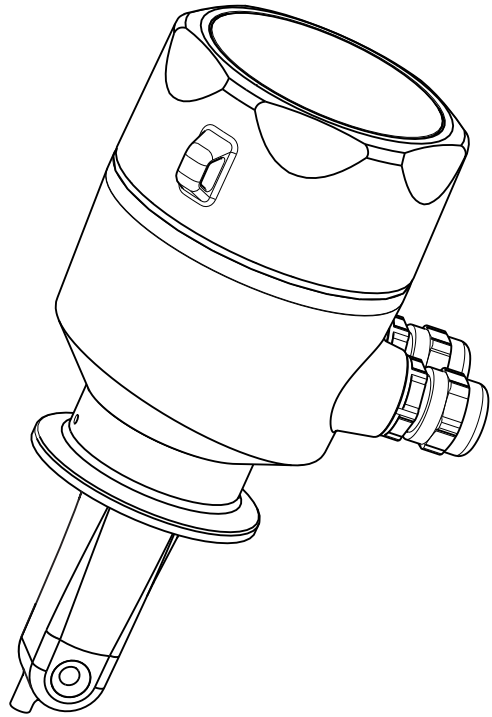
BA01149C/07/EN/06.17
71393688

Operating Instructions
Smartec CLD18

Conductivity measuring system



Endress+Hauser
People for Process Automation

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1 Document information

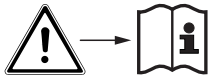
1.1 Warnings

Structure of information	Meaning
⚠ DANGER **Causes (/consequences)** If necessary, Consequences of non-compliance (if applicable) ▶ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid the dangerous situation **will** result in a fatal or serious injury.
⚠ WARNING **Causes (/consequences)** If necessary, Consequences of non-compliance (if applicable) ▶ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid the dangerous situation **can** result in a fatal or serious injury.
⚠ CAUTION **Causes (/consequences)** If necessary, Consequences of non-compliance (if applicable) ▶ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or more serious injuries.
NOTICE **Cause/situation** If necessary, Consequences of non-compliance (if applicable) ▶ Action/note	This symbol alerts you to situations which may result in damage to property.

1.2 Symbols used

Symbol	Meaning
	Additional information, tips
	Permitted or recommended
	Not permitted or not recommended
	Reference to device documentation
	Reference to page
	Reference to graphic
	Result of a step

1.3 Symbols on device

Symbol	Meaning
	Reference to device documentation

2 Basic safety instructions

2.1 Requirements for the personnel

- Installation, commissioning, operation and maintenance of the measuring system may be carried out only by specially trained technical personnel.
- The technical personnel must be authorized by the plant operator to carry out the specified activities.
- The electrical connection may be performed only by an electrical technician.
- The technical personnel must have read and understood these Operating Instructions and must follow the instructions contained therein.
- Faults at the measuring point may only be rectified by authorized and specially trained personnel.

Repairs not described in the Operating Instructions provided must be carried out only directly at the manufacturer's site or by the service organization.

2.2 Designated use

The compact measuring system is used for inductive conductivity measurement in liquids with medium to high conductivity.

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

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

NOTICE

Applications outside specifications!

Incorrect measurements, malfunctions and even measuring point failure could result

- ► Use the product only in accordance with the specifications.
- ► Pay attention to the technical data on the nameplate.

2.3 Occupational safety

As the user, you are responsible for complying with the following safety conditions:

- Installation guidelines
- Local standards and regulations

Electromagnetic compatibility

- The product has been tested for electromagnetic compatibility in accordance with the applicable European standards for industrial applications.
- The electromagnetic compatibility indicated applies only to a product that has been connected in accordance with these Operating Instructions.

2.4 Operational safety

Before commissioning the entire measuring point:

1. Verify that all connections are correct.
2. Ensure that electrical cables and hose connections are undamaged.
3. Do not operate damaged products, and protect them against unintentional operation.
4. Label damaged products as defective.

During operation:

- If faults cannot be rectified:
  products must be taken out of service and protected against unintentional operation.

2.5 Product safety

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 relevant regulations and European standards have been observed.

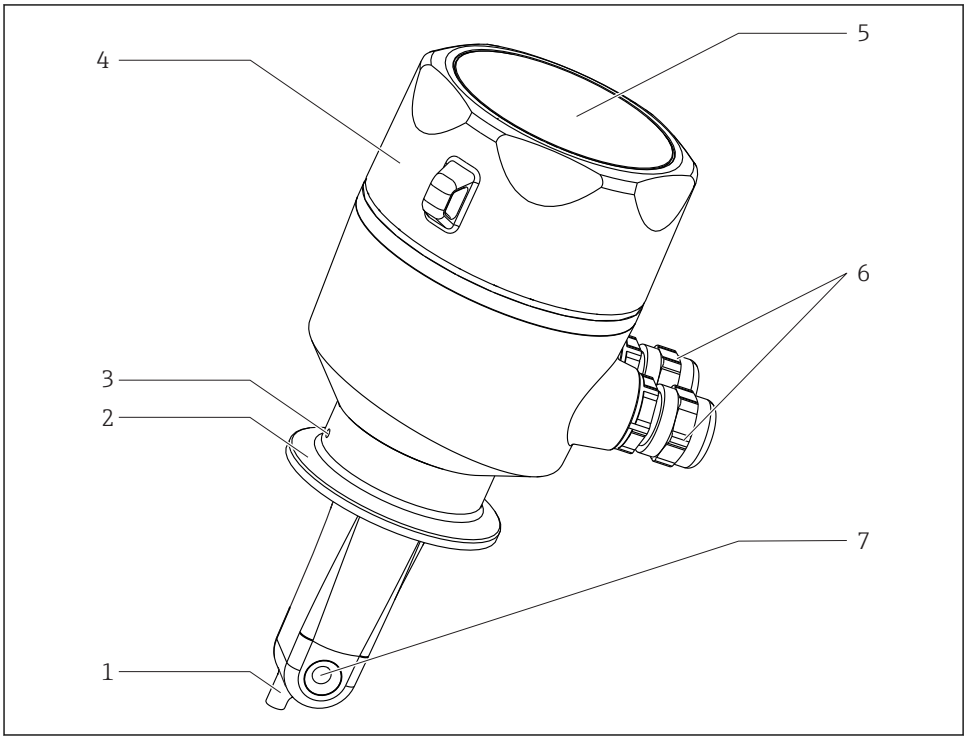
2.6 IT security

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

3.1 Product design



1 Elements

1 Temperature sensor
2 Process connection
3 Leakage bore (offset by 90° in relation to the flow direction)
4 Removable housing cover
5 Window for display
6 Cable glands (M12)
7 Flow opening of sensor

4 Incoming acceptance and product identification

4.1 Incoming acceptance

1. Verify that the packaging is undamaged.
   ↳ Notify the supplier of any damage to the packaging.
   Keep the damaged packaging until the issue has been resolved.
2. Verify that the contents are undamaged.
   ↳ Notify the supplier of any damage to the delivery contents.
   Keep the damaged goods until the issue has been resolved.
3. Check that the delivery is complete and nothing is missing.
   ↳ Compare the shipping documents with your order.
4. Pack the product for storage and transportation in such a way that it is protected against impact and moisture.
   ↳ The original packaging offers the best protection.
   Make sure to comply with the permitted ambient conditions.

If you have any questions, please contact your supplier or your local Sales Center.


Technical data→ 40

4.2 Product identification

4.2.1 Nameplate

The nameplate provides you with the following information on your device:
- Manufacturer identification
- Order code
- Extended order code
- Serial number
- Firmware version
- Ambient and process conditions
- Input and output values
- Measuring range
- Safety information and warnings
- Protection class

► Compare the information on the nameplate with the order.

4.2.2 Product identification

Product page

www.endress.com/CLD18

Interpreting the order code

The order code and serial number of your product can be found in the following locations:
- On the nameplate
- In the delivery papers

Obtaining information on the product

1. Open the product website.
2. At the top of the page, select the link **Services**.
   ↳ An additional sidebar opens up.
3. Select **Online Tools** followed by **Access device specific information**.
   ↳ An additional window opens.
4. Enter the order code from the nameplate into the search field. Then select **Show details**.
   ↳ Details of each feature (selected option) of the order code are displayed.

Manufacturer's address

Endress+Hauser Conducta GmbH+Co. KG
Dieselstraße 24
D-70839 Gerlingen

4.3 Scope of delivery

The delivery comprises:
- A Smartec CLD18 measuring system in the version ordered
- Operating Instructions BA01149C/07/EN

4.4 Certificates and approvals

4.4.1 Declaration of conformity

The product meets the requirements of the harmonized European standards. As such, it complies with the legal specifications of the EU directives. The manufacturer confirms successful testing of the product by affixing to it the CE mark.

4.4.2 Hygiene

FDA

All materials in contact with the product are FDA-listed materials (apart from the PVC process connections).

EHEDG

Certified cleanability according to EHEDG Type EL Class I.

When using the sensor in hygienic applications, please note that the cleanability of the sensor also depends on the way the sensor is installed. To install the sensor in a pipe, use the appropriate and EHEDG-certified flow vessels for the particular process connection.

3-A

Certified according to 3-A Standard 74- ("3-A Sanitary Standards for Sensor and Sensor Fittings and Connections Used on Milk and Milk Products Equipment").

EC Regulation No. 1935/2004

The sensor meets the requirements of EC Regulation No. 1935/2004 on materials and articles intended to come into contact with food.

4.4.3 Pressure approval

Canadian pressure approval for pipes according to ASME B31.3

5 Installation

5.1 Installation conditions

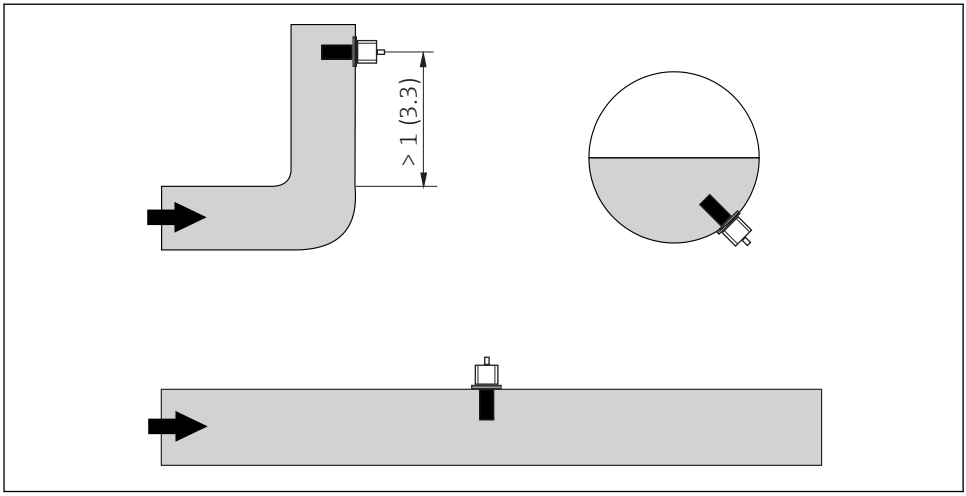
5.1.1 Installation instructions

For a 3-A compliant installation, the following must be noted:

After the instrument is installed its hygienic integrity shall be maintained. The instrument shall be installed with the leakage detection at the lowest point of the assembly. Furthermore all process connections must be 3-A compliant.

Orientations

The sensor must be completely immersed in the medium. Avoid air bubbles in the area of the sensor.



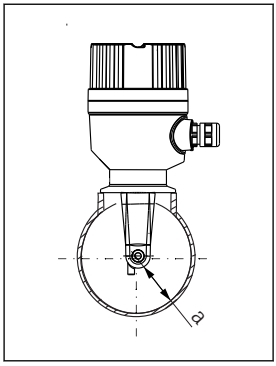
2 *Orientation of conductivity sensors. Engineering unit: m (ft)*

If the flow direction changes (after pipe bends), turbulence in the medium can result.

► Install the sensor at a distance of at least 1 m (3.3 ft) downstream from a pipe bend.

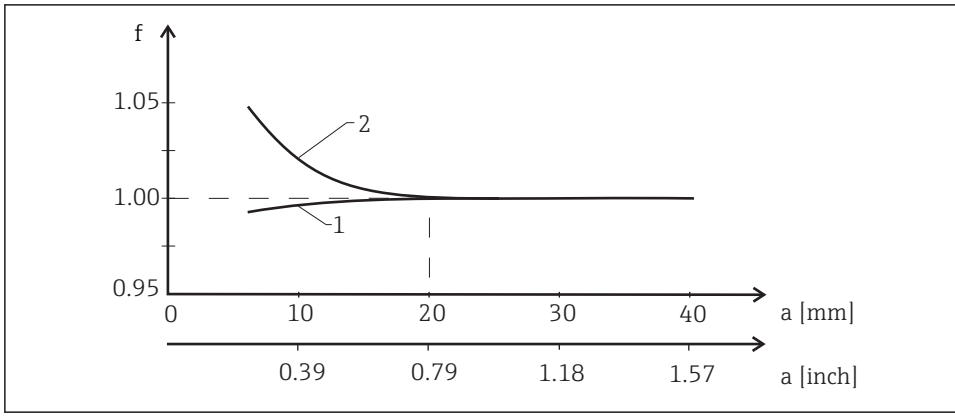
The product should flow along the hole of the sensor (see the arrows on the housing). The symmetrical measuring channel allows flow in both directions.

In confined installation conditions, the walls affect the ionic current in the liquid. This effect is offset by what is referred to as the installation factor. The installation factor can be entered in the transmitter for the measurement or the cell constant is corrected by multiplying by the installation factor.
The value of the installation factor depends on the diameter and the conductivity of the pipe nozzle as well as the distance a between the sensor and the wall.
The installation factor can be disregarded (f = 1.00) if the distance to the wall is sufficient (a > 20 mm, from DN 60).
If the distance to the wall is smaller, the installation factor increases for electrically insulating pipes (f > 1) and decreases for electrically conductive pipes (f < 1).
It can be measured using calibration solutions, or a close approximation can be determined from the following diagram.



3 *Installation of CLD18*

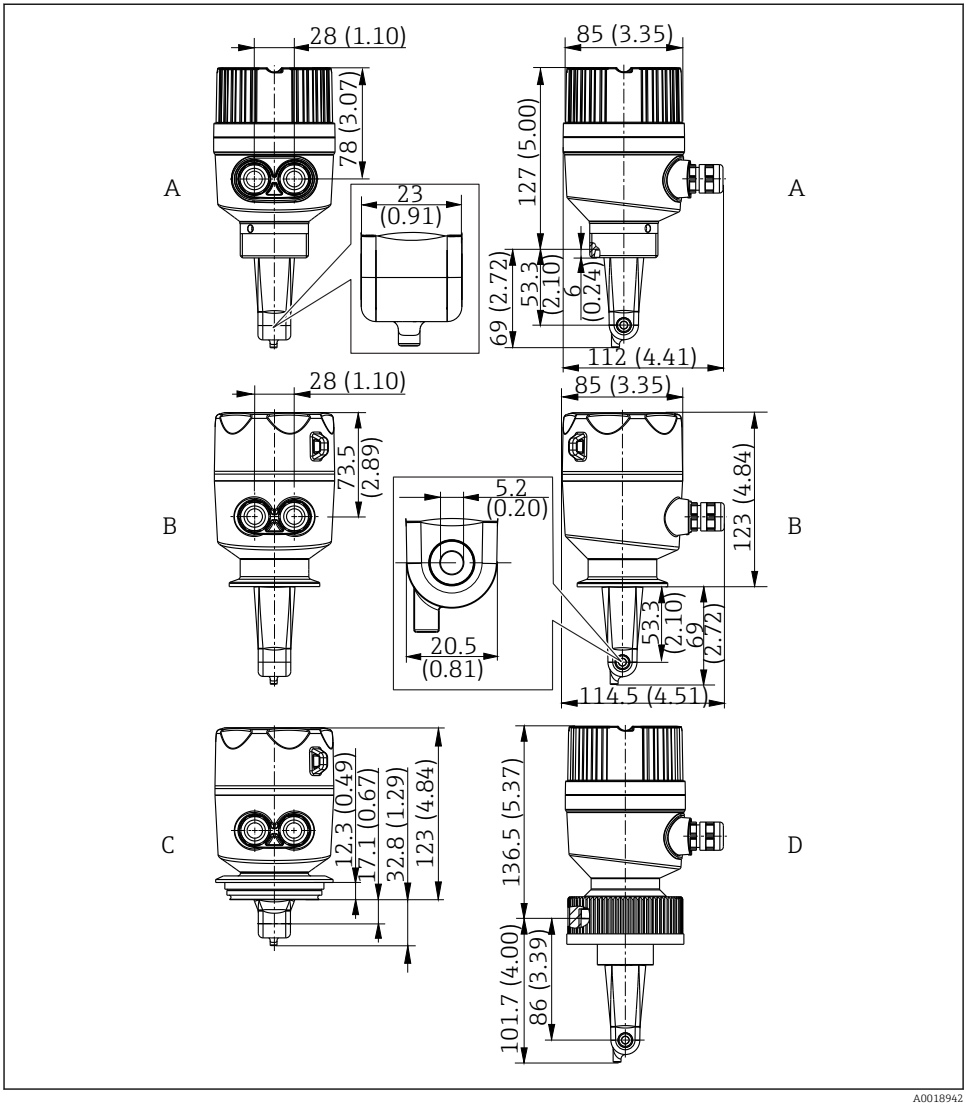
a Wall distance



4 *Relationship between installation factor f and wall distance a*

1 Electrically conductive pipe wall
2 Electrically insulating pipe wall

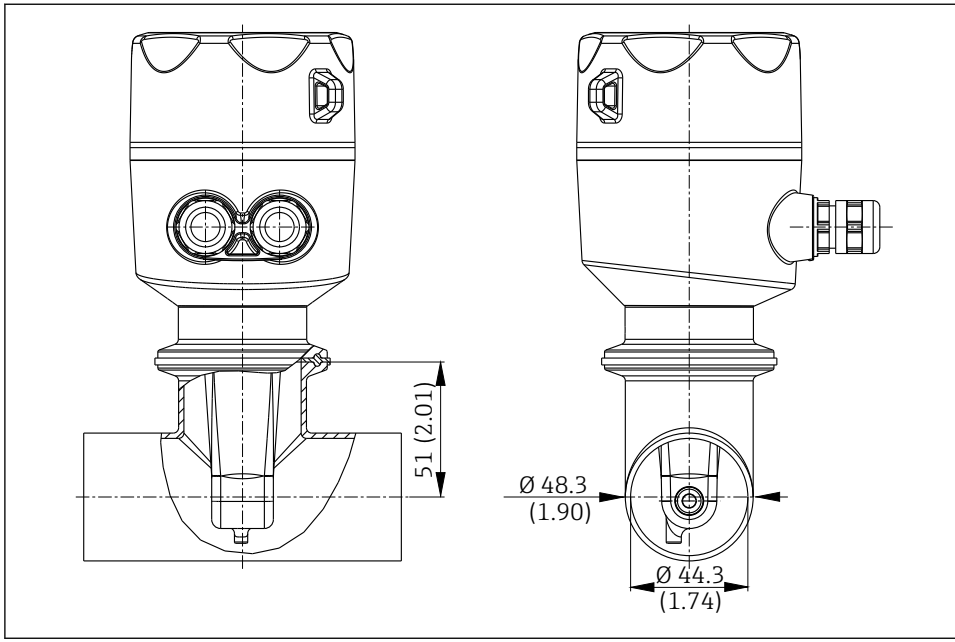
Install the measuring system in such a way that the housing is not exposed to direct sunlight.



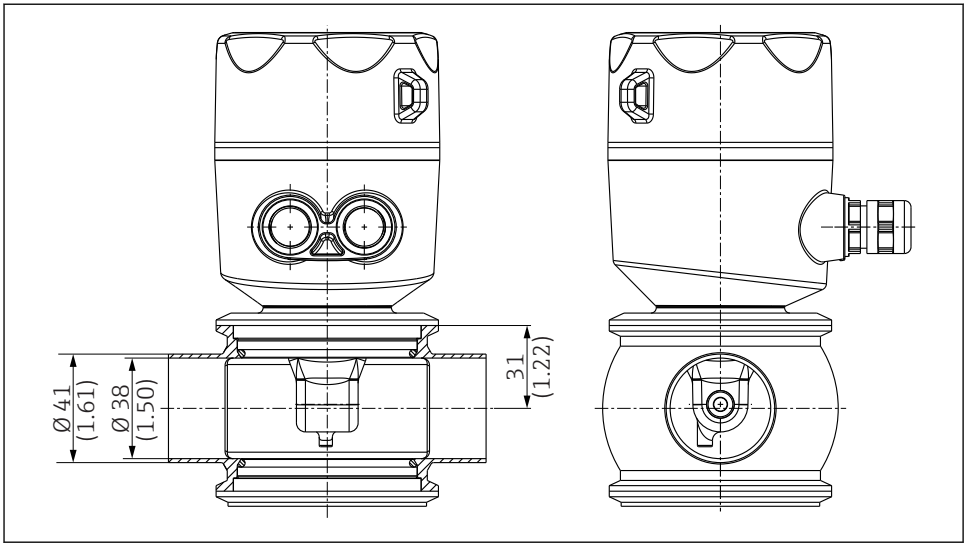
5 Dimensions and versions (examples). Dimensions: mm (in)

A Plastic housing with thread G 1½
B Stainless steel housing with ISO 2852 clamp 2"
C Stainless steel housing with Varivent DN 40 to 125
D Plastic housing with coupling nut 2¼" PVC

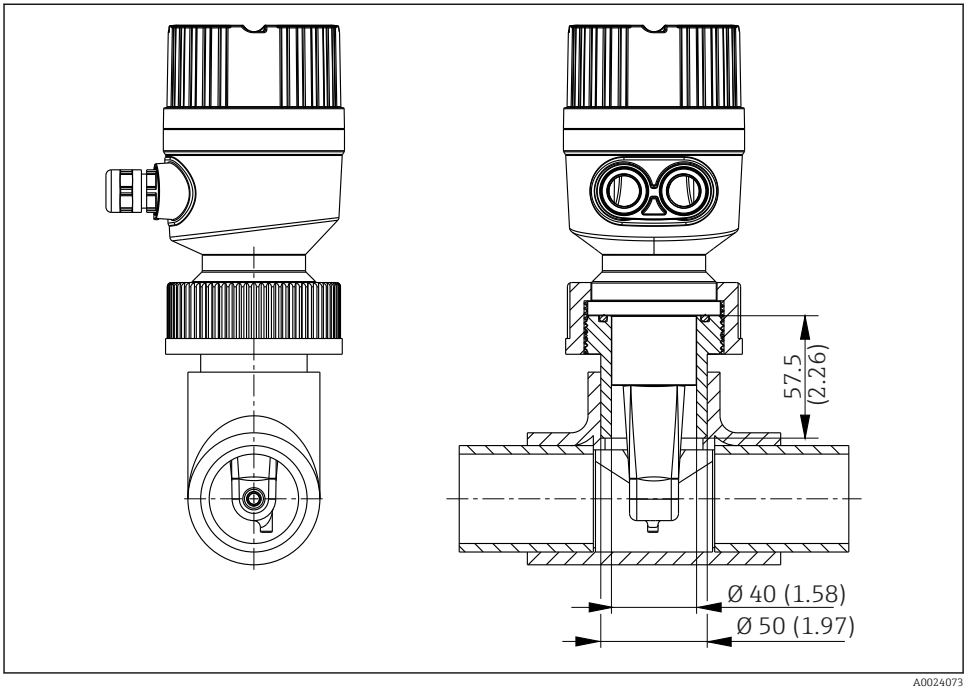
5.1.2 Installation examples



6 Installation in DN 40 pipe with Tri-Clamp 2" process connection. Dimensions: mm (in)



7 Installation in DN 40 pipe with Varivent process connection. Dimensions: mm (in)



8 Installation in DN 40 pipe with 2¼" PVC coupling nut process connection. Dimensions: mm (in)

5.2 Mounting the compact device

- Choose the installation depth of the sensor in the medium such that the coil body is completely immersed in the medium.

Pay attention to the information on wall clearance → 11

1. Mount the compact device directly on a pipe nozzle or tank nozzle via the process connection.
2. For the 1½" threaded connection, use a Teflon tape to seal the connection and an adjustable pin wrench (DIN 1810, flat face, size 45 to 50 mm (1.77 to 1.97 in)) to tighten it.
3. When installing, align the compact device in such a way that the medium flows through the flow opening of the sensor in the direction of medium flow. Use the arrow on the nameplate to help you align the device.
4. Tighten the flange.

5.3 Post-installation check

1. Following installation, check the compact device for damage.
2. Ensure that the compact device is protected against direct sunlight.

6 Electrical connection

WARNING

Device is live!

Incorrect connection may result in injury or death!

- The electrical connection may be performed only by an electrical technician.
- The electrical technician must have read and understood these Operating Instructions and must follow the instructions contained therein.
- **Prior** to commencing connection work, ensure that no voltage is present on any cable.

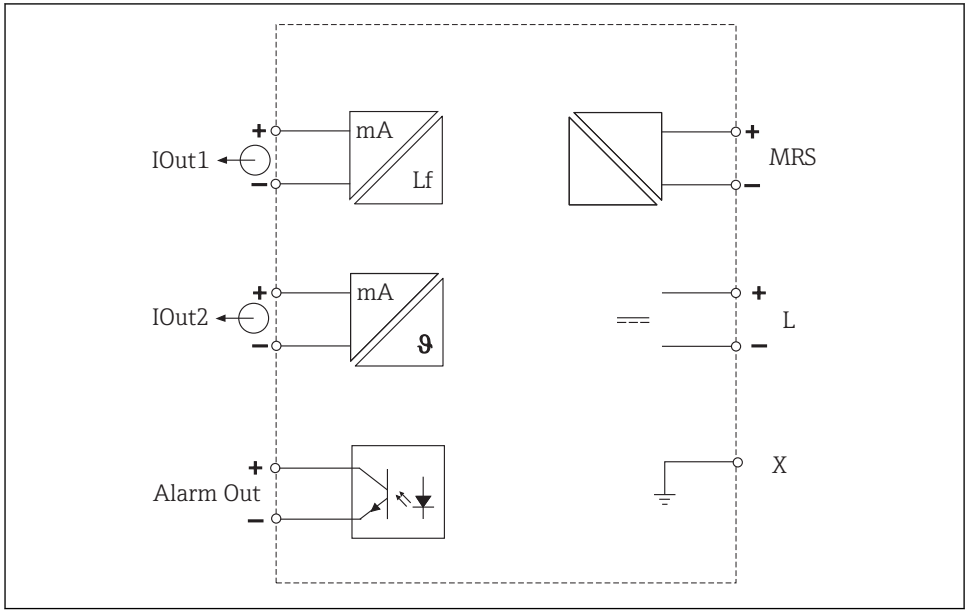
6.1 Connecting the transmitter

WARNING

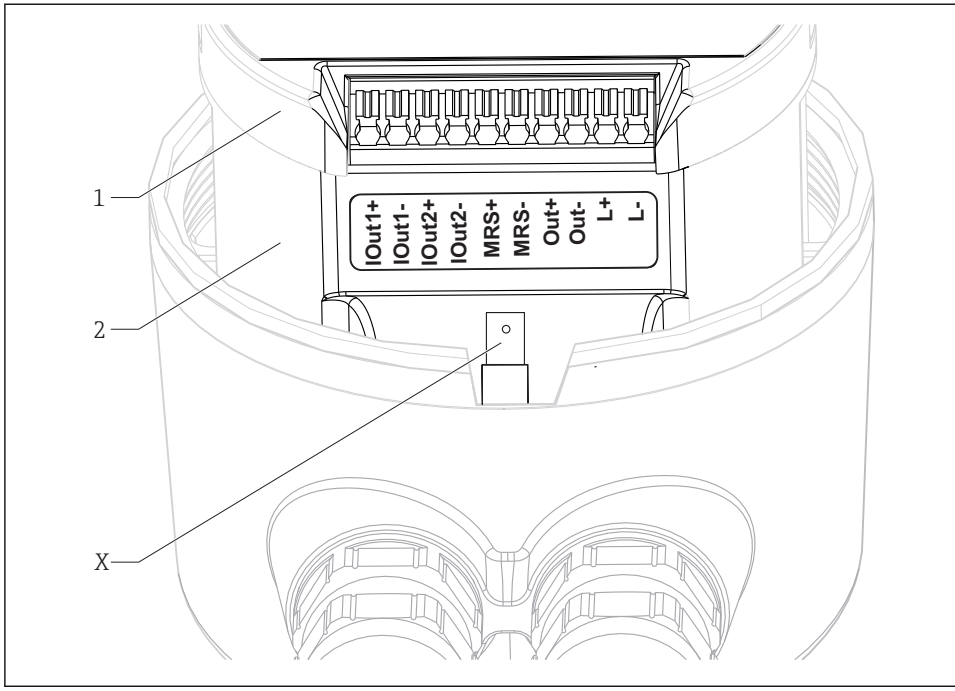
Risk of electric shock!

- At the supply point, the power supply must be isolated from dangerous live cables by double or reinforced insulation in the case of devices with a 24 V power supply.

6.1.1 Direct connection of the cables



9 *Electrical connection*



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10 *Terminal assignment*

IOut1	*Current output conductivity (active)*
IOut2	*Current output temperature (active)*
Out	*Alarm output (open-collector)*
MRS	*Binary input (measuring range switch)*
L+/L-	*Power supply*
X	*Grounding pin (flat male tab 4.8 mm)*
1	*Cover on electronics box*
2	*Electronics box*

NOTICE

Removing the electronics box will destroy the sensor connection!

- ▶ The electronics box must not be removed under any circumstances.
- ▶ Do not open the cover on the electronics box.

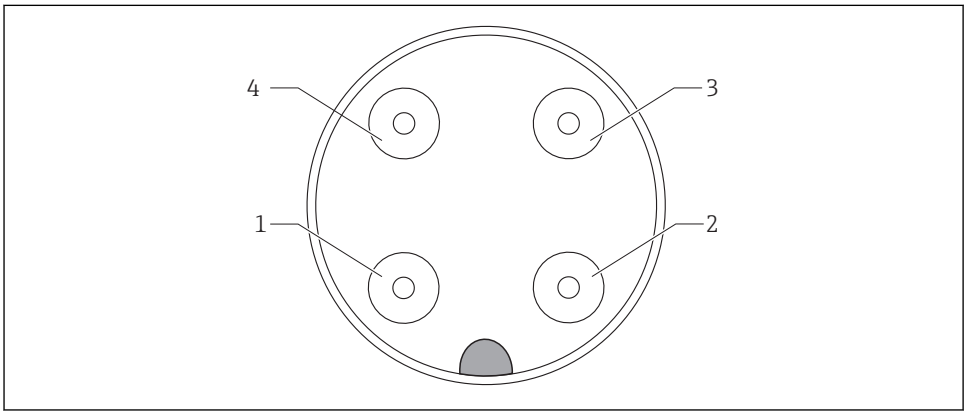
The recommended cable cross-section for the connecting cables is 0.5 mm^2. The maximum cable cross-section is 1.0 mm^2.

Connect the transmitter of the compact device as follows:

1. Unscrew the housing cover.

2. Guide the connecting cables through the cable glands.
3. Connect the cables as per the terminal assignment diagram.
4. Connect the protective ground to the terminal pin for the housing ground.

6.1.2 Connection via M12 connector



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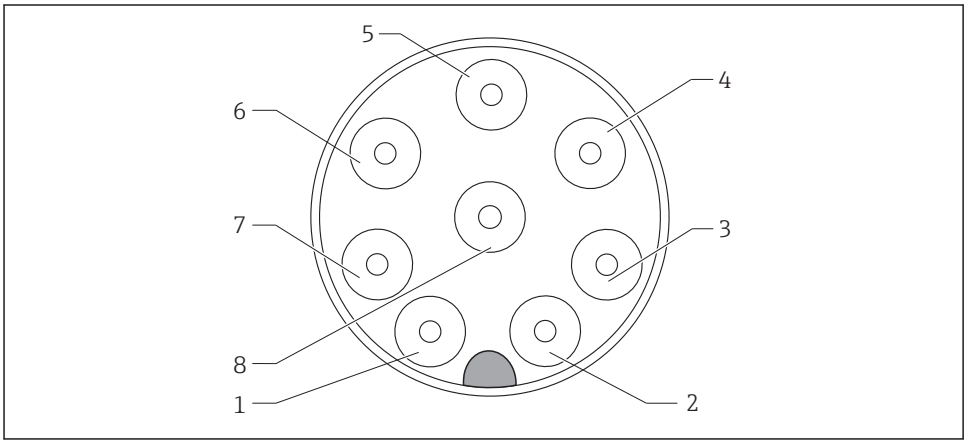
11 *View of connector, 4-pin, data cable (at device)*

1	*IOUT1+*	*Conductivity*	*3*	*IOUT2-*	*Temperature*
2	*IOUT2+*	*Temperature*	*4*	*IOUT1-*	*Conductivity*



A0033109

12 *View of connector, 8-pin, power supply/controller (at device)*

1	*L+*	*Power supply*	*5*	*Out+*	*Alarm output+*
2	*L-*	*Power supply*	*6*	*Out-*	*Alarm output-*
3	*MRS+*	*Binary input*	*7*	*GND*	*Functional ground*
4	*MRS-*	*Binary input*	*8*	*GND*	*Functional ground*

6.2 Ensuring the degree of protection

Guarantee the degree of protection as follows:

1. Verify that the O-ring is seated correctly in the housing cover.
2. Screw the housing cover tight until the stop.
3. Screw the cable glands tight.

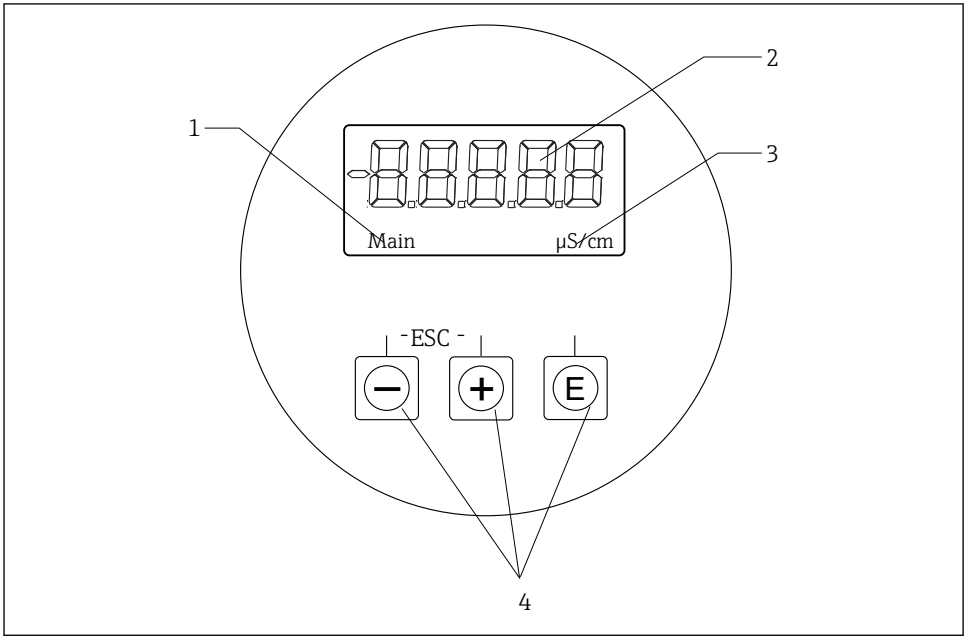
6.3 Post-connection check

Once you have performed the electrical connections, carry out the following checks :

Instrument status and specifications	Notes
Are the transmitter and cables free from damage on the outside?	Visual inspection

Electrical connection	Notes
Are the installed cables strain-relieved and not twisted?	
Is the cable run correct, without loops and cross-overs?	
Are the signal cables correctly connected as per the wiring diagram?	
Are all the cable entries fitted, tightened and leak-proof?	
Are the PE distributor blocks grounded (if present)?	Grounding is carried out at the point of installation.

7 Operation options



13 *Display and keys of the CLD18*

1 Parameters
2 Measured value
3 Unit
4 Operating keys

The ASTN display (Advanced Super Twisted Nematic) is split into two sections. The segment section displays the measured value. The dot-matrix section displays the parameter and unit. The operating texts are displayed in English.

In the event of an error the device automatically alternates between displaying the error and the measured value.

7.1 Overview of operating options

 A0029236	▪ Open the Configuration menu ▪ Confirm the entry ▪ Select a parameter or submenu
 A0029235	Within the Configuration menu: ▪ Gradually select the specified menu items / characters for the parameter ▪ Change the selected parameter Outside the Configuration menu: Display enabled and calculated channels, as well as minimum and maximum values, for all the active channels.
	Press both keys simultaneously (< 3 s) to quit the setup without saving any changes.

Always quit menu items / submenus at the end of the menu via "x Back".

Symbols in the editing mode:

 A0020597	Accept entry. If this symbol is selected, the entry is applied at the position specified by the user, and you quit editing mode.
 A0020598	Reject entry. If this symbol is selected, the entry is rejected and you quit editing mode. The previously set text remains.
 A0020599	Jump one position to the left. If this symbol is selected, the cursor jumps one position to the left.
 A0020600	Delete backwards. If this symbol is selected, the character to the left of the cursor position is deleted.
 A0020601	Delete all. if this symbol is selected, the entire entry is deleted.

7.2 Structure and function of the operating menu

The operating functions of the compact measuring device are divided into the following menus:

Display	Settings for the device display: contrast, brightness, time for alternating measured values on the display
Setup	Device settings
Calibration	Perform sensor calibration*
Diagnostics	Device information, diagnostics logbook, sensor information, simulation

* The air set and the correct cell constant have already been configured at the factory for the Smartec CLD18. A sensor calibration is not necessary during commissioning.

8 Commissioning

8.1 Switching on the measuring device

1. Familiarize yourself with the operation of the transmitter before it is first switched on.
   ↳ After power-up, the device performs a self-test and then goes to the measuring mode.
2. If you are commissioning the device for the first time, **Setup** program the as described in the following sections of the Operating Instructions.

8.2 Display settings (Display menu)

1. Use the 'E' key to call up the main menu.
   ↳ The menu appears on the display **Display**.
2. Press the 'E' key again to open the menu.
3. Use the option, **Back** which can be found at the bottom of each menu, to move up a level in the menu structure.

Parameter	Possible settings	Description
Contrast	1 to 7 Default: **5**	Setting for the contrast
Brightness	1 to 7 Default: **5**	Setting for the brightness of the display
Alternating time	0, 3, 5, 10 s Default: **5**	Alternating time between the two measured values 0 means that the values do not alternate on the display

8.3 Configuring the measuring device

1. Use the 'E' key to call up the main menu.
2. Navigate through the available menus with the '+' and '–' keys.
3. Press the 'E' key to open the desired menu.
4. Use the option, **Back** which can be found at the bottom of each menu, to move up a level in the menu structure.

Default settings are in bold.

Parameter	Possible settings	Description
Current range	**4-20 mA** 0-20 mA	▶ Select the current range.
Out1 0/4 mA	0 to 2000000 µS/cm **0 µS/cm**	▶ Enter the measured value at which the min. current value (0/4 mA) is present at the transmitter output.
Out1 20 mA	0 to 2000000 µS/cm **0 µS/cm**	▶ Enter the measured value at which the max. current value (20 mA) is present at the transmitter output.
Out2 0/4 mA	-50 to 250 °C **0.0 °C**	▶ Enter the measured value at which the min. current value (0/4 mA) is present at the transmitter output.
Out2 20 mA	-50 to 250 °C **100.0 °C**	▶ Enter the measured value at which the max. current value (20 mA) is present at the transmitter output.
Damping main	0 ... 60 s **0 s**	Damping value for the conductivity measured value
Extended setup		Advanced settings→ 🖹 26
Manual hold	**Off**, **On**	Function for freezing the current and alarm outputs

8.4 Advanced settings

1. Use the 'E' key to call up the main menu.
2. Navigate through the available menus with the '+' and '–' keys.
3. Press the 'E' key to open the desired menu.
4. Use the option, **Back** which can be found at the bottom of each menu, to move up a level in the menu structure.

Default settings are in bold.

Parameter		Possible settings	Description
System			General settings
	Device tag	Customized text Max. 16 characters	Enter the device designation

Parameter			Possible settings	Description
	Temp. unit		**°C** °F	Setting for the temperature unit
	Hold release		0 to 600 s **0 s**	Prolongs the device hold when the hold condition no longer applies
	Alarm delay		0 to 600 s **0 s**	Time delay after which an alarm is output This suppresses alarm conditions that are present for a period that is shorter than the alarm delay time.
Input				Setting for the inputs
	Cell const.		Read only	Displays the cell constant
	Inst. factor		0.1 to 5.0 **1.0**	The effects of the distance from the wall can be corrected with the installation factor → 29
	Unit		**Auto**, µS/cm, mS/cm	Unit of conductivity "auto" automatically switches between µS/cm and mS/cm.
	Damping main		0 … 60 s **0 s**	Setting for the damping
	Temp. comp.		**Off**, **Linear**	Setting for temperature compensation
	Alpha coeff.		1.0 to 20.0 %/K **2.1 %/K**	Coefficient for linear temperature compensation
	Ref. temp.		+10 to +50 °C **25 °C**	Enter the reference temperature
	Process check			The process check checks the measuring signal for stagnation. An alarm is triggered if the measuring signal does not change over a specific period (several measured values).
		Function	**On**, **Off**	▶ Switch the process check on or off.
		Duration	1 to 240 min **60 min**	The measured value must change within this time as otherwise an error message is triggered.
		Observation width	1 to 20 % **0.0 %**	Bandwidth for the process check
Analog output				Setting for analog outputs
	Current range		**4-20 mA** 0-20 mA	Current range for analog output
	Out1 0/4 mA		0 to 2000000 µS/cm **0 µS/cm**	▶ Enter the measured value at which the min. current value (0/4 mA) is present at the transmitter output.
	Out1 20 mA		0 to 2000000 µS/cm **0 µS/cm**	▶ Enter the measured value at which the max. current value (20 mA) is present at the transmitter output.
	Out2 0/4 mA		-50 to 250 °C **0.0 °C**	▶ Enter the measured value at which the min. current value (0/4 mA) is present at the transmitter output.
	Out2 20 mA		-50 to 250 °C **100.0 °C**	▶ Enter the measured value at which the max. current value (20 mA) is present at the transmitter output.

Parameter		Possible settings	Description
MRS			Setting for measuring range switching → 31
	Out1 0/4 mA	0 to 2000000 µS/cm **0 µS/cm**	▶ Enter the measured value at which the min. current value (0/4 mA) is present at the transmitter output.
	Out1 20 mA	0 to 2000000 µS/cm **0 µS/cm**	▶ Enter the measured value at which the max. current value (20 mA) is present at the transmitter output.
	Out2 0/4 mA	-50 to 250 °C **0.0 °C**	▶ Enter the measured value at which the min. current value (0/4 mA) is present at the transmitter output.
	Out2 20 mA	-50 to 250 °C **100.0 °C**	▶ Enter the measured value at which the max. current value (20 mA) is present at the transmitter output.
	Damping main	0 … 60 s **0 s**	Setting for the damping
	Alpha coeff.	1.0 to 20 %/K **2.1 %/K**	Coefficient for linear temperature compensation
Factory default			Factory settings
	Please confirm	No **No**, **Yes**	

8.4.1 Installation factor

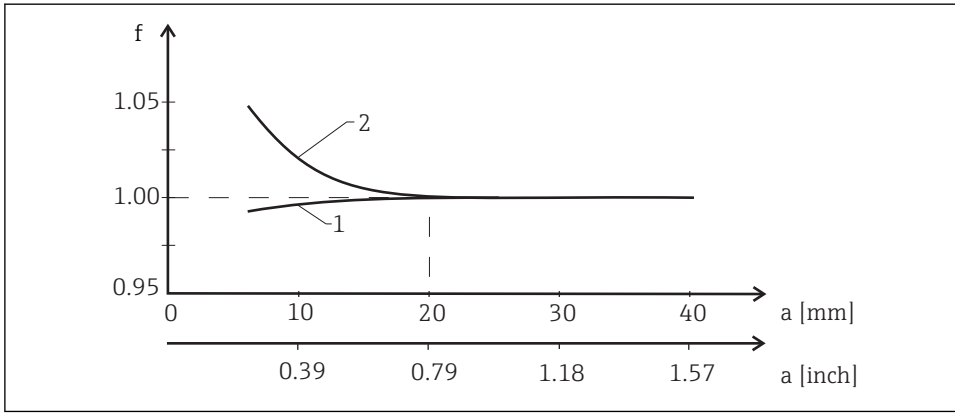
In confined installation conditions, the conductivity measurement in the liquid is affected by the pipe walls. This effect is offset by the installation factor. The cell constant is corrected by multiplying by the installation factor.

The value of the installation factor depends on the diameter and the conductivity of the pipe nozzle as well as the sensor's distance to the wall.

The installation factor f (f = 1.00) can be disregarded if the distance to the wall is sufficient (a>20 mm (0.79 in), from DN60).

If the distance to the wall is small, the installation factor increases for electrically insulating pipes (f > 1), and decreases for electrically conductive pipes (f < 1).

It can be measured using calibration solutions, or a close approximation determined from the following diagram.



14 Relationship between the installation factor (f) and the distance from wall (a)

1 Electrically conductive pipe wall
2 Electrically insulating pipe wall

8.4.2 Temperature compensation

The conductivity of a liquid depends heavily on the temperature, as the mobility of the ions and the number of dissociated molecules are temperature-dependent. In order to compare measured values, they must be referenced to a defined temperature. The reference temperature is 25 °C (77 °F).

The temperature is always specified when the conductivity is specified. $k(T_0)$ represents the conductivity measured at 25 °C (77 °F) or referenced back to 25 °C (77 °F).

The temperature coefficient α represents the percentage change in the conductivity per degree of temperature change. The conductivity k at the process temperature is calculated as follows:

$$\kappa(T) = \kappa(T_0) \cdot (1 + \alpha \cdot (T - T_0))$$

A0009163

Where
$k(T)$ = conductivity at process temperature T
$k(T_0)$ = conductivity at process temperature T_0
The temperature coefficient depends on both the chemical composition of the solution and on the temperature, and is between 1 and 5 % per °C. The electrical conductivity of the majority of diluted saline solutions and natural waters changes in a close-to-linear fashion.

Typical values for the temperature coefficient α:

Natural waters	Approx. 2 %/K
Salts (e.g. NaCl)	Approx. 2.1 %/K
Alkali (e.g. NaOH)	Approx. 1.9 %/K
Acids (e.g. HNO_3)	Approx. 1.3 %/K

8.4.3 Measuring range switch (MRS)

Measuring range switching involves a parameter set changeover for two substances:
- in order to cover a large measuring range
- in order to adjust temperature compensation in the event of a product change

The two analog outputs can each be configured with two parameter sets.
- Parameter set 1:
  - The parameters for the current outputs and the damping can be set **Setup** in the menu.
  - The alpha coefficient for temperature compensation can be set **Setup**/**Extended setup**/**Input** in the menu.
  - Parameter set 1 is active if the "MRS" binary input is **Low** .
- Parameter set 2:
  - The parameters for the current outputs, the damping and the alpha coefficient for temperature compensation can be configured **Setup**/**Extended setup**/**Remote switch** in the menu.
  - Parameter set 2 is active if the "MRS" binary input **High** is .

The settings for parameter set 1 are also listed in **Extended setup**/**Analog output** the menu.

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8.5 Calibration (Calibration menu)

In the case of the Smartec CLD 18, the air set and the correct cell constant have already been configured at the factory. A sensor calibration is not necessary during commissioning.

8.5.1 Types of calibration

The following types of calibration are possible:
- Cell constant with calibration solution
- Air set (residual coupling)

8.5.2 Cell constant

General

The calibration of a conductivity measuring system is always performed in such a way that the suitable calibration solutions determine or verify the exact cell constant. This process is described in the standards EN 7888 and ASTM D 1125, for example, and the method for producing a number of calibration solutions is explained.

Calibrating the cell constant

▶ With this type of calibration, enter a reference value for the conductivity.
↳ In the result, the device calculates a new cell constant for the sensor.

First switch off the temperature compensation:

1. Select the menu **Setup/Extended setup/Input/Temp. comp.** .
2. **Off** Select .
3. Return to the menu **Setup** .

Perform the calculation of the cell constant as follows:

1. Select the menu **Calibration/Cell const.** .
2. **Cond. ref.** Select and enter the value of the standard solution.
3. Place the sensor in the medium.
4. Start the calibration.
   ↳ "**Wait calib.**" - wait for calibration to end. The new value is displayed after the calibration.
5. Press the Plus key.
   ↳ "**Save calib data?**"
6. **Yes** Select .
   ↳ "**Calib successful**"
7. Switch the temperature compensation back on.

8.5.3 Air set (residual coupling)

For physical reasons, the calibration line goes through zero in the case of conductive sensors (a current flow of 0 corresponds to a conductivity of 0). When working with inductive sensors, the residual coupling between the primary coil (transmitter coil) and secondary coil (receiver coil) must be taken into account or compensated for. The residual coupling is not only caused by the direct magnetic coupling of the coils but also by crosstalk in the supply cables.

As is the case with the sensors, the cell constant is then determined using a precise calibration solution.

To perform an airset, the sensor must be dry.

Perform an airset as follows:

1. **Calibration/Airset** Select .
   ↳ The current value is displayed.
2. Press the Plus key.
   ↳ "**Keep sensor in air**"
3. Keep the dried sensor in air and press the Plus key.
   ↳ "**Wait calib.**" - wait for calibration to end. The new value is displayed after the calibration.
4. Press the Plus key.
   ↳ "**Save calib data?**"
5. **Yes** Select .
   ↳ "**Calib successful**"
6. Press the Plus key.
   ↳ The device switches back to the measuring mode.

9 Diagnostics and troubleshooting

9.1 General troubleshooting

User interface	Cause	Solution
No measured value displayed	No power supply connected	Check the device's power supply.
	Power is supplied, device is defective	The device must be replaced.
Diagnostic message is displayed	Diagnostic messages → 35	

9.2 Trouble shooting instructions

1. Use the 'E' key to call up the main menu.
2. Navigate through the available menus with the '+' and '–' keys.
3. Press the 'E' key to open the desired menu.
4. Use the option, **Back** which can be found at the bottom of each menu, to move up a level in the menu structure.

Parameter		Possible settings	Description
Current diag.		Read only	Displays the current diagnostic message
Last diag.		Read only	Displays the last diagnostic message
Diag. logbook		Read only	Displays the last diagnostic messages
Device info		Read only	Displays device information
Sensor info		Read only	Displays sensor information
Simulation			
	Analog out 1	Off 0 mA, 3.6 mA, 4 mA, 10 mA, 12 mA, 20 mA, 21 mA	Outputs a corresponding value at the "**Analog out 1**" output.
	Analog out 2	Off 0 mA, 3.6 mA, 4 mA, 10 mA, 12 mA, 20 mA, 21 mA	Outputs a corresponding value at the "**Analog out 2**" output.
	Alarm out	Off Active Inactive	
Reset device			

9.3 Pending diagnostic messages

The diagnostic message consists of a diagnostic code and a message text. The diagnostic code consists of the error category as per Namur NE 107 and the message number.

Error category (letter in front of the message number):
- F = **Failure**, a malfunction has been detected
  The measured value of the affected channel is no longer reliable. Look for the cause in the measuring point. If a control system is connected, it must be switched to manual mode.
- M = **Maintenance required**, action should be taken as soon as possible
  The device still measures correctly. Immediate measures are not necessary. Proper maintenance efforts may prevent a possible malfunction in the future.
- C = **Function check**, waiting (no error)
  Maintenance work is being performed on the device. Wait until the work has been completed.
- S = **Out of specification**, the measuring point is being operated outside your specification
  Operation is still possible. However, you run the risk of increased wear, shorter operating life or reduced measurement accuracy. Look for the cause in the measuring point.

Diagnostic code	Message text	Description
F61	Sensor elec.	Sensor electronics defective Remedy: Contact the Service Department
F62	Sens. Connect	Sensor connection Remedy: Contact the Service Department
F100	Sensor comm.	Sensor not communicating Possible reasons: No sensor connection Remedy: Contact the Service Department
F130	Sensor supply	Sensor check No conductivity displayed Possible reasons: ▪ Sensor in air ▪ Sensor defective Remedy: ▪ Check sensor installation ▪ Contact the Service Department
F143	Selftest	Sensor self-test error Remedy: Contact the Service Department
F152	No airset	Sensor data No calibration data available Remedy: Perform an air set

Diagnostic code	Message text	Description
F523	Cell constant	Sensor calibration warning Invalid cell constant, max. range reached Remedy: ▪ Enter cell constant as per factory specifications ▪ Contact the Service Department
F524	Cell constant	Sensor calibration warning Min. possible cell constant is undershot Remedy: ▪ Enter cell constant as per factory specifications ▪ Contact the Service Department
F845	Device id	Incorrect hardware configuration
F847	Couldn't save param	Incorrect parameters
F848	Calib AO1	Incorrect calibration values for analog output 1
F849	Calib AO2	Incorrect calibration values for analog output 2
F904	Process check	Process check system alarm Measuring signal has not changed for a long time Possible reasons: ▪ Contaminated sensor, or sensor in air ▪ No flow to sensor ▪ Sensor defective ▪ Software error Remedy: ▪ Check electrode system ▪ Check sensor ▪ Restart device

Diagnostic code	Message text	Description
C107	Calib. active	Sensor calibration is active Remedy: Wait for calibration to be finished
C154	No calib. data	Sensor data No calibration data available, factory settings are used Remedy: ▪ Check the calibration information of the sensor ▪ Contact the Service Department
C850	Simu AO1	Simulation of analog output 1 is active
C851	Simu AO2	Simulation of analog output 2 is active

Diagnostic code	Message text	Description
S844	Process value	Measured value outside the specified range Possible reasons: ▪ Sensor in air ▪ Incorrect flow to sensor ▪ Sensor defective Remedy: ▪ Increase process value ▪ Check electrode system

Diagnostic code	Message text	Description
M500	Not stable	Sensor calibration aborted Main measured value fluctuating Possible reasons: ▪ Sensor in air ▪ Sensor fouled ▪ Incorrect flow to sensor ▪ Sensor defective Remedy: ▪ Check sensor ▪ Check installation
M526	Cell constant	Sensor calibration warning Invalid cell constant, max. range reached Remedy: ▪ Repeat the calibration ▪ Enter cell constant as per factory specifications ▪ Contact the Service Department
M528	Cell constant	Sensor calibration warning Min. possible cell constant is undershot Remedy: ▪ Repeat the calibration ▪ Enter cell constant as per factory specifications ▪ Contact the Service Department

10 Maintenance

WARNING

Risk of injury if medium escapes!

- ▶ Before each maintenance task, ensure that the process pipe is unpressurized, empty and rinsed.

The electronics box does not contain any parts that the user must maintain.
- The cover on the electronics box may be opened only by Endress+Hauser Service staff.
- The electronics box may be removed only by Endress+Hauser Service staff.

10.1 Maintenance tasks

10.1.1 Cleaning the housing

- ▶ Clean the front of the housing using commercially available cleaning agents only.

The front of the housing is resistant to the following in accordance with DIN 42 115:
- Ethanol (for a short time)
- Diluted acids (max. 2% HCl)
- Diluted bases (max. 3% NaOH)
- Soap-based household cleaning agents

- ▶ When performing any work on the device, bear in mind any potential impact this may have on the process control system or on the process itself.

NOTICE

Prohibited cleaning agents!

Damage to the housing surface or housing seal
- ▶ Never use concentrated mineral acids or alkaline solutions for cleaning.
- ▶ Never use organic cleaners such as benzyl alcohol, methanol, methylene chloride, xylene or concentrated glycerol cleaner.
- ▶ Never use high-pressure steam for cleaning.

11 Repairs

The O-ring is defective if medium escapes from the leakage hole.

- Contact the E+H Service department to replace the O-ring.

11.1 General notes

- Only use spare parts from Endress + Hauser to guarantee the safe and stable functioning of the device.

Detailed information on the spare parts is available at:
www.endress.com/device-viewer

11.2 Return

The product must be returned if repairs or a factory calibration are required, or if the wrong product was ordered or delivered. As an ISO-certified company and also due to legal regulations, Endress+Hauser is obliged to follow certain procedures when handling any returned products that have been in contact with medium.

To ensure the swift, safe and professional return of the device:

- Refer to the website www.endress.com/support/return-material for information on the procedure and conditions for returning devices.

11.3 Disposal

The device contains electronic components. and must therefore be disposed of in accordance with regulations on the disposal of electronic waste.

- Observe the local regulations.

12 Accessories

The following are the most important accessories available at the time this documentation was issued.

▶ For accessories not listed here, please contact your Service or Sales Center.

12.1 Calibration solutions

Conductivity calibration solutions CLY11
Precision solutions referenced to SRM (Standard Reference Material) by NIST for qualified calibration of conductivity measuring systems in accordance with ISO 9000:
- CLY11-C, 1.406 mS/cm (reference temperature 25 °C (77 °F)), 500 ml (16.9 fl.oz)
  Order No. 50081904
- CLY11-D, 12.64 mS/cm (reference temperature 25 °C (77 °F)), 500 ml (16.9 fl.oz)
  Order No. 50081905
- CLY11-E, 107.00 mS/cm (reference temperature 25 °C (77 °F)), 500 ml (16.9 fl.oz)
  Order No. 50081906


For further information on "Calibration solutions", see the Technical Information

13 Technical data

13.1 Input

13.1.1 Measured variable

Conductivity

Temperature

13.1.2 Measuring range

Conductivity:	Recommended range: 200 µS/cm to 1000 mS/cm (uncompensated)
Temperature:	−10 to 130 °C (14 to 266 °F)

13.1.3 Temperature measurement

Pt 1000

13.1.4 Binary input

The binary input is used for measuring range switching.

Voltage range	0 V to 30 V
Voltage **High** Min.	12 V
Voltage **Low** max.	9.0 V
Current consumption at 24 V	30 mA
Undefined voltage range	9.0 to 12 V

13.2 Output

13.2.1 Output signal

Conductivity:	0 / 4 to 20 mA, galvanically isolated
Temperature:	0 / 4 to 20 mA, galvanically isolated

13.2.2 Load

Max. 500 Ω

13.2.3 Characteristic

Linear

13.2.4 Signal resolution

Resolution:	> 13 bit
Accuracy:	± 20 µA

13.2.5 Alarm output

The alarm output is implemented as an "open collector".

Max. current	200 mA
Max. voltage	30 V DC

Error or device without supply voltage	Alarm output blocked (0 mA)
No error	Alarm output open (up to 200 mA)

13.3 Power supply

13.3.1 Supply voltage

24 V DC ± 20 %, protected against reverse polarity

13.3.2 Power consumption

3 W

13.3.3 Cable specification

Recommendation	0.5 mm^2
max.	1.0 mm^2

13.4 Performance characteristics

13.4.1 Response time

Conductivity:	t_{95} < 1.5 s
Temperature:	t_{90} < 20 s

13.4.2 Maximum measured error

Conductivity:	± (2.0 % of measured value + 20 µS/cm)
Temperature:	± 1.5 K
Signal outputs	± 50 µA

13.4.3 Repeatability

Conductivity:	max. 0.5 % of measured value ± 5 µS/cm ± 2 digits

13.4.4 Cell constant

11.0 cm^{-1}

13.4.5 Temperature compensation

Range	−10 to 130 °C (14 to 266 °F)
Types of compensation	▪ None ▪ Linear with user-configurable temperature coefficient

13.4.6 Reference temperature

25 °C (77 °F)

13.5 Environment

13.5.1 Ambient temperature

Stainless steel process connection: −20 to 60 °C (−4 to 140 °F)
PVC process connection: −10 to 60 °C (14 to 60 °F)

13.5.2 Storage temperature

Stainless steel process connection: −25 to 80 °C (−13 to 176 °F)
PVC process connection: −10 to 60 °C (14 to 140 °F)

13.5.3 Humidity

≤ 100 %, condensating

13.5.4 Climate class

Climate class 4K4H as per EN 60721-3-4

13.5.5 Degree of protection

IP 69k as per EN 40050:1993

Degree of protection NEMA TYPE 6P as per NEMA 250-2008

13.5.6 Shock resistance

Complies with IEC 61298-3, certified up to 5 g

13.5.7 Vibration resistance

Complies with IEC 61298-3, certified up to 5 g

13.5.8 Electromagnetic compatibility

Interference emission as per EN 61000-6-3:2007 + A1:2011 and EN 55011:2009 + A1:2010

Interference immunity as per EN 61326-1:2013

13.6 Process

13.6.1 Process temperature

Stainless steel process connection:

−10 to 110 °C (14 to 230 °F)

Max.130 °C (266 °F) up to 60 minutes

PVC process connection:

−10 to 60 °C (14 to 140 °F)

13.6.2 Absolute process pressure

Stainless steel process connection:

13 bar (188.5 psi), abs to up to 50 °C (122 °F)

7.75 bar (112 psi), abs at 110 °C (230 °F)

6.0 bar (87 psi), abs at 130 °C (266 °F) max. 60 minutes

1 to 6 bar (14.5 to 87 psi), abs in CRN environment tested with 50 bar (725 psi)

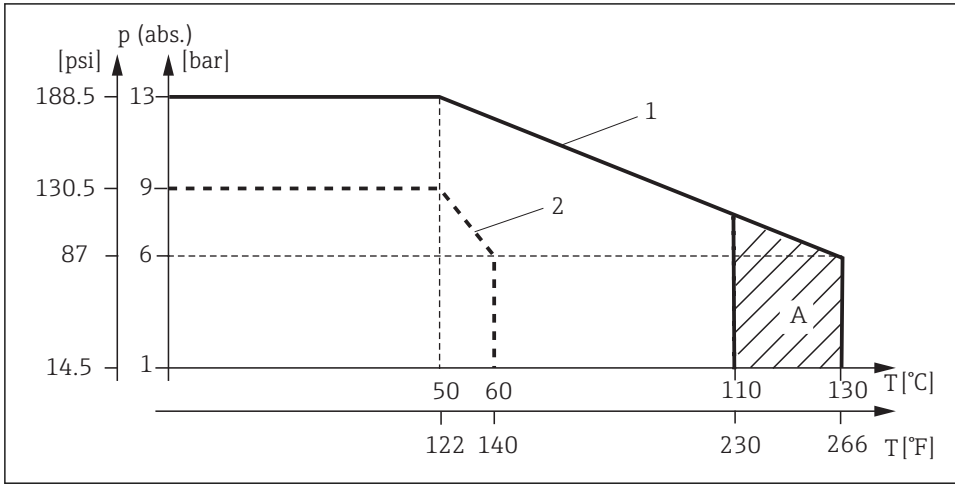
PVC process connection:

9 bar (130.5 psi), abs to up to 50 °C (122 °F)

6.0 bar (87 psi), abs at 60 °C (140 °F)

1 to 6 bar (14.5 to 87 psi), abs in CRN environment tested with 50 bar (725 psi)

13.6.3 Pressure-temperature ratings



15 Pressure-temperature ratings

1 Stainless steel process connection
2 PVC process connection
A Process temperature increased briefly (max. 60 minutes)

13.6.4 Flow velocity

max. 10 m/s (32.8 ft/s) for low-viscosity media in pipe DN 50

13.7 Mechanical construction

13.7.1 Dimensions

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13.7.2 Weight

Stainless steel housing:	up to 1.870 kg (4.12 lbs)
Plastic housing:	up to 1.070 kg (2.36 lbs)

13.7.3 Materials

In contact with medium

Sensor:	PEEK (polyetheretherketone)
Process connection:	Stainless steel 1.4435 (AISI 316 L), PVC-U
Seal:	EPDM

Not in contact with medium

Stainless steel housing:	Stainless steel 1.4308 (ASTM CF-8, AISI 304)
Plastic housing:	PBT GF20, PBT GF10
Seals:	EPDM
Window:	PC
Cable glands:	PA, TPE

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