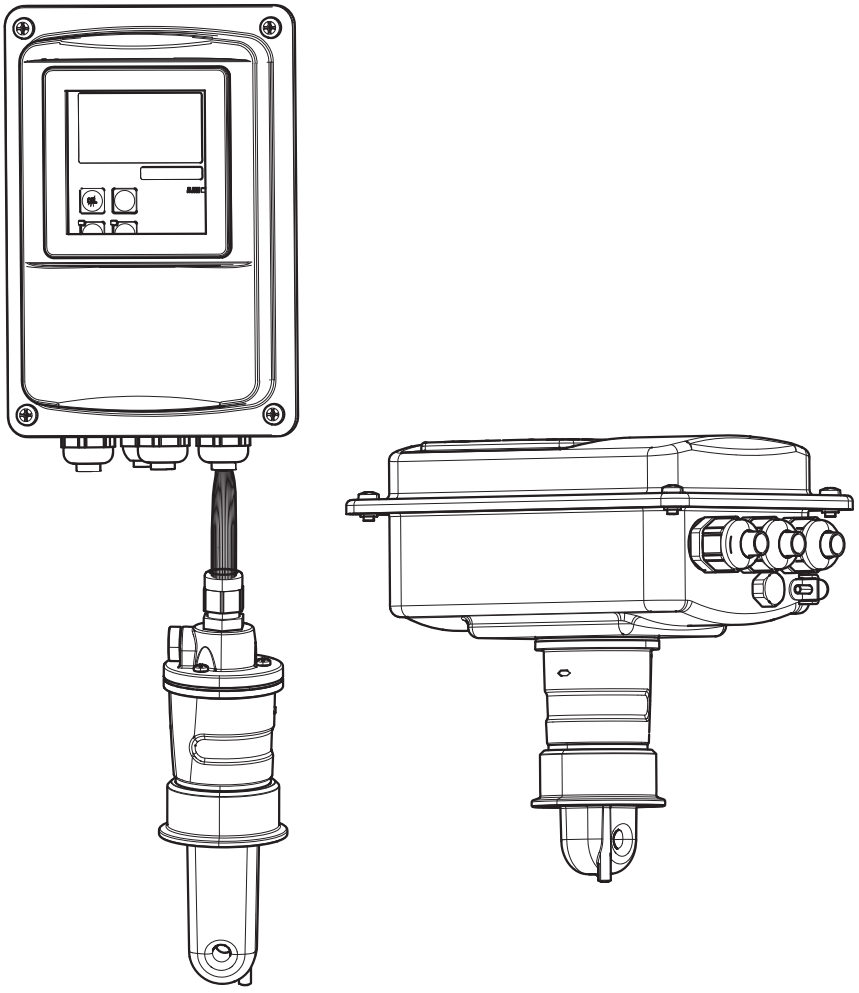
Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Operating Instructions

Smartec S CLD134

Conductivity Measuring System

Standard Number 74-03



BA401C/07/EN/13.11
71155454

Software version 1.13 or later

Endress+Hauser
People for Process Automation

Table of contents

1 Safety instructions

1.1 Designated use

Smartec S CLD134 is a field-tested and reliable transmitter used to determine the conductivity of liquid media.
It is particularly suitable for use in the foodstuffs industry.

Any other use than the one described here compromises the safety of persons and the entire measuring system and is not permitted.
The manufacturer is not liable for damage caused by improper or non-designated use.

1.2 Installation, commissioning and operation

Please note the following items:
- Installation, commissioning, operation and maintenance of the measuring system must only be carried out by trained technical personnel.
  Trained personnel must be authorized for the specified activities by the system operator.
- Electrical connection must only be carried out by a certified electrician.
- Technical personnel must have read and understood these Operating Instructions and must adhere to them.
- Before commissioning the entire measuring point, check all the connections. Ensure that electrical cables and hose connections are not damaged.
- Do not operate damaged products and secure them against unintentional commissioning. Mark the damaged product as being defective.
- Measuring point faults may only be rectified by authorized and specially trained personnel.
- If faults can not be rectified, the products must be taken out of service and secured against unintentional commissioning.
- Repairs not described in these Operating Instructions may only be carried out at the manufacturer's or by the service organization.

1.3 Operational safety

The transmitter has been designed and tested according to the state of the art and left the factory in perfect functioning order.
Relevant regulations and European standards have been met.

As the user, you are responsible for complying with the following safety conditions:
- Installation instructions
- Local prevailing 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 Return

If the transmitter has to be repaired, please return it *cleaned* to the sales center responsible. Please add a detailed failure description. If the failure diagnosis is not clear please send also the cable and the sensor.
Please use the original packaging, if possible.

Please enclose the completed "Declaration of Hazardous Material and De-Contamination" (copy the second last page of these Operating Instructions) with the packaging and also the shipping documents.

1.5 Notes on safety conventions and symbols

Safety symbols

Warning!
This symbol alerts you to hazards that can cause serious damage to the instrument or to persons if ignored.

Caution!
This symbol alerts you to possible faults which could arise from incorrect operation. They could cause damage to the instrument if ignored.

Note!
This symbol indicates important items of information.

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.

Alarm relay

Input

Output

DC voltage source

Temperature sensor

2 Identification

2.1 Device designation

2.1.1 Nameplate

Compare the order code on the nameplate (on the Smartec) with the product structure (see below) and check that it agrees with your order.
You can identify the instrument variant by the order code on the nameplate. Under "Codes", you can find the release code for the software upgrade "MRS".

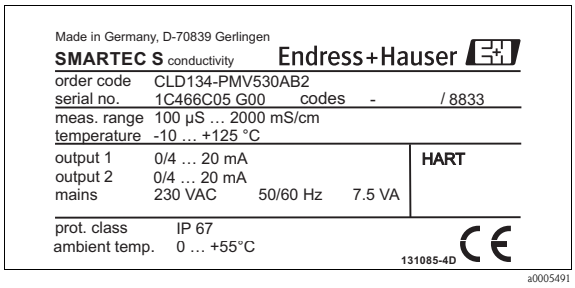


Fig. 1: Nameplate CLD134 (example)

2.1.2 Product structure Smartec S CLD134

Housing							
E	Transmitter only (without sensor)						
P	Compact version						
W	Separate transmitter, cable length 5 m / 16.41 ft						
X	Separate transmitter, cable length 10 m / 32.81 ft						
S	Separate transmitter, cable length 20 m / 65.62 ft						
	Process connection						
	000	Not selected (transmitter only)					
	MV5	Dairy fitting DIN 11851, DN 50[a]					
	AA5	Aseptic fitting DIN 11864-1 form A, pipe DIN 11850, DN 50					
	CS1	Clamp ISO 2852, 2" (long)					
	SMS	SMS 2"[b]					
	VA4	Varivent® N DN 40 to 125					
	BC5	NEUMO BioControl® D50					
		Cable entry					
		3	Cable gland M 20 x 1.5				
		5	Conduit adapter NPT ½ "				
			Power supply				
			0	230 V AC			
			1	115 V AC			
			5	100 V AC			
			8	24 V AC / DC			
				Current output / communication			
				AA	Current output conductivity, without communication		
				AB	Current output conductivity and temperature, without communication		
				HA	HART, current output conductivity		
				HB	HART, current output conductivity and temperature		
				PE	PROFIBUS-PA, no current output		
				PF	PROFIBUS-PA, M 12 connector, no current output		
				PP	PROFIBUS-DP, no current output		
					Additional features		
					1	Basic version	
					2	Remote parameter set switching	
					3	Biological reactivity tests according to USP <87>, <88> class VI	
					4	Remote parameter set switching and biological reactivity tests according to USP <87>, <88> class VI	
					5	CRN approval (according to ASME B31.3)[c]	
					6	CRN approval (according to ASME B31.3)[c] + Biological reactivity tests according to USP <87>, <88> class VI	
CLD134-							complete order code

[a] Dairy pipe fitting DIN 11851 is generally not considered hygienic. With the adapter SKS Siersma, it meets the 3-A standards requirements.
[b] Process connection is not considered hygienic according to the requirements of EHEDG.
[c] CRN approval only valid for process connections MV5, CS1 and VA4.

2.1.3 Basic version and function extensions

Functions of the basic version	Options and their functions
■ Measurement ■ Calibration of cell constant ■ Calibration of residual coupling ■ Calibration of installation factor ■ Read instrument parameters ■ Linear current output ■ Current output simulation ■ Service functions ■ Temperature compensation selectable (e.g. 1 free coefficient table) ■ Concentration measurement selectable (4 defined curves, 1 free table) ■ Relay as alarm contact	■ Second current output for temperature (hardware option) ■ HART communication ■ PROFIBUS communication **Remote parameter set switching (software option)**: ■ Remote switching of max. 4 parameter sets (measuring ranges) ■ Temperature coefficients can be determined ■ Temperature compensation selectable (e.g. 4 free coefficient tables) ■ Concentration measurement selectable (4 defined curves, 4 free tables) ■ Check of measuring system by PCS alarm (live check) ■ Relay can be configured as alarm or limit contact **Biological reactivity according to USP <87>, <88> class VI**

2.2 Scope of delivery

The scope of delivery of the compact version inlcudes:
- Smartec S CLD134 compact measuring system with integrated sensor
- Terminal strip set
- Operating Instructions BA401C/07/en
- Versions with HART communication only:
  Operating Instructions Field communication with HART, BA212C/07/en
- Versions with PROFIBUS interface only:
  – Operating Instructions Field communication with PROFIBUS, BA213C/07/en
  – M12 connector (-******PF* versions only)

The scope of delivery of the separate version includes:
- Smartec S CLD134 transmitter
- CLS54 inductive sensor with fixed cable
- Terminal strip set
- Operating Instructions BA401C/07/en
- Versions with HART communication only:
  Operating Instructions Field communication with HART, BA212C/07/en
- Versions with PROFIBUS interface only:
  – Operating Instructions Field communication with PROFIBUS, BA213C/07/en
  – M12 connector (-******PF* versions only)

The scope of delivery of version "transmitter without sensor" includes:
- Smartec S CLD134 transmitter
- Terminal strip set
- Operating Instructions BA401C/07/en
- Versions with HART communication only:
  Operating Instructions Field communication with HART, BA212C/07/en
- Versions with PROFIBUS interface only:
  – Operating Instructions Field communication with PROFIBUS, BA213C/07/en
  – M12 connector (-******PF* versions only)

2.3 Certificates and approvals

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.

FDA
All materials in contact with medium are listet at FDA.

EHEDG
The sensor CLS54 has been certified for in-place cleanability according to EHEDG document 2.

Note!
The cleanability of a sensor also depends on the way of installation. To install the sensor in a pipe system use the appropriate and EHEDG certified flow assembly for the respective process connection.

3-A
Certification according to 3-A Standard 74-03 ("3-A Sanitary Standards for Sensor and Sensor Fittings and Connections Used on Milk and Milk Products Equipment").

Biological reactivity (USP class VI) (optional)
Certificate on biological reactivity tests according to USP (United States Pharmacopeia) part <87> und part <88> class VI with traceability of the materials in contact with medium.

Pressure approval
Canadian pressure approval for pipes according to ASME B31.3

3 Installation

3.1 Quick installation guide

The following procedure should be followed for a complete measuring point installation:

Compact version:
- Perform an air set. Install the compact version at the measuring point (see chapter "Mounting CLD134 compact version").
- Connect the compact version as described in the chapter "Electrical connection".
- Start up the compact version as described in the chapter "Commissioning".

Separate version:
- Mount the transmitter (see chapter "Mounting CLD134 separate version").
- If you have not yet installed the sensor at the measuring point, perform an Airset and install the sensor (see the Technical Information of the sensor).
- Connect the sensor to the Smartec S CLD134 as described in the chapter "Electrical connection".
- Connect the transmitter as described in the chapter "Electrical connection".
- Start up the Smartec S CLD134 as described in the chapter "Commissioning".

3.1.1 Measuring system

A complete measuring system comprises:
- the Smartec S CLD134 transmitter (separate version)
- the CLS54 conductivity sensor with integrated temperature sensor and fixed cable
  or
- the CLD134 compact version with integrated CLS54 conductivity sensor

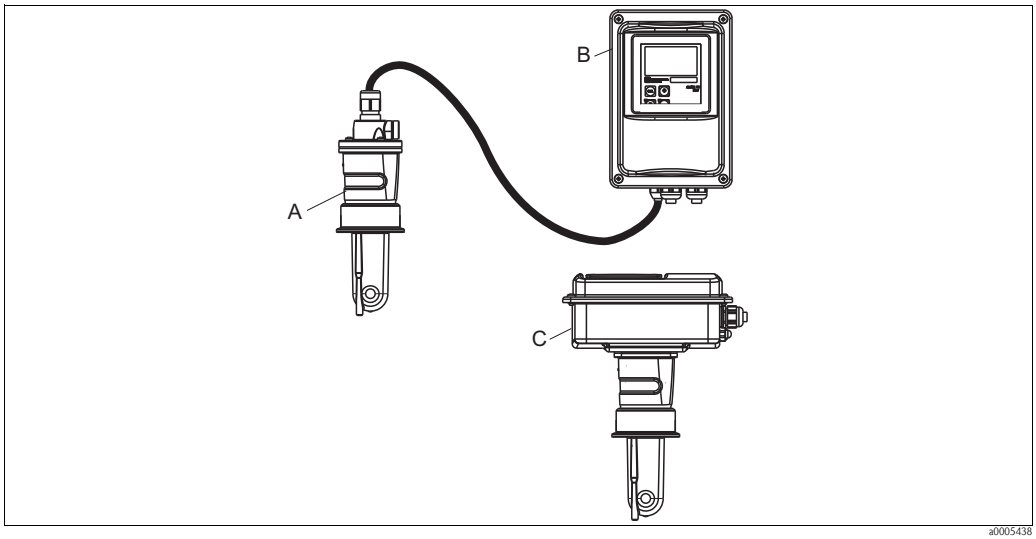


Fig. 2: Complete measuring systems Smartec S CLD134 as separate transmitter and compact version

A CLS54 conductivity sensor
B Smartec S CLD134 transmitter
C Smartec S CLD134 compact version with integrated CLS54

3.2 Incoming acceptance, transport, storage

- 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.

3.3 Installation conditions

3.3.1 Notes on installation

Installation positions
The sensor has to be immersed completely into the media. Avoid bubbles in the area of the sensor.

Note!
For use in hygienic applications only use materials that comply with 3-A standards 74-03 and the FDA requirements. The cleanability of a sensor also depends on the way of installation. To install the sensor in a pipe system use the appropriate and EHEDG certified flow assembly for the respective process connection.

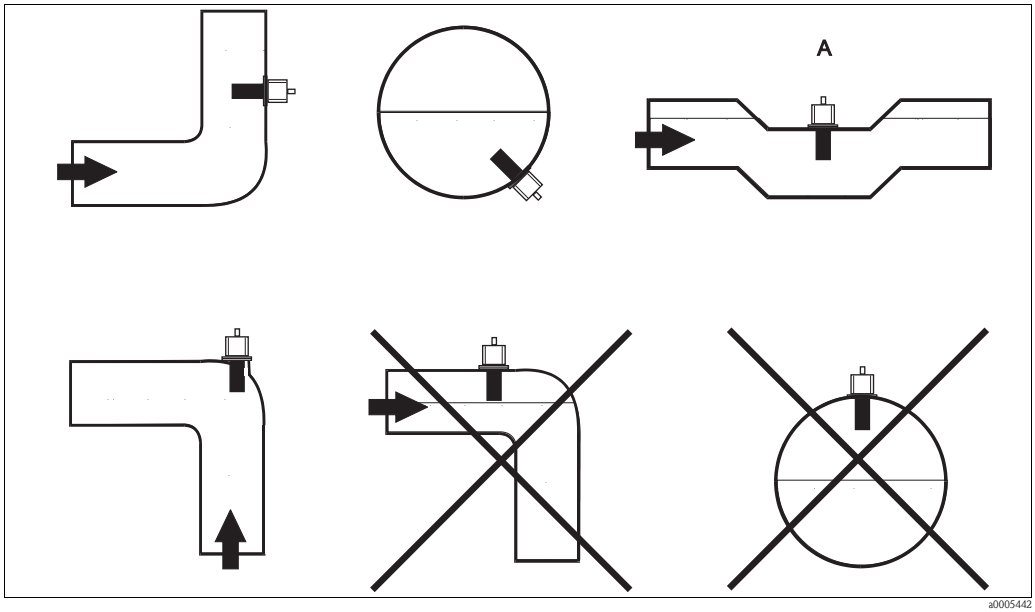


Fig. 3: Installation positions of conductivity sensors

A Not for hygienic applications

Air set
Perform an air set before sensor installation (see chapter "Calibration"). Make sure that the instrument is ready for operation, i.e. mains and sensor are connected.

Wall distance

The sensor's distance from the pipe wall affects the measuring accuracy (see Fig. 5).

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); see Fig. 5.
The determination of the installation factor is described in the chapter "Calibration".

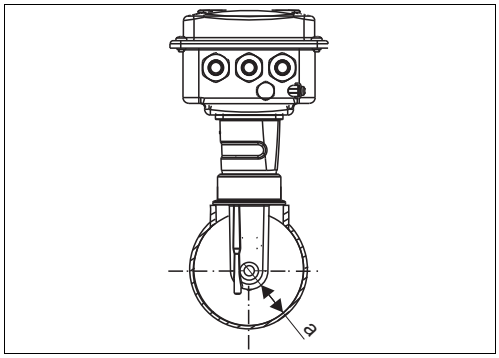


Fig. 4: Installation of CLD134

a Wall distance

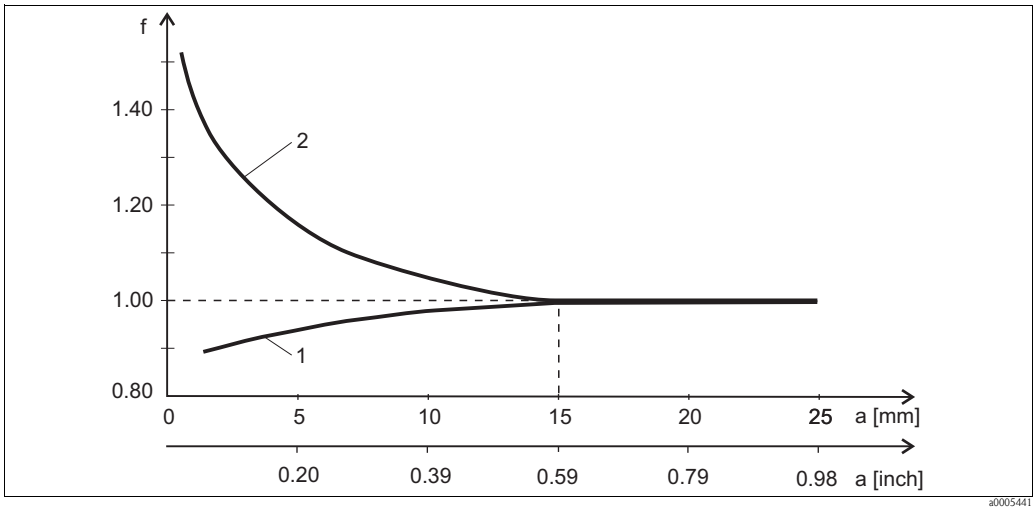


Fig. 5: Relationship between installation factor and distance from wall a

1 Electrically conductive pipe wall
2 Insulating pipe wall

3.3.2 CLD134 separate version

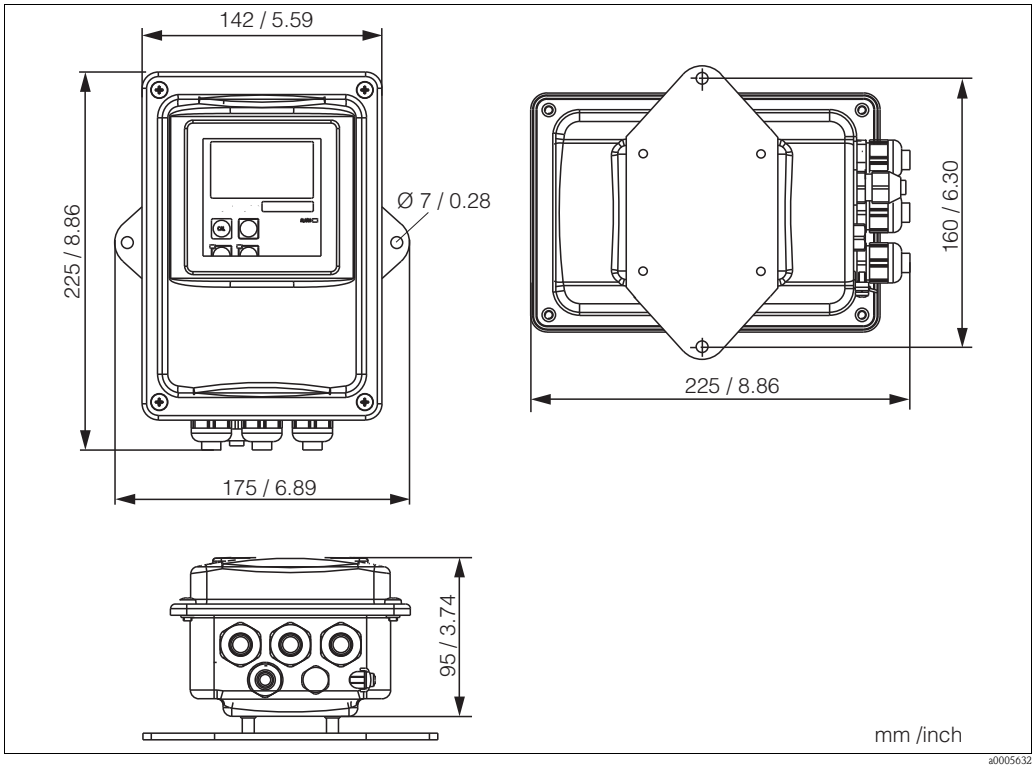


Fig. 6: CLD134 wall mounting with mounting plate

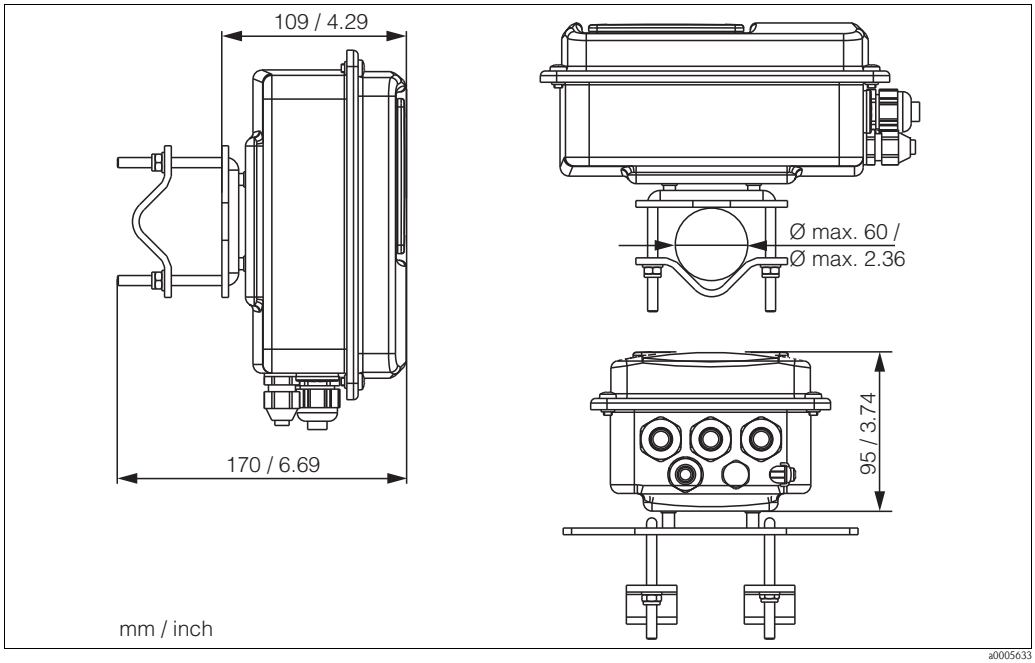


Fig. 7: CLD134 mounting on pipes Ø 60 mm (2.36")

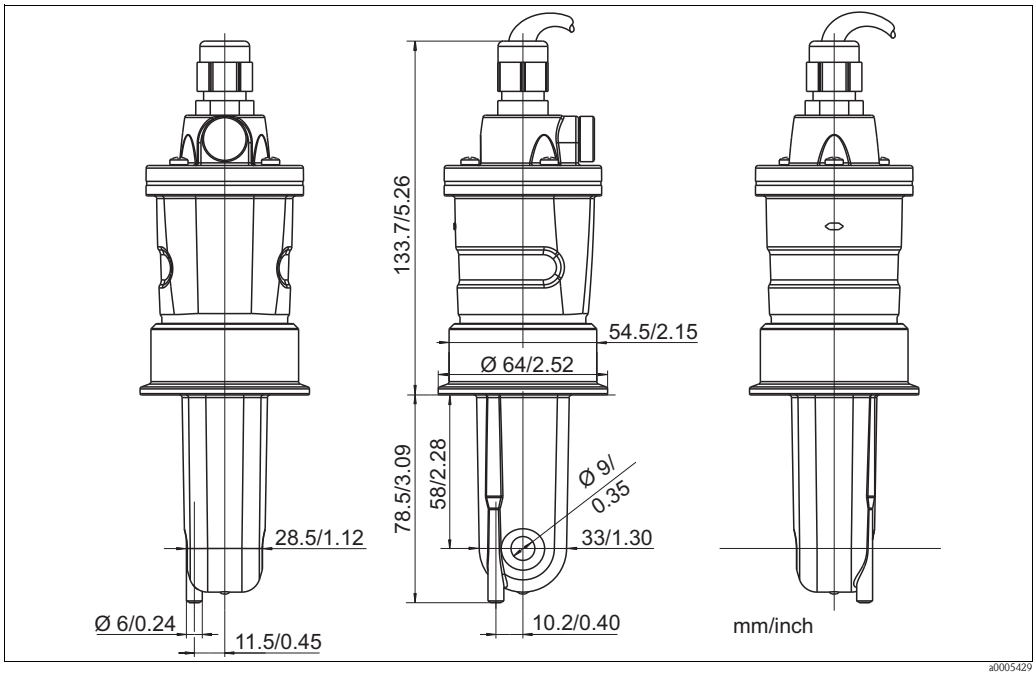


Fig. 8: Dimensions CLS54 (long version)

Conductivity sensors for the separate transmitter

CLS54 conductivity sensors with various process connections covering all common installation conditions are available for the separate version.

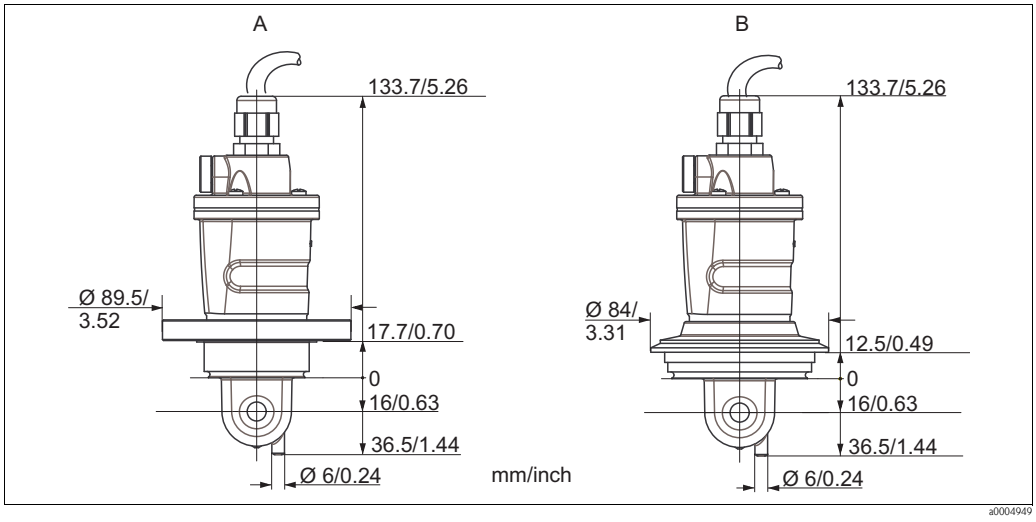


Fig. 9: Process connections CLS54 (short version)

A NEUMO BioControl D50
for pipe connection: DN 40 (DIN 11866 series A, DIN 11850)
DN 42,4 (DIN 11866 series B, DIN EN ISO 1127)
2" (DIN 11866 series C, ASME-BPE)
B Varivent N DN 40 to 125

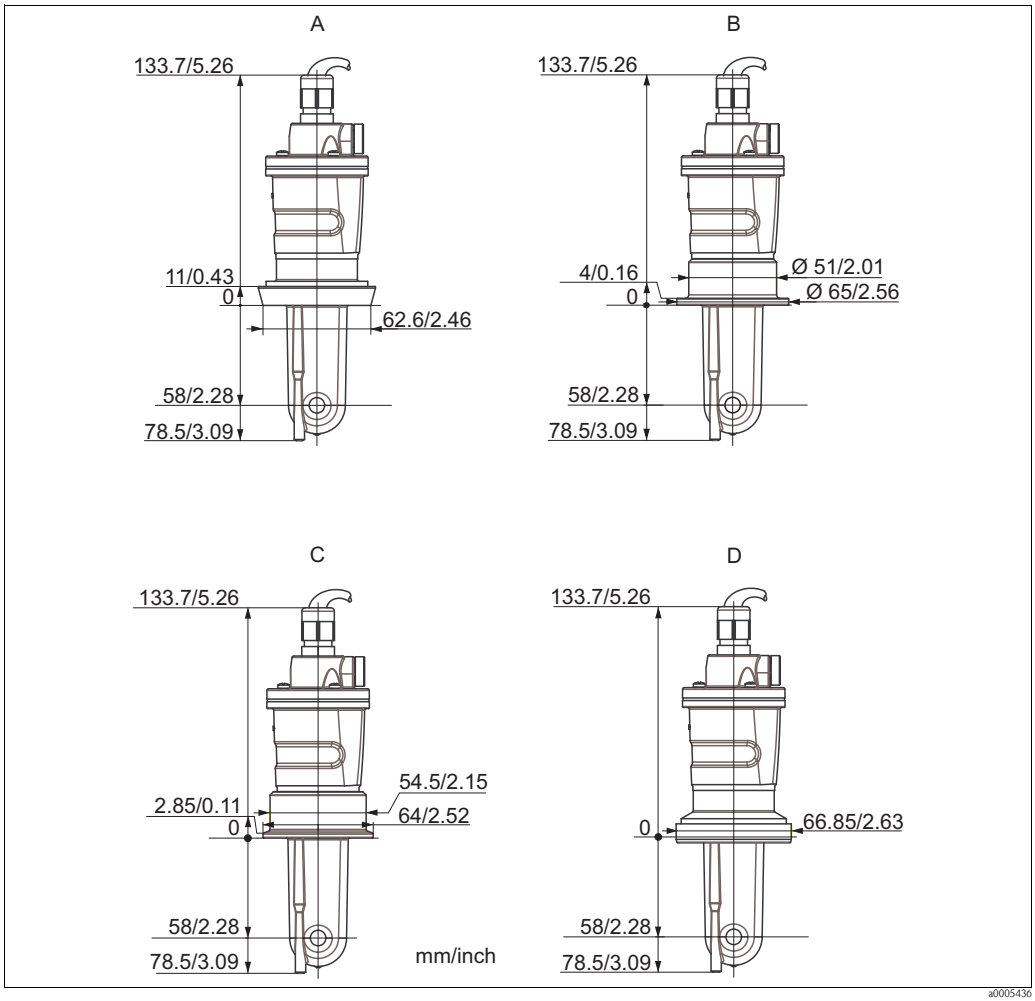


Fig. 10: Process connections CLS54 (long version)

A Dairy pipe fitting DIN 11851, DN 50 (union nut is included)
B SMS 2" (union nut is included)
C Clamp ISO 2852, 2"
D Aseptic- fitting DIN 11864-1 form A, for pipe according to DIN 11850, DN 50

3.3.3 CLD 134 compact version

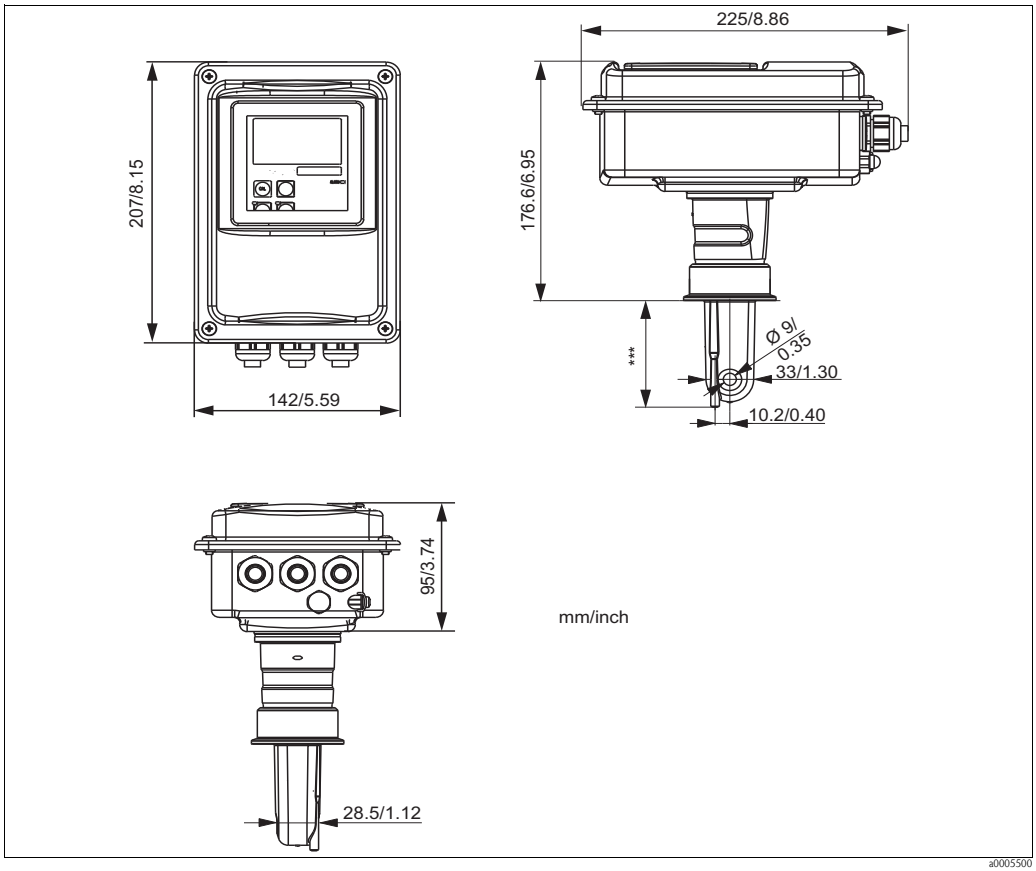


Fig. 11: Dimensions of CLD134 compact version

**** depending on ordered process connection*

Process connections

Various process connections covering all common installation conditions are available for the compact version.

The compact version is installed at the measuring point with the required process connection.

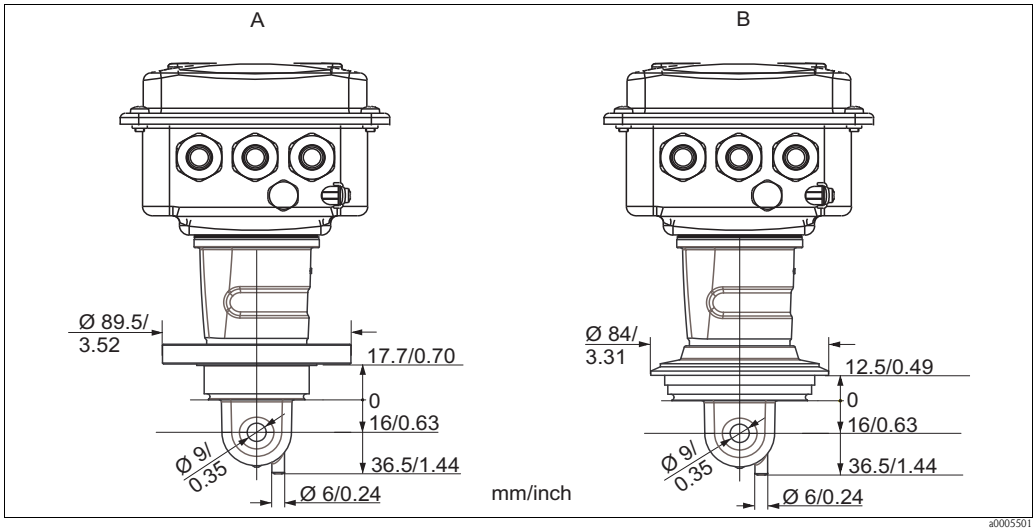


Fig. 12: Process connections compact version (short)

A NEUMO BioControl D50
for pipe connection: DN 40 (DIN 11866 series A, DIN 11850)
DN 42,4 (DIN 11866 series B, DIN EN ISO 1127)
2" (DIN 11866 series C, ASME-BPE)

B Varivent N DN 40 to 125

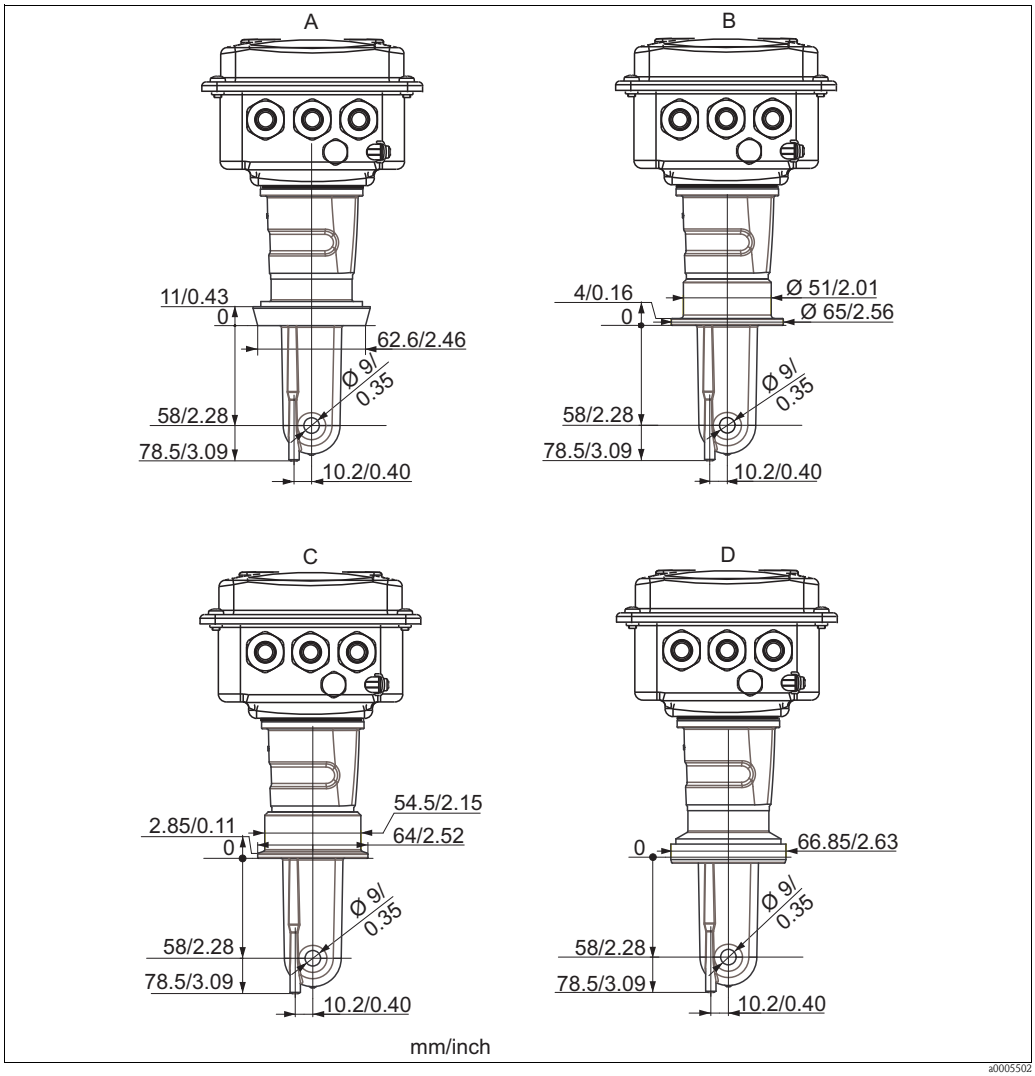


Fig. 13: Process connections compact version (long)

A Dairy pipe fitting DIN 11851 DN 50 (union nut is included)
B SMS 2" (union nut is included)
C Clamp ISO 2852, 2"
D Aseptic fitting DIN 11864-1 form A, for pipe according to DIN 11850, DN 50

3.4 Installation instructions

3.4.1 Mounting CLD134 separate version

Wall mounting
For wall mounting, attach the mounting plate to the wall by drilling holes as required. Anchors and screws are to be provided by the operator.

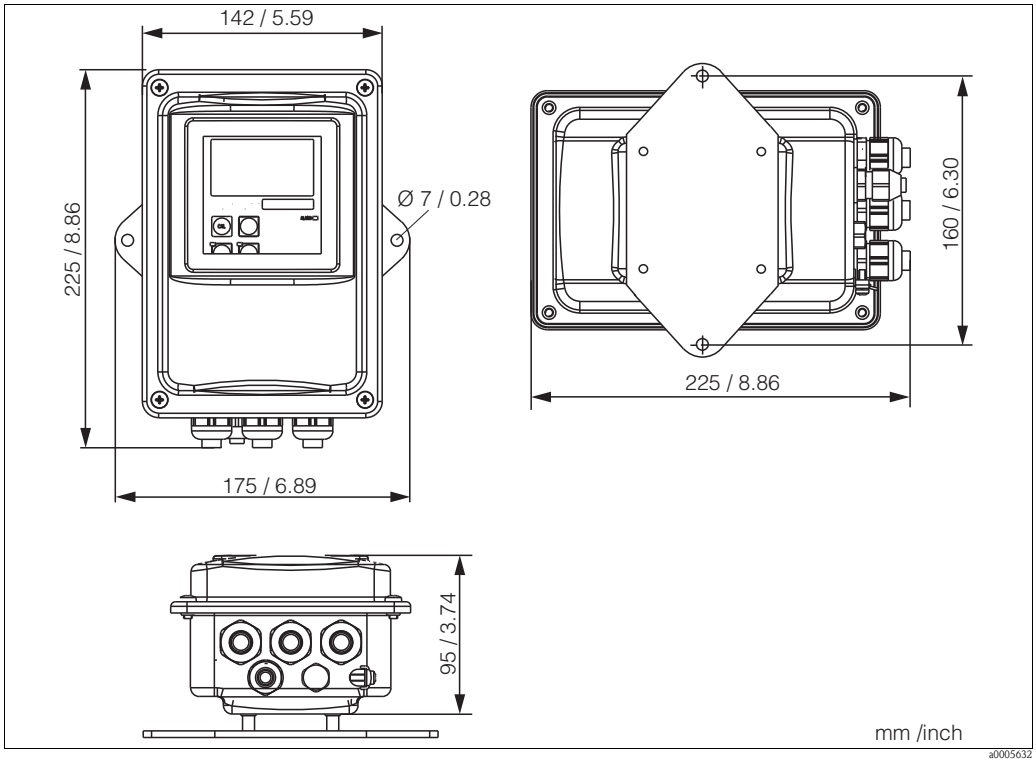


Fig. 14: Wall mounting of CLD134 separate version

Note!
Wall mounting is not recommended for hygenic sensitive areas

Post mounting
A mounting kit for installing the housing on horizontal or vertical posts or pipes (max. Ø 60 mm / Ø 2.36")

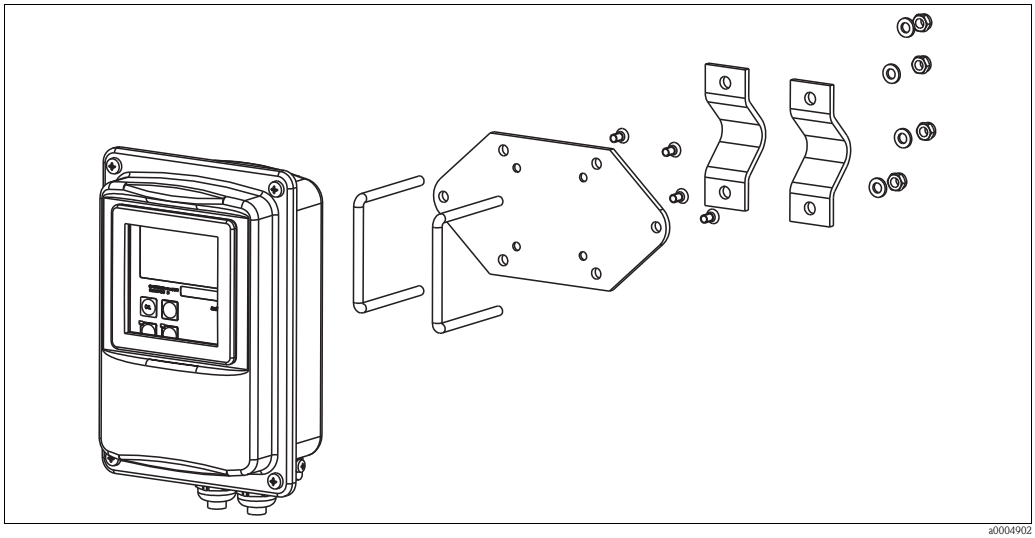


Fig. 15: Mounting kit for installing the CLD134 separate version on posts

Note!
For use in hygienic sensitive areas, shorten the threads as much as possible.

1. Remove the mounting plate.
2. Insert the holding bars through the pre-drilled holes of the mounting plate and screw the mounting plate onto the transmitter.
3. Use the brackets to install the Smartec S on the post or pipe (Fig. 16).

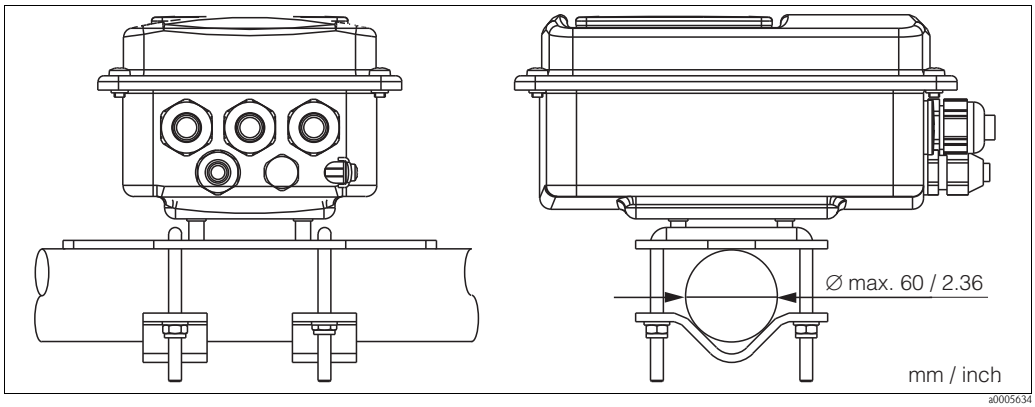


Fig. 16: Post mounting of CLD134 separate version

3.4.2 Mounting CLD134 compact version or CLS54 sensor for separate version

Note!
Perform an Airset and calibrate the sensor before installing the compact version or the sensor.

Install the compact version or the CLS54 sensor directly on the pipe or vessel socket via the process connection (depending on ordered version).

1. When installing the Smartec S CLD134 or the sensor, make sure that the flow opening of the sensor is oriented in the flow direction of the medium. An orientation arrow on the sensor facilitates orientation.
2. Tighten the flange.

Note!
- Choose the immersion depth of the sensor in the medium such that the coil body is completely immersed.
- Please observe the notes on the wall distance in the chapter "Installation conditions".
- Please observe the limits for the medium and ambient temperature when using the compact version (see chapter "Technical data").

Sensor positioning: compact version

The sensor in the compact housing must be oriented in the flow direction.

If you need to reorient the sensor in relation to the housing, proceed as follows:

1. Remove the cover.
2. Loosen the screws of the electronics box and carefully remove the box from the housing.
3. Loosen the three sensor fastening screws until the sensor can be turned.
4. Align the sensor and tighten the screws. Do not exceed the maximum torque of 1.5 Nm!
5. Reassemble the transmitter housing in reverse sequence of operations.

Note!
For exact positions of the electronics box and the sensor screws, see the exploded view in the chapter "Spare parts".

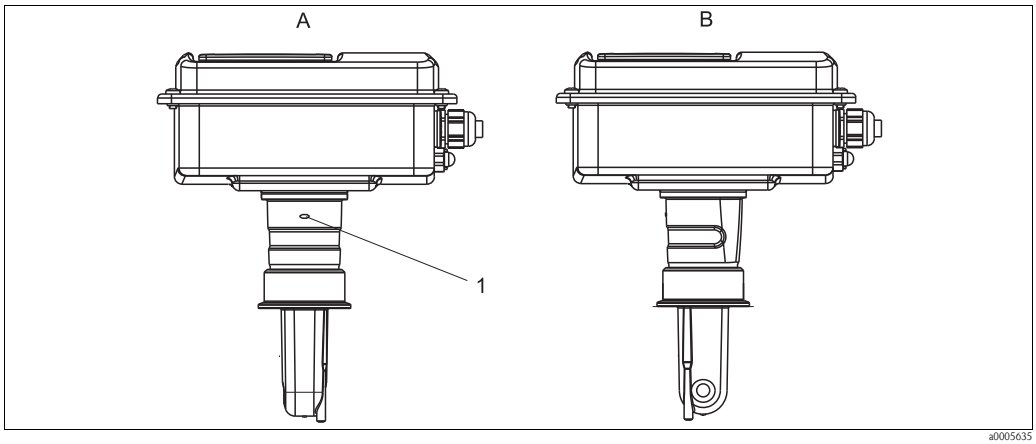


Fig. 17: Sensor orientation in the transmitter housing

A Standard orientation
B Sensor turned by 90°
1 Orientation arrow

3.5 Post-installation check

- After installation, check the measuring system for damages.
- Check the sensor orientation to the flow direction of the medium.
- Check that the coil body of the sensor is completely immersed in the medium.

4 Wiring

4.1 Electrical connection

Warning!
- 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.
- Ensure that there is no voltage at the power cable before beginning the connection work.

4.1.1 Electrical connection of transmitter

Proceed as follows to connect the Smartec S CLD134:

1. Loosen the 4 Phillips screws on the housing cover and remove the cover.
2. Warning!
   Do not remove the cover frame while the instrument is energized!

   Remove the cover frame from the terminal blocks. To do this, introduce a screwdriver in the recess (A) according to Fig. 18 and push the tab inward (B).
3. Thread the cables through the open cable glands into the housing according to the terminal assignments in Fig. 19.
4. Connect the power wires according to the terminal assignments in Fig. 20.
5. Connect the alarm contact according to the terminal assignments in Fig. 20.
6. Connect the housing ground.
7. Separate version: Connect the sensor according to the terminal assignments in Fig. 20.
   In the case of the separate version, the conductivity sensor CLS54 is connected using the shielded multi-core sensor cable. Preparation instructions are supplied with the cable. Use junction box VBM (see chapter "Accessories") to extend the measuring cable. The maximum cable length if extended using a junction box is 55 m.
8. Tighten the cable glands firmly.

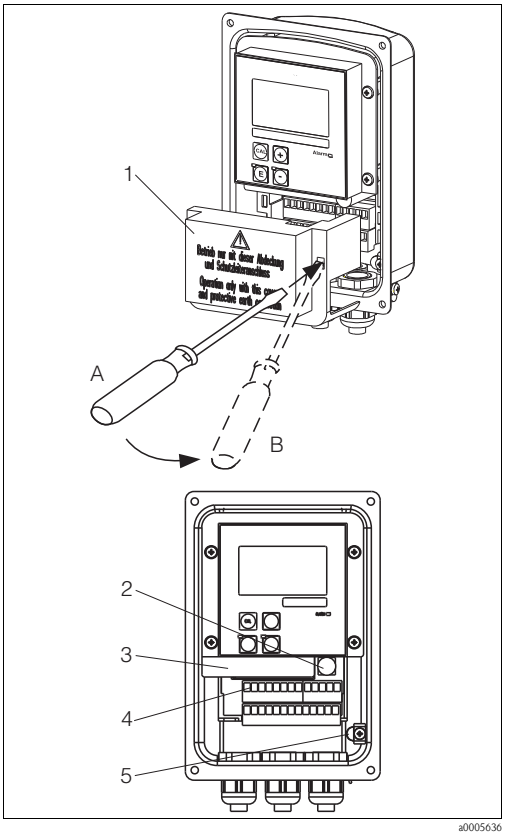


Fig. 18: View of housing with cover removed

1 Cover frame
2 Fuse
3 Removeable electronics box
4 Terminals
5 Housing ground

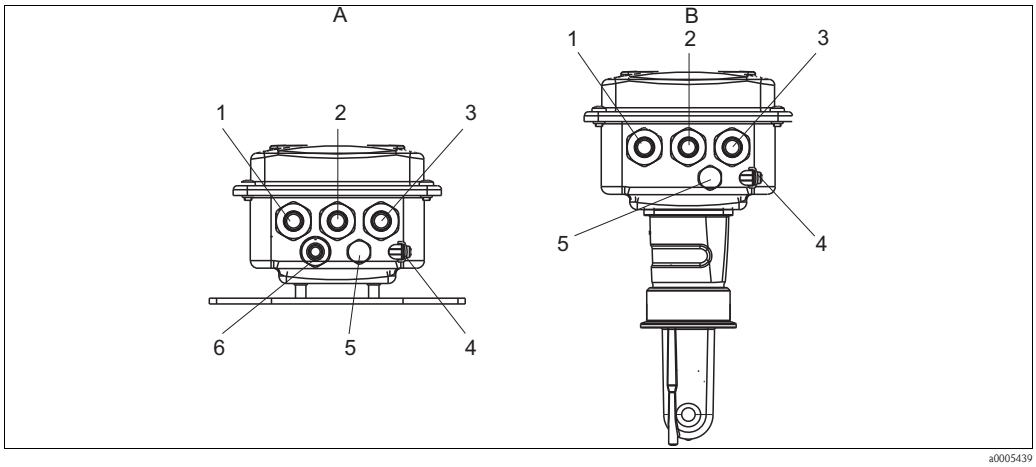


Fig. 19: Terminal assignments of cable glands on Smartec S CLD134

A Separate version
1 Cable gland for analog output, binary input
2 Cable gland for alarm contact
3 Cable gland for power supply
4 Housing ground
5 Pressure comp. element PCE (Goretex®- filter)
6 Cable gland for sensor connection, M 16x1.5

B Compact version
1 Cable gland for analog output, digital input
2 Cable gland for alarm contact
3 Cable gland for power supply
4 Housing ground
5 Pressure comp. element PCE (Goretex®- filter)

Wiring diagram

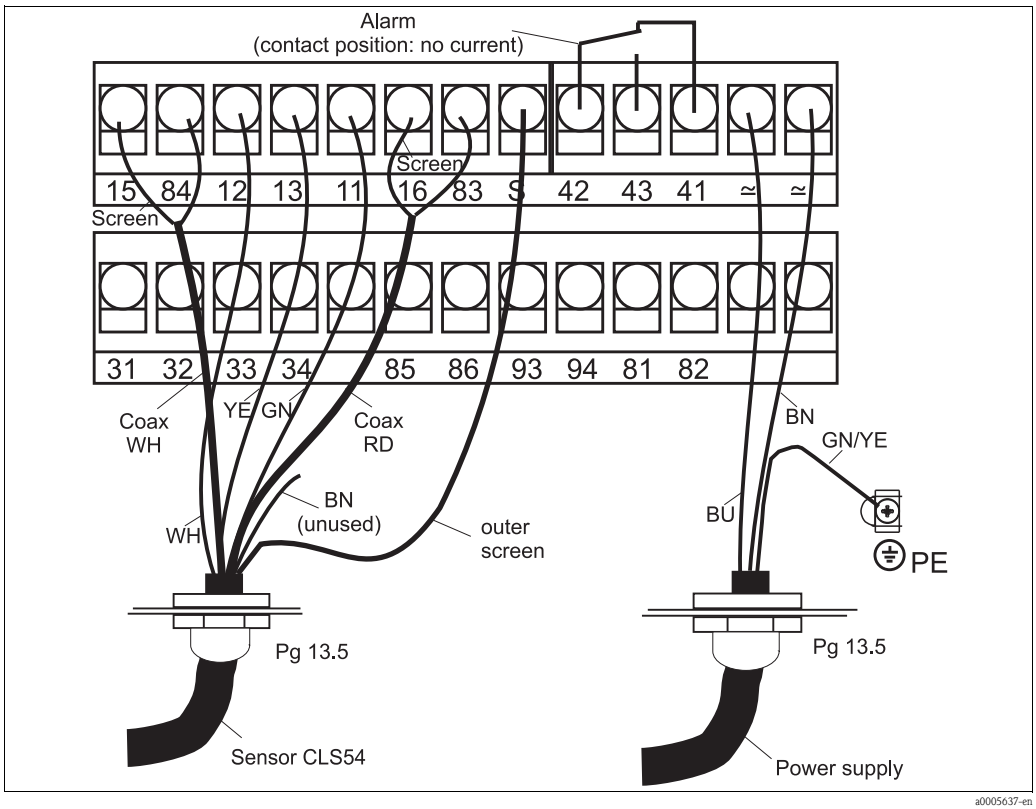


Fig. 20: Electrical connection of Smartec S CLD134

Connection diagram

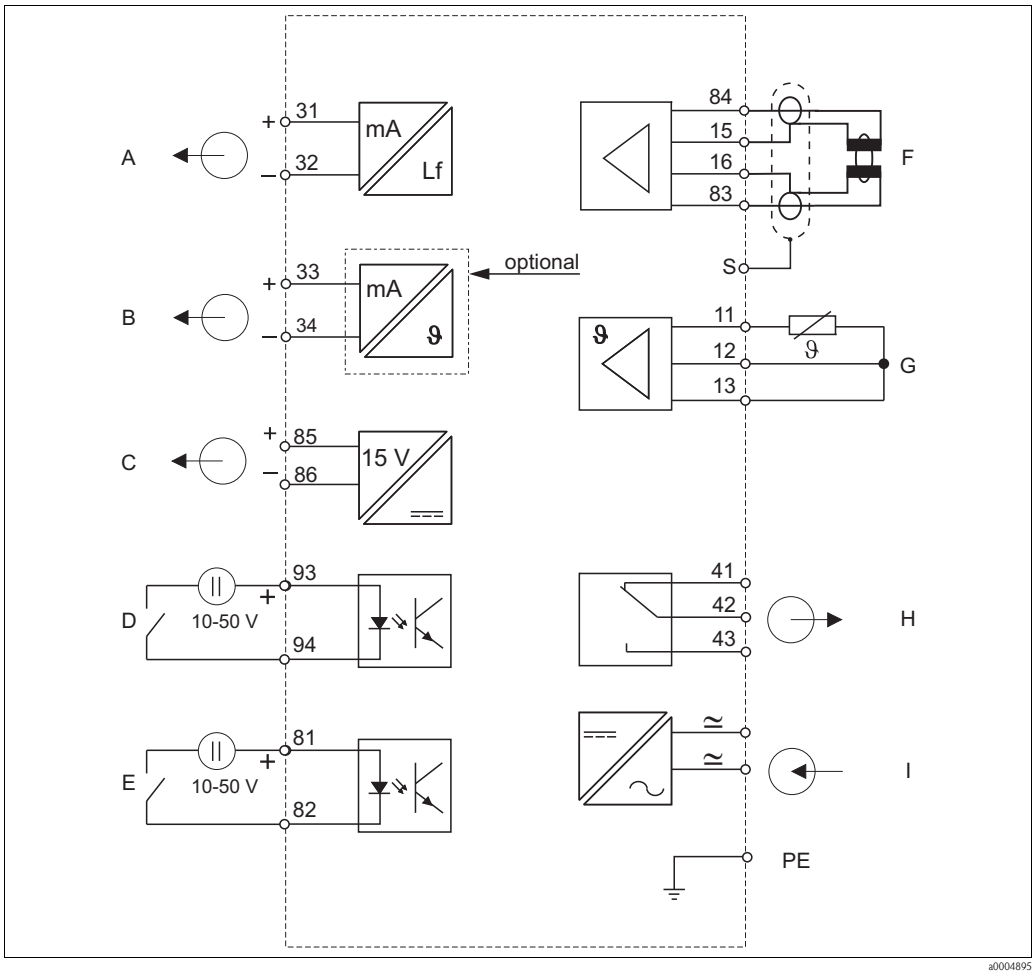


Fig. 21: Electrical connection of Smartec S CLD134

A	*Signal output 1 conductivity*	*F*	*Conductivity sensor*
B	*Signal output 2 temperature*	*G*	*Temperature sensor*
C	*Auxiliary power output*	*H*	*Alarm (contact position: no current)*
D	*Binary input 2 (MRS1+2)*	*I*	*Power supply*
E	*Binary input 1 (hold / MRS 3+4)*	*MRS*	*Remote parameter set switching (measuring range switching)*

Connection of binary inputs

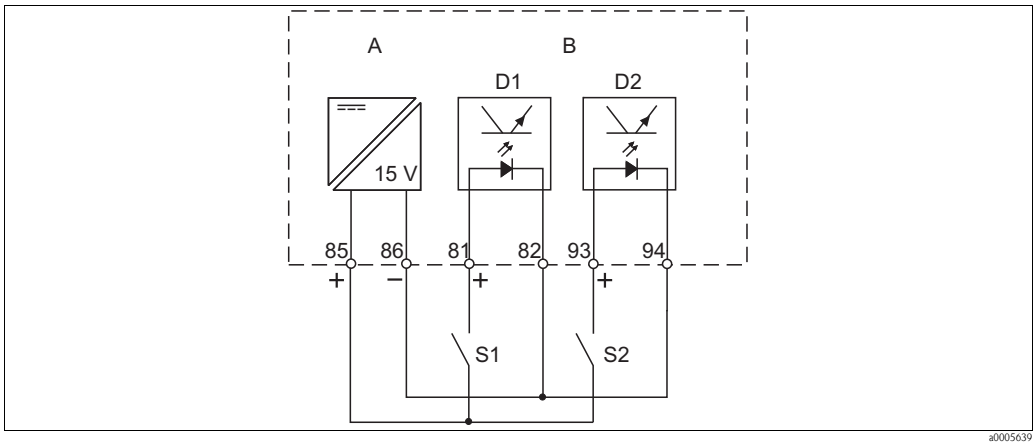


Fig. 22: Connection of binary inputs when using external contacts

A Auxiliary power output
B Contact inputs D1 and D2
S1 External contacts, not energized
S2 External contacts, not energized

Connection compartment sticker

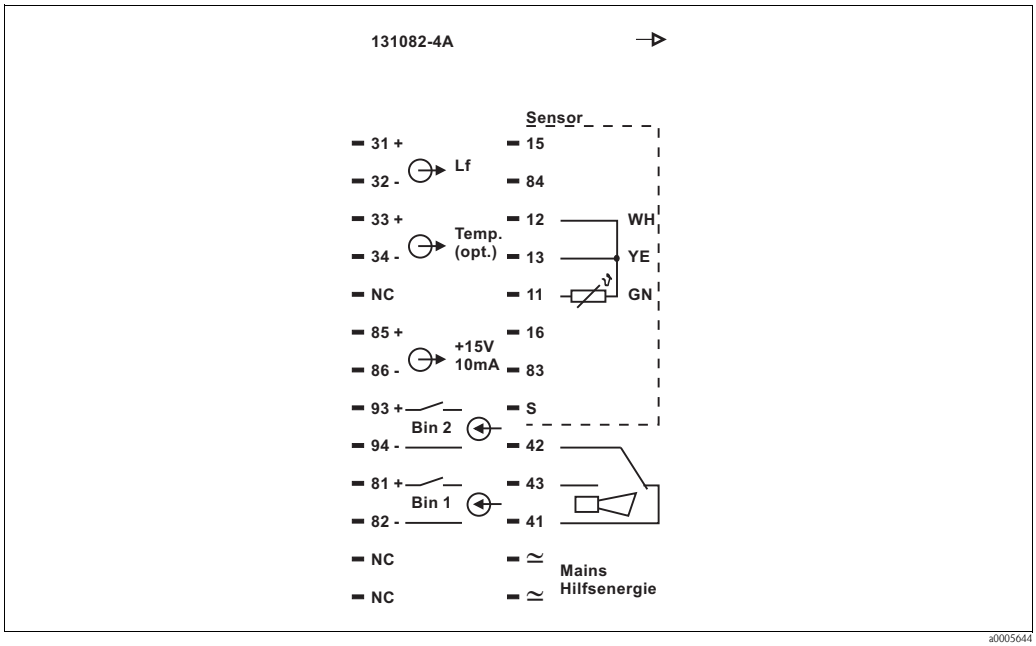


Fig. 23: Connection compartment sticker of Smartec S

Note!
The protection class of this instrument is I. The metal housing must be connected to PE.

Caution!
- Terminals designated as NC may not be switched.
- Undesignated terminals may not be switched.

Structure and termination of measuring cable

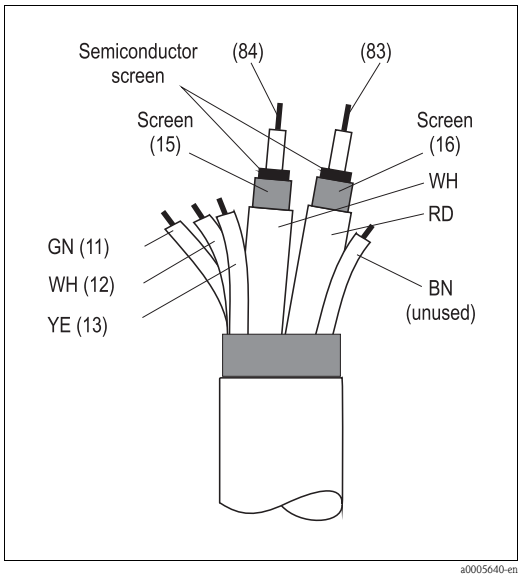


Fig. 24: Structure of sensor cable

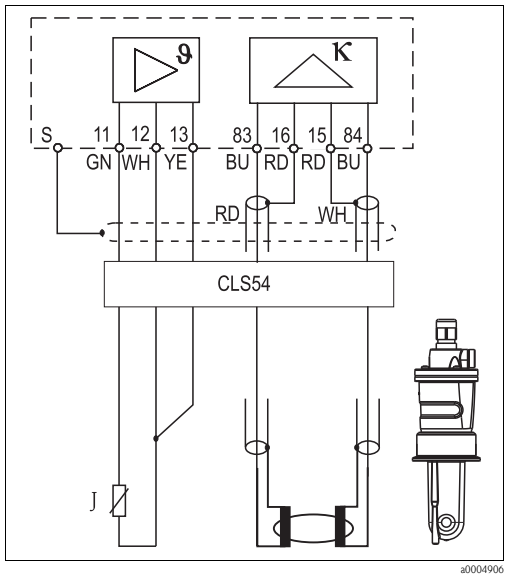


Fig. 25: Electrical connection of the CLS54 sensor for the separate version

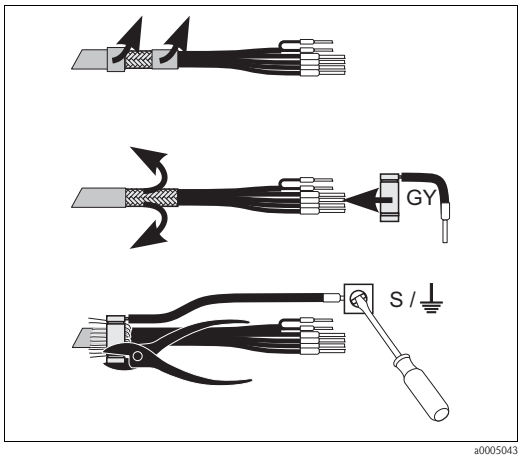


Fig. 26: Screen connection

Install the ready-made special measuring cable as shown in the figure:

- Insert the cable through a cable gland into the wiring compartment.
- Strip approx. 3 cm (1.2 ") of the braided screen and fold it back over the cable insulation.
- Push the crimping ring attached to the supplied screen connection over the prepared braided screen and pull the ring tight with a pair of pliers.
- Connect the litz wire to the screen connection.
- Connect the remaining wires according to the connection diagram.
- Tighten the cable gland.

4.2 Alarm contact

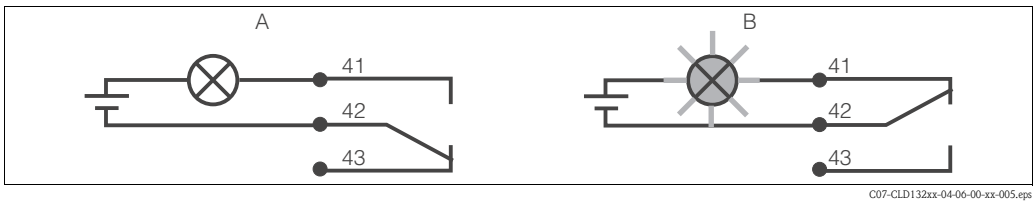


Fig. 27: Recommended fail-safe circuit for an alarm contact
A Normal operating state *B Alarm state*

Normal operating state
- Instrument in operation
- No error message available (Alarm LED off)

→ Relay picked up
→ Contact 42/43 closed

Alarm state
- Error message available (Alarm LED red) or
- Instrument defective or voltage-free (Alarm LED off)

→ Relay dropped out
→ Contact 41/42 closed

4.3 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?	
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 (if present)?	Grounding at place of installation

5 Operation

5.1 Quick operation guide

You have the following options of operating Smartec S:
- Local operation via operating keys
- Via HART® interface (optional, for corresponding order version) via:
  – HART® hand-held terminal or
  – PC with HART® modem and Commuwin II software
- Via PROFIBUS PA/DP (optional, for corresponding order version)
  PC with a corresponding interface and the Commuwin II software (see "Accessories") or via programmable logic controller (PLC).

Note!
For operation via HART or PROFIBUS PA/DP, read the corresponding chapters in the additional operating instructions:
- PROFIBUS PA/DP, field communication with Smartec S CLD134, BA213C/07/en
- HART®, field communication with Smartec S CLD134, BA212C/07/en

The following chapters describe local operation via operating keys.

5.2 Display and operating elements

5.2.1 Display

LED indicators

ALARM Alarm indication for continuous limit violation, temperature sensor failure or system errors (see error list in chapter "Troubleshooting").

Liquid crystal display

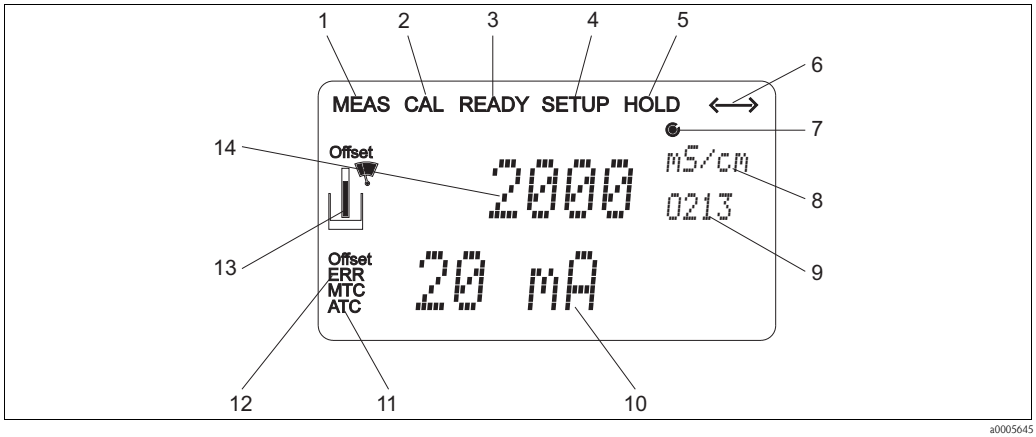


Fig. 28: LCD of Smartec S CLD134

1 Measuring mode indicator (normal operation)
2 Calibration mode indicator
3 Calibration complete indicator
4 Setup mode indicator (configuration)
5 "Hold" mode indicator (outputs reflect last current status)
6 Signal reception indicator for units with communication
7 Indication of relay state: ○ inactive, ◉ active
8 In measuring mode: variable measured
In setup mode: parameter adjusted
9 Function coding display
10 In measuring mode: secondary measured value
In setup / calibr. mode: e.g. parameter
11 Manual / automatic temperature compensation display
12 Error indicator
13 Sensor symbol, flashes during calibration
14 In measuring mode: Main measured valued
In setup / calibr. mode: e.g. parameter

5.2.2 Operating elements

The operating keys are located underneath the housing cover. The display and the alarm LED are visible through the viewing window. For operation, open the housing cover by removing the 4 screws.

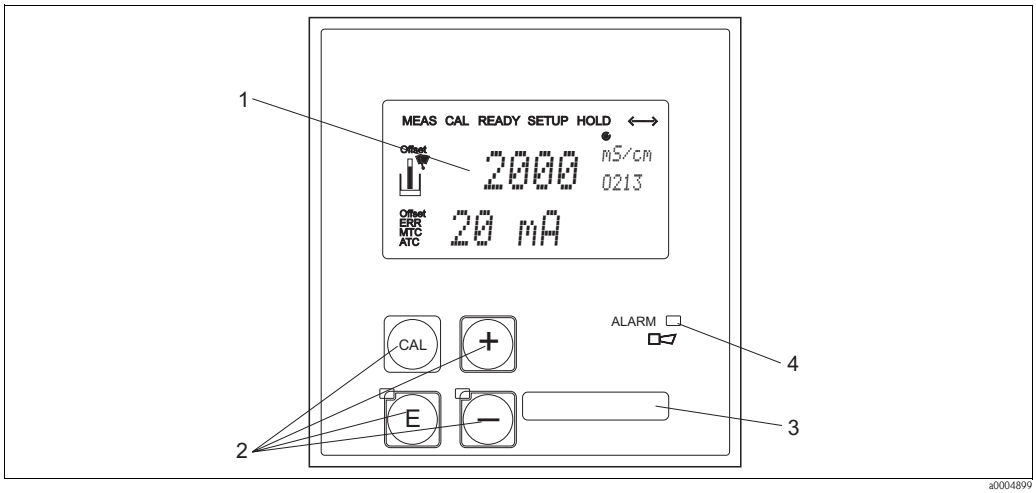
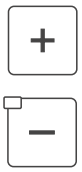


Fig. 29: Operating elements of Smartec S CLD134

1 Liquid crystal display showing measured values and configuration data
2 4 operating keys for calibration and instrument configuration
3 Field for user labeling
4 LED indicator for alarm function

5.2.3 Key assignment

CAL	**CAL key** When the CAL key is pressed, the instrument prompts for the calibration access code: ■ Code 22 for calibration ■ Code 0 or any other number to view the calibration data Use the CAL key to acknowledge calibration data and to continue through the calibration process.
E	**ENTER key** When the ENTER key is pressed, the instrument prompts for the setup access code: ■ Code 22 for setup and configuration ■ Code 0 or any other number to view the configuration data. The ENTER key has several functions: ■ It calls up the setup menus from the measuring mode ■ It is used to store (acknowledge) data entered in setup mode ■ It is used to move on within function groups



PLUS key and MINUS key
In setup mode, the PLUS and MINUS keys have the following functions:

- Selection of function groups

  ✎ Note!
  To select function groups in the order given in the chapter "Instrument configuration", use the MINUS key.

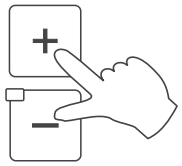
- Setting of parameters and numeric values

In measuring mode, **repeatedly pressing the PLUS key** displays the following settings in sequence:

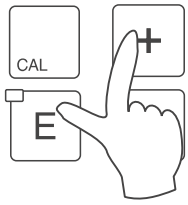
1. Temperature display in °F
2. Hide temperature display
3. Display of uncompensated conductivity value
4. Back to basic setting

In measuring mode, **repeatedly pressing the MINUS key** displays the following settings in sequence:

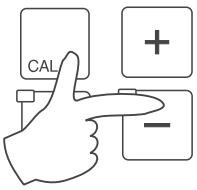
1. Display of current measuring range
2. Display of current errors in sequence (max. 10)
3. After all errors are displayed, the standard display is shown again. In function group F, you can define an alarm for each error code.



Escape function
Press the PLUS and MINUS keys simultaneously to return to the main menu. During calibration, this key combination goes directly to the end of calibration. When the PLUS and MINUS keys are pressed once more, the instrument returns to the measuring mode.



Locking the keypad
Pressing the PLUS and ENTER keys simultaneously for minimum 3s locks the keypad against unintentional entries. However, all settings can still be read.
The code prompt displays the code 9999.



Unlocking the keypad
Pressing the CAL and MINUS keys simultaneously for minimum 3s unlocks the keypad.
The code prompt displays the code 0.

5.3 Local operation

5.3.1 Operating concept

Operating modes

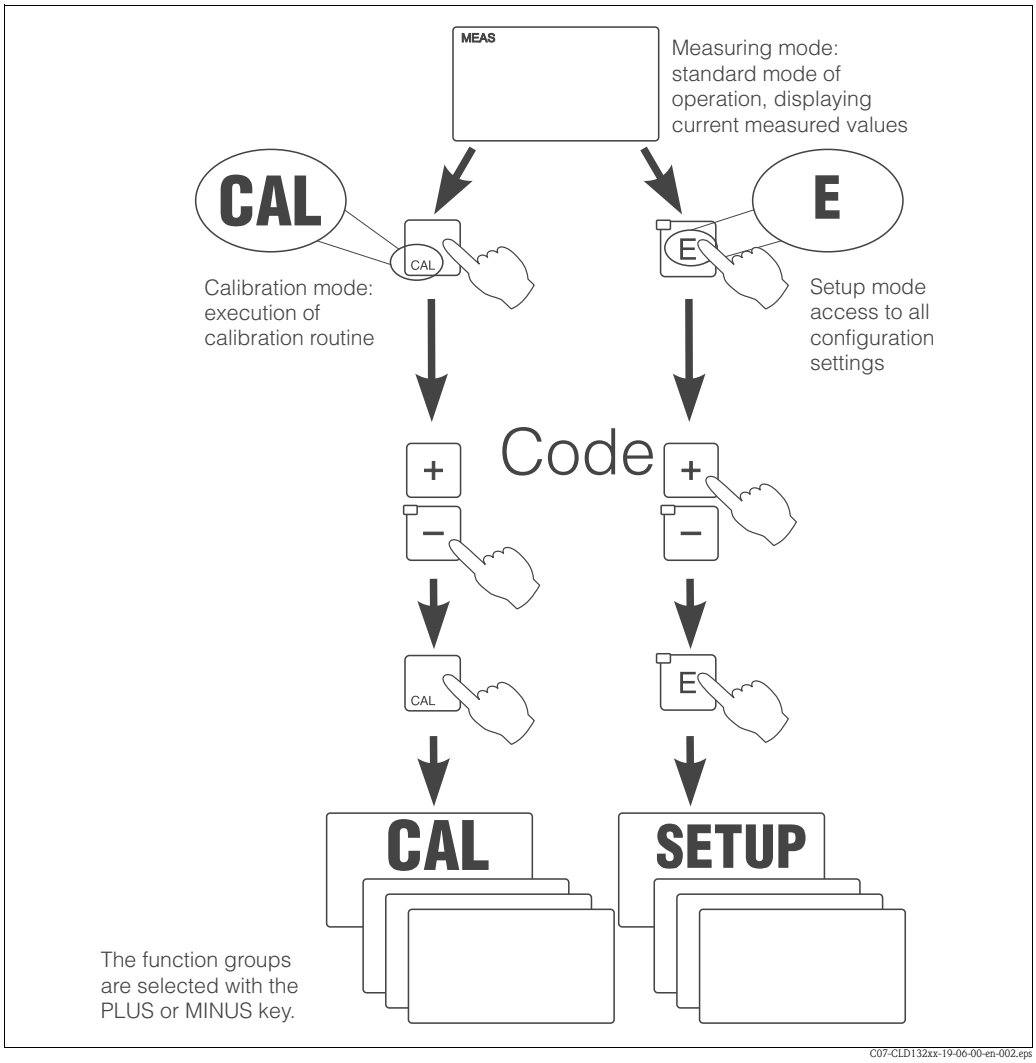


Fig. 30: Description of operating modes

Note!
If no key is pressed for 15 min. in setup mode, the instrument automatically switches back to the measuring mode. An active Hold function (Hold at Setup) is then reset.

Access codes

All instrument access codes are fixed, i.e. they cannot be modified. When the instrument requests the access codes, it recognizes the difference between codes.

- **CAL key + Code 22:** access to calibration and offset menus.
- **ENTER key + Code 22:** access to the configuration menus, allowing configuration and user-specific settings.
- **PLUS + ENTER keys:** locks the keypad.
- **CAL + MINUS keys:** unlocks the keypad.
- **CAL or ENTER key + any code:** access to Read mode, i.e. all settings can be read but not changed.

Menu structure

The configuration and calibration functions are arranged in a menu structure by function groups. The function groups are selected in the setup mode with the PLUS and MINUS keys. The ENTER key is used to move from one function to the next within a function group.
The PLUS and MINUS keys are used for option selection and editing. Selections must be confirmed by pressing the ENTER key. This also moves the cursor to the next function.
Pressing the PLUS and MINUS keys at the same time terminates programming (return to main menu).
When the PLUS and MINUS keys are pressed once more, the instrument returns to the measuring mode.

Note!
- If a change is made but not confirmed by pressing the ENTER key, the previous setting is retained.
- See the appendix of these operating instructions for an overview of the Smartec menu structure.

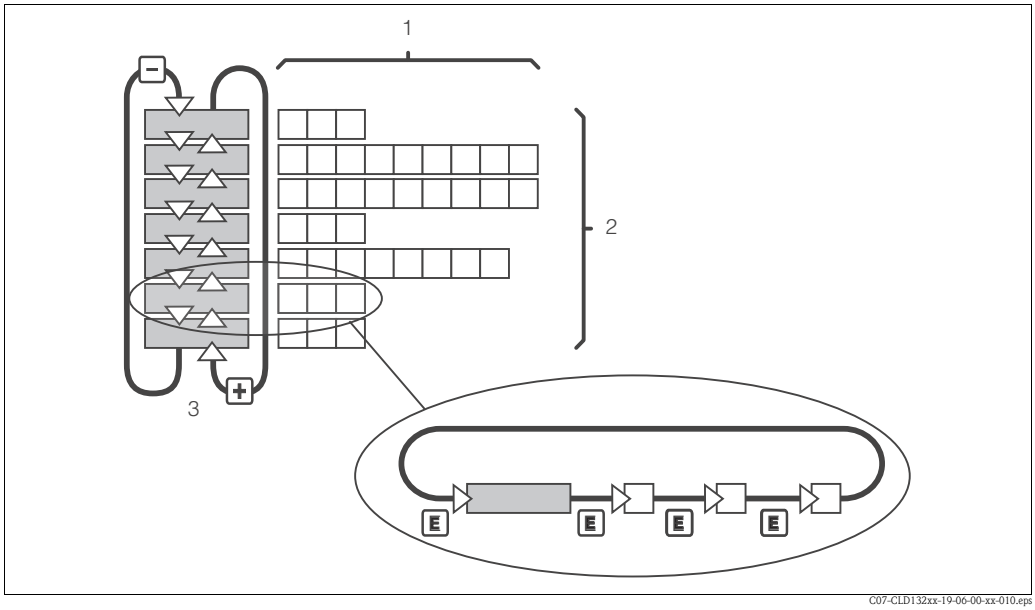


Fig. 31: Schematic of the SmarTec menu structure

Hold function: "Freezing" the outputs

The current output can be “frozen” in the setup mode and during calibration, i.e. the last current value is constantly output. The display shows the “HOLD” message.

Note!
- Hold settings can be found in the chapters "Service" and "Remote parameter set switching (measuring range switching, (MRS)".
- During “HOLD” in the measuring mode the contact will go to the normal position if it is configured as a limit contact.
- An active hold has priority over all other automatic functions.
- A possibly accumulated alarm delay is reset to “0”.
- The hold function can also be activated externally via the hold input (see wiring diagram; binary input 1).
- The manual hold (field S5) remains active even after a power failure.

6 Commissioning

6.1 Function check

⚠ Warning!
- Check all connections for correctness.
- Make sure that the supply voltage is identical to the voltage indicated on the nameplate!

6.2 Start-up

Before first start-up, make sure you understand how to operate the transmitter. You should make particular reference to chapters 1 (Safety instructions) and 5 (Operation).
After power-up (connection to power), the instrument performs a self-test and then enters the measuring mode.
Calibrate the sensor as described in the chapter "Calibration".

✎ Note!
During first start-up, calibration of the sensor is absolutely required to enable the measuring system to perform accurate measurement.

Configure the transmitter as described in the chapter "Quick setup". The values set by the user are kept even in the event of a power failure.
The following function groups are available on the Smartec S CLD134 (the function groups that are only available on the version equipped with the function extension are marked accordingly in the function descriptions):

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

Calibration mode
- CALIBRATION (C)

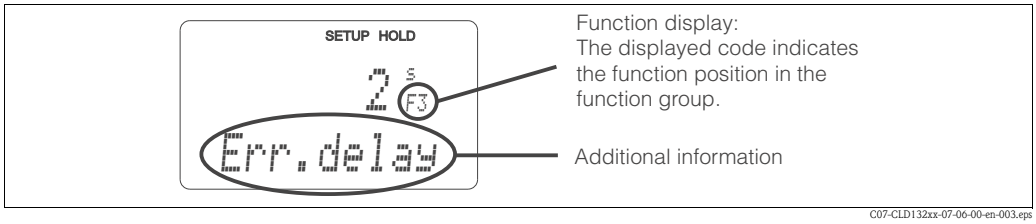


Fig. 32: Example for display in setup mode

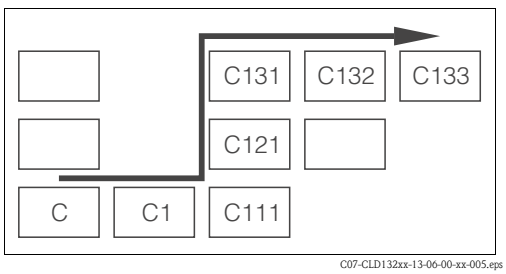


Fig. 33: Function coding

Selecting and locating functions is facilitated by a code displayed for each function in a special display field Fig. 32.
The structure of this coding is given in Fig. 33. 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.

For a detailed description of the function groups available on the Smartec S CLD134 see the chapter "Instrument configuration".

Factory settings

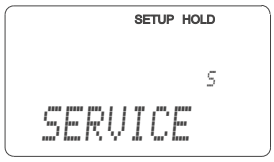
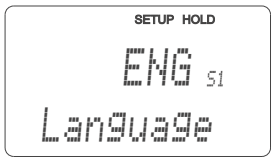
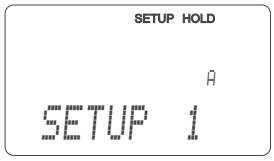
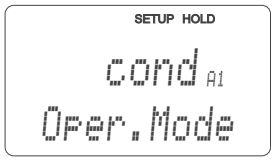
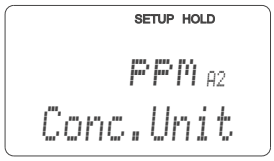
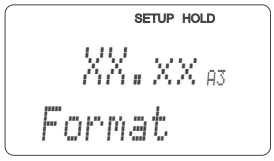
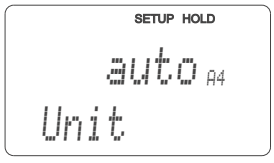
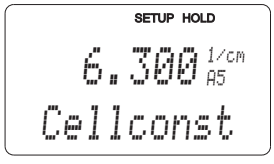
When the instrument is switched on for the first time, the factory settings are in effect. The following table provides an overview of all major settings.
Please refer to the description of the individual functions in the chapter "Instrument configuration" for all other factory settings (the factory settings are printed in **bold** letters).

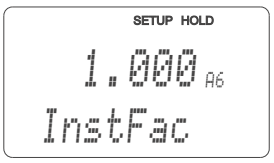
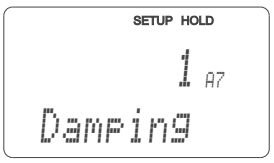
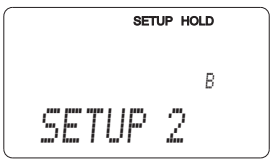
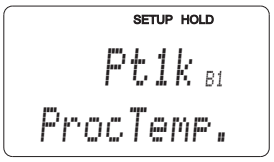
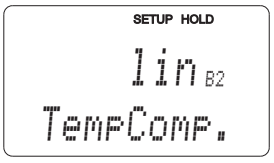
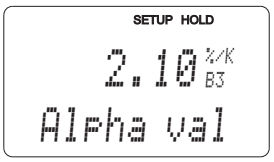
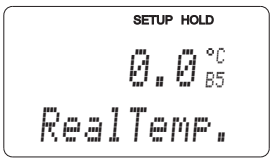
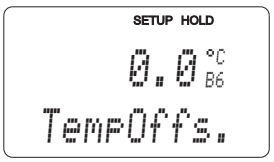
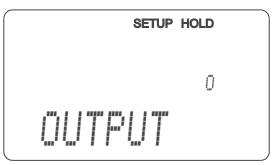
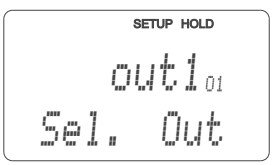
Function	Factory setting
Type of measurement	Inductive conductivity measurement, temperature measurement in °C
Temperature compensation type	Linear with reference temperature 25 °C (77 °F)
Temperature compensation	Automatic (ATC on)
Relay function	Alarm
Hold	Active during configuration and calibration
Measuring range	100 µS/cm ... 2000 mS/cm (measuring range set automatically)
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: measured value for 4 mA signal current*	0.0 °C (32 °F)
Current output 2: measured value for 20 mA signal current*	150.0 °C (302 °F)

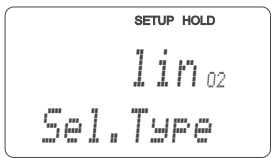
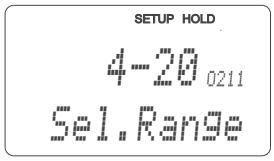
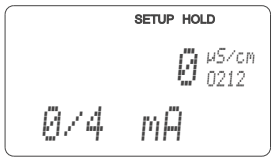
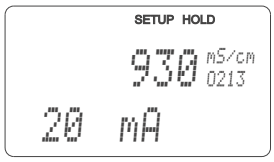
* if equipped accordingly

6.3 Quick setup

After switching the transmitter on, configure the major functions required for accurate measurement. The following section gives you an example for a basic configuration.

Input	Selection or range (factory setting bold)	Display
1. Press the ENTER key. 2. Enter the code 22 to be able to edit the setup. Press the ENTER key.		
3. Press the MINUS key several times until the "Service" function group is displayed. 4. Press the ENTER key to edit this function group.		
5. Select your language, e.g. "ENG" for English. Confirm your entry be pressing the ENTER key.	**ENG = English** GER = German FRA = French ITA = Italian NEL = Dutch ESP = Spanish	
6. Press the PLUS and MINUS keys simultaneously to quit the "Service" function group.		
7. Press the MINUS key several times until the "Setup 1" function group is displayed. 8. Press the ENTER key to edit "Setup 1".		
9. In A1, select the operating mode, e.g. "cond" = conductivity. Confirm your selection by pressing the ENTER key.	**cond = conductivity** conc = concentration	
10. In A2, press the ENTER key to confirm the factory setting.	% **ppm** mg/l TDS = Total Dissolved Solids none	
11. In A3, press the ENTER key to confirm the factory setting.	**XX.xx** X.xxx XXX.x XXXX	
12. In A4, press the ENTER key to confirm the factory settting.	**auto**, µS/cm, mS/cm, S/cm, µS/m, mS/m, S/m	
13. In A5, enter the cell constant for the connected sensor. Refer to the sensor's or the compact version's quality certificate for the exact value.	0.10 ... **6.3** ... 99.99	

Input	Selection or range (factory setting bold)	Display
14. In A6, press the ENTER key to confirm the factory setting. If your wall distance is smaller than 15 mm / 0.59", refer to the chapters 3.3.1 and 6.4.14 for information on determining the installation factor.	0.10 ... **1** ... 5.00	
15. If you are working in applications that fluctuate a great deal and you need to stabilize the display, enter the required damping factor in A7. Confirm your entry by pressing ENTER. The display returns to the inital display of "Setup 1".	**1** 1 ... 60	
16. Press the MINUS key to go to the "Setup 2" function group. 17. Press the ENTER key to edit "Setup 2".		
18. In B1, select the temperature sensor of your conductivity sensor. By default, your measuring system is supplied with the CLS54 sensor with Pt 1000 temperature sensor. Confirm your entry by pressing ENTER.	Pt100 **Pt1k = Pt 1000** NTC30 fixed	
19. In B2, select the appropriate temperature compensation for your process, e.g. "lin" = linear. Confirm your selection by pressing ENTER. For detailed information on temperature compensation, see chapter 6.4.2.	none **lin = linear** NaCl = common salt (IEC 60746) Tab 1 ... 4	
20. In B3, enter the temperature coefficient α. Confirm your entry by pressing ENTER. For detailed information on determining the temperature coefficient, see chapters 6.4.2 or 6.4.12.	**2.1 %/K** 0.0 ... 20.0 %/K	
21. The real temperature is displayed in B5. If necessary, calibrate the temperature sensor to an external measurement. Confirm your entry by pressing ENTER.	Display and entry of real temperature -35.0 ... 250.0 °C	
22. The difference between the measured and the entered temperatures is displayed. Press the ENTER key. The display returns to the initial display of the "Setup 2" function group.	**0.0 °C** -5.0 ... 5.0 °C	
23. Press the MINUS key to go to the "Output" function group. 24. Press the ENTER key to edit the output settings.		
25. In O1, select your output, e.g. "out1" = output 1. Confirm your selection by pressing ENTER.	**out 1** out 2	

Input	Selection or range (factory setting bold)	Display
26. In O2, select the linear characteristic. Confirm your selection by pressing ENTER.	**lin = linear (1)** sim = simulation (2)	
27. In O211, select the current range for your output, e.g. 4 ... 20 mA. Confirm your selection by pressing ENTER.	**4 ... 20 mA** 0 ... 20 mA	
28. In O212, enter the conductivity corresponding to the minium current value at the transmitter output, e.g. 0 µS/cm. Confirm your entry by pressing ENTER.	**0.00 µS/cm** 0.00 µS/cm ... 2000 mS/cm	
29. In O213, enter the conductivity corresponding to the maximum current value at the transmitter output, e.g. 930 mS/cm. Confirm your entry by pressing ENTER. The display returns to the initial display of the "Output" function group.	**2000 mS/cm** 0.0 µS/cm ... 2000 mS/cm	
30. Press the PLUS and MINUS keys simultaneously to return to measuring mode.		

Note!
You must perform an air set before installing the sensor. To do so, refer to the chapter "Calibration".

6.4 Instrument configuration

The following sections give a detailed description of all Smartec S CLD134 functions.

6.4.1 Setup 1 (conductivity, concentration)

In the SETUP 1 function group, you can change the operating mode and the sensor settings. You have already made all settings of this menu during the quick setup but you can modify the settings at any time.

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 ☝ Caution! Any change in operating mode causes an automatic reset of user settings.
	A2	Select concentration unit to be displayed	% **ppm** mg/l TDS = Total Dissolved Solids none	SETUP HOLD PPM A2 Conc.Unit	
	A3	Select display format for concentration unit	**XX.xx** X.xxx XXX.x XXXX	SETUP HOLD XX.xx A3 Format	
	A4	Select unit to be displayed for conductivity	**auto**, µS/cm, mS/cm, S/cm, µS/m, mS/m, S/m	SETUP HOLD auto A4 Unit	When “auto” is selected, the maximum resolution possible is automatically selected.
	A5	Enter cell constant for connected sensor	0.10 ... **6.3** ... 99.99	SETUP HOLD 6.300 1/cm A5 Cellconst	For the exact value of the cell constant, refer to the sensor’s or the compact version’s quality certificate.
	A6	Installation factor	0.10 ... **1** ... 5.00	SETUP HOLD 1.000 A6 InstFac	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 ... 60	SETUP HOLD 1 A7 Damping	Measured value damping causes averaging over the specified number of individual measured values. It is used, for example, to stabilize 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 compensation only needs to be performed in the conductivity mode (selection in field A1).
The temperature coefficient 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, three different compensation types can be selected in the Smartec S:

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. The reference temperature is 25 °C / 77 °F.

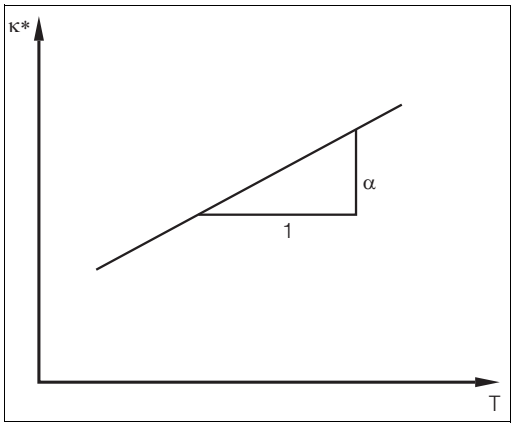


Fig. 34: Linear temperature compensation
** uncompensated conductivity*

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.

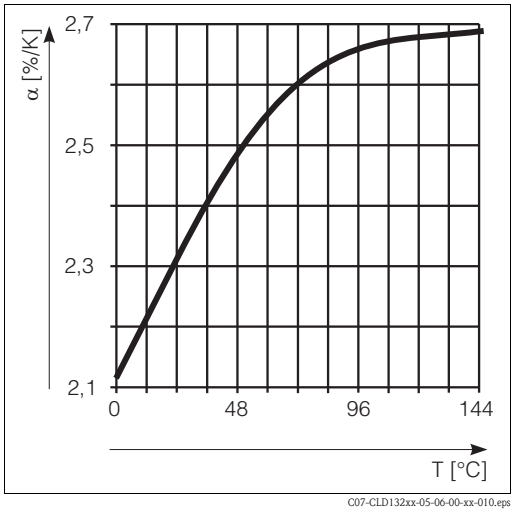


Fig. 35: NaCl compensation

Temperature compensation with table
When using the alpha table function for temperature compensation, the following conductivity data of the process medium to be measured are 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

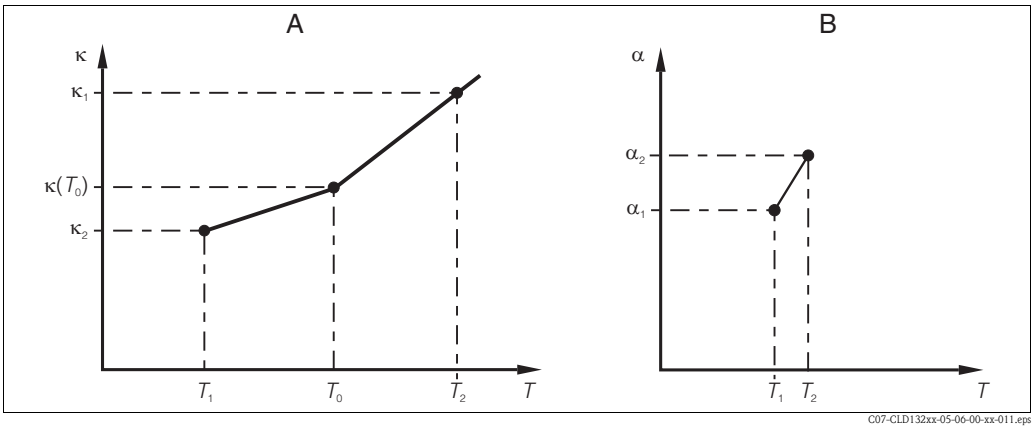


Fig. 36: Determination of temperature coefficient

A Required data
B Calculated α values

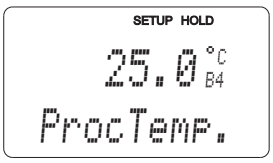
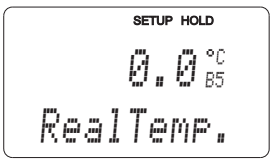
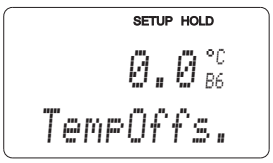
Use the following formula to calculate the α values for the temperatures occurring in your process:

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

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

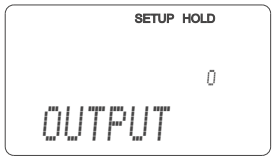
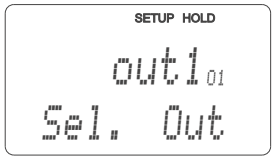
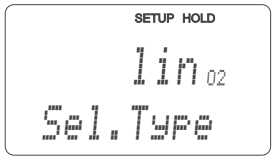
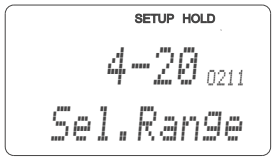
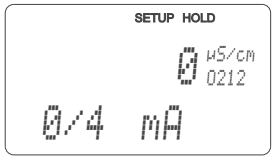
In the SETUP 2 function group, you can change the settings for temperature measurement.
You have already made the settings of this function group during quick setup but you can modify the settings at any time.

Coding		Field	Selection or range (factory settings bold)	Display	Info
B		**Function group SETUP 2**		SETUP HOLD B SETUP 2	Settings for temperature measurement.
	B1	Select temperature sensor	Pt100 **Pt1k = Pt 1000** NTC30 fixed	SETUP HOLD Pt1k B1 ProcTemp.	If set to "fixed": no temperature measurement, a fixed temperature value is entered instead.
	B2	Select temperature compensation type	none **lin = linear** NaCl = common salt (IEC 60746) Tab 1 ... 4	SETUP HOLD lin B2 TempComp.	This option is not displayed for concentration measurement. The options Tab 2 ... 4 are only available for transmitters with the "Remote measuring range switching" upgrade.
	B3	Enter temperature coefficient α	**2.1 %/K** 0.0 ... 20.0 %/K	SETUP HOLD 2.10 %/K B3 Alpha val	Only if B2 = lin. Tables defined in B2 are not active in this case.

Coding		Field	Selection or range (factory settings bold)	Display	Info
	B4	Enter process temperature	**25 °C** -10.0 ... 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 -35.0 ... 250.0 °C		This entry is used to calibrate the temperature sensor to an external measurement. Omitted if B1 = fixed.
	B6	Temperature difference is displayed	**0.0 °C** -5.0 ... 5.0 °C		The difference between the entered actual value and the measured temperature is displayed. Omitted if B1 = fixed.

6.4.3 Current outputs

The OUTPUT function group is used to configure the individual outputs.
Furthermore, a current output value can be simulated to check the current outputs (O2 (2)).

Coding			Field	Selection or range (factory settings bold)	Display	Info
O			**Function group OUTPUT**			Configuration of the current output (not available for PROFIBUS versions).
O1			Select current output	**out1** out2		A different characteristic can be selected for each output.
O2	O2 (1)		Enter linear characteristic	**lin = linear** (1) sim = simulation (2)		The slope of the characteristic may be positive or negative.
		O211	Select current range	**4 ... 20 mA** 0 ... 20 mA		
		O212	0/4 mA value: enter corresponding measured value	Cond: **0.00 µS/cm** Conc: **0.00 %** Temp.: **-10.0 °C** entire measuring range		Enter the measured value corresponding to the minimum current value (0/4 mA) at the transmitter output. Display format from A3. (Spreading: see Technical data.)

Coding			Field	Selection or range (factory settings bold)	Display	Info
		O213	20 mA value: enter corresponding measured value	Cond: **2000 mS/cm** Conc: **99.99 %** Temp.: **60.0 °C** entire measuring range	SETUP HOLD 2000 mS/cm 0213 20 mA	Enter the measured value corresponding to the maximum current value (20 mA) at the transmitter output. Display format from A3. (Spreading: see Technical data.)
	O2 (2)		Current output simulation	lin = linear (1) **sim = simulation** (2)	SETUP HOLD sim 02 Sel.Type	The simulation is terminated by selecting (1).
		O221	Enter simulation value	**current value** 0.00 ... 22.00 mA	SETUP HOLD 4.00 mA 0221 Simulat.	The current value entered here is output through the current output.

6.4.4 Alarm

The ALARM function group is used to define various alarms and to set output contacts.
Each individual error can be defined to be effective or not (at the contact or as an error current).

Coding		Field	Selection or range (factory settings bold)	Display	Info
F		**Function group ALARM**		SETUP HOLD F ALARM	Alarm function settings.
	F1	Select contact type	**Stead = steady contact** Fleet = fleeting contact	SETUP HOLD Stead F1 Cont.Type	The contact type selected here only applies to the alarm contact.
	F2	Select time unit	**s** min	SETUP HOLD s F2 Time unit	
	F3	Enter alarm delay	**0 s (min)** 0 ... 2000 s (min)	SETUP HOLD 0 s F3 Err.Delay	Depending on the unit selected in F2, the alarm delay is entered in s or min. The alarm delay does not affect the LED; it indicates the alarm immediately
	F4	Select error current	**22 mA** 2.4 mA	SETUP HOLD 22mA F4 Err.Curr	This selection must be made even if all error messages are suppressed in F5. ☝ Caution! If you selected the "0-20 mA" range in O211, you may not select the "2.4 mA" option here.

Coding		Field	Selection or range (factory settings bold)	Display	Info
	F5	Select error	**1** 1 ... 255	SETUP HOLD 1 F5 Sel.Error	Select the errors that are to trigger an alarm signal. The errors are selected via the error number. Please refer to the table in chapter 9.2 "System error messages" for the error numbers. The factory settings remain in effect for all errors not edited.
	F6	Set alarm contact to be effective for selected error	**yes** no	SETUP HOLD yes F6 Rel.Assg	If set to “no”, all the other alarm settings (e.g. alarm delay) are also deactivated. 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 selected error	**no** yes	SETUP HOLD no F7 Curr.Assg	The error current selected in F4 becomes effective or is suppressed when an error occurs. This setting **only** applies to the error selected in F5.
	F8	Return to menu or select next error	next = next erorr ←**R**	SETUP HOLD ←R F8 Select	If next is selected, the software returns to F5. If ←R is selected, it returns to F.

6.4.5 Check

PCS alarm (Process Check System)

The PCS alarm is only available for transmitters with remote parameter set switching.
This function is used to examine the measuring signal for deviations. If the measuring signal is constant for a specific period of time (several measured values), an alarm is issued. This type of sensor behaviour may be caused by soiling, etc.

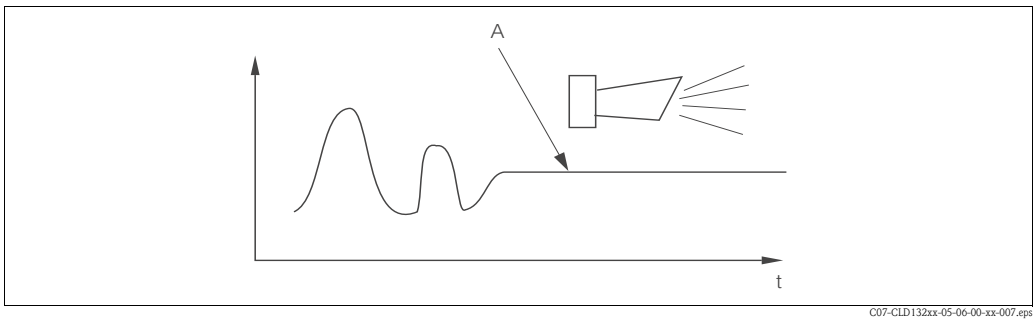


Fig. 37: PCS alarm (live check)

A Constant measuring signal = alarm is triggered after the configured PCS period

Note!
An active PCS alarm is automatically cleared when the measuring signal changes.

Coding		Field	Selection or range (factory settings bold)	Display	Info
P		**Function group CHECK**		SETUP HOLD P CHECK	Settings for sensor and process monitoring.
	P1	Set PCS alarm (live check)	**off** 1 h 2 h 4 h	SETUP HOLD off P1 PCS alarm	This function is used to monitor the measuring signal. An alarm is triggered if it does not change for the period selected here. Monitoring limit: 0.3 % of mean value over selected period of time. (Error no.: E152)

6.4.6 Relay configuration

For Smartec S CLD134 equipped with remote parameter set switching (measuring range switching), there are three options for configuring the relay (selection in field R1):

- **Alarm**
  The relay closes the contact 41/42 (voltage-free, safe state) if an alarm condition according to chapter 9.2 occurs and if the setting in the "Alarm contact" column is "yes". You can change these settings as required (field F5 ff).
- **Limit**
  The relay only closes the contact 42/43 if one of the defined limits is violated (value above or below limit, see Fig. 38) but not when an alarm condition is detected.
- **Alarm + Limit**
  The relay closes the contact 41/42 if an alarm condition occurs. Limit violations only cause the relay to switch if error E067 is set to "yes" during relay assignment (field F6).

Please refer to Fig. 38 for a graphic representation of the contact states of the alarm contact.
- When the measured value increases (max function), the relay goes into alarm state (limit exceeded) at time t2 when the switch-on point has been exceeded (t1) and the pickup delay (t2 – t1) has expired.
- When the measured value decreases, the relay returns to normal operating state when the measured value drops below the switch-off point and after the dropout delay (t4 – t3).
- When the pickup and dropout delays are set to 0 s, the switch-on and switch-off points are identical to the contact switching points.

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

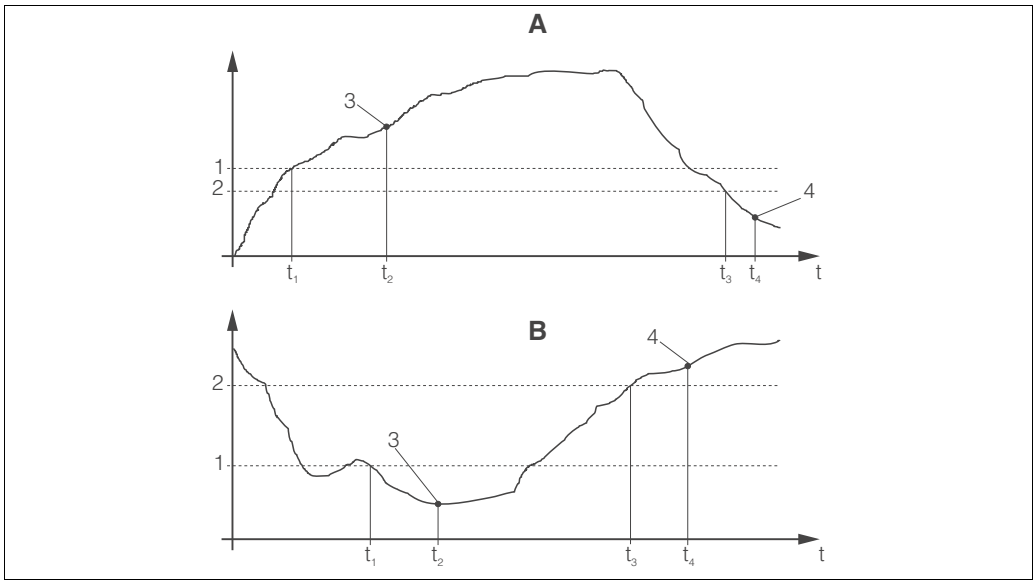
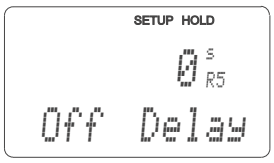
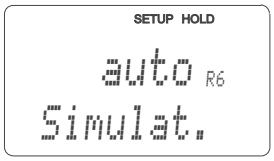
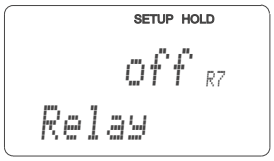


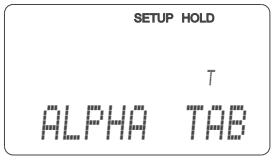
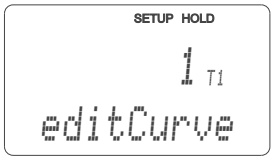
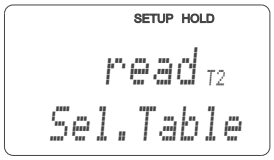
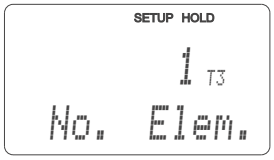
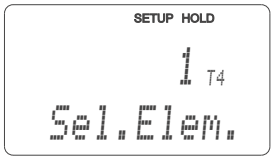
Fig. 38: Relation of switch-on and switch-off points and pickup and dropout delays
A Switch-on point > switch-off point: Max. function
B Switch-on point < switch-off point: Min. function
1 Switch-on point
2 Switch-off point
3 Contact ON
4 Contact OFF

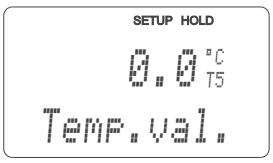
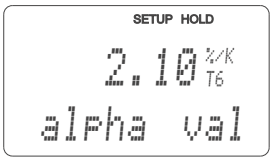
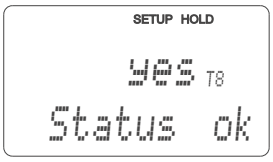
Coding		Field	Selection or range (factory settings bold)	Display	Info
R		**Function group RELAY**		SETUP HOLD R RELAY	Settings for relay contacts.
	R1	Select function	**alarm** limit al+li = alarm + limit	SETUP HOLD alarm R1 Function	When “alarm” is selected, the fields R2 to R5 are irrelevant.
	R2	Enter contact switch-on point	Cond: **2000 mS/cm** Conc: **99.99 %** entire measuring range	SETUP HOLD 2000 mS/cm R2 On Value	Only the operating mode selected in A1 appears. Note! Never set the switch-on point and the switch-off point to the same value.
	R3	Enter contact switch-off point	Cond: **2000 mS/cm** Conc: **99.99 %** entire measuring range	SETUP HOLD 2000 mS/cm R3 Off Value	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 a hysteresis function (see Fig. 32).
	R4	Enter pickup delay	**0 s** 0 ... 2000 s	SETUP HOLD 0 s R4 On Delay	

Coding		Field	Selection or range (factory settings bold)	Display	Info
	R5	Enter dropout delay	**0 s** 0 ... 2000 s		
	R6	Select simulation	**auto** manual		This selection can only be made if limit has been selected in R1.
	R7	Switch relay on or off	**on** off		This selection can only be made if manual has been selected in R6. The relay can be switched on and off.

6.4.7 Temperature compensation with table

This function group is used to perform a temperature compensation with table (field B2 in SETUP 2 function group).
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**			Settings for temperature compensation.
	T1	Select table	**1** 1 ... 4		Selection of table to be edited. Options 1 ... 4 are only available if the instrument is equipped with the remote measuring range switching.
	T2	Select table option	**read** edit		
	T3	Enter number of table value pairs	**1** 1 ... 10		Up to 10 value pairs can be entered in the α table. These are numbered from 1 ... 10 and can be edited individually or in sequence.
	T4	Select table value pair	**1** 1 ... number of table value pairs assign		If "assign", go to T8.

Coding		Field	Selection or range (factory settings bold)	Display	Info
	T5	Enter temperature value	**0.0 °C** -10.0 ... 150.0 °C		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	**2.10 %/K** 0.00 ... 20.00 %/K		
	T8	Enter whether or not the table status is ok	**yes** no		If “yes”, return to T. If “no”, return to T3.

6.4.8 Concentration measurement

The transmitter can convert conductivity values to concentration values. For this, set the operating mode to Concentration measurement (see field A1).

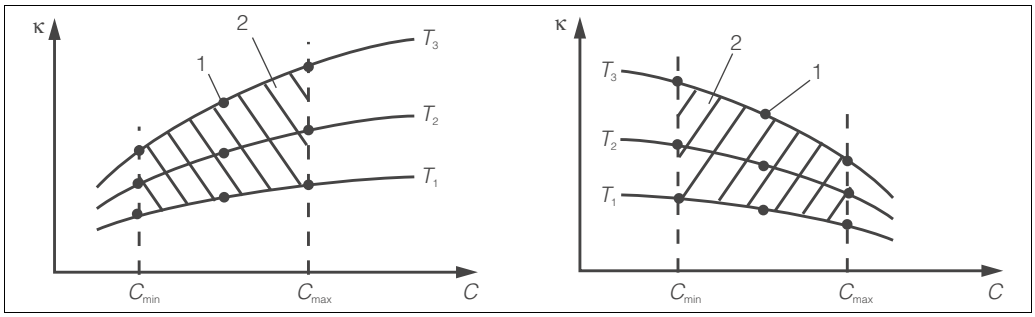
You must enter the basic data to which the concentration calculation should refer. For the most common substances, the required data is already saved in your device. You can select one of these substances in field K1.
If you want to specify the concentration of a sample, which is not saved in the device, 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. To get the uncompensated conductivity, press the PLUS key several times in measuring mode (see chapter "Key functions") or deactivate the temperature compensation (Setup 2, field B 2).

   – 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 (0.9 °F).
   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.

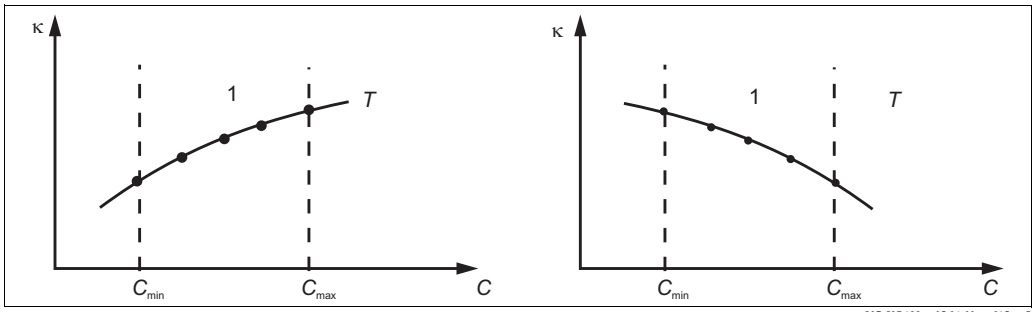
Finally, you should have measuring data which are similar to those shown in the following figures:



C07-CLD132xx-05-06-00-xx-012.eps

Fig. 39: Measured data for variable process temperatures (example)

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

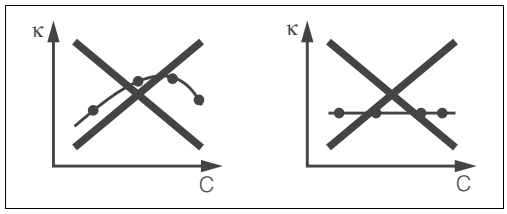


C07-CLD132xx-05-06-00-xx-015.epsB

Fig. 40: 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 Fig. 41 are not permitted.



C07-CLD132xx-05-06-00-xx-016.eps

Fig. 41: Impermissible curve profiles

κ *Conductivity*
C Concentration

Value entry

Enter the three characteristic values for each measured sample in the fields K6 to K8 (value triplets of conductivity, temperature and concentration).

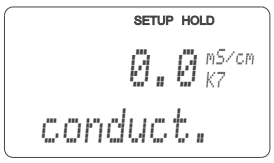
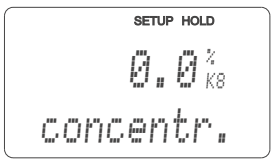
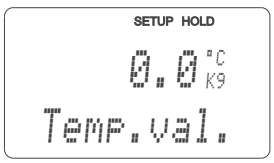
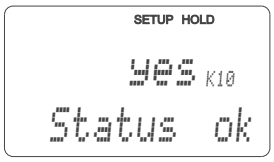
- Variable process temperature:
  Enter at least four value triplets.
- Constant process temperature:
  Enter at least two value triplets.

Note!

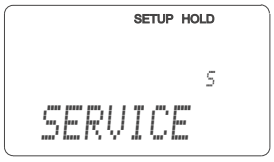
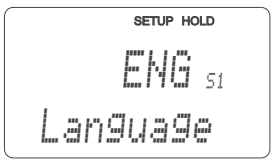
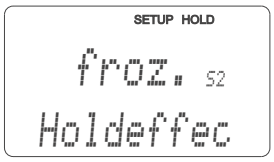
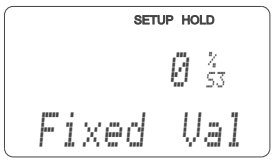
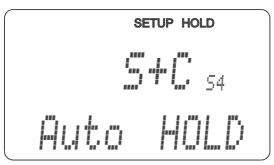
- Please make sure that the concentrations and temperatures measured for your samples correspond to the measuring range of the process. If the measured values of the process are outside the range of your sample values, this considerably reduces the level of accuracy and the error messages E078 or E079 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.
- In case of concentration measurement, temperature compensation is automatically performed using the entered table values. Therefore, the temperature coefficient set in the SETUP 2 function group is not active.
- Enter the values in the order of increasing concentration (see the following example).

mS/cm	%	°C (°F)
240	96	60 (140)
380	96	90 (194)
220	97	60 (140)
340	97	90 (194)
120	99	60 (140)
200	99	90 (194)

Coding		Field	Selection or range (factory settings bold)	Display	Info
K		**Function group CONCENTRATION**		SETUP HOLD K CONCENTRA	Settings for concentration measurement. Four fixed and four editable concentration fields are stored in this function group.
	K1	Select concentration curve to be used to calculate the display value	**NaOH 0... 15 %** H_2SO_4 0 ... 30 % H_3PO_4 0 ... 15 % HNO_3 0 ... 25 % Tab 1 ... 4	SETUP HOLD NaOH K1 act.curve	The user tables 2 ... 4 can only be selected if the instrument is equipped with the remote measuring range switching.
	K2	Select correction factor	**1** 0.5 ... 1.5	SETUP HOLD 1 K2 Conc.Fact	If required, select a correction factor (only available for the user tables).
	K3	Select table to be edited	**1** 1 ... 4	SETUP HOLD 1 K3 editCurve	When editing a curve, another curve should be used to calculate the current display values (see K1). Selections 2 ... 4 are only available with the remote measuring range switching.
	K4	Select table option	**read** edit	SETUP HOLD read K4 Table	This selection applies to all concentration curves.
	K5	Enter number of reference triplets	**4** 1 ... 16	SETUP HOLD 4 K5 No. Elem.	Each triplet consists of three numeric values.
	K6	Select triplet	**1** 1 ... number of triplets in K4 assign	SETUP HOLD 1 K6 Sel.Elem.	Any triplet can be edited. If "assign", go to K10.

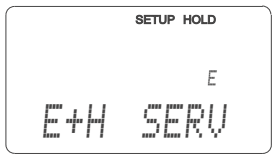
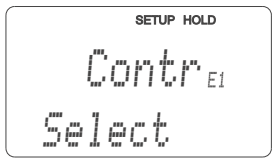
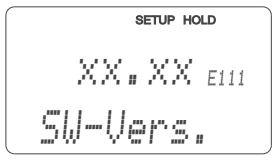
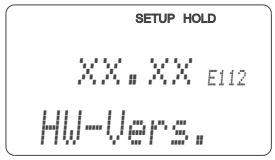
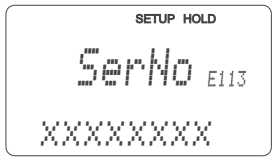
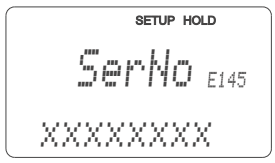
Coding		Field	Selection or range (factory settings bold)	Display	Info
	K7	Enter uncompensated conductivity	**0.0 mS/cm** 0.0 ... 9999 mS/cm		
	K8	Enter concentration value for K6	**0.00 %** 0.00 ... 99.99 %		
	K9	Enter temperature value for K6	**0.0 °C** -35.0 ... 250.0 °C		
	K10	Enter whether or not the table status is ok	**yes** no		Back to K.

6.4.9 Service

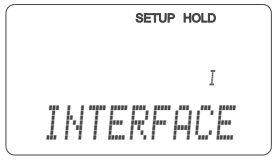
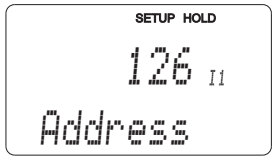
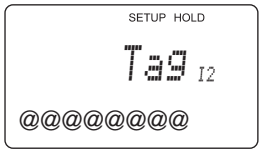
Coding		Field	Selection or range (factory settings bold)	Display	Info
S		**Function group SERVICE**			Settings for service functions.
	S1	Select language	**ENG = English** GER = German FRA = French ITA = Italian NEL = Dutch ESP = Spanish		This field must be configured once during start-up. Then you can 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	**0** 0 ... 100 % (of current output value)		Only available if S2 = fixed value.
	S4	Hold configuration	**S+C = setup and calibration** CAL = calibration Setup = setup none = no hold		S = setup C = calibration

Coding		Field	Selection or range (factory settings bold)	Display	Info
	S5	Manual hold	**On** Off	SETUP HOLD off S5 Man.HOLD	
	S6	Enter hold dwell period	**10 s** 0 ... 999 s	SETUP HOLD 10 s S6 Cont.Time	
	S7	Enter SW upgrade release code of function extension MRS	**0** 0 ... 9999	SETUP HOLD 0 S7 MRSCode	Entering an incorrect code returns you to the measurement menu. The number is edited with the PLUS or MINUS key and confirmed with the ENTER key.
	S8	Order number is displayed		SETUP HOLD order S8 CLD134-xx	The order code is **not** automatically changed to reflect an upgrade.
	S9	Serial number is displayed		SETUP HOLD SerNo S9 xxxxxxxx	
	S10	Reset of instrument (restore default values) 	**no** Sens = sensor data Facty = factory settings	SETUP HOLD no S10 S.Default	Facty= All data are cleared and reset to the factory settings! Sens = Sensor data are cleared (temp. offset, air set value, cell constant, installation factor) ✎ Note! After a reset plesase change the cell constant in field A5 to **6.3** and the temperature sensor in field B1 to **Pt1k**.
	S11	Perform instrument test	**no** Displ = display test	SETUP HOLD no S11 Test	

6.4.10 E+H Service

Coding			Field	Selection or range (factory settings bold)	Display	Info
E			**Function group E+H SERVICE**			E+H service settings.
	E1		Select module	**Contr = controller** (1) Trans = transmitter (2) MainB = mainboard (3) Sens = sensor (4)		
		E111 E121 E131 E141	Software version is displayed			E111: Version of transmitter software E121-141: Version of module firmware (if available)
		E112 E122 E132 E142	Hardware version is displayed			Cannot be edited.
		E113 E123 E133 E143	Serial number is displayed			Cannot be edited.
		E145 E146 E147 E148	Enter and confirm serial number			

6.4.11 Interfaces

Coding		Field	Selection or range (factory settings bold)	Display	Info
I		**Function group INTERFACE**			Communication settings (HART or PROFIBUS transmitter versions only).
	I1	Enter address	Address HART: 0 ... **15** or PROFIBUS: 0 ... **126**		
	I2	Tag description			

6.4.12 Determining the temperature coefficient

Determining the temperature coefficient by the following method is only possible for instruments equipped with remote parameter set switching (see "Product structure"). Standard instruments (basic versions) can be retrofitted with remote parameter set switching (see chapter "Accessories").

Coding		Field	Selection or range (factory settings bold)	Display	Info
D		**Function group TEMPERATURE COEFFICIENT**		SETUP HOLD D DET.ALPHA	Settings for temperature coefficient. Calculator function: calculates the α value from the compensated conductivity + uncompensated conductivity + temperature value.
	D1	Enter compensated conductivity	**current value** 0 ... 9999	SETUP HOLD 2000 µS/cm D1 Cond.comp	Displays the current compensated conductivity. If necessary, change this value to the desired value (determined by a comparison measurement for example).
	D2	Display of uncompensated conductivity	**current value** 0 ... 9999	SETUP HOLD 2077 µS/cm D2 Cond.unc.	Current value of uncompensated conductivity, cannot be edited.
	D3	Enter current temperature	**current value** -35.0 ... 250.0 °C	SETUP HOLD 60.0 °C D3 Meas.temp	
	D4	Display of determined α value		SETUP HOLD 2.20 %/K D4 alpha val	Used in B3 for example. You must enter the value manually.

6.4.13 Remote parameter set switching (measuring range switching, MRS)

You can order the remote parameter set switching via binary inputs directly as an option of your transmitter (see "Product structure") or you can retrofit a standard transmitter with the MRS function extension (see the chapter "Accessories").
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:

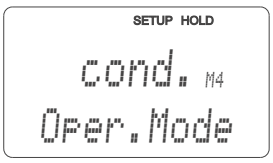
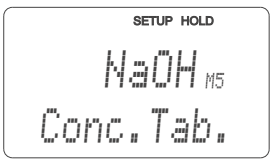
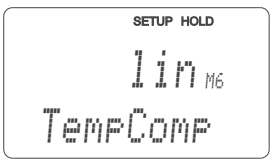
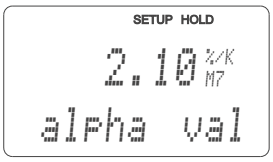
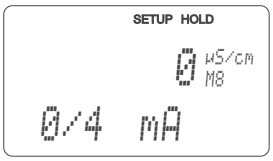
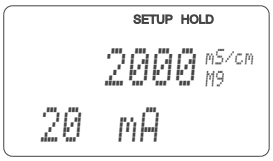
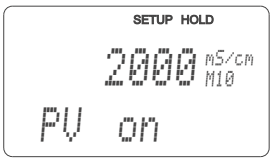
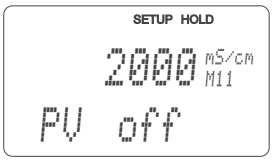
Assignment of field M1	Assignment of binary inputs
M1 = 0	MRS not active. The binary input 1 can be used for external hold.
M1 = 1	The binary input 2 can be used to switch between 2 measuring ranges (parameter sets). The binary input 1 can be used for external hold.
M1 = 2	The binary inputs 1 and 2 can 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 ... 3 mS/cm	0.1 ... 0.8 mS/cm	0.5 ... 5%	0.5 ... 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**		SETUP HOLD M MRS	Settings of remote parameter set switching (measuring range switching). M1 + M2: apply to measuring mode. M3 ... M11: apply to configuration of parameter sets.
	M1	Select binary inputs	**1** 0, 1, 2	SETUP HOLD 2 M1 Bin.Input	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 ... 4 if M1 = 0	SETUP HOLD 1 M2 Act.MR	If M1 = 0, selectable. If M1 = 1 or 2, display depending on binary inputs.
	M3	Select parameter set to be configured in M4 ... M8	**1** 1 ... 4 if M1=0 1 ... 2 if M1=1 1 ... 4 if M1=2	SETUP HOLD 1 M3 Edit MR	Selection of parameter set **to be configured** (the **active** parameter set is selected in M2 or with the binary inputs).

Coding		Field	Selection or range (factory settings bold)	Display	Info
	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 ... 4		Only available if M4 = conc.
	M6	Select temperature compensation	none, **lin**, NaCl, Tab 1 ... 4 if M4 = cond		Only available if M4 = cond.
	M7	Enter α value	**2.10 %/K** 0 ... 20 %/K		Can only be entered if M6 = lin.
	M8	Enter measured value for 0/4 mA value	Cond.: **0** ... 2000 mS/cm Conc.: Unit: A2, format: A3		
	M9	Enter measured value for 20 mA value	Cond.: 0 ... **2000 mS/cm** Conc.: Unit: A2, format: A3		
	M10	Enter switch-on point for limit	Cond.: 0 ... **2000 mS/cm** Conc.: Unit: A2, format: A3		
	M11	Enter switch-off point for limit	Cond.: 0 ... **2000 mS/cm** Conc.: Unit: A2, format: A3		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.

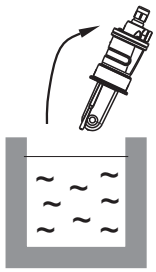
Note!
If remote parameter set switching is selected, the parameter sets that have been entered are processed internally but the fields A1, B1, B3, R2, K1, O212, O213 show the values of the first measuring range.

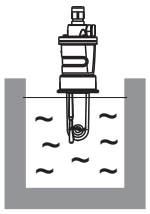
6.4.14 Calibration

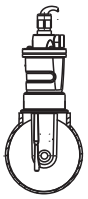
To access the "Calibration" function group, press the CAL key.
This function group is used to calibrate the transmitter. Two different types of calibration are possible:

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

Note!
- 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).

Coding			Field	Selection or range (factory settings bold)	Display	Info
C			**Function group CALIBRATION**		CAL C CALIBRAT	Calibration settings.
	C1 (1)		Compensation of residual coupling	**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 ... 80.0 µS	CAL HOLD 5.3 µS/cm C112 AirSetVal	Residual coupling of measuring system (sensor and transmitter).
		C113	Calibration status is displayed	o.k. E xxx	CAL READY HOLD o.k. C113 Status	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
		C114	Store calibration results?	**yes** no new	CAL READY HOLD yes C114 Store	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)	CAL HOLD Cellc C1 Calibrat	
Immerse sensor in calibration solution. ✎ Note! This section decribes the calibration for temperature compensated conductivity. For calibration with uncompensated conductivity, set the temperature coefficient α to 0.						The sensor should be immersed at a sufficient distance from the vessel wall (installation factor has no influence if a > 15 mm / 0.59").
		C121	Enter process temperature (MTC)	**25 °C** -35.0 ... 250.0 °C	CAL HOLD 25.0 °C C121 ProcTemP.	Only exists if B1 = fixed.
		C122	Enter α value of calibration solution	**2.10 %/K** 0.00 ... 20.00 %/K	CAL HOLD 2.10 %/K C122 alPha val	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	**current measured value** 0.0 ... 9999 mS/cm	CAL HOLD 10.30 mS/cm C123 Real. val	The display is always in mS/cm.
		C124	Calculated cell constant is displayed	0.1 ... **6.3** ... 99.99 cm^{-1}	CAL HOLD 6.300 1/cm C124 Cellconst	The calculated cell constant is displayed and entered in A5.
		C125	Calibration status is displayed	o.k. E xxx	CAL READY HOLD o.k. C125 Status	If the calibration status is not o.k., the second display line shows an explanation of the error.
		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”.

Coding			Field	Selection or range (factory settings bold)	Display	Info
	C1 (3)		Calibration with sensor adaptation for inductive sensors	Airs = Airset (1) Cellc = cell constant (2) **InstF = installation factor** (3)	CAL HOLD InstF C1 Calibrat	Sensor calibration with compensation of wall influence. The distance from the sensor to the pipe wall and the pipe material (conductive or nonconductive) influence the measured value. The installation factor compensates this influence. See chapter "Installation conditions".
The sensor is installed in the process.						
		C131	Enter process temperature (MTC)	**25 °C** -35.0 ... 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 ... 20.00 %/K	CAL HOLD 2.10 %/K C132 alpha val	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.
		C133	Enter correct conductivity value of the medium	**current measured value** 0.0 ... 9999 mS/cm	CAL HOLD 10.30 mS/cm C133 Real val.	Determine the correct conductivity value by a reference measurement.
		C134	Calculated installation factor is displayed	**1** 0.10 ... 5.00	CAL HOLD 1 C134 InstFact	The distance of the sensor to the pipe wall and the pipe material (conductive or nonconductive) influence the measured value. The installation factor compensates this influence. See chapter "Installation conditions".
		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”.

6.5 Communication interfaces

Please refer to separate operating instructions BA212C/07/en (HART) or BA213C/07/en (PROFIBUS) for transmitters equipped with a communication interface.

7 Maintenance

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

Maintenance on the Smartec S CLD134 includes:
- Calibration (see chapter "Calibration")
- Cleaning of assembly and sensor
- Checking of cables and connections.

Warning!
- Please be aware of effects work performed on the instrument might have on the process control system or the process itself.
- When removing the sensor during maintenance or calibration, please consider potential hazards due to pressure, high temperatures and contamination.
- Disconnect the instrument from the power source before opening it up.
  Work with live lines may only be performed by trained electricians!
- Switched contacts may be supplied from separate circuits. These circuits must also be de-energized before work on the terminals is performed.

Caution ESD!
- Electronic components are sensitive to electrostatic discharges. Personal protective measures, such as discharge via PE or permanent grounding using a wrist strap, are to be taken.
- For your own safety, use only original spare parts. Original parts will guarantee functionality, accuracy and reliability after repairs.

Note!
Please contact your Endress+Hauser representative if you have any questions. You can also send your queries to the Endress+Hauser Service Organisation via the Internet: **www.endress.com**

7.1 Maintenance of Smartec S CLD134

7.1.1 Dismantling Smartec S CLD134

Caution!
Consider potential effects on process when removing the instrument from service!

Note!
For item numbers see the exploded view drawing in chapter 9.5.

1. Remove the cover (item 40).
2. Remove the internal protecting cover (item 140). Release the lateral latches with a screwdriver.
3. Pull off the five-pole terminal block first to de-energize the instrument.
4. Then pull off the remaining terminal blocks. Now you can dismantle the instrument.
5. Loosen 4 screws to remove the complete electronics box from the steel housing.
6. The power supply module is snapped in and can be loosened and removed by slightly bending the electronics box walls. Start with the rear catches!
7. Pull off the ribbon cable connected (item 110); now the power supply can be removed.
8. The central module is also snapped in and easy to remove. Note! The central module may be fastened with an additional center screw. Remove this screw if present.

7.1.2 Replacement of central module

Note!
A replacement central module LSCx-x is supplied from the factory with the instrument serial number of the new module. Since the serial and release numbers are linked to enable the extended functions and parameter set switching, an existing extension / MRS cannot be active. All the editable data are reset to the factory settings following central module replacement.

Proceed as described below when replacing the central module:

1. If possible, record the user settings of the instrument, e.g.:
   – Calibration data
   – Conductivity and temperature current assignment
   – Relay function selections
   – Limit settings
   – Alarm settings, alarm current assignment
   – Monitoring functions
   – Interface parameters
2. Dismantle the instrument as described in the chapter "Dismantling Smartec S CLD134".
3. Refer to the part number of the central module to determine whether the new module has the same part number as the old one.
4. Assemble the instrument with the new module.
5. Start up the instrument and test its basic functions (e.g. measured value and temperature display, operation via keyboard).
6. Enter the instrument serial number:
   – Read the instrument serial number (“ser-no.”) on the nameplate.
   – Enter this number in the fields E115 (year, one-digit), E116 (month, one-digit), E117 (sequence number, four-digit).
   – Field E118 displays the complete number for verification;

     Caution!
     The serial number can only be entered – and **only once** – in the case of a new module from the factory with a new module number! Make sure that your entry is correct before confirming with ENTER!
     Entry of an incorrect code will prevent the extended functions from being enabled. An incorrect serial number can only be corrected at the factory.

   – confirm with ENTER or abort and re-enter.
7. Enter the release code in field Feld S7 (see nameplate "/Codes:").
8. Verify that the functions have been enabled:
   Extension functions e.g. PCS function in function group CHECK / code P, must be available;
   Measuring range switching e.g. alpha tables 1 ... 4 in function group T / must be selectable .
9. Enter the default values of the cell constant (6.3 cm^{-1}) in field A5 and of the temperature sensor (Pt1k) in field B1.
10. Restore the user settings of the instrument.

7.2 Maintenance of measuring system

7.2.1 Cleaning conductivity sensors

Inductive sensors are less sensitive to soiling than conventional conductive sensors since there is no galvanic contact with the medium.
However, dirt may collect in the flow opening (making it narrower), which changes the cell constant. In this case, an inductive sensor also requires cleaning.

Recommended cleaning procedure:
- Oily and greasy coatings:
  Clean with detergent (fat solvent, e.g. alcohol, acetone, poss. detergent).

Warning!
Protect your hands, eyes and clothes when using the cleaning agents described below!

- Limestone deposits or metal hydroxide coatings:
  Loosen coatings with diluted hydrochloric acid (3 %), brush off carefully if necessary and rinse thoroughly with plenty of clear water.
- Coatings containing sulphide (from FGD or sewage treatment plants):
  Use mixture of hydrochloric acid (3 %) and thiourea (commercially available), brush off carefully if necessary and rinse thoroughly with plenty of clear water.
- Coatings containing protein (food industry):
  Use mixture of hydrochloric acid (0.5 %) and pepsin (commercially available), brush off carefully if necessary and rinse thoroughly with plenty of clear water.

7.2.2 Checking inductive conductivity sensors

The following specifications apply to the CLS54 sensor.
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 approx. 1 ... 3 Ω.
  – Inductivity approx. 180 ... 550 mH (at 2 kHz; serial connection as equivalent circuit diagram)
  Separate version: measure the white and red coaxial cables.
  Compact version: measure the white and brown 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 brown or red coaxial cable and white coaxial cable.
- Testing the temperature sensor
  Use the table in chapter "Instrument check by medium simulation" to check the Pt1000 in the sensor.
  Measure between the green and white wires in the case of the separate version and between green and yellow. The resistance values should be identical.
  Compact version: measure between the two red wires.
- 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 or red + red) and the coils (red and white coaxial cables or brown and white coaxial cables).

7.2.3 Instrument check by medium simulation

The inductive sensor cannot be simulated.
However, the overall system comprising the CLD134 and inductive sensor can be checked using equivalent resistances. Note the cell constant ($k_{nominal}$ = 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:

Conductivity$_{[mS/cm]}$ = k ·1/($R_{[k\Omega]}$ · 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.

Temperature sensor simulation:
The temperature sensor of the inductive sensor is connected to terminals 11, 12 and 13 on the instrument (compact version and separate version).
For simulation, the temperature sensor is disconnected, and an equivalent resistance is connected instead. This resistance must also be connected using a three-wire arrangement, i.e. connection to terminals 11 and 12, with a bridge from 12 to 13.

The table shows some resistance values for temperature simulation:

Temperature	Resistance
- 20 °C (-4 °F)	921.3 Ω
-10 °C (14 °F)	960.7 Ω
0 °C (32 °F)	1000.0 Ω
10 °C (50 °F)	1039.0 Ω
20 °C (68 °F)	1077.9 Ω
25 °C (77 °F)	1097.3 Ω
50 °C (122 °F)	1194.0 Ω
80 °C (176 °F)	1308.9 Ω
100 °C (212 °F)	1385.0 Ω
150 °C (302 °F)	1573.2 Ω
200 °C (392 °F)	1758.4 Ω

7.3 Service equpipment "Optoscope"

The Optoscope together with the “Scopeware” software offers the following possibilities, without having to remove or open the transmitter and without galvanic connection to the instrument:

- Documentation of the instrument settings in conjunction with Commuwin II
- Software update by the service technician
- Upload/download a hex dump to duplicate configurations.

The Optoscope serves as an interface between the transmitter and PC / laptop. The information exchange takes place via the optical interface on the transmitter and via an RS 232 interface on the PC / laptop (see "Accessories").

8 Accessories

8.1 Sensors

- Indumax H CLS54
  Inductive conductivity sensor with fast response time and hygienic design;
  with integrated temperature sensor.
  Order according to product structure, see Technical Information TI400C/07/en.

8.2 Post mounting kit

- Mounting kit for installation of Smartec S CLD132/CLD134 on horizontal or vertical pipes and posts (max. Ø 60 mm (2.36")), material stainless steel 1.4301;
  order no.: 50062121

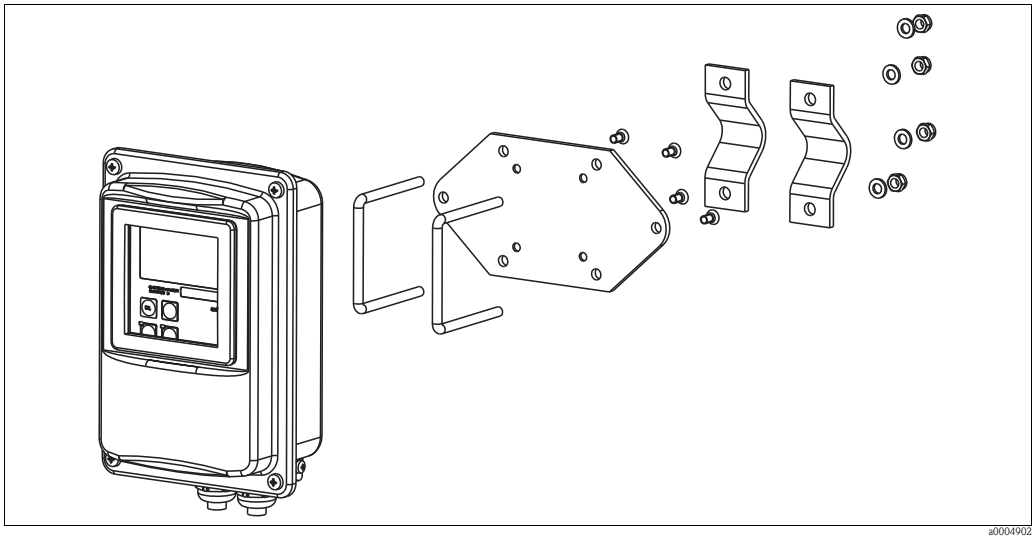


Fig. 42: Mounting kit for installing CLD132/CLD134 separate version on posts or pipes (base plate belongs to the scope of delivery of the transmitter)

8.3 Software upgrade

- Software upgrade
  Remote parameter set switching (measuring range switching, MRS) and determination of temperature coefficient;
  order no.: 51501643
  Serial number of instrument must be specified with order.

8.4 Calibration solutions

Precision solutions, traceable to SRM (standard reference material) by NIST, for qualified calibration of conductivity measurement systems according to ISO 9000, with temperature table

- CLY11-B
  149.6 µS/cm (reference temperature 25 °C / 77 °F), 500 ml / 16.9 fl.oz
  Order no. 50081903
- CLY11-C
  1.406 mS/cm (reference temperature 25 °C / 77 °F), 500 ml / 16.9 fl.oz
  Order no. 50081904
- CLY11-D
  12.64 mS/cm (reference temperature 25 °C/ 77 °F), 500 ml / 16.9 fl.oz
  Order no. 50081905
- CLY11-E
  107.0 mS/cm (reference temperature 25 °C / 77 °F), 500 ml / 16.9 fl.oz
  Order no. 50081906

8.5 Optoscope

Optoscope

- Interface between transmitter and PC / laptop for service purposes.
- The Windows software "Scopeware" required for the PC or laptop is supplied with the Optoscope. The Optoscope is supplied in a sturdy plastic case with all the accessories required.
- Order no. 51500650

9 Troubleshooting

9.1 Troubleshooting instructions

The transmitter continually monitors its own functions. If the instrument detects a defect, the error number appears on the display. This error number is displayed underneath the main value unit display. If several errors are detected, these can be called up with the MINUS key.
Refer to the table "System error messages" for error numbers and the appropriate corrective measures.
In case of malfunctions or errors without error messages, use the tables "Process-specific errors" and "Instrument-specific errors" to locate and eliminate the error. The "Instrument-specific errors" table also specifies required spare parts.

9.2 System error messages

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

Error no.	Display	Tests and / or measures	Alarm contact		Error current	
			Factory	User	Factory	User
E001	EEPROM memory error	1. Switch instrument off and back on. 2. Set to factory settings (S11). 3. Load hardware-compatible software (with Optoscope, see chapter "Service equipment Optoscope"). 4. If problem persists, return instrument to your local Endress+Hauser sales agency for repair or replace instrument.	yes		no	
E002	Instrument not calibrated, calibration data invalid, no user data or user data invalid (EEPROM error), software does not match hardware (central module)		yes		no	
E003	Download error	Download must not access locked functions (e.g. temperature table in basic version).	yes		no	
E007	Transmitter malfunction, software does not match transmitter version		yes		no	
E008	Sensor or sensor connection faulty	Check sensor and sensor connection (see chapter "Instrument check by medium simulation" or call the E+H Service).	yes		no	
E010	No temperature sensor connected or temperature sensor short-circuited (temperature sensor faulty)	Check temperature sensor and connections; if necessary, check instrument with temperature simulator.	yes		no	
E025	Limit for air set offset exceeded	Repeat air set (in air) or replace sensor. Clean and dry sensor before air set.	yes		no	
E036	Sensor calibration range exceeded	Clean and recalibrate sensor; if necessary, check sensor and connections.	yes		no	
E037	Below calibration range of sensor		yes		no	
E045	Calibration aborted	Recalibrate.	yes		no	
E049	Calibration range of installation factor exceeded	Check pipe diameter, clean sensor and repeat calibration.	yes		no	
E050	Below calibration range of installation factor		yes		no	
E055	Below measuring range of main parameter	Immerse sensor in conductive medium or perform air set.	yes		no	
E057	Measuring range of main parameter exceeded	Check measurement, control and connections (simulation see chapter "Instrument check by medium simulation").	yes		no	
E059	Below temperature measuring range		yes		no	
E061	Temperature measuring range exceeded		yes		no	

Error no.	Display	Tests and / or measures	Alarm contact		Error current	
			Factory	User	Factory	User
E063	Below current output range 1	Check measured value and current output assignment (function group O).	yes		no	
E064	Current output range 1 exceeded		yes		no	
E065	Below current output range 2	Check measured value and current output assignment.	yes		no	
E066	Current output range 2 exceeded		yes		no	
E067	Limit contactor set value exceeded	Check measured value, limit setting and metering devices. Only available with R1 = alarm + limit value or limit value.	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 parameter range too small	Spread current output.	no		no	
E081	Current output 2 parameter range too small	Spread current output.	no		no	
E100	Current simulation active		no		no	
E101	Service function yes	Switch service function off or switch instrument off and back on.	no		no	
E102	Manual mode active		no		no	
E106	Download yes	Wait for download to end.	no		no	
E116	Download error	Repeat download.	no		no	
E150	Distance between temperature values in α value table too small	Enter correct values in α value table (minimum distance of 1 K required between temperature values).	no		no	
E152	Live Check alarm	Check sensor and connection.	no		no	

9.3 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

Error	Possible cause	Tests and / or remedial measures	Equipment, spare parts, personnel
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 assignments of measured value to current signal.	
	Incorrect output function	Check 0-20 / 4 -20 mA selection and curve shape (linear / table).	
	Air cushion in assembly	Check assembly and installation.	
	Incorrect temperature measurement / temperature sensor defective	Check instrument with equivalent resistance/ check Pt1000 in sensor.	Pt1000 simulation: s. chapter "Instrument check by medium simulation". Pt1000 test: s. chapter "Checking inductive conductivity sensors".
	Transmitter module defective	Test with new module.	See chapters "Instrument-specific errors" and "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 Endress+Hauser Service to test.
Incorrect temperature value	Incorrect sensor connection	Verify connections using connection diagram; three-wire connection mandatory.	Connection diagramm in chapter "Electrical connection"
	Measuring cable defective	Check cable for interruption/short circuit/ shunt.	Ohmmeter; also see chapter "Instrument check by medium simulation".
	Incorrect temperature sensor type	Select temperature sensor type on instrument (field B1).	
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	
	Incorrect sensor orientation	Flow opening of sensor must point in medium flow direction.	Compact version: Remove electronics box to turn sensor (s. chapter "Sensor positioning"). Separate version: turn sensor in flange.
	Flow rate too high (may cause bubbles)	Reduce flow or choose low turbulence mounting position.	
	Interference current in medium	Ground medium close to sensor; remove/repair interference source.	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.
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.	

Error	Possible cause	Tests and / or remedial measures	Equipment, spare parts, personnel
Limit contact does not work	Relay configured for alarm	Activate limit contactor.	See field R1.
	Pickup delay setting too long	Shorten pickup delay.	See field R4.
	"Hold" function active	“Automatic Hold” during calibration, “Hold” input activated; “Hold” via keyboard active.	See fields S2 to S5.
Limit contact works continuously	Dropout delay setting too long	Shorten dropout delay.	See field R5.
	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 O22.
	Impermissible operating state of processor system	Switch instrument off and back on.	EMC problem: check installation, screen, grounding if problem persists/ call Endress+Hauser 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 screened lines, ground screens on both sides, route line in other duct if necessary.
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".
	Instrument with PROFIBUS PA	PA instrument has no current output!	
Extension package functions not available (Live Check, current curve 2 ... 4, alpha value curve 2 ... 4, user conc. curve 1 ... 4)	Extension package not enabled (enable with code that depends on serial number and is received from Endress+Hauser with order of extension package)	– When upgrading instrument with extension package: code received from Endress+Hauser ⇒ enter. – After replacing defective LSCH/LSCP module: first enter instrument serial number (s. nameplate) manually, then enter code.	For a detailed description, see chapter "Replacement of central module".
No HART communication	No central HART module	Verify by looking at nameplate: HART = -xxxxxxHAx and -xxxxxxHBx	Upgrade to LSCH-H1 / -H2.
	Current output < 4 mA	For further information see BA 212C/07/en, “Field communication with HART”.	
	No or wrong DD (device description)		
	HART interface missing		
	Instrument not registered with HART server		
	Load too low (load > 230 Ω required)		
	HART receiver (e.g. FXA 191) not connected via load but via power supply		
	Incorrect device address (addr. = 0 for single operation, addr. > 0 for multi-drop operation)		
	Line capacitance too high		
	Line interferences		
	Several devices set to same address	Set addresses correctly.	Communication not possible with several devices set to same address.

Error	Possible cause	Tests and / or remedial measures	Equipment, spare parts, personnel
No PROFIBUS® communication	No central PA/DP module	Verify by looking at nameplate: PA = -xxxxxxPEx or xxxxxxPFx DP = -xxxxxxPPx	Upgrade to LSCP module, see chapter "Spare parts".
	Incorrect instrument software version (without PROFIBUS)	For further information, see BA213C/07/en "Field communication with PROFIBUS PA/DP".	
	Commuwin (CW) II: Incompatible CW II and instrument software versions		
	No or incorrect DD/DLL		
	Incorrect baud rate setting for segment coupler in DPV-1 server		
	Incorrect station (master) addressed or duplicate address		
	Incorrect station (slaves) address		
	Bus line not terminated		
	Line problems (too long, cross section too small; not screened, screen not grounded, wires not twisted)		
	Bus voltage too low (bus supply voltage typ. 24 V DC for non-Ex)	Voltage at instrument's PA/DP connector must be at least 9 V.	

9.4 Instrument-specific errors

The table below will help you diagnose problems and specifies the spare parts required.

A diagnosis depending on difficulty and measuring equipment at hand is to be performed by:
- trained operator personnel
- operator's electricians
- company responsible for system installation / operation
- E+H Service

Please refer to the chapter "Spare parts" for information on the exact designations of the spare parts and their installation.

Error	Possible cause	Tests and / or remedial measures	Equipment, spare parts, personnel
Display dark, no LEDs active	No mains voltage	Check if mains voltage is available.	Electrician / e.g. multimeter
	Wrong supply voltage / voltage too low	Compare mains voltage and rating on nameplate.	Operator (utility company specification or multimeter)
	Connection fault	Terminal not tightened;; insulation clamped in terminal; wrong terminals used.	Electrician
	Fuse blown	Compare mains voltage and rating on nameplate and replace fuse.	Electrician / correct fuse; see drawing in chapter "Spare parts".
	Power supply unit defective	Replace power supply unit using correct variant.	On-site diagnosis by E+H Service (test module required)
	Central module LSCH / LSCP defective	Replace central module using correct variant.	On-site diagnosis by E+H Service (test module required)
	Ribbon cable between central module and power supply unit loose or defective	Check ribbon cable, replace if necessary.	See chapter "Spare parts".
Display dark, LED active	Central module defective (module: LSCH/LSCP)	Replace central module.	On-site diagnosis by E+H Service (test module required)

Error	Possible cause	Tests and / or remedial measures	Equipment, spare parts, personnel
Display shows measured value but – value does not change and / or – instrument cannot be operated	Ribbon cable or transmitter module not properly installed	Reinsert transmitter module, use additional fastening screw M3 if necessary. Check if ribbon cable is inserted correctly.	Refer to exploded view in chapter "Spare parts".
	Impermissible operating system state	Switch instrument off and back on.	Possible EMC problem: if problem persists, check the installation or call E+H Service to have it checked.
Incorrect display, missing dots, segments, characters or lines	Moisture or dirt in display frame, rubber not pressed on correctly or PCB contacts soiled	Replace central module LSC.... Emergency: Remove display frame, clean glass and PCB, dry well and reinstall. Do not touch conducting rubber with hands!	See chapter "Spare parts".
Instrument gets hot	Incorrect voltage / too high	Compare mains voltage and rating on nameplate.	Operator, electrician
	Heating from process or solar radiation	Improve positioning or use separate version. Use sun protection outdoors.	
	Power supply unit defective	Replace power supply unit.	Can only be diagnosed by E+H Service.
Incorrect measured conductivity and / or temperature value	Transmitter module defective (module: MKIC), please perform tests and take measures according to chapter "Process errors without messages"	Test measuring inputs: – Simulation with resistance, see table in chpt. "Instrument check by medium simulation". – Connect 1000 Ω resistor to terminals 11 / 12 + 13 = display 0 °C.	Test negative: replace module (using correct variant). Refer to exploded view in chapter "Spare parts".
Incorrect current output signal	Not calibrated correctly	Test with built-in current simulation (field O221), connecting mA meter directly to current output.	If simulation value is incorrect: recalibration at factory or new LSCxx module are required. If simulation value is correct: check current loop for load and shunts.
	Load excessive		
	Shunt / short-circuit to frame in current loop		
	Incorrect mode of operation	Check whether 0–20 mA or 4–20 mA has been selected.	
No current output signal	Current output stage defective (LSCH/LSCP module)	Test with built-in current simulation, connecting mA meter directly to current output.	If test fails: Replace central module LSCH/LSCP (using correct variant).
Additional functions (extended functions or measuring range switching) missing	No or wrong release codes used	If upgraded: Check whether correct serial number was used when ordering extension functions or MRS.	To be handled by E+H Sales.
	Incorrect instrument serial number stored in LSCH/LSCP module	Check whether serial number on nameplate matches SNR in LSCH/ LSCP (field S 10).	**Instrument** serial no. in LSCH/LSCP module is required for the function extensions.
Additional (extended functions or measuring range switching) not available after replacement of LSCH/LSCP module	LSCH or LSCP replacement modules are supplied with the **instrument** serial no. 0000. Extensions are not released ex-factory.	For LSCH / LSCP with serial no. 0000, an **instrument** serial no. can be entered **once** in fields E115 to E118. Then enter release code for extension package.	For a detailed description, see chapter "Replacement of central module".
No HART or PROFIBUS PA/DP interface function	Wrong central module	HART: LSCH-H1 or -H2 module, PROFIBUS PA: LSCP-PA module, PROFIBUS DP: LSCP-DP module, see fields E111 ... 113.	Replace central module; operator or E+H-Service.
	Wrong instrument software	SW version, see field E111.	SW can be changed with Optoscope.
	Incorrect configuration	See troubleshooting table in chapter "System errors without messages".	

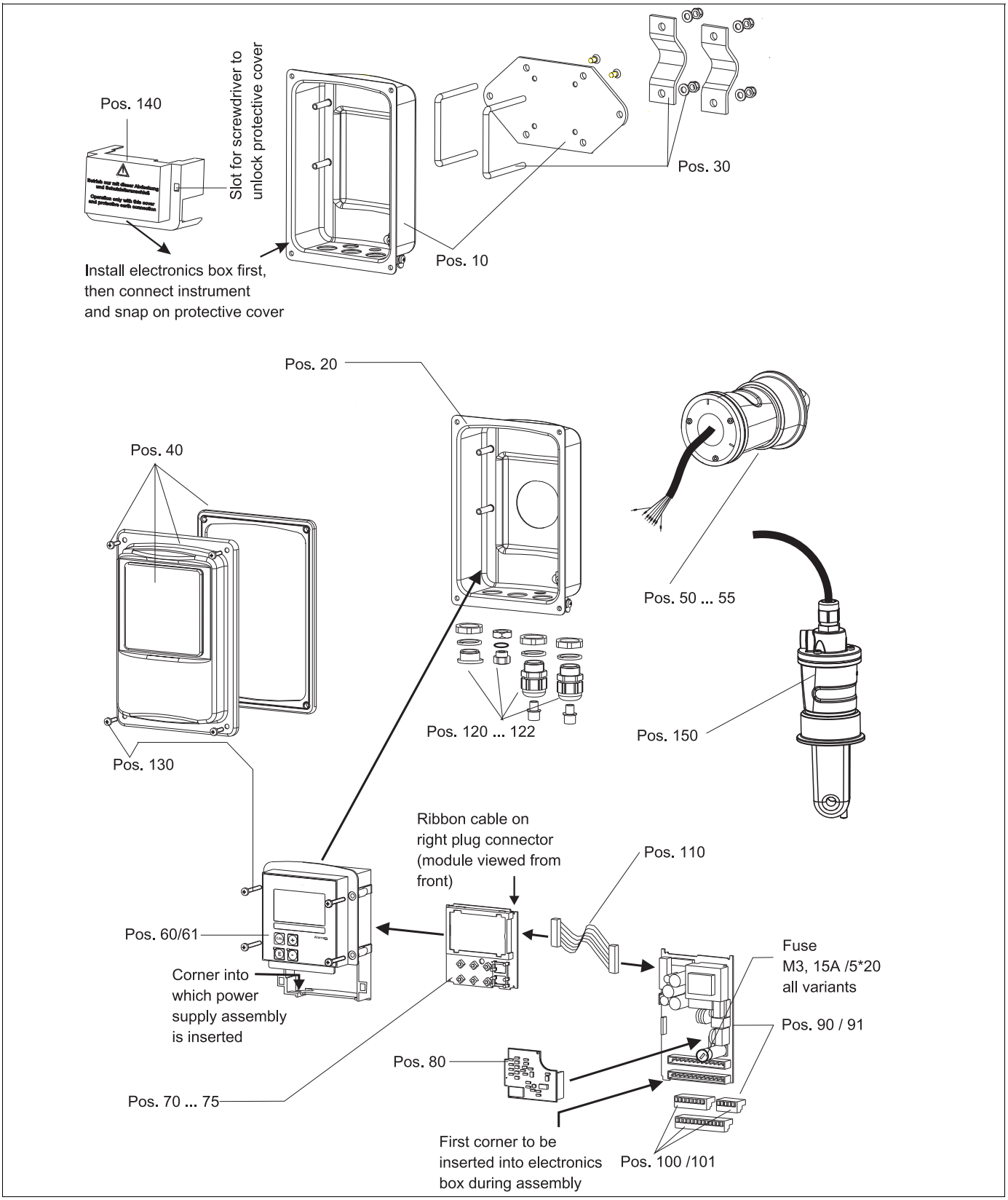
9.5 Spare parts

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 sofware (see chapter "Instrument configuration") if the instrument processor system is functional.

9.5.1 Exploded view



The exploded view drawing shows all components and spare parts of Smartec S CLD134. Use the position numbers to find the spare parts designation and their order number in the following section.

9.5.2 Spare part kits

Item	Kit designation	Name	Function/content	Order number
10	Housing bottom, separate		Bottom assembly	51501574
20	Housing bottom, compact		Bottom assembly	51501576
30	Post mounting kit		1 pair of post mounting parts	50062121
40	Housing cover		Cover with accessories	51501577
50	Sensor assembly MV5, dairy fitting		Spare sensor	71020487
51	Sensor assembly AA5, aseptic fitting		Spare sensor	71020488
	Sensor assembly AA5, aseptic fitting USP 87		Spare sensor	71020493
52	Sensor assembly CS1, clamp ISO 2852 2"		Spare sensor	71020489
	Sensor assembly CS1, clamp ISO 2852 2" USP 87		Spare sensor	71020495
53	Sensor assembly SMS, SMS 2"		Spare sensor	71020490
54	Sensor assembly VA4, Varivent® N DN 40 to 125		Spare sensor	71020491
	Sensor assembly VA4, Varivent® N DN 40 to 125 USP 87		Spare sensor	71020496
55	Sensor assembly BC5, Neumo BioControl® D50		Spare sensor	71020492
	Sensor assembly BC5, Neumo BioControl® D50 USP 87		Spare sensor	71020497
60	Elektronics box		Box w. membrane, key tappets	51501584
61	Electronics box PA/DP		Box with front foil, key tappets, protection cover	51502280
70	Central module (controller)	LSCH-S1	1 current output	51502376
71	Central module (controller)	LSCH-S2	2 current outputs	51502377
72	Central module (controller)	LSCH-H1	1 current output + HART	51502378
73	Central module (controller)	LSCH-H2	2 current outputs + HART	51502379
74	Central module (controller)	LSCP-PA	PROFIBUS PA / no current output!	51502380
75	Central module (controller)	LSCP-DP	PROFIBUS DP / no current output!	51502381
80	Conductivity transmitter	MKIC	Conductivity + temperature input	51501206
90	Power supply unit (main module)	LTGA	100/115/230 V AC	51501585
91	Power supply unit (main module)	LTGD	24 V AC + DC	51501586
100	Terminal strip kit		Terminal strips 5/8/13 poles	51501587
101	Terminal strip kit PA/DP		Terminal strips 5/8/13 poles	51502281
110	Ribbon cable		20-wire line with connector	51501588
121	Cable entry kit M20		Cable glands, plugs, Goretex filter	51502282
122	Cable entry kit Conduit		Cable glands, plugs, Goretex filter	51502283

Item	Kit designation	Name	Function/content	Order number
130	Screw and gasket kit		All screws and gaskets	51501596
140	Protection cover kit		Protection cover for connection compartment	51502382
150	Sensor descrete		Standard CLS54	see TI400C

9.6 Return

If the transmitter has to be repaired, please return it *cleaned* to the sales center responsible. Please add a detailed failure description. If the failure diagnosis is not clear please send also the cable and the sensor.
Please use the original packaging, if possible.

Please enclose the completed "Declaration of Hazardous Material and De-Contamination" (copy the second last page of these Operating Instructions) with the packaging and also the shipping documents.

9.7 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.

9.8 Software history

Date	Version	Changes to Software	Documentation: Edition
03/2006	1.12	Original Software	BA401C/07/en/03.06
07/2007	1.13	Change of cell konstant	BA401C/07/en/07.07

10 Technical Data

10.1 Input

Measured variables	Conductivity Concentration Temperature	
Measuring range	Conductivity:	recommended range: 100 µS/cm to 2000 mS/cm (uncompensated)
	Concentration – NaOH: – HNO_3: – H_2SO_4: – H_3PO_4:	 0 to 15 % 0 to 25 % 0 to 30 % 0 to 15 %
	Temperature:	–35 to +250 °C (-31 to +482 °F)
Cable specification	max. cable length 20 m (65.6 ft) (separate version)	
Binary inputs 1 and 2	Voltage:	10 to 50 V DC
	Current consumption:	max. 10 mA at 50 V

10.2 Output

Output signal	Conductivity, concentration: Temperature (optional second current output)	0 / 4 to 20 mA, galvanically isolated
Minimum distance for 0 / 4 ... 20 mA output signal	Conductivity measurement: – 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 0 to 19.99 mS/cm: – Measured value 20 to 200 mS/cm: – Measured value 200 to 2000 mS/cm:	 2 µS/cm 20 µS/cm 200 µS/cm 2 mS/cm 20 mS/cm 200 mS/cm
	Concentration measurement:	no minimum distance
Signal on alarm	2.4 mA or 22 mA error current	
Load	max. 500 Ω	
Output range	Conductivity: Temperature:	adjustable adjustable
Signal resolution	max. 700 digits/mA	
Separation voltage	max. 350 V_{RMS} / 500 V DC	
Overvoltage protection	acc. to EN 61000-4-5:1995	
Auxiliary voltage output	Output voltage:	15 V ± 0.6 V
	Output current:	max. 10 mA
Contact outputs	Switching current with ohmic load (cos φ = 1):	max. 2 A
	Switching current with inductive load (cos φ = 0.4):	max. 2 A
	Switching voltage:	max. 250 V AC, 30 V DC
	Switching power with ohmic load (cos φ = 1):	max. 500 VA AC, 60 W DC
	Switching power with inductive load (cos φ = 0.4):	max. 500 VA AC
Limit contactor	Pickup / dropout delay:	0 to 2000 s
Alarm	Function (switchable):	steady / fleeting contact
	Alarm delay:	0 to 2000 s (min)

10.3 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 fuse	Fine-wire fuse, medium time lag, 250 V / 3.15 A

10.4 Performance characteristics

Measured value resolution	Temperature:	0.1 °C (0.18 °F)
Measured value deviation[1)]	Conductivity: – Display: – Conductivity signal output:	 max. 0.5 % of measured value ± 4 digits max. 0.75 % of current output range
	Temperature – Display: – Temperature signal output:	 max. 0.6 % of measuring range max. 0.75 % of current output range
Repeatability[1]	Conductivity:	max. 0.2% of measured value ± 2 digits
Measuring frequency (oscillator)	2 kHz	
Temperature compensation	Range:	–10 to +150 °C (14 to 302 °F)
	Compensation types:	– none – linear with freely selectable temperature coefficient α – one freely programmable coefficient table (four tables available in versions with remote parameter set switching) – NaCl acc. to IEC 746-3
	Minimum distance for table:	1 K
Reference temperature	25 °C (77 °F)	
Temperature offset	adjustable, ± 5 °C / 9 °F, for temperature display adjustment	

1) acc. to IEC 746 part 1, nominal operating conditions

10.5 Environment

Ambient temperature	0 to +55 °C (32 to 131 °F)	
Ambient temperature limits	–10 to +70 °C (14 to 158 °F) (separate version and separate transmitter) –10 to +55 °C (14 to 131 °F) (compact version) (see Fig. 41 "Permissible temperature ranges of Smartec S CLD134")	
Storage temperature	–25 to +70 °C (-13 to 158 °F)	
Electromagnetic compatibility	Interference emission and interference resistance acc. to EN 61326: 1997 / A1: 1998	
Ingress protection	IP 67	
Relative humidity	10 to 95%, non-condensing	
Vibration resistance acc. to IEC 60770-1 and IEC 61298-3	Oscillation frequency:	10 to 500 Hz
	Deflection (peak value):	0.15 mm / 0.01"
	Acceleration (peak value):	19.6 m/s^2 (64.3 ft/s^2)
Impact resistance	Display window:	9 J

10.6 Mechanical construction

Design, dimensions	Separate transmitter with mounting plate	L x W x D: 225 x 142 x 109 mm (8.86 x 5.59 x 4.29 ")
	Compact transmitter MV5, CS1, AA5, SMS:	L x W x D: 225 x 142 x 109 mm (8.86 x 5.59 x 10.04 ")
	Compact transmitter VA4, BC5:	L x W x D: 225 x 142 x 109 mm (8.86 x 5.59 x 8.39 ")
Weight	Separate version	
	Transmitter:	approx. 2.5 kg (5.5 lb.)
	Sensor CLS54:	depending on version 0.3 ... 0.5 kg (0.66 ... 1.1 lb.)
	Compact version with CLS54 sensor:	approx. 3 kg (6.6 lb.)
Transmitter materials	Housing:	stainless steel 1.4301, polished
	Front window:	polycarbonate

10.7 Measurement data of CLS54 sensor

Conductivity measuring range	recommended range: 100 µS/cm to 2000 mS/cm (uncompensated)
Measured value deviation	± (0.5 % of measured value + 10 µS/cm) after calibration (plus inaccuracy of the conductivity of the calibration solution)
Cell constant	k = 6.3 cm^{-1}
Temperature sensor	Pt 1000 (class A acc. to IEC 60751)
Temperature measuring range	-10 to +150 °C (+14 to +302 °F)
Temperature response time	$t_{90} \leq 26$ s
Materials in contact with medium	Virgin PEEK
Materials not in contact with medium	PPS-GF40, stainless steel 1.4404 (AISI 316L), screws: 1.4301 (AISI 304), FKM, EPDM (seal), PVDF (cable gland - separate version only), TPE (cable - separate version only)
Surface roughness	$R_a \leq 0.8$ µm (smooth, injection-molded PEEK surface) for the surfaces in contact with medium

10.8 Process

Process temperature	CLS54 sensor with separate version:	max. 125 °C (257 °F) at 70 °C (158 °F) ambient temperature
	Compact version:	max. 55 °C (131 °F) at 55 °C ambient temperature
Sterilisation	CLS54 sensor with separate version:	150 °C (302 °F) at 70 °C (158 °F) ambient temperature, 5 bar (72.5 psi), max. 60 min
	Compact version:	150 °C (302 °F) at 35 °C (95 °F) ambient temperature, 5 bar (72.5 psi), max. 60 min
Process pressure	max. 12 bar (174 psi) up to 90 °C (194 °F) 8 bar (116 psi) at 125 °C (257 °F) 0 to 5 bar (0 to 72.5 psi) when in CRN-applicable areas (tested with 50 bar (725 psi)) underpressure down to 0.1 bar (1.45 psi) absolute	
Ingress protection CLS54 sensor	IP 68 / NEMA 6P (1m water column, 50 °C, 168 h)	

Permissible temperature ranges of Smartec S CLD134

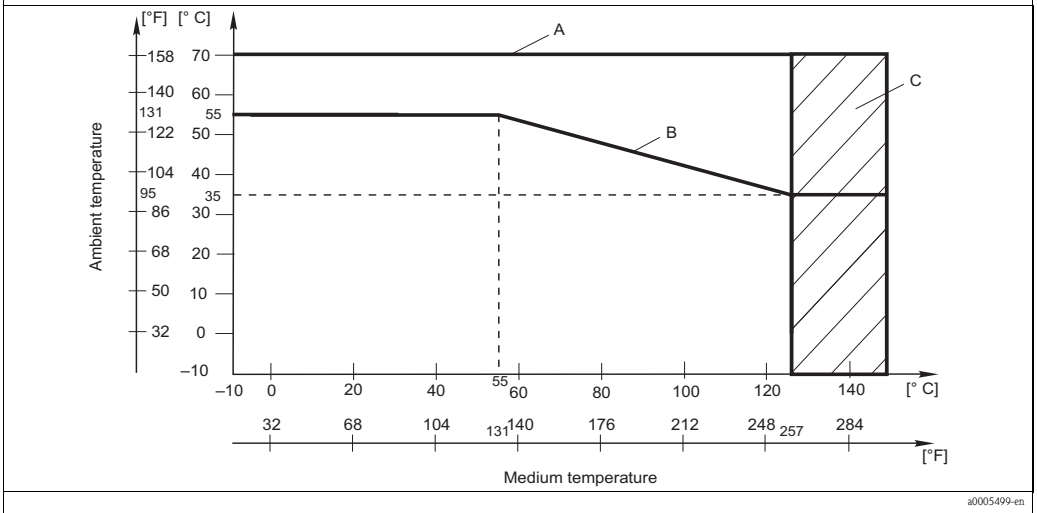


Fig. 43: Permissible temperature ranges of Smartec S CLD134

A CLS54 senor with separate version
B Compact version
C Short term for sterilization (<60 min)

Pressure-temperature load curve of CLS54 sensor

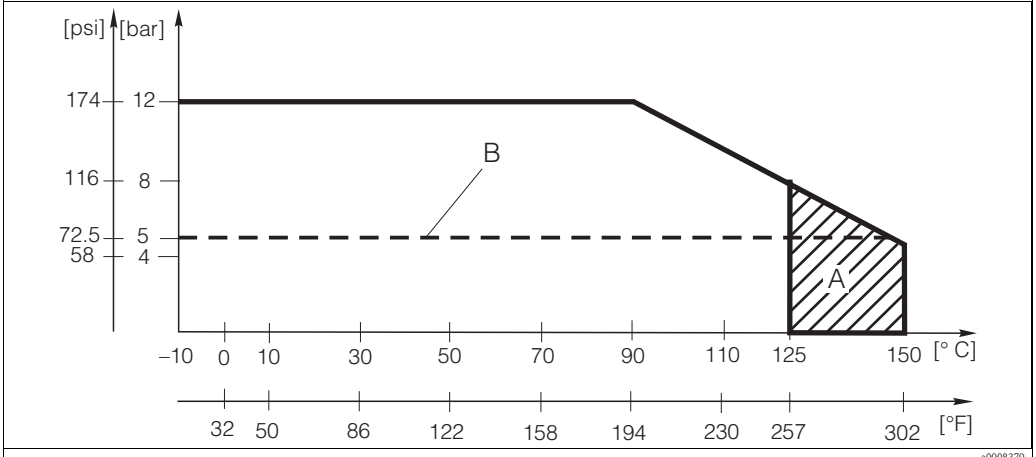


Fig. 44: Pressure / temperature load curve

A short-time sterilization (max. 60 min)
B MAWP (maximum allowable working pressure) according to ASME-BPVC Sec. VIII, Div 1, UG101 for CRN registration

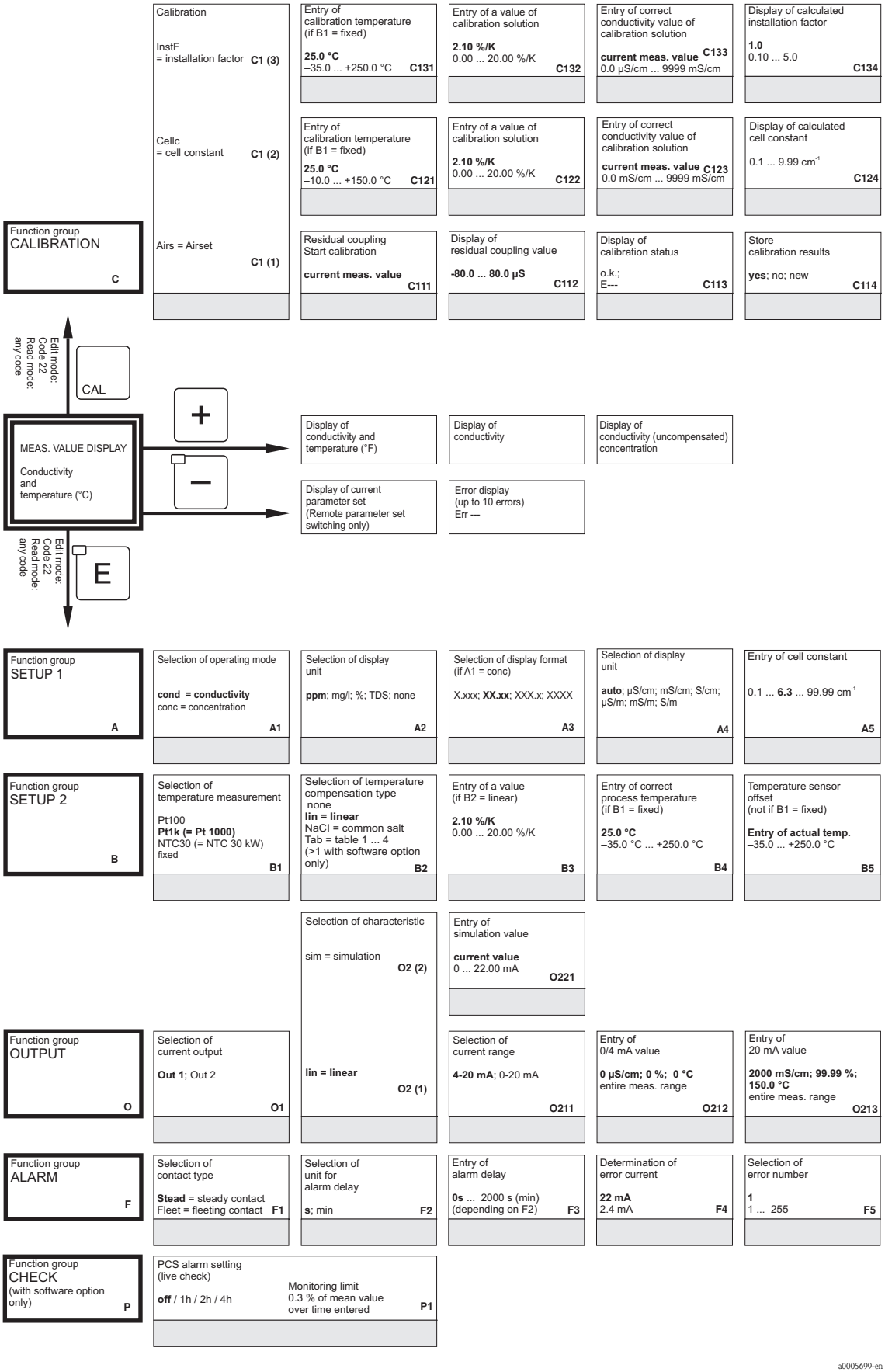
10.9 Chemical durability of CLS54 sensor

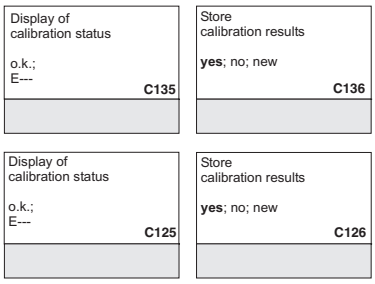
Medium	Concentration	PEEK
Caustic soda NaOH	0 to 15 %	20 to 90 °C (68 to 194 °F)
Nitric acid HNO_3	0 to 25 %	20 to 90 °C (68 to 194 °F)
Phosphoric acid H_3PO_4	0 to 15 %	20 to 80 °C (68 to 176 °F)
Sulphuric acid H_2SO_4	0 to 30 %	20 °C (68 °F)
Peracetic acid H_3C-CO-OOH	0.2 %	20 °C (68 °F)

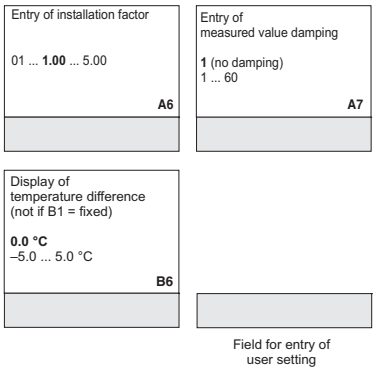
No responsibility is taken for the correctness of this information.

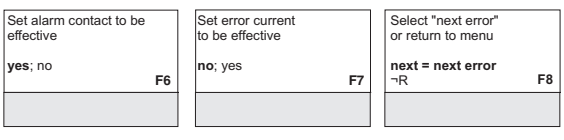
11 Appendix

Operating matrix

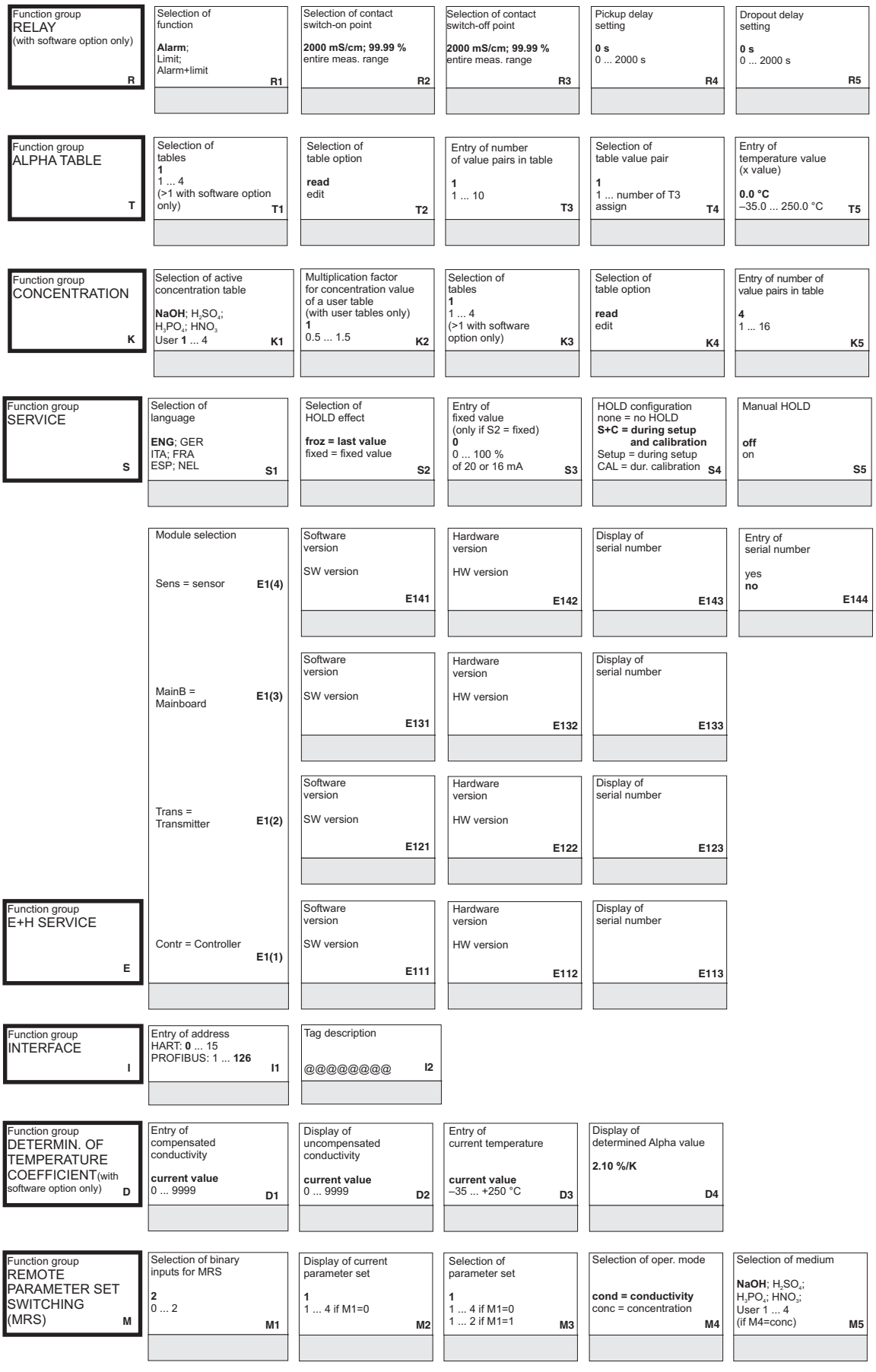



Display of
calibration status
o.k.;
E---
C135
Store
calibration results
yes; no; new
C136
Display of
calibration status
o.k.;
E---
C125
Store
calibration results
yes; no; new
C126


Entry of installation factor
01 ... 1.00 ... 5.00
A6
Entry of
measured value damping
1 (no damping)
1 ... 60
A7
Display of
temperature difference
(not if B1 = fixed)
0.0 °C
–5.0 ... 5.0 °C
B6
Field for entry of
user setting


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

a0005700-en


Function group RELAY (with software option only) R
Selection of function
Alarm; Limit; Alarm+limit
R1
Selection of contact switch-on point
2000 mS/cm; 99.99 % entire meas. range
R2
Selection of contact switch-off point
2000 mS/cm; 99.99 % entire meas. range
R3
Pickup delay setting
0 s
0 ... 2000 s
R4
Dropout delay setting
0 s
0 ... 2000 s
R5
Function group ALPHA TABLE T
Selection of tables
1
1 ... 4
(>1 with software option only)
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 of T3 assign
T4
Entry of temperature value (x value)
0.0 °C
–35.0 ... 250.0 °C
T5
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 (with user tables only)
1
0.5 ... 1.5
K2
Selection of tables
1
1 ... 4
(>1 with software option only)
K3
Selection of table option
read edit
K4
Entry of number of value pairs in table
4
1 ... 16
K5
Function group SERVICE S
Selection of language
ENG; GER
ITA; FRA
ESP; NEL
S1
Selection of HOLD effect
froz = last value
fixed = fixed value
S2
Entry of fixed value (only if S2 = fixed)
0
0 ... 100 % of 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
Function group E+H SERVICE E
Module selection
Sens = sensor E1(4)
Software version
SW version
E141
Hardware version
HW version
E142
Display of serial number
E143
Entry of serial number
yes
no
E144
MainB = Mainboard E1(3)
Software version
SW version
E131
Hardware version
HW version
E132
Display of serial number
E133
Trans = Transmitter E1(2)
Software version
SW version
E121
Hardware version
HW version
E122
Display of serial number
E123
Contr = Controller E1(1)
Software version
SW version
E111
Hardware version
HW version
E112
Display of serial number
E113
Function group INTERFACE I
Entry of address
HART: **0** ... 15
PROFIBUS: 1 ... **126**
I1
Tag description
@@@@@@@@
I2
Function group DETERMIN. OF TEMPERATURE COEFFICIENT (with software option only) 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 determined Alpha value
2.10 %/K
D4
Function group REMOTE PARAMETER SET SWITCHING (MRS) M
Selection of binary inputs for MRS
2
0 ... 2
M1
Display of current parameter set
1
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
M4
Selection of medium
NaOH; H_2SO_4; H_3PO_4; HNO_3; User 1 ... 4 (if M4=conc)
M5

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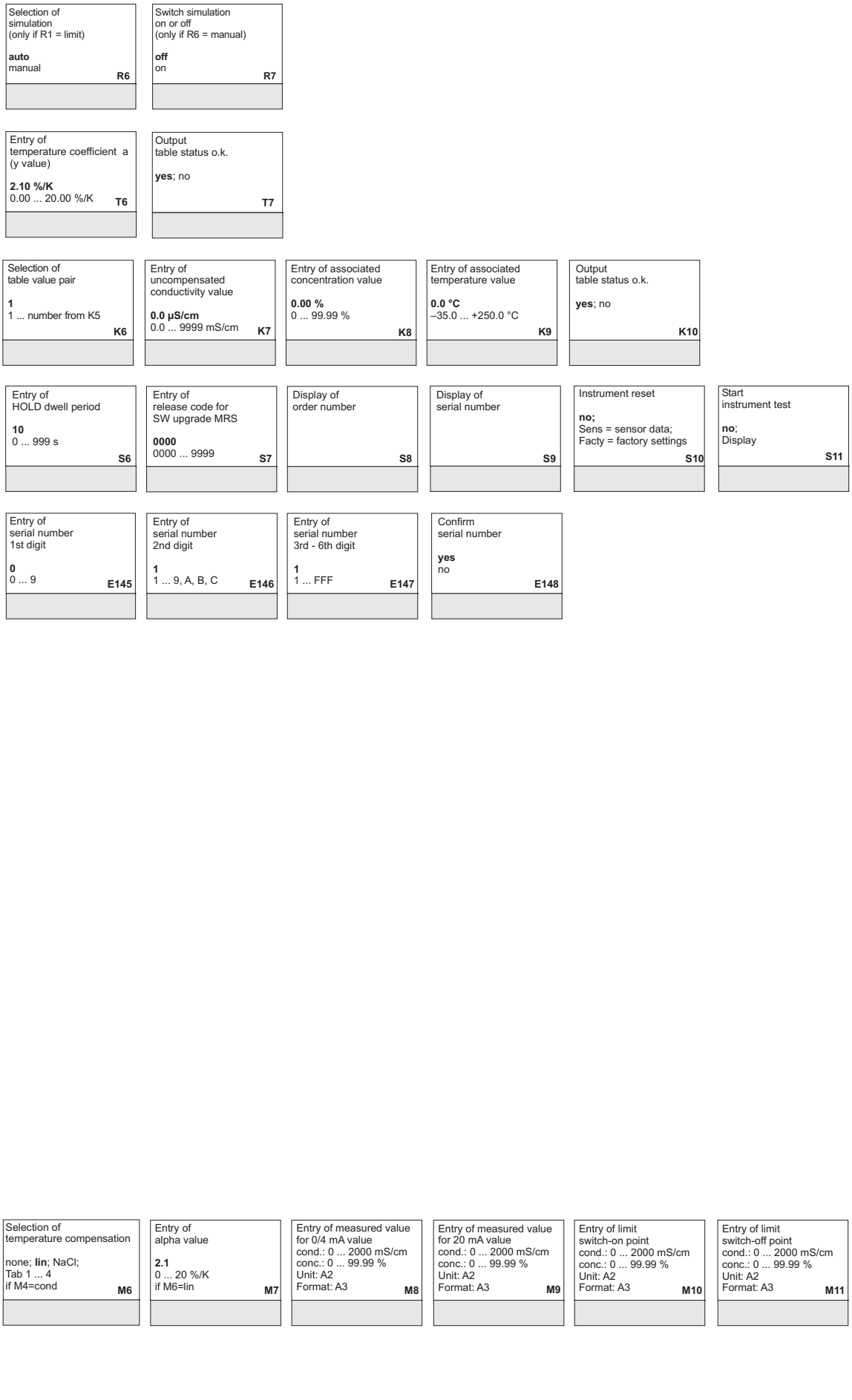
Selection of simulation (only if R1 = limit)
auto
manual
R6
Switch simulation on or off (only if R6 = manual)
off
on
R7
Entry of temperature coefficient a (y value)
2.10 %/K
0.00 ... 20.00 %/K
T6
Output table status o.k.
yes; no
T7
Selection of table value pair
1
1 ... number from K5
K6
Entry of uncompensated 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
Entry of HOLD dwell period
10
0 ... 999 s
S6
Entry of release code for SW upgrade MRS
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
Entry of serial number 1st digit
0
0 ... 9
E145
Entry of serial number 2nd digit
1
1 ... 9, A, B, C
E146
Entry of serial number 3rd - 6th digit
1
1 ... FFF
E147
Confirm serial number
yes
no
E148
Selection of temperature compensation
none; **lin**; NaCl;
Tab 1 ... 4
if M4=cond
M6
Entry of alpha value
2.1
0 ... 20 %/K
if M6=lin
M7
Entry of measured value for 0/4 mA value
cond.: 0 ... 2000 mS/cm
conc.: 0 ... 99.99 %
Unit: A2
Format: A3
M8
Entry of measured value for 20 mA value
cond.: 0 ... 2000 mS/cm
conc.: 0 ... 99.99 %
Unit: A2
Format: A3
M9
Entry of limit switch-on point
cond.: 0 ... 2000 mS/cm
conc.: 0 ... 99.99 %
Unit: A2
Format: A3
M10
Entry of limit switch-off point
cond.: 0 ... 2000 mS/cm
conc.: 0 ... 99.99 %
Unit: A2
Format: A3
M11

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Endress+Hauser

People for Process Automation

Declaration of Hazardous Material and De-Contamination
Erklärung zur Kontamination und Reinigung

RA No. ☐☐☐☐☐☐☐☐

Please reference the Return Authorization Number (RA#), obtained from Endress+Hauser, on all paperwork and mark the RA# clearly on the outside of the box. If this procedure is not followed, it may result in the refusal of the package at our facility.
Bitte geben Sie die von E+H mitgeteilte Rücklieferungsnummer (RA#) auf allen Lieferpapieren an und vermerken Sie diese auch außen auf der Verpackung. Nichtbeachtung dieser Anweisung führt zur Ablehnung ihrer Lieferung.

Because of legal regulations and for the safety of our employees and operating equipment, we need the "Declaration of Hazardous Material and De-Contamination", with your signature, before your order can be handled. Please make absolutely sure to attach it to the outside of the packaging.
Aufgrund der gesetzlichen Vorschriften und zum Schutz unserer Mitarbeiter und Betriebseinrichtungen, benötigen wir die unterschriebene "Erklärung zur Kontamination und Reinigung", bevor Ihr Auftrag bearbeitet werden kann. Bringen Sie diese unbedingt außen an der Verpackung an.

Type of instrument / sensor
Geräte-/Sensortyp _____

Serial number
Seriennummer _____

☐ Used as SIL device in a Safety Instrumented System / *Einsatz als SIL Gerät in Schutzeinrichtungen*

Process data/ *Prozessdaten*
Temperature / *Temperatur*_____ [°F] _____ [°C]
Conductivity / *Leitfähigkeit* _____ [µS/cm]
Pressure / *Druck* _____ [psi] _____ [Pa]
Viscosity / *Viskosität* _____ [cp] _____ [mm^2/s]

Medium and warnings
Warnhinweise zum Medium

	Medium /concentration *Medium /Konzentration*	Identification CAS No.	 flammable *entzündlich*	 toxic *giftig*	 corrosive *ätzend*	 harmful/ irritant *gesundheits-schädlich/ reizend*	 other * *sonstiges**	 harmless *unbedenklich*
Process medium / *Medium im Prozess*								
Medium for process cleaning / *Medium zur Prozessreinigung*								
Returned part cleaned with / *Medium zur Endreinigung*								

* explosive; oxidising; dangerous for the environment; biological risk; radioactive
* *explosiv; brandfördernd; umweltgefährlich; biogefährlich; radioaktiv*

Please tick should one of the above be applicable, include safety data sheet and, if necessary, special handling instructions.
Zutreffendes ankreuzen; trifft einer der Warnhinweise zu, Sicherheitsdatenblatt und ggf. spezielle Handhabungsvorschriften beilegen.

Description of failure / *Fehlerbeschreibung* _____

_____

_____

Company data / *Angaben zum Absender*

Company / *Firma* _____

_____

Address / *Adresse*

_____

_____

Phone number of contact person / *Telefon-Nr. Ansprechpartner:*

_____

Fax / E-Mail _____

Your order No. / *Ihre Auftragsnr.* _____

"We hereby certify that this declaration is filled out truthfully and completely to the best of our knowledge.We further certify that the returned parts have been carefully cleaned. To the best of our knowledge they are free of any residues in dangerous quantities."
"Wir bestätigen, die vorliegende Erklärung nach unserem besten Wissen wahrheitsgetreu und vollständig ausgefüllt zu haben. Wir bestätigen weiter, dass die zurückgesandten Teile sorgfältig gereinigt wurden und nach unserem besten Wissen frei von Rückständen in gefahrbringender Menge sind."

_____ (place, date / *Ort, Datum*)

_____ Name, dept./*Abt.* (please print / *bitte Druckschrift*)

_____ Signature / *Unterschrift*

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