



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services



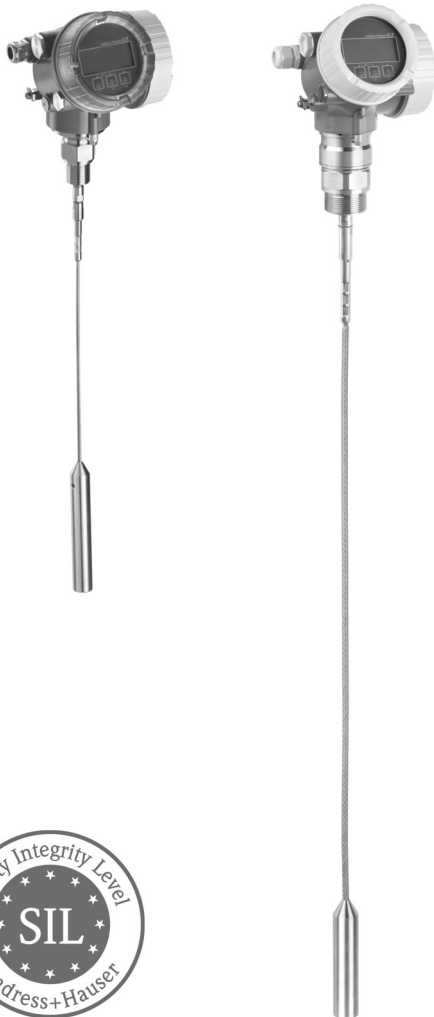
Solutions

Technical Information

Levelflex FMP56, FMP57

Guided Level-Radar

Level measurement in bulk solids



Application

- FMP56 – economically attractive basic device for common bulk solids applications in small silos and tanks.
- FMP57 – premium device for level measurement in bulk solids.
- Process connection starting 3/4" thread or flange
- Tensile load limit of rope probes up to 30 kN
- Measuring range up to 45 m (148 ft)
- Temperature range:
 - 40 to +150 °C (–40 to +302 °F)
- Pressure range: –1 to 16 bar (–14.5 to 232 psi)
- The following interfaces are available for system integration:
 - HART with 4...20 mA analog
 - PROFIBUS PA
- Used for level monitoring (MIN, MAX, range) up to SIL 2, independently assessed by TÜV as per IEC 61508

Your benefits

- Reliable measuring:
 - in dusty atmosphere
 - in high and narrow silos
 - in vessels and obstacles
- High availability
- Integrated data memory
- Factory precalibrated
- Intuitive, menu-guided operating concept in national languages
- Simple integration into control or asset management systems
- Exact instrument and process diagnosis to assist fast decisions
- Approvals: ATEX, IEC Ex, FM, CSA

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Important document information

Document conventions



Electrical symbols

Symbol	Meaning
 A0011197	Direct current A terminal to which DC voltage is applied or through which direct current flows.
 A0011198	Alternating current A terminal to which alternating voltage (sine-wave) is applied or through which alternating current flows.
 A0011200	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
 A0011199	Protective ground connection A terminal which must be connected to ground prior to establishing any other connections.
 A0011201	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 and notation for certain types of information

Symbol	Meaning
 A0011182	Allowed Indicates procedures, processes or actions that are allowed.
 A0011183	Preferred Indicates procedures, processes or actions that are preferred.
 A0011184	Forbidden Indicates procedures, processes or actions that are forbidden.
 A0011193	Tip Indicates additional information.
 A0011194	Reference to documentation Refers to the corresponding device documentation.
 A0011195	Reference to page Refers to the corresponding page number.
 A0011196	Reference to graphic Refers to the corresponding graphic number and page number.

Symbols and notation in graphics

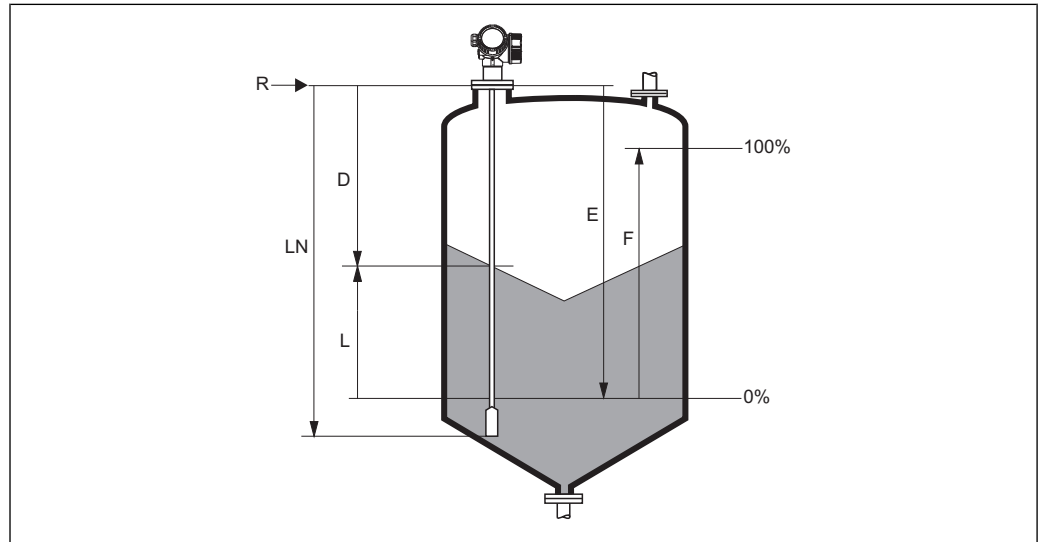
Symbol	Meaning
1,2,3 ...	Item numbers
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections
 A0011187	Hazardous area Indicates a hazardous area.
 A0011188	Safe area (non-hazardous area) Indicates a non-hazardous location.

Function and system design

Measuring principle

Level measurement

The Levellflex is a "downward-looking" measuring system that functions according to the ToF method (ToF = Time of Flight). The distance from the reference point to the product surface is measured. High-frequency pulses are injected to a probe and led along the probe. The pulses are reflected by the product surface, received by the electronic evaluation unit and converted into level information. This method is also known as TDR (Time Domain Reflectometry).



A0012838

LN = probe length

D = distance

L = level

R = reference point of measurement

E = empty calibration (= zero)

F = full calibration (= span)

Dielectric constant

The dielectric constant (DC) of the medium has a direct impact on the degree of reflection of the high-frequency pulses. In the case of large DC values, such as for water or ammonia, there is strong pulse reflection while, with low DC values, such as for hydrocarbons, weak pulse reflection is experienced.

Input

The reflected pulses are transmitted from the probe to the electronics. There, a microprocessor analyzes the signals and identifies the level echo which was generated by the reflection of the high-frequency pulses at the product surface. This clear signal detection system benefits from over 30 years' experience with pulse time-of-flight procedures that have been integrated into the development of the PulseMaster® software.

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

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

where c is the speed of light.

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

$$L = E - D$$

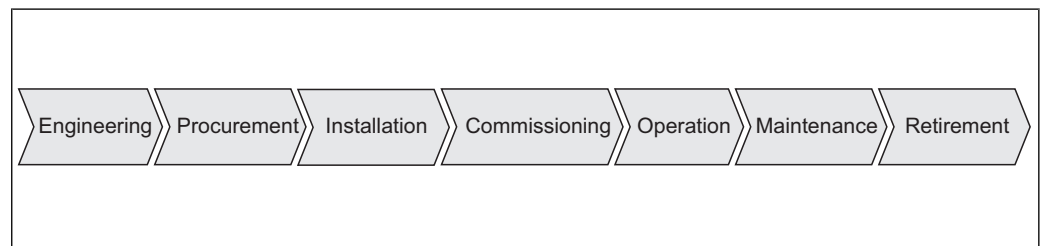
Reference point for "E" see diagram above.

The Levellflex possesses functions for interference echo suppression that can be activated by the user. They guarantee that interference echoes from e.g. internals and struts are not interpreted as level echoes.


Output

The Levellflex is preset at the factory to the probe length ordered so that in most cases only the application parameters that automatically adapt the device to the measuring conditions need to be entered. 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 0 % and 100 %. A linearization function with max. 32 points, which is based on a table entered manually or semi-automatically, can be activated on site or via remote operation. This function allows the level to be converted into units of volume or mass, for example.

Life cycle of the product



A0013773-EN

 1 Life cycle process

Engineering

- Universal measuring principle
- Measurement unaffected by medium properties
- Hardware and software developed according to SIL IEC 61508
- Genuine, direct interface measurement

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 6 steps
- 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: Increased echo rate and analysis as well as automatic suppression of interfering 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
- Housing cover 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


Measuring system


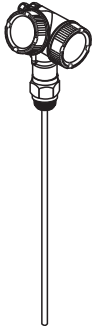
General notes on probe selection

- Normally, rope probes should be used for bulk solids, rod probes are only suitable for short measuring ranges up to approx. 2 m (6.6 ft) in bulk solids. This applies above all to applications in which the probe is installed laterally at an angle and for light and pourable bulk solids.
- In the case of large silos, the lateral pressure on the rope can be so high that a rope with plastic jacketing must be used. We recommend PA-coated ropes be used for cereal products wheat, flour etc..

Probe selection

The various types of probe in combination with the process connections are suitable for the following applications:

Levellflex FMP56		
Type of probe	Rope probe	
		
	A0011388	
Feature 060 - Probe:	Option:	
	LA	4 mm (316)
	LB	1/6" (316)
	NB	6 mm (PA>Steel)
	NE	1/4" (PA>Steel)
Max. probe length	12 m (40 ft)	
Max. tensile loading capacity	12 kN	
For application	level measurement in bulk solids	

Levelflex FMP57				
Type of probe	Rope probe		Rod probe	
	 <small>A0011388</small>		 <small>A0011387</small>	
Feature 060 - Probe:	Option:		Option:	
	LA	4 mm (316)	AE AF	16 mm (316L)
	LB	1/6" (316)		
	LC	6 mm (316)		
	LD	1/4" (316)		
	NB	6 mm (PA>Steel)		
	NC	8 mm (PA>Steel)		
	NE	1/4" (PA>Steel)		
	NF	1/3" (PA>Steel)		
Max. probe length	45 m (148 ft)		4 m (13 ft)	
For application	level measurement in bulk solids			

Input

Measured variable	<p>The measured variable is the distance between the reference point and the product surface.</p> <p>Subject to the empty distance entered "E" the level is calculated.</p> <p>Alternatively, the level can be converted into other variables (volume, mass) by means of linearization (32 points).</p>
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Measuring range	<p>The following table describes the media groups and the possible measuring range as a function of the media group.</p>
------------------------	--

Levellflex FMP56				
Media group	DC (ε _r)	Typical bulk solids	Measuring range	
			bare metallic rope probes	PA-coated rope probes
1	1.4...1.6	plastic powder	12 m (39 ft) ¹⁾	—
2	1.6...1.9	<ul style="list-style-type: none"> plastic granulate white lime, special cement sugar 	12 m (39 ft)	12 m (39 ft)
3	1.9...2.5	portland cement, plaster	12 m (39 ft)	—
		flour	—	12 m (39 ft)
4	2.5...4	grain, seeds	—	12 m (39 ft)
		<ul style="list-style-type: none"> ground stones sand 	12 m (39 ft)	12 m (39 ft)
5	4...7	<ul style="list-style-type: none"> naturally moist (ground) stones, ores salt 	12 m (39 ft)	12 m (39 ft)
6	> 7	<ul style="list-style-type: none"> metallic powder carbon black coal 	12 m (39 ft)	12 m (39 ft)

1) Take into account restrictions for strongly damping media, e.g. ground material, wheat bran, silicic acid

Levellflex FMP57					
Media group	DC (ε _r)	Typical bulk solids	Measuring range		
			bare metallic rod probes	bare metallic rope probes	PA-coated rope probes
1	1.4...1.6	plastic powder	4 m (13 ft) ¹⁾	20 to 25 m (66 to 82 ft) ¹⁾	—
2	1.6...1.9	<ul style="list-style-type: none"> plastic granulate white lime, special cement sugar 	4 m (13 ft)	25 to 30 m (82 to 98 ft)	12.5 to 15 m (41 to 49 ft)
3	1.9...2.5	portland cement, plaster	4 m (13 ft)	30 to 45 m (98 to 148 ft)	—
		flour	4 m (13 ft)	—	15 to 25 m (49 to 82 ft)
4	2.5...4	grain, seeds	4 m (13 ft)	—	25 to 35 m (82 to 115 ft)
		<ul style="list-style-type: none"> ground stones sand 	4 m (13 ft)	45 m (148 ft)	25 to 35 m (82 to 115 ft)
5	4...7	<ul style="list-style-type: none"> naturally moist (ground) stones, ores salt 	4 m (13 ft)	45 m (148 ft)	35 to 45 m (115 to 148 ft)
6	> 7	<ul style="list-style-type: none"> metallic powder carbon black coal 	4 m (13 ft)	45 m (148 ft)	45 m (148 ft)

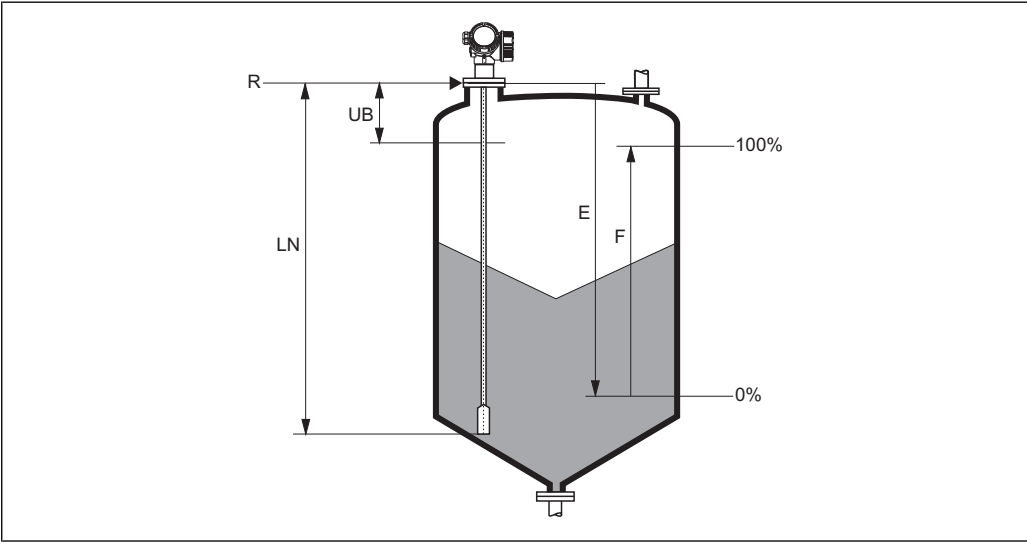
1) Take into account restrictions for strongly damping media, e.g. ground material, wheat bran, silicic acid



- Reduction of the max. possible measuring range through buildup, above all of moist products.
- The respective lower group applies for very loose or loosened bulk solids.

Blocking distance

The upper blocking distance (= UB) is the minimum distance from the reference point of the measurement (mounting flange) to the maximum level.



R = reference point of measurement *E = empty calibration (= zero)*
LN = probe length *F = full calibration (= span)*
UB = upper blocking distance

Blocking distance (factory setting):

- with rod and rope probes up to 8 m (26 ft): 200 mm (8 in)
- with rod and rope probes exceeding a length of 8 m (26 ft): 0.025 * (length of probe)



The specified blocking distances are preset on delivery. Depending on the application these settings can be changed.

Within the blocking distance, a reliable measurement can not be guaranteed.

Measuring frequency spectrum

100 MHz to 1,5 GHz

Output

Output signal

HART

Signal coding	FSK ±0.5 mA over currency signal
Data transmission rate	1200 Baud
Galvanic isolation	Ja

PROFIBUS PA

Signal coding	Manchester Bus Powered (MBP)
Data transmission rate	31,25 KBit/s, voltage mode
Galvanic isolation	Ja

Signal on alarm

Maintenance information can be viewed via the following interfaces:

- Local display:
 - Error symbol (in accordance with NAMUR Recommendation NE 107)
 - Plain text display
- Current output: failsafe mode selectable (in accordance with NAMUR Recommendation NE 43):
 - Minimum alarm: 3.6 mA
 - Maximum alarm (= factory setting): 22 mA
- Digital interface such as HART communication or CDI service interface (in accordance with NAMUR Recommendation NE 107)

Linearization

The linearization function of the Micropilot M 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	0x34
HART specification	6.0
Device description files (DTM, DD)	Information and files under: <ul style="list-style-type: none"> ■ www.endress.com ■ www.hartcom.org
HART load	Min. 250 Ω
HART device variables	<p>The measured values can be freely assigned to the device variables.</p> <p>Measured values for PV (primary variable)</p> <ul style="list-style-type: none"> ■ Level linearized ■ Distance ■ Electronic temperature ■ Relative echo amplitude <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 ■ Calculated DC
Supported functions	<ul style="list-style-type: none"> ■ Burst mode ■ Additional transmitter status

PROFIBUS PA

Manufacturer ID	17 (0x11)
Ident number	0x1558
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	Analog Input: <ul style="list-style-type: none"> ■ Level linearized ■ Distance ■ Terminal voltage ■ Electronic temperature ■ Absolute echo amplitude ■ Relative echo amplitude ■ Calculated DC Digital Input: <ul style="list-style-type: none"> ■ Extended diagnostic blocks ¹⁾ ■ Status output PFS Block
Input values	Analog Output: <ul style="list-style-type: none"> ■ Analog value from PLC (for sensor block external pressure and temperature) ■ Analog value from PLC to be indicated on the display Digital Output: <ul style="list-style-type: none"> ■ Extended diagnostic block ¹⁾ ■ Level limiter ■ Sensor block measurement on ■ Sensor block save history on ■ Status output
Supported functions	<ul style="list-style-type: none"> ■ Identification & Maintenance <ul style="list-style-type: none"> Simple device identification via control system and nameplate ■ Automatic Ident Number Adoption <ul style="list-style-type: none"> GSD compatibility mode with respect to the previous device Levelflex M FMP4x ■ Physical Layer Diagnostics <ul style="list-style-type: none"> Installation check of the PROFIBUS segment and the Levelflex FMP4x via terminal voltage and telegram monitoring ■ PROFIBUS Up-/Download <ul style="list-style-type: none"> Up to 10 times faster reading and writing of parameters via PROFIBUS Up-/Download ■ Condensed Status <ul style="list-style-type: none"> Simple and self-explanatory diagnostic information due to categorization of diagnostic messages

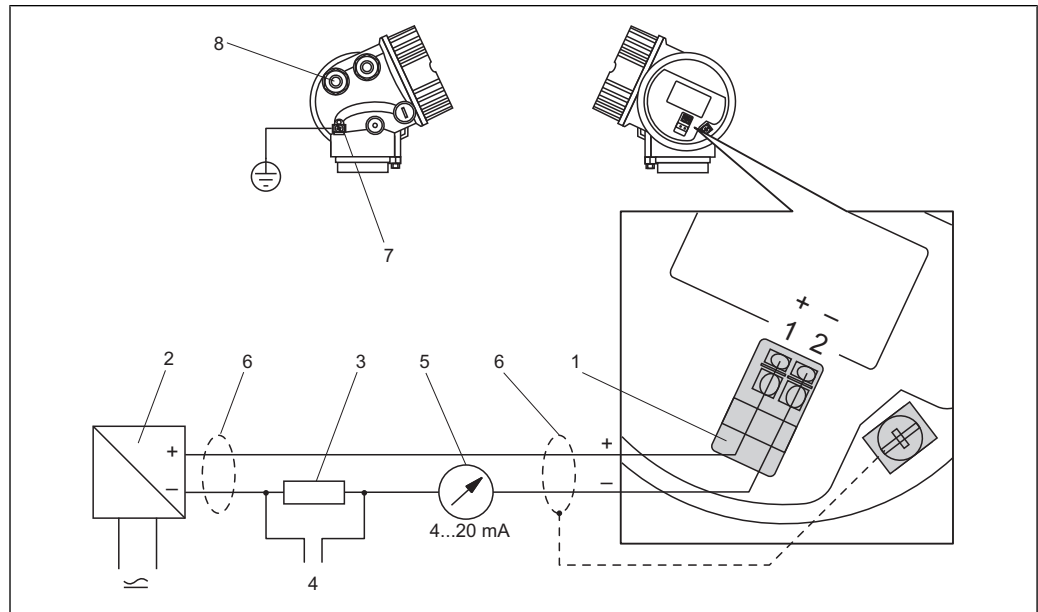
1) in preparation

Auxiliary energy

Electrical connection

2-wire, 4-20mA HART (FMP5x - **A...)

Without integrated overvoltage protection

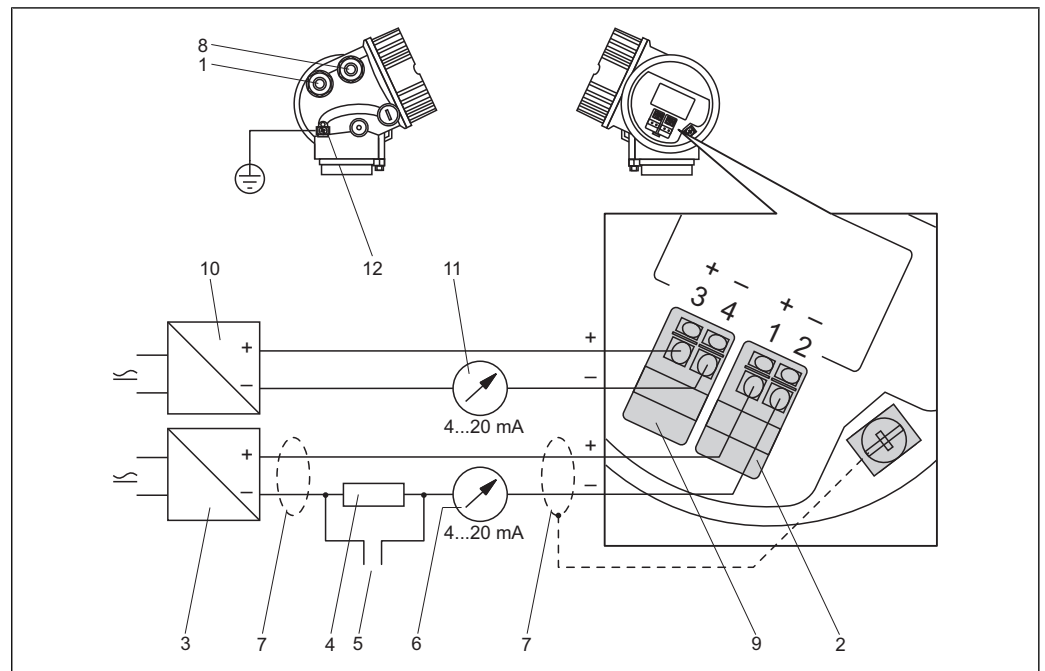


A0011294

- 1 Terminal 4...20mA HART passive
- 2 Active barrier with power supply (e.g. RN221N): Observe terminal voltage (→ 15)
- 3 HART communication resistor ($\geq 250 \Omega$): Observe maximum load (→ 17)
- 4 Connection for Field Communicator 375/475 or Commubox FXA195
- 5 Analog display device: Observe maximum load (→ 17)
- 6 Observe cable specification (→ 16)
- 7 Potential equalization
- 8 Cable entry

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

Without integrated overvoltage protection



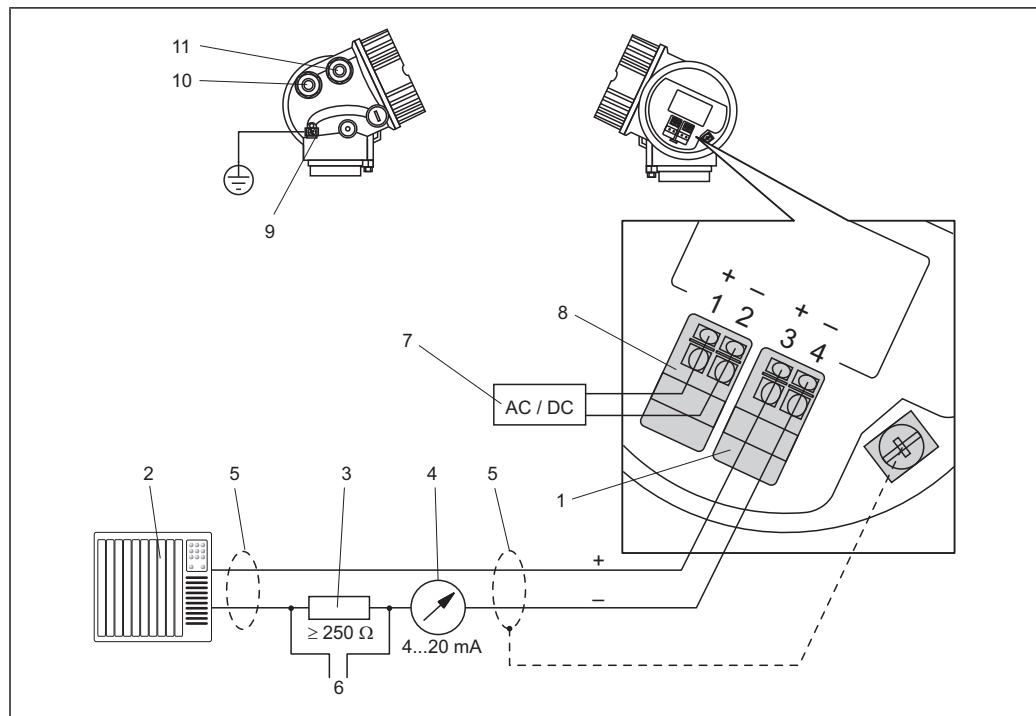
A0013923

- 1 Cable entry for current output 1
- 2 Terminal for current output 1
- 3 Supply voltage for current output 1 (e.g. RN221N); Observe terminal voltage (→ 16)
- 4 HART communication resistor ($\geq 250 \Omega$); Observe maximum load (→ 17)
- 5 Connection for Field Communicator 375/475 or Commubox FXA195
- 6 Analog display device ; observe maximum load (→ 17)
- 7 Observe cable specification (→ 16)
- 8 Cable entry for current output 2
- 9 Terminal for current output 2
- 10 Supply voltage for current output 2 (e.g. RN221N); Observe terminal voltage (→ 16)
- 11 Analog display device ; observe maximum load
- 12 Terminal for the potential equalization line


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

4-wire, 4-20 mA HART (FMP5x - **K/L...)

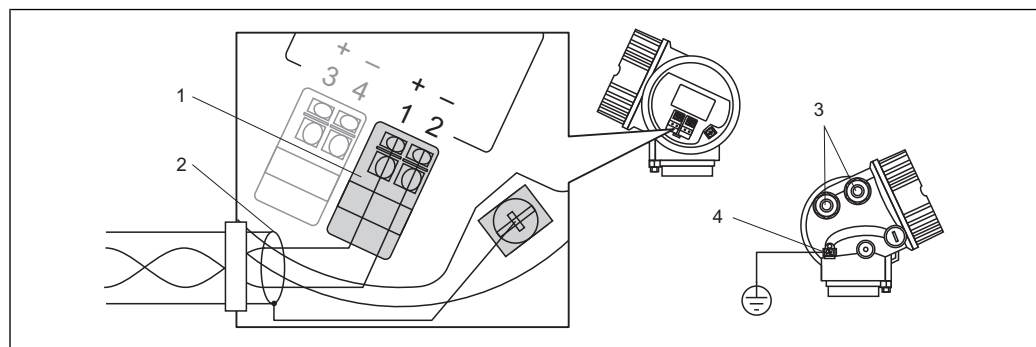
Without integrated overvoltage protection



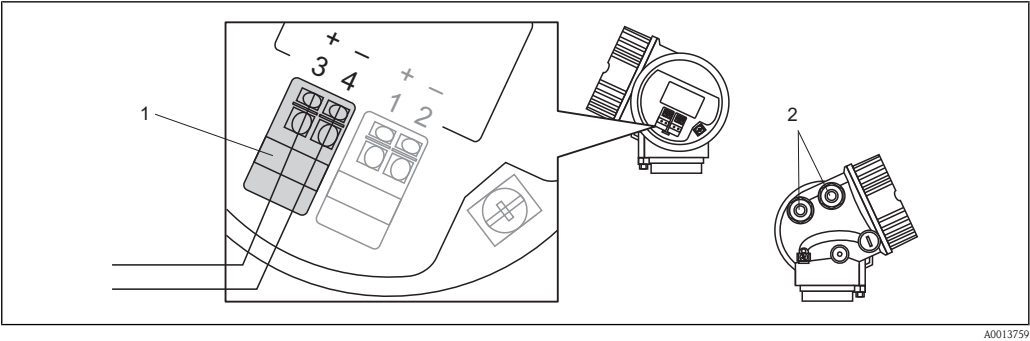
- 1 Terminal 4...20mA HART
- 2 Evaluation unit, e.g. PLC
- 3 HART communication resistor ($\geq 250 \Omega$): Observe maximum load (\rightarrow 17)
- 4 Analog display device: Observe maximum load (\rightarrow 17)
- 5 Observe cable specification (\rightarrow 16)
- 6 Connection Field Communicator 375/475 or Commubox FXA195
- 7 Supply voltage: Observe terminal voltage (\rightarrow 16)
- 8 Terminal supply voltage
- 9 Potential equalization
- 10 Cable entry for power supply
- 11 Cable entry for signal line

 In order to ensure electromagnetic compatibility (EMC): Do not ground the device via the protective earth conductor of the supply cable. Instead, ground the device via the process connection (flange or threaded connection) or the external ground terminal .

PROFIBUS PA



- 1 Terminals PROFIBUS PA
- 2 Cable screen
- 3 Cable entry
- 4 Potential equalization



A0013759

- 1 Terminals switching output
2 Cable entry

Switching 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	$U = 10.4 \text{ to } 35 \text{ V}_{\text{DC}}$, $I = 0 \text{ to } 70 \text{ mA}$
Insulation voltage	floating, Insulation voltage $1 \text{ } 350 \text{ V}_{\text{DC}}$ to power supply and $500 \text{ V}_{\text{AC}}$ 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
Number of switching cycles	unlimited

Supply voltage

An external power supply is required.



 Various supply units can be ordered from Endress+Hauser: see "Accessories" section (→  50)

2-wire, 4-20mA HART, passive

"Power Supply, Output" ¹⁾	Outputs	Terminal voltage	"Approval" ²⁾
A: 2-wire; 4-20mA HART	1	11.5 to 35 V	Non-Ex, Ex nA, CSA GP
		11.5 to 32 V	Ex ic
		11.5 to 30 V	Ex ia / IS
		13.5 to 30 V	Ex d / XP, Ex ic(ia), Ex tD / DIP
C: 2-wire; 4-20mA HART, 4-20mA	1	13.5 to 30 V	all
	2	12 to 30 V	all

1) Feature 020 of the product structure

2) Feature 010 of the product structure

 Load (→  17)

4-wire, 4-20mA HART, active

"Power supply; Output" ¹⁾	Terminal voltage
K: 4-wire 90-253VAC; 4-20mA HART	90 to 253 V _{AC} (50 to 60 Hz)
L: 4-wire 10,4-48VDC; 4-20mA HART	10.4 to 48 V _{DC}

1) Feature 020 of the product structure

PROFIBUS PA

"Power supply; Output" ¹⁾	Terminal voltage
G: 2-wire; PROFIBUS PA, switch output	9 to 32 V _{DC}

1) Feature 020 der Produktstruktur

Terminals

Plug-in spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)


Cable entries

- Cable gland (not for Ex d):
 - Plastics M20x1,5 with cable Ø 5 to 10 mm (0.2 to 0.39 in): non-Ex, ATEX/IECEX/NEPSI Ex ia/ic/nA
 - Metal M20x1,5 with cable Ø 7 to 10 mm (0.28 to 0.39 in): dust-Ex, FM IS, CSA IS, CSA GP
- Thread for cable entry:
 - ½" NPT
 - G ½"
 - M20 × 1.5
- Connector (only for non-Ex, Ex ic, Ex ia): M12 or 7/8"

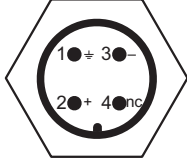
Cable specification

- For ambiente temperature T_U ≥ 60 °C (140 °F): use cable for temperature T_U + 20 K.
- 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.

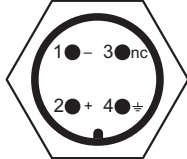
Device plug connectors

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

Pin assignment of the M12 plug connector

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

Pin assignment of the 7/8" plug connector

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

Power consumption

min. 60 mW, max. 900 mW

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

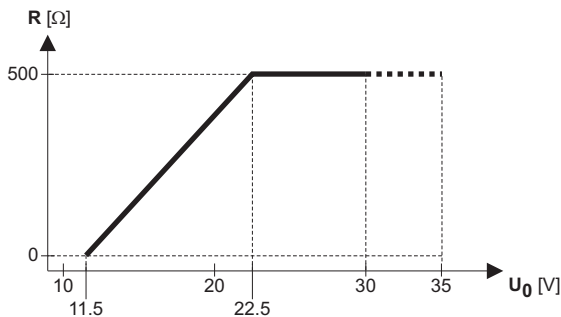
PROFIBUS PA

Nominal current	max. 15 mA
Error current FDE (Fault Disconnection Electronic)	0 mA

Power supply failure

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

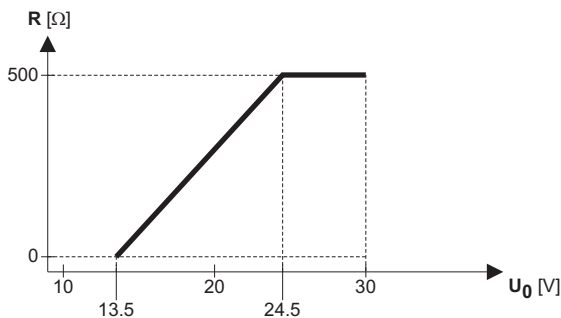
Load



A0014076

Feature 20 "Power Supply, Output", Option A "2-wire; 4-20mA HART"

Outputs	Terminal voltage	Feature 010 - Approval
1	11.5 to 35 V	Non-Ex, Ex nA, CSA GP
	11.5 to 32 V	Ex ic
	11.5 to 30 V	Ex ia / IS



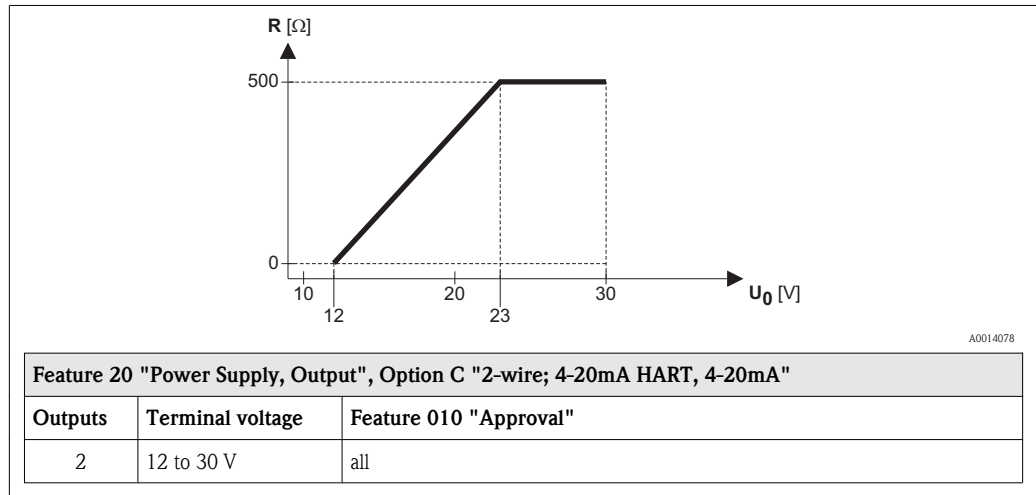
A0014077

Feature 20 "Power Supply, Output", Option A "2-wire; 4-20mA HART"

Outputs	Terminal voltage	Feature 010 - Approval
1	13.5 to 30 V	Ex d / XP, Ex ic(ia), Ex tD / DIP

Feature 20 "Power Supply, Output", Option C "2-wire; 4-20mA HART, 4-20mA"

Outputs	Terminal voltage	Feature 010 "Approval"
1	13.5 to 30 V	all



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).

Overvoltage protection

If the measuring device is used for level measurement in flammable liquids which requires the use of overvoltage protection according to DIN EN 60079-14, standard for test procedures 60060-1 (10 kA, pulse 8/20 μ s), overvoltage protection has to be ensured by one of the following measures:

- Integrated overvoltage protection (in preparation);
Product structure: Feature 610 "Accessory mounted", option NA "Overvoltage protection".
- External overvoltage protection, e.g. Endress+Hauser's HAW262Z.

Performance characteristics

Reference operating conditions

- Temperature = +24 °C (+75 °F) \pm 5 °C (\pm 9 °F)
- Pressure = 960 mbar abs. (14 psia) \pm 100 mbar (\pm 1.45 psi)
- Humidity = 60 % \pm 15 %
- Reflection factor \geq 0,8 (metal plate for rod and rope probe with min. 1 mm (0.04 in) diameter)
- Flange for rod or rope probe \geq 300 mm (12 in) diameter
- Abstand zu Hindernissen \geq 1 m (40 in)

Maximum measured error

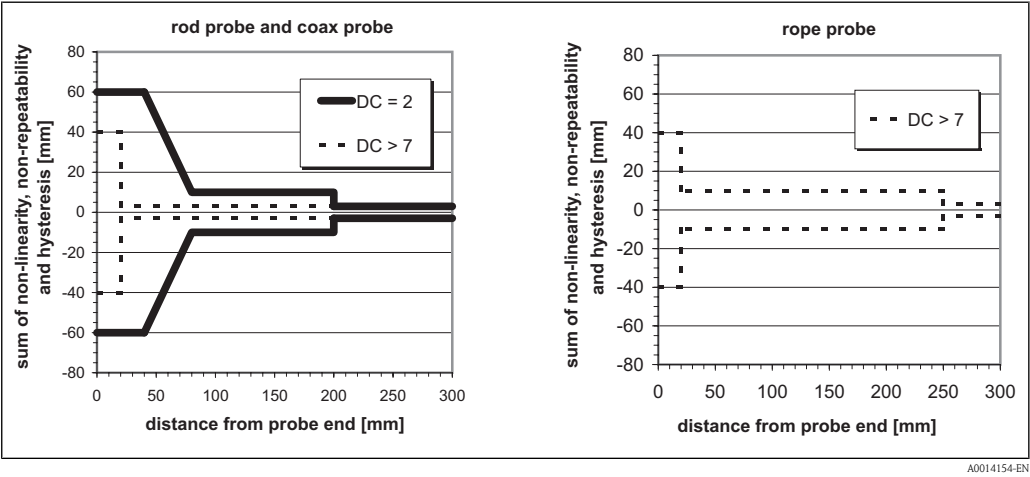
Typical data under reference operating conditions: DIN EN 61298-2, percentage values in relation to the span.

Output:	digital	analog ¹⁾
Sum of non-linearity, nonrepeatability and hysteresis	Level measurement: <ul style="list-style-type: none"> ■ Measuring range up to 15 m (49 ft): \pm 2 mm (0.08 in) ■ Measuring range > 15 m (49 ft): \pm 10 mm (0.39 in) 	\pm 0.02 %
Offset / Zero	\pm 4 mm (0.16 in)	\pm 0.03 %

1) Add error of the analogous value to the digital value.

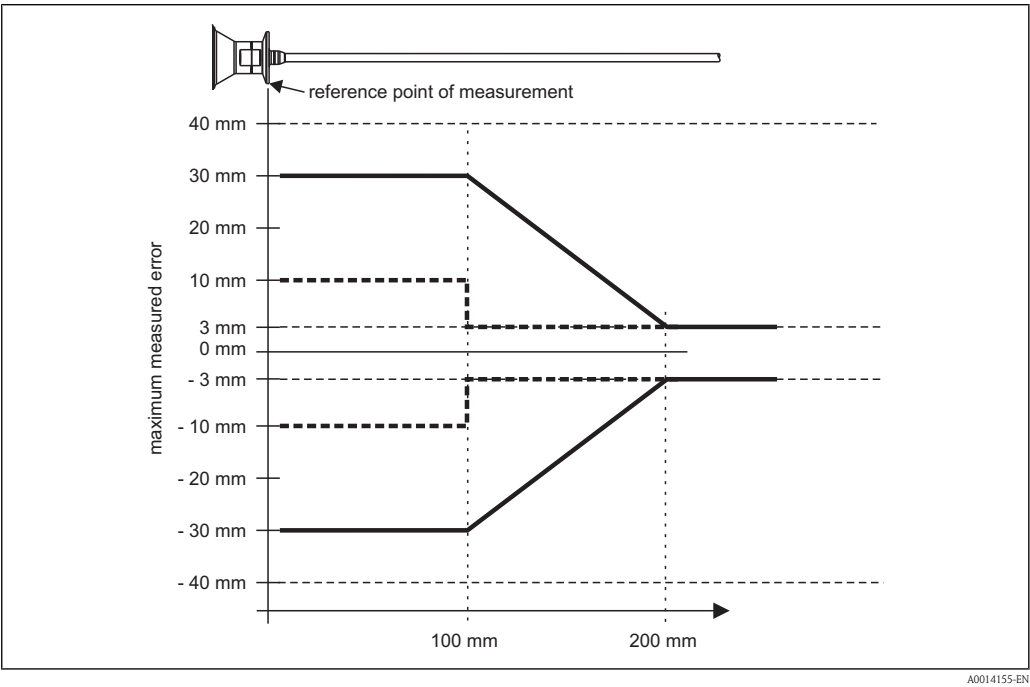
If the reference conditions are not met, the offset/zero point arising from the mounting situation may be up to \pm 12 mm (0.47 in) for rope and rod probes. This additional offset/zero point can be compensated for by entering a correction (parameter "level correction") during commissioning.

Differing from this, the following measuring error is present in the vicinity of the lower probe end:



If for rope probes the DC value is less than 7, then measurement is not possible in the area of the straining weight (0 to 250 mm from end of probe; lower blocking distance).

Differing from this, the following measuring error is present in the vicinity of the upper probe end (rod/rope only):



Resolution

- digital: 1 mm
- analog: 1 μ A

Reaction time

The reaction time can be parametrized. The fastest possible reaction time is given by the measuring rate:

Probe length	Level measurement
<10 m (33 ft)	3.6 measurements/second
up to 40 m (131 ft)	≥ 2.7 measurements/second

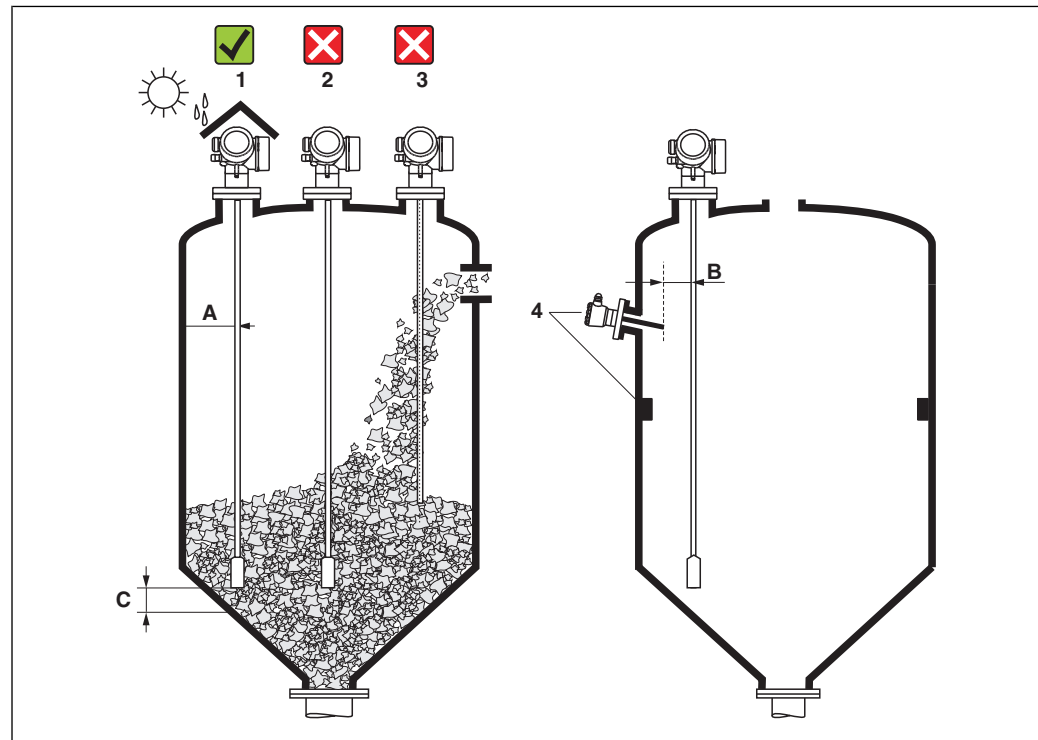
Influence of ambient temperature

The measurements are carried out in accordance with EN 61298-3

- digital (HART, PROFIBUS PA, FOUNDATION Fieldbus): average $T_K = 0.6 \text{ mm}/10 \text{ K}$
- analog (current output):
 - zero point (4 mA): average $T_K = 0.02 \text{ } \%/10 \text{ K}$
 - span (20 mA): average $T_K = 0.05 \text{ } \%/10 \text{ K}$

Operating conditions: Installation

Suitable mounting position



A0012851-DE

Mounting distances

- Distance (A) between wall and rod or rope probe:
 - for smooth metallic walls: $> 50 \text{ mm}$ (2")
 - for plastic walls: $> 300 \text{ mm}$ (12") mm to metallic parts outside the vessel
 - for concrete walls: $> 500 \text{ mm}$ (20") , otherwise the available measuring range may be reduced.
- Distance (B) between rod or rope probe and internal fittings in the vessel: $> 300 \text{ mm}$ (12")
- Distance (C) from end of probe to bottom of the vessel: $> 10 \text{ mm}$ (0.4").

Additional conditions

- When mounting in the open: Use a weather protection cover (1)
- In metallic vessels: Do not mount the probe in the center of the vessel (2).
- Do not mount the probe in the filling curtain (3)
- Avoid buckling the rope probe during installation or operation (e.g. through product movement against silo wall) by selecting a suitable mounting location.
- Check the probe regularly for defects.

i With suspended rope probes (probe end not fixed at the bottom) the distance between the probe rope and internal fittings in the tank must not fall below 300 mm (12") during the entire process. A sporadic contact between the probe weight and the cone of the vessel, however, does not influence the measurement as long as the dielectric constant of the medium is at least $DC = 1.8$.

i When mounting the electronics housing into a recess (e.g. in a concrete ceiling), observe a minimum distance of 100 mm (4 inch) between the cover of the terminal compartment and the wall.

Wall and pipe mounting

Endress+Hauser offers a mounting bracket for installing the device on pipes or on walls.

Ordering information: Feature 600 "Probe Design", Option MB "Sensor remote, 3m/9ft cable" (→ 47).
Dimensions (→ 34).

Additional mounting hints

Bending strength of rod probes

Sensor	Feature 060	Probe	Bending strength [Nm]
FMP57	AE, AF	Rod 16mm (0.63") 316L	30

Tensile load limit of rope probes

Sensor	Feature 060	Probe	Tensile load limit [kN]	Max. rupture load [kN] ¹⁾
FMP56	LA, LB	Rope 4mm (1/6") 316	12	16
	NB, NE	Rope 6mm (1/4") PA>Steel	12	16
FMP57	LA, LB	Rope 4mm (1/6") 316	12	16
	LC, LD	Rope 6mm (1/4") 316	30	35
	NB, NE	Rope 6mm (1/4") PA>Steel	12	16
	NC, NF	Rope 8mm (1/3") PA>Steel	30	35

1) The ceiling of the silo must be designed to withstand this load.

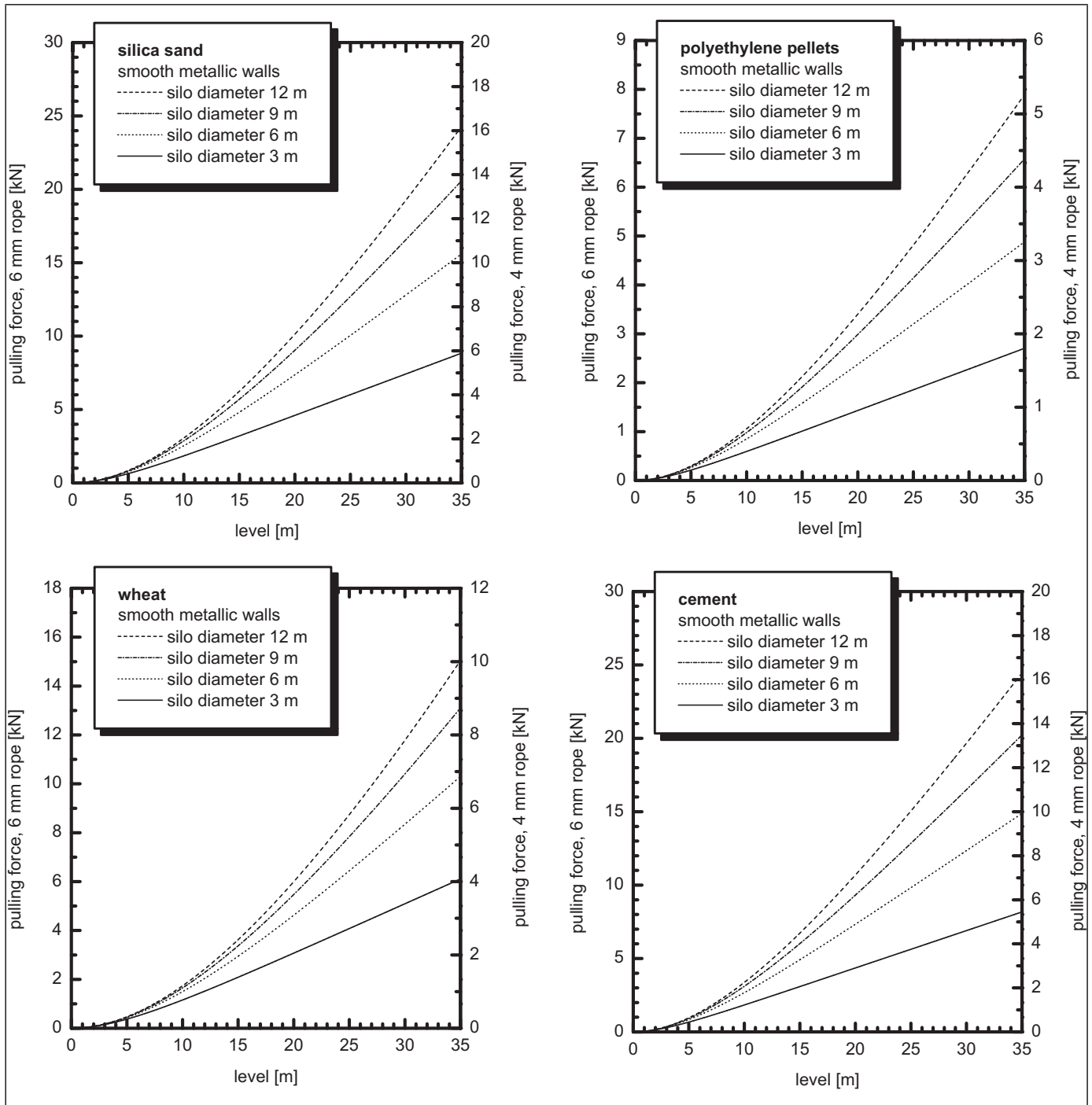
Tensile load

Bulk solids exert tensile forces on rope probes whose height increases with:

- the length of the probe, i.e. max. cover
- the bulk density of the product,
- the silo diameter and
- the diameter of the probe rope

The following diagrams show typical loads for frequently occurring bulk solids as reference values. The calculation is performed for the following conditions:

- Suspended probe (probe end not fixed at the bottom)
- Free-flowing bulk solid, i.e. mass flow. A calculation for core flow is not possible. In the event of collapsing cornices, considerably higher loads can occur.
- The specification for tensile forces contains the safety factor 2, which compensates for the normal fluctuation range in pourable bulk solids.



A0014133-EN

Since the tensile forces are also heavily dependent on the viscosity of the product, a higher safety factor is necessary for highly viscous products and if there is a risk of cornice buildup. In critical cases it is better to use a 6 mm rope instead of a 4 mm one.

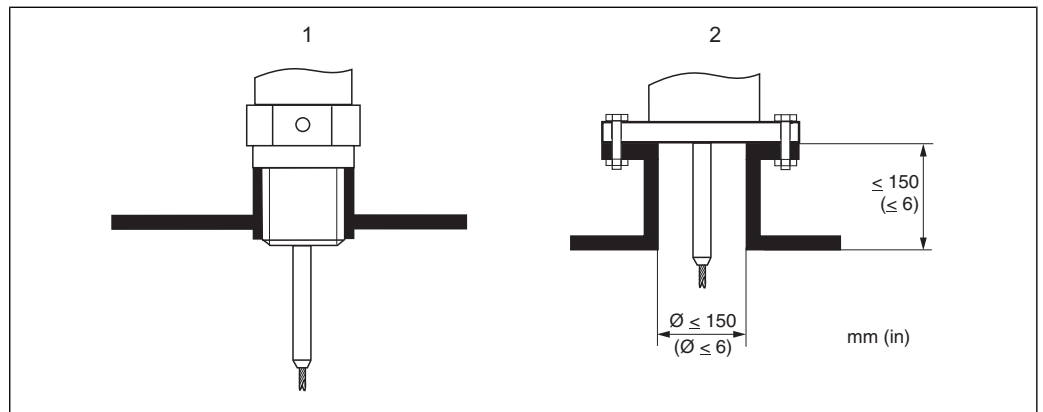
The same forces also act on the silo cover. On a fixed rope, the tensile forces are definitely greater, but this can not be calculated. Observe the tensile strength of the probes.

Options for reducing the tensile forces:

- Shorten the probe.
- If the maximum tensile load is exceeded, check whether it would be possible to use a non-contact Ultrasonic or Level-Radar device.

Type of probe installation

- Probes are mounted to the process connection with threaded connections or flanges and are usually also secured with these. If during this installation there is the danger that the probe end moves so much that it touches the tank floor or cone at times, the probe must, if necessary, be shortened and fixed down. The easiest way to fix the rope probes is to screw them to the internal thread on the lower end of the weight (→ 25).
- The ideal installation is mounting in a screwed joint / screw-in sleeve which is internally flush with the container ceiling.
- Alternative: nozzle mounting



- 1 Mounting with screwed joint; flush with the container ceiling
2 Nozzle mounting

- Permissible nozzle diameter: ≤ 150 mm (6 in).
For larger diameters the near range measuring capability may be reduced.
- Permissible nozzle height: ≤ 150 mm (6 in).
For a larger height the near range measuring capability may be reduced.

Extension rod for FMP57

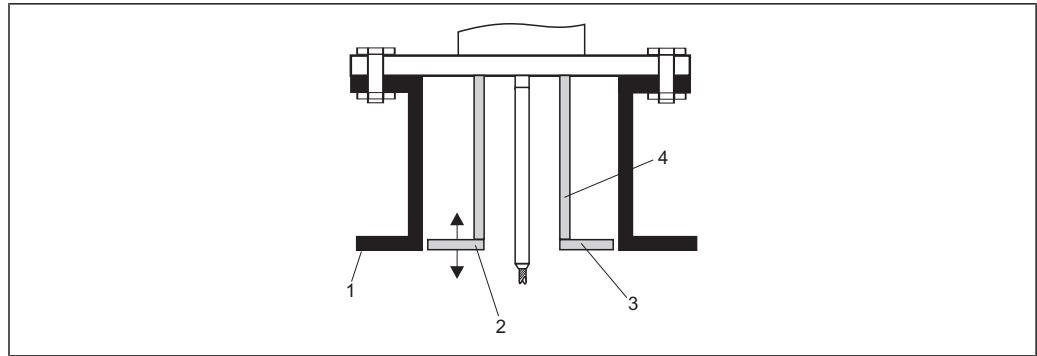
If - for installations in nozzles > 150 mm (6 in) - the probe could touch the lower nozzle edge due to moving materials in the container, we recommend using an extension rod with or without centering disk (HMP40, see "Accessories").

i This accessory consists of the extension rod corresponding to the nozzle height, on which a centering disk is also mounted if the nozzles are narrow or when working in bulk solids. This component is delivered separately from the device. Please order the probe length correspondingly shorter.

Only use centering disks with small diameters (DN40 and DN50) if there is no significant build-up in the nozzle above the disk. The nozzle must not become clogged by the product.

Installation in nozzles \geq DN300

If installation in ≥ 300 mm/12" nozzles is unavoidable, installation must be carried out in accordance with the sketch on the right.

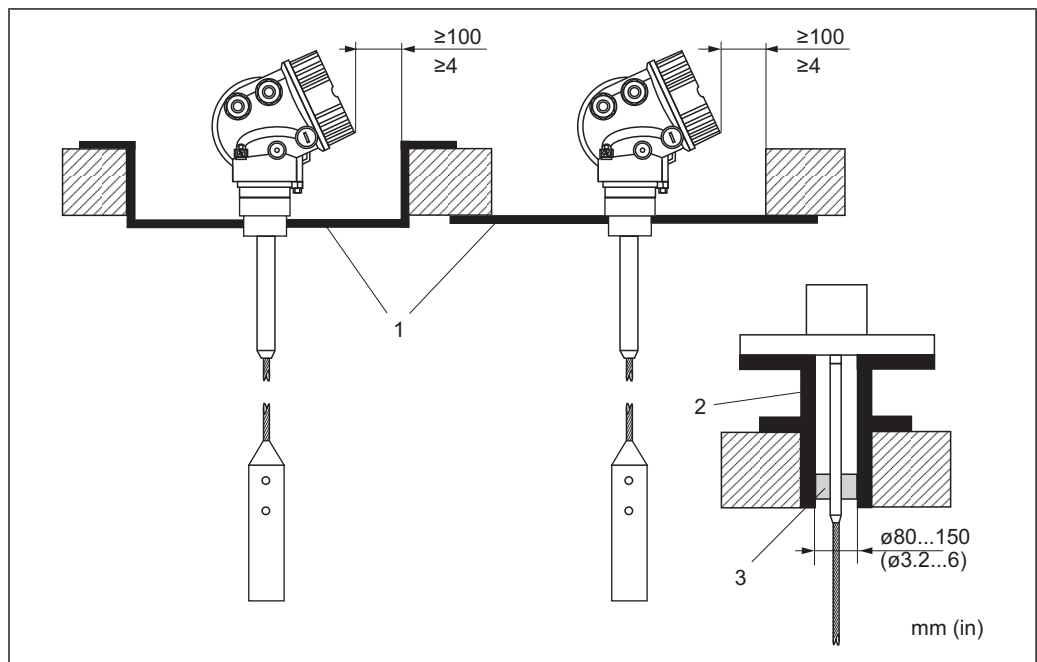


- 1 Lower edge of the nozzle
2 Approx. flush with the lower edge of the nozzle ($\pm 50 \text{ mm}/2''$)
3 Plate
4 Pipe \varnothing 150 to 180 mm (6 to 7 inch)

Nozzle diameter	Plate diameter
300 mm (12")	280 mm (11")
$\geq 400 \text{ mm}$ (16")	$\geq 350 \text{ mm}$ (14")

Installation in concrete silos

Installation, for example, into a thick concrete ceiling should be made flush with the lower edge. Alternatively, the probe can also be installed into a pipe that must not protrude over the lower edge of the silo ceiling. The pipe should kept at a minimum length. Installation suggestions see diagram.



- 1 Metal sheet
2 Metal tube
3 Extension rod / Centering HMP40 (see "Accessories")

Note for installations with rod extension/center washer (accessories): Strong dust generation can lead to build-up behind the center washer. This can cause an interference signal. For other installation possibilities please contact Endress+Hauser.

Securing rod probes

- Rod probes must be supported if there is a horizontal flow (e.g. from an agitator) or in the case of strong vibrations.
- Rod probes may only be supported at the end of the probe.

NOTICE

Poor grounding of the end of probe may cause measuring errors.

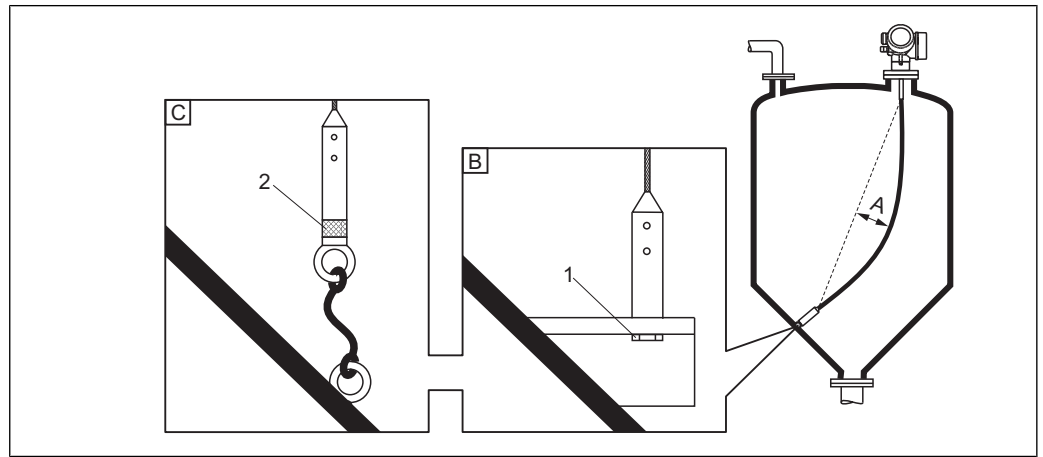
- Apply a narrow sleeve which has good electrical contact to the probe.

NOTICE

Welding may damage the electronics.

- Before welding: Ground the probe and dismount electronics.

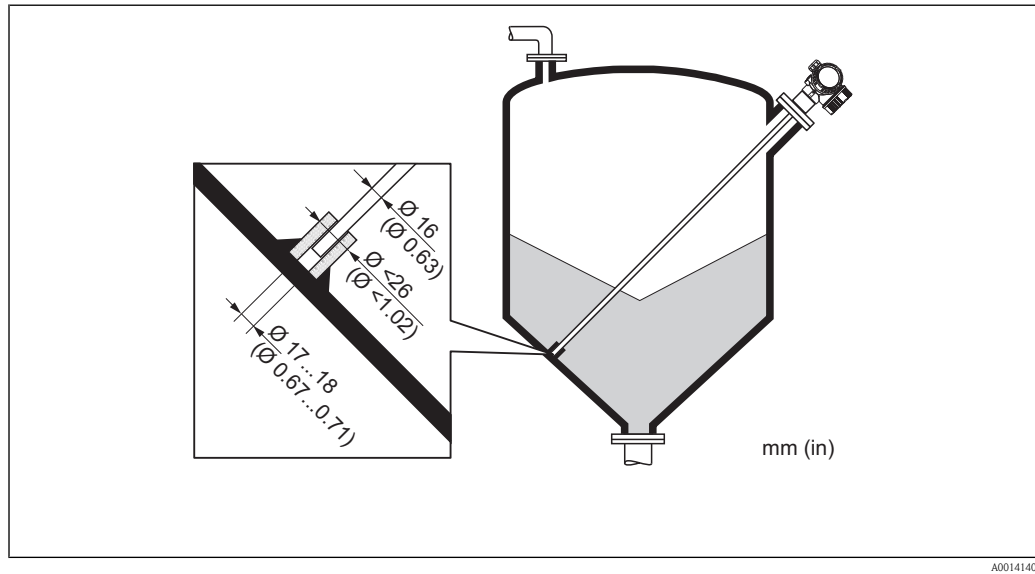
Securing rope probes



- A Sag of the rope: ≥ 1 cm per 1m of the probe length (0.12 inch per 1 ft of the probe length)*
B: Mounting and contact with a bolt
C Mounting kit isolated (→ 49)
1 Reliably grounded end of probe
2 Reliably isolated end of probe

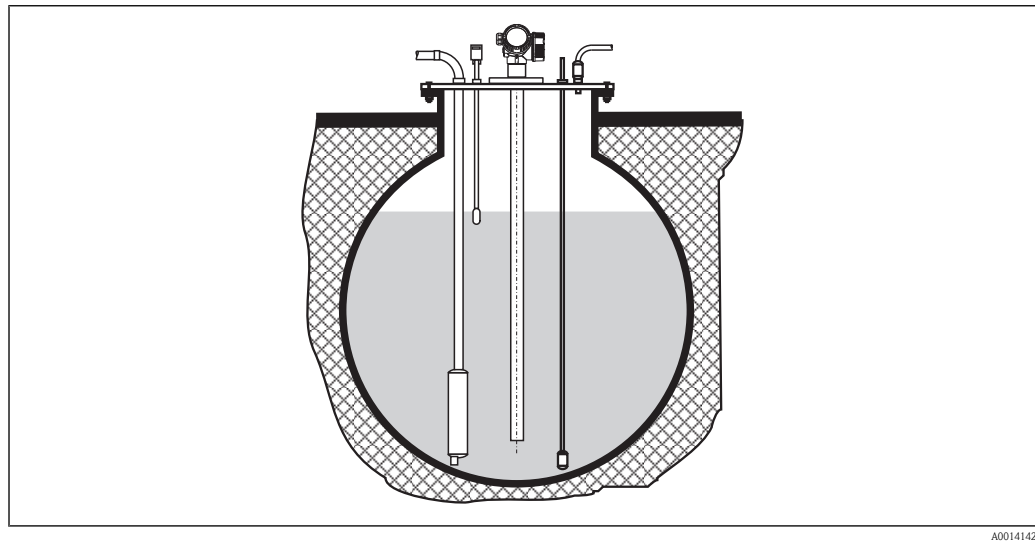
- The end of the probe needs to be secured under the following conditions:
 - if otherwise the probe sporadically comes into contact with the wall of the vessel, the outlet cone, internal fittings or other parts of the installation.
 - if otherwise the probe sporadically gets close to a concrete wall (minimum distance 0.5 m / 20 inch).
- The end of probe can be secured at its internal thread
 - for 4 mm (1/6") rope: M 14
 - for 6 mm (1/4") rope: M 20
- Preferably use the 6 mm (1/4") rope probe due to the higher tensile strength when fixing a rope probe.
- The fixing must be either reliably grounded or reliably insulated. If it is not possible to mount the probe weight with a reliably insulated connection, it can be secured using an isolated eyelet, which is available as an accessory (→ 49).
- In order to prevent an extremely high tensile load (e.g. due to thermal expansion) and the risk of rope crack, the rope has to be slack. Make the rope longer than the required measuring range such that there is a sag in the middle of the rope that is ≥ 1 cm/(1 m rope length) [0.12 inch/(1 ft rope length)]. Tensile load limit of rope probes: (→ 21)

Installation from the side



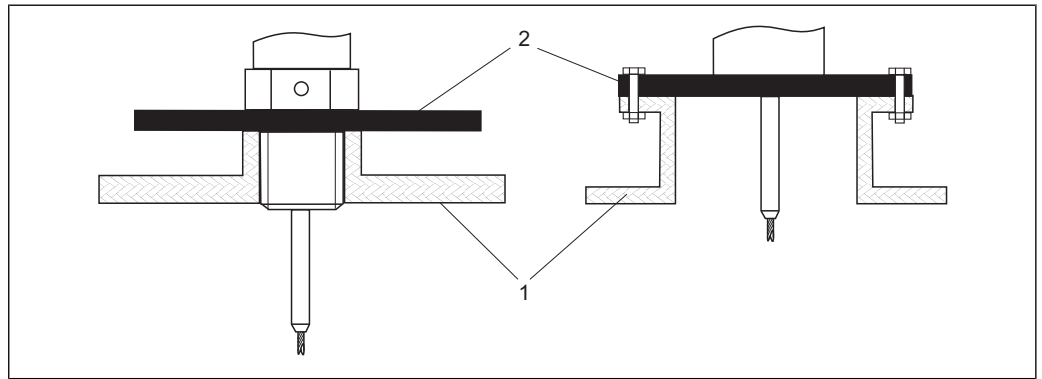
- If installation from above is not possible, the Levelflex can also be mounted from the side.
- In this case, always fix the rope probe (\rightarrow 25).
- Support rod probe if the lateral loadbearing capacity is exceeded (\rightarrow 21). Only fix rod probes at the probe end (\rightarrow 25).

Installation in underground tanks



Use coax probe for nozzles with large diameters in order to avoid reflections at the nozzle wall.

Mounting in non-metallic vessels



A0012527

- 1 Non-metallic vessel
2 Metal sheet or metal flange

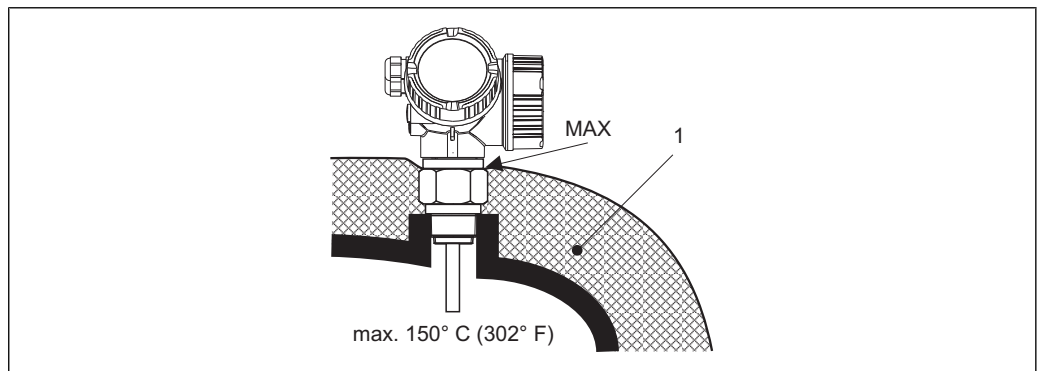
To measure, Levelflex with a rod probe needs a metallic surface at the process connection. Therefore:

- Select an instrument version with metal flange (minimum size DN50/2").
- Or: mount a metal sheet with a diameter of at least 200 mm (8") to the probe at the process connection. Its orientation must be perpendicular to the probe.

Installation with heat insulation

- 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 points labeled "MAX" in the drawings.

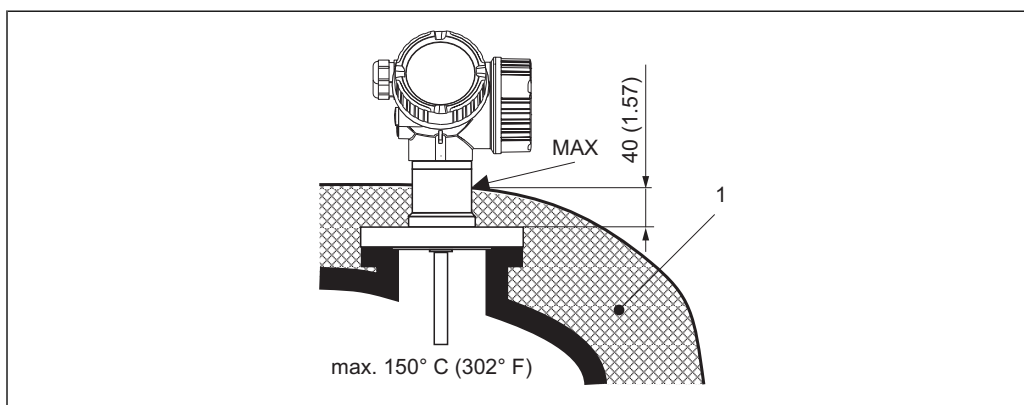
Process connection with thread



A0014143

- 1 Tank insulation

Process connection with flange



A0014144

1 Tank insulation

Operating conditions: Environment

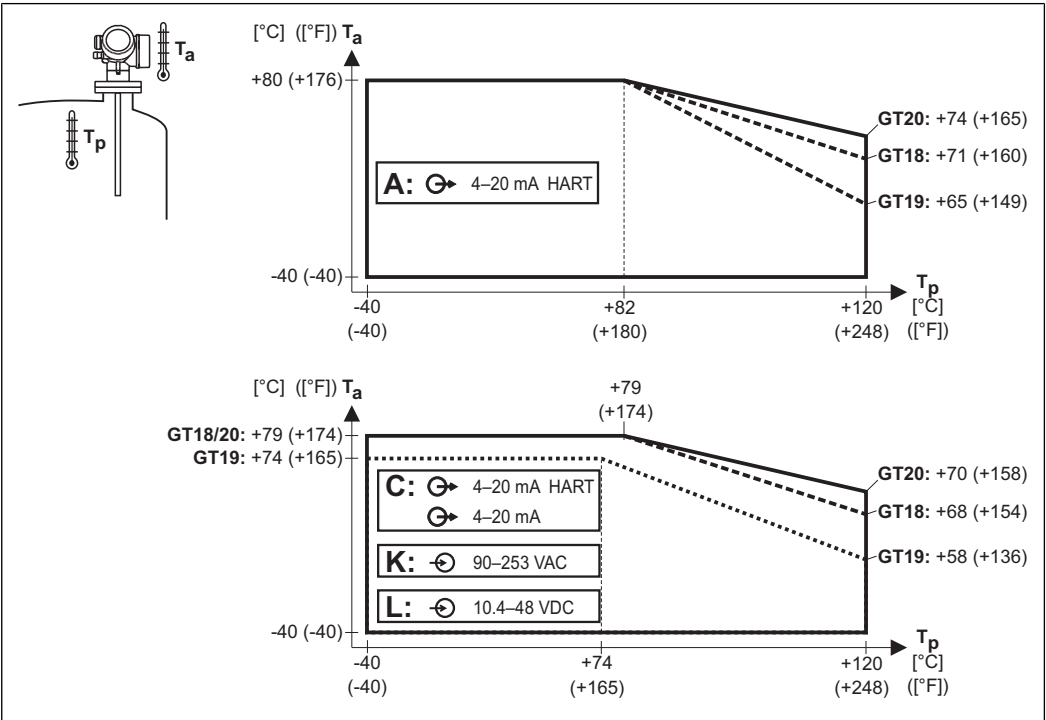
Ambient temperature range	Measuring device	-40 to +80 °C (-40 to +176 °F)
	Local display	-20 to +70 °C (-4 to +158 °F), the readability of the display may be impaired at temperatures outside the temperature range.

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

Temperature derating for FMP56 with threaded connection $G\frac{3}{4}$ or $NPT\frac{3}{4}$



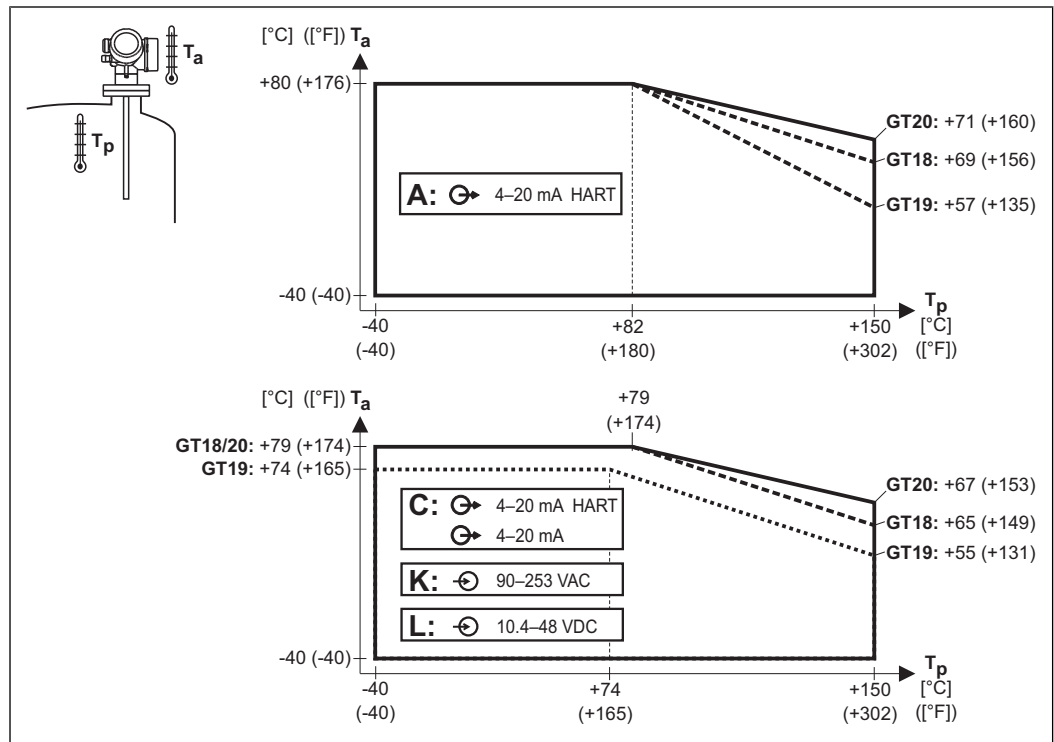
GT18 = stainless steel housing
GT19 = plastic housing
GT20 = aluminum housing

A = 1 current output
C = 2 current outputs
K, L = 4-wire

T_a = ambient temperature
 T_p = temperature at the process connection

A0014122

Temperature derating for FMP57



GT18 = stainless steel housing
GT19 = plastic housing
GT20 = aluminum housing

A = 1 current output
C = 2 current outputs
K, L = 4-wire

T_a = ambient temperature
T_p = temperature at the process connection

Storage temperature	–40 to +80 °C (–40 to +176 °F)
Climate class	DIN EN 60068-2-38 (test Z/AD)
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) IP66, NEMA4X With open housing: IP20, NEMA1 (also ingress protection of the display) <p>i 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 68-2-64: 20 to 2000 Hz, 1 (m/s ²)/Hz
Cleaning the probe	Depending on the application, contamination or buildup can accumulate on the probe. A thin, even layer only influences measurement slightly. Thick layers can dampen the signal and then reduce the measuring range. Severe, uneven buildup, adhesion e.g. through crystallization, can lead to incorrect measurement. In this case, we recommend that you use a non-contact measuring principle, or check the probe regularly for soiling.
Electromagnetic compatibility (EMC)	<p>Electromagnetic compatibility to EN 61326 and NAMUR Recommendation EMC (NE21). Details are provided in the Declaration of Conformity. A standard installation cable is sufficient if only the analog signal is used.</p> <p>Use a shielded cable when working with a superimposed communications signal (HART).</p> <p>Maximum measured error: < 0.5 % of the span.</p> <p>When installing the probes in metal and concrete tanks and when using a coax probe:</p> <ul style="list-style-type: none"> Interference emission to EN 61326 - x series, electrical equipment Class B. Interference immunity to EN 61326 - x series, requirements for industrial areas and NAMUR Recommendation NE 21 (EMC) <p>The measured value can be affected by strong electromagnetic fields when installing rod and rope probes without a shielding/metallic wall, e.g. in plastic and wooden silos.</p> <ul style="list-style-type: none"> Interference emission to EN 61326 - x series, electrical equipment Class A. Interference Immunity: the measured value can be affected by strong electromagnetic fields.

Operating conditions: Process

Process temperature range

The maximum permitted temperature at the process connection is determined by the O-ring version ordered:

Device	O-ring material	Process temperature
FMP56	FKM (Viton GLT)	–30 to +120 °C (–22 to +248 °F)
	EPDM	–40 to +120 °C (–40 to +248 °F)
FMP57	FKM (Viton GLT)	–30 to +150 °C (–22 to +302 °F)
	EPDM	–40 to +120 °C (–40 to +248 °F)



The medium temperature can be higher.

However, when using rope probes the stability of the probe rope is reduced by structural changes at temperatures over 350 °C (662 °F).

Process pressure limits

Device	Process pressure
FMP56, FMP57	–1 to 16 bar (–14.5 to 232 psi)



This range may be reduced by 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. BPay attention to pressure-temperature dependencies.

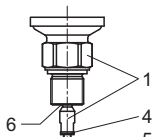
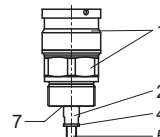
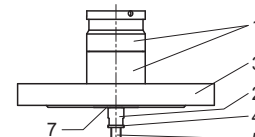
Please refer to the following standards for the pressure values permitted for higher temperatures:


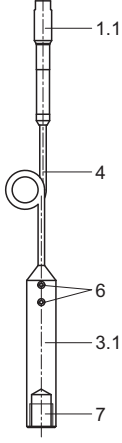
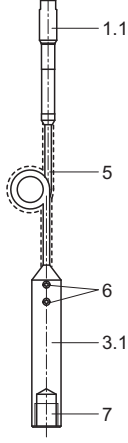
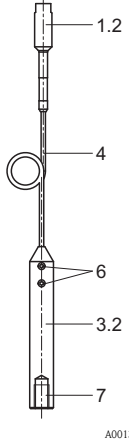
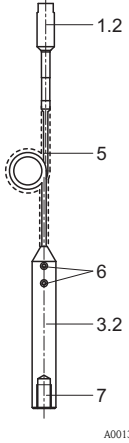
- EN 1092-1: 2001 Tab. 18
With regard to their temperature stability properties, the materials 1.4435 and 1.4404 are grouped under 13E0 in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.
- ASME B 16.5a - 1998 Tab. 2-2.2 F316
- ASME B 16.5a - 1998 Tab. 2.3.8 N10276
-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

Materials in contact with process



- Endress+Hauser supplies DIN/EN flanges and threaded process connections made of stainless steel according to AISI 316L (DIN/EN material number 1.4404 or 1.4435). With regard to their temperature stability properties, the materials 1.4404 and 1.4435 are grouped under 13E0 in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.
- Further material specifications (→ 36)

Levelflex FMP56, FMP57				
Threaded connection		Flange	No.	Material
$G\frac{3}{4}$, NPT $\frac{3}{4}$	$G1\frac{1}{2}$, NPT1 $\frac{1}{2}$			
 A0013890	 A0013888	 A0013889	1	304 (1.4301)
			2	316L (1.4404)
			3	316L (1.4435/1.4404)
			4	Nordlock washer: 1.4547
			5	1.4462, Duplex CR22
			6	PPS-GF40
			7	PEEK GF30

Levellflex FMP56, FMP57						
Rod probe	Rope probe				No.	Material
Ø 16 mm (2/3")	Ø 6 mm (1/4")	Ø 8 mm (1/3") coated	Ø 4 mm (1/6")	Ø 6 mm (1/4") coated		
 A0013891	 A0013892	 A0013893	 A0013894	 A0013895	1.1	304 (1.4301)
					1.2	316L (1.4404)
					2	316L (1.4435/1.4404)
					3.1	304 (1.4301)
					3.2	316L (1.4404)
					4	316 (1.4401)
					5	Rope: galvanized steel Coating: PA 12 (Vestamid L 1940)
					6	Set screw: A4-70
					7	Screw for tightening: A2-70

Dielectric constant

Rod and rope probe: DC (ϵ_r) ≥ 1.4

Extension of the rope probes through tension and temperature

4 mm rope:

- Elongation through tension: at max. permitted tensile load (12 kN): 11 mm / m rope length
- Elongation through temperature increase from 30 °C (86 °F) to 150 °C (302 °F): 2 mm / m rope length

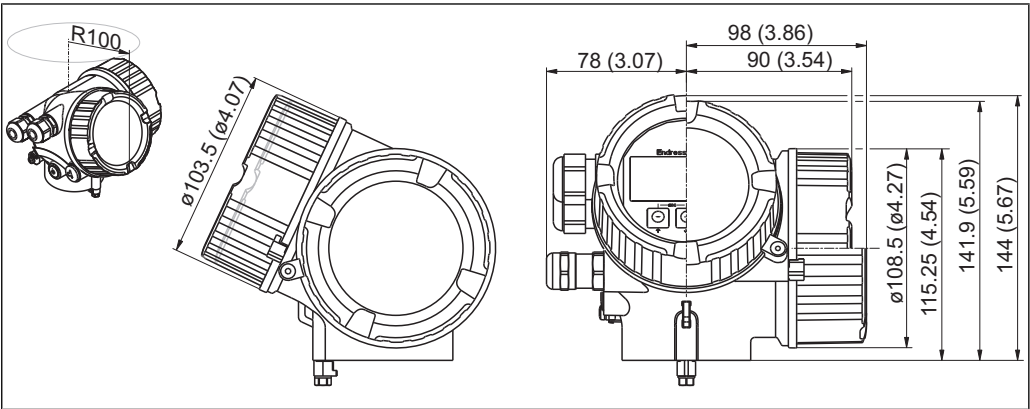
6 mm rope:

- Elongation through tension: at max. permitted tensile load (30 kN): 13 mm / m rope length
- Elongation through temperature increase from 30 °C (86 °F) to 150 °C (302 °F): 2 mm / m rope length

Mechanical construction

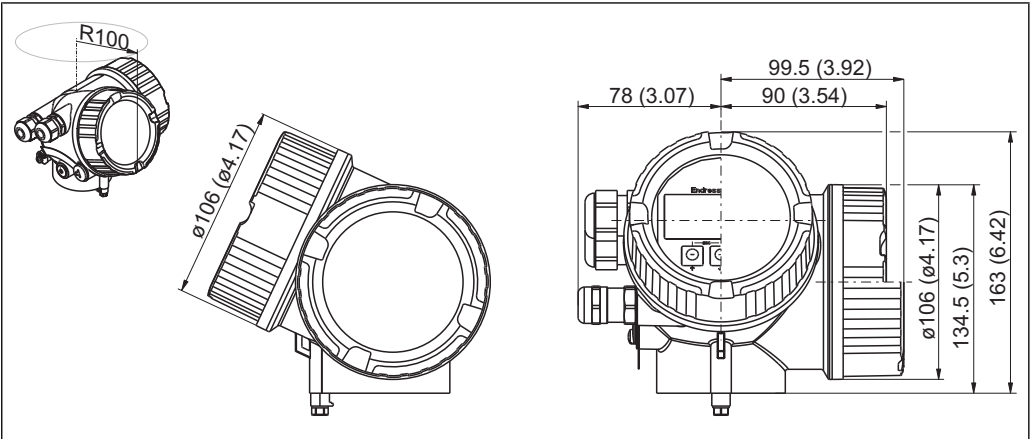
Design, dimensions

Dimensions of the electronics housing



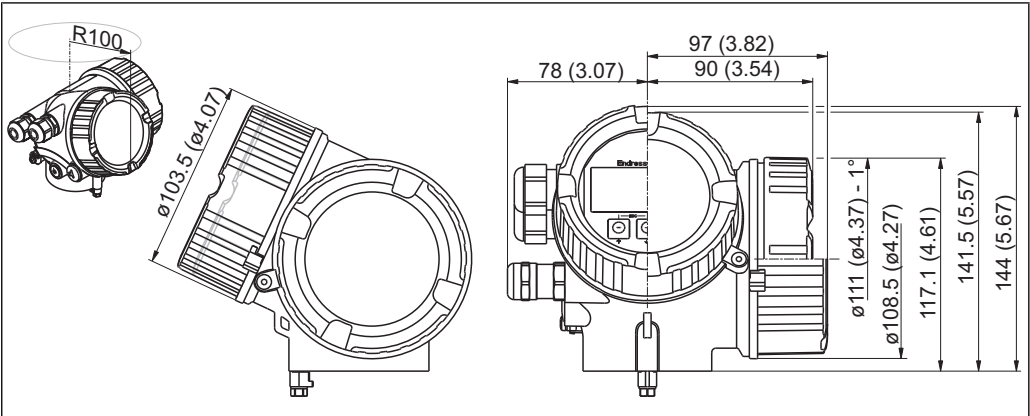
A0011666

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



A0011346

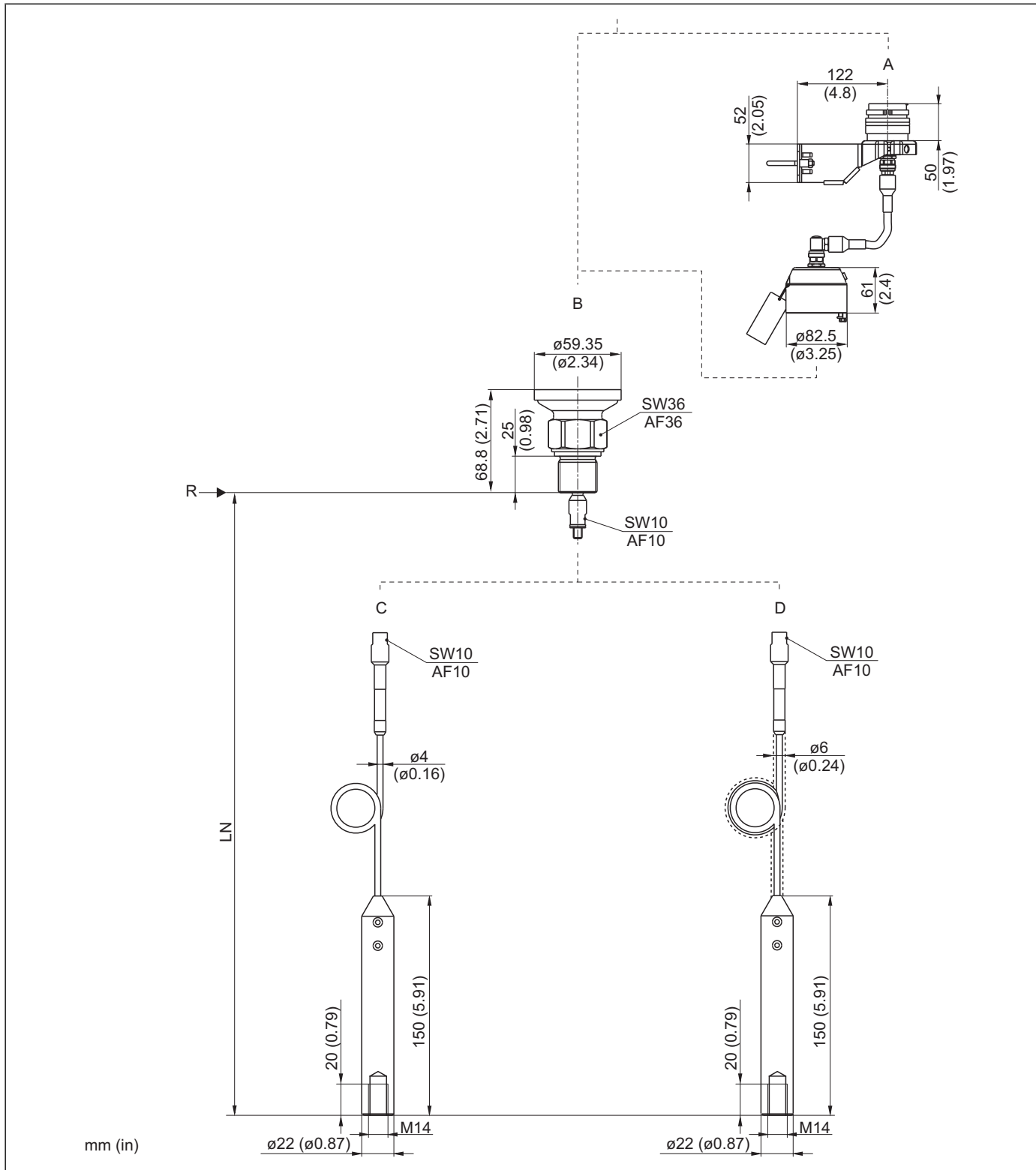
3 Housing GT19 (Plastics PBT); Dimensions in mm (in)



A0011665

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

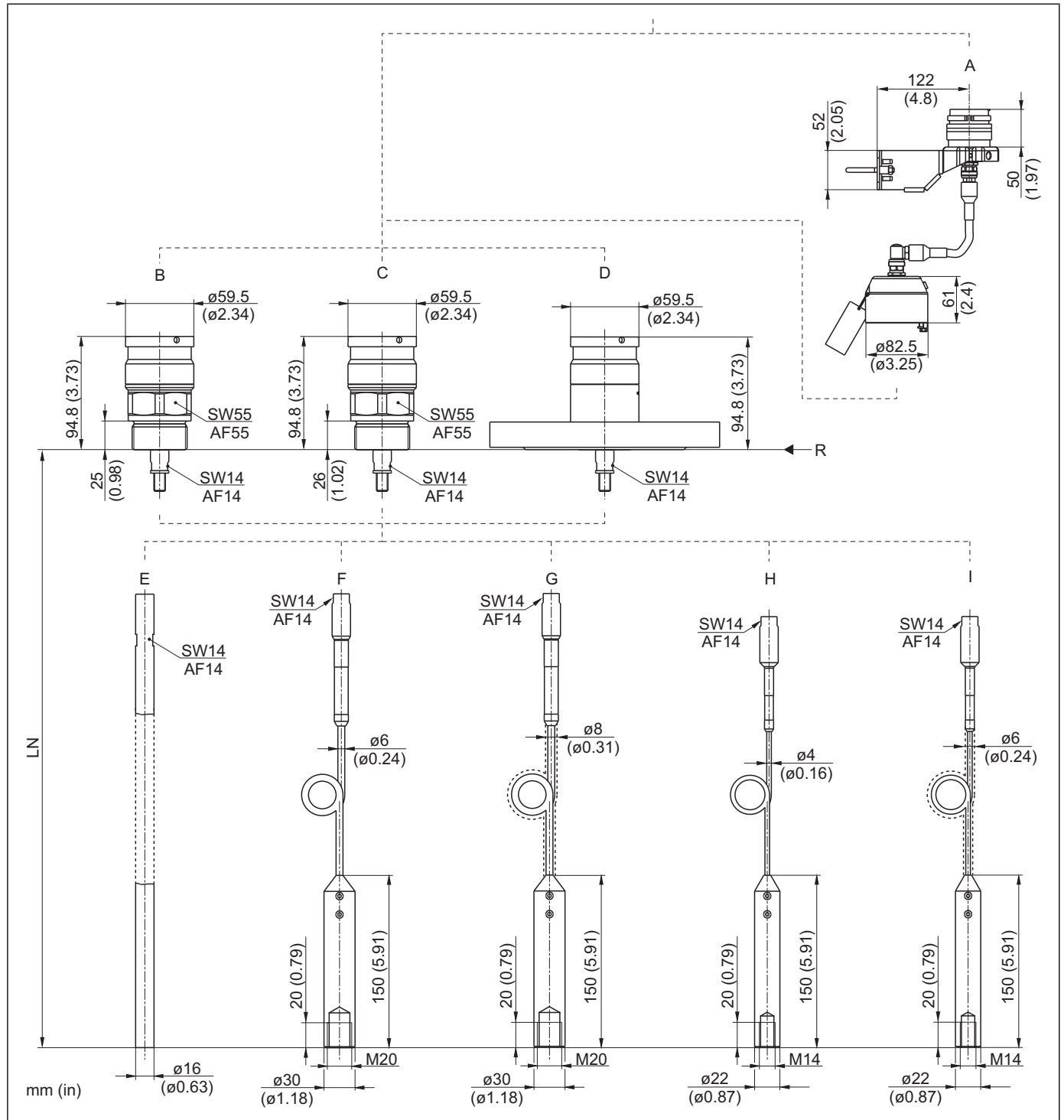
FMP56: Dimensions of process connection and probe



A0012781

- A Mounting bracket for probe design "Sensor remote" Feature 600)
- B Thread ISO228 G3/4 or ANSI MNPT3/4 (Feature 100)
- C Rope probe 4mm or 1/6" (Feature 060)
- D Rope probe 6mm or 1/4", PA>Steel (Feature 060)
- LN Length of probe
- R Reference point of the measurement

FMP57: Dimensions of process connection and probe



A0012782

- A Mounting bracket for probe design "Sensor remote" (Feature 600)
- B Thread ISO228 G1-1/2 (Feature 100)
- C Thread ANSI MNPT1-1/2 (Feature 100)
- D Flange ANSI B16.5, EN1092-1, JIS B2220 (Feature 100)
- E Rod probe 16mm (Feature 060)
- F Rope probe 6mm or 1/4" (Feature 060)
- G Rope probe 8mm or 1/3", PA>Steel (Feature 060)
- H Rope probe 4mm or 1/6" (Feature 060)
- I Rope probe 6mm or 1/4", PA>Steel (Feature 060)
- LN Length of probe
- R Reference point of the measurement

Tolerance of probe length

Rod probes				
Over [m (ft)]	—	1 (3,3)	3 (9,8)	6 (20)
Up to [m (ft)]	1 (3,3)	3 (9,8)	6 (20)	—
Admissible tolerance [mm (in)]	-5 (-0,2)	-10 (-0,39)	-20 (-0,79)	-30 (-1,18)

Rope probes				
Over [m (ft)]	—	1 (3,3)	3 (9,8)	6 (20)
Up to [m (ft)]	1 (3,3)	3 (9,8)	6 (20)	—
Admissible tolerance [mm (in)]	-10 (-0,39)	-20 (-0,79)	-30 (-1,18)	-40 (-1,57)

Weight
Housing

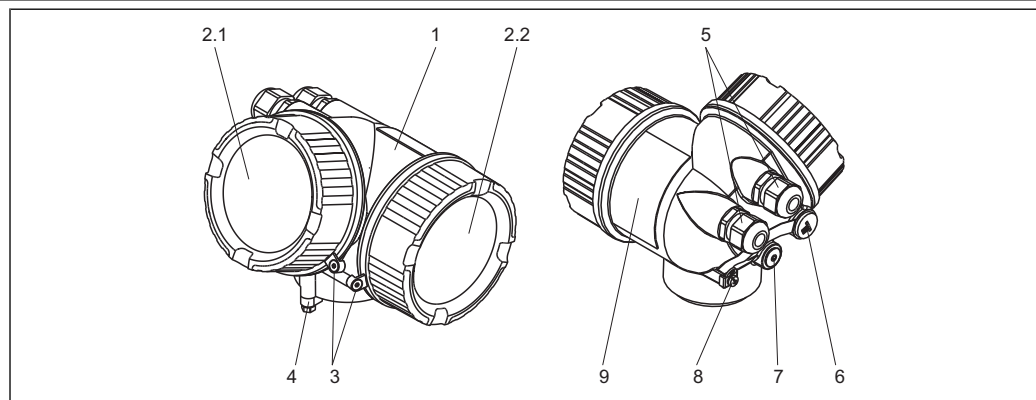
Part	Weight
Housing GT18 - stainless steel	approx. 4.5 kg
Housing GT19 - plastic	approx. 1.2 kg
Housing GT20 - aluminium	approx. 1.9 kg

FMP56

Part	Weight	Part	Weight
Sensor	approx. 0.8 kg	Rope probe 4 mm	approx. 0.1 kg/m probe length
		Rope probe 6 mm	approx. 0.2 kg/m probe length

FMP57

Part	Weight	Part	Weight
Sensor	approx. 1.4 kg + weight of flange	Rope probe 6 mm	approx. 0.2 kg/m probe length
Rope probe 4 mm	approx. 0.1 kg/m probe length	Rod probe 16 mm	approx. 1.6 kg/m probe length

Material


A0013788

Housing GT18 - stainless steel, corrosion-resistant			
No.	Part: material	No.	Part: material
1	Housing: 316L (CF-3M)	5	Cable entry
2.1	Compartment for the display module		■ Sealing: EMPB
	■ Cover: 316L (CF-3M)		■ Cable gland: polyamide (PA), nickel-plated brass (CuZn)
	■ Window: glass		■ Adapter: 316L (1.4435)
	■ Cover seal: EPDM		

Housing GT18 - stainless steel, corrosion-resistant			
No.	Part: material	No.	Part: material
2.2	Terminal compartment ■ Cover: 316L (CF-3M) ■ Cover seal: EPDM	6	Dummy plug: 316L (1.4404)
3	Cover lock ■ Screw: A4 ■ Clamp: 316L (1.4404)	7	Pressure relief stopper: 316L (1.4404)
4	Turn housing ■ Screw: A4-70 ■ Clamp: 316L (1.4404)	8	Ground terminal ■ Screw: A4 ■ Spring washer: A4 ■ Clamp: 316L (1.4404) ■ Holder: 316L (1.4404)
		9	Identification ■ Nameplate: 304 (1.4301) ■ Groove pin: A2

Housing GT19 - plastic			
No.	Part: material	No.	Part: material
1	Housing: PBT	5	Cable entry ■ Sealing: EMPB ■ Cable gland: polyamide (PA), nickel-plated brass (CuZn) ■ Adapter: 316L (1.4435)
2.1	Compartment for the display module ■ Cover: PBT / PA ■ Cover seal: EPDM	6	Dummy plug: PBT
2.2	Terminal compartment ■ Cover: PBT ■ Cover seal: EPDM	7	Pressure relief stopper: PBT
4	Turn housing ■ Screw: A4-70 ■ Clamp: 316L (1.4404)	8	Ground terminal ■ Screw: A2 ■ Spring washer: A4 ■ Clamp: 304 (1.4301) ■ Holder: 304 (1.4301)
		9	Identification Nameplate: sticker

Housing GT20 - die-cast aluminum, powder-coated, seawater-resistant			
No.	Part: material	No.	Part: material
1	Housing: AlSi10Mg(<0.1% Cu)	5	Cable entry ■ Sealing: EMPB ■ Cable gland: polyamide (PA), nickel-plated brass (CuZn) ■ Adapter: 316L (1.4435)
2.1	Compartment for the display module ■ Cover: AlSi10Mg(<0.1% Cu) ■ Window: glass ■ Cover seal: EPDM	6	Dummy plug: nickel-plated brass (CuZn)
2.2	Terminal compartment ■ Cover: AlSi10Mg(<0.1% Cu) ■ Cover seal: EPDM	7	Pressure relief stopper: nickel-plated brass (CuZn)
3	Cover lock ■ Screw: A4 ■ Clamp: 316L (1.4404)	8	Ground terminal ■ Screw: A2 ■ Spring washer: A2 ■ Clamp: 304 (1.4301) ■ Holder: 304 (1.4301)
4	Turn housing ■ Screw: A4-70 ■ Clamp: 316L (1.4404)	9	Identification Nameplate: sticker



Further material specifications

- Materials in contact with process (→ 31)
- Ordering information (→ 44)
- Accessories materials (→ 48)

Human interface

Operating concept

Operator-oriented menu structure for user-specific tasks

- Commissioning
- Operation
- Diagnostics
- Expert level

Quick and safe commissioning

- Guided menus ("Make-it-run" wizards) for applications
- Menu guidance with brief explanations of the individual parameter functions

Reliable operation

- Local operation in several languages possible (→ Product structure → Feature 500 → Additional Operation Language)
- Standardized operation at the device and in the operating tools

Efficient diagnostics increase measurement reliability

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

Display elements

- 4-line display
- Format for displaying measured values 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

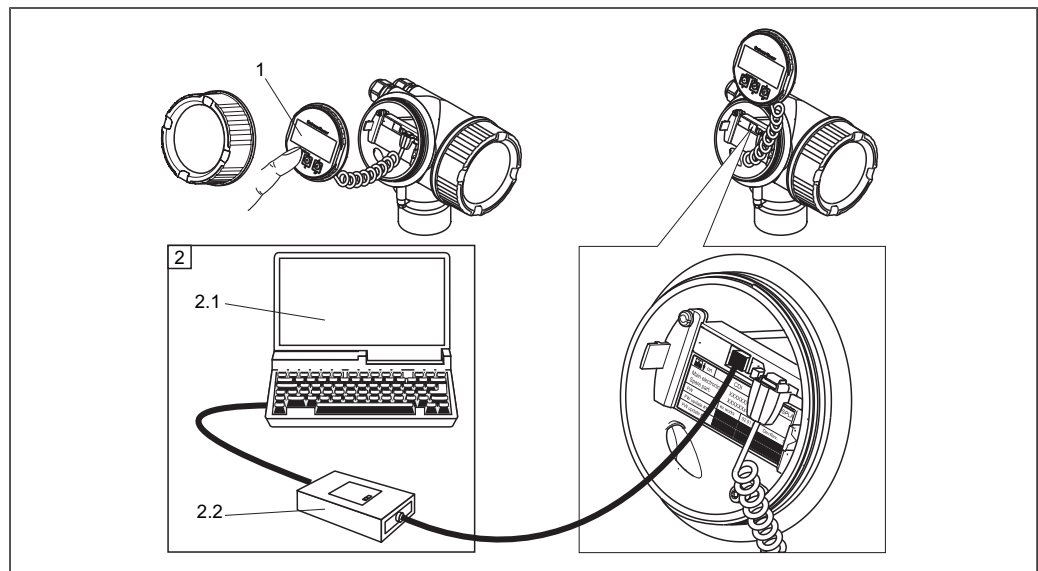
- Local operation with 3 push buttons (⊕, ⊖, Ⓜ)
- Operating elements also accessible in various hazardous areas

Additional functionality

The display module offers:

- 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.

On-site operation



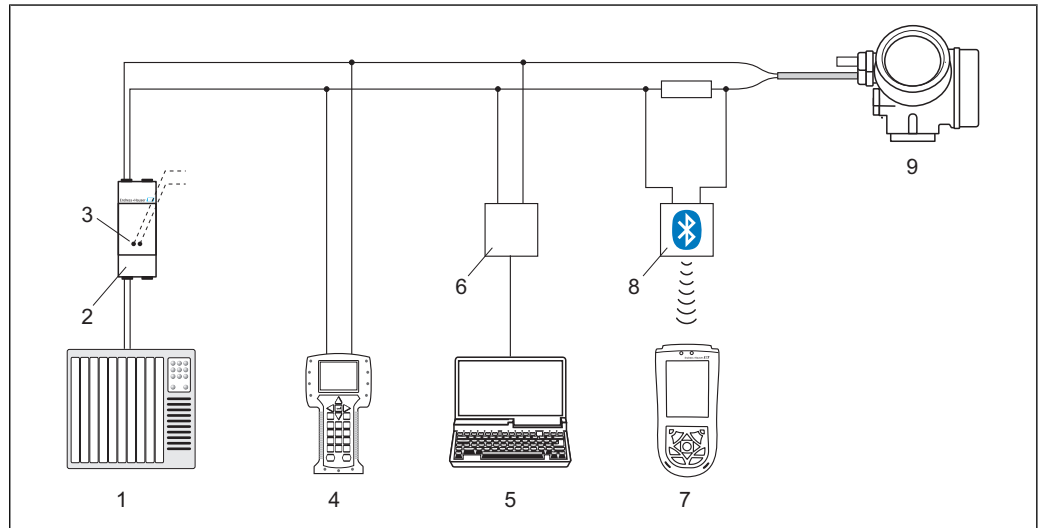
5 On-site operation options

- 1 Display module SD02, push buttons; cover must be open for operation
- 2 Operating options via CDI interface (= Endress+Hauser Common Data Interface)
 - 2.1 Computer with operating tool (FieldCare)
 - 2.2 Commubox FXA291, connected to the CDI interface of the device

Remote operation

Operation via:

- HART protocol
- Operating tools
 - FieldCare (→ 50)
 - AMS Device Manager
 - SIMATIC PDM



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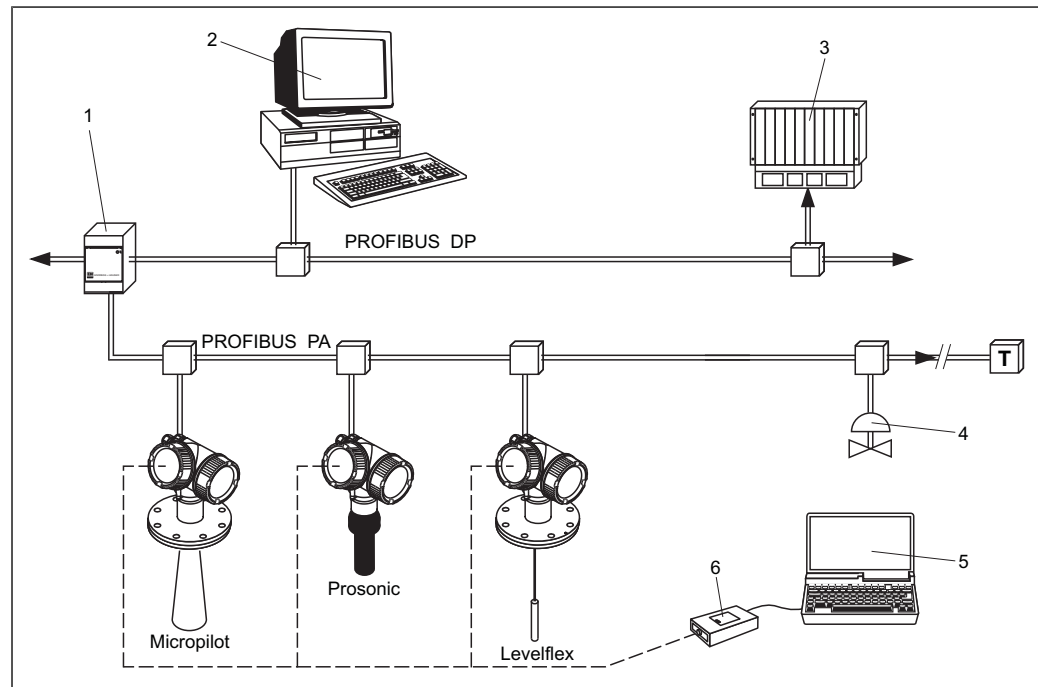
6 Options for remote operation via HART protocol

- 1 PLC (programmable logic controller)
- 2 Transmitter power supply unit, e.g. RN221N (with communication resistor)
- 3 Connection for Commubox FXA195 and Field Communicator 375, 475
- 4 Field Communicator 375, 475
- 5 Computer with operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)
- 6 Commubox FXA195 (USB)
- 7 Field Xpert SFX100
- 8 VIATOR Bluetooth modem with connecting cable
- 9 Transmitter

System integration

System integration via PROFIBUS PA

A maximum of 32 devices (8 if mounted in an explosion hazardous location EEx ia IIC according to FISCO-model) can be connected to the bus. The segment coupler provides the operating voltage to the bus. Both on-site as well as remote operation are possible.



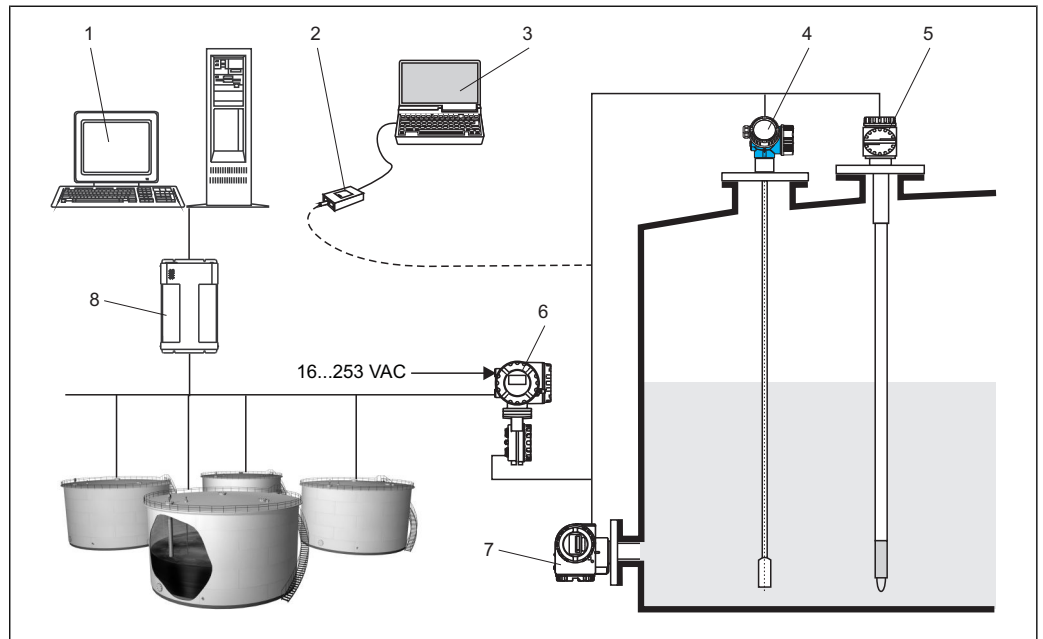
A0011275

7 The complete measuring system consists of devices and:


- 1 Segment coupler
- 2 Computer with Profiboard/Proficard and operating tool (FieldCare)
- 3 PLC (programmable logic controller)
- 4 More functions (valves etc.)
- 5 Computer with operating tool (FieldCare)
- 6 Commubox FXA291 (CDI interface)

Integrated 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.



A0011277

-  8 The complete measuring system consists of:
- 1 Computer with Fuels Manager Software
 - 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 Remote Terminal Unit RTU8130

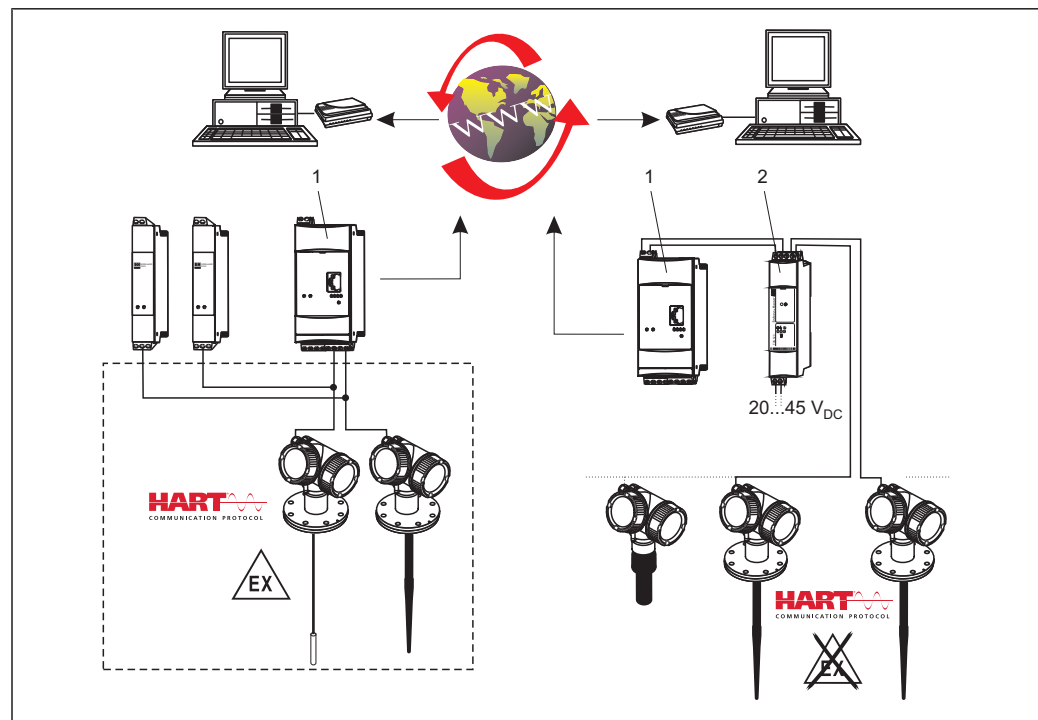
System integration via Fieldgate

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.






A0011278

9 The complete measuring system consists of devices and:

- 1 Fieldgate FXA520
- 2 Multidrop Connector FXN520

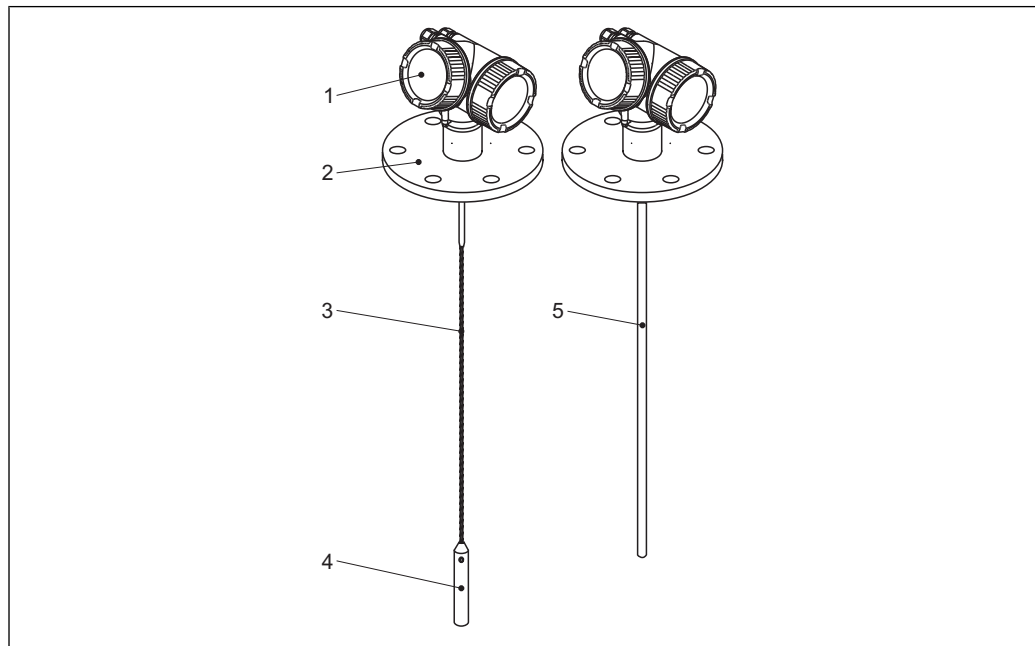
i The number of instruments which can be connected in multidrop mode can be calculated by the "FieldNetCalc" program. A description of this program can be found in Technical Information TI 400F (Multidrop Connector FXN520). The program is available from your Endress+Hauser sales organisation or in the 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>
Ex approval	<p>The devices are certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Safety Instructions" (XA) document. Reference is made to this document on the nameplate.</p> <p> The separate documentation "Safety Instructions" (XA) containing all the relevant explosion protection data is available from your Endress+Hauser Sales Center. Correlation of documentations to the device (→  51).</p>
Functional Safety (in preparation)	<p>Used for level monitoring (MIN, MAX, range) up to SIL 2, independently assessed by TÜV Rhineland as per IEC 61508. Other information see documentation "Functional Safety Manual".</p>
Marine certificate (in preparation)	<ul style="list-style-type: none"> ■ GL (Germanischer Lloyd) ■ ABS (American Bureau of Shipping) ■ NK (Nippon Kaiji Kyokai) ■ DNV (Det Norske Veritas) <p> Only in connection with HART or PROFIBUS PA.</p>
Telecommunications	<p>Complies with part 15 of the FCC rules for an unintentional radiator. All probes meet the requirements for a Class A digital device.</p> <p>In addition, all probes in metallic tanks as well as the coax probe meet the requirements for a Class B digital device.</p>
CRN approval (in preparation)	<p>Some device versions have CRN approval. For a CRN-approved device, a CRN-approved process connection has to be ordered with a CSA approval.</p>
Other standards and guidelines	<ul style="list-style-type: none"> ■ 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

Ordering information

Compact device Levelflex



A0012470

10 Design of the Levelflex

- 1 Electronics housing
- 2 Process connection (here as an example: flange)
- 3 Rope probe
- 4 End of probe weight
- 5 Rod probe

Product structure FMP56, FMP57



This overview does not mark options which are mutually exclusive.

Option with * = in preparation

010	Approval:	FMP	
		56	57
AA	Non-hazardous area	x	x
BA	ATEX II 1G Ex ia IIC T6	x	x
BB	ATEX II 1/2G Ex ia IIC T6	x	x
BE	ATEX II 1 D Ex tD IIIC IP6x	x	x
BF	ATEX II 1/2 D Ex tD IIIC IP6x	x	x
BG	ATEX II 3G Ex nA IIC T6	x	x
BH	ATEX II 3G Ex ic IIC T6	x	x
B2	ATEX II 1/2G Ex ia IIC T6, 1/2D Ex tD IIIC IP6x	x	x
B3	ATEX II 1/2G Ex d(ia) IIC T6, 1/2D Ex tD IIIC IP6x	x	x
CA	CSA General Purpose	x	x
CD	CSA C/US DIP Cl.I,II,III Div.1 Gr.E-G	x	x
C2	CSA C/US IS Cl.I,II,III Div.1 Gr.A-G, NI Cl.1 Div.2, Ex ia	x	x
C3	CSA C/US XP Cl.I,II,III Div.1 Gr.A-G, NI Cl.1 Div.2, Ex d	x	x
*FB	FM IS Cl.I,II,III Div.1 Gr.A-G, AEx ia, NI Cl.1 Div.2	x	x
*FD	FM XP Cl.I,II,III Div.1 Gr.A-G, AEx d, NI Cl.1 Div.2	x	x
*FE	FM DIP Cl.I,II,III Div.1 Gr. E_G	x	x
IA	IEC Ex Zone 0 Ex ia IIC T6 Ga	x	x
IB	IEC Ex Zone 0/1 Ex ia IIC T6 Ga/Gb	x	x

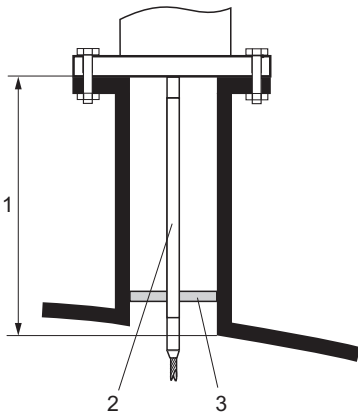
010	Approval:	FMP	
		56	57
IE	IEC Ex Zone 20 tD IIIC A20 IP6x Da	x	x
IF	IEC Ex Zone 20/21 tD IIIC A20/21 IP6x Da/Db	x	x
IG	IEC Ex Zone 2 Ex nA IIC T6 Gc	x	x
IH	IEC Ex Zone 2 Ex ic IIC T6 Gc	x	x
I2	IEC Ex Zone 0/1 Ex ia IIC T6 Ga/Gb, Zone 20/21 Ex tD IIIC A20/21 IP6x Da/Db	x	x
I3	IEC Ex Zone 0/1 Ex d(ia) IIC T6 Ga/Gb, Zone 20/21 Ex tD IIIC A20/21 IP6x Da/Db	x	x
*8A	FM/CSA IS+XP CL I,II,III Div.1 Gr.A-G	x	x
99	Special version, TSP-no. to be sepc.	x	x
020	Power Supply, Output	FMP	
		56	57
A	2-wire; 4-20mA HART	x	x
C	2-wire; 4-20mA HART, 4-20mA	x	x
*G	2-wire; PROFIBUS PA, switch output	x	x
K	4-wire 90-253VAC; 4-20mA HART	x	x
L	4-wire 10,4-48VDC; 4-20mA HART	x	x
Y	Special version, TSP-no. to be sepc.	x	x
030	Display, Operation:	FMP	
		56	57
A	W/o, via communication	x	x
C	SD02 4-line, push buttons + data backup function	x	x
Y	Special version, TSP-no. to be sepc.	x	x
040	Housing:	FMP	
		56	57
A	GT19 dual compartment, Plastics PBT	x	x
B	GT18 dual compartment, 316L	x	x
C	GT20 dual compartment, Alu coated	x	x
Y	Special version, TSP-no. to be sepc.	x	x
050	Electrical connection:	FMP	
		56	57
A	Gland M20, IP66/68 NEMA4X/6P	x	x
B	Thread M20, IP66/68 NEMA4X/6P	x	x
C	Thread G1/2, IP66/68 NEMA4X/6P	x	x
D	Thread NPT1/2, IP66/68 NEMA4X/6P	x	x
I	Plug M12, IP66/68 NEMA4X/6P	x	x
M	Plug 7/8", IP66/68 NEMA4X/6P	x	x
Y	Special version, TSP-no. to be sepc.	x	x
060	Probe:	FMP	
		56	57
AE	..... mm, rod 16mm 316L		x
AF	..... inch, rod 16mm 316L		x
LA	..... mm, rope 4mm 316	x	x
LB	..... inch, rope 1/6" 316	x	x

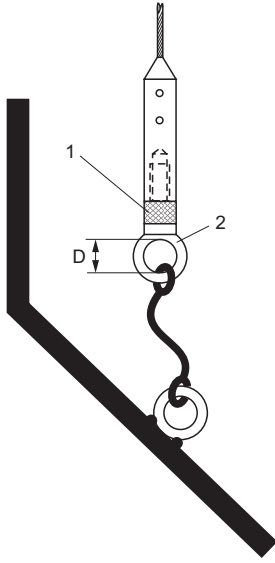

060	Probe:	FMP	
		56	57
LC	..... mm, rope 6mm 316		x
LD	..... inch, rope 1/4" 316		x
NB	..... mm, rope 6mm PA>Steel	x	x
NC	..... mm, rope 8mm PA>Steel		x
NE	..... inch, rope 1/4" PA>Steel	x	x
NF	..... inch, rope 1/3" PA>Steel		x
YY	Special version, TSP-no. to be sepc.	x	x
090	Seal:	FMP	
		56	57
AB	Viton, -30...120°C	x	
A4	Viton, -30...150°C		x
B3	EPDM, -40...120°C	x	x
Y9	Special version, TSP-no. to be sepc.	x	x
100	Process connection:	FMP	
		56	57
AEJ	1-1/2" 150lbs RF, 316/316L flange ANSI B16.5		x
AFJ	2" 150lbs RF, 316/316L flange ANSI B16.5		x
AGJ	3" 150lbs RF, 316/316L flange ANSI B16.5		x
AHJ	4" 150lbs RF, 316/316L flange ANSI B16.5		x
AJJ	6" 150lbs RF, 316/316L flange ANSI B16.5		x
AKJ	8" 150lbs RF, 316/316L flange ANSI B16.5		x
CFJ	DN50 PN10/16 B1, 316L flange EN1092-1		x
CGJ	DN80 PN10/16 B1, 316L flange EN1092-1		x
CHJ	DN100 PN10/16 B1, 316L flange EN1092-1		x
CJJ	DN150 PN10/16 B1, 316L flange EN1092-1		x
CKJ	DN200 PN16 B1, 316L flange EN1092-1		x
CQJ	DN40 PN10-40 B1, 316L flange EN1092-1		x
GDE	Thread ISO228 G3/4, 304	x	
GGE	Thread ISO228 G1-1/3, 304		x
KEJ	10K 40 RF, 316L flange JIS B2220		x
KFJ	10K 50 RF, 316L flange JIS B2220		x
KGJ	10K 80 RF, 316L flange JIS B2220		x
KHJ	10K 100 RF, 316L flange JIS B2220		x
RDE	Thread ANSI MNPT3/4, 304	x	
RGE	Thread ANSI MNPT1-1/2, 304		x
YYY	Special version, TSP-no. to be sepc.	x	x
500	Additional Operation Language:	FMP	
		56	57
AA	English	x	x
AB	German	x	x
AC	French	x	x
AD	Spanish	x	x

500	Additional Operation Language:	FMP	
		56	57
AE	Italian	x	x
AF	Dutch	x	x
AL	Japanese	x	x
550	Calibration:	56	57
*F4	5-point linearity protocol	x	x
F9	Special version, TSP-no. to be sepc.	x	x
570	Service: <i>(Multiple options can be selected)</i>	FMP	
		56	57
IJ	Customized parametrization HART	x	x
IK	Customized parametrization PA	x	x
IW	W/o Tooling DVD (FieldCare setup)	x	x
I9	Special version, TSP-no. to be sepc.	x	x
590	Additional Approval: <i>(Multiple options can be selected)</i>	FMP	
		56	57
*LA	SIL	x	x
L9	Special version, TSP-no. to be sepc.	x	x
600	Probe Design: <i>(Multiple options can be selected)</i>	FMP	
		56	57
MB	Sensor remote, 3m/9ft cable, detachable+mounting bracket	x	x
M9	Special version, TSP-no. to be sepc.	x	x
620	Accessory Enclosed: <i>(Multiple options can be selected)</i>	FMP	
		56	57
PG	Mounting kit, insulated, rope	x	x
R9	Special version, TSP-no. to be sepc.	x	x
850	Firmware Version:	FMP	
		56	57
77	01.00.zz, PROFIBUS PA, DevRev01	x	x
78	01.00.zz, HART, DevRev01	x	x
895	Tagging: <i>(Multiple options can be selected)</i>	FMP	
		56	57
Z1	Tagging (TAG), see additional spec.	x	x
Z2	Bus address, see additional spec.	x	x

Accessories


Device-specific accessories


Accessory	Description
Extension rod / centering HMP40	 <p>1 Nozzle height 2 Extension rod 3 Center washer</p> <p>A0013597</p>
010	Approval:
A	A: Non-hazardous area
M	M: FM DIP Cl.II Div.1 Gr.E-G N.I., zone 21,22
P	P: CSA DIP Cl.II Div.1 Gr.G + coal dust N.I.
S	S: FM Cl.I, II, III Div.1 Gr.A-G N.I., zone 0,1,2,20,21,22
U	U: CSA Cl.I, II, III Div.1 Gr.A-G N.I., zone 0,1,2
1	1: ATEX II 1G
2	2: ATEX II 1D
020	Extension rod; nozzle height:
1	115mm; 150-250mm / 6-10"
2	215mm; 250-350mm / 10-14"
3	315mm; 350-450mm / 14-18"
4	415mm; 450-550mm / 18-22"
9	Special version, TSP-no. to be spec.
030	Center washer:
A	Not selected
B	DN40 / 1-1/2", inside-d. = 40-45mm, PPS
C	DN50 / 2", inside-d. = 50-57mm, PPS
D	DN80 / 3", inside-d. = 80-85mm, PPS
E	DN80 / 3", inside-d. = 76-78mm, PPS
G	DN100 / 4", inside-d. = 100-110mm, PPS
H	DN150 / 6", inside-d. = 152-164mm, PPS
J	DN200 / 8", inside-d. = 210-215mm, PPS
K	DN250 / 10", inside-d. = 253-269mm, PPS
Y	Special version, TSP-no. to be spec.


Accessory	Description
Mounting kit, isolated	 <p>1 Insulating sleeve 2 Eye-bolt</p> <p>For reliably insulated fixing of the probe. Maximum process temperature: 150 °C (300 °F)</p> <p>For rope probes 4 mm (1/6 in):</p> <ul style="list-style-type: none"> ■ Eye-bolt M8 DIN 580 ■ Diameter D = 20 mm (0.8 in) ■ Order-No.: 52014249 <p>For rope probes 6 mm (1/4 in):</p> <ul style="list-style-type: none"> ■ Eye-bolt M10 DIN 580 ■ Diameter D = 25 mm (1 in) ■ Order-No.: 52014250 <p>Due to the risk of electrostatic charge, the insulating sleeve is not suitable for use in hazardous areas. In these cases the fixing must be reliably grounded.</p> <p> The mounting kit can also be ordered directly with the device (see the Levelflex product structure, feature 620 "Accessory Enclosed", option PG "Mounting kit, isolated, rope").</p>


A0013586


Communication-specific accessories


Accessory	Description
Commubox FXA195 HART	<p>For intrinsically safe HART communication with FieldCare via the USB interface.</p> <p> For details refer to Technical Information TI404F/00</p>


Accessory	Description
Commubox FXA291	<p>Connects Endress+Hauser field devices with CDI interface (= Endress+Hauser Common Data Interface) to the USB interface of a computer.</p> <p> For details refer to Technical Information TI405C/07</p>

Accessory	Description
HART Loop Converter HMX50	<p>Evaluates the dynamic HART variables and converts them to analog current signals or limit values.</p> <p> For details refer to Technical Information " TI429F/00 and Operating Instructions BA371F/00</p>


Accessory	Description
WirelessHART Adapter SWA70	<p>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.</p> <p> For details refer to Operating Instructions BA061S/04</p>

Accessory	Description
Fieldgate FXA320	<p>Gateway for remote monitoring of connected 4-20mA measuring devices via web browser.</p> <p> For details refer to Technical Information TI025S/04 and Operating Instructions BA053S/04</p>




Accessory	Description
Fieldgate FXA520	<p>Gateway for remote diagnosis and parametrization of connected HART measuring devices via web browser.</p> <p> For details refer to Technical Information TI025S/04/xx and Operating Instructions BA051S/04</p>

Accessory	Description
Field Xpert SFX100	<p>Compact, flexible and robust industry handheld terminal for remote parametrization and measured value inspection via the HART current output (4-20mA).</p> <p> For details refer to Operating Instructions BA060S/04</p>

Service-specific accessories

Accessory	Description
FieldCare	<p>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.</p> <p> For details refer to Operating Instructions BA027S/04 and BA059AS/04</p>

System components

Accessory	Description
Graphic Data Manager Memograph M	<p>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.</p> <p> For details refer to Technical Information TI133R/09 and Operating Instructions BA247R/09</p>
RN221N	<p>Active barrier with power supply for safe separation of 4 to 20 mA current circuits. Provides bi-directional HART transmission.</p> <p> For details refer to Technical Information TI073R/09 and Operating Instructions BA202R/09</p>
RNS221	<p>Transmitter supply for 2-wire sensors or transmitters exclusively for non-Ex areas. Provides bi-directional communication using the HART communication sockets.</p> <p> For details refer to Technical Information TI081R/09 and Operating Instructions KA110R/09</p>

Documentation

Standard 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

Levellflex FMP56, FMP57

Correlation of documentations to the device:

Device	Power supply, output	Communication	Document type	Document code
FMP56, FMP57	A, B, C, K, L	HART	Operating Instructions	BA01004F/00/DE
			Brief Operating Instructions	KA01061F/00/DE
			Description of Device Parameters	GP01000F/00/DE
	G	PROFIBUS PA	Operating Instructions	BA01009F/00/DE
			Brief Operating Instructions	KA01073F/00/DE
			Description of Device Parameters	GP01001F/00/DE

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

Description	Document type	Document code
Time of Flight Liquid Level Measurement Selection and engineering for the process industry	Special Documentation	SD157F/00/EN
Radar Tank Gauging brochure For inventory control and custody transfer applications in tank farms and terminals	Special Documentation	SD001V/00/EN
Engineering hints PROFIBUS PA Guidelines for planning and commissioning	Operating Instructions	BA198F/00/EN

Certificates

Safety Instructions (XA) for Levellflex FMP56, FMP57

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

FMP 56	FMP 57	Feature 010	Approval	Safety Instructions
x	x	BA	ATEX II 1 G Ex ia IIC T6 Ga	XA496F-A
x	x	BB	ATEX II 1/2 G Ex ia IIC T6 Ga/Gb	XA496F-A
x	x	BE	ATEX II 1 D Ex t[ia] IIIC Txx°C Da IP6x	XA501F-A
x	x	BF	ATEX II 1/2 D Ex t[ia] IIIC Txx°C Da/Db IP6x	XA501F-A
x	x	BG	ATEX II 3 G Ex nA IIC T6 Gc	XA498F-A
x	x	BH	ATEX II 3 G Ex ic IIC T6 Gc	XA498F-A
x	x	B2	ATEX II 1/2 G Ex ia IIC T6 Ga/Gb, II 1/2 D Ex t[ia] IIIC Txx°C Da/Db IP6x	XA502F-A
x	x	B3	ATEX II 1/2 G Ex d[ia] IIC T6 Ga/Gb, II 1/2 D Ex t[ia] IIIC Txx°C Da/Db IP6x	XA503F-A
x	x	IA	IECEx Zone 0 Ex ia IIC T6 Ga	XA496F-A
x	x	IB	IECEx Zone 0/1 Ex ia IIC T6 Ga/Gb	XA496F-A

FMP		Feature 010	Approval	Safety Instructions
56	57			
x	x	IE	IECEEx Zone 20 Ex t[ia] IIIC Txx°C Da IP6x	XA501F-A
x	x	IF	IECEEx Zone 20/21 Ex t[ia] IIIC Txx°C Da/Db IP6x	XA501F-A
x	x	IG	IECEEx Zone 2 Ex nA IIC T6 Gc	XA498F-A
x	x	IH	IECEEx Zone 2 Ex ic IIC T6 Gc	XA498F-A
x	x	I2	IECEEx Zone 0/1 Ex ia IIC T6 Ga/Gb, Zone 20/21 Ex t[ia] IIIC Txx°C Da/Db IP6x	XA502F-A
x	x	I3	IECEEx Zone 0/1 Ex d[ia] IIC T6 Ga/Gb, Zone 20/21 Ex t[ia] IIIC Txx°C Da/Db IP6x	XA503F-A

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

Registered trademarks

HART®

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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
5.827.985	—
5.884.231	—
5.973.637	—
6.087.978	955 527
6.140.940	—
6.481.276	—
6.512.358	1 301 914
6.559.657	1 020 735
6.640.628	—
6.691.570	—
6.847.214	—
7.441.454	—

US Patents	EP Patents
7.477.059	—
—	1 389 337

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