Technical Information

Micropilot FMR20

Free space radar

Level measurement for liquids

Application
- Ingress protection: IP66/68 / NEMA 4X/6P
- Measuring range: up to 20 m (66 ft)
- Process temperature: –40 to 80 °C (–40 to 176 °F)
- Process pressure: –1 to 3 bar (–14 to 43 psi)
- Accuracy: up to ± 2 mm (0.08 in)
- International explosion protection certificates

Your benefits
- Level measurement for liquids in storage tanks, open basins, pump shafts and canal systems
- Radar measuring device with Bluetooth® wireless technology and HART communication
- Simple, safe and secure wireless remote access – ideal for installation in hazardous 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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*Environment*: 
- Ambient temperature range
- Storage temperature
- Climate class
- Installation height as per IEC 61010-1 Ed.3
- Degree of protection
- Vibration resistance
- Electromagnetic compatibility (EMC)

*Process*: 
- Process temperature, process pressure
- Dielectric constant

*Mechanical construction*: 
- Dimensions
- Weight
- Materials

*Operability*: 
- Operating concept
- Via Bluetooth® wireless technology
- Via HART protocol

*Certificates and approvals*: 
- CE mark
- RoHS
- EAC conformity
- RCM-Tick marking
- Ex approval
- Explosion-protected smartphones and tablets
- Pressure equipment with allowable pressure
- EN 302729-1/2 radio standard
- FCC / Industry Canada
- Other standards and guidelines

*Ordering information*: 
- Accessories
- Supplementary documentation
- Safety Instructions (XA)
### Important document information

#### Symbols for certain types of information

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔️</td>
<td>Permitted Procedures, processes or actions that are permitted.</td>
</tr>
<tr>
<td>✔️ ✔️</td>
<td>Preferred Procedures, processes or actions that are preferred.</td>
</tr>
<tr>
<td>✗</td>
<td>Forbidden Procedures, processes or actions that are forbidden.</td>
</tr>
<tr>
<td>🚀</td>
<td>Tip Indicates additional information.</td>
</tr>
<tr>
<td>📚</td>
<td>Reference to documentation</td>
</tr>
<tr>
<td>📖</td>
<td>Reference to page</td>
</tr>
<tr>
<td>📝</td>
<td>Reference to graphic</td>
</tr>
<tr>
<td>🕵️</td>
<td>Visual inspection</td>
</tr>
</tbody>
</table>

#### Safety symbols

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

#### Electrical symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>➡️ ➡️</td>
<td>Direct current</td>
</tr>
<tr>
<td>➡️ ➡️</td>
<td>Direct current and alternating current</td>
</tr>
<tr>
<td>➡️ ➡️</td>
<td>Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.</td>
</tr>
<tr>
<td>➡️ ➡️</td>
<td>Protective ground connection A terminal which must be connected to ground prior to establishing any other connections.</td>
</tr>
<tr>
<td>➡️ ➡️</td>
<td>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.</td>
</tr>
</tbody>
</table>

#### Symbols in graphics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2, 3 ...</td>
<td>Item numbers</td>
</tr>
<tr>
<td>1, 2, 3...</td>
<td>Series of steps</td>
</tr>
<tr>
<td>A, B, C,...</td>
<td>Views</td>
</tr>
<tr>
<td>A-A, B-B, C-C,...</td>
<td>Sections</td>
</tr>
<tr>
<td>Symbol</td>
<td>Meaning</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| 🚨     | Hazardous area  
Indicates a hazardous area.                                 |
| ✕      | Safe area (non-hazardous area)  
Indicates the non-hazardous area. |
Terms and abbreviations

<table>
<thead>
<tr>
<th>Term/abbreviation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA</td>
<td>Document type &quot;Operating Instructions&quot;</td>
</tr>
<tr>
<td>KA</td>
<td>Document type &quot;Brief Operating Instructions&quot;</td>
</tr>
<tr>
<td>TI</td>
<td>Document type &quot;Technical Information&quot;</td>
</tr>
<tr>
<td>SD</td>
<td>Document type &quot;Special Documentation&quot;</td>
</tr>
<tr>
<td>XA</td>
<td>Document type &quot;Safety Instructions&quot;</td>
</tr>
<tr>
<td>PN</td>
<td>Nominal pressure</td>
</tr>
<tr>
<td>MWP</td>
<td>Maximum Working Pressure The MWP can also be found on the nameplate.</td>
</tr>
<tr>
<td>ToF</td>
<td>Time of Flight</td>
</tr>
<tr>
<td>FieldCare</td>
<td>Scalable software tool for device configuration and integrated plant asset management solutions</td>
</tr>
<tr>
<td>DeviceCare</td>
<td>Universal configuration software for Endress+Hauser HART, PROFIBUS, FOUNDATION Fieldbus and Ethernet field devices</td>
</tr>
<tr>
<td>DTM</td>
<td>Device Type Manager</td>
</tr>
<tr>
<td>DD</td>
<td>Device Description for HART communication protocol</td>
</tr>
<tr>
<td>DC</td>
<td>Relative dielectric constant $\varepsilon_r$</td>
</tr>
</tbody>
</table>
| 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.  
|                   | • FieldCare / DeviceCare, for operation via HART communication and PC |
| BD                | Blocking Distance; no signals are analyzed within the BD. |

Registered trademarks

HART®
Registered trademark of the HART Communication Foundation, Austin, USA

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.
# Micropilot FMR20

## Product life cycle

### Engineering
- Proven radar measuring technology
- Level- and open channel flow measurement for Ex and non-Ex
- Indication of over-flooding situation
- Wide range of installation possibilities and accessories
- Highest degree of ingress protection
- 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
- Global availability
- Order code includes variety of mounting accessories and remote HART indicator RIA15

### Installation
- Rear- and front side thread for flexible installation
- Slip-on flange for nozzle installation
- Complete measuring point: Including mounting accessory, RIA15 and flooding protection tube

### Commissioning
- Easy and fast setup via SmartBlue (app) and DeviceCare / FieldCare or RIA15
- 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) and DeviceCare / FieldCare
- Encrypted single point-to-point data transmission (Fraunhofer-Institut, third party, tested) and password-protected communication via Bluetooth® 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.

![Setup parameters of the Micropilot]

\[ L = E - D \]

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:

\[ D = c \cdot \frac{t}{2}, \]

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 (HART, SmartBlue): 0 to 10 m (0 to 33 ft) or 0 to 20 m (0 to 66 ft) depending on antenna version
## 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.

### Measuring range

<table>
<thead>
<tr>
<th>Device</th>
<th>Maximum measuring range</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMR20 with 40 mm (1.5 in) antenna</td>
<td>10 m (33 ft)</td>
</tr>
<tr>
<td>FMR20 with 80 mm (3 in) antenna</td>
<td>20 m (66 ft)</td>
</tr>
</tbody>
</table>

**Requirements of the installation**
- recommended tank height > 1.5 m (5 ft) or media with low DC value
- Open channel minimum width 0.5 m (1.6 ft)
- Calm surfaces
- No agitators
- No buildup
- Relative dielectric constant $\varepsilon_r > 4$

**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**

<table>
<thead>
<tr>
<th>$\varepsilon_r$</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 to 10</td>
<td>E.g. concentrated acid, organic solvents, ester, aniline, alcohol, acetone.</td>
</tr>
<tr>
<td>&gt; 10</td>
<td>Conductive liquids, aqueous solutions, diluted acids and bases</td>
</tr>
</tbody>
</table>

Reduction of the max. possible measuring range by:
- Media with bad reflective properties (= low $\varepsilon_r$ value)
- Formation of buildup, particularly of moist products
- Strong condensation
- Foam generation
- Freezing of sensor

**Operating frequency**
- K-band (~ 26 GHz)

**Transmission power**

<table>
<thead>
<tr>
<th>Distance</th>
<th>Mean power density in the direction of the beam</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 m (3.3 ft)</td>
<td>&lt; 12 nW/cm$^2$</td>
</tr>
<tr>
<td>5 m (16 ft)</td>
<td>&lt; 0.4 nW/cm$^2$</td>
</tr>
</tbody>
</table>
**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**  
HART®  
- Signal encoding; FSK ±0.5 mA over current signal  
- Data transmission rate; 1200 Bit/s

**Bluetooth® wireless technology (available as an optional extra)**  
The device has a Bluetooth® 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 Bluetooth® 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)  
- Operating tool via digital communication (HART) or 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 using DeviceCare and FieldCare, linearization tables for volume calculation in vessels are preprogrammed (see following list).

- **Pre-programmed linearization curves**  
  - Cylindrical tank  
  - Spherical tank  
  - Tank with pyramid bottom  
  - Tank with conical bottom  
  - Tank with flat bottom

  Other linearization tables of up to 32 value pairs can be entered manually.

**Protocol-specific data**  
**HART**  

<table>
<thead>
<tr>
<th>Manufacturer ID</th>
<th>17 (0x11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device type ID</td>
<td>44 (0x112c)</td>
</tr>
<tr>
<td>HART specification</td>
<td>7.0</td>
</tr>
</tbody>
</table>
| Device description files (DTM, DD) | Information and files under:  
  - www.endress.com  
  - www.hartcomm.org |
| HART load | Min. 250 Ω |
| HART device variables | Assignment of HART device variables is fixed and cannot be changed.  
  - Measured values for PV (primary variable)  
  - Level linearized  
  - Advanced diag. measured values for SV (secondary variable)  
  - Distance  
  - Advanced diag. measured values for TV (tertiary variable)  
  - Relative echo amplitude  
  - Advanced diag. measured values for QV (quarternary variable)  
  - Temperature |
| Supported functions | Additional transmitter status |
| Multidrop current | 4 mA |
| Time for connection setup | < 1 s |
**Electrical connection**

**Cable assignment**

![Cable assignment diagram]

1. Plus, brown wire
2. Minus, blue wire

### Supply voltage

An external power supply is necessary.

<table>
<thead>
<tr>
<th>Terminal voltage $U$ at device</th>
<th>Maximum load $R$, depending on supply voltage $U_0$ of power supply unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.5 to 30 V&lt;sub&gt;DC&lt;/sub&gt; 2-wire</td>
<td><img src="image.png" alt="Resistance graph" /></td>
</tr>
</tbody>
</table>

**Potential equalization**

No special measures for potential equalization are required.

In the case of a device for the hazardous area, please comply with the safety instructions in the separate ‘Safety Instructions’ (XA, ZD) document.

- Various power supply units can be ordered from Endress+Hauser: see ‘Accessories’ section → 51
- Battery operation
  - The sensor’s Bluetooth<sup>®</sup> 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<sub>DC</sub>)
Power supply failure
The configuration remains stored in the sensor.

Connection
FMR20, 4 to 20 mA HART

<table>
<thead>
<tr>
<th>Circuit diagram / Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMR20 connection with HART communication, voltage source and 4 to 20 mA display</td>
</tr>
</tbody>
</table>

![FMR20 block diagram, HART](image)

1. Micropilot FMR20
2. HART resistance
3. Power supply

The HART communication resistor of 250 Ω in the signal line is always necessary in the case of a low-impedance power supply.

The voltage drop to be taken into account is:
Max. 6 V with 250 Ω communication resistor
FMR20 with RIA15 (incl. option for basic configuration FMR20)

The RIA15 remote display can be ordered together with the device.

Product structure, feature 620 "Accessory enclosed":
- Option R4 'Remote display RIA15 non-hazardous area, field housing'
- Option R5 'Remote display RIA15 with explosion protection approval, field housing'

Alternatively available as an accessory, for details see Technical Information TI01043K and Operating Instructions BA01170K

The RIA15 process display unit is loop-powered and does not require any external power supply.

The voltage drop to be taken into account is:
- ≤1 V in the standard version with 4 to 20 mA communication
- ≤1.9 V with HART communication
- additional 2.9 V if display light is used

<table>
<thead>
<tr>
<th>Circuit diagram / Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMR20 connection, HART communication and RIA15 without backlight</td>
</tr>
<tr>
<td><img src="A0019567" alt="Circuit Diagram" /></td>
</tr>
<tr>
<td>1 Micropilot FMR20</td>
</tr>
<tr>
<td>2 Power supply</td>
</tr>
<tr>
<td>3 HART resistance</td>
</tr>
</tbody>
</table>

| FMR20 connection, HART communication and RIA15 with backlight |
| ![Circuit Diagram](A0019568) |
| 1 Micropilot FMR20 |
| 2 Power supply |
| 3 HART resistance |
FMR20, RIA15 with installed HART communication resistor module

The HART communication module for installation in the RIA15 can be ordered together with the device.

Product structure, feature 620 "Accessory enclosed":
Option R6 'HART communication resistor hazardous / non-hazardous area'
The voltage drop to be taken into account is:
Max. 7 V

Alternatively available as an accessory, for details see Technical Information TI01043K and Operating Instructions BA01170K

<table>
<thead>
<tr>
<th>Circuit diagram / Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMR20 connection and RIA15 without backlight</td>
</tr>
<tr>
<td><img src="image1" alt="Circuit Diagram 1" /></td>
</tr>
<tr>
<td>1 HART communication resistor module</td>
</tr>
<tr>
<td>2 Micropilot FMR20</td>
</tr>
<tr>
<td>3 Power supply</td>
</tr>
</tbody>
</table>

| FMR20 connection and RIA15 with backlight |
| ![Circuit Diagram 2](image2) |
| 1 HART communication resistor module |
| 2 Micropilot FMR20 |
| 3 Power supply |

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 FMR20 is supplied with 5 m (16 ft) cable length as standard. Optional lengths are available with 10 m (33 ft) and 20 m (66 ft).
Lengths can be selected by the user up to an overall length of 300 m (980 ft) and are available by the meter (ordering option "B") or foot (ordering option "A").

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.

<table>
<thead>
<tr>
<th>Device</th>
<th>Value</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sum of non-linearity, non-repeatability and hysteresis</td>
<td>±2 mm (0.08 in)</td>
</tr>
<tr>
<td></td>
<td>Offset/Zero</td>
<td>±4 mm (0.16 in)</td>
</tr>
</tbody>
</table>

1) HART, 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

Measure value resolution
- Dead band as per EN61298-2:
  - Digital: 1 mm (0.04 in)
  - Analog: 4 µA
Response time

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

<table>
<thead>
<tr>
<th>Tank height</th>
<th>Sampling rate</th>
<th>Response time</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 20 m (66 ft)</td>
<td>1 s(^1)</td>
<td>&lt; 3 s</td>
</tr>
</tbody>
</table>

Influence of ambient temperature

The measurements are carried out in accordance with EN 61298-3.
- Digital (HART, 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 \( T_K = 0.02 \% / 10 \text{ K} \)
  - Span (20 mA): average \( T_K = 0.05 \% / 10 \text{ K} \)

---

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.
Installation

Installation conditions

<table>
<thead>
<tr>
<th>Installation types</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Wall or ceiling mount, adjustable</td>
</tr>
<tr>
<td>B Mounted at front thread</td>
</tr>
<tr>
<td>C Mounted at rear thread</td>
</tr>
<tr>
<td>D Ceiling installation with counter nut (included in delivery)</td>
</tr>
</tbody>
</table>

Caution!
The sensor cables are not designed as supporting cables. Do not use as a suspension wire.

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.

<table>
<thead>
<tr>
<th>A 80 mm (3 in) antenna</th>
<th>B 80 mm (3 in) antenna, outside nozzle</th>
<th>C 40 mm (1.5 in) antenna, outside nozzle</th>
<th>D 40 mm (1.5 in) antenna, inside nozzle</th>
</tr>
</thead>
<tbody>
<tr>
<td>D min. 120 mm (4.72 in)</td>
<td>min. 80 mm (3 in)</td>
<td>min. 40 mm (1.5 in)</td>
<td>min. 80 mm (3 in)</td>
</tr>
<tr>
<td>L max. 205 mm (8.07 in)</td>
<td>max. D × 4.5</td>
<td>max. D × 1.5</td>
<td>max. 140 mm (5.5 in) + D × 1.5</td>
</tr>
</tbody>
</table>
Orientation

- If possible install the sensor so that its lower edge projects into the vessel.
- Recommended distance A wall - nozzle outer edge: ~ 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.

Sensor alignment when mounting in tank
Beam angle

The beam angle is defined as the angle $\alpha$, 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 $\alpha$ and distance $D$.
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.

![Measurement in a plastic vessel](image)

Weather protection cover

For outdoor use, a weather protection cover is recommended.

![Weather protection cover](image)

The sensor is not completely covered in the case of the 40 mm (1.5”) antenna or the 80 mm (3 in) antenna.

The weather protection cover is available as an accessory. -> 38
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.

![Function of flooding protection tube](image)

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".

Alternatively available as an accessory; order number 71325090.

Flooding protection tube 80 mm (3 in) Antenna, metallized PBT-PC:

For use with devices in product structure, feature 100 "Process connection on front", option XR0 "Customer mounting device without flange".

The flooding protection tube can be ordered with the device. Product structure, feature 620 "Accessory enclosed", option R8 "Flooding protection tube, metallized PBT-PC suitable for 80 mm (3 in) antenna.

Alternatively available as an accessory; order number 71327051.
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. → 38

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)

The cantilever, wall bracket and mounting frame are available as accessories. → 38
### Environment

<table>
<thead>
<tr>
<th><strong>Ambient temperature range</strong></th>
<th>Measuring device: –40 to +80 °C (–40 to +176 °F)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Storage temperature</strong></td>
<td>–40 to +80 °C (–40 to +176 °F)</td>
</tr>
<tr>
<td><strong>Climate class</strong></td>
<td>DIN EN 60068-2-38 (test Z/AD)</td>
</tr>
<tr>
<td><strong>Installation height as per IEC 61010-1 Ed.3</strong></td>
<td>Generally up to 2000 m (6600 ft) above sea level.</td>
</tr>
<tr>
<td><strong>Degree of protection</strong></td>
<td>Tested acc. to:</td>
</tr>
<tr>
<td></td>
<td>– IP66, NEMA 4X</td>
</tr>
<tr>
<td></td>
<td>– IP68, NEMA 6P (24 h at 1.83 m (6.00 ft) under water)</td>
</tr>
<tr>
<td><strong>Vibration resistance</strong></td>
<td>DIN EN 60068-2-64 / IEC 60068-2-64: 20 to 2000 Hz, 1 (m/s²)²/Hz</td>
</tr>
<tr>
<td><strong>Electromagnetic compatibility (EMC)</strong></td>
<td>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)</td>
</tr>
</tbody>
</table>

Process temperature, process pressure

**FMR20**

### Feature 100 "Process connection"

<table>
<thead>
<tr>
<th>Process temperature range</th>
<th>Process pressure range</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40 to +80 °C</td>
<td>-1 to 3 bar (-14.5 to 43.5 psi)</td>
</tr>
<tr>
<td>(-40 to +176 °F)</td>
<td>$p_{abs} &lt; 4$ bar (58 psi)</td>
</tr>
</tbody>
</table>

1) The pressure range may be further restricted in the event of a CRN approval.

2) The pressure range may be further restricted in the event of a CRN approval.

### Dielectric constant

**For liquids**

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

A0028805

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

A  Cable gland
B  Conduit connection NPT 1/2"

Applies to the following device versions

- Feature 095 "Process connection rear side"
  - VCE: Thread ASME MNPT1; PVDF; conduit connection NPT 1/2"
  - 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 G 2" or MNPT 2" thread

![Diagram of 40 mm antenna with G 2" or MNPT 2" thread]

2.1 Dimensions process connection G 2" or MNPT 2" thread, engineering unit: mm (in)

A  Cable gland
B  Conduit connection NPT 1/2"

 Applies to the following device versions
- **Feature 095 "Process connection rear side"**
  - VCE: Thread ASME MNPT1; PVDF; conduit connection NPT 1/2'
  - WDE: Thread G1 ISO228; PVDF; cable gland
- **Feature 100 "Process connection front side"**
  - VFE: Thread ASME MNPT2; PVDF
  - WGE: Thread ISO228 G2; PVDF
40 mm (1.5 in) antenna with flooding protection tube

![Diagram of 40 mm antenna with flooding protection tube]

**22 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'.

80 mm (3 in) antenna

![Diagram of 80 mm antenna]

**23 Dimensions 80 mm (3 in) antenna; engineering unit: mm (in)**

- A Cable gland
- B Conduit connection NPT 1/2
Applies to the following device versions

Feature 095 "Process connection rear side"
- VCE: Thread ASME MNPT1; PVDF; conduit connection NPT 1/2"
- WDE: Thread G1 ISO228; PVDF; cable gland
80 mm (3 in) antenna with flooding protection tube

24 Dimensions 80 mm (3 in) antenna with flooding protection tube; engineering unit: mm (in)

A  Cable gland
B  Conduit connection NPT 1/2"

Applies to the following device versions
- **Feature 095 "Process connection rear side"**
  - VCE: Thread ASME MNPT1; PVDF; conduit connection NPT 1/2"
  - WDE: Thread G1 ISO228; PVDF; cable gland
- **Feature 100 "Process connection front side"**
  XR0: Mounting customer side w/o flange
- **Feature 620 "Accessory enclosed"**
  Option R8 "Flooding protection tube, metallized PBT-PC suitable for 80 mm (3 in) antenna"
80 mm (3 in) antenna with UNI slip-on flange 3"/DN80

Applies to the following device versions
- Feature 095 "Process connection rear side"
  - VCE: Thread ASME MNPT1; PVDF; conduit connection NPT 1/2"
  - WDE: Thread G1 ISO228; PVDF; cable gland
- Feature 100 "Process connection front side"
  RPF: UNI slip-on flange 3"/DN80/80; PP, suitable for 3" 150 lbs/DN80 PN16/10K 80

80 mm (3 in) antenna with slip-on flange 4"/DN100

Applies to the following device versions
- Feature 095 "Process connection rear side"
  - VCE: Thread ASME MNPT1; PVDF; conduit connection NPT 1/2"
  - WDE: Thread G1 ISO228; PVDF; cable gland
- Feature 100 "Process connection front side"
  RPF: UNI slip-on flange 4"/DN100/100; PP, suitable for 4" 150 lbs/DN100 PN16/10K 100
80 mm (3 in) antenna with slip-on flange 6"/DN150

Applies to the following device versions
- **Feature 095 "Process connection rear side"**
  - VCE: Thread ASME MNPT1; PVDF; conduit connection NPT 1/2"
  - WDE: Thread G1 ISO228; PVDF; cable gland
- **Feature 100 "Process connection front side"**
  RSF: UNI slip-on flange 6"/DN150/150; PP, suitable for 6" 150 lbs/DN150 PN16/10K 150

Counter nut for process connection rear side

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

<table>
<thead>
<tr>
<th>Weight</th>
<th>Micropilot FMR20, 40 mm (1.5 in) antenna</th>
<th>Weight (incl. 5 m (16.4 ft) cable)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FMR20, 40 mm (1.5 in) antenna</td>
<td>Approx. 2.5 kg (5.5 lb)</td>
</tr>
<tr>
<td></td>
<td>FMR20, 80 mm (3 in) antenna</td>
<td>Approx. 2.8 kg (6.2 lb)</td>
</tr>
</tbody>
</table>
### Materials

<table>
<thead>
<tr>
<th>Item</th>
<th>Component part</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sensor housing</td>
<td>PVDF</td>
</tr>
<tr>
<td>2</td>
<td>Seal</td>
<td>EPDM</td>
</tr>
<tr>
<td>3</td>
<td>Process connection rear side</td>
<td>PVDF</td>
</tr>
<tr>
<td>4</td>
<td>Cable gland</td>
<td>PA</td>
</tr>
<tr>
<td>5</td>
<td>Pipe adapter</td>
<td>CuZn, nickel-plated</td>
</tr>
<tr>
<td>6</td>
<td>O-ring</td>
<td>EPDM</td>
</tr>
<tr>
<td>7</td>
<td>Counter nut</td>
<td>PA6.6</td>
</tr>
<tr>
<td>8</td>
<td>Design ring</td>
<td>PBT PC</td>
</tr>
<tr>
<td>9</td>
<td>Process connection front side</td>
<td>PVDF</td>
</tr>
</tbody>
</table>

**Connecting cable**

Available cable length: 5 to 300 m (16 to 980 ft)

Material: PVC
Operability

Operating concept
- 4 to 20 mA, HART
- Menu guidance with brief explanations of the individual parameter functions in the operating tool
- Optional: SmartBlue (app) via Bluetooth® wireless technology

Via Bluetooth® wireless technology

30 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

Via HART protocol

31 Options for remote operation via HART protocol
1 PLC (programmable logic controller)
2 Transmitter power supply unit, e.g. RN221N (with communication resistor)
3 Connection for Commubox FXA195 and Field Communicator 375, 475
4 RIA15 loop-powered process display unit
5 Field Communicator 475
6 Computer with operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM)
7 Commubox FXA195 (USB)
8 Field Xpert SFX350/SFX370
9 VIATOR modem with Bluetooth® wireless technology
10 Smartphone / tablet with SmartBlue (app)
11 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.

Ex approval
- Non-hazardous area
- ATEX II 1 G Ex ia IIC T4 Ga
- ATEX II 1/2 G Ex ia IIC T4 Ga/Gb
- CSA C/US General Purpose
- CSA C/US IS CL1 Div.1 Gr.A-D, AEx ia / Ex ia T4
- EAC Ex ia IIC T4 Ga/Gb
- Non-hazardous area + EAC mark
- IEC Ex ia IIC T4 Ga/Gb
- KC Ex ia IIC T4 Ga/Gb
- INMETRO Ex ia IIC T4 Ga/Gb 3)
- NEPSI Ex ia IIC T4 Ga/Gb 3)
- TIIS Ex ia IIC T4 3)

Additional safety instructions must be followed for use in hazardous areas. Please refer to the separate 'Safety Instructions' (XA) document included in the delivery. Reference to the applicable XA can be found on the nameplate.

Explosion-protected smartphones and tablets
Only mobile end devices with Ex approval may be used in hazardous areas.

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.

3) Under development at time of going to press
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 FMR20 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

<table>
<thead>
<tr>
<th>Country</th>
<th>Name of the station</th>
<th>Latitude</th>
<th>Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>Effelsberg</td>
<td>50°31'32&quot; North</td>
<td>06°53'00&quot; East</td>
</tr>
<tr>
<td>Finland</td>
<td>Metsähovi</td>
<td>60°13'04&quot; North</td>
<td>24°23'37&quot; East</td>
</tr>
<tr>
<td></td>
<td>Tuorla</td>
<td>60°24'56&quot; North</td>
<td>24°26'31&quot; East</td>
</tr>
<tr>
<td>France</td>
<td>Plateau de Bure</td>
<td>44°38'01&quot; North</td>
<td>05°54'26&quot; East</td>
</tr>
<tr>
<td></td>
<td>Floriac</td>
<td>44°50'10&quot; North</td>
<td>00°31'37&quot; West</td>
</tr>
<tr>
<td>Great Britain</td>
<td>Cambridge</td>
<td>52°09'59&quot; North</td>
<td>00°02'20&quot; East</td>
</tr>
<tr>
<td></td>
<td>Damhall</td>
<td>53°09'22&quot; North</td>
<td>02°32'03&quot; West</td>
</tr>
<tr>
<td></td>
<td>Jodrell Bank</td>
<td>53°14'10&quot; North</td>
<td>02°18'26&quot; West</td>
</tr>
<tr>
<td></td>
<td>Knockin</td>
<td>52°47'24&quot; North</td>
<td>02°59'45&quot; West</td>
</tr>
<tr>
<td></td>
<td>Pickmere</td>
<td>53°17'18&quot; North</td>
<td>02°26'38&quot; West</td>
</tr>
<tr>
<td>Italy</td>
<td>Medicina</td>
<td>44°31'14&quot; North</td>
<td>11°38'49&quot; East</td>
</tr>
<tr>
<td></td>
<td>Noto</td>
<td>36°52'34&quot; North</td>
<td>14°59'21&quot; East</td>
</tr>
<tr>
<td></td>
<td>Sardinia</td>
<td>39°29'50&quot; North</td>
<td>09°14'00&quot; East</td>
</tr>
<tr>
<td>Poland</td>
<td>Fort Skala Krakow</td>
<td>50°03'18&quot; North</td>
<td>19°49'36&quot; East</td>
</tr>
<tr>
<td>Russia</td>
<td>Dmitrov</td>
<td>56°26'00&quot; North</td>
<td>37°27'00&quot; East</td>
</tr>
<tr>
<td></td>
<td>Kalyazin</td>
<td>57°13'22&quot; North</td>
<td>37°54'01&quot; East</td>
</tr>
<tr>
<td></td>
<td>Pushchino</td>
<td>54°49'00&quot; North</td>
<td>37°40'00&quot; East</td>
</tr>
<tr>
<td></td>
<td>Zelenchukskaya</td>
<td>43°49'53&quot; North</td>
<td>41°35'32&quot; East</td>
</tr>
<tr>
<td>Sweden</td>
<td>Onsala</td>
<td>57°23'45&quot; North</td>
<td>11°55'35&quot; East</td>
</tr>
<tr>
<td>Switzerland</td>
<td>Bleien</td>
<td>47°20'26&quot; North</td>
<td>08°06'44&quot; East</td>
</tr>
<tr>
<td>Spain</td>
<td>Yebes</td>
<td>40°31'27&quot; North</td>
<td>03°05'22&quot; West</td>
</tr>
</tbody>
</table>
As a general rule, the requirements outlined in EN 302729-1/2 must be observed.

<table>
<thead>
<tr>
<th>Country</th>
<th>Name of the station</th>
<th>Latitude</th>
<th>Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robledo</td>
<td>40°25'38&quot; North</td>
<td>04°14'57&quot; West</td>
<td></td>
</tr>
<tr>
<td>Hungary</td>
<td>Penc</td>
<td>47°47'22&quot; North</td>
<td>19°16'53&quot; East</td>
</tr>
</tbody>
</table>

**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.
Other standards and guidelines

- IEC/EN 61010-1
  Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use
- IEC/EN 50511
  "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](http://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](http://www.addresses.endress.com)

1 **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

Werkstoff: PVDF

The weather protection cover can be ordered with the device (product structure, feature 620 "Accessory enclosed", option R1 "weather protection cover"). Alternatively it can be ordered separately as an accessory; order number 52025686.

The sensor is not completely covered in the case of the 40 mm (1.5 in) antenna or the 80 mm (3 in) antenna.

Securing nut G 1-1/2"
Suitable for use with devices with G 1-1/2" and MNPT 1-1/2" process connection.
Material: PC
Order number: 52014146

**Securing nut G 2"**

![Diagram of securing nut G 2"

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

Suitable for use with devices with G 2" and MNPT 2" process connection on front.
Material: PC
Order number: 52000598

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

![Diagram of 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

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".
Alternatively available as an accessory; order number 71325090.
Flooding protection tube 80 mm (3 in) antenna, metallized PBT-PC

For use with devices in product structure, feature 100 'Process connection on front', option XR0 'Customer mounting device without flange'.

Material: PBT-PC, metallized

The flooding protection tube can be ordered with the device. Product structure, feature 620 'Accessory enclosed', option R8 'Flooding protection tube, metallized PBT-PC suitable for 80 mm (3 in) antenna.

Alternatively available as an accessory; order number 71327051.

Mounting bracket, adjustable

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

The mounting bracket can be ordered with the device (product structure, feature 620 'Accessory enclosed', option R3 'Mounting bracket adjustable, 316L').

Alternatively, it is available as an accessory; order number 71325079.
UNI flanges

<table>
<thead>
<tr>
<th>Product structure</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>D (mm)</th>
<th>E</th>
<th>F Number of bores</th>
<th>G Product structure Feature 95 &quot;Process connection on front&quot; Option:</th>
<th>G Product structure Feature 100 &quot;Process connection on rear&quot; Option:</th>
<th>Accessory order code</th>
</tr>
</thead>
<tbody>
<tr>
<td>RA 2&quot;/DN50/50, PP, on front</td>
<td>120</td>
<td>125</td>
<td>165</td>
<td>19</td>
<td>90°</td>
<td>4</td>
<td>VEE Thread ASME MNPT 1-1/2&quot;</td>
<td></td>
<td>FAX50-XIGG</td>
</tr>
<tr>
<td>RA 2&quot;/DN50/50, PP, on front</td>
<td>120</td>
<td>125</td>
<td>165</td>
<td>19</td>
<td>90°</td>
<td>4</td>
<td>WFE Thread ISO228 G 1-1/2&quot;</td>
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<tr>
<td>RA 2&quot;/DN50/50, PP, on front</td>
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<td>125</td>
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<td>90°</td>
<td>4</td>
<td>VFE Thread ASME MNPT 2&quot;</td>
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<td>B (mm)</td>
<td>C (mm)</td>
<td>D (mm)</td>
<td>E</td>
<td>F Number of bores</td>
<td>G Product structure Feature 95 <em>Process connection on front</em> Option:</td>
<td>G Product structure Feature 100 <em>Process connection on rear</em> Option:</td>
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<td>--------</td>
<td>---</td>
<td>-------------------</td>
<td>-------------------------------</td>
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<td>RA UNI flange 2′/DN50/50, PP, on front</td>
<td></td>
<td>120</td>
<td>125</td>
<td>165</td>
<td>19</td>
<td>90°</td>
<td>4</td>
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<tr>
<td>RB *UNI flange 2′/DN50/50, PP, on rear</td>
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<td>120</td>
<td>125</td>
<td>165</td>
<td>19</td>
<td>90°</td>
<td>4</td>
<td>VCE Thread ASME MNPT 1&quot;</td>
<td></td>
</tr>
<tr>
<td>RB *UNI flange 2′/DN50/50, PP, on rear</td>
<td></td>
<td>120</td>
<td>125</td>
<td>165</td>
<td>19</td>
<td>90°</td>
<td>4</td>
<td>WDE Thread G 1&quot; ISO228</td>
<td></td>
</tr>
<tr>
<td>RD UNI flange 3′/DN80/80, PP, on front</td>
<td></td>
<td>150</td>
<td>160</td>
<td>200</td>
<td>19</td>
<td>45°</td>
<td>8</td>
<td>VEE Thread ASME MNPT 1-1/2&quot;</td>
<td></td>
</tr>
<tr>
<td>RD UNI flange 3′/DN80/80, PP, on front</td>
<td></td>
<td>150</td>
<td>160</td>
<td>200</td>
<td>19</td>
<td>45°</td>
<td>8</td>
<td>WFE Thread ISO228 G 1-1/2&quot;</td>
<td></td>
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<tr>
<td>RD UNI flange 3′/DN80/80, PP, on front</td>
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<td>150</td>
<td>160</td>
<td>200</td>
<td>19</td>
<td>45°</td>
<td>8</td>
<td>VFE Thread ASME MNPT 2&quot;</td>
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</tr>
<tr>
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<td>150</td>
<td>160</td>
<td>200</td>
<td>19</td>
<td>45°</td>
<td>8</td>
<td>WGE Thread ISO228 G 2&quot;</td>
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</tr>
<tr>
<td>RE UNI flange 3′/DN80/80, PP, on rear</td>
<td></td>
<td>150</td>
<td>160</td>
<td>200</td>
<td>19</td>
<td>45°</td>
<td>8</td>
<td>VCE Thread ASME MNPT 1&quot;</td>
<td></td>
</tr>
<tr>
<td>RE UNI flange 3′/DN80/80, PP, on rear</td>
<td></td>
<td>150</td>
<td>160</td>
<td>200</td>
<td>19</td>
<td>45°</td>
<td>8</td>
<td>WDE Thread G 1&quot; ISO228</td>
<td></td>
</tr>
<tr>
<td>RG UNI flange 4′/ DN100/100, PP, on front</td>
<td></td>
<td>175</td>
<td>190.5</td>
<td>228.6</td>
<td>19</td>
<td>45°</td>
<td>8</td>
<td>VEE Thread ASME MNPT 1-1/2&quot;</td>
<td></td>
</tr>
<tr>
<td>RG UNI flange 4′/ DN100/100, PP, on front</td>
<td></td>
<td>175</td>
<td>190.5</td>
<td>228.6</td>
<td>19</td>
<td>45°</td>
<td>8</td>
<td>WFE Thread ISO228 G 1-1/2&quot;</td>
<td></td>
</tr>
<tr>
<td>RG UNI flange 4′/ DN100/100, PP, on front</td>
<td></td>
<td>175</td>
<td>190.5</td>
<td>228.6</td>
<td>19</td>
<td>45°</td>
<td>8</td>
<td>VFE Thread ASME MNPT 2&quot;</td>
<td></td>
</tr>
<tr>
<td>Product structure</td>
<td>Feature 620</td>
<td>A (mm)</td>
<td>B (mm)</td>
<td>C (mm)</td>
<td>D (mm)</td>
<td>E</td>
<td>F Number of bores</td>
<td>G Product structure Feature 95</td>
<td>Option:</td>
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<td>--------</td>
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<tr>
<td>RG UNI flange 4&quot;/ DN100/100, PP, on front</td>
<td>175</td>
<td>190.5</td>
<td>228.6</td>
<td>19</td>
<td>45°</td>
<td>8</td>
<td>WGE Thread ISO228 G 2&quot;</td>
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<td></td>
</tr>
<tr>
<td>BH UNI flange 4&quot;/ DN100/100, PP, on rear</td>
<td>175</td>
<td>190.5</td>
<td>228.6</td>
<td>19</td>
<td>45°</td>
<td>8</td>
<td>VCE Thread ASME MNPT 1&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RH UNI flange 4&quot;/ DN100/100, PP, on rear</td>
<td>175</td>
<td>190.5</td>
<td>228.6</td>
<td>19</td>
<td>45°</td>
<td>8</td>
<td>WDE Thread G 1&quot; ISO228</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Angle bracket for wall mount

![Dimensions of angle bracket](image)

**Dimensions of angle bracket, engineering unit: mm (in)**

<table>
<thead>
<tr>
<th>Process connection</th>
<th>Order No.</th>
<th>Material</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>G 1-1/2&quot;</td>
<td>942669-0000</td>
<td>316 Ti (1.4571)</td>
<td>3.4 kg (7.5 lb)</td>
</tr>
<tr>
<td>G 2&quot;</td>
<td>942669-0001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Also suitable for MNPT 1-1/2" and MNPT 2"
Cantilever with pivot

Installation type sensor process connection rear side

![Diagram of cantilever with pivot](Image)

38 Installation type sensor process connection rear side

A Installation with cantilever and wall bracket
B Installation with cantilever and mounting frame
1 Cantilever
2 Wall bracket
3 Mounting frame

Cantilever with pivot, sensor process connection on rear

![Diagram of cantilever with pivot, sensor process connection on rear](Image)

39 Dimensions of cantilever with pivot for sensor process connection on rear, engineering unit: mm (in)

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>585 mm (23 in)</td>
<td>250 mm (9.84 in)</td>
<td>2 mm (0.08 in)</td>
<td>200 mm (7.87 in)</td>
<td>2.1 kg (4.63 lb)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.0 kg (4.41 lb)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>35 mm (1.38 in)</td>
</tr>
<tr>
<td>1085 mm (42.7 in)</td>
<td>750 mm (29.5 in)</td>
<td>3 mm (0.12 in)</td>
<td>300 mm (11.8 in)</td>
<td>4.5 kg (9.92 lb)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.3 kg (9.48 lb)</td>
</tr>
</tbody>
</table>

- 35 mm (1.38 in) Openings for all G 1" or MNPT 1" connections on rear.
- 22 mm (0.87 in) Opening can be used for an additional sensor.

Retaining screws are included in delivery.
Installation type sensor process connection on front

40  Installation type sensor process connection on front
A  Installation with cantilever and wall bracket
B  Installation with cantilever and mounting frame
1  Cantilever
2  Wall bracket
3  Mounting frame

Cantilever with pivot, sensor process connection on front

41  Dimensions of cantilever with pivot for sensor process connection on front, engineering unit: mm (in)
### Micropilot FMR20

**Weight Sensor, process connection front side**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Weight</th>
<th>Sensor, process connection front side</th>
<th>Material</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>585 mm (23 in)</td>
<td>250 mm (9.84 in)</td>
<td>2 mm (0.08 in)</td>
<td>200 mm (7.87 in)</td>
<td>1.9 kg (4.19 lb)</td>
<td>1-1/2&quot;</td>
<td>Steel, hot-dip galvanized</td>
<td>52014131</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>316Ti (1.4571)</td>
<td>52014132</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2&quot;</td>
<td>Steel, hot-dip galvanized</td>
<td>52014135</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>316Ti (1.4571)</td>
<td>52014136</td>
</tr>
<tr>
<td>1,085 mm (42.7 in)</td>
<td>750 mm (29.5 in)</td>
<td>3 mm (0.12 in)</td>
<td>300 mm (11.8 in)</td>
<td>4.4 kg (9.7 lb)</td>
<td>1-1/2&quot;</td>
<td>Steel, hot-dip galvanized</td>
<td>52014133</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>316Ti (1.4571)</td>
<td>52014134</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2&quot;</td>
<td>Steel, hot-dip galvanized</td>
<td>52014137</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>316Ti (1.4571)</td>
<td>52014138</td>
</tr>
</tbody>
</table>

- 50 mm (2.17 in) or 62 mm (2.44 in) openings for all connections on front G 1-1/2" (MNPT 1-1/2") or G 2" (MNPT 2").
- 22 mm (0.87 in) Opening can be used for an additional sensor.

Retaining screws are included in delivery.

**Mounting stand for cantilever with pivot**

![Mounting stand for cantilever with pivot](image)

**Dimensions of mounting frame, engineering unit: mm (in)**

<table>
<thead>
<tr>
<th>Height</th>
<th>Material</th>
<th>Weight</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>700 mm (27.6 in)</td>
<td>Steel, galvanized</td>
<td>3.2 kg (7.06 lb)</td>
<td>919791-0000</td>
</tr>
<tr>
<td>700 mm (27.6 in)</td>
<td>316Ti (1.4571)</td>
<td>4.9 kg (10.08 lb)</td>
<td>919791-0001</td>
</tr>
<tr>
<td>1,400 mm (55.1 in)</td>
<td>Steel, galvanized</td>
<td></td>
<td>919791-0002</td>
</tr>
<tr>
<td>1,400 mm (55.1 in)</td>
<td>316Ti (1.4571)</td>
<td></td>
<td>919791-0003</td>
</tr>
</tbody>
</table>
Wall bracket for cantilever with pivot

![Wall Bracket Diagram]

### Dimensions of wall bracket, engineering unit: mm (in)

<table>
<thead>
<tr>
<th>Material</th>
<th>Weight</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel, galvanized</td>
<td>1.4 kg (3.09 lb)</td>
<td>919792-0000</td>
</tr>
<tr>
<td>316Ti (1.4571)</td>
<td></td>
<td>919792-0001</td>
</tr>
</tbody>
</table>

Ceiling mounting bracket

![Ceiling Mounting Bracket Diagram]

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

Material: 316L (1.4404)

The mounting bracket can be ordered with the device (product structure, feature 620 'Accessory enclosed', option R2 'Ceiling mounting bracket, 316L'). Alternatively, it is available as an accessory; order number 71093130.
RIA15 in the field housing (incl. option for basic configuration FMR20)

The RIA15 remote display can be ordered together with the device. Product structure, feature 620 "Accessory enclosed”:
- Option R4 "Remote display RIA15 non-hazardous area, field housing”
- Option R5 "Remote display RIA15 Ex= explosion protection approval, field housing”

Alternatively available as an accessory, for details see Technical Information TI01043K and Operating Instructions BA01170K.

HART communication resistor

A communication resistor is required for HART communication. If this is not already present (e.g. in the power supply RMA, RN221N, RNS221, ...), it can be ordered with the device via the product structure, feature 620 "Accessory enclosed”: option R6 "HART communication resistor hazardous / non-hazardous area”.

Alternatively available as an accessory, for details see Technical Information TI01043K and Operating Instructions BA01170K.

The HART communication resistor is specially designed for use with the RIA15 and can be attached easily.
1. Disconnect plug-in terminal block.
2. Insert the terminal block into the slot provided on the HART communication resistor module.
3. Insert the HART communication resistor in the slot in the housing.
| Accessories                          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
## Service-specific accessories

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FieldCare / DeviceCare</td>
<td>Endress+Hauser's FDT-based Plant Asset Management tool. Helps to configure and maintain all field devices of your plant. By supplying status information it also supports the diagnosis of the devices. For details refer to Operating Instructions BA00027S and BA00059S.</td>
</tr>
</tbody>
</table>

## System components

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memograph M graphic display recorder</td>
<td>The Memograph M graphic data manager provides information on all the relevant process variables. Measured values are recorded safely, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on an SD card or USB stick. For details, see Technical Information TI01180R and Operating Instructions BA01338R</td>
</tr>
<tr>
<td>RNS221</td>
<td>Supply unit for powering two 2-wire measuring devices. Bidirectional communication is possible via the HART communication jacks. For details, see Technical Information TI00081R and Operating Instructions KA00110R</td>
</tr>
<tr>
<td>RN221N</td>
<td>Active barrier with power supply for safe separation of 4...20 mA current circuits Bi-directional HART-communication is possible using the built-in communication sockets (with resistance R=250 Ω) For details, see Technical Information TI073R and Operating Instructions BA202R</td>
</tr>
<tr>
<td>RMA42</td>
<td>Digital process transmitter for monitoring and visualizing analog measured values For details, see Technical Information TI00150R and Operating Instructions BA00287R</td>
</tr>
<tr>
<td>RIA452</td>
<td>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</td>
</tr>
<tr>
<td>HAW562</td>
<td>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</td>
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</table>
# Supplementary documentation

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

<table>
<thead>
<tr>
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<th>Document type</th>
<th>Document code</th>
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<tbody>
<tr>
<td>FMR20</td>
<td>Brief Operating Instructions</td>
<td>KA01248F</td>
</tr>
<tr>
<td></td>
<td>Operating Instructions</td>
<td>BA01578F</td>
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### Supplementary documentation

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<thead>
<tr>
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<tbody>
<tr>
<td>RIA15</td>
<td>Technical Information</td>
<td>TI01043K</td>
</tr>
<tr>
<td></td>
<td>Operating Instructions</td>
<td>BA01170K</td>
</tr>
</tbody>
</table>

### Safety Instructions (XA) 

Depending on the approval, the following Safety Instructions (XA) are supplied with the device. They are an integral part of the Operating Instructions.

<table>
<thead>
<tr>
<th>Feature 010</th>
<th>Approval</th>
<th>Feature 020: “Power Supply; Output&quot;</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>A¹, P ²¹</td>
</tr>
<tr>
<td>BA</td>
<td>ATEX II 1 G Ex ia IIC T4 Ga</td>
<td>XA01443F</td>
</tr>
<tr>
<td>BB</td>
<td>ATEX II 1/2 G Ex ia IIC T4 Ga/Gb</td>
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¹) 2 wire; 4-20 mA HART configuration
²) 2 wire; 4-20 mA HART/Bluetooth® (app) configuration
³) At the time of printing in preparation

The nameplate indicates the Safety Instructions (XA) that are relevant to the device.