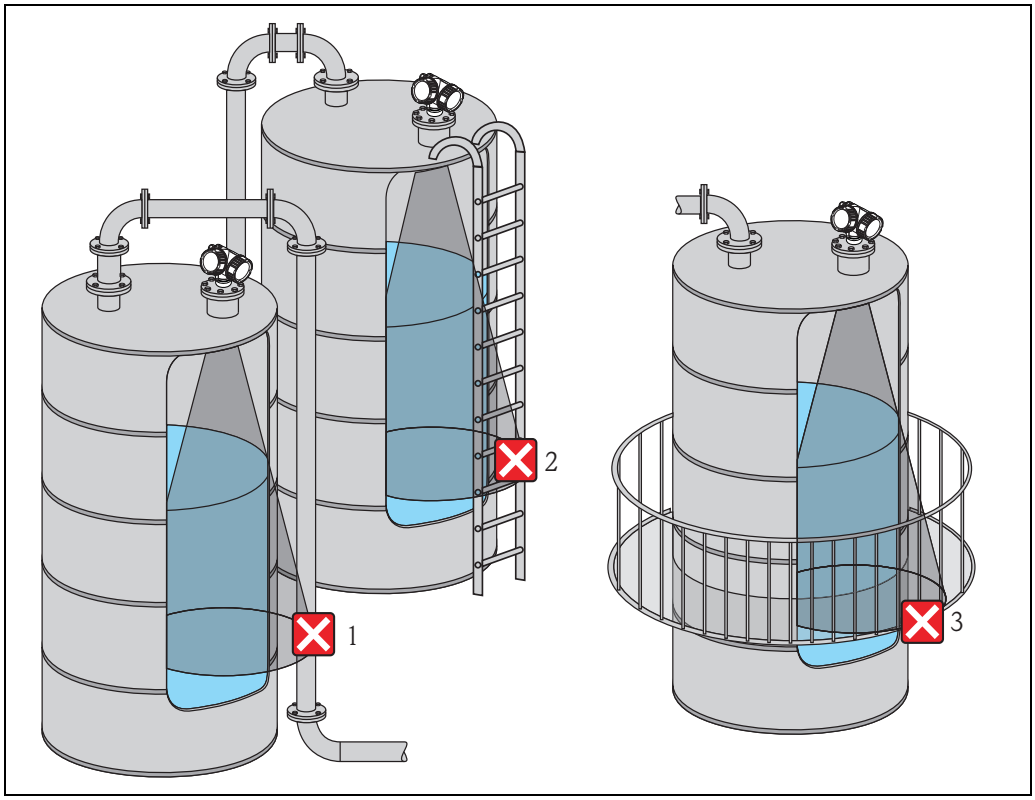
Measurement in a plastic tank

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



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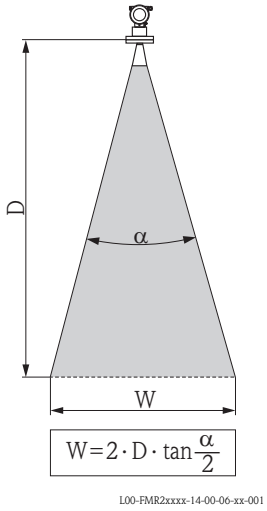
Beam angle

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)



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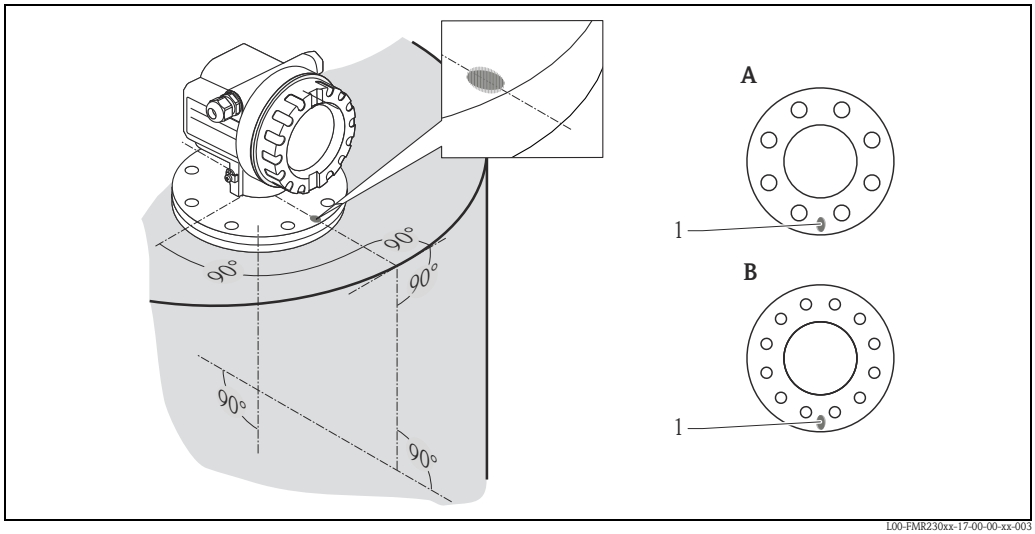
Antenna size (horn diameter)					
	FMR240	40 mm (1½")	50 mm (2")	80 mm (3")	100 mm (4")
	FMR244	40 mm (1½")	—	80 mm (3")	—
	FMR245	—	50 mm (2")	80 mm (3")	—
Beam angle α		23°	18°	10°	8°

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

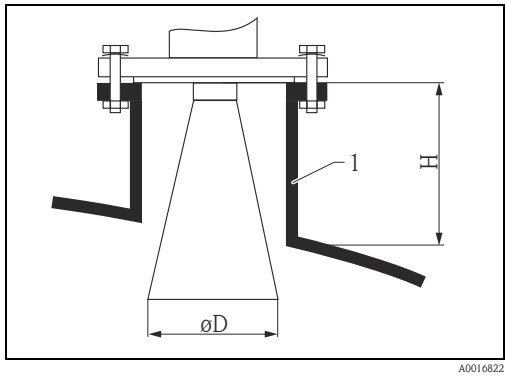


L00-FMR230xx-17-00-00-xx-003

A DN 150, ANSI 6"
B DN 200 to 250, ANSI 8 to 10"
1 Marker at device flange

Standard installation

- Observe installation instructions, → 📄 26.
- Marker is aligned towards tank wall.
- The marker is good visibly situated between the sensor neck and the bolt-holes of the flange.
- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.
- The horn antenna must extend below the nozzle, otherwise use antenna extension FAR10.
- Align horn antenna vertically.



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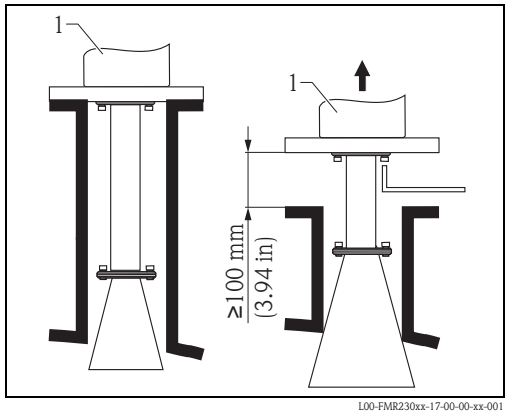
1 Nozzle

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)

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 device lifted up. The extension has to be selected such that the device can be lifted by at least 100 mm (3.94 in).
- Recommended torque: 10 Nm (7.37 lbf ft).



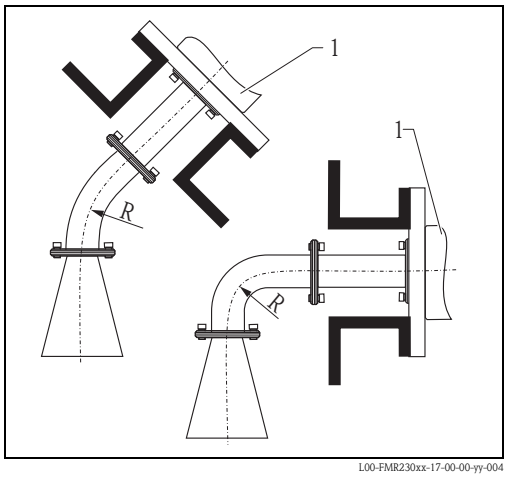
L00-FMR230xx-17-00-00-xx-001

1 FMR230

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).

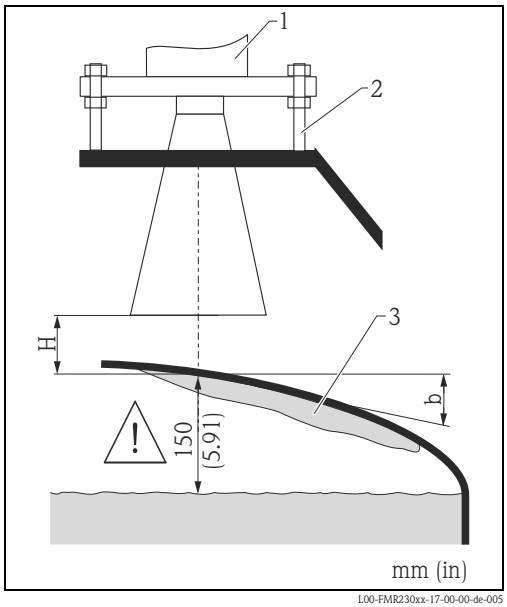
Please contact Endress+Hauser for further information.



1 FMR230

Measurement from the outside through plastic walls

- Medium with dielectric constant $\varepsilon r > 10$.
- 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 DN 250 (10").
- Do not mount any potential reflectors (i.e. pipes) outside the tank in the signal beam.

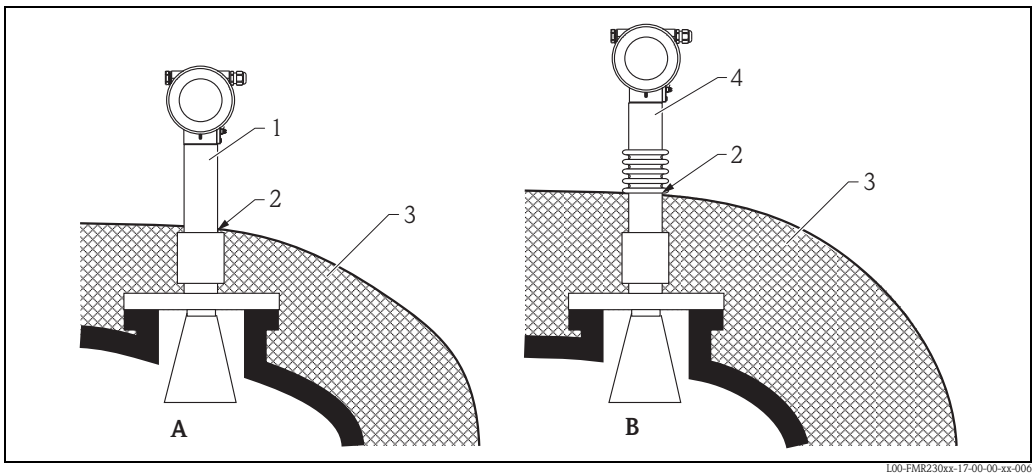


1 FMR230
2 Bolt
3 Condensation and build-up attenuate the measuring signal

Penetrated material	PE	PTFE	PP	Perspex
DK / εr	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), …)

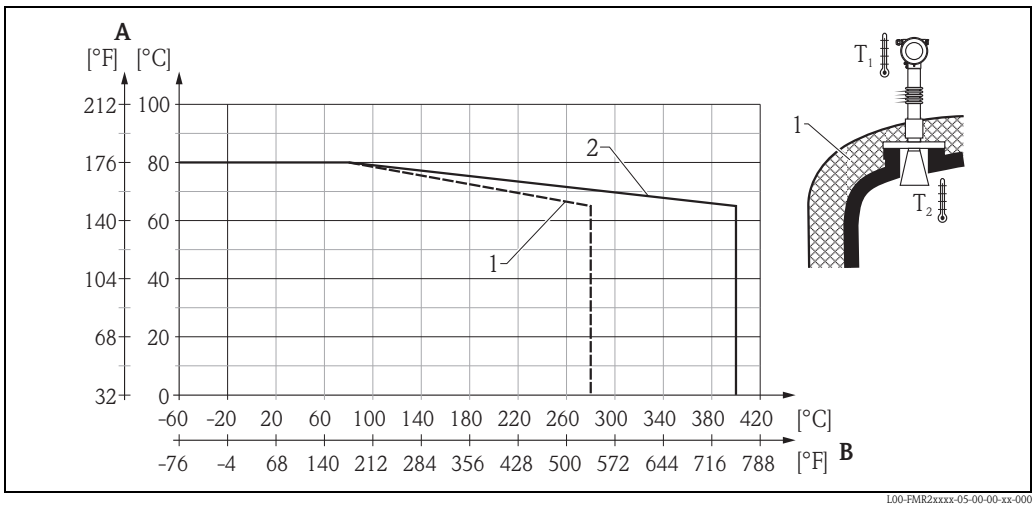
Installation FMR230 with heat insulation



A *Max. 280 °C (536 °F)*
B *Max. 400 °C (752 °F)*

1 *Extended temperature version (type of antenna L)*
2 *MAX*
3 *Tank insulation*
4 *High temperature version (type of antenna M)*

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

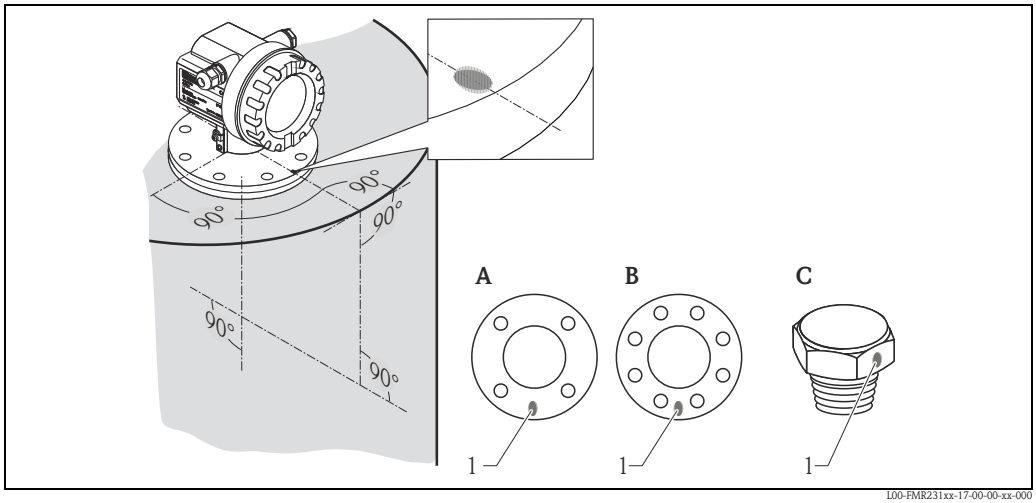


A *Max. ambient temperature T_1*
B *Max. process connection temperature T_2*
1 *FMR230 with type of antenna L (extended temperature)*
2 *FMR230 with type of antenna M (high temperature)*

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

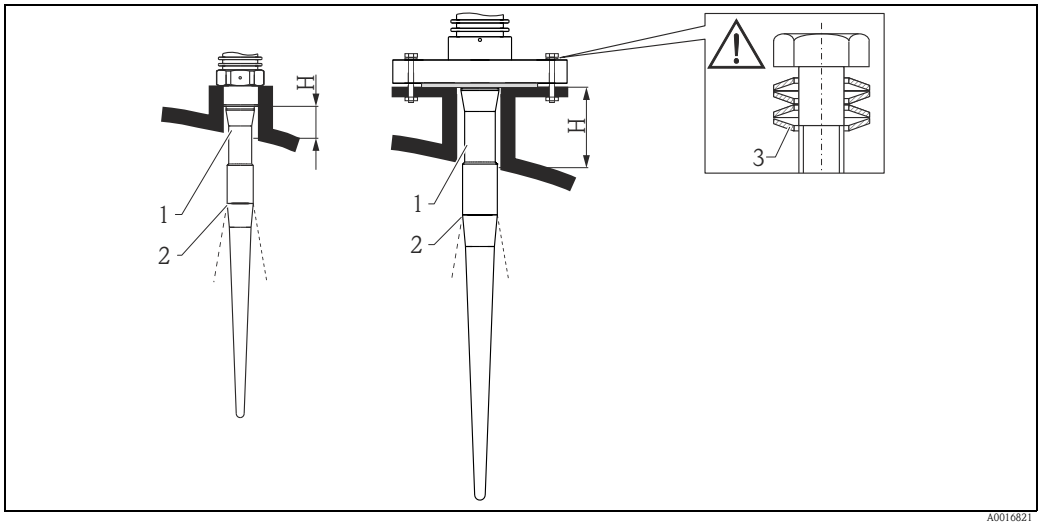


A *DN 50, ANSI 2"*
B *DN 80 to 150, ANSI 3 to 6"*
C *R1½ oder 1½ NPT*

1 *Marker at device flange or threaded boss*

Standard installation

- Observe installation instructions, → 📄 26.
- Marker is aligned towards tank wall.
- The marker is good visibly situated between the sensor neck and the bolt-holes of 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.

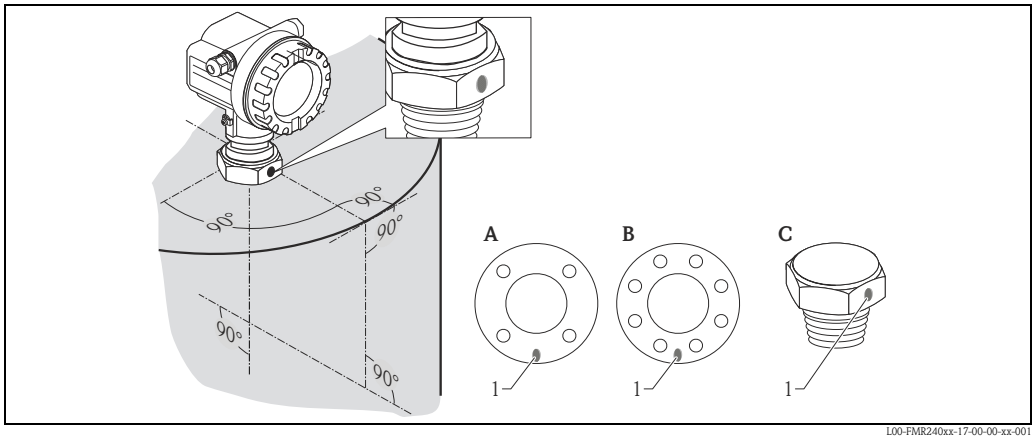


1 *Inactive length*
2 *Beam launched here*
3 *Spring washers*

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

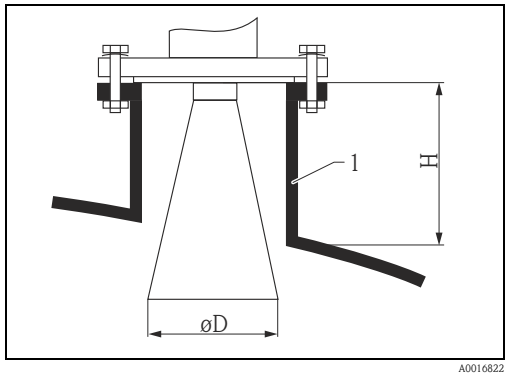
Optimum mounting position



A *DN50, ANSI 2"*
B *DN80 to 150, ANSI 3 to 6"*
C *R1½, G1½ (FMR244) oder 1½ NPT*
1 *Marker at device flange or threaded boss*

Standard installation FMR240

- Observe installation instructions, → 🖹 26.
- Marker is aligned towards tank wall.
- The marker is good visibly situated between the sensor neck and the bolt-holes of 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.



1 *Nozzle*

- **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 (→ 🖹 82, "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

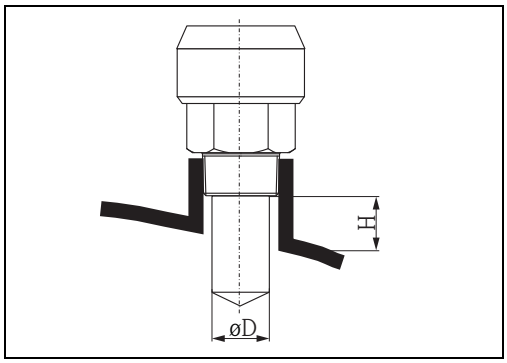
- Observe instructions, → 🖹 26.
- If possible, use an antenna 100 mm (4").

Penetrated material	PE	PTFE	PP	Perspex
DK / εr	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, → 📄 26.
- 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.



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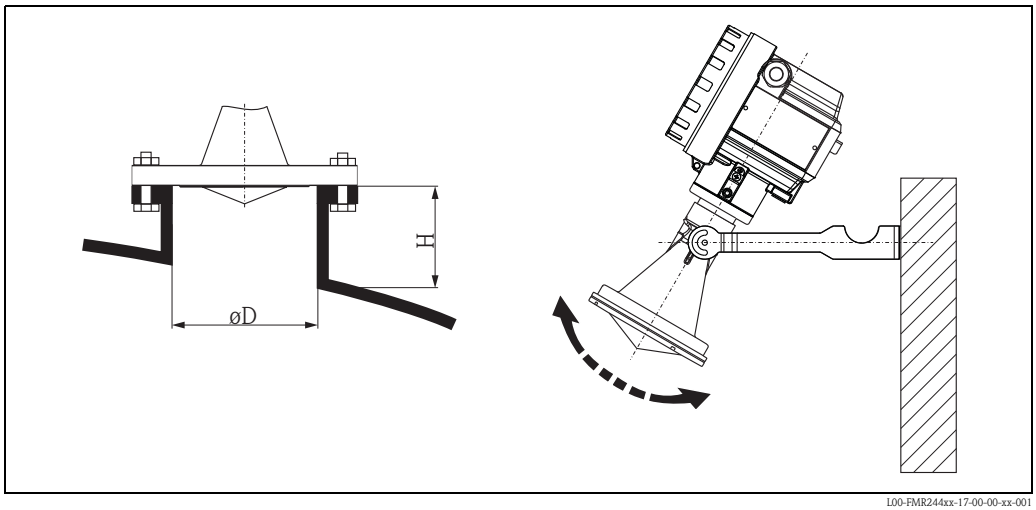
Antenna size	40 mm (1½")
D [mm (in)]	39 (1.54)
H [mm (in)]	< 85 (3.35)

Standard installation FMR244 - 80 mm (3") antenna

- Observe installation instructions, → 📄 26.
- 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 (→ 📄 82, "Accessories") can be used to align the device (solid applications).
- If using a mounting bracket (→ 📄 82, "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.



L00-FMR244xx-17-00-00-xx-001

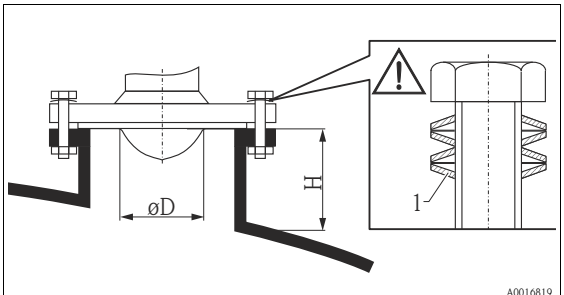
Antenna size	80 mm (3")		
D [mm (in)]	80 (3.15)	100 (3.94)	150 (5.91)
H [mm (in)]	< 500 (19.7)	< 500 (19.7)	< 500 (19.7)

Standard installation FMR245

- Observe installation instructions, → 📄 26.
- Marker is aligned towards tank wall.
- The marker is good visibly situated between the sensor neck and the bolt-holes of 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)

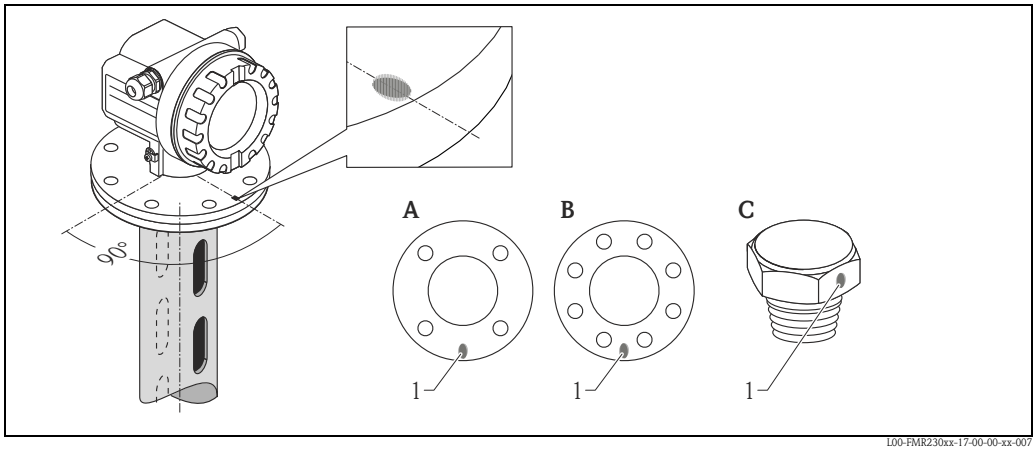


1 Spring washer

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

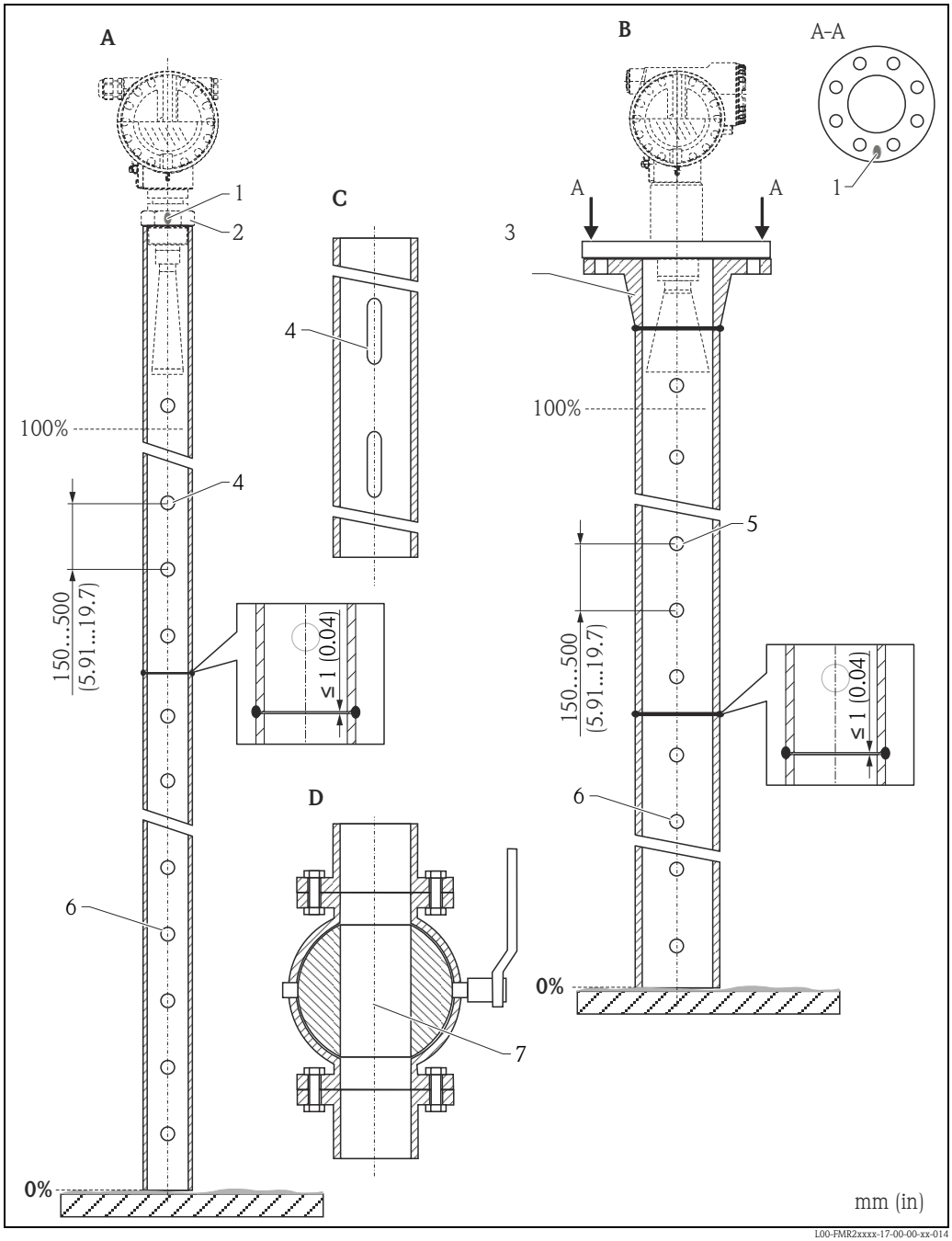


A *DN 50, ANSI 2"*
B *DN 80 to 150, ANSI 3 to 6"*
C *R1½, G1½ (FMR244) oder 1½ NPT*
1 *Marker at device flange or threaded boss*

Standard installation
- Marker is aligned toward slots.
- The marker is good visibly situated between the sensor neck and the bolt-holes of 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, → 📄 26.

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 $Rz \leq 6.3$ µm (248 µin)). Use extruded or parallel welded stainless steel pipe. An extension of the pipe is possible with welded flanges or pipe sleeves. Flange and pipe have to be properly aligned at the inside.
- Do not weld through the pipe wall. The inside of the stilling well must remain smooth. In case of unintentional welding through the pipe, the weld seam and any unevenness on the inside need to be carefully removed and smoothened. Otherwise, strong interference echoes will be generated and material build-up will be promoted.
- Particularly on smaller nominal widths it needs to be observed that flanges are welded to the pipe such that they allow for a correct orientation (marker aligned toward slots).

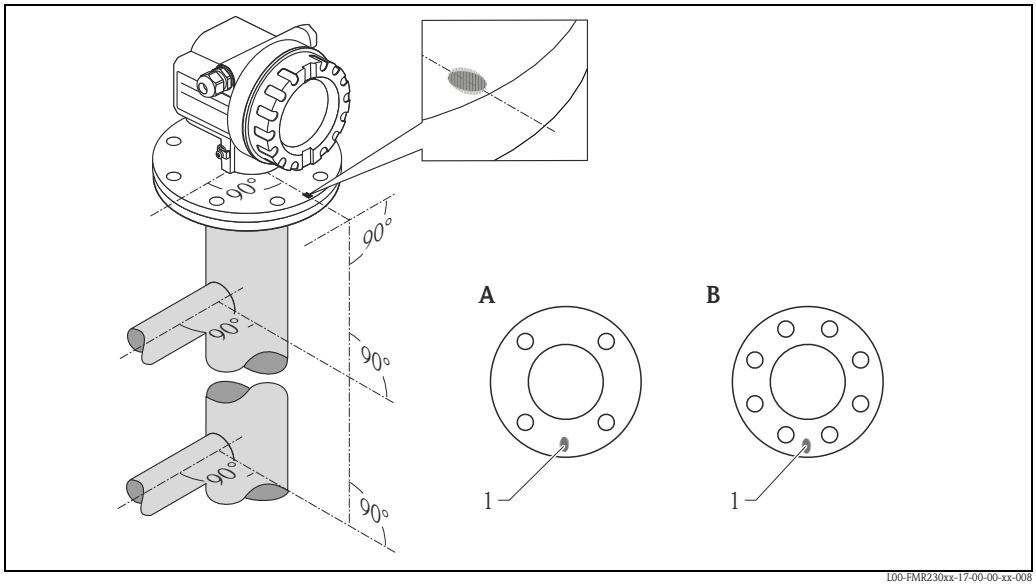
Examples for the construction of stilling wells



A *FMR240, FMR244 (40 mm (1½"))*
B *FMR230, FMR240, FMR244 (80 mm (3")), FMR245*
C *Stilling well with slots*
D *Full bore ball valve*
1 *Marker*
2 *Threaded connection 1½"BSPT (R1½"), G1½" (FMR244) or 1½NPT*
3 *E.g. welding neck flange DIN2633*
4 *<1/10 pipe diameter*
5 *Hole <1/10 pipe diameter, single sided or drilled through*
6 *Inside of holes deburred*
7 *Diameter of opening of ball valve must always be equivalent to pipe diameter. Avoid edges and constrictions.*

Installation in bypass FMR230, FMR240, FMR245

Optimum mounting position

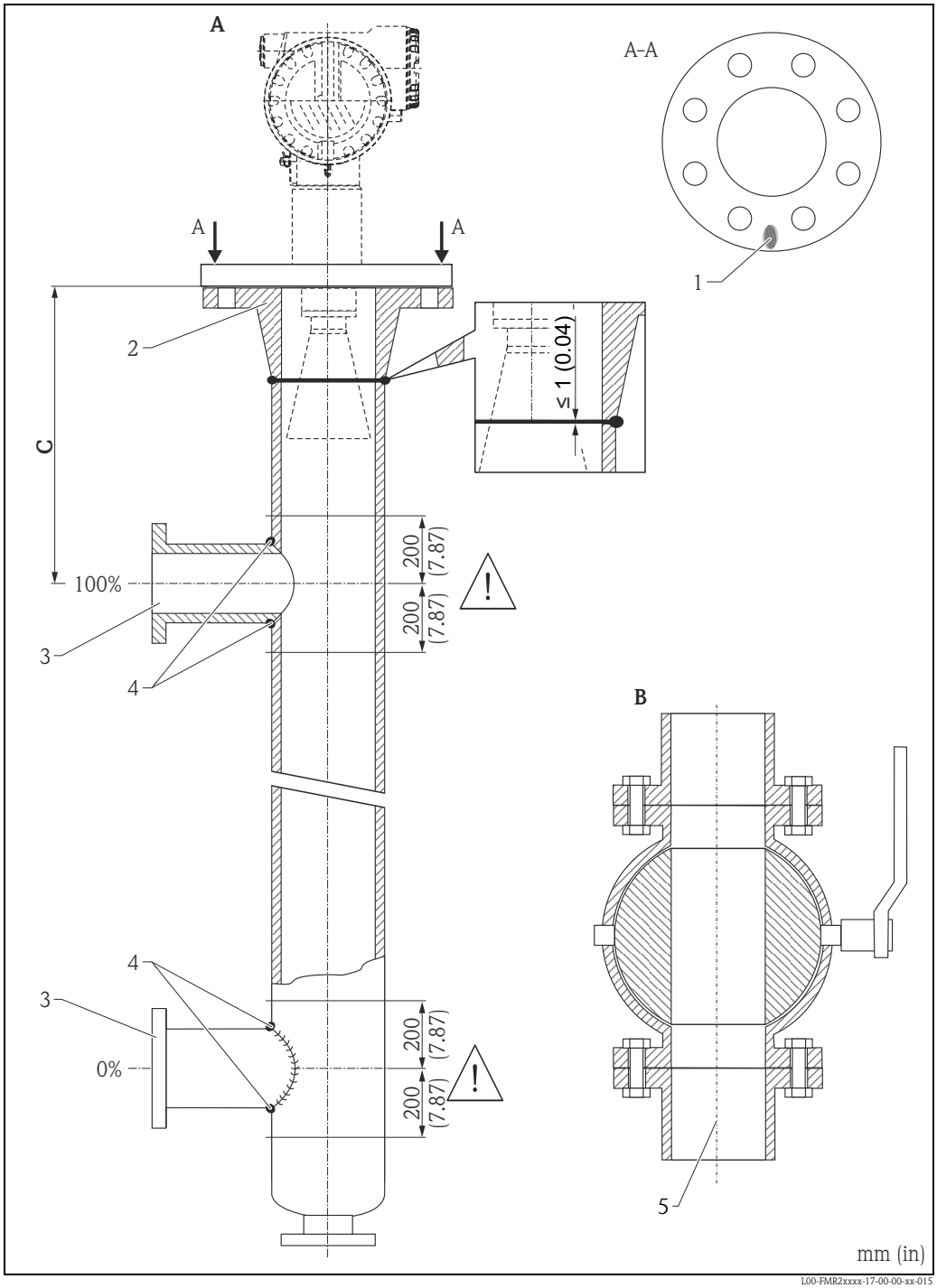


A *DN 50, ANSI 2"*
B *DN 80 to 150, ANSI 3 to 6"*
1 *Marker at device flange*

Standard installation
- Marker is aligned perpendicular (90°) to tank connectors.
- The marker is good visibly situated between the sensor neck and the bolt-holes of 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, → 📄 26.

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 (~ ±20 cm (7.87 in)) a reduced accuracy of the measurement has to be expected.

Example for the construction of a bypass.



A *FMR230, FMR240, FMR244 (80 mm (3")), FMR245*
B *Full bore ball valve*
C *Recommendation: min. 400 mm (15.7 in)*
1 *Marker*
2 *E.g. welding neck flange DIN2633*
3 *Diameter of the connection pipes as small as possible*
4 *Do not weld through the pipe wall. The inside of the bypass must remain smoth.*
5 *Diameter of opening of ball valve must always be equivalent to pipe diameter. Avoid edges and constrictions.*

Operating conditions: Environment

Ambient temperature range	Ambient temperature for the transmitter: -40 to +80 °C (-40 to +176 °F), -50 °C (-58 °F) with manufacturer declaration on request. The functionality of the LCD display may be limited for temperatures Ta < -20 °C (-4 °F) and Ta > +60 °C (+140 °F). A weather protection cover should be used for outdoor operation if the device is exposed to direct sunlight.
Storage temperature	-40 to +80 °C (-40 to +176 °F), -50 °C (-58 °F) with manufacturer declaration on request.
Climate class	DIN EN 60068-2-38 (test Z/AD)
Geometric height according to IEC61010-1 Ed.3	Up to 2 000 m (6 600 ft) above MSL. Can be expanded to 3 000 m (9 800 ft) above MSL by application of an overvoltage protection, e.g. HAW562 or HAW569.
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 $(m/s^2)^2/Hz$ (FMR230/231; FMR240; FMR245; FMR244 with 40 mm (1½") antenna) ■ 20 to 2000 Hz, 0.5 $(m/s^2)^2/Hz$ (FMR244 with 80 mm (3") antenna)
Cleaning of the antenna	The antenna can get contaminated, depending on the application. The emission and reception of microwaves can thus eventually be hindered. The degree of contamination leading to an error depends on the medium and the reflectivity, mainly determined by the dielectric constant εr. If the medium tends to cause contamination and deposits, cleaning on a regular basis is recommended. Care has to be taken not to damage the antenna in the process of a mechanical or hose-down cleaning (eventually connection for cleaning liquid). The material compatibility has to be considered if cleaning agents are used! The maximum permitted temperature at the flange should not be exceeded.
Electromagnetic compatibility (EMC)	■ Electromagnetic compatibility 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 to +200 °C [1] (-40 to +392 °F)	-1 to +64 bar (-14.5 to +928 psi)	PTFE, seal, 316L resp. Alloy C4
E	Standard	EPDM	-40 to +150 °C (-40 to +302 °F)		
K	Standard	Kalrez (Spectrum 6375)	-20 to +200 °C [1] (-4 to +392 °F)		
L	Extended temperature	Graphit	-60 to +280 °C (-76 to +536 °F)	-1 to +100 bar (-14.5 to +1450 psi)	Ceramic (Al_2O_3: 99,7%), Graphit, 316L
M	High temperature	Graphit	-60 to +400 °C (-76 to +752 °F)	-1 to +160 bar (-14.5 to +2320 psi)	

↑ Ordering information, → 67

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

FMR231					
Type of antenna		**Process connection**	**Temperature**	**Pressure**	**Wetted parts**
A, B	PPS	—	-20 to +120 °C (-4 to +248 °F)	-1 to +16 bar (-14.5 to +232 psi)	316L, Viton, PPS
E, F	PTFE (conform to FDA 21 CFR 177.1550 and USP <88> Class VI)	PVDF threaded connection	-40 to +80 °C (-40 to +176 °F)	-1 to +3 bar (-14.5 to +43.5 psi)	PVDF, PTFE
		Metal threaded connection	-40 to +150 °C (-40 to +302 °F)	-1 to +40 bar (-14.5 to +302 °F)	316L, PTFE (conform to FDA 21 CFR 177.1550 and USP <88> Class VI)
		Flange unclad			
		Flange clad [1]		-1 to +16 bar (-14.5 to +232 psi)	PTFE (conform to FDA 21 CFR 177.1550 and USP <88> Class VI)
		Tri-Clamp 2"		-1 to +16 bar (-14.5 to +232 psi)	316L, PTFE (conform to FDA 21 CFR 177.1550 and USP <88> Class VI)
		Tri-Clamp 3"		-1 to +10 bar (-14.5 to +145 psi)	
		Aseptic, Dairy		-1 to +25 bar (-14.5 to +362.5 psi)	

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

↑ Ordering information, → 🖹 70

1) On DN 150, 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 to +150 °C (-4 to +302 °F)	-1 to +40 bar (-14.5 to +580 psi)	PTFE, seal, 316L resp. Alloy C22
E	Standard	FKM Viton GLT	-40 to +150 °C (-40 to +302 °F)		
K	Standard	Kalrez (Spectrum 6375)	-20 to +150 °C (-4 to +302 °F)		

↑ Ordering information, → 🖹 73

FMR244					
Type of antenna		**Seal**	**Temperature**	**Pressure**	**Wetted parts**
V	Standard, completely PTFE encapsulated	FKM Viton GLT	-40 to +130 °C (-40 to +266 °F)	-1 to +3 bar (-14.5 to +43.5 psi)	PTFE (conform to FDA 21 CFR 177.1550 and USP <88> Class VI), Viton, PVDF
S	Standard, PP clad	Silicone	-40 to +80 °C (-40 to +176 °F)		PP, Silicone, PBT

↑ Ordering information, → 🖹 76

FMR245					
Type of antenna		**Seal**	**Temperature**	**Pressure**	**Wetted parts**
B, C, F, G	Standard, PTFE clad	none	-40 to +200 °C (-40 to +392 °F)	-1 to +16 bar (-14.5 to +232 psi)	PTFE (conform to FDA 21 CFR 177.1550 and USP <88> Class VI) [1]

↑ Ordering information, → 🖹 79

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

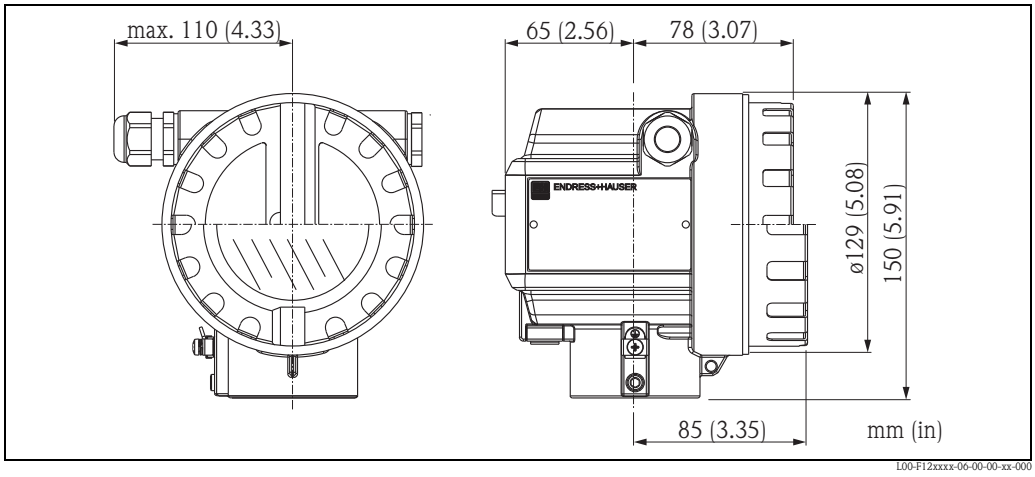
Dielectric constant

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

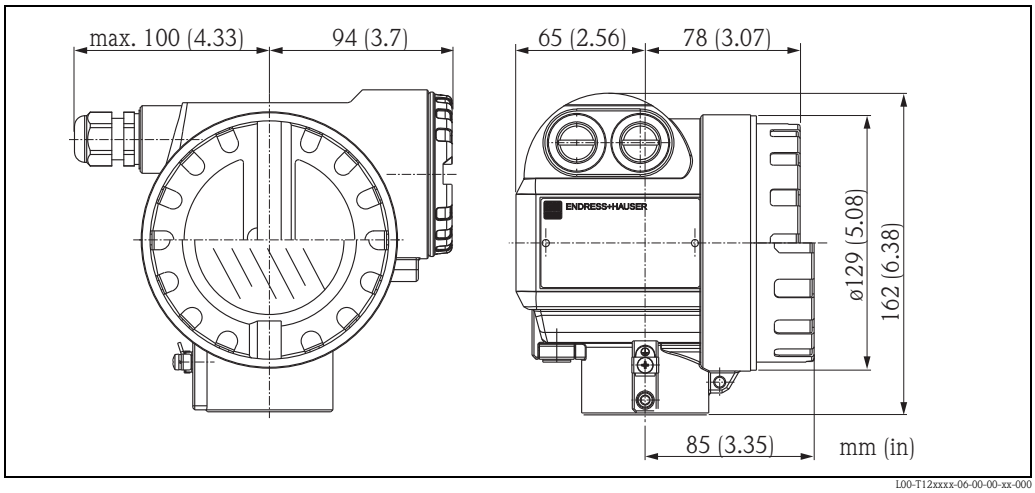
Mechanical construction

Design, dimensions

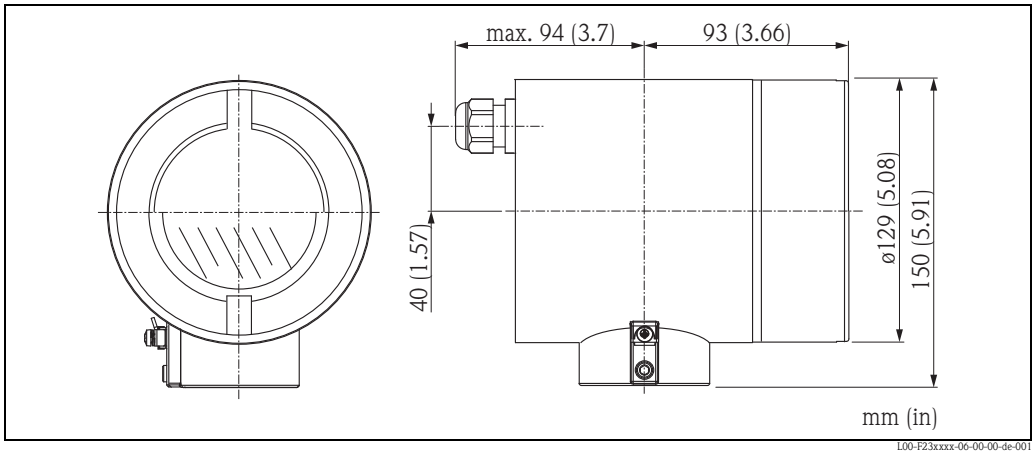
Housing dimensions



F12 housing (Aluminium)

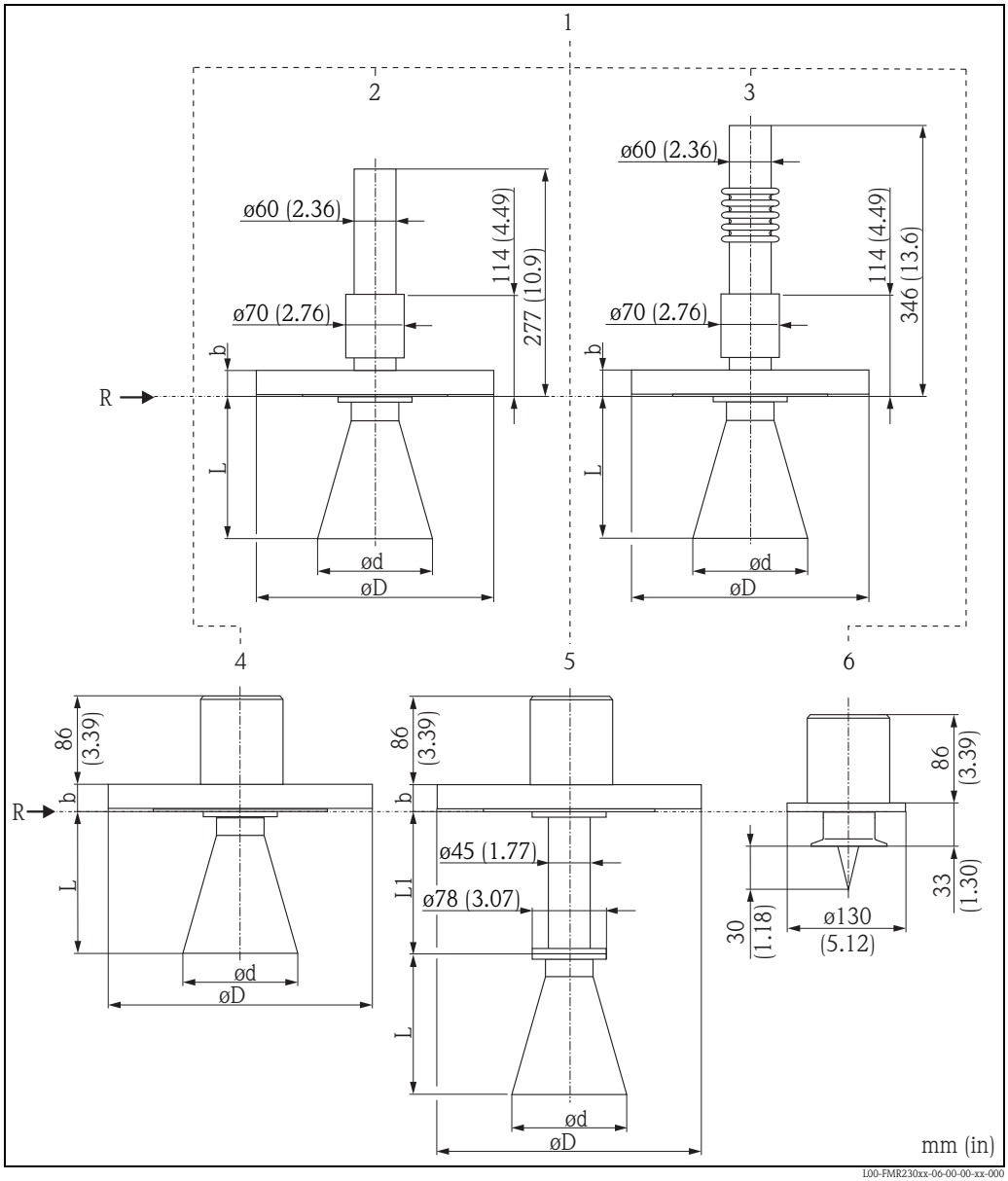


T12 housing (Aluminium)



F23 housing (316L)

Micropilot M FMR230 – Process connection and antenna



1 F12/T12/F23 housing
2 Ext. temperature version; feature 30, version L
3 High temperature version ; feature 30, version M
4 Standard antenna
5 Antenna extension
6 3" Tri-Clamp ISO 2852
R Reference point of measurement
L1 Antenna extension:
standard length 100 mm (3.94 in), 200 mm (7.87 in), 300 mm (11.8 in), 400 mm (15.7 in)

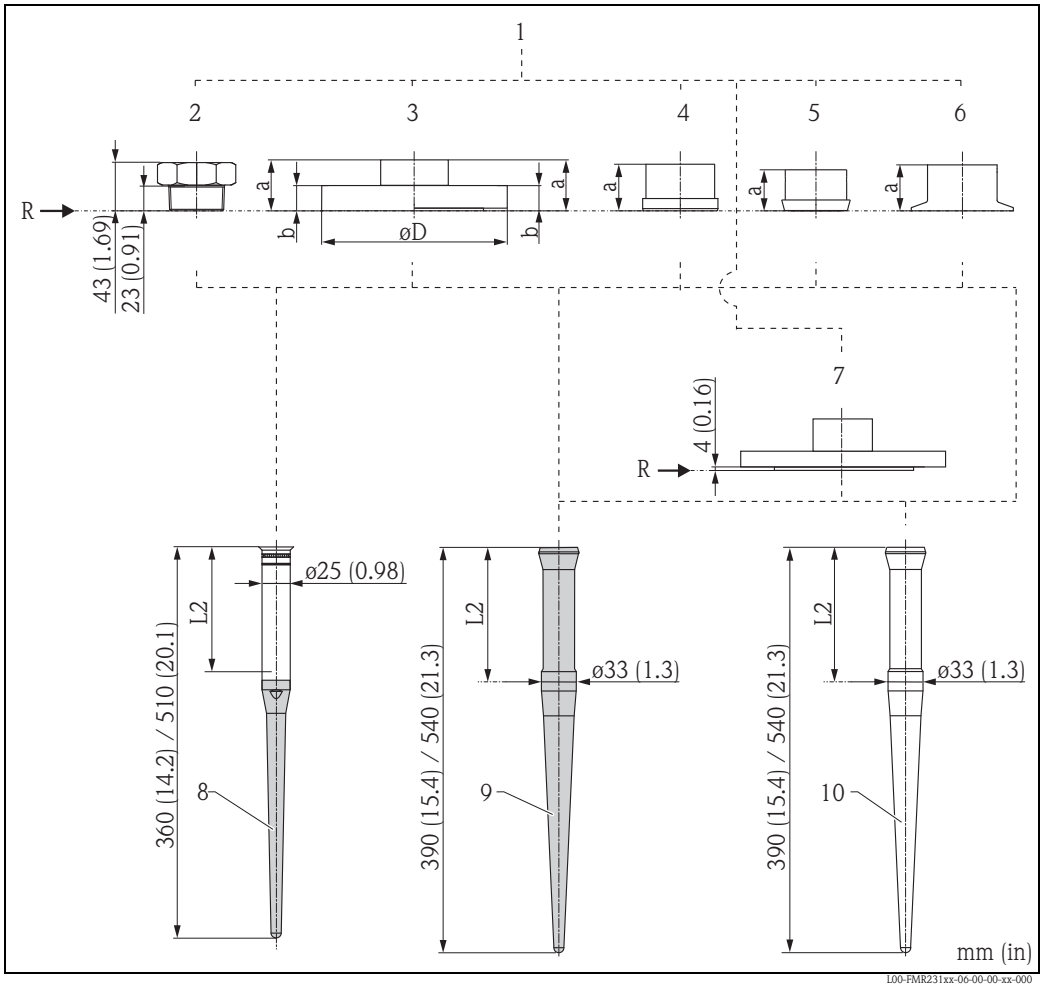
Horn antenna; mm (in)						
Antenna size		**80 (3")**	**100 (4")**	**150 (6")**	**200 (8")**	**250 (10")**
L	316L	68 (2.68)	105 (4.13)	185 (7.28)	268 (10.6)	360 (14.2)
	Alloy4C	74 (2.91)	119 (4.69)	204 (8.03)	289 (11.4)	379 (14.9)
d		75 (2.95)	95 (3.74)	145 (5.71)	190 (7.48)	240 (9.45)

Flange to ANSI B16.5; mm (in)						
Flange		**3"**	**4"**	**6"**	**8"**	**10"**
b	150 lbs	23,9 (0.94)	23,9 (0.94)	25,4 (1)	28,4 (1.12)	30,2 (1.19)
	300 lbs	28,4 (1.12)	31,8 (1.25)	-	-	-
D	150 lbs	190,5 (7.5)	228,6 (9)	279,4 (11)	342,9 (13.5)	406,4 (16)
	300 lbs	209,5 (8.25)	254 (10)	-	-	-

Flange to EN 1092-1 (agreeable to DIN 2527); mm (in)						
Flange		**DN 80**	**DN 100**	**DN 150**	**DN 200**	**DN 250**
b	PN16	20 (0.79)	20 (0.79)	22 (0.87)	24 (0.94)	26 (1.02)
	PN40	24 (0.94)	24 (0.94)	-	-	-
D	PN16	200 (7.87)	220 (8.66)	285 (11.2)	340 (13.4)	405 (15.9)
	PN40	200 (7.87)	235 (9.25)	-	-	-

Flange to JIS B2220; mm (in)					
Flansch	**DN 80**	**DN 100**	**DN 150**	**DN 200**	**DN 250**
b	18 (0.79)	18 (0.79)	22 (0.87)	22 (0.87)	24 (0.94)
D	185 (7.28)	210 (8.27)	280 (11)	330 (13)	400 (15.7)

Micropilot M FMR231 - Process connection and antenna



1 F12/T12/F23 housing
2 Threaded connection 1½"BSPT (R1½") or 1½ NPT
3 Flange DN 50 to 150 or equivalent
4 DN 50 aseptic DIN 11864-1 form A with O-ring for tubes according to DIN 11850
5 DN 50 dairy coupling DIN 11851
6 2"/3" Tri-Clamp ISO 2852
7 Flange cladded version
8 PPS, antistatic
9 PTFE, antistatic
10 PTFE, conform to FDA21 CFR177.1550 and USP<88> Class VI (in conjunction with DN 50 aseptic/diary coupling respectively Tri-Clamp)
R Reference point of measurement
L2 Inactive length, equivalent to max. nozzle height 100 mm (3.94 in), 250 mm (9.84 in)

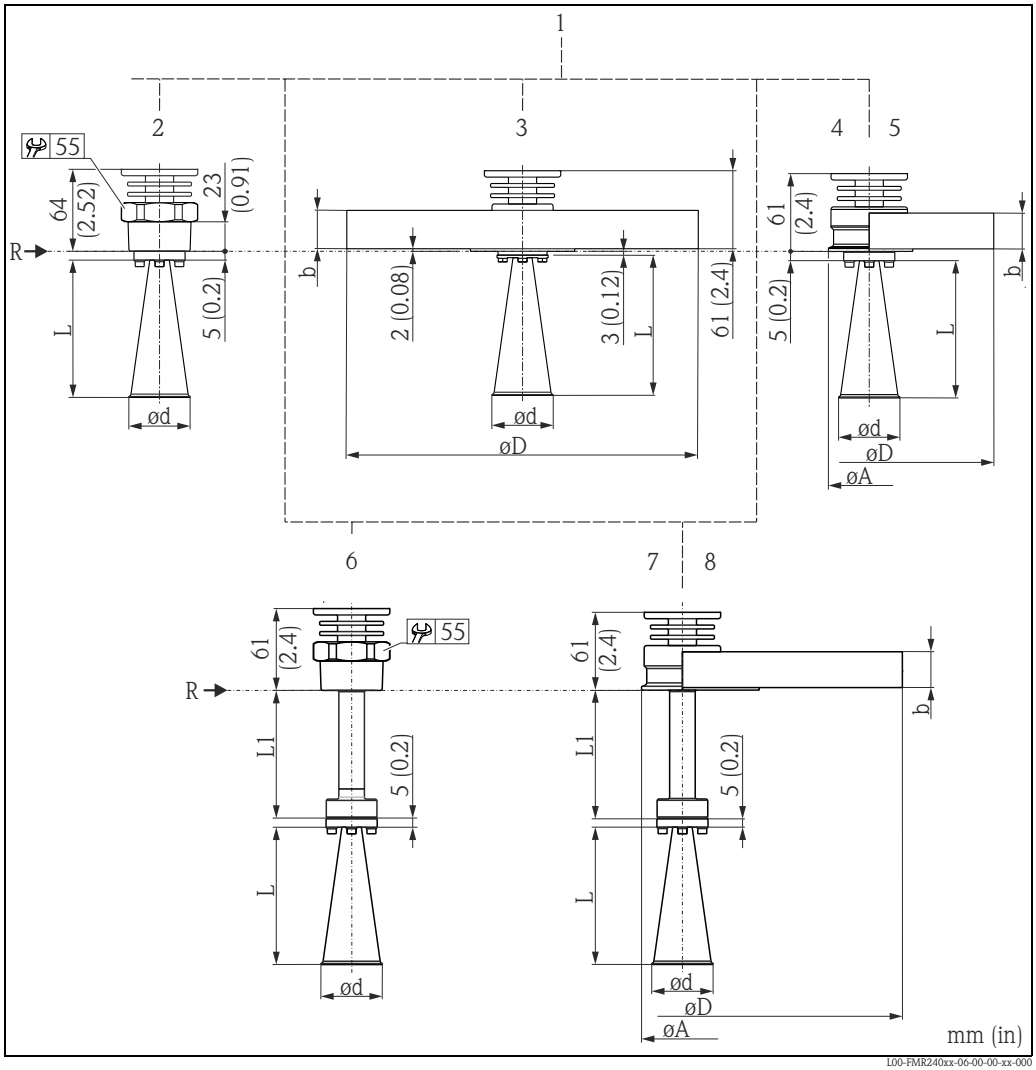
Flange to EN 1092-1 (agreeable to DIN 2527); mm (in)					
Flange		**DN 50**	**DN8 0**	**DN 100**	**DN 150**
b	PN16	20 (0.79)	20 (0.79)	20 (0.79)	22 (0.87)
	PN40	-	24 (0.94)	-	-
D	PN16	165 (6.5)	200 (7.87)	220 (8.66)	285 (11.2)
	PN40	-	200 (7.87)	-	-

Flange to ANSI B16.5; mm (in)					
Flange		**2"**	**3"**	**4"**	**6"**
b	150 lbs	19,1 (0.75)	23,9 (0.94)	23,9 (0.94)	25,4 (1)
	300 lbs	-	28,4 (1.12)	31,8 (1.25)	-
D	150 lbs	152,4 (6)	190,5 (7.5)	228,6 (9)	279,4 (11)
	300 lbs	-	209,5 (8.25)	254 (10)	-

Flange to JIS B2220 (für 10K); mm (in)				
Flange	**DN 50**	**DN 80**	**DN 100**	**DN 150**
b	16 (0.63)	18 (0.71)	18 (0.71)	22 (0.87)
D	155 (6.1)	185 (7.28)	210 (8.27)	280 (11)

Process connection; mm (in)					
Process connection		**Flange DN 50 to 150**	**DN 50 aseptic coupling**	**DN 50 diary coupling**	**2"/3" Tri-Clamp**
a	without gastight feedthrough	41 (1.61)	44,5 (1.75)	41 (1.61)	41 (1.61)
	with gastight feedthrough	77 (3.03)	80,5 (3.17)	77 (3.03)	77 (3.03)

Micropilot M FMR240 – Process connection and antenna



1 F12/T12/F23 housing
2 Screw-in adapter, compact R1½" or 1½ NPT
3 Flange plated DN 50 to 150 or equivalent
4 2"/3" Tri-Clamp ISO 2852
5 Flange DN 50 to 150 or equivalent
6 Screw-in adapter, compact R1½" or 1½ NPT
7 2"/3" Tri-Clamp ISO 2852
8 Flange DN 50 to 150 or equivalent
R Reference point of measurement
L1 With tube extension 100 mm (3.94 in)

Horn antenna; mm (in)				
Antenna size	**40 (1")**	**50 (2")**	**80 (3")**	**100 (4")**
L	86 (3.39)	115 (4.53)	211 (8.31)	282 (11.1)
d	40 (1.57)	48 (1.89)	75 (2.95)	95 (3.74)

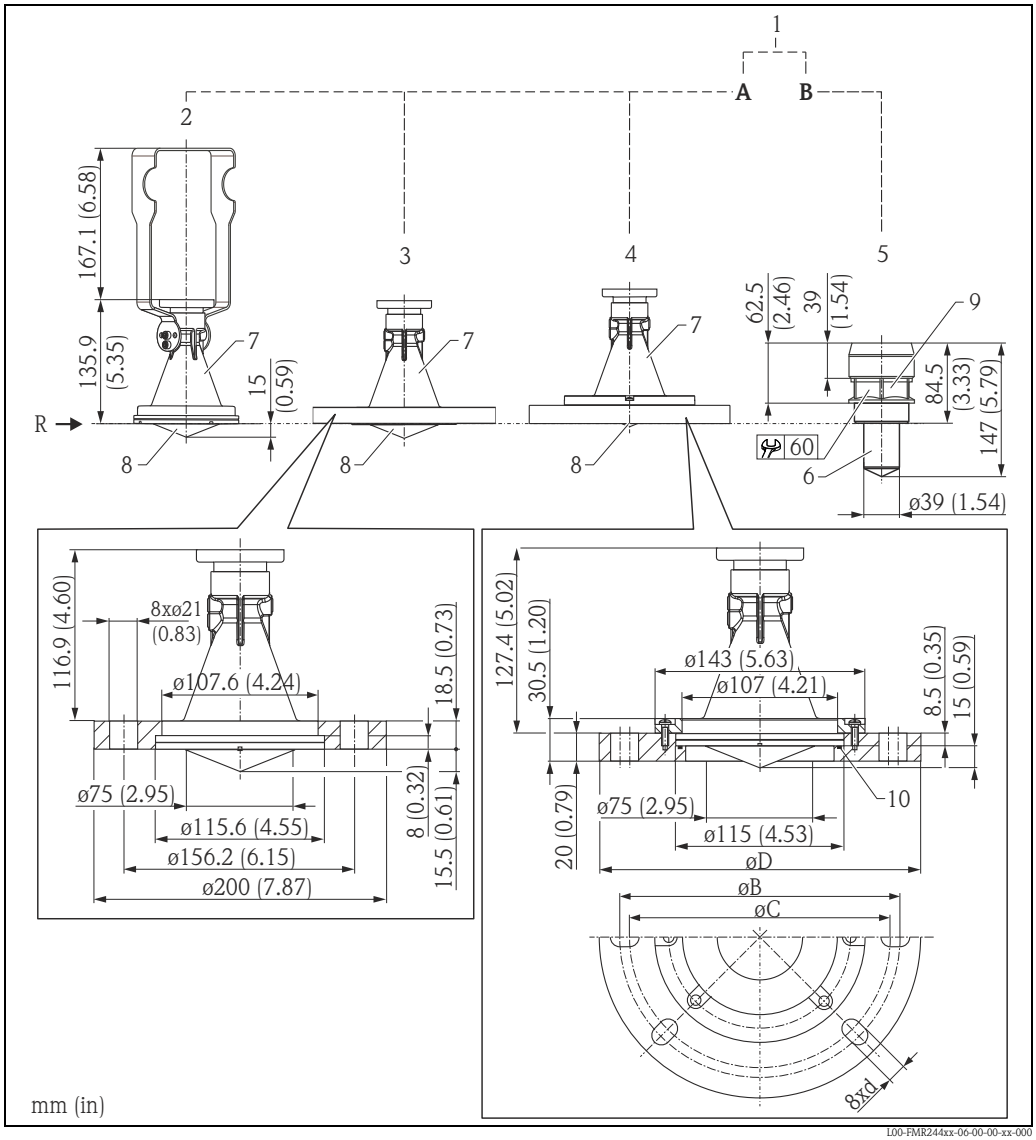
Flange to JIS B2220 (für 10K); mm (in)				
Flange	**DN 50**	**DN 80**	**DN 100**	**DN 150**
b	16 (0.63)	18 (0.71)	18 (0.71)	22 (0.87)
D	155 (6.1)	185 (7.28)	210 (8.27)	280 (11)

Flange to EN 1092-1 (passend zu DIN 2527); mm (in)					
Flange		**DN 50**	**DN 80**	**DN 100**	**DN 150**
b	PN16	18 (0.71)	20 (0.79)	20 (0.79)	22 (0.87)
	PN40	20 (0.79)	24 (0.94)	24 (0.94)	-
D	PN16	165 (6.5)	200 (7.87)	220 (8.66)	285 (11.2)
	PN40	165 (6.5)	200 (7.87)	235 (9.25)	-

Flange to ANSI B16.5; mm (in)					
Flange		**2"**	**3"**	**4"**	**6"**
b	150 lbs	19,1 (0.75)	23,9 (0.94)	23,9 (0.94)	25,4 (1)
	300 lbs	22,4 (0.88)	28,4 (1.12)	31,8 (1.25)	-
D	150 lbs	152,4 (6)	190,5 (7.5)	228,6 (9)	279,4 (11)
	300 lbs	165,1 (6.5)	209,5 (8.25)	254 (10)	-

Tri-Clamp to ISO 2852; mm (in)		
Clamp	**2"**	**3"**
A	64 (2.52)	91 (3.58)

Micropilot M FMR244 - Process connection and antenna

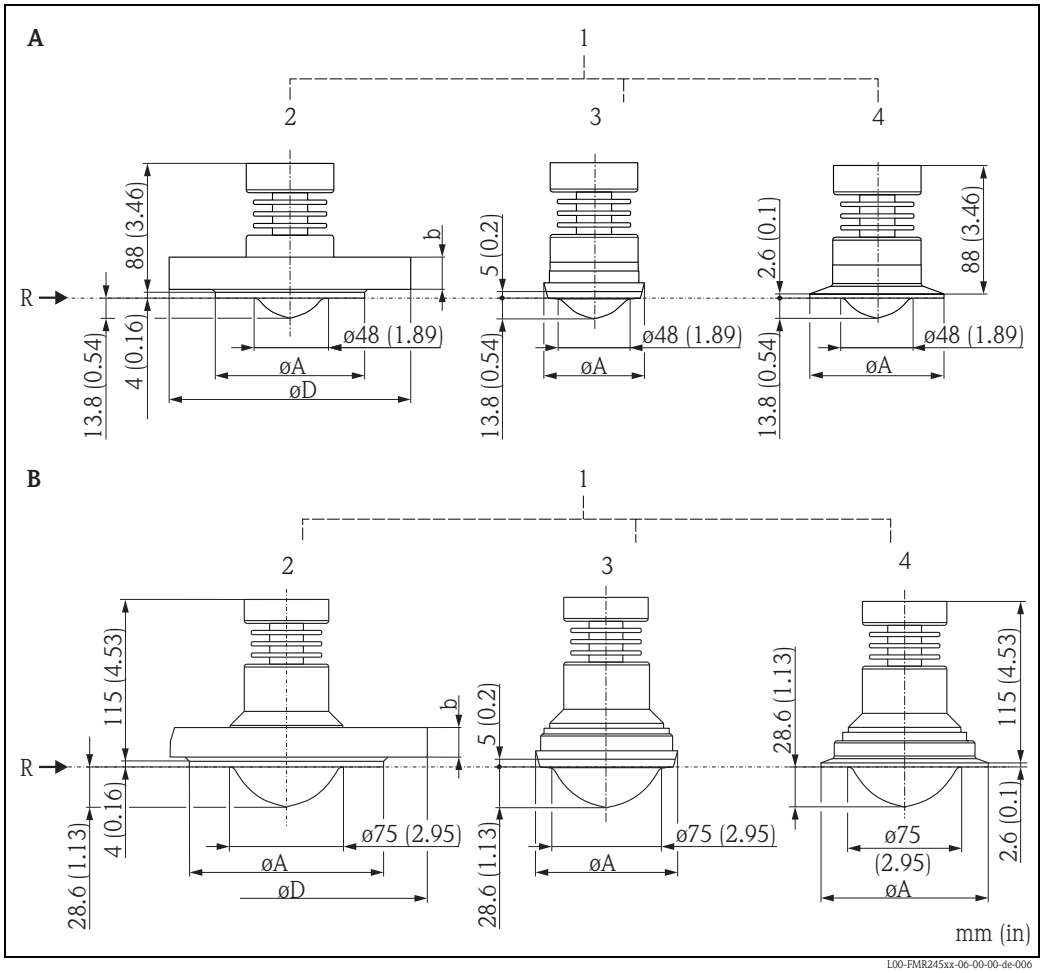


A *Feature 20, version 4*
B *Feature 20, version 2*
1 F12/T12 housing
2 Standard, mounting bracket optional[2)]
3 Endress+Hauser UNI flange DN80[3)]; suitable for DN80 PN16 / ASME 3" 150 lbs / 10K 80
4 Endress+Hauser flange DN100/DN150 suitable for DN 100 PN16 / ASME 4" 150 lbs / 10K 100 and for DN 150 PN16 / ASME 6" 150lbs / 10K 150[3)]
5 Screw-in adapter G1½", 1½ NPT
6 PTFE, conform to FDA21 CFR 177.1550 and USP <88> Class VI
7 PBT
8 PP
9 PVDF
10 Seal Viton
R Reference point of measurement

Flange	øD	øB	øC	d
DN100	228,6 mm (9 in)	190,5 mm (7.5 in)	175 mm (6.89 in)	19 mm (0.75 in)
DN150	285 mm (11.2 in)	241,3 mm (9.5 in)	240 mm (9.45 in)	23 mm (0.91 in)

2) Housing T12: mounting limited only.
3) Installation hints: The bolt-holes have been enlarged for adaption of dimensions, therefore, the flange needs to be poperly aligned to the counterflange before the bolts are tightened.

Micropilot M FMR245 - Process connection and antenna



A *Feature 20, version B, F*
1 *F12/T12/F23 housing*
2 *Flange DN 50 or equivalent*
3 *DN 50 diary coupling DIN 11851*
4 *2"/3" Tri-Clamp ISO 2852*
R *Reference point of measurement*

B *Feature 20, version C, G*
1 *F12/T12/F23 housing*
2 *Flange DN 80 or equivalent*
3 *DN 80 diary coupling DIN 11851*
4 *4" Tri-Clamp ISO 2852*

Note!
Plating from PTFE (conform to FDA21 CFR 177.1550 and USP <88> Class VI):
3A / EHEDG approval with Tri-Clamp process connection.

Flange to EN 1092-1 (agreeable to DIN 2527); mm (in)					
Flange		**DN 50**	**DN 80**	**DN 100**	**DN 150**
b	PN16	20 (0.79)	20 (0.79)	20 (0.79)	22 (0.87)
D	PN16	165 (6.5)	200 (7.87)	220 (8.66)	285 (11.2)
A	PN16	102 (4.02)	138 (5.43)	158 (6.22)	212 (8.35)

Flange to ANSI B16.5; mm (in)					
Flange		**2"**	**3"**	**4"**	**6"**
b	150 lbs	19,1 (0.75)	23,9 (0.94)	23,9 (0.94)	25,4 (1)
D	150 lbs	152,4 (6)	190,5 (7.5)	228,6 (9)	279,4 (11)
A	150 lbs	92 (3.62)	127 (5)	158 (6.22)	212 (8.35)

Flange to JIS B2220 (für 10K); mm (in)				
Flange	**DN 50**	**DN 80**	**DN 100**	**DN 150**
b	16 (0.63)	18 (0.71)	18 (0.71)	22 (0.87)
D	155 (6.1)	185 (7.28)	210 (8.27)	280 (11)
A	96 (3.78)	127 (5)	151 (5.94)	212 (8.35)

Tri-Clamp; mm (in)			
Tri-Clamp	**2"**	**3"**	**4"**
A	64 (2.52)	91 (3.58)	119 (4.69)

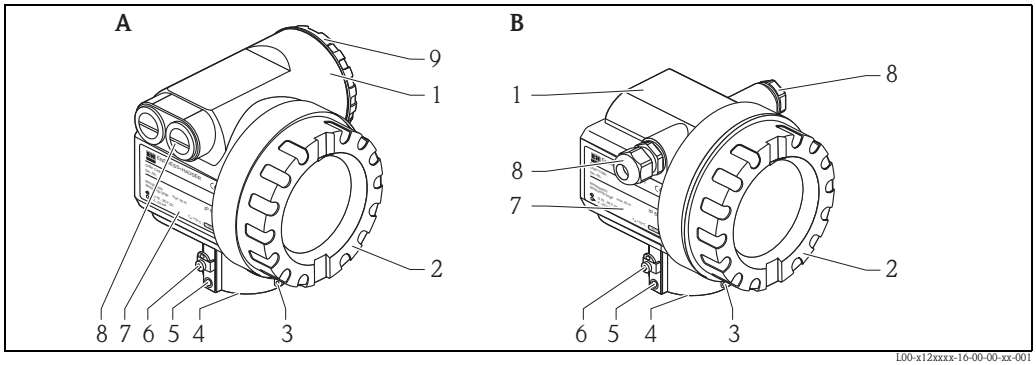
Diary coupling; mm (in)		
Diary coupling	**DN 50**	**DN 80**
A	68,5 (2.7)	100 (3.94)

Weight

Micropilot M	FMR230	FMR231	FMR240	FMR244	FMR245
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
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)

T12 and F12 housing (seawater-resistant[1)], powder-coated)

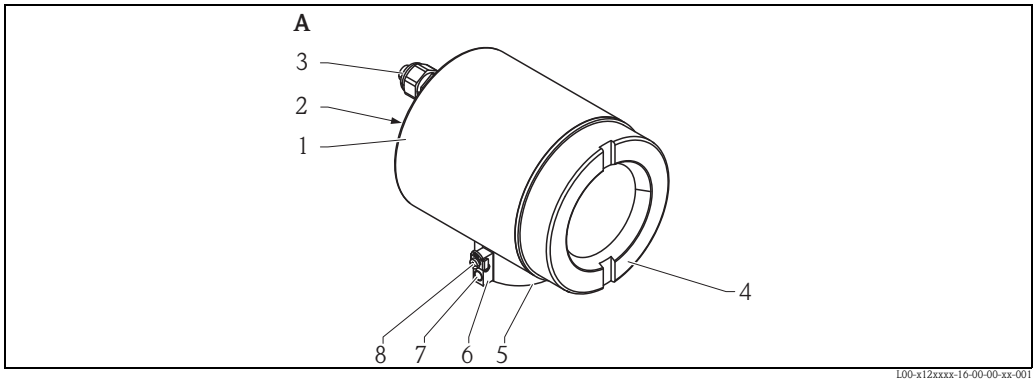


A T12 housing *B F12 housing*

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	Tag	304 (1.4301)	
	Rope	VA	
	Crimp sleeve	Aluminium	
4	Sealing ring	Fa. SHS: EPDM 70pW FKN	Trelleborg: EPDM E7502/E7515
5	Screws[1)]	A2-70	
6	Ground terminal[1)]	Screws: A2; Spring washer: A4; Clamp: 304 (1.4301) Holder: 301 (1.4310)	
7	Nameplate[1)]	304 (1.4301)	
	Groove pin[1)]	A2	
8	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
	Adapter	316L (1.4435)	AlMgSiPb (anodized)
9	Cover (Connection compartment)	AlSi10Mg	
	Sealing	Fa. SHS: EPDM 70pW FKN	Trelleborg: EPDM E7502/E7515
	Clamp	Screws: A4; Clamp: Ms nickel-plated; Spring washer: A4	

1) Seawater-resistant on request (complete in 316L (1.4404)).

F23 housing (seawater-resistant[1)], corrosion-resistant)



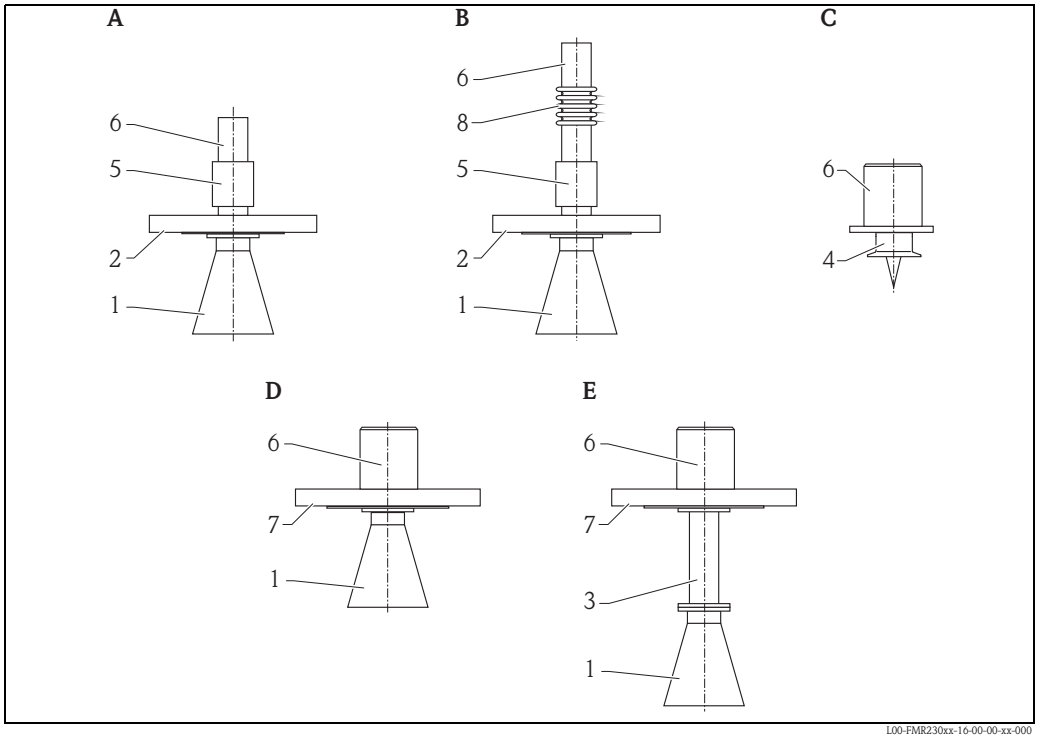
A T23 housing

Pos.	Part	Material	
1	F23 housing	Housing body: 316L (1.4404); Sensor neck: 316 L(1.4435); earth connection block: 316L (1.4435)	
2	Nameplate[1)]	304 (1.4301)	
	Groove pin[1)]	A2	
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	Cover	316L (1.4404)	
	Sealing	Fa. SHS: EPDM 70pW FKN	
	Window	ESG-K-Glass (Toughened safety glass)	
	Sealing of the glass	Silicone sealing compound Gomastit 402	
5	Sealing ring	Fa. SHS: EPDM 70pW FKN	Trelleborg: EPDM E7502
6	Tag	304 (1.4301)	
	Rope	316 (1.4401)	
	Crimp sleeve	Aluminium	
7	Screw[1)]	A2-70	
8	Grounding terminal[1)]	Screws: A2; Spring washer: A4; Clamp: 304 (1.4301); Holder: 301 (1.4310)	

1) Seawater-resistant on request (complete in 316L (1.4404)).

Material (in contact with process)

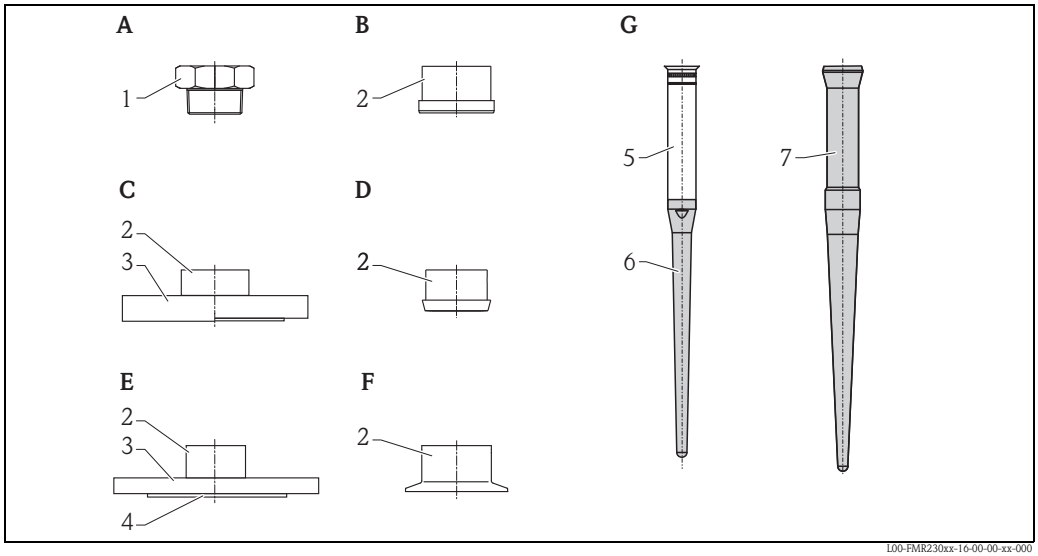
FMR230



A Extended temperature version
B High temperature version
C 3" Tri-Clamp ISO 2852
D Standard antenna
E Antenna extension

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	Process separation	316L (1.4404)	
6	Housing adapter	304 (1.4301)	
7	Flange	316L (1.4404) optional Hastelloy plated	
	Coupling	316L (1.4435)	Hastelloy
8	Temperature reduction	304 (1.4301)	

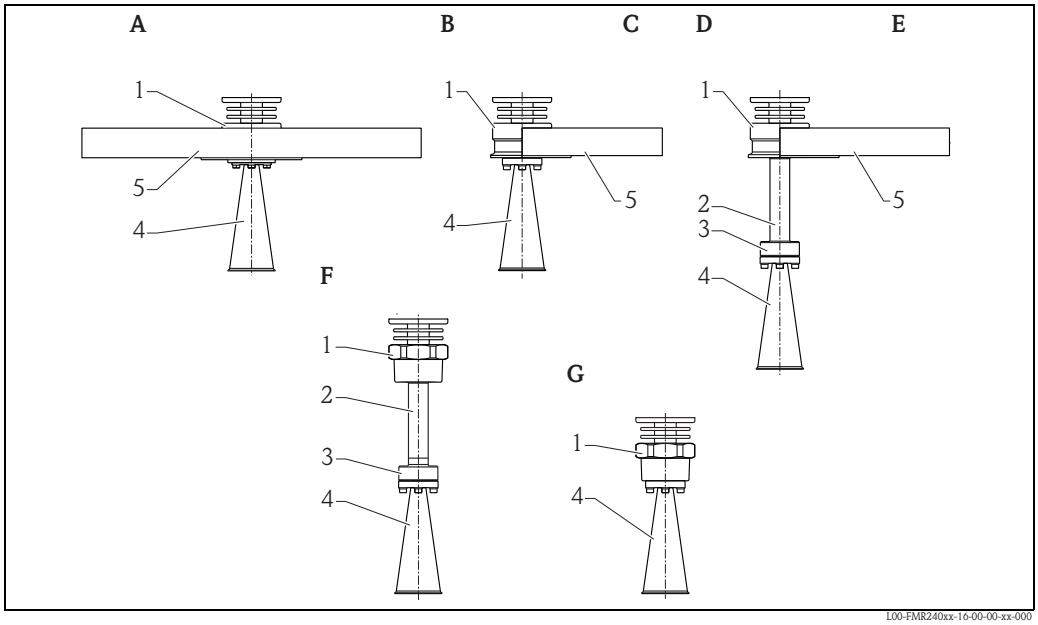
FMR231



A Threaded connection 1½" BSPT (R1½") or 1½"NPT
B DN 50 aseptic; DIN 11864-1 form A with o-ring for tubes according to DIN 11850
C Flange DN 50 to DN 150
D DN 50 diary coupling; DIN 11851
E Flange, cladded version
F 2"/3" Tri-Clamp; ISO 2852
G Antennas

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, conform to FDA 21 CFR 177.1550 and USP <88> Class VI (in conjunction with flange, DN 50 aseptic/dairy coupling respectively Tri-clamp)

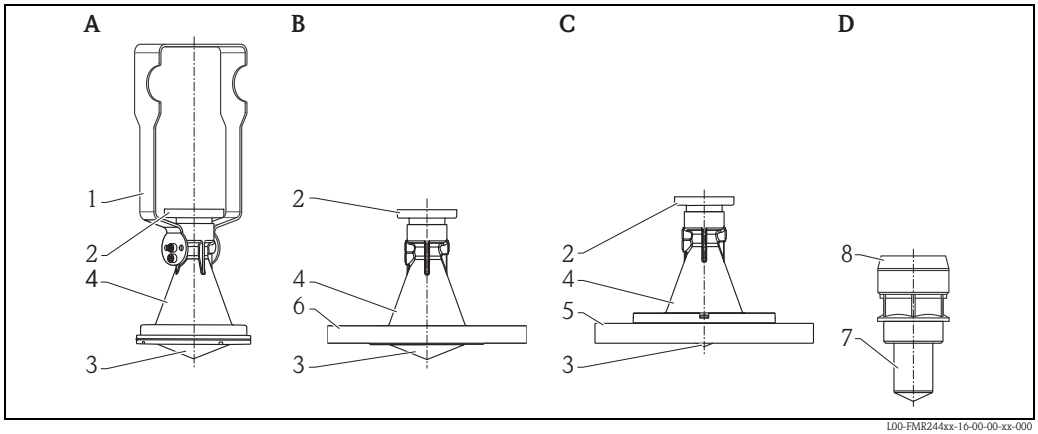
FMR240



A Flange plated, DN 50 to DN 150 or equivalent
B 2"/3" Tri-Clamp; ISO 2852
C Flange DN 50 to DN 150 or equivalent
D 2"/3" Tri-Clamp; ISO 2852
E Flange DN 50 to DN 150 or equivalent
F Screw-in adapter R1½" oder 1½"NPT
G Screw-in adapter, compact R1½" oder 1½"NPT

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	

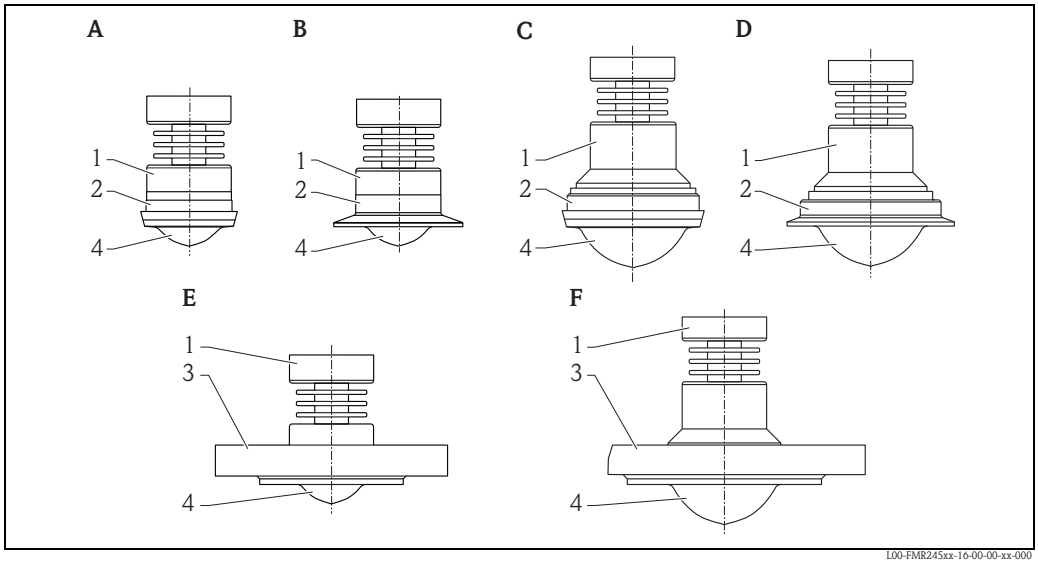
FMR244



A Standard
B Endress+Hauser UNI flange DN 80
C Endress+Hauser UNI flange DN 100/DN 150
D Screw-in adapter G1½", NPT1½"

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 (conform to FDA 21 CFR 177.1550 and USP <88> Class VI)
	Sealing	Viton
8	Adapter	PVDF

FMR245



A DN 50 dairy coupling; DIN 11851
B 2"/3" Tri-Clamp; ISO 2852
C DN 80 dairy coupling; DIN 11851
D 4" Tri-Clamp; ISO 2852
E Flange DN 50 or equivalent
F Flange DN 80 to DN 150 or equivalent

Pos.	Part	Material
1	Adapter	304 (1.4301)
2	Process connection	316L (1.4435)
3	Flange	316L (1.4404 / 1.4435)
4	Plating	PTFE (conform to FDA 21 CFR 177.1550 and USP <88> Class VI)

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 EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.

Process connection

See "Ordering information", → 67.

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

Seal

See "Ordering information", → 67.

Antenna

See "Ordering information", → 67.

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

Human interface

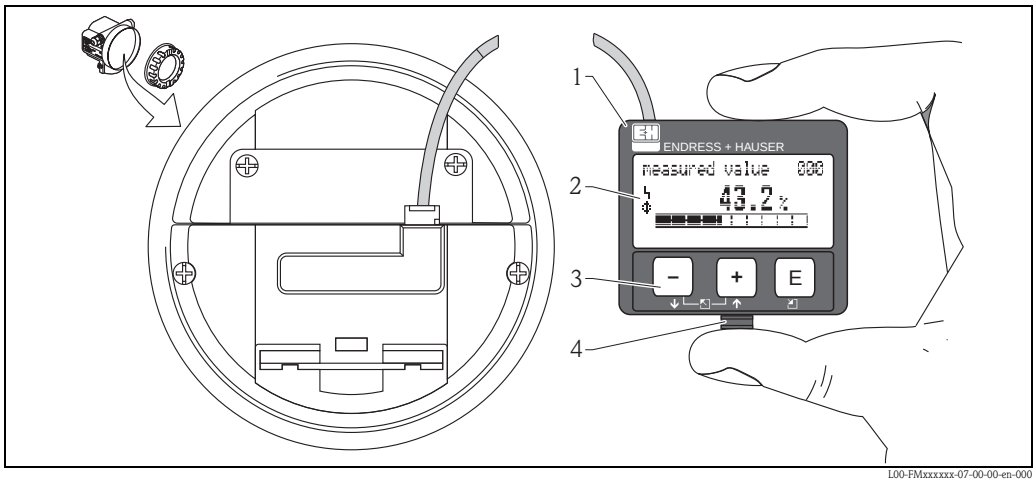
Operation concept

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.



L00-FMxxxxxx-07-00-00-en-000

1 LCD (liquid crystal display)
2 Symbols
3 3 keys
4 snap-fit

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

Operating elements

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

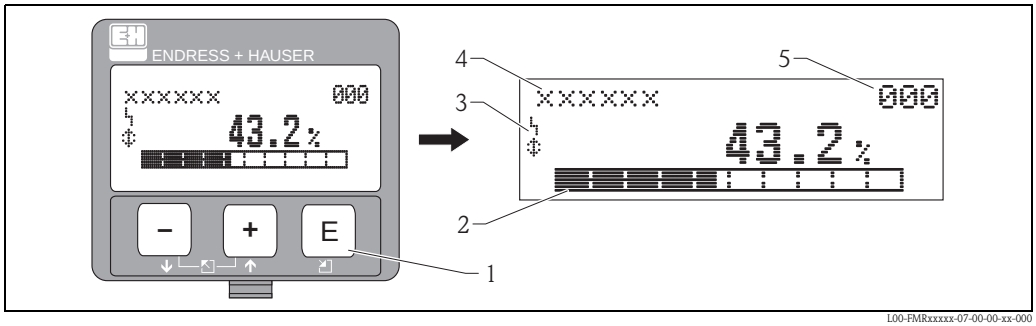
Function of the keys

Key(s)	Meaning
[+] or [↑]	Navigate upwards in the selection list. Edit numeric value within a function.
[−] or [↓]	Navigate downwards in the selection list. Edit numeric value within a function.
[Esc] or [←]	Navigate to the left within a function group.
[E]	Navigate to the right within a function group, confirmation.
[+] and [E] or [−] and [E]	Contrast settings of the LCD.
[+] and [−] and [E]	Hardware lock / unlock After a hardware lock, an operation of the device 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 device. 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.



1 Operating keys
2 Bargraph
3 Symbols
4 Function name
5 Parameter Identification number

Remote operation

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

Field Xpert SFX100

Field Xpert is an industrial PDA with integrated 3.5" touchscreen from Endress+Hauser based on WindowsMobile. It offers wireless communication via the optional VIATOR Bluetooth modem as a point-to-pointconnection to a HART device, or via WiFi and Endress+Hauser's Fieldgate FXA520 to offer communication toone or more HART devices. Field Xpert also works as a stand-alone device for asset management applications.For details, refer to BA00060S/04/EN.

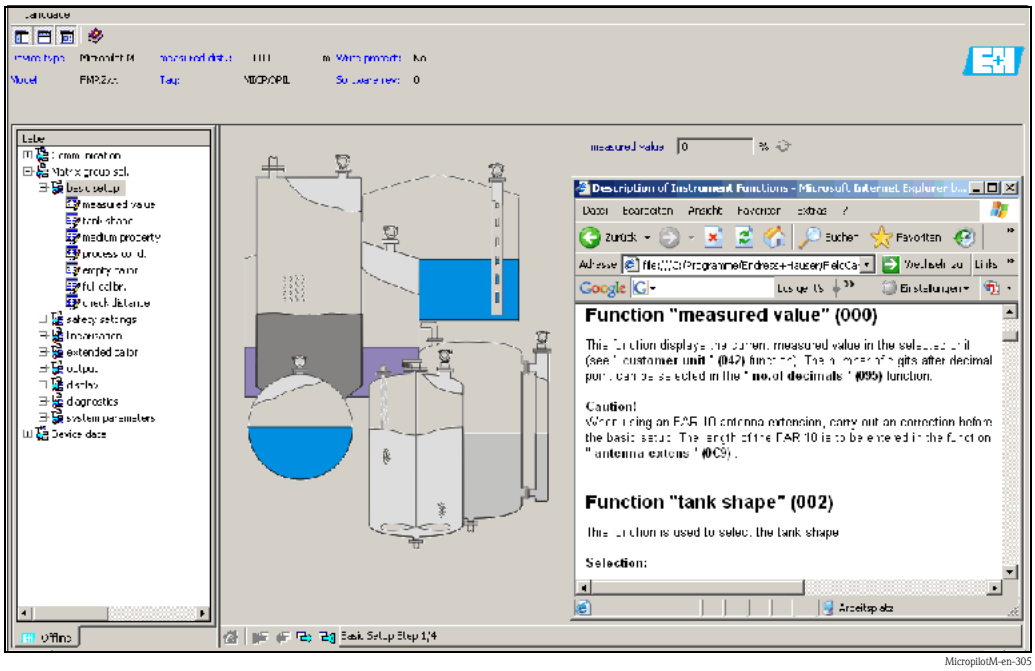
FieldCare

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

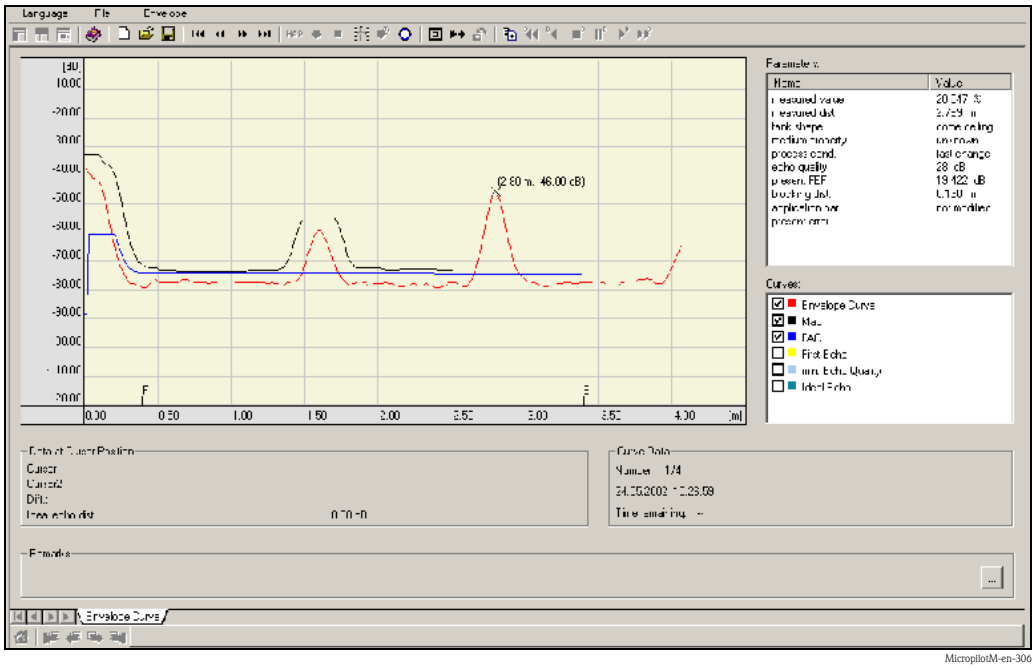
Connection options:
- HART via Commubox FXA195 and the USB port on a computer
- PROFIBUS PA via segment coupler and PROFIBUS interface card
- Commubox FXA291 with ToF Adapter FXA291 (USB) via service interface

Menu-guided commissioning



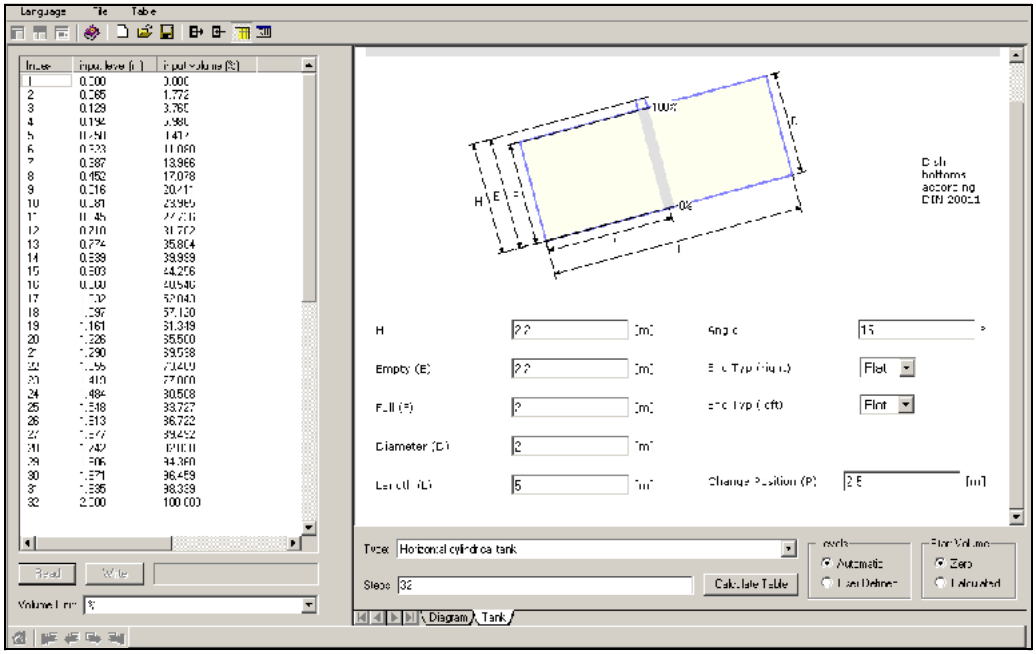
MicropilotM-en-305

Signal analysis via envelope curve



MicropilotM-en-306

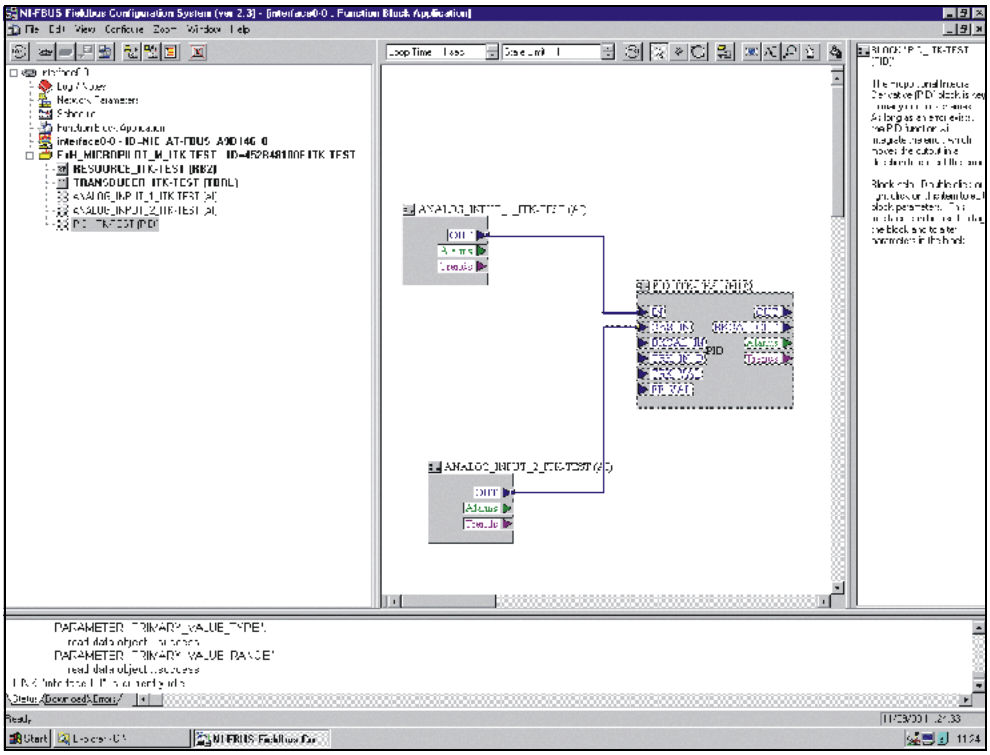
Tank linearisation



Operation with NI-FBUS configurator (only FOUNDATION Fieldbus)

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

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



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

Certificates and approvals

CE approval

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

Ex approval

See "Ordering information", → 67.

Sanitary compatibility

FMR231 with antenna made of PTFE (conform to FDA 21 CFR 177.1550 and USP <88> Class VI).

FMR245 with flange cladding made of PTFE (conform to FDA 21 CFR 177.1550 and USP <88> Class VI)
– 3A/EHEDG approval with Tri-clamp process connection.

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", → 67. (see ZE00244F/00/DE).
SIL 2, for 4 to 20 mA output signal (see SD00327F/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

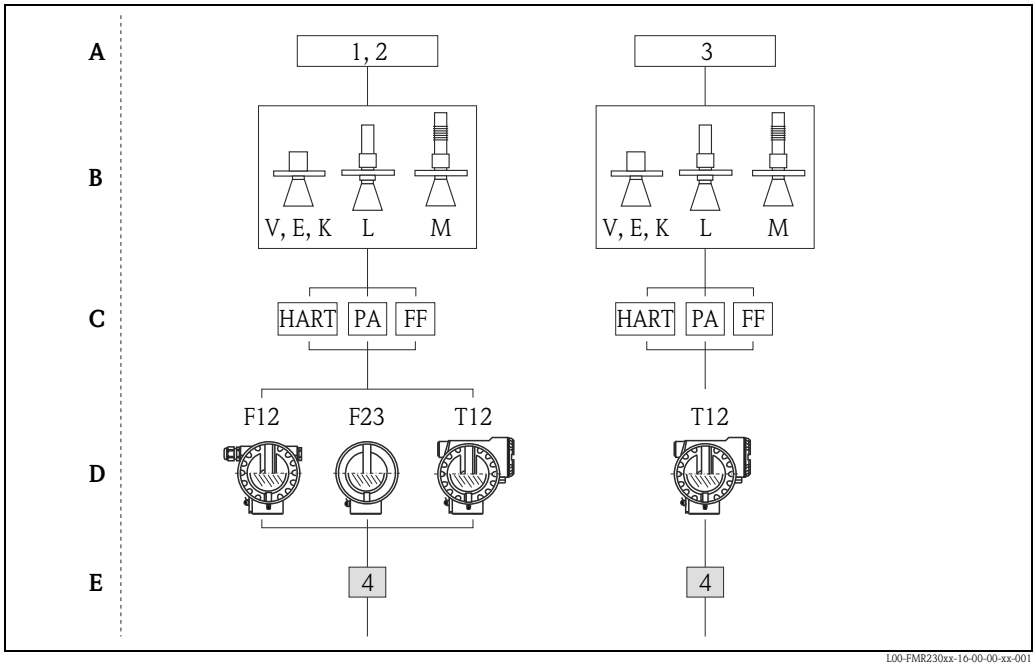
R&TTE, FCC

Pressure measuring device guideline

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

Ordering information

Micropilot M FMR230 **Device selection**



A *Certificate*
B *Type of antenne / Seal*
C *Communication*
D *Housing*
E *Gas-tight feed through*

1 *Non-hazardous area*
2 *Ex ia IS*
3 *Ex em / d XP*
4 *Gas-tight - standard* [4)]

4) The gas-tight feed through 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, TSP-no. to be spec.

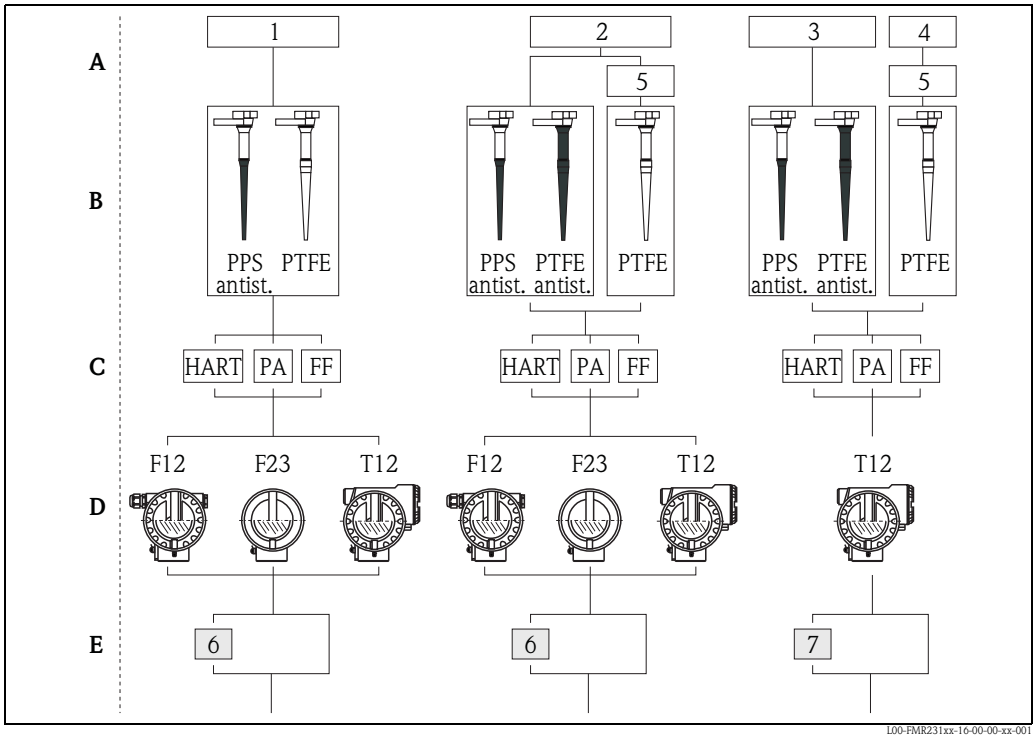
20	Antenna
1	w/o horn, for pipe installation
2	80mm/3"
3	100mm/4"
4	150mm/6"
5	200mm/8"
6	250mm/10"
Y	Special version, TSP-no. to be spec.

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
Y	Special version, TSP-no. to be spec.

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)
	CXJ	DN200 PN16 B1, 316L flange EN1092-1 (DIN2527 C)
	C6J	DN250 PN16 B1, 316L flange EN1092-1 (DIN2527 C)
	C65	DN200 PN16, AlloyC4 > 316Ti flange EN1092-1 (DIN2527)
	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
	A3J	8" 150lbs RF, 316/316L flange ANSI B16.5
	A35	8" 150lbs, AlloyC4 > 316Ti flange ANSI B16.5
	A5J	10" 150lbs RF, 316/316L flange ANSI B16.5
	A55	10" 150lbs, AlloyC4 > 316Ti flange ANSI B16.5
	KA2	10K 80A RF, 316Ti flange JIS B2220
	KH2	10K 100A RF, 316Ti flange JIS B2220
	KV2	10K 150A RF, 316Ti flange JIS B2220
	KD2	10K 200A RF, 316Ti flange JIS B2220
	K52	10K 250A RF, 316Ti flange JIS B2220

40				**Process Connection**							
				TL2	Tri-Clamp ISO2852 DN70-76.1 (3"), 316Ti						
				UV6	6" 150lbs FF, AlloyC4, purge flange ANSI B16.5 NUS						
				YY9	Special version, TSP-no. to be spec.						
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					
					E	FOUNDATION Fieldbus; 4-line display, envelope curve display on site					
					F	FOUNDATION Fieldbus; w/o display, via communication					
					Y	Special version, TSP-no. to be spec.					
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, TSP-no. to be spec.				
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, TSP-no. to be spec.			
80								**Additional Option**			
								A	Basic version		
								B	EN10204-3.1 material, watted 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, TSP-no. to be spec.		
995									**Marking**		
									1	Tagging (TAG), see additional spec.	
									2	Bus adress, see additional spec.	
FMR230-											Complete product designation

Micropilot M FMR231 **Device selection**



A *Certificate*
B *Type of antenna / seal*
C *Communication*
D *Housing*
E *Gas-tight feed through*

1 *Non-hazardous area*
2 *Ex ia IS*
3 *Ex em / d XP*
4 *Ex d XP*
5 *Note electrostatic charging!*
6 *Gas-tight - standard* [5)]
7 *Gas-tight - standard - Essential to Ex em!* [5)]

5) The gas-tight feed through 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 insutalted antenna: Note safety instruction (XA) (electrostatic charging)!
	H		ATEX II 1/2G EEx ia IIC T6, ATEX II 3D, XA, fully insutalted antenna: Note safety instruction (XA) (electrostatic charging)!
	S		FM IS - Cl.I Div.1 Gr. A-D, 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, TSP-no. to be spec.

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, TSP-no. to be spec.

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)
		BQJ		DN100 PN10/16 A, 316L flange EN1092-1 (DIN2527 B)
		CQJ		DN100 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
		CQK		DN100 PN10/16, PTFE > 316L flange EN1092-1 (DIN2527)
		BWJ		DN150 PN10/16 A, 316L flange EN1092-1 (DIN2527 B)
		CWJ		DN150 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
		CWK		DN150 PN10/16, PTFE (black) > 316L flange EN1092-1 (DIN2527) PTFE (black) = conductive cladding
		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, TSP-no. to be spec.

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
E	FOUNDATION Fieldbus; 4-line display, envelope curve display on site
F	FOUNDATION Fieldbus; w/o display, via communication
Y	Special version, TSP-no. to be spec.

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, TSP-no. to be spec.

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.

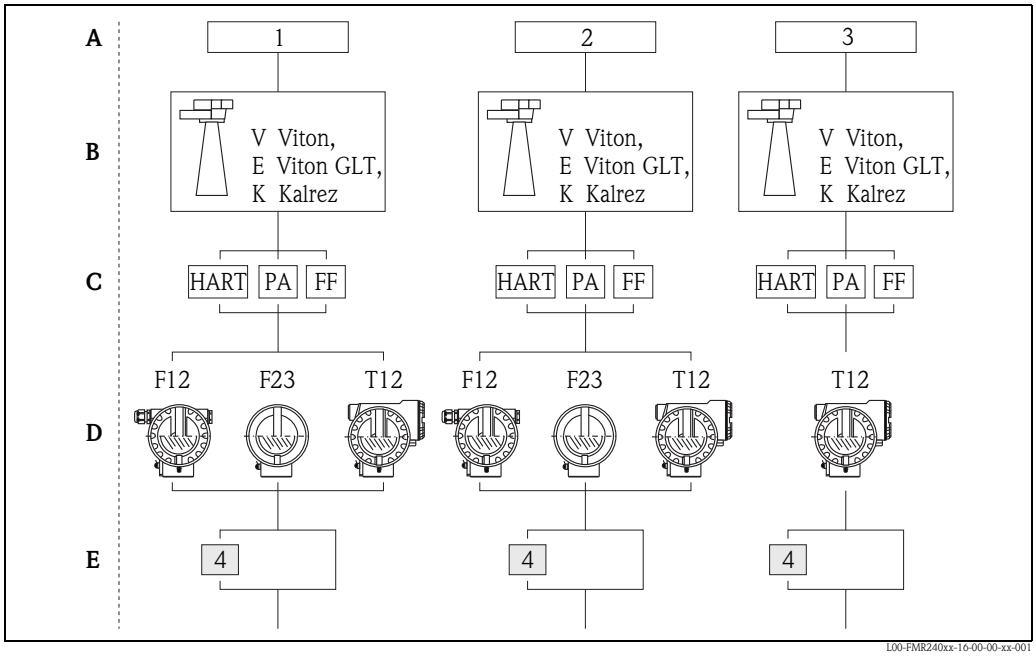
70	Gas-Tight Feed Through
A	Not selected
C	Selected, TSP-no. to be spec.

80	Additional Option
A	Basic version
B	EN10204-3.1 material, watted parts, (316L wetted parts) inspection certificate
C	EN10204-3.1 material, pressurized, (316/316L pressurized) inspection certificate
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, TSP-no. to be spec.

995	Marking
1	Tagging (TAG), see additional spec.
2	Bus adress, see additional spec.

FMR231-	Complete product designation

Micropilot M FMR240 **Device selection**



A Certificate
B Type of antenne / Seal
C Communication
D Housing
E Gas-tight feed through

1 Non-hazardous area
2 Ex ia IS
3 Ex em / d XP
4 Gas-tight - standard [6)]

6) The gas-tight feed through 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, TSP-no. to be spec.

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, TSP-no. to be spec.

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, TSP-no. to be spec.

40	Antenna Extension
1	Not selected
2	100 mm/4"
9	Special version, TSP-no. to be spec.

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

50	Process Connection
AMJ	3" 300lbs RF, 316/316L flange ANSI B16.5
ALM	3" 150lbs, AlloyC22 > 316/316L flange ANSI B16.5
AMM	3" 300lbs, AlloyC22 > 316/316L flange ANSI B16.5
APJ	4" 150lbs RF, 316/316L flange ANSI B16.5
AQJ	4" 300lbs RF, 316/316L flange ANSI B16.5
APM	4" 150lbs, AlloyC22 > 316/316L flange ANSI B16.5
AQM	4" 300lbs, AlloyC22 > 316/316L flange ANSI B16.5
AWJ	6" 150lbs RF, 316/316L flange ANSI B16.5
AWM	6" 150lbs, AlloyC22 > 316/316L flange ANSI B16.5
KEJ	10K 50A RF, 316L flange JIS B2220
KEM	10K 50A, AlloyC22 > 316L flange JIS B2220
KLJ	10K 80A RF, 316L flange JIS B2220
KLM	10K 80A, AlloyC22 > 316L flange JIS B2220
KPJ	10K 100A RF, 316L flange JIS B2220
KPM	10K 100A, AlloyC22 > 316L flange JIS B2220
KWJ	10K 150A RF, 316L flange JIS B2220
KWM	10K 150A, AlloyC22 > 316L flange JIS B2220
YY9	Special version, TSP-No. to be spec.

60	Output; Operation
A	4-20mA SIL HART; 4-line display VU331, envelope curve display on site
B	4-20mA SIL HART; w/o display, via communication
K	4-20mA SIL HART; Prepared for FHX40, remote display (accessory)
C	PROFIBUS PA; 4-line display VU331, envelope curve display on site
D	PROFIBUS PA; w/o display, via communication
E	FOUNDATION Fieldbus; 4-line display, envelope curve display on site
F	FOUNDATION Fieldbus; w/o display, via communication
Y	Special version, TSP-no. to be spec.

70	Housing
A	F12 Alu, coated IP65 NEMA4X
B	F23 316L IP65 NEMA4X
C	T12 Alu, coated IP65 NEMA4X, separate conn. compartment
D	T12 Alu, coated IP65 NEMA4X+OVP, separate conn. compartment, OVP=overvoltage protection
Y	Special version, TSP-no. to be spec.

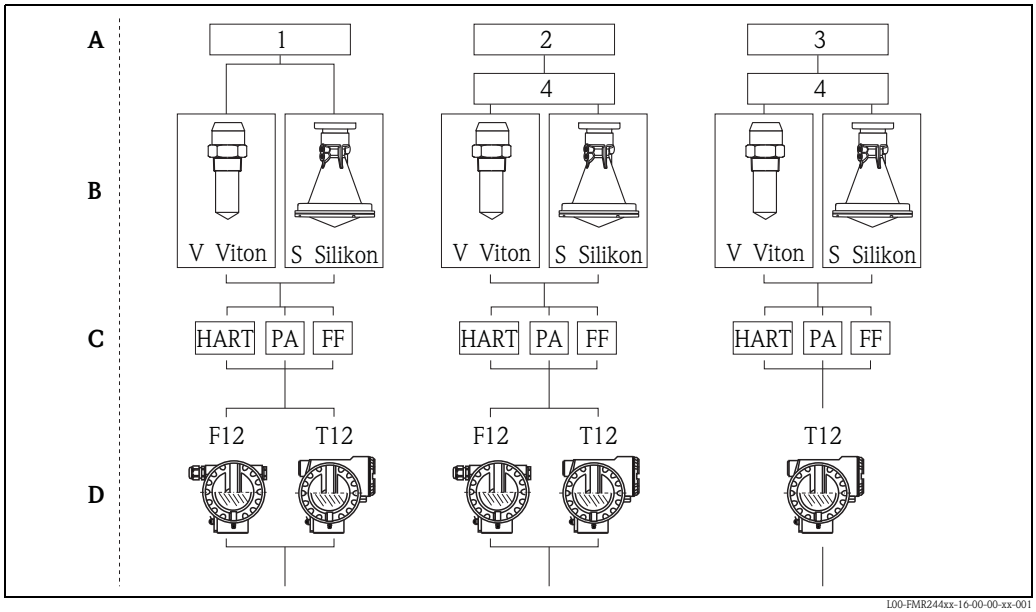
80	Cable Entry
2	Gland M20 (EEx d > thread M20)
3	Thread G1/2
4	Thread NPT1/2
5	Plug M12
6	Plug 7/8"
9	Special version, TSP-no. to be spec.

90	Additional Option
A	Basic version
B	EN10204-3.1 material, wetted parts, (316L wetted parts) inspection certificate
F	Advanced dynamics, max. MB=70m liquids, MB=measuring range
G	Advanced dynamics, 3.1, NACE, max. MB=70m liquids, MB=measuring range EN10204-3.1 material, NACE MR0175 (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
L	5-point, advanced dynamics, 3.1, NACE, 5-point linearity protocol, see additional spec., Advanced dynamics, max MB=70m liquids, MB=measuring range 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, TSP-no. to be spec.

995	Marking
1	Tagging (TAG), see additional spec.
2	Bus address, see additional spec.

FMR240-	Complete product designation

Micropilot M FMR244 **Device selection**



A *Certificate*
B *Type of antenne / Seal*
C *Communication*
D *Housing*

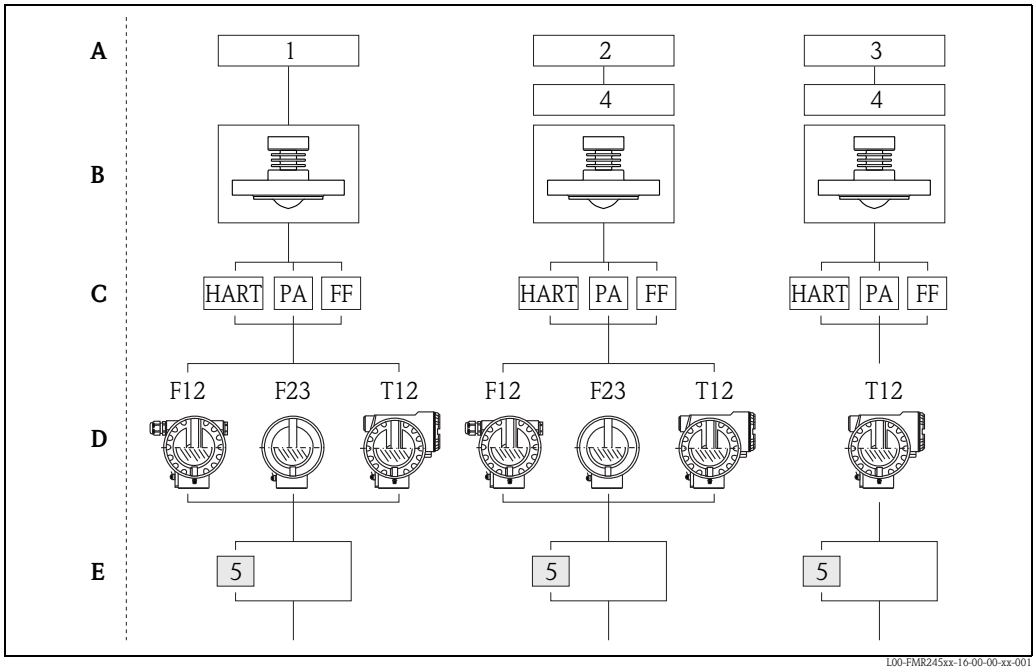
1 *Non-hazardous area*
2 *Ex ia IS*
3 *Ex em / d XP*
4 *Note electrostatic charging!*

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, TSP-no. to be spec.						
20		**Antenna**						
		2	40mm/1-1/2", PTFE encapsulated					
		4	80mm/3", PP cladded					
		9	Special version, TSP-no. to be spec.					
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, TSP-no. to be spec.				
40				**Process Connection**				
				GGS	Thread ISO228 G1-1/2, PVDF			
				GNS	Thread ANSI NPT1-1/2, PVDF			
				XME	Mounting bracket, 304			
				XRX	W/o slip on flange/mounting bracket, customer side connection			
				XVG	UNI slip on flange 3"/DN80/80, PP max 4bar abs/58psia, suitable for 3" 150lbs/DN80 PN16/10K 80			
				XXG	UNI slip on flange 4"/DN100/100, PP max 4bar abs/58psia, suitable for 4" 150lbs / DN100 PN16 / 10K 100			
				X1G	UNI slip on flange 6"/DN150/150, PP max 4bar abs/58psia, suitable for 6" 150lbs / DN150 PN16 / 10K 150			
				YY9	Special version, TSP-no. to be spec.			
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		
					E	FOUNDATION Fieldbus; 4-line display, envelope curve display on site		
					F	FOUNDATION Fieldbus; w/o display, via communication		
					Y	Special version, TSP-no. to be spec.		
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, TSP-no. to be spec.	
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, TSP-no. to be spec.

80								**Additional option**		
								A		Basic version
								F		Advanced dynamics, max. MB=70m liquids, max. MB=15m solids, MB=measuring range
								H		5-point linearity protocol, see additional spec.
								L		5-point, advanced dynamics, 5-point linearity protocol, see additional spec., Advanced dynamics, max MB=70m liquids, max MB=15m solids, MB=measuring range
								S		GL/ABS/NK marine certificate
								Y		Special version, TSP-no. to be spec.
995									**Marking**	
									1	Tagging (TAG), see additional spec.
									2	Bus address, see additional spec.
FMR244-										Complete product designation

Micropilot M FMR245 **Device selection**



A	*Certificate*	*1*	*Non-hazardous area*
B	*Type of antenne*	*2*	*Ex ia IS*
C	*Communication*	*3*	*Ex em / d XP*
D	*Housing*	*4*	*Note electrostatic charging*
E	*Gas-tight feed through*	*5*	*Gas-tight - standard* [7]

7) The gas-tight feed through 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, TSP-no. to be spec.

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, TSP-no. to be spec.

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, TSP-no. to be spec.

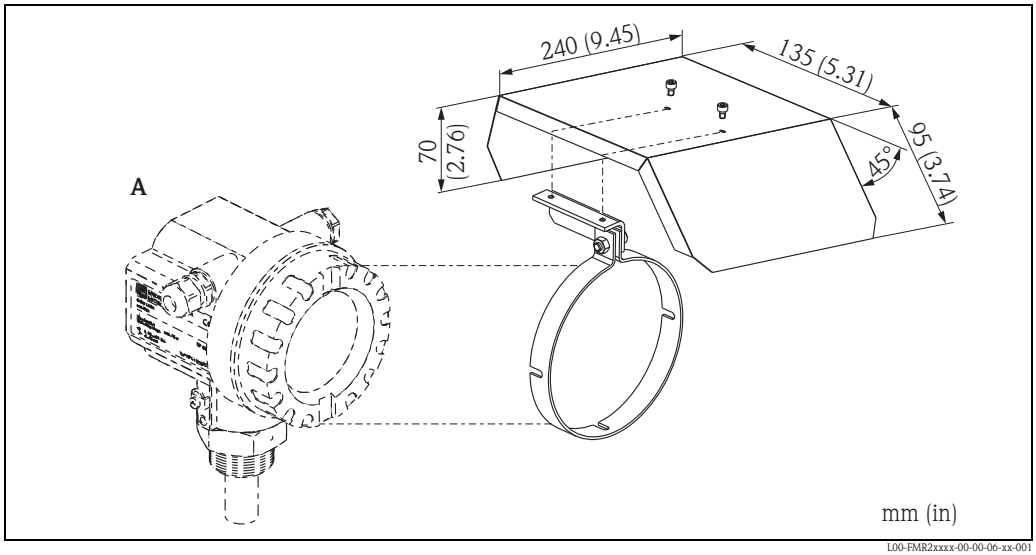
40	Output; Operation
A	4-20mA SIL HART; 4-line display VU331, envelope curve display on site
B	4-20mA SIL HART; w/o display, via communication
K	4-20mA SIL HART; Prepared for FHX40, remote display (Accessory)
C	PROFIBUS PA; 4-line display VU331, envelope curve display on site
D	PROFIBUS PA; w/o display, via communication
E	FOUNDATION Fieldbus; 4-line display, envelope curve display on site
F	FOUNDATION Fieldbus; w/o display, via communication
Y	Special version, TSP-no. to be spec.

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, TSP-no. to be spec.				
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							**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 pressurized) inspection certificate		
							S	GL/ABS/NK marine certificate		
							Y	Special version, TSP-no. to be spec.		
995								**Marking**		
								1	Tagging (TAG), see additional spec.	
								2	Bus address, see additional spec.	
FMR245-										Complete product designation

Accessories

Weather protection cover

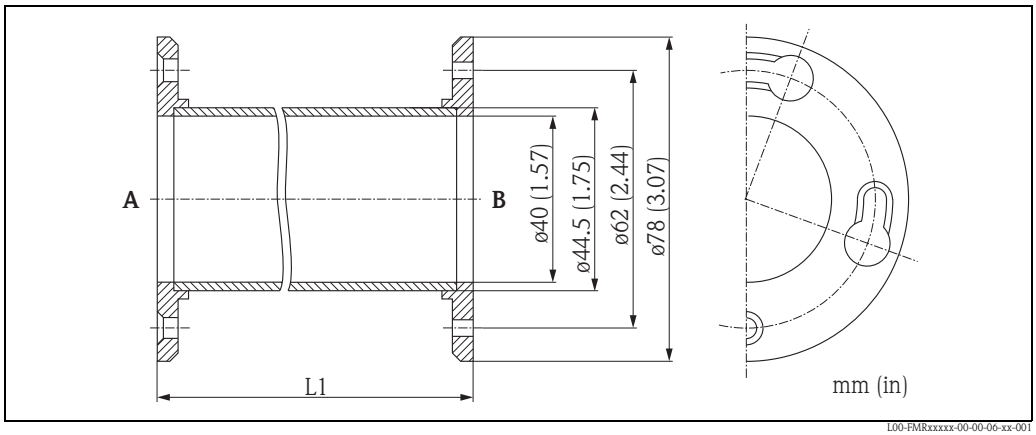
A Weather protection cover made of stainless steel is recommended for outdoor mounting (order code: 543199-0001). The shipment includes the protective cover and tension clamp.



A F12/T12 housing

Antenna extension FAR10 (for FMR230)

Dimensions

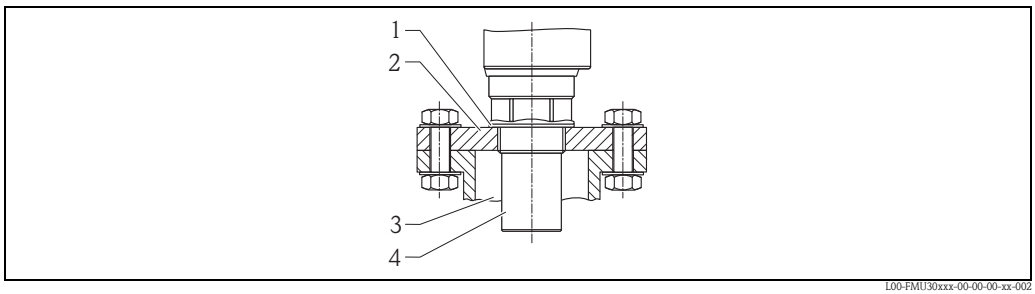


A Device
B Horn

Ordering information:

010	**Material**		
	6		316L
	7		316L + EN10204-3.1, NACE MR1075 (316L wetted parts) inspection certificate
	4		AlloyB2
	5		AlloyC4
	9		Special version, TSP-no. to be spec.
020		**Extension**	
		A	100 mm / 4"
		B	200 mm / 8"
		C	300 mm / 12"
		D	400 mm / 16"
		Y	Special version, TSP-no to be spec.
FAR10-			Complete product designation

Screw in flange for FMR244 - 40 mm (1½") antenna



A Sealing ring EPDM (supplied)
B Screw in flange
C Sensor
D Nozzle

Ordering information:

015	Material	
	BR1	DN50 PN10/16 A, steel flange EN1092-1
	BS1	DN80 PN10/16 A, steel flange EN1092-1
	BT1	DN100 PN10/16 A, steel flange EN1092-1
	JF1	2" 150lbs FF, steel flange ANSI B16.5
	JG1	3" 150lbs FF, steel flange ANSI B16.5
	JH1	4" 150lbs FF, steel flange ANSI B16.5
	JK2	8" 150lbs FF, PP max 3bar abs/44psia flange ANSI B16.5
	XIF	UNI flange 2"/DN50/50, PVDF max 4bar abs/58psia, suitable for 2" 150lbs/DN50 PN16/10K 50
	XIG	UNI flange 2"/DN50/50, PP max 4bar abs/58psia, suitable for 2" 150lbs/DN50 PN16/10K 50
	XIJ	UNI flange 2"/DN50/50, 316L max 4bar abs/58psia, suitable for 2" 150lbs/DN50 PN16/10K 50
	XJF	UNI flange 3"/DN80/80, PVDF max 4bar abs/58psia, suitable for 3" 150lbs/DN80 PN16/10K 80
	XJG	UNI flange 3"/DN80/80, PP max 4bar abs/58psia, suitable for 3" 150lbs/DN80 PN16/10K 80
	XJJ	UNI flange 3"/DN80/80, 316L max 4bar abs/58psia, suitable for 3" 150lbs/DN80 PN16/10K 80
	XKF	UNI flange 4"/DN100/100, PVDF max 4bar abs/58psia, suitable for 4" 150lbs/DN100 PN16/10K 100
	XKG	UNI flange 4"/DN100/100, PP max 4bar abs/58psia, suitable for 4" 150lbs/DN100 PN16/10K 100
	XKJ	UNI flange 4"/DN100/100, 316L max 4bar abs/58psia, suitable for 4" 150lbs/DN100 PN16/10K 100
	XLF	UNI flange 6"/DN150/150, PVDF max 4bar abs/58psia, suitable for 6" 150lbs/DN150 PN16/10K 150
	XLG	UNI flange 6"/DN150/150, PP max 4bar abs/58psia, suitable for 6" 150lbs/DN150 PN16/10K 150
	XLJ	UNI flange 6"/DN150/150, 316L max 4bar abs/58psia, suitable for 6" 150lbs/DN150 PN16/10K 150
	XMG	UNI flange DN200/200, PP max 4bar abs/58psia, suitable for DN200 PN16/10K 200
	XNG	UNI flange DN250/250, PP max 4bar abs/58psia, suitable for DN250 PN16/10K 250
	YYY	Special version, TSP-no to be spec.

020		Sensor Connection	
		A	Thread ISO228 G3/4
		B	Thread ISO228 G1
		C	Thread ISO228 G1-1/2
		D	Thread ISO228 G2
		E	Thread ANSI NPT3/4
		F	Thread ANSI NPT1
		G	Thread ANSI NPT1-1/2
		H	Thread ANSI NPT2
		Y	Special version, TSP-no to be spec.

FAX50-			Vollständige Produktbezeichnung

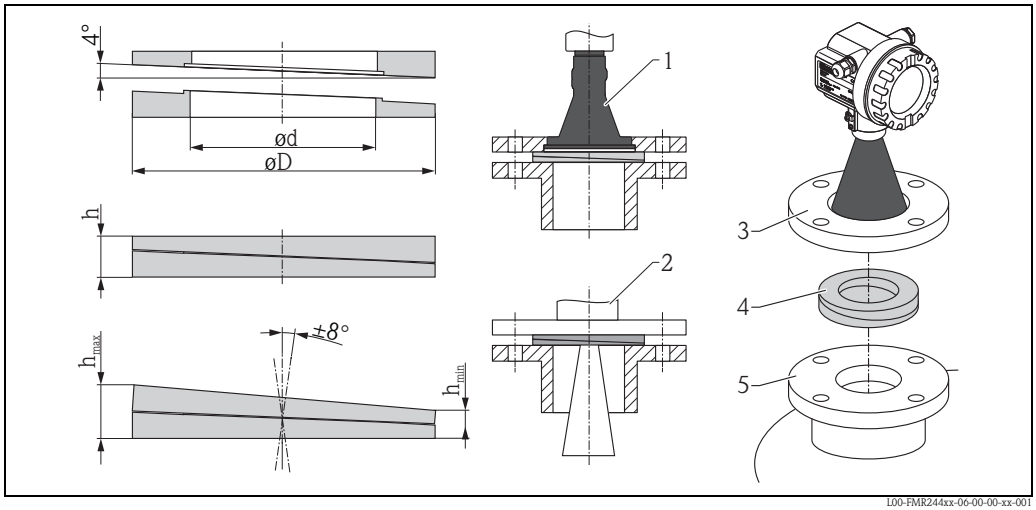
Variable flange seal for FMR244 - 80 mm (3") antenna and FMR240 -100 mm (4") horn antenna

Technical data and ordering information

Variable flange seal	DN 80	DN 100	DN 150
compatible with	DN 80 PN10-40 ANSI 3" 150lbs JIS 10K 80A	DN 100 PN10-40 ANSI 4" 150lbs JIS 10K 100A	DN 150 PN10-40 ANSI 6" 150lbs JIS 10K 150A
Material	EPDM		
Process pressure	-0.1 to 0.1bar (-1.45 to 1.45 psi)		
Process temperature	-40 to +80 °C (-40 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



1 E.g. FMR244 - DN 80
2 E.g. FMR240 - 100 mm (4") horn
3 UNI slip on flange
4 Variable flange seal
5 Nozzle

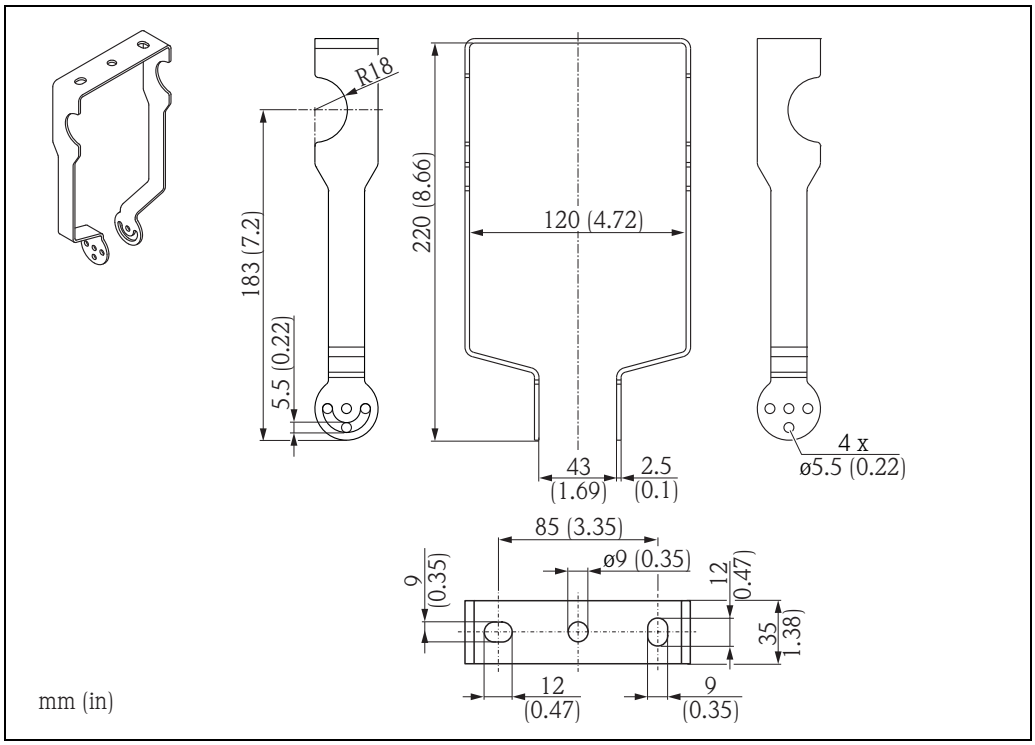
Variable flange seal	DN 80 [1]	DN 100 [1] [2]	DN 150 [1] [2]
D [mm (in)]	142 (5.59)	162 (6.38)	218 (8.58)
d [mm (in)]	89 (3.5)	115 (4.53)	169 (6.65)
h [mm (in)]	22 (0.87)	23.5 (0.93)	26.5 (1.04)
h_{min} [mm (in)]	14 (0.55)	14 (0.55)	14 (0.55)
h_{max} [mm (in)]	30 (1.18)	33 (1.3)	39 (1.54)

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**

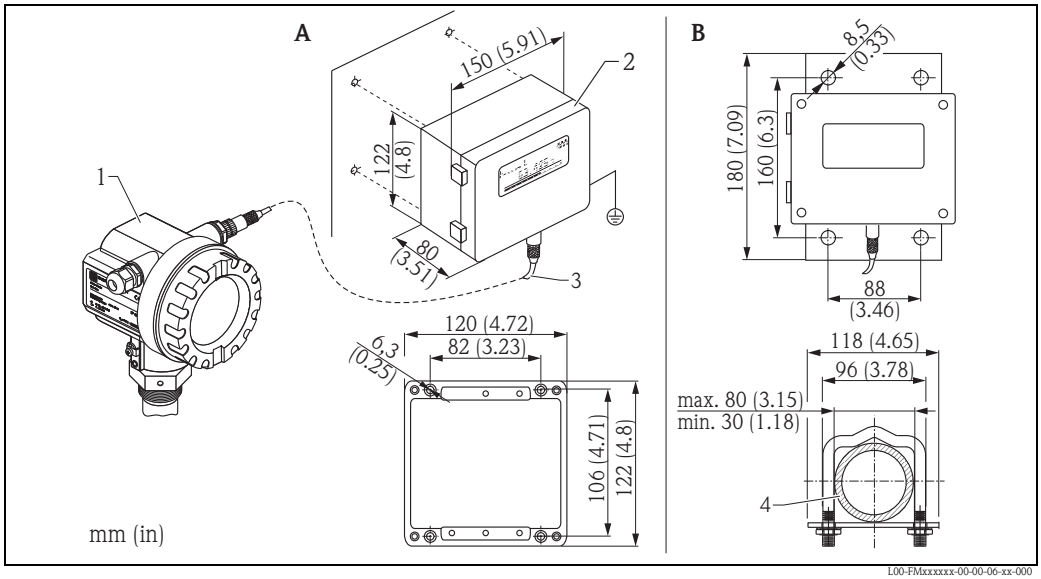
Mounting bracket to the alignment of FMR244 in solid applications uses(order code: 71091643).



L00-FMR244xx-06-00-00-xx-002

Note!
With T12 housing it‘s not possible to mount the device direct at the ceiling.

Remote display FHX40



1 Micropilot M, Levelflex M, Prosonic M
2 Separate housing FHX40 (IP65)
3 Cabel
4 Pipe

A Wall mounting (without mounting bracket)
B Pipe mounting (mounting bracket and plate supplied optionally, see product structure)

Note!
For the device families Micropilot FMR2xx, Levelflex FMP4x and Prosonic FMU4x, the remote display FHX40 must be only used for the HART communication version.

Ordering information:

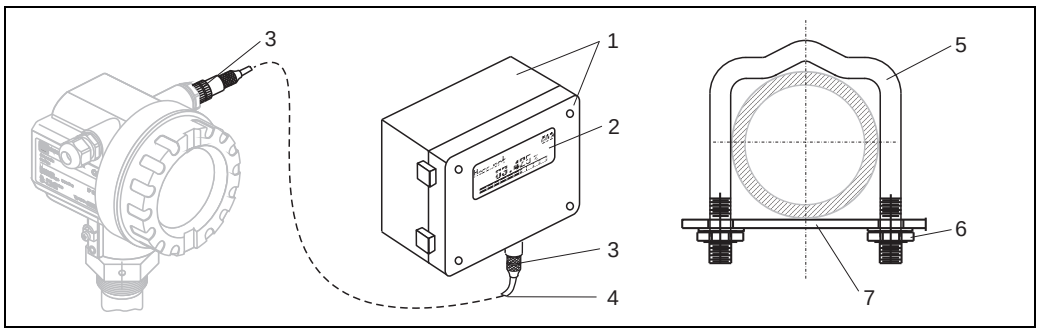
010	**Approval**					
	A	Non-hazardous area				
	2	ATEX II 2G Ex ia IIC T6				
	3	ATEX II 2D Ex ia IIIC T80°C				
	G	IECEx zone1 Ex ia IIC T6/T5				
	S	FM IS Cl.I Div.1 Gr.A-D, zone 0				
	U	CSA IS Cl.I Div.1 Gr.A-D, zone 0				
	N	CSA General Purpose				
	K	TIIS Ex ia IIC T6				
	C	NEPSI Ex ia IIC T6/T5				
	Y	Special version, TSP-no. to be spec.				
020		**Cable**				
		1	20m/65ft; for HART			
		5	20 m/65 ft (> PROFIBUS PA / FOUNDATION Fieldbus)			
		9	Special version, TSP-no. to be spec.			
030			**Additional option**			
			A	Basic version		
			B	Mounting bracket, pipe 1"/ 2"		
			Y	Special version, TSP-no. to be spec.		
995				**Marking**		
				1	Messstelle (TAG), see additional spec.	
FHX40 -					Complete product designation	

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

Technical data (cable and housing)

Max. cable length	20 m (66 ft) (fixed length including the cast-on plugs)
Temperature range	-40 to +60 °C (-40 to +140 °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

Materials



L00-FMxxxxxx-00-00-06-de-003

Position	Part	Material
1	Housing/Cover	AlSi12, Screw: V2A
	Ground terminal	CuZn nickel-plated, Screw: V2A
2	Display	Glass
3	Cable gland	CuZn nickel-plated
4	Cable	PVC
5	Mounting bracket	316 Ti (1.4571) or 316 L (1.4435) or 316 (1.4401)
6	Nut	V4A
7	Plate) Screw set (M5	316 Ti (1.4571) Spring washer: 301 (1.4310) or V2A Screw: V4A, Nut: V4A

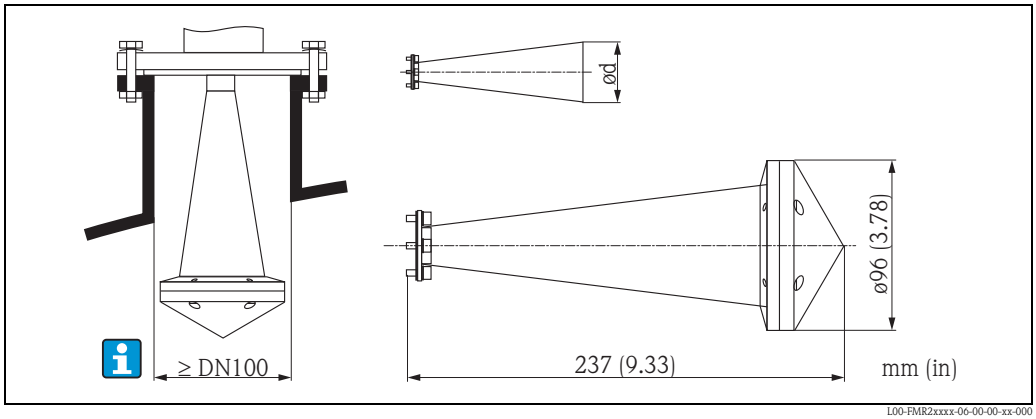
Horn cover for 80 mm (3") and 100 mm (4") horn antenna

Technical data

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

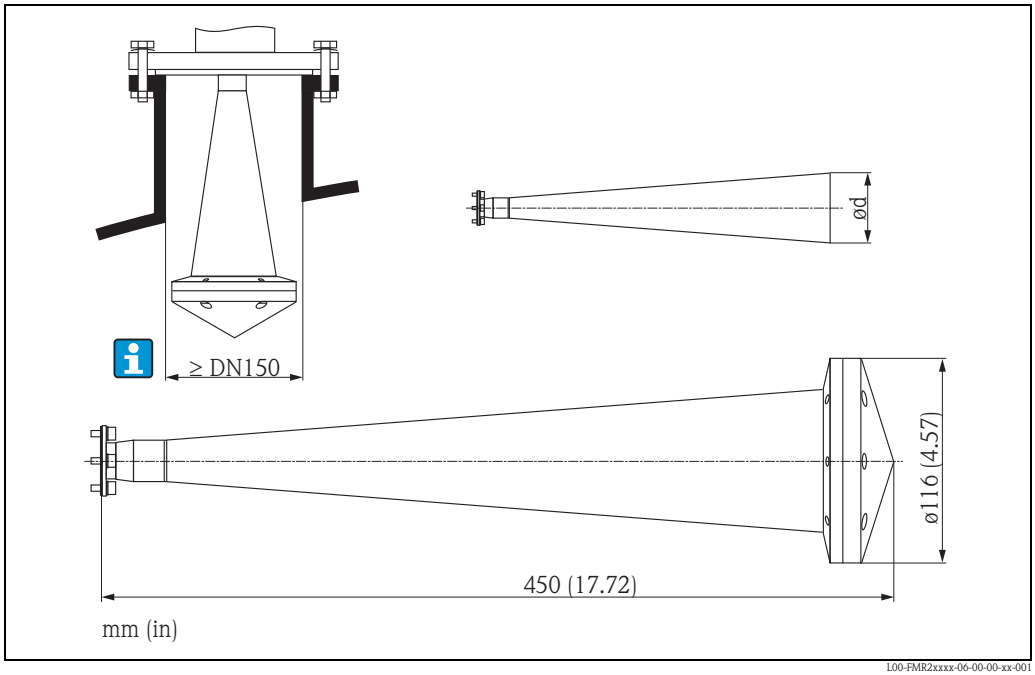
Process conditions	
Vessel pressure max.	0.5 bar (7.252 psi)
Process temperature max.	130 °C (266 °F)

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, 5*
- *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 TI00404F/00/EN.

Commubox FXA291

The Commubox FXA291 connects Endress+Hauser field devices with CDI interface (= Endress+Hauser Common Data Interface) to the USB interface of a personal computer or a notebook.
For details refer to TI00405C/07/EN.

Note!
For the device 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 device. For details refer to KA00271F/00/A2.

Field Xpert SFX100

Compact, flexible and robust industry handheld terminal for remote parametrization and measured value inspection via the HART current output or FOUNDATION Fieldbus.
For details refer to Operating Instructions BA00060S/04/EN

Documentation

Special Documentation

Continuous level measurement in liquids

Selection and engineering guide for the process industry, CP00023F/00/EN.

Radar Tank Gauging brochure

For inventory control and custody transfer applications in tank farms and terminals, SO00001G/00/EN.

Technical Information

Tank Side Monitor NRF590

Technical Information for Tank Side Monitor NRF590, TI00402F/00/EN.

Fieldgate FXA520

Technical Information for Fieldgate FXA520, TI00369F/00/EN.

Operating Instructions

Micropilot M

Correlation of operating instructions to the device:

Device	Output	Communication	Operating Instructions	Description of Device Functions	Brief Operating Instructions (in the device)
FMR230	A, B, K	HART	BA00218F/00/EN	BA00221F/00/EN	KA00159F/00/A2
	C, D, L	PROFIBUS PA	BA00225F/00/EN	BA00221F/00/EN	KA00159F/00/A2
	E, F, M	FOUNDATION Fieldbus	BA00228F/00/EN	BA00221F/00/EN	KA00159F/00/A2
FMR231	A, B, K	HART	BA00219F/00/EN	BA00221F/00/EN	KA00159F/00/A2
	C, D, L	PROFIBUS PA	BA00226F/00/EN	BA00221F/00/EN	KA00159F/00/A2
	E, F, M	FOUNDATION Fieldbus	BA00229F/00/EN	BA00221F/00/EN	KA00159F/00/A2
FMR240	A, B, K	HART	BA00220F/00/EN	BA00291F/00/EN	KA00235F/00/A2
	C, D, L	PROFIBUS PA	BA00227F/00/EN	BA00291F/00/EN	KA00235F/00/A2
	E, F, M	FOUNDATION Fieldbus	BA00230F/00/EN	BA00291F/00/EN	KA00235F/00/A2
FMR244	A, B, K	HART	BA00248F/00/EN	BA00291F/00/EN	KA00235F/00/A2
	C, D, L	PROFIBUS PA	BA00249F/00/EN	BA00291F/00/EN	KA00235F/00/A2
	E, F, M	FOUNDATION Fieldbus	BA00250F/00/EN	BA00291F/00/EN	KA00235F/00/A2
FMR245	A, B, K	HART	BA00251F/00/EN	BA00291F/00/EN	KA00235F/00/A2
	C, D, L	PROFIBUS PA	BA00252F/00/EN	BA00291F/00/EN	KA00235F/00/A2
	E, F, M	FOUNDATION Fieldbus	BA00253F/00/EN	BA00291F/00/EN	KA00235F/00/A2

Tank Side Monitor NRF590

Operating Instructions for Tank Side Monitor NRF590, BA00256F/00/EN.
Description of Device Functions for Tank Side Monitor NRF590, BA00257F/00/EN.

Certificates

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

Authority	Version	Designation	Housing			Output	Document	Type
			F12	T12	F23			
ATEX	FMR240/245: B	II 1/2 G Ex ia IIC T6 II 1/2 D	X	X[1)]	X	HART, HART für FHX40, PA, FF	XA00406F XA00407F	240 245
	FMR244: B, C	II 1/2 G Ex ia IIC T6 II 1/2 D II 1/3D					XA00408F	244
ATEX IECEx	H, 1, 6,	II 1/2 G Ex ia IIC T6 Zone 0/1	X			HART	XA00099F	230, 231, 240
				X[1)]			XA00207F	230, 231, 240
					X		XA00203F	230, 231, 240
			X			HART für FHX40	XA00099F	230, 231, 240
					X		XA00203F	230, 231, 240
			X			PA, FF	XA00102F	230, 231, 240
					X		XA00204F	230, 231, 240
				X[1)]			XA00208F	230, 231, 240
ATEX IECEx	FMR230/231: 1, 6, FMR240/244/245: D	II 1/2 G Ex ia IIC T6 Zone 0/1			X	HART	XA00366F XA00367F	230, 231, 240 245,
				X[1)]			XA00368F XA00369F	230, 231, 240 244, 245,
			X				XA00354F XA00358F	230, 231, 240 244, 245
					X	HART für FHX40	XA00366F XA00367F	230, 231, 240 245,
			X				XA00354F XA00358F	230, 231 244, 245
			X			PA, FF	XA00357F XA00361F	230, 231, 240 244, 245
					X		XA00362F XA00363F	230, 231, 240 245,
				X[1)]			XA00364F XA00365F	230, 231, 240 244, 245
ATEX	H	II 3 D	X	X[1)]	X	HART, HART für FHX40, PA, FF	XA00277F	230, 231, 240, 245
			X	X[1)]			XA00277F	244,
ATEX	3, 8	II 1/2 G Ex em (ia) IIC T6		X		HART, PA, FF	XA00100F	230, 231, 240
ATEX IECEx	FMR230/231: 4 FMR240: E	II 1/2 G Ex d (ia) IIC T6 Zone 0/1		X		HART, PA, FF	XA00101F XA00356F	230, 231, 240 230, 231, 240
						HART für FHX40	XA00356F	230, 231, 240
ATEX	FMR230/231/240: 5 FMR244/245: E	II 1/2 G Ex d (ia) IIC T6 Zone 0/1		X		HART, PA, FF	XA00105F XA00360F	230, 231, 244 245
						HART für FHX40	XA00360F	230, 231, 244, 245

Authority	Version	Designation	Housing			Output	Document	Type
			F12	T12	F23			
ATEX IECEx	H, 2[2], 7[2]	II 1/2 G Ex ia IIC T6 Zone 0/1	X			HART	XA00103F	230, 231, 244
				X[1]			XA00209F	230, 231, 244, 245
					X		XA00205F	230, 231, 245
			X			HART für FHX40	XA00103F	230, 231, 244
					X		XA00205F	230, 231, 245
			X			PA, FF	XA00106F	230, 231, 244
				X[1]			XA00210F	230, 231, 244, 245
					X		XA00206F	230, 231, 245
ATEX IECEx	2[2], 7[2]	II 1/2 G Ex ia IIC T6 Zone 0/1	X			HART	XA00358F	230, 231
				X[1]			XA00369F	230, 231
					X		XA00367F	230, 231
			X			HART für FHX40	XA00358F	230, 231
					X		XA00367F	230, 231
			X			PA, FF	XA00361F	230, 231
					X		XA00363F	230, 231
				X[1]			XA00365F	230, 231
ATEX	G	II 3 G Ex nA II T6	X	X[1]	X	HART, HART für FHX40, PA, FF	XA00233F	230, 231, 240, 245
			X	X[1]			XA00233F	244,

1) Housing with overvoltage protection (OVP)

2) Note safety instructions (XA) (electrostatic charging)!

Authority	Version	Designation	Housing			Output	Document	Type
			F12	T12	F23			
NEPSI	I	Ex ia IIC T6	X	X[1)]	X	HART, HART für FHX40	XA00370F XA00372F	230, 231, 240 230, 231, 245
			X	X[1)]			XA00372F	244
			X	X[1)]	X	PA, FF	XA00373F XA00375F	230, 231, 240 230, 231, 245
			X	X[1)]			XA00375F	244
	J	Ex d (ia) ia IIC T6		X		HART, HART für FHX40, PA, FF	XA00371F XA00374F	230, 231, 240 230, 231, 244, 245
	R	Ex nAL IIC T6	X	X[1)]	X	HART, HART für FHX40, PA, FF	XC00007F	230, 231, 240, 245
			X	X[1)]			XC00007F	244

1) Housing with overvoltage protection (OVP)

Authority	Version	Designation	Housing			Output	Document	Type
			F12	T12	F23			
FM	S	IS Cl. I Div. 1 Gr. A-D Zone 0, 1, 2	X			HART	ZD00055F	230, 231, 240, 244, 245
				X[1)]			ZD00127F	230, 231, 240, 244, 245
					X		ZD00126F	230, 231, 240, 245
			X			HART für FHX40	ZD00055F	230, 231, 240, 244, 245
					X		ZD00126F	230, 231, 240, 245
			X			PA, FF	ZD00056F	230, 231, 240, 244, 245
			X	X[1)]	X		ZD00021F	230, 231, 240, 245
			X	X[1)]			ZD00021F	244
				X[1)]			ZD00129F	230, 231, 240, 244, 245
					X		ZD00128F	230, 231, 240, 245
	T	XP Cl. I Div. 1 Gr. A-D Zone 1, 2		X		HART, PA, FF	ZD00058F	230, 231, 240, 244, 245
CSA	U	IS Cl. I Div. 1 Gr. A-D Zone 0, 1, 2	X			HART	ZD00059F	230, 231, 240, 244, 245
				X[1)]			ZD00133F	230, 231, 240, 244, 245
					X		ZD00132F	230, 231, 240, 245
			X			HART für FHX40	ZD00059F	230, 231, 240, 244, 245
					X		ZD00132F	230, 231, 240, 245
			X			PA, FF	ZD00060F	230, 231, 240, 244, 245
				X[1)]			ZD00135F	230, 231, 240, 244, 245
					X		ZD00134F	230, 231, 240, 245
	V	XP Cl. I Div. 1 Gr. A-D Zone 1, 2		X		HART, PA, FF	ZD00062F	230, 231, 240, 244, 245

1) Housing with overvoltage protection (OVP)

Authority	Version	Designation	Housing			Output	Document	Type
			F12	T12	F23			
WHG	FMR2xx: F FMR230/231/240: 6 FMR230/231/244/245: 7[1)] FMR230/231/240: 8	Ex-freier Bereich, WHG	X	X, X[1)]	X	HART, PA	ZE00244F	230, 231, 240, 245
						HART für FHX40		230, 231, 240, 244

1) Only for FMR230, FMR231, FMR244

Safety Manual Functional safety manual for Micropilot M (→ SD00327F/00/EN).

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

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

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