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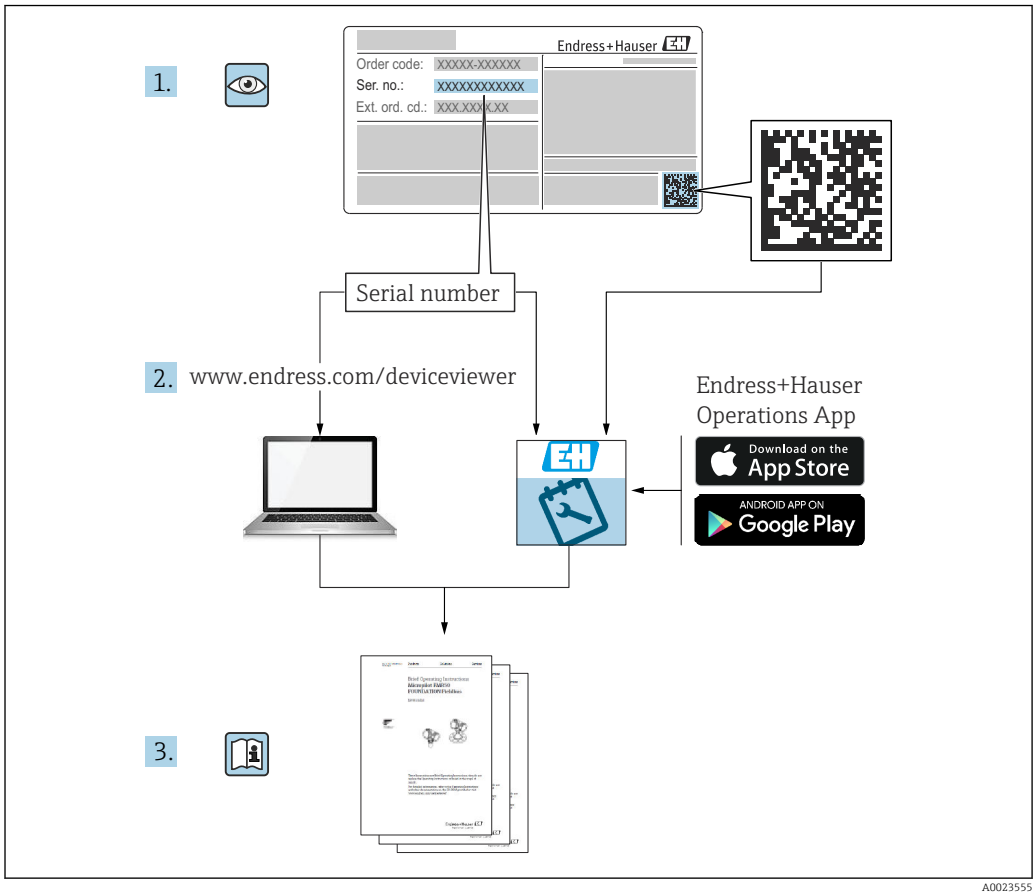
Operating Instructions
Nivotester FTC325 PFM

Capacitance
Level switch with intrinsically safe signal circuit for connection to capacitance sensors

Endress+Hauser
People for Process Automation



- Make sure the document is stored in a safe place such that it is always available when working on or with the device
- Avoid danger to individuals or the facility: read the "Basic safety instructions" section carefully, as well as all other safety instructions in the document that are specific to working procedures

The manufacturer reserves the right to modify technical data without prior notice. The Endress+Hauser sales organization will supply you with current information and updates to these instructions.

Table of contents

1 About this document

1.1 Purpose of this document

These Operating Instructions contain all the information that is required in the various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

1.2 Symbols

1.2.1 Safety symbols

⚠ DANGER
This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

⚠ WARNING
This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

⚠ CAUTION
This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in minor or medium injury.

NOTICE
This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

1.2.2 Electrical symbols

Output

Input

Fault

No fault

Relay
Switch that can be activated via a control circuit, which can switch other circuits.

Direct current

Alternating current

Limit signal

1.2.3 Light emitting diodes (LED)

LED not lit

LED lit

LED flashing

1.2.4 Tool symbols

Flat blade screwdriver

1.2.5 Symbols for certain types of information

Tip
Indicates additional information

Reference to page

Reference to documentation

Notice or individual step to be observed

1., 2., 3.
Series of steps

Result of a step

Visual inspection

1.2.6 Symbols in graphics

Permitted
Procedures, processes or actions that are permitted

Forbidden
Procedures, processes or actions that are forbidden

Reference to graphic

1., 2., 3.
Series of steps

Visual inspection

1, 2, 3, ...
Item numbers

A, B, C, ...
Views

Hazardous area

Safe area (non-hazardous area)

1.3 Documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

2 Basic safety instructions

2.1 Requirements for the personnel

The personnel must fulfill the following requirements to carry out their tasks, e. g. commissioning and maintenance:

- ▶ Trained specialists must have a qualification that is relevant to the specific function and task.
- ▶ Must be authorized by the plant owner/operator.
- ▶ Must be familiar with national regulations.
- ▶ Must have read and understood the instructions in the manual and supplementary documentation.
- ▶ Personnel must follow instructions and comply with general policies.

2.2 Intended use

- Use device only as a transmitter supply unit for level switches from Endress+Hauser with 2-wire PFM signal
- Incorrect use of the device may pose a hazard
- Use only tools that have been insulated against ground
- Only use original parts

2.2.1 Incorrect use

The manufacturer is not liable for damage caused by improper or non-designated use.

Deviating operating conditions impair safety. The correct functioning of the device cannot be guaranteed.

2.3 Workplace safety

For work on and with the device:

- ▶ Wear the required personal protective equipment according to federal/national regulations.

2.4 Operational safety

Damage to the device!

- ▶ Operate the device only if it is in proper technical condition, free from errors and faults.
- ▶ The operator is responsible for ensuring that the device is in good working order.

For applications requiring functional safety in accordance with IEC 61508 (SIL), see the Functional Safety Manual. For WHG applications, see the associated WHG documents.

Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers:

- ▶ If modifications are nevertheless required, consult with the manufacturer.

Repair

To ensure continued operational safety and reliability:

- ▶ Only perform repair work on the device if this is expressly permitted.
- ▶ Observe federal/national regulations pertaining to the repair of an electrical device.
- ▶ Use original spare parts and accessories from Endress+Hauser only.

Hazardous area

NOTICE

To eliminate the risk of danger to persons or the facility when the device is used in the approval-related area (e.g. explosion protection, pressure equipment safety):

- ▶ Check the nameplate to verify if the device ordered can be put to its intended use in the hazardous area.
- ▶ Observe the specifications in the separate supplementary documentation included as an integral part of these instructions.

2.5 Product safety

This state-of-the-art device is designed and tested in accordance with good engineering practice to meet operational safety standards. It left the factory in a condition in which it is safe to operate.

It meets general safety standards and legal requirements. It also complies with the EU directives listed in the device-specific EU declaration of conformity. The manufacturer confirms this by affixing the CE mark.

2.6 IT security

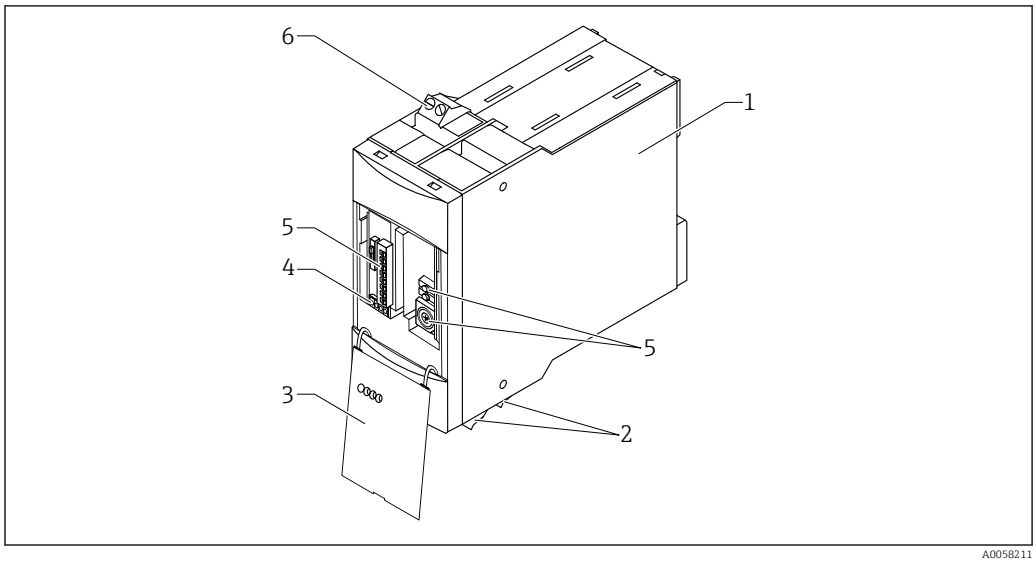
We only provide a warranty if the device is installed and used as described in the Operating Instructions. The device is equipped with security mechanisms to protect it against any inadvertent changes to the device settings. IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

3 Product description

Level switch with 2-wire PFM signal:

- With intrinsically safe signal circuit for connection to capacitance sensors
- Point level measurement in liquid tanks and bulk solids silos, also in hazardous areas

3.1 Product design



1 *Product design*

1 *Housing*
2 *Bottom terminal blocks*
3 *Front panel can be opened out*
4 *LEDs*
5 *Operating elements*
6 *Top terminal block*

4 Incoming acceptance and product identification

4.1 Incoming acceptance

On receipt of the delivery:

1. Check the packaging for damage.
   ↳ Report all damage immediately to the manufacturer.
   Do not install damaged components.
2. Check the scope of delivery using the delivery note.
3. Compare the data on the nameplate with the order specifications on the delivery note.
4. Check the technical documentation and all other necessary documents, e.g. certificates, to ensure they are complete.

If one of the conditions is not satisfied, contact the manufacturer.

4.2 Product identification

The following options are available for identification of the device:
- Nameplate specifications
- Extended order code with breakdown of the measuring instrument features on the delivery note

- *Device Viewer*(www.endress.com/deviceviewer); manually enter the serial number from the nameplate.
  ↳ All the information about the measuring device is displayed.
- *Endress+Hauser Operations app*; manually enter the serial number indicated on the nameplate or scan the 2D matrix code on the nameplate.
  ↳ All the information about the measuring device is displayed.

4.2.1 Nameplate

Do you have the correct device?

The nameplate provides you with the following information on the device:
- Manufacturer identification, device designation
- Order code
- Extended order code
- Serial number
- Tag name (TAG) (optional)
- Technical values, e.g. supply voltage, current consumption, ambient temperature, communication-specific data (optional)
- Degree of protection
- Approvals with symbols
- Reference to Safety Instructions (XA) (optional)

- Compare the information on the nameplate with the order.

4.2.2 Manufacturer address

Endress+Hauser SE+Co. KG
Hauptstraße 1
79689 Maulburg, Germany
Place of manufacture: See nameplate.

4.3 Storage and transport

4.3.1 Storage conditions

- Use the original packaging
- Store the device in clean and dry conditions and protect from damage caused by shocks

Storage temperature

–25 to +85 °C (–13 to +185 °F), preferably 20 °C (68 °F)

4.3.2 Transporting the device to the measuring point

Transport the device to the measuring point in the original packaging.

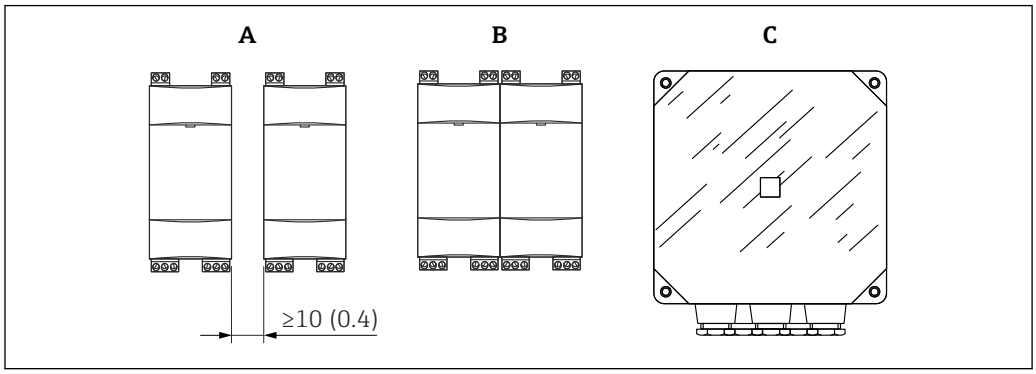
5 Installation

5.1 Installation requirements

The device must be housed in a cabinet or protective housing outside the hazardous area.

Mount the device so that it is protected against weather and impact:
- If you are operating the device outdoors and in warmer climates, avoid direct sunlight
- A protective housing (IP66) is available for outdoor installation, for up to 2 devices

Take ambient temperature into account:



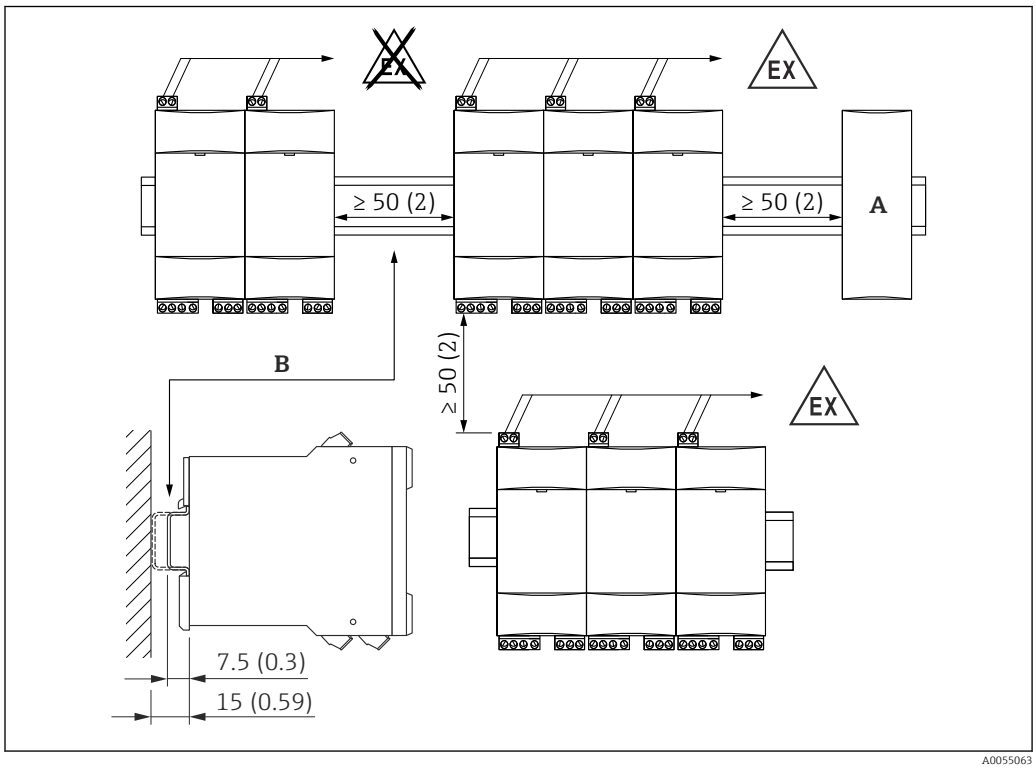
2 *Installing multiple devices. Unit of measurement mm (in)*

A Installing an individual device –20 to +60 °C (–4 to +140 °F)
B Side-by-side installation without lateral spacing –20 to +50 °C (–4 to +122 °F)
C Installation in protective housing –20 to +40 °C (–4 to +104 °F)

5.2 Installing the device

A horizontal installation ensures better dissipation of heat than a vertical orientation.

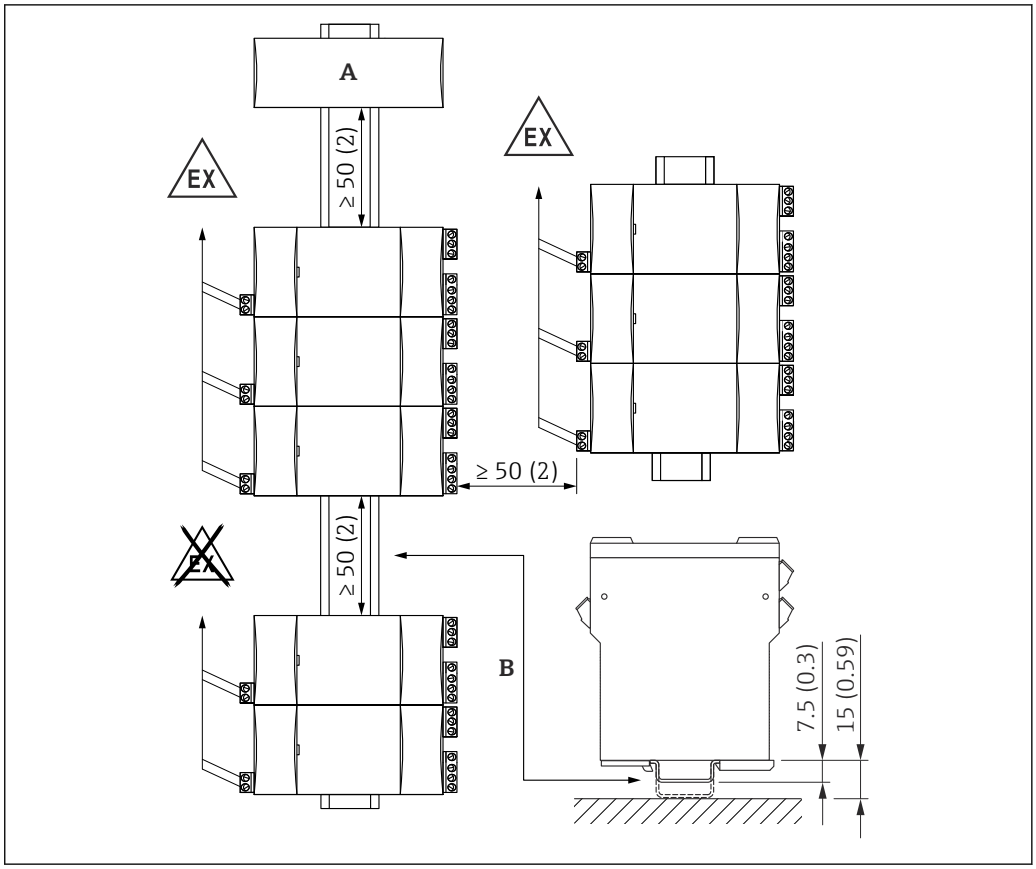
5.2.1 Horizontal orientation



3 *Minimum distance for horizontal orientation. Unit of measurement mm (in)*

A Connection of another device type
B DIN rail in accordance with EN 60715 TH35-7.5/15

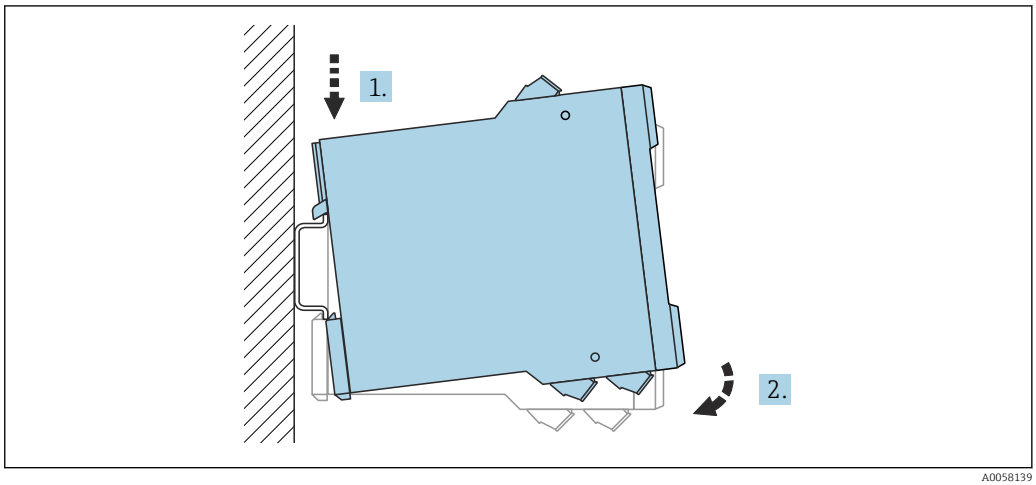
5.2.2 Vertical orientation



4 *Minimum distance for vertical orientation*

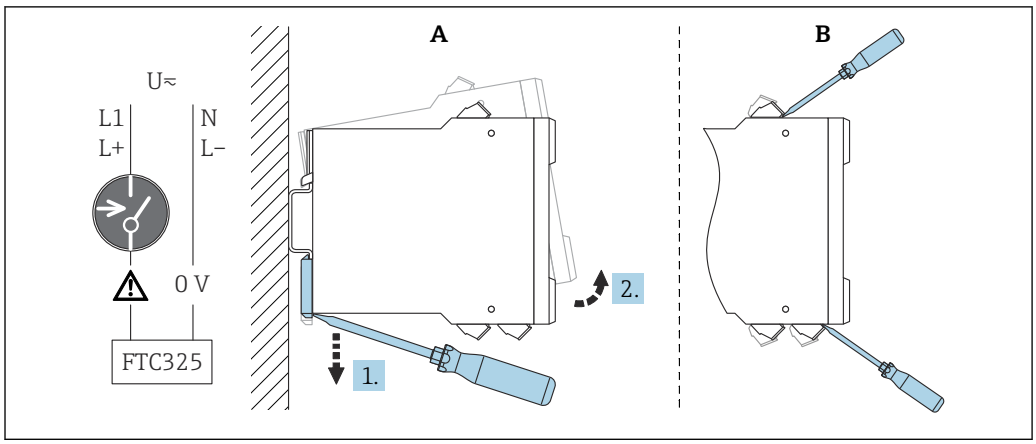
A Connection of another device type
B DIN rail in accordance with EN 60715 TH35-7.5/15

5.2.3 Mounting the device on the DIN rail



5 *Mounting on DIN rail according to EN 60715 TH35-7.5/EN 60715 TH35-15*

5.2.4 Removing the device from the DIN rail



6 *Removing from DIN rail*

A Removing the device from the DIN rail
B For quick replacement of devices without cable replacement, remove the terminal blocks

5.3 Post-installation check

❑ Is the device undamaged (visual inspection)?

❑ Is the device properly secured?

❑ Does the device meet the measuring point specifications?

For example:
- Supply voltage
- Ambient temperature

❑Are the measuring point identification and labeling correct (visual inspection)?

❑ Is the measuring instrument adequately protected against precipitation and direct sunlight?

6 Electrical connection

Observe the specifications on the nameplate of the device.

6.1 Connecting requirements

WARNING

If the device is not connected properly, personal injury and explosion may occur due to limited electrical safety.

- Comply with applicable national standards.
- Comply with the specifications in the Safety Instructions (XA).
- Check to ensure that the power supply matches the information on the nameplate.
- Switch off the supply voltage before connecting.
- When connecting to the public mains, install a mains switch for the device such that it is within easy reach of the device. Mark the switch as a disconnector for the device (IEC 61010).

6.2 Connecting the device

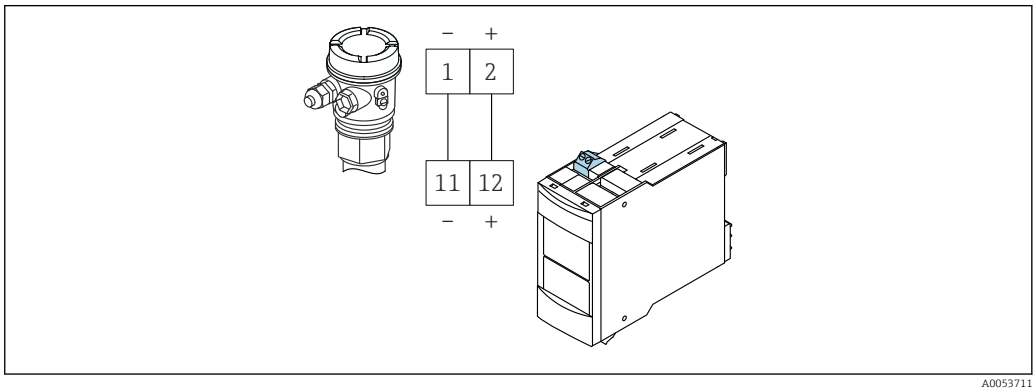
WARNING

Risk of electric shock from contact with live components! This may result in burns and injuries due to startle responses.

- Switch off the supply voltage before connecting the device.

The removable terminal blocks are color-coded into intrinsically safe and non-intrinsically safe terminals. This difference helps to ensure safe wiring.

6.2.1 Connecting the sensor



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7 *Connecting the power supply to any sensor*

Connectable sensors and electronic insert FEI57S:

- Liquicap M FTI51, FTI52
- Solicap M FTI55, FTI56
- Solicap S FTI77

Blue terminal blocks at top for hazardous area
- Two-wire connection cable between the Nivotester and sensor, e.g. commercially available installation cable or wires in a multi-core cable for measurement purposes
- Use a shielded cable in the event of strong electromagnetic interference, e.g. from machines or radio equipment
  Only connect the shield to the grounding terminal in the sensor. Do not connect it to the Nivotester

If the sensor's electronic insert has been replaced, a recalibration must be carried out.

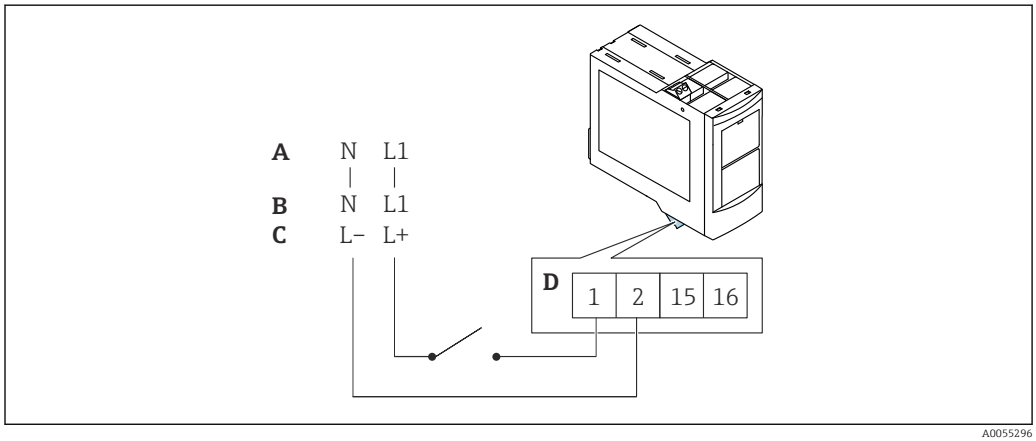
6.2.2 Connecting the signal and control systems

Lower, grey terminal blocks for non-hazardous areas
- Observe relay function depending on the level and safety mode.
- If a high-inductance device is connected (e.g. contactor, solenoid valve etc.), a spark arrester must be provided to protect the relay contact

6.2.3 Connecting the supply voltage

Bottom, green terminal blocks

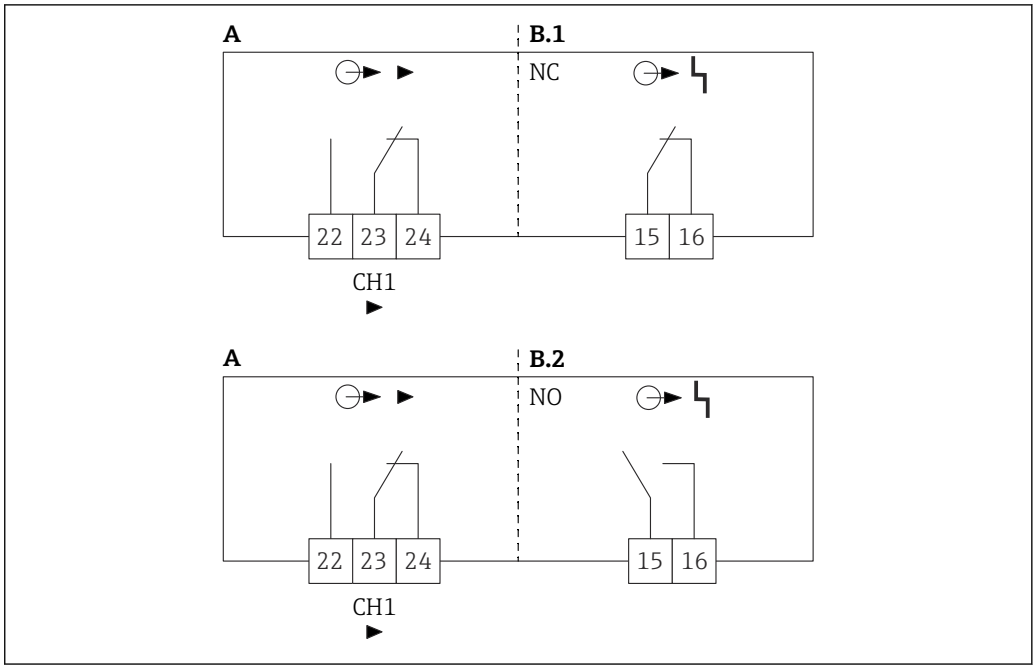
A fuse is integrated into the power supply circuit. An additional fine-wire fuse is not necessary. The device is equipped with reverse polarity protection.



8 Arrangement of terminals

A U ~ AC 85 to 253 V, 50/60 Hz
B U ~ AC 20 to 30 V, 50/60 Hz
C U ⎓ DC 20 to 60 V
D 1.5 mm² (16 AWG) maximum

6.2.4 Connecting the outputs



9 *Connecting the outputs*

A Level, limit signal
B1 Fault, NC alarm (normally-closed contact)
B2 Fault, NO alarm (normally-open contact)

6.3 Post-connection check

❑ Is the device or cable undamaged (visual inspection)?

❑ Do the mounted cables have adequate strain relief?

❑ Does the supply voltage match the specifications on the nameplate?

❑ No reverse polarity, is terminal assignment correct?

❑ Do the cables used comply with the requirements?

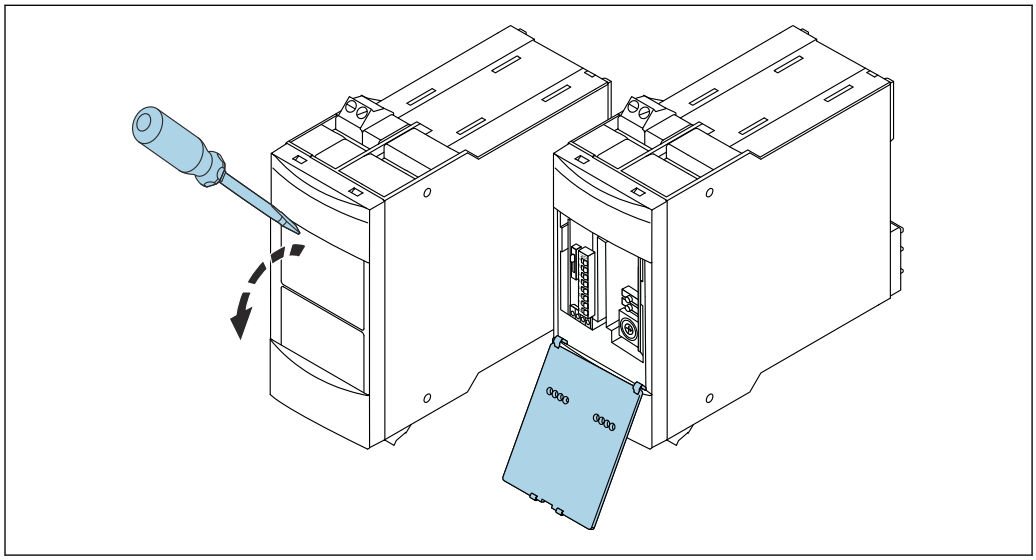
❑If necessary, has a protective ground connection been established?

❑If supply voltage is present, is the device operational and does a screen appear?

7 Operation options

7.1 Overview of operation options

7.1.1 Opening the front panel



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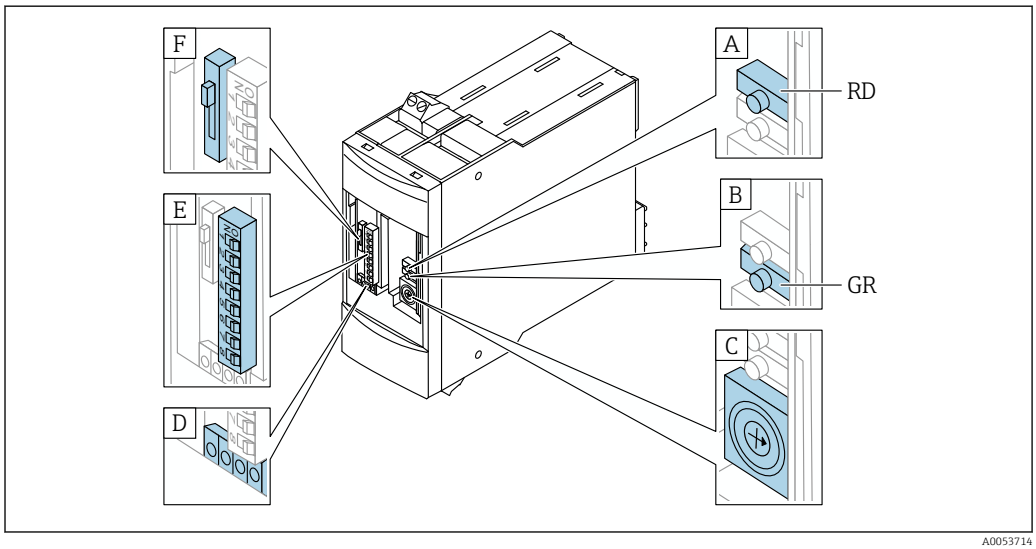
10 *Opening the front panel*

7.1.2 Operating elements



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A Calibration button (red)
B Test and correction key (green)
C Control dial for switch point shift for buildup compensation (16-stage)
D LEDs
E DIP switch
F Switch for calibration mode (probe covered or uncovered)

7.1.3 Calibration button (red)

Automatic calibration at the touch of a button
For maximum detection (MAX) and minimum detection (MIN)

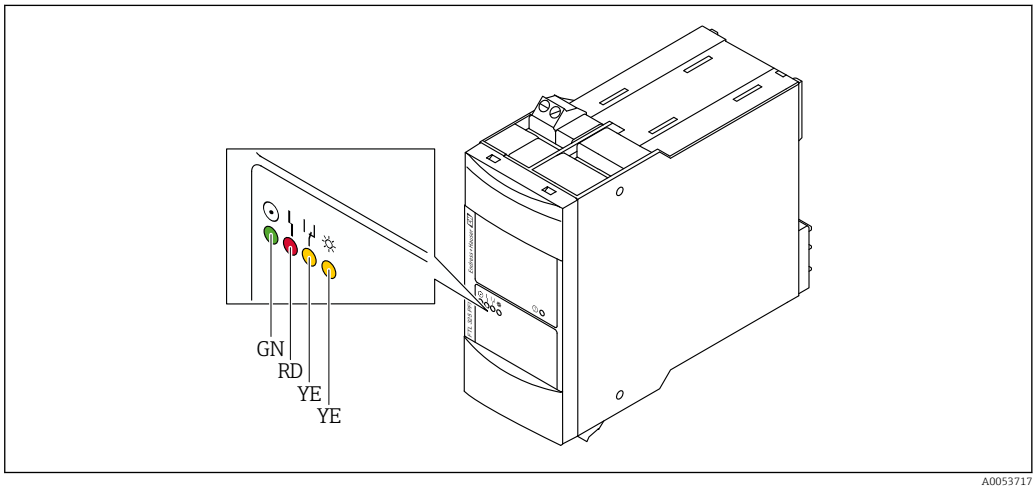
7.1.4 Test and correction key (green)

- Controls the functionality of the output and fault-signaling relay
- Confirms a change in the operating mode, e.g., if the switching delay changes after initial calibration. This corrects the operating mode without the need to perform a recalibration
- Saves changed settings at the touch of a button

7.1.5 Control dial for switch point shift for buildup compensation

- Ensures system operation with media that form buildup
- Adjustable in 16 stages depending on buildup

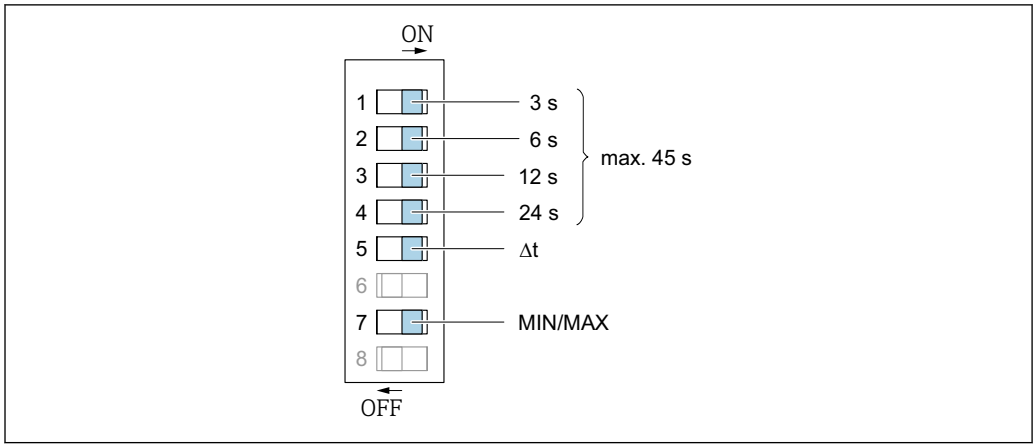
7.1.6 LED indicator



11 *LEDs*

GN Green → Operation
RD Red → Fault
YE Yellow → Relay switch status

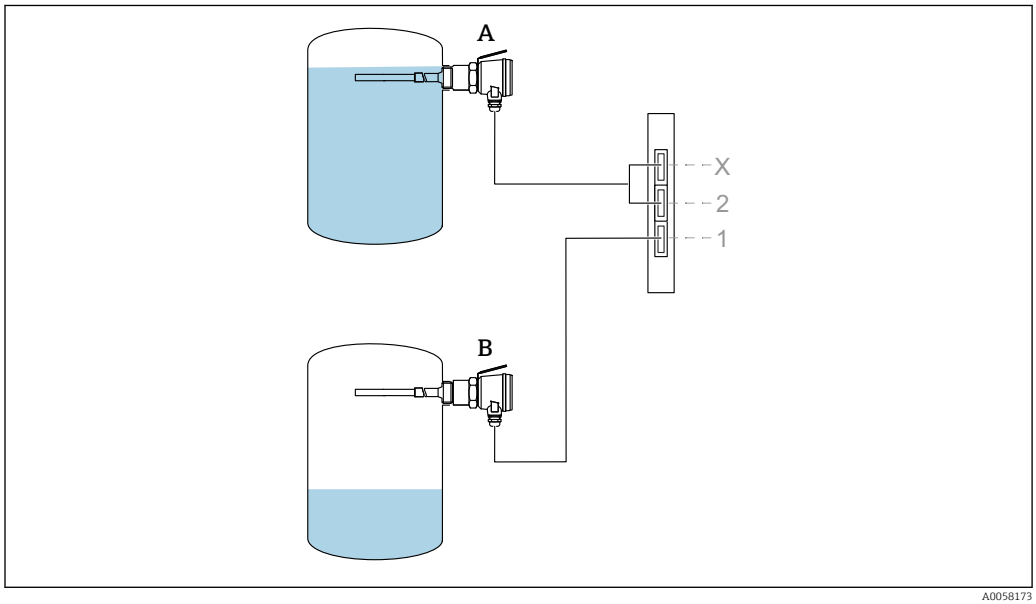
7.1.7 DIP switch



12 *DIP switch*

1 Switching delay 3s if DIP switch is set to ON
2 Switching delay 6s if DIP switch is set to ON
3 Switching delay 12s if DIP switch is set to ON
4 Switching delay 24s if DIP switch is set to ON
5 Delay when the probe is uncovered or covered
6 No function
7 Minimum or maximum detection (DIP switch OFF = MIN; DIP switch ON = MAX)
8 No function

7.1.8 Configuring the calibration mode



13 *Calibration mode switch positions*

A Probe covered: Middle or top switch position
B Probe uncovered: Bottom switch position

8 Commissioning

8.1 Post-installation and function check

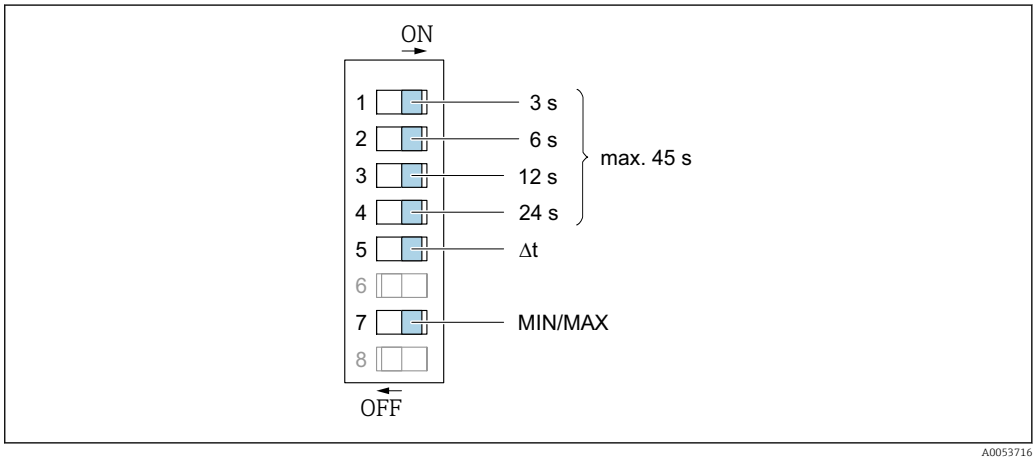
Before commissioning the measuring point, check whether the post-installation and post-connection checks have been performed.

Post-mounting check

Post-connection check

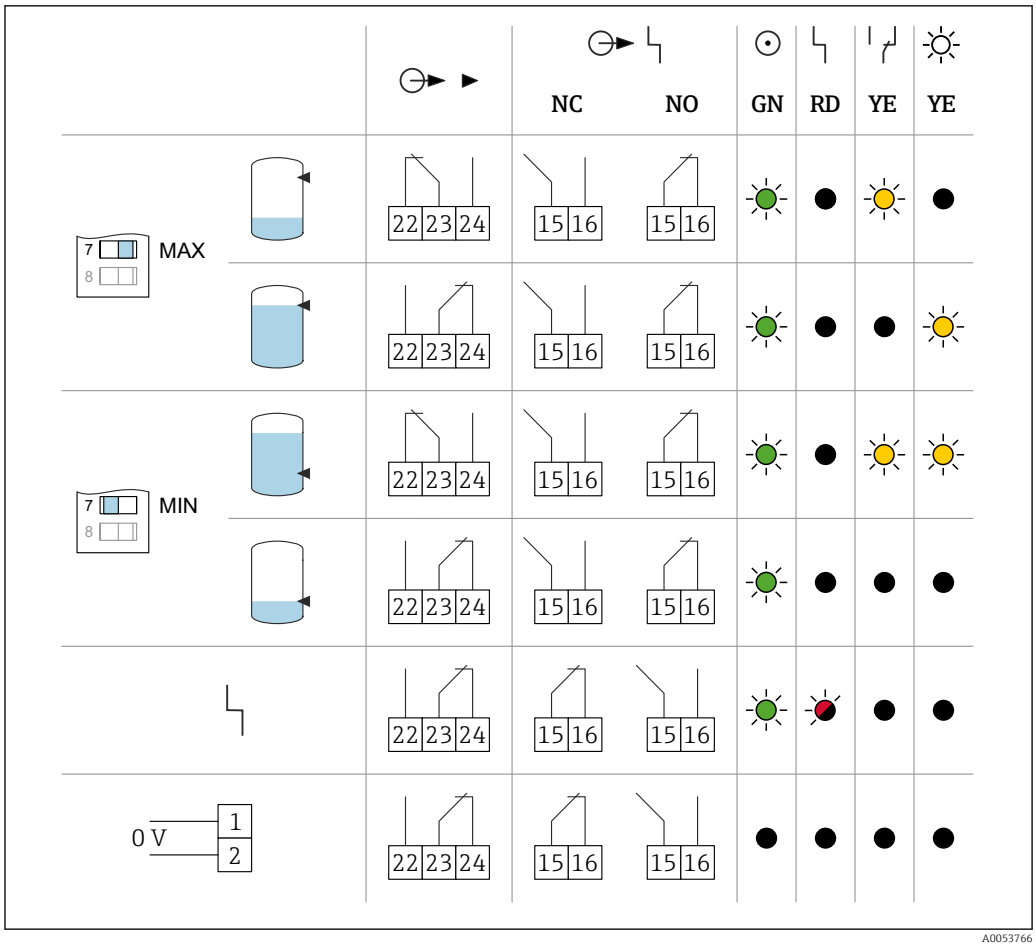
8.2 Select operating mode

Depending on the wiring of the outputs and setting of DIP switch 7, one of the following operating modes can be selected:
- Maximum detection (MAX) → overflow protection
- Minimum detection (MIN) → no-load protection



14 DIP switch for MIN/MAX setting

▶ Select the wiring of the outputs and setting of DIP switch 7 as per the desired operating mode.



15 *Possible safety modes as level alarm and fault message*

The current switch status is displayed by the LEDs on the device during operation. The LEDs do not light up when the power supply fails.

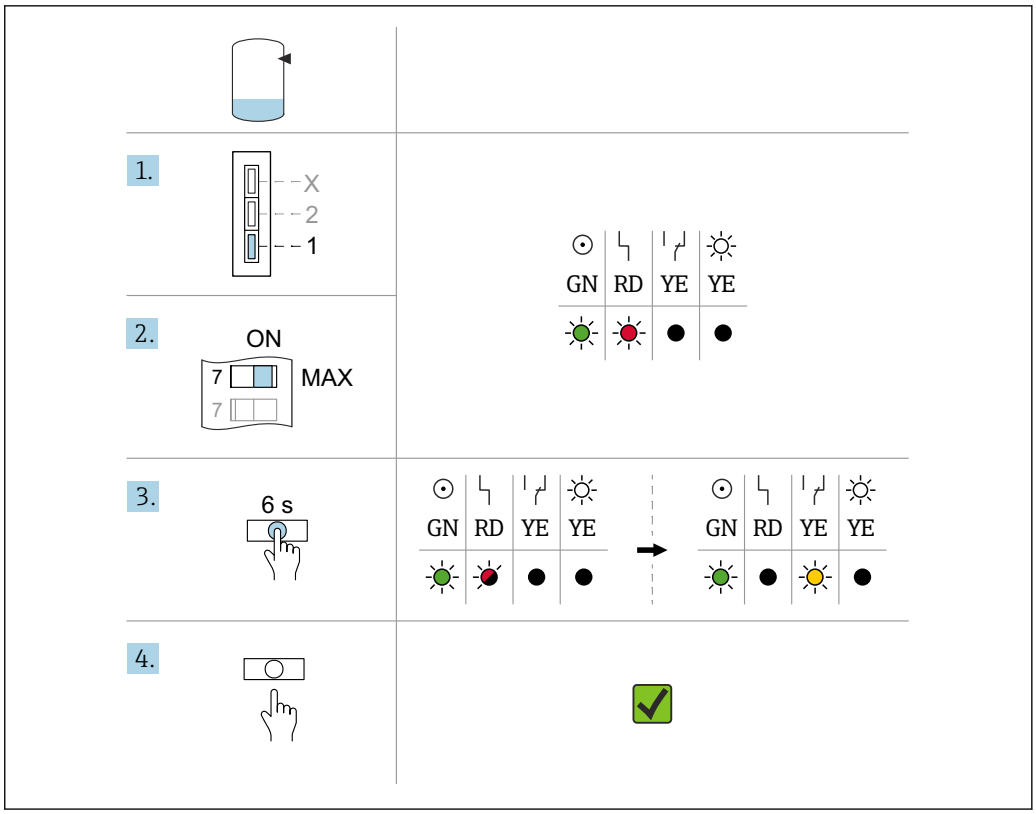
8.3 Calibration of MIN/MAX application

The device must be calibrated before commissioning for each new application.

1. Turn the control dial for switch point shift for buildup compensation (16 stages) to the left limit stop.
2. Select one of the following applications and carry out the steps shown. The displayed LED indicators are used to verify correct execution.

8.3.1 Calibration for MAX application

Ensure that the probe is not covered before calibration.

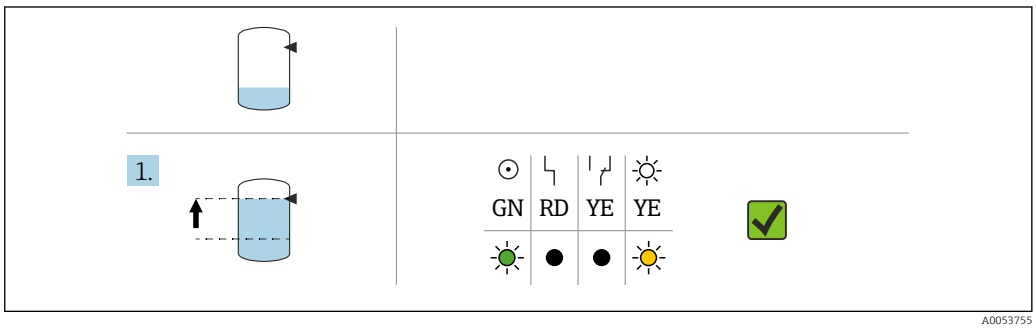


16 *Calibration for MAX application*

1. Set the calibration mode switch to position 1 (bottom).
2. Set DIP switch 7 to the ON position.
3. Press the calibration key (red) for 6 seconds.
   ↳ The LED indicator changes.
4. Release the calibration key (red) and check the LED status.

Checking after calibration for MAX application

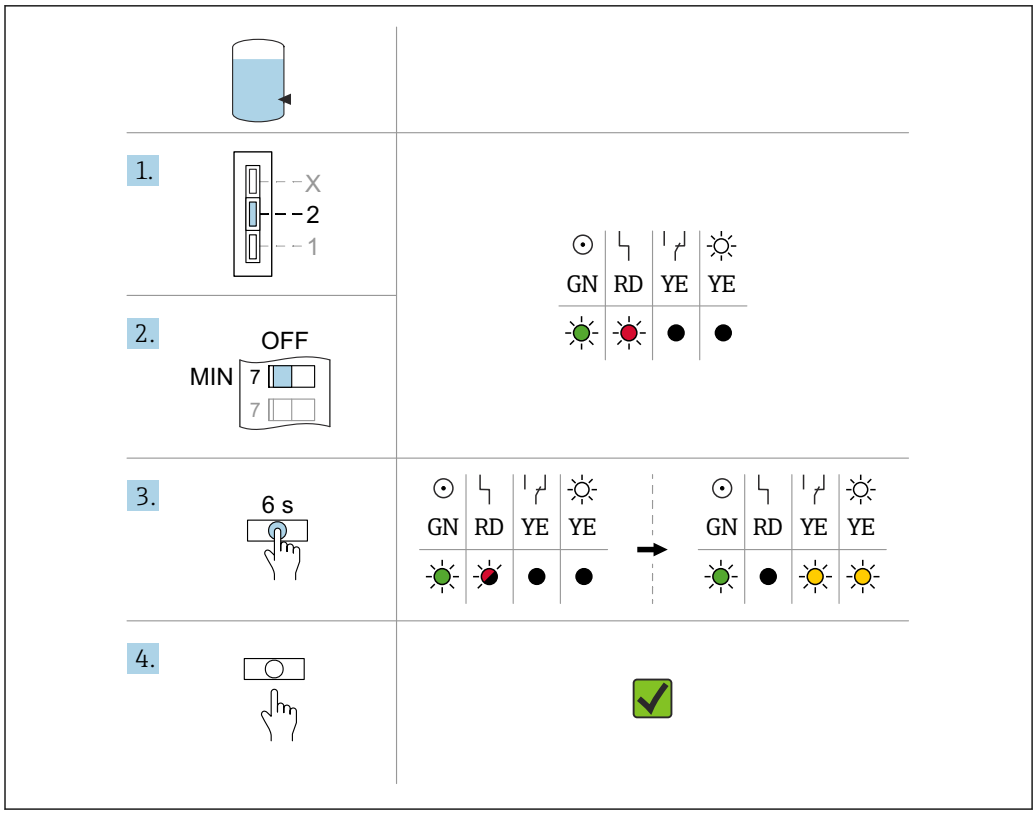
▶ Fill the container up to the top switch point.
↳ The LED indicator changes as soon as the top switch point is reached.



17 *Checking calibration*

8.3.2 Calibration of MIN application

Ensure that the probe is covered before calibration.

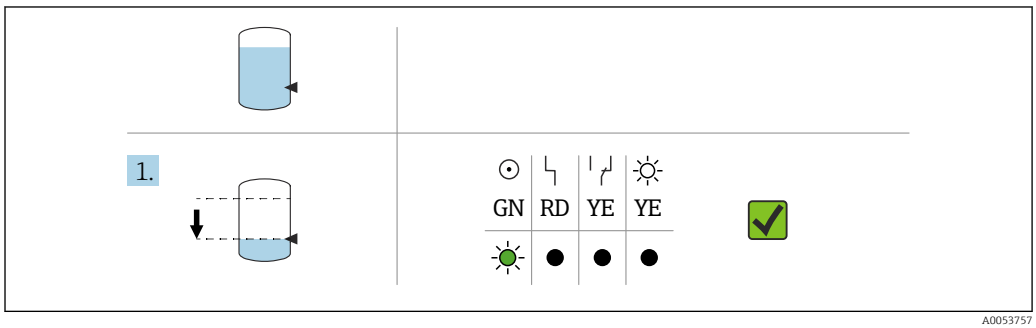


18 *Calibration for MIN application*

1. Set the calibration mode switch to position 2 (middle or top).
2. Set DIP switch 7 to the OFF position.
3. Press the calibration key (red) for 6 seconds.
   ↳ The LED indicator changes.
4. Release the calibration key (red) and check the LED status.

Check after calibration for MIN application

▶ Drain the container to the bottom switch point.
↳ The LED indicator changes as soon as the bottom switch point is reached.



19 *Checking calibration*

8.4 Setting the switching delay

A switching delay prevents the device from switching immediately if the sensor is in contact with the medium only briefly. This may occur in the following situations:
- Dispensers: Brief contact with syringes
- Wave-like motion of the liquid: Movement of the liquid, e.g., when the container is filled

Because of a switching delay, the sensor only sends the output signal after a preset time of a status change.

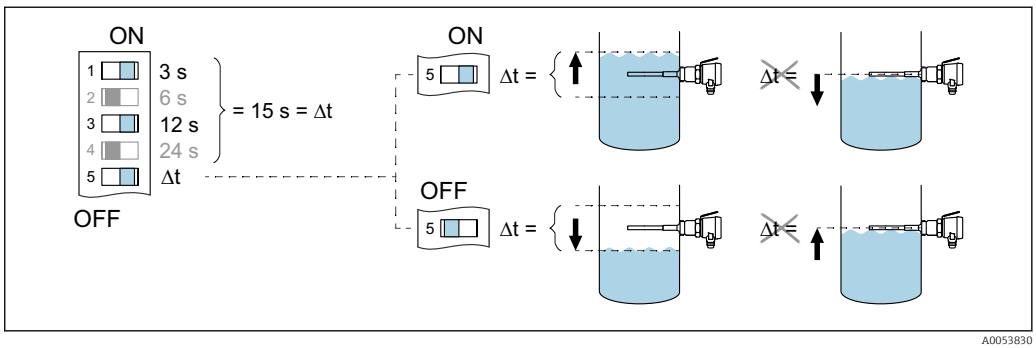
Carry out calibration first. See the "Calibration of MIN/MAX application" section.

DIP switches 1 to 4 can be used to set a time period (Δt 45 s maximum) as a switching delay.

DIP switch 5 is used to specify whether the sensor reports covered or uncovered with a delay.

Example of setting a switching delay to 15 s:

1. Set DIP switches 1 and 3 to ON.
2. Set DIP switches 2 and 4 to OFF.
3. Set DIP switch 5 to ON.
   ↳ Delayed switching of the relay when the probe is covered.
   or
4. Set DIP switch 5 to OFF.
   ↳ Delayed switching of the relay when the probe is uncovered.

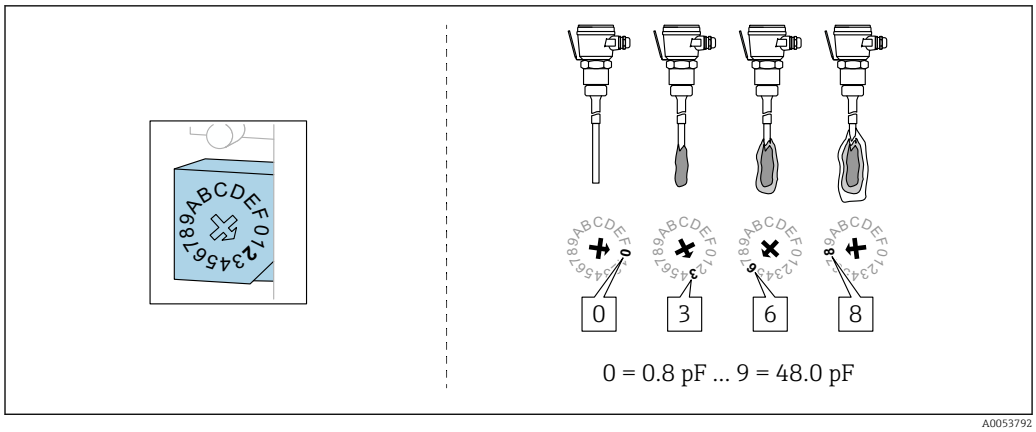


20 *Example of switching delay configuration*

8.5 Switch point shift for buildup compensation

If the switch point is shifted too far, the device can no longer switch. Pay attention to the shift limits!

The control dial must be at the left limit stop for calibration!



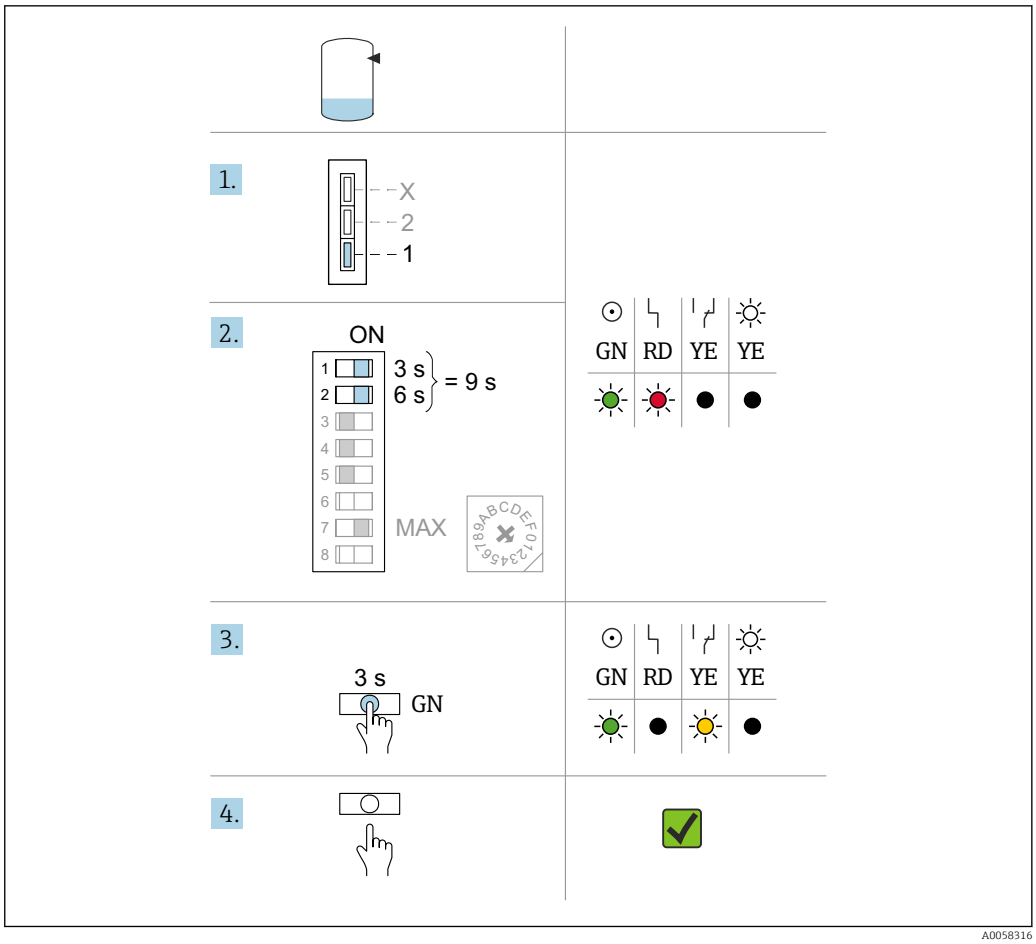
21 16-stage sensitivity setting

Control dial position and switch point shift for initial capacitance (CA) = 30 pF
- Maximum sensitivity: 0.8 pF
- Minimum sensitivity: 48 pF

Examples of products	εr	Conductivity	Buildup	Probe design				Standard switch position	
				Insulation		Ground tube		Standard operation	Operation as overfill protection system
				Full	Partial	With	Without		
Solvents, fuels	<3	low	low	✔	✔	✔	-	2 to 3	3
Dry bulk solids	<3	low	low	-	✔	-	✔	2 to 3	-
Moist bulk solids	>3	average	average	✔	✔	-	✔	4 to 5	-
Aqueous liquids and alcohols	>3	high	low	✔	✔	-	✔	4 to 5	4
			heavy	-	✔	-	✔	6 to 7	5
Sludge	>3	high	very heavy	-	✔	-	✔	8 to 9	-

8.6 Changing the switching delay

Ensure that the switch point is uncovered before starting.

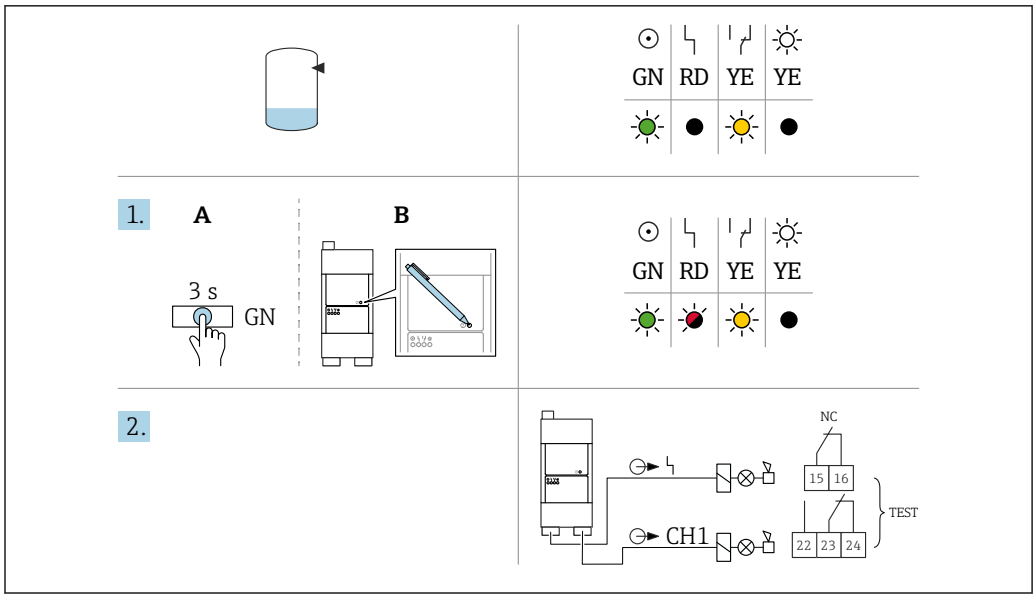


22 *Releasing a change via the test and correction key (green)*

1. Set the calibration mode switch to position 1 (bottom).
2. Set the new delay time via DIP switch to ON.
3. Press the test and correction key (green) for 3 seconds.
   ↳ The LED indicator changes.
4. Release the test and correction key (green) and check the LED status.

8.7 Output function test

Ensure that the switch point is uncovered before starting.



23 Simulation of a fault via the test and correction key (green)

1. Press the test and correction key (green) for 3 seconds. Alternatively, a stylus can be used for operation.
2. The LEDs indicate the simulated fault and the outputs are switched as in the event of a fault.

9 Diagnostics and troubleshooting

9.1 General troubleshooting

If the sensor's electronic insert has been replaced, a recalibration must be carried out.

The device does not switch

- Possible causes: no supply voltage present (green LED is not lit)
  Remedial action: check power supply
- Possible causes: electronics defective
  Remedial action: replace Nivotester
- Possible causes: welded contacts (following a short-circuit)
  Remedial action: replace Nivotester; install fuse in contact circuit
- Possible causes: sensor defective
  Remedial action: replace sensor
- Possible causes: incorrect signal input
  Remedial action: connect correct input

Device switches incorrectly

- Possible causes: change-over switch on Nivotester for limit signal is incorrectly set
  Remedial action: correctly set the change-over switch behind the front panel on the Nivotester
- Possible causes: inverted sensor function
  Remedial action: reverse output signal at sensor, e.g. minimum/maximum safety mode

Continuous fault signaling

- Possible causes: switch connected as sensor without current limiting resistors
  Remedial action: connect resistors or switch off fault signaling
- Possible causes: interruption or short-circuit in the cable to the sensor
  Remedial action: check cable
- Possible causes: sensor electronics defective
  Remedial action: replace electronics
- Possible causes: no sensor connected
  Remedial action: switch off fault signaling for unused channel
- Possible causes: Nivotester defective
  Remedial action: replace Nivotester

10 Maintenance

10.1 Maintenance schedule

As a general rule, no specific maintenance work is required.

10.2 Maintenance tasks

10.2.1 Cleaning

Cleaning of surfaces not in contact with the medium

- Recommendation: Use a lint-free cloth that is either dry or slightly dampened using water.
- Do not use any sharp objects or aggressive cleaning agents that corrode the surfaces (displays, housing, for example) and seals.
- Do not use high-pressure steam.
- Observe the degree of protection of the device.

The cleaning agent used must be compatible with the materials of the device configuration. Do not use cleaning agents with concentrated mineral acids, bases or organic solvents.

11 Repair

Repair is not envisaged for this device.

11.1 Return

The requirements for safe device return can vary depending on the device type and national legislation.

1. Refer to the web page for information:
   https://www.endress.com/support/return-material
   ↳ Select the region.
2. If returning the device, pack the device in such a way that it is reliably protected against impact and external influences. The original packaging offers the best protection.

11.2 Disposal

If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

12 Accessories

Accessories currently available for the product can be selected via the Product Configurator at www.endress.com:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Spare parts & Accessories**.

12.1 Device-specific accessories

12.1.1 Protective housing

The protective housing with IP66 protection is fitted with an integrated DIN rail. The protective housing can be closed with a transparent cover and lead-sealed.

- Dimensions in mm (in) B/H/D: 180/182/165 (7.1/7.2/6.5)
- Part number: 52010132

13 Technical data

13.1 Input

13.1.1 Measured variable

The point level signal is triggered at MIN level or MAX level, depending on the setting.

13.1.2 Measuring range

The measuring range depends on the installation location of the sensors.

13.1.3 Input signal

- Galvanically isolated from power supply and output
- Type of protection: intrinsic safety [Ex ia] IIC
- Connectable sensors and electronic insert FEI57S:
  - Liquicap M FTI51, FTI52
  - Solicap M FTI55, FTI56
  - Solicap S FTI77
- Sensors powered by Nivotester FTC325 PFM
- Connection cable: two-wire
  Shielding not required, except in the event of strong electromagnetic interference (see also "Electromagnetic compatibility" (EMC))
- Cable length/cable resistance: 1000 m (3281 ft)/max. 25 Ω per wire
- Signal transmission: pulse-frequency modulation (PFM)

13.2 Output

13.2.1 Output signal

- Relay output: a potential-free change-over contact for the level alarm
- Quiescent current fail-safe mode: MIN/MAX safety can be selected with DIP switch
- Fault-signaling relay: potential-free change-over contact for fault signaling; only two contacts are available with the PFM version (specify NC (normally-closed contact) or NO (normally-open contact) when ordering a PFM device)
- Switching delay: approx. 0 to 45 s
  Depending on the setting, the relay switches when the probe is covered or uncovered

- Relay contact switching capacity:
  AC voltage (AC)
  U ~ maximum 250 V
  I ~ maximum 2 A
  P ~ maximum 500 VA for cos φ ≥0.7
  Direct current (DC)
  U = maximum 40 V
  I = maximum 2 A
  P = maximum 80 W
- Operating life: at least 10^5 switching operations with maximum contact load
- Function indicator: LEDs for operation, level alarm and fault
  Is lit as long as the probe is covered.

13.2.2 Overvoltage protection

Overvoltage category in accordance with IEC 61010

II

13.2.3 Protection class

II (double or reinforced insulation)

13.2.4 Signal on alarm

Level relay per channel dropped out; fault signaled by red LEDs, fault-signaling relay dropped out

13.2.5 Galvanic isolation

All input and output channels and relay contacts are galvanically isolated from each other. If the power supply circuit or the fault-signaling relay contacts is/are simultaneously connected to functional extra-low voltage, safe galvanic isolation is guaranteed up to a voltage of 150 V_{AC}.

13.3 Performance characteristics

13.3.1 Switch-on behavior

Correct switch status after power supply switched on: 10 to 40 s, depending on the connected sensor.

13.4 Environment

13.4.1 Ambient temperature range

- Installation of an individual device: −20 to +60 °C (−4 to 140 °F)
- Side-by-side installation without lateral spacing: −20 to +50 °C (−4 to +122 °F)
- Installation in protective housing: −20 to +40 °C (−4 to +104 °F)
  A maximum of two FTC325 PFM units can be installed in a protective housing.
- Storage temperature: −25 to +85 °C (−13 to 185), preferably 20 °C (68 °F)

13.4.2 Climate and mechanical application class

3K3 and 3M2 in accordance with IEC 60721-3-3

13.4.3 Operating altitude

As per IEC 61010-1 Ed.3:
Up to 2 000 m (6 500 ft) above sea level

13.4.4 Relative humidity

5 to 85 %

13.4.5 Pollution degree

Pollution degree 2 as per IEC 61010-1

13.4.6 Degree of protection

- IP20 (as per IEC 60529)
- IK06 (as per IEC 62262)

13.4.7 Shock resistance

EN 60068-2-27: a = 150 m/s^2 t = 11 ms, 3 axes x 2 directions x 3 shocks

13.4.8 Vibration resistance

EN 60068-2-64: a(RMS) = 28 m/s^2, f = 5 to 2000 Hz, t = 3 axes x 2 h

13.4.9 Electromagnetic compatibility (EMC)

- Interference emission according to EN 61326, Class A equipment.
- Interference immunity according to EN 61326; Annex A (Industrial) and NAMUR Recommendation NE 21 (EMC)

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