

Technical Information

Micropilot FMR10

Free space radar

Level measurement for liquids

Application

- Ingress protection: IP66/68 / NEMA 4X/6P
- Measuring range: up to 8 m (26.25 ft)
- Process temperature: -40 to 60 °C (-40 to 140 °F)
- Process pressure: -1 to 3 bar (-14 to 43 psi)
- Accuracy: up to ± 5 mm (0.2 in)

Your benefits

- Level measurement for liquids in storage tanks, open basins, pump shafts and canal systems
- Radar measuring device with *Bluetooth®* wireless technology
- Simple, safe and secure wireless remote access – ideal for installation in areas or places difficult to reach
- Commissioning, operation and maintenance via free iOS / Android app SmartBlue – saves time and reduces costs
- Full PVDF body – for a long sensor lifetime
- Hermetically sealed wiring and fully potted electronics – eliminates water ingress and allows operation under harsh environmental conditions
- Most compact radar due to unique radar chip design – fits in limited space installations
- Best price-performance-ratio radar



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Important document information

Symbols for certain types of information

Symbol	Meaning
	Permitted Procedures, processes or actions that are permitted.
	Preferred Procedures, processes or actions that are preferred.
	Forbidden Procedures, processes or actions that are forbidden.
	Tip Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
	Visual inspection

Safety symbols

Symbol	Meaning
	DANGER! This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
	WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
	CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
	NOTE! This symbol contains information on procedures and other facts which do not result in personal injury.

Electrical symbols

Symbol	Meaning	Symbol	Meaning
	Direct current		Alternating current
	Direct current and alternating current		Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	Protective ground connection A terminal which must be connected to ground prior to establishing any other connections.		Equipotential connection A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

Symbols in graphics

Symbol	Meaning
1, 2, 3 ...	Item numbers
	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections

Symbol	Meaning
	Hazardous area Indicates a hazardous area.
	Safe area (non-hazardous area) Indicates the non-hazardous area.

Terms and abbreviations

Term/abbreviation	Explanation
BA	Document type "Operating Instructions"
KA	Document type "Brief Operating Instructions"
TI	Document type "Technical Information"
SD	Document type "Special Documentation"
XA	Document type "Safety Instructions"
PN	Nominal pressure
MWP	Maximum Working Pressure The MWP can also be found on the nameplate.
ToF	Time of Flight
DC	Relative dielectric constant ϵ_r
Operating tool	The term "operating tool" is used in place of the following operating software: SmartBlue (app), for operation using an Android or iOS smartphone or tablet.
BD	Blocking Distance; no signals are analyzed within the BD.

Registered trademarks

Bluetooth®

The *Bluetooth®* word mark and logos are registered trademarks owned by the Bluetooth SIG, Inc. and any use of such marks by Endress+Hauser is under license. Other trademarks and trade names are those of their respective owners.

Apple®

Apple, the Apple logo, iPhone, and iPod touch are trademarks of Apple Inc., registered in the U.S. and other countries. App Store is a service mark of Apple Inc.

Android®

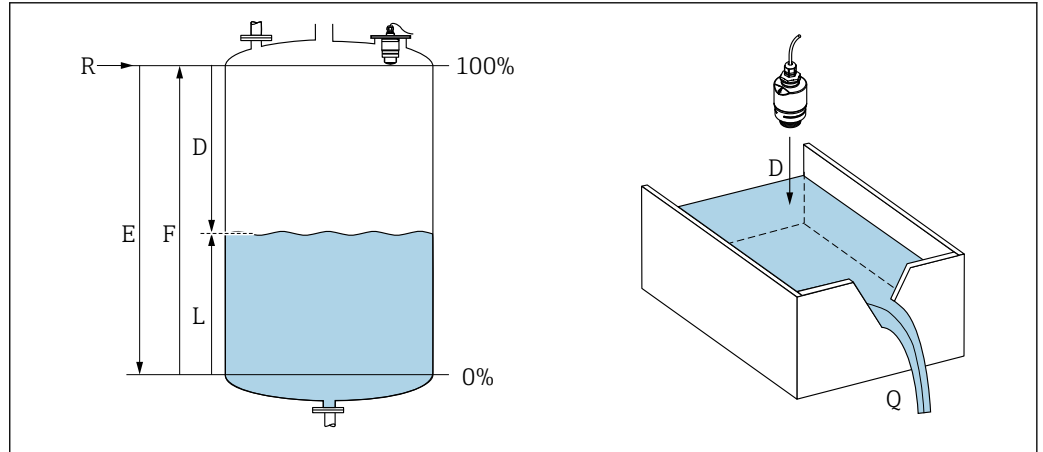
Android, Google Play and the Google Play logo are trademarks of Google Inc.

Product life cycle

Engineering	■ Proven radar measuring technology ■ Indication of over-flooding situation ■ 2D / 3D drawings ■ Spec Sheet Producer ■ Applicator Selection tool for the selection of the perfect measurement solution  Device not compatible with transmitters and sensors of ultrasonic measurement technology (e.g. Prosonic FMU9x, FDU9x)
Procurement	■ Best price-performance-ratio radar ■ Easy to order via Global E-direct Portal with 48h delivery time ■ Global availability
Installation	Rear- and front side thread for flexible installation
Commissioning	■ Easy and fast setup via SmartBlue (app) ■ No additional tools or adapters required ■ Local languages (up to 15)
Operation	■ Continuous self-monitoring ■ Diagnosis information acc. NAMUR NE107 with clear text messages remedy directives ■ Signal curve via SmartBlue (app) ■ Encrypted single point-to-point data transmission (Fraunhofer-Institut, third party, tested) and password-protected communication via <i>Bluetooth®</i> wireless technology
Maintenance	■ No maintenance required ■ Technical experts on-call around the global
Retirement	■ Environmentally responsible recycling concepts ■ RoHS compliance (Restriction of certain hazardous substances), lead-free soldering of electronic components

Measuring principle

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



1 Setup parameters of the Micropilot

- E* Empty calibration (= zero)
- F* Full calibration (= span)
- D* Measured distance
- L* Level ($L = E - D$)
- Q* Flow rate at measuring weirs or channels (calculated from the level using linearization)
- R* Reference point

Input

The reflected radar impulses are received by the antenna and transmitted into the electronics. A microprocessor evaluates the signal and identifies the level echo caused by the reflection of the radar impulse at the product surface. This clear signal detection system benefits from over 30 years' experience with time-of-flight procedures.

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

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

where **c** is the speed of light.

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

$$L = E - D$$

Output

The Micropilot is adjusted by entering the empty distance **E** (= zero point) and the full distance **F** (= span).

- Current output: 4 to 20 mA
- Digital output (SmartBlue): 0 to 5 m (0 to 16 ft) or 0 to 8 m (0 to 26.25 ft) in combination with accessory "flooding protection tube"

Input

Measured variable	The measured variable is the distance between the reference point and the product surface. The level is calculated based on E , the empty distance entered.
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Measuring range	Maximum measuring range
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Device	Maximum measuring range
FMR10	5 m (16 ft)
FMR10 with accessory "flooding protection tube"	8 m (26.25 ft)

Requirements of the installation

- Tank height > 1.5 m (5 ft)
- Open channel minimum width 0.5 m (1.6 ft)
- Calm surfaces
- No agitators
- No buildup
- Relative dielectric constant $\epsilon_r > 4$

Usable measuring range

The usable measuring range depends on the antenna size, the medium's reflective properties, the installation position and any possible interference reflections.

The following table describes the media groups.

Media groups

ϵ_r	Example
4 to 10	E.g. concentrated acid, organic solvents, ester, aniline, alcohol, acetone.
> 10	Conductive liquids, aqueous solutions, diluted acids and bases

Reduction of the max. possible measuring range by:

- Media with bad reflective properties (= low ϵ_r value)
- Formation of buildup, particularly of moist products
- Strong condensation
- Foam generation
- Freezing of sensor

Operating frequency	K-band (~ 26 GHz)
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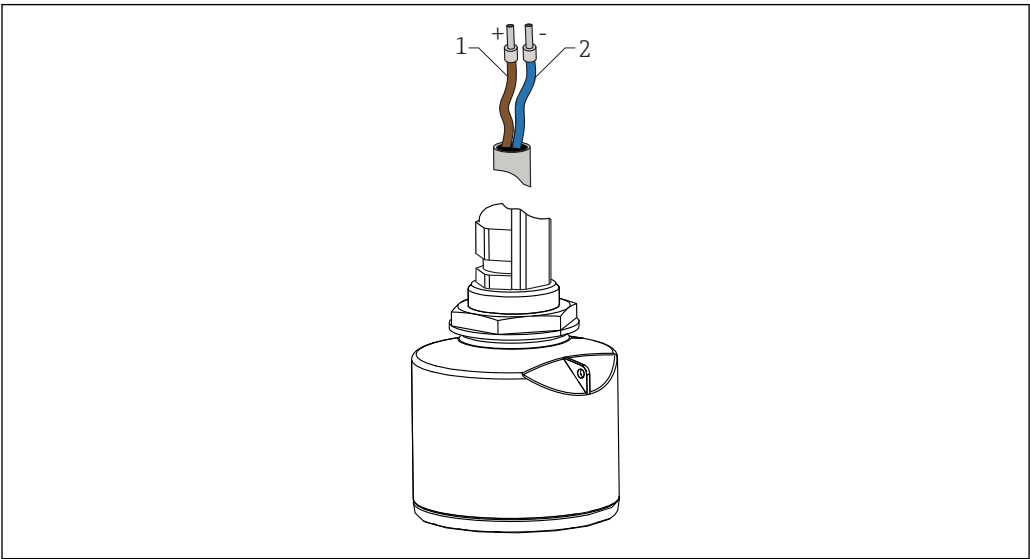
Transmission power	<table> <tr> <th>Distance</th><th>Mean power density in the direction of the beam</th></tr> <tr> <td>1 m (3.3 ft)</td><td>< 12 nW/cm²</td></tr> <tr> <td>5 m (16 ft)</td><td>< 0.4 nW/cm²</td></tr> </table>	Distance	Mean power density in the direction of the beam	1 m (3.3 ft)	< 12 nW/cm ²	5 m (16 ft)	< 0.4 nW/cm ²
Distance	Mean power density in the direction of the beam						
1 m (3.3 ft)	< 12 nW/cm ²						
5 m (16 ft)	< 0.4 nW/cm ²						

Output

Output signal	4 to 20 mA An 4 to 20 mA interface is used for measured value output and to power to the device.
Digital output	Bluetooth® wireless technology The device has a <i>Bluetooth</i> ® wireless technology interface and can be operated and configured via this interface using the SmartBlue app. ■ The range under reference conditions is 25 m (82 ft) ■ Incorrect operation by unauthorized persons is prevented by means of encrypted communication and password encryption. ■ The <i>Bluetooth</i>® wireless technology interface can be deactivated.
Signal on alarm	Depending on the interface, failure information is displayed as follows: ■ Current output Alarm current: 22.5 mA (as per NAMUR Recommendation NE 43) ■ SmartBlue (app) – Status signal (as per NAMUR Recommendation NE 107) – Plain text display with remedial action
Linearization	The linearization function of the device allows the conversion of the measured value into any unit of length, weight, flow or volume. When operating via SmartBlue (app), up to 32 value pairs can be entered manually into the linearization table.

Electrical connection

Cable assignment

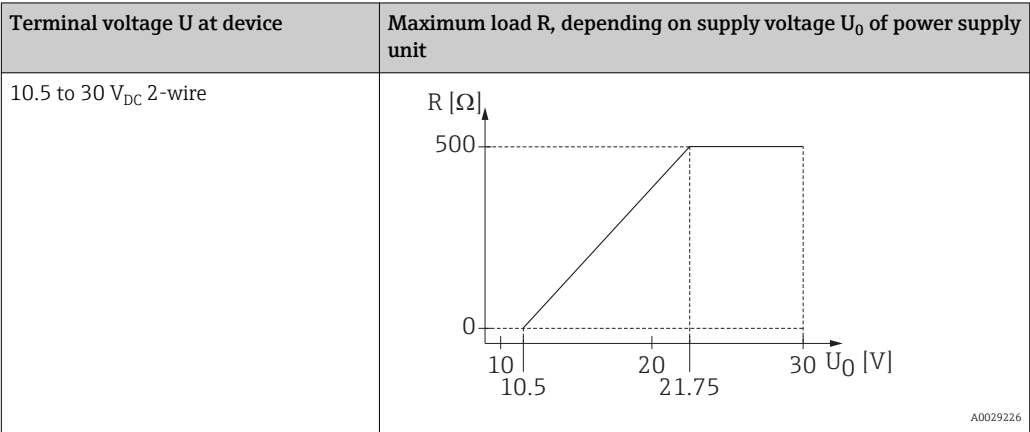


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- 2 Cable assignment
- 1 Plus, brown wire
- 2 Minus, blue wire

Supply voltage

An external power supply is necessary.



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Potential equalization

No special measures for potential equalization are required.

Various power supply units can be ordered from Endress+Hauser.

Battery operation

The sensor's *Bluetooth*® wireless technology communication can be disabled to increase the operating life of the battery.

Power consumption

Maximum input power: 675 mW

Current consumption

- maximum input current: <25 mA
- Maximum start-up current: 3.6 mA

Starting time

First stable measured value after 20 s (with supply voltage = 24 V_{DC})

Power supply failure

The configuration remains stored in the sensor.

Connection 4 to 20 mA	Circuit diagram / Description
FMR10 connection with voltage source and 4 to 20 mA display	3 <i>FMR10 block diagram</i> 1 <i>Micropilot FMR10, 4 to 20 mA</i> 2 <i>Power supply</i>

Cable specification	Unshielded cable, $2 \times 0.75 \text{ mm}^2$ As per IEC/EN 60079-11 section 10.9, the cable is designed for a tensile strength of 30 N (6.74 lbf) (over a period of 1 h). The FMR10 is supplied with 10 m (33 ft) cable length as standard.
Overvoltage protection	The device is equipped with integrated overvoltage protection.

Performance characteristics

Reference operating conditions

- Temperature = +24 °C (+75 °F) ±5 °C (±9 °F)
- Pressure = 960 mbar abs. (14 psia) ±100 mbar (±1.45 psi)
- Humidity = 60 % ±15 %
- Reflector: metal plate with diameter ≥ 1 m (40 in)
- No major interference reflections inside the signal beam

Maximum measured error

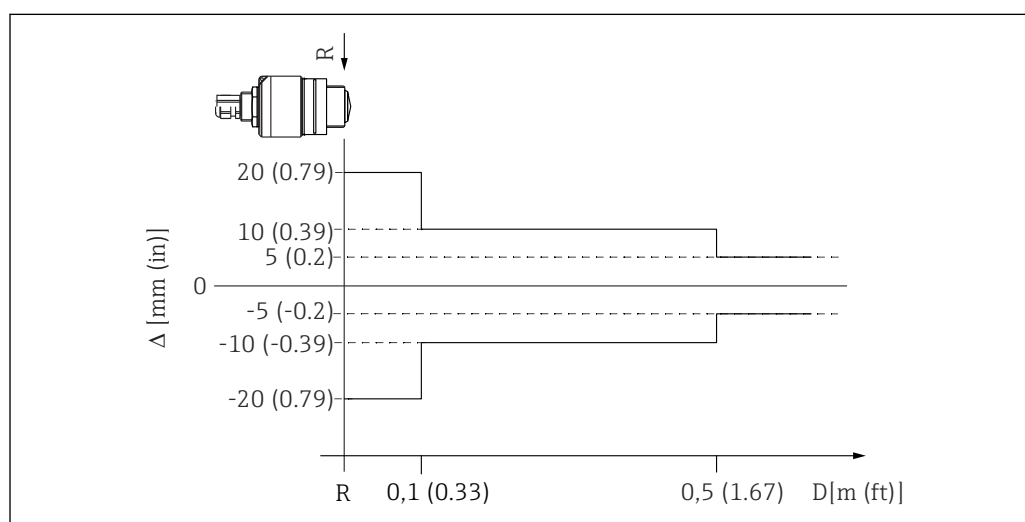
Typical data under reference operating conditions: DIN EN 61298-2, percentage values in relation to the span.

Device	Value	Output	
		digital ¹⁾	analog ²⁾
FMR10	Sum of non-linearity, non-repeatability and hysteresis	±5 mm (0.2 in)	±0.02 %
	Offset/Zero	±4 mm (0.16 in)	±0.03 %

1) SmartBlue (app)

2) Only relevant for 4-20mA current output; add error of the analog value to the digital value

Differing values in near-range applications



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4 Maximum measured error in near-range applications

Δ Maximum measured error

R Reference point of the distance measurement

D Distance from reference point of antenna

Measured value resolution

Dead band as per EN61298-2:

- Digital: 1 mm (0.04 in)
- Analog: 4 μ A

Response time

The response time can be configured. The following step response times (as per DIN EN 61298-2) ¹⁾ apply if the damping is switched off:

Tank height	Sampling rate	Response time
< 5 m (16 ft)	1 s ⁻¹	< 3 s

1) According to DIN EN 61298-2 the step response time is the time which passes after a sudden change of the input signal until the output signal assumes 90% of the steady-state value for the first time.

Influence of ambient temperature

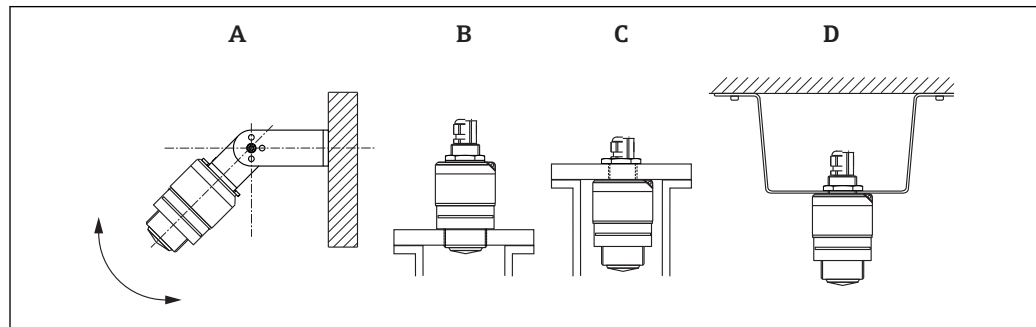
The measurements are carried out in accordance with EN 61298-3.

- Digital (*Bluetooth*® wireless technology):
Standard version: average $T_K = \pm 3 \text{ mm (0.12 in)}/10 \text{ K}$
- Analog (current output):
 - Zero point (4 mA): average $T_K = 0.02 \text{ %}/10 \text{ K}$
 - Span (20 mA): average $T_K = 0.05 \text{ %}/10 \text{ K}$

Installation

Installation conditions

Installation types



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 5 Wall, ceiling or nozzle installation

- A Wall or ceiling mount, adjustable
 B Mounted at front thread
 C Mounted at rear thread
 D Ceiling installation with counter nut (included in delivery)

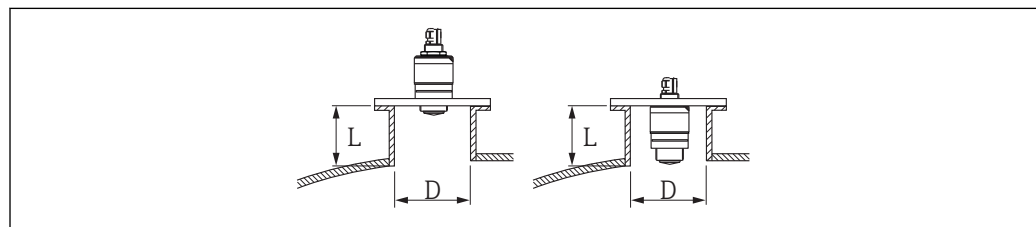


Caution!

- The sensor cables are not designed as supporting cables. Do not use as a suspension wire.
- In the free-field, a vertically downward orientation must be ensured at all times

Nozzle installation

The antenna should be just out of the nozzle for optimum measurement. The interior of the nozzle must be smooth and may not contain any edges or welded joints. The edge of the nozzle should be rounded if possible. The maximum nozzle length **L** depends on the nozzle diameter **D**. Please note the specified limits for the diameter and length of the nozzle.

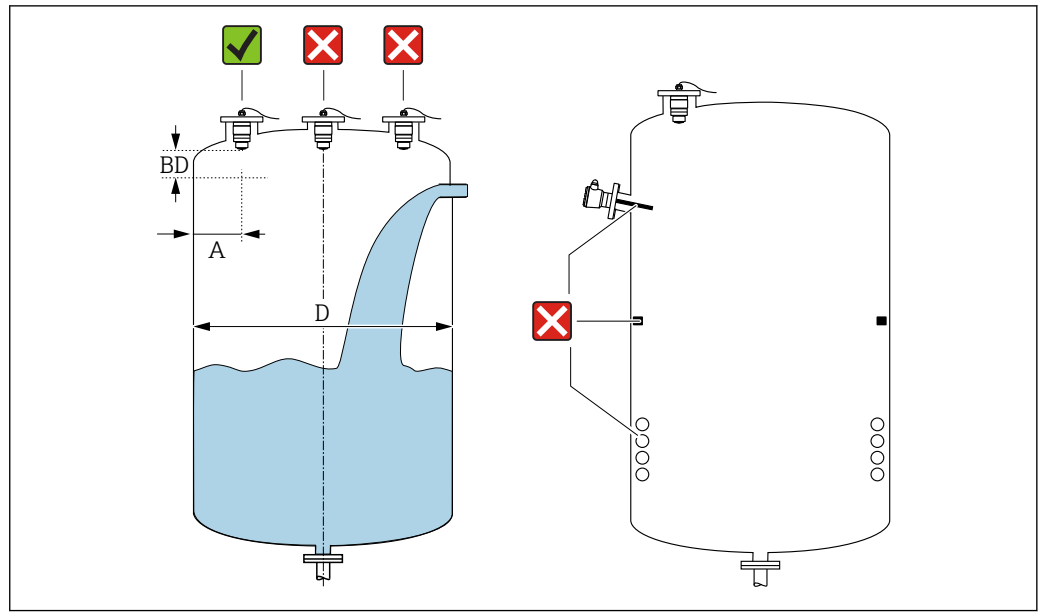


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 6 FMR10 nozzle installation

	40 mm (1.5 in) Antenna, outside nozzle	40 mm (1.5 in) Antenna, inside nozzle
D	min. 40 mm (1.5 in)	min. 80 mm (3 in)
L	max. $D \times 1,5$	max. 140 mm (5.5 in) + $D \times 1,5$

Orientation



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7 Tank installation position

- If possible install the sensor so that its lower edge projects into the vessel.
- Recommended distance **A** wall - nozzle outer edge: $\sim 1/6$ of the tank diameter **D**. However, the device must not under any circumstances be mounted closer than 15 cm (5.91 in) to the tank wall.
- Do not mount the sensor in the center of the tank.
- Avoid measurements through the filling curtain.
- Avoid equipment such as limit switches, temperature sensors, baffles, heating coils etc.
- Several devices can be operated in a single tank without impacting on each other.
- No signals are analyzed within the Blocking distance (BD). It can therefore be used to suppress interference signals (e.g. the effects of condensate) close to the antenna.
An automatic Blocking distance of at least 0.1 m (0.33 ft) is configured as factory setting. However, this can be overwritten manually (0 m (0 ft) is also permitted).

Automatic calculation:

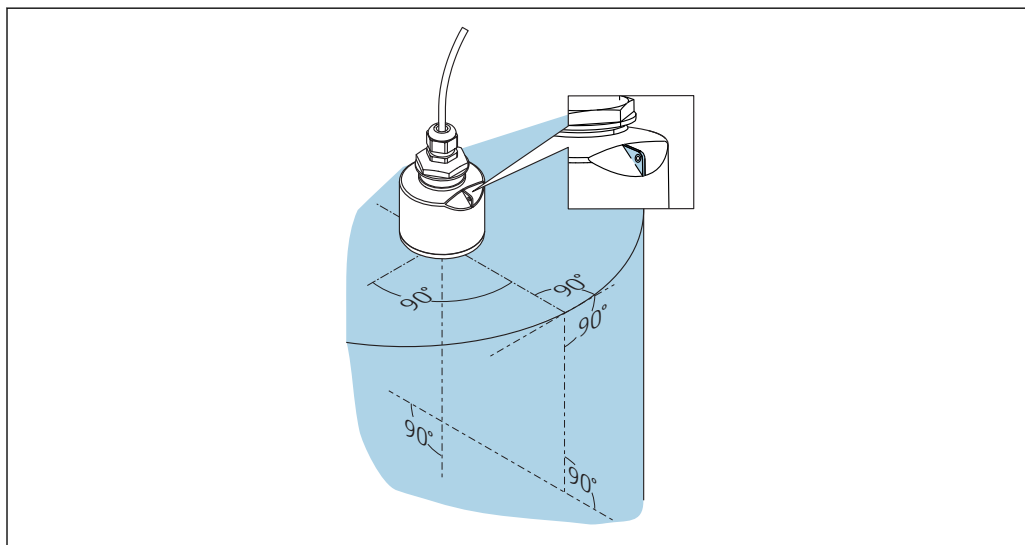
Blocking distance = Empty calibration - Full calibration - 0.2 m (0.656 ft).

Each time a new entry is made in the **Empty calibration** parameter or **Full calibration** parameter, the **Blocking distance** parameter is recalculated automatically using this formula.

If the result of the calculation is a value < 0.1 m (0.33 ft), the Blocking distance of 0.1 m (0.33 ft) continues to be used.

Alignment

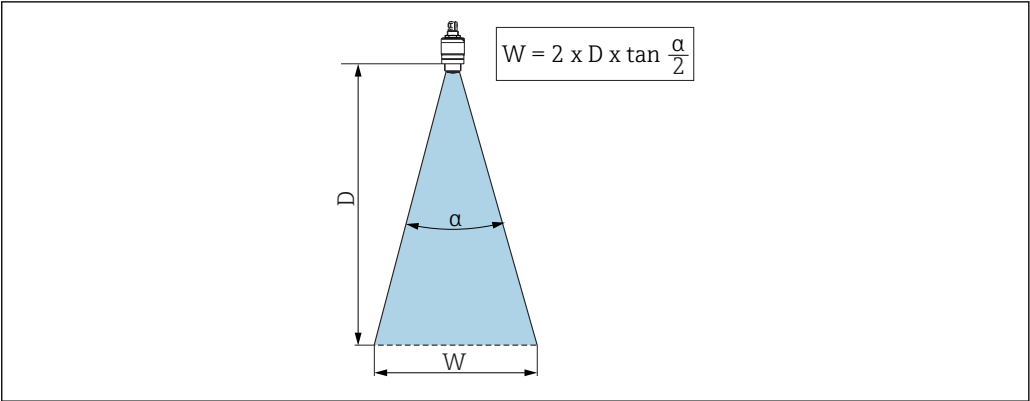
- Align the antenna vertically to the product surface.
- Align the eyelet with the mounting eye as well as possible towards the tank wall.



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 8 Sensor alignment when mounting in tank

Beam angle



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9 Relationship between beam angle α , distance D and beam diameter W

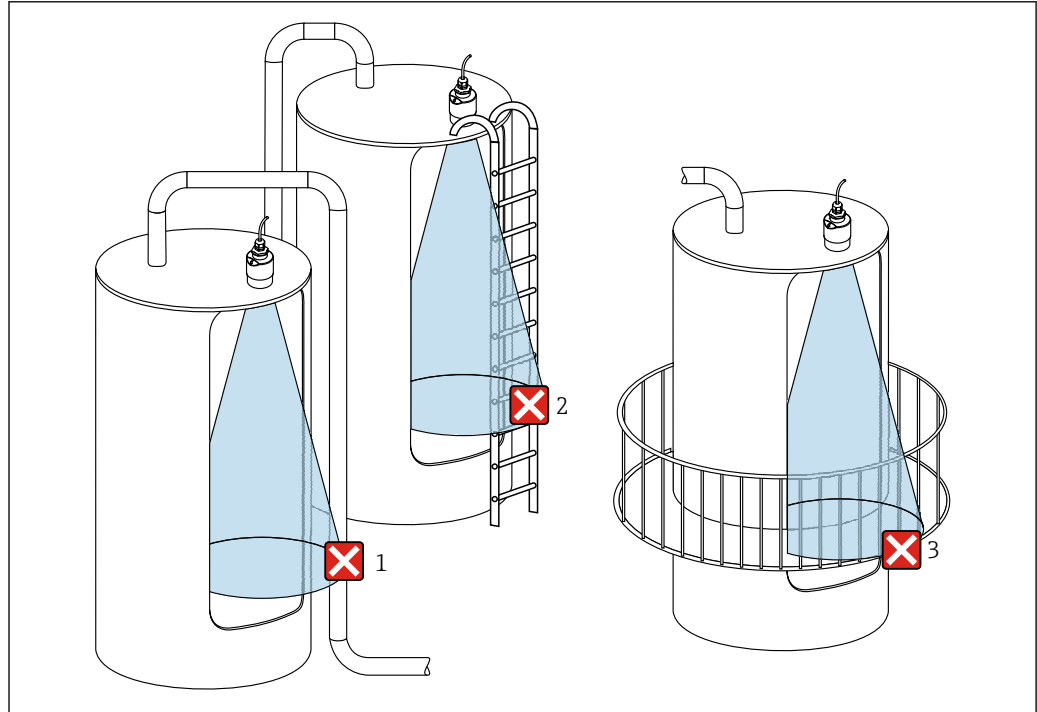
The beam angle is defined as the angle α , at which the power density of the radar waves reaches half the value of the maximum power density (3dB width). Microwaves are also emitted outside the signal beam and can be reflected off interfering installations.

Beam diameter W as a function of beam angle α and distance D .

FMR10		
Antenna size	40 mm (1.5 in)	40 mm (1.5 in) with accessory "flooding protection tube"
Beam angle α	30°	12°
Distance (D)	Beam diameter W	
3 m (9.8 ft)	1.61 m (5.28 ft)	0.63 m (2.07 ft)
5 m (16.4 ft)	2.68 m (8.79 ft)	1.51 m (4.95 ft)
8 m (26.25 ft)	-	1.68 m (5.52 ft)

Measurement in plastic vessels

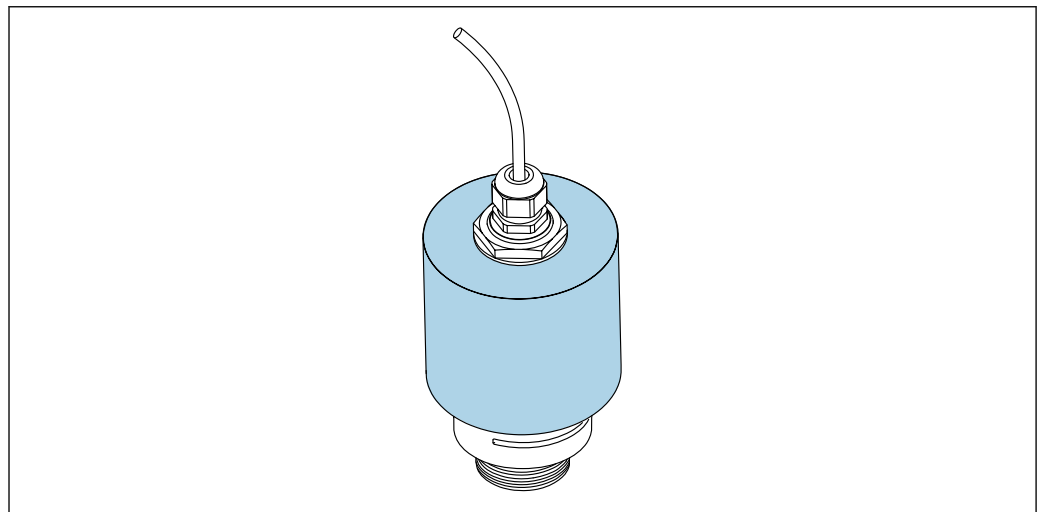
If the outer wall of the vessel is made of a non-conductive material (e.g. GFR) microwaves can also be reflected off interfering installations outside of the vessel (e.g. metallic pipes (1), ladders (2), grates (3), ...). Therefore there should be no such interfering installations in the signal beam.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



10 Measurement in a plastic vessel

Weather protection cover

For outdoor use, a weather protection cover is recommended.



11 Weather protection cover, e.g. with 40 mm (1.5") antenna



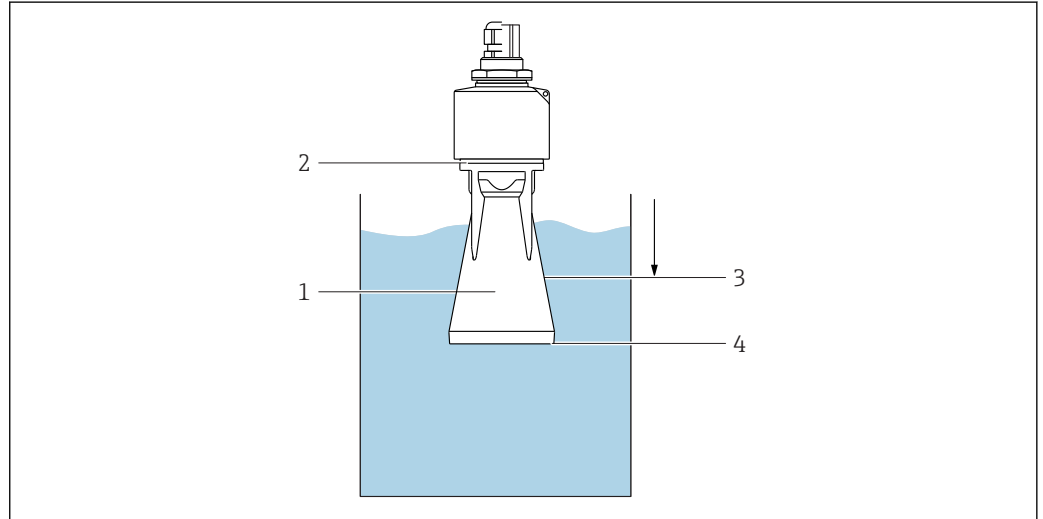
The sensor is not completely covered.

The weather protection cover is available as an accessory. → 31

Free-field measurement with flooding protection tube

The flooding protection tube guarantees a definitive analysis of the maximum level even in the event that the sensor is completely flooded.

In free-field installations and / or in applications where there is a risk of flooding, the flooding protection tube must be used.



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 12 Function of flooding protection tube

- 1 Air pocket
- 2 O-ring (EPDM) seal
- 3 Blocking distance
- 4 Max. Level



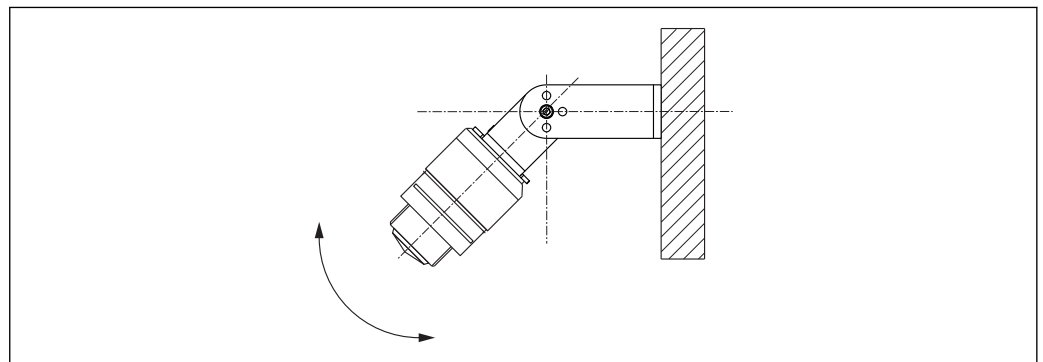
Flooding protection tube 40 mm (1.5 in) Antenna, metallized PBT-PC:

For use with devices in product structure, feature 100 "Process connection front", option WFE "Thread ISO228 G1-1/2".

The flooding protection tube can be ordered with the device. Product structure, feature 620 "Accessory enclosed", option R7 "Flooding protection tube, metallized PBT-PC suitable for 40 mm (1.5 in) antenna with G1-1/2 process connection on front, extended measuring range 8 m (26.25 ft) liquid".

Alternatively available as an accessory; order number 71325090.

Installation with mounting bracket, adjustable



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 13 Installation with mounting bracket, adjustable

- Wall or ceiling installation is possible.
- Using the mounting bracket, position the antenna so that it is perpendicular to the product surface.

NOTICE

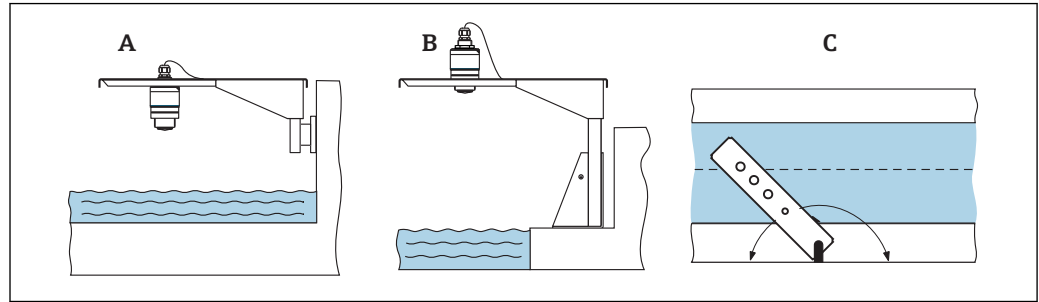
There is no conductive connection between the mounting bracket and transmitter housing.
Risk of electrostatic charge.

- Integrate the mounting bracket in the local potential equalization system.



The mounting bracket is available as an accessory. → 31

Cantilever installation, with pivot



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14 Cantilever installation, with pivot

A Installation with cantilever and wall bracket

B Installation with cantilever and mounting frame

C The cantilever can be turned (e.g. in order to position the sensor over the center of the channel, for example)

Environment

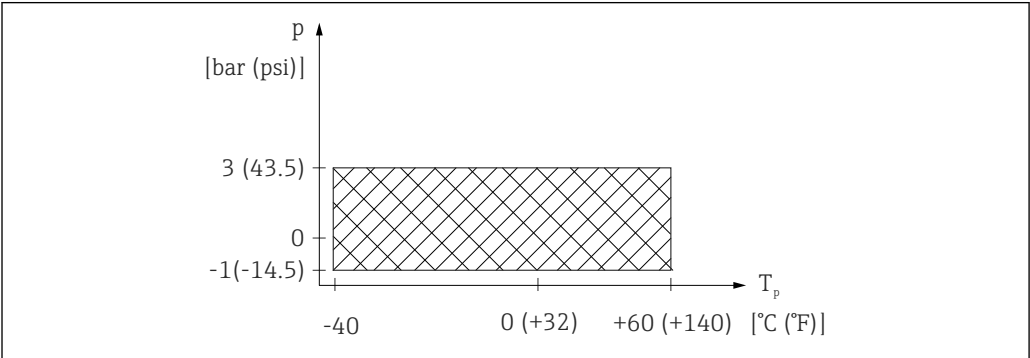
Ambient temperature range	Measuring device: -40 to +60 °C (-40 to +140 °F) Outdoor operation in strong sunlight: ■ Mount the device in the shade. ■ Avoid direct sunlight, especially in warmer climatic regions. ■ Use a weather protection cover →  31.
Storage temperature	-40 to +80 °C (-40 to +176 °F)
Climate class	DIN EN 60068-2-38 (test Z/AD)
Installation height as per IEC 61010-1 Ed.3	Generally up to 2 000 m (6 600 ft) above sea level.
Degree of protection	Tested acc. to: – IP66, NEMA 4X – IP68, NEMA 6P (24 h at 1.83 m (6.00 ft) under water)
Vibration resistance	DIN EN 60068-2-64 / IEC 60068-2-64: 20 to 2 000 Hz, 1 (m/s ²)/Hz
Electromagnetic compatibility (EMC)	Electromagnetic compatibility in accordance with all of the relevant requirements outlined in the EN 61000 series and NAMUR Recommendation EMC (NE 21). For details, please refer to the Declaration of Conformity ²⁾

2) Available for download at www.endress.com.

Process

Process temperature, process pressure

FMR10



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15 FMR10: Permitted range for process temperature and process pressure

Feature 100 "Process connection"	Process temperature range	Process pressure range
- VEE: Thread ASME MNPT1-1/2; PVDF - WFE: Thread ISO228 G1-1/2; PVDF	-40 to +60 °C (-40 to +140 °F)	$p_{rel} = -1 \text{ to } 3 \text{ bar } (-14.5 \text{ to } 43.5 \text{ psi})$ $p_{abs} < 4 \text{ bar } (58 \text{ psi})$

Dielectric constant

For liquids

$\epsilon_r \geq 4$



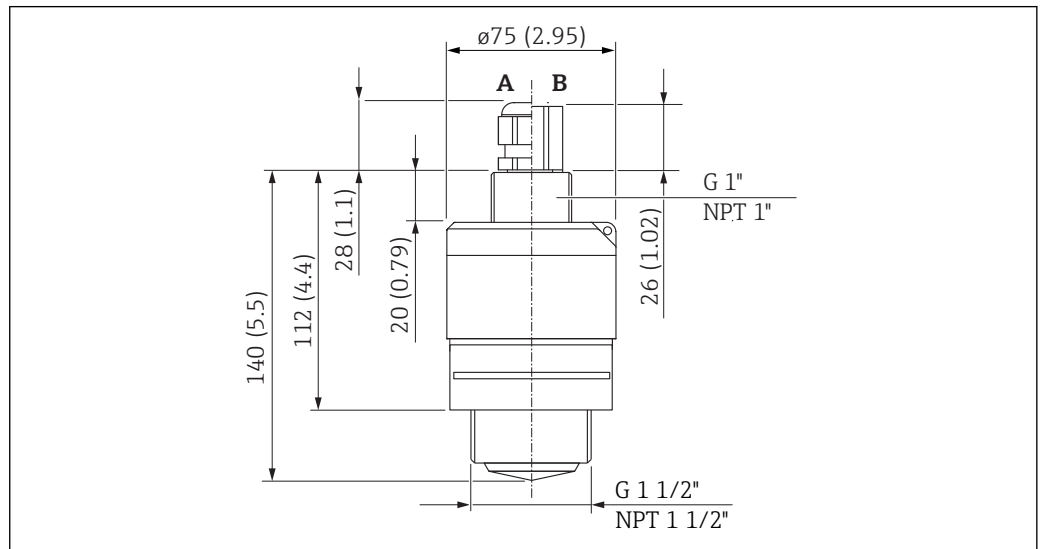
For dielectric constants (DC values) of many media commonly used in various industries refer to:

- the Endress+Hauser DC manual (CP01076F)
- the Endress+Hauser "DC Values App" (available for Android and iOS)

Mechanical construction

Dimensions

40 mm (1.5 in) antenna with G 1-1/2" or MNPT 1-1/2" thread



16 Dimensions process connection G 1-1/2" or MNPT 1-1/2" thread, engineering unit: mm (in)

A Cable gland

B FNPT 1/2" conduit connection

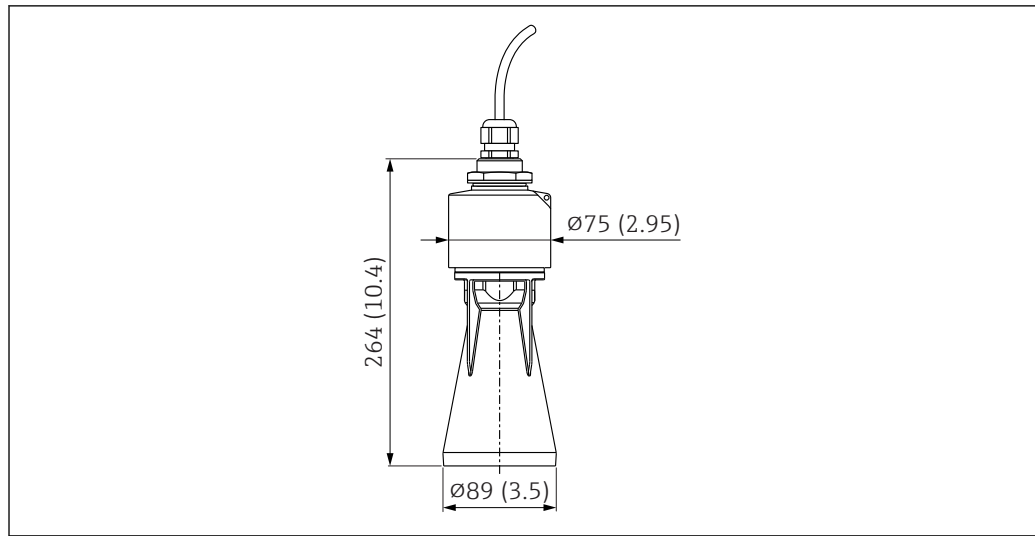
Applies to the following device versions

■ Feature 095 "Process connection rear side"

- VCE: Thread ASME MNPT1; PVDF; FNPT 1/2" conduit connection
- WDE: Thread G1 ISO228; PVDF; cable gland

■ Feature 100 "Process connection front side"

- VEE: Thread ASME MNPT1-1/2; PVDF
- WFE: Thread ISO228 G1-1/2; PVDF

40 mm (1.5 in) antenna with flooding protection tube

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17 Dimensions 40 mm (1.5 in) antenna with mounted flooding protection tube, engineering unit: mm (in)

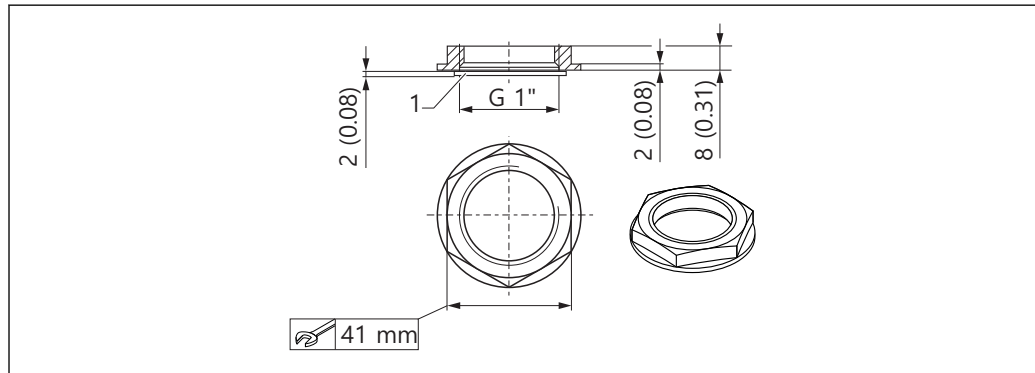
Applies to the following device versions

- **Feature 100 "Process connection front side"**

WFE: Thread ISO228 G1-1/2; PVDF

- **Feature 620 "Accessory enclosed"**

Option R7 "Flooding protection tube, metallized PBT-PC suitable for 40 mm (1.5 in) antenna with process connection on front G1-1/2", extended measuring range 8 m (26.25 ft) liquids.

Counter nut for process connection rear side

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18 Dimensions of counter nut for process connection rear side, engineering unit: mm (in)

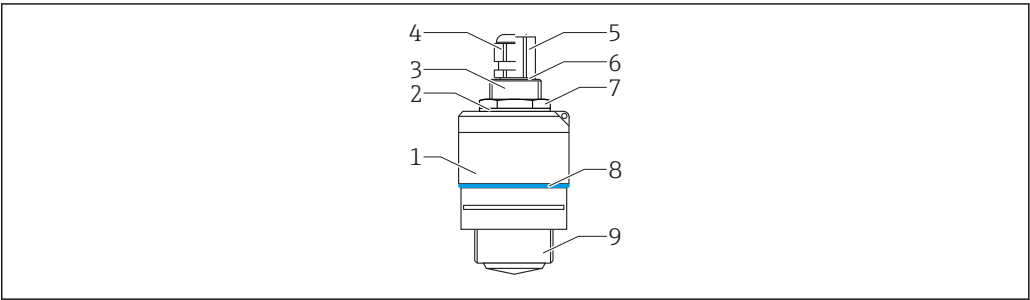
1 Seal

- The counter nut with seal (EPDM) is included in the scope of supply.
- Material: PA6.6

Weight

Micropilot	Weight (incl. 10 m (32.8 ft) cable)
FMR10	Approx. 3.0 kg (6.6 lb)

Materials



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19 FMR10 materials

Item	Component part	Material
1	Sensor housing	PVDF
2	Seal	EPDM
3	Process connection rear side	PVDF
4	Cable gland	PA
5	Conduit connection adapter	CuZn, nickel-plated
6	O-ring	EPDM
7	Counter nut	PA6.6
8	Design ring	PBT PC
9	Process connection front side	PVDF

Connecting cable

Standard length: 10 m (33 ft)

If longer cable lengths are required, an extension cable must be used.

In this case, the total cable length (sensor cable + extension cable) must not exceed 300 m (984 ft).

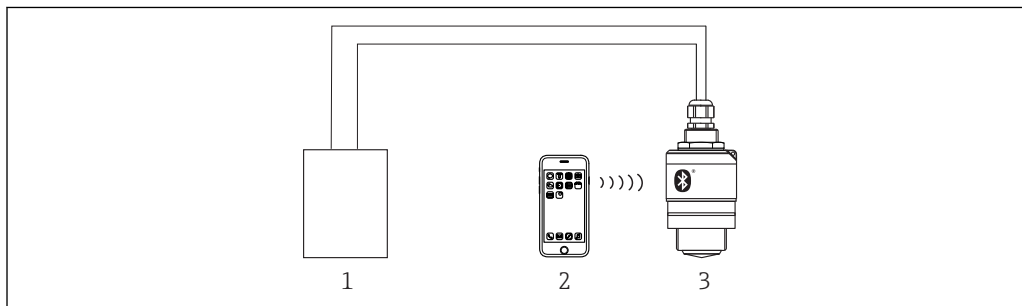
Material : PVC

Operability

Operating concept

- 4 to 20 mA
- SmartBlue (app) via *Bluetooth*® wireless technology
- Menu guidance with brief explanations of the individual parameter functions in the operating tool

Via *Bluetooth*® wireless technology



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20 Possibilities for remote operation via *Bluetooth*® wireless technology

- 1 Transmitter power supply unit
- 2 Smartphone / tablet with SmartBlue (app)
- 3 Transmitter with *Bluetooth*® wireless technology

Certificates and approvals

CE mark	The measuring system meets the legal requirements of the applicable EC guidelines. These are listed in the corresponding EC Declaration of Conformity together with the standards applied. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
RoHS	The measuring system complies with the substance restrictions of the Restriction on Hazardous Substances Directive 2011/65/EU (RoHS 2).
EAC conformity	The measuring system meets the legal requirements of the applicable EAC guidelines. These are listed in the corresponding EAC Declaration of Conformity together with the standards applied. Endress+Hauser confirms successful testing of the device by affixing to it the EAC mark.
RCM-Tick marking	The supplied product or measuring system meets the ACMA (Australian Communications and Media Authority) requirements for network integrity, interoperability, performance characteristics as well as health and safety regulations. Here, especially the regulatory arrangements for electromagnetic compatibility are met. The products are labelled with the RCM- Tick marking on the name plate.  A0029561
Ex approval	■ Non-hazardous area ■ CSA C/US General Purpose ■ Non-hazardous area + EAC mark
Pressure equipment with allowable pressure ≤ 200 bar (2 900 psi)	Pressure instruments with a flange and threaded boss that do not have a pressurized housing do not fall within the scope of the Pressure Equipment Directive, irrespective of the maximum allowable pressure. Reasons: According to Article 2, point 5 of EU Directive 2014/68/EU, pressure accessories are defined as "devices with an operational function and having pressure-bearing housings". If a pressure instrument does not have a pressure-bearing housing (no identifiable pressure chamber of its own), there is no pressure accessory present within the meaning of the Directive. Note: A partial examination shall be performed for pressure instruments that are part of safety equipment for the protection of a pipe or vessel from exceeding allowable limits (equipment with safety function in accordance with Pressure Equipment Directive 2014/68/EU, Article 2, point 4).
EN 302729-1/2 radio standard	The Micropilot FMR10 devices comply with the LPR (Level Probing Radar) radio standard EN 302729-1/2. The devices are approved for unrestricted use inside and outside of closed vessels in countries of the EU and EFTA. that have implemented this standard. The following countries are those that have currently implemented the directive: Belgium, Bulgaria, Germany, Denmark, Estonia, France, Greece, UK, Ireland, Iceland, Italy, Liechtenstein, Lithuania, Latvia, Malta, The Netherlands, Norway, Austria, Poland, Portugal, Romania, Sweden, Switzerland, Slovakia, Spain, Czech Republic and Cyprus. Implementation is still underway in all of the countries not listed. Please note the following for operation of the devices outside of closed vessels: 1. The device must be mounted in accordance with the instructions in the "Installation" section. 2. Installation must be carried out by properly trained, expert staff. 3. The device antenna must be installed in a fixed location pointing vertically downwards.

4. The installation site must be located at a distance of 4 km from the astronomy stations listed below or otherwise approval must be provided by the relevant authority. If the device is installed at a distance of 4 to 40 km from one of the listed stations, it must not be installed at a height of more than 15 m (49 ft) above the ground.

Astronomy stations

Country	Name of the station	Latitude	Longitude
Germany	Effelsberg	50°31'32" North	06°53'00" East
Finland	Metsähovi	60°13'04" North	24°23'37" East
	Tuorla	60°24'56" North	24°26'31" East
France	Plateau de Bure	44°38'01" North	05°54'26" East
	Floirac	44°50'10" North	00°31'37" West
Great Britain	Cambridge	52°09'59" North	00°02'20" East
	Damhall	53°09'22" North	02°32'03" West
	Jodrell Bank	53°14'10" North	02°18'26" West
	Knockin	52°47'24" North	02°59'45" West
	Pickmere	53°17'18" North	02°26'38" West
Italy	Medicina	44°31'14" North	11°38'49" East
	Noto	36°52'34" North	14°59'21" East
	Sardinia	39°29'50" North	09°14'40" East
Poland	Fort Skala Krakow	50°03'18" North	19°49'36" East
Russia	Dmitrov	56°26'00" North	37°27'00" East
	Kalyazin	57°13'22" North	37°54'01" East
	Pushchino	54°49'00" North	37°40'00" East
	Zelenchukskaya	43°49'53" North	41°35'32" East
Sweden	Onsala	57°23'45" North	11°55'35" East
Switzerland	Bleien	47°20'26" North	08°06'44" East
Spain	Yebes	40°31'27" North	03°05'22" West
	Robledo	40°25'38" North	04°14'57" West
Hungary	Penc	47°47'22" North	19°16'53" East



As a general rule, the requirements outlined in EN 302729-1/2 must be observed.

FCC / Industry Canada

This device complies with Part 15 of the FCC Rules [and with Industry Canada licence-exempt RSS standard(s)]. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

[Any] Changes or modifications made to this equipment not expressly approved by Endress+Hauser may void the FCC authorization to operate this equipment.



This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help



- The installation of the LPR/TLPR device shall be done by trained installers, in strict compliance with the manufacturer's instructions.
- The use of this device is on a "no-interference, no-protection" basis. That is, the user shall accept operations of high-powered radar in the same frequency band which may interfere with or damage this device. However, devices found to interfere with primary licensing operations will be required to be removed at the user's expense.
- Only for usage without the accessory "flooding protection tube", i.e. NOT in the free-field: This device shall be installed and operated in a completely enclosed container to prevent RF emissions, which can otherwise interfere with aeronautical navigation.

Other standards and guidelines

- IEC/EN 61010-1
Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use
- IEC/EN 55011
"EMC Emission, RF Emission for Class B". Industrial, scientific and medical equipment – Electromagnetic disturbance characteristics - Limits and methods of measurement
- IEC/EN 61000-4-2
EMC Immunity, ESD (Performance Criteria A). Electromagnetic compatibility (EMC): Testing and measurement techniques - Electrostatic discharge immunity test (ESD)
- IEC/EN 61000-4-3
EMC Immunity, RF field susceptibility (Performance Criteria A). Electromagnetic compatibility (EMC): Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test
- IEC/EN 61000-4-4
EMC Immunity, bursts (Performance Criteria B). Electromagnetic compatibility (EMC): Testing and measurement techniques - Electrical fast transient/burst immunity test
- IEC/EN 61000-4-5
EMC Immunity, surge (Performance Criteria B). Electromagnetic compatibility (EMC): Testing and measurement techniques - Surge immunity test
- IEC/EN 61000-4-6
EMC Immunity, conducted HF (Performance Criteria A). Electromagnetic compatibility (EMC): Testing and measurement techniques - Immunity to conducted disturbances induced by radio-frequency fields
- IEC/EN 61000-4-8
EMC Immunity, magnetic fields 50 Hz. Electromagnetic compatibility (EMC): Testing and measurement techniques - Power frequency magnetic field immunity test
- EN 61000-6-3
EMC Emission, conducted HF. EMC: Radiated interference - Residential, commercial and light industry environment
- NAMUR NE 21
Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment
- NAMUR NE 43
Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 107
Status classification as per NE107
- NAMUR NE 131
Requirements for field devices for standard applications.
- IEEE 802.15.1
Requirements for the *Bluetooth*® wireless technology interface

Ordering information

Detailed ordering information is available from the following sources:

- In the Product Configurator on the Endress+Hauser website: www.endress.com -> Click "Corporate" -> Select your country -> Click "Products" -> Select the product using the filters and search field -> Open product page -> The "Configure" button to the right of the product image opens the Product Configurator.
- From your Endress+Hauser Sales Center: www.addresses.endress.com



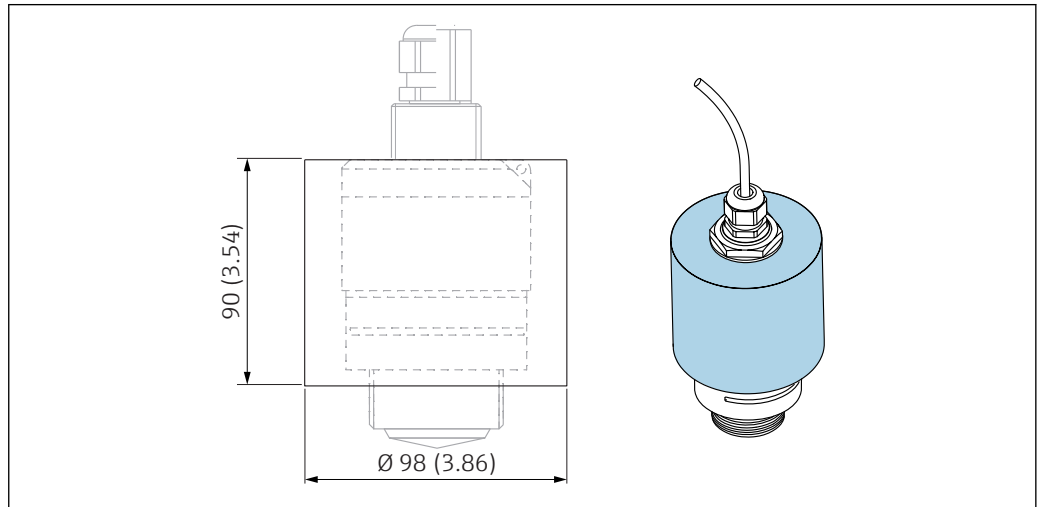
Product Configurator - the tool for individual product configuration

- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

Accessories

Device-specific accessories

Weather protection cover



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21 Dimensions of weather protection cover, engineering unit: mm (in)

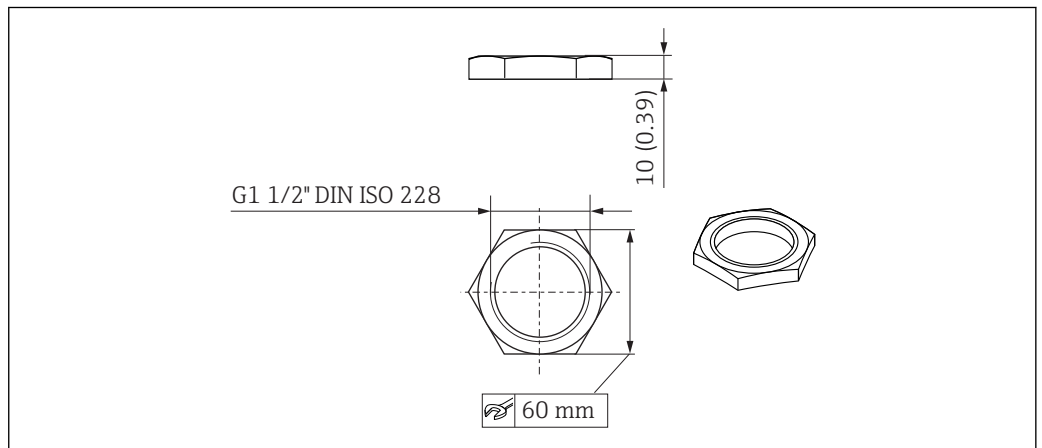
Werkstoff: PVDF



The weather protection cover is available as an accessory; order number 52025686.

The sensor is not completely covered.

Securing nut G 1-1/2"



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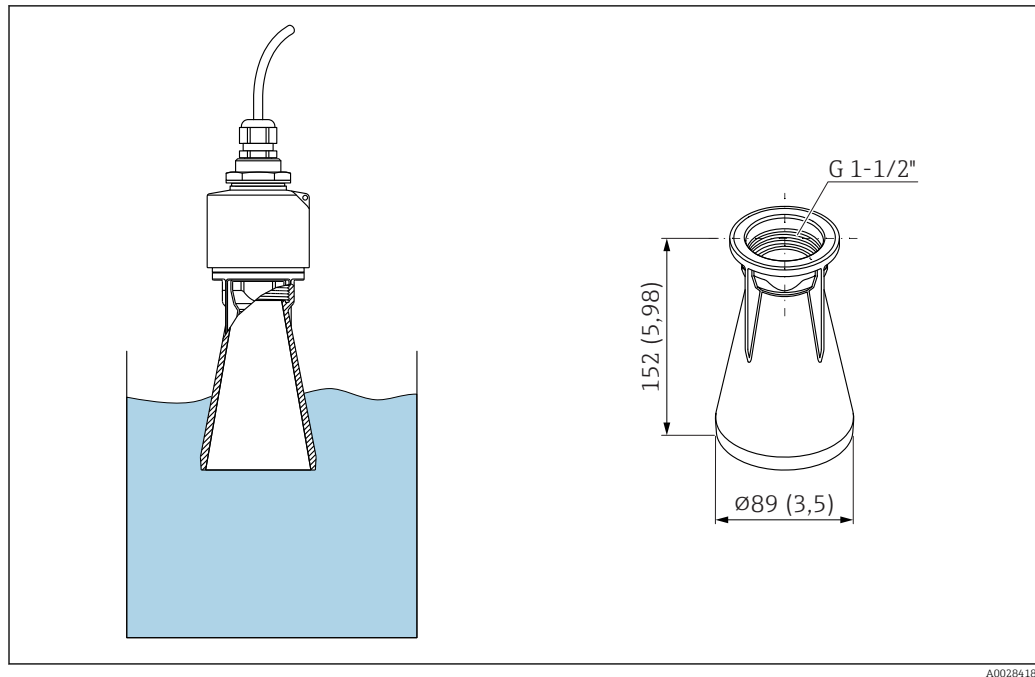
22 Dimensions of securing nut, engineering unit: mm (in)

Suitable for use with devices with G 1-1/2" and MNPT 1-1/2" process connection.

Material: PC

Order number: 52014146

Flooding protection tube 40 mm (1.5 in) antenna, metallized PBT-PC



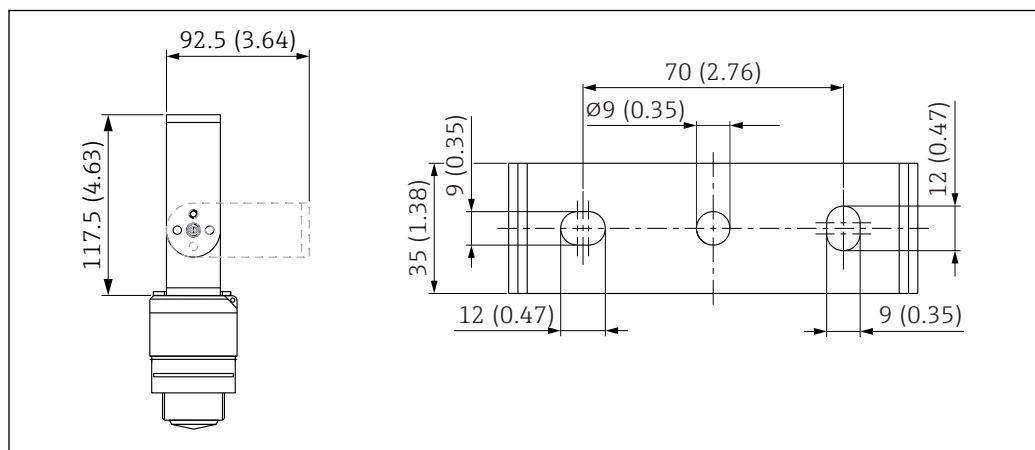
For use with devices in product structure, feature 100 "Process connection on front", option WFE "Thread ISO228 G1-1/2".

Material: PBT-PC, metallized

i The flooding protection tube can be ordered with the device. Product structure, feature 620 "Accessory enclosed", option R7 "Flooding protection tube, metallized PBT-PC suitable for 40 mm (1.5 in) antenna with G1-1/2" process connection on front", extended measuring range 8 m (26.25 ft) in liquids.

Alternatively available as an accessory; order number 71325090.

Mounting bracket, adjustable



23 Dimensions of mounting bracket, engineering unit: mm (in)

Consists of:

- Mounting bracket: 316 (1.4404)
- Angle bracket: 316L (1.4404)
- Screws: A4
- Retaining rings: A4

i The mounting bracket is available as an accessory; order number 71325079.

Additional accessories



For additional suitable accessories, see Technical Information TI01267F (FMR20)

Communication-specific accessories

Accessories	Description
Fieldgate FXA320	Gateway for remote monitoring of field devices with 4 to 20 mA and digital output signal  For details, see Technical Information TI00025S and Operating Instructions BA00053S

System components

Accessories	Description
RMA42	Digital process transmitter for monitoring and visualizing analog measured values  For details, see Technical Information TI00150R and Operating Instructions BA00287R
RIA452	Digital process meter RIA452, in panel mounted housing for monitoring and displaying analog measured values, batch, pump control functions and can be used as a preset counter and for measuring flow  For details, see Technical Information TI113R and Operating Instructions BA00254R
HAW562	Surge arrester for DIN rail according to IEC 60715, used to protect electronic components from being destroyed by overvoltage.  For details, see Technical Information TI01012K

Supplementary documentation

The following document types are available in the Download Area of the Endress+Hauser Internet site: www.endress.com → Download:

Standard documentation

Device	Document type	Document code
FMR10	Brief Operating Instructions	KA01247F

Device	Document type	Document code
FMR10	Operating Instructions	BA01577F



www.addresses.endress.com
