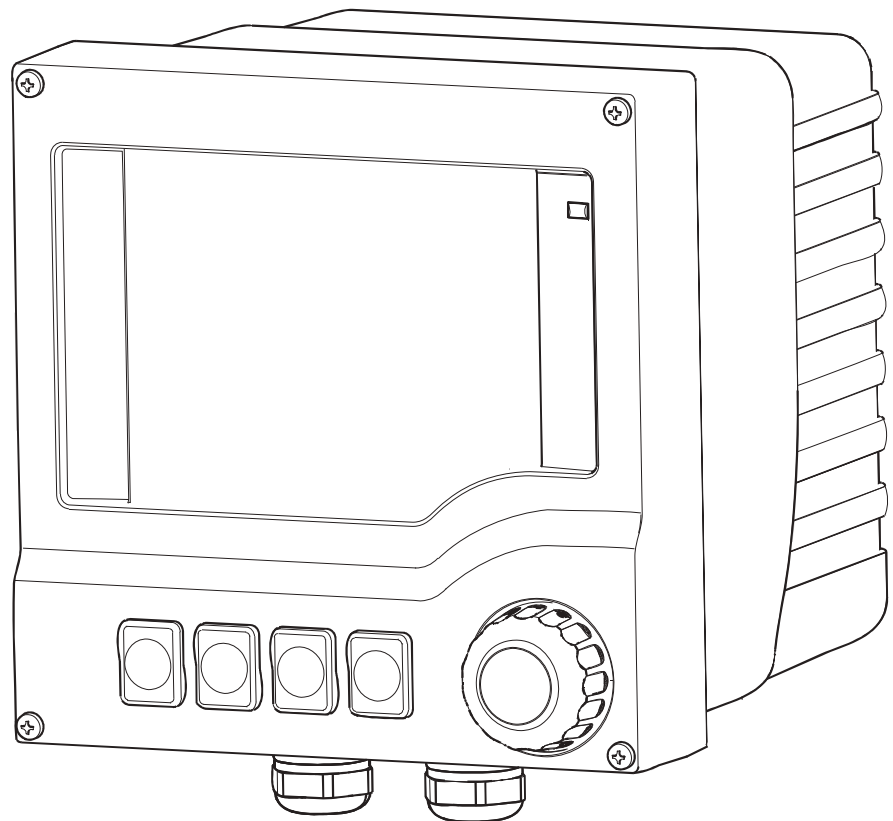


Operating Instructions Transmitter H220X COND

Two-wire transmitter for conductive measurement
of conductivity (analog sensors)

Part 1



Ref. No. 243081-12





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1 Document information

1.1 Warnings

The structure, signal words and color coding of the warnings follow the specifications of ANSI Z535.6 ("Product safety information in product manuals, instructions and other collateral materials").

Structure of the safety symbol	Meaning
 DANGER Causes (/consequences) Possible consequences if ignored ► Preventive measures	This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
 WARNING Causes (/consequences) Possible consequences if ignored ► Preventive measures	This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
 CAUTION Causes (/consequences) Possible consequences if ignored ► Preventive measures	This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in medium or minor injury.
 NOTICE Cause/situation Possible consequences if ignored ► Action/note	This symbol alerts you to situations that can cause damage to equipment or property.

1.2 Symbols used



Additional information, tips



Permitted or recommended



Forbidden or not recommended



Reference to device documentation



Reference to page



Reference to graphic



Result of an action

1.3 Documentation

1.3.1 Operating Instructions

The Operating Instructions are split into two parts:

- **Part 1 (BA016160)**
 - Basic safety instructions
 - Device description
 - Installation, connection and commissioning
 - Configuration via local operation
- **Part 2 (BA016170)**
 - Sensor calibration and adjustment
 - Diagnostics and troubleshooting
 - Maintenance, repair and accessories
 - Technical data

1.3.2 In addition

- 1 manufacturer's certificate
- Adhesive labels:
 - Interior nameplate
 - Wiring adhesive label

Attach the adhesive labels that concern your device to the inside of the cover.

2 Basic safety instructions

2.1 Requirements for personnel

- ▶ Installation, commissioning, operation and maintenance of the measuring system must only be carried out by trained technical personnel.
- ▶ The technical personnel must be authorized to perform the tasks by the owner-operator.
- ▶ The electrical connection may only be established by an electrical technician.
- ▶ The technical personnel must have read and understood these Operating Instructions and must follow the instructions they contain.
- ▶ Faults at the measuring point may only be rectified by authorized and properly trained personnel.

 Repairs not described in the enclosed Operating Instructions may only be carried out directly at the manufacturer's or by the Service Organization.

2.2 Designated use

2.2.1 Applications

The primary applications comprise:

- Chemical processes
- Pharmaceutical industry
- Food technology
- Applications in hazardous areas

 The use of the transmitter depends strongly on the sensor deployed. For this reason, please pay attention to the information on "designated use" provided in the sensor manual.

The transmitter is suitable for pollution degree 3 as per IEC/EN 61010-1.

2.2.2 Non-designated use

If the device is used for any purpose other than that described, this poses a threat to the safety of people and the entire measuring system and is thus not permitted.

The manufacturer does not accept liability for damage caused by improper or non-designated use.

2.3 Occupational safety

As the user, you are responsible for observing the following safety regulations:

- Guidelines for explosion protection
- Installation guidelines
- Local standards and regulations

2.4 Operational safety

- ▶ Prior to commissioning the entire measuring point, check that all connections are correct. Make sure that electric cables and hose connections are not damaged.
- ▶ Do not commission damaged products. Protect them against unintentional startup. Label and identify the damaged product as defective.
- ▶ If the faults cannot be eliminated, take the products out of service and protect them against unintentional startup.

2.5 Product safety

2.5.1 State-of-the-art technology

The product is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate.

The applicable regulations and European standards have been taken into account.

2.5.2 Electrical equipment in hazardous areas

The transmitter meets the requirements of the Explosion Protection Directive 2014/34/EU. is suitable for use in hazardous areas.

The harmonized standards or normative documents applied are listed in the EU Declaration of Conformity.

- The transmitter is an intrinsically safe electrical apparatus in:
 - equipment group II, equipment category (1)2 G, for use in Zone 1 with Gb device protection
- You may only connect suitable sensors and must use them as designated in accordance with the Operating Instructions.
- You can connect suitable sensors, which may be arranged in Zone 0, to the sensor circuits. Suitable sensors are identified by a red ring.
- The transmitter may only be connected to suitable transmitter power supply units or to fieldbus systems as per the FISCO model.
- Please observe the information provided in the Operating Instructions on the characteristic values of the input and output circuits.
- Only devices with a plastic housing may be deployed for use in Zone 22.
- Only genuine spare parts may be used for maintenance and repair work on the device. This work may only be carried out by service staff or specially trained and authorized personnel.
- Installation, electrical connection, commissioning, inspection, maintenance and repair may only be carried out by qualified specialists properly trained to carry out work on Ex-rated devices in accordance with the applicable standards, e.g. EN 60079-14, -17, -19,. The instructions in the Operating Instructions must be observed.
- To avoid electrostatic charge, the device bears a warning sign with the following information: "Protect against electrostatic charge. Clean the device with a damp cloth only."

3 Device description

3.1 Housing closed

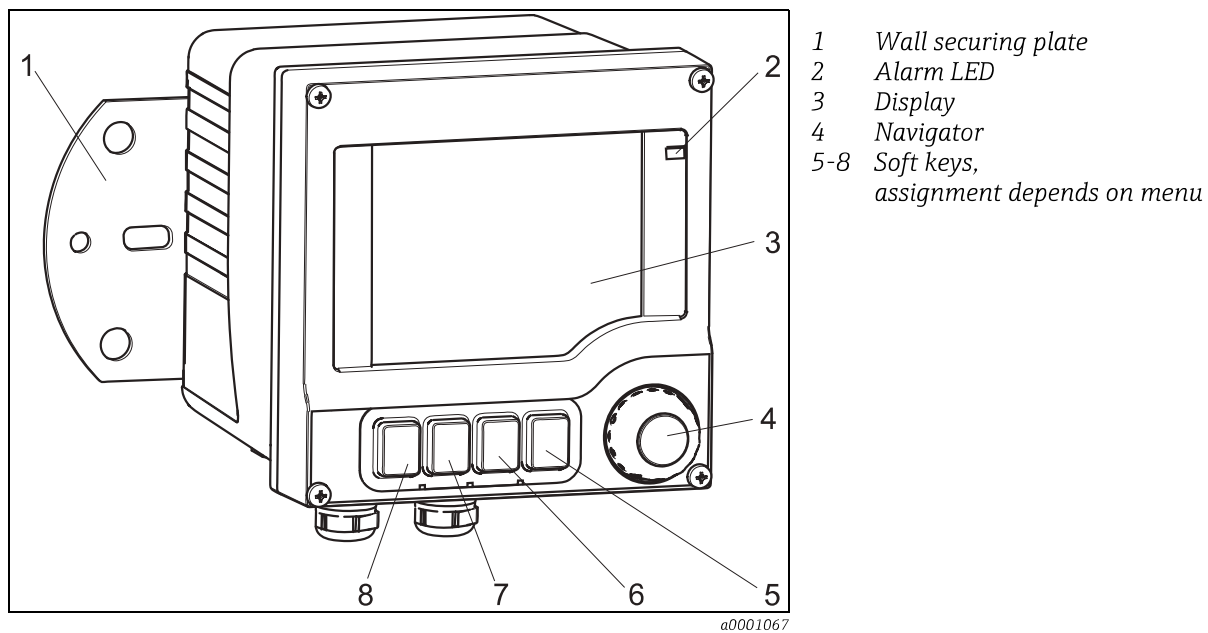


Fig. 1: transmitter with closed display cover

3.2 Housing open

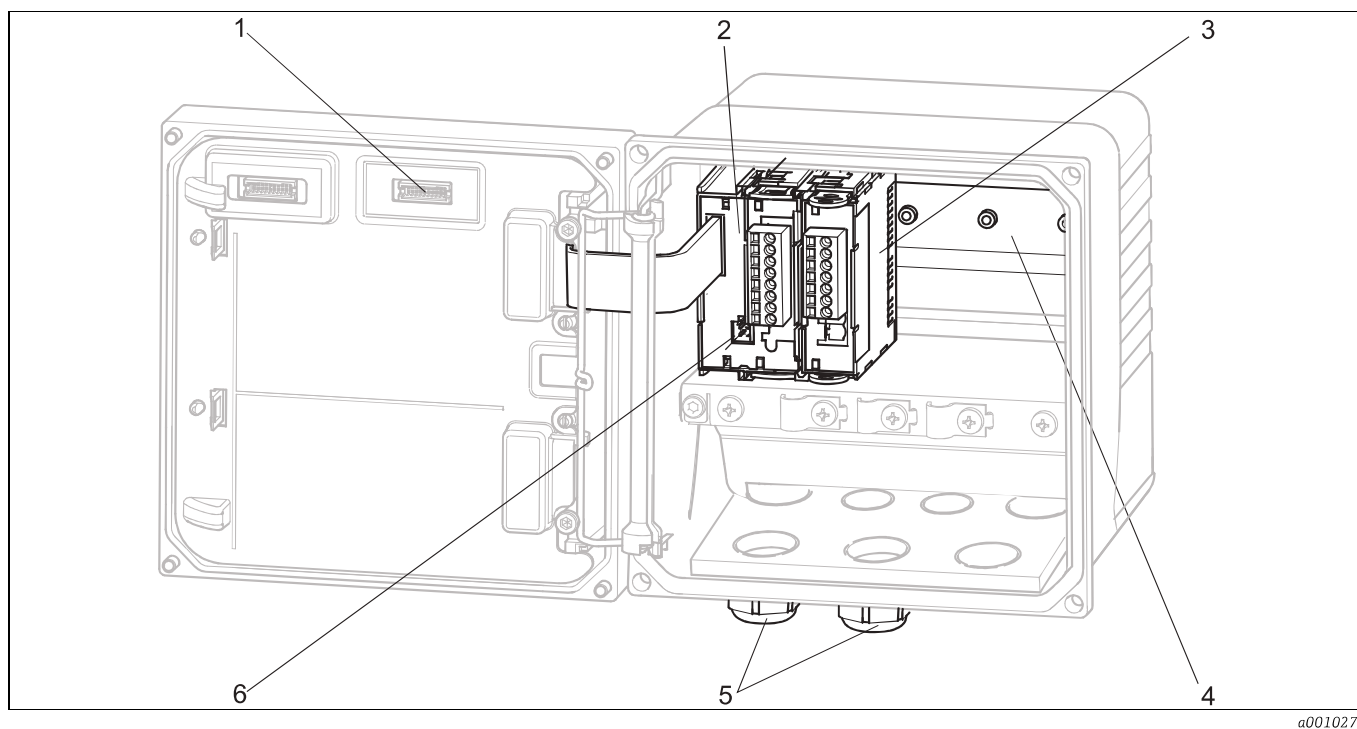


Fig. 2: With open display cover (without wiring)

- | | | | |
|---|---------------------|---|--------------------------------|
| 1 | Slot for DAT module | 4 | DIN rail |
| 2 | CPU module | 5 | Threaded joints |
| 3 | Sensor module | 6 | CDI socket (service interface) |

4 Incoming acceptance and product identification

4.1 Incoming acceptance

1. Make sure the packaging is not damaged.
 - ↳ Inform your supplier of any damage to the packaging.Please keep the damaged packaging until any issues have been resolved.
2. Make sure the contents are not damaged.
 - ↳ Inform your supplier of any damage to the contents.Please keep the damaged goods until any issues have been resolved.
3. Make sure that the delivery is complete and nothing is missing.
 - ↳ Compare it against the shipping documents and your order.
4. For storage and transportation: pack the product in such a way as to protect it reliably against impact and moisture.
 - ↳ Optimum protection is provided by the original packaging materials.The permitted ambient conditions must be observed (see Technical data).

If you have any queries, contact your supplier or local sales center.

4.2 Product identification

4.2.1 Nameplate

Nameplates can be found:

- On the outside of the housing (lasered)
- On the packaging (adhesive label, portrait format)
- On the adhesive label sheet provided (landscape format, for your own use)

Compare the data on the nameplate with your order.


The nameplate provides you with certain information about your device, including:

- Manufacturer name, address and logo
- Device type / order code
- Serial number, coded date of manufacture
- Firmware version
- Measuring range(s)
- Input, output values
- Approvals (depending on the version ordered)
- Ex version, equipment class, Ex warning signs
- Ambient temperature range
- Approval symbols
- Safety notices, warnings

4.2.2 Serial number and order code

The order code and serial number of your device can be found in the following locations:

- On the nameplate
- On the front page of the Operating Instructions supplied
- In the delivery papers

 The documentation only contains information that was valid at the time of delivery. If you have any queries, contact your local sales center.

4.3 Scope of delivery

- 1 transmitter in the version ordered
- 1 mounting plate incl. 4 flat head screws
- 1 sheet of adhesive labels (nameplate, terminal connection diagrams)
- Operating Instructions Part 1 and 2, BA016160 and BA016170 in the language ordered
- 1 manufacturer's certificate

If you have any queries, contact your supplier or local sales center.

4.4 Certificates and approvals

4.4.1 CE mark: Declaration of Conformity

With this declaration, the manufacturer guarantees that the product conforms to the regulations of European EMC Directive 2014/30/EU and Ex Directive 2014/34/EU. This is proven by observing the standards listed in the Declaration of Conformity.

4.4.2 Ex approval

- ATEX II (1)2G Ex ib [ia Ga] IIC T4/T6 Gb

4.4.3 Notified body

The EC type-examination certificate for the product has been issued by the following notified body in accordance with Article 18 of the EU Directive 2014/34/EU (ATEX Directive) :

TÜV Rheinland Industrie Service GmbH, Cologne

5 Installation

5.1 Installation conditions

5.1.1 Measuring system

A complete measuring system consists of:

- transmitter
- An immersion assembly (optional)
- A conductive conductivity sensor
- A relevant measuring cable.

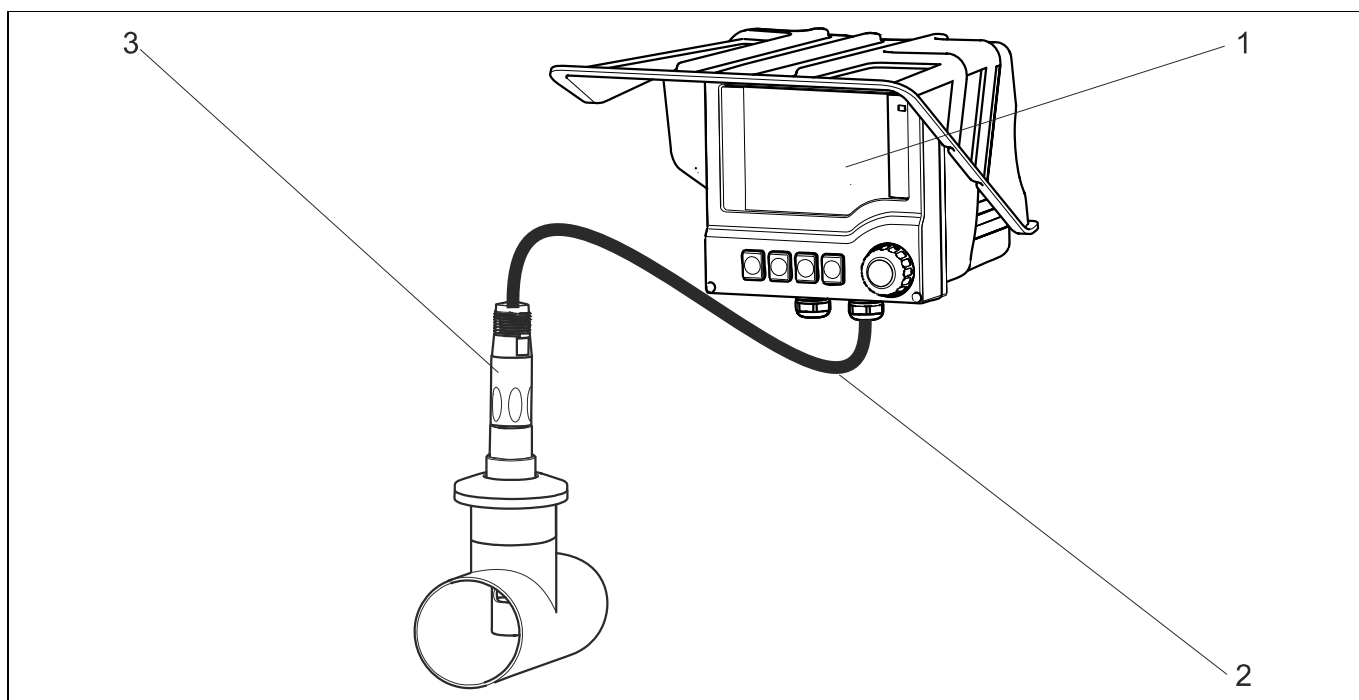


Fig. 3: Example of a measuring system

- 1 transmitter
- 2 Cable
- 3 Conductive conductivity sensor

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5.1.2 Dimensions

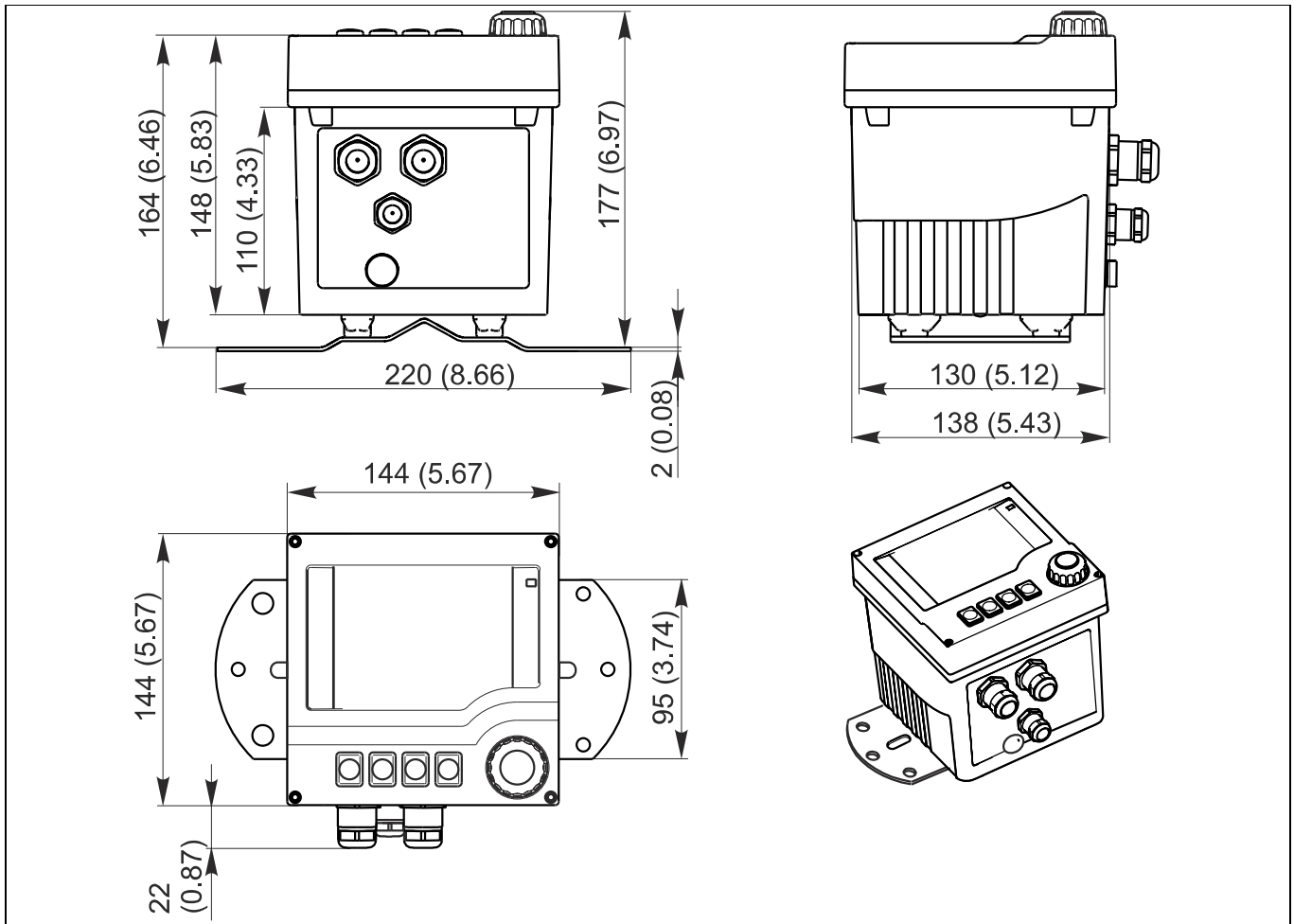


Fig. 4: Dimensions in mm (inch)

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5.1.3 Mounting plate

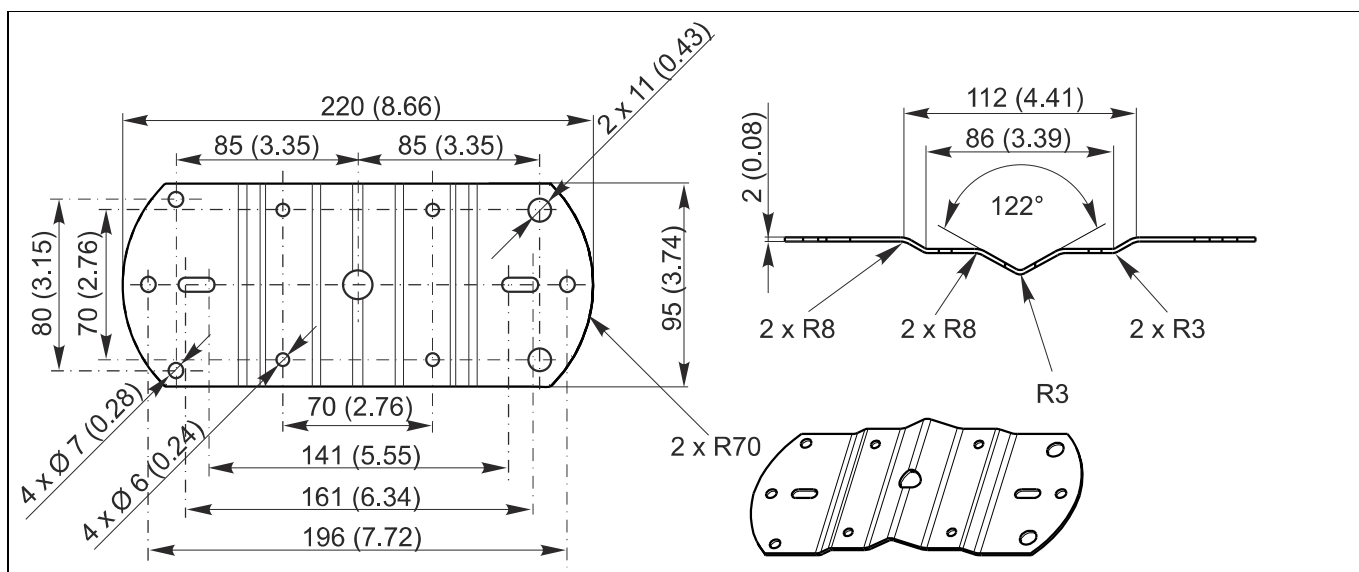


Fig. 5: Dimensions of the mounting plate in mm (inch)

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5.1.4 Weather protection cover

NOTICE

Effect of climatic conditions (rain, snow, direct sun etc.)

Impaired operation to complete transmitter failure

- ▶ When installing outside, always use the weather protection cover (accessory).

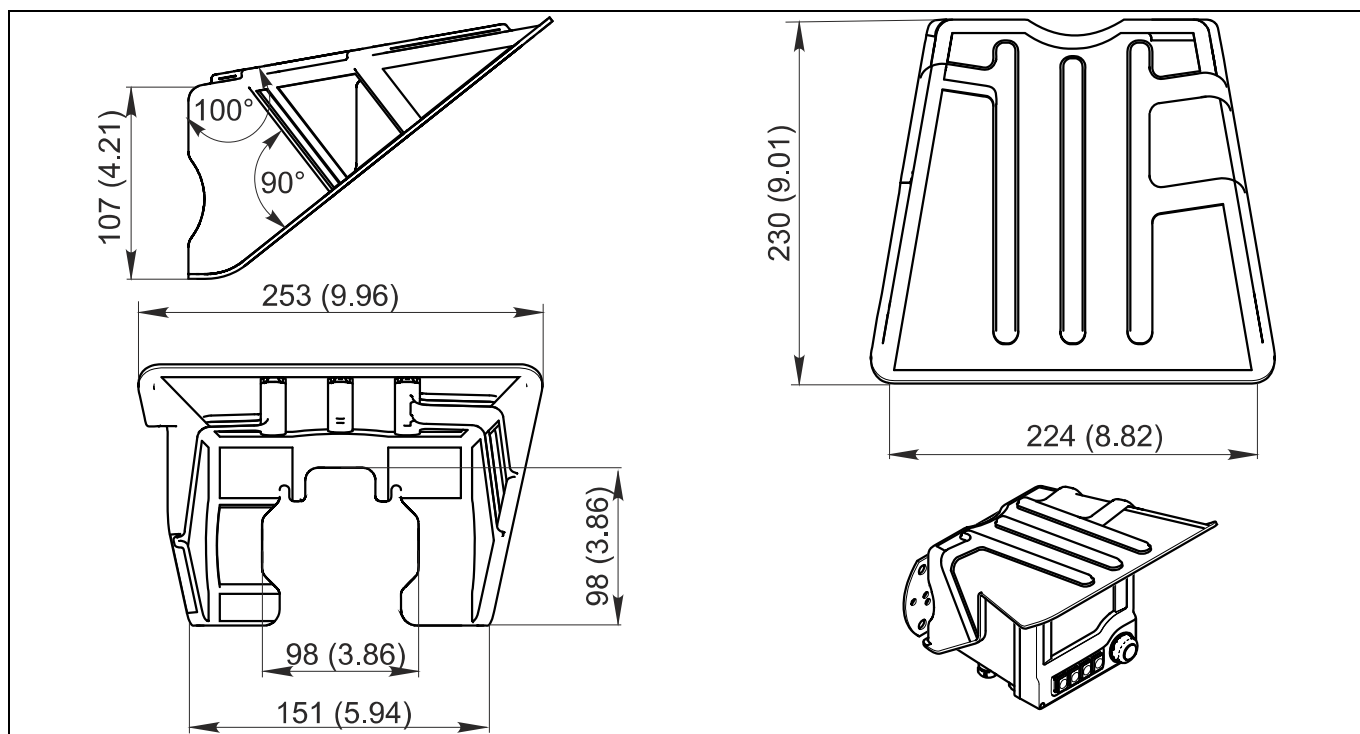


Fig. 6: Dimensions of the weather protection cover in mm (inch)

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5.2 Mounting the measuring device

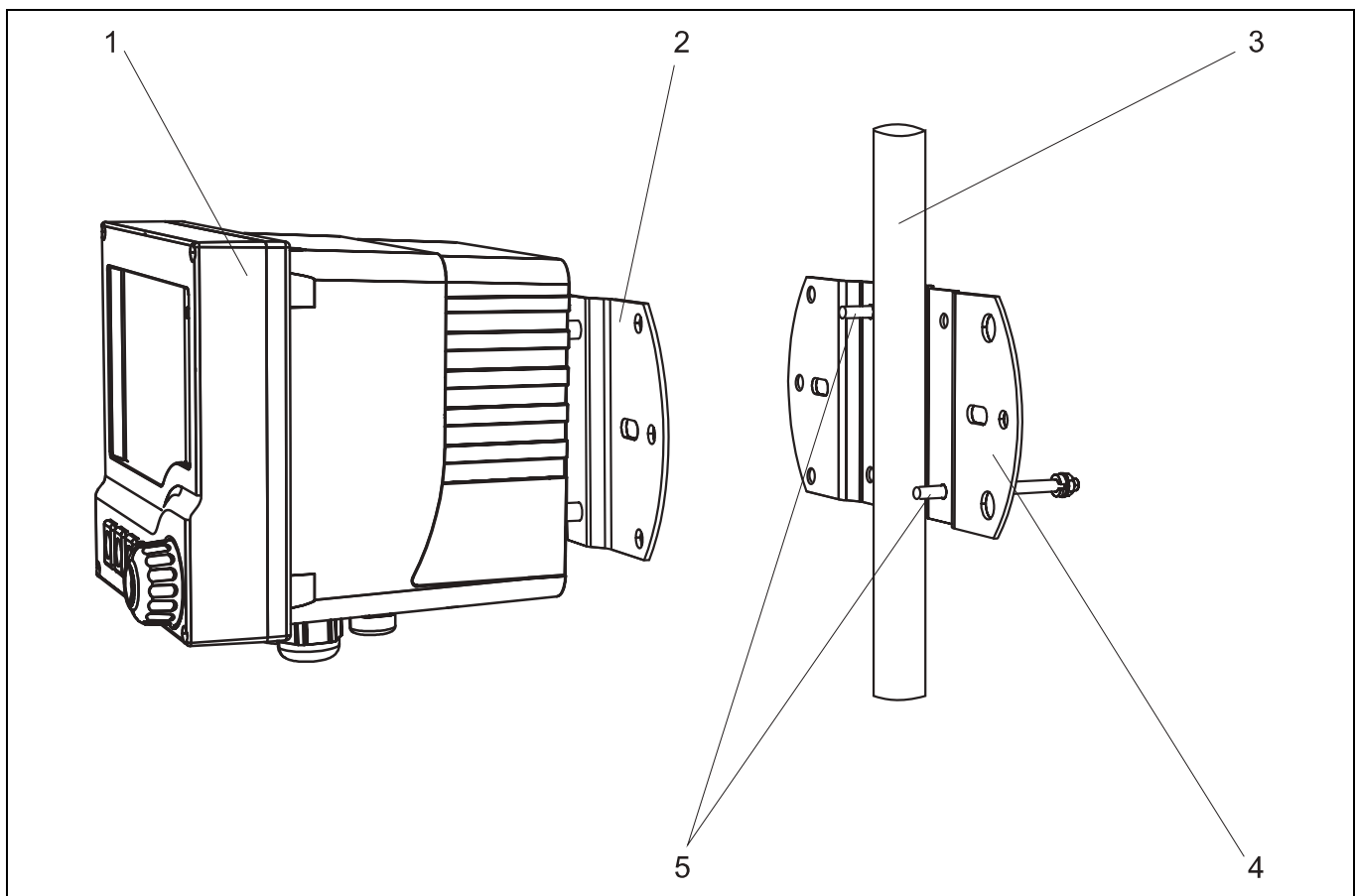
5.2.1 Wall or field mounting

There are many ways of mounting the device:

- Wall mounting
- Mounting on a vertical pipe or post (round or square)
- Mounting on railing or on a horizontal pipe (round or square)

i Diameter of a pipe, post or railing suitable for mounting:
30 to 61 mm (1.18 to 2.40").

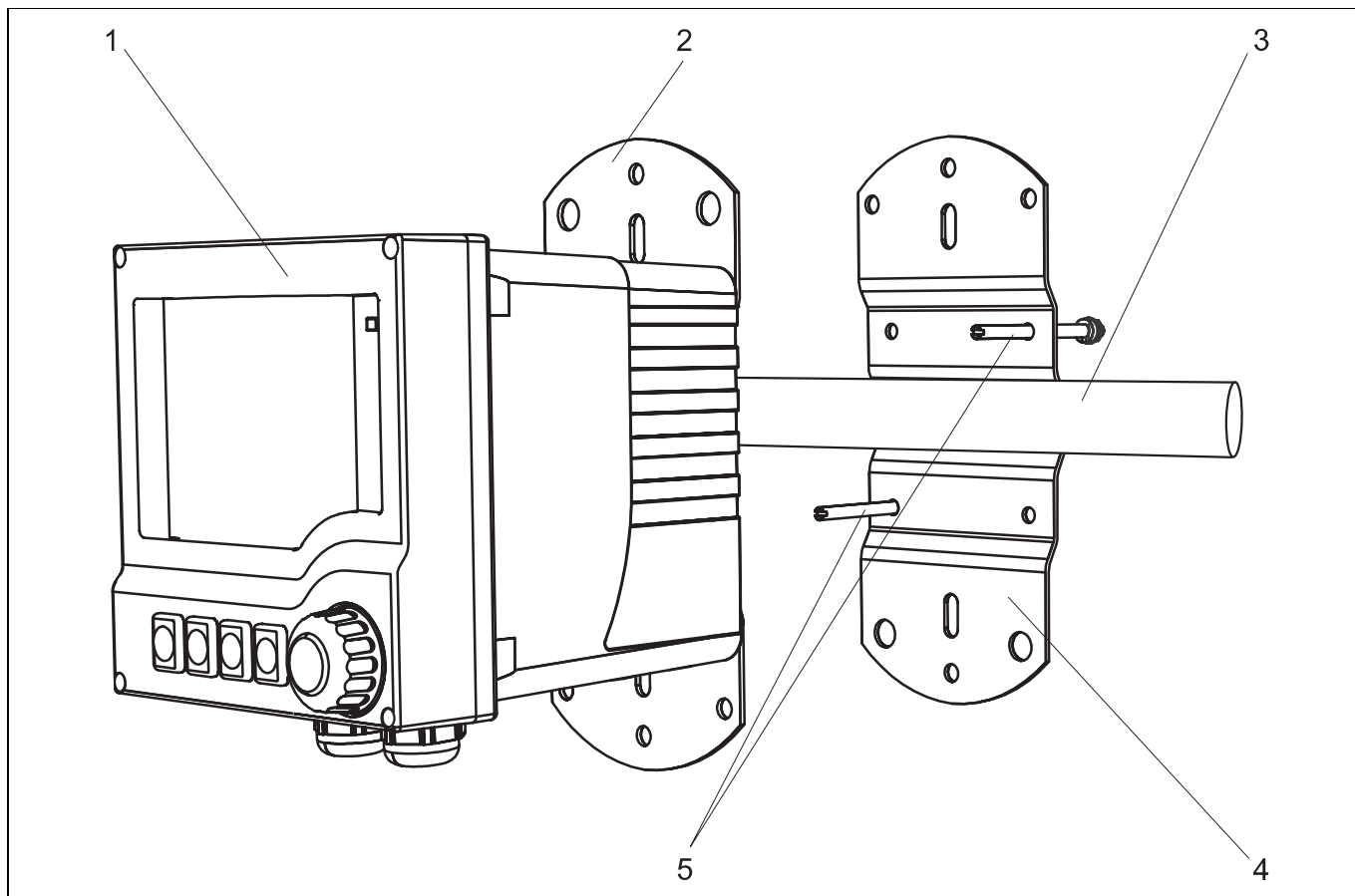
You require the post retainer when mounting. This is an accessory and is not included in the scope of delivery.



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Fig. 7: Mounting on a vertical pipe/post

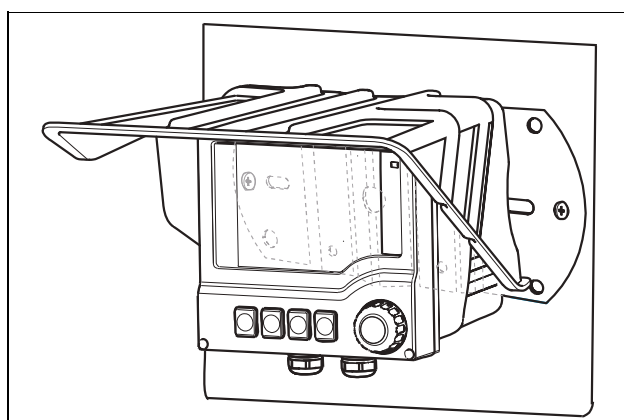
- 1 transmitter
- 2 Mounting plate (part of scope of delivery)
- 3 Pipe or post (circular/square)
- 4 Mounting plate
- 5 Threaded rods with spring washer, washer and nut



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Fig. 8: Mounting on a horizontal pipe/railing

- 1 transmitter
- 2 Mounting plate
- 3 Pipe or railing
- 4 Mounting plate
- 5 Threaded rods with spring washer, washer and nut



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Fig. 9: Wall mounting

5.2.2 Panel mounting

- For panel mounting, you need the installation kit consisting of tensioning screws and a front seal. This is an accessory (see "Accessories") and is not included in the scope of delivery.
- If installing the units **above one another**, you must observe a minimum distance for the cable glands of the upper device.
- If installing the units **beside one another**, you must observe a minimum distance for opening the front of the housing.
- If arranging **in a square**, you must take into account the lengths of the mounting plates at the rear of the device or the cable glands for minimum spacing distance.

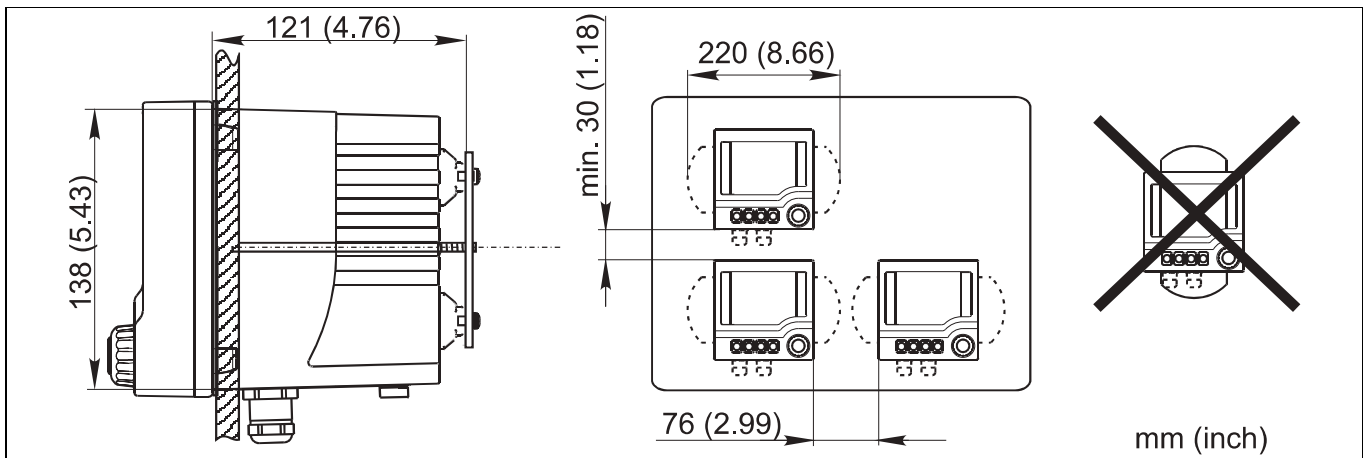


Fig. 10: Panel mounting: left side view, right front view

a0002402

5.3 Post-installation check

- ▶ After installation, check the transmitter for damage.
- ▶ Check whether the transmitter is protected against precipitation and direct sunlight (e.g. by the weather protection cover).

6 Electrical connection

6.1 Connection conditions

6.1.1 Temperature ranges

	Temperature class	
	T4	T6
Ambient temperature T_a	-20 to +55 °C	-20 to +50 °C

If the ambient temperatures specified are observed, no impermissible temperatures occur at the transmitter for the temperature class in question.

6.1.2 Electrical connection data

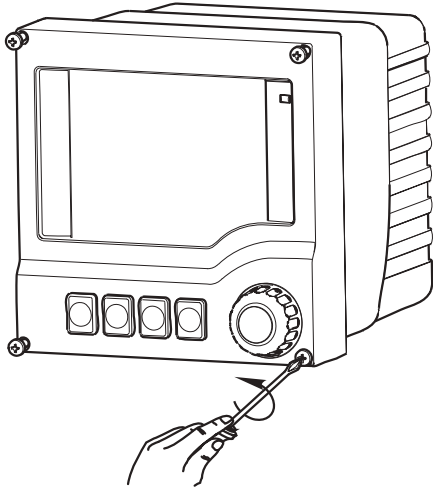
Intrinsically safe sensor circuit with type of protection: Ex ia IIC		
	Glass	ISFET
Max. output voltage U_o	10.08 V	10.08 V
Max. loop current I_o	4.1 mA	50.7 mA
Max. output performance P_o	10.2 mW	128 mW
Max. outer inductance L_o	1 mH	1 mH
Max. outer capacitance C_o	250 nF	250 nF
Connection category according to NE116	SensISCO1X	-

When pH/ORP glass electrodes are connected to terminals 317, 318, 320, 111, 112 and 113, the device corresponds to connection class 1 as per NAMUR Recommendation NE116 (SensISCO). Terminals 315 and 316 may not be connected for this categorization. The device is labeled SensISCO1X.

Intrinsically safe sensor circuit with type of protection: Ex ia IIC	
Max. output voltage U_o	10.08 V
Max. loop current I_o	23 mA
Max. output performance P_o	57 mW
Max. outer inductance L_o	300 μ H
Max. outer capacitance C_o	50 nF

6.1.3 Opening the housing

1. Loosen the four screws on the front with a Phillips screwdriver.



2. Open the housing.

NOTICE

Pointed or sharp tools

Damaged housing seal and scratched housing

- ▶ Do not use any sharp or pointed tools, such as screwdrivers or knives, to open the housing.

6.1.4 Housing grounding

⚠ WARNING

Electric voltage at ungrounded cable mounting rail

No shock protection

- ▶ Connect the cable mounting rail to the foundation ground with a separate $\geq 2.5 \text{ mm}^2$ (14 AWG) functional ground.

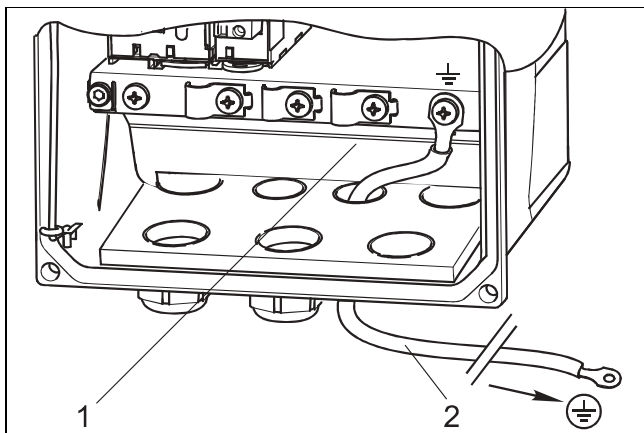


Fig. 11: Grounding the housing

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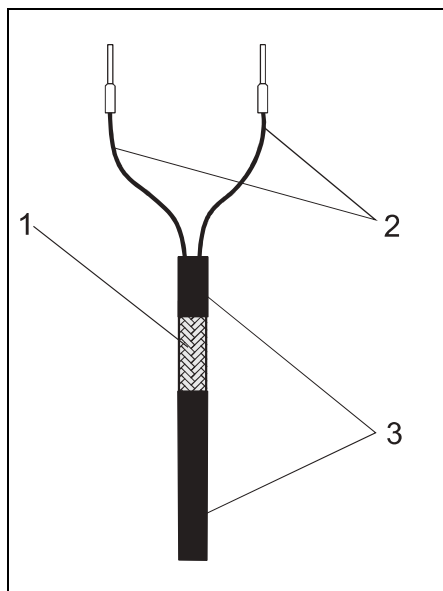
1
2

Cable mounting rail
 $\geq 2.5 \text{ mm}^2$ (14 AWG) functional ground

6.1.5 Cable grounding in housing

If possible, only use terminated genuine cables.

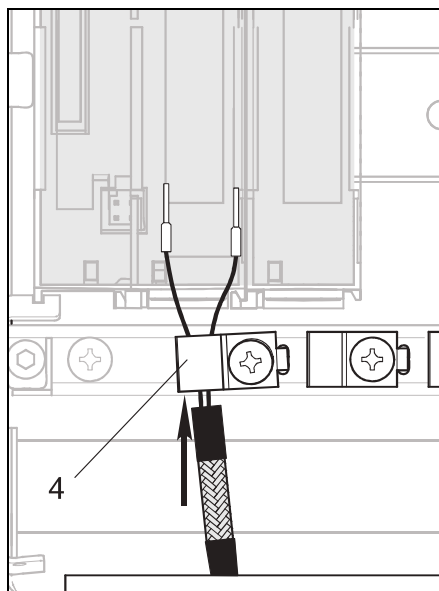
- ▶ Ground all the cables in the housing of the transmitter as shown in the following diagrams (sample cable, does not necessarily correspond to the original cable).



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Fig. 12: Terminated cable (example)

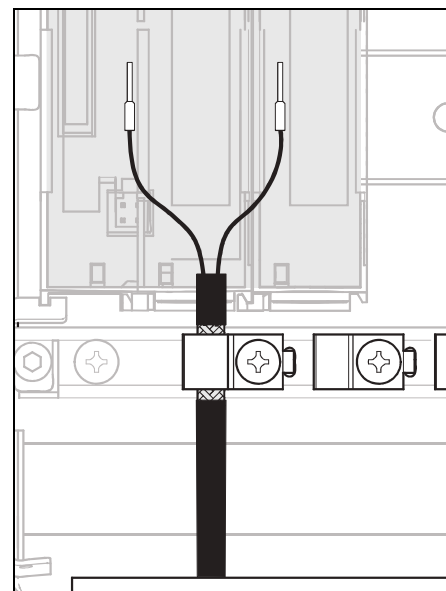
- 1 Outer shield (exposed)
- 2 Cable cores with ferrules
- 3 Cable sheath (insulation)



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Fig. 13: Inserting the cable

- 4 Grounding clip



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Fig. 14: Tightening the screw, the cable shield is grounded by the grounding clip

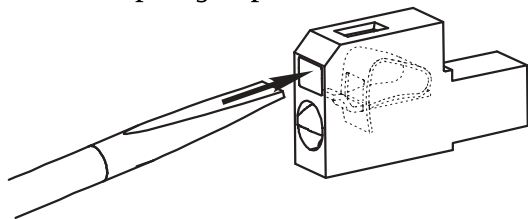
6.1.6 Cable terminals

Connecting the cable cores

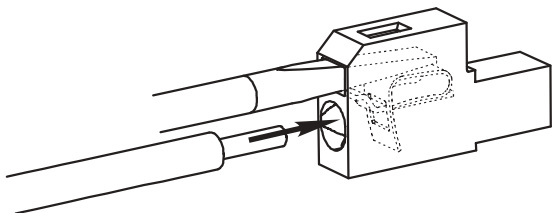
- i** Single-wire, multi-wire and fine-wire cables can be used for the connection, with and without ferrules. Only one wire is permitted per terminal.

1. Insert a suitable screwdriver into the opening of the terminal spring (square opening) until the stop.

- ↳ The spring is pressed down and the terminal opening is free:

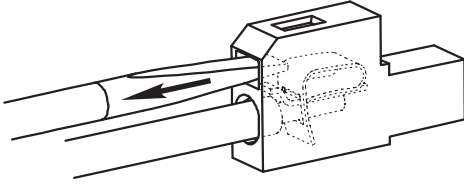


2. Insert the terminated wire end into the terminal opening (round opening):



3. Remove the screwdriver.

- ↳ The spring is released and the wire is secured in place:



Make sure the cable is securely positioned in the terminal.

6.2 Connecting the measuring device

⚠ WARNING

The device is live!

Incorrect wiring can result in injury or fatality

- ▶ The electrical connection may only be established by an electrical technician.
- ▶ The electrical technician must have read and understood these Operating Instructions and must follow the instructions they contain.
- ▶ **Prior** to beginning any wiring work, make sure voltage is not applied to any of the cables.

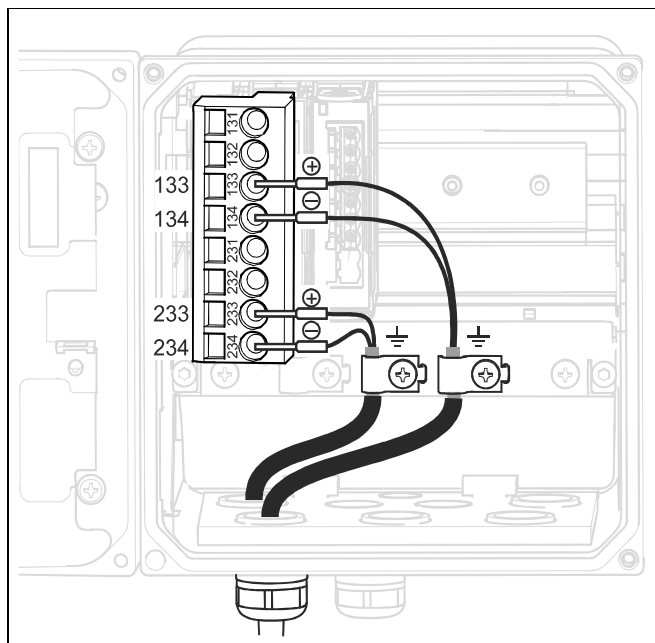
NOTICE

Incorrect supply voltage can cause damage or a malfunction

- ▶ Comply with the specifications on the permitted and minimum supply voltage (see "Electrical connection" under Technical data).

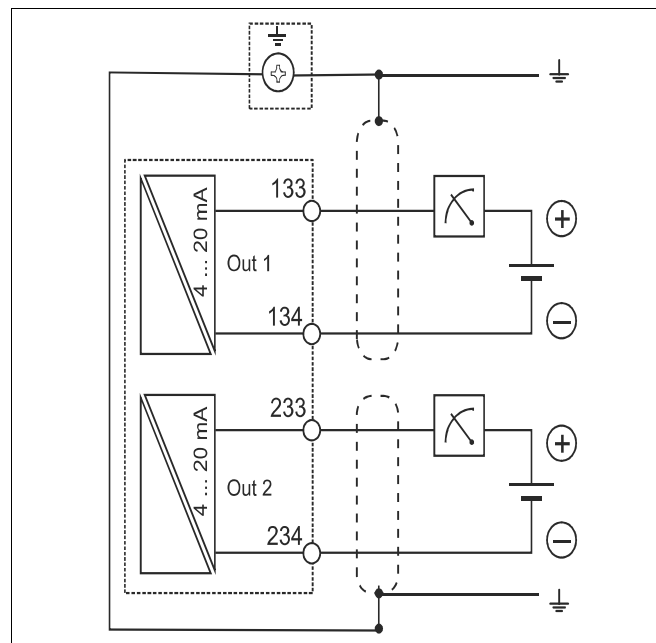
6.2.1 Connection in transmitter

- ▶ Connect the transmitter with a shielded two-wire cable.
 - ↳ How the shield is connected depends on the interference influence expected. To suppress electrical fields, it suffices to ground the shield at one end. If you also want to suppress interference from a magnetic alternating field, you must ground the shield on both sides.



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Fig. 15: View in device (CPU module)



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Fig. 16: Wiring diagram

i Power is only supplied to the device via current output 1, not via current output 2.

6.3 Connecting the sensor

Explanation of abbreviations in the following diagrams:

Abbreviation	Meaning
9	Signal of the temperature sensor
d.n.c.	Do not connect!

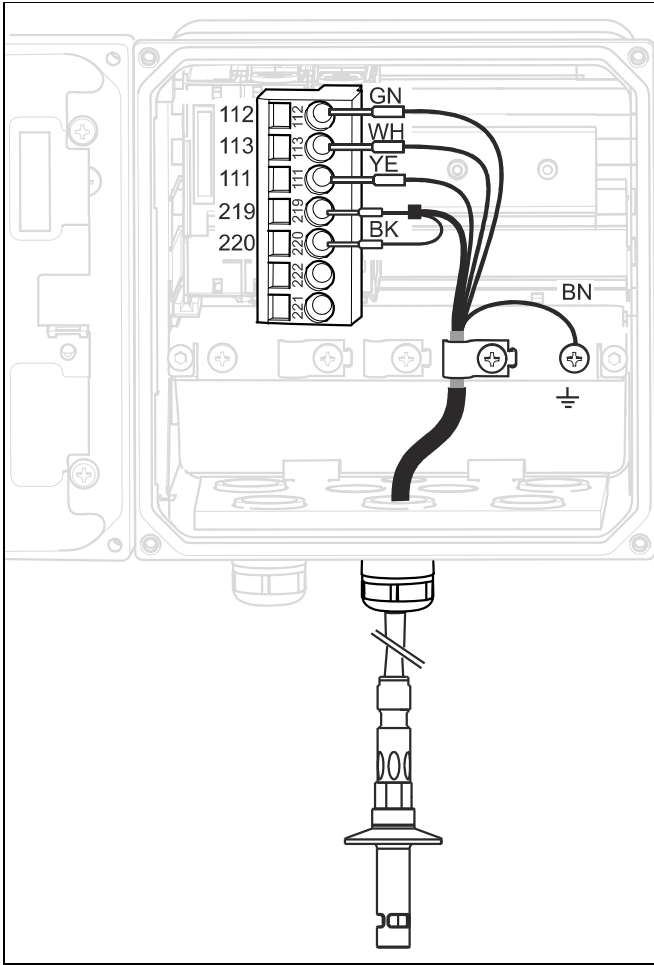
NOTICE

No shielding against electrical and magnetic interference

Interference can give erroneous measurement results

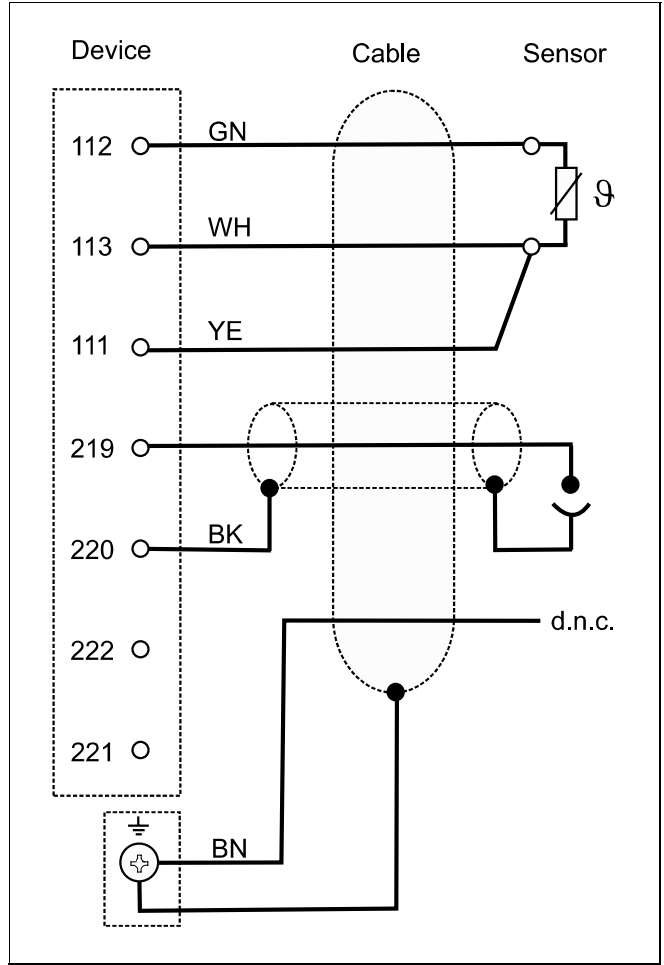
- You must connect shield connections or terminals to the functional ground (\perp) (there is no protective ground on the plastic housing (\oplus)).

6.3.1 Two-electrode sensors



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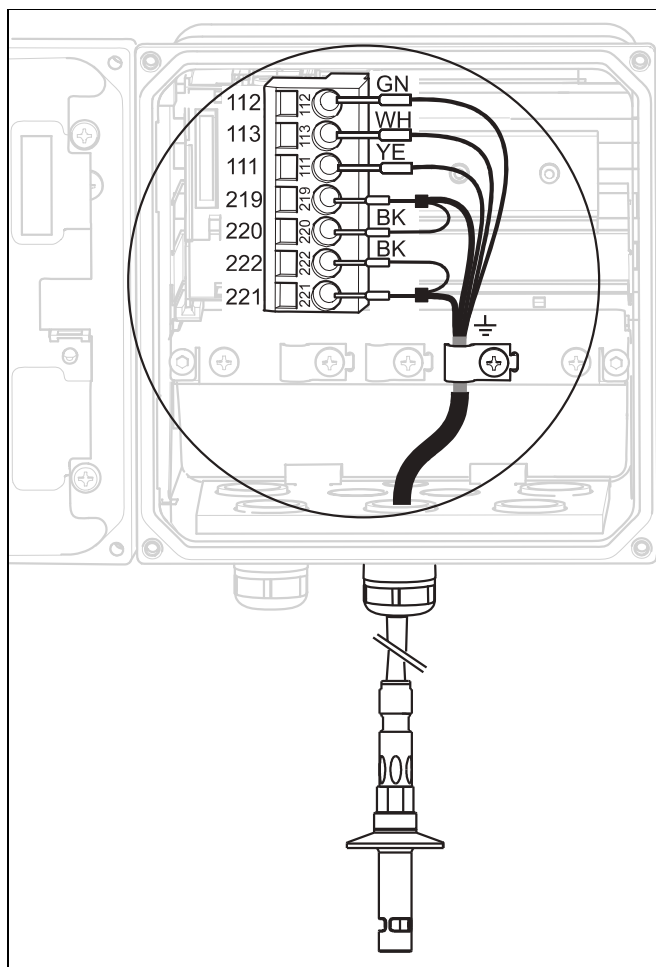
Fig. 17: View in device (sensor module)



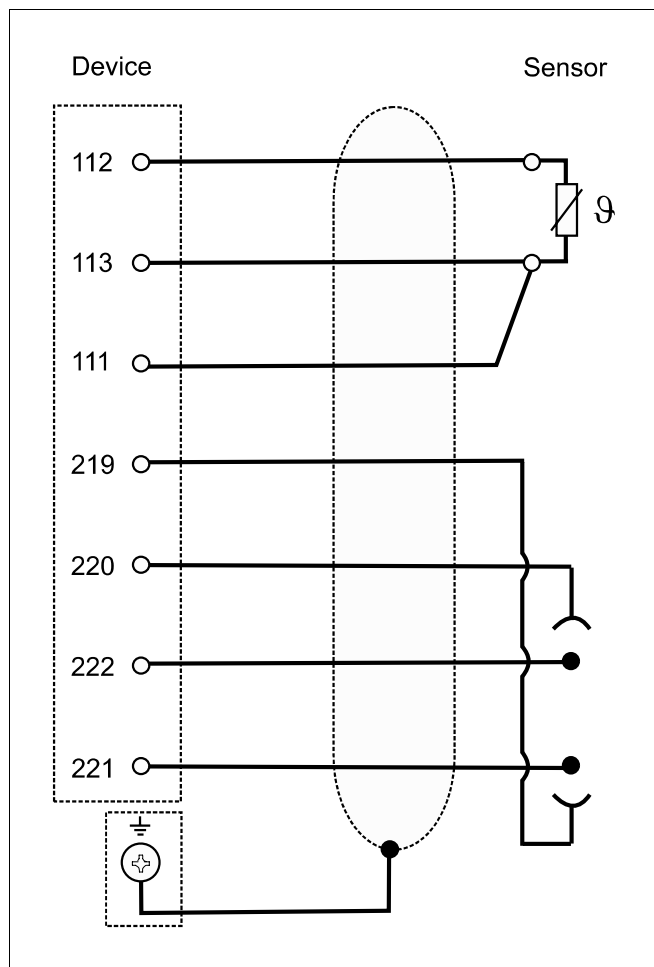
a0001083

Fig. 18: Wiring diagram

6.3.2 Four-electrode sensors



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a0002371

Fig. 19: View in device (sensor module)

Fig. 20: Wiring diagram

One or two two-electrode sensors or a four-electrode sensor can be connected to the transmitter.

Terminal	Connection of cable cores with the following combinations:		
	1 Two-electrode sensor	2 Two-electrode sens.	1 Four-electrode sensor
112	GN	GN	GN
113	WH	WH	WH
111	YE	YE	YE
219	Coax inner	Coax inner, sensor 1	External electrode
220	Coax BK	Coax BK, sensor 1	External electrode
222	d.n.c. ¹⁾	Coax BK, sensor 2	Inner electrode
221	d.n.c.	Coax inner, sensor 2	Inner electrode

1) d.n.c. = do not connect!

6.4 Ensuring the degree of protection

Only the mechanical and electrical connections that are described in this manual, and are necessary for the required, designated application, may be established on the device supplied.

- ▶ Please pay close attention when performing the work as degrees of protection individually confirmed for this product (ingress protection (IP), electrical safety, EMC interference immunity, explosion protection) can no longer be guaranteed as a result of things such as:
 - Leaving off covers
 - Not tightening cable glands sufficiently (must be tightened with 2 Nm for the confirmed level of IP protection)
 - Loose or insufficiently tightened cables/cable ends
 - Conductive cable strands left in the device

6.5 Post-connection check

WARNING

Wiring errors

Incorrect wiring puts the safety of people and the measuring point at risk. The manufacturer does not accept any responsibility for errors that result from failure to comply with the instructions in this manual.

- ▶ Only put the device into operation if you can answer **yes** to **all** of the following questions.

Electrical connection

- Are the mounted cables strain relieved?
- Are the cables run without loops and cross-overs?
- Are the signal lines correctly connected in accordance with the wiring diagram?
- Have you connected unused connection wires to the cable mounting rail?
- Are all plug-in terminals securely engaged?
- Are all the connection wires securely positioned in the cable terminals?

7 Operation options

7.1 Access to the operating menu via local operation

7.1.1 Display and soft key function

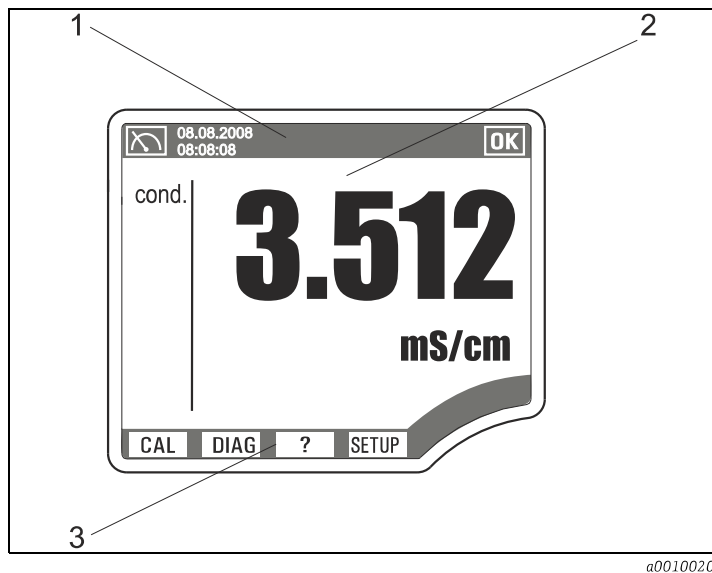


Fig. 21: Local display (measuring mode)

- 1 Status line
- 2 Display and setting field
- 3 Assignment of the soft keys

7.1.2 Operation concept

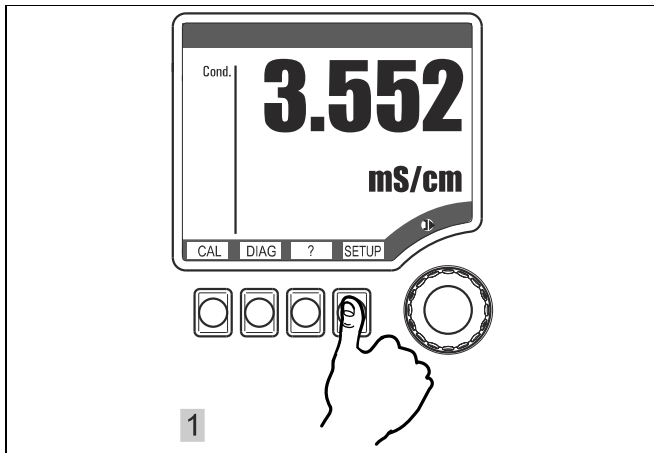


Fig. 22: Pressing the soft key: selecting the menu directly

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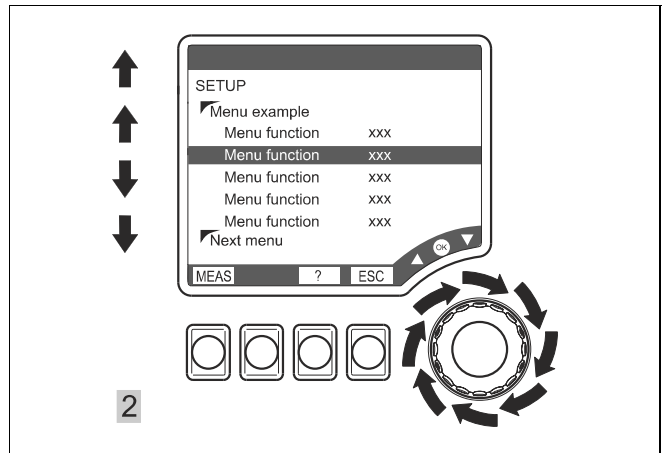


Fig. 23: Turning the navigator: moving the cursor in the menu

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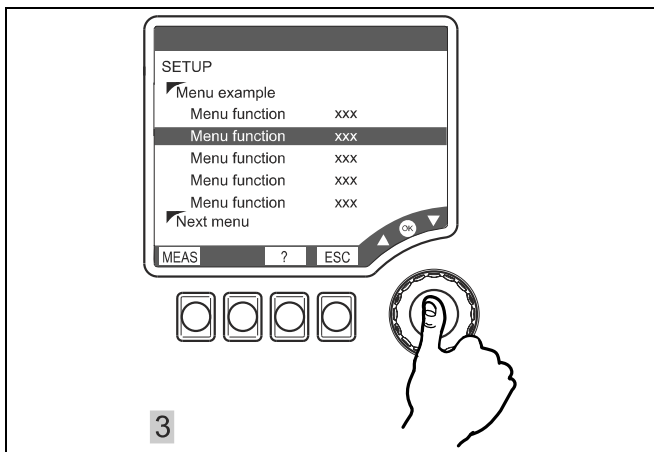


Fig. 24: Press navigator: select a function

a0010036-de

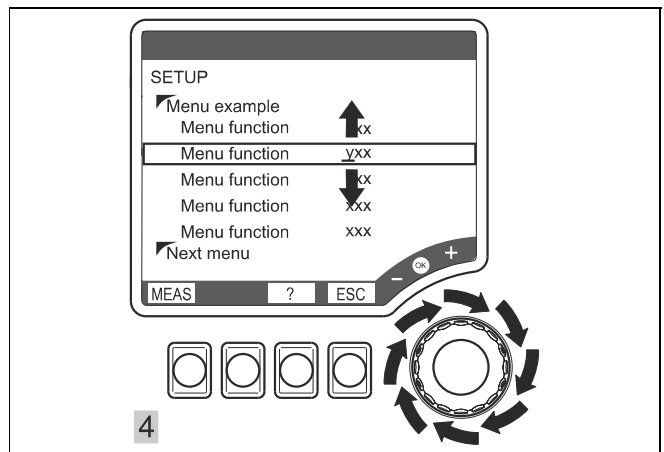


Fig. 25: Turn navigator: change value

a0010037-de

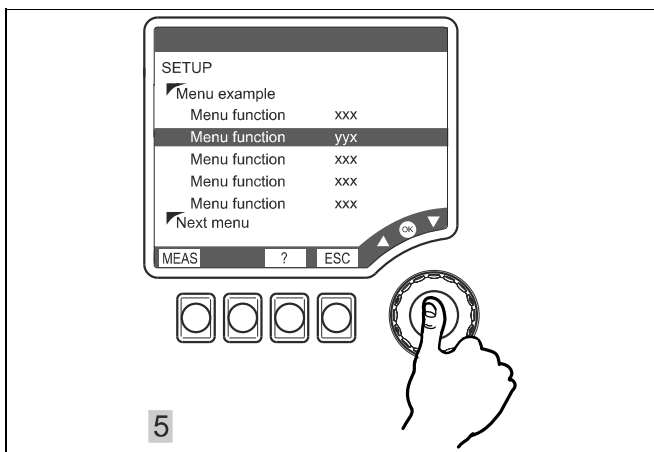


Fig. 26: Press navigator: accept new value

a0010038-de

1. Select the main menu: press the appropriate soft key.
2. Move the cursor in the menu: turn the navigator.
3. Select a function: press the navigator.
4. Change the value: turn the navigator.
5. Accept a new value: press the navigator.

7.1.3 Types of setting

- Display fields
 - You can only read the values but cannot change them.
- Selection fields
 - You receive a list with options.
 - You select one of the options.
- Input fields
 - There are value ranges with upper and lower range limits that depend on the measured value configured and its units.
 - There are also menu functions where you can enter arbitrary text. The number of characters is then limited.
 - Set a value with the navigator:
 - Turn** to increase/reduce a value/letter/special character,
 - Press** to confirm or to enter the next character for arbitrary text.

7.1.4 Editing tables

You can set some software functions using a table:

- The number of columns depends on the menu function that is set via the table.
- You can add lines ("Insert") or delete lines ("Del").
- The maximum number of lines also depends on the menu function in question.
- You can press "Esc" at any time to exit the table and stop entering information.
- If the values entered result in a valid table, you receive the message "Table is valid" and the options:
 - Save table
 - Continue edit table
 - Discard table
- If the values entered are invalid, an error message is output with the options:
 - Continue edit table
 - Discard table

7.1.5 Hold function

You can "freeze" the current output in the SETUP mode and during calibration. The current output then retains its current status or outputs a fixed, user-defined value. The message "Hold" appears on the display.

- Settings for the "Hold" function can be found in the function group "SETUP/General settings/Hold settings".
- An active hold has priority over all other automatic functions.
- Any alarm delay that has built up is reset to "0".

8 Commissioning

8.1 Function check

⚠ WARNING

Incorrect connection, incorrect supply voltage

Safety risks for staff and incorrect operation of the device

- ▶ Check that all connections have been established correctly in accordance with the wiring diagram.
- ▶ Make sure that the supply voltage matches the voltage indicated on the nameplate.

8.2 First steps (Quick Setup via local operation)

1. Connect the supply voltage.
2. Wait for the initialization to complete.

If you do not want to work with the language set at the factory:

3. Navigate to SETUP\Quick setup and select the desired language.
4. In "Quick setup" configure all the basic settings to adapt your device to the local conditions of the measuring point.

Path: SETUP / Quick setup

Function	Options	Info
Language	Options <ul style="list-style-type: none"> ▪ Second language ▪ English Factory setting Second language	You selected the "second language" in the order code. If the language is changed, the settings configured for the device remain intact. You can load another second language from the SystemDAT. → SETUP/DAT menu
Date format	Options <ul style="list-style-type: none"> ▪ DDMMYYYY ▪ MMDDYYYY Factory setting DDMMYYYY	Editing mode: DD (day): 1 to 31 MM (month): 1 to 12 YYYY (year): 2005 to 2100
Set date	Depends on the format DDMMYYYY	
Time format	Options <ul style="list-style-type: none"> ▪ hhmmss (24h) ▪ hhmmss (am/pm) Factory setting hhmmss (24h)	24-hour display or 12-hour display Editing mode: hh (hour): 0 to 23 / 0 am to 12 pm mm (minutes): 0 to 59 ss (seconds): 0 to 59
Set time	Depends on the format hh:mm:ss	

Path: SETUP / Quick setup

Function	Options	Info
Sensor	Options <ul style="list-style-type: none"> ▪ 2 electr. sensor ▪ 4 electr. sensor Factory setting 2 electr. sensor	
Cell constant	0.0025 to 99.99 1/cm Factory setting	
Temperature sensor	Options <ul style="list-style-type: none"> ▪ none ▪ Pt100/Pt1000 Factory setting Pt100/Pt1000	If Pt100/Pt1000 is selected, the system automatically detects whether a Pt100 or Pt1000 is connected.
Temperature unit	Options <ul style="list-style-type: none"> ▪ °C ▪ °F Factory setting °C	Decide whether you want to use the ISO or the American temperature unit. All the values and settings are automatically converted to match the option selected.
Measured value	Options <ul style="list-style-type: none"> ▪ Conductivity ▪ Resistivity ▪ Concentration Factory setting Conductivity	Some subsequent functions depend on the option selected here.

9 Operation via local operation

9.1 Measured value display (MEAS)

9.1.1 Display mode

There are various display modes:

(Press the navigator button to change the mode)

1. Main value
2. Primary and secondary value
3. All measured values

Sensor type	Main value	Main value / secondary value	All values
Conductivity, measured conductively	Conductivity, resistivity, concentration	Conductivity, resistivity, concentration, temperature	Main value, raw value ¹⁾ , temperature Current outputs



1) The raw value is the uncompensated conductivity

i When you exit the measuring mode, the current measured value is displayed in the status bar in the top left-hand corner:



9.1.2 Status display

	Symbol for the measuring menu (MEAS)
	Device state is OK. No alarms or warnings are present.
F	Diagnostics message "Failure"
C	Diagnostics message "Check"
S	Diagnostics message "Out of specification"
M	Diagnostics message "Maintenance request"
17.03.2008 16:59:01	Date and time display in measuring menu
3.618 mS/cm 25 °C	Measured value display in the status line if a menu other than MEAS is launched. The main value and the secondary value are displayed.
	Hold is set to "ON", the measured value is "frozen". The status bit "Loop current fixed"=0x08 is set at the PLC. Displayed measured values are not frozen. They correspond to the current measurement. Depending on the configuration, the current value is a fixed, predefined value or the last valid value.
	Symbol for the simulation mode The status bit "Loop current fixed"=0x08 is set at the PLC. (Only for current output 1, simulation of current output 2 does not affect HART communication.)
	Symbol is displayed while the device is actively communicating via the fieldbus.

	Symbol is displayed if user administration is switched on.
	Symbol is displayed if local operation has been disabled via the fieldbus.

9.2 Configuration (SETUP)

9.2.1 Sensor conductivity

Operating mode

Path: SETUP/Sensor conductivity/Operating mode

Function	Options	Info
Measured value	Options <ul style="list-style-type: none"> ▪ Conductivity ▪ Resistivity ▪ Concentration Factory setting Conductivity	Some subsequent functions depend on the option selected here.
Medium <i>Measured value = Concentration</i>	Options <ul style="list-style-type: none"> ▪ NaOH ▪ HNO₃ ▪ H₂SO₄ ▪ H₃PO₄ ▪ HCl ▪ {UserTab C1} ▪ {UserTab C2} ▪ {UserTab C3} ▪ {UserTab C4} Factory setting NaOH	The transmitter can convert from conductivity to concentration. You select the table saved at the factory, which depends on the medium, or a table you defined yourself (tables are defined in the "SETUP/Conc. table" menu). Concentration tables saved at the factory: NaOH: 0 to 15%, 0 to 100 °C HNO ₃ : 0 to 25%, 0 to 90 °C H ₂ SO ₄ : 0 to 30%, 0 to 100 °C H ₃ PO ₄ : 0 to 15%, 0 to 90 °C HCl: 0 to 20%, 0 to 80 °C
Temp. compensation <i>Measured value = Concentration or Resistivity</i>	Options <ul style="list-style-type: none"> ▪ None ▪ linear ▪ NaCl (IEC 746-3) ▪ Water ISO7888 (25°C) ▪ UPW NaCl ▪ UPW HCl ▪ {UserTab T1} ▪ {UserTab T2} ▪ {UserTab T3} ▪ {UserTab T4} Factory setting Linear	The "UPW HCl" type of compensation is also suitable for ammonia (NH ₃). You edit the user tables in the "SETUP/Temp. comp. tab." menu
Factor alpha <i>Temp. compensation = linear</i>	0.00 to 20.00 % / K Factory setting 2.10 % / K	Conversion factor The temperature-dependent, uncompensated conductivity is converted to a (compensated) conductivity related to the reference temperature.

Path: SETUP/Sensor conductivity/Operating mode

Function	Options	Info
Reference temp. <i>Temp. compensation = linear</i>	-5 to +100 °C Factory setting 25.0 °C	Reference temperature for calculating the temperature-compensated conductivity The alpha coefficients and alpha reference temperatures of Endress+Hauser calibration solutions can be found on the CD-ROM.
Temp. source	Options <ul style="list-style-type: none"> ■ Temperature sensor ■ Manual input Factory setting Temperature sensor	
Medium temp. <i>Temp. source = Manual input</i>	-35.0 to 250.0 °C Factory setting 25.0 °C	

Sensor-specific settings

Path: SETUP/Sensor conductivity

Function	Options	Info
Sensor	Options <ul style="list-style-type: none"> ■ 2 electr. sensor ■ 4 electr. sensor Factory setting 2 electr. sensor	
Cell constant	0.0025 to 99.99 1/cm Factory setting 0.100 1/cm	Enter the cell constant from the quality certificate of your sensor. If you do not have any quality certificate, enter the nominal cell constant.
Damping	0 to 600 s Factory setting 0 s	The damping causes a floating average curve of the measured values over the time specified.
Temperature sensor	Options <ul style="list-style-type: none"> ■ none ■ Pt100/Pt1000 Factory setting Pt100/Pt1000	If Pt100/Pt1000 is selected, the system automatically detects whether a Pt100 or Pt1000 is connected.


Cable compensation

Increasing conductivity can distort the measurement result on account of the cable resistance.

Path: SETUP/Sensor conductivity/Cable compensation

Function	Options	Info
Cable resistance	0.00 to 99.99 Ω Factory setting 10.00 Ω	Enter the cable resistance so that the transmitter can compensate for the effect it has on the measurement result.

Concentration table

 Only select tables without temperature compensation in very small temperature ranges.

Path: SETUP/Sensor conductivity/Conc. table

Function	Options	Info
Table selection	Options <ul style="list-style-type: none"> ▪ {UserTab C1} ▪ {UserTab C2} ▪ {UserTab C3} ▪ {UserTab C4} 	Select a table and then assign a name for this table. This name then appears in the table selection menu instead of the name that was used previously. You can create all the tables both with and without temperature compensation.
Table name	Enter any text (max. 10 characters)	You can create four tables with and four tables without temperature compensation, which means you can create eight tables in total. Only four are offered for selection, however.
Temp. comp. mode	Options <ul style="list-style-type: none"> ▪ with temp. comp ▪ without temp. comp Factory setting with temp. comp	A message appears if you change the compensation mode of an existing table. The table of the same name with the previous compensation mode setting is not lost, however. If you change the compensation mode again, your old table values are displayed once again.
Conc. unit	Options <ul style="list-style-type: none"> ▪ None ▪ % ▪ ppm ▪ mg/l ▪ TDS Factory setting %	TDS = Total dissolved solids (sum parameter commonly used in America for dissolved salts)
Edit table	Column-based entry <ul style="list-style-type: none"> ▪ Temperature¹⁾ ▪ Conductivity (uncompensated) ▪ Concentration 	Maximum number of rows: <ul style="list-style-type: none"> ▪ 25 (with temp. comp) ▪ 15 (without temp. comp)

1) Only if a table with temperature compensation has been selected

Conditions the table must meet:

- With temperature compensation you have to enter at least two curves of constant concentration. The curves must not intersect.

- The curves must always be monotone.

With temperature compensation, also monotone in the same direction (**all** monotone rising or **all** monotone falling). → e.g.

Example of a concentration table:

Conductivity (uncompensated)	Concentration	Temperature
1.000 mS/cm	0.000 mg/l	0.00 °C
2.000 mS/cm	0.000 mg/l	100.00 °C
100.0 mS/cm	3.000 mg/l	0.00 °C
300.0 mS/cm	3.000 mg/l	100.00 °C

Calibration settings


Type of calibration

Path: SETUP/Sensor conductivity/Cal. settings/Type of calibration

Function	Options	Info
Cell constant	Options <ul style="list-style-type: none"> ■ off ■ on Factory setting on	You can switch every type of calibration on or off. If you switch off a type of calibration here, it is not displayed in the calibration menu!

Sensor diagnosis

Adjusting diagnostic behavior

-  Diagnostic messages are classified and prioritized by their message status and message number according to Namur NE 107 (→ BA016170, "Diagnostics and troubleshooting").

In this menu, you have the option of increasing or decreasing the priority of a pending error. You do this by editing the message in question in the diagnose list.

By giving an error currently displayed a lower priority, you can disable an error-related hold and set the device back to the measuring mode.

Example:

The diagnostics message "M501" is present. The screen alternates between displaying the measurement and displaying the diagnostic message (screen with black background). The maintenance symbol (M) is permanently visible in the status bar.

You want to lower the priority of message 501 so that a maintenance error is no longer displayed.

1. Go to the diagnostics list (SETUP\General settings\Device diagnostics\Diagnostics list) and select message M501.
 - ↳ You can change the category of the message in the screen that follows.
2. Select "Function check (C)" for instance.
3. Switch back to the measuring mode.
 - ↳ The maintenance symbol is no longer displayed and "C" is displayed instead.

NOTICE**Diagnostic function switched off or important diagnostics messages downgraded**

Critical device errors are ignored. This can result in incorrect measurement results and even the failure of the transmitter.

- ▶ Only switch off the diagnostic function or reduce the priority of a diagnostics message if you can be absolutely sure that a critical error is not present and your measurement results remain plausible.
- ▶ Always notify your Service Department.

Path: SETUP/Sensor conductivity/Cal. settings/Sensor diagnostics

Function	Options	Info
Diagnostics list	Priority adjustable	You can change the priority of the errors by moving them up or down in the list.

9.2.2 Current output

You assign one measured variable and a measuring range to the current output.

For the measuring range, you can decide whether a linear or non-linear function should be used to calculate the current output values:

- **Linear characteristic**
 - You define the measuring range by specifying the start and end value in the unit of your measured variable. These values are output at the current output with 4 mA (start of measuring range) and 20 mA (end of measuring range) respectively. All the current output values within this range are calculated with a linear function.
 - You can also map the measuring range with a negative slope. For this purpose, set the measuring range upper limit to 4 mA and the lower limit to 20 mA.
 - In accordance with Namur NE43 the current output is linearly extended to 20.5 mA or 3.8 mA if the measuring range is exceeded or undershot. A diagnostic message (404 or 405) appears on the display if this occurs.
 - The smaller the span you select between the 4 mA and 20 mA value, the more accurately you map the measuring range.
- **Tabular characteristic**
 - Using a tabular, non-linear characteristic, you can specifically control the accuracy over one or more measuring range subsections.
 - **Example:**
Define a wide turndown (e.g. 4 to 19 mA) for the range where you would normally expect your measured values and where you thus require a high level of accuracy. In contrast, assign a narrow turndown (e.g. 19 to 20 mA) for the range where you could live with a lower level of accuracy.

Path: SETUP / Current output

Function	Options	Info
Current output 1		
Output value	Options <ul style="list-style-type: none"> ■ Main value ■ Temperature Factory setting Main value	Specify the measured variable that should be output at current output 1.
Characteristic	Options <ul style="list-style-type: none"> ■ linear ■ Table Factory setting linear	Use this function to select the characteristic curve for calculating the current output values
Low value (4mA) <i>Characteristic = linear</i>	Depends on the output variable selected	The firmware permits all values. You can also set the same values for the start and end of the range. For this reason, use values that are plausible for your process. You will expect your measured values to fall within this range. Recommended minimum span between 4 mA and 20 mA value: <ul style="list-style-type: none"> ■ Main measured value: 0.1 µS/cm ■ Uncompensated conductivity: 0.1 µS/cm ■ 1 °C (1.8 °F)
Upper value (20mA) <i>Characteristic = linear</i>	Factory setting Depends on the output variable selected	

Path: SETUP / Current output

Function	Options	Info
Edit table <i>Characteristic = Table</i>	Enter value pairs See Section "Edit table"	Enter the value pairs (measurement value, output current) here. A minimum of 2 value pairs have to be entered. The maximum is 10.
Current output 2		
Output value	Options <ul style="list-style-type: none"> ▪ Main value ▪ Temperature Factory setting Temperature	Specify the measured variable that should be output at current output 2.

9.2.3 General settings**Bus address****Path: SETUP / General settings**

Function	Options	Info
Bus address	0 to 63 Factory setting 0	Each address may only be assigned once in a network. For addresses > 0, the current of current output 1 is permanently set to 4 mA, even in the event of an error.

Date and time**Path: SETUP/General settings/Date/Time**

Function	Options	Info
Date format	Options <ul style="list-style-type: none"> ▪ DDMMYYYY ▪ MMDDYYYY Factory setting DDMMYYYY	Editing mode: DD (day): 1 to 31 MM (month): 1 to 12 YYYY (year): 2005 to 2100
Set date	Depends on the format DDMMYYYY	
Time format	Options <ul style="list-style-type: none"> ▪ hhmmss (24h) ▪ hhmmss (am/pm) Factory setting hhmmss (24h)	24-hour display or 12-hour display Editing mode: hh (hour): 0 to 23 / 0 am to 12 pm mm (minutes): 0 to 59 ss (seconds): 0 to 59
Set time	Depends on the format hh:mm:ss	

Alarms

Path: SETUP/General settings/Alarms

Function	Options	Info
Alarm message	An alarm can be output at current output 1 (I1) or at both current outputs (I1+I2).	
Alarm active	Options <ul style="list-style-type: none"> ■ off ■ freeze (I1) ■ set value (I1) ■ set value (I1+I2) Factory setting set value (I1)	freeze (I1): In the event of an alarm, the last measured value before the alarm occurred is displayed. set value (I1) and set value (I1+I2): A fixed value is displayed in the event of an alarm.
Alarm value <i>Alarm active = set value (I1) or set value (I1+I2)</i>	3.60 to 21.50 mA Factory setting 21.50 mA	Enter the set value which you want to have displayed in the event of an alarm.
Maintenance message	A maintenance message can be output at current output 2 (I2) or at both current outputs (I1+I2).	
Maintenance active	Options <ul style="list-style-type: none"> ■ off ■ freeze (I2) ■ set value (I2) ■ set value (I1+I2) Factory setting off	freeze (I2): The last measured value is displayed in the event of a maintenance message. set value (I2) and set value (I1+I2): A set value is displayed in the event of a maintenance message.
Maintenance value <i>Maintenance active = set value (I2) or set value (I1+I2)</i>	3.60 to 21.50 mA Factory setting 21.50 mA	Enter the set value which you want to have displayed in the event of a maintenance message.

The settings only apply for the measuring mode.

Hold settings

Hold settings apply for the configuration, diagnosis and calibration. The measured value is displayed on the status bar.

A hold and diagnostics messages cannot be output simultaneously. Priority is given to whatever event occurs first. For example, if a hold is triggered no diagnostics messages are output until the hold is disabled. Conversely a hold cannot be triggered if a warning or alarm is present. You can start a simulation (via DIAG/Service) even if a hold is active. The hold remains active when you finish the simulation.

Path: SETUP/General settings/Hold settings

Function	Options	Info
Calibration active	Options <ul style="list-style-type: none"> ▪ No hold ▪ freeze ▪ set value (I1+I2) Factory setting No hold	<ul style="list-style-type: none"> ▪ No hold: The current measured value continues to be displayed. ▪ freeze: The device keeps the last measured value. ▪ set value (I1+I2): You define a set display value.
Calibration value <i>Calibration active = freeze</i>	3.60 to 21.50 mA Factory setting 12.00 mA	Enter the value which you want to have displayed during calibration.
SETUP active	Options <ul style="list-style-type: none"> ▪ No hold ▪ freeze ▪ set value (I1+I2) Factory setting No hold	<ul style="list-style-type: none"> ▪ No hold: The current measured value continues to be displayed. ▪ freeze: The device keeps the last measured value. ▪ set value (I1+I2): You define a set display value.
SETUP value <i>SETUP active = freeze</i>	3.60 to 21.50 mA Factory setting 12.00 mA	Enter the value which you want to have displayed during configuration.
DIAG active	Options <ul style="list-style-type: none"> ▪ No hold ▪ freeze ▪ set value (I1+I2) Factory setting No hold	<ul style="list-style-type: none"> ▪ No hold: The current measured value continues to be displayed. ▪ freeze: The device keeps the last measured value. ▪ set value (I1+I2): You define a set display value.
DIAG value <i>DIAG active = freeze</i>	3.60 to 21.50 mA Factory setting 12.00 mA	Enter the value which you want to have displayed during diagnosis.
Hold delay	0 to 300 s Factory setting 15 s	After changing to the measuring mode, the specified hold is maintained for the hold delay period.

Device diagnosis

Explanations →  34

Path: SETUP/General settings/Device diagnostics

Function	Options	Info
Diag. function	Options <ul style="list-style-type: none"> ▪ on ▪ off Factory setting off	Deactivate ("off") means: <ul style="list-style-type: none"> ▪ No message shown on the display ▪ Alarm LED is switched off ▪ No error current at the current output
Housing monitoring	Options <ul style="list-style-type: none"> ▪ on ▪ off Factory setting off	If housing monitoring is switched on, the software detects if the housing is opened and outputs a corresponding diagnosis message.
Diagnostics list	Priority adjustable	You can change the priority of the errors by moving them up or down in the list.

Logbooks

i The logbook memories are "ring memories". They are filled with data while storage space is available. As soon as the memory is full, each new entry overwrites the oldest entry in the memory.

A maintenance message is displayed when a logbook is almost full and another when the logbook is completely full. You can then empty the logbook ("Delete entries") so that the message is no longer displayed.

NOTICE

Delete entries

Recorded data are permanently deleted and cannot be retrieved

- ▶ Only delete entries if you are sure you no longer need these data.

Path: SETUP/General settings/Logbooks

Function	Options	Info
Recording	Options <ul style="list-style-type: none"> ▪ on ▪ off Factory setting on	Here, you can enable or disable the logging of all log books with the exception of the data logbook. The entries recorded can be found in the "DIAG/Logbooks" menu.

Path: SETUP/General settings/Logbooks

Function	Options	Info
Data logbook		
Recording	Options <ul style="list-style-type: none"> ▪ on ▪ off Factory setting off	Here, you can start or stop recording measured values in the data logbook.
Sample time	5 s to 17 h Factory setting 60 s	Specify how often a measured value should be recorded (after how many seconds, minutes or hours).
Meas. value	Options <ul style="list-style-type: none"> ▪ Raw value ▪ Temperature ▪ Main value Factory setting Main value	Select the measured value which should be recorded in the data logbook. The entries can be found in the "DIAG/LogbooksData logbook" menu.
Delete entries	Options <ul style="list-style-type: none"> ▪ All logbooks ▪ Calibration logbook ▪ Event logbook ▪ Parameter logbook ▪ User logbook ▪ Data logbook 	Select the logbooks which you want to empty and confirm your choice by choosing "Delete entries".

User administration*Switching on the unit*

The user administration function is **not enabled** at the factory. All the menus and functions can be accessed and configured openly.

To view the following functions, you must first switch on the function.

Path: SETUP/General settings/User administration

Function	Options	Info
Function	Options <ul style="list-style-type: none"> ▪ on ▪ off Factory setting off	If the user administration function has already been activated, you can only switch it on and off subsequently in the "Expert" role. Depending on the operating mode selected, either log on in the role or as a user with an Expert role.

You must log on after power-up. Use the "Expert" role or a user with an Expert role (e.g. "Admin"). The operating mode last selected dictates whether you have to select a role or a user (under ...User administration/Settings).

Path: SETUP/General settings/User administration

Function	Options	Info
Login	Options (Security level = Roles) <ul style="list-style-type: none"> ■ Operator ■ Maintenance ■ Expert Factory setting Operator	Depending on the "Security level": Roles Select a user role and enter the password. User accounts Enter your user name and the password.

The first time you log on you will be asked to specify a new password (one other than 0000). If you have specified and confirmed your password using the navigator, you must press the **"OK" soft key** to continue.

After logging on you can change your password or continue to "Settings".

Path: SETUP/General settings/User administration

Function	Options	Info
Change password		You can change your password here. An error message is displayed if the password you enter is invalid or too short. If this occurs enter another password.

Settings

Path: SETUP/General settings/User administration/Settings

Function	Options	Info			
Function		Switch the user administration function on/off. The default setting is "off" (disabled). Only an "Expert" can switch on the function. A password must be entered for this purpose.			
Security level	Options <ul style="list-style-type: none"> ■ Roles ■ User accounts Factory setting Roles	Roles To log into the menu you must select one of the three set roles: Operator, Maintenance or Expert. User accounts To log into the menu you must enter your user name and the password.			
Actions					
<table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">Diagnostics</td> <td rowspan="2" style="width: 50%;">Options <ul style="list-style-type: none"> ■ None ■ Maintenance ■ Operator/Mainten. </td> </tr> <tr> <td>Calibrate</td> </tr> </table>	Diagnostics	Options <ul style="list-style-type: none"> ■ None ■ Maintenance ■ Operator/Mainten. 	Calibrate		When you are logged on as an "Expert" you can specify which users - apart from you - are authorized to use the "DIAG" and "CAL" menus here. "None" means that no-one other than an "Expert" has authorization. For the other two roles you can decide whether only the Maintenance role or both the Operator and Maintenance role should have authorization.
Diagnostics	Options <ul style="list-style-type: none"> ■ None ■ Maintenance ■ Operator/Mainten. 				
Calibrate					

Path: SETUP/General settings/User administration/Settings

Function	Options	Info
User accounts <i>Security level = User accounts</i>	Functions <ul style="list-style-type: none"> ▪ Create ▪ Modify ▪ Delete 	"Experts" can manage the user accounts here. Select the desired function and then follow the instructions on the screen.
Auto logout time	Options <ul style="list-style-type: none"> ▪ 5 minutes ▪ 10 minutes ▪ 15 minutes ▪ 30 minutes Factory setting 15 minutes	If no action is executed for the selected period of time, you are logged out automatically. You must then log on again if you want to configure more settings.
Logbooks	Options <ul style="list-style-type: none"> ▪ on ▪ off Factory setting on	As an "Expert" you can switch off the logbook function here. The setting then changes the setting under General settings/Logbooks/Recording.

9.2.4 Display

Path: SETUP / Display

Function	Options	Info
Language	Options <ul style="list-style-type: none"> ▪ Second language ▪ English Factory setting Second language	You selected the "second language" in the order code. If the language is changed, the settings configured for the device remain intact. You can load another second language from the SystemDAT. → SETUP/DAT menu
Main meas. unit	Options <ul style="list-style-type: none"> ▪ Auto ▪ $\mu\text{S/cm}$, mS/cm, S/cm, $\mu\text{S/m}$, mS/m, S/m ▪ $\text{k}\Omega\text{cm}$, $\text{M}\Omega\text{cm}$, $\text{k}\Omega\text{m}$ Factory setting Auto	Menu only applies to conductivity and resistance You specify the concentration unit in the "Concentration table" menu.
Main value format	Options <ul style="list-style-type: none"> ▪ Auto ▪ xxxx ▪ xxx.x ▪ xx.xx ▪ x.xxx Factory setting Auto	You select how many commas should appear after the decimal point in the measured value display.

Path: SETUP / Display

Function	Options	Info
Temperature unit	Options <ul style="list-style-type: none"> ■ °C ■ °F Factory setting °C	Decide whether you want to use the ISO or the American temperature unit. All the values and settings are automatically converted to match the option selected.
Temperature format	Options <ul style="list-style-type: none"> ■ xxx ■ xxx.x ■ xxx.xx Factory setting xxx.x	You select how many commas should appear after the decimal point in the temperature display.

9.2.5 DAT menu

There are 3 different types of DAT module that can either be ordered as optional accessories or are already included in the delivery:

- **SystemDAT**

Firmware updates (more recent firmware version) or change of language group

- **FunctionDAT**

Extending the function scope ("Advanced" firmware or 2nd current output)

- **CopyDAT**

Memory for own configuration settings

Check whether your device's functions can be extended

- ▶ Before you order a FunctionDAT, check whether it is at all possible to extend the function scope of your device.

Change of sensor type with a hardware change

If you also have to install another sensor module for the new sensor type:

1. Disconnect the device from the power supply.
2. Open the housing.
3. Replace the sensor module and connect the new sensor.
4. Reestablish the power supply.
5. Follow the steps that apply for changing the sensor type without a hardware change.

Change of sensor type without a hardware change

If you do not need another sensor module for the new sensor type:

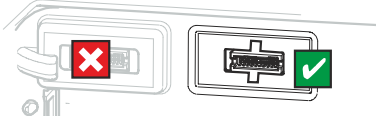
1. Go to SETUP/DAT menu/SystemDAT/Sensor type.

2. Select the sensor type you wish to change to and confirm your choice.
 - ↳ The new sensor type is now ready for measurement and you can configure it.

DAT module for firmware updates or upgrades, change of language group or to save the configuration

The device does not need to be disconnected from the power supply.

1. Open the housing.
2. Insert a DAT module into the right-hand slot in the housing cover:



3. In the menu, select your type of DAT module: SystemDAT, FunctionDAT or CopyDAT.
 - ↳ The transmitter reads in the DAT information. Data processing is interrupted for this purpose.
 4. Select your preferred DAT action (see Table).
 5. Follow the instructions.
 - ↳ You can keep a CopyDAT plugged in for later use. You should remove all the others.
 6. Close the housing again.
- i** You can use SystemDATs and CopyDATs for as many devices as you like. FunctionDATs extend the device functions and can only be used for one device.

Path: SETUP / DAT menu

Function	Options	Info
SystemDAT	Each of the options possible here causes the device to be restarted	
Sensor type	Options Depends on the type of sensor currently used	Select through the available sensor types (configurations) The sensor types that you can switch to are displayed. The sensor type currently being used is not displayed.
Language	Options <ul style="list-style-type: none"> ▪ English ▪ German ▪ French ▪ Polish ▪ Czech ▪ Spanish ▪ Dutch ▪ Italian ▪ Chinese ▪ Japanese ▪ Portuguese ▪ Russian ▪ Swedish ▪ Korean 	You can only change the second language of your device here. It is not possible to change English as the first language. The new second language replaces the second language previously used. It is not installed as an additional (third) language. If you want to return to the original second language, you will have to go through the DAT menu to do so.

Path: SETUP / DAT menu

Function	Options	Info
Update	Options <ul style="list-style-type: none"> ▪ PH 02.xx.xx-xxxx ▪ COND 02.xx.xx-xxxx ▪ DO 02.xx.xx-xxxx 	Choice of software packages and versions available on the SystemDAT Only use this action to update the current software package. If you also want to change the sensor type, select the "Sensor type" option.
FunctionDAT	<ul style="list-style-type: none"> ▪ Software extension 	Displays the possible function extensions A FunctionDAT can only be used for one device.
CopyDAT	Options <ul style="list-style-type: none"> ▪ Read from DAT ▪ Write to DAT 	Displays information already saved You can now save the current configuration or download a saved configuration from the DAT.

9.2.6 Quick Setup

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