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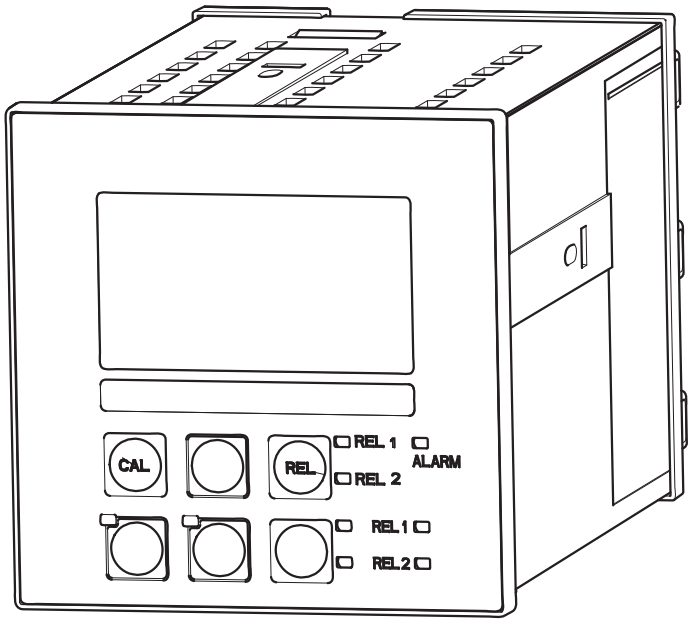
Operating Instructions
Liquisys M CLM223F
Transmitter for Conductivity



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About this document

Safety messages

The structure, signal words and safety colors of the signs comply with the specifications of ANSI Z535.6 ("Product safety information in product manuals, instructions and other collateral materials").

Safety message structure	Meaning
⚠ DANGER **Cause (/consequences)** Consequences if safety message is not heeded ▶ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid the situation **will** result in a fatal or serious injury.
⚠ WARNING **Cause (/consequences)** Consequences if safety message is not heeded ▶ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid the situation **can** result in a fatal or serious injury.
⚠ CAUTION **Cause (/consequences)** Consequences if safety message is not heeded ▶ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
NOTICE **Cause/situation** Consequences if safety message is not heeded ▶ Action/note	This symbol alerts you to situations that can result in damage to property and equipment.

Symbols

- Additional information, tips
- Permitted or recommended
- Forbidden or not recommended

Table of contents

1 Basic safety instructions

1.1 Requirements for the personnel

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

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

1.2 Designated use

CLM223 F is a transmitter for determining the conductivity of a liquid medium.

The transmitter is particularly suited for use in the following areas:
- Concentration control
- CIP plants control
- Phase separation
- Product quality assurance
- Wash mobiles and cleaning plants

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 caused by improper or non-designated use.

1.3 Workplace safety

As the user, you are responsible for complying with the following safety conditions:
- Regulations for explosion protection
- Installation instructions
- Local standards and regulations

Electromagnetic compatibility
With regard to electromagnetic compatibility, this device has been tested in accordance with the applicable European standards for industrial applications.
The electromagnetic compatibility indicated only applies to a device that has been connected in accordance with the instructions in these Operating Instructions.

1.4 Operational safety

- Before commissioning the entire measuring point, make sure all the connections are correct. Ensure that electrical cables and hose connections are not damaged.
- Do not operate damaged products, and safeguard them to ensure that they are not operated inadvertently. Mark the damaged product as defective.
- If faults cannot be rectified, the products must be taken out of service and secured against unintentional commissioning.

1.5 Product safety

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

1.6 Electrical symbols

Direct Current (DC)
A terminal at which DC is applied or through which DC flows.

Alternating Current (AC)
A terminal at which (sine-form) AC is applied or through which AC flows.

Ground connecting
A terminal which, from the user's point of view, is already grounded using a grounding system.

Protective ground terminal
A terminal which must be grounded before other connections may be set up.

Class II (isolated) device
Double insulation

Alarm relay

Input

Output

DC voltage source

Temperature sensor

2 Incoming acceptance and product identification

2.1 Incoming acceptance

- Make sure the packaging is undamaged!
- Inform the supplier about any damage to the packaging.
  Keep the damaged packaging until the matter has been settled.
- Make sure the contents are undamaged!
- Inform the supplier about damage to the contents. Keep the damaged products until the matter has been settled.
- Check that the order is complete and agrees with your shipping documents.
- The packaging material used to store or to transport the product must provide shock protection and humidity protection. The original packaging offers the best protection. Also, keep to the approved ambient conditions (see "Technical data").
- If you have any questions, please contact your supplier or your local sales center.

2.2 Scope of delivery

The delivery of the panel mounted instrument includes:
- 1 transmitter CLM223 F
- 1 test resistor
- 1 set of plug-in screw terminals
- 2 tensioning screws
- 1 Operating Instructions BA00237C/07/EN

2.3 Product identification

2.3.1 Nameplate

The nameplate contains the following information:
- Manufacturer data
- Order code
- Extended order code
- Serial number
- Operating conditions
- Safety icons

Compare the order code on the nameplate with your order.

2.3.2 Identifying the product

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

To find out the version of your device, enter the order code indicated on the nameplate in the search screen at the following address: www.products.endress.com/order-ident

2.4 Certificates and approvals

2.4.1 CE mark

Declaration of conformity
The product meets the requirements of the harmonized European standards. It thus complies with the legal requirements of the EC directives.
The manufacturer confirms successful testing of the product by affixing the CE symbol.

2.4.2 CSA general purpose

CSA General Purpose
The products listed below are eligible to bear the CSA Mark shown with adjacent indicators "C" and "US":

Version	Approval
CLM223F-..2... CLM223F-..3... CLM223F-..7...	CSA Mark for Canada and USA

3 Mounting

3.1 Quick installation guide

Proceed as follows to completely install the measuring point:

- Install the transmitter (see "Installation instructions" section).
- If the sensor is not yet installed in the measuring point, install it (see Technical Information of the sensor).
- Connect the sensor to the transmitter as illustrated in the "Electrical connection" section.
- Connect the transmitter as illustrated in the "Electrical connection" section.
- Commission the transmitter as explained in the "Commissioning" section.

3.1.1 Measuring system

A complete measuring systems comprises:
- The transmitter Liquisys M CLM223 F
- A sensor with or without an integrated temperature sensor
- A measuring cable CYK71 (conductive) or CLK5 (inductive)

Options: extension cable, junction box VBM

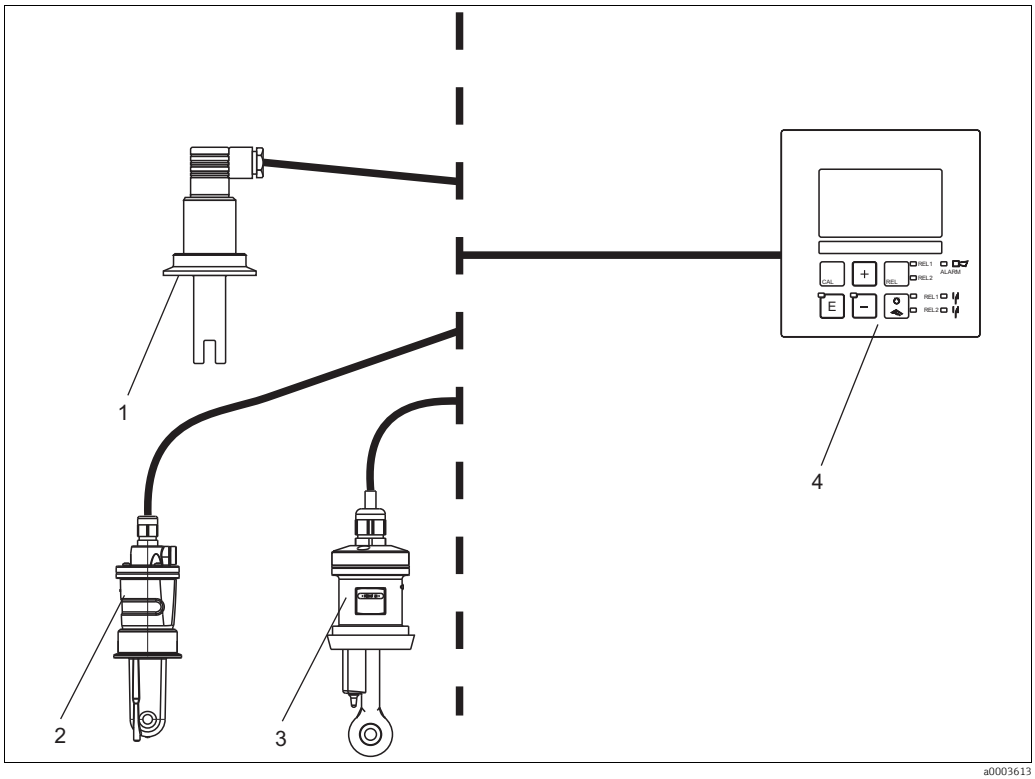


Fig. 1: Complete measuring system Liquisys CLM223 F

1 Conductive sensor CLS21
2 Inductive sensor CLS54
3 Inductive sensor CLS52
4 Liquisys M CLM223 F

3.2 Installation conditions

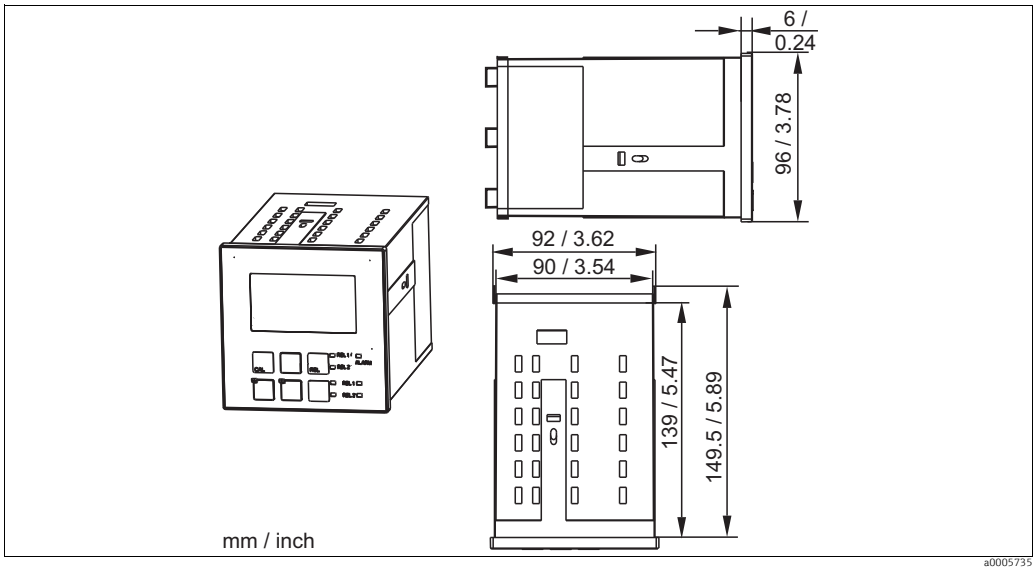


Fig. 2: Panel-mounted instrument

3.3 Installation instructions

The panel-mounted instrument is secured with the clamping screws supplied (see → 3). The necessary installation depth is approx. 165 mm (6.50").

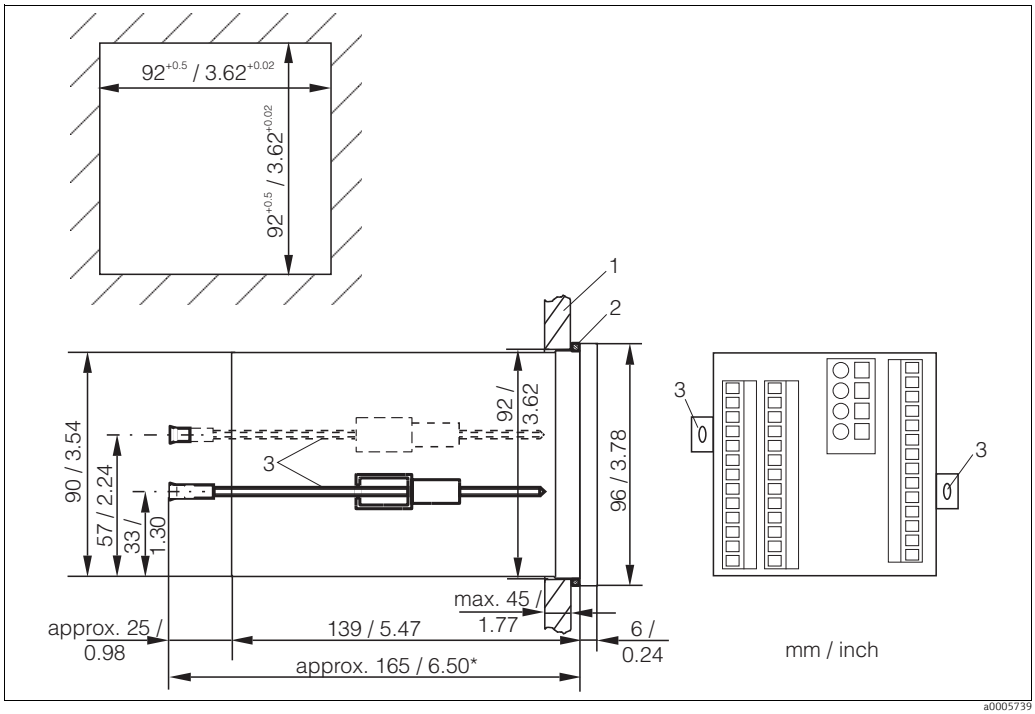


Fig. 3: Securing the panel-mounted instrument

1 Wall of the cabinet
2 Seal
3 Clamping screws
** Required installation depth*

3.4 Post-installation check

- After installation, check the transmitter for damage.
- Check whether the transmitter is protected against moisture and direct sunlight.

4 Electrical connection

⚠ WARNING

Device is energized

Improper connection can cause injury or death.

- The electrical connection must only be carried out by a certified electrician.
- Technical personnel must have read and understood the instructions in this manual and must adhere to them.
- **Prior to beginning** any wiring work, make sure voltage is not applied to any of the cables.

4.1 Wiring

NOTICE

The device does not have a power switch

- You must provide a protected circuit breaker in the vicinity of the device.
- This must be a switch or a power-circuit breaker and you must label it as the circuit breaker for the device.
- At the supply point, the power supply for the 24 V versions must be isolated from dangerous live cables by double or reinforced insulation.

4.1.1 Connection diagram

The wiring diagram depicted in → 4 shows the connections of an instrument equipped with all the options. Connecting the sensors and the various measuring cables is explained in more detail in the "Measuring cables and sensor connection" section.

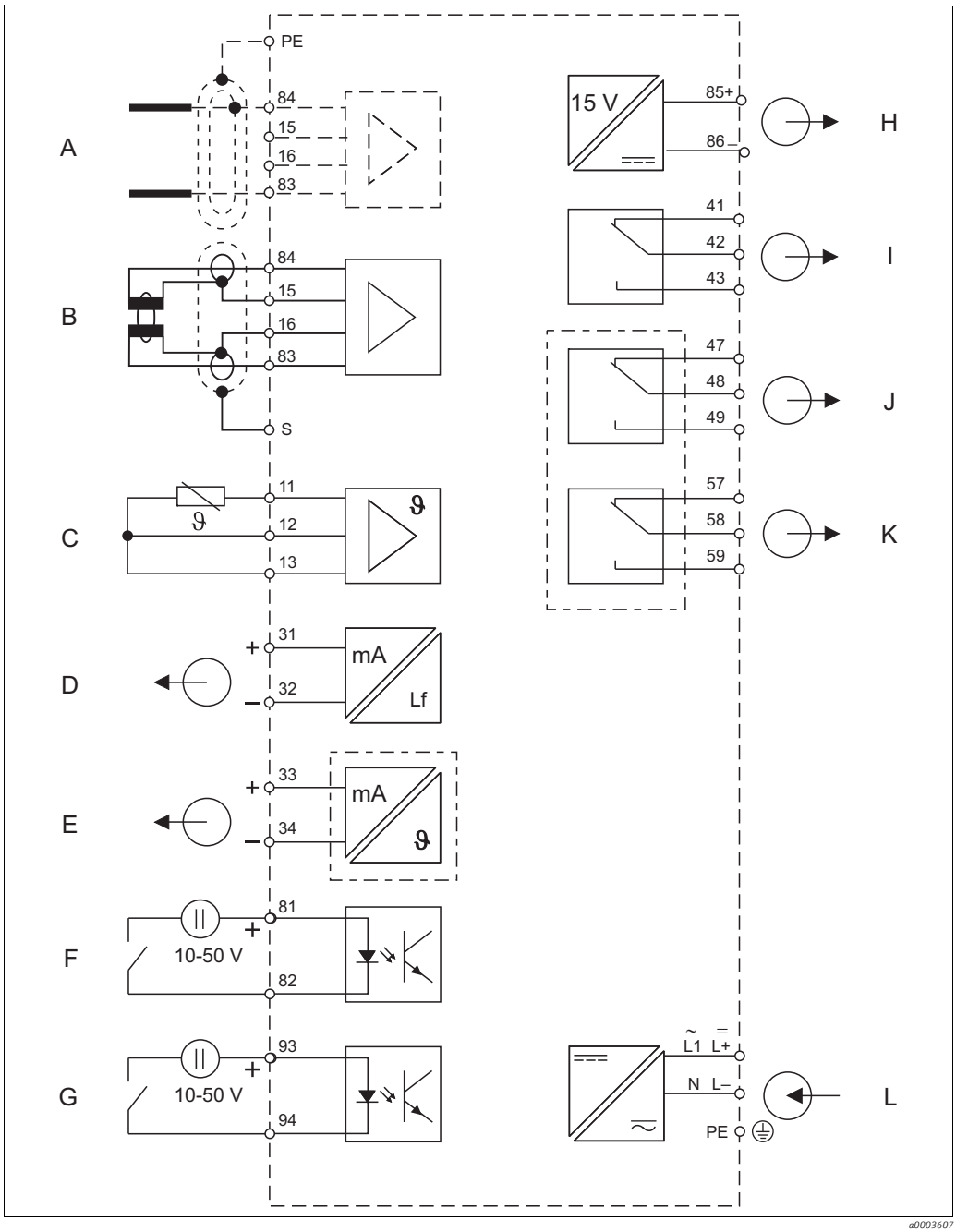


Fig. 4: Electrical connection of the transmitter

A Sensor (conductive)
B Sensor (inductive)
C Temperature sensor
D Signal output 1 conductivity
E Signal output 2 temperature
F Binary input 1 (MRS)
G Binary input 2 (MRS)
H Aux. voltage output
I Alarm (current-free contact position)
J Relay 1 (current-free contact position)
K Relay 2 (current-free contact position)
L Power supply

Pay attention to the following:
- The device is approved for protection class II and is generally operated without a protective earth connection.
- To guarantee measuring stability and functional safety, you have to ground the outer screen of the sensor cable:
  – Inductive sensors: terminal "S"
  – Conductive sensors: PE distributor rail
    This is on the cover frame for panel-mounted instruments and in the connection compartment for field devices. Ground the PE distributor rail or the ground terminal.
- The circuits "E" and "H" are not galvanically isolated from each other.

Panel-mounted instrument connection

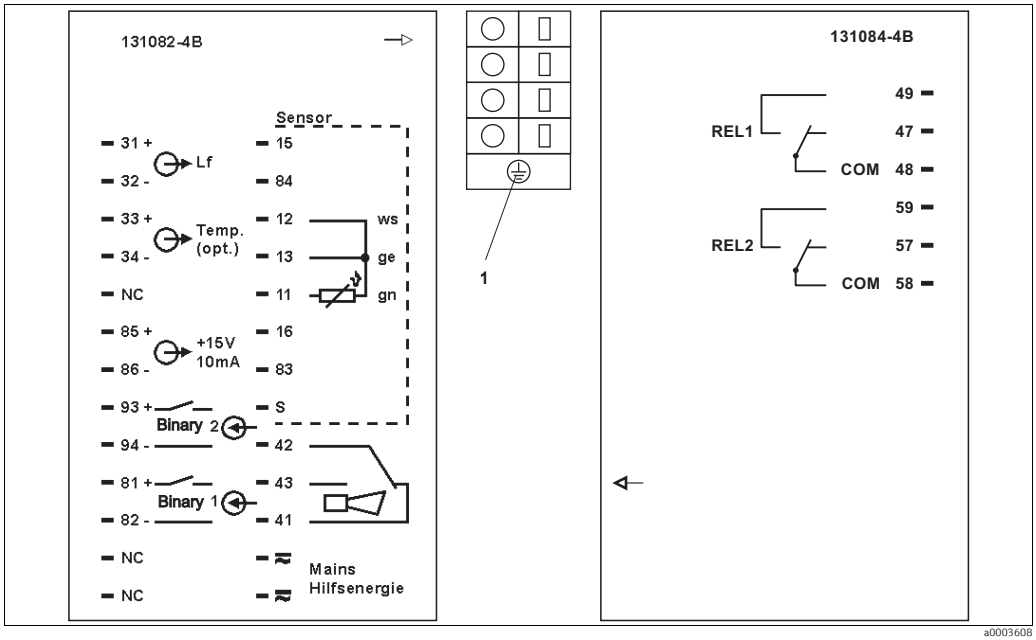


Fig. 5: Connection compartment sticker

NOTICE

Nonobservance could cause incorrect measurement

- ▶ Terminals marked NC may not be wired.
- ▶ Unmarked terminals may not be wired.

Power supply of binary inputs

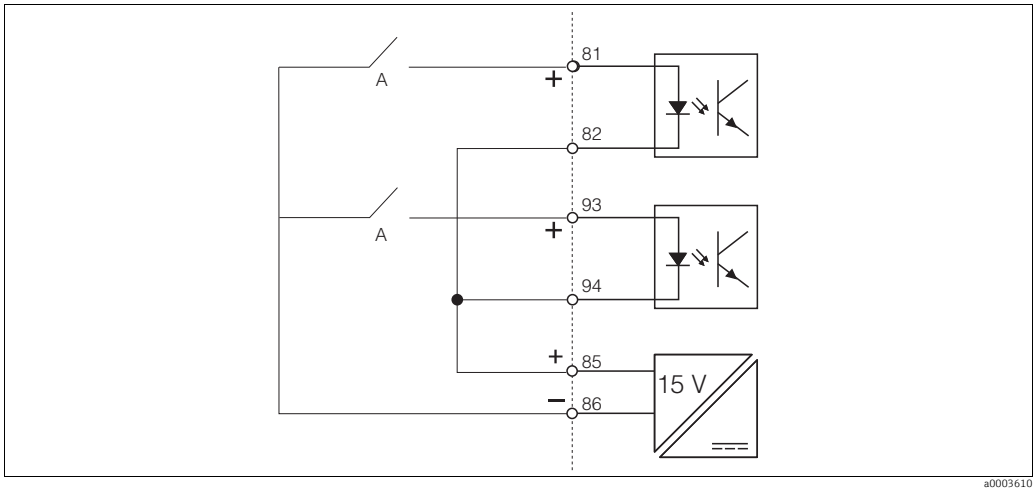


Fig. 6: Power supply of binary inputs

A Hold / MRS (for function "MRS 4 measuring ranges" switches are digital coded

4.1.2 Measuring cable and sensor connection

You require screened special measuring cables to connect conductivity sensors to the transmitter. The following multi-core and ready-to-use cable types can be used:

Sensor type	Cable	Extension
Two-electrode sensors with or without temperature sensor Pt 100	CYK71	Junction box VBM + CYK71
Inductive sensors CLS50, CLS52, CLS54	Cable permanently attached to sensor	Junction box VBM + CLK5

Maximum cable length	
Conductivity measurement (conductive)	max. 100 m (328 ft) with CYK71
Conductivity measurement (inductive)	max. 55 m (180.46 ft) with CLK5 (sensor cable incl.)

Structure and termination of the measuring cables

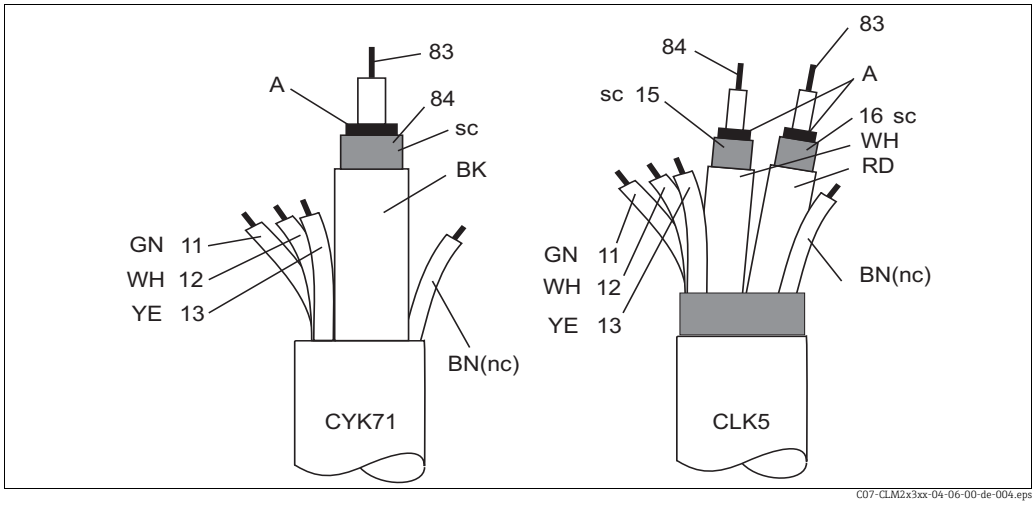


Fig. 7: Structure of the special measuring cables

A Semiconductor layer
sc Screening

For further information on the cables and junction boxes, please refer to the "Accessories" section.

Measuring cable connection
To connect a conductivity sensor, connect the measuring cable in accordance with the terminal assignment to the terminals on the rear of the device (see connection sticker).

Example of connecting a conductivity sensor

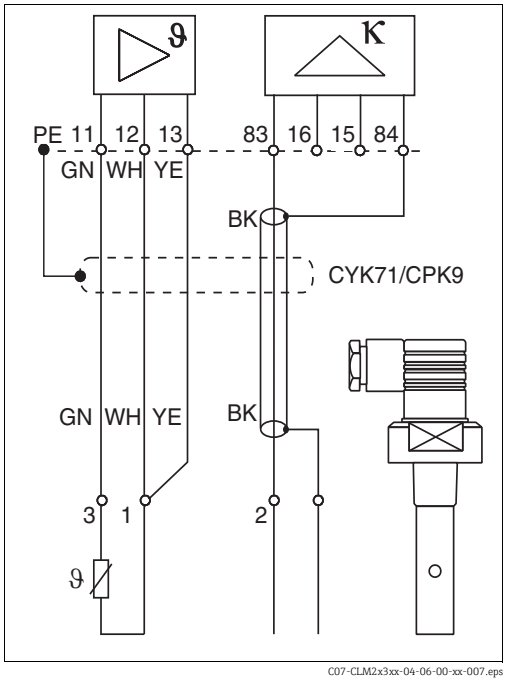


Fig. 8: Connection of conductive sensors

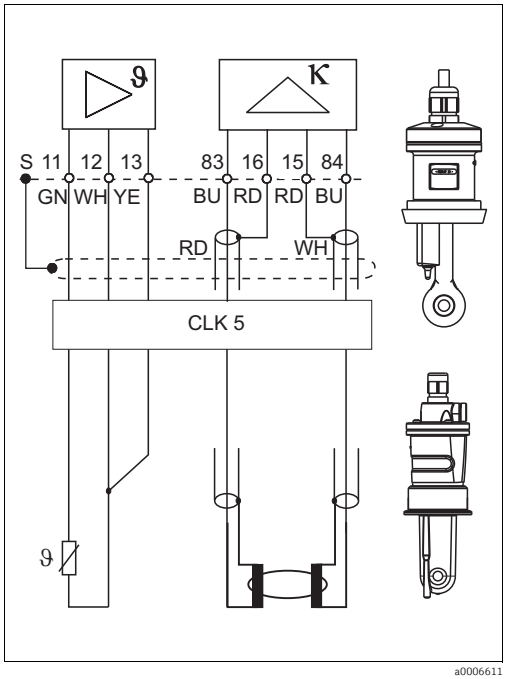


Fig. 9: Connection of inductive sensors

4.1.3 Alarm contact

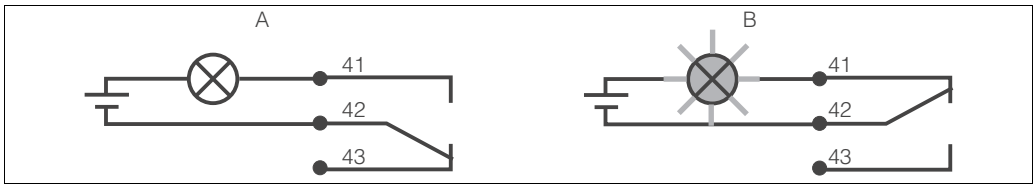


Fig. 10: Recommended fail-safe switching for the alarm contact
A Normal operating status *B Alarm condition*

Normal operating status:
- Device in operation
- No error message present (Alarm LED off)

Relay energized
Contact 42/43 closed

Alarm condition
- Error message present (alarm LED red) or
- Device defective or voltage-free (alarm LED off)

Relay de-energized
Contact 41/42 closed

4.2 Post-connection check

After wiring up the electrical connection, carry out the following checks:

Device status and specifications	Remarks
Are the transmitter or the cable externally damaged?	Visual inspection

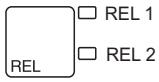
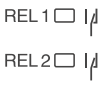
Electrical connection	Remarks
Are the installed cables strain-relieved?	Bracket joint for cable ties at the rear plate
No loops and cross-overs in the cable run?	
Are the signal cables correctly connected acc. to the wiring diagram?	
Are all screw terminals tightened?	
Are all cable entries installed, tightened and sealed?	
Are the PE distributor rails grounded (present at version CF)?	Grounding at place of installation

5 Operability

5.1 Display and operating elements

5.1.1 Display

LED display

	Indicates the current operating mode, "Auto" (green LED) or "Manual" (yellow LED)
	Indicates the activated relay in the "Manual" mode (red LED)
	Indicates the working status of relay 1 and 2 LED green: measured value within the permitted limit, relay inactive LED red: measured value outside the permitted limit, relay active
	Alarm display, e.g. for continuous limit value overshoot, temperature sensor failure or system error (see error list)

LC display

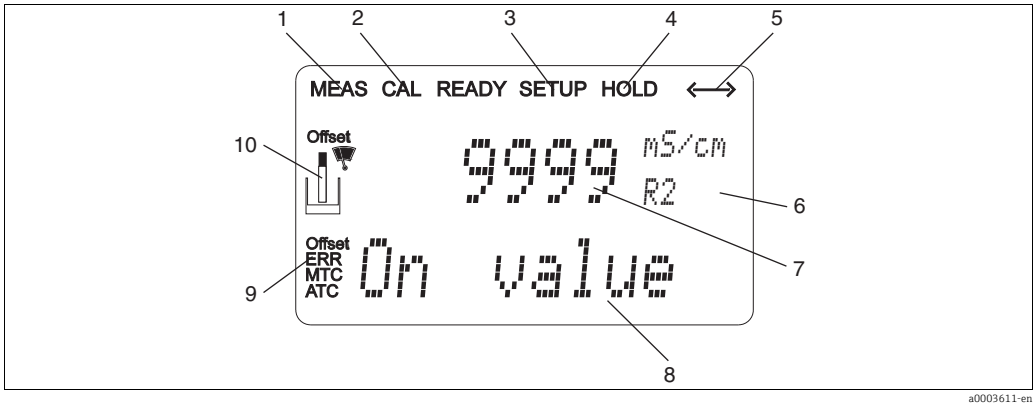


Fig. 11: LC display transmitter

1 *Indicator for measuring mode (normal operation)*
2 *Indicator for calibration mode*
3 *Indicator for setup mode (configuration)*
4 *Indicator for "Hold" mode (current outputs remain at last current state)*
5 *Indicator for receipt of a message for devices with communication*
6 *Function code display*
7 *In measuring mode: measured variable*
In setup mode: configured variable
8 *In measuring mode: secondary measured value*
In setup/calibr. mode: e.g. setting value
9 *"Error": error display*
10 *Sensor symbol*

5.1.2 Operating elements

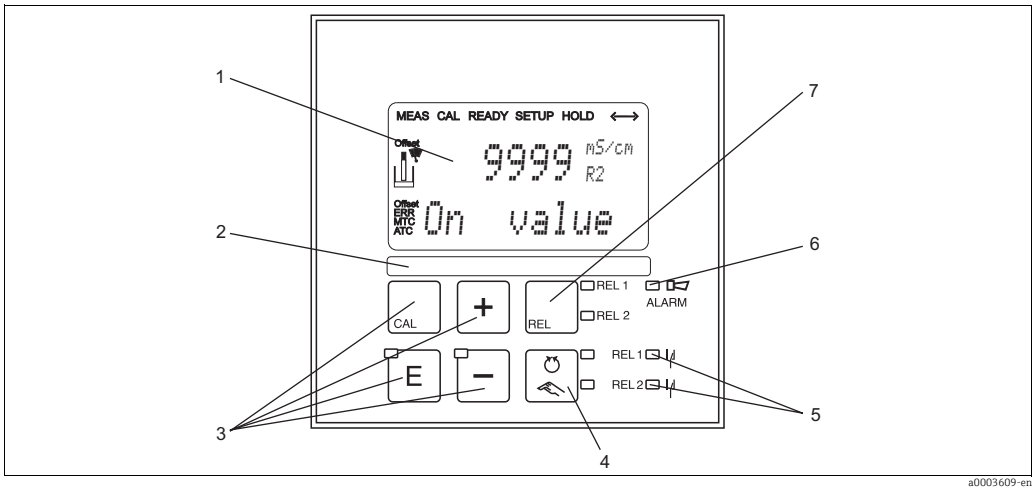
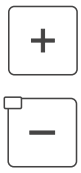
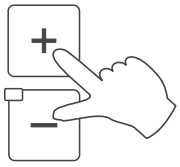
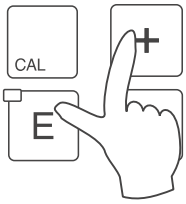
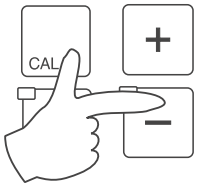


Fig. 12: Operating elements

1 LC display for displaying the measured values and configuration data
2 Field for user labelling
3 4 main operating keys for calibration and device configuration
4 Changeover switch for automatic/manual mode of the relays
5 LEDs for limit contactor relay (switch status)
6 LED for alarm function
7 Display of the active contact and key for relay changeover in manual mode

5.1.3 Key assignment

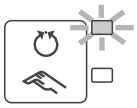
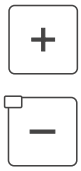
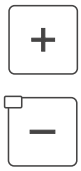
	**CAL key** When you press the CAL key, the device first prompts you for the calibration access code: ▪ Code 22 for calibration ▪ Code 0 or any other code for reading the last calibration data Use the CAL key to accept the calibration data or to switch from field to field within the calibration menu.
	**ENTER key** When you press the ENTER key, the device first prompts you for the setup mode access code: ▪ Code 22 for setup and configuration ▪ Code 0 or any other code for reading all configuration data. The ENTER key has several functions: ▪ Calls up the Setup menu from the measuring mode. ▪ Saves (confirms) data entered in the setup mode. ▪ Moves on within function groups.
	**PLUS key and MINUS key** In the setup mode, the PLUS and MINUS keys have the following functions: ▪ Selection of function groups. Press the MINUS key to select the function groups in the order given in the "System configuration" section. ▪ Configuration of parameters and numerical values ▪ Operation of the relay in manual mode In the measuring mode, you get the following sequence of functions by **repeatedly pressing the PLUS key**: 1. Temperature display in F 2. Temperature display hidden 3. Display of the uncompensated conductivity 4. Return to basic settings In the measuring mode, the following is displayed in sequence by **repeatedly pressing the MINUS key:** 1. Current errors are displayed in rotation (max. 10). 2. Once all the errors have been displayed, the standard measurement display appears. In the function group F, an alarm can be defined separately for each error code.
	**REL key** In the manual mode, you can use the REL key to switch between the relay and the manual start of cleaning. In the automatic mode, you can use the REL key to read out the switch-on points assigned to the relay in question. Press the PLUS key to jump to the settings of the next relay. Use the REL key to get back to the display mode (automatic return after 30 s).

	**AUTO key** You can use the AUTO key to switch between automatic mode and manual mode.
	**Escape function** If you press the PLUS and MINUS key simultaneously, you return to the main menu or are taken to the end of calibration if calibrating. If you press the PLUS and MINUS key again, you return to the measuring mode.
	**Locking the keyboard** Press the PLUS and ENTER key for at least 3 s to lock the keyboard against any unauthorized data entry. All the settings can continue to be read. The code prompt displays the code 9999.
	**Unlocking the keyboard** Press the CAL and MINUS key for at least 3 s to unlock the keyboard. The code prompt displays the code 0.

5.2 Local Operation

5.2.1 Automatic/manual mode

The transmitter normally operates in automatic mode. Here, the relays are triggered by the transmitter. In the manual mode, you can trigger the relays using the REL key or start the cleaning function.
How to change the operating mode:

	1. The transmitter is in **Automatic mode**. The top LED beside the AUTO key is lit.
	2. Press the AUTO key.
	3. To enable the manual mode, enter the code **22** via the PLUS and MINUS keys. The bottom LED beside the AUTO key lights up.
	4. Select the relay or the function. You can use the REL key to switch between the relays. The relay selected and the switch status (ON/OFF) is displayed on the second line of the display. In the manual mode, the measured value is displayed continuously (e.g. for measured value monitoring for dosing functions).
	5. Switch the relay. It is switched on with PLUS and switched off with MINUS. The relay remains in its switched state until it is switched over again.
	6. Press the AUTO key to return to the measuring mode, i.e. to the automatic mode. All the relays are triggered again by the transmitter.

Pay attention to the following:
- The selected operating mode remains in effect even after a power failure.
- The manual mode has priority over all automatic functions (Hold).
- Hardware locking is not possible in the manual mode.
- The manual settings are kept until they are actively reset.
- Error code E102 is signalled in the manual mode.

5.2.2 Operating concept

Operating modes

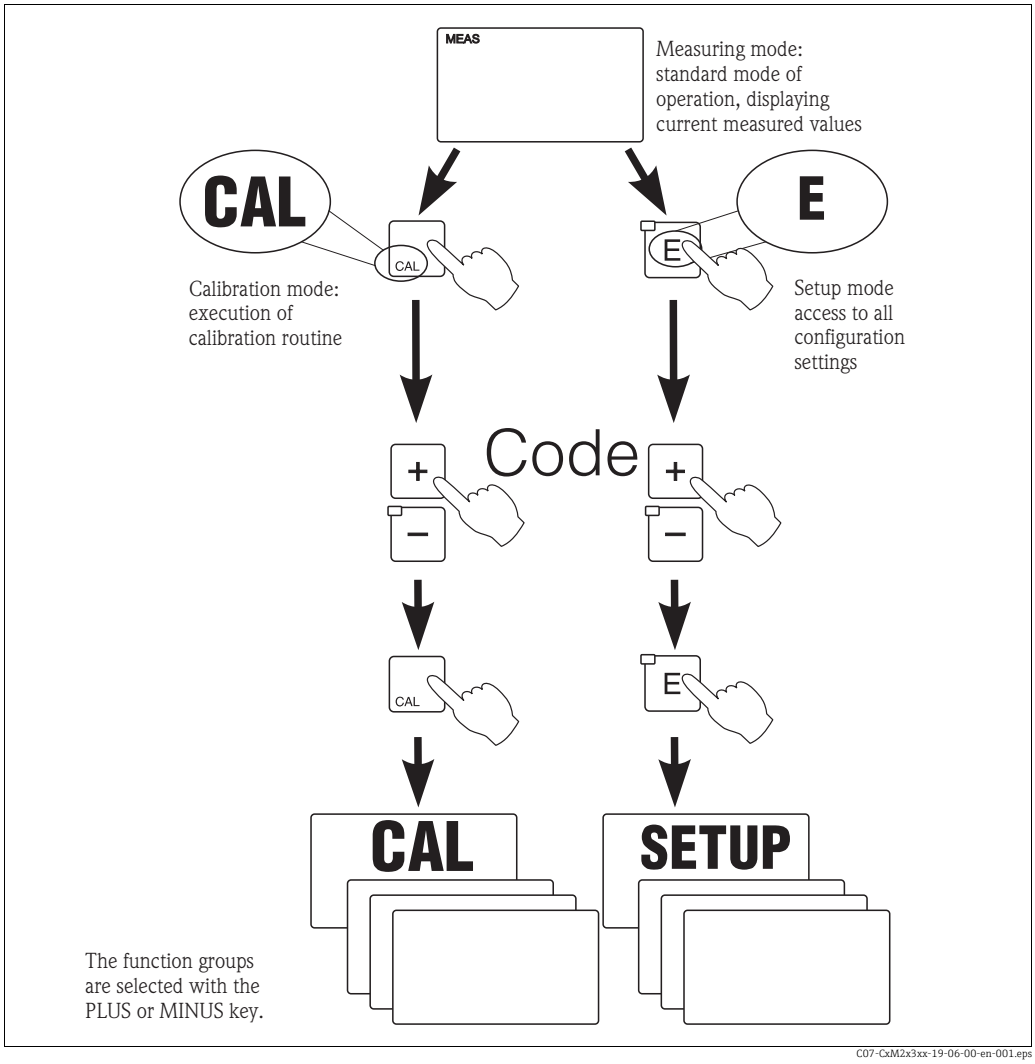


Fig. 13: Description of the possible operating modes

If no key is pressed in the setup mode for approx. 15 min, the device automatically returns to the measuring mode. Any active Hold (Hold during setup) is reset.

Access codes

All device access codes are fixed and cannot be altered. When the device requests the access code, it distinguishes between different codes.

- **Key CAL + Code 22:** access to Calibration and Offset menu
- **Key ENTER + Code 22:** access to the setup menus
- **Keys PLUS + ENTER:** locks the keyboard
- **Keys CAL + MINUS:** unlocks the keyboard
- **Key CAL or ENTER + any code:** access to read mode, i.e. all the settings can be read but not modified.
  The device continues measuring in the read mode. It does not shift to the Hold status. The current output and the controllers remain active.

Menu structure

The configuration and calibration functions are arranged in function groups.

- In setup mode, select a function group with the PLUS and MINUS keys.
- In the function group itself, switch from function to function with the ENTER key.
- Within the function, select the desired option with the PLUS and MINUS keys or edit the settings with these keys. Then confirm with the ENTER key and continue.
- Press the PLUS and MINUS keys simultaneously (Escape function) to exit programming (return to the main menu).
- Press the PLUS and MINUS simultaneously keys again to switch to the measuring mode.

If a modified setting is not confirmed with ENTER, the old setting is retained.
An overview of the menu structure is provided in the Appendix to these Operating Instructions.

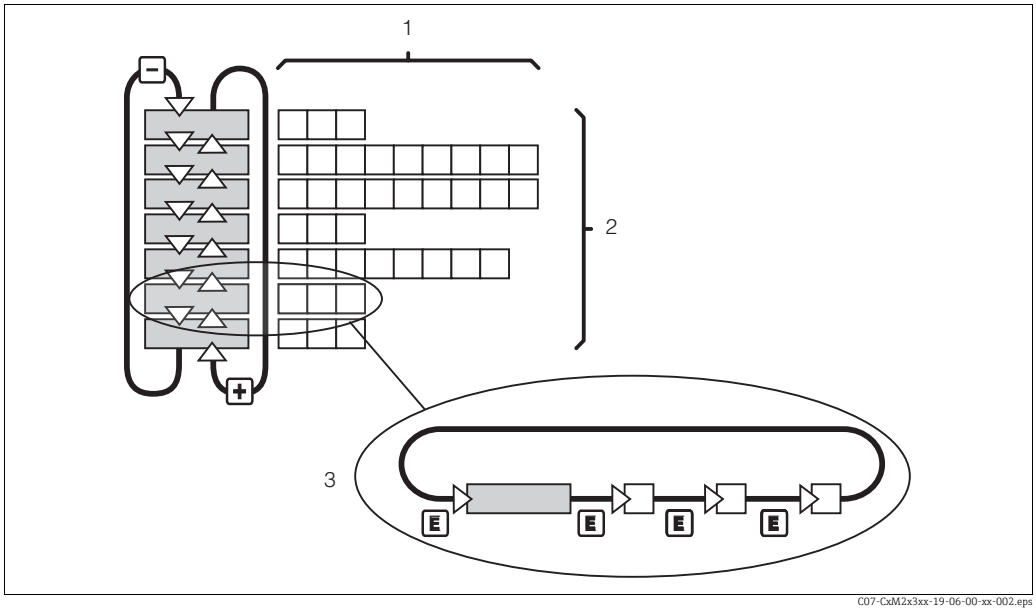


Fig. 14: Diagram of the menu structure

1 Functions (parameters selected, numbers entered)
2 Function groups, scroll backwards and forwards with the PLUS and MINUS keys
3 Switch from function to function with the ENTER key

Hold function: "freezing" of the outputs

During setup and calibration, the current output can be "frozen". It constantly retains its current status. "HOLD" appears on the display. If the controller actuating variable (steady control 4 to 20 mA) is output via current output 2, it is set to 0/4 mA in Hold.

Pay attention to the following:
- Hold settings can be found in the "Service" section.
- During Hold, all contacts will go to their normal positions.
- An active Hold has priority over all other functions.
- With every Hold, the I-component of the controller is set to zero.
- Any alarm delay is reset to "0".
- This function can also be activated externally via the Hold input (see Wiring diagram; binary input 1).
- The manual Hold (field S3) remains active even after a power failure.

6 Commissioning

6.1 Function check

⚠ WARNING

Incorrect connection, incorrect supply voltage

Safety risks for staff and incorrect operation of the device

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

6.2 Switching on

Familiarize yourself with the operation of the transmitter before it is first switched on. Please refer in particular to the "Safety instructions" and "Operation" sections.
After power-up, the device performs a self-test and then goes to the measuring mode.
Now calibrate the sensor in accordance with the instructions in the "Calibration" section.

During commissioning, the sensor must be calibrated so that the measuring system can return precise measurement data.

Then perform the first configuration in accordance with the instructions in the "Quick start-up" section. The values set by the user are kept even in the event of a power failure.
The following function groups are available in the transmitter (the groups only available in the Plus Package are marked accordingly in the functional description):

Setup mode

- SETUP 1 (A)
- SETUP 2 (B)
- CURRENT OUTPUT (O)
- ALARM (F)
- CHECK (P)
- RELAY (R)
- TEMPERATURE COMPENSATION (T)
- CONCENTRATION MEASUREMENT (K)
- SERVICE (S)
- E+H SERVICE (E)
- INTERFACE (I)
- TEMPERATURE COEFFICIENT (D)
- MRS (M)

Calibration mode

- CALIBRATION (C)

A detailed explanation of the function groups available in the transmitter can be found in the "System configuration" section.

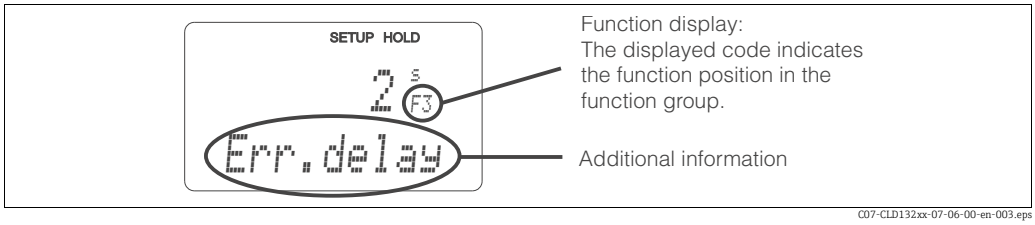


Fig. 15: Example for display in setup mode

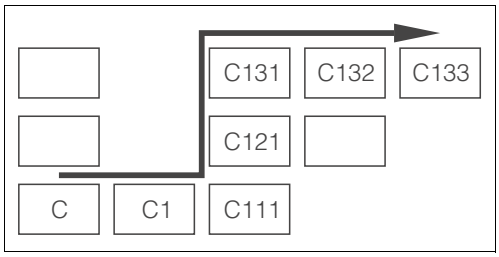


Fig. 16: Function coding

Selecting and locating functions is facilitated by a code displayed for each function in a special display field → 15.
The structure of this coding is given in → 16.
The first column indicates the function group as a letter (see group designations).
The functions in the individual groups are counted from the top to the bottom and from the left to the right.

Factory settings

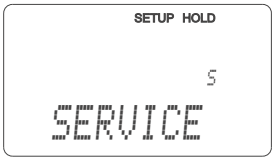
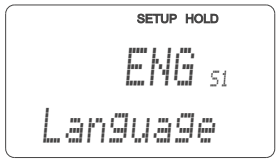
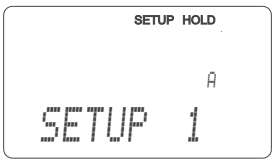
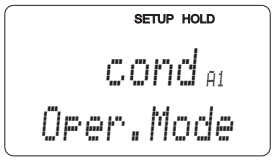
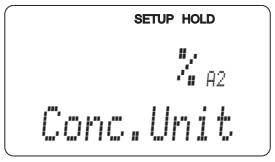
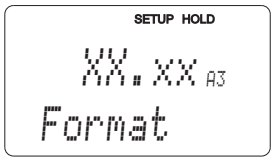
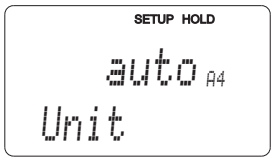
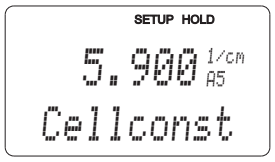
The first time it is switched on, the device has the factory setting for all functions. The table below provides an overview of the most important settings.
All other factory settings can be found in the description of the individual function groups in the "System configuration" section (the factory setting is highlighted in **bold**).

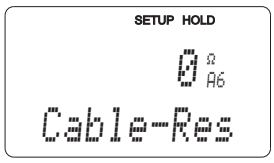
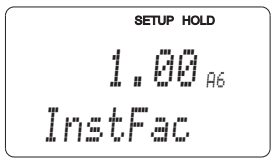
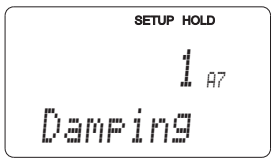
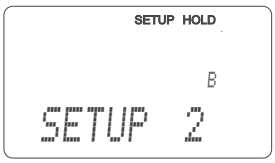
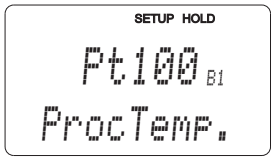
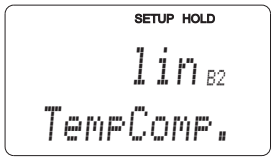
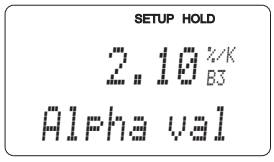
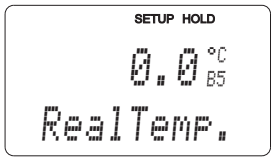
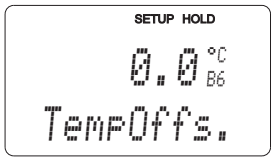
Function	Factory setting
Type of measurement	Conductive conductivity measurement Temperature measurement in °C
Type of measurement compensation	Linear with reference temperature 25 °C (77 °F)
Temperature compensation	Automatic (ATC on)
Limit value for controller 1	2000 mS/cm
Limit value for controller 2	2000 mS/cm
Hold	Active during configuration and calibration
Measuring range	10 µS/cm to 2000 mS/cm (no measuring ranges for setting). The setting is flowing and is guided by the connected sensors.
Current outputs 1* and 2*	4 ... 20 mA
Current output 1: measured value for 4 mA signal current*	0 µS/cm
Current output 1: measured value for 20 mA signal current*	2000 mS/cm
Current output 2: temperature value for 4 mA signal current*	0.0 °C (32 °F)
Current output 2: temperature value for 20 mA signal current*	150.0 °C (302 °F)

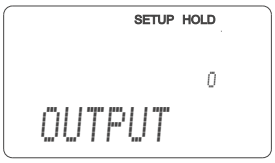
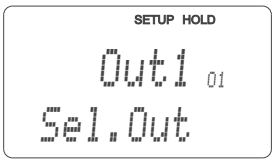
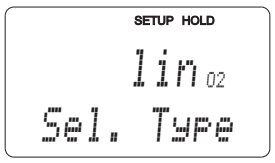
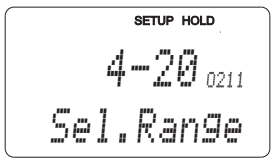
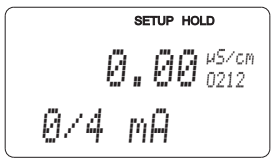
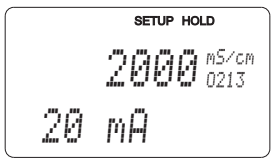
* For corresponding version

6.3 Quick start-up

After power-up, you must make some settings to configure the most important functions of the transmitter which are required for correct measurement. The following section gives an example of this.

User input	Setting range (Factory settings, bold)	Display
1. Press the ENTER key. 2. Enter the code 22 to edit the setup. Press ENTER.		
3. Press MINUS until you get to the "Service" function group. 4. Press ENTER to be able to make your settings.		
5. In S1, select your language, e.g. "ENG" for English. Press ENTER to confirm.	**ENG = English** GER = German FRA = French ITA = Italian NEL = Dutch ESP = Spanish	
6. Press the PLUS and the MINUS keys simultaneously to exit the "Service" function group.		
7. Press MINUS until you get to the "Setup 1" function group. 8. Press tENTER to be able to make your settings for "Setup 1".		
9. In A1, select the desired mode of operation, e.g. "cond" = conductive. Press ENTER to confirm.	**cond = conductive** ind = inductive	
10. In A2, press ENTER to confirm the factory settings. (if A1 = conc, else step 12)	**%** ppm mg/l TDS = Total Dissolved Solids none	
11. In A3, press ENTER to confirm the factory settings.	**XX.xx** X.xxx XXX.x XXXX	
12. In A4, press ENTER to confirm the factory settings.	**auto**, µS/cm, mS/cm, S/cm, µS/m, mS/m, S/m	
13. In A5, enter the cell constant of the connected sensor. Refer to the sensor's quality certificate for the exact value.	0.0025 ... 5.9 ... 99.99	

User input	Setting range (Factory settings, bold)	Display
14. In A6, enter the resistance of the cable (conductive sensors only) or enter the installation factor (inductive sensors only).	**0 Ω** 0 to 99.99 Ω	
	0.10 to 1 to 5.00	
15. If you need to stabilise the display, enter the required damping factor in A7. Press ENTER to confirm. The display returns to the initial display of "Setup 1"	**1** 1 to 60	
16. Press MINUS to go to the "Setup 2" function group 17. Press ENTER to edit "Setup 2"		
18. In B1, select your temperature sensor. Press ENTER to confirm.	**Pt 100** Pt 1k = Pt 1000 NTC30 fixed	
19. In B2, select the appropriate temperature compensation for your process, e.g. "lin" = linear. Press ENTER to confirm your selection. For detailed information on temperature compensation, see chapter "Setup 2"	**lin = linear** Tab = Tabelle 1 to 4 NaCl = common salt (IEC 60746) none	
20. In B3, enter the temperature coefficient α. Press ENTER to confirm.	**2.1 %/K** 0.0 to 20.0 %/K	
21. The real temperature is displayed in B5. If necessary, calibrate the temperature sensor to an external measurement. Press ENTER to confirm.	Display and entry of real temperature -10.0 to 150.0 °C fixed	
22. The difference between the measured and the entered temperatures is displayed. Press ENTER. The display returns to the initial display of the "Setup 2" function group.	**0.0 °C** -5.0 to 5.0 °C	

User input	Setting range (Factory settings, bold)	Display
23. Press MINUS to go to the "Current output" function group. 24. Press ENTER to edit the output settings.		
25. In O1, select your output, e.g. "Out1" = output 1. Press ENTER to confirm.	**Out1** Out2	
26. In O2, select the linear characteristic. Press ENTER to confirm.	**lin = linear (1)** sim = simulation	
27. In O211, select the current range for your output, e.g. 4 to 20 mA. Press ENTER to confirm.	4 to 20 mA 0 to 20 mA	
28. In O212, enter the conductivity corresponding to the minimum current value at the transmitter output, e.g. 0 µS/cm. Press ENTER to confirm.	cond/ind: **0.00 µS/cm** Conc: **0.00 %** Temp: **0.00 °C**	
29. In O213, enter the conductivity corresponding to the maximum current value at the transmitter output, e.g. 2000 mS/cm. Press ENTER to confirm. The display returns to the initial display of the "Current output" function group.	cond/ind: **2000 mS/cm** Conc: **99.99 %** Temp: **150 °C**	
30. Press the MINUS and the PLUS keys simultaneously to switch to the measurement mode.		

For inductive sensors you must perform an airset before installation of the sensor, refer to the chapter "Calibration"

6.4 System configuration

6.4.1 Setup 1 (Conductivity)

Wall distance
The sensor's distance from the pipe wall affects the measuring accuracy (→ 17).
In narrow installation conditions, the ion flow in the medium is affected by the pipe walls. This effect is compensated by the so-called installation factor.
When the distance from the wall is sufficient, i.e. a > 15 mm / 0.59", the installation factor can be ignored (f = 1.00). When the wall distance is lower, the installation factor increases in the case of electrically insulating pipes (f > 1) while it decreases for electrically conductive pipes (f < 1); → 17.
The determination of the installation factor is described in the chapter "Calibration".

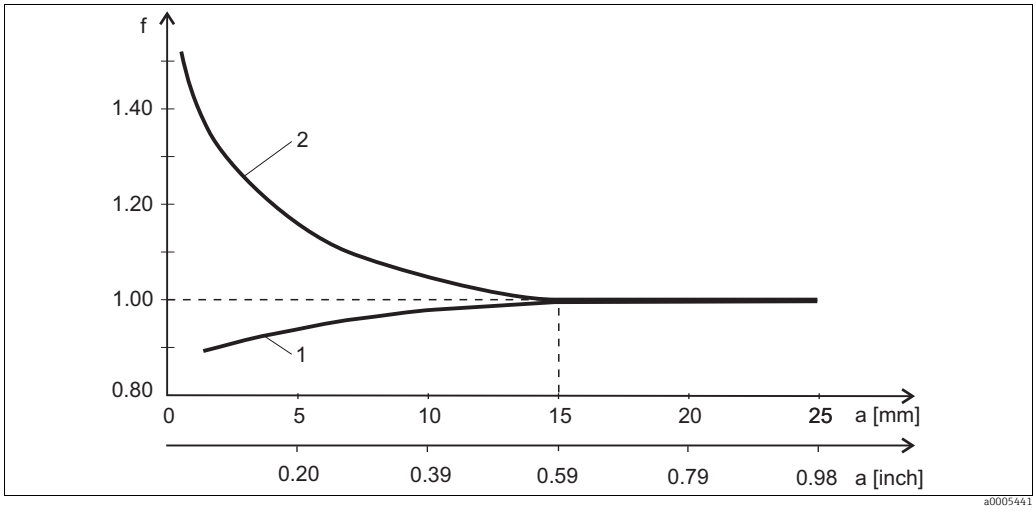
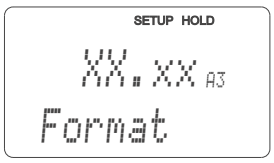
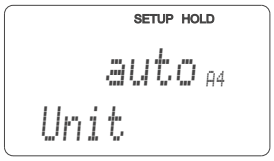
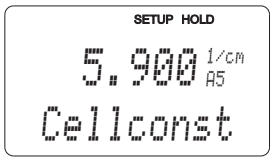
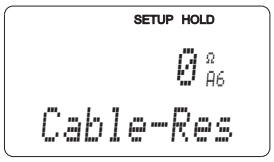
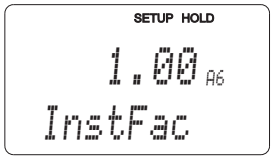
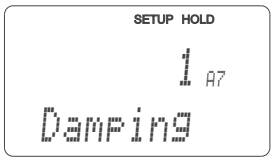


Fig. 17: Relationship between installation factor and distance from wall a

1 Electrically conductive pipe wall
2 Insulating pipe wall

In the SETUP 1 function group, you can change the operating mode and the sensor settings. Basic version does not include functions in *italic*.

Coding		Field	Selection or range (factory settings bold)	Display	Info
A		**Function group SETUP 1**		SETUP HOLD A SETUP 1	Basic settings.
	A1	Select operating mode	**cond = conductivity** conc = concentration	SETUP HOLD cond A1 Oper.Mode	Display varies depending on instrument version: – cond – conc Any change in operating mode causes an automatic reset of user settings.
	A2	Select concentration unit to be displayed (only with Plus Package)	**%** ppm mg/l TDS = Total Dissolved Solids none	SETUP HOLD % A2 Conc.Unit	A2 only active if A1 = conc.

Coding		Field	Selection or range (factory settings bold)	Display	Info
	A3	Select display format for concentration unit	**XX.xx** X.xxx XXX.x XXXX		A3 only active if A1 = conc.
	A4	Select unit to be displayed	**auto**, µS/cm, mS/cm, S/cm, µS/m, mS/m, S/m		When “auto” is selected, the maximum resolution possible is automatically selected. A4 not active if A1 = conc.
	A5	Enter cell constant for connected sensor	0.0025 to **5.9** to 99.99 cm^{-1}		For the exact value of the cell constant, refer to the quality certificate.
	A6	Conductive: Enter cable resistance	**0 Ω** 0 to 99.99 Ω		Only with conductive sensors. Multiply the standardised line resistance by the actual cable length. CYK71: 0.165 Ω/m
		Inductive: Enter installation factor	0.10 to **1** to 5.0		This is where the installation factor is edited. The correct factor is determined in C1(3), see chapter "Calibration" or referring to the installation factor diagram.
	A7	Enter measured value damping	**1** 1 to 60		Measured value damping causes averaging over the specified number of individual measured values. It is used, for example, to stabilise the display with applications that fluctuate a great deal. There is no damping if “1” is entered.

6.4.2 Setup 2 (Temperature)

The temperature coefficient α specifies the change in conductivity per degree of temperature change. It depends on the chemical composition of the medium and the temperature itself. In order to compensate for this dependence, four different compensation types can be selected in the transmitter:

- Linear temperature compensation
- NaCl compensation
- Temperature compensation with table

Linear temperature compensation
The change between two temperature points is considered to be constant, i.e. α = const. The α value can be edited for the linear compensation type. You can edit the reference temperature in field B7, the factory setting is 25 °C (77 °F).

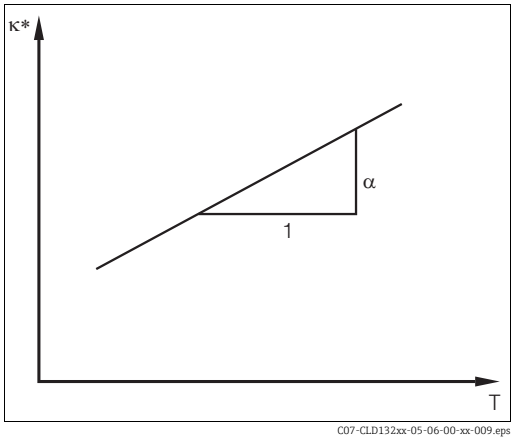


Fig. 18: Linear temperature compensation
** uncompensated conductivity*

NaCl compensation
The NaCl compensation (according to IEC 60746) is based on a fixed nonlinear curve that defines the relationship between the temperature coefficient and the temperature. This curve is used for lower concentrations of up to approx. 5 % NaCl.

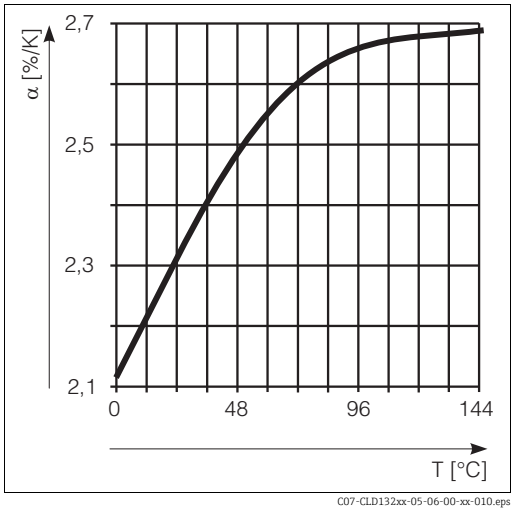


Fig. 19: NaCl compensation

Temperature compensation with table

In case of transmitter with Plus package you can enter a table with temperature coefficients α in relation to temperature. When using the alpha table function for temperature compensation, the following conductivity data of the process medium to be measured is required:

Value pairs of temperature T and conductivity κ with:
- $\kappa(T_0)$ for the reference temperature T_0
- $\kappa(T)$ for temperatures which occur in the process

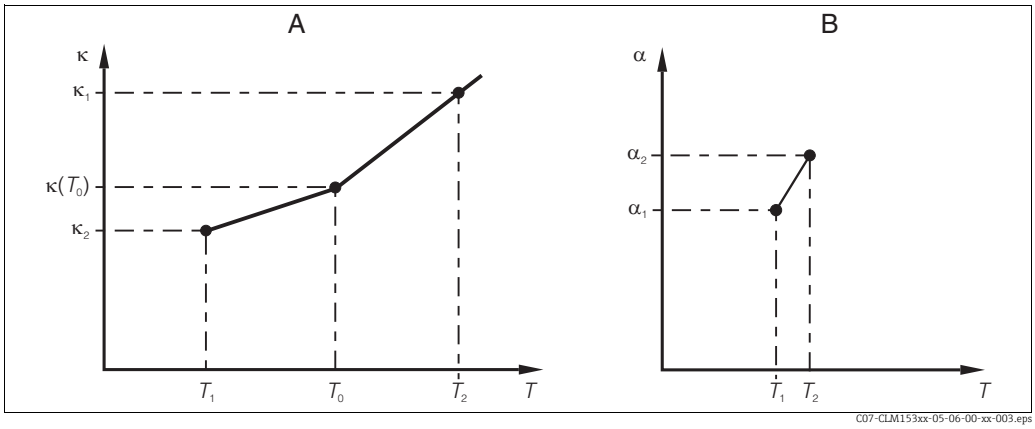


Fig. 20: Determination of temperature coefficient

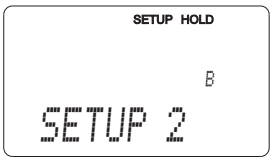
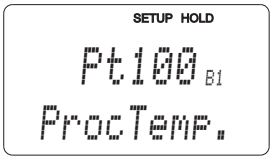
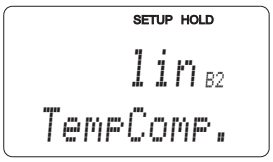
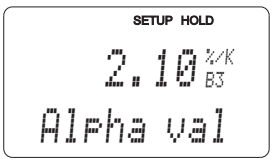
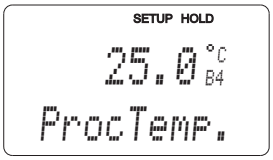
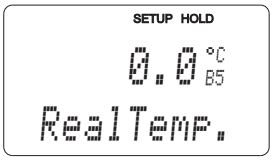
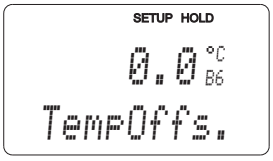
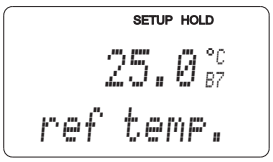
A Required data
B Calculated α values

Use the following formula to calculate the α values for the temperatures occurring in your process:

$$\alpha = \frac{100\%}{\kappa(T_0)} \cdot \frac{\kappa(T) - \kappa(T_0)}{T - T_0}\,;\; T \neq T_0$$

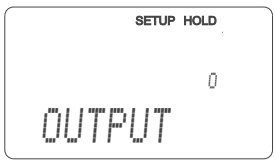
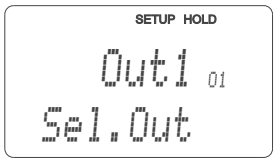
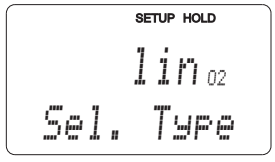
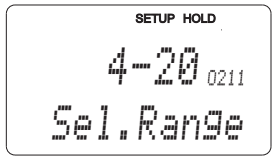
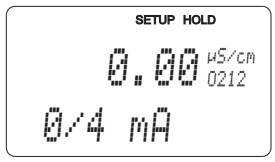
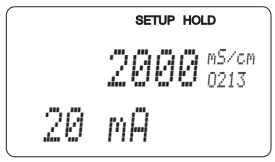
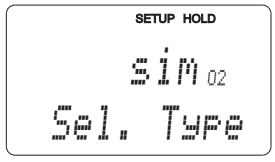
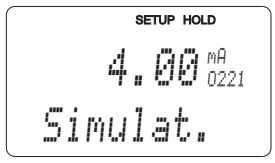
Enter the α–T value pairs calculated with this formula in the fields T5 and T6 of the function group "ALPHA TABLE".

In the SETUP 2 function group, you can change the settings for temperature measurement. Basic version does not include functions in *italic*.

Coding		Field	Selection or range (factory settings bold)	Display	Info
B		**Function group SETUP 2**			Settings for temperature measurement.
	B1	Select temperature sensor	**Pt100** Pt1k = Pt 1000 NTC30 fixed		If set to "fixed": Manual temperature compensation (MTC), no temperature measurement if fixed temperature value is specified in B4. No temperature output if "fixed"!
	B2	Select temperature compensation type	none **lin = linear** NaCl = common salt (IEC 60746) Tab = table		This option is not displayed for concentration measurement.
	B3	Enter temperature coefficient α	**2.10 %/K** 0.00 to 20.00 %/K		Only if B2 = lin. With other settings in B2, field B3 has no influence.
	B4	Enter process temperature	**25 °C** -10.0 to 150.0 °C		Only if B1 = fixed. This value can only be specified in °C.
	B5	Display temperature and calibrate temperature sensor	Display and entry of real temperature -15.0 to 150.0 °C		This entry is used to calibrate the temperature sensor to an external measurement. Effects B6. Omitted if B1 = fixed.
	B6	Enter temperature difference (offset)	**Curent offset** -5.0 to 5.0 °C		The offset is the difference between the entered actual value and the measured temperature. Omitted if B1 = fixed.
	B7	Enter reference temperature	**25 °C** -35.0 to 250 °C		

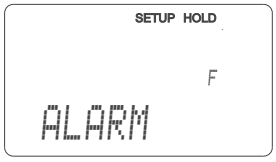
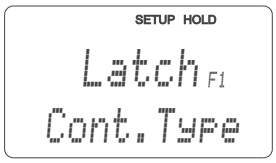
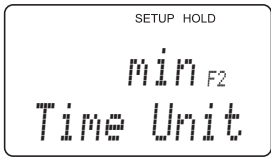
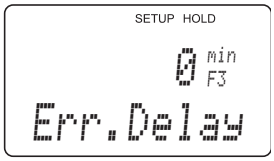
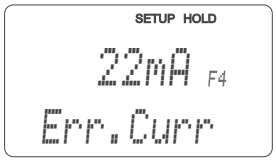
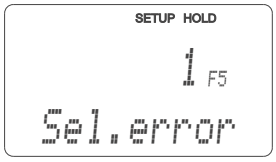
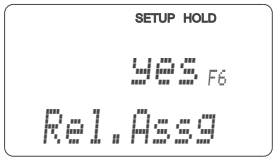
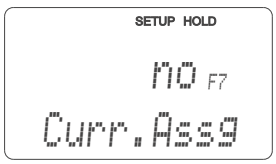
6.4.3 Current outputs

In the function group "Current output" you can configure the outputs. To check the outputs you can simulate a current output value (O2 (2)).

Coding	Field	Setting range (Factory settings, bold)	Display	Info
O	**CURRENT OUTPUT function group**			Configuration of the current output.
O1	Select current output	**Out1** Out 2		A characteristic can be selected for every output.
O2 (1)	Enter or output linear characteristic	**Lin = linear** (1) Sim = simulation (2)		The characteristic can have a positive or negative slope for the measured value output.
O211	Select current range	**4 to 20 mA** 0 to 20 mA		
O212	0/4 mA value: Enter corresponding measured value	cond/ind: **0.00 µS/cm** Conc: **0.00 %** Temp: **0.0 °C**		Here you can enter the measured value at which the min. current value (0/4 mA) is applied at the transmitter output. (Spreading: see Technical data.)
O213	20 mA value: Enter corresponding measured value	cond/ind: **2000 mS/cm** Conc: **99.99 %** Temp: **150 °C**		Here you can enter the measured value at which the max. current value (20 mA) is applied at the transmitter output. (Spreading: see Technical data.)
O2 (2)	Simulate current output	Lin = linear (1) **Sim = simulation** (2)		Simulation is not ended until (1) or (3) is selected.
O221	Enter simulation value	**Current value** 0.00 to 22.00 mA		Entering a current value results in this value being directly output at the current output.

6.4.4 Alarm

In the ALARM function group, you can define various alarms and configure output contacts. Each individual error can be defined to be effective or not (at the contact or as an error current).

Coding		Field	Setting range (Factory settings, bold)	Display	Info
F		**ALARM function group**			Alarm function settings.
	F1	Select contact type	**Latch = latching contact** Momen = momentary contact		The contact type selected only applies to the alarm contact.
	F2	Select time unit	**min** s		
	F3	Enter alarm delay	**0 min (s)** 0 to 2000 min (s)		Depending on the option selected in F2, the alarm delay is entered in s or min.
	F4	Select error current	**22 mA** 2.4 mA		This selection must be made even if all error reporting is switched off in F5. If "0-20 mA" was selected in O211, "2.4 mA" may not be used.
	F5	Select error	**1** 1 to 255		Here you can select all the errors which should trigger an alarm. The errors are selected via the error numbers. Please refer to the table in section "System error messages" for the meaning of the individual error numbers. The factory settings remain in effect for all errors not edited.
	F6	Set alarm contact to be effective for the selected error	**yes** no		If “no” is selected, all other alarm settings are deactivated (e.g. alarm delay). The settings themselves are retained. This setting **only** applies to the error selected in F5. Factory setting is **no** starting with E080!
	F7	Set error current to be effective for the selected error	**no** yes		The option selected in F4 is effective or ineffective in the event of an error. This setting **only** applies to the error selected in F5.

Coding		Field	Setting range (Factory settings, bold)	Display	Info
	F8	Select return to menu or next error	**next** = next error ←R	SETUP HOLD next F8 Select	If ←R is selected, you return to F, if next is selected, you go to F5.

6.4.5 Check

Polarisation detection

Polarisation effects in the interface between sensor and measuring solution limit the measuring range of conductive conductivity sensors. The transmitter has the ability to detect polarisation effects using an intelligent evaluation process. Error code E071 will be generated.

PCS alarm (Process Check System)

This function (field P2) is used to check measuring signals for deviations. If the measuring signal is constant during the selected time frame, an alarm (E152) is triggered. The reason for such sensor behaviour can be contamination, cable rupture or similar.

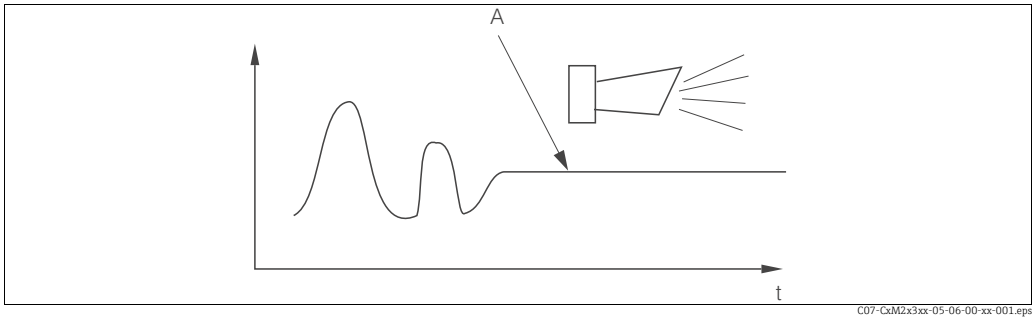


Fig. 21: PCS alarm (live check)

A Constant measuring signal = alarm triggered after PCS alarm time has elapsed

Any PCS alarm pending is automatically deleted as soon as the sensor signal changes.

Coding		Field	Setting range (Factory settings, bold)	Display	Info
P		**CHECK function group**		SETUP HOLD P CHECK	Settings for sensor and process monitoring
	P1	Switch polarisation detection on or off (conductive only)	**Off** On	SETUP HOLD Off P1 Pol.Detec	Polarisation only occurs with conductive sensors. Polarisation is detected, but not compensated. (error no.: E071)
	P2	*Set PCS Alarm (live check)*	**off** 1 h 2 h 4 h	SETUP HOLD off P2 PCS alarm	Alarm signalling optionally with or without simultaneous controller switch-off. XXXX = without controller switch-off XXXX! = with controller switch-off (error no.: E152)

6.4.6 Relay contact configuration

To use the RELAY function group you need a relay board which is not part of the basic version.

Limit contactor for measured conductivity value and temperature

The transmitter has different ways of assigning a relay contact.
Switch-on and switch-off points and pick-up and drop-out delays can be assigned to the limit contactor. In addition, you can configure an alarm threshold to output an error message and to start a cleaning function in conjunction with this.
These functions can be used both for conductivity measurement and for temperature measurement.

Please refer to Fig. 22 for a clear illustration of the relay contact states.

- When the measured values increase (maximum function), the relay contact is closed as of t_2 after the switch-on point (t_1) has been overshot and the pick-up delay has elapsed (t_2 - t_1).
  The alarm contact switches if the alarm threshold (t_3) is reached and the alarm delay (t_4 - t_3) (field F3) has also elapsed.
- When the measured values decrease, the alarm contact is reset when the alarm threshold (t_5) is undershot as is the relay contact (t_7) after the drop-out delay (t_7 - t_6).
- If the pick-up and drop-out delays are set to 0 s, the switch-on and switch-off points are also switch points of the contacts.

Settings can also be made for a minimum function in the same way as for a maximum function.

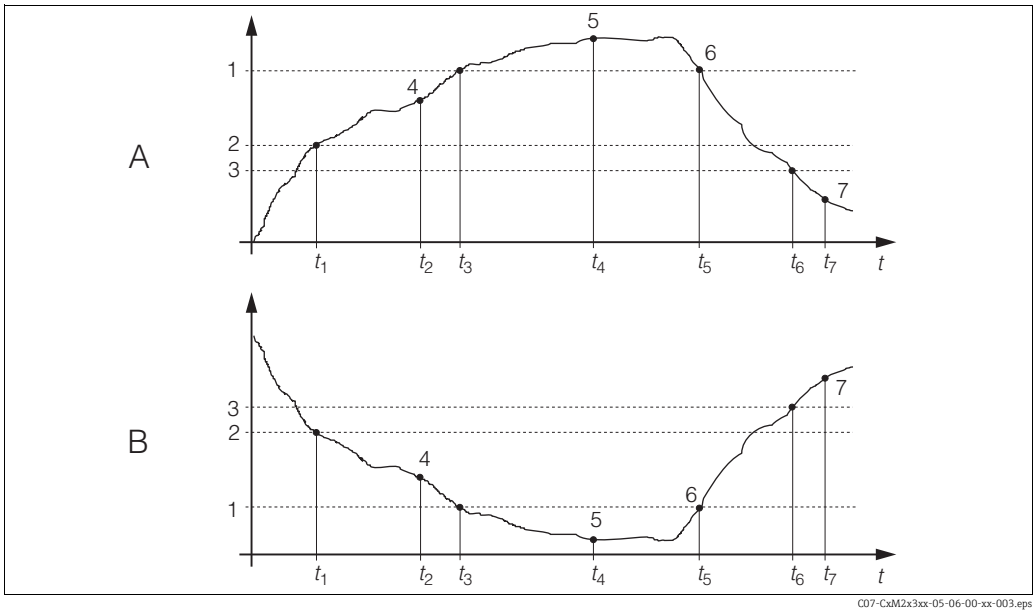
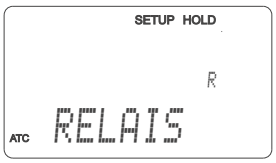
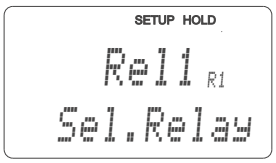
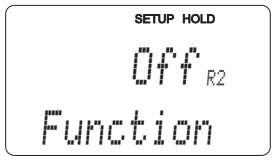
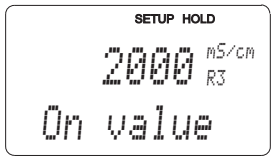
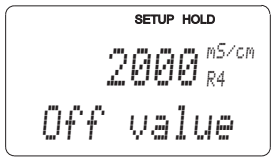
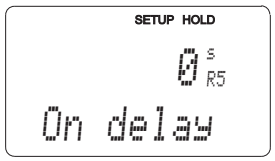
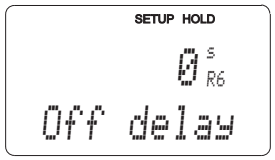


Fig. 22: Illustration of the alarm and limit value functions

A Switch-on point > switch-off point: Max. function
B Switch-on point < switch-off point: Min. function

1 Alarm threshold
2 Switch-on point
3 Switch-off point
4 Contact ON
5 Alarm ON
6 Alarm OFF
7 Contact OFF

Coding		Field	Setting range (Factory settings, bold)	Display	Info
R		**RELAY function group**			Relay contact settings.
	R1	Select contact to be configured	**Rel1** Rel2		
	R2	Switch function of R1 off or on	**Off** On		All the settings are retained.
	R3	Enter the switch-on point of the contact	cond/ind: **2000 mS/cm** conc: **99.99 %**		Never set the switch-on point and the switch-off point to the same value! (Only the operating mode selected in A1 is displayed.)
	R4	Enter the switch-off point of the contact	cond/ind: **2000 mS/cm** conc: **99.99 %**		Entering a switch-off point selects either a Max contact (switch-off point < switch-on point) or a Min contact (switch-off point > switch-on point), thereby implementing a hysteresis that is constantly required (see "Illustration of the alarm and limit functions" figure).
	R5	Enter pick-up delay	**0 s** 0 to 2000 s		
	R6	Enter drop-out delay	**0 s** 0 to 2000 s		
	R7	Enter alarm threshold	cond/ind: **2000 mS/cm** conc: **99.99 %**		If the alarm threshold is undershot/ overshot, this triggers an alarm with the error message and error current at the transmitter (note alarm delay in field F3). If defined as a Min contact, the alarm threshold must be < switch-off point.

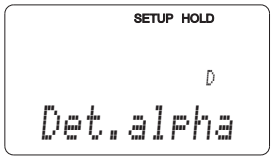
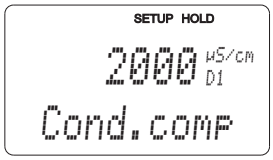
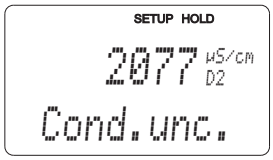
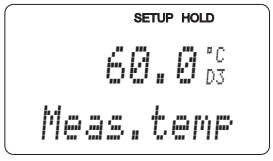
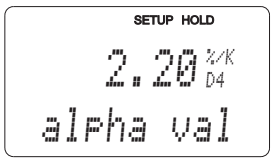
6.4.7 Temperature compensation with table

This function group is used to perform a temperature compensation with table (field B2). Enter the α–T value pairs in the fields T5 and T6.

Coding		Field	Selection or range (factory settings bold)	Display	Info
T		**Function group ALPHA TABLE**		SETUP HOLD T ALPHA TAB	Settings for temperature compensation.
	T1	Selection of table	**1** 1 to 4	SETUP HOLD 1 T1 editCurve	Selection of table to be edited.
	T2	Select table option	**read** edit	SETUP HOLD read T2 Sel.Table	
	T3	Enter number of table value pairs	**1** 1 to 10	SETUP HOLD 1 T3 No.Elem.	Up to 10 value pairs can be entered in the α table. These are numbered from 1 to 10 and can be edited individually or in sequence.
	T4	Select table value pair	**1** 1 to number of table value pairs assign	SETUP HOLD 1 T4 Sel.Elem.	The function chain T4 to T6 will run through as many times as correspond to the value in T3. "Assign" appears as the last step. After confirmation , the system jumps to T7.
	T5	Enter temperature value (x value)	**0.0 °C** -35.0 to 250.0 °C	SETUP HOLD 0.0 °C T5 Temp.val.	The temperature values must have a minimum distance of 1 K. Factory setting for temperature value of value pairs in table: 0.0 °C; 10.0 °C; 20.0 °C; 30.0 °C ...
	T6	Enter temperature coefficient α (y value)	**2.10 %/K** 0.00 to 20.00 %/K	SETUP HOLD 2.10 %/K T6 alpha val	
	T8	Message, whether or not the table status is ok	**yes** no	SETUP HOLD yes T8 Status ok	Only display If status = "no", then set table correctly (all previous settings are kept) or back to measurement mode (this makes the table invalid)

6.4.8 Determination of the temperature coefficient

This function group is used to determine the temperature coefficient.

Coding		Field	Selection or range (factory settings bold)	Display	Info
D		**Function group TEMPERATURE COEFFICIENT**			
	D1	Enter compensated conductivity	**current value** 0 to 9999		Edit the measured (uncompensated) conductivity value you have determined at 25 °C in the medium used in the process.
	D2	Display of uncompensated conductivity	**current value** 0 to 9999		The uncompensated conductivity is displayed (no edit).
	D3	Display of current temperature	**current value** -35.0 to +250.0 °C		The current temperature is displayed (no edit). Please note down this value.
	D4	Display of the α value determined			Please note down this value.

6.4.9 Concentration measurement

The transmitter can convert conductivity values to concentration values. For this, set the operating mode to Concentration measurement (see field A1).
Then, you must enter the basic data to which the concentration calculation should refer. You require the conductivity characteristics of the medium. To get the characteristics, you can either refer to the data sheets of the medium or determine the characteristics yourself.

1. To do so, create samples of the medium with the concentrations occurring in your process.
2. Measure the uncompensated conductivity of these samples at temperatures which likewise occur in your process.
   – For variable process temperature:
     If the variable process temperature should be taken into account for concentration measurement, you must measure the conductivity of each created sample at two different temperatures at least (ideally at the lowest and highest process temperature). The temperature values for the various samples must be identical. However, the difference between the temperatures must be at least 0.5 °C.
     At least two differently concentrated samples measured at two different temperatures are required because the transmitter needs a minimum of four references.
   – For constant process temperature:
     Measure the differently concentrated samples at this constant process temperature. A minimum of two samples is necessary.

Finally, you should have measuring data which are similar to those shown in the following figures:

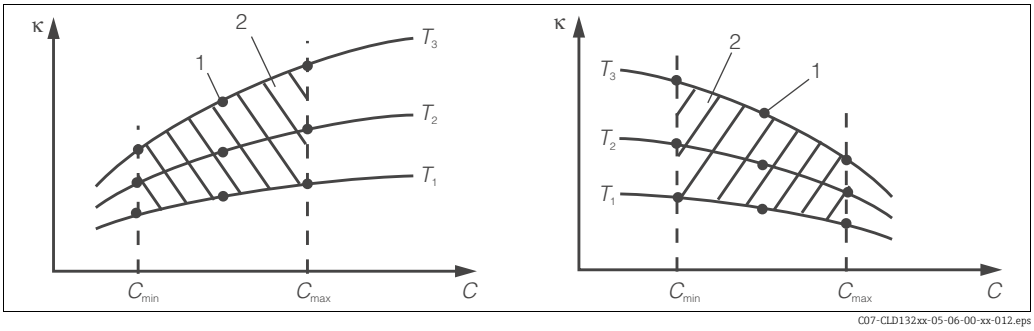


Fig. 23: Measured data for variable process temperatures (example)

κ Conductivity
C Concentration
T Temperature
1 Measuring point
2 Measuring range

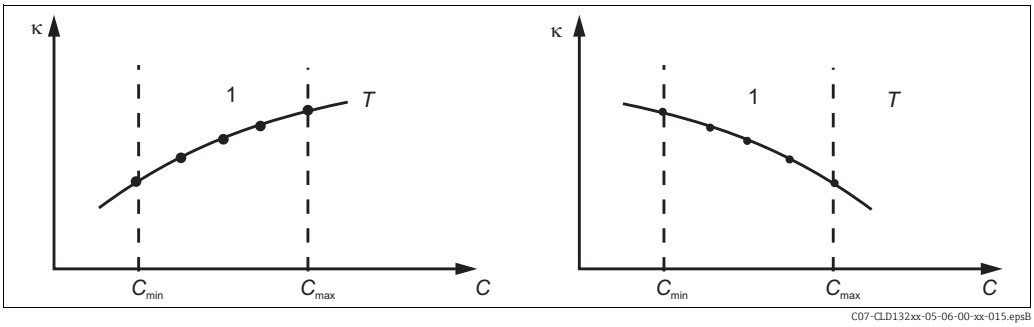


Fig. 24: Measured data for a constant process temperature (example)

κ Conductivity
C Concentration
T Constant temperature
1 Measuring range

The characteristics received from the measuring points must be strictly monotonously increasing or strictly monotonously decreasing in the range of the process conditions. Therefore, neither maxima / minima nor ranges with a constant behaviour can occur. Curve profiles such as those in → 25 are not permitted.

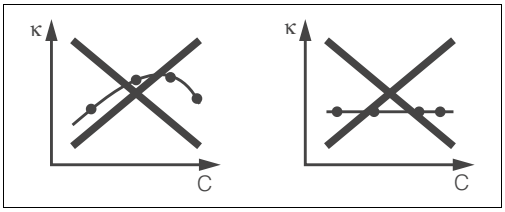


Fig. 25: Impermissible curve profiles

κ Conductivity
C Concentration

Value entry
Enter the three characteristic values for each measured sample in the fields K7 to K9 (value triplets of uncompensated conductivity, temperature and concentration).

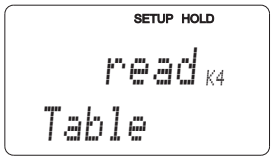
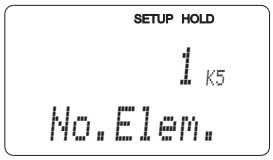
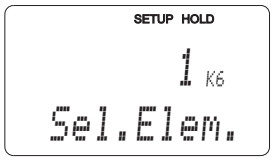
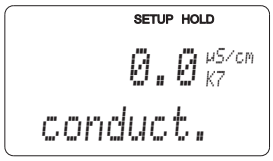
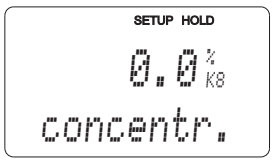
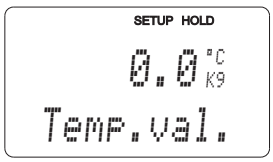
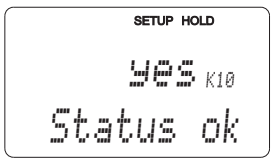
- Variable process temperature:
  Enter at least four value triplets.
- Constant process temperature:
  Enter at least two value triplets.

Pay attention to the following:
- Please make sure that the concentrations and temperatures measured for your samples correspond to the measuring range of the process. If the measured values of the process are outside the range of your sample values, this considerably reduces the level of accuracy and the error message E078 or E079 will be displayed.
- If you enter an additional value triplet of 0 µS/cm and 0 % for each temperature used, you can work from the start of measuring range with sufficient accuracy and without an error message.
  Enter the values in the order of increasing concentration (see the following example).

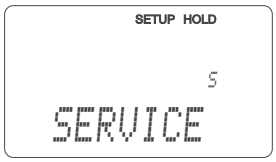
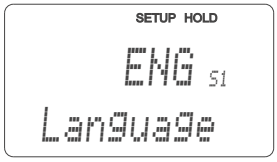
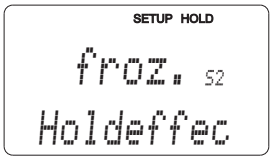
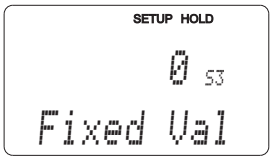
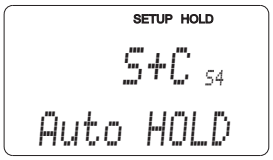
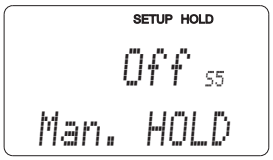
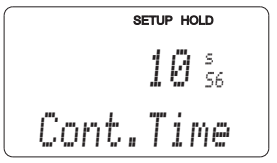
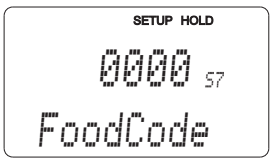
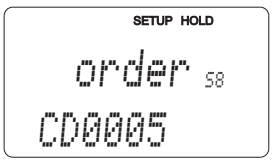
mS/cm	%	°C
240	96	60
380	96	90
220	97	60
340	97	90
120	99	60
200	99	90

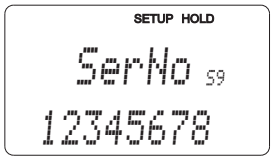
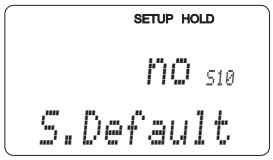
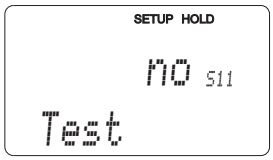
Basic version does not include functions in *italic*.

Coding		Field	Selection or range (factory settings bold)	Display	Info
K		**Function group CONCENTRATION**		SETUP HOLD K CONCENTRA	Four fixed and four editable concentration fields are stored in this function group.
	K1	Selection of concentration curve to be used to calculate the display value	**NaOH 0 to 15 %** H_2SO_4 0 to 30 % H_3PO_4 0 to 15 % HNO_3 0 to 25 % User 1 to 4	SETUP HOLD NaOH K1 akt.Curve	
	K2	Selection of correction factor	**1** 0.5 to 1.5	SETUP HOLD 1 K2 Conc.Fact	If required select a correction factor (only available for the user table).
	K3	Select the table to be edited	**1** 1 to 4	SETUP HOLD 1 K3 editCurve	When editing a curve, another curve should be used to calculate the current display values (see K1).

Coding		Field	Selection or range (factory settings bold)	Display	Info
	K4	Select the table option	**read** edit		This selection applies to all concentration curves.
	K5	Enter number of reference triplets	**1** 1 to 16		Each triplet consists of three numeric values.
	K6	Select triplet	**1** 1 to number of triplets in K5		Any triplet can be edited.
	K7	Enter uncompensated conductivity value for K6	**0.0 to 9999 mS/cm**		The function chain K6 to K9 will run through automatically as many times as corresponds to the value in K5. Then the system jumps to K10.
	K8	Enter concentration value for K6	0.00 to 99.99 %		Measuring unit selected as in A2. Format selected as in A3.
	K9	Enter temperature value for K6	-35.0 to 250.0 °C		
	K10	Message whether or not the table status is ok	**yes** no		Only display If not, then set table correctly (all previous settings are kept) or back to measurement mode (this makes the table invalid).

6.4.10 Service

Coding		Field	Setting range (Factory settings, bold)	Display	Info
S		**SERVICE function group**			Service function settings.
	S1	Select language	**ENG = English** GER = German FRA = French ITA = Italian NL = Dutch ESP = Spanish		This field has to be configured once during device configuration. Then you can exit S1 and continue.
	S2	HOLD effect	**froz = last value** fix = fixed value		"froz" = Display of last value before activation of hold. "fix" = When hold is active, the fixed value entered in S3 is displayed.
	S3	Enter fixed value for current output	**0** 0 to 100 % (of current output value)		Only if S2 = fixed value
	S4	Configure Hold	**S+C = Hold during setup and calibration** Cal = Hold during calibration Setup = Hold during setup None = no hold		S = setup C = calibration
	S5	Manual Hold	**Off** On		
	S6	Enter Hold dwell period	**10 s** 0 to 999 s		
	S7	Enter SW upgrade release code for Food package	**0000** 0000 to 9999		The release code for the "Food" package is entered in the factory already. You have to edit this code only after replacement of the central module.
	S8	Order number is displayed			If the device is upgraded, the order code is **not** automatically adjusted.

Coding		Field	Setting range (Factory settings, bold)	Display	Info
	S9	Serial number is displayed			
	S10	Reset the device to the basic settings 	**no** Sens = sensor data Facty = factory settings		Sens = Sensor data are deleted (temp. offset, airset value, cell constant, installation factor, serial number). Facty = all data except for the language (field S1) are deleted and reset to the factory setting!
	S11	Perform device test	**No** Displ = display test		

Compensation of the internal resistance
If you use a conductive sensor in higher conductivities (> 45 mS/cm) you should compensate the internal resistance of the transmitter. Otherwise a measuring error of more than 1 % could occur in some cases.
With the fields S12 to S14 the transmitter determines and saves its internal resistance. The conductivity will be compensated by this value.
Inductive sensors do not require such a compensation.

To perform the compensation proceed as follows:

1. Disconnect the transmitter from power.
2. Remove the transmitter.
3. Disconnect the sensor and connect the test resistor (included in the delivery) at the terminals 83 and 84. Use the delivered resistor - no other one!
4. Reconnect the power.
5. Perform the menu fields S12 to S14.

To reinstall the transmitter proceed as follows:

1. Disconnect the transmitter from power.
2. Remove the test resistor.
3. Connect the sensor (see chapter "Wiring").
4. Reinstall the transmitter (see chapter "Installation").
5. Reconnect the power.

The cable resistance is not considered (see field A6).

Coding		Field	Setting range (Factory settings, bold)	Display	Info
	S12	Compensation of the internal resistance	off on	SETUP HOLD Error off S12 Ri-Calib.	Start the compensation.
	S13	Status of resistance determination	**wait** o. k. E xxx	SETUP HOLD wait S13 Status 30s	Countdown: 30 s If the status is not o. k. error E xxx will be displayed.
	S14	Store the compensation?	**yes** no new	SETUP HOLD yes S14 Store	If S13 = E xxx, only "yes" or "no". If "new" = jump back to S12. The internal resistance will be stored and will be valid till a new compensation is performed.

6.4.11 E+H Service

Coding			Field	Setting range (Factory settings, **bold**)	Display	Note
E			**E+H SERVICE function group**		SETUP HOLD E E+H SERV	Information on the device version
	E1		Select module	**Contr = controller** (1) Trans = transmitter (2) Main = power unit (3) Sens = sensor(4)	SETUP HOLD Contr E1 Select	
		E111 E121 E131 E141	Software version is displayed		SETUP HOLD xx.xx E111 SW-Vers.	If E1 = contr: instrument software If E1 = trans, main: module firmware If E1 = sens: sensor software
		E112 E122 E132 E142	Hardware version is displayed		SETUP HOLD xx.xx E112 HW-Vers.	Only display function
		E113 E123 E133 E143	Serial number is displayed		SETUP HOLD SerNo E113 12345678	Only display function
		E114 E124 E134 E144	Module ID is displayed		SETUP HOLD LSG E114 Modul-ID	Only display function

6.4.12 Remote measuring range switching (MRS)

The remote parameter set switching function permits complete parameter sets to be entered for up to 4 substances.

Individual settings for each parameter set:
- Operating mode (conductivity or concentration)
- Temperature compensation
- Current output (main parameter and temperature)
- Concentration table
- Limit relay

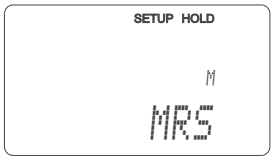
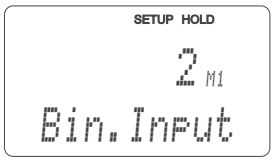
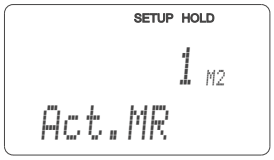
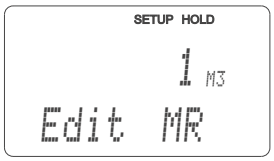
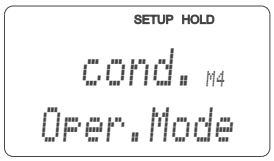
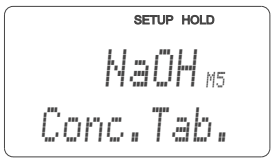
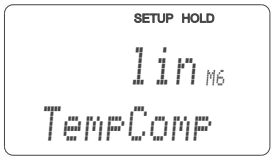
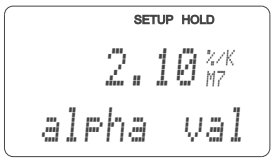
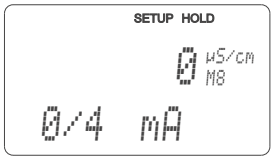
Assignment of binary inputs
The transmitter has 2 binary inputs. They can be defined in field M1 as follows:

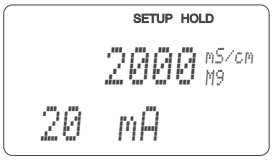
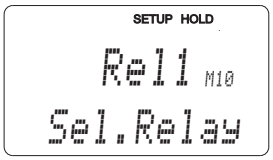
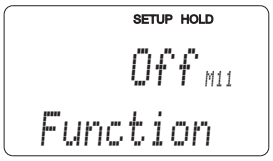
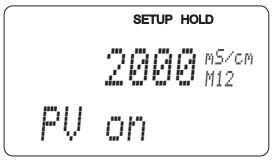
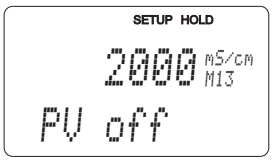
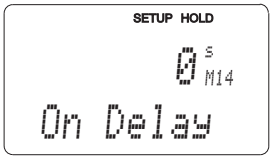
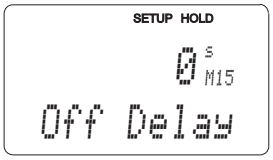
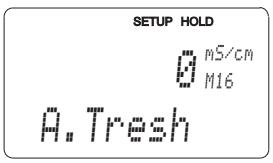
Assignment of field M1	Assignment of binary inputs
M1 = 0	MRS not active. The binary input 1 can be used for external hold.
M1 = 1	The binary input 2 can be used to switch between 2 measuring ranges (parameter sets). The binary input 1 can be used for external hold.
M1 = 2	The binary inputs 1 and 2 can be used to switch between 4 measuring ranges (parameter sets). This is the setting used in the following example.

Settings of the 4 parameter sets

Example: CIP cleaning

Binary input 1		0	0	1	1
Binary input 2		0	1	0	1
	Parameter set	1	2	3	4
Coding / software field	Medium	Beer	Water	Alkaline solution	Acid
M4	Operating mode	Conductivity	Conductivity	Concentration	Concentration
M8, M9	Current output	1 to 3 mS/cm	0.1 to 0.8 mS/cm	0.5 to 5%	0.5 to 1.5 %
M6	Temp. comp.	User Tab. 1	linear	-	-
M5	Conc. tab.	-	-	NaOH	User Tab.
M10, M11	Limits	on: 2.3 mS/cm off: 2.5 mS/cm	on: 0.7 µS/cm off: 0.8 µS/cm	on: 2 % off: 2.1 %	on: 1.3 % off: 1.4 %

Coding		Field	Selection or range (factory settings bold)	Display	Info
M		**Function group MRS**			Settings of remote parameter set switching (measuring range switching). M1 + M2: apply to measuring mode. M3 to M11: apply to configuration of parameter sets.
	M1	Select binary inputs	**1** 0, 1, 2		0 = no MRS 1 = 2 parameter sets selectable via binary input 2. Binary input 1 for hold. 2 = 4 parameter sets selectable via binary inputs 1+2.
	M2	Displays active parameter set or, if M1 = 0, select active parameter set	**1** 1 to 4 if M1 = 0		If M1 = 0, selectable. If M1 = 1 or 2, display depending on binary inputs.
	M3	Select parameter set to be configured in M4 to M16	**1** 1 to 4 if M1=0 1 to 2 if M1=1 1 to 4 if M1=2		Selection of parameter set **to be configured** (the **active** parameter set is selected in M2 or with the binary inputs).
	M4	Select operating mode	**cond = conductivity** conc = concentration		The operating mode can be individually defined for each parameter set.
	M5	Select medium	**NaOH**, H2SO4, H3PO4, HNO3 Tab 1 to 4		Only available if M4 = conc.
	M6	Select temperature compensation	none, **lin**, NaCl, Tab 1 to 4 if M4 = cond		Only available if M4 = cond.
	M7	Enter α value	**2.10 %/K** 0 to 20 %/K		Can only be entered if M6 = lin.
	M8	Enter measured value for 0/4 mA value	Cond.: **0** to 2000 mS/cm Conc.: **0** to 99.99 %		For concentration: edit Unit in field A2 edit Format in field A3

Coding		Field	Selection or range (factory settings bold)	Display	Info
	M9	Enter measured value for 20 mA value	Cond.: 0 to **2000 mS/cm** Conc.: 0 to **99.99 %**		For concentration: edit Unit in field A2 edit Format in field A3
	M10	Select contact to be configured	**Rel 1** Rel 2		
	M11	Switch function of relais off or on	**Off** On		All settings are retained.
	M12	Enter switch-on point for limit	Cond.: 0 to **2000 mS/cm** Conc.: 0 to **99.99 %**		For concentration: edit Unit in field A2 edit Format in field A3 Never set the switch-on point and the switch-off point to the same value!
	M13	Enter switch-off point for limit	Cond.: 0 to **2000 mS/cm** Conc.: 0 to **99.99 %**		The switch-off point entry selects a max contact (switch-off point < switch-on point) or a min contact (switch-off point > switch-on point), thereby implementing an always required hysteresis function. Never set the switch-off point and the switch-on point to the same value.
	M14	Enter pick-up delay	0 s 0 to 2000 s		
	M15	Enter drop-out delay	0 s 0 to 2000 s		
	M16	Enter alarm threshold	Cond.: 0 to 2000 mS/cm Conc.: 0 to 99.99 %		

If remote parameter set switching is selected, the parameter sets that have been entered are processed internally but the fields A1, B1, B3, R2, K1, O212, O213 show the values of the first measuring range.

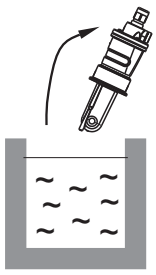
6.5 Calibration

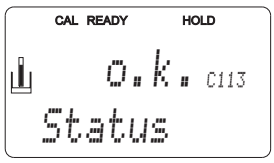
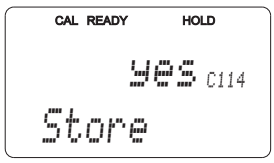
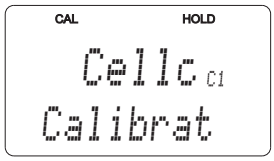
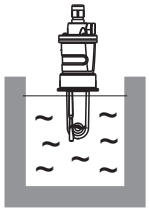
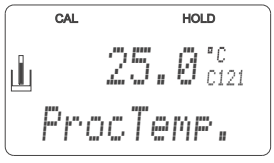
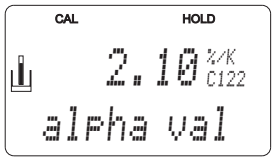
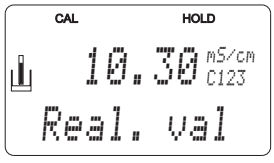
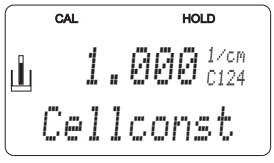
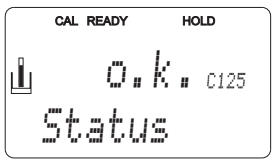
To access the "Calibration" function group, press the CAL key.
This function group is used to calibrate and adjust the transmitter. Two different types of calibration are possible:

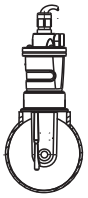
- Calibration by measurement in a calibration solution of a known conductivity.
- Calibration by entering the exact cell constant of the conductivity sensor.

Pay attention to the following:

- At first start-up of inductive sensors, an airset is absolutely required in order for the measuring system to be able to generate accurate measuring values.
- If the calibration procedure is aborted by pressing the PLUS and MINUS keys at the same time (return to C114, C126 or C136) or if the calibration is faulty, then the previous calibration data are reinstated. A calibration error is indicated by the “ERR” message and flashing of the sensor symbol on the display.
  Repeat calibration!
- The instrument is automatically switched to hold during calibration (factory setting).
- After calibration, the system jumps back to the measuring mode. During the hold dwell period the hold symbol is displayed.
- For conductive sensors only the fields C121 to C126 are relevant.

Coding			Field	Selection or range (factory settings bold)	Display	Info
C			**Function group CALIBRATION**		CAL C CALIBRAT	Calibration settings.
	C1 (1)		Calibration of inductive sensors with a ring-shaped opening	**Airs = Airset** (1) Cellc = cell constant (2) InstF = installation factor (3)	CAL HOLD AirS C1 Calibrat	When commissioning inductive sensors, an airset is mandatory. The calibration of the sensor is to be performed in air. The sensor must be dry.
	Remove sensor from the medium and dry **completely**.					
		C111	Residual coupling start calibration (airset)	**current measured value**	CAL HOLD 0.0 µS/cm C111 AirSet	Start calibration with CAL.
		C112	Residual coupling is displayed (airset)	-80.0 to 80.0 µS/cm	CAL HOLD 5.3 µS/cm C112 AirSetVal	Residual coupling of measuring system (sensor and transmitter).

Coding			Field	Selection or range (factory settings bold)	Display	Info
		C113	Calibration status is displayed	o.k. E xxx		If the calibration status is not o.k., the second display line shows an explanation of the error.
		C114	Store calibration results?	**yes** no new		If C113 = E xxx, then only no or **new**. If new, return to C. If yes/no, return to "Measurement".
	C1 (2)		Calibration of cell constant	Airs = Airset (1) **Cellc = cell constant** (2) InstF = installation factor (3)		The sensor should be immersed at a sufficient distance from the vessel wall (installation factor has no influence if a > 15 mm / 0.59").
	Immerse sensor in calibration solution. This describes the calibration for temperature compensated conductivity. For calibration with uncompensated conductivity set the temperature coefficient α to 0.					
		C121	Enter calibration temperature (MTC)	**25 °C** -35.0 to 250.0 °C		Only exists if B1 = fixed.
		C122	Enter α value of calibration solution	**2.10 %/K** 0.00 to 20.00 %/K		This value is specified in the Technical Information of all E+H calibration solutions. You can also use the printed-on table to calculate the value. Set α to 0 for calibration with uncompensated values.
		C123	Enter correct conductivity value of calibration solution (25 °C)	**current measured value** 0.0 µS/cm to 9999 mS/cm		You should select a value close to the application range.
		C124	Calculated cell constant is displayed	0.1 to 5.9 to 99.99 cm^{-1}		The calculated cell constant is displayed and entered in A5.
		C125	Calibration status is displayed	o.k. E xxx		If the calibration status is not o.k., the second display line shows an explanation of the error.

Coding			Field	Selection or range (factory settings bold)	Display	Info
		C126	Store calibration results?	**yes** no new	CAL READY HOLD yes C126 Store	If C125 = E xxx, then only no or **new**. If new, return to C. If yes/no, return to “Measurement”.
	C1 (3)		Calibration with sensor adaptation for inductive sensors (Plus Package only)	Airs = Airset (1) Cellc = cell constant (2) **InstF = installation factor** (3)	CAL HOLD InstF C1 Calibrat	Sensor calibration with compensation of wall influence. On inductive sensors, the distance from the sensor to the wall of the pipe and the material of the pipe (conductive or nonconductive) influence the measured value. The installation factor shows this influence. See the technical information of the installed sensor.
	The sensor is installed in the process.					
		C131	Enter process temperature (MTC)	**25 °C** -35.0 to 250.0 °C	CAL HOLD 25.0 °C C131 MTC temP.	Only exists if B1 = fixed.
		C132	Enter α value of the calibration solution	**2.10 %/K** 0.00 to 20.00 %/K	CAL HOLD 2.10 %/K C132 alpha val	This value is specified in the TI of all E+H calibration solutions. You can also use the printed-on table to calculate the value. Set α to 0 for calibration with uncompensated values.
		C133	Enter correct conductivity value of the calibration solution	**current measured value** 0.0 µS/cm to 9999 mS/cm	CAL HOLD 10.30 mS/cm C133 Real val.	You should select a value close to the application range.
		C134	Calculated installation factor is displayed	**1** 0.10 to 5.00	CAL HOLD 1 C134 InstFact	On inductive sensors, the distance from the sensor to the wall of the pipe and the material of the pipe (conductive or nonconductive) influence the measured value. The installation factor shows this influence. See the technical information of the installed sensor.
		C135	Calibration status is displayed	o.k. E xxx	CAL READY HOLD o.k. C135 Status	If the calibration status is not o.k., the second display line shows an explanation of the error.
		C136	Store calibration results?	**yes** no new	CAL READY HOLD yes C136 Store	If C135 = E xxx, then only no or **new**. If new, return to C. If yes/no, return to “Measurement”.

7 Diagnostics and troubleshooting

7.1 Troubleshooting instructions

The transmitter constantly monitors its functions itself. If an error occurs which the device recognizes, this is indicated on the display. The error number is shown below the display of the main measured value. If more than one error occurs, you can call these up with the MINUS key.
Refer to the "System error messages" table for the possible error numbers and remedial measures.
Should a malfunction occur without any transmitter error message, please refer to the "Process-specific errors" or the "Device-specific errors" tables to localize and rectify the error. These tables provide you with additional information on any spare parts required.

7.2 System error messages

The system error messages can be called up and selected with the MINUS key.

Error no.	Display	Tests and/or remedial measures	Alarm contact		Error current	
			Factory	User	Factory	User
E001	EEPROM memory error	1. Switch device off and then on again.	Yes		No	
E002	Instrument not calibrated, calibration data invalid, no user data, user data invalid (EEPROM error), instrument software not suitable to hardware (controller)	2. Load device software compatible with the hardware (with optoscope, see "Optoscope service tool" section). 3. Load measurement-parameter specific device software. 4. If the error persists, send in the device for repair to your local service organisation or replace the device.	Yes		No	
E003	Download error	Invalid configuration. Repeat download, check optoscope.	Yes		No	
E004	Instrument software version not compatible with module hardware version	Load software compatible with hardware. Load measurement-parameter specific device software.	Yes		No	
E007	Transmitter malfunction, instrument software not compatible with transmitter version		Yes		No	
E008	Sensor or sensor connection faulty	Check sensor and sensor connection (Service).	Yes		Yes	
E010	Temperature sensor defective, not connected or short-circuited	Check temperature sensor and connections; check device and measuring cable with temperature simulator if necessary.	Yes		No	
E025	Limit for Airset offset exceeded	Repeat Airset (in air) or replace sensor. Dry sensor. Check sensor connection.	No		No	
E036	Calibration range of sensor exceeded	Clean sensor and recalibrate; if necessary, check sensor and connections.	No		No	
E037	Below calibration range of sensor		No		No	
E040	Range of test resistor exceeded	Check test resistor	No		No	
E045	Calibration aborted	Recalibrate	No		No	
E049	Calibration range of installation factor exceeded	Check pipe diameter, clean sensor and recalibrate.	No		No	
E050	Below calibration range of installation factor		No		No	
E055	Below main parameter measuring range	Immerse sensor in conductive medium or perform Airset	Yes		No	

Error no.	Display	Tests and/or remedial measures	Alarm contact		Error current	
			Factory	User	Factory	User
E057	Main parameter measuring range exceeded	Check measurement and connections; check device and measuring cable with simulation if necessary.	Yes		No	
E059	Below temperature measuring range		Yes		No	
E061	Temperature measuring range exceeded		Yes		No	
E063	Below current output range 1	Check measured value and current assignment.	Yes		No	
E064	Current output range 1 exceeded		Yes		No	
E065	Below current output range 2		Yes		No	
E066	Current output range 2 exceeded		Yes		No	
E067	Alarm threshold for limit contactor exceeded	Check measured value, limit setting, alarm threshold and metering devices.	Yes		No	
E071	Polarisation	Clean sensor; use higher cell constant.	Yes		No	
E077	Temperature outside α value table range	Check measurement and tables.	Yes		No	
E078	Temperature outside concentration table		Yes		No	
E079	Conductivity outside concentration table		Yes		No	
E080	Current output 1 range too small	Increase range in "Current outputs" menu.	Yes		No	
E081	Current output 2 range too small		Yes		No	
E085	Incorrect setting for error current	If the current range "0 ... 20 mA" was selected in field O211, the error current "2.4 mA" may not be set.	Yes		No	
E100	Current simulation active		No		No	
E101	Service function active	Switch off service function or switch device off and then on again.	No		No	
E102	Manual mode active		No		No	
E106	Download active	Wait for download to finish.	No		No	
E116	Download error	Repeat download.	Yes		No	
E150	Distance between temp. values in α value table too small or not monotonously increasing	Enter correct values in α value table (minimum distance between temperature values of 1 K required)	No		No	
E152	Live check alarm	Check sensor and connection.	Yes		No	

7.3 Process specific errors

Use the following table to locate and correct errors.

Error	Possible cause	Tests and / or remedial measures	Equipment, spare parts, personnel
Display deviates from reference measurement	Calibration faulty	Calibrate instrument according to chapter "Calibration".	Calibration solution or sensor certificate
	Sensor soiled	Clean sensor.	See chapter "Cleaning conductivity sensors".
	Incorrect temperature measurement	Check temperature value on instrument and reference unit.	Temperature measuring instrument, precision thermometer
	Incorrect temperature compensation	Check compensation method (none / ATC / MTC) and compensation type (linear/substance/user table).	Please note: transmitter has separate calibration and operating temperature coefficients.
	Reference instrument calibration faulty	Calibrate reference instrument or use calibrated instrument.	Calibration solution, operating instructions of reference instrument
	Incorrect ATC setting on reference instrument	Compensation method and compensation type must be identical on both instruments.	Operating instructions of reference instrument
	Polarisation error	Use suitable sensor: ▪ Use larger cell constant. ▪ Use graphite instead of stainless steel (check resistance).	Measuring range tables e.g. in FA "Conductivity" or technical data of conductivity sensors
	Incorrect line resistance in field A6	Enter correct value	CYK71: 165 Ω/km
Implausible measured values in general: – continuous measured value overflow – measured value always 000 – measured value too low – measured value too high – measured value frozen – incorrect current output value	Short circuit / moisture in sensor	Check sensor.	See chapter "Checking inductive conductivity sensors".
	Short circuit in cable or junction box	Check cable and junction box.	See chapter "Checking extension cable and junction box".
	Interruption in sensor	Check sensor.	See chapter "Checking inductive conductivity sensors".
	Interruption in cable or junction box	Check cable and junction box.	See chapter "Checking extension cable and junction box".
	Incorrect cell constant setting	Check cell constant.	Sensor nameplate or certificate
	Incorrect output assignment	Check assignment of measured values to current signals.	
	Incorrect output function	Check 0-20 / 4 -20 mA selection and curve shape (linear /table).	
	Air cushion in assembly	Check assembly and installation.	
	Grounding short on or in device	Measure in insulated container	Plastic container, calibration solutions
	Transmitter module defective	Test with new module.	See chapter "Spare parts".
	Impermissible instrument operating state (no response to key actuation)	Switch instrument off and back on.	EMC problem: check grounding and line routing if problem persists or call E+H Service to test.
Incorrect temperature value	Incorrect sensor connection	Verify connections using connection diagram; three-wire connection mandatory.	Connection diagram in chapter "Electrical connection"
	Measuring cable defective	Check cable for interruption/short circuit/ shunt.	Ohmmeter
	Incorrect temperature sensor type	Select temperature sensor type on instrument (field B1).	

Error	Possible cause	Tests and / or remedial measures	Equipment, spare parts, personnel
Measured value fluctuates	Measuring cable interferences	Connect cable screen according to connection diagram.	See chapter "Electrical connection".
	Signal output line interferences	Check line routing, try separate line routing.	Separate routing of signal output and measuring input lines
	Interference currents in medium	Eliminate source of interference or ground medium close to sensor.	
	With conductive sensors: Electromagnetic interferences on signal lines	Use shielded cables and ground the cable shield	
Incorrect conductivity measured value in process	No / incorrect temperature compensation	ATC: select compensation type; linear: set correct coefficient. MTC: set process temperature.	
	Incorrect temperature measurement	Check temperature value.	Reference instrument, thermometer
	Bubbles in medium	Suppress bubble formation: – gas bubble trap – counterpressure (cover) – bypass measurement	
	Polarisation effects (only with conductive sensors)	Use suitable sensor ▪ Use larger cell constant ▪ Use graphite instead of stainless steel (check resistance)	Measuring range tables e.g. in FA "Conductivity" or technical data of conductivity sensors
	Flow rate too high (may cause bubbles)	Reduce flow or choose low turbulence mounting position.	
	Interference current in medium (only when conductive)	Ground medium close to sensor.	Most frequent cause of currents in medium: defective submerged motors
	Sensor soiled or coated	Clean sensor (see chapter "Cleaning conductivity sensors").	Heavily soiled media: use spray cleaning.
	Incorrect line resistance in field A6	Enter correct value.	CYK71: 165 Ω/km
Controller/limit contact does not work	Controller switched off	Activate controller.	See fields R2.
	Controller in "Manual/Off" mode	Choose "Auto" or "Manual/On" mode.	Keyboard, REL-key
	Pickup delay setting too long	Disable or shorten pickup delay.	See fields R5.
	"Hold" function active	“Automatic Hold” during calibration, “Hold” input activated; “Hold” via keyboard active.	See fields S2 to S5.
Controller/limit contact works continuously	Controller in "Manual/On" mode	Set controller to "Manual/Off" or "Auto".	Keyboard, REL and AUTO keys
	Dropout delay setting too long	Shorten dropout delay.	See field R6.
	Control loop interruption	Check measured value, current output, actuators, chemical supply.	
No conductivity current output signal	Line open or short-circuited	Disconnect line and measure directly on instrument.	mA meter 0–20 mA
	Output defective	See chapter "Instrument specific errors".	
Fixed conductivity current output signal	Current simulation active	Switch off simulation.	See field O2 (2).
	Impermissible operating state of processor system	Switch instrument off and back on.	EMC problem: check installation, screen, grounding if problem persists / call E+H Service to test.
Incorrect current output signal	Incorrect current assignment	Check current assignment: 0–20 mA or 4–20 mA?	Field O211
	Total load in current loop excessive (> 500 Ω.)	Disconnect output and measure directly on instrument.	mA meter for 0–20 mA DC
	EMC (interference coupling)	Disconnect both output lines and measure directly on instrument.	Use shielded lines, ground screens on both sides, route line in other duct if necessary.

Error	Possible cause	Tests and / or remedial measures	Equipment, spare parts, personnel
Current output table not accepted	Value interval too small	Select practical intervals	
No temperature output signal	Instrument does not have 2nd current output	Refer to nameplate for variant; change LSCH-x1 module if necessary.	Module LSCH-x2, see chapter "Spare parts".
	HOLD active	Check HOLD configuration	

7.4 Instrument specific errors

The following table helps you during the diagnosis and points to any spare parts required.

Depending on the degree of difficulty and the measuring equipment present, diagnosis is carried out by:
- Trained operator personnel
- The user's trained electrical technicians
- Company responsible for system installation/operation
- Endress+Hauser Service

Information on the exact spare part designations and on how to install these parts can be found in the "Spare parts" section.

Error	Possible cause	Tests and/or remedial measures	Execution, tools, spare parts
Device cannot be operated, display value 9999	Operation locked	Press CAL and MINUS keys simultaneously.	See "Function of keys" section.
Display dark, no light-emitting diode active	No line voltage	Check whether line voltage is present.	Electrical technician/e.g. multimeter
	Supply voltage wrong/too low	Compare actual line voltage and nameplate data.	User (data for energy supply company or multimeter)
	Connection faulty	Terminal not tightened; insulation jammed; wrong terminals used.	Electrical technician
	Device fuse defective	Compare line voltage and the nameplate data and replace fuse.	Electrical technician/suitable fuse; see drawing in "Spare parts" section.
	Power unit defective	Replace power unit, note variant.	On-site diagnosis by Endress+Hauser Service, test module necessary
	Central module defective	Replace central module, note variant.	On-site diagnosis by Endress+Hauser Service, test module necessary
Display dark, light-emitting diode active	Central module defective (module: LSCH/LSCP)	Renew central module, note variant.	On-site diagnosis by Endress+Hauser Service, test module necessary
Display is on but – No change in display and/or – Device cannot be operated	Device or module in device not correctly mounted	Reinstall module	Perform with the aid of the installation drawings in the "Spare parts" section.
	Operating system in unpermitted mode	Switch device off and then on again.	Poss. EMC problem: if this persists, check the installation or have it checked by Endress+Hauser Service.
Device gets hot	Voltage wrong/too high	Compare line voltage and nameplate data.	User, electrical technician
	Power unit defective	Replace power unit.	Diagnosis only by Endress+Hauser Service
Incorrect meas. cond. and/or temperature	Transmitter module defective (module: MKIC), please first carry out tests and take measures as per the "Process errors without messages" section.	Measuring input test: – Connect resistor in place of conductivity sensor – Resistance 100 Ω at terminals 11/12 + 13 = display 0 °C	If test negative: replace module (note variant). Perform with the aid of the exploded drawings in the "Spare parts" section.
Current output, current value incorrect	Adjustment not correct	Check with installed current simulation, connect mA meter directly to current output.	If simulation value incorrect: adjustment in factory or new module LSCxx required. If simulation value correct: check current loop for load and shunts.
	Load too big		
	Shunt/short to ground in current loop		
	Incorrect mode of operation	Check whether 0–20 mA or 4–20 mA is selected.	
No current output signal	Current output stage defective (module LSCH/LSCP)	Check with installed current simulation, connect mA meter directly to current output.	If test negative: Renew central module LSCH/LSCP (note variant).

8 Maintenance

Take all the necessary measures in time to guarantee the operational safety and reliability of the entire measuring system.

Maintenance work at the transmitter comprises:
- Calibration (see "Calibration" section)
- Cleaning of assembly and sensor
- Cable and connection check

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

NOTICE
Electrostatic discharge (ESD)
Risk of damage to electronic components
- ▶ Take personal protective measures to avoid ESD, such as discharging beforehand at PE or permanent grounding with a wrist strap.
- ▶ For your own safety, use only genuine spare parts. With genuine spare parts, the function, accuracy and reliability are also guaranteed after repair.

8.1 Maintenance of the entire measuring point

8.1.1 Cleaning the transmitter

Clean the front of the housing with usual commercial cleaning agents.

In accordance with DIN 42 115, the front is resistant to:
- Ethanol (short periods)
- Diluted acids (max. 2% HCl)
- Diluted bases (max. 3% NaOH)
- Soap-based household cleaners

NOTICE
Prohibited cleaning agents
Damage to the housing surface or housing seal
- ▶ For cleaning purposes, never use concentrated mineral acids or bases.
- ▶ Never use organic cleaners such as benzyl alcohol, methanol, methylene chloride, xylene or concentrated glycerol cleaner.
- ▶ Never use high-pressure steam for cleaning purposes.

8.1.2 Cleaning the conductivity sensors

⚠ CAUTION

Chemicals burns to the eyes and skin

- ▶ Wear protective goggles and safety gloves.
- ▶ Clean away splashes on clothes and other objects to prevent any damage.
- ▶ Pay particular attention to the information provided in the safety data sheets for the chemicals used.

Clean away fouling on the sensor as follows depending on the particular type of fouling:

- Oily and greasy films:
  Clean with grease remover, e.g. alcohol, acetone, as well as hot water and dish washing detergent if necessary.
- Lime and metal hydroxide buildup:
  Dissolve buildup with diluted hydrochloric acid (3 %) and then rinse thoroughly with plenty of clear water.
- Sulfidic buildup (from flue gas desulfurising or sewage treatment plants):
  Use a mixture of hydrochloric acid (3 %) and thiocarbamide (commercially available) and then rinse thoroughly with plenty of clear water.
- Buildup containing proteins (e.g. food industry):
  Use a mixture of hydrochloric acid (0.5 %) and pepsin (commercially available) and then rinse thoroughly with plenty of clear water.

8.1.3 Simulation of conductive sensors for device test

Check a measuring device for conductivity by replacing the measuring section and temperature sensor with resistors. Simulation accuracy is dependent on the accuracy of the resistors.

Temperature

The values in the right-hand table are valid, if no temperature offset is set on the transmitter.
With the temperature sensor type Pt 1000, all the resistance values are increased by a factor of 10.

Connect the temperature equivalent resistor in a three-line system.
To connect decade resistors instead of the conductivity sensor, you can use the "Conductivity Test Adapter" service kit (order no. 51500629).

Pt 100 replacement resistors	
Temperature (°C/°F)	**Resistance value**
-20/-4	92.13 Ω
-10/14	96.07 Ω
0/32	100.00 Ω
10/50	103.90 Ω
20/68	107.79 Ω
25/77	109.73 Ω
50/122	119.40 Ω
80/176	130.89 Ω
100/212	138.50 Ω
200/392	175.84 Ω

Conductivity
For conductivity, the values in the following table are valid, if the cell constant k is set to the nominal value according to column 2.
Otherwise: Display conductivity [mS/cm] = k[cm^{-1}] · 1 / R[kΩ]

Resistance R	Cell constant k	Display for conductivity
10 Ω	1 cm^{-1}	100 mS/cm
	10 cm^{-1}	1000 mS/cm
100 Ω	0.1 cm^{-1}	1 mS/cm
	1 cm^{-1}	10 mS/cm
	10 cm^{-1}	100 mS/cm
1000 Ω	0.1 cm^{-1}	0.1 mS/cm
	1 cm^{-1}	1 mS/cm
	10 cm^{-1}	10 mS/cm
10 kΩ	0.01 cm^{-1}	1 µS/cm
	0.1 cm^{-1}	10 µS/cm
	1 cm^{-1}	100 µS/cm
	10 cm^{-1}	1 mS/cm
100 kΩ	0.01 cm^{-1}	0.1 µS/cm
	0.1 cm^{-1}	1 µS/cm
	1 cm^{-1}	10 µS/cm
1 MΩ	0.01 cm^{-1}	0.01 µS/cm
	0.1 cm^{-1}	0.1 µS/cm
	1 cm^{-1}	1 µS/cm
10 MΩ	0.01 cm^{-1}	0.001 µS/cm
	0.1 cm^{-1}	0.01 µS/cm

The MΩ measurement is normally used for pure and ultrapure water and therefore is only wise for cell constants where k= 0.01 or k = 0.1 cm^{-1}.

8.1.4 Simulation of inductive sensors for device test

The inductive sensor cannot be simulated.
However, the overall system comprising the transmitter and inductive sensor can be checked using equivalent resistances. Note the cell constant (e.g. $k_{nominal}$ = 5.9 cm^{-1} for CLS52, $k_{nominal}$ = 6.3 cm^{-1} for CLS54).

For an accurate simulation, the actual cell constant (can be read in field C124) is to be used to calculate the display value.
The exact formula depends on the sensor type:
CLS52: Display conductivity [mS/cm] = k(cm^{-1}) ·1/R [kΩ]
CLS54: Display conductivity [mS/cm] = k(cm^{-1}) ·1/R [kΩ] · 1.21

Values for simulation with CLS54 at 25 °C (77 °F):

Simulation resistance R	Default cell constant k	Conductivity display
10 Ω	6.3 cm^{-1}	520 mS/cm
26 Ω	6.3 cm^{-1}	200 mS/cm
100 Ω	6.3 cm^{-1}	52 mS/cm
260 Ω	6.3 cm^{-1}	20 mS/cm
2.6 kΩ	6.3 cm^{-1}	2 mS/cm
26 kΩ	6.3 cm^{-1}	200 µS/cm
52 kΩ	6.3 cm^{-1}	100 µS/cm

Conductivity simulation:
Pull a cable through the sensor opening and then connect, e.g. to a decade resistor.

8.1.5 Check of conductive sensors

- Measuring surface connection:
  The measuring surfaces are directly connected to the connections of the sensor connector.
  Check with ohmmeter at < 1 Ω.
- Measuring surface shunt:
  There may not be any shunt between the measuring surfaces.
  Check with ohmmeter at > 20 MΩ.
- Temperature sensor shunt:
  There may not be any shunt between the measuring surfaces and the temperature sensor.
  Check with ohmmeter at > 20 MΩ.
- Temperature sensor:
  You can find out the type of the temperature sensor being used by consulting the sensor nameplate. The sensor can be checked at the sensor connector with an ohmmeter:
  – Pt 100 at 25 °C (77 °F) = 109.79 Ω
  – Pt 1000 at 25 °C (77 °F) = 1097.9 Ω
  – NTC 10 k at 25 °C (77 °F) = 10 kΩ
- Connection:
  For sensors with a terminal connection (CLS12/13) check the assignment of the terminals for reversals and the tightness of the terminal screws.

8.1.6 Check of inductive sensors

The sensor lines on the instrument or junction box are to be disconnected for all tests described here!

- Testing transmitting and receiving coils
  - Ohmic resistance
    CLS52: approx. 0.5 to 2 Ω
    CLS54: approx. 1 to 3 Ω
  - Inductivity (at 2 kHz, series connection as equivalent circuit diagram)
    CLS52/54: approx. 180 ... 550 mH

  (Measure the white and red coaxial cables, between the inner conductor and screen in both cases.)
- Testing the coil shunt
  - A shunt between the two sensor coils is not allowed. The resistance measured should be >20 MΩ.

  Test with ohmmeter between red coaxial cable and white coaxial cable.
- Testing the temperature sensor
  Use the table in chapter "Simulation of inductive sensors for device test" to check the Pt100 in the sensor.
  Measure between the green and white wires and between green and yellow. The resistance values should be identical.
- Testing the temperature sensor shunt
  - Shunts between the temperature sensor and the coils are not allowed. Check with ohmmeter for >20 MΩ.

  Measure between the temperature sensor wires (green + white + yellow) and the coils (red and white coaxial cables).

8.1.7 Connecting lines and junction boxes

- Use the methods described in chapters "Simulation of conductive/inductive sensors for device test" to perform a quick functional check from the conductivity sensor (sensor connector) to the measuring instrument via an extension.
  Connect the decade resistors simply with the service kit "Conductivity Test Adapter", order no. 51500269 (for CLS15, CLS19, CLS21).
- Check junction boxes for:
  - Moisture (influence at low conductivity, if necessary dry box, replace seals, insert dehydrating bag)
  - Correct connection of all lines
  - Connection of the outer screens
  - Tightness of the terminal screws

9 Repair

9.1 Spare parts

Spare parts are to be ordered from your sales center responsible. Specify the order numbers listed in the chapter "Spare parts kits".

To be on the safe side, you should **always** specify the following data with your spare part orders:
- Instrument order code (order code)
- Serial number (serial no.)
- Software version where available

Refer to the nameplate for the order code and serial number.
The software version is displayed in the instrument software (see chapter "Instrument configuration") if the instrument processor system is functional.

9.2 Dismantling the panel-mounted instrument

Please note the effects on the process if the device is taken out of service!

Please refer to the following diagram for the item numbers.

1. Disconnect the terminal block (item 420 b) from the rear of the device to de-energize the device.
2. Then remove the terminal blocks (item 420 a and poss. 430) from the rear of the device. Now you can disassemble the device.
3. Press in the latches of the end frame (item 340) and remove the frame from the rear.
4. Release the special screw (item 400) by turning it counter-clockwise.
5. Remove the entire electronics block from the housing. The modules are only mechanically connected and can be easily separated:
   – Simply remove the processor/display module from the front.
   – Pull out the brackets of the rear plate (item 320) slightly.
   – Now you can remove the side modules.
6. Remove the cond. transmitter (item 240) as follows:
   – Using fine side-cutting pliers, nip off the heads of the synthetic distance holders.
   – Then remove the module from above.

Assembly is the reverse of the disassembly sequence. Tighten the special screw hand-tight without a tool.
If the transmitter is exposed to shocks or vibrations you have to replace the synthetic distance holders.

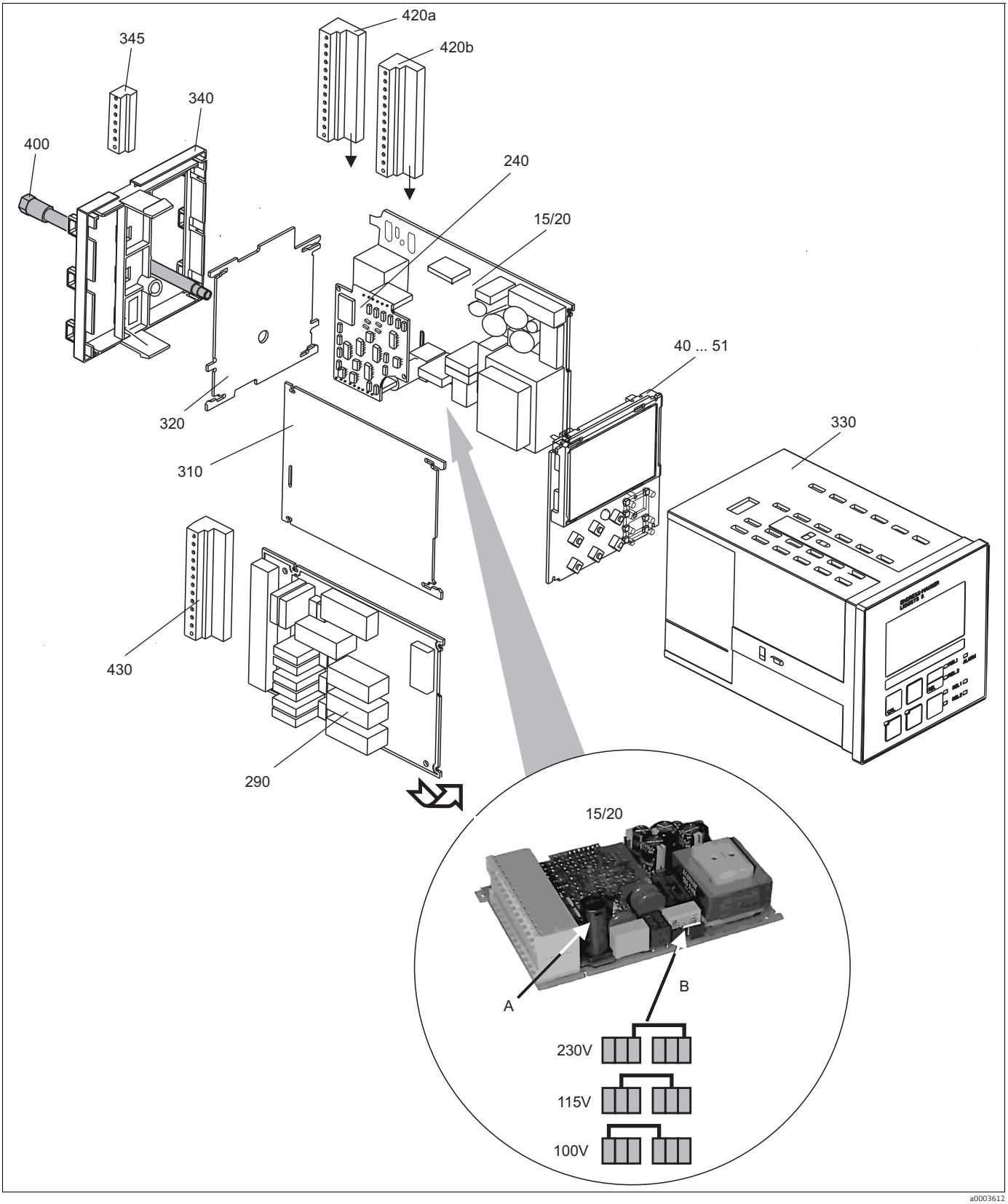


Fig. 26: Exploded drawing

The exploded drawing contains the components and spare parts of the panel-mounted instrument. You can take the spare parts and the corresponding order number from the following section using the item numbers.

Item	Kit description	Name	Function/contents	Order number
15	Power unit (main module)	LSGA	100 / 115 / 230 V AC	51500317
20	Power unit (main module)	LSGD	24 V AC + DC	51500318
40	Central module cond. (controller)	LSCH-S1	1 current output	51506379
50	Central module cond. (controller)	LSCH-S2	2 current outputs	51506380
41	Central module ind. (controller)	LSCH-S1	1 current output	51506385
51	Central module ind. (controller)	LSCH-S2	2 current outputs	51506386
240	Conductivity transmitter (for use in hazardous areas)	MKIC	Cond. + temperature input	71161137
	Conductivity transmitter	MKIC	Cond. + temperature input	71161133
290	Relay module	LSR1-2	2 relays	51500320
310	Side panel		Kit with 10 parts	51502124
310, 320, 340, 400	Housing mechanical parts		Rear plate, side panel, end frame, special screw	51501076
330, 400	Housing module		Housing with front membrane, sensory tappets, gasket, special screw, tensioning dogs, connection plates and nameplates	51501075
345	Grounding terminal strip		PE and screening connections	51501086
420a, 420b	Terminal strip set		Complete terminal strip set,	51501203
430	Terminal strip		Terminal strip for relay module	51501078
A	Fuse		Part of power unit, item 15	
B	Choice of line voltage		Position of jumper on power unit, item 15 depending on line voltage	

9.3 Replacing the central module

Generally, when a central module has been replaced, all data which can be changed are set to the factory setting.

Proceed as described below if a central module is replaced:

1. If possible, note the customized settings of the device, such as:
   - Calibration data
   - Current assignment, main parameter and temperature
   - Relay function selections
   - Limit value/controller settings
   - Concentration tables
   - Monitoring functions
   - ATC tables
   - MRS settings
2. Disassemble the device as explained in the "Dismantling the panel-mounted instrument" or "Dismantling the field instrument" section.
3. Use the part number on the central module to check whether the new module has the same part number as the previous module.
4. Assemble the device with the new module.
5. Start up the device again and check the basic functions (e.g. measured value and temperature display, operation via keyboard).
6. Enter the serial number:
   - Read the serial number ("ser-no.") off the nameplate of the device.
   - Enter this number in the fields E115 (year, one-digit), E116 (month, one-digit), E117 (cons. number, four-digit).
   - In the field E118, the complete number is displayed again so you can check it is correct.

   You can only enter the serial number for new modules with the serial number 0000. This can only be done **once**! For this reason, make sure the number entered is correct before you confirm with ENTER!
   Entry of an incorrect code will prevent the additional functions from being enabled. An incorrect serial number can only be corrected at the factory!

   Press ENTER to confirm the serial number or cancel the entry to enter the number again.
7. Enter the release code for the Food Package in the "Service" menu.
8. Re-enter the customer device settings again.

9.4 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

9.5 Disposal

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

10 Accessories

10.1 Sensors

Condumax W CLS21
- Two-electrode sensor in fixed cable and plug-in head version
- Ordering according to product structure, www.products.endress.com/cls21
- Technical Information TI00085C/07/EN

Condumax W CLS30
- Two-electrode sensor with fixed cable
- With Pt 100 temperature sensor
- Cell constant k = 10 cm^{-1}
- Ordering according to product structure, see Technical Information TI00086C/07/EN

Indumax H CLS52
- Inductive conductivity sensor with short response time for food applications
- Ordering according to product structure, www.products.endress.com/cls52
- Technical Information TI00167C/07/EN

Indumax H CLS54
- Inductive conductivity sensor in certified, hygienic design for food, beverages, pharma and biotechnology
- Ordering according to product structure, www.products.endress.com/cls54
- Technical Information TI00400C/07/EN

10.2 Connection accessories

CYK71 measuring cable
- Non-terminated cable for the connection of sensors (e.g. conductivity sensors) or the extension of sensor cables
- Sold by the meter, order numbers:
  - non-Ex version, black: 50085333
  - Ex version, blue: 50085673

Extension cable CLK6
- For inductive conductivity sensors, for extension via the VBM junction box, sold by the meter
- Order no.: 71183688

Junction box VBM
- For cable extension
- 10 terminals
- Cable entries: 2 x Pg 13.5 or 2 x NPT ½"
- Material: aluminum
- Ingress protection: IP 65 (≙ NEMA 4X)
- Order numbers:
  - cable entries Pg 13.5: 50003987
  - cable entries NPT ½": 51500177

10.3 Hardware add-ons

The add-ons can only be ordered by quoting the serial number of the device in question.

- Two-relay card
  Order no. 51500320

10.4 Calibration solutions

Precision calibration solutions, acc. to SRM (Standard reference material) of NIST, error limit ± 0.5 %, reference temperature 25 °C (77 °F), with temperature table

- CLY11-A, 74.0 µS/cm, 500 ml (0.132 Us.gal); order no. 50081902
- CLY11-B, 149.6 µS/cm, 500 ml (0.132 Us.gal); order no. 50081903
- CLY11-C, 1.406 mS/cm, 500 ml (0.132 Us.gal); order no. 50081904
- CLY11-D, 12.64 mS/cm, 500 ml (0.132 Us.gal); order no. 50081905
- CLY11-E, 107.0 mS/cm, 500 ml (0.132 Us.gal); order no. 50081906

11 Technical data

11.1 Input

Measured variables	Conductivity, temperature	
Measuring range	Conductivity (conductive):	0 to 400 mS/cm (uncompensated)
	Conductivity (inductive):	0 to 2000 mS/cm (uncompensated)
	Concentration:	0 to 9999 %
	Temperature:	-35 to +250 °C (-31 to +482 °F)
Cable specification	Cable length (conductive):	conductivity: max. 100 m (328.1 ft) (CYK71)
	Cable length (inductive):	max 55 m (180.46 ft) (CLK5)
	Cable resistance CYK71:	165 Ω/km (conductivity measurement)
Cell constant	Adjustable cell constant:	k = 0.0025 to 99.99 cm^{-1}
Temperature sensors	Pt 100, Pt 1000, NTC 30K	
Measuring frequency	Conductivity, resistivity (conductive):	170 Hz to 2 kHz
	Conductivity (inductive):	2 kHz
Binary inputs	Voltage:	10 to 50 V
	Power consumption:	max. 10 mA

11.2 Output

Output signal	0/4 to 20 mA, galvanically separated, active	
Signal on alarm	2.4 or 22 mA in case of an error	
Load	maximum 500 Ω	
Linearization transmission behaviour	Conductivity: Temperature:	adjustable adjustable, Δ10 to Δ100 % of upper range value
Resolution	max. 700 digits/mA	
Min. distance for 0 / 4 to 20 mA signal	Conductivity: Measured value 0 to 19.99 µS/cm Measured value 20 to 199.9 µS/cm Measured value 200 to 1999 µS/cm Measured value 2 to 19.99 mS/cm Measured value 20 to 2000 mS/cm Concentration Temperature	 2 µS/cm 20 µS/cm 200 µS/cm 2 mS/cm 20 mS/cm no minimum distance 15 °C
Isolation voltage	max. 350 V_{RMS}/500 V DC	
Overvoltage protection	according to EN 61000-4-5	
Auxiliary voltage output	Output voltage: Output current:	15 V ± 0.6 max. 10 mA
Contact outputs	Switching current with ohmic load (cos φ = 1): Switching current with inductive load (cos φ = 0.4): Switching voltage: Switching power with ohmic load (cos φ = 1): Switching power with inductive load (cos φ = 0.4):	max. 2 A max. 2 A max. 250 V AC, 30 V DC max. 500 VA AC, 60 W DC max. 500 VA AC, 60 W DC
Limit contactor	Pickup/dropout delay:	0 to 2000 s
Alarm	Function (selectable): Alarm threshold adjustment range: Alarm delay:	Latching/momentary contact Conductivity, resistivity, concentration, temperature, USP, EP: complete measuring range 0 to 2000 s (min)

11.3 Power supply

Supply voltage	Depending on ordered version: 100/115/230 V AC +10/-15 %, 48 to 62 Hz 24 V AC/DC +20/-15 %
Power consumption	max. 7.5 VA
Mains protection	Fine-wire fuse, medium-slow blow 250 V/3.15 A

11.4 Performance characteristics

Reference temperature	25 °C (77 °F); adjustable for the compensation of the medium temperature	
Resolution	Temperature:	0.1 °C
Maximum measured error[1)]	Conductivity:	
	Display:	max. 0.5 % of measured value ± 4 digits
	Conductivity signal output:	max. 0.75 % of current output range
	Temperature:	
	Display:	max. 1.0 % of measuring range
	Temperature signal output:	max. 1.25 % of current output range
Repeatability[1]	Conductivity:	max. 0.2 % of measured value ± 2 digits
Temperature compensation	Range:	-35 to +250 °C (-31 to +482 °F)
	Types of compensation:	linear, NaCl, table
Temperature offset	±5 °C; for the adjustment of the temperature display	

1) acc. to IEC 746-1, for nominal operating conditions

11.5 Environment

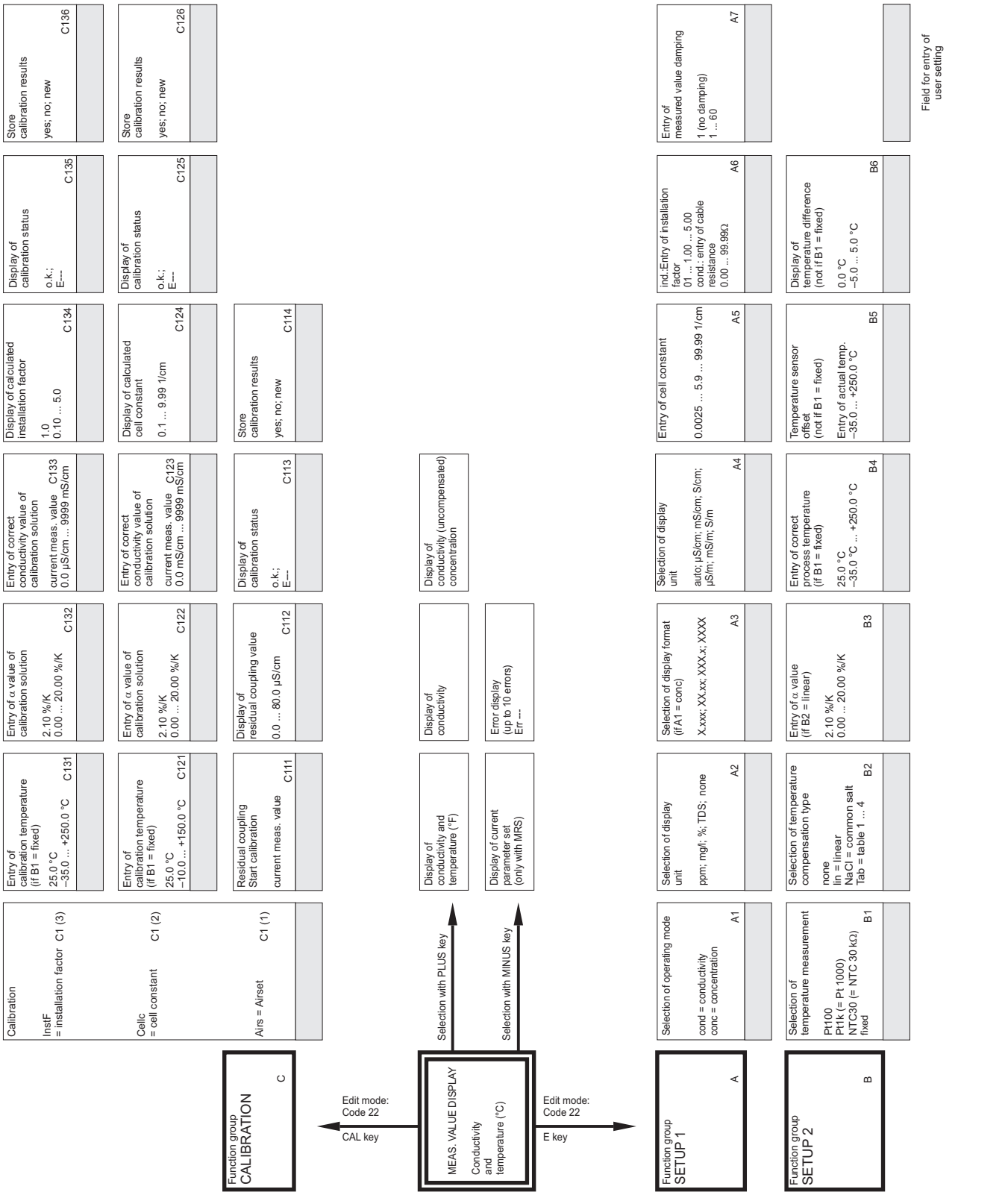
Ambient temperature	-10 to +55 °C (+14 to +131 °F)	
Storage temperature	–25 to +65 °C (-13 to +149 °F)	
Electromagnetic compatibility	Interference emission and interference immunity as per EN 61326-1:2006, EN 61326-2-3:2006	
Ingress protection	Panel mounted instrument: Field instrument:	IP 54 (front), IP 30 (housing) IP 65 / tightness acc. to NEMA 4X
Electrical safety	according EN/IEC 61010-1:2001, Installation Category II, for use up to 2000 m above sea level	
CSA	Apparatus with CSA General Purpose Approval are certified for indoor use.	
Relative humidity	10 to 95%, non-condensing	
Pollution degree	The product is suitable for pollution degree 2.	

11.6 Mechanical construction

Dimensions	Panel-mounted instrument:	L x W x D: 96 x 96 x 145 mm (3.78" x 3.78" x 5.71") Installation depth: approx. 165 mm (6.50")
Weight	Panel-mounted instrument:	max. 0.7 kg (1.54 lbs)
Material	Housing: Front membrane:	Polycarbonate Polyester, UV-resistant
Terminals	Cross section	max. 2.5 mm^2

12 Appendix

Operating matrix



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Function group OUTPUT
O
Selection of Current output
Out 1; Out 2
O1
Selection of characteristic
sim = simulation
lin = linear
O2 (2)
O2 (1)
Entry of simulation value
current value
0 ... 22.00 mA
O221
Selection of current range
4-20 mA; 0-20 mA
O211
Entry of 0/4 mA value
0 µS/cm; 0 %; 0 °C
entire meas. range
O212
Entry of 20 mA value
2000 mS/cm; 99.99 %; 150.0 °C
entire meas. range
O213
Function group ALARM
F
Selection of contact type
Stead = steady contact
Fleet = fleeting contact
F1
Selection of unit for alarm delay
s; min
F2
Entry of alarm delay
0 ... 2000 s (min)
(dependent on F2)
F3
Determination of error current
22 mA
2.4 mA
F4
Selection of error number
1
1 ... 255
F5
Set alarm contact to be effective
yes; no
F6
Set error current to be effective
no; yes
F7
Select "next error" or return to menu
next = next error
↵ R
F8
Function group CHECK
P
Switch polarisation detection on or off
off; on
P1
PCS Alarm setting (live check)
off / 1h / 2h / 4h
Monitoring limit
0.3 % of mean value over time entered
P2
Function group RELAY (only if MRS)
R
Selection of contact to be configured
Rel1
Rel2
R1
Switch limit function for selected contact off or on
off
on
R2
Selection of contact switch-on point
9999 mS/cm; 2000 mS/cm; 9999 %
entire meas. range
R3
Selection of contact switch-off point
9999 mS/cm; 2000 mS/cm; 9999 %
entire meas. range
R4
Pickup delay setting
0 s
0 ... 2000 s
R5
Dropout delay setting
0 s
0 ... 2000 s
R6
Setting of alarm threshold (as an absolute value)
9999 mS/cm; 2000 mS/cm; 9999 %
entire meas. range
R7
Function group ALPHA TABLE
T
Selection of tables
1
1 ... 4
(>1 only with MRS)
T1
Selection of table option
read
edit
T2
Entry of number of value pairs in table
1
1 ... 10
T3
Selection of table value pair
1
1 ... number from R3
asign
T4
Entry of temperature value (x value)
0.0 °C
–35.0 ... 250.0 °C
T5
Entry of temperature coefficient α (y value)
2.10 %/K
0.00 ... 20.00 %/K
T6
Output table status o.k.
yes; no
T7
Function group CONCENTRATION
K
Selection of active concentration table
NaOH; H_2SO_4; H_3PO_4; HNO_3
User 1 ... 4
K1
Multiplication factor for concentration value of a user table
1
0.5 ... 1.5
K2
Selection of tables
1
1 ... 4
K3
Selection of table option
read
edit
K4
Entry of number of value pairs in table
1
1 ... 16
K5
Selection of table value pair
1
1 ... number from K5
K6
Entry of uncompensated conductivity value
0.0 µS/cm
0.0 ... 9999 mS/cm
K7
Entry of associated concentration value
0.00 %
0 ... 99.99 %
K8
Entry of associated temperature value
0.0 °C
–35.0 ... +250.0 °C
K9
Output table status o.k.
yes; no
K10

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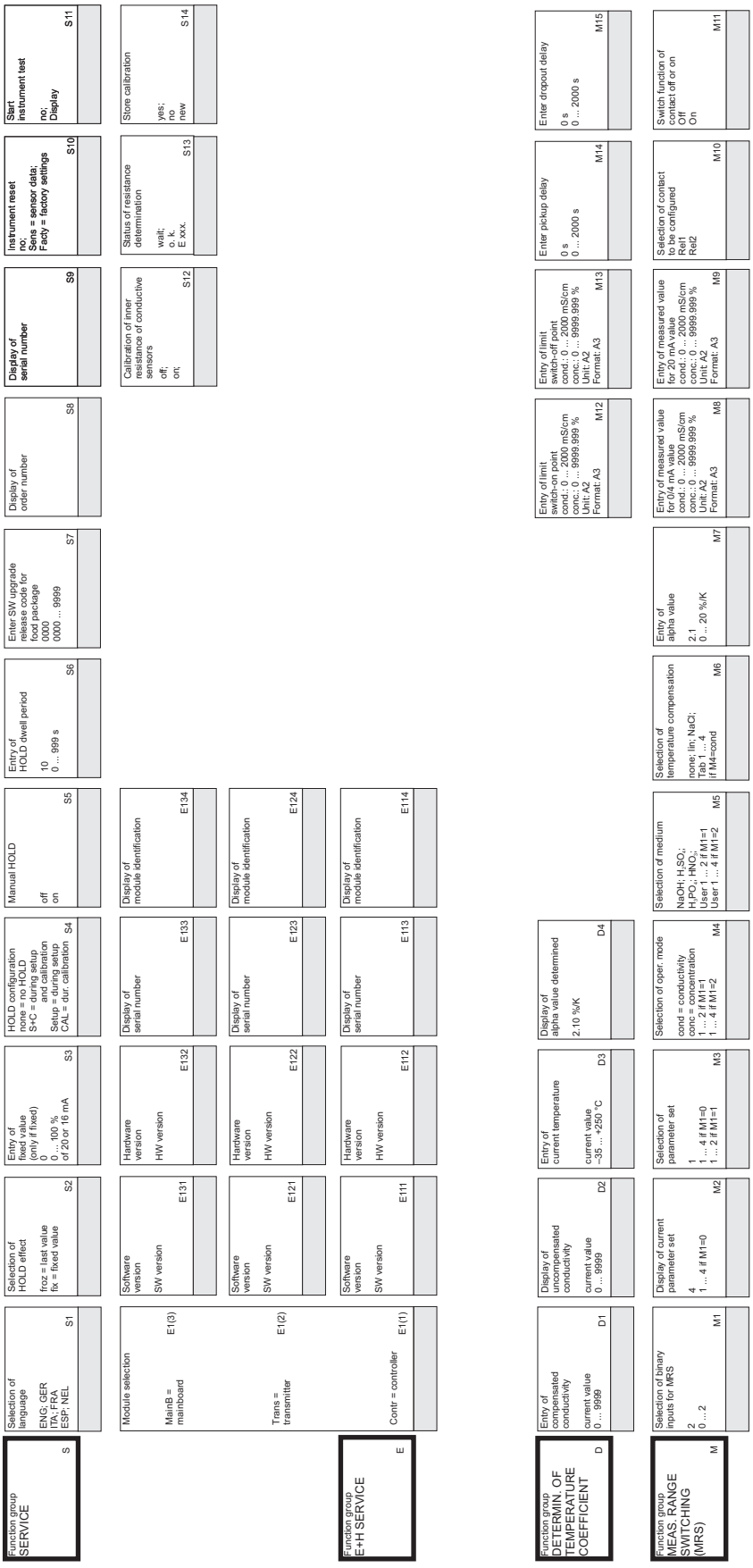
Function group SERVICE S
Selection of language ENG: GER ITA: FRA ESP: NEL S1
Selection of HOLD effect froz = last value fix = fixed value S2
Entry of fixed value (only if fixed) 0 ... 100 % cf 20 or 16 mA S3
HOLD configuration none = no HOLD S+C = during setup and calibration Setup = during setup CAL = dur. calibration S4
Manual HOLD off on S5
Entry of HOLD dwell period 10 0 ... 999 s S6
Enter SW upgrade release code for food package 0000 0000 ... 9999 S7
Display of order number S8
Display of serial number S9
Instrument reset no; Sens = sensor data; Facty = factory settings S10
Start instrument test no; Display S11
Module selection MainB = mainboard E1(3)
Software version SW version E131
Hardware version HW version E132
Display of serial number E133
Display of module identification E134
Trans = transmitter E1(2)
Software version SW version E121
Hardware version HW version E122
Display of serial number E123
Display of module identification E124
Contr = controller E1(1)
Software version SW version E111
Hardware version HW version E112
Display of serial number E113
Display of module identification E114
Calibration of inner resistance of conductive sensors off; on; S12
Status of resistance determination wait; o. k.; E xxx; S13
Store calibration yes; no new S14
Function group E+H SERVICE E
Function group DETERMIN. OF TEMPERATURE COEFFICIENT D
Entry of compensated conductivity current value 0 ... 9999 D1
Display of uncompensated conductivity current value 0 ... 9999 D2
Entry of current temperature current value –35 ... +250 °C D3
Display of alpha value determined 2.10 %/K D4
Function group MEAS. RANGE SWITCHING (MRS) M
Selection of binary inputs for MRS 2 0 ... 2 M1
Display of current parameter set 4 1 ... 4 if M1=0 M2
Selection of parameter set 1 1 ... 4 if M1=0 1 ... 2 if M1=1 M3
Selection of oper. mode cond = conductivity conc = concentration 1 ... 2 if M1=1 1 ... 4 if M1=2 M4
Selection of medium NaOH; H_2SO_4; H_3PO_4; HNO_3; User 1 ... 2 if M1=1 User 1 ... 4 if M1=2 M5
Selection of temperature compensation none; lin; NaCl; Tab 1 ... 4 if M4=cond M6
Entry of alpha value 2.1 0 ... 20 %/K M7
Entry of measured value for 0/4 mA value cond.: 0 ... 2000 mS/cm conc.: 0 ... 9999.999 % Unit: A2 Format: A3 M8
Entry of measured value for 20 mA value cond.: 0 ... 2000 mS/cm conc.: 0 ... 9999.999 % Unit: A2 Format: A3 M9
Entry of limit switch-on point cond.: 0 ... 2000 mS/cm conc.: 0 ... 9999.999 % Unit: A2 Format: A3 M12
Entry of limit switch-off point cond.: 0 ... 2000 mS/cm conc.: 0 ... 9999.999 % Unit: A2 Format: A3 M13
Enter pickup delay 0 s 0 ... 2000 s M14
Enter dropout delay 0 s 0 ... 2000 s M15
Selection of contact to be configured Rel1 Rel2 M10
Switch function of contact off or on Off On M11

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