Services

Technical Information Micropilot FMR50

Free space radar

Level measurement in liquids

Application

- Continuous, non-contact level measurement of liquids, pastes and slurries
- Encapsulated PVDF or PP cladded horn antenna
- Maximum measuring range: 40 m (131 ft)
- Process temperature: -40 to +130 °C (-40 to +266 °F)
- Process pressure: -1 to +3 bar (-14.5 to +43.5 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
- 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	
A DANGER	DANGER! This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.	
A WARNING	WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.	
	CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.	
NOTICE	NOTE! This symbol contains information on procedures and other facts which do not result in personal injury.	

Electrical symbols

Symbol	Meaning	
	Direct current	
\sim	Alternating current	
2	Direct current and alternating current	
<u>+</u>	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via grounding system.	
٢	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
\checkmark	Permitted Procedures, processes or actions that are permitted.
$\checkmark\checkmark$	Preferred Procedures, processes or actions that are preferred.
×	Forbidden Procedures, processes or actions that are forbidden.
i	Tip Indicates additional information.
	Reference to documentation.
	Reference to page.
	Reference to graphic.
۲	Visual inspection.

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 Indicates a hazardous area.
×	Safe area (non-hazardous area) Indicates the non-hazardous area.

Symbols at the device

Symbol	Meaning	
$\mathbf{A} \rightarrow \mathbf{B}$	Safety instructions Observe the safety instructions contained in the associated Operating Instructions.	
- K	Temperature resistance of the connection cablesSpecifies the minimum value of the temperature resistance of the connection cables.	

Terms and abbreviations

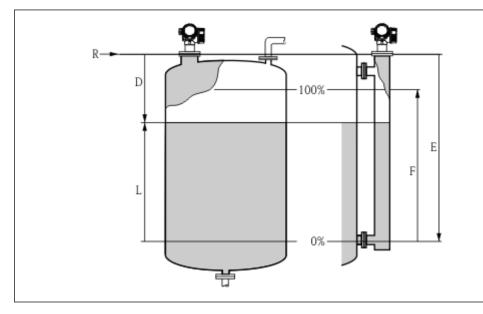
Term/abbreviation	Explanation	
BA	Document type "Operating Instructions"	
KA	Document type "Brief Operating Instructions"	
TI	Document type "Technical Information"	
SD	Document type "Special Documentation"	
ХА	Document type "Safety Instructions"	
PN	Nominal pressure	
MWP	Maximum Working Pressure The 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
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	FOUNDATIONTM Fieldbus Registered trademark of the FieldComm Group, Austin, Texas, USA
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	TRI CLAMP[®] Registered trademark of Alfa Laval Inc., Kenosha, USA
Endress+Hauser	V. 10, Rev. 2, 1-10-2019

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.



I 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
- $L \qquad Level (L = E D)$

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:

FMR50: → 🗎 54

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.

A0017871

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 guarantees 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

Retirement

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

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	
FMR50 - standard version	30 m (98 ft)	
FMR50 - with "Advanced dynamics" application package	40 m (131 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

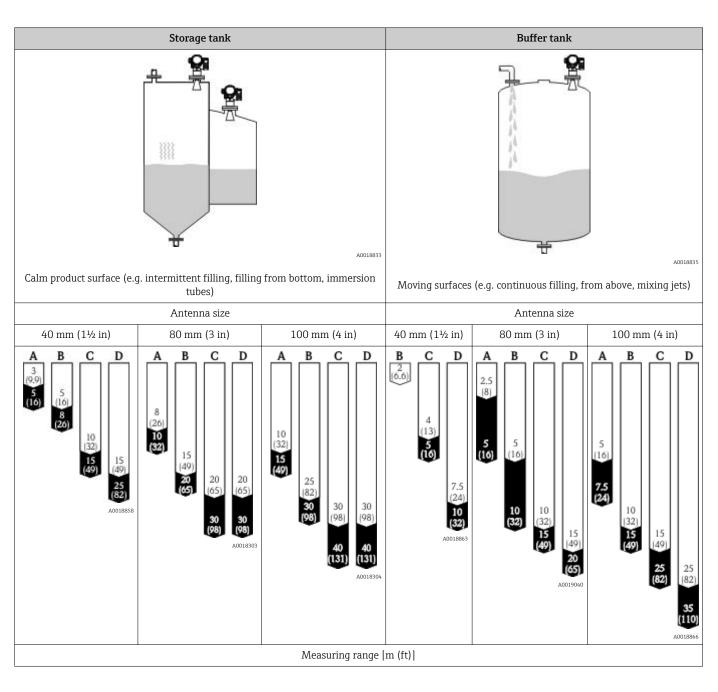
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Media groups	DC (ε _r)	Example
Α	1.4 to 1.9	non-conducting liquids, e.g. liquefied gas $^{1)}$
В	1.9 to 4	non-conducting liquids, e.g. benzene, oil, toluene,
С	4 to 10	e.g. concentrated acids, organic solvents, esters, aniline, alcohol, acetone,
D	> 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 to:

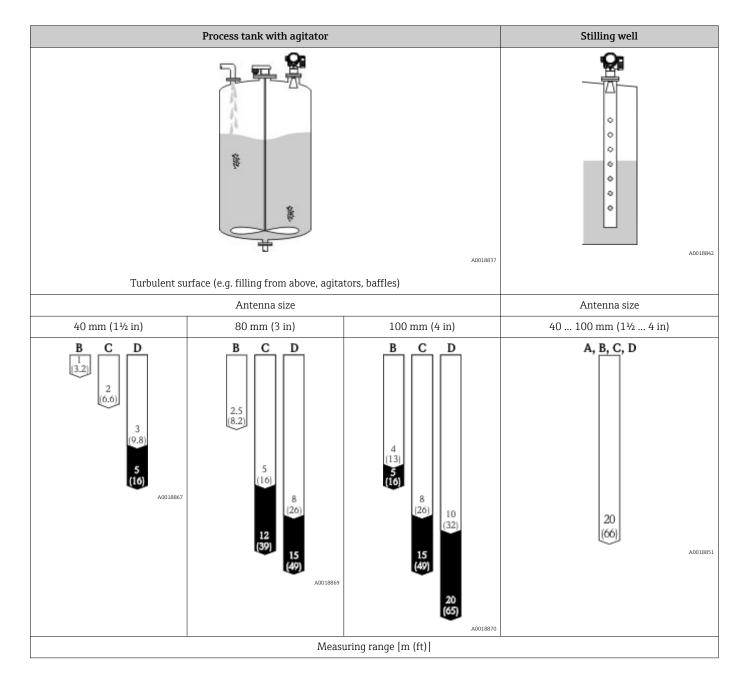
- the Endress+Hauser DC manual (CP01076F)
- the Endress+Hauser "DC Values App" (available for Android and iOS)



Legend

	Measuring range of the standard version
	Measuring range for the "Advanced dynami

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")

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 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"

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	$U = 16 \text{ to } 35 \text{ V}_{DC}, I = 0 \text{ to } 40 \text{ mA}$	
	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 aund 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	 Level linearized Distance Terminal voltage Electronic temperature Relative echo amplitude Diagnostic values, Advanced diagnostics 	
	Number of switching cycles	unlimited	
	 Failsafe mode with us Local display Status signal (in accor Plain text display Operating tool via digita service interface (CDI) 	actory setting): 22 mA ser-selectable value: 3.59 to 22.5 mA rdance with NAMUR Recommendation NE 107) al communication (HART, PROFIBUS PA, FOUNDATION Fieldbus) or rdance with NAMUR Recommendation NE 107)	
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	HART	
	Manufacturer ID	17 (0x11)	
	Device type ID	0x1128	
	HART specification	7.0	
	Device description files (DTN	A, 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 Avec of incounting
	Area of incouplingAnalog output adv. diagnostics 1
	 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	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	www.endress.comwww.profibus.org
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: • Digital output AD 1 • Digital output AD 2 • Switch output

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	 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 PRFIBUS 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	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	 Following methods are supported: 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	 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	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.		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

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

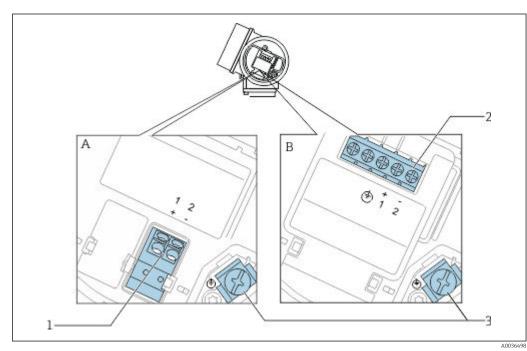


Up to 20 blocks can be instantiated in the device altogether, including the blocks already instantiated on delivery.

Power supply

Terminal assignment

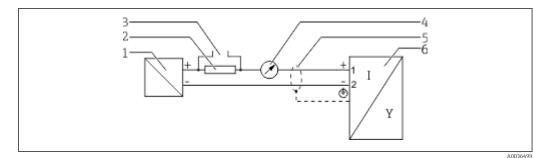
Terminal assignment 2-wire: 4-20 mA HART



🗟 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 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

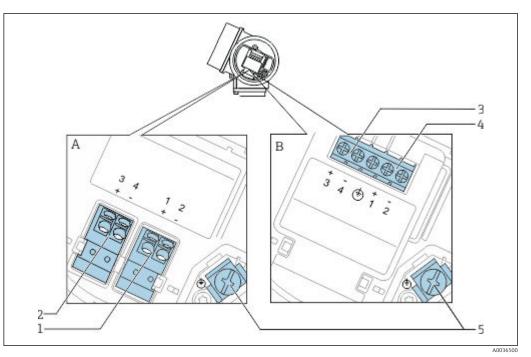


🗟 3 Block diagram 2-wire: 4-20 mA HART

- 1 Active barrier with power supply (e.g. RN221N); observe terminal voltage
- 2 HART communication resistor ($\geq 250 \Omega$); observe maximum load
 - 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

3

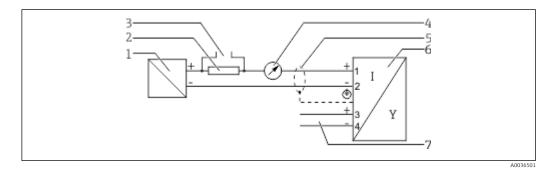
Terminal assignment 2-wire: 4-20 mA HART, switch output



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

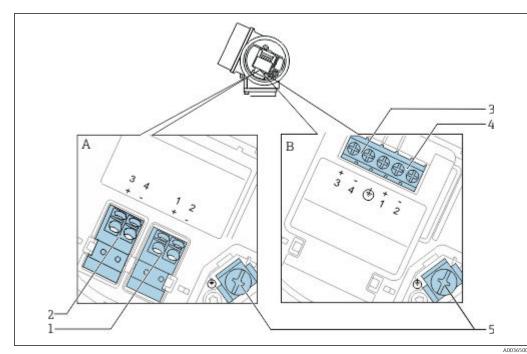
- A Without integrated overvoltage protection
- *B* With integrated overvoltage protection
- 1 Connection 4-20 mA HART passive: terminals 1 and 2, without integrated overvoltage protection
- 2 Connection switch output (Open Collector): terminals 3 and 4, without integrated overvoltage protection
- 3 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



- 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)

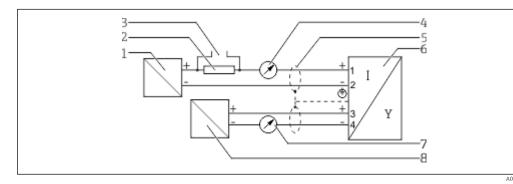
Terminal assignment 2-wire: 4-20 mA HART, 4-20 mA



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

- 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

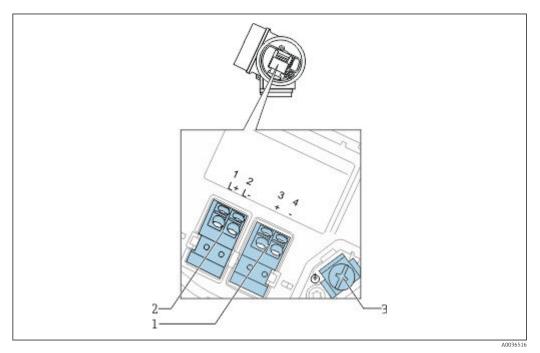
Block diagram 2-wire: 4-20 mA HART, 4-20 mA



🖻 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

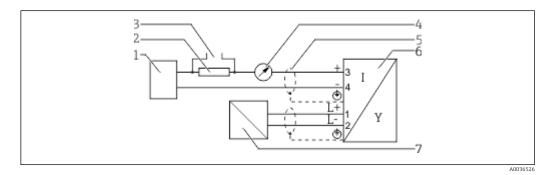
Terminal assignment 4-wire: 4-20 mA HART (10.4 to 48 V_{DC})



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

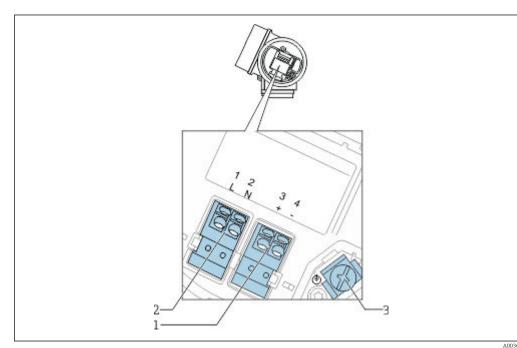
- 1 Connection 4-20 mA HART (active): terminals 3 and 4
- 2 Connection supply voltage: terminals 1 and 2
- 3 Terminal for cable screen

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



- 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 screen; observe cable specification
- 6 Measuring device
- 7 Supply voltage; observe terminal voltage, observe cable specification

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



 \blacksquare 10 Terminal assignment 4-wire: 4-20 mA HART (90 to 253 V_{AC})

- 1 Connection 4-20 mA HART (active): terminals 3 and 4
- 2 Connection supply voltage: terminals 1 and 2
- 3 Terminal for cable screen

Н

To ensure electrical safety:

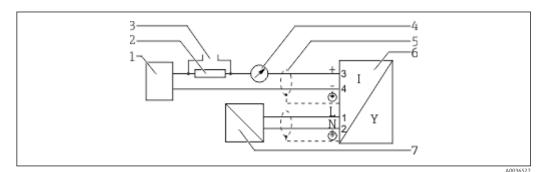
- Do not disconnect the protective connection.
- Disconnect the supply voltage before disconnecting the protective earth.

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).

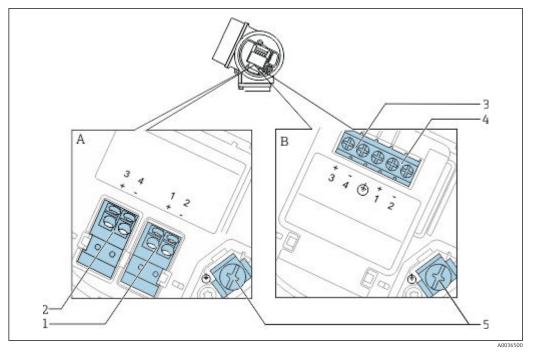
Block diagram 4-wire: 4-20 mA HART (90 to 253 V_{AC})



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

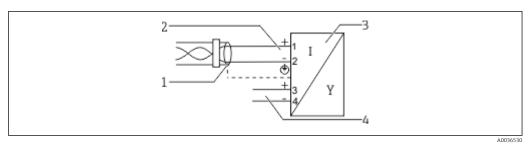
- 1 Evaluation unit, e.g. PLC
- 2 HART communication resistor ($\geq 250 \Omega$); observe maximum load
- 3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- 4 Analog display device; observe maximum load
- 5 Cable scree; observe cable specification
- 6 Measuring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

Terminal assignment PROFIBUS PA / FOUNDATION Fieldbus



- I2 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



🖻 13 Block diagram PROFIBUS PA / FOUNDATION Fieldbus

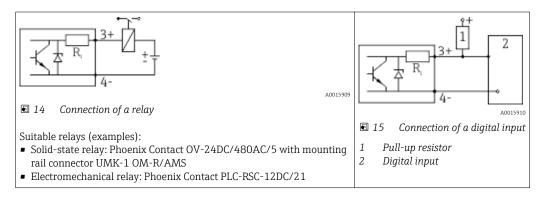
- 1 Cable screen; observe cable specifications
- 2 Connection PROFIBUS PA / FOUNDATION Fieldbus
- *3 Measuring device*
- 4 Switch output (open collector)

Connection examples for the switch output

A

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.

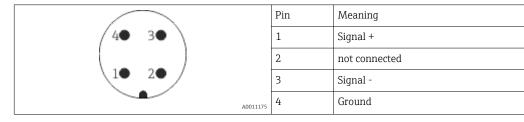


For optimum interference immunity we recommend to connect an external resistor (internal i resistance of the relay or Pull-up resistor) of $< 1000 \Omega$.

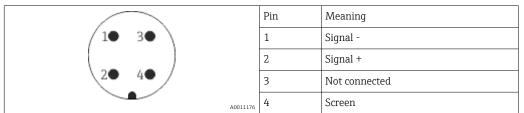
Device plug connectors

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.



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	Non-ExEx nAEx icCSA GP	10.4 to 35 V ^{3) 4) 5)}	R [Ω] 500
	Ex ia / IS	10.4 to 30 V ^{3) 4) 5)}	0 10 10.4 20 30 35 U ₀ [V] A0017140
	 Ex d(ia) / XP Ex ic(ia) Ex nA(ia) Ex ta / DIP 	13 to 35 V ^{5) 6)}	R [Ω]
	Ex ia + Ex d(ia) / IS + XP	13 to 30 V ^{5) 6)}	0 10 10 13 20 30 35 U ₀ V A0094771

1) Feature 020 of the product structure

Feature 010 of the product structure 2)

3) 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 \geq 5,5 mA (HART multidrop mode), a voltage of U \geq 10,4 V is sufficient throughout the entire range of ambient temperatures.

4) In the current simulation mode a voltage U \ge 12.5 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 6) (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	 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)}	R [Ω]
	 Ex ia / IS Ex ia + Ex d(ia) / IS + XP 	13 to 30 V ^{3) 4)}	0 10 10 13 20 30 35 U ₀ V A0034771

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) (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)}	R Ω 500 0 10 13 20 24 28 U ₀ V Δ03891

1) Feature 020 of the product structure

2) Feature 010 of the product structure

3) 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	$U_{SS} < 10 \text{ mV}$

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	 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⁾
	 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

r 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

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

HART

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

Power

FOUNDATION Fieldbus

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

FISCO

	Ui	17.5 V		
	Ii	550 mA		
	Pi	5.5 W		
	Ci	5 nF		
	L _i	10 µH		
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			
	 Gland M20; M For Non-Ex Plastics M2 For Dust-Ex For Ex d: No gland av Thread ½" NPT G ½" M20 × 1.5 Plug M12 / Pl Only available 			
	Feature 030 "Dis	play, Operation"	Cable entry for FHX50 connection	
	L: "Prepared for d	isplay 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	Pluggable spri Devices with Screw termina	but integrated overvoltage protection ing-force terminals for wire cross-sections 0.5 to integrated overvoltage protection als for wire cross-sections 0.2 to 2.5 mm ² (24 to comparature T $>$ 60 °C (140 °E), use cable for term	9 14 AWG)	

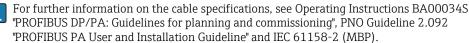
• For ambient temperature $T_U \ge 60 \degree$ C (140 °F): use cable for temperature $T_U + 20$ K.

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.



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 °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)
	• Reflector: metal plate with a minimum diameter of 1 m (40 m)

• No major interference reflections inside the signal beam

Maximum measured error

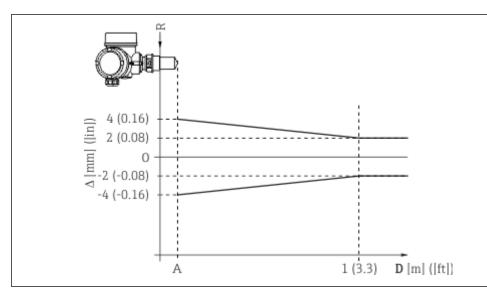
Typical data under reference operating conditions: DIN EN IEC 61298-2 / DIN EN IEC 60770-1; percentage values in relation to the span.

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"

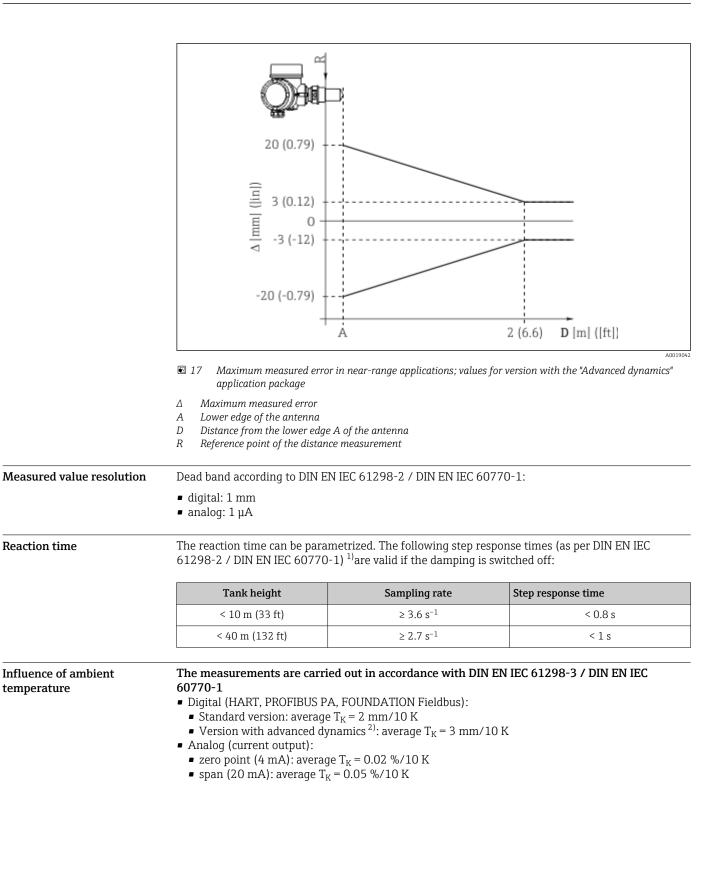
Differing values in near-range applications



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

- △ 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*

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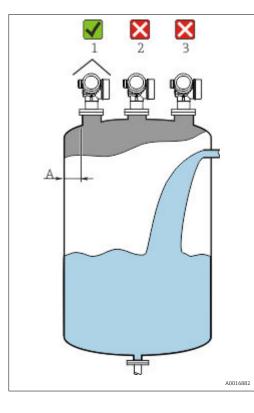


According to DIN EN IEC 61298-2 / DIN EN IEC 60770-1 the response time is the time which passes after a sudden change of the input signal until the output signal for the first time assumes 90% of the steady-state value. Feature 540 "Application Package", option EM

Installation

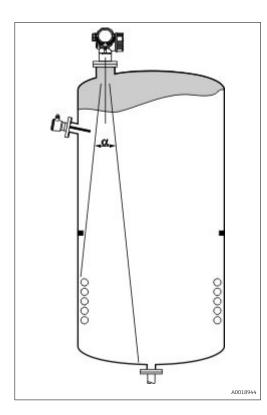
Installation conditions

Mounting position



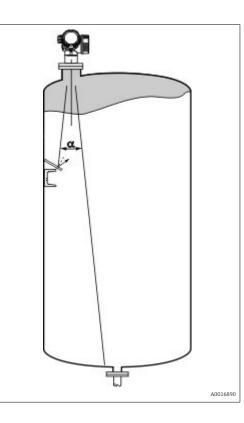
- Recommended distance A from wall to outer edge of nozzle: ~ 1/6 of tank diameter. Nevertheless the device should not be installed closer than 15 cm (5.91 in) to the tank wall.
- Not in the center (2), as interference can cause signal loss.
- Not above the fill stream (3).
- It is recommended to us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

Vessel installations



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 $\rightarrow \square 38$.

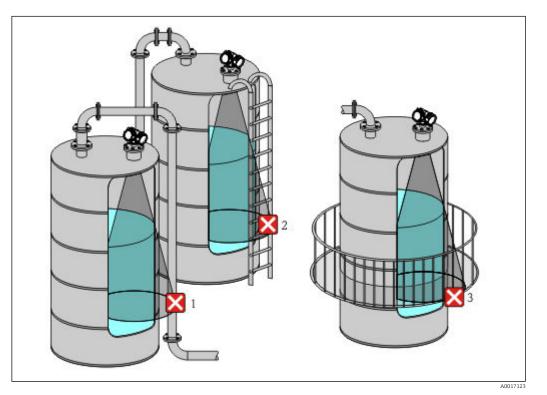
Reduction of interference echoes



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

Measurement in a plastic vessel

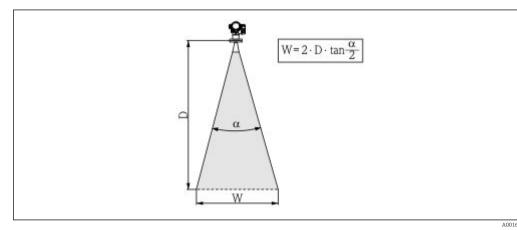
If the outer wall of the vessel is made of a non-conductive material (e.g. GRP), microwaves can also be reflected off interfering installations outside the vessel (e.g. metallic pipes (1), ladders (2), grates (3), ...). Therefore, there should be no such interfering installations in the signal beam. 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
 →
 ⁽¹⁾
 ⁽²⁾
 ⁽²
- 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 $\rightarrow \textcircled{B} 40 \rightarrow \textcircled{B} 41$. • Stilling well
- A stilling well can be applied to avoid interferences $\rightarrow \square 44$.
- 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 a, 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)

Aeasuring conditions				ncy for foaming use FMR53 or FM	
	Measurer	nent is possible unde	er certain conditi	rowaves or reflect them off the foa ons. For FMR50, FMR51 and FMR	52, the additiona
	option "Ac option EN		recommended in	n these cases (feature 540: "Applic	ation Package",
	 In case of FMR51 at 	heavy steam devel nd FMR52 may decr	ease depending o	nsate , the maximum measuring r on density, temperature and compo	
	 For the m use Level 	flex or Micropilot FM	rbing gases such AR54 in a stilling		-
	or conical	outlets the level car	not be detected l	hits the tank bottom. Particularly v pelow this point. Ic waves do not propagate complet	
	tube. It m guarantee	ust be taken into acc	count that the acc acy in these cases	curacy may be reduced in the area , it is recommended to position the	C . In order to
	 In case of through t 	media with a low di he medium at low le	electric constant vels (low height	$(\varepsilon_r = 1.5 \text{ to } 4)^{(4)}$ the tank bottom c C). Reduced accuracy has to be exp positioning the zero point at a dis	ected in this
	figure) ab In princip	ove the tank bottom le it is possible to me	in these applicates in these applicates as the second second second second second second second second second s		AR53 and FMR5
	should no • When usi	t be chosen any clos ng FMR54 with plar	er than A (see fig ar antenna, espe	gure) to the tip of the antenna. ecially for media with low dielectric	c constants, the
	 The small 		ing range B depe	er than A: 1 m (3.28 ft) to the flan nds on the antenna version (see fig).	
			4		
		100%			
			۹ /		
		0%			
			-	D D	
					A001
	Device	A [mm (in)]	B [m (ft)]	C [mm (in)]	H [m (ft)]

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.

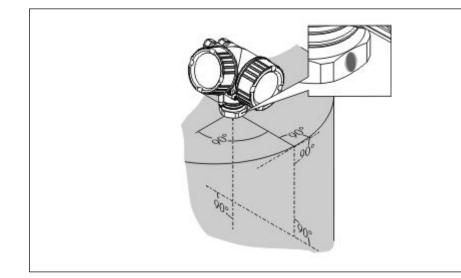
⁴⁾ Dielectric constants of important media commonly used in various industries are summarized in the DC manual (CP01076F) and in the Endress +Hauser "DC Values App" (available for Android and iOS).

Installation in vessel (free space)

Horn antenna encapsulated (FMR50)

Alignment

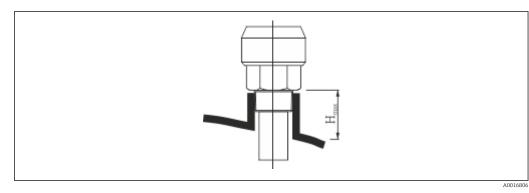
- Align the antenna vertically to the product surface.
- A marking at the threaded connection enables alignment of the antenna. This marking must be aligned towards the tank wall as well as possible.



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

Nozzle mounting

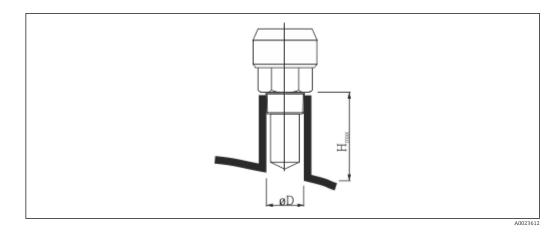
For optimum measurement, the tip of the antenna should extend below the nozzle. This is achieved by a nozzle height up to H_{max} = 60 mm (2.36 in).



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

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:



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)

F

If the antenna doesn't extend below the nozzle, observe the following:

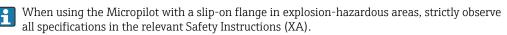
- The nozzle end must be smooth and free of burrs. If possible its edge should be rounded.
 An interference echo suppression must be performed.
- Please contact Endress+Hauser for applications with higher nozzles than those indicated in the table.

Threaded connection

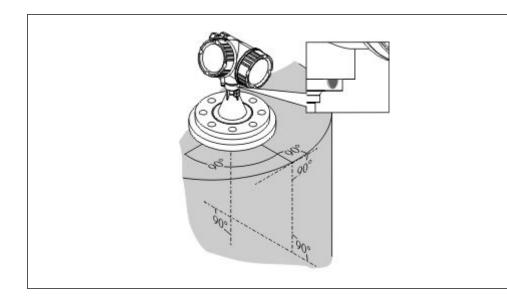
- Tighten with the hexagonal nut only.
- Tool : 50 mm hexagonal wrench
- Maximum permissible torque: 35 Nm (26 lbf ft)

Horn antenna with slip-on flange (FMR50)

Alignment

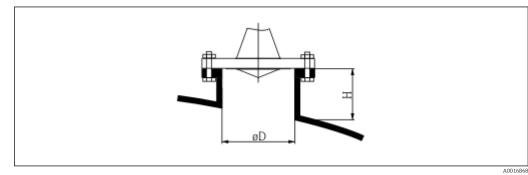


- Align the antenna vertically to the product surface.
 Optionally, a variable flange seal, which is available as an accessory, can be used for alignment (see Technical Information BA01048F, chapter "Accessories").
- A marking at the feedthrough enables alignment of the antenna. This marking must be aligned towards the tank wall as well as possible.



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

Nozzle mounting

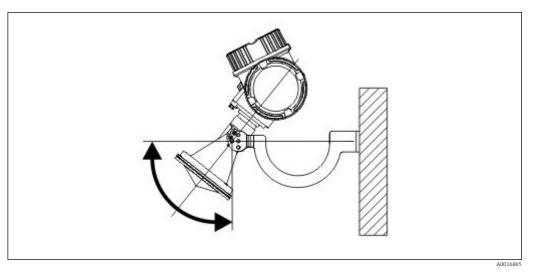


20 Nozzle height and diameter for horn antenna with slip-on flange

Nozzle diameter D	Maximum nozzle height H_{max}
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)

A0019439

Horn antenna with mounting bracket (FMR50)



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)

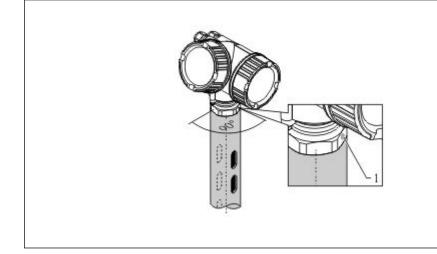
- Dielectric constant of the medium: $\epsilon_r > 10$
- If possible, use an antenna 100 mm (4 in).
- The distance from the lower edge of the antenna to the tank ceiling should be about 100 mm (4 in).
- If possible, avoid mounting locations where condensation or build-up might occur.
- In case of outdoor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

Installation in stilling well



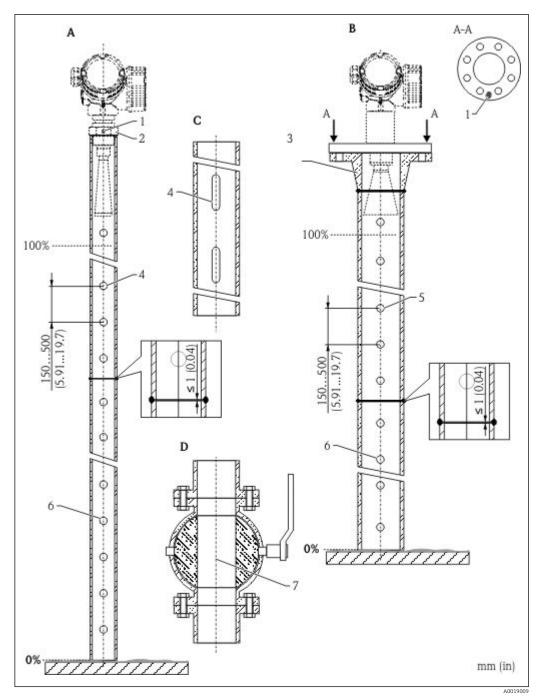
🖻 22 Installation in stilling well

- 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

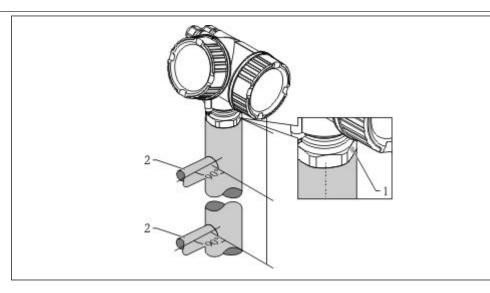
- Metal (no enamel coating; plastic on request).
- Constant diameter.
- Diameter of stilling well not larger than antenna diameter.
- Diameter difference between horn antenna and inner diameter of the stilling well as small as possible.
- Weld seam as smooth as possible and on the same axis as the slots.
- 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).
- The stilling well must be smooth on the inside (average roughness $R_z \le 6.3 \mu m$ (248 μin)). 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



- 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.

Installation in bypass



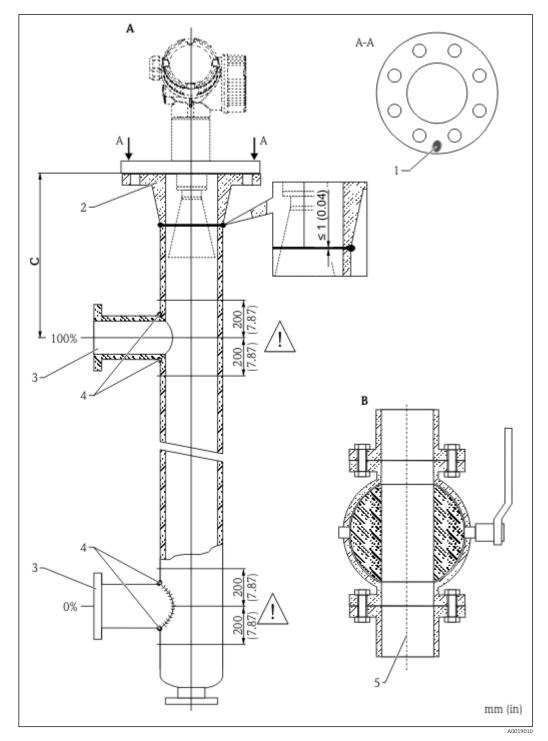
■ 23 Installation in bypass

- 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

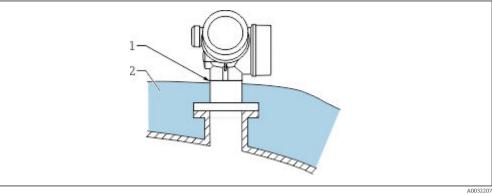
- Metal (no plastic or enamel coating).
- Constant diameter.
- Select horn antenna as big as possible. For intermediate sizes (e.g. 95 mm (3.5 in)) select next larger antenna and adapt it mechanically (for horn antennas).
- Diameter difference between horn antenna and inner diameter of the bypass as 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.

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.





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

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⁾										
	 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 refere to the separate Safety Instructions → P 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 Me	eaning									
	A 2-1	wire; 4-20 mA HART									
	В 2-т	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									
	К 4-	wire 90-253VAC; 4-20 mA HART									
	L 4-wire 10, 4-48VDC; 4-20 mA HART										

FMR50 Housing: GT19 (Plastics PBT) Temperature unit: °C (°F)										Γ, Δ	-@_	10019351
Power Supply; Output (Pos. 2	Р	1	Р	2	Р	3	Р	4	Р	5	Р	6
of the product structure)	Tp	Ta	Tp	Ta	Tp	Ta	Tp	Ta	Tp	Ta	Tp	Ta
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)	-	-

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Housing: GT19 (Plastics PBT) Temperature unit: °C (°F)											-®_	P3
Power Supply; Output (Pos. 2	P1		P2		P3		P4		P5		P6	
of the product structure)	T_p	Ta	Tp	Ta	Tp	Ta	Tp	Ta	Tp	Ta	Tp	Ta
C Channel 2 used	-40 (-40)	74 (165)	74 (165)	74 (165)	80 (176)	73 (163)	80 (176)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output not used	-40 (-40)	79 (174)	79 (174)	79 (174)	80 (176)	79 (174)	80 (176)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output used	-40 (-40)	63 (145)	63 (145)	63 (145)	80 (176)	60 (140)	80 (176)	-40 (-40)	-40 (-40)	-40 (-40)	-	-

									69—	-		@ A0019351
Power Supply; Output (Pos. 2	P	1	P	P2		3	P	4	P	5	P6	
of the product structure)	Tp	Ta	Tp	Ta	Tp	Ta	Tp	Ta	Tp	Ta	Tp	Ta
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)	80 (176)	80 (176)	80 (176)	80 (176)	80 (176)	80 (176)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output used	-40 (-40)	77 (171)	77 (171)	77 (171)	80 (176)	76 (169)	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)	-	-
C Channel 2 used	-40 (-40)	79 (174)	79 (174)	79 (174)	80 (176)	79 (174)	80 (176)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output not used	-40 (-40)	80 (176)	80 (176)	80 (176)	80 (176)	80 (176)	80 (176)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output used	-40 (-40)	78 (172)	78 (172)	78 (172)	80 (176)	78 (172)	80 (176)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
K, L	-40 (-40)	77 (171)	77 (171)	77 (171)	80 (176)	77 (171)	80 (176)	-40 (-40)	-40 (-40)	-40 (-40)	-	-

Storage temperature	-40 to +80 °C (-40 to +176 °F)
	–50 °C (–58 °F) with manufacturer declaration on request
Climate class	DIN EN 60068-2-38 (test Z/AD)
Altitude according to IEC61010-1 Ed.3	 Generally up to 2 000 m (6 600 ft) above MSL. Above 2 000 m (6 600 ft) if the following conditions are met: Ordering feature 020 "Power supply; Output" = A, B, C, E or G (2-wire versions) Supply voltage U < 35 V Supply voltage of overvoltage category 1

FMR50

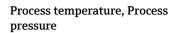
Housing: GT20 (Alu, coated) Temperature unit: °C (°F)

Degree of protection	 With closed housing tested according to: 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 	
	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.	
Vibration resistance	DIN EN 60068-2-64 / IEC 60068-2-64: 20 to 2000 Hz, 1 (m/s ²) 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 ϵ_r .	
	If the medium tends to cause contamination and deposits, cleaning on a regular basis is recommended. Care has to be taken not to damage the antenna in the process of a mechanical or hose-down cleaning. The material compatibility has to be considered if cleaning agents are used! The maximum permitted temperature at the flange should not be exceeded.	
Electromagnetic compatibility (EMC)	Electromagnetic compatibility to all relevant requirements of the EN 61326- series and NAMUR recommendation EMC (NE21). For details see declaration of conformity. ⁶⁾ .	
	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.	

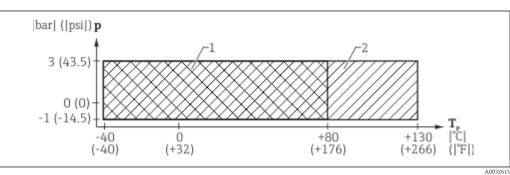
5) This restriction is valid if the following options of the product structure have been selected at the same time: 030 ("Display, Operation") = C ("SD02") or E ("SD03"); 040 ("Housing") = A ("GT19").

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

Process



FMR50



■ 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
GGF: Thread ISO228 G1-1/2RGF: Thread ANSI MNPT1-1/2	-40 to +130 ℃ (-40 to +266 ℉)	$p_{rel} = -1$ to 3 bar (-14.5 to 43.5 psi) $p_{abs} < 4$ bar (58 psi) ¹⁾ .
 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 $\rightarrow~\textcircled{}75$

Dielectric constant

- For liquids • $\epsilon_r \ge 1.9$ in free-field applications
- $\epsilon_r \ge 1.4$ in stilling well
- For bulk solids
- $\epsilon_r \geq 1.6$

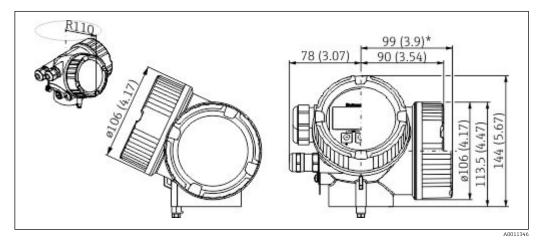
For dielectric constants (DC values) of many media commonly used in various industries refer to:

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

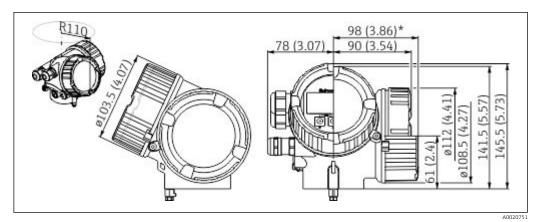
Mechanical construction

Dimensions

Dimensions of the electronics housing

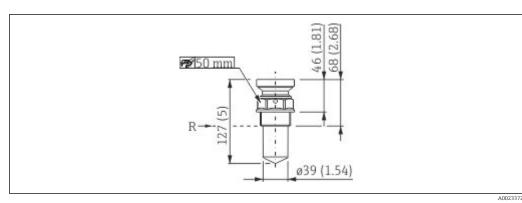


B 25 Housing GT19 (Plastics PBT); Dimensions in mm (in)
 *for devices with integrated overvoltage protection.



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

FMR50 with thread



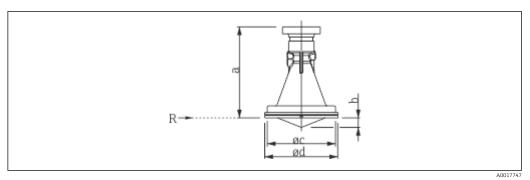
27 FMR50 with thread; dimensions: mm (in)

R Reference point of the measurement

Valid for the following device versions

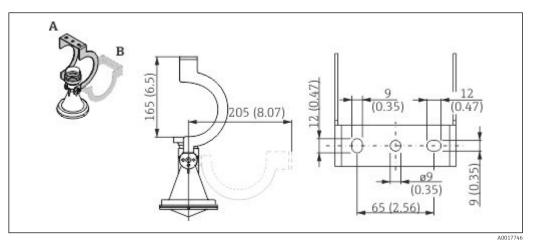
- Feature 100 "Process connection"
 - GGF: Thread ISO228 G1-1/2, PVDF
 - RGF: Thread ANSI MNPT1-1/2, PVDF
- Feature 070 "Antenna" BM: Horn 40mm/1-1/2", PVDF encapsulated

FMR50 with mounting bracket or customer side connection



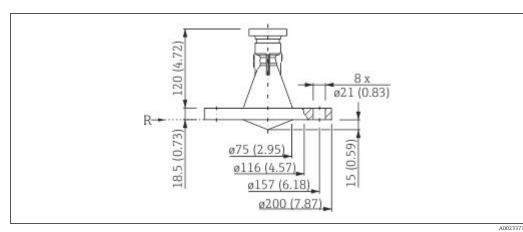
- ☑ 28 FMR50 without process connection; dimensions: mm (in)
- *R* Reference point of the measurement

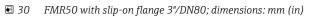
	Feature 100 "Process connection" • UAE Mounting bracket • XRO: Customer side connection	
	Feature 070 "Antenna" Feature 070 "Antenna" BN: Horn 80mm/3" BR: Horn 100mm/4"	
a	138 mm (5.43 in)	151 mm (5.94 in)
b	15 mm (0.59 in) 20 mm (0.79 in)	
Фc	107 mm (4.21 in)	127 mm (5 in)
Ød	115 mm (4.53 in) 135 mm (5.31 in)	



- 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 3"/DN80



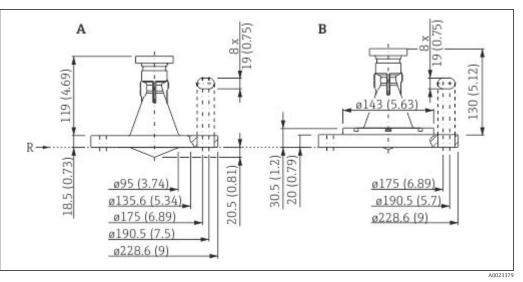


R Reference point of the measurement

Valid for the following device versions

- Feature 100 "Process connection" XWG: UNI slip-on flange 3"/DN80, PP
- Feature 070 "Antenna"
 BN: Horn 80mm/3", PP cladded
- The UNI slip-on flange is suitable for:
 - ASME: NPS 3" Cl.150
 - EN: DN80 PN16
 - JIS: 10K 80

FMR50 with slip-on flange 4"/DN100

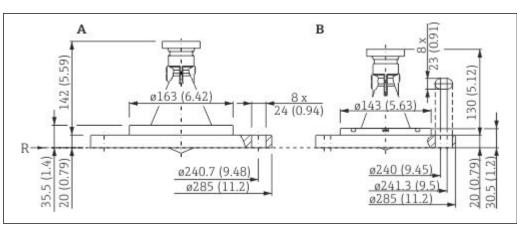


- S1 FMR50 with slip-on flange 4"/DN100; dimensions: mm (in)
- A Horn antenna 100mm/4" (without adapter ring)
- B Horn antenna 80mm/3" (with adapter ring)
- *R* Reference point of the measurement

Valid for the following device versions

- Feature 100 "Process connection": XZG: UNI slip-on flange 4"/DN100
- Feature 070 "Antenna":
- BR: Horn 100mm/4", PP cladded (diagram A)
- BN: Horn 80mm/3", PP cladded (diagram B)
- The UNI slip-on flange is suitable for:
 - ASME: NPS 4" Cl.150
 - EN: DN100 PN16
 - JIS: 10K 100

FMR50 with slip-on flange 6"/DN150



■ 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

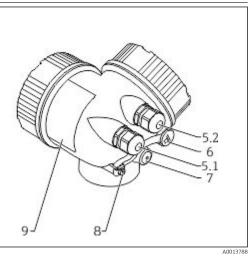
Part	Weight
Housing GT19 - plastic	approx. 1.2 kg (2.7 lb)
Housing GT20 - aluminium	approx. 1.9 kg (4.2 lb)

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)



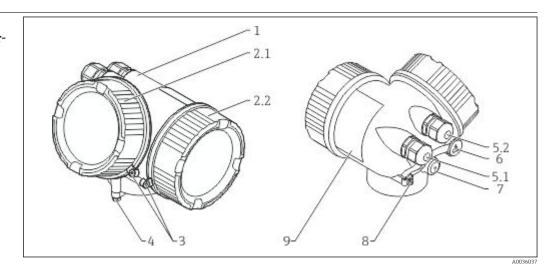
No.	Part	Material
1	Housing	PBT
2.1	Cover of the electronics compartment	 Cover glass: PC Cover frame: PBT-PC Cover seal: EPDM Thread-coating: Graphite-based lubricant varnish
2.2	Cover of the terminal compartment	Cover: PBTCover seal: EPDMThread-coating: Graphite-based lubricant varnish
4	Lock at the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

Micropilot FMR50

Materials: GT20 housing (die-cast aluminum, powdercoated)



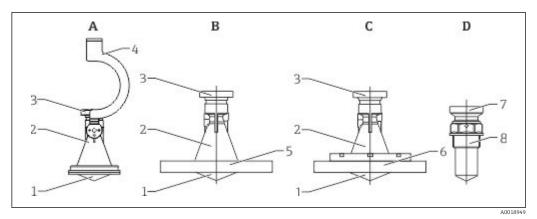
Nr.	Part	Material
1	Housing, RAL 5012 (blue)	Housing: AlSi10Mg(<0,1% Cu)Coating: Polyester
2.1	Cover of the electronics compartment; RAL 7035 (gray)	 Cover: AlSi10Mg(<0,1% Cu) Window: Glass Cover seal: NBR Seal of the window: NBR Thread-coating: Graphite-based lubricant varnish
2.2	Cover of the terminal compartment; RAL 7035 (gray)	 Cover: AlSi10Mg(<0,1% Cu) Cover seal: NBR Thread-coating: Graphite-based lubricant varnish
3	Cover lock	Screw: A4Clamp: 316L (1.4404)
4	Lock at the housing neck	Screw: A4-70Clamp: 316L (1.4404)
5.1	Dummy plug, cable gland, adapter or plug (depending on the device version)	 Dummy plug, depending on the device version: PE PBT-GF Cable gland, depending on the device version: Nickel-plated brass (CuZn) PA Adapter: 316L (1.4404/1.4435) Seal: EPDM M12 plug: Nickel-plated brass ¹⁾ 7/8" plug: 316 (1.4401)²⁾
5.2	Dummy plug, cable gland or adapter (depending on the device version)	 Dummy plug, depending on the device version: PE PBT-GF Nickel-plated steel Cable gland, depending on the device version: Nickel-plated brass (CuZn) PA Adapter: 316L (1.4404/1.4435) Seal: EPDM
6	Dummy plug or M12 socket (depending on the device version)	 Dummy plug : Nickel-plated brass (CuZn) M12 socket: Nickel-plated GD-Zn
7	Pressure relief stopper	Nickel-plated brass (CuZn)

Nr.	Part	Material
8	Ground terminal	 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



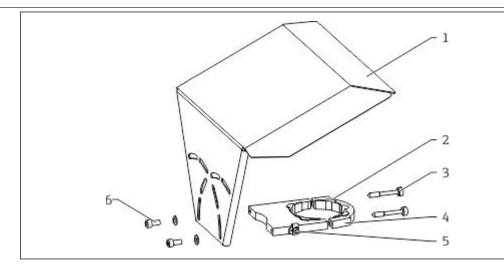
- A Standard version with mounting bracket
- *B* Horn antenna with slip-on flange
- C Horn antenna with flange and adapter ring
- D Threaded version

FMR50

Pos.	Part	Material
1	Focusing lense	РР
	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	РР
6	Flange + adapter ring	РР
	Screw	A2
	Seal	FKM
7	Housing adapter	PBT
8	Schrew-in adapter	PVDF

Materials: Weather protection cover

protection cover



No	Part: Material	
1	Protection cover: 316L (1.4404)	
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)	
6	Washer: A4Cheese head screw: A4-70	

A0015473

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
	 balasa 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

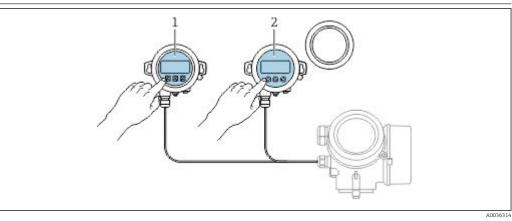
Integrated Bluetooth module (option for HART devices)

- 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

Operation with	Pushbuttons	Touch Control
Order code for "Display; Operation"	Option C "SD02"	Option E "SD03"
Display elements	A036312 4-line display	A0036313 4-line display white background lighting; switches to red in
	Format for displaying measured variables and st	event of device error
	Permitted ambient temperature for the display: The readability of the display may be impaired a range.	-20 to +70 °C (-4 to +158 °F)
Operating elements	local operation with 3 push buttons (\oplus , \Box , \mathbb{E})	external operation via touch control; 3 optical keys: ⊕, ⊡, ₪
	Operating elements also accessible in various hazardous areas	
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 dev configuration.	
	Data transfer function The transmitter configuration can be transmitte	d to another device using the display module.

Operation with remote display and operating module FHX50

Local operation

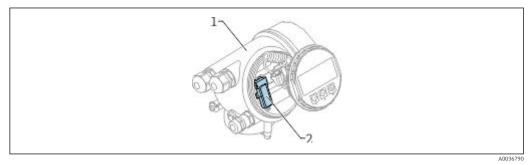


- 33 FHX50 operating options
- 1 Display and operating module SD03, optical keys; can be operated through the glass of the cover
- 2 Display and operating module SD02, push buttons; cover must be removed

Endress+Hauser

Operation via Bluetooth[®] wireless technology

Requirements



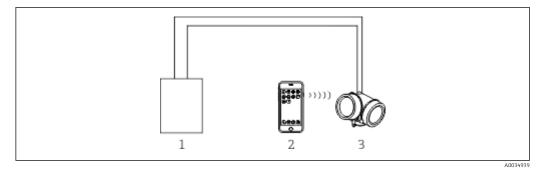
- 34 Device with Bluetooth module
 - Electronics housing of the device
- 2 Bluetooth module

1

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.

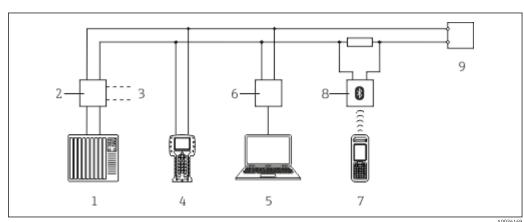
Operation via SmartBlue (app)



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

Remote operation

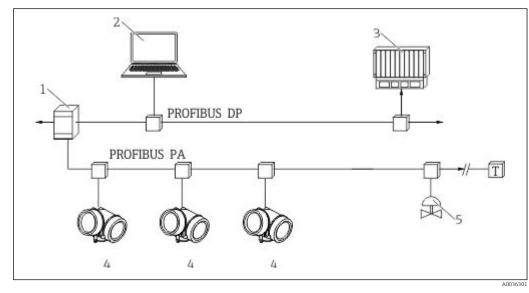
Via HART protocol



■ 36 Options for remote operation via HART protocol

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

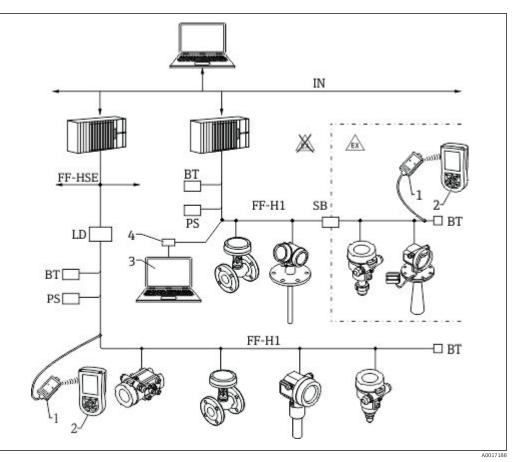
Via PROFIBUS PA protocol



37 Options for remote operation via PROFIBUS PA protocol

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

Via FOUNDATION Fieldbus

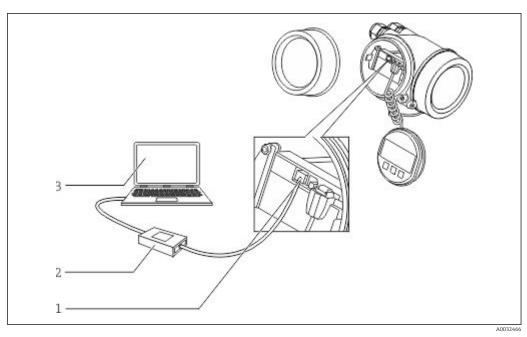


38 FOUNDATION Fieldbus system architecture with associated components

- 1 FFblue Bluetooth modem
- 2 Field Xpert SFX350/SFX370
- 3 DeviceCare/FieldCare
- 4 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)

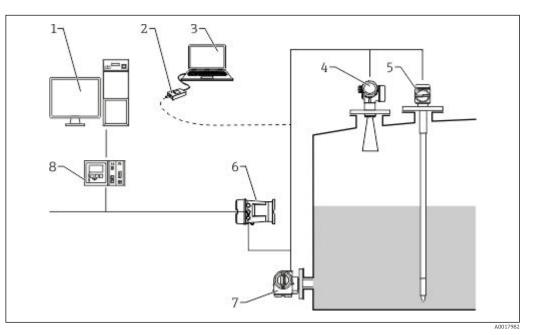


39 DeviceCare/FieldCare via service interface (CDI)

- 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.



■ 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

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

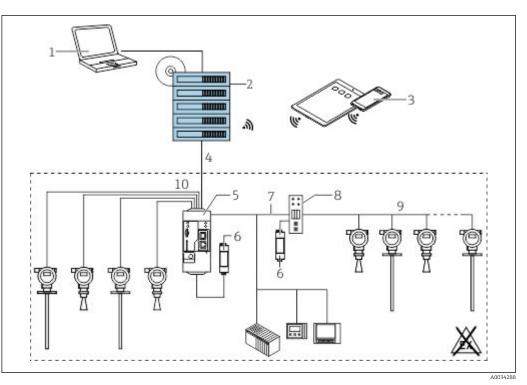
All the tanks and the tank inventories are represented graphically on a map (based on Google Maps). The tanks and inventory situations can be filtered by tank group, product, supplier or location.

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.

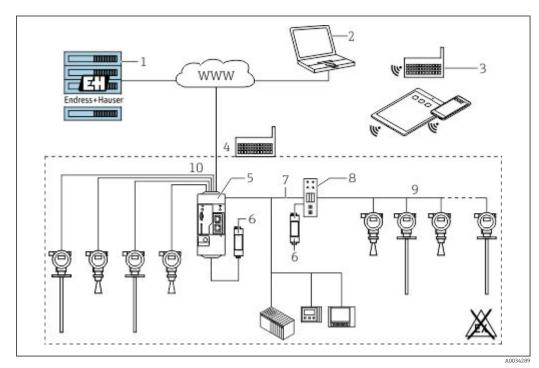


☑ 41 Example of inventory management platform with SupplyCare Enterprise SCE30B

- 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
- Modbus TCP via Ethernet as server/client
 Converter from Modbus to HART Multidrop
- 9 HART Multidrop
- 10 4 x 4 to 20 mA analog input (2-wire/4-wire)

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.



42 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
- 9 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.
	A0029561
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: $\rightarrow \square$ 95.
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 TÜV Rheinland in accordance with IEC 61508, refer to the "Functional Safety Manual" for information.
WHG	WHG approval: Z-65.16-524
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.

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 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.

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.

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 FMR50 with antenna 100 mm / 4" PP cladded, 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 km around RAS stations the maxium operation height of devices is 15 m (49 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 model FMR50T is a submodel of the FMR50 that fulfills the requirements for use as TLPR (Tank Level Probe Radar).
 - The model FMR50L is a submodel of the FMR50. "L" indicates the unique option BR 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 folowing 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	
	GGF	Gewinde ISO228 G1-1/2, PVDF	
	RGF	Thread ANSI MNPT1-1/2, PVDF	

Feature 100 of the product structure	Process connection
XWG	UNI slip on flange 3"/DN80/80, PP
XZG	UNI slip on flange 4"/DN100/100, PP
X0G	UNI slip on flange 6"/DN150/150, PP

• 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 → 🗎 52 is not affected by the CRN approval.

Product	Antenna 1)	Process connection ²⁾	Seal ³⁾	max. pressure
FMR50/FMR56	BN: Horn 80mm/3"	XWG: UNI slip-on flange 3"		1.6 bar (23.2 psi)
		XZG: UNI slip-on flange 4"		1.5 bar (21.75 psi)
		X0G: UNI slip-on flange 6"		1.5 bar (21.75 psi)
	BR: Horn 100mm/4"	XZG: UNI slip-on flange 4"		12 bar (17.4 psi)
		XOG: UNI slip-on flange 6"		1.8 bar (26.1 psi)

1) Feature 070 of the product structure

2) Feature 100 of the product structure

3) Feature 090 of the product structure

Track record

FMR5x is the upgrade model of the corresponding FMR2xx series.

Test, Certificate	Test reports, declarations and material test certificates can be obtained electronically from the <i>W@M Device Viewer</i> : 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"
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

Ordering information

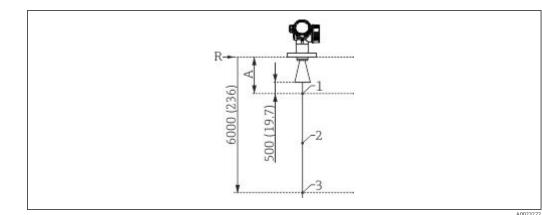
Ordering information	Detailed ordering information is available from the following sources:
-	In the Product Configurator on the Endress+Hauser website: www.endress.com -> Click "Corporate"
	-> Select your country -> Click "Products" -> Select the product using the filters and search field ->
	Open product 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
	 Product Configurator - the tool for individual product configuration Up-to-the-minute configuration data Depending on the device: Direct input of measuring point apositis information such as
	 Depending on the device: Direct input of measuring point energific information such as

- 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:



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

- A 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)
- 3 Third measuring point

Measuring point	Position	
1 st measuring point	 At the distance A from the reference point A = antenne length + antenna extension (if present) + 500 mm (19.7 in) Minimum distance: A_{min} = 1 000 mm (39.4 in) 	
2 nd measuring point	entrally between 1 st and 3 rd measuring point	
3 rd measuring point	6000 mm (236 in) below the reference point, R	

The position of the measuring points may vary by ±1 cm (±0.04 in).



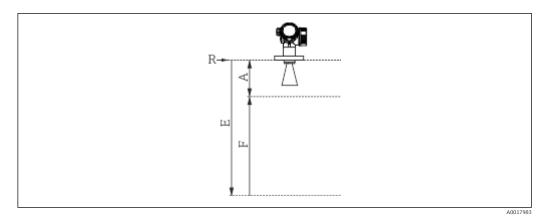
The linearity is checked under reference conditions.

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 $^{7)}$.

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



Minimum distance between reference point (R) and 100% level	Minimum span	Maximum value for "Empty calibration"
A ≥ Antenna length + 200 mm (8 in) Minimum value: 400 mm (16 in)	F ≥ 400 mm (16 in)	E ≤ 24 m (79 ft)



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 →
82.

⁷⁾ 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 \rightarrow Distance unit	HARTPAFF	 in ft mm m
Setup \rightarrow Empty calibration	HARTPAFF	max. 70 m (230 ft)
Setup \rightarrow Full calibration	HARTPAFF	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	MinMaxLast valid value
Setup \rightarrow Adv. Setup \rightarrow Current output 1/2 \rightarrow Burst mode	HART	OffOn

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 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		e selected via the product structure in the Product Configurator ⁸⁾ : etting impairment substances) on HART $\rightarrow \square$ 82

- Customized parametrization HART \rightarrow 🗎 82
- Customized parametrization $PA \rightarrow \square 82$
- Customized parametrization $FF \rightarrow \cong 82$
- Without tooling DVD (FieldCare)

⁸⁾ 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

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 ⁹ 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 10)

- 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

SD01871F

9) DTM: Device Type Manager; controls device operation via DeviceCare, FieldCare or a DTM-based process control system.

10) Only relevant for devices with SIL or WHG approval: order code 590 ("Additional approval"), option LA ("SIL") or LC ("WHG").

- 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

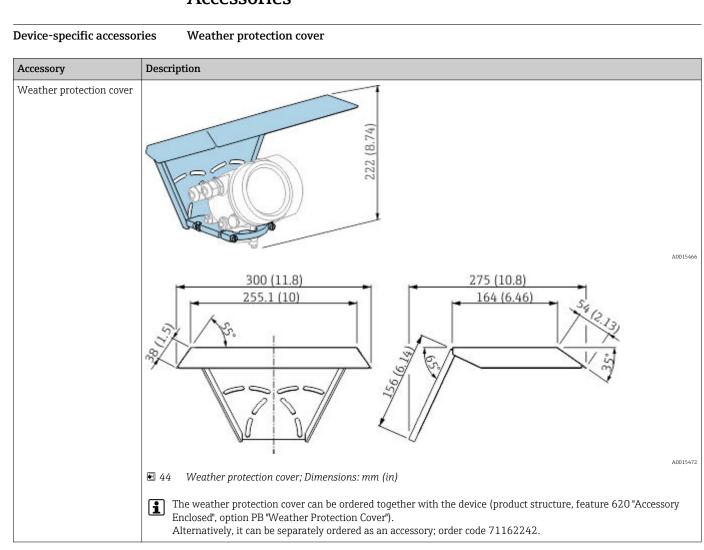
- The Heartbeat Monitoring module contains the **Build-up detection** wizard.
- The wizard is used to configure automatic buildup detection, which detects the buildup of deposits on the antenna on the basis of the increased area of the coupling signal. Buildup detection can be linked to a switch output 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





Accessories

Mounting nut G1-1/2

Accessory	Description
Mounting nut G1-1/2	Drawing in preparation For FMR50 with with 40mm/1-1/2" horn antenna and G1-1/2" thread Material: PC Order code: 52014146

Description Accessory Variable flange seal for FMR50/FMR56 2 ød वाय <u>a 12</u> øD ab 212 2 -3 A0018871 1 UNI slip-on flange 2 Variable flange seal 3 Nozzle The material and process conditions of the adjustable flange seal must fit the process properties (temperature, 1 pressure, resistance). Technical data: DN/JIS version Order code 71074263 71074264 71074265 DN80 PN10/40 DN100 PN10/16 DN150 PN10/16 Compatible with JIS 10K 150A Length of screws 100 mm (3.9 in) 100 mm (3.9 in) 110 mm (4.3 in) Size of screws M14 M14 M18 Material EPDM Process pressure -0.1 to 0.1 bar (-1.45 to 1.45 psi) -40 to +80 °C (-40 to +176 °F) Process temperature D 142 mm (5.59 in) 162 mm (6.38 in) 218 mm (8.58 in) d 169 mm (6.65 in) 89 mm (3.5 in) 115 mm (4.53 in) h 22 mm (0.87 in) 23.5 mm (0.93 in) 26.5 mm (1.04 in) 14 mm (0.55 in) 14 mm (0.55 in) 14 mm (0.55 in) \mathbf{h}_{\min} h_{max} 30 mm (1.18 in) 33 mm (1.3 in) 39 mm (1.45 in)

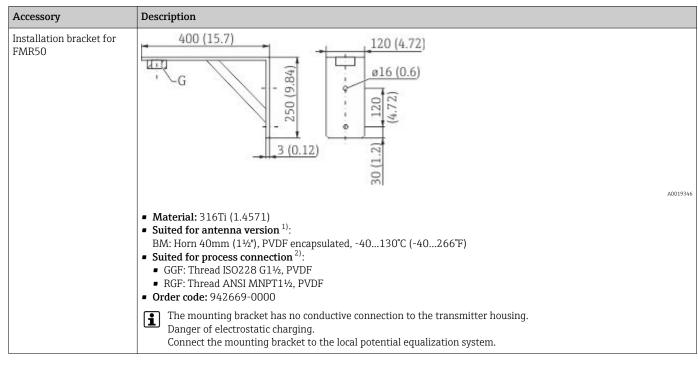
Variable flange seal for FMR50/FMR56

Accessory	Description			
	Technical data: ASME/JIS version			
	Order code	71249070	71249072	71249073
	Compatible with	ASME 3" 150lbsJIS 80A 10K	ASME 4" 150lbs	ASME 6" 150lbs
	Length of screws	100 mm (3.9 in)	100 mm (3.9 in)	110 mm (4.3 in)
	Recommended screw size	M14	M14	M18
	Material		EPDM	I
	Process pressure		-0.1 to 0.1 bar (-1.45 to 1	.45 psi)
	Process temperature		-40 to +80 °C (-40 to +176 °F)	
	D	133 mm (5.2 in)	171 mm (6.7 in)	219 mm (8.6 in)
	d	89 mm (3.5 in)	115 mm (4.53 in)	168 mm (6.6 in)
	h	22 mm (0.87 in)	23.5 mm (0.93 in)	26.5 mm (1.04 in)
	h _{min}	14 mm (0.55 in)	14 mm (0.55 in)	14 mm (0.55 in)
	h _{max}	30 mm (1.18 in)	33 mm (1.3 in)	39 mm (1.45 in)

Mounting bracket for wall or ceiling mounting of FMR50/FMR56

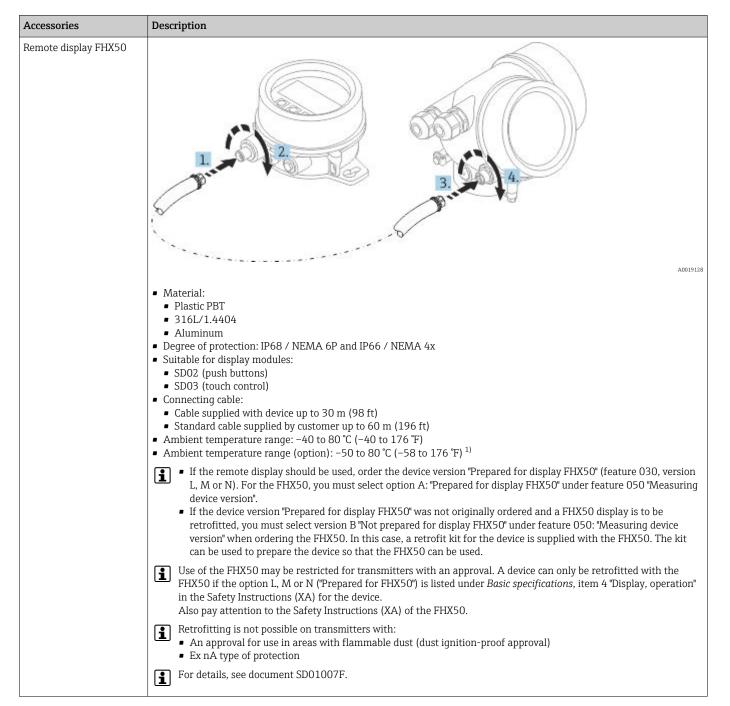
Accessory	Description
Mounting bracket for wall or ceiling mounting of FMR50/FMR56	$\begin{array}{c} \mathbf{A} \\ \begin{array}{c} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$
	A00177 © 45 Mounting bracket for FMR50/FMR56 with horn antenna
	 A Mounting at ceiling B Mounting at wall
	 Material: Mounting bracket: 304 (1.4301) Screws: A2 Nordlock washer: A4 Order code: 71162776

Installation bracket for FMR50



1) Feature 070 of the product structure

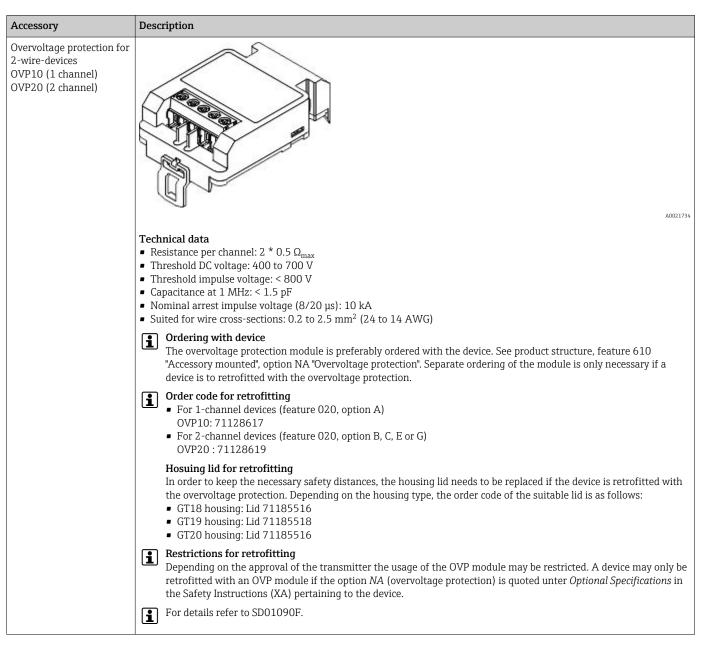
2) Feature 100 of the product structure



Remote display FHX50

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.

Overvoltage protection



Description Accessory Bluetooth module A0036493 • 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. **i** Ordering with device [**i**] 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 li Bluetooth module (BT10): 71377355 Restrictions in case of retrofitting |**i**| 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.

Bluetooth module for HART devices

Endress+Hauser

Communication-specific accessories

Accessory	Description
Commubox FXA195 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 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 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 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 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 Enterprise 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

Accessories	Description
SupplyCare 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 non-Ex area .
	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 non-Ex area and the Ex area . 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
		 DeviceCare is available for download at www.software-products.endress.com. The download requires a registration in the Endress+Hauser software portal. Alternatively, a DeviceCare DVD can be ordered with the device. Product structure: Feature 570 "Service", Option IV "Tooling DVD (DeviceCare Setup)".
	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 the relevant process variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on an SD card or USB stick.
		For details 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

Documentation



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

Standard documentation

Micropilot FMR50

Correlation of documentations to the device:

Device	Power supply, output	Communication	Document type	Document code
FMR50	A, B, C, K, L	HART	Operating Instructions	BA01045F/00/EN
			Brief Operating Instructions	KA01099F/00/EN
			Description of Device Parameters	GP01014F/00/EN
	G PROFIBUS PA	Operating Instructions	BA01124F/00/EN	
			Brief Operating Instructions	KA01128F/00/EN
			Description of Device Parameters	GP01018F/00/EN
	E FOUNDATION Fieldbus	FOUNDATION Fieldbus	Operating Instructions	BA01120F/00/EN
			Brief Operating Instructions	KA01124F/00/EN
			Description of Device Parameters	GP01017F/00/EN

Supplementary documentation

Application Package 1)	Document type	Document code
EH: Heartbeat Verification + MonitoringEJ: Heartbeat Verification	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 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"		y; Output"		
010			A ¹⁾	B ²⁾	C ³⁾	E ⁴⁾ /G ⁵⁾	K ⁶⁾ /L ⁷⁾
BA	ATEX: II 1 G Ex ia IIC T6-T1 Ga	FMR50	XA00677F	XA00677F	XA00677F	XA00685F	-
BB	ATEX: II 1/2 G Ex ia IIC T6-T1 Ga/Gb	FMR50	XA00677F	XA00677F	XA00677F	XA00685F	-
BC	ATEX: II 1/2 G Ex d [ia] IIC T6-T1 Ga/Gb	FMR50	XA00680F	XA00680F	XA00680F	XA00688F	XA00680F
BG	ATEX: II 3 G Ex nA IIC T6-T1 Gc	FMR50	XA00679F	XA00679F	XA00679F	XA00687F	XA00679F
BH	ATEX: II 3 G Ex ic IIC T6-T1 Gc	FMR50	XA00679F	XA00679F	XA00679F	XA00687F	XA00679F
B2	ATEX: II 1/2 G Ex ia IIC T6-T1 Ga/Gb ATEX: II 1/2 D Ex ia IIIC Txx°C Da/Db	FMR50	XA00683F	XA00683F	XA00683F	XA00691F	-
В3	ATEX: II 1/2 G Ex d [ia] IIC T6-T1 Ga/Gb ATEX: II 1/2 D Ex ta IIIC Txx°C Da/Db	FMR50	XA00684F	XA00684F	XA00684F	XA00692F	XA00684F

Feature	Approval	Available for	Feature 020 "Power Supply; Output"				
010			A ¹⁾	B ²⁾	C ³⁾	E ⁴⁾ /G ⁵⁾	K ⁶⁾ /L ⁷⁾
B4	ATEX:II 1/2 G Ex ia IIC T6-T1 Ga/Gb ATEX: II 1/2 G Ex d [ia] IIC T6-T1 Ga/Gb	FMR50	XA00681F	XA00681F	XA00681F	XA00689F	-
CB	CSA C/US XP Cl.I Div.1 Gr.A-D	FMR50	XA01112F	XA01112F	XA01112F	XA01114F	-
CC	CSA C/US XP Cl.I Div.1 Gr.A-D	FMR50	XA01113F	XA01113F	XA01113F	XA01115F	XA01113F
C2	CSA C/US IS Cl.I,II,III Div.1 Gr.A-G, NI Cl.1 Div. 2, Ex ia	FMR50	XA01112F	XA01112F	XA01112F	XA01114F	-
С3	CSA C/US XP Cl.I,II,III Div.1 Gr.A-G, NI Cl.1 Div.2, Ex d	FMR50	XA01113F	XA01113F	XA01113F	XA01115F	XA01113F
FA	FM IS Cl.I Div.1 Gr.A-D	FMR50	XA01116F	XA01116F	XA01116F	XA01118F	-
FB	FM IS Cl.I,II,III Div.1 Gr.A-G, AEx ia, NI Cl.1 Div.2	FMR50	XA01116F	XA01116F	XA01116F	XA01118F	-
FC	FM XP Cl.I Div.1 Gr.A-D	FMR50	XA01117F	XA01117F	XA01117F	XA01119F	XA01117F
FD	FM XP Cl.I,II,III Div.1 Gr.A-G, AEx d, NI Cl.1 Div.2	FMR50	XA01117F	XA01117F	XA01117F	XA01119F	XA01117F
IA	IECEx: Ex ia IIC T6-T1 Ga	FMR50	XA00677F	XA00677F	XA00677F	XA00685F	-
IB	IECEx: Ex ia IIC T6-T1 Ga/Gb	FMR50	XA00677F	XA00677F	XA00677F	XA00685F	-
IC	IECEx: Ex d [ia] IIC T6-T1 Ga/Gb	FMR50	XA00680F	XA00680F	XA00680F	XA00688F	XA00680F
IG	IECEx: Ex nA IIC T6-T1 Gc	FMR50	XA00679F	XA00679F	XA00679F	XA00687F	XA00679F
IH	IECEx: Ex ic IIC T6-T1 Gc	FMR50	XA00679F	XA00679F	XA00679F	XA00687F	XA00679F
I2	IECEx: Ex ia IIC T6-T1 Ga/Gb IECEx: Ex ia IIIC Txx°C Da/Db	FMR50	XA00683F	XA00683F	XA00683F	XA00691F	-
I3	IECEx: Ex d [ia] IIC T6-T1 Ga/Gb IEXEx: Ex ta IIIC Txx°C Da/Db	FMR50	XA00684F	XA00684F	XA00684F	XA00692F	XA00684F
I4	IECEx: Ex ia IIC T6-T1 Ga/Gb IECEx: Ex d [ia] IIC T6-T1 Ga/Gb	FMR50	XA00681F	XA00681F	XA00681F	XA00689F	-
JI	JPN Ex ia IIC T6 Ga/Gb	FMR50	XA01716F	XA01716F	-	-	-
JJ	JPN Ex [ia] IIC T6 Ga/Gb	FMR50	XA01717F	XA01717F	-	-	-
KA	KC Ex ia IIC T6 Ga	FMR50	XA01045F	XA01045F	XA01045F	XA01047F	-
KB	KC Ex ia IIC T6 Ga/Gb	FMR50	XA01045F	XA01045F	XA01045F	XA01047F	-
KC	KC Ex d[ia] IIC T6	FMR50	XA01046F	XA01046F	XA01046F	XA01048F	XA01046F
MA	INMETRO: Ex ia IIC T6 Ga	FMR50	XA01286F	XA01287F	XA01288F	XA01296F	-
MC	INMETRO: Ex d[ia] IIC T6 Ga/Gb	FMR50	XA01292F	XA01292F	XA01293F	XA01298F	XA01294F
MH	INMETRO: Ex ic IIC T6 Gc	FMR50	XA01289F	XA01290F	XA01291F	XA01297F	-
NA	NEPSI Ex ia IIC T6 Ga	FMR50	XA01199F	XA01199F	XA01199F	XA01208F	-
NB	NEPSI Ex ia IIC T6 Ga/Gb	FMR50	XA01199F	XA01199F	XA01199F	XA01208F	-
NC	NEPSI Ex d[ia] IIC T6 Ga/Gb	FMR50	XA01202F	XA01202F	XA01202F	XA01211F	XA01202F
NG	NEPSI Ex nA II T6 Gc	FMR50	XA01201F	XA01201F	XA01201F	XA01210F	XA01201F
NH	NEPSI Ex ic IIC T6 Gc	FMR50	XA01201F	XA01201F	XA01201F	XA01210F	XA01201F
N2	NEPSI Ex ia IIC T6 Ga/Gb, Ex iaD 20/21 T85 90oC	FMR50	XA01205F	XA01205F	XA01205F	XA01214F	-

Feature	Approval	Available for	Feature 020 "Power Supply; Output"				
010			A ¹⁾	B ²⁾	C ³⁾	E ⁴⁾ /G ⁵⁾	K ⁶⁾ /L ⁷⁾
N3	NEPSI Ex d[ia] IIC T6 Ga/Gb, DIP A20/21 T8590oC IP66	FMR50	XA01206F	XA01206F	XA01206F	XA01215F	XA01206F
8A	FM/CSA IS+XP Cl.I,II,III Div.1 Gr.A-G	FMR50	 XA01112F XA01113F XA01116F XA01117F 	• XA01113F • XA01116F	• XA01113F • XA01116F		-

2-wire; 4-20mA HART

1)

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
В3	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
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

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



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