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

Technical Information

Micropilot M FMR250

Level-Radar
Smart Transmitter for continuous and non-contact level measurement in solids.
Cost-effective 4...20 mA 2-wire technology.

Application

The Micropilot M performs continuous, non-contact level measurement especially in powdery to granular bulk solids. Additionally it can be used in liquids as well. Dust, filling noises, temperature layers and gas stratification do not affect measurement.

Typical areas of application are:
- Level measurement in tall silos with extremely dusty bulk solids e.g. cement, raw meal or animal feed.
- Applications with high temperature requirements up to 200 °C (392 °F), e.g. clinker or fly ash.
- Applications with highly abrasive bulk solids e.g. ferrite.

The FMR250 with DN80 or DN100 horn antenna for all standard applications, particularly also for small nozzle sizes.
The FMR250 with DN200 parabolic antenna offers high beam focussing of 4° and is thus ideal for applications with many installations.

Your benefits
- 2-wire technology, low price:
  2-wire technology reduces wiring costs and allows easy implementation into existing systems.
- Non-contact measurement:
  Measurement is almost independent from product properties.
- Easy on-site operation via menu-driven alphanumeric display.
- Easy commissioning, documentation and diagnostics via operating software (ToF Tool).
- Integrated air purge connection for extremely dusty conditions or media tending to create build-up.
- Max. measuring range 70 m (229 ft).
- Suitable for process temperatures up to 200 °C (392 °F).
- HART or PROFIBUS PA protocol.
- Optional remote display and operation.

TI390F/00/en

Endress+Hauser
People for Process Automation

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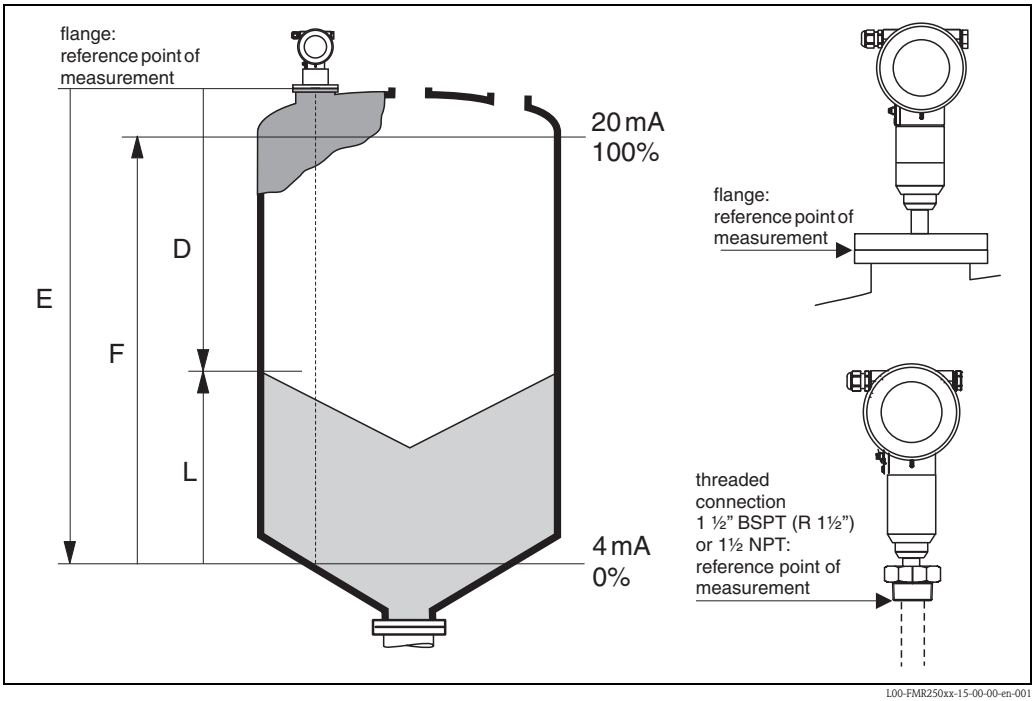
Function and system design

Measuring principle

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



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Input

The reflected radar impulses are received by the antenna and transmitted into the electronics. A microprocessor evaluates the signal and identifies the level echo caused by the reflection of the radar impulse at the product surface. The unambiguous signal identification is accomplished by the PulseMaster® 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 internals and struts) are not interpreted as level echo.

Output

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

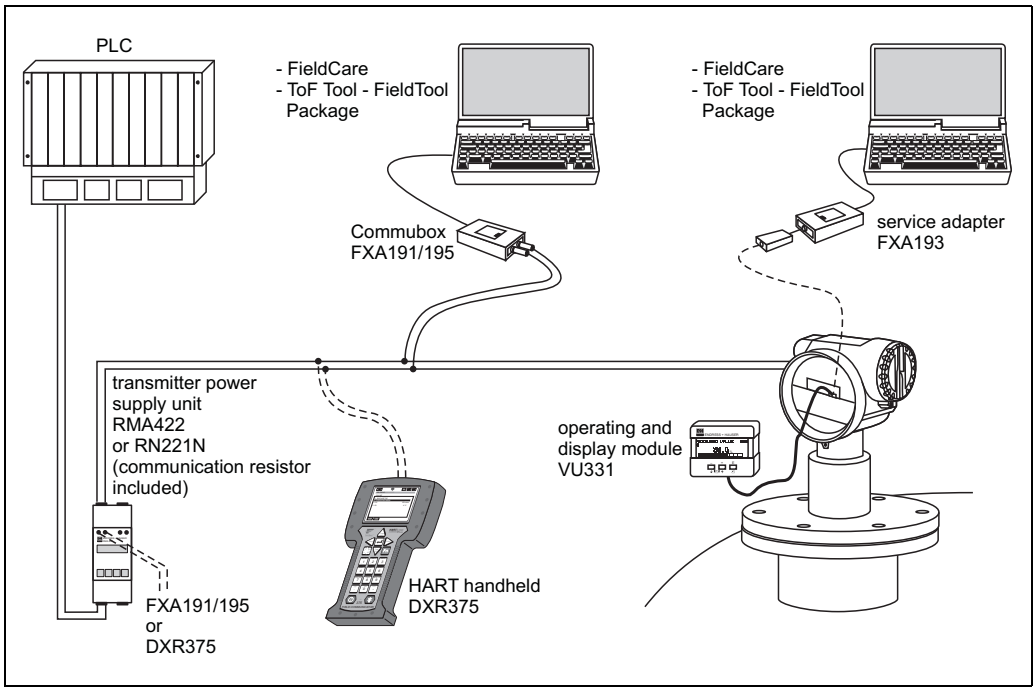
Equipment architecture

Stand-alone

The instrument provides a 4…20 mA output with HART or PROFIBUS PA protocol.

4…20 mA output with HART protocol.

The complete measuring system consists of:



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On-site operation

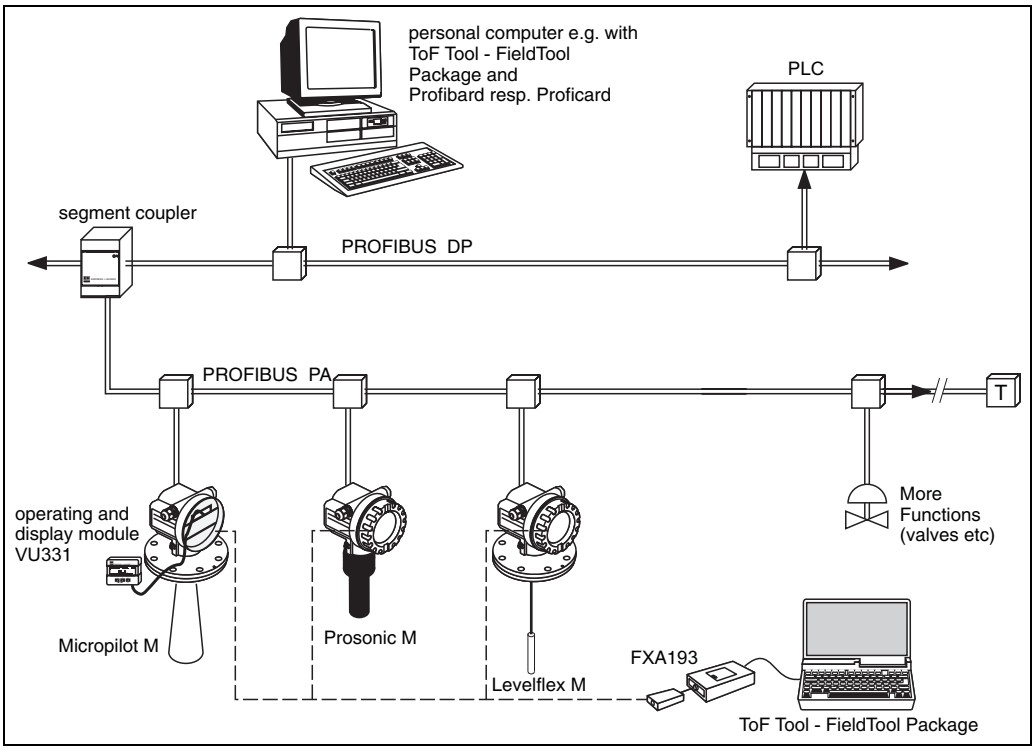
- with display and operating module VU331,
- with a Personal Computer, FXA193 and the operating software "ToF Tool – FieldTool Package" respectively "FieldCare".
  The ToF Tool is a graphical operating software for instruments from Endress+Hauser that operate based on the time-of-flight principle (radar,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

Remote operation

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

System integration via PROFIBUS PA

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



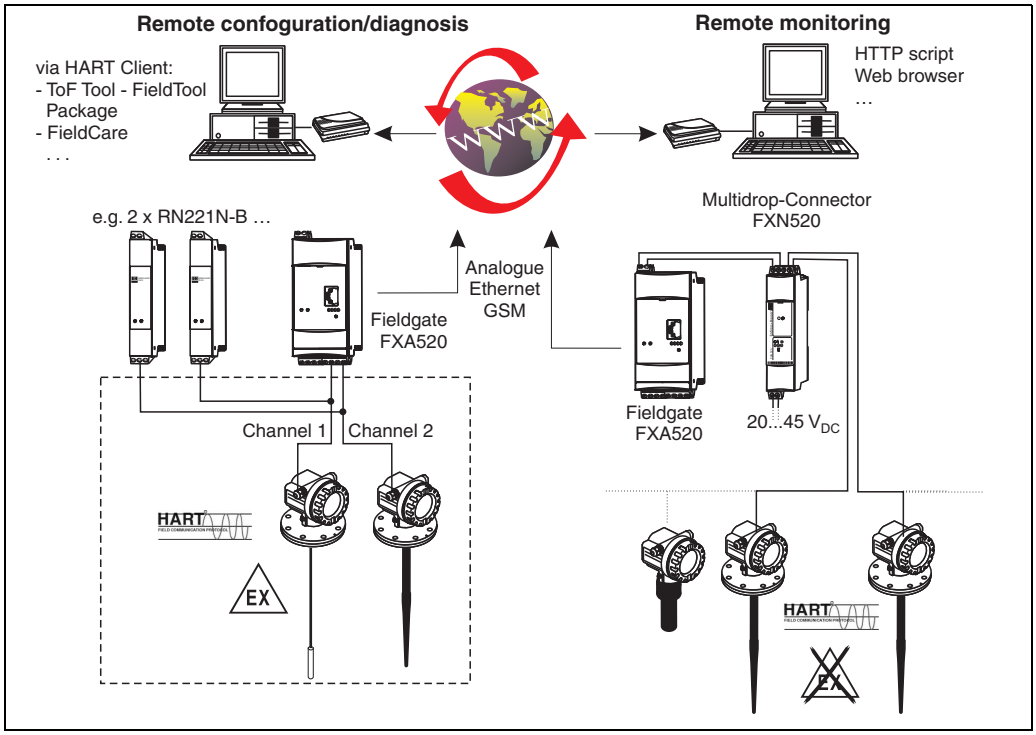
System integration via Fieldgate

Vendor Managed Inventory

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

Remote maintenance of measuring equipment

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



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

Input

Measured variable

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

Measuring range

The usable measuring range depends on the size of the antenna, the reflectivity of the medium, the mounting location and eventual interference reflections. The maximum configurable range is 70 m (229 ft) for Micropilot M FMR250.

Reduction of the max. possible measuring range through:
- Media with poor reflection properties (= small DC). For examples refer to table 1.
- 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.

Table 1:
The following table describes the media groups and the dielectric constant εr.

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

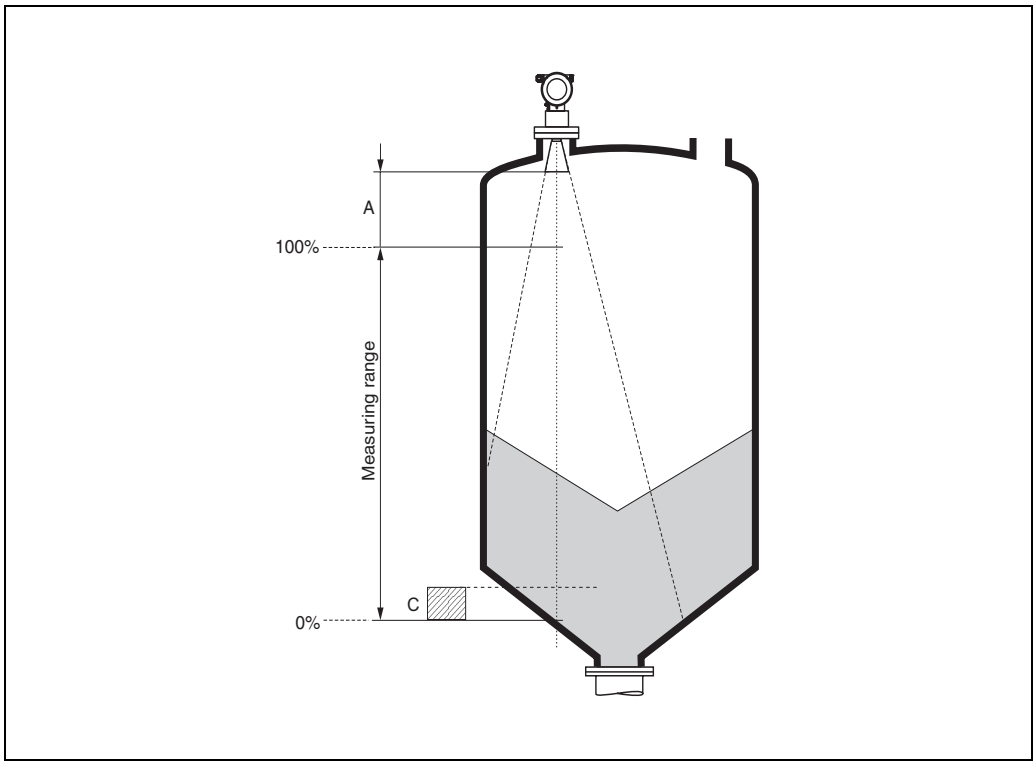
The respective lower group applies for very loose or loosened bulk solids.

Antenna selection

Antenna type	Application
FMR250-*4*... (DN80) **FMR250-*5*...** (DN100) 	The FMR250 with DN80 or DN100 horn antenna for all standard applications, particularly also for small nozzle sizes. To achieve an optimised signal strength it is recommended to use an antenna with as large as possible diameter. In small tanks in particular, an antenna extension should not be used wherever possible to optimize dynamics at close range.
FMR250-*6*... (DN200) 	The FMR250 with DN200 parabolic antenna offers high beam focussing of 4° and is thus ideal for applications with many installations.

Measuring conditions

- The measuring range begins, where the beam hits the vessel bottom. Particularly with dish bottoms or 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 (see Page 13).
- In case of media with a low dielectric constant (groups A and B), the vessel 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** =50...150 mm above the vessel bottom (see Fig.).
- In principle it is possible to measure up to the tip of the antenna with FMR250. However, due to considerations regarding abrasion and build-up, the end of the measuring range should not be chosen any closer than **A**=400 mm (see Fig.) to the tip of the antenna.



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Operating frequency

- FMR250: K-band

Transmitting power

Average energy density in beam direction:

Distance	Average energy density
1 m	< 4 nW/cm^2
5 m	< 0,16 nW/cm^2

Output

Output signal

- 4…20 mA with HART protocol
- PROFIBUS PA

Signal on alarm

Error information can be accessed via the following interfaces:
- Local display:
  - Error symbol
  - Plain text display
- Current output
- 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 vessels are pre-programmed. Other tables of up to 32 value pairs can be entered manually or semi-automatically.

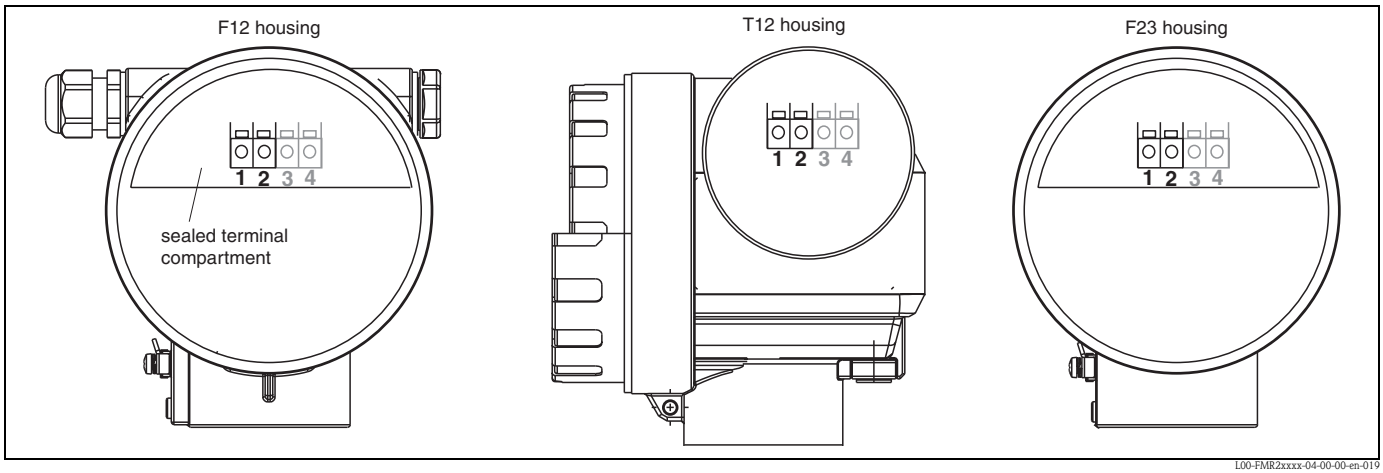
Auxiliary energy

Electrical connection

Terminal compartment

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

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



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Cable gland

	Type	Clamping area
Standard, EEx ia, IS	Plastic M20x1.5	5...10 mm
EEx em, EEx nA	Metal M20x1.5	7...10.5 mm

Terminals

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

Terminal assignment

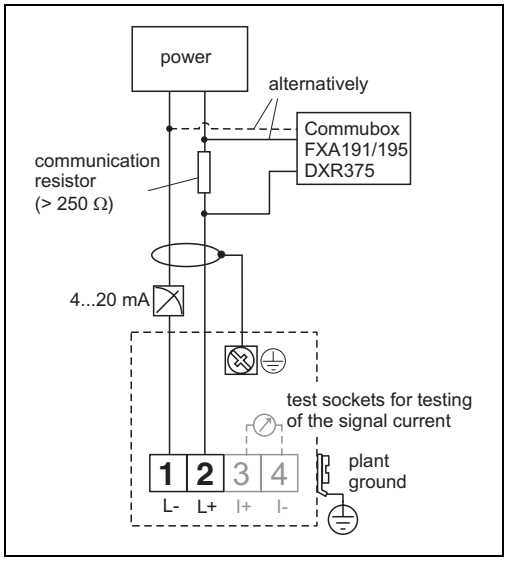
2-wire, 4…20 mA with HART

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

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

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

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



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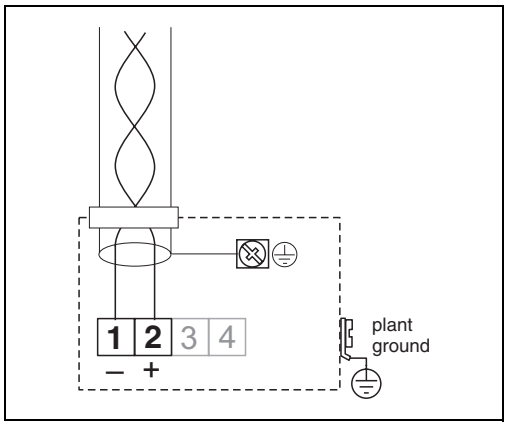
PROFIBUS PA

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

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



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

Load HART

Minimum load for HART communication: 250 Ω

Supply voltage

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

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

1) Start up current 11 mA.

Cable entry

Cable gland: M20x1,5 (for EEx d: cable entry)
Cable entry: G ½ or ½ NPT

Power consumption

min. 60 mW, max. 900 mW

Current consumption

Communication	Current consumption
HART	3,6...22 mA[1)]
PROFIBUS PA	max. 13 mA

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

Ripple HART

47...125 Hz: Uss = 200 mV (at 500 Ω)

Max. noise HART

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

Overvoltage protector

The level transmitter Micropilot M with T12-housing (housing version "D", see ordering information on page 29-31) is equipped with an internal overvoltage protector (600 V surge arrester). Connect the metallic housing of the Micropilot M to the vessel wall or screen directly with an electrically conductive lead to ensure reliable potential matching.

Performance characteristics

Reference operating conditions

- temperature = +20 °C (68 °F) ±5 °C (9 °F)
- pressure = 1013 mbar abs. (14.7 psia) ±20 mbar (0.3 psi)
- relative humidity (air) = 65 % ±20%
- ideal reflector
- no major interference reflections inside the signal beam

Maximum measured error

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

- up to 1 m: ±30 mm
- ex 1 m: ±15 mm (or 0.04% of measuring range, whatever is larger)

Resolution

Digital / analog in % 4…20 mA

- FMR250: 1mm / 0.03 % of measuring range

Reaction time

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

Influence of ambiente temperature

The measurements are carried out in accordance with EN 61298-3:

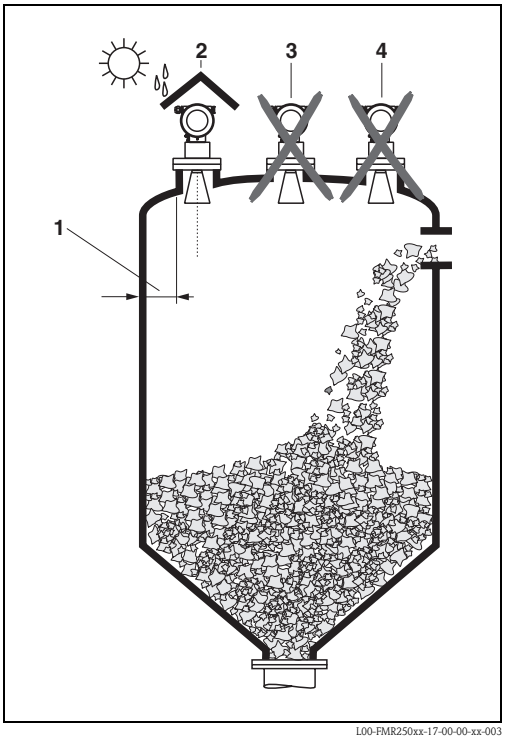
- digital output (HART, PROFIBUS PA):
  - **FMR250**
    average T_K: 5 mm/10 K, max. 15 mm over the entire temperature range -40 °C...+80 °C
- Current output (additional error, in reference to the span of 16 mA):
  - **Zero point (4 mA)**
    average T_K: 0,03 %/10 K, max. 0,45 % over the entire temperature range -40 °C...+80 °C
  - **Span (20 mA)**
    average T_K: 0,09 %/10 K, max. 0,95 % over the entire temperature range -40 °C...+80 °C

Operating conditions: Installation

Installation instructions

Orientation

- Recommended distance (1) wall – **outer edge** of nozzle: ~1/6 of vessel diameter. However, the device should not, under any circumstances, be mounted less than 20 cm/8“ from the vessel wall. Note!
  If the tank wall is not smooth (corrugated metal, welding seams, irregularities etc.) the distance from the wall should be kept as large as possible. If necessary, use a top target positioner to prevent interference reflections from the tank wall.
- Not in the centre (3), interference can cause signal loss.
- Not above the fill stream (4).
- It is recommended to use a weather protection cover (2) in order to protect the transmitter from direct sun or rain. Assembly and disassembly is simply done by means of a tension clamp (see Accessorieson Seite 32).
- In extremely dusty applications, the integrated air purge connection can prevent clogging of the antenna.



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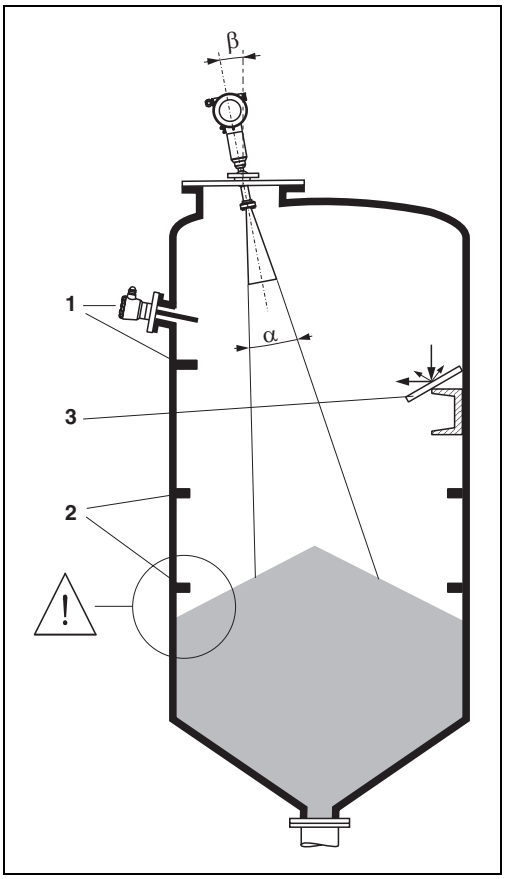
Vessel installations

- Avoid any installations (1), like limit switches, struts, etc., inside the signal beam (see Beam angle on Page 14).
- Symmetrical installations (2), i.e. reinforcing rings, heating coils, 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"
- In devices with top target positioner, the sensor can be optimally aimed within the vessel, and/or interference reflections can be avoided.
  The max. angle β is ±15°.
- In particular, sensor alignment serves to:
  – prevent interference reflections
  – extend the maximum possible measuring range in conical outlets.
- Metallic screens (3) mounted at a slope spread the radar signals and can, therefore, reduce interference echoes.

Please contact Endress+Hauser for further information.



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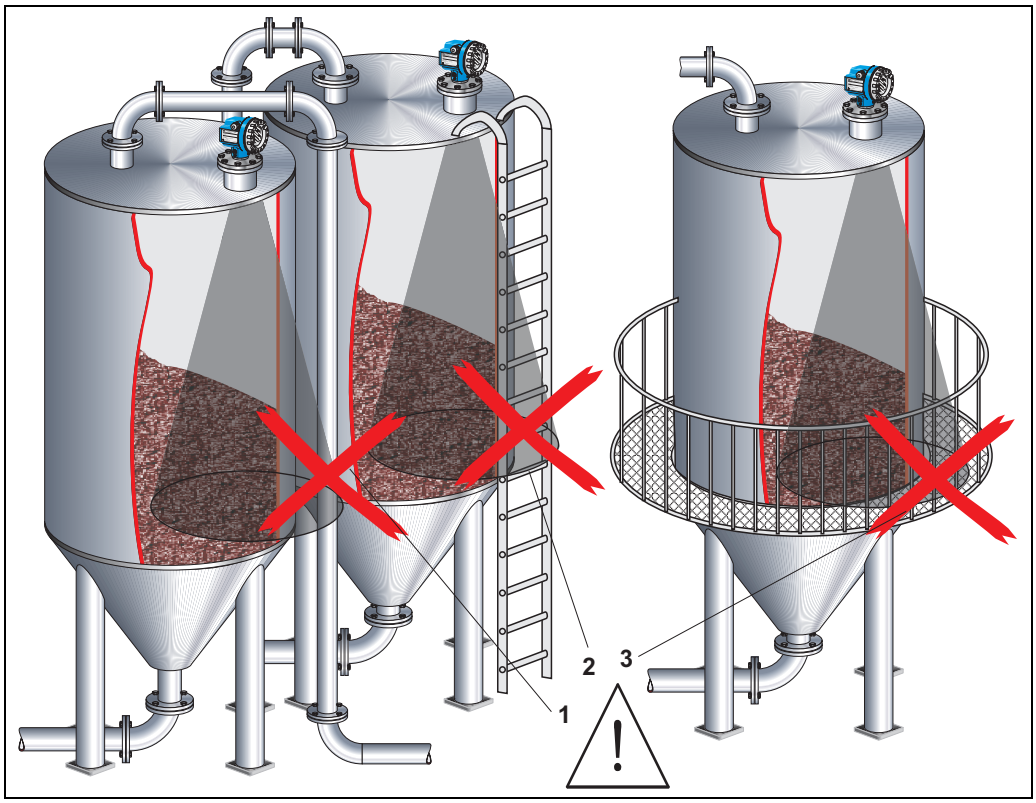
Measurement in a plastic tank

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



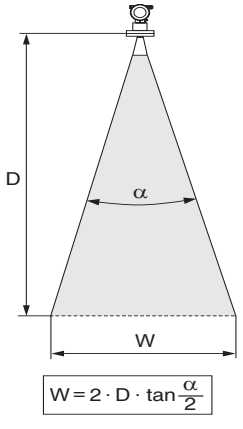
Please contact Endress+Hauser for further information.

Beam angle

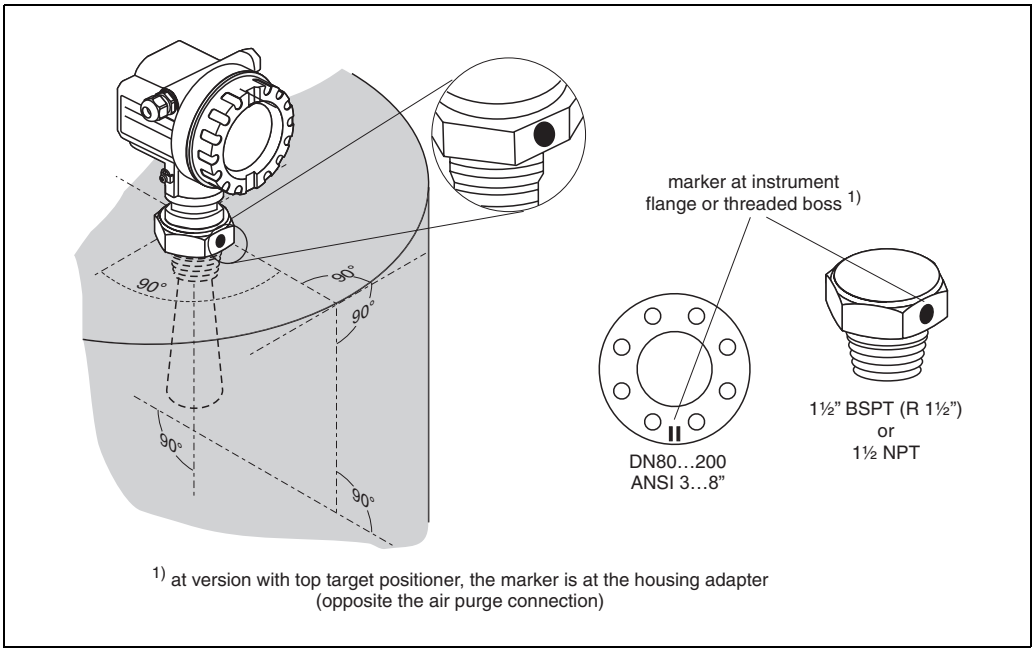
The beam angle is defined as the angle a where the energy density of the radar waves reaches half the value of the maximum energy density (3dB-width). Microwaves are also emitted outside the signal beam and can be reflected off interfering installations. Beam diameter **W** as function of antenna type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

Antenna size FMR250	Horn antenna		Parabolic antenna
	80 mm / 3"	100 mm / 4"	200 mm / 8"
Beam angle α	10°	8°	4°

Measuring distance (D)	Beamwidth diameter (W)		
	80 mm / 3"	100 mm / 4"	200 mm / 8"
5 m / 16 ft	0.87 m / 2.80 ft	0.70 m / 2.24 ft	0.35 m / 1.12 ft
10 m / 32 ft	1.75 m / 5.60 ft	1.40 m / 4.48 ft	0.70 m / 2.23 ft
15 m / 49 ft	2.62 m / 8.57 ft	2.10 m / 6.85 ft	1.05 m / 3.42 ft
20 m / 65 ft	3.50 m / 11.37 ft	2.80 m / 9.09 ft	1.40 m / 4.54 ft
30 m / 98 ft	5.25 m / 17.15 ft	4.20 m / 13.71 ft	2.10 m / 6.84 ft
40 m / 131 ft	7.00 m / 22.92 ft	5.59 m / 18.32 ft	2.79 m / 9.15 ft
50 m / 164 ft	8.75 m / 28.70 ft	6.99 m / 22.94 ft	3.50 m / 11.45 ft



Installation in vessel FMR250 **Optimum mounting position**



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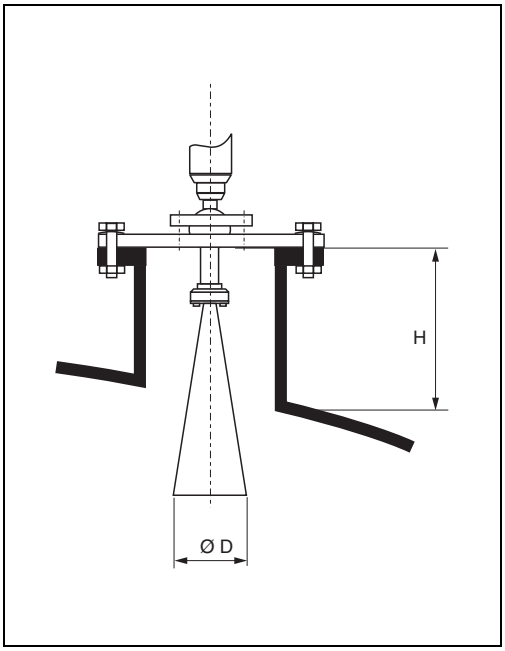
Standard installation FMR250 with horn antenna

- Observe installation instructions on Page 13.
- Marker is aligned towards vessel wall.
- The marker is always exactly in the middle between two bolt-holes in the flange.
- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.
- The horn antenna should protrude from the nozzle. If this is not possible for mechanical reasons, larger nozzle heights can be accepted.
  Note!
  Please contact Endress+Hauser for application with higher nozzle.
- **Vertical horn antenna.**
  Ideally, the horn antenna should be installed vertically.
  To avoid interference reflections or for optimum alignment within the vessel, the FMR250 with optional top target positioner can be swiveled by 15° in all directions.



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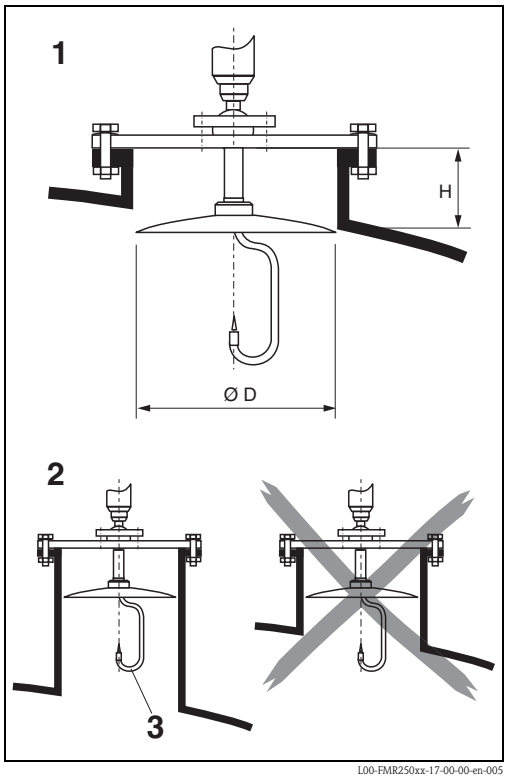
Antenna size	80 mm / 3"	100 mm / 4"
D [mm / inch]	75 / 3	95 / 3.7
H [mm / inch] (without antenna extension)	< 260 / < 10.2	< 330 / < 12.9 [1]

1) from 28.11.2005: H < 480 mm / 18.8 inch

Standard installation FMR250 with parabolic antenna

- Observe installation instructions on Page 13.
- Marker is aligned towards vessel wall.
- The marker is always exactly in the middle between two bolt-holes in the flange.
- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.
- Ideally the parabolic antenna should protrude from the nozzle (1).
  Particularly when using the top target positioner, please ensure that the parabolic reflector is protruding from the nozzle/roof so as not to inhibit alignment.
  Note!
  For application with higher nozzle install parabolic antenna completely in the nozzle (2), including RF-wave guide (3).
- **Vertical parabolic antenna.**
  Ideally, the parabolic antenna should be installed vertically.
  To avoid interference reflections or for optimum alignment within the vessel, the FMR250 with optional top target positioner can be swiveled by 15° in all directions.



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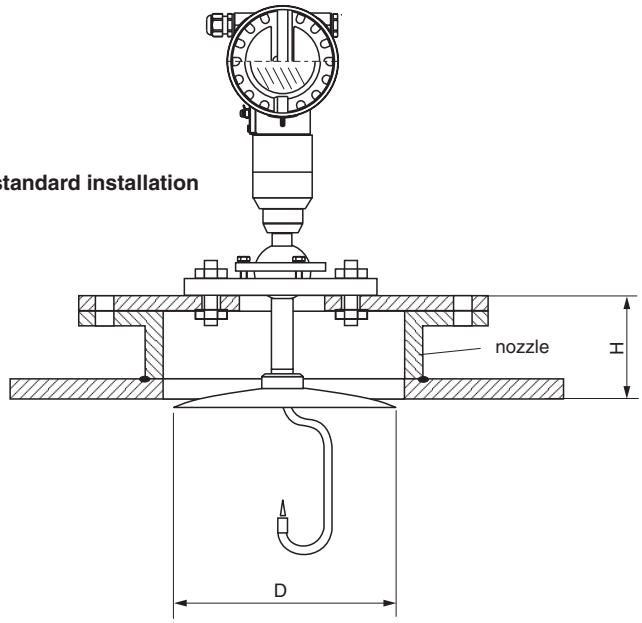
Antenna size	200 mm / 8"
D [mm / inch]	197 / 7.75
H [mm / inch] (without antenna extension)	< 50 / < 1.96

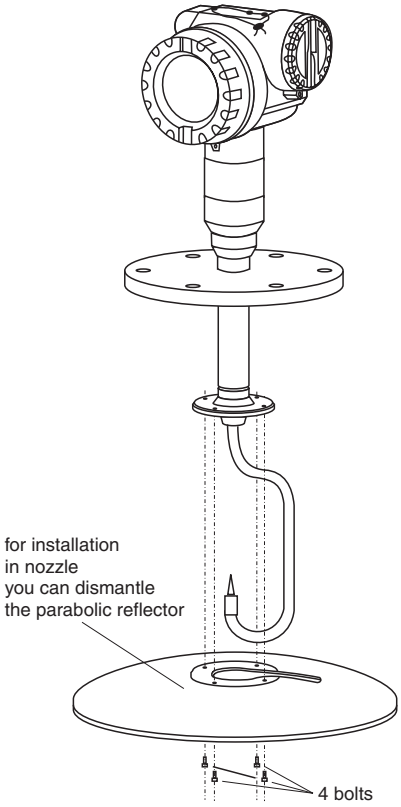
Examples for installation with small flange (< parabolic reflector)

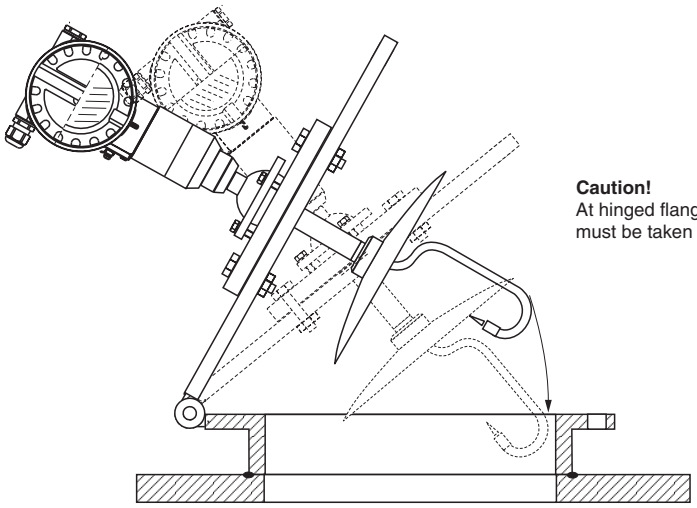
standard installation



Antenna size	200mm/8”
D [mm]	197
H [mm] 1)	< 50

1) without antenna extension





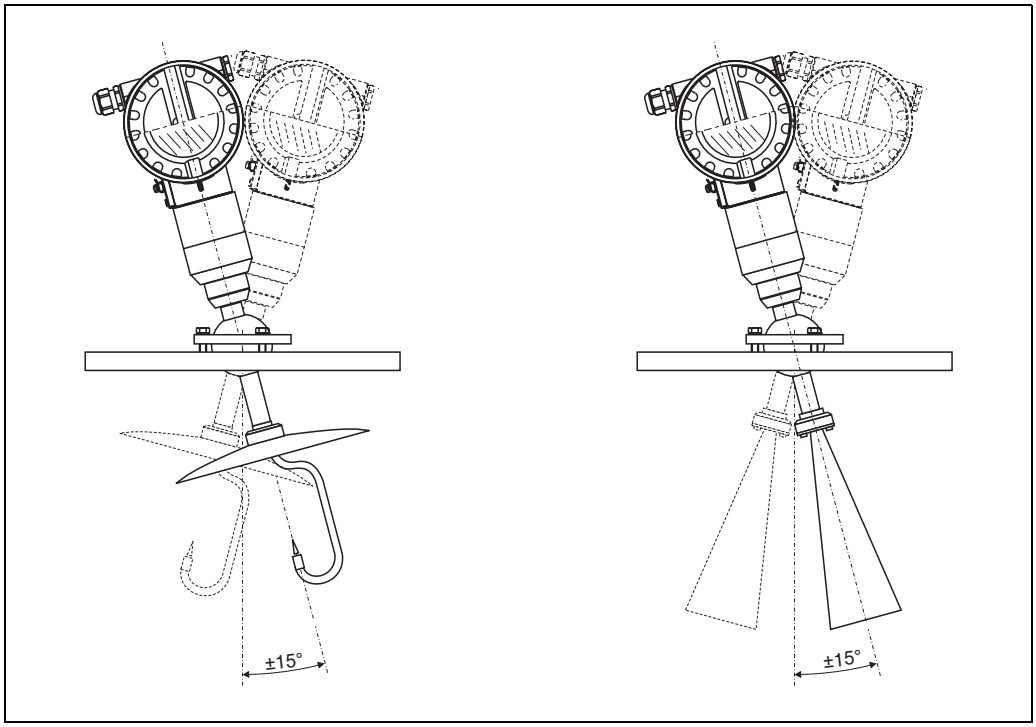
Caution!
At hinged flanges, the length of the antenna must be taken into account!

L00-FMR250xx-17-00-00-en-007

FMR250 with top target positioner

Optimum mounting position

Using top target positioner it is possible to tilt the antenna axis by up to 15° in all directions. The top target positioner is used for the optimum alignment of the radar beam with the bulk solids surface.



L00-FMR250xx-17-00-00-de-008

Align antenna axis:

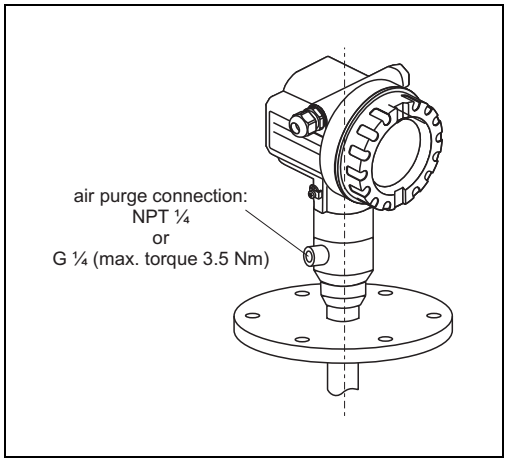
1. Loosen screws.
2. Align antenna axis (here this is possible up to max. ±15° in all directions).
3. Tighten screws.

Integrated air purge connection

In extremely dusty applications, the integrated air purge connection can prevent clogging of the antenna. Pulsed operation is recommended.

- Pulsed operation:
  max. pressure of purge air: 6 bar abs.
- Permanent operation:
  recommended pressure range of the purge air:
  200...500 mbar.

Caution!
Make sure to use dry purge air.



L00-FMR250xx-17-00-00-en-010

Operating conditions: Environment

Ambient temperature range

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

Storage temperature

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

Climate class

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

Degree of protection

- housing: IP 65, NEMA 4X (open housing and pulled out display: IP20, NEMA 1)
- antenna: IP 68 (NEMA 6P)

Vibration resistance

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

Cleaning of the antenna

The antenna can get contaminated, depending on the application. The emission and reception of microwaves can thus eventually be hindered. The degree of contamination leading to an error depends on the medium and the reflectivity, mainly determined by the dielectric constant 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 air purge connection). The material compatibility has to be considered if cleaning agents are used!
The maximum permitted temperature at the flange should not be exceeded.

Electromagnetic compatibility

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

Operating conditions: Process

Process temperature range / Process pressure limits

	Type of antenna		Seal	Temperature	Pressure	Wetted parts
FMR250	**E**	Standard	FKM Viton GLT	-40 °C ... +200 °C	-1 ... 16 bar [1]	PEEK, seal, 316L/1.4404/1.4435

↑

Ordering information see Page 29

1) E+H UNI flange: -1...1 bar (...14.5 psi)

Optional top target positioner: ±15°, seal: FMK Viton GLT

Dielectric constant

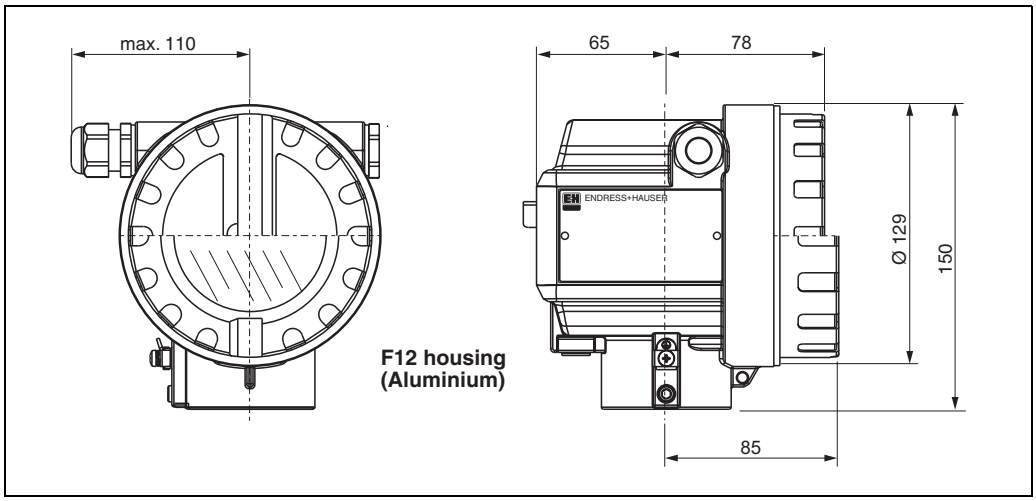
- in free space: $\varepsilon r \geq 1.6$ (for horizontal, even product surfaces: $\varepsilon r \geq 1.4$)

Mechanical construction

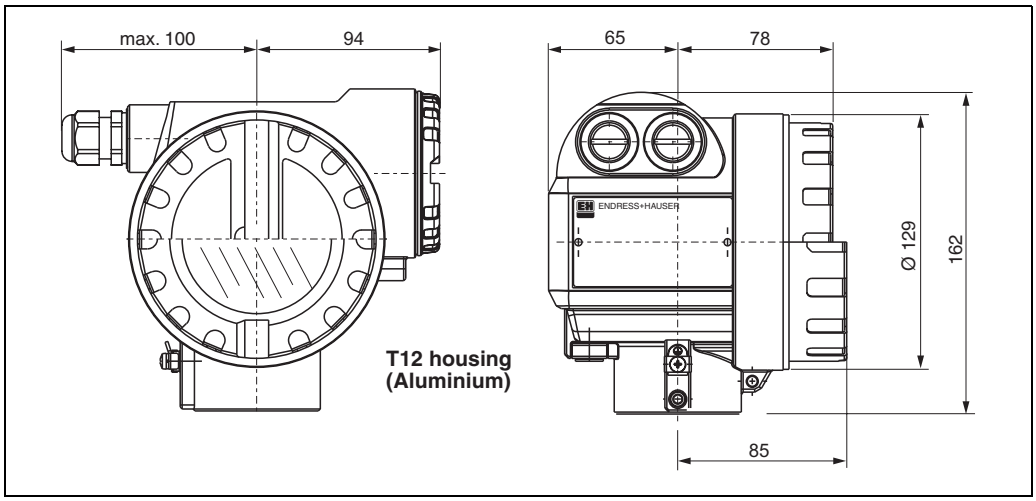
Design, dimensions

Housing dimensions

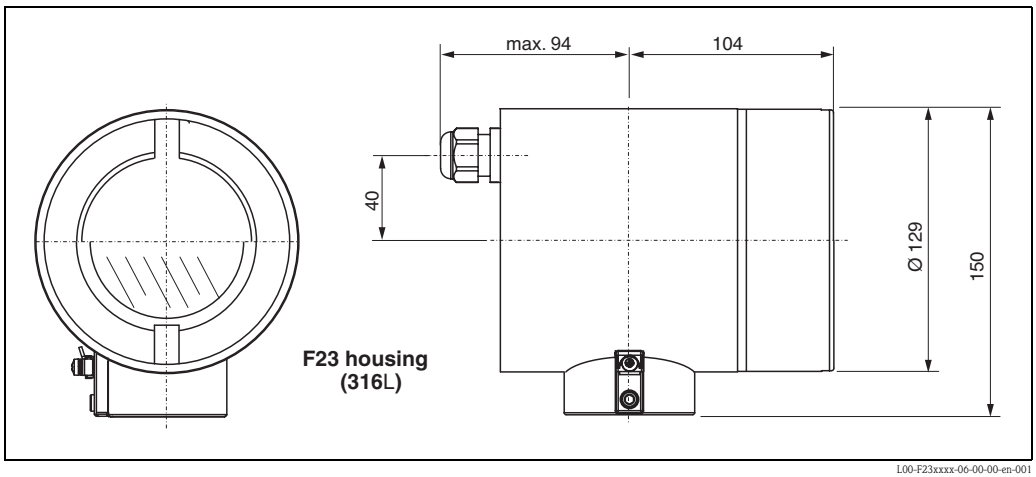
Dimensions for process connection and type of antenne see Page 21.



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



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

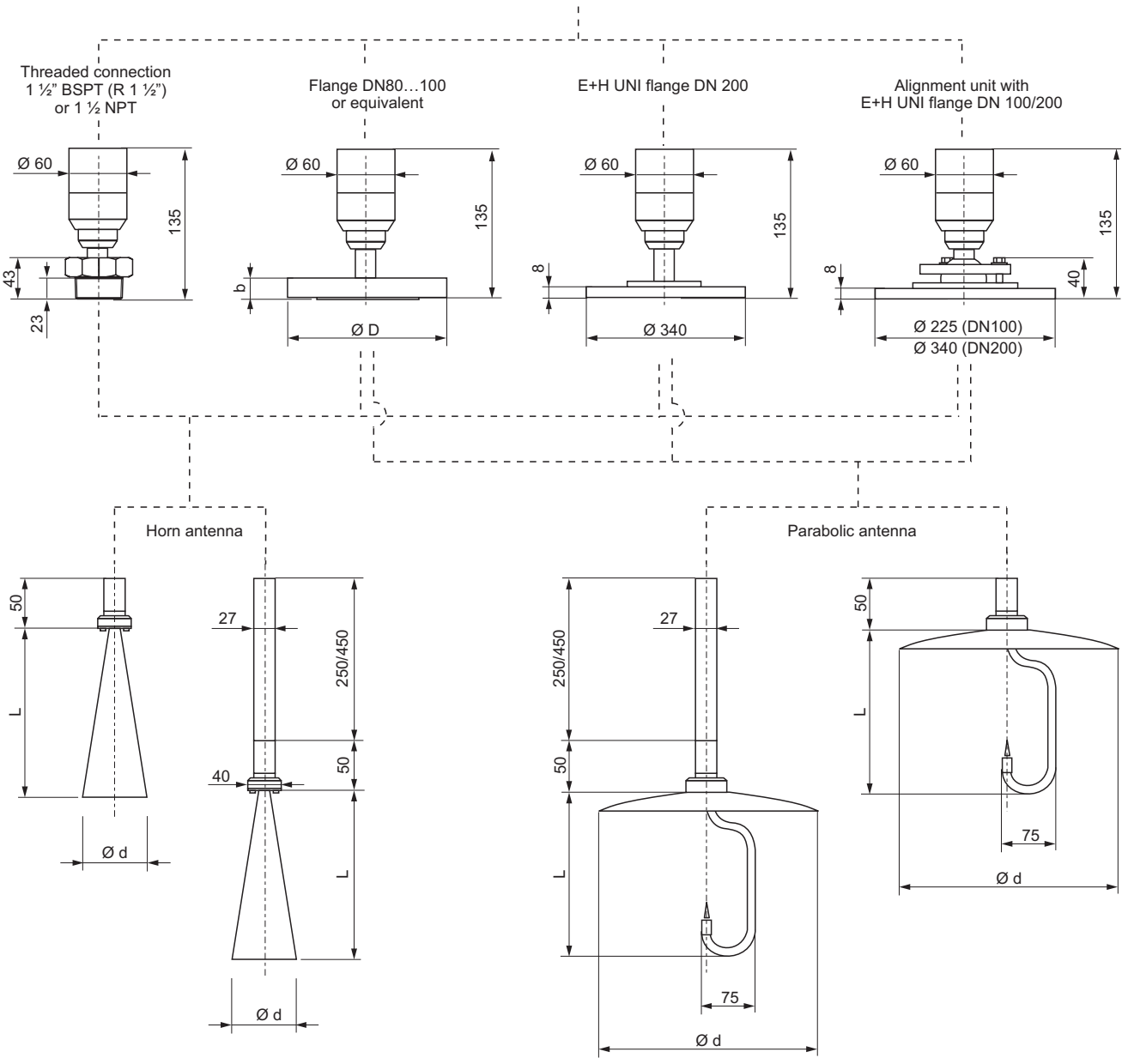


L00-F23xxxx-06-00-00-en-001

Micropilot M FMR250 - process connection, type of antenna

Housing dimensions see Page 20.

F12 / T12 / F23 housing



Horn antenna

Antenna size	80mm/3"	100mm/4"
L [mm]	211	282 [1]
d [mm]	75	95

1) 430 mm (from 28.11.2005)

Parabolic antenna

Antenna size	200mm/8"
L [mm]	195
d [mm]	197

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

Flange	DN 80	DN 100
b [mm]	20	20
D [mm]	200	220

for PN10/16

Flange to ANSI B16.5

Flange	3"	4"
b [mm]	23.9	23.9
D [mm]	190.5	228.6

for 150 lbs

Flange to JIS B2210

Flange	DN 80	DN 100
b [mm]	18	18
D [mm]	185	210

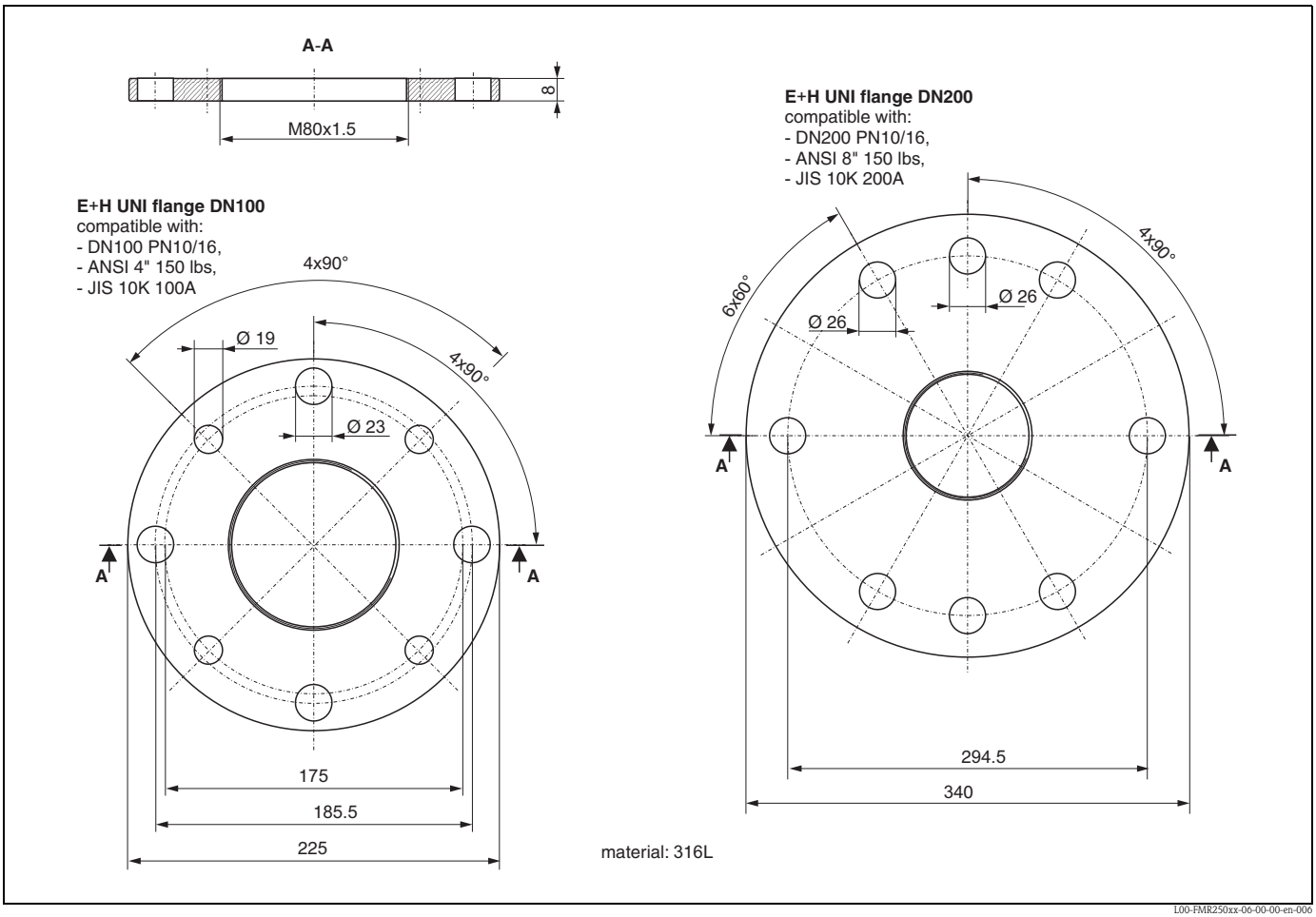
for 10K

L00-FMR250xx-06-00-00-en-005

E+H UNI flange

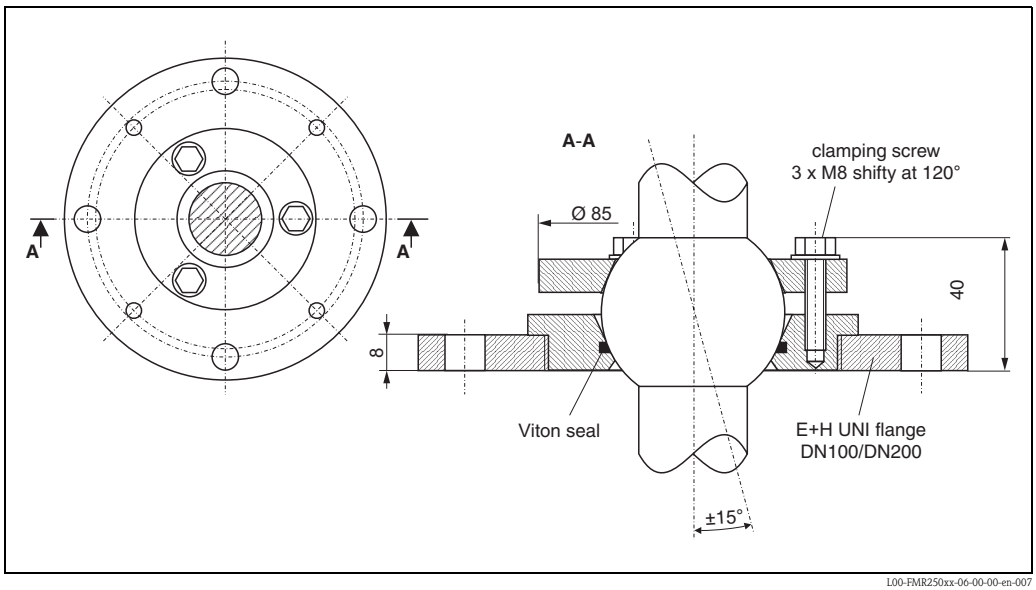
Installation hints

The number of bolts has sometimes been reduced. The bolt-holes have been enlarged for adaption of dimensions, therefore, the flange needs to be properly aligned to the counterflange before the bolts are tightened.



L00-FMR250xx-06-00-00-en-006

Top target positioner with E+H UNI flange



L00-FMR250xx-06-00-00-en-007

Weight

Micropilot M	FMR250
Weight for F12 or T12 housing	Approx. 6 kg + weight of flange
Weight for F23 housing	Approx. 9.4 kg + weight of flange

Material

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

Process connection

See "Ordering information" on Page 29-31.

Seal

See "Ordering information" on Page 29-31.

Antenna

See "Ordering information" on Page 29-31.

Human interface

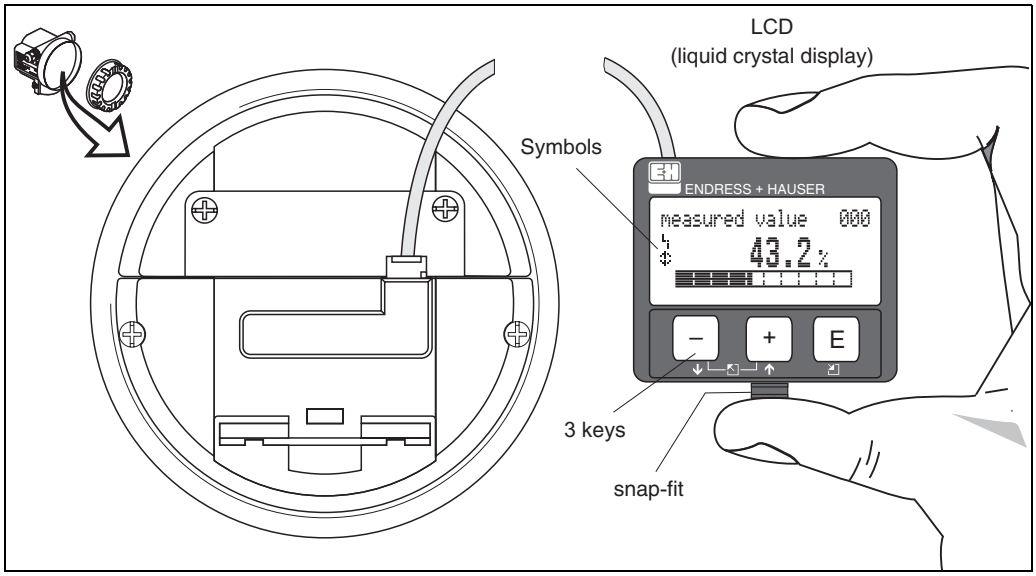
Operation concept

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

Display elements

Liquid crystal display (LCD):

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



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

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

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

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

Operating elements

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

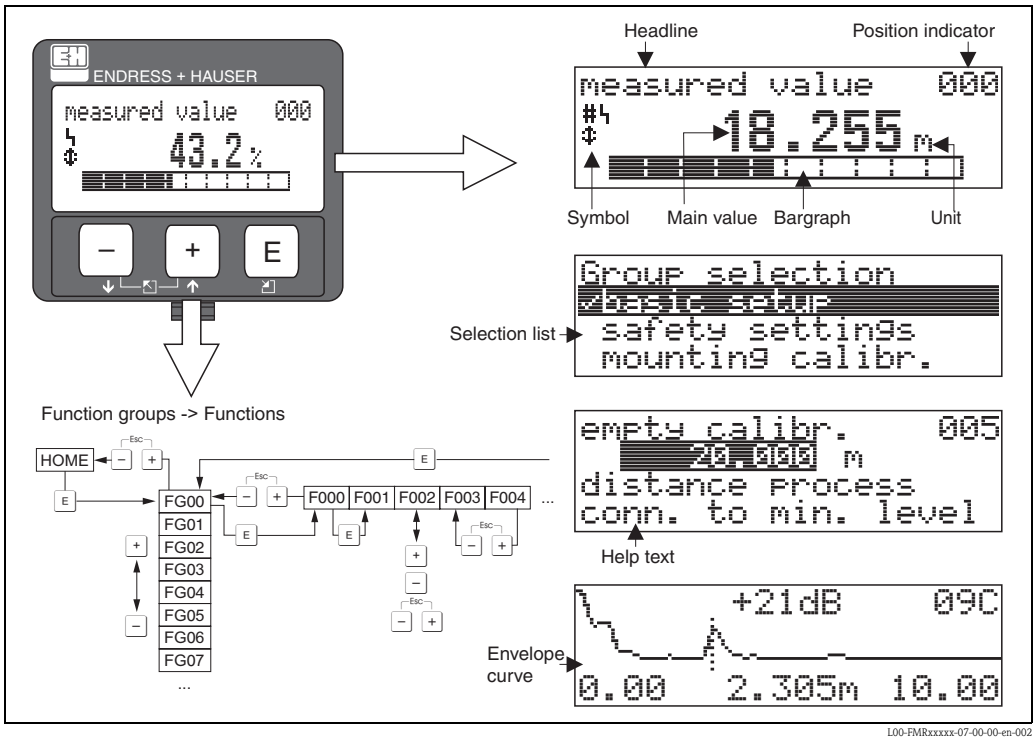
Function of the keys

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

On-site operation

Operation with VU331

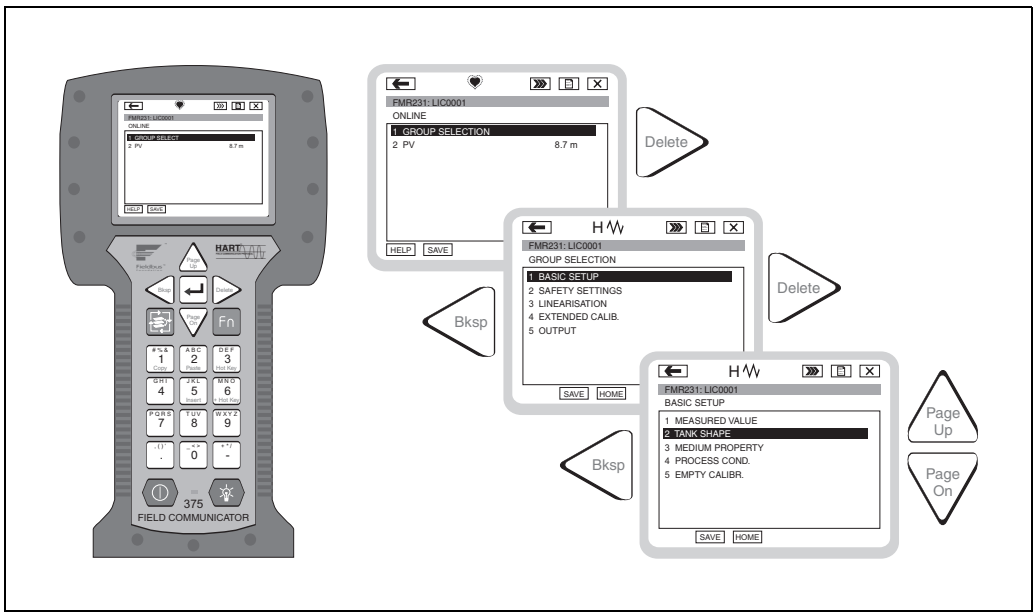
The LC-Display VU331 allows configuration via 3 keys directly at the instrument. All device functions can be set through a menu system. The menu consists of function groups and functions. Within a function, application parameters can be read or adjusted. The user is guided through a complete configuration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



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

Operation with handheld unit Field Communicator DXR375

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



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

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

Remote operation

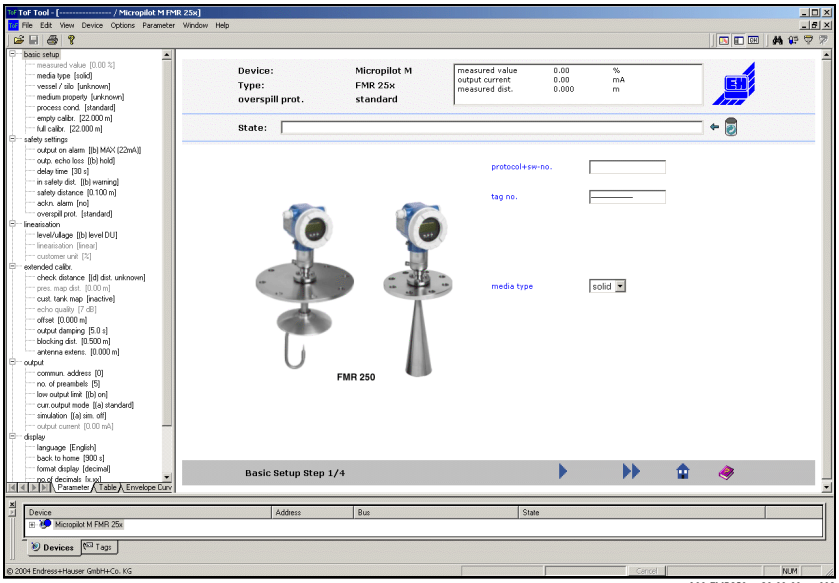
The Micropilot M can be remotely operated via HART. On-site adjustments are also possible.

Operation with ToF Tool

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

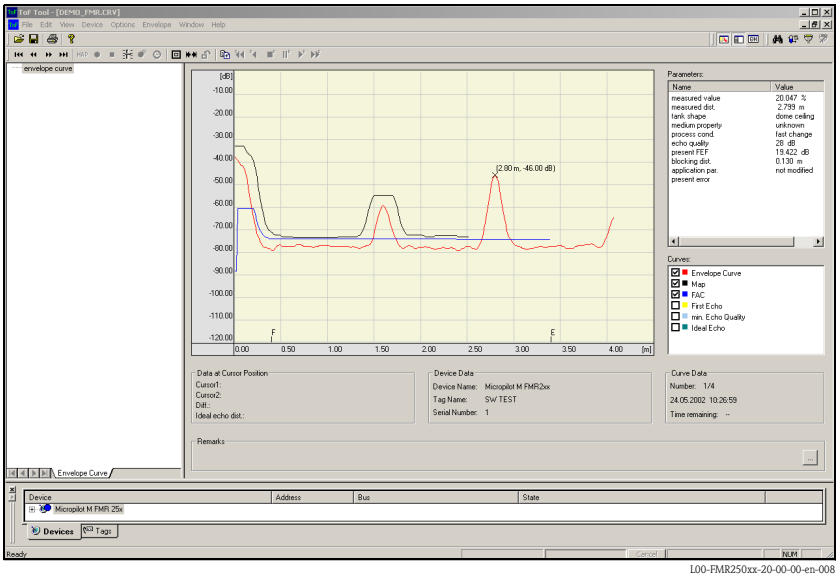
The ToF Tool supports the following functions:
- Online configuration of transmitters
- Signal analysis via envelope curve
- Linearisation table (create, edit, import and export)
- Loading and saving of instrument data (Upload/Download)
- Documentation of measuring point

Menu-guided commissioning:



L00-FMR250xx-20-00-00-en-002

Signal analysis via envelope curve:



L00-FMR250xx-20-00-00-en-008

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

Operation with FieldCare

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

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

Certificates and approvals

CE approval

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

Ex approval

See "Ordering information" on Page 29-31.

External standards and guidelines

EN 60529

Protection class of housing (IP-code)

EN 61010

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

EN 61326

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

NAMUR

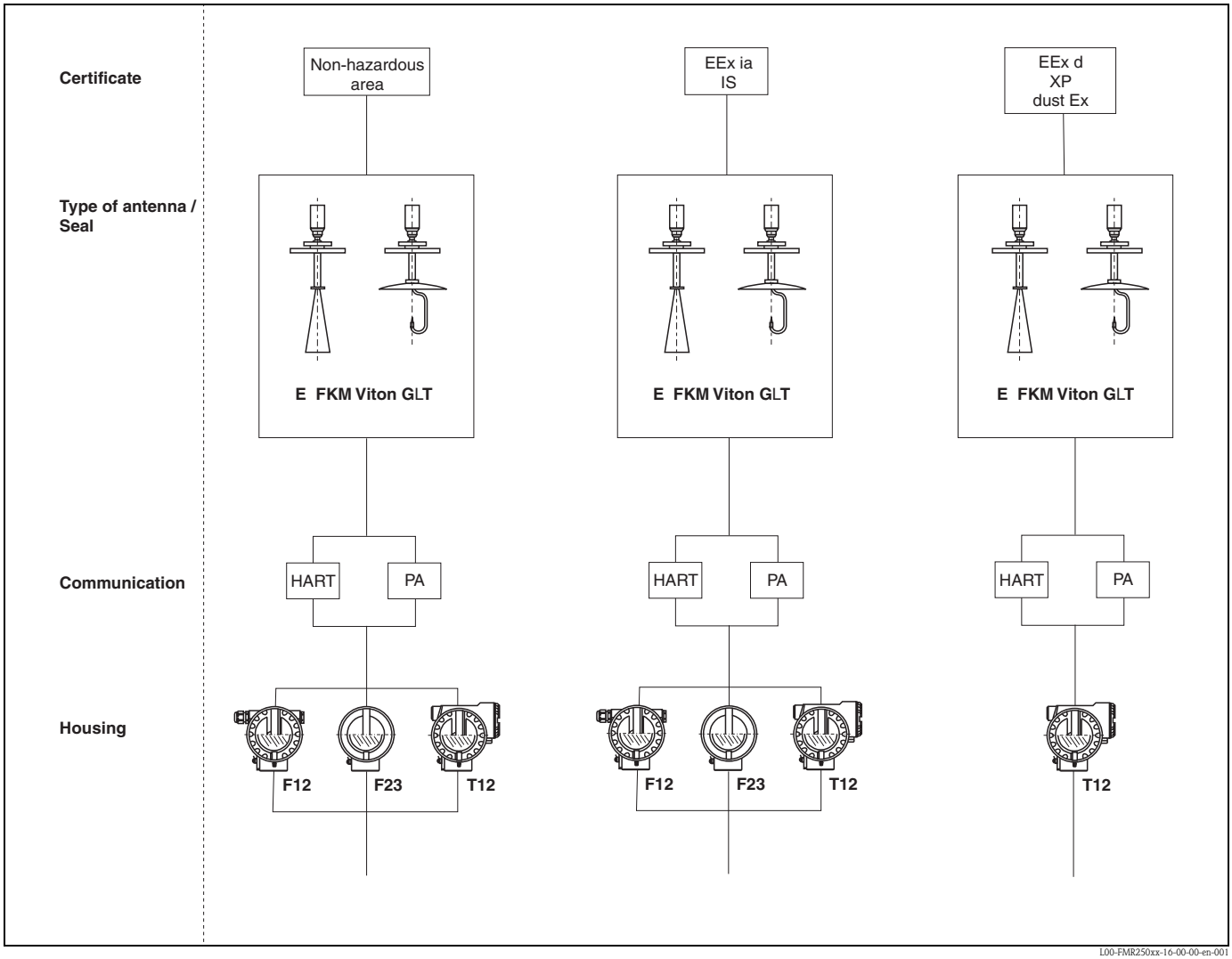
Standards committee for measurement and control in the chemical industry

RF approvals

R&TTE, FCC

Ordering information

Micropilot M FMR250 **Instrument selection**



Ordering structure Micropilot M FMR250

10	**Approval:**	
	A	Non-hazardous area
	1	ATEX II 1/2G EEx ia IIC T6
	4	ATEX II 1/2G EEx d [ia] IIC T6
	G	ATEX II 3G EEx nA II T6
	B	ATEX II 1/2GD EEx ia IIC T6, Alu blind cover
	C	ATEX II 1/2G EEx ia IIC T6, ATEX II 1/3D
	D	ATEX II 1/2D, Alu blind cover
	E	ATEX II 1/3D
	S	FM IS-Cl.I/II/III Div.1 Gr.A-G
	T	FM XP-Cl.I/II/III Div.1 Gr.A-G
	N	CSA General Purpose
	U	CSA IS-Cl.I/II/III Div.1 Gr.A-G
	V	CSA XP-Cl.I/II/III Div.1 Gr.A-G
	Y	Special version
20	**Antenna:**	
	4	Horn 80mm/3"
	5	Horn 100mm/4"
	6	Parabolic 200mm/8"
	9	Special version
30	**Antenna seal; Temperature:**	
	E	FKM Viton GLT; -40...200°C/-40...392 °F
	Y	Special version
40	**Antenna extension:**	
	1	Not selected
	2	250mm/10"
	3	450mm/18"
	9	Special version
50	**Process connection:**	
	GGJ	Thread DIN2999 R1-1/2, 316L
	GNJ	Thread ANSI NPT1-1/2, 316L
	X3J	UNI flange DN200/8"/200A, 316L max PN1/14.5lbs/1K, compatible DN200 PN10/16, 8" 150lbs, 10K 200A
	XCJ	Top target pos., UNI DN100/4"/100A, 316L max PN1/14.5lbs/1K, compatible DN100 PN10/16, 4" 150lbs, 10K 100A
	XEJ	Top target pos., UNI DN200/8"/200A, 316L max PN1/14.5lbs/1K, compatible DN200 PN10/16, 8" 150lbs, 10K 200A
	CMJ	DN80 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
	CQJ	DN100 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
	ALJ	3" 150lbs RF, 316/316L flange ANSI B16.5
	APJ	4" 150lbs RF, 316/316L flange ANSI B16.5
	KLJ	10K 80A RF, 316L flange JIS B2220
	KPJ	10K 100A RF, 316L flange JIS B2220
	YY9	Special version
60	**Output; Operation:**	
	A	4-20mA HART; 4-line display VU331, envelope curve display on site
	B	4-20mA HART; w/o display, via communication
	K	4-20mA HART; prepared for FHX40, remote display (Accessory)
	C	PROFIBUS PA; 4-line display VU331, envelope curve display on site
	D	PROFIBUS PA; w/o display, via communication
	L	PROFIBUS PA; prepared for FHX40, remote display (Accessory)
	Y	Special version
FMR250-		Product designation (part 1)

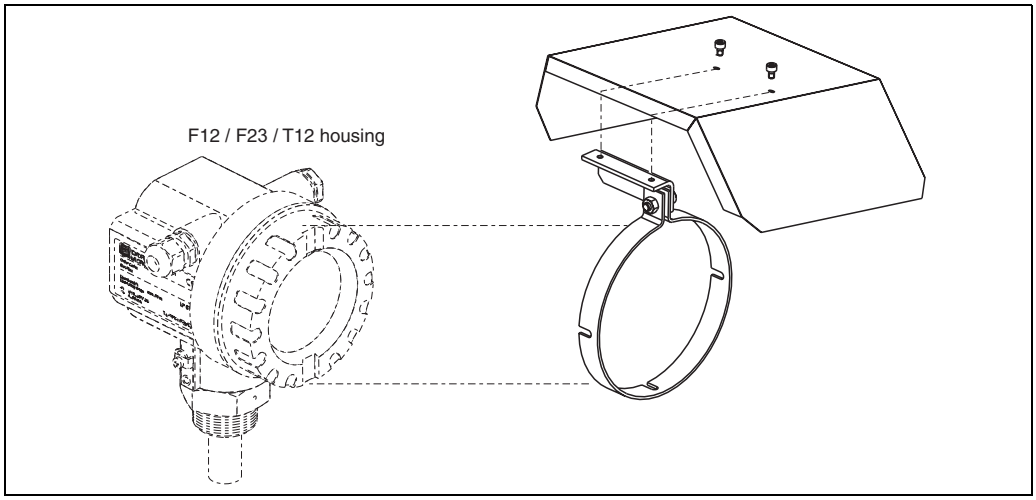
Ordering structure Micropilot M FMR250 (continued)

70		**Housing:**
	A	F12 Alu, coated IP65 NEMA4X
	B	F23 316L IP65 NEMA4X
	C	T12 Alu, coated IP65 NEMA4X, separate connection compartment
	D	T12 Alu, coated IP65 NEMA4X + OVP, separate connection compartment, OVP = overvoltage protection
	Y	Special version
80		**Cable entry:**
	2	Gland M20x1.5 (EEx d > thread M20)
	3	Thread G1/2
	4	Thread NPT1/2
	9	Special version
90		**Additional option:**
	K	Air purge connection G1/4
	M	Air purge connection NPT1/4
	Y	Special version
FMR250-		Complete product designation

Accessories

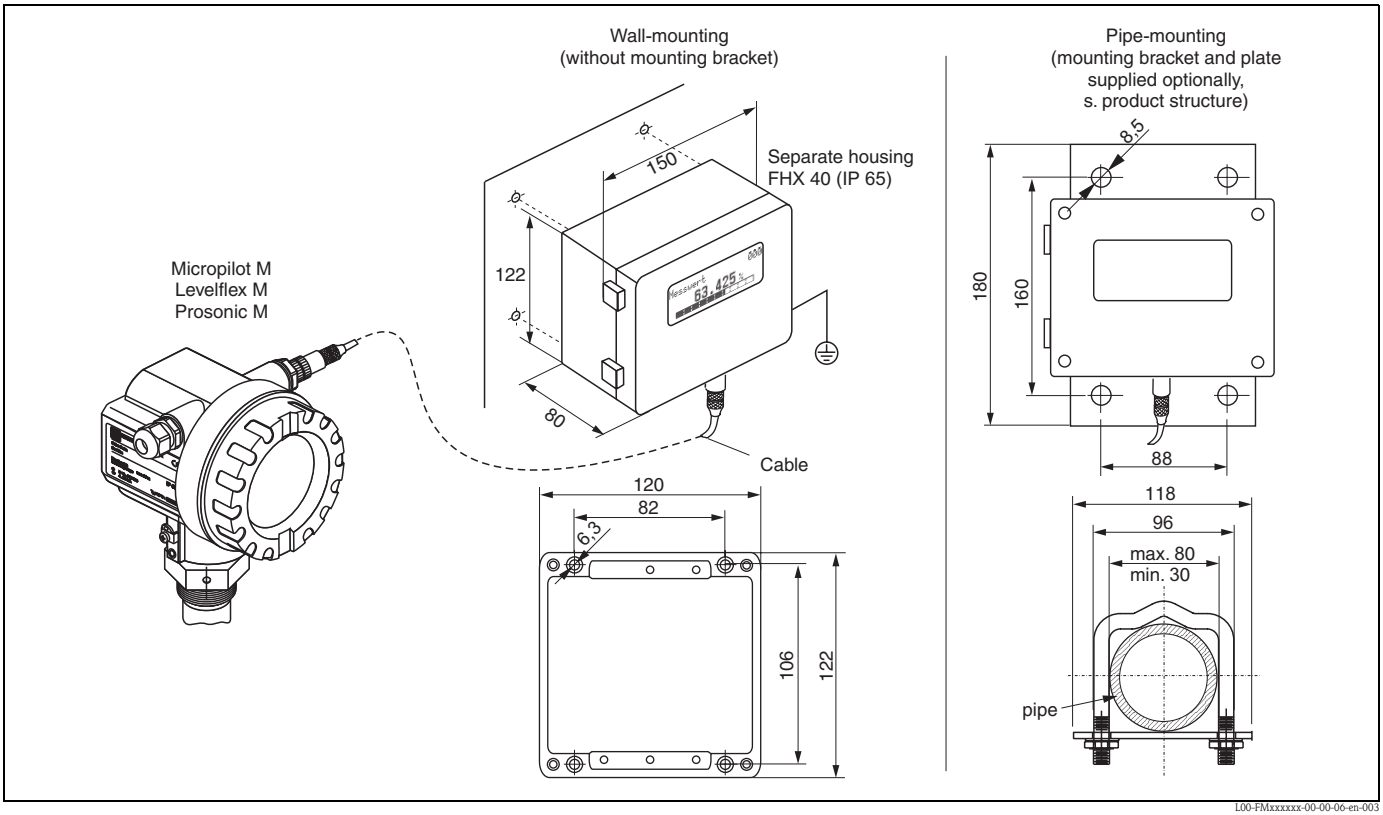
Weather protection cover

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



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

Remote display FHX40



L00-FMxxxxxx-00-00-06-en-003

Technical data (cable and housing) and product structure:

Max. cable length	20 m (65 ft)
Temperature range	-30 °C...+70 °C (-22 °F...158 °F)
Degree of protection	IP65 acc. to EN 60529 (NEMA 4)
Materials	Housing: AlSi12; cable glands: nickle plated brass
Dimensions [mm] / [inch]	122x150x80 (HxWxD) / 4.8x5.9x3.2

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

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

Commubox FXA191 HART

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

Commubox FXA195 HART

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

Service Interface FXA193

The Service-Interface connects the Service plug of Proline and ToF instruments with the 9 pin RS 232C interface of a PC. (USB connectors must be equipped with a usual commercial USB/Serial adapter.)

Product structure

	Approvals			
	A	For use in non-hazardous areas		
	B	ATEX II (1) GD		
	C	CSA/FM Class I Div. 1		
	D	ATEX, CSA, FM		
	9	other		
		Connection cable		
		B	Connection cable for ToF devices	
		E	Connection cable for Proline and ToF devices	
		H	Connection cable for Proline and ToF devices and Connection cable for Ex two-wire devices	
		X	without connection cable	
		9	others	
FXA193-				Complete product designation

Associated documentation

- Technical Information: TI063D
- Safety Instructions for ATEX II (1) GD: XA077D
- Supplementary information for the cable adapters: SD092D

Documentation

This supplementary documentation can be found on our product pages on "www.endress.com".

System Information

System Information for Micropilot, SI019F/00/en.

Technical Information

Fieldgate FXA320, FXA520

Technical Information for Fieldgate FXA320/520, TI369F/00/en.

Operating Instructions

Micropilot M

Correlation of operating instructions to the instrument:

Instrument	Output	Communication	Operating Instructions	Description of Instrument Functions	Brief Operating Instructions (in the Instrument)
FMR250	A, B	HART	BA284F/00/en	BA291F/00/en	KA235F/00/a2
	C, D	PROFIBUS PA	BA331F/00/de	BA291F/00/de	KA235F/00/a2

Certificates

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

Instrument	Certificate	Explosion protection	Output	Communication	Housing	PTB 04 ATEX	XA
FMR250	A	Non-hazardous area	A, B, C, D, K, L	HART, PROFIBUS PA	—	—	—
	1	ATEX II 1/2G EEx ia IIC T6	A, B, K	HART	A, B, D	2108	XA313F-A
			C, D, L	PROFIBUS PA	A, B, D	2108	XA343F-A
	4	ATEX II 1/2G EEx d [ia] IIC T6	A, B, K	HART	C	2108	XA314F-A
			C, D, L	PROFIBUS PA	C	2108	XA342F-A
	G	ATEX II 3G EEx nA II T6	A, B, C, D, K, L	HART, PROFIBUS PA	—	2108	XA233F-B
	B	ATEX II 1/2GD EEx ia IIC T6, Alu blind cover	A, B, K	HART	A, B	2108	XA312F-A
			A, B	HART	D	2108	XA312F-A
			C, D, L	PROFIBUS PA	A, B	2108	XA342F-A
			C, D	PROFIBUS PA	D	2108	XA342F-A
	C	ATEX II 1/2G EEx ia IIC T6 ATEX II 1/3D	A, B, K	HART	A, B	2108	XA312F-A
			A, B	HART	D	2108	XA312F-A
			C, D, L	PROFIBUS PA	A, B	2108	XA342F-A
			C, D	PROFIBUS PA	D	2108	XA342F-A
	D	ATEX II 1/2D, Alu blind cover	A, B, K	HART	C	2108	XA315F-A
			A, B	HART	A, B, D	2108	XA315F-A
			C, D, L	PROFIBUS PA	C	2108	XA345F-A
			C, D	PROFIBUS PA	A, B, D	2108	XA345F-A
	E	ATEX II 1/3D	A, B, K	HART	A, D, C	2108	XA315F-A
			A, B	HART	B	2108	XA315F-A
			C, D, L	PROFIBUS PA	A, D, C	2108	XA345F-A
			C, D	PROFIBUS PA	B	2108	XA345F-A

Correlation of Control Drawings (ZD) to the instrument:

Instrument	Certificate	Explosion protection	Output	Communication	Housing	ZD
FMR250	S	FM IS	A, B, K	HART	A, B	ZD168F/00/en
			A, B	HART	D	ZD168F/00/en
			C, D, L	PROFIBUS PA	A, B	in preparation
			C, D	PROFIBUS PA	D	in preparation
	T	FM XP	A, B, K C, D, L	HART PROFIBUS PA	C	ZD169F/00/en
	U	CSA IS	A, B, K	HART	A, B	ZD170F/00/en
			A, B	HART	D	ZD170F/00/en
			C, D, L	PROFIBUS PA	A, B	in preparation
			C, D	PROFIBUS PA	D	in preparation
	V	CSA XP	A, B, K C, D, L	HART PROFIBUS PA	C	ZD171F/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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