



Technical Information

Micropilot S FMR530/531/532/533

Level-Radar

Smart Transmitter for continuous and non-contact precision level measurement. For custody transfer and inventory control applications with NMI- and PTB-approvals.



Application

The Micropilot S is used for highly accurate level measurement in storage tanks and can be applied in custody transfer applications. It meets the relevant requirements according to OIML R85 and API 3.1B.

- The FMR533 with parabolic antenna is excellently suited for free space applications up to 40 m (131 ft).
- The FMR532 with planar antenna is specifically suited for stilling well applications with ranges up to 38 m (124 ft).
- The FMR531 with rod antenna is used for highly accurate measurements of very aggressive products and in narrow nozzles.
- The FMR530 with horn antenna is suitable for free space applications that disallow the use of a parabolic antenna due to tank/nozzle geometry.

Your benefits

- 0.5 mm accuracy (2σ value)
- National approvals (NMI, PTB) for custody transfer.
- Applicable as stand-alone system or tied into tank gauging systems via the Tank Side Monitor NRF590.
- Easy on-site operation via menu-driven alphanumeric display.
- Easy commissioning, documentation and diagnostics via FDT/DTM technology (FieldCare).
- Application-specific antenna selection. Planar antenna versions allow direct installation on tapered stilling wells.
- Cost-effective and simple installation via 4-wire cable with HART and 24 V DC intrinsically safe power supply.
- Gas-tight process connection (second line of defense) standard for any antenna version.
- Inventory Control Version with reduced accuracy (3 mm) available for all instrument types.

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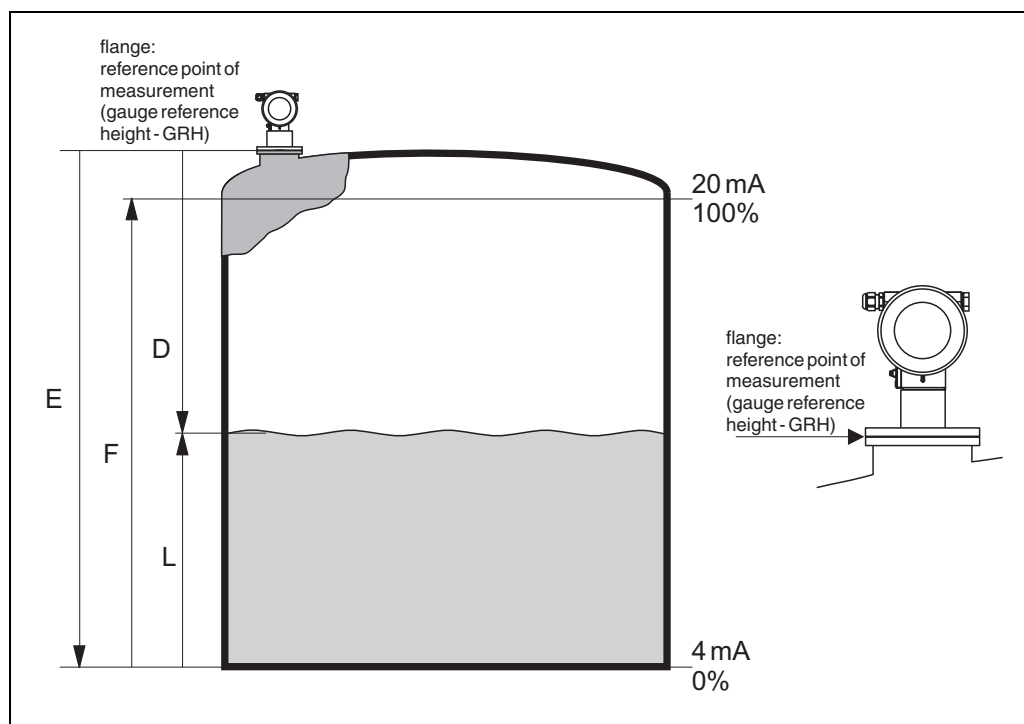
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Function and system design

Measuring principle

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



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 mm-accuracy of the Micropilot S could be achieved with the patented algorithms of the PhaseMaster® software.

The distance D to the product surface is proportional to the time of flight t of the impulse:

$$D = c \cdot t/2,$$

with c being the speed of light.

Based on the known empty distance E , the level L is calculated:

$$L = E - D$$

Refer to the above figure for the reference point for "E".

The Micropilot is equipped with functions to suppress interference echoes. The user can activate these functions. They ensure that interference echoes (i.e. from edges and weld seams) are not interpreted as level echo.

Output

The Micropilot is commissioned by entering an empty distance E (=zero), a full distance F (=span) and an application parameter. The application parameter automatically adapts the instrument to the process conditions. The data points "E" and "F" correspond with 4mA and 20mA for instruments with current output. They correspond with 0 % and 100 % for digital outputs and the display module.

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

Equipment architecture

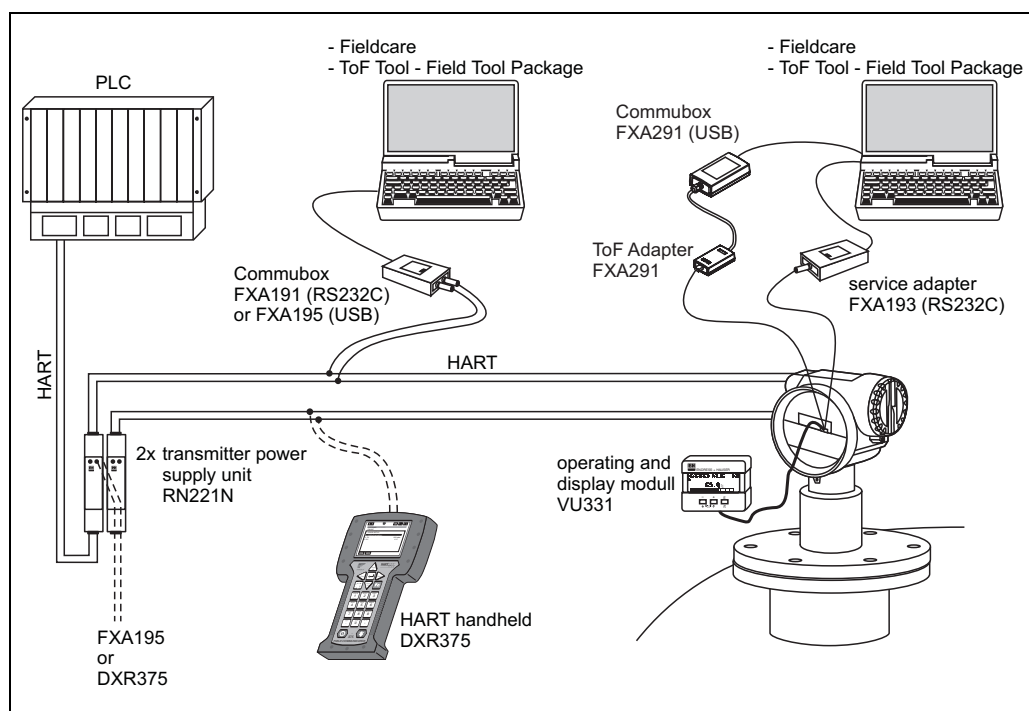
Stand-alone

The Micropilot S can be used for measurement in a stilling well as well as in free space. The different instrument versions are applied as follows:

- The Micropilot S FMR532 with planar antenna is the preferred device in stilling wells ≥ 150 mm.
- In stilling wells with a diameter < 150 mm, the Micropilot S FMR532 can be applied in connection with a suitable reducing adapter. For more information please contact your Endress+Hauser representative.
- The Micropilot S FMR533 with parabolic antenna is preferred for free-space measurements. The Micropilot S FMR530 with horn antenna can be used as an alternative for small nozzle. It is essential to keep the minimum distance from the tank wall.
- The Micropilot S FMR531 with rod antenna (PTFE) should be used for measurements of highly aggressive media (e.g. sulphur).
- The instruments are equipped with a passive 4...20 mA output with HART protocol.
- Reliable transmission of a measurement with mm accuracy is only ensured by the HART 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 (RS232C) or FXA291 and ToF Adapter FXA291 (USB) 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 FXA195 and the operating software "ToF Tool - FieldTool Package" respectively "FieldCare".
- With a Personal Computer, TSM (Tank Side Monitor) and the operating software FuelsManager.

Integration into the Asset Management System

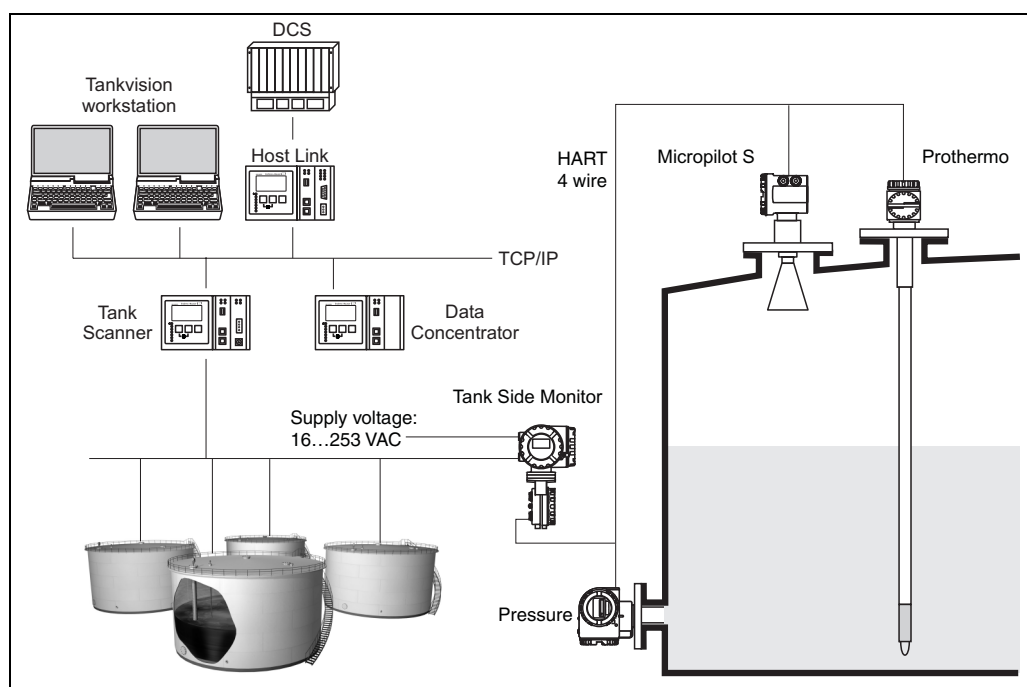
The HART interface allows the integration into the AMS® (Asset Management System) from Fisher-Rosemount.

Custody transfer applications

The Micropilot S is suitable for custody transfer and inventory control applications. The on-site testing has to be done in compliance with the applicable regulatory standards. The Micropilot S can be sealed after successful on-site calibration to be protected against any access to the electronics compartment and any changes of software settings. If the Micropilot S is used for custody transfer or inventory control, any temperature influence on the tank shell height can be compensated for using the Tank Side Monitor (TSM). In addition, the vertical movement of the gauge reference point due to the hydrostatic tank deformation can be compensated in the Tank Side Monitor. A Tank Side Monitor can provide 24 VDC for a Micropilot S. The Tank Side Monitor can communicate with up to 6 devices via HART Multidrop.

Integrated in tank gauging system

The Endress+Hauser Tank Side Monitor NRF590 provides integrated communications for sites with multiple tanks, each with one or more sensors on the tank, such as radar, spot or average temperature, capacitive probe for water detection and/or pressure sensors. Multiple protocols out of the Tank Side Monitor guarantee connectivity to nearly any of the existing industry standard tank gauging protocols. Optional connectivity of analog 4...20 mA sensors, digital I/O and analog output simplify full tank sensor integration. Use of the proven concept of the intrinsically safe HART bus (HART multidrop) for all on-tank sensors yields extremely low wiring costs, while at the same time providing maximum safety, reliability and data availability.



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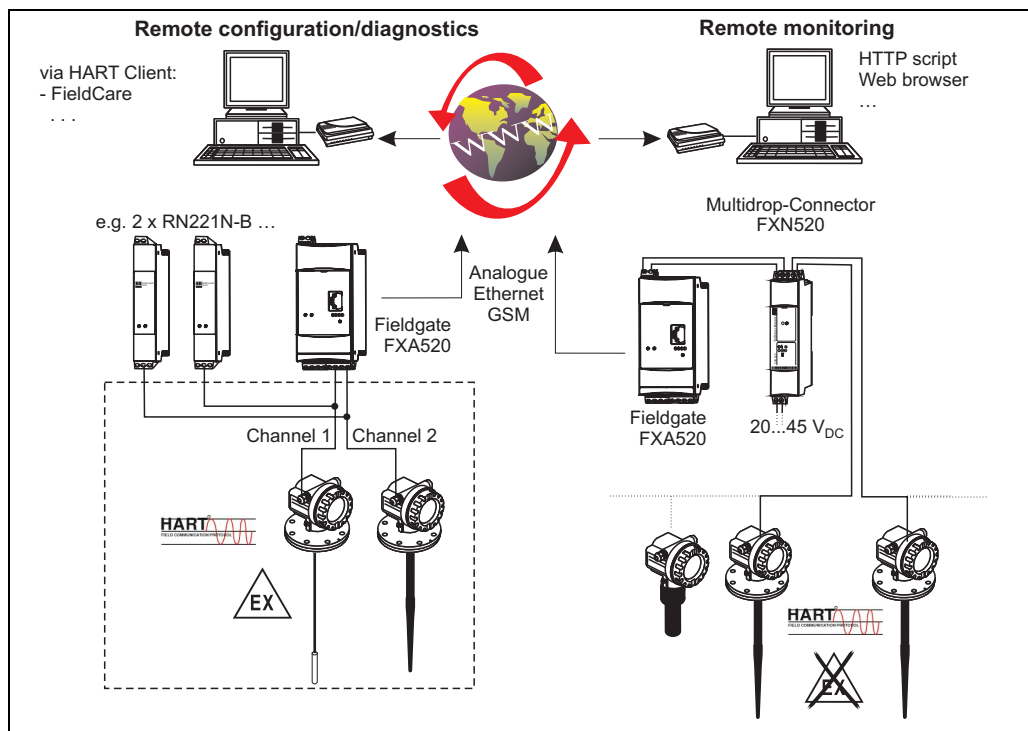
System integration via Fieldgate

Vendor Managed Inventory

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

Remote maintenance of measuring equipment

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



Note!

The number of instruments which can be connected in multidrop mode can be calculated by the "FieldNetCalc" program. A description of this program can be found in Technical Information TI 400F (Multidrop Connector FXN520). The program is available from 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 GRH (mounting flange) and a reflective surface (e.g. product surface). The measured value and all parameters are displayed using either metrical SI-units or US/UK-units (inch, ft, ...).

The level is calculated based on the tank height entered.

In order to compensate for non-linear effects like movement of the tank roof, an additional correction table (diptable) can be entered.

Antenna selection for Micropilot S-series

It is essential for each and every application and installation to evaluate the right antenna type.

The antenna selection depends on the following criteria:

- Type of application (i.e. free space vs. stilling well)
- Installation possibilities (size, location and height of nozzle)
- Properties of the product stored in the tank (radar reflectivity, vapor pressure, temperature, etc.)
- Accuracy requirements

The Micropilot S series radar comes with 4 basic radar antenna forms.

For stilling well applications:

- Planar stilling well antenna (FMR532)

For free space applications:

- Rod antenna (FMR531)
- Horn antenna [FMR530 > 4" (DN100)]
- Parabolic antenna (FMR533)

Each of these antennas fits specific applications:

Planar antenna (for stilling well)

The planar stilling well antenna is specially designed for stilling well applications only. The emitted circular mode radar pattern is a must for high accuracy applications on stilling wells. This special mode allows the software to compensate for variations of the inside diameter of the stilling well and layering of adhering product. The diameter of the antenna itself fits in 6" (DN150) stilling wells directly. Cone adapters allow installation on larger diameter stilling wells. A good match between well and adapter is essential. The Endress+Hauser planar antenna with pulsed radar technology allows direct installation even on tapered stilling wells – a unique feature.



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Parabolic antenna

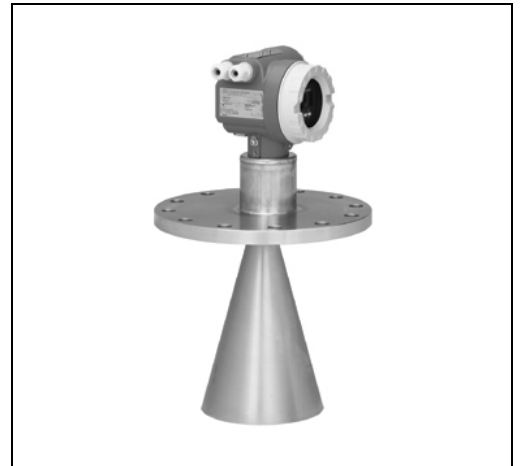
The parabolic antenna is the largest free space antenna with the smallest beam angle. It is ideal for applications close to tank walls, where a manway cover is available. The parabolic antenna is also an excellent choice on products with a low reflectivity, such as asphalts and bitumens.



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Horn antenna

For free space applications, it is essential that the horn extends below the nozzle (see Page 20). The general rule for diameter selection is "the larger, the better," as a larger aperture of the antenna generates a narrower beam and has a better gain – signal to noise (S/N) ratio.



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Rod antenna

The rod antenna is ideal for tanks where only small diameter nozzles are available and tanks containing condensing products (or heavy water condensation) or corrosive products, such as sulphur, as the rod is easy to clean and has good "drip-off" properties. The "inactive" length of the antenna should extend below the nozzle (see Page 21).



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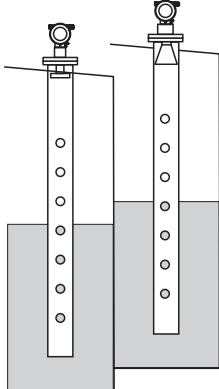
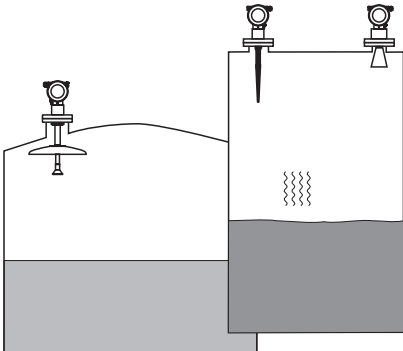
Measuring range

The usable measuring range depends on the size of the antenna, the reflectivity of the medium, the mounting location, and eventual interference reflections.

The following tables describe the groups of media as well as the achievable measuring range as a function of application and media group. If the dielectric constant of a medium is unknown, it is recommended to assume media group B to ensure a reliable measurement.

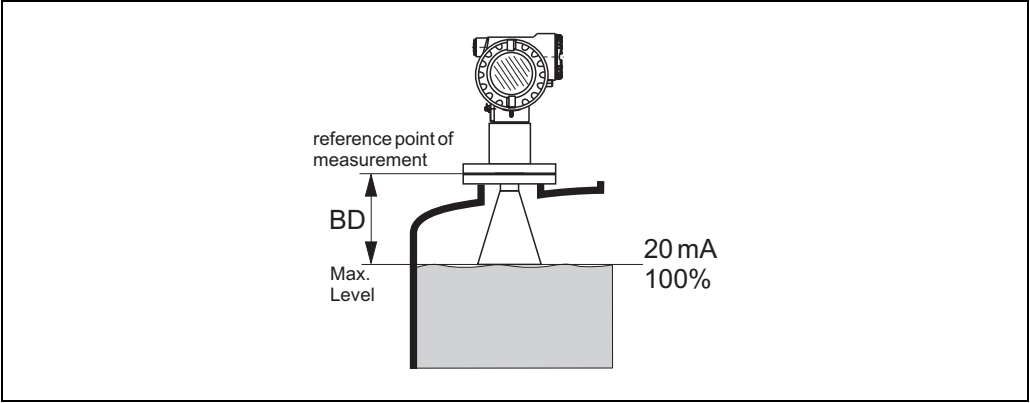
Media group	DC (ϵ_r)	Examples
A	1.4...1.9	non-conducting liquids, e.g. liquefied gas (LPG). For more information please contact your Endress+Hauser representative.
B	1.9...4	non-conducting liquids, e.g. benzene, oil, toluene, white products, black products, crudes, bitumen/asphalts, ...
C	4...10	e.g. concentrated acids, organic solvents, esters, aniline, alcohol, acetone, ...
D	> 10	conducting liquids, e.g. aqueous solutions, dilute acids and alkalis

Measuring range depending on vessel type, conditions, and product for Micropilot S

Media group		Stilling well/ Bypass	Free space (Storage tank)		
					
		Measuring range	Measuring range		
A	DC (ϵ_r) = 1.4...1.9	FMR532 ≥ DN150	FMR533	FMR530 DN150/200/250	FMR531
		38 m/124 ft	—	—	—
	DC (ϵ_r) = 1.9...4	38 m/124 ft	40 m/131 ft	DN150: 10 m/33 ft DN200/250: 15/49 ft m	10 m/33 ft
	DC (ϵ_r) = 4...10	38 m/124 ft	40 m/131 ft	DN150: 15 m/49 ft DN200/250: 20 m/65 ft	15 m/49 ft
	DC (ϵ_r) > 10	38 m/124 ft	40 m/131 ft	DN150: 20 m/65 ft DN200/250: 25 m/82 ft	20 m/65 ft
max. measuring range with custody transfer approvals		NMi: 25m/82 ft PTB: 30 m/98 ft	NMi: 25 m/82 ft PTB: 30 m/98 ft	NMi and PTB: DN150: 20 m/65 ft DN200/250: 25 m/82 ft	NMi and PTB: 10 m/33 ft

Blocking distance

The blocking distance (= BD) is the minimum distance from the reference point of the measurement (mounting flange) to the medium surface at maximum level.



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Blocking distance (BD) ¹	Stilling well / Bypass	Free space (Storage tank)		
		FMR532	FMR530	FMR531
from flange	1 m/40"	1 m/40"	Length of horn (see Page 28)	390 mm/15" 540 mm/21"

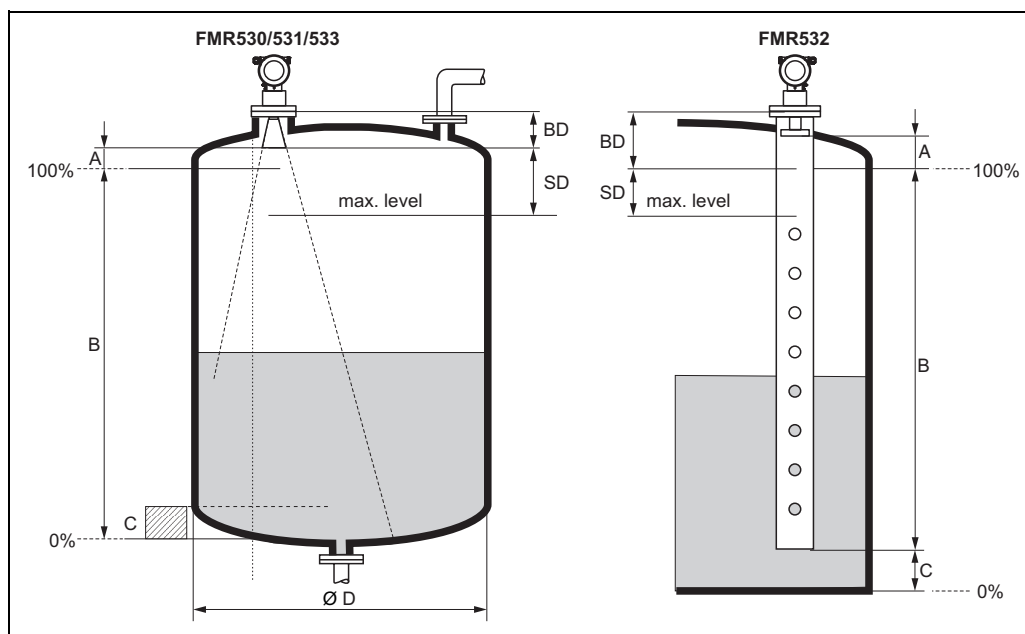
1) 1 mm accuracy under reference conditions

Note!

- If an antenna extension is used, its length has to be added.
- Inside the blocking distance of FMR532/533, a reliable measurement can not be guaranteed.

Measuring conditions

- 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.
- For **overspill protection**, it is possible to define a safety distance (**SD**) additionally to the blocking distance (**BD**).
- Depending on its consistence, foam can either absorb microwaves or reflect them off the foam surface. Measurement is possible under certain conditions.
- Distance **B** defined the smallest recommended measurement range.
- Tank diameter and height should be at least dimensioned such that a reflection of the radar signal on both sides of the tank can be ruled out (see »Beam angle« on Page 18).
- **FMR530, FMR531, FMR533:** 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.
- **FMR532:** The zero should be positioned at the end of the tube, as the electromagnetic waves do not propagate completely outside the tube. It must be taken into account that the accuracy may be reduced in the area C. In order to guarantee the required accuracy in these cases, it is recommended to position the zero-point at a distance **C** above the tank bottom (see Fig.).
- In principle it is possible to measure up to the tip of the **rod** and **horn** antenna. However, due to considerations regarding accuracy corrosion and build-up, the end of the measuring range should not be chosen any closer than 50 mm (2") to the tip of the **rod** and **horn** antenna (see **A** in Fig.).
- In applications with **planar** or **parabolic** antennas, especially for media with low dielectric constants (group A and B see Page 10), the end of the measuring range should not be closer than 1 m (40") to the flange (cf. **BD** in Fig.).
- This safety distance (**SD**) is set to 0.1 m (4") by default for FMR530 (horn antenna) and FMR531 (rod antenna) and generating an alarm in case the product level rises inside the safety distance.
- For FMR533 (parabolic antenna) and FMR532 (planar antenna) the safety distance (**SD**) is set to 0.5 m (20") by default, generating an alarm in case the product level rises inside the safety distance.



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	reference: flange / BD (cf. picture)		reference: antenna tip (cf. picture)		
	Blocking distance	Safety distance	recommended additional settings		
	BD [m / ft]	SD [m / ft]	A [mm / inch]	B [m / ft]	C [mm / inch]
FMR530 (horn)	horn length	0.1 / 0.3	50 / 2	0.5 / 1.6	150...300 / 6...12
FMR531 (rod)	0.39/1.3 or 0.54/1.8	0.1 / 0.3	50 / 2	0.5 / 1.6	150...300 / 6...12
FMR532 (planar)	1 / 3.28"	0.5 / 1.6	1000 / 40	0.5 / 1.6	150...300 / 6...12
FMR533 (parabolic)	1 / 3.28	0.5 / 1.6	1000 / 40	0.5 / 1.6	150...300 / 6...12

Behaviour if measuring range is exceeded

The behaviour in case of the measuring range being exceeded can be freely set: the default setting is a current of 22 mA and the generation of a digital warning (E681).

Output

Output signal

- 4...20 mA with HART protocol (e.g. for multidrop connection to the Tank Side Monitor NRF 590): this version can be operated via the PC operating software ToF Tool. The instrument supports both point-to-point and multidrop operation.
For measurements with mm accuracy, the measured value must be transmitted via the HART protocol in order to ensure the required accuracy.

Signal on alarm

Error information can be accessed via the following interfaces:

- Local display:
 - Error symbol
 - Plain text display
 - LED's: red LED continuously on = alarm, red LED flashes = warning
- Current output
- Digital interface

Linearization

The linearization function of the Micropilot S 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.

Galvanic isolation

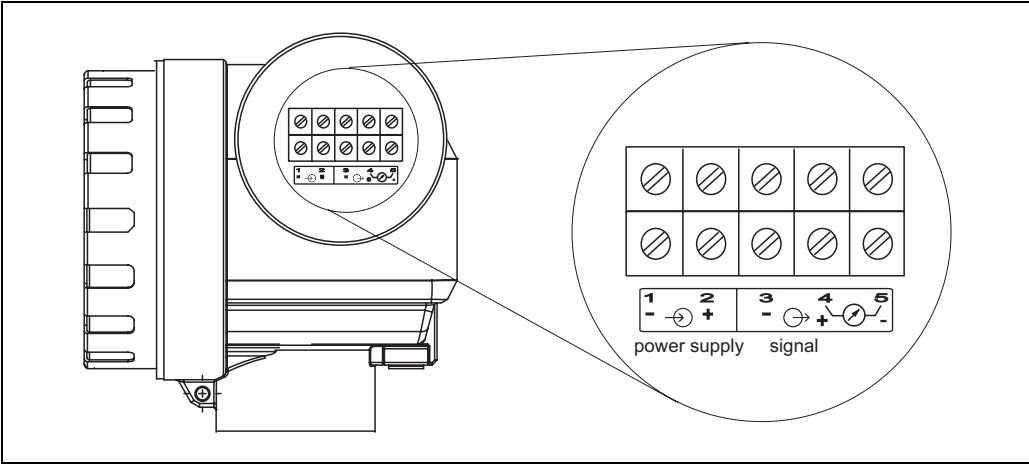
500 V towards ground.
500 V between power supply and signal.

Auxiliary energy

Electrical connection

Terminal compartment

The housing features a separate terminal compartment.

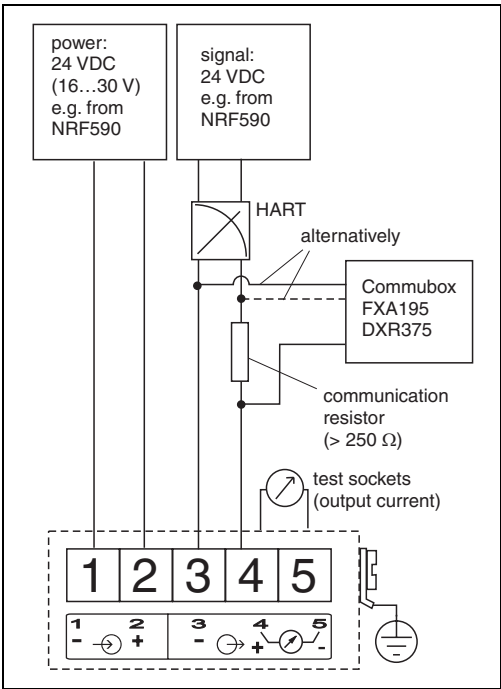


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Terminal assignment

4...20 mA with HART

The 4-wire cable is connected to the screw terminals (wire diameter 0.5...2.5 mm) in the terminal compartment. Use 4-wire twisted pair cable with screen for the connection. Protective circuitry against reverse polarity, RFI, and over-voltage peaks is built into the device (refer to TI241F »basics for EMC-tests«). Refer to TI402F for connection to the Tank Side Monitor NRF 590.



L00-FMRS3xxx-04-00-00-en-003

Load HART

Minimum load for HART communication: 250 Ω

Supply voltage

DC voltage: 16...36 VDC

Communication		Terminal voltage	minimum	maximum
Power supply	Standard	U (20 mA) =	16 V	36 V
	Ex	U (20 mA) =	16 V	30 V
Signal	Ex	U (4 mA) =	11.5 V	30 V
		U (20 mA) =	11.5 V	30 V

Cable entry	Cable gland: 2 x M20x1.5 Cable entry: 2 x G ½ or 2 x ½ NPT
Power consumption	Max. 330 mW at 16 V, max. 500 mW at 24 V, max. 600 mW at 30 V.
Current consumption	Max. 21 mA (50 mA inrush current).
Ripple HART	47...125 Hz: U _{ss} = 200 mV (at 500 Ω)
Power supply	For stand alone operation recommended via two Endress+Hauser RN221N.
mm accuracy	For measurements with mm accuracy the measured variable must be transmitted using HART protocol to ensure the necessary resolution.
Overvoltage protector	■ The level transmitter Micropilot S is equipped with an internal overvoltage protector (600 Vrms surge arrester) according to DIN EN 60079-14 or IEC 60060-1 (impulse current test 8/20 μs, I_p = 10 kA, 10 pulses). Additionally, the instrument is protected by a galvanic insulation of 500 Vrms between the power supply and the (HART) current output. Connect the metallic housing of the Micropilot S to the tank wall or screen directly with an electrically conductive lead to ensure reliable potential matching. ■ Installation with additional overvoltage protector HAW262Z/HAW56xZ (see XA081F-A "Safety instructions for electrical apparatus certified for use in explosion-hazardous areas"). – Connect the external overvoltage protector and the Micropilot S transmitter to the local potential matching system. – Potentials shall be equalised both inside and outside the explosion hazardous area. – The cable connecting the overvoltage protector and the Micropilot S transmitter shall not exceed 1 m in length; – The cable shall be protected e.g. routed in an armoured hose.

Performance characteristics

Note	Performance characteristics for instruments that can be calibrated for inventory control and custody transfer applications according to regulatory standards in compliance with OIML R85. General operating / environmental conditions see Page 26.
Reference operating conditions	According to OIML R85: ■ Temperature = -25 °C... +55 °C (-13...+131 °F) ■ Atmospheric pressure ■ Relative humidity (air) = 65 % ±15% ■ Medium properties: e.g. medium with good reflectivity and calm surface. ■ Tank diameter: signal beam hits the tank wall only at one side. ■ No major interference reflections inside the signal beam.
Maximum measured error	Absolute accuracy: better than ±1 mm Note! Free space Micropilot S radar gauges typically provide accuracy of ±0.5 mm (2 sigma value). The Micropilot S FMR532 stilling well radar gauges typically provide accuracy of ±0.8 mm (2 sigma value). Depending on the respective national gauging regulations, the admissible errors AFTER installation of the instrument on the tank are ±3 mm (OIML), ±4 mm (API),
Non-repeatability	0.3 mm (1/64")
Hysteresis	0.3 mm (1/64")
Long-term drift	The long-term drift is within the specified accuracy.
Influence of ambiente temperature	Within the specified accuracy according to OIML R85
Proof of accuracy of custody transfer versions	The accuracy of each Micropilot S is established through a calibration certificate that records the absolute and relative error at 10 equidistant points during the final test. A Laser Interferometer (Jenaer Messtechnik ZLM 500) with an absolute accuracy of 0.1 mm is used as a reference for the free space measurements with FMR530, 531 and 533. For stilling well measurements with FMR532, a NMI / PTB calibrated tape with an absolute accuracy of 0.25 mm is used. Each Micropilot S is delivered with the PTB and NMI type approval. Additional initial factory verifications for custody applications are available on demand for radar instrument Micropilot S.
Maximum fill speed	By the first pass trough of measuring range: 100 mm/min., thereafter unlimited.
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.
Resolution	■ digital: 0.1 mm ■ analog: 0.03 % of measuring range
Settling time	Typical 15 sec
Software reliability	The software used in the radar instrument Micropilot S fulfills the requirements of OIML R85. This particularly includes: ■ cyclical test of data consistency ■ non-volatile memory ■ segmented data storage The radar instrument Micropilot S continuously monitor the compliance with accuracy requirements for custody transfer measurements according to OIML R85. If the accuracy cannot be maintained, a specific alarm is generated on the local display and via the digital communication (see Page 39).

Inventory control versions

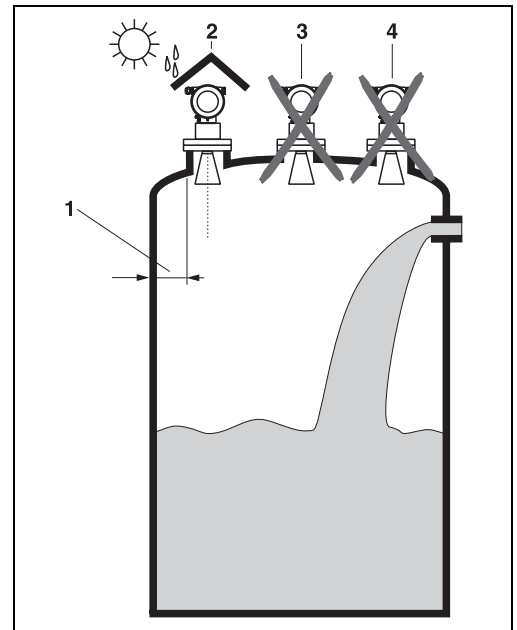
All device types can be delivered as "Inventory Control Versions" with a reduced accuracy of ± 3 mm (under reference conditions).

To these versions, the calibration certificate or custody transfer type approval is NOT attached. The "Inventory Control Versions" can be selected by choosing the option »R« in the order code section »Custody transfer approvals« on Page 44 ff..

Operating conditions: Installation

Installation instructions**Orientation**

- Recommended distance (1) wall – **outer edge** of nozzle:: $\sim 1/6$ of tank diameter (see Beam angle on Page 18).
- 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 "Accessories" on Page 51).



L00-FMR53xxx-17-00-00-yy-004

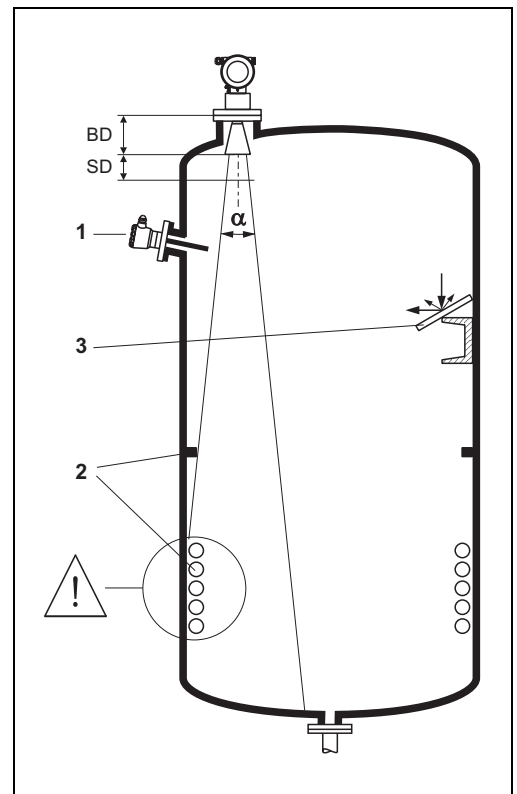
Tank installations

- Avoid any installations (1), like limit switches, temperature sensors, etc., inside the signal beam (refer to beam angle see Page 18).
- It is essential that HiHi alarm is below the blocking distance (BD) and the safety distance (SD).
- Symmetrical installations (2), e.g. vacuum rings, heating coils, baffles, etc., can also interfere with the measurement.

Optimisation 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" (see Page 20 ff.).
- Stilling well: a stilling well can always be used to avoid interference. The FMR532 with planar antenna is recommended for stilling wells with a diameter DN150 (6") and larger.
- Metallic screens (3) mounted at a slope spread the radar signals and can, therefore, reduce interference echoes.

Please contact Endress+Hauser for further information.



L00-FMR53xxx-17-00-00-xx-002

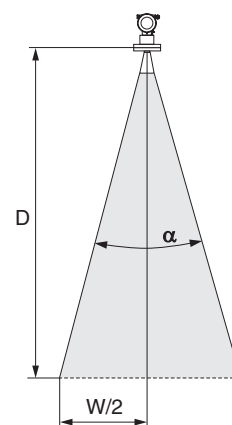
Beam angle

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.

Beamwidth diameter **W** as function of antenna type (beam angle α) and measuring distance **D**:

Antenna size ($\varnothing$ horn)	FMR530			FMR531	FMR533
	150 mm	200 mm	250 mm	rod	parabolic
Beam angle α	23°	19°	15°	30°	7°

Gauge Reference height (GRH)	recommended distance from the tank wall (W/2)				
	150 mm	200 mm	250 mm	rod	parabolic
3 m	0.6 m	0.5 m	0.5 m	0.8 m	0.2 m
6 m	1.2 m	1 m	0.8 m	1.6 m	0.4 m
9 m	1.8 m	1.5 m	1.2 m	2.4 m	0.6 m
12 m	2.5 m	2 m	1.5 m	3.2 m	0.7 m
15 m	3 m	2.5 m	2 m	4 m	0.9 m
20 m	4 m	3 m	2.5 m	5 m	1.2 m
25 m	5 m	4 m	3.3 m	—	1.5 m
38 m	—	—	—	—	2.3 m
40 m	—	—	—	—	2.4 m



L00-FMR53xxx-14-00-00-xx-003

Note!

The Micropilot S FMR532 is designed for level measurement in **stilling wells** only!

Caution!

Make sure that **only one** tank wall (**not two** tank walls) is directly hit by the radar beam!

Nozzle for manual gauging

See »Installation hints« on Page 36.

Roof reflector

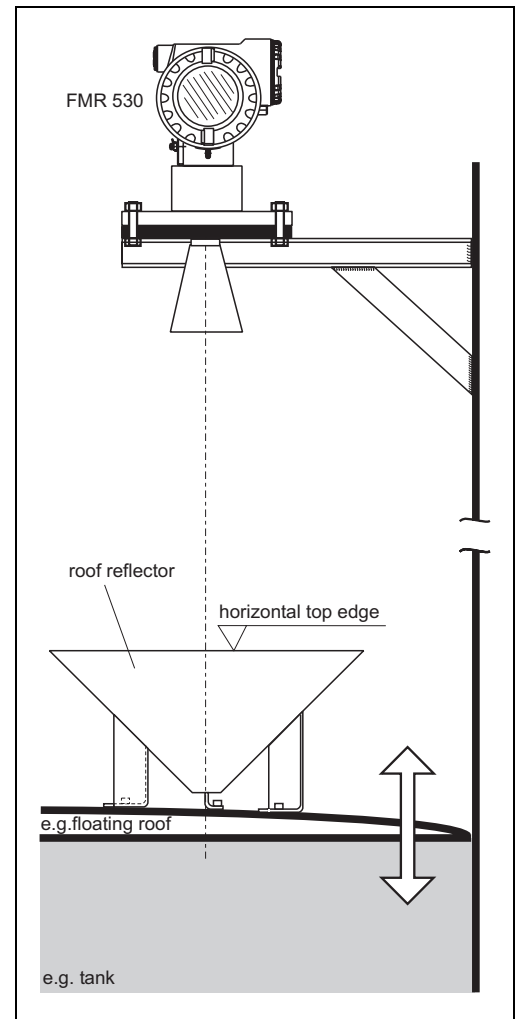
Measurements on floating roofs are not recommended for highly accurate measurements due to the unsteady movements of the floating roofs. A special reflector can be used for applications on floating roofs (not for FMR 532 with planar antenna!). (See »Construction hints« on Page 35).

Optimum mounting position

Positioning of the reflector on a floating roof:

- The upper edges of the reflector have to be aligned horizontally.
- For slanted locations (e.g. dome-shaped floating roof), the feet must be extended accordingly.

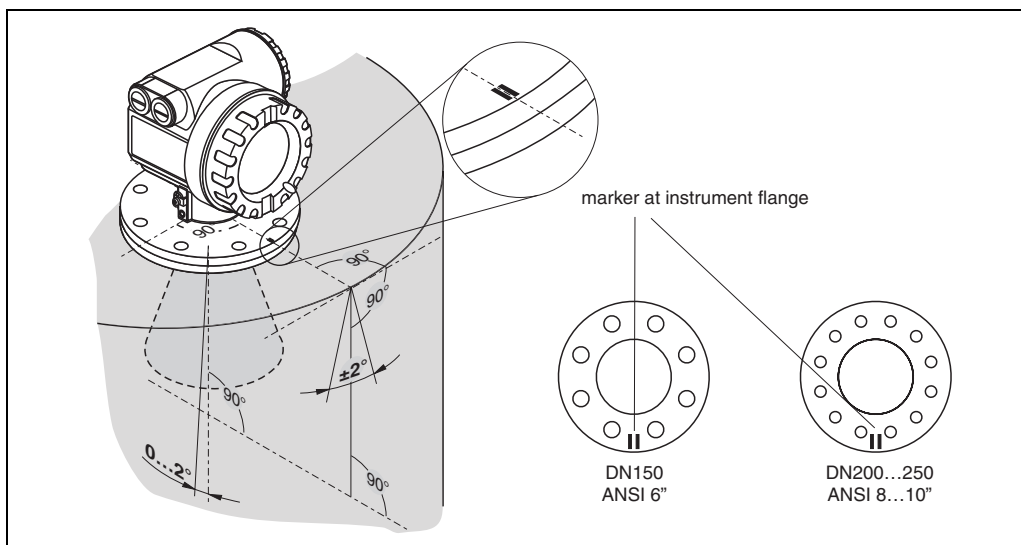
Please contact Endress+Hauser for further information.



L00-FMRS30xx-17-00-00-en-012

Installation in tank (free space) FMR530

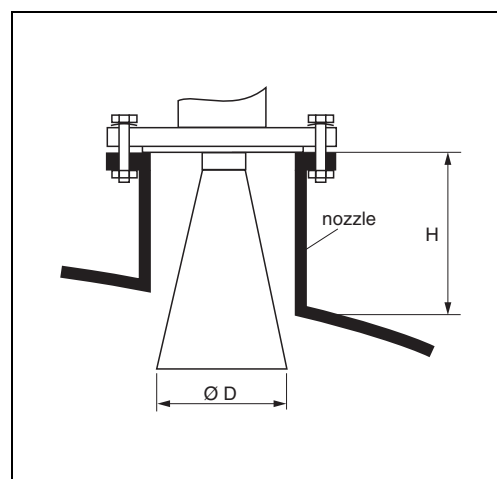
Optimum mounting position



L00-FMR530xx-17-00-00-en-001

Standard installation

- Observe installation instructions on Page 17.
- Marker is aligned towards tank wall.
- The marker is always exactly in the middle between two bolt-holes in the flange.
- The device shall not be mounted in a slant towards the tank wall.
- 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.
- The horn antenna must be aligned vertically.

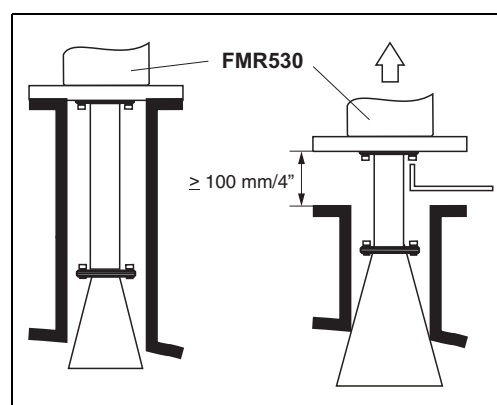


L00-FMR230xx-17-00-00-en-002

Antenna size	150 mm / 6"	200 mm / 8"	250 mm / 10"
D [mm / inch]	146 / 5.8	191 / 7.5	241 / 9.5
H [mm / inch]	< 180 / 7.2	< 260 / 10.4	< 350 / 14

Antenna extension FAR10

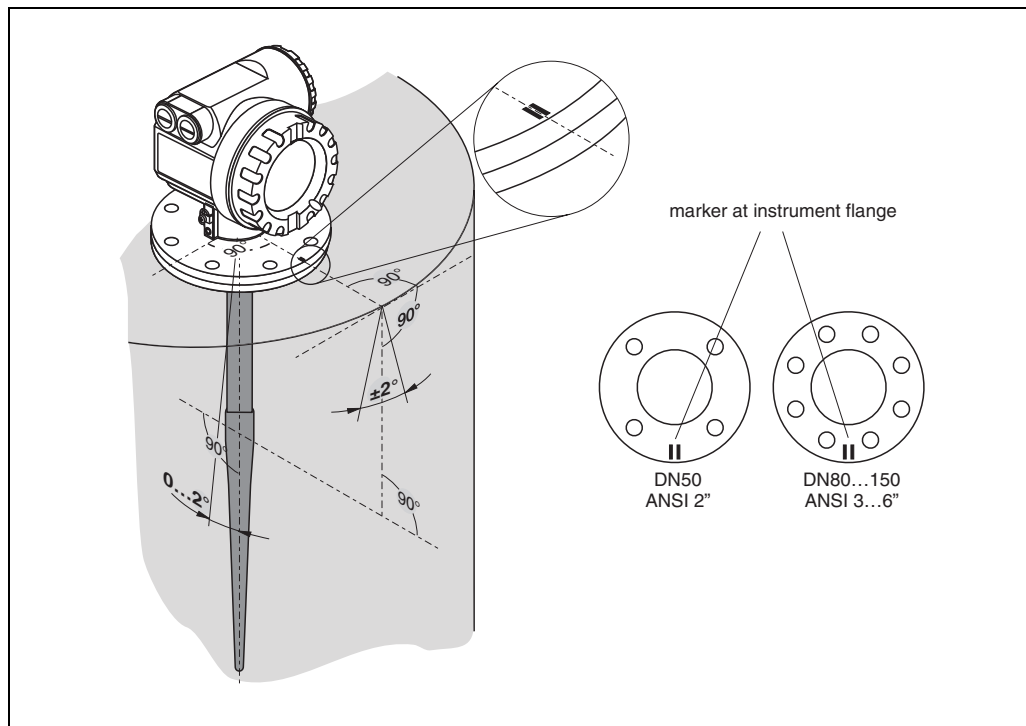
- The antenna extension has to be selected such that the horn extends below the nozzle.
- If the horn diameter is greater than the nominal width of the nozzle, the antenna including the extension is mounted from inside the vessel. The bolts are tightened from outside, with the instrument lifted up. The extension has to be selected such that the instrument can be lifted by at least 100 mm (4").



L00-FMR530xx-17-00-00-yy-014

Installation in tank (free space) FMR531

Optimum mounting position



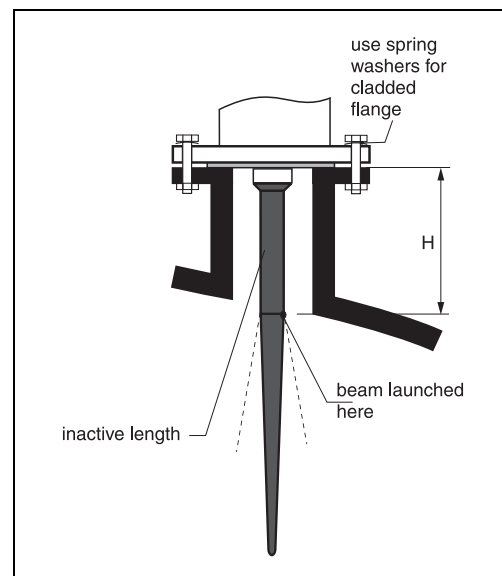
L00-FMR531xx-17-00-00-en-001

Standard installation

- Observe mounting instructions on Page 17.
- Marker is aligned towards tank wall.
- The marker is always exactly in the middle between two bolt-holes in the flange.
- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.
- In order to minimize temperature influences, spring washers should be used in combination with the plated flange of the FMR531.
- The rod antenna must extend below the nozzle.
- Align rod antenna vertically.

Caution!

Do not point the radar beam towards the tank wall (refer to figure).

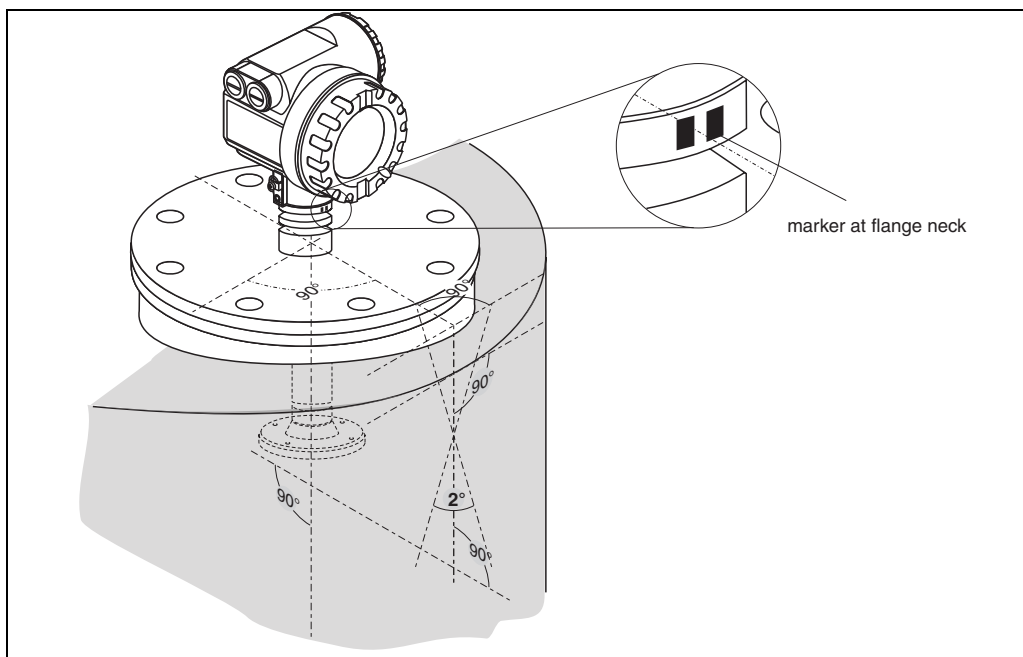


L00-FMR531xx-17-00-00-en-002

Antenna length [mm / inch]	390 / 15	540 / 21
H [mm]	< 100 / < 4	< 250 / < 10

Installation in tank (free space) FMR533

Optimum mounting position



L00-FMR533ex-17-00-00-en-001

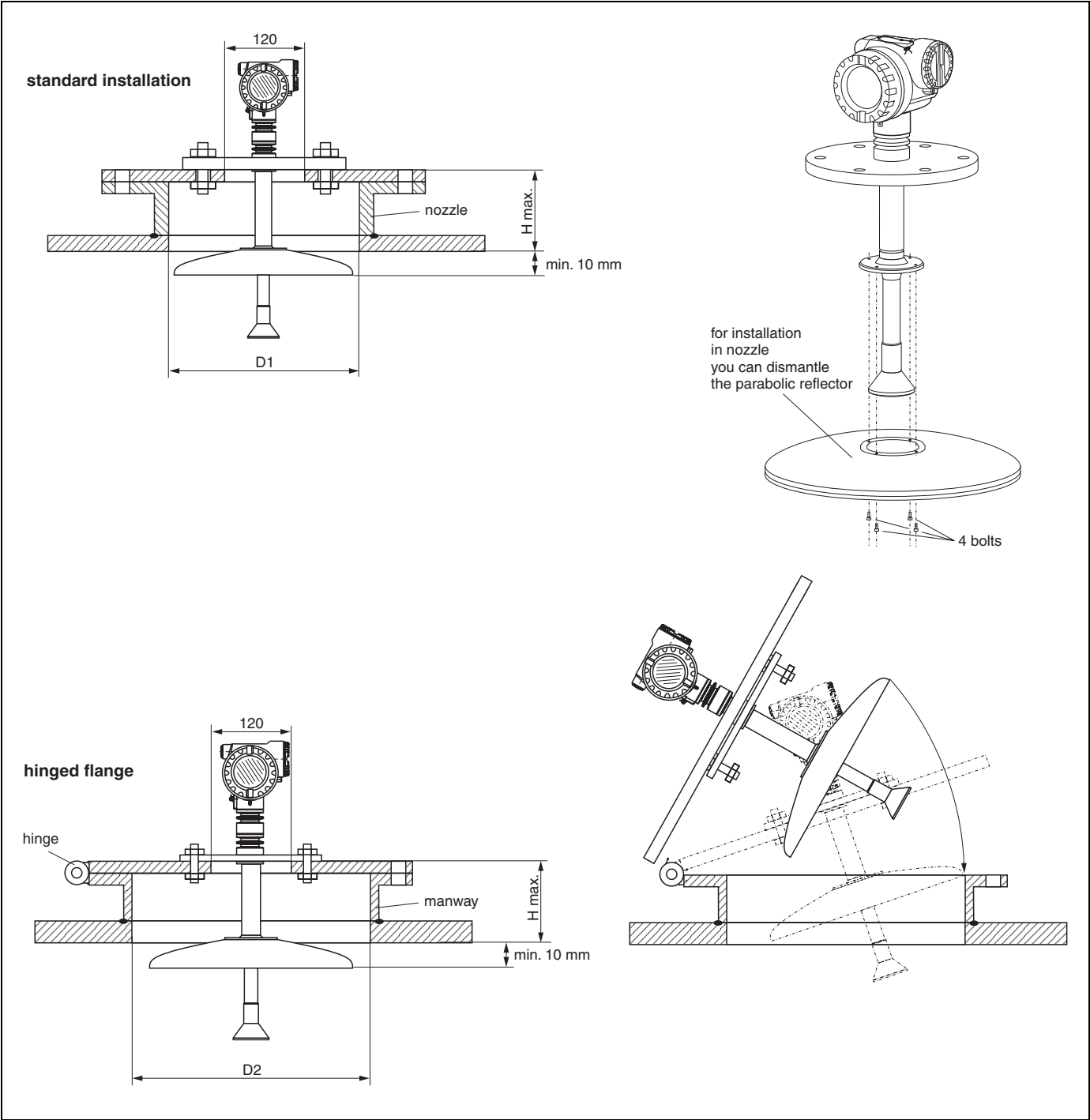
Standard installation

- Observe installation instructions on Page 17.
- Marker is aligned towards tank wall.
- The marker is located below the housing at the neck of the flange.
- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.
- The parabolic mirror must extend below the nozzle
- Align parabolic antenna vertically.

Mounting in manway

The parabolic antenna can be mounted on a manway cover. The manway cover must have an opening with a diameter D1 or D2 for mounting of the antenna (refer to fig. below). It has to be possible to remove the cover in order to mount the antenna. Please consider the maximum height of the nozzle (H max. = 200 mm/8") for the diameter of the basis.

Examples for installation in a manway

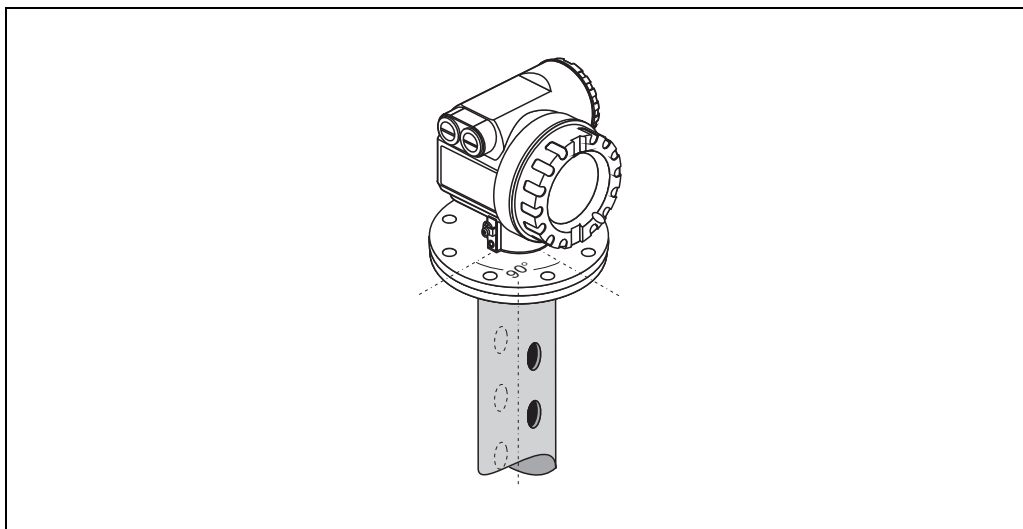


L00-FMRS33xx-17-00-00-en-003

	D (=inside diameter of manway)	H max. (=maximum height of nozzle)
Standard installation D1	≥ 500 mm / ≥ 20"	200 mm / 8"
Hinged flange D2	≥ 600 mm / ≥ 24"	200 mm / 8"

Installation in stilling well FMR532

Optimum mounting position



100-FMR532xx-17-00-00-xx-008

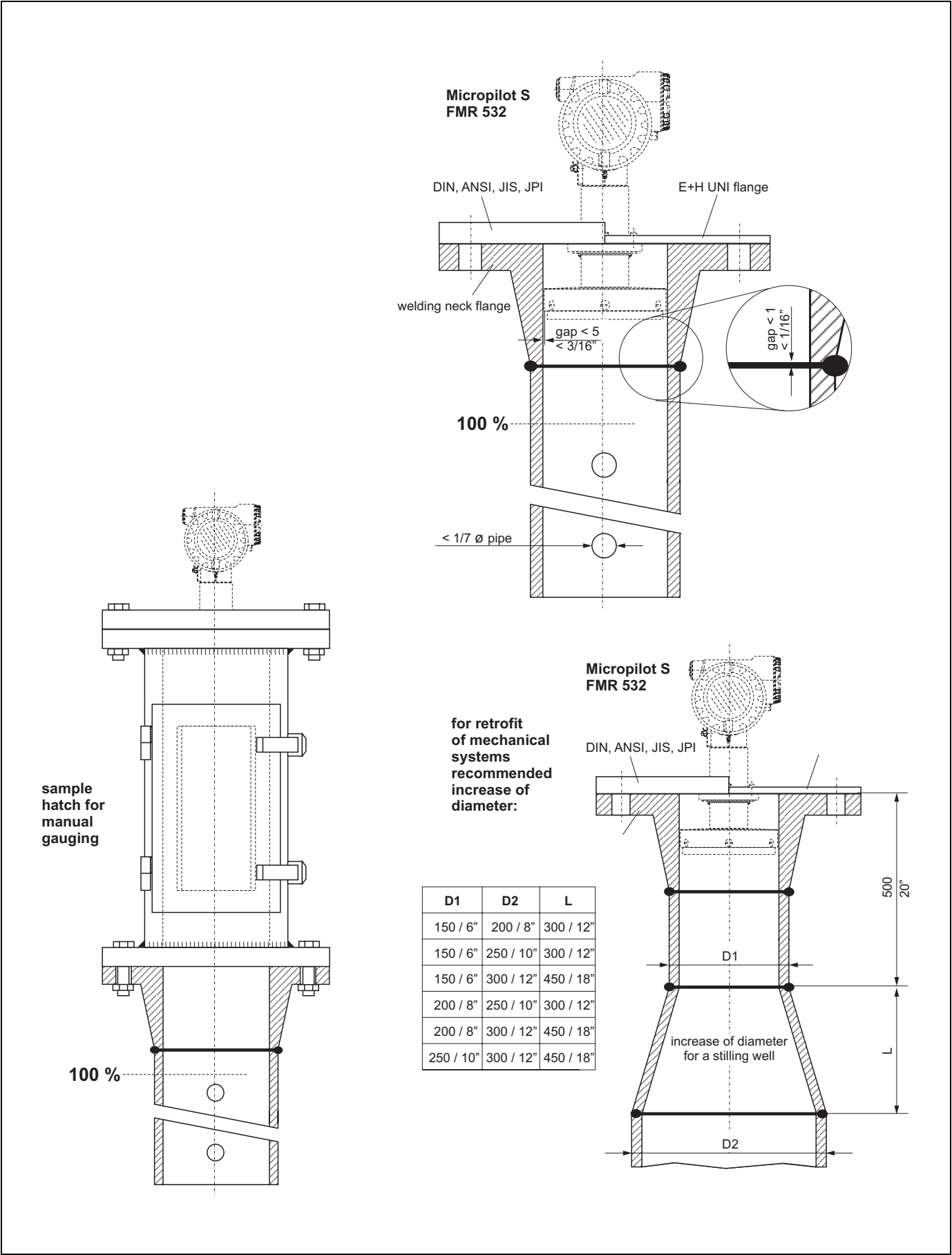
Standard installation

- No alignment is required.
- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.
- Planar axis vertical to flange.
- Measurements can be performed through an open ball valve without any problems.

Recommendations for the stilling well

- Metal (no enamel coating, plastic on request).
- Constant diameter.
- When using a FMR532, an increase of the pipe diameter from DN150 to DN200 / DN200 to DN250 / DN250 to DN300 is acceptable. A larger step-width for the increase of the pipe diameter (e.g. DN150 to DN300) is possible if the upper part of the pipe has a suitable length. The length of the stilling well enlargement must be kept. In this case, the upper end of the pipe must have a minimum length of 0.5 m (20") before the diameter increases (refer to table on page 25). If the length is less than L, please contact Endress+Hauser in order to determine a suitable antenna adapter (separable antenna horn). Ideally, a sample hatch is used.
- Any rectangular increase of the pipe diameter has to be avoided.
- Weld seam as smooth as possible and on the same axis as the slots.
- For best radar propagation behavior holes it is recommended to have holes instead of slots. If slots can not be avoided, they should be as thin and short as possible.
- The diameter of the holes (deburred) can be up to 1/7 of the pipe diameter but should not exceed 30 mm.
- Length and number of the slots or holes do not affect the measurement.
- Maximum gap allowed between the antenna/horn and the inside of the stilling well is 5 mm (3/16").
- At any transition (e.g. when using a ball valve or mending pipe segments), no gap may be created exceeding 1 mm.
- The stilling well must be smooth on the inside (average roughness $R_z \leq 6.3 \mu\text{m}$). Use extruded or parallel welded stainless steel pipe. An extension of the pipe is possible with welded flanges or pipe sleeves. Flange and pipe have to be properly aligned at the inside.
- Do not weld through the pipe wall. The inside of the stilling well must remain smooth. In case of unintentional welding through the pipe, the weld seam and any unevenness on the inside need to be carefully removed and smoothed. Otherwise, strong interference echoes will be generated and material build-up will be promoted.

Examples for the construction of stilling wells



L00-FMR532xx-17-00-00-en-006

Operating conditions: Environment

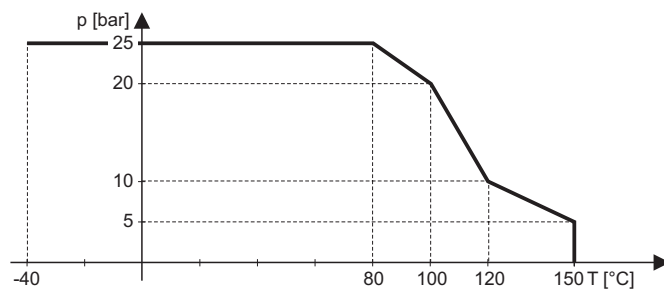
Ambient temperature range	Ambient temperature for the transmitter: ■ Standard: -40 °C ... +80 °C (-40 °F...+176 °F) ■ For calibration to regulatory standards: -25 °C ... +55 °C (-30 °F...+140 °F) With $T_u < -20$ °C and $T_u > +60$ °C the operability of the LC-display is reduced. A weather protection 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)
Climate class	DIN EN 60068-2-38 (test Z/AD)
Degree of protection	■ Housing: IP 68, NEMA 6P (open housing and removed liquid crystal 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)/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 ϵ_r . If the medium tends to cause contamination and deposits, cleaning on a regular basis is recommended. Care has to be taken not to damage the antenna in the process of a mechanical or hose-down cleaning. 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)	■ Interference Emission to EN 61326, Electrical Equipment Class B. ■ Interference Immunity to EN 61326, Annex A (Industrial) and NAMUR Recommendation NE 21 (EMC) ■ Use a screened cable for the connection to the sensor.
Approvals for custody transfer applications	All aspects of OIML R85 are fulfilled.

Operating conditions: Process

Process temperature range	Antenna	Horn antenna	Rod antenna	Planar antenna	Parabolic antenna
	Temperature range	-40 °C...+200 °C -40 °F...+ 392 °F	-40 °C...+150 °C -40 °F...+ 302 °F	-40 °C...+150 °C (-40 °F...+302 °F), (-4 °F...+302 °F) for FKM-seal	-40 °C...+200 °C -40 °F...+ 392 °F

Process pressure limits

- FMR530: 0...40 bar / 14.5...580 psi (option 64 bar / 928 psi)
- FMR531: 0...40 bar / 14.5...580 psi
- FMR532: 0...25 bar / 14.5...362 psi



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- FMR533: 0...16 bar / 14.5...232 psi

Dielectric constant

- In a stilling well: $\epsilon_r \geq 1.4$
- In free space: $\epsilon_r \geq 1.9$

Wetted parts**FMR530**

Type of antenna / Seal	Media	Antenna cone	Wetted parts
Standard / Viton -20...+200 °C (-4 °F...+392 °F)	for non-conductive media	PTFE	PTFE and 1.4571
Standard / EPDM -40...+150 °C (-40 °F...+302 °F)			
Standard / Kalrez 0...+200 °C (+32 °F...392 °F)			
Standard -20...+200 °C (-4 °F...392 °F) PTFE seal (non wetted Viton O-Ring)	for conductive media	PTFE	PTFE and 1.4571

Note!

All process connections are gas-tight. The horn version for conductive media is resistant to hot vapour.

FMR531

Type of antenna / Seal	Wetted parts
Rod gas-tight , antistatic	1.4435 / SS 316 L / PTFE
Stab gas-tight ¹	1.4435 / SS 316 L / PTFE (TFM 1600)

- 1) Rod antenna with FDA listed materials, white PTFE (TFM 1600), 3A approved in combination with 2" and 3" Tri-clamp process connection.

FMR532

Type of antenna / Seal	Wetted parts
Planar, gas-tight	1.4435 / HNBR (Hydrated Nitrit Butadien Rubber, resistant to NH ₃) or FKM / PTFE glas fibre laminat
Horn adapter for increase of diameter	1.4435
Note! The planar antenna is not resistant to hot vapour and NH ₃ !	

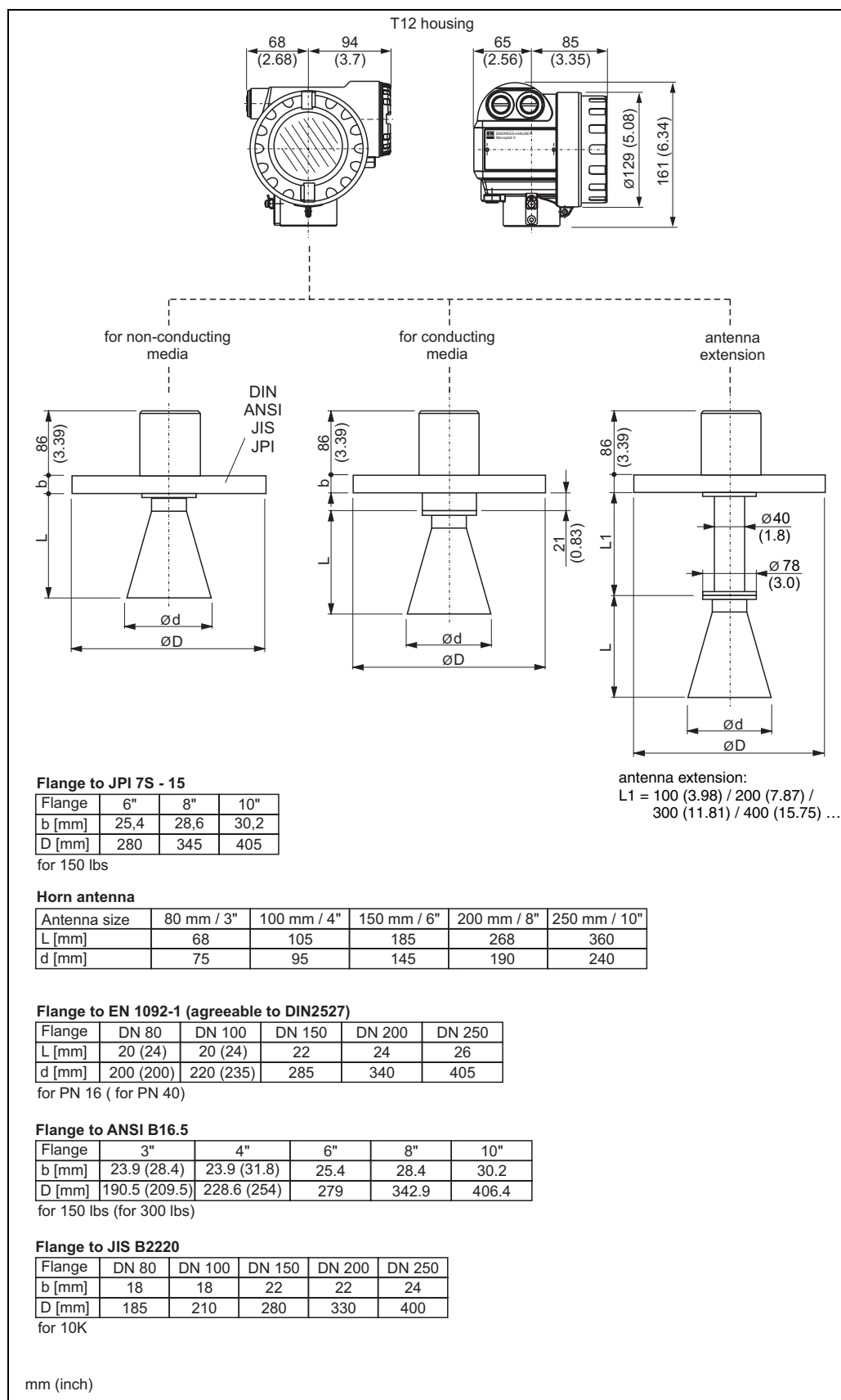
FMR533

Type of antenna / Seal	Wetted parts
Parabolic, gas-tight	1.4435 / SS 316 L / PTFE

Mechanical construction

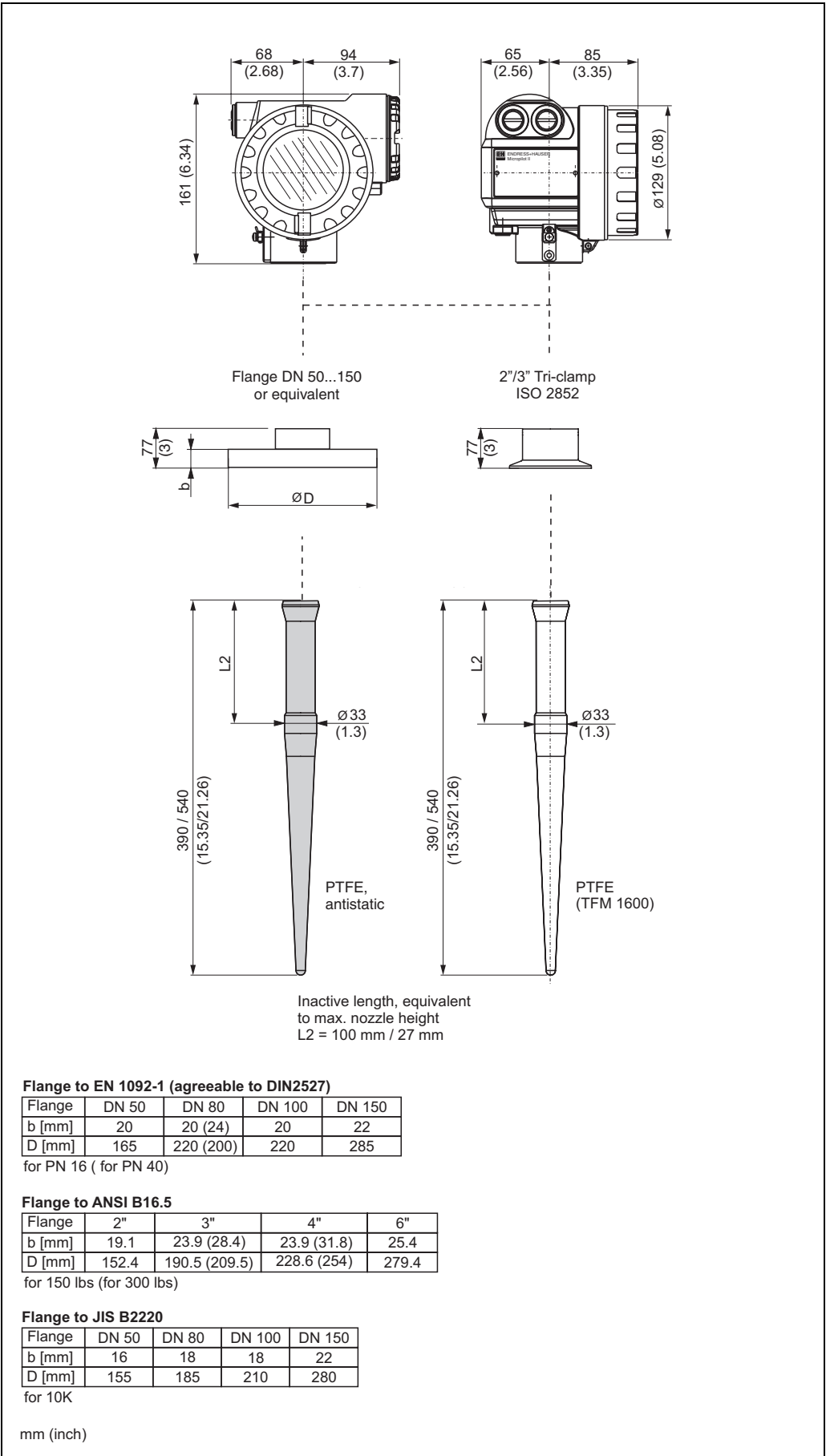
Design, dimensions

Micropilot S FMR530 with horn antenna

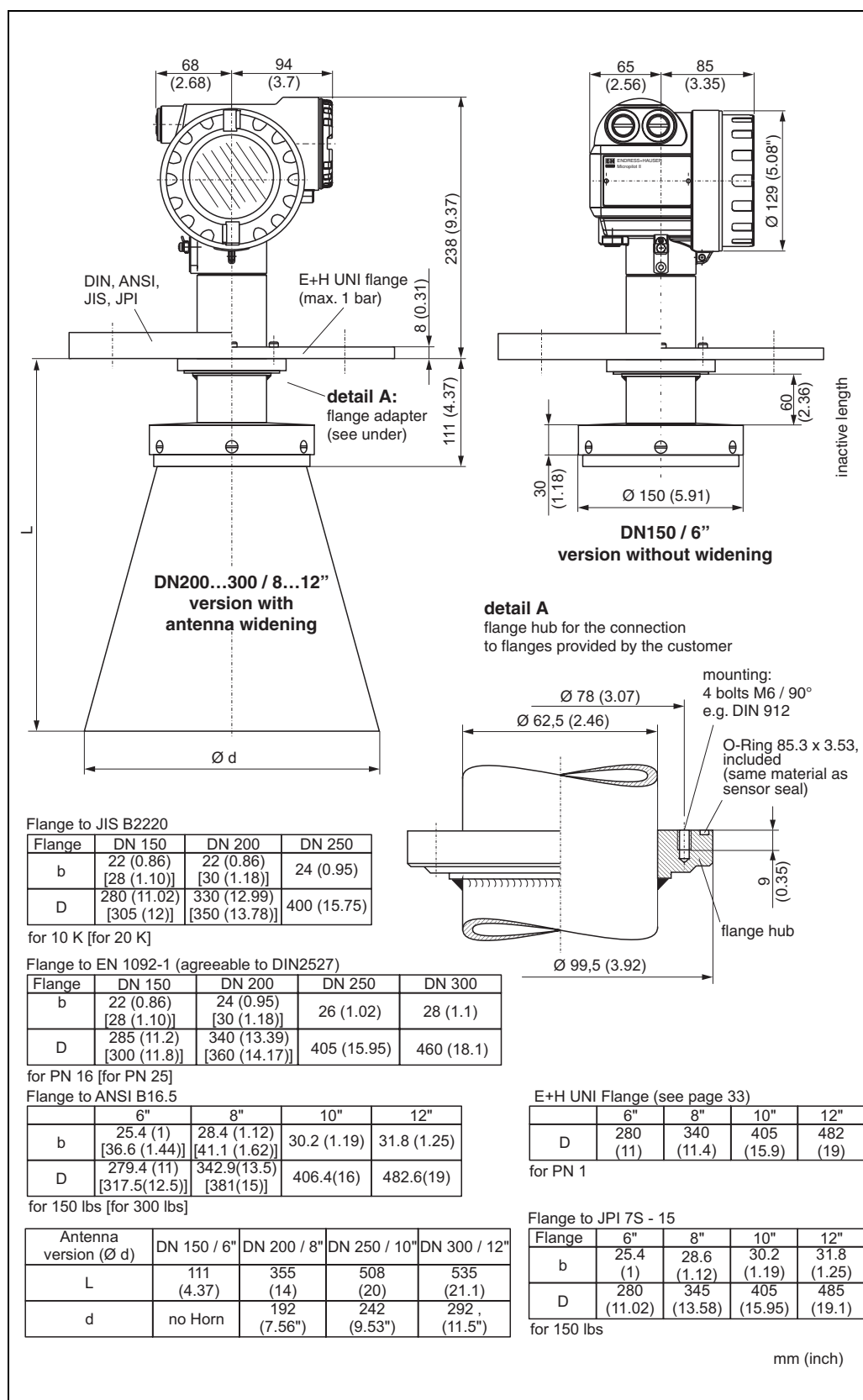


1) Antenna extension see Page 51

Micropilot S FMR531 with rod antenna



Micropilot S FMR532 with planar antenna

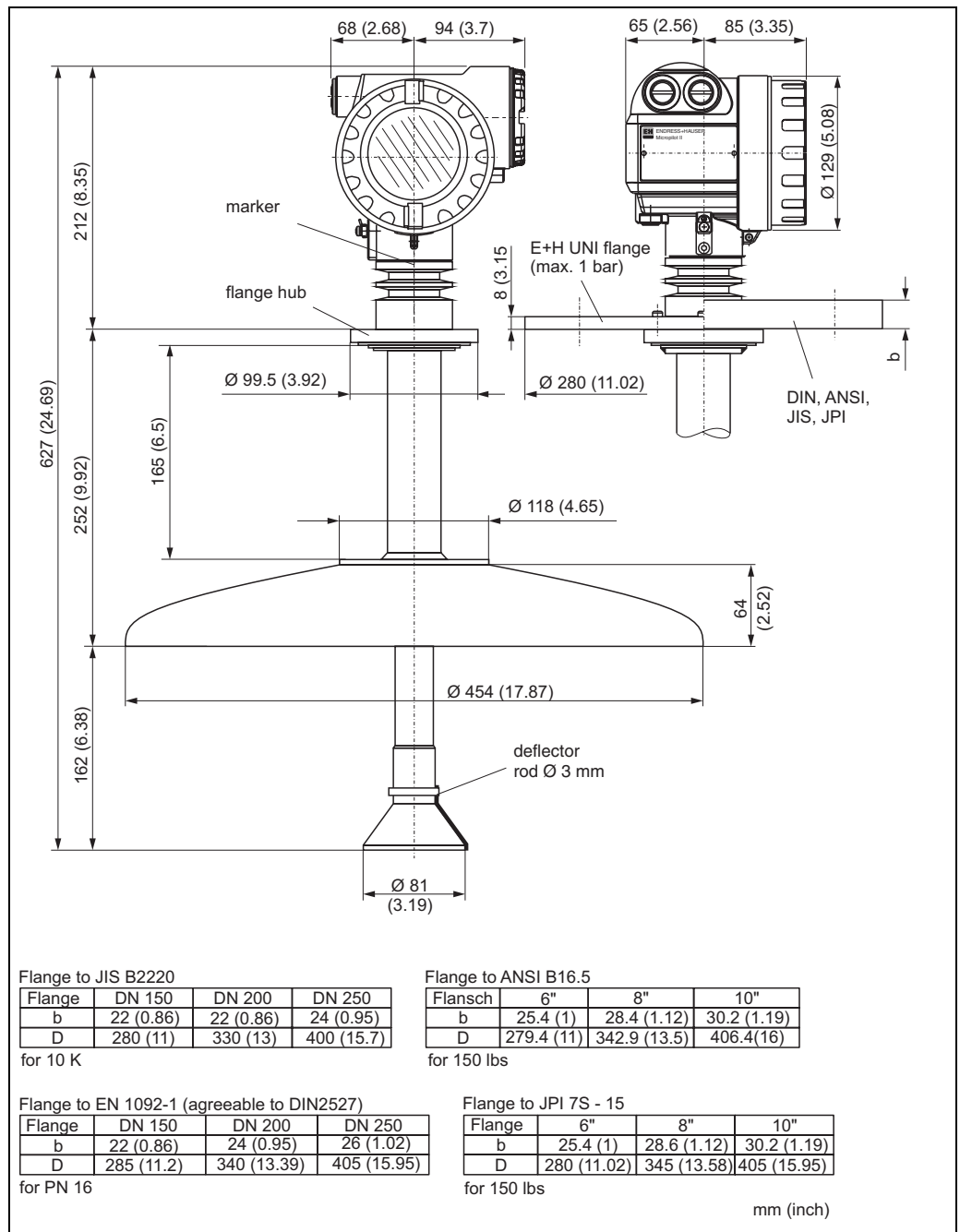


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Note!

The inactive length of 60 mm prevents condensation effects to the antenna performance. Special versions with longer construction are available.

Micropilot S FMR533 with parabolic antenna



100-FMR533xx-00-00-00-en-002

Weight

Micropilot S	FMR530	FMR531	FMR532	FMR533
	7.1 kg + weight of flange ¹⁾	5 kg + weight of flange ¹⁾	6.5 kg + weight of flange ¹⁾	13 kg + weight of flange ¹⁾

1) Flange weights according to form sheet.

Material

- Type of housing:
 - Housing T12: separate terminal compartment for increased safety respectively explosion proof.
Material: aluminium, seawater repellent, chromate, powder coated
- Sight window:
 - glass
- Cable entry:
 - M20x1.5; Pg 13.5 (gland included); ¾ NPT; G ¾ internal thread

Process connection

See "Ordering information" on Page 44 – Page 50.
All process connections dispose of a gas-tight glass feed-through to prevent any gas leakage to the inside of the housing.

Seal

See "Ordering information" on Page 44 – Page 50.

Antenna

See "Ordering information" on Page 44 – Page 50.

Type plate / type plate for custody transfer applications

In addition to the standard type plate, the instrument features a type plate for custody transfer applications with the following statements:

- manufacturer
- instrument type
- label for custody transfer approval
 - PTB : „Z“ with approval number and issuing agency, the 4-digit approval number is shown in the upper part of the „Z“, the lower part shows year and month of type approval.
 - NMi : field for 5-digit approval number
- year of manufacturing
- space for imprinted tank identification number
- statement of measuring range suitable for custody transfer approval including unit
- statement of ambient temperature range suitable for calibration to regulatory standards.

The following statements are also required for calibration to regulatory standards. They are listed on the standard type plate and are not repeated here:

- date of manufacturing
- tester

NMi type plate (example)

The diagram shows a rectangular type plate with various fields and labels. Labels with lines pointing to specific fields include:

- Certification no. (points to T7480)
- Year of construction (points to Baujahr / Year of constr.)
- Tank reference height (points to Tankreferenzhöhe / Tank reference height)
- Tank-no. (points to Tank-Nr.)
- Certified Measuring range (points to Zert.Messbereich / Cert.Measuring range)
- from ... (points to von / from)
- to ... (points to bis / to)
- min. environment temperature (points to TUmgeb. / Environm. min)
- max. environment temperature (points to TUmgeb. / Environm. max)

 The plate itself contains the following text:

- Hersteller / Producer : ENDRESS+HAUSER
- MICROPILOT S FMR
- Zertifikat-Nr. / Certification no. : T7480
- Baujahr / Year of constr. : [blank]
- Tankreferenzhöhe / Tank reference height : [blank] m
- Tank-Nr. : [blank]
- Zert.Messbereich / Cert.Measuring range : von [blank] bis [blank] m
- TUmgeb. / Environm. : min [blank] max [blank] °C

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PTB type plate (example)

The diagram shows a rectangular type plate with various fields and labels. Labels with lines pointing to specific fields include:

- Approval number (points to 4.413)
- Year and month of type approval (points to 01.06)
- Year of construction (points to Baujahr / Year of constr.)
- Tank reference height (points to Tankreferenzhöhe / Tank reference height)
- Tank-no. (points to Tank-Nr.)
- Certified Measuring range (points to Zert.Messbereich / Cert.Measuring range)
- from ... (points to von / from)
- to ... (points to bis / to)
- min. environment temperature (points to TUmgeb. / Environm. min)
- max. environment temperature (points to TUmgeb. / Environm. max)

 The plate itself contains the following text:

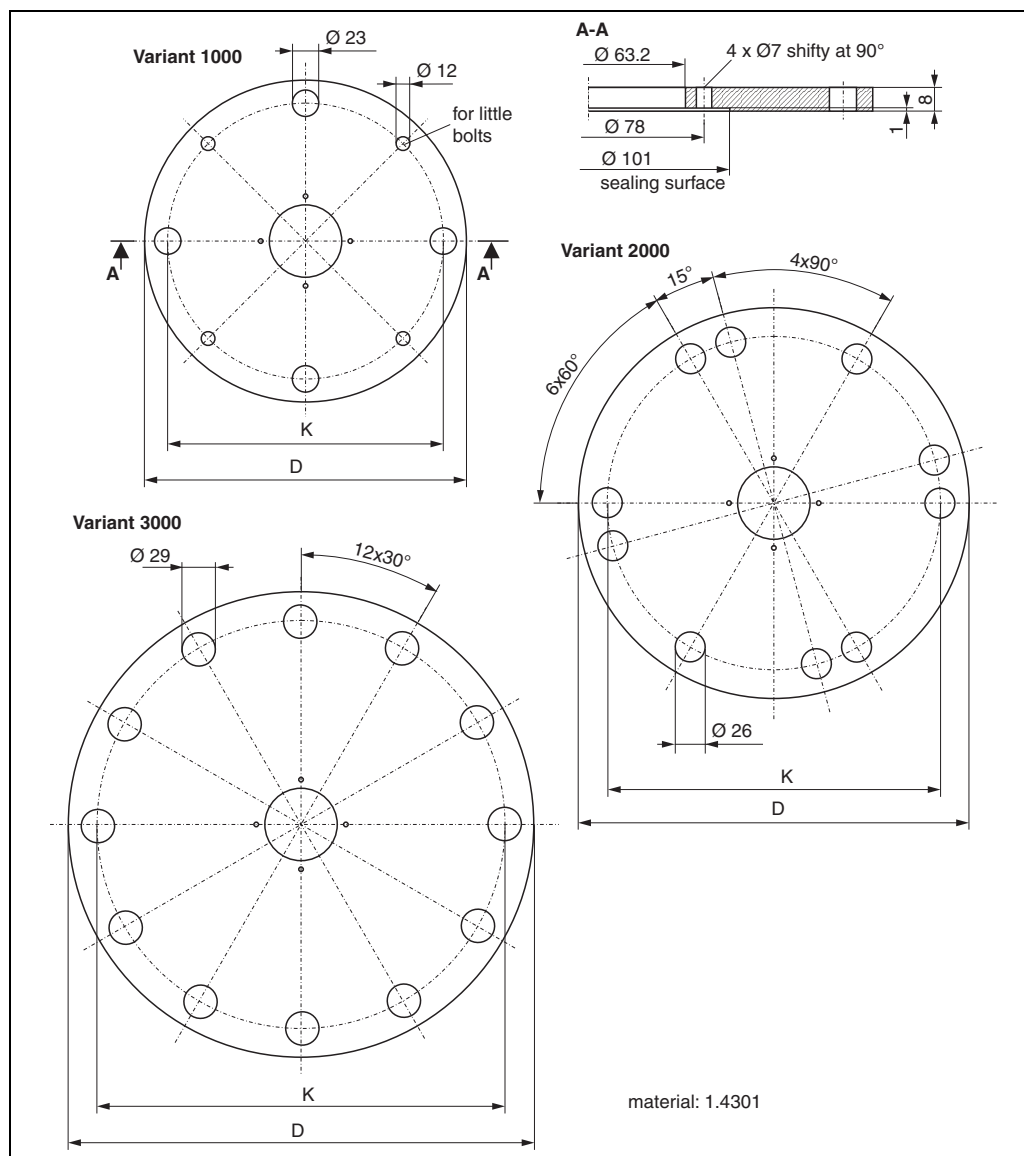
- Hersteller / Producer : ENDRESS+HAUSER
- MICROPILOT S FMR
- Approval number : 4.413
- Year and month of type approval : 01.06
- Baujahr / Year of constr. : [blank]
- Tankreferenzhöhe / Tank reference height : [blank] m
- Tank-Nr. : [blank]
- Zert.Messbereich / Cert.Measuring range : von [blank] bis [blank] m
- TUmgeb. / Environm. : min [blank] max [blank] °C

L00-FMRS3xxx-18-00-00-en-005

Endress+Hauser UNI flange

Installation hints

Endress+Hauser UNI flanges are designed for non-pressurized operation. Typical pressure fluctuations of breather valves can be tolerated. 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-FMRS3xxx-06-00-00-en-001

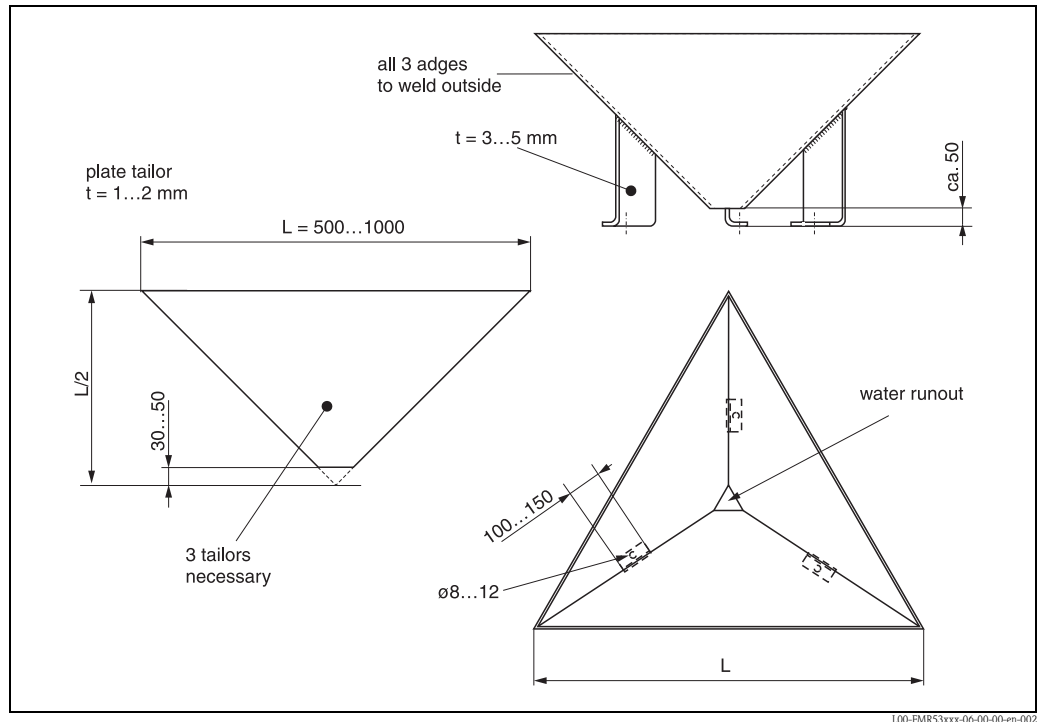
Version	Compatible with	D [mm]	K [mm]	Type plate no.
1000	DN150 PN16 ANSI 6" 150lbs JIS 10K 150	280	240	942455-3001
2000	DN200 PN16 ANSI 8" 150lbs JIS 10K 200	340	294.5	942455-3002
3000	DN250 PN16 ANSI 10" 150lbs JIS 10K 250	405	358	942455-3003
4000	DN300 PN16 ANSI 12" 150lbs JIS 10K 300	482	410 (for DIN) 431.8 (for ANSI) 400 (for JIS) 404.5 (for DIN + JIS)	942455-3004

Roof reflector

For high precision applications, measurements from a floating roof are inadvisable due to the unsteady movements of the floating roof. For floating roof applications, a special reflector can be used.

Note!

The roof reflector is not part of the standard offering from Endress+Hauser.

**Construction hints**

- The construction serves as retroreflector such that a tank roof incline does not influence the measured value.
- The cross-sectional area shouldn't be smaller than specified in the figure above to receive and transmit enough energy.
- The construction should be open in the bottom part to allow rainwater to drop out. Thin stainless steel sheets should be used, to prevent the construction from becoming too heavy.

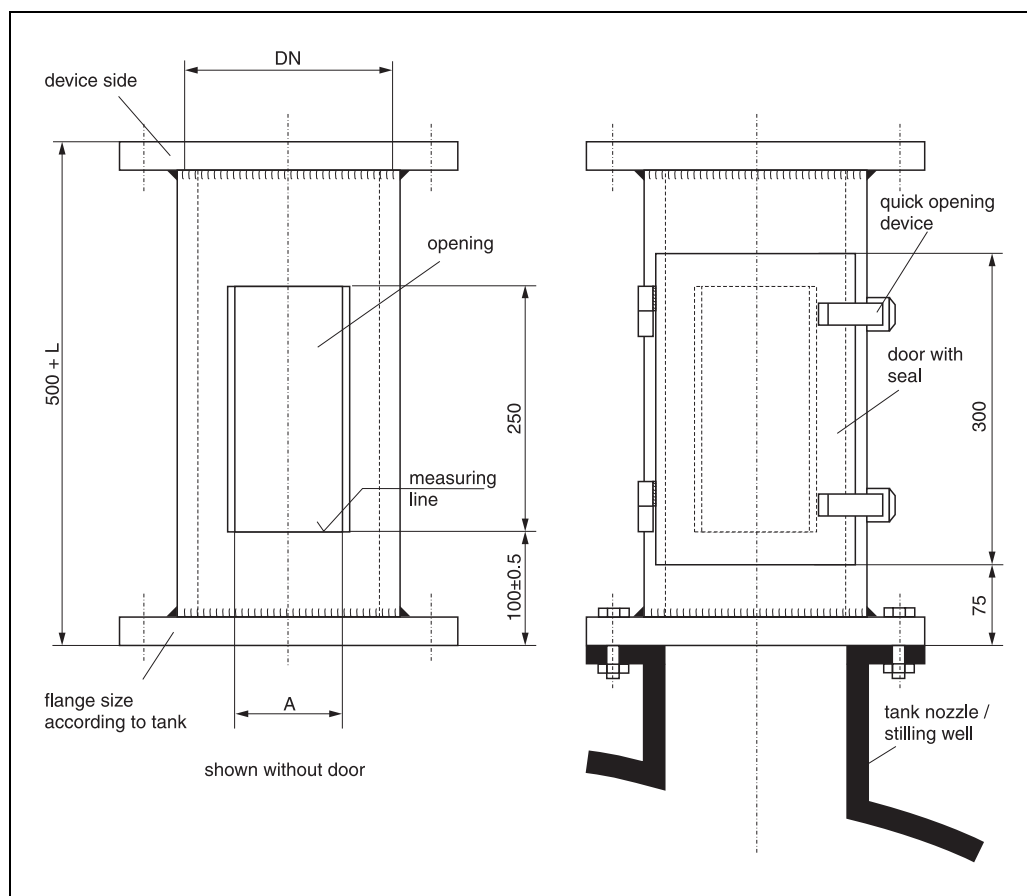
Sample hatch for Micropilot S FMR532

Installation hints

For control and cleaning purposes for sample taking as well as for hand dipping (tape), a sample hatch is recommended. The sensor head of FMR532 (planar antenna!) can be easily checked in the area of the opening. Manual gauging with gauge rod or tape is possible without removal of the transmitter. The lower edge of the opening is the reference for the gauging. The construction is only suitable for non-pressurized operation and should be used for the planar antenna version FMR532 only.

Note!

The sample hatch is not part of the standard offering from Endress+Hauser.
Please contact Endress+Hauser for further information.

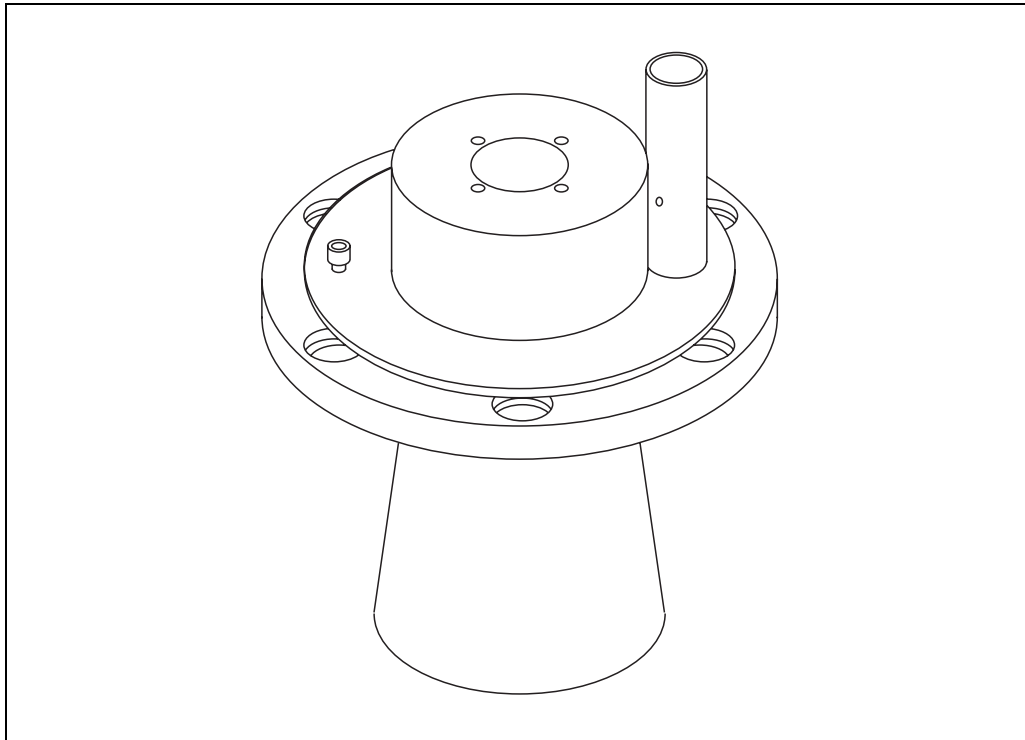


L00-FMR53xxx-06-00-00-en-004

Flange	DN150	DN200	DN250/300		Flange	ANSI 6"	ANSI 8"	ANSI 10"
PN [bar]	16	16	16		PN [lbs]	150	150	150
A [mm]	110	140	170		A [mm]	110	140	170
L [mm]	—	300	450		L [mm]	—	300	450

**Pivoting element for
Micropilot S FMR532****Installation hints**

The pivoting element is intended for the Micropilot S with planar antenna. It serves to swivel the Micropilot S from the measuring position, e.g. to clean the antenna or dip the tank. The pivoting element is not part of the standard offering from Endress+Hauser. For more information please contact your Endress+Hauser representative.



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Note!

When mounting, avoid any gaps within the path of the beam.

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.

Display and operation can occur in one out of six languages (English, German, French, Italian, Dutch, and Spanish). During the first start-up, the instrument explicitly asks for the desired unit / language.

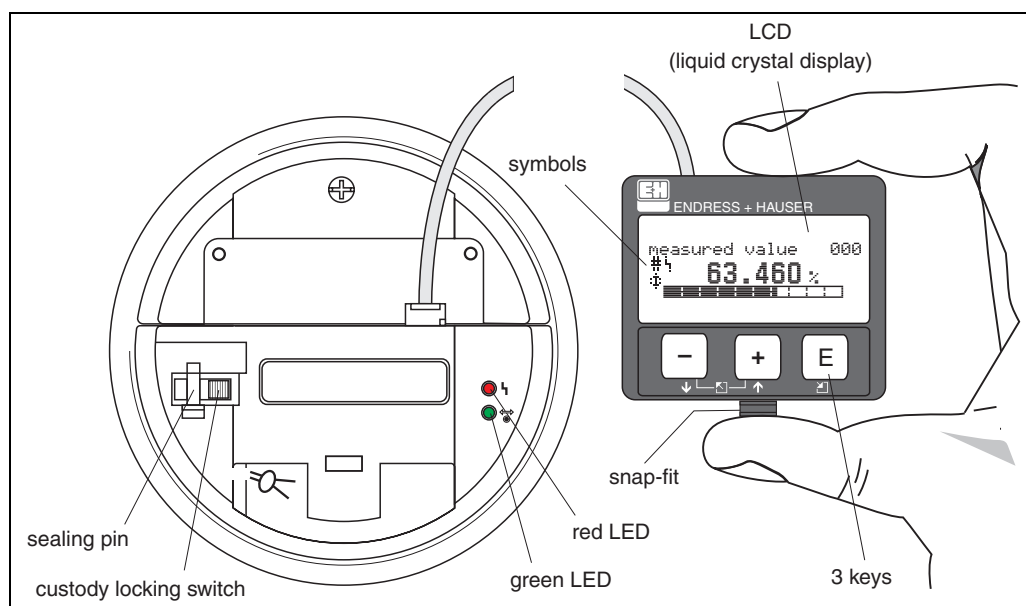
Remote commissioning, including documentation of the measuring point and in-depth analysis functions, is supported via FieldCare, the FDT-based Plant Asset Management Tool by Endress+Hauser.

Access to the electronics can be prevented by means of a custody locking switch that locks the device settings. The custody locking switch can be sealed for custody transfer applications.

Display elements

Liquid crystal display (LCD):

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



100-FMRS3xxx-07-00-00-en-001

Note!

To access the display, it is possible to open the cover of the electronics compartment even in an explosion hazardous area.

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.

Display symbols

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

Symbols	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 is in progress.
	Calibration to regulatory standards disturbed If the instrument is not locked or it cannot guarantee the calibration to regulatory standards, the situation will be indicated on the display via the symbol.

Light emitting diodes (LEDs):

There is a green and a red LED besides the Liquid Crystal Display.

LED (LED)	Meaning
red LED continuously on	Alarm
red LED flashes	Warning
red LED off	No alarm
green LED continuously on	Operation
Green LED flashes	Communication with external device

Operating elements

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

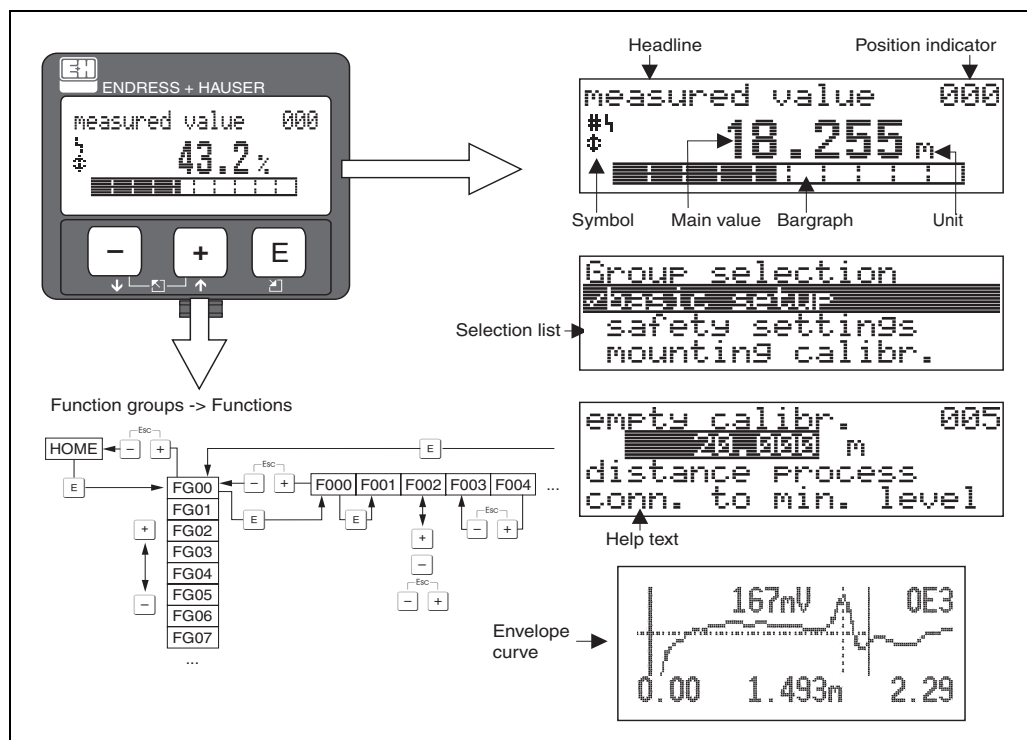
Function of the keys

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

On-site operation

Operation with VU331

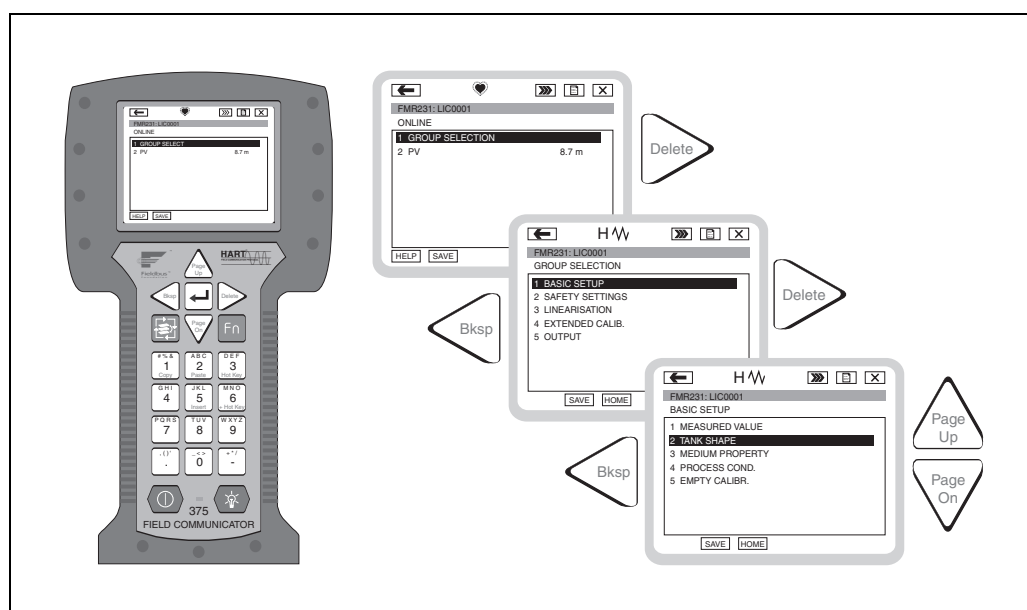
The LC-Display VU331 allows configuration via 3 keys directly at the instrument. All device functions can be set through a menu system. The menu consists of function groups and functions. Within a function, application parameters can be read or adjusted. The user is guided through a complete configuration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



100-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.



100-FMR2xxxxx-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

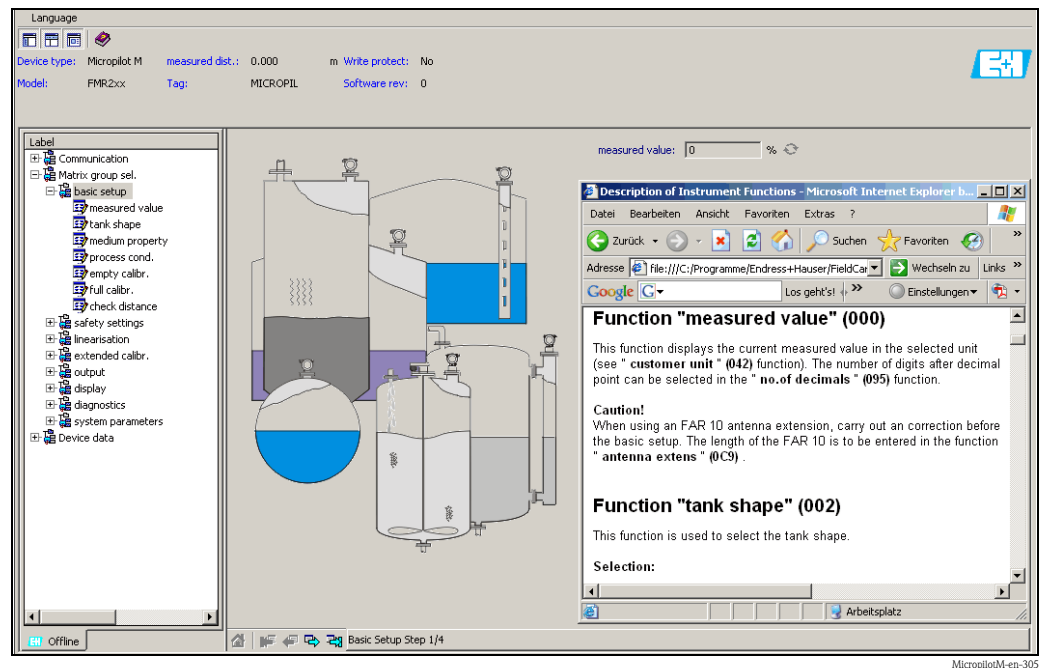
The Micropilot S can be remotely operated via HART. On-site adjustments are also possible.

Operation with FieldCare

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

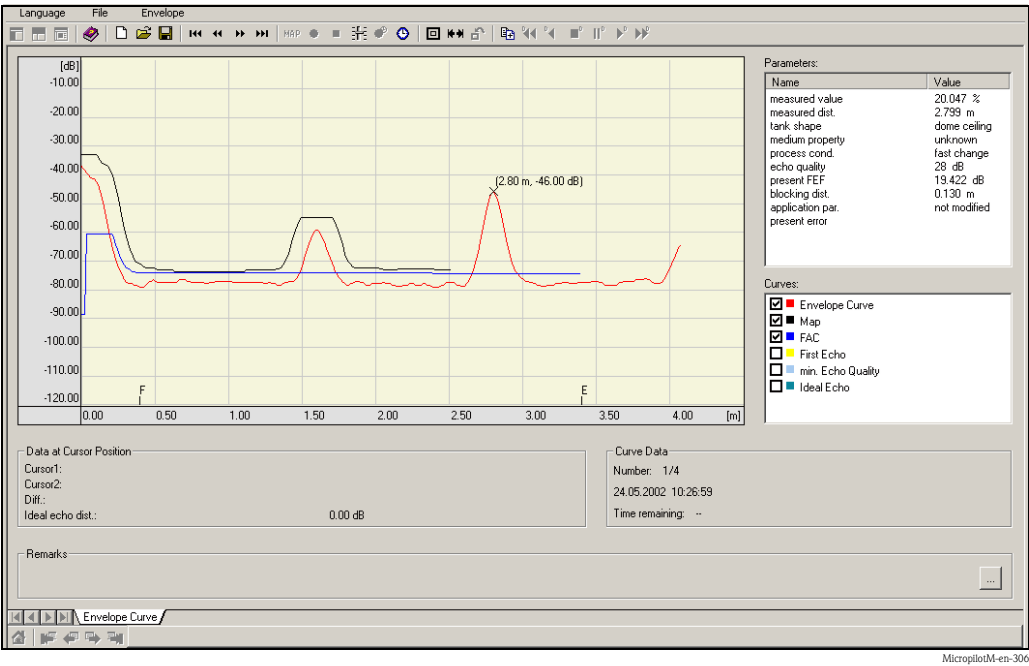
- Supports Ethernet, HART, PROFIBUS, FOUNDATION Fieldbus etc.
- Operates all Endress+Hauser devices
- Operates all third-party actuators, I/O systems and sensors supporting the FDT standard
- Ensures full functionality for all devices with DTMs
- Offers generic profile operation for any third-party fieldbus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

Menu-guided commissioning



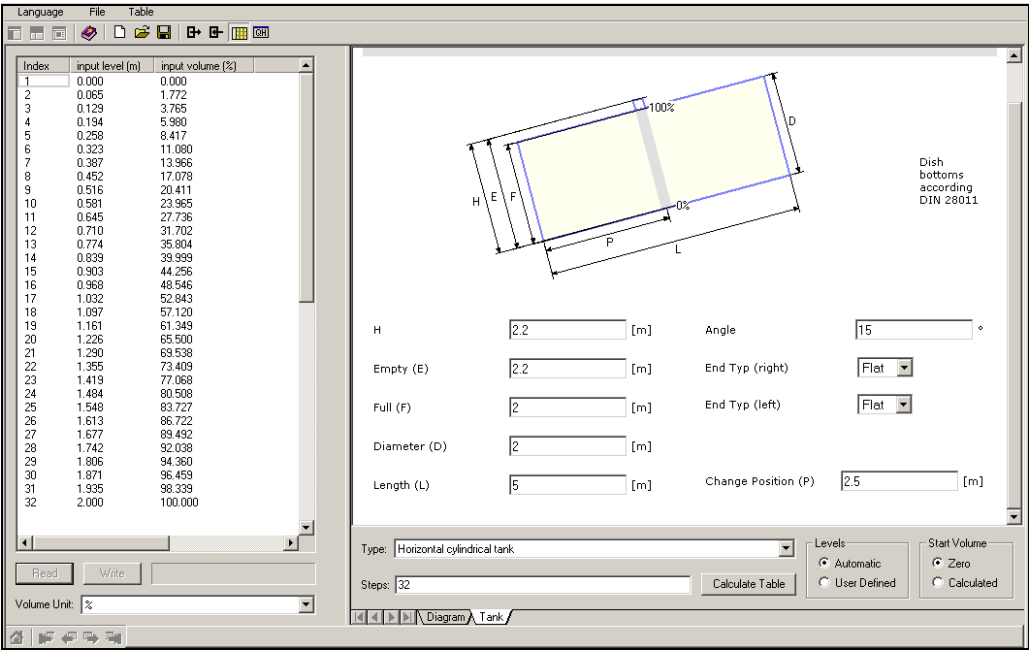
MicropilotM-en-305

Signal analysis via envelope curve



MicropilotM-en-300

Tank linearisation



MicropilotM-en-307

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 44 - Page 50.
External standards and guidelines	To conception and development for Micropilot S have been followed the 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 API (American Petroleum Institute) Particularly "Manual of Petroleum Measurement Standards". OIML R85 (Organisation Internationale de Métrologie Légale)
Overspill protection	WHG, see ZE243F/00/de.
Custody type approval	All aspects of OIML R85 are fulfilled.
RF approvals	R&TTE 1999/5/EG, FCC CRF 47, part 15
Marine certificate	GL (Germanischer Lloyd)

Ordering information

Micropilot S FMR530

This overview does not mark options which are mutually exclusive.

10	Approval:		Basic weight
	A	Non-hazardous area	7.1 kg
	I	ATEX II 1/2G EEx ia IIC T6	
	6	ATEX II 1/2G EEx ia IIC T6, WHG	
	D	IEC Ex ia IIC T6 (in preparation)	
	G	ATEX II 3G EEx nA II T6	
	I	NEPSI Ex ia IIC T6 (in preparation)	
	K	TIIS Ex ia IIC T3	
	L	TIIS Ex ia IIC T6	
	S	FM IS Cl.I Div.1 Gr. A-D, zone 0,1,2	
	U	CSA IS Cl.I Div.1 Gr. A-D, zone 0,1,2	
	Y	Special version	
20	Antenna; Seal:		Additional weight
	M	80mm/3"; FKM, non-conductive media	0.5 kg
	P	80mm/3"; Kalrez, non-conductive media	0.5 kg
	R	80mm/3"; PTFE, conductive media	0.5 kg
	I	100mm/4", FKM, non-conductive media	1.3 kg
	K	100mm/4", Kalrez, non-conductive media	1.3 kg
	L	100mm/4", PTFE, conductive media	1.3 kg
	A	150mm/6", FKM, non-conductive media	0.3 kg
	C	150mm/6", Kalrez, non-conductive media	0.3 kg
	D	150mm/6", PTFE, conductive media	0.3 kg
	U	200mm/8", FKM, non-conductive media	0.2 kg
	W	200mm/8", Kalrez, non-conductive media	0.2 kg
	X	200mm/8", PTFE, conductive media	0.2 kg
	E	250mm/10", FKM, non-conductive media	0.9 kg
	G	250mm/10", Kalrez, non-conductive media	0.9 kg
	H	250mm/10", PTFE, conductive media	0.9 kg
	Y	Special version	
30	Process connection:		Mehrgewicht
	— EN-Flanges —		
	CMJ	DN80 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)	4.8 kg
	CNJ	DN80 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C)	5.9 kg
	CQJ	DN100 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)	5.8 kg
	CRJ	DN100 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C)	7.6 kg
	CWJ	DN150 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)	10.6 kg
	CXJ	DN200 PN16 B1, 316L flange EN1092-1 (DIN2527 C)	16.5 kg
	C6J	DN250 PN16 B1, 316L flange EN1092-1 (DIN2527 C)	25.6 kg
	— ANSI-Flanges —		
	ALJ	3" 150lbs RF, 316/316L flange ANSI B16.5	5.0 kg
	AMJ	3" 300lbs RF, 316/316L flange ANSI B16.5	6.8 kg
	APJ	4" 150lbs RF, 316/316L flange ANSI B16.5	7.0 kg
	AQJ	4" 300lbs RF, 316/316L flange ANSI B16.5	11.5 kg
	AVJ	6" 150lbs RF, 316/316L flange ANSI B16.5	11.3 kg
	A3J	8" 150lbs RF, 316/316L flange ANSI B16.5	19.6 kg
	A5J	10" 150lbs RF, 316/316L flange ANSI B16.5	28.8 kg
	— JIS-Flanges —		
	KA2	10K 80 RF, 316Ti flange JIS B2220	3.7 kg
	KD2	10K 200 RF, 316Ti flange JIS B2220	13.8 kg
	KH2	10K 100 RF, 316Ti flange JIS B2220	4.5 kg
	KV2	10K 150 RF, 316Ti flange JIS B2220	9.9 kg
	K52	10K 250 RF, 316Ti flange JIS B2220	22.5 kg
	JPI-Flanges		
	LJJ	6" 150lbs RF, JPI, 316/316L flange JPI 7S-15 (in preparation)	11.3 kg
	LKJ	8" 150lbs RF, JPI, 316/316L flange JPI 7S-15 (in preparation)	19.6 kg
	LLJ	10" 150lbs RF, JPI, 316/316L flange JPI 7S-15 (in preparation)	28.8 kg
	YY9	Special version	
40	Output; Operation:		
	A	4-20mA HART; 4-line display, envelope curve display on site	
	Y	Special version	
FMR530-		Product designation (Part 1)	

FMR530 continued

50																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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Micropilot S FMR531

This overview does not mark options which are mutually exclusive.

10	Approval:		Basic weight
	A	Non-hazardous area	7.1 kg
	I	ATEX II 1/2G EEx ia IIC T6	
	6	ATEX II 1/2G EEx ia IIC T6, WHG	
	G	ATEX II 3G EEx nA II T6	
	I	NEPSI Ex ia IIC T6 (in preparation)	
	S	FM IS Cl.I Div.1 Gr. A-D	
	U	CSA IS Cl.I Div.1 Gr. A-D	
	K	TIIS Ex ia IIC T3	
	L	TIIS Ex ia IIC T6	
	Y	Special version	
20	Antenna; Inactive length:		Additional weight
	H	PTFE antistatic 390mm/15", fully insul.; nozzle height max 100mm/4"	
	J	PTFE antistatic 540mm/21", fully insul.; nozzle height max 250mm/10"	0.4 kg
	E	PTFE 390mm/15", fully insulated; nozzle height max 100mm/4"	
	F	PTFE 540mm/21", fully insulated; nozzle height max 250mm/10"	0.4 kg
	Y	Special version	
30	Process connection:		Additional weight
	— Clamp-connections —		
	TEJ	Tri-Clamp ISO2852 DN40-51 (2"), 316L	
	TLJ	Tri-Clamp ISO2852 DN70-76.1 (3"), 316L	0.4 kg
	— EN-Flanges —		
	CFJ	DN50 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)	2.9 kg
	CFK	DN50 PN10/16, PTFE >316L flange EN1092-1 (DIN2527)	3.0 kg
	CMJ	DN80 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)	4.8 kg
	CNJ	DN80 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C)	5.9 kg
	CMK	DN80 PN10/16, PTFE >316L flange EN1092-1 (DIN2527)	4.9 kg
	COJ	DN100 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)	5.8 kg
	COK	DN100 PN10/16, PTFE >316L flange EN1092-1 (DIN2527)	5.9 kg
	CWJ	DN150 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)	10.6 kg
	CWK	DN150 PN10/16, PTFE >316L flange EN1092-1 (DIN2527)	10.8 kg
	— ANSI-Flanges —		
	AEJ	2" 150lbs RF, 316/316L flange ANSI B16.5	2.4 kg
	AEK	2" 150lbs, PTFE >316/316L flange ANSI B16.5	2.5 kg
	ALJ	3" 150lbs RF, 316/316L flange ANSI B16.5	5.0 kg
	AMJ	3" 300lbs RF, 316/316L flange ANSI B16.5	6.8 kg
	ALK	3" 150lbs, PTFE >316/316L flange ANSI B16.5	5.1 kg
	APJ	4" 150lbs RF, 316/316L flange ANSI B16.5	7.0 kg
	AQJ	4" 300lbs RF, 316/316L flange ANSI B16.5	11.5 kg
	APK	4" 150lbs, PTFE >316/316L flange ANSI B16.5	7.1 kg
	AVJ	6" 150lbs RF, 316/316L flange ANSI B16.5	11.3 kg
	AVK	6" 150lbs, PTFE >316/316L flange ANSI B16.5	11.5 kg
	— JIS-Flanges —		
	KEJ	10K 50 RF, 316L flange JIS B2238	2.1 kg
	KEK	10K 50, PTFE >316L flange JIS B2238	2.2 kg
	KLJ	10K 80 RF, 316L flange JIS B2238	3.4 kg
	KLK	10K 80, PTFE >316L flange JIS B2238	3.5 kg
	KPJ	10K 100 RF, 316L flange JIS B2238	4.5 kg
	KPK	10K 100, PTFE >316L flange JIS B2238	
	KVJ	10K 150 RF, 316L flange JIS B2238	9.9 kg
	KVK	10K 150, PTFE >316L flange JIS B2238	10.1 kg
	YY9	Special version	
40	Output; Operation:		
	A	4-20mA HART; 4-line display VU331, envelope curve display on site	
	Y	Special version	
50	Housing:		
	C	T12 Alu, coated. IP65 NEMA4X, separate conn. compartment	
	Y	Special version	
FMR531-			Product designation (Part 1)

FMR531 continued

60										Cable entry:
										2 Gland M20
										3 Thread G1/2
										4 Thread NPT1/2
										9 Special version
70										Weight + measure approval:
										A NMi + PTB (<1mm) type approval
										F NMi witnessed initial verificat. (<1mm) type approval
										G PTB witnessed initial verificat. (<1mm) type approval
										R Not selected; Inventory control version (3mm)
										Y Special version
80										Additional option:
										A Basic version
										S GL/ABS marine certificate
										Y Special version
FMR531-										Complete product designation

Micropilot S FMR532

This overview does not mark options which are mutually exclusive.

10	Approval:		Basic weight
	A	Non-hazardous area	6.5 kg
	1	ATEX II 1/2G EEx ia IIC T6 - XA Note safety instruction (electrostatic charging)!	
	6	ATEX II 1/2G EEx ia IIC T6, WHG - XA Note safety instruction (electrostatic charging)!	
	D	IEC Ex ia IIC T6 (in preparation)	
	G	ATEX II 3G EEx nA II T6	
	I	NEPSI Ex ia IIC T6 (in preparation)	
	S	FM IS Cl.I Div.1 Gr. A-D, zone 0,1,2	
	U	CSA IS Cl.I Div.1 Gr. A-D, zone 0,1,2	
	K	TIIS Ex ia IIC T3	
	L	TIIS Ex ia IIC T6	
	Y	Special version	
20	Antenna:		Additional weight
	1	150mm/6", PTFE surface, FKM, Planar (in preparation)	
	2	200mm/8", PTFE surface, FKM, Planar (in preparation)	
	3	250mm/10", PTFE surface, FKM, Planar (in preparation)	
	4	300mm/12", PTFE surface, FKM, Planar (in preparation)	
	A	150mm/6", FKM, Planar	
	B	150mm/6", HNBR, Planar	
	U	200mm/8", FKM, Planar	1.1 kg
	V	200mm/8", HNBR, Planar	
	E	250mm/10", FKM, Planar	2.1 kg
	F	250mm/10", HNBR, Planar	
	W	300mm/12", HNBR, Planar	2.5 kg
	X	300mm/12", FKM, Planar	
	Y	Special version	
FMR532-		Product designation (Part 1)	

FMR532 continued

30					Process connection:	Additional weight
					— EN-Flanges —	
				CWJ	DN150 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)	10.6 kg
				C1J	DN150 PN25 B1, 316L flange EN1092-1 (DIN2527 C)	14.7 kg
				CXJ	DN200 PN16 B1, 316L flange EN1092-1 (DIN2527 C)	16.5 kg
				CZJ	DN200 PN25 B1, 316L flange EN1092-1 (DIN2527 C)	22.7 kg
				C6J	DN250 PN16 B1, 316L flange EN1092-1 (DIN2527 C)	25.6 kg
				C8J	DN300 PN16 B1, 316L flange EN1092-1 (DIN2527 C)	36.1 kg
					— ANSI-Flanges —	
				AVJ	6" 150lbs RF sch.40, 316/316L flange ANSI B16.5	11.3 kg
				AWJ	6" 300lbs RF sch.40, 316/316L flange ANSI B16.5	20.9 kg
				A3J	8" 150lbs RF sch.40, 316/316L flange ANSI B16.5	19.6 kg
				AXJ	8" 300lbs RF sch.40, 316/316L flange ANSI B16.5	34.3 kg
				A5J	10" 150lbs RF sch.40, 316/316L flange ANSI B16.5	28.8 kg
				A7J	12" 150lbs RF, 316/316L flange ANSI B16.5	43.2 kg
					— JIS-Flanges —	
				KVJ	10K 150 RF, 316L flange JIS B2220	
				KWJ	20K 150 RF, 316L flange JIS B2220	14.7 kg
				KDJ	10K 200 RF, 316L flange JIS B2220	13.8 kg
				KXJ	20K 200 RF, 316L flange JIS B2220	21.2 kg
				K5J	10K 250 RF, 316L flange JIS B2220	22.5 kg
					— JPI-Flanges —	
				LJJ	6" 150lbs RF, JPI, 316/316L flange JPI 7S-15	11.3 kg
				LKJ	8" 150lbs RF, JPI, 316/316L flange JPI 7S-15	19.6 kg
				LLJ	10" 150lbs RF, JPI, 316/316L flange JPI 7S-15	28.8 kg
				LMJ	12" 150lbs RF, JPI, 316/316L flange JPI 7S-15	43.2 kg
					— Miscellaneous—	
				XXJ	With flange hub, 316L	
				XVU	UNI-Flange 6"/DN150/150, 304 max 14.5lbs/PN1/1K, compatible with 6" 150lbs / DN150 PN16 / 10K 150	3.5 kg
				X3U	UNI-Flange 8"/DN200/200, 304 max 14.5lbs/PN1/1K, compatible with 8" 150lbs / DN200 PN16 / 10K 200	5.2 kg
				X5U	UNI-Flange 10"/DN250/250, 304 max 14.5lbs/PN1/1K, compatible with 10" 150lbs / DN250 PN16 / 10K 250	7.5 kg
				X7U	UNI-Flange 12"/DN300/300, 304 max 14.5lbs/PN1/1K, compatible with 12" 150lbs / DN300 PN16 / 10K 300	10.8 kg
				YY9	Special version	
40					Output; Operation:	
				A	4-20mA HART; 4-line display VU331, envelope curve display on site	
				Y	Special version	
50					Housing:	
				C	T12 Alu, coated IP65 NEMA4X, separate conn. compartment	
				Y	Special version	
60					Cable entry:	
				2	Gland M20	
				3	Thread G1/2	
				4	Thread NPT1/2	
				9	Special version	
70					Weight + measure approval:	
				A	NMi + PTB (<1mm) type approval	
				F	NMi witnessed initial verificat. (<1mm) type approval	
				G	PTB witnessed initial verificat. (<1mm) type approval	
				R	Not selected; Inventory control version (3mm)	
				Y	Special version	
80					Additional option:	
				A	Basic version	
				S	GL/ABS marine certificate	
				Y	Special version	
FMR532-						Complete product designation

Micropilot S FMR533

This overview does not mark options which are mutually exclusive.

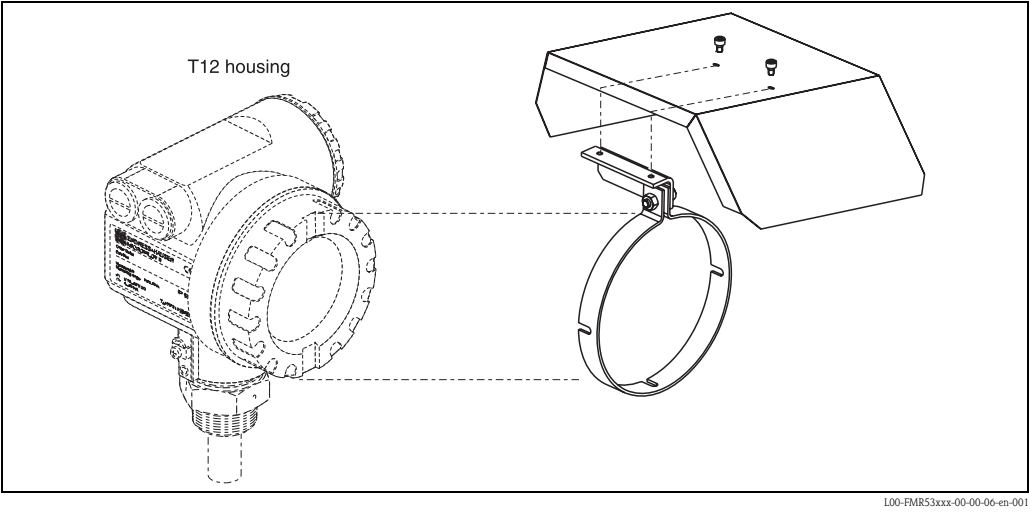
10	Approval:				Basic weight
	A	Non-hazardous area			7.1 kg
	1	ATEX II 1/2G	EEx ia IIC T6 – XA Note safety instruction (electrostatic charging)!		
	6	ATEX II 1/2G	EEx ia IIC T6, WHG – XA Note safety instruction (electrostatic charging)!		
	D	IEC	Ex ia IIC T6 (in preparation)		
	G	ATEX II 3G	EEx nA II T6		
	I	NEPSI	Ex ia IIC T6 (in preparation)		
	S	FM	IS Cl.I Div.1 Gr. A-D, zone 0,1,2		
	U	CSA	IS Cl.I Div.1 Gr. A-D, zone 0,1,2		
	K	TIIS	Ex ia IIC T3		
	L	TIIS	Ex ia IIC T6		
	Y	Special version			
20	Antenna:				Additional weight
	A	450mm/20", Parabolic, no wetted O-ring			
	Y	Special version			
30	Process connection:				Additional weight
			– EN-Flanges –		
		CWJ	DN150 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)		10.6 kg
		CXJ	DN200 PN16 B1, 316L flange EN1092-1 (DIN2527 C)		16.5 kg
		C6J	DN250 PN16 B1, 316L		25.6 kg
			– ANSI-Flanges –		
		AVJ	6" 150lbs RF, 316/316L		11.3 kg
		A3J	8" 150lbs RF, 316/316L		19.6 kg
		A5J	10" 150lbs RF, 316/316L		28.8 kg
			– JIS-Flanges –		
		KVJ	10K 150 RF, 316L flange JIS B2238		9.9 kg
		KDJ	10K 200 RF, 316L flange JIS B2238		13.8 kg
		K5J	10K 250 RF, 316L flange JIS B2238		22.9 kg
			– JPI-Flanges –		
		LJJ	6" 150lbs RF, JPI, 316/316L flange JPI 7S-15		11,3 kg
		LKJ	8" 150lbs RF, JPI, 316/316L flange JPI 7S-15		19,6 kg
		LLJ	10" 150lbs RF, JPI, 316/316L flange JPI 7S-15		28,8 kg
			– Miscellaneous –		
		XXJ	With flange hub, 316L		3.5 kg
		XVU	UNI-Flange 6"/DN150/150, 304		
			max 14.5lbs/PN1/1K, compatible with		
			6" 150lbs / DN150 PN16 / 10K 150		
		YY9	Special version		
40	Output; Operation:				
	A	4-20mA HART; 4-line display VU331, envelope curve display on site			
	Y	Special version			
50	Housing:				
	C	T12 Alu, coated IP65 NEMA4X, separate conn. compartment			
	Y	Special version			
60	Cable entry:				
	2	Gland M20			
	3	Thread G1/2			
	4	Thread NPT1/2			
	9	Special version			
70	Weight + measure approval:				
	A	NMi + PTB (<1mm) type approval			
	F	NMi witnessed initial verificat. (<1mm) type approval			
	G	PTB witnessed initial verificat. (<1mm) type approval			
	R	Not selected; Inventory control version (3mm)			
	Y	Special version			
80	Additional option:				
	A	Basic version			
	Y	Special version			
FMR533-					Complete product designation

Accessories

A variety of accessories is available for the Micropilot S. They can be ordered separately from Endress+Hauser.

Weather protection cover

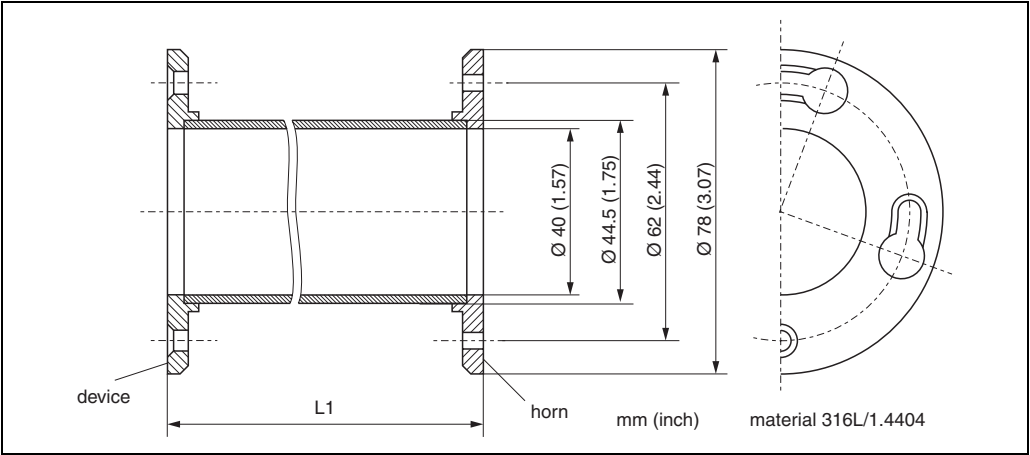
A weather protective cover made of stainless steel is available for outdoor mounting (order code: 543199-0001). The shipment includes the protective cover and tension clamp.



L00-FMR53xxx-00-00-06-en-001

Antenna extension
FAR 10 (for FMR530)

Dimensions



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

Ordering information

10	Material:	
	6	316L
	7	316L + EN10204-3.1B, NACE MR1075 Inspection certificate
	4	AlloyB2
	5	AlloyC4
	9	Special material
20	Extension:	
	A	100 mm / 4"
	B	200 mm / 8"
	C	300 mm / 12"
	D	400 mm / 16"
	Y	Special length
FAR10-		Complete product designation

Commubox FXA191 HART	For intrinsically safe communication with ToF Tool/FieldCare via the RS232C interface. For details refer to TI237F/00/en.
Commubox FXA195 HART	For intrinsically safe communication with ToF Tool/FieldCare via the USB interface. For details refer to TI404F/00/en.
Commubox FXA291	The Commubox FXA291 connects Endress+Hauser field instruments with CDI interface (= Endress+Hauser Common Data Interface) to the USB interface of a personal computer or a notebook. For details refer to TI405C/07/en. Note! For the following Endress+Hauser instruments you need the "ToF Adapter FXA291" as an additional accessory: ■ Cerabar S PMC71, PMP7x ■ Deltabar S PMD7x, FMD7x ■ Deltapilot S FMB70 ■ Gammapilot M FMG60 ■ Levelflex M FMP4x ■ Micropilot FMR130/FMR131 ■ Micropilot M FMR2xx ■ Micropilot S FMR53x, FMR540 ■ Prosonic FMU860/861/862 ■ Prosonic M FMU4x ■ Tank Side Monitor NRF590 (with additional adapter cable)
ToF Adapter FXA291	The ToF Adapter FXA291 connects the Commubox FXA291 via the USB interface of a personal computer or a notebook to the following Endress+Hauser instruments: ■ Cerabar S PMC71, PMP7x ■ Deltabar S PMD7x, FMD7x ■ Deltapilot S FMB70 ■ Gammapilot M FMG60 ■ Levelflex M FMP4x ■ Micropilot FMR130/FMR131 ■ Micropilot M FMR2xx ■ Micropilot S FMR53x, FMR540 ■ Prosonic FMU860/861/862 ■ Prosonic M FMU4x ■ Tank Side Monitor NRF590 (with additional adapter cable) For details refer to KA271F/00/a2.

Supplementary Documentation

System Information System Information for Micropilot, SI019F/00/en.

Special Documentation **Time of Flight Liquid Level Measurement**
Selection and engineering for the process industry, SD157F/00/en.

Radar Tank Gauging brochure

For inventory control and custody transfer applications in tank farms and terminals, SD001V/00/en.

Technical Information **Tank Side Monitor NRF590**
Technical Information for Tank Side Monitor NRF590, TI402F/00/en.

Fieldgate FXA520

Technical Information for Fieldgate FXA520, TI369F/00/en.

Operating Instructions **Correlation of operating instructions to the instrument:**

Instrument	Output	Communication	Operating Instructions	Description of Instrument Functions	Brief Operating Instructions (in the Instrument)
FMR530	A	HART	BA206F/00/en	BA217F/00/en	KA161F/00/a2
FMR531			BA207F/00/en		
FMR532			BA208F/00/en		
FMR533			BA209F/00/en		

Tank Side Monitor NRF590

Operating Instructions for Tank Side Monitor NRF590, BA256F/00/en.

Description of Instrument Functions for Tank Side Monitor NRF590, BA257F/00/en.

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

Instrument	Certificate	Explosion protection	Output	Communication	ATEX-Nr.	XA	WHG
FMR530, FMR531, FMR532, FMR533	1	ATEX II 1/2 G EEx ia IIC T6	A	HART	PTB 00 ATEX 2067 X	XA081F	—
	6	ATEX II 1/2 G EEx ia IIC T6 + WHG	A	HART	PTB 00 ATEX 2067 X	XA081F	ZE243F/00/de
NRF590	6	ATEX II 2 (1) G EEx d[ia] IIC T4	—	—	PTB 02 ATEX 2216 X	XA160F	—
NRF590 IS Module	6	ATEX II 2 (1) G EEx d[ia] IIC T4	—	—	PTB 02 ATEX 2216 X	XA169F	—

Correlation of Control Drawings (ZD) to the instrument:

Instrument	Certificate	Explosion protection	Output	Communication	ZD
FMR530, FMR531, FMR532, FMR533	S	FM IS	A	HART	ZD065F/00/en
	U	CSA IS	A	HART	ZD073F/00/en
NRF590	S	FM IS	—	—	ZD084F/00/en
	U	CSA IS	—	—	ZD103F/00/en
NRF590 IS Module	S	FM IS	—	—	ZD085F/00/en
	U	CSA IS	—	—	ZD104F/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

For more Endress+Hauser product please visit: www.ainstru.com

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