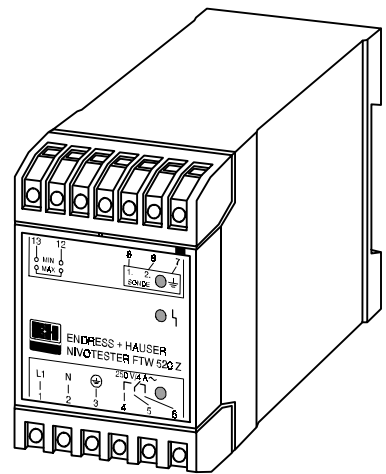
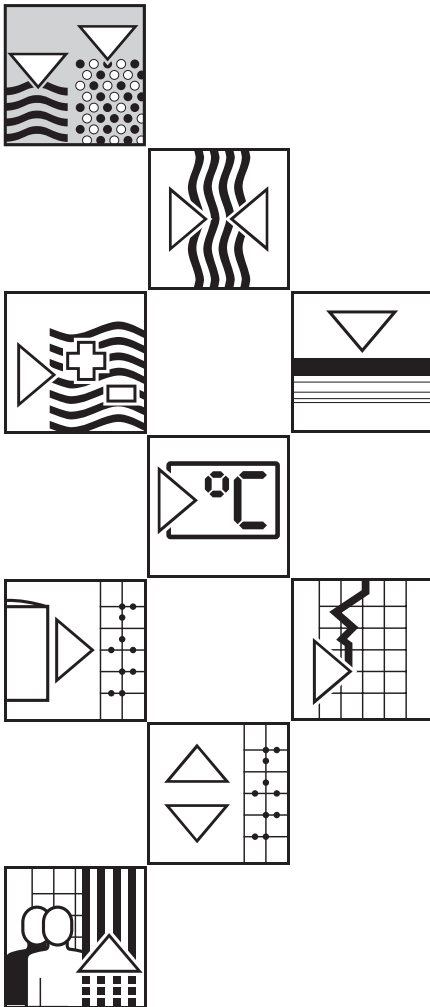


Nivotester FTW 520 Z Level limit switch

Installation and operating manual



Endress + Hauser

The Power of Know How



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Reference Guide

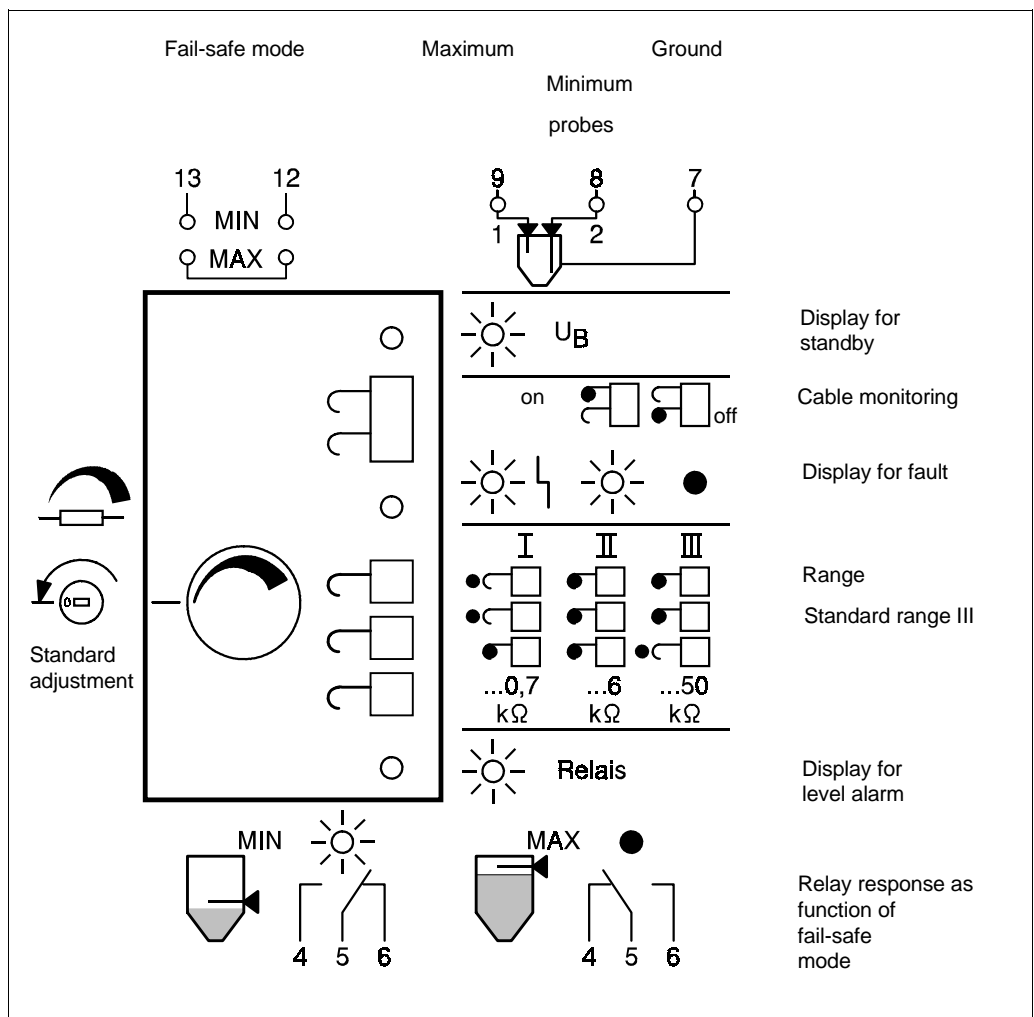


Fig. 1
Switches and adjusting elements
for calibration

Application

The Nivotester FTW 520 Z is a level limit switch for use in tanks, troughs, piping, etc. which contain electrically conductive liquids.

The most important applications are:

- limit detection for minimum and maximum levels
- overspill protection
- two-point control within a set range of levels
- indication when the conductivity of the liquid exceeds set limits.

The intrinsically-safe circuit [EEx ia] IIC also enables the probes to be used in explosion-hazardous area, Zone 0.

The limit switch is approved for use for overspill protection conforming to VAWS (§19 WHG). Approval pending for the limit switch to be used as an overspill protection system conforming to VbF.

The Measuring System

The measuring system consists of:

- the Nivotester FTW 520 Z
- one or two suitable probes
- control or signalling systems

Two probes and the two-point detection mode are recommended for limit detection of liquids with turbulent surfaces.

If the Nivotester FTW 520 Z is used for overspill protection to conform to VbF or WHG, then a maximum probe containing local electronics EW 11 Z is to be used for monitoring probe cable breakage.

Please refer to the certificate of conformity for probes and their use in explosion-hazardous areas.

Please refer to the IfBt test certificate for probes and their use as overspill protection conforming to VAWS.

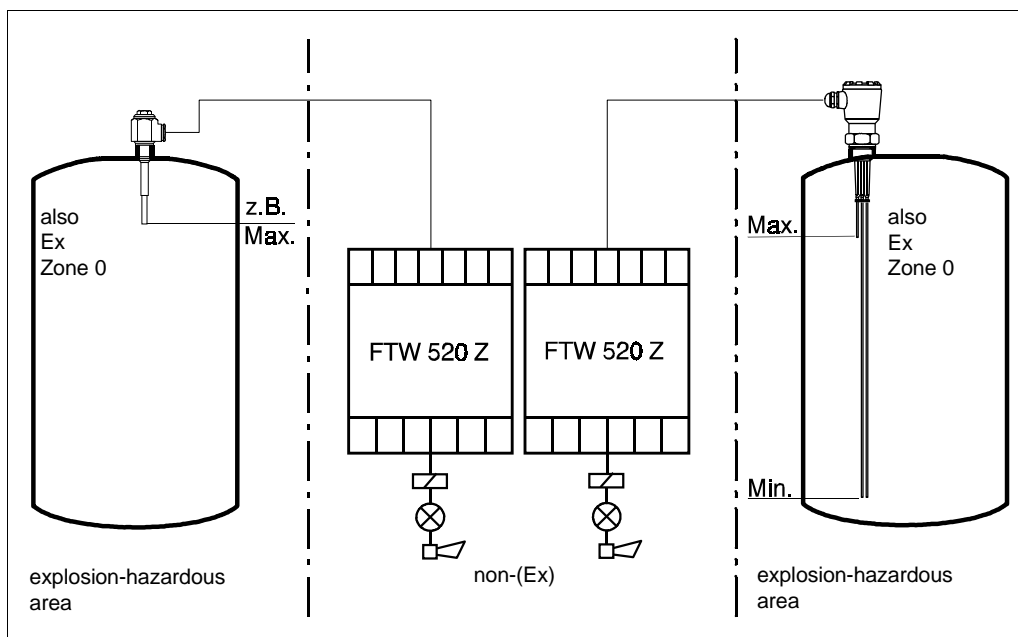


Fig. 2
 Left:
 The measuring system used for limit detection
 Right:
 The measuring system used for two-point control

Function

Level limit

The Nivotester supplies a small, load independent alternating current to the vessel over the input signal cable. The cable is connected both to the metal container or ground probe, and to the measuring probe.

As soon as electrically conductive material touches the measuring probe, then a voltage drop occurs which is amplified and used to activate the relay in the Nivotester.

Two-point control

With two-point control, the Nivotester switches in parallel from the minimum probe to the maximum probe when the maximum level is reached. It then switches to the minimum probe from the maximum probe when the minimum level is reached.

This gives two-point control with just *one* limit switch.

Fail-safe mode

In **maximum** fail-safe mode, or overspill protection, the relay de-energises,

- when the measuring probe for maximum level is in contact with the material
- when the cable between the Nivotester and probe is short-circuited,
- when the cable between the Nivotester and probe is broken
(only if local electronics EW 11 Z for cable monitoring are contained in the probe)

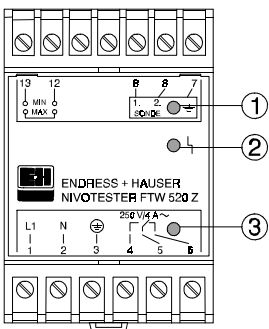
In **minimum** fail-safe mode, the relay de-energises,

- when the material no longer contacts the probe,
- when the cable between the Nivotester and probe is broken.

The relay also de-energises if the power fails.

Function displays

- ① The green LED for «**standby**» shows that a power supply is connected and that the fine-wire fuse is not defective.
- ② The red LED for «**fault**» lights up with cable monitoring if the cabling to a probe containing local electronics is broken.
- ③ The red LED for «**level alarm**» lights up if the upper limit is overstepped in maximum fail-safe mode or the lower limit is understepped in minimum fail-safe mode and the output relay is de-energised.
It also lights up on fault.
























































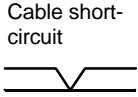



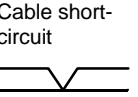



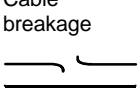




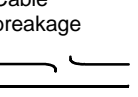








Maximum fail-safe mode			Minimum fail-safe mode		
with jumper 			without jumper 		
Single-point level detection			Single-point level detection		
Level	Relay contact	LEDs	Level	Relay contact	LEDs
		 green			 green
 full		 green  red	 empty		 green  red
Two-point detection			Two-point detection		
		 green			 green  red
		 green			 green  red
 full		 green  red	 full		 green  red
		 green  red			 green  red
 empty		 green	 empty		 green  red
Faults			Faults		
Cable short-circuit	 	 green  red	Cable short-circuit	  no alarm	 green  red
Cable breakage	 	 green  red  red	Cable breakage	 	 green  red  red
with cable monitoring only					
Power failure			Power failure		

Fig. 3
Function of relay and LEDs for level and fail-safe switching mode

Technical Data

Design

- Housing: row housing (MINIPAC format) in plastic
- Mounting: on standard rail conf. to EN 50022-35 x 7.5 or EN 50022-35 x 15
- Protection conf. to DIN 40050: Housing IP 40, Terminals IP 20

Permissible ambient temperatures

- Single mounting: -20 °C...+60 °C
Row mounting without side spacing: -20 °C...+50 °C
- In protective housing (2 units): -20 °C...+40 °C
- Storage temperature: -25°C...+85°C

Electrical connection

- Terminals: removable terminal blocks, non-interchangeable, 6-pole, 7-pole
- Max. wire diameter: 1x0.5 mm² to 1x2.5 mm² or 2x0.5 mm² to 2x1.5 mm²
- Power supply, AC: 220 V -10% to 230 V +10%, 50/60 Hz 240 V, 127 V, 115 V, 110 V, 48 V, 42 V, 24 V, each +15% -10%, 50/60 Hz 100 V, ±10%, 50/60 Hz
- Power consumption: approx. 3 VA

Signal input

- Protection: intrinsically-safe [Ex ia] II C, electrically isolated from output and from power supply.
- Probe connection: two-wire for limit detection, three-wire for two-point detection
- Measuring signal: trapezoidal superimposed AC, approx. 70 µA ... 1 mA
- Frequency: approx. 40 Hz
- Voltage: U_p: approx. 0.1 V...3.6 V

Electromagnetic compatibility

- Interference Emission to EN 61326, Electrical Equipment Class B
- Interference Immunity to EN 61326
- For general references to electromagnetic compatibility see TI 241F/00/en

Ordering key

FTW 520 Z Nivotester

Certificate

- A ATEX II (1) G, [Ex ia] IIC, WHG
- Y Special version

Version

- 0 Minipac, 50 mm, with detachable terminal block
- 1 Minipac, 50 mm, for flat plug
- 2 Weather proof Minipac, with terminal block
- 3 Weather proof Minipac, for flat plug
- 9 Special version

Power supply

- A 230 V AC, 50/60 Hz
- B 110 V AC, 50/60 Hz
- C 48 V AC, 50/60 Hz
- D 24 V AC, 50/60 Hz
- F 115 V AC, 50/60 Hz
- G 127 V AC, 50/60 Hz
- J 240 V AC, 50/60 Hz
- K 42 V AC, 50/60 Hz
- L 100 V AC, 50/60 Hz
- Y Special version

Output

- 0 1 relay, volt-free SPDT
- 9 Special version



Order code

Calibration ranges

- I: approx. 100 Ω ... 700 Ω
- II: approx. 700 Ω ... 6 k Ω
- III: approx. 6 k Ω ... 50 k Ω overlapping
- Adjusting elements: 3 switches and one adjuster behind the front panel

Output

- Relay output: one potential-free change-over contact
- Switching consumption: max. 4 A, max. 250 V AC, max. 500 VA at cos φ ≥ 0.7
- Quiescent current fail-safe mode: for minimum or maximum, selectable
- Switching hysteresis: approx. 10% in Range I, approx. 5% in Range II and III; or determined by the difference in length between the maximum and minimum probes
- Temperature coefficient of the switchpoint: < 0.1% K
- Switching delay: < 1 s
- Function displays: 3 LEDs on the front panel for standby, fault, level alarm

Subject to modification

Nivotester FTW 520

- EC type-examination certificate: PTB 02 ATEX 2185
- WHG: Z-65.13-101

Probes

- EC type-examination certificate: TÜV 02 ATEX 1951 X
- WHG: Z-65.13-101

For certified applications, please note the special remarks in the certificates and governing regulations as well as the following instructions.



Certificates

Mounting

- Please compare the order code on the nameplate of your instrument with the order key on Page 6 in order to ensure that you are installing the correct instrument.
- Mount the Nivotester FTW...Z outside the explosion-hazardous area in a control panel or in a protective housing (accessory).
- Please also note the permissible ambient temperatures (see Technical Data) and the minimum distance between rows of instruments (Fig.4).

Nivotester FTW 520 Z

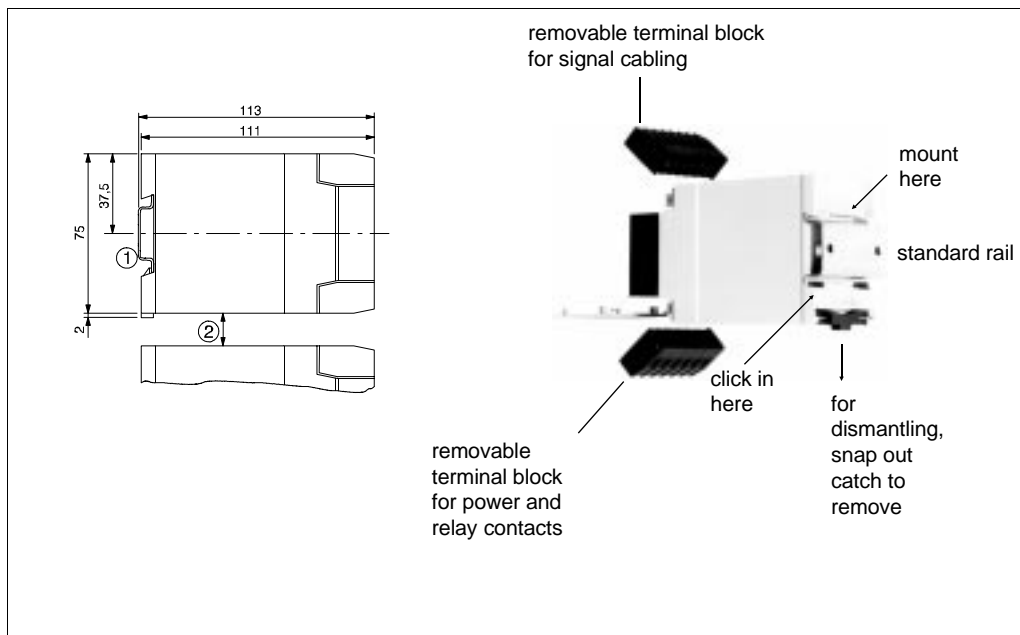


Fig. 4
 Left
 Dimension of the Nivotester FTW 520 Z in Minipac format
 Width of housing: 50 mm
 ① Mounted on standard rail 35 x 7.5 or 35 x 15
 ② Minimum interval between the bottom edge and top edge of next row of instruments:
 For probes used in explosion-hazardous area, min. 50 mm
 For probes used in non-explosion-hazardous area, min. 25 mm.

Fig.4
 Right
 Nivotester FTW...Z, mounting, dismantling

Please refer to the mounting recommendations in the Technical Information brochures for the probes and the remarks given in the certificates.

Probes

Connection

The Nivotester must only be connected up by trained personnel who also have the necessary experience in installing instruments in explosion-hazardous areas.

Connecting the probes

Standard screened installation cable may be used for the connecting cable to the probe. Ground the screening at both ends. If this is not possible, then at the probe end only.

Two cores are required for limit detection; three cores for two-point control. The maximum permissible values for the cable resistance R_L , the cable capacitance C_L and, therefore, cable length L are dependent on the set value R_M .

For R_L :

Range I ($R_M < 700 \Omega$)
 R_L max. $12.5 \Omega/\text{core}$

Range II and III ($R_M > 700 \Omega$)
 R_L max. $25 \Omega/\text{core}$

For C_L and L with cable monitoring:

Range I and II ($R_M < 6 \text{ k}\Omega$)
 C_L max. 50 nF , L_{max} . 500 m

Range III ($R_M > 6 \text{ k}\Omega$)
 C_L max. 30 nF , L_{max} . 300 m

When using the probe in the explosion-hazardous area:



Please note the regulations governing explosion protection regarding the type and laying out of intrinsically-safe signal cabling!

Please refer to Fig. 5 for main connections

Please refer to the particular Technical Information brochures when connecting special probes, e.g. double or triple rod probes.

After connection, ensure that the cover and cable gland are tight.

Selecting the fail-safe mode

- Minimum fail-safe: without jumper 12/13
 - Maximum fail-safe: with jumper 12-13
- For function see Fig. 3 on Page 5

The fail-safe mode is part of the intrinsically-safe circuit.

Only a short insulated jumper is to be used.

Ensure that the screws are tight so that the jumper cannot become loose!

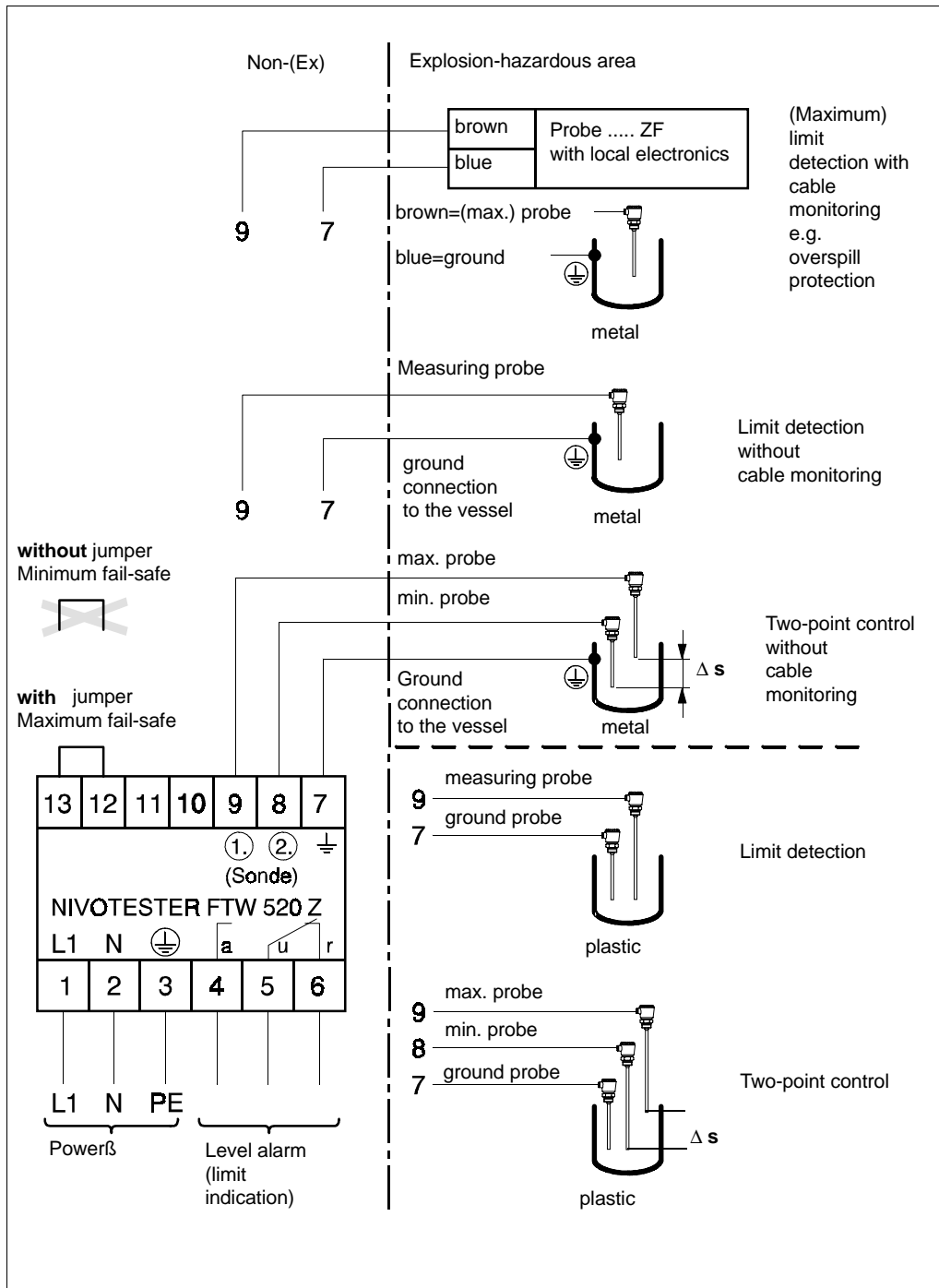


Fig. 5
Connecting the Nivotester FTW 520 Z with the main probe connections
Above:
when used in metal tanks
Below:
when used in plastic tanks

Please note the maximum switching capacity of the potential-free relay contact and the function of the level limit switch Nivotester FTW...Z regarding the fail-safe mode and the level. See Fig. 3 on Page 5.

Note:

The power supply and the potential-free change-over contact are isolated from one another so that one circuit can be operated at maximum permissible voltage while the other is operating with a safe functional low voltage.

Connecting control and signal systems

Connecting the power supply



Before connection, ensure that the power supply used agrees with the specifications given on the nameplate of the Nivotester FTW...Z.

A fine-wire fuse is integrated into the unit so that no fine-wire fuse is required for the power cable.

Note: The ground cable connection Terminal 3 is *not* connected to the probe ground connection Terminal 7 (electrically isolated).

Switching over the power supply

If you have a Nivotester FTW 520 Z for power supply 220 V, 230 V, or 240 V, or one for 110 V, 115 V or 127 V, then the instrument can be simply adapted to the power voltage:

- ① Remove the terminal blocks (Points a and b)
 - ② Open the front panel (Points c and d)
 - ③ Remove the unit from the housing: Grasp the instrument by the black plastic at the top and the bottom of the instrument and pull it firmly towards you.
 - ④ Reposition the jumper to suit the power supply used.
The fine-wire fuse does not have to be changed.
- Reassemble the instrument
 - Change the power supply specifications on the nameplate

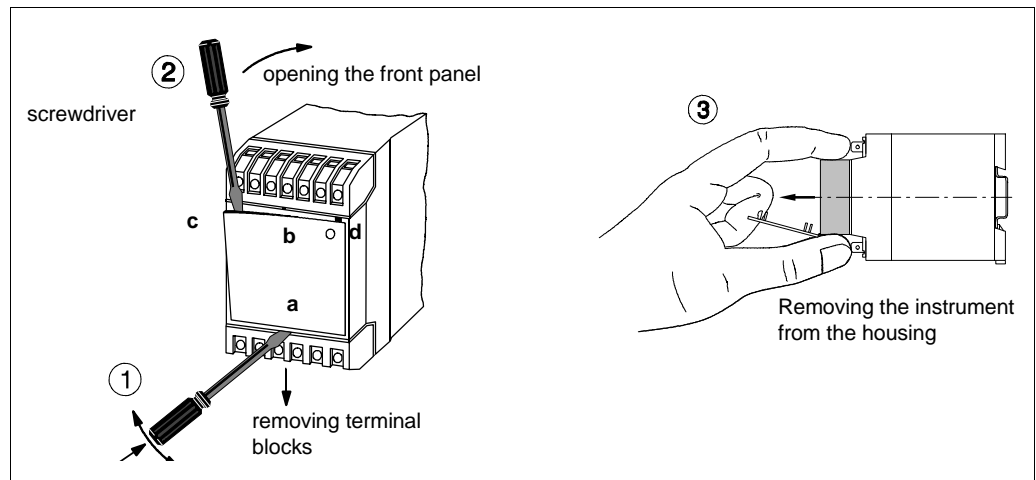


Fig. 6
Opening the instrument

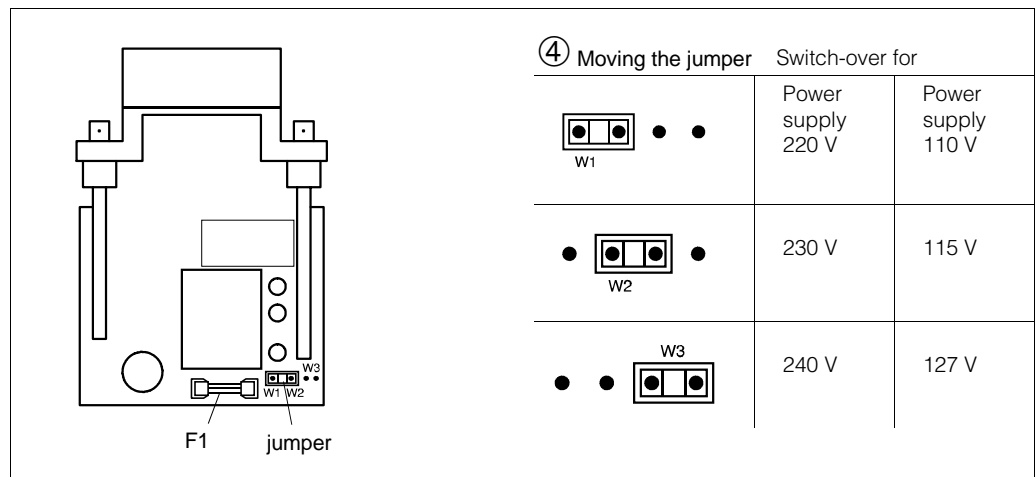


Fig. 7
Adjusting the instrument to the power supply

Fine-wire fuse F1
 50 mA time-lag fuse for 220/230/240 V
 80 mA time-lag fuse for 110/115/125 V
 80 mA time-lag fuse for 100 V
 200 mA time-lag fuse for 48 V
 250 mA time-lag fuse for 42 V
 500 mA time-lag fuse for 24 V

Calibration

Calibration, preliminary work

- Switch on the power supply to the Nivotester. In order to prevent any unwanted control sequences, turn off any control instruments connected until the Nivotester is calibrated.
- The adjusting elements are found behind the hinged front panel
To open the front panel, refer to Fig. 8

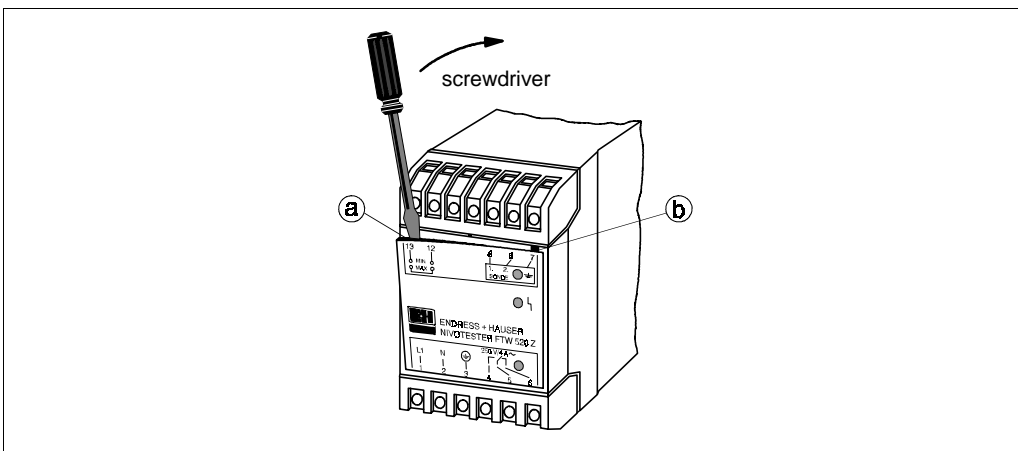


Fig. 8
Opening the front panel

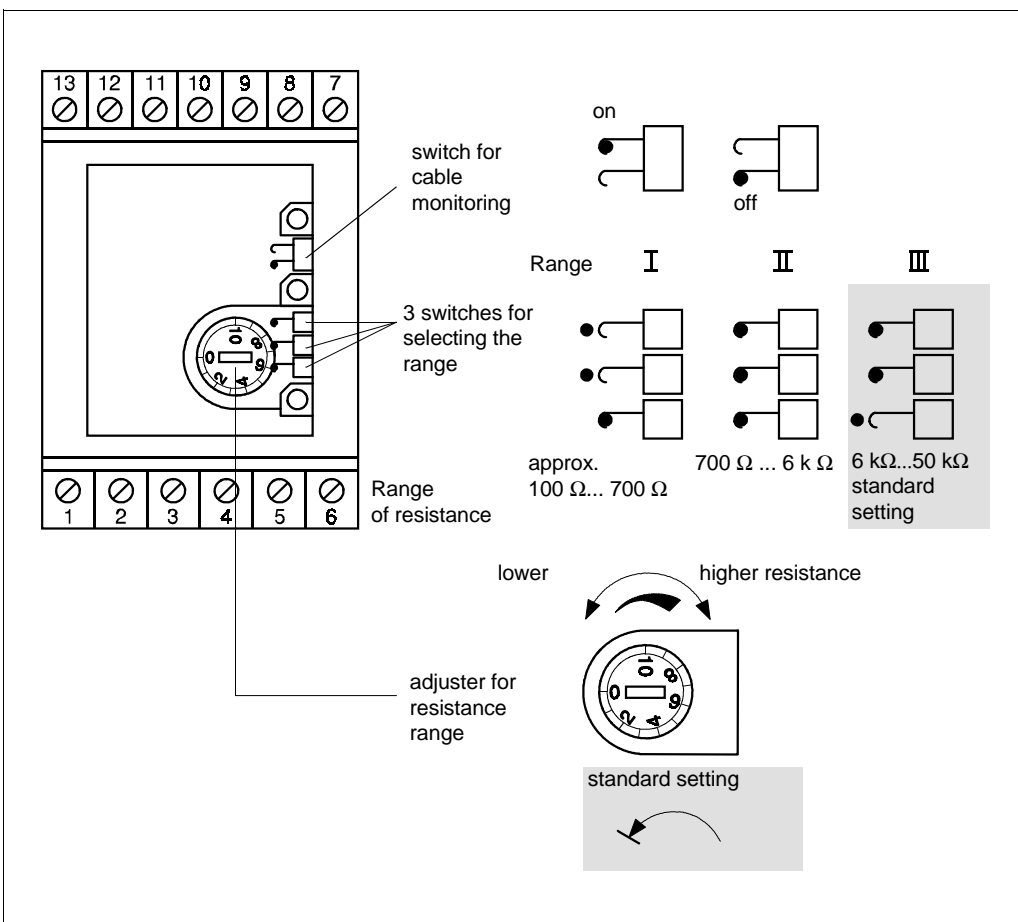
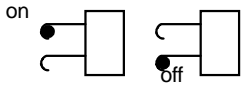


Fig. 9
Adjusting elements and
standard setting

Calibration and adjustment

Switching on and off cable monitoring

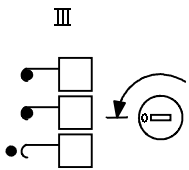


Switch on the cable monitoring mode only if a probe containing local electronics is connected (Probe ... ZF or probe with the electronic insert EW 11 Z).

Switch off the cable monitoring mode if no local electronics is in the probe otherwise the Nivotester will indicate a fault.

Selecting the adjustment range

The adjustment (resistance) range is determined by the application.



- For **limit detection** it is essential that the Nivotester can clearly distinguish between two resistance values:
the lower value when the active part of the probe is in contact with the liquid in the tank,
the higher value when the probe is free although the insulation is still moist.

- Standard adjustment:
Range III
Turn the adjuster anti-clockwise as far as it will go

The Ranges II or I are mainly used with good conductive liquids which form a conductive layer on the probe insulation.

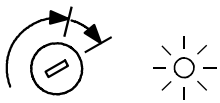
- For **monitoring the conductivity** of a liquid to indicate a concentration limit value:
the switchpoint is first determined at calibration.

Adjusting the resistance for limit or two-point detection

- Fill the tank to the switchpoint (probe tip 1 covered)
– Probe 1 is the (max.) probe connected to Terminal 9 – .
- Carry out standard adjustment (= factory-set - check:
Range III; the adjuster is turned in an anti-clockwise direction as far as it will go)
- Turn on the power supply

In **maximum fail-safe** (Jumper 12-13):

If the lower red LED lights up, then no further adjustment is required.



If it does not light up:

Turn the adjuster *slowly* in a clockwise direction until the LED lights up.
To ensure correct switching, turn an extra 1 division (30°) *.

In **minimum fail-safe** (No jumper 12/13):

If the lower red LED does not light up, then no further adjustment is required.



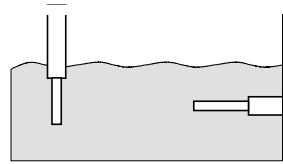
If it lights up:

Turn the adjuster *slowly* in a clockwise direction until the LED goes out.
To ensure correct switching, turn an extra 1 division (30°) *.

* A bit more if large variations in conductivity of the material are expected.

A bit less if a layer with good conductivity on the probe insulation is expected.

If a layer builds up with good conductivity during operation and the Nivotester does not switch correctly, then recalibrate with Range II or I.

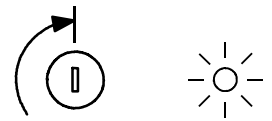
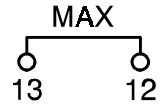


Adjusting the resistance for monitoring the concentration of a liquid

The active part of the probe must be fully covered

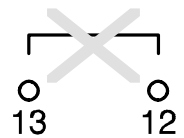
If the Nivotester is to switch at the **upper conductivity limit** (with low resistance):

- Select maximum fail-safe (jumper 12-13)
- Carry out a calibration when the liquid has maximum conductivity
- Select the range depending on the expected conductivity
- Turn the adjuster *slowly* in a clockwise direction starting from its most anti-clockwise position, until the lower red LED lights up.
- If adjustment is no longer possible, then select another range



If the Nivotester is to switch at the **lower conductivity limit** (with high resistance):

- Select minimum fail-safe (no jumper 12/13)
- Carry out a calibration when the liquid has minimum conductivity
- Select the range depending on the expected conductivity
- Turn the adjuster *slowly* in an anti-clockwise direction starting from its most clockwise position, until the lower red LED lights up.
- If adjustment is no longer possible, then select another range.



Function test

Please check correct switching of the Nivotester FTW 520 Z by raising and lowering the level over the switchpoint selected.

With cable monitoring in the probe only:
 Remove the upper terminal block on the Nivotester.
 All three LEDs must light up after approx. 1 s.
 Click in the terminal block.

After calibration and function test:
 Turn on the instruments which are connected to the Nivotester.

Level alarm

Fault indication

Replacing an Instrument

The Nivotester FTW 520 Z can be replaced without disconnecting the electrical cabling:



- Switch off the power supply and the voltage to the relay contact
- Remove terminal blocks, see Fig. 6 on Page 10
- Undo the catch on the bottom of the instrument housing by pulling it down with a screwdriver and then remove the Nivotester from the rail
See Fig. 4 on Page 7
- Mount the new instrument on the rail
- Push and click in terminal blocks
- Carry out adjustments as with the old instrument
- Due to the tolerances of individual components, a recalibration must be carried out on the Nivotester FTW 520 Z for monitoring the concentration limit value
- Carry out function test.

Supplementary Documentation

- Technical Information on the specific probe
- Technical Information for Minipac accessories (standard rail, protective housing)
- Certificate of conformity for the Nivotester FTW 520 Z
- IfBT check certificate for the Nivotester FTW 520 Z.

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Belorgsintez
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