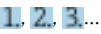



Heartbeat Verification 84
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

Accessories 86
Device-specific accessories 86
Communication-specific accessories 93
Service-specific accessories 94
System components 94

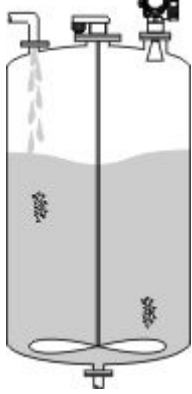
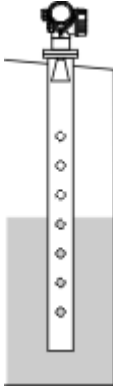
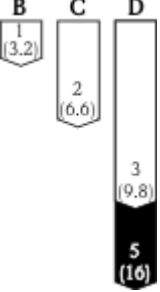
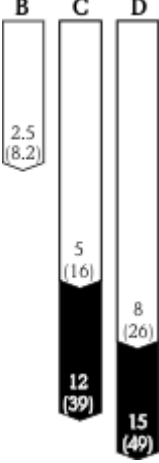
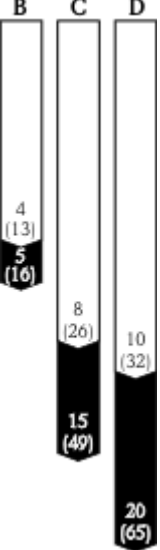

Documentation 95
Standard documentation 95
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Symbols in graphics

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

Symbols at the device

Symbol	Meaning
	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.

Process tank with agitator			Stilling well
 <p style="text-align: center;">A0018837</p>			 <p style="text-align: right;">A0018842</p>
Turbulent surface (e.g. filling from above, agitators, baffles)			
Antenna size			Antenna size
40 mm (1½ in)	80 mm (3 in)	100 mm (4 in)	40 ... 100 mm (1½ ... 4 in)
 <p style="text-align: center;">A0018867</p>	 <p style="text-align: center;">A0018869</p>	 <p style="text-align: center;">A0018870</p>	 <p style="text-align: right;">A0018851</p>
Measuring range [m (ft)]			

Legend

<input type="checkbox"/>	Measuring range of the standard version
<input checked="" type="checkbox"/>	Measuring range for the "Advanced dynamics" application package (product structure: feature 540: "Application Package", Option EM: "Advanced dynamics")

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 ¹⁾
1 m (3.3 ft)	< 12 nW/cm ²	< 64 nW/cm ²
5 m (16 ft)	< 0.4 nW/cm ²	< 2.5 nW/cm ²

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 <i>SmartBlue</i> 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"

Devices with PROFIBUS PA and FOUNDATION Fieldbus always have a 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	$U = 16 \text{ to } 35 \text{ V}_{\text{DC}}, I = 0 \text{ to } 40 \text{ mA}$
Internal resistance	$R_i < 880 \Omega$ 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 1350 V _{DC} to power supply and 500 V _{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 device variables	<ul style="list-style-type: none"> ■ Level linearized ■ Distance ■ Terminal voltage ■ Electronic temperature ■ Relative echo amplitude ■ Diagnostic values, Advanced diagnostics
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 pre-programmed. 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: <ul style="list-style-type: none"> ■ www.endress.com ■ www.fieldcommgroup.org
HART load	min. 250 Ω

HART device variables	<p>The measured values can be freely assigned to the device variables.</p> <p>Measured values for PV (primary variable)</p> <ul style="list-style-type: none"> ▪ Level linearized ▪ Distance ▪ Electronic temperature ▪ Relative echo amplitude ▪ Area of incoupling ▪ Analog output adv. diagnostics 1 ▪ Analog output adv. diagnostics 2 <p>Measured values for SV, TV, FV (second, third and fourth variable)</p> <ul style="list-style-type: none"> ▪ 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 style="list-style-type: none"> ▪ Burst mode ▪ Additional transmitter status

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

Manufacturer ID	17 (0x11)
Ident number	0x1559
Profile version	3.02
GSD file	Information and files under:
GSD file version	<ul style="list-style-type: none"> ▪ www.endress.com ▪ www.profibus.org
Output values	<p>Analog Input:</p> <ul style="list-style-type: none"> ▪ Level linearized ▪ Distance ▪ Terminal voltage ▪ Electronic temperature ▪ Absolute echo amplitude ▪ Relative echo amplitude ▪ Analog output adv. diagnostics 1 ▪ Analog output adv. diagnostics 2 <p>Digital Input:</p> <ul style="list-style-type: none"> ▪ Digital output AD 1 ▪ Digital output AD 2 ▪ Switch output

Input values	<p>Analog Output:</p> <ul style="list-style-type: none"> ▪ Analog value from PLC (for sensor block external pressure to compensate gas phase effects) ▪ Analog value from PLC to be indicated on the display <p>Digital Output:</p> <ul style="list-style-type: none"> ▪ Extended diagnostic block ▪ Level limiter ▪ Sensor block measurement on ▪ Sensor block save history on ▪ Status output
Supported functions	<ul style="list-style-type: none"> ▪ Identification & Maintenance Einfachste Geräteidentifizierung seitens des Leitsystems und des Typenschildes ▪ Automatic Ident Number Adoption GSD compatibility mode with respect to the preceding product Micropilot M FMR2xx ▪ Physical Layer Diagnostics Installation check of the PROFIBUS segment and the Micropilot FMR5x via the terminal voltage and telegram surveillance. ▪ PROFIBUS Up-/Download Up to 10 times faster writing and reading of parameters via PROFIBUS up-/download ▪ Condensed Status Simple and self-explanatory diagnostic information by categorization of occurring diagnostic messages.

FOUNDATION Fieldbus

Manufacturer ID	0x452B48
Device type	0x1028
Device Revision	0x01
DD Revision	Information and files can be found:
CFF Revision	<ul style="list-style-type: none"> ▪ www.endress.com ▪ www.fieldcommgroup.org
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	<p>Following methods are supported:</p> <ul style="list-style-type: none"> ▪ Restart ▪ ENP Restart ▪ Setup ▪ Linearization ▪ Self Check
Virtual Communication Relationships (VCRs)	
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 style="list-style-type: none"> ▪ Level or volume ¹⁾ (Channel 1) ▪ Distance (Channel 2)
Advanced Setup 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 Block	Contains diagnostic information	no output values
Advanced Diagnostic Transducer Block	Contains parameters for the Advanced Diagnostic	no output values
Expert Configuration Transducer Block	Contains parameters which require detailed knowledge of the functionalities of the device	no output values
Expert Information Transducer Block	Contains information about the state of the device	no output values
Service Sensor Transducer Block	Contains parameters which can only be operated by Endress+Hauser service personnel	no output values
Service Information Transducer Block	Contains information on the state of device which is relevant for service operations	no output values
Data Transfer Transducer 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

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 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 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 Analog Output Block	This block is used to transfer analog data from the bus into the device	1	0	20 ms	standard
Mutiple Discrete Output Block	This block is used to transfer discrete data from the bus to the device.	1	0	20 ms	standard

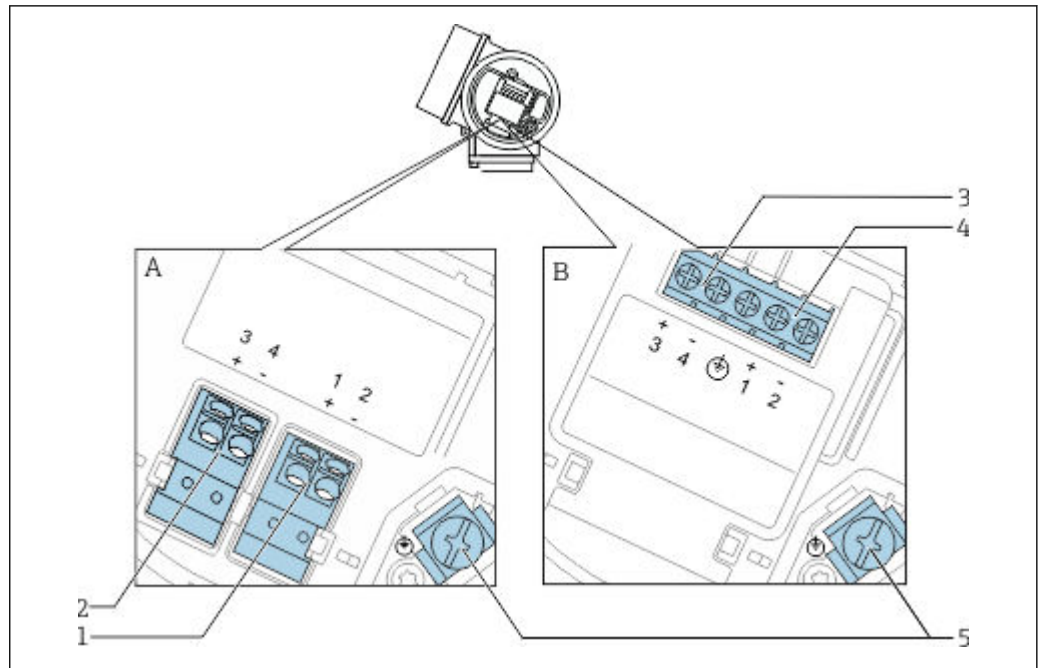
DRAFT DRAFT

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-loop-control in the field including cascade and feedforward.	1	1	25 ms	standard
Arithmetic 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 Characterizer 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 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 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 Block		1	1	25 ms	standard

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

DRAFT DRAFT

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

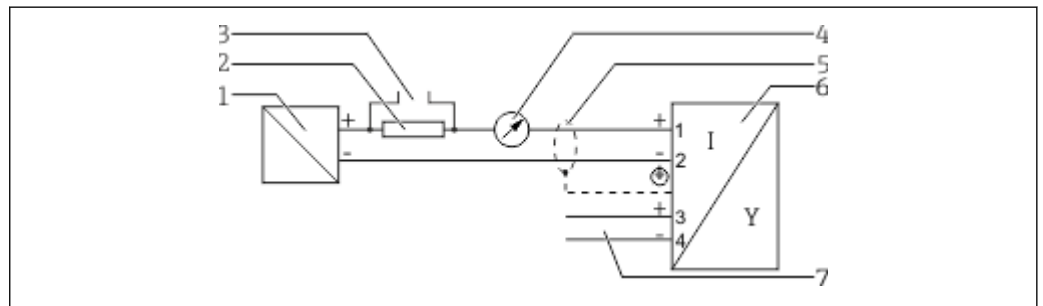


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▣ 4 Terminal assignment 2-wire: 4-20 mA HART, switch output

- 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

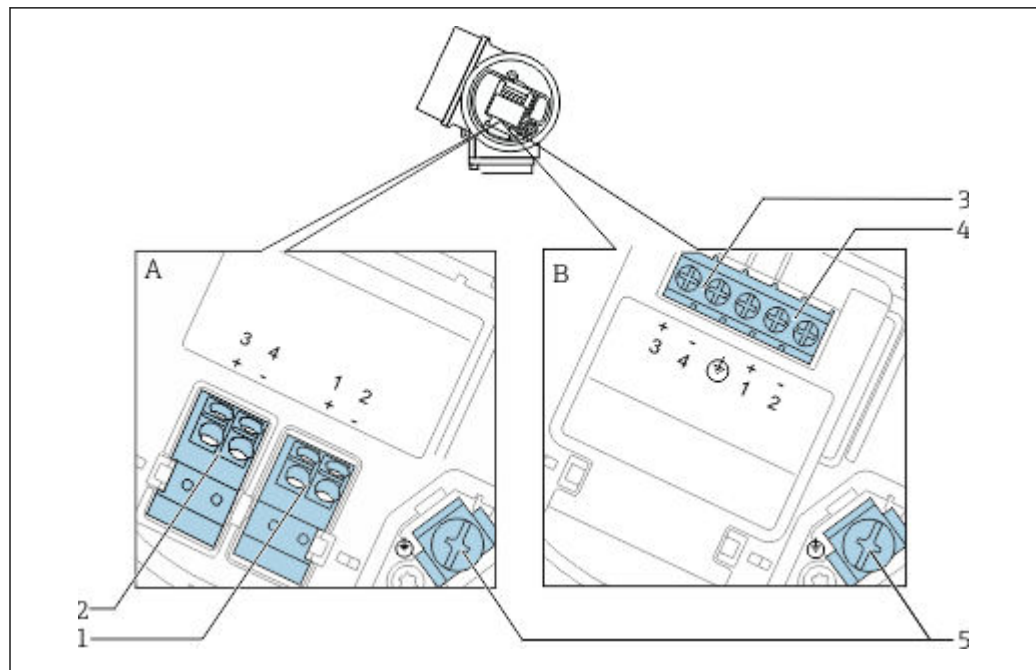


A0036501

▣ 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



A0036500

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

A Without integrated overvoltage protection

B With integrated overvoltage protection

1 Connection current output 1, 4-20 mA HART passive: terminals 1 and 2, without integrated overvoltage protection

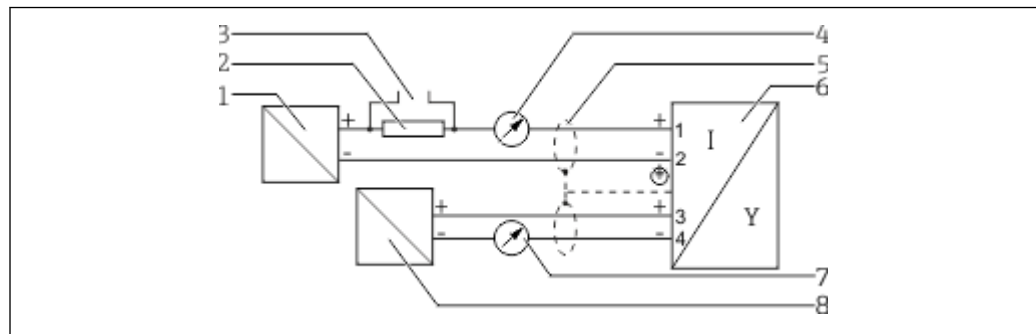
2 Connection current output 2, 4-20 mA: terminals 3 and 4, without integrated overvoltage protection

3 Connection current output 2, 4-20 mA: terminals 3 and 4, with integrated overvoltage protection

4 Connection current output 1, 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, 4-20 mA



A0036502

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

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

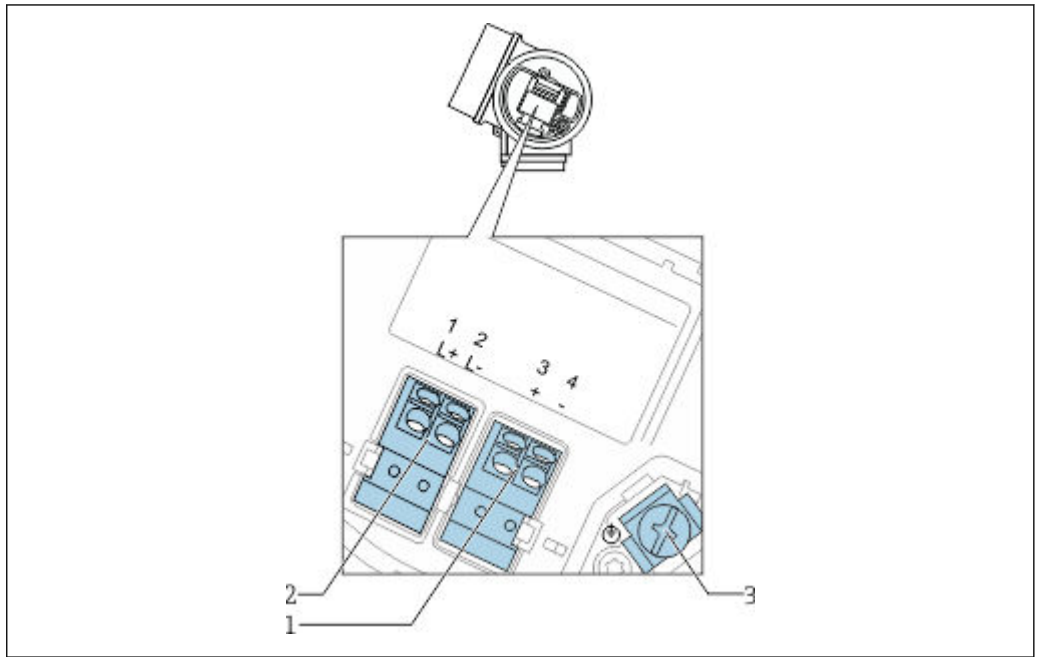
5 Cable screen; observe cable specification

6 Measuring device

7 Analog display device; observe maximum load

8 Active barrier with power supply (e.g. RN221N), current output 2; observe terminal voltage

Terminal assignment 4-wire: 4-20 mA HART (10.4 to 48 V_{DC})

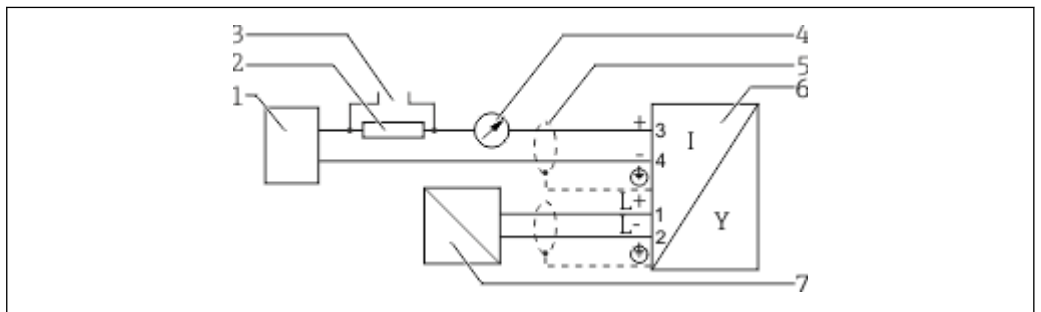


A0036516

8 Terminal assignment 4-wire: 4-20 mA HART (10.4 to 48 V_{DC})

- 1 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 V_{DC})

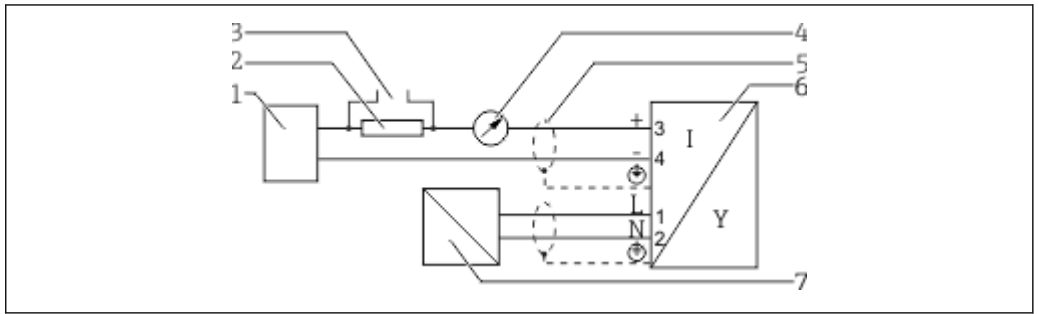


A0036526

9 Block diagram 4-wire: 4-20 mA HART (10.4 to 48 V_{DC})

- 1 Evaluation unit, e.g. PLC
- 2 HART communication resistor (≥ 250 Ω); 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 Supply voltage; observe terminal voltage, observe cable specification

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

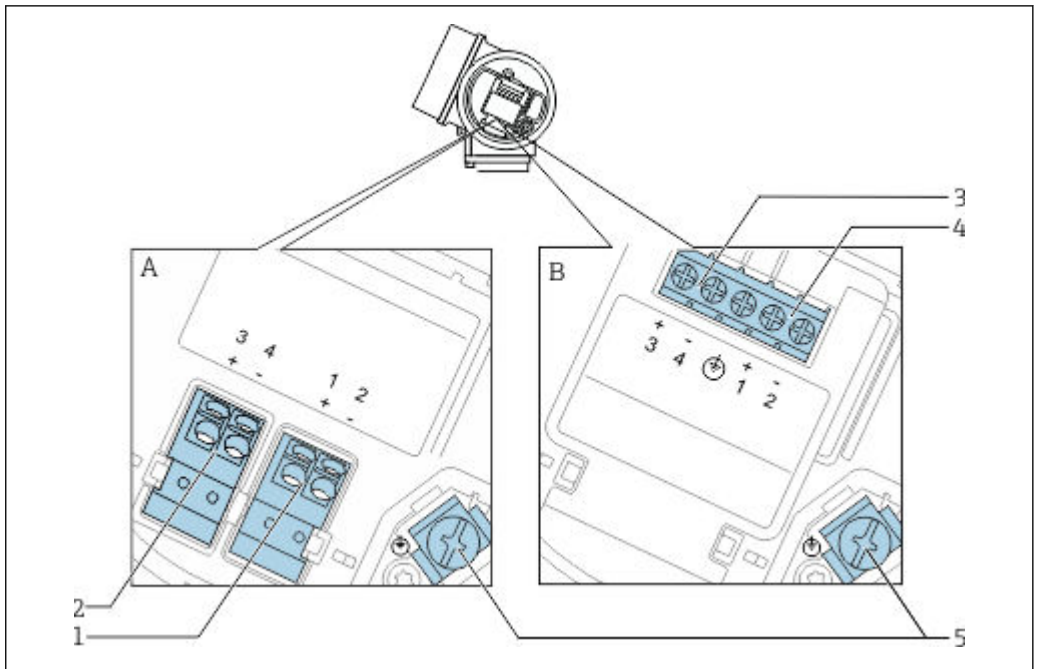


A0036527

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

- 1 Evaluation unit, e.g. PLC
- 2 HART communication resistor (≥ 250 Ω); 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



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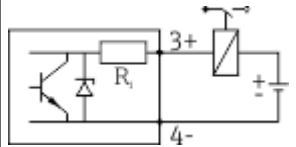
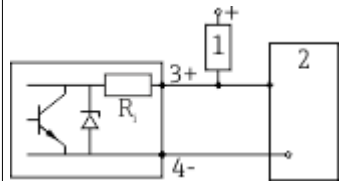
12 Terminal assignment PROFIBUS PA / FOUNDATION Fieldbus

- 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

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.

 <p>14 Connection of a relay</p> <p>Suitable relays (examples):</p> <ul style="list-style-type: none"> ■ Solid-state relay: Phoenix Contact OV-24DC/480AC/5 with mounting rail connector UMK-1 OM-R/AMS ■ Electromechanical relay: Phoenix Contact PLC-RSC-12DC/21 	 <p>15 Connection of a digital input</p> <p>1 Pull-up resistor 2 Digital input</p>
--	--

i For optimum interference immunity we recommend to connect an external resistor (internal resistance of the relay or Pull-up resistor) of < 1 000 Ω.

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	Meaning
	1	Signal +
	2	not connected
	3	Signal -
	4	Ground



A0011175

Pin assignment of the 7/8" plug connector

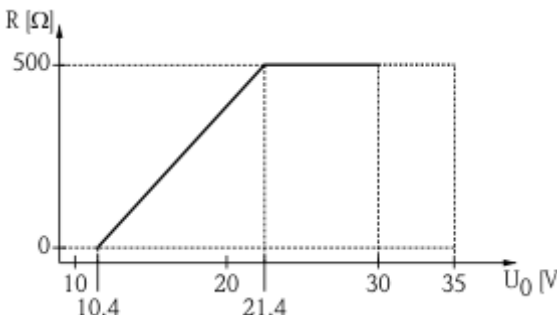
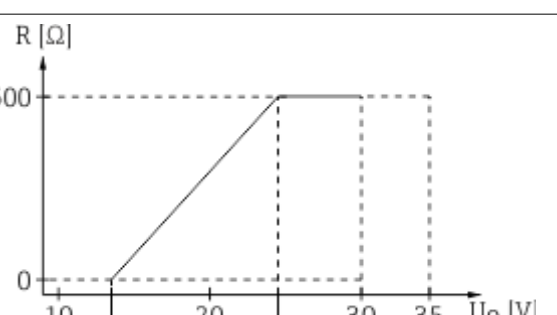
	Pin	Meaning
	1	Signal -
	2	Signal +
	3	Not connected
	4	Screen

A0011176

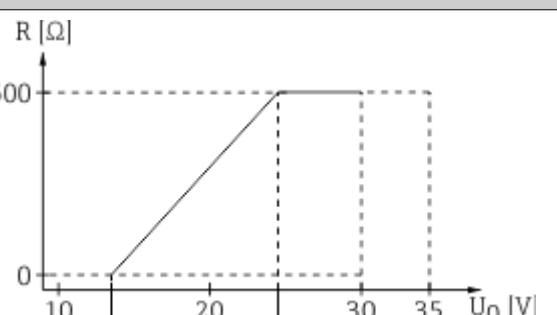
Supply voltage An external power supply is required.

 Various supply units can be ordered from Endress+Hauser: see "Accessories" section →  94

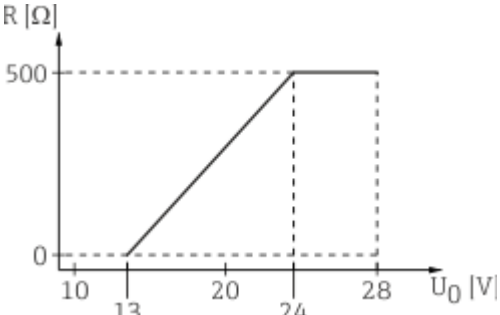
2-wire, 4-20mA HART, passive

"Power Supply, Output" ¹⁾	"Approval" ²⁾	Terminal voltage U at the device	Maximum load R, depending on the supply voltage U ₀ at the supply unit
A: 2-wire; 4-20mA HART	<ul style="list-style-type: none"> ▪ Non-Ex ▪ Ex nA ▪ Ex ic ▪ CSA GP 	10.4 to 35 V ^{3) 4) 5)}	
	Ex ia / IS	10.4 to 30 V ^{3) 4) 5)}	
	<ul style="list-style-type: none"> ▪ Ex d(ia) / XP ▪ Ex ic(ia) ▪ Ex nA(ia) ▪ Ex ta / DIP 	13 to 35 V ^{5) 6)}	
	Ex ia + Ex d(ia) / IS + XP	13 to 30 V ^{5) 6)}	

- 1) Feature 020 of the product structure
- 2) Feature 010 of the product structure
- 3) For ambient temperatures $T_a \leq -20\text{ }^\circ\text{C}$ (-4 °F) a minimum voltage of 15 V is required for the start-up of the device at the minimum error current (3,6 mA). The start-up current can be parametrized. If the device is operated with a fixed current $I \geq 5,5\text{ mA}$ (HART multidrop mode), a voltage of $U \geq 10,4\text{ V}$ is sufficient throughout the entire range of ambient temperatures.
- 4) In the current simulation mode a voltage $U \geq 12,5\text{ V}$ is required.
- 5) If the Bluetooth modem is used, the minimum supply voltage increases by 3 V.
- 6) For ambient temperatures $T_a \leq -20\text{ }^\circ\text{C}$ (-4 °F) a minimum voltage of 16 V is required for the start-up of the device at the minimum error current (3.6 mA).

"Power Supply, Output" ¹⁾	"Approval" ²⁾	Terminal voltage U at the device	Maximum load R, depending on the supply voltage U ₀ at the supply unit
B: 2-wire; 4-20 mA HART, switch output	<ul style="list-style-type: none"> ▪ Non-Ex ▪ Ex nA ▪ Ex nA(ia) ▪ Ex ic ▪ Ex ic(ia) ▪ Ex d(ia) / XP ▪ Ex ta / DIP ▪ CSA GP 	13 to 35 V ^{3) 4)}	
	<ul style="list-style-type: none"> ▪ Ex ia / IS ▪ Ex ia + Ex d(ia) / IS + XP 	13 to 30 V ^{3) 4)}	

- 1) Feature 020 of the product structure
- 2) Feature 010 of the product structure
- 3) For ambient temperatures $T_a \leq -30\text{ }^\circ\text{C}$ (-22 °F) a minimum voltage of 16 V is required for the start-up 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 U ₀ at the supply unit
C: 2-wire; 4-20mA HART, 4-20mA	any	13 to 28 V ^{3) 4)}	 <p style="text-align: right; font-size: small;">A0034841</p>

- 1) Feature 020 of the product structure
- 2) Feature 010 of the product structure
- 3) For ambient temperatures T_a ≤ -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 V
Admissible residual ripple at f = 100 to 10000 Hz	U _{SS} < 10 mV

4-wire, 4-20mA HART, active

"Power supply; Output" ¹⁾	Terminal voltage	Maximum load R _{max}
K: 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 _{DC}	

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 style="list-style-type: none"> ▪ Non-Ex ▪ Ex nA ▪ Ex nA(ia) ▪ Ex ic ▪ Ex ic(ia) ▪ Ex d(ia) / XP ▪ Ex ta / DIP ▪ CSA GP 	9 to 32 V ³⁾
	<ul style="list-style-type: none"> ▪ Ex ia / IS ▪ Ex ia + Ex d(ia) / IS + XP 	9 to 30 V ³⁾

- 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" ¹⁾	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

1) 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 (NAMUR NE43)	adjustable: 3.59 to 22.5 mA

PROFIBUS PA

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

FOUNDATION Fieldbus

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

FISCO

U_i	17.5 V
I_i	550 mA
P_i	5.5 W
C_i	5 nF
L_i	10 μ H

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 mm² (20 to 14 AWG)
- **With integrated overvoltage protection**
Screw terminals for wire cross-sections 0.2 to 2.5 mm² (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 \varnothing 5 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
 - $\frac{1}{2}$ " NPT
 - G $\frac{1}{2}$ "
 - M20 \times 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 mm² (20 to 14 AWG)
- **Devices with integrated overvoltage protection**
Screw terminals for wire cross-sections 0.2 to 2.5 mm² (24 to 14 AWG)
- For ambient temperature $T_U \geq 60$ °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 μ 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 μ s)	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 °C (+75 °F) ±5 °C (±9 °F)
- Pressure = 960 mbar abs. (14 psia) ±100 mbar (±1.45 psi)
- Humidity = 60 % ±15 %
- Reflector: metal plate with a minimum diameter of 1 m (40 in)
- No major interference reflections inside the signal beam

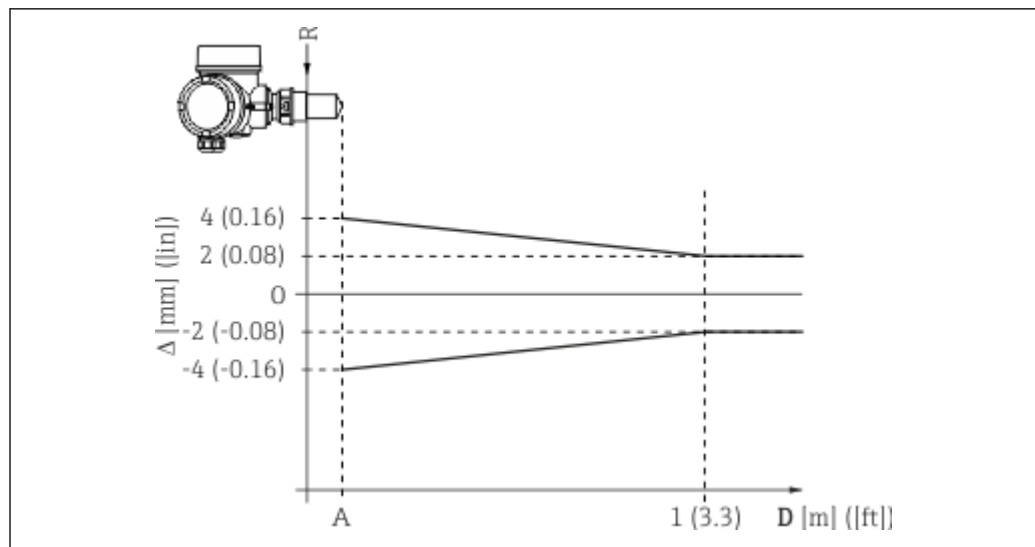
Maximum measured error

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 ¹⁾
FMR50 Standard version	Sum of non-linearity, nonrepeatability and hysteresis	± 2 mm (0.08 in)	± 0.02 %
	Offset/Zero	± 4 mm (0.2 in)	± 0.03 %
FMR50 Version with application package "Advanced dynamics" ²⁾	Sum of non-linearity, nonrepeatability and hysteresis	± 3 mm (0.12 in)	± 0.02 %
	Offset/Zero	± 4 mm (0.2 in)	± 0.03 %

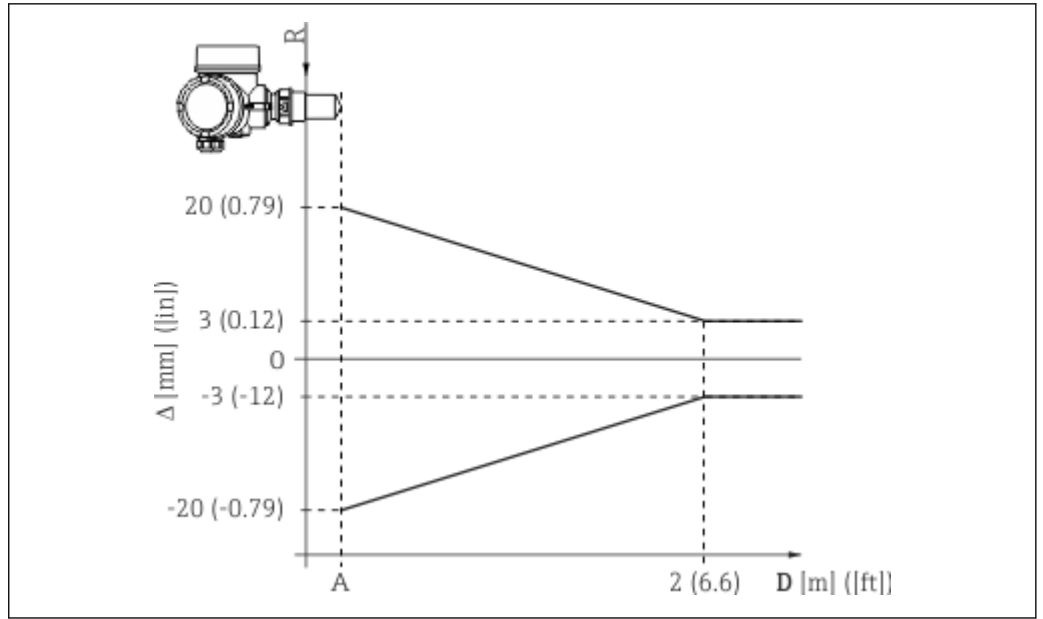
- 1) Only relevant for 4-20mA current output; add error of the analog value to the digital value.
- 2) Product structure: Feature 540 "Application Package", Option EM "Advanced dynamics"

Differing values in near-range applications



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

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



A0019042

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

Δ 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 mm
- analog: 1 μ A

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)¹⁾ are valid if the damping is switched off:

Tank height	Sampling rate	Step response time
< 10 m (33 ft)	$\geq 3.6 \text{ s}^{-1}$	< 0.8 s
< 40 m (132 ft)	$\geq 2.7 \text{ s}^{-1}$	< 1 s

Influence of ambient temperature The measurements are carried out in accordance with DIN EN IEC 61298-3 / DIN EN IEC 60770-1

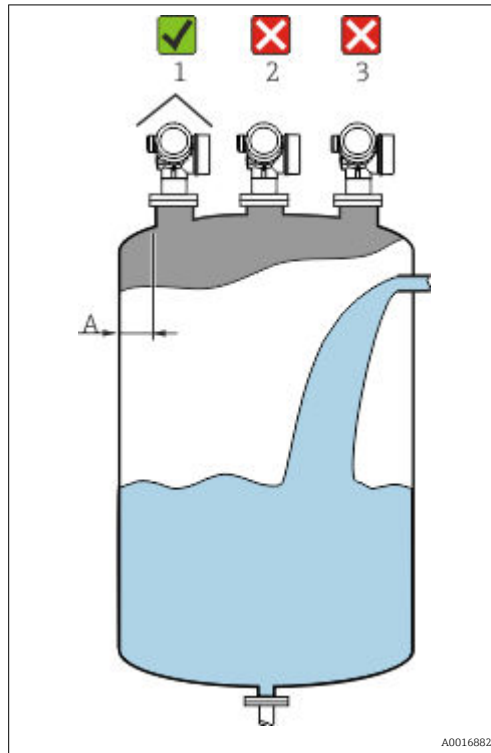
- Digital (HART, PROFIBUS PA, FOUNDATION Fieldbus):
 - Standard version: average $T_K = 2 \text{ mm}/10 \text{ K}$
 - Version with advanced dynamics²⁾: average $T_K = 3 \text{ mm}/10 \text{ K}$
- Analog (current output):
 - zero point (4 mA): average $T_K = 0.02 \text{ \%/}10 \text{ K}$
 - span (20 mA): average $T_K = 0.05 \text{ \%/}10 \text{ K}$

1) 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.
2) Feature 540 "Application Package", option EM

Installation

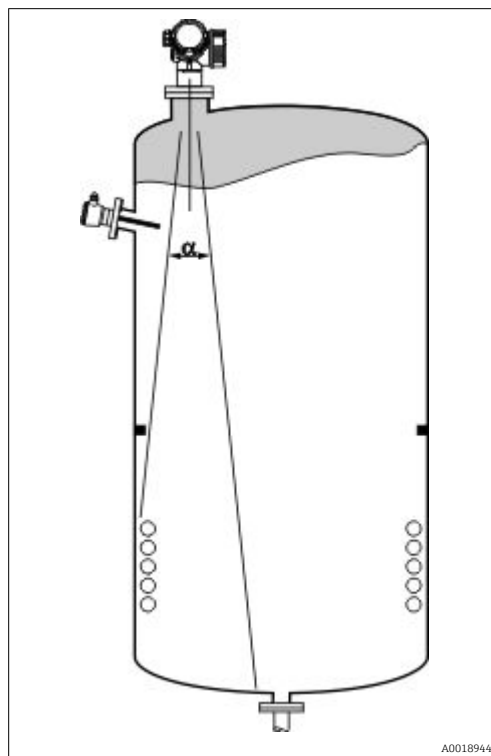
Installation conditions

Mounting position



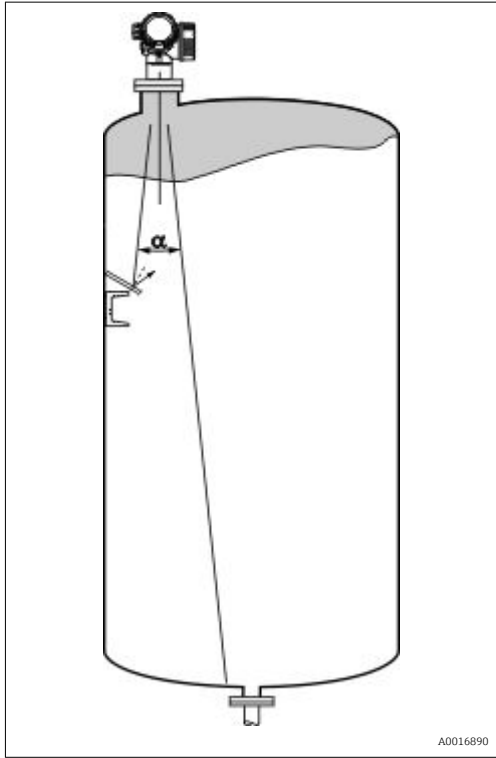
- Recommended distance **A** from wall to outer edge of nozzle: $\sim 1/6$ of tank diameter. Nevertheless the device should not be installed closer than 15 cm (5.91 in) to the tank wall.
- Not in the center (2), as interference can cause signal loss.
- Not above the fill stream (3).
- It is recommended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

Vessel installations



Avoid any installations (point level switches, temperature sensors, braces, vacuum rings, heating coils, baffles etc.) inside the signal beam. Take into account the beam angle
 → 38.

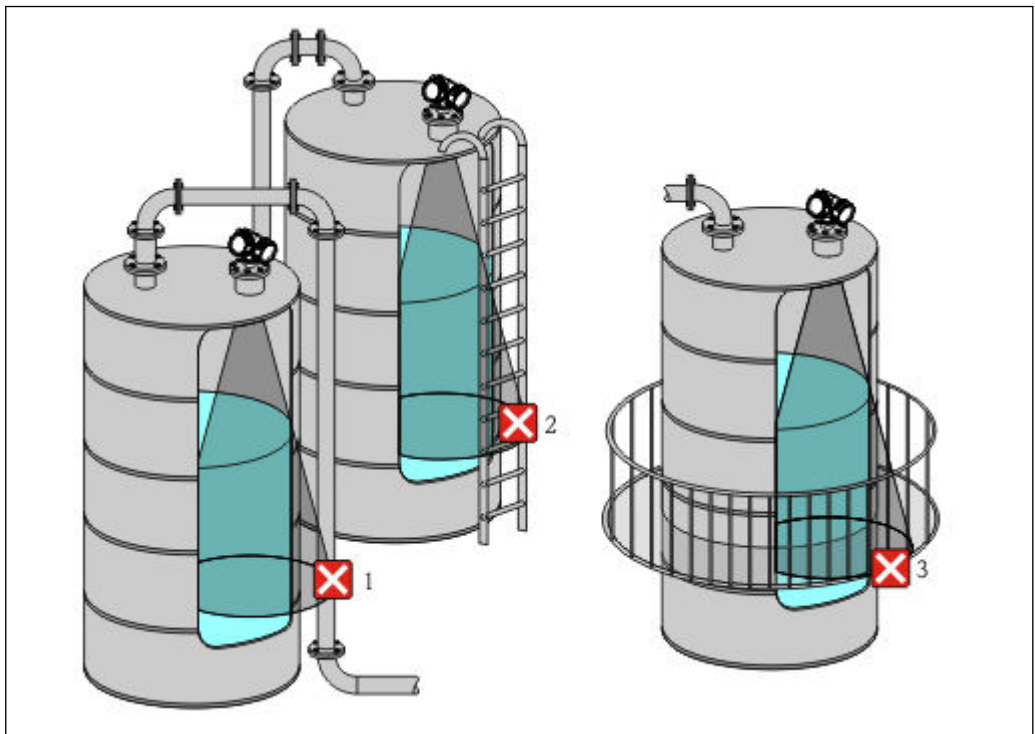
Reduction of interference echoes



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

Measurement in a plastic vessel

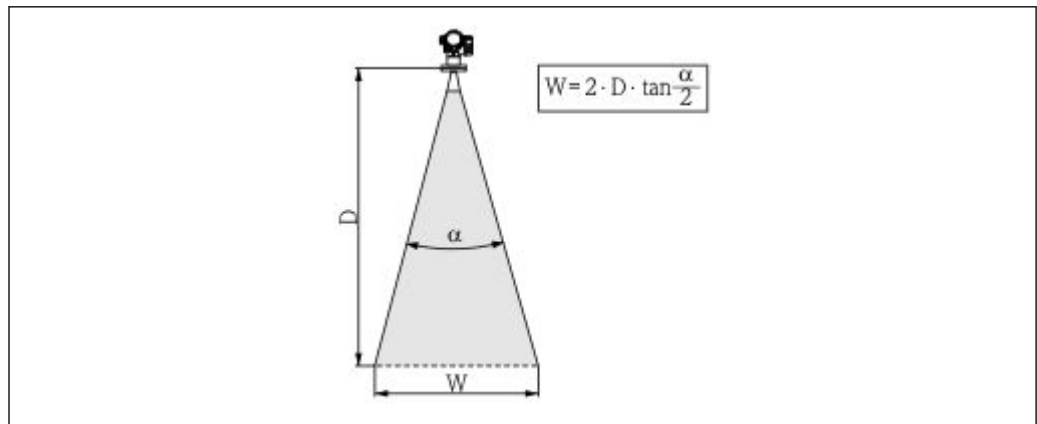
If the outer wall of the vessel is made of a non-conductive material (e.g. GRP), microwaves can also be reflected off interfering installations outside the vessel (e.g. metallic pipes (1), ladders (2), grates (3), ...). Therefore, there should be no such interfering installations in the signal beam.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



Optimization options

- Antenna size
The bigger the antenna, the smaller the beam angle α and the fewer interference echoes
→ 38.
- 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 → 40 → 41.
- Stilling well
A stilling well can be applied to avoid interferences → 44.
- Metallic screens mounted at a slope
They spread the radar signals and can, therefore, reduce interference echoes.

Beam angle



18 Relationship between beam angle α , distance D and beamwidth diameter W

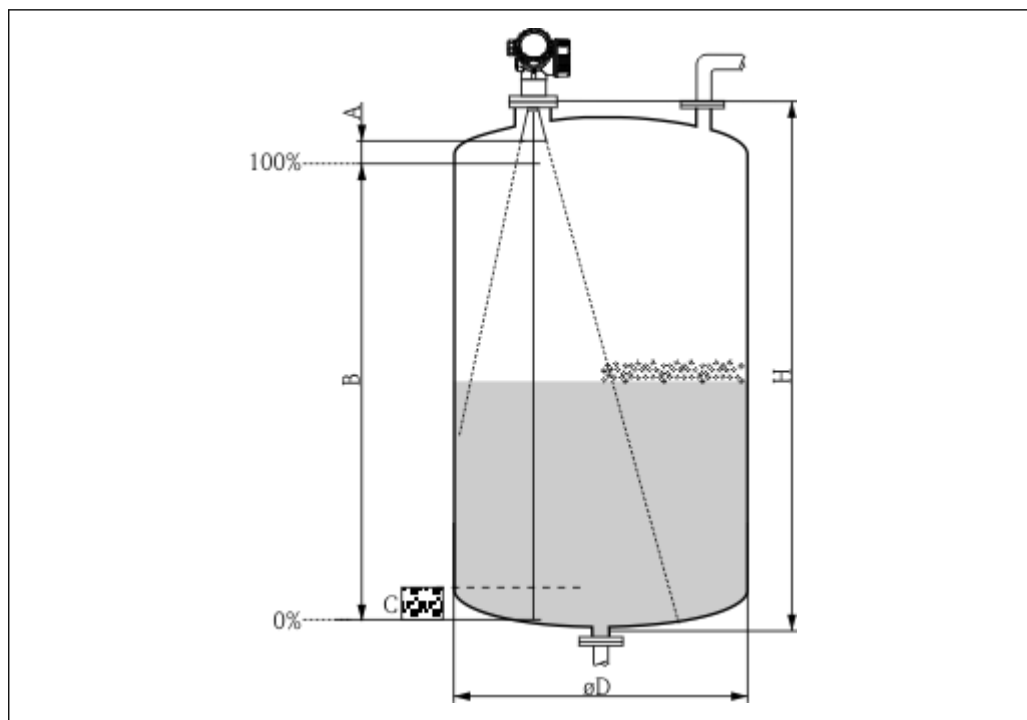
The beam angle is defined as the angle α where the energy density of the radar waves reaches half the value of the maximum energy density (3-dB-width). Microwaves are also emitted outside the signal beam and can be reflected off interfering installations.

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

FMR50			
Antenna size	40 mm (1½ in)	80 mm (3 in)	100 mm (4 in)
Beam angle α	23°	10°	8°
Measuring distance (D)	Beamwidth diameter W		
3 m (9.8 ft)	1.22 m (4 ft)	0.53 m (1.7 ft)	0.42 m (1.4 ft)
6 m (20 ft)	2.44 m (8 ft)	1.05 m (3.4 ft)	0.84 m (2.8 ft)
9 m (30 ft)	3.66 m (12 ft)	1.58 m (5.2 ft)	1.26 m (4.1 ft)
12 m (39 ft)	4.88 m (16 ft)	2.1 m (6.9 ft)	1.68 m (5.5 ft)
15 m (49 ft)	6.1 m (20 ft)	2.63 m (8.6 ft)	2.10 m (6.9 ft)
20 m (66 ft)	8.14 m (27 ft)	3.50 m (11 ft)	2.80 m (9.2 ft)
25 m (82 ft)	10.17 m (33 ft)	4.37 m (14 ft)	3.50 m (11 ft)
30 m (98 ft)	-	5.25 m (17 ft)	4.20 m (14 ft)
35 m (115 ft)	-	6.12 m (20 ft)	4.89 m (16 ft)
40 m (131 ft)	-	7.00 m (23 ft)	5.59 m (18 ft)

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", option EM).
- 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 → use FMR53 or FMR54.
- For the measurement of absorbing gases such as **ammonia NH₃** or some **fluorocarbons³⁾**, 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 guarantee 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 ($\epsilon_r = 1.5$ to 4)⁴⁾ 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).



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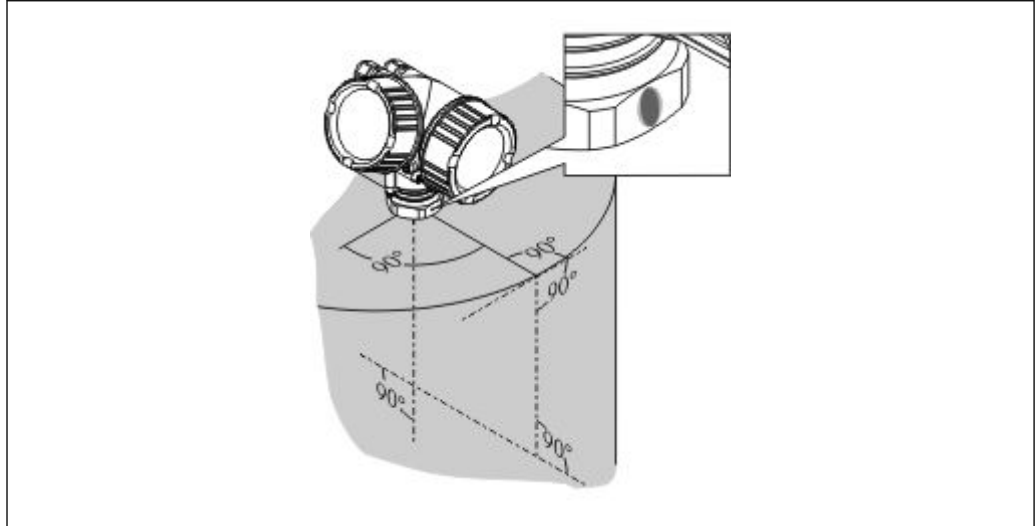
Device	A [mm (in)]	B [m (ft)]	C [mm (in)]	H [m (ft)]
FMR50	150 (5.91)	> 0.2 (0.7)	50 to 250 (1.97 to 9.84)	> 0.3 (1.0)

3) Affected compounds are e.g. R134a, R227, Dymel 152a.

4) 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).

Installation in vessel (free space)**Horn antenna encapsulated (FMR50)***Alignment*

- Align the antenna vertically to the product surface.
- A marking at the threaded connection enables alignment of the antenna. This marking must be aligned towards the tank wall as well as possible.



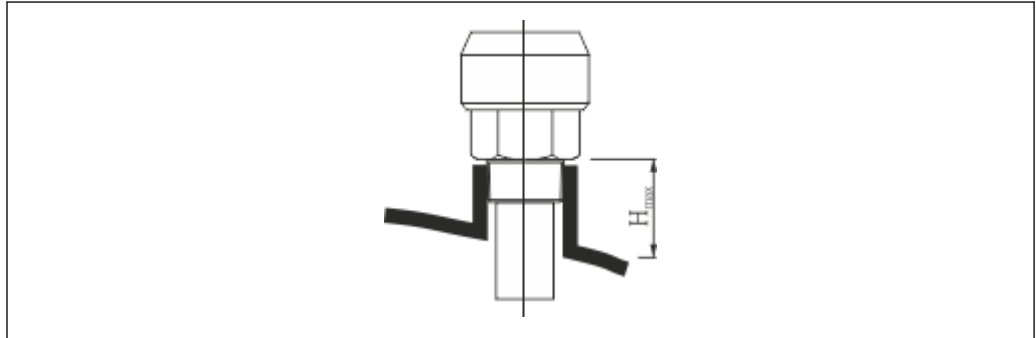
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Depending on the device version the marking may be a circle or two short parallel lines.

Nozzle mounting

For optimum measurement, the tip of the antenna should extend below the nozzle. This is achieved by a nozzle height up to $H_{max} = 60 \text{ mm}$ (2.36 in).

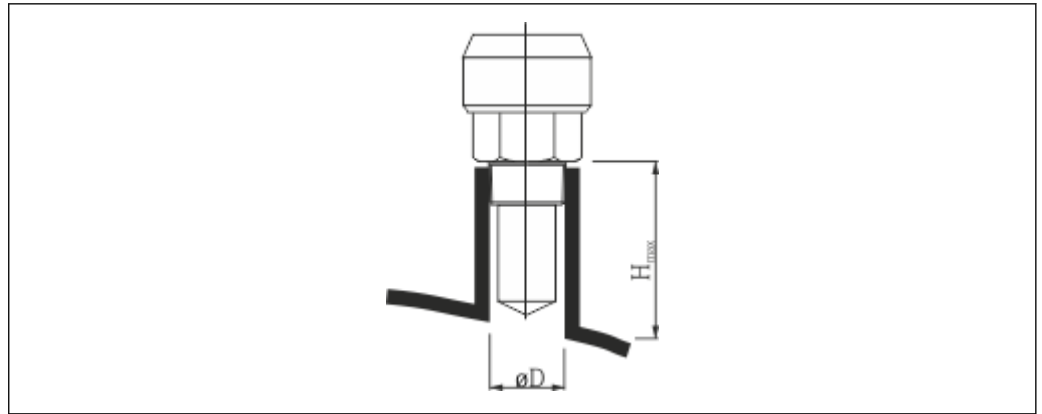


A0016806

19 Nozzle height for horn antenna, encapsulated (FMR50); $H_{max} = 60 \text{ mm}$ (2.36 in)

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 :



A0023612

Nozzle diameter D	Maximum nozzle height H_{max}
40 mm (1.5 in)	200 mm (7.9 in)
50 mm (2 in)	250 mm (9.9 in)
80 mm (3 in)	300 mm (11.8 in)
100 mm (4 in)	400 mm (15.8 in)
150 mm (6 in)	500 mm (19.7 in)

- i** 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.

Threaded connection

- Tighten with the hexagonal nut only.
- Tool : 50 mm hexagonal wrench
- Maximum permissible torque: 35 Nm (26 lbf ft)

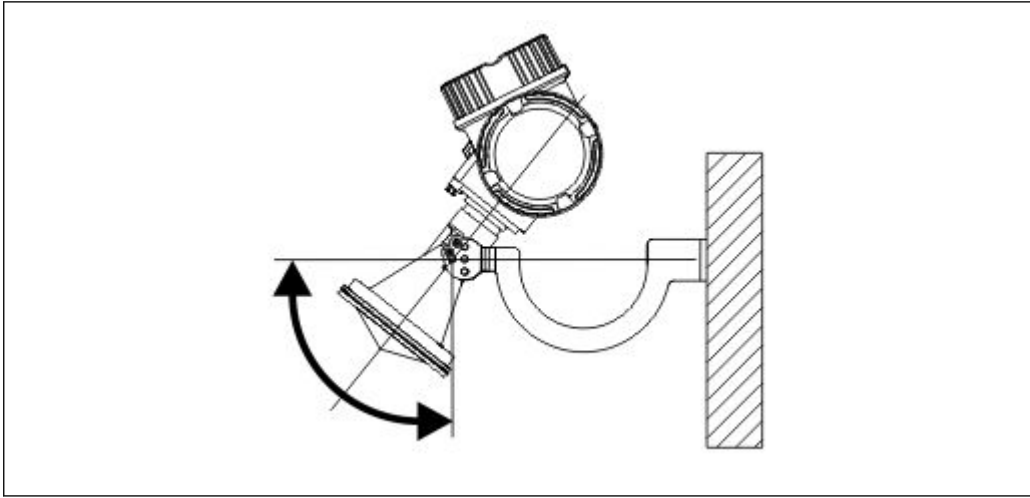
Horn antenna with slip-on flange (FMR50)

Alignment

- i** When using the Micropilot with a slip-on flange in explosion-hazardous areas, strictly observe all specifications in the relevant Safety Instructions (XA).
- Align the antenna vertically to the product surface.
Optionally, a variable flange seal, which is available as an accessory, can be used for alignment (see Technical Information BA01048F, chapter "Accessories").
 - A marking at the feedthrough enables alignment of the antenna. This marking must be aligned towards the tank wall as well as possible.

DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT

Horn antenna with mounting bracket (FMR50)



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▣ 21 Installation of the horn antenna with mounting bracket

Align the antenna vertically to the product surface using the mounting bracket.

NOTICE

The mounting bracket has no conductive connection to the transmitter housing.
 Danger of electrostatic charge

- ▶ Connect the mounting bracket to the local potential equalization system.

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

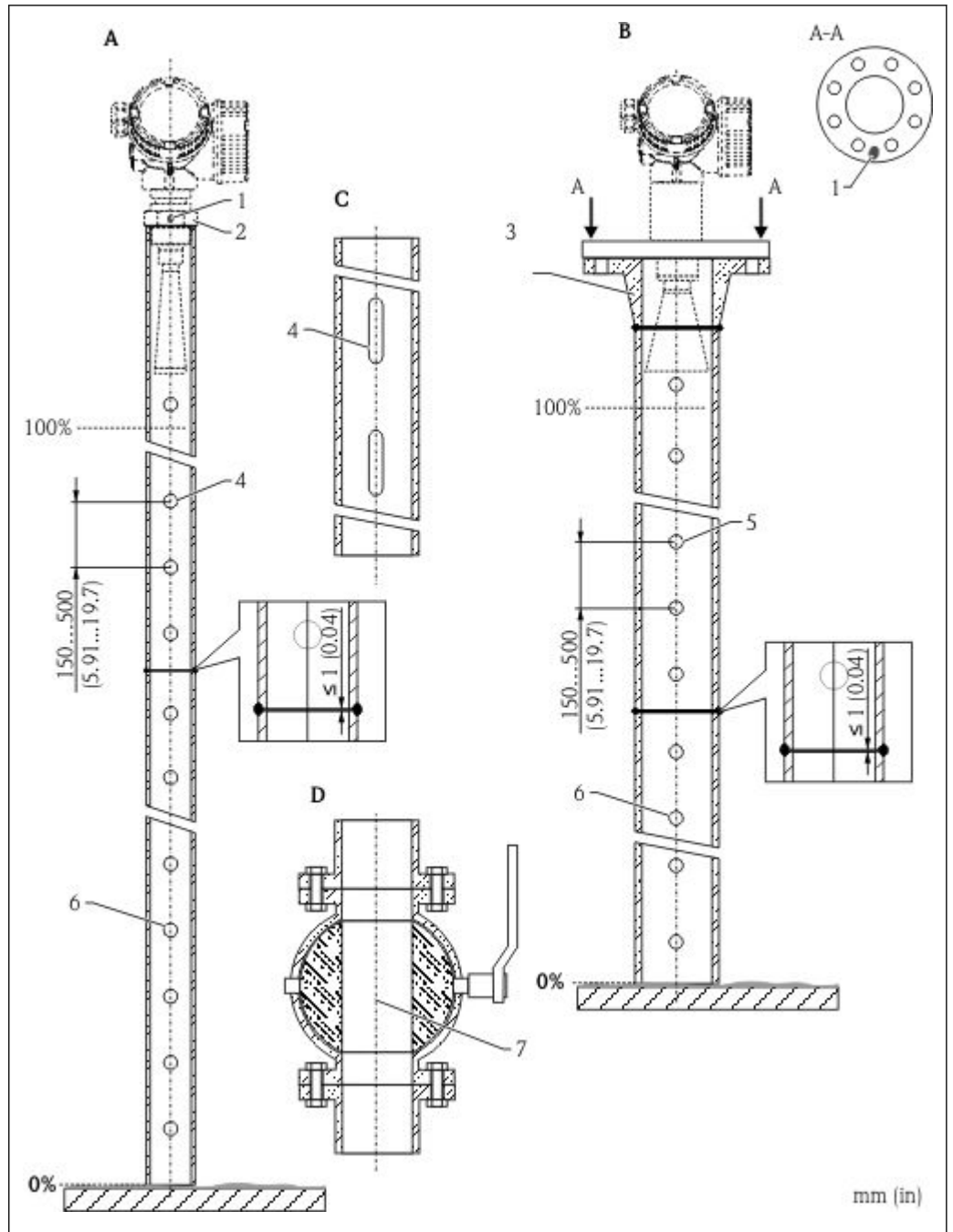
- Dielectric constant of the medium: $\epsilon_r > 10$
- If possible, use an antenna 100 mm (4 in).
- The distance from the lower edge of the antenna to the tank ceiling should be about 100 mm (4 in).
- If possible, avoid mounting locations where condensation or build-up might occur.
- In case of outdoor 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.

Suitable thickness of the tank ceiling:

Penetrated material	PE	PTFE	PP	Perspex
DK / ϵ_r	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))

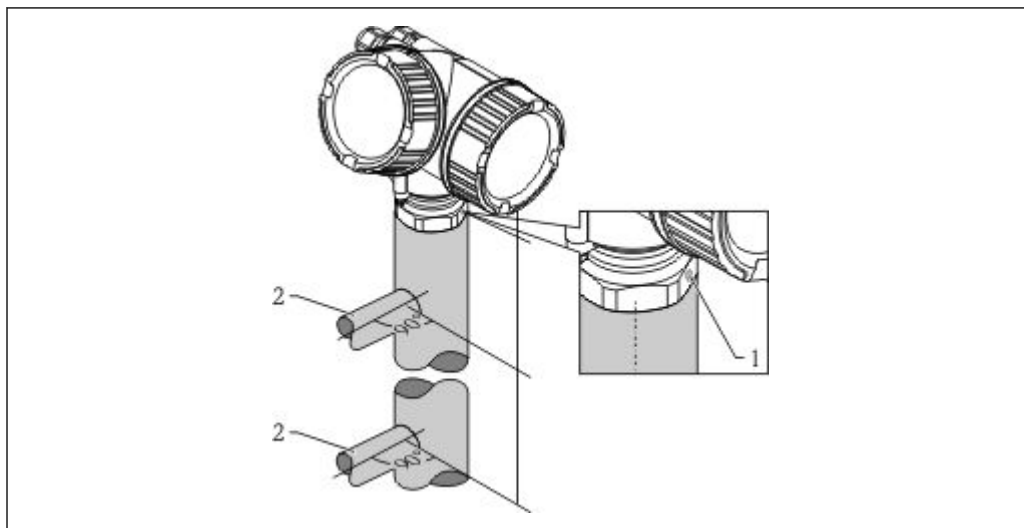
Examples for the construction of stilling wells



- A Micropilot FMR50/FMR51: Horn 40mm(1½")
- B Micropilot FMR50/FMR51/FMR52/FMR54: Horn 80mm(3")
- C Stilling well with slots
- D Full bore ball valve
- 1 Marking for axial alignment
- 2 Threaded connection
- 3 e.g. welding neck flange DIN2633
- 4 ϕ hole max. 1/10 ϕ stilling well
- 5 ϕ hole max. 1/10 ϕ stilling well; single sided or drilled through
- 6 Inside of holes deburred
- 7 Diameter of opening of ball valve must always be equivalent to pipe diameter; avoid edges and constrictions.

A0019009

Installation in bypass



23 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 (~ ±20 cm (7.87 in)) a reduced accuracy of the measurement has to be expected.

Environment

Ambient temperature range

Measuring device	-40 to +80 °C (-40 to +176 °F); -50 °C (-58 °F) with manufacturer declaration on request
Local display	-20 to +70 °C (-4 to +158 °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) ¹⁾

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), 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



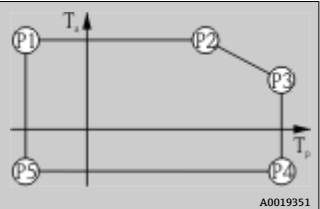
The following diagrams take into account only functional aspects. There may be further restrictions for certified device versions. Please refer to the separate Safety Instructions → 95.


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
B	2-wire; 4-20 mA HART, switch output
C	2-wire; 4-20 mA HART, 4-20 mA
E	2-wire; FF, switch output
G	2-wire; PA, switch output
K	4-wire 90-253VAC; 4-20 mA HART
L	4-wire 10, 4-48VDC; 4-20 mA HART

Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T_p	T_a	T_p	T_a	T_p	T_a	T_p	T_a	T_p	T_a	T_p	T_a
A	-40 (-40)	80 (176)	80 (176)	80 (176)	80 (176)	80 (176)	80 (176)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output not used	-40 (-40)	76 (169)	76 (169)	76 (169)	80 (176)	75 (167)	80 (176)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output used	-40 (-40)	60 (140)	60 (140)	60 (140)	80 (176)	58 (136)	80 (176)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
C Channel 2 not used	-40 (-40)	80 (176)	80 (176)	80 (176)	80 (176)	80 (176)	80 (176)	-40 (-40)	-40 (-40)	-40 (-40)	-	-



Degree of protection	<ul style="list-style-type: none"> ■ With closed housing tested according to: <ul style="list-style-type: none"> ■ IP68, NEMA6P (24 h at 1.83 m under water surface) ■ For plastic housing with transparent cover (display module): IP68 (24 h at 1.00 m under water surface) ⁵⁾ ■ IP66, NEMA4X ■ With open housing: IP20, NEMA1 ■ Display module: IP22, NEMA2 <p> 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.</p>
Vibration resistance	DIN EN 60068-2-64 / IEC 60068-2-64: 20 to 2 000 Hz, 1 (m/s ²)/Hz
Cleaning the antenna	<p>The antenna can get contaminated, depending on the application. The emission and reception of microwaves can thus eventually be hindered. The degree of contamination leading to an error depends on the medium and the reflectivity, mainly determined by the dielectric constant ϵ_r.</p> <p>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.</p>
Electromagnetic compatibility (EMC)	<p>Electromagnetic compatibility to all relevant requirements of the EN 61326- series and NAMUR recommendation EMC (NE21). For details see declaration of conformity. ⁶⁾</p> <p>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.</p> <p>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 SDO2 or SD03) if strong electromagnetic interferences in the frequency range of 1 to 2 GHz are present.</p>

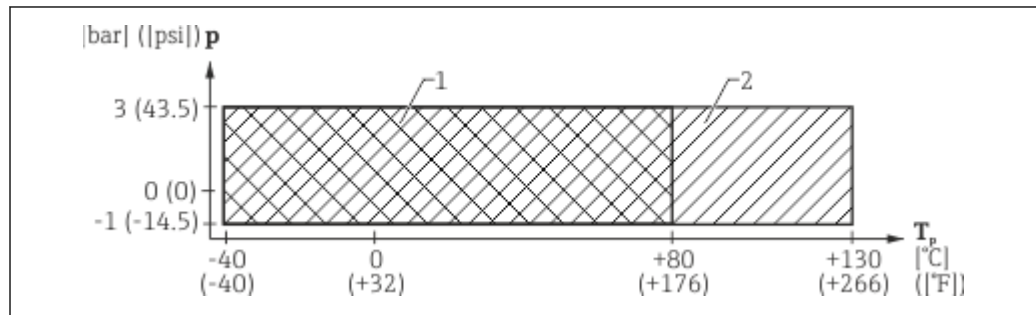
5) This restriction is valid if the following options of the product structure have been selected at the same time: 030 ("Display, Operation") = C ("SD02") or E ("SD03"); 040 ("Housing") = A ("GT19").

6) Can be downloaded from www.endress.com.

Process

Process temperature, Process pressure

FMR50



A0032615

24 FMR50: Admissible range of process temperature and process pressure

- 1 Process connection: Flange
- 2 Process connection: Thread

Feature 100 "Process Connection"	Admissible process temperature	Admissible process pressure
<ul style="list-style-type: none"> ■ GGF: Thread ISO228 G1-1/2 ■ RGF: Thread ANSI MNPT1-1/2 	-40 to +130 °C (-40 to +266 °F)	p _{rel} = -1 to 3 bar (-14.5 to 43.5 psi) p _{abs} < 4 bar (58 psi) ¹⁾ .
<ul style="list-style-type: none"> ■ XWG: UNI slip-on flange 3"/DN80/80 ■ XZG: UNI slip-on flange 4"/DN100/100 XOG: UNI slip-on flange 6"/DN150/150 	-40 to +80 °C (-40 to +176 °F)	

1) For devices with CRN approval the pressure range may be reduced → 75

Dielectric constant

- **For liquids**
 - ε_r ≥ 1.9 in free-field applications
 - ε_r ≥ 1.4 in stilling well
- **For bulk solids**
ε_r ≥ 1.6



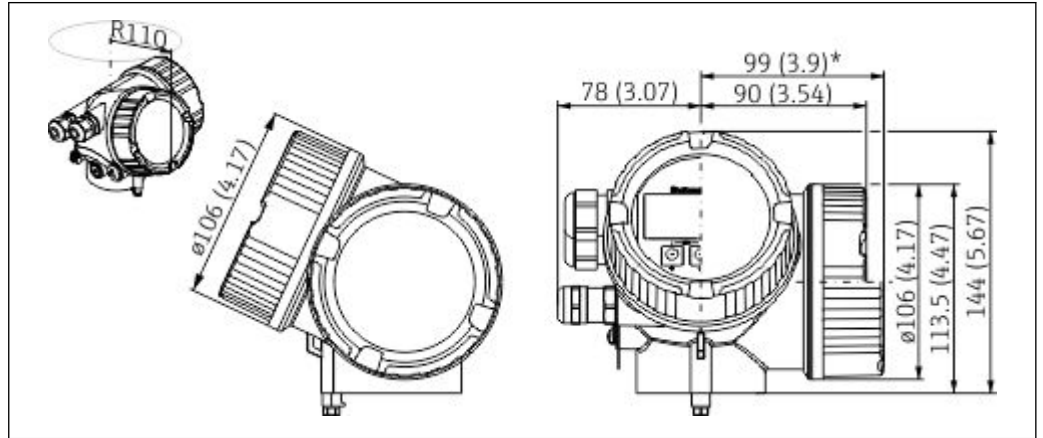
For dielectric constants (DC values) of many media commonly used in various industries refer to:

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

Mechanical construction

Dimensions

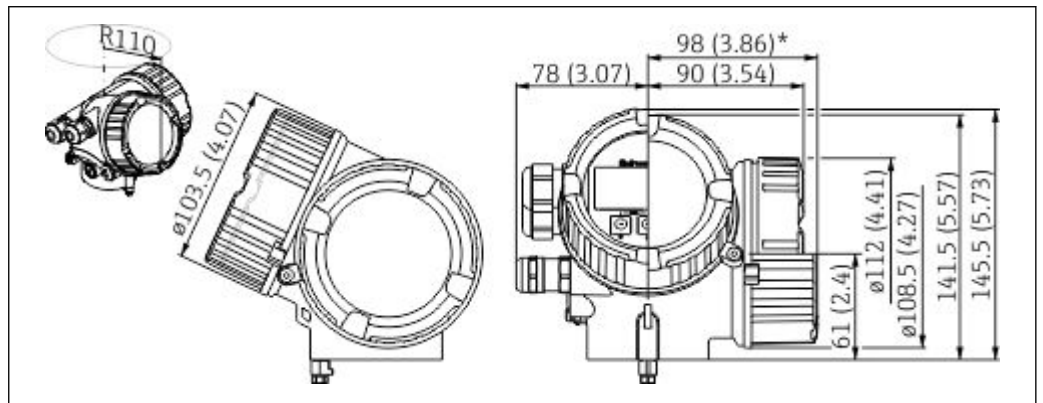
Dimensions of the electronics housing



A0011346

25 Housing GT19 (Plastics PBT); Dimensions in mm (in)

*for devices with integrated overvoltage protection.

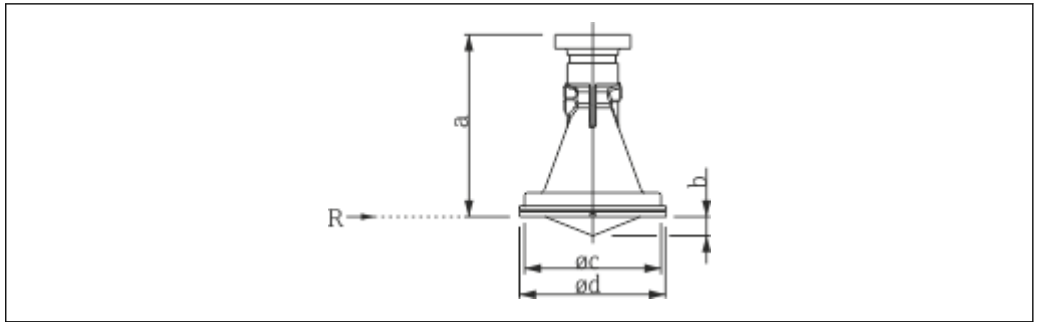


A0020751

26 Housing GT20 (Alu coated); Dimensions in mm (in)

*for devices with integrated overvoltage protection.

FMR50 with mounting bracket or customer side connection

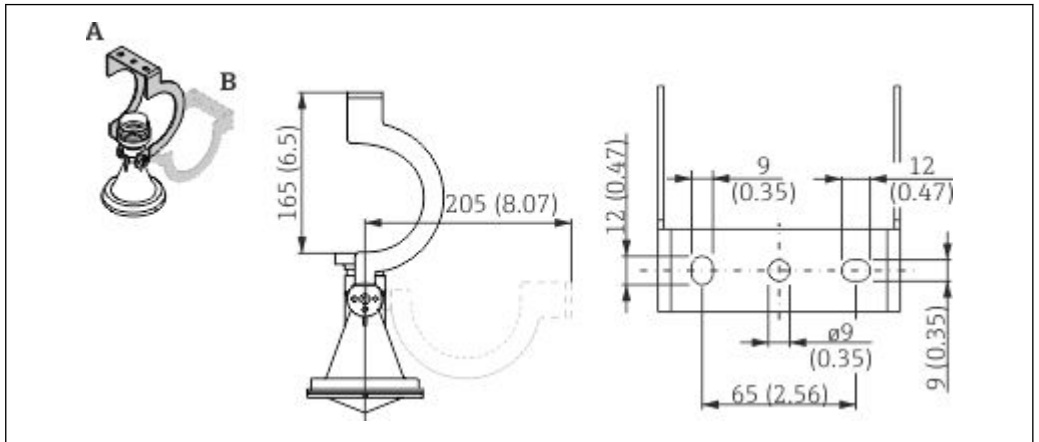


A0017747

28 FMR50 without process connection; dimensions: mm (in)

R Reference point of the measurement

Feature 100 "Process connection"		
	<ul style="list-style-type: none"> ▪ UAE Mounting bracket ▪ XRO: Customer side connection 	
	Feature 070 "Antenna" BN: Horn 80mm/3"	Feature 070 "Antenna" BR: Horn 100mm/4"
a	138 mm (5.43 in)	151 mm (5.94 in)
b	15 mm (0.59 in)	20 mm (0.79 in)
øc	107 mm (4.21 in)	127 mm (5 in)
ød	115 mm (4.53 in)	135 mm (5.31 in)

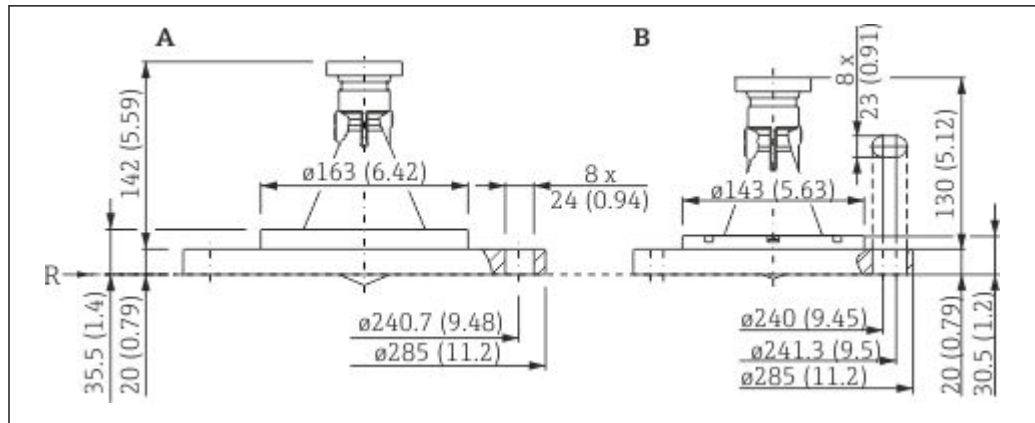


A0017746

29 Mounting bracket for FMR50/FMR56; dimensions: mm (in)

- A Mounting bracket aligned for roof mounting
- B Mounting bracket aligned for wall mounting

FMR50 with slip-on flange 6"/DN150



A0023380

32 FMR50 with slip-on flange 6"/DN150; dimensions: mm (in)

- A Horn antenna 100mm/4"
 B Horn antenna 80mm/3"
 R Reference point of the measurement

Valid for the following device versions

- **Feature 100 "Process connection":**
XOG: UNI slip-on flange 6"/DN150, PP
- **Feature 070 "Antenna":**
 - BR: Horn 100mm/4", PP cladded (Diagramm A)
 - BN: Horn 80mm/3", PP cladded (Diagramm B)



The UNI slip-on flange is suitable for:

- ASME: NPS 6" Cl.150
- EN: DN150 PN16
- JIS: 10K 150

Weight

Housing

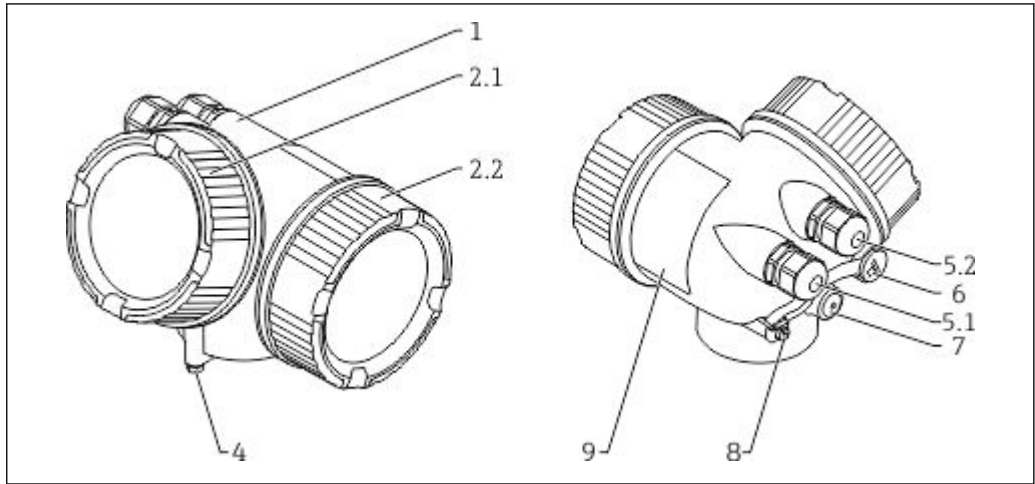
Part	Weight
Housing GT19 - plastic	approx. 1.2 kg (2.7 lb)
Housing GT20 - aluminium	approx. 1.9 kg (4.2 lb)

Antenna and process connection

Device	Weight of antenna and process connection
FMR50	max. 1.5 kg (3.3 lb) + weight of flange ¹⁾

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

Materials: GT19 housing (plastic)



A0013788

No.	Part	Material
1	Housing	PBT
2.1	Cover of the electronics compartment	<ul style="list-style-type: none"> ▪ Cover glass: PC ▪ Cover frame: PBT-PC ▪ Cover seal: EPDM ▪ Thread-coating: Graphite-based lubricant varnish
2.2	Cover of the terminal compartment	<ul style="list-style-type: none"> ▪ Cover: PBT ▪ Cover seal: EPDM ▪ Thread-coating: Graphite-based lubricant varnish
4	Lock at the housing neck	<ul style="list-style-type: none"> ▪ Screw: A4-70 ▪ Clamp: 316L (1.4404)
5.1	Dummy plug, cable gland, adapter or plug (depending on the device version)	<ul style="list-style-type: none"> ▪ Dummy plug, depending on the device version: <ul style="list-style-type: none"> ▪ PE ▪ PBT-GF ▪ Cable gland, depending on the device version: <ul style="list-style-type: none"> ▪ Nickel-plated brass (CuZn) ▪ PA ▪ Adapter: 316L (1.4404/1.4435) ▪ Seal: EPDM ▪ M12 plug: Nickel-plated brass¹⁾ ▪ 7/8" plug: 316 (1.4401)²⁾
5.2	Dummy plug, cable gland or adapter (depending on the device version)	<ul style="list-style-type: none"> ▪ Dummy plug, depending on the device version: <ul style="list-style-type: none"> ▪ PE ▪ PBT-GF ▪ Nickel-plated steel ▪ Cable gland, depending on the device version: <ul style="list-style-type: none"> ▪ Nickel-plated brass (CuZn) ▪ PA ▪ Adapter: 316L (1.4404/1.4435) ▪ Seal: EPDM
6	Dummy plug or M12 socket (depending on the device version)	<ul style="list-style-type: none"> ▪ Dummy plug: Nickel-plated brass (CuZn) ▪ M12 socket: Nickel-plated GD-Zn
7	Pressure relief stopper	Nickel-plated brass (CuZn)
8	Ground terminal	<ul style="list-style-type: none"> ▪ Screw: A2 ▪ Spring washer: A4 ▪ Clamp: 304 (1.4301) ▪ Holder: 304 (1.4301)
9	Adhesive nameplate	Plastic

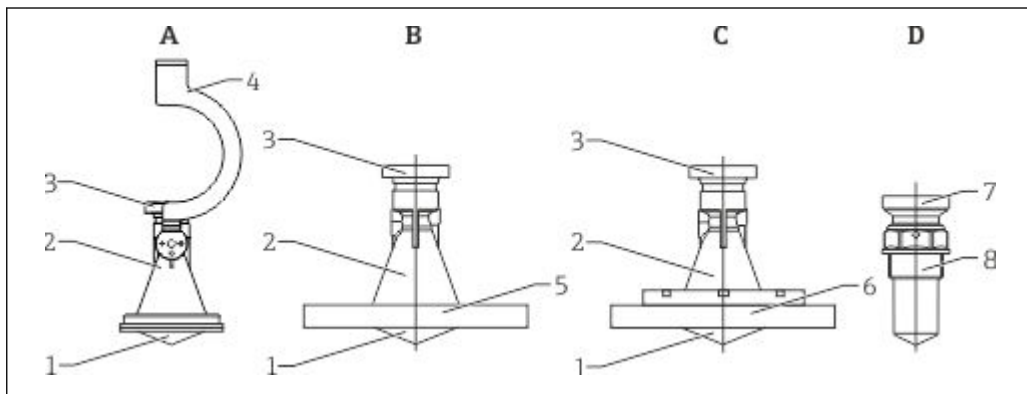
1) For the version with M12 plug the sealing material is Viton.
 2) For the version with 7/8" plug, the sealing material is NBR.

Nr.	Part	Material
8	Ground terminal	<ul style="list-style-type: none"> ▪ Screw: A2 ▪ Spring washer: A2 ▪ Clamp: 304 (1.4301) ▪ Holder: 304 (1.4301)
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

FMR50



- A Standard version with mounting bracket
 B Horn antenna with slip-on flange
 C Horn antenna with flange and adapter ring
 D Threaded version

Pos.	Part	Material
1	Focusing lense	PP
	Seal	VMQ
2	Horn	PBT
3	Housing adapter	304 (1.4301)
4	Mounting bracket	304 (1.4301)
	Screw	A2
	Nordlock washer	A4
5	Slip-on flange	PP
6	Flange + adapter ring	PP
	Screw	A2
	Seal	FKM
7	Housing adapter	PBT
8	Schrew-in adapter	PVDF

Operability

Operating concept

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)



Feature 500 of the product structure determines which of these languages is preset on delivery.

Quick and save commissioning

- Interactive wizard with graphical interface for easy commissioning via FieldCare/DeviceCare
- Menu guidance with brief explanations of the individual parameter functions
- 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.

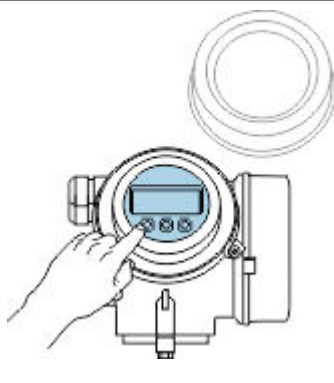
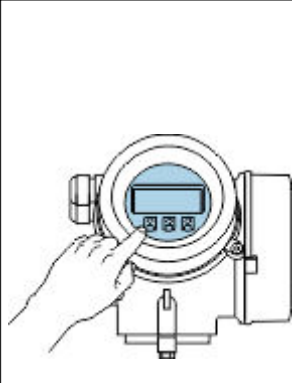
Efficient diagnostics increase measurement reliability

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

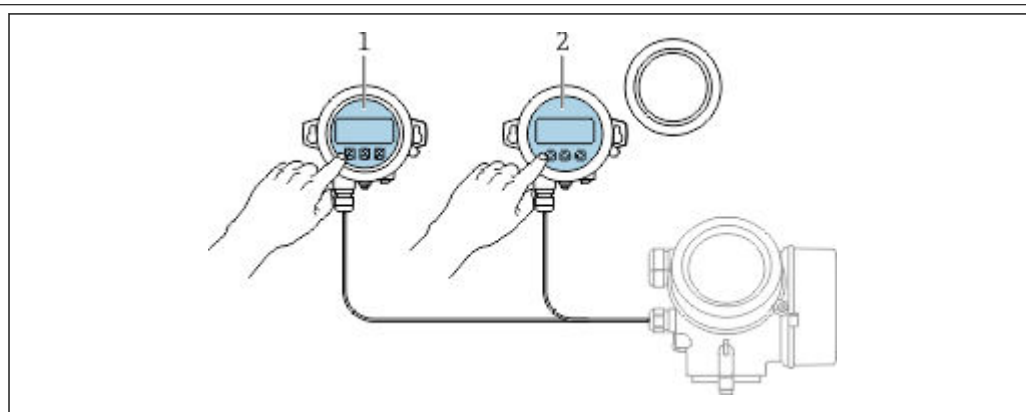
Integrated Bluetooth module (option for HART devices)

- 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

Local operation

Operation with	Pushbuttons	Touch Control
Order code for "Display; Operation"	Option C "SD02"	Option E "SD03"
		
Display elements	4-line display Format for displaying measured variables and status variables can be individually configured Permitted ambient temperature for the display: -20 to +70 °C (-4 to +158 °F) The readability of the display may be impaired at temperatures outside the temperature range.	4-line display white background lighting; switches to red in event of device error
Operating elements	local operation with 3 push buttons (◻, ◻, ◻) Operating elements also accessible in various hazardous areas	external operation via touch control; 3 optical keys: ◻, ◻, ◻
Additional functionality	Data backup function The device configuration can be saved in the display module.	
	Data comparison function The device configuration saved in the display module can be compared to the current device configuration.	
	Data transfer function The transmitter configuration can be transmitted to another device using the display module.	

Operation with remote display and operating module FHX50

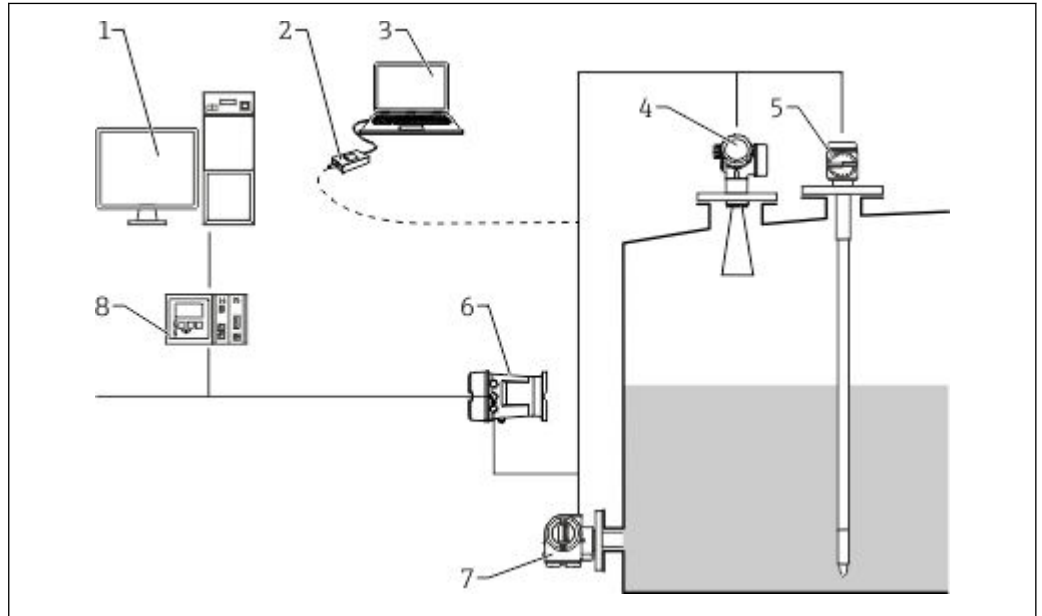


33 FHX50 operating options

- 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

Integration in tank gauging system

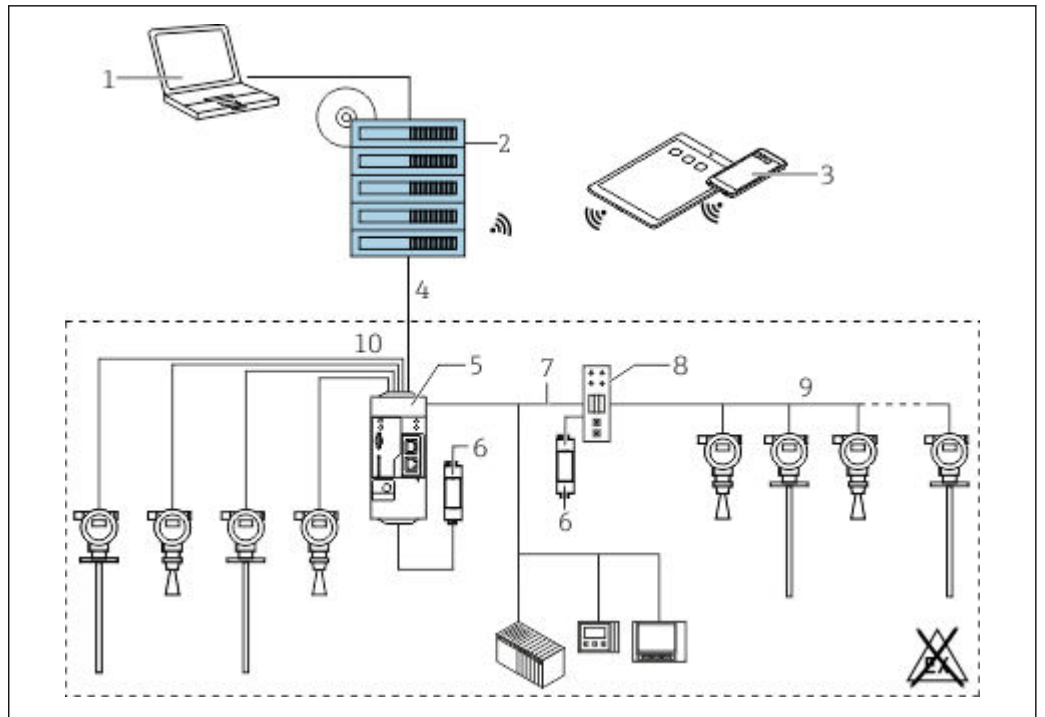
The Endress+Hauser Tank Side Monitor NRF81 provides integrated communications for sites with multiple tanks, each with one or more sensors on the tank, such as radar, spot or average temperature, capacitive probe for water detection and/or pressure sensors. Multiple protocols out of the Tank Side Monitor 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.



A0017982

40 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



A0034288

41 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)
- 4 Ethernet/WLAN/UMTS
- 5 Fieldgate FXA42
- 6 Power supply 24 V DC
- 7 Modbus TCP via Ethernet as server/client
- 8 Converter from Modbus to HART Multidrop
- 9 HART Multidrop
- 10 4 x 4 to 20 mA analog input (2-wire/4-wire)

DRAFT DRAFT

Radio standard EN302729

The devices Micropilot FMR50, with Antenna Horn 100 mm /4" cladded are conform with the LPR (Level Probing Radar) standard EN302729. The devices Micropilot FMR50, with Antenna Horn 100 mm /4" cladded are allowed to be used inside or outside of closed bins or tanks in countries of the 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.

Alle nicht aufgeführten Länder sind derzeit noch mit der Umsetzung beschäftigt.

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



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

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

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 (→  95); chapter "Diagnostics and trouble shooting"

Feature 010	Approval	Available for	Feature 020 "Power Supply; Output"				
			A ¹⁾	B ²⁾	C ³⁾	E ^{4)/G⁵⁾}	K ^{6)/L⁷⁾}
N3	NEPSI Ex d ia IIC T6 Ga/Gb, DIP A20/21 T85...90oC IP66	FMR50	XA01206F	XA01206F	XA01206F	XA01215F	XA01206F
8A	FM/CSA IS+XP Cl.I,II,III Div.1 Gr.A-G	FMR50	<ul style="list-style-type: none"> ▪ XA01112F ▪ XA01113F ▪ XA01116F ▪ XA01117F 	<ul style="list-style-type: none"> ▪ XA01112F ▪ XA01113F ▪ XA01116F ▪ XA01117F 	<ul style="list-style-type: none"> ▪ XA01112F ▪ XA01113F ▪ XA01116F ▪ XA01117F 	<ul style="list-style-type: none"> ▪ XA01114F ▪ XA01115F ▪ XA01118F ▪ XA01119F 	-

- 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
- 7) 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 ¹¹⁾:

Feature 010 ("Approval")	Feature 030 ("Display, Operation")	Ex marking
BG	L, M or N	ATEX II 3G Ex nA ia Ga IIC T6-T1 Gc
BH	L, M or N	ATEX II 3G Ex ic ia Ga IIC T6-T1 Gc
B3	L, M or N	ATEX II 1/2G Ex d ia IIC T6-T1 Ga/Gb, 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
I3	L, M or N	IECEX Ex d ia IIC T6-T1 Ga/Gb, IECEX Ex ta ia Db IIIC Txx°C Da/Db
MH	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

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

