



Level



Pressure



Flow



Temperature



Liquid  
Analysis



Registration



Systems  
Components



Services

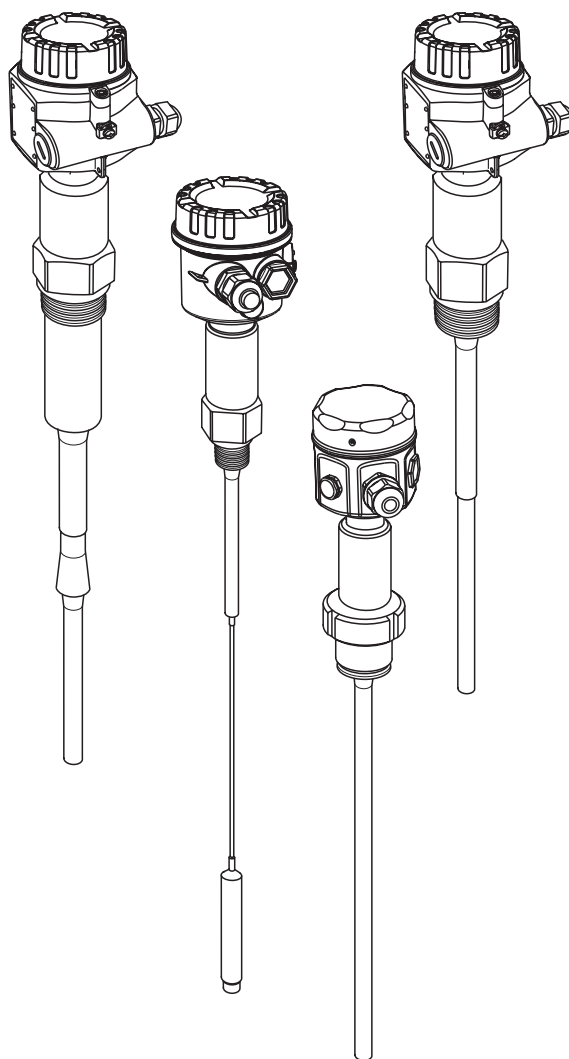


Solutions

## Operating Instructions

# Liquicap M FTI51, FTI52

## Capacitive level measurement



## Brief overview



Note!

This Operating Manual describes the installation and initial commissioning of the level measuring device. It considers all of the functions that are necessary for a usual measuring task.

For quick and easy commissioning:

Safety instructions	
Explanation of the warning symbols For special instructions, refer to the corresponding location in the respective chapter. The priority is indicated by the symbols for "Warning" ⚠, "Caution" ⚡ and "Note" 📌.	→ Page 6



Installation	
This section describes the required steps when installing the device and the installation conditions (such as dimensions).	→ Page 17



Wiring	
The device is shipped, for the most part, completely wired and ready to plug in.	→ Page 38



Display and operating elements	
This section provides an overview of the arrangement of the display and operating elements of the device.	→ Page 48



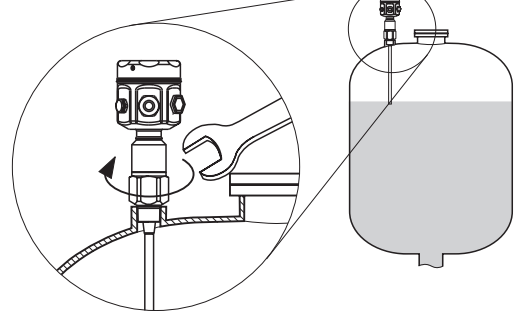
Commissioning	
The "Commissioning" chapter shows you how to switch on the device and check its functions.	→ Page 50



Troubleshooting	
If faults occur during operation, use the checklist to find the reason. This section lists measures you can take yourself to remedy any faults that may occur.	→ Page 67

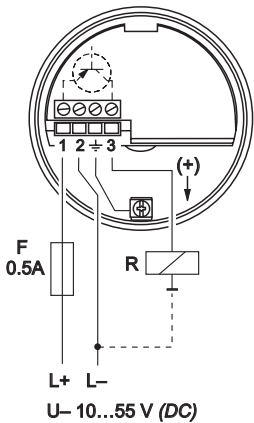
Brief operating instructions

1. Install probe

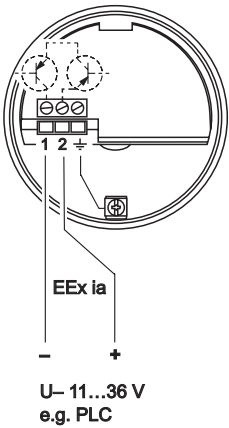


- 2. Wiring
- 3. Connect power supply

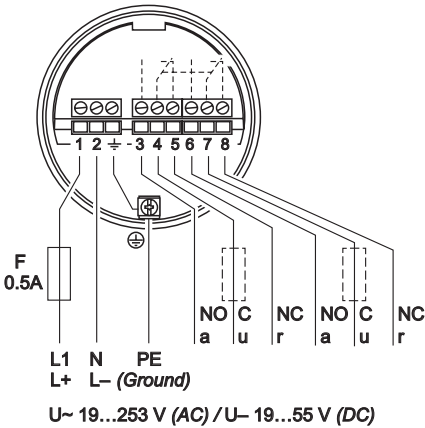
FEI52



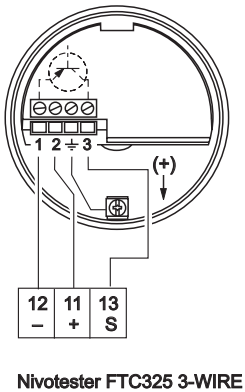
FEI55



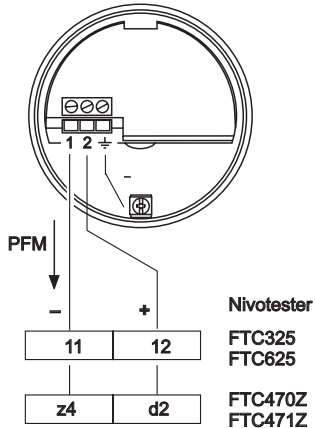
FEI54



FEI53



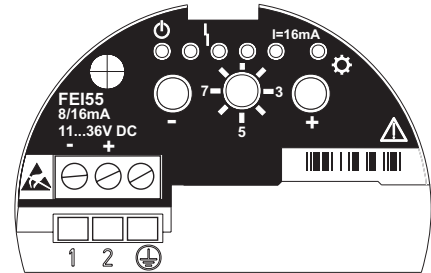
FEI57S



4. Configuring the device and switching on the power supply

FEI52, FEI54, FEI55

- Green LEDs (ⓘ operational status - flashing)
- Red LED (⚡ fault message)
- Yellow LED (\* switching status)
- Key (-)
- Key (+)
- Mode switch (position 1–8)
  - 1 : Operation
  - 2: Calibration (empty/full)
  - 3: Switch point shift
  - 4: Measuring range setting
    - Pump control Δs operation/build-up mode
  - 5: Switching delay
  - 6 : Self-test
  - 7: Fail-safe mode (MIN/MAX)
  - 8: Configuration/upload, download



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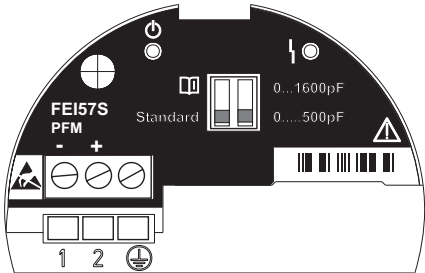
**Note!**  
To execute the functions in question, press and hold the key for at least 2 seconds.

Mode	Key	Key			
			Symbol	Function/Mode	LED Signals
1				Operation	
	press together for 20 sec.			Reset to factory settings	
2	press			Empty calibration	
		press		Full calibration	
3	press for <	press for >		Switchpoint adjustment	
4	press			Measurement range, small/blg	
		press 2 x		Pump control Build-up mode	
5	press for <	press for >		Switching delay	
6	press together			Device self test (Proof test)	
7	press for MIN	press for MAX		Minimum/ maximum failsafe	
8	press for down-load	press for up-load		Up-Download Sensor EEPROM	

BA299Fen003

FEI53, FEI57S

- Green LED (ⓘ operational status)
- Red LED (⚡ fault message)
- DIP switch (left),
  - Standard: No alarm is output if the measuring range is exceeded,
  - : An alarm is output if the measuring range is exceeded
- DIP switch (right), span
  - Range 1: 0... 500 pF
  - Range 2: 0...1600 pF



L00-FTI5xxxx-07-05-xx-xx-002

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# **1 Safety instructions**

## **1.1 Designated use**

The Liquicap M FTI51 and FTI52 are compact capacitive level measuring devices for level limit detection of liquids.

## **1.2 Installation, commissioning and operation**

The Liquicap M has been safely built with state-of-the-art technology and meets all applicable standards and EU directives. However, if it is used improperly or other than intended, it can be a source of application-related dangers, such as product overflow due to incorrect installation or configuration. Therefore, the installation, electrical connection, commissioning, operation and maintenance of the measuring device only may be carried out by trained specialist personnel authorized by the facility's owner/operator for this purpose. The specialist personnel must have read and understood these Operating Instructions and must follow the instructions they contain. Modifications or repairs to the device are permitted only if express permission is granted in the Operating Manual.

## **1.3 Operational safety**













### **1.3.1 Hazardous location**

If the measuring system is used in potentially explosive atmospheres, the corresponding national/federal standards and regulations must be observed. The device is accompanied by separate Ex documentation, which is an integral part of this documentation. Observe the installation instructions, connection data and safety instructions provided there.

- Ensure that the specialists are adequately trained.
- Observe the metrological and technical safety requirements for the measuring points.

## 1.4 Safety conventions and icons

We have defined the following safety instructions to indicate safety-related or alternative procedures. Each instruction is identified by a corresponding pictogram.

Safety instructions	
	<b>Warning!</b> This symbol indicates an action or procedure which, if not performed correctly, can result in serious injury, a safety hazard or the destruction of the device.
	<b>Caution!</b> This symbol indicates an action or procedure which, if not performed correctly, can result in injury or destruction of the device.
	<b>Note!</b> This symbol indicates an action or procedure which, if not performed correctly, can have an indirect effect on operation or trigger an unexpected response on the part of the device.
Type of protection	
	<b>Explosion-protected, prototype-tested apparatus</b> If this symbol appears on the nameplate of the device, the device can be used in hazardous or non-hazardous areas according to its approval.
	<b>Hazardous area</b> In the drawings in this Operating Manual, this symbol identifies the hazardous area. Devices located in a potentially explosive area and lines for these devices must have corresponding explosion protection.
	<b>Safe area (non-hazardous area)</b> In the drawings in this Operating Manual, this symbol identifies the non-hazardous area. Devices in the non-hazardous area also must be certified if the connecting lines lead into the hazardous area.
Electrical symbols	
	<b>Direct current</b> A terminal at which DC voltage is present or through which DC voltage flows.
	<b>Alternating current</b> A terminal at which AC voltage (sinusoidal) voltage is present or through which AC flows.
	<b>Ground connection</b> A grounded terminal which, from the viewpoint of the user, is grounded via a grounding system.
	<b>Protective ground connection</b> A terminal that has to be grounded before other connections can be made.
	<b>Equipotential connection</b> A connection that has to be connected to the grounding system of the plant. This can be a potential equalization line or a radial grounding system depending on national and company codes of practice.
	<b>Temperature resistance of the connecting cables</b> This means that the connecting cables must withstand a temperature of at least 85 °C.

## 2 Identification

### 2.1 Device designation

#### 2.1.1 Name plate

Refer to the name plate of the device for the following technical data:

Order number  
(see ordering information)

Active porbe length

Serial number

Electronic insert

Ambient temperature  
at housing

Functional  
safety

Max. permissible pressure  
in tank

Safety information

Protection class

Approval No.  
ATEX

WHG approval  
(German Water  
Resources Act)

Month and year  
of production

Made in Germany, D- 79689 Maulburg

**Liquicap M**

**Endress+Hauser**

Order Code.: FTI51 - CAA2RCJ45A1A

Ser.No.: 123456789

L1 = 250 mm

L = 250 mm

IP65/66/  
NEMA4X

FEI54 U: 19-253VAC (50/60Hz), 19-55VDC

30VDC, 4A; 125VDC, 0.2A; 253VAC, 4A

Pmax.: 1,5W

BVS 06 ATEX E 103 X

ATEX II 1/2G EEx ia IIC T6

Z 65.13.xxx

XA 327 F-A

Dat.: 05/06

250002075 - A

MWP: 25bar

CE

Ex

SIL

BA299Fen004

Information on the name plate of the Liquicap M (example)



## 2.1.2 Liquicap M FTI51

<b>10</b>	<b>Approval:</b>
	<p>A Non-hazardous area</p> <p>B Non-hazardous area, WHG (German Water Resources Act)</p> <p>C ATEX II 1/2 GD EEx ia IIC T6</p> <p>D ATEX II 1/2 GD EEx ia IIC T6, WHG (German Water Resources Act)</p> <p>G ATEX II 1/2 GD EEx de (ia) IIC T6, WHG (German Water Resources Act)</p> <p>XA, observe safety instructions (electrostatic charge)!</p> <p>H ATEX II 1/2 GD EEx ia IIC T6, XA, observe safety instructions (electrostatic charge)!</p> <p>J ATEX II 1/2 GD EEx ia IIC T6, WHG (German Water Resources Act)</p> <p>XA, observe safety instructions (electrostatic charge)!</p> <p>K ATEX II 1/2 G EEx ia IIC T6, WHG (German Water Resources Act)</p> <p>XA, observe safety instructions (electrostatic charge)!</p> <p>L ATEX II 1/2 G EEx d (ia) IIC T6, WHG (German Water Resources Act)</p> <p>XA, observe safety instructions (electrostatic charge)!</p> <p>M ATEX II 3GD EEx nA II T6, WHG (German Water Resources Act)</p> <p>XA, observe safety instructions (electrostatic charge)!</p> <p>N CSA General Purpose, C US CSA</p> <p>P CSA/FM IS Cl. I, II, III Div. 1+2 Gr. A-G</p> <p>R CSA/FM XP Cl. I, II, III Div. 1+2 Gr. A-G</p> <p>S TIIS Ex ia IIC T3</p> <p>T TIIS Ex d IIC T3</p> <p>Y Special version, to be specified</p>
<b>20</b>	<b>Inactive length (L3):</b>
	<p>Price per 100 mm/1 inch</p> <p>L3: 100...2000 mm/4...80 inch for 316L</p> <p>L3: 150...1000 mm/6...40 inch for PTFE fully insulated</p> <p>Protection against condensate + bypassing container nozzles</p> <p>A Not selected</p> <p>B Not selected + 125 mm/5 inch 316L</p> <p>Active build-up compensation</p> <p>1 .... mm 316L</p> <p>2 .... mm 316L, PTFE fully insulated</p> <p>3 .... mm (≤ 500 mm) 316L</p> <p>+ 125 mm active build-up compensation</p> <p>4 .... mm (&gt; 500 mm) 316L</p> <p>+ 125 mm active build-up compensation</p> <p>5 .... inch 316L, PTFE fully insulated</p> <p>6 .... inch 316L</p> <p>7 .... inch (≤ 20 inch) 316L</p> <p>+ 5 inch active build-up compensation</p> <p>8 .... inch (&gt; 20 inch) 316L</p> <p>+ 5 inch active build-up compensation</p> <p>9 Special version</p>
<b>30</b>	<b>Active probe length (L1); insulation:</b>
	<p>Price per 100 mm/1 inch</p> <p>L1: 100 to 4000 mm/4 to 160 inch for ø10 mm, ø16 mm</p> <p>L1: 150 to 3000 mm/6 to 120 inch for ø22 mm (fully insulated)</p> <p>A mm L1, 10 mm, 316L; PTFE</p> <p>B mm L1, 16 mm, 316L; PTFE</p> <p>C mm L1, 22 mm, 316L; PTFE</p> <p>D mm L1, 16 mm, 316L; PFA</p> <p>E mm L1, 10 mm, 316L; PTFE + ground tube</p> <p>F mm L1, 16 mm, 316L; PTFE + ground tube</p> <p>G mm L1, 16 mm, 316L; PFA + ground tube</p> <p>H inch L1, 0.4 inch, 316L; PTFE</p> <p>K inch L1, 0.6 inch, 316L; PTFE</p> <p>M inch L1, 0.9 inch, 316L; PTFE</p> <p>N inch L1, 0.6 inch, 316L; PFA</p> <p>P inch L1, 0.4 inch, 316L; PTFE + ground tube</p> <p>R inch L1, 0.6 inch, 316L; PTFE + ground tube</p> <p>S inch L1, 0.6 inch, 316L; PFA + ground tube</p> <p>Y Special version, to be specified</p>

40					Insulation (L2)
				1	Fully insulated
				2	... mm, partially insulated
				3	... inch, partially insulated
				9	Special version, to be specified
50					Process connection:
					<b>Threaded connection</b>
				GCJ	G ½, 316L, 25 bar Thread ISO228
				GDJ	G ¾, 316L, 25 bar Thread ISO228
				GEJ	G 1, 316L, 25 bar Thread ISO228
				GGJ	G 1½, 316L, 100 bar Thread ISO228
				RCJ	NPT ½, 316L, 25 bar Thread ANSI
				RDJ	NPT ¾, 316L, 25 bar Thread ANSI
				REJ	NPT 1, 316L, 25 bar Thread ANSI
				RGJ	NPT 1½, 316L, 100 bar Thread ANSI
					<b>Hygiene connection</b>
				GQJ	G ¾ 316L, 25 bar, EHEDG Thread ISO2852
					Accessories installation, welding neck
				GWJ	G 1 316L, 25 bar, EHEDG Thread ISO2852
					Accessories installation, welding neck
				MRJ	DN50 PN40, 316L DIN11851
				UPJ	Adapter 44 mm 316L, 16 bar, EHEDG
					<b>Tri-Clamp connection</b>
				TCJ	DN25 (1"), EHEDG 316L, Tri-Clamp ISO2852
				TJJ	DN38 (1½"), EHEDG 316L, Tri-Clamp ISO2852
				TDJ	DN40-51 (2"), 316L, Tri-Clamp ISO2852
				TNJ	DN38 (1½"), 316L, 3A Tri-Clamp ISO2852
					Tri-Clamp removable
					<b>EN flanges</b>
				B0J	DN25 PN25/40 A, 316L Flange EN1092-1 (DIN2527 B)
				B1J	DN32 PN25/40 A, 316L Flange EN1092-1 (DIN2527 B)
				B2J	DN40 PN25/40 A, 316L Flange EN1092-1 (DIN2527 B)
				B3J	DN50 PN25/40 A, 316L Flange EN1092-1 (DIN2527 B)
				CRJ	DN50 PN25/40 B1, 316L Flange EN1092-1 (DIN2527 C)
				DRJ	DN50 PN40 C, 316L Flange EN1092-1 (DIN2512 F)
				ERJ	DN50 PN40 D, 316L Flange EN1092-1 (DIN2512 N)
				BSJ	DN80 PN10/16 A, 316L Flange EN1092-1 (DIN2527 B)
				CGJ	DN80 PN10/16 B1, 316L Flange EN1092-1 (DIN2527 C)
				DGJ	DN80 PN16 C, 316L Flange EN1092-1 (DIN2512 F)
				EGJ	DN80 PN16 D, 316L Flange EN1092-1 (DIN2512 N)
				BTJ	DN100 PN10/16 A, 316L Flange EN1092-1 (DIN2527 B)
				CHJ	DN100 PN10/16 B1, 316L Flange EN1092-1 (DIN2527 C)
					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
				ANJ	1" 300 lbs RF, 316/316L Flange ANSI B16.5
				AEJ	1½" 150 lbs RF, 316/316L Flange ANSI B16.5
				AQJ	1½" 300 lbs RF, 316/316L Flange ANSI B16.5
				AFJ	2" 150 lbs RF, 316/316L Flange ANSI B16.5
				ARJ	2" 300 lbs RF, 316/316L Flange ANSI B16.5
				AGJ	3" 150 lbs RF, 316/316L Flange ANSI B16.5
				ASJ	3" 300 lbs RF, 316/316L Flange ANSI B16.5
				AHJ	4" 150 lbs RF, 316/316L Flange ANSI B16.5
				ATJ	4" 300 lbs RF, 316/316L Flange ANSI B16.5
				AJJ	6" 150 lbs RF, 316/316L Flange ANSI B16.5
				AUJ	6" 300 lbs RF, 316/316L Flange ANSI B16.5

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\* 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.

### 2.1.3 Liquicap M FTI52

10	Approval:		
	A	Non-hazardous area	
	B	Non-hazardous area, 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 d (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/FM IS 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	TIIIS Ex ia IIC T3	
	T	TIIIS Ex d IIC T3	
	Y	Special version, to be specified	

20	Inactive length L3:		
	Price per 100 mm/1 inch		
	L3: 100...2000 mm/4...80 inch for 316L		
	L3: 150...1000 mm/6...40 inch for PFA fully insulated		
	Protection against condensate + bypassing container nozzles		
	1	Not selected	
	2	... mm,	316L
	3	... mm,	316L + PFA fully insulated
	5	... inch,	316L
	6	... inch,	316L + PFA fully insulated
	9	Special version, to be specified	

30	Active length L1; insulation:		
	Price per 1000 mm/10 inch		
	L1: 420...10000 mm/17...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	

40	Insulation L2		
	1	Fully insulated	
	9	Special version, to be specified	

50	Process connection:		
	Threaded connection		
	GDJ	G ¾,	316L, 25 bar Thread ISO228
	GEJ	G 1,	316L, 25 bar Thread ISO228
	GGJ	G 1½,	316L, 100 bar Thread ISO228
	RDJ	NPT ¾,	316L, 25 bar Thread ANSI
	REJ	NPT 1,	316L, 25 bar Thread ANSI
	RGJ	NPT 1½,	316L, 100 bar Thread ANSI
	Hygiene connection		
	GWJ	G 1	316L, 25 bar, EHEDG Thread ISO2852
		Accessories installation, welding neck	
	MRJ	DN50 PN40,	316L DIN11851
	UPJ	Adapter 44 mm	316L, 16 bar, EHEDG
	Tri-Clamp connection		
	TCJ	DN25 (1"), EHEDG	316L Tri-Clamp ISO2852

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Process connection:			
TJJ	DN38 (1½"), EHEDG	316L	Tri-Clamp ISO2852
TDJ	DN40-51 (2"),	316L	Tri-Clamp ISO2852
EN flanges			
B0J	DN25 PN25/40 A,	316L	Flange EN1092-1 (DIN2527 B)
B1J	DN32 PN25/40 A,	316L	Flange EN1092-1 (DIN2527 B)
B2J	DN40 PN25/40 A,	316L	Flange EN1092-1 (DIN2527 B)
B3J	DN50 PN25/40 A,	316L	Flange EN1092-1 (DIN2527 B)
CRJ	DN50 PN25/40 B1,	316L	Flange EN1092-1 (DIN2527 C)
DRJ	DN50 PN40 C,	316L	Flange EN1092-1 (DIN2512 F)
ERJ	DN50 PN40 D,	316L	Flange EN1092-1 (DIN2512 N)
BSJ	DN80 PN10/16 A,	316L	Flange EN1092-1 (DIN2527 B)
CGJ	DN80 PN10/16 B1,	316L	Flange EN1092-1 (DIN2527 C)
DGJ	DN80 PN16 C,	316L	Flange EN1092-1 (DIN2512 F)
EGJ	DN80 PN16 D,	316L	Flange EN1092-1 (DIN2512 N)
BTJ	DN100 PN10/16 A,	316L	Flange EN1092-1 (DIN2527 B)
CHJ	DN100 PN10/16 B1,	316L	Flange EN1092-1 (DIN2527 C)
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)
ANSI flanges			
ACJ	1" 150 lbs RF,	316/316L	Flange ANSI B16.5
ANJ	1" 300 lbs RF,	316/316L	Flange ANSI B16.5
AEJ	1½" 150 lbs RF,	316/316L	Flange ANSI B16.5
AQJ	1½" 300 lbs RF,	316/316L	Flange ANSI B16.5
AFJ	2" 150 lbs RF,	316/316L	Flange ANSI B16.5
ARJ	2" 300 lbs RF,	316/316L	Flange ANSI B16.5
AGJ	3" 150 lbs RF,	316/316L	Flange ANSI B16.5
ASJ	3" 300 lbs RF,	316/316L	Flange ANSI B16.5
AHJ	4" 150 lbs RF,	316/316L	Flange ANSI B16.5
ATJ	4" 300 lbs RF,	316/316L	Flange ANSI B16.5
AJJ	6" 150 lbs RF,	316/316L	Flange ANSI B16.5
AUJ	6" 300 lbs RF,	316/316L	Flange ANSI B16.5
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
JIS flanges			
KCJ	10K 25 RF,	316L	Flange JIS B2220
KEJ	10K 40 RF,	316L	Flange JIS B2220
KFJ	10K 50 RF,	316L	Flange JIS B2220
KGJ	10K 80 RF,	316L	Flange JIS B2220
KHJ	10K 100 RF,	316L	Flange JIS B2220
KRJ	20K 50 RF,	316L	Flange JIS B2220
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		

Endress+Hauser

## 2.2 Scope of delivery

The scope of delivery consists of:

- The mounted device
- Where applicable, accessories (see Page 65)

Provided documentation:

- Operating Instructions
- Approval documentation, if not included in the Operating Manual.

## 2.3 Certificates and approvals

### **CE mark, Declaration of Conformity**

The device is designed to meet state-of-the-art operating safety requirements, has been tested, and has left the factory in a condition in which it is safe to operate. The device meets the relevant standards and directives listed in the EC Declaration of Conformity and thus fulfills the legal requirements of the EC Directives. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.

## 2.4 Registered trademarks

KALREZ<sup>®</sup>, VITON<sup>®</sup>, TEFLON<sup>®</sup>

Registered trademarks of E.I. Du Pont de Nemours & Co., Wilmington, USA

Tri-Clamp<sup>®</sup>

Registered trademark of Ladish & Co., Inc., Kenosha, USA

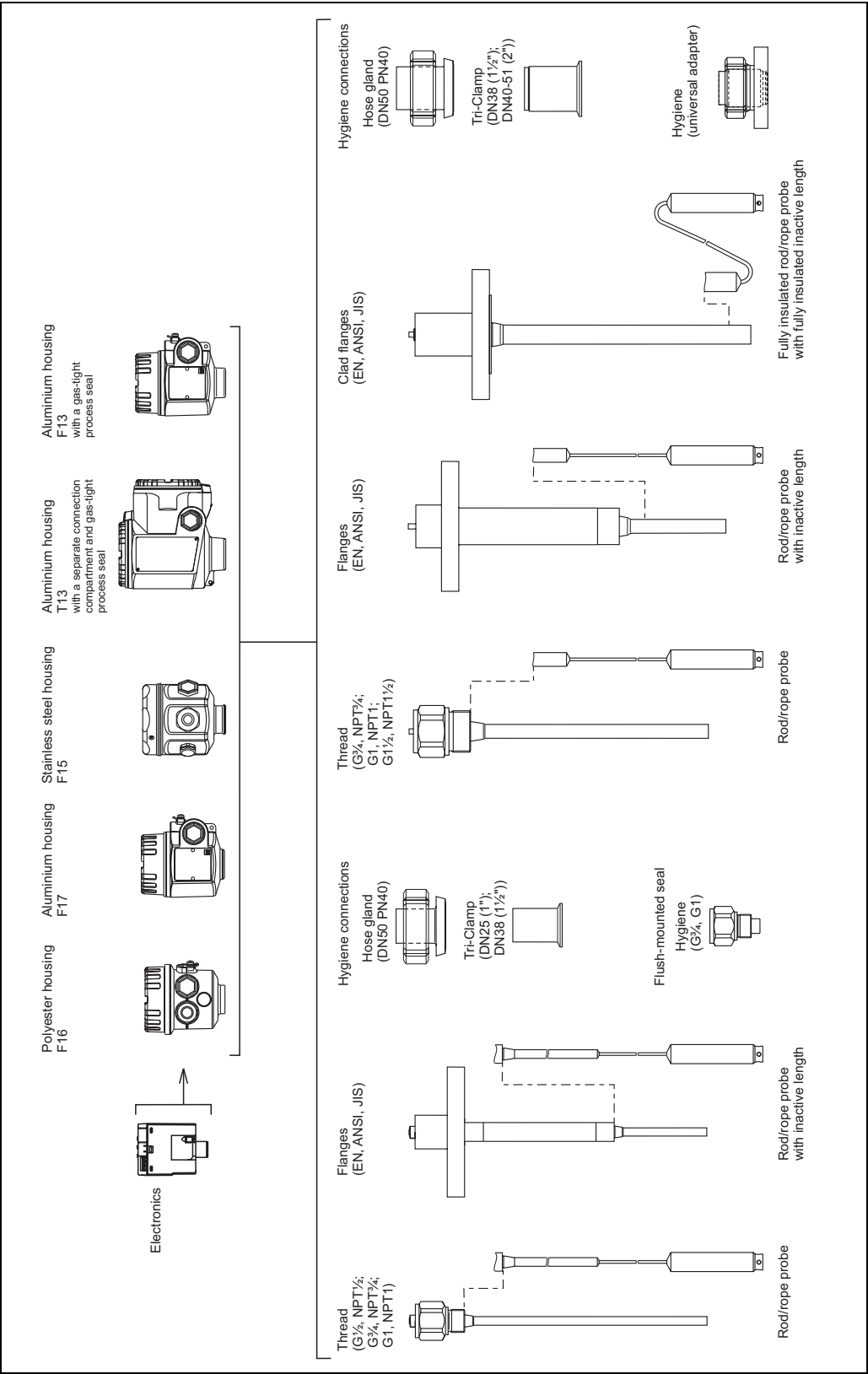


### 3 Installation



Note!  
All dimensions in mm.

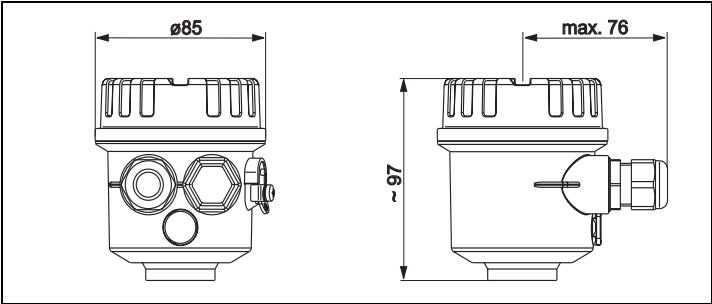
#### Overview



BA299Fes005

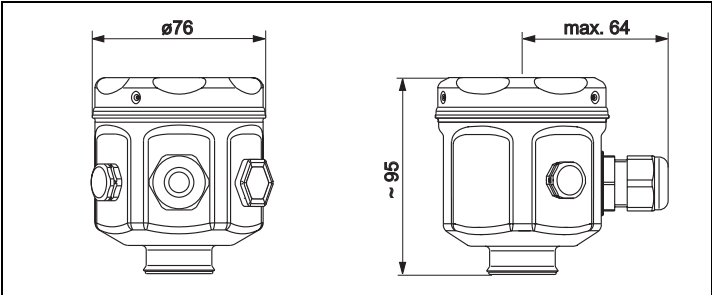
3.1 Housing

Polyester housing F16



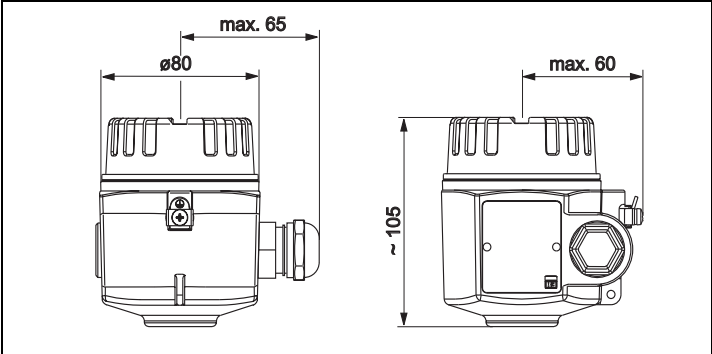
L00-FT15xxxx-06-05-xx-xx-001

Stainless steel housing F15



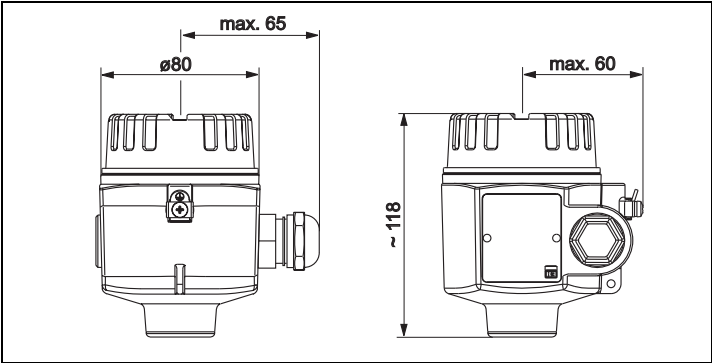
L00-FT15xxxx-06-05-xx-xx-003

Aluminum housing F17



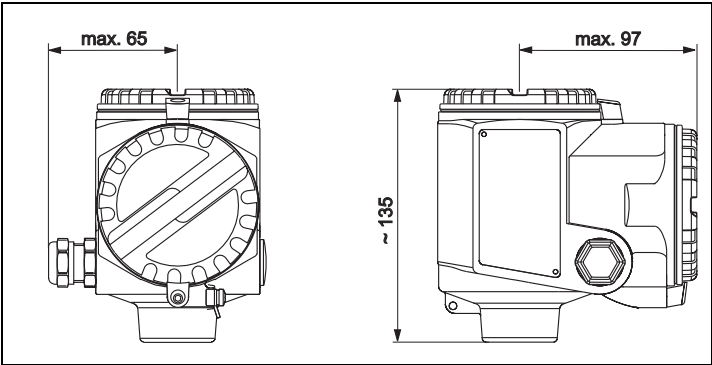
L00-FT15xxxx-06-05-xx-xx-002

Aluminum housing F13  
with gas-tight process seal



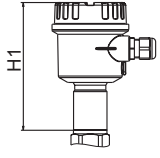
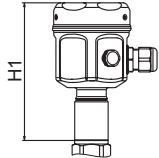
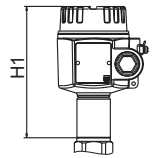
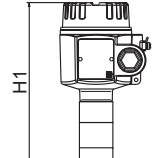
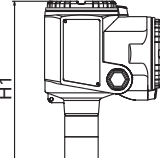
L00-FT15xxxx-06-05-xx-xx-000

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



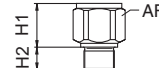
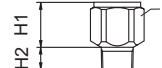
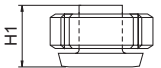
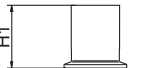
L00-FT15xxxx-06-05-xx-xx-004

### 3.2 Housing heights with adapter

	Polyester housing F16	Stainless steel housing F15	Aluminum housing F17	Aluminum housing F13*	Aluminum housing with separate connection compartment 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-047
Order code	2	1	3	4	5
<b>FTI51, FTI52</b>					
H1	144	142	152	194	202

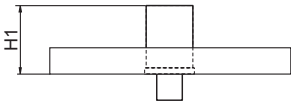
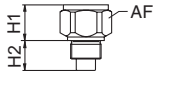
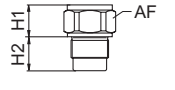
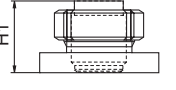
\* Housing with gas-tight process seal

### 3.3 Process connections

	Thread G		Thread NPT		Threaded pipe joint	Tri-Clamp		
	 L00-FMI5xxxx-06-05-xx-en-007 (DIN ISO228/1)		 L00-FMI5xxxx-06-05-xx-en-008 (ANSI B 1.20.1)		 L00-FMI5xxxx-06-05-xx-xx-040 (DIN11851)	 L00-FMI5xxxx-06-05-xx-xx-041 (ISO2852)		
Rod probes ø10, rope probes								
For pressures up to	25 bar		25 bar		25 bar	16 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	H1 = 38 H2 = 19 AF = 41		H1 = 38 H2 = 19 AF = 41		H1 = 57	H1 = 57		
Surface roughness	–		–		≤ 0.8 µm	≤ 0.8 µm		
Additional information	With elastomer flat seal		–		–	EHEDG*		
Rod probes ø16, rope probes								
For pressures up to	25 bar	100 bar	25 bar	100 bar	40 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 / TJJ (1½")	DN40–51 / TDJ (2")	
Dimensions	H1 = 38 H2 = 19 AF = 41	H1 = 41 H2 = 25 AF = 55	H1 = 38 H2 = 19 AF = 41	H1 = 41 H2 = 25 AF = 55	H1 = 66	H1 = 47	H1 = 66	
Surface roughness	–		–		≤ 0.8 µm	≤ 0.8 µm	≤ 0.8 µm	
Additional information	With elastomer flat seal		–		–	–		

\* The EHEDG certificate applies only for probes with a fully insulated probe rod. It does not apply to probes with an inactive length or an active build-up compensation.

	Thread G	Thread NPT	Threaded pipe joint	Tri-Clamp
<b>Rod probes ø22, rope probes</b>				
For pressures up to	50 bar	50 bar	–	–
Version / order code	G 1 ½ / GGJ	NPT 1 ½ / RGJ	–	–
Dimensions	H1 = 85 H2 = 25 AF = 55	H1 = 85 H2 = 25 AF = 55	–	–
Surface roughness	–	–	≤ 0.8 µm	≤ 0.8 µm
Additional information	With elastomer flat seal	–	–	–

	Flanges	Hygiene connection	Hygiene connection	Hygiene connection
	 (EN1092-1) (ANSI B 16.5) (JIS B2220)	 With flush-mounted seal	 With flush-mounted seal	 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 bar	25 bar	–
Version / order code	EN / B** ANSI / A** JIS / K**	G ¾ / GQJ	G 1 / GWJ	–
Dimensions	H1 = 57	H1 = 31 H2 = 26 AF = 41	H1 = 30 H2 = 27 AF = 41	–
Additional information	Also clad (PTFE)	Welding neck see "Accessories" EHEDG*	Welding neck see "Accessories" EHEDG*	–
<b>Rod probes ø16, rope probes</b>				
For pressures up to	Max. 100 bar (depends on flange) Max. 50 bar (with active build-up compensation)	–	–	16 bar (tightening torque 10 Nm)
Version / order code	EN / B** ANSI / A** JIS / K**	–	–	Universal adapter / UPJ
Dimensions	H1 = 66	–	–	H1 = 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** ANSI / A** JIS / K**	–	–	–
Dimensions	H1 = 110	–	–	–
Additional information	Only clad (PTFE)	–	–	–

\* The EHEDG certificate applies only for probes with a fully insulated probe rod. It does not apply to probes with an inactive length or an active build-up compensation.

\*\* Wildcard for nominal diameter and permitted process pressure

Note! Only use clad flanges for aggressive liquids!

### 3.4 1. Fully insulated rod probes FTI51



Note!

- The active rod probe is always fully insulated (dimension L1).
- Total length of the probe beginning at the sealing surface:  $L = L1 + L3$  (+ 125 mm with active build-up compensation + H2\*)
- Thickness of insulation for probe rod  $\varnothing$  10 mm = 1 mm; 16 mm = 2 mm; 22 mm = 2 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 build-up compensation	Rod probe with fully insulated inactive length and active build-up compensation
<p>L00-FMI5xxxx-06-05-xx-xx-061</p>						<p>L00-FMI5xxxx-06-05-xx-xx-060</p>	
Total length (L)	100 to 4000	100 to 4000	100 to 6000	100 to 6000	300 to 4000	100 to 4125	100 to 6000
Active rod length (L1)	100 to 4000	100 to 4000	100 to 4000	100 to 4000	150 to 3000	100 to 4000	100 to 4000
Inactive rod length (L3)	–	–	100 to 2000	100 to 2000	150 to 1000	–	100 to 2000
Probe rod diameter	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 build-up compensation length (mm)	– / –	– / –	– / –	– / –	– / –	19 / 26 125	19 / 26 125
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

X = Recommended

H2\* = Thread height (important for calculating the exact probe length for process connection with thread G½, G¾, G1, G1½.) For specifications for measurement H2, refer to Page 19 ff. under Process connections → Thread → G → H2.

**Length tolerance**

Up to 1 m: 0 to 5 mm

Up to 3 m: 0 to 10 mm

Up to 6 m: 0 to 20 mm

### 3.5 2. Partially insulated rod probes FTI51



Note!

- Total length of the probe beginning at the sealing surface:  $L = L1 + L3 (+ 125 \text{ mm with active build-up compensation} + H2^*)$

	Partially insulated rod probe	Partially insulated rod probe with ground tube	Partially insulated rod probe with inactive length	Partially insulated rod probe with inactive length and ground tube	Partially insulated rod probe with active build-up compensation	Partially insulated rod probe with inactive length and active build-up compensation
<p>L00-FMI5xxxx-06-05-xx-xx-063</p>						<p>L00-FMI5xxxx-06-05-xx-xx-062</p>
Total length (L)	100 to 4000	100 to 4000	100 to 6000	100 to 6000	100 to 4125	100 to 6000
Active rod length (L1)	100 to 4000	100 to 4000	100 to 4000	100 to 4000	100 to 4000	100 to 4000
Inactive rod length (L3)	–	–	100 to 2000	100 to 2000	–	100 to 2000
Length of partial insulation (L2)	75 to 3950	75 to 3950	75 to 3950	75 to 3950	75 to 3950	75 to 3950
Probe rod diameter	10 / 16	10 / 16	10 / 16	10 / 16	10 / 16	10 / 16
Ø Inactive length/ground tube	– / –	10 / 16	22 / 43	22 / 43	– / –	22 / 43
Ø Active build-up compensation length (mm)	– / –	– / –	– / –	– / –	19 / 26 125	19 / 26 125
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

X = Recommended

H2\* = Thread height (important for calculating the exact probe length for process connection with thread G½, G¾, G1, G1½.) For specifications for measurement H2, refer to Page 19 ff. under Process connections → Thread → G → H2.

**Length tolerance**

Up to 1 m: 0 to 5 mm

Up to 3 m: 0 to 10 mm

Up to 6 m: 0 to 20 mm

### 3.6 Rope probes FTI52



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

	Rope probe Fully insulated	Rope probe with inactive length	Rope probe with fully insulated inactive length
<p>L00-FMI5xxxx-06-05-xx-xx-001</p>			<p>L00-FMI5xxxx-06-05-xx-xx-036</p>
Total length (L)	420 to 10000	420 to 12000	420 to 11000
Active rope length (L1)	420 to 10000	420 to 10000	420 to 10000
Inactive length (L3)	–	150 to 2000	150 to 1000
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
In the event of condensate on tank ceiling	–	X	X
For high-viscosity liquids	–	–	–

X = recommended

#### Length tolerance

Up to 1 m: 0 to 10 mm

Up to 3 m: 0 to 20 mm

Up to 6 m: 0 to 30 mm

Up to 12 m: 0 to 40 mm

## 3.7 Configuration instructions

### 3.7.1 Installation instructions

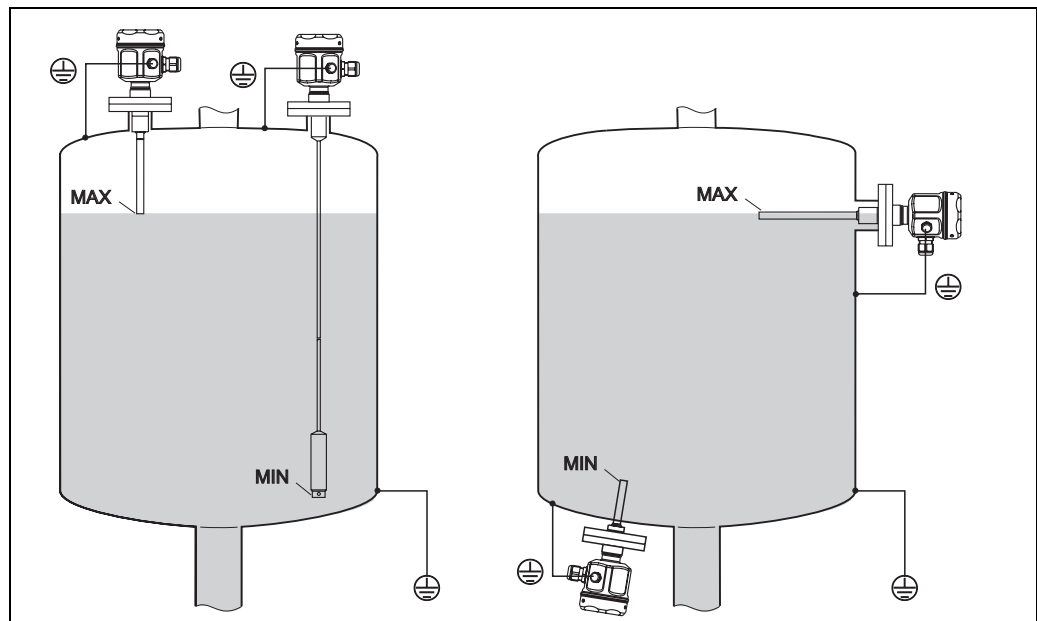
Liquicap M FTI51 (rod probe) can be installed from above, from below and from the side.  
Liquicap M FTI52 (rope probe) can be installed vertically from above.



Note!

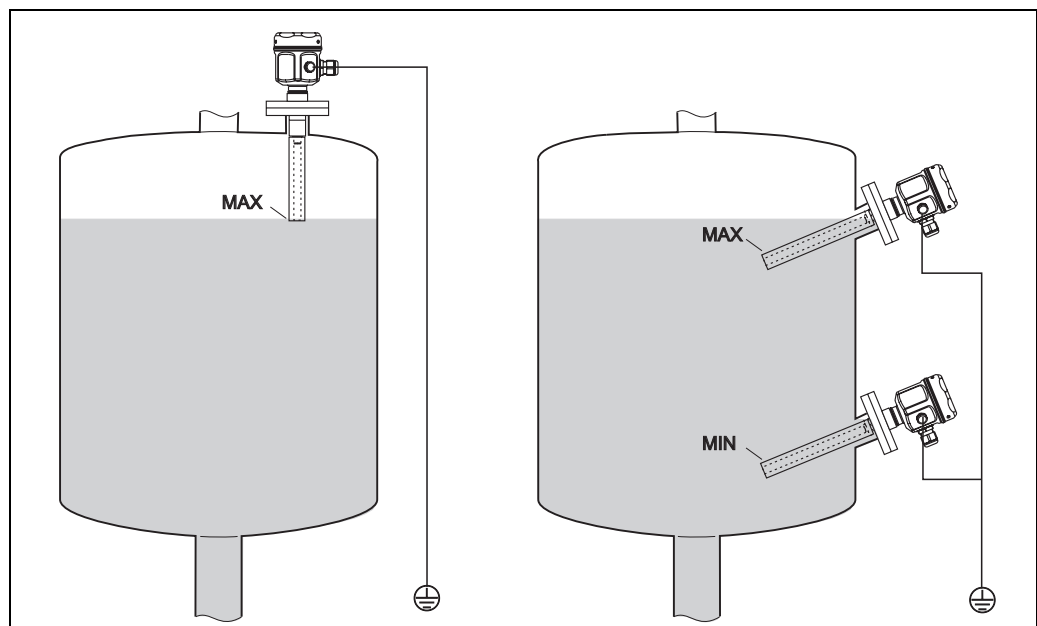
- The probe may not come into contact with the container wall! Do not install probes in the area of the filling curtain!
- When using in agitating tanks, make sure you install at a safe distance from the agitator. If there are strong lateral loads, use rod probes with ground tube.

**For electrically conductive tanks, e.g. steel tanks**



L00-FTI5xxxx-11-06-xx-xx-001

**For non-conductive tanks, e.g. plastic tanks**



L00-FTI5xxxx-11-06-xx-xx-002

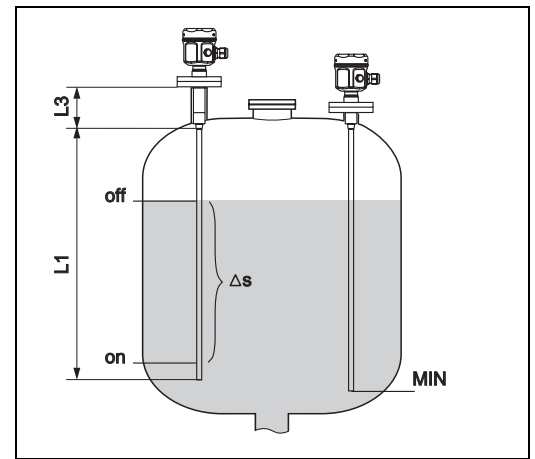
*Probes with ground tube and grounding*



### 3.7.2 Measuring conditions

#### Notes!

- When installing in a nozzle, use inactive length (L3).
- Probes with active build-up compensation must be used for high-viscosity liquids that tend to form build-up.
- Fully insulated rod and rope probes can be used for pump control ( $\Delta S$  operation). The switch-on and switch-off point 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  $1600\text{pF}/380\text{pF per m} = 4\text{ m}$  total length.
- The minimum change in capacitance for level limit detection must be  $\geq 5\text{ pF}$ .



L00-FT15xxxx-15-05-xx-xx-002

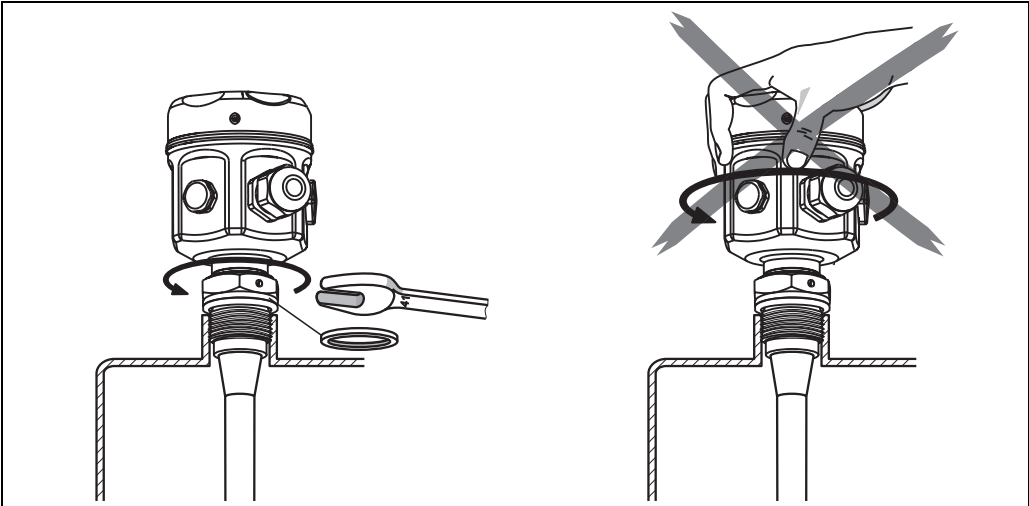
3.8 Installation



Caution!  
Do not damage the probe insulation during installation.



Caution!  
Do not turn the housing while screwing in the probe, as otherwise the housing fixture can be damaged.



L00-FMI5xxxx-17-00-00-xx-003

Probe with thread

- G ½, G ¾, G 1 or G 1½ (cylindrical):
  - Use with the elastomer seal (temperature-resistant up to 300 °C) or another chemically resistant seal.



Note!  
The following applies to probes with parallel threads and included seals:

Thread	For pressures up to 25 bar	For pressures up to 100 bar	Maximum tightening torque
G ½	25 Nm	–	80 Nm
G ¾	30 Nm	–	100 Nm
G 1	50 Nm	–	180 Nm
G 1½	–	300 Nm	500 Nm

- ½ NPT, ¾ NPT, 1 NPT and 1½ NPT (conical):
  - Wrap thread in suitable seal material (e.g. Teflon) (note conductivity).

Probe with Tri-Clamp, sanitary connection or flange

- The process seal must conform to the specifications of the application (temperature and media-resistant).  
If the flange is PTFE-clad, this is generally a sufficient seal up to the permitted operating pressure.

3.8.1 Installation tools

The following tools are required for installation:

- Tool for flange mounting or
- a size 41 or size 55 Allen key for the threaded connection and
- a Phillips-head screwdriver for aligning the cable entry.

### 3.8.2 Aligning the housing

To align the cable entry, the housing can be rotated by 270°.

For additional protection against ingress of moisture, particularly for outdoor installation, we recommend routing the connecting cable downwards in front of the cable gland and securing it with a cable tie.

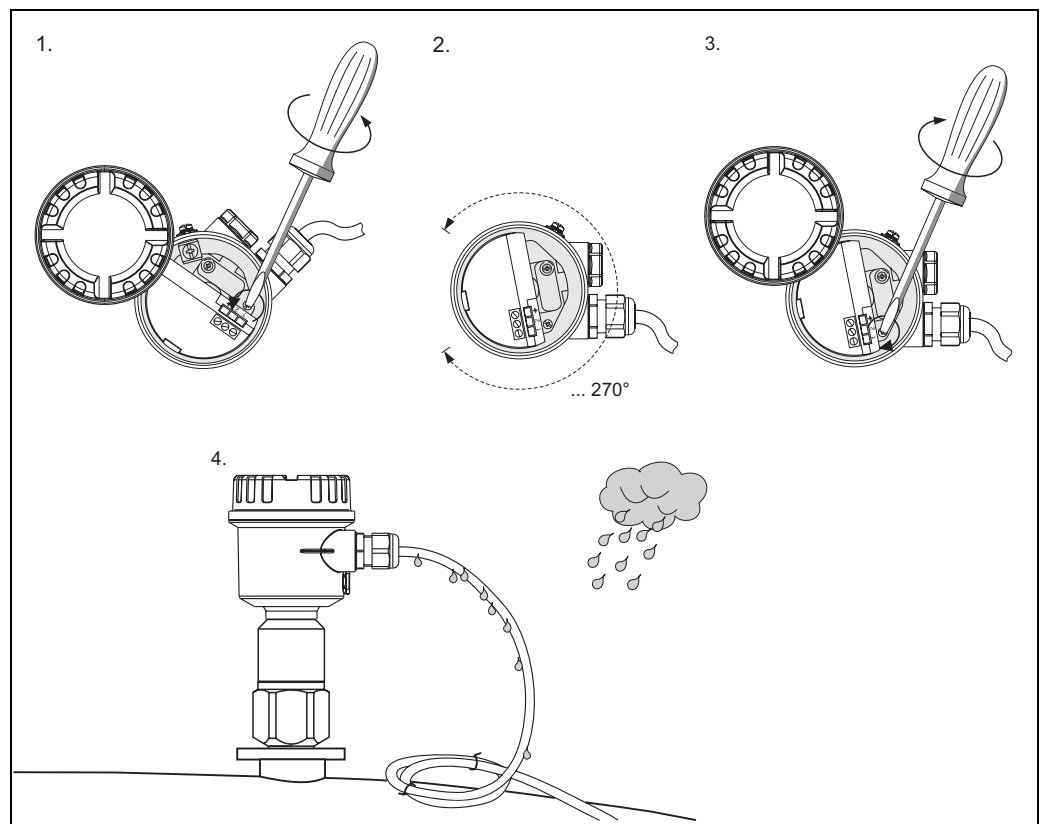
Housing (Type F16, F15, F17, F13, T13)

- Screw open the cover.
- Unscrew the Phillips-head screw at the bottom of the housing by 3 to 4 complete turns.
- Rotate the housing into the desired position (max. 270°, from one limit stop to the other)
- Tighten the Phillips-head screw at the bottom of the housing.



Note!

For the Type T13 housing with separate connection compartment, the Phillips-head screw for aligning the housing is also in the electronics compartment.



L00-FMI5xxxx-04-00-00-xx-002

1. Unscrew the locking screw in the housing until you can turn the housing slightly.
2. Align the housing as necessary.
3. Tighten the locking screw ( $< 1 \text{ Nm}$ ) until you can no longer turn the housing.
4. Provide additional protection against moisture in the electronics compartment.

### 3.8.3 Sealing the probe housing

It is important that when installing the probe, connecting the electronic insert and during subsequent operation, no moisture enters the probe housing. Therefore, always close the housing cover and the cable entries tightly.

The O-ring seal on the housing cover is shipped with a coat of lubricant applied.

This allows the cover to seal tightly and ensures that the aluminum thread does not become jammed during closing.

Never use mineral oil-based grease! This would destroy the O-ring.

## 3.9 Installation examples

### 3.9.1 Rod probes

#### *Conductive tanks (metal tanks)*

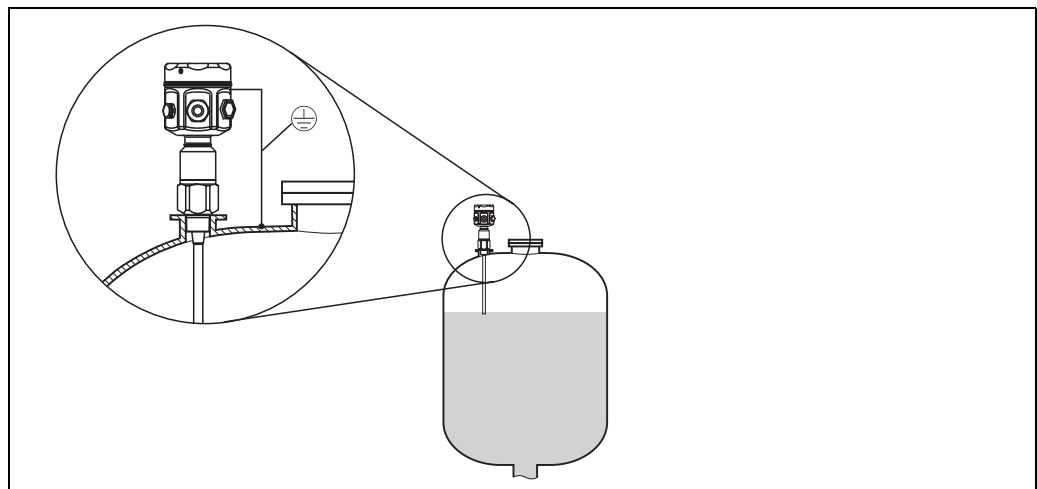
If the process connection of the probe is insulated from the metal tank (e.g. using seal material), connect the ground connection on the probe housing to the tank using a short line.



#### Note!

- A fully insulated rod probe may be neither shortened nor extended.
- If the insulation of the probe rod is damaged, this will falsify the measurement result.
- These application examples show vertical installation for MAX level limit detection.

#### FTI51 rod probe

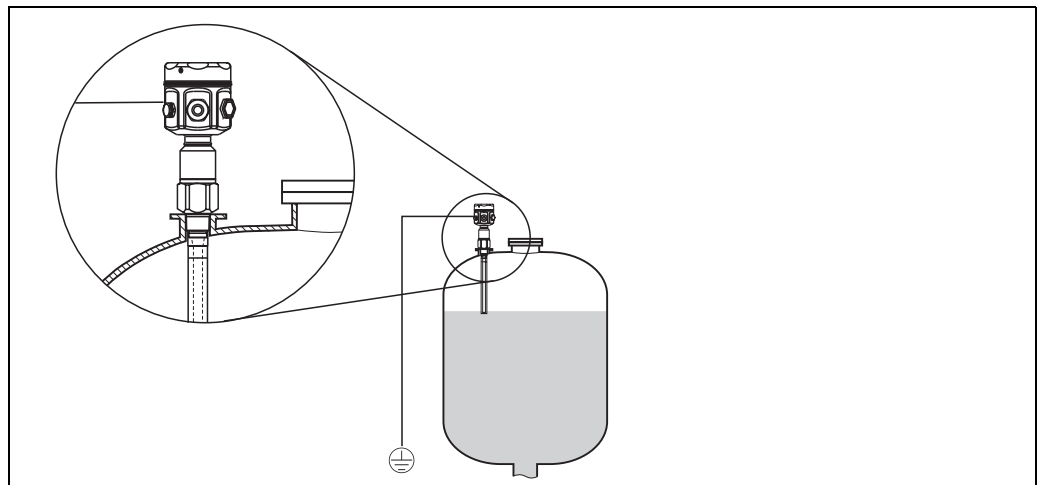


L00-FTI5xxxx-11-06-xx-xx-004

#### FTI51 rod probe with ground tube

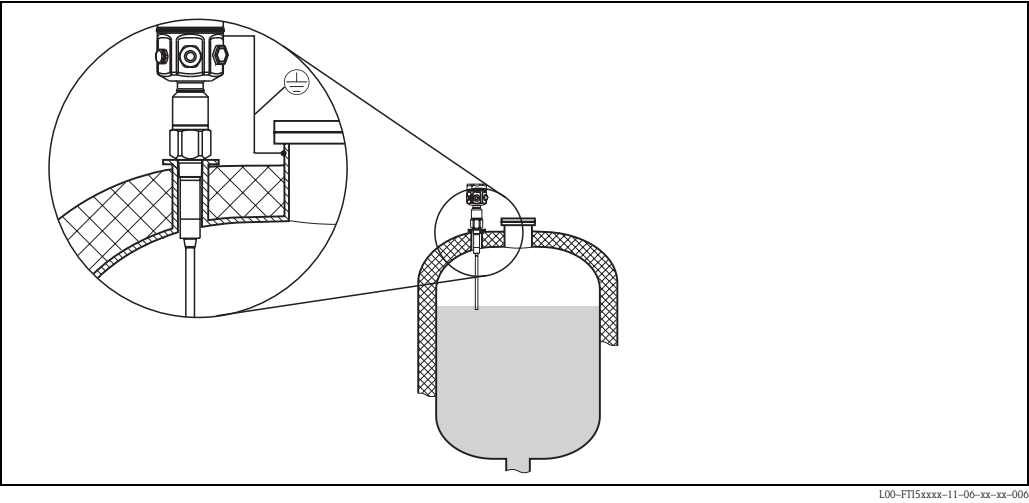
#### *Non-conductive tanks (plastic tanks)*

For installation in a plastic tank, use a probe with ground tube.

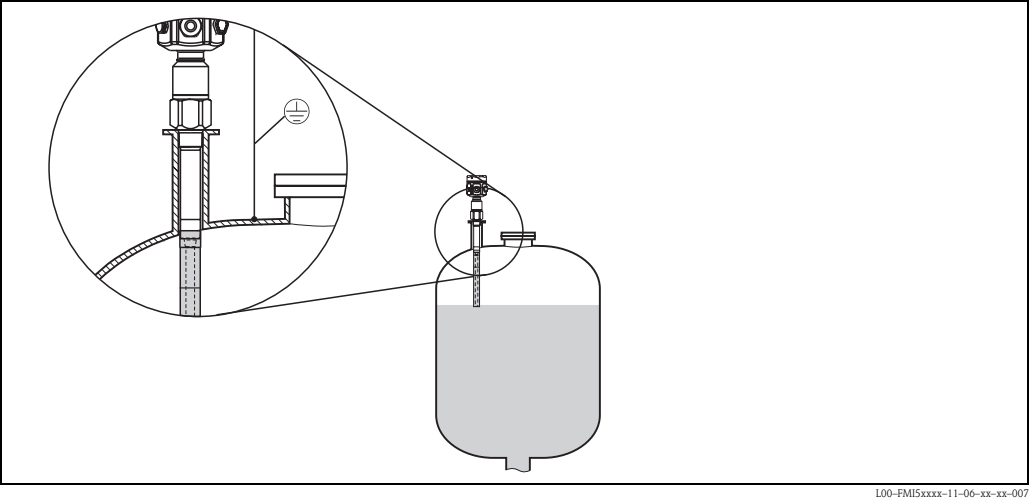


L00-FTI5xxxx-11-06-xx-xx-005

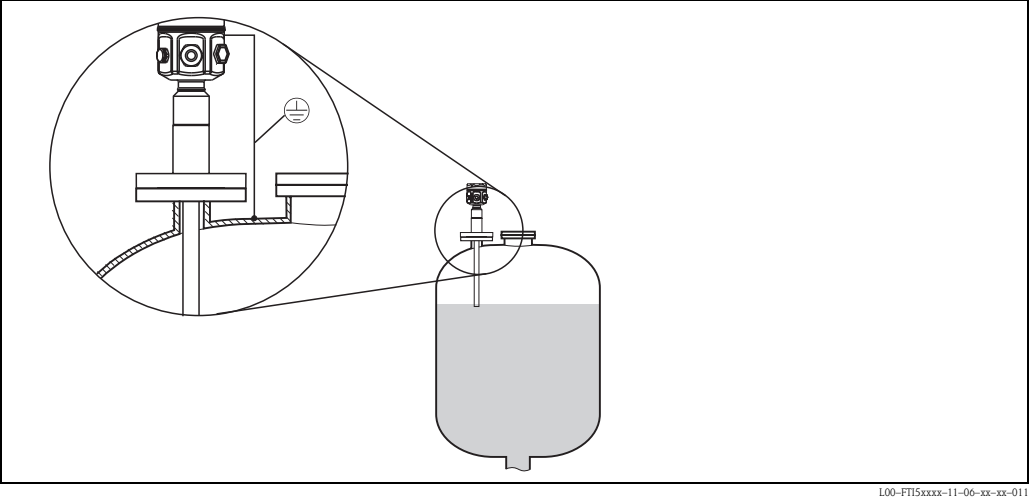
**FTI51 rod probe with inactive length (e.g. for insulated tanks)**



**FTI51 rod probe with ground tube and inactive length (for mounting nozzles)**



**FTI51 fully insulated probe with clad flange for aggressive media**



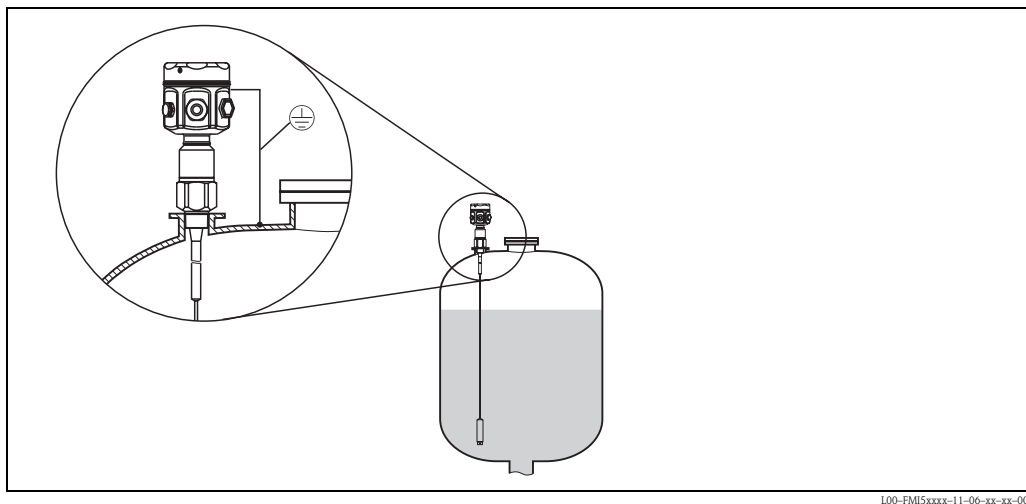
### 3.9.2 Rope probes



Note!

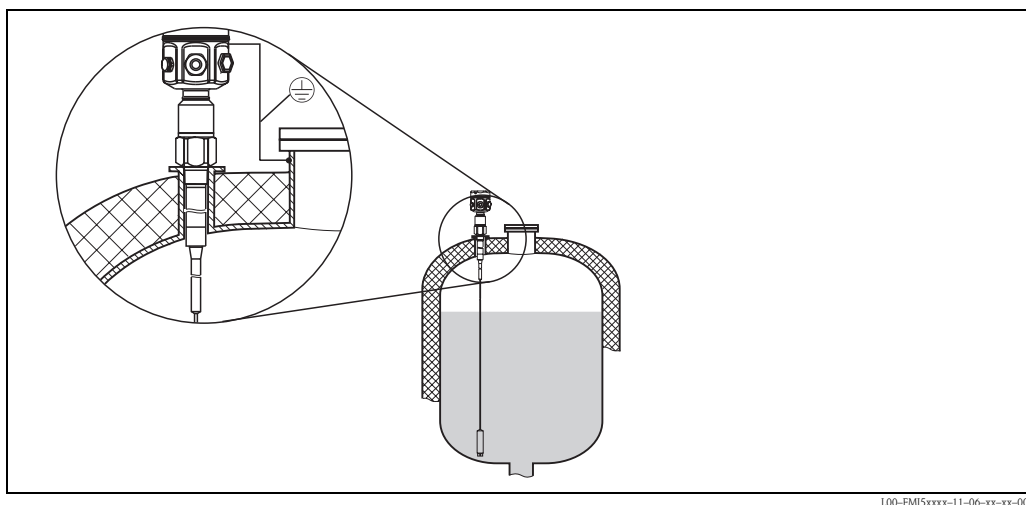
These application examples show vertical installation of rope probes for MIN level limit detection.

#### FTI52 rope probe

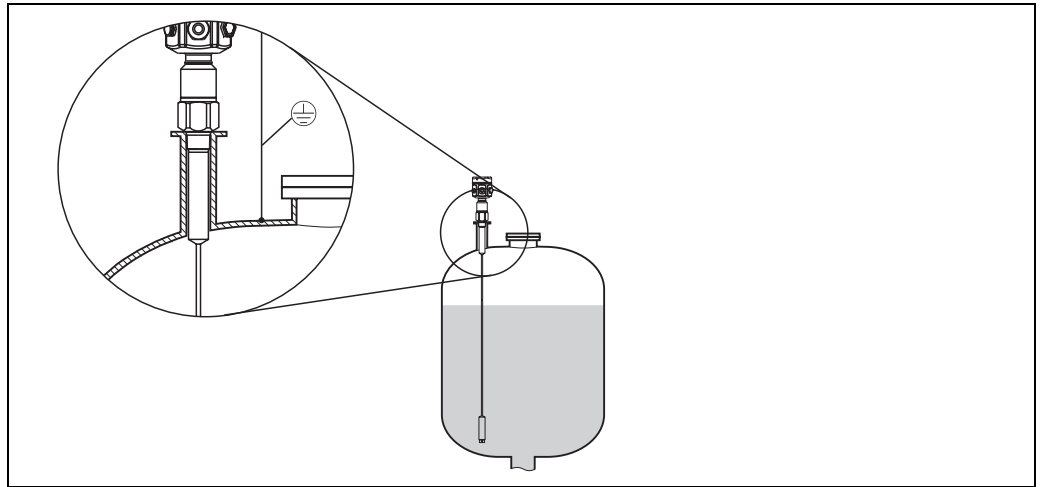


L00-FMI5xxxx-11-06-xx-xx-008

#### FTI52 rod probe with inactive length (e.g. for insulated tanks)



L00-FMI5xxxx-11-06-xx-xx-009

**FTI52 rope probe with fully insulated inactive length (for mounting nozzles)**

L00-FMI5xxxx-11-06-xx-xx-010

**3.9.3 Shortening the rope****Note!**

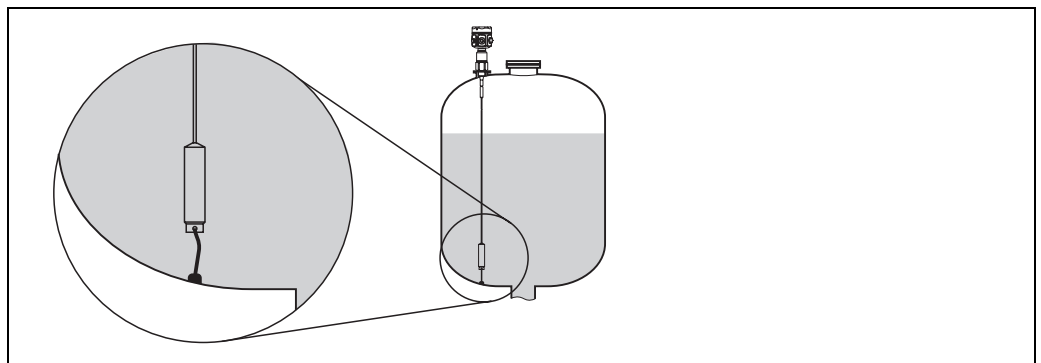
Refer to the operating manual for the rope shortening kit KA061F/00.

**3.9.4 Tensioning weight with bracing**

It may be necessary to fasten the probe end if the probe sometimes touches the tank wall or another part. An anchor hole is provided in the probe weight for this purpose.

The bracing can be attached to the tank wall so that it is either conductive or insulating.

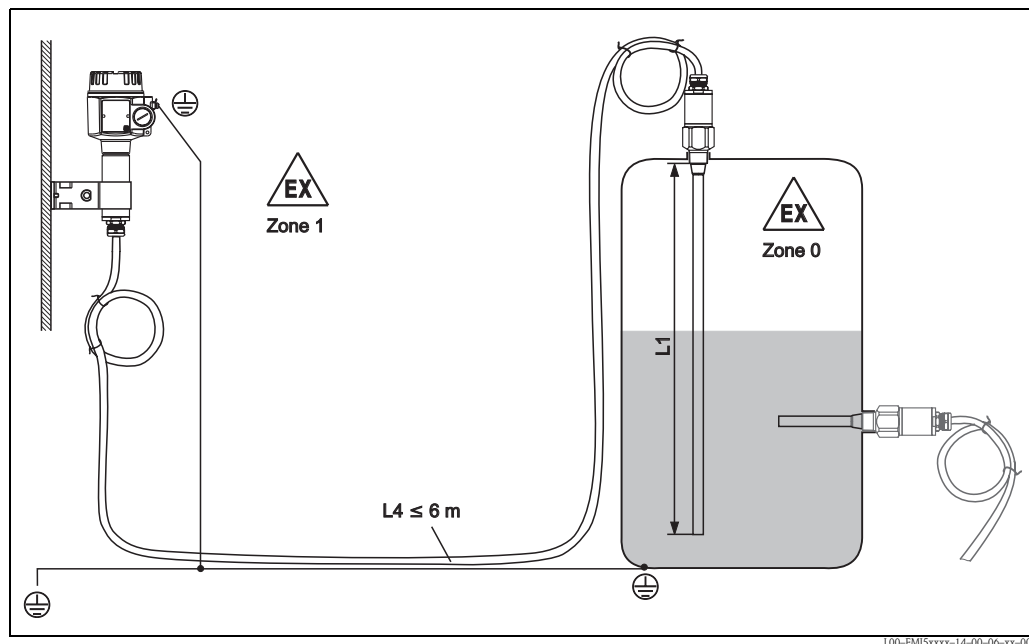
To prevent the danger of a high tensile load, the rope should be loose or braced with a spring. The maximum tensile load must not exceed 200 N.



L00-FMI5xxxx-11-06-xx-xx-012

### 3.10 With separate housing

For information on ordering, refer to "Ordering information" => "Probe design"



Rod length L1 max. 4 m

Rod length L1 max. 10 m



Note!

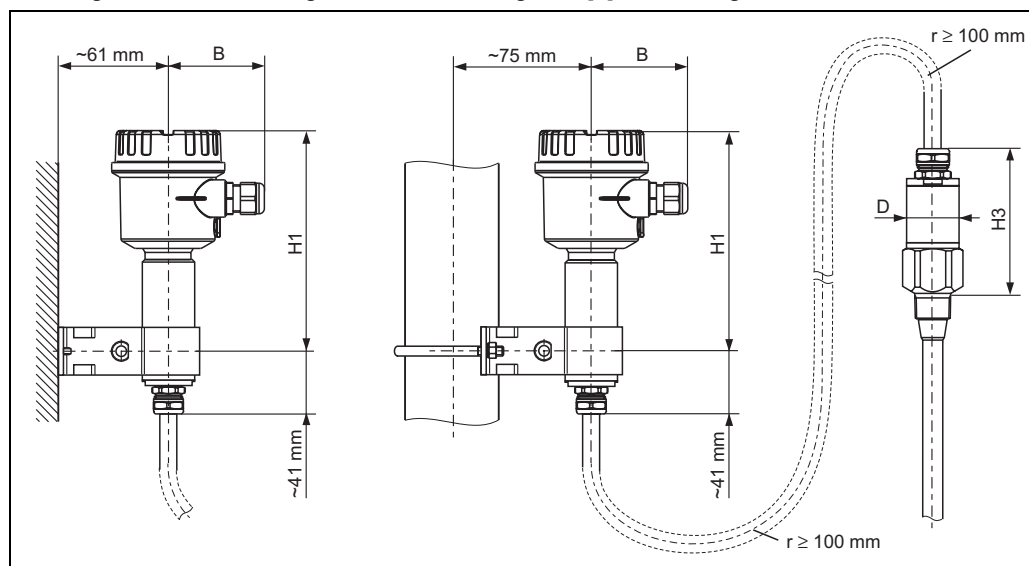
- The maximum connection length between the probe and the separate housing is 6 m (L4). The desired length must be quoted when ordering a Liquicap M with a separate housing.
- If the connecting cable is to be shortened or guided through a wall, it has to be separated from the process connection. For more information, refer to → Chap. 3.11.1.
- The cable has a bending radius of  $r \geq 100$  mm which may not be undershot!

#### 3.10.1 Extension heights

Housing side: wall mounting

Housing side: pipe mounting

Sensor side





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

**Rod probes, rope probes with tube diameter D: ø38 mm**

	bar	H3 (mm)
G 1½, G ¾, G 1, NPT ½, NPT ¾, NPT 1	25	103
Clamp 1, 1½	16	122

**Rod probes, rope probes with tube diameter D: ø50 mm**

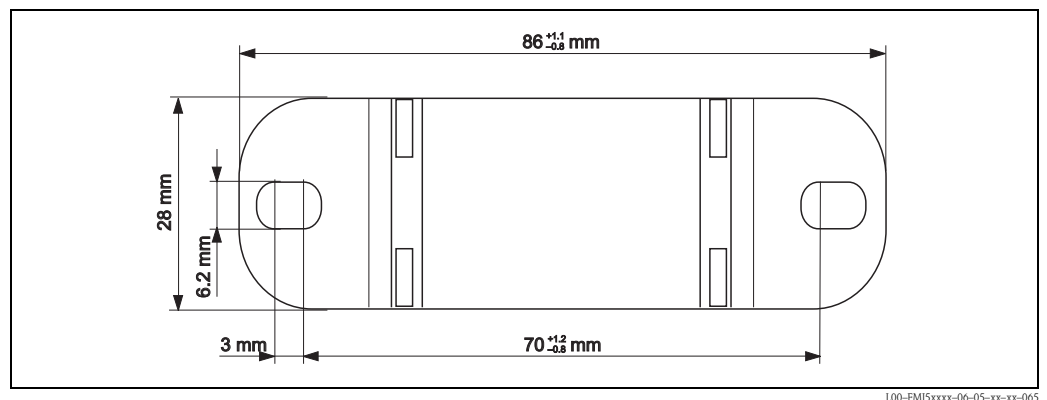
	bar	H3 (mm)
G 1½, NPT 1½	100	130
Clamp 1½	16	137
Clamp 2	16	156



Note!

Connecting cable: ø10.5 mm

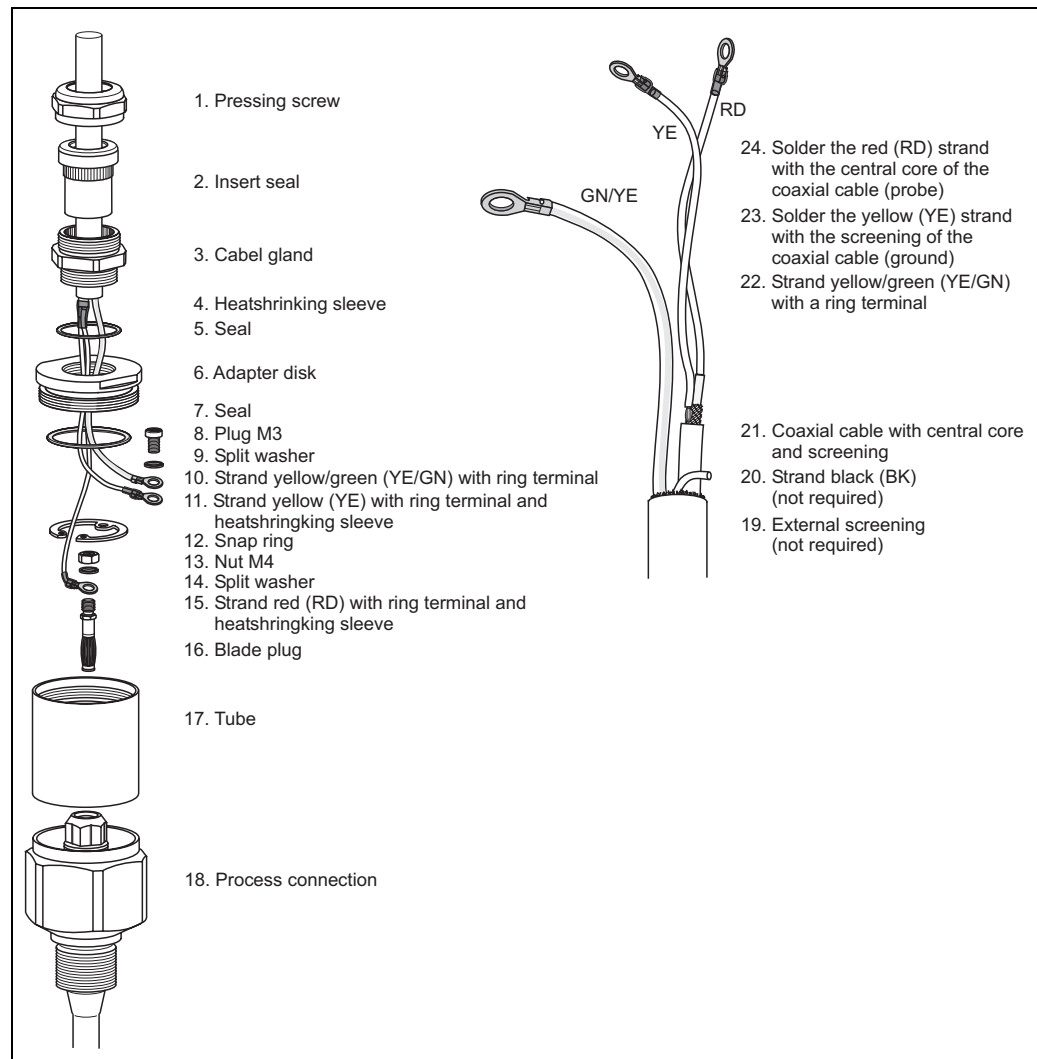
Outer jacket: silicone, mechanical resistance

**Wall holder unit**

L00-FMI5xxxx-06-05-xx-xx-065

Note that 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.

### 3.11 Probe without active build-up compensation



BA299Fen013

#### 3.11.1 Shortening the connecting cable



Note!

The maximum connection length between the probe and separate housing is 6 m and is indicated by dimension L4. The connection length must be quoted when ordering a Liquicap M with a separate housing.

If the connecting cable is to be shortened or guided through a wall, it must be disconnected from the process connection. To do so, proceed as follows:

- Unscrew the pressure screw (1) using a 22mm open-end wrench. If necessary, hold the process connection. In doing so, ensure that neither the connecting cable nor the probe is turned in the process.
- Pull the insert seal (2) out of the cable gland (3).
- Using a 22mm open-end wrench, disconnect the cable gland (3) from the adapter disc. If necessary, hold it against the adapter disc (6) using a 34mm open-end wrench.
- Disconnect the adapter disc (6) from the sleeve (17).
- Remove the snap ring using a snap ring pliers.
- Using pliers, grab the nut (M6) on the Multilam plug and pull out the plug.

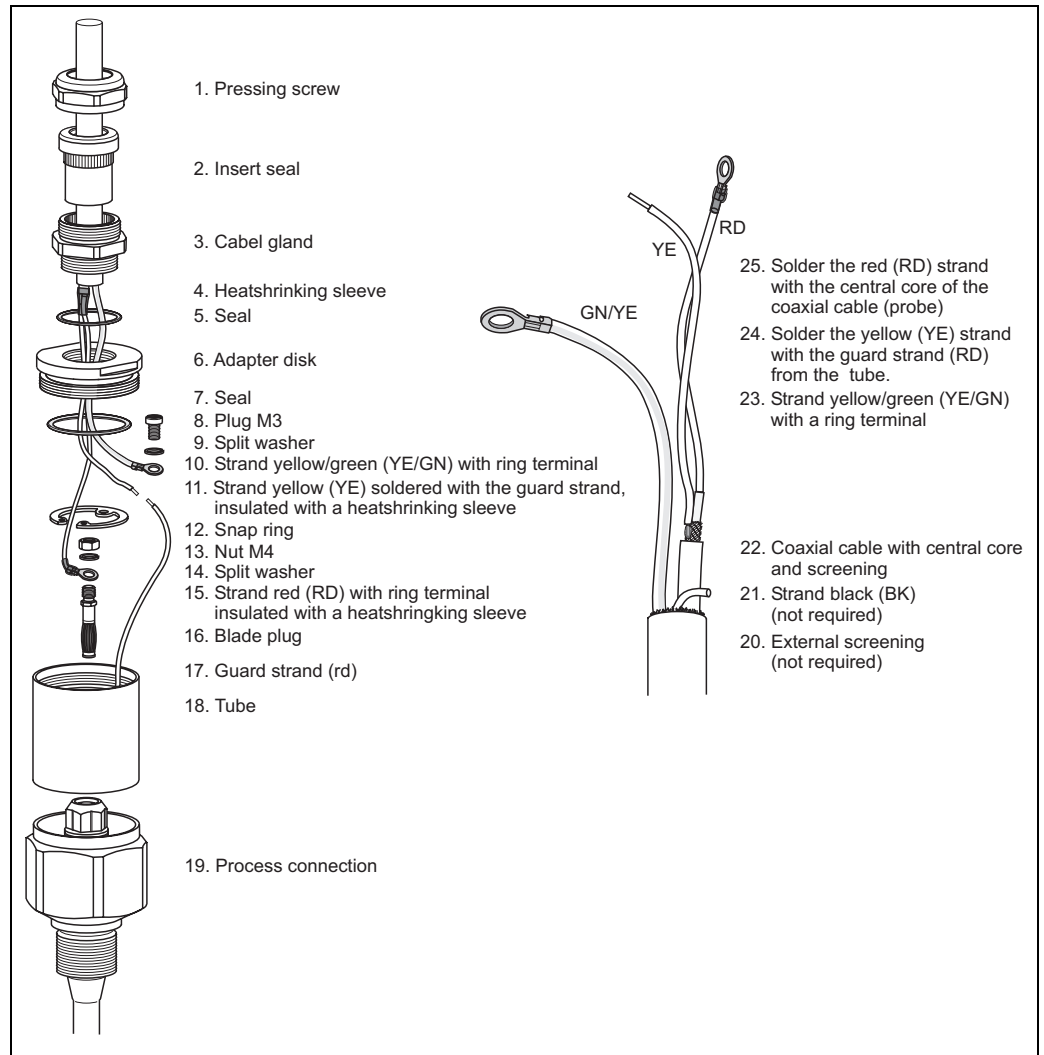


Note!

- If you shorten the connecting cable, we recommend reusing all wires with eyelets.

- If the wires are not reused, the crimp connections of the newly attached eyelets must be insulated, for example using a heat-shrinking sleeve (danger of short circuit).
- All soldered joints must be insulated.

### 3.12 Probe with active build-up compensation



BA209Fen014

#### 3.12.1 Shortening the connecting cable



**Note!**

The maximum connection length between the probe and separate housing is 6 m and is indicated by dimension L4. The connection length must be quoted when ordering a Liquicap M with a separate housing.

If the connecting cable is to be shortened or guided through a wall, it must be disconnected from the process connection. To do so, proceed as follows:

- Unscrew the pressure screw (1) using a 22mm open-end wrench. If necessary, hold the process connection. In doing so, ensure that neither the connecting cable nor the probe is turned in the process.
- Pull the insert seal (2) out of the cable gland (3).
- Using a 22mm open-end wrench, disconnect the cable gland (3) from the adapter disc. If necessary, hold it against the adapter disc (6) using a 34mm open-end wrench.
- Disconnect the adapter disc (6) from the sleeve (17).
- Remove the snap ring using a snap ring pliers.

- Using pliers, grab the nut (M6) on the Multilam plug and pull out the plug.
- Disconnect the connection between the yellow and red (guard) wires.
- Then, shorten the connecting cable to the desired length. If the separate housing is in a different room than the probe, you can now route the connecting cable through the wall.
- You can now reassemble the device by following the reverse order of steps.



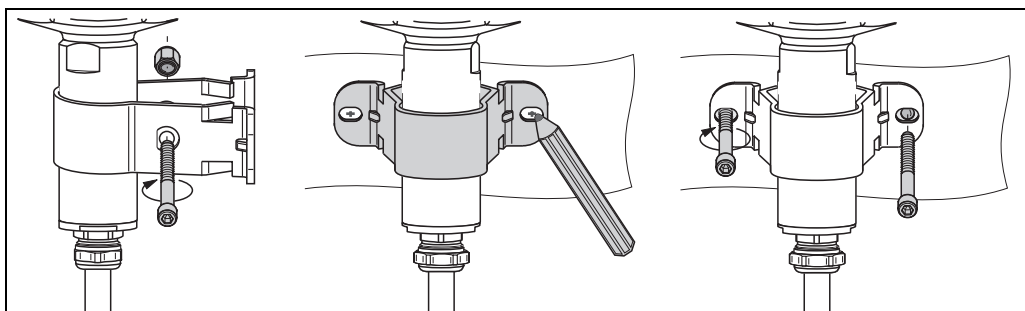
Note!

- If you shorten the connecting cable, we recommend reusing all wires with eyelets.
- If the wires are not reused, the crimp connections of the newly attached eyelets must be insulated, for example using a heat-shrinking sleeve (danger of short circuit).
- All soldered joints must be insulated.

### 3.13 Bracket for Wall and pipe mounting

#### 3.13.1 Wall mounting

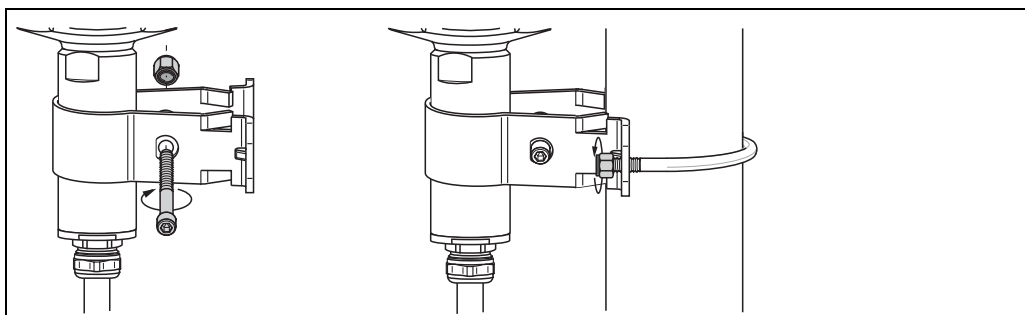
- Push the bracket onto the sleeve and screw it into place.
- Mark the distance between holes on the wall, then drill the holes.
- Screw the separate housing to the wall.



L00-FMI5xxxx-03-05-xx-xx-010

#### 3.13.2 Pipe mounting

- Push the bracket onto the sleeve and screw it into place.
- Screw the separate housing to the pipe (max. 2").



L00-FMI5xxxx-03-05-xx-xx-011

### 3.14 Post-installation check

After installing the measuring device, carry out the following checks:

- Is the device damaged (visual inspection)?
- Does the device meet the specifications at the measuring point, including process temperature and pressure, ambient temperature, measuring range etc.?
- Is the process connection tightened with the correct torque?
- Are the measuring point number and labeling correct (visual inspection)?
- Is the measuring device adequately protected from precipitation and direct sunlight?

## 4 Wiring



### Caution!

Before connecting the supply voltage, note the following:

- The supply voltage must match that specified on the nameplate (1).
- Switch off the supply voltage before connecting the device.
- Connect the potential equalization line to the ground terminal on the sensor.



### Note!

- When using the probe in potentially explosive atmospheres, observe the corresponding national standards and the information in the safety instructions (XA).
- Use the specified cable gland only.

## 4.1 Connection recommendation

### 4.1.1 Potential equalization

Connect the potential equalization line to the outer ground terminal of the housing (T13, F13, F16, F17).

For the stainless steel housing F15, the ground terminal (depending on the version) can also be located in the housing.

For additional safety instructions, refer to the separate documentation for applications in potentially explosive atmospheres.

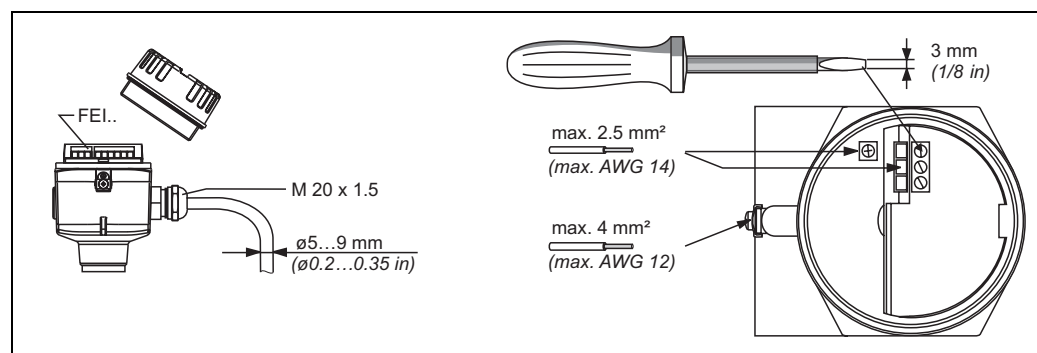
### 4.1.2 Electromagnetic compatibility (EMC)

Interference emission in accordance with EN 61326, Class B electrical device, interference immunity in accordance with EN 61326 appendix A (industrial use) and NAMUR EMC recommendation NE 21 (EMC).

### 4.1.3 Cable specification

The electronic inserts can be connected using the usual commercial instrument cables.

If shielded instrument cables are used, apply the shield on both sides.

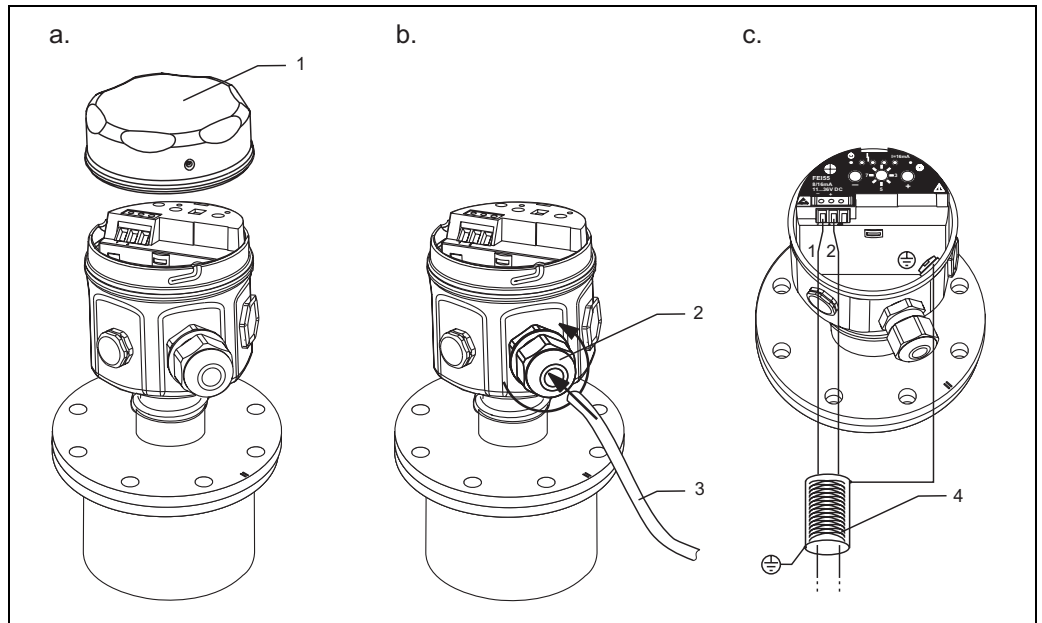


L00-FT5xxxx-04-05-xx-xx-011

## 4.2 Wiring in the housing F16, F15, F17, F13

To connect the electronic insert to the power supply, proceed as follows:

- Unscrew the housing cover (1).
- Remove the cable gland (2) and insert the cable (3).
- Ground the shield (4) on both sides!



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### Note!

All further steps depend on the specific electronic insert used, and are described on the following pages:

FEI52 → Page 42

FEI53 → Page 43

FEI54 → Page 44

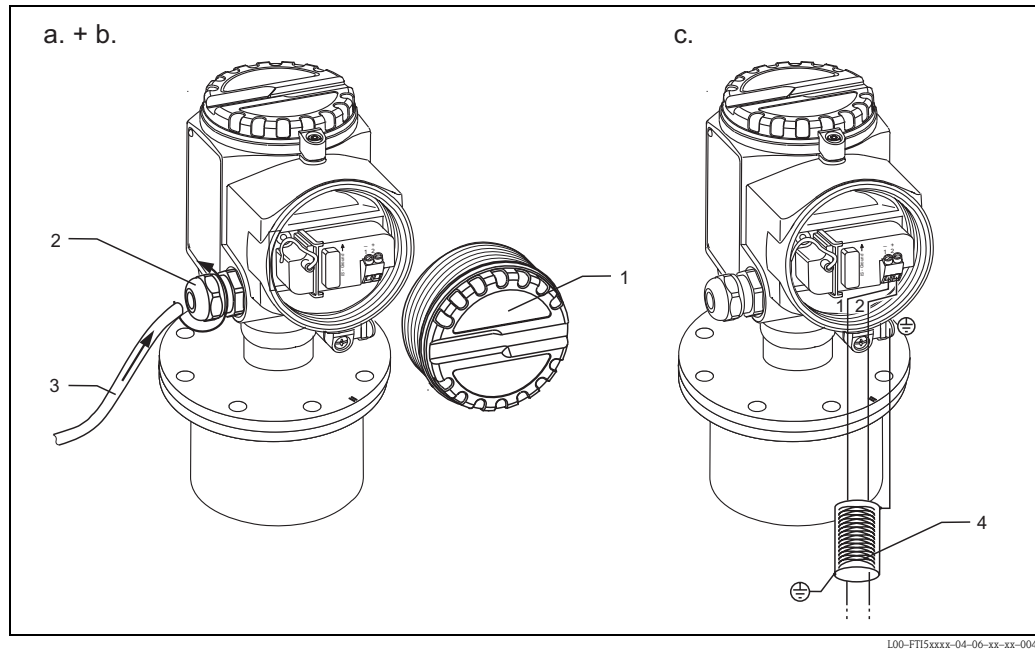
FEI55 → Page 45

FEI57S → Page 46

### 4.3 Wiring in the housing T13

To connect the electronic insert to the power supply, proceed as follows:

- a. Unscrew the housing cover (1).
- b. Remove the cable gland (2) and insert the cable (3).
- c. Ground the shield (4) on both sides!



**Note!**

The connection shown under (c.) depends on the type of protection ordered. This illustration shows the terminal module for EEx d. For connection in a separate connection compartment, the same connection descriptions apply as for the electronic inserts.



**Note!**

All further steps depend on the specific electronic insert used, and are described on the following pages:

FEI52→ Page 42

FEI53→ Page 43

FEI54→ Page 44

FEI55→ Page 45

FEI57S→ Page 46

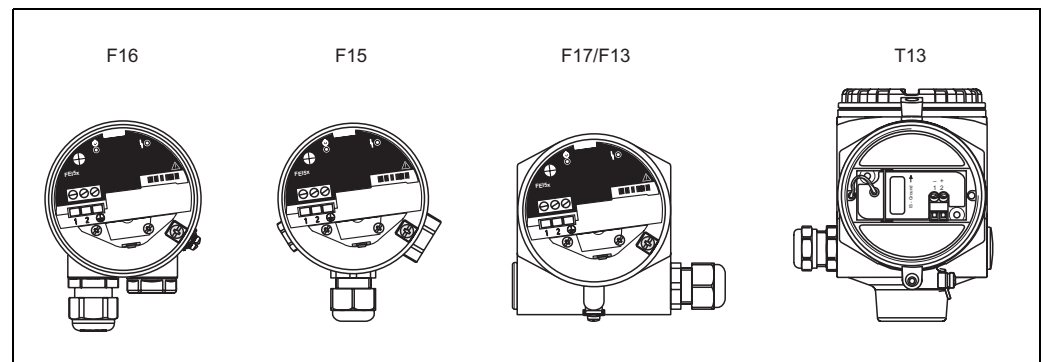


## 4.4 Connecting the device

### Connection compartment

Five types of housing are available:

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



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Note!

The nameplate contains important device data.

### Cable entry

Cable gland: M20x1.5 (for EEx d, cable entry only) A second cable gland is included with every device.

Cable entry: G ½ or NPT ½, NPT ¾

## 4.5 Degree of protection

In accordance with EN 60529

	IP66	IP67	IP68	NEMA 4X
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
Aluminum housing T13 With gas-tight process seal and separate connection compartment (EEx d)	X	–	X	X

## 4.6 Connecting the electronic insert FEI52 (DC PNP)

The three-wire DC connection should, wherever possible, be connected as follows:

- To programmable logic controllers (PLCs),
- To DI modules in accordance with EN 61131-2

A positive signal is present at the switch output of the electronic system (PNP).

### Power supply

DC voltage: 10 V...55 V

Ripple: max. 1.7 V, 0...400 Hz

Current consumption: < 20 mA

Power consumption: max. 0.9 W

Reverse polarity protection: yes

Separation voltage: 3.7 kV

FEI52 overvoltage protection: overvoltage category III

### 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)
- Capacitive 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)

Connect the FEI52 (DC PNP) as follows:

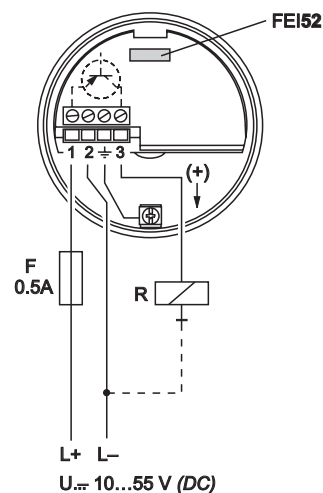
1. Make the connection as shown in the graphic.
2. Turn the cable gland until tight.
3. Set the function switch (5) to position 1 (operation).

 **Note!**

Do not switch on the supply voltage until you have familiarized yourself with the device functions as described in chapter 5, "Operation". This will ensure that you do not accidentally trigger any processes by switching on the supply voltage.

4. Switch on the supply voltage.

\* R = External load ( $I_{max}$  350 mA,  $U_{max}$  55 V DC)



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## 4.7 Connecting the electronic insert FEI53 (3-WIRE)

The 3-wire DC connection is used in conjunction with the Nivotester switching device FTC325 3-WIRE from Endress+Hauser; the switching device's communication signal operates at 3 to 12 V.

The changeover of fail-safe mode (MIN) / (MAX) and the level limit calibration take place on the Nivotester.

### Power supply

DC voltage: 14.5 V

Current consumption: < 15 mA

Power consumption: max. 230 mW

Reverse polarity protection: yes

Separation voltage: 0.5 kV

### Signal on alarm

< 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.

Connect the FEI53 (3-WIRE) as follows:

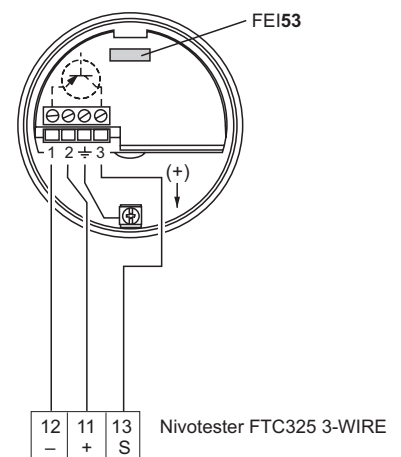
1. Make the connection as shown in the graphic.
2. Turn the cable gland until tight.



#### Note!

Do not switch on the supply voltage until you have familiarized yourself with the device functions as described in chapter 5, "Operation". This will ensure that you do not accidentally trigger any processes by switching on the supply voltage.

3. Switch on the supply voltage.



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## 4.8 Connecting the electronic insert FEI54 (AC/DC with relay output)

The universal voltage connection with relay output (DPDT) operates in two different voltage ranges (AC and DC).



Note!

When connecting devices with high inductivity, use a spark suppression system to protect the relay contacts.

### Power supply

Alternating voltage 19 V...253 V, 50/60 Hz or DC voltage: 19 V...55 V

Power consumption: max. 1.5 W

Reverse polarity protection: yes

Separation voltage: 3.7 kV

FEI54 overvoltage protection: overvoltage category III

### 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 (EEx d 4 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 (EEx d 4 A) to 30 V, I– max. 0.2 A to 125 V
- When connecting a functional extra low voltage circuit with dual insulation in accordance with IEC 1010, the following applies: the sum of the voltages of the relay output and power supply must not exceed 300 V.

Connect the FEI54 (AC/DC relay) as follows:

1. Make the connection as shown in the graphic.
2. Turn the cable gland until tight.
3. Set the function switch (5) to position 1 (operation).

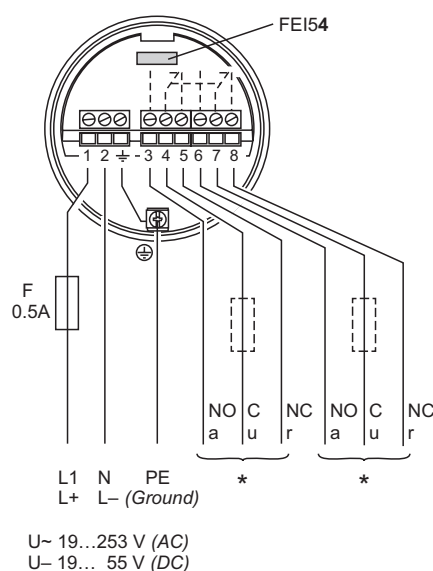


Note!

Do not switch on the supply voltage until you have familiarized yourself with the device functions as described in chapter 5, "Operation". This will ensure that you do not accidentally trigger any processes by switching on the supply voltage.

4. Switch on the supply voltage.

\* Refer also to Connectable load



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## 4.9 Connecting the electronic insert FEI55 (8/16 mA)

The two-wire DC connection should, wherever possible, be connected as follows:

- To programmable logic controllers (PLCs),
- To AI modules 4-20 mA in accordance with EN 61131-2

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

### Power supply

Supply voltage: 11 to 36 VDC

Power consumption: < 600 mW

Reverse polarity protection: yes

Separation voltage: 0.5 kV

### 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 V...36 V
- $I_{\max} = 16 \text{ mA}$

Connect the FEI55 (8/16 mA) as follows:

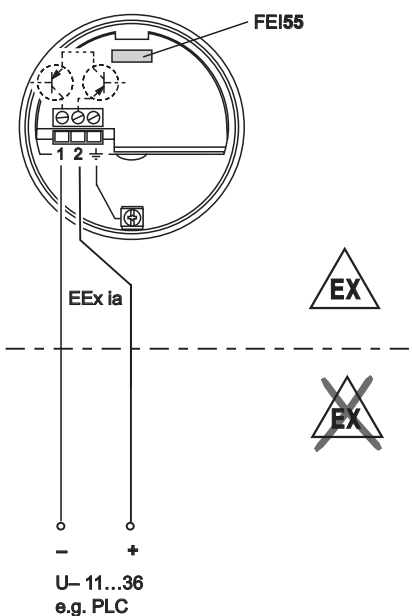
1. Make the connection as shown in the graphic.
2. Turn the cable gland until tight.
3. Set the function switch (5) to position 1 (operation).



**Note!**

Do not switch on the supply voltage until you have familiarized yourself with the device functions as described in chapter 5, "Operation". This will ensure that you do not accidentally trigger any processes by switching on the supply voltage.

4. Switch on the supply voltage.



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## 4.10 Connecting the electronic insert FEI57S (PFM)

The two-wire DC connection is used in conjunction with one of the following Nivotester switching devices from Endress+Hauser:

- FTC325 PFM,
- FTC625 PFM (from SW V1.4),
- FTC470Z,
- FTC471Z

The PFM signal is between 17 and 185 Hz.

The changeover of fail-safe mode (MIN) / (MAX) and the level limit calibration take place on the Nivotester.

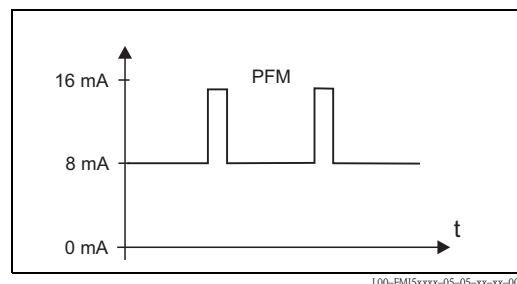
### Power supply

Supply voltage: 9.5 to 12.5 VDC

Power consumption: < 150 mW

Reverse polarity protection: yes

Separation voltage: 0.5 kV



Frequency: 17 ...185 Hz

### Output signal

PFM 17 to 185 Hz (Endress+Hauser)

### Connectable load

- Floating relay contacts in the connected Nivotester switching device FTC325 PFM, FTC625 PFM (from SW V1.4), FTC470Z, FTC471Z
- For the contact load capacity, refer to the technical data of the switching device.

Connect the FEI57 (PFM) as follows:

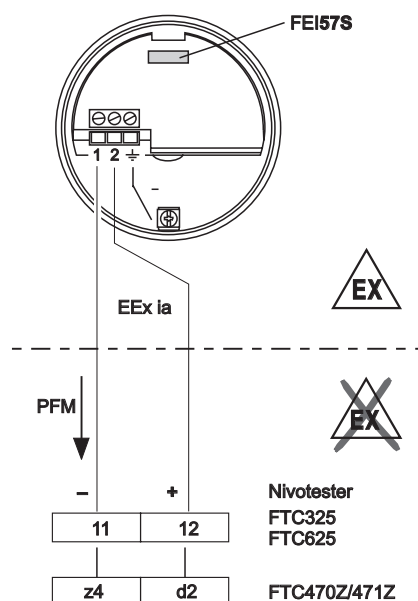
1. Make the connection as shown in the graphic.
2. Turn the cable gland until tight.



**Note!**

Do not switch on the supply voltage until you have familiarized yourself with the device functions as described in chapter 5, "Operation". This will ensure that you do not accidentally trigger any processes by switching on the supply voltage.

3. Switch on the supply voltage.



## 4.11 Post-connection check

After wiring the measuring device, carry out the following checks:

- Is the terminal assignment correct?
- Is the cable gland tightly sealed?
- Is the housing cover screwed on all the way?
- If a power supply is present:  
If the device is operational, the green LED flashes in a 5-second rhythm.

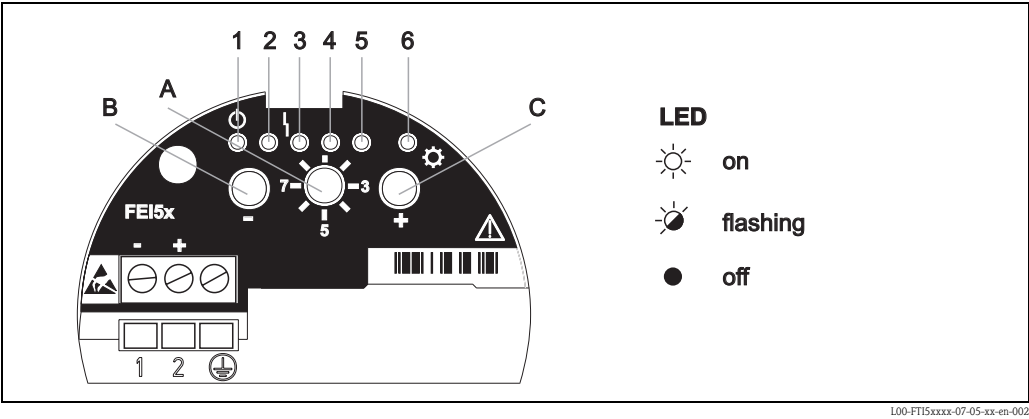
## 5 Operation

### 5.1 Human interface and display elements for FEI52, FEI54, FEI55

You can operate the electronic inserts FEI52, FEI54 and FEI55 using a functional switch A, the B key (–) and the C (+) key.

The function switch A has eight possible positions. Each position has at least one function.

The operating status of the device is indicated by light emitting diodes (LEDs 1 to 6) on the electronic insert and depends on the position of the function switch.



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**Note!**

- To select a function, press the function keys (– and/or +) for at least 2 s.

Function switch position A	Function	– key B	+ key C	Light emitting diodes (LED)					
				1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
1	Operation			Flashes Operational LED		Flashes (warning/ alarm)			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**
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**
	Pump control (Δs)/ build-up mode		Press once Press twice				Off build-up mode	Off Δs	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**
8	Upload/download sensor DAT (EEPROM)	Press for download	Press for upload	Flashes (download)				Flashes (upload)	On/off/ flashes**

\* These settings are factory settings.

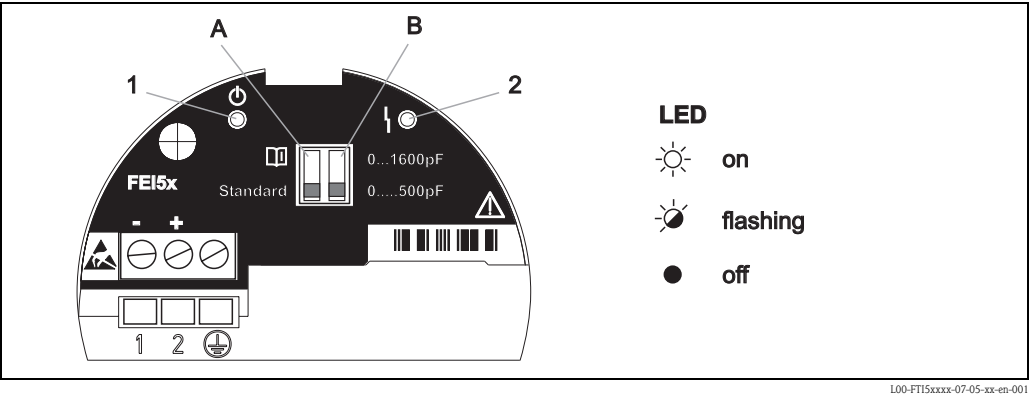
\*\* Switch status signaling depends on the mounting location selected and the fail-safe mode (MIN/MAX) set. The LED flashes if a calibration has not yet been carried out.



## 5.2 Human interface and display elements for FEI53, FEI57S

The electronic inserts FEI53 and FEI57S are used in conjunction with Nivotester switching devices. The functions of the DIP switches (A and B) and the LEDs (1 and 2) are described in the table below.

The operating status of the device is indicated by LEDs (LEDs 1 and 2) on the electronic insert, providing information on operational readiness (1) and, where applicable, the type of fault (2).



L00-FT15xxxx-07-05-xx-en-001



**Note!**  
A description of the human interface and display elements of the Nivotester switching device is provided in the documentation that accompanies the device.

DIP switches	Function	Light emitting diodes (LED)	
		1 (green) ⏻ Operational	2 (red) ⚠ Fault
A	Standard: If the measuring range is exceeded, <b>no</b> alarm is output.  Note! ■ Set this mode of operation for partially insulated probes to deactivate the probe insulation monitoring. ■ Set this mode of operation when using one of the following switching units: FTC470Z, FTC471Z	Flashes***	Flashes */on **
	⏻: If the measuring range is exceeded, <b>one</b> alarm is output.  Note! ■ Set this mode of operation for fully insulated probes to activate the probe insulation monitoring.	Flashes***	Flashes */on **
B	Span: The measuring range is between 0 and 500 pF.	Flashes***	Flashes */on **
	Span: The measuring range is between 0 and 1600 pF.	Flashes***	Flashes */on **

\* The red LED flashes if there is a fault that you can correct.  
\*\* The red LED lights up continuously (on) if the device has a fault that cannot be corrected. Refer also to Chapter 9, "Troubleshooting".  
\*\*\* Flashes in 5-second intervals.

## 6 Commissioning

### 6.1 Installation and function check

Make sure that the post-installation check and final check have been completed before you start your measuring point:

- For the "Post-installation check" checklist, refer to → Page 37.
- For the "Post-connection check" checklist, refer to → Page 47.

### 6.2 Commissioning the electronic insert FEI52, FEI54, FEI55

This chapter describes the commissioning of the Liquicap M FTI51, FTI52 with the electronic inserts FEI52, FEI54, FEI55. These electronic inserts operate with the following firmware (FW):

- FW electronic insert FEI52: V 01.00.00
- FW electronic insert FEI54: V 01.00.00
- FW electronic insert FEI55: V 01.00.00



Note!

- When you start up the device for the first time, the output is in safe status. This is signaled by the flashing yellow LED 6.
- The device is not operational until you have carried out a calibration. To attain maximum operational safety, carry out an empty and a full calibration. This is particularly recommended for critical applications.

Refer to the following subchapters for information on how to carry out the calibration.

6.2.1     Setting the measuring range



- Note!
- The selection of the measuring range (0 to 500 pF and 0 to 1600 pF) depends on the function of the probe.
  - If the probe is used as a limit switch, you can retain the factory setting of 0 to 500 pF.
  - If you use the probe for pump control (two-point control), the following recommendations apply for vertical installation:
    - Measuring range from 0 to 500 pF for probe lengths up to 1.0 m
    - Measuring range from 0 to 1600 pF for probe lengths up to 4.0 m

Mode	Key	Key	Symbol	Function/Mode	LED Signals
4	press			Measurement range, small/big	

BA299Fen020

Mode switch setting	Function	– key	+ key	Light emitting diodes (LED Signals)					
				1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
4	Measuring range	Press		On* (500 pF)	Off (1600 pF)				

\* This is a factory setting.

- To set the range to 0 to 1600 pF, proceed as follows:
1. Turn the mode switch to position 4.
  2. Press the "-" key for at least 2 seconds until the green LED 2 lights up.
  3. Release the "-" key when the green LED 2 lights up.
- The process for storing the measuring range changeover is now complete. Turn the mode switch to position 2 to continue the calibration.

6.2.2 Carrying out empty calibration

Mode	Key	Key	Symbol	Function/Mode	LED Signals
	● —	● +			
2	press			Empty calibration	
		press		Full calibration	
	press both keys for approx. 10 s			Reset: Calibration Switchpoint adjust.	

BA299Fen021

Mode switch setting	Function	– key	+ key	Light emitting diodes (LED Signals)					
				1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
2	Empty calibration	Press		On (Calibration carried out)					On/off/ flashes**
	Full calibration		Press					On (Calibration carried out)	On/off/ flashes**
	Reset: Calibration and switch point shift	Press both keys for approx. 10 s		On	->	->	->	->	

\*\* Switch status signaling depends on the mounting location selected and the fail-safe mode (MIN/MAX) set. The LED flashes if a calibration has not yet been carried out.



**Note!**  
The empty calibration stores the capacitance value of the probe when the tank is empty. If the measured capacitance value is, for example, 50 pF (empty calibration), a switching threshold of 2 pF is added to this value. The capacitance value of the switch point would, in this case, be 52 pF.  
The switching threshold depends on the set value of the switch point shift (for more information, refer to → Chap. 6.2.5).

To carry out an empty calibration, proceed as follows:

- 1. Check to make sure that the probe is not covered with product.
- 2. Turn the mode switch to position 2.
- 3. Press the "–" key for at least two seconds.
- 4. Release the "–" key when the green LED 1 starts flashing.

The process of saving the empty calibration is finished when the green LED 1 lights up continuously. You can turn the mode switch back to position 1 to return to operation.

**Reset calibration**

To reset the calibration and switch point shift, proceed as follows:

- 1. Turn the mode switch to position 2.
- 2. Press the "–" and "+" keys for at least 10 seconds.
- 3. The green LEDs 1–5 light up in succession.

The rest calibration has been carried out and saved. The yellow LED 5 is flashing. To make the device ready for use a new calibration must be accomplished.

### 6.2.3 Carrying out the full calibration



Note!

The full calibration measures the capacitance value of the probe when the tank is full. If the measured capacitance value is, for example, 100 pF (full calibration), a switching threshold of 2 pF is subtracted from this value. The capacitance value of the switch point is thus 98 pF.

The switching threshold depends on the set value of the switch point shift (for more information, refer to → Chap. 6.2.5).

To carry out a full calibration, proceed as follows:

1. Make sure that the probe is covered by the medium up to the desired switch point.
2. Turn the mode switch to position 2.
3. Press the "+" key for at least two seconds.
4. Release the "+" key when the green LED 5 starts flashing.

The process of saving the full calibration is finished when the green LED 5 is lit and stops flashing. You can turn the mode switch back to position 1 to return to operation.

### 6.2.4 Carrying out the empty and full calibration



Note!

- An empty and full calibration provides the greatest possible operational security. This is particularly recommended for critical applications.
- The empty and full calibration measures the capacitance values of the probes when the tank is full and when it is empty. If, for example, the measured capacitance value of the empty calibration is 50 pF and that of the full calibration is 100 pF, the average capacitance value, 75 pF, is stored as the switch point.

To carry out an **empty calibration**, proceed as follows:

1. Check to make sure that the probe is not covered with product.
2. Turn the mode switch to position 2.
3. Press the "-" key for at least two seconds.
4. Release the "-" key when the green LED 1 starts flashing.

The process of saving the empty calibration is finished when the green LED 1 lights up continuously.

To carry out a **full calibration**, proceed as follows:

1. Make sure that the probe is covered by the medium up to the desired switch point.
2. Turn the mode switch to position 2.
3. Press the "+" key for at least two seconds.
4. Release the "+" key when the green LED 5 starts flashing.

The process of saving the full calibration is finished when the green LED 5 lights up continuously. You can turn the mode switch back to position 1 to return to operation.

6.2.5     Setting the switch point shift

Mode	Key	Key			
3	<	>		Switchpoint adjustment	

BA299Fen022

Mode switch setting	Function	– key	+ key	Light emitting diodes (LED Signals)					
				1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
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**

\* This is a factory setting.

\*\* Switch status signaling depends on the mounting location selected and the fail-safe mode (MIN/MAX) set. The LED flashes if a calibration has not yet been carried out.
















- Note!
- If only a full calibration or empty calibration was carried out and if a build-up forms on the probe rod during operation, this can cause a delayed or no reaction of the device to changes in level. By setting the switch point shift (e.g. 4, 8, 16, 32 pF), you compensate for this status and thus obtain a constant switch point.
  - For media that do not have a tendency to build up, we recommend a setting of 2 pF, as the probe is the most sensitive to changes in level at this setting.
  - For media with heavy build-up (e.g. yogurt), we recommend using probes with active build-up compensation.
  - A switch point shift can be carried out only if a full **or** empty calibration has been carried out first.
  - A switch point shift is not possible if an empty **and** a full calibration have been carried out.
  - The switch point shift is disabled if you switch on the pump control (as described under → Chap. 6.2.6).

To shift the switch point, proceed as follows:

1. Turn the mode switch to position 3.  
The green LED 1 lights up (factory setting).
2. Press the "+" key for at least two seconds to switch to the next higher value. If you press and hold down the "+" or "-" key, the value changes by one more every two seconds. The active value is indicated by an LED (1 to 5).

After you have carried out the switch point shift, turn the mode switch to position 1 to return to operation.

## 6.2.6 Setting the pump control and build-up mode

Mode	Key	Key	Symbol	Function/Mode	LED Signals
	● —	● +			
4	press			Measurement range, small/big	      500 1600 pf
		press 2 x	$\Delta s$	Pump control Build-up mode	      build-up on

BA299Feb023

Mode switch setting	Function	– key	+ key	Light emitting diodes (LED Signals)					
				1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
4	Measuring range	Press for <		On* (500 pF)	Off (1600 pF)				On/off/ flashes**
	Pump control ( $\Delta s$ )/ build-up mode		Press once Press twice				Off build-up mode	Off $\Delta s$	On/off/ flashes**

\* This is a factory setting.

\*\* Switch status signaling depends on the mounting location selected and the fail-safe mode (MIN/MAX) set. The LED flashes if a calibration has not yet been carried out.



### Note!

- You can also use the probe rod of a fully insulated and vertically installed probe for pump control (two-point control). The switch points of the empty **and** full calibration activate the pump.  
If you want to use the pump control, observe the following:
  - Carry out the empty calibration with the probe partially covered.
  - Set the measuring range from 0 to 1600 pF. For more information, refer to → Chap. 6.2.1, "Setting the measuring range."
  - Set the fail-safe mode (MIN/MAX) according to your requirements. For more information, refer to → Chap. 6.2.9, "Setting the MIN/MAX fail-safe mode"
- If you switch on the pump control ( $\Delta s$  mode), the switch point shift (as described in → Chap. 6.2.5) is disabled.
- "Build-up mode" has the effect that an accurate switch point is output even if the probe rod/rope is not completely cleared of the medium (e.g. yogurt). Over time, build-up accumulates in the switching area of the probe rod/rope.

To set the pump control and/or build-up mode, proceed as follows:

1. Turn the mode switch to position 4.
2. Press the "+" key for at least two seconds to switch on the **pump control**. The green LED 5 lights up.
3. Press the "+" key again for at least two seconds to switch on **build-up mode**. Green LEDs 4 and 5 light up.  
Pressing the "+" again for at least two seconds switches off both functions. Green LEDs 4 and 5 are off.
4. After you have configured the desired setting, turn the mode switch to position 1 to return to operation.

You have now completed the settings for the pump control and the build-up mode.

6.2.7     Setting the switching delay

Mode	Key	Key	Symbol	Function/Mode	LED Signals
5	<	>	$\tau$	Switching delay	

BA299Fer024

Mode switch setting	Function	– key	+ key	Light emitting diodes (LED Signals)					
				1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
5	Switching delay	Press for <	Press for >	Off (0.3 s)	On* (1.5 s)	Off (5 s)	Off (10 s)		On/off/ flashes**

\* This is a factory setting.

\*\* Switch status signaling depends on the mounting location selected and the fail-safe mode (MIN/MAX) set. The LED flashes if a calibration has not yet been carried out.



**Note!**  
The switching delay causes the device to signal the level limit after a delay. This is particularly useful in tanks with turbulent medium surfaces caused, for example, by the filling process or an agitator. By doing so, you ensure that the filling of the tank does not end until the probe is continuously covered by the medium. If too short of a switching delay is set, this will cause problems such as the filling process restarting as soon as the medium surface settles.



**Caution!**  
If too long of a switching delay is set, this can cause the tank to overflow.

To set the switching delay, proceed as follows:

1. Turn the mode switch to position 5.
2. Press the "+" key for at least two seconds to select the next higher value. Press and hold down the "+" or "-" key to jump from value to value. The possible values are signaled by LEDs 1 to 4.
3. Set the desired value.

You have now set the switching delay and can turn the mode switch back to position 1 (operation).



6.2.8     Activating the self-test (function test)



Caution!  
Make sure that you do not accidentally activate any processes with the self-test! This could result, for example, in overflowing of the tank.

Mode	Key	Key	Symbol	Function/Mode	LED Signals
6	press together			Device self test (Proof test)	

BA299Fest025

Mode switch setting	Function	- key	+ key	Light emitting diodes (LED Signals)					
				1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
6	Self-test (Proof test)	Press both keys		On* (inactive)				Flashes (active)	On/off**

\* This is a factory setting.  
\*\* Switch status signaling depends on the mounting location selected and the fail-safe mode (MIN/MAX) set. The LED flashes if a calibration has not yet been carried out.



Note!  
The self-test simulates switching states (probe not covered, probe covered). This allows you to check whether, the connected devices are activated correctly.  
The self-test lasts approx. 20 seconds and ends automatically.

- To carry out a self-test, proceed as follows:
1. Turn the mode switch to position 6.
  2. Press the "-" and "+" keys simultaneously for at least two seconds.  
The self-test is active if the green LED 5 flashes.  
The green operation LED 1 is off.
  3. After about 20 s, the test is completed, which is signaled by operation LED 1 lighting up.
- You have now carried out the self-test and can turn the mode switch back to position 1 (operation).

6.2.9 Setting the MIN/MAX fail-safe mode

Mode	Key	Key	Symbol	Function/Mode	LED Signals
7	press for MIN	press for MAX		Minimum/ maximum failsafe	 MIN MAX

BA299Fen026

Mode switch setting	Function	– key	+ key	Light emitting diodes (LED Signals)					
				1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
7	MIN/MAX fail-safe mode	Press for MIN	Press for MAX	Off (MIN)				On * (MAX)	On/off/ flashes**

\* This is a factory setting.

\*\* Switch status signaling depends on the mounting location selected and the fail-safe mode (MIN/MAX) set. The LED flashes if a calibration has not yet been carried out.



























Note!

By selecting the fail-safe mode correctly, you ensure that the output always operates safely with quiescent current.

- **Minimum fail-safe mode (MIN):** The output switches if the switch point is undershot (probe rod/rope uncovered), a fault occurs or the line voltage fails.
- **Maximum fail-safe mode (MAX):** The output switches if the switch point is exceeded (probe rod/rope covered), a fault occurs or the line voltage fails.

- To set the MIN or MAX fail-safe mode, proceed as follows:
1. Turn the mode switch to position 7.
  2. Fail-safe mode
    - a. Press the "-" key for at least two seconds to switch on the MIN fail-safe mode. The green LED 1 starts to light up.
    - b. Press the "+" key for at least two seconds to switch on the MAX fail-safe mode. The green LED 5 starts to light up.
- You have now set the fail-safe mode and can turn the mode switch back to position 1 (operation).


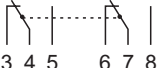




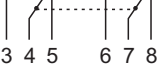




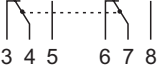




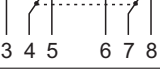








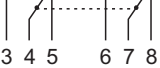



### Output signal FEI52

Safety mode	Level	Output signal	LEDs green red yellow
MAX		$L^+ \xrightarrow{I_L} 3$	  
		$1 \xrightarrow{I_R} 3$	  
MIN		$L^+ \xrightarrow{I_L} 3$	  
		$1 \xrightarrow{I_R} 3$	  
Maintenance required *		$1 \xrightarrow{I_L / I_R} 3$	  
Instrument failure		$1 \xrightarrow{I_R} 3$	  

\* Refer to chapter 9, "Troubleshooting".

BA299Fen035























### Output signal FEI54

Safety mode	Level	Output signal	LEDs green red yellow
MAX			  
			  
MIN			  
			  
Maintenance required *			  
Instrument failure			  

\* Refer to chapter 9, "Troubleshooting".

BA299Fen036









## Output signal FEI55

Safety mode	Level	Output signal	LEDs green red yellow
MAX		$\begin{matrix} + \\ 2 \end{matrix} \xrightarrow{\sim 16 \text{ mA}} 1$	  
		$\begin{matrix} + \\ 2 \end{matrix} \xrightarrow{\sim 8 \text{ mA}} 1$	  
MIN		$\begin{matrix} + \\ 2 \end{matrix} \xrightarrow{\sim 16 \text{ mA}} 1$	  
		$\begin{matrix} + \\ 2 \end{matrix} \xrightarrow{\sim 8 \text{ mA}} 1$	  
Maintenance required *		$\begin{matrix} + \\ 2 \end{matrix} \xrightarrow{8/16 \text{ mA}} 1$	 
Instrument failure		$\begin{matrix} + \\ 2 \end{matrix} \xrightarrow{< 3.6 \text{ mA}} 1$	 

BA299Fen037

\* Refer to chapter 9, "Troubleshooting".









## Output signal FEI53

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	 

BA299Fen038

\* Refer to chapter 9, "Troubleshooting".

## Output signal FEI57S

Mode	Output signal	LEDs green red
Normal operation	60...185 Hz $1 \xrightarrow{\text{dashed line}} 2$	 
Maintenance required * 	60...185 Hz $1 \xrightarrow{\text{dashed line}} 2$	 
Instrument failure 	< 20 Hz $1 \xrightarrow{\text{dashed line}} 2$	 

BA299Fen039

\* Refer to chapter 9, "Troubleshooting".

### 6.2.10 Sensor DAT (EEPROM) upload/download



Note!

- The customer-specific settings of the electronic insert (e.g. empty/full calibration, switch point shift etc.) are stored automatically in the sensor DAT (EEPROM) and in the electronic insert.
- If the electronic insert is replaced all data stored in the sensor DAT (EEPROM) can be transferred to the electronic insert (manual upload). No additional settings have to be configured.
- Changes of parameter cause an automatical update of the sensor DAT (EEPROM).
- If you want to, for example, transfer the customer-specific settings of an electronic insert to multiple sensor DAT (EEPROM), you have to carry out a manual download after installing the electronic insert.

Mode	Key	Key	Symbol	Function/Mode	LED Signals
	—	+	↓↑	Up-Download Sensor EEPROM	
8	press for down-load	press for up-load			<div>down-load</div> <div>up-load</div>

BA299Fen027

Mode switch setting	Function	– key	+ key	Light emitting diodes (LED Signals)					
				1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
8	Upload/download sensor DAT (EEPROM)	Press for download	Press for upload	Flashes (download)				Flashes (upload)	On/off/ flashes**

\*\* Switch status signaling depends on the mounting location selected and the fail-safe mode (MIN/MAX) set. The LED flashes if a calibration has not yet been carried out.

- **Upload:** An upload transfers the saved data from the sensor DAT (EEPROM) to the electronic insert. The electronic insert does not have to be configured any more, and the device is then operational.
- **Download:** A download transfers the saved data from the electronic insert to the sensor DAT (EEPROM).

To carry out a sensor upload/download, proceed as follows:

1. Turn the mode switch to position 8.
2. Press the "–" key for at least 2 seconds to carry out a download (the data from the electronic insert are copied to the sensor DAT (EEPROM)). During the download, the green LED 1 flashes.
3. Press the "+" key for at least 2 seconds to carry out an upload (the data from the sensor DAT (EEPROM) are copied to the electronic insert). During the upload, the green LED 5 flashes.

You have now transferred the data and can turn the mode switch back to position 1 (operation).

6.2.11 Restoring factory settings

Mode	Key	Key	Symbol	Function/Mode	LED Signals
1				Operation	
	press both keys for 20 s			Reset to factory settings	

BA299Fen028

Mode switch setting	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		Flashes (warning/ alarm)			On/off/ flashes**
	Restore factory setting	Press both keys for approx. 20 s		On	->	->	->	->	On/off/ flashes**

\*\* Switch status signaling depends on the mounting location selected and the fail-safe mode (MIN/MAX) set. The LED flashes if a calibration has not yet been carried out.



**Note!**  
This function allows you to restore the factory settings. This is particularly useful if the device has already been calibrated and, for example, there is a fundamental change of the medium in the tank. After restoring the factory settings, you have to repeat the calibration!

To restore the factory settings, proceed as follows:

- 1. Turn the function switch to position 1.
- 2. Press the "-" and "+" keys simultaneously for at least 20 seconds. During the time it takes to restore the factory settings, LEDs 1–5 light up consecutively.
- 3. The factory settings have been successfully restored if the green LED 1 and the yellow LED are flashing.

You have now restored the factory settings and can continue with setting the measuring range and the calibration.

6.3 Commissioning with the electronic inserts  
FEI53 or FEI57S

This chapter describes the commissioning of the Liquicap M FTI51, FTI52 with the electronic inserts FEI53 and FEI57S. These electronic inserts operate with the following firmware (FW):

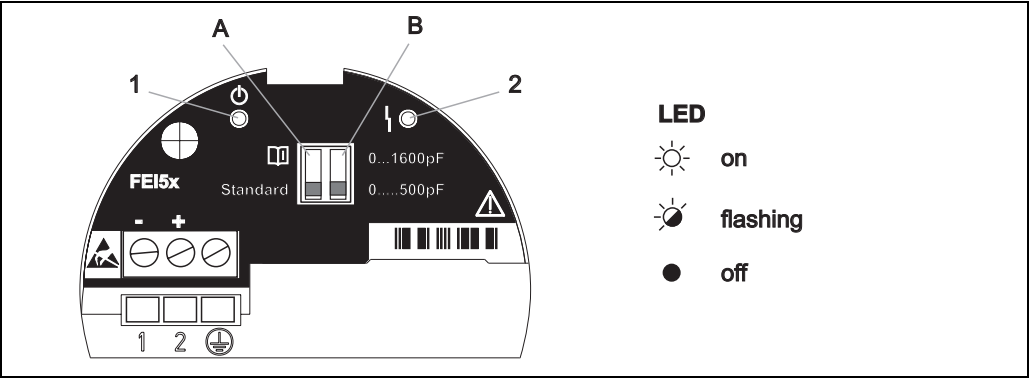
- FW electronic insert FEI53: V 01.00.00
- FW electronic insert FEI57S: V 01.00.00



**Note!**  
The measuring system is not operational until you have carried out a calibration at the switching unit.

For information on how to carry out the calibration, refer to the associated documentation of the Nivotester switching device FTCxxx.

6.3.1 Setting the alarm response if the measuring range is exceeded



L00-FTI5xxxx-07-05-xx-en-001

DIP switches	Function	Light emitting diodes (LED)	
		1 (green) ☉ Operational	2 (red) ⚡ Fault
A	Standard *: If the measuring range is exceeded, <b>no</b> alarm is output.	Flashes	Off
	☐: If the measuring range is exceeded, <b>one</b> alarm is output.	Flashes	Flashes

\* This is a factory setting.



Note!  
With this setting, you can determine the alarm response of the measuring system If the measuring range is exceeded. You can switch the alarm on or off If the measuring range is exceeded.

All other settings with regard to the alarm response have to be configured on the respective Nivotester switching device.

6.3.2 Setting the measuring range

DIP switches	Function	Light emitting diodes (LED)	
		1 (green) ☉ Operational	2 (red) ☐ Fault
B	Span: The measuring range is between 0 and 500 pF*.	Flashes	Flashes **/on ***
	Span: The measuring range is between 0 and 1600 pF.	Flashes	Flashes **/on ***

\* This is a factory setting.

\*\* The red LED flashes if there is a fault that you can correct.

\*\*\* The red LED lights up continuously (on) if the device has a fault that cannot be corrected. Refer also to Chapter 9, "Troubleshooting".



- Note!
- The selection of the measuring range (0 to 500 pF and 0 to 1600 pF) depends on the function of the probe.
  - If the probe is used as a limit switch, you can retain the factory setting of 0 to 500 pF.
  - If you used the probe for pump control (two-point control), the following recommendations apply for vertical installation:
    - Measuring range from 0 to 500 pF for probe lengths up to 1.0 m
    - Measuring range from 0 to 1600 pF for probe lengths up to 4.0 m

All other settings with regard to the alarm response have to be configured on the respective Nivotester switching device FTCxxx.

## 7 Maintenance

No special maintenance work is required for the level measuring device Liquicap M.

### External cleaning

When cleaning the exterior of the Liquicap M, always use cleaning agents that do not attack the surface of the housing or the seals.

### Seals

The process seals of the pick-up must be replaced periodically, particularly in the case of molded seals (aseptic version). The period between changes depends on the frequency of cleaning cycles, the cleaning temperature and the medium temperature.

### Repair

According to the Endress+Hauser repair concept, the measuring devices have a modular design and repairs can be carried out by the customer.

Spare parts are grouped logically into kits along with the respective replacement instructions. The "Spare parts" section lists all spare part kits, with their order numbers, that you can order from Endress+Hauser for repair of the Liquicap M. For more information about service and spare parts, contact Endress+Hauser Service.

### Repair of Ex-certified devices

The following information also has to be taken into account for repairs of Ex-certified devices:

- Ex-certified devices may be repaired only by experienced, skilled staff or by Endress+Hauser Service.
- Applicable standards, federal/national Ex standards and the Safety Instructions (XA) and certificates must be observed.
- Only genuine spare parts from Endress+Hauser may be used.
- When ordering spare parts, please note the device designation on the nameplate. Parts can only be replaced by the same parts.
- Repairs must be carried out according to the instructions. Following the repair, the individual testing specified for the device must be carried out.
- Certified devices can only be converted into other certified devices by Endress+Hauser Service.
- Every conversion and repair made to the device must be documented.

### Replacement

After replacing a Liquicap M or the electronic insert, the calibration values must be transferred to the replacement device.

=> If the probe is replaced, the calibration values in the electronic insert are transferred (manual download) to the sensor DAT (EEPROM).

=> If the electronic insert is replaced, the calibration values of the sensor DAT (EEPROM) are transferred (manual upload) to the electronics.

You can put the device back into operation without recalibrating it. (For more information, refer to chapter 6.2.10, Sensor DAT (EEPROM) upload/download.)



## 8 Accessories

### 8.1 Protective cover

For F13 and F17 housing  
Order number: TSP17090

### 8.2 Shortening set

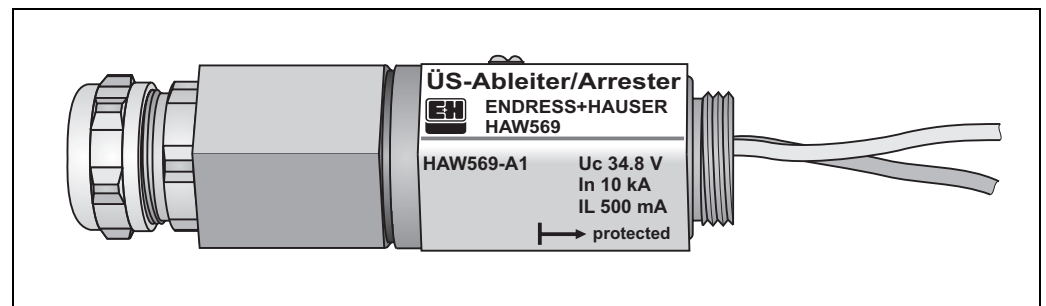
For Liquicap M FMI52  
Order number: 942901-0001

### 8.3 Overvoltage protection HAW569

Order number:

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

Surge arrester for limiting overvoltage in signal lines and components. The HAW562Z module can be used in hazardous areas.



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### 8.4 Weld-in adapter for universal adapter

- Order number: 52006262  
Diameter D: 85 mm  
Height H: 12 mm
- Order number: 214880-0002  
Diameter D: 65 mm  
Height H: 8 mm

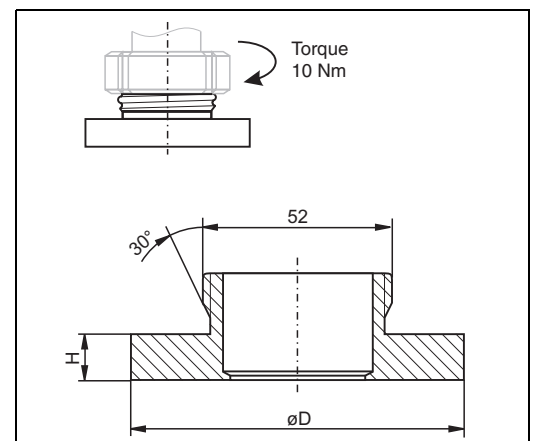
With process connection UPJ

Material: 1.4435/SS316L

Replacement seal:

Silicone O-ring (Set of 5 seals—FDA-listed)

Order number: 52023572



BA299Fen030

## 8.5 Weld-in adapter G $\frac{3}{4}$

Order number: 52018765

max. 25 bar / max. 150 °C

For flush-mounted installation of a Liquicap M with process connection GOJ

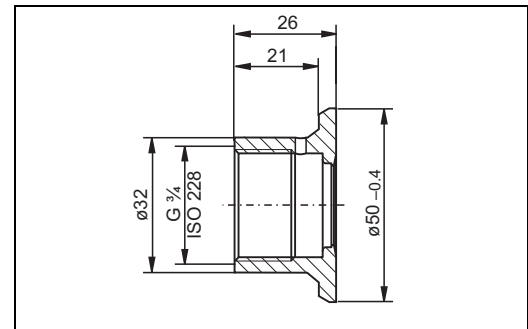
Material: corrosion-resistant steel  
1.4435 (AISI 316L)

Weight: 0.13 kg

Replacement seal:

Silicone O-ring (Set of 5 seals—FDA-listed)

Order number: 52021717



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## 8.6 Weld-in adapter G 1

Order number: 52001051

max. 25 bar / max. 150 °C

with 3.1.B material certificate: 52011896

For flush-mounted installation of a Liquicap M with process connection GWJ

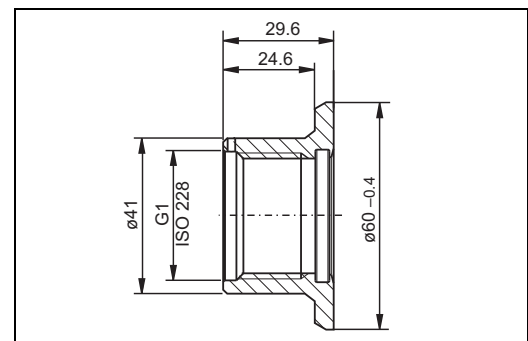
Material: corrosion-resistant steel  
1.4435 (AISI 316L)

Weight: 0.19 kg

Replacement seal:

Silicone O-ring (Set of 5 seals - FDA-listed)

Order number: 52014472



L00-FTL5xxxx-06-05-xx-xx-020

## 9 Troubleshooting

### 9.1 Fault diagnostics on the electronics insert



Note!

In the event of faults during commissioning or operation of the device, you have the ability to carry out fault diagnostics on the electronic insert. This function is supported by the electronic inserts FEI52, FEI54, FEI55 (see fault tables 1 and 2 below).

The electronic inserts FEI53 and FEI57S signal two types of faults:

- Correctable faults: The red LED flashes.
- Non-correctable faults: The red LED is lit continuously.

For additional information on fault detection and fault elimination, refer to fault table 2 below.

#### 9.1.1 Activating fault diagnostics



Note!

The diagnostics provide information about the operating status of the device. The results of the diagnostics are displayed by LEDs 1, 2, 4 and 5. If the diagnostics detect multiple faults, these are shown according to their priority. A serious fault (e.g. priority 3) is always displayed before a less serious fault (e.g. priority 5).

To activate the fault diagnostics, proceed as follows:

1. Set the function switch to position 1 (operation).
2. Press the "-" key.
3. The "Fault table 1" lists possible causes of faults and information for eliminating them.

LEDs for diagnostics						Fault table 1 (FEI52, FEI54, FEI55)		Priority
1 green	2 green	3 red	4 green	5 green	6 yellow	Cause	Remedy	
						No fault.		
On						Internal fault.	The device is defective.	1
	On					The calibration point is too close to the measuring range limit.	Reduce the switch point or select a new installation location.	2
On	On					No calibration has yet been carried out.	Carry out empty and/or full calibration.	3
			On			The DC PNP output is overloaded.*	Reduce the connected load.	4
On			On			The capacitance change from "Probe not covered" to "Probe covered" is too small.	The capacitance change between the uncovered and covered probe must be greater than 2 pF.	5
	On		On			Sensor DAT (EEPROM) data are invalid.	Carry out download from the electronic insert.	6
On	On		On			Probe is not detected.**	This probe type is not compatible. Use a Liquicap M probe.	7
				On		The measured temperature is outside the permitted temperature range.	The device may be operated in the specified temperature range only.	8

\* Applies to electronic insert FEI52 only.

\*\* No connection to the sensor DAT (EEPROM) could be established.

Fault table 2 (FEI53, FEI57S)	
Cause	Remedy
The device does not switch.	Check the connection and the supply voltage.
Alarm LED flashes.	The ambient temperature of the electronics is outside the permitted range or the connection to the probe is interrupted.
Water in the housing.	Dry the housing and ensure that the cable gland is pulled tight and the housing cover is tightly sealed.

## 9.2 Spare parts



Note!

- You can order spare parts directly from your E+H service organization by quoting the order number (see below).
- The corresponding spare part number is on every spare part. Installation instructions can be found in the form supplied with the spare parts.
- Before ordering, please note that all ordered spare parts must correspond with the indications on your nameplate. Otherwise, the indications on the nameplate will no longer correspond with the instrument version.

### Electronic insert

- FEI52 electronic insert  
71025819
- FEI53 electronic insert  
71025820
- FEI54 electronic insert  
71025814
- FEI55 electronic insert  
71025815
- FEI57S electronic insert  
71025816

### Cover for housing

- Cover for aluminum housing F13: gray with sealing ring  
52002698
- Cover for stainless steel housing F15: with sealing ring  
52027000
- Cover for stainless steel housing F15: with clasp and sealing ring  
52028268
- Cover for polyester housing F16, flat: gray with sealing ring  
52025606
- Cover for aluminum housing F17, flat: with sealing ring  
52002699
- Cover for aluminum housing T13, flat: gray with sealing ring/electronics compartment  
52006903
- Cover for aluminum housing T13, flat: gray with sealing ring/connection compartment  
52007103

### Seal set for stainless steel housing

- Seal set for stainless steel housing F15: with 5 sealing rings  
52028179

## 9.3 Return

You must take the following measures before returning a measuring device to Endress+Hauser, for example for repair:

- Remove all traces of the medium. Pay particular attention to crevices and grooves for seals into which the medium can penetrate. This is particularly important if the medium is hazardous to health, e.g. combustible, toxic, caustic, carcinogenic etc.
- Always enclose a fully completed "Declaration of Contamination" with the device (a master copy of the "Declaration of Contamination" can be found at the end of these Operating Instructions). Only then can Endress+Hauser check or repair a returned device.
- If necessary, enclose special handling instructions when returning the device, e.g. a safety data sheet in accordance with EN 91/155/EEC.

In addition, specify the following:

- The chemical and physical properties of the medium
- A description of the application
- A description of the fault that occurred
- Operating time of the device

## 9.4 Disposal

At disposal, ensure that materials are properly separated and the device components are reused.

## 9.5 Firmware history

- FW electronic insert FEI52: V 01.00.00
- FW electronic insert FEI54: V 01.00.00
- FW electronic insert FEI55: V 01.00.00
- FW electronic insert FEI53: V 01.00.00
- FW electronic insert FEI57S: V 01.00.00

## 9.6 Contact addresses at Endress+Hauser

On the back page of these Operating Instructions, you can find an Internet address for Endress+Hauser. The web site provides contact addresses that you can use if you have any questions.

## 10 Technical data

### 10.1 Input

#### 10.1.1 Measured variable

Level limit detection of change in capacitance between probe rod and container wall or ground tube, depending on the level of a liquid.

#### 10.1.2 Measuring range (valid for all FEI5x)

- Measuring frequency:  
500 kHz
- Span:  
 $\Delta C = 0$  to 1600 pF
- Final capacitance:  
 $C_E = \text{max. } 1600 \text{ pF}$
- Adjustable initial capacitance:  
 $C_A = 0$  to 500 pF (range 1 = factory setting)  
 $C_A = 0$  to 1600 pF (range 2)

#### 10.1.3 Input signal

Probe covered  $\Rightarrow$  high capacitance  
Probe not covered  $\Rightarrow$  low capacitance

### 10.2 Output

#### 10.2.1 Galvanic isolation

FEI52:  
Between rod probe and power supply  
FEI54:  
Between rod probe, power supply and load  
FEI53, FEI55, FEI57S:  
See connected switching unit

#### 10.2.2 Switch behavior

Binary or  $\Delta s$  operation (pump control)

#### 10.2.3 Switch-on behavior

When the power supply is switched on, the switching status of the outputs corresponds to the signal on alarm.  
After max. 3 s the correct switching status is achieved.

### 10.2.4 Fail-safe mode

Minimum/maximum quiescent current safety can be switched at the electronic insert (for FEI53 and FEI57S only at Nivotester FTCxxx)

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

MAX = maximum safety: The output switches safety-oriented when the probe is covered (signal on alarm). For use with overfill protection for example

### 10.2.5 Switching delay

At electronic inserts FEI52, FEI54, FEI55, the switching delay can be set in steps between 0.3 s and 10 s. At electronic inserts FEI53 and FEI57S, these settings are made at the additional Nivotester FTCxxx switching unit.

## 10.3 Performance characteristics

### 10.3.1 Reference operating conditions

- Temperature: +20 °C ±5 °C
- Pressure: 1013 mbar abs. ±20 mbar
- Humidity: 65 % ±20%
- Medium: Tap water (conductivity ≥ 180 µS/cm)

### 10.3.2 Switch point

Reproducibility: 0.1 % (related to the probe length)

### 10.3.3 Influence of ambient temperature

#### Electronic insert

< 0.06 % / 10 K related to the full scale value

#### Separate housing

Change in capacitance of connecting cable 0.015 pF/m per K

## 10.4 Operating conditions: Environment

### 10.4.1 Ambient temperature range

- Ambient temperature of the transmitter: –50 °C to +70 °C (observe derating; see Page 73 ff.)
- A weather protection cover should be used when operating outdoors in strong sunlight. For additional information on the protective cover, refer to the chapter on "Accessories".

### 10.4.2 Storage temperature

–50 °C to +85 °C

### 10.4.3 Climate class

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

### 10.4.4 Degree of protection

In accordance with EN60529

	IP66	IP67	IP68	NEMA4X
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
Aluminum housing T13 with gas-tight process seal and separate connection compartment (EEx d)	X	–	X	X
Separate housing	X		X	X

### 10.4.5 Vibration resistance

DIN EN 60068–2–64/IEC 68–2–64: 20 to 2000 Hz, 1 (m/s<sup>2</sup>)<sup>2</sup>/Hz

### 10.4.6 Cleaning

#### Housing:

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

#### Probe:

Depending on the application, build-up (contamination and soiling) can form on the probe rod. A high degree of material build-up can affect the measurement result. If the medium tends to create a high degree of build-up, 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!

### 10.4.7 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.

### 10.4.8 Shock resistance

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



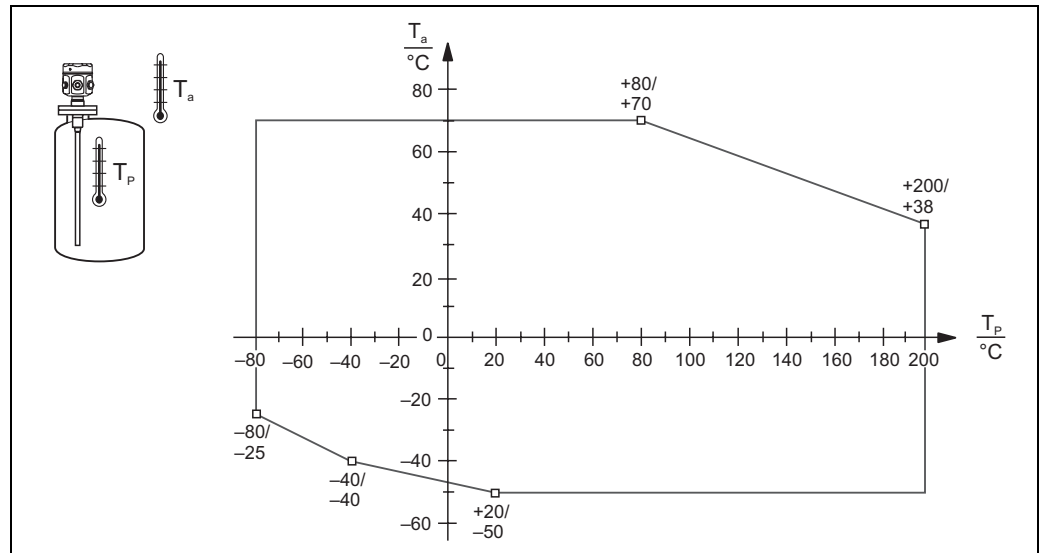
## 10.5 Operating conditions: Process

### 10.5.1 Process temperature range

#### With compact housing

The following diagram applies to:

- Rod and rope version
- Insulation: PTFE, PFA, FEP



$T_a$ : Ambient temperature

$T_P$ : Process temperature

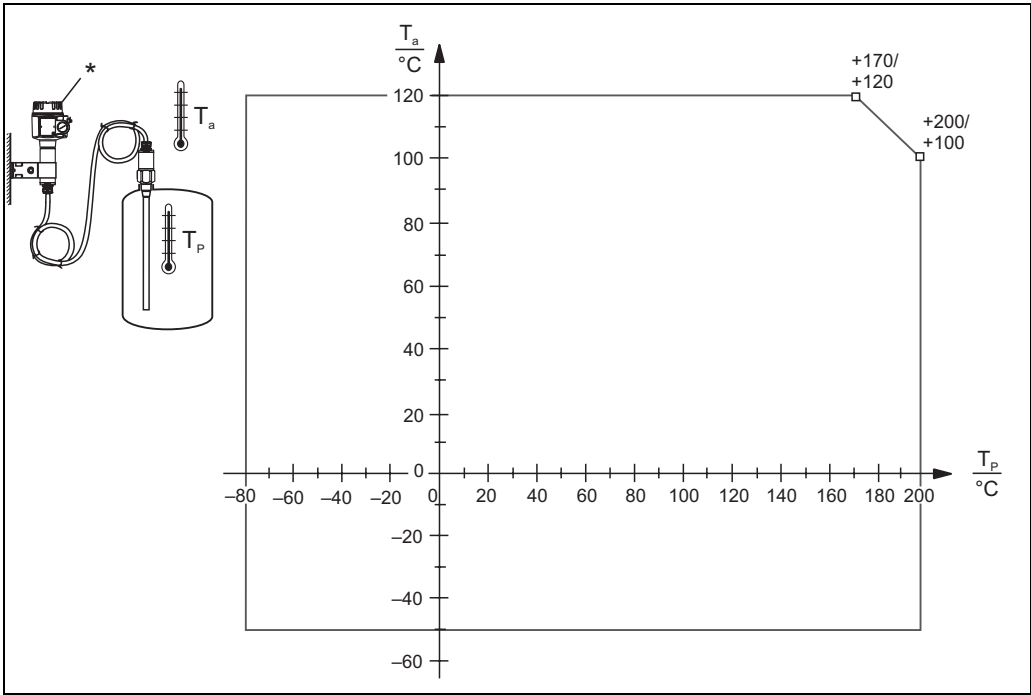


Note!

Only relevant for FTI51!

If additional option B is selected (free from paint-wetting impairment substances), the minimum ambient temperature  $T_a$  is  $-40^{\circ}\text{C}$ .

With separate housing



$T_a$ : Ambient temperature  
 $T_p$ : Process temperature  
\* The temperature at the separate housing is  $\leq 70\text{ }^{\circ}\text{C}$



Note!  
The maximum connection length between the probe and the separate housing is 6 m (L4). The desired length must be quoted when ordering a Liquicap M with a separate housing.  
If the connecting cable is to be shortened or guided through a wall, it must be disconnected from the process connection. For more information, refer to chapter 3.10.2, "Shortening the connecting cable".

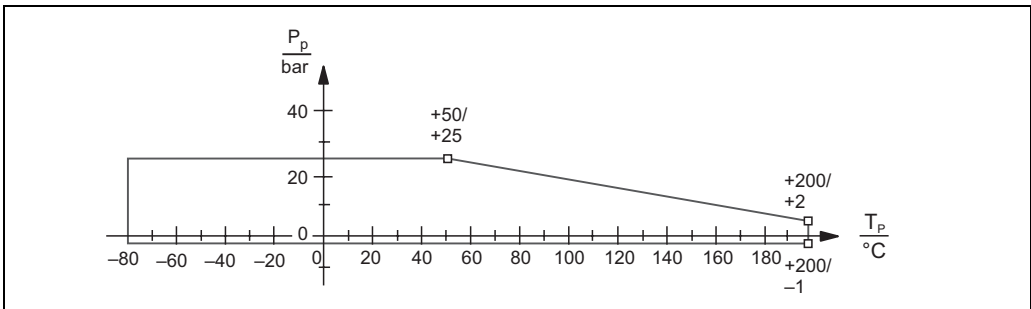
10.5.2 Pressure and temperature derating

For process connections 1/2"; 3/4" and 1"

Rod insulation: PTFE  
Rope insulation: FEP, PFA



Note!  
Refer also to the "Process connections" subchapter in the "Installation" chapter.



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



Note!

In the case of flange process connections, the maximum pressure is limited by the nominal pressure of the flange.

### For process connections 1½"

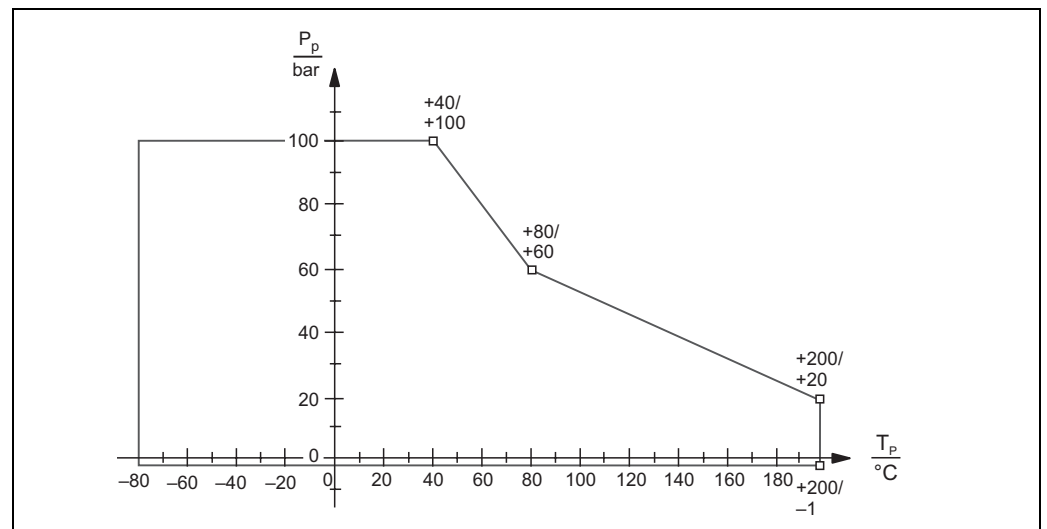
Rod insulation: PTFE, PFA

Rope insulation: FEP, PFA



Note!

Refer also to the "Process connections" subchapter in the "Installation" chapter.

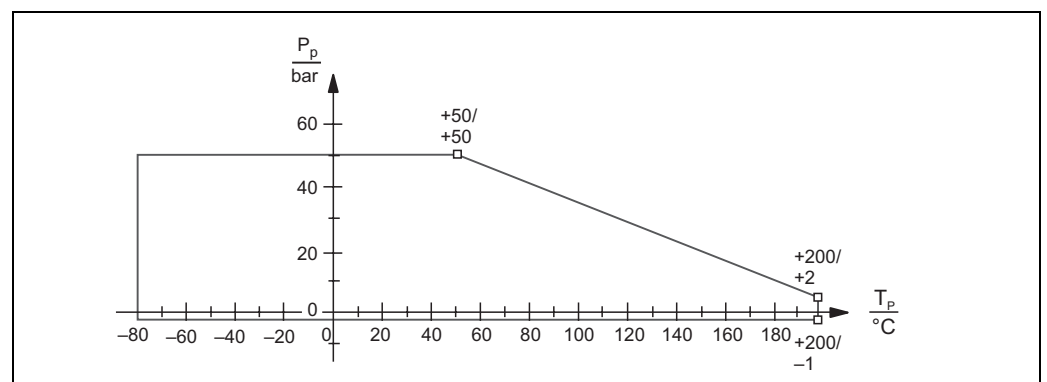


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$P_p$ : Process pressure

$T_p$ : Process temperature

### With fully insulated shielding and active build-up compensation with 16 mm rod:



L00-FMI5xxxx-05-05-xx-xx-012

$P_p$ : Process pressure

$T_p$ : Process temperature



Note!

In the case of flange process connections, the maximum pressure is limited by the nominal pressure of the flange.

### 10.5.3 Process pressure limits

**Probe ø10 mm (including insulation)**

–1 to 25 bar (note dependencies: process temperature and process connection on Page 73)

**Probe ø16 mm / ø22 mm (including insulation)**

–1 to 100 bar (note dependencies: process temperature and process connection on Page 73)

### 10.5.4 State of aggregation

Medium liquid

## 10.6 Other standards and guidelines

**EN 60529**

Degrees of protection by housing (IP code)

**EN 61010**

Protection measures for electrical equipment for measurement, control, regulation and laboratory procedures

**EN 61326**

Interference emission (Class B equipment), interference immunity (Appendix A – Industrial).

**NAMUR**

Association for Standards for Control and Regulation in the Chemical Industry

## 10.7 Documentation



Note!

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

### 10.7.1 Technical Information

- Liquicap M FTI51, FTI52  
TI417F/00/en

### 10.7.2 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  
XA327F/00/a3
- Liquicap M FTI51, FTI52  
ATEX II 1/2 G (EEx d (ia) IIC/IIB T3 to T6)  
XA328F/00/a3

**Overfill protection DIBt (WHG)**

- Liquicap M FTI51, FTI52  
ZE265F/00/de

**Functional safety (SIL2)**

- Liquicap M FTI51, FTI52  
Under development

**Control Drawings (for FM and CSA)**

- Liquicap M FTI51, FTI52  
ZD211F/00/en (in development)

**10.7.3 Patents**

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

- DE 203 00 901 U1
- DE 103 22 279,  
WO 2004 102 133,  
US 2005 003 9528
- DE 203 13 695,  
WO 2005 025 015

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