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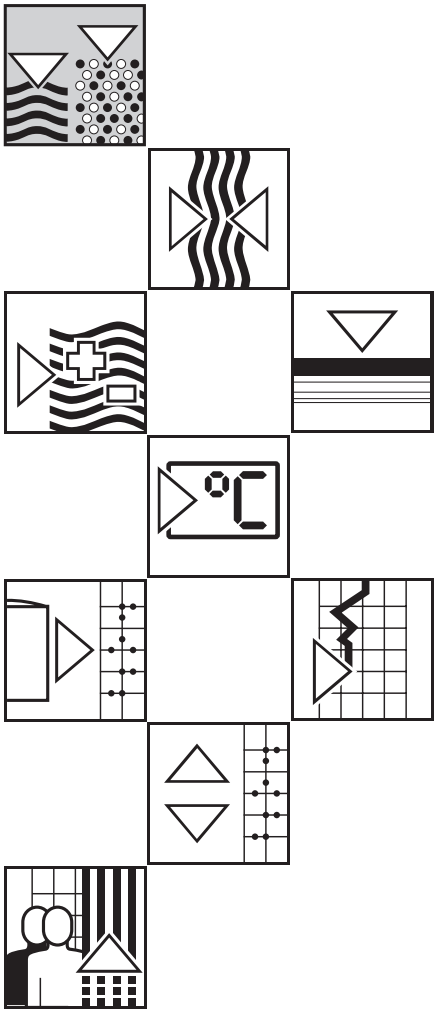
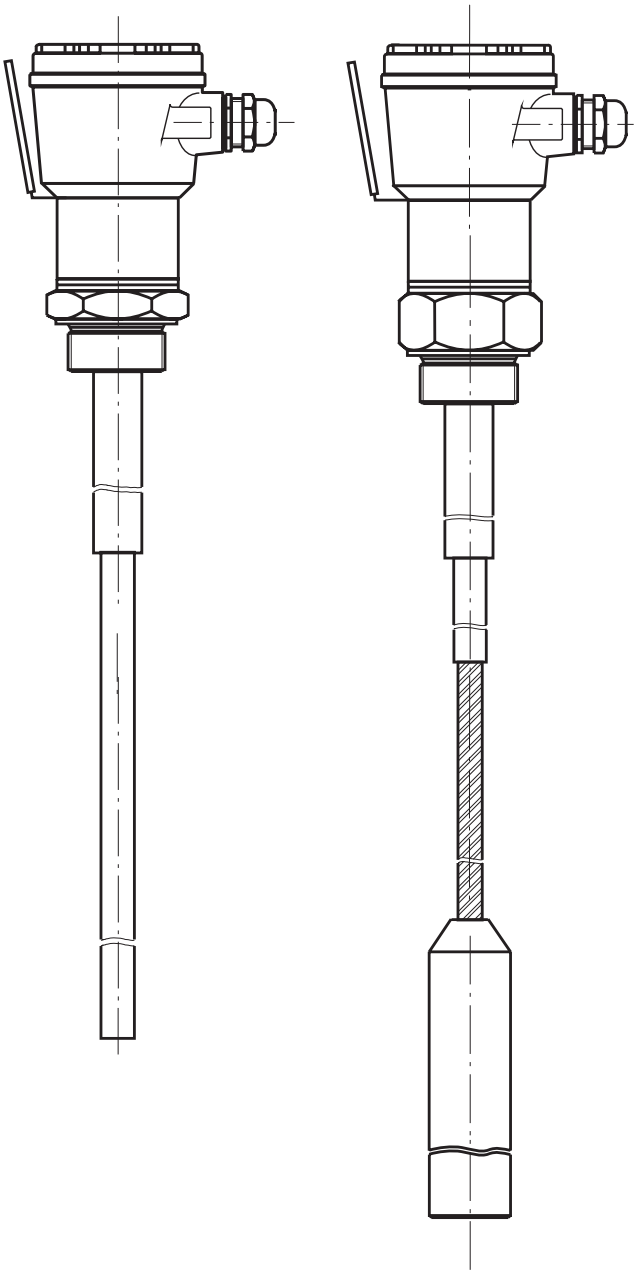
nivocompact
FTC 131 Z, FTC 331 Z
Level Limit Switch

Installation and Operating Manual





Endress+Hauser

The Power of Know How

Contents

Application

Combustible dusts

The Nivocompact FTC 131 Z, FTC 331 Z is designed for limit detection in silos containing flammable bulk solids (for minimum or maximum level indication).
For use in combustible dusts (Zone 10, Germany)

- FTC 131 Z with rod probe for mounting from the side (laterally) or from above.
  Mainly for maximum detection of fine-grained or powdery bulk solids.
  For minimum detection in small silos or in silos with light bulk solids.
- FTC 331 Z with rope probe for mounting from above.
  For maximum and minimum detection with heavy bulk solids.
- FTC 331 Z with rope probe and screening against condensation and material build-up on the silo roof. For mounting from above.
  For maximum and minimum detection in bulk solids producing steam or dust.

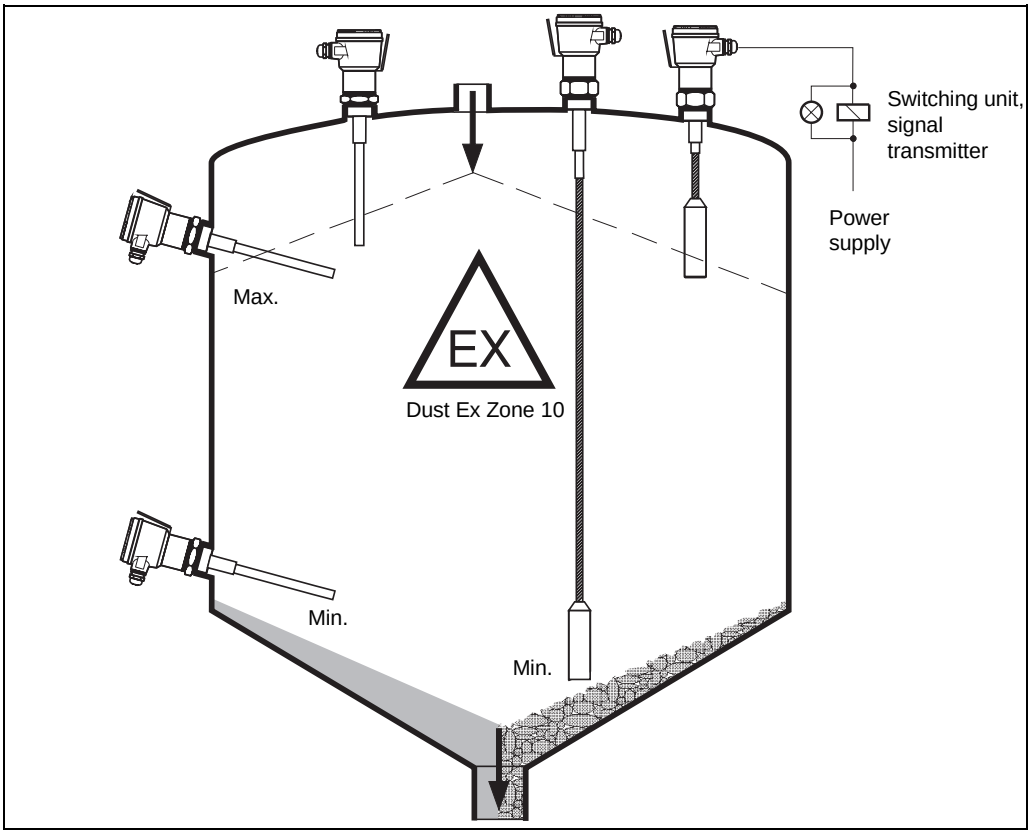


Fig. 1
Level limit detection in bulk solid silos with the capacitive level limit switch Nivocompact FTC 131 Z or FTC 331 Z.

Application Examples

Sugar, Flour, Grain, Coal
and similar bulk solids.

Note:
Bulk solids should have dielectric constants $\varepsilon_r \geq 2.5$.
Please contact us for advice if the dielectric constant of the bulk solid is not known.

Technical Data

Certificates

Combustible dusts

- Two approval certificates have been issued for the level limit switches Nivocompact FTC 131 Z and FTC 331 Z for use in combustible dusts Zone 10:
  - ☐ Design approval certificate BVS 93.Y.8004 B (Germany) for:
    - the rod probe for FTC 131 Z corresponding to the partially insulated probe 11450 ZS;
    - the rope probe for FTC 331 Z corresponding to the partially insulated probe 21265 S.

    and
  - ☐ Certificate of conformity PTB No. Ex-92.C.2167 X for the electronic inserts with intrinsically safe probe circuits.
- These certificates can be ordered under the following documentation order numbers:
  - ☐ ZE 088F/00/e, Design approval certificate
  - ☐ ZE 089F/00/e, Certificate of conformity

Operating data

- Operating temperature in silo: –20 °C ... +60 °C (0 ... 140 °F)
- Operating pressure p_e: max. 10 bar (150 psi)
- Dielectric constant ε_r of material: min. 2.5
- Operating temperature for the housing: –20 °C ... +60 °C
- Storage temperature: –40 °C ... +85 °C

Probes

- FTC 131 Z: rod probe, ∅ 18 mm, length max. 4 m
- FTC 331 Z: rope probe, ∅ 12 mm, length max. 22 m
- Tensile load on probes:
  Rod probe max. 30 Nm lateral
  Rope probe max. 40 kN vertical

Probe length tolerances

Probe length	Tolerance
to 1 m	+0 mm, – 5 mm
to 3 m	+0 mm, –10 mm
to 6 m	+0 mm, –20 mm
to 22 m	+0 mm, –30 mm

Process connections

- Parallel thread: G $1^1/_2$ A, to DIN ISO 228/I
- Tapered thread: NPT $1^1/_2$ - $11^1/_2$, to ANSI B 1.20.1
- Material: steel or stainless steel 1.4571 (≙ SS 316 L)

Housing versions

- Aluminium housing, IP 55
- Aluminium housing, IP 66
- Plastic housing in polyester, IP 66
  (Ingress protection IP ... to DIN 40050)

Cable gland

- Housing IP 55: standard Pg in nickel-plated brass with NBR seal for cable diameter 7…10 mm
- Housing IP 66: water-proof Pg in polyamide with Neoprene-CR seal for cable diameter 5…12 mm

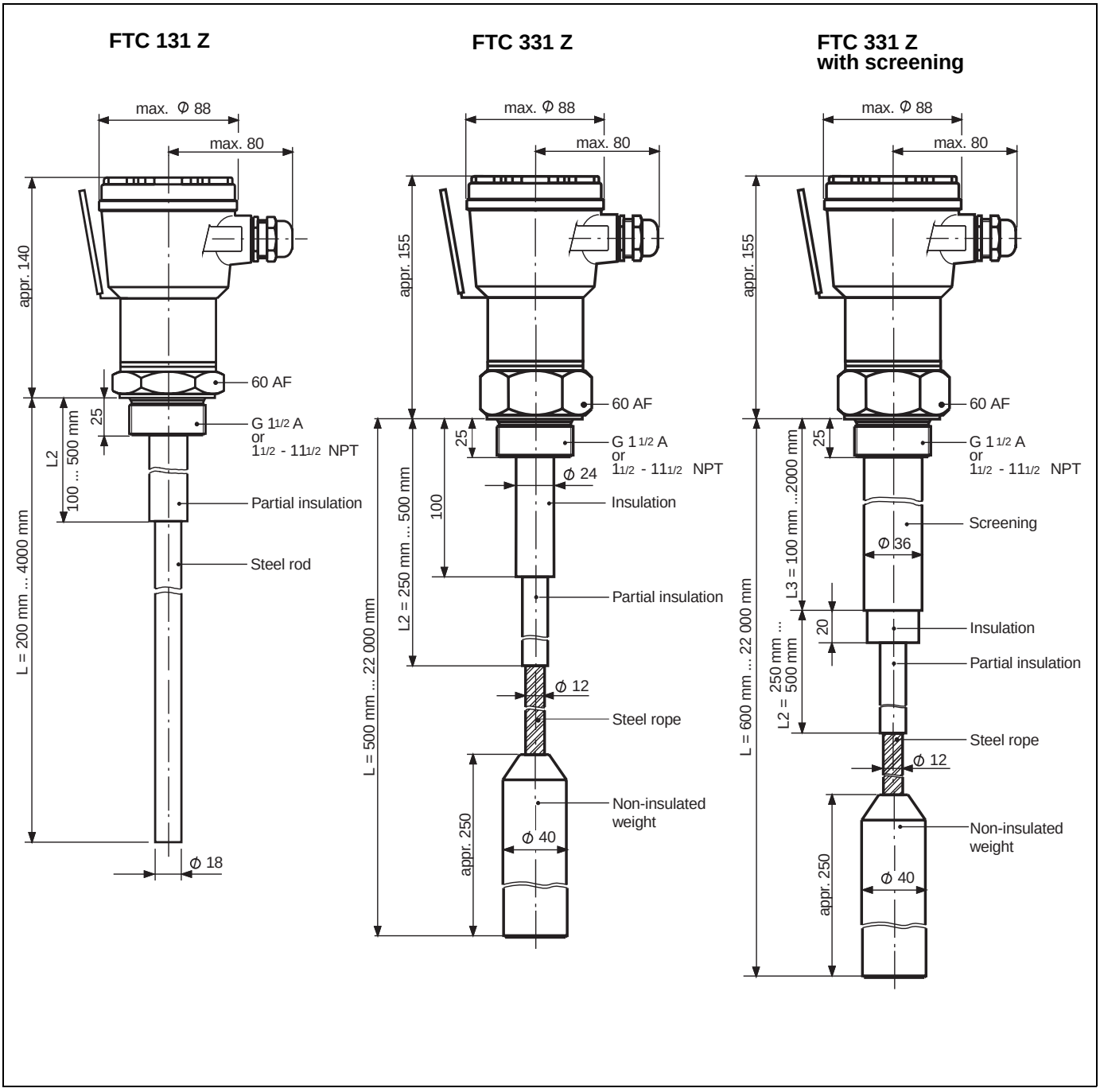


Fig. 2
Dimensions in mm
of the Nivocompact
FTC 131 Z, FTC 331 Z

100 mm = 3.94 in
1 in = 25.4 mm

Electronic inserts

- Terminal connections for max. 1.5 mm^2
- Measuring frequency: approx. 750 kHz for short probes up to 4 m, switchable to approx. 450 kHz for long probes
- Initial capacitance, adjustable: to approx. 400 pF
- Switching delay: approx. 0.5 s
- Minimum/maximum fail-safe switching: selectable with rotary switch
- Switching indication: red LED

Electronic insert EC 20 Z for AC voltage (two-wire connection)

- Power supply U~: 21 V...250 V, 50/60 Hz
- Connected loads, short-term (max. 40 ms): max. 1.5 A; max. 375 VA at 250 V; max. 36 VA at 24 V
- Maximum voltage drop: 11 V
- Connected loads, continuous: max. 350 mA; max. 87 VA at 250 V; max. 8.4 VA at 24 V
- Minimum load current at 250 V: 10 mA (2.5 VA)
- Minimum load current at 24 V: 20 mA (0.5 VA)
- No-load current (rms): < 5 mA

Electronic inserts EC 22 Z and EC 23 Z for DC voltage (three-wire connection)

- Power supply U–: 10 V…55 V
- Superimposed AC voltage U_{pp}: max. 5 V
- Current consumption: max. 15 mA
- Load connection: open collector; PNP (EC 22 Z) or NPN (EC 23 Z)
- Switching voltage: max. 55 V
- Connected load, continuous: max. 350 mA
- Peak inrush current: max. 1.2 A, max. 20 µs
- Parallel capacitance to load: max. 500 nF
- Protection against short-circuiting and overload: response threshold approx. 550 mA
- No-load current with transistor blocked: < 100 µA
- Protected against reverse polarity

Electronic insert EC 24 Z for DC and AC voltages (relay output)

- Power supply U–: 20 V…125 V
  or
  Power supply U~: 21 V…250 V, 50/60 Hz
- Current consumption (rms.): max. 5 mA
- Peak inrush current: max. 200 mA, max. 5 ms
- Pulse current: max. 50 mA, max. 5 ms
- Pulse frequency: approx. 1.5 s
- Output: potential-free change-over contact
- Contact load capacity:
  U~ max. 250 V, I~ max. 4 A,
  P~ max. 1000 VA ($\cos\varphi$ =1) or P~ max. 350 VA, $\cos\varphi \geq 0.7$
  U– max. 100 V, I– max. 4 A, P– max. 100 W
- Operating life: min. 10^5 switchings at max. contact load
- Additional switching delay: max. 1.5 s

EMC

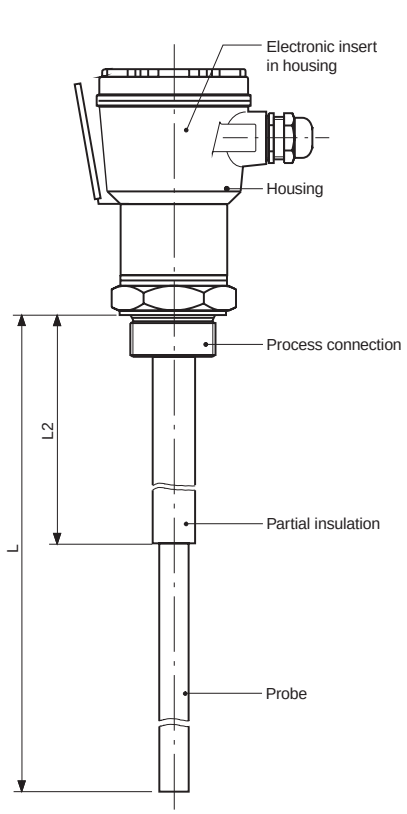
- Electromagnetic compatibility:
  Interference Emission to EN 61326, Electrical Equipment Class A
  Interference Immunity to EN 61326.

Type key

See Page 7 and 8 for product structure

Subject to modification.

Product structure
Nivocompact FTC 131 Z



FTC 131 Z, capacitive level limit switch with rod probe

Certificate, Approval
E Dust Ex Zone 10

Process Connection / Material
G1 Thread G 1 $^1/_2$ A / steel
G2 Thread G 1 $^1/_2$ A / 1.4571 (≙ SS 316 L)
H1 Thread NPT 1 $^1/_2$" / steel
H2 Thread NPT 1 $^1/_2$" / 1.4571

Partial Insulation, Material and Length L2
A Insulation PE, 100 mm ... 500 mm

Probe, Material and Length L
1 Rod steel, 200 mm ... 4000 mm
2 Rod 1.4571, 200 mm ... 4000 mm

Housing / Cable Gland (Protection)
B Aluminium housing (IP 66) / Pg 16 (IP 66)
K Polyester housing (IP 66) / Pg 16 (IP 66)

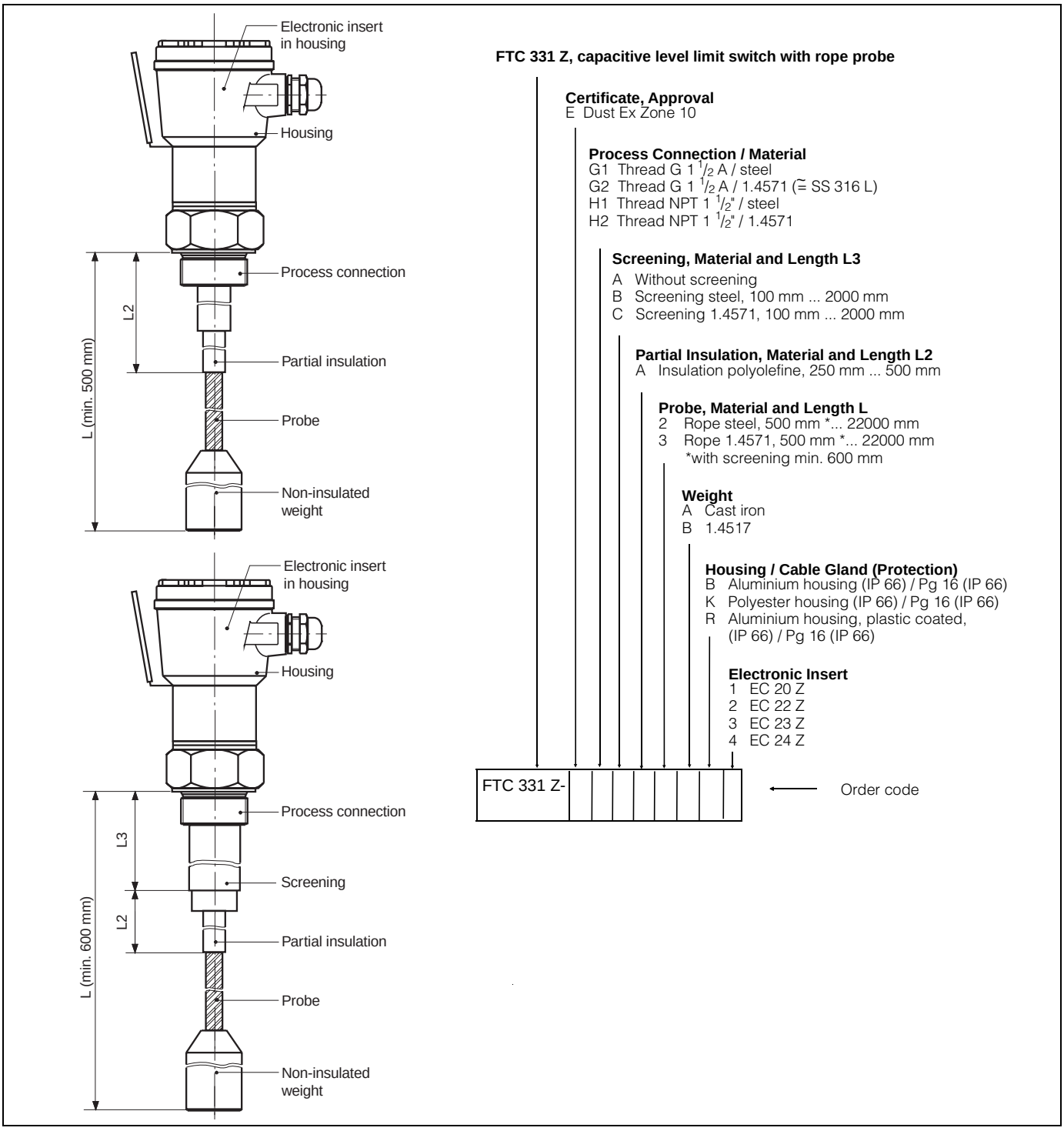
Electronic Insert
1 EC 20 Z
2 EC 22 Z
3 EC 23 Z
4 EC 24 Z

FTC 131 Z- ← Order code

The order code is stated on the nameplate and indicates
from which modules the Nivocompact FTC 131 Z is assembled.

The length of the probe at delivery is also stated on the nameplate:
L = total length of probe
L2 = length of partial insulation

Product structure
Nivocompact FTC 331 Z



The order code is stated on the nameplate and indicates
from which modules the Nivocompact FTC 331 Z is assembled.
The length of the probe at delivery is also stated on the nameplate:
L = total length of probe
L2 = length of partial insulation
L3 = length of screening (cannot be altered)

Accessories

- Gasket for thread G $1^1/_2$ A:
  elastomer/fibre (asbestos-free), supplied

- All-weather protective cover for aluminium housing
  Material: polyamide

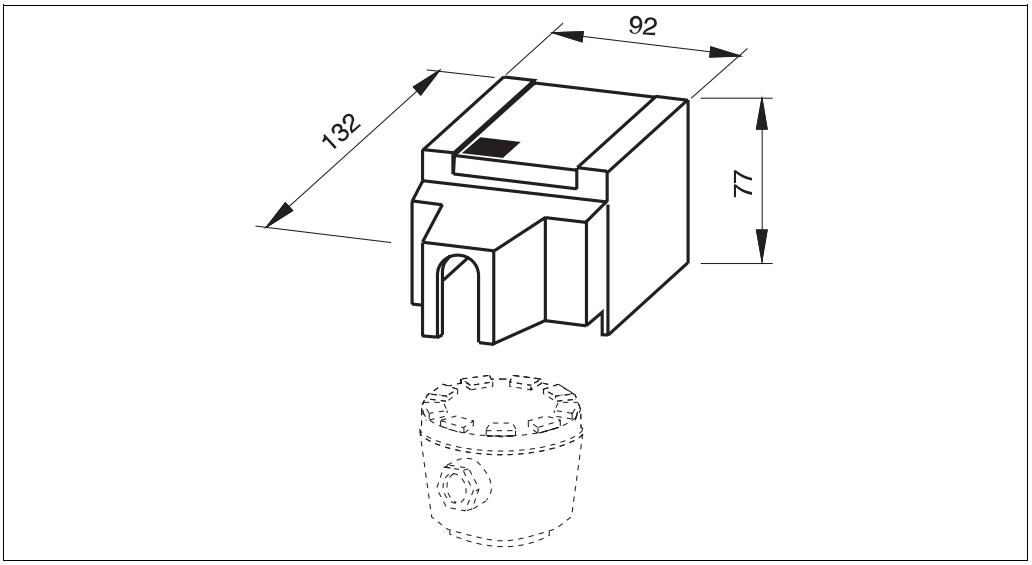


Fig. 3
Dimensions of all-weather protective cover (accessory). This cover prevents condensation in the housing

- Butterfly weight for FTC 331 Z
  Material: steel, weight: approx. 3.2 kg

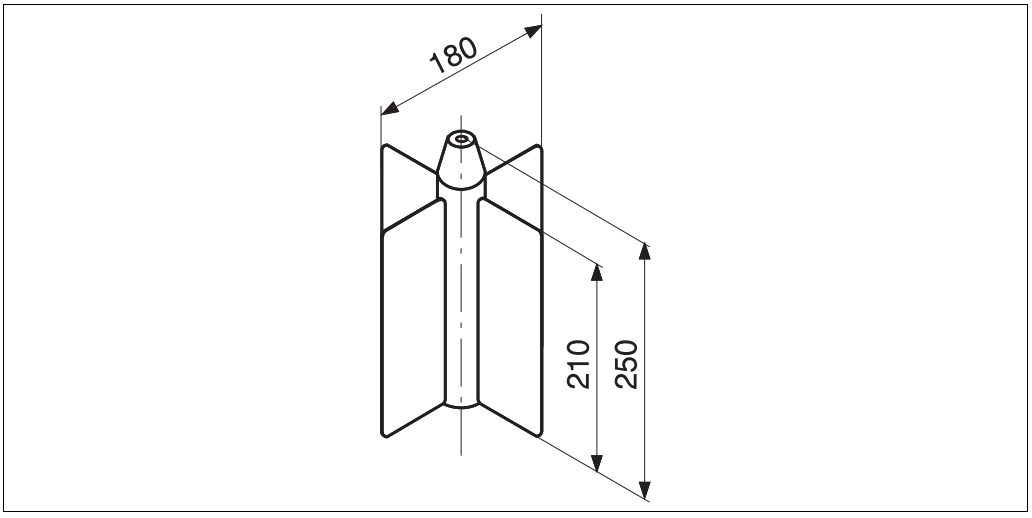


Fig. 4
Dimensions of the butterfly weight for FTC 331 Z (accessory).
This weight increases the capacitance difference for rope probes

Measuring System

The Nivocompact is a complete electronic switch.
The entire measuring system consists of:
- Nivocompact FTC
- power supply and
- connected control systems, switches, signal transmitters
  (e.g. process control systems, PLC, relays, microcontactors, lamps, sirens, etc.)

Function

The probe and silo wall form the two electrodes of a capacitor, between which a high frequency voltage is generated.
The limit value is based on the principle of a discharge circuit:
As long as the probe is in air with a dielectric constant ε_r=1, then the discharge time constant is $\tau = R \times C_A$ where R is the resistance of the circuit and C_A the capacitance of the capacitor formed by the probe and silo wall.
If bulk material with a high dielectric constant moves into the electrical field, between the probe and silo wall, then the capacitance C_A increases and with it the time constant τ.
The change in the time constant is evaluated and the Nivocompact is activated according to its switching mode.
The Nivocompact is extremely insensitive to build-up on the probe and silo wall as long as the material does not form a bridge between the probe and silo wall or roof (at threaded boss).

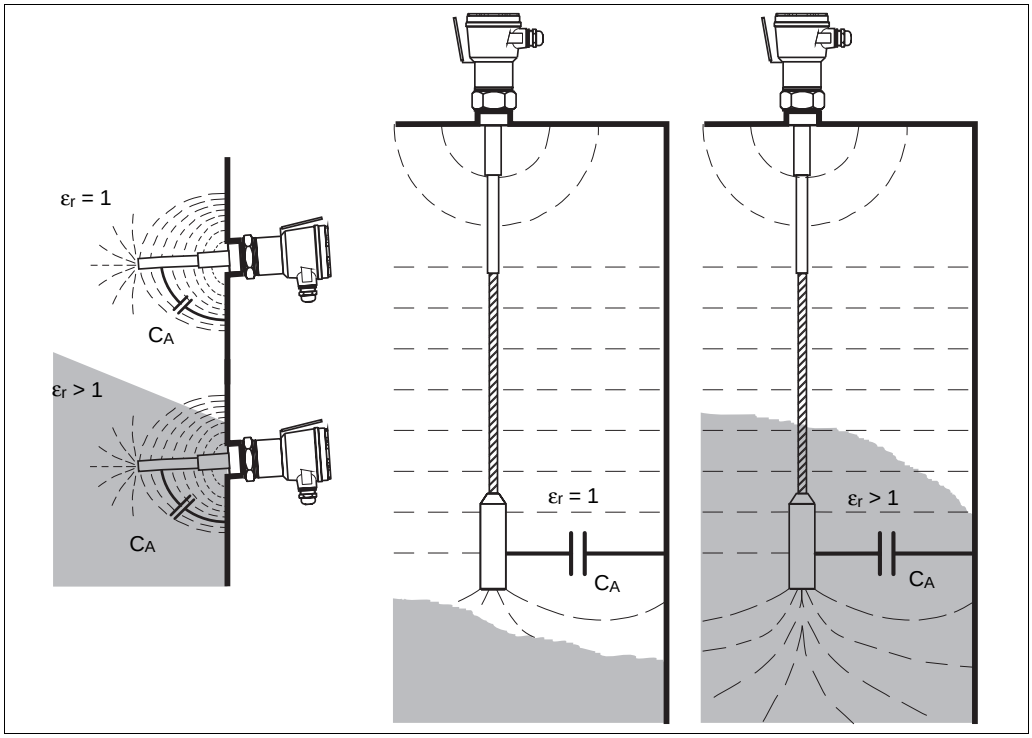


Fig. 5
The capacitor consisting of the silo wall and probe

The built-in feature for minimum/maximum fail-safe switching allows the Nivocompact to be used in a quiescent current mode in all applications requiring high operational safety:

Maximum fail-safe: The circuit is blocked if the probe is covered or the power supply fails.

Minimum fail-safe: The circuit is blocked if the probe is free or the power supply fails.

A red LED on the electronic insert indicates the switching status.

See also Fig. 26 in Section "Fail-Safe Switching", Page 28.

Installation

Project Planning

All local regulations and instructions given in certificates must be observed when mounting in explosion hazardous areas!

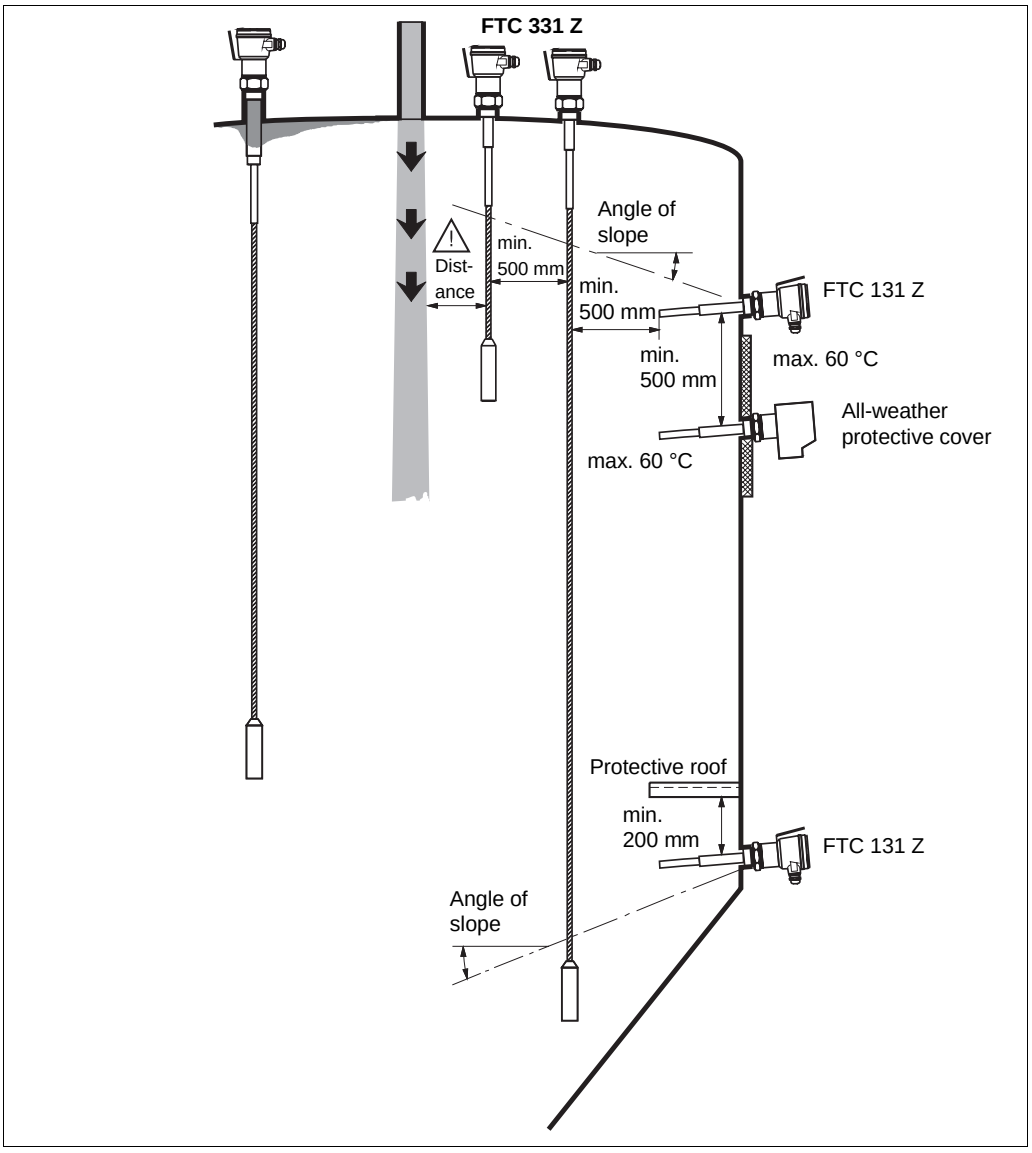


Fig. 6
General information for installing the Nivocompact FTC

Type of bulk solid

Applications for the instruments:
FTC 131 Z is used mainly for limit detection in small silos with fine-grained bulk solids.
FTC 331 Z also used for limit detection in large silos with fine and coarse-grained bulk solids.
For silos with very coarse or abrasive material, the Nivocompact FTC 331 Z should be used for maximum detection only.

Distance between probes

To avoid mutual interference of the probes, a minimum distance of 0.5 m must be allowed for. This also applies if there are a number of Nivocompact FTC units mounted in adjacent silos with non-conducting walls.
If the silo is filled pneumatically, then probes should be as far apart as possible so that, even when the probes sway, the minimum distance is maintained.

Filling the silo

The filling curtain should not be directed onto the probe.

Angle of material mounds

Note the angle of the material mounds and the outlet funnel when determining the measuring point or probe length.

Silo roof

When mounting the Nivocompact FTC 331 Z, ensure that the silo roof is strong enough!
Long rope probes may be subjected to very high tensile forces occurring at the material outlet. These depend on the type of outlet, the length of the probe, the installation point of the probe and the material itself:
- for free flowing bulk materials 1000 ... 10000 N (100 kg ... 1 t),
- for heavy, powdery bulk materials which tend to form build-up up to 100000 N (10 t).

Threaded socket for mounting

Use the shortest possible threaded socket when mounting the Nivocompact FTC 131 Z and FTC 331 Z without screening.
Condensation can form or dust can settle in long threaded sockets and interfere with correct operation of the probe.

Condensation and material build-up in the silo

Heat insulation prevents condensation in the silo near the threaded boss and so reduces build-up and the danger of incorrect switching.

The effects of condensation and build-up on the roof of the silo can be prevented by installing a Nivocompact FTC 331 Z with screening.

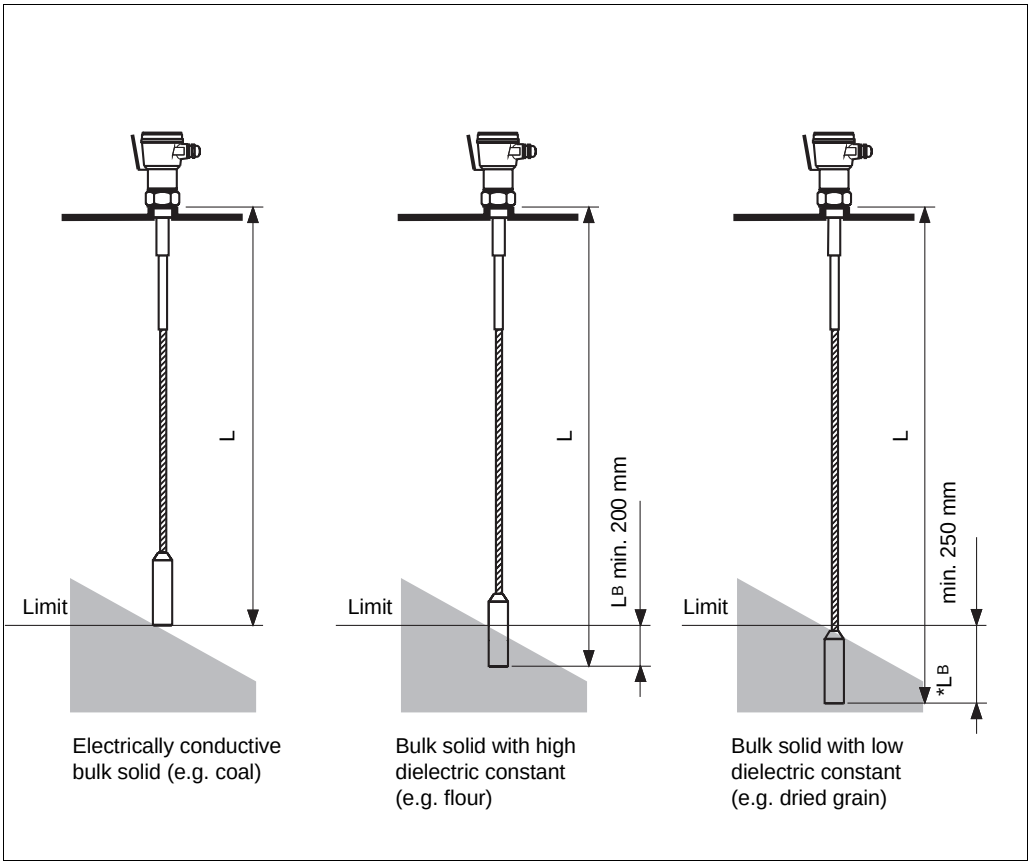
Installation in the open

The all-weather protective cover accessory protects the Nivocompact with aluminium housing from excessive temperatures and from condensation which may form in the housing due to large temperature variations.

Probe lengths for lateral mounting

A probe length of 350 mm is sufficient for a bulk solid with a dielectric constant $\varepsilon_r \geq 2.5$ in a silo made of metal or steel reinforced concrete.
A probe length of 200 mm is normally sufficient for electrically conducting bulk solids.

Partial insulation L2 with dry bulk solids min. 100 mm, with moist bulk solids min. 200 mm, max. 500 mm, according to build-up.
Partial insulation min. 100 mm shorter than the probe length.



Probe lengths for vertically mounted probes

✯L_B (covered length):

For *non-conductive* materials with low dielectric constants, the probe must be approx. 5 % (or minimum 250 mm) longer than the distance from the roof of the vessel to the switch point.
If it is not possible to select the correct L_B for minimum detection with very long probes, then instead of the cylindrical weight, a special "butterfly weight" accessory can be used for the FTC 331 Z with rope probe.
The increased surface area of this weight ensures that there is a large enough change in capacitance when the probe is covered by material. An L_B of 250 mm is normally sufficient.
An opening of at least 200 mm diameter is required for the butterfly weight.

For *conductive* materials, contact with the probe is sufficient to ensure reliable switching.

Partial insulation length L2: 250 mm ... 500 mm, according to condensation and build-up.

Installing the Nivocompact FTC 131 Z
Examples for Mounting

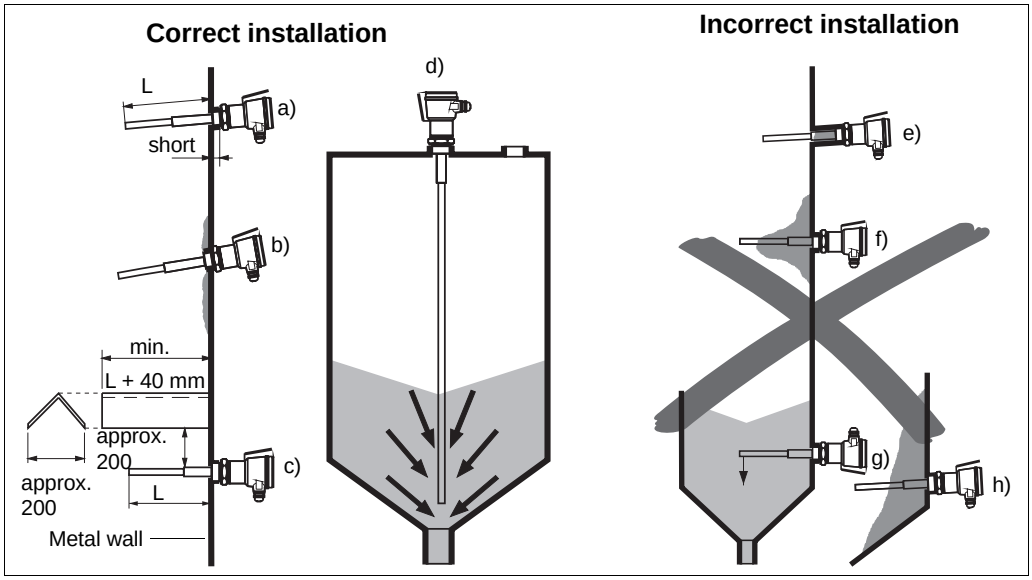


Fig. 7
Silo with metal walls

Correct installation

a) Maximum probe length L for lateral mounting approx. 500 mm.
Short threaded socket (ideal 25 mm = half standard socket)
b) With slight build-up on the silo wall: threaded socket welded on the inside.
Probe tip slopes downwards so that material falls off more easily.
c) With protective roof to protect against collapsing mounds or high strain on the rod probe caused by material discharge when the Nivocompact FTC 131 Z is used for minimum detection.
d) Centre the long rod probe accurately to reduce lateral strain on the probe during material discharge.

Incorrect installation

e) Threaded socket too long.
Material can settle and lead to error switching.
f) Error switching caused by high build-up on the silo wall.
A Nivocompact FTC 331 Z with rope probe is recommended for mounting in the silo roof.
g) High strain on the rod probe due to material discharge.
A Nivocompact FTC 331 Z is recommended.
Cable gland pointed upwards can cause moisture to enter.
h) The instrument cannot recognise an "empty" silo in areas where material can settle.
An FTC 331 Z is recommended.

Mounting for small differences in level

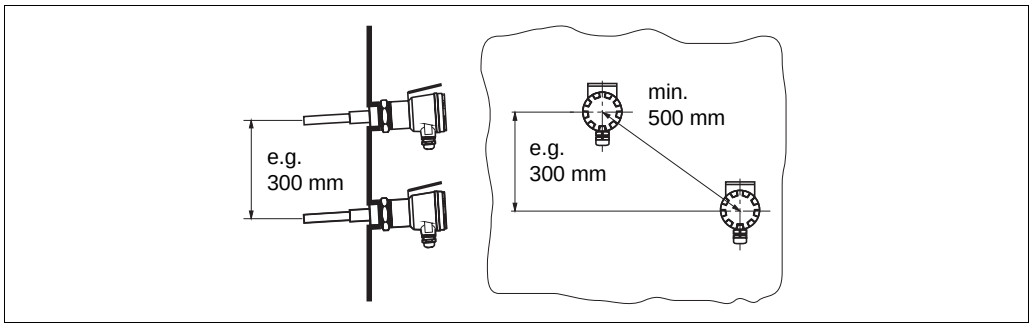
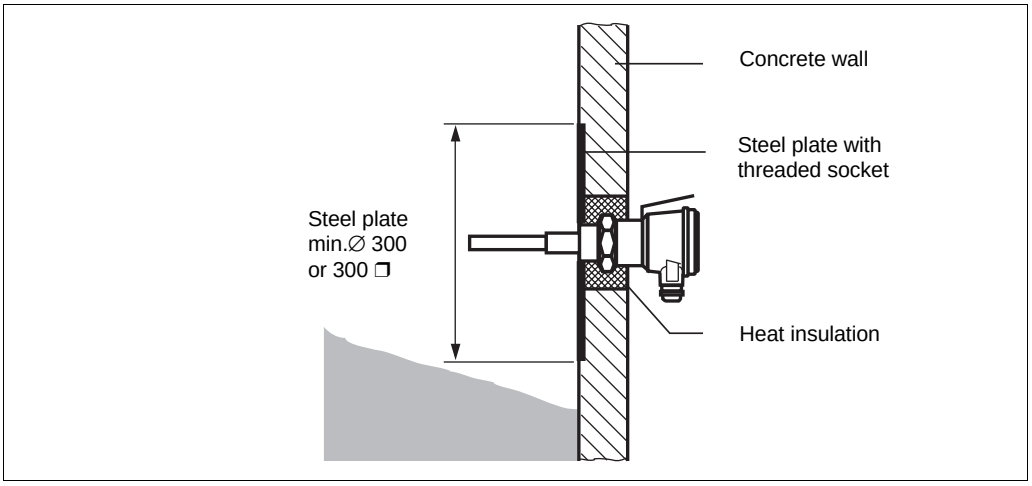


Fig. 8
Example for mounting

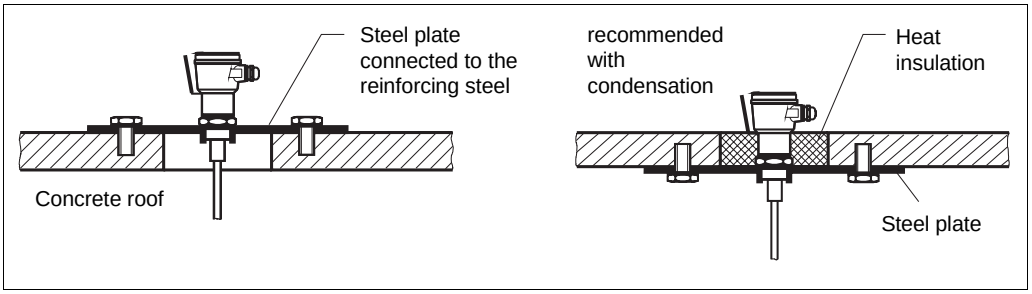
The minimum distance required can be maintained by staggered mounting.



Lateral mounting in a reinforced concrete silo

Fig. 9
Lateral mounting in a silo with concrete walls

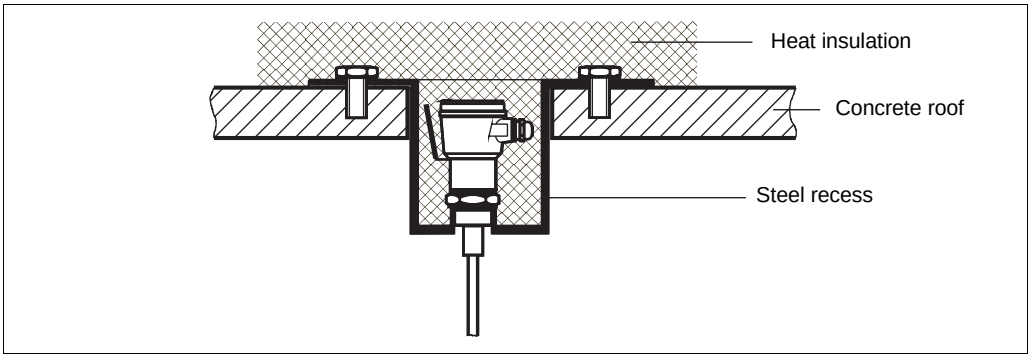
A steel plate on the inner wall of the concrete silo acts as the counter-electrode for the probe. For bulk solids with a low dielectric constant, this is an even better counter-electrode than the existing steel-reinforced concrete wall.
Heat insulation prevents condensation and material build-up on the steel plate.



Installation in a reinforced concrete roof

Fig. 10
Vertical mounting in a silo with concrete walls

The 25 mm long threaded socket should project into the silo so as to minimise effects due to condensation and material build-up.
The reinforcing steel acts as the counter electrode for vertically mounted probes.
Heat insulation prevents condensation and material build-up on the steel plate.



Protection against condensation

Fig. 11
The ideal solution with high condensation: The base of the steel recess is the same temperature as in the silo itself: no liquid condensates

Installing the Nivocompact FTC 331 Z
Examples for Mounting

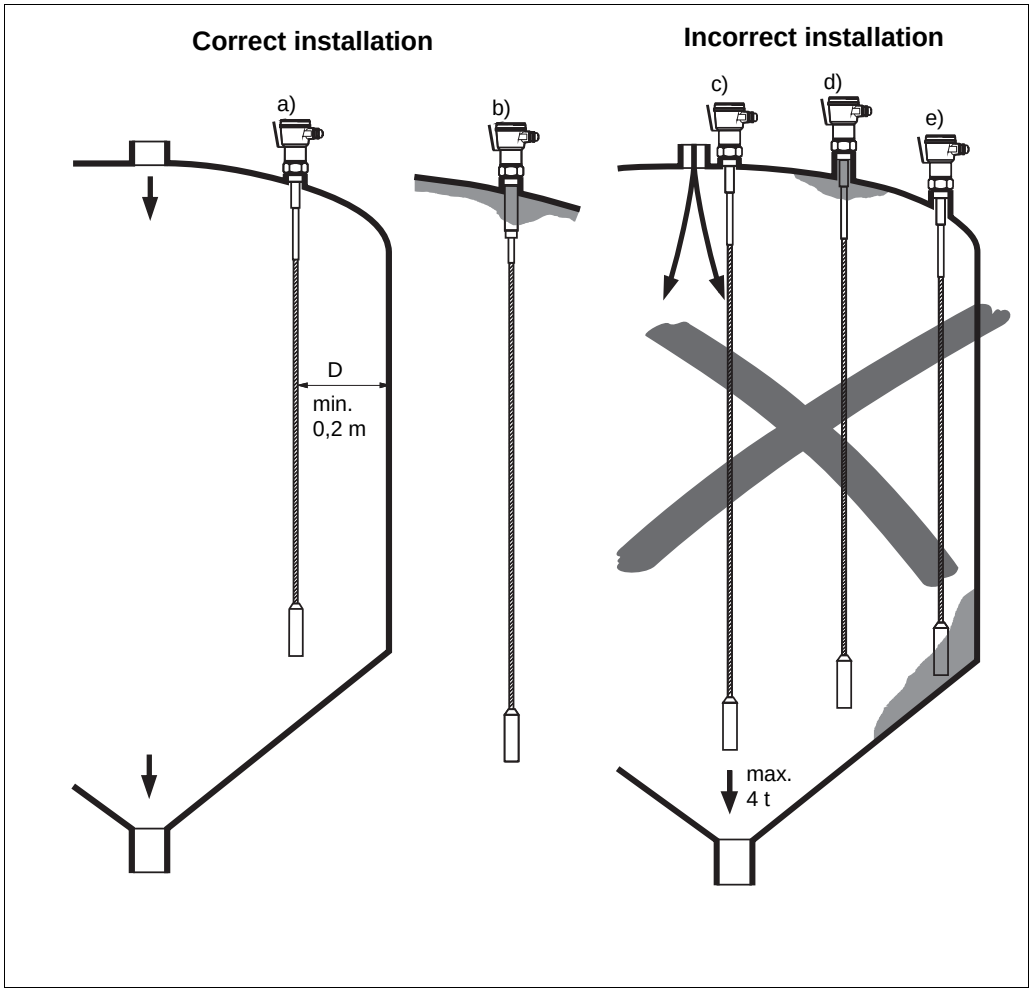


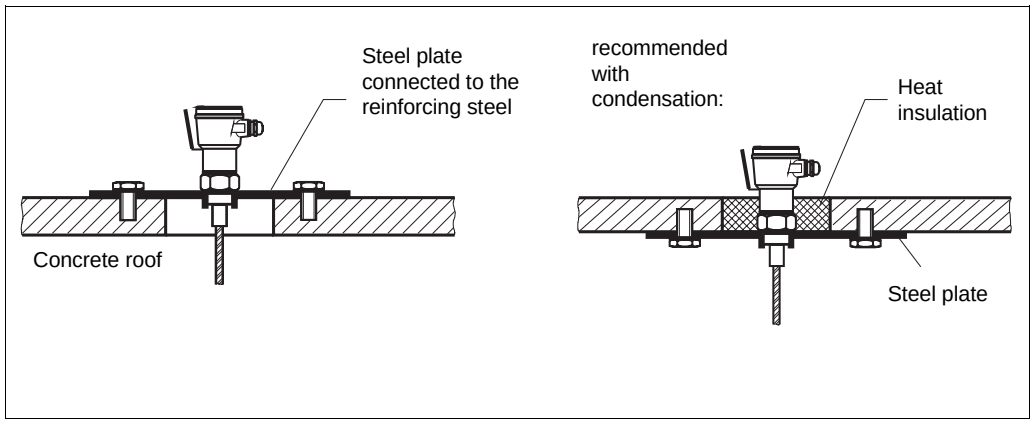
Fig. 12
Mounting in a silo with metal walls. Distance D of probe from the wall approx. 10 % to 25 % of the diameter of the silo

Correct installation

a) The correct distance from the silo wall, the material filling curtain and the material outlet.
Mounted very close to the wall for reliable switching with products having low dielectric constants (not for use with pneumatic filling systems).
For pneumatic systems, the distance of the probe from the wall should not be too small as the probe may swing against it.
b) Nivocompact FTC 331 Z with screening against condensation and build-up on the silo roof.

Incorrect installation

c) Too near the inlet:
the probe can be torn off by the material curtain.
Near the centre of the outlet:
the high tensile forces present at this point may damage the probe or subject the silo roof to excessive strain.
d) Threaded socket too long:
condensation and dust may penetrate and cause error switching.
e) Too near the silo wall:
the probe touches build-up. Result: incorrect switching.

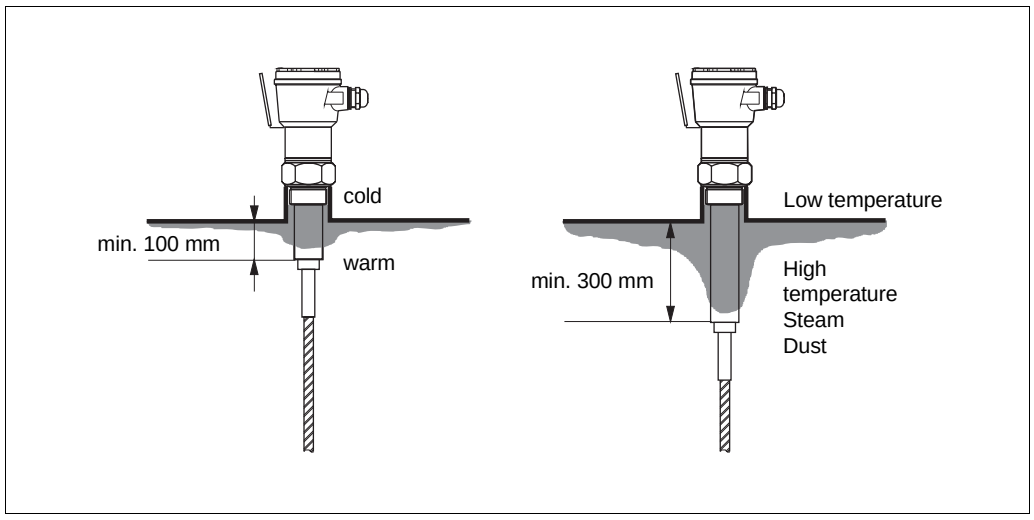


Installation in a reinforced concrete roof

Fig. 13
Silo with concrete walls

For the FTC 331 Z without screening: The 25 mm long threaded socket should project into the silo so as to minimise effects due to condensation and build-up.
The reinforced concrete acts as a counter-electrode to the probe.

Heat insulation prevents condensation and build-up of material on the steel plate.



FTC 331 Z with screening

Fig. 14
Length of screening according to process conditions

Ensure that the screening projects far enough into the silo:
Approx. 100 mm is sufficient for small temperature differences between the silo and outside temperature, low moisture and dust levels in the silo.
At least 300 mm for large temperature differences between the silo and outside temperature, high moisture and dust levels in the silo.

Mounting

Tools required for installation

- Open-end spanner 60 AF
- Screwdriver, blade width 5 to 6 mm
  or Phillips screwdriver PZD 2

Initial check

Compare the order code on the nameplate of your instrument with the product structure to ensure that the correct instrument is being installed.
See Technical Data, Page 7 and 8.
Check the length of the probe!
The length of the probe of the Nivocompact *at delivery* is stated on the nameplate.

Shortening the probe

The probe can be shortened if it is too long:
FTC 131 Z, Rod Probe
① Grip the probe at the uninsulated part only where it is to be sawn off and not at the threaded boss or insulation!
② If, after shortening, the uninsulated part of the probe rod is less than 100 mm, then shorten the insulation accordingly.
FTC 331 Z, Rope Probe
① Loosen the three screws in the weight (Allen screws 5 AF).
② Pull off the weight.
③ Cut off a length of the rope (e.g. with a cutting wheel).
④ Put the weight back on the rope.
⑤ Screw up the 3 screws in the weight tightly enough to cut into the rope.

Lengthening the probe

The probe can be lengthened if it is too short:
FTC 131 Z, Rod Probe
Weld a length of rod or tubing onto it.
Do not damage the insulation!
Also take into account that a longer or thicker probe rod is then subject to greater lateral forces exerted by the material.
FTC 331 Z, Rope Probe
Weld a length of tubing with an external diameter of max. 40 mm, directly on the lower end of the weight.

Changing the nameplate

If the length of the probe has been changed, then the length of the probe L stated on the nameplate must also be changed before screwing in the probe.
The length of the probe is important for calibration at a later date.

Installation

- Observe all explosion protection regulations!
- Nivocompact with parallel thread G $1^1/_2$:
  Place the gasket supplied against the sealing surface
- Nivocompact with tapered thread NPT $1^1/_2$":
  Before screwing in, apply a suitable sealant around the tapered thread
- Nivocompact FTC 331 Z:
  Straighten out the bottom two meters of the probe rope.
- When screwing in, turn the instrument by the hex nut 60 AF only!
  Do not tighten too tightly!
  A torque of approx. 100 Nm is sufficient for providing a good seal up to 10 bar.
  A torque of more than 300 Nm will destroy the seal for the parallel thread G $1^1/_2$.

Rotating the housing

The housing can be rotated if the cable gland is facing in the wrong direction after the Nivocompact has been installed in:

Loosening
- Unscrew and remove the housing cover
- Loosen the central screw in the electronic insert
- Remove the plug-in electronic insert from the housing using the handle
- Slightly loosen the 3 screws in the housing, see Fig. 15.

Rotating
- The housing can now be rotated through 360°
  When the Nivocompact FTC 131 Z is mounted laterally, the cable gland should point downwards so that no moisture can enter.

Tightening
- Tighten up the 3 screws in the housing so that the housing is well sealed at the hex nut
- Insert the plug for the electronic insert in the housing at the correct point which is just opposite the ground terminal
- Insert the electronic insert in the plug ensuring that the cable shoe of the two yellow/green wires is a tight fit with the grounding screw
- Securely tighten the central mounting screw while making sure that the cable gland remains free.

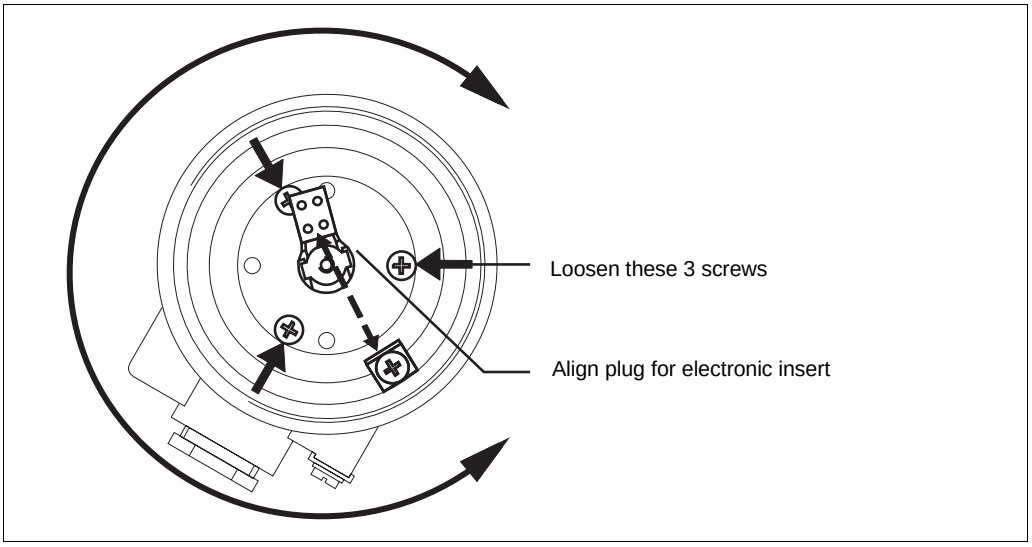


Fig. 15
Loosening and rotating the housing

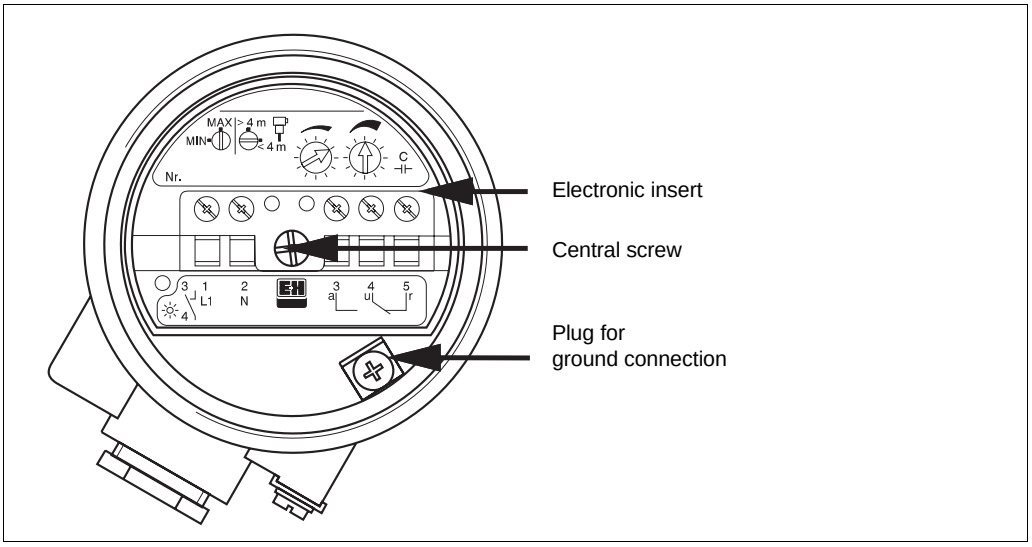


Fig. 16
Tightening the electronic insert

Connection

Wiring

Main features of the different electronic inserts

The last number of the order code on the nameplate indicates the electronic insert mounted in the Nivocompact FTC:

1=Electronic Insert EC 20 Z
Two-wire AC voltage 21 V…250 V
Electronic switch, max. 350 mA

2=Electronic Insert EC 22 Z
Three-wire DC voltage 10 V…55 V
Transistor circuit, load connection PNP, max. 350 mA

3=Electronic Insert EC 23 Z
Three-wire DC voltage 10 V…55 V
Transistor circuit, load connection NPN, max. 350 mA

4=Electronic Insert EC 24 Z
With potential-free relay output
AC power supply 21 V…250 V or
DC power supply 20 V…125 V

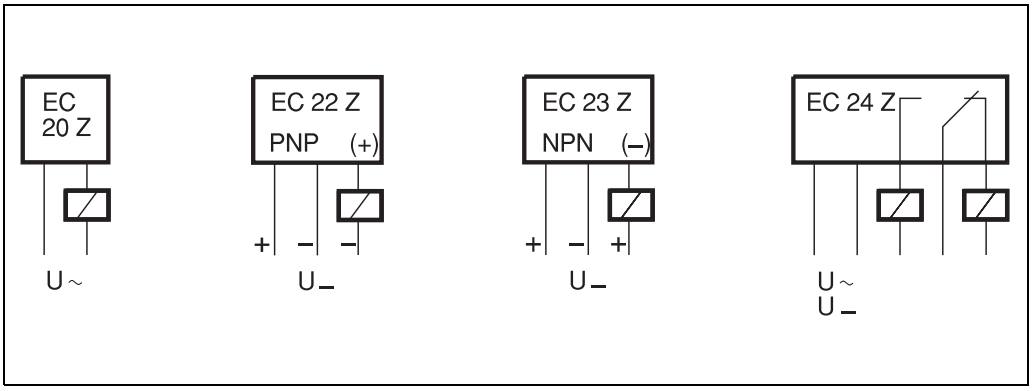


Fig. 17
Electronic connections available with the different electronic inserts

Load limit values

Note the limit values of the loads to which you want to connect the Nivocompact. Exceeding the load can damage or destroy the electronic insert.

Diameter of wiring

Because of the small current used, only small diameter cabling is required.
Low-cost cabling with diameters of 0.5 mm^2 to max. 1.5 mm^2 are recommended.

Grounding, earth bonding

The Nivocompact must be grounded to give reliable operation free from interference. This is done by either connecting it to a grounded silo with metal or steel reinforced walls, or else to the earth conductor PE.
If a counter-electrode is connected to a silo made of plastic material, then there must be a short ground connection from the Nivocompact to the counter-electrode.
Observe all local regulations covering explosion protection, especially when avealing an equipotential plane (earth bonding and grounding practices) and also all instructions given in the certificates!
The special requirements/conditions stated in the design approval certificate under (A7) 1 and 2 are fulfilled when an electronic insert is mounted in the Nivocompact.

Connecting the Nivocompact with Electronic Insert EC 20 Z for AC Voltage (Two-Wire Connection)

Connecting in series to a load

The level limit switch Nivocompact with electronic insert EC 20 Z must – like all switches – be connected in series with the load (e.g. relays, microcontactors, lamps) to the power supply.

Direct connection to the power supply without any intermediate load connected (short circuit!) will result in immediate and permanent damage to the electronic insert.

The load can be connected to Terminal 1 or 2 of the electronic insert.
It is unimportant whether L1 is connected to Terminal 1 or 2.

Power voltage

The voltage across Terminal 1 and 2 of the electronic insert must be at least 21 V.
The power voltage must be correspondingly higher to compensate for the voltage drop across the connected load.

Load cutoff

Note that loads connected in series are not completely disconnected from the power supply when the electronic switch in the electronic insert of the Nivocompact "is disconnected" (blocks) on a level alarm.
Because of the current requirements of the electronics, a small "no-load current" still flows through the connected load.
If the load is a relay with a very small retaining current, then the relay may not de-energise. In this case, connect an additional load in parallel to the relay, e.g. a resistor or signal lamp.

Fuse

Ensure that the rating of the fine-wire fuse corresponds to the maximum load to be connected.
The fine-wire fuse does not protect the electronic insert EC 20 Z.

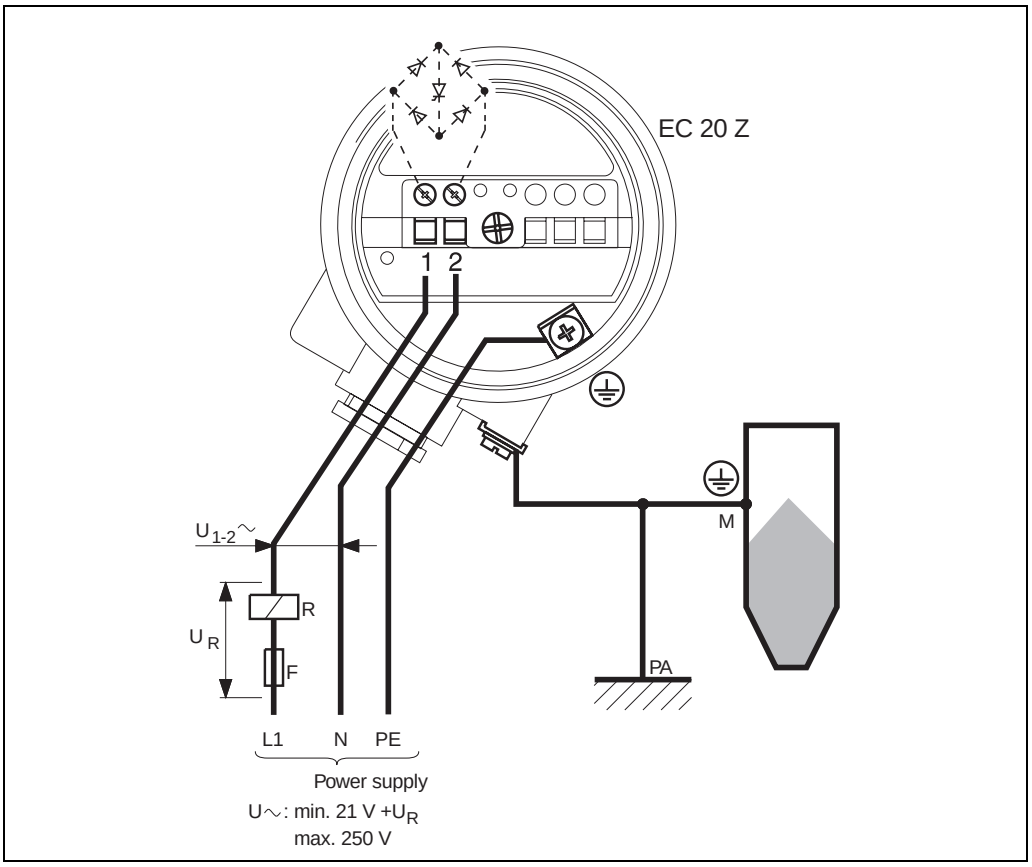


Fig. 18
Connecting the Nivocompact with electronic insert EC 20 Z

U_{1-2}~: 21 V… 250 V across Terminals 1 and 2 of the EC 20 Z
R: Connected (external) load, e.g. relay
F: Fine-wire fuse, load-dependent
U_R: Voltage drop across the load and the fine-wire fuse
M: Ground connection to the silo or to the counter electrode
PA: Earth bonding and ground

Connecting the Nivocompact with Electronic Insert EC 22 Z (Three-Wire PNP) for DC Voltage

Transistor circuit for load

The load connected to Terminal 3 is switched by a transistor, contactless and therefore without bounce.

Terminal 3 has a **positive** signal in normal switching mode.

The transistor is blocked on level alarm or a power failure.

Protection against short-circuiting

The load circuit between Terminal 1 and 3 is protected against overload and short-circuiting (pulsed overload protection). The transistor blocks on overload or short-circuiting.

Protection against voltage peaks

Connecting to an instrument with a high inductance:
a voltage limiter should be connected.

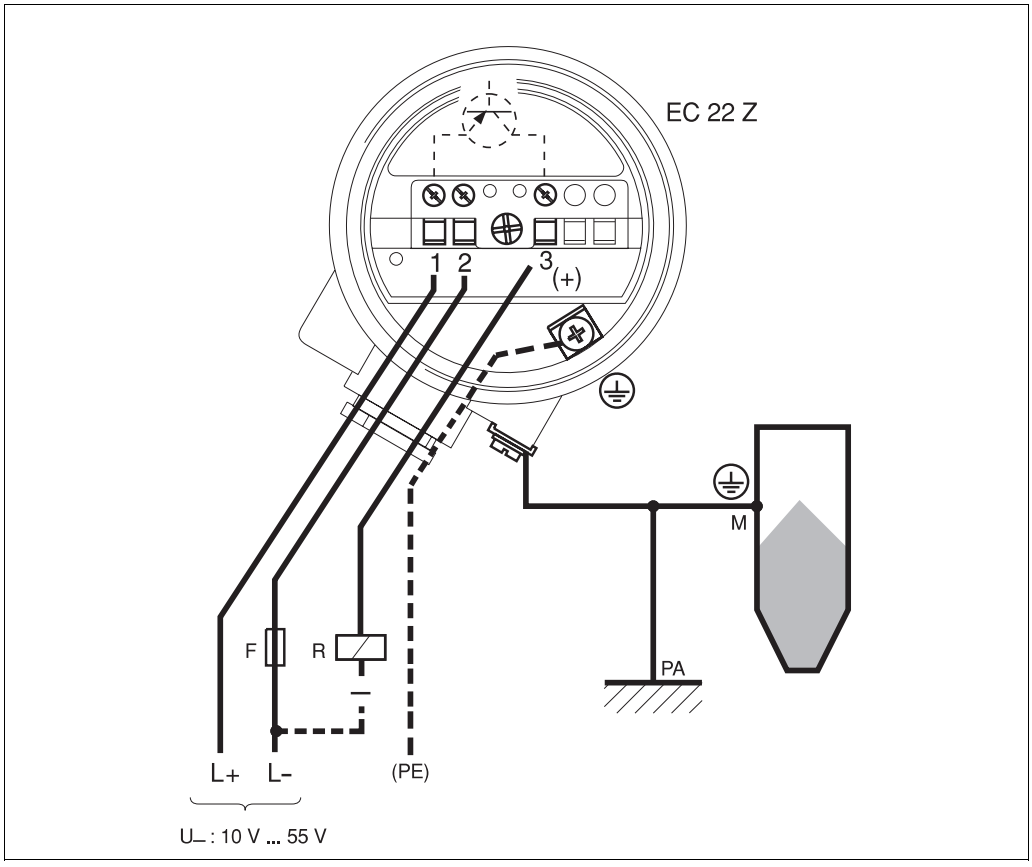


Fig. 19
Connecting the Nivocompact with electronic insert EC 22 Z (PNP connection)

F: Fine-wire fuse, 20 mA medium slow-blow recommended. The load circuit is protected against short-circuiting
R: Connected load, e.g. PLC, PCS, relay
M: Ground connection to the silo or to the counter electrode
PA: Earth bonding and ground

Connecting the Nivocompact with Electronic Insert EC 23 Z (Three-Wire NPN) for DC Voltage

Transistor circuit for load

The load connected to Terminal 3 is switched by a transistor, contactless and therefore without bounce.

Terminal 3 has a **negative** signal in normal switching mode.

The transistor is blocked on level alarm or a power failure.

Protection against short-circuiting

The load circuit between Terminal 2 and 3 is protected against overload and short circuiting (pulsed overload protection). The transistor blocks on overload or short circuiting.

Protection against Voltage Peaks

Connecting to an instrument with a high inductance:
a voltage limiter should be connected.

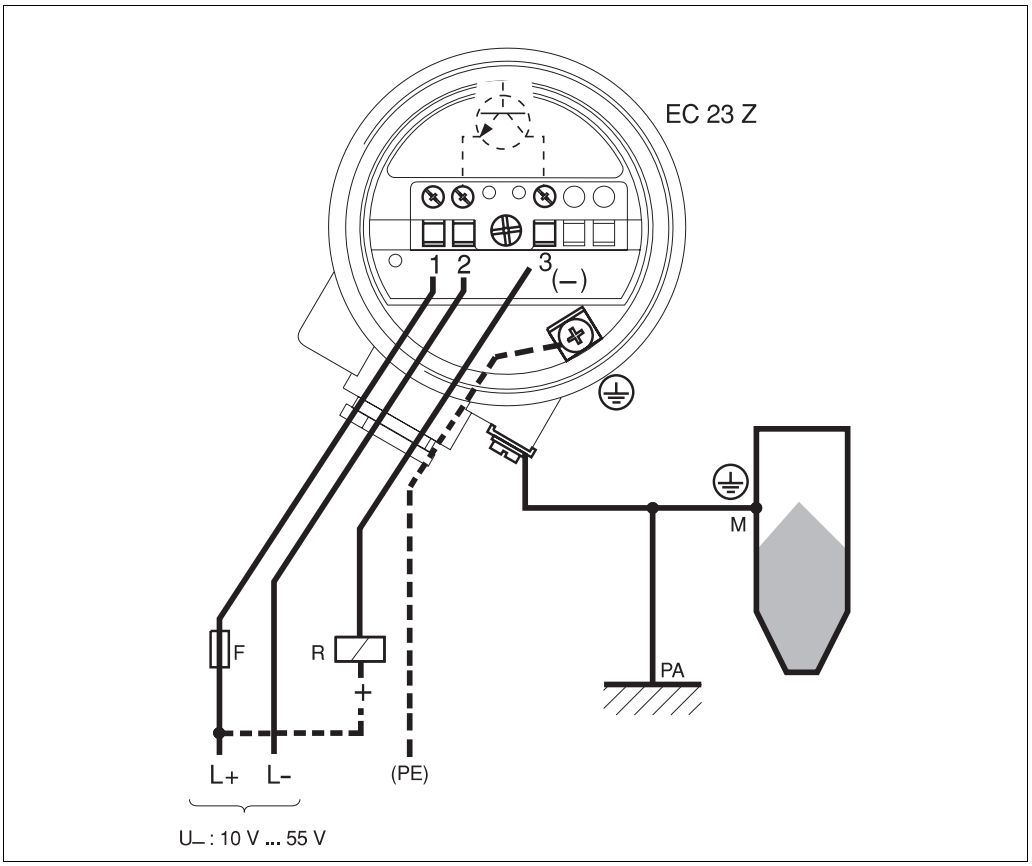


Fig. 20
Connecting the Nivocompact with electronic insert EC 23 Z (NPN connection)

F: Fine-wire fuse, 20 mA medium slow-blow recommended. The load circuit is protected against short-circuiting.
R: Connected load, e.g. PLC, PCS, relay
M: Ground connection to the silo or to the counter electrode
PA: Earth bonding and ground

Connecting the Nivocompact with Electronic Insert EC 24 Z Relay Output for DC and AC Voltages

Power supply

With AC, it is unimportant whether L1 or N is connected to Terminal 1.
With DC, it is unimportant whether L+ or L– is connected to Terminal 1.

Relay contact for load

The load is connected via a potential-free relay contact (change-over contact).
The relay contact breaks the connection between Terminal 3 and Terminal 4 on level alarm or power failure.

Protection against voltage peaks and short-circuiting

Protect the relay contact by connecting a spark arrester to instruments with high inductance.

A fine-wire fuse (load-dependent) can protect the relay contact if a short-circuit occurs.

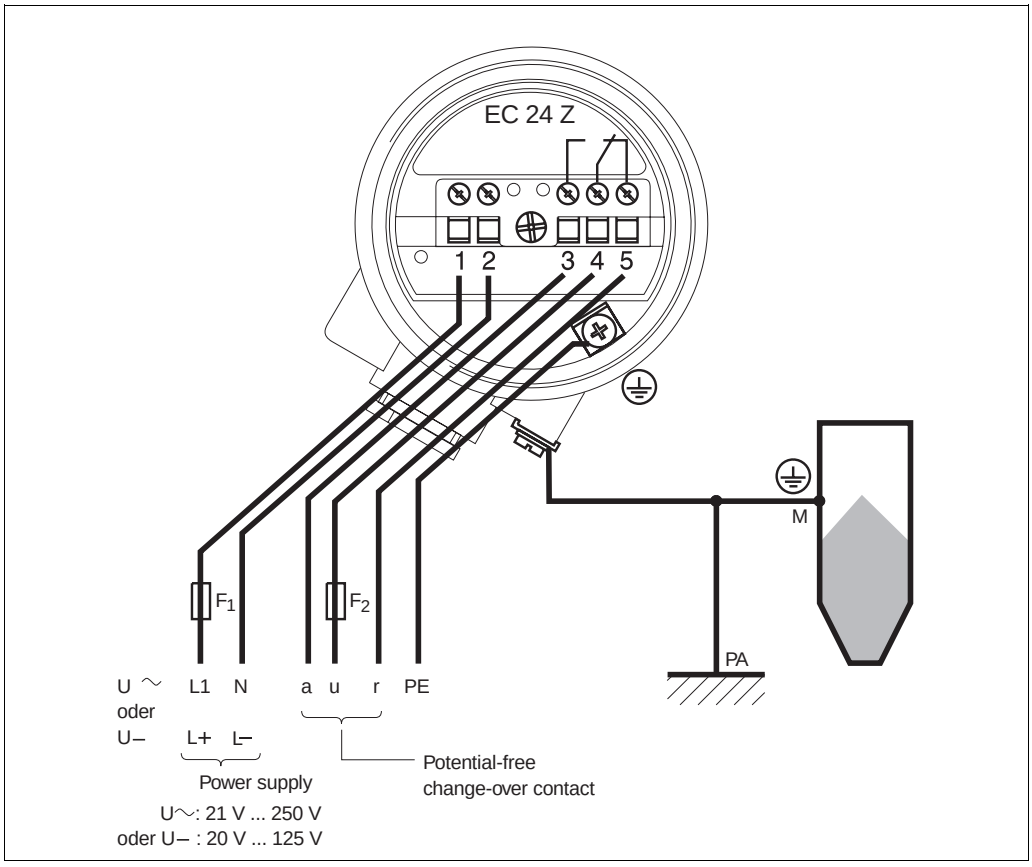


Fig. 21
Connecting the Nivocompact with electronic insert EC 24 Z; (relay output)

F_1: Fine-wire fuse 200 mA, medium slow-blow recommended
F_2: Fine-wire fuse to protect the relay contact, load- dependent
M: Ground connection to the silo or to the counter electrode
PA: Earth bonding and ground

Wiring On-Site

Tools required for connection

- Open-end spanner 22 AF
- Screwdrivers, blade widths approx. 4 mm and 7 mm or Phillips screwdrivers PZD 1 and PZD 2
- Usual electrical tools

Before connecting, make sure that the power supply used is the same as that stated on the nameplate of the electronic insert.

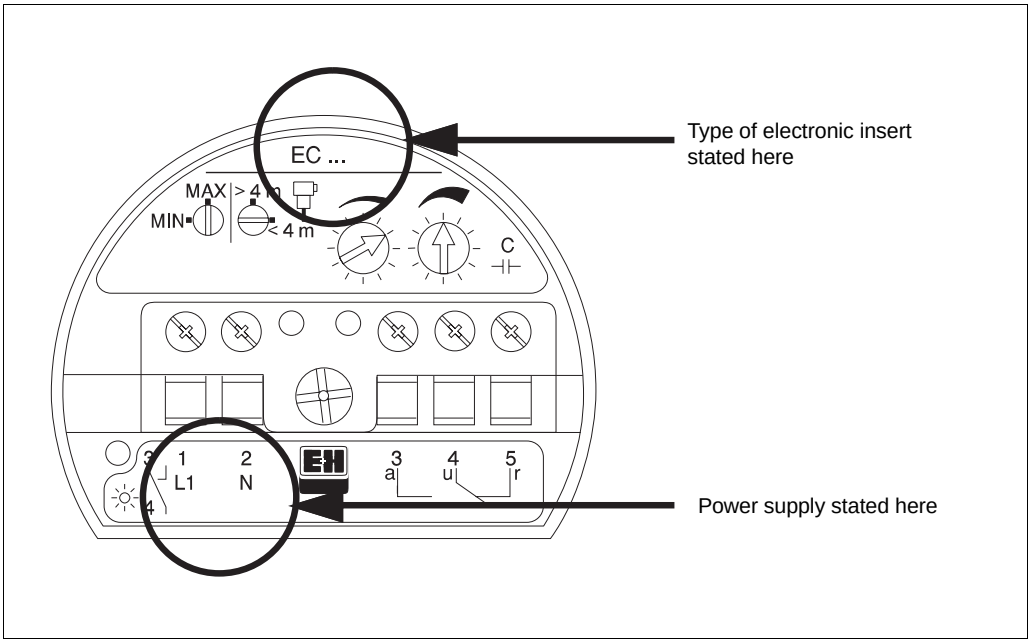


Fig. 22
Note the power voltage stated on the nameplate!

Electrical connections

Connect the Nivocompact according to the appropriate diagram Fig. 18 to Fig. 21.

Ensure that no water gets into the housing while connecting up.

The gasket in the standard cable gland is designed for cable diameter from 7 mm to 10 mm.
A suitable gasket must also be used for other cable diameters.

You can seal with the "water-tight" cable gland with cables of diameter from 5 mm to 12 mm.

Ensure that there is a good **short ground connection** from the housing of the Nivocompact to the silo, to the counter-electrode or to, e.g. the metal reinforcement of a steel reinforced silo.
No special ground connection is required if a Nivocompact without sealing material on the thread is screwed into a metal silo. Observe all local regulations covering the creation of an equipotential plane (earth bonding).

After connecting

Screw the thread of the cable gland tightly to comply with the standards of protection IP 55 or IP 66.

For applications in the open or in moist surroundings, it is recommended that the standard cable gland be sealed with sealing compound .
(This is not required with the "water-tight" cable gland).

Calibration

Tools required for calibration

- Screwdriver with blade width approx. 3 mm
- Screwdriver with blade width approx. 5 mm

The rotary switches and adjusting elements for calibration are on the electronic insert in the housing.

Directly beside these calibration elements are the power connections with voltages up to 250 V.
Only use an electrician's screwdriver with insulated shaft or else tape over the terminals with insulating tape before calibration.

Capacitance calibration

For capacitance calibration, the silo must be empty or the level of material must be at least 200 mm below the probe.

- Turn on the power supply
- Carry out the calibration according to the sequence of diagrams Fig. 23 to Fig. 25.
- Ensure that no water gets into the housing while calibrating.

Capacitance calibration, initial settings

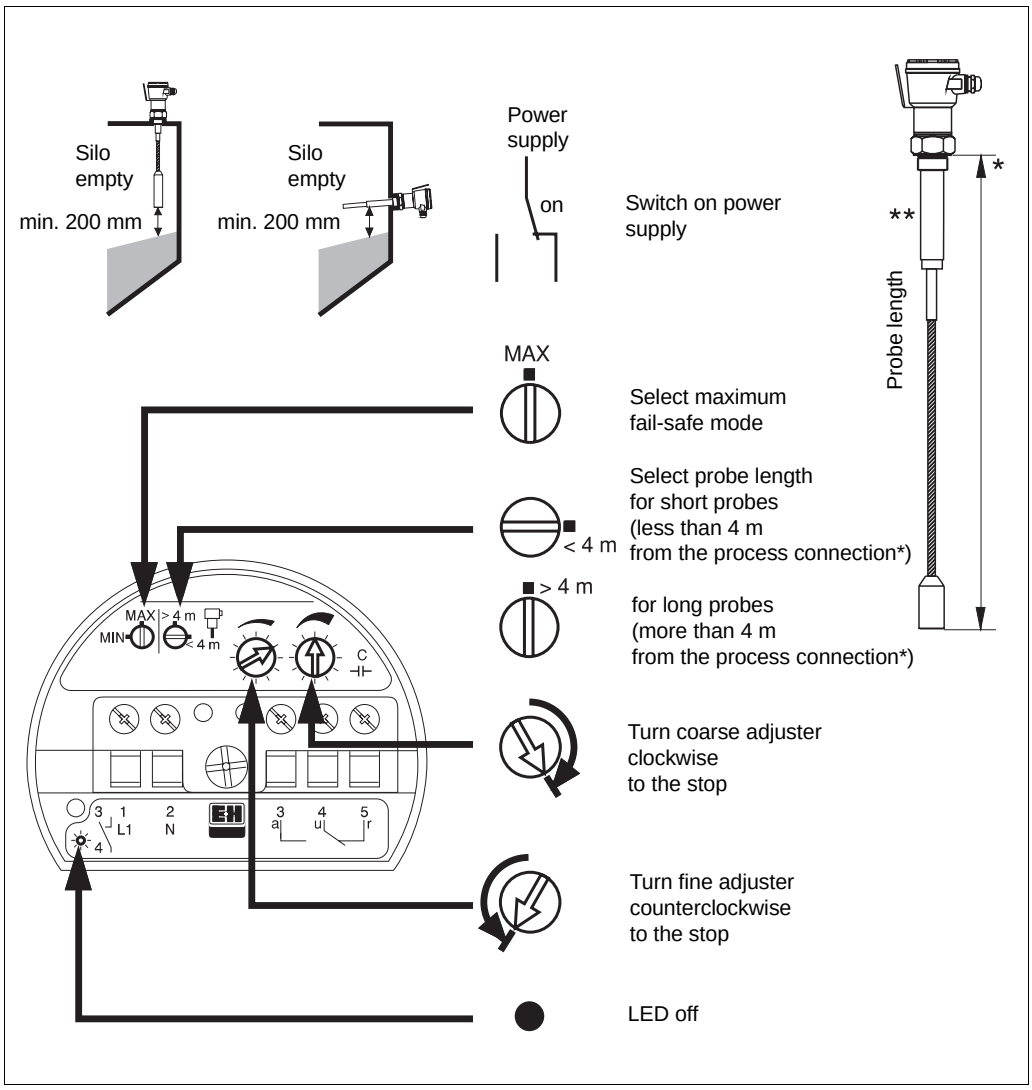


Fig. 23
These are the initial switch positions for carrying out capacitance calibration.

***)*
The capacitance of that part of the probe in the screening is about twice as large as the capacitance of the probe in the silo when uncovered. Assume a screening length of twice that for calibration purposes <4 m or > 4 m. The length of the screening L3 and the probe length L are stated on the nameplate.

Capacitance calibration

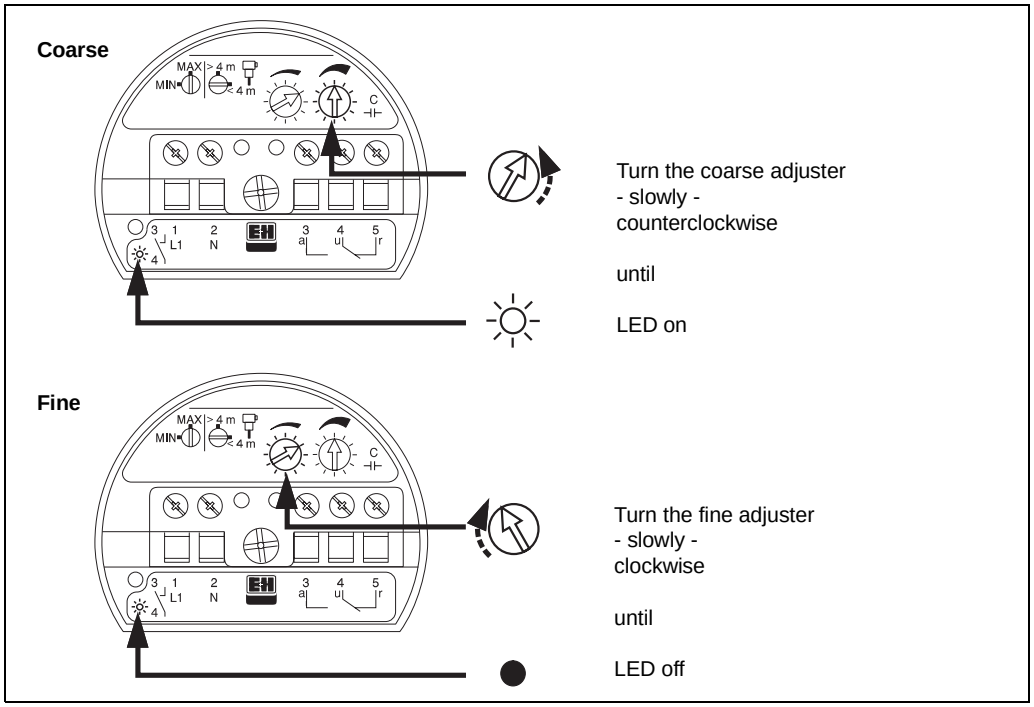


Fig. 24
Capacitance calibration must be carried out slowly and carefully.

Adjusting for material characteristics

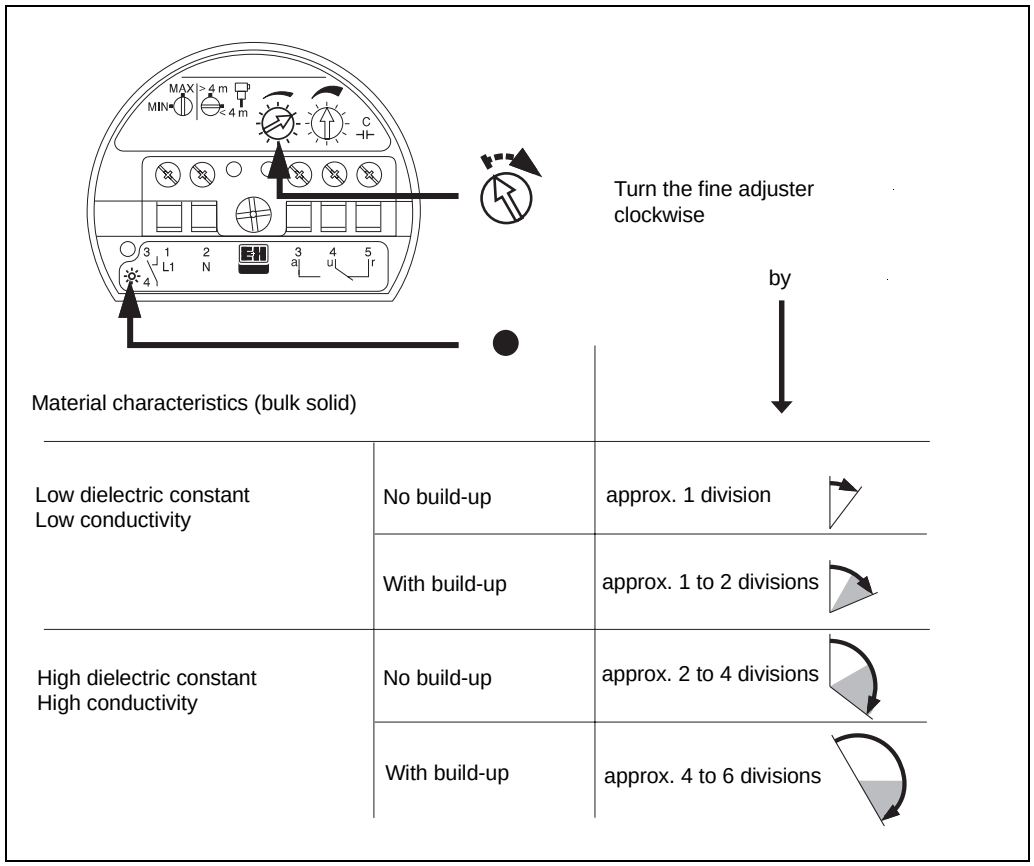


Fig. 25
Accurate adjustment ensures high switching reliability

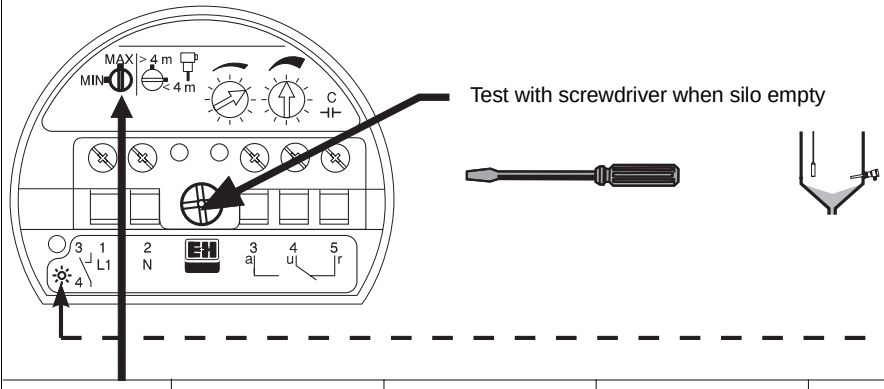
When the probe is covered with non-conductive bulk solid with a low dielectric constant, then the Nivosonic only switches when a section of the vertically mounted probe is well covered with the material or when a laterally mounted short probe is completely covered with the material.
The degree of covering depends on the calibration.
Turning the fine calibrating element clockwise causes the Nivocompact to become less sensitive, e.g. the covering must be greater before the instrument switches.

Fail-safe mode

By using the rotary switch, select the fail-safe mode for your particular application:

- **Maximum** fail-safe: The circuit is blocked if the probe is covered or the power supply fails.
- **Minimum** fail-safe: The circuit is blocked if the probe is free or the power supply fails.

Changing the fail-safe mode also changes the LED status indication.



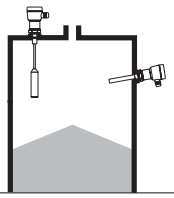
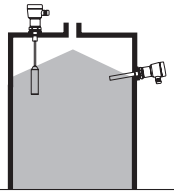
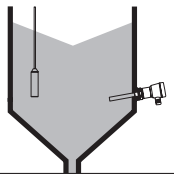
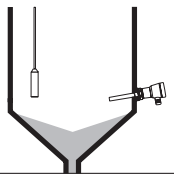
Fail-safe mode	Level	Electronic switch on EC 20, 22, 23 Z	Relay contact on EC 24 Z	LED on EC (red)
Maximum fail-safe 		connected  (load circuit closed)		●
		blocked (load circuit open)		
Minimum fail-safe 		connected (load circuit closed)		●
		blocked (load circuit open)		
Power failure		blocked (load circuit open)		●

Abb. 26
Selection of fail-safe mode and function

Function Control

With the probe uncovered, touch the central retaining screw of the electronic insert with a screwdriver, holding it by the insulated handle. This simulates the bulk solid covering the probe.
The LED indicates a change of status.

This is a function control test of the instrument only.
Also check for correct operation of limit detection by filling and emptying the silo so that the level is approximately
– at the same height as the installation point of a laterally mounted rod probe
– or at the same height as the probe tip of a vertically mounted rod probe
– or at the same height as the weight of a rope probe!

Final Points

Screw the housing cover securely down after connection and calibration to comply with the standards of Protection IP 55 or IP 66.

For applications in the open, a protective all-weather cover accessory is to be used to cover the aluminium housing of the Nivocompact.

Maintenance

The capacitive level limit switch Nivocompact FTC requires no maintenance when correctly installed and used properly under the normal conditions specified by the system.

When cleaning and checking the silo:
- Examine the probe to check for damage to the insulation
- Remove material build-up, especially around the threaded boss of a probe without screening.

With initial but permanently low material build-up:
Recalibrate the Nivocompact after the build-up has occurred.

Ensure that the cable gland and housing cover are tight fitting, so that no moisture can enter.

Trouble-shooting

When an error is indicated, first check to make sure that
- the Nivocompact is properly connected
- there is a good ground connection to the silo or to the counter electrode
- there is a power supply at the terminals
- all instruments connected are operating correctly
- in the case of the electronic insert EC 20 Z, the minimum required load of the connected instruments is at least present
- the correct fail-safe mode has been chosen
- calibration has been carried out correctly (see Calibration)

Carry out a function control (see above)

Refer to the trouble-shooting tables, Fig. 27 and Fig. 28.

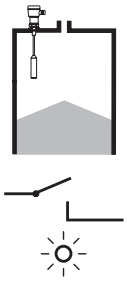
Fault for **maximum** fail-safe mode 	Possible causes
Probe free (level below maximum) but with load circuit open LED on 	- Water condensing around the threaded boss - High material build-up on the threaded boss or at the area between the screening and rope - Probe insulation damaged - Rope probe touching silo wall - Water in housing
Probe covered (level above maximum) but with load circuit closed LED off 	- Rope probe or weight torn off - Dielectric constant of the material too small - Different material now in silo than expected on calibration - Drier material than that expected on calibration

Fig. 27
Trouble-shooting with maximum fail-safe mode

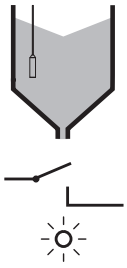
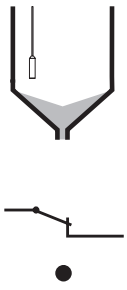
Fault for **minimum** fail-safe mode 	Possible causes
Probe covered (level above minimum) but with load circuit open LED on 	- Rope probe or weight torn off - Dielectric constant of the material too small - Different material now in silo than expected on calibration - Drier material than that expected on calibration - Material has formed cavities
Probe free (level below minimum) but with load circuit closed LED off 	- Water condensing around the threaded boss - High material build-up on the threaded boss or at the area between the screening and rope - Probe insulation damaged - Rope probe touching silo wall - Water in housing

Fig. 28
Trouble-shooting with minimum fail-safe mode

Guarantee

Our guarantee terms are included with the documents which accompany delivery. Copies may also be obtained from the agent responsible.
Any modifications carried out within the instrument during the guarantee period invalidates the terms of the guarantee.

Replacement of Parts

Replacing the Electronic Insert

Removal

- Switch off all sources of power to the Nivocompact
- Loosen the electrical connections to the electronic insert
- Loosen the central screw in the electronic insert
- Lift out the electronic insert from the housing using the handle
- If a new electronic insert is not installed immediately:
  connect the central screw to the ground terminal in the housing in order to prevent electrostatic build-up on the probe and to prevent explosion.

Insertion

- Push the new electronic insert carefully into the plug in the housing
- Tighten the central screw
- Connect up the electrical wires

Calibration

- Switch on the power supply
- Turn the switch for probe length to the same position as it was on the old electronic insert
- Carry out a new capacitance calibration with an empty silo
- Select the same fail-safe mode as for the old electronic insert

Replacing Probes

If a probe is to be replaced with one of a different length, then a new capacitance calibration must be carried out.

Testing

All local regulations covering explosion protection must be observed if testing or recommissioning an instrument you have repaired.

Returning Parts for Repair

If a Nivocompact FTC 131 Z or FTC 331 Z cannot be repaired and needs to be sent back to Endress+Hauser, then please note the following:

Cleaning the probe

Remove all material attached to the probe.
This is especially important as the material may be of a dangerous nature, e.g. corrosive, poisonous, carcinogenic, radioactive, etc.
Please return parts only after they have been thoroughly cleaned of dangerous materials. Check in particular scratches and the possibility of diffusion through plastic material.

Stating material and defect

Please state with the instrument:
- the full name of the material in which it was used
- a description of the characteristics of the material.
- a brief description of the error.

This information will help us to diagnose the error and at the same time keep your costs down. Thank you for your co-operation.

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