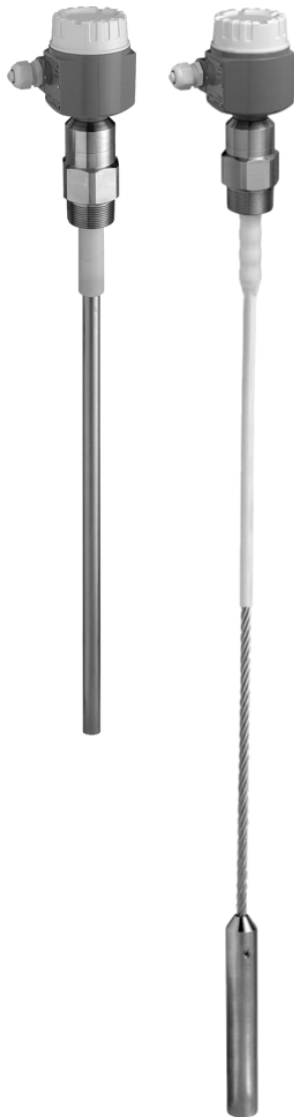




Technical Information

Solicap M FTI55, FTI56

Capacitance



Point level switch for bulk solids

Application

Solicap M is used for point level detection in bulk solids and can be operated in minimum or maximum fail-safe mode.

Due to its robust construction, it can also be used to provide accurate measurements in applications with very high tensile loads (up to 60 kN for rope version) or lateral loads (up to 300 Nm for rod version).

In combination with Fieldgate (for remote interrogation of measured values using internet technology), Solicap M represents an ideal solution for material provisioning and logistical optimization (inventory control).

Your benefits

- Extremely robust design for harsh process conditions
- Easy and fast commissioning as calibration is performed at the press of a button
- Universal application thanks to wide range of certificates and approvals
- Two-stage overvoltage protection against static discharges from the silo
- Active buildup compensation for bulk solids that tend to cake
- Use in safety systems with specific requirements
in terms of functional safety to SIL2/SIL3 in conjunction with electronic insert FEI55
- Increased safety due to permanent automatic monitoring of electronics
- Reduction in storage costs thanks to easy-to-shorten rod model (for partial insulation) and rope model (for partial and full insulation)
- Two-point control (e.g. for controlling a handling device)

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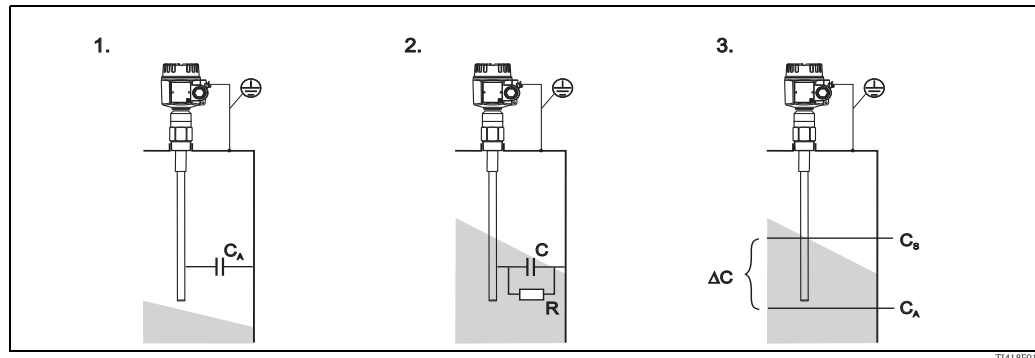
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Function and system design

Measuring principle

The principle of capacitance point level detection is based on the change in capacitance of a capacitor as a result of the probe being covered by bulk solids. 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. If the container is being filled, the capacitance of the capacitor increases as more of the probe is covered (2), (3).

The point level switch switches when the capacitance C_S specified during calibration is reached. In addition, a probe with inactive length ensures that the effects of medium buildup or condensate near the process connection are avoided. A probe with active buildup compensation compensates for the effects of buildup on the probe in the area of the process connection.



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

Function

The electronic insert selected for the probe determines the change in capacitance depending on how much of the probe is covered. This ensures accurate switching at the switchpoint (level) calibrated for this purpose.

Application examples

Sand, glass aggregate, gravel, molding sand, lime, ore (crushed), plaster, aluminum shavings, cement, grain, pumice, flour, dolomite, sugar beet, kaolin, fodder and similar bulk solids.

In general:

Bulk solids with a relative dielectric constant $\epsilon_r \geq 2.5$.

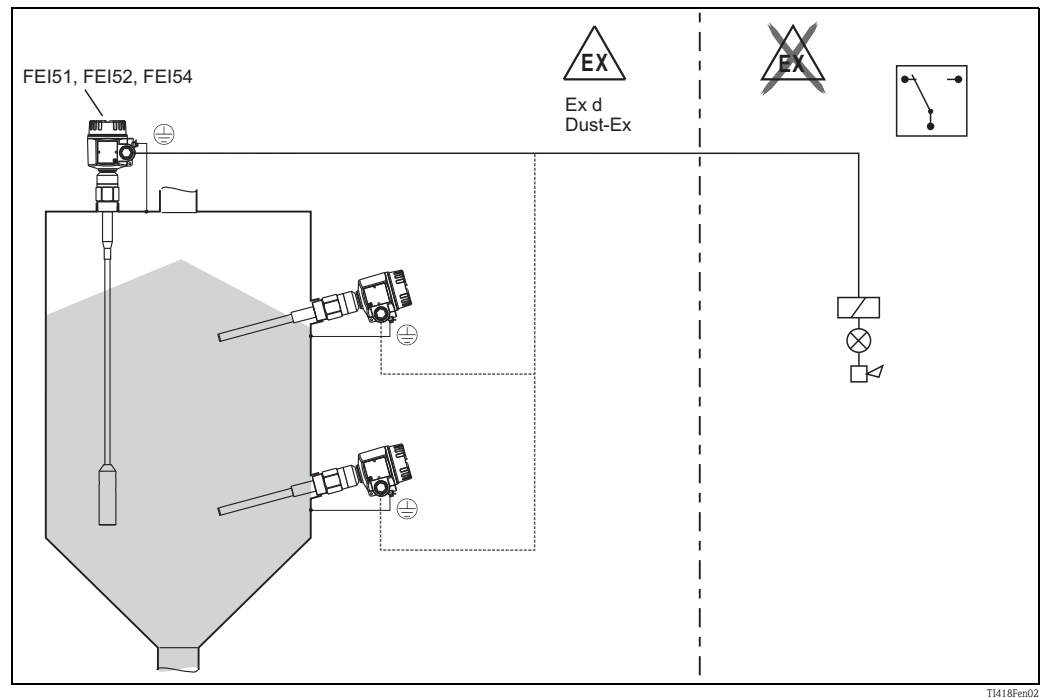
Measuring system

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

Point level switch

The complete measuring system consists of:

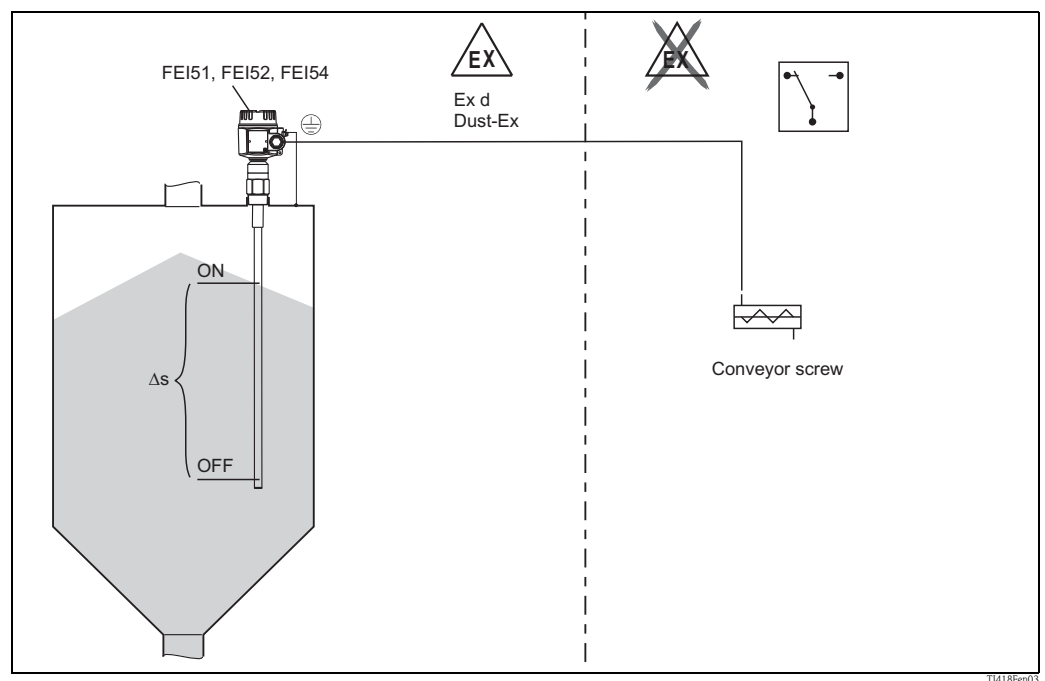
- the point level switch, Solicap M FTI55 or FTI56
- An electronic insert FEI51, FEI52, FEI54



Two-point control (Δs function)

Note!

Partially insulated probes only in conjunction with nonconductive bulk solids.



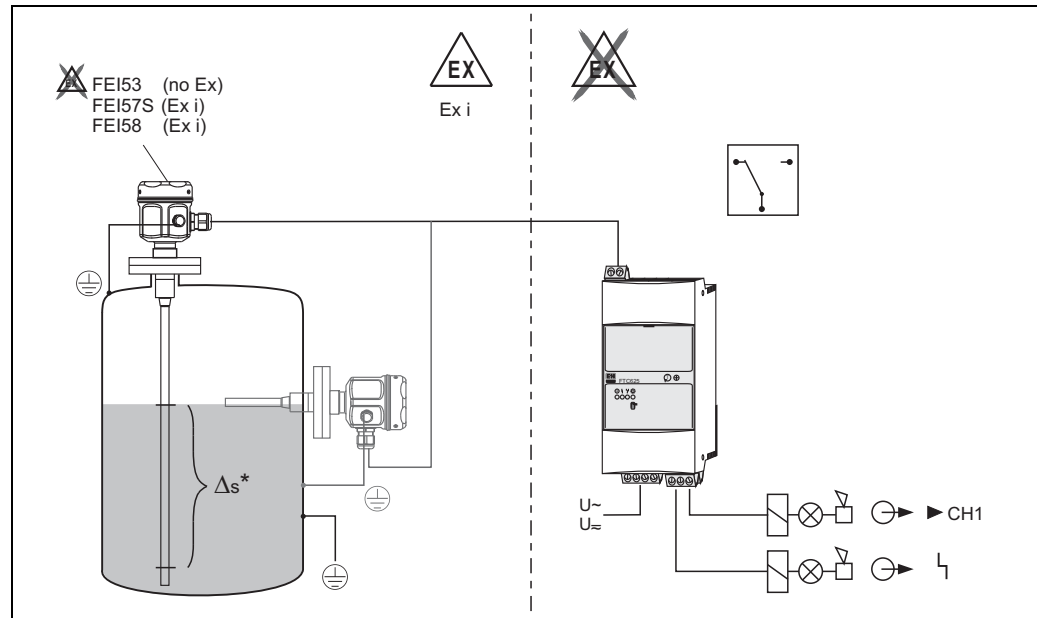
The point level switch can also be used to control a screw conveyor, for example, where the on and off values can be freely defined.

Point level switch

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

The complete measuring system consists of:

- the capacitance point level switch, Solicap M FTI55 or FTI56
- an electronic insert FEI53, FEI57S, FEI58
- a transmitter power supply unit e.g. FTC325, FTC625 (SW V1.4 or higher), FTC470Z, FTC471Z, FTL325N, FTL375N



* Only possible with FEI53

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

Electronic insert	FEI57S	FEI53	FEI58
Transmitter power supply unit			
FTC625	X	—	—
FTC325	X	X	—
FTL325N	—	—	X
FTL375N	—	—	X
FTC470Z	X	—	—
FTC471Z	X	—	—
FTC520Z*	X	—	—
FTC521Z*	X	—	—
FTC420*	—	X	—
FTC421*	—	X	—
FTC422*	—	X	—

x Combination is possible

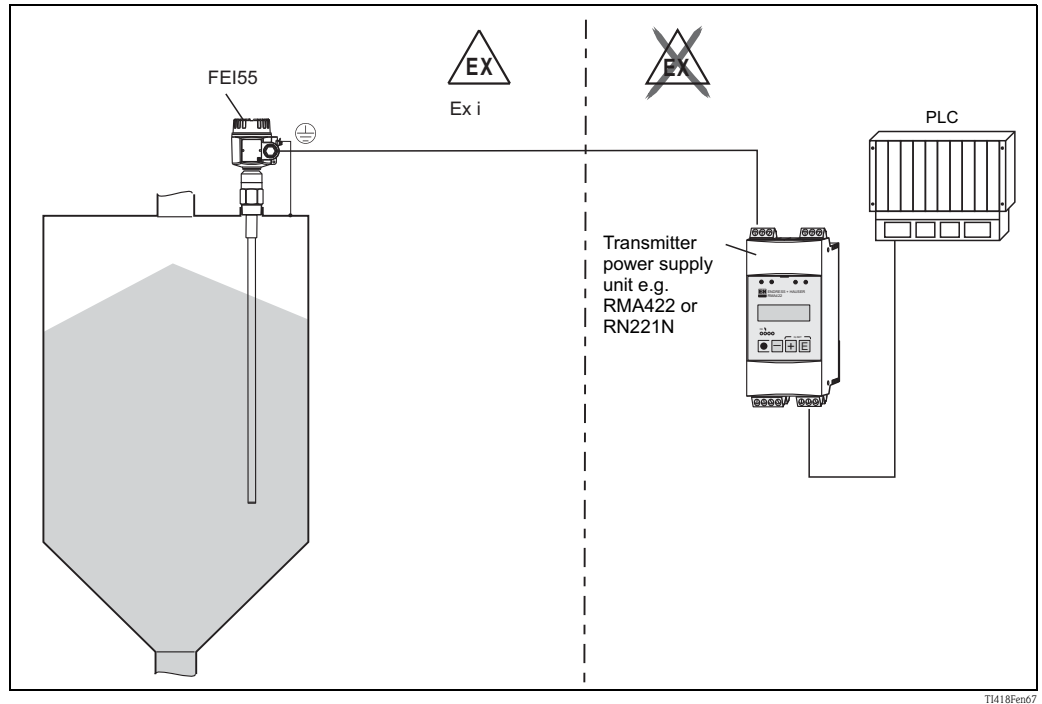
— Combination is not possible

* Product phase-out 2006

Point level switch 8/16 mA

The complete measuring system consists of:

- the point level switch, Solicap M FTI55 or FTI56
- the FEI55 electronic insert
- a transmitter power supply unit (e.g. RN221N, RNS221, RMA421, RMA422)



Electronic versions

FEI51

Two-wire AC connection

- Load switched directly into the power supply circuit via the thyristor.
- Point level adjustment directly at the point level switch.

FEI52

3-wire direct current version:

- Switch the load via the transistor (PNP) and separate supply voltage connection.
- Point level adjustment directly at the point level switch.

FEI53

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

- For separate switching unit, Nivotester FTC325 3-WIRE.
- Point level adjustment directly at the switching unit.

FEI54

Universal current version with relay output:

- Switch the loads via 2 floating changeover contacts (DPDT).
- Point level adjustment directly at the point level switch.

FEI55

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

- SIL2 approval for the hardware
- SIL3 approval for the software
- For separate switching unit (e.g. RN221N, RNS221, RMA421, RMA422).
- Point level adjustment directly at the point level switch.

FEI57S

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

- For separate switching unit with PFM signal transmission e.g. FTC325 PFM, FTC625 PFM and FTC470Z/471Z
- Self-test from the switching unit without changing levels.
- Point level adjustment directly at the point level switch.
- Cyclical checking from the switching unit.

FEI58 (NAMUR)

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

- For a separate switching unit (e.g. Nivotester FTL325N and FTL375N).
- Point level adjustment directly at the point level switch.
- Test the connection cables and slaves by pressing the button on the electronic insert.

Note!

For additional information see → 11 ff.

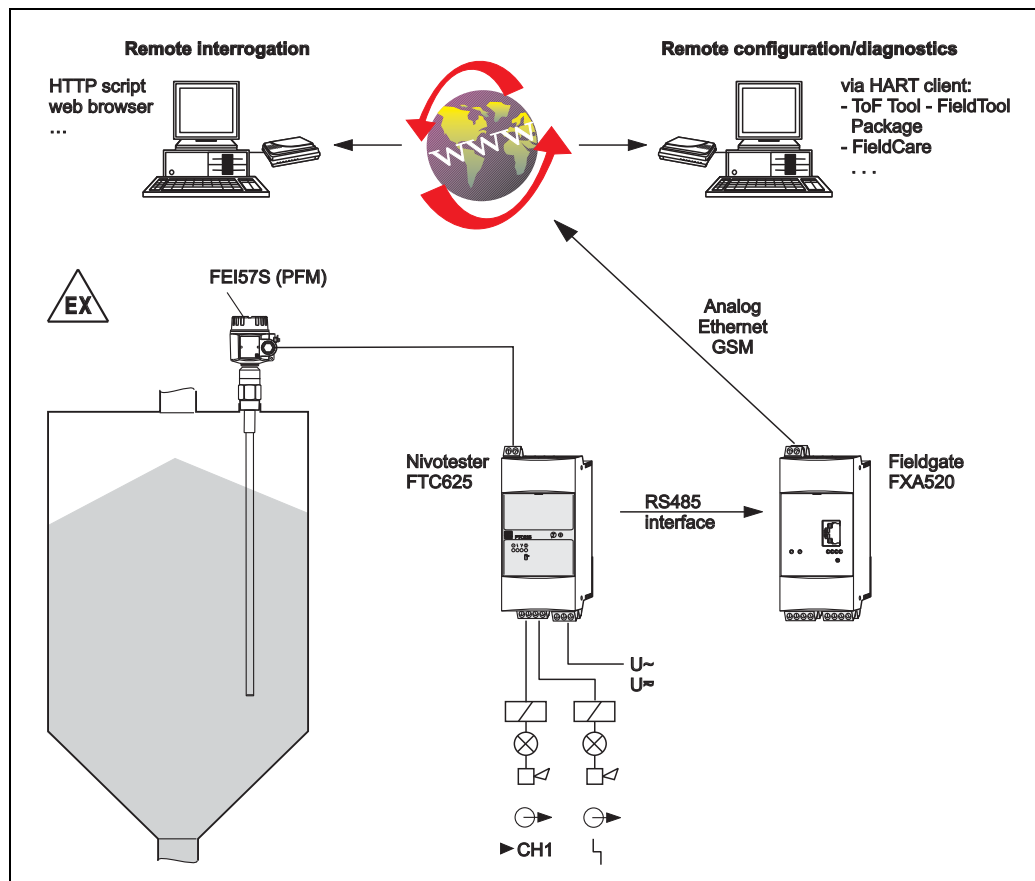
System integration via Fieldgate

Vendor managed inventory

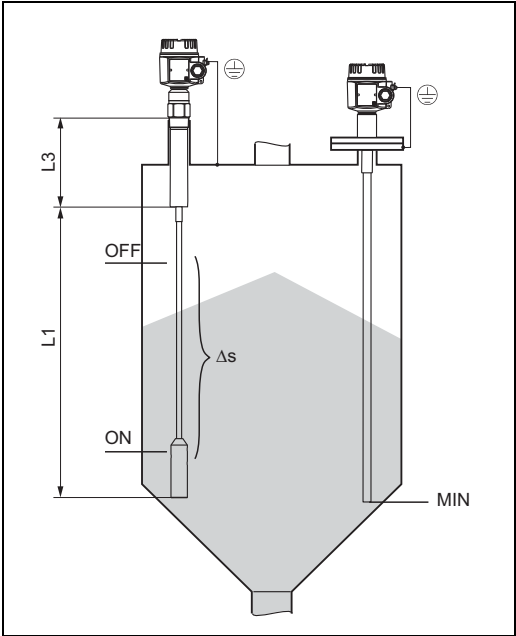
The remote interrogation of tank or silo levels via Fieldgate enables suppliers of raw materials to gather information about the current inventories of their regular customers at any time and, for example, to take this into account in their own production planning. The Fieldgate monitors the configured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

Remote maintenance of measuring systems

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



Input

Measured variable	Measurement of the change in capacitance between the probe rod and the tank wall, depending on the level of the bulk solids.
Measuring range (valid for all FEI5x)	■ Measuring frequency: 500 kHz ■ Span: ΔC = 5 to 1600 pF ΔC = 5 to 500 pF (with FEI58) ■ Final capacitance: C_E = max. 1600 pF ■ Adjustable initial capacitance: C_A = 5 to 500 pF (range 1 = factory setting) C_A = 5 to 1600 pF (range 2; not with FEI58)
Input signal	Probe covered => high capacitance Probe not covered=> low capacitance
Measuring conditions	When installing in a nozzle, use inactive length (L3). To control a screw conveyor (Δs mode), rod probes and rope probes can be used. The on-value and off-value are determined by the empty and full calibration; Partially insulated probes are only suitable for nonconductive bulk solids. DK > 10 Measuring range up to 4 m 5 < DK < 10 Measuring range up to 12 m 2 < DK < 5 Measuring range up to 20 m The minimum capacitance change for point level detection must be ≥ 5 pF. 

Minimum probe length for nonconductive media (<1μs/cm)	$l_{min} = \Delta C_{min} / (C_s * [\epsilon_r - 1])$ l_{min} = Minimum probe length ΔC_{min} = 5 pF C_s = Probe capacitance in air ϵ_r = Dielectric constant e.g. dried grain = 3.0
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Output

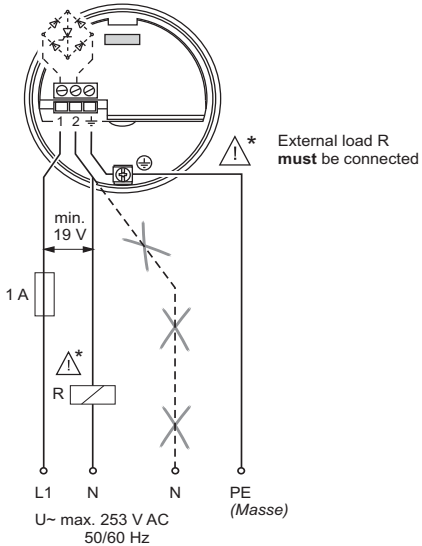
Galvanic isolation	FEI51, FEI52 between rod probe and power supply FEI54: between rod probe, power supply and load FEI53, FEI55, FEI57S, FEI58 see connected switching device (functional galvanic isolation in the electronic insert)
Switch behavior	Binary or Δ s operation (pump control, not with FEI58)
Switch-on behavior	When the power supply is switched on, the switching status of the outputs corresponds to the signal on alarm. The correct switch condition is reached after max. 3 seconds.
Fail-safe mode	Minimum/maximum quiescent current safety can be switched at the electronic insert (for FEI53 and FEI57S only at Nivotester FTCxxx) MAX = 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 overflow protection for example
Switching delay	FEI51, FEI52, FEI54, FEI55 Can be adjusted incrementally at the electronic insert: 0.3 to 10 s FEI53, FEI57S Depends on the connected Nivotester (transmitter): FTC325, FTC625, FTC470Z or FTC471Z FEI58 Can be adjusted alternately at the electronic insert: 1 s / 5 s

Electronic insert FEI51 (AC 2-wire)

Connect in series with an external load.

Power supply	Supply voltage: 19 to 253 V AC Power consumption: < 1.5 W Residual current consumption: < 3.8 mA Short-circuit protection FEI51 overvoltage protection: overvoltage category II
--------------	---

Electrical connection	Always connect in series with a load! Check the following: - the residual current consumption in blocked state. - that for low voltage: - the voltage drop across the load is such that the minimum terminal voltage at the electronic insert (19 V) when blocked is not undershot. - the voltage drop across the electronics when switched through is observed (up to 12 V). - that a relay cannot de-energize with holding power below 1 mA. If this is the case, a resistor should be connected parallel to the relay (RC module available on request). When selecting the relay, pay attention to the holding power / rated power (see below: "Connectable load").
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L00-FMISxxxx-06-05-xx-en-071

Signal on alarm

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

BA300Fes017

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

Connectable load	- For relays with a minimum holding power or rated power > 2.5 VA at 253 V AC (10 mA) or > 0.5 VA at 24 V AC (20 mA) - Relays with a lower holding power or rated power can be operated by means of an RC module connected in parallel. - For relays with a maximum holding power or rated power < 89 VA at 253 V AC or < 8.4 VA at 24 V AC - Voltage drop across FEI51 max. 12 V - Residual current with blocked thyristor max. 3.8 mA - Load switched directly into the power supply circuit via the thyristor.
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FEI52 electronic insert (DC PNP)

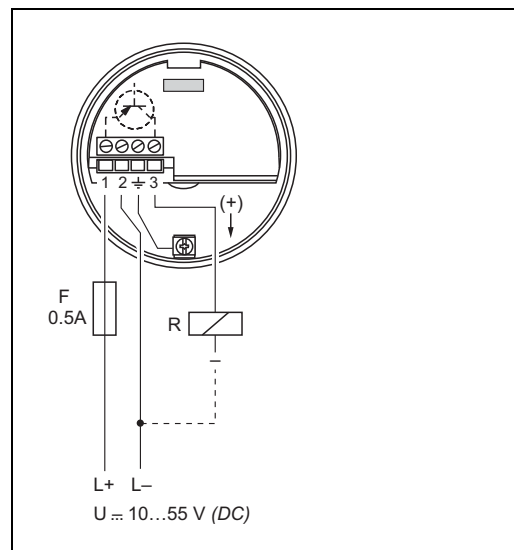
Power supply

Supply voltage: 10 to 55 V DC
 Ripple: max. 1.7 V, 0...400 Hz
 Current consumption: < 20 mA
 Power consumption without load: max. 0.9 W
 Power consumption with full load (350 mA): 1.6 W
 Reverse polarity protection: yes
 Separation voltage: 3.7 kV
 FEI52 overvoltage protection: overvoltage category II

Electrical connection

Three-wire DC connection

Preferably in conjunction with programmable logic controllers (PLC),
 DI modules in accordance with EN 61131-2.
 Positive signal present at the switch output of the electronic system (PNP).



TI418F42

Output signal

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

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

Lit

Flashes

Unlit

TI418Fen43

TI418F44

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

Electronic insert FEI53 (3-wire)

Power supply

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

Electrical connection

Three-wire DC connection

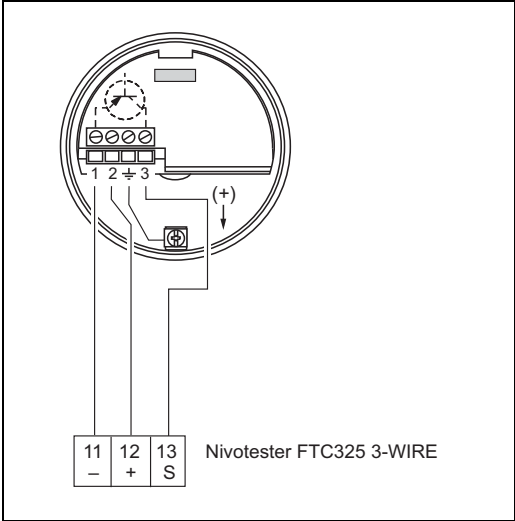
3 to 12 V signal

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

Switching between minimum/maximum

Safety in the Nivotester FTC325 3-WIRE.

Point level adjustment directly at the Nivotester.



TI418F45

Output signal

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

TI418Fen46

 Lit
 Flashes
 Unlit

TI418F44

Signal on alarm

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

Connectable load

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

FEI54 electronic insert (AC/DC with relay output)

Power supply

Supply voltage: 19 to 253 V AC, 50/60 Hz or 19 to 55 V DC
 Power consumption: max. 1.6 W
 Reverse polarity protection: yes
 Separation voltage: 3.7 kV
 FEI54 overvoltage protection: overvoltage category II

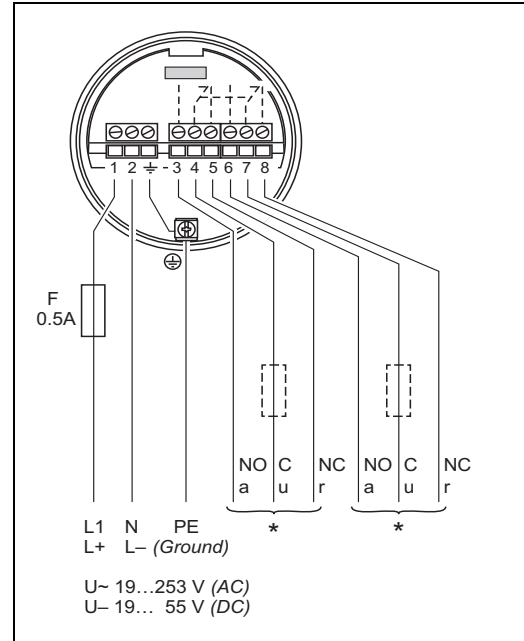
Electrical connection

Universal current connection with relay output (DPDT)

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

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

* See below "Connectable load"



TI418F47

Output signal

Safety mode	Level	Output signal	LEDs
MAX			gn gn rd gn gn ye
			gn gn rd gn gn ye
MIN			gn gn rd gn gn ye
			gn gn rd gn gn ye
Maintenance required			gn gn rd gn gn ye
Instrument failure			gn gn rd gn gn ye

TI418F48

TI418F49

| Relay energized
 | Relay de-energized
 Lit
 Flashes
 Unlit

Signal on alarm

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

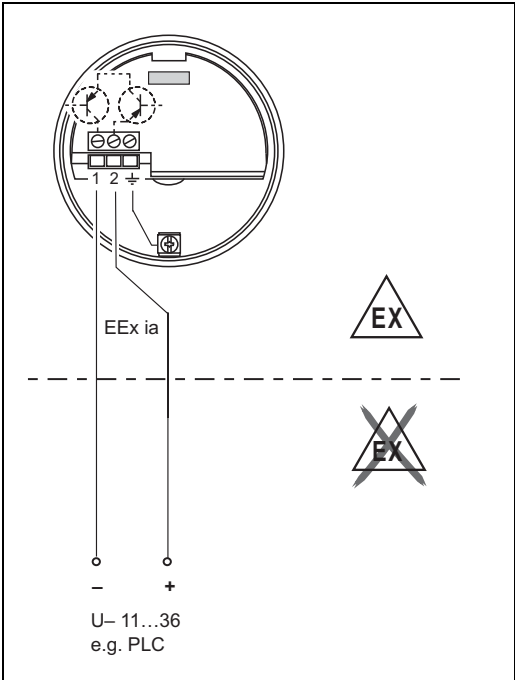
Connectable load

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

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

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

Electrical connection
Two-wire connection for separate switching unit
For connecting to programmable logic controllers (PLC), AI modules 4 to 20 mA in accordance with EN 61131-2.
The point level signal is sent via an output signal jump from 8 mA to 16 mA.



TI418Fen50

Output signal

Safety mode	Level	Output signal	LEDs gn gn rd gn gn ye
MAX		$\begin{matrix} + \\ 2 \end{matrix} \xrightarrow{\sim 16 \text{ mA}} 1$	
		$\begin{matrix} + \\ 2 \end{matrix} \xrightarrow{\sim 8 \text{ mA}} 1$	
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		$\begin{matrix} + \\ 2 \end{matrix} \xrightarrow{< 3.6 \text{ mA}} 1$	

TI418Fen51

TI418F44

$\sim 16 \text{ mA} = 16 \text{ mA} \pm 5 \%$
 $\sim 8 \text{ mA} = 8 \text{ mA} \pm 6 \%$

Lit
 Flashes
 Unlit

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

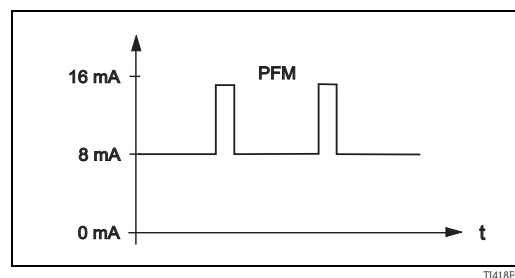
Connectable load

- U = Connection DC voltage:
 - 11 to 36 V DC (non-hazardous area and Ex ia)
 - 14.4 to 30 V DC (Ex d)
- I_{max} = 16 mA

FEI57S electronic insert (PFM)

Power supply

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



TI418F52

Frequency: 17 to 185 Hz

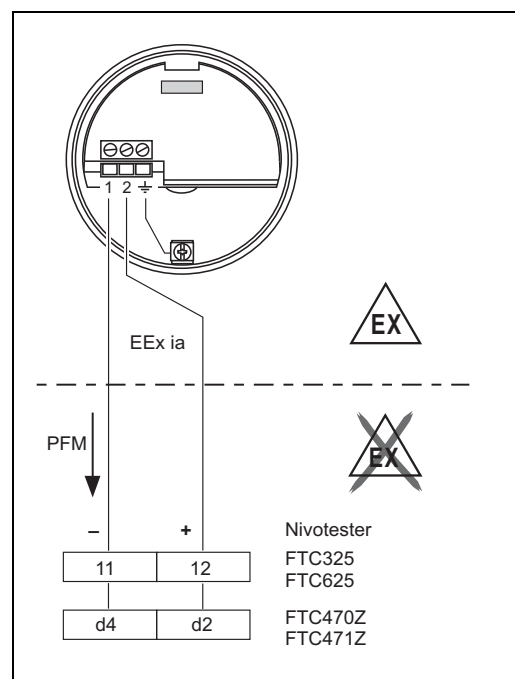
Electrical connection

Two-wire connection for separate switching unit

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

PFM signal 17 to 185 Hz

Switching between minimum/maximum
safety in the Nivotester.



TI418F53

Output signal

PFM 60 to 185 Hz (Endress+Hauser)

Signal on alarm

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

TI418Fen54

Lit
 Flashes
 Unlit

TI418F44

Connectable load

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

Electronic insert FEI58 (NAMUR H-L edge)

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

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

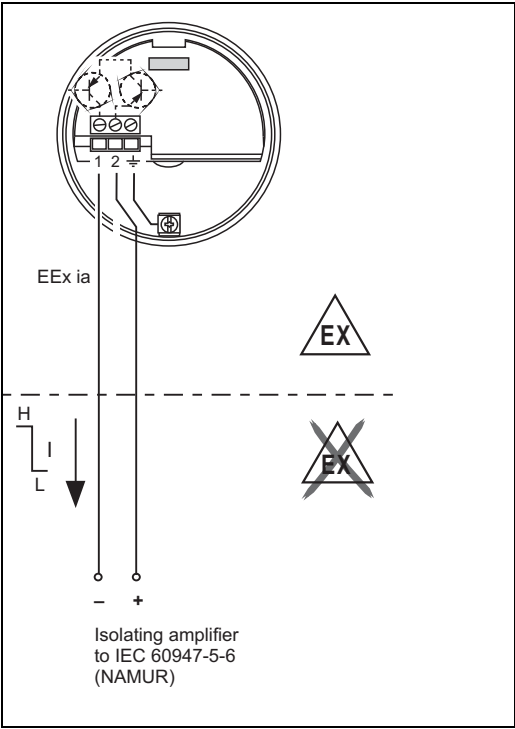
For connecting to isolating amplifiers as per NAMUR (IEC 60947-5-6), e.g. FXN421, FXN422, FTL325N, FTL375N from Endress+Hauser. Change in output signal from high to low current in event of point level detection.

(H-L edge)

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

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

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



Output signal

 = Lit
 = Flashes
 = Unlit

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

Fail-safe mode	Level	Output signal	LEDs	
			green	yellow
Max.		$\begin{matrix} + & 2.2 \dots & 3.5 \text{ mA} \\ 2 & \xrightarrow{\hspace{1cm}} & 1 \end{matrix}$		
		$\begin{matrix} + & 0.6 \dots & 1.0 \text{ mA} \\ 2 & \xrightarrow{\hspace{1cm}} & 1 \end{matrix}$		
Min.		$\begin{matrix} + & 2.2 \dots & 3.5 \text{ mA} \\ 2 & \xrightarrow{\hspace{1cm}} & 1 \end{matrix}$		
		$\begin{matrix} + & 0.6 \dots & 1.0 \text{ mA} \\ 2 & \xrightarrow{\hspace{1cm}} & 1 \end{matrix}$		

L00-FTL5xxxx-04-05-xx-xx-007

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

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

Power supply

Electrical connection

Connection compartment

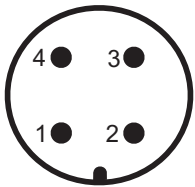
Five housings with the following protection classes are available:

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

Connector

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

PIN assignment for M12 connector

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

Cable entry

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

Performance characteristics

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)

Switch point

- Uncertainty as per DIN 61298-2: max ±0.3%
- Non-repeatability (reproducibility) as per DIN 61298-2: max. ±0.1 %

Ambient temperature effect

Electronic insert

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

Separate housing

Capacitance change of connecting cable per meter 0.15 pF/10K

Installation

All dimensions in mm!

General notes

Filling the silo

The filling stream should not be directed onto the probe.

Angle of material flow

Note the expected angle of the material flow or of the outlet funnel when determining the mounting location or probe length.

Distance between probes

When installing several probes in a silo, a minimum distance of 0.5 m between the probes must be observed.

Threaded coupling for mounting

When installing the Solicap M FTI55, FTI56, the threaded coupling should be as short as possible.

Condensation or product residue may occur in a long threaded coupling and interfere with the correct operation of the probe.

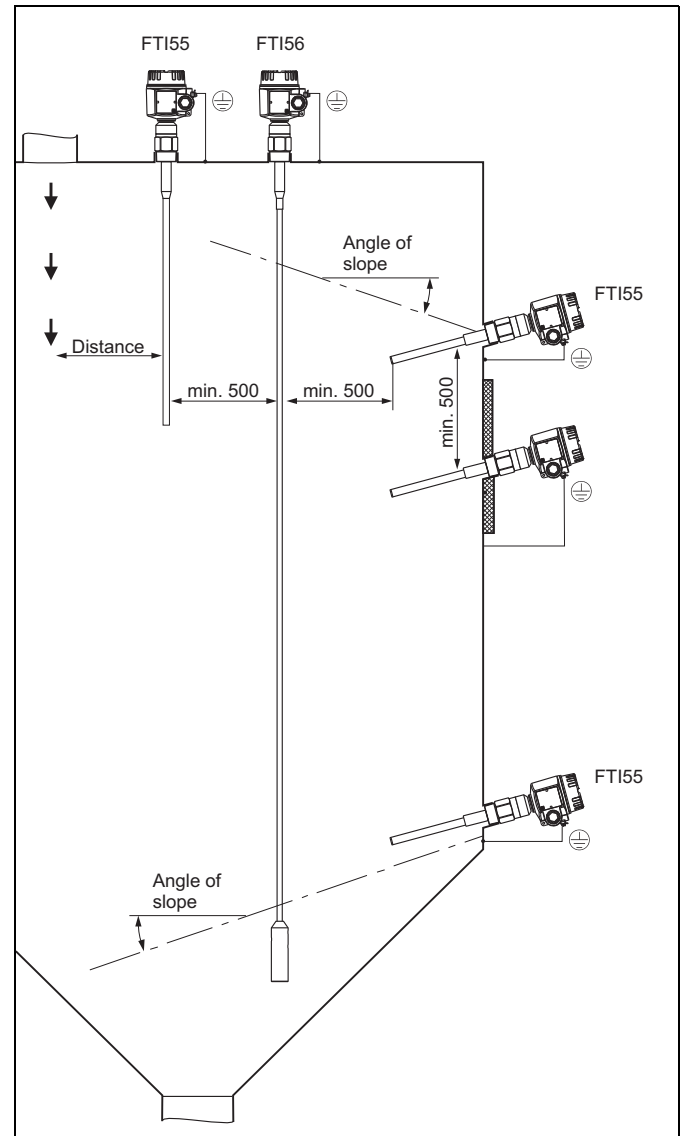
Heat insulation

In the event of high temperatures in the silo:

Insulate the external silo wall to avoid exceeding the permitted temperature of the Solicap M housing.

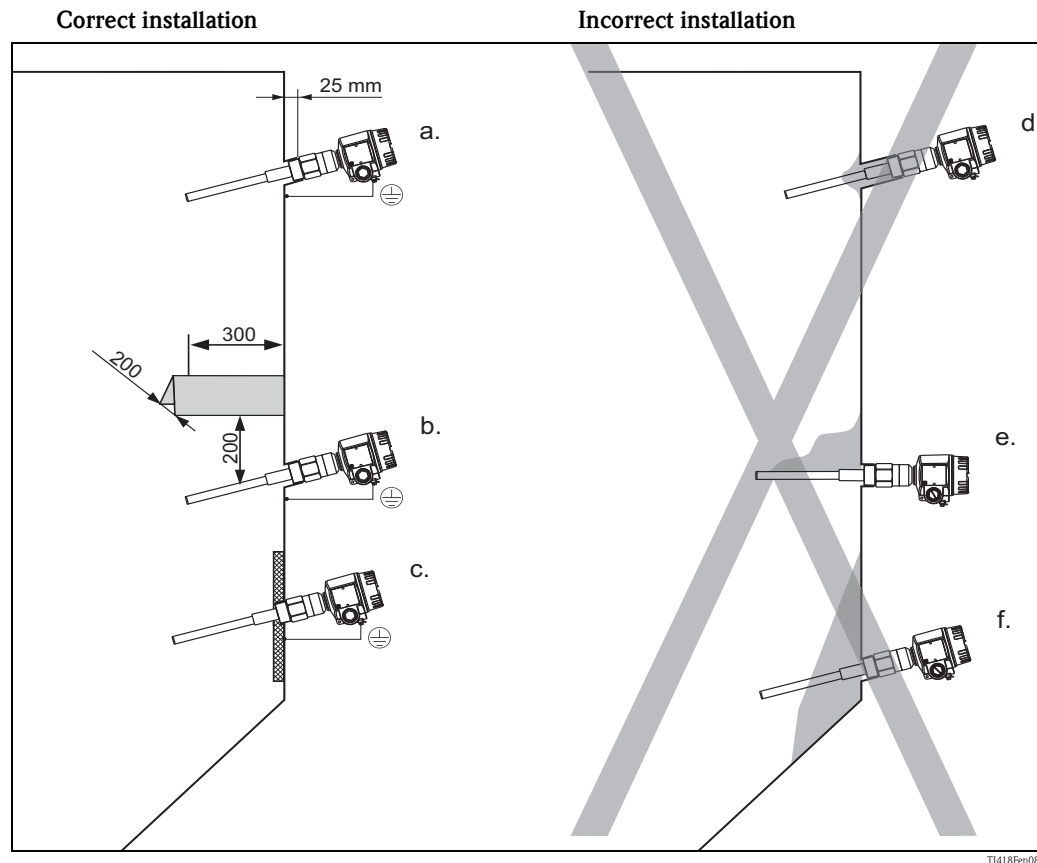
Heat insulation also prevents condensation from forming near the threaded boss in the silo.

This reduces buildup and the risk of error switching.



TI418Fen07

Preparing to install rod probes FTI55



TI418Fen08

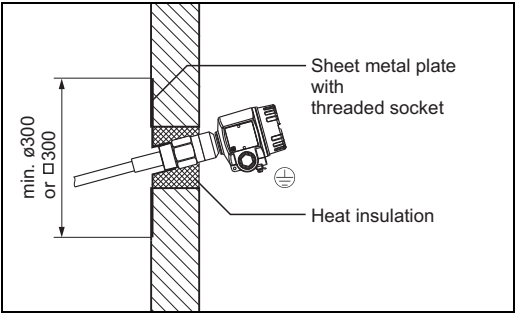
Correct installation

- a. For maximum point level detection, a short threaded coupling is used.
- b. For minimum point level detection, a short threaded coupling is used.
The probe tip points slightly downwards so that bulk solids slide off more easily.
The protective cover protects the probe rod from collapsing mounds or mechanical strain at the outflow.
- c. In the event of light buildup on the silo wall, the threaded coupling is welded internally.
The probe tip points slightly downwards so that bulk solids slide off more easily.

Incorrect installation

- d. The threaded coupling is too long. This may cause material to settle inside and result in error switching.
- e. Horizontal mounting means a risk of error switching in the event of heavy buildup on the silo wall.
In this case, the Solicap M FTI55 (rod probe) with inactive length is recommended.
- f. In areas where product buildup occurs, the device cannot detect if the silo is "empty".
In this case, the FTI56 (rope probe) should be installed from above.

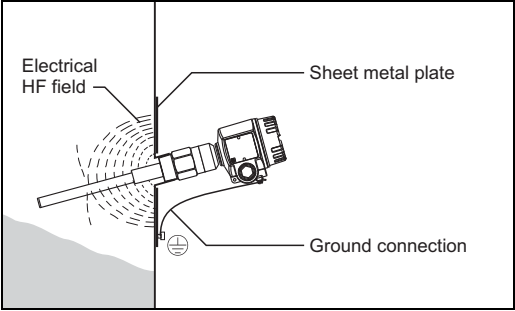
In this example, the grounded steel plate forms the counter electrode.
Heat insulation prevents condensation and therefore buildup on the steel plate.



In a silo with concrete walls

When installing in a silo made of plastic, a sheet metal plate must be attached to the exterior of the silo as a counter electrode.
This plate can be either square or round.

- Dimensions in the case of a thin silo wall with a low dielectric constant:
approx. 0.5 m along each side or ø0.5 m;
- Dimensions in the case of a thicker silo wall or wall with a higher dielectric constant:
approx. 0.7 m along each side or ø0.7 m.

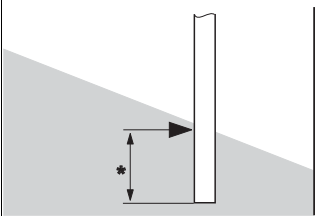


In a silo with plastic walls

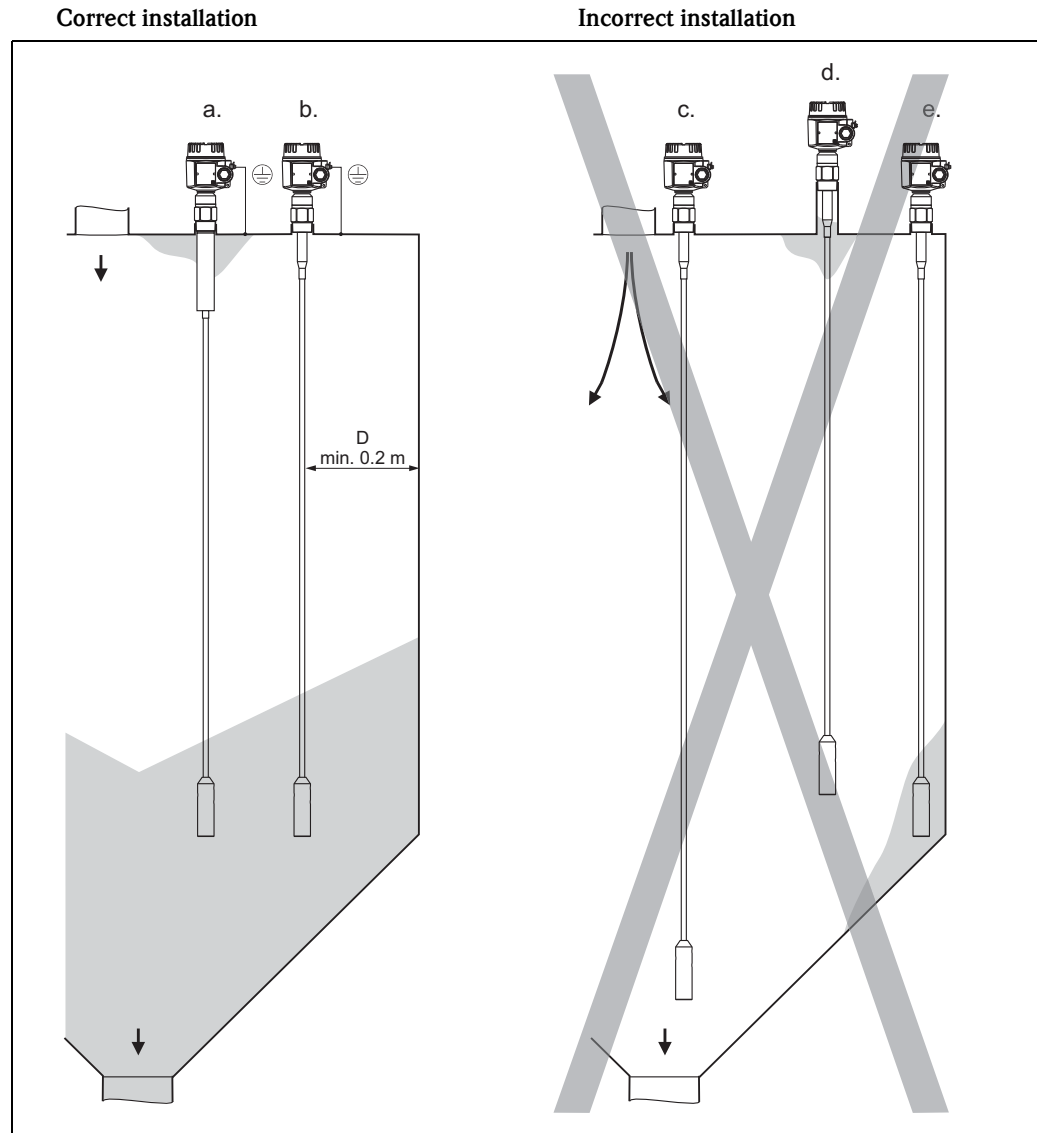
Probe length and minimum coverage

Note!

- When selecting the probe length, pay attention to the dependency between the relative dielectric constant ϵ_r and the minimum amount the probe rod needs to be covered (see Table).
- For probe length tolerances see → 36.
- To ensure problem-free operation, it is important that the difference in capacitance between the covered and uncovered parts of the probe is at least 5 pF.
- If you do not know the dielectric constant of the material, contact us for advice.

Product properties, relative dielectric constant ϵ_r	
	* Minimum coverage
Electrically conductive	25 mm
Nonconductive	
$\epsilon_r > 10$	100 mm
$\epsilon_r > 5$ to 10	200 mm
$\epsilon_r > 2$ to 5	500 mm

Preparing to install rope probes FTI56



In a silo with metal walls

Distance D between the probe and the wall approx. 10 to 25 % of the silo diameter

Correct installation

- Solicap M FTI55, FTI56 with inactive length in the event of condensation and material buildup on the silo roof.
- At the correct distance from the silo wall, the material inlet and the material outlet.
Close to the wall, for reliable switching in the case of a low dielectric constant (not for pneumatic filling).
For pneumatic filling, the distance from the probe to the wall should not be too short, as the probe may swing.

Incorrect installation

- If too close to the material inlet, inflowing bulk solids may damage the sensor.
If close to the center of the material outflow, high tensile forces at this point may cause the probe to break off or subject the silo roof to excessive strain.
- The threaded coupling is too long. This may cause condensation and dust to settle inside which may result in error switching.
- If too close to the silo wall, the probe may swing slightly against the wall or come in contact with buildup. This can result in error switching.

Silo roof

Ensure that the silo roof is of a sufficiently stable construction.

High tensile forces may occur when material is being extracted, particularly in the case of heavy and powdery bulk solids which have a tendency to form buildup.

Coarse-grained bulk solids

In silos with extremely coarse-grained or extremely abrasive bulk solids, the use of a Solicap M FTI55 or FTI56 is recommended only for maximum detection.

Distance between the rope probes

To rule out mutual probe interference, you must maintain a minimum distance of 0.5 m between the rope probes. This also applies if you are installing several Solicap M units in adjacent silos with nonconductive walls.

In the event of condensation:

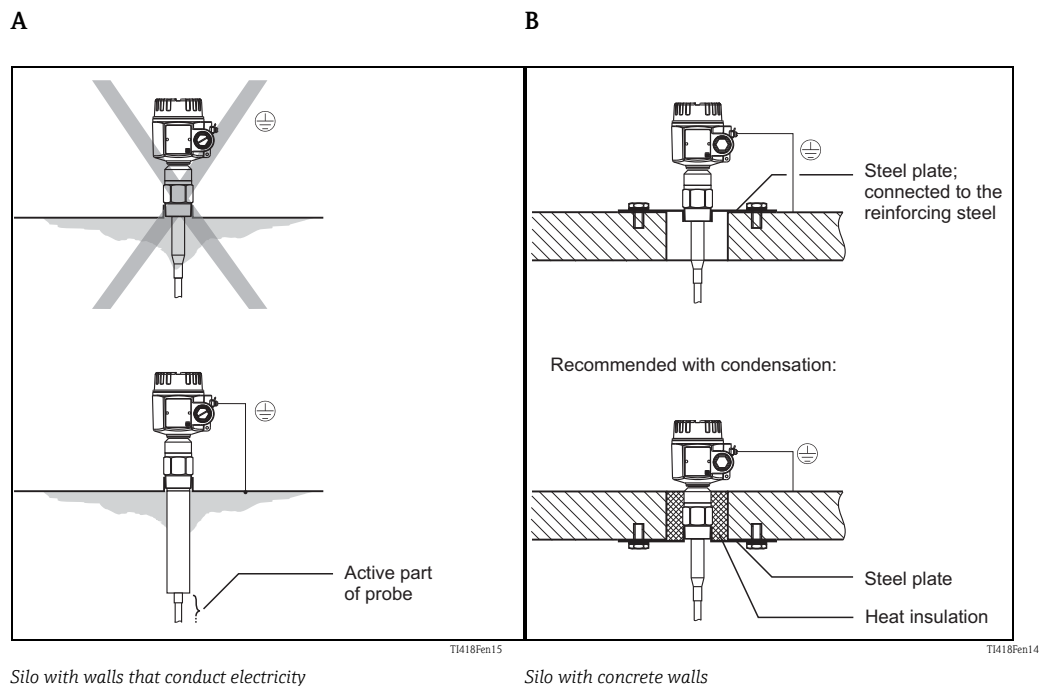
Use the Solicap M with inactive length.

The inactive length (**A**) prevents moisture and buildup forming between the active part of the probe and the silo roof.

Or:

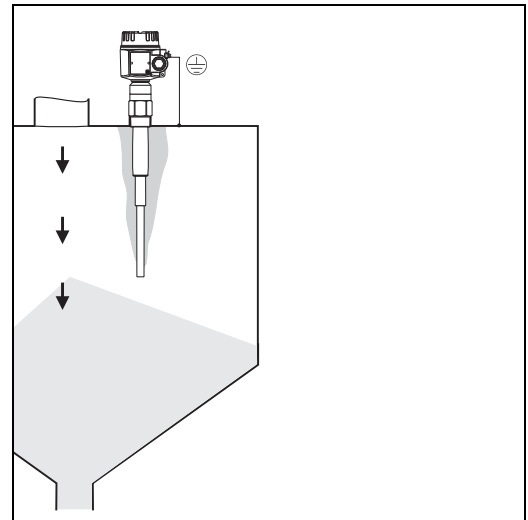
To reduce the effects of condensation (**B**) and buildup, the threaded coupling (length: max. 25 mm) must project into the silo.

Heat insulation reduces condensation and therefore buildup on the steel plate.



Installation in the event of buildup

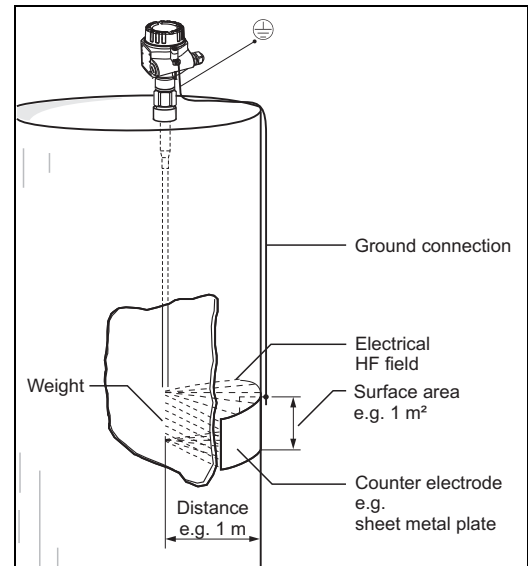
If buildup on the probe rod can be expected when operating the measuring system, the active buildup compensation function prevents the measurement result from becoming distorted. No cleaning work has to be performed on the probe rod.



BA300Fxx020

Installation in plastic tanks

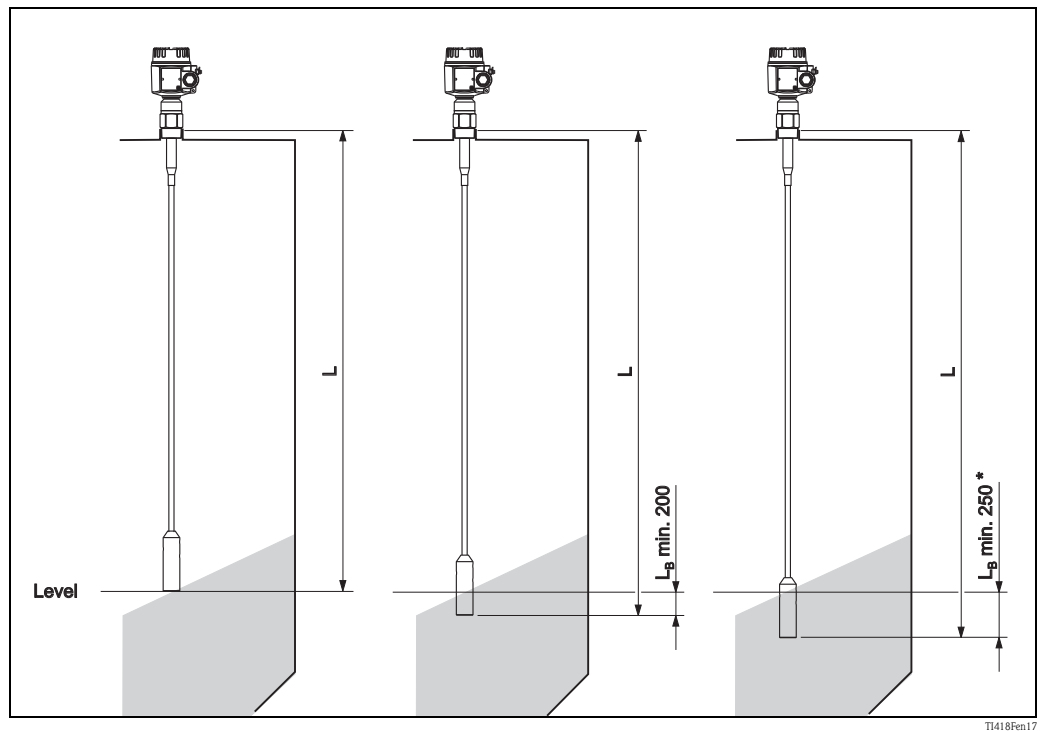
When installing in a silo made of plastic, a counter electrode must be mounted on the silo exterior at the same height as the tensioning weight. The length of the edge of the counter electrode should be approximately the same length as the distance between the tensioning weight and the silo wall.



TI418Pen10

In a silo with plastic walls

Range of sensor lengths



- Electrically conductive bulk solids (e.g. coal)
- Bulk solids with high dielectric constant (e.g. rock salt)
- Bulk solids with low dielectric constant (e.g. dried grain)
- * L_B (covered length):
For nonconductive bulk solids with a low dielectric constant, the rope probe must be approx. 5 % (but no less than 250 mm) longer than the distance between the tank roof and the required point level.

Shortening the probe

Rod probe:

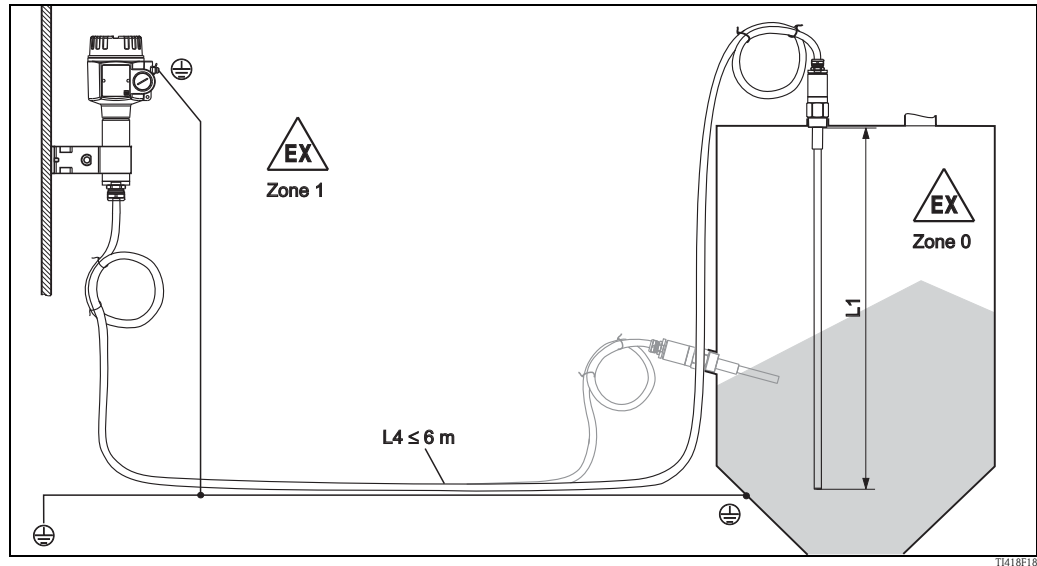
The partially insulated version can be shortened at a later stage by the user.

Rope probe:

Both versions (partially and fully insulated) may be shortened at a later stage.

Probe with separate housing

- For information on how to order, see also "Ordering information" from → 42 under "Probe design".
- The maximum connection length between the probe and the separate housing is 6 m (L4).
- When ordering a Solicap M with a separate housing, the desired length must be specified.
- If the connecting cable is to be shortened or passed through a wall, it must be separated from the process connection. See also → 26 (extension heights).
- The cable has a bending radius of $r \geq 100$ mm. This must be observed as a minimum.



Rod length $L1$ max. 4 m

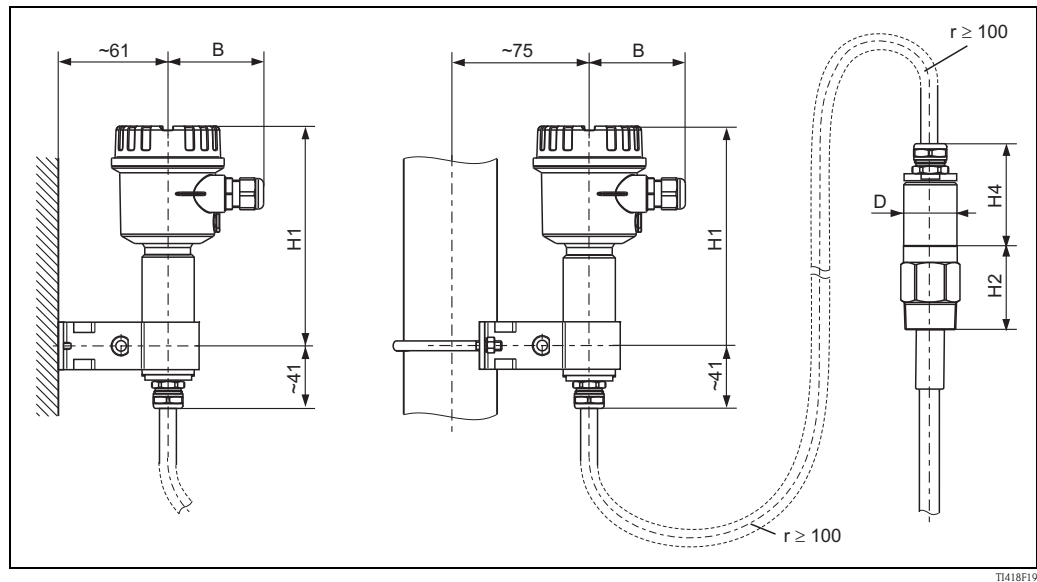
Rope length $L1$ max. 19.7 m (the maximum total length of $L1 + L4$ should not exceed 20 m.)

Extension heights

Housing side: wall mounting

Housing side: pipe mounting

Sensor side



		Polyester housing F16	Stainless steel housing F15	Aluminum housing F17
B	-	76	64	65
H1	-	172	166	177
D	50	-	-	-
H4	62	-	-	-

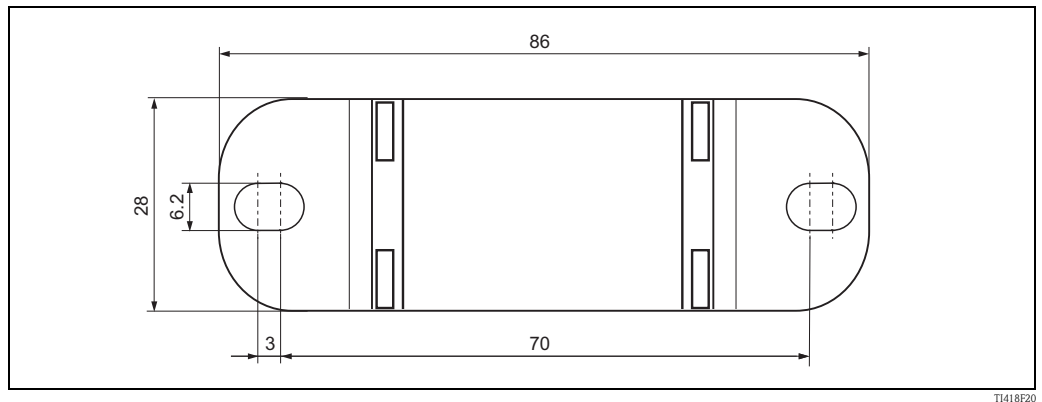
Connecting cable: $\phi 10.5$ mm

Outer jacket: silicone, notch-resistant

Wall holder unit

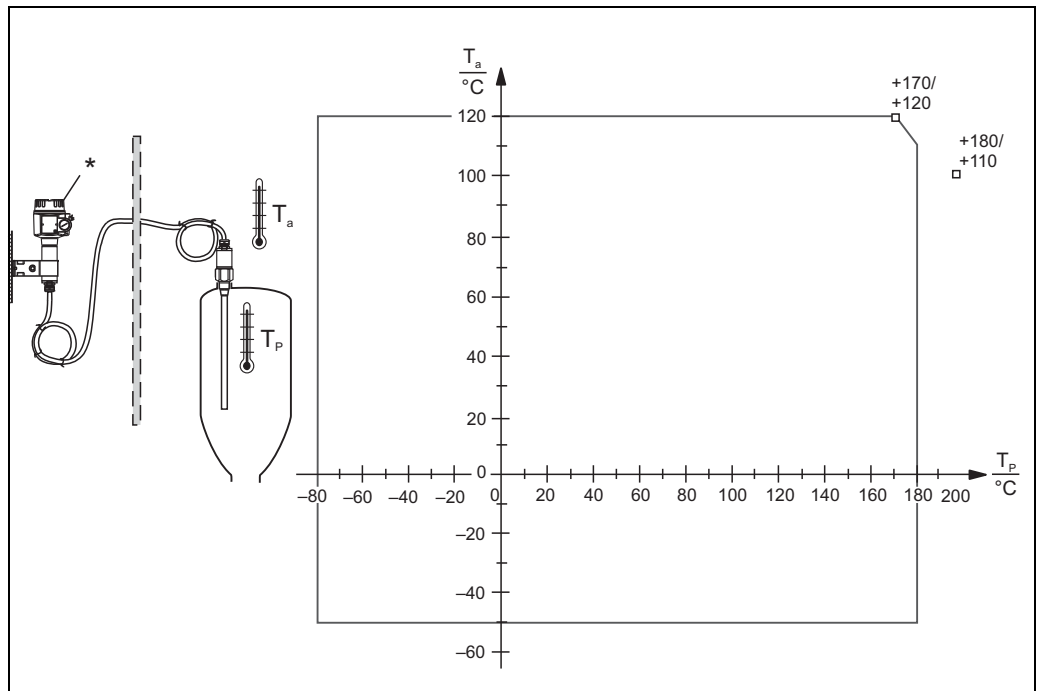
The wall holder unit is part of the scope of supply.

The wall holder unit 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.



TI418F20

Temperature-derating separate housing



BA300Fxx021

T_a : ambient temperature

T_p : process temperature

* temperature at separate housing ≤ 70 °C

The maximum connection length between the probe and the separate housing is 6 m (L4). When ordering a device with a separate housing, the desired length must be specified.

If the connecting cable is to be shortened or passed through a wall, it must be separated from the process connection. See "Documentation" => "Operating Instructions" on → 47.

Operating conditions: Environment

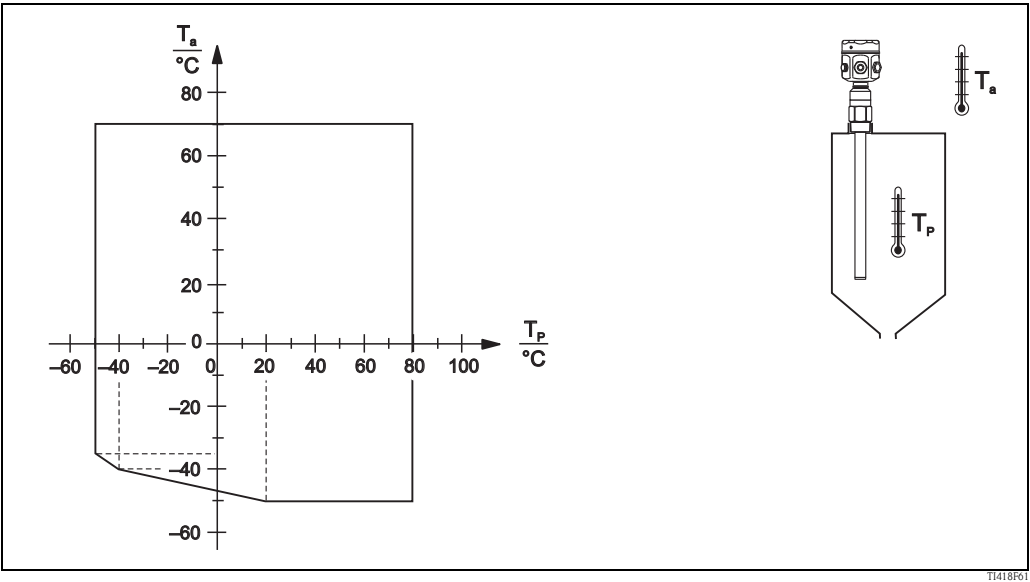
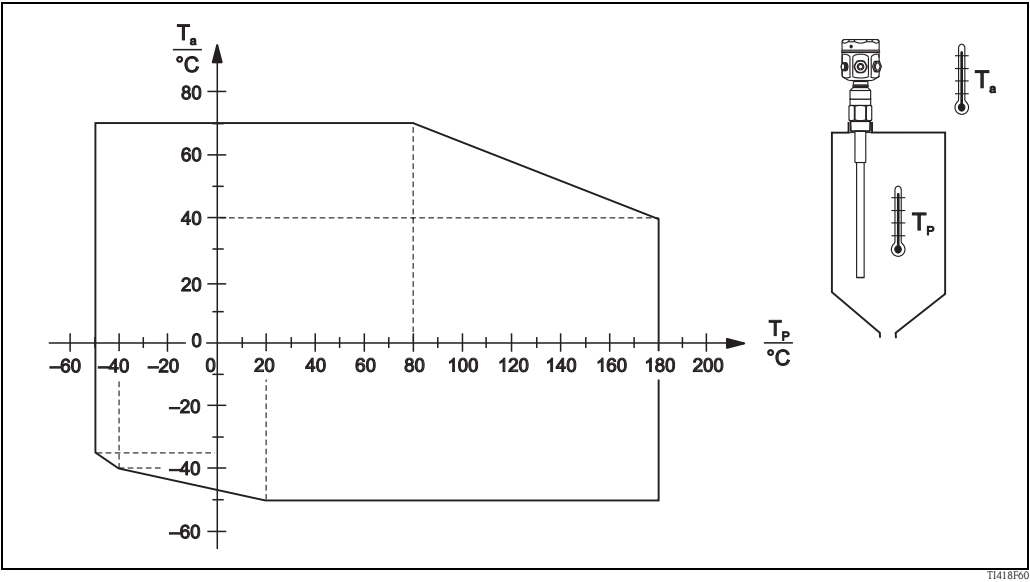
Ambient temperature range	- Ambient temperature of the transmitter (note derating, see → 29): –50 to +70 °C –40 to +70 °C (with F16 housing) - A weather protection cover should be used when operating outdoors in strong sunlight. For further information on the weather protection cover, see → 46.																																						
Storage temperature	–50 to +85 °C																																						
Climate class	DIN EN 60068-2-38/IEC 68-2-38: test Z/AD																																						
Degree of protection	<table border="1"> <thead> <tr> <th></th><th>IP66*</th><th>IP67*</th><th>IP68*</th><th>NEMA4X**</th></tr> </thead> <tbody> <tr> <td>Polyester housing F16</td><td>X</td><td>X</td><td>–</td><td>X</td></tr> <tr> <td>Stainless steel housing F15</td><td>X</td><td>X</td><td>–</td><td>X</td></tr> <tr> <td>Aluminum housing F17</td><td>X</td><td>X</td><td>–</td><td>X</td></tr> <tr> <td>Aluminum housing F13 with gas-tight process seal</td><td>X</td><td>–</td><td>X***</td><td>X</td></tr> <tr> <td>Aluminum housing T13 with gas-tight process seal and separate connection compartment (EEx d)</td><td>X</td><td>–</td><td>X***</td><td>X</td></tr> <tr> <td>Separate housing</td><td>X</td><td>–</td><td>X***</td><td>X</td></tr> </tbody> </table> * As per EN60529 ** As per NEMA 250 *** Only with M20 cable entry or G1/2 thread					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
	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 Hz– 2000 Hz; 0.01 g ² /Hz																																						
Cleaning	Housing: When cleaning, make sure that the cleaning agent used does not corrode the housing surface or the seals. Probe: Depending on the application, buildup (contamination and soiling) can form on the probe rod. A high degree of material buildup can affect the measurement result. If the medium tends to create a high degree of buildup, regular cleaning is recommended. When cleaning, it is important to make sure that the insulation of the probe rod is not damaged. If cleaning agents are used make sure the material is resistant to them!																																						
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.																																						
Shock resistance	DIN EN 60068-2-27/IEC 68-2-27: 30g acceleration																																						

Operating conditions: Process

Process temperature range

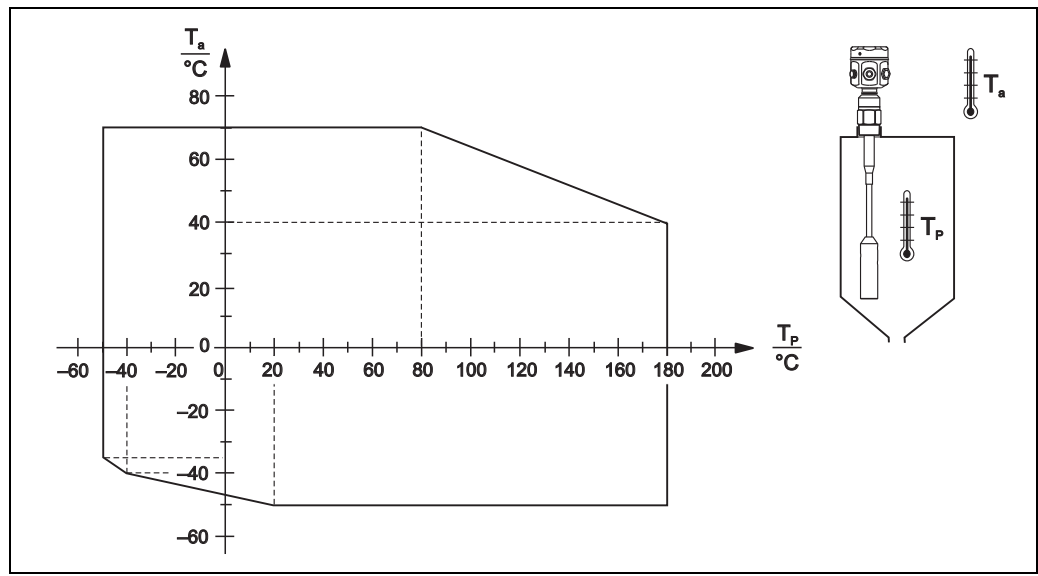
The following process temperature ranges only apply for standard applications outside hazardous areas. Regulations for use in hazardous areas are provided in the Supplementary Documentation XA00389F/00. Permitted ambient temperature T_a at the housing depending on the process temperature T_p in the tank.

Rod probe FTI55

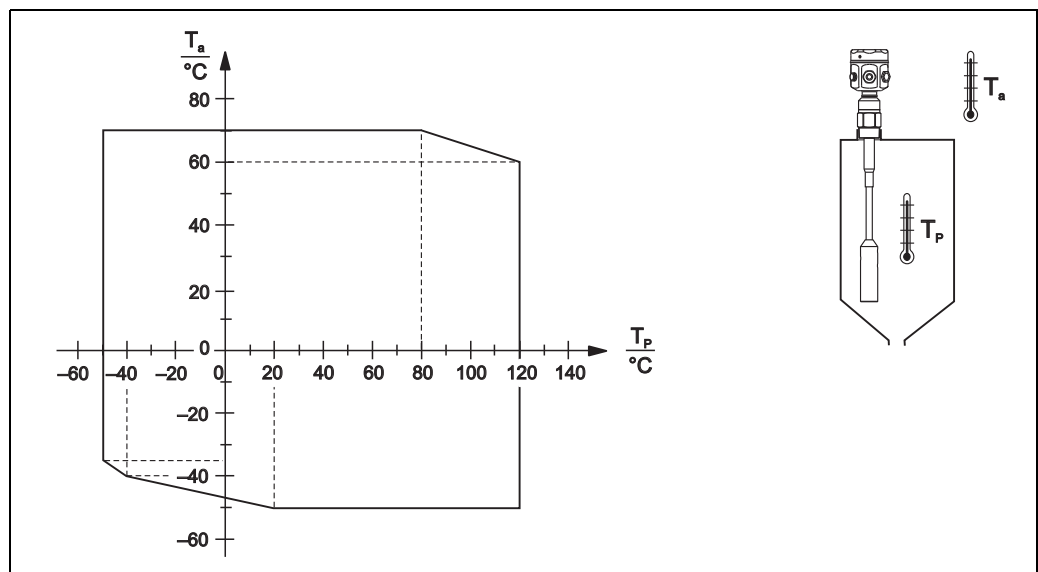


Note! Restriction to $T_a -40\text{ °C}$ for polyester housing F16.

Rope probe FTI56



TI418F62

Partially insulated (PTFE):

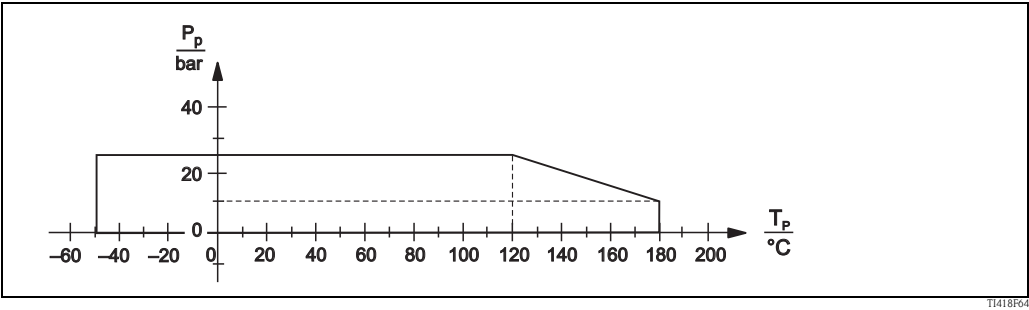
TI418F63

Fully insulated (PA):

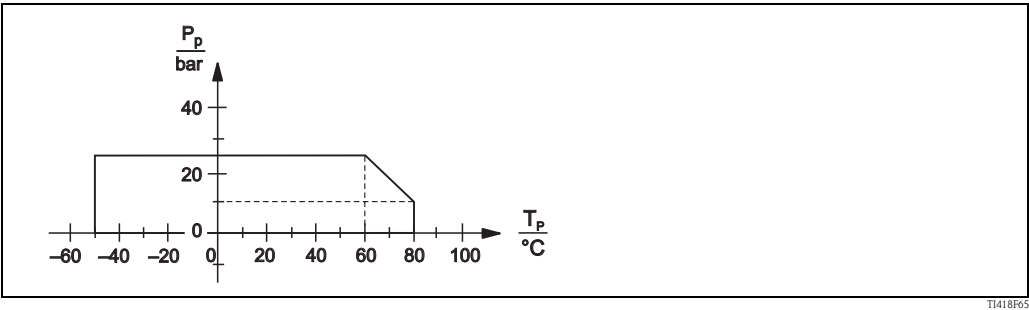
Process pressure and temperature derating

The lowest value from the derating curves of the device and the selected flange applies.
In the case of flange process connections, the maximum pressure is limited by the nominal pressure of the flange.
See also "Process connections" on → 35.

Rod probe FTI55

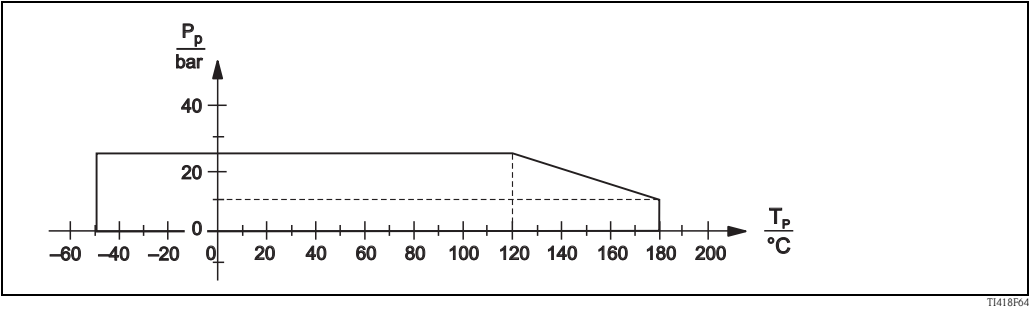


Partially insulated (PPS):

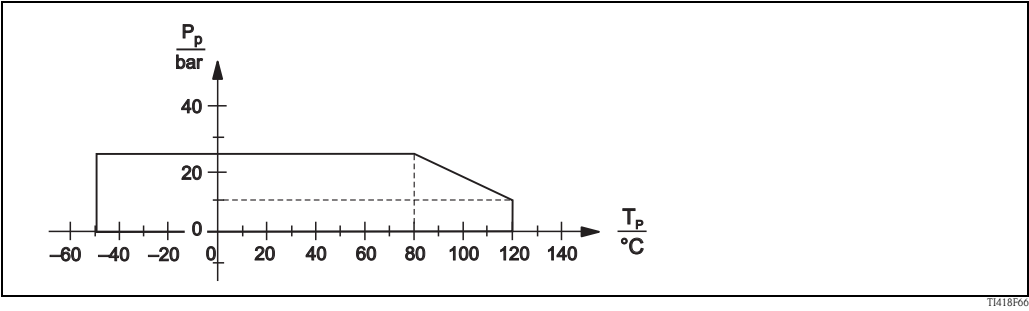


Fully insulated (PE):

Rope probe FTI56



Partially insulated (PTFE):



Fully insulated (PA):

Process pressure limits

–1 to 25 bar

(observe dependencies => process connections from →  35 and operating conditions: process from →  29.)

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

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

- pR EN 1092-1: 2005 Table, Appendix G2

With regard to its resistance/temperature property, the material 1.4435 is identical to 1.4404 (AISI 316L) which is grouped under 13E0 in EN 1092-1 Tab. 18. The chemical makeup of the two materials can be identical.

- ASME B 16.5a - 1998 Tab. 2-2.2 F316

- ASME B 16.5a - 1998 Tab. 2.3.8 N10276

- JIS B 2220

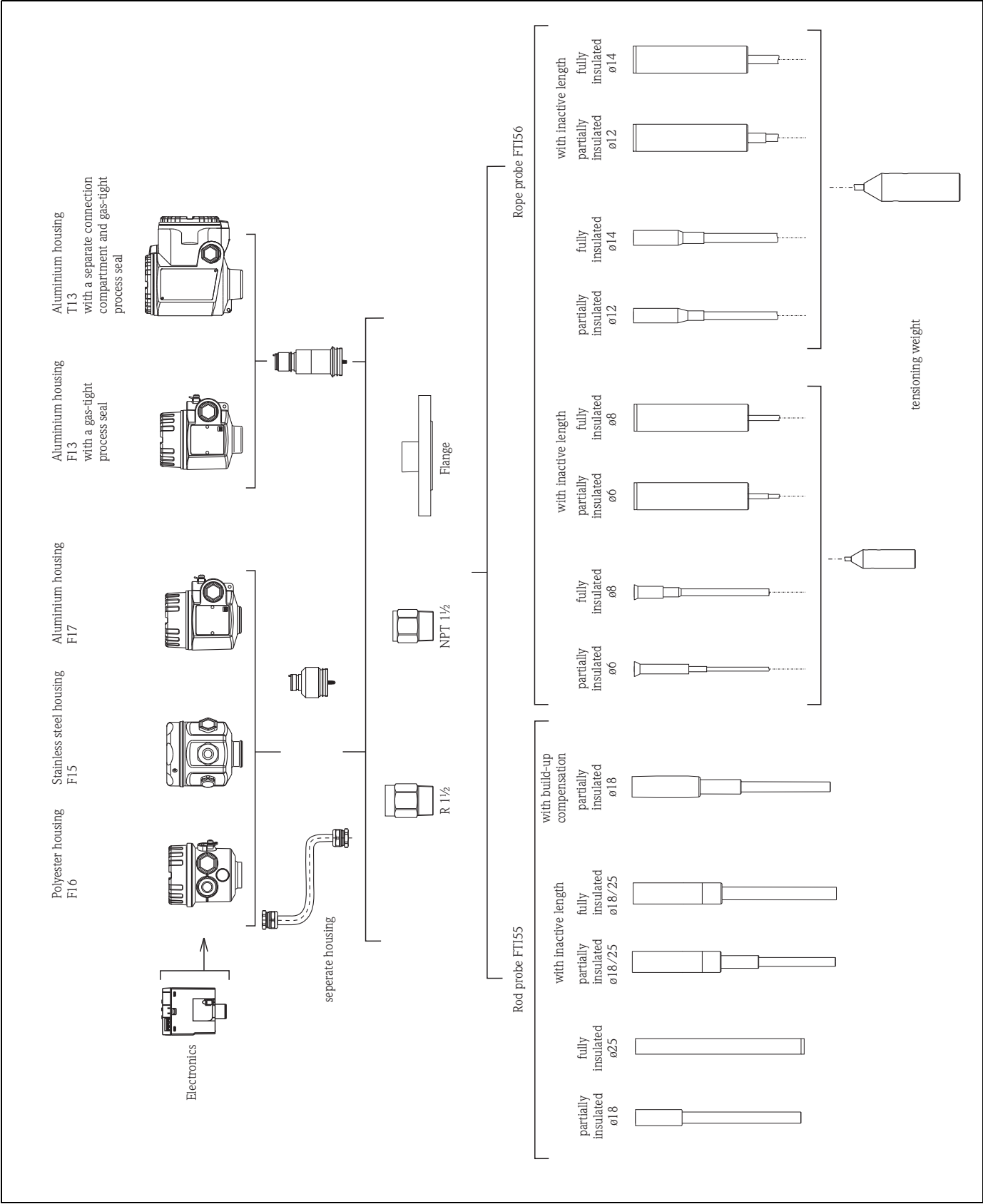
State of aggregation

See →  4, "Application examples"

Mechanical construction

All dimensions in mm!

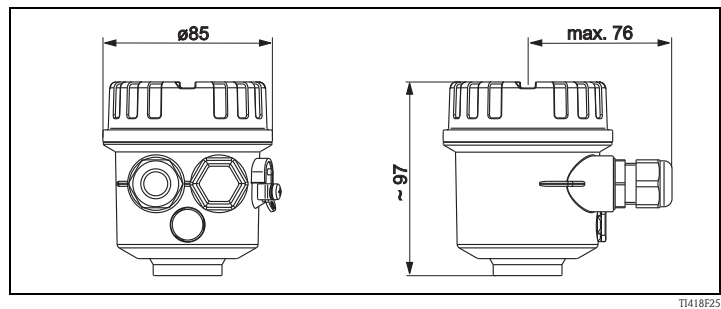
Overview



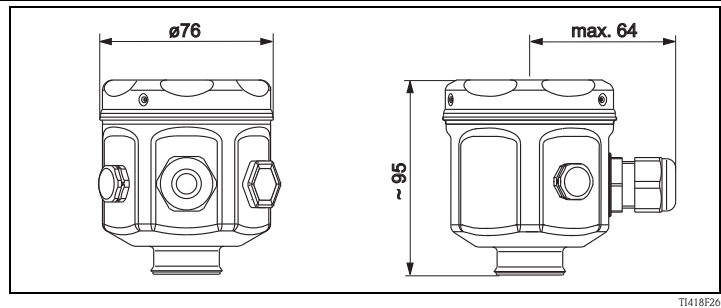
T1418Fen24

Housing

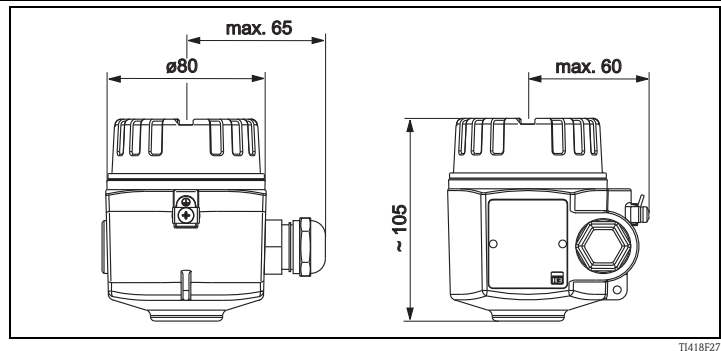
Polyester housing F16



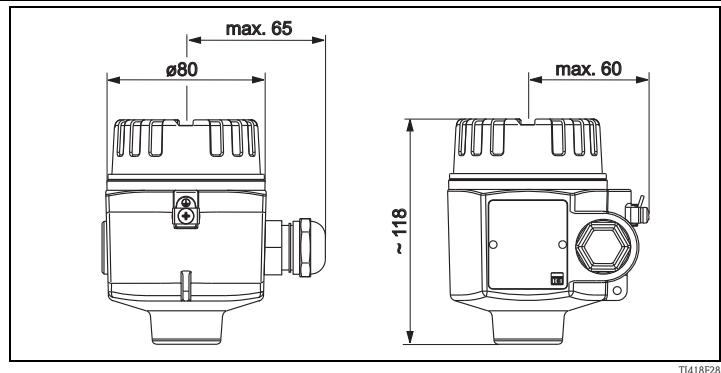
Stainless steel housing F15



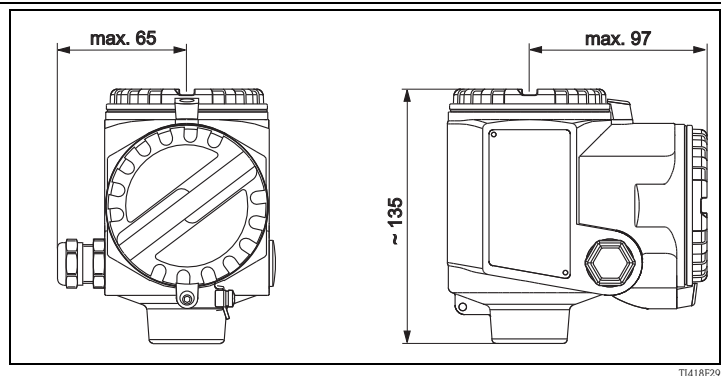
Aluminum housing F17



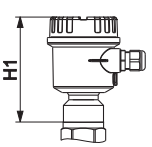
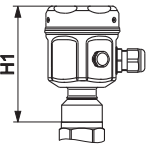
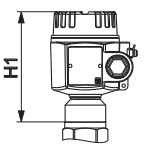
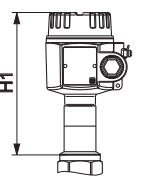
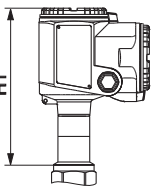
Aluminum housing F13
with gas-tight process seal



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

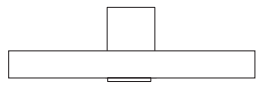


Housing heights with adapter

	Polyester housing F16	Stainless steel housing F15	Aluminum housing F17	Aluminum housing F13*	Aluminum housing with separate connection compartment T13*
	 TI418F30	 TI418F31	 TI418F32	 TI418F33	 TI418F34
Order code	2	1	3	4	5
FTI55, FTI56					
H1	125	121	131	177	194

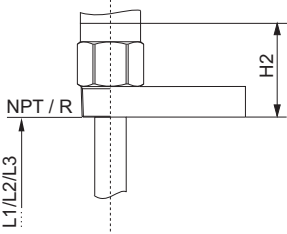
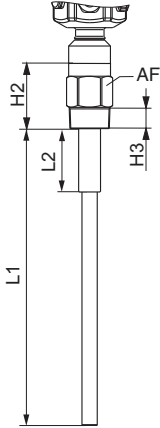
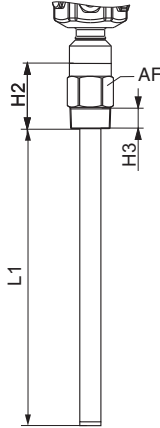
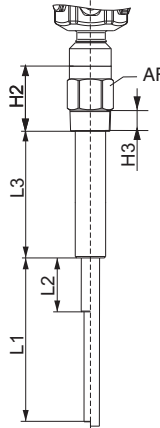
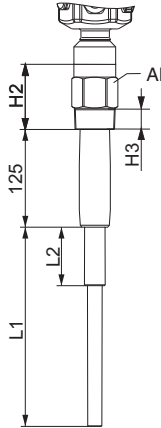
* Housing with gas-tight process seal

Process connections and flanges

	Thread: R 1½	Thread: NPT 1½	Flanges
	 TI418Fen35 (DIN EN 10226-1)	 TI418Fen36 (ANSI B 1.20.1)	 TI418F37 (EN1092-1) (ANSI B 16.5) (JIS B2220)
Order code/material	RVJ / 316L RV1 / steel	RGJ / 316L RG1 / steel	
Pressures up to	25 bars	25 bars	Depends on flange max. 25 bar

Rod probes FTI55

Total length of the probe from the start of the thread: $L = L1 + L3$
 (+ 125 mm with active buildup compensation)

	Rod probe partially insulated	Rod probe fully insulated	Rod probe with inactive length partially/fully insulated	Rod probe with active buildup compensation partially insulated
				
H2	77	77	66	92
H3	25	25	25	25
Across flats (AF)	50	50	50	50
Total length (L)	200 to 4000	200 to 4000	300 to 6000	225 to 4000
Active rod length (L1)	200 to 4000	200 to 4000	200 to 4000	200 to 4000
Inactive rod length (L3)	-	-	200 to 2000	-
ø Inactive length	-	-	43	-
Length of partial insulation (L2)	75	-	75 / -	75
Probe rod diameter (with insulation)	18 (25)	18 (25)	18 (25)	18 (25)
ø Active build-up compensation/length	- / -	- / -	- / -	36/ 125
Lateral loading capacity (Nm) at 20 °C	300	300	300	200
Maximum process temperature (°C)	180	80	180/80	180
For use in mounting nozzles	-	-	X	-
In the event of condensate on tank ceiling	-	-	X	X

TJ418Fen39

TI418Fen39

X = recommended

Length tolerance

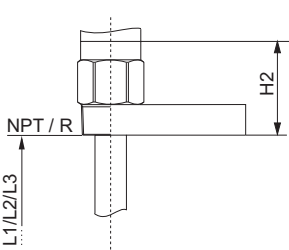
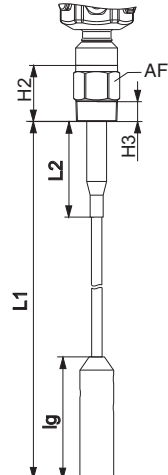
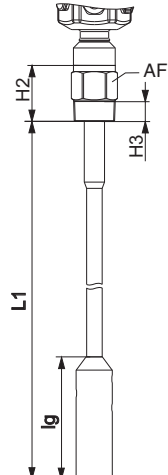
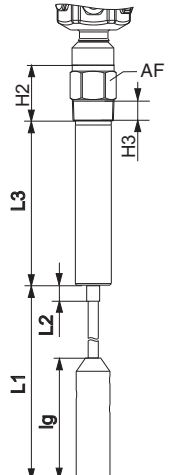
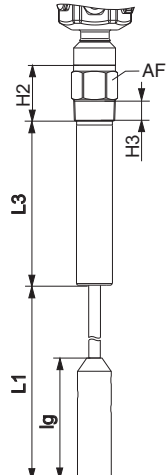
up to 1 m: 0 to -5 mm

> 1 m to 3 m: 0 to -10 mm

> 3 m to 6 m: 0 to -20 mm

Rope probes FTI56

Total length of probe from start of thread: $L = L1 + L3$

	Rod probe Partially insulated rope		Rod probe Fully insulated rope		Rope probe with inactive length Partially insulated rope		Rope probe with inactive length Fully insulated rope	
     T1418F38 T1418Fen40								
H2	66		66		66		66	
H3	25		25		25		25	
Across flats (AF)	50		50		50		50	
Total length (L)	500 to 20000		500 to 20000		700 to 20000		700 to 20000	
Active rope length (L1)	500 to 20000		500 to 20000		500 to 19800		500 to 19800	
Length of partial insulation (L2)*	500		-		500		-	
Inactive length (L3)	-		-		200 to 2000		200 to 2000	
ø Inactive length	-		-		43		43	
Probe rope diameter (with insulation)	6 (8)	12 (14)	6 (8)	12 (14)	6 (8)	12 (14)	6 (8)	12 (14)
ø Tensioning weight**	30	40	30	40	30	40	30	40
Length of tensioning weight (lg)	150	250	150	250	150	250	150	250
Tensile loading capacity (kN) of probe rope at 20 °C	30	60	30	60	30	60	30	60
Maximum process temperature (°C)	180		120		180		120	
For use in mounting nozzles	-		-		X		X	
In the event of condensate on tank ceiling	-		-		X		X	

X = recommended

* The length of the partial insulation extends, at maximum, to the tensioning weight.

** The tensioning weight is always uninsulated.

Length tolerance

up to 1 m: 0 to -10 mm > 1 m to 3 m: 0 to -20 mm > 3 m to 6 m: 0 to -30 mm > 6 m to 20 m: 0 to -40 mm

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 (14404), uninsulated

Housing cover and seals

- Aluminum housing F17, F13, T13: EN-AC-AISi10Mg, plastic-coated cover seal: EPDM
- Polyester housing F16: Cover made of PBT-FR or cover with sight glass made of PA12
Cover seal: EPDM
- Stainless steel housing F15: AISI 316L Cover seal: silicone

Probe material

- Process connection, tensioning weight for rope probe: 1.4404 (316L) or steel
- Inactive length: 1.4404 (316L)
- Probe rope partially insulated: PTFE, 1.4401 (AISI 316)
- Probe rope fully insulated: PA, galvanized steel
- Probe rod partially insulated: PPS, 1.4404 (316L)
- Probe rod fully insulated: PE, galvanized steel

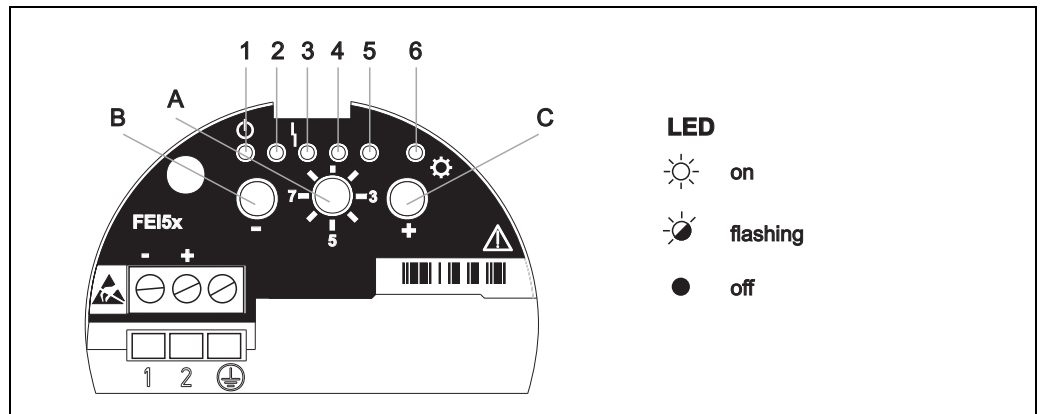
Weight

- with F15, F16, F17 or F13 housing approx. 4.0 kg
+ flange weight or process connection
+ probe rod 2.0 kg/m (for ø18 mm probe rod) or
+ probe rope 0.180 kg/m (for ø6 mm rope probes) or
+ probe rope 0.550 kg/m (for ø12 mm rope probes)
- with T13 housing approx. 4.5 kg
+ flange weight or process connection
+ probe rod 2.0 kg/m (for ø18 mm probe rod) or
+ probe rope 0.180 kg/m (for ø6 mm rope probes) or
+ probe rope 0.550 kg/m (for ø12 mm rope probes)

Human interface

Electronic inserts

FEI51, FEI52, FEI54, FEI55



BA300Fes015

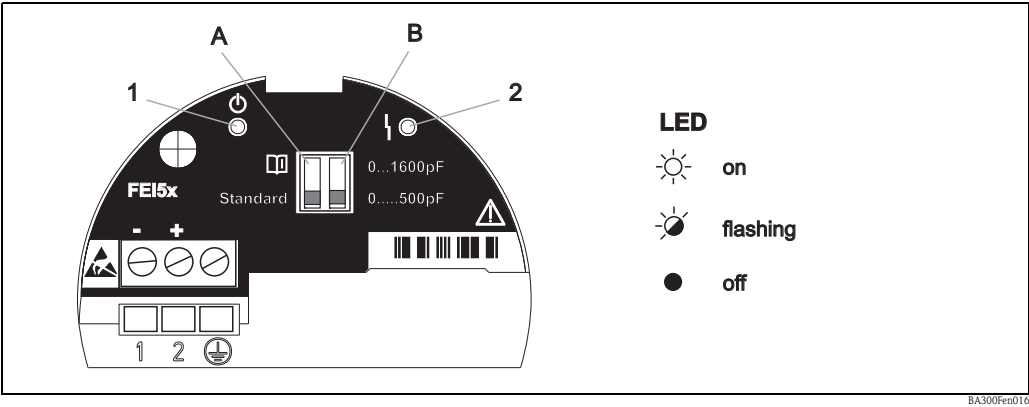
Green LED 1 (⏻ ready for operation), red LED 3 (⚠ error indicated), yellow LED 6 (* switching state)

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

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

Electronic inserts

FEI53, FEI57S

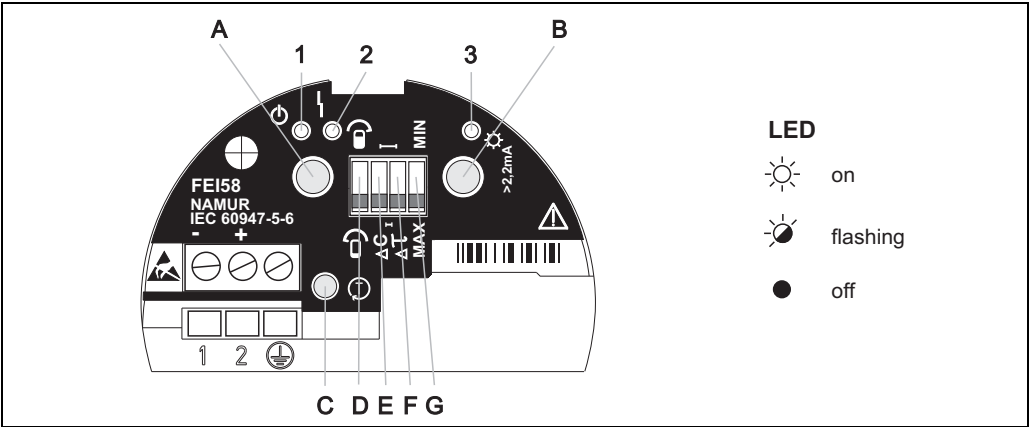


Green LED (🟢 ready for operation), red LED (🔴 error indicated)

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

Electronic insert

FEI58



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

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

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

Certificates and approvals

CE approval

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

Additional certification

- See also "Ordering information" → 42
- AD2000
The wetted material (316L) corresponds to AD2000 – W0/W2

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

IEC 61508

Functional safety

IEC 60947-5-6

Low-voltage switchgear and control gear; DC interface for proximity sensors and switching amplifiers (NAMUR)

Ordering information

Note!

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

Solicap M FTI55

10	Approval:		
	A	Non-hazardous areas	
	B	ATEX II 1/3 D	
	C	ATEX II 1/2 D	
	F	ATEX II 1 D, 1/2 D, 1/3 D EEx ia D	
	L	CSA/FM IS Cl. I, II, III,	Div. 1+2, Gr. A-G
	M	CSA/FM XP Cl. I, II, III,	Div. 1+2, Gr. A-G
	N	CSA/FM DIP Cl. I, II, III,	Div. 1+2, Gr. E-G
	S	TIIIS Ex ia IIC T3	
	T	TIIIS Ex d IIC T3	
	3	NEPSI	DIP A20
	Y	Special version, to be specified	

20	Inactive length L3:		
	A	Not selected	
	B	Not selected + 125 mm/5 inch	316L
		Active buildup compensation	
	1	 mm	316L
	5	 inch	316L
	9	Special version	

30	Active length L1:		
	A	 mm,	steel
	B	325 mm,	steel
	C	 mm,	316L
	D	325 mm,	316L
	E	600 mm,	steel
	H	 inch,	steel
	K	13 inch,	steel
	M	 inch,	316L

30					Active length L1:		
				N	13 inch,	316L	
				P	24 inch,	steel	
				Y	Special version, to be specified		
40					Insulation:		
				1	fully insulated PE,	max. 80 °C	
				2	75 mm L2, partially insulated PPS,	max. 180 °C	
				3	3 inch L2, partially insulated PPS,	max. 180 °C	
				9	Special version, to be specified		
50					Process connection:		
				AFJ	2", 150 lbs RF	316/316L	
				AGJ	3", 150 lbs RF	316/316L	
				AHJ	4", 150 lbs RF	316/316L	
				BSJ	DN80, PN10/16 A	316L EN1092-1 (DIN2527 B)	
				BTJ	DN100, PN10/16 A	316L EN1092-1 (DIN2527 B)	
				B3J	DN50, PN25/40 A	316L EN1092-1 (DIN2527 B)	
				KFJ	10K 50, RF	316L JIS B2220	
				KGJ	10K 80, RF	316L JIS B2220	
				KHJ	10K 100, RF	316L JIS B2220	
				RGJ	NPT 1½,	316L thread ANSI	
				RG1	NPT 1½,	steel thread ANSI	
				RVJ	R 1½,	316L thread DIN2999	
				RV1	R 1½,	steel thread DIN2999	
				YY9	Special version, to be specified		
60					Electronics; output:		
				1	FEI51; 2-wire	19 to 253VAC	
				2	FEI52; 3-wire PNP,	10 to 55VDC	
				3	FEI53; 3-wire,	3 to 12 V signal	
				4	FEI54; relay DPDT,	19 to 253VAC, 19 to 55VDC	
				5	FEI55; 8/16 mA,	11 to 36VDC	
				7	FEI57S;2-wire PFM		
				8	FEI58; NAMUR+test key (H-L signal)		
				W	Prepared for FEI5x		
				Y	Special version, to be specified		
70					Housing:		
				1	F15 316L	IP66, NEMA4X	
				2	F16 polyester	IP66, NEMA4X	
				3	F17 aluminum	IP66, NEMA4X	
				4	F13 Alu + gas-tight probe seal	IP66, NEMA4X	
				5	T13 Alu + gas-tight probe 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		
				G	Thread M20		
				E	M12 connector		
				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
											D EN10204-3.1 material (316L wetted), Inspection certificate
											E EN10204-3.1 material (316L wetted), Inspection certificate NACE MR0175
											F SIL Declaration of Conformity
											Y Special version, to be specified
FTI55											Product designation

Solicap M FTI56

10						Approval:
						A Non-hazardous areas
						B ATEX II 1/3 D
						C ATEX II 1/2 D
						F ATEX II 1 D, 1/2 D, 1/3 D EEx ia D
						L CSA/FM IS Cl. I, II, III, Div. 1+2, Gr. A-G
						M CSA/FM XP Cl. I, II, III, Div. 1+2, Gr. A-G
						N CSA/FM DIP Cl. I, II, III, Div. 1+2, Gr. E-G
						S TIS Ex ia IIC T3
						T TIS Ex d IIC T3
						3 NEPSI DIP A20
						Y Special version, to be specified
20						Inactive length L3:
						A Not selected
						1 mm 316L
						5 inch 316L
						9 Special version
30						Active length L1; tensioning weight:
						A mm, 6 mm rope 316L; 316L
						B mm, 12 mm rope 316L; 316L
						C mm, 8 mm rope galvanized steel; steel
						D mm, 14 mm rope galvanized steel; steel
						H inch, 0.2" rope 316L; 316L
						K inch, 0.5" rope 316L, 316L
						M inch, 0.3" rope galvanized steel; steel
						N inch, 0.6" rope galvanized steel; steel
						Y Special version, to be specified
40						Insulation:
						1 fully insulated PA, max. 120 °C
						2 500 mm partially insulated max. 180 °C L2, PTFE,
						9 Special version, to be specified
50						Process connection:
						AFJ 2", 150 lbs RF 316/316L
						AGJ 3", 150 lbs RF 316/316L
						AHJ 4", 150 lbs RF 316/316L
						BSJ DN80, PN10/16 A 316L EN1092-1 (DIN2527 B)
						BTJ DN100, PN10/16 A 316L EN1092-1 (DIN2527 B)
						B3J DN50, PN25/40 A 316L EN1092-1 (DIN2527 B)
						KFJ 10K 50, RF 316L JIS B2220
						KGJ 10K 80, RF 316L JIS B2220
						KHJ 10K 100, RF 316L JIS B2220
						RGJ NPT 1½ 316L thread ANSI
						RG1 NPT 1½, steel thread ANSI
						RVJ R 1½, 316L thread DIN2999
						RV1 R 1½, steel thread DIN2999
						YY9 Special version, to be specified
60						Electronics; output:
						1 FEI51; 2-wire 19 to 253VAC
						2 FEI52; 3-wire PNP, 10 to 55VDC
						3 FEI53; 3-wire, 3 to 12 V signal

60										Electronics; output:	
										4	FEI54; relay DPDT, 19 to 253VAC, 19 to 55VDC
										5	FEI55; 8/16 mA, 11 to 36VDC
										7	FEI57S; 2-wire PFM
										8	FEI58; NAMUR+test key (H-L signal)
										W	Prepared for FEI5x
										Y	Special version, to be specified
70										Housing:	
										1	F15 316L IP66, NEMA4X
										2	F16 polyester IP66, NEMA4X
										3	F17 aluminum IP66, NEMA4X
										4	F13 Alu + gas-tight probe seal IP66, NEMA4X
										5	T13 Alu + gas-tight probe 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
										G	Thread M20
										E	M12 connector
										F	7/8" connector
										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
										F	SIL Declaration of Conformity
										Y	Special version, to be specified
FTI56										Product designation	

Accessories

Weather protection cover

For F13 and F17 housing
Order number: 71040497

Overvoltage protection HAW56x

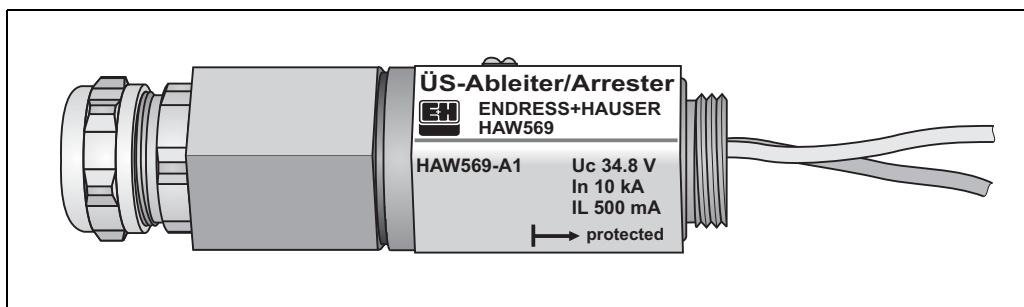
Overvoltage protection (housing)

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

Note!

These two versions can be screwed directly into the housing (M20x1.5).

Surge arrester for limiting overvoltage in signal lines and components.



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

Overvoltage protection (cabinet)

- HAW562Z (hazardous area)

The HAW562Z module can be used if installing in cabinets.

Spare parts

Electronic inserts

Electronic insert	Parts number
FEI51	71042887
FEI52	71025819
FEI53	71025820
FEI54	71025814
FEI55	71025815
FEI57S	71025816
FEI58	71100895

You can order spare parts directly from your E+H service organization by quoting the order number (see below).

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.

Housing cover

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

Documentation

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

Technical Information

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

Operating Instructions

- Solicap M FTI55, FTI56
BA00300F/00/en

Certificates

Safety information (ATEX)

- Solicap M FTI55, FTI56
ATEX II 1 D Ex tD A20 IP65 T 90 °C,
ATEX II 1/2 D Ex tD A20/A21 IP65 T 100 °C
XA00389F/00/a3
- Solicap M FTI55, FTI56
DIP A21 T_A, T 100°C IP65
NEPSI GYJ071369
XA00426F/00/a3

Control Drawings (for FM and CSA)

- Solicap M FTI55, FTI56
FM ZD00222F/00/en
- Solicap M FTI55, FTI56
CSA ZD00225F/00/en

Functional safety (SIL2/SIL3)

- Solicap M FTI55, FTI56
SIL
SD00278F/00/en

CRN registration

- CRN 0F12978.5

Other

- AD2000
The wetted material (316L) corresponds to AD2000 – W0/W2

Patents

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

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



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