Hengesbach
Prozessmesstechnik
The fine art of measuring.

Conductive conductivity sensor

Condumess

Operating instructions

English

A-MAN-Condumess-E-26-1

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1 Safety information

The operating instructions enable the safe and efficient handling of the conductive conductivity sensor **Condumess**.

The operating instructions belong to the product and must be stored in its direct vicinity and easily accessible to the staff at all times. Before starting any work, the staff must read these operating instructions carefully and understand them.

If these operating instructions incorporate documentation from suppliers (as an attachment), Hengesbach Prozessmesstechnik assumes no guarantee for its contents, individual statements, technical data, etc.

1.1 Safety signs

1.1.1 Warning symbols

DANGER!	
	This symbol indicates that personal injury from electrocucion may occur if the appropriate precautionary measures are not taken.

WARNING!	
	This symbol in connection with the signal word indicates that **personal injury** may occur if the respective precautionary measures are not carried out.

CAUTION!	
	This symbol in connection with the signal word indicates that **material damage or data loss** will occur if the respective precautionary measures are not taken.

CAUTION!	
	This symbol indicates that **components could be destroyed** by electrostatic discharge (ESD = Electro Static Discharge) if the respective cautionary measures are not taken. Only use the ESD packages intended for this purpose to return device inserts, assembly groups or assembly components.

READ THE DOCUMENTATION!	
	This symbol, which is attached to the device, indicates that the associated documentation for the device must be observed. This is necessary to identify the nature of the potential hazard, and to take measures to prevent it.

1.1.2 Note symbols

NOTE!	
	This symbol refers to **important information** about the product, its handling or additional benefits.

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REFERENCE!	
	This symbol refers to **important information** about the product, its handling or additional benefits.

DISPOSAL!	
	At the end of its service life, the device and any batteries present do not belong in the trash! Please ensure that they are **disposed of** properly and in an **environmental friendly** manner.

1.2 Intended use

The device described in these instructions is used to measure analytical process variables in liquids in an industrial environment as specified in the technical data. Other uses beyond those defined are not viewed as intended uses.

The device is built according to the relevant standards and directives as well as to the applicable safety regulations. Nevertheless, improper use, incorrect installation or configuration can result in erroneous measurements. Depending on the plant, this may cause unwanted control actions (e. g. overmetering) in the plant. Personal injury and property damage must be prevented through appropriate safety measures and safety devices provided by the customer.

To avoid danger, only use the device:

- for the intended use
- when in good order and condition
- in compliance with these instructions.

WARNING!	
	**Error during installation, mounting, or configuration of Condumess sensors can disrupt proper execution of the downstream process or cause damage.** ►For this reason, it is always necessary to provide safety devices that are independent of the device and to allow settings to be made only by technical personnel.

CAUTION!	
	**Condumess sensors must be calibrated correctly to prevent measurement errors.**

1.3 Qualification of personnel

This manual contains the necessary information for the intended use of the device described therein.

It is intended for technically qualified personnel who have received special training or have the appropriate knowledge in the field of automation technology (measuring and control technology).

Understanding and technically correct observance of the safety instructions and warnings contained in this manual are prerequisites for safe mounting, installation, and startup as well as safety during operation of the described device. Only qualified individuals have the required technical knowledge to interpret and put into practice the safety instructions and warnings used in this manual in any given situation.

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2 Acceptance of goods, storage and transport

2.1 Checking the delivery

- On delivery, ensure that the packaging and its contents are undamaged.
- Check the delivery for completeness against the packing slip and order confirmation.

Proceed as follows if external transport damage is visible:

- Do not accept the delivery or only conditionally.
- Note the extent of damage on the transport documents or on the delivery note of the freight forwarder.
- File a complaint.

2.2 Important information about storage and transport

- Store the device in a dry, clean environment. Observe the admissible environmental influences.
- Protect the device from shock during transport. The original packaging offers optimal protection.

2.3 Returning goods

If repairs are needed, return the device in clean condition and in its entirety. Use the original packaging when returning the device. Please observe the following points when returning the sensor:

1. Secure the probe from mechanical stress.
2. Pack the device in a transport-safe outer packaging.
3. Pack electronic modules in ESD-compliant outer packaging.
4. Use the QS return form when returning the device. The form is available at www.hengesbach.com/downloads.
5. Include a detailed description of the sensor's fault with the return shipment.
6. If neccessary state what is to happen to the delivered item.

The return address of the manufacturer is:

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2.3.1 Decontamination statement

In compliance with legal requirements, Hengesbach is required to handle all incoming products that come into contact with liquids in compliance with statutory regulations.

Before returning a device for repair or calibration:

- Remove all adhering residues of the substance measured.
  Pay special CAUTION! to grooves for seals and cracks where residues of the material being measured may adhere. This is especially important when the material being measured is a hazardous substance.

A returned device can only be accepted if the information regarding protection against contamination has been completed correctly on the letter of transmittal accompanying the product returned. If the device has come into contact with hazardous substances, state this and attach the appropriate safety data sheets to the letter of transmittal.

2.3.2 Protection against electrostatic discharge

To prevent damage from ESD (ESD = **E**lectro **S**tatic **D**ischarge), electronic assemblies, or components with a high internal resistance must be handled, packaged, and stored in an environment that protects against ESD. Measures that protect against electro-

static discharge and electric fields are described in DIN EN 61 340-5-1 and DIN EN 61 340-5-2 "Electrostatics – Part 5-2 – Protection of electronic devices from electrostatic phenomena".

If you are returning electronic assemblies or components for repair:

- Pack sensitive components only in an environment providing protection against ESD. Workspaces such as this divert electrostatic charges to ground in a controlled manner and prevent static charges due to friction.
- Use only packaging intended specifically for ESD-sensitive assemblies/components. These must consist of conductive plastics.

Keep in mind that the manufacturer assumes no liability for damage caused by ESD.

CAUTION!	
	**Electrostatic charges occur in non-ESD-protected environments.** Electrostatic discharges can damage modules or components. ► For transport purposes, use only the ESD packaging provided.

2.4 Disposal

- Do not dispose of the device or replaced parts in the trash after use.
- Delete programs and data stored on the device.
- Remove batteries, if any, if this can be done without damaging the device.
- Dispose of the device and the packaging material in a responsible and environmentally friendly manner.
- Observe the country-specific laws and regulations for waste treatment and disposal.

In accordance with Directive 2012/19/EU on Waste from Electrical and Electronic Equipment, manufacturers are obliged to offer the option of returning waste equipment.

3 Device description

3.1 Introduction

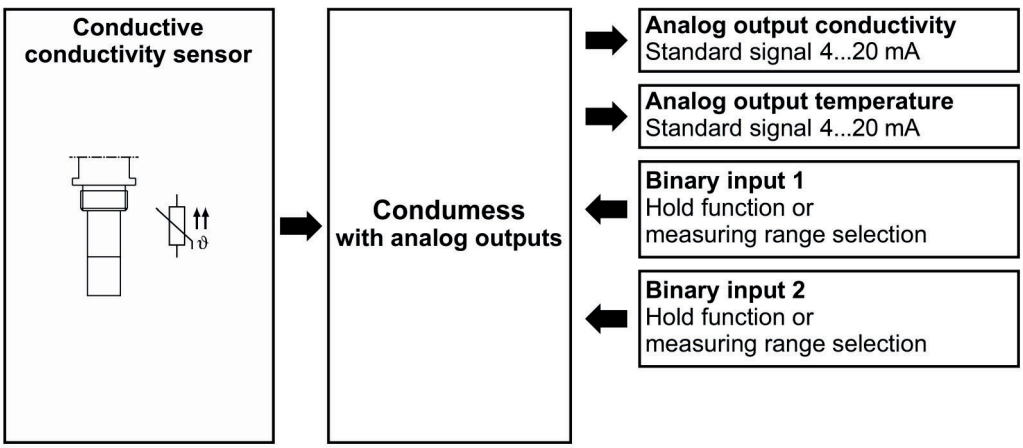
General

The **Condumess** has an 8-pin M12 plug connector for electrical connection to your system. Two standard signals (4...20 mA) for the measured temperature and conductivity values are transmitted via this interface.

Condumess consists of two separate modules which are connected to one another by a cable. The conductivity measurement cell is installed in a suitable fitting. The transmitter is mounted in the vicinity of the sensor using the supplied wall/pipe/DIN rail holder. If the sensor needs to be replaced due to a defect or wear and tear, the electronics can be disconnected from the sensor, and the intact components can be reused.

3.2 Block diagram

Condumess with analog outputs



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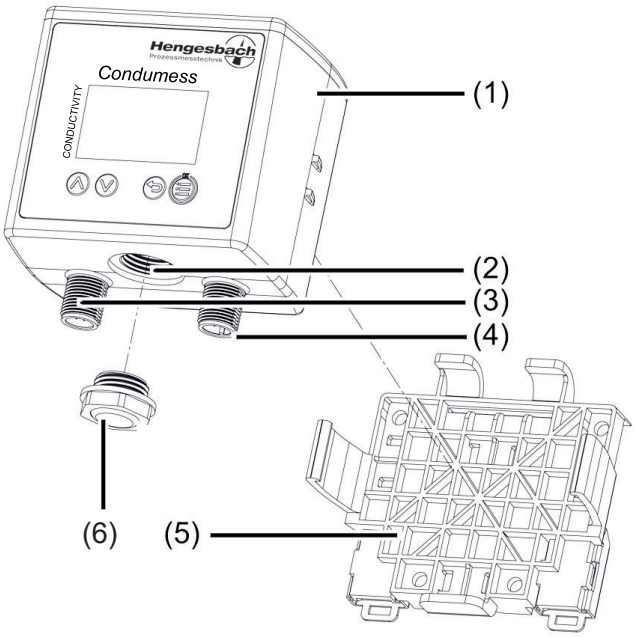
3.3 Device setup

Condumess transmitter



(1) Transmitter for **Condumess** sensor

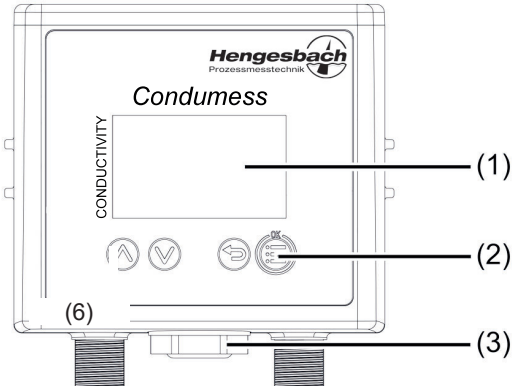
(2) Status LED

(3) M12 plug connector, 8 pin, for sensor connection

(4) M12 socket connector, 8 pin, for output signals

(5) Holder for wall, pipe and DIN rail mounting

(6) Venting element (embedded in threaded coupling)



(1) Display

(2) Operating keys

(3) Status display via transparent housing threaded coupling with internal status LED

The status is always indicated via the display (1) and additionally via the internal status LED (3).

3.4 Description

Condumess provides 2 analog outputs and 2 binary inputs for actuation via external switching signals. At the analog outputs, conductivity and temperature measured values are output as freely-scalable standard signals 4...20 mA. The binary inputs can be actuated to actuate hold functions or measuring range selection, either with potential-free contacts or with 24-Volt logic signals.

Temperature compensation

Temperature compensation is handled by the transmitter. Alternatively, a fixed temperature can be specified in the configuration.

Calibration

Calibration can be performed via the display. The calibration data are saved in the transmitter. The sensor calibration can therefore be performed ahead of commissioning, so that the sensor can then simply be mounted on the system. This reduces the plant downtime to a minimum when it becomes necessary to replace the sensor.

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Calibration logbook

The **Condumess** electronics contain a calibration logbook in which the last 10 calibration operations are saved with the date, time, and calibration values. This logbook provides an overview of the calibration history of the sensor.

Sensor information

Numerous data such as type information, operating data, information on measuring point identification etc. are stored in the **Condumess** electronics. This information allows clear identification and optimal management of each sensor.

Sensor monitoring

To monitor the stress on the sensor from sensor cleaning, counters are implemented for CIP and SIP cycles. CIP and SIP cycles are recognized automatically on the basis of the criteria specified in the configuration for sensor monitoring. The counters for the CIP and SIP cycles each retain the number of cleaning processes performed.

Sensor stress

To assess the stress on the sensor from the thermal stress, the current "sensor stress" is calculated on the basis of the measurement data provided by the sensor. In the **Condumess** electronic components, a sensor stress alarm signal can be configured. If a critical sensor stress level is reached, this signals a sensor stress alarm on the master device and on the display of the **Condumess**.

Customer-specific characteristic lines

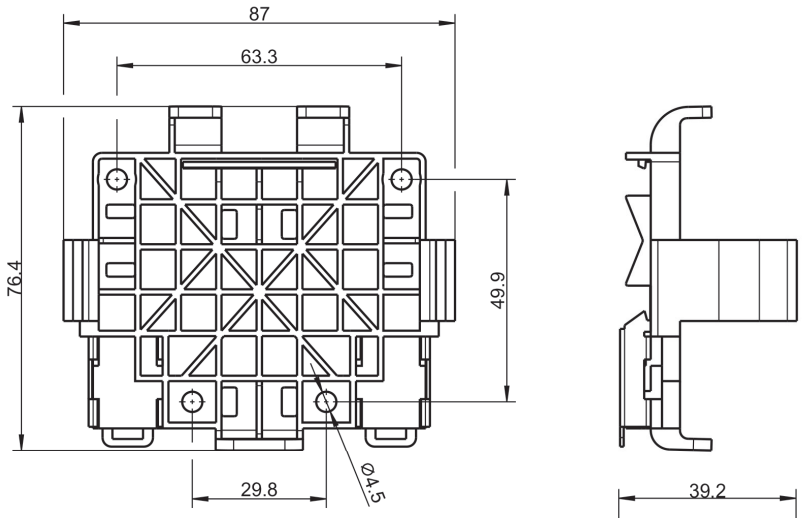
For each measuring range, a linearization table with up to 30 value pairs each can be activated in the **Condumess**. These show the measured electrolytic conductance to any unit (e.g. a concentration value derived from the conductance). The linearization tables can be used to provide customer-specific linearization of the conductivity values measured by the device.

4 Mounting

4.1 Mounting site and climatic conditions

The installation site should be, as far as possible, free from vibration. Electromagnetic fields, caused by equipment such as motors and transformers, should be avoided. The ambient temperature at the mounting site and the relative humidity must correspond to the technical data. Aggressive gases and vapors have a negative effect on the operating life of the device.

Dimensions of the mounting plate for wall, pipe and DIN rail mounting



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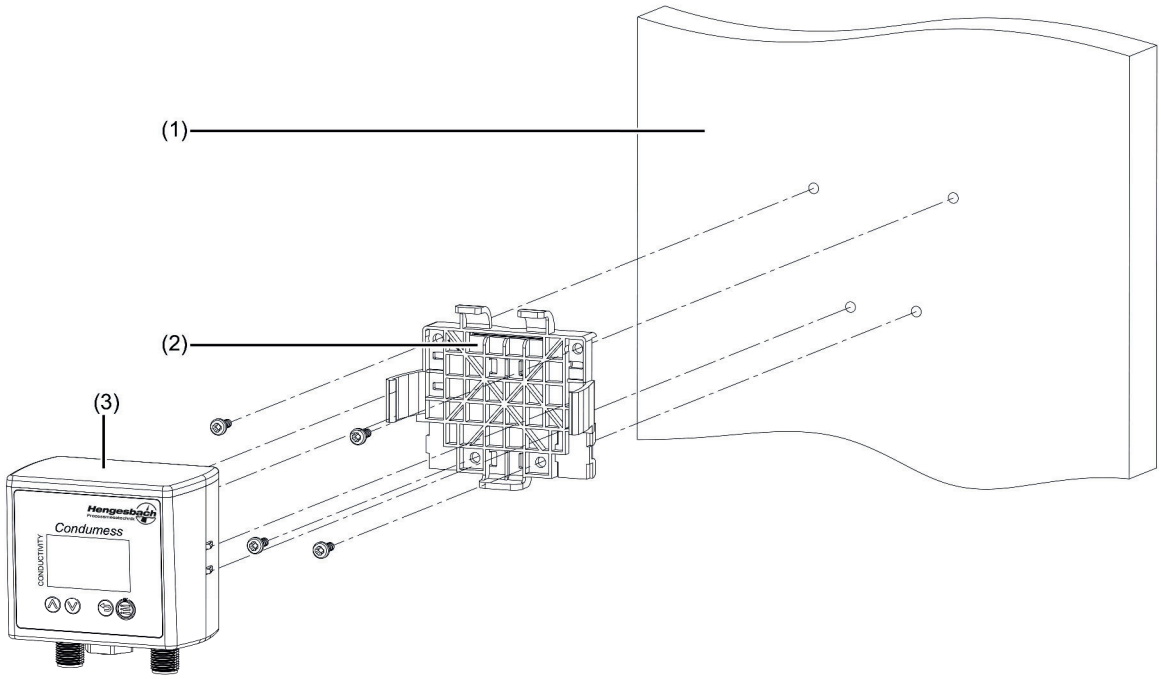
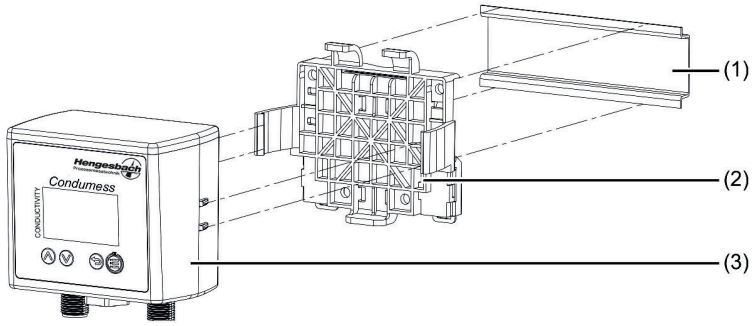
Wall mounting



1 Wall/mounting surface
2 Mounting plate included in the scope of delivery of the Condumess
3 Condumess electronics

DIN rail mounting



1 DIN rail
2 Mounting plate included in the scope of delivery of the Condumess
3 Condumess electronics

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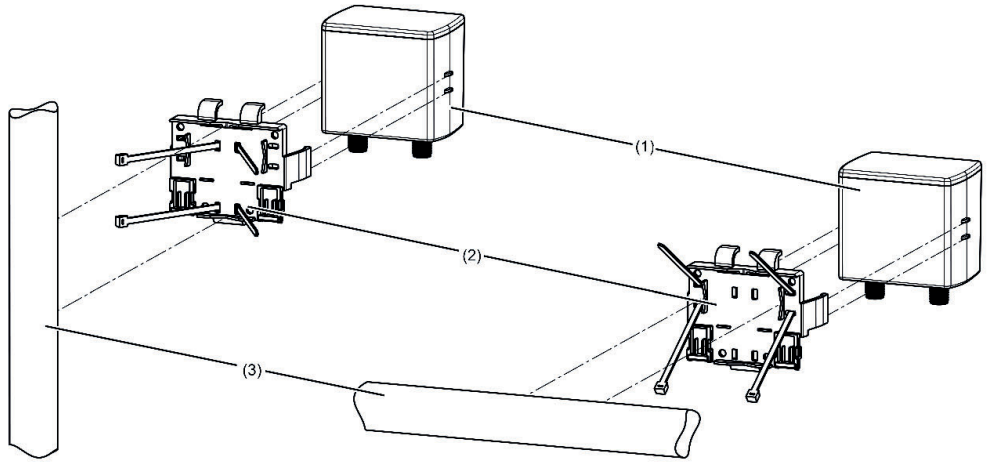
Pipe mounting

When used in conjunction with cable ties, the mounting plate allows mounting of the device on horizontal and vertical pipes or masts.



1 Condumess electronics
2 Mounting plate included in the scope of delivery of the Condumess
3 Pipe/mast (at customer's site); cable ties are not included in the scope of delivery of the device

5 Electrial connection

5.1 Installation notes

NOTE!	
	Connection cables for connecting **Condumess** electronics with analog or binary outputs to systems must be shielded. Therefore, use shielded cable material when assembling these connection cables!

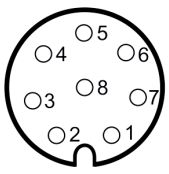
5.2 Connection diagram

General information

For electrical connection of **Condumess**, an 8-pin A-coded M12 connector with a piece of shielded cable in accordance with the following table for terminal assignment must be provided by the customer.
The union nuts on the cable connecting sockets are tightened to a maximum torque of 0.5 Nm.

8-pin M12 socket

Pin	Description	Pin	Description
1	Binary input 1	5	+ Analog output 4...20 mA Temperature
2	Binary input 2	6	- Analog output 4...20 mA Temperature
3	+ Analog output 4...20 mA Conductivity	7	+ 24 V Supply voltage
4	- Analog output 4...20 mA Conductivity	8	Reference ground



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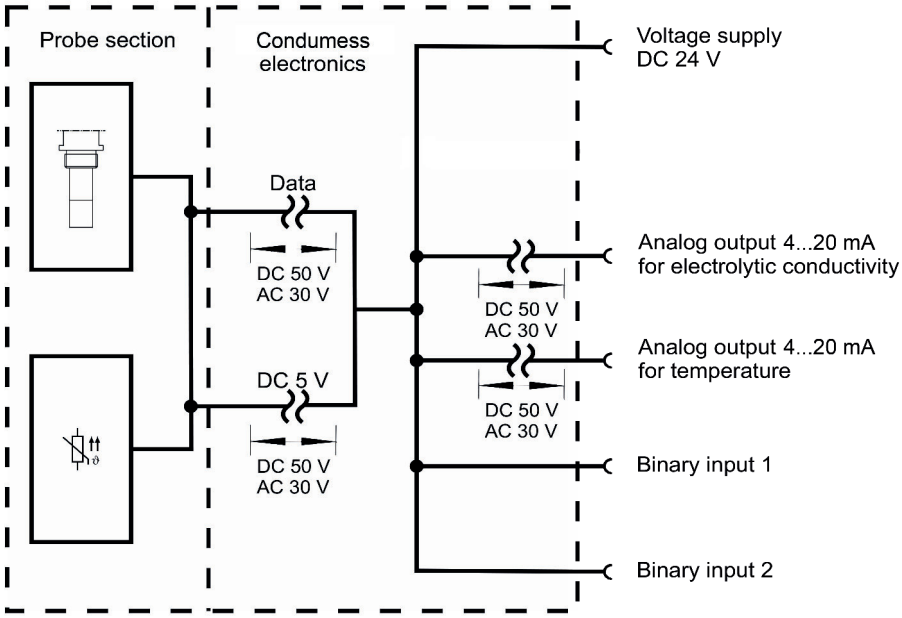
Binary input

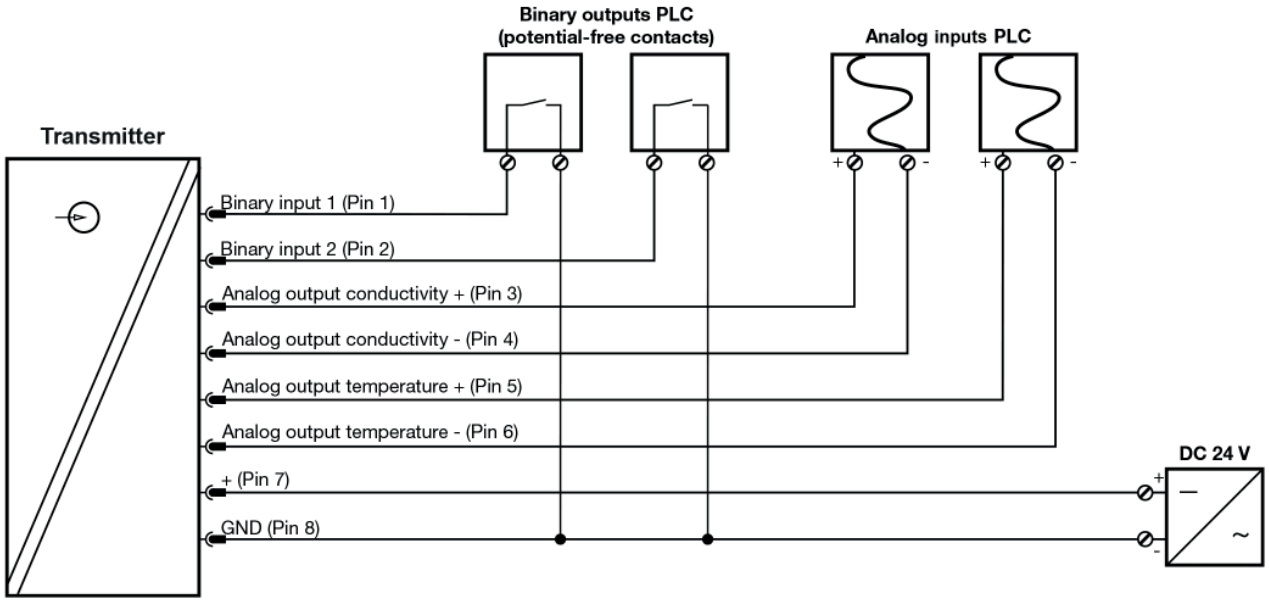
Signal type	Switching thresholds	
	On	Off
Potential-free contact	< 800 Ω	> 1.5 Ω
Logic input (external voltage supply max. DC 28 V)	> 6 V	< 5 V

5.2.1 Galvanic isolation

Condumess with analog outputs



Condumess transmitter wiring diagram



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6 Operation

6.1 General Information

Operating the **Condumess**

Condumess has a status LED inside the housing which shines through the transparent housing threaded coupling.
The status LEDs show the operating statii of the device. They are signaled as follows:

- **Flashing green in one-second interval:** Measuring mode
- **Flashing red in one-second interval:** Error (see chapter 9 "Troubleshooting in the event of faults", Page 20)
- **Flashing red very quickly (5× per second):** Serious error (see chapter 9 "Troubleshooting in the event of faults", Page 20)

Explanation	Operating key
"OK" Opens submenus and confirms entries	
"Back" Returns to the previous menu level; leaves Settings and discards entries and setting changes	
"Up" Move cursor up in the current menu level, scroll up or adjust setting values higher When the "Up" operating key is held down while adjusting numerical values, the change in the value accelerates.	
"Down" Move cursor down in the current menu level, scroll down or adjust setting values lower When the "Down" operating key is held down while adjusting numerical values, the change in the value accelerates.	

Measuring mode

The "Up" and "Down" operating keys can be used to navigate through 3 different display screens:

- Main display screen with electrolytic conductivity and temperature
- Detailed measurement display with compensated and uncompensated measured values
- Bar graph display of the sensor stress level (for degree of current sensor stress, see chapter 10.5 "CIP/SIP", Page 24)

6.2 Device menu

The device menu is opened from the measuring mode by pressing the "OK" operating key. The submenus listed in the following table are available here.

Untermenü	Erläuterung
Log-on/Log-out	The user logs on and out here. In addition, passwords can be changed here. ⇨ chapter 6.2.1 "Log-on/Log-out", Page 14
Calibration	Functions for calibrating the **Condumess** with the currently connected sensor ⇨ chapter 6.2.2 "Calibration", Page 14
Configuration	Device settings ⇨ chapter 10 "Configuration", Page 20
Device info	Functions for calibrating the **Condumess** with the currently connected sensor ⇨ chapter 6.2.3 "Device information", Page 15
Service	Functions and information on diagnosis and maintenance of the device hardware ⇨ chapter 6.2.4 "Service", Page 15

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To navigate through the menu hierarchy, use the "Up" and "Down" operating keys to move the cursor to the submenu you wish to open. You can recognize the position of the cursor by the inverted appearance of the highlighted menu entry. Pressing the "OK" operating key opens the submenu marked by the cursor. Arrow symbols (pointed brackets) at the end of the line after menu entries indicate that additional submenus are available. If the number of menu entries in a menu exceeds the number of display lines, a scroll bar appears at the right edge of the display.

To change setting values (e.g. configuration settings or parameters in the Service menu) proceed through the menu structure to the desired setting item. Press the "OK" operating key. The setting value now starts to flash. While it is flashing, you can change the value with the "up" and "down" operating keys. To apply the new setting value, press the "OK" operating key again. The value stops flashing and is applied in the device.

6.2.1 Log-on/Log-out

You can log on to the device in the "Log-on/Log-out" submenu. Depending on the rights required, this is necessary to change device settings and to perform calibrations. When you are logged in, the logged-in user is shown in the header of the measurement display.

In addition, you can log out again or change passwords in the "Log-on/Log-out" submenu. The password for a user can be changed only when the user is logged in.

Factory-set passwords

Users	**Administrator**	**User**
Factory-set-password	9200	300
Default rights	• General operation (measuring mode and device information)	• General operation (measuring mode and device information)
	• Calibration rights • Administrator rights	

Log-on

Accessing a menu: Device menu > Log-on/Log-out > Logon

After Log-on opens, the device requires that a user be selected (flashing user name). Use the "Up" and "Down" operating keys to select the desired user and confirm by pressing the "OK" operating key. The password is requested next (flashing display). The password is a numerical value. You use the "Up" and "Down" operating keys to change the password. Press the "OK" operating key to confirm the entry.

After successful logon, the logged-in user appears in the header (flashing) in the measuring mode.

Log-off

Accessing a menu: Device menu > Log-on/Log-out > Logout

Opening the menu item "Logoff" logs off logged in users from the device. The device then signals successful logoff in the display and you can return to the menu hierarchy or measured-value display by means of the "Back" key.

Change the password

Accessing a menu: Device menu > Log-on/Log-out > Change password

Log on the user for whom the password is to be changed and then open "Change password".
Once you have accessed "Change password", you are requested to enter a new password for the logged-in user (flashing password value "0"). You now use the "Up" and "Down" operating keys to change the password value to the desired value. Finally, you confirm the new password by pressing "OK" operating key. The device then indicates successful acceptance of the new password and you can use the "Back" operating key to return to the menu hierarchy or measured value display.

6.2.2 Calibration

You can find all functions for calibrating your sensor in this menu. A detailed description of the calibration procedure can be found in chapter 8 "Calibration", Page 16.

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6.2.3 Device information

The "Device info" submenu is available for checking and diagnosis purposes. Information on the device hardware and software is shown here:

- **Version:** Version information on device hardware and software
- **Device version:** Description of your device version
- **Sensor information (for head transmitters only):** Information and data regarding the sensor section of the head transmitter

6.2.4 Service

Maintenance functions and functions for setting the device hardware are found in the "Service" menu:

- **Contrast:** Sets the display contrast in 10 steps - adjustable by means of the "Up" and "Down" operating keys
- **Cip/Sip counter:** Display of the number of CIP/SIP cycles already performed in response to exceeding the CIP/SIP temperatures and status display of the CIP/SIP alarms. The CIP/SIP temperatures are set in the configuration data (see chapter 10.5 "CIP/SIP", Page 24).
- **Simulation outputs:** Fixed output values can be set here manually for test purposes. The following tables explain the individual settings for simulation of the output values. In order to simulate output values, you must log in on the device as administrator.

Settings for simulation of output values of analog outputs

Configuration item	Selection/ setting option	Explanation
Simulation of analog output 1	Inactive Active	Activates simulation of the analog output value for analog output 1
Value at analog output 1	0...20 mA	Any output current value during active simulation of output 1
Simulation of analog output 2	Inactive Active	Activates simulation of the analog output value for analog output 2
Value at analog output 2	0...20 mA	Any output current value during active simulation of output 2

7 Startup

General information

Startup of the **Condumess** is described in the following.

CAUTION!	
	**The electrical characteristics of analysis sensors are dependent upon numerous factors, e.g. aging and wear.** For accurate measurements, analysis sensors must be calibrated. ► In the course of startup, it is necessary to ensure that the sensor was calibrated correctly. ⇨ chapter 8 "Calibration", Page 16

WARNING!	
	**Errors during installation, mounting, or configuration of sensors with Condumess electronics can disrupt proper execution of the downstream process or cause damage.** For accurate measurements, analysis sensors must be calibrated. ► For this reason, it is always necessary to provide safety devices that are independent of the device and to allow settings to be made only by technical personnel.

Startup of the Condumess (standard signal of 4...20 mA)

When correctly wired and configured, the **Condumess** electronics start operating immediately after the measuring or automation device is put into service and deliver your measured value as an analog standard signal (4...20 mA).

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Language selections

With the device switched on and in the measuring mode, press and hold the menu key until the display on the device changes to language selection. Using the "up" and "down" operating keys, you can now select one of the operating languages displayed with the cursor and then confirm your selection with the "OK" operating key.

8 Calibration

8.1 General information

The actual electrical characteristics of analysis sensors always deviate somewhat from the nominal specifications. The reasons for this include:

- Like every measuring instrument, analysis sensors always have a certain uncertainty of measurement that results from manufacturing tolerances.
- During use, analysis sensors are exposed to chemical processes. Deposits and wear phenomena caused by these processes result in changes of the electrical characteristics of sensors.

To optimize the accuracy of measurements, analysis sensors must be calibrated. Calibrations are required:

- during installation or when changing a sensor
- regularly at time intervals that must be specified by the user
- if implausible measured values are displayed
- if process conditions change (e. g. as the result of equipment modification)

Each successfully completed calibration of the relative cell constant and TC calibration is recorded in the calibration logbook.

8.2 Calibration methods

Rel. cell constant

The deviation from the nominal cell constant of a sensor is described by the relative cell constant. The relative cell constant is determined by making a measurement in a test solution with a defined conductivity. Depending on the mode set for the relative cell constant in the configuration of the conductivity input, either a common relative cell constant is used for all 2 measuring ranges or a relative cell constant is determined separately for each measuring range. If "One cell constant per measuring range" has been set, a separate calibration of the cell constant must be performed for each measuring range.

Temperature coefficient

The temperature coefficient is a measure of the temperature dependence of the electrolytic conductivity of a liquid. It is used to compensate for the effect of temperature when measuring the electrolytic conductivity. When performing a temperature-compensated conductivity measurement, the conductivity value measured is always indicated with reference to the fixed reference temperature. With the aid of the temperature coefficient, the value of the electrolytic conductivity displayed at the reference temperature is calculated from the currently measured values of conductivity and temperature of the liquid. The reference temperature is set in the configuration.
The temperature coefficient is determined from 2 measurements in a sample of the process medium from your system at different temperatures (reference temp. and operation temp.). The reference temperature is obtained from the configuration. The operation temp. (usual temperature of the process in your system) is entered by the user during the calibration or acquired automatically. The two temperatures must differ from each other by more than 6°C.

TC curve (for nonlinear temperature coefficients)

If the conductivity of a liquid whose temperature coefficient changes with temperature has to be measured, this method can determine 6 temperature coefficients for 6 temperature intervals. In this way, it is possible to determine a good approximation of the temperature coefficient curve. While the operator brings the sample solution to the temperature values requested by the device, the device determines the temperature coefficient for each interval. The series of temperature values constists of 7 values in total:

- "Starting temperature and end temperature of the TC-curve" (see "Calibrating the temperature coefficient curve (TC-curve)", Page 19)
- Reference temp.
- 4 additional temperature values between the "starting temperature and end temperature of the TC curve"

The "end temperature of the TC-curve" must be at least 20°C higher than the "starting temperature of the TC curve". The two values are requested at the start of the TC-curve calibration and must be entered by the user.

The reference temperature must lie between the "starting temperature and end temperature of the TC curve" and must differ from the starting temperature and end temperature by at least 1°C. It is set in the configuration.

The intervals between the starting, reference- and end temperature are automatically divided into 6 intervals by the device. The remaining 4 temperatures are determined in this way.

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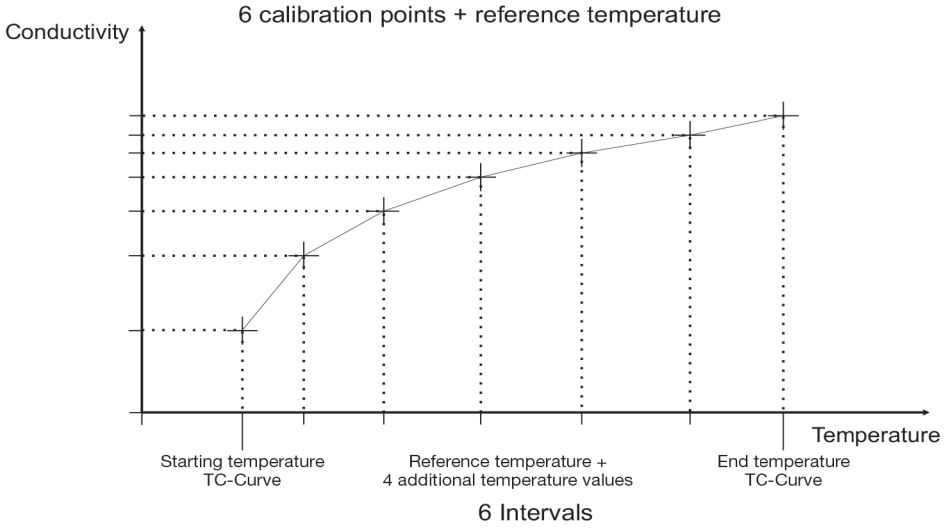

8.3 Calibration default settings

The calibration routines of the device can be enabled//locked in the calibration default settings for the "User". To do this, you must first log in on the device as "Admin". ⇨ chapter 6.2.1 "Log-on/Log-out", Page 14

In addition, the way the temperature is acquired can be set:

- **Automatic temperature acquisition:** During the calibration, the device acquires the calibration measuring points automatically by scanning past the operation or reference temperature.
- **Manual temperature acquisition:** This setting can be selected if you wish to trigger acquisition of the calibration measuring points manually by pressing a key during calibration of the temperature coefficient.

8.4 Calibrating the Condumess with analog/binary outputs

Condumess can be calibrated from a PC via the local device controls on devices with a display. The calibration values are calculated in the **Condumess** electronics. The calculated calibration values and the data in the calibration logbook are saved in the Condumess electronics.

CAUTION!	
	**The conductivity measurement by the device has 2 measuring ranges.** During calibration, it is necessary to ensure that all measuring ranges used are taken into account. ► Calibrate the two measuring ranges individually. For the relative cell constant, the mode for the relative cell constant can also be set to 1 cell constant for all measuring ranges in the configuration of the conductivity input. If you select this setting, you only need to calibrate the relative cell constant once for both measuring ranges.

NOTE!	
	To perform calibrations, you must log in on the device as a user with calibration rights. By default, the "Administrator" has calibration rights. ⇨ chapter 6.2.1 "Log-on/Log-out", Page 14

Calibrating the relative cell constant

NOTE!	
	Depending on the mode set for the relative cell constant in the configuration of the conductivity input, either a common relative cell constant is used for both measuring ranges or a relative cell constant is determined separately for each measuring range.

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Procedure for calibrating the relative cell constant

1. Start calibration of the relative cell constant:
   Device menu > Calibrate > Calibration of relative cell constant
2. If in the configuration of the conductivity input the mode is set to "One CC for all MR", this step can be skipped.
   Use the "Up" and "Down" operating keys to select the measuring range to calibrate from measuring ranges 1 to 2 and confirm by pressing the "OK" operating key.
3. Make sure that the sensor has been cleaned and is immersed in the test solution.
   Wait until the measured value displayed stabilizes and then confirm the result of the measurement by pressing the "OK" operating key.
4. Use the "Up" and "Down" operating keys to set the conductivity value to the reference conductivity of your test solution and confirm the entry by pressing the "OK" operating key.
5. The device displays the relative cell constant determined. The relative cell constant is accepted if you press the "OK" operating key or discarded if you press the "Back" operating key. This completes the calibration.

Calibrating the temperature coefficient (TC)

NOTE!	
	In the calibration default settings, the "Temperature acquisition" item can be set for automatic acquisition of calibration values when the calibration temperatures are reached. ⇨ chapter 8.3 "Calibration default settings", Page 17

Procedure for calibrating the temperature coefficient (TC)

1. Start calibration of the temperature coefficient:
   Device menu > Calibrate > Calibration of temperature coefficient
2. Use the "Up" and "Down" operating keys to select the measuring range to calibrate from measuring ranges 1 to 2 and confirm by pressing the "OK" operating key.
3. Use the "Up" and "Down" operating keys to change the displayed operation temp. to the temperature value normally encountered in the process in your system and confirm by pressing the "OK" operating key. The operation temp. must differ from the configured reference temp. by at least 6°C (see display of allowed temperature ranges on the display). The device accepts the operation temp. only if this difference exists.
4. **with "automatic" temperature acquisition**

The current measured values for conductivity and temperature as well as operation temp. and reference temp. are shown on the display. Bring the temperature of your sample in succession to the values of the operation temp. and reference temp. The order does not matter. Value acquisition takes place automatically.

with "manual" temperature acquisition

The current measured values for conductivity are shown on the display.

Bring the temperature of your sample in succession to the values of the operation temp. and reference temp. The order does not matter. When each of the temperatures is reached, press the "OK" operating key to trigger value acquisition.

5. The device displays the temperature coefficient determined. The temperature coefficient is accepted if you press the "OK" operating key or discarded if you press the "Back" operating key. This completes the calibration.

Calibrating the temperature coefficient curve (TC-curve)

Procedure for calibrating the temperature coefficient curve (TC-curve)

1. Start calibration of the temperature coefficient curve:
   Device menu > Calibrate > Calibration of TC-curve
2. Use the "Up" and "Down" operating keys to select the measuring range to calibrate from measuring ranges 1 to 2 and confirm by pressing the "OK" operating key.
3. Use the "Up" and "Down" operating keys to change the displayed starting temperature and confirm entry of the value by pressing the "OK" operating key.

Keep in mind that the starting and end temperature must differ by at least 20°C.

4. Use the "Up" and "Down" operating keys to change the displayed end temperature and confirm entry of the value by pressing the "OK" operating key.

Keep in mind that the starting and end temperature must differ by at least 20°C.

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5. The device now displays in succession the calibration points of all 7 temperature values from the starting to the end temperature. Each of the temperature values to be approached and the currently measured conductivity value are displayed. Bring the temperature of your process medium sample to the each temperature displayed. When each of the temperature values is reached, automatic value acquisition takes place for the requested temperature.
6. After successful value acquisition at all 7 calibration points, a summary of the temperature coefficients determined for the individual temperature intervals is displayed. The temperature coefficients are accepted if you press the "OK" operating key, or discarded if you press the "Back" operating key. This completes the calibration.

8.5 Calibration values

General information

In the Calibration > Calibration values menu, you can view the current calibration values and also edit them manually. To enter calibration values manually, you must log in on the device as "Administrator" (see chapter 6.2.1 "Log-on/Log-out", Page 13).

Manual entry of calibration values

CAUTION!	
	**Incorrect calibration values result in incorrect measured values!** This can disrupt proper execution of the downstream process and cause damage. ► Make sure that you enter the correct calibration values!

If the calibration values are known, you can enter them manually in the ***Calibration > Calibration values*** menu. This may be the case with temperature-compensated conductivity measurements, for instance, when the temperature coefficient of a liquid is known.

8.6 Calibration logbook

The calibration logbook is saved in the electronics. The last 10 successful calibrations are saved in the calibration logbook. The following data are retained in the logbook:

- Calibration values determined or entered
- Calibration mode (true calibration/manual entry of calibration values)
- Calibration assessment (assessment of the calibration values determined during the true calibration)

8.7 Evaluation criteria for calibration

Evaluation criteria for calibration of relative cell constant

Calibration value [unit]	**invalid**		**Warning**		**OK**	**Warning**		**invalid**
Relative cell constant [%]	...	< 50 ≤	...	<	75 to 125	<	≤ 150 <	...

Evaluation criteria for of temperature coefficient

Calibration value [unit]	**invalid**	**Warning**	**OK**	**Warning**	**invalid**
Temperature coefficient [%/K]	...	<	0 to 8	<	

9 Troubleshooting in the event of faults

General troubleshooting

If malfunctions occur during operation of the **Condumess** electronics, check the following items:

- All plug-in and terminal connections must be made correctly and be tight.
- The maximum load resistance for the current loop must not be exceeded.
- The voltage supply for the device must be intact and stable (cf. chapter 5.2 "Connection diagram", Page 11)

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10 Configuration

10.1 General information

Condumess electronics can be configured by means of the operating keys on the device. To change configuration settings, you must log on to the device as "Administrator" beforehand (see chapter 6.2.1 "Log-on/Log-out", Page 14).

The tables in this chapter explain all of the configuration parameters of the **Condumess** electronics.

10.2 Important information

CAUTION!	
	**Incorrect configurations can cause sensor malfunctions.** The consequence may be erroneous measured values. ► Prior to startup, check all information in the configuration.

10.3 Input

Configuration item	**Selection/ setting option**	**Explanation**
Signal for Hold	No hold Binary input 1 Binary input 2	Selects the binary input for activation of hold function for the measured conductivity value When hold is activated, the measured conductivity value is frozen and sensor monitoring alarms are suppressed (see chapter 10.5 "CIP/SIP", Page 24).
Measuring range selection	No hold Binary input 1 Binary input 2	Selects the binary inputs for selection of the measuring range Measuring range selection permits selection of the measuring ranges 1 to 2 by controlling the binary signals. ⇨ chapter 10.3.1 "Measuring ranges 1 to 2 for the input", Page 21
Compensation temperature	Manual temperature Temperature input	Selects the source for the compensation temperature **Manual temperature:** Compensation using a fixed temperature value entered in the "Manual temperature" configuration item. **Temperature input:** The integrated temperature probe of the sensor supplies the compensation temperature.
Manual temperature	-50 to +250°C	Constant compensation temperature value If the **"Compensation temperature"** configuration item is set to **"Manual temperature"**, this value is used for temperature compensation of the measured conductivity value.
Configuration item	**Selection/ setting option**	**Explanation**
Reference temperature for linear TC	15 to 30°C	**Required only for conductivity measurement with "TC linear", "TC curve" and TDS temperature compensation:** The temperature at which the conductivity value displayed was set
Wire break detection	Off On	A sensor alarm is activated in the event of a sensor wire break when this function is activated.
Filter Time Constant	0.0 to 25.0 s	Optimization of measured value updating The larger the value of the filter time constant, the slower is the change in measured value at the output.
Rel. cell constant mode	One CC for all MR One CC for each MR	This parameter can be used to specify whether one relative cell constant should be used for all 2 measuring ranges, or whether each measuring range should have its own cell constant and that is used for the measured value calculation. ⇨ "Calibrating the relative cell constant", Page 18
Nominal cell constant	0.01 to 10 cm^{-1}	Nominal cell constant of the conductivity sensor (can be read from the sensor nameplate)

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10.3.1 Measuring ranges 1 and 2 for the input

Measuring range selection

The measuring ranges can be selected as shown in the following table by using the binary input that was configured for measuring range selection:

Active measuring range	Binary input for measuring range selection
Measuring range 1	0
Measuring range 2	1

Configuration data for measuring ranges 1 and 2

Configuration item	Selection/setting option	Explanation
Compensation	None, TC linear, TC curve, natural waters, natural waters with expanded temperature range, TDS, ASTM neutral, ASTM acidic, ASTM alkaline	Type of temperature compensation
Temperature coefficient	0.0 to 8.0 %/K	**applicable only to "TC linear" and "TDS" compensation** The temperature coefficient is a measure of the temperature dependence of the electrolytic conductivity of a liquid. It is used to compensate for the effect of temperature when measuring the electrolytic conductivity. If it is known, the temperature coefficient can be entered here or, if it is not yet known, determined by the calibration.
Configuration item	**Selection/setting option**	**Explanation**
Unit (for calculation)[a]	µS/cm mS/cm **only without TDS:** kΩ×cm MΩ×cm	Unit in which the electrolytic conductivity is displayed when the parameter "Compensation" is set to "TDS" and/or the customer-specific linearization is active, the unit text set in the parameter "Unit" appears in the measured-value display instead of the unit for the electrolytic conductivity. The electrolytic conductivity in µS/cm or mS/cm multiplied by the TDS factor (see below in this table) yields the TDS measured value. The unit for the electrolytic conductivity is selected in the parameter "Unit for calculation" as the basis for the TDS calculation. Because of the text length, the parameter "Unit for calculation" appears only as "Unit" in the configuration of the device.
Offset	-9999 to +9999	Correction value added to measured value
TDS factor	0.01 to 2.00	**only for TDS compensation:** Conversion factor from measured conductivity to display unit (see configuration item "Unit" in this table) For TDS compensation, see configuration item "Compensation" in this table
Linearization table	Yes No	The linearization table for the measuring range concerned can be activated/deactivated with this parameter. Linearization tables for **Condumess** contain up to 30 value pairs in any measurement characteristic line. Each value pair assigns a display value (Y-column) to a measured value (X-column). A linearization table is available for every measuring range.

[a] Because of the text length, the parameter "Unit for calculation" appears only as "Unit" in the configuration menu of the device.

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10.3.2 Temperature input

Configuration item	Selection/setting option	Explanation
Temperature input function	active inactive	Activation of the temperature input
Filter Time Constant	0.0 to 25.0 s	Optimization of measured value updating The larger the value of the filter time constant, the slower is the change in measured value at the output.
Offset	-10 to +10°C	Correction value added to measured value
Hold input	inactive Binary input 1 Binary input 2	Selects the binary input for activation/deactivation of the hold function The hold function freezes the measured value (e. g. during maintenance work). The hold function is On-Active (measured value at binary input is held with On signal).
Connection type	2-wire 3-wire	Connection variants for the connected resistance thermometer

10.3.3 Binary inputs 1 and 2

Configuration item	Selection/setting option	Explanation
Input type	Potential-free contact Voltage source	Type of digital signal connected **Potential-free contact:** Connection of external potential-free switching contacts **Voltage source:** Connection of an external logic signal 0/24 V
Inversion	Yes No	Switching status inverted or not inverted

10.4 Analog outputs

Analog output 1 and 2 (measured value of conductivity)

Configuration item	Selection/setting option	Explanation
Hold input	inactive Binary input 1 Binary input 2	Selects the function of the digital input for the analog output **inactive:** No function **Binary input 1:** Binary input 1 controls the hold function **Binary input 2**: Binary input 2 controls the hold function The hold function freezes the analog output value (e. g. during maintenance work). The hold function is On-Active (measured value at binary input is held with On signal).
Response at hold	low (4 mA) high (20 mA) frozen replacement value	Selects the response of the analog output value at hold
Response during calibration	moving frozen replacement value	Selects the response of the analog output value during calibration

Output parameter for measuring ranges 1 to 2

Configuration item	Selection/setting option	Explanation
Scale start measuring range x	0 to < scale end	Measured value for lower limit of measuring range span (measured value at output current of 4 mA)

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Configuration item	Selection/setting option	Explanation
Scale end measuring range x	> scale start to 9999	Measured value for upper limit of measuring range span (measured value at output current of 20 mA)
Response at error measuring range x	low (4 mA) high (20 mA) Namur low (3.4 mA) Namur high (22 mA) frozen replacement value	Selects the response of the analog output in case of a fault (e. g. overrange) **Note:** In the event of sudden changes in the measured value at the moment an error occurs, the hold value can differ from the true value due to internal latent times!
Replacement value measuring range x	3.4 to 22 mA	Specifies an analog value that the output assumes at hold, at calibration or in case of a fault

10.5 CIP/SIP

NOTE!	
	Sensor monitoring requires plant-specific empirical values for the sensor stress caused by process conditions. Configure the sensor monitoring parameters on the basis of these empirical values.

CIP/SIP

Configuration item	Selection/setting option	Explanation
Minimum CIP temperature	-20 to+150 °C	Temperature thresholds for identifying CIP/SIP cycles If the CIP/SIP cycle takes place above one of these values for the set duration of a CIP/SIP cycle, the values identify a successfully completed CIP/SIP cycle and the CIP or SIP counter is incremented. The respective counter is reset only after the value has dropped below the CIP/SIP temperature.
Minimum SIP temperature		
CIP cycle duration	0 to 65535 s	Duration of a CIP/SIP cycle
SIP cycle duration		
CIP/SIP alarming	Inactive Active	Activates/deactivates the CIP/SIP alarm on reaching the maximum number of CIP/SIP cycles
Alarm limit value CIP cycles	0 to 999	Specifies the number of CIP/SIP cycles at which the CIP/SIP alarm and pre-alarm are triggered[a]
Alarm limit value SIP cycles		
Pre-alarm limit value CIP cycles		
Pre-alarm limit value SIP cycles		

[a] The counters for CIP and SIP cycles are automatically incremented by the **Comdumess** electronics each time a CIP or SIP process is recognized on the basis of the configured CIP/SIP temperatures and duration of the CIP/SIP cycle.

10.6 Limit value monitoring function

Configuration item	Selection/setting option	Explanation
Input signal	Temperature uncomp. Conductivity comp. Conductivity	Signal source of the analog value to be monitored by the limit value monitoring function
Startup alarm suppression	No alarm suppression, time-limited, alarm suppression	Activation of alarm suppression after the device is switched on Limit value alarms are suppressed until the input signal value has left the alarm range for the limit value alarm after the device is switched on.

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Configuration item	Selection/setting option	Explanation
Startup alarm suppression time	0 to 99999 s	**only if "Startup alarm suppression" set to "time-limited" is valid:** Duration of startup alarm suppression after the device starts
Self-lock mode	off Ackn. if inactive Ackn. always possible	Self-locking acknowledgment mode **Acknowledgment if inactive:** Self-locking of an activated limit value alarm can only be acknowledged if the input signal value is outside the alarm range for the limit value alarm. **Acknowledgment always possible:** Self-locking of an activated limit value alarm can be acknowledged at any time, regardless of the input signal value.
Acknowledging self-locking	Binary input 1 Binary input 2 "Back" operating key	Selects the signal with which an activated limit value alarm can be acknowledged
Signal for Hold	No function Binary input 1 Binary input 2	Digital signal for activating the hold function When the hold function is activated, the alarm assumes the state defined in the "Response at hold" setting.
Behavior during calibration	inactive active frozen normal operation	Specifies the alarm state during calibration **inactive:** alarm suppressed **active:** Alarm forced **hold:** alarm state is maintained regardless of alarm condition changes **Normal operation**: Alarm in acc. with alarm condition

Limit value monitoring settings for measuring ranges 1 to 2

Configuration item	Selection/setting option	Explanation
Alarm type	No function Min. alarm Max. alarm Alarm window Window inverted USP645 alarm Purified water	Selects the alarm types (comparator functions) for monitoring measured values for alarm violations 4 basic mathematical limit value functions and limit value alarms according to USP <645> or European Pharmacopoeia (Ph.Eur.) for purified water ⇨ Characteristic lines of the basic limit value functions in connection with the table
Limit value	**for conductivity** 0 to 9999 **for temperature** -50 to +250°C	**only if "Startup alarm suppression" set to "time-limited" is valid:** Duration of startup alarm suppression after the device starts
Pre-alarm lim.	0 to 100 %	Pre-alarm limit for alarm types "USP645 alarm" and "Purified water"
Hysteresis	**for conductivity** 0 to 9999 **for temperature** -50 to +250°C	Spacing between switch-on and switch-off points for the alarm types ⇨ Characteristic lines of the basic limit value functions in connection with the table For alarm types "USP645 alarm" and "Purified water", the unit µS/cm applies. For all other alarm types, the unit for the measurand selected under "Input signal" applies. The unit from the configuration of the respective measuring range of the input configuration applies in the case of conductivity.

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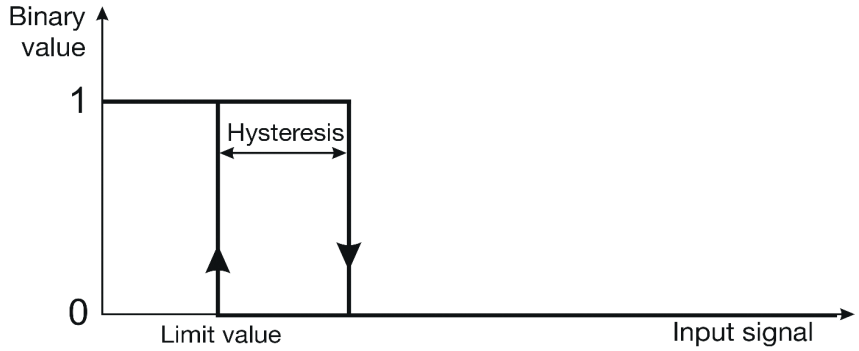
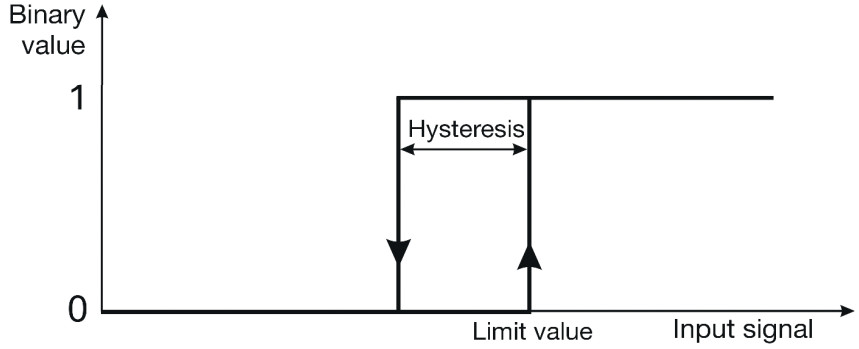
Configuration item	Selection/setting option	Explanation
Window range	**for conductivity** 0 to 9999 **for temperature** -50 to +250°C	**only for alarm types "Alarm window" and "Window inverted"** Range of the alarm window ⇨ Characteristic lines of the basic limit value functions in connection with the table The unit for the measurand selected under "Input signal" applies. The unit from the configuration of the respective measuring range of the input configuration applies in the case of conductivity.
Alarm delay On	0 to 9999 s	Time delay between occurrence of the alarm condition and triggering of the alarm
Alarm delay Off	0 to 9999 s	**only without self-locking** Time delay between ending of the alarm condition and clearing of the alarm
Pulse time	0 to 9999 s	**only without self-locking** Time limit for alarm with the wiper time as maximum alarm duration With a setting of 0 s, the wiper function is deactivated.
Response at hold Response in case of an error	inactive active frozen	Specifies the alarm state while hold function is activated or in the event of a fault **inactive:** alarm suppressed **active:** Alarm forced **hold:** alarm state is maintained regardless of alarm condition changes
Suppression on measuring range change	No alarm suppression, time-limited, alarm suppression	Activates alarm suppression after a measuring range change Limit value alarms are suppressed until the input signal value has left the alarm range for the limit value alarm after the device is switched on.
Suppress. time	to 99999 s	**only when "Suppression on measuring range change" is set to "time-limited"**: Duration of startup alarm suppression after a measuring range change

Min. alarm (On-signal when value drops below lower limit)



Max. alarm (On-signal when value exceeds upper limit)



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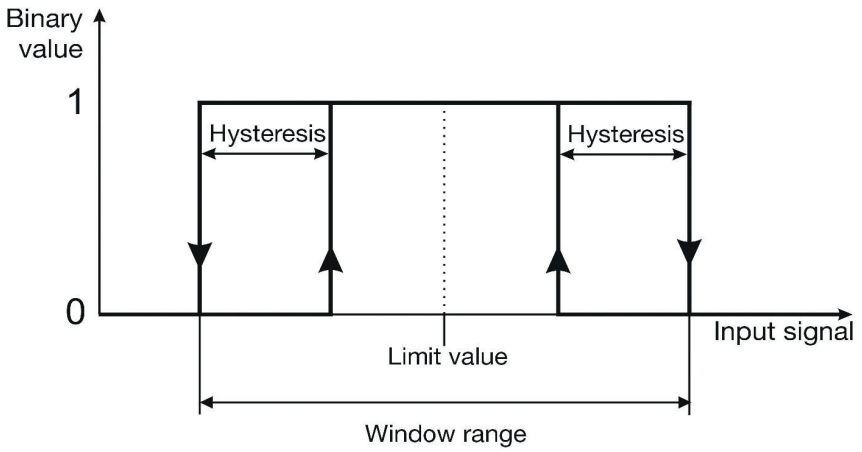
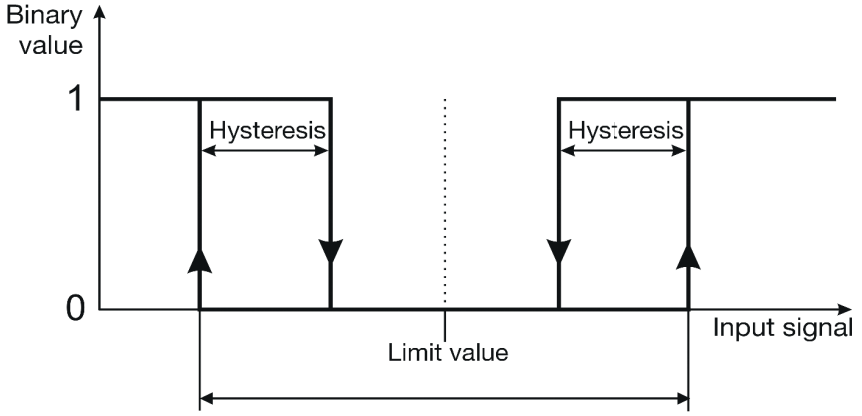
Alarm window (On-signal within a configurable value range)



Invert alarm window (On-signal outside a configurable value range)



10.7 Calibration timer

Calibration timer

Configuration item	Selection/setting option	Explanation
Calibration interval	0 to 9999 days	Time from one calibration to the next. The time at which a calibrationis due is indicated by the calibration alarm on device versions with a display.

10.8 Sensor stress

Configuration item	Selection/setting option	Explanation
Sensor stress	Inactive Active	Activates/deactivates the sensor stress alarm The "Sensor stress" value reflects the current level of stress on the sensor from high temperatures and high conductivity values. The following sensor stress alarm states are signaled on the device display (only on device versions with a display) on reaching the specified limit values: ● Pre-alarm for sensor stress above sensor stress level 3 ● Alarm for sensor stress above sensor stress level 7

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10.9 Display

General information

Configuration item	Selection/setting option	Explanation
Key lock	Noe Binary input 1 Binary input 2	Selects the signal source for locking the keyboard If so desired, the operating keys can be locked by the binary input signals. A key symbol appears on the device display when locked.
Language	German English French Spanish	Selects the operating language for the **Condumess** As an alternative to manual configuration, the language setting can also be accessed by pressing the "OK" operating key for a longer period of time (see "Language selections", Page 16).
Automatic logoff time	0 to 15 min.	The automatic logoff time can be set here. The logged-in user is logged off as soon as no key has been pressed on the device during the set time. If the automatic logoff time is set to the value 0 s, then automatic logoff is inactive. The user then remains logged in until he logs off again or the device is restarted. ⇨ chapter 6.2.1 "Log-on/Log-out", Page 14
Display type	Standard display Large display Bargraph	In the normal and large display, 2 values are shown on the display in the measuring mode (main and secondary value). In the bargraph display, the main value is shown as a numerical value at the center in the measuring mode and visualized underneath as a bargraph display. In contrast to the normal and large display, the secondary value is not shown in this case. The value range of the main value for the bargraph can be set (see next table). The compensated conductivity is the main value and the temperature is the secondary value in the default setting. However, this setting can also be changed to meet your requirements (see further below in this table).
Temperature Unit	°C °F	Temperature unit setting for the device
Sign. main value	No signal Temperature input Compensation temp. Uncomp. conductivity Compens. Conductivity	Signal source for the main value display In the measuring mode, the main value is shown on the display as the central value (upper display value). The appearance of the display can be set in the display type (higher up in this table).
Sig. sec. value	No signal Temperature input Compensation temp. Uncomp. conductivity Compens. Conductivity	Signal source for the secondary value display In the measuring mode, the secondary value is shown on the display as an additional value accompanying the main value (below the main value). The appearance of the display can be set in the display type (higher up in this table).

Measuring ranges 1 to 2

Configuration item	Selection/setting option	Explanation
Bargraph start	0 to < bargraph end	Measured value of main value at start of the bargraph display
Bargraph end	> bargraph start up to 9999	Measured value of main value at end of the bargraph display
Decimal place	XXXX XXX.x XX.xx X.xxx	Number of desired decimal places The number of decimal places can be set from 0 to 3.

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11 Operation, maintenance and care

11.1 Cleaning

The front of devices can be cleaned with standard detergents, rinsing and cleaning agents.

CAUTION!	
	**The front of devices with plastic housings is not resistant to aggressive acids and lyes or scouring agents.** Use of these media can cause damage to devices with plastic housing. ►Only clean the front of devices with plastic housing with suitable agents.

12 Conductive conductivity sensors

12.1 Description

Conductive conductivity sensors are used in conjunction with suitable transmitters in industrial analysis measurement technology to determine the electrolytic conductivity of liquids.

The **Condumess** fills the gap between conductive conductivity measurement with two-electrode measuring sensors, and inductive conductivity measurements.

The employed four-electrode configuration covers a very wide measuring range from about 1 µS/cm to 600 mS/cm, with just one measuring sensor.

The hygienic design of both the sensor and the process connection (PZM) allows its use in pharmaceutical and food technology without difficulty.

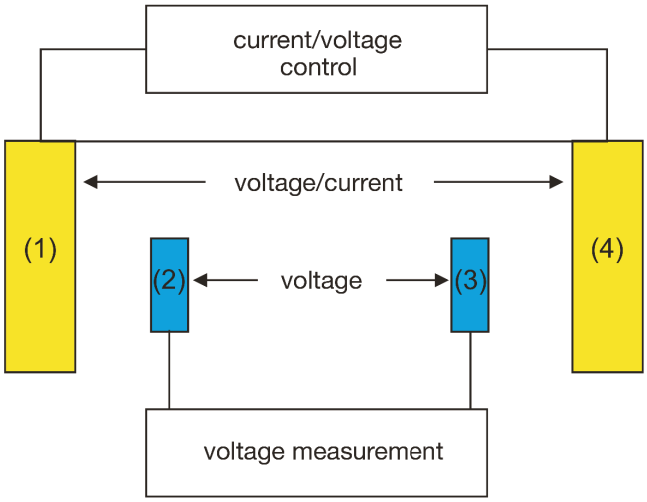
Stainless steel electrodes are inserted into a circular, plastic body. The standard process seal provided is an EPDM O-ring. A fast-response temperature probe delivers information about the process temperature to the measurement amplifier. Electrical connection is made via an M12 connector.

The measuring sensor can also be installed in tanks. No incident flow is required to make it work, but is recommended for fast, stable measurement values and to prevent the accumulation of deposits.

Operative range

Their vast measuring range of 1 µS/cm to 600 mS/cm allows the sensors to be used in processes in food and drink applications, pharmaceuticals and biotechnology, where the different conductivities have to be safely recorded by a measuring system (e.g. CIP/SIP applications, reverse processes in ion exchangers, phase separation, bottle cleaning plants, process water).

Function



The measuring sensor consists of two pairs of electrodes. The transmitter applies alternating current at the outer pair of electrodes. A voltage is released at the inner electrodes - subject to the conductivity of the measuring material. The transmitter acquires the voltage and uses it to calculate the electrolytic conductivity value. Functionally, excitation and measurement are kept separate. Compared to 2-electrode measuring sensors, the effects of polarization recede into the background. To a large extent, incoming resistances are automatically compensated. Measurement errors as a result of contamination or deposits are reduced.

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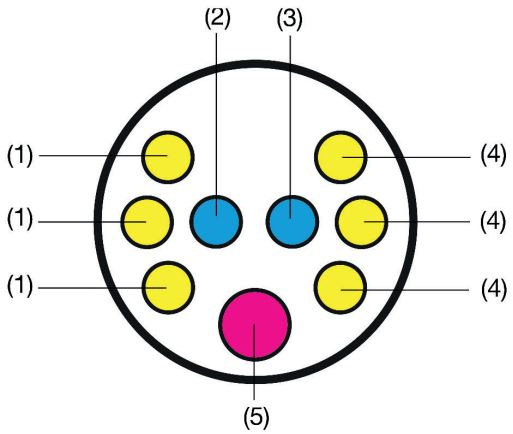
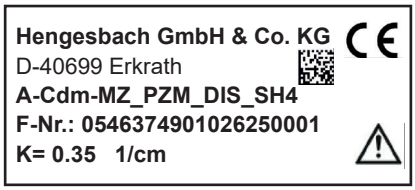
Measuring sensor



	Description	M12 connector pin
(1)	Current supply, outer electrode 1	6
(2)	Voltage tap, inner electrode 1	7
(3)	Voltage tap, inner electrode 2	3
(4)	Current supply, outer electrode 2	4
(5)	Pt1000 temperature probe	1, 2 and 5

12.2 Identifying the device version

12.2.1 Name plate



12.3 Mounting

12.3.1 General

Mounting location

Find a location that ensures easy accessibility for the later calibration.

The fastening must be secure and must ensure low vibration for the instrument.

The operating conditions (temperature, pressure, chemical composition of the measuring material, etc.) must not be allowed to damage the sensor.

The sensor must not be modified mechanically (e.g. shortened, drilled, ground).

CAUTION!	
	Do not touch (contaminate) the electrodes! **A minimum distance** (MD) of 18 mm between the electrodes and the tank or pipe wall must be maintained!

Installation position

The conductivity sensor can be mounted in any position. But it is essential to make sure that the sensor electrodes are fully immersed in the measuring material.

Incident flow

No incident flow is required to make the conductivity sensor work, but is recommended for fast, stable measurement values and to prevent the accumulation of deposits. Structural measures must be taken to prevent flow separation or gas bubbles in the measuring material.

12.3.2 PZM process connection with EPDM O-ring seal

Cleaning Notes

The process connection system PZM consists of a PZM process adaptor (e.g. PZM welding socket Z-PEM5FPZM) and a PZM sensor (e.g. pressure transmitter type PZM).

The process connection system PZM is cleanable via CIP and sterilizable via SIP. Cleaning and sterilization can thus be completed inline.

Please avoid any mechanical contact with the in-process parts as this may damage the pressure membrane.

Installation notes

The PZM process adaptor must be installed front-flush and without dead spaces, both in tanks as well as in pipes. If dead spaces cannot be avoided (as in t-pieces, extrusions) their length L should always be smaller than their diameter d, thus L < d. They must always mounted to be self-draining. In tanks, the cleaning jet must be able to directly impinge and clean these spaces completely.

In storage, take care to avoid corrosion. Do not let stainless steel parts be exposed to inferior metals.

Avoid mechanical damage (scratches, dents) during installation of the PZM sensor into its respective process connection. Remove the protective cap just as the PZM sensor is to be inserted, not earlier. Act accordingly during PZM sensor removal.

Clean all sealing surfaces prior to inserting the PZM sensor to avoid leaks and contamination. The supplied o-ring may be greased (only use NSF-approved substances).

Restrict the greasing to small amounts to avoid problems with microorganism contamination.

To attain front-flush installation, slowly and with care push the PZM sensor until the axial stop of the process connection (adaptor or welding socket) is reached. Only then screw in and tighten the hexagon screw.

Use PZM process adaptors together with the corresponding sealing according to the EHEDG position paper Easy cleanable Pipe couplings and Process connections, e.g. ASEPTO-STAR k-flex-sealing (process connection according to DIN 11851) or Tri-Clamp seals (process connections according to DIN 32676 and ISO 2852).

Further installation instructions may be found in the EHEDG guideline Doc. 37 (Hygienic design and application of sensors).

Welding notes

The PZM welding adaptors are welded using the WIG procedure. To protect the seam root forming gas should be used.
Skilled personnel must perform the preparations and the welding itself. The EHEDG guidelines Doc. 9 (Welding stainless steel to meet hygienic requirements) and Doc. 35 (Hygienic welding of stainless steel tubing in the food processing industry) may serve as further instructions. During welding, the PZM sensor must not be present in the adaptor. Use a welding dummy instead.

Avoid mechanical damages (scratches, dents) to any of the welding parts, and avoid corrosion (see “Installation notes” also)

To avoid welding distortion Hengesbach recommends:

- Use a welding dummy or a comparable, state-of-the-art cooling procedure
- Tack the adaptor to multiple, opposing points which are roughly the same distance apart
- Weld opposing segments segmentally between the tack points
- After welding opposing segments allow all parts to cool down before proceeding

The welding seam must be cohesive, and its surface must be flat, regular and free of welding defects. The first welding seam should be from the process product side (inside). As a rule, a post-treatment of the welding seam (e.g. polishing) is necessary to attain the required surface finish.

Before inserting the PZM sensor, all welded parts must be allowed to cool down completely.

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12.4 Installation

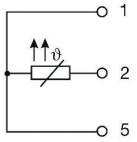
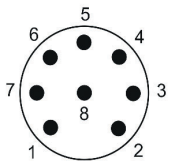
12.4.1 Electrical connection

- Lay the input, output, and supply lines so they are physically separate from each other and are not parallel.
- Use the supplied cable to connect the conductivity sensor to the transmitter. Do not lay the connecting cable close to components or lines through which current is flowing.
- The cables must have an uninterrupted run (do not route them via terminal blocks or similar arrangements).
- No other consumers can be connected to the power terminals of the instrument.
- The conductivity sensor is not suitable for installation in areas with an explosion hazard.
- Apart from faulty installation, incorrect settings of the transmitter may also affect the proper functioning of the subsequent process or lead to damage; you should therefore always provide independent safety equipment. It should only be possible for qualified personnel to change settings.

12.4.2 Terminal assignment and wiring colors

CAUTION!

Incorrect connection of the conductivity sensor will produce inaccurate measurement results!

Connection for		M12 connector		Connection cable
		Pin	Assignment	Color
Pt1000 temperature probe for temperature compensation		1 2 5		GN YE BN
Voltage tap inner electrode 2		3		PK
Current entry outer electrode 2		4		BL
Current entry outer electrode 1		6		RD
Voltage tap inner electrode 1		7		GR
NC		8		
Warning: The shielding of the cable has to be connected to the transmitter only – not to the sensor!				

12.5 Calibration

12.5.1 Notes

NOTE!

Ageing and contamination (deposits) can cause the cell constant of the conductivity sensor to change. The transmitter should therefore be calibrated to the connected conductivity sensor at regular intervals (subject to the measuring material and the operating conditions)!

12.5.2 General

Condumess conductivity sensors are calibrated at the factory. The cell constant of every measuring sensor is documented on the cell stem.

To monitor and increase the quality of measurement, the conductivity measurement chain (conductivity sensor + connecting cable + transmitter) should be regularly calibrated.

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Reference solutions

It is advisable to use one of the following reference solutions for calibration:

- ASTM D 1125, reference solution B: 0.1 N KCl with 12,856 µS/cm
- DIN 38404, Part 8, Section 8.3: 0.1 mol/l KCl with 12.95 x 10^3 µS/cm

However, any calibration solution in the process or cleaning medium conductivity range can also be used.

12.5.3 Settings on the transmitter

The following settings are at minimum necessary:

- Cell type (type of connection): 4-electrode or 4-wire
- Nominal cell constant 1.01/cm
- Relative cell constant as % (see sensor nameplate or certificate)

12.6 Maintenance/Troubleshooting

12.6.1 Cleaning the conductivity sensor

CAUTION!	
	Conductive conductivity sensors are not authorized for use in highly adherent, oily or glutinous media. We recommend using our **INDUTEC** inductive conductivity sensor here! After cleaning the conductivity sensor, always rinse it with water!

NOTE!	
	The conductive conductivity sensor electrodes are in direct contact with the measurement medium. **Regular cleaning must therefore be performed, relative to the contamination susceptibility of the measuring material!** Abrasive cleaners have limited suitability! The measurement electrodes must not be damaged!

- Light contamination can be wiped off with a soft, cleansing tissue, or similar.
- Wash off sticky contamination or greasy and oily contamination with a hot rinsing agent solution and a soft cloth or soft brush; Ethanol can also be used to clean the sensor, if necessary.
- Diluted hydrochloric acid (3 % by weight) can also be used to dissolve the contamination in the event of calciferous coatings or precipitated metal hydroxides or metal oxides.
- If none of the methods mentioned above remove the contamination, other solvents, acids or caustic solutions may be used, with the aid of ultrasonic baths where required; in this case, it is necessary to ensure that the conductivity sensor components are resistant to the cleaning agents being used.

12.6.2 Troubleshooting

Troubleshooting must always consider all the components of the conductivity measurement chain. The transmitter and the connecting cable must also be tested, as well as the conductivity sensor.

Error	**Possible cause**	**Remedy**
Measurement value is too high or to low	Conductivity sensor is dirty	Clean the conductivity sensor
The transmitter does not display conductivity (e.g. display shows "0")	Broken lead or incorrect electrical connection	Check the electrical connection
	Measuring sensor exposed to air (not fully immersed)	Check the measuring sensor installation location Is measuring material present?.
Conductivity displayed by transmitter is too high or to low	The measuring sensor electrical connection is incorrect: poles are inverted or "right - left" assignment is incorrect	Check the electrical connection

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Error	Possible cause	Remedy
The transmitter does not display temperature	Broken lead or incorrect electrical connection	Check the electrical connection
Display value unstable, fluctuating	Malfunction caused by incorrectly/insufficiently shielded connecting cable Malfunction caused by gas bubbles	Check cable Check cable connection and cable routing Check installation location and position of the measuring sensor

The conductivity sensor can also be tested for short-circuits or internal contact problems, see section 12.1 "Description", part "Measuring sensors" and section 12.4.2 "Terminal assignment and wiring colors". A continuity tester (such as the diode tester of a multimeter) is needed for this.

12.7 Technical data

Measuring range	1 µS/cm to approx. 600 mS/cm
Cell constant[a]	Typically, K = 0.3 - 0.4 cm^{-1}
Operating temperature	-10 to +120°C, briefly +140°C(sterilization)
Maximum pressure	16 bar at 25°C 6 bar at -10°C and +140°C
Temperature measurement	With Pt1000, DIN EN 60751 Class A
Electrical connection[b]	M12 connector
Protection according to EN 60529	IP 65
Insertion length	18 mm
Materials in contact with the measuring medium	In accordance with EN 1935/2004 an EN 10/2011
• Cell housing	PEEK
• Electrodes	Stainless steel 1.4435 (AISI 316L)
• Probe pocket	Stainless steel 1.4435 (AISI 316L)
• Seal	EPDM (other material on request)
Process connection	PZM
Measuring sensor installation	via welding socket (tank or pipe) or VARIVENT N adapter
Surface quality (roughness)	Stainless steel components ≤ 0,6 µm Plastic components ≤ 0,8 µm

[a] The measured cell constant is recorded on the stem of the conductivity sensor.
A cell constant deviation can be adjusted at the transmitter.

[b] The connection cable is required for connection.

Please observe the permissible pressure of the process connection selected.
All specifications and certifications specified are only guaranteed when Hengesbach original components are used.
Our devices are subject to continuous development and are therefore subject to change.

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