



Füllstand



Druck



Durchfluss



Temperatur



Flüssigkeits-  
analyse



Registrierung



Systeme  
Komponenten



Services



Solutions

## Technical Information

# Liquicap M FTI51, FTI52

## Capacitance

## Point level switch for liquids



### Application

The Liquicap M FTI5x is used for point level detection. It is preferably used for the following measuring tasks:

- Detection of liquids and pastes that are highly viscous and tend to form buildup
- Interface detection of different liquids (e.g. oil on water)
- Two-point control (e.g. pump control) with just one process connection
- Foam detection of conductive liquids

Thanks to its robust and tried-and-tested construction, the probe can be used both in vacuums and in overpressure up to 100 bar. The materials used allow operating temperatures from  $-80^{\circ}\text{C}$  to  $+200^{\circ}\text{C}$ .

### Your benefits

- Active buildup compensation for high-viscosity media
- Easy and fast commissioning at the press of a button
- Universal application thanks to wide range of certificates and approvals
- Corrosion-resistant, FDA-listed materials in contact with the process
- Two-stage overvoltage protection against discharge from the container
- Short reaction times
- No need for recalibration after replacing electronics
- Use in safety systems with specific requirements in terms of functional safety to SIL2/SIL3
- Automatic monitoring of electronics

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## Function and system design

### Measuring principle

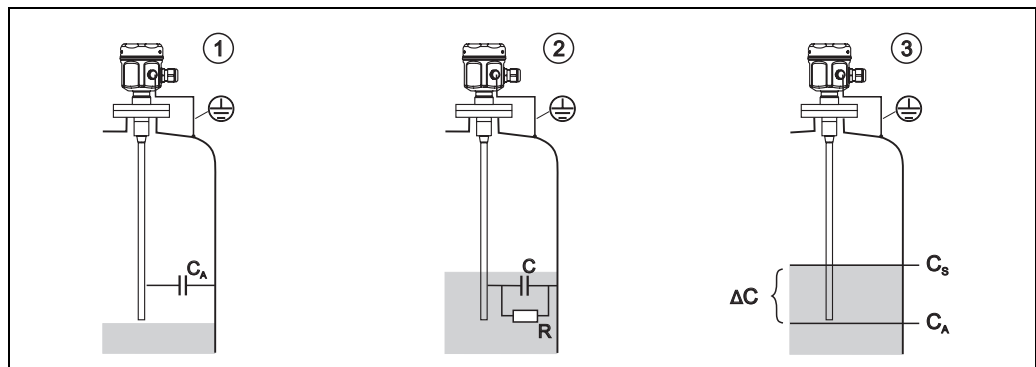
The principle of capacitance point level detection is based on the change in capacitance of the capacitor due to the probe being covered by liquid. The probe and container wall (conductive material) form an electric capacitor. When the probe is in air ①, a certain low initial capacitance is measured. When the container is filled, the capacitance of the capacitor increases the more the probe is covered ②, ③.

The point level switch switches when the capacitance  $C_S$  specified during calibration is reached. In addition, a probe with inactive length ensures that the effects of medium buildup or condensate near the process connection are avoided. Active buildup compensation compensates influences resulting from buildup on the probe.



Note!

A ground tube is used as a counterelectrode for containers made of nonconductive materials.

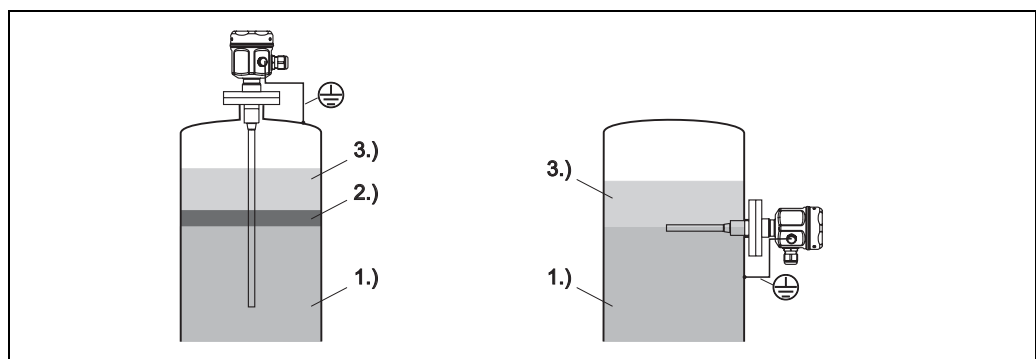


$R$ : Conductivity of the liquid  
 $C$ : Capacitance of the liquid  
 $C_A$ : Initial capacitance (probe not covered)  
 $C_S$ : Switching capacitance  
 $\Delta C$ : Change in capacitance

### Function

The selected electronic insert of the probe determines the change in capacitance of the liquid depending on how much the probe is covered and thereby allows precise switching at the point level calibrated for this.

### Interface detection

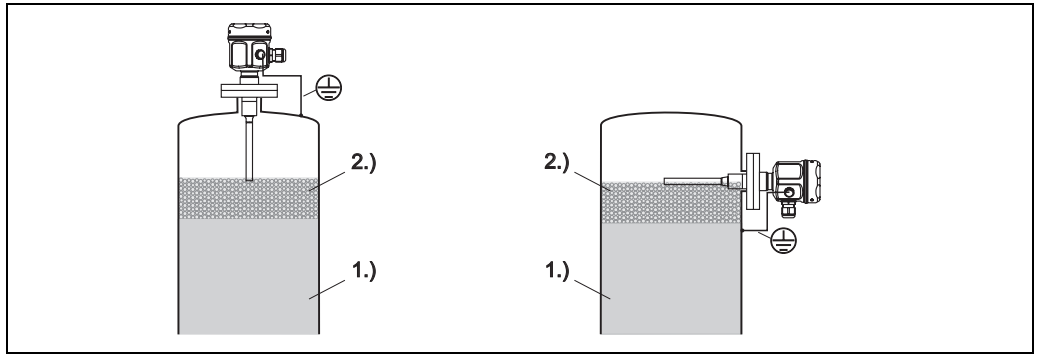


1.) Water, for example (the medium must be conductive  $\geq 100 \mu S/cm$ )  
 2.) Emulsion  
 3.) Oil, for example (nonconductive medium  $< 1 \mu S/cm$ )

A prior adjustment also ensures a certain and definite switch point even if the emulsion layer is of varying thickness.

**Foam detection**

Foam detection for conductive liquids.



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- 1.) Liquid
- 2.) Foam



Note!  
Preferably use partially insulated probes.

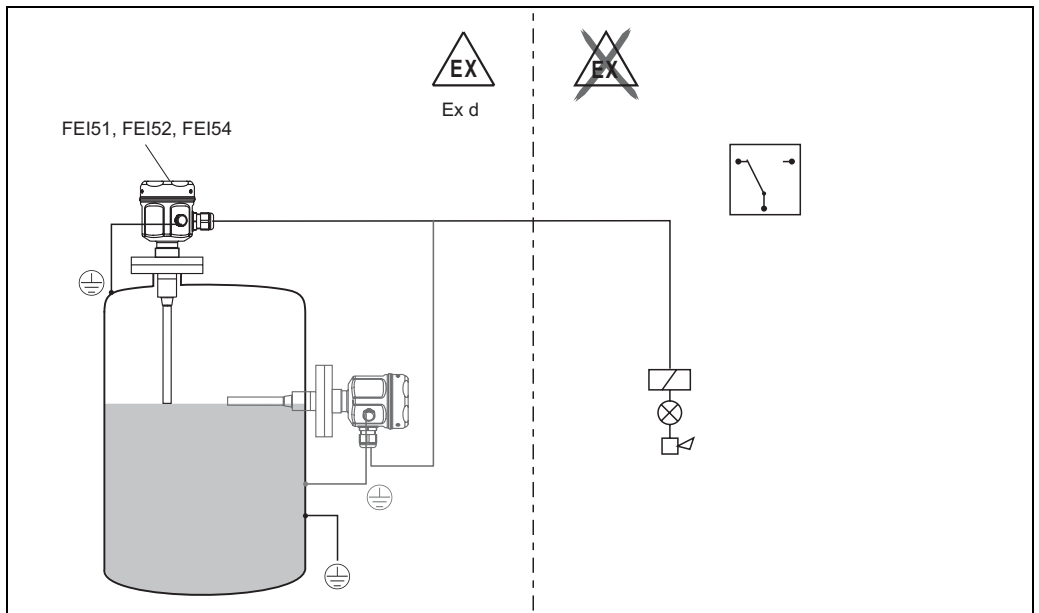
**Measuring system**

The make-up of the measuring system depends on the electronic insert selected.

**Point level switch**

The compact measuring system consists of:

- The Liquicap M FTI51 or FTI52 point level switch
- An electronic insert FEI51, FEI52, FEI54

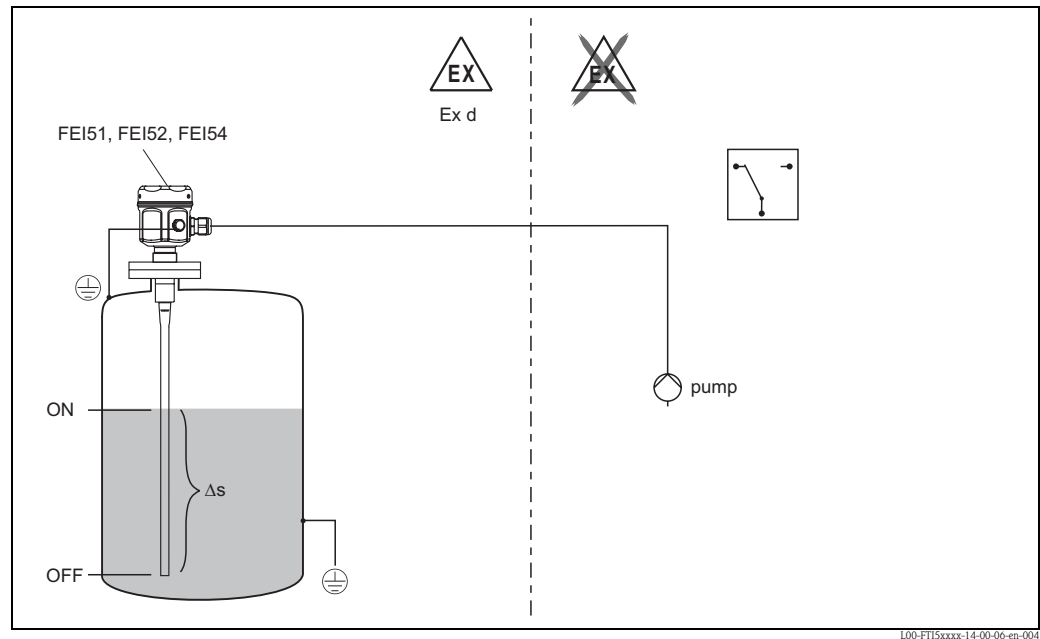


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**Pump control ( $\Delta s$ )**

Note!

Only possible with a fully insulated probe.



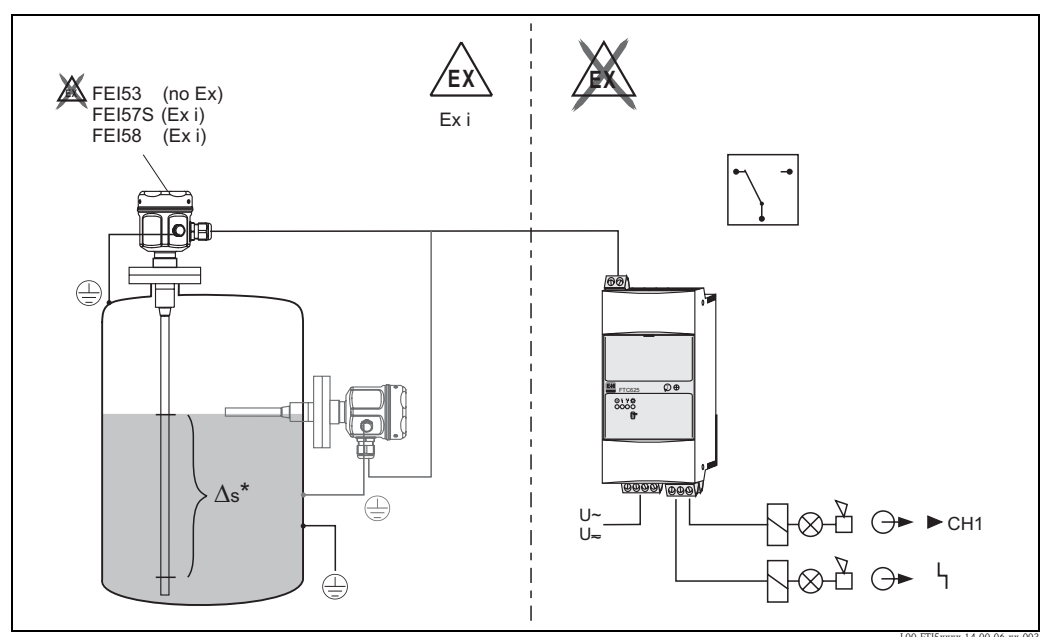
The point level switch can also be used to control a pump, for example, where the switch-on and switch-off point can be freely defined.

**Point level switch**

Liquicap M FTI5x with electronic versions FEI53, FEI57S and FEI58 for connecting to a separate switching unit.

The complete measuring system consists of:

- The capacitance Liquicap M FTI51 or FTI52 point level switch
- An electronic insert FEI53, FEI57S, FEI58
- A transmitter power supply unit (see table below)



\* Only possible with FEI53

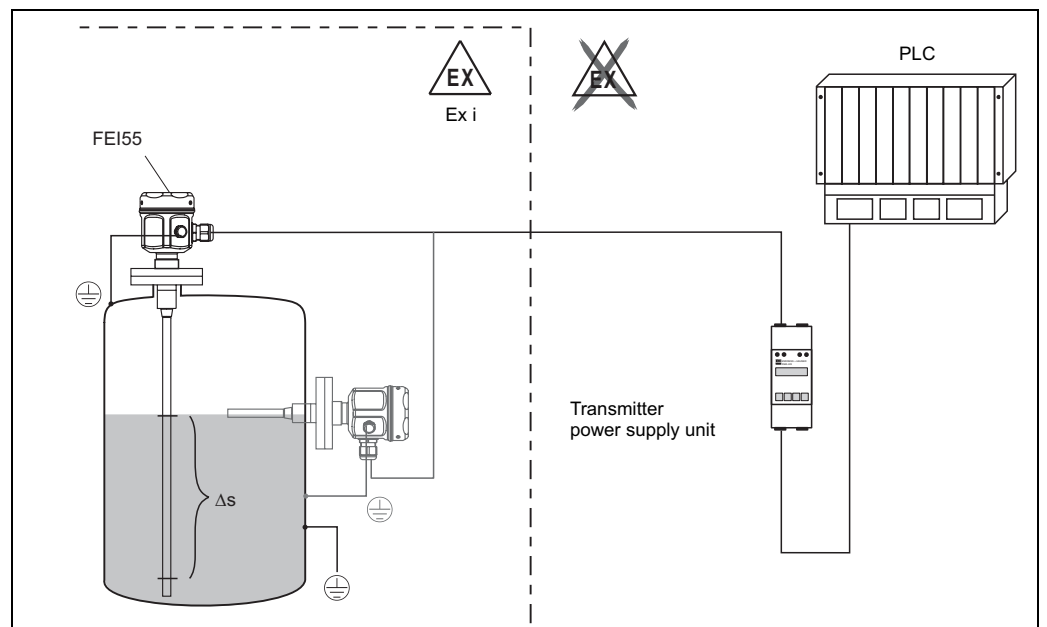
The following table shows the transmitter power supply units available which can be operated with electronic inserts FEI53, FEI57S and FEI58.

Electronic insert	FEI57S	FEI53	FEI58
<b>Transmitter power supply unit</b>			
FTC625 (from SW V1.4)	X	–	–
FTC325	X	X	–
FTL325N	–	–	X
FTL375N	–	–	X
FTC470Z	X	–	–
FTC471Z	X	–	–

**Point level switch 8/16 mA**

The complete measuring system consists of:

- The Liquicap M FTI51 or FTI52 point level switch
- The FEI55 electronic insert
- A transmitter power supply unit, e.g. RN221N, RNS221, RMA421, RMA422



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**Electronic inserts**

## FEI51

Two-wire AC connection

- Load switched directly into the power supply circuit via the thyristor
- Point level adjustment at the touch of a button

## FEI52

3-wire direct current version:

- Switch the load via the transistor (PNP) and separate supply voltage connection
- Point level adjustment at the touch of a button

## FEI53

3-wire direct current version with 3 to 12 V signal output:

- For separate switching unit, Nivotester FTC325 3-WIRE
- Self-test from the switching unit without changing levels
- Point level adjustment at the touch of a button

## FEI54

Universal current version with relay output:

- Switch the loads via 2 floating changeover contacts (DPDT)
- Point level adjustment at the touch of a button

## FEI55

Signal transmission 8/16 mA on two-wire cabling:

- SIL2 approval for the hardware
- SIL3 approval for the software
- For separate switching unit (e.g. RN221N, RNS221, RMA421, RMA422)
- Point level adjustment at the touch of a button

## FEI57S

PFM signal transmission (current pulses are superimposed on the supply current):

- For separate switching unit with PFM signal transmission e.g. FTC325 PFM, FTC625 PFM and FTC470Z/471Z
- Self-test from the switching unit without changing levels
- Point level adjustment at the touch of a button
- Cyclical checking (function check) from the switching unit.

## FEI58 (NAMUR)

Signal transmission H-L edge 2.2 to 3.5 / 0.6 to 1.0 mA as per IEC 60947-5-6 on two-wire cable:

- For a separate switching unit (e.g. Nivotester FTL325N and FTL375N)
- Point level adjustment at the touch of a button
- Connection cables and slaves tested at the touch of a button



Note!

For additional information see → 31 ff.



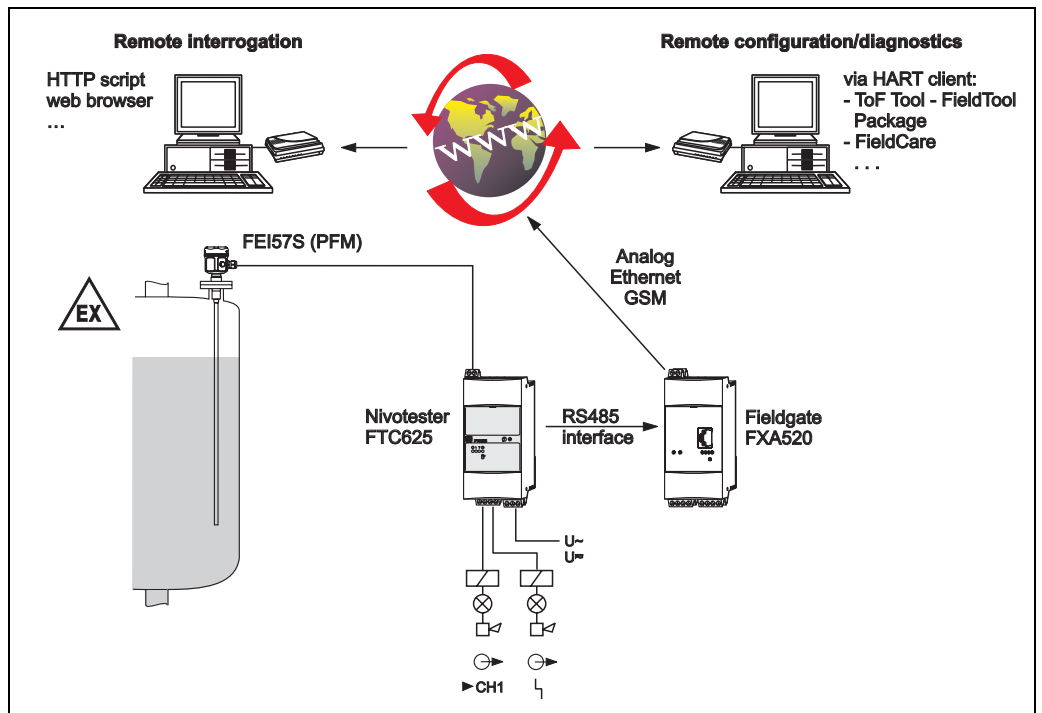
**System integration via Fieldgate**

**Vendor managed inventory**

The remote interrogation of tank or silo levels via Fieldgate enables suppliers of raw materials to gather information about the current inventories of their regular customers at any time and, for example, take this into account in their own production planning. The Fieldgate monitors the configured point levels and automatically triggers the next order as required. Here, the range of possibilities ranges from simple requisitioning by e-mail through to fully automatic order processing by incorporating XML data into the planning systems on both sides.

**Remote maintenance of measuring systems**

Not only does Fieldgate transmit the current measured values, it also alerts the standby personnel responsible by e-mail or SMS as required. Fieldgate forwards the information transparently. In this way, all options of the operating software in question are available remotely. By using remote diagnosis and remote configuration some onsite service operations can be avoided and all others can at least be planned and prepared better.



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## Operating conditions: Installation

### Installation instructions

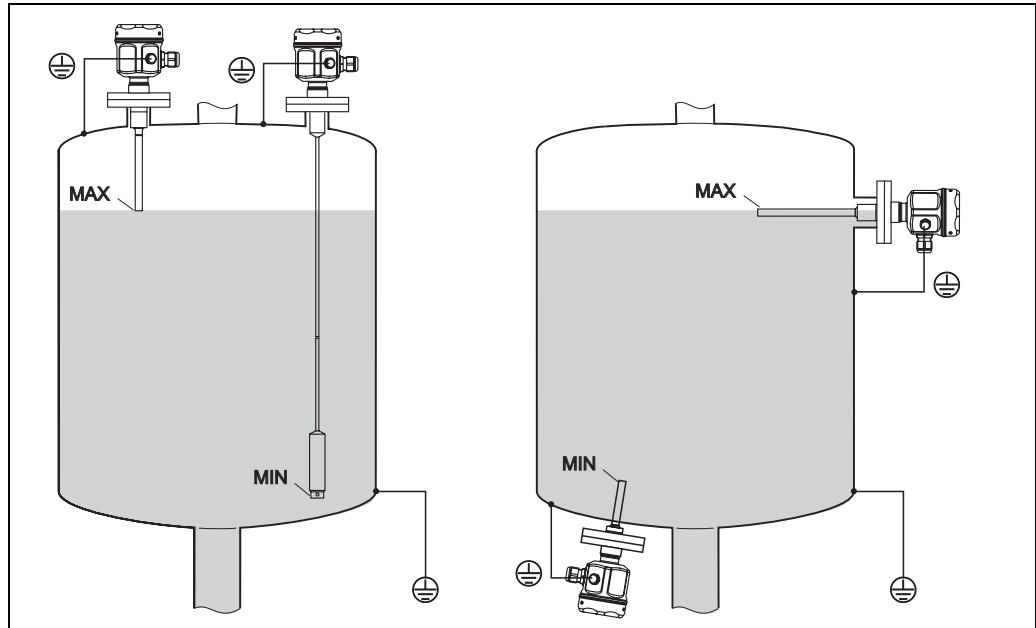
Liquicap M FTI51 (rod probe) can be installed from above, from below and from the side.  
Liquicap M FTI52 (rope probe) can be installed vertically from above.



Note!

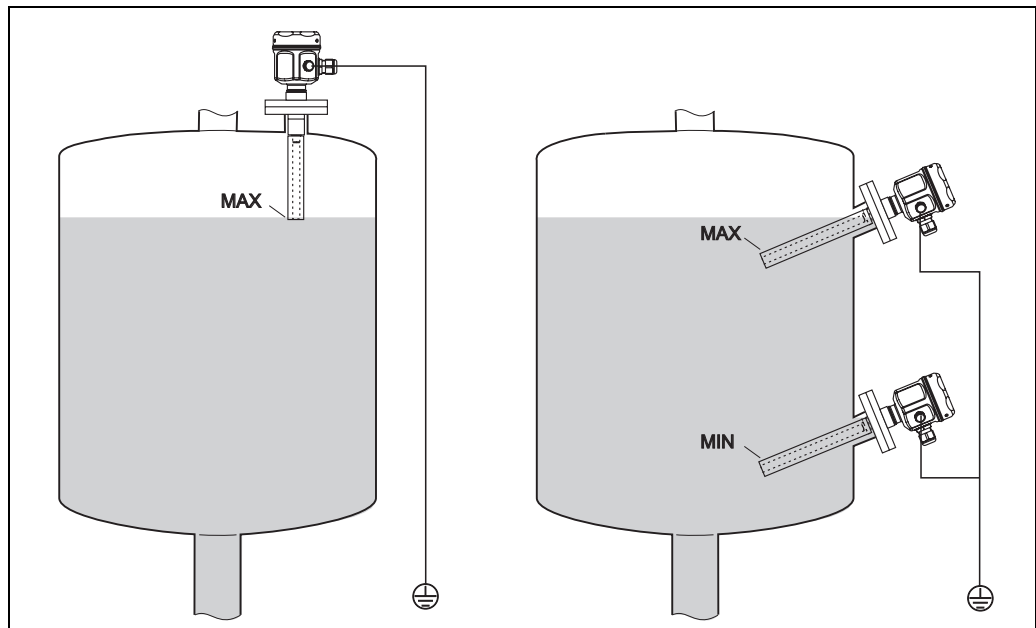
- The probe may not come into contact with the container wall!
- Recommended distance from the container floor:  $\geq 10$  mm.
- Do not install probes in the area of the filling curtain!
- Make sure the probe is at a sufficient distance from the agitator.
- In the event of severe lateral loads, use rod probes with a ground tube.

### For containers that conduct electricity e.g. steel tanks



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### For containers that do not conduct electricity e.g. plastic tanks



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*Probes with ground tube and grounding*

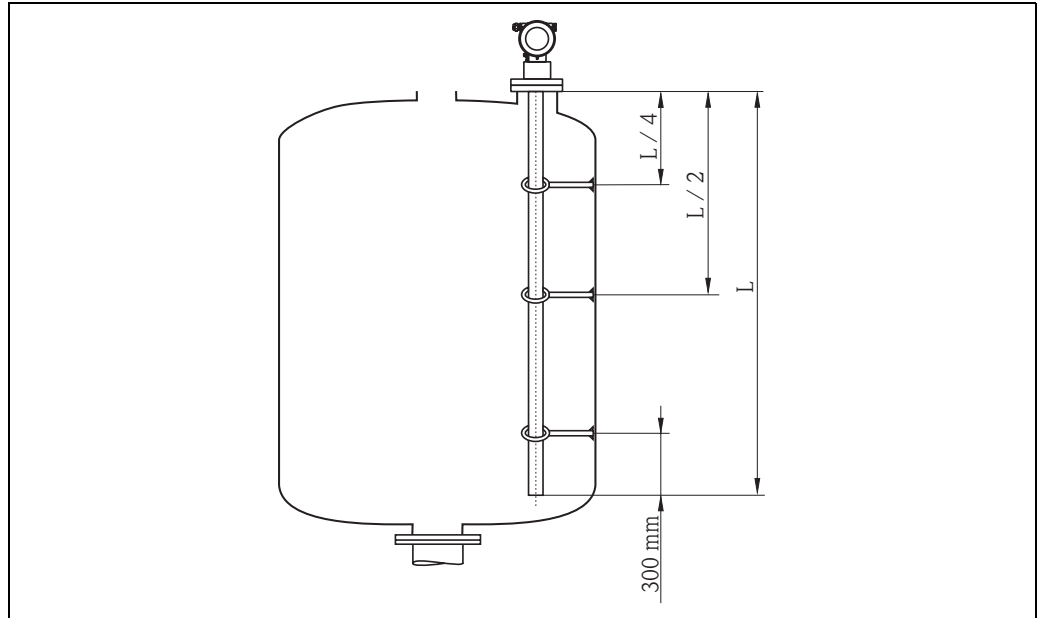
**Support for marine approval (GL)**

Fully insulated rod probes can be supported conductively or non-conductively.  
 Partially insulated rod probes may only be supported with insulation at the uninsulated probe end.



Note!

Rod probes with a diameter of 10 mm and 16 mm have to be supported with a length  $\geq 1$  m (see drawing).



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**Example for calculating distances:**

Probe length  $L = 2000$  mm.

$L/4 = 500$  mm

$L/2 = 1000$  mm

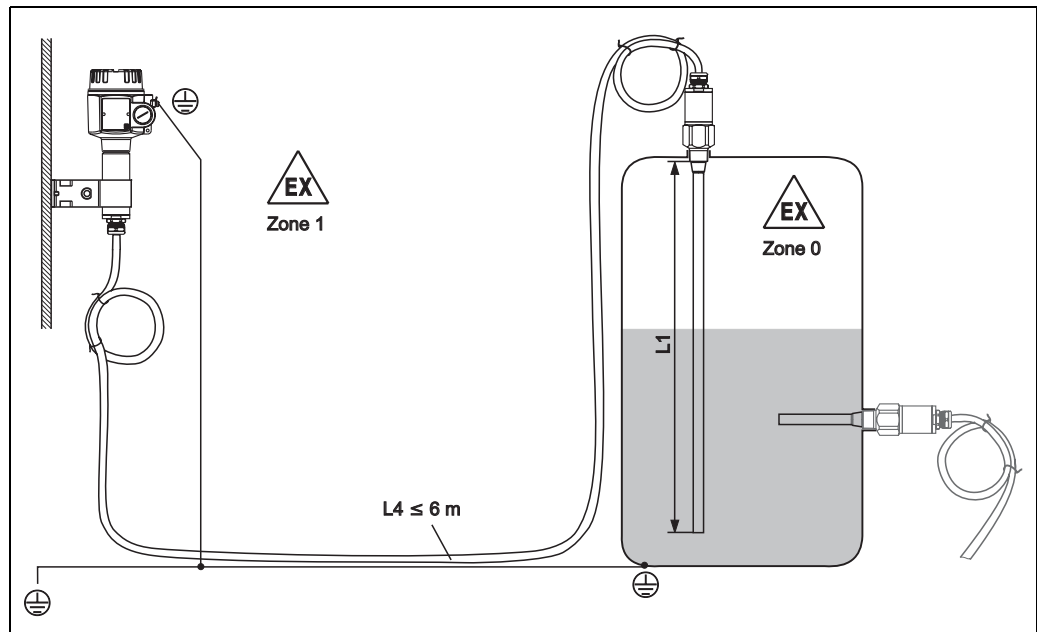
Measured from the end of the probe rod = 300 mm.

## With separate housing



Note!

- The maximum connection length between the probe and the separate housing is 6 m (L4). When ordering a device with a separate housing, the desired length must be specified.
- Maximum total length:  $L1 + L4 = 10$  m
- If the connecting cable is to be shortened or passed through a wall, it must be separated from the process connection.
- For information on ordering, please refer also to "Ordering information" => "Probe design" → 44



L00-FM15xxxx-14-00-06-xx-003

Rod length L1 max. 4 m

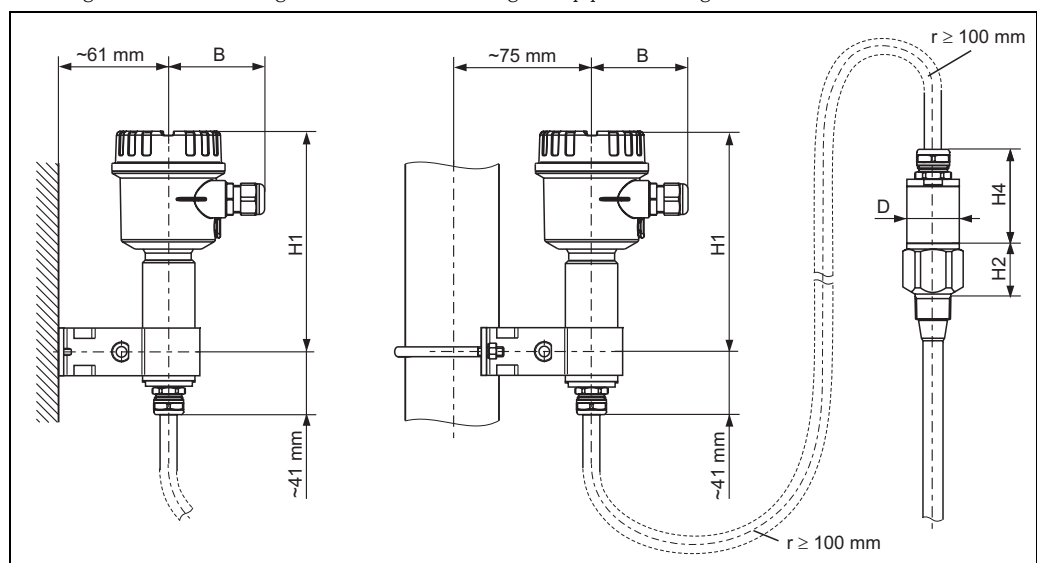
Rope length L1 max. 9.7 m (the maximum total length of L1 + L4 should not exceed 10 m).

## Extension heights: separate housing

Housing side: wall mounting

Housing side: pipe mounting

Sensor side



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Note!

- The cable has a bending radius of  $r \geq 100$  mm
- Connecting cable:  $\varnothing 10.5$  mm
- Outer jacket: silicone, notch-resistant

	Polyester housing (F16)	Stainless steel housing (F15)	Aluminum housing (F17)
B (mm)	76	64	65
H1 (mm)	172	166	177

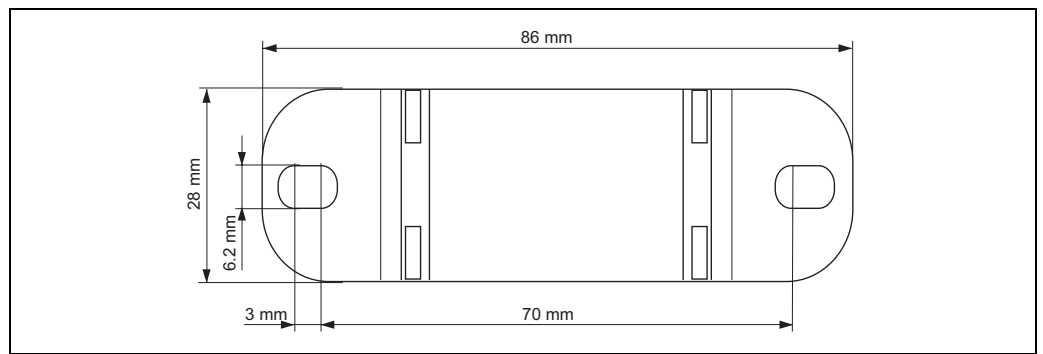
		H4 (mm)	D (mm)
Probes Ø10 mm rod		66	38
Probes Ø16 mm rod or rope (without fully insulated inactive length)	G 1/2", G 3/4", G 1", NPT 1/2", NPT 3/4", NPT 1", Clamp 1", Clamp 1 1/2", Universal Ø44, flange < DN 50, ANSI 2", 10K50	66	38
	G 1 1/2", NPT 1 1/2", Clamp 2", DIN 11851, flanges ≥ DN 50, ANSI 2", 10K50	89	50
Probes Ø 22 mm rod or rope (with fully insulated inactive length)		89	38

### Wall holder unit



Note!

- The wall holder unit is part of the scope of supply for device versions with a separate housing.
- The wall holder unit first has to be screwed to the separate housing before you can use it as a drilling template. The distance between the holes is reduced by screwing it to the separate housing.



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## Operating conditions: Environment

### Ambient temperature range

- -50 to +70 °C
- -40 to +70 °C (with F16 housing)
- Observe derating → 15
- If operating outdoors, use a protective cover! → 51.

### Storage temperature

-50 to +85 °C

### Climate class

DIN EN 60068-2-38/IEC 68-2-38: test Z/AD

### Vibration resistance

DIN EN 60068-2-64/IEC 68-2-64: 20 Hz– 2000 Hz; 0.01 g<sup>2</sup>/Hz

### Shock resistance

DIN EN 60068-2-27/IEC 68-2-27: 30g acceleration

### Cleaning

#### Housing:

When cleaning, make sure that the cleaning agent used does not corrode the housing surface or the seals.

#### Probe:

Depending on the application, buildup (contamination and soiling) can form on the probe rod. A high degree of material buildup can affect the measurement result. If the medium tends to create a high degree of buildup, regular cleaning is recommended. When cleaning, it is important to make sure that the insulation of the probe rod is not damaged. If cleaning agents are used make sure the material is resistant to them!

**Degree of protection**

	<b>IP66*</b>	<b>IP67*</b>	<b>IP68*</b>	<b>NEMA4X**</b>
Polyester housing F16	X	X	–	X
Stainless steel housing F15	X	X	–	X
Aluminum housing F17	X	X	–	X
Aluminum housing F13 with gas-tight process seal	X	–	X***	X
Stainless steel housing F27	X	X	X***	X
Aluminum housing T13 with gas-tight process seal and separate connection compartment (EEx d)	X	–	X***	X
Separate housing	X	–	X***	X

\* As per EN60529

\*\* As per NEMA 250

\*\*\* Only with M20 cable entry or G1/2 thread

**Electromagnetic compatibility (EMC)**

- Interference emission to EN 61326, Electrical Equipment Class B  
Interference immunity in accordance with EN 61326, Appendix A (Industrial) and NAMUR Recommendation NE 21 (EMC)
- A usual commercial instrument cable can be used.

## Operating conditions: Process

### Process temperature range

The following diagrams apply for:

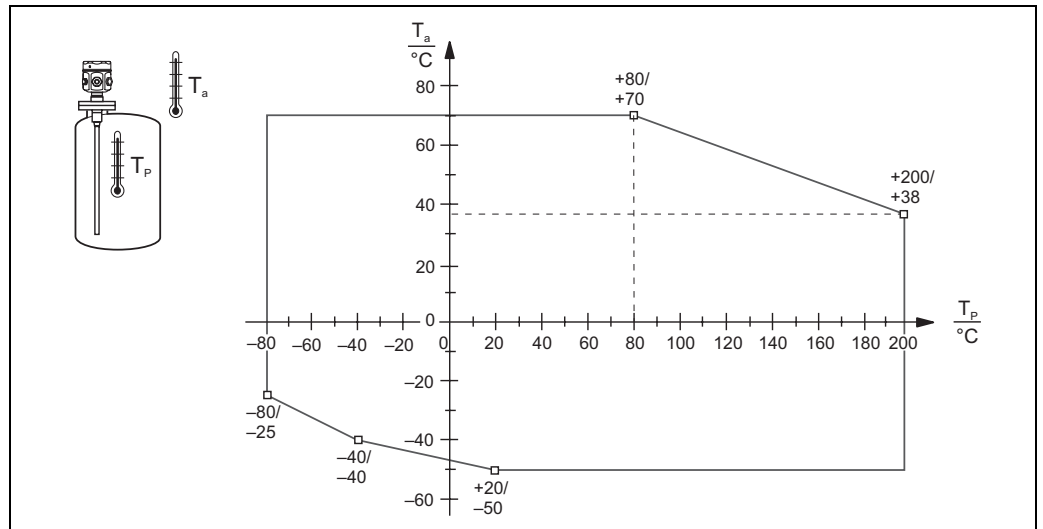
- Rod and rope version
- Insulation: PTFE, PFA, FEP
- Standard applications outside hazardous areas



Note!

The temperature is restricted to  $T_a -40\text{ °C}$  if the polyester housing F16 is used or if additional option B is selected (free from paint-wetting impairment substances, only FTI51).

### With compact housing

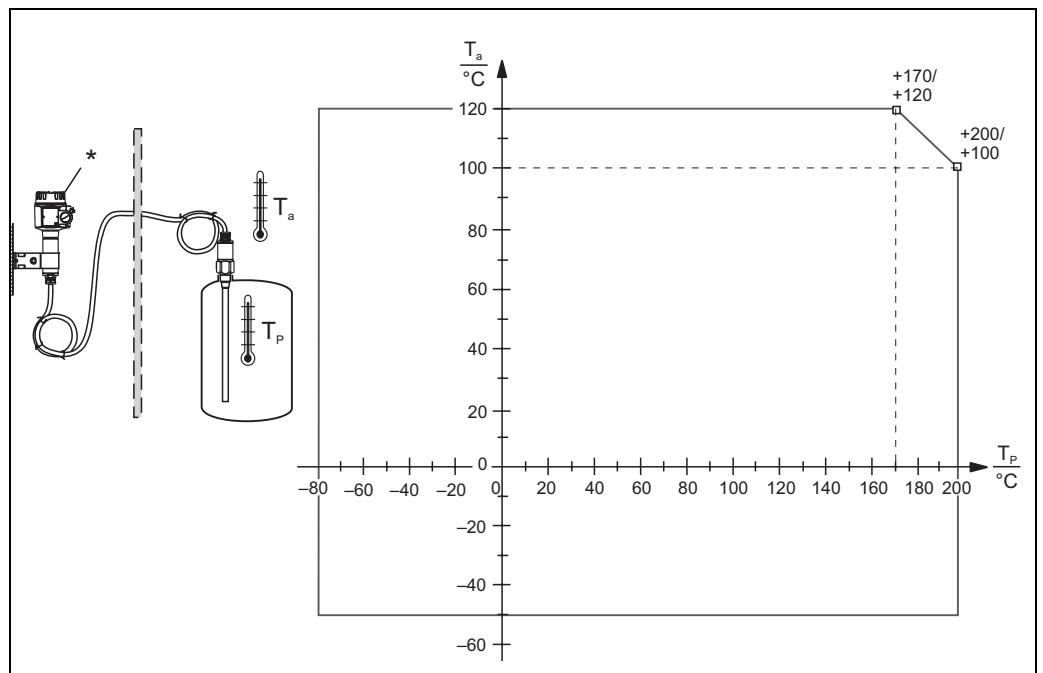


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$T_a$ : Ambient temperature

$T_P$ : Process temperature

### With separate housing



L00-FM15xxxx-05-05-xx-xx-011

$T_a$  = Ambient temperature

$T_P$  = Process temperature

\* The permitted ambient temperature at the separate housing is the same as indicated for the compact housing → 15.

**Process pressure limits****Probe  $\varnothing 10$  mm,  $\varnothing 14$  mm (including insulation)**

-1 to 25 bar (observe dependencies: process temperature and process connection → 15 and → 21).

**Probe  $\varnothing 16$  mm (including insulation)**

- -1 to 100 bar (observe dependencies: process temperature and process connection → 15 and → 21).
- In the event of an inactive length, the maximum permitted process pressure is 63 bar
- In the event of CRN approval and inactive length, the maximum permitted process pressure is 32 bar.

**Probe  $\varnothing 22$  mm (including insulation)**

-1 to 50 bar (observe dependencies: process temperature and process connection → 15 and → 21).

Refer to the following standards for the pressure values permitted at higher temperatures:

- EN 1092-1: 2005 Table, Appendix G2  
With regard to its resistance/temperature property, the material 1.4435 is identical to 1.4404 (AISI 316L) which is grouped under 13E0 in EN 1092-1 Tab. 18. The chemical makeup 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

The lowest value from the derating curves of the device and the selected flange applies.

**Pressure and temperature derating**

**For process connections  $\frac{1}{2}$ ",  $\frac{3}{4}$ ", 1", flanges < DN50, < ANSI 2", < JIS 10K (10 and 14 mm rod)**

**For process connections  $\frac{3}{4}$ ", 1", flanges < DN50, < ANSI 2", < JIS 10K (16 mm rod)**

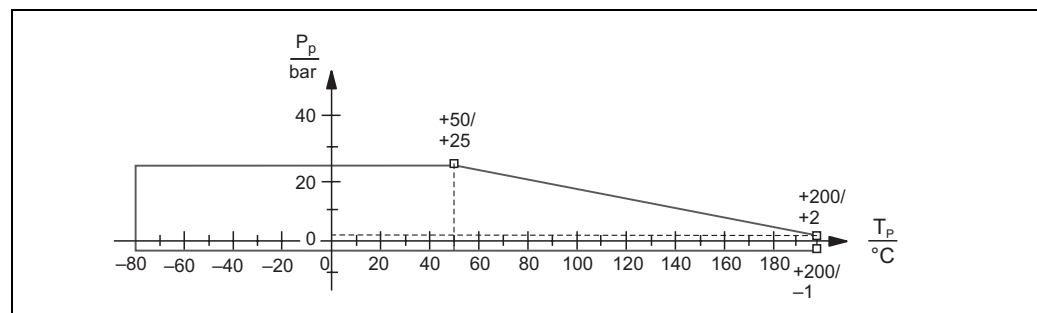
Rod insulation: PTFE, PFA

Rope insulation: FEP, PFA



Note!

See also "Process connections" → 21.



$P_p$  : Process pressure

$T_p$  : Process temperature

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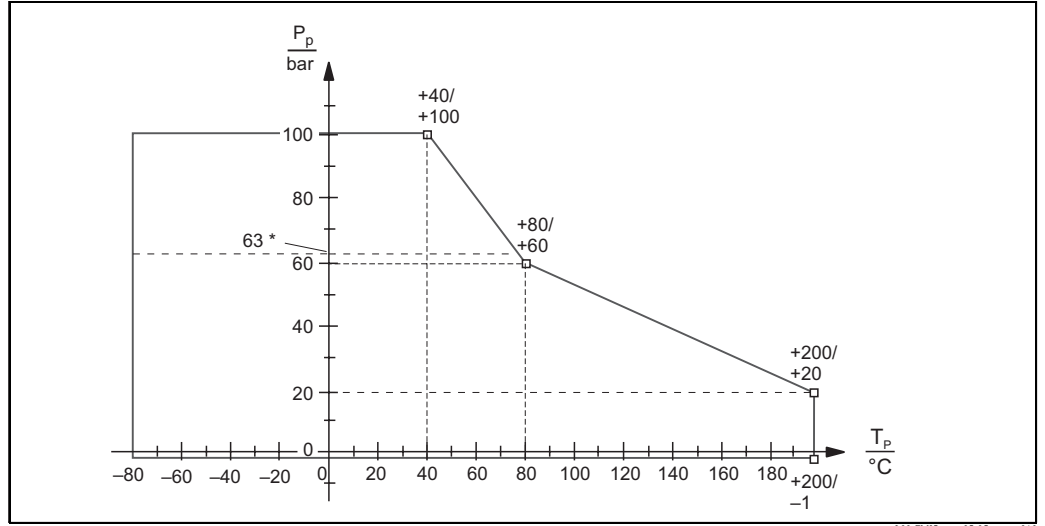


**For process connections 1 1/2", flanges ≥ DN50, ≥ ANSI 2", ≥ JIS 10K (16 mm rod)**

Rod insulation: PTFE, PFA  
 Rope insulation: FEP, PFA

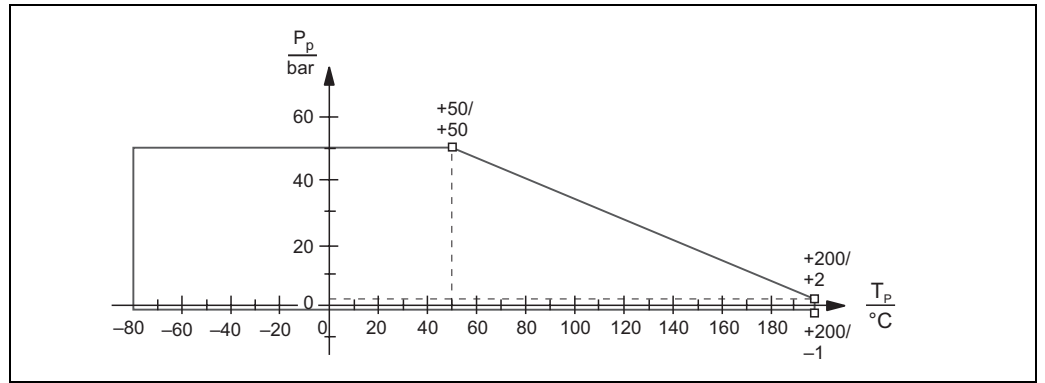


Note!  
 See also "Process connections" → 21



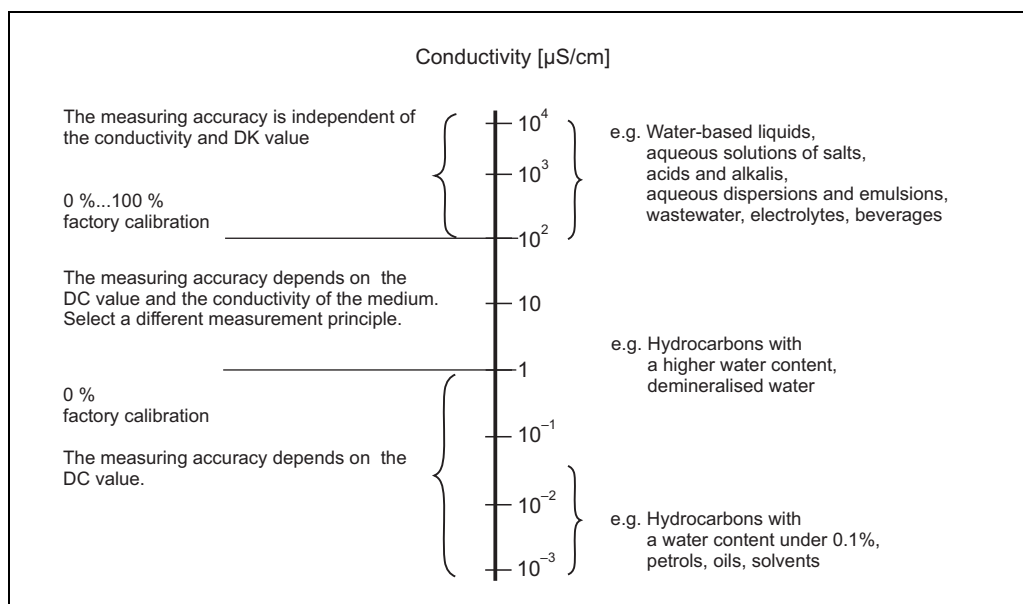
$P_p$  : process pressure  
 $T_p$  : process temperature  
 \* For probes with an inactive length .

**With a fully insulated inactive length (22 mm rod):**



$P_p$  : Process pressure  
 $T_p$  : Process temperature

## Liquicap M operational range



Typical DK values (dielectric constant)	
Air	1
Vacuum	1
Liquefied gases, general	1.2 - 1.7
Gasoline	1.9
Cyclohexane	2
Diesel fuel	2.1
Oils, general	2 - 4
Methyl ether	5
Butanol	11
Ammonia	21
Latex	24
Ethanol	25
Caustic soda	22 - 26
Acetone	20
Glycerine	37
Water	81



Note!

Further DC-Values are available in file "CP00019F" on:

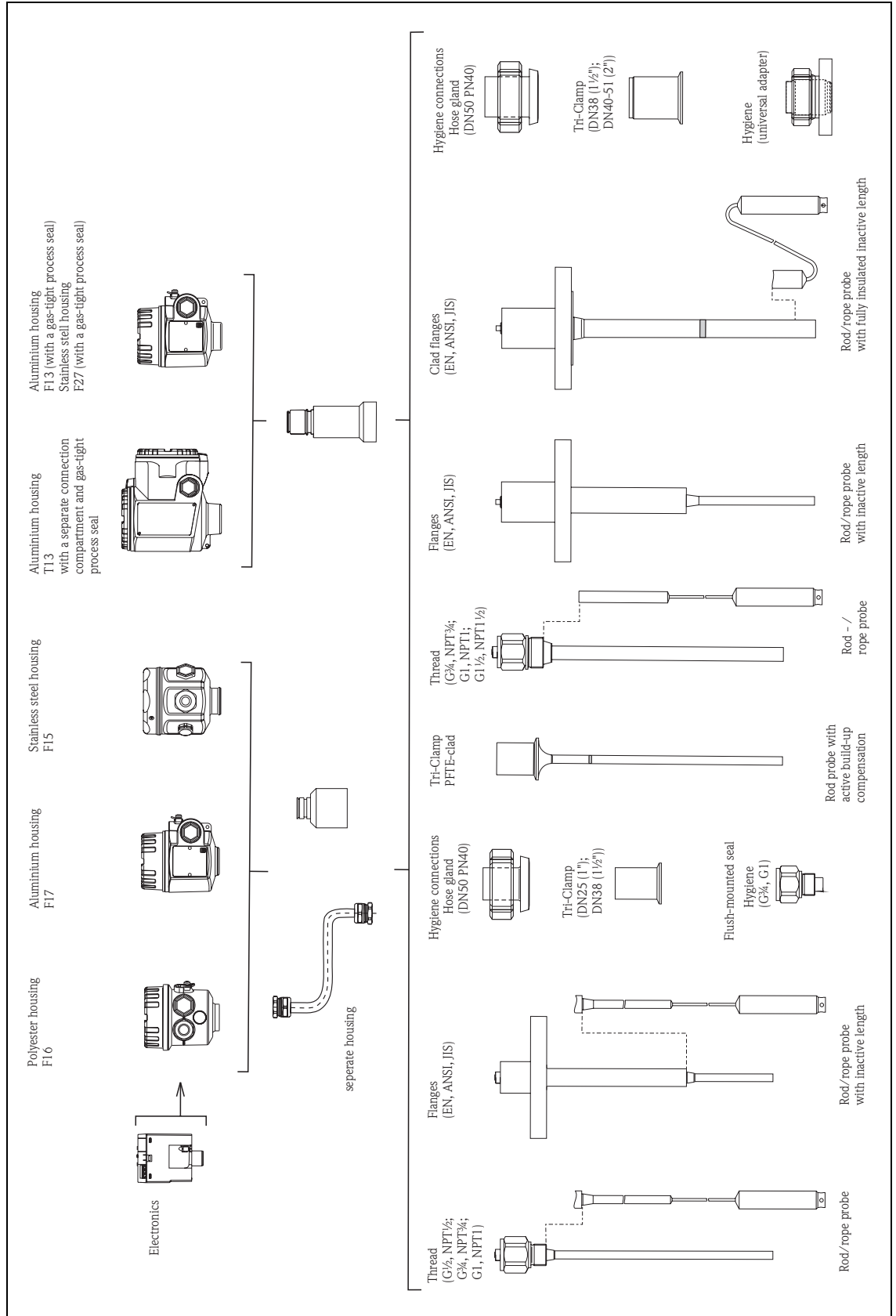
[www.endress.com](http://www.endress.com) => Download => Advanced => Documentation code = CP00019F => Start search

# Mechanical construction



Note!  
The dimensions on the following pages are indicated in mm.

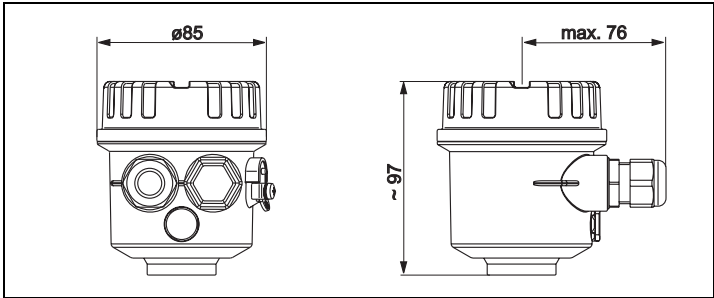
## Overview



T1418Fen24

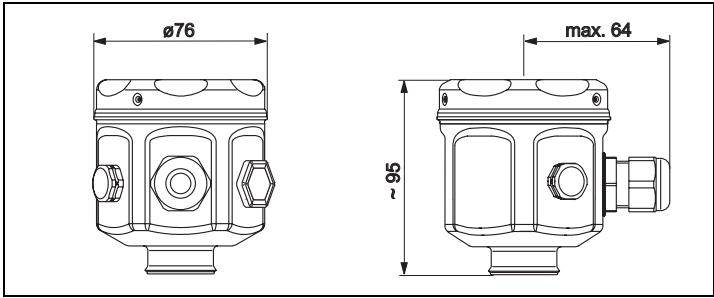
**Housing**

*Polyester housing F16*



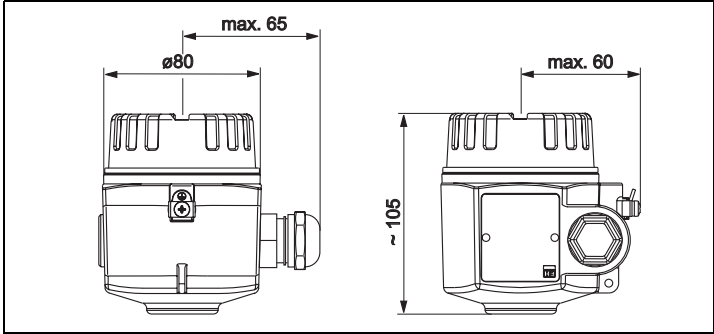
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*Stainless steel housing F15*



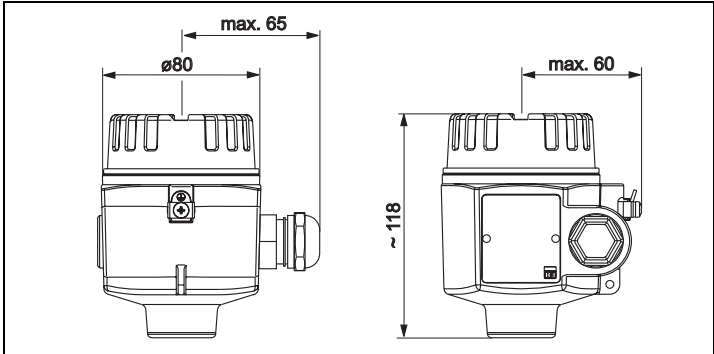
L00-FTI5xxxx-06-05-xx-xx-003

*Aluminum housing F17*



L00-FTI5xxxx-06-05-xx-xx-002

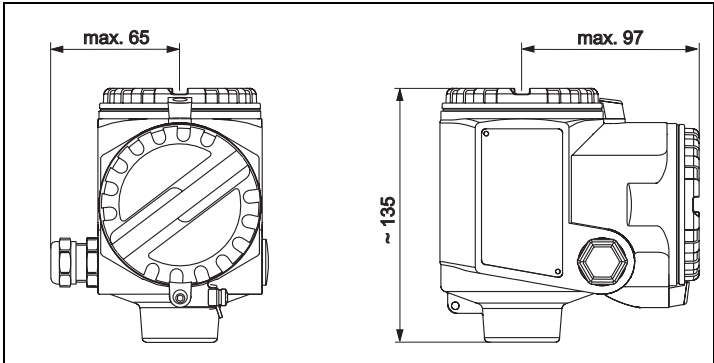
*Aluminum housing F13 with gas-tight process seal*



L00-FTI5xxxx-06-05-xx-xx-000

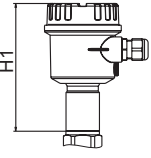
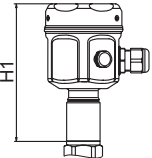
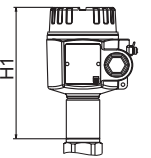
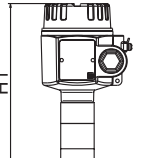
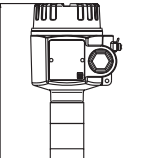
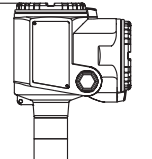
*Stainless steel housing F27 with gas-tight process seal*

*Aluminum housing T13 with separate connection compartment and gas-tight process seal*

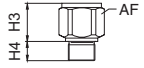
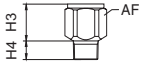
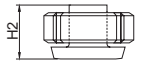




L00-FTI5xxxx-06-05-xx-xx-004

## Housing heights with adapter

	Polyester housing F16	Stainless steel housing F15	Aluminum housing F17	Aluminum housing F13	Stainless steel housing F27	Aluminum housing T13
	 L00-FTI5xxxx-06-05-xx-xx-044	 L00-FTI5xxxx-06-05-xx-xx-046	 L00-FTI5xxxx-06-05-xx-xx-045	 L00-FTI5xxxx-06-05-xx-xx-048	 L00-FTI5xxxx-06-05-xx-xx-048	 L00-FTI5xxxx-06-05-xx-xx-047
Order code	2	1	3	4	4	5
H1	143	141	150	194	194	210

## Process connections

	Thread G	Thread NPT	Threaded pipe joint	Tri-Clamp	Tri-Clamp clad	
	 L00-FMI5xxxx-06-05-xx-yy-007 (DIN EN ISO228-1)	 L00-FMI5xxxx-06-05-xx-yy-008 (ANSI B 1.20.1)	 L00-FMI5xxxx-06-05-xx-xx-040 (EN 11851)	 L00-FMI5xxxx-06-05-xx-xx-041 (ISO2852)	 L00-FMI5xxxx-06-05-xx-xx-069 (ISO2852)	
<b>Rod probes Ø10, rope probes</b>						
For pressures up to	25 bars	25 bars	25 bars	25 bar**	—	
Version / order code	G ½ / GCJ G ¾ / GDJ G 1 / GEJ	NPT ½ / RCJ NPT ¾ / RDJ NPT 1 / REJ	DN50 PN40 / MRJ	DN25 (1") / TCJ DN38 (1½") / TJJ	—	
Dimensions	H2 = 38 H3 = 19 AF = 41	H2 = 38 H3 = 19 AF = 41	H2 = 57	H2 = 57	—	
Surface roughness***	—	—	≤ 0.8 µm	≤ 0.8 µm	—	
Additional information	Elastomer flat seal	—	—	EHEDG*, 3A*	—	
<b>Rod probes Ø14</b>						
For pressures up to	25 bars	25 bars	25 bars	25 bar**	16 bar**	16 bar**
Version / order code	G ¾ / GDJ G 1 / GEJ	NPT ¾ / RDJ NPT 1 / REJ	DN50 PN40 / MRJ	DN25 (1") / TCJ DN38 (1½") / TJJ DN40-51 (2") / TDJ	DN38 / TJK (1½")	DN40-51 TDK (2")
Dimensions	H2 = 38 H3 = 19 AF = 41	H2 = 38 H3 = 19 AF = 41	H2 = 66	H2 = 66	H2 = 66	
Surface roughness***	—	—	≤ 0.8 µm	≤ 0.8 µm	≤ 0.8 µm	
Additional information	Elastomer flat seal	—	—	EHEDG, 3A	EHEDG, 3A	

\* The EHEDG, 3A certificate only applies to probes with a fully insulated probe rod. It does not apply to probes with an inactive length or active buildup compensation.

\*\* In the event of CRN approval, the maximum permitted process pressure is 11 bar.

\*\*\* Does not apply for inactive lengths.

	Thread G		Thread NPT		Threaded pipe joint	Tri-Clamp		Tri-Clamp clad	
<b>Rod probes Ø16, rope probes</b>									
For pressures up to	25 bars	100 bar	25 bars	100 bar	40 bar	16 bar**	16 bar**	16 bar**	16 bar**
Version / order code	G ¾ / GDJ G 1 / GEJ	G 1½ / GGJ	NPT ¾/ RDJ NPT 1 / REJ	NPT 1½/ RGJ	DN50 PN40 / MRJ	DN38 / TNJ (1½")	DN40-51 / TDJ (2")	DN38 / TJK (1½")	DN40-51 TDK (2")
Dimensions	H2 = 38 H3 = 19 AF = 41	H2 = 41 H3 = 25 AF = 55	H2 = 38 H3 = 19 AF = 41	H2 = 41 H3 = 25 AF = 55	H2 = 66	H2 = 98****	H2 = 66	H2 = 66	
Surface roughness***	—		—		≤ 0.8 µm	≤ 0.8 µm		≤ 0.8 µm	
Additional information	Elastomer flat seal		—		—	EHEDG*, 3A*	—	EHEDG, 3A	

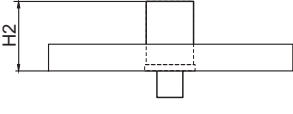
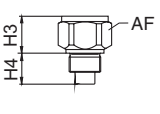
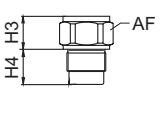
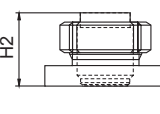
<b>Rod probes Ø22, rope probes</b>							
For pressures up to	50 bar		50 bar		—	—	—
Version / order code	G 1½ / GGJ		NPT 1½/ RGJ		—	—	—
Dimensions	H2 = 85 H3 = 25 AF = 55		H2 = 85 H3 = 25 AF = 55		—	—	—
Additional information	Elastomer flat seal		—		—	—	—

\* The EHEDG, 3A certificate only applies to probes with a fully insulated probe rod. It does not apply to probes with an inactive length or active buildup compensation.

\*\* In the event of CRN approval, the maximum permitted process pressure is 11 bar.

\*\*\* Does not apply for inactive lengths.

\*\*\*\* Process connection: Tri-Clamp (47 mm) with deattachable clamp (49 mm) and seal (2 mm).

	Flanges	Hygiene connection	Hygiene connection	Hygiene connection
	 L00-FMI5xxxx-06-05-xx-xx-042  (EN1092-1) (ANSI B 16.5) (JIS B2220)	 L00-FMI5xxxx-06-05-xx-en-009  With flush-mounted seal	 L00-FMI5xxxx-06-05-xx-en-010  With flush-mounted seal	 L00-FMI5xxxx-06-05-xx-xx-043  Adapter 44 mm with flush-mounted seal

<b>Rod probes Ø10, rope probes</b>				
For pressures up to	Max. 25 bar (depends on flange)	25 bars	25 bars	—
Version / order code	EN / B## → 44+ ANSI / A## → 44+ JIS / K## → 44+	G ¾ / GQJ	G 1 / GWJ	—
Dimensions	H2 = 57	H2 = 31 H3 = 26 AF = 41	H2 = 27 H3 = 30 AF = 41	—
Additional information	Also clad (PTFE) for aggressive process media	Weld-in adapter see "Accessories" EHEDG*, 3A*	Weld-in adapter see "Accessories" EHEDG, 3A	—

<b>Rod probes Ø14</b>				
For pressures up to	Max. 25 bar (depends on flange)	—	25 bars	16 bar (tightening torque 10 Nm)

	Flanges	Hygiene connection	Hygiene connection	Hygiene connection
Version / order code	EN / B## → 44+ ANSI / A## → 44+ JIS / K## → 44+	—	G 1 / GWJ	Universal adapter / UPJ
Dimensions	H2 = 57	—	H2 = 27 H3 = 30 AF = 41	H2 = 57
Additional information	Also clad (PTFE)	—	Weld-in adapter see "Accessories" EHEDG, 3A	Universal adapter see "Accessories"
<b>Rod probes Ø16, rope probes</b>				
For pressures up to	Max. 100 bar (depends on flange) Max. 50 bar (with active buildup compensation)	—	—	16 bar (tightening torque 10 Nm)
Version / order code	EN / B## → 44+ ANSI / A## → 44+ JIS / K## → 44+	—	—	Universal adapter / UPJ
Dimensions	H2 = 66	—	—	H2 = 57
Additional information	Also clad (PTFE)	—	—	Universal adapter see "Accessories"
<b>Rod probes Ø22, rope probes</b>				
For pressures up to	Max. 50 bar (depends on flange)	—	—	—
Version / order code	EN / B## → 44+ ANSI / A## → 44+ JIS / K## → 44+	—	—	—
Dimensions	H2 = 111	—	—	—
Additional information	Only clad (PTFE)	—	—	—

\* The EHEDG, 3A certificate only applies to probes with a fully insulated probe rod. It does not apply to probes with an inactive length or active buildup compensation.

## 1. Fully insulated rod probes FTI51



Note!

- The active rod probe is always fully insulated (dimension L1).
- Total length of probe from sealing surface:  $L = L1 + L3$  (+ 125 mm with active buildup compensation + H3\*)
- Thickness of insulation with probe rod diameter 10 mm = 1 mm; 16 mm = 2 mm; 22 mm = 2 mm
- Length tolerances L1, L3: < 1 m: 0 to -5 mm, 1 to 3 m: 0 to -10 mm, 3 to 6 m: 0 to -20 mm

	Rod probe		Rod probe with ground tube		Rod probe with inactive length		Rod probe with inactive length and ground tube		Rod probe with fully insulated inactive length		Rod probe with active buildup compensation		Rod probe with inactive length + active buildup compensation	
	L00-FM15xxxx-06-05-xx-xx-061												L00-FM15xxxx-06-05-xx-xx-060	
Total length (L)	100...4000		100...4000		200...6000		200...6000		300...4000		225...4125		325...6000	
Active rod length (L1)	100...4000		100...4000		100...4000		100...4000		150...3000		100...4000		100...4000	
Inactive rod length (L3)	—		—		100...2000		100...2000		150...1000		—		100...2000	
ø Probe rod	10	16	10	16	10	16	10	16	22**	10	16	10	16	
ø Ground tube	—	—	22	43	—	—	22	43	—	—	—	—	—	
ø Inactive length	—	—	—	—	22	43	22	43	22**	—	—	22	43	
ø Active buildup compensation	—	—	—	—	—	—	—	—	—	19	26	19	26	
Length (mm) active buildup compensation	—		—		—		—		—		125		125	
Lateral loading capacity (Nm) at 20 °C	<15	<30	<40	<300	<30	<60	<40	<300	<25	<30	<60	<30	<60	
For use in agitating tanks	—		—	X	—		—	X	—		—		—	
For aggressive liquids	X		—		—		—		X		—		—	
For high-viscosity liquids	X		—		X		—		X		X		X	
For use in plastic tanks	—		X		—		X		—		—		—	
For use in mounting nozzles	—		—		X		X		X		—		X	
In the event of condensate on tank ceiling	—		—		X		X		X		—		X	
For high-viscosity conductive liquids	—		—		—		—		—		X		X	

\* H3 = Thread height (important for calculating the exact probe length for process connections with a thread.) → 21

\*\* Probe tube



## 2. Fully insulated rod probes FTI51 for hygiene applications



Note!

- Total length of probe from sealing surface:  $L = L1$  (+ 125 mm with active buildup compensation)
- Thickness of insulation with probe rod diameter 14 mm = 1 mm; 16 mm = 2 mm
- Length tolerances L1, L3: < 1 m: 0 to -5 mm, 1 to 3 m: 0 to -10 mm, 3 to 6 m: 0 to -20 mm

	Rod probe with clad Tri-Clamp	Rod probe with fully insulated active buildup compensation and clad Tri-Clamp
Total length (L)	100...4000	200...2125
Active rod length (L1)	100...4000	75...2000
Probe rod diameter	16	14
∅ Ground tube	—	—
∅ Inactive length	—	—
∅ Active buildup compensation	—	14
Length, active buildup compensation	—	125
Lateral loading capacity (Nm) at 20 °C	<30	<15
For use in agitating tanks	—	—
For aggressive liquids	X	X
For high-viscosity liquids	X	X
For use in plastic tanks	—	—
For use in mounting nozzles	—	X
In the event of condensate on tank ceiling	—	X
For high-viscosity conductive liquids	—	X

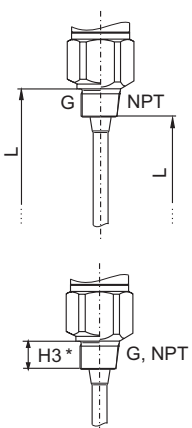
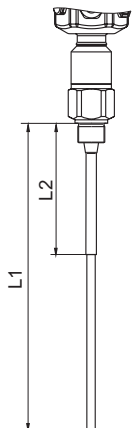
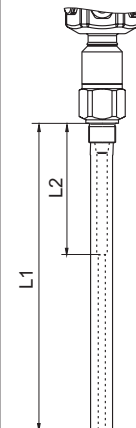
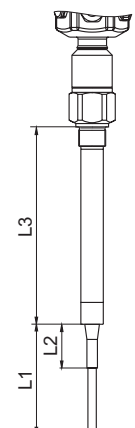
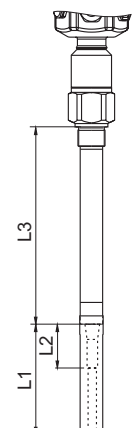
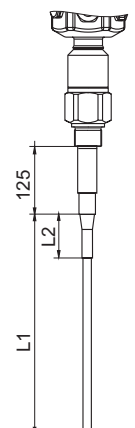
### 3. Partially insulated rod probes FTI51

For a switch point with millimeter accuracy in conductive liquids



Note!

- Total length of probe from sealing surface:  $L = L1 + L3$  (+ 125 mm with active buildup compensation +  $H3^*$ )
- Thickness of partial insulation with probe rod diameter 10 mm = 1 mm; 16 mm = 2 mm
- Length tolerances  $L1, L3$ : < 1 m: 0 to -5 mm, 1 to 3 m: 0 to -10 mm, 3 to 6 m: 0 to -20 mm

	Rod probe		Rod probe with ground tube		Rod probe with inactive length		Rod probe with inactive length and ground tube		Rod probe with active buildup compensation		Rod probe with inactive length and active buildup compensation	
												
	100-FM15xxxx-06-05-xx-xx-061										100-FM15xxxx-06-05-xx-xx-062	
Total length (L)	100...4000		100...4000		200...6000		200...6000		225...4000		100...6000	
Active rod length (L1)	100...4000		100...400		100...4000		100...4000		100...4000		100...4000	
Inactive rod length (L3)	-		-		100...2000		100...2000		-		100...2000	
Length of partial insulation (L2)	75...3950		75...3950		75...3950		75...3950		75...3950		75...3950	
Probe rod diameter	10	16	10	16	10	16	10	16	10	16	10	16
ø Inactive length / ground tube	-	-	22	43	22	43	22	43	-	-	22	43
ø Active buildup compensation	-	-	-	-	-	-	-	-	19	26	19	26
Length, active buildup compensation	-		-		-		-		125		125	
Lateral loading capacity (Nm) at 20 °C	<15	<30	<40	<300	<30	<60	<40	<300	<30	<60	<30	<60
For use in agitating tanks	-	-	-	X	-	-	-	X	-	-	-	-
For aggressive liquids	-	-	-	-	-	-	-	-	-	-	-	-
For use in plastic tanks	-	-	X	-	-	-	X	-	-	-	-	-
For use in mounting nozzles	-	-	-	-	X	-	X	-	-	-	X	-
In the event of condensate on tank ceiling	-	-	-	-	X	-	X	-	-	-	X	-
For high-viscosity liquids	X	-	-	-	X	-	-	-	X	-	X	-
For high-viscosity conductive liquids	-	-	-	-	-	-	-	-	X	-	X	-

\* H3 = Thread height (important for calculating the exact probe length for process connections with a thread.) → 21

**Rope probes FTI52 (fully insulated)**



Note!

- The active probe length is always fully insulated (dimension L1).
- Total length of probe from sealing surface:  $L = L1 + L3$
- All rope probes are prepared for tensioning in containers (tensioning weight with anchor hole)
- Not suitable for agitator tanks, high-viscosity liquids and plastic tanks
- Thickness of rope insulation 0.75 mm
- Length tolerances L1, L3: <1 m: 0 to -10 mm, 1 to 3 m: 0 to -20 mm, 3 to 6 m: 0 to -30 mm, 6 to 12 m: 0 to -40 mm,

	Rod probe	Rope probe with clad Tri-Clamp	Rod probe with inactive length (uninsulated)	Rope probe with fully insulated inactive length
<p style="text-align: center; font-size: small;">L00-FMI5xxxx-06-05-xx-xx-070</p>				<p style="text-align: center; font-size: small;">L00-FMI5xxxx-06-05-xx-xx-036</p>
Total length (L)	420...10000		570...12000	570...11000
Active rope length (L1)	420...10000		420...10000	420...10000
Inactive length (L3)*	—		150...2000	150...1000
Ø Inactive length	—		22/43*	22**
Probe rope diameter	4		4	4
Ø Anchor weight	22		22	22
Ø Anchor hole	5		5	5
Tensile loading capacity (N) of probe rope at 20 C	200		200	200
For aggressive liquids	X		—	X
For use in mounting nozzles	—		X	X
For conductive liquids > 100 µS/cm	—		X	X
For non-conductive liquids < 1 µS/cm	—		X	X
In the event of condensate on tank ceiling	—		X	X
For high-viscosity liquids	—		—	—

\* The Ø value of the inactive length depends on the process connection selected. → 44

\*\* Probe tube

<b>Weight</b>	Housing with process connection: <ul style="list-style-type: none"> <li>■ F15, F16, F17, F13 approx. 4.0 kg</li> <li>■ T13 approx. 4.5 kg</li> <li>■ F27 approx. 5.5 kg</li> </ul> + Flange weight + Probe rod Ø 10 mm: 0.5 kg/m, + Probe rod Ø 22 mm: 0.8 kg/m + Probe rod Ø 14 mm, Ø 16 mm: 1.1 kg/m + Probe rope: 0.04 kg/m
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**Technical data: probe****Capacitance values of the probe**

Basic capacitance: approx. 18 pF

**Additional capacitance**

Mount the probe at a minimum distance of 50 mm from a conductive container wall:

- Probe rod: approx. 1.3 pF/100 mm in air
- Probe rope: approx. 1.0 pF/100 mm in air

Fully insulated probe rod in water:

- Approx. 38 pF/100 mm (16 mm rod)
- Approx. 74 pF/100 mm (14 mm rod)
- Approx. 45 pF/100 mm (10 mm rod)
- Approx. 50 pF/100 mm (22 mm rod)

Insulated probe rope in water: approx. 19 pF/100 mm

Rod probe with ground tube:

- Insulated probe rod: approx. 6.4 pF/100 mm in air
- Insulated probe rod: approx. 38 pF/100 mm in water (16 mm rod)
- Insulated probe rod: approx. 45 pF/100 mm in water (10 mm rod)


**Material**

Material specifications as per AISI and DIN-EN.

**In contact with the process**

- Probe rod, ground tube, inactive length, tensioning weight for rope probe: 316L (1.4435)
- Probe rope: 316 (1.4401)
- Probe rod insulation: PFA or PTFE (FDA: 21 CFR 177.1550)
- Probe rope insulation: PFA or FEP (FDA: 21 CFR 177.1550)
- Process connection: 316L (1.4435 or 1.4404)
- Flat seal for process connection G  $\frac{3}{4}$  or G 1: elastomer fiber, asbestos-free
- Sealing ring for process connection G  $\frac{1}{2}$ , G  $\frac{3}{4}$ , G 1, G 1 $\frac{1}{2}$ :  
Elastomer fiber, asbestos-free, resistant to lubricants, solvents, steam, weak acids and alkalis;  
to 300 C and to 100 bar

**Not in contact with the process**

- Ground terminals on housing (exterior): 304 (1.4301)
- Nameplate on housing (exterior): 304 (1.4301)
- Cable glands
  - Housing F13, F15, F16, F17, F27: polyamide (PA)  
With C, D, E, F, H, M, J, P, S, 1, 4, 5 approval (→  44 ordering information): nickel-plated brass
  - Housing T13: nickel-plated brass
- Polyester housing F16: PBT-FR with cover made of PBT-FR or with sight glass made of PA12,
  - Cover seal: EPDM
  - Adhesive nameplate: polyester foil (PET)
  - Pressure compensation filter: PBT-GF20
- Stainless steel housing F15: 316L (1.4404)
  - Cover seal: silicone
  - Cover clamp: 304 (1.4301)
  - Pressure compensation filter: PBT-GF20, PA
- Aluminum housing F17/F13/T13: EN-AC-AISi10Mg, plastic-coated,
  - Cover seal: EPDM
  - Cover clamp: nickel-plated brass
  - Pressure compensation filter: silicone (not T13)

- Stainless steel housing F27: 316L (1.4435)
  - Cover seal: FVMQ (optional: EPDM seal available as spare part)
  - Cover clamp: 316L (1.4435)

## Input

**Measured variable** Measurement of change in capacitance between probe rod and tank wall or ground tube; depends on the level of a liquid.

Probe covered => high capacitance  
 Probe not covered => low capacitance

### Measuring range

- Measuring frequency: 500 kHz
- Span:
  - $\Delta C = 5$  to 1600 pF
  - $\Delta C = 5$  to 500 pF (with FEI58)
- Final capacitance:  $C_E = \text{max. } 1600$  pF
- Adjustable initial capacitance:
  - $C_A = 5$  to 500 pF (range 1 = factory setting)
  - $C_A = 5$  to 1600 pF (range 2; not with FEI58)
- The minimum change in capacitance for point level detection must be  $\geq 5$  pF.

### Minimum probe length for nonconductive media ( $< 1 \mu\text{s/cm}$ )

$$l_{\min} = \Delta C_{\min} / (C_s * [\epsilon_r - 1])$$

$l_{\min}$  = Minimum probe length (m)

$\Delta C_{\min}$  = 5 pF

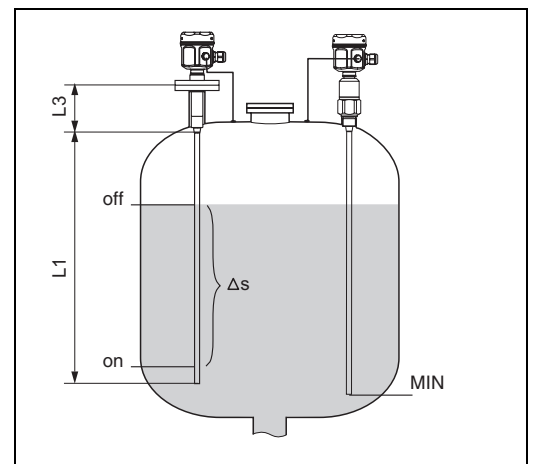
$C_s$  = Probe capacitance in air → 28 "Technical data: Probe"

$\epsilon_r$  = Dielectric constant e.g. oil = 2.0

### Measuring conditions

#### Notes!

- When installing in a nozzle, use inactive length (L3).
- Probes with active buildup compensation must be used for high-viscosity liquids that tend to form buildup.
- Fully insulated rod and rope probes have to be used for pump control ( $\Delta S$  operation). The switch-on and switch-off points are determined by the empty and full calibration.
  - The maximum length depends on the probe used.  
 A 16 mm rod, for example, generates a capacitance of 380 pF/m in a conductive liquid.  
 With a maximum span of 1600 pF, this gives  
 $1600\text{pF}/380\text{pF}$   
 per m =  
 4 m total length.
- In the case of nonconductive media:  
 use a ground tube.



L00-FTI5xxxx-15-05-xx-xx-002

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## Output

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<b>Switch behavior</b>	Binary or $\Delta$ s operation (pump control, not with FEI58)
<b>Fail-safe mode</b>	<p>Minimum/maximum quiescent current safety can be switched at the electronic insert (for FEI53 and FEI57S only on the associated Nivotester: FTC325 3-Wire, FTC325 PFM and FTC625</p> <p>MIN = minimum safety: The output switches safety-oriented when the probe is uncovered (signal on alarm). For use for dry running protection and pump protection for example</p> <p>MAX = maximum safety: The output switches safety-oriented when the probe is covered (signal on alarm). For use with overflow protection for example</p>
<b>Switching delay</b>	<p>FEI51, FEI52, FEI54, FEI55 Can be adjusted incrementally at the electronic insert: 0.3 to 10 s</p> <p>FEI53, FEI57S Depends on the connected Nivotester (transmitter): FTC325, FTC625, FTC470Z or FTC471Z</p> <p>FEI58 Can be adjusted alternately at the electronic insert: 1 s / 5 s</p>
<b>Galvanic isolation</b>	<p>FEI51, FEI52 between rod probe and power supply</p> <p>FEI54: between rod probe, power supply and load</p> <p>FEI53, FEI55, FEI57S, FEI58 see connected switching device (functional galvanic isolation in the electronic insert)</p>

## Electronic insert FEI51 (AC 2-wire)

### Power supply

- Supply voltage: 19 to 253 V AC
- Power consumption: < 1.5 W
- Residual current consumption: < 3.8 mA
- Short-circuit protection
- Overvoltage category II

### Electrical connection

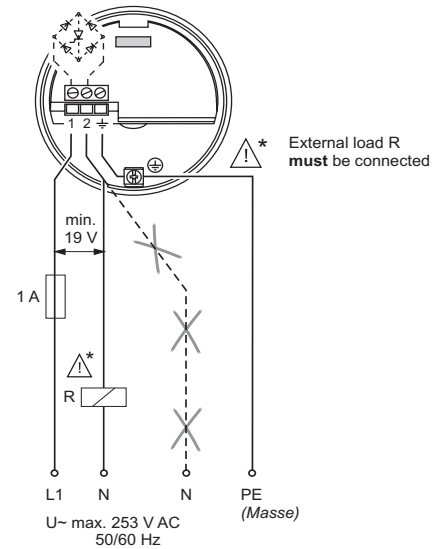
#### Notes!

Always connect in series with a load!

Check the following:

- the residual current consumption in blocked stat.
- that for low voltage:
  - the voltage drop across the load is such that the minimum terminal voltage at the electronic insert (19 V) when blocked is not undershot.
  - the voltage drop across the electronics when switched through is observed (up to 12 V).
- that a relay cannot de-energize with holding power below 1 mA.  
If this is the case, a resistor should be connected parallel to the relay (RC module available on request).

When selecting the relay, pay attention to the holding power / rated power (see below: "Connectable load").



L00-FMI5xxxx-06-05-xx-en-071

### Signal on alarm

Safety mode	Level	Output signal	LEDs					
			gn	gn	rd	gn	gn	ye
MAX		$L^+ \xrightarrow{I_L} +$ 1 → 3	☀	●	●	●	●	☀
		$1 \xrightarrow{< 3,8 \text{ mA}} 3$	☀	●	●	●	●	●
MIN		$L^+ \xrightarrow{I_L} +$ 1 → 3	☀	●	●	●	●	☀
		$1 \xrightarrow{< 3,8 \text{ mA}} 3$	☀	●	●	●	●	●
Maintenance required		$I_L / < 3,8 \text{ mA}$ 1 → 3	☀	●	☀	●	●	●
Instrument failure		$1 \xrightarrow{< 3,8 \text{ mA}} 3$	☀	●	☀	●	●	●

BA300Fes017

### Output signal

Output signal on power failure or in the event of damage to the sensor: < 3.8 mA

### Connectable load

- For relays with a minimum holding power or rated power > 2.5 VA at 253 V AC (10 mA) or > 0.5 VA at 24 V AC (20 mA)
- Relays with a lower holding power or rated power can be operated by means of an RC module connected in parallel.
- For relays with a maximum holding power or rated power < 89 VA at 253 V AC or < 8.4 VA at 24 V AC
- Voltage drop across FEI51 max. 12 V
- Residual current with blocked thyristor max. 3.8 mA
- Load switched directly into the power supply circuit via the thyristor.

## Electronic insert FEI52 (DC PNP)

### Power supply

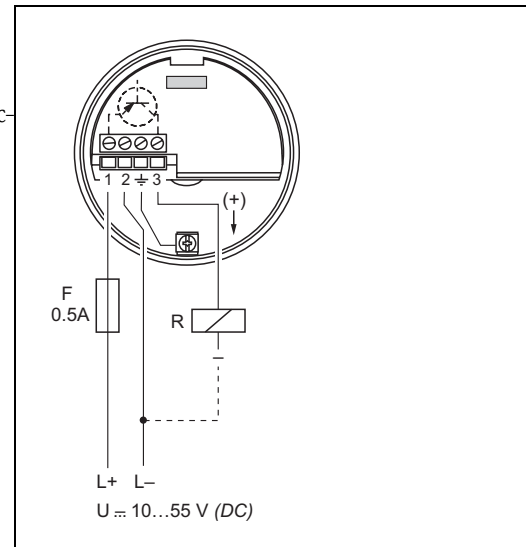
- Supply voltage: 10 to 55 V DC
- Ripple: max. 1.7 V, 0 to 400 Hz
- Current consumption: < 20 mA
- Power consumption without load: max. 0.9 W
- Power consumption with full load (350 mA): 1.6 W
- Reverse polarity protection: yes
- Separation voltage: 3.7 kV
- Overvoltage category II

### Electrical connection

#### Three-wire DC connection

Preferably in conjunction with programmable logic controllers (PLC),  
DI modules in accordance with EN 61131-2.

Positive signal present at the switch output of the electronic system (PNP).



TI418F42

### Output signal

Safety mode	Level	Output signal	LEDs					
			gn	gn	rd	gn	gn	ye
MAX		$L+ \xrightarrow{I_L} +$ 1 → 3						
		$1 \text{---} I_R \text{---} 3$						
MIN		$L+ \xrightarrow{I_L} +$ 1 → 3						
		$1 \text{---} I_R \text{---} 3$						
Maintenance required		$1 \text{---} I_L / I_R \text{---} 3$						
Instrument failure		$1 \text{---} I_R \text{---} 3$						

TI418Fen43

TI418F44

$I_L$  = Load current  
(switched through)  
 $I_R$  = Residual current  
(blocked)

Lit

Flashes

Unlit

### Signal on alarm

Output signal on power failure or in the event of device failure:  $I_R < 100 \mu A$

### Connectable load

- Load switched via transistor and separate PNP connection, max. 55 V
- Load current max. 350 mA (cyclical overload and short-circuit protection)
- Residual current < 100  $\mu A$  (with transistor blocked)
- Capacitance load max. 0.5  $\mu F$  at 55 V; max. 1.0  $\mu F$  at 24 V
- Residual voltage < 3 V (for transistor switched through)



## Electronic insert FEI53 (3-wire)

### Power supply

- Supply voltage: 14.5 V DC
- Current consumption: < 15 mA
- Power consumption: max. 230 mW
- Reverse polarity protection: yes
- Separation voltage: 0.5 kV

### Electrical connection

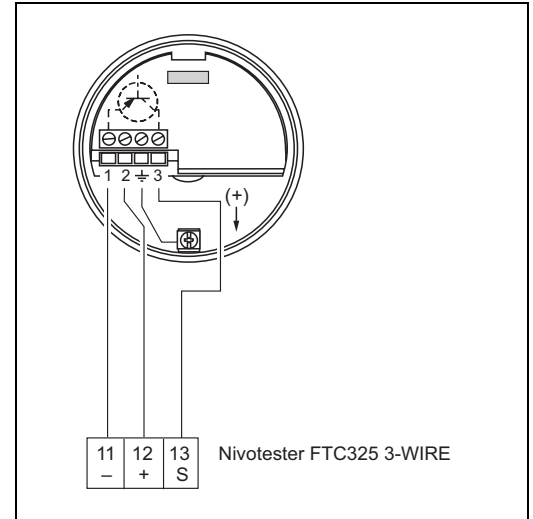
#### Three-wire DC connection

3 to 12 V signal

For connecting to the switching unit, Nivotester FTC325 3-WIRE from Endress+Hauser.









Switching between minimum/maximum Safety in the Nivotester FTC325 3-WIRE.

Point level adjustment directly at the Nivotester.






TI418F45

### Output signal

Mode	Output signal	LEDs green red
Normal operation	3...12 V at terminal 3	 
Maintenance required *	 3...12 V at terminal 3	 
Instrument failure	 < 2,7 V at terminal 3	 

TI418Fen46

TI418F44

-  Lit
-  Flashes
-  Unlit

### Signal on alarm

Voltage at terminal 3 vis-à-vis terminal 1: < 2.7 V

### Connectable load

- Floating relay contacts in the connected switching unit Nivotester FTC325 3-WIRE
- For the contact load capacity, refer to the technical data of the switching device.

## Electronic insert FEI54 (AC/DC with relay output)

### Power supply

- Supply voltage: 19 to 253 V AC, 50/60 Hz or 19 to 55 V DC
- Power consumption: max. 1.6 W
- Reverse polarity protection: yes
- Separation voltage: 3.7 kV
- Overvoltage category II

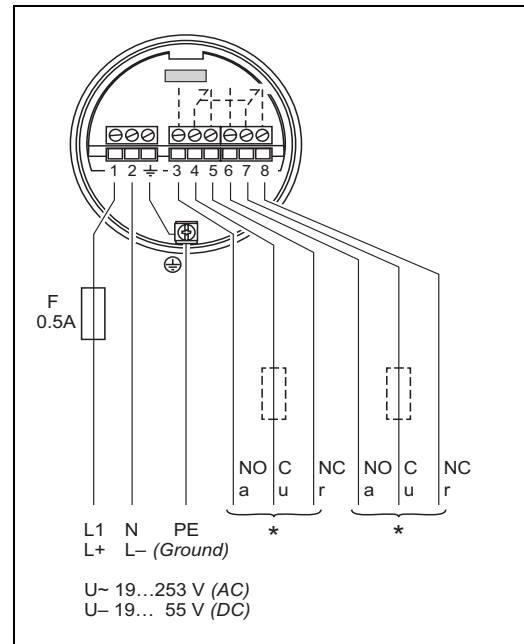
### Electrical connection

#### Universal current connection with relay output (DPDT)

Power supply:  
Please note the different  
voltage ranges for AC and DC.  
Alternating current.

Output:  
When connecting an instrument with  
high inductance, provide a spark arrester  
to protect the relay contact.  
A fine-wire fuse (depending on the  
load connected) protects the relay  
contact on short-circuiting.  
Both relay contacts switch simultaneously.

\* See below "Connectable load"



TI418F47

### Output signal

Safety mode	Level	Output signal	LEDs					
			gn	gn	rd	gn	gn	ye
MAX		3 4 5 6 7 8						
		3 4 5 6 7 8						
MIN		3 4 5 6 7 8						
		3 4 5 6 7 8						
Maintenance required								
Instrument failure		3 4 5 6 7 8						

TI418Fen48

TI418F49

Relay energized

Relay de-energized

Lit

Flashes

Unlit

### Signal on alarm

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

### Connectable load

- Loads switched via 2 floating changeover contacts (DPDT)
- I~ max. 6 A, U~ max. 253 V; P~ max. 1500 VA at  $\cos \varphi = 1$ , P~ max. 750 VA at  $\cos \varphi > 0.7$
- I- max. 6 A to 30 V, I- max. 0.2 A to 125 V
- The following applies when connecting a functional low-voltage circuit with double isolation as per IEC 1010: Sum of voltages of relay output and power supply max. 300 V

## Electronic insert FEI55 (8/16 mA; SIL2/SIL3)

### Power supply

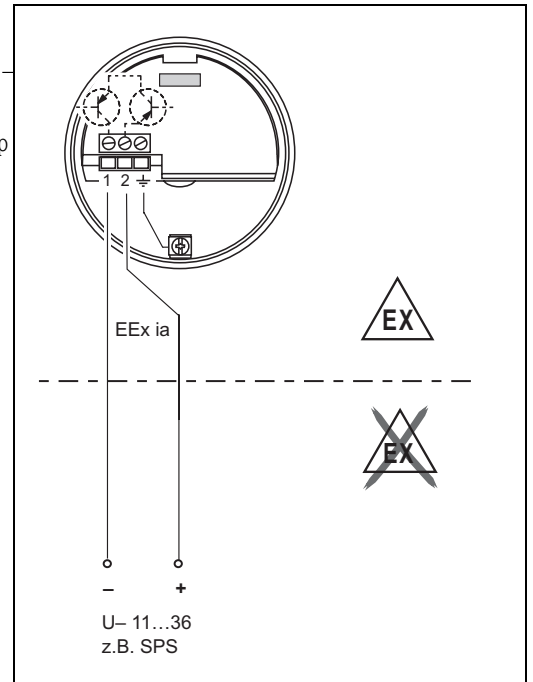
- Supply voltage: 11 to 36 V DC
- Power consumption: < 600 mW
- Reverse polarity protection: yes
- Separation voltage: 0.5 kV

### Electrical connection

#### Two-wire connection for separate switching unit

For connecting to programmable logic controllers (PLC), AI modules 4 to 20 mA in accordance with EN 61131-2.

The point level signal is sent via an output signal jump from 8 mA to 16 mA.



TI418Fen50

### Output signal

Safety mode	Level	Output signal	LEDs gn gn rd gn gn ye
MAX		$\frac{+}{2} \xrightarrow{\sim 16 \text{ mA}} 1$	
		$\frac{+}{2} \xrightarrow{\sim 8 \text{ mA}} 1$	
MIN		$\frac{+}{2} \xrightarrow{\sim 16 \text{ mA}} 1$	
		$\frac{+}{2} \xrightarrow{\sim 8 \text{ mA}} 1$	
Maintenance required *		$\frac{+}{2} \xrightarrow{8/16 \text{ mA}} 1$	
Instrument failure		$\frac{+}{2} \xrightarrow{< 3.6 \text{ mA}} 1$	

~ 16 mA = 16 mA ± 5 %  
~ 8 mA = 8 mA ± 6 %

Lit  
 Flashes  
 Unlit

TI418Fen51

TI418F44

### Signal on alarm

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

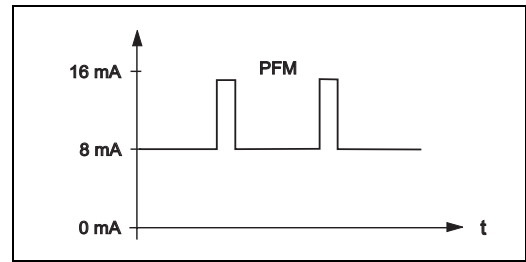
### Connectable load

- U = Connection DC voltage:
  - 11 to 36 V DC (non-hazardous area and Ex ia)
  - 14.4 to 30 V DC (Ex d)
- I<sub>max</sub> = 16 mA

## Electronic insert FEI57S (PFM)

### Power supply

Supply voltage: 9.5 to 12.5 VDC  
 Power consumption: < 150 mW  
 Reverse polarity protection: yes  
 Separation voltage: 0.5 kV



TI418F52

Frequency: 17 to 185 Hz

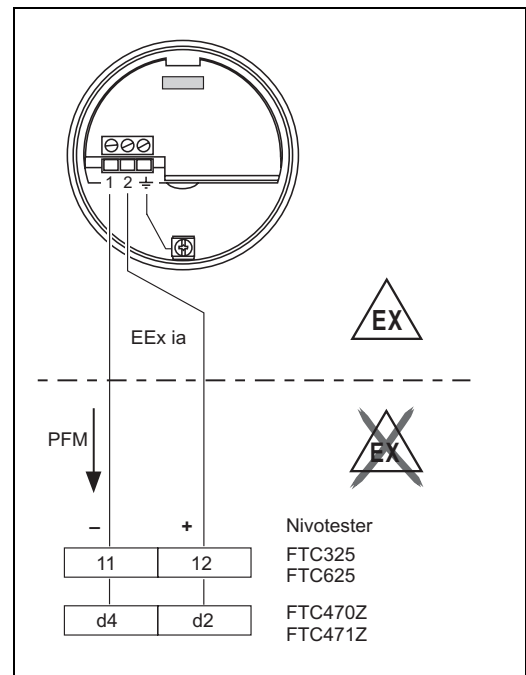
### Electrical connection

#### Two-wire connection for separate switching unit

For connecting to switching units  
 Nivotester FTC325, FTC625, FTC470Z, FTC471Z  
 from Endress+Hauser.

PFM signal 17 to 185 Hz

Switching between minimum/maximum  
 safety in the Nivotester.



TI418F53

### Output signal

PFM 60 to 185 Hz (Endress+Hauser)

### Signal on alarm

Mode	Output signal	LEDs	
		green	red
Normal operation	60...185 Hz 1 -----> 2		
Maintenance required * 	60...185 Hz 1 -----> 2		
Instrument failure 	< 20 Hz 1 -----> 2		

TI418Fen54

TI418F44

Lit

Flashes

Unlit

### Connectable load

- Floating relay contacts in the connected switching unit Nivotester FTC325, FTC625, FTC470Z, FTC471Z
- For the contact load capacity, refer to the technical data of the switching device.

## Electronic insert FEI58 (NAMUR H-L edge)

**Power supply**

- Power consumption: < 6 mW at I < 1 mA; < 38 mW at I = 2.2 to 4 mA
- Interface connection data: IEC 60947-5-6


**Electrical connection**

**Two-wire connection for separate switching unit**

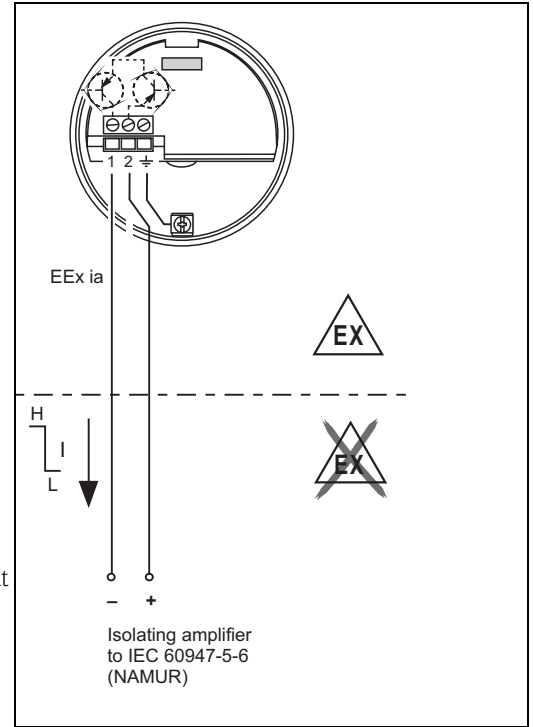
For connecting to isolating amplifiers as per NAMUR (IEC 60947-5-6), e.g. FXN421, FXN422, FTL325N, FTL375N from Endress+Hauser. Change in output signal from high to low current in event of point level detection.

**(H-L edge)**

Additional function:  
Test key on the electronic insert.  
Pressing the key interrupts the connection to the isolating amplifier.













 **Note!**  
In the case of Ex-d operation, the additional function can only be used if the housing is not exposed to an explosive atmosphere.




Connection to Multiplexer: set 3 s as the cycle time at least.



L00-FTL5xxxx-04-05-xx-en-002

**Output signal**

Fail-safe mode	Level	Output signal	LEDs green yellow
Max.		+ 2.2 ... 3.5 mA → 1	 
		+ 0.6 ... 1.0 mA → 1	 
Min.		+ 2.2 ... 3.5 mA → 1	 
		+ 0.6 ... 1.0 mA → 1	 

-  = Lit
-  = Flashes
-  = Unlit

L00-FTL5xxxx-07-05-xx-xx-002

L00-FTL5xxxx-04-05-xx-xx-002

**Signal on alarm**

Output signal in the event of damage to the sensor: < 1.0 mA

**Connectable load**

- See the technical data of the connected isolating amplifier as per IEC 60947-5-6 (NAMUR)
- Connection also to isolating amplifiers which have special safety circuits (I > 3.0 mA)

## Power supply

### Electrical connection

### Connection compartment

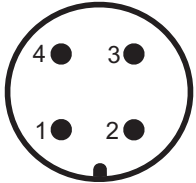
Six housings with the following protection classes are available:

Housing	Standard	EEx ia	EEx d	Gas-tight process seal
Polyester housing F16	X	X	-	-
Stainless steel housing F15	X	X	-	-
Aluminum housing F17	X	X	-	-
Aluminum housing F13	X	X	X	X
Stainless steel housing F27	X	X	X	X
Aluminum housing T13 (with separate connection compartment)	X	X	X	X

### Connector

For the version with a connector M12, the housing does not have to be opened for connecting the signal line.

### PIN assignment for M12 connector

	PIN	2-wire-electronic insert FEI55, FEI57, FEI58, FEI50H, FEI57C	3-wire-electronic insert FEI52, FEI53
	1	+	+
	2	not used	not used
	3	-	-
	4	ground	external load / signal

### Cable entry

- Cable gland: M20x1.5 (for EEx d only cable entry M20)  
Two cable glands included in scope of delivery.
- Cable entry: G ½, NPT ½ and NPT ¾.

## Performance characteristics

Uncertainty: DIN 61298-2: max  $\pm 0.3\%$

Non-repeatability (reproducibility): DIN 61298-2: max.  $\pm 0.1\%$

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### Reference operating conditions

- Room temperature:  $+20\text{ °C} \pm 5\text{ °C}$
  - Span:
    - $\Delta C = 5 \dots 1600\text{ pF}$
    - $\Delta C = 5 \dots 500\text{ pF}$  (with FEI58)
- 

### Switch-on behavior

When the power supply is switched on, the switching status of the outputs corresponds to the signal on alarm. The correct switch condition is reached after max. 3 seconds.

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### Ambient temperature effect

#### Electronic insert

$< 0.06\% / 10\text{ K}$  related to the full scale value

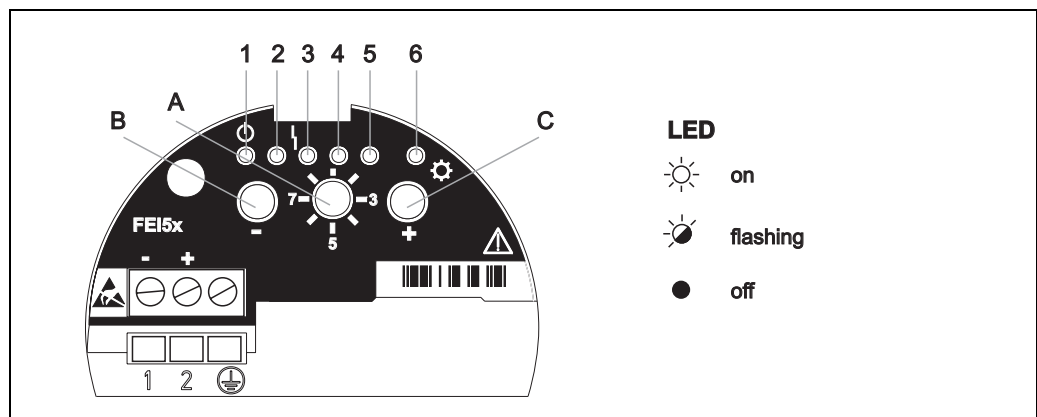
#### Separate housing

Capacitance change of connecting cable per meter  $0.15\text{ pF}/10\text{K}$

## Human interface

### Electronic inserts

### FEI51, FEI52, FEI54, FEI55



Green LED 1 (☺ ready for operation), red LED 3 (⚡ error indicated), yellow LED 6 (⚙ switching state)

BA300Fen015

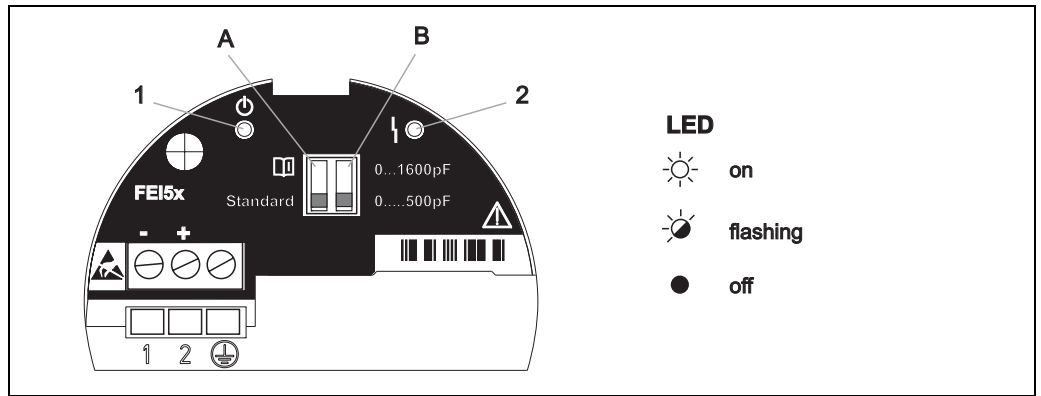
Function switch position	Function	- key	+ key	Light emitting diodes (LED signals)					
				☺	☺	⚡	☺	☺	⚙
				☺ 1 (green)	☺ 2 (green)	⚡ 3 (red)	☺ 4 (green)	☺ 5 (green)	☺ 6 (yellow)
1	Operation			Flashes Operational LED	On (MIN-SIL)	Flashes (warning/ alarm)	On (MAX-SIL)		On/off/ flashes
	Restore factory setting	Press both keys for approx. 20 s		On	->	->	->	->	On/off/ flashes
2	Empty calibration	Press		On (present)					On/off/ flashes
	Full calibration		Press					On (present)	On/off/ flashes
	Reset: Calibration and switchpoint adjustment	Press both keys for approx. 10 s		On	->	->	->	->	On/off/ flashes
3	Switch point shift	Press for <	Press for >	On (2 pF)	Off (4 pF)	Off (8 pF)	Off (16 pF)	Off (32 pF)	On/off/ flashes
4	Measuring range	Press for <		On (500 pF)	Off (1600 pF)				On/off/ flashes
	Two-point control Δs		Press once					On	On/off/ flashes
	buildup mode		Press twice				On	On	On/off/ flashes
5	Switching delay	Press for <	Press for >	Off (0.3 s)	On (1.5 s)	Off (5 s)	Off (10 s)		On/off/ flashes
6	Self-test (function test)	Press both keys		Off (inactive)				Flashes (active)	On/off/ flashes
7	MIN-/MAX Fail-safe mode	Press for MIN	Press for MAX	Off (MIN)				On (MAX)	On/off/ flashes
	SIL mode* lock/unlock	Press both keys			On (MIN-SIL)		On (MAX-SIL)		On/off/ flashes
8	Upload/download sensor DAT (EEPROM)	Press for download	Press for upload	Flashes (download)				Flashes (upload)	On/off/ flashes

\* Only in conjunction with FEI55 electronic insert (SIL).



Electronic inserts

FEI53, FEI57S



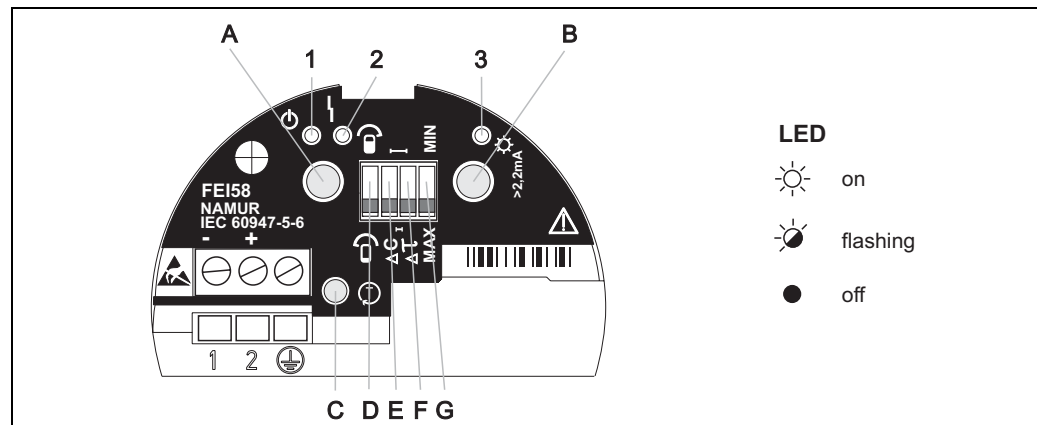
BA300Fen016

Green LED (⏻ ready for operation), red LED (⚡ error indicated)

DIP switch	Function
A	Standard <sup>1)</sup> : If the measuring range is exceeded <b>no</b> alarm is output.
A	: If the measuring range is exceeded <b>an</b> alarm is output.
B	Measuring range: The measuring range is between 0 and 500 pF Span: The span is between 5 and 500 pF.
B	Measuring range: The measuring range is between 0 and 1600 pF Span: The span is between 5 and 1600 pF.

## Electronic insert

## FEI58








Green LED 1 (☺ ready for operation), red LED 2 (⚠ error indicated), yellow LED 3 (⚡ switching state)

DIP switches (C, D, E, F)		Function
D		The probe is covered during calibration.
D		The probe is uncovered during calibration.
E		Switchpoint adjustment: 10 pF
E		Switchpoint adjustment: 2 pF
F		Switching delay: 5 s
F		Switching delay: 1 s
G		Fail-safe mode: MIN The output switches safety-oriented when the probe is uncovered (signal on alarm). For use for dry running protection and pump protection for example
G		Fail-safe mode: MAX The output switches safety-oriented when the probe is covered (signal on alarm). For use with overflow protection for example

Key	Function		
A	B	C	
X			Display diagnostic code
	X		Display calibration situation
X	X		Perform calibration (during operation)
X	X		Delete calibration points (during startup)
		X	Test key  , (disconnects the transmitter from the switching unit)

## Certificates and approvals

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<b>CE mark</b>	The devices are designed to meet state-of-the-art safety requirements, have been tested and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations that are listed in the EC Declaration of Conformity and thus meet the legal requirements of the EC Directives. Endress+Hauser confirms the conformity of the device by affixing to it the CE mark.
<b>Ex approval</b>	See "Ordering information" from →  44.
<b>Other standards and guidelines</b>	<p><b>EN 60529</b> Degrees of protection by housing (IP code)</p> <p><b>EN 61010</b> Protection measures for electrical equipment for measurement, control, regulation and laboratory procedures</p> <p><b>EN 61326</b> Interference emission (Class B equipment), interference immunity (Annex A - Industrial).</p> <p><b>NAMUR</b> Association for Standards for Control and Regulation in the Chemical Industry</p> <p><b>IEC 61508</b> Functional safety</p>
<b>Additional approvals</b>	<ul style="list-style-type: none"><li>■ See also "Ordering information: approval" →  44 ff.</li><li>■ TSE Certificate of Suitability (FMI51) The following applies to wetted device components:<ul style="list-style-type: none"><li>– They do not contain any materials derived from animals.</li><li>– No additives or operating materials derived from animals are used in production or processing.</li></ul><p> <b>Note!</b> The wetted device components are listed in the "Mechanical construction" (→  19 ff) and "Ordering information" (→  44 ff) sections.</p></li><li>■ AD2000 The wetted material (316L) corresponds to AD2000 – W0/W2</li></ul>

## Ordering information



Note!

In this list, versions which are mutually exclusive are not marked.

### Liquicap M FTI51

10	Approval:
A	Non-hazardous areas
B	Non-hazardous areas, WHG (German Water Resources Act)
C	ATEX II 1/2 GD EEx ia IIC T6
D	ATEX II 1/2 GD EEx ia IIC T6, WHG (German Water Resources Act)
G	ATEX II 1/2 GD EEx de (ia) IIC T6, WHG (German Water Resources Act)
	XA, observe safety instructions (electrostatic charge)!
H	ATEX II 1/2 GD EEx ia IIC T6,
	XA, observe safety instructions (electrostatic charge)!
J	ATEX II 1/2 GD EEx ia IIC T6, WHG (German Water Resources Act)
	XA, observe safety instructions (electrostatic charge)!
K	ATEX II 1/2 G EEx ia IIC T6, WHG (German Water Resources Act)
	XA, observe safety instructions (electrostatic charge)!
L	ATEX II 1/2 G EEx de (ia) IIC T6, WHG (German Water Resources Act)
	XA, observe safety instructions (electrostatic charge)!
M	ATEX II 3GD EEx nA/nL/nC II T6, WHG (German Water Resources Act)
	XA, observe safety instructions (electrostatic charge)!
N	CSA General Purpose, C US CSA
P	CSA/FMIS Cl. I, II, III Div. 1+2 Gr. A-G
R	CSA/FM XP Cl. I, II, III Div. 1+2 Gr. A-G
S	TIIS Ex ia IIC T3
T	TIIS Ex d IIC T3
Y	Special version, to be specified
1	NEPSI Ex ia IIC T6
2	NEPSI Ex d(ia) IIC T6
4	NEPSI Ex nA/nC IIC T6
5	IECEX Ga/Gb Ex ia IIC T6; Ex iaD 20/Ex tD A21
6	IECEX Ga/Gb Ex ia IIC T6
20	Inactive length (L3):
	L3: 100 to 2000 mm/4 to 80 inch for 316L
	L3: 150 to 1000 mm/6 to 40 inch for PTFE fully insulated
	Protection against condensate + bypassing container nozzles
A	Not selected
B	Not selected + 125mm/5inch 316L Active buildup compensation
C	Not selected + 125mm/5inch PFA, 316L Fully insulated active buildup compensation
	Price per 100 mm
1	.... mm 316L
2	.... mm 316L, PTFE fully insulated
	Price does not depend on length
3	.... mm (<= 500 mm) 316L + 125 mm active buildup compensation
4	.... mm (> 500 mm) 316L + 125 mm active buildup compensation
	Price per inch
5	.... inch 316L
6	.... inch 316L, PTFE fully insulated
	Price does not depend on length
7	.... inch (<= 20 inch) 316L + 5 inch active buildup compensation
8	.... inch (> 20 inch) 316L + 5 inch active buildup compensation
9	Special version, to be specified
30	Active probe length (L1); insulation:
	Price per 100 mm/1 inch
	L1: 100 to 4000 mm/4 to 160 inch for Ø10 mm, Ø16 mm
	L1: 150 to 3000 mm/6 to 120 inch for Ø22 mm (fully insulated)
A	mm L1, 10 mm, 316L; PTFE
B	mm L1, 16 mm, 316L; PTFE
C	mm L1, 22 mm, 316L; PTFE
D	mm L1, 16 mm, 316L; PFA

30				
<b>Active probe length (L1); insulation:</b>				
E	mm L1, 10 mm,		316L; PTFE + ground tube	
F	mm L1, 16 mm,		316L; PTFE + ground tube	
G	mm L1, 16 mm,		316L; PFA + ground tube	
H	inch L1, 0.4 inch,		316L; PTFE	
K	inch L1, 0.6 inch,		316L; PTFE	
M	inch L1, 0.9 inch,		316L; PTFE	
N	inch L1, 0.6 inch,		316L; PFA	
P	inch L1, 0.4 inch,		316L; PTFE + ground tube	
R	inch L1, 0.6 inch,		316L; PTFE + ground tube	
S	inch L1, 0.6 inch,		316L; PFA + ground tube	
T	inch L1, 0.55 inch,		316L; PFA	
Y	Special version, to be specified			
I	mm L1, 14 mm,		316L; PFA	
40				
<b>Insulation (L2)</b>				
1	Fully insulated			
2	...mm, partially insulated			
3	...inch, partially insulated			
9	Special version, to be specified			
50				
<b>Process connection:</b>				∅ Inactive length (mm)
<b>Threaded connection</b>				
GCJ	G ½,	316L, 25 bar	Thread ISO228	22
GDJ	G ¾,	316L, 25 bar	Thread ISO228	22
GEJ	G 1,	316L, 25 bar	Thread ISO228	22
GGJ	G 1½,	316L, 100 bar	Thread ISO228	43
RCJ	NPT ½,	316L, 25 bar	thread ANSI	22
RDJ	NPT ¾,	316L, 25 bar	thread ANSI	22
REJ	NPT 1,	316L, 25 bar	thread ANSI	22
RGJ	NPT 1½,	316L, 100 bar	thread ANSI	43
<b>Hygiene connection</b>				
GQJ	G ¾	316L, 25 bar, EHEDG	Thread ISO228	–
Accessories installation, weld-in adapter				
GWJ	G 1	316L, 25 bar, EHEDG	Thread ISO228	–
Accessories installation, weld-in adapter				
MRJ	DN50 PN40,	316L	DIN11851	22/43**
UPJ	Adapter 44 mm	316L, 16 bar		–
<b>Tri-Clamp connection</b>				
TCJ	DN25 (1"), EHEDG	316L,	Tri-Clamp ISO2852	22
TJJ	DN38 (1½"), EHEDG	316L,	Tri-Clamp ISO2852	22
TJK	DN38 (1½"), EHEDG	PTFE >316L, 3A	Tri-Clamp ISO2852	22
TDJ	DN40-51 (2"),	316L,	Tri-Clamp ISO2852	43
TDK	DN40-51 (2"), EHEDG	PTFE >316L, 3A,	Tri-Clamp ISO2852	–
TNJ	DN38 (1½"),	316L, 3A, EHEDG	Tri-Clamp ISO2852	–
Tri-Clamp removable				
<b>EN flanges</b>				
B0J	DN25 PN25/40 A,	316L	Flange EN1092-1 (DIN2527 B)	22
B1J	DN32 PN25/40 A,	316L	Flange EN1092-1 (DIN2527 B)	22
B2J	DN40 PN25/40 A,	316L	Flange EN1092-1 (DIN2527 B)	22
B3J	DN50 PN25/40 A,	316L	Flange EN1092-1 (DIN2527 B)	22/43**
CRJ	DN50 PN25/40 B1,	316L	Flange EN1092-1 (DIN2527 C)	43
DRJ	DN50 PN40 C,	316L	Flange EN1092-1 (DIN2512 F)	43
ERJ	DN50 PN40 D,	316L	Flange EN1092-1 (DIN2512 N)	43
BSJ	DN80 PN10/16 A,	316L	Flange EN1092-1 (DIN2527 B)	43
CGJ	DN80 PN10/16 B1,	316L	Flange EN1092-1 (DIN2527 C)	43
DGJ	DN80 PN16 C,	316L	Flange EN1092-1 (DIN2512 F)	43

50	Process connection:				∅ Inactive length (mm)
EJ	DN80 PN16 D,	316L	Flange EN1092-1 (DIN2512 N)	43	
BTJ	DN100 PN10/16 A,	316L	Flange EN1092-1 (DIN2527 B)	43	
CHJ	DN100 PN10/16 B1,	316L	Flange EN1092-1 (DIN2527 C)	43	
	PTFE clad				
B0K	DN25 PN25/40,	PTFE >316L	Flange EN1092-1 (DIN2527)	-	
B1K	DN32 PN25/40,	PTFE >316L	Flange EN1092-1 (DIN2527)	-	
B2K	DN40 PN25/40,	PTFE >316L	Flange EN1092-1 (DIN2527)	-	
B3K	DN50 PN25/40,	PTFE >316L	Flange EN1092-1 (DIN2527)	-	
BSK	DN80 PN10/16,	PTFE >316L	Flange EN1092-1 (DIN2527)	-	
BTK	DN100 PN10/16,	PTFE >316L	Flange EN1092-1 (DIN2527)	-	
	<b>ANSI flanges</b>				
ACJ	1" 150 lbs RF,	316/316L	Flange ANSI B16.5	22	
ANJ	1" 300 lbs RF,	316/316L	Flange ANSI B16.5	22	
AEJ	1½" 150 lbs RF,	316/316L	Flange ANSI B16.5	22	
AQJ	1½" 300 lbs RF,	316/316L	Flange ANSI B16.5	22	
AFJ	2" 150 lbs RF,	316/316L	Flange ANSI B16.5	22/43**	
ARJ	2" 300 lbs RF,	316/316L	Flange ANSI B16.5	22/43**	
AGJ	3" 150 lbs RF,	316/316L	Flange ANSI B16.5	43	
ASJ	3" 300 lbs RF,	316/316L	Flange ANSI B16.5	43	
AHJ	4" 150 lbs RF,	316/316L	Flange ANSI B16.5	43	
ATJ	4" 300 lbs RF,	316/316L	Flange ANSI B16.5	43	
AJJ	6" 150 lbs RF,	316/316L	Flange ANSI B16.5	43	
AUJ	6" 300 lbs RF,	316/316L	Flange ANSI B16.5	43	
	PTFE clad				
ACK	1" 150 lbs,	PTFE >316/316L	Flange ANSI B16.5	-	
ANK	1" 300 lbs,	PTFE >316/316L	Flange ANSI B16.5	-	
AEK	1½" 150 lbs,	PTFE >316/316L	Flange ANSI B16.5	-	
AQK	1½" 300 lbs,	PTFE >316/316L	Flange ANSI B16.5	-	
AFK	2" 150 lbs,	PTFE >316/316L	Flange ANSI B16.5	-	
ARK	2" 300 lbs,	PTFE >316/316L	Flange ANSI B16.5	-	
AGK	3" 150 lbs,	PTFE >316/316L	Flange ANSI B16.5	-	
AHK	4" 150 lbs,	PTFE >316/316L	Flange ANSI B16.5	-	
	<b>JIS flanges</b>				
KCJ	10K 25 RF,	316L	Flange JIS B2220	22	
KEJ	10K 40 RF,	316L	Flange JIS B2220	22	
KFJ	10K 50 RF,	316L	Flange JIS B2220	22/43**	
KGJ	10K 80 RF,	316L	Flange JIS B2220	22/43**	
KHJ	10K 100 RF,	316L	Flange JIS B2220	22/43**	
KRJ	20K 50 RF,	316L	Flange JIS B2220	43	
	PTFE clad				
KCK	10K 25 RF,	PTFE >316L	Flange JIS B2220	-	
KEK	10K 40 RF,	PTFE >316L	Flange JIS B2220	-	
KFK	10K 50 RF,	PTFE >316L	Flange JIS B2220	-	
KGK	10K 80 RF,	PTFE >316L	Flange JIS B2220	-	
KHK	10K 100 RF,	PTFE >316L	Flange JIS B2220	-	
YY9	Special version, to be specified				
60	Electronics				
W	Prepared for FEI5x				
Y	Special version, to be specified				
1	FEI51; 2-wire	19-253 V AC			
2	FEI52; 3-wire PNP,	10 to 55 V DC			
3	FEI53; 3-wire,	3 to 12 V signal			
4	FEI54; relay DPDT,	19 to 253 V AC, 19 to 55 V DC			
5	FEI55; 8/16mA,	11 to 36 V DC			
7	FEI57S; 2-wire PFM				

<b>60</b>											<b>Electronics</b>
											8 FEI58; NAMUR+test key (H-L signal)
<b>70</b>											<b>Housing:</b>
											1 F15 316L IP66, NEMA4X
											2 F16 polyester IP66, NEMA4X
											3 F17 aluminum IP66, NEMA4X
											4 F13 aluminum IP66, NEMA4X + gas-tight probe seal
											5 T13 Alu IP66, NEMA4X + gas-tight probe seal + separate connection compartment
											6 F27 316L IP68, NEMA6P + gas-tight probe seal
											9 Special version, to be specified
<b>80</b>											<b>Cable entry:</b>
											A M20 threaded joint (EEx d > thread M20)
											B Thread G ½
											C Thread NPT ½
											D Thread NPT ¾
											E M12 connector
											Y Special version, to be specified
<b>90</b>											<b>Probe design:</b>
											1 Compact
											2 2000 mm L4 cable > separate housing
											3 ....mm L4 cable > separate housing
											4 80 inch L4 cable > separate housing
											5 ....inch L4 cable > separate housing
											9 Special version, to be specified
<b>100</b>											<b>Additional equipment:</b>
											A Basic version
											B Cleaned for applications free from paint-wetting impairment substances*
											C Finished metal probe rod surface**
											D EN10204-3.1 (316L wetted), Inspection certificate
											E EN10204-3.1 (316L wetted), NACE MR0175 Inspection certificate
											F SIL Declaration of Conformity
											S GL marine approval
											Y Special version, to be specified
<b>FTI51</b>											Product designation
<p>* With this option, the complete device is cleaned for applications free from paint-wetting impairment substances.                  ** With this option, the surface of the probe rod (316L) is passivated and acts as additional corrosion protection.</p>											

## Liquicap M FTI52

<b>10</b>	<b>Approval:</b>			
	A	Non-hazardous areas		
	B	Non-hazardous areas,		WHG (German Water Resources Act)
	G	ATEX II 1/2 GD	EEx de (ia) IIC T6,	WHG (German Water Resources Act)
		XA, observe safety instructions (electrostatic charge)!		
	H	ATEX II 1/2 GD	EEx ia IIC T6,	
		XA, observe safety instructions (electrostatic charge)!		
	J	ATEX II 1/2 GD	EEx ia IIC T6,	WHG (German Water Resources Act)
		XA, observe safety instructions (electrostatic charge)!		
	K	ATEX II 1/2 G	EEx ia IIC T6,	WHG (German Water Resources Act)
		XA, observe safety instructions (electrostatic charge)!		
	L	ATEX II 1/2 G	EEx de (ia) IIC T6,	WHG (German Water Resources Act)
		XA, observe safety instructions (electrostatic charge)!		
	M	ATEX II 3GD	EEx nA/nL/nC II T6,	WHG
		XA, observe safety instructions (electrostatic charge)!		
	N	CSA General Purpose, C US CSA		
	P	CSA/FMIS Cl. I, II, III	Div. 1+2 Gr. A-G	
	R	CSA/FM XP Cl. I, II, III	Div. 1+2 Gr. A-G	
	S	TIIS Ex ia IIC T3		
	T	TIIS Ex d IIC T3		
	Y	Special version, to be specified		
	1	NEPSI Ex ia IIC T6		
	2	NEPSI Ex d(ia) IIC T6		
	4	NEPSI Ex nA/nC IIC T6		
	5	IECEX Ga/Gb Ex ia IIC T6; Ex iaD 20/Ex tD A21		
	6	IECEX Ga/Gb Ex ia IIC T6		
<b>20</b>	<b>Inactive length L3:</b>			
		Price per 100 mm/1 inch		
		L3: 100 to 2000 mm/4 to 80 inch for 316L		
		L3: 150 to 1000 mm/6 to 40 inch for PFA fully insulated		
		Protection against condensate + bypassing container nozzles		
	A	Not selected		
	1	...mm,	316L	
	2	...mm,	316L + PFA fully insulated	
	5	...inch,	316L	
	6	...inch,	316L + PFA fully insulated	
	9	Special version, to be specified		
<b>30</b>	<b>Active probe length L1; insulation:</b>			
		Price per 1000 mm/10 inch		
		L1: 420 to 10000 mm/17 to 400 inch; fully insulated		
	A	...mm,	316; FEP	
	B	...mm,	316; PFA	
	C	...inch,	316; FEP	
	D	...inch,	316; PFA	
	Y	Special version, to be specified		
<b>40</b>	<b>Insulation L2</b>			
	1	Fully insulated		
	9	Special version, to be specified		
<b>50</b>	<b>Process connection:</b>			
				∅ Inactive length (mm)
		<b>Threaded connection</b>		
	GDJ	G ¾,	316L, 25 bar	Thread ISO228 22
	GEJ	G1,	316L, 25 bar	Thread ISO228 22
	GGJ	G 1½,	316L, 100 bar	Thread ISO228 43
	RDJ	NPT ¾,	316L, 25 bar	thread ANSI 22
	REJ	NPT1,	316L, 25 bar	thread ANSI 22
	RGJ	NPT 1½,	316L, 100 bar	thread ANSI 43
		<b>Hygiene connection</b>		
	GWJ	G 1	316L, 25 bar, EHEDG	Thread ISO228 -
		Accessories installation, weld-in adapter		
	MRJ	DN50 PN40,	316L	DIN11851 43
	UPJ	Adapter 44 mm	316L, 16 bar, EHEDG	-



50	Process connection:			∅ Inactive length (mm)
	<b>Tri-Clamp connection</b>			
	TCJ	DN25 (1"), EHEDG	316L,	Tri-Clamp ISO2852 22
	TJJ	DN38 (1½"), EHEDG	316L,	Tri-Clamp ISO2852 22
	TJK	DN38 (1½"), EHEDG	PTFE >316L, 3A	Tri-Clamp ISO2852 22
	TDJ	DN40-51 (2"),	316L,	Tri-Clamp ISO2852 43
	TDK	DN40-51 (2"), EHEDG	PTFE >316L, 3A,	Tri-Clamp ISO2852 -
	<b>EN flanges</b>			
	B0J	DN25 PN25/40 A,	316L	Flange EN1092-1 (DIN2527 B) 22
	B1J	DN32 PN25/40 A,	316L	Flange EN1092-1 (DIN2527 B) 22
	B2J	DN40 PN25/40 A,	316L	Flange EN1092-1 (DIN2527 B) 22
	B3J	DN50 PN25/40 A,	316L	Flange EN1092-1 (DIN2527 B) 43
	CRJ	DN50 PN25/40 B1,	316L	Flange EN1092-1 (DIN2527 C) 43
	DRJ	DN50 PN40 C,	316L	Flange EN1092-1 (DIN2512 F) 43
	ERJ	DN50 PN40 D,	316L	Flange EN1092-1 (DIN2512 N) 43
	BSJ	DN80 PN10/16 A,	316L	Flange EN1092-1 (DIN2527 B) 43
	CGJ	DN80 PN10/16 B1,	316L	Flange EN1092-1 (DIN2527 C) 43
	DGJ	DN80 PN16 C,	316L	Flange EN1092-1 (DIN2512 F) 43
	EGJ	DN80 PN16 D,	316L	Flange EN1092-1 (DIN2512 N) 43
	BTJ	DN100 PN10/16 A,	316L	Flange EN1092-1 (DIN2527 B) 43
	CHJ	DN100 PN10/16 B1,	316L	Flange EN1092-1 (DIN2527 C) 43
	B0K	DN25 PN25/40,	PTFE clad >316L	Flange EN1092-1 (DIN2527) -
	B1K	DN32 PN25/40,	PTFE >316L	Flange EN1092-1 (DIN2527) -
	B2K	DN40 PN25/40,	PTFE >316L	Flange EN1092-1 (DIN2527) -
	B3K	DN50 PN25/40,	PTFE >316L	Flange EN1092-1 (DIN2527) -
	BSK	DN80 PN10/16,	PTFE >316L	Flange EN1092-1 (DIN2527) -
	BTK	DN100 PN10/16,	PTFE >316L	Flange EN1092-1 (DIN2527) -
	<b>ANSI flanges</b>			
	ACJ	1" 150 lbs RF,	316/316L	Flange ANSI B16.5 22
	ANJ	1" 300 lbs RF,	316/316L	Flange ANSI B16.5 22
	AEJ	1½" 150 lbs RF,	316/316L	Flange ANSI B16.5 22
	AQJ	1½" 300 lbs RF,	316/316L	Flange ANSI B16.5 43
	AFJ	2" 150 lbs RF,	316/316L	Flange ANSI B16.5 43
	ARJ	2" 300 lbs RF,	316/316L	Flange ANSI B16.5 43
	AGJ	3" 150 lbs RF,	316/316L	Flange ANSI B16.5 43
	ASJ	3" 300 lbs RF,	316/316L	Flange ANSI B16.5 43
	AHJ	4" 150 lbs RF,	316/316L	Flange ANSI B16.5 43
	ATJ	4" 300 lbs RF,	316/316L	Flange ANSI B16.5 43
	AJJ	6" 150 lbs RF,	316/316L	Flange ANSI B16.5 43
	AUJ	6" 300 lbs RF,	316/316L	Flange ANSI B16.5 43
	ACK	1" 150 lbs,	PTFE clad >316/316L	Flange ANSI B16.5 -
	ANK	1" 300 lbs,	PTFE >316/316L	Flange ANSI B16.5 -
	AEK	1½" 150 lbs,	PTFE >316/316L	Flange ANSI B16.5 -
	AQK	1½" 300 lbs,	PTFE >316/316L	Flange ANSI B16.5 -
	AFK	2" 150 lbs,	PTFE >316/316L	Flange ANSI B16.5 -
	ARK	2" 300 lbs,	PTFE >316/316L	Flange ANSI B16.5 -
	AGK	3" 150 lbs,	PTFE >316/316L	Flange ANSI B16.5 -
	AHK	4" 150 lbs,	PTFE >316/316L	Flange ANSI B16.5 -
	<b>JIS flanges</b>			
	KCJ	10K 25 RF,	316L	Flange JIS B2220 22

50	<b>Process connection:</b>					∅ Inactive length (mm)
	KEJ	10K 40 RF,	316L	Flange JIS B2220	22	
	KFJ	10K 50 RF,	316L	Flange JIS B2220	43	
	KGJ	10K 80 RF,	316L	Flange JIS B2220	43	
	KHJ	10K 100 RF,	316L	Flange JIS B2220	43	
	KRJ	20K 50 RF, PTFE clad	316L	Flange JIS B2220	43	
	KCK	10K 25 RF,	PTFE >316L	Flange JIS B2220	-	
	KEK	10K 40 RF,	PTFE >316L	Flange JIS B2220	-	
	KFK	10K 50 RF,	PTFE >316L	Flange JIS B2220	-	
	KGK	10K 80 RF,	PTFE >316L	Flange JIS B2220	-	
	KHK	10K 100 RF,	PTFE >316L	Flange JIS B2220	-	
	YY9	Special version, to be specified				-
60	<b>Electronics</b>					
	W	Prepared for FEI5x				
	Y	Special version, to be specified				
	1	FEI51; 2-wire	19-253 V AC			
	2	FEI52; 3-wire PNP,	10 to 55 V DC			
	3	FEI53; 3-wire,	3 to 12 V signal			
	4	FEI54; relay DPDT,	19 to 253 V AC, 19 to 55 V DC			
	5	FEI55; 8/16mA,	11 to 36 V DC			
	7	FEI57S; 2-wire PFM				
	8	FEI58; NAMUR+test key (H-L signal)				
70	<b>Housing:</b>					
	1	F15 316L		IP66, NEMA4X		
	2	F16 polyester		IP66, NEMA4X		
	3	F17 aluminum		IP66, NEMA4X		
	4	F13 aluminum + gas-tight probe seal		IP66, NEMA4X		
	5	T13 Alu + gas-tight probe seal + separate connection compartment		IP66, NEMA4X		
	6	F27 316L + gas-tight probe seal		IP68, NEMA6P		
	9	Special version, to be specified				
80	<b>Cable entry:</b>					
	A	M20 threaded joint (EEx d > thread M20)				
	B	Thread G ½				
	C	Thread NPT ½				
	D	Thread NPT ¾				
	E	M12 connector				
	Y	Special version, to be specified				
90	<b>Probe design:</b>					
	L4:	100 to 6000 mm / 12 to 240 inch				
	1	Compact				
	2	2000 mm L4 cable	> separate housing			
	3	....mm L4 cable	> separate housing			
	4	80 inch L4 cable	> separate housing			
	5	....inch L4 cable	> separate housing			
	9	Special version, to be specified				
100	<b>Additional equipment:</b>					
	A	Basic version				
	D	EN10204-3.1 (316L wetted),		Inspection certificate		
	E	EN10204-3.1 (316L wetted), NACE MR0175		Inspection certificate		
	F	SIL Declaration of Conformity				
	S	GL marine approval				
	Y	Special version, to be specified				
<b>FTI52</b>		Product designation				

## Accessories

### Protective cover

For F13, F17 and F27 housing (without display)  
Order number: 71040497

For F16 housing  
Order number: 71127760

### Shortening kit for FTI52

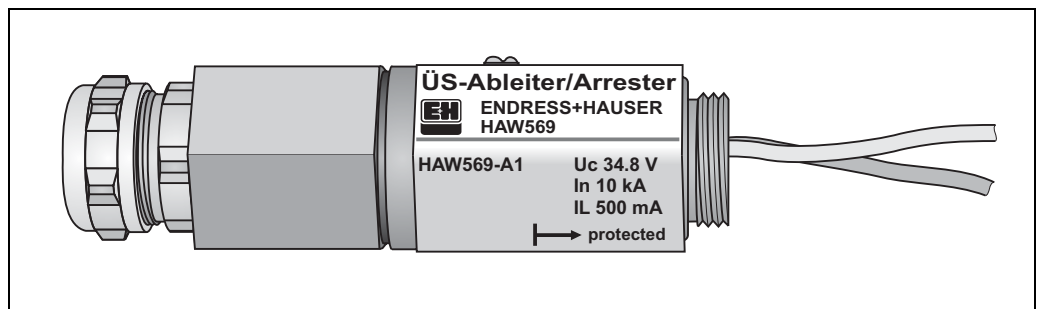
Order number: 942901-0001

### Overvoltage protection HAW56x

Surge arrester for limiting overvoltage in signal lines and components.

#### Overvoltage protection (installation on housing M20x1.5)

- HAW569-A11A (non-hazardous)
- HAW569-B11A (hazardous area)



#### Overvoltage protection (installation in cabinet)

- HAW562Z (hazardous area)

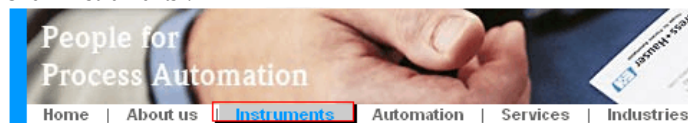
### Weld-in adapter

All the weld-in adapters available are described in the document TI426F.  
[www.endress.com](http://www.endress.com) => Country => Download => Advanced => Documentation code => TI426F.

### Spare Parts

An overview of the spare parts for your device is available in the internet at [www.endress.com](http://www.endress.com).  
To obtain information on the spare parts, proceed as follows:

1. Go to "[www.endress.com](http://www.endress.com)" and select your country.
2. Click "Instruments".



3. Enter the product name into the "product name" field.

#### Endress+Hauser product search

**Via product name**

Enter the product name


4. Select the device.

5. Click the "Accessories/Spare parts" tab.

General information	Technical information	Documents/ Software	Service	Accessories/ Spare parts
---------------------	-----------------------	---------------------	---------	--------------------------

▶ Accessories  
 ▼ All Spare parts
 

- ▶ Housing/housing accessories
- ▶ Sealing
- ▶ Cover
- ▶ Terminal module
- ▶ HF module
- ▶ Electronic
- ▶ Power supply
- ▶ Antenna module



**Advice**  
 Here you'll find a list of all available accessories and spare parts. To only view accessories and spare parts specific to your product(s), please contact us and ask about our Life Cycle Management Service.

◀ | 1 / 2 | ▶ | 🔍

6. Select the required spare parts (You may also use the overview drawing on the right side of the screen.)  
 When ordering spare parts, always quote the serial number indicated on the nameplate. As far as necessary, the spare parts also include replacement instructions.

## Documentation



Note!

This documentation is available on the product pages at [www.endress.com](http://www.endress.com)

### Technical Information

- Nivotester FTL325N  
TI00353F/00/en
- Nivotester FTL375N  
TI00361F/00/en
- EMC test procedures  
TI00241F/00/en

### Operating Instructions

- Liquicap M FTI51, FTI52  
BA00299F/00/en

### Certificates

#### ATEX safety instructions

- Liquicap M FTI51, FTI52  
ATEX II 1/2 G EEx ia IIC/IIB T3 to T6, II 1/2 D IP65 T 85 °C  
XA00327F/00/a3
- Liquicap M FTI51, FTI52  
ATEX II 1/2 G EEx d [ia] IIC/IIB T3 to T6  
XA00328F/00/a3

#### NEPSI safety instructions

- Liquicap M FTI51, FTI52  
Ex ia IIC/IIB T3 to T6  
XA00417F/00/a3
- Liquicap M FTI51, FTI52  
EEx d [ia] IIC/IIB T3 to T6  
XA00418F/00/a3

#### Overfill protection DIBt (WHG)

- Liquicap M FTI51, FTI52  
ZE00268F/00/en

#### Functional safety (SIL2/SIL3)

- Liquicap M FTI51, FTI52  
SD00278F/00/en

#### Control Drawings (FM and CSA)

- Liquicap M FTI51, FTI52  
CSA: ZD00221F/00/en
- Liquicap M FTI51, FTI52  
FM: ZD00220F/00/en

#### CRN registration

- CRN 0F1988.75

### Patents

This product is protected by at least one of the patents listed below.  
Further patents are under development.

- DE 103 22 279,  
WO 2004 102 133,  
US 2005 003 9528
- DE 203 13 695,  
WO 2005 025 015





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## 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](http://www.endress.com)  
[info@ii.endress.com](mailto:info@ii.endress.com)

