

Technical Information

Micropilot FMR53, FMR54

Free space radar

Level measurement in liquids



Application

- Continuous, non-contact level measurement of liquids, pastes and slurries
- Rod antenna (FMR53); horn or planar antenna (FMR54)
- Maximum measuring range: 20 m (66 ft);
for FMR54 with planar antenna in stilling well: 38 m (125 ft)
- Temperature: -196 to +400 °C (-321 to +752 °F)
- Pressure: -1 to +160 bar (-14.5 to +2 320 psi)
- Accuracy: ± 6 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
- Easy proof test for SIL and WHG

Table of contents





Important document information	4	Degree of protection	57
Symbols	4	Vibration resistance	57
Function and system design	6	Cleaning the antenna	57
Measuring principle	6	Electromagnetic compatibility (EMC)	57
Input	8	Process	58
Measured variable	8	Process temperature, Process pressure	58
Measuring range	8	Dielectric constant	60
Operating frequency	11	Mechanical construction	61
Transmitting power	11	Dimensions	61
Output	12	Weight	68
Output signal	12	Materials: GT18 housing (stainless steel, corrosion-resistant)	69
Signal on alarm	13	Materials: GT19 housing (plastic)	70
Linearization	13	Materials: GT20 housing (die-cast aluminum, powder-coated, seawater-resistant)	71
Galvanic isolation	13	Materials: Antenna and process connection	72
Protocol-specific data	13	Materials: Weather protection cover	75
Power supply	18	Operability	76
Terminal assignment	18	Operating concept	76
Device plug connectors	25	Local operation	76
Supply voltage	26	Operation with remote display and operating module	
Power consumption	28	FHX50	77
Current consumption	28	Remote operation	77
Power supply failure	29	Integration in tank gauging system	81
Potential equalization	29	System integration via Fieldgate	82
Terminals	29	Certificates and approvals	83
Cable entries	29	CE mark	83
Cable specification	29	RoHS	83
Overvoltage protection	30	RCM-Tick marking	83
Performance characteristics	31	Ex approval	83
Reference operating conditions	31	Dual seal according to ANSI/ISA 12.27.01	83
Maximum measured error	31	Functional Safety	83
Measured value resolution	31	WHG	83
Reaction time	31	Sanitary compatibility	83
Influence of ambient temperature	31	NACE MR 0175 / ISO 15156	83
Influence of gas layer	31	NACE MR 0103	83
Gas phase compensation with external pressure sensor (PROFIBUS PA, FOUNDATION Fieldbus)	32	Pressure Equipment Directive	84
Installation	33	Marine certificate	84
Installation conditions	33	Radio standard EN302372-1/2	84
Measuring conditions	36	FCC / Industry Canada	84
Mounting cladded flanges	37	Japanese radio approval	84
Installation in vessel (free space)	38	CRN approval	84
Installation in stilling well	41	Track record	85
Installation in bypass	44	Test, Certificate	86
Vessels with heat insulation	46	Product documentation on paper	86
Environment	47	Other standards and guidelines	87
Ambient temperature range	47	Ordering information	88
Ambient temperature limits	47	Ordering information	88
Storage temperature	56	3-point linearity protocol	89
Climate class	56	5-point linearity protocol	90
Altitude according to IEC61010-1 Ed.3	57	Customized parametrization	91
		Services	91

Accessories	92
Device-specific accessories	92
Communication-specific accessories	96
Service-specific accessories	97
System components	97
Documentation	98
Standard documentation	98
Supplementary documentation	98
Safety Instructions (XA)	98
Registered trademarks	101
Patents	101







Important document information

Symbols









Safety symbols

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



Electrical symbols

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

Symbols for certain types of information

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

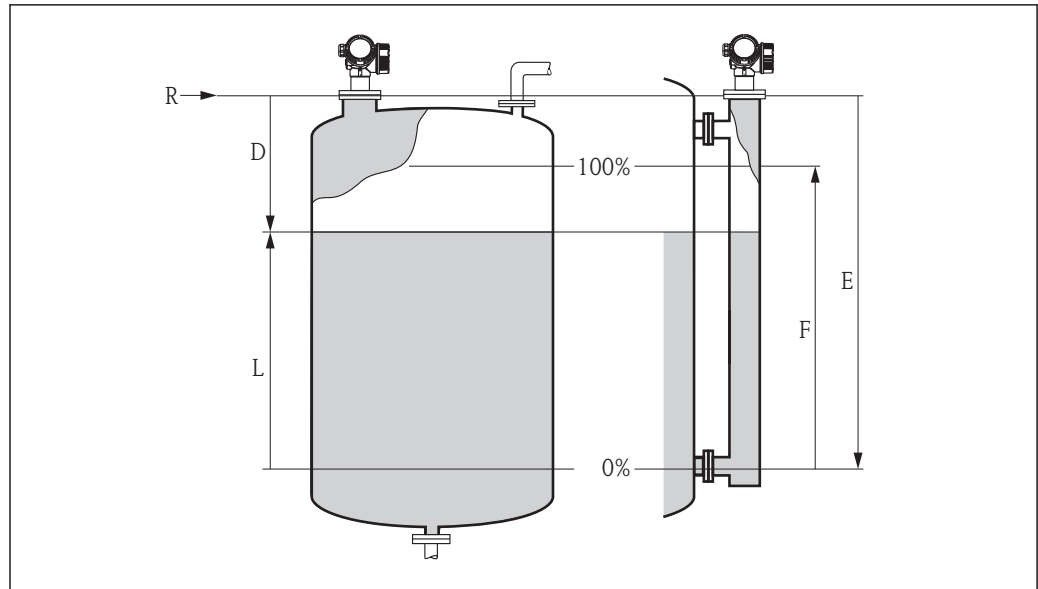
Symbols in graphics

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

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.



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1 Setup parameters of the Micropilot

- R* Reference point of the measurement (lower edge of the flange or threaded connection)
E Empty calibration (= zero)
F Full calibration (= span)
D Measured distance
L Level ($L = E - D$)

Input

The reflected radar impulses are received by the antenna and transmitted into the electronics. A microprocessor evaluates the signal and identifies the level echo caused by the reflection of the radar impulse at the product surface. The unambiguous signal identification is accomplished by the PulseMaster® eXact software together with the Multi-echo tracking algorithms, based on many years of experience with time-of-flight technology.

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

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

with c being the speed of light.

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

$$L = E - D$$

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

- FMR53: → 62
- FMR54: → 65

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.

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-guided 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

Input

Measured variable

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

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

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

Measuring range

Maximum measuring range

Device	Maximum measuring range
FMR53	20 m (66 ft)
FMR54 - horn antenna	20 m (66 ft)
FMR54 - planar antenna in stilling well	38 m (125 ft)

Usable measuring range

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

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

Media groups

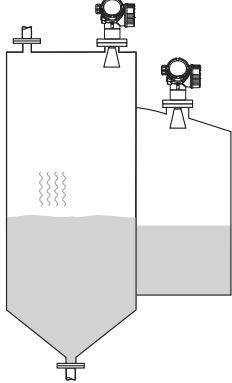
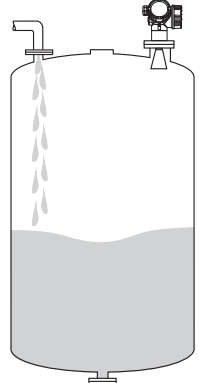
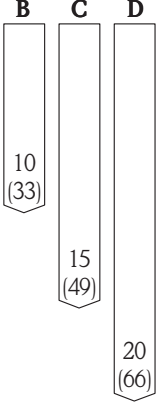
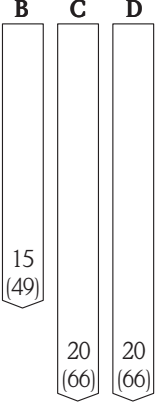
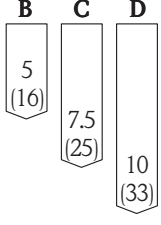
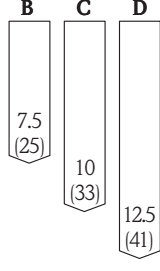
Media groups	DC (ϵ_r)	Example
A	1.4 to 1.9	non-conducting liquids, e.g. liquefied gas ¹⁾
B	1.9 to 4	non-conducting liquids, e.g. benzene, oil, toluene, ...
C	4 to 10	e.g. concentrated acids, organic solvents, esters, aniline, alcohol, acetone, ...
D	> 10	conducting liquids, e.g. aqueous solutions, dilute acids and alkalis

1) Treat Ammonia NH₃ as a medium of group A.

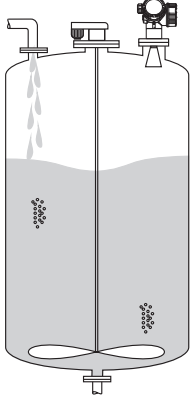
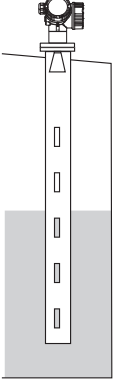






For dielectric constants (DC values) of many media commonly used in various industries refer to:

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

Device	Storage tank		Buffer tank	
	 <p style="text-align: right; font-size: small;">A0018833</p> <p>Calm product surface (e.g. intermittent filling, filling from bottom, immersion tubes)</p>		 <p style="text-align: right; font-size: small;">A0018835</p> <p>Moving surfaces (e.g. continuous filling, from above, mixing jets)</p>	
	Antenna type and size		Antenna type and size	
FMR53	Rod 390 mm (15 in) Rod 540 mm (21 in)	-	Rod 390 mm (15 in) Rod 540 mm (21 in)	-
FMR54 ¹⁾	Horn 150 mm (6 in)	Horn 200 mm (8 in) Horn 250 mm (10 in)	Horn 150 mm (6 in)	Horn 200 mm (8 in) Horn 250 mm (10 in)
	 <p style="text-align: right; font-size: x-small;">A0018844</p>	 <p style="text-align: right; font-size: x-small;">A0018845</p>	 <p style="text-align: right; font-size: x-small;">A0018846</p>	 <p style="text-align: right; font-size: x-small;">A0018847</p>
Measuring range [m (ft)]				

1) FMR54 with the antenna version BC (80mm/3") and BD: (100mm/4") should not be mounted directly in the tank. They are only suited for bypasses or stilling wells.

Device	Process tank with agitator		Stilling well		Bypass
	 <p style="text-align: right;">A0018837</p> <p>Turbulent surface (e.g. filling from above, agitators, baffles)</p>		 <p style="text-align: right;">A0018839</p>		 <p style="text-align: right;">A0018840</p>
	A Antenna type and size		Antenna type and size		
FMR53	Rod 390 mm (15 in) Rod 540 mm (21 in)	-	-	-	-
FMR54	Horn 150 mm (6 in)	Horn 200 mm (8 in) Horn 250 mm (10 in)	Horn 80 to 250 mm (3 to 10 in)	Planar 150 to 300 mm (6 to 12 in)	Horn 80 to 250 mm (3 to 10 in)
	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> B 4 (13) </div> <div style="text-align: center;"> C 6 (20) </div> <div style="text-align: center;"> D 8 (26) </div> </div> <p style="text-align: right;">A0018848</p>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> B 6 (20) </div> <div style="text-align: center;"> C 8 (26) </div> <div style="text-align: center;"> D 10 (33) </div> </div> <p style="text-align: right;">A0018850</p>	A, B, C, D  <p style="text-align: right;">A0018851</p>	A, B, C, D  <p style="text-align: right;">A0018854</p>	C, D  <p style="text-align: right;">A0018852</p>
Measuring range [m (ft)]					

Operating frequency

C-band (~ 6 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
1 m (3.3 ft)	< 12 nW/cm ²
5 m (16 ft)	< 0.4 nW/cm ²

Output

Output signal

HART

Signal coding	FSK ± 0.5 mA over current signal
Data transmission rate	1 200 Bit/s
Galvanic isolation	Yes


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	$U = 10.4$ to $35 V_{DC}$, $I = 0$ to 40 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 $1\ 350 V_{DC}$ to power supply and $500 V_{AC}$ to ground
Switch point	freely programmable, separately for switch-on and switch-off point
Switching delay	freely programmable from 0 to 100 sec. , separately for switch-on and switch-off point
Number of switching cycles	corresponds to the measuring cycle
Signal source device variables	<ul style="list-style-type: none"> ▪ Level linearized ▪ Distance ▪ Terminal voltage ▪ Electronic temperature ▪ Relative echo amplitude ▪ Diagnostic values, Advanced diagnostics
Number of switching cycles	unlimited

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

- Current output (for HART devices)
 - Failsafe mode selectable (in accordance with NAMUR Recommendation NE 43):
 - Minimum alarm: 3.6 mA
 - Maximum alarm (= factory setting): 22 mA
 - Failsafe mode with user-selectable value: 3.59 to 22.5 mA
- Local display
 - Status signal (in accordance with NAMUR Recommendation NE 107)
 - Plain text display
- Operating tool via digital communication (HART, PROFIBUS PA, FOUNDATION Fieldbus) or service interface (CDI)
 - Status signal (in accordance with NAMUR Recommendation NE 107)
 - Plain text display

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

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

Protocol-specific data

HART

Manufacturer ID	17 (0x11)
Device type ID	0x1128
HART specification	7.0
Device description files (DTM, DD)	Information and files under: <ul style="list-style-type: none"> ■ www.endress.com ■ www.hartcomm.org
HART load	Min. 250 Ω
HART device variables	The measured values can be freely assigned to the device variables. <p>Measured values for PV (primary variable)</p> <ul style="list-style-type: none"> ■ Level linearized ■ Distance ■ Electronic temperature ■ Relative echo amplitude ■ Analog output adv. diagnostics <p>Measured values for SV, TV, FV (second, third and fourth variable)</p> <ul style="list-style-type: none"> ■ Level linearized ■ Distance ■ Terminal voltage ■ Electronic temperature ■ Absolute echo amplitude ■ Relative echo amplitude ■ Area of incoupling
Supported functions	<ul style="list-style-type: none"> ■ Burst mode ■ Additional transmitter status

Wireless HART data

Minimum start-up voltage	16 V
Start-up current	3.6 mA
Start-up time	40 s
Minimum operating voltage	12.3 V
Multidrop current	3.6 mA
Set-up time	1 s

PROFIBUS PA

Manufacturer ID	17 (0x11)
Ident number	0x1559
Profile version	3.02
GSD file	Information and files under:
GSD file version	<ul style="list-style-type: none"> ▪ www.endress.com ▪ www.profibus.org
Output values	<p>Analog Input:</p> <ul style="list-style-type: none"> ▪ Level linearized ▪ Distance ▪ Terminal voltage ▪ Electronic temperature ▪ Absolute echo amplitude ▪ Relative echo amplitude ▪ Analog output advanced diagnostics 1/2 <p>Digital Input:</p> <ul style="list-style-type: none"> ▪ Advanced diagnostic blocks ▪ Status output switch block
Input values	<p>Analog Output:</p> <ul style="list-style-type: none"> ▪ Analog value from PLC (for sensor block external pressure to compensate gas phase effects) ▪ Analog value from PLC to be indicated on the display <p>Digital Output:</p> <ul style="list-style-type: none"> ▪ Extended diagnostic block ▪ Level limiter ▪ Sensor block measurement on ▪ Sensor block save history on ▪ Status output
Supported functions	<ul style="list-style-type: none"> ▪ Identification & Maintenance Einfachste Geräteidentifizierung seitens des Leitsystems und des Typenschildes ▪ Automatic Ident Number Adoption GSD compatibility mode with respect to the preceding product Micropilot M FMR2xx ▪ Physical Layer Diagnostics Installation check of the 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	<ul style="list-style-type: none"> ▪ www.endress.com ▪ www.fieldbus.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: <ul style="list-style-type: none"> ▪ Restart ▪ ENP Restart ▪ Setup ▪ Linearization ▪ Self Check
Virtual Communication Relationships (VCRs)	
Number of VCRs	44
Number of Link Objects in VFD	50
Permanent entries	1
Client VCRs	0
Server VCRs	10
Source VCRs	43
Sink VCRs	0
Subscriber VCRs	43
Publisher VCRs	43
Device Link Capabilities	
Slot time	4
Min. inter PDU delay	8
Max. response delay	20

Transducer Blocks

Block	Content	Output values
Setup Transducer Block	Contains all parameters for a standard commissioning procedure	<ul style="list-style-type: none"> ▪ Level or volume ¹⁾ (Channel 1) ▪ Distance (Channel 2)
Advanced Setup Transducer Block	Contains all parameters for a more detailed configuration of the device	no output values
Display Transducer Block	Contains all parameters for the configuration of the display module	no output values
Diagnostic Transducer Block	Contains diagnostic information	no output values
Advanced Diagnostic Transducer Block	Contains parameters for the Advanced Diagnostic	no output values
Expert Configuration Transducer Block	Contains parameters which require detailed knowledge of the functionalities of the device	no output values
Expert Information Transducer Block	Contains information about the state of the device	no output values
Service Sensor Transducer Block	Contains parameters which can only be operated by Endress+Hauser service personnel	no output values
Service Information Transducer Block	Contains information on the state of device which is relevant for service operations	no output values
Data Transfer Transducer Block	Contains parameters which allow to backup the device configuration in the display module and to restore it into the device. Access to these parameters is restricted to the Endress+Hauser service.	no output values

1) depending on the configuration of the block

Function Blocks

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

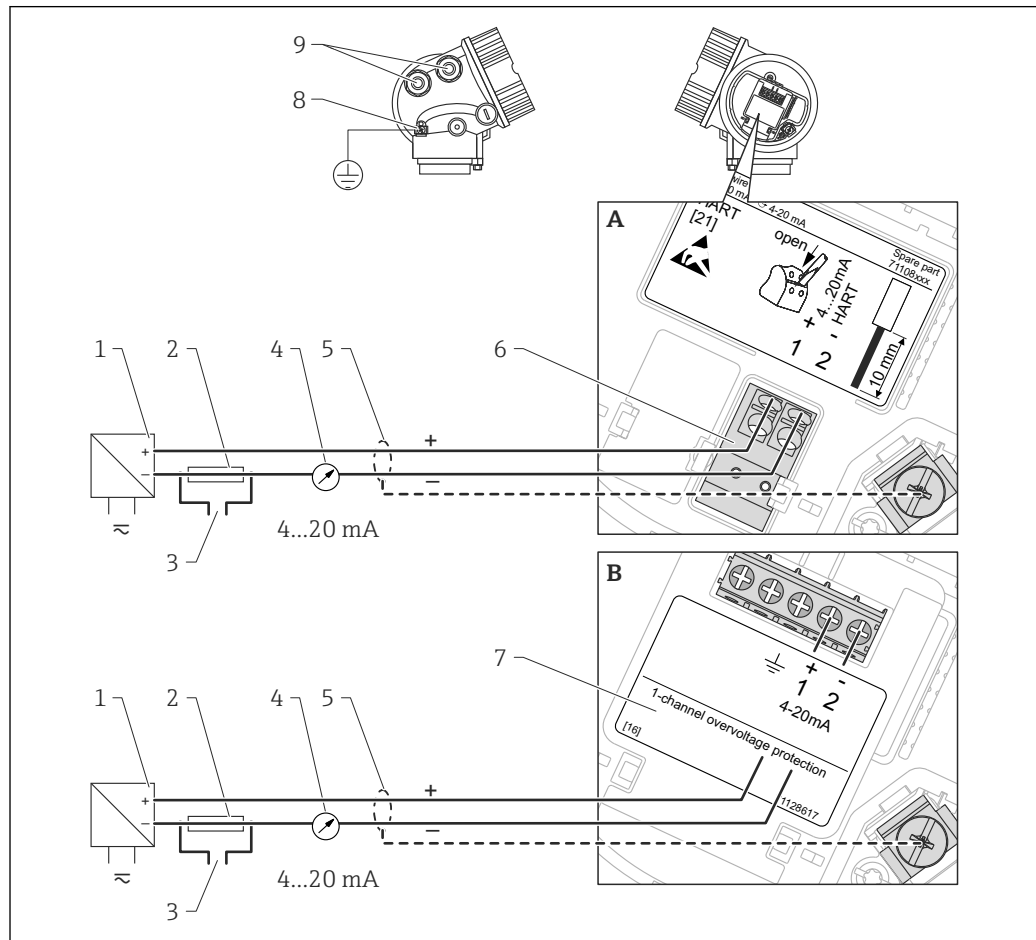
Block	Content	Number of permanent blocks	Number of instantiable blocks	Execution time	Functionality
Integrator Block	The Integrator Function Block integrates a variable as a function of the time or accumulates the counts from a Pulse Input block. The block may be used as a totalizer that counts up until 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

2-wire: 4-20mA HART

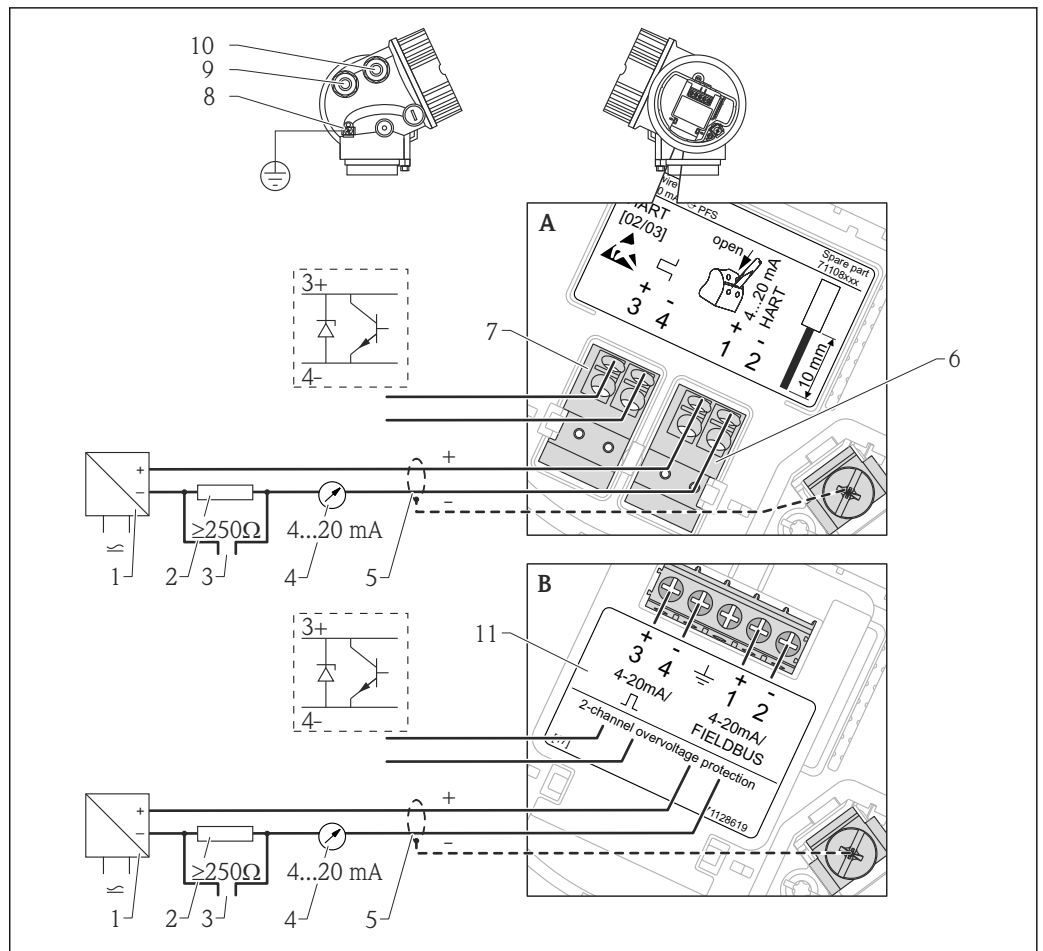


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2 Terminal assignment 2-wire; 4-20mA HART

- A Without integrated overvoltage protection
 B With integrated overvoltage protection
 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 4-20mA HART (passive): Terminals 1 and 2
 7 Overvoltage protection module
 8 Terminal for potential equalization line
 9 Cable entry

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



A0013759

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

A Without integrated overvoltage protection

B With integrated overvoltage protection

1 Active barrier with power supply (e.g. RN22 1N): 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 4-20mA HART (passive): Terminals 1 and 2

7 Switch output (open collector): Terminals 3 and 4

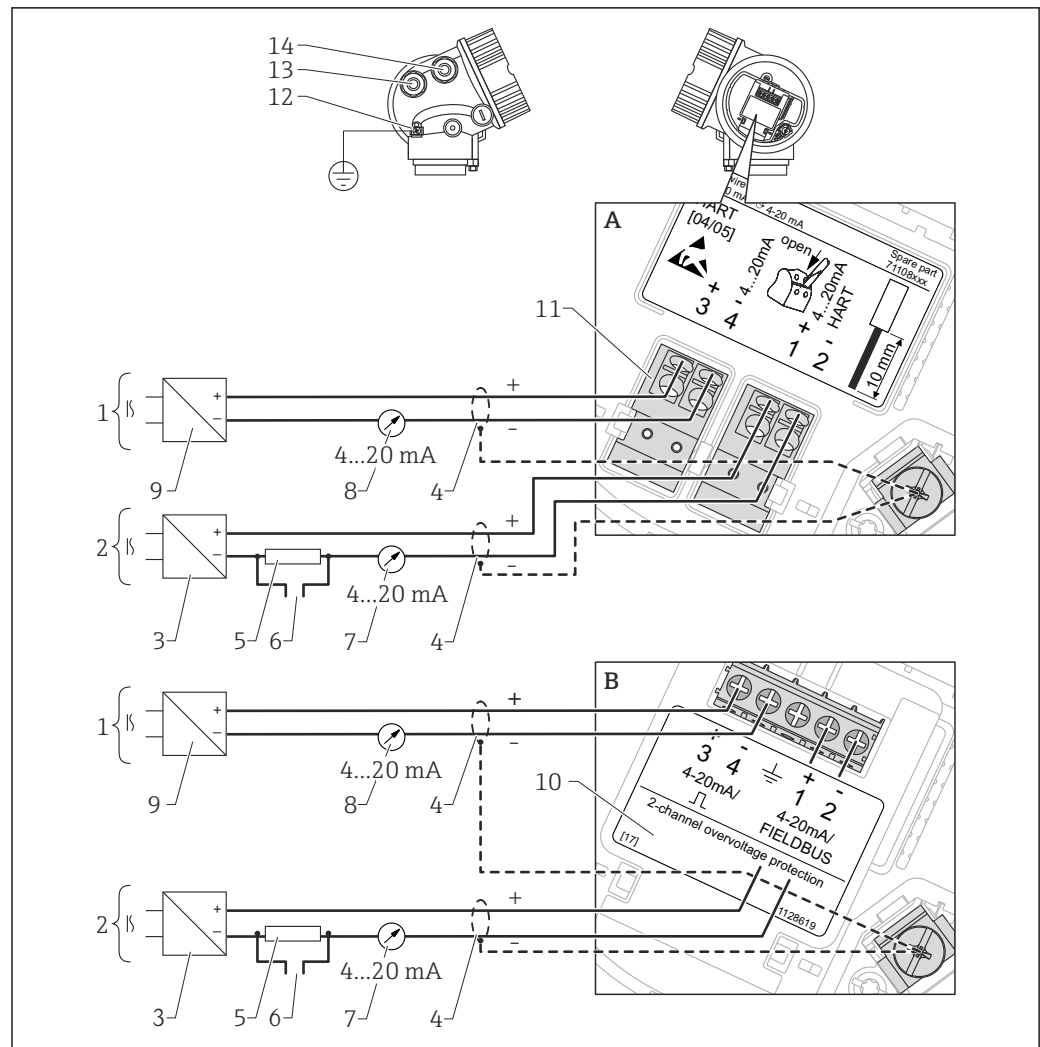
8 Terminal for potential equalization line

9 Cable entry for 4-20mA HART line

10 Cable entry for switch output line

11 Overvoltage protection module

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



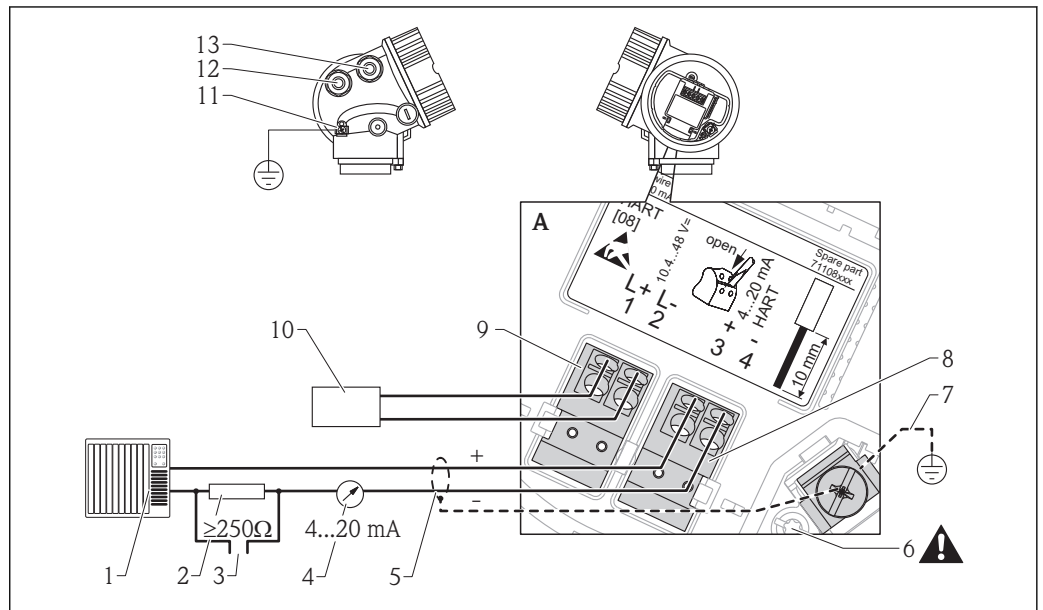
A0013923

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

- A Without integrated overvoltage protection
- B With integrated overvoltage protection
- 1 Connection current output 2
- 2 Connection current output 1
- 3 Supply voltage for current output 1 (e.g. RN221N); Observe terminal voltage
- 4 Cable screen; observe cable specification
- 5 HART communication resistor ($\geq 250 \Omega$); Observe maximum load
- 6 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- 7 Analog display device ; observe maximum load
- 8 Analog display device ; observe maximum load
- 9 Supply voltage for current output 2 (e.g. RN221N); Observe terminal voltage
- 10 Overvoltage protection module
- 11 Current output 2: Terminals 3 and 4
- 12 Terminal for the potential equalization line
- 13 Cable entry for current output 1
- 14 Cable entry for current output 2

i This version is also suited for single-channel operation. In this case, current output 1 (terminals 1 and 2) must be used.

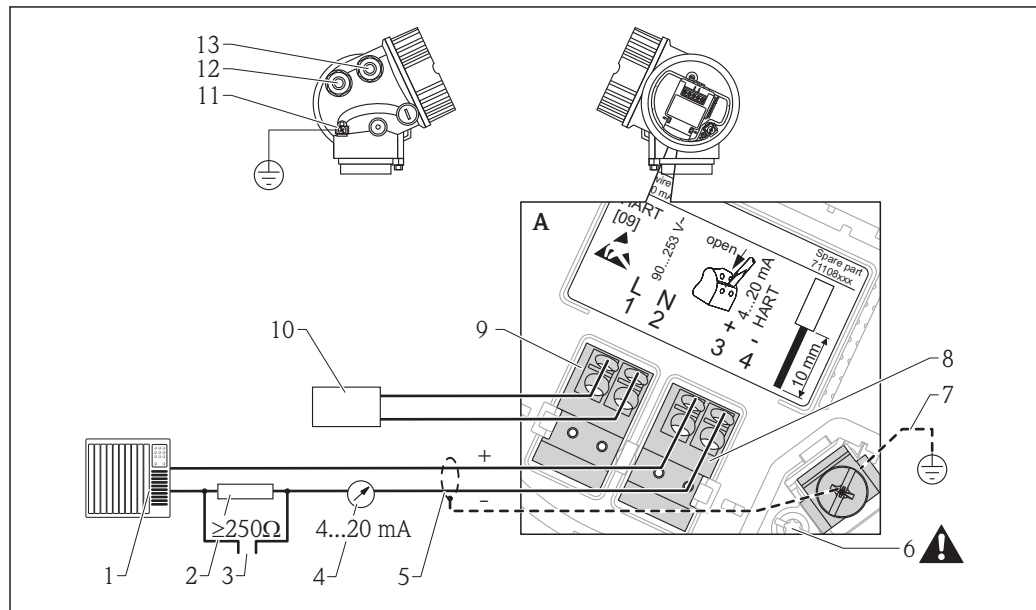
4-wire: 4-20mA HART (10.4 to 48 V_{DC})



A0011340

5 Terminal assignment 4-wire; 4-20mA HART (10.4 to 48 VDC)

- 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 Signal cable including screening (if required), observe cable specification
- 6 Protective connection; do not disconnect!
- 7 Protective earth, observe cable specification
- 8 4...20mA HART (active): Terminals 3 and 4
- 9 Supply voltage: Terminals 1 and 2
- 10 Supply voltage: Observe terminal voltage, observe cable specification
- 11 Terminal for potential equalization
- 12 Cable entry for signal line
- 13 Cable entry for power supply

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

A0018965

6 Terminal assignment 4-wire; 4-20mA HART (90 to 253 VAC)

- 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 Signal cable including screening (if required), observe cable specification
- 6 Protective connection; do not disconnect!
- 7 Protective earth, observe cable specification
- 8 4...20mA HART (active): Terminals 3 and 4
- 9 Supply voltage: Terminals 1 and 2
- 10 Supply voltage: Observe terminal voltage, observe cable specification
- 11 Terminal for potential equalization
- 12 Cable entry for signal line
- 13 Cable entry for power supply

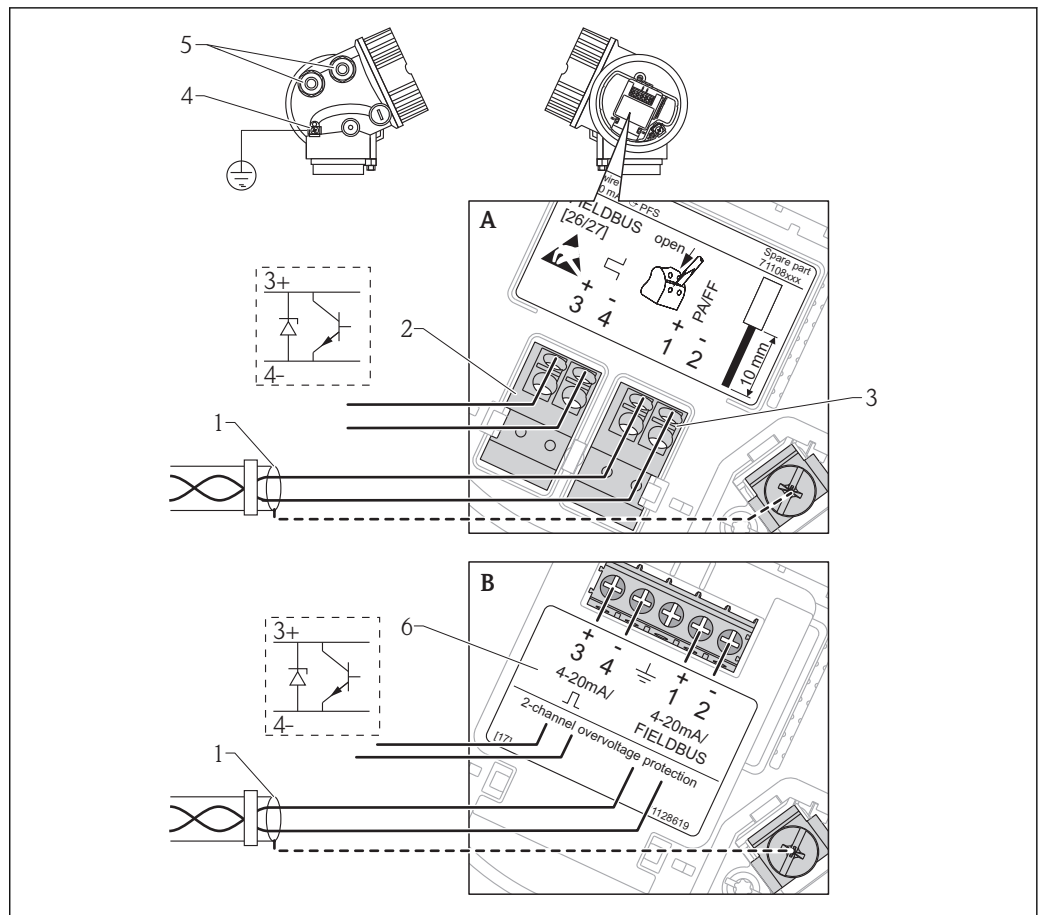
CAUTION

To ensure electrical safety:

- ▶ Do not disconnect the protective connection (6).
- ▶ Disconnect the supply voltage before disconnecting the protective earth (7).

- i** Connect protective earth to the internal ground terminal (7) before connecting the supply voltage. If necessary, connect the potential matching line to the external ground terminal (11).
- i** 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.
- i** An easily accessible power switch must be installed in the proximity of the device. The power switch must be marked as a disconnecter for the device (IEC/EN61010).

PROFIBUS PA / FOUNDATION Fieldbus



A0011341

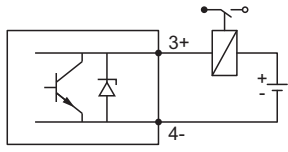
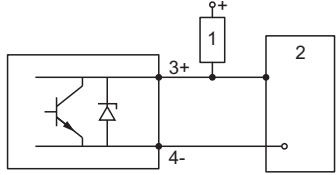
7 Terminal assignment PROFIBUS PA / FOUNDATION Fieldbus

- A Without integrated overvoltage protection
- B With integrated overvoltage protection
- 1 Cable screen: Observe cable specifications
- 2 Switch output (open collector): Terminals 3 and 4
- 3 PROFIBUS PA / FOUNDATION Fieldbus: Terminals 1 and 2
- 4 Terminal for potential equalization line
- 5 Cable entries
- 6 Overvoltage protection module

Connection examples for the switch output

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

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

 <p style="text-align: right;">A0015909</p> <p>8 Connection of a relay</p> <p>Suitable relays (examples):</p> <ul style="list-style-type: none"> ▪ Solid-state relay: Phoenix Contact OV-24DC/480AC/5 with mounting rail connector UMK-1 OM-R/AMS ▪ Electromechanical relay: Phoenix Contact PLC-RSC-12DC/21 	 <p style="text-align: right;">A0015910</p> <p>9 Connection of a digital input</p> <ol style="list-style-type: none"> 1 Pull-up resistor 2 Digital input
--	--

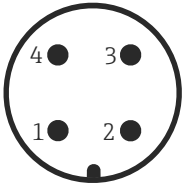
i For optimum interference immunity we recommend to connect an external resistor (internal resistance of the relay or Pull-up resistor) of $< 1\,000\ \Omega$.

Device plug connectors

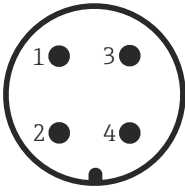


For the versions with fieldbus plug connector (M12 or 7/8"), the signal line can be connected without opening the housing.

Pin assignment of the M12 plug connector

 <p style="text-align: right; font-size: small;">A0011175</p>	Pin	Meaning
	1	Signal +
	2	not connected
	3	Signal -
	4	Ground

Pin assignment of the 7/8" plug connector

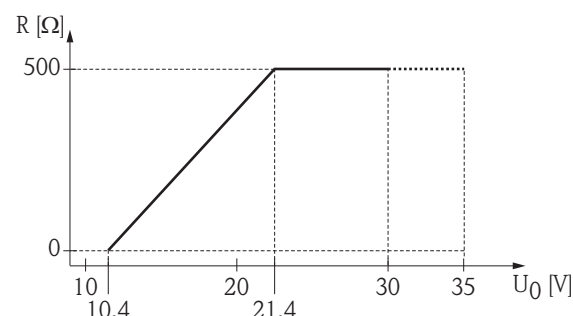
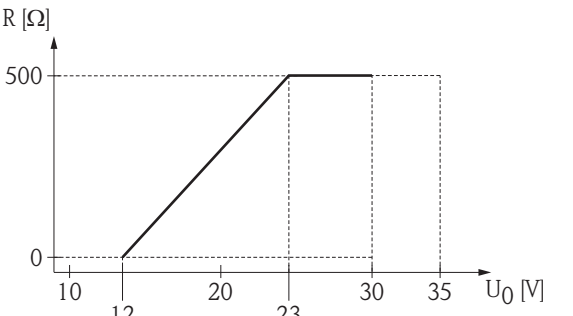
 <p style="text-align: right; font-size: small;">A0011176</p>	Pin	Meaning
	1	Signal -
	2	Signal +
	3	Not connected
	4	Screen

Supply voltage

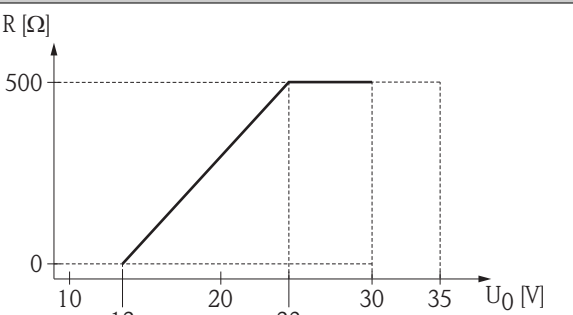
An external power supply is required.

 Various supply units can be ordered from Endress+Hauser: see "Accessories" section →  97

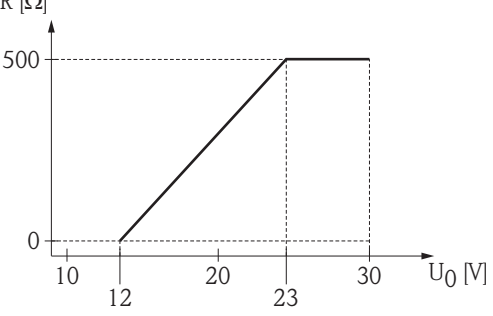
2-wire, 4-20mA HART, passive

"Power Supply, Output" ¹⁾	"Approval" ²⁾	Terminal voltage U at the device	Maximum load R, depending on the supply voltage U ₀ at the supply unit
A: 2-wire; 4-20mA HART	<ul style="list-style-type: none"> ■ Non-Ex ■ Ex nA ■ Ex ic ■ CSA GP 	10.4 to 35 V ³⁾	 <p style="text-align: right; font-size: small;">A0017140</p>
	Ex ia / IS	10.4 to 30 V ³⁾	
	<ul style="list-style-type: none"> ■ Ex d(ia) / XP ■ Ex ic(ia) ■ Ex nA(ia) ■ Ex ta / DIP 	12 to 35 V ⁴⁾	 <p style="text-align: right; font-size: small;">A0019136</p>
	Ex ia + Ex d(ia) / IS + XP	12 to 30 V ⁴⁾	

- 1) Feature 020 of the product structure
- 2) Feature 010 of the product structure
- 3) For ambient temperatures T_a ≤ -20 °C (-4 °F) a minimum voltage of 15 V is required for the startup of the device at the MIN error current (3,6 mA). The startup current can be parametrized. If the device is operated with a fixed current I ≥ 5,5 mA (HART multidrop mode), a voltage of U ≥ 10,4 V is sufficient throughout the entire range of ambient temperatures.
- 4) For ambient temperatures T_a ≤ -20 °C (-4 °F) a minimum voltage of 16 V is required for the startup of the device at the MIN error current (3.6 mA).

"Power Supply, Output" ¹⁾	"Approval" ²⁾	Terminal voltage U at the device	Maximum load R, depending on the supply voltage U ₀ at the supply unit
B: 2-wire; 4-20 mA HART, switch output	<ul style="list-style-type: none"> ■ Non-Ex ■ Ex nA ■ Ex nA(ia) ■ Ex ic ■ Ex ic(ia) ■ Ex d(ia) / XP ■ Ex ta / DIP ■ CSA GP 	12 to 35 V ³⁾	 <p style="text-align: right; font-size: small;">A0019136</p>
	<ul style="list-style-type: none"> ■ Ex ia / IS ■ Ex ia + Ex d(ia) / IS + XP 	12 to 30 V ³⁾	

- 1) Feature 020 of the product structure
- 2) Feature 010 of the product structure
- 3) For ambient temperatures T_a ≤ -30 °C (-22 °F) a minimum voltage of 16 V is required for the startup of the device at the MIN error current (3.6 mA).

"Power Supply, Output" ¹⁾	"Approval" ²⁾	Terminal voltage U at the device	Maximum load R, depending on the supply voltage U ₀ at the supply unit
C: 2-wire; 4-20mA HART, 4-20mA	any	12 to 30 V ³⁾	 <p>The graph plots Maximum load R [Ω] on the y-axis (0 to 500) against supply voltage U₀ [V] on the x-axis (10 to 30). The load is 0 Ω for U₀ < 12 V. It increases linearly from 0 Ω at 12 V to 500 Ω at 23 V. It remains constant at 500 Ω for U₀ between 23 V and 30 V.</p>

A0017055

- 1) Feature 020 of the product structure
- 2) Feature 010 of the product structure
- 3) For ambient temperatures $T_a \leq -30\text{ °C}$ (-22 °F) a minimum voltage of 16 V is required for the startup of the device at the MIN error current (3.6 mA).

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

1) Feature 020 of the product structure

2) Feature 010 of the product structure

3) Input voltages up to 35 V will not spoil the device.

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

Power consumption

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

1) Feature 020 of the product structure

Current consumption**HART**

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

PROFIBUS PA

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

FOUNDATION Fieldbus

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

FISCO

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

Power supply failure

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

Potential equalization

No special measures for potential equalization are required.



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

Terminals

- **Without integrated overvoltage protection**
Plug-in spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)
- **With integrated overvoltage protection**
Screw terminals for wire cross-sections 0.2 to 2.5 mm² (24 to 14 AWG)

Cable entries

Connection of power supply and signal line

To be selected in feature 050 "Electrical connection"

- Gland M20; Material dependent on the approval:
 - For Non-Ex, ATEX, IECEx, NEPSI Ex ia/ic:
Plastics M20x1.5 for cable ϕ 5 to 10 mm (0.2 to 0.39 in)
 - For Dust-Ex, FM IS, CSA IS, CSA GP, Ex nA:
Metal M20x1.5 for cable ϕ 7 to 10 mm (0.28 to 0.39 in)¹⁾
 - For Ex d:
No gland available
- Thread
 - 1/2" NPT
 - G 1/2"
 - M20 x 1.5
- Plug M12 / Plug 7/8"
Only available for Non-Ex, Ex ic, Ex ia

Connection of remote display FHX50

Dependent on feature 030: "Display, Operation":

- "Prepared for display FHX50 + M12 connection":
M12 socket
- "Prepared for display FHX50 + custom connection":
M16 cable gland

Cable specification

- Minimum cross-section: dependent on terminals → 29
- For ambient temperature $T_U \geq 60^\circ\text{C}$ (140 °F): use cable for temperature $T_U + 20\text{ K}$.


1) The material of the gland is dependent on the housing type; GT18 (stainless steel housing): 316L (1.4404); GT19 (plastic housing) and GT20 (aluminum housing): nickel-coated brass (CuZn).

HART

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

PROFIBUS

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

-  For further information on the cable specifications, see Operating Instructions BA00034S "Guidelines for planning and commissioning PROFIBUS DP/PA", PNO Guideline 2.092 "PROFIBUS PA User and Installation Guideline" and IEC61158-2 (MBP).

FOUNDATION Fieldbus

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

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

Overvoltage protection

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

Integrated overvoltage protection


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

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

-  For detailed information please refer to the following documents:
- HAW562: TI01012K
 - HAW569: TI01013K

Performance characteristics

Reference operating conditions

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

Maximum measured error

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

Device	Value	Output	
		digital	analog ¹⁾
FMR53/FMR54	Sum of non-linearity, nonrepeatability and hysteresis	± 6 mm (0.24 in) throughout the complete measuring range	± 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.

Measured value resolution

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

- digital: 1 mm
- analog: 1 µA

Reaction time

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

Tank height	Sampling rate	Step response time
< 10 m (33 ft)	≥ 3.6 s ⁻¹	< 0.8 s
< 20 m (66 ft)	≥ 2.7 s ⁻¹	< 1 s

Influence of ambient temperature

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

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


Influence of gas layer

High pressures reduce the propagation velocity of the measuring signals in the gas/vapor above the fluid. This effect depends on the kind of gas/vapor and of its temperature. This results in a systematic measuring error that gets bigger as the distance increases between the reference point of the measurement (flange) and the product surface. The following table illustrates this measured error for a few typical gases/vapors (with regard to distance; a positive value means that too large a distance is being measured):

Gas layer	Temperature		Pressure				
	°C	°F	1 bar (14,5 psi)	10 bar (145 psi)	50 bar (725 psi)	100 bar (1450 psi)	160 bar (2320 psi)
Air/ Nitrogen	20	68	0.00 %	0.22 %	1.2 %	2.4 %	3.89 %
	200	392	-0.01 %	0.13 %	0.74 %	1.5 %	2.42 %
	400	752	-0.02 %	0.08 %	0.52 %	1.1 %	1.70 %
Hydrogen	20	68	-0.01 %	0.10 %	0.61 %	1.2 %	2.00 %

2) 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.

Gas layer	Temperature		Pressure				
	°C	°F	1 bar (14,5 psi)	10 bar (145 psi)	50 bar (725 psi)	100 bar (1450 psi)	160 bar (2320 psi)
	200	392	-0.02 %	0.05 %	0.37 %	0.76 %	1.23 %
	400	752	-0.02 %	0.03 %	0.25 %	0.53 %	0.86 %
Water (saturated steam)	100	212	0.02 %	-	-	-	-
	180	356	-	2.1 %	-	-	-
	263	505,4	-	-	8.6 %	-	-
	310	590	-	-	-	22 %	-
	364	687	-	-	-	-	41.8 %

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

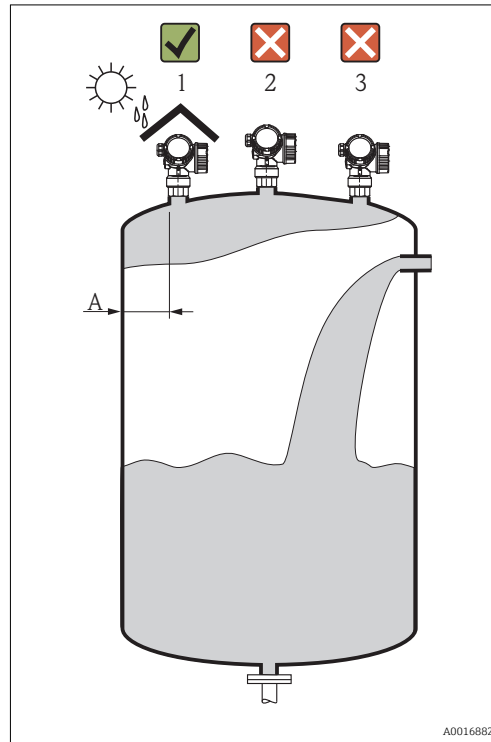
**Gas phase compensation
with external pressure
sensor (PROFIBUS PA,
FOUNDATION Fieldbus)**

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

Installation

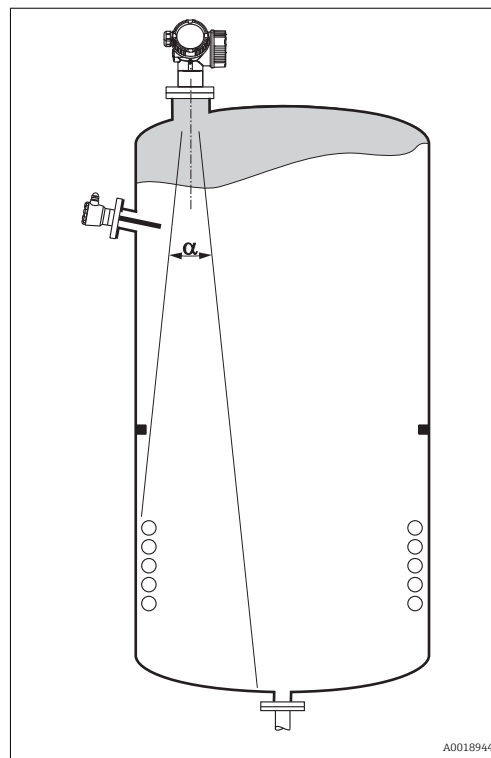
Installation conditions

Mounting position



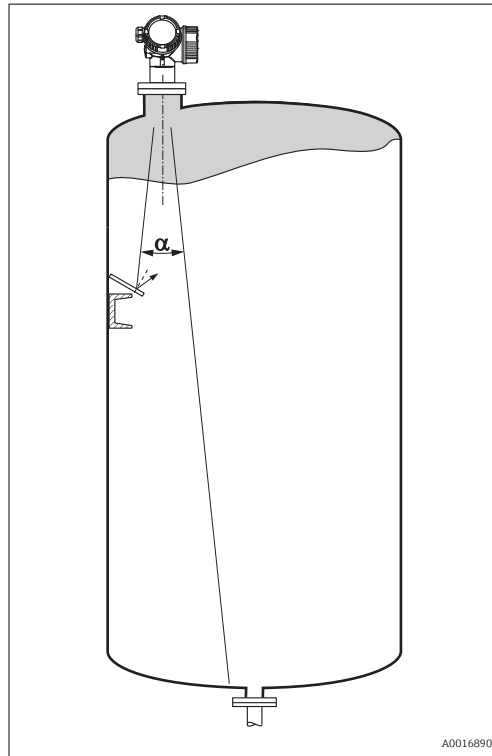
- Recommended distance **A** from wall to outer edge of nozzle: ~ 1/6 of tank diameter. Nevertheless the device should not be installed closer than 30 cm (11.8 in) to the tank wall.
- Not in the center (2), as interference can cause signal loss.
- Not above the fill stream (3).
- It is recommended to use a weather protection cover (1) in order to protect the device from direct sun or rain.

Vessel installations



Avoid any installations (point level switches, temperature sensors, braces, vacuum rings, heating coils, baffles etc.) inside the signal beam. Take into account the beam angle → 35.

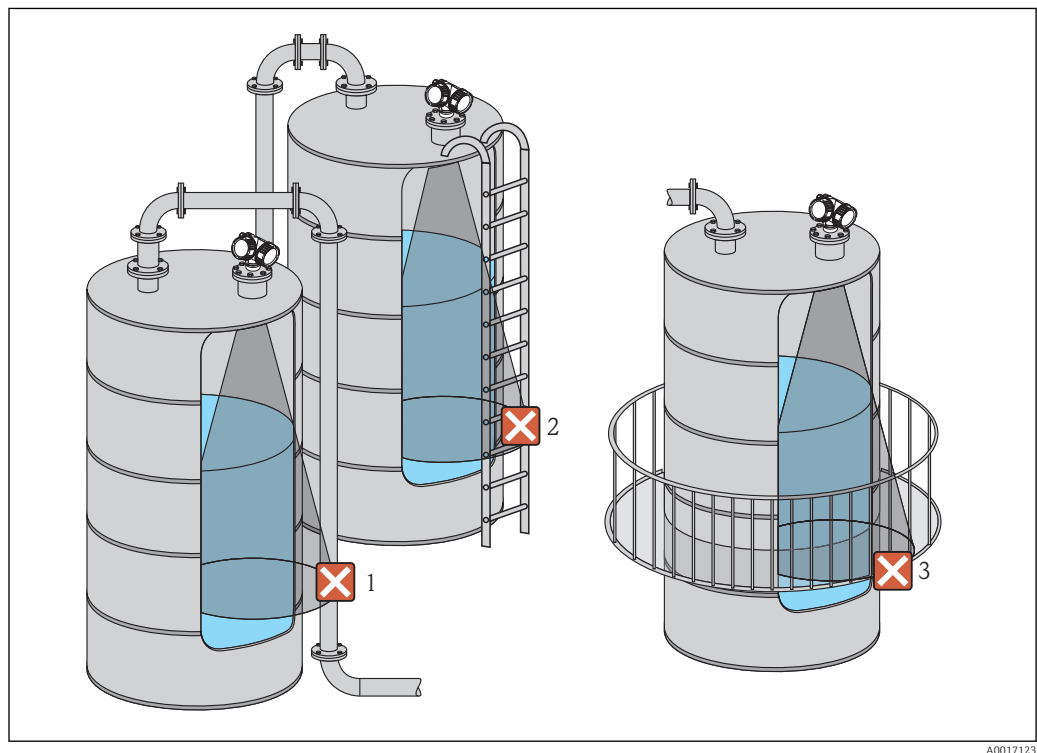
Reduction of interference echoes



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

Measurement in a plastic vessel

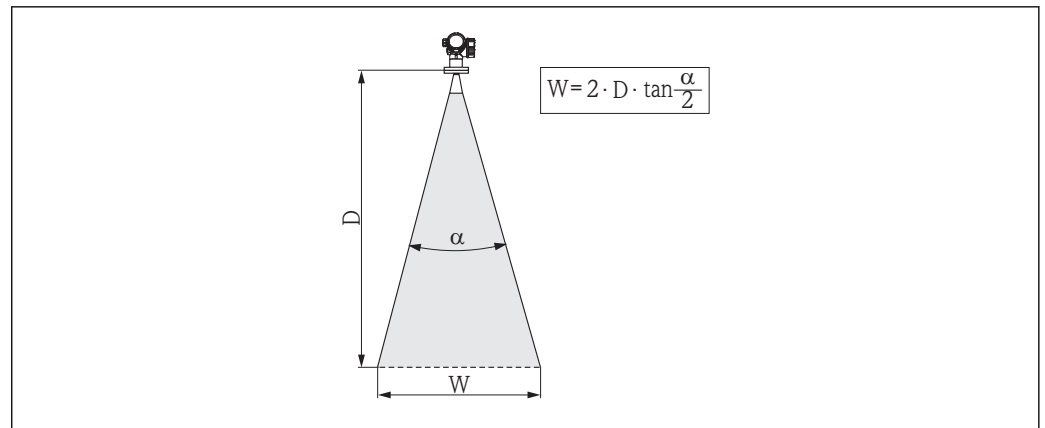
If the outer wall of the vessel is made of a non-conductive material (e.g. GRP), microwaves can also be reflected off interfering installations outside the signal beam (e.g. metallic pipes (1), ladders (2), grates (3), ...). Therefore, there should be no such interfering installations in the signal beam. 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
→ 35.
- **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 → 38 → 39 .
- **Stilling well**
A stilling well can be applied to avoid interferences → 41.
- **Metallic screens mounted at a slope**
They spread the radar signals and can, therefore, reduce interference echoes.

Beam angle



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

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

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

FMR53	
Beam angle α	23°
Measuring distance (D)	Beamwidth diameter W
3 m (9.8 ft)	1.22 m (4 ft)
6 m (20 ft)	2.44 m (8 ft)
9 m (30 ft)	3.66 m (12 ft)
12 m (39 ft)	4.88 m (16 ft)
15 m (49 ft)	6.1 m (20 ft)
20 m (66 ft)	8.14 m (27 ft)

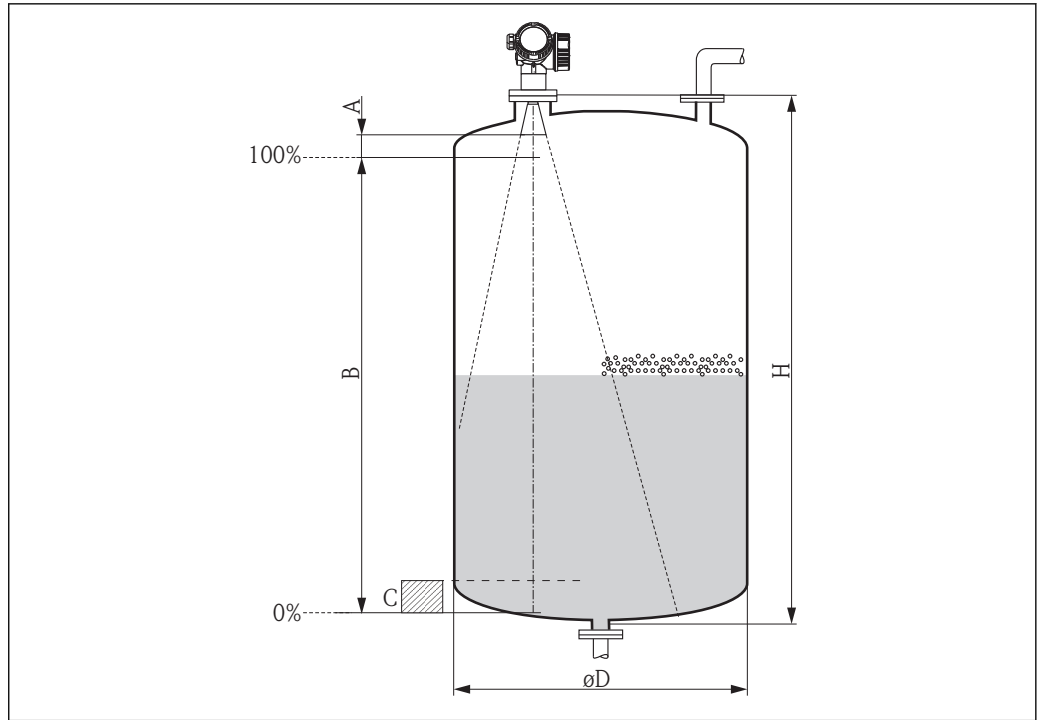
FMR54 - Horn antenna			
Antenna size	150 mm (6 in)	200 mm (8 in)	250 mm (10 in)
Beam angle α	23°	19°	15°
Distance (D)	Beamwidth diameter W		
3 m (9.8 ft)	1.22 m (4 ft)	1 m (3.3 ft)	0.79 m (2.6 ft)
6 m (20 ft)	2.44 m (8 ft)	2.01 m (6.6 ft)	1.58 m (5.2 ft)
9 m (30 ft)	3.66 m (12 ft)	3.01 m (9.9 ft)	2.37 m (7.8 ft)
12 m (39 ft)	4.88 m (16 ft)	4.02 m (13 ft)	3.16 m (10 ft)
15 m (49 ft)	6.1 m (20 ft)	5.02 m (16 ft)	3.95 m (13 ft)
20 m (66 ft)	8.14 m (27 ft)	6.69 m (22 ft)	5.27 m (17 ft)

Measuring conditions

- In case of **boiling surfaces, bubbling** or tendency for **foaming** use FMR53 or FMR54. Depending on its consistence, foam can either absorb microwaves or reflect them off the foam surface. Measurement is possible under certain conditions. For FMR50, FMR51 and FMR52, the additional option "Advanced dynamics" is recommended in these cases (feature 540: "Application Package", option EM).
- In case of heavy **steam development** or **condensate**, the maximum measuring range of FMR50, FMR51 and FMR52 may decrease depending on density, temperature and composition of the steam → use FMR53 or FMR54.
- For the measurement of absorbing gases such as **ammonia NH₃** or some **fluorocarbons**³⁾, please use Levelflex or Micropilot FMR54 in a stilling well.
- The measuring range begins, where the beam hits the tank bottom. Particularly with dish bottoms or conical outlets the level cannot be detected below this point.
- For stilling well applications, the zero should be positioned at the end of the tube, as the electromagnetic waves do not propagate completely outside the tube. It must be taken into account that the accuracy may be reduced in the area **C**. In order to guarantee the required accuracy in these cases, it is recommended to position the zero-point at a distance **C** above the end of the tube (see figure).
- In case of media with a low dielectric constant ($\epsilon_r = 1.5$ to 4)⁴⁾ the tank bottom can be visible through the medium at low levels (low height **C**). Reduced accuracy has to be expected in this range. If this is not acceptable, we recommend positioning the zero point at a distance **C** (see figure) above the tank bottom in these applications.
- In principle it is possible to measure up to the tip of the antenna with FMR51, FMR53 and FMR54. However, due to considerations regarding corrosion and build-up, the end of the measuring range should not be chosen any closer than **A** (see figure) to the tip of the antenna.
- When using FMR54 with planar antenna, especially for media with low dielectric constants, the end of the measuring range should not be closer than **A: 1 m (3.28 ft)** to the flange.
- The smallest possible measuring range **B** depends on the antenna version (see figure).
- The tank height should be at least **H** (see table).

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).



A0018872

Device	A	B	C	H
FMR53	50 mm (1.97 in)	> 0.5 m (1.6 ft)	150 to 300 mm (5.91 to 11.8 in)	> 1.5 m (4.9 ft)
FMR54 - horn antenna	50 mm (1.97 in)			
FMR54 - planar antenna	1 m (3.28 ft)			

Mounting cladded flanges



For cladded flanges of FMR53, observe the following:

- Use flange screws according to the number of flange holes.
- Tighten the screws with the required torque (see table).
- Retighten the screws after 24 hours or after the first temperature cycle.
- Depending on process pressure and process temperature check and retighten the screws at regular intervals.



Usually, the PTFE flange cladding also serves as a seal between the nozzle and the device flange.

Flange size	Number of screws	Recommended torque [Nm]	
		minimum	maximum
EN			
DN50/PN16	4	45	65
DN80/PN16	8	40	55
DN100/PN16	8	40	60
DN150/PN16	8	75	115
ASME			
2"/150lbs	4	40	55
3"/150lbs	4	65	95
4"/150lbs	8	45	70
6"/150lbs	8	85	125

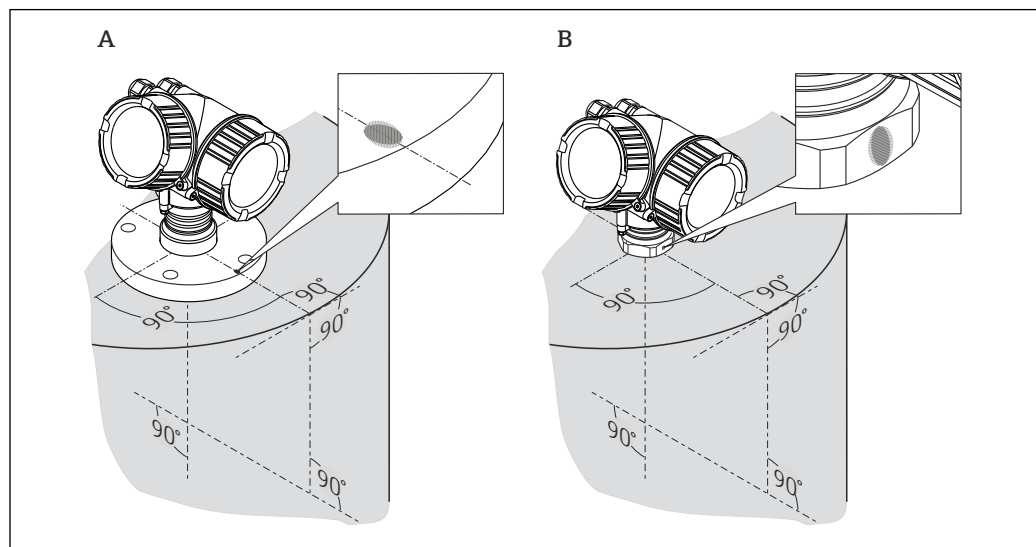
Flange size	Number of screws	Recommended torque [Nm]	
		minimum	maximum
JIS			
10K 50A	4	40	60
10K 80A	8	25	35
10K 100A	8	35	55
10K 100A	8	75	115

Installation in vessel (free space)

Rod antenna (FMR53)

Alignment

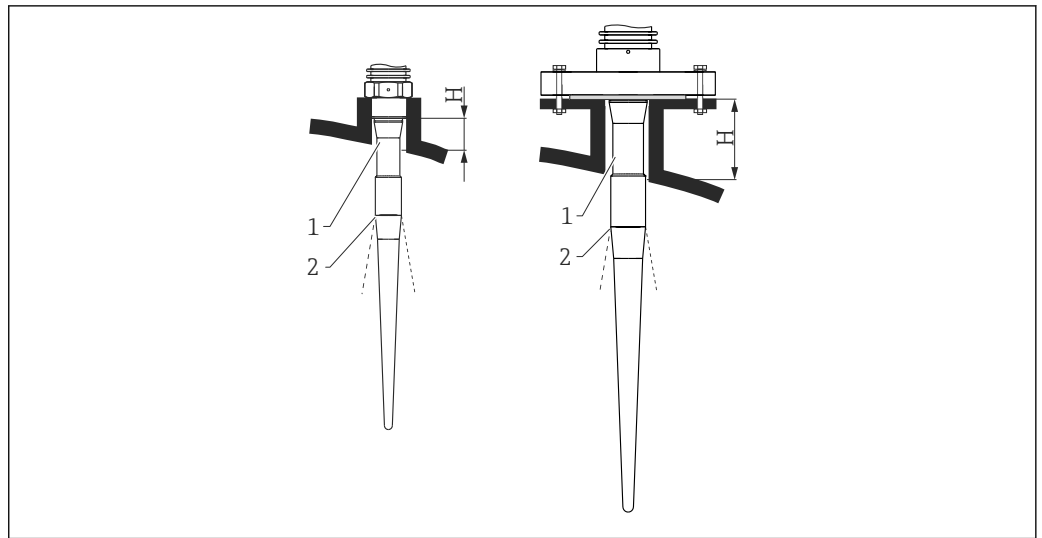
- Align the antenna vertically to the product surface.
- A marking at the flange (somewhere between the flange holes) or the boss enables alignment of the antenna. This marking must be aligned towards the tank wall as well as possible.



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

Nozzle mounting



11 Nozzle height and diameter for the rod antenna (FMR53)

- 1 Inactive length of the antenna
- 2 Beam launched here

Antenna length	390 mm (15.4 in)	540 mm (21.3 in)
Nozzle height H	< 100 mm (3.94 in)	< 250 mm (9.84 in)

- i** The inactive part (1) of the rod antenna must extend below the nozzle.
- i**
 - For flanges with PTFE cladding: Observe the notes on the mounting of cladded flanges → 37.
 - Usually, the PTFE flange cladding also serves as a seal between the nozzle and the device flange.

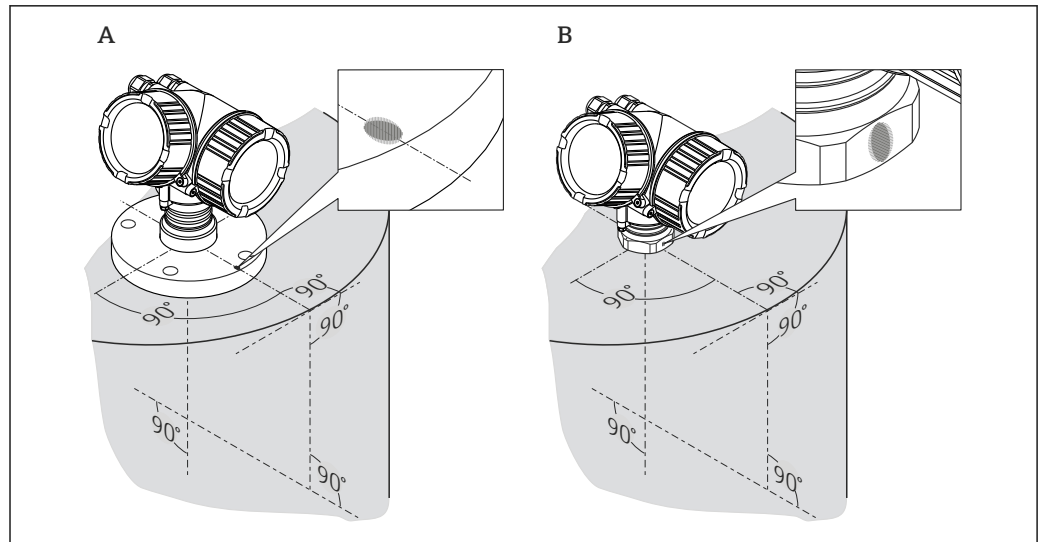
Threaded connection

- Tighten with the hexagonal nut only.
- Tool : 55 mm hexagonal wrench
- Maximum permissible torque:
 - Thread PVDF: 35 Nm (26 lbf ft)
 - Thread 316L: 60 Nm (44 lbf ft)

Horn antenna (FMR54)

Alignment

- Align the antenna vertically to the product surface.
- A marking at the flange (somewhere between the flange holes) enables alignment of the antenna. This marking must be aligned towards the tank wall as well as possible.

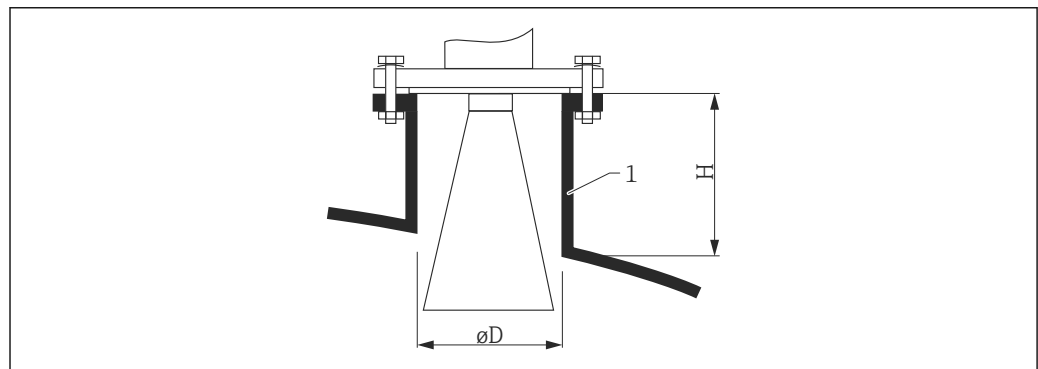


A0018974

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

Nozzle mounting

The horn antenna must extend below the nozzle; if necessary select the device version with antenna extension 100 to 400 mm (4 to 16 in) ⁵⁾.



A0016822

12 Nozzle height and diameter for the horn antenna (FMR54)

1 Mounting nozzle

Antenna ¹⁾	Nozzle diameter D	Maximum nozzle height H_{max} ²⁾
BE: 150mm/6"	146 mm (5.75 in)	185 mm (7.28 in)
BF: 200mm/8"	191 mm (7.52 in)	268 mm (10.6 in)
BG: 250mm/10"	241 mm (9.49 in)	360 mm (14.2 in)

- 1) Feature 070 of the product structure; the antenna versions BC (Horn 80mm/3") and BD (Horn 100mm/4") should not be mounted directly into the tank. They are only suited for bypass and stilling well applications.
- 2) valid for antennas without antenna extension

Measurement from the outside through plastic walls

- Dielectric constant of the medium: $\epsilon_r > 10$
- If possible use the 250 mm (10 in) antenna.
- The distance between the lower edge of the antenna and the tank should be about 100 mm (4 in).

5) See product structure: feature 610 "Accessory Mounted", options OM, ON, OR, OS.

- If possible, avoid mounting location 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.

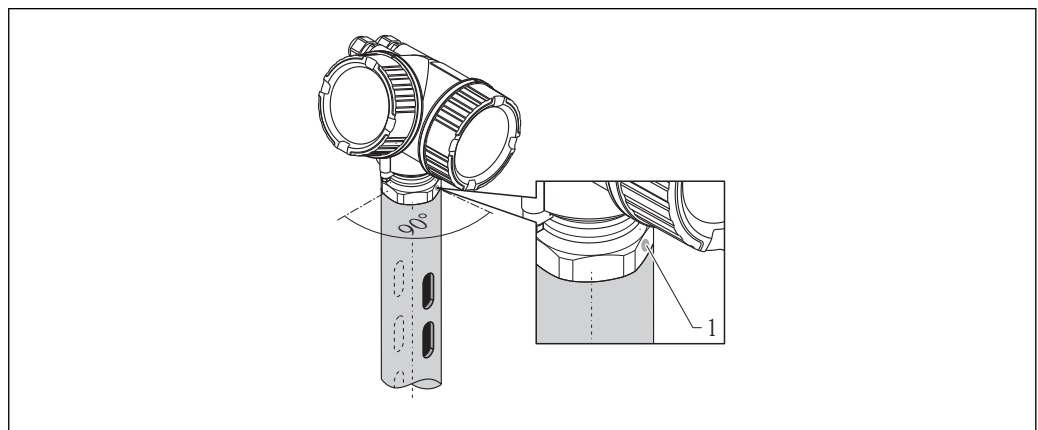
Suitable thickness of the tank ceiling

Penetrated material	PE	PTFE	PP	Plexiglas
DK / ϵ_r	2.3	2.1	2.3	3.1
Optimum thickness	16 mm (0.65 in)	17 mm (0.68 in)	16 mm (0.65 in)	14 mm (0.56 in)

Planar antenna (FMR54)

The planar antenna is only suited for stilling well applications → 41. It can not be used for free space applications.

Installation in stilling well



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13 Installation in stilling well

1 Marking for antenna alignment

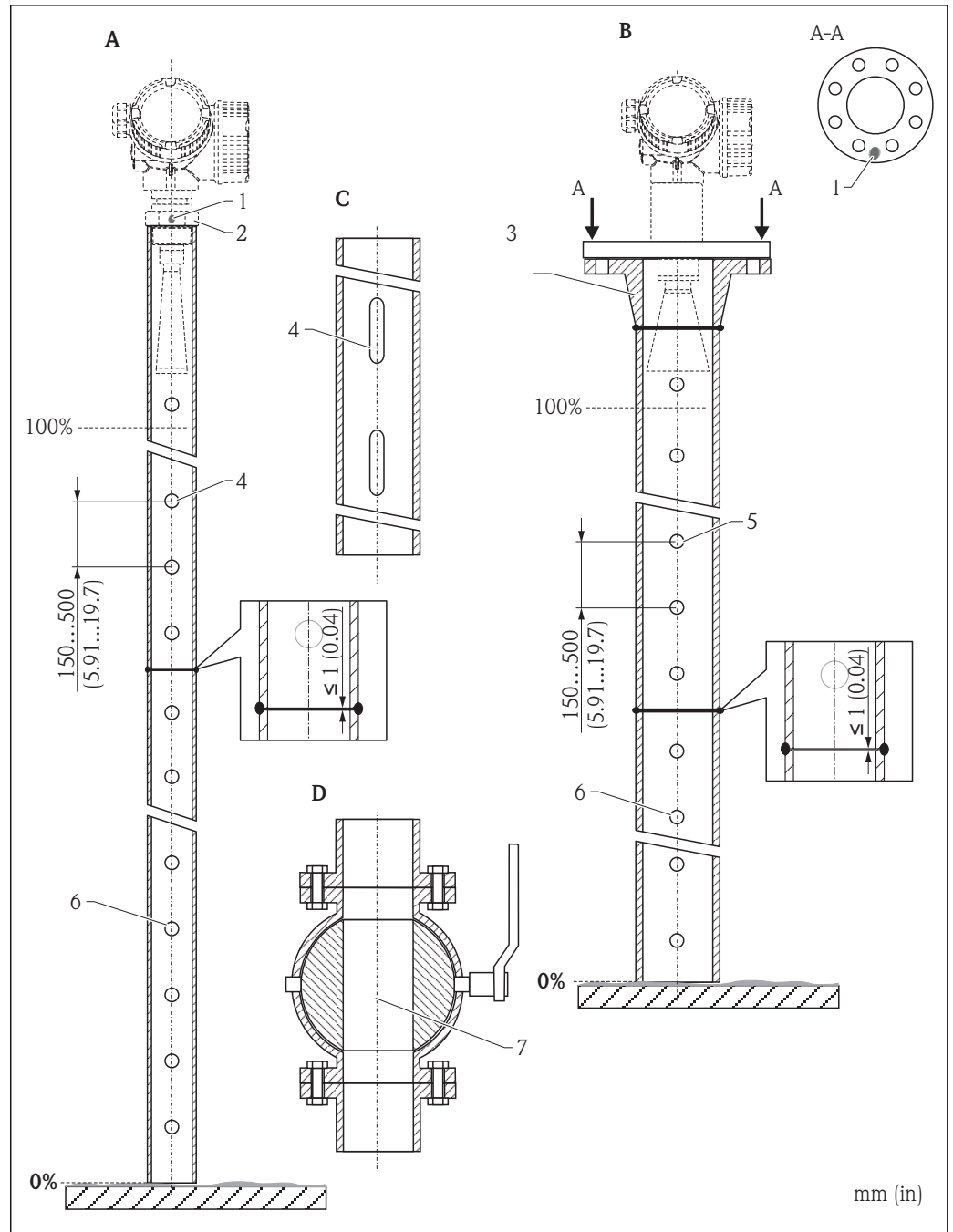
- For horn antenna: Align the marking towards the slots of the stilling well.
- No alignment is required for planar antennas.
- Measurements can be performed through an open full bore ball valve without any problems.
- After mounting, the housing can be turned 350° in order to facilitate access to the 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 $R_z \leq 6.3 \mu\text{m}$ (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 smoothed. 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).
-  The performance of Micropilot FMR54 with planar antenna is not dependent on the alignment or geometry of standard stilling wells. No special alignment is required. However, make sure that the planar antenna is installed vertically relative to the stilling well axis.

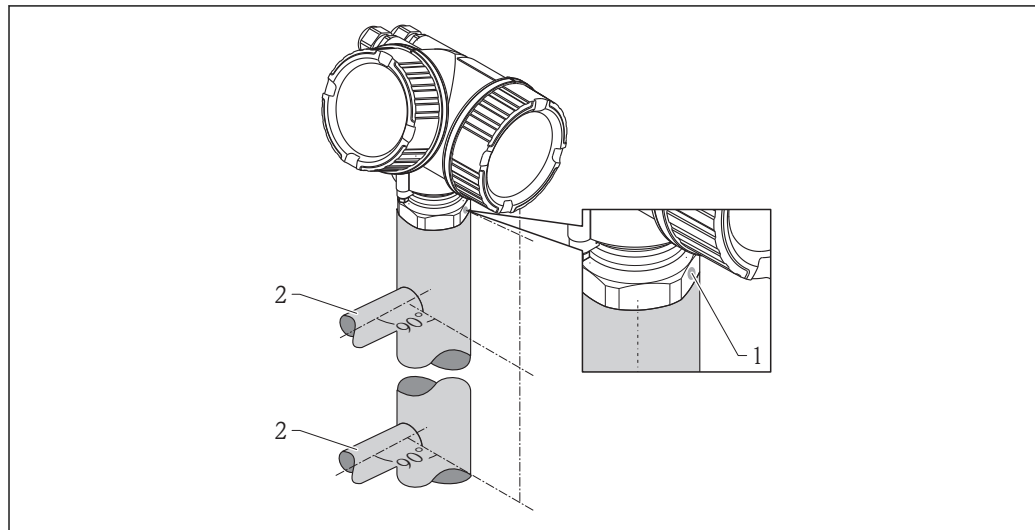
Examples for the construction of stilling wells



A0019009

- 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



A0019446

 14 Installation in bypass

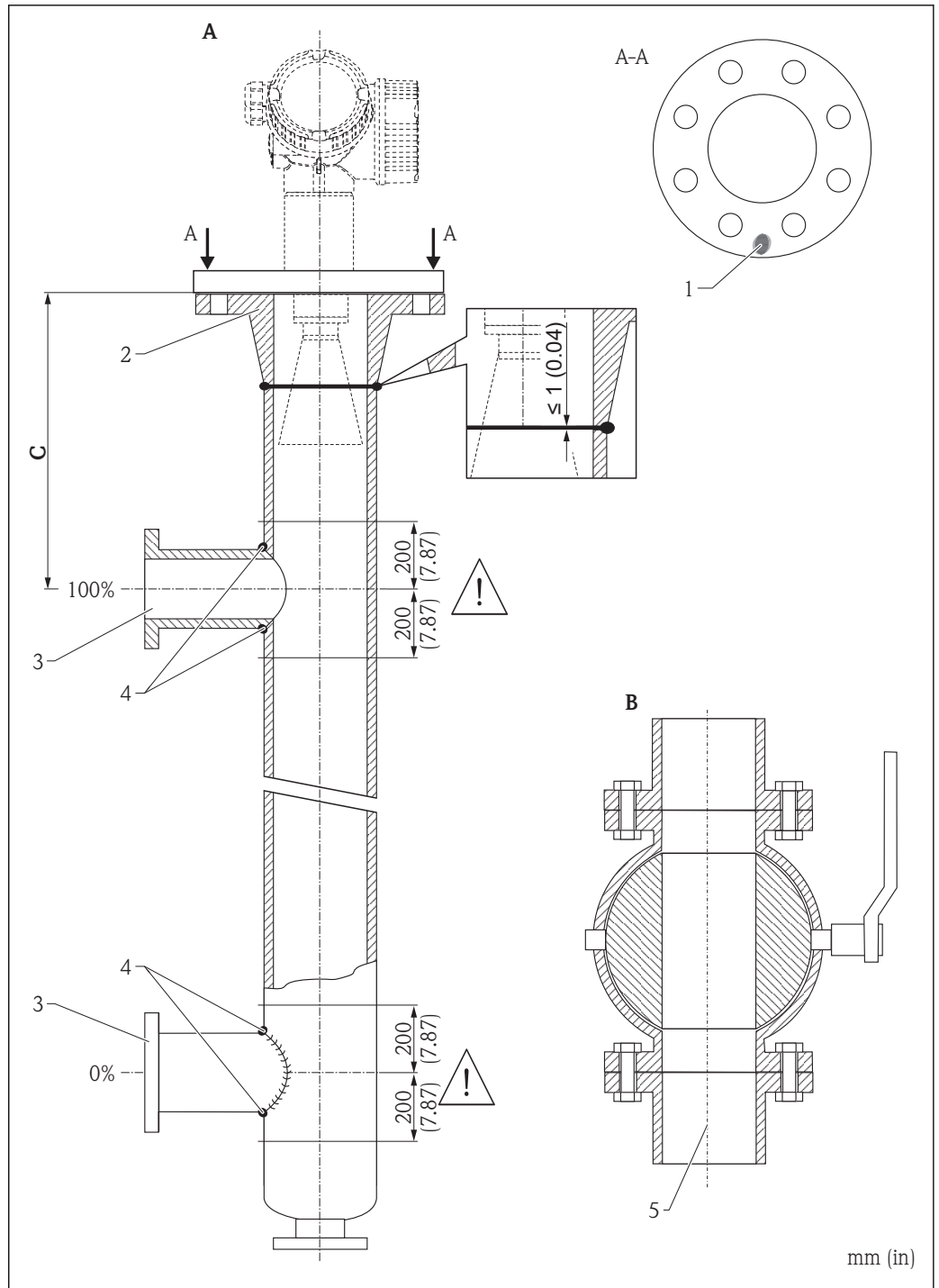
- 1 Marking for antenna alignment
2 Tank connectors

- 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.

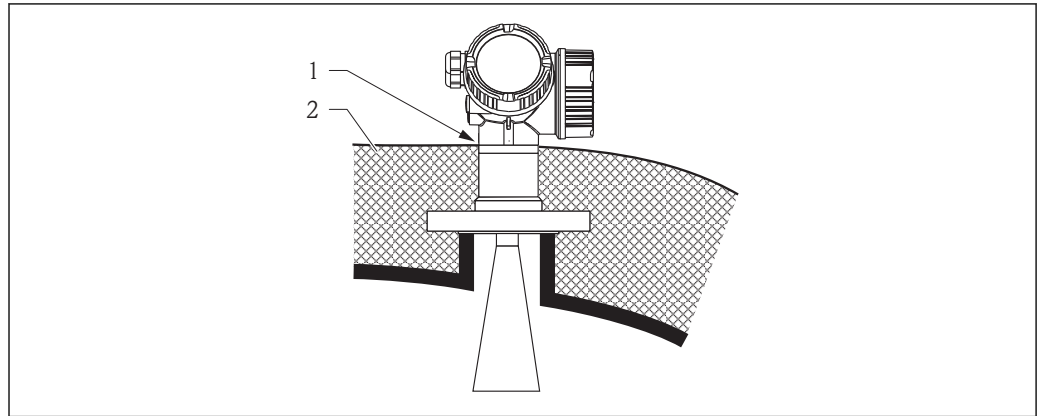
Recommendations for the bypass pipe

- 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.

Vessels with heat insulation

A0019142


If process temperatures are high, the device must be included in normal tank insulation to prevent the electronics heating up as a result of heat radiation or convection. The insulation may not exceed beyond the neck of the housing.

Environment

Ambient temperature range	Measuring device	-40 to +80 °C (-40 to +176 °F); -50 °C (-58 °F) with manufacturer declaration on request
	Local display	-20 to +70 °C (-4 to +158 °F), the readability of the display may be impaired at temperatures outside the temperature range.

When operating the device in the open with strong sunlight:

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

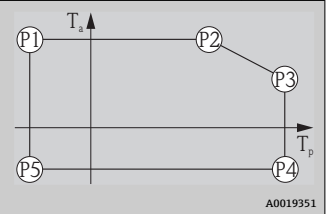
Ambient temperature limits  The following diagrams take into account only functional aspects. There may be further restrictions for certified device versions. Please refer to the separate Safety Instructions → 98.

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

Information concerning the derating tables

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

Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T_p	T_a	T_p	T_a	T_p	T_a	T_p	T_a	T_p	T_a	T_p	T_a
A	-40 (-40)	80 (176)	80 (176)	80 (176)	80 (176)	80 (176)	80 (176)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output not used	-40 (-40)	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)	-	-

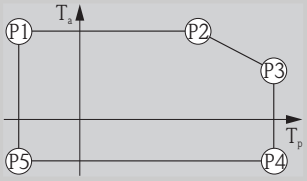


FMR53 Process connection: Thread PVDF Housing: GT18 (316 L) Temperature unit: °C (°F)												
<small>A0019351</small>												
Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a
E, G Switch output used	-40 (-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)	-	-

FMR53 Process connection: Thread PVDF Housing: GT19 (Plastics PBT) Temperature unit: °C (°F)												
<small>A0019351</small>												
Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a
A	-40 (-40)	80 (176)	80 (176)	80 (176)	80 (176)	80 (176)	80 (176)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output not used	-40 (-40)	76 (169)	76 (169)	76 (169)	80 (176)	75 (167)	80 (176)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output used	-40 (-40)	60 (140)	60 (140)	60 (140)	80 (176)	58 (136)	80 (176)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
C Channel 2 not used	-40 (-40)	80 (176)	80 (176)	80 (176)	80 (176)	80 (176)	80 (176)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
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 (173)	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)	-	-

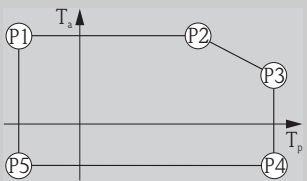
FMR53 Process connection: Thread PVDF Housing: GT20 (Alu, coated) Temperature unit: °C (°F)												
<small>A0019351</small>												
Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a
A	-40 (-40)	80 (176)	80 (176)	80 (176)	80 (176)	80 (176)	80 (176)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output not used	-40 (-40)	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)	-	-

FMR53
Process connection: Thread PVDF
Housing: GT20 (Alu, coated)
Temperature unit: °C (°F)



Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a
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)	-	-

FMR53
Process connection:
 ■ Thread 316L
 ■ Flange
Housing: GT18 (316 L)
Temperature unit: °C (°F)



Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a
A	-40 (-40)	81 (178)	81 (178)	81 (178)	150 (302)	65 (149)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output not used	-40 (-40)	82 (180)	82 (180)	82 (180)	150 (302)	66 (151)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output used	-40 (-40)	77 (171)	77 (171)	77 (171)	150 (302)	59 (138)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
C Channel 2 not used	-40 (-40)	82 (180)	82 (180)	82 (180)	150 (302)	66 (151)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
C Channel 2 used	-40 (-40)	79 (174)	79 (174)	79 (174)	150 (302)	62 (144)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output not used	-40 (-40)	82 (180)	82 (180)	82 (180)	150 (302)	67 (153)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output used	-40 (-40)	78 (172)	78 (172)	78 (172)	150 (302)	61 (142)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
K, L	-40 (-40)	77 (171)	77 (171)	77 (171)	150 (302)	60 (140)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-

FMR53												
Process connection: <ul style="list-style-type: none"> ▪ Thread 316L ▪ Flange Housing: GT19 (Plastics PBT) Temperature unit: °C (°F)												
Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a
A	-40 (-40)	80 (176)	80 (176)	80 (176)	150 (302)	55 (131)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output not used	-40 (-40)	76 (169)	76 (169)	76 (169)	150 (302)	55 (131)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output used	-40 (-40)	60 (140)	60 (140)	60 (140)	150 (302)	37 (99)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
C Channel 2 not used	-40 (-40)	82 (180)	82 (180)	82 (180)	150 (302)	55 (131)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
C Channel 2 used	-40 (-40)	74 (165)	74 (165)	74 (165)	150 (302)	54 (129)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output not used	-40 (-40)	79 (174)	79 (174)	79 (174)	150 (302)	55 (131)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output used	-40 (-40)	63 (145)	63 (145)	63 (145)	150 (302)	40 (104)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-

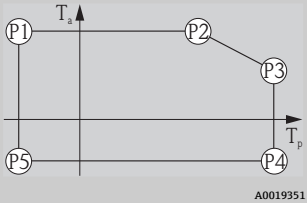
FMR53												
Process connection: <ul style="list-style-type: none"> ▪ Thread 316L ▪ Flange Housing: GT20 (Alu, coated) Temperature unit: °C (°F)												
Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a
A	-40 (-40)	81 (178)	81 (178)	81 (178)	150 (302)	68 (154)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output not used	-40 (-40)	82 (180)	82 (180)	82 (180)	150 (302)	69 (156)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output used	-40 (-40)	77 (171)	77 (171)	77 (171)	150 (302)	63 (145)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
C Channel 2 not used	-40 (-40)	82 (180)	82 (180)	82 (180)	150 (302)	69 (156)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
C Channel 2 used	-40 (-40)	79 (174)	79 (174)	79 (174)	150 (302)	65 (149)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output not used	-40 (-40)	83 (181)	83 (181)	83 (181)	150 (302)	70 (158)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output used	-40 (-40)	78 (172)	78 (172)	78 (172)	150 (302)	64 (147)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
K, L	-40 (-40)	77 (171)	77 (171)	77 (171)	150 (302)	64 (147)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-

FMR54
Horn antenna

Seal:

- Viton
- EPDM
- Kalrez

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



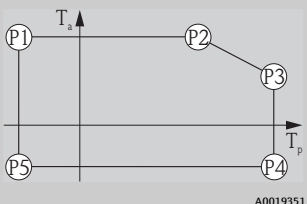
Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a
A	-40 (-40)	81 (178)	81 (178)	81 (178)	200 (392)	52 (126)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output not used	-40 (-40)	82 (180)	82 (180)	82 (180)	200 (392)	52 (126)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output used	-40 (-40)	77 (171)	77 (171)	77 (171)	200 (392)	46 (115)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
C Channel 2 not used	-40 (-40)	82 (180)	82 (180)	82 (180)	200 (392)	52 (126)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
C Channel 2 used	-40 (-40)	79 (174)	79 (174)	79 (174)	200 (392)	49 (120)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output not used	-40 (-40)	83 (181)	83 (181)	83 (181)	200 (392)	52 (126)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output used	-40 (-40)	78 (172)	78 (172)	78 (172)	200 (392)	48 (118)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
K, L	-40 (-40)	77 (171)	77 (171)	77 (171)	200 (392)	47 (117)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-

FMR54
Horn antenna

Seal:

- Viton
- EPDM
- Kalrez

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



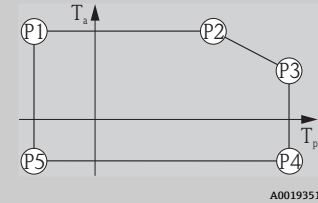
Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a
A	-40 (-40)	80 (176)	80 (176)	80 (176)	200 (392)	29 (84)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output not used	-40 (-40)	76 (169)	76 (169)	76 (169)	200 (392)	29 (84)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output used	-40 (-40)	60 (140)	60 (140)	60 (140)	200 (392)	23 (73)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
C Channel 2 not used	-40 (-40)	82 (180)	82 (180)	82 (180)	200 (392)	29 (84)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
C Channel 2 used	-40 (-40)	74 (165)	74 (165)	74 (165)	200 (392)	29 (84)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output not used	-40 (-40)	79 (174)	79 (174)	79 (174)	200 (392)	29 (84)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output used	-40 (-40)	63 (145)	63 (145)	63 (145)	200 (392)	26 (79)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-

FMR54
Horn antenna

Seal:

- Viton
- EPDM
- Kalrez

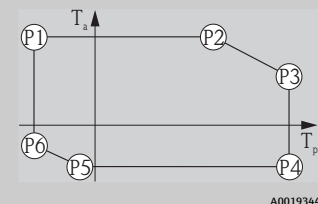
Housing: GT20 (Alu, coated)
Temperature unit: °C (°F)



Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a
A	-40 (-40)	81 (178)	81 (178)	81 (178)	200 (392)	57 (135)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output not used	-40 (-40)	82 (180)	82 (180)	82 (180)	200 (392)	58 (136)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output used	-40 (-40)	77 (171)	77 (171)	77 (171)	200 (392)	52 (126)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
C Channel 2 not used	-40 (-40)	82 (180)	82 (180)	82 (180)	200 (392)	58 (136)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
C Channel 2 used	-40 (-40)	79 (174)	79 (174)	79 (174)	200 (392)	54 (129)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output not used	-40 (-40)	83 (181)	83 (181)	83 (181)	200 (392)	58 (136)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output used	-40 (-40)	78 (172)	78 (172)	78 (172)	200 (392)	54 (129)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
K, L	-40 (-40)	77 (171)	77 (171)	77 (171)	200 (392)	53 (127)	200 (392)	-40 (-40)	-40 (-40)	-40 (-40)	-	-

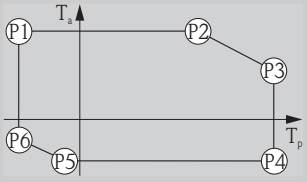
FMR54
Horn antenna

Seal: Graphite -196 to 280 °C (-321 to 536 °F)
Housing: GT18 (316 L)
Temperature unit: °C (°F)



Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a
A	-196 (-321)	81 (178)	81 (178)	81 (178)	280 (536)	46 (115)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-9 (16)
B Switch output not used	-196 (-321)	82 (180)	82 (180)	82 (180)	280 (536)	46 (115)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-9 (16)
B Switch output used	-196 (-321)	77 (171)	77 (171)	77 (171)	280 (536)	42 (108)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-9 (16)
C Channel 2 not used	-196 (-321)	82 (180)	82 (180)	82 (180)	280 (536)	46 (115)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-9 (16)
C Channel 2 used	-196 (-321)	79 (174)	79 (174)	79 (174)	280 (536)	44 (111)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-9 (16)
E, G Switch output not used	-196 (-321)	83 (181)	83 (181)	83 (181)	280 (536)	46 (115)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-9 (16)
E, G Switch output used	-196 (-321)	78 (172)	78 (172)	78 (172)	280 (536)	44 (111)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-9 (16)
K, L	-196 (-321)	77 (171)	77 (171)	77 (171)	280 (536)	43 (109)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-9 (16)

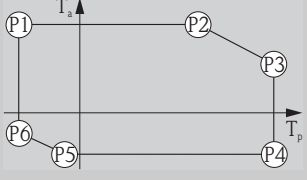
FMR54
Horn antenna
Seal: Graphite -196 to 280 °C (-321 to 536 °F)
Housing: GT19 (Plastics PBT)
Temperature unit: °C (°F)



A0019344

Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a
A	-196 (-321)	80 (176)	80 (176)	80 (176)	280 (536)	13 (55)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	18 (64)
B Switch output not used	-196 (-321)	76 (169)	76 (169)	76 (169)	280 (536)	13 (55)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	18 (64)
B Switch output used	-196 (-321)	60 (140)	60 (140)	60 (140)	280 (536)	13 (55)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	18 (64)
C Channel 2 not used	-196 (-321)	82 (180)	82 (180)	82 (180)	280 (536)	13 (55)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	18 (64)
C Channel 2 used	-196 (-321)	74 (165)	74 (165)	74 (165)	280 (536)	13 (55)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	18 (64)
E, G Switch output not used	-196 (-321)	79 (174)	79 (174)	79 (174)	280 (536)	13 (55)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	18 (64)
E, G Switch output used	-196 (-321)	63 (145)	63 (145)	63 (145)	280 (536)	13 (55)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	18 (64)

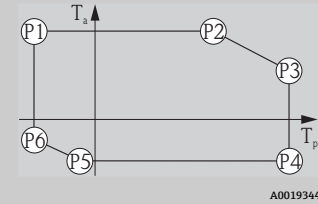
FMR54
Horn antenna
Seal: Graphite -196 to 280 °C (-321 to 536 °F)
Housing: GT20 (Alu, coated)
Temperature unit: °C (°F)



A0019344

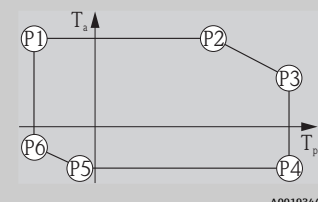
Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a
A	-196 (-321)	81 (178)	81 (178)	81 (178)	280 (536)	54 (129)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-15 (+5)
B Switch output not used	-196 (-321)	82 (180)	82 (180)	82 (180)	280 (536)	54 (129)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-15 (+5)
B Switch output used	-196 (-321)	77 (171)	77 (171)	77 (171)	280 (536)	49 (120)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-15 (+5)
C Channel 2 not used	-196 (-321)	82 (180)	82 (180)	82 (180)	280 (536)	54 (129)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-15 (+5)
C Channel 2 used	-196 (-321)	79 (174)	79 (174)	79 (174)	280 (536)	51 (124)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-15 (+5)
E, G Switch output not used	-196 (-321)	83 (181)	83 (181)	83 (181)	280 (536)	54 (129)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-15 (+5)
E, G Switch output used	-196 (-321)	78 (172)	78 (172)	78 (172)	280 (536)	50 (122)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-15 (+5)
K, L	-196 (-321)	77 (171)	77 (171)	77 (171)	280 (536)	50 (122)	280 (536)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-15 (+5)

FMR54
Horn antenna
Seal: Graphite -196 to 400 °C (-321 to 752 °F)
Housing: GT18 (316 L)
Temperature unit: °C (°F)



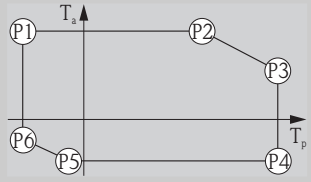
Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a
A	-196 (-321)	81 (178)	81 (178)	81 (178)	400 (752)	31 (88)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-13 (+9)
B Switch output not used	-196 (-321)	82 (180)	82 (180)	82 (180)	400 (752)	31 (88)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-13 (+9)
B Switch output used	-196 (-321)	77 (171)	77 (171)	77 (171)	400 (752)	29 (84)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-13 (+9)
C Channel 2 not used	-196 (-321)	82 (180)	82 (180)	82 (180)	400 (752)	31 (88)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-13 (+9)
C Channel 2 used	-196 (-321)	79 (174)	79 (174)	79 (174)	400 (752)	31 (88)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-13 (+9)
E, G Switch output not used	-196 (-321)	83 (181)	83 (181)	83 (181)	400 (752)	31 (88)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-13 (+9)
E, G Switch output used	-196 (-321)	78 (172)	78 (172)	78 (172)	400 (752)	31 (88)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-13 (+9)
K, L	-196 (-321)	77 (171)	77 (171)	77 (171)	400 (752)	30 (86)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-13 (+9)

FMR54
Horn antenna
Seal: Graphite -196 to 400 °C (-321 to 752 °F)
Housing: GT19 (Plastics PBT)
Temperature unit: °C (°F)



Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a
A	-196 (-321)	80 (176)	80 (176)	80 (176)	400 (752)	-19 (-2)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	11 (52)
B Switch output not used	-196 (-321)	76 (169)	76 (169)	76 (169)	400 (752)	-19 (-2)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	11 (52)
B Switch output used	-196 (-321)	60 (140)	60 (140)	60 (140)	400 (752)	-19 (-2)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	11 (52)
C Channel 2 not used	-196 (-321)	82 (180)	82 (180)	82 (180)	400 (752)	-19 (-2)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	11 (52)
C Channel 2 used	-196 (-321)	74 (165)	74 (165)	74 (165)	400 (752)	-19 (-2)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	11 (52)
E, G Switch output not used	-196 (-321)	79 (174)	79 (174)	79 (174)	400 (752)	-19 (-2)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	11 (52)
E, G Switch output used	-196 (-321)	63 (145)	63 (145)	63 (145)	400 (752)	-19 (-2)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	11 (52)

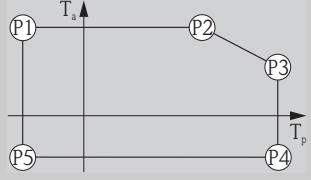
FMR54
Horn antenna
Seal: Graphite -196 to 400 °C (-321 to 752 °F)
Housing: GT20 (Alu, coated)
Temperature unit: °C (°F)



A0019344

Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a
A	-196 (-321)	81 (178)	81 (178)	81 (178)	400 (752)	42 (108)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-19 (-2)
B Switch output not used	-196 (-321)	82 (180)	82 (180)	82 (180)	400 (752)	42 (108)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-19 (-2)
B Switch output used	-196 (-321)	77 (171)	77 (171)	77 (171)	400 (752)	39 (102)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-19 (-2)
C Channel 2 not used	-196 (-321)	82 (180)	82 (180)	82 (180)	400 (752)	42 (108)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-19 (-2)
C Channel 2 used	-196 (-321)	79 (174)	79 (174)	79 (174)	400 (752)	41 (106)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-19 (-2)
E, G Switch output not used	-196 (-321)	83 (181)	83 (181)	83 (181)	400 (752)	42 (108)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-19 (-2)
E, G Switch output used	-196 (-321)	78 (172)	78 (172)	78 (172)	400 (752)	40 (104)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-19 (-2)
K, L	-196 (-321)	77 (171)	77 (171)	77 (171)	400 (752)	40 (104)	400 (752)	-40 (-40)	-40 (-40)	-40 (-40)	-196 (-321)	-19 (-2)

FMR54
Planar antenna
Housing: GT18 (316 L)
Temperature unit: °C (°F)



A0019351


Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a
A	-40 (-40)	81 (178)	81 (178)	81 (178)	150 (302)	69 (156)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output not used	-40 (-40)	82 (180)	82 (180)	82 (180)	150 (302)	69 (156)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output used	-40 (-40)	77 (171)	77 (171)	77 (171)	150 (302)	63 (145)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
C Channel 2 not used	-40 (-40)	82 (180)	82 (180)	82 (180)	150 (302)	70 (158)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
C Channel 2 used	-40 (-40)	79 (174)	79 (174)	79 (174)	150 (302)	66 (151)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output not used	-40 (-40)	83 (181)	83 (181)	83 (181)	150 (302)	71 (160)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output used	-40 (-40)	78 (172)	78 (172)	78 (172)	150 (302)	65 (149)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
K, L	-40 (-40)	77 (171)	77 (171)	77 (171)	150 (302)	64 (147)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-

FMR54 Planar antenna Housing: GT19 (Plastics PBT) Temperature unit: °C (°F)												
<small>A0019351</small>												
Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a
A	-40 (-40)	80 (176)	80 (176)	80 (176)	150 (302)	60 (140)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output not used	-40 (-40)	76 (169)	76 (169)	76 (169)	150 (302)	60 (140)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output used	-40 (-40)	60 (140)	60 (140)	60 (140)	150 (302)	41 (106)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
C Channel 2 not used	-40 (-40)	82 (180)	82 (180)	82 (180)	150 (302)	60 (140)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
C Channel 2 used	-40 (-40)	74 (165)	74 (165)	74 (165)	150 (302)	57 (135)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output not used	-40 (-40)	79 (174)	79 (174)	79 (174)	150 (302)	60 (140)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output used	-40 (-40)	63 (145)	63 (145)	63 (145)	150 (302)	44 (111)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-

FMR54 Planar antenna Housing: GT20 (Alu, coated) Temperature unit: °C (°F)												
<small>A0019351</small>												
Power Supply; Output (Pos. 2 of the product structure)	P1		P2		P3		P4		P5		P6	
	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a	T _p	T _a
A	-40 (-40)	81 (178)	81 (178)	81 (178)	150 (302)	71 (160)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output not used	-40 (-40)	82 (180)	82 (180)	82 (180)	150 (302)	72 (162)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
B Switch output used	-40 (-40)	77 (171)	77 (171)	77 (171)	150 (302)	66 (151)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
C Channel 2 not used	-40 (-40)	82 (180)	82 (180)	82 (180)	150 (302)	72 (162)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
C Channel 2 used	-40 (-40)	79 (174)	79 (174)	79 (174)	150 (302)	68 (154)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output not used	-40 (-40)	83 (181)	83 (181)	83 (181)	150 (302)	73 (163)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
E, G Switch output used	-40 (-40)	78 (172)	78 (172)	78 (172)	150 (302)	68 (154)	150 (302)	-40 (-40)	-40 (-40)	-40 (-40)	-	-
K, L	-40 (-40)	77 (171)	77 (171)	77 (171)	150 (302)	67 (153)	150 (302)	-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	<ul style="list-style-type: none"> ■ Generally up to 2 000 m (6 600 ft) above MSL. ■ Above 2 000 m (6 600 ft) if the following conditions are met: <ul style="list-style-type: none"> – 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
Degree of protection	<ul style="list-style-type: none"> ■ With closed housing tested according to: <ul style="list-style-type: none"> – IP68, NEMA6P (24 h at 1.83 m under water surface) – For plastic housing with transparent cover (display module): IP68 (24 h at 1.00 m under water surface) ⁶⁾ – IP66, NEMA4X ■ With open housing: IP20, NEMA1 ■ Display module: IP22, NEMA2 <p> Degree of protection IP68 NEMA6P applies for M12 PROFIBUS PA plugs only when the PROFIBUS cable is plugged in and is also rated IP68 NEMA6P.</p>
Vibration resistance	DIN EN 60068-2-64 / IEC 60068-2-64: 20 to 2 000 Hz, 1 (m/s ²)/Hz
Cleaning the antenna	<p>The antenna can get contaminated, depending on the application. The emission and reception of microwaves can thus eventually be hindered. The degree of contamination leading to an error depends on the medium and the reflectivity, mainly determined by the dielectric constant ϵ_r.</p> <p>If the medium tends to cause contamination and deposits, cleaning on a regular basis is recommended. Care has to be taken not to damage the antenna in the process of a mechanical or hose-down cleaning. The material compatibility has to be considered if cleaning agents are used! The maximum permitted temperature at the flange should not be exceeded.</p>
Electromagnetic compatibility (EMC)	<p>Electromagnetic compatibility to all relevant requirements of the EN 61326- series and NAMUR recommendation EMC (NE21). For details see declaration of conformity. ⁷⁾</p> <p>If only the analogue signal is used, unshielded interconnection lines are sufficient for the installation. In case of using the digital signal (HART/ PA/ FF) use shielded interconnection lines.</p> <p>Max. fluctuations during EMC- tests: < 0.5 % of the span. As an exception to this, the maximum fluctuations may amount to 2 % of the span for devices with plastic housing and see-through lid (integrated display SD02 or SD03) if strong electromagnetic interferences in the frequency range of 1 to 2 GHz are present.</p>

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

Process

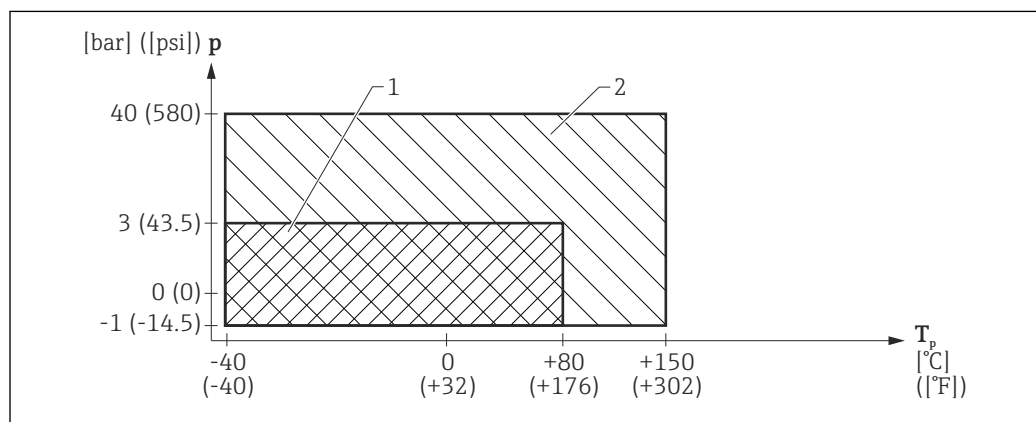
Process temperature, Process pressure

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

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

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

FMR53



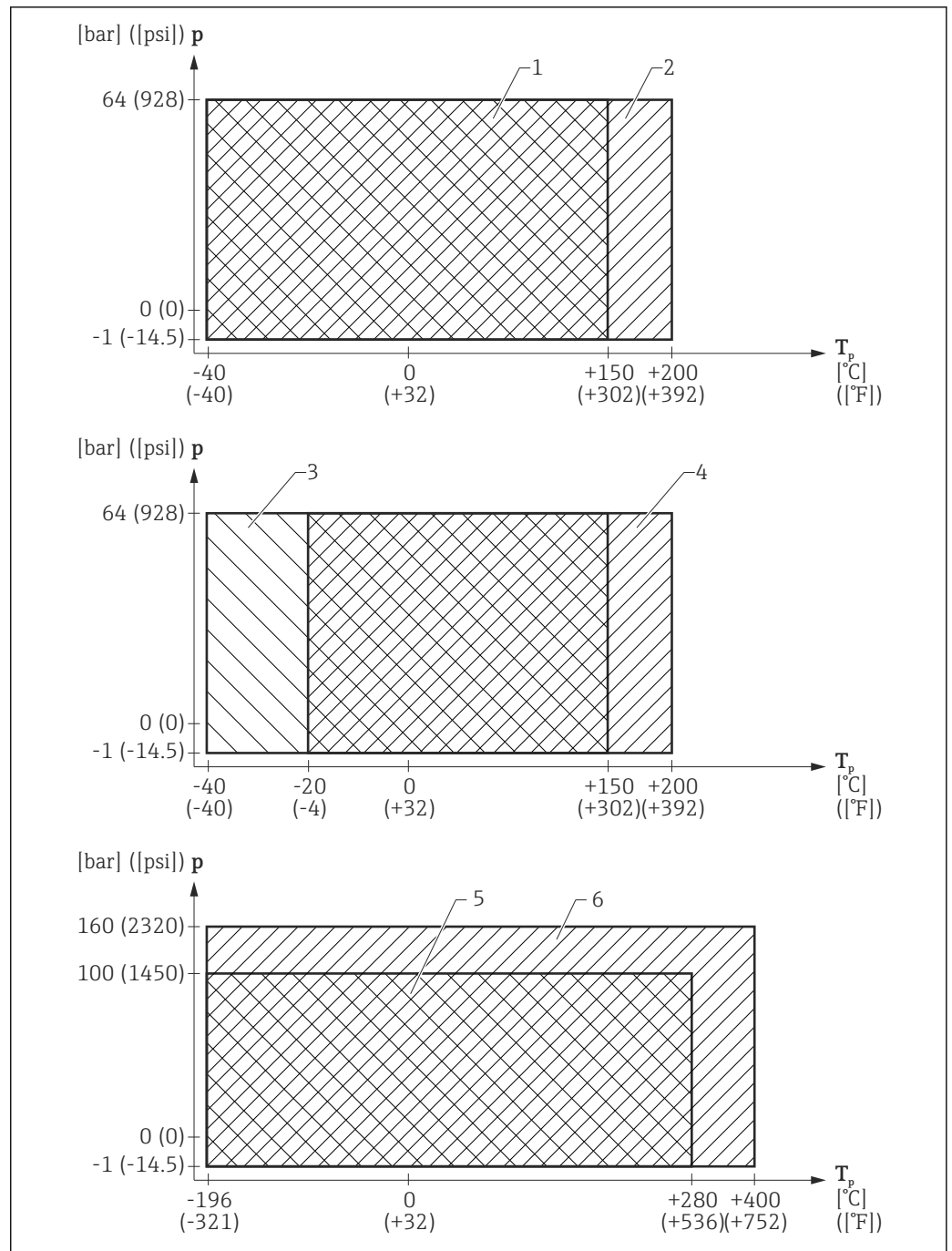
A0023251-EN

15 FMR53: Admissible range of process temperature and process pressure

- 1 Process connection: Thread PVDF
- 2 Any other process connection (thread 316L, flange)

Feature 100 "Process connection"	Admissible process temperature	Admissible process pressure
<ul style="list-style-type: none"> ▪ RGF: Thread ANSI MNPT1-1/2, PVDF ▪ RVF: Thread EN10226 R1-1/2, PVDF 	-40 to +80 °C (-40 to +176 °F)	$p_{rel} = -1$ to 3 bar (-14.5 to 43.5 psi) $p_{abs} < 4$ bar (58 psi)
Any other process connection	-40 to +150 °C (-40 to +302 °F)	$p_{rel} = -1$ to 40 bar (-14.5 to 580 psi)

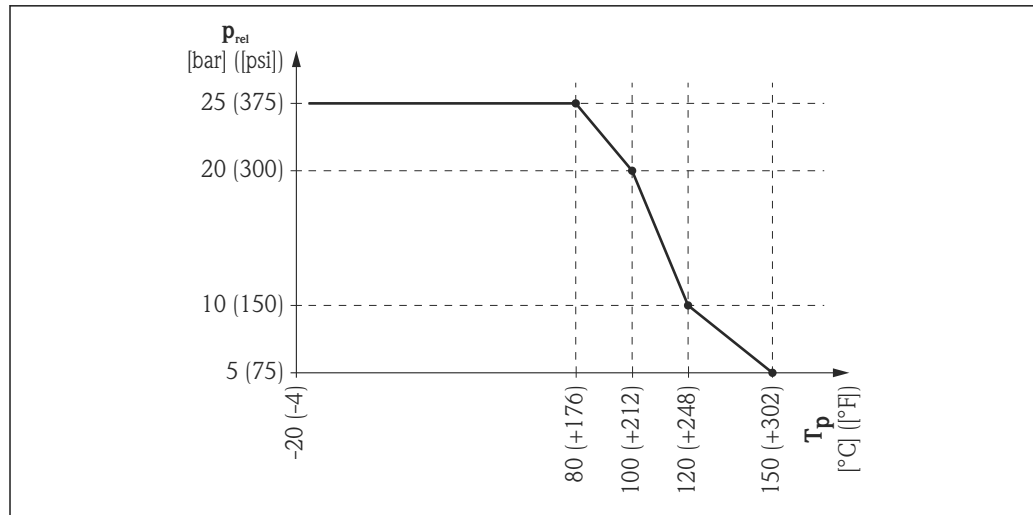
FMR54



A0023254-EN

16 FMR54 with horn antenna: Admissible range of process temperature and process pressure

- 1 Seal: Viton (Feature 090 "Seal", Option A8); valid for conductive media
- 2 Seal: Viton (Feature 090 "Seal", Option A8); enlarged area for non-conductive media
- 3 Seal: EPDM (Feature 090 "Seal", Option B4)
- 4 Seal: Kalrez
- 5 Seal: Graphite (XT) (Feature 090 "Seal", Option D1)
- 6 Seal: Graphite (HT) (Feature 090 "Seal", Option D2)



A0020552-EN

17 FMR54 with planar antenna: Admissible range of process temperature and process pressure

Feature 070 "Antenna"	Feature 090 "Seal"	Admissible process temperature	Admissible process pressure	
<ul style="list-style-type: none"> ■ AA: W/o horn, for pipe installation ■ BC: Horn 80mm/3" ■ BD: Horn 100mm/4" ■ BE: Horn 150mm/6" ■ BF: Horn 200mm/8" ■ BG: Horn 250mm/10" 	A8: Viton	<ul style="list-style-type: none"> ■ conductive media: -40 to +150 °C (-40 to +302 °F) ■ non-conductive media: -40 to +200 °C (-40 to +392 °F) 	-1 to 64 bar (-14.5 to 928 psi)	
	B4: EPDM	-40 to +150 °C (-40 to +302 °F)		
	C2: Kalrez	-20 to +200 °C (-4 to +392 °F)		
		D1: Graphite (XT)	-196 to +280 °C (-321 to +536 °F)	-1 to 100 bar (-14.5 to 1450 psi) ¹⁾
		D2: Graphite (HT)	-196 to +400 °C (-321 to +752 °F)	-1 to 160 bar (-14.5 to 2320 psi) ¹⁾
<ul style="list-style-type: none"> ■ DA: Planar 150mm/6" ■ DB: Planar 200mm/8" ■ DC: Planar 250mm/10" ■ DD: Planar 300mm/12" 	A7: Viton	-20 to +150 °C (-4 to +302 °F)	Dependent on the process temperature, T_p , see the diagram above	

1) For devices with CRN approval the pressure range may be reduced → 84

Dielectric constant

■ For liquids

- $\epsilon_r \geq 1.9$ in free-field applications
- $\epsilon_r \geq 1.4$ in stilling well

■ For bulk solids

$$\epsilon_r \geq 1.6$$

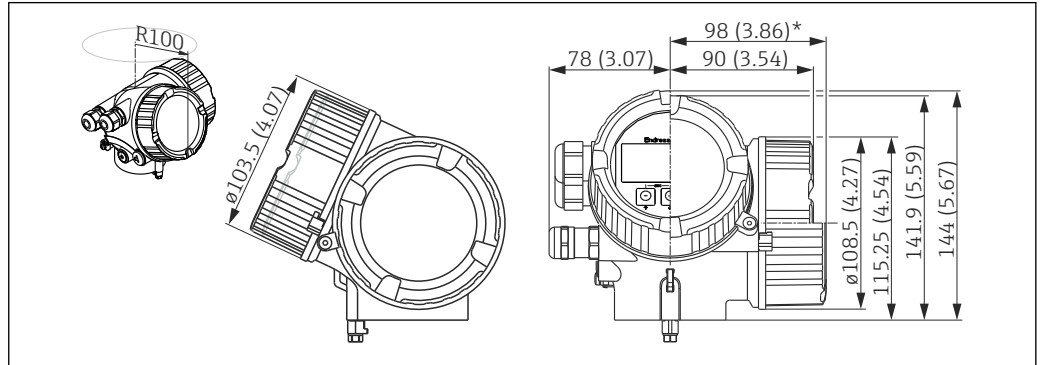
i For dielectric constants (DC values) of many media commonly used in various industries refer to:

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

Mechanical construction

Dimensions

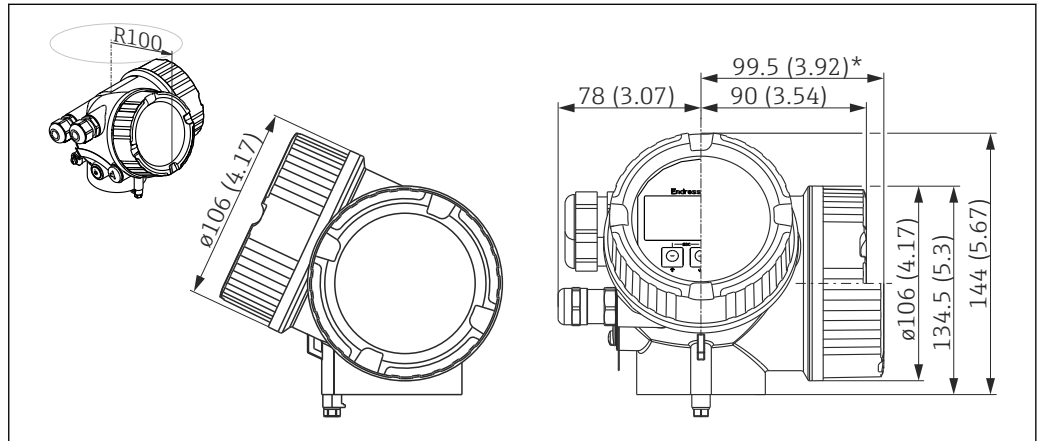
Dimensions of the electronics housing



A0011666

18 Housing GT18 (316L); Dimensions in mm (in)

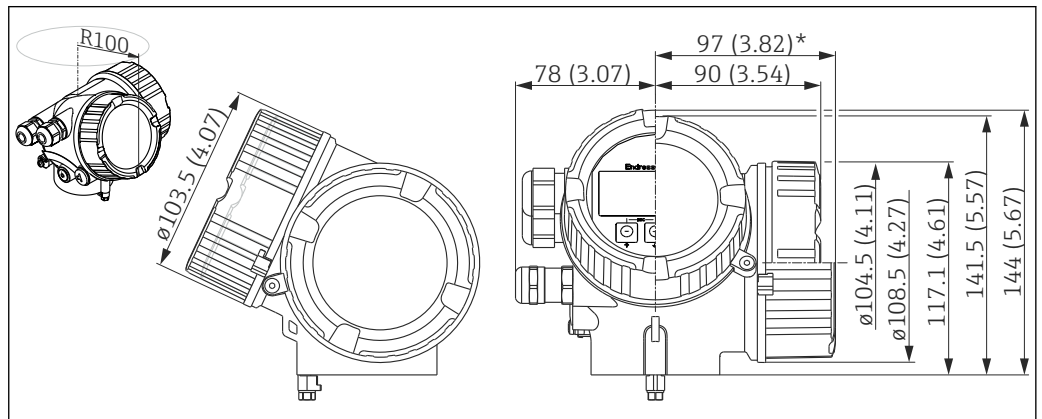
*for devices with integrated overvoltage protection.



A0011346

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

*for devices with integrated overvoltage protection.

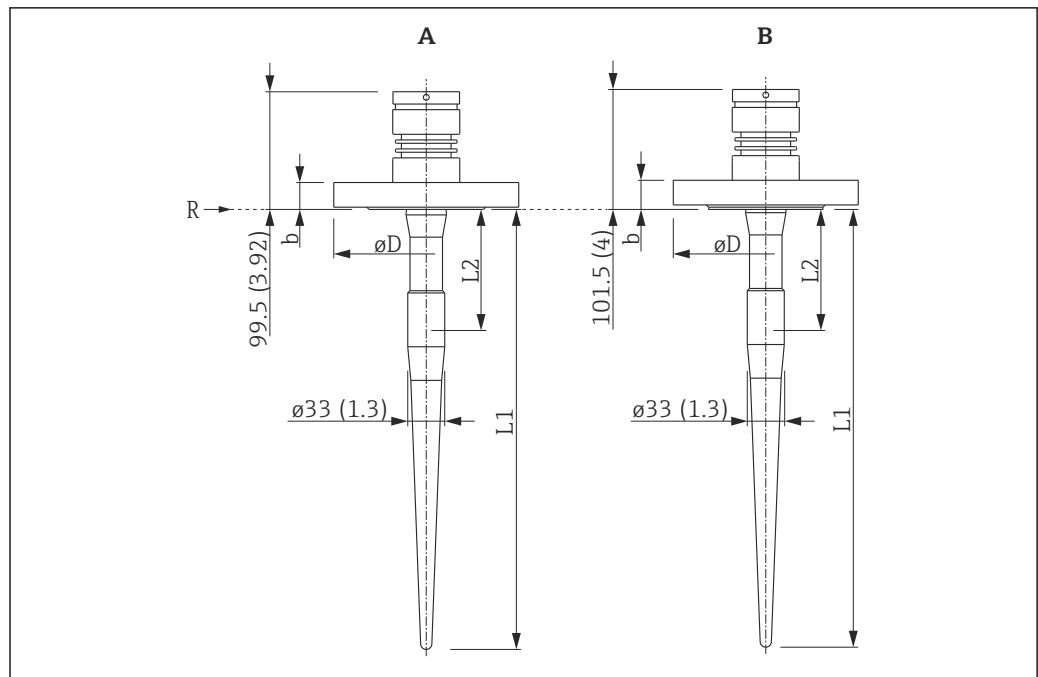


A0020751

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

*for devices with integrated overvoltage protection.

FMR53 with flange



A0023390

21 FMR53 with flange; dimensions: mm (in)

- A Process connection: Flange 316/316L (without cladding)
- B Process connection: Flange PTFE>316L (cladded)
- R Reference point of the measurement

Feature 070 "Antenna"	Antenna length L1	Inactive length L2
CA: Rod 390mm/15"	390 mm (15.4 in)	100 mm (3.94 in)
CB: Rod 540mm/21"	540 mm (21.3 in)	250 mm (9.84 in)

Flanges according to EN1092-1 (suitable for DIN2527)

Pressure rating	Dimension	Nominal diameter			
		DN50	DN80	DN100	DN150
PN10/16	b	20 mm (0.79 in)	20 mm (0.79 in)	20 mm (0.79 in)	22 mm (0.87 in)
	øD	ø165 mm (6.5 in)	ø200 mm (7.87 in)	ø220 mm (8.66 in)	ø285 mm (11.2 in)
PN25/40	b	-	24 mm (0.94 in)	-	-
	øD	-	ø200 mm (7.87 in)	-	-

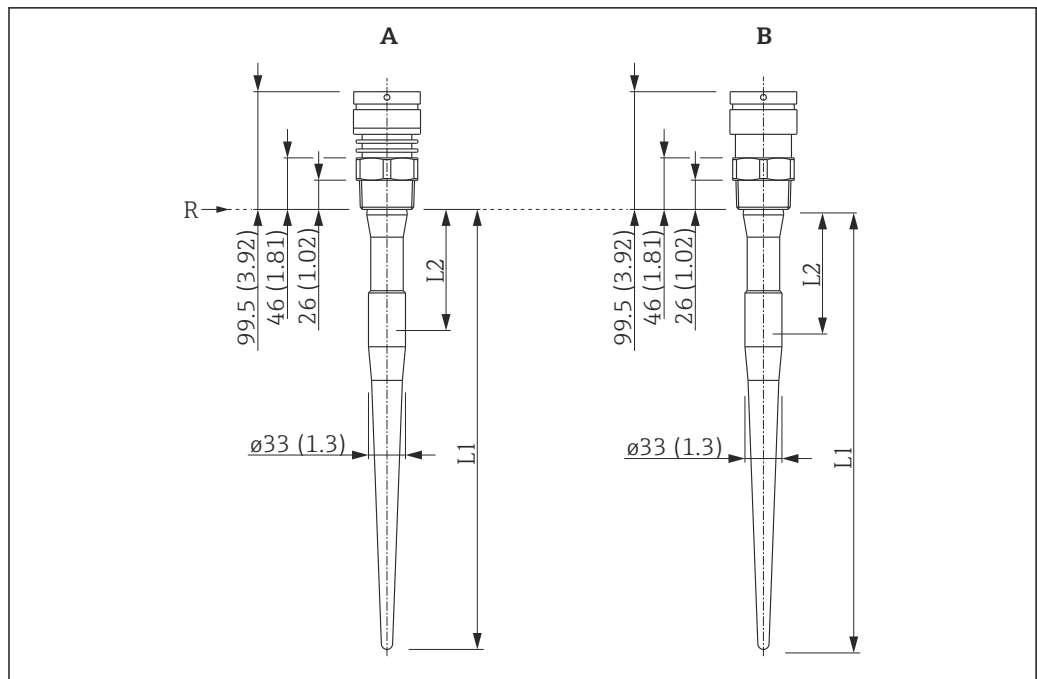
Flanges according to ANSI B16.5

Pressure rating	Dimension	Nominal diameter			
		2"	3"	4"	6"
150 lbs	b	19.1 mm (0.75 in)	23.9 mm (0.94 in)	23.9 mm (0.94 in)	25.4 mm (1 in)
	øD	ø152.4 mm (6 in)	ø190.5 mm (7.5 in)	ø228.6 mm (9 in)	ø279.4 mm (11 in)
300 lbs	b	-	28.4 mm (1.12 in)	31.8 mm (1.25 in)	-
	øD	-	ø209.5 mm (8.25 in)	ø254 mm (10 in)	-

Flanges according to JIS B2220

		Nominal diameter			
Pressure rating	Dimension	50A	80A	100A	150A
10 K	b	16 mm (0.63 in)	18 mm (0.71 in)	18 mm (0.71 in)	22 mm (0.87 in)
	φD	φ155 mm (6.1 in)	φ185 mm (7.28 in)	φ210 mm (8.27 in)	φ280 mm (11 in)

FMR53 with thread



A0023991

22 FMR53 with thread; dimensions: mm (in)

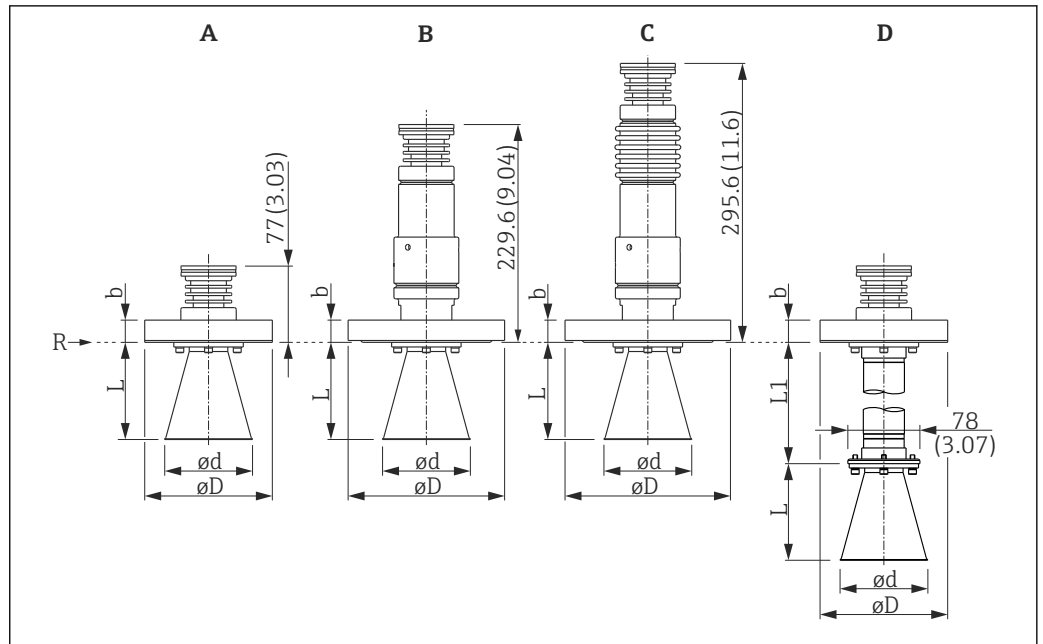
A Process connection: Thread 316L

B Process connection: Thread PVDF

R Reference point of the measurement

Feature 070 "Antenna"	Antenna length L1	Inactive length L2
CA: Rod 390mm/15"	390 mm (15.4 in)	100 mm (3.94 in)
CB: Rod 540mm/21"	540 mm (21.3 in)	250 mm (9.84 in)

FMR54 with horn antenna



A0017809

23 FMR54 with horn antenna; dimensions: mm (in)

- A Seal: Viton/EPDM/Kalrez
- B Seal: Graphite, -196...280°C/-321...536°F (XT)
- C Seal: Graphite, -196...400°C/-321...752°F (HT)
- D Antenna extension; optionally available for all horn antennas
- R Reference point of the measurement

Dimension	Feature 070 "Antenna"				
	BC: Horn 80mm/3"	BD: Horn 100mm/4"	BE: Horn 150mm/6"	BF: Horn 200mm/8"	BG: Horn 250mm/10"
L	68 mm (2.68 in)	105 mm (4.13 in)	185 mm (7.28 in)	268 mm (10.6 in)	360 mm (14.2 in)
ød	ø75 mm (2.95 in)	ø95 mm (3.74 in)	ø145 mm (5.71 in)	ø190 mm (7.48 in)	ø240 mm (9.45 in)
L1	100 mm (3.94 in) / 200 mm (7.87 in) / 300 mm (11.8 in) / 400 mm (15.7 in)				

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

Pressure rating ²⁾	Dimension	Nominal diameter ²⁾				
		DN80	DN100	DN150	DN200	DN250
PN10/16	b	20 mm (0.79 in)	20 mm (0.79 in)	22 mm (0.87 in)	24 mm (0.94 in)	26 mm (1.02 in)
	øD	ø200 mm (7.87 in)	ø220 mm (8.66 in)	ø285 mm (11.2 in)	ø340 mm (13.4 in)	ø405 mm (15.9 in)
PN25/40	b	24 mm (0.94 in)	24 mm (0.94 in)	-	-	-
	øD	ø200 mm (7.87 in)	ø235 mm (9.25 in)	-	-	-

- 1) For flanges with a higher pressure rating than those listed in the product structure please contact Endress+Hauser.
- 2) Feature 100 of the product structure

Flanges according to ANSI B16.5 ¹⁾

Pressure rating ¹⁾	Dimension	Nominal diameter ²⁾				
		3"	4"	6"	8"	10"
150 lbs	b	23.9 mm (0.94 in)	23.9 mm (0.94 in)	25.4 mm (1 in)	28.4 mm (1.12 in)	30.2 mm (1.19 in)
	φD	φ190.5 mm (7.5 in)	φ228.6 mm (9 in)	φ279.4 mm (11 in)	φ342.9 mm (13.5 in)	φ406.4 mm (16 in)
300 lbs	b	28.4 mm (1.12 in)	31.8 mm (1.25 in)	-	-	-
	φD	φ209.5 mm (8.25 in)	φ254 mm (10 in)	-	-	-

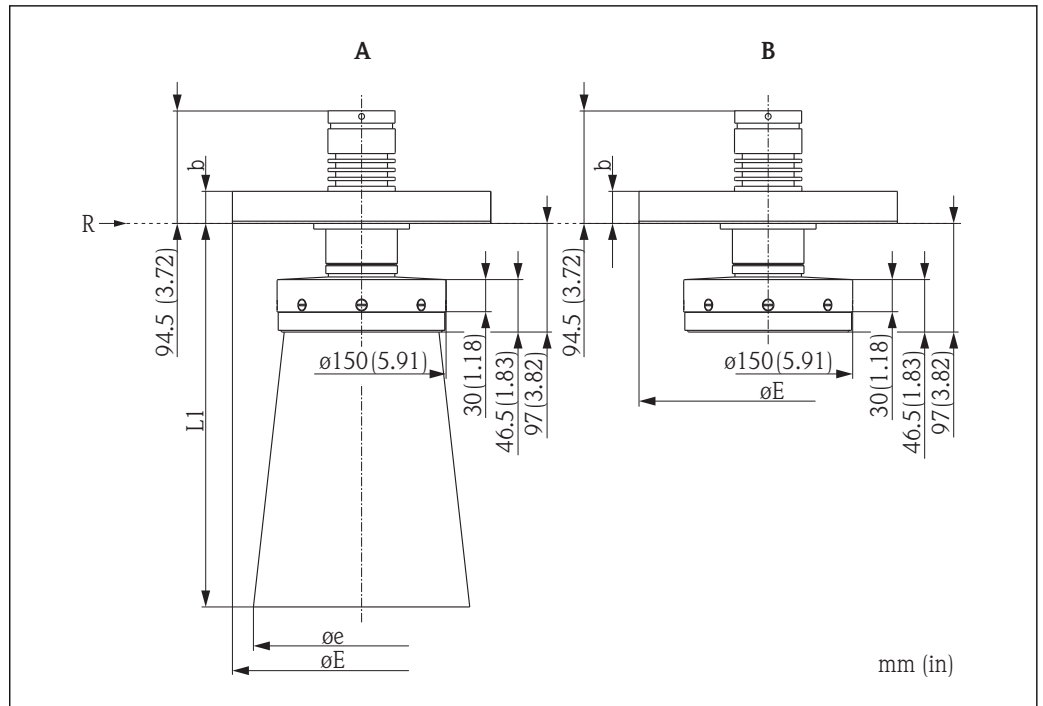
- 1) For flanges with a higher pressure rating than those listed in the product structure please contact Endress +Hauser.
- 2) Feature 100 of the product structure

Flanges according to JIS B 2220 ¹⁾

Pressure rating ¹⁾	Dimensions	Nominal diameter ²⁾				
		DN80	DN100	DN150	DN200	DN250
10 K	b	18 mm (0.71 in)	18 mm (0.71 in)	22 mm (0.87 in)	22 mm (0.87 in)	24 mm (0.94 in)
	φD	φ185 mm (7.28 in)	φ210 mm (8.27 in)	φ280 mm (11 in)	φ330 mm (13 in)	φ400 mm (15.7 in)

- 1) For flanges with a higher pressure rating than those listed in the product structure please contact Endress +Hauser.
- 2) Feature 100 of the product structure

FMR54 with planar antenna



A0017810

- A With antenna extension (for planar antenna 200mm/8" to 300mm/12")
- B Withput horn extension (for planar antenna 150mm/6")
- R Reference point of the measurement

Antenna extension

Dimension	Feature 070 "Antenna"		
	DB: Planar 200mm/8"	DC: Planar 250mm/10"	DD: Planar 300mm/12"
e	192 mm (7.56 in)	242 mm (9.53 in)	292 mm (11.5 in)
L1	341 mm (13.4 in)	494 mm (19.4 in)	521 mm (20.5 in)

Flanges according to EN1092-1 (suitable for DIN2527)

Pressure rating ¹⁾	Dimension	Nominal diameter ¹⁾			
		DN150	DN200	DN250	DN300
PN16	b	22 mm (0.87 in)	24 mm (0.94 in)	26 mm (1.02 in)	28 mm (1.1 in)
	øE	ø285 mm (11.2 in)	ø340 mm (13.4 in)	ø405 mm (15.9 in)	ø460 mm (18.1 in)
PN25	b	28 mm (1.1 in)	30 mm (1.18 in)	-	-
	øE	ø300 mm (11.8 in)	ø360 mm (14.2 in)	-	-

1) Feature 100 of the product structure

Flanges according to ANSI B16.5

Pressure rating ¹⁾	Dimension	Nominal diameter ¹⁾			
		6"	8"	10"	12"
150 lbs	b	25.4 mm (1 in)	28.4 mm (1.12 in)	30.2 mm (1.19 in)	31.8 mm (1.25 in)
	øE	ø279.4 mm (11 in)	ø342.9 mm (13.5 in)	ø406.4 mm (16 in)	ø482.6 mm (19 in)

Pressure rating ¹⁾	Dimension	Nominal diameter ¹⁾			
		6"	8"	10"	12"
300 lbs	b	36.6 mm (1.44 in)	41.1 mm (1.62 in)	-	-
	ϕE	ϕ317.5 mm (12.5 in)	ϕ381 mm (15 in)	-	-

1) Feature 100 of the product structure

Flanges according to JIS B2220

Pressure rating ¹⁾	Dimension	Nominal diameter ¹⁾		
		DN150	DN200	DN250
10 K	b	22 mm (0.87 in)	22 mm (0.87 in)	24 mm (0.94 in)
	ϕE	ϕ280 mm (11 in)	ϕ330 mm (13 in)	ϕ400 mm (15.7 in)
20 K	b	28 mm (1.1 in)	30 mm (1.18 in)	-
	ϕE	ϕ305 mm (12 in)	ϕ350 mm (13.8 in)	-

1) Feature 100 of the product structure

Weight

Housing

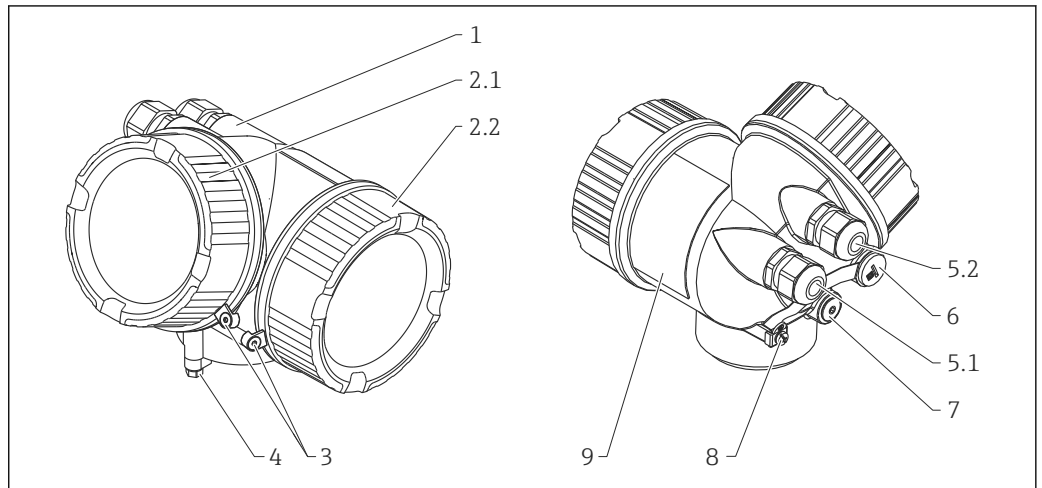
Part	Weight
Housing GT18 - stainless steel	approx. 4.5 kg (9.9 lb)
Housing GT19 - plastic	approx. 1.2 kg (2.7 lb)
Housing GT20 - aluminium	approx. 1.9 kg (4.2 lb)

Antenna and process connection

Device	Weight of antenna and process connection
FMR53	max. 3.0 kg (6.6 lb) + weight of flange ¹⁾
FMR54	max. 9 kg (19.9 lb) + weight of flange ¹⁾

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

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



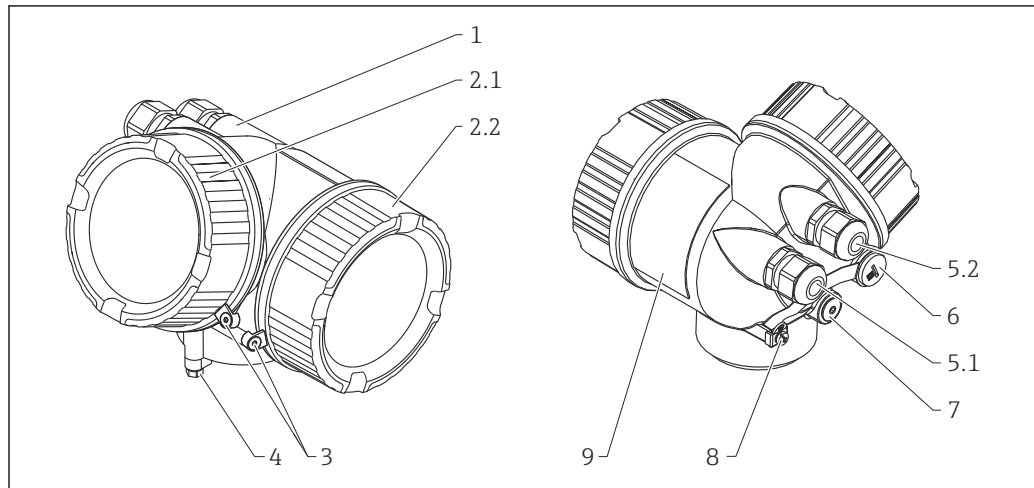
A0013788

No.	Part	Material
1	Housing	CF3M similar to 316L/1.4409
2.1	Cover of the electronics compartment	<ul style="list-style-type: none"> ▪ Cover: CF3M (similar to 316L/1.4404) ▪ Window: glass ▪ Cover seal: NBR ▪ Seal of the window: NBR ▪ Thread-coating: Graphite-based lubricant varnish
2.2	Cover of the terminal compartment	<ul style="list-style-type: none"> ▪ Cover: CF3M (similar to 316L/1.4404) ▪ Cover seal: NBR ▪ Thread-coating: Graphite-based lubricant varnish
3	Cover lock	<ul style="list-style-type: none"> ▪ Screw: A4 ▪ Clamp: 316L (1.4404)
4	Lock at the housing neck	<ul style="list-style-type: none"> ▪ Screw: A4-70 ▪ Clamp: 316L (1.4404)
5.1	Dummy plug, cable gland, adapter or plug (depending on the device version)	<ul style="list-style-type: none"> ▪ Dummy plug, depending on the device version: <ul style="list-style-type: none"> - PE - PBT-GF ▪ Cable gland: 316L (1.4404) or nickel-plated brass ▪ 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)	<ul style="list-style-type: none"> ▪ Dummy plug: 316L (1.4404) ▪ Cable gland: 316L (1.4404) or nickel-plated brass ▪ Adapter: 316L (1.4404/1.4435) ▪ Seal: EPDM
6	Dummy plug or M12 socket (depending on the device version)	<ul style="list-style-type: none"> ▪ Dummy plug: 316L (1.4404) ▪ M12 socket: 316L (1.4404)
7	Pressure relief stopper	316L (1.4404)
8	Ground terminal	<ul style="list-style-type: none"> ▪ Screw: A4 ▪ Spring washer: A4 ▪ Clamp: 316L (1.4404) ▪ Holder: 316L (1.4404)
9	Nameplate	<ul style="list-style-type: none"> ▪ Plate: 316L (1.4404) ▪ Groove pin: A4 (1.4571)

1) For the version with M12 plug the sealing material is Viton.

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

Materials: GT19 housing (plastic)

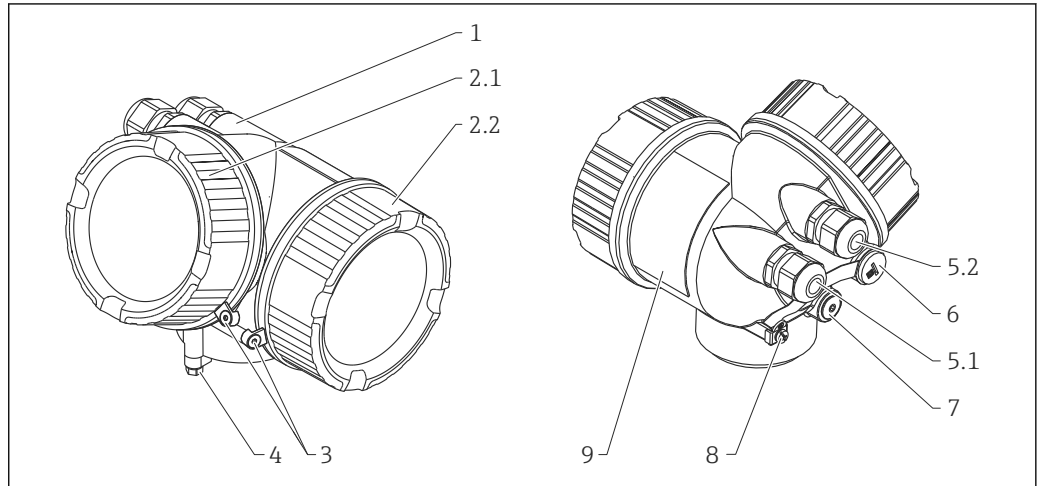


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No.	Part	Material
1	Housing	PBT
2.1	Cover of the electronics compartment	<ul style="list-style-type: none"> ■ Cover glass: PC ■ Cover frame: PBT-PC ■ Cover seal: EPDM ■ Thread-coating: Graphite-based lubricant varnish
2.2	Cover of the terminal compartment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

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

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



A0013788

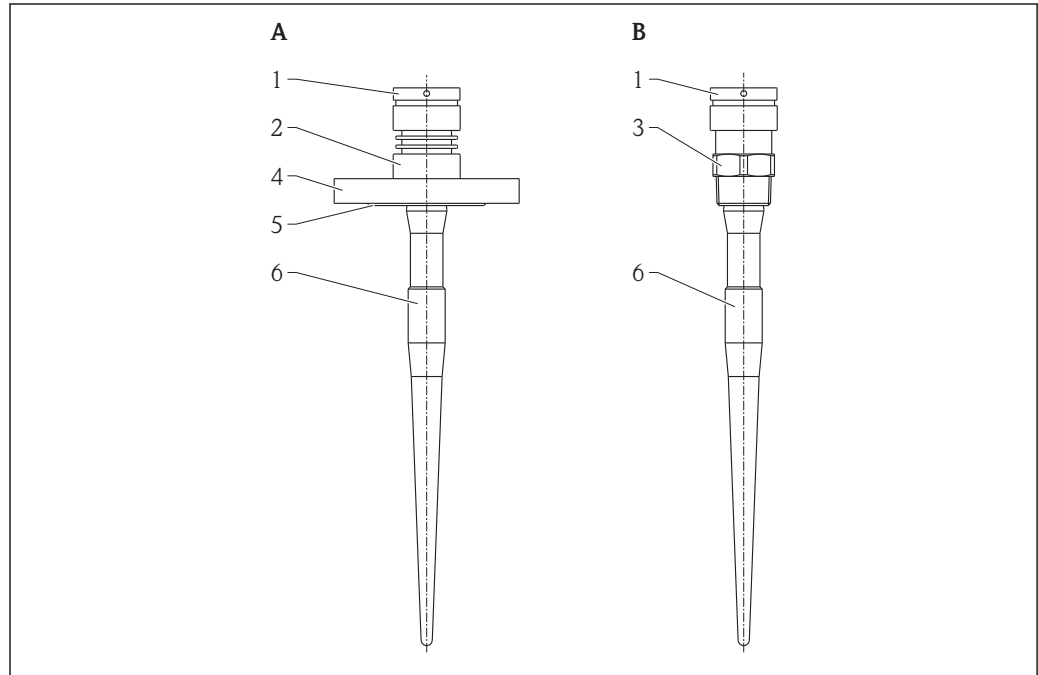
Nr.	Part	Material
1	Housing, RAL 5012 (blue)	<ul style="list-style-type: none"> ▪ Housing: AlSi10Mg(<0,1% Cu) ▪ Coating: Polyester
2.1	Cover of the electronics compartment; RAL 7035 (gray)	<ul style="list-style-type: none"> ▪ Cover: AlSi10Mg(<0,1% Cu) ▪ Window: Glass ▪ Cover seal: NBR ▪ Seal of the window: NBR ▪ Thread-coating: Graphite-based lubricant varnish
2.2	Cover of the terminal compartment; RAL 7035 (gray)	<ul style="list-style-type: none"> ▪ Cover: AlSi10Mg(<0,1% Cu) ▪ Cover seal: NBR ▪ Thread-coating: Graphite-based lubricant varnish
3	Cover lock	<ul style="list-style-type: none"> ▪ Screw: A4 ▪ Clamp: 316L (1.4404)
4	Lock at the housing neck	<ul style="list-style-type: none"> ▪ Screw: A4-70 ▪ Clamp: 316L (1.4404)
5.1	Dummy plug, cable gland, adapter or plug (depending on the device version)	<ul style="list-style-type: none"> ▪ Dummy plug, depending on the device version: <ul style="list-style-type: none"> - PE - PBT-GF ▪ Cable gland, depending on the device version: <ul style="list-style-type: none"> - Nickel-plated brass (CuZn) - PA ▪ Adapter: 316L (1.4404/1.4435) ▪ Seal: EPDM ▪ M12 plug: Nickel-plated brass ¹⁾ ▪ 7/8" plug: 316 (1.4401) ²⁾
5.2	Dummy plug, cable gland or adapter (depending on the device version)	<ul style="list-style-type: none"> ▪ Dummy plug, depending on the device version: <ul style="list-style-type: none"> - PE - PBT-GF - Nickel-plated steel ▪ Cable gland, depending on the device version: <ul style="list-style-type: none"> - Nickel-plated brass (CuZn) - PA ▪ Adapter: 316L (1.4404/1.4435) ▪ Seal: EPDM
6	Dummy plug or M12 socket (depending on the device version)	<ul style="list-style-type: none"> ▪ Dummy plug : Nickel-plated brass (CuZn) ▪ M12 socket: Nickel-plated GD-Zn
7	Pressure relief stopper	Nickel-plated brass (CuZn)

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

- 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

FMR53

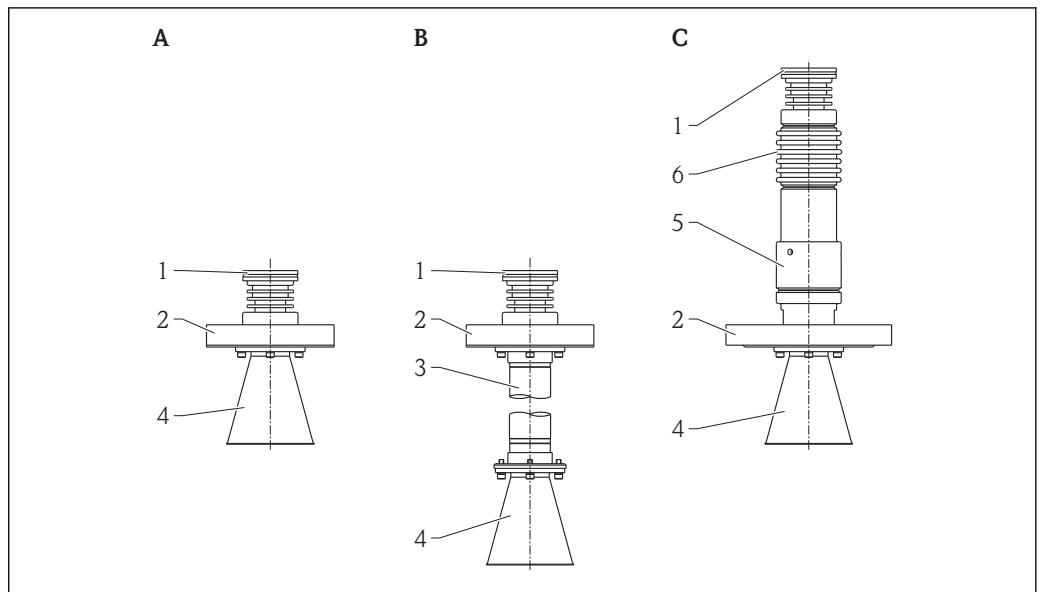


A0018954

- A Flange version
 B Version with threaded connection

Pos.	Part	Material
1	Housing adapter	316L (1.4404)
2	Connection	316L (1.4404)
3	Connection	316L (1.4404)
		PVDF
4	Flange	316L (1.4404/1.4435)
5	Cladding	PTFE
6	Rod antenna	PTFE

FMR54 mit Hornantenne

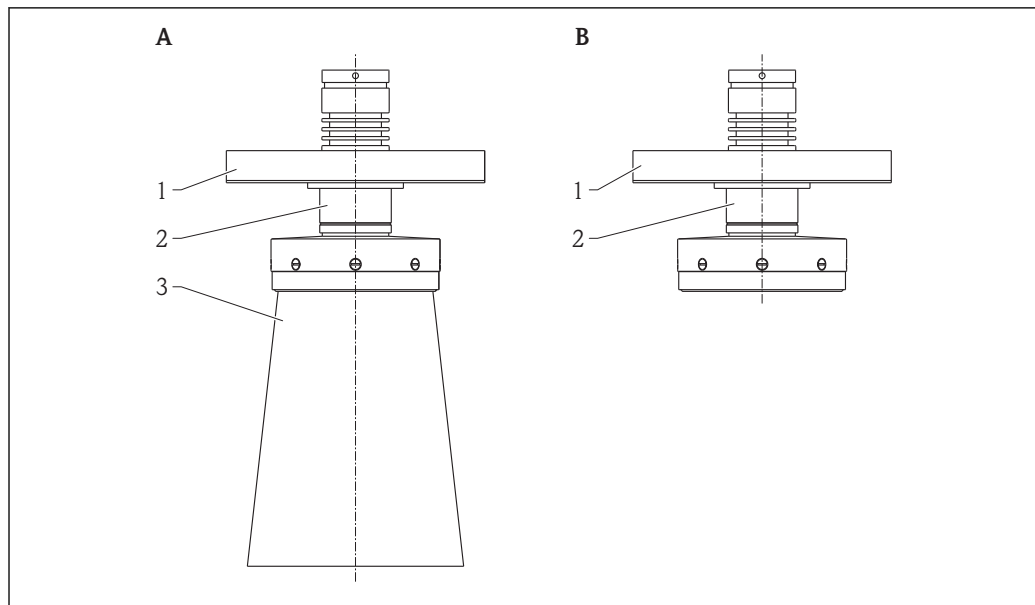


A0018956

- A Compact version
- B Version with antenna extension
- C High temperature version

Pos.	Part	Material		
1	Sensor adapter	316L (1.4404)		
2	Flange	316L (1.4404/1.4435)		
3	Antenna extension	316L (1.4435)		
	Screw	A4		
	Spring-lock washer	A4		
4	Horn antenna	316L (1.4404)		
	Screw	A4		
	Spring-lock washer (compact)	A4		
	Nordlock washer (XT and HT version)	A4		
	Process separation cone	Compact version: PTFE	High temperature version: Al ₂ O ₃	
	Seal	Compact version: ■ Viton: FKM ■ Kalrez: FFKM (K6375) ■ EPDM	High temperature version: Graphite	
5	Process separation	316L (1.4404)		
6	Temperature reduction	316L (1.4404)		

FMR54 with planar or drip-off antenna

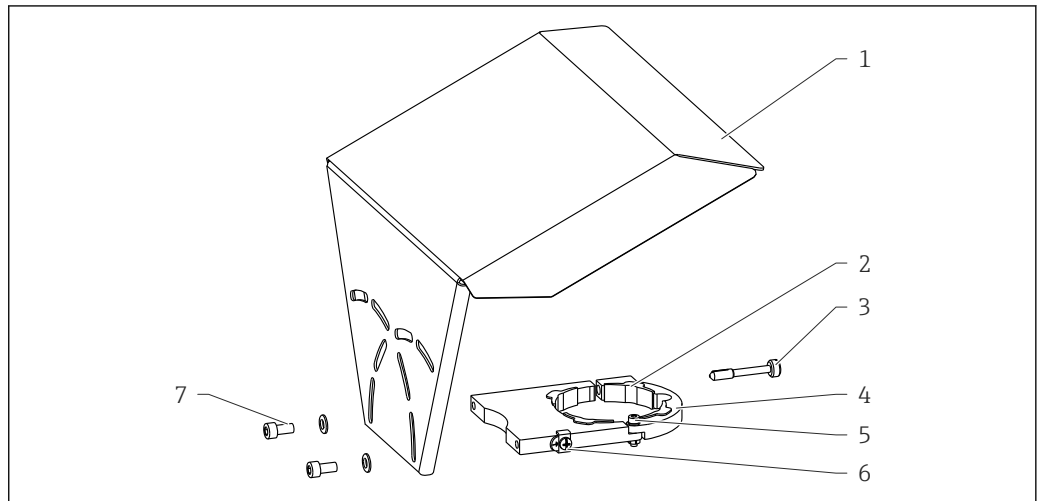


A0018957

- A Version with horn
B Version without horn

Pos.	Part	Material
1	Flange	316L (1.4404/1.4435)
	Adapter	316L (1.4404)
2	Housing adapter	316L (1.4404)
	Sensor adapter	316L (1.4404)
	Housing and retaining ring	316L (1.4404)
	Screw	A2
	Planar antenna	PTFE
	Sealing ring	FKM
3	Horn antenna	316L (1.4404)

Materials: Weather protection cover



A0015473

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	<ul style="list-style-type: none"> ▪ Cheese head screw: A4-70 ▪ Nut: A4 ▪ Spring washer: A4
6	Ground terminal <ul style="list-style-type: none"> ▪ Screw: A4 ▪ Spring washer: A4 ▪ Clamp: 316L (1.4404) ▪ Holder: 316L (1.4404)
7	<ul style="list-style-type: none"> ▪ Washer: A4 ▪ Cheese head screw: A4-70

Operability

Operating concept

Operator-oriented menu structure for user-specific tasks

- Commissioning
- Operation
- Diagnostics
- Expert level

Operating languages

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



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

Quick and save commissioning

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

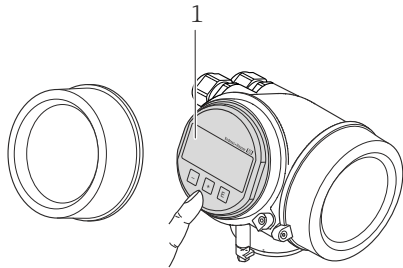
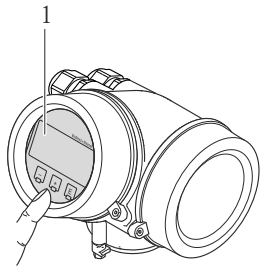
Integrated data storage device (HistoROM)

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

Efficient diagnostics increase measurement reliability

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

Local operation

Order code for "Display; Operation", option C "SD02"	Order code for "Display; Operation", option E "SD03"
	
1 Operation with pushbuttons	1 Operation with touch control

Display elements

- 4-line display
- In the case of order code for "Display; Operation", option E: white background lighting; switches to red in event of device errors
- Format for displaying measured variables and status variables can be individually configured
- Permitted ambient temperature for the display: -20 to +70 °C (-4 to +158 °F)
The readability of the display may be impaired at temperatures outside the temperature range.

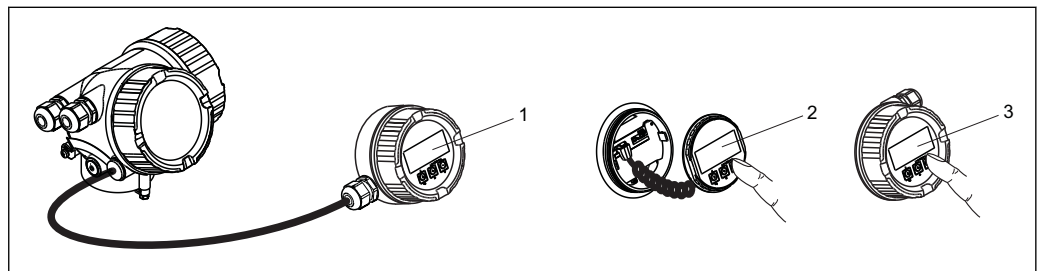
Operating elements

- In the case of order code "Display; Operation", Option C: local operation with 3 push buttons (⊕, ⊖, ⊞)
- In the case of order code for "Display; Operation", option 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 device configuration.
- Data transfer function
The transmitter configuration can be transmitted to another device using the display module.

Operation with remote display and operating module FHX50

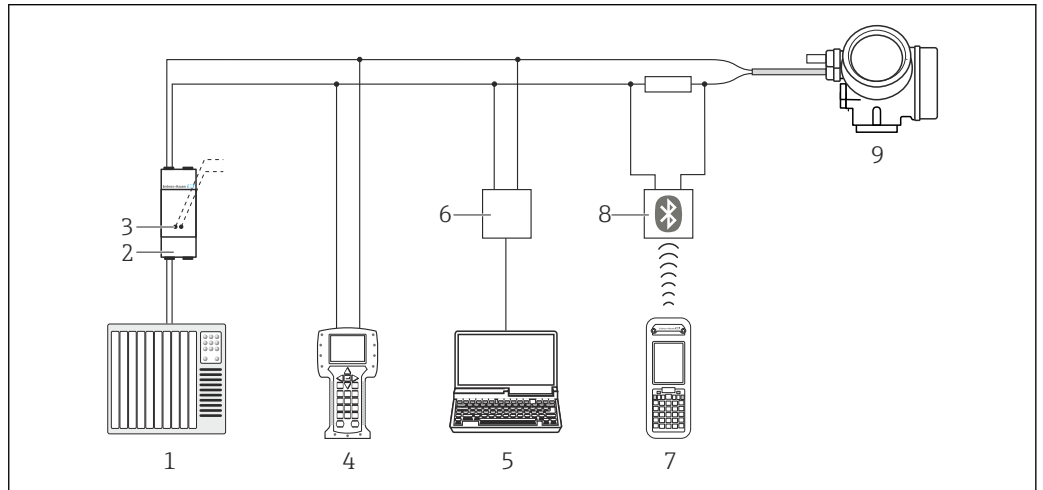


24 FHX50 operating options

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

Remote operation

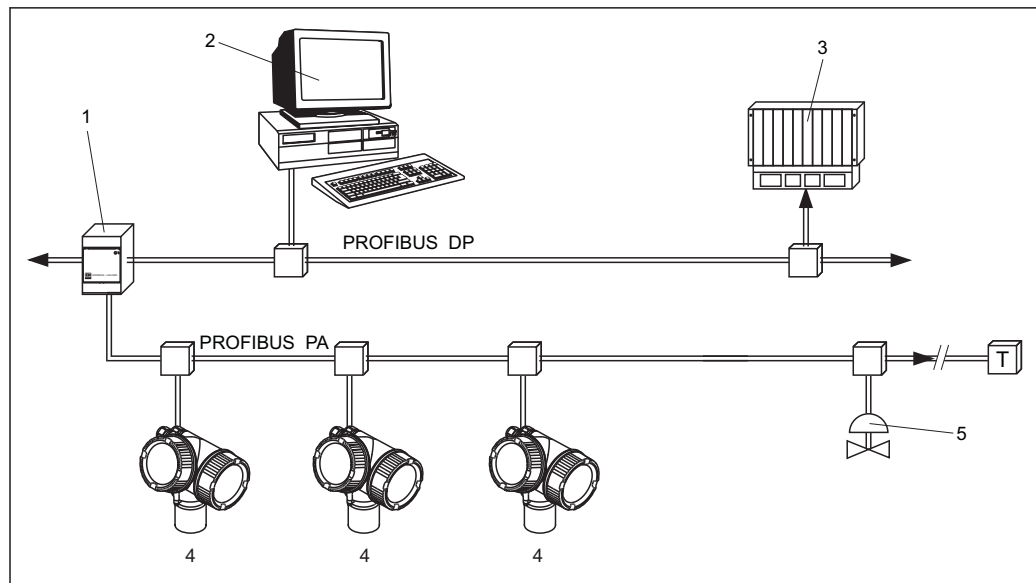
Via HART protocol



25 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. 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

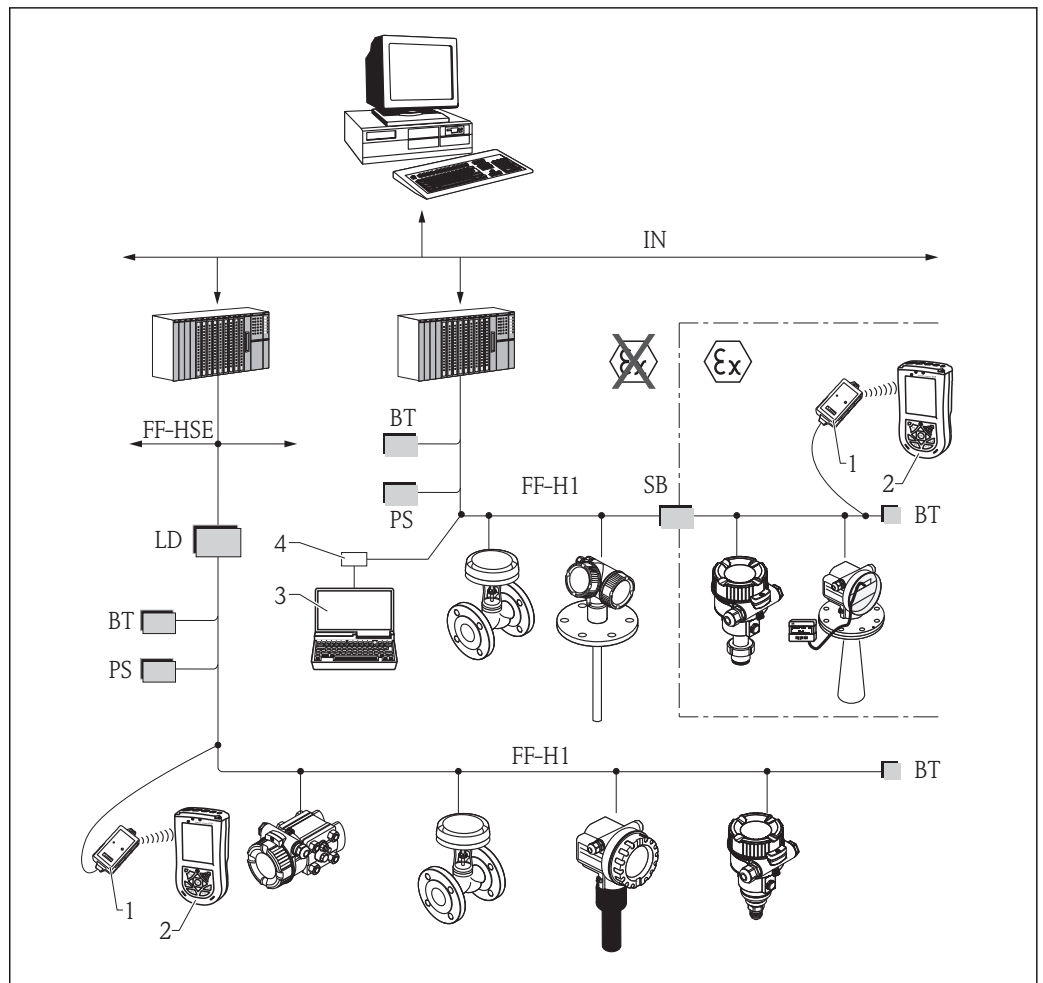
Via PROFIBUS PA protocol



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

Via FOUNDATION Fieldbus



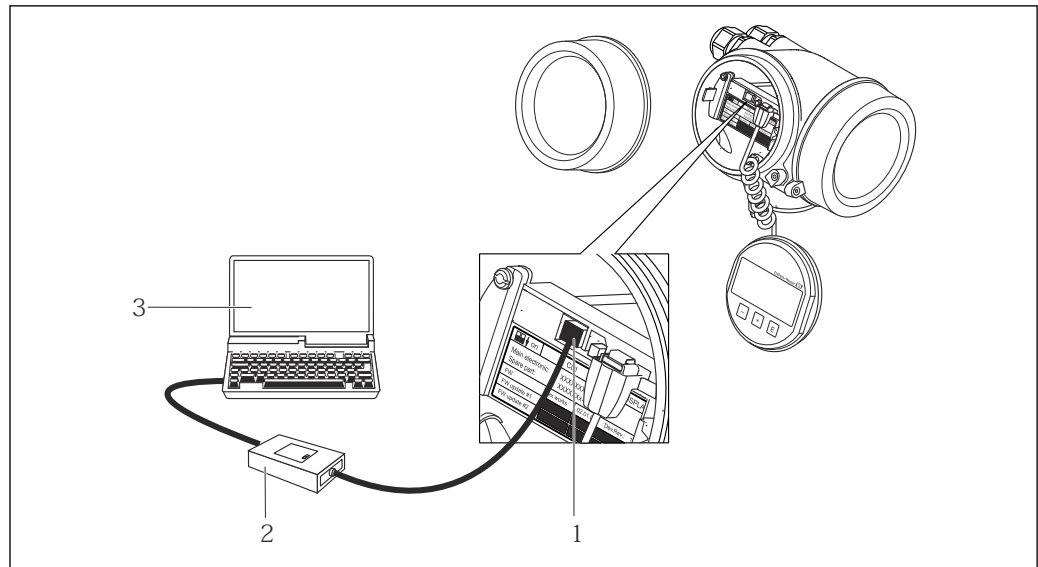
A0017188

26 FOUNDATION Fieldbus system architecture with associated components

- 1 FFblue Bluetooth modem
- 2 Field Xpert SFX350/SFX370
- 3 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

Via service interface (CDI)

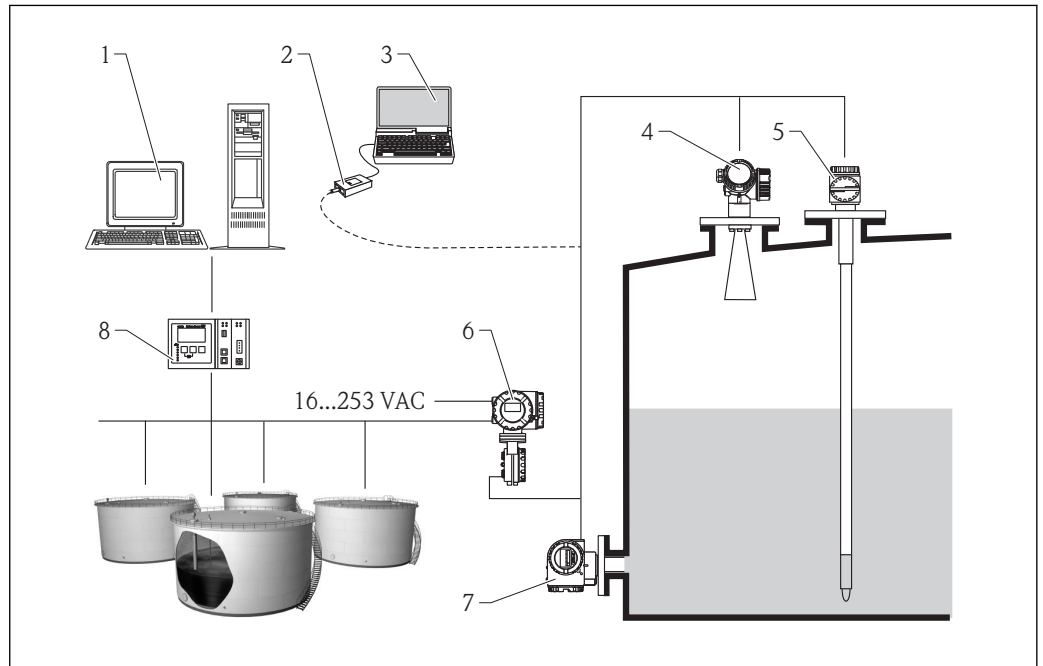


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- 1 Service interface (CDI) of the measuring device (= Endress+Hauser Common Data Interface)
- 2 Commubox FXA291
- 3 Computer with "FieldCare" operating tool

Integration in tank gauging system

The Endress+Hauser Tank Side Monitor NRF590 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.



27 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 NRF590
- 7 Pressure measuring device
- 8 Tankvision Tank Scanner NXA820

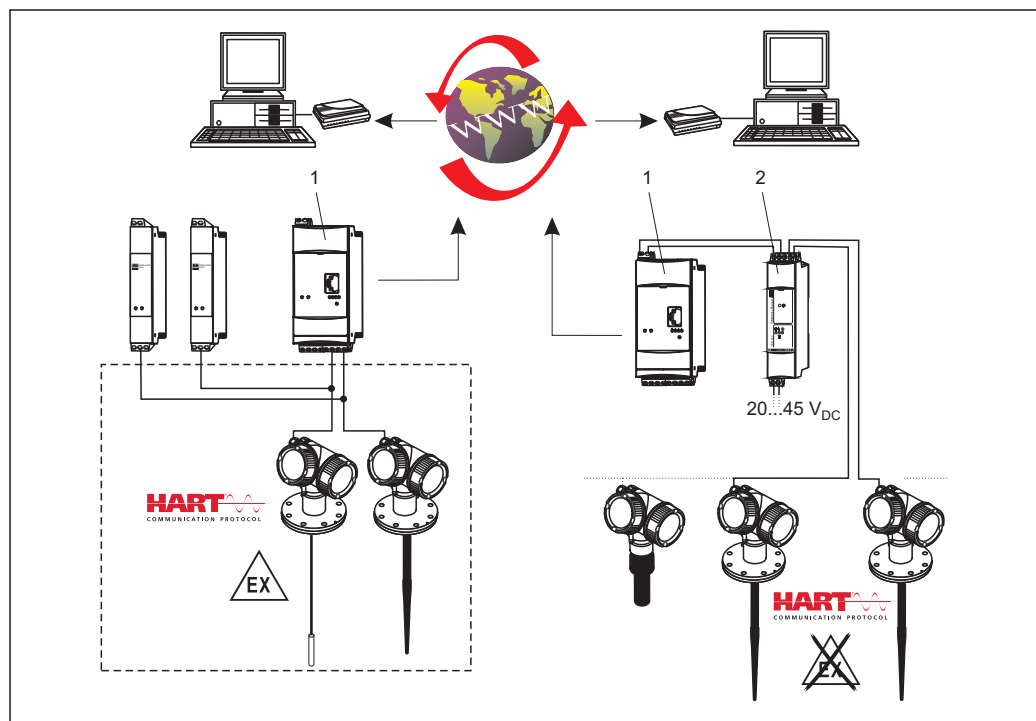
System integration via Fieldgate

Vendor Managed Inventory

By using Fieldgates to interrogate tank or silo levels remotely, suppliers of raw materials can provide their regular customers with information about the current supplies at any time and, for example, account for them in their own production planning. For their part, the Fieldgates monitor the configured level limits and, if required, automatically activate the next supply. The spectrum of options here ranges from a simple purchasing requisition via e-mail through to fully automatic order administration by coupling XML data into the planning systems on both sides.

Remote maintenance of measuring equipment

Fieldgates not only transfer the current measured values, they also alert the responsible standby personnel, if required, via e-mail or SMS. In the event of an alarm or also when performing routine checks, service technicians can diagnose and configure connected HART devices remotely. All that is required for this is the corresponding HART operating tool (e.g. FieldCare, ...) for the connected device. Fieldgate passes on the information transparently, so that all options for the respective operating software are available remotely. Some on-site service operations can be avoided by using remote diagnosis and remote configuration and all others can at least be better planned and prepared.






28 The complete measuring system consists of devices and:

- 1 Fieldgate FXA520
- 2 Multidrop Connector FXN520

i The number of instruments which can be connected in multidrop mode can be calculated by the "FieldNetCalc" program. A description of this program can be found in Technical Information TI 400F (Multidrop Connector FXN520). The program is available from your Endress+Hauser sales organisation or in the internet at: www.de.endress.com/Download (text search = "Fieldnetcalc").

Certificates and approvals

CE mark	<p>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.</p> <p>Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.</p>
RoHS	<p>The measuring system complies with the substance restrictions of the Restriction on Hazardous Substances Directive 2011/65/EU (RoHS 2).</p>
RCM-Tick marking	<p>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.</p> <div data-bbox="501 667 1533 801" style="text-align: center;">  </div> <p style="text-align: right; font-size: small;">A0029561</p>
Ex approval	<ul style="list-style-type: none"> ▪ ATEX ▪ IEC Ex ▪ CSA ▪ FM ▪ NEPSI ▪ KC ▪ INMETRO ▪ TIIS (in preparation) <p>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.</p> <p> Details on the available certificates as well as the associated XAs can be found in the Associated documentation chapter in the Safety instructions section: →  98.</p>
Dual seal according to ANSI/ISA 12.27.01	<p>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.</p> <p>Further information can be found in the Safety Instructions (XA) of the relevant devices.</p>
Functional Safety	<p>Used for level monitoring (MIN, MAX, range) up to SIL 3 (homogeneous or inhomogeneous redundancy), independently assessed by TÜV Rhineland as per IEC 61508. Other information see documentation SD01087F: "Functional Safety Manual".</p>
WHG	<p>WHG approval: Z-65.16-524</p>
Sanitary compatibility	<p>The PTFE antenna of FMR53 conforms to FDA 21 CFR 177.1550 and USP <88> Class VI.</p>
NACE MR 0175 / ISO 15156	<p>For FMR51 and FMR54:</p> <ul style="list-style-type: none"> ▪ The wetted, metallic materials comply with the requirements of NACE MR 0175 / ISO 15156. ▪ Declaration of conformity: see product structure, feature 580, option JB.
NACE MR 0103	<p>For FMR51 and FMR54:</p> <ul style="list-style-type: none"> ▪ The wetted, metallic materials comply with the requirements of NACE MR 0103. ▪ The certificate of compliance is based on NACE MR 0175. <p>The hardness and the intercrystalline corrosion have been tested, as well as the heat treatment (solution annealed) has been carried out. The used materials comply therefore with the requirements of NACE MR 0103.</p> <ul style="list-style-type: none"> ▪ Declaration of conformity: see product structure, feature 580, option JE.

Pressure Equipment Directive

The Micropilot is not subject to the scope of the Pressure Equipment Directive 97/23/EC, as it does not have a pressure-bearing housing according to article 1, section 2.1.4 of the directive.

Marine certificate

Device	Marine certificate ¹⁾				
	GL	ABS	LR	BV	DNV
FMR53	-	-	-	-	-
FMR54	✓	✓	✓	✓	✓

1) see ordering feature 590 "Additional approval"

Radio standard EN302372-1/2

The devices Micropilot FMR50, FMR51, FMR52, FMR53, FMR54, FMR56 and FMR57 are conform with the TLPR (Tanks Level Probing Radar) standard EN302372-1/2 and can always be used in closed tanks or bins. For installation, points a to f in Annex B of EN302372-1 have to be taken into account.

FCC / Industry Canada

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.

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.

Japanese radio approval

The devices FMR50, FMR51, FMR52, FMR54 and FMR57 comply with the Japanese Radio Law, Article 6, Section 1(1).




CRN approval



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

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

Feature 100 of the product structure	Process connection
AFJ	NPS 2" Cl.150 RF, 316/316L
AFK	NPS 2" Cl.150, PTFE >316/316L
AGJ	NPS 3" Cl.150 RF, 316/316L
AGK	NPS 3" Cl.150, PTFE >316/316L
AHJ	NPS 4" Cl.150 RF, 316/316L
AHK	NPS 4" Cl.150, PTFE >316/316L
AJJ	NPS 6" Cl.150 RF, 316/316L
AJK	NPS 6" Cl.150, PTFE >316/316L
AKJ	NPS 8" Cl.150 RF, 316/316L
ALJ	NPS 10" Cl.150 RF, 316/316L
AMJ	NPS 12" Cl.150 RF, 316/316L
ASJ	NPS 3" Cl.300 RF, 316/316L
ATJ	NPS 4" Cl.300 RF, 316/316L
AUJ	NPS 6" Cl.300 RF, 316/316L

Feature 100 of the product structure	Process connection
AVJ	NPS 8" Cl.300 RF, 316/316L
RGF	Thread ANSI MNPT1-1/2, PVDF
RGJ	Thread ANSI MNPT1-1/2, 316L
RVF	Thread EN10226 R1-1/2, PVDF
RVJ	Thread EN10226 R1-1/2, 316L

-  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.
-  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 →  58 is not affected by the CRN approval.

Product	Antenna ¹⁾	Prozessanschluss ²⁾	Dichtung ³⁾	max. pressure
FMR54			D1: Graphite (XT)	100 bar (1 450 psi)
			D2: Graphite (HT)	100 bar (1 450 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

Feature 580 "Test, Certificate"	Designation	Available for
JA	3.1 Material certificate, wetted metallic parts, EN10204-3.1 inspection certificate	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54
JB	Conformity to NACE MR0175, wetted metallic parts	FMR54
JD	3.1 Material certificate, pressurized parts, EN10204-3.1 inspection certificate	FMR53
JE	Conformity to NACE MR0103, wetted metallic parts	FMR54
JF	Conformity to AD2000, wetted metallic parts: Material of all wetted/pressurized parts conform to AD2000 (Technical rules W2, W9, W10)	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54
KD	Helium leak test, internal procedure, inspection certificate	FMR54
KE	Pressure test, internal procedure, inspection certificate	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54
KG	3.1 Material certificate+PMI test (XRF), internal procedure, wetted metallic parts, EN10204-3.1 inspection certificate	FMR54
KP	Liquid penetrant test AD2000-HP5-3 (PT), wetted/pressurized metallic parts, inspection certificate	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54
KQ	Liquid penetrant test ISO23277-1 (PT), wetted/pressurized metallic parts, inspection certificate	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54
KR	Liquid penetrant test ASME VIII-1 (PT), wetted/pressurized metallic parts, inspection certificate	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54
KS	Welding documentation, wetted/pressurized seams consisting of <ul style="list-style-type: none"> ■ Drawing ■ WPQR (Welding Procedure Qualification Report) ■ WPS (Welding Process Specification) ■ Manufacturer Declaration 	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54
KV	Conformity to ASME B31.3: The dimensions, materials of construction, pressure / temperature ratings and identification markings of the device comply with the requirements of ASME B31.3	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54



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

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

This applies to the options of the following ordering features:

- 550 "Calibration"
- 580 "Test, Certificate"

Product documentation on paper

Test reports, declarations and material certificates can be ordered as hardcopies via ordering feature 570 "Service", option I7 „Product documentation on paper“. The printouts will be enclosed in the product delivery.

Other standards and guidelines

- EN 60529
Degrees of protection by housing (IP code)
- EN 61010-1
Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures.
- 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 electrical/electronic/programmable electronic safety-related 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



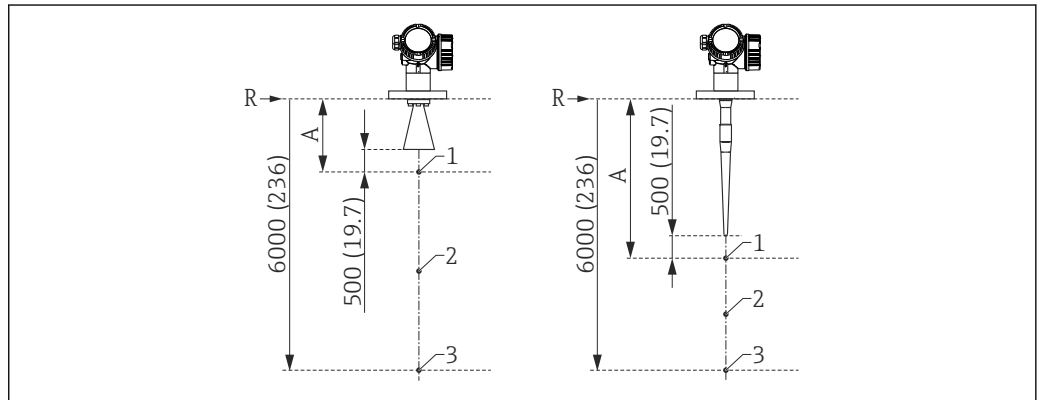
Product Configurator - the tool for individual product configuration

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

3-point linearity protocol

i 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:



29 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	<ul style="list-style-type: none"> ▪ 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	centrally between 1 st and 3 rd measuring point
3 rd measuring point	6 000 mm (236 in) below the reference point, R

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

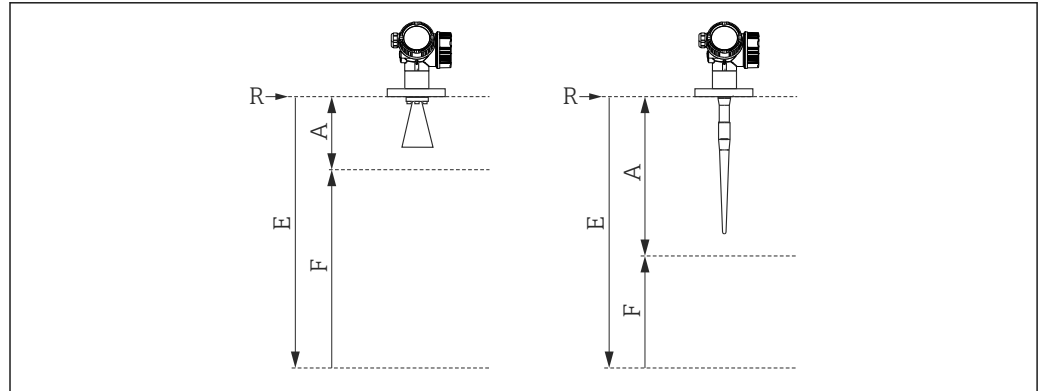
i The linearity is checked under reference conditions.

5-point linearity protocol

i 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 specified⁸⁾.

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



A0019161

Device version	Minimum distance between reference point (R) and 100% level	Minimum span	Maximum value for "Empty calibration"
FMR53/FMR54 Without antenna extension	$A \geq \text{antenna length} + 200 \text{ mm (8 in)}^1$	$F \geq 400 \text{ mm (16 in)}$	$E \leq 20 \text{ m (66 ft)}$
FMR54 with antenna extension ²⁾	$A \geq \text{antenna length} + \text{antenna extension} + 200 \text{ mm (8 in)}^3$		

1) Minimum value for FMR53: 590 mm (23.6 in); Minimum value for FMR54: 400 mm (16 in)

2) Feature 610 "Accessory Mounted", option OM, ON, OR or OS

3) Minimum value: 400 mm (8 in)

i The linearity is checked under reference conditions.

i 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 → 91.




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

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

Parameter	Communication	Selection list / range of values
Setup → Distance unit	<ul style="list-style-type: none"> ■ HART ■ PA ■ FF 	<ul style="list-style-type: none"> ■ in ■ ft ■ mm ■ m
Setup → Empty calibration	<ul style="list-style-type: none"> ■ HART ■ PA ■ FF 	max. 70 m (230 ft)
Setup → Full calibration	<ul style="list-style-type: none"> ■ HART ■ PA ■ FF 	max. < 70 m (230 ft)
Setup → Adv. Setup → Current output 1/2 → Damping	HART	0 to 999.9 s
Setup → Adv. Setup → Current output 1/2 → Failure mode	HART	<ul style="list-style-type: none"> ■ Min ■ Max ■ Last valid value
Setup → Adv. Setup → Current output 1/2 → Burst mode	HART	<ul style="list-style-type: none"> ■ Off ■ On

Services

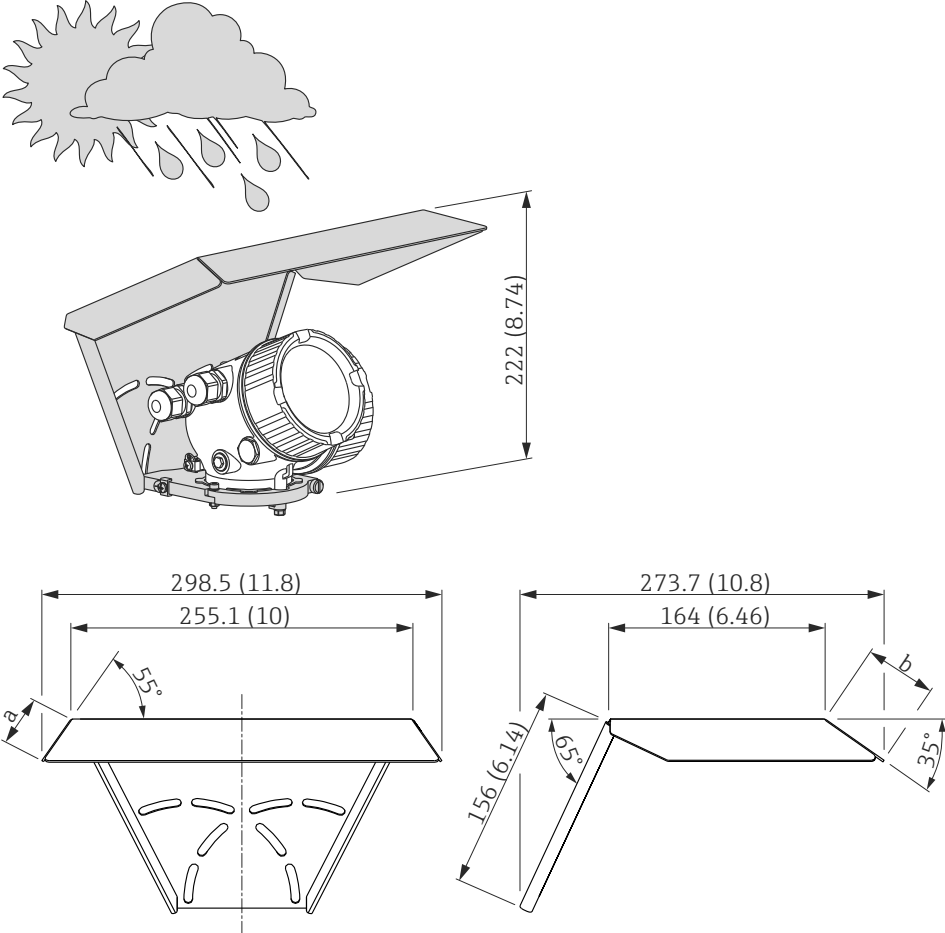


The following services can be selected via the product structure in the Product Configurator⁹⁾:

- PWIS free (PWIS: paint wetting impairment substances)
- Customized parametrization HART →  91
- Customized parametrization PA →  91
- Customized parametrization FF →  91
- Without tooling DVD (FieldCare)

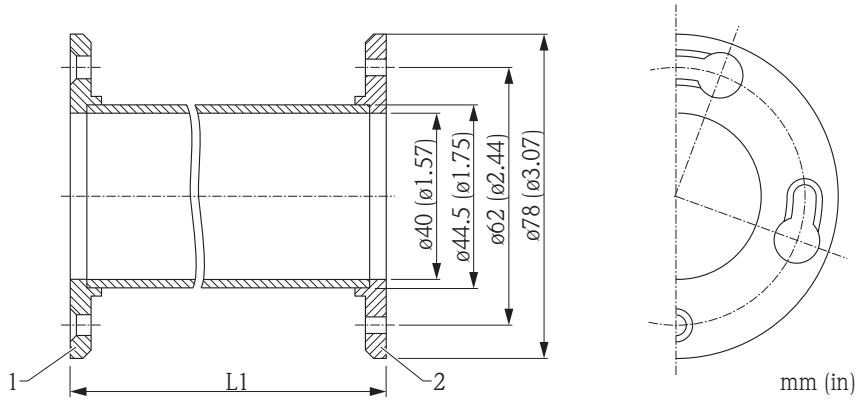
9) Feature 570 of the product structure

Accessories

Device-specific accessories Weather protection cover

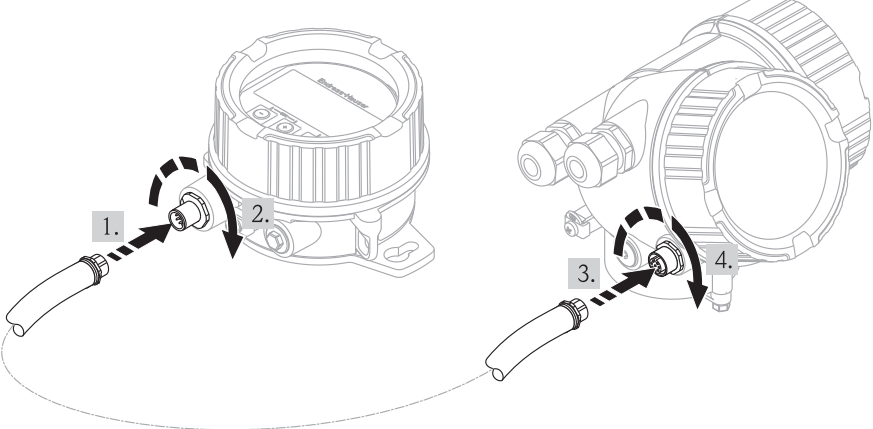
Accessory	Description
Weather protection cover	 <p data-bbox="1380 929 1436 952">A0015466</p> <p data-bbox="1380 1344 1436 1366">A0015472</p> <p data-bbox="327 1366 837 1400">  30 Weather protection cover; Dimensions: mm (in) </p> <p data-bbox="327 1411 534 1444">a 37,8 mm (1,5 in)</p> <p data-bbox="327 1444 518 1478">b 54 mm (2,1 in)</p> <p data-bbox="327 1489 1404 1568">  The weather protection cover can be ordered together with the device (product structure, feature 620 "Accessory Enclosed", option PB "Weather Protection Cover"). Alternatively, it can be separately ordered as an accessory; order code 71162242. </p>

Antenna extension FAR10 (for FMR54)

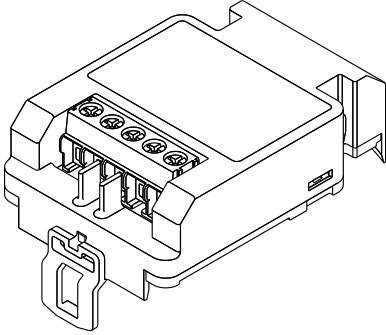
Accessory	Description
Antenna extension FAR10 (for FMR54)	 <p> 1 Instrument connection 2 Horn connection </p> <p> Material: <ul style="list-style-type: none"> ▪ 316L (1.4404) ▪ Alloy B2 ▪ Alloy C4 </p> <p> Length L1: <ul style="list-style-type: none"> ▪ 100 mm (4 in) ▪ 200 mm (8 in) ▪ 300 mm (12 in) ▪ 400 mm (16 in) </p> <p> Detailed ordering information is available from the following sources: <ul style="list-style-type: none"> ▪ In the Product Configurator on the Endress+Hauser website: www.endress.com → Select country → Instruments → Select device → Product page function: Configure this product ▪ From your Endress+Hauser Sales Center: www.endress.com/worldwide </p>

A0018879

Remote display FHX50

Accessory	Description
Remote display FHX50	<div style="text-align: center;">  </div> <p style="text-align: right; font-size: small;">A0019128</p> <ul style="list-style-type: none"> ■ Material: <ul style="list-style-type: none"> - Plastics PBT - CF3M (similar to 316L/1.4404) - Aluminum (in preparation) ■ Ingress protection: IP68 / NEMA 6P and IP66 / NEMA 4x ■ Suitable for the display modules: <ul style="list-style-type: none"> - SD02 (push buttons) - SD03 (touch control) ■ Connection cable: <ul style="list-style-type: none"> - Cable with M12 plug; supplied with the FHX50; up to 30 m (98 ft) - Customer supplied standard cable; up to 60 m (196 ft) ■ Ambient temperature: -40 to 80 °C (-40 to 176 °F) <p> i ■ If the remote display is to be used, the device must be ordered in the version "Prepared for display FHX50" (feature 030, option L or M). For the FHX50, on the other hand, the option A: "Prepared for display FHX50" has to be selected in feature 050: "Option Measurement Device". </p> <p> i ■ If a device has not been ordered in the version "Prepared for display FHX50", but is nevertheless to be equipped with an FHX50, it is essential to select the option B: "Not prepared for display FHX50" in feature 050: "Option Measurement Device" of the FHX50. In this case, a retrofit kit, needed to prepare the device for the remote display, is supplied together with the FHX50. </p> <p> i For transmitters with approval, application of the FHX50 may be restricted. A device may only be retrofitted with the FHX50 if option L or M ("Prepared for FHX50") is quoted under <i>Basic specifications</i>, position 4 "Display, operation" in the associated Safety Instructions (XA). In addition to this, observe the Safety Instructions (XA) of the FHX50. </p> <p> i Do not retrofit transmitters with: <ul style="list-style-type: none"> ■ approval for use in areas with combustible dusts (Dust-Ex approval) ■ type of protection Ex nA </p> <p> i For details refer to the document SD01007F. </p>


Overvoltage protection


Accessory	Description
Overvoltage protection for 2-wire-devices OVP10 (1 channel) OVP20 (2 channel)	<div style="text-align: right; font-size: small;">A0021734</div>  <p>Technical data</p> <ul style="list-style-type: none"> ▪ Resistance per channel: $2 * 0.5 \Omega_{max}$ ▪ Threshold DC voltage: 400 to 700 V ▪ Threshold impulse voltage: < 800 V ▪ Capacitance at 1 MHz: < 1.5 pF ▪ Nominal arrest impulse voltage (8/20 μs): 10 kA ▪ Suited for wire cross-sections: 0.2 to 2.5 mm² (24 to 14 AWG) <p>i Ordering with device The overvoltage protection module is preferably ordered with the device. See product structure, feature 610 "Accessory mounted", option NA "Overvoltage protection". Separate ordering of the module is only necessary if a device is to be retrofitted with the overvoltage protection.</p> <p>i Order code for retrofitting</p> <ul style="list-style-type: none"> ▪ For 1-channel devices (feature 020, option A) OVP10: 71128617 ▪ For 2-channel devices (feature 020, option B, C, E or G) OVP20 : 71128619 <p>Housing lid for retrofitting In order to keep the necessary safety distances, the housing lid needs to be replaced if the device is retrofitted with the overvoltage protection. Depending on the housing type, the order code of the suitable lid is as follows:</p> <ul style="list-style-type: none"> ▪ GT18 housing: Lid 71185516 ▪ GT19 housing: Lid 71185518 ▪ GT20 housing: Lid 71185516 <p>i Restrictions for retrofitting Depending on the approval of the transmitter the usage of the OVP module may be restricted. A device may only be retrofitted with an OVP module if the option NA (overvoltage protection) is quoted under <i>Optional Specifications</i> in the Safety Instructions (XA) pertaining to the device.</p> <p>i For details refer to SD01090F.</p>


Gas-tight feedthrough


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


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 easily 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


Accessory	Description
Fieldgate FXA320	Gateway for remote monitoring of connected 4-20mA measuring devices via web browser.  For details refer to Technical Information TI00025S and Operating Instructions BA00053S

Accessory	Description
Fieldgate FXA520	Gateway for remote diagnosis and parametrization of connected HART measuring devices via web browser.  For details refer to Technical Information TI00025S and Operating Instructions BA00051S




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

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:

- On the CD supplied with the device
- In the Download Area of the Endress+Hauser Internet site: www.endress.com → Download

Standard documentation

Micropilot FMR53, FMR54

Correlation of documentations to the device:

Device	Power supply, output	Communication	Document type	Document code
FMR53 FMR54	A, B, C, K, L	HART	Operating Instructions	BA01050F/00/EN
			Brief Operating Instructions	KA01101F/00/EN
			Description of Device Parameters	GP01014F/00/EN
	G	PROFIBUS PA	Operating Instructions	BA01126F/00/EN
			Brief Operating Instructions	KA01130F/00/EN
			Description of Device Parameters	GP01018F/00/EN
	E	FOUNDATION Fieldbus	Operating Instructions	BA01122F/00/EN
			Brief Operating Instructions	KA01126F/00/EN
			Description of Device Parameters	GP01017F/00/EN

Supplementary documentation

Device	Document type	Document code
Fieldgate FXA520	Technical Information	TI369F/00/EN
Tank Side Monitor NRF590	Technical Information	TI402F/00/EN
	Operating Instructions	BA256F/00/EN
	Description of Device Parameters	BA257F/00/EN

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 010	Approval	Available for	Feature 020 "Power Supply; Output"				
			A ¹⁾	B ²⁾	C ³⁾	E ^{4)/G⁵⁾}	K ^{6)/L⁷⁾}
BA	ATEX: II 1 G Ex ia IIC T6-T1 Ga	<ul style="list-style-type: none"> ▪ FMR53 ▪ FMR54 	XA00677F	XA00677F	XA00677F	XA00685F	-
BB	ATEX: II 1/2 G Ex ia IIC T6-T1 Ga/Gb	<ul style="list-style-type: none"> ▪ FMR53 ▪ FMR54 	XA00677F	XA00677F	XA00677F	XA00685F	-
BC	ATEX: II 1/2 G Ex d [ia] IIC T6-T1 Ga/Gb	<ul style="list-style-type: none"> ▪ FMR53 ▪ FMR54 	XA00680F	XA00680F	XA00680F	XA00688F	XA00680F
BD	ATEX: II 1/2/3 G Ex ic [ia Ga] IIC T6-T1 Ga/Gb/Gc	<ul style="list-style-type: none"> ▪ FMR53 ▪ FMR54 	XA00678F	XA00678F	XA00678F	XA00686F	XA00678F
BG	ATEX: II 3 G Ex nA IIC T6-T1 Gc	<ul style="list-style-type: none"> ▪ FMR53 ▪ FMR54 	XA00679F	XA00679F	XA00679F	XA00687F	XA00679F
BH	ATEX: II 3 G Ex ic IIC T6-T1 Gc	<ul style="list-style-type: none"> ▪ FMR53 ▪ FMR54 	XA00679F	XA00679F	XA00679F	XA00687F	XA00679F
BL	ATEX: II 1/2/3 G Ex nA [ia Ga] IIC T6-T1 Ga/Gb/Gc	<ul style="list-style-type: none"> ▪ FMR53 ▪ FMR54 	XA00678F	XA00678F	XA00678F	XA00686F	XA00678F
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	<ul style="list-style-type: none"> ▪ FMR53 ▪ FMR54 	XA00683F	XA00683F	XA00683F	XA00691F	-

Feature 010	Approval	Available for	Feature 020 "Power Supply; Output"				
			A ¹⁾	B ²⁾	C ³⁾	E ^{4)/G⁵⁾}	K ^{6)/L⁷⁾}
B3	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	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA00684F	XA00684F	XA00684F	XA00692F	XA00684F
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	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA00681F	XA00681F	XA00681F	XA00689F	-
CB	CSA C/US XP Cl.I Div.1 Gr.A-D	FMR54	XA01112F	XA01112F	XA01112F	XA01114F	-
CC	CSA C/US XP Cl.I Div.1 Gr.A-D	FMR54	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	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA01112F	XA01112F	XA01112F	XA01114F	-
C3	CSA C/US XP Cl.I,II,III Div.1 Gr.A-G, NI Cl.1 Div.2, Ex d	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA01113F	XA01113F	XA01113F	XA01115F	XA01113F
FA	FM IS Cl.I Div.1 Gr.A-D	FMR54	XA01116F	XA01116F	XA01116F	XA01118F	-
FB	FM IS Cl.I,II,III Div.1 Gr.A-G, AEx ia, NI Cl.1 Div.2	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA01116F	XA01116F	XA01116F	XA01118F	-
FC	FM XP Cl.I Div.1 Gr.A-D	FMR54	XA01117F	XA01117F	XA01117F	XA01119F	XA01117F
FD	FM XP Cl.I,II,III Div.1 Gr.A-G, AEx d, NI Cl.1 Div.2	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA01117F	XA01117F	XA01117F	XA01119F	XA01117F
IA	IECEEx: Ex ia IIC T6-T1 Ga	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA00677F	XA00677F	XA00677F	XA00685F	-
IB	IECEEx: Ex ia IIC T6-T1 Ga/Gb	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA00677F	XA00677F	XA00677F	XA00685F	-
IC	IECEEx: Ex d [ia] IIC T6-T1 Ga/Gb	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA00680F	XA00680F	XA00680F	XA00688F	XA00680F
ID	IECEEx: Ex ic [ia Ga] IIC T6-T1 Ga/Gb/Gc	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA00678F	XA00678F	XA00678F	XA00686F	XA00678F
IG	IECEEx: Ex nA IIC T6-T1 Gc	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA00679F	XA00679F	XA00679F	XA00687F	XA00679F
IH	IECEEx: Ex ic IIC T6-T1 Gc	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA00679F	XA00679F	XA00679F	XA00687F	XA00679F
IL	IECEEx: Ex nA [ia Ga] IIC T6-T1 Ga/Gb/Gc	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA00678F	XA00678F	XA00678F	XA00686F	XA00678F
I2	IECEEx: Ex ia IIC T6-T1 Ga/Gb IECEEx: Ex ia IIIC Txx°C Da/Db	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA00683F	XA00683F	XA00683F	XA00691F	-
I3	IECEEx: Ex d [ia] IIC T6-T1 Ga/Gb IEXEx: Ex ta IIIC Txx°C Da/Db	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA00684F	XA00684F	XA00684F	XA00692F	XA00684F
I4	IECEEx: Ex ia IIC T6-T1 Ga/Gb IECEEx: Ex d [ia] IIC T6-T1 Ga/Gb	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA00681F	XA00681F	XA00681F	XA00689F	-
KA	KC Ex ia IIC T6 Ga	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA01045F	XA01045F	XA01045F	XA01047F	-
KB	KC Ex ia IIC T6 Ga/Gb	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA01045F	XA01045F	XA01045F	XA01047F	-
KC	KC Ex d[ia] IIC T6	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA01046F	XA01046F	XA01046F	XA01048F	XA01046F
MA	INMETRO: Ex ia IIC T6 Ga	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA01286F	XA01287F	XA01288F	XA01296F	-
MC	INMETRO: Ex d[ia] IIC T6 Ga/Gb	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA01292F	XA01292F	XA01293F	XA01298F	XA01294F
MH	INMETRO: Ex ic IIC T6 Gc	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA01289F	XA01290F	XA01291F	XA01297F	-
NA	NEPSI Ex ia IIC T6 Ga	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA01199F	XA01199F	XA01199F	XA01208F	-

Feature 010	Approval	Available for	Feature 020 "Power Supply; Output"				
			A ¹⁾	B ²⁾	C ³⁾	E ⁴⁾ /G ⁵⁾	K ⁶⁾ /L ⁷⁾
NB	NEPSI Ex ia IIC T6 Ga/Gb	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA01199F	XA01199F	XA01199F	XA01208F	-
NC	NEPSI Ex d[ia] IIC T6 Ga/Gb	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA01202F	XA01202F	XA01202F	XA01211F	XA01202F
NG	NEPSI Ex nA II T6 Gc	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA01201F	XA01201F	XA01201F	XA01210F	XA01201F
NH	NEPSI Ex ic IIC T6 Gc	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA01201F	XA01201F	XA01201F	XA01210F	XA01201F
N2	NEPSI Ex ia IIC T6 Ga/Gb, Ex iaD 20/21 T85...90oC	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA01205F	XA01205F	XA01205F	XA01214F	-
N3	NEPSI Ex d[ia] IIC T6 Ga/Gb, DIP A20/21 T85...90oC IP66	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	XA01206F	XA01206F	XA01206F	XA01215F	XA01206F
8A	FM/CSA IS+XP Cl.I,II,III Div.1 Gr.A-G	<ul style="list-style-type: none"> ■ FMR53 ■ FMR54 	<ul style="list-style-type: none"> ■ XA01112F ■ XA01113F ■ XA01116F ■ XA01117F 	<ul style="list-style-type: none"> ■ XA01112F ■ XA01113F ■ XA01116F ■ XA01117F 	<ul style="list-style-type: none"> ■ XA01112F ■ XA01113F ■ XA01116F ■ XA01117F 	<ul style="list-style-type: none"> ■ XA01114F ■ XA01115F ■ XA01118F ■ XA01119F 	-

- 1) 2-wire; 4-20mA HART
- 2) 2-wire; 4-20mA HART, switch output
- 3) 2-wire; 4-20mA HART, 4-20mA
- 4) 2-wire; FOUNDATION Fieldbus, switch output
- 5) 2-wire; PROFIBUS PA, switch output
- 6) 4-wire 90-253VAC; 4-20mA HART
- 7) 4-wire 10.4-48VDC; 4-20mA HART

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

If the device is prepared for the remote display FHX50 (product structure: feature 030: Display, Operation", option L or M), the Ex marking of some certificates changes according to the following table¹⁰⁾:

Feature 010 ("Approval")	Feature 030 ("Display, Operation")	Ex marking
BG	L or M	ATEX II 3G Ex nA [ia Ga] IIC T6-T1 Gc
BH	L or M	ATEX II 3G Ex ic [ia Ga] IIC T6-T1 Gc
B3	L or M	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 or M	IECEX Ex nA [ia Ga] IIC T6-T1 Gc
IH	L or M	IECEX Ex ic [ia Ga] IIC T6-T1 Gc
I3	L or M	IECEX Ex d [ia] IIC T6-T1 Ga/Gb, IECEX Ex ta [ia Db] IIIC Txx°C Da/Db
MH	L or M	Ex ic [ia Ga] IIC T6 Gc
NG	L or M	NEPSI Ex nA [ia Ga] IIC T6-T1 Gc
NH	L or M	NEPSI Ex ic [ia Ga] IIC T6-T1 Gc
N3	L or M	NEPSI Ex d [ia] IIC T6-T1 Ga/Gb, DIP A20/21 [ia D] TA, Txx°C IP6X

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

Registered trademarks

HART®

Registered trademark of the FieldComm Group, Austin, USA

PROFIBUS®

Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany

FOUNDATION™ Fieldbus

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

KALREZ®, VITON®

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

TEFLON®

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

TRI CLAMP®

Registered trademark of Alfa Laval Inc., Kenosha, USA

Patents

This product may be protected by at least one of the following patents.

Further patents are pending.

US Patents	EP Patents
5.948.979	882 957
6.087.978	955 527
6.140.940	-
6.155.112	834 722
-	882 955
6.266.022	1 083 413
6.295.874	210 567
6.512.358	1 301 914
6.606.904	-
6.640.628	-
6.679.115	1 360 523
-	1 389 337
6.779.397	-
7.201.050	-
7.412.337	-
7.552.634	-
7.730.760	-
7.819.002	-
-	1 774 616
7.966.141	-
8.040.274	-
8.049.371	-



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