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.
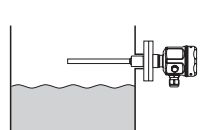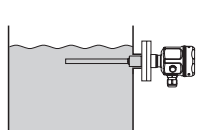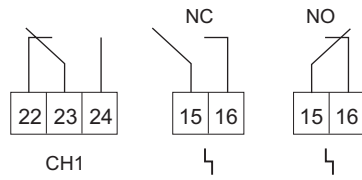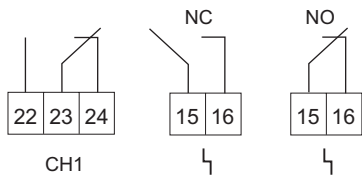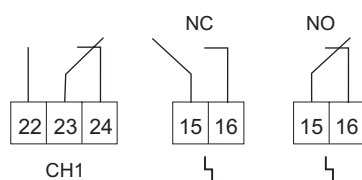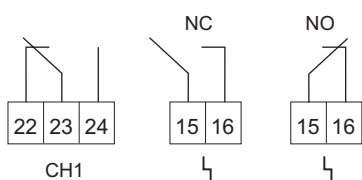
Signal analysis

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.

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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

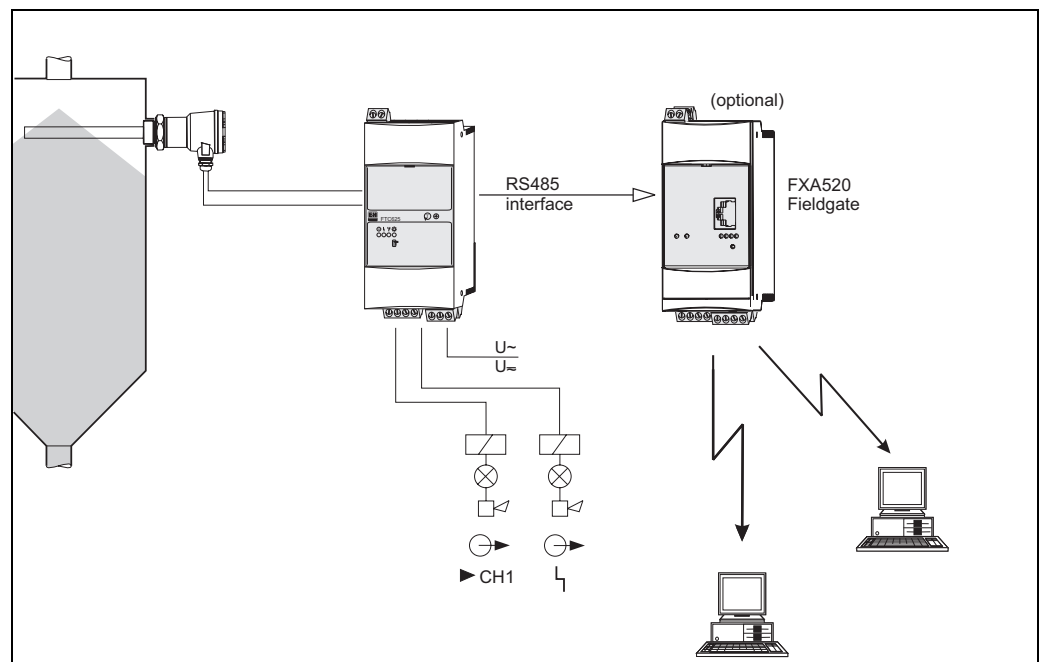* Phase-out: 2007, ** Phase-out: 2008, *** Phase-out: 2009

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
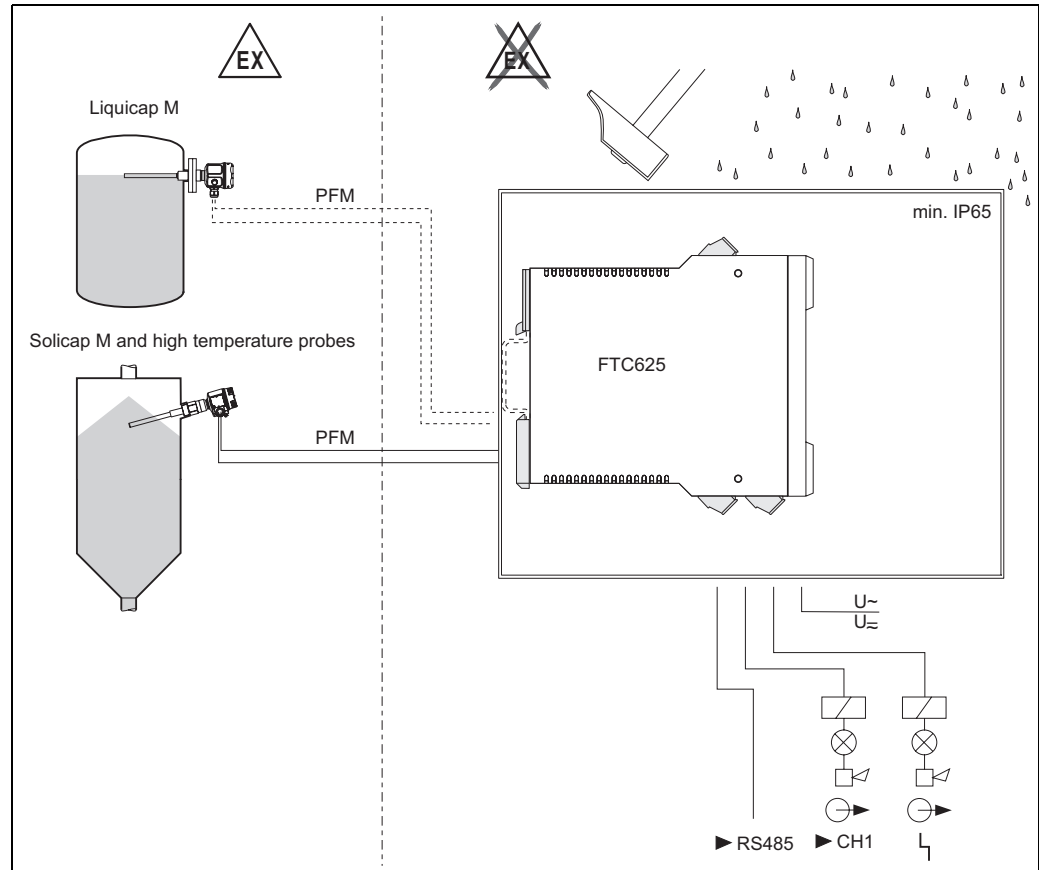
AC version

maximum 6.0 VA

DC version

maximum 2.0 W (at Umin 20 V)

Operating conditions (installation conditions)

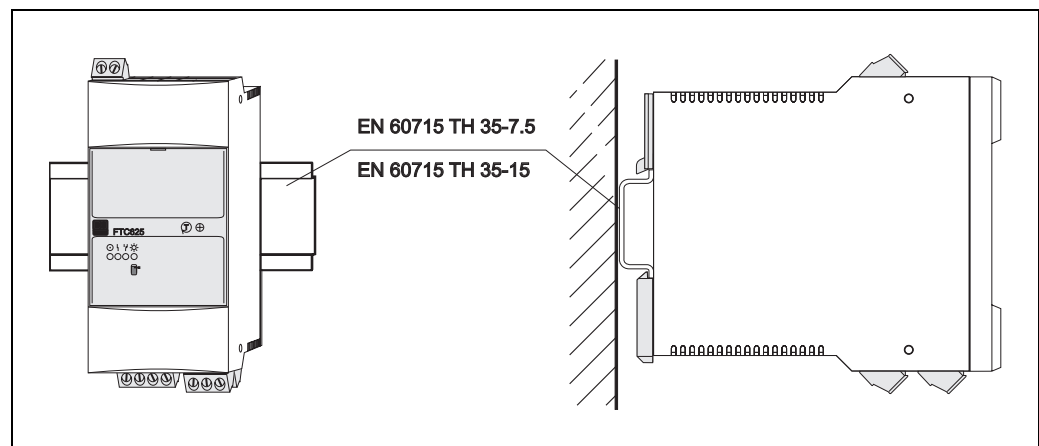**Installation instructions**

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).
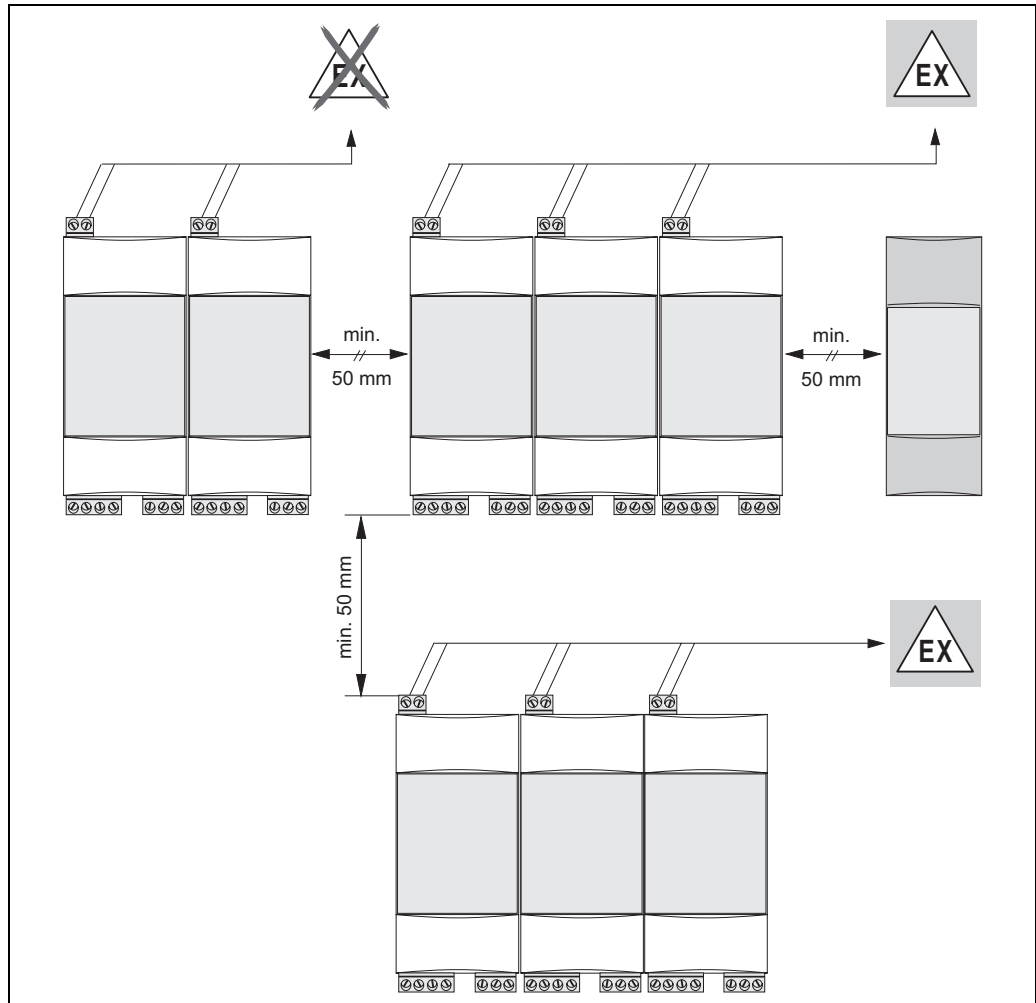

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Operating conditions (environmental conditions)

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
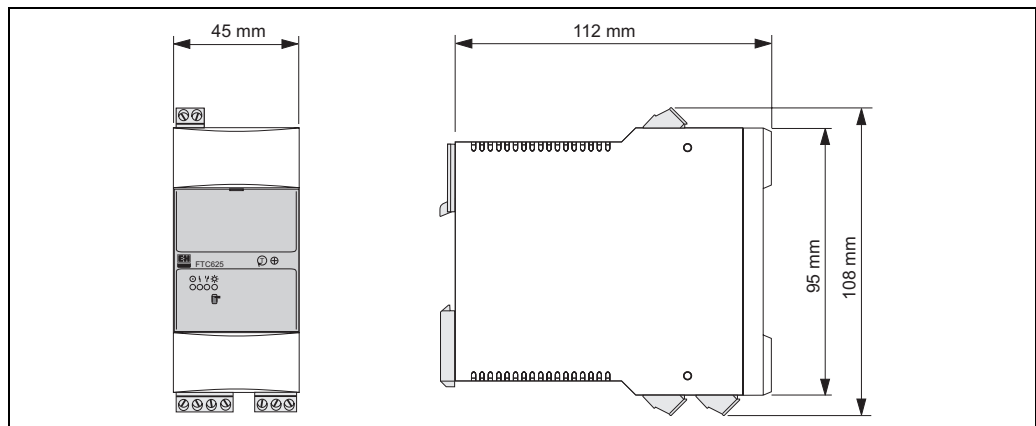
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Note!
100 mm = 3.94 in

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
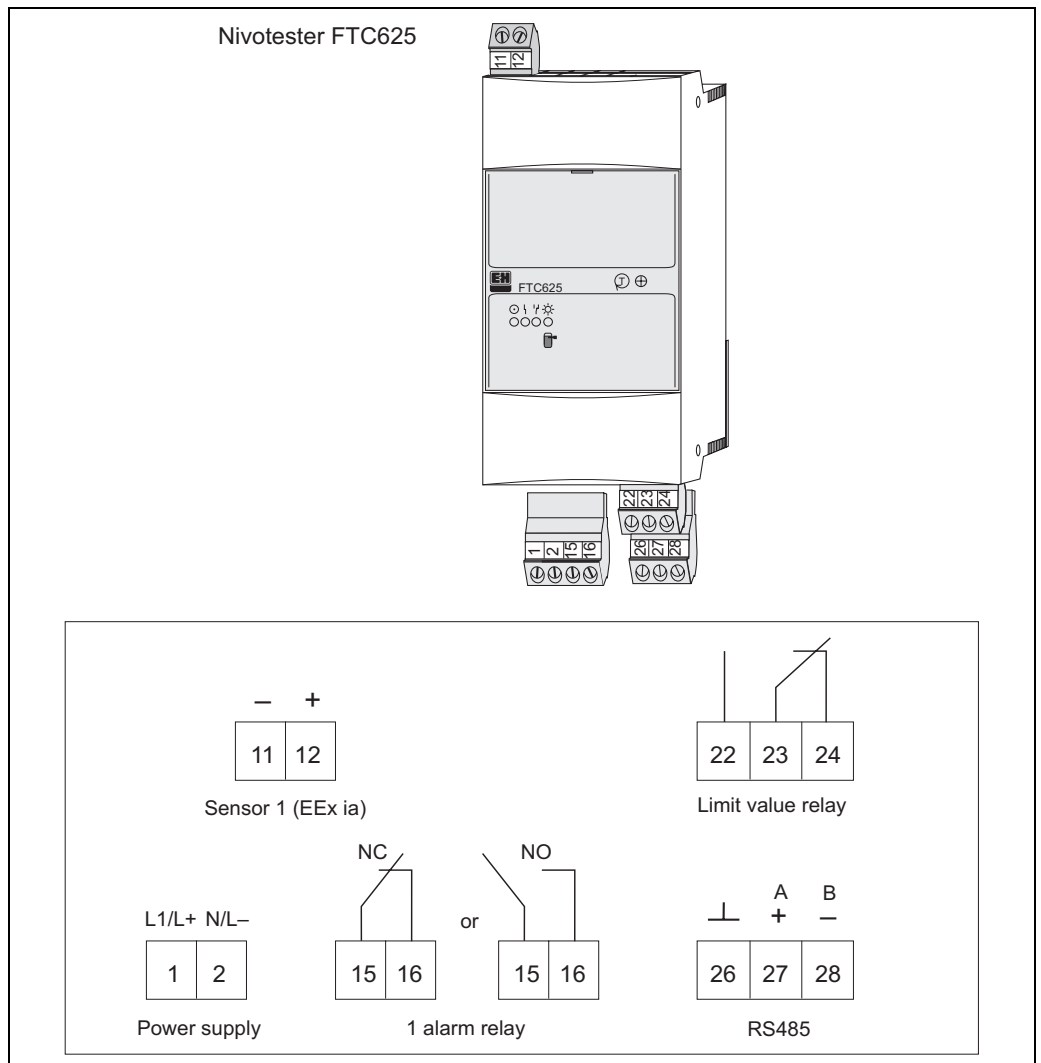
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Human interface

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)
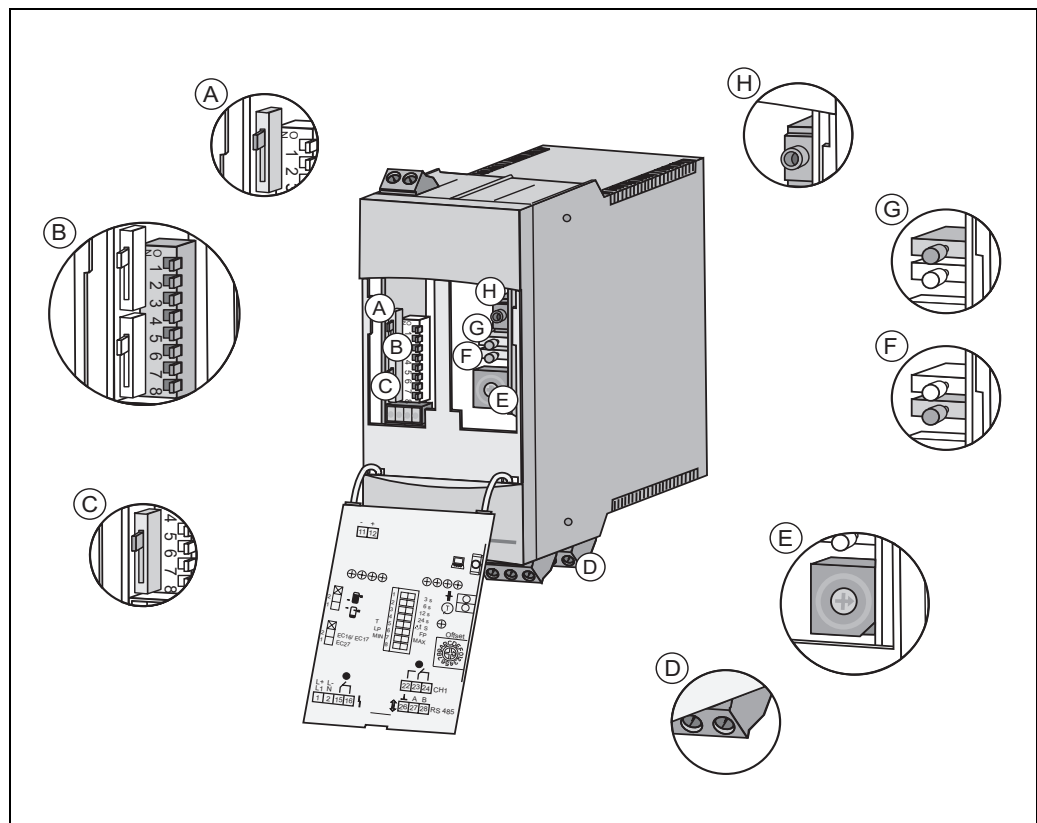
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Operating concept

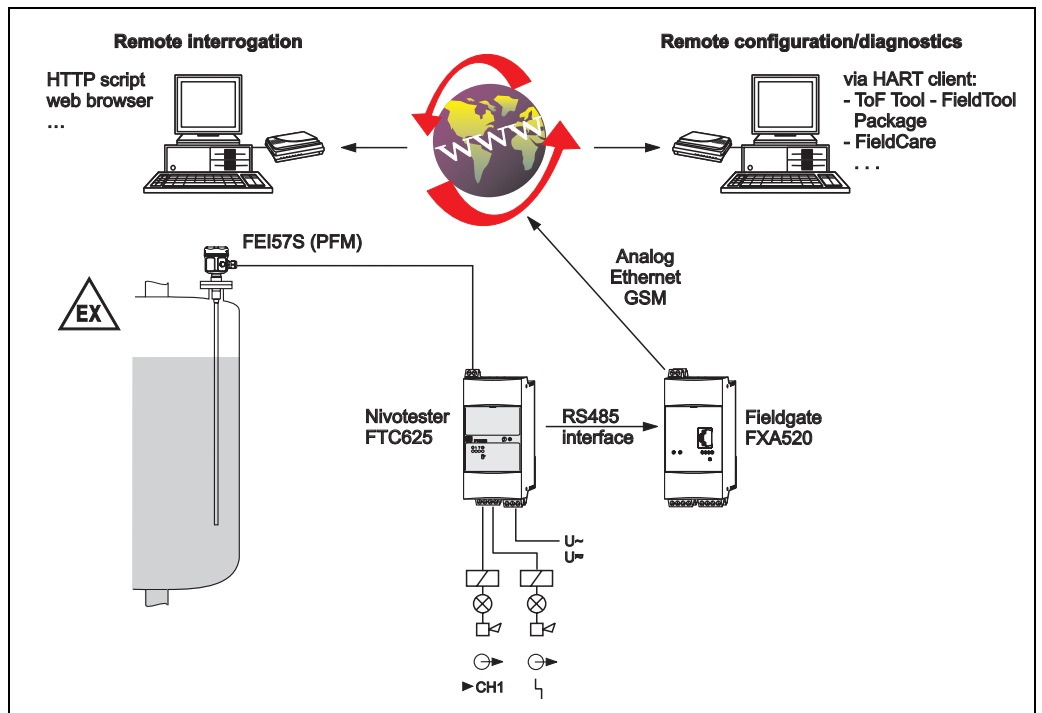On-site configuration with switches behind the folding front panel

System integration via Fieldgate	**Vendor managed inventory**

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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