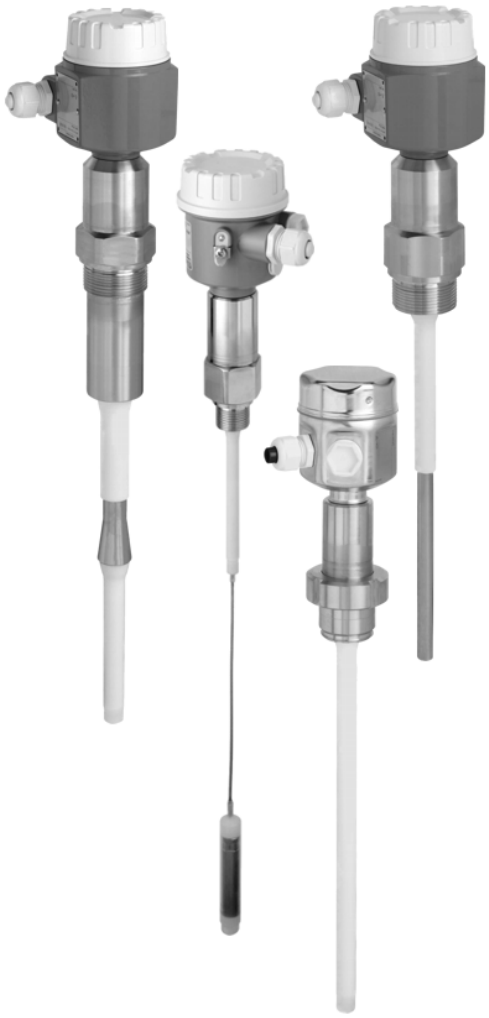
Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Liquicap M FTI51, FTI52

Level limit switch
Universal capacitive limit switch for liquids



Application

The Liquicap M FTI5x is a compact transmitter for level limit detection. It is preferably used for the following measuring tasks:

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

Thanks to its robust and tried-and-tested construction (self-sealing cone), the probe can be used both in vacuums and in overpressure up to 100 bar. The sealing and insulation materials used allow operating temperatures of -80 °C to +200 °C in the medium container.

Your benefits

- Active build-up compensation for high-viscosity media
- Easy and fast commissioning as calibration takes place at the press of a button
- Universal application thanks to wide range of certificates and approvals
- Material in contact with the process made of corrosion-resistant material and FDA-listed materials for wetted parts
- Two-stage overvoltage protection against discharge from the container (gas discharger + protective diodes)
- Short measured value reaction time
- No need for recalibration after replacing electronics
- Automatic monitoring of electronics

TI417F/00/en

Endress+Hauser

People for Process Automation

Table of contents

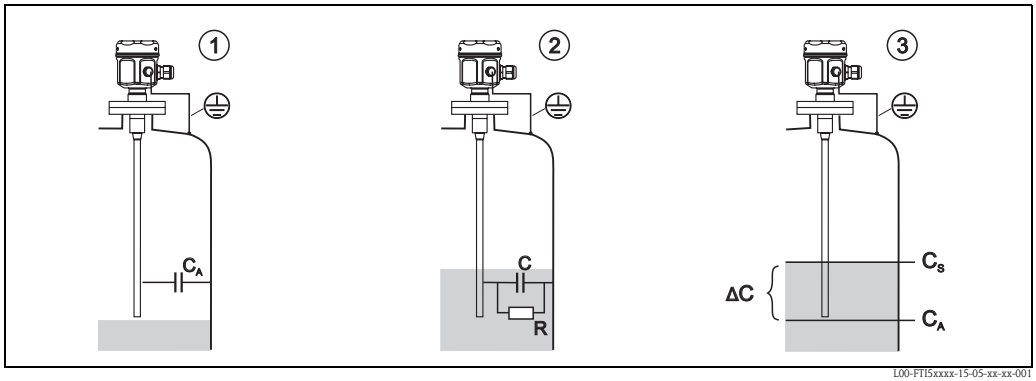
Function and system design

Measuring principle

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

The limit switch switches when the capacitance C_S specified during calibration is reached.
Furthermore, the system also prevents the effect of medium build-up or condensate near the process connection for probes with an inactive length. A probe with active build-up compensation compensates influences resulting from build-up on the probe.

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



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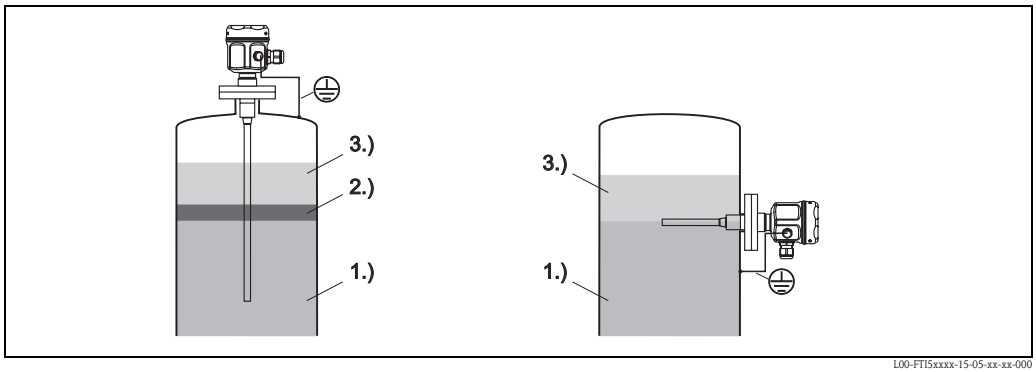
R: Conductivity of liquid
C: Capacitance of liquid
C_A: Initial capacitance (probe not covered)
C_S: Switching capacitance
ΔC: Change in capacitance

Function

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

Interface detection



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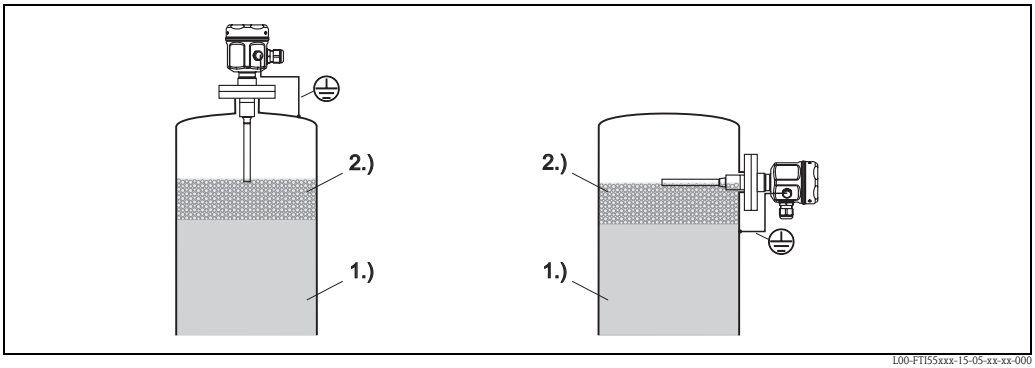
1.) Water, for example (the medium must be conductive ≥ 100 µS/cm)
2.) Emulsion
3.) Oil, for example (nonconductive medium < 1 µS/cm)

A certain and definite switch point is ensured even if the emulsion layer is of varying thickness.

Foam detection

Foam detection for conductive liquids.



1.) Liquid
2.) Foam

Note!
Preferably use partially insulated probes.

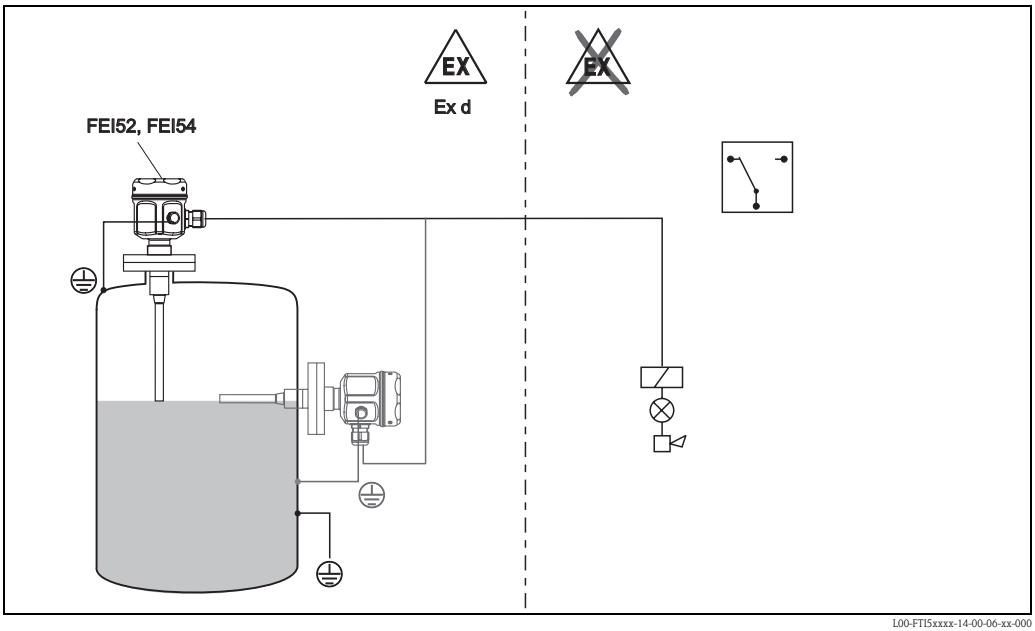
Measuring system

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

Level limit switch

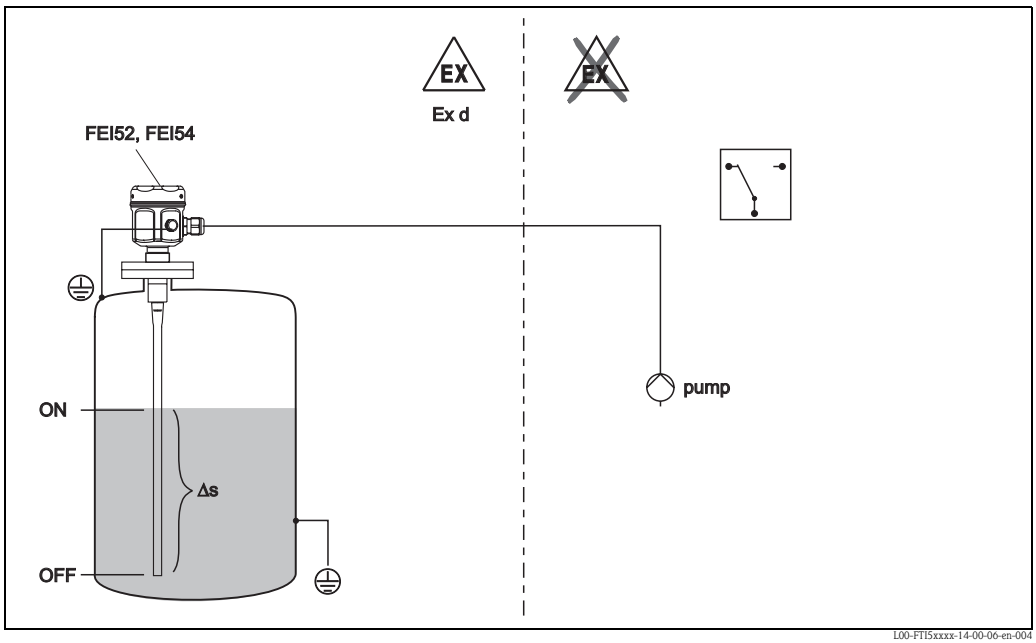
The compact measuring system consists of:

- the capacitive Liquicap M FTI51 or FTI52 level limit probe
- an FEI52, FEI54 electronic insert



Pump control (Δs)

Note!
Only possible with a fully insulated probe.



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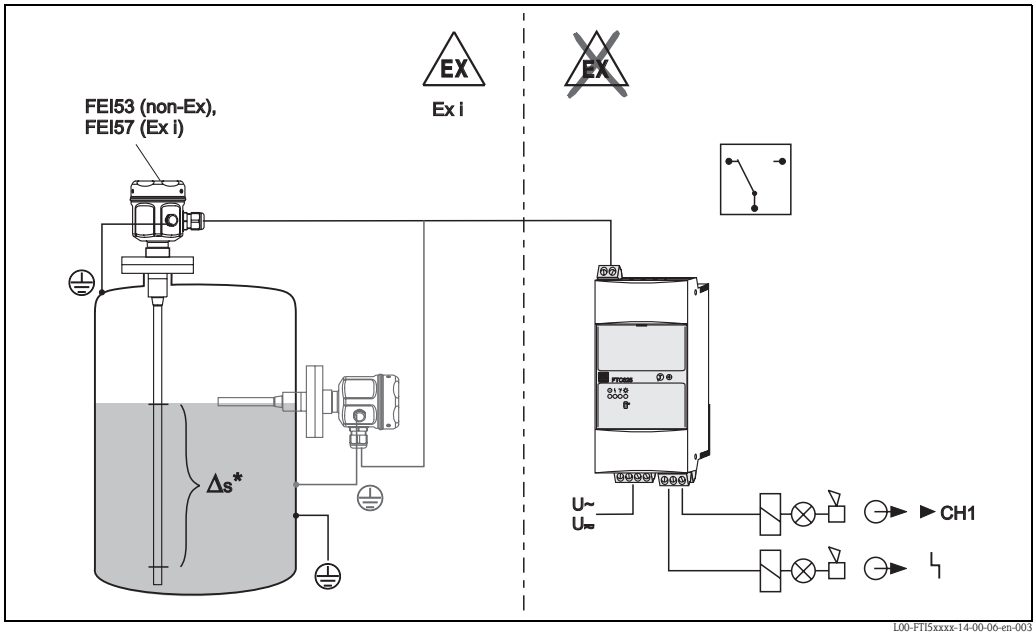
The level limit switch can also be used to control a pump, for example, where the switch-on and switch-off point can be freely defined.

Level limit sensor

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

The complete measuring system consists of:

- the capacitive Liquicap M FTI51 or FTI52 level limit probe
- an FEI53, FEI57S electronic insert
- a transmitter power supply unit (e.g. FTC325, FTC625 (from SW V1.4), FTC470Z, FTC471Z)



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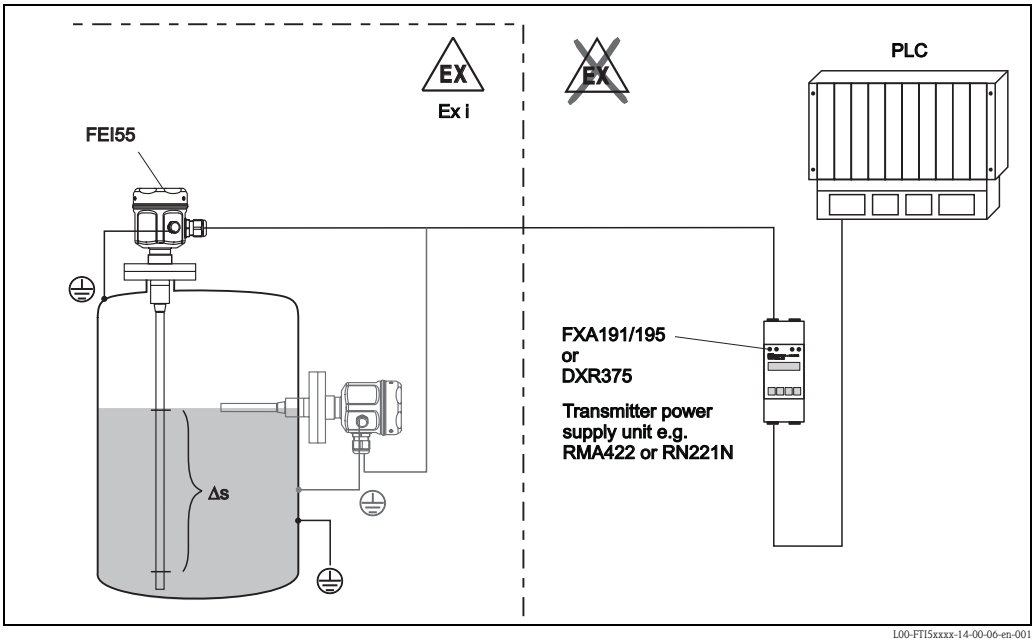
** only possible with FEI53*

Level limit sensor 8/16 mA

The complete measuring system consists of:

- the capacitive Liquicap M FTI51 or FTI52 level probe
- the FEI55 electronic insert
- a transmitter power supply unit (e.g. RN221N, RNS221, RMA421, RMA422)



Electronic versions

FEI52
3-wire direct current version:

- Switch the load via the transistor (PNP) and separate supply voltage connection.
- Level limit adjustment directly at the level limit probe.

FEI53
3-wire direct current version with 3 to 12 V signal output:

- For separate switching unit Nivotester FTC325 3-WIRE.
- Level limit adjustment directly at the switching unit.

FEI54
Universal current version with relay output:

- Switch the loads via 2 floating changeover contacts (DPDT).
- Level limit adjustment directly at the level limit probe.

FEI55
Signal transmission 8/16 mA on two-wire cabling:

- For separate switching unit (e.g. RN221N, RNS221, RMA421, RMA422).
- Level limit adjustment directly at the level limit probe.

FEI57S
PFM signal transmission (current pulses are superimposed on the supply current):

- For separate switching unit with PFM signal transmission e.g. FTC325 PFM, FTC625 PFM and FTC47*Z
- Self-test from the switching unit without changing levels.
- Level limit adjustment directly at the switching unit.
- Cyclical checking from the switching unit.

Note!
For additional information see Page 23 ff.

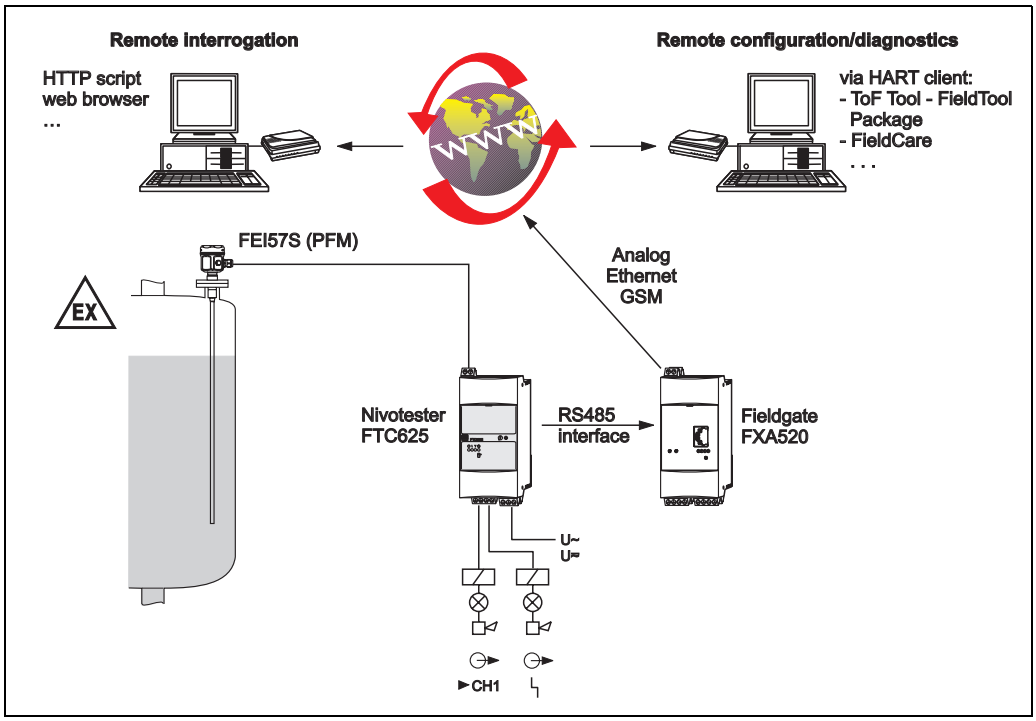
System integration via Fieldgate

Vendor managed inventory

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

Remote maintenance of measuring systems

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



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Operating conditions: Installation

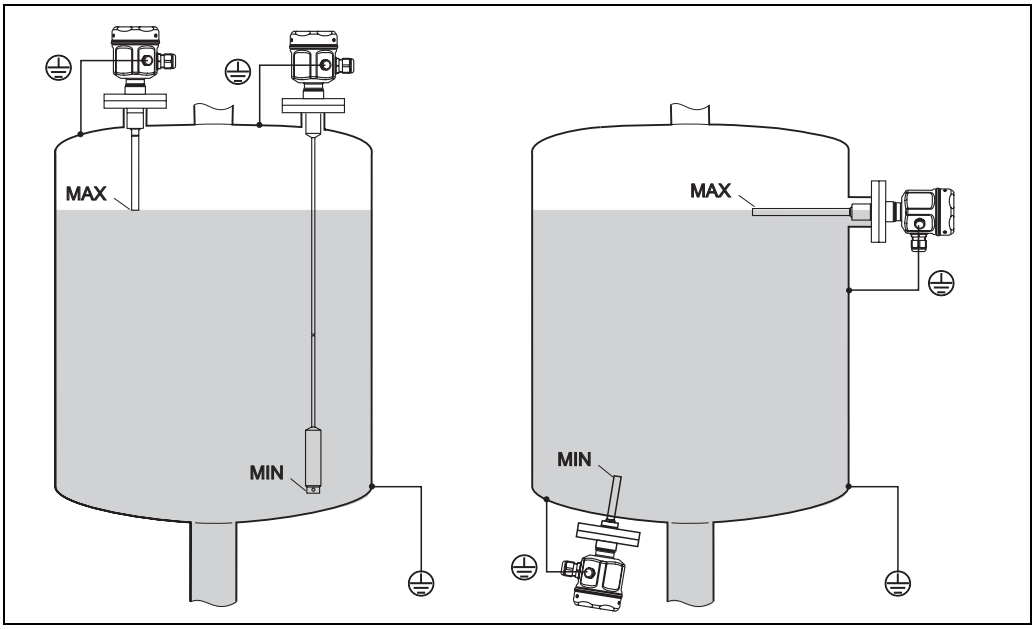
Installation instructions

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

Note!
The probe may not come into contact with the container wall! Do not install probes in the area of the filling curtain!

Note!
When using in agitating tanks, make sure you install at a safe distance from the agitator.
Rod probes with a ground tube should be used in the event of severe lateral load.

For containers that conduct electricity e.g. steel tanks



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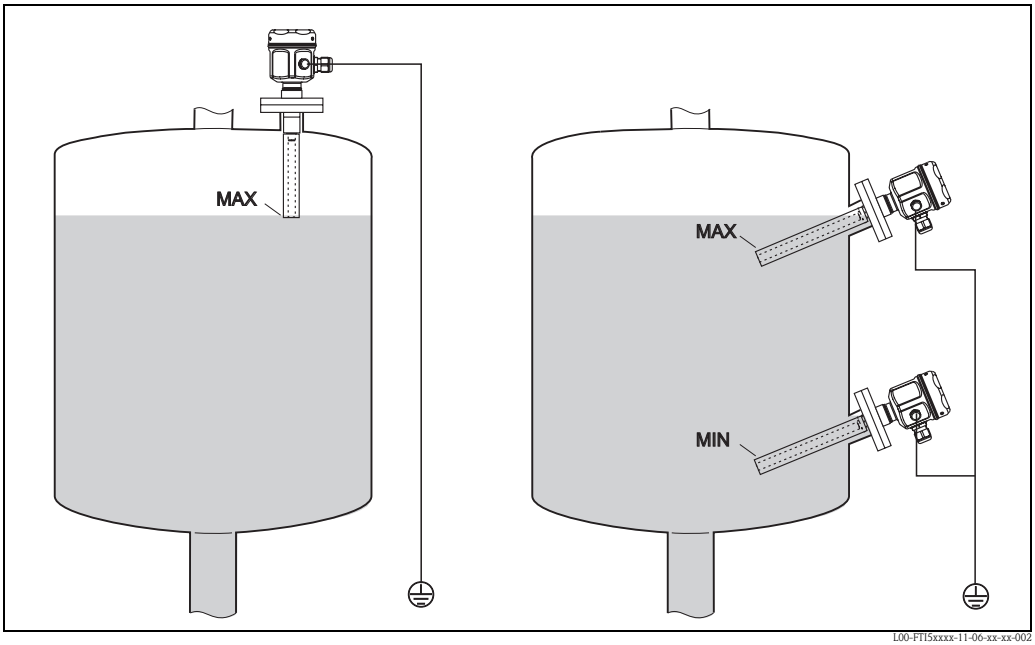
For containers that do not conduct electricity e.g. plastic tanks



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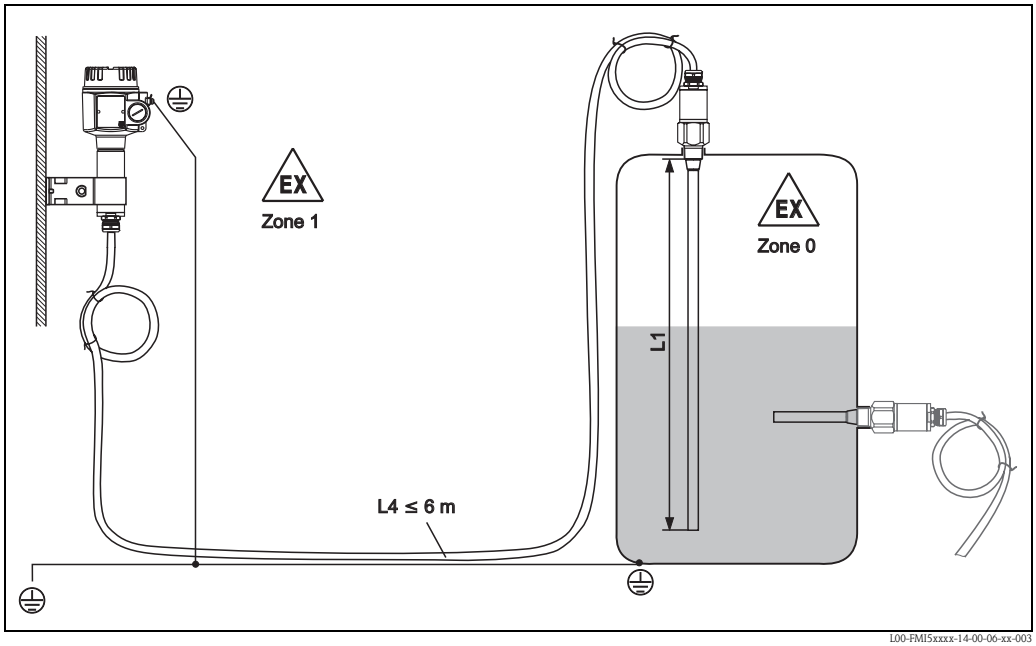
Probes with ground tube and grounding

With separate housing

For information on ordering, please refer also to the "Ordering information" => "Probe design" on Page 33 ff.

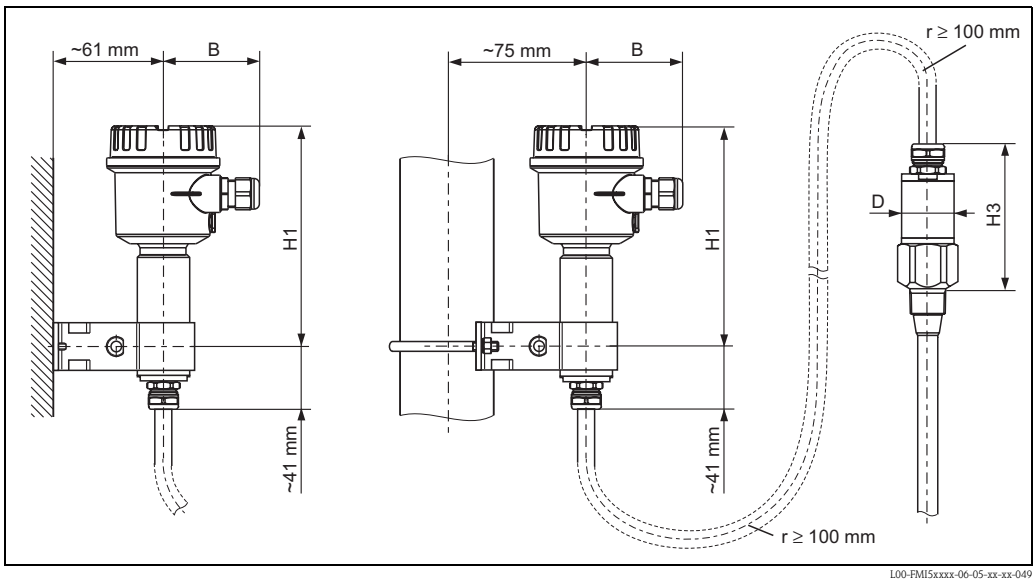


Rod length L1 max. 4 m
Rope length L1 max. 10 m

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. See "Documentation" => "Operating Instructions" on Page 42.

Extension heights

Housing side: wall mounting | Housing side: pipe mounting | Sensor side



Note!
The cable has a bending radius of r ≥ 100 mm which may not be undershot!

	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

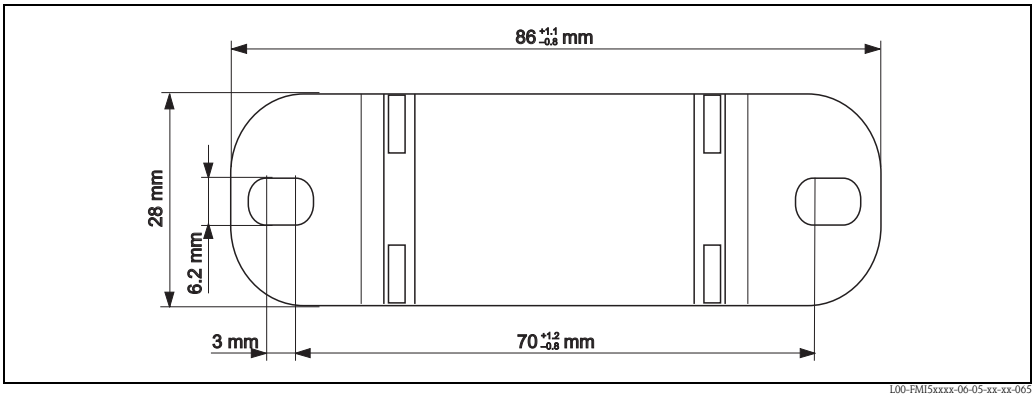
	bar	**H3** (mm)
G ½, G ¾, G 1, NPT ½, NPT ¾, NPT 1	25	103
Tri-Clamp 1, 1½	16	122

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

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

Note!
Connecting cable: ø10.5 mm
Outer jacket: silicone, mechanical resistance

Wall holder unit



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.

Operating conditions: Environment

Ambient temperature range

- Ambient temperature of the transmitter: -50...+70 °C (observe derating; see Page 12 ff.)
- A weather protection cover should be used when operating outdoors in strong sunlight. For further information on the protective cover see Page 40.

Storage temperature

-50...+85 °C

Climate class

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

Degree of protection

As per 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

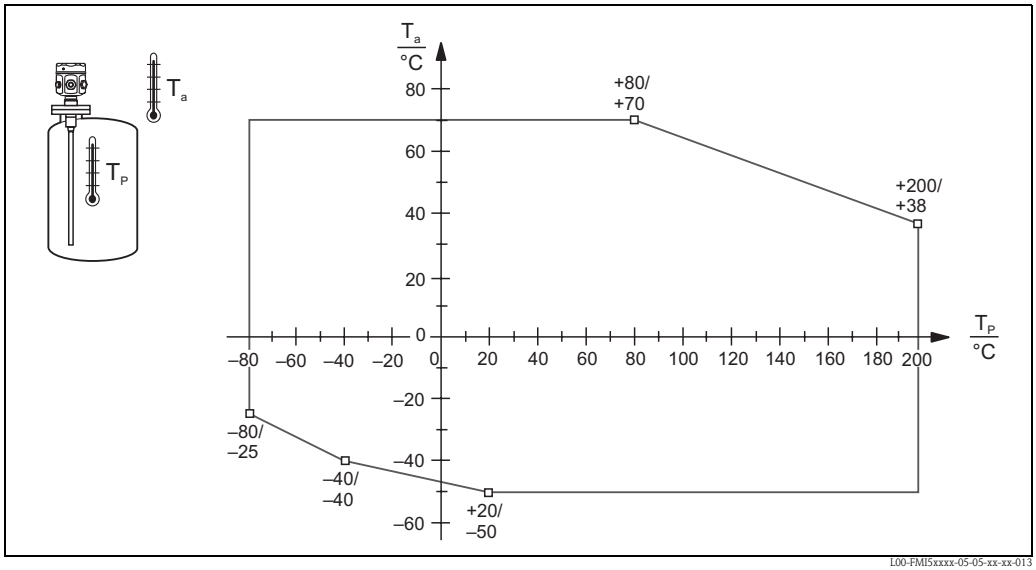
Vibration resistance	DIN EN 60068-2-64/IEC 68-2-64: 20 to 2000 Hz, 1 $(m/s^2)^2/Hz$
Cleaning	**Housing**: When cleaning, make sure that the cleaning agent used does not attack or corrode the housing surface or seals. **Probe**: Depending on the application, build-up (contamination and soiling) can form 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!
Electromagnetic compatibility (EMV)	■ Interference emission to EN 61326, Electrical Equipment Class B Interference immunity to EN 61326, Annex A (Industrial) and NAMUR Recommendation NE 21 (EMC) ■ A usual commercial instrument cable can be used.
Shock resistance	DIN EN 60068-2-27/IEC 68-2-27: 30g acceleration

Operating conditions: Process

Process temperature range

With compact housing

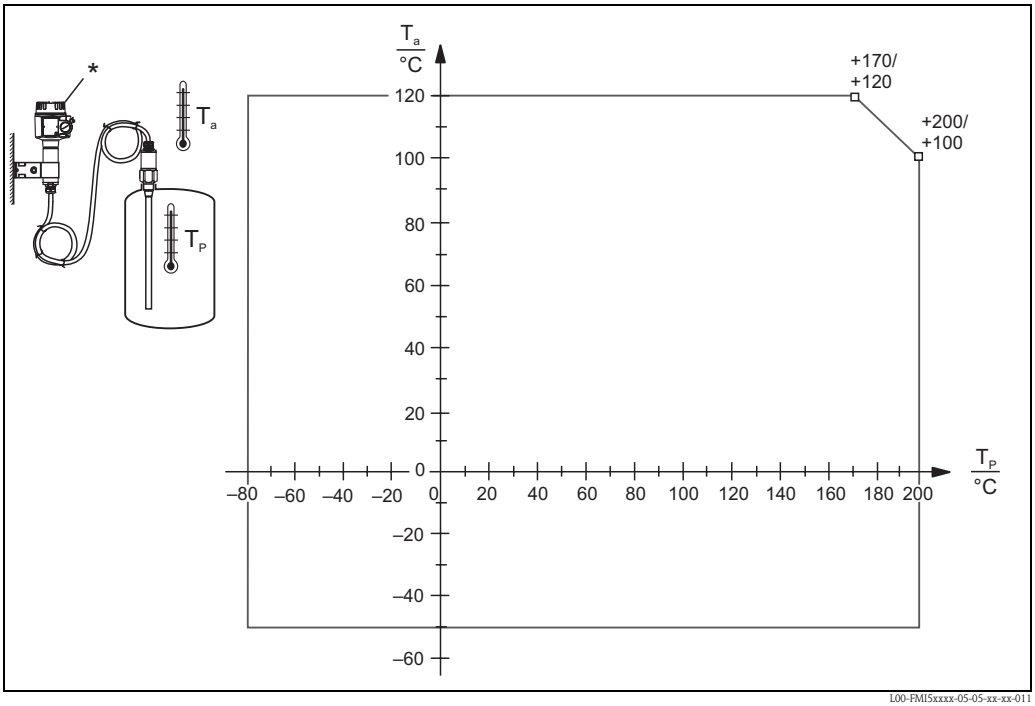
The following diagram applies to:
- Rod and rope version
- Insulation: PTFE, PFA, FEP



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 °C.

With separate housing



T_a: Ambient temperature
T_P: Process temperature
** temperature at the separate housing ≤ 70 °C*

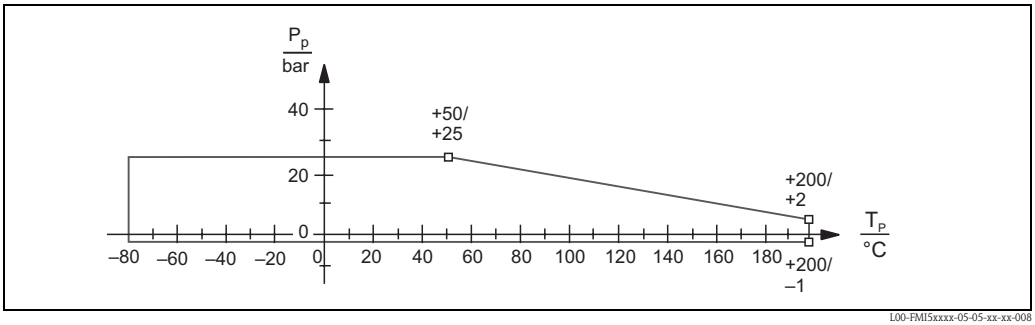
Note!
The maximum connection length between the probe and the separate housing is 6 m (L4). The desired length must be quoted when ordering a Liquicap M with a separate housing.
If the connecting cable is to be shortened or guided through a wall, it has to be separated from the process connection. See "Documentation" => "Operating Instructions" on Page 42.

Pressure and temperature derating

For process connections ½"; ¾" and 1"

Rod insulation: PTFE
Rope insulation: FEP, PFA

Note!
See also "Process connections" on Page 17 ff.



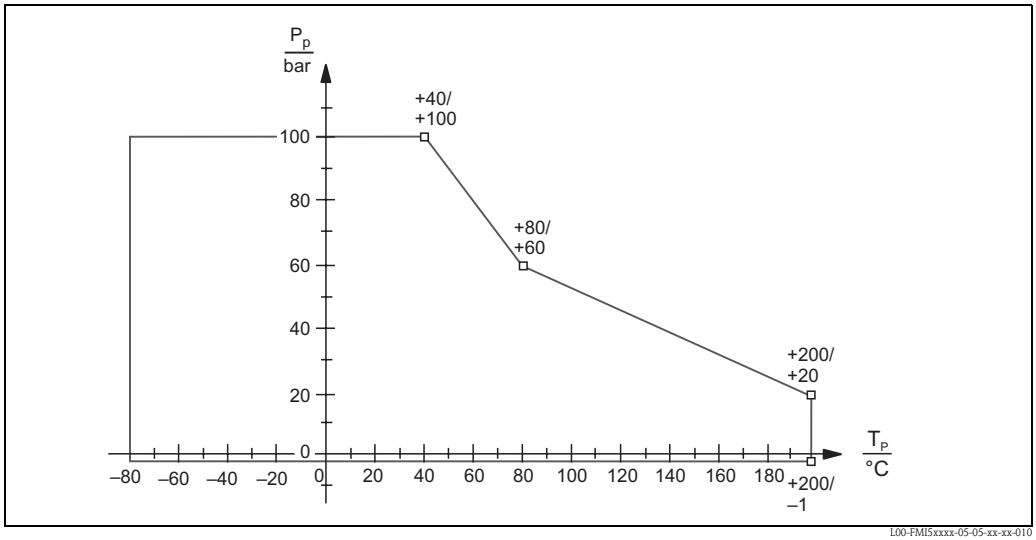
P_p: Process pressure
T_p: Process temperature

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

For process connections 1½"

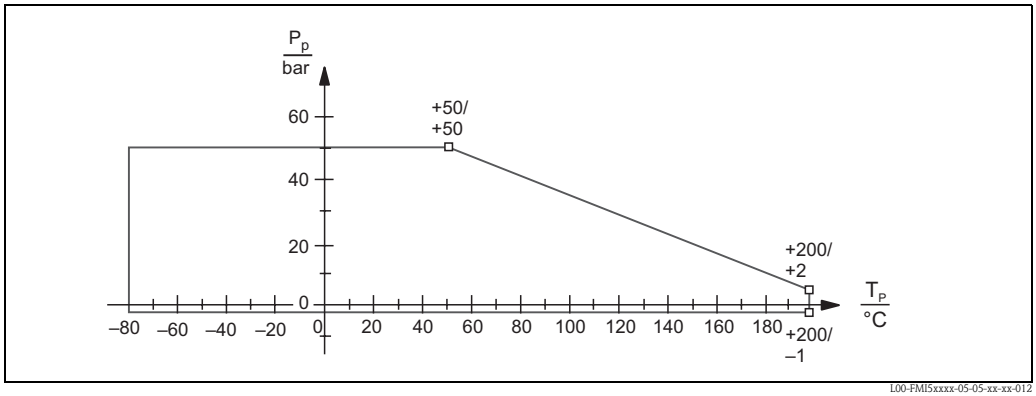
Rod insulation: PTFE, PFA
Rope insulation: FEP, PFA

Note!
See also "Process connections" on Page 17 ff.



P_p: Process pressure
T_p: Process temperature

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



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.

Process pressure limits

Probe ø10 mm (including insulation)

-1...25 bar (observe dependencies: process temperature and process connection from Page 12 and Page 17 ff.)

Probe ø16 mm/ø22 mm (including insulation)

-1...100 bar (observe dependencies: process temperature and process connection from Page 12 and Page 17 ff.)

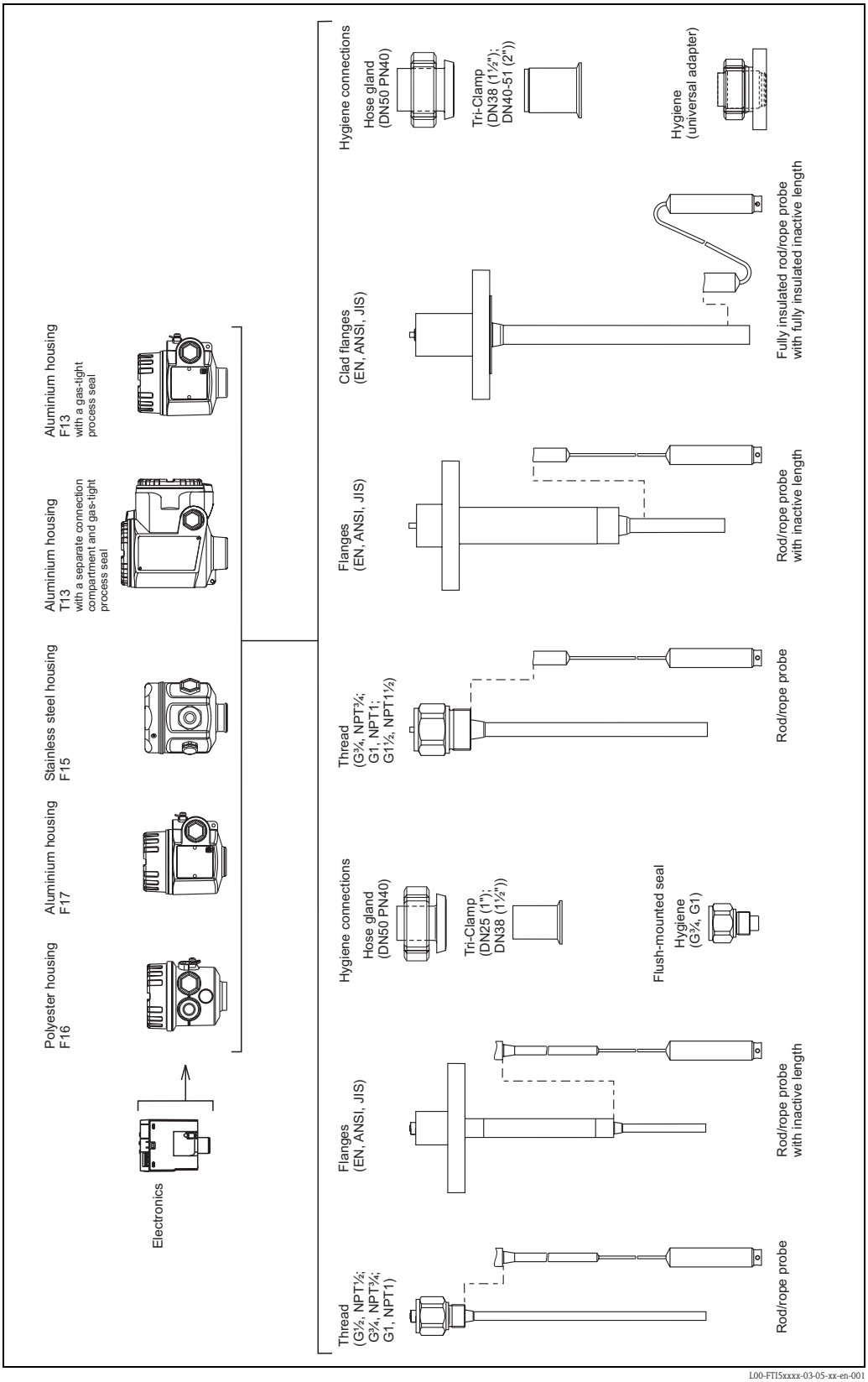
State of aggregation

Medium liquid

Mechanical construction

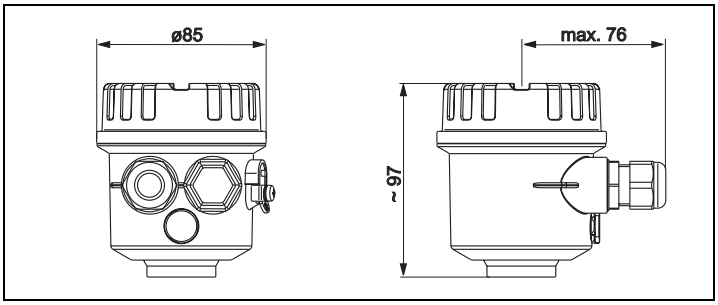
Note!
All dimensions in mm.

Overview



Housing

Polyester housing F16



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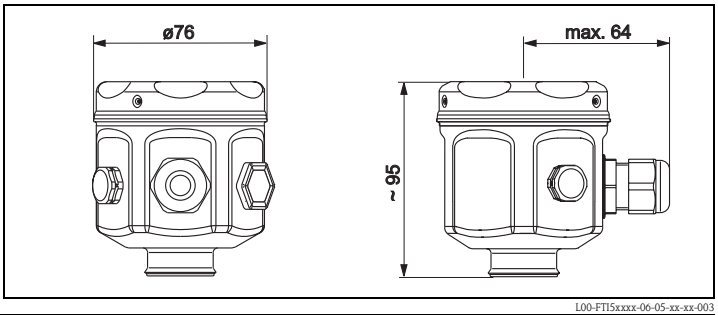
Stainless steel housing F15



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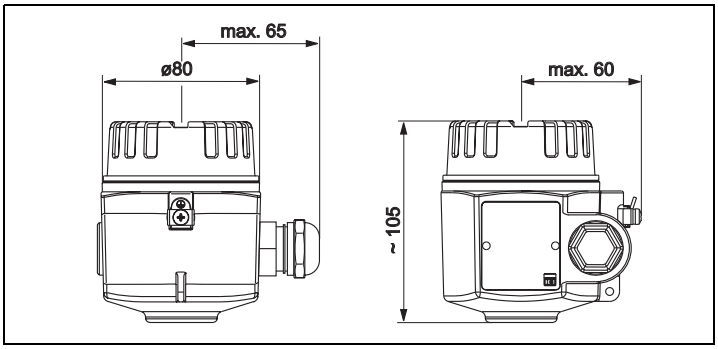
Aluminum housing F17



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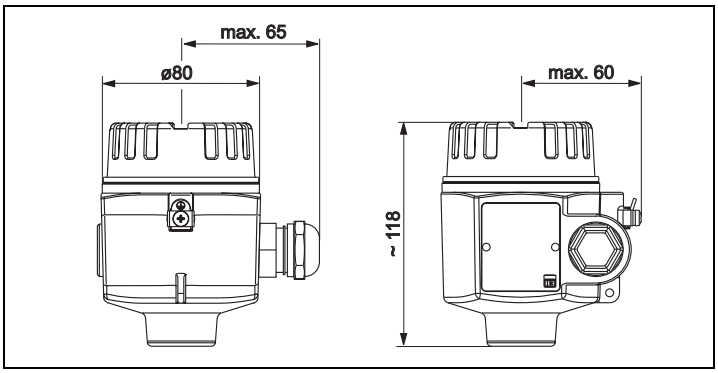
Aluminum housing F13
with gas-tight process seal



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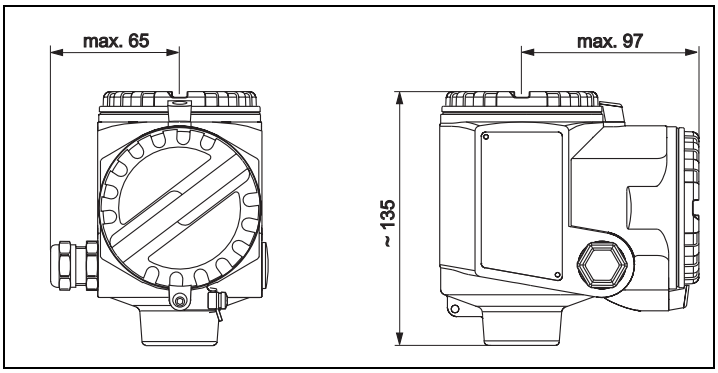
Aluminum housing T13
With separate connection compartment and gas-tight process seal



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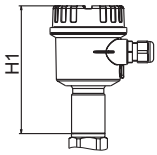
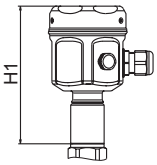
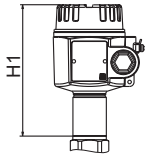
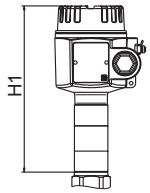
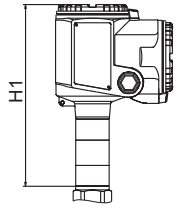
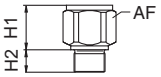
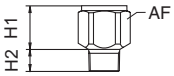
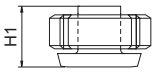
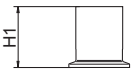
Housing extension heights with adapter

	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
FTI51, FTI52					
H1	144	142	152	194	202

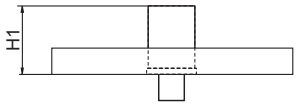
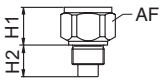
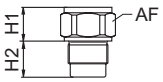
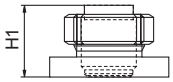
* Housing with gas-tight process seal

Process connections

	Thread G		Thread NPT		Threaded pipe joint	Tri-Clamp	
	 L00-FMI5xxxx-06-05-xx-en-007		 L00-FMI5xxxx-06-05-xx-en-008		 L00-FMI5xxxx-06-05-xx-xx-040	 L00-FMI5xxxx-06-05-xx-xx-041	
	(DIN ISO228/I)		(ANSI B 1.20.1)		(DIN11851)	(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
Rod probes ∅22, rope probes				
For pressures up to	50 bar	50 bar	–	–
Version / order code	G 1½ / GGJ	NPT 1½/ 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	-	-	-

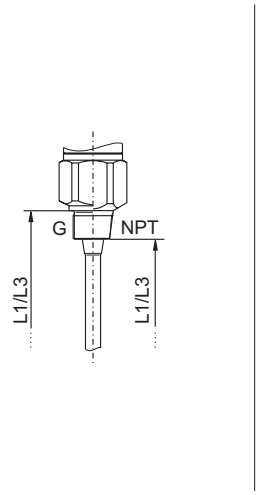
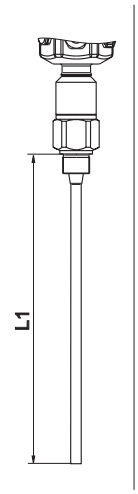
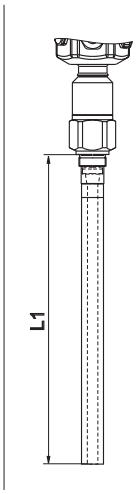
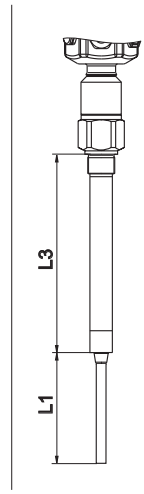
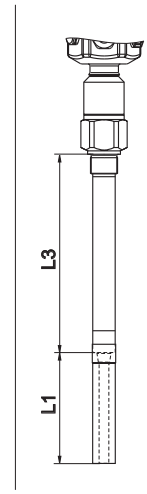
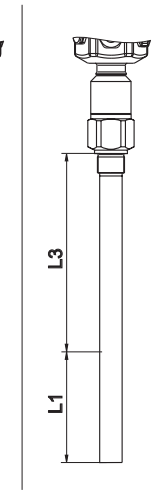
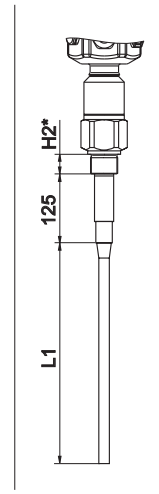
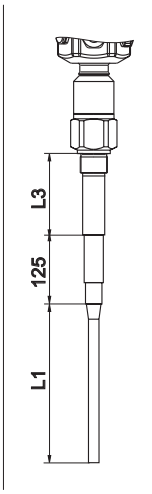
	Flanges	Hygiene connection	Hygiene connection	Hygiene connection
	 L00-FMI5xxxx-06-05-xx-xx-042	 L00-FMI5xxxx-06-05-xx-en-009	 L00-FMI5xxxx-06-05-xx-en-010	 L00-FMI5xxxx-06-05-xx-xx-043
	(EN1092-1) (ANSI B 16.5) (JIS B2220)	With flush-mounted seal	With flush-mounted seal	Adapter 44 mm with flush-mounted seal
Rod probes ø10, rope probes				
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*	-
Rod probes ø16, rope probes				
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"
Rod probes ø22, rope probes				
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!

1. Fully insulated rod probes FTI51

Note!
- The active rod probe is always fully insulated (dimension L1).
- Total length of probe from sealing surface: L = L1 + L3 (+ 125 mm with active build-up compensation + H2*)
- Thickness of insulation for probe rod ø 10 mm = 1 mm; 16 mm = 2 mm; 22 mm = 2 mm

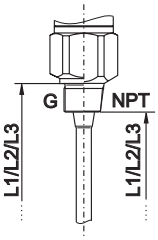
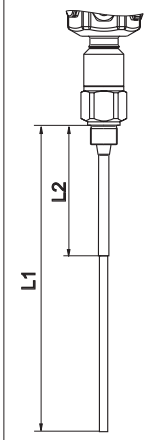
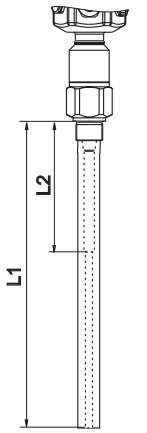
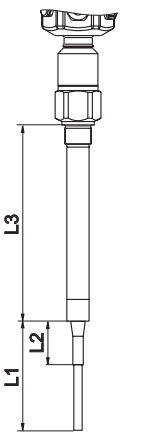
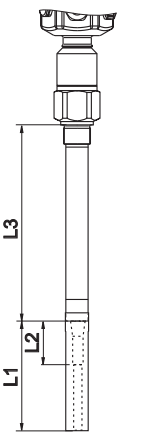
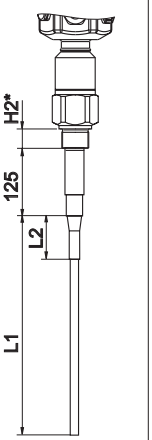
	Rod probe	Rod probe with ground tube	Rod probe with inactive length	Rod probe with inactive length and ground tube	Rod probe with fully insulated inactive length	Rod probe with active build-up compensation	Rod probe with active build-up compensation and inactive length
							
Total length (L)	100 to 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 connections with G½, G¾, G1, G1½ thread.) Information on dimension H2 is provided on Page 17 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

2. Partially insulated rod probes FTI51
For mm exact switch point in conductive liquids

Note!
- Total length of probe from sealing surface: L = L1 + L3 (+ 125 mm with active build-up compensation + H2*)

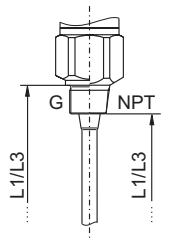
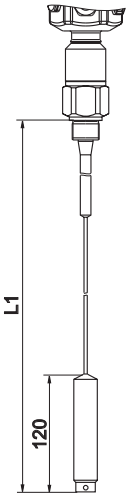
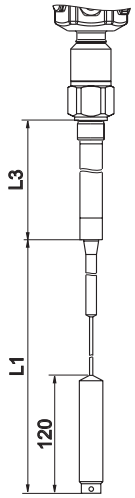
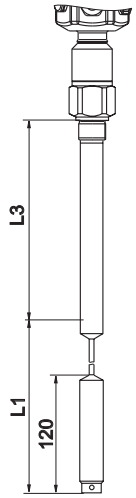
	Partially insulated rod probe	Partially insulated rod probe with ground tube	Partially insulated Rod probe with inactive length	Partially insulated Rod probe with inactive length and ground tube	Partially insulated Rod probe with active build-up compensation	Partially insulated Rod probe with inactive length and active build-up compensation
						
	L00-FMI5xxxx-06-05-xx-xx-063					L00-FMI5xxxx-06-05-xx-xx-062
Total length (L)	100 to 4000	100 to 4000	100 to 6000	100 to 6000	100 to 4000	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 connections with G½, G¾, G1, G1½ thread.) Information on dimension H2 is provided on Page 17 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

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**
 L00-FMI5xxxx-06-05-xx-xx-061			 L00-FMI5xxxx-06-05-xx-xx-036
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

Technical data (probe)

Capacitance values of probe

- Basic capacitance: approx. 18 pF

Additional capacitance

- Mount the probe with a minimum distance of 50 mm from a conductive container wall:
  Probe rod: approx. 1.3 pF/100 mm in air
  Probe rope: approx. 1.0 pF/100 mm in air
- Fully insulated probe rod in water:
  Approx. 38 pF/100 mm (16 mm rod)
  Approx. 45 pF/100 mm (10 mm rod)
  Approx. 50 pF/100 mm (22 mm rod)
- Insulated probe rope in water: approx. 19 pF/100 mm
- Rod probe with ground tube:
  Insulated probe rod: in air approx. 6.4 pF/100 mm
  Insulated probe rod: in water approx. 38 pF/100 mm (16 mm rod)
  Insulated probe rod: in water approx. 45 pF/100 mm (10 mm rod)

Material

Housing

- Aluminum housing F17, F13, T13: GD-Al Si 10 Mg, DIN 1725, with plastic coating (blue/gray)
- Polyester housing F16: PBT-FR fiberglass reinforced polyester (blue/gray)
- Stainless steel housing F15: corrosion-resistant steel 316L (14435), uninsulated

Housing cover and seals

- Aluminum housing F17, F13, T13: EN-AC-AlSi10Mg, plastic-coated
  Cover seal: EPDM
- Polyester housing F16: cover made of PBT-FR or with cover with sight glass made of PA12
  Cover seal: EPDM
- Stainless steel housing F15: AISI 316L
  Cover seal: silicone

Process connection seal

- Sealing ring for process connection G ½, G ¾, G 1, G 1½:
  Elastomer fiber, asbestos-free, resistant to lubricants, solvents, steam, weak acids and alkalis;
  To 300 °C and to 100 bar

Probe material

- Probe rod, ground tube, process connection, inactive length, tensioning weight for rope probe: 1.4435 (316L)
- Probe rope: 1.4401 (AISI 316)
- Probe insulation: PFA or PTFE (in conformity with FDA)
- Rope insulation: PFA or FEP (in conformity with FDA)

Weight

- With F15, F16, F17 or F13 housing approx. 4.0 kg
  + Flange weight
  + Probe rod 0.5 kg/m (with ∅ 10 mm probe rod) or
  + Probe rod 1.1 kg/m (with ∅ 16 mm probe rod) or
  + Probe rope 0.04 kg/m (with rope probes)
- With T13 housing approx. 4.5 kg
  + Flange weight
  + Probe rod 0.5 kg/m (with ∅ 10 mm probe rod) or
  + Probe rod 1.1 kg/m (with ∅ 16 mm probe rod) or
  + Probe rope 0.04 kg/m (with rope probes)

Input

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.

Measuring range (valid for all FEI5x)

- Measuring frequency:
  500 kHz
- Span:
  ΔC = 0 to 1600 pF
- Final capacitance:
  C_E = max. 1600 pF
- Adjustable initial capacitance:
  C_A = 0 to 500 pF (range 1 = factory setting)
  C_A = 0 to 1600 pF (range 2)

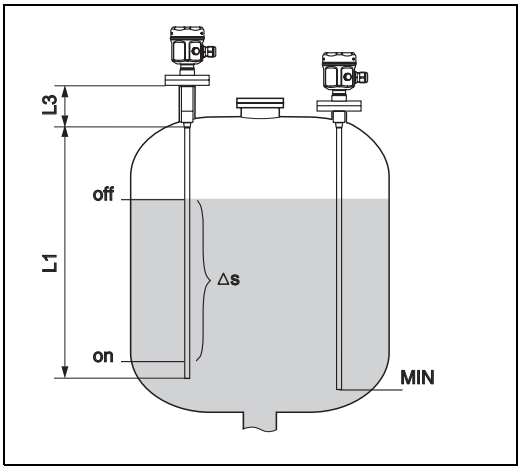
Input signal

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

Measuring condition

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 (ΔS 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 1600pF/380pF per m = 4 m total length.
  See also Page 22 ("Technical data (probe)")
- The minimum change in capacitance for level limit detection must be ≥ 5 pF.



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

Output

Galvanic isolation

FEI52:
Between rod probe and power supply

FEI54:
Between rod probe, power supply and load

FEI53, FEI55, FEI57S:
See connected switching unit

Switch behavior

Binary or Δs operation (pump control)

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.

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

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.

FEI52 electronic insert (DC PNP)

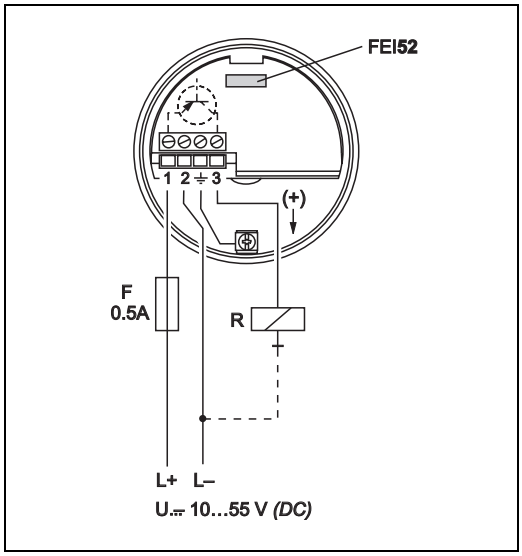
Power supply

DC voltage: 10…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

Electrical connection

Three-wire DC connection

Preferably used with programmable logic controllers (PLC),
DI modules as per EN 61131-2.
Positive signal at switch output of the electronics (PNP).



L00-FTI5xxxx-04-05-xx-xx-007

Output signal

Safety mode	Level	Output signal	LEDs green	LEDs red	LEDs yellow
MAX		L+ 1 I_L + 3	☼	●	☼
		1 I_R 3	◕	●	●
MIN		L+ 1 I_L + 3	☼	●	☼
		1 I_R 3	◕	●	●
Maintenance required *		1 I_L / I_R 3	◕	●	☼
Instrument failure		1 I_R 3	●	☼	●

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

☼ lit
◕ flashes
● unlit

L00-FTI5xxxx-04-05-xx-en-007 L00-FTL5xxxx-07-05-xx-xx-000

Signal on alarm

Output signal on power failure or in the event of device failure: I_R < 100 µA

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 µA (with transistor blocked)
- Capacitive load max. 0.5 µF at 55 V, max. 1.0 µF at 24 V
- Residual voltage < 3 V (for transistor switched through)

FEI53 electronic insert (3-wire)

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

Electrical connection

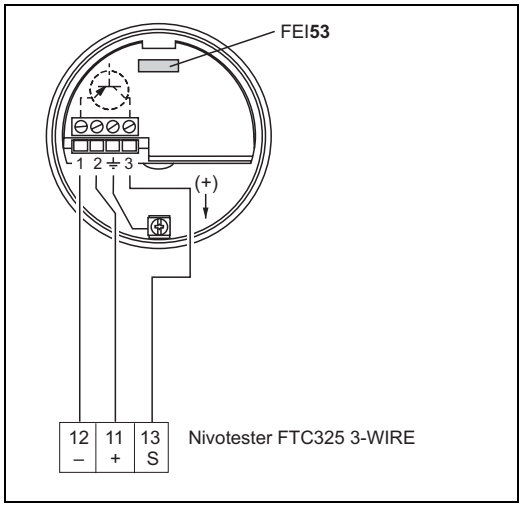
Three-wire DC connection

3...12 V signal

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

Switchover of minimum (MIN) and maximum (MAX) safety in Nivotester FTC325 3-WIRE.

Level limit adjustment directly at the Nivotester.



L00-FTI5xxxx-04-05-xx-xx-003

Output signal

Mode	Output signal	LEDs green	LEDs 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	☼	☼

☼ lit
☼ flashes
● unlit

L00-FTI5xxxx-04-05-xx-en-009 L00-FTL5xxxx-07-05-xx-xx-000

Signal on alarm

< 2.7 V

Connectable load

- Floating relay contacts in the connected switching unit Nivotester FTC325 3-WIRE
- For contact load see the Technical Data of the switching unit

FEI54 electronic insert (AC/DC with relay output)

Power supply

Alternating voltage 19…253 V, 50/60 Hz or DC voltage: 19…55 V
Power consumption: max. 1.5 W
Reverse polarity protection: yes
Separation voltage: 3.7 kV
FEI54 overvoltage protection: overvoltage category III

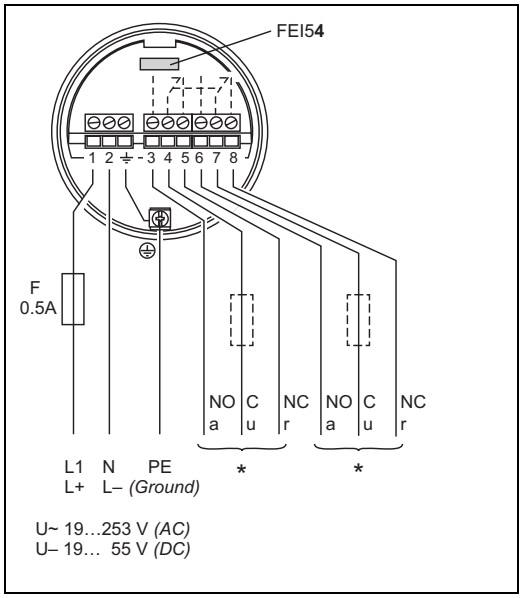
Electrical connection

Universal current connection with relay output (DPDT)

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

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

* See below "Connectable load"



L00-FTI5xxxx-04-05-xx-xx-004

Output signal

Safety mode	Level	Output signal	LEDs green	red	yellow
MAX		3 4 5 6 7 8	☀	●	☼
		3 4 5 6 7 8	☀	●	●
MIN		3 4 5 6 7 8	☀	●	☼
		3 4 5 6 7 8	☀	●	●
Maintenance required *			☀	☀	
Instrument failure		3 4 5 6 7 8	☀	☀	

L00-FTI5xxxx-04-05-xx-en-008

relay energized
relay de-energized
☼ lit
☀ flashes
● unlit

L00-FTL5xxxx-07-05-xx-xx-001

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 φ = 1, P~ max. 750 VA at cos φ > 0.7
- I- max. 6 A (EEx d 4 A) to 30 V, I- max. 0.2 A to 125 V
- The following applies when connecting a functional low-voltage circuit with double isolation as per IEC 1010: Sum of voltages of relay output and power supply max. 300 V

FEI55 electronic insert (8/16 mA)

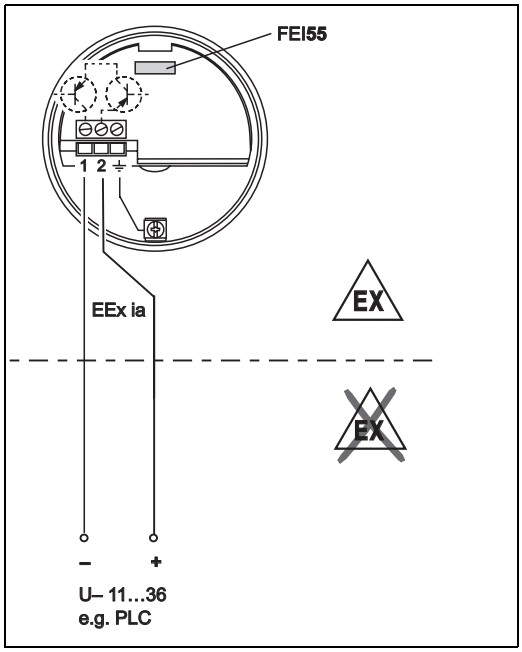
Power supply

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

Electrical connection

Two-wire connection for separate switching unit

For connecting to programmable logic controllers (PLC) for example, AI module 4 to 20 mA to EN 61131-2. Output signal jump from high to low current on limit.



L00-FTI5xxxx-04-05-xx-en-000

Output signal

Safety mode	Level	Output signal	LEDs green	LEDs red	LEDs yellow
MAX		+ 2 ~16 mA 1	lit	●	lit
		+ 2 ~8 mA 1	lit	●	●
MIN		+ 2 ~16 mA 1	lit	●	lit
		+ 2 ~8 mA 1	lit	●	●
Maintenance required *		+ 2 8/16 mA 1	lit	lit	
Instrument failure		+ 2 < 3.6 mA 1	lit	lit	

L00-FTI5xxxx-04-05-xx-en-006

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

lit
flashes
● unlit

L00-FTL5xxxx-07-05-xx-xx-000

Signal on alarm

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

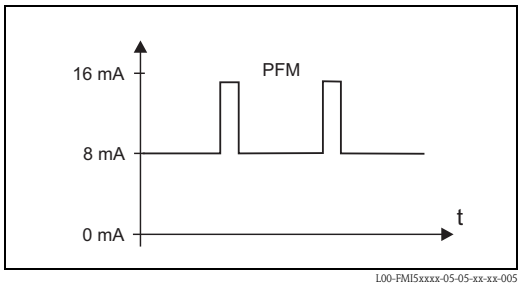
Connectable load

- U = connection DC voltage 11…36 V
- I_{max} = 16 mA

FEI57S electronic insert (PFM)

Power supply

DC voltage: 9.5...12.5 V
Power consumption: < 150 mW
Reverse polarity protection: yes
Separation voltage: 0.5 kV



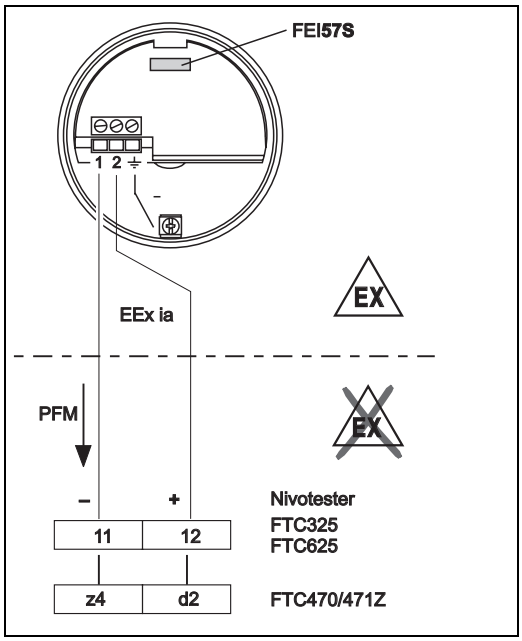
L00-FMI5xxxx-05-05-xx-xx-005

Frequency: 17 ...180 Hz

Electrical connection

Two-wire connection for separate switching unit

For connecting to switching units
Nivotester FTC325, FTC625 (from SW V1.4),
FTC470Z, FTC471Z from Endress+Hauser.
PFM signal 60 to 180 Hz
Switching between minimum/maximum
safety in the Nivotester.



L00-FTI5xxxx-04-05-xx-yy-003

Output signal

PFM 60...180 Hz (Endress+Hauser)

Signal on alarm

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

☼ lit
◑ flashes
● unlit

L00-FTI5xxxx-04-05-xx-en-010 L00-FTL5xxxx-07-05-xx-xx-000

Connectable load

- Floating relay contacts in the connected switching unit Nivotester FTC325, FTC625, FTC470Z, FTC471Z
- For contact load see the Technical Data of the switching unit

Power supply

Electrical connection

Connection compartment

Five housings with the following protection classes are available:

Housing	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
Aluminum housing T13 (with separate connection compartment)	X	X	X	X

Cable entry

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

Performance characteristics

Reference operating conditions

- Temperature: +20 °C ±5 °C
- Pressure: 1013 mbar abs. ±20 mbar
- Humidity: 65 % ±20%
- Medium: water from mains (conductivity ≥ 180 µS/cm with reference to the full scale value)

Switch point deviation

Reproducibility: 0.1 % (related to the probe length)

Influence of ambient temperature

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

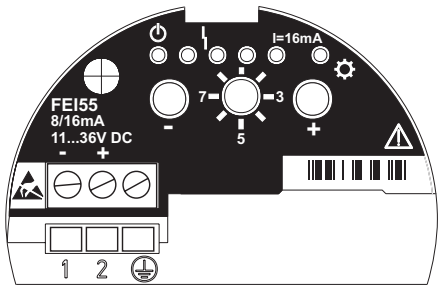
Separate housing
Change in capacitance of connecting cable 0.015 pF/m per K

Human interface

Electronic inserts

FEI52, FEI54, FEI55

- Green LEDs (⏻ operational status - flashing)
- Red LED (ϟ 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: Safety mode (MIN/MAX)
  - 8: Configuration/upload, download



L00-FTI5xxxx-07-05-xx-xx-000

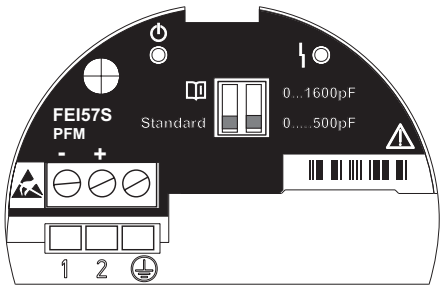
Note!
To execute the functions in question, pres and hold the key for at least 2 seconds.

Mode 1-8 switch setting	Function	- key	+ key	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 ****
	Restore factory setting	Press both keys for approx. 20 s		On	->	->	->	->	**On/off ****
2	Empty calibration	Press		**On** (present)					**On/off ****
	Full calibration		Press					**On** (present)	**On/off ****
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 ****
4	Measuring range	Press for <		**On** * (500 pF)	**Off** (1600 pF)				**On/off ****
	Pump control (Δs)/ build-up mode		Press once Press twice				**Off** build-up mode	**Off** Δs	**On/off ****
5	Switching delay	Press for <	Press for >	**Off** (0.3 s)	**On** * (1.5 s)	**Off** (5 s)	**Off** (10 s)		**On/off ****
6	Self-test (function test)	Press both keys		**Off *** (inactive)				**Flashes** (active)	**On/off ****
7	MIN/MAX safety mode	Press for MIN	Press for MAX	**Off** (MIN)				**On *** (MAX)	**On/off ****
8	Upload/download sensor EEPROM	Press for download	Press for upload	**Flashes** (download)				**Flashes** (upload)	**On/off ****

* These settings are factory settings.
** Switch status signaling depends on the mounting location selected and the safety mode (MIN/MAX) set.

FEI53, FEI57S

- Green LED (⏻ operational status)
- Red LED (ϟ 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

Certificates and approvals

CE mark

The devices are designed to meet state-of-the-art safety requirements, have been tested and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations that are listed in the EC Declaration of Conformity and thus meet the legal requirements of the EC Directives. Endress+Hauser confirms that the device has been tested successfully and the conformity of the device by affixing to it the CE-mark.

Ex approval

See "Ordering information" from Page 33

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 (Annex A - Industrial).

NAMUR
Association for Standards for Control and Regulation in the Chemical Industry

Ordering information

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

Liquicap M FTI51

10	**Approval:**			
	A	Non-hazardous area		
	B	Non-hazardous area,		WHG (German Water Resources Act)
	C	ATEX II 1/2 GD	EEx ia IIC T6	
	D	ATEX II 1/2 GD	EEx ia IIC T6,	WHG (German Water Resources Act)
	G	ATEX II 1/2 GD	EEx de (ia) IIC T6,	WHG (German Water Resources Act)
		XA, observe safety instructions (electrostatic charge)!		
	H	ATEX II 1/2 GD	EEx ia IIC T6,	
		XA, observe safety instructions (electrostatic charge)!		
	J	ATEX II 1/2 GD	EEx ia IIC T6,	WHG (German Water Resources Act)
		XA, observe safety instructions (electrostatic charge)!		
	K	ATEX II 1/2 G	EEx ia IIC T6,	WHG (German Water Resources Act)
		XA, observe safety instructions (electrostatic charge)!		
	L	ATEX II 1/2 G	EEx d (ia) IIC T6,	WHG (German Water Resources Act)
		XA, observe safety instructions (electrostatic charge)!		
	M	ATEX II 3GD	EEx nA II T6,	WHG (German Water Resources Act)
		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	TIIS Ex ia IIC T3		
	T	TIIS Ex d IIC T3		
	Y	Special version, to be specified		

20		**Inactive length (L3):**	
		L3: 100 to 2000 mm/4 to 80 inch for 316L	
		L3: 150 to 1000 mm/6 to 40 inch for PTFE fully insulated	
		Protection against condensate + bypassing container nozzles	
	A	Not selected	
	B	Not selected + 125mm/5inch Active build-up compensation	316L
		Price per 100 mm	
	1	.... mm	316L
	2	.... mm	316L, PTFE fully insulated
		Price is independent from length	
	3	.... mm (<= 500 mm) + 125 mm active build-up compensation	316L
	4	.... mm (> 500 mm) + 125 mm active build-up compensation	316L
		Price per 1 inch	
	5	.... inch	316L, PTFE fully insulated
	6	.... inch	316L
		Price is independent from length	
	7	.... inch (<= 20 inch) + 5 inch active build-up compensation	316L
	8	.... inch (> 20 inch) + 5 inch active build-up compensation	316L
	9	Special version	

30			**Active probe length (L1); insulation:**	
			Price per 100 mm/1 inch	
			L1: 100 to 4000 mm/4 to 160 inch for ∅10 mm, ∅16 mm	
			L1: 150 to 3000 mm/6 to 120 inch for ∅22 mm (fully insulated)	
		A	mm L1, 10 mm,	316L; PTFE
		B	mm L1, 16 mm,	316L; PTFE
		C	mm L1, 22 mm,	316L; PTFE
		D	mm L1, 16 mm,	316L; PFA
		E	mm L1, 10 mm,	316L; PTFE + ground tube
		F	mm L1, 16 mm,	316L; PTFE + ground tube
		G	mm L1, 16 mm,	316L; PFA + ground tube
		H	inch L1, 0.4 inch,	316L; PTFE
		K	inch L1, 0.6 inch,	316L; PTFE
		M	inch L1, 0.9 inch,	316L; PTFE
		N	inch L1, 0.6 inch,	316L; PFA

30	Active probe length (L1); insulation:		
P	inch L1, 0.4 inch,	316L; PTFE + ground tube	
R	inch L1, 0.6 inch,	316L; PTFE + ground tube	
S	inch L1, 0.6 inch,	316L; PFA + ground tube	
Y	Special version, to be specified		

40	Insulation (L2)		
1	Fully insulated		
2	... mm, partially insulated		
3	... inch, partially insulated		
9	Special version, to be specified		

50	Process connection:		
Threaded connection			
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
Hygiene connection			
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	
Tri-Clamp connection			
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		
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

50	Process connection:		
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		

60	Electronics	
W	Prepared for FEI5x	
Y	Special version, to be specified	
2	FEI52; 3-wire PNP,	10 to 55 V DC
3	FEI53; 3-wire,	3 to 12 V signal
4	FEI54; relay DPDT,	19 to 253 V AC, 19 to 55 V DC
5	FEI55; 8/16mA,	11 to 36 V DC
7	FEI57S; 2-wire PFM	

70	Housing:	
1	F15 316L	IP66, NEMA4X
2	F16 polyester	IP66, NEMA4X
3	F17 aluminum	IP66, NEMA4X
4	F13 aluminum + gas-tight process seal	IP66, NEMA4X
5	T13 aluminum + gas-tight process seal + separate connection compartment	IP66, NEMA4X
9	Special version, to be specified	

80	Cable entry:
A	M20 threaded joint
B	Thread G ½
C	Thread NPT ½
D	Thread NPT ¾
Y	Special version, to be specified

90	Probe design:	
1	Compact	
2	2000 mm L4 cable	> separate housing
3	....mm L4 cable	> separate housing
4	80 inch L4 cable	> separate housing
5	....inch L4 cable	> separate housing
9	Special version, to be specified	

100										**Additional equipment:**	
										A	Basic version
										B	Cleaned for applications free from paint-wetting impairment substances*
										C	Finished metal probe rod surface**
										D	EN10204-3.1 (316L wetted), Inspection certificate
										E	EN10204-3.1 (316L wetted), NACE MR0175 Inspection certificate
										F	SIL2/IEC61508 declaration of conformity
										S	GL marine approval
										Y	Special version, to be specified
FTI51											Product designation

* 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.

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	TIIS Ex ia IIC T3		
T	TIIS Ex d IIC T3		
Y	Special version, to be specified		

20 Inactive length L3:

Price per 100 mm/1 inch
L3: 100 to 2000 mm/4 to 80 inch for 316L
L3: 150 to 1000 mm/6 to 40 inch for PFA fully insulated
Protection against condensate + bypassing container nozzles

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 to 10000 mm/17 to 400 inch; fully insulated

A	... mm,	316; FEP
B	... mm,	316; PFA
C	... inch,	316; FEP
D	... inch,	316; PFA
Y	Special version, to be specified	

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
TJJ	DN38 (1½"), EHEDG	316L,	Tri-Clamp ISO2852
TDJ	DN40-51 (2"),	316L,	Tri-Clamp ISO2852

50	Process connection:			
	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		

60	Electronics	
	W	Prepared for FEI5x
	Y	Special version, to be specified
	2	FEI52; 3-wire PNP, 10 to 55 V DC

60	**Electronics**		
	3	FEI53; 3-wire,	3 to 12 V signal
	4	FEI54; relay DPDT,	19 to 253 V AC, 19 to 55 V DC
	5	FEI55; 8/16mA,	11 to 36 V DC
	7	FEI57S; 2-wire PFM	

70	**Housing:**		
	1	F15 316L	IP66, NEMA4X
	2	F16 polyester	IP66, NEMA4X
	3	F17 aluminum	IP66, NEMA4X
	4	F13 aluminum + gas-tight probes	IP66, NEMA4X
	5	T13 aluminum + gas-tight probes + separate connection compartment	IP66, NEMA4X
	9	Special version, to be specified	

80	**Cable entry:**	
	A	M20 threaded joint
	B	Thread G ½
	C	Thread NPT ½
	D	Thread NPT ¾
	Y	Special version, to be specified

90	**Probe design:**		
	L4: 100 to 6000 mm/12 to 240 inch		
	1	Compact	
	2	2000 mm L4 cable	> separate housing
	3	....mm L4 cable	> separate housing
	4	80 inch L4 cable	> separate housing
	5	....inch L4 cable	> separate housing
	9	Special version, to be specified	

100	**Additional equipment:**		
	A	Basic version	
	D	EN10204-3.1 (316L wetted),	Inspection certificate
	E	EN10204-3.1 (316L wetted), NACE MR0175	Inspection certificate
	F	SIL2/IEC61508 declaration of conformity	
	S	GL marine approval	
	Y	Special version, to be specified	

FTI52	Product designation

Accessories

Protective cover

For F13 and F17 housing
Order number: TSP17090

Shortening kit for FTI52

Order number: 942901-0001

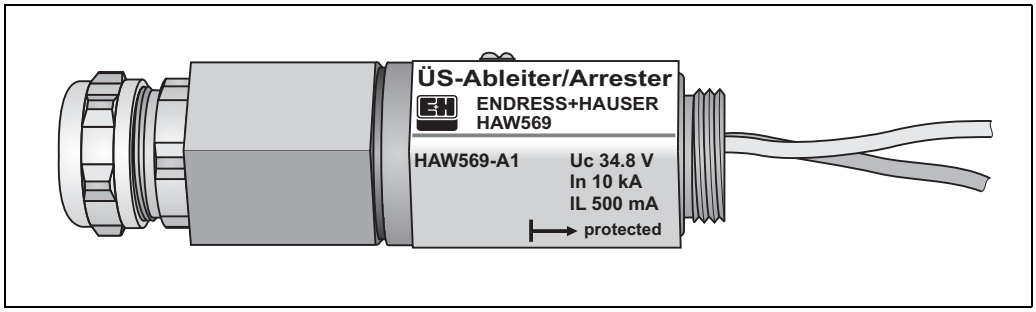
HAW569 surge arrester for FEI55 and FEI57S

Order number:

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

Note!
Both these versions can be screwed directly into the housing (M20x1.5).

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



L00-FMI5xxxx-03-05-xx-xx-009

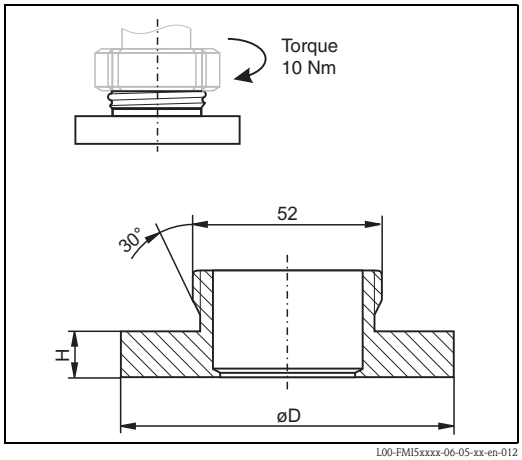
Universal weld-in adapter

- 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 (adapter 44 mm)

Material: 1.4435/SS316L

Replacement seal:
Silicon O-ring (Set with 5 pieces - FDA-listed)
Order number: 52023572



L00-FMI5xxxx-06-05-xx-en-012

Weld-in adapter G ¾

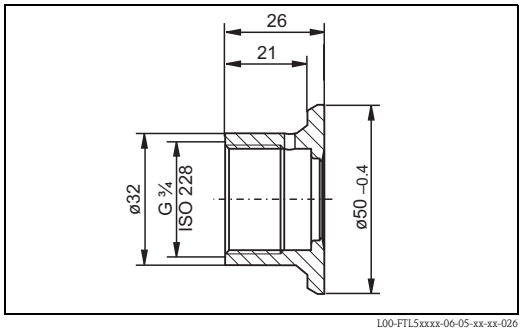
Max. 25 bar / max. 150 °C

Order number: 52018765
For flush-mounted Liquicap M installation
with process connection GQJ
(seal included in scope of delivery)

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

Weight: 0.13 kg

Replacement seal:
Silicon O-ring (Set with 5 pieces - FDA-listed)
Order number: 52021717



L00-FTL5xxxx-06-05-xx-xx-026

Weld-in adapter G 1

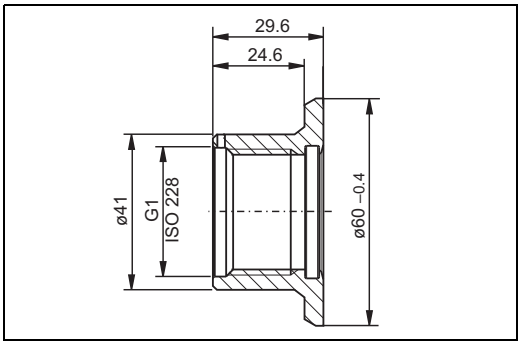
Order number: 52001051
with 3.1.B material certificate: 52011896
For flush-mounted Liquicap M installation
with process connection GWJ
(seal included in scope of delivery)

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

Weight: 0.19 kg

Replacement seal:
Silicon O-ring (Set with 5 pieces - FDA-listed)
Order number: 52014472

Max. 25 bar / max. 150 °C



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

Spare parts

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), transparent plastic with seal
  52025790
- 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

Supplementary Documentation

Note!
This documentation is available on the product pages at www.endress.com

Technical Information

- Fieldgate FXA320, FXA520
  TI369F/00/en

Operating Instructions

- Liquicap M FTI51, FTI52
  BA299F/00/en

Certificates

ATEX safety instructions

- Liquicap M FTI51, FTI52
  ATEX II 1/2 G (EEx ia IIC/IIB T3...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...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 (under development)

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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