

Operating Instructions

Conducual CLY421

Conductivity calibration kit for ultrapure water applications

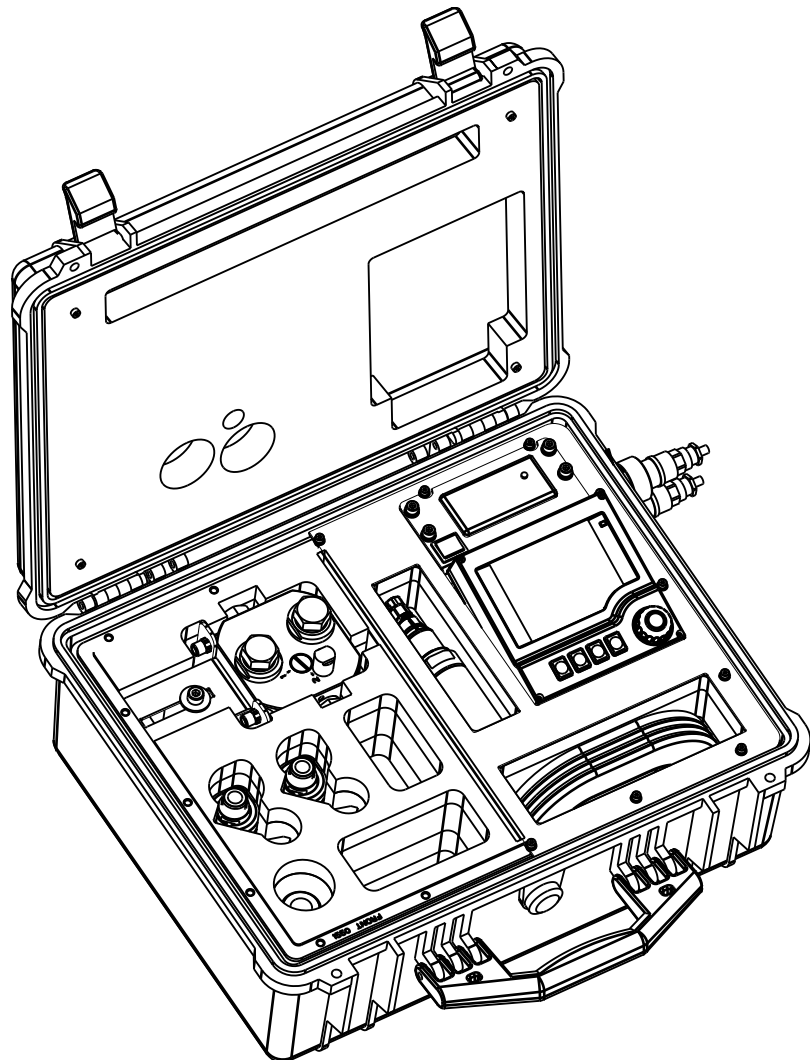


Table of contents

1	Safety instructions	4
1.1	Designated use	4
1.2	Installation, commissioning and operation	4
1.3	Operational safety	4
1.4	Notes on safety conventions and icons	4
2	Identification	6
2.1	Nameplate	6
2.2	Scope of delivery	6
2.3	Certificates and approvals	6
3	Device description and operation	7
3.1	Calibration kit design	7
3.2	Operation	8
4	Maintenance	15
4.1	Cleaning	15
4.2	Recalibration	15
4.3	Repair	15
4.4	Return	15
4.5	Disposal	15
5	Accessories	16
6	Troubleshooting	17
6.1	Diagnostic messages	17
6.2	Spare parts	19
7	Technical data	20
7.1	Input	20
7.2	Power supply	20
7.3	Performance characteristics	20
7.4	Environment	21
7.5	Process	21
7.6	Mechanical construction	21
	Index	22

1 Safety instructions

1.1 Designated use

Conducal CLY421 is a calibration kit designed for checking and calibrating conductivity measurements in the pure water and ultrapure water range. With the calibration kit, process measuring devices can be calibrated and checked without the need for calibration solutions. Only the specific conductivity or the resistivity is determined when the calibration kit is operated.

Any other use than the one described here compromises the safety of persons and the entire measuring system and is therefore not permitted.

The manufacturer is not liable for damage resulting from improper or non-designated use.

1.2 Installation, commissioning and operation

Note the following points:

- Installation, commissioning, operation and maintenance of the measuring system must only be carried out by trained technical personnel.
The technical personnel must be authorized to perform the tasks by the owner-operator.
- The device may only be operated on a low-voltage network that is protected by a circuit breaker.
- The technical personnel must have read and understood these Operating Instructions and must follow the instructions they contain.
- Before commissioning the entire measuring point, check that all the connections are correct. Ensure that electrical cables and hose connections are not damaged.
- Do not operate damaged products. Secure them against unintentional commissioning. Mark the damaged product as defective.
- Faults at the measuring point may only be rectified by authorized and specially trained personnel.
- If faults cannot be rectified, the products must be taken out of service and secured against unintentional commissioning.
- Repairs not described in these Operating Instructions may only be carried out directly at the manufacturer's or by the Service Organization.
- The cover plate, transmitter and charger may not be opened.
- Connection of the system must only be carried out by electrically instructed persons.

1.3 Operational safety

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

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

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

- Installation specifications
- Local standards and regulations
- Mechanical hazard due to transport and handling

1.4 Notes on safety conventions and icons

The structure, signal words and color coding of warning information are in compliance with ANSI Z535.6 specifications ("Product safety information in product manuals, instructions and other collateral materials").

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

2 Identification

2.1 Nameplate

The following information is provided on the nameplate:

- Manufacturer details
- Order code
- Extended order code
- Serial number
- Operating conditions
- Safety information symbols

Compare the order code on the nameplate with your order.

2.2 Scope of delivery

The delivery comprises:

- 1 Calibration kit in the version ordered
- 1 Set of Operating Instructions for Conducal CLY421
- 1 Certificate of calibration

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

2.3 Certificates and approvals

Declaration of Conformity

The product meets the requirements of the harmonized European standards.

As such, it complies with the legal specifications of the EC directives.

The manufacturer confirms successful testing of the product by affixing to it the **CE** mark.

Factory calibration certificate

The Conducal CLY421 calibration kit is calibrated and adjusted at the factory. With the aid of a reference system, the CLS15D reference sensor is calibrated precisely in accordance with the specifications of ASTM Standard 5391-93. In this way, the cell constant and temperature offset of the sensor are determined and recorded in the factory calibration certificate.

The certificate, which is created for each individual Conducal CLY421 kit, is enclosed in the calibration kit.

3 Device description and operation

3.1 Calibration kit design

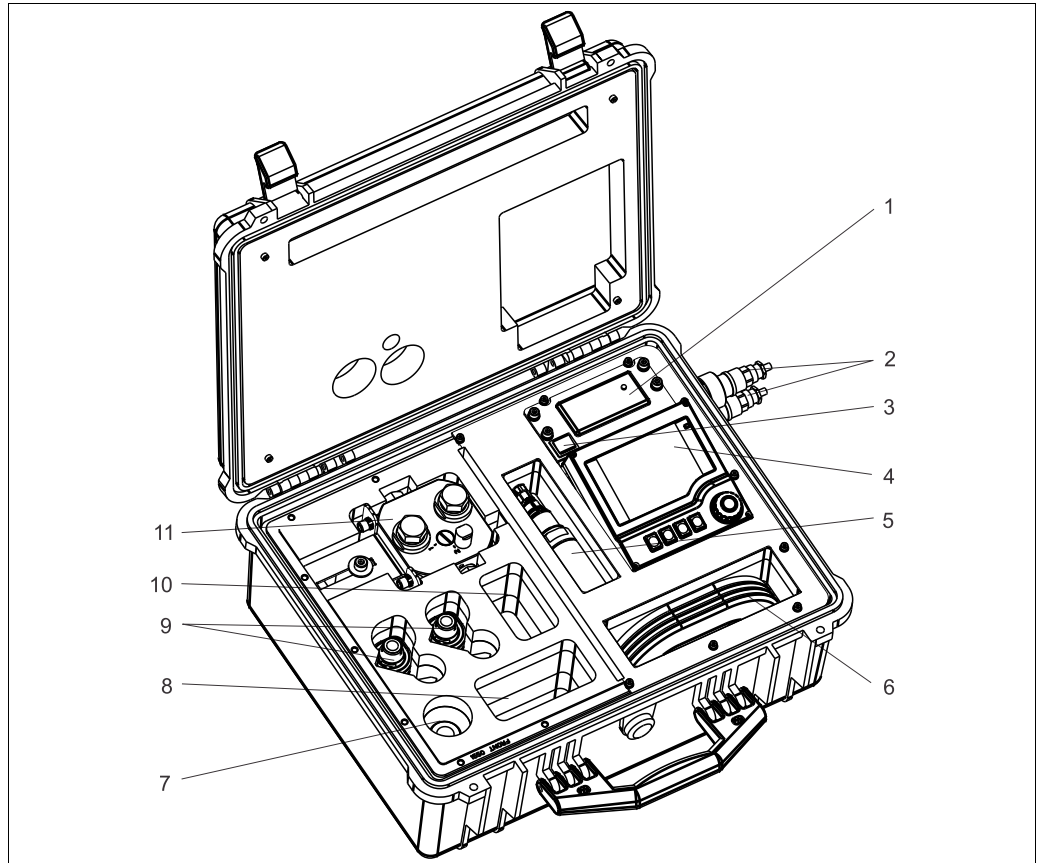


Fig. 1: Elements

- | | | | |
|---|--|----|-------------------------------|
| 1 | Charger | 7 | G1 adapter clamp |
| 2 | Connections for power supply and measuring cable | 8 | Compartment for accessories |
| 3 | On/Off switch for CM42 transmitter | 9 | DN20 hose connection adapters |
| 4 | CM42 transmitter | 10 | Spare compartment |
| 5 | Condumax CLS15D conductivity sensor | 11 | Flow assembly with carrier |
| 6 | Measuring cable and power supply cable | | |

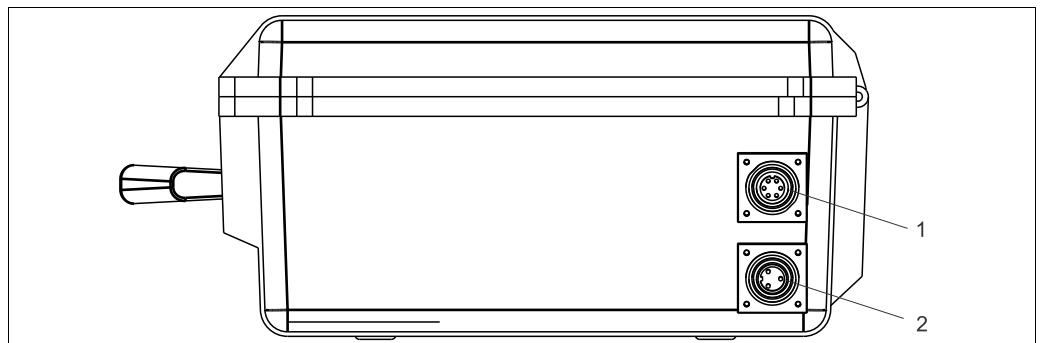


Fig. 2: External connections

- | | |
|---|---|
| 1 | Connection for measuring cable (with cap) |
| 2 | Connection for power supply (with cap) |

3.2 Operation

3.2.1 Rechargeable battery

You must charge the lithium ion battery before you connect the calibration kit.

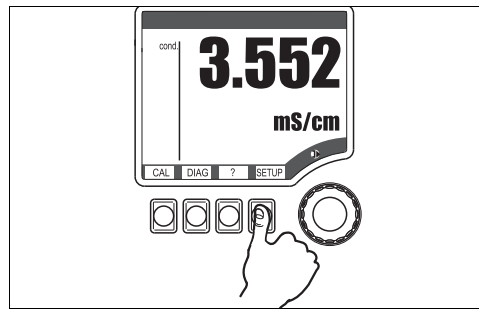
1. Insert the round connector of the power supply cable into the power supply connection on the right-hand side of the case.
2. Insert the mains plug of the power supply cable into the socket.
3. The lithium ion battery will now be charged.

The light emitting diode on the charger can indicate two charge states:

- **Orange:** The battery is being charged.
- **Green:** The battery is fully charged.

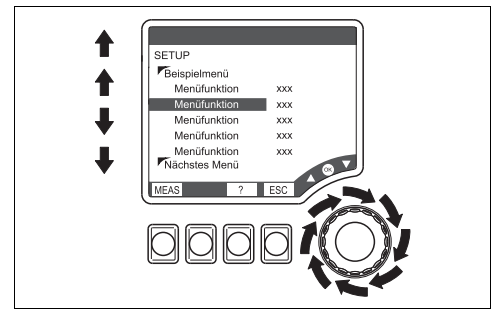
It can take several hours to charge the battery.

3.2.2 Operating concept of the transmitter



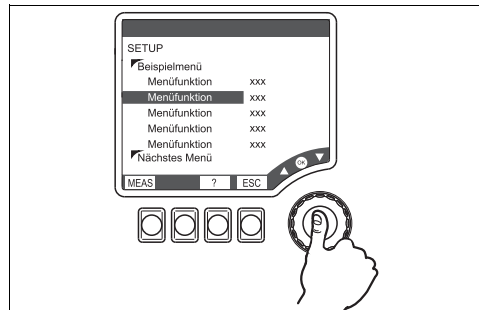
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Fig. 3: Press the soft key: select the menu directly



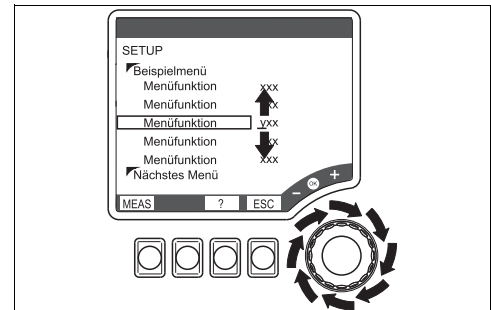
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Fig. 4: Turn the navigator: move the cursor in the menu



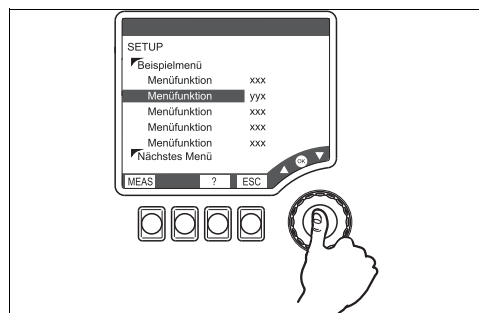
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Fig. 5: Press the navigator: select a function



a0010037-en

Fig. 6: Turn the navigator: change a value



a0010038-en

Fig. 7: Press the navigator: accept new value

Operating concept

1. Select a menu directly by pressing the appropriate soft key.
2. Move the cursor in the menu by turning the navigator.
3. Select the desired function by pressing the navigator.
4. Change the value by turning the navigator.
5. Accept the new value by pressing the navigator.

- i** The transmitter of the CLY421 is already configured. You just have to switch on the transmitter. The transmitter displays the measured value after a few moments. You need only switch on temperature compensation if the difference in temperature between the calibration sensor and the process sensor is $> 0.1\text{ }^{\circ}\text{C}$. This is described in the "Comparison measurement" section.

3.2.3 Measuring arrangements

The calibration kit can be used for two measuring arrangements:

- Comparison measurement with a bypass
- Direct comparison measurement

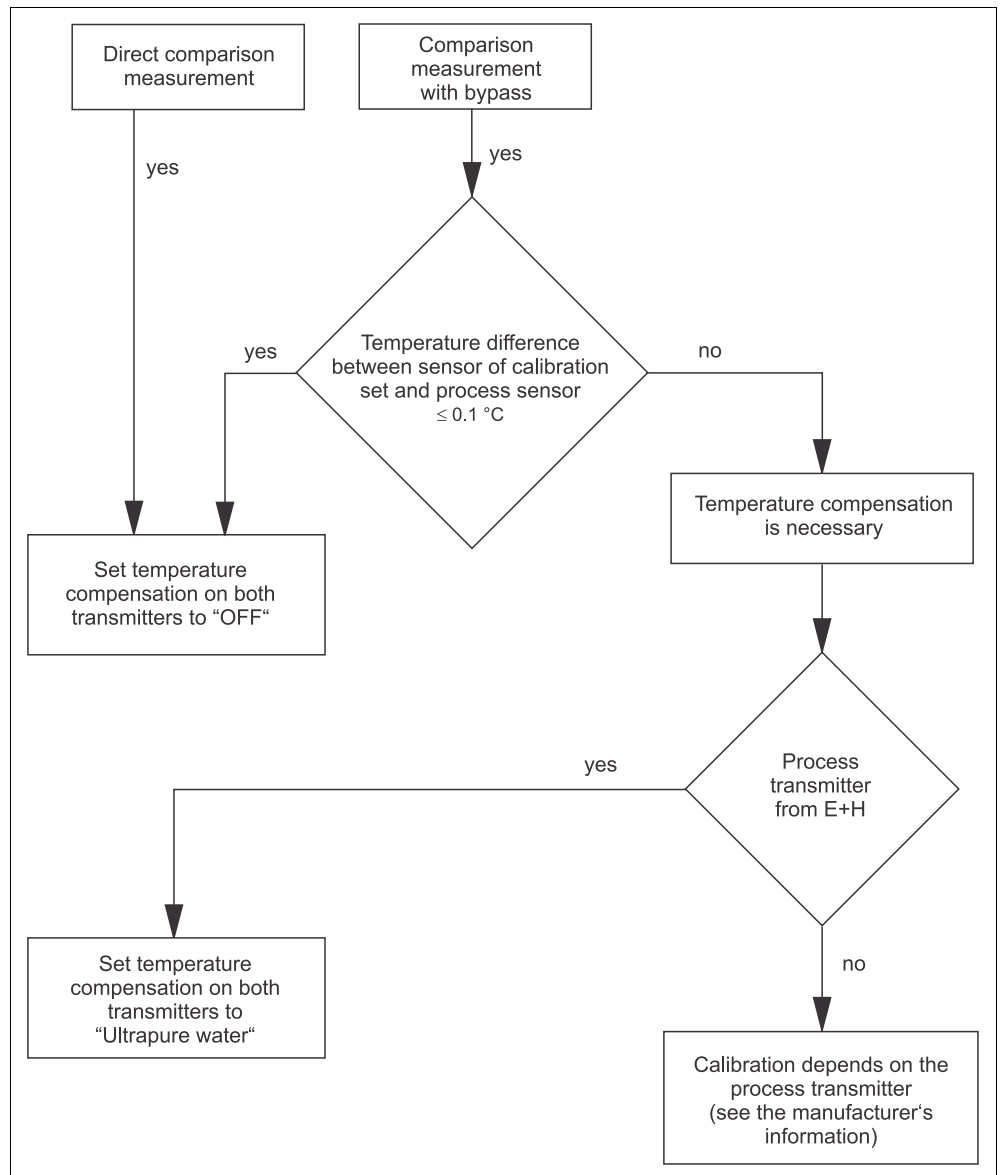


Fig. 8: Comparison of comparison measurement with a bypass and direct comparison measurement

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Comparison measurement with a bypass

With this arrangement, it is important to make sure that the composition of the medium and the temperature at the process measurement point and comparison measurement point are the same. This is ensured by:

- Using short hose connections
- Wait until the temperature in the flow assembly adjusts to match the process temperature.

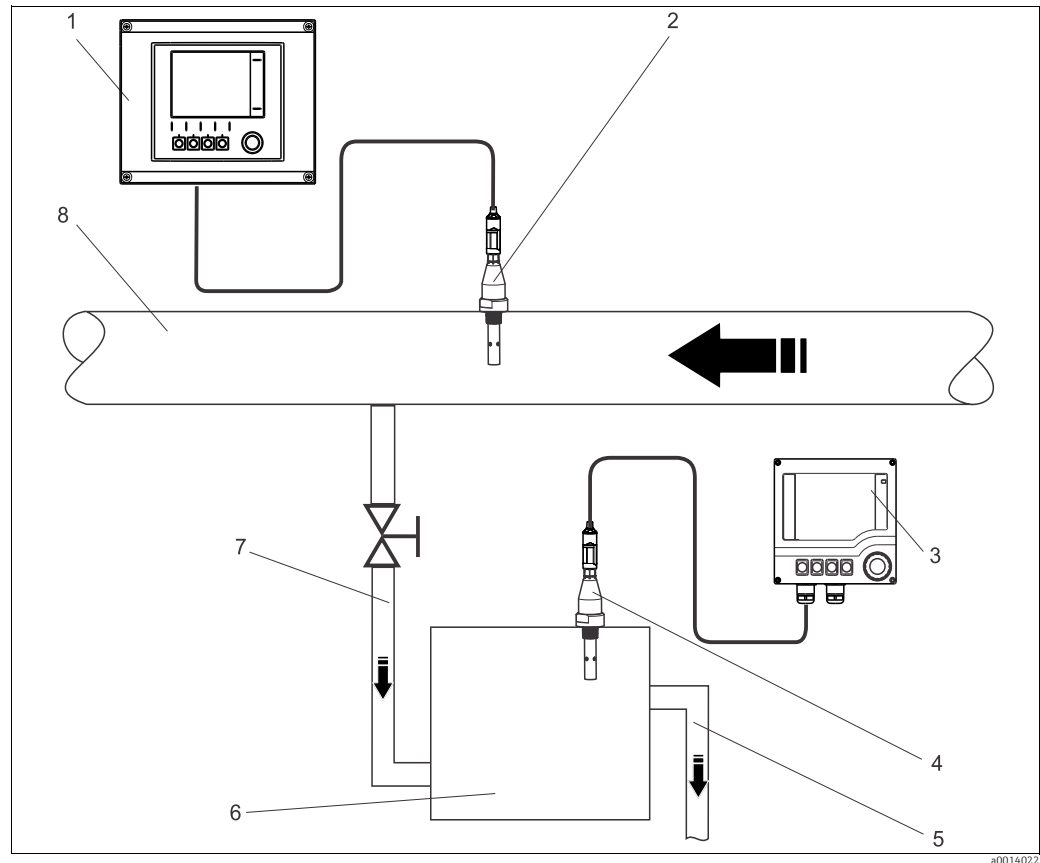


Fig. 9: Measuring arrangement for comparison measurement with a bypass

- | | | | |
|---|-------------------------------------|---|-------------------------------|
| 1 | Process transmitter | 5 | Bypass outlet |
| 2 | Process conductivity sensor | 6 | Calibration kit flow assembly |
| 3 | Calibration kit transmitter | 7 | Bypass inlet |
| 4 | Calibration kit conductivity sensor | 8 | Sterile main pipe |

Direct comparison measurement

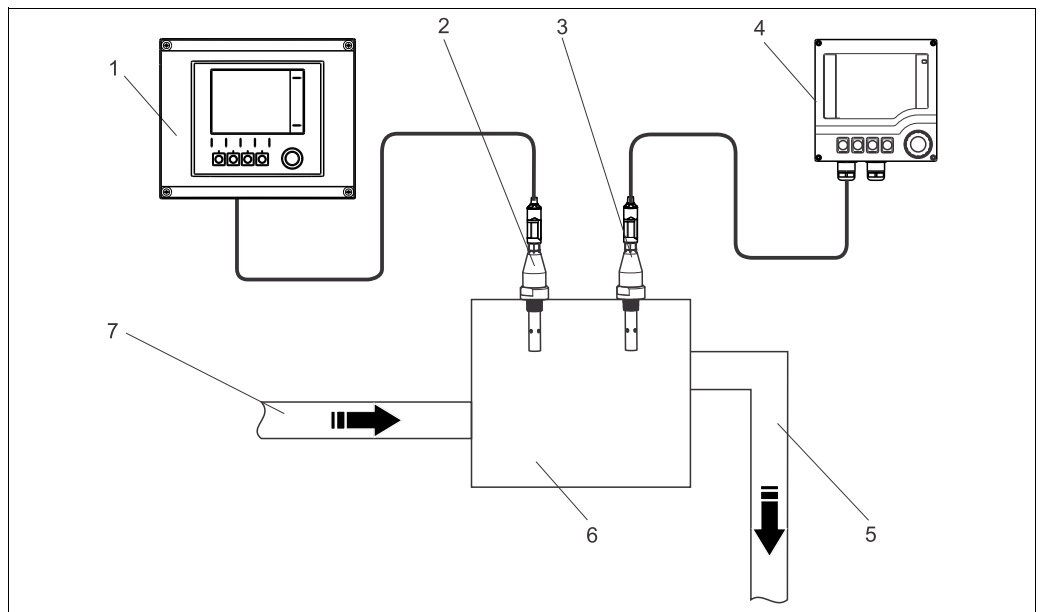


Fig. 10: Measuring arrangement for direct comparison measurement

- | | | | |
|---|-------------------------------------|---|-------------------------------|
| 1 | Process transmitter | 5 | Outlet |
| 2 | Process conductivity sensor | 6 | Calibration kit flow assembly |
| 3 | Calibration kit conductivity sensor | 7 | Inlet |
| 4 | Calibration kit transmitter | | |

In the case of direct comparison measurement, all the important parameters match:

- Temperature and
- Absolutely identical medium

As it is necessary to remove the sensor from the process, the medium can be contaminated.

3.2.4 Installation

The calibration kit can be used for two measuring arrangements:

- Comparison measurement with a bypass
- Direct comparison measurement

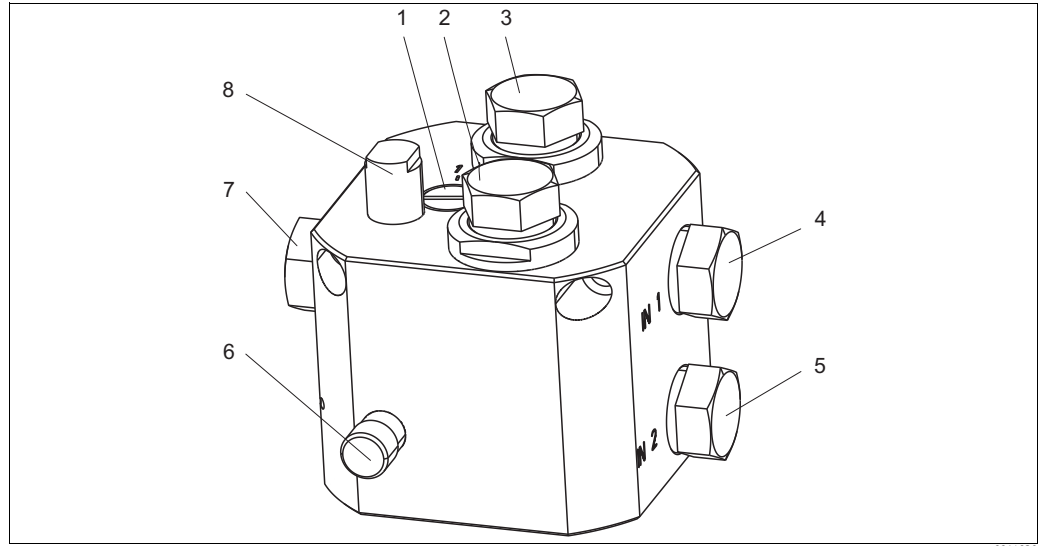


Fig. 11: Flow assembly

1	Switchover from bypass (1) to direct (2)	5	Inlet for direct comparison measurement
2	Installation point for calibration kit conductivity sensor	6	Flow regulation valve
3	Installation point for process conductivity sensor	7	Outlet
4	Inlet for bypass measurement	8	Flow monitoring

Preparatory steps for comparison measurement with a bypass

Install the measuring arrangement as follows:

1. Secure the flow assembly with the carrier on a pipe (e.g. railing).
On square pipes mount the clamping jaw with the V-notch facing outwards, and facing inwards on circular pipes,
or position the flow assembly safely.
2. Set the "Bypass - Direct" switch to "Bypass" (Position 1).
3. Using a hose connection adapter (provided in the case) mount the outflow hose on the "OUT" outlet of the flow assembly (Item 7). Only screw the hose connection adapter finger-tight into the flow assembly.
4. Using a hose connection adapter mount the medium hose on the "IN 1" inlet of the flow assembly (Item 4).
5. Seal the "IN 2" inlet (Item 5) with a stopper (provided in the case).
6. Screw the sensor of the calibration kit into the flow assembly (Item 2).
7. In the flow assembly, seal the installation point for the process sensor (Item 3) with a stopper.

Preparatory steps for direct comparison measurement

Install the measuring arrangement as follows:

1. Secure the flow assembly with the carrier on a pipe (e.g. railing).
On square pipes mount the clamping jaw with the V-notch facing outwards, and facing inwards on circular pipes,
or position the flow assembly safely.
2. Set the "Bypass - Direct" switch to "Direct" (Position 2).
3. Using a hose connection adapter (provided in the case) mount the outflow hose on the "OUT" outlet of the flow assembly (Item 7). Only screw the hose connection adapter finger-tight into the flow assembly.
4. Using a hose connection adapter mount the medium hose on the "IN 2" inlet of the flow assembly (Item 5).
5. Seal the "IN 1" inlet (Item 4) with a stopper (provided in the case).
6. Screw the sensor of the calibration kit into the flow assembly (Item 2).
7. Screw the process sensor into the flow assembly (Item 3). For sensors with a G1 process connection, use the G1 adapter clamp (provided in the case).

3.2.5 Electrical connection

Connecting the calibration kit:

1. Install the measuring cable between the sensor, calibration kit and transmitter (exterior of the case).
2. In the case of direct comparison measurement:
Install the measuring cable between the process sensor and process transmitter.
3. If a power supply is available, connect the mains cable (exterior of the case).

3.2.6 Comparison measurement

1. Open the medium flow to the flow assembly.
2. Optimize the flow with the regulation valve (Item 6).
Procedure: Close the regulation valve. Now open the regulation valve slowly until the flow meter (Item 8) is at the upper limit.
3. Switch on the two transmitters. It takes up to 8 seconds until information is displayed on the transmitter of the calibration kit.
4. In the case of comparison measurement with a bypass: Waiting until the temperature in the flow assembly has adjusted to match the process temperature (around 30 minutes).
 - i** If the temperature difference is $< 0.1\text{ }^{\circ}\text{C}$, you do not need to change any settings on the transmitter of the calibration kit.
If the temperature difference is $> 0.1\text{ }^{\circ}\text{C}$, set the temperature compensation on both transmitters to ultrapure water. Setting on transmitter of the calibration kit:
SETUP/Operating mode/Temp.compensation/UPW (NaCl)
Now select the measuring mode again.
5. Vent the flow assembly by unscrewing the sensor of the calibration kit slightly. Tighten the sensor again as soon as water comes out.
6. Start the measurement.
7. Adjust the process measuring point with the comparison value (see Operating Instructions of the process transmitter).
8. Disconnect the calibration kit from the power supply.

NOTICE

Water can damage the electrical parts of the calibration kit

- ▶ Empty the flow assembly completely before you put it back in the case.

4 Maintenance

4.1 Cleaning

▲ WARNING

The device is energized.

Performing cleaning work on live parts can result in injury or death.

- ▶ Disconnect the case from the power supply before commencing the cleaning tasks.

Clean the front of the housing of the transmitter and the case with commercially available cleaning agents.

NOTICE

Cleaning agents can damage the surface of the device

Never use any of the following to clean the device:

- ▶ Concentrated mineral acids or bases
- ▶ Benzyl alcohol
- ▶ Methylene chloride
- ▶ High-pressure steam

If used correctly in the pure and ultrapure water range, no contamination will occur on the flowmeter and the comparison sensor. Nevertheless, if the units do need to be cleaned, you can rinse them with hot water or isopropyl alcohol.

4.2 Recalibration

Depending on the operating conditions and the frequency of use, the conductivity calibration kit must be calibrated regularly at the factory (annual recalibration is recommended). You then receive an updated factory calibration certificate.

4.3 Repair

If the device requires repair, please return the case containing the complete calibration kit to Endress+Hauser.

4.4 Return

The device must be returned if repairs or a factory calibration are required, or if the wrong device has been ordered or delivered. According to legal regulations, Endress+Hauser, as an ISO-certified company, is required to follow certain procedures when handling returned products that are in contact with medium.

To ensure swift, safe and professional device returns, please read the return procedures and conditions on the internet site:

www.services.endress.com/return-material

4.5 Disposal

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

Observe local regulations.

5 Accessories

Recalibration

- Depending on the operating conditions and the frequency of use, the conductivity calibration kit must be calibrated regularly at the manufacturer's factory.
- Recommended recalibration period: 1 year

6 Troubleshooting


6.1 Diagnostic messages

6.1.1 Classification of diagnostic messages

You can find more detailed information on the errors currently pending in the "DIAG/Error messages" menu (red alarm LED lit¹⁾).

The error messages are characterized by:

- Error class (internal variable, not visible)
- Error status (letter in front of the error number)
 - F=Failure, general error message
 - M=Maintenance required. Action must be taken (where applicable the measured value is still valid)
 - C=Device is in service (Check), (no error)
 - U=Device status is uncertain, unidentifiable error
- Type of message
 - Alarm
 - Maintenance
 - Service

 You have the option of increasing or decreasing the priority of an error. You do so by resorting the diagnostics list (see "SETUP/Sensor/Sensor diagnosis" section).

The following tables are categorized by error message type.

1) Red LED only lit if the error current ≥ 20 mA

6.1.2 Available diagnostic messages

The table of diagnostic messages is sorted by the message number. This number cannot be changed. The "Cat." column contains the error category which is assigned at the factory .

No.	Message text	Cat.	Tests and/or remedial measures
003	Temperature failure	F	Check wiring
004	Scanning sensor	C	Establish connection to sensor
010	Sensor initialization	C	Wait for the initialization to finish.
011	Sensor no comm.	F	<ul style="list-style-type: none"> - Data processing interrupted due to user interaction with DAT module (F011) - Test the measuring chain with a new sensor - Check the settings for the sensor type used.
012	Sensor defective alarm	F	
013	Wrong sensor type	F	
104	Contents uncertain	F	
108	Cellconst upper limit	F	
109	Cellconst lower limit	F	
110	Cellconst upper limit	M	
114	Cellconst lower limit	M	
119	Temp offset upper limit	F	
120	Temp offset lower limit	F	
127	Temp offset upper limit	F	
128	Temp offset lower limit	F	
129	Sensor change aborted	C	
130	Calibration active	C	Wait for the calibration to finish.
131	PV not stable	M	<ul style="list-style-type: none"> - Sensor too old - Defective cable or connector
132	Temperature not stable	M	
133	Polarization warning	M	
180	Calibration expired alarm	M	
183	Usage >80 °C warning	M	
194	Usage >140 °C warning	M	
195	Usage >80 °C<100 nS alarm	M	
200	Transmitter initialization	C	Wait for the initialization to finish.
201	Transmitter no comm.	F	Check that the sensor module is firmly seated on the DIN rail, and check the lateral pin contacts to the CPU module for damage.
202	Transmitter failure	F	
203	Wrong transmitter type	F	
215	Simulation active	C	Active corresponding to your settings
216	Hold active	C	Active corresponding to your settings
218	Curr. out module defect	F	Contact the Service Team.
220	Multidrop mode active	C	Notification that the device is being operated in the HART multidrop mode
221	Multidrop switch on	C	
404	Lower limit current output	S	<ul style="list-style-type: none"> - Measured value outside the specified current range - Check plausibility - Adapt current output limits (Setup/Current output.../Low value (4 mA) or Upper value (20 mA))
405	Upper limit current output	S	
406	Setup active	C	End parameter entry
407	Diag active	C	End interrogation of device and sensor information
408	Calibration aborted	M	
500	Software not valid	F	Contact the Service Team.

No.	Message text	Cat.	Tests and/or remedial measures
501	Device open	M	Close the housing and tighten the screws.
504	Added new user	C	Message relating to changes in the user administration
505	User deleted	C	
506	Changed user data	C	
510	Invalid parameters	F	Check your settings and adjust them.
513	InternCFW (xxxxxxx)	F	Contact the Service Team. Quote the error number and the text displayed. The (xxxxxxx) here stands for the text actually displayed.
514	InternCFW (xxxxxxx)	M	
531	(Logbook): full	M	The ring memory of the specified logbook is full. From now on, new events will overwrite the oldest entries.
810	PV upper limit	F	<ul style="list-style-type: none"> - Sensor in air - Air pockets in assembly - Check measuring chain PV = Primary value
811	PV lower limit	F	
812	Temp upper limit	F	
840	PV upper limit	M	<ul style="list-style-type: none"> - Sensor in air - Air pockets in assembly - Check measuring chain
841	PV lower limit	M	
842	Temp upper limit	M	
843	Temp lower limit	M	
950	Conc temp lower limit	M	<ul style="list-style-type: none"> - Check your process conditions. - Adjust the measuring range where necessary. ⓘ These messages only apply for the concentration tables saved at the factory. These messages do not appear if you use user-defined tables.
951	Conc temp upper limit	M	
952	Conc kappa lower limit	M	
953	Conc kappa upper limit	M	
954	Conc lower limit	M	
955	Conc upper limit	M	
956	Cond temp lower limit	M	
957	Cond temp upper limit	M	
958	Cond kappa lower limit	M	
959	Cond kappa upper limit	M	
960	Cond kappa comp lower limit	M	
961	Cond kappa comp upper limit	M	

6.2 Spare parts

Name and content	Order number for spare parts kit
Flow assembly complete with carrier, EPDM seals	71148156
Hose connection adapter, locking clamp, EPDM clamp seal	71148157
G1 adapter / clamp	71148158
3 x dummy plugs + 10 x O-rings (EPDM)	71148159
3 x EPDM clamp seals DN20	71148160
4 x Bulgin protection caps (for connecting measuring cables and power supply)	71148161

7 Technical data

7.1 Input

Measured variables $\mu\text{S/cm}$ or $\text{M}\Omega\text{cm}$; configurable

7.2 Power supply

Supply voltage Wide-area power pack 100 to 240 VAC, 47 to 63 Hz, Class II equipment with functional grounding

Rechargeable battery Integrated lithium ion battery 14.4 V; 2.4 Ah
The fully charged battery enables a calibration kit operating time of over 80 hours.

External sensor cable connection Buccaneer plug, 6-pin , IP 68

7.3 Performance characteristics

Error calculation

Reference system adjustment with standard NIST reference material


Uncertainty of reference solution	0.2 %
Uncertainty of temperature measurement	<< 0.1 %
Uncertainty of reference system display	0.2 %
Total uncertainty of reference system adjustment	0.3 %

Conducal adjustment with 5 $\mu\text{S/cm}$ (or 200 $\text{k}\Omega\text{cm}$)

Uncertainty of reference system adjustment	0.3 %
Uncertainty of reference system measurement at 5 $\mu\text{S/cm}$	0.6 %
Uncertainty of Conducal display at 5 $\mu\text{S/cm}$	0.6 %
Total uncertainty of Conducal adjustment with 5 $\mu\text{S/cm}$	0.9 %

(Only corresponds to the uncertainty of Conducal. The adjustment of measuring points with Conducal requires an additional uncertainty analysis)

The change of the CLS15D cell constant in the conductivity range between the standard reference material and 5 $\mu\text{S/cm}$ is not considered.

 Depending on availability, different standard NIST reference materials are used to adjust the reference system. Normally SRM 3191 is used with a nominal value of 100 $\mu\text{S/cm}$.

Reference devices

Reference measuring device used	Liquiline CM42
Reference measuring cell used	Condumax CLS15D

7.4 Environment

Ambient and storage temperature range	5 to 40 °C (41 to 104 °F)
Humidity	Max. 80 %
Altitude	Up to 2000m
Degree of protection	IP 30 with case open IP 67 at closed case without power cord Use indoors (pollution level II)

7.5 Process

Process temperature	0 to 100 °C (32 to 210°F)
Process pressure	Max. 6 bar (87 psi)
Minimum flow	30 l/h (8 gal/hr)

7.6 Mechanical construction

Dimensions	L x W x H	530 x 442 x 215 mm (20.9" x 17.4" x 8.5")
Weight	Approx. 12.7 kg (28 lbs)	
Material	Flow assembly	PVDF
	Clamp seal	EPDM
	Adapter	PVDF
Process connection	Inlet	G ¹ / ₂ or clamp ¹ / ₂ "
	Outlet	G ¹ / ₂ or clamp ¹ / ₂ "
	Vent	G ¹ / ₂

Index

B

Battery 8

C

Calibration kit
 Content 7
 Charger 8
 Cleaning 15
 Commissioning 4
 Comparison measurement
 Bypass 12
 Direct 12

D

Declaration of Conformity 6
 Designated use 4
 Diagnostic messages 17
 Disposal 15

E

Electrical connections 7

F

Flow assembly 12

I

Icons
 Safety conventions 4
 Installation 4, 12

M

Maintenance 15
 Measuring arrangements 9

N

Nameplate 6
 Notes on safety conventions and icons 4

O

Operating concept 8
 Operation 4
 Operational safety 4

R

Recalibration 15
 Rechargeable battery 8
 Repair 15

S

Safety instructions 4
 Scope of delivery 6
 Service 15
 Spare parts 19

T

Technical data 20
 Troubleshooting 17

U

Use 4



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