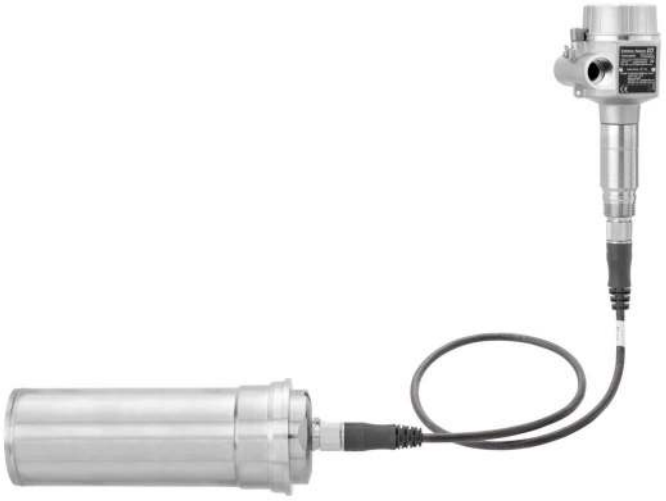
Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Gammapilot FTG20

Radiometric measuring technology
Separate sensor and transmitter for non-invasive point level detection



Application

- Non-invasive point level measurement for liquids, solids, suspensions and sludges etc.
- Used under extreme measuring conditions, e.g. high pressure, high temperature, corrosiveness, toxicity, abrasion.
- All kinds of process vessels, e.g. reactors, autoclaves, separators, acid tanks, mixers, cyclones, cupola furnaces.

Your benefits

- Sensor and transmitter:
  One instrument for all measuring tasks
- Highest availability, reliability and safety, even for extreme process and ambient conditions
- Optimum adjustment to the respective application and measuring range via a variety of sensitivity versions:
- Relay, 8/16 mA (passive) or 4 to 20 mA output for easy system integration
- Aluminium or stainless steel housing for heavy-duty applications
- Easy commissioning and fast, on-site operation
- Can be used universally due to numerous certificates and approvals
- Short response time
- No recalibration required following replacement of electronics
- Electronics self-monitoring

TI01023F/00/EN/02.12
71204355

Endress+Hauser
People for Process Automation

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Document information

Symbols used

Electrical symbols

Symbol	Meaning
A0018335	**Direct current** A terminal to which DC voltage is applied or through which direct current flows.
A0011198	**Alternating current** A terminal to which alternating voltage (sine-wave) is applied or through which alternating current flows.
 A0011200	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
 A0011199	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.

Tool symbols

Symbols for certain types of information

Symbol	Meaning
 A0011193	**Tip** Indicates additional information.
 A0011195	**Reference to page** Refers to the corresponding page number.

Symbols in graphics

Symbol	Meaning
1, 2, 3 ...	Item numbers
1. , 2. , 3. ...	Series of steps
A, B, C, ...	Views
 A0011187	**Hazardous area** Indicates a hazardous area.
 A0011188	**Safe area (non-hazardous area)** Indicates the non-hazardous area.

Function and system design

Measuring principle

Radiometric point level detection is based on the fact that gamma radiation is attenuated when it penetrates a material. As a general rule, the attenuation is a function of the following parameters:
Density ρ and thickness d of the material as well as a substance-specific, linear attenuation coefficient μ which depends on the type of radiation source.

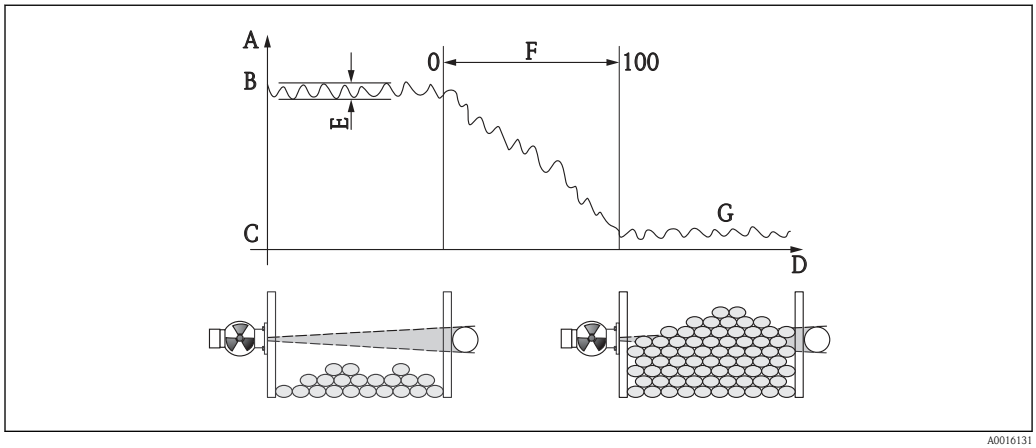
The attenuation is defined by the following formula: $Fs = e^{-\mu\rho d}$

A gamma radiation source and a Gammapilot FTG20 are mounted on opposite sides of the vessel at the height of the desired level limit.

"μ" and "d" remain constant for point level detection and the radiation intensity only depends on the medium being present:
- The count rate at the FTG20 reaches a maximum if the radiation path in the vessel is free (no medium in the radiation path).
- The count rate at the FTG20 reaches a minimum if the radiation path in the vessel is covered with medium and the radiation is attenuated as a result.

The min. and max. count rates, N_{min}, N_{max}, are determined when the transmitter is commissioned and are calibrated, whereby the following formula defines the relationship between them: $N_{min} = N_{max}\ e^{-\mu\rho d}$

The switching points are defined automatically following calibration.



A0016131

A Count rate
B Nmax
C Nmin
D Time
E Statistical fluctuations in the count rate
F The count rate changes when the radiation path becomes free from the product or when the product blocks the radiation path
G Count rate of residual radiation and background radiation

Measuring system

Radiometric point level detection typically consists of the following components:

Gamma radiation source

A preparation of ^{137}Cs or ^{60}Co acts as the gamma radiation source. Gamma radiation sources with different activities are available to adapt the system to the specific application. The "Applicator" [1] selection and sizing tool can be used to calculate the required activity. For additional information on the gamma radiation source, refer to TI00439F/00/EN.

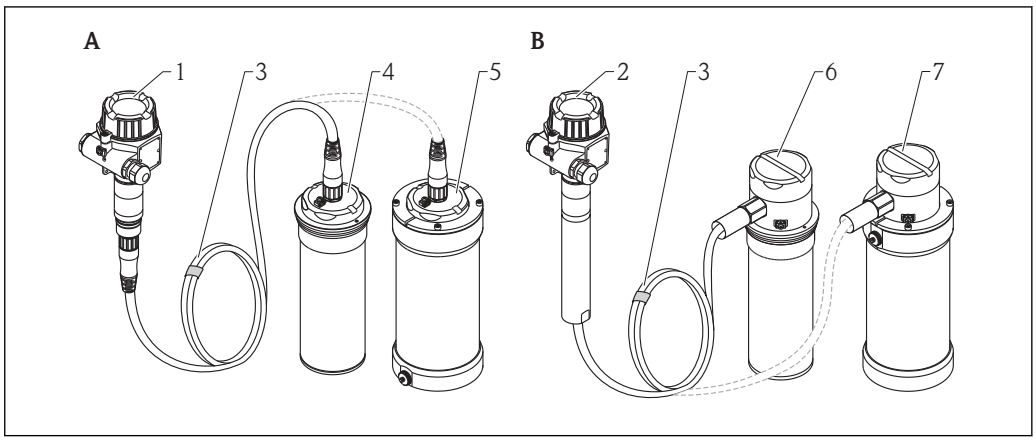
Radiation source container

The radiation source is enclosed in a source container, which allows the radiation to be emitted only in one direction and screens it off in any other direction. Source containers of different sizes and with different radiation exit angles are available. The "Applicator" [1] program can be used to select the source container that suits your application. For further information on source containers, refer to Technical Information TI00435F/00/EN (FQG61, FQG62), TI00346F/00/EN (QG2000) and TI00445F/00/EN (FQG60).

1) See: www.endress.com/applicator

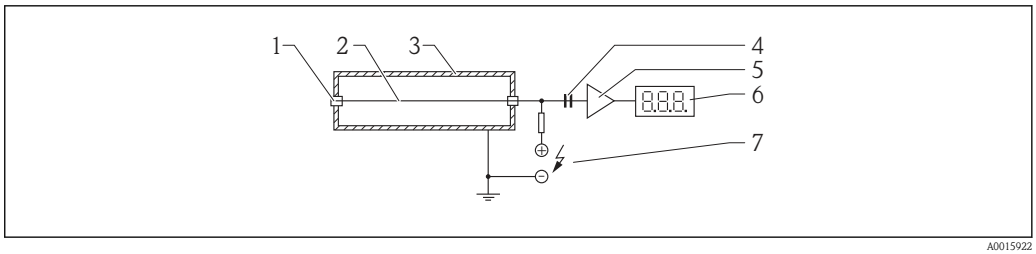
Gammapilot FTG20

Components of the FTG20



A Standard version
1 Transmitter housing
3 Connecting cable between the transmitter housing and sensor
4 Sensor with Geiger-Müller counters
5 Sensor with Geiger-Müller counters and cooling jacket
B Version with impact protection tube and connection compartment for conduiting
2 Transmitter housing with impact protection tube
3 Connecting cable between the transmitter housing and sensor (connecting cable in installations sided tube)
6 Sensor with Geiger-Müller counters and connection compartment
7 Sensor with Geiger-Müller counters, cooling jacket and connection compartment

Geiger-Müller counter



1 Schematic diagram of a Geiger-Müller counter

1 Insulator
2 Counter wire (anode)
3 Counter casing
4 Decoupling capacitor
5 Amplifier
6 Counter
7 High voltage source

The Geiger-Müller counter of the Gammapilot FTG20 comprises a cylindrical metal tube (cathode) filled with noble gas, with a centrally mounted, insulated anode wire. The counter is connected to a direct current supply of several hundred volts via a high-impedance resistor. In the absence of radioactive radiation the system behaves as an almost ideal insulator. However, when gamma radiation passes through the tube, the noble gas within is ionized, producing so-called primary electrons. These move towards the anode, creating on their way avalanches of secondary electrons. The number of pulses output by the Geiger-Müller counter is dependent upon the number of impinging gamma particles, and thus from the local dose rate at the tube.

The pulses are transmitted to the electronic evaluation unit in the transmitter housing via a current loop, are evaluated there and used to switch the output. The Gammapilot FTG20 is available with one, two or three Geiger-Müller counters depending on the application and associated sensitivity.

Depending on the electronics used, mini contactors, solenoid valves, signaling devices, programmable controllers etc. can be connected directly.

Decay compensation

A decay compensation function for ^{137}Cs or ^{60}Co can be configured on site at the customer's. The device runtime is counted in days starting from the time of calibration [2]. A warning is displayed if, as a result of the decay, the interval between empty and full calibration is no longer adequate to guarantee sufficiently fast switching behaviour.

The memory module for the decay compensation and calibration parameters is located in the transmitter housing. The parameters can still be used in the event of failure of the electronic insert. Recalibration is not required.

2) Only device runtime is used. This must be taken into account during longer downtimes.

Input

Input signal

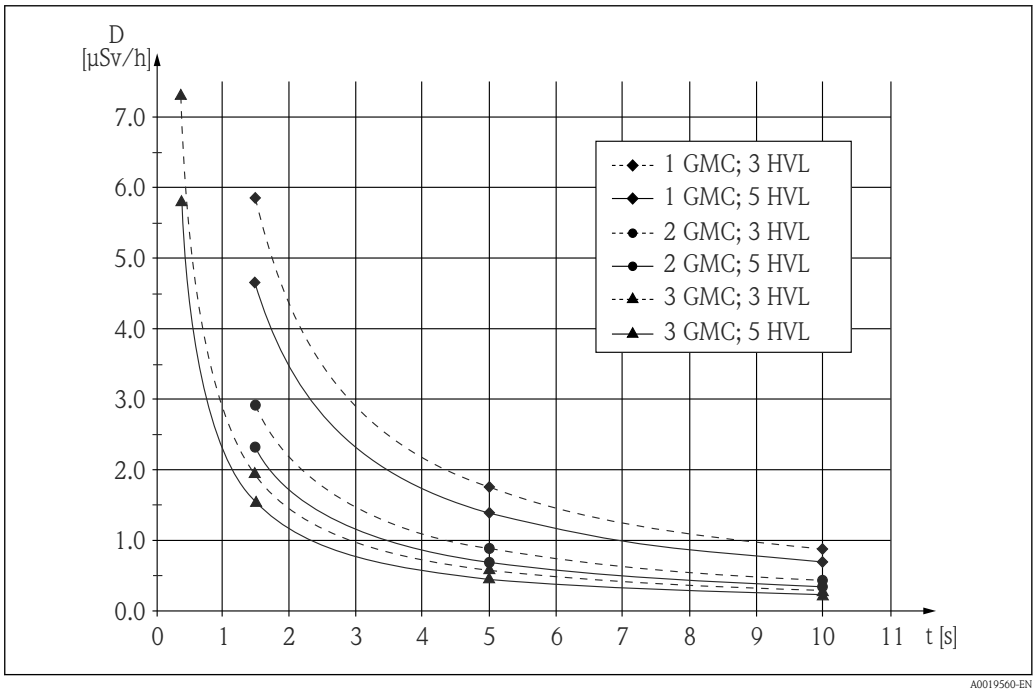
The measured variable is the local dose rate at the Geiger-Müller counter (at the Geiger-Müller counters). The sensor sensitivity and maximum local dose rate depend on the number of counters (see feature 020 in the product structure). All details on the local dose rate are based on ^{137}Cs (see table below) as the radiation source. If ^{60}Co is used, an approx. 20% increase in sensitivity is to be expected.

Number of Geiger-Müller counters	Local dose rate when mounted horizontally	Local dose rate when mounted at front	Maximum local dose rate when mounted horizontally [1]
1	1 to 8 µSv/h	2 to 16 µSv/h	24 µSv/h
2	0.5 to 4 µSv/h	1 to 8 µSv/h	12 µSv/h
3	0.33 to 2.7 µSv/h	0.66 to 5.4 µSv/h	8 µSv/h

1) An alarm is triggered if the local dose rate is too high or too low.

The required local dose rate at the detector when the status is "uncovered" depends on the number Geiger-Müller counters, the half-value layers (HVL) and the selected switching time (0.4 s, 1.5 s, 5 s and 10 s).

The graphs shown below are only displayed/provided for ^{137}Cs ≥5 HVL.



2 Required local dose rate, Geiger-Müller counters

D Local dose rate in microsievert (µSv/h)
t Switching delay in seconds (s)

- 3 HVL: change in the pulse rate (free → covered) by 87.5% (e.g.: ≈350 mm (13.8 in) water)
- 5 HVL: change in the pulse rate (free → covered) by 97% (e.g.: ≈600 mm (23.6 in) water)
- Calculation of the measuring point using the Applicator tool: www.endress.com/applicator

Output

Output signal

Relay output (FEG24)

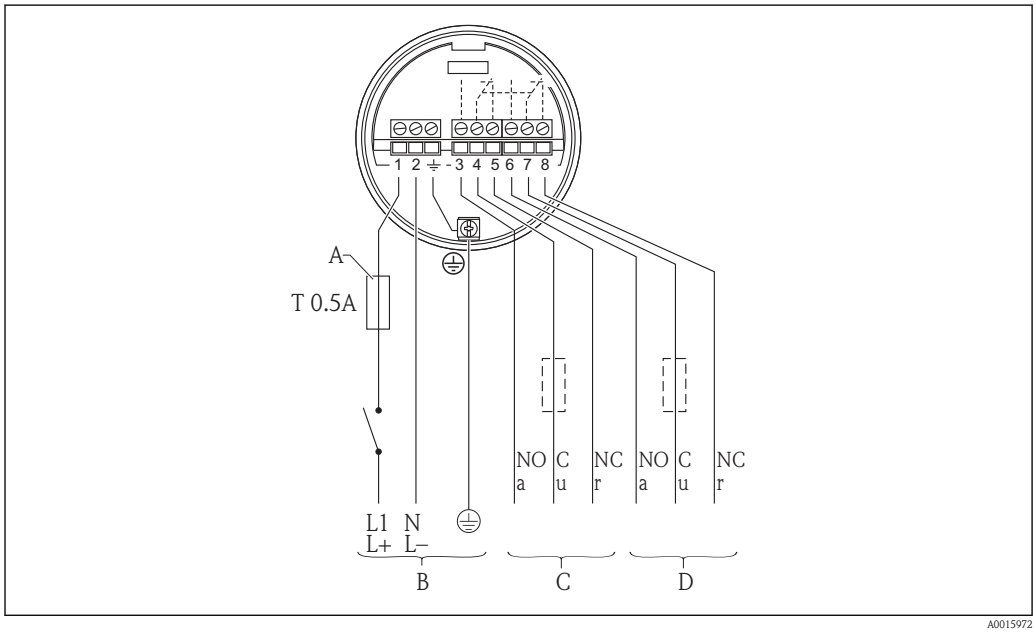
The universal current connection with relay output (DPDT) works with two different voltage ranges (19 to 253 V_{AC} or 19 to 55 V_{DC}) and is suitable for overvoltage category II.

Use spark suppression to protect the relay contacts when connecting high-inductivity devices.

Signal on alarm:
Output signal on power failure or in the event of device failure: relay de-energized.

Connectable power
- Loads switched via 2 potential-free changeover contacts (DPDT)
- I~ max. 4 A; U~ max. 253 V; P~ max. 1 000 VA where cos φ = 1; P~ max. 750 VA where cos φ = 0.7
- I- max. 4 A to 30 V; I- max. 0.2 A to 125 V
- Switching delay: 0.4 s, 1.5 s, 5 s, 10 s

	Max. point level switch	Min. point level switch
Radiation path	**Relay**	**Relay**
"Free"	Energized	De-energized
"Covered"	De-energized	Energized



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A Fuse as per IEC 60127, T 0.5 A
B Supply voltage: 19 to 253 VAC or 19 to 55 VDC
C Relay: contact circuit 1
D Relay: contact circuit 2

Contact circuit 1 (terminals 3, 4, 5) is separated from contact circuit 2 (terminals 6, 7, 8) by basic insulation only.

Do not connect any circuits which must be separated by double or reinforced insulation to contact circuit 1 and 2. For example, a SELV circuit must **not** be combined with a mains supply circuit.

Current output (FEG25)

Ideally, the two-wire direct current connection is connected to the following:
- Programmable controllers (PLC)
- AI modules 4 to 20 mA in accordance with EN 61131-2

An output signal jump from 8 mA to 16 mA indicates that the point level is reached.

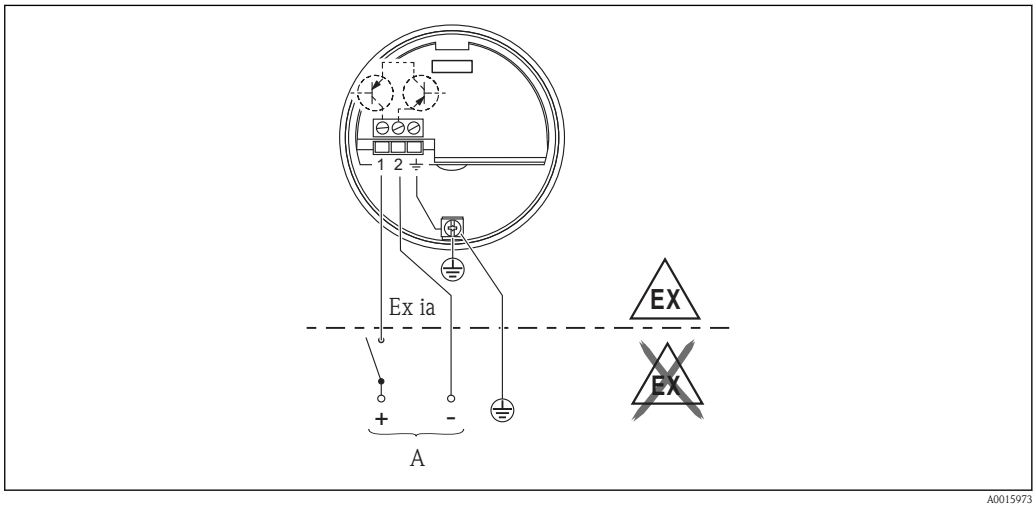
Current output operating modes

Operating mode	Comments
Switching mode 8/16 mA (min. or max. point level detection)	■ The switching time can be selected: 0.4 s, 1.5 s, 5 s, 10 s (depending on the calibration values) ■ Output current: 8/16 mA switching ■ Error current: ≥21 mA
Analog mode 4 to 20 mA	■ The output current continuously changes from 4 mA (radiation path completely covered) to 20 mA (radiation path completely free). The conversion to a switch signal takes place in an external transmitter (e.g. RMA42) or the PLC. ■ Error current: ≥21 mA ■ Integration time 0.4 s, 1.5 s, 5 s, 10 s (can be selected), does not depend on calibration values

	Max. point level switch	Min. point level switch	Analog mode
Radiation path	**8/16 mA**	**8/16 mA**	**4 to 20 mA**
"Free"	16	8	20
"Covered"	8	16	4

Signal on alarm:
Output signal on power failure or in the event of a device failure: < 3.6 mA

Connectable power
- U = direct current connection:
  11 to 36 V DC (non-hazardous area) 11 to 30 V DC (Ex ia)
- Error current: ≥21 mA



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A U- 11 to 36 VDC (30 VDC); e.g. from PLC

Sensor failure

Values for failure rates and diagnostic time

Conditions:
- Database: SN29500 (Ta40 °C (104 °F))
- Evaluation of the Gammapilot FTG20 electronics
- The device including the software 01.00.zz is not rated for use in protective equipment
- Diagnostic time is 5 minutes

Summary FTG20	Current output (FEG25)		Relay output (FEG24)	
	HiHi	LoLo	HiHi	LoLo
Safe Detected (sd) Failure Rate [1/h]	3.21E-07	2.95E-09	3.20E-07	2.95E-09
Safe Undetected (su) Failure Rate [1/h]	6.10E-07	2.00E-07	4.52E-07	4.20E-08
Dangerous Detected (dd) Failure Rate [1/h]	2.12E-09	3.20E-07	2.12E-09	3.19E-07
Dangerous Undetected (du) Failure Rate [1/h]	8.32E-08	4.94E-07	7.78E-08	4.88E-07
Fail High (H) Failure Rate [1/h]	7.80E-09	7.80E-09	6.35E-08	6.35E-08
Fail Low (L) Failure Rate [1/h]	5.77E-08	5.77E-08	1.12E-07	1.12E-07
Annunciation Detection (ad) Failure Rate [1/h]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Annunciation Undetected (au) Failure Rate [1/h]	3.15E-08	3.15E-08	3.12E-08	3.12E-08
"No effect" (#) Failure Rate [1/h]	2.64E-07	2.64E-07	2.24E-07	2.24E-07
"Not considered" (!) Failure Rate [1/h]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
"No part" (-) Failure Rate [1/h]	3.43E-08	3.43E-08	3.43E-08	3.43E-08
Total Failure Rate [1/h] - Device	1.41E-06	1.41E-06	1.32E-06	1.32E-06
MTBF [h] - Device	7.09E+05	7.09E+05	7.59E+05	7.59E+05
MTBF [year] - Device	81	81	87	87

Signal on alarm

- Relay output (FEG24): Relay de-energized
- Current output (FEG25): Error current to NE43, i.e. ≤3.6 mA or ≥21 mA
- LED 5 (red) on the electronic insert lights up.

Ex connection data

	FEG25 (intrinsically safe power supply)
U_i	30 V
I_i	100 mA
P_i	1 W
C_i	2.4 nF
L_i	0

Power supply

Supply voltage

Version with current output (FEG25)	Version with relay output (FEG24)
11 to 36 VDC, 11 to 30 VDC (Ex ia)	19 to 55 VDC or 19 to 253 VAC (50 to 60 Hz)
Overvoltage category I	Overvoltage category II
Reverse polarity protection: yes	Reverse polarity protection: yes

Power consumption

FEG25:
Max. 900 mW

FEG24:
- DC max. 1.4 W
- AC max. 23 VA

Connecting cable

See (→ 24)

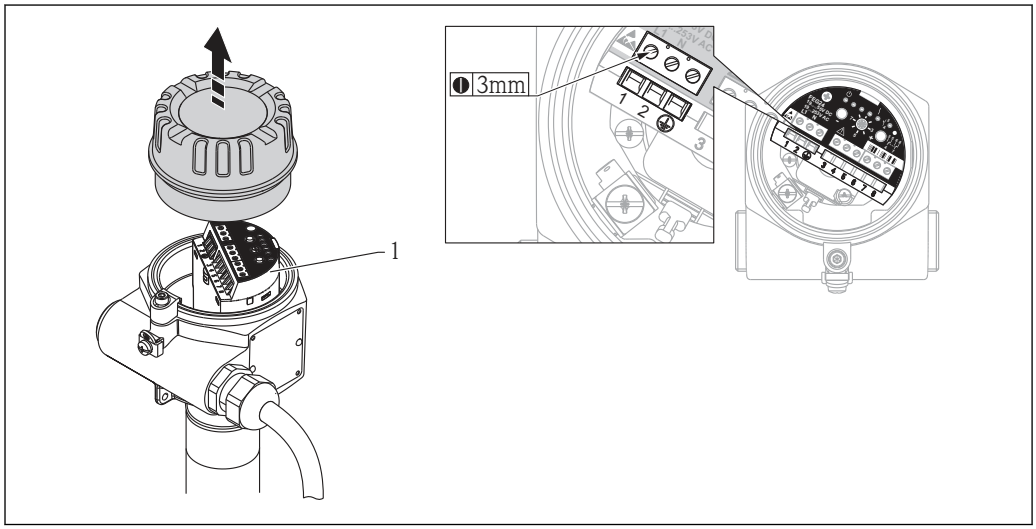
Potential equalization

Connect the potential equalization line to the external ground terminal of the sensor and transmitter housing. Please refer to the separate documentation on applications in hazardous areas for further safety instructions.

Terminals

Terminals at the transmitter

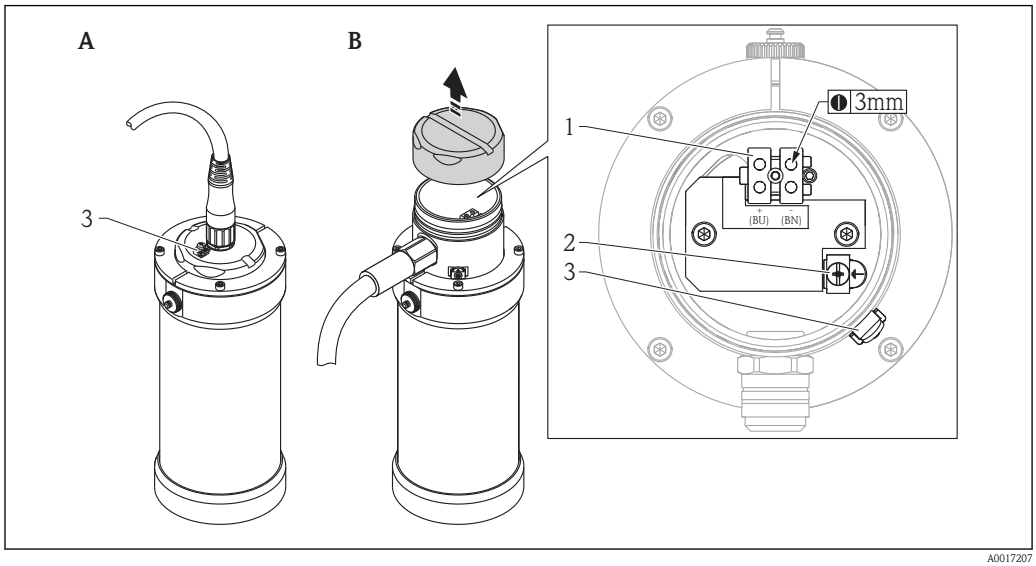
The electronic inserts can be connected using commercially available installation cables. If using shielded installation cables, it is recommended to connect the shielding on both sides for best results (if a potential equalization line is available).



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1 Electronic insert

Terminals at the sensor



A0017207

1 Terminals
2 Ground terminal, internal
3 Ground terminal, external

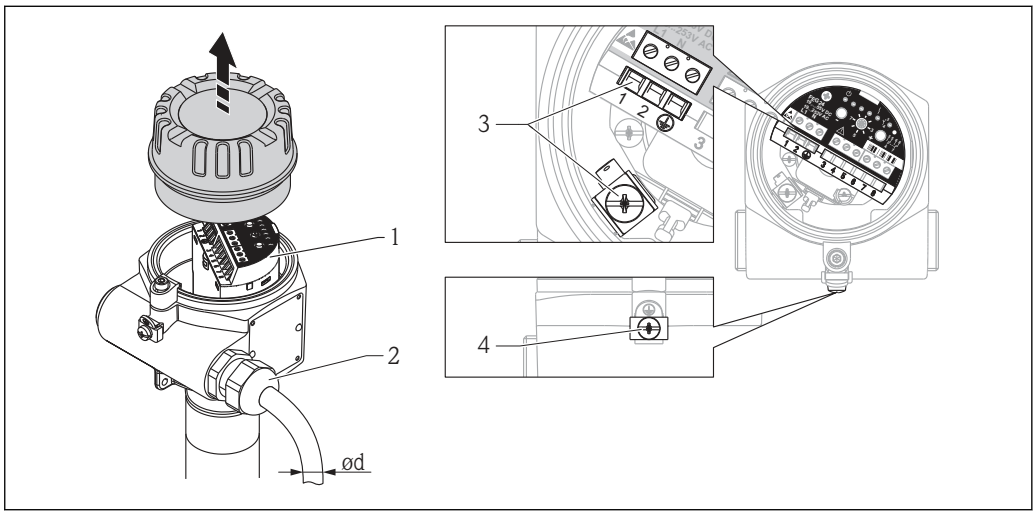
Cable entries

Transmitter housing
- Coupling M20x1.5
- Thread G½"
- Thread NPT¾"
- Thread M20x1.5

Sensor
- Connector
- Thread NPT½"

Cable specifications

Cable specifications at the transmitter



1 Electronic insert
2 Cable entry, M20x1.5 (for further information, see table below)
3 Cable core, max. 2.5 mm² (AWG 14)
4 Cable core with max. 4 mm² (AWG 12)

Cable entry material	Cable diameter d
Brass	7 to 15.5 mm (0.28 to 0.41 in)
Plastic	5 to 10 mm (0.2 to 0.38 in)
Stainless steel	7 to 12 mm (0.28 to 0.47 in)

Performance characteristics

Hysteresis

The device features a hysteresis, which is automatically determined based on the calibration values, to prevent accidental switching caused by statistical fluctuations. The minimum possible switching time is limited by the calibration values and displayed to the user.

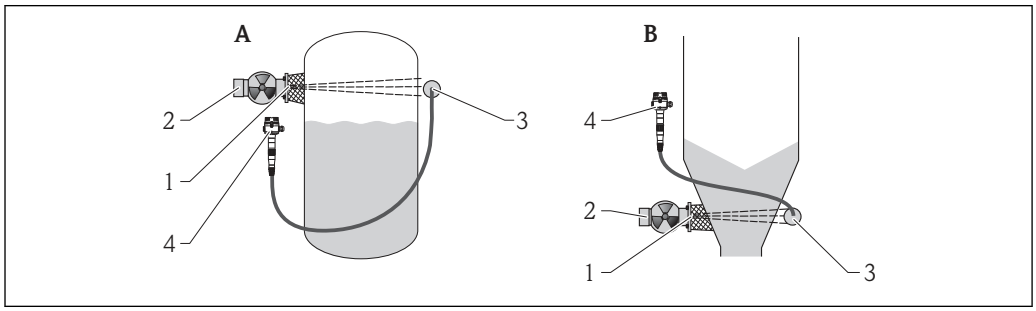
Installation

Mounting location

The measuring system is mounted outside the container and does not come in contact with the product being measured. The entire measuring system consists of the Gammapilot FTG20 as well as a radioactive radiation source ^{137}Cs or ^{60}Co, which is installed in a radiation source container. The FTG20 is securely mounted exactly opposite to the radiation source container.

The mounting position depends on the intended operating mode:

- Maximum point level detection (example of application: overfill protection)
  The detector and radiation source container are installed at the height of the **upper** level limit. A signal is output if the level limit is exceeded.
- Minimum point level detection (example of application: dry running protection)
  The detector and radiation source container are installed at the height of the **lower** level limit. A signal is output if the level limit is not reached.



A Maximum point level detection
B Minimum point level detection
1 Radiation exit channel
2 Radiation source container
3 Gammapilot FTG20, sensor
4 Gammapilot FTG20, transmitter

Environment

Ambient temperature range

The device version depends on the ambient conditions present.

	Aluminum	316L
At the transmitter housing	–40 to +70 °C (–40 to +158 °F)	–40 to +70 °C (–40 to +158 °F) [1]
At the sensor housing	–40 to +70 °C (–40 to +158 °F)	Without water cooling: –40 to +70 °C (–40 to +158 °F) [1]
		With water cooling: 0 to +120 °C (32 to +248 °F)

1) Note! The lower temperature limit only applies to a permanently installed connecting cable. Minimum temperature during installation: -20 °C (-4 °F)

Storage temperature

–40 to +70 °C (–40 to +158 °F)

Climate class

IEC EN 60068-2-38 (Test Z/AD)

Installation height as per IEC61010-1 Ed.3

2 000 m (6 600 ft)

Degree of protection

Transmitter housing F13 (aluminium)	Transmitter housing F27 (316L)	Sensor housing (aluminium)	Sensor housing (316L)
IP66/IP67	IP66/IP68	IP66/IP67	IP66/IP68
TYPE 4/6 Enclosure	TYPE 4X/6P Enclosure	TYPE 4/6 Enclosure	TYPE 4X/6P Enclosure

Shock resistance

IEC EN 60068-2-27 (test Ea; 30 g acceleration, 18 ms, 3 shocks/direction/axis)

Vibration resistance

IEC EN 60068-2-64 (test Fh; 10 to 2 000 Hz, $1(m/s^2)^2/Hz$)

Electromagnetic compatibility

- Interference emission: EN 61326, equipment class B
- Interference immunity: EN 61326, appendix A (industrial sector)
- NAMUR Recommendation: NE 21

Process

The measurement takes place from the outside with absolutely no contact. Therefore, there are no specific requirements regarding process conditions. The process pressure must be taken into account, however, when calculating the radiation source activity. There are no further limitations when measuring with the FTG20. Furthermore, applications in the food industry are possible without any additional requirements.

Minimum damping depends on the local dose rate when the radiation path is free and on the number of Geiger-Müller counters. The required dependency is shown in the Applicator program.

The maximum measurable dose rate depends on the number of Geiger-Müller counters.

300 events/s can be measured. This results in the following upper limits for horizontal irradiation (^{137}Cs source) for the three sensitivity versions:
- 1 Geiger-Müller counter: 26 µSv/h
- 2 Geiger-Müller counters: 13 µSv/h
- 3 Geiger-Müller counters: 8.6 µSv/h

An alarm is triggered if the irradiation is higher (→ 🖹 7).

For empty calibration, the specified dose rates are the maximum recommended (^{137}Cs source) (→ 🖹 7):
- 1 Geiger-Müller counter: 24 µSv/h
- 2 Geiger-Müller counters: 12 µSv/h
- 3 Geiger-Müller counters: 8 µSv/h

A switching speed of 0.4 s is possible with these specified values. Always double the values for frontal irradiation. If the values for the switching time are higher, the local dose rate can be reduced according to the table.

The currently measured pulse rate (switch position 8) can be displayed during operation . All details on the local dose rate are based on ^{137}Cs as the radiation source. If ^{60}Co is used, an approx. 20% increase in sensitivity is to be expected.

Process pressure range

The process pressure may influence the required source activity and is taken into account at the configuration stage.

Process temperature range

Does not affect source activity. In the case of high process temperatures, please ensure there is adequate insulation between the process vessel and detector or order a detector with a water cooling jacket.

Mounting the cooling jacket

Ambient temperature Ta: ≤120 °C (248 °F)

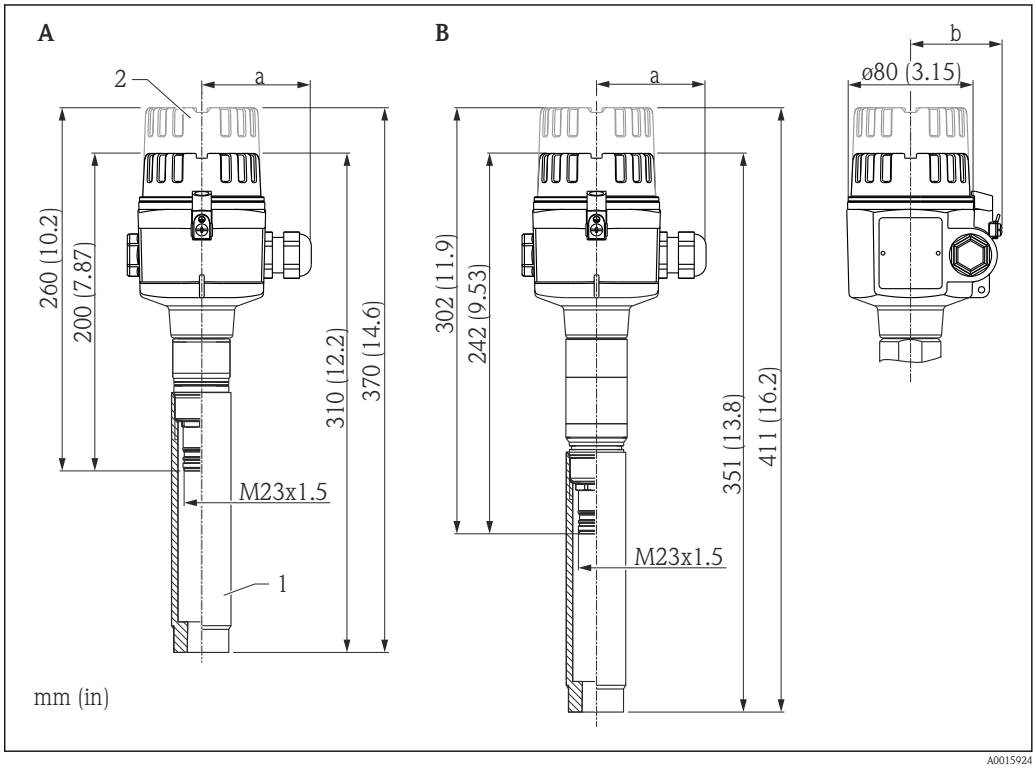
Maximum pressure: 4 bar (58 psi)

Flow temperature	Required flow
Max.40 °C (104 °F)	0.2 l/min
Max.50 °C (122 °F)	0.5 l/min

Mechanical construction

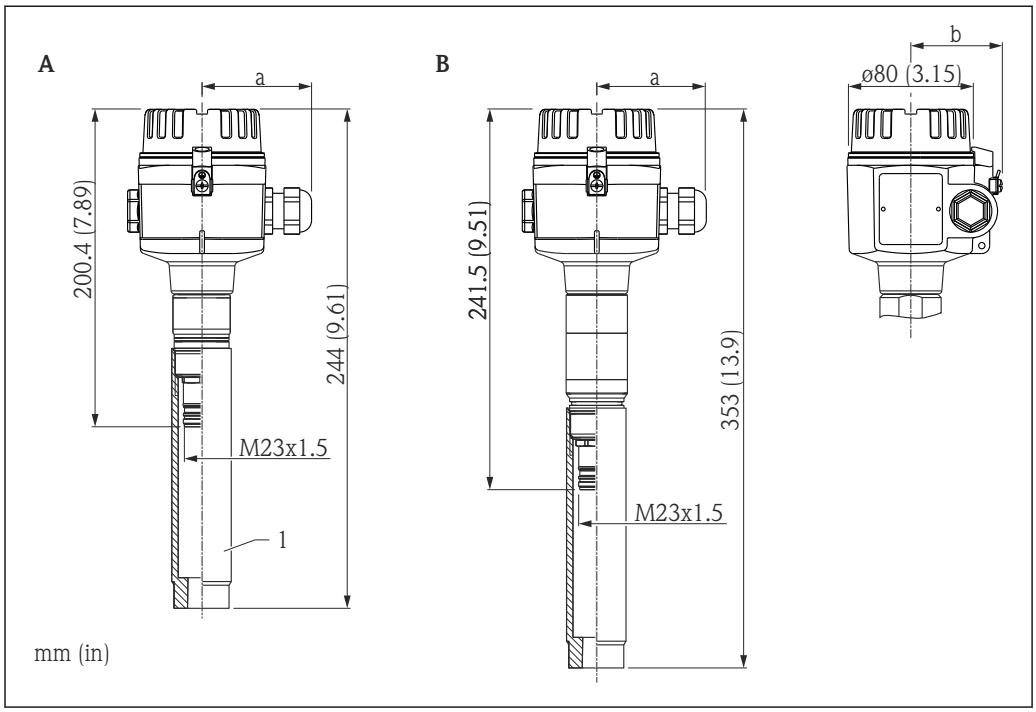
Design, dimensions

Dimensions of the aluminium housing



1 Impact protection (→ 🖹 31)
2 Glass cover optional
A Device version for non-hazardous area
B Device version for hazardous area
a Max. 70 mm (2.76 in)
b Max. 60 mm (2.36 in)

Dimensions of the stainless steel housing

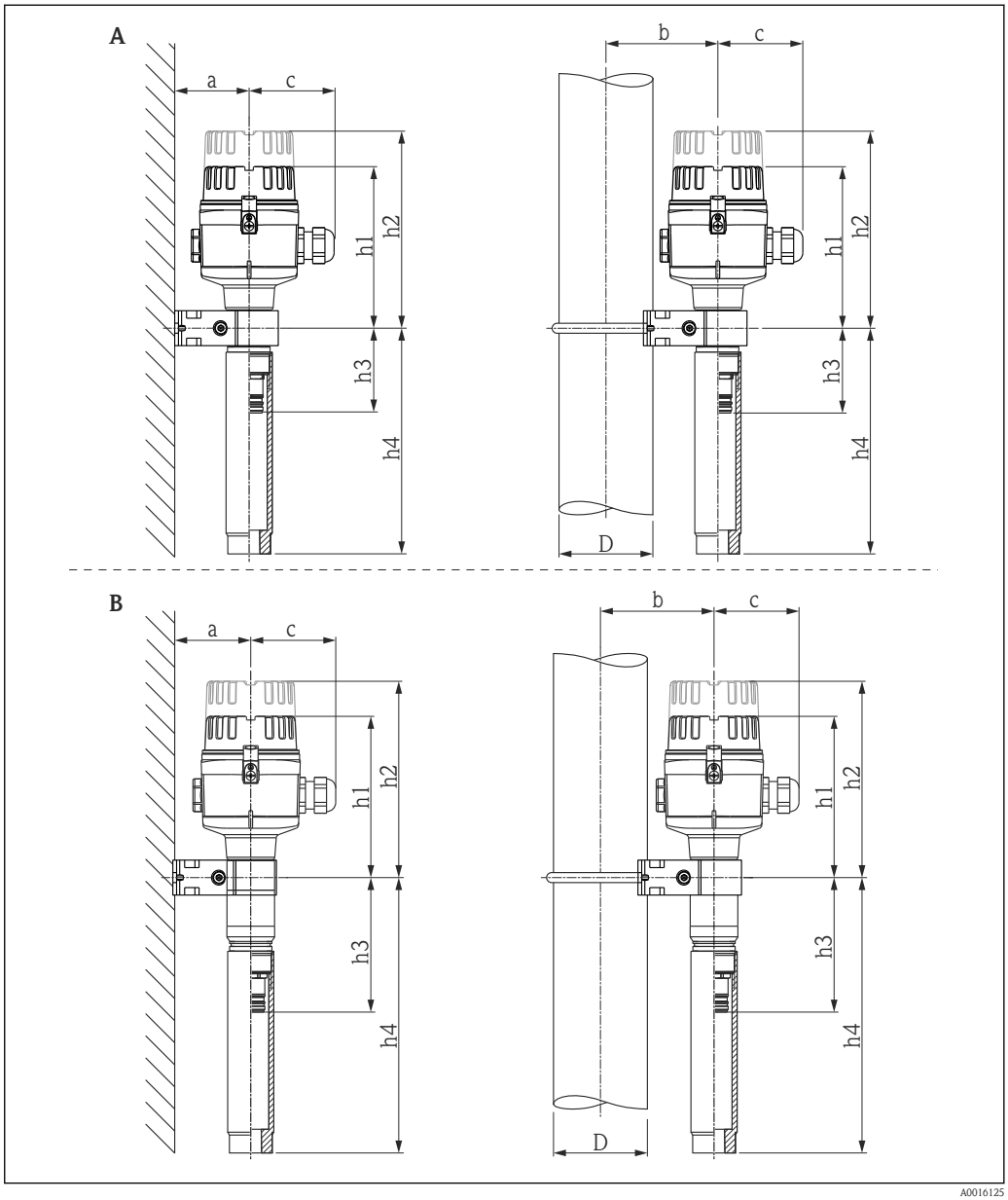


1 Impact protection (→ 31)
A Device version for non-hazardous area
B Device version for hazardous area
a Max. 70 mm (2.76 in)
b Max. 60 mm (2.36 in)

Mounting bracket dimensions

The mounting set for wall and pipe mounting can be ordered as an accessory.

Wall and pipe mounting



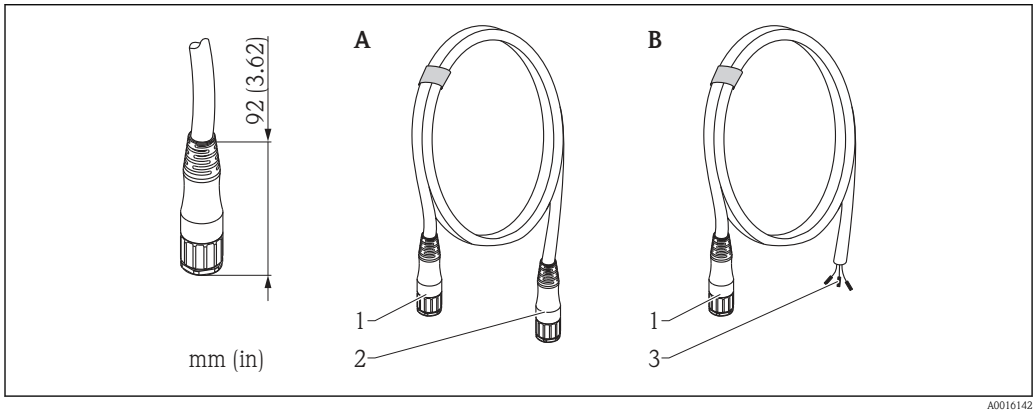
A0016125

Dimensions	A= non-hazardous area [mm (in)]		B= hazardous area [mm (in)]
	Standard cover	Glass cover	
a	~61 mm (2.4 in)		
b	~75 mm (2.95 in)		
c	Max. 70 mm (2.76 in)		
h1	132 mm (5.2 in)	160 mm (6.3 in)	135 mm (5.31 in)
h2	165 mm (6.5 in)	195 mm (7.68 in)	175 mm (6.89 in)
h3	70 mm (2.76 in)		~110 mm (4.33 in)
h4	178 mm (7.01 in)		~218 mm (8.58 in)

Connecting cable dimensions

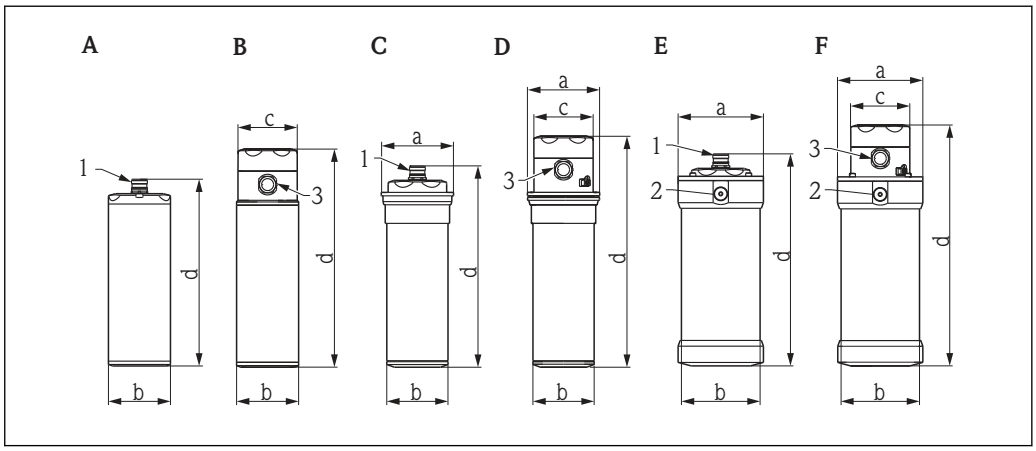
Different connecting cable versions are available depending on the application:
- Cable with two plug connections for the transmitter and sensor
- Cable with plug connection for the transmitter and cable tail for the sensor with connection compartment

The connecting cable between the transmitter and sensor is available in the following lengths:
- 5 m (16 ft)
- 10 m (33 ft)
- 20 m (66 ft)
- Special lengths on request



A Connecting cable with two plug connections
B Connecting cable with one plug connection and cable tail
1 M23 connector with 6-pole pin contacts (transmitter side)
2 M23 connector with 6-pole bushing contact (sensor side)
3 Cable tail

Sensor housing dimensions



A Sensor (aluminium)
B Sensor (aluminium) with connection compartment
C Sensor (316L)
D Sensor (316L) with connection compartment
E Sensor (316L) with cooling jacket
F Sensor (316L) with cooling jacket and connection compartment
1 Connector M23x1.5
2 Cooling water connection G1/4"
3 Cable entry NPT1/2"

Dimensions	A	B	C	D	E	F
a	-	-	∅105 mm (4.13 in)	∅105 mm (4.13 in)	∅124 mm (4.88 in)	∅124 mm (4.88 in)
b	∅90 mm (3.54 in)	∅90 mm (3.54 in)	∅88.9 mm (3.5 in)	∅88.9 mm (3.5 in)	∅114.3 mm (4.5 in)	∅114.3 mm (4.5 in)
c	-	∅86 mm (3.39 in)	-	∅86 mm (3.39 in)	-	∅86 mm (3.39 in)
d	271 mm (10.7 in)	316.5 mm (12.5 in)	292.6 mm (11.5 in)	335.5 mm (13.2 in)	308.1 mm (12.1 in)	351 mm (13.8 in)

Pipe bracket dimensions

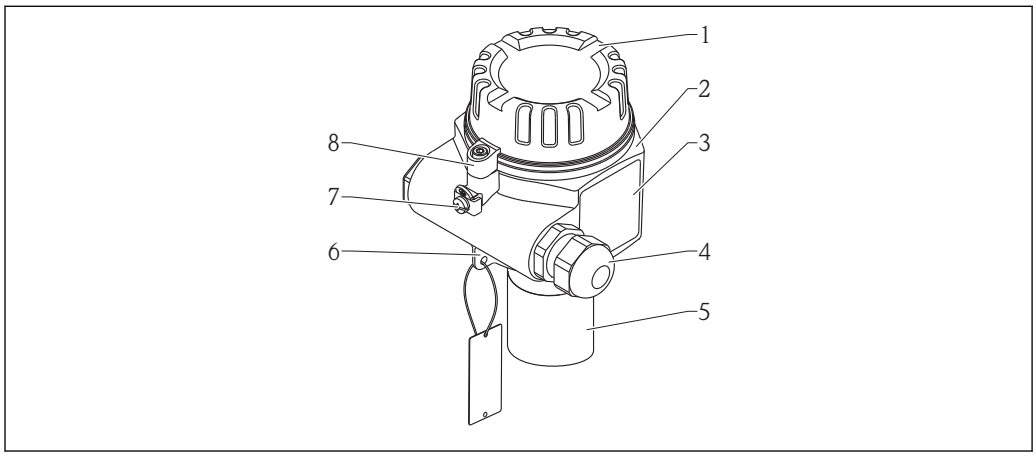
For the pipe bracket dimensions, see (→ 30).

Weight

Component part	Weight
Aluminium sensor	Approx. 1.7 kg (3.75 lbs)
Aluminium sensor with connection compartment	Approx. 2.1 kg (4.63 lbs)
SS sensor	Approx. 4.2 kg (9.26 lbs)
SS sensor with connection compartment	Approx. 5.2 kg (11.47 lbs)
SS sensor and water cooling jacket	Approx. 8.9 kg (19.62 lbs)
SS sensor, water cooling jacket and connection compartment	Approx. 9.7 kg (21.39 lbs)
Aluminum transmitter	Approx. 1.0 kg (2.21 lbs)
Aluminum transmitter and SS adapter	Approx. 1.2 kg (2.65 lbs)
SS transmitter	Approx. 2.2 kg (4.85 lbs)
Cable (each 5 m)	Approx. 0.75 kg (1.65 lbs)
Protection tube	Approx. 0.65 kg (1.43 lbs)

Materials

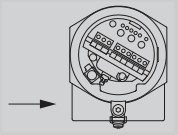
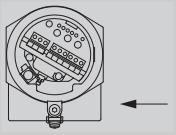
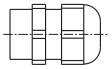
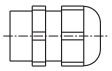
Transmitter housing



A0016085

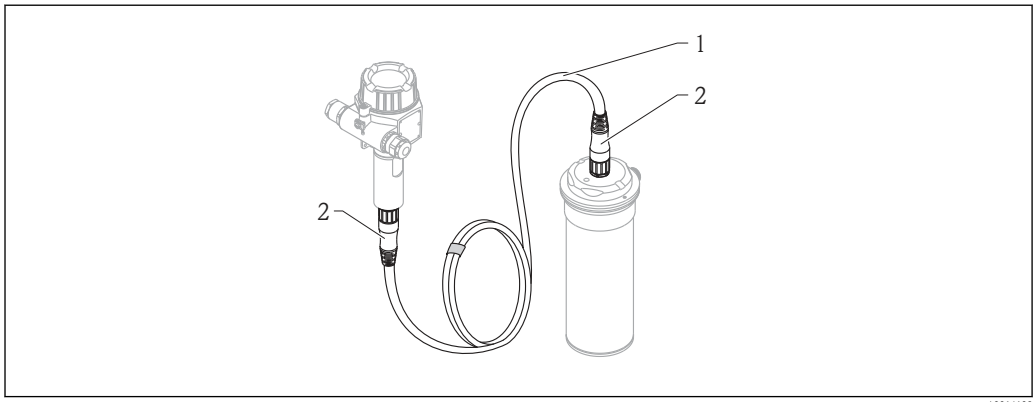
Item	Designation		Material
1	Cover F13 (low)		AlSi10Mg (Fe) [EN-AC-43400 powder-coated]
	■ Cover F18 (high) ■ Sight glass ■ Sight glass seal ■ Snap ring		■ AlSi10Mg (Fe) [EN-AC-43400 powder-coated] ■ Borosilicate glass ■ NBR ■ 301 (1.4310)
	Cover F27		316L (1.4404/1.4435)
	Cover seal (all covers)		EPDM PTFE-coated
2	Housing F13		AlSi10Mg (Fe) [EN-AC-43400 powder-coated]
	Housing F27		316L (1.4404/1.4435)
3	Nameplate		304 (1.4301) with adhesive label
	Adhesive label		Laser foil black-white; Adhesive: Acrylate, strong adhesion
	Grooved pin		A2
4	Cable gland		(→ 23)
	Blind plug		
5	Adapter		316L (1.4404/1.4435)
			EN-AW-6082
	O-ring		EPDM 70 + PTFE/FDA
6	Tag		304 (1.4301)
	Cable		316 (1.4401)
	Crimp sleeve		Aluminium
7	Ground terminal	Screw	A2 PTFE-coated
		Spring ring	A4
		Clamping bracket	304 (1.4301)
		Bracket	301 (1.4310)
8	Cover clamp		F27 transmitter: 316L (1.4404/1.4435) F13 transmitter: CuZn37
	Screw		A4
	Spring ring		A4

Cable entries

Cable entry, left  A0018996		Cable entry, right  A0019000	
 A0016087	Description: Sealing plug connection M20x1.5 (non-hazardous area) [1]	 A0018986	Description: Cable gland M20x1.5 (non-hazardous area) [1]
	Material: PBT-GF-FR		Material: PA
	Housing: F13		Housing: F13
 A0018987	Description: Sealing plug connection M20x1.5 (hazardous area) [1]	 A0018988	Description: Cable gland M20x1.5 (hazardous area) [1]
	Material: 316L (1.4404/1.4435)		Material: Nickel-plated CuZn
	Housing: F13		Housing: F13
 A0018987	Description: Sealing plug thread M20x1.5 [1]	 A0018990	Description: Sealing plug M20x1.5 [1]
	Material: 316L (1.4404/1.4435)		Material: Polyethylene PE-LD
	Housing: F13		Housing: F13
 A0018991	Description: Sealing plug G1/2 [1]	 A0018990	Description: Sealing plug G1/2 [1]
	Material: 316L (1.4404/1.4435)		Material: Polyethylene PE-HD
	Housing: F13		Housing: F13
 A0018987	Description: Sealing plug connection M20x1.5 (hazardous or non-hazardous area) [1]	 A0018986	Description: Cable gland M20x1.5 (hazardous or non-hazardous area) [2]
	Material: 316L (1.4404/1.4435)		Material: 316L (1.4404/1.4435)
	Housing: F27		Housing: F27
 A0018987	Description: Sealing plug thread M20x1.5 [1]	 A0018992	Description: Sealing plug M20x1.5 [1]
	Material: 316L (1.4404/1.4435)		Material: Polyethylene PE-LD
	Housing: F27		Housing: F27
 A0018989	Description: Adapter M20x1.5 - G1/2 [1]	 A0018995	Description: Adapter M20x1.5 - G1/2 [1]
	Material: 316L (1.4404/1.4435)		Material: 316L (1.4404/1.4435)
	Housing: F27		Housing: F27
 A0018991	Description: Sealing plug G1/2 [1]	 A0018990	Description: Sealing plug G1/2 [1]
	Material: 316L (1.4404/1.4435)		Material: Polyethylene (PE-HD or PE-LD)
	Housing: F27		Housing: F27
 A0018993	Description: Sealing plug NPT3/4	 A0018993	Description: Sealing plug NPT3/4
	Material: 316L (1.4404/1.4435)		Material: Polyethylene PE-LD
	Housing: F13 and F27		Housing: F13 and F27

1) An O-ring is also used. Material: EPDM
2) An O-ring is also used. Material: NBR

Connecting cable



A0016109

Item	Designation		Material	Use
1	Cable (Cable sheath)	Lapp ÖLFLEX ROBUST 215C	TPE P4/11 halogen-free	Transmitter/sensor, aluminium
		Lapp ÖLFLEX HEAT 180 EWKF or HELU THERMFLEX 180 EWKF-C	Silicone	Transmitter/sensor, 316L
2	M23 connector Housing surface		Cable entry, black: Polyurethane (PUR)	Transmitter/sensor, aluminium and 316L
			Metal parts, nickel-plated: ■ Ms58 (CuZn39Pb3) ■ Z410 (ZnAl4Cu1)) ■ Polished and nickel-plated (3–5 µm)	Transmitter/sensor, aluminium
			316L (1.4404)	Transmitter/sensor, 316L
	Seal		NBR	Transmitter/sensor, aluminium
			FKM	Transmitter/sensor, 316L

Sensor housing

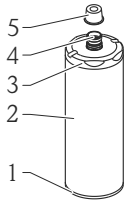
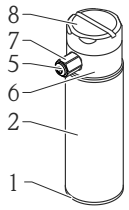
Diagram	Item	Designation	Materials	
			A = Sensor (aluminium)	B = Sensor (aluminium) with connection compartment
A  	1	Base plate	EN-AW-6082	EN-AW-6082
		Seal	EPDM+PTFE-coated	EPDM+PTFE-coated
	2	Housing	EN-AW-6060	EN-AW-6060
	3	Cover	EN-AW-6082	
		Seal	EPDM+PTFE-coated	
	4	M23 connector	Z410 (ZnAl4Cu1)	
		Seal	NBR	
B  A0018994	5	Dummy plugs (transport protection)	PE-LD	PE-LD
	6	Housing top, connection compartment		EN-AW-6082
		Seal		EPDM+PTFE-coated
	7	Adapter M20x1.5 - NPT1/2		316L (1.4404/1.4435)
		Seal		EPDM+PTFE-coated
	8	Cover, connection compartment		EN-AW-6082
		Seal		EPDM+PTFE-coated

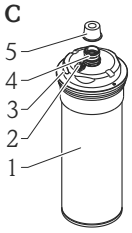
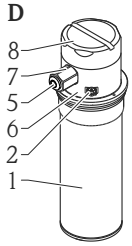
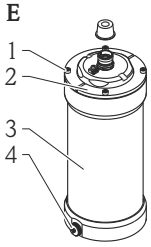
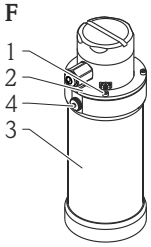
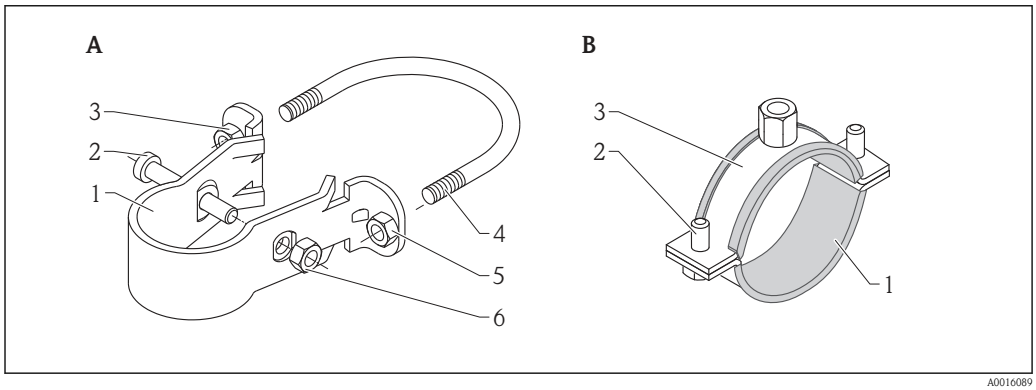
Diagram	Item	Designation	Materials	
			C = Sensor (316L)	D = Sensor (316L) with connection compartment
C  	1	Housing, welded	316L (1.4404/1.4435)	316L (1.4404/1.4435)
	2	Screw	A4	A4
		Spring ring	A4	A4
		Clamping bracket	304 (1.4301)	304 (1.4301)
		Earth connection box	316L (1.4404/1.4435)	316L (1.4404/1.4435)
	3	Cover	316L (1.4404/1.4435)	
		Seal	EPDM+PTFE-coated	
		Threaded pin	A4	
D  A0018997	4	M23 connector	316L (1.4404/1.4435)	
		Seal	FKM	
	5	Dummy plugs (transport protection)	PE-LD	PE-LD
	6	Housing top, connection compartment		316L (1.4404/1.4435)
		Seal		EPDM+PTFE-coated
	7	Adapter M20x1.5 - NPT1/2		316L (1.4404/1.4435)
		Seal		EPDM+PTFE-coated
	8	Cover, connection compartment		316L (1.4404/1.4435)
		Seal		EPDM+PTFE-coated

Diagram	Item	Designation	Material	
			E = Sensor (like C) + water cooling jacket	E = Sensor (like D) + water cooling jacket
E  F  A0016113	1	Cylinder screw	A4	A4
	2	Water cooling jacket flange, 2 separate parts	316L (1.4404/1.4435)	316L (1.4404/1.4435)
		Threaded pin	A4	A4
	3	Housing water cooling jacket, welded	316L (1.4404/1.4435)	316L (1.4404/1.4435)
	4	Sealing plug	PE-HD	PE-HD

Accessories



A0016089

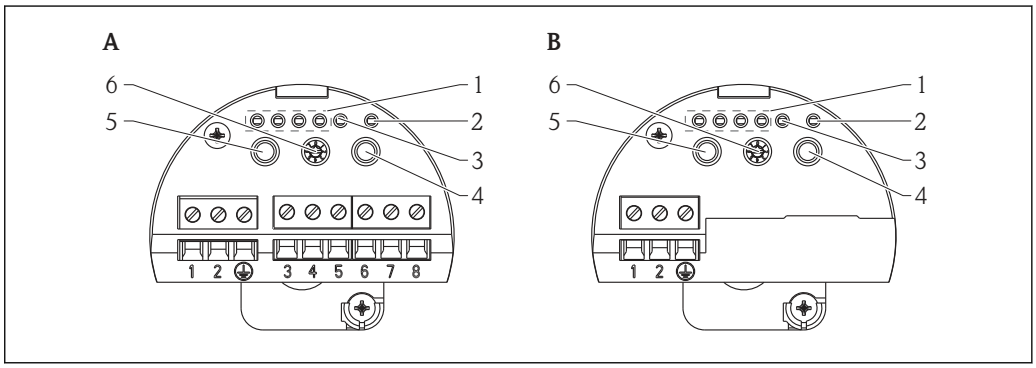
A = wall and pipe mounting for transmitter housing		
Item	**Designation**	**Material**
1	Wall bracket	304 (1.4301)
2	Screw M6x45	A2
3	Nut M6	A2
4	Pipe support	304 (1.4301)
5	Nut M6	A2
6	Nut M6	A2

B = Fastening clamps for sensor and water cooling jacket		
Item	**Designation**	**Material**
1	Rubber strip	EPDM (only for version without water cooling jacket)
2	Screw	V4A
3	Mounting clamp	V4A

Operability

Display and operating elements

You can operate the FEG24 and FEG25 electronic inserts using function switch (6) and keys "-" (5) and "+" (4). The function switch has 8 settings, each setting having at least one function. Light emitting diodes (LEDs 1 to 6) on the electronic insert indicate the operating status which depends on the function switch setting.



A FEG24
B FEG25
1 Green LEDs 1 to 4; meaning depends on the function switch setting and the operating mode
2 Yellow LED; displays the current switching position
3 Red LED; indicates fault
4 "+" key; meaning depends on function switch setting
5 "-" key; meaning depends on function switch setting
6 Function switch (settings 1 to 8)

Operating concept

Manual commissioning

Manual "free" and "covered" calibration must be performed at the Gammapilot FTG20.

The following settings can also be made:
- Analog mode 4 to 20 mA
- Adjust "free" calibration
- Switching delay
- Decay compensation
- Backup and restore parameters
- Display pulse rate via 4 LEDs

If manual commissioning is activated, at least "free" and "covered" calibration must be carried out. If mode "Commissioning without calibration" is selected, manual commissioning can be activated again by performing a reset of the device (see BA01035F/00/EN, section "Performing a total reset").

Commissioning without calibration

After mounting the Gammapilot FTG20, the automatic mode has to be selected. The user must ensure that the following boundary conditions are met during all operating time to guarantee reliable automatic operation:
- The pulse rate must be greater than 30 cps (visible in position 8) when the status is "uncovered"
- The pulse rate must be smaller than 10 cps (visible in position 8) when the status is "covered"
- There are ≥ 5 half-value layers between the covered and uncovered status (corresponds to approx. 60 cm (23.6 in) water for ^{137}Cs)
- The change in status (from covered to uncovered or vice versa) must be faster than 10 s (not suitable for slow processes)

To start the automatic mode, see BA01035F/00/EN section "Starting the automatic mode".

Depending on the sensor version, the following are thus the requirements for configuring the measuring point:

Number of Geiger-Müller counters	Local dose rate for ^{137}Cs		Local dose rate for ^{60}Co	
	Status "free"	Status "covered"	Status "free"	Status "covered"
1	≥ 3.0 µSv/h	≤1.0 µSv/h	≥ 2.5 µSv/h	≤0.8 µSv/h
2	≥1.5 µSv/h	≤0.5 µSv/h	≥1.3 µSv/h	≤0.4 µSv/h
3	≥1.0 µSv/h	≤0.3 µSv/h	≥0.9 µSv/h	≤0.2 µSv/h

If these basic conditions are not met, manual calibration is required!

The operating mode must then be selected:
- Minimum point level detection
- Maximum point level detection

Certificates and approvals

CE mark

The measuring system is in conformity with the statutory requirements of the applicable EC Directives. These are listed in the corresponding EC Declaration of Conformity along with the standards applied.

Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.

C-Tick symbol

The measuring system complies with EMC requirements of the "Australian Communications and Media Authority (ACMA)".

Ex approval

See (→ 32)

Inspection certificates

Inspection certificates are available on request.

Other standards and guidelines

- IEC/EN 60529
  Degrees of protection provided by enclosures (IP code)
- IEC/EN 61010-1
  Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures
- IEC/EN 61326
  Electromagnetic compatibility (EMC requirements)
- NE 21
  Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.
- NE 43
  Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.

Ordering information

Ordering information

Detailed ordering information is available from the following sources:
- In the Product Configurator on the Endress+Hauser website: www.endress.com → Select country → Instruments → Select device → Product page function: Configure this product
- From your Endress+Hauser Sales Center: www.endress.com/worldwide

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

Scope of delivery

The scope of delivery comprises:
- Device components (sensor, transmitter and cable)
- Optional accessories
- Approval documentation provided it is not included in the Operating Instructions
- Operating Instructions BA01035F/00/EN

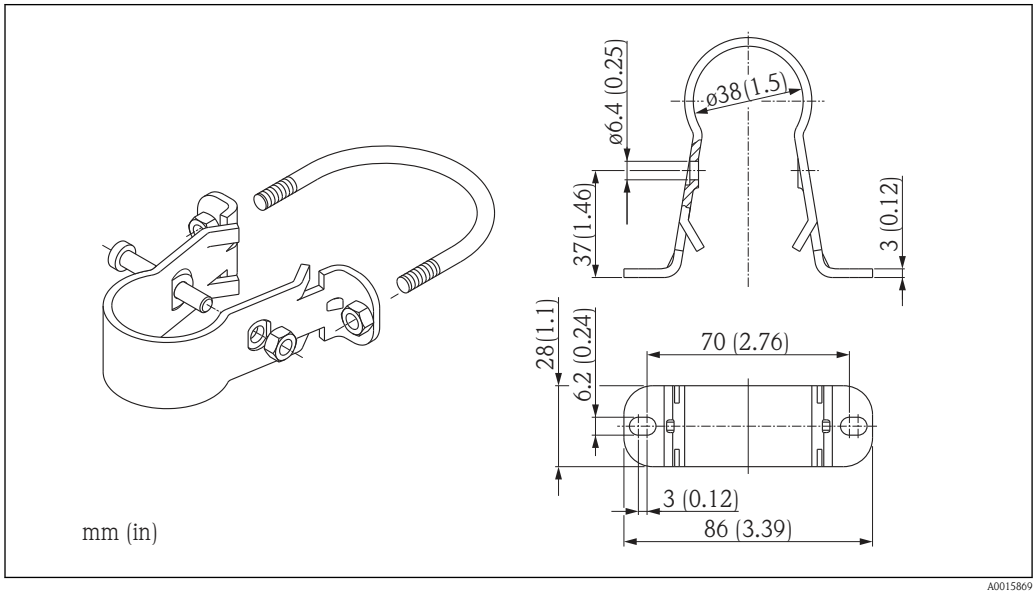
Accessories

Device-specific accessories

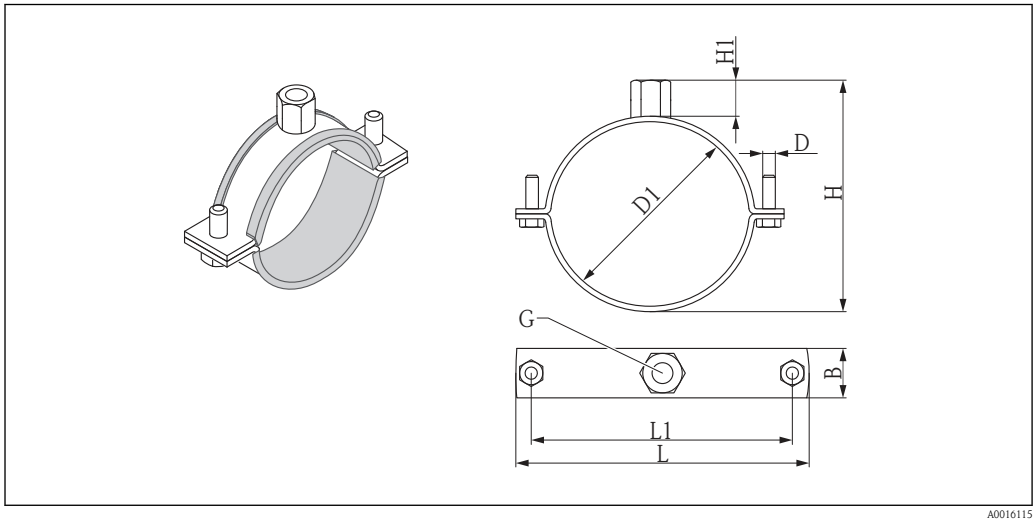
Mounting set

The mounting set for wall and pipe mounting and the mounting bracket for the sensor housing and cooling jacket can be ordered as accessories (see feature 620 in the product structure).

Wall and pipe mounting of aluminium and SS transmitter



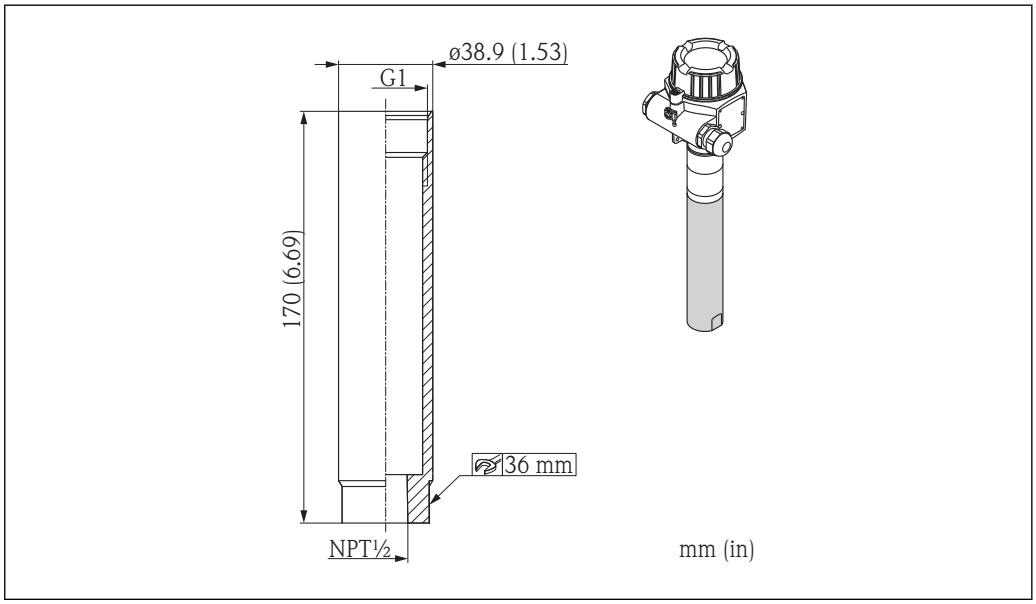
Mounting bracket for sensor housing and cooling jacket



Version	D1	H	H1	D	L	L1	B	G
316L (DN80)	88.9 mm (3.5 in)	112 mm (4.41 in)	6.5 mm (0.26 in)	M6	142 mm (5.59 in)	120 mm (4.72 in)	24 mm (0.94 in)	M8
316L with cooling jacket (DN100)	114.3 mm (4.5 in)	138 mm (5.43 in)	8 mm (0.31 in)	M8	170 mm (6.69 in)	148 mm (5.83 in)	27 mm (1.06 in)	M10

Impact protection tube for conduiting

The impact protection tube protects the cable connector when there is conduiting between the transmitter and sensor and can be ordered as an accessory (see feature 620 in the product structure).



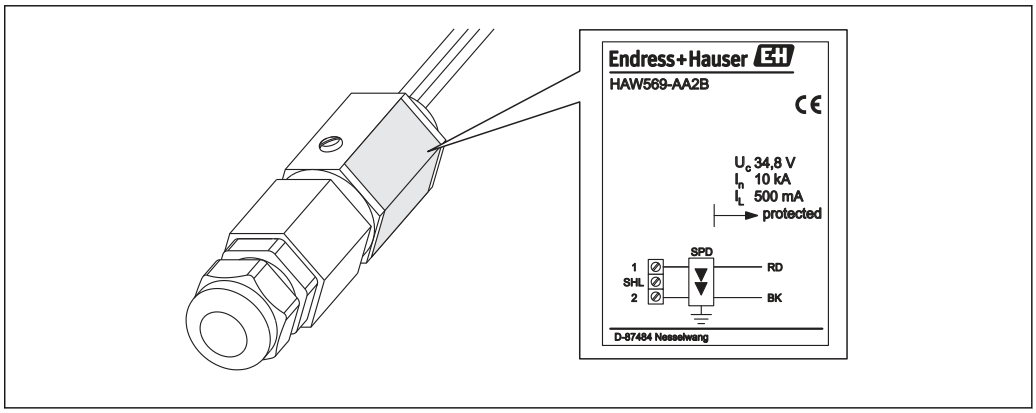
3 Impact protection tube (316L)

HAW56x overvoltage protection

Overvoltage protection is used to limit high voltages in signal lines and components.

HAW562
- Installed in the control cabinet
- Suitable for use in hazardous areas
- For further information, see TI01012K/09/EN/13.10

HAW569
- Installed at the housing M20x1.5
- Suitable for use in hazardous and non-hazardous areas
- For further information, see TI01013K/09/EN/13.10



Documentation

Standard documentation

Document type	Documentation code
Operating Instructions	BA01035F/00/EN

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

Supplementary device-dependent documentation

Safety Instructions (XA) are supplied with the device depending on the approval. These instructions are an integral part of the Operating Instructions.

Feature 010	Approval	Safety instructions
BA	ATEX II 2 G Ex d ia IIC Txx °C	XA00616F/00/A3
BB	ATEX II 2 G Ex d [ia] IIC Txx °C Gb	XA00616F/00/A3
BD	ATEX II 2 D Ex tb ia IIIC Txx °C Db	XA00616F/00/A3
BE	ATEX II 2 D Ex tb [ia] IIIC Txx °C Db	XA00616F/00/A3
CB	CSA/US Ex d ia Cl.I Gr.A-D / Cl.II Gr. E-G / Cl.III, Cl.I, Zone 1 Ex d ia IIC Txx °C	FEG24 = XA00618F/00/EN FEG25 = XA00674F/00/EN
CC	CSA/US Ex d [ia] Cl.I Gr.A-D / Cl.II Gr.E-G / Cl.III, Cl.I, Zone 1 Ex d [ia] IIC Txx °C	FEG24 = XA00618F/00/EN FEG25 = XA00674F/00/EN
IA	IECEx Ex d ia IIC Txx °C Gb	XA00617F/00/EN
IB	IECEx Ex d [ia] IIC Txx °C Gb	XA00617F/00/EN
ID	IECEx Ex tb ia IIIC Txx °C Db	XA00617F/00/EN
IE	IECEx Ex tb (ia) IIIC Txx °C Db	XA00617F/00/EN

The nameplate provides information on the Safety Instructions (XA) that are relevant for the device.

Instruments International

Endress+Hauser
Instruments International AG
Kaegenstrasse 2
4153 Reinach
Switzerland

Tel.+41 61 715 81 00
Fax+41 61 715 25 00
www.endress.com
info@ii.endress.com

Endress+Hauser
People for Process Automation

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71204355
CCS/EH-COSIMA ProMoDo

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