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

Technical Information

Solicap S FTI77

Capacitance
Robust point level switch for applications with bulk solids and very high temperatures

Application

Solicap S is used for point level detection at high temperatures in bulk solids. It can be operated in minimum or maximum failsafe mode.

Due to its robust construction, it can also be used to provide accurate measurements in applications with very high lateral loads (up to 800 Nm for sword version) and in applications with abrasive media.

Active buildup compensation facilitates safe switching, even in the event of media that tend to cause buildup.

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 with caking tendency
- Use in safety systems requiring functional safety to SIL2/SIL3 in combination with electronic insert FEI55
- Increased safety due to permanent automatic monitoring of electronics
- Reduction in storage costs thanks to easy-to-shorten sword model and rope model

TI433F/00/en
71110977

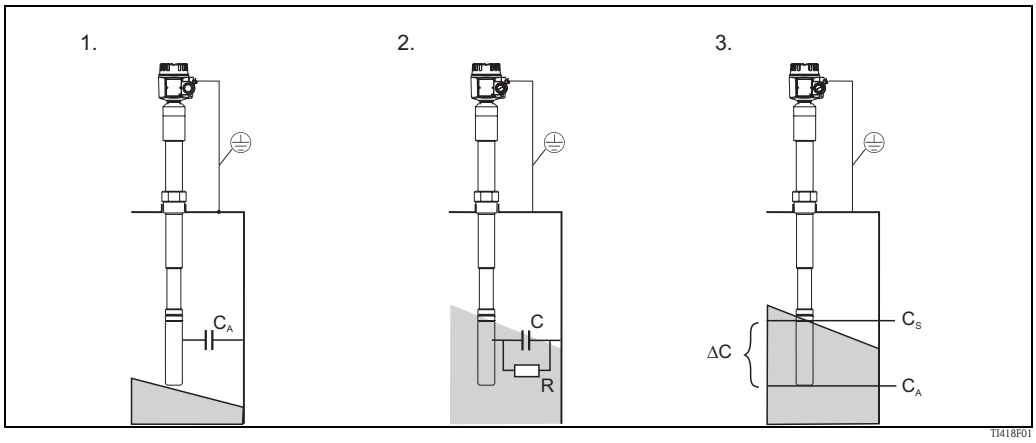
Endress+Hauser
People for Process Automation

Table of contents

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

Fly ash, sand, glass aggregate, gravel, molding sand, lime, ore (crushed), plaster, aluminum shavings, cement, pumice, dolomite, kaolin and similar bulk solids.

In general:
Bulk solids with a relative dielectric constant $\varepsilon_r \geq 2.5$.

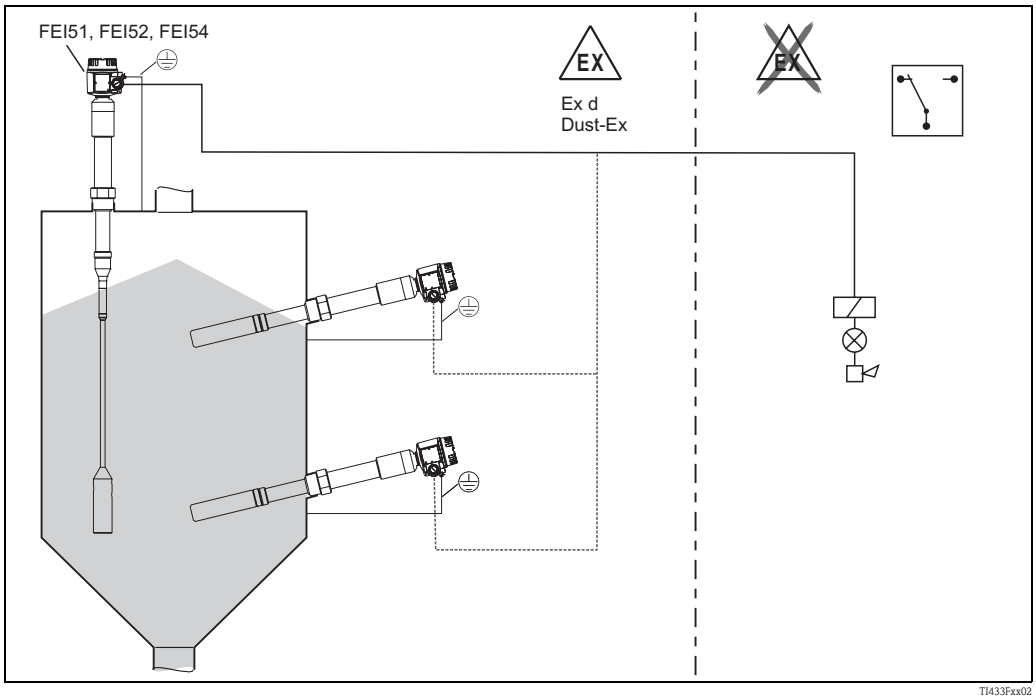
Measuring system

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 S FTI77
- An electronic insert FEI51, FEI52, FEI54



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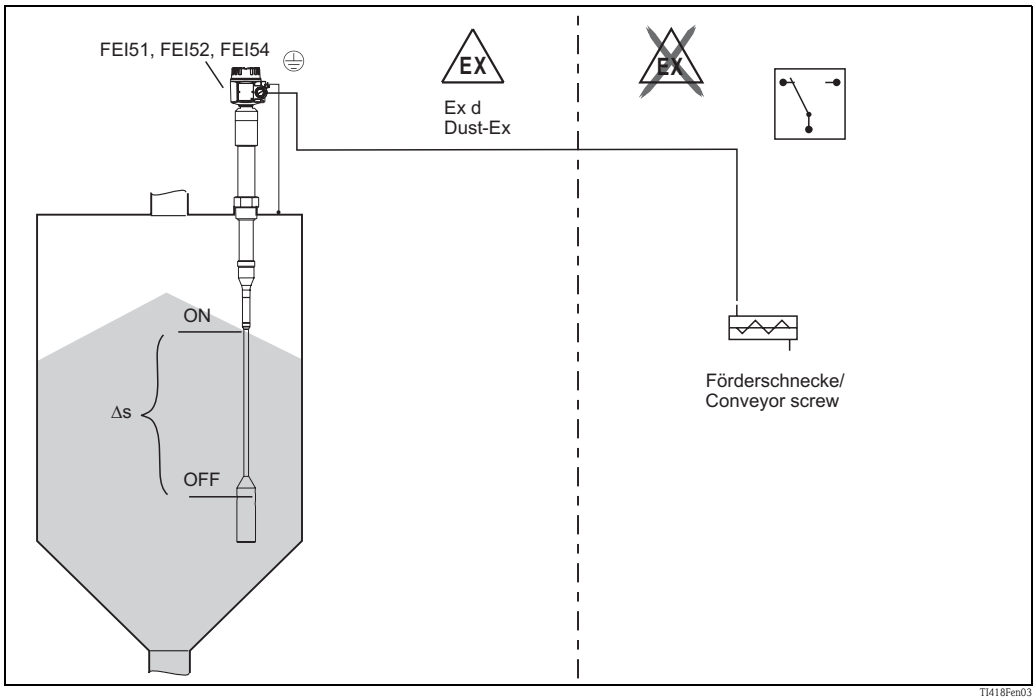
Two-point control (Δs function)

Note!
Only in conjunction with nonconductive bulk solids.



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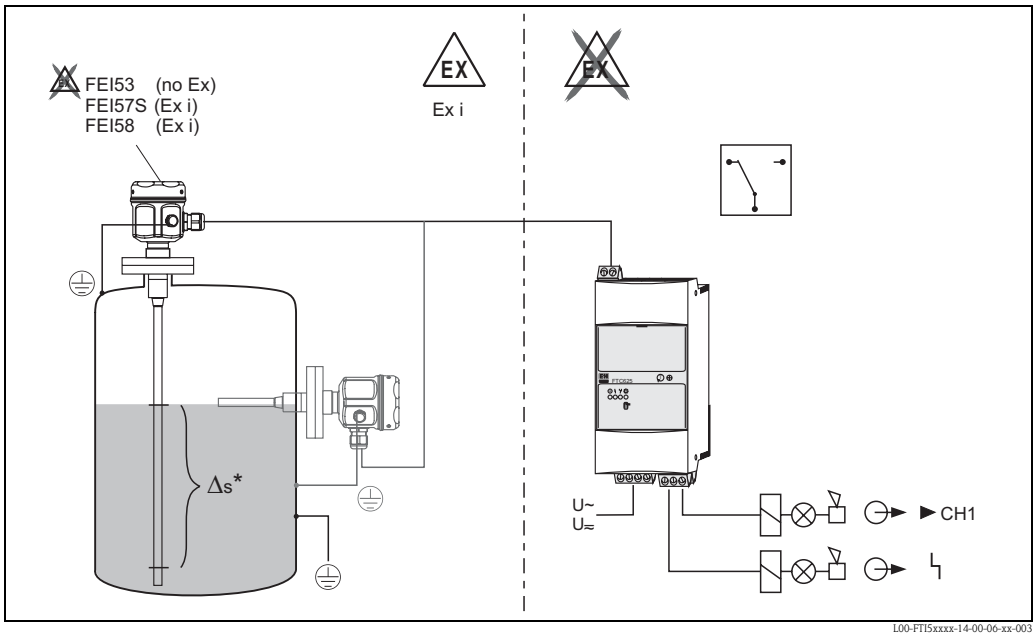
The point level switch can also be used to control a screw conveyor, for example, where the on and off values can be freely defined.

Point level switch

Solicap S FTI77 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 S FTI77
- an FEI53, FEI57S, FEI58 electronic insert
- a transmitter power supply e.g. FTC325, FTC625 (SW V1.4 or higher), FTC470Z, FTC471Z, FTL325N, FTL375N



** Only possible with FEI53*

The following table lists the transmitter power supply units that are available and can be operated with the electronic inserts FEI57S and FEI53.

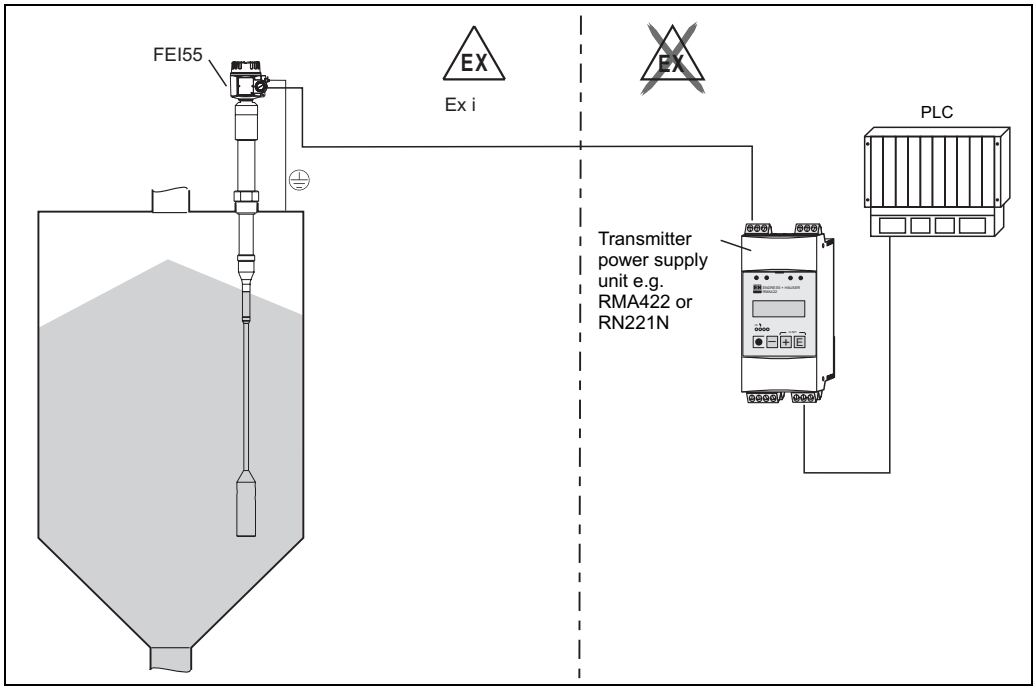
Electronic insert Transmitter power supply unit	FEI57S	FEI53	FEI58
FTC625	x	–	–
FTC325	x	x	–
FTL325N	–	–	x
FTL375N	–	–	x
FTC470Z	x	–	–
FTC471Z	x	–	–
FTC520Z*	x	–	–
FTC521Z*	x	–	–
FTC420*	–	x	–
FTC421*	–	x	–
FTC422*	–	x	–

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 S FTI77
- the FEI55 electronic insert
- a transmitter power supply unit (e.g. RN221N, RNS221, RMA421, RMA422)



Electronic versions

FEI51
Two-wire AC connection

- Switching the load 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.
- Recurrent function test 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 of the connection cables and slave devices by pressing a key on the electronic insert.

Note!
For additional information see → 28 ff.

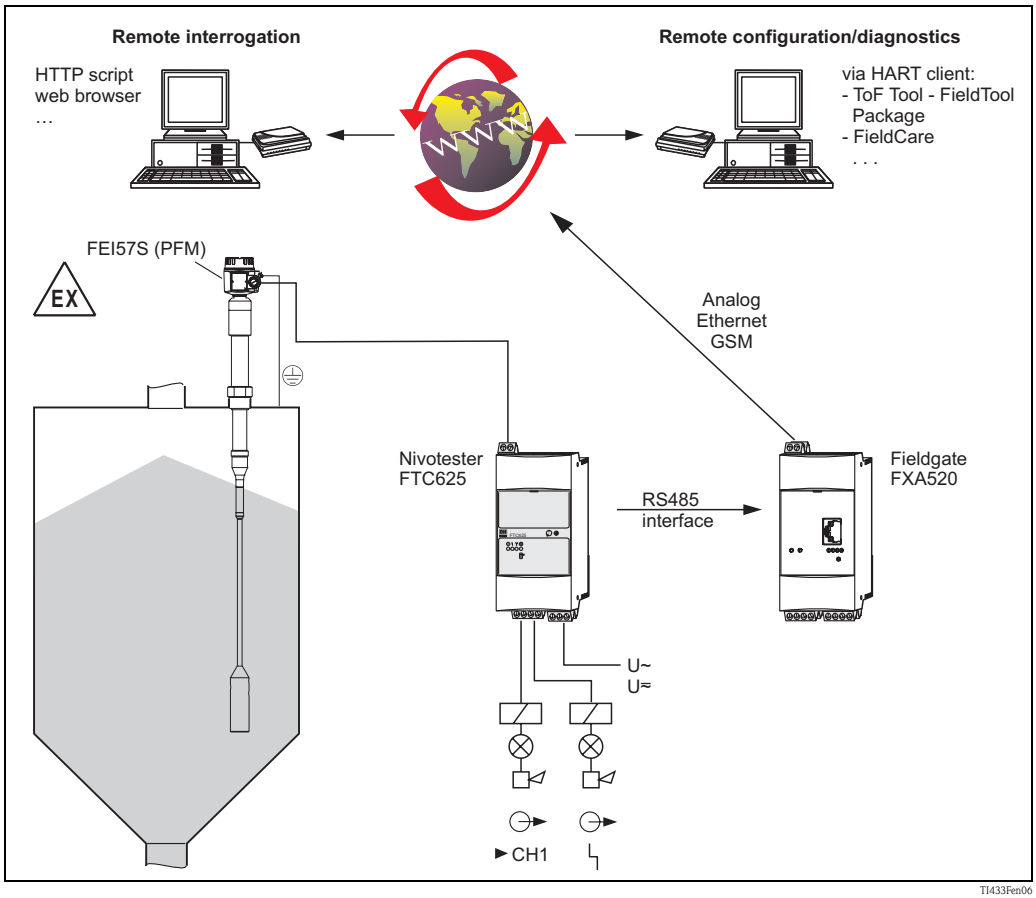
System integration via Fieldgate

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.



Operating conditions: Installation

Note!
All dimensions in mm.

Installation

Installation instructions

The Solicap S FTI77 (sword probe) can be installed from above and from the side.
The Solicap S FTI77 (rope probe) can be installed vertically from above.

Caution!
If you order a probe that is prepared for subsequent mounting of an active length (feature: active length; version: VV), grounding must take place at the lower ceramic fixture when welding on the active length.

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

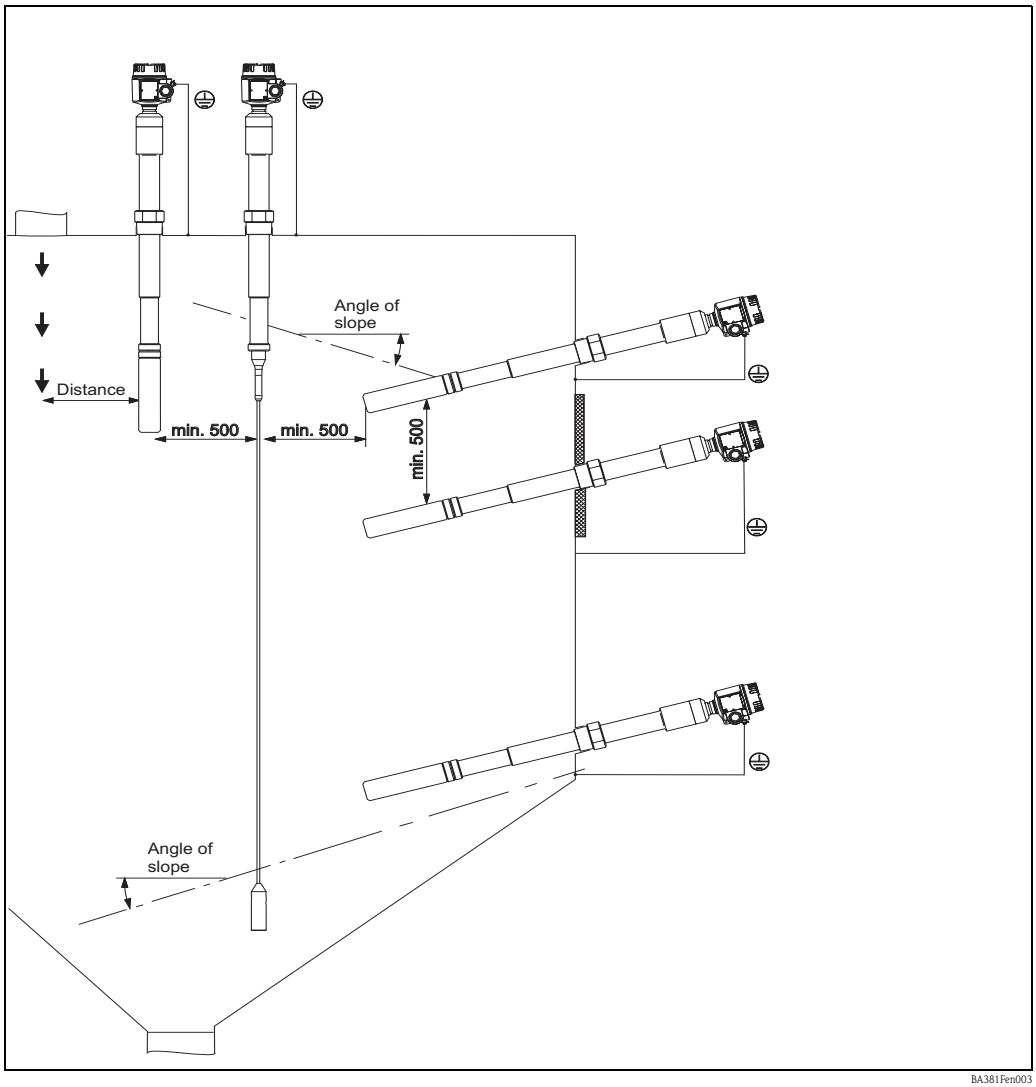
General notes

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.



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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

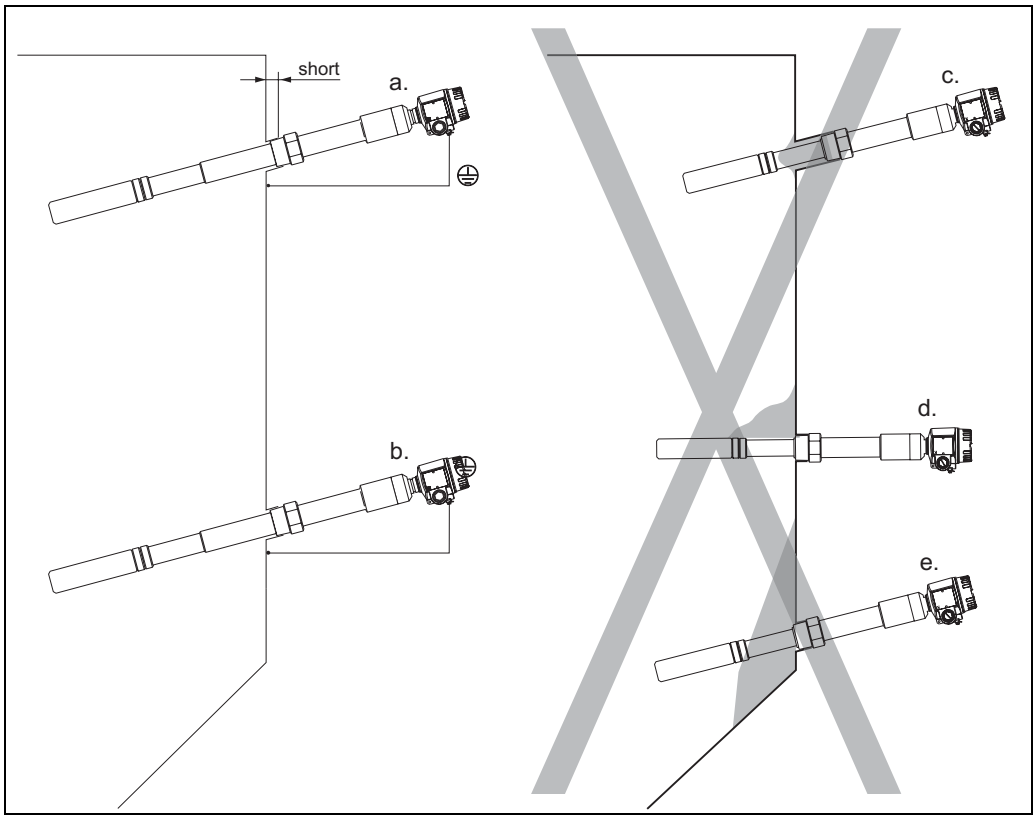
When installing the Solicap S FTI77, the threaded coupling should be as short as possible. Condensation or product residue may occur in a long threaded coupling and interfere with the correct operation of the probe.

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 S housing. Heat insulation also prevents condensation from forming near the threaded boss in the silo. This reduces buildup and the risk of error switching.

Preparing to install sword probes FTI77

Correct installation **Incorrect installation**



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.

Note!
Aligning the sword probe
To prevent unnecessary lateral load when installing the sword probe from the side, the sword must be installed with the narrow edge pointing upwards. An adhesive label indicates the installation position of the sword.

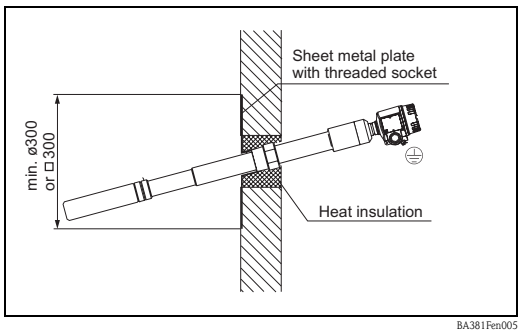
Incorrect installation

c. The threaded coupling is too long. This may cause material to settle inside and result in error switching.

d. Horizontal mounting means a risk of error switching in the event of heavy buildup on the silo wall. In this case, the Solicap S FTI77 (sword probe) with inactive length is recommended.

e. In areas where product buildup occurs, the device cannot detect if the silo is "empty". In this case, the FTI77 (rope probe) should be installed from above.

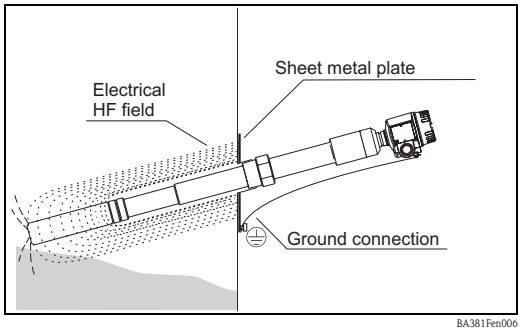
In this example, the grounded steel plate forms the counter electrode.
Heat insulation prevents condensation and therefore buildup on the steel plate.



In a silo with concrete walls

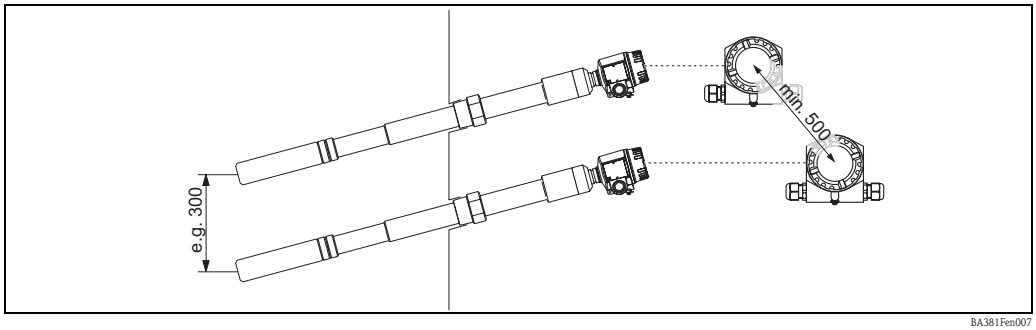
When installing in a nonconductive container, a sheet metal plate must be attached to the exterior of the silo as a counter electrode.
This plate can be either square or round.

– 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

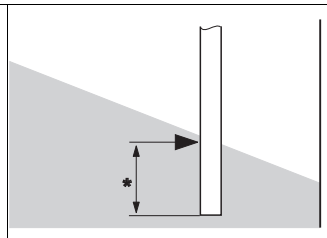
The required minimum distances can be achieved by offset installation.



For small differences in level

Probe length and minimum coverage

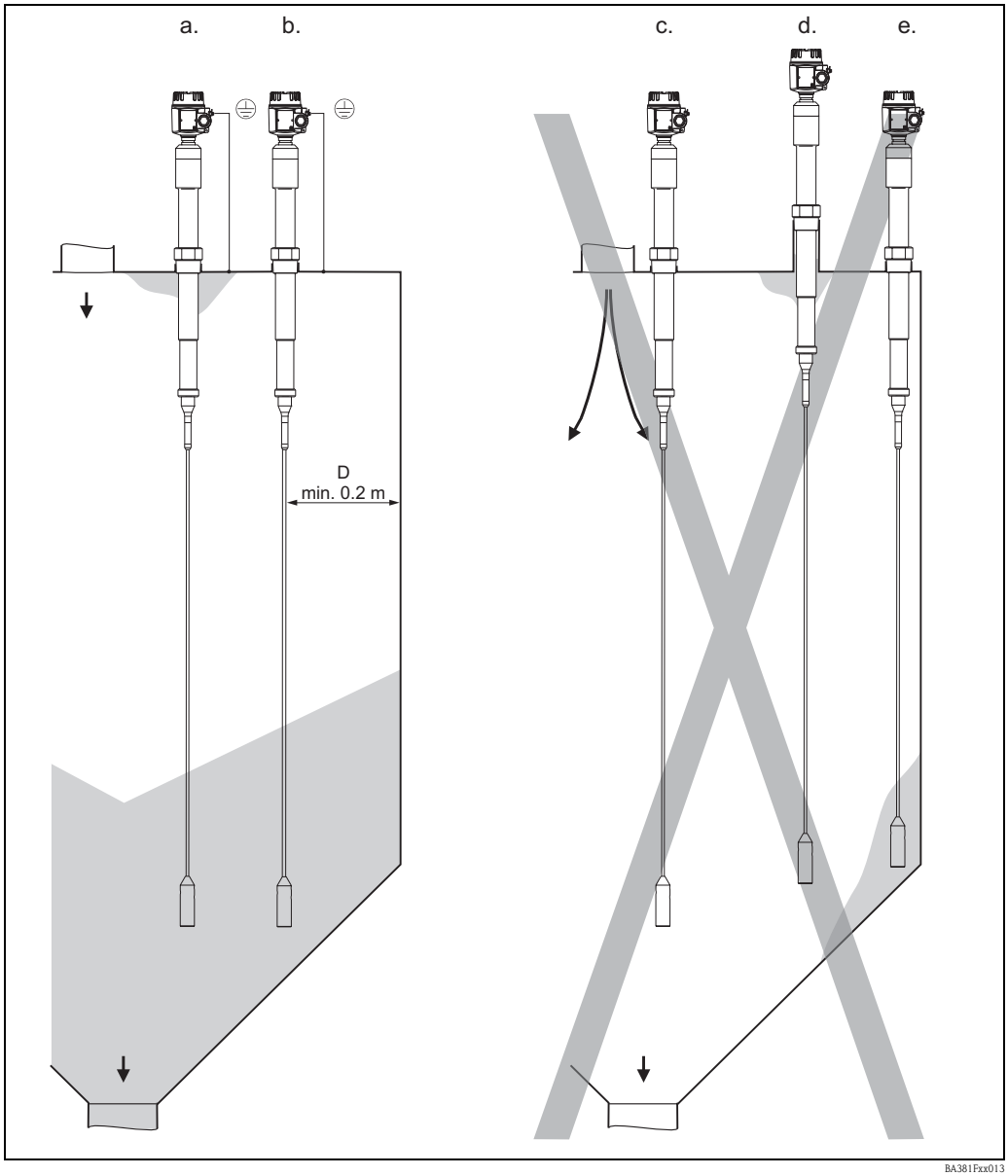
Note!
- When selecting the probe length, pay attention to the dependency between the relative dielectric constant ε_r and the minimum amount the probe needs to be covered (see Table).
- For probe length tolerances see Seite 23 ff.
- To ensure problem-free operation, it is important that the difference 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	
ε_r > 10	100 mm
ε_r > 5 to 10	200 mm
ε_r > 2 to 5	500 mm

Preparing to install rope probes FTI77

Correct installation **Incorrect installation**



In a silo with metal walls Distance D between the probe and the wall approx. 10 to 25 % of the silo diameter

Correct installation

a. Solicap S FTI77 with inactive length in the event of condensation and material buildup on the silo roof.

b. 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

c. 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.

d. The threaded coupling is too long. This may cause condensation and dust to settle inside which may result in error switching.

e. 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.

Abrasive bulk solids

In silos with extremely abrasive bulk solids, the use of a Solicap S FTI77 is recommended only for maximum detection.

Distance between the rope probes

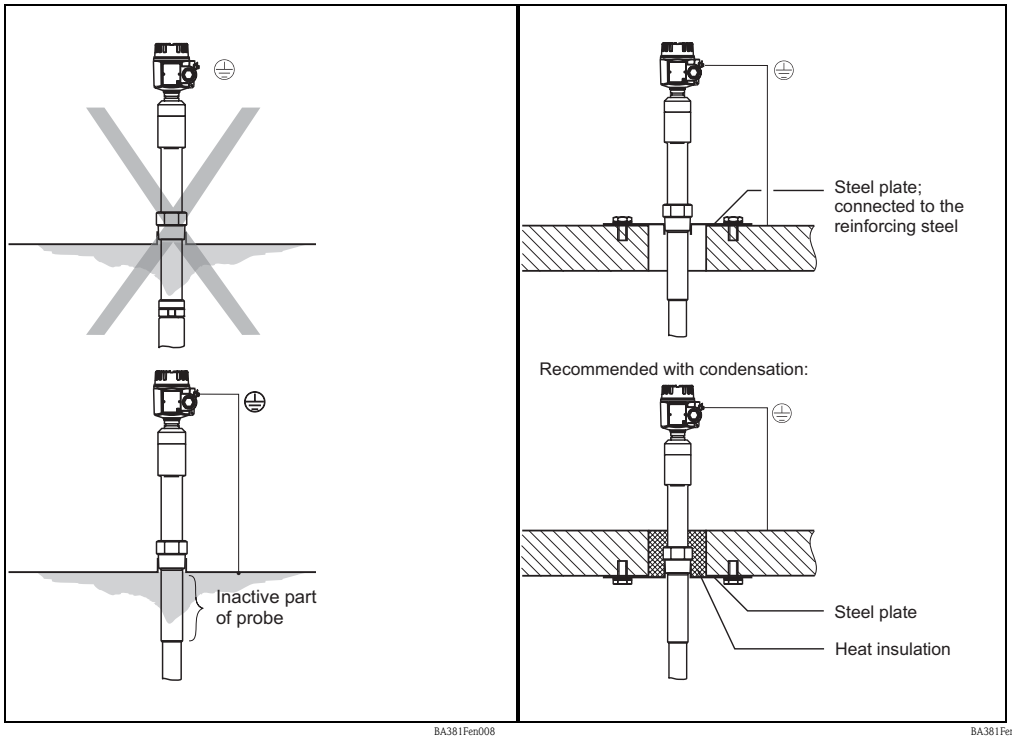
To rule out mutual probe interference, you must maintain a minimum distance of 0.5 m between the rope probes. This also applies if you are installing several Solicap S units in adjacent silos with nonconductive walls.

In the event of condensation:

Use the FTI77 with inactive length.
The inactive length (**Fig. A**) prevents moisture and buildup forming between the active part of the probe and the silo roof.

Or:
To reduce the effects of condensation (**Fig. 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.

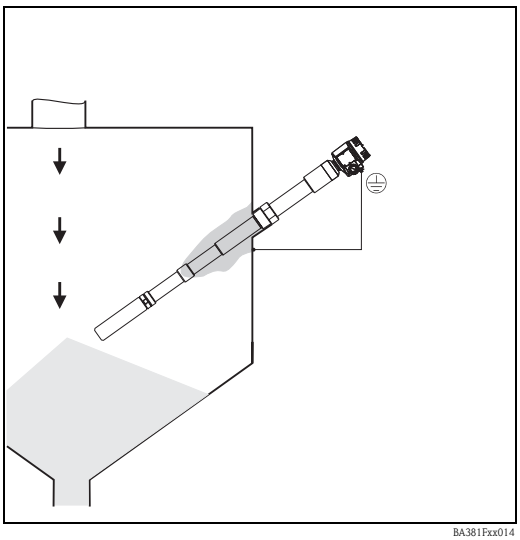
Fig. A **Fig. B**



Silo with walls that conduct electricity *Silo with concrete walls*

In the event of buildup:

If buildup on the sword probe can be expected when operating the measuring system, the active buildup compensation function prevents the measurement result from becoming distorted. This renders cleaning work on the sword probe unnecessary.



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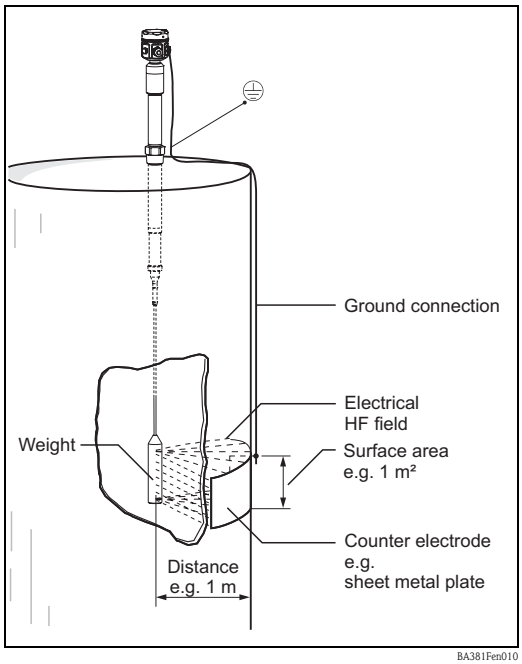
Installation in a nonconductive tank

When installing in a silo made of concrete, 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.



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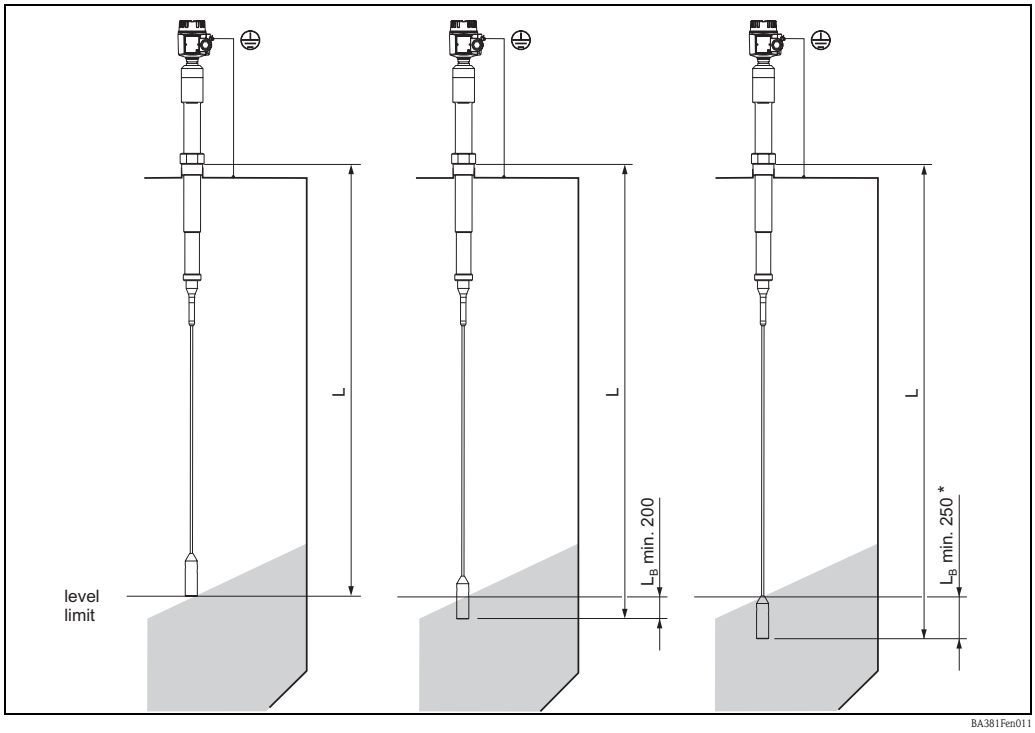
In a silo with plastic walls

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. fly ash)

* 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

Sword probe:
The sword probe can be shortened at a later stage by the user.

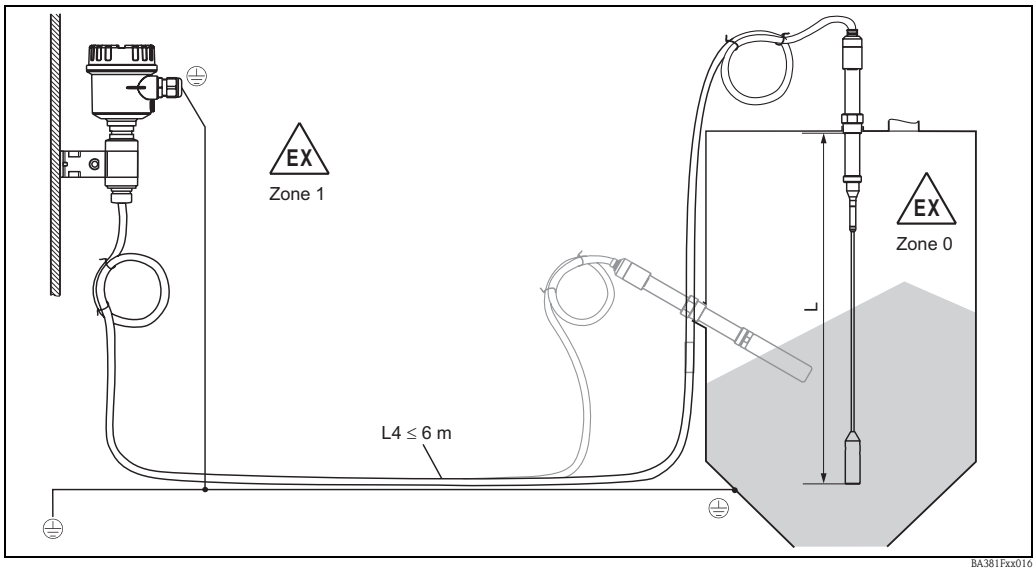
Rope probe:
The rope probe can be shortened at a later stage by the user.

Probe with separate housing

With separate housing

Note!

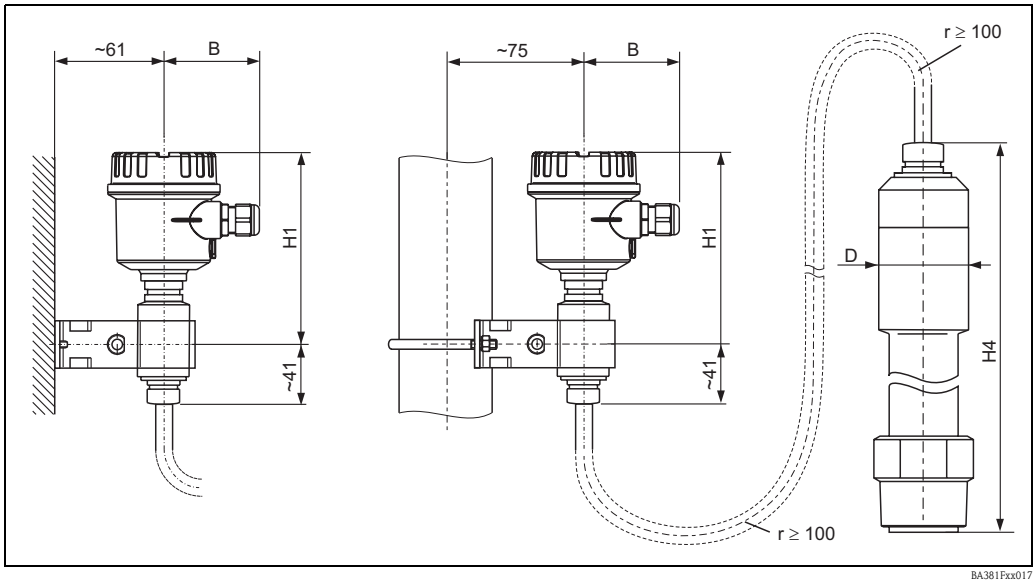
- For information on how to order, see also "Ordering information" from → 41 under "Probe design".
- The maximum connection length between the probe and the separate housing is 6 m (L4). When ordering a Solicap S with a separate housing, the desired length must be specified.
- If the connecting cable is to be shortened or passed through a wall, it must be separated from the process connection. See also → 16 (extension heights).
- The cable has a bending radius of r ≥ 100 mm. This must be observed as a minimum.



The maximum overall length of L + L4 may not exceed 20 m.

Extension heights

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

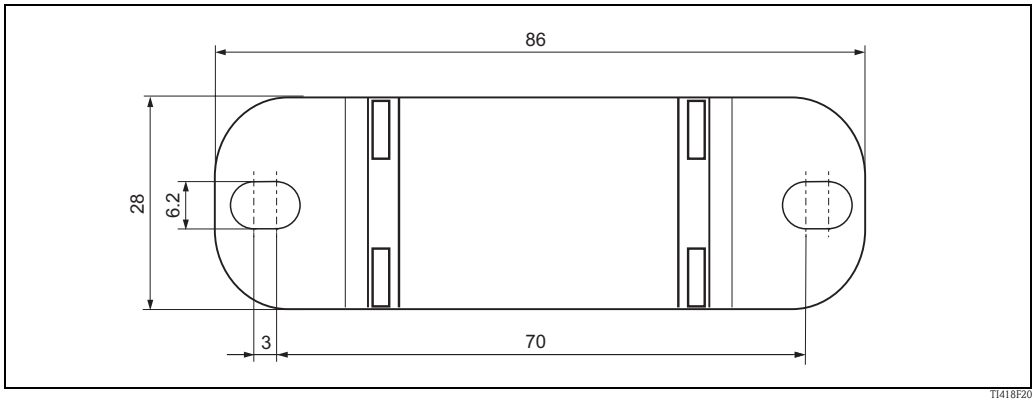


		Polyester housing F16	Stainless steel housing F15	Aluminum housing F17
B	-	76	64	65
H1	-	172	166	177
D	50	-	-	-
H4	330	-	-	-

Note!
- Connecting cable: ø10.5 mm
- Outer jacket: silicone, notch-resistant

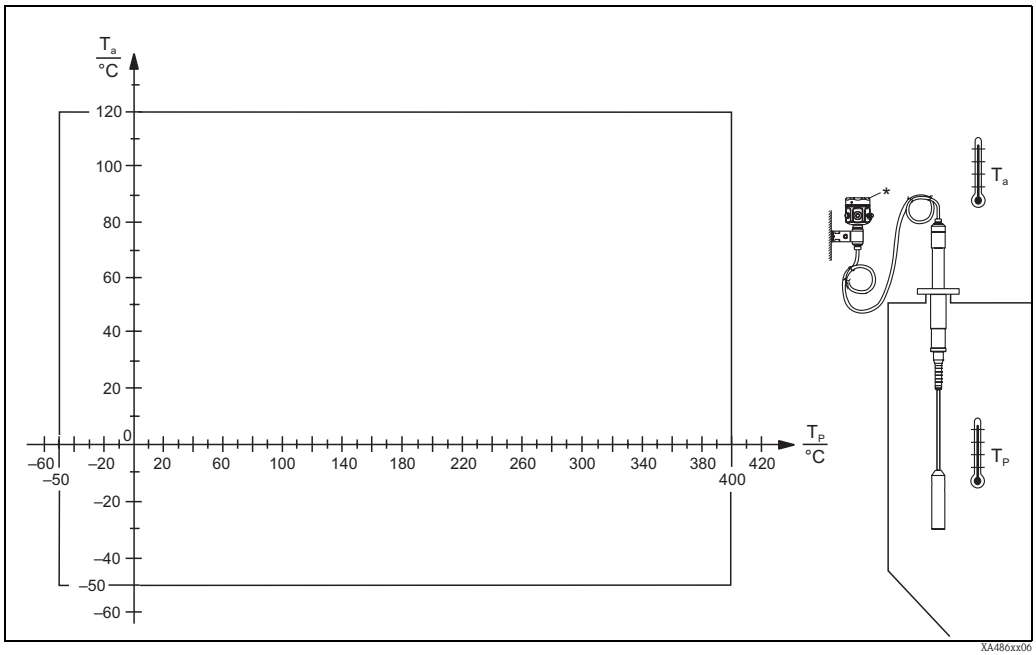
Wall holder unit

Note!
- The wall holder unit forms part of the scope of supply.
- 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.



Temperature derating with separate housing

Note!
The maximum connection length between the probe and the separate housing is 6 m (L4). When ordering a Solicap S 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 → 44.



T_a = ambient temperature,

T_p = process temperature,

** temperature at separate housing: –40 °C ≤ Ta ≤ 70 °C*

Operating conditions: Environment

Ambient temperature range

- Ambient temperature of the point level switch (note derating, see → 19):
  - –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 → 43.

Storage temperature

–50 to +85 °C

Climate class

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

Degree of protection

	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

* As per EN60529
** As per NEMA 250
*** Only with M20 cable entry or G1/2 thread

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 sword of the probe. 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. 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

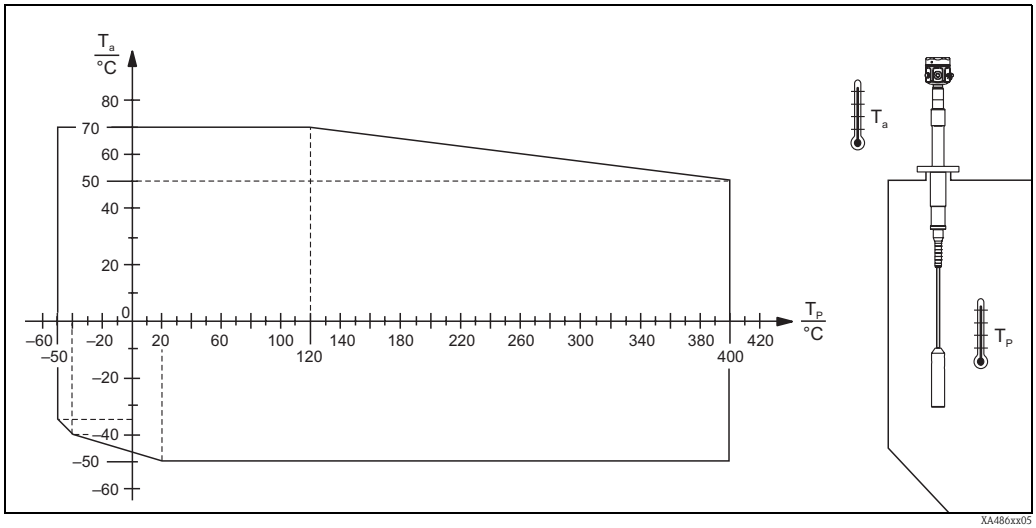
Process temperature range

Note!
- 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 XA389F/00.

Permitted ambient temperature T_a at the housing depending on the process temperature T_p in the tank.

Compact version

Sword and rope version



T_a = ambient temperature,

T_p = process temperature

Process pressure limits

–1 to 10 bar

The permitted pressure values depend on the flange selected. In the case of higher temperatures, the permitted pressure values can be taken from the following standards.

- pR EN 1092-1: 2005 table, Appendix G2
- ASME B 16.5a – 1998 Tab. 2-2.2 F316
- ASME B 16.5a – 1998 Tab. 2.3.8 N10276
- JIS B 2220

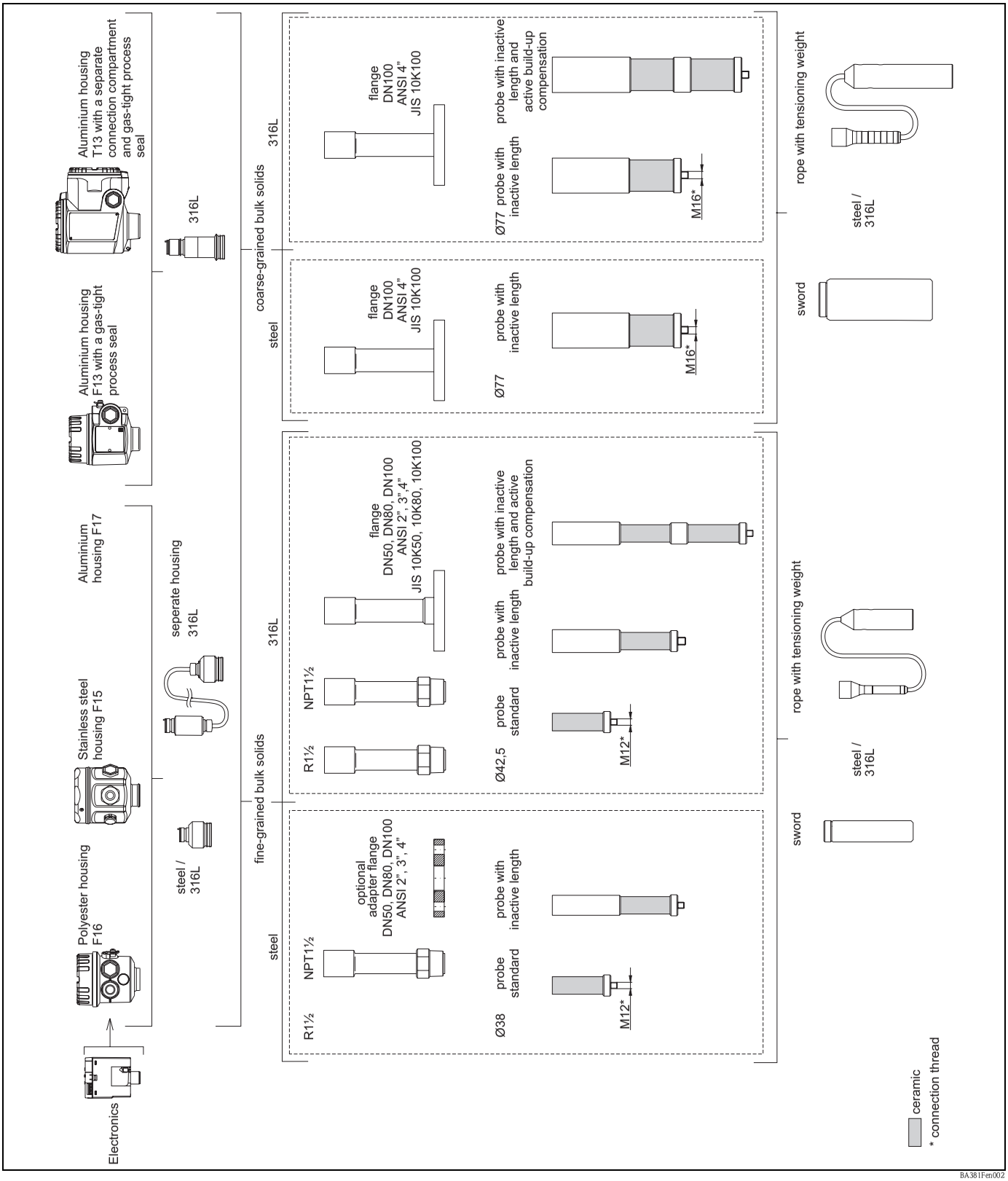
State of aggregation

See → 4, "Application examples"

Mechanical construction

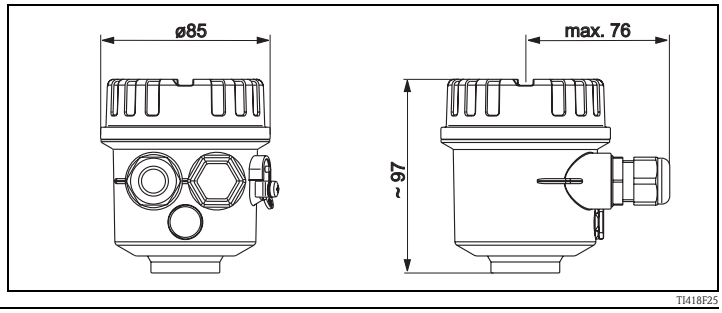
Note!
All dimensions in mm.

Overview

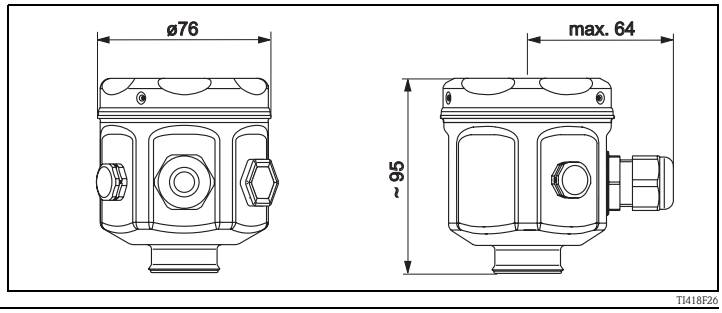


Housing

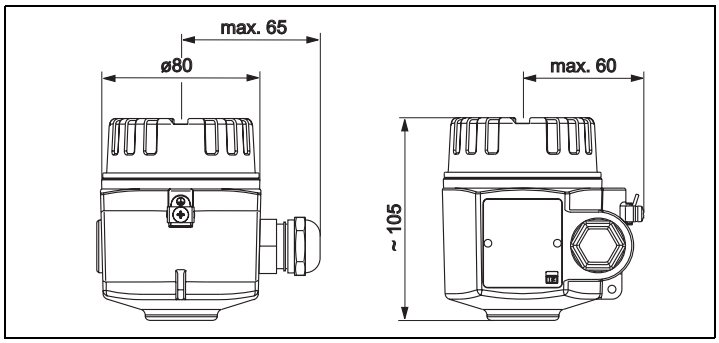
Polyester housing F16



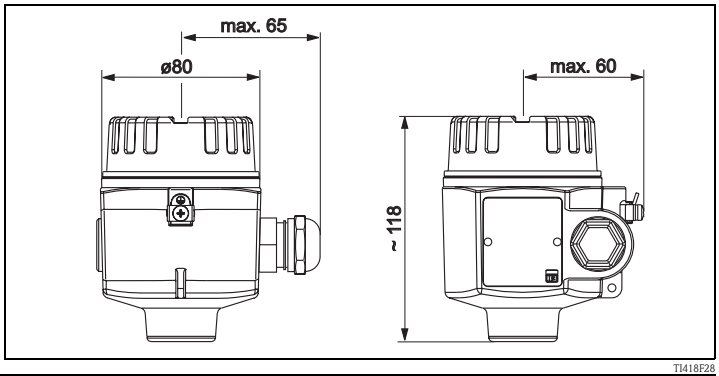
Stainless steel housing F15



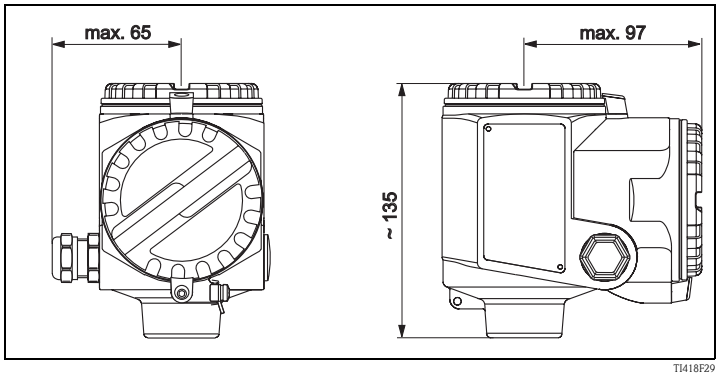
Aluminum housing F17



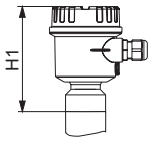
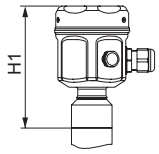
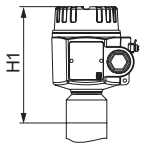
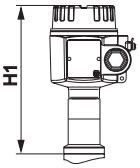
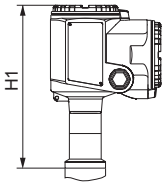
Aluminum housing F13
with gas-tight process seal



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

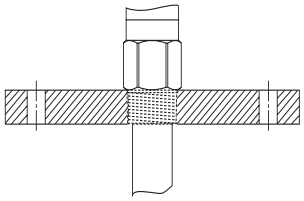
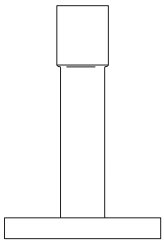


Housing heights with adapter

	Polyester housing F16	Stainless steel housing F15	Aluminum housing F17	Aluminum housing F13*	Aluminum housing with separate connection compartment T13*
	 BA381Fxx003	 BA381Fxx004	 BA381Fxx005	 BA381Fxx006	 BA381Fxx007
Order code	2	1	3	4	5
FTI77					
H1	125**/177	121**/ 173	131**/183	177	194

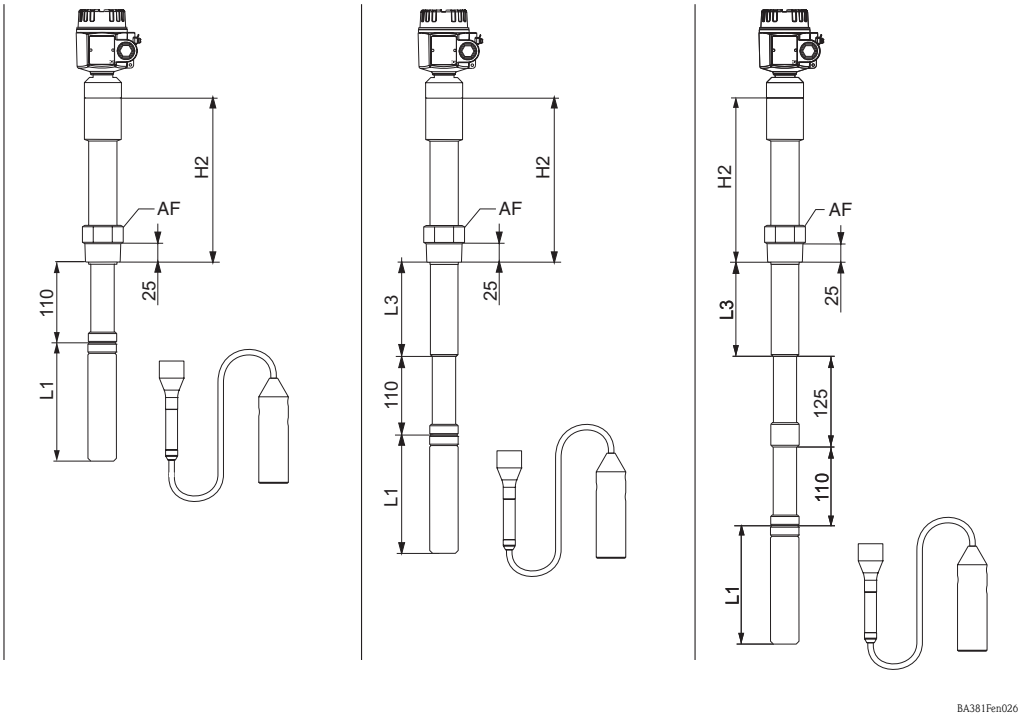
* Housing with gas-tight process seal
** For Approval: A (Non-hazardous area) or K (CSA General Purpose, CSA C US). => Device identification.

Process connections and flanges

	Thread: R 1½*	Thread: NPT 1½*	Flanges
 BA381Fxx025 ** Optional with adapter flange (for steel)*	 BA381Fxx008 (DIN EN 10226-1)	 BA381Fxx009 (ANSI B 1.20.1)	 BA381Fxx010 (EN1092-1) (ANSI B 16.5) (JIS B2220)
Order code/material	RVJ / 316L RV1 / steel*	RGJ / 316L RG1 / steel*	
Pressures up to	10 bars	10 bars	Depends on flange max. 10 bar

Sword probes FTI77 for fine-grained bulk solids

Note!
Total length of the probe from the start of the thread: L = L1 + L3 + 110 mm (ceramic) + 125 mm with active buildup compensation (optional)

	Probe without inactive length		Probe with inactive length		Probe with inactive length and active buildup compensation	
						
Sword/rope	Sword	Rope	Sword	Rope	Sword	Rope
H2	259	259	259	259	259	259
Across flats (AF)	55	55	55	55	55	55
Total length (L)	310 to 1110	610 to 20000	410 to 2110	710 to 20000	535 to 2235	835 to 20000
Active length L1	200 to 1000	500 to 19890	200 to 1000	500 to 19790	200 to 1000	500 to 19665
Inactive length (L3)	–	–	100 to 1000	100 to 1000	100 to 1000	100 to 1000
ø inactive length [L3 (steel/316L)]	–	–	38/42.5	38/42.5	38/42.5	38/42.5
Sword width	40	–	40	–	40	–
ø rope	–	6	–	6	–	6
ø active buildup compensation	–	–	–	–	40	40
ø tensioning weight	–	30	–	30	–	30
Lateral loading capacity (Nm) at 20 °C	250	–	250	–	250	–
For use in mounting nozzles	–	–	X	X	X	X
In the event of condensate on tank ceiling	–	–	X	X	X	X
Tensile loading capacity kN	–	7.5	–	7.5	–	7.5
Length of tensioning weight	–	150	–	150	–	150

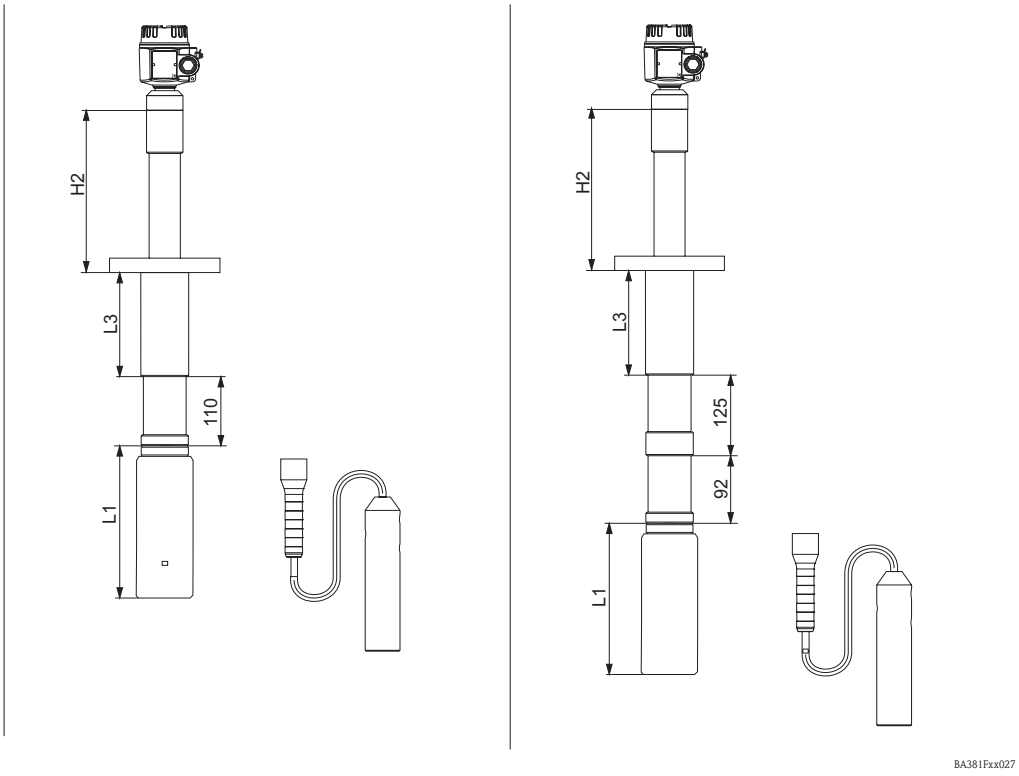
X = recommended

Length tolerance of sword probe	< 1 m: 0 to –5 mm; > 1 m up to 3 m: 0 to –10 mm
Length tolerance of rope probe	< 1 m: 0 to –10 mm; > 1 m up to 3 m: 0 to –20 mm; > 3 m up to 6 m: 0 to –30 mm, > 6 m up to 20 m: 0 to –40 mm

Sword probes FTI77 for coarse-grained bulk solids

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

- + 110 mm (ceramic for probe with inactive length) **or**
  + 92 mm (ceramic for probe with inactive length and active buildup compensation)
- + 125 mm in the event of active buildup compensation (optional)

	Probe with inactive length		**Probe with inactive length and active buildup compensation**	
				
				BA381Fxx027
Sword/rope	Sword	Rope	Sword	Rope
H2	259	259	259	259
Total length (L)	410 to 2110	710 to 20000	517 to 2235	817 to 20000
Active length (L1)	200 to 1000	500 to 19790	200 to 1000	500 to 19665
Inactive length (L3)	100 to 1000	100 to 1000	100 to 1000	100 to 1000
ø inactive length	77	77	77	77
Sword width	90	–	90	–
ø rope	–	12	–	12
ø active buildup compensation	–	–	76	76
ø tensioning weight	–	40	–	40
Lateral loading capacity (Nm) at 20 °C	800	–	800	–
For use in mounting nozzles	X	X	X	X
In the event of condensate on tank ceiling	X	X	X	X
Tensile loading capacity kN	–	20	–	20
Length of tensioning weight	–	250	–	250

X = recommended

Length tolerance of sword probe	< 1 m: 0 to –5 mm; > 1 m up to 3 m: 0 to –10 mm
Length tolerance of rope probe	< 1 m: 0 to –10 mm; > 1 m up to 3 m: 0 to –20 mm; > 3 m up to 6 m: 0 to –30 mm, > 6 m up 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-AlSi10Mg, 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, inactive length, sword, tensioning weight for rope probe: 316L or steel
- Probe rope: 1.4401 (AISI 316)

Weight

Probes for fine-grained bulk solids:
The probe weighs approx. 3 kg. This weight comprises:

- Housing
- Process connection: thread
- Temperature spacing sleeve

Additional weights have to be taken into consideration depending on the make-up of the device:

- + Flange weight
- + Inactive length 0.288 kg/100 mm
- + Probe sword 0.25 kg/100 mm
- + Probe rope (ø6) 0.180 kg/m

Probes for coarse-grained bulk solids (always with flange)
The probe weighs approx. 9 kg. This weight comprises:

- Housing
- Process connection: flange
- Temperature spacing sleeve

Additional weights have to be taken into consideration depending on the make-up of the device:

- + Inactive length 0.844 kg/100 mm
- + Probe sword 0.6 kg/100 mm
- + Probe rope (ø12) 0.550 kg/m

Input

Measured variable

Measurement of the change in capacitance between the probe sword and the tank wall, depending on the level of the bulk solids.

Measuring range (valid for all)

- 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 1600 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

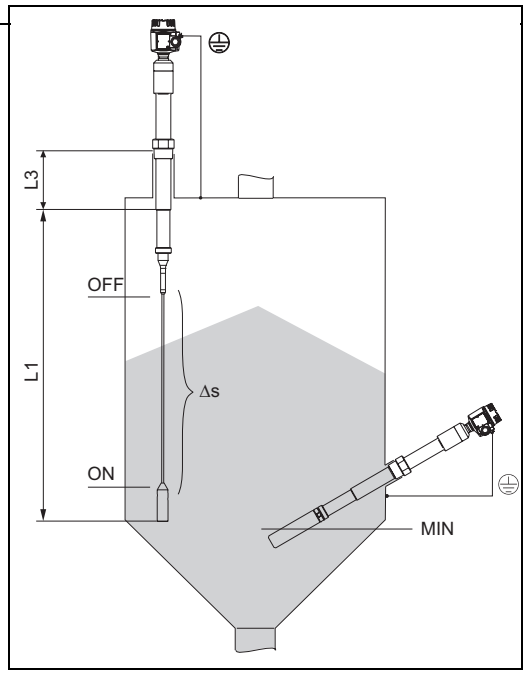
Measuring conditions

Note!

- When installing in a nozzle, use inactive length (L3).
- To control a screw conveyor (Δs mode), sword probes and rope probes can be used (only for nonconductive bulk solids). The on-value and off-value are determined by the empty and full calibration.

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.



BA381Fxx015

Minimum probe length for nonconductive media (<1µs/cm)

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

l_{min}	=	Minimum probe length
ΔC_{min}	=	5 pF
C_s	=	Probe capacitance in air
εr	=	Dielectric constant, for example of dried grain = 3.0

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 Δs mode (controlling a screw conveyor, 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 overfill 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)

Note!
Connect in series with an external load.

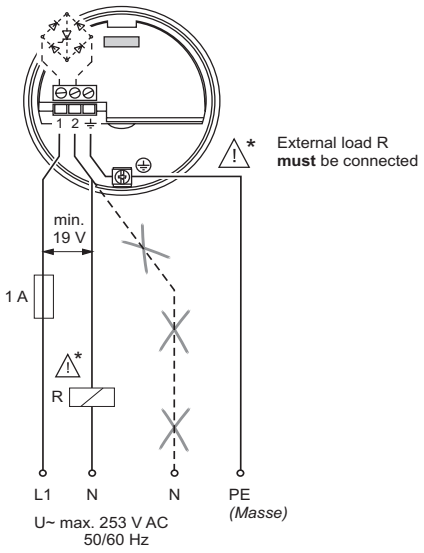
Power supply

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").



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

Signal on alarm

Safety mode	Level	Output signal	LEDs gn gn rd gn gn ye
MAX		L+ 1 → I_L → + 3	☼ ● ● ● ● ☼
		1 - - - - - - → < 3,8 mA 3	☼ ● ● ● ● ●
MIN		L+ 1 → I_L → + 3	☼ ● ● ● ● ☼
		1 - - - - - - → < 3,8 mA 3	☼ ● ● ● ● ●
Maintenance required		1 - - - - - - → I_L / < 3,8 mA 3	☼ ● ☼ ● ● ●
Instrument failure		1 - - - - - - → < 3,8 mA 3	☼ ● ☼ ● ● ●

BA300Fen017

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.

FEI52 electronic insert (DC PNP)

Power supply

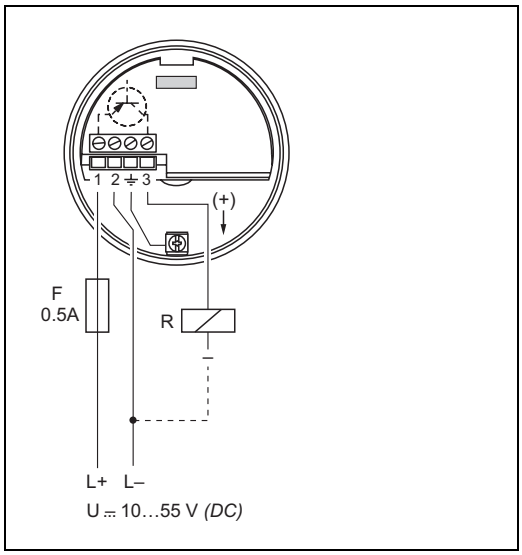
Supply voltage: 10 to 55 V DC
Ripple: max. 1.7 V, 0…400 Hz
Current consumption: < 20 mA
Power consumption without load: max. 0.9 W
Power consumption with full load (350 mA): 1.6 W
Reverse polarity protection: yes
Separation voltage: 3.7 kV
FEI52 overvoltage protection: overvoltage category II

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+ 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

TI418Fen43 TI418F44

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)
- 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

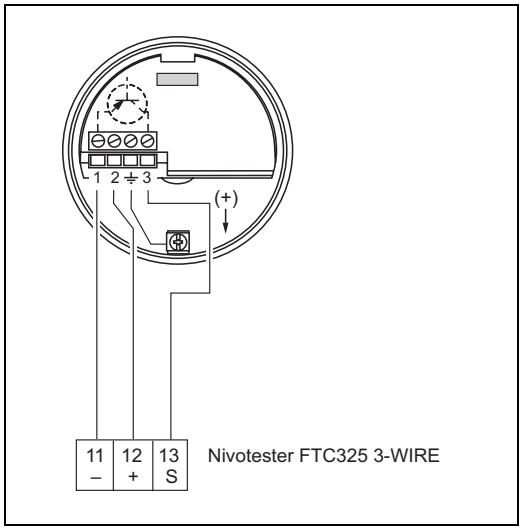
Three-wire DC connection

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	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	☼	☼

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

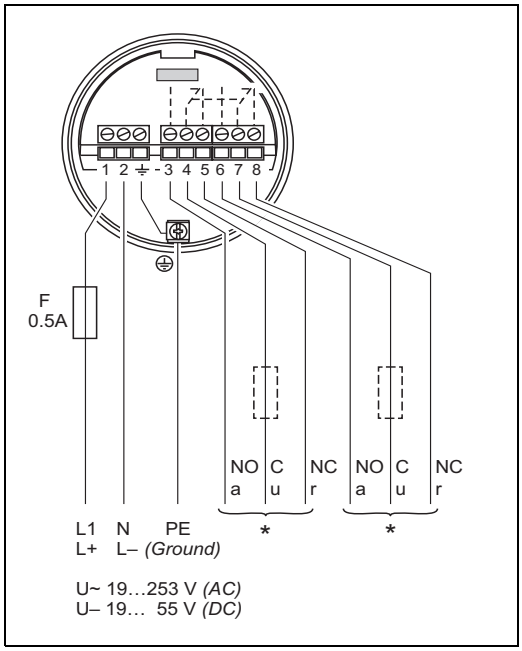
Electrical connection

Universal current connection with relay output (DPDT)

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

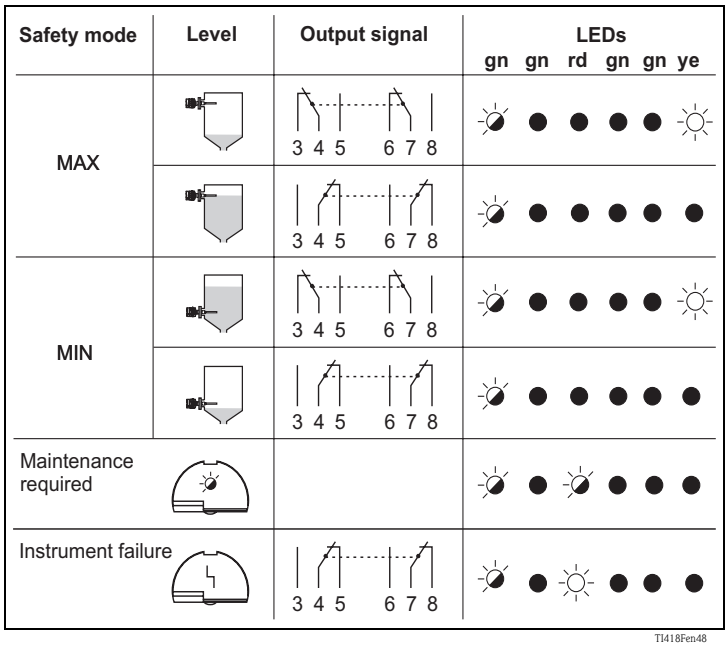
Output:
When connecting an instrument with high inductance, provide a spark arrester to protect the relay contact.
A fine-wire fuse (depending on the load connected) protects the relay contact on short-circuiting.
Both relay contacts switch simultaneously.

* See below "Connectable load"



TI418F47

Output signal



TI418Fen48

TI418F49

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 φ = 1, P~ max. 750 VA at cos φ > 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

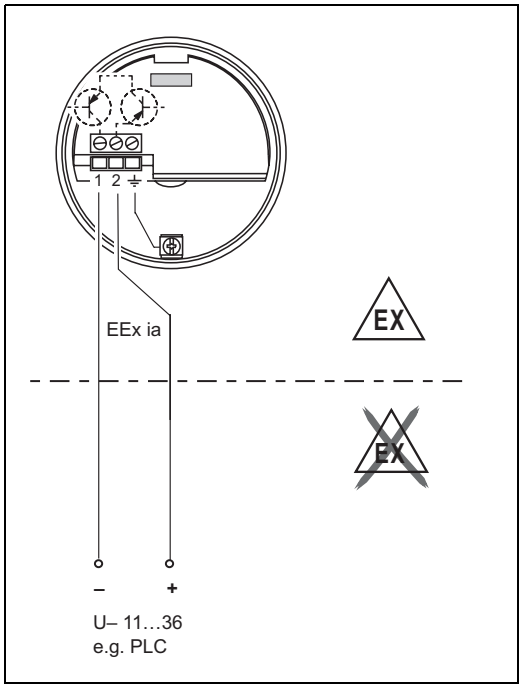
Supply voltage: 11 to 36 V DC
Power consumption: < 600 mW
Reverse polarity protection: yes
Separation voltage: 0.5 kV

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		+ 2 ~16 mA → 1	☀ ● ● ● ● ☀
		+ 2 ~8 mA → 1	◑ ● ● ● ● ●
MIN		+ 2 ~16 mA → 1	☀ ● ● ● ● ☀
		+ 2 ~8 mA → 1	◑ ● ● ● ● ●
Maintenance required *		+ 2 8/16 mA → 1	◑ ● ◑ ● ● ●
Instrument failure		+ 2 < 3.6 mA → 1	◑ ● ☀ ● ● ●

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

☀ Lit
◑ Flashes
● Unlit

TI418Fen51 TI418F44

Signal on alarm

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

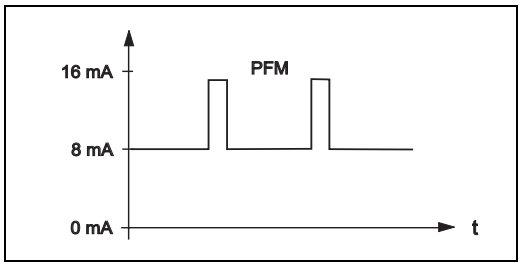
Connectable load

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

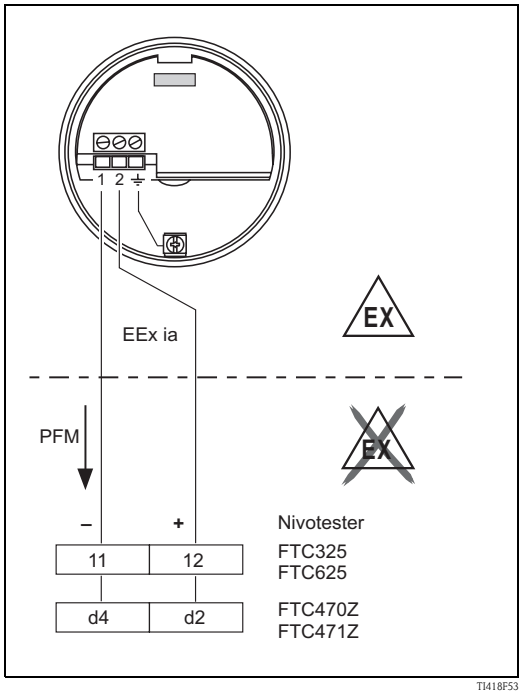
Electrical connection

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	LEDs 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

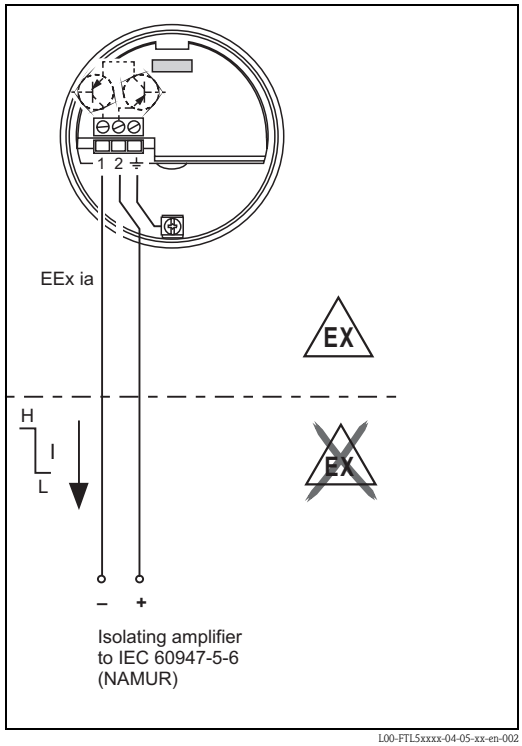
For connecting to isolating amplifiers
as per NAMUR (IEC 60947-5-6),
e.g. FXN421, FXN422, FTL325N,
FTL375N from Endress+Hauser.
Change in output signal from high to low current
in event of point level detection.

(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.



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

Output signal

☼ = Lit
☼ = Flashes
● = Unlit

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

Fail-safe mode	Level	Output signal	LEDs green	LEDs yellow
Max.		+ 2 → 1 : 2.2 … 3.5 mA	☼	☼
		+ 2 → 1 : 0.6 … 1.0 mA	☼	●
Min.		+ 2 → 1 : 2.2 … 3.5 mA	☼	☼
		+ 2 → 1 : 0.6 … 1.0 mA	☼	●

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

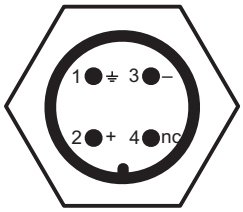
Five housings with the following protection classes are available:

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

In the case of the versions with a connector (M12 or 7/8"), the housing does not have to be opened to connect the signal cable.

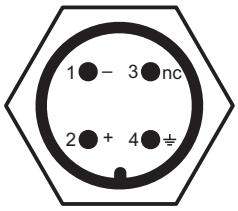
PIN assignment for the M12 connector (PROFIBUS PA standard, HART)



L00-FMxxxxxx-04-00-00-yy-016

PIN	Meaning for FEI52, FEI53	Meaning for FEI55, FEI57S, FEI58
1	External load/ voltage output	Not assigned
2	Not assigned	Not assigned
3	Signal –	Signal –
4	Signal +	Signal +

PIN assignment for the 7/8" connector (Fieldbus FOUNDATION standard, HART)



L00-FMxxxxxx-04-00-00-yy-017

PIN	Meaning for FEI52, FEI53	Meaning for FEI55, FEI57S, FEI58
1	Signal –	Signal –
2	Signal +	Signal +
3	External load/ voltage output	Not assigned
4	Ground	Ground

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 , NPT ¾ or M20 thread

Performance characteristics

Reference operating conditions

- Room temperature: +20 °C ±5 °C
- Span:
  - Standard measuring range: 5 to 500 pF
  - Extended measuring range: 5 to 1600 pF
  - Span for reference: 5 to 250 pF
- Uncertainty according to DIN 61298-2: max ±0.3%
- Non-repeatability (reproducibility) according to DIN 61298-2: max. ±0.1 %

Switch point

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

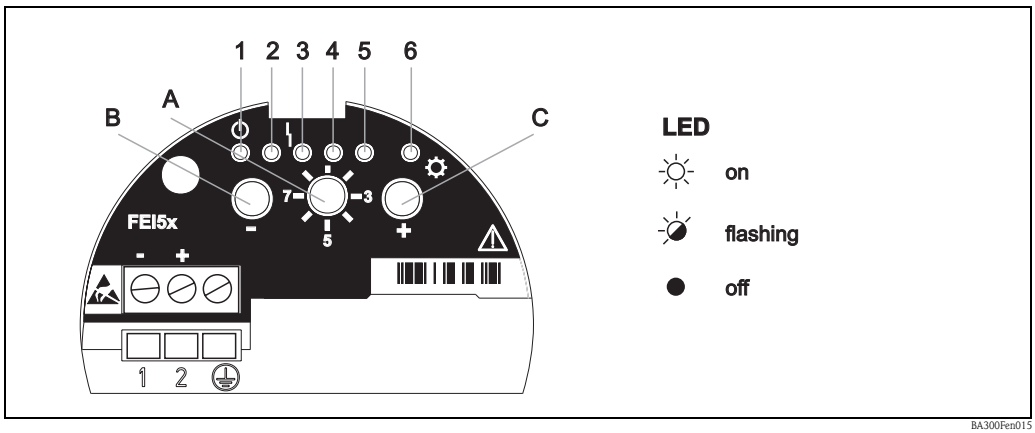
Ambient temperature effect

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

Human interface

Electronic inserts **FEI51, FEI52, FEI54, FEI55**

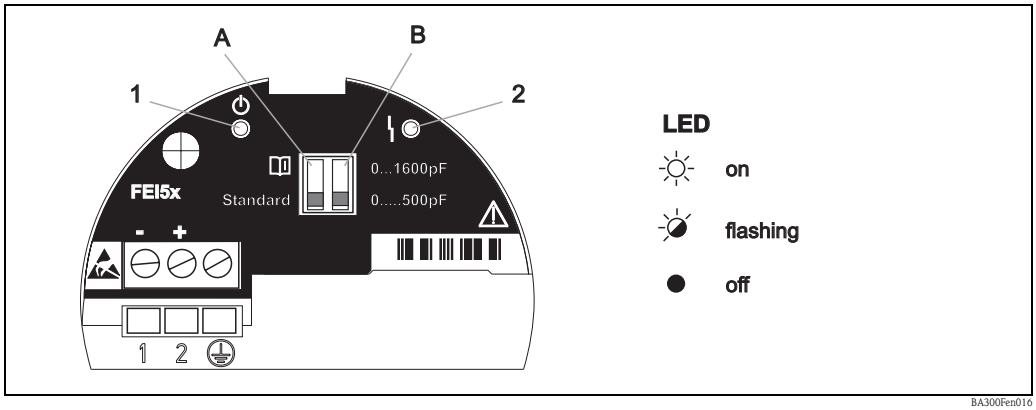


Green LED 1 (⏻ operational), red LED 3 (ϟ fault), yellow LED 6 (✲ switching state)

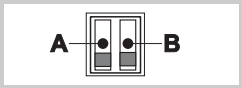
Function switch setting	Function	– key	+ key	Light emitting diodes (LED signals)					
				⏻		ϟ			✲
				1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
1	Operation			**Flashes** Operational LED	**On** (MIN-SIL)	**Flashes** (warning/ alarm)	**On** (MAX-SIL)		**On/off/ flashes**
	Restore factory 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	Switchpoint adjustment	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**
	Lock/unlock SIL mode*	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 electronic insert FEI55 (SIL).

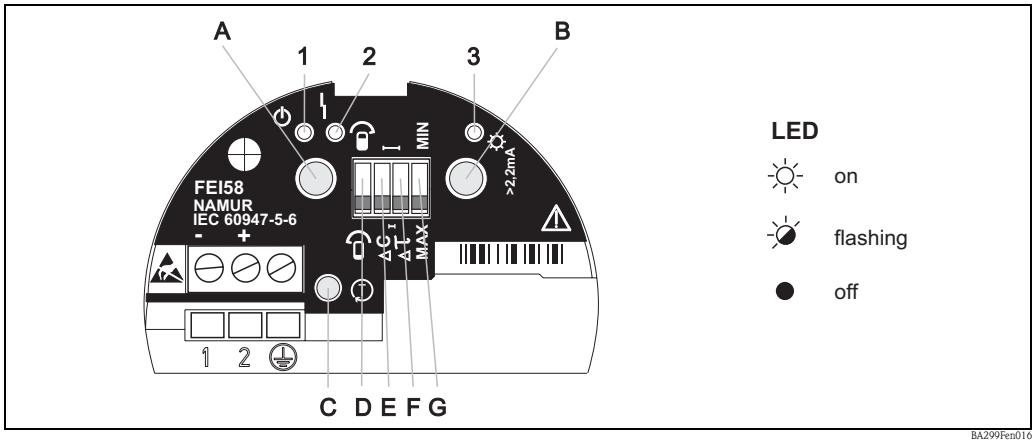
Electronic inserts **FEI53, FEI57S**



Green LED (⏻ operational), red LED (ϟ fault)

DIP switches 	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 (⏻ operational), red LED 2 (ϟ fault), 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	ΔC	Switchpoint adjustment: 10 pF
E	ΔC	Switchpoint adjustment: 2 pF
F	Δτ	Switching delay: 5 s
F	Δτ	Switching delay: 1 s
G	MIN	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	MAX	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	B	C	
X			Display diagnostic code
	X		Display calibration situation
X	X		Perform calibration (during operation)
X	X		Delete calibration points (during startup)
		X	Test key Ⓣ, (disconnects the transmitter from the switching unit)

Certificates and approvals

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 the successful testing of the device by affixing to it the CE approval.

Other certificates

- See also "Ordering information" → 📄 41
- 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
Safety requirements for electrical equipment for measurement, control and laboratory use

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 S FTI77

10	Approval:		
	A	Non-hazardous area	
	B	ATEX II 1/3 D	Ex tD
	C	ATEX II 1/2 D	Ex tD
	D	ATEX II 3 D	Ex nA/nL/nC
	F	ATEX II 1 D, 1/2 D, 1/3 D	EEx ia D20 T 90 °C
	K	CSA General Purpose,	CSA C US
	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. II, III,	Div. 1+2, Gr. E-G
	Y	Special version, TSP-no. to be specified	

15		Application:
	1	Solid, fine-grained
	2	Solid, coarse-solids
	9	Special version

20		Inactive length L3:	
	A	Not selected	
	B	200 mm	steel
	C	400 mm	steel
	E	200 mm	316L
	F	400 mm	316L
	G	... mm	316L
	H	... mm, inactive length + 125 mm active buildup compensation	316L
	L	8 inch	steel
	M	16 inch	steel
	N	8 inch	316L
	P	16 inch	316L
	R	... inch	316L
	S	... inch, inactive length + 5 inch active buildup compensation	316L
	9	Special version	

30		Active length L1:			
	AB	200 mm	sword	steel	
	AC	400 mm	sword	steel	
	AD	700 mm	sword	steel	
	BB	200 mm	sword	316L	
	BC	400 mm	sword	316L	
	BR	... mm	sword	316L	
	CR	... mm	6 mm rope	steel zinc coated	tension weight steel
	CS	... mm	12 mm rope	steel zinc coated	tension weight steel
	DR	... mm	6 mm rope	316L	tension weight 316L
	DS	... mm	12 mm rope	316L	tension weight 316L
	EB	8 inch	sword	steel	
	EC	16 inch	sword	steel	
	ED	28 inch	sword	steel	
	FB	8 inch	sword	316L	
	FC	16 inch	sword	316L	
	FR	... inch	sword	316L	
	GR	... inch	0.24 " rope	steel zinc coated	tension weight steel
	GS	... inch	0.47 " rope	steel zinc coated	tension weight steel
	HR	... inch	0.24 " rope	316L	tension weight 316L
	HS	... inch	0.47 " rope	316L	tension weight 316L
	VV	Connection thread, prepared for active probe length			
	YY	Special version, TSP-no. 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
	AH1	4",	150 lbs RF	steel

50	Process connection:			
BSJ	DN80,	PN10/16 A	316L	EN1092-1 (DIN2527 B)
BTJ	DN100,	PN10/16 A	316L	EN1092-1 (DIN2527 B)
BT1	DN100,	PN10/16 A	steel	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
KH1	10K 100,	RF	steel	JIS B2220
RGJ	NPT 1½,		316L	thread ANSI
RG1	NPT 1½,		steel	thread ANSI
RVJ	R 1½,		316L	thread EN10226
RV1	R 1½,		steel	thread EN10226
YY9	Special version, TSP-no. to be specified			

60	Electronics; output:	
1	FEI51; 2-wire	19 to 253 VAC
2	FEI52; 3-wire PNP,	10 to 55VDC
3	FEI53; 3-wire,	3 to 12 V signal
4	FEI54; relay DPDT,	19 to 253 VAC, 19 to 55 VDC
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, TSP-no. to be specified	

70	Housing:	
1	F15 316L	IP66, NEMA4X
2	F16 polyester	IP66, NEMA4X
3	F17 Alu	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, TSP-no. to be specified	

80	Cable entry:
A	Gland M20
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, TSP-no. to be specified

90	Type of probe:
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, TSP-no. to be specified

100	Additional option:	
A	Basic version	
D	EN10204-3.1 material (316L pressurized),	Inspection certificate
F	SIL Declaration of Conformity	
Y	Special version, TSP-no. to be specified	

FTI77	Product designation

Accessories

Weather protection cover

For F13 and F17 housing
Order number: 71040497

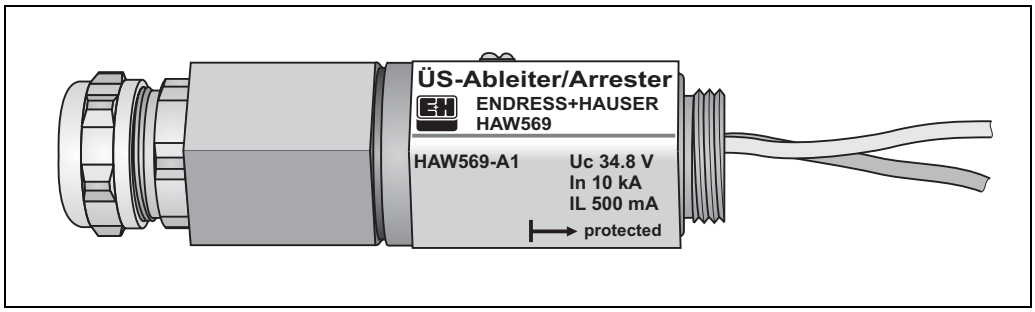
Overvoltage protection HAW56x

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 for installation in cabinets.

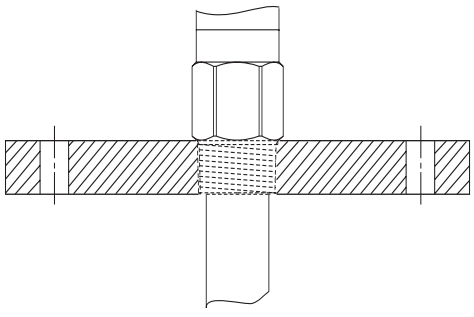
Adapter flange FAU70E / FAU70A

The following (steel) probe versions are available for fine-grained bulk solids:

- R 1½
- NPT 1½

Adapter flanges that can be ordered via the following FAU70E and FAU70A product structures are optionally available.

- **FAU70E**
  - 1233 -> DN50 PN16 A, flange EN1092-1 (DIN2527 B)
  - 1433 -> DN80 PN16 A, flange EN1092-1 (DIN2527 B)
  - 1533 -> DN100 PN16 A, flange EN1092-1 (DIN2527 B)
- **FAU70A**
  - 2253 -> 2" 150lbs FF, flange ANSI B16.5
  - 2453 -> 3" 150lbs FF, flange ANSI B16.5
  - 2553 -> 4" 150lbs FF, flange ANSI B16.5



BA381Fxx025

Spare parts

Electronic inserts

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

Note!
- 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 F13, flat: gray 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

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

Technical Information

- EMC test procedures
  TI241F/00/en
- Nivotester FTL325N
  TI353F/00/en
- Nivotester FTL375N
  TI361F/00/en

Operating Instructions

- Solicap S FTI77
  BA381F/00/en

Certificates

Safety information (ATEX)

- Solicap S FTI77
  ATEX II 1 D Ex tD A20 IP65 T 90 °C,
  ATEX II 1/2 D Ex tD A20/A21 IP65 T 100 °C
  XA486F/00/a3

Control drawings

- Solicap S FTI77
  FM: ZD243F/00/en

- Solicap S FTI77
  CSA ZD225F/00/en

Functional safety

- Solicap S FTI77
  SD278F/00/en

CRN registration

- CRN 0F1988.75

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

Instruments International

Endress+Hauser
Instruments International AG
Kaegenstrasse 2
4153 Reinach
Switzerland

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

Endress+Hauser

People for Process Automation

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