

# Capacitance Limit Detection *nivotester FTC 420/421/422*

## Limit switches in Minipac design for liquids and bulk solids



- Nivotester FTC 420:  
basic version
- Nivotester FTC 421:  
with adjustable switching delay
- Nivotester FTC 422:  
with adjustable switching differential  
for two-point control

### Application

Nivotester FTC 420...422 capacitive limit switches can be used for a variety of purposes, e.g., for:

- overspill protection,
- inventory monitoring,
- interface layer detection,
- pump protection,
- constant level monitoring and
- material flow optimisation.

When used with a suitable probe, the Nivotester allows level detection:

- in aggressive materials,
- at high pressures or in vacuum,
- at high or low temperatures,
- in coarse- or fine-grained bulk goods,
- in high or low viscosity liquids,
- in materials with a tendency to form deposits at the probe.

### Features

- Proven 3-wire cabling technique gives interference-free transmission from probe to limit switch.
- Calibration from switch cabinet or control room.
- Operates in minimum or maximum level failsafe mode.
- Operational status of unit and level switch indicated by LEDs on front panel.
- Potential-free change-over contact allows connection of alarms, relays, contactors, solenoid valves etc..
- Removable terminal blocks for quick connection.

Endress + Hauser

Nothing beats know-how



# Measuring System

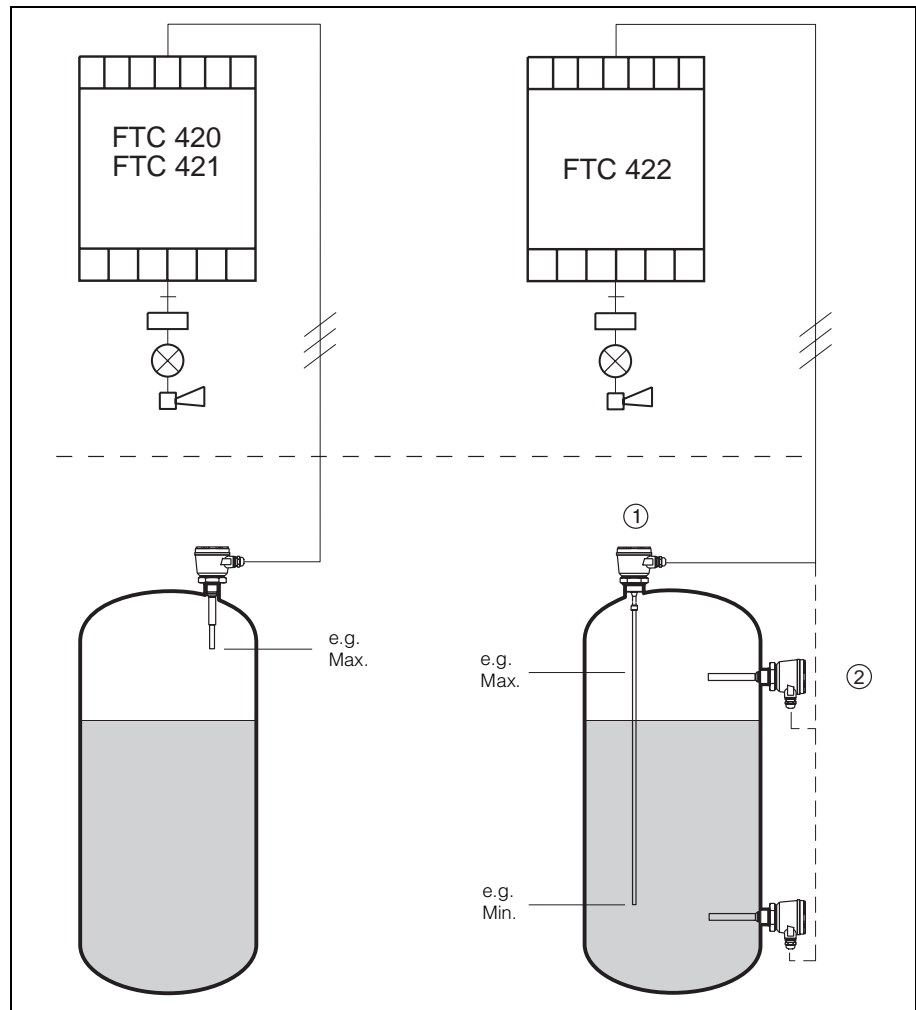
## Function

The probe and container act as a capacitor, the capacitance of which is dependent upon the level of liquid or solids present. The electronic insert, usually mounted in the probe head, passes a level-proportional voltage signal to the Nivotester for evaluation. This actuates the output relay when the preset level is violated. The resulting signal can be used to drive an annunciator, actuator or further relay.

A bridge on the terminal block sets the output relay to act in minimum or maximum fail-safe mode.

The switching status of the relay is indicated at the front panel by a red, the operational status by a green LED. On power failure both LEDs extinguish – the output relay de-energises.

- A typical measuring system comprises:
- the Nivotester FTC 420, 421 or 422,
  - the EC 61 Z electronic insert and
  - a probe, suitable for the medium to be measured (for FTC 422 one ① or two ② for two-point control).



# Installation

## Mounting

The Nivotester limit switches use Minipac housings with snap-on fastenings suitable for switch cabinet installation on a symmetrical (top hat) rail.



Row-mounting on a top hat rail

## Spacing

The units can be mounted flush to each other provided the operating temperature does not exceed 50 °C. For ambient temperatures of 60 °C, a gap of 10 mm must be left between adjacent units. The vertical spacing must exceed 15 mm.

## Protective Housing IP 55

A protective housing with transparent cover, accommodating two units, is available for field installation.



Protective housing IP 55

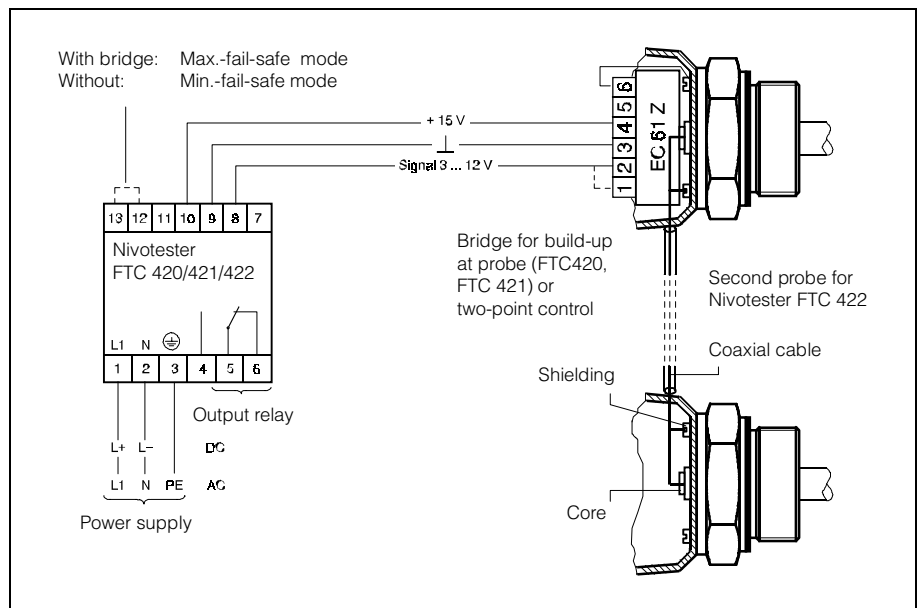
## Electrical Connection

The Nivotester and electronic insert are connected by a 3-wire screened installation cable: two wires supply direct current to the insert, the third carries a voltage signal (3...12 V) proportional to the capacitance of the probe back to the unit.

The evaluation circuit is isolated from the power supply by a transformer and from the output circuit by a potential-free relay.

- A bridge can be inserted between terminals 1 and 2 of the electronic insert when there is a tendency for conductive build-up to form on the probe.
- The fail-safe mode is controlled by a bridge between terminals 12 and 13.
- The potential-free change-over contact is located at terminals 4, 5 and 6.

When the Nivotester FTC 422 is used with two probes, the second probe is used without electronic insert and the connection is made between probe ground and core via a coaxial cable. Terminals 1 and 2 of the insert are short-circuited.



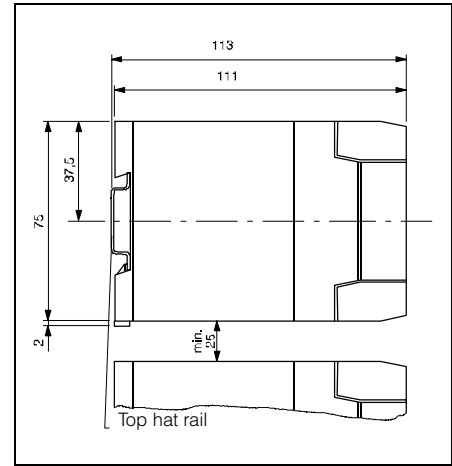
# Technical Data

## Mechanical

- Housing: Minipac housing in light grey plastic, front panel blue. Protection: IP 40
- Dimensions (l x b x h): 113 mm x 50 mm x 75 mm
- Weight: approx. 0.3 kg.
- Mounting rail: EN 50022-35x15 or EN 50022-35x7.5

## Ambient Temperature

- Permissible temperature:
  - 20...+60 °C (single instrument),
  - 20...+50 °C (multiple instruments),
  - 25...+80 °C (storage).



Dimensions for cabinet mounting [mm]

## Electrical Connection

- Terminals: Removable terminal block, black, 1 x 6-pole, 1 x 7-pole, Protection: IP 20.
- Wire cross-section:
  - 1 x 0.5 mm<sup>2</sup> to 1 x 2.5 mm<sup>2</sup> or
  - 2 x 0.5 mm<sup>2</sup> to 2 x 1.5 mm<sup>2</sup>.
- Without terminals: Flat plug 0.8 x 6.3 as per DIN 46244.
- Power supply:
  - 200 V...240 V 50/60 Hz +15 % -10 %
  - 100 V...127 V 50/60 Hz +15 % -10 %
  - 42 V... 48 V 50/60 Hz ±15 %
  - 24 V 50/60 Hz ±15 %
  - 20 V... 30 V d.c.
- Power consumption: ca. 3 W (4 VA).
- Electrical isolation:
  - Transformer between power supply and evaluation circuit.
  - Relay between evaluation circuit and output circuit.

## Adjustable Probe Capacitance

- Hook switch

Range	Capacitance	Input voltage
I	ca. 10...100 pF	ca. 3...6.6 V
II	ca. 80...180 pF	ca. 6...8.8 V
III	ca. 160...350 pF	ca. 8.2...12 V

- Switching delay for FTC 421: 0...20 s.
- Hysteresis for FTC 422: Separate control, ranges as above.

## Outputs

- Output signal: Potential-free change-over contact, selectable maximum or minimum fail-safe mode.
- Switching capacity:
  - max. 250 V a.c., max 6 A,
  - max. 1500 VA, cos φ = 1
  - max. 750 VA, cos φ ≥ 0.7,
  - max. 250 V d.c., max.6 A, max. 200 W.
- Operational display: Green LED lights.
- Relay switching status: Red LED lights when de-energised.
- Response time: 0.2 s, for FTC 421 adjustable 0...20 s.
- Short-out time on power failure: approx. 0.3 s.

## Electronic Insert

- Housing: Plastic, cast resin electronics, Protection: IP 55.
- Terminals: Protection: IP 00.
- Connection: 3-core screened cable.
- Permissible ambient temperature: -20...+100 °C.
- Frequency: approx. 500 kHz.
- Power supply: 15 V from Nivotester FTC.
- Output signal voltage: 3...12 V.
- Weight: 130 g

## Protective Housing for FTC ...

- Base: ABS
- Front: Impact-resistant plexiglas, matt with transparent window, Protection: IP 55.
- Cable glands: 5 x PG 16.
- Dimensions (l x b x h): 124 mm x 160 mm x 164 mm.
- Weight: 0.5 kg.
- Permissible ambient temperature: -20...+50 °C; -20...+40 °C for two units.

Subject to modification.

## CE Mark

The device fulfils the legal requirements of the following EC Guidelines:  
 Guideline 89/336/EC (Electromagnetic compatibility),  
 Guidelines 73/23/EC and 93/68/EC (Low Voltage Appliances).

Electromagnetic compatibility (EMC):  
 Immunity to EN 50082-1.  
 Emission to EN 50081-1.

For general information on electromagnetic compatibility (test methods, installation hints) see TI 241F/00/e.



EC 61 Z electronic insert.

# Maximum and Minimum Fail-safe Mode

## Nivotester FTC 420/421

This instrument can be set to operate as a maximum or a minimum limit switch. For the Nivotester FTC 421 the switching can be delayed by up to 20 s, e.g. to prevent spurious switching due to turbulence etc..

### Minimum fail-safe mode

The relay de-energises when the product drops below the switch point: the red LED lights.

### Maximum fail-safe mode:

The relay de-energises when the switch point is exceeded: the red LED lights

### Power failure

On a power failure both green and red LEDs extinguish: the relay de-energises.

## Nivotester FTC 422

This instrument provides two-point control with a maximum or minimum switch point and a switching differential (hysteresis).

### Minimum fail-safe mode

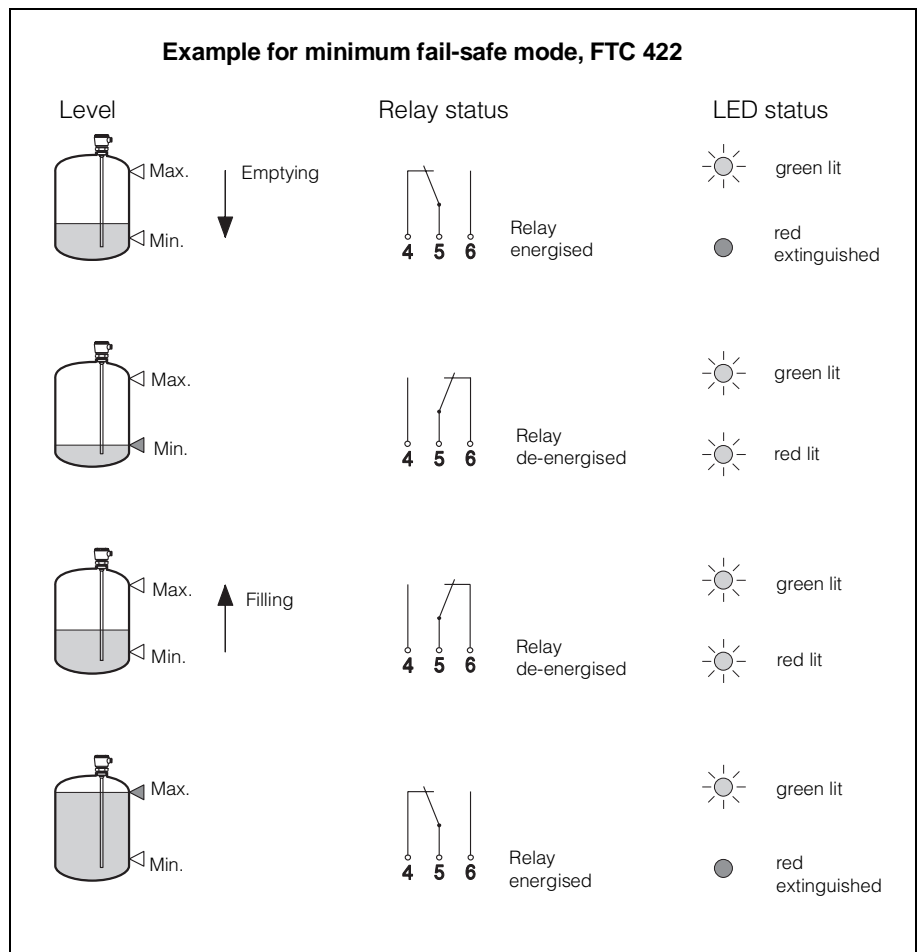
The relay de-energises when the product drops below the switch point. The red LED lights and remains lit until the switching differential point is exceeded: the relay energises again.

### Maximum fail-safe mode:

The relay de-energises when the switch point is exceeded. The red LED lights and remains lit until the product drops below the switching differential point: the relay energises again.

### Power failure

On power failure both green and red LEDs extinguish: the relay de-energises.



## Ordering Information

Nivotester FTC 420	
<b>Power Supply</b>	
A	200 VAC ... 240 VAC, 50/60 Hz
B	100 VAC ... 127 VAC, 50/60 Hz
C	42 VAC ... 48 VAC, 50/60 Hz
D	24 VAC, 50/60 Hz
E	20 VDC ... 30 VDC.
Y	Special version, please state
	↓
<b>FTC 420 N</b>	<input type="checkbox"/>

Nivotester FTC 421	
<b>Power Supply</b>	
A	200 VAC ... 240 VAC, 50/60 Hz
B	100 VAC ... 127 VAC, 50/60 Hz
C	42 VAC ... 48 VAC, 50/60 Hz
D	24 VAC, 50/60 Hz
E	20 VDC ... 30 VDC.
Y	Special version, please state
	↓
<b>FTC 421</b>	<input type="checkbox"/>

Nivotester FTC 422	
<b>Power Supply</b>	
A	200 VAC ... 240 VAC, 50/60 Hz
B	100 VAC ... 127 VAC, 50/60 Hz
C	42 VAC ... 48 VAC, 50/60 Hz
D	24 VAC, 50/60 Hz
E	20 VDC ... 30 VDC.
Y	Special version, please state
	↓
<b>FTC 422</b>	<input type="checkbox"/>

## Supplementary Documentation

- Electronic Insert EC 61 Z  
Technical Information TI 267F/00/en
- System Components Minipac  
Technical Information TI 009F/00/e
- Separate housing for electronic insert  
Technical Information TI 228F/00/e

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