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

Technical Information

Nivotester FTC325

Level limit switch
With Intrinsically Safe Signal Circuit for Connection to a Capacitance Sensor

Applications

- Level limit detection in tanks containing liquids and silos containing bulk solids. For capacitance level probes, which may also be applied in hazardous areas of category ATEX II (1) GD
- Overspill protection for tanks containing flammable or non-flammable fluids hazardous to water
- Dry running protection for pumps
- Two-point control (Δs with 3-WIRE)

Your benefits

- Intrinsically safe signal circuit [EEx ia] IIC for using sensors in hazardous areas
- Calibration using operating keys
- High functional safety thanks to:
  - fail-safe pulse-frequency modulation (PFM) or 3-WIRE technology
  - Checkable relay function
- Compact housing for easy series mounting on a standard DIN rail in the cabinet
- Pluggable terminal blocks make wiring easy
- Can be used with FEI57S (PFM), EC16Z (PFM), EC17Z (PFM), FEI53 (3-WIRE) and EC61 (3-WIRE)
- Limit value and alarm relay
- WHG approval (PFM)
- Protection against maloperation and manipulation
  - each change of the device configuration leads to signalling via the red LED and a fault message

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Table of contents

Function and system design

Measuring principle

Function

Probe and tank (or ground tube/counterpotential) form a capacitor whose capacitance changes with the level of the product.

PFM	3-WIRE
The electronic insert FEI57, EC16Z or EC17Z converts the change of capacitance into a change of frequency, which switches the output relay in the Nivotester FTC325 PFM.	The electronic insert FEI53 or EC61 converts the change of capacitance into a voltage signal, which switches the output relay in the Nivotester FTC325 3-WIRE.

Signal transmission

The signal input of the Nivotester FTC325 limit switch is galvanically isolated from the mains and from the output.

PFM	3-WIRE
The Nivotester supplies the capacitance sensor with intrinsically safe direct current via a two-wire cable and from there receives a frequency, which signals whether the level limit has been reached or not. Here, the transmitter superimposes current impulses (PFM signals) with a pulse width of approx. 200 µs and a current intensity of approx. 10 mA on the supply current. The measuring capacitance lies in the range from 20 pF... 350pF. This corresponds to a transmission frequency of 185 Hz...116 Hz.	The Nivotester supplies the capacitance sensor with direct current via a two-wire cable and receives the voltage signal via a third wire, which signals whether the level limit has been reached or not. The measuring capacitance lies in the range from 10 pF...350 pF. This corresponds to a voltage of 3 V...12 V.

Signal evaluation

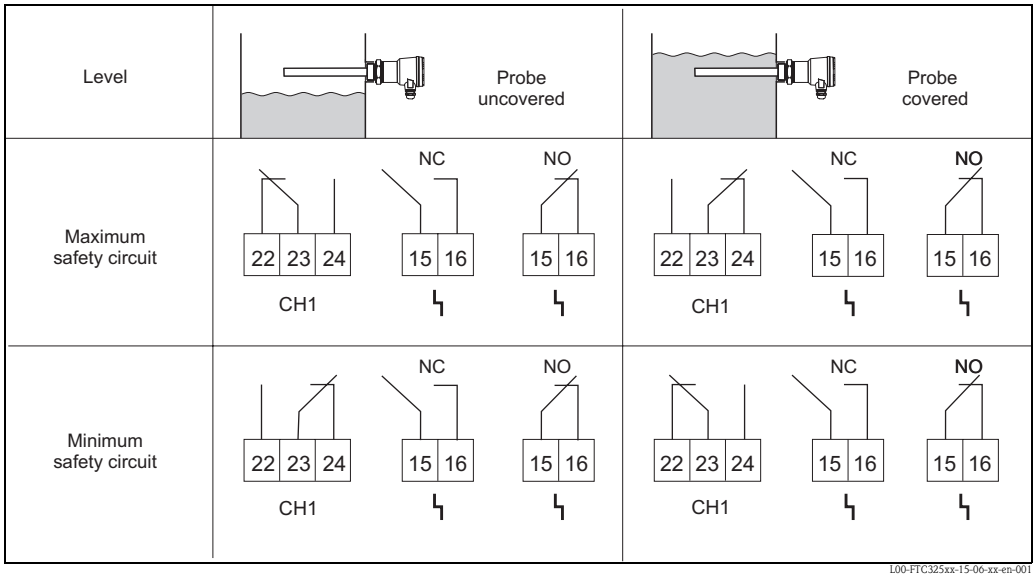
The Nivotester analyses the frequency or the voltage signal, and switches the output relay for the level alarm. The switching state of the relay (energised or de-energised) is displayed on the front panel of the Nivotester by means of two yellow LEDs.

Fail-safe circuit

Selecting the correct fail-safe circuit ensures that the relay always works in quiescent current fail-safe mode.

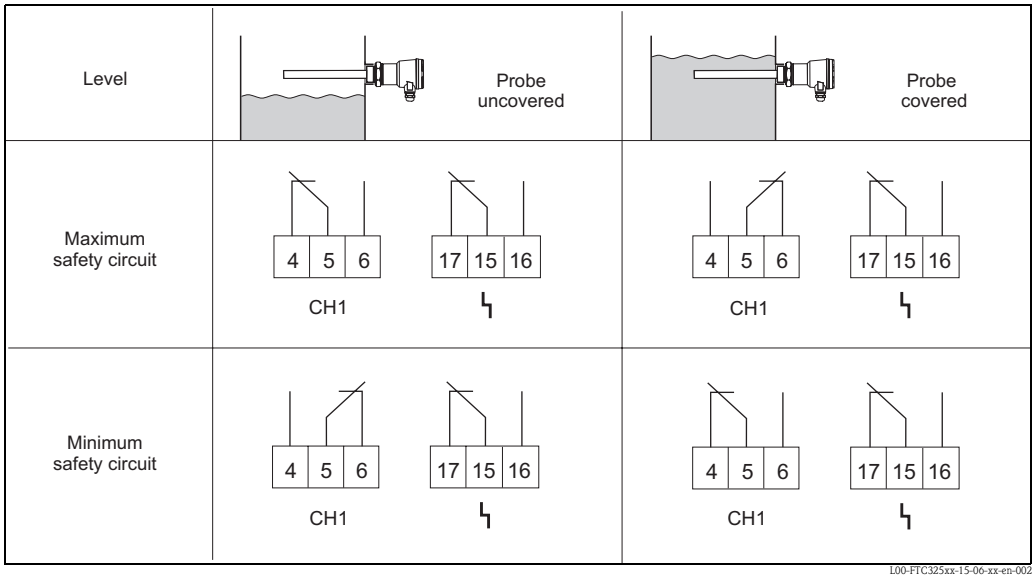
- Maximum fail-safe mode: the relay de-energises when the level rises above the switch point (sensor covered), a fault occurs or the power fails.
- Minimum fail-safe mode: the relay de-energises when the level falls below the switch point (sensor uncovered), a fault occurs or the power fails.

PFM



Function of the limit indicator dependent on the level and fail-safe circuit.

3-WIRE



Function of the limit indicator dependent on the level and fail-safe circuit.

Function monitoring

To increase operational safety the Nivotester is equipped with a function monitoring facility.
A fault is displayed by the red light emitting diode and de-energises the relay for the level alarm and the alarm relay. A fault is reported if the Nivotester is no longer receiving a measuring signal. This occurs, for example, when:

- there is a short-circuit
- the signal line to the sensor is interrupted
- the sensor electronics are defective
- the Nivotester's input switching is defective

After calibration, every further change to the device configuration de-energises the relay.
A fault message is signalled via the red LED.

Calibration key (red)

Calibration is carried out automatically by means of operating keys. This makes setting via rotary switches inapplicable.

The test/correction key (green - FTC325 PFM only):

- allows for a function check of the output relay and alarm relay.
- confirms a change in the operating mode – e.g. by changing the switching delay after initial calibration. This enables a correction of the operating mode without requiring recalibration. The changed settings are saved by pressing the operating key.

Additional switch functions

- An adjustable switching delay of 0...45 s allows for the relay to be switched with a delay when covering or uncovering the probe. In the opposite direction, each switching delay is 0.2 s.
- Two-point control (Δs function, FTC325 3-WIRE), see page 7
- A potentiometer (rotary switch) for shifting the operating point allows safe operation of the system, even with media that are prone to build-up.

Measuring device

A simple measuring system consists of a capacitance sensor, a Nivotester FTC325 and the control or signal instruments.
The following sensors can be used in conjunction with the electronic inserts (EC) listed.

	FTC325 PFM	**FTC325 3-WIRE**
Liquicap M FTI51, FTI52 with	FEI57S	FEI53
Solicap M FTI55, FTI56 with	FEI57S	FEI53
Solicap S FTI77 with	FEI57S	FEI53
Solicap FTC51*, FTC52*, FTC53* with	EC17Z	EC61
Multicap T* with	EC17Z	EC61
Multicap Classic* with	EC16Z, EC17Z	EC61
Multicap EA* with	EC17Z	
High-temperature probes T12656***, T12892*** with	EC17Z	EC61
High-temperature probe 11500** with	EC17Z	
Double rod probe 11304** with	EC17Z	

* Phase-out: 2007, ** Phase-out: 2008, *** Phase-out: 2009

Probe construction

Example: Material	εr	Conductivity	Build-up	Type of probe mounting			
				full insulation	partial insulation	with ground tube	without ground tube
Solvents, fuels	< 3	low	low	√	√	√	–
Dry bulk solids	< 3	low	low	–	√	–	√
Moist bulk solids	> 3	average	average	√	√	–	√
Aqueous liquids and alcohols	> 3	strong	low	√	√	–	√
			strong	–	√	–	√
Sludge	> 3	strong	very strong	–	√	–	√

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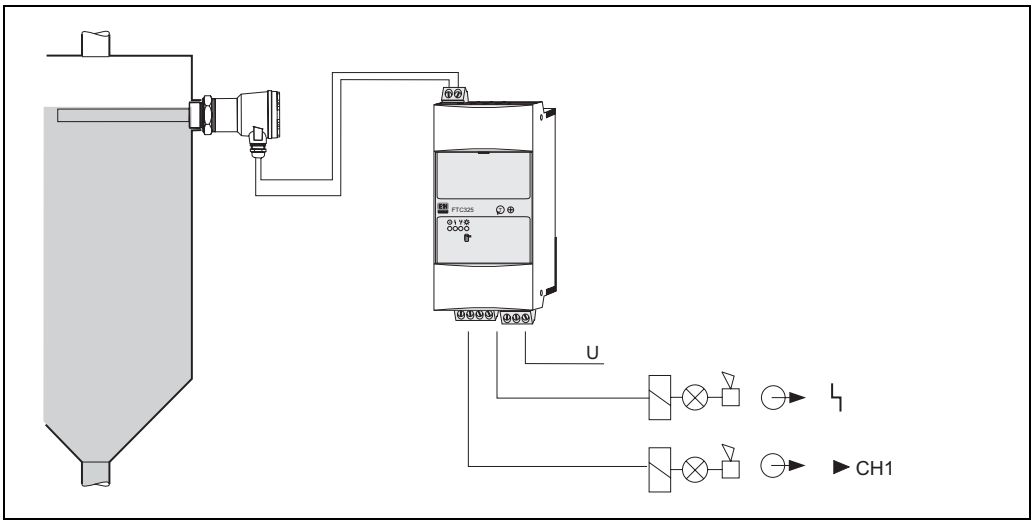
Nivotester FTC325 PFM	**Nivotester FTC325 3-WIRE**
The measuring system consists of: ■ Sensor – capacitance probe – electronic insert – FEI57S, EC16Z, EC17Z ■ Nivotester FTC325 PFM ■ Control or signal instruments	The measuring system consists of: ■ Sensor – one or two capacitance probes – electronic insert – FEI53, EC61 ■ Nivotester FTC325 3-WIRE ■ Control or signal instruments

Level limit detection with FTC325 PFM



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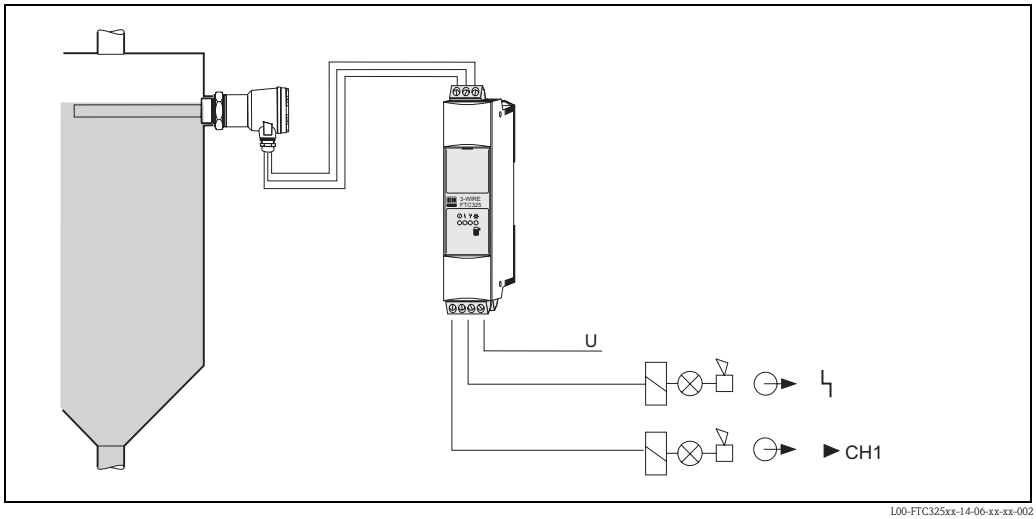
Partially or fully insulated probe

Level limit detection with FTC325 3-WIRE



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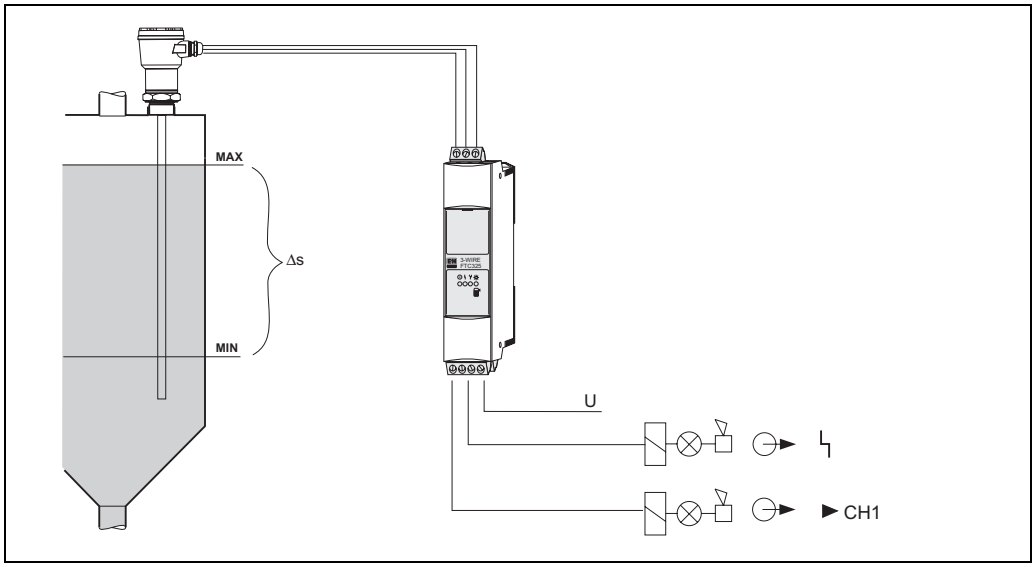
Partially or fully insulated probe



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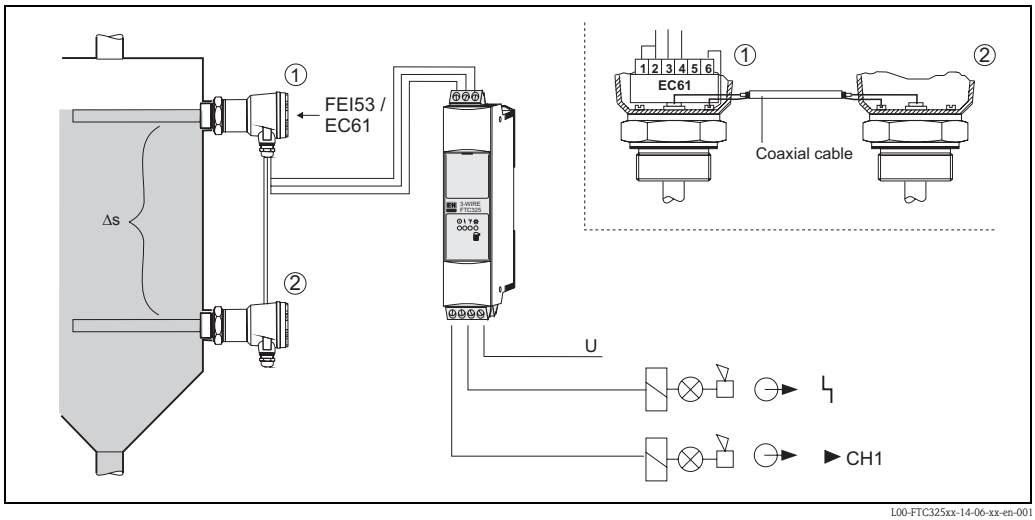
Two-point control with fully insulated probe



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Two-point control with two fully or partially insulated probes and an electronic insert EC61 resp. FEI53.
The probes are connected by a coaxial cable.

Input parameters

Measured variable

The limit signal is generated at minimum or maximum level, depending on the selection

Measuring range

The measuring range is dependent on the mounting location of the probes.

Input signal

FTC325 PFM

- FTC325 PFM input: galvanically isolated from power supply and output
- Type of protection: intrinsic safety [EEx ia] IIC
- Connectable sensors:
  Liquicap M (FTI51, FTI52) with FEI57S
  Solicap M (FTI55, FTI56) with FEI57S
  Solicap S (FTI77) with FEI57S
  Solicap (FTC51, FTC52, FTC53)* with EC17ZS
  Multicap T* with EC17Z
  Multicap Classic* with EC16Z, EC17Z
  Multicap EA* with EC17Z
  High-temperature probes 11500**, T12656***, T12892*** with EC17Z, EC27Z
  Double rod probe 11304*** with EC17Z
- Sensor's power supply: from Nivotester FTC325 PFM
- Connecting cable: two-wire, shielded wire not required, except for strong electromagnetic interferences (see also Electromagnetic Compatibility (EMC) on page 12)
- Cable resistance: max. 25 Ω per wire
- Signal transmission: pulse-frequency modulation (PFM)

* Phase-out: 2007, ** Phase-out: 2008, *** Phase-out: 2009

FTC325 3-WIRE

- FTC325 3-WIRE input: galvanically isolated from power supply and output
- Type of protection: version for non-hazardous areas
- Connectable sensors:
  Liquicap M (FTI51, FTI52) with FEI53S
  Solicap M (FTI55, FTI56) with FEI53S
  Solicap S (FTI77) with FEI53S
  Solicap (FTC51, FTC52, FTC53)* with EC61
  Multicap T* with EC61
  Multicap Classic* with EC61
  High-temperature probes T12656,** T12892** with EC61
- Sensor's power supply: from Nivotester FTC325 3-WIRE
- Connecting cable: three-wire, shielded wire not required, except for strong electromagnetic interferences (see also Electromagnetic Compatibility (EMC) on page 12)
- Cable resistance: max. 25 Ω per wire
- Signal transmission: voltage change is transmitted via a separate wire

* Phase-out: 2007, ** Phase-out: 2009

Output parameters

Output signal

FTC325 PFM and FTC325 3-WIRE

- Relay output: a potential-free change-over contact for the level alarm
- Quiescent current fail-safe circuit: minimum/maximum fail-safe mode can be selected using the DIL switch
- Alarm relay: potential-free change-over contact for fault indication; with the PFM version, only two contacts brought out (state type of contact NC or NO when ordering a PFM device)
- Switching delay: 0...45 s
  Relay switches when covering or uncovering the probe, depending on the setting
- Switching capacity of relay contacts:
  U~ maximum 253 V
  I~ maximum 2 A
  P~ maximum 500 VA at cos $\varphi \geq 0.7$

  U- maximum 40 V
  I- maximum 2 A
  P- maximum 80 W

- Service life: at least 10^5 switching cycles at maximum contact load
- Function indicators: light emitting diodes for operation, level alarm, fault and level signal (lights up as long as the probe is covered)

Signal on alarm

Limit relay de-energised; fault indication via red LED, alarm relay de-energised

Galvanic isolation

All input and output channels and relay contacts are provided with secure galvanic isolation from each other. In the case of simultaneous connection of the power supply circuit or the alarm relay contacts to the functional extra-low voltage, the secure galvanic isolation is guaranteed up to a voltage of 150 V AC.

Overvoltage category as per EN 61010

II

Protection class

II (double or increased insulation)

Power supply

Electrical connection

Terminal blocks

The removable terminal blocks are isolated after intrinsically safe connections (top of device) and non-intrinsically safe connections (bottom of device). Furthermore, the terminal blocks are also colour-coded. Blue is for the intrinsically safe area and grey for the non-intrinsically safe area. These distinctions allow for safe cable routing.

Sensor connection

(To the upper, blue/grey terminal blocks).
Use a usual commercial instrument cable or multi-core cable for measuring purposes for the connecting cable between the Nivotester FTC325 and the sensor. Cable resistance of maximum 25 Ω per wire.
If strong electromagnetic interferences have to be expected, e.g. from machines or radios, a screened cable must be used. Only connect the screening to the grounding connection in the sensor, not to the Nivotester.

Use of measuring cell in potentially explosive atmospheres

Compliance with the national explosion protection regulations for the design and laying of intrinsically safe signal line is mandatory.
High-reliability values for capacitance and inductance are contained in Safety Instructions XA 195F.

Connection of signal and control instruments

(To the lower, grey terminal blocks)
The relay function must be observed dependent on the level and fail-safe circuit.
If a device with high inductance (e.g. contactor, solenoid valve, etc.) is connected, a spark suppressor must be added to protect the relay contact.

Supply voltage connection

(To the lower, grey terminal blocks)
For the voltage versions, see the Ordering information on page 17.
A fuse (T 200 mA) is built into the power supply circuit, so that it is not necessary to pre-connect a fine-wire fuse. The Nivotester is equipped with reverse polarity protection.

Supply voltage

Alternating current version (AC):

- Voltage ranges: 85...253 V, 50/60 Hz

Direct current version (DC):

- Voltage range: 20...60 V
- Power supply direct current: maximum 100 mA
- Permitted residual ripple within the tolerance: Uss = maximum 2 V

Power consumption

AC version

maximum 6.0 VA

DC version

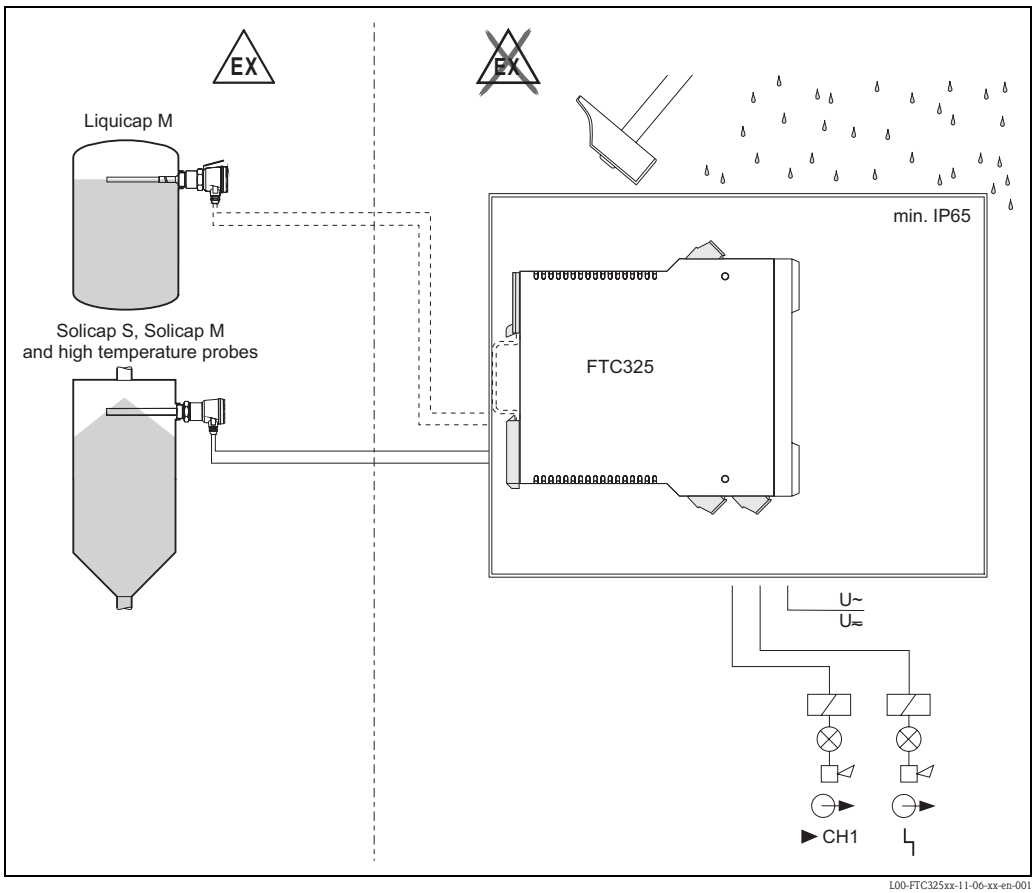
maximum 2.0 W (at Umin 20 V)

Operating conditions (installation conditions)

Installation instructions

Installation location

The Nivotester must be housed outside of hazardous areas in a cabinet. For installation outdoors, there is also a protective housing (IP65) for up to three Nivotester FTC325 available.



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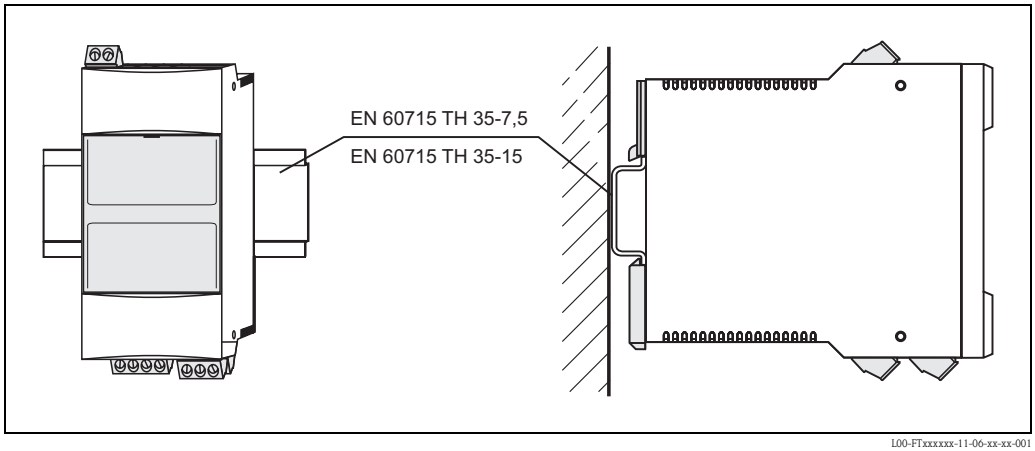
Orientation

Vertical on DIN rail (EN 60715 TH 35).



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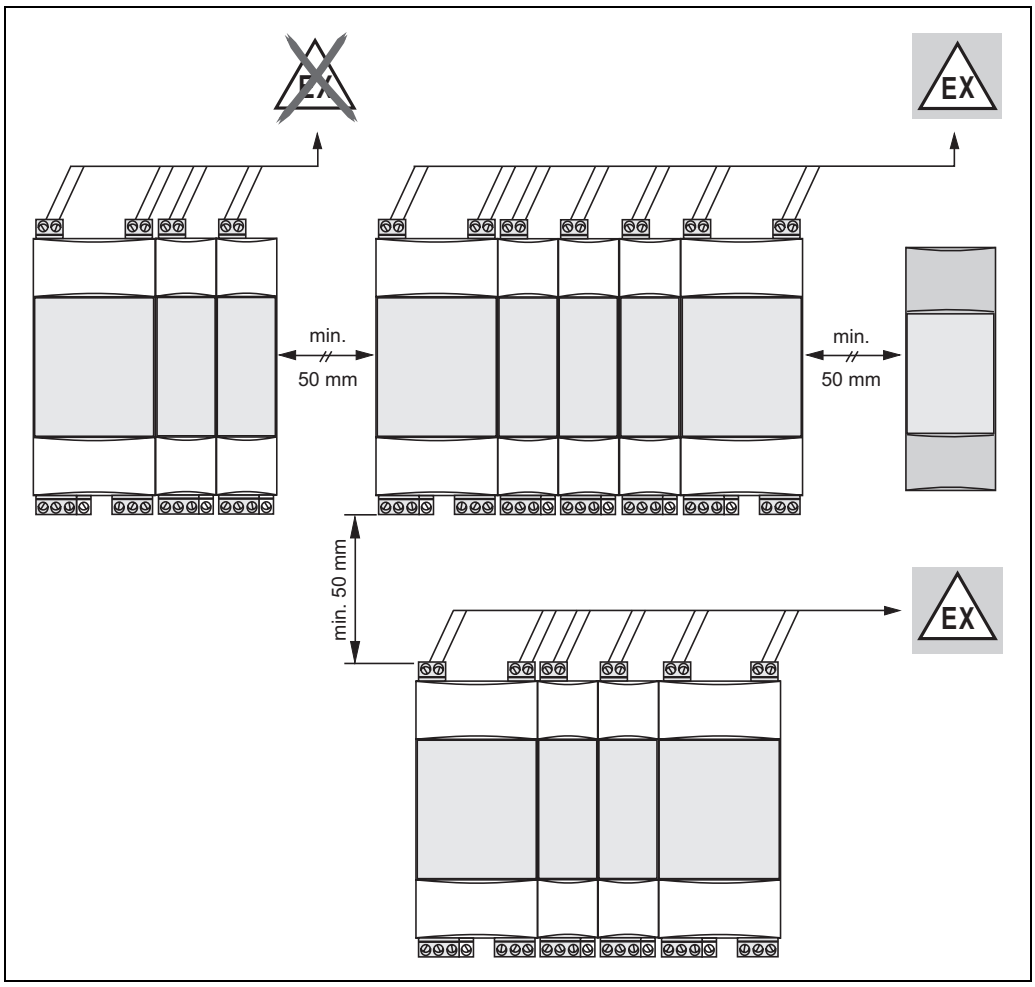
Operating conditions (environmental conditions)

Installation location	Cabinet or protective housing
Permitted ambient temperatures	**For single mounting** ■ –20 °C...+60 °C **For series mounting without lateral spacing** ■ –20 °C...+50 °C **Storage temperature** ■ –25 °C...+85 °C (preferably at +20 °C) **Installation in protective housing** ■ –20 °C...+40 °C ■ No more than three Nivotesters can be installed into one protective housing  Caution! The devices should be installed in locations which are protected from direct solar radiation, weather and impacts. This is of particular importance in hot climates.
Climatic and mechanical application class	3K3 In acc. with DIN EN 60721-3-3 3M2 In acc. with DIN EN 60721-3-3
Degree of protection	IP20
Electromagnetic compatibility (EMC)	Interference Emission to EN 61326; Electrical Equipment Class B Interference Immunity to EN 61326; Annex A (Industrial) and NAMUR Recommendation NE 21 (EMC)

Mechanical construction

Design, dimensions

- Housing: row housing made of plastic
- Mounting: on DIN rail as per EN 60715 TH 35-7.5 or EN 60715 TH 35-15
- Degree of protection as per EN 60529; IP20



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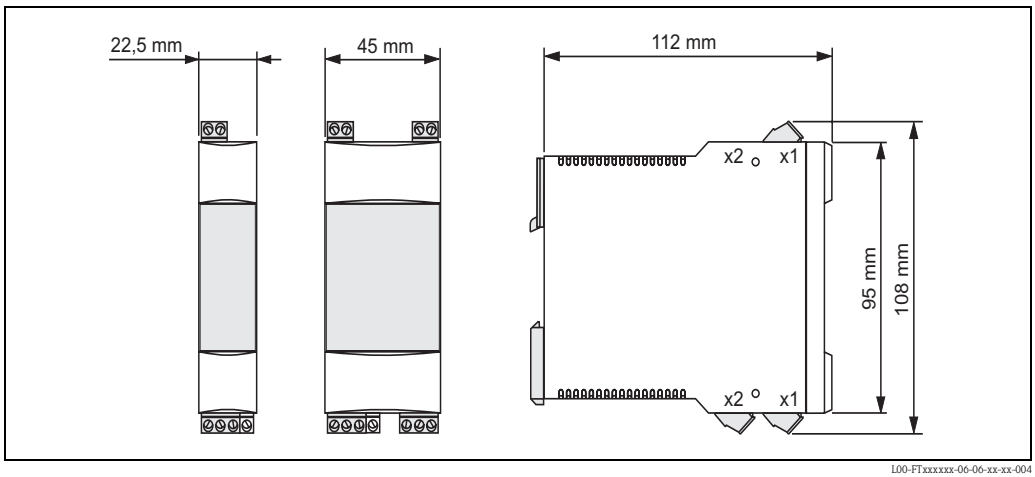
Dimensions: **3-WIRE** **PFM**



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Note!
100 mm = 3.94 in

Weight

approx. 250 g

Materials

Housing

- Polycarbonate
  Colour: light grey, RAL 7035

Front cover

- Polypropylene PPN
  Colour: blue

Fixing bracket (for securing on the DIN rail)

- Polyamide PA6
  Colour: black, RAL 9005

Terminals

Nivotester FTC325 PFM

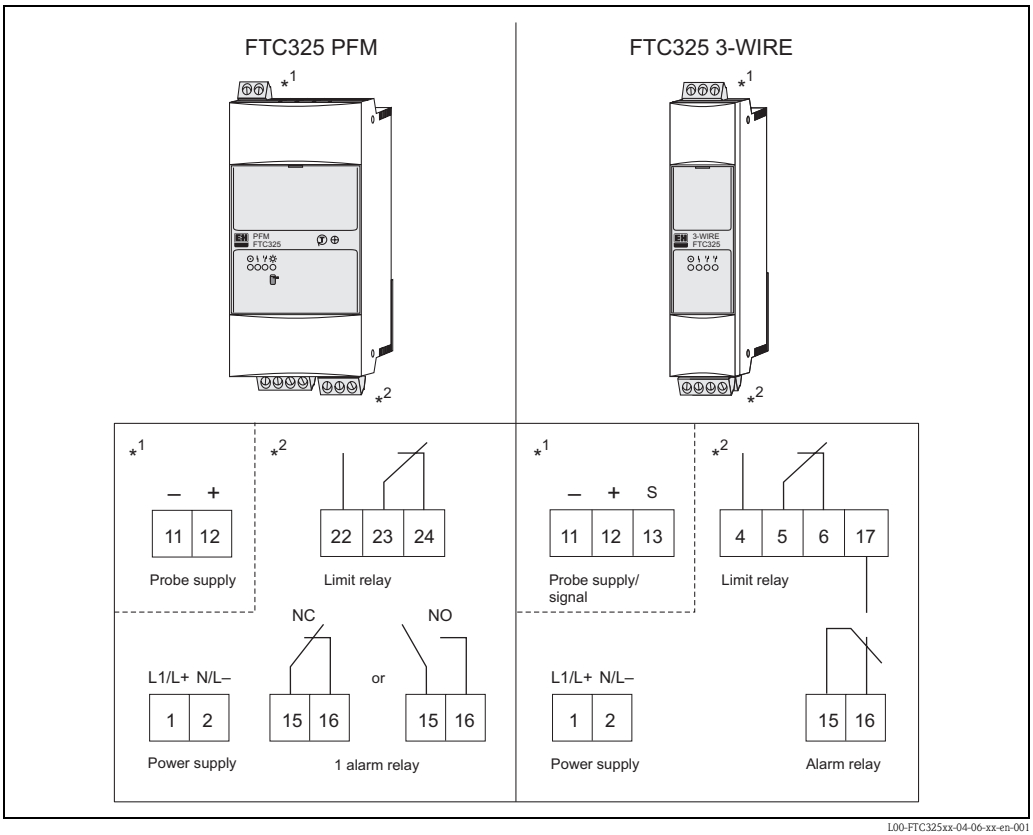
- 2 screw terminals: probe supply
- 3 screw terminals: limit relay
- 2 screw terminals: alarm relay
- 2 screw terminals: power supply

Nivotester FTC325 3-WIRE

- 3 screw terminals: probe supply + signal
- 4 screw terminals:
  – 3 limit value relay
  – 1 for contact 3 of the alarm relay
- 4 screw terminals:
  – 2 AC/DC supply (power supply)
  – 2 alarm relay

Connection cross-section

maximum 1 x 2.5 mm or 2 x 1.5 mm



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User interface

Display elements

1. red light emitting diode: fault indication
2. green light emitting diode: standby
3. yellow light emitting diode (left): "limit relay energised"
4. yellow light emitting diode (right): "probe uncovered/covered"
   level indication independent of the selected fail-safe circuit

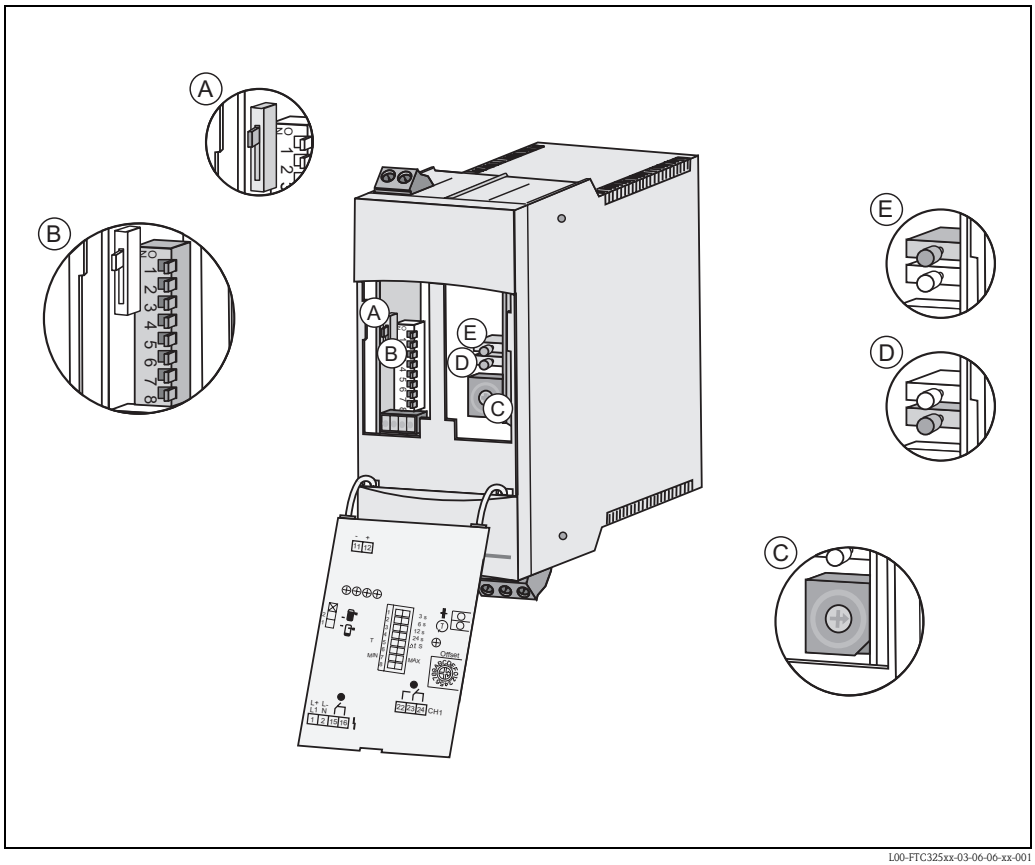
Operating elements

Operating concept

On-site configuration with switches behind the folding front panel

Nivotester FTC325 PFM

A Calibration for covered or uncovered probe
B DIL switch 1-4: switching delay (3 s, 6 s, 12 s, 24 s) = max. 45 s
DIL switch 5: delay when covering or uncovering the probe
DIL switch 6: no function
DIL switch 7: min/max fail-safe mode
DIL switch 8: no function
C Switch point shift for build-up compensation (16-stage)
D Correction key (green)
E Calibration key (red)



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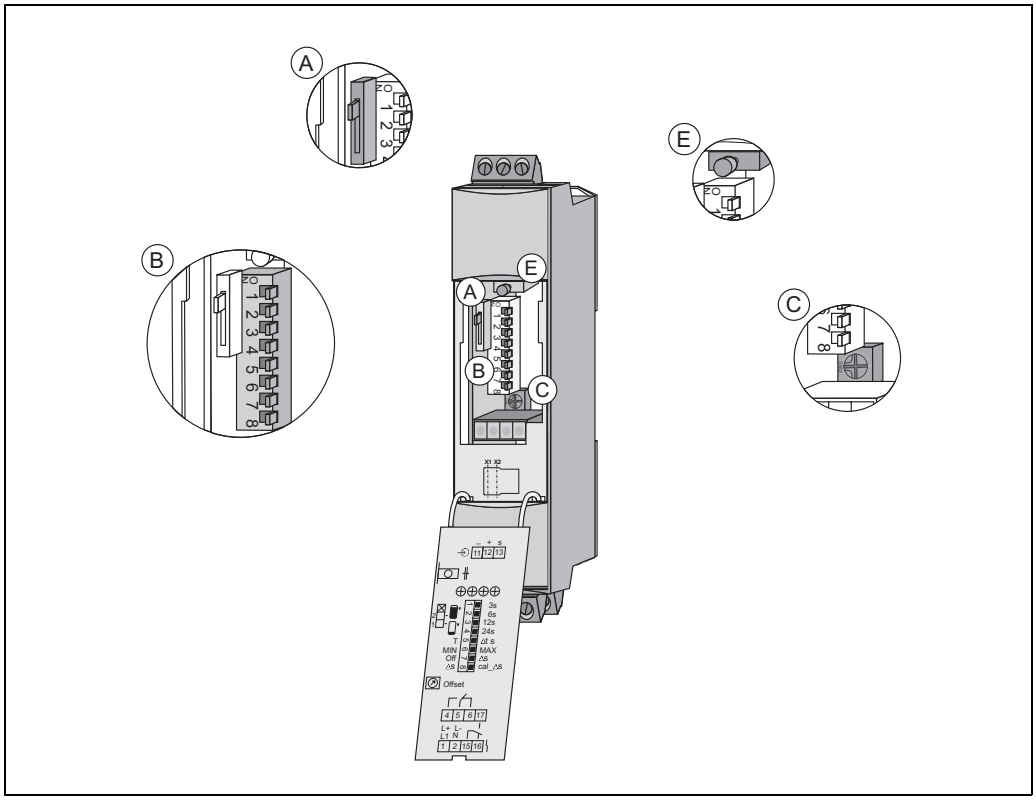
Operating elements

Nivotester FTC325 3-WIRE

A Calibration for covered or uncovered probe
B DIL switch 1-4: switching delay (3 s, 6 s, 12 s, 24 s) = max. 45 s
DIL switch 5: delay when covering or uncovering the probe
DIL switch 6: min/max fail-safe mode
DIL switch 7: two-point controller mode (ON/OFF)
DIL switch 8: calibration switch point (upper/lower), operation as two-point controller
C Switch point shift for build-up compensation (infinitely variable)
E Calibration key (red)



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Certificates and approvals

CEmark	The Nivotester meets all the statutory requirements arising from EC directives. Endress+Hauser confirms the successful testing of the device by affixing the CE-symbol.
Ex approval	Endress+Hauser Sales Centers provide information about the currently available versions for use in hazardous areas (ATEX EEx ia IIC; FM IS; CSA IS) All the relevant data for explosion protection is contained in separate Ex documentation (see: Supplementary Documentation), which can be requested.
Type of protection	[EEx ia] IIC (only for FTC325 PFM)
Overspill protection	WHG (only for FTC325 PFM)
Other standards and regulations	Other standards and regulations which were complied with during the conception and development of the Nivotester FTC325. ■ EN 60529 Degrees of protection through housing (IP code) ■ EN 61010 Safety regulations for electrical control and instrumentation devices and laboratory instruments ■ EN 61326 Interference emission (Equipment Class B), interference immunity (Annex A – Industrial)

Ordering information

Nivotester FTC325 PFM

10	Certificates
A	For non-hazardous areas
B	For non-hazardous areas, WHG
C	ATEX II (1) GD (EEx ia) IIC, WHG
D	FM IS Cl.I,II,III Div1 Group A-G
E	CSA IS Cl.I,II,III Div1 Group A-G
F	CSA General Purpose
Y	Special version

20	Input
1	2-wire PFM rail mounting 45 mm
9	Special version

30	Power supply
A	Power supply 85... 253 V AC, 50/60 Hz
B	Power supply 20... 30 V AC / 20... 60 V DC
Y	Special version

40	Output
1	1 x level SPDT + 1 x alarm SPST NC (normally closed)
2	1 x level SPDT + 1 x alarm SPST NO (normally open)
9	Special version

50	Additional options
1	Additional options not selected
9	Special version

995	Marking
1	Tagging (TAG)

FTC325 PFM	Complete product name

Nivotester FTC325 3-WIRE

10	Certificates
A	For non-hazardous areas
F	CSA General Purpose
Y	Special version

20	Input
2	3-WIRE analogue rail mounting 22.5 mm
9	Special version

30	Power supply
A	Power supply 85... 253 V AC, 50/60 Hz
B	Power supply 20... 30 V AC / 20... 60 V DC
Y	Special version

40	Output
3	1 x level SPDT + 1x alarm SPDT
9	Special version

50	Additional options
1	Additional options not selected
9	Special version

995	Marking
1	Tagging (TAG)

FTC325 3-WIRE	Complete product name

Accessories

Protective housing

The protective housing in protection class IP66 is equipped with an integrated DIN rail and closed by a transparent cover, which can also be lead-sealed.

Dimensions:

W: 180 / H: 182 / D: 165

Technical Data:

- Ingress protection (EN 60529): IP66
- Lower housing section: fibre-glass reinforced polycarbonate, grey
- Upper housing section: polycarbonate, transparent
- Cover screws: PA, 4 pieces, 2 of which are sealing
- Seal: PU seal
- Top-hat rail (EN 50022): galvanized
- Cable entries: 5 pieces M 20x1,5
- Part number: 52010132

Supplementary Documentation

System Information (SI)

- Capacitance level measurement
  SI001F/00

Technical Information (TI)

Capacitance level probes

- Liquicap M
  FTI51, FTI52
  TI417F/00
- Solicap M
  FTI55, FTI56
  TI418F/00
- Solicap S
  FTI77
  TI433F/00

Protective housing

- Protective housing
  TI367F/00

Operating manual (KA)

- Nivotester
  FTC325 PFM
  KA221F/00
- Nivotester
  FTC325 3-WIRE
  KA222F/00

Certificates (only for PFM)

ATEX:

- Nivotester
  FTC325, FTC625
  XA 195F/00

WHG (DIBt):

- Nivotester
  FTC325
  ZE 211F/00

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

Technical Information

Nivotester FTC625 PFM

Level limit switch
With Intrinsically Safe Signal Circuit for Connection to a Capacitance Sensor

Applications

- Level limit detection in tanks containing liquids and silos containing bulk solids. For capacitance level probes, which may also be applied in hazardous areas of category ATEX II (1) GD
- Overspill protection for tanks containing flammable or non-flammable fluids hazardous to water
- Dry running protection for pumps

Your benefits

- Intrinsically safe signal circuit [EEx ia] IIC for using sensors in hazardous areas
- Calibration using operating keys
- High functional safety thanks to:
  - Fail-safe PFM technology
  - Cable monitoring up to sensor with FEI57S or EC27Z
  - Checkable relay function using operating keys
- Compact housing for easy series mounting on standard DIN rail in the cabinet
- Pluggable terminal blocks make wiring easy
- RS485 interface for connection, e.g. by Fieldgate technology, for remote monitoring
- RS232 diagnosis socket with connection to, for example, FieldCare for reading out data
- Can be used also with EC16Z and EC17Z
- Permanent self-monitoring with FEI57S and EC27Z
- Protection against maloperation and manipulation
  - Every change in the switch setting triggers a red LED signal and a fault message
- Full- or empty push button calibration

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Function and system design

Measuring principle

Function

Probe and tank (or ground tube/counterpotential) form a capacitor whose capacitance changes with the level of the product. The electronic insert converts the capacitance change into a PFM frequency change, which switches the output relay in the Nivotester FTC625.

Signal transmission

The Nivotester FTC625 limit switch's intrinsically safe signal input is galvanically isolated from the mains and from the output.
The Nivotester supplies the capacitance sensor with power via a two-wire cable with direct current and receives a frequency from it which signals whether the level limit has been reached or not.
Here, the transmitter superimposes current pulses (PFM signals) with a pulse width of approx. 200 µs and an amperage of approx. 10 mA on the supply current.

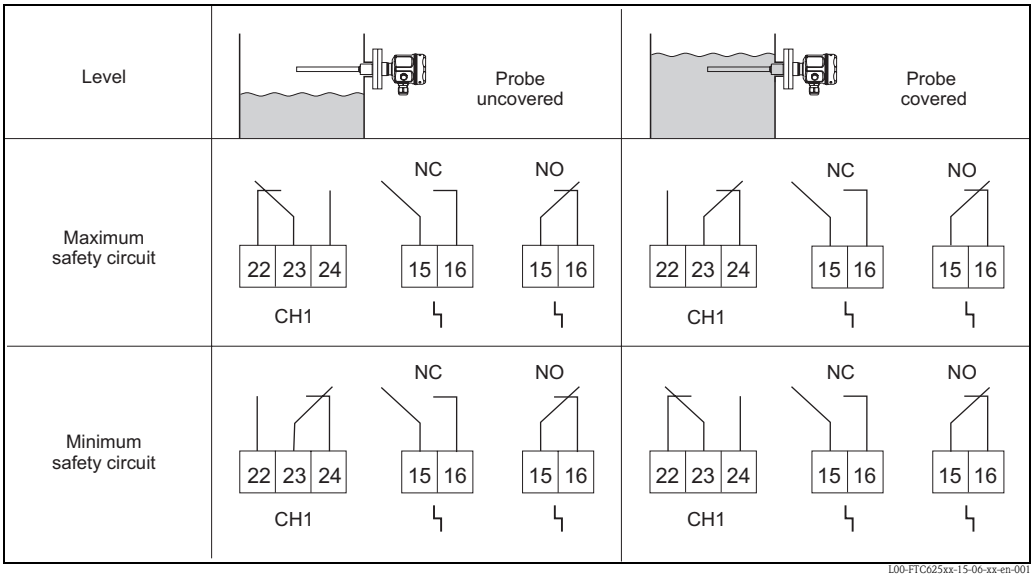
Signal analysis

The Nivotester analyses the frequency and switches the output relay for the level alarm. The switching state of the relay is displayed on the front panel of the Nivotester by means of a yellow light emitting diode (left).

Fail-safe circuit

Selecting the correct fail-safe circuit ensures that the relay always works in quiescent current fail-safe mode.

- Maximum fail-safe mode: the relay de-energises when the level rises above the switch point (sensor covered), a fault occurs or the power fails.
- Minimum fail-safe mode: the relay de-energises when the level falls below the switch point (sensor uncovered), a fault occurs or the power fails.



Function of the limit indicator dependent on the level and fail-safe circuit.

Function monitoring

To increase operational safety, the Nivotester is equipped with a function monitoring facility.
A fault is displayed by the red light emitting diode and de-energises the relay for the level alarm and the alarm relay. A fault is indicated if the Nivotester does not receive any more current pulses. This occurs, for example, when:

- there is a short-circuit
- the signal line to the sensor is interrupted
- the sensor electronics are defective
- the Nivotester's input switching is defective

Permanent function monitoring is implemented by the FEI57S and EC27Z electronic insert. Here, the Nivotester sends a test pulse to the FEI57S or EC27Z, which then returns it. This occurs in one second cycles. If the frequency measurement is interrupted, the Nivotester triggers the alarm.

Note!
The Nivotester FTC625 was optimised for the new electronic inserts of Liquicap M and Solicap M series. From the software version (SV) 1.4 the Nivotester is fully compatible with the FEI57S.

The function alarm priority (only in conjunction with FEI57S or EC27Z) ensures that a limit indication is not signalled before a fault message. With this setting you ensure that a fault message has the first priority.

After calibration, every further change to the device configuration de-energises the relay.
A fault message is signalled via the red LED.

Calibration key (red)

Calibration is carried out automatically by means of operating keys. This makes setting via rotary switches inapplicable.

Adjustable switching delay and switch point shift

- An adjustable switching delay of 0...45 s allows for the relay to be switched with a delay when covering or uncovering the probe. In the opposite direction, each switching delay is 0.2 s.
- A 16-stage switch point shift allows for safe system operation even when using media that are prone to build-up.

The test/correction key (green):

- allows for a function check of the output relay and alarm relay.
- confirms a change in the operating mode – e.g. by changing the switching delay after initial calibration. This enables a correction of the operating mode without requiring recalibration.
  The changed settings are saved by pressing the operating key.

Diagnosis plug (RS232)

The RS232 interface serves as a PC interface and enables on-site operation using a laptop in conjunction with a FieldCare.

RS485 interface

The RS485 interface enables, for example, connection to a Fieldgate, with which remote monitoring can also be performed via the Internet. This remotely monitors the probe frequency, for example in order to receive a message by e-mail should build-up occur and to initiate a new calibration.

Measuring system

A measuring system consists of a capacitance sensor, a Nivotester FTC625 and the control or signal instruments.
The following sensors can be used in conjunction with the electronic inserts (EC) listed.

- Liquicap M (FTI51, FTI52) with FEI57S
- Solicap M (FTI55, FTI56) with FEI57S
- Solicap S (FTI77) with FEI57S
- Solicap (FTC51, FTC52, FTC53)* with EC17Z
- Multicap T* with EC17Z
- Multicap Classic* with EC16Z, EC17Z, EC27Z
- Multicap EA* with EC17Z
- High-temperature probes (HT) 11500**, T12656***, T12892*** with EC17Z, EC27Z
- Double rod probe11304** with EC17Z, EC27Z

* Phase-out: 2007, ** Phase-out: 2008, *** Phase-out: 2009

Probe construction

Example: Material	εr	Conductivity	Build-up	Type of probe mounting			
				full insulation	partial insulation	with ground tube	without ground tube
Solvents, fuels	< 3	low	low	√	√	√	–
Dry bulk solids	< 3	low	low	–	√	–	√
Moist bulk solids	> 3	average	average	√	√	–	√
Aqueous liquids and alcohols	> 3	strong	low	√	√	–	√
			strong	–	√	–	√
Sludge	> 3	strong	very strong	–	√	–	√

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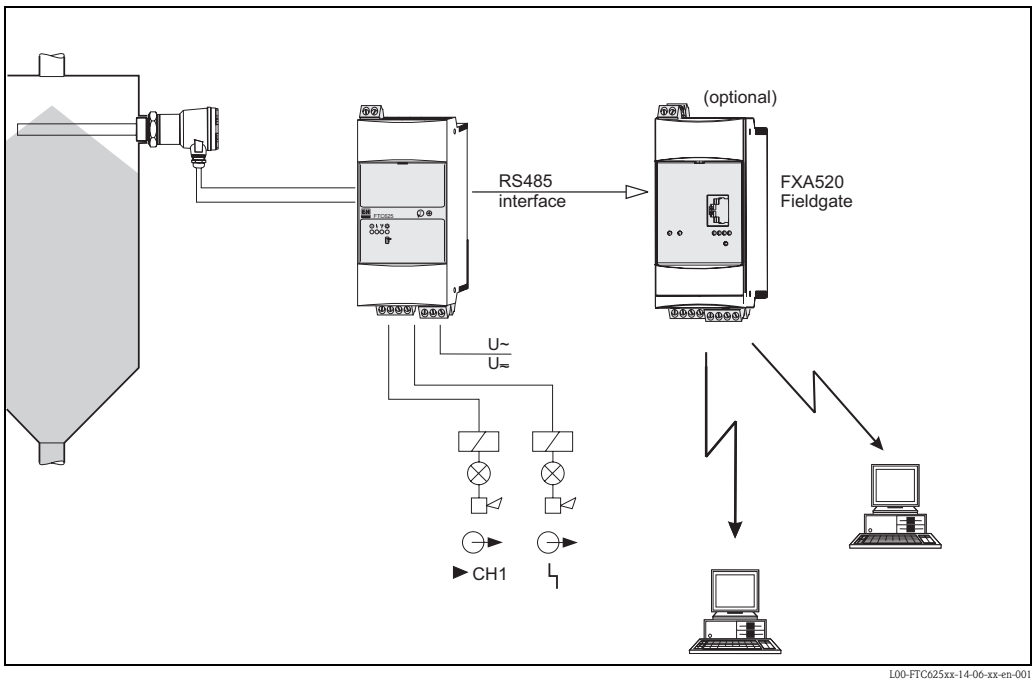
Nivotester FTC625

The measuring system consists of:
- Sensor
  - capacitance probe
  - electronic insert
    - FEI57S or EC27Z with cable monitoring
    - EC16/17Z without cable monitoring
- Nivotester FTC625
- Control or signal instruments



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Input

Measured variable

The limit signal is generated at minimum or maximum level, depending on the selection

Measuring range

The measuring range is dependent on the mounting location of the probes.

Input signal

- FTC625 input: galvanically isolated from power supply and output
- Type of protection: intrinsic safety [EEx ia] IIC
- Connectable sensors:
  Liquicap M (FTI51, FTI52) with FEI57S
  Solicap M (FTI55, FTI56) with FEI57S
  Solicap S (FTI77) with FEI57S
  Solicap (FTC51, FTC52, FTC53)* with EC17Z
  Multicap T* with EC17Z
  Multicap Classic* with EC16Z, EC17Z, EC27Z
  Multicap EA* with EC17Z
  High-temperature probes (HT) 11500**, T12656***, T12892*** mit EC17Z, EC27Z
  Double rod probe11304** with EC17Z, EC27Z
- Sensor's power supply: from Nivotester FTC625
- Connecting cable: two-wire, screening not required, except for strong electromagnetic interferences (see also page 6)
- Cable resistance: max. 25 Ω per wire
- Signal transmission: pulse-frequency modulation (PFM)

* Phase-out: 2007, ** Phase-out: 2008, *** Phase-out: 2009

Output

Output signal

- Relay output: a potential-free change-over contact for the level alarm
- RS485 interface for connection to, for example, Fieldgate (remote monitoring)
- Quiescent current fail-safe circuit: minimum/maximum fail-safe mode can be selected using the DIL switch
- Alarm relay: potential-free change-over contact for fault indication, only two contacts made (NC or NO contact)
- Switching delay: 0...45 s
  relay switches when covering or uncovering the probe, depending on the setting
- Switching capacity of relay contacts:
  U~ maximum 253 V
  I~ maximum 2 A
  P~ maximum 500 VA at cos $\varphi \geq 0.7$

  U- maximum 40 V
  I- maximum 2 A
  P- maximum 80 W

- Service life: at least 10^5 switching cycles at maximum contact load
- Function indicator: light emitting diodes for operation/communication, level alarm, fault and level signal (lights up as long as the probe is covered)

Signal on alarm

Limit relay de-energised; fault indication via red LED, alarm relay de-energised

Galvanic isolation

All input and output channels and relay contacts are galvanically safe isolated from each other.
When making a simultaneous connection from the power supply circuit to the function's extra-low voltage or to the alarm relay's contacts, safe galvanic isolation is guaranteed up to a voltage of 150 V AC.

Overvoltage category as per EN 61010

II

Protection class

II (double or increased insulation)

Power supply

Electrical connection

Terminal blocks

The removable terminal blocks are isolated after intrinsically safe connections (top of device) and non-intrinsically safe connections (bottom of device). Furthermore, the terminal blocks are also colour-coded. Blue is for the intrinsically safe area and grey for the non-intrinsically safe area. These distinctions allow for safe cable routing.

Sensor connection

(To the upper, blue terminal blocks).
Use a usual commercial instrument cable or multi-core cable for measuring purposes for the two-wire connecting cable between the Nivotester FTC625 and the sensor. Cable resistance of maximum 25 Ω per wire. If strong electromagnetic interferences have to be expected, e.g. from machines or radios, a screened cable must be used. Only connect the screening to the grounding connection in the sensor, not to the Nivotester.

Using the sensor in hazardous areas

Compliance with the national explosion protection regulations for the design and routing of the intrinsically safe signal cable is mandatory.
High-reliability values for capacitance and inductance are contained in Safety Instructions XA 195F.

Connection of signal and control instruments

(To the lower, grey terminal blocks)
The relay function must be observed dependent on the level and fail-safe circuit.
If a device with high inductance (e.g. contactor, solenoid valve, etc.) is connected, a spark suppressor must be added to protect the relay contact.

Supply voltage connection

(To the lower, grey terminal blocks)
For voltage versions, see the Ordering information.
A fuse (T 200mA) is built in to the power supply circuit, so that it is not necessary to pre-connect a fine-wire fuse. The Nivotester is equipped with reverse polarity protection.

Supply voltage

Alternating current version (AC):

- Voltage ranges: 85...253 V, 50/60 Hz

Direct current version (DC):

- Voltage range: 20...30 V AC / 20...60 V DC
- Power supply direct current: maximum 100 mA
- Permitted residual ripple within the tolerance: Uss = maximum 2 V

Power consumption

AC version

maximum 6.0 VA

DC version

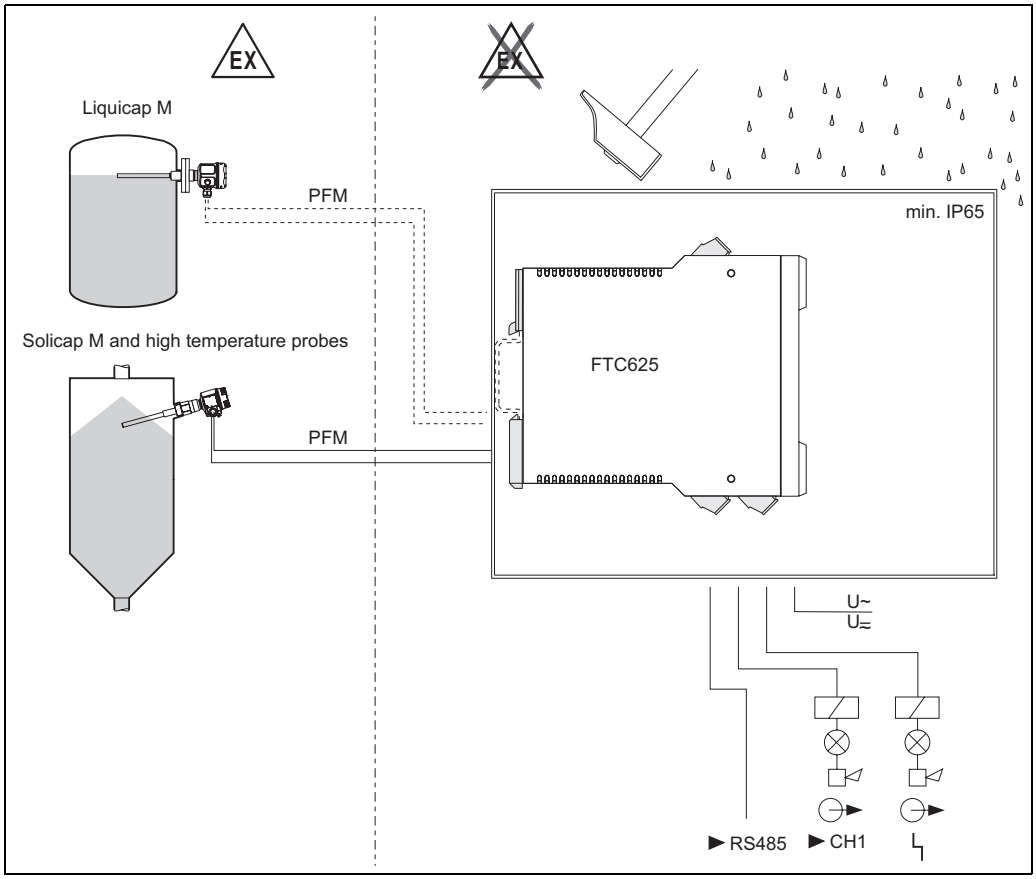
maximum 2.0 W (at Umin 20 V)

Operating conditions (installation conditions)

Installation instructions

Installation location

The Nivotester must be housed outside of hazardous areas in a cabinet. For installation outdoors, there is also a protective housing (IP65 – see Accessories) for up to three Nivotester FTC625 available.



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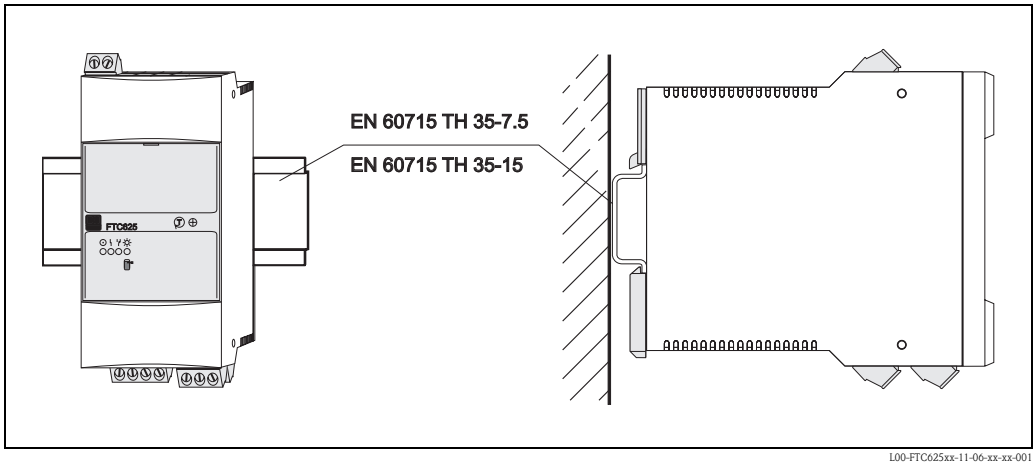
Orientation

Vertical on DIN rail (EN 60715 TH 35).



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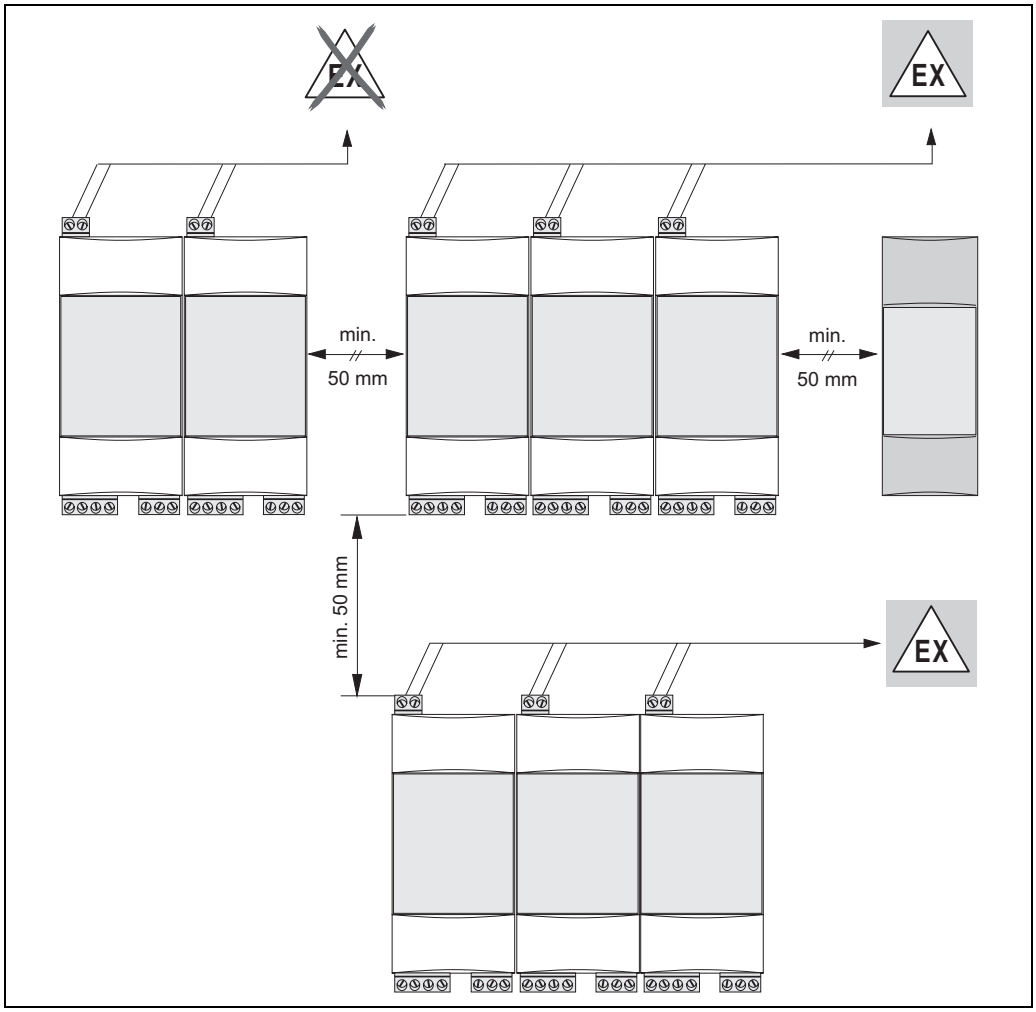
Operating conditions (environmental conditions)

Installation location	Cabinet or protective housing
Permitted ambient temperatures	**For single mounting** ■ –20 °C...+60 °C **For series mounting without lateral spacing** ■ –20 °C...+50 °C **Storage temperature** ■ –25 °C...+85 °C (preferably at +20 °C) **Installation in protective housing** ■ –20 °C...+40 °C ■ No more than three Nivotesters can be installed into one protective housing  Caution! The devices should be installed in locations which are protected from direct solar radiation, weather and impacts. This is of particular importance in hot climates.
Climatic and mechanical application class	3K3 As per DIN EN 60721-3-3 3M2 As per DIN EN 60721-3-3
Degree of protection	IP20
Electromagnetic Compatibility (EMC)	Interference emission as per EN 61326; Equipment Class B Interference immunity as per EN 61326; Appendix A (industrial applications) and NAMUR Recommendation NE 21 (EMC)

Mechanical construction

Design, dimensions

- Housing: row housing made of plastic
- Mounting: on DIN rail as per EN 60715 TH 35-7.5 or EN 60715 TH 35-15
- Degree of protection as per EN 60529; IP20



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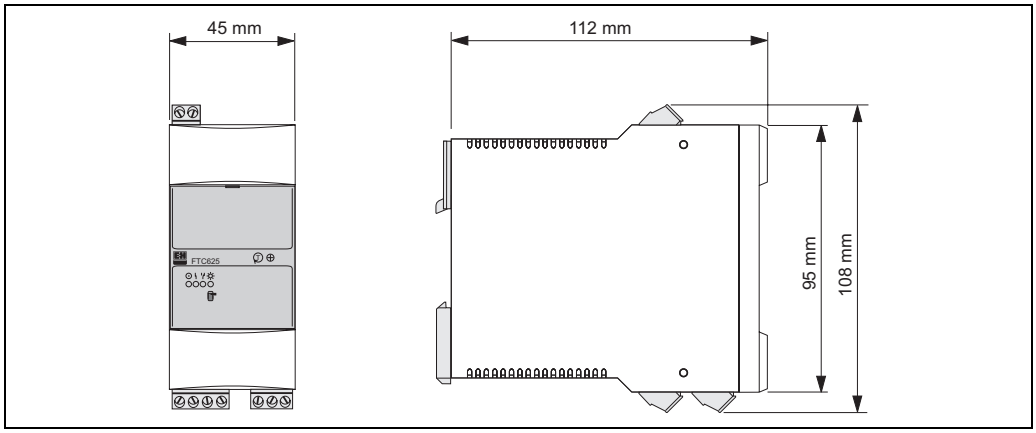
Dimensions



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Note!
100 mm = 3.94 in

Weight

approx. 250 g

Materials

Housing

- Polycarbonate
  Colour: light grey, RAL 7035

Front cover

- Polypropylene PPN
  Colour: blue

Fixing bracket (for securing on the DIN rail)

- Polyamide PA6
  Colour: black, RAL 9005

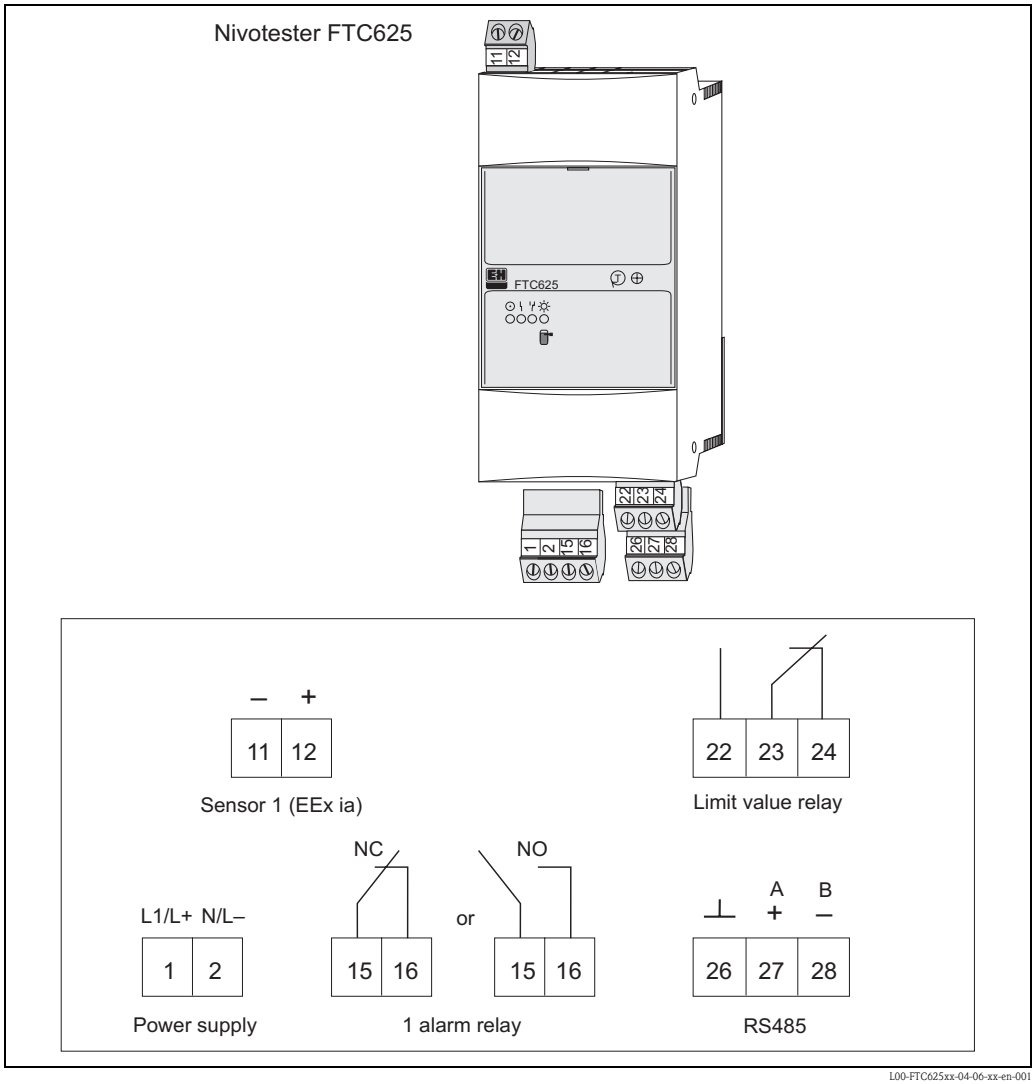
Terminals

Nivotester FTC625

- 2 screw terminals: probe supply
- 3 screw terminals: limit relay
- 2 screw terminals: alarm relay
- 2 screw terminals: power supply
- 3 screw terminals: RS485 interface

Connection cross-section

maximum 1 x 2.5 mm or 2 x 1.5 mm



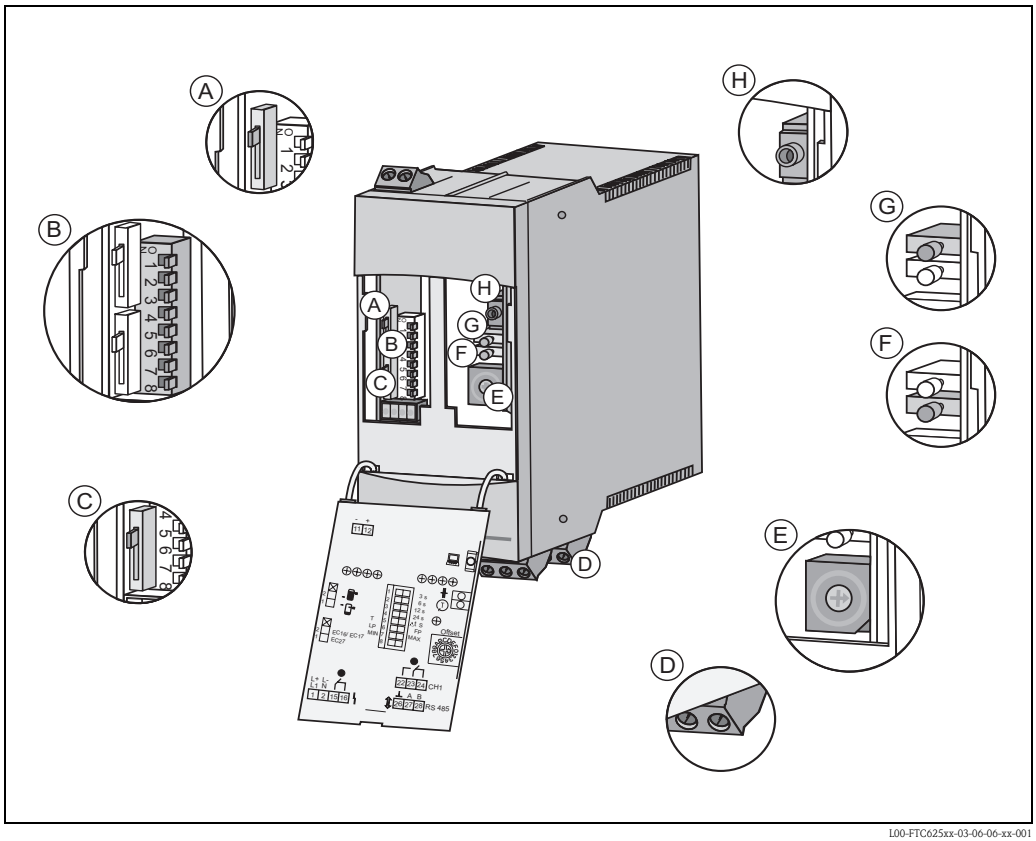
Human interface

Display elements

1. green light emitting diode: standby (flashing = communication)
2. red light emitting diode: fault indication
3. yellow light emitting diode (left): "limit relay energised"
4. yellow light emitting diode (right): "probe uncovered/covered"
   level indication independent of the selected fail-safe circuit

Operating elements

A Calibration for covered or uncovered probe
B DIL switches 1–4: switching delay (3 s, 6 s, 12 s, 24 s) = max. 45 s
DIL switch 5: delay when covering or uncovering the probe
DIL switch 6: only with FEI57S or EC27Z – level limit indication immediately or after functional test
DIL switch 7: min/max fail-safe mode
DIL switch 8: no function
C Sensor selection: FEI57S, EC27Z or EC16Z, EC17Z
D RS485 interface
E Switch point shift for build-up compensation (16-stage)
F Correction key (green)
G Calibration key (red)
H Diagnosis socket (RS232/FieldCare)



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Operating concept

On-site configuration with switches behind the folding front panel

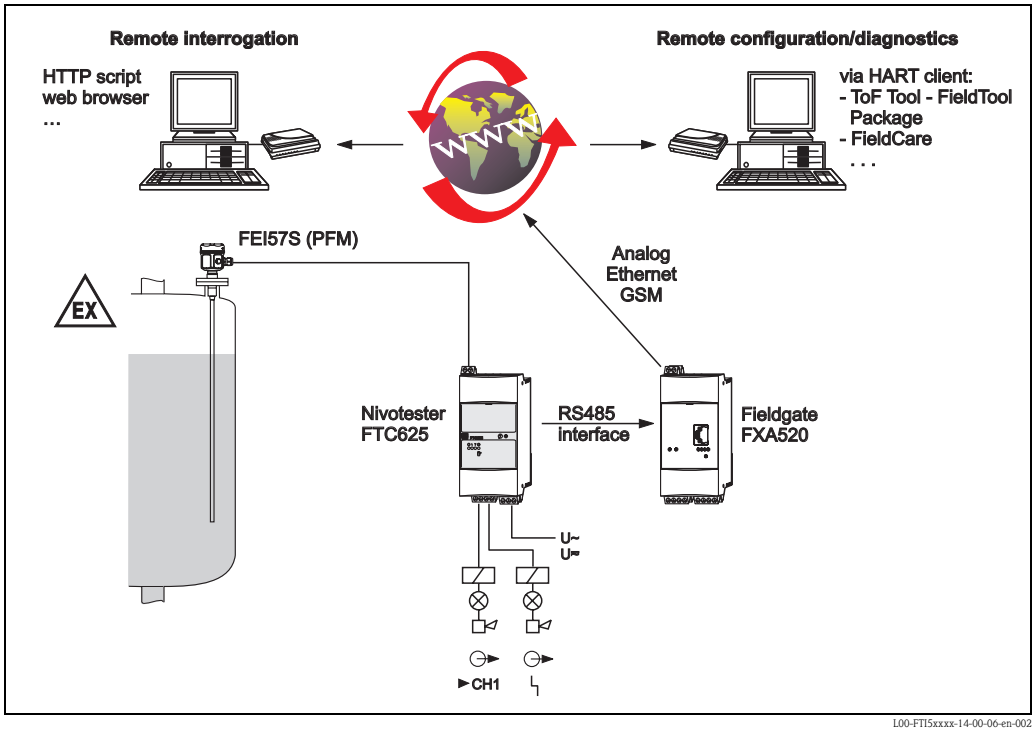
System integration via Fieldgate

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, 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.



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Certificates and approvals

CE mark

The Nivotester meets all the statutory requirements arising from EC directives.
Endress+Hauser confirms the successful testing of the device by affixing the CE symbol.

Ex approval

Endress+Hauser Sales Centers provide information about the currently available versions for use in hazardous areas (ATEX EEx ia IIC; FM IS; CSA IS)
All the relevant data for explosion protection is contained in separate Ex documentation (see: Supplementary Documentation), which can be requested.

Type of protection

[EEx ia] IIC

Overspill protection

WHG

Other standards and regulations

Other standards and regulations which were complied with during the conception and development of the Nivotester FTC625.

- EN 60529
  Degrees of protection provided by enclosures (IP code)
- EN 61010
  Safety requirements for electrical equipment for measurement, control and laboratory use
- EN 61326
  Interference emission (Equipment Class B), interference immunity (Appendix A – industrial applications)

Ordering information

Nivotester FTC625

10	**Certificates**							
	C	ATEX II (1) GD [EEx ia] IIC, WHG						
	D	FM IS	Cl. I, II, III Div. 1 Group A-G					
	E	CSA IS	Cl. I, II, III Div. 1 Group A-G					
	S	TIIS	Ex ia IIC					
	Y	Special version						
20		**Version**						
		1	Rail mounting 1-channel 45 mm					
		9	Special version					
30			**Power supply**					
			A	Power supply 85...253 V AC, 50/60 Hz				
			B	Power supply 20... 30 V AC / 20... 60 V DC				
			Y	Special version				
40				**Output**				
				1	1x level SPDT + 1x alarm SPST NC (Normal closed)			
				2	1x level SPDT + 1x alarm SPST NO (Normal open)			
				9	Special version			
50					**Additional option**			
					1	Additional option not selected		
					9	Special version		
995						**Marking**		
						1	Tagging (TAG)	
FTC625							Complete product name	

Accessories

Protective housing

The protective housing in protection class IP66 is equipped with an integrated DIN rail and closed by a transparent cover, which can also be lead-sealed.

Dimensions:

W: 180 / H: 182 / D: 165

Technical Data:

- Ingress protection (EN 60529): IP66
- Lower housing section: fibre-glass reinforced polycarbonate, grey
- Upper housing section: polycarbonate, transparent
- Cover screws: PA, 4 pieces, 2 of which are sealing
- Seal: PU seal
- Top-hat rail (EN 50022): galvanized
- Cable entries: 5 pieces M 20x1,5
- Part number: 52010132

Cable

Cable for connecting the Nivotester FTC625 to a PC (RS232/3.5 mm jack plug)

- Part number: 52013982
  (included in delivery)

Supplementary Documentation

System Information (SI)

- Capacitance level measurement
  SI001F/00

Technical Information (TI)

Capacitance measuring devices

- Liquicap M, FTI51, FTI52
  TI417F/00
- Solicap S, FTI77
  TI433F/00
- Solicap M, FTI55, FTI56
  TI418F/00

Protective housing

- Protective housing
  TI367F/00

Fieldgate

- FXA320, FXA520
  TI369F/00

Operating Instructions (KA)

- Nivotester FTC625
  KA194F/00

Certificates

ATEX:

- Nivotester FTC625
  XA195F/00

WHG (DIBt):

- Nivotester FTC625
  ZE211F/00

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People for Process Automation

TI370F/00/EN/05.10
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FM+SGML 6.0

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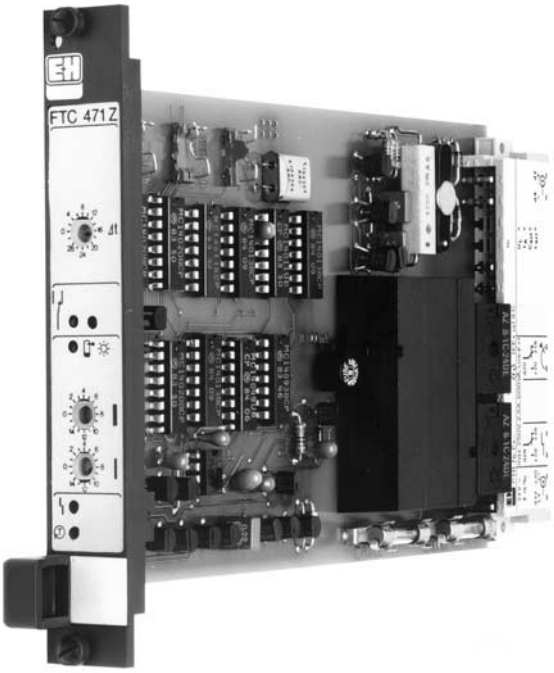
Technical
Information
TI 088F/00/en

Capacitance Limit Detection
nivotester FTC 470 Z, 471 Z

Capacitance limit switch for liquids and bulk solids



Application
The Nivotester FTC 470 Z, 471 Z is a level limit switch in compact Racksyst format for limit detection in liquids tanks and bulk solids silos.

The intrinsically safe probe current circuit [EEx ia] IIC T6 allows the use of the probes also in explosion-hazardous areas.

FTC 470 Z: without switching delay

FTC 471 Z: with adjustable switching delay

Features and Benefits
- Approved for overspill protection
  – for water-polluting liquids conforming to German water regulations (WHG)
- User-friendly calibration
- Signal transmission over two-core cable
- With function monitoring of electronics and connection cables
- Each with one potential-free output for level signal and flow alarm, consequently safety precaution against fault response
- Wide supply voltage tolerance allows low-cost power supply from simple power pack

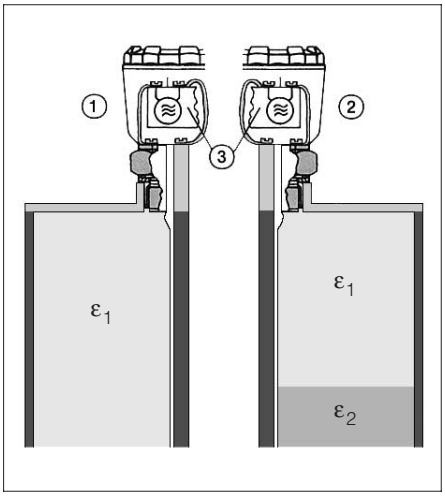
Endress+Hauser
The Power of Know How

Measuring System

The complete measuring system comprises:
- a Nivotester FTC 470 Z or FTC 471 Z
- a suitable electronic insert (see Technical Data)
- a probe matching the application.

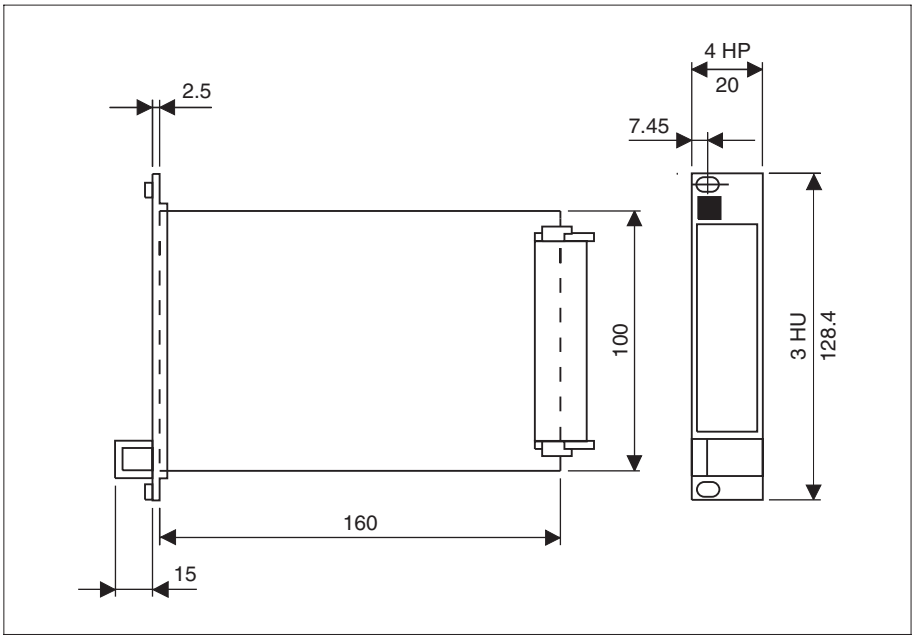
Measuring Principle

The capacitance measurement principle is based on the physical properties of a capacitor formed by the sensor and the vessel wall. The capacitance is affected by the dielectric value of the product. When the sensor is not covered ①, the dielectric constant is ε_1 (usually ε_1 of air with $\varepsilon_r = 1$). When the sensor is covered with material ② (dielectric constant ε_2), an increase in capacitance occurs. The electronic insert EC… is either mounted in the probe head (③) or, at operating temperatures above 100 °C, in the separate protection housing HTC. It converts the level-dependent capacitance signal into a frequency, which is then transmitted over two-core cable to the Nivotester FTC… as a series of current pulses superimposed on the DC power supply: pulse-frequency-modulation (PFM).



The principle of capacitance limit detection

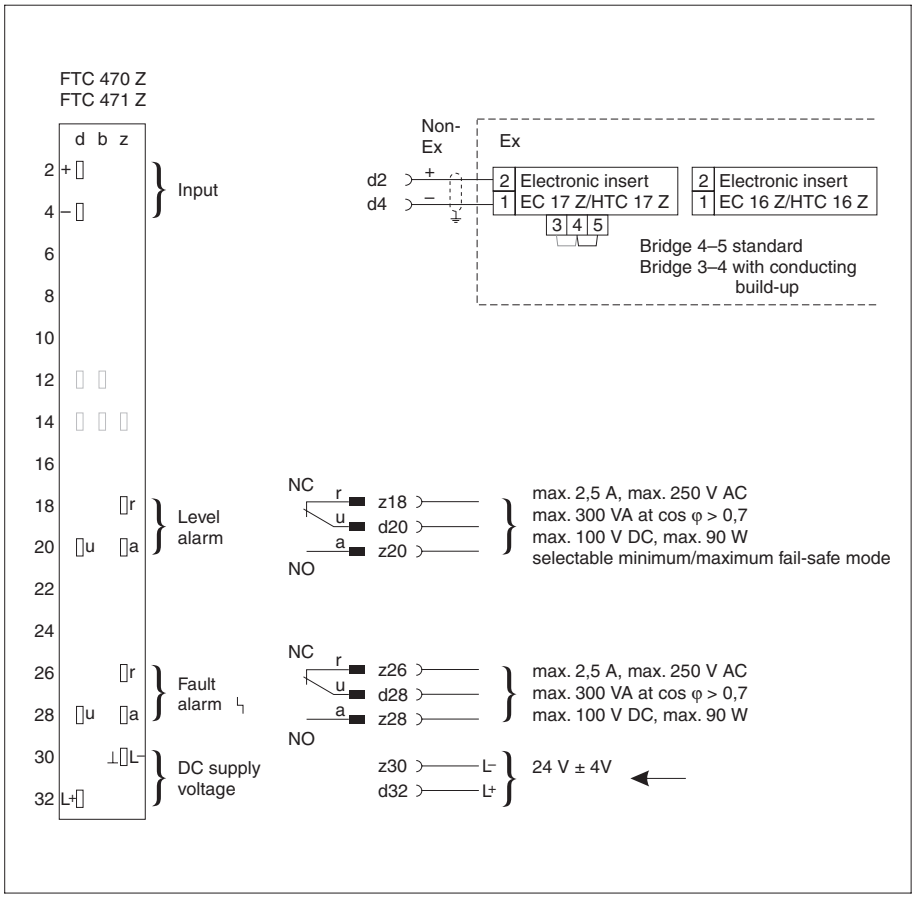
Dimensions



Dimensions in mm
of the Nivotester
FTC 470 Z / FTC 471 Z

100 mm = 3.94 in

Electrical Connection



Electrical connection of the Nivotester FTC 470 Z / FTC 471 Z in the assembly rack.

View on the contact blades on the unit's male multipoint or on the connection side of the female connector in the rack.

Product Structure

FTC 470 Z Level limit switch
FTC 471 Z Level limit switch with adjustable switching delay

Certificate

A ATEX II (1) GD [EEx ia] IIC, WHG
C CSA, Class I, Groups A-D, Class II, Group E-G
K TIIS, Ex ia IIC T3
Y Special version

Version

0 RACKSYST plug-in card, 4PU
9 Special version

Power supply

E Power supply 20…28 V DC
Y Special version

Switch output; Limit signal and fault indication

0 Output: 1relay, volt free SPDT
3 Output: 1 open collector
9 Special version

FTC 47x Z – | | | | | Product designation

Technical Data

Mechanical construction	Racksyst plug-in board to DIN 41494, Part 2 and Part 4; t = 160, h = 100 (Europa format)
Connection	strip to DIN 41612, Part 3, Format F
Coding pins in strip	for FTC 470 Z / 471 Z with relay output at Points 1 and 6
Width	4 HP (20 mm)
Protection type to DIN 40050	front panel IP 20, plug-in board IP 00
Permissible ambient temperature	0 °C…+70 °C (30 °F…160 °F)
Storage temperature	–20 °C…+85 °C (0 °F…185 °F)
DC supply voltage	24 V ± 4 V
Current consumption	70 mA
Input	galvanically isolated from other circuits
Suitable electronic insert • in probe head • in separate housing	 EC 16 Z / EC 17 Z HTC 16 Z / HTC 17 Z
Explosion protection type	[EEx ia] IIC T6 (Zone 0)
Electromagnetic compatibility	Interference Emission to EN 61326, Electrical Equipment Class A Interference Immunity to EN 61326
Connection cable	2 -core, screened
Cable resistance	max. 25 Ω per core
Short circuit current	max. 50 mA (continuous short circuit proof)
Initial capacitance range C_A	approx. 20 pF…1000 pF
Outputs	each with 1 relay with potential-free change-over contact
Max. contact load	U~: 250 V, U–: 100 V, I~: 2.5 A, P~: 300 VA, cos φ > 0.7, P–: 90 W
Electrical connection	See diagram on page 3
Safety mode for level alarm	selectable min./max. safety mode
Switching delay	FTC 470 Z: 0.5 s, FTC 471 Z: 0…30 s
Switching hysteresis	0.5 pF (at C_A = 30 pF)
Compensation for build-up	The switchpoint can be adjusted further from point C_A with the switch if build-up is expected on the probe.

Supplementary Documentation

- ❏ Electronic Insert EC 16 Z
  Technical Information TI 170F/00/en
- ❏ Electronic Insert EC 17 Z
  Technical Information TI 268F/00/en
- ❏ Electronic insert in separate housing HTC 16 Z
  Technical Information TI 171F/00/en
- ❏ Separate housing for electronic insert
  Technical Information TI 228F/00/en
- ❏ EMC Test Procedures
  Technical Information TI 241F/00/en

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