unbekannt Products Solutions Services

# Technical Information Micropilot FMR51, FMR52

Free space radar

# Level measurement in liquids

# Application

- Continuous, non-contact level measurement of liquids, pastes and slurries
- Horn antenna (FMR51); flush mounted, completely filled PTFE horn antenna (FMR52)
- Maximum measuring range: 70 m (230 ft)
- Process temperature: -196 to +450 °C (-321 to +842 °F)
- Process pressure: -1 to +160 bar (-14.5 to +2320 psi)
- Accuracy: ± 2 mm
- International explosion protection certificates; WHG; marine approvals
- Linearity protocol (3-point, 5-point)

#### Your benefits

- Reliable measurement even for changing product and process conditions
- HistoROM data management for easy commissioning, maintenance and diagnostics
- Highest reliability due to Multi-Echo Tracking
- SIL2 according to IEC 61508, SIL3 in case of homogeneous or heterogeneous redundancy
- Seamless integration into control or asset management systems
- ullet Intuitive user interface in national languages
- Bluetooth® wireless technology for commissioning, operation and maintenance via free iOS / Android app SmartBlue
- Easy proof test for SIL and WHG
- Heartbeat Technology™





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# Wichtige Hinweise zum Dokument

# Symbols Safety symbols

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

# **Electrical symbols**

| Symbol        | Meaning   |  |
|---------------|---|--|
|               | Direct current  |  |
| ~             | Alternating current   |  |
| $\overline{}$ | 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 Earth (PE) A terminal which must be connected to ground prior to establishing any other connections.   |  |
|               | The ground terminals are situated inside and outside the device:  Inner ground terminal: Connects the protectiv earth to the mains supply.  Outer ground terminal: Connects the device to the plant grounding system. |  |

# Symbols for certain types of information

| Symbol     | Meaning  |
|------------|--|
| <b>✓</b>   | Permitted Procedures, processes or actions that are permitted. |
| <b>✓ ✓</b> | Preferred Procedures, processes or actions that are preferred. |
| X          | Forbidden Procedures, processes or actions that are forbidden. |
| i          | Tip Indicates additional information.                          |
|            | Reference to documentation.                                    |
|            | Reference to page.   |
|            | Reference to graphic.  |
| •          | Visual inspection.   |

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## Symbols in graphics

| Symbol         | Meaning  |
|----------------|--|
| 1, 2, 3        | Item numbers   |
| 1., 2., 3      | Series of steps  |
| A, B, C,       | Views  |
| A-A, B-B, C-C, | Sections   |
| EX             | Hazardous area<br>Indicates a hazardous area.                    |
| ×              | Safe area (non-hazardous area) Indicates the non-hazardous area. |

# Symbols at the device

| Symbol     | Meaning   |
|------------|---|
| <b>★</b> → | Safety instructions Observe the safety instructions contained in the associated Operating Instructions.                             |
|            | Temperature resistance of the connection cables Specifies the minimum value of the temperature resistance of the connection cables. |

# 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   |  |
| FieldCare                     | Scalable software tool for device configuration and integrated plant asset management solutions  |  |
| DeviceCare                    | Universal configuration software for Endress+Hauser HART, PROFIBUS, FOUNDATION Fieldbus and Ethernet field devices   |  |
| DTM                           | Device Type Manager  |  |
| DD                            | Device Description for HART communication protocol   |  |
| $\epsilon_{\rm r}$ (DC value) | Relative dielectric constant   |  |
| Operating tool                | The term "operating tool" is used in place of the following operating software:  FieldCare / DeviceCare, for operation via HART communication and PC  SmartBlue (app), for operation using an Android or iOS smartphone or tablet. |  |
| BD                            | Blocking Distance; no signals are analyzed within the BD.  |  |
| PLC                           | Programmable Logic Controller  |  |
| CDI                           | Common Data Interface  |  |
| PFS                           | Pulse Frequence Status (Switching output)  |  |
| MBP                           | Manchester Bus Powered   |  |
| PDU                           | Protocol Data Unit   |  |

#### Registered trademarks

#### **HART®**

Registered trademark of the FieldComm Group, Austin, USA

#### PROFIBUS®

Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany

#### FOUNDATIONTM Fieldbus

Registered trademark of the FieldComm Group, Austin, Texas, USA

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#### Android®

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#### KALREZ®, VITON®

Registered trademark of DuPont Performance Elastomers L.L.C., Wilmington, USA

#### TEFLON<sup>o</sup>

Registered trademark of E.I. DuPont de Nemours & Co., Wilmington, USA

#### TRI CLAMP®

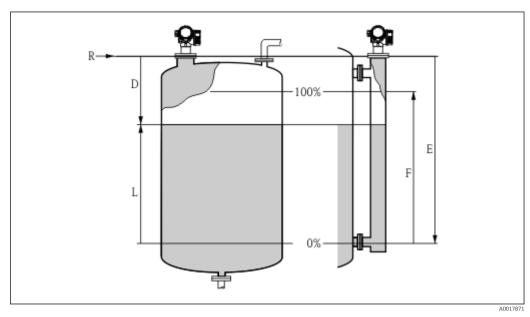
Registered trademark of Alfa Laval Inc., Kenosha, USA

Endress+Hauser

# Function and system design

#### 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 (process connection) to the product surface. Radar impulses are emitted by an antenna, reflected off the product surface and received again by the radar system.



■ 1 Setup parameters of the Micropilot

- *R* Reference point of the measurement (lower edge of the flange or threaded connection)
- E Empty calibration ( = zero)
- F Full calibration (= span)
- D Measured distance
- L Level (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. The unambiguous signal identification is accomplished by the PulseMaster® eXact software together with the Multi-echo tracking algorithms, based on many years of experience with time-of-flight technology.

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

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

with c being the speed of light.

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

$$L = E - D$$

The reference point R of the measurement is located at the process connection. For details see the dimensional drawing:

- FMR51: → 🗎 68
- FMR52: → 🗎 74

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

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#### Output

The Micropilot is commissioned by entering an empty distance "E" (=zero), a full distance "F" (=span) and application parameters which automatically adapt the instrument to the process conditions. For models with a current output, the factory adjustment for zero point "E" and span "F" is 4 mA and 20 mA. For digital outputs and the display module, the factory adjustment for zero point "E" and span "F" is 0 % and 100 %.

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

#### Life cycle of the product

#### **Engineering**

- Universal measuring principle
- Measurement unaffected by medium properties
- Hardware and software developed according to SIL IEC 61508

#### Procurement

- Endress+Hauser being the world market leader in level measurement quarantees asset protection
- Worldwide support and service

#### Installation

- Special tools are not required
- Reverse polarity protection
- Modern, detachable terminals
- Main electronics protected by a separate connection compartment

#### Commissioning

- Fast, menu-quided commissioning in only a few steps on site or from the control room
- Plain text display in national languages reduces the risk of error or confusion
- Direct local access of all parameters
- Short instruction manual at the device

#### Operation

- Multi-echo tracking: Reliable measurement through self-learning echo-search algorithms taking
  into account the short-term and long-term history in order to check the found echoes for
  plausibility and to suppress interference echoes.
- Diagnostics in accordance with NAMUR NE107

#### Maintenance

- HistoROM: Data backup for instrument settings and measured values
- Exact instrument and process diagnosis to assist fast decisions with clear details concerning remedies
- Intuitive, menu-guided operating concept in national languages saves costs for training, maintenance and operation
- Cover of the electronics compartment can be opened in hazardous areas

#### Ratirament

- Order code translation for subsequent models
- RoHS-conforming (Restriction of certain Hazardous Substances), unleaded soldering of electronic components
- Environmentally sound recycling concept

# Input

#### Measured variable

The measured variable is the distance between the reference point and the product surface.

The level is calculated from this distance, taking into account the empty distance "E" entered by the user.

If required, the level can be converted into other variables (volume, mass) by means of a linearization (up to 32 points).

#### Measuring range

#### Maximum measuring range

| Device   | Maximum measuring range |
|--|-------------------------|
| FMR51 - standard version                             | 40 m (131 ft)           |
| FMR51 - with "Advanced dynamics" application package | 70 m (230 ft)           |
| FMR52 - standard version                             | 40 m (131 ft)           |
| FMR52 - with "Advanced dynamics" application package | 60 m (197 ft)           |

#### Usable measuring range

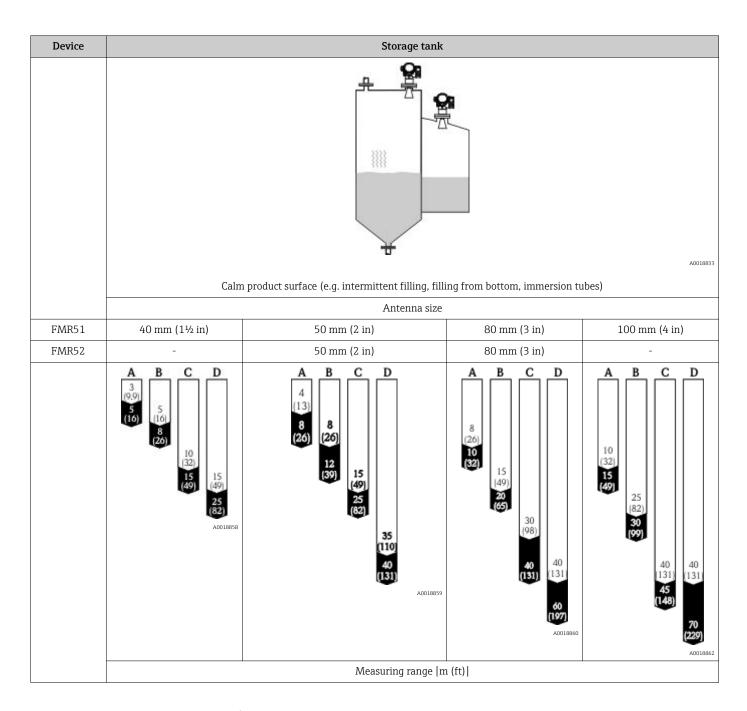
The usable measuring range depends on the size of the antenna, the reflectivity of the medium, the mounting location and eventual interference reflections.

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

#### Media groups

| Media groups | DC ( $\epsilon_{\rm r}$ ) | Example   |  |
|--------------|---------------------------|---|--|
| Α            | 1.4 to 1.9                | non-conducting liquids, e.g. liquefied gas $^{1)}$                            |  |
| В            | 1.9 to 4                  | non-conducting liquids, e.g. benzene, oil, toluene,                           |  |
| С            | 4 to 10                   | e.g. concentrated acids, organic solvents, esters, aniline, alcohol, acetone, |  |
| D            | > 10                      | conducting liquids, e.g. aqueous solutions, dilute acids and alkalis          |  |

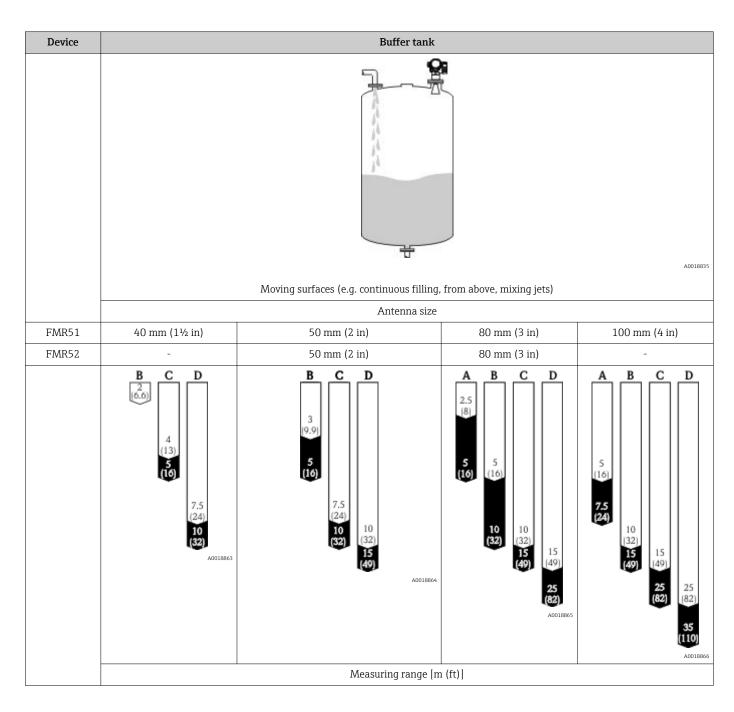
- 1) Treat Ammonia  $NH_3$  as a medium of group A.
- For dielectric constants (DC values) of many media commonly used in various industries refer
  - the Endress+Hauser DC manual (CP01076F)
  - the Endress+Hauser "DC Values App" (available for Android and iOS)



# Legend

Measuring range of the standard version

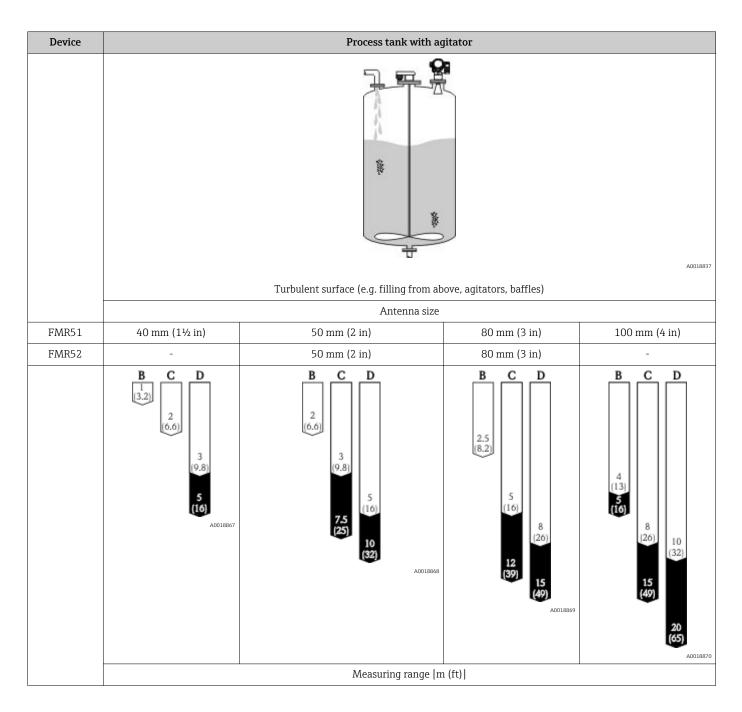
Measuring range for the "Advanced dynamics" application package (product structure: feature 540: "Application Package", Option EM: "Advanced dynamics")



#### Legend

Measuring range of the standard version

Measuring range for the "Advanced dynamics" application package (product structure: feature 540: "Application Package", Option EM: "Advanced dynamics")



#### Legend

Measuring range of the standard version

Measuring range for the "Advanced dynamics" application package (product structure: feature 540: "Application Package", Option EM: "Advanced dynamics")

| Device | Stilling well        | Bypass                   |
|--------|----------------------|--------------------------|
|        | A0018842             | A0018840                 |
|        | Antenna size         | Antenna size             |
| FMR51  | 40 100 mm ( 1½ 4 in) | 40 100 mm ( 1½ 4 in)     |
| FMR52  | 50 80 mm ( 2 3 in)   | 50 80 mm ( 2 3 in)       |
|        | A, B, C, D  20 (66)  | 20<br>(66)               |
|        | 100,0002             | Measuring range [m (ft)] |
|        | 1                    |                          |

# Operating frequency

K-band (~ 26 GHz)

Up to 8 Micropilot transmitters can be installed in the same tank because the transmitter pulses are statistically coded.

#### Transmitting power

| Distance     | Average energy density in beam direction |  |  |  |
|--------------|--|--|--|--|
|              | Standard version                         | With "Advanced dynamics" application package <sup>1)</sup> |  |  |
| 1 m (3.3 ft) | < 12 nW/cm <sup>2</sup>                  | < 64 nW/cm <sup>2</sup>                                    |  |  |
| 5 m (16 ft)  | < 0.4 nW/cm <sup>2</sup>                 | < 2.5 nW/cm <sup>2</sup>                                   |  |  |

1) Product structure, feature 540: "Application package", option EM: "Advanced dynamics"

# Output

#### Output signal

#### **HART**

| Signal coding          | FSK ±0.5 mA over current signal |
|------------------------|---------------------------------|
| Data transmission rate | 1200 Bit/s                      |
| Galvanic isolation     | Yes                             |

# Bluetooth® wireless technology

| Device version                   | Ordering feature 610 "Accessory mounted", option NF "Bluetooth"                                      |  |
|----------------------------------|--|--|
| Operation / configuration        | By the SmartBlue app.  |  |
| Range under reference conditions | > 10 m (33 ft)   |  |
| Encryption                       | Encrypted communication and password encryption prevent incorrect operation by unauthorized persons. |  |

#### **PROFIBUS PA**

| Signal coding          | Manchester Bus Powered (MBP) |  |
|------------------------|------------------------------|--|
| Data transmission rate | 31.25 kBit/s, voltage mode   |  |
| Galvanic isolation     | Yes                          |  |

# FOUNDATION Fieldbus

| Signal coding          | Manchester Bus Powered (MBP) |
|------------------------|------------------------------|
| Data transmission rate | 31.25 kBit/s, voltage mode   |
| Galvanic isolation     | Yes                          |

## Switch output



For HART devices, the switch output is available as an option. See product structure, feature 20: "Power Supply, Output", option B: "2-wire; 4-20mA HART, switch output"

 $\label{thm:profibus} \mbox{ Devices with PROFIBUS PA and FOUNDATION Fieldbus always have a switch output.}$ 

| Switch output                     | Switch output  |  |
|-----------------------------------|--|--|
| Function                          | Open collector switching output  |  |
| Switching behavior                | Binary (conductive or non-conductive), switches when the programmable switch point is reached  |  |
| Failure mode                      | non-conductive   |  |
| Electrical connection values      | U = 16 to 35 V <sub>DC</sub> , I = 0 to 40 mA  |  |
| Internal resistance               | $R_{\rm i} < 880\Omega$ The voltage drop at this internal resistance has to be taken into account on planning the configuration. For example, the resulting voltage at a connected relay must be sufficient to switch the relay. |  |
| Insulation voltage                | floating, Insulation voltage 1 350 $\mathrm{V}_{\mathrm{DC}}$ to power supply aund 500 $\mathrm{V}_{\mathrm{AC}}$ to ground  |  |
| Switch point                      | freely programmable, separately for switch-on and switch-off point   |  |
| Switching delay                   | freely programmable from 0 to 100 s, separately for switch-on and switch-off point   |  |
| Number of switching cycles        | corresponds to the measuring cycle   |  |
| Signal source<br>device variables | <ul> <li>Level linearized</li> <li>Distance</li> <li>Terminal voltage</li> <li>Electronic temperature</li> <li>Relative echo amplitude</li> <li>Diagnostic values, Advanced diagnostics</li> </ul>                               |  |
| Number of switching cycles        | unlimited  |  |

# Signal on alarm

Depending on the interface, failure information is displayed as follows:

- Current output (for HART devices)
  - Failsafe mode selectable (in accordance with NAMUR Recommendation NE 43): Minimum alarm: 3.6 mA

Maximum alarm (= factory setting): 22 mA

- Failsafe mode with user-selectable value: 3.59 to 22.5 mA
- Local display
  - Status signal (in accordance with NAMUR Recommendation NE 107)
  - Plain text display
- Operating tool via digital communication (HART, PROFIBUS PA, FOUNDATION Fieldbus) or service interface (CDI)
  - Status signal (in accordance with NAMUR Recommendation NE 107)
  - Plain text display

## Linearization

The linearization function of the device allows the conversion of the measured value into any unit of length or volume. Linearization tables for calculating the volume in cylindrical tanks are preprogrammed. Other linearization tables of up to 32 value pairs can be entered manually or semi-automatically.

#### Galvanic isolation

All circuits for the outputs are galvanically isolated from each other.

#### Protocol-specific data

#### **HART**

| Manufacturer ID                    | 17 (0x11)   |
|------------------------------------|---|
| Device type ID                     | 0x1128  |
| HART specification                 | 7.0   |
| Device description files (DTM, DD) | Information and files under:  www.endress.com  www.fieldcommgroup.org |
| HART load                          | min. 250 Ω  |

| HART device variables | The measured values can be freely assigned to the device variables.  |
|-----------------------|--|
|                       | Measured values for PV (primary variable)  Level linearized  Distance  Electronic temperature  Relative echo amplitude  Area of incoupling  Analog output adv. diagnostics 1   |
|                       | • Analog output adv. diagnostics 2   |
|                       | Measured values for SV, TV, FV (second, third and fourth variable)  Level linearized  Distance  Electronic temperature  Terminal voltage  Relative echo amplitude  Absolute echo amplitude  Area of incoupling  Analog output adv. diagnostics 1  Analog output adv. diagnostics 2 |
| Supported functions   | <ul><li>Burst mode</li><li>Additional transmitter status</li></ul>   |

# Wireless HART data

| Minimum start-up voltage  | 16 V   |
|---------------------------|--------|
| Start-up current          | 3.6 mA |
| Start-up time             | 65 s   |
| Minimum operating voltage | 14.0 V |
| Multidrop current         | 4.0 mA |
| Set-up time               | 15 s   |

# PROFIBUS PA

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| Manufacturer ID  | 17 (0x11)   |
|------------------|---|
| Ident number     | 0x1559  |
| Profile version  | 3.02  |
| GSD file         | Information and files under:  |
| GSD file version | <ul><li>www.endress.com</li><li>www.profibus.org</li></ul>  |
| Output values    | Analog Input:  Level linearized  Distance  Terminal voltage  Electronic temperature  Absolute echo amplitude  Relative echo amplitude  Analog output adv. diagnostics 1  Analog output adv. diagnostics 2  Digital Input: |
|                  | <ul> <li>Digital output AD 1</li> <li>Digital output AD 2</li> <li>Switch output</li> </ul>   |

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| Input values        | Analog Output:  ■ Analog value from PLC (for sensor block external pressure to compensate gas phase effects)  ■ Analog value from PLC to be indicated on the display   |
|---------------------|--|
|                     | Digital Output:  Extended diagnostic block  Level limiter  Sensor block measurement on  Sensor block save history on  Status output  |
| Supported functions | <ul> <li>Identification &amp; Maintenance         Einfachste Geräteidentifizierung seitens des Leitsystems und des Typenschildes</li> <li>Automatic Ident Number Adoption         GSD compatibility mode with respect to the preceding product Micropilot M FMR2xx</li> <li>Physical Layer Diagnostics         Installation check of the PRFIBUS segment and the Micropilot FMR5x via the terminal voltage and telegram surveillance.</li> <li>PROFIBUS Up-/Download         Up to 10 times faster writing and reading of parameters via PROFIBUS up-/download</li> <li>Condensed Status         Simple and self-explanatory diagnostic information by categorization of occurring diagnostic messages.</li> </ul> |

# FOUNDATION Fieldbus

| Manufacturer ID                          | 0x452B48   |
|--|--|
| Device type                              | 0x1028   |
| Device Revision                          | 0x01   |
| DD Revision                              | Information and files can be found:  |
| CFF Revision                             | <ul><li>www.endress.com</li><li>www.fieldcommgroup.org</li></ul>                         |
| Device Tester Version (ITK Version)      | 6.0.1  |
| ITK Test Campaign Number                 | IT085300   |
| Link Master (LAS) capable                | yes  |
| Link Master / Basic Device selectable    | yes; default: Basic Device   |
| Node address                             | Default: 247 (0xF7)  |
| Features supported                       | Following methods are supported:  Restart  ENP Restart  Setup  Linearization  Self Check |
| Virtual Communication Relationships (VCR | s)   |
| Number of VCRs                           | 44   |
| Number of Link Objects in VFD            | 50   |
| Permanent entries                        | 1  |
| Client VCRs                              | 0  |
| Server VCRs                              | 10   |
| Source VCRs                              | 43   |
| Sink VCRs                                | 0  |
| Subscriber VCRs                          | 43   |
| Publisher VCRs                           | 43   |
| Device Link Capabilities                 |  |
| Slot time                                | 4  |

| Min. inter PDU delay | 8  |
|----------------------|----|
| Max. response delay  | 20 |

# Transducer Blocks

| Block                                    | Content   | Output values   |
|--|---|---|
| Setup Transducer Block                   | Contains all parameters for a standard commissioning procedure  | <ul> <li>Level or volume <sup>1)</sup>     (Channel 1)</li> <li>Distance (Channel 2)</li> </ul> |
| Advanced Setup<br>Transducer Block       | Contains all parameters for a more detailed configuration of the device   | no output values  |
| Display Transducer Block                 | Contains all parameters for the configuration of the display module   | no output values  |
| Diagnostic Transducer<br>Block           | Contains diagnostic information   | no output values  |
| Advanced Diagnostic<br>Transducer Block  | Contains parameters for the Advanced Diagnostic   | no output values  |
| Expert Configuration<br>Transducer Block | Contains parameters which require detailed knowledge of the functionalities of the device   | no output values  |
| Expert Information<br>Transducer Block   | Contains information about the state of the device  | no output values  |
| Service Sensor Transducer<br>Block       | Contains parameters which can only be operated by Endress+Hauser service personnel  | no output values  |
| Service Information<br>Transducer Block  | Contains information on the state of device which is relevant for service operations  | no output values  |
| Data Transfer Transducer<br>Block        | Contains parameters which allow to backup the device configuration in the display module and to restore it into the device. Access to these parameters is restricted to the Endress+Hauser service. | no output values  |

# 1) depending on the configuration of the block

# Function Blocks

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| Block                               | Content   | Number of permanent blocks | Number of instantiable blocks | Execution time | Functionality |
|-------------------------------------|---|----------------------------|-------------------------------|----------------|---------------|
| Resource Block                      | The Resource Block contains all the data that uniquely identifies the field device. It is an electronic version of a nameplate of the device. | 1                          | 0                             | -              | enhanced      |
| Analog Input<br>Block               | The AI block takes the manufacturer's input data, selected by channel number, and makes it available to other function blocks at its output.  | 2                          | 3                             | 25 ms          | enhanced      |
| Discrete Input<br>Block             | The DI block takes a discrete input value (e.g. indication of an level limit), and makes it available to other function blocks at its output. | 1                          | 2                             | 20 ms          | standard      |
| Mutiple<br>Analog Output<br>Block   | This block is used to transfer analog data from the bus into the device   | 1                          | 0                             | 20 ms          | standard      |
| Mutiple<br>Discrete<br>Output Block | This block is used to transfer discrete data from the bus to the device.  | 1                          | 0                             | 20 ms          | standard      |

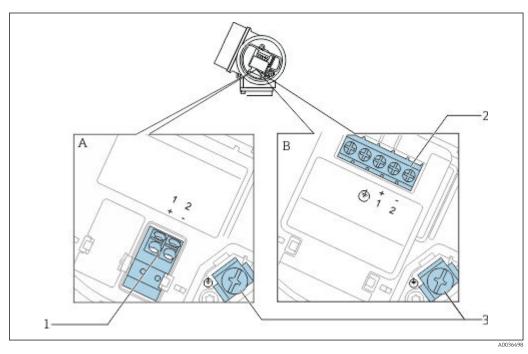
| Block                            | Content  | Number of permanent blocks | Number of instantiable blocks | Execution time | Functionality |
|----------------------------------|--|----------------------------|-------------------------------|----------------|---------------|
| PID Block                        | The PID block serves as proportional-integralderivative controller and is used almost universally to do closed-loopcontrol in the field including cascade and feedforward.   | 1                          | 1                             | 25 ms          | standard      |
| Arithmetic<br>Block              | This block is designed to permit simple use of popular measurement math functions. The user does not have to know how to write equations. The math algorithm is selected by name, chosen by the user for the function to be done.  | 1                          | 1                             | 25 ms          | standard      |
| Signal<br>Characterizer<br>Block | The signal characterizer block has two sections, each with an output that is a non-linear function of the respective input. The non-linear function is determined by a single look-up table with 21 arbitrary x-y pairs.   | 1                          | 1                             | 25 ms          | standard      |
| Input Selector<br>Block          | The input selector block provides selection of up to four inputs and generates an output based on the configured action. This block normally receives its inputs from AI blocks. The block performs maximum, minimum, middle, average and 'first good' signal selection.   | 1                          | 1                             | 25 ms          | standard      |
| Integrator<br>Block              | The Integrator Function Block integrates a variable as a function of the time or accumulates the counts from a Pulse Input block. The block may be used as a totalizer that counts up until reset or as a batch totalizer that has a setpoint, where the integrated or accumulated value is compared to pre-trip and trip settings, generating discrete signals when these settings are reached. | 1                          | 1                             | 25 ms          | standard      |
| Analog Alarm<br>Block            |  | 1                          | 1                             | 25 ms          | standard      |

Up to 20 blocks can be instantiated in the device altogether, including the blocks already instantiated on delivery.

# Power supply

#### Terminal assignment

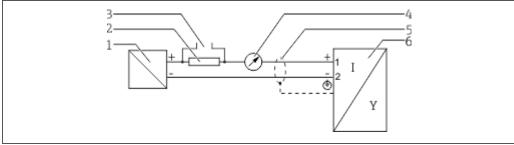
# Terminal assignment 2-wire: 4-20 mA HART



■ 2 Terminal assignment 2-wire: 4-20 mA HART

- A Without integrated overvoltage protection
- B With integrated overvoltage protection
- 1 Connection 4-20 mA HART passive: terminals 1 and 2, without integrated overvoltage protection
- $2\qquad \textit{Connection 4-20 mA HART passive: terminals 1 and 2, with integrated overvoltage protection}$
- 3 Terminal for cable screen

# Block diagram 2-wire: 4-20 mA HART



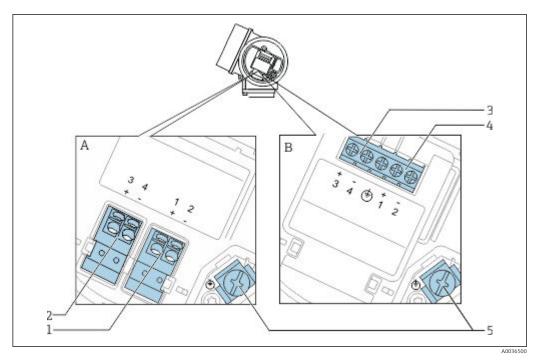
A003649

# ■ 3 Block diagram 2-wire: 4-20 mA HART

- 1 Active barrier with power supply (e.g. RN221N); observe terminal voltage
- 2 HART communication resistor ( $\geq 250 \Omega$ ); observe maximum load
- 3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- 4 Analog display device; observe maximum load
- 5 Cable screen; observe cable specification
- 6 Measuring device

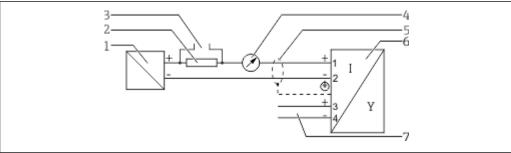
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#### Terminal assignment 2-wire: 4-20 mA HART, switch output



- 4 Terminal assignment 2-wire: 4-20 mA HART, switch output
- A Without integrated overvoltage protection
- B With integrated overvoltage protection
- 1 Connection 4-20 mA HART passive: terminals 1 and 2, without integrated overvoltage protection
- 2 Connection switch output (Open Collector): terminals 3 and 4, without integrated overvoltage protection
- 3 Connection switch output (Open Collector): terminals 3 and 4, with integrated overvoltage protection
- 4 Connection 4-20 mA HART passive: terminals 1 and 2, with integrated overvoltage protection
- 5 Terminal for cable screen

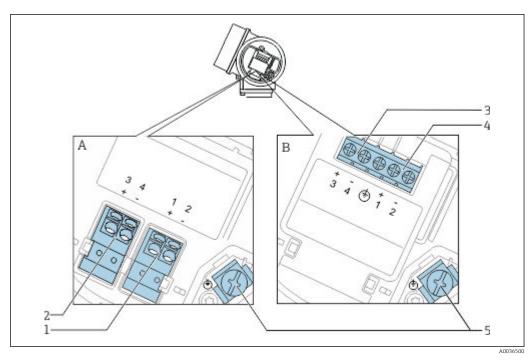
#### Block diagram 2-wire: 4-20 mA HART, switch output



A003650

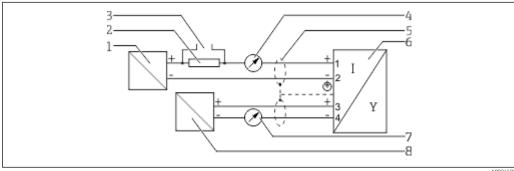
- 5 Block diagram 2-wire: 4-20 mA HART, switch output
- 1 Active barrier with power supply (e.g. RN221N); observe terminal voltage
- 2 HART communication resistor ( $\geq 250 \Omega$ ); observe maximum load
- 3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- 4 Analog display device; observe maximum load
- 5 Cable screen; observe cable specification
- 6 Measuring device
- 7 Switch output (Open Collector)

# Terminal assignment 2-wire: 4-20 mA HART, 4-20 mA



- € 6 Terminal assignment 2-wire: 4-20 mA HART, 4-20 mA
- Α Without integrated overvoltage protection
- В With integrated overvoltage protection
- 1 Connection current output 1, 4-20 mA HART passive: terminals 1 and 2, without integrated overvoltage protection
- 2 Connection current output 2, 4-20 mA: terminals 3 and 4, without integrated overvoltage protection
- Connection current output 2, 4-20 mA: terminals 3 and 4, with integrated overvoltage protection
- Connection current output 1, 4-20 mA HART passive: terminals 1 and 2, with integrated overvoltage 4 protection
- Terminal for cable screen

#### Block diagram 2-wire: 4-20 mA HART, 4-20 mA

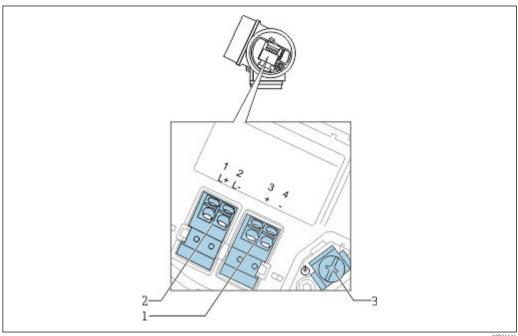


#### **₽** 7 Block diagram 2-wire: 4-20 mA HART, 4-20 mA

- Active barrier with power supply (e.g. RN221N); observe terminal voltage
- 2 HART communication resistor ( $\geq 250 \Omega$ ); observe maximum load
- 3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- 4 Analog display device; observe maximum load
- 5 Cable screen; observe cable specification
- 6 Measuring device
- Analog display device; observe maximum load
- Active barrier with power supply (e.g. RN221N), current output 2; observe terminal voltage

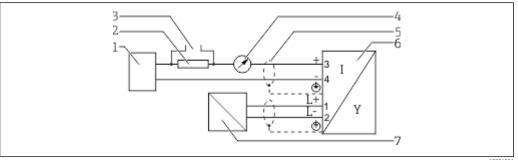
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## Terminal assignment 4-wire: 4-20 mA HART (10.4 to 48 V<sub>DC</sub>)



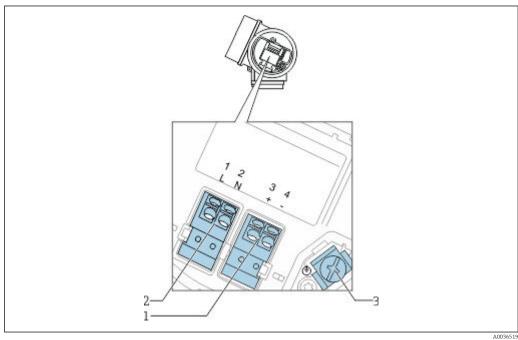
- € 8 Terminal assignment 4-wire: 4-20 mA HART (10.4 to 48  $V_{DC}$ )
- Connection 4-20 mA HART (active): terminals 3 and 4
- 2 Connection supply voltage: terminals 1 and 2
- 3 Terminal for cable screen

#### Block diagram 4-wire: 4-20 mA HART (10.4 to 48 VDC)



- ₩ 9 Block diagram 4-wire: 4-20 mA HART (10.4 to 48  $V_{DC}$ )
- 1 Evaluation unit, e.g. PLC
- HART communication resistor ( $\geq 250 \Omega$ ); observe maximum load 2
- 3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- Analog display device; observe maximum load
- Cable screen; observe cable specification
- Measuring device
- Supply voltage; observe terminal voltage, observe cable specification

## Terminal assignment 4-wire: 4-20 mA HART (90 to 253 VAC)



- Terminal assignment 4-wire: 4-20 mA HART (90 to 253  $V_{AC}$ ) ■ 10
- Connection 4-20 mA HART (active): terminals 3 and 4
- Connection supply voltage: terminals 1 and 2
- Terminal for cable screen

## **A** CAUTION

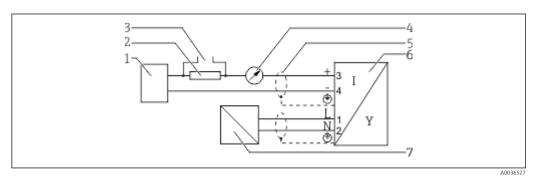
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#### To ensure electrical safety:

- Do not disconnect the protective connection.
- Disconnect the supply voltage before disconnecting the protective earth.
- Connect protective earth to the internal ground terminal (3) before connecting the supply voltage. If necessary, connect the potential matching line to the external ground terminal.
- In order to ensure electromagnetic compatibility (EMC): Do not only ground the device via the protective earth conductor of the supply cable. Instead, the functional grounding must also be connected to the process connection (flange or threaded connection) or to the external ground terminal.
- An easily accessible power switch must be installed in the proximity of the device. The power switch must be marked as a disconnector for the device (IEC/EN61010).

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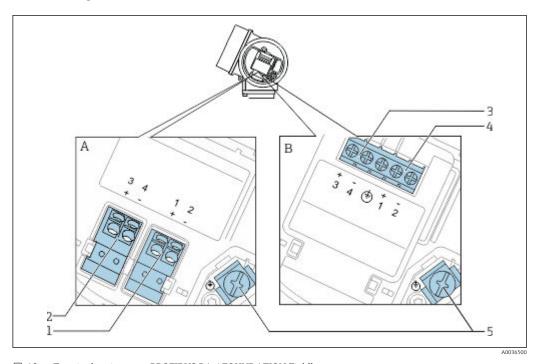
## Block diagram 4-wire: 4-20 mA HART (90 to 253 VAC)



 $\blacksquare$  11 Block diagram 4-wire: 4-20 mA HART (90 to 253  $V_{AC}$ )

- 1 Evaluation unit, e.g. PLC
- 2 HART communication resistor ( $\geq 250 \Omega$ ); observe maximum load
- 3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- 4 Analog display device; observe maximum load
- 5 Cable scree; observe cable specification
- 6 Measuring device
- 7 Supply voltage; observe terminal voltage, observe cable specification

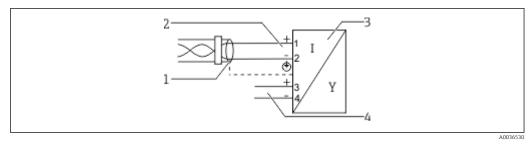
## Terminal assignment PROFIBUS PA / FOUNDATION Fieldbus



 ${
m I\!\!I}$  12 Terminal assignment PROFIBUS PA / FOUNDATION Fieldbus

- A Without integrated overvoltage protection
- B With integrated overvoltage protection
- 1 Connection PROFIBUS PA / FOUNDATION Fieldbus: terminals 1 and 2, without integrated overvoltage protection
- 2 Connection switch output (Open Collector): terminals 3 and 4, without integrated overvoltage protection
- 3 Connection switch output (Open Collector): terminals 3 and 4, with integrated overvoltage protection
- 4 Connection PROFIBUS PA / FOUNDATION Fieldbus: terminals 1 and 2, with integrated overvoltage protection
- 5 Terminal for cable screen

# Block diagram PROFIBUS PA / FOUNDATION Fieldbus



Block diagram PROFIBUS PA / FOUNDATION Fieldbus

- 1 Cable screen; observe cable specifications
- 2 Connection PROFIBUS PA / FOUNDATION Fieldbus
- 3 Measuring device

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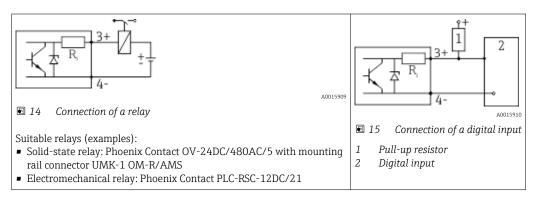
4 Switch output (open collector)

## Connection examples for the switch output

i

For HART devices, the switch output is available as an option. See product structure, feature 20: "Power Supply, Output", option B: "2-wire; 4-20 mA HART, switch output"

Devices with PROFIBUS PA and FOUNDATION Fieldbus always have a switch output.

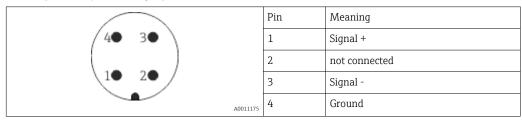


For optimum interference immunity we recommend to connect an external resistor (internal resistance of the relay or Pull-up resistor) of  $< 1000 \Omega$ .

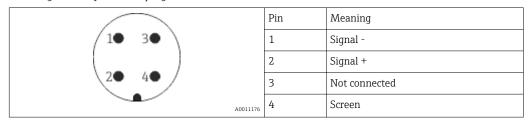
# **Device plug connectors**

For the versions with fieldbus plug connector (M12 or 7/8"), the signal line can be connected without opening the housing.

Pin assignment of the M12 plug connector



# Pin assignment of the 7/8" plug connector



#### Supply voltage

An external power supply is required.

i

# 2-wire, 4-20mA HART, passive

| "Power Supply,<br>Output" <sup>1)</sup> | "Approval" 2)  | Terminal voltage U at the device | Maximum load R, depending on the supply voltage $\mathbf{U}_0$ at the supply unit |
|---|--|----------------------------------|---|
| A: 2-wire; 4-20mA<br>HART               | <ul><li>Non-Ex</li><li>Ex nA</li><li>Ex ic</li><li>CSA GP</li></ul>                          | 10.4 to 35 V <sup>3) 4) 5)</sup> | R [Ω]<br>500  |
|   | Ex ia / IS   | 10.4 to 30 V <sup>3) 4) 5)</sup> | 10 20 30 35 U <sub>0</sub> [V]  |
|   | <ul> <li>Ex d(ia) / XP</li> <li>Ex ic(ia)</li> <li>Ex nA(ia)</li> <li>Ex ta / DIP</li> </ul> | 13 to 35 V <sup>5) 6)</sup>      | R [Ω]   |
|   | Ex ia + Ex d(ia) / IS + XP   | 13 to 30 V <sup>5) 6)</sup>      | 0 10 20 30 35 U <sub>0</sub>  V   |

- 1) Feature 020 of the product structure
- 2) Feature 010 of the product structure
- For ambient temperatures  $T_a \le -20$  °C (-4 °F) a minimum voltage of 15 V is required for the sartup of the device at the minimum error current (3,6 mA). The startup current can be parametrized. If the device is operated with a fixed current  $I \ge 5,5$  mA (HART multidrop mode), a voltage of  $U \ge 10,4$  V is sufficient throughout the entire range of ambient temperatures.
- 4) In the current simulation mode a voltage  $U \ge 12.5 \text{ V}$  is required.
- 5) If the Bluetooth modem is used, the minimum supply voltage increases by 3 V.
- For ambient temperatures  $T_a \le -20$  °C (-4 °F) a minimum voltage of 16 V is required for the startup of the device at the minimum error current (3.6 mA).

| "Power Supply, Output" 1)                     | "Approval" <sup>2)</sup>   | Terminal voltage<br>U at the device | Maximum load R, depending on the supply voltage $\mathbf{U}_0$ at the supply unit |
|---|--|-------------------------------------|---|
| <b>B:</b> 2-wire; 4-20 mA HART, switch output | <ul> <li>Non-Ex</li> <li>Ex nA</li> <li>Ex nA(ia)</li> <li>Ex ic</li> <li>Ex ic(ia)</li> <li>Ex d(ia) / XP</li> <li>Ex ta / DIP</li> <li>CSA GP</li> </ul> | 13 to 35 V <sup>3) 4)</sup>         | R [Ω]   |
|   | ■ Ex ia / IS<br>■ Ex ia + Ex d(ia) / IS + XP   | 13 to 30 V <sup>3) 4)</sup>         | 0 10 20 30 35 U <sub>0</sub> [V]  |

- 1) Feature 020 of the product structure
- 2) Feature 010 of the product structure
- For ambient temperatures  $T_a \le -30 \,^{\circ}\text{C}$  (-22  $^{\circ}\text{F}$ ) a minimum voltage of 16 V is required for the startup of the device at the minimum error current (3.6 mA).
- 4) If the Bluetooth modem is used, the minimum supply voltage increases by 3 V.

| "Power Supply, Output" 1)             | "Approval" 2) | Terminal voltage U at the device | Maximum load R, depending on the supply voltage $\mathbf{U}_0$ at the supply unit |
|---------------------------------------|---------------|----------------------------------|---|
| <b>C:</b> 2-wire; 4-20mA HART, 4-20mA | any           | 13 to 28 V <sup>3) 4)</sup>      | R  Ω <br>500<br>10 20 28 U <sub>0</sub>  V  |

- 1) Feature 020 of the product structure
- 2) Feature 010 of the product structure
- For ambient temperatures  $T_a \le -30$  °C (-22 °F) a minimum voltage of 16 V is required for the startup of the device at the minimum error current (3.6 mA).
- 4) If the Bluetooth modem is used, the minimum supply voltage increases by 3 V.

| Polarity reversal protection                      | Yes                     |
|---|-------------------------|
| Admissible residual ripple at f = 0 to 100 Hz     | $U_{SS} < 1 \text{ V}$  |
| Admissible residual ripple at f = 100 to 10000 Hz | U <sub>SS</sub> < 10 mV |

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#### 4-wire, 4-20mA HART, active

| "Power supply; Output" 1)               | Terminal voltage  | Maximum load<br>R <sub>max</sub> |
|---|---|----------------------------------|
| <b>K:</b> 4-wire 90-253VAC; 4-20mA HART | 90 to 253 $V_{AC}$ (50 to 60 Hz), overvoltage category II | 500 Ω                            |
| L: 4-wire 10,4-48VDC; 4-20mA HART       | 10.4 to 48 V <sub>DC</sub>                                |                                  |

1) Feature 020 of the product structure

# PROFIBUS PA, FOUNDATION Fieldbus

| "Power supply; Output" 1)   | "Approval" 2)  | Terminal voltage        |
|---|--|-------------------------|
| E: 2-wire; FOUNDATION Fieldbus, switch output G: 2-wire; PROFIBUS PA, switch output | <ul> <li>Non-Ex</li> <li>Ex nA</li> <li>Ex nA(ia)</li> <li>Ex ic</li> <li>Ex ic(ia)</li> <li>Ex d(ia) / XP</li> <li>Ex ta / DIP</li> <li>CSA GP</li> </ul> | 9 to 32 V <sup>3)</sup> |
|   | <ul><li>Ex ia / IS</li><li>Ex ia + Ex d(ia) / IS + XP</li></ul>  | 9 to 30 V <sup>3)</sup> |

- 1) Feature 020 of the product structure
- 2) Feature 010 of the product structure
- 3) Input voltages up to 35 V will not spoil the device.

| Polarity sensitive                              | No  |
|---|-----|
| FISCO/FNICO compliant according to IEC 60079-27 | Yes |

#### Power consumption

| "Power supply; Output" <sup>1)</sup>  | Power consumption |
|---------------------------------------|-------------------|
| A: 2-wire; 4-20mA HART                | < 0.9 W           |
| B: 2-wire; 4-20mA HART, switch output | < 0.9 W           |
| C: 2-wire; 4-20mA HART, 4-20mA        | < 2 x 0.7 W       |
| K: 4-wire 90-253VAC; 4-20mA HART      | 6 VA              |
| L: 4-wire 10,4-48VDC; 4-20mA HART     | 1.3 W             |

Feature 020 of the product structure

#### **Current consumption**

#### **HART**

| Nominal current                  | 3.6 to 22 mA, the start-up current for multidrop mode can be parametrized (is set to 3.6 mA on delivery) |
|----------------------------------|--|
| Breakdown signal<br>(NAMUR NE43) | adjustable: 3.59 to 22.5 mA  |

# **PROFIBUS PA**

| Nominal current                                      | 14 mA |
|--|-------|
| Failure current FDE (Fault Disconnection Electronic) | 0 mA  |

# Micropilot FMR51, FMR52

#### **FOUNDATION Fieldbus**

| Device basic current                                 | 15 mA |
|--|-------|
| Failure current FDE (Fault Disconnection Electronic) | 0 mA  |

#### **FISCO**

| U <sub>i</sub> | 17.5 V |
|----------------|--------|
| I <sub>i</sub> | 550 mA |
| P <sub>i</sub> | 5.5 W  |
| C <sub>i</sub> | 5 nF   |
| L <sub>i</sub> | 10 μΗ  |

#### Power supply failure

- Configuration is retained in the HistoROM (EEPROM).
- Error messages (incl. value of operated hours counter) are stored.

# Potential equalization

No special measures for potential equalization are required.



If the device is designed for hazardous areas, observe the information in the documentation "Safety Instructions" (XA).

#### **Terminals**

## Without integrated overvoltage protection

Plug-in spring terminals for wire cross-sections 0.5 to 2.5 mm<sup>2</sup> (20 to 14 AWG)

With integrated overvoltage protection

Screw terminals for wire cross-sections 0.2 to 2.5 mm<sup>2</sup> (24 to 14 AWG)

#### Cable entries

#### Connection of power supply and signal line

To be selected in feature 050 "Electrical connection"

- Gland M20; Material dependent on the approval:
  - For Non-Ex, ATEX, IECEx, NEPSI Ex ia/ic:
    - Plastics M20x1.5 for cable Ø5 to 10 mm (0.2 to 0.39 in)
  - For Dust-Ex, FM IS, CSA IS, CSA GP, Ex nA:
  - For Ex d:

No gland available

- Thread
  - ½" NPT
  - G ½"
  - M20 × 1.5
- Plug M12 / Plug 7/8"

Only available for Non-Ex, Ex ic, Ex ia

#### Connection of remote display FHX50

| Feature 030 "Display, Operation"                                   | Cable entry for FHX50 connection |
|--|----------------------------------|
| L: "Prepared for display FHX50 + M12 connection"                   | M12 socket                       |
| M: "Prepared for display FHX50 + M16 gland, custom connection"     | M12 cable gland                  |
| N: "Prepared for display FHX50 + NPT1/2 thread, custom connection" | NPT1/2 thread                    |

# Cable specification

# Devices without integrated overvoltage protection

Pluggable spring-force terminals for wire cross-sections 0.5 to 2.5 mm<sup>2</sup> (20 to 14 AWG)

- Devices with integrated overvoltage protection
  - Screw terminals for wire cross-sections 0.2 to 2.5 mm<sup>2</sup> (24 to 14 AWG)
- For ambient temperature  $T_U \ge 60$  °C (140 °F): use cable for temperature  $T_U + 20$  K.

#### **HART**

- A normal device cable suffices if only the analog signal is used.
- A shielded cable is recommended if using the HART protocol. Observe grounding concept of the plant.
- For 4-wire devices: Standard device cable is sufficient for the power line.

#### PROFIBUS

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



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

#### **FOUNDATION Fieldbus**

Endress+Hauser recommends using twisted, shielded two-wire cables.



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

#### Overvoltage protection

If the measuring device is used for level measurement in flammable liquids which requires the use of overvoltage protection according to DIN EN 60079-14, standard for test procedures 60060-1 (10 kA, pulse 8/20  $\mu s$ ), an overvoltage protection module has to be installed.

#### Integrated overvoltage protection module

An integrated overvoltage protection module is available for 2-wire HART as well as PROFIBUS PA and FOUNDATION Fieldbus devices.

Product structure: Feature 610 "Accessory mounted", option NA "Overvoltage protection".

| Technical data                           |                |  |  |  |
|--|----------------|--|--|--|
| Resistance per channel                   | 2 × 0.5 Ω max. |  |  |  |
| Threshold DC voltage                     | 400 to 700 V   |  |  |  |
| Threshold impulse voltage                | < 800 V        |  |  |  |
| Capacitance at 1 MHz                     | < 1.5 pF       |  |  |  |
| Nominal arrest impulse voltage (8/20 µs) | 10 kA          |  |  |  |

#### External overvoltage protection module

HAW562 or HAW569 from Endress+Hauser are suited as external overvoltage protection.

# Performance characteristics

#### Reference operating conditions

- Temperature =  $+24 \,^{\circ}\text{C} \, (+75 \,^{\circ}\text{F}) \, \pm 5 \,^{\circ}\text{C} \, (\pm 9 \,^{\circ}\text{F})$
- Pressure = 960 mbar abs. (14 psia) ±100 mbar (±1.45 psi)
- Humidity =  $60 \% \pm 15 \%$
- Reflector: metal plate with a minimum diameter of 1 m (40 in)
- No major interference reflections inside the signal beam

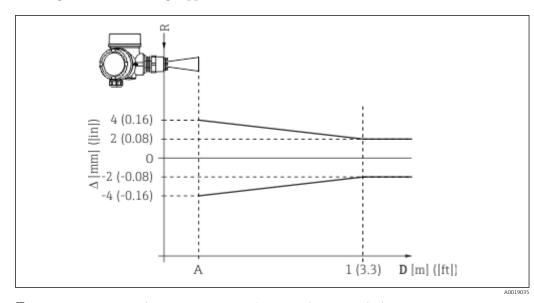
#### Maximum measured error

Typical data under reference operating conditions: DIN EN IEC 61298-2 / DIN EN IEC 60770-1; percentage values in relation to the span.

| Device   | Value   | Output           |                      |
|--|---|------------------|----------------------|
|  |   | digital          | analog <sup>1)</sup> |
| FMR51/FMR52<br>Standard version  | Sum of non-<br>linearity,<br>nonrepeatability and<br>hysteresis | ± 2 mm (0.08 in) | ± 0.02 %             |
|  | Offset/Zero   | ± 4 mm (0.2 in)  | ± 0.03 %             |
| FMR51/FMR52<br>Version with application package<br>"Advanced dynamics" <sup>2)</sup> | Sum of non-<br>linearity,<br>nonrepeatability and<br>hysteresis | ± 3 mm (0.12 in) | ± 0.02 %             |
|  | Offset/Zero   | ± 4 mm (0.2 in)  | ± 0.03 %             |

- Only relevant for 4-20mA current output; add error of the analog value to the digital value. 1)
- Product structure: Feature 540 "Application Package", Option EM "Advanced dynamics"

#### Differing values in near-range applications

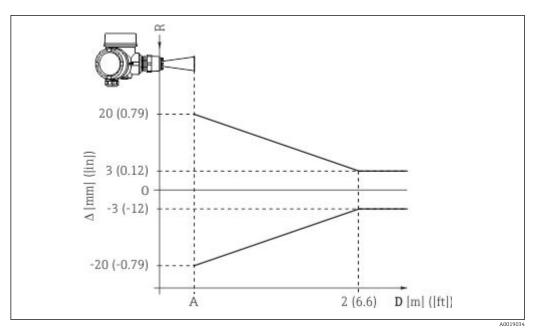


**■** 16 Maximum measured error in near-range applications; values for standard version

- Δ Maximum measured error
- Α Lower edge of the antenna
- D Distance from the lower edge A of the antenna
- Reference point of the distance measurement

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Maximum measured error in near-range applications; values for version with the "Advanced dynamics" application package

- △ Maximum measured error
- A Lower edge of the antenna
- D Distance from the lower edge A of the antenna
- R Reference point of the distance measurement

## Measured value resolution

Dead band according to DIN EN IEC 61298-2 / DIN EN IEC 60770-1:

digital: 1 mmanalog: 1 μA

#### Reaction time

The reaction time can be parametrized. The following step response times (as per DIN EN IEC 61298-2 / DIN EN IEC 60770-1) <sup>1)</sup>are valid if the damping is switched off:

| Tank height     | Sampling rate         | Step response time |
|-----------------|-----------------------|--------------------|
| < 10 m (33 ft)  | ≥ 3.6 s <sup>-1</sup> | < 0.8 s            |
| < 70 m (230 ft) | ≥ 2.2 s <sup>-1</sup> | < 1 s              |

# Influence of ambient temperature

# The measurements are carried out in accordance with DIN EN IEC 61298-3 / DIN EN IEC 60770-1

- Digital (HART, PROFIBUS PA, FOUNDATION Fieldbus):
  - Standard version: average T<sub>K</sub> = 2 mm/10 K
  - Version with advanced dynamics  $^{2)}$ : average  $T_K = 3 \text{ mm}/10 \text{ K}$
- Analog (current output):
  - zero point (4 mA): average  $T_K = 0.02 \%/10 \text{ K}$
  - span (20 mA): average  $T_K = 0.05 \%/10 K$

### Influence of gas layer

High pressures reduce the propagation velocity of the measuring signals in the gas/vapor above the fluid. This effect depends on the kind of gas/vapor and of its temperature. This results in a systematic measuring error that gets bigger as the distance increases between the reference point of the measurement (flange) and the product surface. The following table illustrates this measured

<sup>1)</sup> According to DIN EN IEC 61298-2 / DIN EN IEC 60770-1 the response time is the time which passes after a sudden change of the input signal until the output signal for the first time assumes 90% of the steady-state value.

<sup>2)</sup> Feature 540 "Application Package", option EM

error for a few typical gases/vapors (with regard to distance; a positive value means that too large a distance is being measured):

| Gas layer         | Tempe | erature | Pressure         |                  |                  |                    |                    |
|-------------------|-------|---------|------------------|------------------|------------------|--------------------|--------------------|
|                   | °C    | °F      | 1 bar (14,5 psi) | 10 bar (145 psi) | 50 bar (725 psi) | 100 bar (1450 psi) | 160 bar (2320 psi) |
| Air/              | 20    | 68      | 0.00 %           | 0.22 %           | 1.2 %            | 2.4 %              | 3.89 %             |
| Nitrogen          | 200   | 392     | -0.01 %          | 0.13 %           | 0.74 %           | 1.5 %              | 2.42 %             |
|                   | 400   | 752     | -0.02 %          | 0.08 %           | 0.52 %           | 1.1 %              | 1.70 %             |
| Hydrogen          | 20    | 68      | -0.01 %          | 0.10 %           | 0.61 %           | 1.2 %              | 2.00 %             |
|                   | 200   | 392     | -0.02 %          | 0.05 %           | 0.37 %           | 0.76 %             | 1.23 %             |
|                   | 400   | 752     | -0.02 %          | 0.03 %           | 0.25 %           | 0.53 %             | 0.86 %             |
| Water             | 100   | 212     | 0.02 %           | -                | -                | -                  | -                  |
| (saturated steam) | 180   | 356     | -                | 2.1 %            | -                | -                  | -                  |
|                   | 263   | 505,4   | -                | -                | 8.6 %            | -                  | -                  |
|                   | 310   | 590     | -                | -                | -                | 22 %               | -                  |
|                   | 364   | 687     | -                | -                | -                | -                  | 41.8 %             |

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

Gas phase compensation with external pressure sensor (PROFIBUS PA, FOUNDATION Fieldbus)

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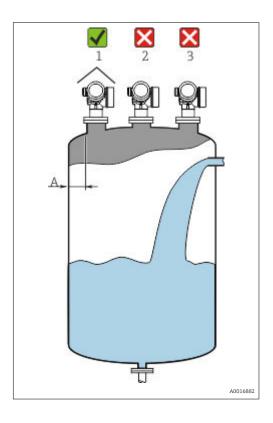
PROFIBUS devices can receive the signal of an external pressure sensor through the bus and use it to perform a pressure dependent time-of-flight correction. In the case of saturated steam in the temperature range from 100 to 350  $^{\circ}$ C (212 to 662  $^{\circ}$ f), for example, the measuring error of the distance measurement can be reduced by this method from up to 29  $^{\circ}$ C (without compensation) to less than 3  $^{\circ}$ C (with compensation).

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## Installation

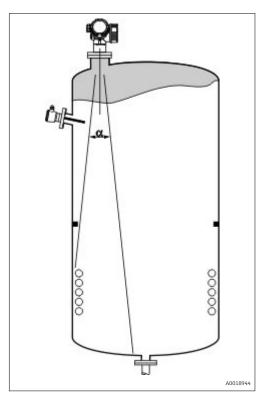
## **Installation conditions**

## Mounting position

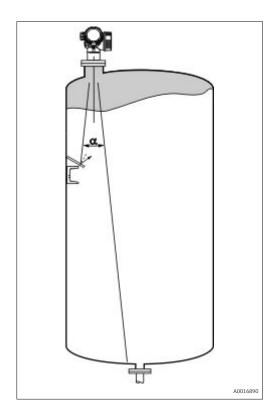


- Recommended distance A from wall to outer edge of nozzle: ~ 1/6 of tank diameter.
   Nevertheless the device should not be installed closer than 15 cm (5.91 in) to the tank wall.
- Not in the center (2), as interference can cause signal loss.
- Not above the fill stream (3).
- It is recommended to us a weather protection cover (1) in order to protect the device from direct sun or rain.

## Vessel installations



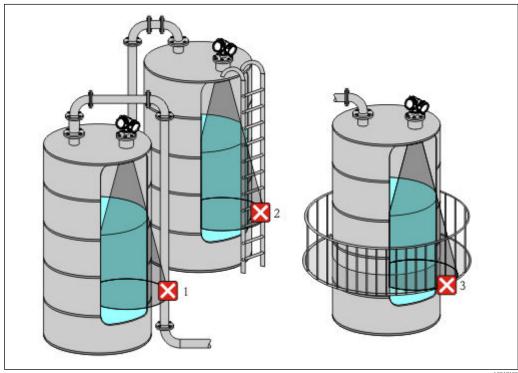
## Reduction of interference echoes



Metallic screens mounted at a slope spread the radar signal and can, therefore, reduce interference echoes.

## Measurement in a plastic vessel

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



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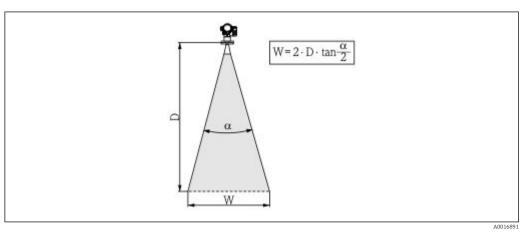
## **Optimization options**

- Antenna size
- Mapping

The measurement can be optimized by means of electronic suppression of interference echoes.

- Antenna alignment
  - Take into account the marker on the flange or threaded connection.
- Stilling well
  - A stilling well can be applied to avoid interferences  $\rightarrow \triangleq 48$ .
- Metallic screens mounted at a slope
   They spread the radar signals and can, therefore, reduce interference echoes.

## Beam angle



 $\blacksquare 18$  Relationship between beam angle lpha, distance D and beamwidth diameter W

The beam angle is defined as the angle  $\alpha$  where the energy density of the radar waves reaches half the value of the maximum energy density (3-dB-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 measuring distance  $D\!:$ 

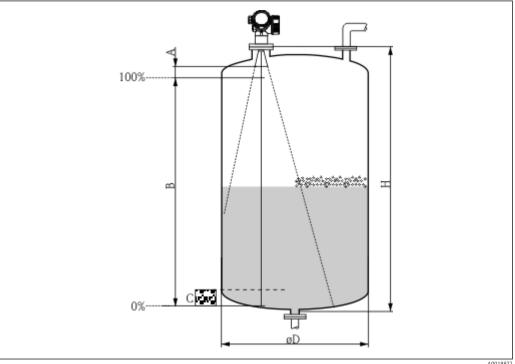
|                           |                 | FMR51           |                 |                 |
|---------------------------|-----------------|-----------------|-----------------|-----------------|
| Antenna size              | 40 mm (1½ in)   | 50 mm (2 in)    | 80 mm (3 in)    | 100 mm (4 in)   |
| Beam angle α              | 23°             | 18°             | 10°             | 8°              |
| Measuring<br>distance (D) |                 | Beamwidth dia   | meter W         |                 |
| 3 m (9.8 ft)              | 1.22 m (4 ft)   | 0.95 m (3.1 ft) | 0.53 m (1.7 ft) | 0.42 m (1.4 ft) |
| 6 m (20 ft)               | 2.44 m (8 ft)   | 1.9 m (6.2 ft)  | 1.05 m (3.4 ft) | 0.84 m (2.8 ft) |
| 9 m (30 ft)               | 3.66 m (12 ft)  | 2.85 m (9.4 ft) | 1.58 m (5.2 ft) | 1.26 m (4.1 ft) |
| 12 m (39 ft)              | 4.88 m (16 ft)  | 3.80 m (12 ft)  | 2.1 m (6.9 ft)  | 1.68 m (5.5 ft) |
| 15 m (49 ft)              | 6.1 m (20 ft)   | 4.75 m (16 ft)  | 2.63 m (8.6 ft) | 2.10 m (6.9 ft) |
| 20 m (66 ft)              | 8.14 m (27 ft)  | 6.34 m (21 ft)  | 3.50 m (11 ft)  | 2.80 m (9.2 ft) |
| 25 m (82 ft)              | 10.17 m (33 ft) | 7.92 m (26 ft)  | 4.37 m (14 ft)  | 3.50 m (11 ft)  |
| 30 m (98 ft)              | -               | 9.50 m (31 ft)  | 5.25 m (17 ft)  | 4.20 m (14 ft)  |
| 35 m (115 ft)             | -               | 11.09 m (36 ft) | 6.12 m (20 ft)  | 4.89 m (16 ft)  |
| 40 m (131 ft)             | -               | 12.67 m (42 ft) | 7.00 m (23 ft)  | 5.59 m (18 ft)  |
| 45 m (148 ft)             | -               | -               | 7.87 m (26 ft)  | 6.29 m (21 ft)  |
| 60 m (197 ft)             | -               | -               | 10.50 m (34 ft) | 8.39 m (28 ft)  |
| 70 m (230 ft)             | -               | -               | -               | 9.79 m (32 ft)  |

|                        | FMR52           |                 |
|------------------------|-----------------|-----------------|
| Antenna size           | 50 mm (2 in)    | 80 mm (3 in)    |
| Beam angle α           | 18°             | 10°             |
| Measuring distance (D) | Beamwidth d     | liameter W      |
| 3 m (9.8 ft)           | 0.95 m (3.1 ft) | 0.53 m (1.7 ft) |
| 6 m (20 ft)            | 1.9 m (6.2 ft)  | 1.05 m (3.4 ft) |
| 9 m (30 ft)            | 2.85 m (9.4 ft) | 1.58 m (5.2 ft) |
| 12 m (39 ft)           | 3.80 m (12 ft)  | 2.1 m (6.9 ft)  |
| 15 m (49 ft)           | 4.75 m (16 ft)  | 2.63 m (8.6 ft) |
| 20 m (66 ft)           | 6.34 m (21 ft)  | 3.50 m (11 ft)  |
| 25 m (82 ft)           | 7.92 m (26 ft)  | 4.37 m (14 ft)  |
| 30 m (98 ft)           | 9.50 m (31 ft)  | 5.25 m (17 ft)  |
| 35 m (115 ft)          | 11.09 m (36 ft) | 6.12 m (20 ft)  |
| 40 m (131 ft)          | 12.67 m (42 ft) | 7.00 m (23 ft)  |
| 45 m (148 ft)          | -               | 7.87 m (26 ft)  |
| 60 m (197 ft)          | -               | 10.50 m (34 ft) |

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## Measuring conditions

- In case of **boiling surfaces**, **bubbling** or tendency for **foaming** use FMR53 or FMR54. Depending on its consistence, foam can either absorb microwaves or reflect them off the foam surface. Measurement is possible under certain conditions. For FMR50, FMR51 and FMR52, the additional option "Advanced dynamics" is recommended in these cases (feature 540: "Application Package",
- In case of heavy **steam development** or **condensate**, the maximum measuring range of FMR50, FMR51 and FMR52 may decrease depending on density, temperature and composition of the steam  $\rightarrow$  use FMR53 or FMR54.
- For the measurement of absorbing gases such as **ammonia NH**<sub>3</sub> or some **fluorocarbons**<sup>3)</sup>, please use Levelflex or Micropilot FMR54 in a stilling well.
- The measuring range begins, where the beam hits the tank bottom. Particularly with dish bottoms or conical outlets the level cannot be detected below this point.
- In stilling well applications, the electromagnetic waves do not propagate completely outside the tube. It must be taken into account that the accuracy may be reduced in the area C. In order to quarantee the required accuracy in these cases, it is recommended to position the zero-point at a distance **C** above the end of the tube (see figure).
- In case of media with a low dielectric constant ( $\varepsilon_r = 1.5$  to 4) <sup>4)</sup> the tank bottom can be visible through the medium at low levels (low height C). Reduced accuracy has to be expected in this range. If this is not acceptable, we recommend positioning the zero point at a distance C (see figure) above the tank bottom in these applications.
- In principle it is possible to measure up to the tip of the antenna with FMR51, FMR53 and FMR54. However, due to considerations regarding corrosion and build-up, the end of the measuring range should not be chosen any closer than **A** (see figure) to the tip of the antenna.
- When using FMR54 with planar antenna, especially for media with low dielectric constants, the end of the measuring range should not be closer than **A: 1 m (3.28 ft)** to the flange.
- The smallest possible measuring range **B** depends on the antenna version (see figure).
- The tank height should be at least **H** (see table).



| Device | A [mm (in)] | B [m (ft)]  | C [mm (in)]              | H [m (ft)]  |
|--------|-------------|-------------|--------------------------|-------------|
| FMR51  | 50(1.97)    | > 0.2 (0.7) | 50 to 250 (1.97 to 9.84) | > 0.3 (1.0) |
| FMR52  | 200(7.87)   | > 0.2 (0.7) | J0 t0 2J0 (1.77 t0 7.04) | 7 0.5 (1.0) |

<sup>3)</sup> Affected compounds are e.g. R134a, R227, Dymel 152a.

<sup>4)</sup> Dielectric constants of important media commonly used in various industries are summarized in the DC manual (CP01076F) and in the Endress +Hauser "DC Values App" (available for Android and iOS).

## Mounting cladded flanges

- Use flange screws according to the number of flange holes.
  - Tighten the screws with the required torque (see table).
  - Retighten the screws after 24 hours or after the first temperature cycle.
- Depending on process pressure and process temperature check and retighten the screws at regular intervals.
- Usually, the PTFE flange cladding also serves as a seal between the nozzle and the device flange.

| Flange size | Number of screws | Recommended torque [Nm] |         |  |  |
|-------------|------------------|-------------------------|---------|--|--|
|             |                  | minimum                 | maximum |  |  |
| EN          |                  |                         |         |  |  |
| DN50/PN16   | 4                | 45                      | 65      |  |  |
| DN80/PN16   | 8                | 40                      | 55      |  |  |
| DN100/PN16  | 8                | 40                      | 60      |  |  |
| DN150/PN16  | 8                | 75                      | 115     |  |  |
| ASME        | ASME             |                         |         |  |  |
| 2"/150lbs   | 4                | 40                      | 55      |  |  |
| 3"/150lbs   | 4                | 65                      | 95      |  |  |
| 4"/150lbs   | 8                | 45                      | 70      |  |  |
| 6"/150lbs   | 8                | 85                      | 125     |  |  |
| JIS         |                  |                         |         |  |  |
| 10K 50A     | 4                | 40                      | 60      |  |  |
| 10K 80A     | 8                | 25                      | 35      |  |  |
| 10K 100A    | 8                | 35                      | 55      |  |  |
| 10K 100A    | 8                | 75                      | 115     |  |  |

# Installation in vessel (free space)

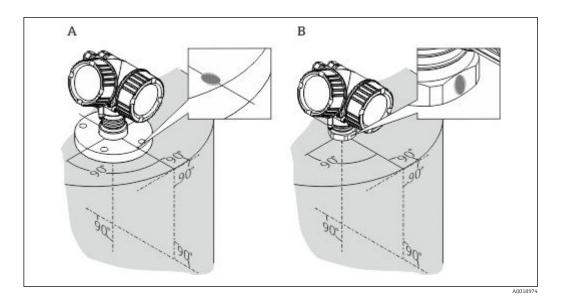
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## Horn antenna (FMR51)

## Alignment

- Align the antenna vertically to the product surface.
   The maximum range may be reduced if the horn antenna is not vertically aligned.
- A marking at the flange (somewhere between the flange holes) or the boss enables alignment of the antenna. This marking must be aligned towards the tank wall as well as possible.

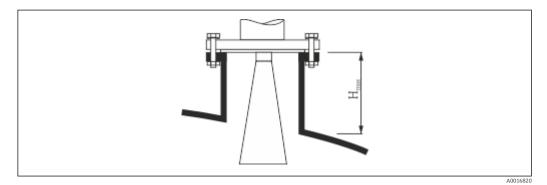
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Depending on the device version the marking may be a circle or two short parallel lines.

## Nozzle mounting

For optimum measurement, the tip of the antenna should extend below the nozzle. Depending on the antenna size this is achieved by the following maximum nozzle heights:



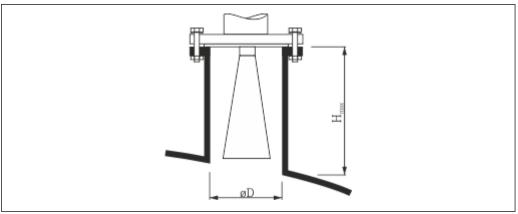
🖪 19 🛮 Nozzle height for horn antenna (FMR51)

| Antenna 1)           | Maximum nozzle height $H_{max}$ |
|----------------------|---------------------------------|
| BA: Horn 40mm/1-1/2" | 86 mm (3.39 in)                 |
| BB: Horn 50mm/2"     | 115 mm (4.53 in)                |
| BC: Horn 80mm/3"     | 211 mm (8.31 in)                |
| BD Horn 100mm/4"     | 282 mm (11.1 in)                |

## 1) Feature 070 of the product structure

## Conditions for longer nozzles

If the medium has good reflective properties, higher nozzles can be accepted. In this case the maximum nozzle height,  $H_{max}$ , is dependent on the nozzle diameter, D:



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| <b>Nozzle diameter</b> <i>D</i> | $\begin{array}{c} \textbf{Maximum nozzle height} \\ H_{max} \end{array}$ | Recommended antenna <sup>1)</sup> |
|---------------------------------|--|-----------------------------------|
| 40 mm (1.5 in)                  | 100 mm (3.9 in)  | BA: Horn 40mm/1-1/2"              |
| 50 mm (2 in)                    | 150 mm (5.9 in)  | BB: Horn 50mm/2"                  |
| 80 mm (3 in)                    | 250 mm (9.8 in)  | BC: Horn 80mm/3"                  |
| 100 mm (4 in)                   | 500 mm (19.7 in)   | BD: Horn 100mm/4"                 |
| 150 mm (6 in)                   | 800 mm (31.5 in)   | BD: Horn 100mm/4"                 |

- 1) Feature 070 of the product structure
- If the antenna doesn't extend below the nozzle, observe the following:
  - The nozzle end must be smooth and free of burrs. If possible its edge should be rounded.
  - An interference echo suppression must be performed.
  - Please contact Endress+Hauser for applications with higher nozzles than those indicated in the table.
- For mounting in heigh nozzles the device is available in a version with an antenna extension of up to 1000 mm (39.4 in) 5)
  - The antenna extension may cause interference echoes in the near range. In this case it may occur that the maximum measurable level is reduced.

## Threaded connection

- For devices with a threaded connection it may be necessary depending on the antenna size to unmount the horn before fastening the device and to mount it again afterwards.
- Tighten with the hexagonal nut only.
- Tool: 55 mm hexagonal wrench
- Maximum permissible torque: 60 Nm (44 lbf ft)

## Measurement from the outside through plastic walls (FMR50/FMR51)

- Dielectric constant of the medium:  $\varepsilon_r > 10$
- If possible, use an antenna 100 mm (4 in).
- The distance from the lower edge of the antenna to the tank ceiling should be about 100 mm (4 in).
- If possible, avoid mounting locations where condensation or build-up might occur.
- In case of outdoor mounting, the space between antenna and vessel has to be protected from the elements
- Do not mount any potential reflectors (e.g. pipes) outside the tank in the signal beam.

<sup>5)</sup> Feature 610 "Accessory mounted" of the product structure.

## Suitable thickness of the tank ceiling:

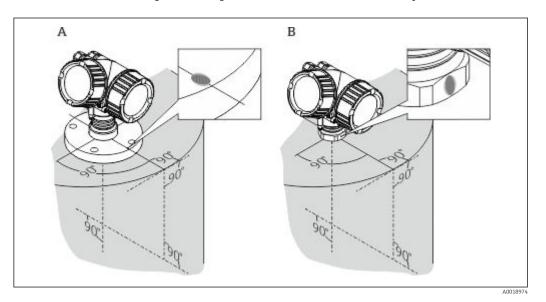
| Penetrated material  | PE               | PTFE             | PP               | Perspex          |
|----------------------|------------------|------------------|------------------|------------------|
| DK / ε <sub>r</sub>  | 2.3              | 2.1              | 2.3              | 3.1              |
| Optimum thickness 1) | 3.8 mm (0.15 in) | 4.0 mm (0.16 in) | 3.8 mm (0.15 in) | 3.3 mm (0.13 in) |

1) Other possible values for the thickness are multiples of the values listed (e.g. for PE: 7,6 mm (0.3 in), 11,4 mm (0.45 in)

## Horn antenna, flush mount (FMR52)

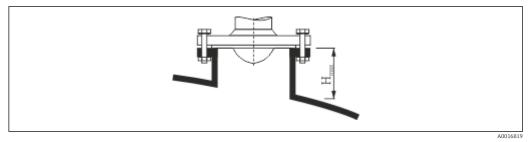
## Alignment

- Align the antenna vertically to the product surface.
   The maximum range may be reduced if the horn antenna is not vertically aligned.
- A marking at the flange (somwhere between the flange holes) or the boss enables alignment of the antenna. This marking must be aligned towards the tank wall as well as possible.



Depending on the device version the marking may be a circle or two short parallel lines.

## Nozzle mounting



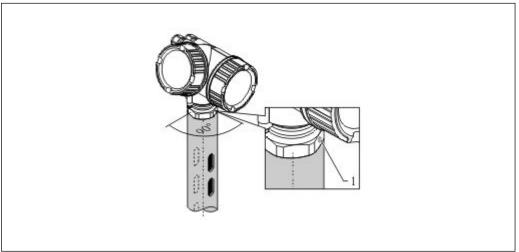
■ 20 Nozzle height for horn antenna, flush mount (FMR52)

| Antenna 1)       | Maximum nozzle height $H_{max}$ |
|------------------|---------------------------------|
| BO: Horn 50mm/2" | 500 mm (19.7 in)                |
| BP: Horn 80mm/3" | 500 mm (19.7 in)                |

- 1) Feature 070 of the product structure
- Please contact Endress+Hauser for applications with higher nozzle.
- For flanges with PTFE cladding: Observe the notes on the mounting of cladded flanges
   → ≅ 44.
  - Usually, the PTFE flange cladding also serves as a seal between the nozzle and the device flange.

## Installation in stilling well

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## ■ 21 Installation in stilling well

- 1 Marking for antenna alignment
- For horn antenna: Align the marking towards the slots of the stilling well.
- Measurements can be performed through an open full bore ball valve without any problems.
- After mounting, the housing can be turned 350° in order to facilitate access to the display and the terminal compartment.

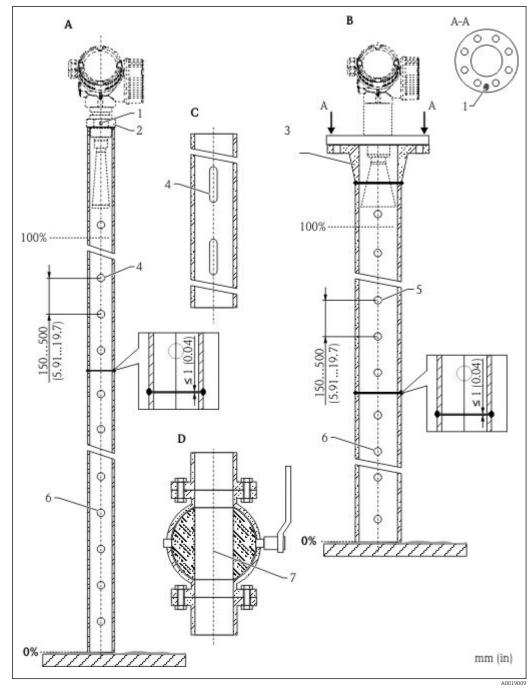
## Recommendations for the stilling well

- Metal (no enamel coating; plastic on request).
- Constant diameter.
- Diameter of stilling well not larger than antenna diameter.
- Diameter difference between horn antenna and inner diameter of the stilling well as small as possible.
- Weld seam as smooth as possible and on the same axis as the slots.
- Slots offset 180° (not 90°).
- Slot width or diameter of holes max. 1/10 of pipe diameter, de-burred. Length and number do not have any influence on the measurement.
- Select horn antenna as big as possible. For intermedaite sizes (e.g. 180 mm (7 in)) select next larger antenna and adapt it mechanically (for horn antennas)
- At any transition (i.e. when using a ball valve or mending pipe segments), no gap may be left exceeding 1 mm (0.04 in).

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

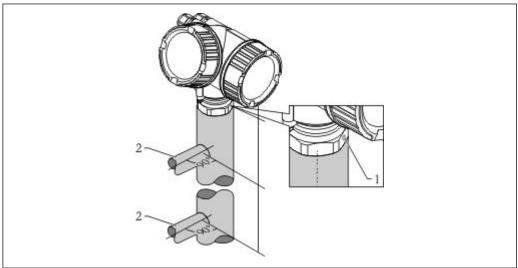
## Examples for the construction of stilling wells



- Α Micropilot FMR50/FMR51: Horn 40mm(11/2")
- Micropilot FMR50/FMR51/FMR52/FMR54: Horn 80mm(3") В
- С Stilling well with slots
- D Full bore ball valve
- Marking for axial alignment 1
- 2 Threaded connection
- 3 e.g. welding neck flange DIN2633
- $\phi$  hole max.  $1/10 \phi$  stilling well
- 5  $\phi$  hole max. 1/10  $\phi$  stilling well; single sided or drilled through
- 6 Inside of holes deburred
- Diameter of opening of ball valve must always be equivalent to pipe diameter; avoid edges and constrictions.

## Installation in bypass

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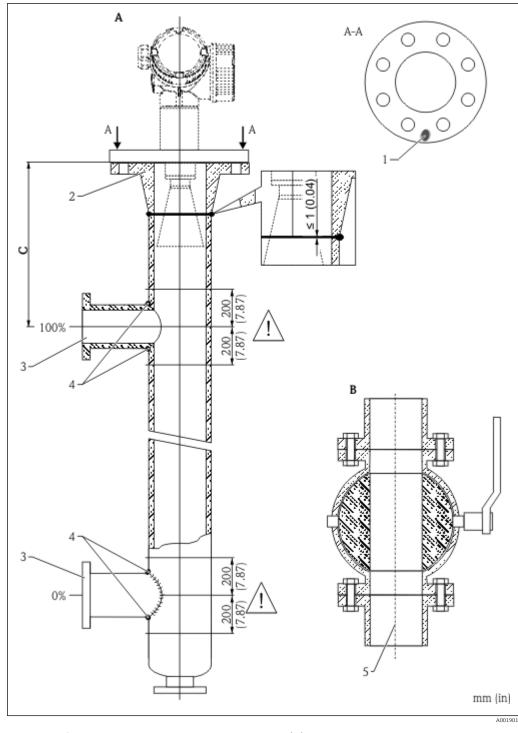
## ■ 22 Installation in bypass

- 1 Marking for antenna alignment
- 2 Tank connectors
- Align the marker perpendicular (90°) to the tank connectors.
- Measurements can be performed through an open full bore ball valve without any problems.
- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.

## Recommendations for the bypass pipe

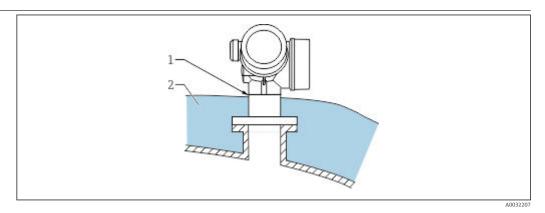
- Metal (no plastic or enamel coating).
- Constant diameter.
- Select horn antenna as big as possible. For intermediate sizes (e.g. 95 mm (3.5 in)) select next larger antenna and adapt it mechanically (for horn antennas).
- Diameter difference between horn antenna and inner diameter of the bypass as small as possible.
- At any transition (i.e. when using a ball valve or mending pipe segments), no gap may be created exceeding 1 mm (0.04 in).
- In the area of the tank connections ( $\sim \pm 20$  cm (7.87 in)) a reduced accuracy of the measurement has to be expected.

## Example for the construction of a bypass



- A Micropilot FMR50/FMR51/FMR52/FMR54: Horn 80mm(3")
- B Full bore ball valve
- C Minimum distance to upper connection pipe: 400 mm (15,7 in)
- 1 Marking for axial alignment
- 2 e.g. welding neck flange DIN2633
- 3 Diameter of the connection pipes as small as possible
- 4 Do not weld through the pipe wall; the inside of the bypass must remain smooth.
- 5 Diameter of opening of ball valve must always be equivalent to pipe diameter. Avoid edges and constrictions.

# Container with heat insulation



If process temperatures are high, the device should be included in the usual container insulation system (2) to prevent the electronics from heating as a result of thermal radiation or convection. The insulation should not be higher than the neck of the device (1).

## **Environment**

## Ambient temperature range

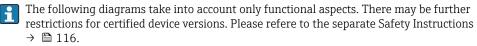
| Measuring device   | -40 to +80 °C (–40 to +176 °F); –50 °C (–58 °F) with manufacturer declaration on request   |
|--|--|
| Measuring device (option<br>for FMR51, FMR52 and<br>FMR54) | -50 to +80 °C (-58 to +176 °F) <sup>1)</sup>   |
| Local display  | $-20$ to $+70^{\circ}\text{C}$ ( $-4$ to $+158^{\circ}\text{F}$ ), the readability of the display may be impaired at temperatures outside the temperature range. |
| Remote display FHX50                                       | −40 to 80 °C (−40 to 176 °F)   |
| Remote display FHX50 (option)                              | −50 to 80 °C (−58 to 176 °F) <sup>1)</sup>   |

1) This range is valid if option JN "Ambient temperature transmitter  $-50\,^{\circ}\text{C}$  ( $-58\,^{\circ}\text{F}$ )" has been selected in ordering feature 580 "Test, Certificate". If the temperature is permanently below  $-40\,^{\circ}\text{C}$  ( $-40\,^{\circ}\text{F}$ ), increased failure rates have to be expected.

When operating the device in the open with strong sunlight:

- Mount the device in a shady position.
- Avoid direct sunlight, especially in warmer regions.
- Use a weather protection cover (see accessories).

## Ambient temperature limits



With a temperature  $(T_p)$  at the process connection the admissible ambient temperature  $(T_a)$  is reduced according to the following diagram (temperature derating):

Information concerning the derating tables

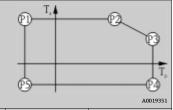
| Option | Meaning                             |
|--------|-------------------------------------|
| A      | 2-wire; 4-20 mA HART                |
| В      | 2-wire; 4-20 mA HART, switch output |
| С      | 2-wire; 4-20 mA HART, 4-20 mA       |
| Е      | 2-wire; FF, switch output           |
| G      | 2-wire; PA, switch output           |
| К      | 4-wire 90-253VAC; 4-20 mA HART      |
| L      | 4-wire 10, 4-48VDC; 4-20 mA HART    |

## FMR51

#### Seal:

- Viton GLT, -40 to 150 °C (-40 to 302 °F)
- Kalrez, -20 to 150 °C (-4 to 302 °F)

Housing: GT18 (316 L) Temperature unit: °C (°F)



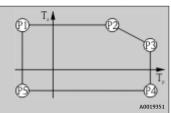
| Power Supply; Output (Pos. 2 | P                | 1           | P                | 2           | P                | 3              | P                | 4            | P            | 5            | P              | 6  |
|------------------------------|------------------|-------------|------------------|-------------|------------------|----------------|------------------|--------------|--------------|--------------|----------------|----|
| of the product structure)    | $T_{\mathrm{p}}$ | Ta          | $T_{\mathrm{p}}$ | Ta          | $T_{\mathrm{p}}$ | T <sub>a</sub> | $T_{\mathrm{p}}$ | Ta           | $T_{\rm p}$  | Ta           | T <sub>p</sub> | Ta |
| A                            | -40<br>(-40)     | 81<br>(178) | 81<br>(178)      | 81<br>(178) | 150<br>(302)     | 66<br>(151)    | 150<br>(302)     | -40<br>(-40) | -40<br>(-40) | -40<br>(-40) | -              | -  |
| B<br>Switch output not used  | -40<br>(-40)     | 82<br>(180) | 82<br>(180)      | 82<br>(180) | 150<br>(302)     | 67<br>(153)    | 150<br>(302)     | -40<br>(-40) | -40<br>(-40) | -40<br>(-40) | -              | -  |
| B<br>Switch output used      | -40<br>(-40)     | 77<br>(171) | 77<br>(171)      | 77<br>(171) | 150<br>(302)     | 61<br>(142)    | 150<br>(302)     | -40<br>(-40) | -40<br>(-40) | -40<br>(-40) | -              | -  |

## FMR51

#### Seal:

- Viton GLT, -40 to 150 °C (-40 to 302 °F)
- Kalrez, -20 to 150 °C (-4 to 302 °F)

Housing: GT18 (316 L) Temperature unit: °C (°F)



| Power Supply; Output (Pos. 2   | P              | 1           | P              | 2           | P            | 3           | P              | 4            | P              | 5            | P                | 6  |
|--------------------------------|----------------|-------------|----------------|-------------|--------------|-------------|----------------|--------------|----------------|--------------|------------------|----|
| of the product structure)      | T <sub>p</sub> | Ta          | T <sub>p</sub> | Ta          | $T_{p}$      | Ta          | T <sub>p</sub> | Ta           | T <sub>p</sub> | Ta           | $T_{\mathrm{p}}$ | Ta |
| C<br>Channel 2 not used        | -40<br>(-40)   | 82<br>(180) | 82<br>(180)    | 82<br>(180) | 150<br>(302) | 67<br>(153) | 150<br>(302)   | -40<br>(-40) | -40<br>(-40)   | -40<br>(-40) | -                | -  |
| C<br>Channel 2 used            | -40<br>(-40)   | 79<br>(174) | 79<br>(174)    | 79<br>(174) | 150<br>(302) | 63<br>(145) | 150<br>(302)   | -40<br>(-40) | -40<br>(-40)   | -40<br>(-40) | -                | -  |
| E, G<br>Switch output not used | -40<br>(-40)   | 83<br>(181) | 83<br>(181)    | 83<br>(181) | 150<br>(302) | 68<br>(154) | 150<br>(302)   | -40<br>(-40) | -40<br>(-40)   | -40<br>(-40) | -                | -  |
| E, G<br>Switch output used     | -40<br>(-40)   | 78<br>(172) | 78<br>(172)    | 78<br>(172) | 150<br>(302) | 63<br>(145) | 150<br>(302)   | -40<br>(-40) | -40<br>(-40)   | -40<br>(-40) | -                | -  |
| K, L                           | -40<br>(-40)   | 77<br>(171) | 77<br>(171)    | 77<br>(171) | 150<br>(302) | 62<br>(144) | 150<br>(302)   | -40<br>(-40) | -40<br>(-40)   | -40<br>(-40) | -                | -  |

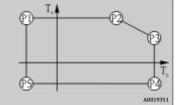
## FMR51

## Seal:

■ Viton GLT, -40 to 150 °C (-40 to 302 °F)

Kalrez, -20 to 150 °C (-4 to 302 °F)

Housing: GT19 (Plastics PBT) Temperature unit: °C (°F)



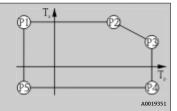
| Power Supply; Output (Pos. 2   | P              | 1           | P              | 2           | P            | 3           | P              | 4            | P              | 5            | P              | 6  |
|--------------------------------|----------------|-------------|----------------|-------------|--------------|-------------|----------------|--------------|----------------|--------------|----------------|----|
| of the product structure)      | T <sub>p</sub> | Ta          | T <sub>p</sub> | Ta          | $T_{p}$      | Ta          | T <sub>p</sub> | Ta           | T <sub>p</sub> | Ta           | T <sub>p</sub> | Ta |
| A                              | -40<br>(-40)   | 80<br>(176) | 80<br>(176)    | 80<br>(176) | 150<br>(302) | 56<br>(133) | 150<br>(302)   | -40<br>(-40) | -40<br>(-40)   | -40<br>(-40) | -              | -  |
| B<br>Switch output not used    | -40<br>(-40)   | 76<br>(169) | 76<br>(169)    | 76<br>(169) | 150<br>(302) | 56<br>(133) | 150<br>(302)   | -40<br>(-40) | -40<br>(-40)   | -40<br>(-40) | -              | -  |
| B<br>Switch output used        | -40<br>(-40)   | 60<br>(140) | 60<br>(140)    | 60<br>(140) | 150<br>(302) | 38<br>(100) | 150<br>(302)   | -40<br>(-40) | -40<br>(-40)   | -40<br>(-40) | -              | -  |
| C<br>Channel 2 not used        | -40<br>(-40)   | 82<br>(180) | 82<br>(180)    | 82<br>(180) | 150<br>(302) | 56<br>(133) | 150<br>(302)   | -40<br>(-40) | -40<br>(-40)   | -40<br>(-40) | -              | -  |
| C<br>Channel 2 used            | -40<br>(-40)   | 74<br>(165) | 74<br>(165)    | 74<br>(165) | 150<br>(302) | 55<br>(131) | 150<br>(302)   | -40<br>(-40) | -40<br>(-40)   | -40<br>(-40) | -              | -  |
| E, G<br>Switch output not used | -40<br>(-40)   | 79<br>(174) | 79<br>(174)    | 79<br>(174) | 150<br>(302) | 56<br>(133) | 150<br>(302)   | -40<br>(-40) | -40<br>(-40)   | -40<br>(-40) | -              | -  |
| E, G<br>Switch output used     | -40<br>(-40)   | 63<br>(145) | 63<br>(145)    | 63<br>(145) | 150<br>(302) | 41<br>(106) | 150<br>(302)   | -40<br>(-40) | -40<br>(-40)   | -40<br>(-40) | -              | -  |

## FMR51

## Seal:

- Viton GLT, -40 to 150 °C (-40 to 302 °F)
- Kalrez, -20 to 150 °C (-4 to 302 °F)

Housing: GT20 (Alu, coated) Temperature unit: °C (°F)



| Power Supply; Output (Pos. 2   | P              | 1           | P           | 2           | P                | 3           | P                | 4            | P            | 5            | P                | 6  |
|--------------------------------|----------------|-------------|-------------|-------------|------------------|-------------|------------------|--------------|--------------|--------------|------------------|----|
| of the product structure)      | T <sub>p</sub> | Ta          | $T_{p}$     | Ta          | $T_{\mathrm{p}}$ | Ta          | $T_{\mathrm{p}}$ | Ta           | $T_{p}$      | Ta           | $T_{\mathrm{p}}$ | Ta |
| A                              | -40<br>(-40)   | 81<br>(178) | 81<br>(178) | 81<br>(178) | 150<br>(302)     | 69<br>(156) | 150<br>(302)     | -40<br>(-40) | -40<br>(-40) | -40<br>(-40) | -                | -  |
| B<br>Switch output not used    | -40<br>(-40)   | 82<br>(180) | 82<br>(180) | 82<br>(180) | 150<br>(302)     | 70<br>(158) | 150<br>(302)     | -40<br>(-40) | -40<br>(-40) | -40<br>(-40) | -                | -  |
| B<br>Switch output used        | -40<br>(-40)   | 77<br>(171) | 77<br>(171) | 77<br>(171) | 150<br>(302)     | 64<br>(147) | 150<br>(302)     | -40<br>(-40) | -40<br>(-40) | -40<br>(-40) | -                | -  |
| C<br>Channel 2 not used        | -40<br>(-40)   | 82<br>(180) | 82<br>(180) | 82<br>(180) | 150<br>(302)     | 70<br>(158) | 150<br>(302)     | -40<br>(-40) | -40<br>(-40) | -40<br>(-40) | -                | -  |
| C<br>Channel 2 used            | -40<br>(-40)   | 79<br>(174) | 79<br>(174) | 79<br>(174) | 150<br>(302)     | 66<br>(151) | 150<br>(302)     | -40<br>(-40) | -40<br>(-40) | -40<br>(-40) | -                | -  |
| E, G<br>Switch output not used | -40<br>(-40)   | 83<br>(181) | 83<br>(181) | 83<br>(181) | 150<br>(302)     | 71<br>(160) | 150<br>(302)     | -40<br>(-40) | -40<br>(-40) | -40<br>(-40) | -                | -  |
| E, G<br>Switch output used     | -40<br>(-40)   | 78<br>(172) | 78<br>(172) | 78<br>(172) | 150<br>(302)     | 65<br>(149) | 150<br>(302)     | -40<br>(-40) | -40<br>(-40) | -40<br>(-40) | -                | -  |
| K, L                           | -40<br>(-40)   | 77<br>(171) | 77<br>(171) | 77<br>(171) | 150<br>(302)     | 65<br>(149) | 150<br>(302)     | -40<br>(-40) | -40<br>(-40) | -40<br>(-40) | -                | -  |

## FMR51

Seal: Graphite, -40 to 250 °C (-40 to 482 °F)

Housing: GT18 (316 L) Temperature unit: °C (°F)

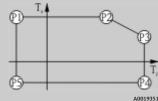


|                                |                |                |             |                |                |                |                |                |                |                |                  | A0019351       |
|--------------------------------|----------------|----------------|-------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|------------------|----------------|
| Power Supply; Output (Pos. 2   | P              | 1              | P           | 2              | P              | 3              | P              | 4              | P              | 5              | P                | 6              |
| of the product structure)      | T <sub>p</sub> | T <sub>a</sub> | $T_{\rm p}$ | T <sub>a</sub> | T <sub>p</sub> | T <sub>a</sub> | T <sub>p</sub> | T <sub>a</sub> | T <sub>p</sub> | T <sub>a</sub> | $T_{\mathrm{p}}$ | T <sub>a</sub> |
| A                              | -40<br>(-40)   | 81<br>(178)    | 81<br>(178) | 81<br>(178)    | 250<br>(482)   | 63<br>(145)    | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40)   | -                | -              |
| B<br>Switch output not used    | -40<br>(-40)   | 82<br>(180)    | 82<br>(180) | 82<br>(180)    | 250<br>(482)   | 64<br>(147)    | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40)   | -                | -              |
| B<br>Switch output used        | -40<br>(-40)   | 77<br>(171)    | 77<br>(171) | 77<br>(171)    | 250<br>(482)   | 58<br>(136)    | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40)   | -                | -              |
| C<br>Channel 2 not used        | -40<br>(-40)   | 82<br>(180)    | 82<br>(180) | 82<br>(180)    | 250<br>(482)   | 64<br>(147)    | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40)   | -                | -              |
| C<br>Channel 2 used            | -40<br>(-40)   | 79<br>(174)    | 79<br>(174) | 79<br>(174)    | 250<br>(482)   | 61<br>(142)    | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40)   | -                | -              |
| E, G<br>Switch output not used | -40<br>(-40)   | 83<br>(181)    | 83<br>(181) | 83<br>(181)    | 250<br>(482)   | 65<br>(149)    | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40)   | -                | -              |
| E, G<br>Switch output used     | -40<br>(-40)   | 78<br>(172)    | 78<br>(172) | 78<br>(172)    | 250<br>(482)   | 60<br>(140)    | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40)   | -                | -              |
| K, L                           | -40<br>(-40)   | 77<br>(171)    | 77<br>(171) | 77<br>(171)    | 250<br>(482)   | 59<br>(138)    | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40)   | -                | -              |

## FMR51

Seal: Graphite, -40 to 250 °C (-40 to 482 °F)

Housing: GT19 (Plastics PBT) Temperature unit: °C (°F)

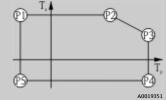


|                                |                |             |                |             |                |             |                |                |                |              |             | A0019351 |
|--------------------------------|----------------|-------------|----------------|-------------|----------------|-------------|----------------|----------------|----------------|--------------|-------------|----------|
| Power Supply; Output (Pos. 2   | P              | 1           | P              | 2           | P              | 3           | P              | 4              | P              | 5            | P           | 6        |
| of the product structure)      | T <sub>p</sub> | Ta          | T <sub>p</sub> | Ta          | T <sub>p</sub> | Ta          | T <sub>p</sub> | T <sub>a</sub> | T <sub>p</sub> | Ta           | $T_{\rm p}$ | Ta       |
| A                              | -40<br>(-40)   | 80<br>(176) | 80<br>(176)    | 80<br>(176) | 250<br>(482)   | 44<br>(111) | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40) | -           | -        |
| B<br>Switch output not used    | -40<br>(-40)   | 76<br>(169) | 76<br>(169)    | 76<br>(169) | 250<br>(482)   | 44<br>(111) | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40) | -           | -        |
| B<br>Switch output used        | -40<br>(-40)   | 60<br>(140) | 60<br>(140)    | 60<br>(140) | 250<br>(482)   | 32<br>(90)  | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40) | -           | -        |
| C<br>Channel 2 not used        | -40<br>(-40)   | 82<br>(180) | 82<br>(180)    | 82<br>(180) | 250<br>(482)   | 44<br>(111) | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40) | -           | -        |
| C<br>Channel 2 used            | -40<br>(-40)   | 74<br>(165) | 74<br>(165)    | 74<br>(165) | 250<br>(482)   | 44<br>(111) | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40) | -           | -        |
| E, G<br>Switch output not used | -40<br>(-40)   | 79<br>(174) | 79<br>(174)    | 79<br>(174) | 250<br>(482)   | 44<br>(111) | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40) | -           | -        |
| E, G<br>Switch output used     | -40<br>(-40)   | 63<br>(145) | 63<br>(145)    | 63<br>(145) | 250<br>(482)   | 35<br>(95)  | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40) | -           | -        |

## FMR51

Seal: Graphite, -40 to 250 °C (-40 to 482 °F)

Housing: GT20 (Alu, coated) Temperature unit: °C (°F)



|                                |                |                |                |             |                |             |                |                |                |              |                | A0019351 |
|--------------------------------|----------------|----------------|----------------|-------------|----------------|-------------|----------------|----------------|----------------|--------------|----------------|----------|
| Power Supply; Output (Pos. 2   | P              | 1              | P              | 2           | P              | 3           | P              | 4              | P              | 5            | P              | 6        |
| of the product structure)      | T <sub>p</sub> | T <sub>a</sub> | T <sub>p</sub> | Ta          | T <sub>p</sub> | Ta          | T <sub>p</sub> | T <sub>a</sub> | T <sub>p</sub> | Ta           | T <sub>p</sub> | Ta       |
| A                              | -40<br>(-40)   | 81<br>(178)    | 81<br>(178)    | 81<br>(178) | 250<br>(482)   | 67<br>(153) | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40) | -              | -        |
| B<br>Switch output not used    | -40<br>(-40)   | 82<br>(180)    | 82<br>(180)    | 82<br>(180) | 250<br>(482)   | 68<br>(154) | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40) | -              | -        |
| B<br>Switch output used        | -40<br>(-40)   | 77<br>(171)    | 77<br>(171)    | 77<br>(171) | 250<br>(482)   | 62<br>(144) | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40) | -              | -        |
| C<br>Channel 2 not used        | -40<br>(-40)   | 82<br>(180)    | 82<br>(180)    | 82<br>(180) | 250<br>(482)   | 68<br>(154) | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40) | -              | -        |
| C<br>Channel 2 used            | -40<br>(-40)   | 79<br>(174)    | 79<br>(174)    | 79<br>(174) | 250<br>(482)   | 64<br>(147) | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40) | -              | -        |
| E, G<br>Switch output not used | -40<br>(-40)   | 83<br>(181)    | 83<br>(181)    | 83<br>(181) | 250<br>(482)   | 69<br>(156) | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40) | -              | -        |
| E, G<br>Switch output used     | -40<br>(-40)   | 78<br>(172)    | 78<br>(172)    | 78<br>(172) | 250<br>(482)   | 64<br>(147) | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40) | -              | -        |
| K, L                           | -40<br>(-40)   | 77<br>(171)    | 77<br>(171)    | 77<br>(171) | 250<br>(482)   | 63<br>(154) | 250<br>(482)   | -40<br>(-40)   | -40<br>(-40)   | -40<br>(-40) | -              | -        |

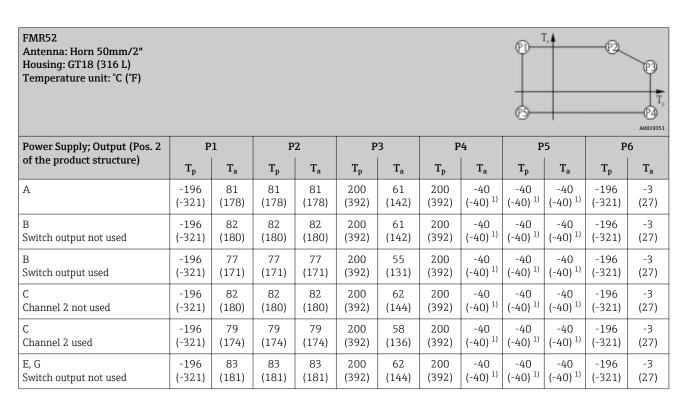
| FMR51<br>Seal: Graphite, -196 to 450 °C<br>Housing: GT18 (316 L)<br>Temperature unit: °C (°F) | (-321 to       | 842 °F) |                |       |                |      |                |                     |                     | T. A                | -Q             | P3<br>T <sub>p</sub> |
|---|----------------|---------|----------------|-------|----------------|------|----------------|---------------------|---------------------|---------------------|----------------|----------------------|
| Power Supply; Output (Pos. 2  | P              | 1       | P              | 2     | P              | 3    | P              | 4                   | P                   | 5                   | P              | 6                    |
| of the product structure)   | T <sub>p</sub> | Ta      | T <sub>p</sub> | Ta    | T <sub>p</sub> | Ta   | T <sub>p</sub> | Ta                  | T <sub>p</sub>      | Ta                  | T <sub>p</sub> | Ta                   |
| A   | -196           | 81      | 81             | 81    | 450            | 26   | 450            | -40                 | -40                 | -40                 | -196           | -15                  |
|   | (-321)         | (178)   | (178)          | (178) | (842)          | (79) | (842)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321)         | (+5)                 |
| B   | -196           | 82      | 82             | 82    | 450            | 26   | 450            | -40                 | -40                 | -40                 | -196           | -15                  |
| Switch output not used  | (-321)         | (180)   | (180)          | (180) | (842)          | (79) | (842)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321)         | (+5)                 |
| B   | -196           | 77      | 77             | 77    | 450            | 25   | 450            | -40                 | -40                 | -40                 | -196           | -15                  |
| Switch output used  | (-321)         | (171)   | (171)          | (171) | (842)          | (77) | (842)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321)         | (+5)                 |
| C   | -196           | 82      | 82             | 82    | 450            | 26   | 450            | -40                 | -40                 | -40                 | -196           | -15                  |
| Channel 2 not used  | (-321)         | (180)   | (180)          | (180) | (842)          | (79) | (842)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321)         | (+5)                 |
| C   | -196           | 79      | 79             | 79    | 450            | 26   | 450            | -40                 | -40                 | -40                 | -196           | -15                  |
| Channel 2 used  | (-321)         | (174)   | (174)          | (174) | (842)          | (79) | (842)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321)         | (+5)                 |
| E, G  | -196           | 83      | 83             | 83    | 450            | 26   | 450            | -40                 | -40                 | -40                 | -196           | -15                  |
| Switch output not used  | (-321)         | (181)   | (181)          | (181) | (842)          | (79) | (842)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321)         | (+5)                 |
| E, G  | -196           | 78      | 78             | 78    | 450            | 26   | 450            | -40                 | -40                 | -40                 | -196           | -15                  |
| Switch output used  | (-321)         | (172)   | (172)          | (172) | (842)          | (79) | (842)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321)         | (+5)                 |
| K, L  | -196           | 77      | 77             | 77    | 450            | 26   | 450            | -40                 | -40                 | -40                 | -196           | -15                  |
|   | (-321)         | (171)   | (171)          | (171) | (842)          | (79) | (842)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321)         | (+5)                 |

1) -50 °C (-58 °F) for ordering feature 580 ("Test, Certificate") = JN ("Ambient temperature transmitter -50 °C/-58 °F")

| FMR51<br>Seal: Graphite, -196 to 450 °C<br>Housing: GT19 (Plastics PBT)<br>Temperature unit: °C (°F) | (-321 to       | 842 °F) |                |       |                |                |                |       | 0              | r. A  | -Q             | A0019344 |
|--|----------------|---------|----------------|-------|----------------|----------------|----------------|-------|----------------|-------|----------------|----------|
| Power Supply; Output (Pos. 2   | P              | 1       | P              | 2     | P              | 3              | P              | 4     | P              | 5     | P              | 6        |
| of the product structure)  | T <sub>p</sub> | Ta      | T <sub>p</sub> | Ta    | T <sub>p</sub> | T <sub>a</sub> | T <sub>p</sub> | Ta    | T <sub>p</sub> | Ta    | T <sub>p</sub> | Ta       |
| A  | -196           | 80      | 80             | 80    | 450            | -29            | 450            | -40   | -40            | -40   | -196           | 9        |
|  | (-321)         | (176)   | (176)          | (176) | (842)          | (-20)          | (842)          | (-40) | (-40)          | (-40) | (-321)         | (48)     |
| B  | -196           | 76      | 76             | 76    | 450            | -29            | 450            | -40   | -40            | -40   | -196           | 9        |
| Switch output not used   | (-321)         | (169)   | (169)          | (169) | (842)          | (-20)          | (842)          | (-40) | (-40)          | (-40) | (-321)         | (48)     |
| B  | -196           | 60      | 60             | 60    | 450            | -29            | 450            | -40   | -40            | -40   | -196           | 9        |
| Switch output used   | (-321)         | (140)   | (140)          | (140) | (842)          | (-20)          | (842)          | (-40) | (-40)          | (-40) | (-321)         | (48)     |
| C  | -196           | 82      | 82             | 82    | 450            | -29            | 450            | -40   | -40            | -40   | -196           | 9        |
| Channel 2 not used   | (-321)         | (180)   | (180)          | (180) | (842)          | (-20)          | (842)          | (-40) | (-40)          | (-40) | (-321)         | (48)     |
| C  | -196           | 74      | 74             | 74    | 450            | -29            | 450            | -40   | -40            | -40   | -196           | 9        |
| Channel 2 used   | (-321)         | (165)   | (165)          | (165) | (842)          | (-20)          | (842)          | (-40) | (-40)          | (-40) | (-321)         | (48)     |
| E, G   | -196           | 79      | 79             | 79    | 450            | -29            | 450            | -40   | -40            | -40   | -196           | 9        |
| Switch output not used   | (-321)         | (174)   | (174)          | (174) | (842)          | (-20)          | (842)          | (-40) | (-40)          | (-40) | (-321)         | (48)     |
| E, G   | -196           | 63      | 63             | 63    | 450            | -29            | 450            | -40   | -40            | -40   | -196           | 9        |
| Switch output used   | (-321)         | (145)   | (145)          | (145) | (842)          | (-20)          | (842)          | (-40) | (-40)          | (-40) | (-321)         | (48)     |

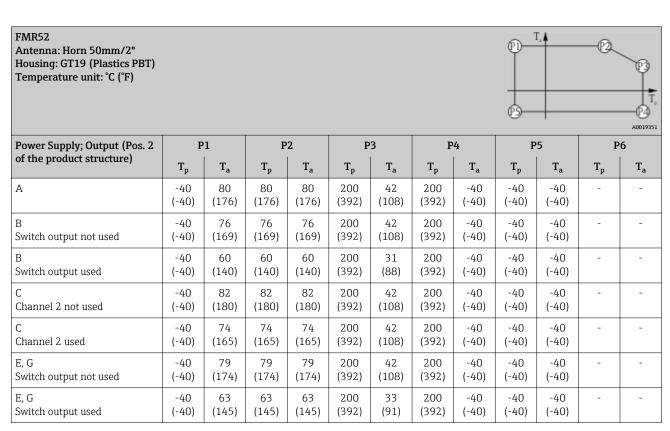
#### FMR51 Seal: Graphite, -196 to 450 °C (-321 to 842 °F) Housing: GT20 (Alu, coated) Temperature unit: °C (°F) (P4) A0019344 Power Supply; Output (Pos. 2 **P1** P2 **P3** P4 P5 **P6** of the product structure) $T_a$ $T_p$ Ta $T_p$ Ta $T_p$ Ta $T_p$ Ta $T_p$ $T_p$ $T_{a}$ -196 -40 Α 81 81 81 450 39 450 -40 -40 -196 -2.0 (-40) <sup>1)</sup> $(-4)^{2)}$ $(-40)^{1)}$ $(-40)^{1)}$ (-321)(178)(178)(178)(842)(102)(842)(-321)В -196 82 82 82 450 450 -196 -20 $(-40)^{1)}$ $(-4)^{2}$ $(-40)^{1)}$ $(-40)^{1)}$ Switch output not used (-321)(180)(180)(180)(-321)(842)(102)(842)-196 77 77 77 450 36 450 -40 -196 -2.0 $(-40)^{1)}$ $(-4)^{2}$ $(-40)^{1)}$ $(-40)^{1)}$ Switch output used (-321)(171)(171)(171)(842)(97)(842)(-321)C -196 450 82 82 82 39 450 -40 -40 -40 -196 -2.0 $(-40)^{1)}$ (-40) <sup>1)</sup> $(-40)^{1)}$ $(-4)^{2}$ Channel 2 not used (-321)(180)(180)(180)(842)(102)(842)(-321)С -196 79 450 38 450 -40 -40 -40 -196 -20 $(-40)^{1)}$ $(-40)^{1)}$ $(-40)^{1)}$ (-4)<sup>2)</sup> Channel 2 used (-321)(174)(174)(174)(842)(100)(842)(-321)E. G -196 83 83 83 450 39 450 -40 -40 -40 -196 -20 $(-40)^{1)}$ (-40) <sup>1)</sup> $(-40)^{1)}$ (-4)<sup>2)</sup> Switch output not used (-321)(181)(181)(181)(842)(102)(842)(-321)E. G -196 78 78 78 450 38 450 -196 -2.0 -40 -40 -40 $(-40)^{1)}$ (-40) <sup>1)</sup> $(-40)^{1)}$ Switch output used (-321)(172)(172)(172)(842)(100)(842)(-321) $(-4)^{2}$ K, L -196 450 37 450 -40 -40 -196 -20 (99) $(-40)^{1)}$ $(-40)^{1)}$ $(-40)^{1)}$ $(-4)^{2}$ (-321)(171)(171)(171)(842)(842)(-321)

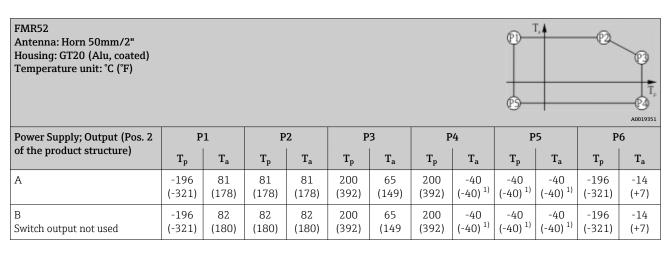
- 1) -50 °C (-58 °F) for ordering feature 580 ("Test, Certificate") = JN ("Ambient temperature transmitter -50 °C/-58 °F")
- 2)  $-28 \,^{\circ}\text{C}$  (-18  $^{\circ}\text{F}$ ) for ordering feature 580 ("Test, Certificate") = JN ("Ambient temperature transmitter -50 $^{\circ}\text{C}$ /-58 $^{\circ}\text{F}$ ")



#### FMR52 Antenna: Horn 50mm/2" Housing: GT18 (316 L) Temperature unit: °C (°F) A0019351 Power Supply; Output (Pos. 2 P1 P2 **P3** P4 P5 P6 of the product structure) $T_p$ $T_p$ Ta $T_p$ Ta Ta $T_p$ Ta $T_p$ Ta $T_p$ $T_a$ E, G -196 78 78 78 200 57 200 -40 -40 -40 -196 -3 (-40) <sup>1)</sup> (-40) <sup>1)</sup> $(-40)^{1)}$ Switch output used (-321)(172)(392)(135)(392)(-321(27)(172)(172)K, L 77 77 77 56 200 -196 200 -40 -40 -40 -196 -3 $(-40)^{1)}$ $(-40)^{1)}$ $(-40)^{1)}$ (-321)(171)(171)(171)(392)(133)(392)(-321)(27)

1) -50 °C (-58 °F) for ordering feature 580 ("Test, Certificate") = JN ("Ambient temperature transmitter -50 °C/-58 °F")





| FMR52<br>Antenna: Horn 50mm/2"<br>Housing: GT20 (Alu, coated)<br>Temperature unit: °C (°F) |                |                |                |       |                |        |                |                     | (D)                 | Γ. 4                | -Q      | P3 T, P3 A0019351 |
|--|----------------|----------------|----------------|-------|----------------|--------|----------------|---------------------|---------------------|---------------------|---------|-------------------|
| Power Supply; Output (Pos. 2   | P              | 1              | P              | 2     | P              | 3      | P              | 4                   | P                   | 5                   | P       | 6                 |
| of the product structure)  | T <sub>p</sub> | T <sub>a</sub> | T <sub>p</sub> | Ta    | T <sub>p</sub> | Ta     | T <sub>p</sub> | T <sub>a</sub>      | T <sub>p</sub>      | Ta                  | $T_{p}$ | Ta                |
| B  | -196           | 77             | 77             | 77    | 200            | 59     | 200            | -40                 | -40                 | -40                 | -196    | -14               |
| Switch output used   | (-321)         | (171)          | (171)          | (171) | (392)          | (138)  | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321)  | (+7)              |
| C  | -196           | 82             | 82             | 82    | 200            | 66     | 200            | -40                 | -40                 | -40                 | -196    | -14               |
| Channel 2 not used   | (-321)         | (180)          | (180)          | (180) | (392)          | (151)  | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321)  | (+7)              |
| C  | -196           | 79             | 79             | 79    | 200            | 62     | 200            | -40                 | -40                 | -40                 | -196    | -14               |
| Channel 2 used   | (-321)         | (174)          | (174)          | (174) | (392)          | (144)  | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321)  | (+7)              |
| E, G   | -196           | 83             | 83             | 83    | 200            | 66     | 200            | -40                 | -40                 | -40                 | -196    | -14               |
| Switch output not used   | (-321)         | (181)          | (181)          | (181) | (392)          | (1512) | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321)  | (+7)              |
| E, G   | -196           | 78             | 78             | 78    | 200            | 61     | 200            | -40                 | -40                 | -40                 | -196    | -14               |
| Switch output used   | (-321)         | (172)          | (172)          | (172) | (392)          | (142)  | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321)  | (+7)              |
| K, L   | -196           | 77             | 77             | 77    | 200            | 60     | 200            | -40                 | -40                 | -40                 | -196    | -14               |
|  | (-321)         | (171)          | (171)          | (171) | (392)          | (140)  | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321)  | (+7)              |

-50 °C (-58 °F) for ordering feature 580 ("Test, Certificate") = JN ("Ambient temperature transmitter -50 °C/-58 °F")

| FMR52<br>Antenna: Horn 80mm/2"<br>Housing: GT18 (316 L)<br>Temperature unit: °C (°F) |        |                |       |       |                |       |                |                     | D-1                 | Γ. Δ                | -Q     | P3 T, A0019351 |
|--|--------|----------------|-------|-------|----------------|-------|----------------|---------------------|---------------------|---------------------|--------|----------------|
| Power Supply; Output (Pos. 2   | P      | 1              | P     | 2     | P              | 3     | P              | 4                   | P                   | 5                   | P      | 6              |
| of the product structure)  | Tp     | T <sub>a</sub> | Tp    | Ta    | T <sub>p</sub> | Ta    | T <sub>p</sub> | T <sub>a</sub>      | T <sub>p</sub>      | Ta                  | Tp     | Ta             |
| A  | -196   | 81             | 81    | 81    | 200            | 57    | 200            | -40                 | -40                 | -40                 | -196   | 10             |
|  | (-321) | (178)          | (178) | (178) | (392)          | (135) | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321) | (50)           |
| B  | -196   | 82             | 82    | 82    | 200            | 57    | 200            | -40                 | -40                 | -40                 | -196   | 10             |
| Switch output not used   | (-321) | (180)          | (180) | (180) | (392)          | (135) | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321) | (50)           |
| B  | -196   | 77             | 77    | 77    | 200            | 51    | 200            | -40                 | -40                 | -40                 | -196   | 10             |
| Switch output used   | (-321) | (171)          | (171) | (171) | (392)          | (124) | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321) | (50)           |
| C  | -196   | 82             | 82    | 82    | 200            | 57    | 200            | -40                 | -40                 | -40                 | -196   | 10             |
| Channel 2 not used   | (-321) | (180)          | (180) | (180) | (392)          | (135) | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321) | (50)           |
| C  | -196   | 79             | 79    | 79    | 200            | 54    | 200            | -40                 | -40                 | -40                 | -196   | 10             |
| Channel 2 used   | (-321) | (174)          | (174) | (174) | (392)          | (129) | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321) | (50)           |
| E, G   | -196   | 83             | 83    | 83    | 200            | 57    | 200            | -40                 | -40                 | -40                 | -196   | 10             |
| Switch output not used   | (-321) | (181)          | (181) | (181) | (392)          | (135) | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321) | (50)           |
| E, G   | -196   | 78             | 78    | 78    | 200            | 53    | 200            | -40                 | -40                 | -40                 | -196   | 10             |
| Switch output used   | (-321) | (172)          | (172) | (172) | (392)          | (127) | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321) | (50)           |
| K, L   | -196   | 77             | 77    | 77    | 200            | 52    | 200            | -40                 | -40                 | -40                 | -196   | 10             |
|  | (-321) | (171)          | (171) | (171) | (392)          | (126) | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321) | (50)           |

 $-50\,^{\circ}\text{C}$  (-58 °F) for ordering feature 580 ("Test, Certificate") = JN ("Ambient temperature transmitter  $-50\,^{\circ}\text{C}/-58\,^{\circ}\text{F}$ ") 1)

| FMR52<br>Antenna: Horn 80mm/2"<br>Housing: GT19 (Plastics PBT)<br>Temperature unit: °C (°F) |                |             |                |             |                |                |                |              | D-             | Τ, Δ         | -Q      | P3<br>T,       |
|---|----------------|-------------|----------------|-------------|----------------|----------------|----------------|--------------|----------------|--------------|---------|----------------|
| Power Supply; Output (Pos. 2  | P              | 1           | P              | 22          | P              | 3              | P              | 4            | P              | 5            | P       | 6              |
| of the product structure)   | T <sub>p</sub> | Ta          | T <sub>p</sub> | Ta          | T <sub>p</sub> | T <sub>a</sub> | T <sub>p</sub> | Ta           | T <sub>p</sub> | Ta           | $T_{p}$ | T <sub>a</sub> |
| A   | -40<br>(-40)   | 80<br>(176) | 80<br>(176)    | 80<br>(176) | 200<br>(392)   | 36<br>(97)     | 200<br>(392)   | -40<br>(-40) | -40<br>(-40)   | -40<br>(-40) | -       | -              |
| B<br>Switch output not used   | -40<br>(-40)   | 76<br>(169) | 76<br>(169)    | 76<br>(169) | 200<br>(392)   | 36<br>(97)     | 200<br>(392)   | -40<br>(-40) | -40<br>(-40)   | -40<br>(-40) | -       | -              |
| B<br>Switch output used   | -40<br>(-40)   | 60<br>(140) | 60<br>(140)    | 60<br>(140) | 200<br>(392)   | 27<br>(81)     | 200<br>(392)   | -40<br>(-40) | -40<br>(-40)   | -40<br>(-40) | -       | -              |
| C<br>Channel 2 not used   | -40<br>(-40)   | 82<br>(180) | 82<br>(180)    | 82<br>(180) | 200<br>(392)   | 36<br>(97)     | 200<br>(392)   | -40<br>(-40) | -40<br>(-40)   | -40<br>(-40) | -       | -              |
| C<br>Channel 2 used   | -40<br>(-40)   | 74<br>(165) | 74<br>(165)    | 74<br>(165) | 200<br>(392)   | 36<br>(97)     | 200<br>(392)   | -40<br>(-40) | -40<br>(-40)   | -40<br>(-40) | -       | -              |
| E, G<br>Switch output not used  | -40<br>(-40)   | 79<br>(174) | 79<br>(174)    | 79<br>(174) | 200<br>(392)   | 36<br>(97)     | 200<br>(392)   | -40<br>(-40) | -40<br>(-40)   | -40<br>(-40) | -       | -              |
| E, G  | -40            | 63          | 63             | 63          | 200            | 30             | 200            | -40          | -40            | -40          | -       | -              |

(145)

(392)

(86)

(392)

(-40)

(-40)

(-40)

| FMR52<br>Antenna: Horn 80mm/2"<br>Housing: GT20 (Alu, coated)<br>Temperature unit: °C (°F) |                |       |                |       |                |                |                |                     | D-1                 | Γ, Δ                | -Q     | P3<br>T <sub>p</sub><br>A0019351 |
|--|----------------|-------|----------------|-------|----------------|----------------|----------------|---------------------|---------------------|---------------------|--------|----------------------------------|
| Power Supply; Output (Pos. 2   | P1             |       | P2             |       | Р3             |                | P4             |                     | P5                  |                     | P6     |                                  |
| of the product structure)  | T <sub>p</sub> | Ta    | T <sub>p</sub> | Ta    | T <sub>p</sub> | T <sub>a</sub> | T <sub>p</sub> | Ta                  | T <sub>p</sub>      | Ta                  | Tp     | Ta                               |
| A  | -196           | 81    | 81             | 81    | 200            | 61             | 200            | -40                 | -40                 | -40                 | -196   | -8                               |
|  | (-321)         | (178) | (178)          | (178) | (392)          | (142)          | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321) | (+18)                            |
| B  | -196           | 82    | 82             | 82    | 200            | 62             | 200            | -40                 | -40                 | -40                 | -196   | -8                               |
| Switch output not used   | (-321)         | (180) | (180)          | (180) | (392)          | (144)          | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321) | (+18)                            |
| B  | -196           | 77    | 77             | 77    | 200            | 56             | 200            | -40                 | -40                 | -40                 | -196   | -8                               |
| Switch output used   | (-321)         | (171) | (171)          | (171) | (392)          | (133)          | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321) | (+18)                            |
| C  | -196           | 82    | 82             | 82    | 200            | 62             | 200            | -40                 | -40                 | -40                 | -196   | -8                               |
| Channel 2 not used   | (-321)         | (180) | (180)          | (180) | (392)          | (144)          | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321) | (+18)                            |
| C  | -196           | 79    | 79             | 79    | 200            | 58             | 200            | -40                 | -40                 | -40                 | -196   | -8                               |
| Channel 2 used   | (-321)         | (174) | (174)          | (174) | (392)          | (136)          | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321) | (+18)                            |
| E, G   | -196           | 83    | 83             | 83    | 200            | 62             | 200            | -40                 | -40                 | -40                 | -196   | -8                               |
| Switch output not used   | (-321)         | (181) | (181)          | (181) | (392)          | (144)          | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321) | (+18)                            |
| E, G   | -196           | 78    | 78             | 78    | 200            | 58             | 200            | -40                 | -40                 | -40                 | -196   | -8                               |
| Switch output used   | (-321)         | (172) | (172)          | (172) | (392)          | (136)          | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321) | (+18)                            |
| K, L   | -196           | 77    | 77             | 77    | 200            | 57             | 200            | -40                 | -40                 | -40                 | -196   | -8                               |
|  | (-321)         | (171) | (171)          | (171) | (392)          | (135)          | (392)          | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-40) <sup>1)</sup> | (-321) | (+18)                            |

1) -50 °C (-58 °F) for ordering feature 580 ("Test, Certificate") = JN ("Ambient temperature transmitter -50°C/-58°F")

Storage temperature

Switch output used

(-40)

-40 to +80 °C (-40 to +176 °F)

 $-50\,^{\circ}\text{C}$  ( $-58\,^{\circ}\text{F}$ ) with manufacturer declaration on request

compatibility (EMC)

| Climate class                         | <ul> <li>■ Generally up to 2 000 m (6 600 ft) above MSL.</li> <li>■ Above 2 000 m (6 600 ft) if the following conditions are met:</li> <li>■ Ordering feature 020 "Power supply; Output" = A, B, C, E or G (2-wire versions)</li> <li>■ Supply voltage U &lt; 35 V</li> <li>■ Supply voltage of overvoltage category 1</li> </ul>  |  |  |  |  |
|---------------------------------------|--|--|--|--|--|
| Altitude according to IEC61010-1 Ed.3 |  |  |  |  |  |
| Degree of protection                  | <ul> <li>With closed housing tested according to:         <ul> <li>IP68, NEMA6P (24 h at 1.83 m under water surface)</li> <li>For plastic housing with transparent cover (display module): IP68 (24 h at 1.00 m under water surface) <sup>6)</sup></li> <li>IP66, NEMA4X</li> </ul> </li> <li>With open housing: IP20, NEMA1</li> <li>Display module: IP22, NEMA2</li> <li>Degree of protection IP68 NEMA6P applies for M12 PROFIBUS PA plugs only when the PROFIBUS cable is plugged in and is also rated IP68 NEMA6P.</li> </ul> |  |  |  |  |
| Vibration resistance                  | DIN EN 60068-2-64 / IEC 60068-2-64: 20 to 2000 Hz, 1 (m/s²)²/Hz  |  |  |  |  |
| Cleaning the antenna                  | The antenna can get contaminated, depending on the application. The emission and reception of microwaves can thus eventually be hindered. The degree of contamination leading to an error depends on the medium and the reflectivity, mainly determined by the dielectric constant $\varepsilon_{\rm r}$ .   |  |  |  |  |
|                                       | If the medium tends to cause contamination and deposits, cleaning on a regular basis is recommended. Care has to be taken not to damage the antenna in the process of a mechanical or hose-down cleaning. The material compatibility has to be considered if cleaning agents are used! The maximum permitted temperature at the flange should not be exceeded.   |  |  |  |  |
| Electromagnetic                       | Electromagnetic compatibility to all relevant requirements of the EN 61326- series and NAMUR   |  |  |  |  |

Electromagnetic compatibility to all relevant requirements of the EN 61326- series and NAMUR recommendation EMC (NE21). For details see declaration of conformity. <sup>7)</sup>.

If only the analogue signal is used, unshielded interconnection lines are sufficient for the installation. In case of using the digital signal (HART/PA/FF) use shielded interconnection lines.

Max. fluctuations during EMC- tests:  $<0.5\,$ % of the span. As an exception to this, the maximum fluctuations may amount to 2 % of the span for devices with plastic housing and see-through lid (integrated display SD02 or SD03) if strong electromagnetic interferences in the frequenency range of 1 to 2 GHz are present.

<sup>6)</sup> This restriction is valid if the following options of the product structure have been selected at the same time: 030 ("Display, Operation") = C ("SD02") or E ("SD03"); 040 ("Housing") = A ("GT19").

<sup>7)</sup> Can be downloaded from www.endress.com.

## **Process**

## **Process temperature, Process** pressure

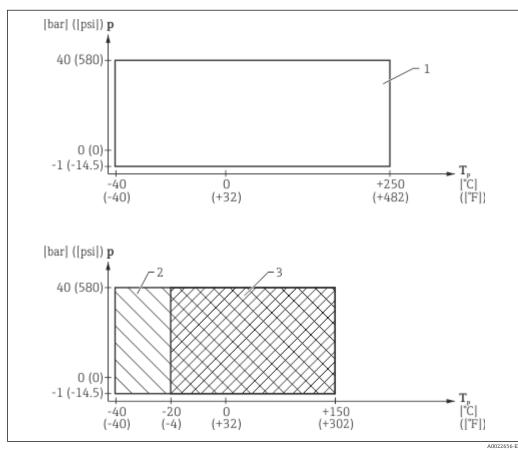


The specified pressure range may be reduced due to the selected process connection. The pressure rating (PN) specified on the flanges refers to a reference temperature of 20 °C, for ASME flanges 100 °F. Pay attention to pressure-temperature dependencies.

Please refer to the following standards for the pressure values permitted for higher temperatures:

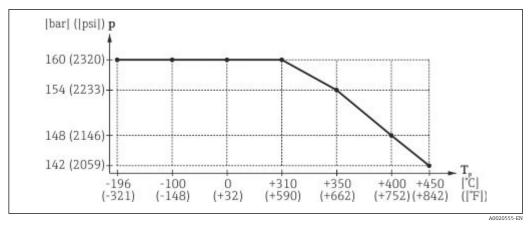
- EN 1092-1: 2001 Tab. 18 With regard to their temperature stability properties, the materials 1.4435 and 1.4404 are grouped under 13E0 in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.
- ASME B 16.5a 1998 Tab. 2-2.2 F316
- ASME B 16.5a 1998 Tab. 2.3.8 N10276
- JIS B 2220

## FMR51



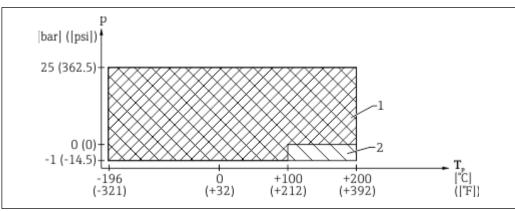
FMR51: Admissible range of process temperature and process pressure

- Seal: Graphite (Feature 090 "Seal", Option D3) 1
- 2 Seal: Viton (Feature 090 "Seal", Option A5)
- Seal: Kalrez (Feature 090 "Seal", Option C1) 3



| Feature 090 "Seal"                       | Admissible process temperature      | Admissible process pressure  |
|--|-------------------------------------|--|
| A5: Viton GLT                            | -40 to +150 °C<br>(-40 to 302 °F)   | $p_{rel} = -1 \text{ to } 40 \text{ bar } (-14.5 \text{ to } 580 \text{ psi})$   |
| C1: Kalrez                               | −20 to +150 °C<br>(−4 to 302 °F)    |  |
| D3: Graphite,<br>40250°C/-40482°F        | −40 to +250 °C<br>(−40 to 482 °F)   |  |
| D2: Graphite,<br>196450°C/-321842°F (HT) | −196 to +450 °C<br>(−321 to 842 °F) | $p_{rel}$ = -1 to 160 bar (-14.5 to 2320 psi)<br>Observe the temperature-dependent<br>restrictions indicated in the diagram<br>above <sup>1)</sup> . |

## FMR52



A00358

■ 25 FMR52: Admissible range of process temperature and process pressure

- 1 Valid for the following process connections: 6" (ANSI), DN150 (EN), 10K150A (JIS)
- 2 Valid for all other types of process connection

| Feature 100 "Process Connection"   | Admissible process temperature      | Admissible process pressure  |
|--|-------------------------------------|--|
| <ul> <li>AFK: 2" 150lbs (ASME)</li> <li>AGK: 3" 150lbs (ASME)</li> <li>AHK: 4" 150lbs (ASME)</li> <li>ATK: 4" 300lbs (ASME)</li> <li>CFK: DN50 PN10/16 (EN)</li> <li>CGK: DN80 PN10/16 (EN)</li> <li>CHK: DN100 PN10/16 (EN)</li> <li>KFK: 10K 50A (JIS)</li> <li>KGK: 10K 80A (JIS)</li> <li>KHK: 10K 100A (JIS)</li> <li>MRK: DIN11851 DN50</li> <li>MTK: DIN11851 DN80</li> <li>TDK: Tri-Clamp 2"</li> <li>TFK: Tri-Clamp 4"</li> </ul> | -196 to +200 °C<br>(-321 to 392 °F) | $p_{rel} = -1 \text{ to } 25 \text{ bar } (-14.5 \text{ to } 363 \text{ psi})^{-1/2}$  |
| <ul> <li>AJK: 6" 150lbs (ANSI)</li> <li>CJK: DN150 PN10/16 (EN)</li> <li>KJK: 10K 150A (JIS)</li> </ul>  |                                     | <ul> <li>Für T = −196 to +100 °C (−321 to 212 °F):<br/>p<sub>rel</sub> = −1 to 25 bar (−14.5 to 363 psi) <sup>1) 2)</sup></li> <li>Für T = 100 to 200 °C (212 to 392 °F):<br/>p<sub>rel</sub> = 0 to 25 bar (0 to 363 psi) <sup>1) 2)</sup></li> </ul> |

- 1)
- 2) Process connections up to 25 bar (363 psi) on request

## Dielectric constant

## • For liquids

- $\epsilon_r \geq 1.9$  in free-field applications
- $\varepsilon_r \ge 1.4$  in stilling well
- For bulk solids

 $\epsilon_r \geq 1.6$ 



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

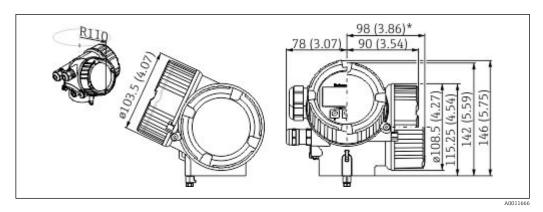
- the Endress+Hauser DC manual (CP01076F)
- the Endress+Hauser "DC Values App" (available for Android and iOS)

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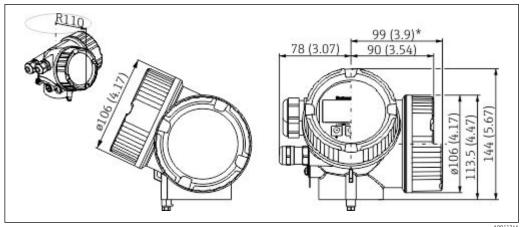
## Mechanical construction

## **Dimensions**

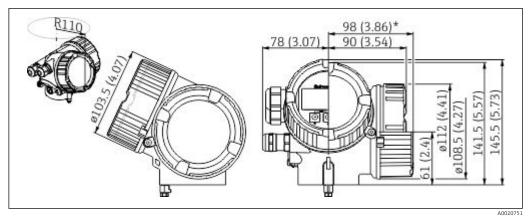
## Dimensions of the electronics housing



₹ 26 Housing GT18 (316L); Dimensions in mm (in) \*for devices with integrated overvoltage protection.

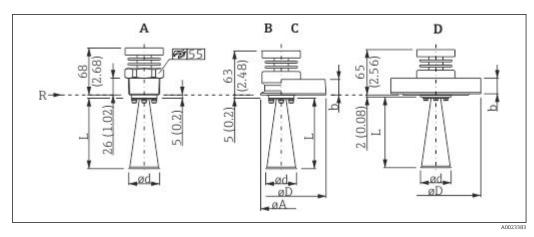


**■** 27 Housing GT19 (Plastics PBT); Dimensions in mm (in) \*for devices with integrated overvoltage protection.



Housing GT20 (Alu coated); Dimensions in mm (in) \*for devices with integrated overvoltage protection.

FMR51: Version T  $\leq$  150 °C (302 °F); without antenna extension



 $\blacksquare$  29 FMR51: Version T < 150 °C (302 °F); without antenna extension; dimensions: mm (in)

- A Process connection: Thread
- B Process connection: Tri-Clamp ISO2852
- C Process connection: Flange 316L
- D Process connection: Flange AlloyC>316L
- R Reference point of the measurement

# Valid for the following device versions Feature 090 "Seal":

- A5: Viton GLT
- C1: Kalrez
- - Dimensions of the horn antenna (L, Ød): → 🖺 72
  - Dimensions of the process connection (ØA, ØD, b): → 🖺 72

C В D E **199**155 PS 55 100(3.94) 68 (2.68) 63 (2.48) 100 (3.94 39.3) (3.98... ø42.5(1.7) ød ød. ØD øD øA

FMR51: Version T  $\leq$  150 °C (302 °F); with antenna extension

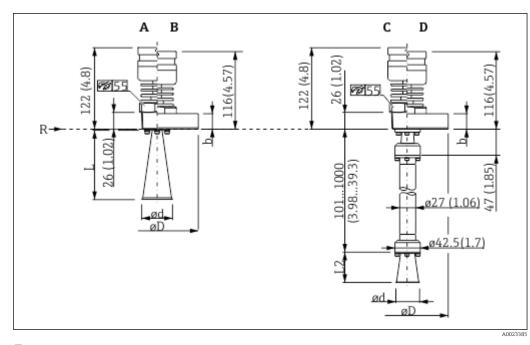
■ 30 MR51: Version T < 150 °C (302 °F); with antenna extension; dimensions: mm (in)

- A Process connections: Thread; Accessory mounted: 100mm/4" antenna extension
- *B* Prozessanschluss: Tri-Clamp ISO2852; Accessory mounted: 100mm/4" antenna extension
- C Process connection: Flange 316L; Accessory mounted: 100mm/4" antenna extension
- D Process connection: Thread; Accessory mounted: ..... mm/inch antenna extension
- E Process connection: Flange 316L; Accessory mounted: ..... mm/inch antenna extension
- *R* Reference point of the measurement

## Valid for the following device versions

- Feature 090 "Seal":
  - A5: Viton GLT
  - C1: Kalrez
- Feature 610 "Accessory mounted"
  - OM: 100mm/4" antenna extension (diagrams A, B, C)
  - OU: ..... mm antenna extension (101 ... 1000 mm) (diagrams D, E)
  - OV: ..... inch antenna extension (3,98 ... 39,3 in) (diagrams D, E)
- Dimensions of the horn antenna (L, L2,  $\emptyset$ d):  $\rightarrow$   $\blacksquare$  72
  - Dimensions of the process connections (ØA, ØD, b): → 🖺 72

**FMR51:** Version T ≤ 250 °C (482 °F)



■ 31 FMR51: Version T < 250 °C (482 °F); dimensions: mm (in)

- A Process connection: Thread
- B Process connection: Flange 316L
- C Process connection: Thread; Accessory mounted: ..... mm/inch antenna extension
- D Process connection: Flange 316L; Accessory mounted: ..... mm/inch antenna extension
- R Reference point of the measurement

# Valid for the following device versions Feature 090 "Seal":

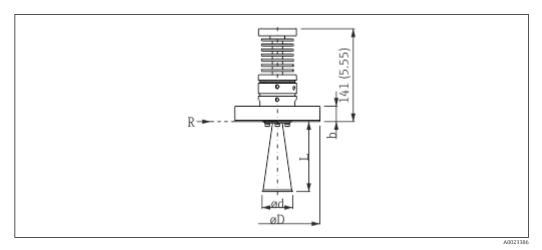
D3: Graphite, -40...250°C/-40...482°F



- Dimensions of the horn antenna (L,  $\emptyset$ d):  $\rightarrow$   $\stackrel{\triangle}{=}$  72
- Dimensions of the process connection (ØD, b):  $\rightarrow$  🗎 72

70

FMR51: Version T ≤ 450 °C (842 °F)



■ 32 FMR51: Version  $T < 450 \,^{\circ}$ C (842 °F); dimensions: mm (in)

# Valid for the following device versions Feature 090 "Seal":

D2: Graphite, -196...450°C/-321...842°F



- Dimensions of the horn antenna (L,  $\emptyset$ d):  $\rightarrow$   $\blacksquare$  72
- Dimensions of the process connection (ØD, b): → 🗎 72

FMR51: Dimensions of the horn antenna

|           | Feature 070 "Antenna" |                  |                  |                   |  |  |  |
|-----------|-----------------------|------------------|------------------|-------------------|--|--|--|
| Dimension | BA: Horn 40mm/1-1/2"  | BB: Horn 50mm/2" | BC: Horn 80mm/3" | BD: Horn 100mm/4" |  |  |  |
| L         | 86 mm (3.39 in)       | 115 mm (4.53 in) | 211 mm (8.31 in) | 282 mm (11.1 in)  |  |  |  |
| L2        | 51 mm (2.01 in)       | 80 mm (3.15 in)  | 176 mm (6.93 in) | 247 mm (9.72 in)  |  |  |  |
| Φd        | Φ40 mm (1.57 in)      | Φ48 mm (1.89 in) | Φ75 mm (2.95 in) | Φ95 mm (3.74 in)  |  |  |  |

## FMR51: Dimensions of the process connections

Flanges according to EN1092-1 (suitable for DIN2527) 1)

| Pressure             | Dimension | Nominal diameter <sup>2)</sup> |                   |                   |                      |  |  |
|----------------------|-----------|--------------------------------|-------------------|-------------------|----------------------|--|--|
| rating <sup>2)</sup> |           | DN50                           | DN80              | DN100             | DN150                |  |  |
|                      | b         | 18 mm (0.71 in)                | 20 mm (0.79 in)   | 20 mm (0.79 in)   | 22 mm (0.87 in)      |  |  |
| PN10/16              | ØD        | φ165 mm (6.5 in)               | φ200 mm (7.87 in) | φ220 mm (8.66 in) | φ285 mm<br>(11.2 in) |  |  |
| PN25/40              | b         | 20 mm (0.79 in)                | 24 mm (0.94 in)   | 24 mm (0.94 in)   | -                    |  |  |
|                      | ØD        | Φ165 mm (6.5 in)               | Φ200 mm (7.87 in) | Φ235 mm (9.25 in) | -                    |  |  |
| PN63                 | b         | -                              | -                 | 30 mm (1.18 in)   | -                    |  |  |
|                      | ØD        | -                              | -                 | φ250 mm (9.84 in) | -                    |  |  |
| PN100                | b         | -                              | -                 | 36 mm (1.42 in)   | -                    |  |  |
|                      | ØD        | -                              | -                 | Φ265 mm (10.4 in) | -                    |  |  |

<sup>1)</sup> For flanges with a higher pressure rating than those listed in the product structure please contact Endress +Hauser.

Flanges according to JIS B2220 1)

|                               |           | Nominal diameter <sup>2)</sup> |                   |                   |                 |  |  |
|-------------------------------|-----------|--------------------------------|-------------------|-------------------|-----------------|--|--|
| Pressure rating <sup>2)</sup> | Dimension | 50A                            | 80A               | 100A              | 150A            |  |  |
| 10K                           | b         | 16 mm (0.63 in)                | 18 mm (0.71 in)   | 18 mm (0.71 in)   | 22 mm (0.87 in) |  |  |
| 1012                          | ΦD        | Φ155 mm (6.1 in)               | Φ185 mm (7.28 in) | Φ210 mm (8.27 in) | Φ280 mm (11 in) |  |  |
| 63K                           | b         | -                              | -                 | 44 mm (1.73 in)   | -               |  |  |
| ΦD                            |           | -                              | -                 | Φ270 mm (10.6 in) | -               |  |  |

<sup>1)</sup> For flanges with a higher pressure rating than those listed in the product structure please contact Endress +Hauser.

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<sup>2)</sup> see feature 100 "Process connection"

<sup>2)</sup> see feature 100 "Process connection"

# Flanges according to ANSI B16.5 1)

|                               |           | Nominal diameter 2) |                      |                   |                      |
|-------------------------------|-----------|---------------------|----------------------|-------------------|----------------------|
| Pressure rating <sup>2)</sup> | Dimension | 2"                  | 3"                   | 4"                | 6"                   |
| 150 lbs                       | b         | 17.5 mm (0.69 in)   | 22.3 mm (0.88 in)    | 22.3 mm (0.88 in) | 23.9 mm (0.94 in)    |
| 100 105                       | ΦD        | Φ150 mm (6 in)      | φ190 mm (7.5 in)     | Φ230 mm (9 in)    | Φ280 mm (11 in)      |
| 300 lbs                       | b         | 20.7 mm (0.81 in)   | 27 mm (1.1 in)       | 30.2 mm (1.2 in)  | 35 mm (1.4 in)       |
|                               | ΦD        | φ165 mm (6.5 in)    | φ210 mm<br>(8.25 in) | φ255 mm (10 in)   | φ320 mm<br>(12.5 in) |

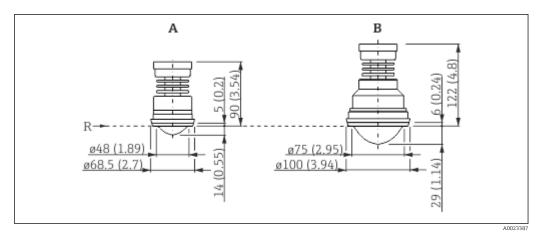
- 1) For flanges with a higher pressure rating than those listed in the product structure please contact Endress +Hauser.
- 2) see feature 100 "Process connection"

# Tri-Clamp according to ISO 2852

|           | Nominal diameter 1) |                 |  |
|-----------|---------------------|-----------------|--|
| Dimension | 51 (2")             | DN70-76.1 (3")  |  |
| A         | 64 mm (2.52 in)     | 91 mm (3.58 in) |  |

1) see feature 100 "Process connection"

# FMR52 with dairy coupling DIN11851



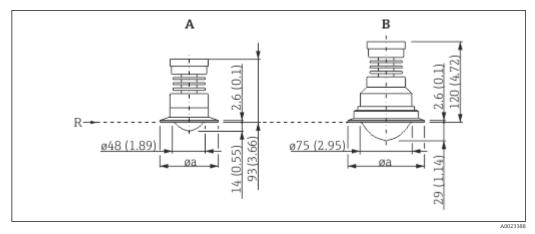
■ 33 FMR52 with dairy coupling DIN11851; dimensions: mm (in)

- A Antenna: Horn 50mm/2"; Process connection DIN11851 DN50 PN25
- B Antenna: Horn 80mm/3"; Process connection DIN11851 DN80 PN25
- R Reference point of the measurement

# Valid for the following device versions: Feature 100 "Process connection"

- MRK: DIN11851 DN50 PN25 slotted nut, PTFE>316L (diagram A)
- MTK: DIN11851 DN80 PN25 slotted nut, PTFE>316L (diagram B)

# FMR52 with Tri-Clamp ISO2852



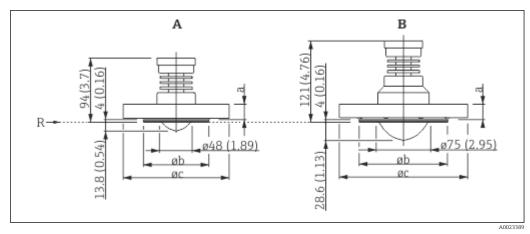
■ 34 FMR52 with Tri-Clamp ISO2852; dimensions: mm (in)

- A Antenna: Horn 50mm/2"
- B Antenna: Horn 80mm/3"
- R Reference point of the measurement

| Antenna 1)                       | BO: "Horn 50mm/2"           |                               | BP: Horn 80mm/3"            |
|----------------------------------|-----------------------------|-------------------------------|-----------------------------|
| Process connection <sup>2)</sup> | TDK: Tri-Clamp DN51<br>(2") | TFK: Tri-Clamp DN70-76.1 (3") | THK: Tri-Clamp DN101.6 (4") |
| Φa                               | Φ64 mm (2.52 in)            | Φ91 mm (3.58 in)              | Φ119 mm (4.69 in)           |

- 1) Feature 070 of the product structure
- 2) Feature 100 of the product structure

# FMR52 with flange



■ 35 Dimensions FMR52 with flange; dimensions: mm (in)

A Antenna: Horn 50mm/2"

B Antenna: Horn 80mm/3"

*R* Reference point of the measurement

# Flanges according to EN1092-1 (suitable for DIN2527)

| Antenna 1)         | Process connection 2) | a               | Ø b              | Øс               |
|--------------------|-----------------------|-----------------|------------------|------------------|
| BO<br>Horn 50mm/2" | CFK<br>Flange DN50    | 20 mm (0.79 in) | 102 mm (4.02 in) | 165 mm (6.5 in)  |
| BP<br>Horn 80mm/3" | CGK<br>Flange DN80    | 20 mm (0.79 in) | 138 mm (5.43 in) | 200 mm (7.87 in) |
|                    | CHK<br>Flange DN100   | 20 mm (0.79 in) | 158 mm (6.22 in) | 220 mm (8.66 in) |
|                    | CJK<br>Flange DN150   | 22 mm (0.87 in) | 212 mm (8.35 in) | 285 mm (11.2 in) |

- 1) Feature 70 of the product structure
- 2) Feature 100 of the product structure

# Flanges according to ANSI B16.5

| Antenna 1)                              | Process connection 2)   | a                 | Ø b              | Øс              |
|---|-------------------------|-------------------|------------------|-----------------|
| BO<br>Horn 50mm/2"                      | AFK<br>Flange 2" Cl.150 | 17.5 mm (0.69 in) | 92 mm (3.62 in)  | 150 mm (6 in)   |
| BP AGK<br>Horn 80mm/3" Flange 3" Cl.150 |                         | 22.3 mm (0.88 in) | 127 mm (5 in)    | 190 mm (7.5 in) |
|   | AHK<br>Flange 4" Cl.150 | 22.3 mm (0.88 in) | 158 mm (6.22 in) | 230 mm (9 in)   |
|   | AJK<br>Flange 6" Cl.150 | 23.9 mm (0.94 in) | 212 mm (8.35 in) | 280 mm (11 in)  |
|   | ATK<br>Flange 4" Cl.300 | 32.2 mm (1.27 in) | 158 mm (6.22 in) | 255 mm (10 in)  |

- 1) Feature 70 of the product structure
- 2) Feature 100 of the product structure

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# Flanges according to JIS B2220

| Antenna 1)                            | Process connection 2)  | a               | Ø b               | Ø c               |
|---------------------------------------|------------------------|-----------------|-------------------|-------------------|
| BO<br>Horn 50mm/2"                    | KFK<br>Flange 10K 50A  | 16 mm (0.63 in) | φ96 mm (3.78 in)  | φ155 mm (6.1 in)  |
| BP KGK<br>Horn 80mm/3" Flange 10K 80A |                        | 18 mm (0.71 in) | Φ127 mm (5 in)    | Φ185 mm (7.28 in) |
|                                       | KHK<br>Flange 10K 100A | 18 mm (0.71 in) | φ151 mm (5.94 in) | Φ210 mm (8.27 in) |
|                                       | KJK<br>Flange 10K 150A | 22 mm (0.87 in) | φ212 mm (8.35 in) | Φ280 mm (11 in)   |

- 1) Feature 70 of the product structure
- 2) Feature 100 of the product structure

# Weight

# Housing

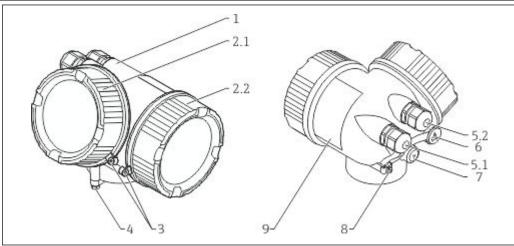
| Part                           | Weight                     |
|--------------------------------|----------------------------|
| Housing GT18 - stainless steel | approx.<br>4.5 kg (9.9 lb) |
| Housing GT19 - plastic         | approx.<br>1.2 kg (2.7 lb) |
| Housing GT20 - aluminium       | approx.<br>1.9 kg (4.2 lb) |

# Antenna and process connection

| Device | Weight of antenna and process connection                 |  |
|--------|--|--|
| FMR51  | max. 3.0 kg (6.6 lb) + weight of flange <sup>1)</sup>    |  |
| FMR52  | MR52 max. 4 kg (8.8 lb) + weight of flange <sup>1)</sup> |  |

1) For the weight of the flange refer to Technical Information TI00426F.

Materials: GT18 housing (stainless steel, corrosion-resistant)

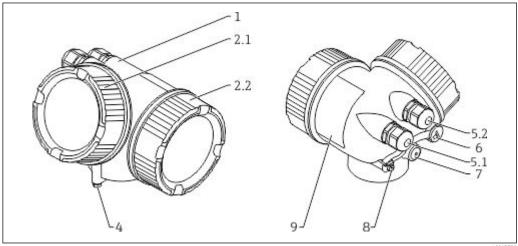


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| No. | Part   | Material   |
|-----|--|--|
| 1   | Housing  | CF3M similar to 316L/1.4404  |
| 2.1 | Cover of the electronics compartment                                       | <ul> <li>Cover: CF3M (similar to 316L/1.4404)</li> <li>Window: glass</li> <li>Cover seal: NBR</li> <li>Seal of the window: NBR</li> <li>Thread-coating: Graphite-based lubricant varnish</li> </ul>  |
| 2.2 | Cover of the terminal compartment  | <ul> <li>Cover: CF3M (similar to 316L/1.4404)</li> <li>Cover seal: NBR</li> <li>Thread-coating: Graphite-based lubricant varnish</li> </ul>  |
| 3   | Cover lock   | <ul><li>Screw: A4</li><li>Clamp: 316L (1.4404)</li></ul>   |
| 4   | Lock at the housing neck   | <ul><li>Screw: A4-70</li><li>Clamp: 316L (1.4404)</li></ul>  |
| 5.1 | Dummy plug, cable gland, adapter or plug (depending on the device version) | <ul> <li>Dummy plug, depending on the device version:</li> <li>PE</li> <li>PBT-GF</li> <li>Cable gland: 316L (1.4404) or nickel-plated brass</li> <li>Adapter: 316L (1.4404/1.4435)</li> <li>Seal: EPDM</li> <li>M12 plug: Nickel-plated brass <sup>1)</sup></li> <li>7/8" plug: 316 (1.4401) <sup>2)</sup></li> </ul> |
| 5.2 | Dummy plug, cable gland or adapter (depending on the device version)       | <ul> <li>Dummy plug: 316L (1.4404)</li> <li>Cable gland: 316L (1.4404) or nickel-plated brass</li> <li>Adapter: 316L (1.4404/1.4435)</li> <li>Seal: EPDM</li> </ul>  |
| 6   | Dummy plug or M12 socket (depending on the device version)                 | <ul> <li>Dummy plug: 316L (1.4404)</li> <li>M12 socket: 316L (1.4404)</li> </ul>   |
| 7   | Pressure relief stopper  | 316L (1.4404)  |
| 8   | Ground terminal  | <ul> <li>Screw: A4</li> <li>Spring washer: A4</li> <li>Clamp: 316L (1.4404)</li> <li>Holder: 316L (1.4404)</li> </ul>  |
| 9   | Nameplate  | <ul> <li>Plate: 316L (1.4404)</li> <li>Groove pin: A4 (1.4571)</li> </ul>  |

- 1) For the version with M12 plug the sealing material is Viton.
- 2) For the version with 7/8" plug, the sealing material is NBR.

# Materials: GT19 housing (plastic)

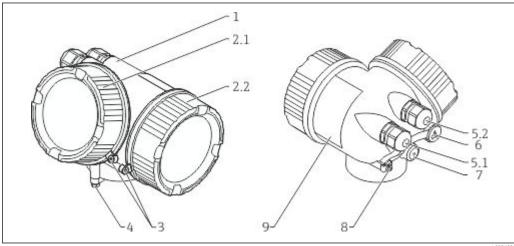


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| No. | Part   | Material   |
|-----|--|--|
| 1   | Housing  | PBT  |
| 2.1 | Cover of the electronics compartment                                       | <ul> <li>Cover glass: PC</li> <li>Cover frame: PBT-PC</li> <li>Cover seal: EPDM</li> <li>Thread-coating: Graphite-based lubricant varnish</li> </ul>   |
| 2.2 | Cover of the terminal compartment  | <ul><li>Cover: PBT</li><li>Cover seal: EPDM</li><li>Thread-coating: Graphite-based lubricant varnish</li></ul>   |
| 4   | Lock at the housing neck   | <ul><li>Screw: A4-70</li><li>Clamp: 316L (1.4404)</li></ul>  |
| 5.1 | Dummy plug, cable gland, adapter or plug (depending on the device version) | <ul> <li>Dummy plug, depending on the device version:</li> <li>PE</li> <li>PBT-GF</li> <li>Cable gland, depending on the device version:</li> <li>Nickel-plated brass (CuZn)</li> <li>PA</li> <li>Adapter: 316L (1.4404/1.4435)</li> <li>Seal: EPDM</li> <li>M12 plug: Nickel-plated brass <sup>1)</sup></li> <li>7/8" plug: 316 (1.4401) <sup>2)</sup></li> </ul> |
| 5.2 | Dummy plug, cable gland or adapter (depending on the device version)       | <ul> <li>Dummy plug, depending on the device version:</li> <li>PE</li> <li>PBT-GF</li> <li>Nickel-plated steel</li> <li>Cable gland, depending on the device version:</li> <li>Nickel-plated brass (CuZn)</li> <li>PA</li> <li>Adapter: 316L (1.4404/1.4435)</li> <li>Seal: EPDM</li> </ul>  |
| 6   | Dummy plug or M12 socket (depending on the device version)                 | <ul><li>Dummy plug: Nickel-plated brass (CuZn)</li><li>M12 socket: Nickel-plated GD-Zn</li></ul>   |
| 7   | Pressure relief stopper  | Nickel-plated brass (CuZn)   |
| 8   | Ground terminal  | <ul> <li>Screw: A2</li> <li>Spring washer: A4</li> <li>Clamp: 304 (1.4301)</li> <li>Holder: 304 (1.4301)</li> </ul>  |
| 9   | Adhesive nameplate   | Plastic  |

- 1) For the version with M12 plug the sealing material is Viton.
- 2) For the version with 7/8" plug, the sealing material is NBR.

Materials: GT20 housing (die-cast aluminum, powder-coated)



A0036037

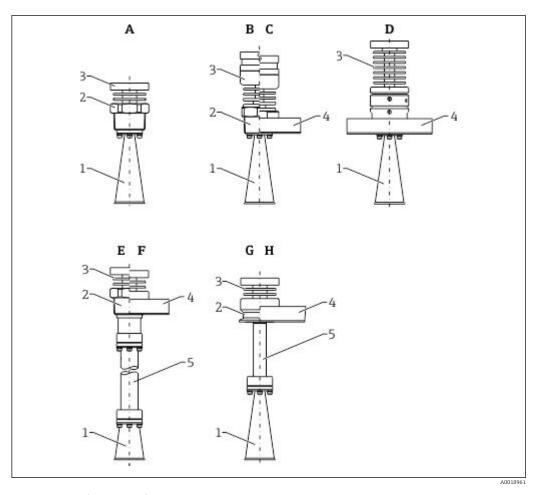
| Nr. | Part  | Material   |  |  |
|-----|---|--|--|--|
| 1   | Housing, RAL 5012 (blue)  | <ul><li>Housing: AlSi10Mg(&lt;0,1% Cu)</li><li>Coating: Polyester</li></ul>  |  |  |
| 2.1 | Cover of the electronics compartment; RAL 7035 (gray)                         | <ul> <li>Cover: AlSi10Mg(&lt;0,1% Cu)</li> <li>Window: Glass</li> <li>Cover seal: NBR</li> <li>Seal of the window: NBR</li> <li>Thread-coating: Graphite-based lubricant varnish</li> </ul>  |  |  |
| 2.2 | Cover of the terminal compartment; RAL 7035 (gray)                            | <ul> <li>Cover: AlSi10Mg(&lt;0,1% Cu)</li> <li>Cover seal: NBR</li> <li>Thread-coating: Graphite-based lubricant varnish</li> </ul>  |  |  |
| 3   | Cover lock  | <ul><li>Screw: A4</li><li>Clamp: 316L (1.4404)</li></ul>   |  |  |
| 4   | Lock at the housing neck  | <ul><li>Screw: A4-70</li><li>Clamp: 316L (1.4404)</li></ul>  |  |  |
| 5.1 | Dummy plug, cable gland, adapter or plug<br>(depending on the device version) | <ul> <li>Dummy plug, depending on the device version:</li> <li>PE</li> <li>PBT-GF</li> <li>Cable gland, depending on the device version:</li> <li>Nickel-plated brass (CuZn)</li> <li>PA</li> <li>Adapter: 316L (1.4404/1.4435)</li> <li>Seal: EPDM</li> <li>M12 plug: Nickel-plated brass <sup>1)</sup></li> <li>7/8" plug: 316 (1.4401) <sup>2)</sup></li> </ul> |  |  |
| 5.2 | Dummy plug, cable gland or adapter (depending on the device version)          | <ul> <li>Dummy plug, depending on the device version:</li> <li>PE</li> <li>PBT-GF</li> <li>Nickel-plated steel</li> <li>Cable gland, depending on the device version:</li> <li>Nickel-plated brass (CuZn)</li> <li>PA</li> <li>Adapter: 316L (1.4404/1.4435)</li> <li>Seal: EPDM</li> </ul>  |  |  |
| 6   | Dummy plug or M12 socket (depending on the device version)                    | <ul><li>Dummy plug: Nickel-plated brass (CuZn)</li><li>M12 socket: Nickel-plated GD-Zn</li></ul>   |  |  |
| 7   | Pressure relief stopper   | Nickel-plated brass (CuZn)   |  |  |

| Nr. | Part               | Material  |
|-----|--------------------|---|
| 8   | Ground terminal    | <ul> <li>Screw: A2</li> <li>Spring washer: A2</li> <li>Clamp: 304 (1.4301)</li> <li>Holder: 304 (1.4301)</li> </ul> |
| 9   | Adhesive nameplate | Plastic   |

- 1) For the version with M12 plug the sealing material is Viton.
- 2) For the version with 7/8" plug, the sealing material is NBR.

# Materials: Antenna and process connection

# FMR51

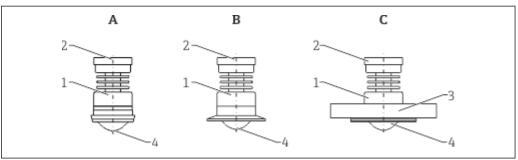


- A Version with screw-in adapter
- B XT version with threaded connection
- C XT version with flange
- D HT version with flange
- E Version with flange and antenna extension > 100 mm (3.94 in) to 500 mm (19.7 in)
- F Version with threaded connection and antenna extension > 100 mm (3.94 in) to 500 mm (19.7 in)
- *G* Version with clamp adapter and antenna extension 100 mm (3.94 in)
- H Version with flange and antenna extension 100 mm (3.94 in)

| Pos.                                 | Part   | Material      |                               |
|--------------------------------------|--|---------------|-------------------------------|
| 1                                    | Horn   | 316L (1.4404) | AlloyC22 (2.4602)             |
| Screws A                             |  | A4            | AlloyC22 (2.4602)             |
| Spring-lock washer (compact version) |  | A4            | without spring-lock<br>washer |
|                                      | Nordlock washer<br>(extension >100 mm, XT and HT<br>version) | A4            | without Nordlock<br>washer    |

| Pos. | Part                       | Material  |  |                                       |  |  |
|------|----------------------------|---|--|---------------------------------------|--|--|
|      | Process separation cone    | Standard:<br>PTFE                                     | XT:<br>PEEK  | HT:<br>Al <sub>2</sub> O <sub>3</sub> |  |  |
|      | Seal                       | Standard:     Viton: FKM     Kalrez: FFKM     (K6375) | XT:<br>Graphite  | HT:<br>Graphite                       |  |  |
| 2    | Process adapter            | 316L (1.4404)   | 316L (1.4404)  |                                       |  |  |
|      | Locking washer             |   |  |                                       |  |  |
| 3    | Housing adapter            | 316L (1.4404)   | 316L (1.4404)  |                                       |  |  |
|      | Temperature reduction (XT) | 316L (1.4404)   | 316L (1.4404)  |                                       |  |  |
|      | Intermediate adapter (HT)  | 316L (1.4404)   | 316L (1.4404)  |                                       |  |  |
|      | Process adapter            | 316L (1.4404)   |  |                                       |  |  |
| 4    | Flange                     | 316L (1.4404/1. clad                                  | 316L (1.4404/1.4435) optionally AlloyC22 (2.4602) clad |                                       |  |  |
| 5    | Extension process adapter  | 316L (1.4404)   | 316L (1.4404)  |                                       |  |  |
|      | Locking washer             |   |  |                                       |  |  |

# FMR52

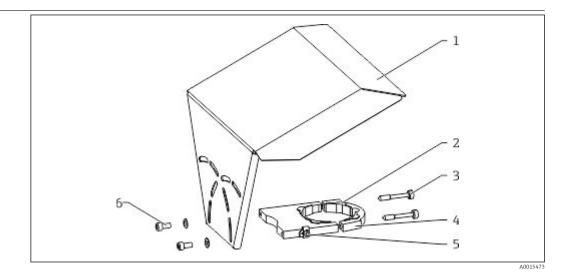


- Dairy coupling Clamp adapter А В
- Flange version

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| Pos. | Part            | Material  |
|------|-----------------|---|
| 1    | Process adapter | 316L (1.4435)   |
| 2    | Housing adapter | 304 (1.4301)  |
| 3    | Flange          | 316L (1.4404/1.4435)  |
| 4    | Cladding        | PTFE<br>(in accordance with FDA 21 CFR 177.1550 and USP<br><88> Class VI) |

Materials: Weather protection cover



Part: Material No Protection cover: 316L (1.4404) 1 2 Molded rubber part (4x): EPDM 3 Clamping screw: 316L (1.4404) + carbon fibre 4 Bracket: 316L (1.4404) 5 Ground terminal ■ Screw: A4 Spring washer: A4 • Clamp: 316L (1.4404) ■ Holder: 316L (1.4404) Washer: A4 6 ■ Cheese head screw: A4-70

# Operability

# Operating concept

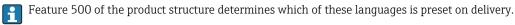
84

## Operator-oriented menu structure for user-specific tasks

- Commissioning
- Operation
- Diagnostics
- Expert level

## Operating languages

- English
- Deutsch
- Français
- Español
- Italiano
- Nederlands
- Portuguesa
- Polski
- русский язык (Russian)
- Svenska
- Türkçe
- 中文 (Chinese)
- 日本語 (Japanese)
- 한국어 (Korean)
- Bahasa Indonesia
- tiếng Việt (Vietnamese)
- čeština (Czech)



# Quick and save commissioning

- Interactive wizard with graphical interface for easy commissioning via FieldCare/DeviceCare
- Menu quidance with brief explanations of the individual parameter functions
- $\ \ \blacksquare$  Standardized operation at the device and in the operating tools

# Integrated data storage device (HistoROM)

- Enables transfer of configuration when changing electronic modules
- Records up to 100 event messages in the device
- Records up to 1000 measured values in the device
- Saves the signal curve on commissioning which can later be used as a reference.

# Efficient diagnostics increase measurement reliability

- Remedy information is integrated in plain text
- Diverse simulation options and line recorder functions

# Integrated Bluetooth module (option for HART devices)

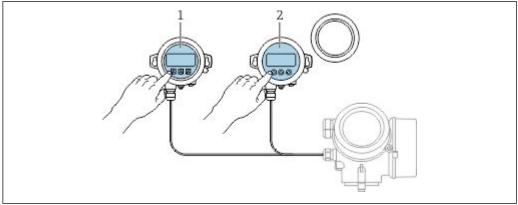
- Easy and fast setup via SmartBlue (app)
- No additional tools or adapters required
- Signal curve via SmartBlue (app)
- Encrypted single point-to-point data transmission (Fraunhofer-Institut, third party, tested) and password-protected communication via Bluetooth® wireless technology

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# Local operation

| Operation with   | Pushbuttons  | Touch Control  |  |
|--|--|--|--|
| Order code for<br>"Display;<br>Operation"  | Option C "SD02"  | Option E "SD03"  |  |
|  | A0036312   | A0036313   |  |
| Display<br>elements  | 4-line display   | 4-line display<br>white background lighting; switches to red in<br>event of device error |  |
|  | catus variables can be individually configured   |  |  |
| Permitted ambient temperature for the display: $-20$ to $+70$ °C ( $-4$ to The readability of the display may be impaired at temperatures outsi range. |  |  |  |
| Operating elements   | local operation with 3 push buttons $( \boxdot, \Box, \mathbb{E} )$  | external operation via touch control; 3 optical keys: ⊕, ⊡, 區                            |  |
|  | Operating elements also accessible in various hazardous areas  |  |  |
| Additional functionality   | r  |  |  |
|  | odule can be compared to the current device  |  |  |
|  | Data transfer function The transmitter configuration can be transmitted to another device using the displa |  |  |

Operation with remote display and operating module FHX50



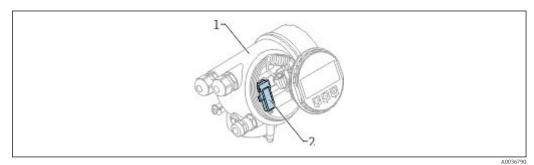
A0036314

# ■ 36 FHX50 operating options

- 1 Display and operating module SD03, optical keys; can be operated through the glass of the cover
- 2 Display and operating module SD02, push buttons; cover must be removed

# Operation via Bluetooth® wireless technology

# Requirements



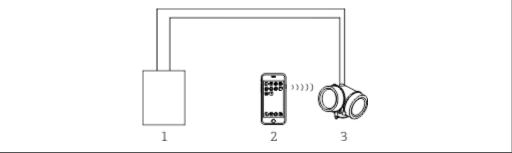
■ 37 Device with Bluetooth module

- 1 Electronics housing of the device
- 2 Bluetooth module

This operation option is only available for devices with Bluetooth module. There are the following options:

- The device has been ordered with a Bluetooth module: Feature 610 "Accessory Mounted", option NF "Bluetooth"
- The Bluetooth module has been ordered as an accessory (ordering number: 71377355) and has been mounted. See Special Documentation SD02252F.

# Operation via SmartBlue (app)



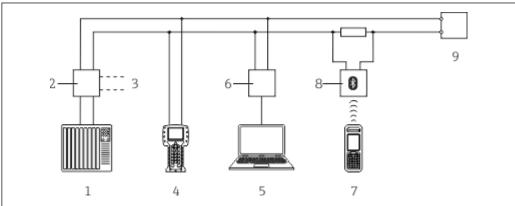
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■ 38 Operation via SmartBlue (app)

- 1 Transmitter power supply unit
- 2 Smartphone / tablet with SmartBlue (app)
- 3 Transmitter with Bluetooth module

# Remote operation

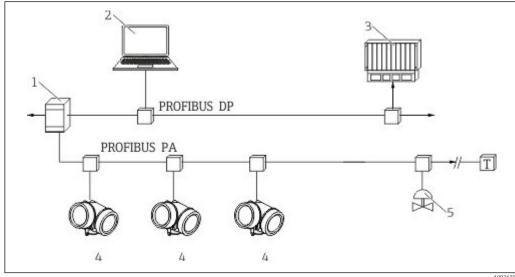
# Via HART protocol



■ 39 Options for remote operation via HART protocol

- 1 PLC (Programmable Logic Controller)
- Transmitter power supply unit, e.g. RN221N (with communication resistor)2
- 3 Connection for Commubox FXA191, FXA195 and Field Communicator 375, 475
- Field Communicator 475
- $Computer\ with\ operating\ tool\ (e.g.\ DeviceCare/FieldCare\ ,\ AMS\ Device\ Manager,\ SIMATIC\ PDM)$ 5
- Commubox FXA191 (RS232) or FXA195 (USB)
- Field Xpert SFX350/SFX370
- 8 VIATOR Bluetooth modem with connecting cable
- Transmitter

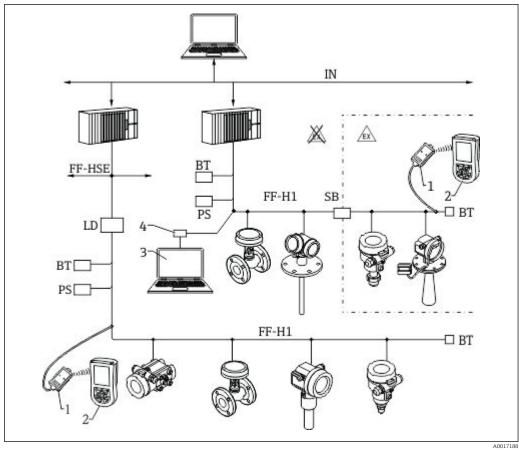
# Via PROFIBUS PA protocol



€ 40 Options for remote operation via PROFIBUS PA protocol

- Segment coupler
- Computer with Profiboard/Proficard and operating tool (e.g. DeviceCare/FieldCare
- 3 PLC (Progrommable Logic Controller)
- Transmitter
- Additional functions (valves etc.)

# Via FOUNDATION Fieldbus

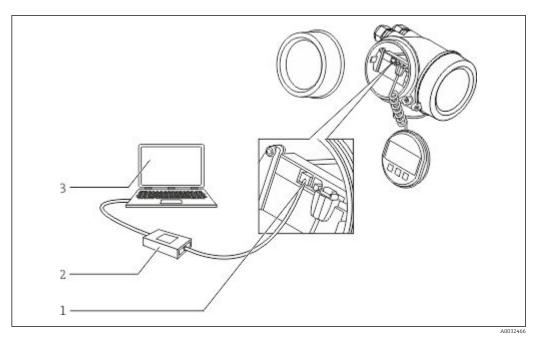


**₽** 41 FOUNDATION Fieldbus system architecture with associated components

- 1 FFblue Bluetooth modem
- 2 Field Xpert SFX350/SFX370
- 3 DeviceCare/FieldCare
- NI-FF interface card

| IN     | Industrial network          |
|--------|-----------------------------|
| FF-HSE | High Speed Ethernet         |
| FF-H1  | FOUNDATION Fieldbus-H1      |
| LD     | Linking Device FF-HSE/FF-H1 |
| PS     | Bus Power Supply            |
| SB     | Safety Barrier              |
| BT     | Bus Terminator              |

# DeviceCare/FieldCare via service interface (CDI)

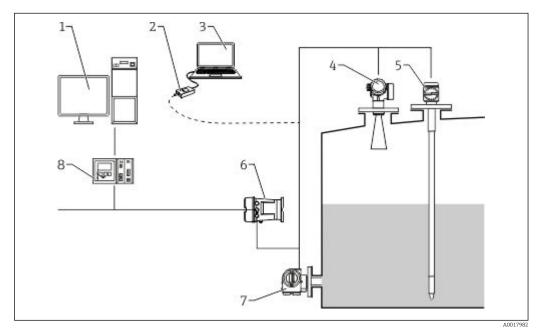


■ 42 DeviceCare/FieldCare via service interface (CDI)

- 1 Service interface (CDI) of the instrument (= Endress+Hauser Common Data Interface)
- 2 Commubox FXA291
- 3 Computer with DeviceCare/FieldCare operating tool

# Integration in tank gauging system

The Endress+Hauser Tank Side Monitor NRF81 provides integrated communications for sites with multiple tanks, each with one or more sensors on the tank, such as radar, spot or average temperature, capacitive probe for water detection and/or pressure sensors. Multiple protocols out of the Tank Side Monitor guarantee connectivity to nearly any of the existing industry standard tank gauging protocols. Optional connectivity of analog 4...20 mA sensors, digital I/O and analog output simplify full tank sensor integration. Use of the proven concept of the intrinsically safe HART bus for all on-tank sensors yields extremely low wiring costs, while at the same time providing maximum safety, reliability and data availability.



■ 43 The complete measuring system consists of:

- 1 Tankvision workstation
- 2 Commubox FXA195 (USB) optional
- 3 Computer with operating tool (ControlCare) optional
- 4 Level measuring device
- 5 Temperature measuring device
- 6 Tank Side Monitor NRF81
- 7 Pressure measuring device
- 8 Tankvision Tank Scanner NXA820

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# SupplyCare inventory management software

SupplyCare is a web-based operating program for coordinating the flow of material and information along the supply chain. SupplyCare provides a comprehensive overview of the levels of geographically distributed tanks and silos, for instance, providing complete transparency over the current inventory situation, regardless of time and location.

Based on the measuring and transmission technology installed onsite, the current inventory data are collected and sent to SupplyCare. Critical levels are clearly indicated and calculated forecasts provide additional security for material requirements planning.

The main functions of SupplyCare:

# Inventory visualization

SupplyCare determines the inventory levels in tanks and silos at regular intervals. It displays current and historical inventory data and calculated forecasts of future demand. The overview page can be configured to suit the user's preferences.

# Master data management

With SupplyCare you can create and manage the master data for locations, companies, tanks, products and users, as well as user authorization.

## **Report Configurator**

The Report Configurator can be used to create personalized reports quickly and easily. The reports can be saved in a variety of formats, such as Excel, PDF, CSV and XML. The reports can be transmitted in many ways, such as by http, ftp or e-mail.

# **Event management**

Events, such as when levels drop below the safety stock level or plan points, are indicated by the software. In addition, SupplyCare can also notify pre-defined users by e-mail.

#### Alarms

If technical problems occur, e.g. connection issues, alarms are triggered and alarm e-mails are sent to the System Administrator and the Local System Administrator.

# **Delivery planning**

The integrated delivery planning function automatically generates an order proposal if a pre-set minimum inventory level is undershot. Scheduled deliveries and disposals are monitored continuously by SupplyCare. SupplyCare notifies the user if scheduled deliveries and disposals are not going to be met as planned.

## **Analysis**

In the Analysis module, the most important indicators for the inflow and outflow of the individual tanks are calculated and displayed as data and charts. Key indicators of material management are automatically calculated and form the basis for optimizing the delivery and storage process.

# Geographical visualization

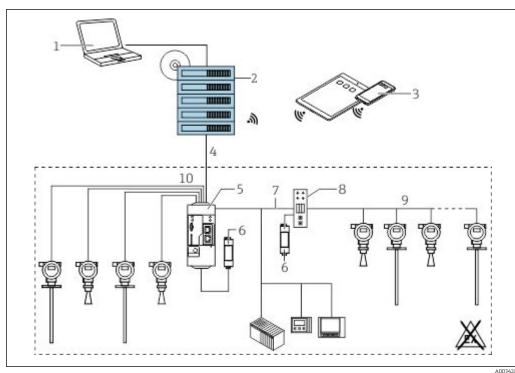
All the tanks and the tank inventories are represented graphically on a map (based on Google Maps). The tanks and inventory situations can be filtered by tank group, product, supplier or location.

# Multi-language support

The multi-language user interface supports 9 languages, thereby enabling global collaboration on a single platform. The language and settings are recognized automatically using the browser settings.

# SupplyCare Enterprise

SupplyCare Enterprise runs by default as a service under Microsoft Windows on an application server in an Apache Tomcat environment. The operators and administrators operate the application via a Web browser from their workstations.

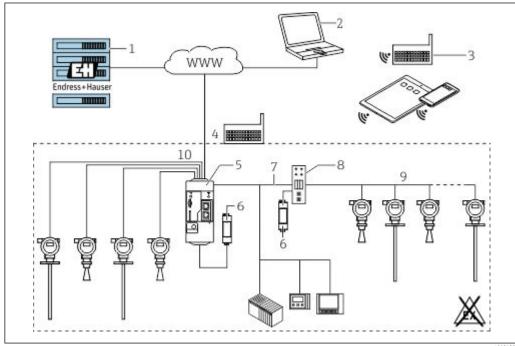


Example of inventory management platform with SupplyCare Enterprise SCE30B

- 1 SupplyCare Enterprise (via Web browser)
- 2 SupplyCare Enterprise installation
- 3 SupplyCare Enterprise on mobile devices (via Web browser)
- Ethernet/WLAN/UMTS 4
- Fieldgate FXA42 5
- Power supply 24 V DC 6
- Modbus TCP via Ethernet as server/client
- 8 Converter from Modbus to HART Multidrop
- HART Multidrop
- 4 x 4 to 20 mA analog input (2-wire/4-wire) 10

# Cloud-based application: SupplyCare Hosting

SupplyCare Hosting is offered as a hosting service (software as a service). Here, the software is installed within the Endress+Hauser IT infrastructure and made available to the user in the Endress+Hauser portal.



■ 45 Example of inventory management platform with SupplyCare Hosting SCH30

- 1 SupplyCare Hosting installation in Endress+Hauser data center
- 2 PC workstation with Internet connection
- 3 Warehouse locations with Internet connection via 2G/3G with FXA42 or FXA30
- 4 Warehouse locations with Internet connection with FXA42
- 5 Fieldgate FXA42
- 6 Power supply 24 V DC
- 7 Modbus TCP via Ethernet as server/client
- 8 Converter from Modbus to HART Multidrop
- HART Multidrop
- 10 4 x 4 to 20 mA analog input (2-wire/4-wire)

With SupplyCare Hosting, users do not need to make the initial software purchase or install and run the IT infrastructure needed. Endress+Hauser constantly update SupplyCare Hosting and enhance the capability of the software in conjunction with the customer. The hosted version of SupplyCare is thus always up-to-date and can be customized to meet different customer requirements. Other services are also offered in addition to the IT infrastructure and the software that is installed in a secure, redundant Endress+Hauser data center. These services include defined availability of the global Endress+Hauser Service and Support Organization and defined response times in a service event

# Certificates an approvals



Currently available certificates and approvals can be called up via the product configurator.

# 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).

# **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.



10029561

# Ex approval

- ATEX
- IEC Ex
- CSA
- FM
- NEPSI
- KC
- INMETRO
- TIIS (in preparation)

Additional safety instructions must be observed for applications in hazardous areas. They are contained in the separate "Safety Instructions" (XA) document, which is included in the scope of delivery. Reference is made to the XA on the nameplate of the device.



Details on the available certificats as well as the associated XAs can be found in the **Associated documentation** chapter in the **Safety instructions** section:  $\rightarrow \triangleq 116$ .

# Dual seal according to ANSI/ISA 12.27.01

The devices have been designed according to ANSI/ISA 12.27.01 as dual seal devices, allowing the user to waive the use and save the cost of installing external secondary process seals in the conduit as required by the process sealing sections of ANSI/NFPA 70 (NEC) and CSA 22.1 (CEC) These instruments comply with the North-American installation practice and provide a very safe and cost-saving installation for pressurized applications with hazardous fluids.

Further information can be found in the Safety Instructions (XA) of the relevant devices.

## **Functional safety**

Use for level monitoring (MIN, MAX, range) up to SIL 3 (homogeneous or diverse redundancy), independently evaluated by  $T\ddot{U}V$  Rheinland in accordance with IEC 61508, refer to the "Functional Safety Manual" for information.

# WHG

WHG approval: Z-65.16-524

# Sanitary compatibility

FMR52 with flange cladding made of PTFE conforms to FDA 21 CFR 177.1550 and USP <88> Class VI

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3A and EHEDG approval with Tri-Clamp and DIN11851 process connection.

To avoid risk of contamination, install according to the "Hygienic Equipment Design Criteria (HDC)" as stated in the Subgroup Design Principles of the EHEDG, Doc. 8 from April 2004.

Suitable fittings and seals must be used to ensure hygiene-compliant design according to the specifications of 3-A SSI and EHEDG.

- The leak-tight connections can be cleaned with the cleaning methods usually used in this industry without leaving residues.
- The 316L housing (GT18), option B in the order attribute 40, is not suitable for applications which need a 3A approval.

# NACE MR 0175 / ISO 15156

- The wetted, metal materials comply with the requirements of NACE MR 0175 / ISO 15156.
- Declaration of Conformity: see the product structure, feature 580, version JB

# **NACE MR 0103**

- The wetted, metal materials comply with the requirements of NACE MR 0103.
- The Declaration of Conformity is based on NACE MR 0175.
  The hardness and intergranular corrosion have been tested, and heat treatment (solution annealed) has been performed. The materials used therefore meet the requirements of NACE MR 0103.
- Declaration of Conformity: see the product structure, feature 580, version JE.

# 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.

# Marine certificate

| Device Marine certificate 1) |    | 1)  |    |    |     |
|------------------------------|----|-----|----|----|-----|
|                              | GL | ABS | LR | BV | DNV |
| FMR51                        | V  | V   | V  | V  | V   |
| FMR52                        | V  | V   | V  | V  | V   |

1) see oredering feature 590 "Additional approval"

# Radio standard EN302729

The devices Micropilot FMR51 with Antenna Horn 100 mm /4" and FMR52 with Antenna Horn 80 mm / 3" flush mounted conform with the LPR (Level Probing Radar) standard EN302729. The devices Micropilot FMR51 with Antenna Horn 100 mm /4" and FMR52 with Antenna Horn 80 mm / 3" flush mounted are allowed to be used inside or outside of closed bins or tanks in countries of th EU and the EFTA. Precondition is that the country itself already has implemented the directive.

At present, the following countries have already implemented the directive:

Belgium, Bulgaria, Germany, Denmark, Estonia, France, Greece, Great Britain, Ireland, Iceland, Italy, Liechtenstein, Lithuania, Latvia, Malta, Netherland, Norway, Austria, Poland, Romania, Sweden, Switzerland, Slovakia, Spain, Czech Republic and Cyprus.

All countries not mentioned above are at present in the implementation phase.

For the use of the devices outside of closed bins or tanks, the following has to be observed:

- 1. The installation has to be done by trained personnel.
- 2. The antenna of the device has to be mounted on a fixed place and vertically to the bottom.
- 3. The mounting place has to be in a distance of at least 4 km to the mentioned astronomical stations or an appropriate permission has to be issued by the national authority. If the device is mounted at a distance of 4 to 40 km from the stations mentioned, the maximum mounting height is restricted to 15 m (49 ft).

# Astronomical stations

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

i

In general the requirements of EN 302729 have to be taken in consideration.

# Radio standard EN 302372

The devices comply with the Tanks Level Probing Radar (TLPR) radio standard EN 302372 and are approved for use in closed containers. For installation, points a to f in Annex E of EN 302372 must be taken into consideration.

# FCC

This device complies with Part 15 of the FCC rules. 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.

[Any] changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The devices are compliant with the FCC Code of Federal Regulations, CFR 47, Part 15, Sections 15.205, 15.207, 15.209.

In addition, the devices FMR51 with antenna Horn  $100 \, \text{mm} / 4$ " and FMR52 with antenna Horn  $80 \, \text{mm} / 3$ " flush mount, are compliant with Section 15.256. For these LPR (Level Probe Radar) applications the devices must be professionally installed in a downward operating position. In addition, the devices are not allowed to be mounted in a zone of 4 km around RAS stations and within a radius of  $40 \, \text{km}$  around RAS stations the maxium operation height of devices is  $15 \, \text{m}$  ( $49 \, \text{ft}$ ) above ground.

# **Industry Canada**

Canada CNR-Gen Section 7.1.3

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

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 not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

In order to comply with FCC/ISED RF Exposure requirements, this device must be installed to provide at least 4,5 cm separation from the human body at all times.

Afin de se conformer aux exigences d'exposition RF FCC / ISED, cet appareil doit être installé pour fournir au moins 4,5 cm de séparation du corps humain en tout temps

- 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.
- This device shall be installed and operated in a completely enclosed container to prevent RF
  emissions, which can otherwise interfere with aeronautical navigation.
- The installer/user of this device shall ensure that it is at least 10 km from the Dominion Astrophysical Radio Observatory (DRAO) near Penticton, British Columbia. The coordinates of the DRAO are latitude 49°19′15″ N and longitude 119°37′12″ W. For devices not meeting this 10 km separation (e.g., those in the Okanagan Valley, British Columbia,) the installer/user must coordinate with, and obtain the written concurrence of, the Director of the DRAO before the equipment can be installed or operated. The Director of the DRAO may be contacted at 250-497-2300 (tel.) or 250-497-2355 (fax). (Alternatively, the Manager, Regulatory Standards Industry Canada, may be contacted.)



- The FMR51T is a submodel of the FMR51 that fulfills the requirements for use as TLPR (Tank Level Probe Radar).
- The model FMR51L is a submodel of the FMR51. "L" indicates the unique option BD of the feature 070 ("Antenna") that fullfills the requirements for use as LPR (Level Probe Radar).
- The FMR52T is a submodel of the FMR52 that fulfills the requirements for use as TLPR (Tank Level Probe Radar).
- The model FMR52L is a submodel of the FMR52. "L" indicates the unique option BP of the feature 070 ("Antenna") that fullfills the requirements for use as LPR (Level Probe Radar).

# Japanese radio approval

The devices comply with Japanese Radio Law, Article 6, Section 1(1)

# CRN approval

Some device versions have a CRN approval. Devices are CRN approved if the following two conditions are met:

- The device has a CSA approval (Product structure: Feature 010 "Approval")
- The device has a CRN approved process connection according to the following table.

| Feature 100 of the product structure | Process connection              |
|--------------------------------------|---------------------------------|
| AFJ                                  | NPS 2" Cl.150 RF, 316/316L      |
| AFK                                  | NPS 2" Cl.150, PTFE >316/316L   |
| AFM                                  | NPS 2" Cl.150, AlloyC >316/316L |
| AGJ                                  | NPS 3" Cl.150 RF, 316/316L      |
| AGK                                  | NPS 3" Cl.150, PTFE >316/316L   |
| AGM                                  | NPS 3" Cl.150, AlloyC >316/316L |
| АНЈ                                  | NPS 4" Cl.150 RF, 316/316L      |
| АНК                                  | NPS 4" Cl.150, PTFE >316/316L   |
| АНМ                                  | NPS 4" Cl.150, AlloyC >316/316L |
| AJJ                                  | NPS 6" Cl.150 RF, 316/316L      |
| AJK                                  | NPS 6" Cl.150, PTFE >316/316L   |
| AJM                                  | NPS 6" Cl.150, AlloyC >316/316L |
| ARJ                                  | NPS 2" Cl.300 RF, 316/316L      |

| Feature 100 of the product structure | Process connection                                     |
|--------------------------------------|--|
| ARM                                  | NPS 2" Cl.300, AlloyC >316/316L                        |
| ASJ                                  | NPS 3" Cl.300 RF, 316/316L                             |
| ASM                                  | NPS 3" Cl.300, AlloyC >316/316L                        |
| ATJ                                  | NPS 4" Cl.300 RF, 316/316L                             |
| ATK                                  | NPS 4" Cl.300, PTFE>316/316L                           |
| ATM                                  | NPS 4" Cl.300, AlloyC >316/316L                        |
| MRK                                  | DIN11851 DN50 PN25 slotted nut, PTFE>316L              |
| MTK                                  | DIN11851 DN80 PN25 slotted nut, PTFE>316L              |
| RGJ                                  | Thread ANSI MNPT1-1/2, 316L                            |
| RVJ                                  | Thread EN10226 R1-1/2, 316L                            |
| TDJ                                  | Tri-Clamp ISO2852 DN51 (2"), 316L                      |
| TDK                                  | Tri-Clamp ISO2852 DN51 (2"), PTFE>316L, 3A, EHEDG      |
| TFJ                                  | Tri-Clamp ISO2852 DN70-76.1 (3"), 316L                 |
| TFK                                  | Tri-Clamp ISO2852 DN70-76.1 (3"), PTFE>316L, 3A, EHEDG |
| ТНК                                  | Tri-Clamp ISO2852 DN101.6 (4"), PTFE>316L, 3A, EHEDG   |

- Process connections without CRN approval are not included in this table.
  - Refer to the product structure to see which process connections are available for a specific device type.
  - For some process connections not listed in the product structure a CRN approval is available on request.
  - CRN approved devices are marked with the registration number OF15872.5C on the nameplate.
- For device versions listed in the table below, the maximum allowed pressure is reduced if they have a CRN approval. For device versions not listed in the table below the pressure range as indicated in the "Process" chapter → 🗎 64 is not affected by the CRN approval.

| Product Antenna 1) |  | Process connection 2) | Seal <sup>3)</sup> | max. pressure    |  |
|--------------------|--|-----------------------|--------------------|------------------|--|
| FMR52              |  | TFK: Tri-Clamp 3"     |                    | 10 bar (145 psi) |  |
|                    |  | THK: Tri-Clamp 4"     |                    | 10 bar (145 psi) |  |
| FMR51              |  | D2: Graphite (HT)     | 100 bar (1450 psi) |                  |  |

- 1) Feature 070 of the product structure
- 2) Feature 100 of the product structure
- 3) Feature 090 of the product structure

## Track record

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FMR5x is the upgrade model of the corresponding FMR2xx series.

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# Test, Certificate

| Feature 580 "Test, Certificate" | Designation  | Available for                         |
|---------------------------------|--|---------------------------------------|
| JA                              | 3.1 Material certificate, wetted metallic parts, EN10204-3.1 inspection certificate  |                                       |
| JB                              | Conformity to NACE MR0175, wetted metallic parts   | FMR51                                 |
| JD                              | 3.1 Material certificate, pressurized parts, EN10204-3.1 inspection certificate  | FMR52                                 |
| JE                              | Conformity to NACE MR0103, wetted metallic parts   | FMR51                                 |
| JF                              | Conformity to AD2000, wetted metallic parts: Material of all wetted/pressurized parts conform to AD2000 (Technical rules W2, W9, W10)  | <ul><li>FMR51</li><li>FMR52</li></ul> |
| KD                              | Helium leak test, internal procedure, inspection certificate   | FMR51                                 |
| KE                              | Pressure test, internal procedure, inspection certificate  |                                       |
| KG                              | 3.1 Material certificate+PMI test (XRF), internal procedure, wetted metallic parts, EN10204-3.1 inspection certificate   |                                       |
| KP                              | Liquid penetrant test AD2000-HP5-3(PT), wetted/pressurized metallic parts, inspection certificate  |                                       |
| KQ                              | Liquid penetrant test ISO23277-1 (PT), wetted/pressurized metallic parts, inspection certificate   |                                       |
| KR                              | Liquid penetrant test ASME VIII-1 (PT), wetted/pressurized metallic parts, inspection certificate  | FMR51                                 |
| KS                              | Welding documentation, wetted/pressurized seams consisting of     Drawing     WPQR (Welding Procedure Qualification Report)     WPS (Welding Process Specification)     Manufacturer Declaration | FMR51                                 |
| KV                              | Conformity to ASME B31.3:<br>The dimensions, materials of construction, pressure / temperature ratings and identification markings of the device comply with the requirements of ASME B31.3      | ■ FMR51<br>■ FMR52                    |



Test reports, declarations and material test certificates can be obtained electronically from the  $W@M\ Device\ Viewer$ :

Enter the serial number from the nameplate (www.endress.com/deviceviewer)

This applies to the options of the following ordering features:

- 550 "Calibration"
- 580 "Test, Certificate"
- 590 "Additional Approval", option LW: "CoC-ASME BPE"

# Hard-copy product documentation

Hard-copy versions of the test reports, declarations and inspection certificates can also be order via order code 570 "Service", option I7 "Hard-copy product documentation". The documents are then supplied with the product.

# Other standards and guidelines

■ EN 60529

Degrees of protection provided by enclosures (IP code)

■ EN 61010-1

Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use

IEC/EN 61326

"Emission in accordance with Class A requirements". Electromagnetic compatibility (EMC requirements).

■ 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 53

Software of field devices and signal-processing devices with digital electronics

■ NAMUR NE 107

Status classification as per NE107

NAMUR NE 131

Requirements for field devices for standard applications.

■ IEC61508

Functional safety of safety-related electric/electronic/programmable electronic systems

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# Ordering information

# Ordering information

Detailed ordering information is available from the following sources:

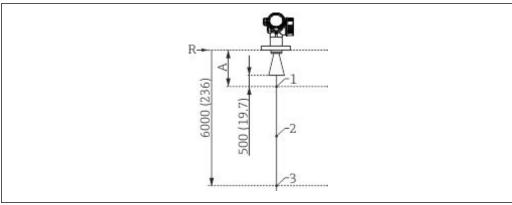
- In the Product Configurator on the Endress+Hauser website: www.endress.com -> Click "Corporate"
   -> Select your country -> Click "Products" -> Select the product using the filters and search field -> Open product page -> The "Configure" button to the right of the product image opens the Product Configurator.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

# 3-point linearity protocol

The following notes must be taken into account if option F3 ("3 point linearity protocol") has been selected in feature 550 ("Calibration").

The 3 points of the linearity protocol are defined as follows:



€ 46 Points of the 3-point linearity protocol; Dimensions: mm (in)

- Α Distance from reference point R to first measuring point
- R Reference point of the measurement
- 1 First measuring point
- 2 Second measuring point (centrally between first and third measuring point)
- Third measuring point

| Measuring point   | Position  |
|---|---|
| 1 <sup>st</sup> measuring point   | <ul> <li>At the distance A from the reference point</li> <li>A = antenne length + antenna extension (if present) + 500 mm (19.7 in)</li> <li>Minimum distance: A<sub>min</sub> = 1000 mm (39.4 in)</li> </ul> |
| 2 <sup>nd</sup> measuring point centrally between 1 <sup>st</sup> and 3 <sup>rd</sup> measuring point |   |
| 3 <sup>rd</sup> measuring point   | 6000 mm (236 in) below the reference point, R   |

- The position of the measuring points may vary by  $\pm 1$  cm ( $\pm 0.04$  in).
- The linearity is checked under reference conditions.

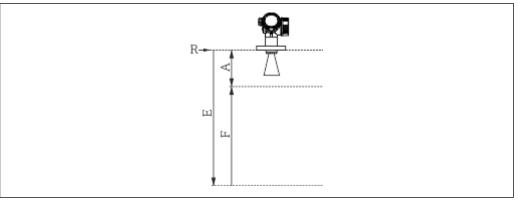
# 5-point linearity protocol



The following notes must be taken into account if option F4 ("5 point linearity protocol") has been selected in feature 550 ("Calibration").

The five points of the linearity protocol are evenly distributed across the measuring range (0% to 100%). In order to define the measuring range, Empty calibration (E) and Full calibration (F) have to be specified 8).

The following restrictions have to be taken into account when defining E and F:



| Device version                                       | Minimum distance<br>between reference point<br>(R) and 100% level                 | Minimum span       | Maximum value for<br>"Empty calibration" |
|--|---|--------------------|--|
| FMR51/FMR52<br>Without antenna extension             | $A \ge antenna length + 200 mm (8 in)^{1}$  |                    |  |
| FMR51 with 100 mm/4" antenna extension <sup>2)</sup> | A ≥ antenna length +<br>antenna extension<br>100 mm (4 in) +<br>200 mm (8 in)     | F ≥ 400 mm (16 in) | E ≤ 24 m (79 ft)                         |
| FMR51 with varaible antenna extension <sup>3)</sup>  | A ≥ antenna length + maximum antenna extension 1000 mm (40 in) 4) + 200 mm (8 in) |                    |  |

- 1) Minimum value:  $A \ge 400 \text{ mm}$  (16 in)
- 2) Feature 610 "Accessory Mounted", option OM
- 3) Feature 610 "Accessory Mounted", option OU or OV
- This value is independent of the actual size of the antenna extension.
  - The linearity is checked under reference conditions.
  - The selected values of **Empty calibration** and **Full calibration** are only used to record the linearity protocol and are reset to their probe specific default values thereafter. If values different from the default are required, they must be ordered as a customized parametrization → ■ 104.

<sup>8)</sup> If E and F are not specified, probe dependent default values will be used instead.

# Customized parametrization

If the option IJ "Customized parametrization HART", IK "Customized parametrization PA" or IL "Customized parametrization FF" has been selected in feature 570 "Service", customer specific presettings can be selected for the following parameters:

| Parameter  | Communication                                | Selection list / range of values                           |
|--|--|--|
| Setup → Distance unit  | • HART<br>• PA<br>• FF                       | • in • ft • mm • m   |
| Setup → Empty calibration  | <ul><li>HART</li><li>PA</li><li>FF</li></ul> | max. 70 m (230 ft)   |
| $Setup \to Full \ calibration$   | <ul><li>HART</li><li>PA</li><li>FF</li></ul> | max. < 70 m (230 ft)                                       |
| Setup $\rightarrow$ Adv. Setup $\rightarrow$ Current output 1/2 $\rightarrow$ Damping      | HART   | 0 to 999.9 s   |
| Setup $\rightarrow$ Adv. Setup $\rightarrow$ Current output 1/2 $\rightarrow$ Failure mode | HART   | <ul><li>Min</li><li>Max</li><li>Last valid value</li></ul> |
| Setup $\rightarrow$ Adv. Setup $\rightarrow$ Current output 1/2 $\rightarrow$ Burst mode   | HART   | Off<br>On  |

# Tagging (TAG)

| Ordering feature                                  | 895: Marking  |
|---|---|
| Option  | Z1: Tagging (TAG), see additional spec.   |
| Position of the measuring point marking           | To be selected in the additional specifications:  Tag plate Stainless Steel Self-adhesive paper label Supplied label/plate RFID TAG RFID TAG + Tag plate Stainless Steel RFID TAG + Self-adhesive paper label RFID TAG + Supplied label/plate |
| Definition of the measuring point designation     | To be defined in the additional specifications: 3 lines containing up to 18 characters each The measuring point designation appears on the selected label and/or the RFID TAG.  |
| Designation in the Electronic<br>Name Plate (ENP) | The first 32 characters of the measuring point designation  |
| Designation on the display module                 | The first 12 characters of the measuring point designation  |

# Services

The following services can be selected via the product structure in the Product Configurator 9:

- PWIS free (PWIS: paint wetting impairment substances)
- Customized parametrization HART → 🖺 104
- Customized parametrization PA  $\Rightarrow$   $\triangleq$  104
- Customized parametrization  $FF \rightarrow \blacksquare 104$
- Without tooling DVD (FieldCare)

<sup>9)</sup> Feature 570 of the product structure

# **Application Packages**

# **Heartbeat Diagnostics**

# Availability

Available in all device versions.

## **Function**

- Continuous self-monitoring of the device.
- Diagnostic messages output to
  - the local display.
  - an asset management system (e.g. FieldCare/DeviceCare).
  - an automation system (e.g. PLC).

# Advantages

- Device condition information is available immediately and processed in time.
- The status signals are classified in accordance with VDI/VDE 2650 and NAMUR recommendation NE 107 and contain information about the cause of the error and remedial action.

## **Detailed description**

See Operating Instructions of the device (→ 🖺 116); chapter "Diagnostics and trouble shooting"

## **Heartbeat Verification**

# **Availability**

Available for the following options of feature 540 "Application Package":

- EH: Heartbeat Verification + Monitoring
- EJ: Heartbeat Verification

## Device functionality checked on demand

- Verification of the correct functioning of the measuring device within specifications.
- The verification result provides information about the condition of the device: **Passed** or **Failed**.
- The results are documented in a verification report.
- The automatically generated report supports the obligation to demonstrate compliance with internal and external regulations, laws and standards.
- Verification is possible without interrupting the process.

# Advantages

- No onsite presence is required to use the function.
- The DTM <sup>10)</sup> triggers verification in the device and interprets the results. No specific knowledge is required on the part of the user.
- The verification report can be used to prove quality measures to a third party.
- Heartbeat Verification can replace other maintenance tasks (e.g. periodic check) or extend the test intervals.

# SIL/WHG-locked devices 11)

- The Heartbeat Verification module contains a wizard for the proof test which must be performed at appropriate intervals for the following applications:
  - SIL (IEC61508/IEC61511)
  - WHG (German Water Resources Act)
- To perform a proof test, the device must be locked (SIL/WHG locking).
- The wizard can be used via FieldCare, DeviceCare or a DTM-based process control system.
- In the case of SIL-locked and WHG-locked devices, it is **not** possible to perform verification without additional measures (e.g. by-passing of the output current) because the output current must be simulated (Increased safety mode) or the level must be approached manually (Expert mode) during subsequent re-locking (SIL/WHG locking).

# **Detailed description**



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<sup>10)</sup> DTM: Device Type Manager; controls device operation via DeviceCare, FieldCare or a DTM-based process control system.

<sup>11)</sup> Only relevant for devices with SIL or WHG approval: order code 590 ("Additional approval"), option LA ("SIL") or LC ("WHG").

Micropilot FMR51, FMR52

# **Heartbeat Monitoring**

## Availability

Available for the following options of feature 540 "Application Package": EH: Heartbeat Verification + Monitoring

#### **Function**

- In addition to the verification parameters, the corresponding parameter values are also logged.
- Existing measured variables, such as the echo amplitude, are used in the Foam detection and Build-up detection wizards.



For Micropilot FMR5x, the **Foam detection** and **Build-up detection** wizards cannot be used together.

## "Foam detection" wizard

- The Heartbeat Monitoring module contains the Foam detection wizard.
- This wizard is used to configure automatic foam detection, which detects foam on the product surface on the basis of the reduced signal amplitude. Foam detection can be linked to a switch output in order to control a sprinkler system, for example, which dissolves the foam.
- This wizard can be used via FieldCare, DeviceCare or a DTM-based process control system.

# "Build-up detection" wizard

- The Heartbeat Monitoring module contains the **Build-up detection** wizard.
- The wizard is used to configure automatic buildup detection, which detects the buildup of deposits on the antenna on the basis of the increased area of the coupling signal. Buildup detection can be linked to a switch output in order to control a compressed air system, for example, to clean the antenna.
- This wizard can be used via FieldCare, DeviceCare or a DTM-based process control system.

# Advantages

- Early detection of changes (trends) to ensure plant availability and product quality.
- Use of information for the proactive planning of measures (e.g. cleaning/maintenance).
- Identification of undesirable process conditions as the basis to optimizing the facility and the processes.
- Automated control of measures to remove foam or buildup.

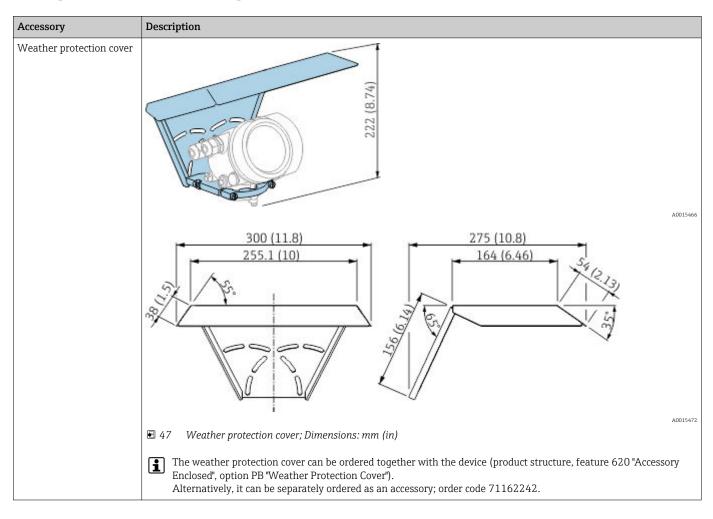
# **Detailed description**



SD01871F

# Accessories

# Device-specific accessories Weather protection cover



### Remote display FHX50

| Accessories          | Description   |
|----------------------|---|
| Remote display FHX50 |   |
|                      | A0019128  |
|                      | <ul> <li>Material:</li> <li>Plastic PBT</li> <li>316L/1.4404</li> <li>Aluminum</li> <li>Degree of protection: IP68 / NEMA 6P and IP66 / NEMA 4x</li> <li>Suitable for display modules:</li> <li>SD02 (push buttons)</li> <li>SD03 (touch control)</li> <li>Connecting cable:</li> <li>Cable supplied with device up to 30 m (98 ft)</li> <li>Standard cable supplied by customer up to 60 m (196 ft)</li> <li>Ambient temperature range: -40 to 80 °C (-40 to 176 °F)</li> <li>Ambient temperature range (option): -50 to 80 °C (-58 to 176 °F)</li> </ul>  |
|                      | <ul> <li>If the remote display should be used, order the device version "Prepared for display FHX50" (feature 030, version L, M or N). For the FHX50, you must select option A: "Prepared for display FHX50" under feature 050 "Measuring device version".</li> <li>If the device version "Prepared for display FHX50" was not originally ordered and a FHX50 display is to be retrofitted, you must select version B "Not prepared for display FHX50" under feature 050: "Measuring device version" when ordering the FHX50. In this case, a retrofit kit for the device is supplied with the FHX50. The kit can be used to prepare the device so that the FHX50 can be used.</li> </ul> |
|                      | Use of the FHX50 may be restricted for transmitters with an approval. A device can only be retrofitted with the FHX50 if the option L, M or N ("Prepared for FHX50") is listed under <i>Basic specifications</i> , item 4 "Display, operation" in the Safety Instructions (XA) for the device.  Also pay attention to the Safety Instructions (XA) of the FHX50.  |
|                      | Retrofitting is not possible on transmitters with:  • An approval for use in areas with flammable dust (dust ignition-proof approval)  • Ex nA type of protection   |
|                      | For details, see document SD01007F.   |

1) This range is valid if option JN "Ambient temperature transmitter -50 °C (-58 °F)" has been selected in ordering feature 580 "Test, Certificate". If the temperature is permanently below -40 °C (-40 °F), failure rates may be increased.

### Horn protection for horn antenna

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This section is **not** valid for the following options of ordering feature 610 "Accessory Mounted".

- OU: ...mm antenna extension
- OV: ... inch antenna extension

For these cases:  $\rightarrow \blacksquare 111$ 

| Accessory D | Description   |
|-------------|---|
| Ø L F P •   | Horn protection  Diameter of horn protection (see table below)  Diameter of horn protection (see table below) |

### Horn protection for FMR51

| Antenna 1)        | Order code horn protection | Dimensions antenna + horn protection |                  |         |
|-------------------|----------------------------|--------------------------------------|------------------|---------|
|                   |                            | L 2)                                 | Ød               | ØD      |
| BC: Horn 80mm/3"  | 71105890                   | 238 mm (9.4 in)                      | 96 mm (3.78 in)  | ≥ DN100 |
| BD: Horn 100mm/4" | 71105889                   | 302 mm (11.9 in)                     | 116 mm (4.57 in) | ≥ DN150 |

- 1) Feature 070 of the product structure
- $\ \, \hbox{A different length is valid for antennas with variable antenna extension (ordering feature 610, option OU or OV)}. \\$ 
  - The horn protection can also be ordered together with the device. Product structure: Feature 610 "Accessory Mounted", option OW "Horn protection, PTFE".

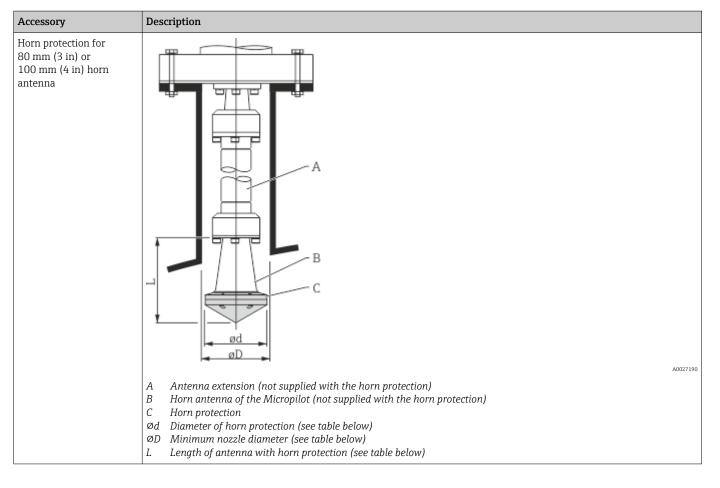
### Horn protection for horn antenna with variable antenna extension

i

This section is valid for the following options of ordering feature 610 "Accdessory Mounted".

- OU: ...mm antenna extension
- OV: ... inch antenna extension

For any other device version:  $\rightarrow \implies 110$ 



### Horn protection for FMR51 with variable antenna extension

| Antenna 1)        | Order code horn protection | Dimensions antenna + horn protection |                  |         |
|-------------------|----------------------------|--------------------------------------|------------------|---------|
|                   |                            | L                                    | Ød               | ØD      |
| BC: Horn 80mm/3"  | 71105890                   | 203 mm (8 in)                        | 96 mm (3.78 in)  | ≥ DN100 |
| BD: Horn 100mm/4" | 71105889                   | 267 mm (10.5 in)                     | 116 mm (4.57 in) | ≥ DN150 |

1) Feature 070 of the product structure

### Overvoltage protection

### Accessory Description Overvoltage protection for 2-wire-devices OVP10 (1 channel) OVP20 (2 channel) A0021734 Technical data • Resistance per channel: 2 \* 0.5 $\Omega_{max}$ • Threshold DC voltage: 400 to 700 V ■ Threshold impulse voltage: < 800 V • Capacitance at 1 MHz: < 1.5 pF Nominal arrest impulse voltage (8/20 μs): 10 kA Suited for wire cross-sections: 0.2 to 2.5 mm<sup>2</sup> (24 to 14 AWG) Ordering with device $The \ overvoltage \ protection \ module \ is \ preferably \ ordered \ with \ the \ device. \ See \ product \ structure, \ feature \ 610$ "Accessory mounted", option NA "Overvoltage protection". Separate ordering of the module is only necessary if a device is to retrofitted with the overvoltage protection. Order code for retrofitting For 1-channel devices (feature 020, option A) OVP10: 71128617 • For 2-channel devices (feature 020, option B, C, E or G) OVP20:71128619 Hosuing lid for retrofitting In order to keep the necessary safety distances, the housing lid needs to be replaced if the device is retrofitted with the overvoltage protection. Depending on the housing type, the order code of the suitable lid is as follows: • GT18 housing: Lid 71185516 • GT19 housing: Lid 71185518 • GT20 housing: Lid 71185516 Restrictions for retrofitting Depending on the approval of the transmitter the usage of the OVP module may be restricted. A device may only be retrofitted with an OVP module if the option NA (overvoltage protection) is quoted unter Optional Specifications in the Safety Instructions (XA) pertaining to the device. For details refer to SD01090F.

### Gas-tight feedthrough

| Accessory             | Description   |
|-----------------------|---|
| Gas-tight feedthrough | Chemically inert glass feedthrough; prevents migration of gases into the electronics housing.  To be ordered with the device: product structure, feature 610 "Accessory Mounted", option NC "Gas-tight feedthrough" |

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### Bluetooth module for HART devices

| Accessory                  | Description   |
|----------------------------|---|
| Accessory Bluetooth module | Poscription  ■ Quick and easy commissioning via SmartBlue (app) ■ No additional tools or adapters required ■ Signal curve via SmartBlue (app) ■ Encrypted single point-to-point data transmission (tested by Fraunhofer institue) and password protected communication via Bluetooth® wireless technology ■ Range under reference conditions: > 10 m (33 ft) ■ When using the Bluetooth module the minimum supply voltage increases by up to 3 V. ■ Ordering with device The Bluetooth module is preferably ordered with the device. See product structure, feature 610 "Accessory" |
|                            | Mounted", option NF "Bluetooth". A separate order is only necessary in case of retrofitting.  Order code for retrofitting  Order code for retrofitting  |
|                            | Bluetooth module (B110): /13//355   |
|                            | Restrictions in case of retrofitting Depending on the approval of the transmitter, application of the Bluetooth module may be restricted. A device may only be retrofitted with a Bluetooth module if the option NF (Bluetooth) is listed in the associated Safety Instructions (XA) under Optional specifications.   |
|                            | For details refer to SD02252F.  |
|                            |   |

## Communication-specific accessories

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| Accessory               | Description  |
|-------------------------|--|
| Commubox FXA195<br>HART | For intrinsically safe HART communication with FieldCare via the USB interface.  For details refer to Technical Information TI00404F |

| Accessory       | Description   |
|-----------------|---|
| Commubox FXA291 | Connects Endress+Hauser field devices with CDI interface (= Endress+Hauser Common Data Interface) to the USB interface of a computer.  Order code: 51516983 |
|                 | For details refer to Technical Information TI00405C   |

| Accessory                    | Description   |
|------------------------------|---|
| HART Loop Converter<br>HMX50 | Evaluates the dynamic HART variables and converts them to analog current signals or limit values.  Order code: 71063562 |
|                              | For details refer to Technical Information TI00429F and Operating Instructions BA00371F                                 |

| Accessory                     | Description   |
|-------------------------------|---|
| WirelessHART Adapter<br>SWA70 | Connects field devices to a WirelessHART network.  The WirelessHART adapter can be mounted directly at a HART device and is easly integrated into an existing HART network. It ensures safe data transmission and can be operated in parallel with other wireless networks.  For details refer to Operating Instructions BA00061S |

| Accessories                    | Description   |
|--------------------------------|---|
| Connect Sensor<br>FXA30/FXA30B | Fully integrated, battery-powered gateway for simple applications with SupplyCare Hosting. Up to 4 field devices with 4 to 20 mA communication (FXA30/FXA30B), serial Modbus (FXA30B) or HART (FXA30B) can be connected. With its robust design and ability to run for years on the battery, it is ideal for remote monitoring in isolated locations. Version with LTE (USA, Canada and Mexico only) or 3G mobile transmission for worldwide communication.  For details, see "Technical Information" TI01356S and Operating Instructions BA01710S. |

| Accessories        | Description  |
|--------------------|--|
| Fieldgate<br>FXA42 | Fieldgates enable communication between connected 4 to 20 mA, Modbus RS485 and Modbus TCP devices and SupplyCare Hosting or SupplyCare Enterprise. The signals are transmitted either via Ethernet TCP/IP, WLAN or mobile communications (UMTS). Advanced automation capabilities are available, such as an integrated Web-PLC, OpenVPN and other functions. |
|                    | For details, see "Technical Information" TI01297S and Operating Instructions BA01778S.   |

| Accessories                        | Description   |
|------------------------------------|---|
| SupplyCare<br>Enterprise<br>SCE30B | Inventory management software that visualizes levels, volumes, masses, temperatures, pressures, densities or other tank parameters. The parameters are recorded and transmitted by means of gateways of the type Fieldgate FXA42.  This Web-based software is installed on a local server and can also be visualized and operated with mobile terminals such as a smartphone or tablet. |
|                                    | For details, see "Technical Information" TI01228S and Operating Instructions BA00055S   |

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| Accessories                 | Description  |
|-----------------------------|--|
| SupplyCare<br>Hosting SCH30 | Inventory management software that visualizes levels, volumes, masses, temperatures, pressures, densities or other tank parameters. The parameters are recorded and transmitted by means of gateways of the type Fieldgate FXA42, FXA30 and FXA30B.  SupplyCare Hosting is offered as a hosting service (Software as a Service, SaaS). In the Endress+Hauser portal, the user is provided with the data over the Internet.  For details, see "Technical Information" TI01229S and Operating Instructions BA00050S. |

| Accessory          | Description   |
|--------------------|---|
| Field Xpert SFX350 | Field Xpert SFX350 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION fieldbus devices in the <b>non-Ex area</b> .  For details, see Operating Instructions BA01202S |

| Accessory          | Description  |
|--------------------|--|
| Field Xpert SFX370 | Field Xpert SFX370 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION fieldbus devices in the <b>non-Ex area</b> and the <b>Ex area</b> .  For details, see Operating Instructions BA01202S |

### Service-specific accessories

| Accessory         | Description   |
|-------------------|---|
| DeviceCare SFE100 | Configuration tool for HART, PROFIBUS and FOUNDATION Fieldbus devices   |
|                   | Technical Information TI01134S  |
|                   | <ul> <li>DeviceCare is available for download at www.software-products.endress.com. The download requires a registration in the Endress+Hauser software portal.</li> <li>Alternatively, a DeviceCare DVD can be ordered with the device. Product structure: Feature 570 "Service", Option IV "Tooling DVD (DeviceCare Setup)".</li> </ul> |
| FieldCare SFE500  | 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.  Technical Information TI00028S  |

### System components

| Accessory  | Description   |  |  |
|--|---|--|--|
| Graphic Data Manager Memograph M  The graphic data manager Memograph M provides information on all process variables. Measured values are recorded correctly, limit value monitored and measuring points analyzed. The data are stored in the internal memory and also on an SD card or USB stick. |   |  |  |
|  | For details refer to Technical Information TI00133R and Operating Instructions BA00247R   |  |  |
| RN221N   | Active barrier with power supply for safe separation of 4 to 20 mA current circuits. Provides bi-directional HART transmission.                                 |  |  |
|  | For details refer to Technical Information TI00073R and Operating Instructions BA00202R   |  |  |
| RNS221   | Transmitter supply for 2-wire sensors or transmitters exclusively for non-Ex areas. Provides bi-directional communication using the HART communication sockets. |  |  |
|  | For details refer to Technical Information TI00081R and Operating Instructions KA00110R   |  |  |

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### **Documentation**



The following document types are available:

In the Download Area of the Endress+Hauser Internet site: www.endress.com → Download

#### Standard documentation

### Micropilot FMR51, FMR52

Correlation of documentations to the device:

| Device | Power supply, output | Communication       | Document type                       | Document code  |  |
|--------|----------------------|---------------------|-------------------------------------|----------------|--|
| FMR51  | A, B, C, K, L        | HART                | Operating Instructions              | BA01049F/00/EN |  |
| FMR52  |                      |                     | Brief Operating Instructions        | KA01100F/00/EN |  |
|        |                      |                     | Description of Device<br>Parameters | GP01014F/00/EN |  |
|        | G                    | PROFIBUS PA         | Operating Instructions              | BA01125F/00/EN |  |
|        |                      |                     | Brief Operating Instructions        | KA01129F/00/EN |  |
|        |                      |                     | Description of Device<br>Parameters | GP01018F/00/EN |  |
|        | Е                    | FOUNDATION Fieldbus | Operating Instructions              | BA01121F/00/EN |  |
|        |                      |                     | Brief Operating Instructions        | KA01125F/00/EN |  |
|        |                      |                     | Description of Device<br>Parameters | GP01017F/00/EN |  |

# **Supplementary** documentation

| Application Package 1)   | Document type         | Document code |
|--|-----------------------|---------------|
| <ul><li>EH: Heartbeat Verification + Monitoring</li><li>EJ: Heartbeat Verification</li></ul> | Special documentation | SD01871F      |

1) Feature 540 of the product structure

| Device                  | Document type                       | Document code |  |
|-------------------------|-------------------------------------|---------------|--|
| Fieldgate FXA520        | Technical Information               | TI00369F      |  |
| Tank Side Monitor NRF81 | Technical Information               | TI01251G      |  |
|                         | Operating Instructions              | BA01465G      |  |
|                         | Description of Device<br>Parameters | GP01083G      |  |

### 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.

| Feature | Approval   | Available for                         | Feature 020 "Power Supply; Output" |          |                 |                                  |                                  |
|---------|--|---------------------------------------|------------------------------------|----------|-----------------|----------------------------------|----------------------------------|
| 010     |  |                                       | A 1)                               | B 2)     | C <sub>3)</sub> | E <sup>4)</sup> /G <sup>5)</sup> | K <sup>6)</sup> /L <sup>7)</sup> |
| ВА      | ATEX: II 1 G Ex ia IIC T6-T1 Ga                      | <ul><li>FMR51</li><li>FMR52</li></ul> | XA00677F                           | XA00677F | XA00677F        | XA00685F                         | -                                |
| BB      | ATEX: II 1/2 G Ex ia IIC T6-T1 Ga/Gb                 | <ul><li>FMR51</li><li>FMR52</li></ul> | XA00677F                           | XA00677F | XA00677F        | XA00685F                         | -                                |
| ВС      | ATEX: II 1/2 G Ex d [ia] IIC T6-T1 Ga/Gb             | <ul><li>FMR51</li><li>FMR52</li></ul> | XA00680F                           | XA00680F | XA00680F        | XA00688F                         | XA00680F                         |
| BD      | ATEX: II 1/2/3 G Ex ic [ia Ga] IIC T6-T1<br>Ga/Gb/Gc | <ul><li>FMR51</li><li>FMR52</li></ul> | XA00678F                           | XA00678F | XA00678F        | XA00686F                         | XA00678F                         |
| BG      | ATEX: II 3 G Ex nA IIC T6-T1 Gc                      | ■ FMR51<br>■ FMR52                    | XA00679F                           | XA00679F | XA00679F        | XA00687F                         | XA00679F                         |

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| Feature | Approval A  | Available for                         | Feature 020 "Power Supply; Output" |                 |                 |                                  |                                  |
|---------|---|---------------------------------------|------------------------------------|-----------------|-----------------|----------------------------------|----------------------------------|
| 010     |   |                                       | A 1)                               | B <sup>2)</sup> | C <sub>3)</sub> | E <sup>4)</sup> /G <sup>5)</sup> | K <sup>6)</sup> /L <sup>7)</sup> |
| ВН      | ATEX: II 3 G Ex ic IIC T6-T1 Gc   | <ul><li>FMR51</li><li>FMR52</li></ul> | XA00679F                           | XA00679F        | XA00679F        | XA00687F                         | XA00679I                         |
| BL      | ATEX: II 1/2/3 G Ex nA [ia Ga] IIC T6-T1<br>Ga/Gb/Gc                              | <ul><li>FMR51</li><li>FMR52</li></ul> | XA00678F                           | XA00678F        | XA00678F        | XA00686F                         | XA00678I                         |
| B2      | ATEX: II 1/2 G Ex ia IIC T6-T1 Ga/Gb<br>ATEX: II 1/2 D Ex ia IIIC Txx°C Da/Db     | <ul><li>FMR51</li><li>FMR52</li></ul> | XA00683F                           | XA00683F        | XA00683F        | XA00691F                         | -                                |
| В3      | ATEX: II 1/2 G Ex d [ia] IIC T6-T1 Ga/Gb<br>ATEX: II 1/2 D Ex ta IIIC Txx°C Da/Db | <ul><li>FMR51</li><li>FMR52</li></ul> | XA00684F                           | XA00684F        | XA00684F        | XA00692F                         | XA006841                         |
| B4      | ATEX:II 1/2 G Ex ia IIC T6-T1 Ga/Gb<br>ATEX: II 1/2 G Ex d [ia] IIC T6-T1 Ga/Gb   | <ul><li>FMR51</li><li>FMR52</li></ul> | XA00681F                           | XA00681F        | XA00681F        | XA00689F                         | -                                |
| CD      | CSA C/US DIP Cl.II,III Div.1 Gr.E-G   | FMR51                                 | XA01113F                           | XA01113F        | XA01113F        | XA01115F                         | XA011131                         |
| C2      | CSA C/US IS Cl.I,II,III Div.1 Gr.A-G, NI Cl.1 Div. 2, Ex ia                       | <ul><li>FMR51</li><li>FMR52</li></ul> | XA01112F                           | XA01112F        | XA01112F        | XA01114F                         | -                                |
| C3      | CSA C/US XP Cl.I,II,III Div.1 Gr.A-G, NI Cl.1 Div.2, Ex d                         | <ul><li>FMR51</li><li>FMR52</li></ul> | XA01113F                           | XA01113F        | XA01113F        | XA01115F                         | XA01113I                         |
| FB      | FM IS Cl.I,II,III Div.1 Gr.A-G, AEx ia, NI Cl.1 Div.2                             | <ul><li>FMR51</li><li>FMR52</li></ul> | XA01116F                           | XA01116F        | XA01116F        | XA01118F                         | -                                |
| FD      | FM XP Cl.I,II,III Div.1 Gr.A-G, AEx d, NI Cl.1 Div.2                              | <ul><li>FMR51</li><li>FMR52</li></ul> | XA01117F                           | XA01117F        | XA01117F        | XA01119F                         | XA01117I                         |
| FE      | FM DIP Cl.II,III Div.1 Gr.E-G   | FMR51                                 | XA01117F                           | XA01117F        | XA01117F        | XA01119F                         | XA011171                         |
| IA      | IECEx: Ex ia IIC T6-T1 Ga   | <ul><li>FMR51</li><li>FMR52</li></ul> | XA00677F                           | XA00677F        | XA00677F        | XA00685F                         | -                                |
| IB      | IECEx: Ex ia IIC T6-T1 Ga/Gb  | <ul><li>FMR51</li><li>FMR52</li></ul> | XA00677F                           | XA00677F        | XA00677F        | XA00685F                         | -                                |
| IC      | IECEx: Ex d [ia] IIC T6-T1 Ga/Gb  | <ul><li>FMR51</li><li>FMR52</li></ul> | XA00680F                           | XA00680F        | XA00680F        | XA00688F                         | XA006801                         |
| ID      | IECEx: Ex ic [ia Ga] IIC T6-T1 Ga/Gb/Gc   | <ul><li>FMR51</li><li>FMR52</li></ul> | XA00678F                           | XA00678F        | XA00678F        | XA00686F                         | XA006781                         |
| IG      | IECEx: Ex nA IIC T6-T1 Gc   | <ul><li>FMR51</li><li>FMR52</li></ul> | XA00679F                           | XA00679F        | XA00679F        | XA00687F                         | XA006791                         |
| IH      | IECEx: Ex ic IIC T6-T1 Gc   | <ul><li>FMR51</li><li>FMR52</li></ul> | XA00679F                           | XA00679F        | XA00679F        | XA00687F                         | XA006791                         |
| IL      | IECEx: Ex nA [ia Ga] IIC T6-T1 Ga/Gb/Gc   | <ul><li>FMR51</li><li>FMR52</li></ul> | XA00678F                           | XA00678F        | XA00678F        | XA00686F                         | XA00678I                         |
| I2      | IECEx: Ex ia IIC T6-T1 Ga/Gb<br>IECEx: Ex ia IIIC Txx°C Da/Db                     | <ul><li>FMR51</li><li>FMR52</li></ul> | XA00683F                           | XA00683F        | XA00683F        | XA00691F                         | -                                |
| I3      | IECEx: Ex d [ia] IIC T6-T1 Ga/Gb<br>IEXEx: Ex ta IIIC Txx°C Da/Db                 | <ul><li>FMR51</li><li>FMR52</li></ul> | XA00684F                           | XA00684F        | XA00684F        | XA00692F                         | XA006841                         |
| I4      | IECEx: Ex ia IIC T6-T1 Ga/Gb<br>IECEx: Ex d [ia] IIC T6-T1 Ga/Gb                  | <ul><li>FMR51</li><li>FMR52</li></ul> | XA00681F                           | XA00681F        | XA00681F        | XA00689F                         | -                                |
| JA      | JPN Ex d ia IIC T4 Ga/Gb  | <ul><li>FMR51</li><li>FMR52</li></ul> | XA01716F                           | XA01716F        | -               | -                                | -                                |
| JC      | JPN Ex d [ia] IIC T4 Ga/Gb  | <ul><li>FMR51</li><li>FMR52</li></ul> | XA01717F                           | XA01717F        | -               | -                                | -                                |
| JD      | JPN Ex d [ia] IIC T1 Ga/Gb  | FMR51                                 | XA01717F                           | XA01717F        | -               | -                                | -                                |
| JE      | JPN Ex d [ia] IIC T2 Ga/Gb  | FMR51                                 | XA01717F                           | XA01717F        |                 |                                  |                                  |
| JF      | JPN Ex d [ia] IIC T3 Ga/Gb  | FMR52                                 | XA01717F                           | XA01717F        | -               | -                                | -                                |
| KA      | KC Ex ia IIC T6 Ga  | <ul><li>FMR51</li><li>FMR52</li></ul> | XA01045F                           | XA01045F        | XA01045F        | XA01047F                         | -                                |

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| Feature | Approval  | Available for                         | Feature 020 "Power Supply; Output"  |   |   |   |           |
|---------|---|---------------------------------------|---|---|---|---|-----------|
| 010     |   |                                       | A 1)  | B 2)  | C 3)  | E <sup>4)</sup> /G <sup>5)</sup>  | K 6)/L 7) |
| КВ      | KC Ex ia IIC T6 Ga/Gb                                   | <ul><li>FMR51</li><li>FMR52</li></ul> | XA01045F  | XA01045F  | XA01045F  | XA01047F  | -         |
| KC      | KC Ex d[ia] IIC T6                                      | <ul><li>FMR51</li><li>FMR52</li></ul> | XA01046F  | XA01046F  | XA01046F  | XA01048F  | XA01046F  |
| MA      | INMETRO: Ex ia IIC T6 Ga                                | <ul><li>FMR51</li><li>FMR52</li></ul> | XA01286F  | XA01287F  | XA01288F  | XA01296F  | -         |
| MC      | INMETRO: Ex d[ia] IIC T6 Ga/Gb                          | <ul><li>FMR51</li><li>FMR52</li></ul> | XA01292F  | XA01292F  | XA01293F  | XA01298F  | XA01294F  |
| МН      | INMETRO: Ex ic IIC T6 Gc                                | <ul><li>FMR51</li><li>FMR52</li></ul> | XA01289F  | XA01290F  | XA01291F  | XA01297F  | -         |
| NA      | NEPSI Ex ia IIC T6 Ga                                   | <ul><li>FMR51</li><li>FMR52</li></ul> | XA01199F  | XA01199F  | XA01199F  | XA01208F  | -         |
| NB      | NEPSI Ex ia IIC T6 Ga/Gb                                | <ul><li>FMR51</li><li>FMR52</li></ul> | XA01199F  | XA01199F  | XA01199F  | XA01208F  | -         |
| NC      | NEPSI Ex d[ia] IIC T6 Ga/Gb                             | <ul><li>FMR51</li><li>FMR52</li></ul> | XA01202F  | XA01202F  | XA01202F  | XA01211F  | XA01202F  |
| NG      | NEPSI Ex nA II T6 Gc                                    | <ul><li>FMR51</li><li>FMR52</li></ul> | XA01201F  | XA01201F  | XA01201F  | XA01210F  | XA01201F  |
| NH      | NEPSI Ex ic IIC T6 Gc                                   | <ul><li>FMR51</li><li>FMR52</li></ul> | XA01201F  | XA01201F  | XA01201F  | XA01210F  | XA01201F  |
| N2      | NEPSI Ex ia IIC T6 Ga/Gb, Ex iaD 20/21 T85<br>90oC      | <ul><li>FMR51</li><li>FMR52</li></ul> | XA01205F  | XA01205F  | XA01205F  | XA01214F  | -         |
| N3      | NEPSI Ex d[ia] IIC T6 Ga/Gb, DIP A20/21<br>T8590oC IP66 | <ul><li>FMR51</li><li>FMR52</li></ul> | XA01206F  | XA01206F  | XA01206F  | XA01215F  | XA01206F  |
| 8A      | FM/CSA IS+XP Cl.I,II,III Div.1 Gr.A-G                   | • FMR51<br>• FMR52                    | <ul><li>XA01112F</li><li>XA01113F</li><li>XA01116F</li><li>XA01117F</li></ul> | <ul><li>XA01112F</li><li>XA01113F</li><li>XA01116F</li><li>XA01117F</li></ul> | <ul><li>XA01112F</li><li>XA01113F</li><li>XA01116F</li><li>XA01117F</li></ul> | <ul><li>XA01114F</li><li>XA01115F</li><li>XA01118F</li><li>XA01119F</li></ul> | -         |

- 1) 2-wire; 4-20mA HART
- 2) 2-wire; 4-20mA HART, switch output
- 3) 2-wire; 4-20mA HART, 4-20mA
- 4) 2-wire; FOUNDATION Fieldbus, switch output
- 5) 2-wire; PROFIBUS PA, switch output
- 6) 4-wire 90-253VAC; 4-20mA HART
- 4-wire 10.4-48VDC; 4-20mA HART

For certified devices the relevant Safety Instructions (XA) are indicated on the nameplate.

If the device is prepared for the remote display FHX50 (product structure: feature 030: Display, Operation", option L or M), the Ex marking of some certificates changes according to the following table 12):

| Feature 010<br>("Approval") | Feature 030 ("Display,<br>Operation") | Ex marking   |
|-----------------------------|---------------------------------------|--|
| BG                          | L, M or N                             | ATEX II 3G Ex nA [ia Ga] IIC T6-T1 Gc  |
| ВН                          | L, M or N                             | ATEX II 3G Ex ic [ia Ga] IIC T6-T1 Gc  |
| В3                          | L, M or N                             | ATEX II 1/2G Ex d [ia] IIC T6-T1 Ga/Gb,<br>ATEX II 1/2D Ex ta [ia Db] IIIC Txx°C Da/Db |
| IG                          | L, M or N                             | IECEx Ex nA [ia Ga] IIC T6-T1 Gc   |
| IH                          | L, M or N                             | IECEx Ex ic [ia Ga] IIC T6-T1 Gc   |

The marking of certificates not mentioned in this table are not affected by the FHX50.

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| Feature 010<br>("Approval") | Feature 030 ("Display,<br>Operation") | Ex marking   |
|-----------------------------|---------------------------------------|--|
| I3                          | L, M or N                             | IECEx Ex d [ia] IIC T6-T1 Ga/Gb,<br>IECEx Ex ta [ia Db] IIIC Txx°C Da/Db |
| МН                          | L, M or N                             | Ex ic [ia Ga] IIC T6 Gc  |
| NG                          | L, M or N                             | NEPSI Ex nA [ia Ga] IIC T6-T1 Gc   |
| NH                          | L, M or N                             | NEPSI Ex ic [ia Ga] IIC T6-T1 Gc   |
| N3                          | L, M or N                             | NEPSI Ex d [ia] IIC T6-T1 Ga/Gb, DIP A20/21 [ia D] TA, Txx°C IP6X        |

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