



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 (Profile 3.02)
 - FOUNDATION Fieldbus
- Used for level monitoring (MIN, MAX, range) up to SIL 2 (single device) or SIL 3 (redundancy, even if homogeneous), 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 to probe length
- 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, CSA, FM, NEPSI





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


Important document information

Document conventions








Safety symbols

Symbol	Meaning
 DANGER! A0011189-EN	DANGER! This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
 WARNING! A0011190-EN	WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
 CAUTION! A0011191-EN	CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
 NOTICE! A0011192-EN	NOTICE! This symbol contains information on procedures and other facts which do not result in personal injury.



Electrical symbols

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

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

Symbols in graphics

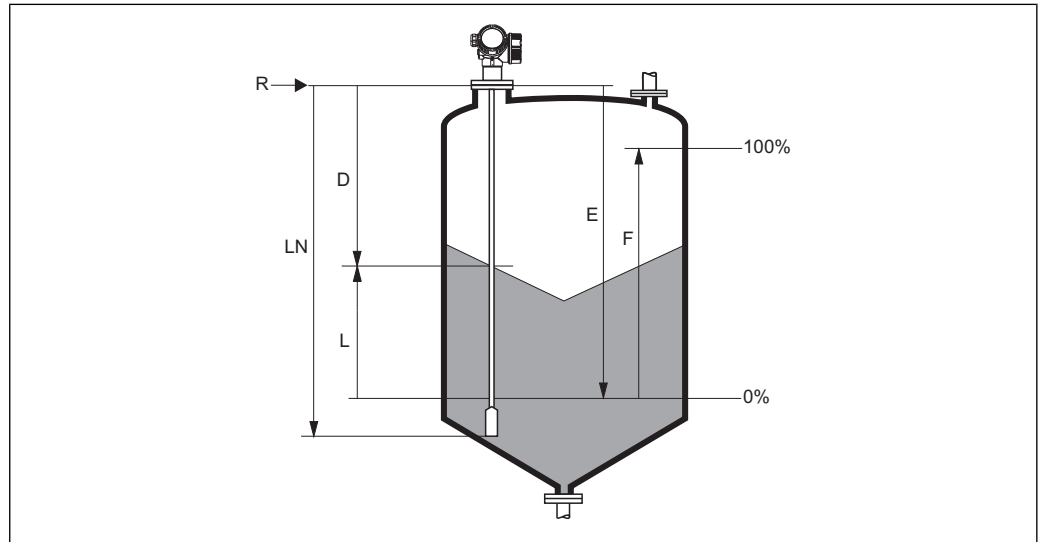
Symbol	Meaning
1, 2, 3 ...	Item numbers
1., 2., 3. ...	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections
 A001187	Hazardous area Indicates a hazardous area.
 A001188	Safe area (non-hazardous area) Indicates a non-hazardous location.

Function and system design

Measuring principle

Level measurement

The Levelflex 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).



LN = probe length

D = distance

L = level

R = reference point of measurement

E = empty calibration (= zero)

F = full calibration (= span)



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).

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:

$$L = E - D$$

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

■ FMP56: (→ 46)

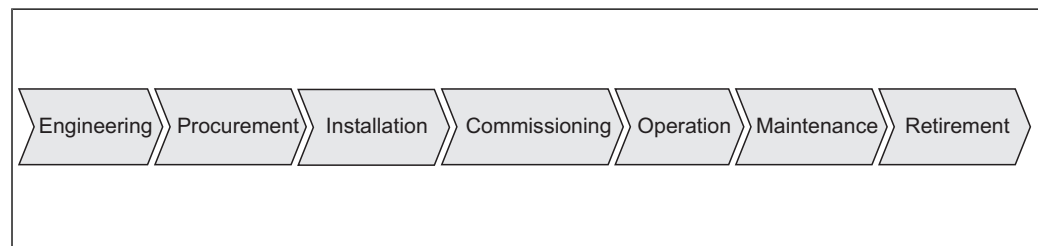
■ FMP57: (→ 47)

The Levelflex 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

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: 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

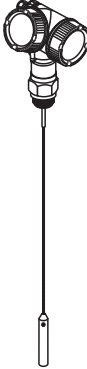
Measuring system


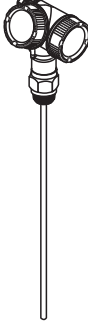
General notes on probe selection

- 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 such as wheat, flour etc.


Probe selection

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

Levelflex FMP56	
Type of probe	Rope probe
	
	<small>A0011388</small>
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 | 16 mm (316L)
			AF | 16 mm (316L)

Levelflex FMP57			
Type of probe	Rope probe		Rod probe
	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)
Max. tensile loading capacity	30 kN		
For application	level measurement in bulk solids		

 If required, rod and rope probes can be replaced. They are secured with Nord-Lock washers. For further information on service and spare parts please contact the Endress+Hauser service.

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>
Measuring range	<p>The following table describes the media groups and the possible measuring range as a function of the media group.</p>

Levelflex 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) Restrictions: for materials with a strong signal damping, e.g. ground material, wheat bran or silicic acid, the measuring range may be reduced.

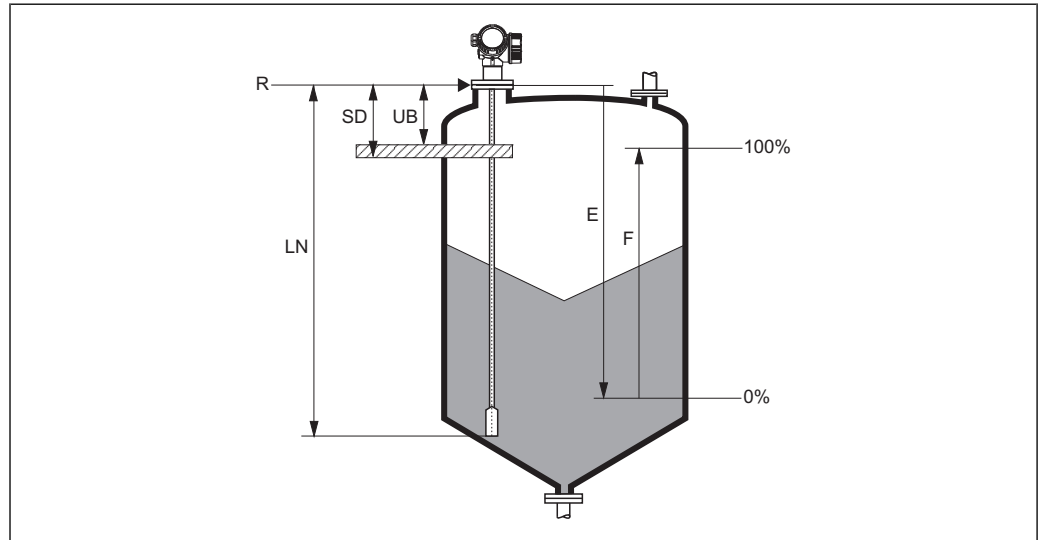
Levelflex FMP57					
Media group	DC (ϵ_r)	Typical bulk solids	Measuring range		
			bare metallic rod probes	bare metallic rope probes	PA-coated rope probes
1	1.4...1.6	plastic powder	4 m (13 ft) ¹⁾	20 to 25 m (66 to 82 ft)	—
2	1.6...1.9	<ul style="list-style-type: none"> ■ plastic granulate ■ white lime, 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 36 m (115 to 118 ft)
6	> 7	<ul style="list-style-type: none"> ■ metallic powder ■ carbon black ■ coal 	4 m (13 ft)	45 m (148 ft)	36 to 45 m (118 to 148 ft)

1) Restrictions: for materials with a strong signal damping, e.g. ground material, wheat bran or silicic acid, the measuring range may be reduced.

- i** ■ 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.



A0013628

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

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

For rod and rope probes and for media with DC > 7 (or generally for stilling well/bypass applications) the blocking distance may be reduced to 100 mm (4").

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

i A safety distance SD can be defined in addition to the blocking distance. A warning is generated if the level rises into this safety distance.

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	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

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	0x34
HART specification	6.0
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. Measured values for PV (primary variable) <ul style="list-style-type: none"> ■ Level linearized ■ Distance ■ Electronic temperature ■ Relative echo amplitude Measured values for SV, TV, FV (second, third and fourth variable) <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	<p>Analog Input:</p> <ul style="list-style-type: none"> ■ Level linearized ■ Distance ■ Terminal voltage ■ Electronic temperature ■ Absolute echo amplitude ■ Relative echo amplitude ■ Calculated DC <p>Digital Input:</p> <ul style="list-style-type: none"> ■ Extended diagnostic blocks ¹⁾ ■ Status output PFS Block
Input values	<p>Analog Output:</p> <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 <p>Digital Output:</p> <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 Simple device identification via control system and nameplate ■ Automatic Ident Number Adoption GSD compatibility mode with respect to the previous device Levelflex M FMP4x ■ Physical Layer Diagnostics Installation check of the PROFIBUS segment and the Levelflex FMP4x via terminal voltage and telegram monitoring ■ PROFIBUS Up-/Download Up to 10 times faster reading and writing of parameters via PROFIBUS Up-/Download ■ Condensed Status Simple and self-explanatory diagnostic information due to categorization of diagnostic messages

1) in preparation

FOUNDATION Fieldbus

Manufacturer ID	452B48 hex
Device type	1022 hex
Device Revision	02 hex
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)	6.01
ITK Test Campaign Number	IT080500
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
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.	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
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
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

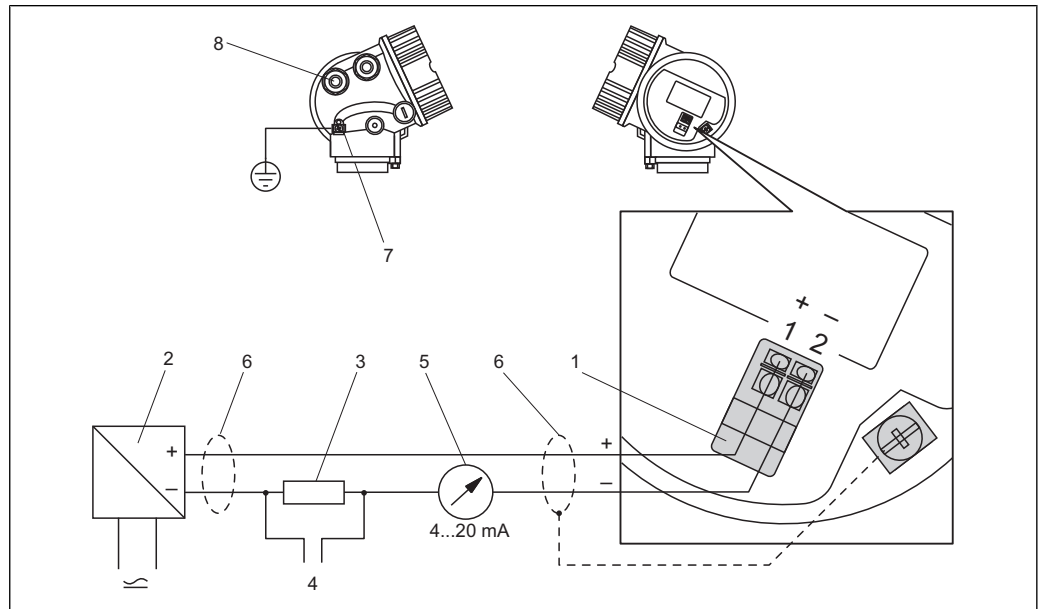
 Up to 20 blocks can be instantiated in the device altogether, including the blocks already instantiated on delivery.

Auxiliary energy

Electrical connection

2-wire, 4-20mA HART

Without integrated overvoltage protection

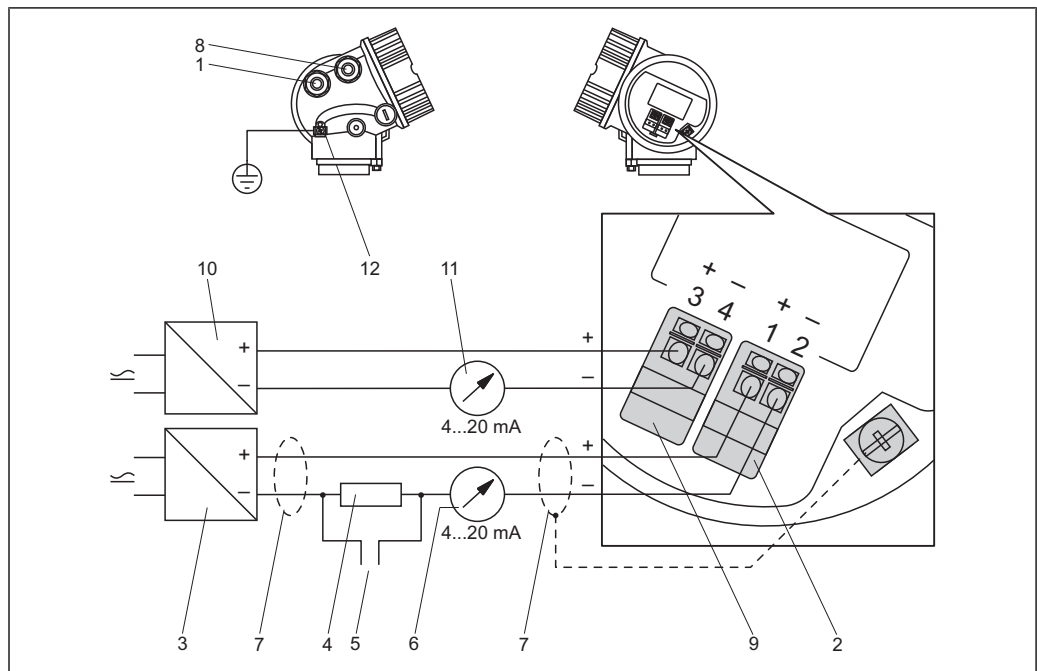


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- 1 Terminal 4...20mA HART passive
- 2 Active barrier with power supply (e.g. RN221N): Observe terminal voltage (→ 20)
- 3 HART communication resistor ($\geq 250 \Omega$): Observe maximum load (→ 23)
- 4 Connection for Field Communicator 375/475 or Commubox FXA195
- 5 Analog display device: Observe maximum load (→ 23)
- 6 Observe cable specification (→ 21)
- 7 Potential equalization
- 8 Cable entry

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

Without integrated overvoltage protection



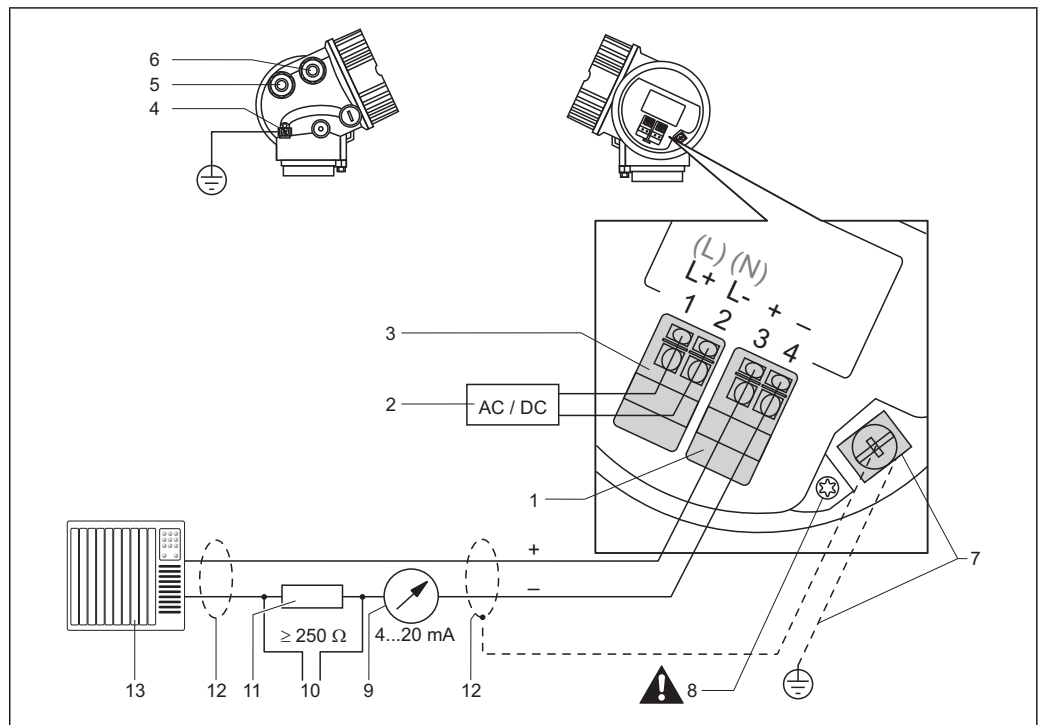
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- 1 Cable entry for current output 1
- 2 Terminal for current output 1
- 3 Supply voltage for current output 1 (e.g. RN221N); Observe terminal voltage (→ 20)
- 4 HART communication resistor ($\geq 250\Omega$); Observe maximum load (→ 23)
- 5 Connection for Field Communicator 375/475 or Commubox FXA195
- 6 Analog display device ; observe maximum load (→ 23)
- 7 Observe cable specification (→ 21)
- 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 (→ 20)
- 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 (terminals 1 and 2) must be used.

4-wire, 4-20 mA HART

Without integrated overvoltage protection



A0011340

- 1 Terminal 4...20mA HART active
- 2 Supply voltage: Observe terminal voltage (-> 20), observe cable specification (-> 21)
- 3 Terminal supply voltage
- 4 Potential equalization
- 5 Cable entry for power supply
- 6 Cable entry for signal line
- 7 Protective earth, observe cable specification (-> 21)
- 8 Protective connection; do not disconnect!
- 9 Analog display device: Observe maximum load (-> 23)
- 10 Connection Field Communicator 375/475 or Commubox FXA195
- 11 HART communication resistor ($\geq 250 \Omega$): Observe maximum load (-> 23)
- 12 Signal cable including screening (if required), observe cable specification (-> 21)
- 13 Evaluation unit, e.g. PLC

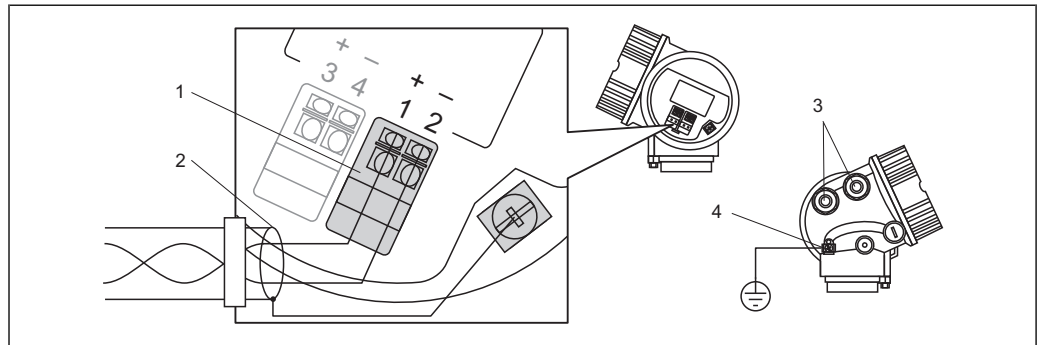
CAUTION

To ensure electrical safety:

- ▶ Do not disconnect the protective earth connection (8).
- ▶ Disconnect the supply voltage before disconnecting the protective earth (7).

- i** Connect protective earth (7) to the internal ground terminal (7) before connecting the supply voltage. If necessary, connect the potential matching line to the external ground terminal (4).
- 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 disconnector for the device (IEC/EN61010).

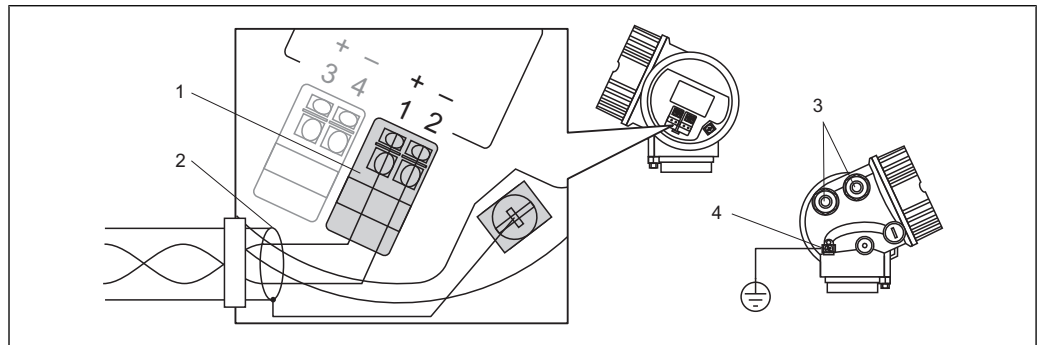
PROFIBUS PA



A0011341

- 1 Terminals PROFIBUS PA
- 2 Cable screen: Observe cable specifications
- 3 Cable entry
- 4 Potential equalization

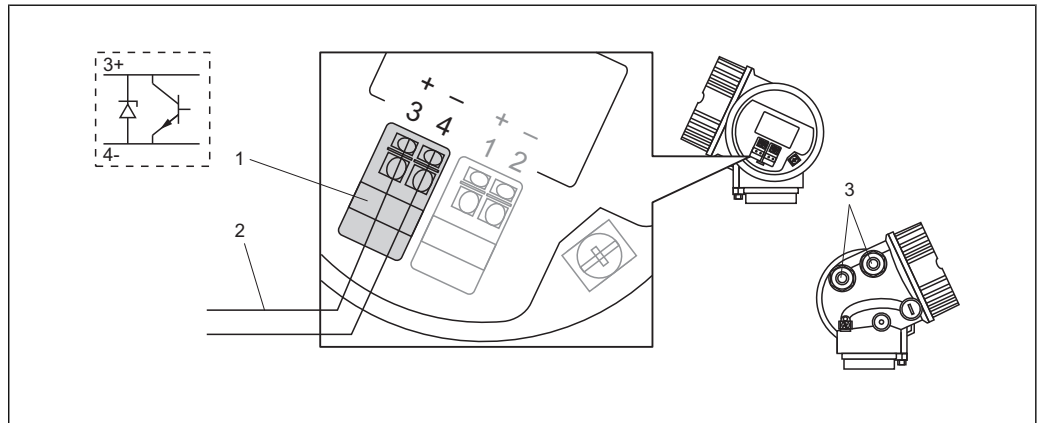
FOUNDATION Fieldbus



A0011341

- 1 Terminal assignment FOUNDATION Fieldbus
- 1 Terminals FOUNDATION Fieldbus
- 2 Cable screen: Observe cable specifications (→ 21)
- 3 Cable entry
- 4 Potential equalization

Switch output

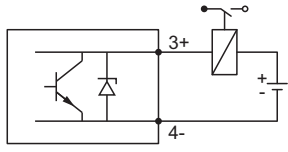


A0013759

- 1 Terminals switching output (Open collector)
- 2 Connection cable switching output
- 3 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	$U = 10.4 \text{ to } 35 \text{ V}_{DC}$, $I = 0 \text{ to } 40 \text{ mA}$
Internal resistance	$R_I < 880 \Omega$ The voltage drop at this internal resistance has to be taken into account on planning the configuration. For example, the resulting voltage at a connected relay must be sufficient to switch the relay.
Insulation voltage	floating, Insulation voltage 1350 V_{DC} to power supply and 500 V_{AC} to ground
Switch point	freely programmable, separately for switch-on and switch-off point
Switching delay	freely programmable from 0 to 100 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

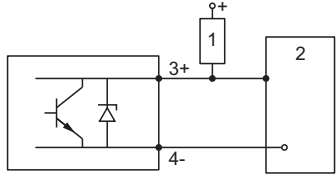
Connection examples for the switch output



2 Connection of a relay

Suitable relays (examples):

- 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



3 Connection of a digital input

1 Pull-up resistor
2 Digital input

Supply voltage

An external power supply is required.

i Various supply units can be ordered from Endress+Hauser: see "Accessories" section (→ 69)

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 ³⁾	Non-Ex, Ex nA, CSA GP
		11.5 to 32 V ³⁾	Ex ic
		11.5 to 30 V ³⁾	Ex ia / IS
		13.5 to 30 V ⁴⁾	Ex d / XP, Ex ic(ia), Ex tD / DIP
C: 2-wire; 4-20mA HART, 4-20mA	1	13.5 to 30 V ⁴⁾	all
	2	12 to 30 V	all

- 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 14 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 $I \geq 4.5\text{ mA}$ (HART multidrop mode), a voltage of 10,4 V is sufficient throughout the entire range of ambient temperatures.
- 4) 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).

i Load (→ 23)

Residual ripple:

- $< 1\text{ V}_{SS}$ (0 to 100 Hz)
- $< 10\text{ mV}_{SS}$ (100 to 10 000 Hz)

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), overvoltage category II
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 of the product structure

FOUNDATION Fieldbus

"Power supply; Output" ¹⁾	Terminal voltage
E: 2-wire; FOUNDATION Fieldbus, switch output	9 to 30 V _{DC} (Ex) 9 to 32 V _{DC} (non Ex)
Device withstanding voltage	35 V
Polarity sensitive	No
FISCO/FNICO compliant according to IEC 60079-27	Yes

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
 - Metal M20x1.5 with cable Ø 7 to 10 mm (0.28 to 0.39 in): dust-Ex, FM IS, CSA IS, CSA GP, Ex nA
- 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

HART

- For ambient 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.


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

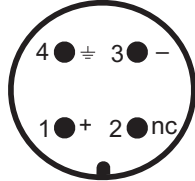
- Endress+Hauser recommends using twisted, shielded two-wire cables.
- Terminals for wire cross-sections: 0.5 to 2.5 mm² (20 to 14 AWG)
- Cable outer diameter: 5 to 9 mm (0.2 to 0.35 in)

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

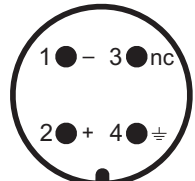
Device plug connectors

 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: center; 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: center; font-size: small;">A0011176</p>	Pin	Meaning
	1	Signal -
	2	Signal +
	3	not connected
4	Ground	

Power consumption

"Power supply; Output" ¹⁾	Power consumption
A: 2-wire; 4-20mA HART	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	14 mA
Error current FDE (Fault Disconnection Electronic)	0 mA

FISCO

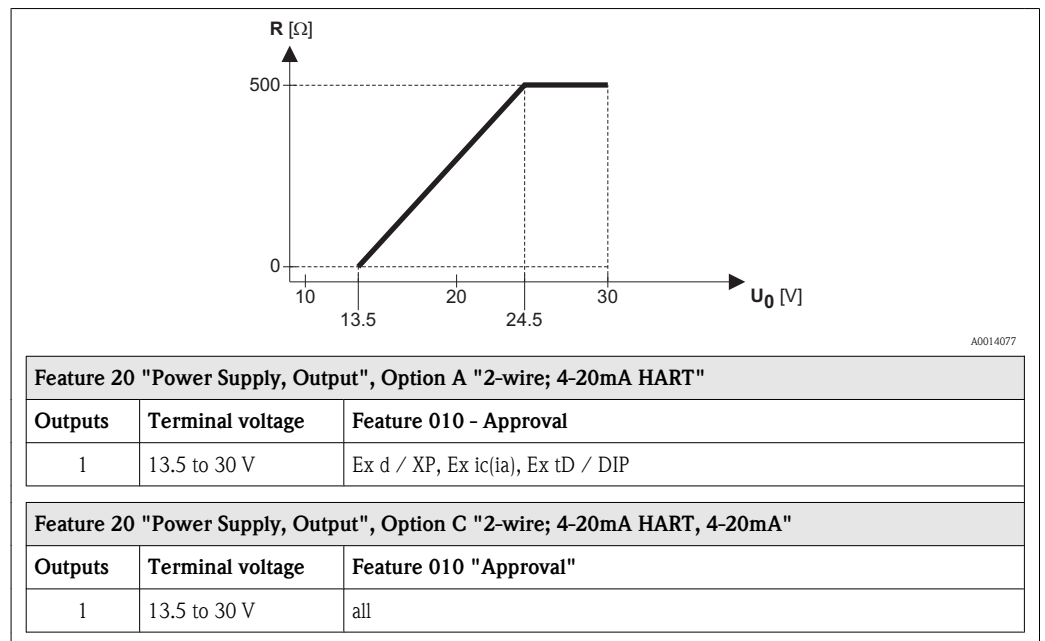
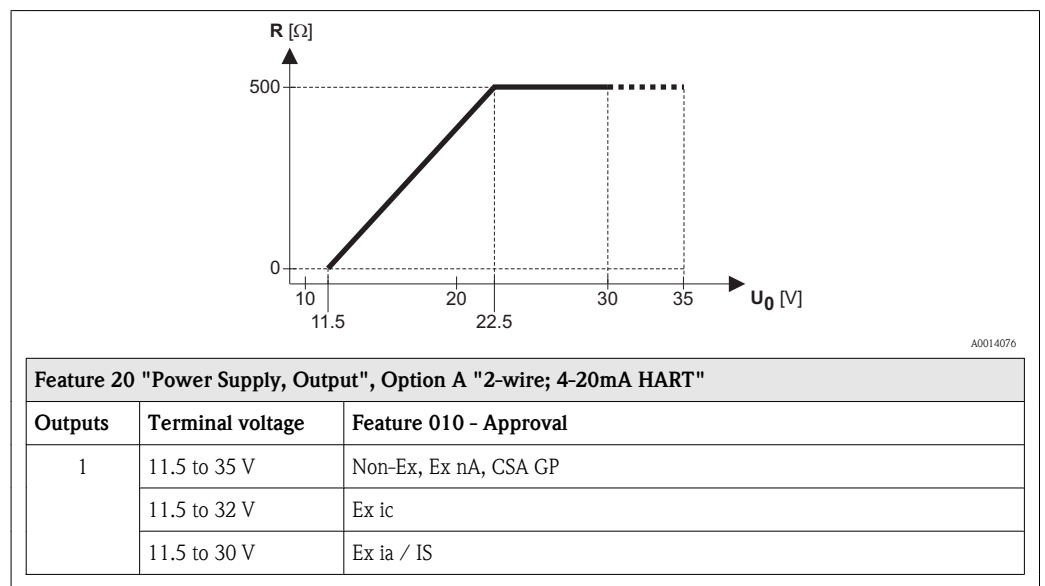
U_i	17.5 V
I_i	500 mA; with surge arrester 273 mA
P_i	5.5 W; with surge arrester 1.2 W
C_i	5 nF
L_i	0.01 mH

Power supply failure

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

Maximum load

In order to ensure a sufficient terminal voltage at the device, the load resistance R (including wire resistance) must not exceed a value depending on the voltage U_0 supplied by the supply unit.



For 4-wire devices (feature 020, options "K" and "L") the admissible load is 0 to 500 Ω.

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 µs), 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 HAW562 or HAW569.



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 %
- Reflection factor ≥ 0,8 (metal plate for rod and rope probe with min. 1 mm (0.04 in) diameter)
- Flange for rod or rope probe ≥ 300 mm (12 in) diameter
- Distance to obstacles ≥ 1 m (40 in)

Maximum measured error

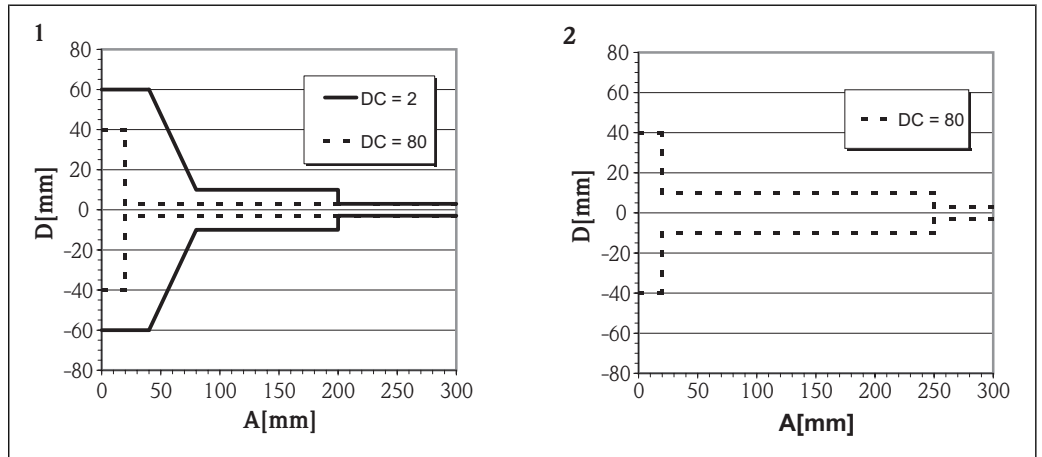
Typical data under reference operating conditions: DIN EN 61298-2, percentage values in relation to the span.

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

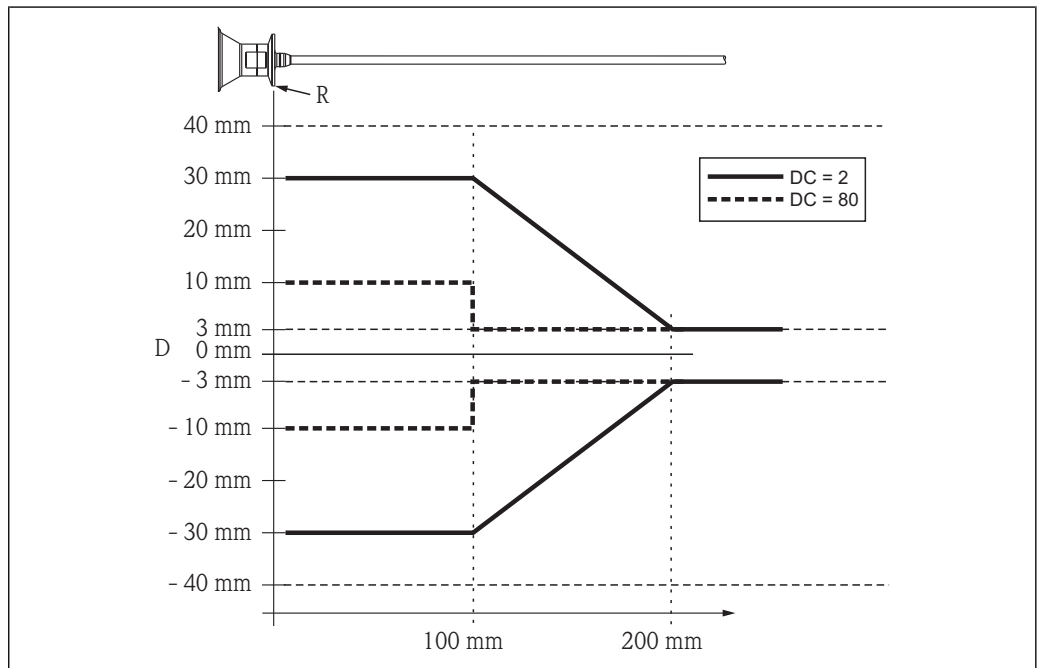


A0016580

- 1 Rod or coax probe
- 2 Rope probe
- A Distance from probe end
- D Sum of non-linearity, non-repeatability and hysteresis

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):



A0015091

- D Sum of non-linearity, non-repeatability and hysteresis
- R Reference point of measurement
- DC Dielectric constant

Resolution

- digital: 1 mm
- analog: 1 μ A

Reaction time

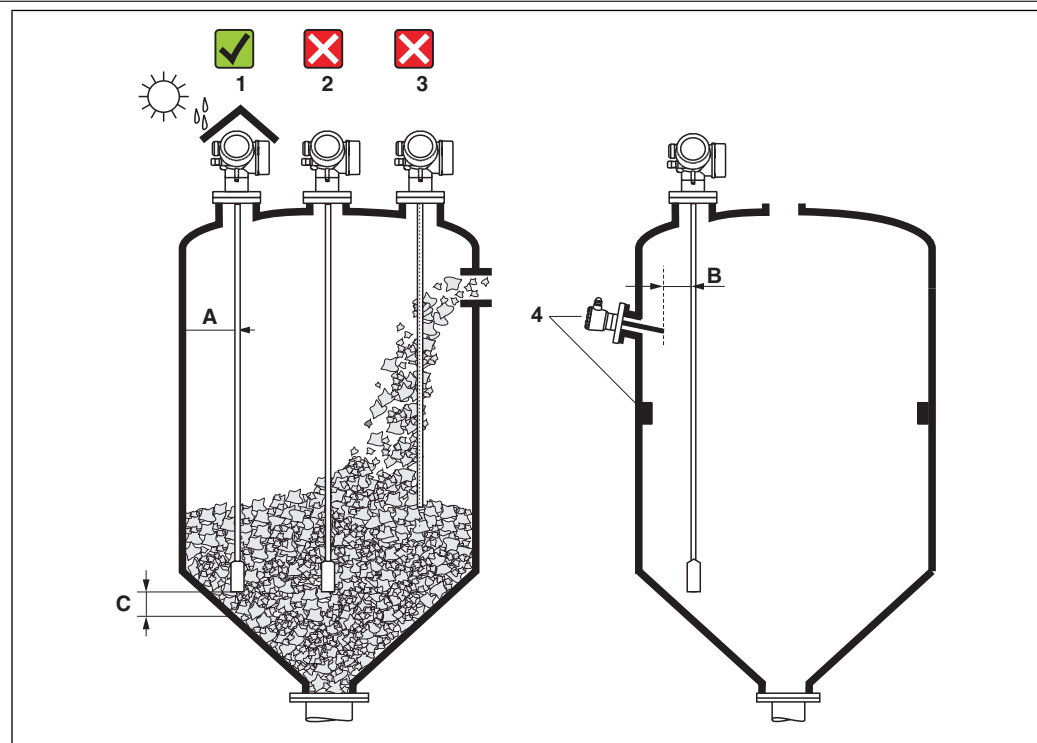
The reaction time can be parametrized. The following step response times (as per DIN EN 61298-2)¹⁾ are valid if the damping is switched off:

Level measurement		
Probe length	Sampling rate	Step response time
< 10 m (33 ft)	3.6 measurements/second	< 0.8 s
< 40 m (131 ft)	≥ 2.7 measurements/second	< 1 s

Influence of ambient temperature
The measurements are carried out in accordance with EN 61298-3

- digital (HART, PROFIBUS PA): 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-EN

Mounting distances

- Distance (A) between wall and rod or rope probe:
 - for smooth metallic walls: > 50 mm (2")
 - for plastic walls: > 300 mm (12") mm to metallic parts outside the vessel
 - for concrete walls: > 500 mm (20") , otherwise the available measuring range may be reduced.
- Distance (B) between rod or rope probe and internal fittings in the vessel: > 300 mm (12")
- Distance (C) from end of probe to bottom of the vessel:
 - Rope probe: > 150 mm (6 in)
 - Rod probe: > 10 mm (0.4 in)

1) According to DIN EN 61209-2 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.

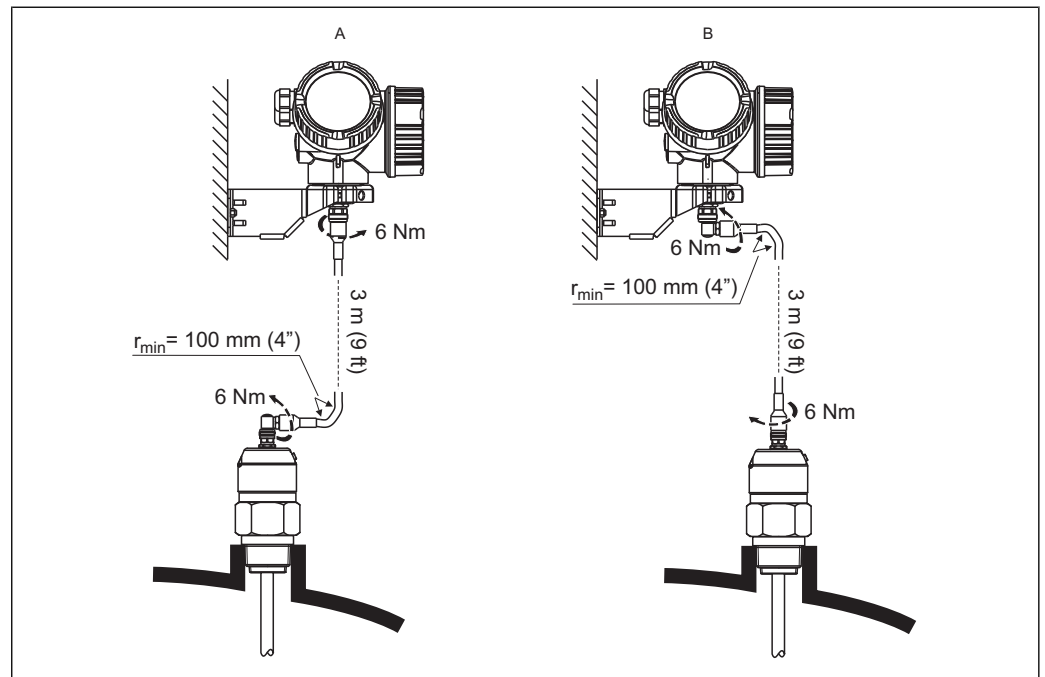
Additional conditions

- When mounting in the open, a weather protection cover (1) may be installed to protect the device against extreme weather conditions.
 - In metallic vessels: Preferably do not mount the probe in the center of the vessel (2), as this would lead to increased interference echoes.
If a central mounting position can not be avoided, it is crucial to perform an interference echo suppression(mapping) after the commissioning of the device.
 - 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 / electronics compartment and the wall. Otherwise the connection compartment / electronics compartment is not accessible after installation.

Applications with restricted mounting space

Mounting with remote sensor

The device version with a remote sensor is suited for applications with restricted mounting space. In this case the electronics housing is mounted at a separate position from which it is easier accessible.



A Angled plug at the probe
 B Angled plug at the electronics housing

- Levelflex version (see product structure):
 Feature 600 "Probe Design", Option MB "Sensor remote, 3m/9ft cable, detachable+mounting bracket" (→ 61)
- A connecting cable is supplied with this device version
 - Length: 3 m (9 ft)
 - Minimum bending radius: 100 mm (4 inch)
- A mounting bracket for the electronics housing is supplied with this device version. Mounting options:
 - Wall mounting
 - Pipe mounting; diameter: 42 to 60 mm (1-1/4 to 2 inch)
- The connection cable has got one straight and one angled plug (90°). Depending on the local conditions the angled plug can be connected at the probe or at the electronics housing.

Notes on the mechanical load of the probe **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	20
	NB, NE	Rope 6mm (1/4") PA>Steel	12	20
FMP57	LA, LB	Rope 4mm (1/6") 316	12	20
	LC, LD	Rope 6mm (1/4") 316	30	42
	NB, NE	Rope 6mm (1/4") PA>Steel	12	20
	NC, NF	Rope 8mm (1/3") PA>Steel	30	42

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

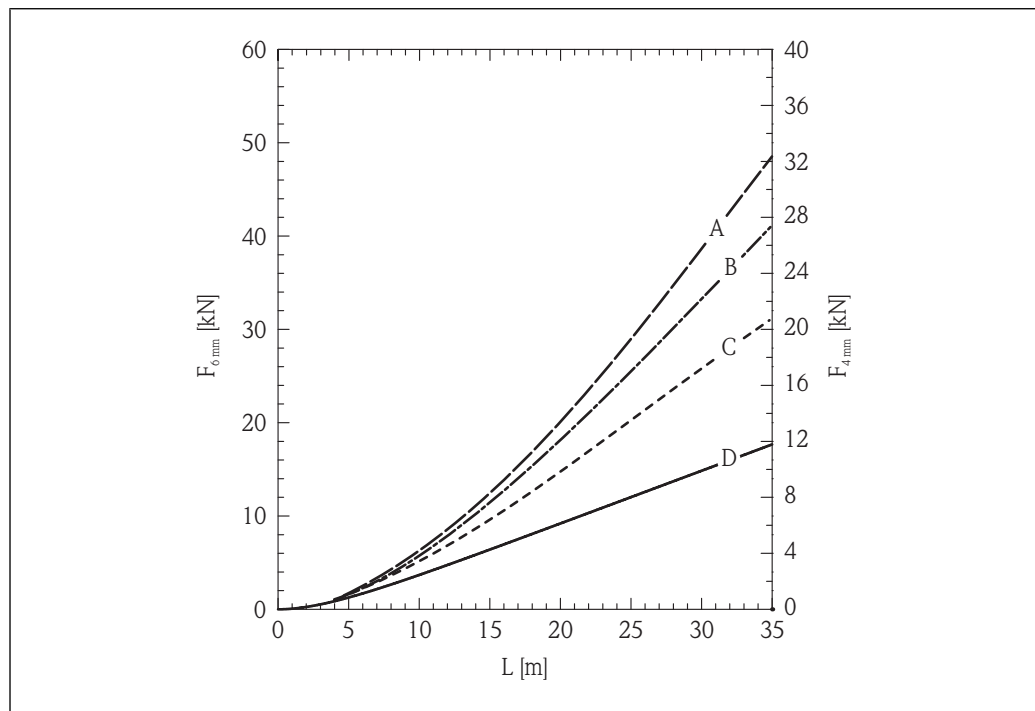
Tensile load

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

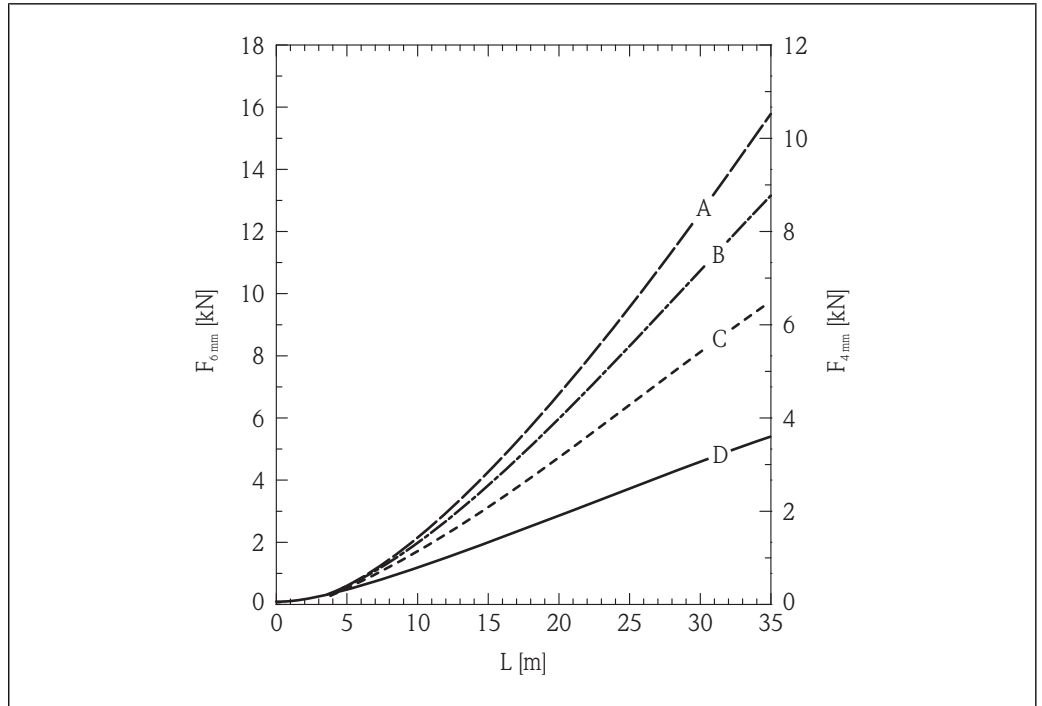
The following diagrams show typical loads for frequently occurring bulk solids as reference values. The calculation is performed for the following conditions:

- Calculation according to DIN 1055, Part 6 for the cylindrical part of the silo.
- 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 (in addition to the safety factors already taken into account by DIN 1055), which compensates for the normal fluctuation range in pourable bulk solids.



4 Silica sand in silo with smooth metallic walls; tensile load as a function of level L for rope diameters 6mm (0,24 in) and 4mm (0,16 in)

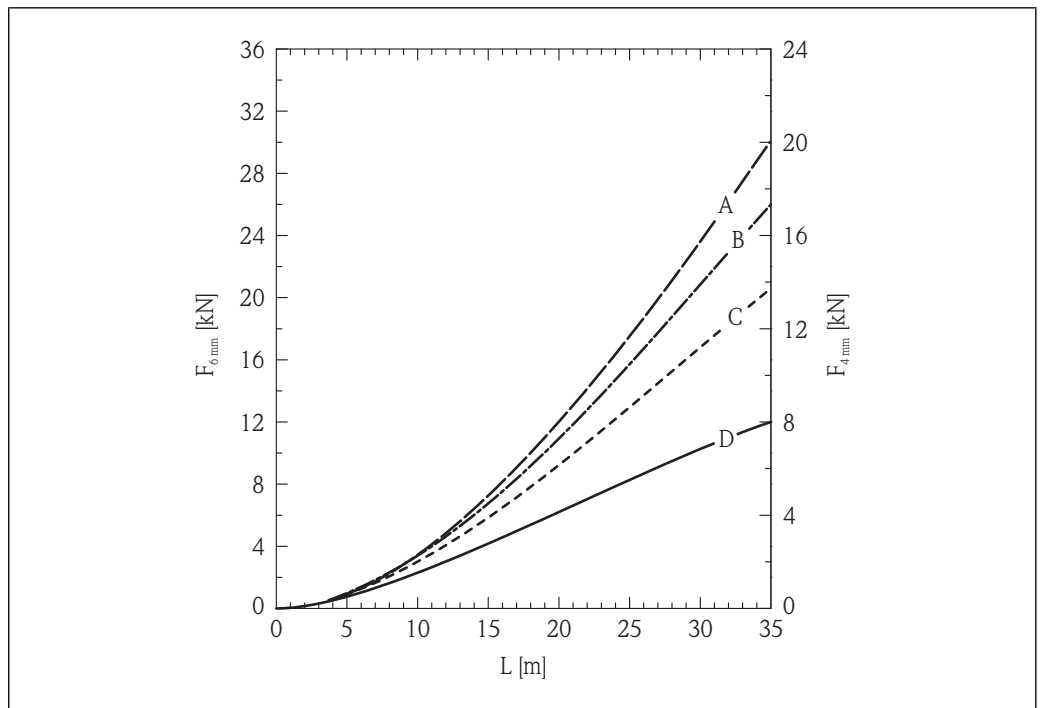
- A Silo diameter 12 m (40 ft)
- B Silo diameter 9 m (30 ft)
- C Silo diameter 6 m (20 ft)
- D Silo diameter 3 m (10 ft)



A0017171

5 Polyethylene pellets in silo with smooth metallic walls; tensile load as a function of level L for rope diameters 6mm (0,24 in) and 4mm (0,16 in)

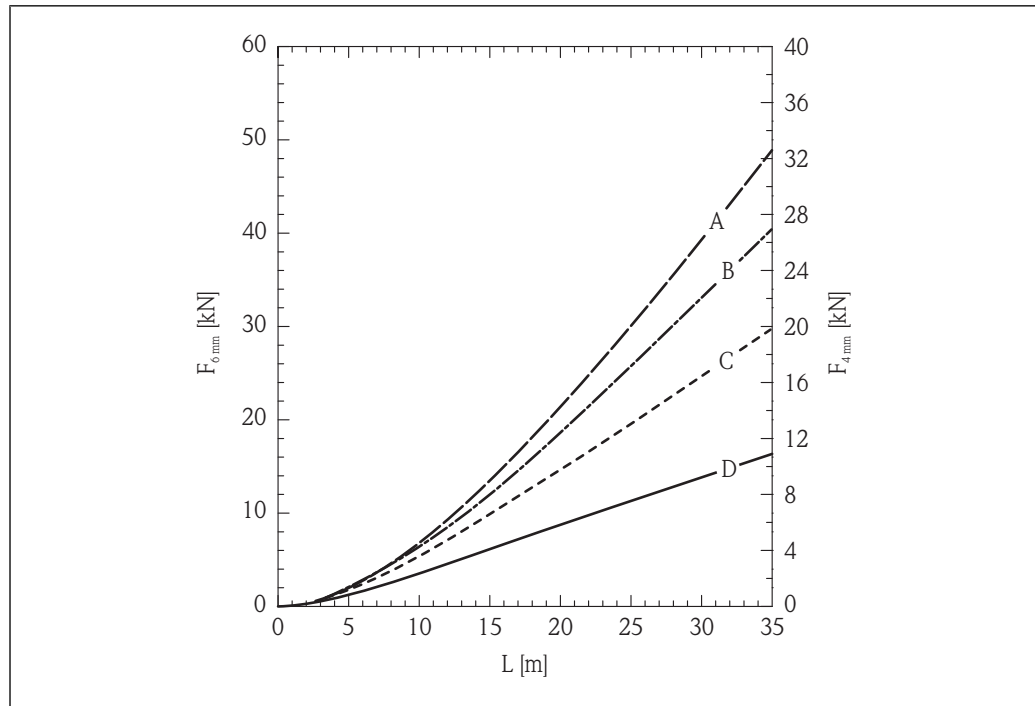
- A Silo diameter 12 m (40 ft)
- B Silo diameter 9 m (30 ft)
- C Silo diameter 6 m (20 ft)
- D Silo diameter 3 m (10 ft)



A0017172

6 Wheat in silo with smooth metallic walls; tensile load as a function of level L for rope diameters 6mm (0,24 in) and 4mm (0,16 in)

- A Silo diameter 12 m (40 ft)
- B Silo diameter 9 m (30 ft)
- C Silo diameter 6 m (20 ft)
- D Silo diameter 3 m (10 ft)



A0017173

7 Cement in silo with smooth metallic walls; tensile load as a function of level L for rope diameters 6mm (0,24 in) and 4mm (0,16 in)

- A Tank diameter 12 m (40 ft)
- B Tank diameter 9 m (30 ft)
- C Tank diameter 6 m (20 ft)
- D Tank diameter 3 m (10 ft)

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.

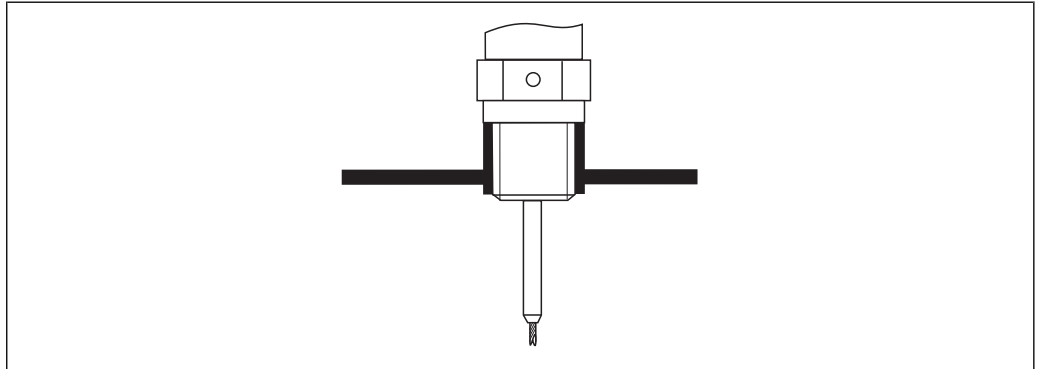
Bending strength of rod probes

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

Notes on the process connection

Probes are mounted to the process connection with threaded connections or flanges. 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 (→ 33).

Threaded connection



A0015121

8 Mounting with threaded connection; flush with the container ceiling

Seal

The thread as well as the type of seal comply to DIN 3852 Part 1, screwed plug form A.

They can be sealed with the following types of sealing rings:

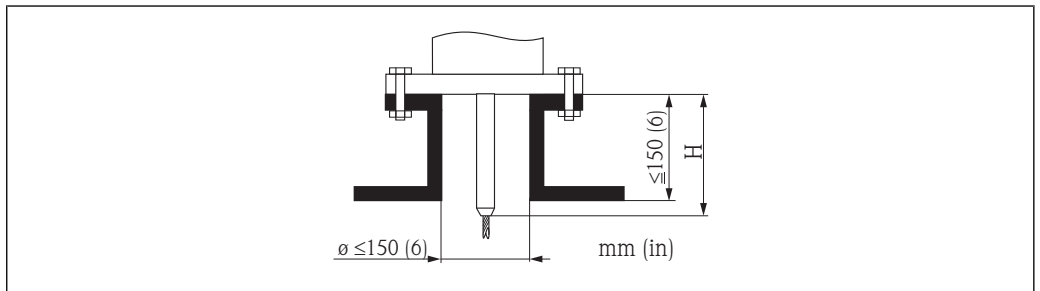
- Thread G3/4": According to DIN 7603 with the dimensions 27 x 32 mm
- Thread G1-1/2": According to DIN 7603 with the dimensions 48 x 55 mm

Please use a sealing ring according to this standard in the form A, C or D and of a material that is resistant to the application.

i For the length of the screwed plug refer to the dimensional drawing:

- FMP56: (→ 46)
- FMP57: (→ 47)

Nozzle mounting with flange



A0015122

Length H of the rigid part of the rope probe

Probe	H
FMP56, \varnothing rope 4 mm (0.16 in)	94 mm (3.7 in)
FMP57, \varnothing rope 4 mm (0.16 in)	120 mm (4.7 in)
FMP57, \varnothing rope 6 mm (0.24 in)	135 mm (5.3 in)

Hight and diameter of the nozzle

- Permissible nozzle diameter: ≤ 150 mm (6 in).
For larger diameters the near range measuring capability may be reduced.
For nozzles ≥ DN300: .
- Permissible nozzle height ²⁾: ≤ 150 mm (6 in).
For a larger height the near range measuring capability may be reduced.
Larger nozzle heights may be possible in special cases (see section "Rod extension/centering HMP40 for FMP57").

i With thermally insulated vessels the nozzle should also be insulated in order to prevent condensate formation.

Rod extension/centering HMP40 for FMP57

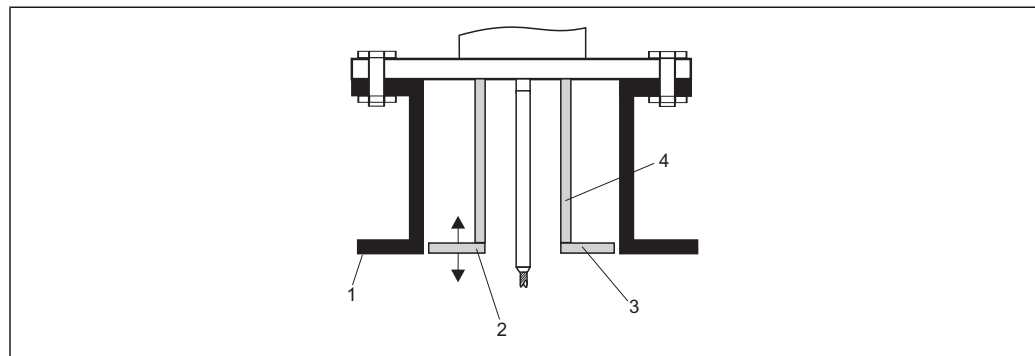
For FMP57 with rope probes the rod extension/centering HMP 40 is available as an accessory . It has to be used if otherwise the probe rope comes into contact with the lower edge of the nozzle.

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.

Centering disks with small diameters (DN40 and DN50) may only be used 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 ≥ DN300

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



A0014199

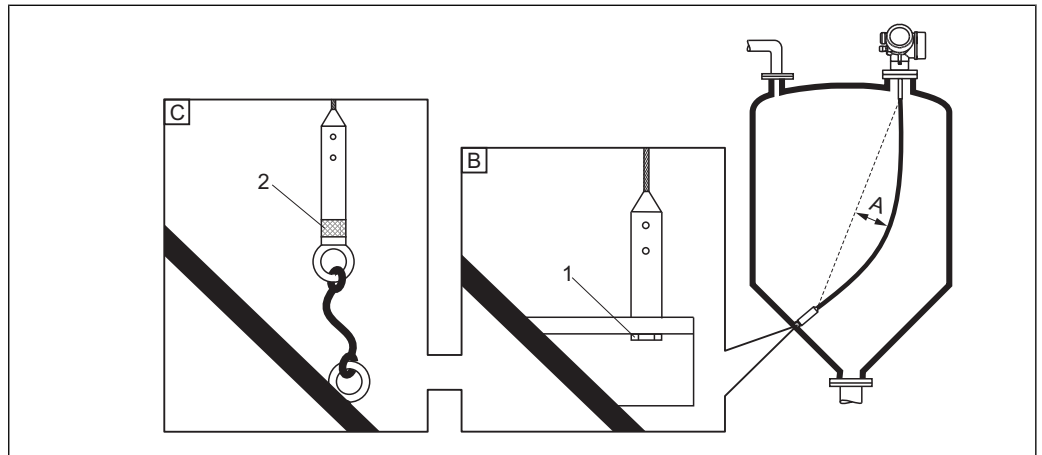
- 1 Lower edge of the nozzle
- 2 Approx. flush with the lower edge of the nozzle (± 50 mm/2")
- 3 Plate
- 4 Pipe Ø 150 to 180 mm (6 to 7 inch)

Nozzle diameter	Plate diameter
300 mm (12")	280 mm (11")
≥ 400 mm (16")	≥ 350 mm (14")

2) Larger nozzle heights on request

Securing the probe

Securing rope probes

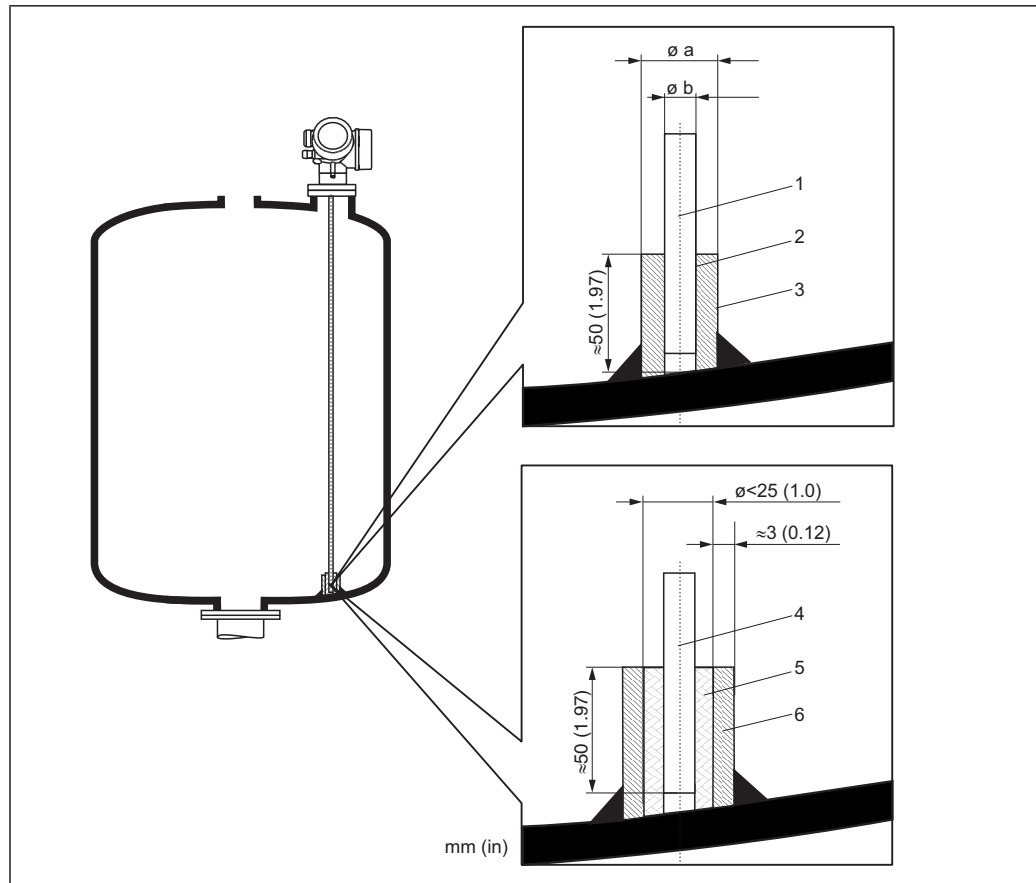


- A Sag of the rope: ≥ 1 cm per 1 m of the probe length (0.12 inch per 1 ft of the probe length)
- B Reliably grounded end of probe
- C Reliably isolated end of probe
- 1: Mounting and contact with a bolt
- 2: Mounting kit isolated (→ 68)

- 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
 - rope 4 mm (1/6"), 316: M 14
 - rope 6 mm (1/4"), 316: M 20
 - rope 6mm (1/4"), PA>steel: M14
 - rope 8mm (1/3"), PA>steel: M20
- 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 (→ 68).
- 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:

Securing rod probes

- For Ex-approvals: For probe lengths ≥ 3 m (10 ft) a support is required.
- In general, 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.



A0012607

- 1 Probe rod, uncoated
- 2 Sleeve bored tight to ensure electrical contact between the rod and sleeve!
- 3 Short metal pipe, e.g. welded in place
- 4 Probe rod, coated
- 5 Plastic sleeve, e.g. PTFE, PEEK or PPS
- 6 Short metal pipe, e.g. welded in place

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

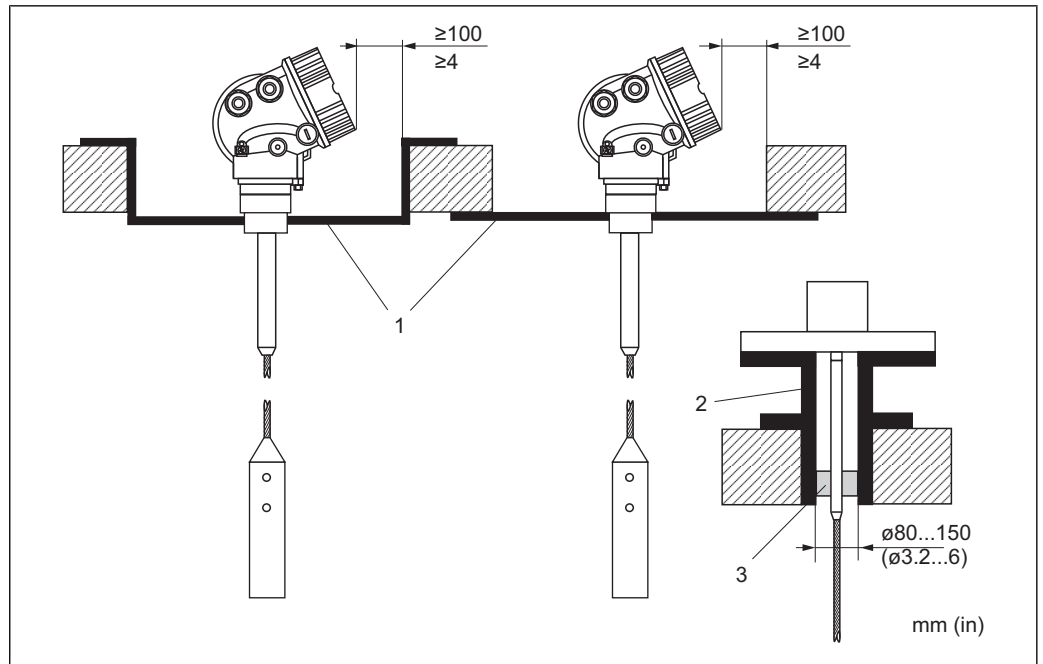
Welding may damage the main electronics module.

- ▶ Before welding: Ground the probe and dismount electronics.

Special mounting conditions

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 be kept at a minimum length. Installation suggestions see diagram.

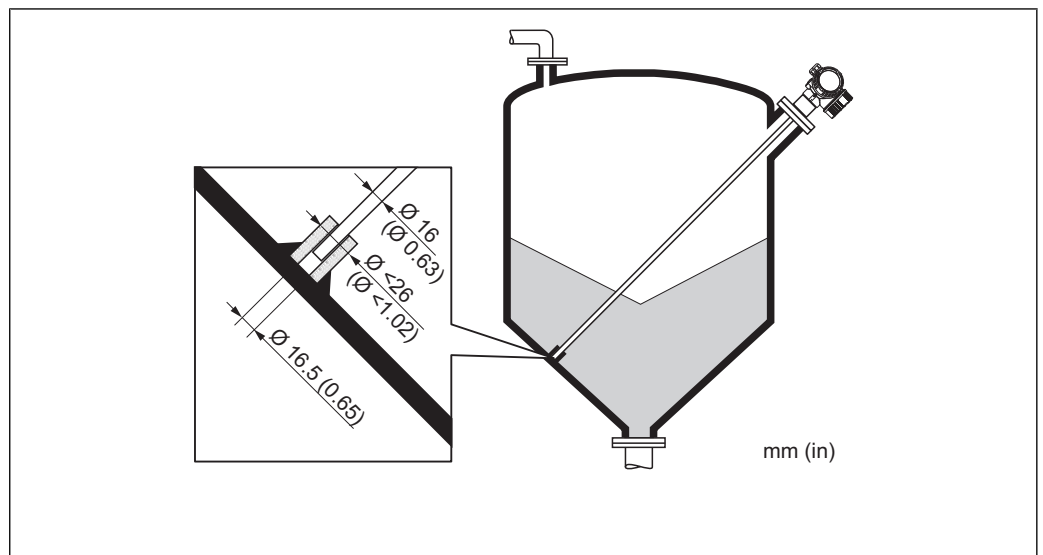


A0014138

- 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.

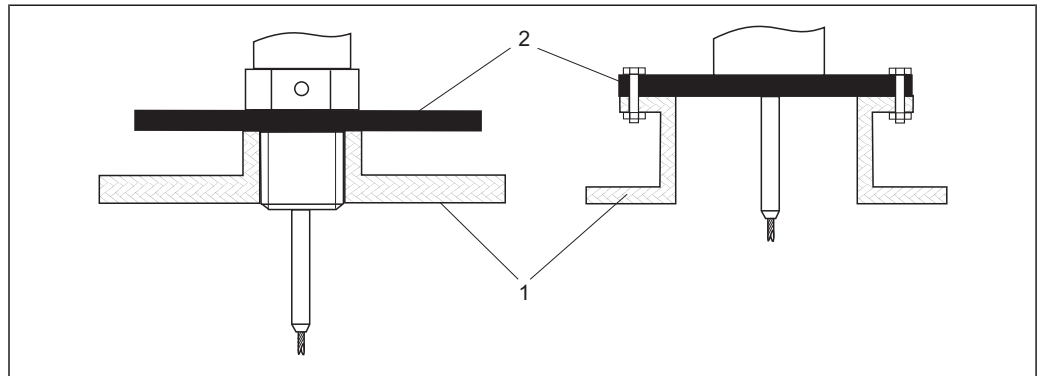
Installation from the side



A0014140

- If installation from above is not possible, the Levelflex can also be mounted from the side.
- In this case, always fix the rope probe (→ 33) .
- Support rod probe if the lateral loadbearing capacity is exceeded (→ 30). Only fix rod probes at the probe end (→ 33).

Non-metallic vessels



A0012527

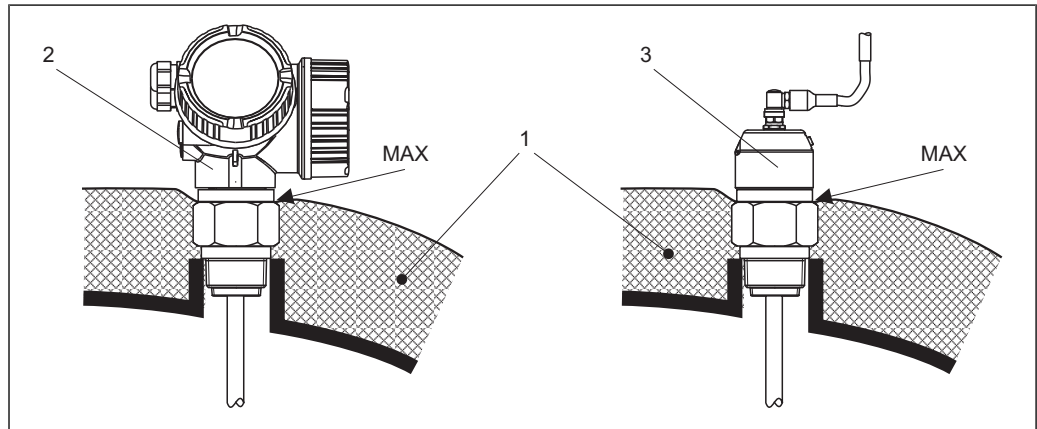
- 1 Non-metallic vessel
- 2 Metal sheet or metal flange

To measure, Levellflex 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.

Vessels with heat insulation

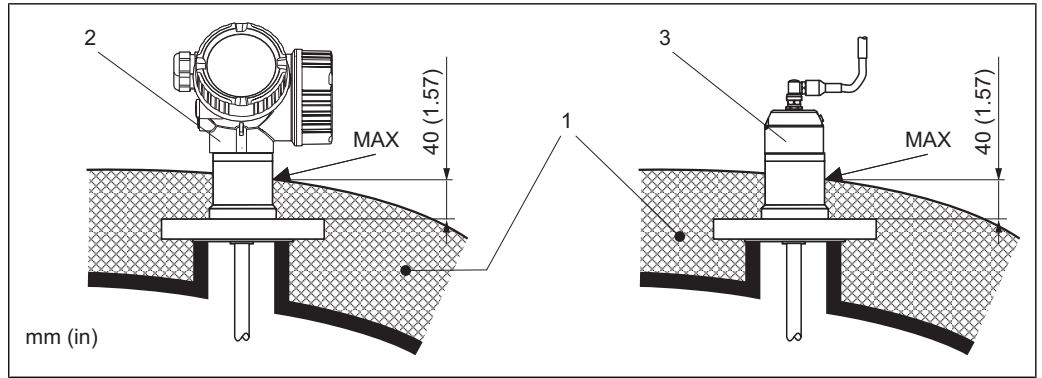
i If process temperatures are high, the device must be included in normal tank insulation to prevent the electronics heating up as a result of heat radiation or convection. The insulation may not exceed beyond the points labeled "MAX" in the drawings.



A0014653

9 Process connection with thread - FMP56, FMP57

- 1 Tank insulation
- 2 Compact device
- 3 Sensor remote (feature 600)



A0014654

10 Process connection with flange - FMP57

- 1 Tank insulation
- 2 Compact device
- 3 Sensor remote (feature 600)

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.
	Connection cable (for "Probe Design" = "Sensor remote")	85 °C (185 °F)

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).

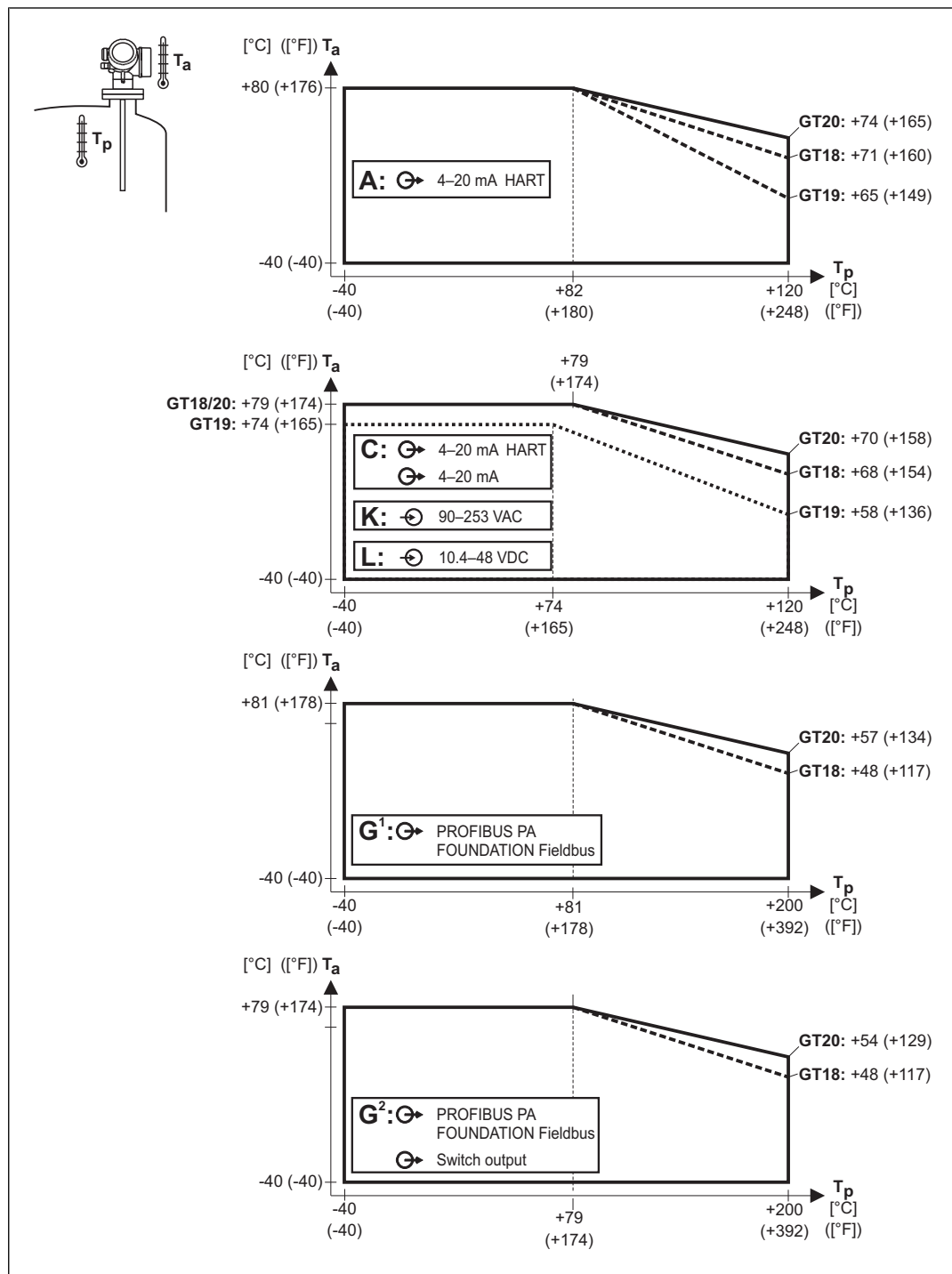
Ambient temperature limits



The following diagrams take into account only function requirements. There may be further restrictions for certified device versions. Please refer to the separate Safety Instructions (→ [71](#)).

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 $\frac{3}{4}$



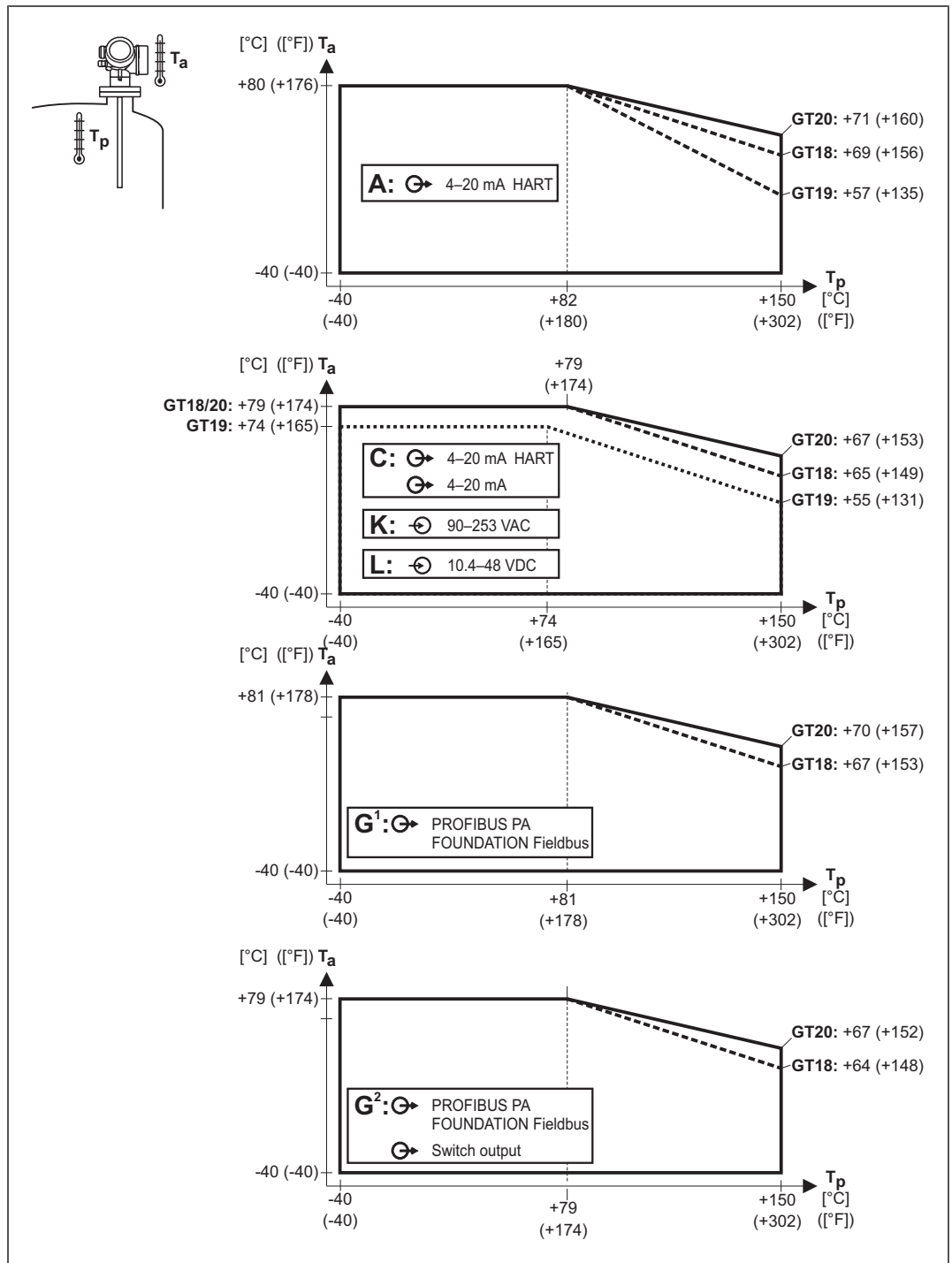
GT18 = stainless steel housing
 GT19 = plastic housing
 GT20 = aluminum housing

A = 1 current output
 C = 2 current outputs
 G¹, G² = PROFIBUS PA¹⁾
 K, L = 4-wire

T_a = ambient temperature
 T_p = temperature at the process connection

1) For PROFIBUS PA and FOUNDATION Fieldbus the temperature derating depends on the usage of the switch output. (G¹: switch output not connected; G²: switch output connected).

Temperature derating for FMP57



A0013634

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

A = 1 current output
 C = 2 current outputs
 G¹, G² = PROFIBUS PA¹⁾
 K, L = 4-wire

T_a = ambient temperature
 T_p = temperature at the process connection


1) For PROFIBUS PA and FOUNDATION Fieldbus the temperature derating depends on the usage of the switch output. (G¹: switch output not connected; G²: switch output connected).

Storage temperature -40 to +80 °C (-40 to +176 °F)

Climate class DIN EN 60068-2-38 (test Z/AD)

Geometric height Up to 2000 m (6600 ft) above MSL.

Can be expanded to 3 000 m (9 800 ft) above MSL by application of an overvoltage protection, e.g. HAW562 or HAW569.

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)³⁾ – IP66, NEMA4X ■ With open housing: IP20, NEMA1 (also ingress protection of the display) <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 68-2-64: 20 to 2000 Hz, 1 (m/s ²) 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 all relevant requirements of the EN 61326- series and NAMUR recommendation EMC (NE21). For details see declaration of conformity.⁴⁾ 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>Use a shielded cable when working with a digital communications signal.</p> <p>Max. fluctuations during EMC- tests: < 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 (70C4 pW FKN)	-40 to +120 °C (-40 to +248 °F)
FMP57	FKM (Viton GLT)	-30 to +150 °C (-22 to +302 °F)
	EPDM (E7502 or E7515)	-40 to +120 °C (-40 to +248 °F)

 With uncoated probes, 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	<table border="1"> <thead> <tr> <th>Device</th> <th>Process pressure</th> </tr> </thead> <tbody> <tr> <td>FMP56, FMP57</td> <td>-1 to 16 bar (-14.5 to 232 psi)</td> </tr> </tbody> </table>	Device	Process pressure	FMP56, FMP57	-1 to 16 bar (-14.5 to 232 psi)
Device	Process pressure				
FMP56, FMP57	-1 to 16 bar (-14.5 to 232 psi)				

3) 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").

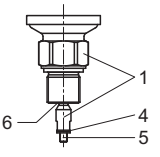
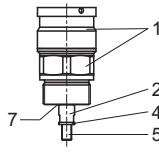
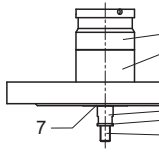
i This range may be reduced by the selected process connection. The pressure rating (PN) specified on the flanges refers to a reference temperature of 20 °C, for ASME flanges 100 °F. Pay attention to pressure-temperature dependencies.


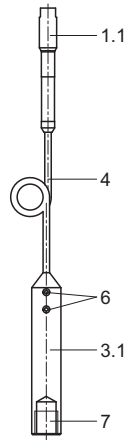
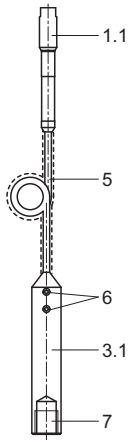
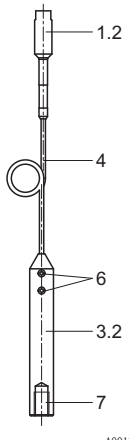
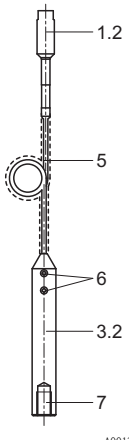
Please refer to the following standards for the pressure values permitted for higher temperatures:

- 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

Materials in contact with process

- i** ■ 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 (→ 48)

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

Levelflex FMP56, FMP57						
Rod probe	Rope probe				No.	Material
\varnothing 16 mm (2/3")	\varnothing 6 mm (1/4")	\varnothing 8 mm (1/3") coated	\varnothing 4 mm (1/6")	\varnothing 6 mm (1/4") coated		
 <p>A0013891</p>	 <p>A0013892</p>	 <p>A0013893</p>	 <p>A0013894</p>	 <p>A0013895</p>	1.1	304 (1.4301)
					1.2	316L (1.4404)
					2	316L (1.4404)
					3.1	304 (1.4301)
					3.2	316L (1.4404)
					4	316 (1.4401)
					5	Rope: galvanized steel Coating 1 mm (0.04 in): PA 12 (Vestamid L 1940)
6	Set screw: A4-70					
7	Screw for tightening: A2-70					

Dielectric constant (DC) Rod and rope probe: DC (ϵ_r) \geq 1.6

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

**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

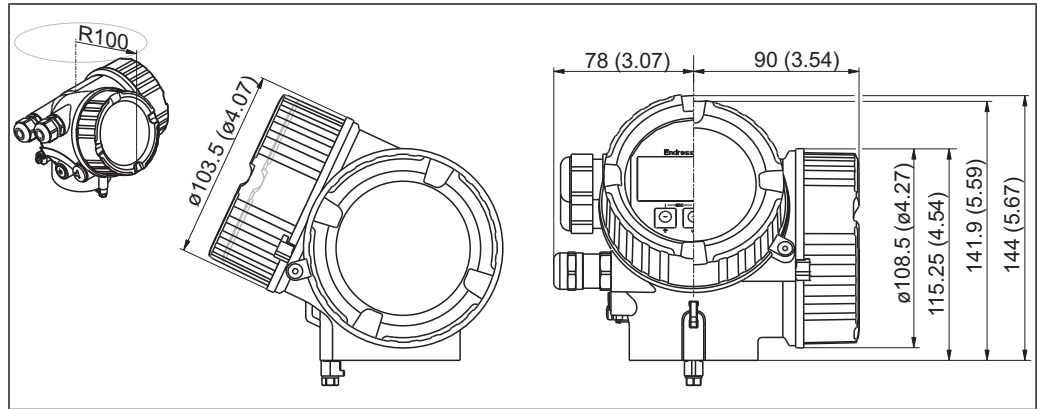
6 mm rope:

- 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

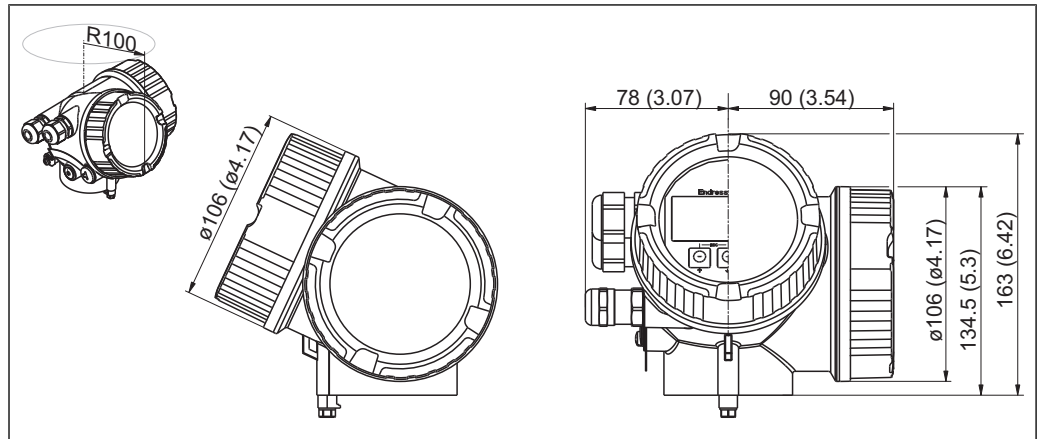
Design, dimensions

Dimensions of the electronics housing



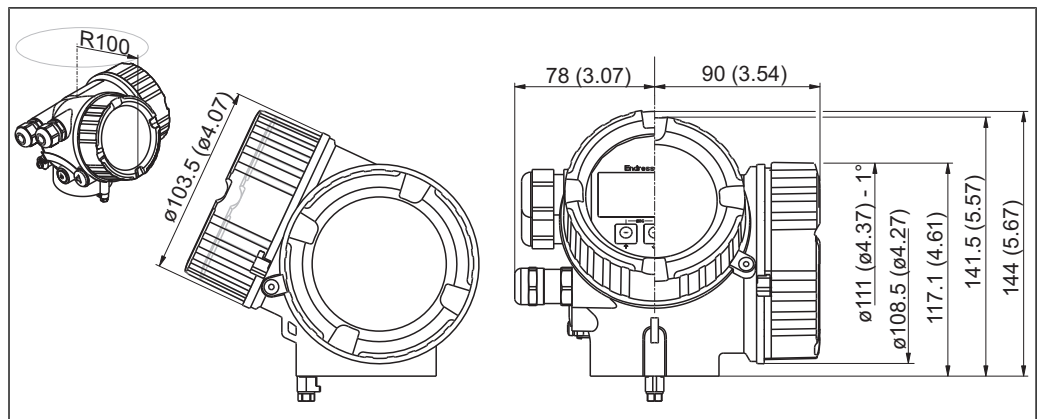
A0015132

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



A0015133

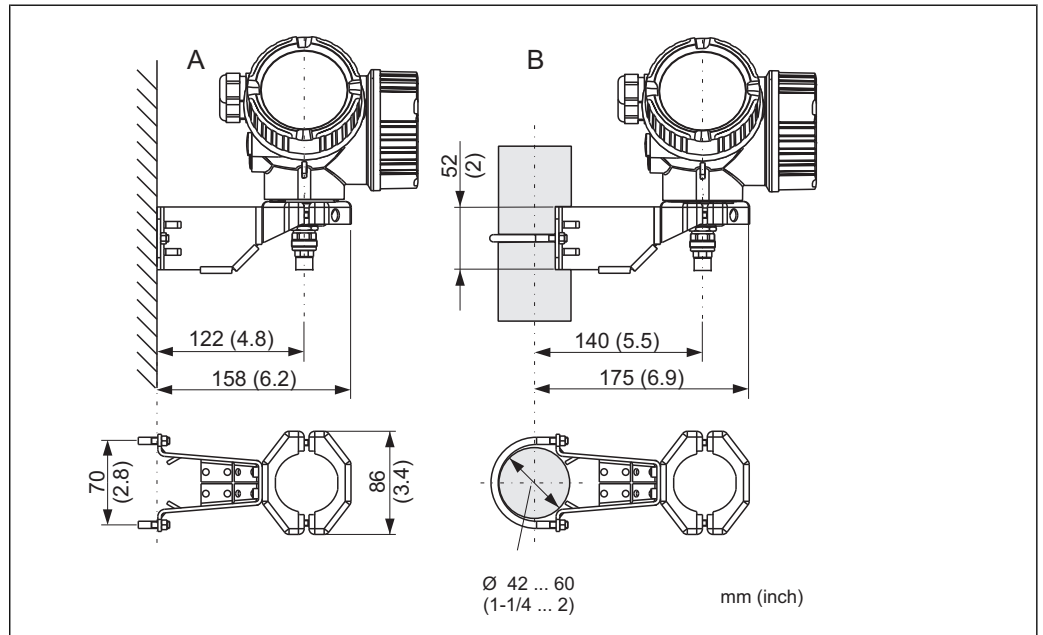
12 Housing GT19 (Plastics PBT); Dimensions in mm (in)



A0015134

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

Dimensions of the mounting bracket



A0014793

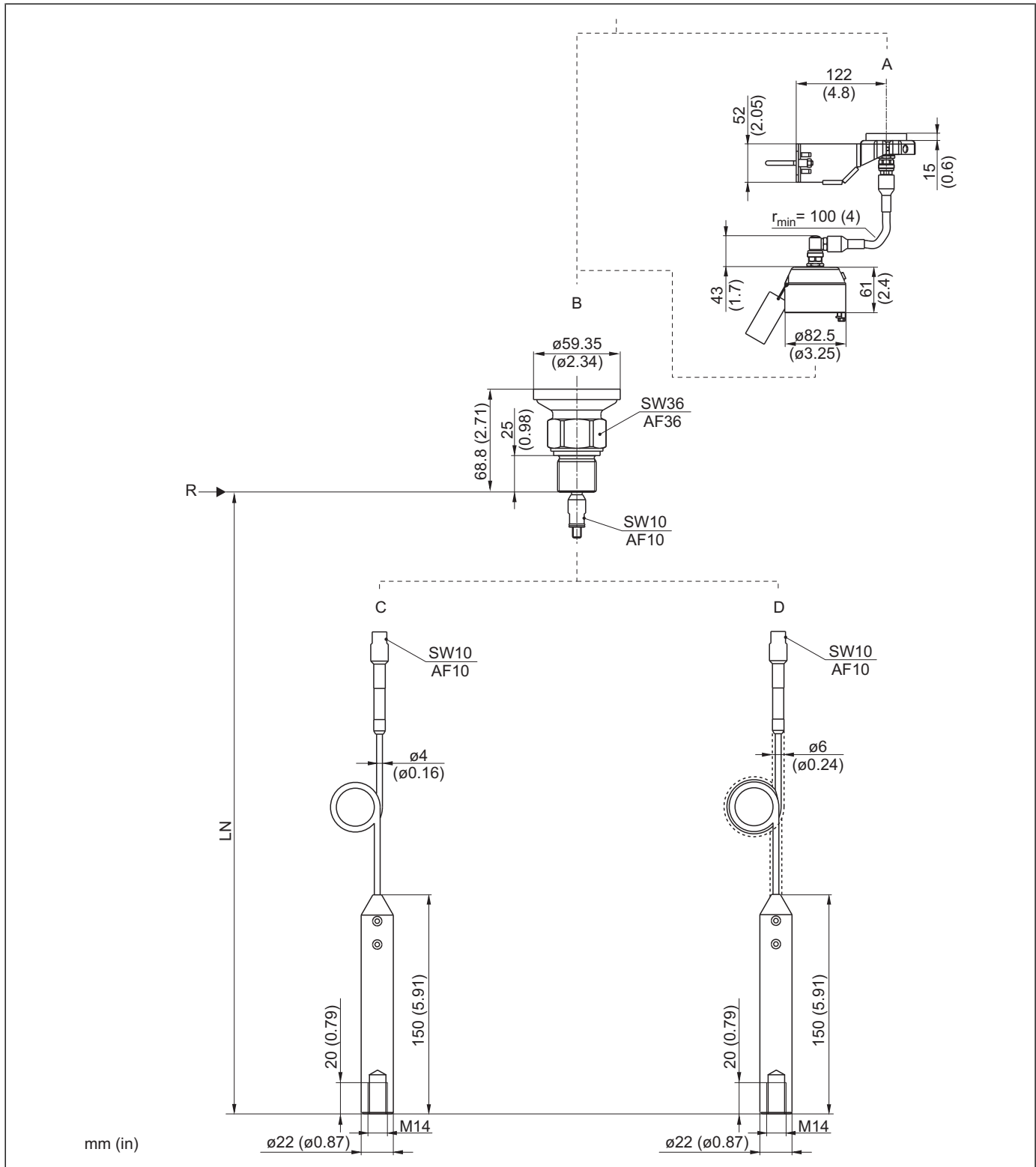
14 *Mounting bracket for the electronics housing*

A *Wall mounting*

B *Pipe mounting*

i For the "Sensor remote" device version (see feature 060 of the product structure), the mounting bracket is part of the delivery. If required, it can also be ordered as an accessory (order code 71102216).

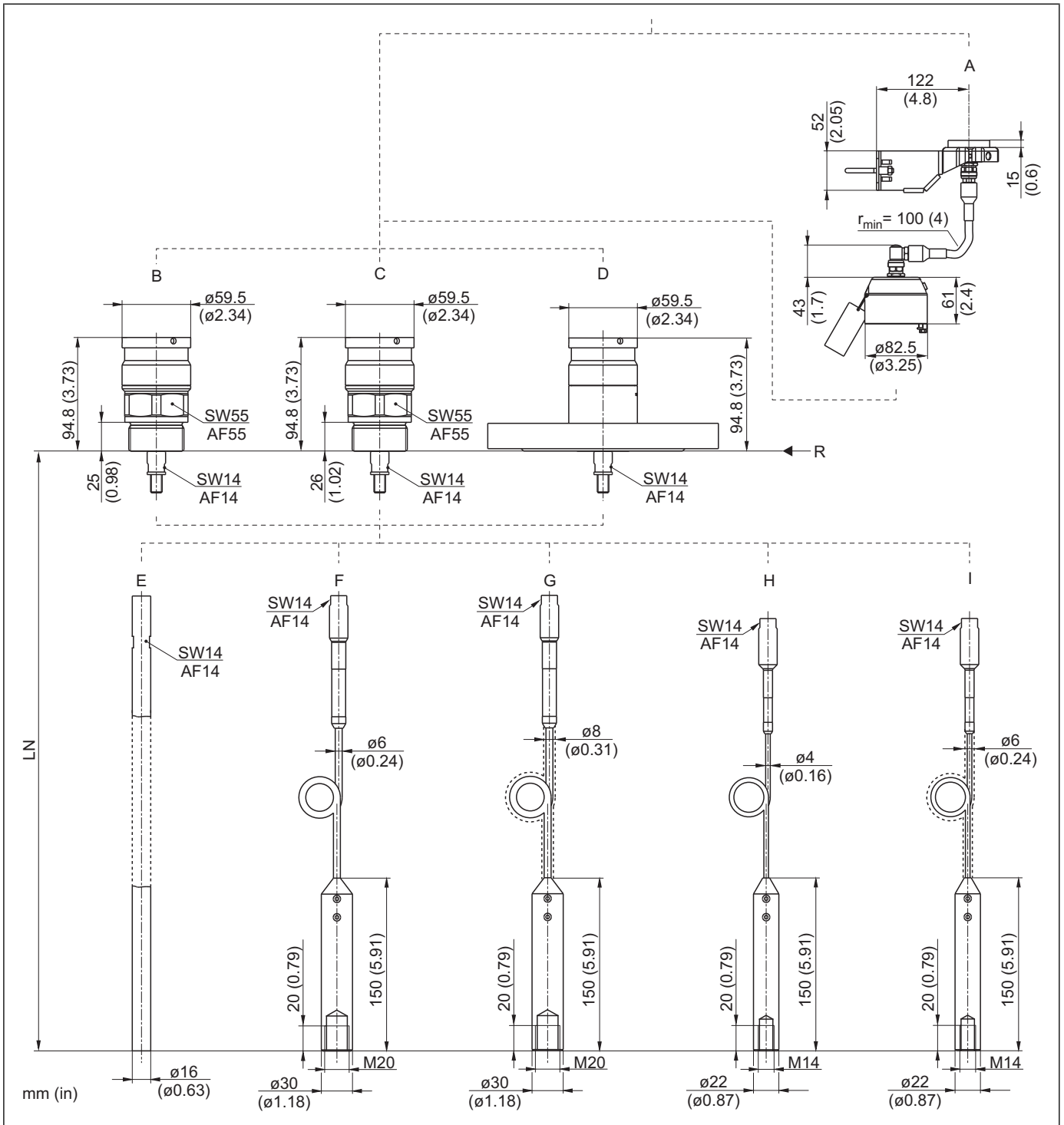
FMP56: Dimensions of process connection and probe



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

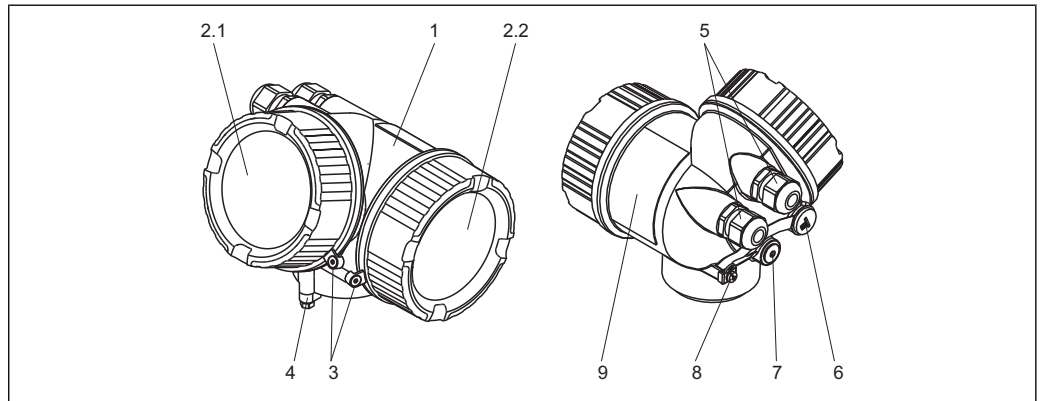
Materials



Further material specifications

- Materials in contact with process (→ 42)
- Ordering information (→ 58)
- Accessories materials (→ 65)

Housing



A0013788

Housing GT18 - stainless steel, corrosion-resistant

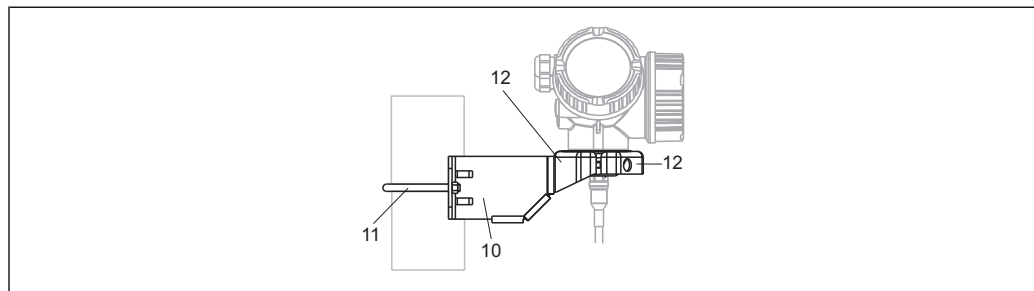
No.	Part: material	No.	Part: material
1	Housing: 316L (CF-3M, 1.4404)	5	Cable entry <ul style="list-style-type: none"> ■ Sealing: EMPB ■ Cable gland: 316L (1.4404) ■ Adapter: 316L (1.4435)
2.1	Cover of the electronics compartment <ul style="list-style-type: none"> ■ Cover: 316L (CF-3M, 1.4404) ■ Window: glass ■ Cover seal: EPDM 	6	Dummy plug: 316L (1.4404)
2.2	Cover of the terminal compartment <ul style="list-style-type: none"> ■ Cover: 316L (CF-3M, 1.4404) ■ Cover seal: EPDM 	7	Pressure relief stopper: 316L (1.4404)
3	Cover lock <ul style="list-style-type: none"> ■ Screw: A4 ■ Clamp: 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)
4	Turn housing <ul style="list-style-type: none"> ■ Screw: A4-70 ■ Clamp: 316L (1.4404) 	9	Identification <ul style="list-style-type: none"> ■ Nameplate: 304 (1.4301) ■ Groove pin: A2

Housing GT19 - plastic

No.	Part: material	No.	Part: material
1	Housing: PBT	5	Cable entry <ul style="list-style-type: none"> ■ Sealing: EMPB ■ Cable gland: polyamide (PA), nickel-plated brass (CuZn) ■ Adapter: 316L (1.4435)
2.1	Cover of the electronics compartment <ul style="list-style-type: none"> ■ Cover: PA ■ Cover seal: EPDM 	6	Dummy plug: PBT
2.2	Cover of the terminal compartment <ul style="list-style-type: none"> ■ Cover: PBT ■ Cover seal: EPDM 	7	Pressure relief stopper: nickel-plated brass (CuZn)
4	Turn housing <ul style="list-style-type: none"> ■ Screw: A4-70 ■ Clamp: 316L (1.4404) 	8	Ground terminal <ul style="list-style-type: none"> ■ 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) Coating: polyester	5	Cable entry <ul style="list-style-type: none"> ■ Sealing: EMPB ■ Cable gland: polyamide (PA), nickel-plated brass (CuZn) ■ Adapter: 316L (1.4435)
2.1	Cover of the electronics compartment <ul style="list-style-type: none"> ■ Cover: AlSi10Mg(<0.1% Cu) ■ Window: glass ■ Cover seal: EPDM 	6	Dummy plug: nickel-plated brass (CuZn)
2.2	Cover of the terminal compartment <ul style="list-style-type: none"> ■ Cover: AlSi10Mg(<0.1% Cu) ■ Cover seal: EPDM 	7	Pressure relief stopper: nickel-plated brass (CuZn)
3	Cover lock <ul style="list-style-type: none"> ■ Screw: A4 ■ Clamp: 316L (1.4404) 	8	Ground terminal <ul style="list-style-type: none"> ■ Screw: A2 ■ Spring washer: A2 ■ Clamp: 304 (1.4301) ■ Holder: 304 (1.4301)
4	Turn housing <ul style="list-style-type: none"> ■ Screw: A4-70 ■ Clamp: 316L (1.4404) 	9	Identification Nameplate: sticker

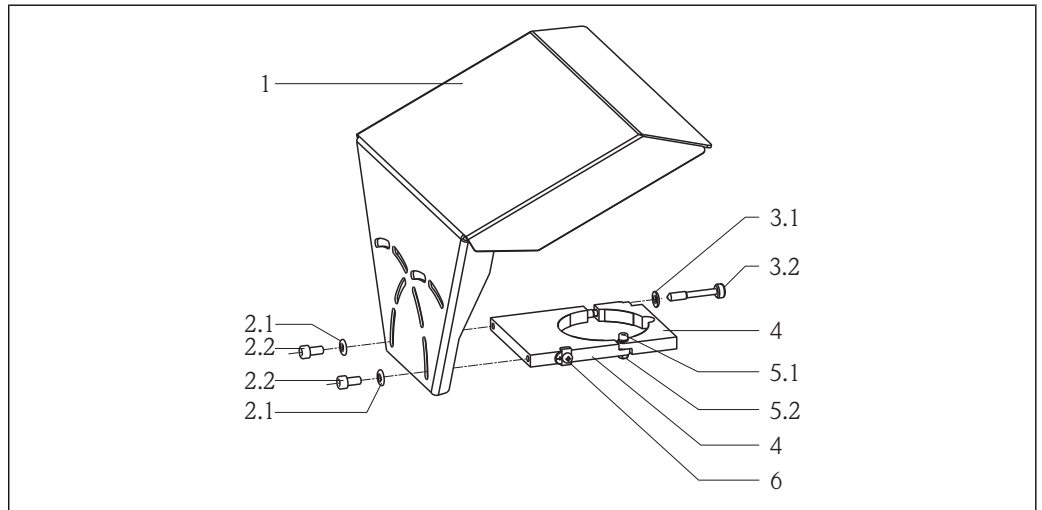
Mounting bracket



A0015143

Mounting bracket for version "Sensor remote"	
No.	Part: material
10	Bracket: AISI 304 (1.4301), AISI 304L (1.4306)
11	Screw and nuts: A2-70
12	Half-shells: AISI 304L (1.4306)

Weather protection cover



A0015473

Weather protection cover			
Nr.	Part: material	Nr.	Part: material
1	Protection cover: 304 (1.4301)	4	Bracket: 304 (1.4301)
2.1	Washer: A2	5.1	Cheese head screw: A2-70
2.2	Cheese head screw: A4-70	5.2	Nut: A2
3.1	Washer: A2	6	Ground terminal ■ Screw: A4 ■ Spring washer: A4 ■ Clamp: 316L (1.4404) ■ Holder: 316L (1.4404)
3.2	Tightening screw: 304 (1.4301)		

Operability

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

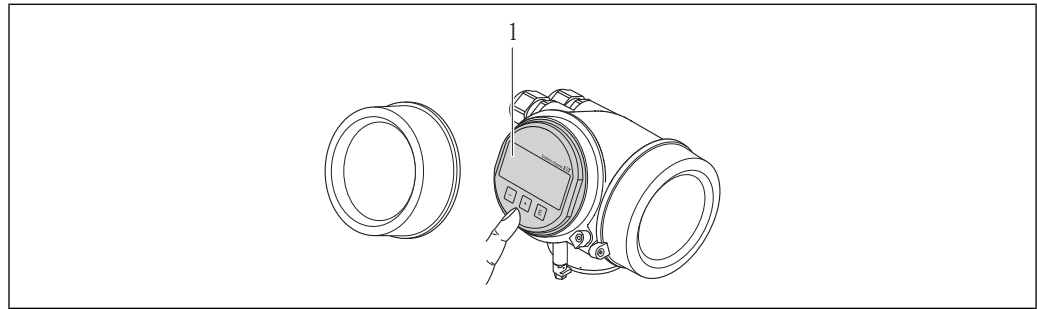
- Local operation in different languages (see product structure, feature "Additional Operation Language")
- Standardized operation at the device and in the operating tools
- Data storage device (HistoROM) for process and measuring device data with event logbook available at all times - even if electronics modules are replaced

Efficient diagnostics increase measurement reliability

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

Local operation

Order characteristic for "Display; Operation", option C



A0015544

1 Operation with pushbuttons

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 +60 °C (-4 to +140 °F)
The readability of the display may be impaired at temperatures outside the temperature range.

Operating elements

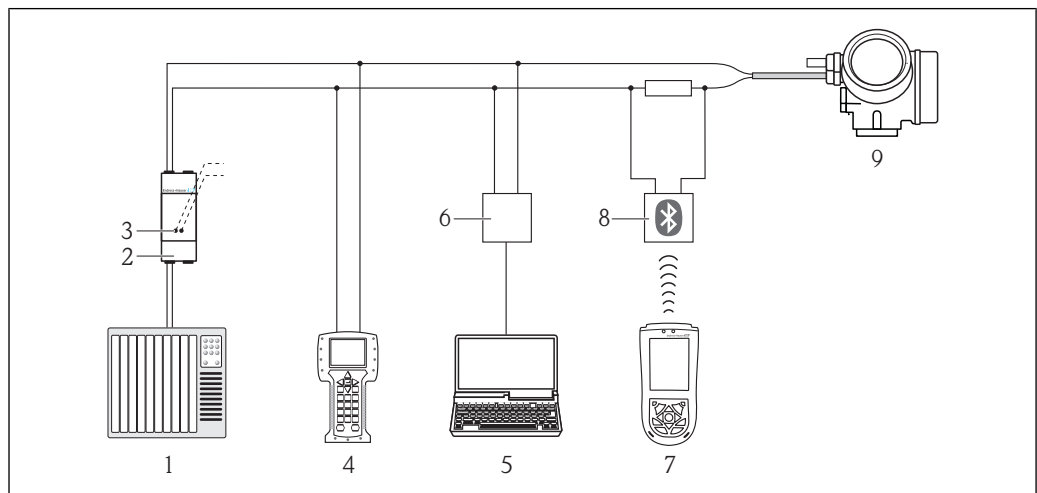
- Local operation with 3 push buttons (☐, ☐, ☐)
- Operating elements also accessible in various hazardous areas

Additional functionality

- 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.

Remote operation

Via HART protocol

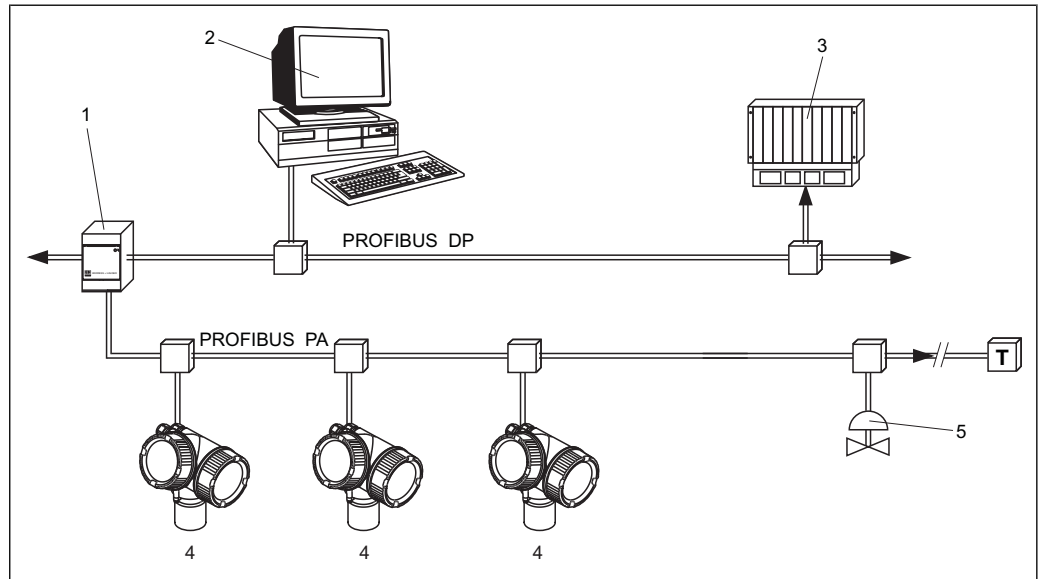


A0013764

15 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 375, 475
- 5 Computer with operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)
- 6 Commubox FXA191 (RS232) or FXA195 (USB)
- 7 Field Xpert SFX100
- 8 VIATOR Bluetooth modem with connecting cable
- 9 Transmitter

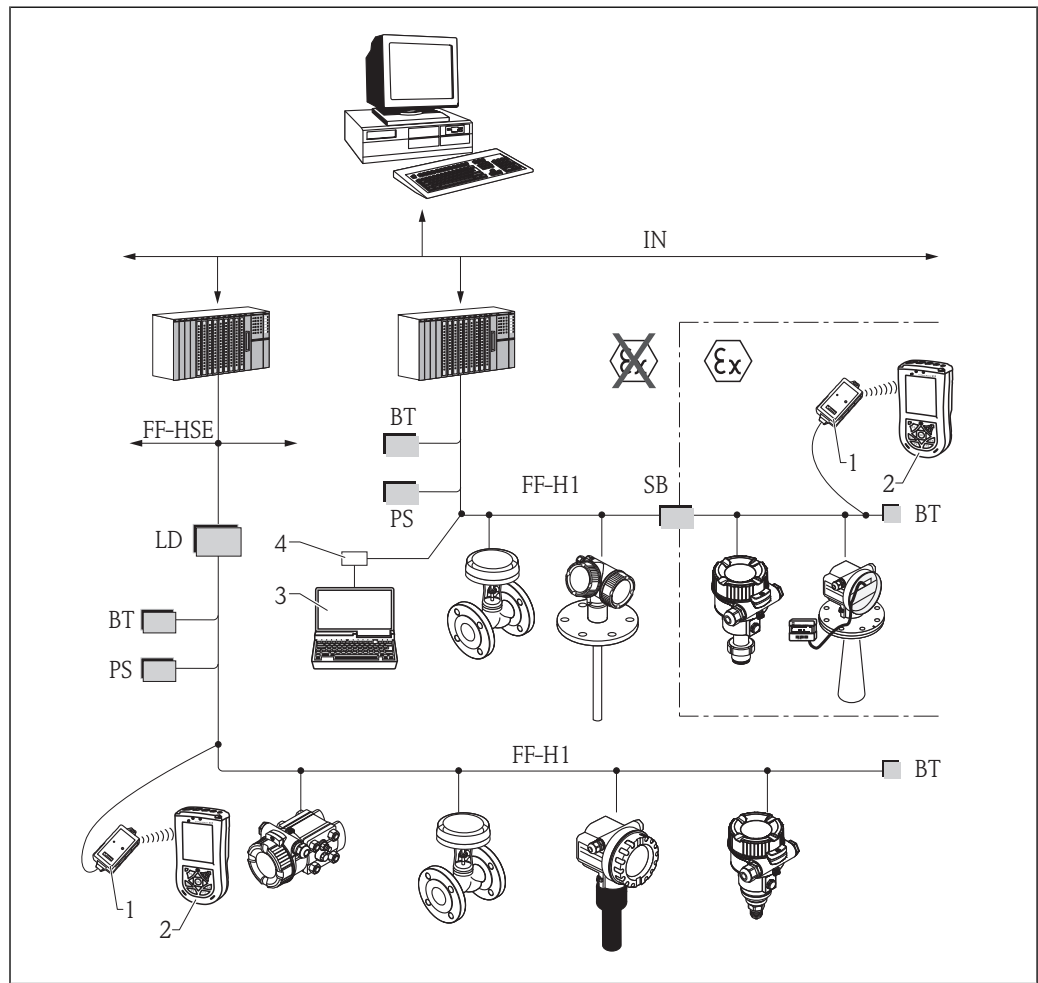
Via PROFIBUS PA protocol



A0015775

- 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

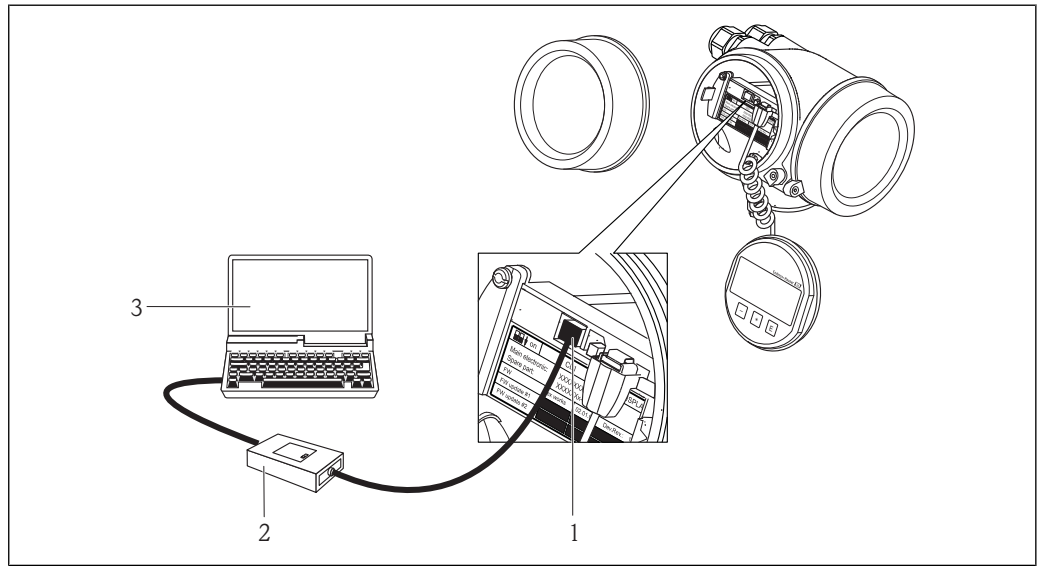


A0017186

16 FOUNDATION Fieldbus system architecture with associated components

- IN Industrial network
- FF- High Speed Ethernet
- HSE
- FF- FOUNDATION Fieldbus-H1
- H1
- LD Linking Device FF-HSE/FF-H1
- PS Bus Power Supply
- SB Safety Barrier
- BT Bus Terminator
- 1 FFblue Bluetooth modem
- 2 Field Xpert SFX100
- 3 FieldCare
- 4 NI-FF interface card

Via service interface (CDI)



A0014019

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

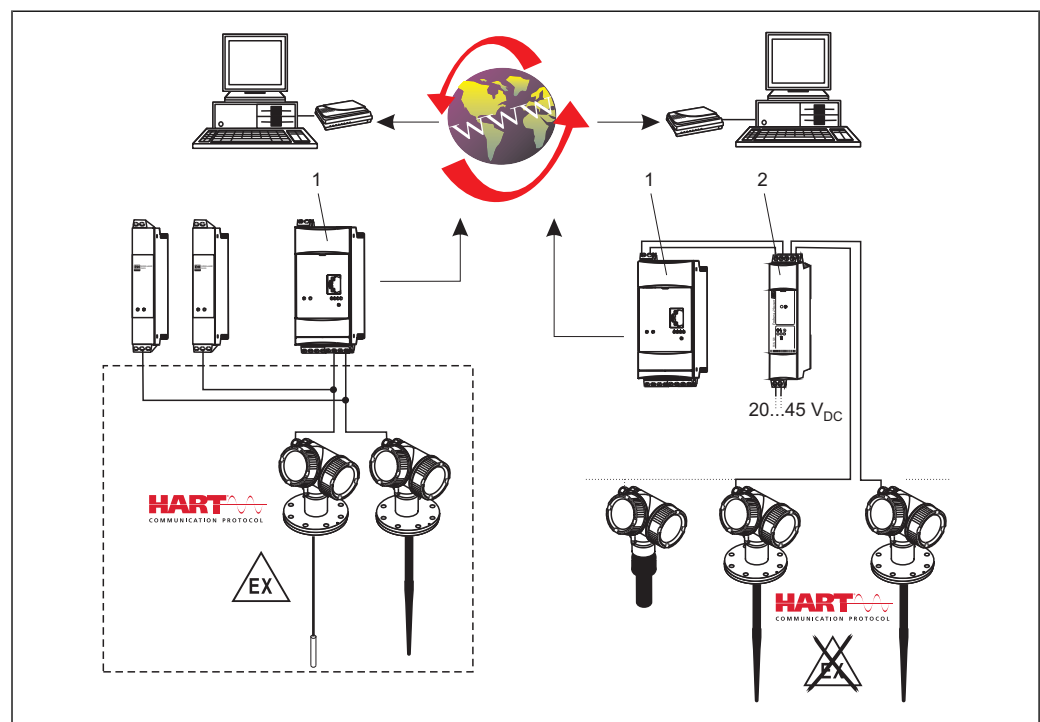
System integration via Fieldgate

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

17 The complete measuring system consists of devices and:

- 1 Fieldgate FXA520
- 2 Multidrop Connector FXN520

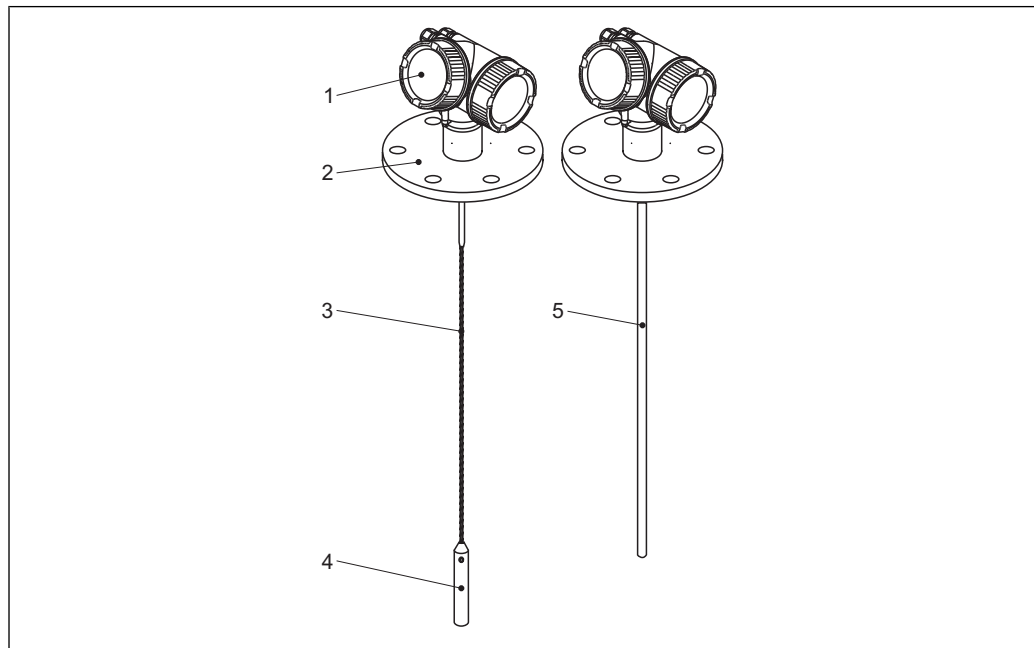
i The number of instruments which can be connected in multidrop mode can be calculated by the "FieldNetCalc" program. A description of this program can be found in Technical Information TI 400F (Multidrop Connector FXN520). The program is available from your Endress+Hauser sales organisation or in the 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>
C-Tick symbol	<p>The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".</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 (→  71).</p>
Functional Safety	<p>Used for level monitoring (MIN, MAX, range) up to SIL 3 (homogeneous redundancy), independently assessed by TÜV Rhineland as per IEC 61508. Other information see documentation SD00326F: "Functional Safety Manual".</p>
AD2000	<p>The pressure retaining material 316L (1.4435/1.4404) corresponds to AD2000 - W2/W10.</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	<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> <p>(→  58), Product structure, Features 010 "Approval" and 100 "Process Connection".</p> <p> These devices are marked with the registration number 0F14480.5 on the nameplate.</p>
Track record	<p>FMP5x is the upgrade model of the corresponding FMP4x series.</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 ■ IEC61508 Functional safety of electrical/electronic/programmable electronic safety-related systems

Ordering information

Compact device Levelflex



A0012470

18 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
BL	ATEX II 1/3G Ex nA(ia) IIC T6	x	x
B2	ATEX II 1/2G Ex ia IIC T6, 1/2D Ex ia 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

010	Approval:	FMP	
		56	57
IB	IEC Ex Zone 0/1 Ex ia IIC T6 Ga/Gb	x	x
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
IL	IECEx zone 0/2 Ex nA(ia) IIC T6 Ga/Gc	x	x
I2	IECEx Zone 0/1 Ex ia IIC T6 Ga/Gb, Zone 20/21 Ex ia 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
NA	NEPSI zone 0 Ex ia IIC T6 Ga	x	x
NB	NEPSI zone 0/1 Ex ia IIC T6 Ga/Gb	x	x
NF	NEPSI zone 20/21 tD IIIC A20/21 IP6x Da/Db	x	x
NG	NEPSI zone 2 Ex nA II T6 Gc	x	x
NH	NEPSI zone 2 Ex ic IIC T6 Gc	x	x
N2	NEPSI Zone 0/1 Ex ia IIC T6 Ga/Gb, Zone 20/21 Ex iaD 20/21 T*	x	x
N3	NEPSI Zone 0/1 Ex d(ia) IIC T6 Ga/Gb, DIP A20/21 T* IP66	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
E	2-wire; FOUNDATION Fieldbus, switch output	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

050	Electrical connection:	FMP	
		56	57
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
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
COJ	DN40 PN10-40 B1, 316L flange EN1092-1		x
GDE	Thread ISO228 G3/4, 304	x	
GGE	Thread ISO228 G1-1/2, 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

100	Process connection:	FMP	
		56	57
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
AE	Italian	X	X
AF	Dutch	X	X
AG	Portuguese	X	X
AH	Polish	X	X
AI	Russian	X	X
AK	Chinese simplified	X	X
AL	Japanese	X	X
AM	Korean	X	X
AR	Czech	X	X
550	Calibration:	56	57
F4	5-point linearity protocol (→ 63)	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 (→ 64)	X	X
IK	Customized parametrization PA (→ 64)	X	X
IL	Customized parametrization FF (→ 64)	X	X
IW	W/o Tooling DVD (FieldCare setup)	X	X
I9	Special version, TSP-no. to be sepc.	X	X
580	Test, Certificate: <i>(Multiple options can be selected)</i>	FMP	
		56	57
JD	3.1 Material certificate, pressure retaining parts, EN10204-3.1 inspection certificate		X
K9	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

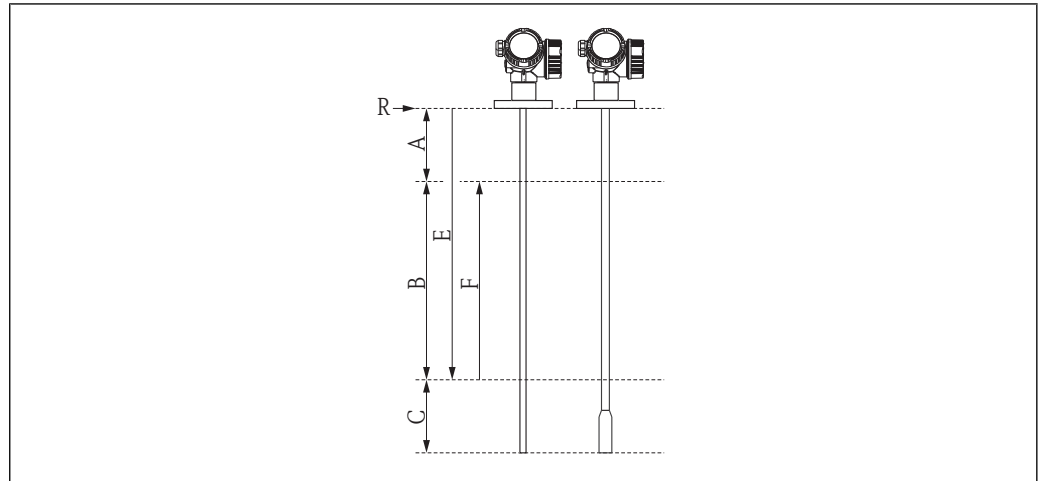
620	Accessory Enclosed: <i>(Multiple options can be selected)</i>	FMP	
		56	57
PB	Weather protection cover	x	x
PG	Mounting kit, insulated, rope	x	x
R9	Special version, TSP-no. to be sepc.	x	x
850	Firmware Version:	FMP	
		56	57
75	01.01.zz, HART, DevRev02	x	x
76	01.00.zz, FF, DevRev01	x	x
77	01.00.zz, 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

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 throughout the measuring range (0% to 100%). In order to define the measuring range, **Empty calibration** (E) and **Full calibration** (F) have to be specified⁵⁾.

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



A0014673

Sensor	Minimum distance between reference point (R) and 100% level	Minimum measuring range
FMP56 FMP57	$A \geq 250 \text{ mm (10 in)}$	$B \geq 400 \text{ mm (16 in)}$

Type of probe	Minimum distance from end of probe to 0% level	Maximum value for "empty calibration"
Rod	$C \geq 100 \text{ mm (4 in)}$	$E \leq 3.9 \text{ m (12.8 ft)}$
Rope, FMP56	$C \geq 1000 \text{ mm (40 in)}$	$E \leq 23 \text{ m (75 ft)}$
Rope, FMP57	$C \geq 1000 \text{ mm (40 in)}$	$E \leq 11 \text{ m (36 ft)}$

i The linearity check is performed with the complete device and 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 (→ 64).

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

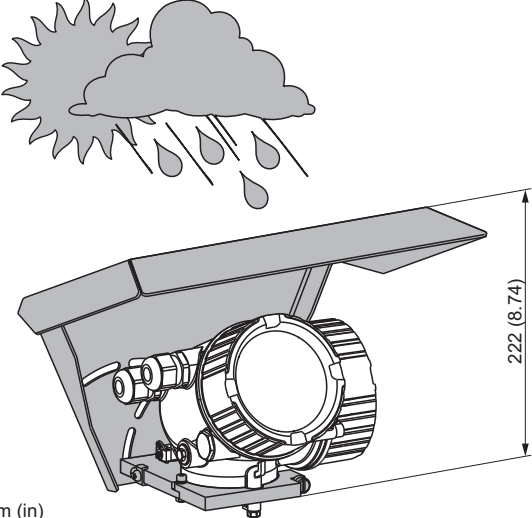
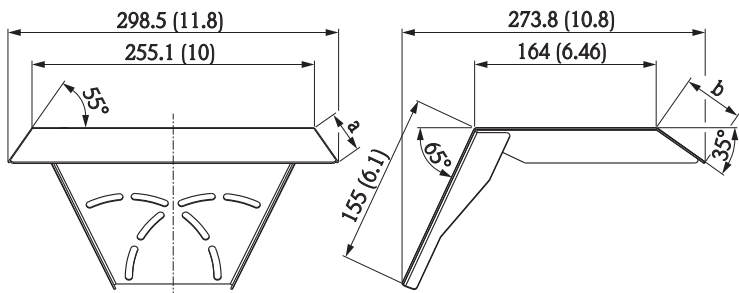
Customized parametrization

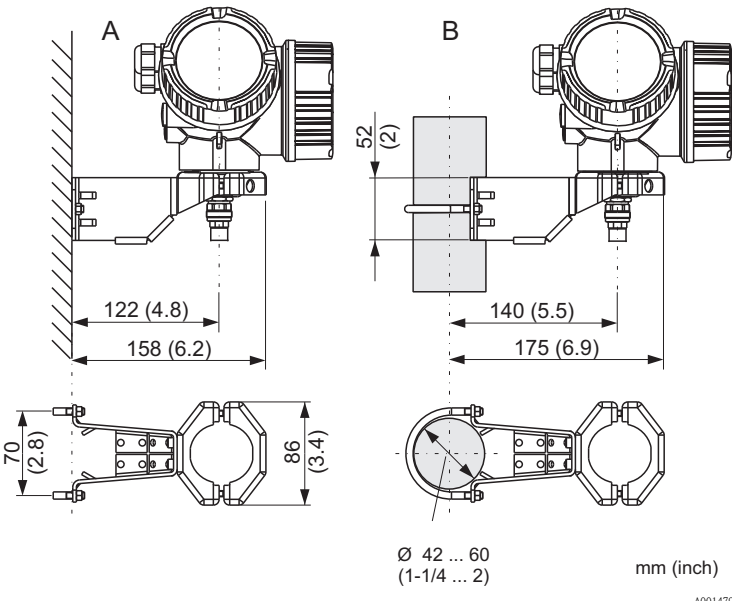

If the option IJ "Customized parametrization HART", IK "Customized parametrization PA" or IL "Customized parametrization FF" has been selected in feature 570 "Service", customer specific presettings can be selected for the following parameters:

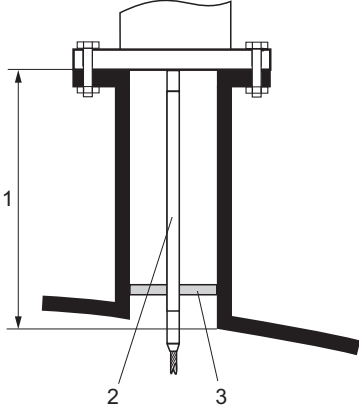
Parameter	Communication	Selection list / range of values
Setup → Distance unit	<ul style="list-style-type: none"> ■ HART ■ PA ■ FF 	<ul style="list-style-type: none"> ■ in ■ mm
Setup → Empty calibration	<ul style="list-style-type: none"> ■ HART ■ PA ■ FF 	0 to 45 m (0 to 147 ft) ¹⁾
Setup → Full calibration	<ul style="list-style-type: none"> ■ HART ■ PA ■ FF 	0 to 45 m (0 to 147 ft) ¹⁾
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
Expert → Comm. → HART config. → Burst mode	HART	<ul style="list-style-type: none"> ■ Off ■ On

1) For FMP56: max. 12 m (36 ft)

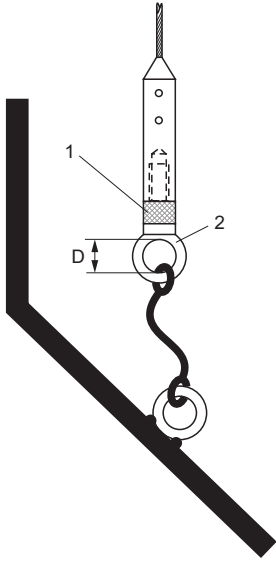

Accessories

Device-specific accessories	Accessory	Description
	Weather protection cover	 <p>The diagram shows a weather protection cover for a sensor. It features a sun and rain cloud icon above a 3D perspective view of the cover. The cover is a rectangular plate with a sloped front edge. A vertical dimension line on the right indicates a height of 222 mm (8.74 in).</p>  <p>Two detailed views of the cover are provided. The left view shows a top-down perspective of the cover with a 55° slope and a width of 298.5 mm (11.8 in). A horizontal dimension of 255.1 mm (10 in) is shown across the top edge. A small dimension 'a' is indicated at the bottom right corner. The right view shows a side profile of the cover with a 65° slope and a horizontal length of 273.8 mm (10.8 in). A horizontal dimension of 164 mm (6.46 in) is shown from the front edge to the start of the slope. A small dimension 'b' is indicated at the bottom right corner. A vertical dimension of 155 mm (6.1 in) is shown for the sloped part.</p> <p>mm (in)</p> <p>A0015466</p> <p>mm (in)</p> <p>A0015472</p> <p>a 37.8 mm (1.49 in) b 54 mm (2.13 in)</p> <p>i 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 71132889.</p>


Accessory	Description
Mounting bracket for the electronics housing	 <p> A Wall mounting B Pipe mounting </p> <p>  For the "Sensor remote" device version (see feature 060 of the product structure), the mounting bracket is part of the delivery. If required, it can also be ordered as an accessory (order code 71102216). </p>


Accessory	Description																
Extension rod / centering HMP40 <ul style="list-style-type: none"> ■ can be used for: FMP57 ■ Admissible temperature at lower nozzle edge: -40 to 150 °C (-40 to 302 °F) ■ Additional information: SD01002F 	 <p> 1 Nozzle height 2 Extension rod 3 Center washer </p> <table border="1" data-bbox="678 1691 1436 2049"> <thead> <tr> <th>010</th> <th>Approval:</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>A: Non-hazardous area</td> </tr> <tr> <td>M</td> <td>M: FM DIP Cl.II Div.1 Gr.E-G N.I., zone 21,22</td> </tr> <tr> <td>P</td> <td>P: CSA DIP Cl.II Div.1 Gr.G + coal dust N.I.</td> </tr> <tr> <td>S</td> <td>S: FM Cl.I, II, III Div.1 Gr.A-G N.I., zone 0,1,2,20,21,22</td> </tr> <tr> <td>U</td> <td>U: CSA Cl.I, II, III Div.1 Gr.A-G N.I., zone 0,1,2</td> </tr> <tr> <td>1</td> <td>1: ATEX II 1G</td> </tr> <tr> <td>2</td> <td>2: ATEX II 1D</td> </tr> </tbody> </table> <p> 020 Extension rod; nozzle height: </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
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																


Accessory	Description	
	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 data-bbox="673 851 869 907"> <i>1 Insulating sleeve</i> <i>2 Eye-bolt</i> </p> <p data-bbox="673 929 1093 985"> For reliably insulated fixing of the probe. Maximum process temperature: 150 °C (300 °F) </p> <p data-bbox="673 996 1220 1019"> For rope probes 4 mm (1/6 in) or 6 mm (1/4 in) with PA>steel: </p> <ul data-bbox="673 1019 949 1097" style="list-style-type: none"> ■ Eye-bolt M8 DIN 580 ■ Diameter D = 20 mm (0.8 in) ■ Order-No.: 52014249 <p data-bbox="673 1108 1220 1131"> For rope probes 6 mm (1/4 in) or 8 mm (1/3 in) with PA>steel: </p> <ul data-bbox="673 1131 949 1209" style="list-style-type: none"> ■ Eye-bolt M10 DIN 580 ■ Diameter D = 25 mm (1 in) ■ Order-No.: 52014250 <p data-bbox="673 1220 1380 1276"> 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 data-bbox="673 1288 1412 1366">  The mounting kit can also be ordered directly with the device (see the Levellflex product structure, feature 620 "Accessory Enclosed", option PG "Mounting kit, isolated, rope"). </p>


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 TI404F/00


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

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


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 BA061S/04

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




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


Accessory	Description
Field Xpert SFX100	Compact, flexible and robust industry handheld terminal for remote parametrization and measured value inspection via the HART output or via FOUNDATION Fieldbus .  For details refer to Operating Instructions BA060S/04

Service-specific accessories

Accessory	Description
FieldCare	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 BA027S/04 and BA059S/04

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 TI133R/09 and Operating Instructions BA247R/09
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 TI073R/09 and Operating Instructions BA202R/09
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 TI081R/09 and Operating Instructions KA110R/09

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>

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

Levelflex 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
	E	FOUNDATION Fieldbus	Operating Instructions	BA01055F/00/EN
			Brief Operating Instructions	KA01110F/00/EN
			Description of Device Parameters	GP01015F/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

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

Certificates

Safety Instructions (XA) for Levelflex 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		Feature 010	Approval	Safety Instructions HART	Safety Instructions PROFIBUS FOUNDATION Fieldbus
56	57				
x	x	BA	ATEX II 1 G Ex ia IIC T6 Ga	XA00496F	XA00516F
x	x	BB	ATEX II 1/2 G Ex ia IIC T6 Ga/Gb	XA00496F	XA00516F
x	x	BE	ATEX II 1 D Ex t[ia] IIIC Txx°C Da IP6x	XA00501F	XA00521F
x	x	BF	ATEX II 1/2 D Ex t[ia] IIIC Txx°C Da/Db IP6x	XA00501F	XA00521F
x	x	BG	ATEX II 3 G Ex nA IIC T6 Gc	XA00498F	XA00518F
x	x	BH	ATEX II 3 G Ex ic IIC T6 Gc	XA00498F	XA00518F
x	x	BL	ATEX II 1/3G Ex nA(ia) IIC T6	XA00497F	XA00517F
x	x	B2	ATEX II 1/2 G Ex ia IIC T6, 1/2D Ex ia IIIC IP6x	XA00502F	XA00522F
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	XA00503F	XA00523F
x	x	CD	CSA C/US DIP Cl.I,II Div.1 Gr.E-G	XA00529F	XA00570F
x	x	C2	CSA C/US IS Cl.I,II,III Div.1 Gr.A-G, NI Cl.1 Div.2, Ex ia	XA00530F	XA00571F
x	x	C3	CSA C/US XP Cl.I,II,III Div.1 Gr.A-G, NI Cl.1 Div.2, Ex d	XA00529F	XA00570F
x	x	FB	FM IS Cl.I,II,III Div.1 Gr.A-G, AEx ia, NI Cl.1 Div.2	XA00531F	XA00573F
x	x	FD	FM XP Cl.I,II,III Div.1 Gr.A-G, AEx d, NI Cl.1 Div.2	XA00532F	XA00572F
x	x	FE	FM DIP Cl.II,III Div.1 Gr.E-G	XA00532F	XA00572F
x	x	IA	IECEX Zone 0 Ex ia IIC T6 Ga	XA00496F	XA00516F
x	x	IB	IECEX Zone 0/1 Ex ia IIC T6 Ga/Gb	XA00496F	XA00516F
x	x	IE	IECEX Zone 20 Ex t[ia] IIIC Txx°C Da IP6x	XA00501F	XA00521F
x	x	IF	IECEX Zone 20/21 Ex t[ia] IIIC Txx°C Da/Db IP6x	XA00501F	XA00521F
x	x	IG	IECEX Zone 2 Ex nA IIC T6 Gc	XA00498F	XA00518F
x	x	IH	IECEX Zone 2 Ex ic IIC T6 Gc	XA00498F	XA00518F
x	x	IL	IECEX zone 0/2 Ex nA(ia) IIC T6 Ga/Gc	XA00497F	XA00517F
x	x	I2	IECEX zone 0/1 Ex ia IIC T6 Ga/Gb, zone 20/21 Ex ia IIIC A20/21 IP6x, Da/Db	XA00502F	XA00522F
x	x	I3	IECEX Zone 0/1 Ex d[ia] IIC T6 Ga/Gb, Zone 20/21 Ex t[ia] IIIC Txx°C Da/Db IP6x	XA00503F	XA00523F
x	x	NA	NEPSI Zone 0 Ex ia IIC T6 Ga	XA00634F	XA00640F
x	x	NB	NEPSI Zone 0/1 Ex ia IIC T6 Ga/Gb	XA00634F	XA00640F
x	x	NF	NEPSI Zone 20/21 tD IIIC A20/21 IP6x Da/Db	XA00637F	XA00643F
x	x	NG	NEPSI Zone 2 Ex nA II T6 Gc	XA00635F	XA00641F
x	x	NH	NEPSI Zone 2 Ex ic IIC T6 Gc	XA00635F	XA00641F
x	x	N2	NEPSI zone 0/1 Ex ia IIC T6 Ga/Gb, zone 20/21 Ex iaD 20/21 T*	XA00638F	XA00644F
x	x	N3	NEPSI zone 0/1 Ex d(ia) IIC T6 Ga/Gb, DIP A20/21 T* IP66	XA00639F	XA00645F
x	x	8A	FM/CSA IS+XP Cl.I,II,III Div.1 Gr.A-G	XA00531F XA00532F	XA00572F XA00573F



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

Registered trademarks

HART®

Registered trademark of the HART Communication Foundation, Austin, USA

PROFIBUS®

Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany

FOUNDATION™ Fieldbus

Registered trademark of the Fieldbus Foundation, 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
5.827.985	—
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	—
7.477.059	—
—	1 389 337
7.965.087	—

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