

# Level Limit Switch *nivector FTC 968, FTC 968 Z*

## Compact capacitance limit switch for powders and fine-grained solids



### Application

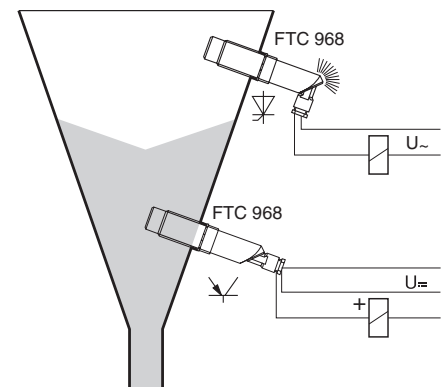
Nivector is a compact level limit switch for use in silos containing free-flowing powders or fine-grained solids (max. particle size 10 mm). Its construction and materials make it suitable for use with foodstuffs. The version Nivector FTC 968 **Z** is designed for use in dust-explosion hazardous areas.

Typical applications:  
plastic granules, detergent, grain,  
sugar, spices, semolina, animal feed.

### Features and Benefits

- No calibration: quick and economical commissioning
- No mechanical moving parts: no wear, long operational life
- High immunity to electromagnetic interference and voltage peaks: reliable operation
- Switching status visible from outside the vessel: simple control
- Wettet parts of the build-in adapter "Protector": FDA listed material (according to 21 CFR 177.1660)
  - Level limit switch protection: function test also with filled silo possible.

Nivector FTC 968 is a compact limit switch for direct connection to miniature contactors, solenoid valves or programmable logic controllers (PLCs).



# Endress + Hauser

The Power of Know How



# Operating Principle

The electronic switch and the LEDs operate according to the level and the fail-safe mode selected. The electronic switch blocks:

- on reaching the limit,
- on a fault and
- on power failure

Level	Fail-safe mode	LED	Versions	
			AC	DC
Max.	●	●		
Min.	●	●		
		●		

The face of the Nivector acts as a sensor. When medium comes into contact with it, the electronics change the switching status. The Nivector can be switched to either min. or max. fail-safe mode, ensuring quiescent current operation in all applications. A LED indicates its switching status.

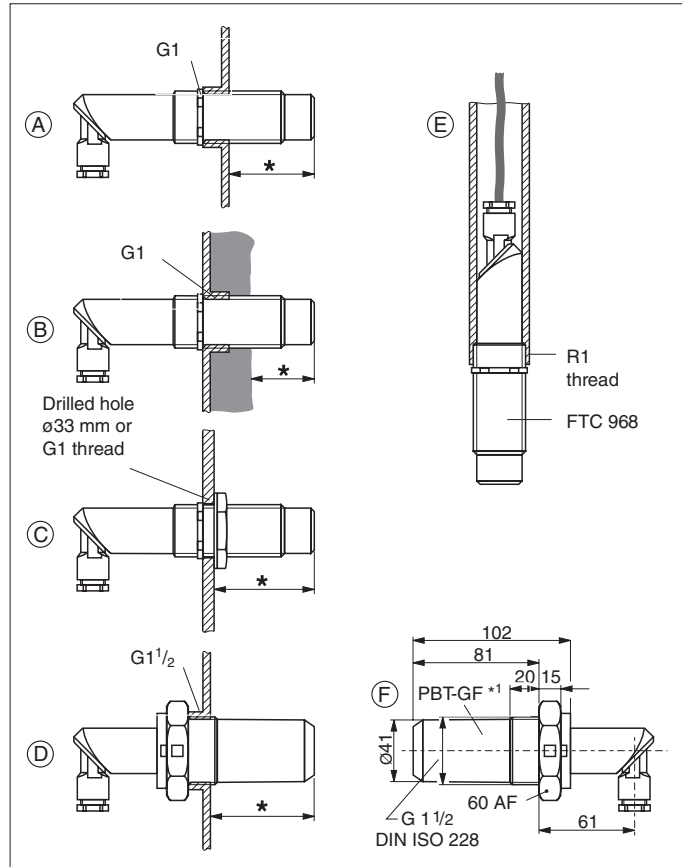
A screened electrode protects the sensor from interference from the vessel wall or from the effects of lateral material build-up.

# Mounting

Nivector FTC 968 may be installed and positioned in any orientation in a bulk solids silo

\* min. 20 mm

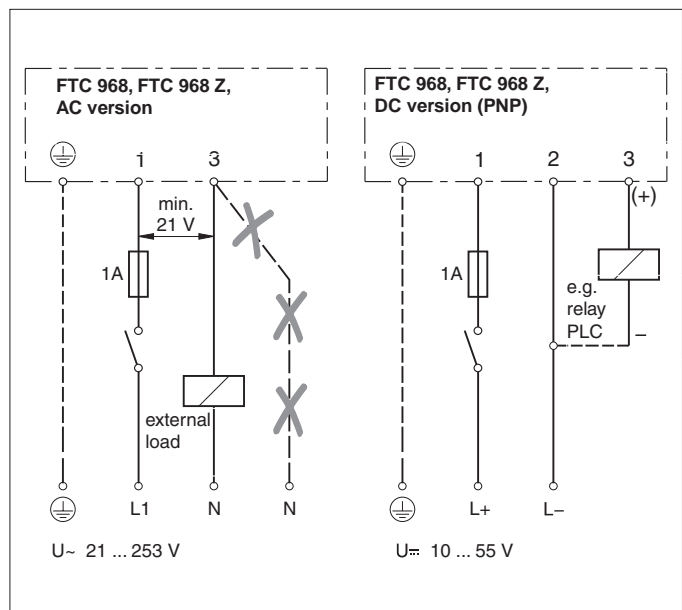
- A Standard mounting with external G 1 thread adapter
  - B Where build-up occurs on the silo wall with internal G 1 thread adapter
  - C Without thread adapter but with drilled hole or threaded directly in the silo wall or a flange
  - D With "Protector" \*1 for G 1½ thread adapter; outflow protection sleeve for function testing when the silo is full. Protection of the limit switch against damage by particularly abrasive or coarse product.
  - E In extension tube for mounting from above (not with FTC 968 Z)
  - F Dimensions of the "Protector" \*1 (accessory)
- \*1 in conformity with FDA



# Electrical Connection

**Two-wire AC version**  
Always connect a load in series!  
Take account of the voltage drop across the electronics when connected (max. 12 V), the quiescent current when blocked (max. 4 mA) as well as the voltage drop across the load at low voltages. This ensures that the voltage across the Nivector does not fall below the minimum value of 21 V.

**Three-wire DC version**  
Preferred for programmable logic controllers (PLCs). Positive signal at the switching output of the electronics (PNP).  
A ground connection is required only for the FTC 968 Z. The Nivector FTC 968 has double isolation



# Technical Data

## General specifications

Manufacturer	Endress+Hauser GmbH+Co.
Designation	Nivector FTC 968, FTC 968 Z
Function	Level limit switch

## Application

Limit detection	Maximum or minimum detection in silos filled with powders and fine-grained solids, especially with limited space for mounting
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## Function and system design

Measuring principle	Capacitance Evaluation of the different dielectric constants of air and the bulk solid; conversion of them into an electronic switching output signal
Modularity	Compact limit switch with the sensor part projecting into the silo
Signal processing	- Two-wire AC version: Load switching via thyristor directly into the power circuit; - Three-wire DC version: Load switching via transistor and separate connection

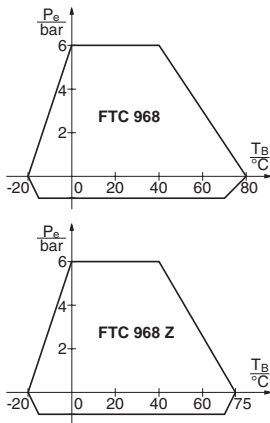
## Input

Measured variable	Level (limit, binary)
Measuring range (detection range)	Determined by mounting point in silo

## Output

Output signal	Binary; output blocked when limit reached
Signal on alarm	Output blocked
Load (connectable) with AC version (load switching via thyristor directly into the power circuit)	Transient (40 ms) max. 1.5 A, max. 375 VA at 253 V or max. 31,5 VA at 21 V (not short-circuit resistant) continuous max. 87 VA at 253 V (max. 250 V with FTC 968 Z), max. 7.4 VA at 21 V min. 2.5 VA at 253 V (10 mA), min. 0.5 VA at 21 V (20 mA) Voltage drop max. 12 V Quiescent current max. 4 mA with blocked thyristor
Load (connectable) for DC version (load switched via transistor and separate PNP connection)	Transient (50 ms) max. 0.5 A, max. 55 V (Resistant to cyclical overload and short-circuit); continuous max. 350 mA; max. 0.5 $\mu$ F at 55 V, max. 1.0 $\mu$ F at 24 V; Quiescent voltage < 3 V (with connected transistor); Quiescent current < 100 $\mu$ A (with blocked transistor)
Fail-safe mode	Minimum or maximum quiescent current, switchable
Switching time	Approx. 0.2 s when covered or uncovered

## Operating conditions



Permissible values for operating pressure  $p_e$  in silo are dependent on the operating temperature  $T_B$  in the silo  
1 bar = 14.5 psi  
 $x^{\circ}\text{C} = (1.8x + 32)^{\circ}\text{F}$

## Mechanical construction

## Installation

Installation	Any orientation; end face min. 20 mm projecting into silo Silo wall thickness max. 35 mm or G 1 threaded adapter max. 50 mm in length
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## Environment

Ambient temperature	-20 °C ... +60 °C
Limiting temperature range	-20 °C ... +60 °C
Storage temperature range	-25 °C ... +85 °C
Ingress protection	FTC 968 : IP 65 / IP 67 to EN 60529 FTC 968 Z: IP 65
Electromagnetic compatibility	Interference Emission to EN 61326, Electrical Equipment Class B Interference Immunity to EN 61326

## Medium

Medium temperature	FTC 968: -20 °C ... +80 °C, see also Fig. left FTC 968 Z: -20 °C ... +75 °C, see also Fig. left
Limiting medium temperature	FTC 968: -40 °C ... +80 °C FTC 968 Z: -20 °C ... +75 °C
Medium pressure $p_e$	-1 bar ... +6 bar, see also Fig. left
Limiting medium pressure	10 bar at 20 °C (test pressure)
Particle size	Max. 10 mm
Relative dielectric constant $\epsilon_r$ of product	Min. 1.6

Design	Dimensions shown in dimensional sketches overleaf
Weight	FTC 968: 0.14 kg, FTC 968 Z: 0.25 kg
Material of wetted parts	FTC 968: Housing in blue PC, locking nuts in black PA FTC 968 Z: Housing in white ECTFE, threaded sleeve in nickel-plated brass, locking nuts in black PA
Other materials	Connection area: in transparent PC

## Mechanical construction (continued)

Process connections	FTC 968: G 1 A parallel thread with two nuts for mounting in a thread adapter or wall opening and R1 thread (DIN 2999) for mounting in extension tube FTC 968 Z: parallel G 1 A thread with two nuts for mounting in a thread adapter or wall opening
Electrical connection	Screw terminals for max. 1.5 mm <sup>2</sup> wires in sleeves A 1.5 - 7 to DIN 46 228 Cable gland Pg 11 (any position), for cable diameters 6 ... 8 mm


## User interface

Display in connection compartment	Red LED to indicate switching status, visible from outside
Operating elements in connection compartment	Rotary switch to switch between minimum/maximum fail-safe modes Adjuster for sensitivity (factory set value at $\epsilon_r > 1.6$ with Protector, at $\epsilon_r > 2.0$ without Protector)

## Power supply

AC version	Voltage at Terminals 1 and 3: 21 ... 253 V, 50 / 60 Hz (max. 250 V with FTC 968 Z); Current consumption (stand-by) max. 4 mA
DC version	10 ... 55 V, ripple max. 1.7 V, 0 ... 400 Hz; Current consumption max. 15 mA, reverse polarity protection

## Certificates and approvals

BVS Nr. St Ex 6/87 B DMT 00 ATEX E 026	FTC 968 Z: Dust-Ex design approval (German Zone 10) ATEX:  II 1/3 D
CE Mark	By attaching the CE Mark, Endress+Hauser confirms that the instrument fulfils all legal requirements of the relevant EC directives

## Ordering

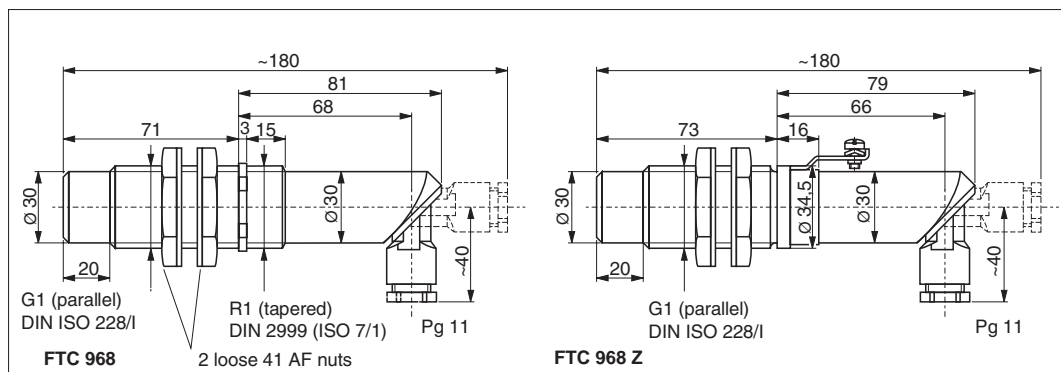
Instruments	FTC 968, AC version: Order No. 918 098-0000 FTC 968, DC version: Order No. 918 098-0140 FTC 968 Z, AC version: Order No. 918 098-1000 FTC 968 Z, DC version: Order No. 918 098-1140
Accessories	Adapter and outflow protection sleeve "Protector" G 1½ A Order No. 917 255-1000 Wetted parts of the build-in adapter "Protector": FDA listed material (according to 21 CFR 177.1660)
Supplementary Documentation	Safety Instructions for FTC 968 Z (ATEX) XA 078F/00/a3 General information on EMC TI 241F/00/en
Certificates	Design approval ZE 168F/00/de

## Dimensions

left:  
Nivector FTC 968  
(plastic thread)

right:  
Nivector FTC 968 Z  
for use in dust explosion  
hazardous areas  
(metal thread,  
ground connection)

100 mm = 3.94 in



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