INDUTEC

Inductive Conductivity / Concentration and Temperature Transmitter
with Switch Contacts

Operating Instructions

TI-IDT-EN-16-1

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Notes / Comments

Device type _____

Serial number _____

TAG number _____

Measuring range _____

Operating location _____

Device delivered on _____

Next calibration on _____

Date _____ Signature _____

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CAUTION!
A sudden failure of the device or of a sensor connected to it could result in dangerous overdosing. Please take suitable precautionary measures for this case.

NOTE!
All the necessary settings are described in this manual. However, if any difficulties should arise during start-up, please do not carry out any unauthorized manipulations. You could endanger your rights under the device warranty!
Please contact the nearest subsidiary or the head office in such a case.

NOTE!
Resetting the LC display:
If the brightness/contrast setting is such that the text in the display is not readable, the basic setting can be restored as follows:

- Switch off the supply voltage.
- Switch on the supply voltage and immediately keep the keys ▲ and ▼ held down

Resetting the operating language to „English“:
If the operating language has been set and you cannot understand the text of the display, the language can be set to „English“ with the Administrator password 7485. Thereafter, the desired language can be set in ADMINISTRATOR LEVEL / DEVICE DATA / ....

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Content

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1 Typographical conventions

1.1 Warning signs

	**DANGER!** This symbol is used when there may be **danger to personnel** if the instructions are ignored or not followed correctly!
	**CAUTION!** This symbol is used when there may be **damage to equipment** or data if the instructions are ignored or not followed correctly!

1.2 Note signs

	**NOTE!** This symbol is used when your **special attention** is drawn to a remark.
abc[1]	**Footnote** Footnotes are **remarks** that refer to specific points in the text. Footnotes consist of two parts: A marker in the text, and the footnote text. The markers in the text are arranged as continuous superscript numbers.
*	**Action instruction** This symbol indicates that an **action to be performed** is described. The individual steps are marked by this asterisk. Example: * Remove crosspoint screws.

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2 General

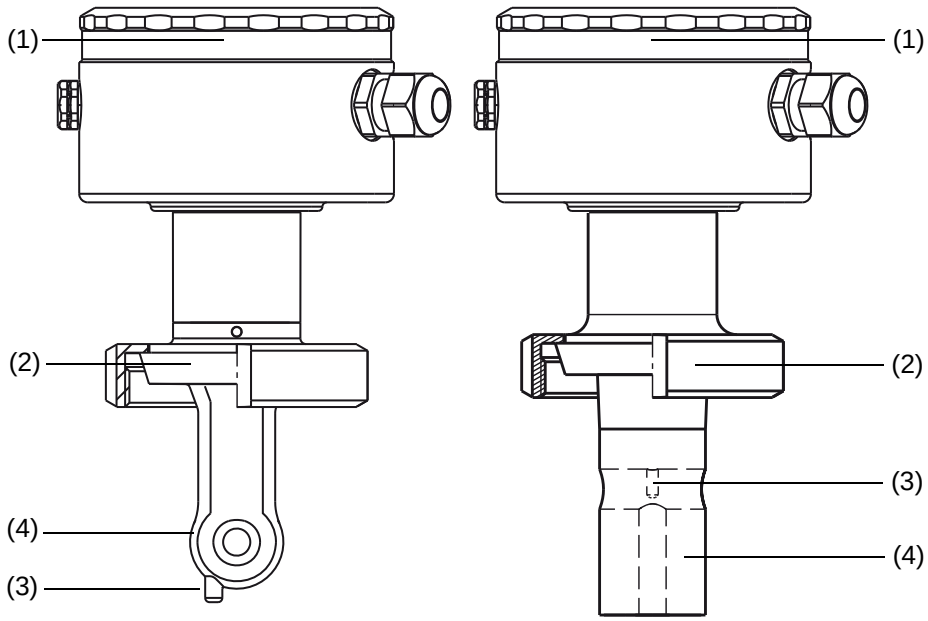
2.1 Preface

Please read these operating instructions before commissioning the device.
Keep the manual in a place that is accessible to all users at all times.

NOTE!
All the necessary settings are described in this manual. However, if any difficulties should arise during start-up, please do not carry out any unauthorized manipulations. You could endanger your rights under the device warranty!
Please contact the technical support of Hengesbach.

2.2 Device configuration

2.2.1 Device as head transmitter



(1) Transmitter (with and without graphic LCD display)
(2) Process connection
(3) Temperature probe
(4) Inductive conductivity measurement sensor

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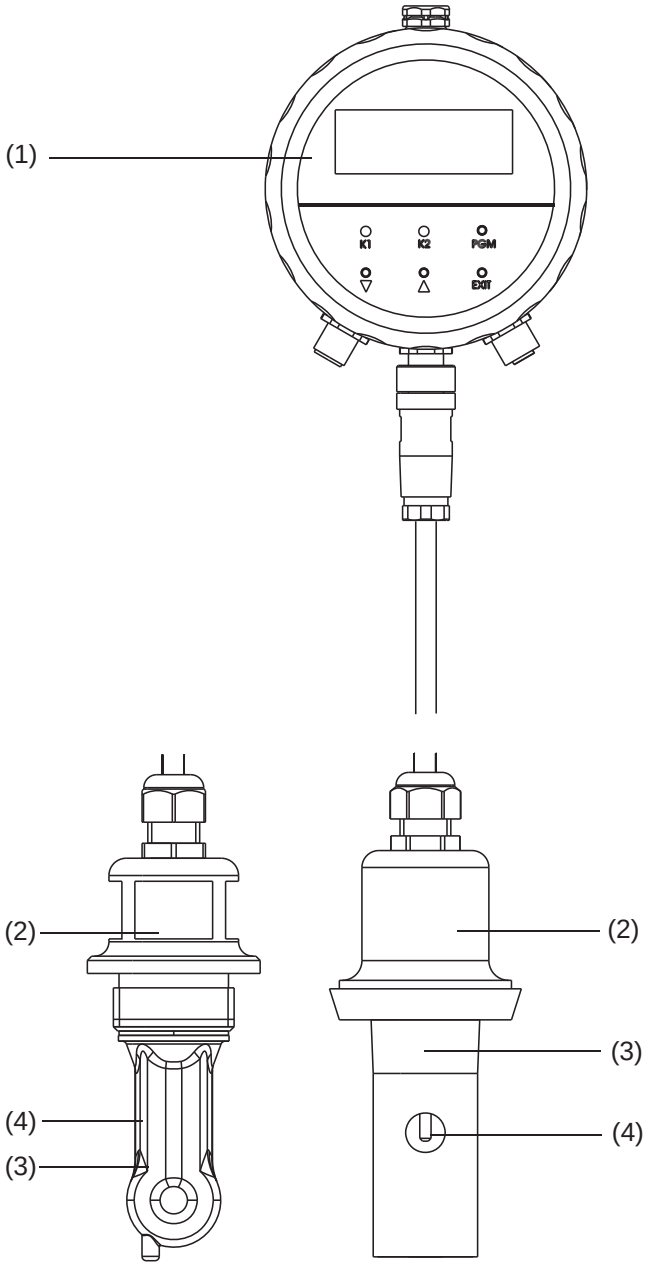
2.2.2 Device with separate sensor

Example



(1) Transmitter (with or without graphics LC-display)
(2) Process connection
(3) Temperature sensor
(4) Inductive conductivity measuring probe

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3 Inductive conductivity measurement

3.1 Area of application

General

The inductive measurement method permits largely maintenance-free acquisition of the specific conductivity, even in difficult media conditions. Unlike the conductive measurement method, problems such as electrode decomposition and polarization do not occur.

Brief description

The device is used for the measurement/control of conductivity or concentration in liquid media. It is particularly recommended for use in media where severe deposits of dirt, oil, grease or gypsum/lime precipitates are to be expected. The integrated temperature measurement enables fast and accurate temperature compensation, which is of particular importance when measuring conductivity. Additional functions, such as the combined changeover of measurement range and temperature coefficient, enable optimum application in CIP processes.
Two built-in switching outputs can be freely programmed to monitor limits for conductivity/ concentration and/or temperature. It is also possible to assign alarm and control functions (dilution).
The device is operated either from the membrane keypad and plain-text graphics display (operator language can be changed over) or through the user friendly PC setup program. Simply rotating the housing cover makes it possible to read the display, regardless of whether the installation is in horizontally or vertically arranged pipes. By using the setup program, the device configuration data for plant documentation can be saved and printed out. To prevent any tampering, the device can also be supplied without keypad or display. In this case, the setup program is needed for programming.
The device is available either as a combined unit (transmitter and measuring cell together in one unit) or as a split version (transmitter and cell connected by cable). The split version is particularly suitable for plant subjected to strong vibration and/or significant heat radiation at the point of measurement, or for installation on sites that are difficult to access.

Typical areas of application

- CIP cleaning (CIP = **C**lean **I**n **P**lace/**P**rocess)
- Concentration monitoring or dosing of chemicals
- Food/beverage and pharmaceutical industries
- Product monitoring (phase separation of product/product mix/water) in the beverage industry, breweries, dairies
- Control (e.g. phase separation of detergent/rinsing water in cleaning processes, e.g. bottle cleaning plant, or for container cleaning)

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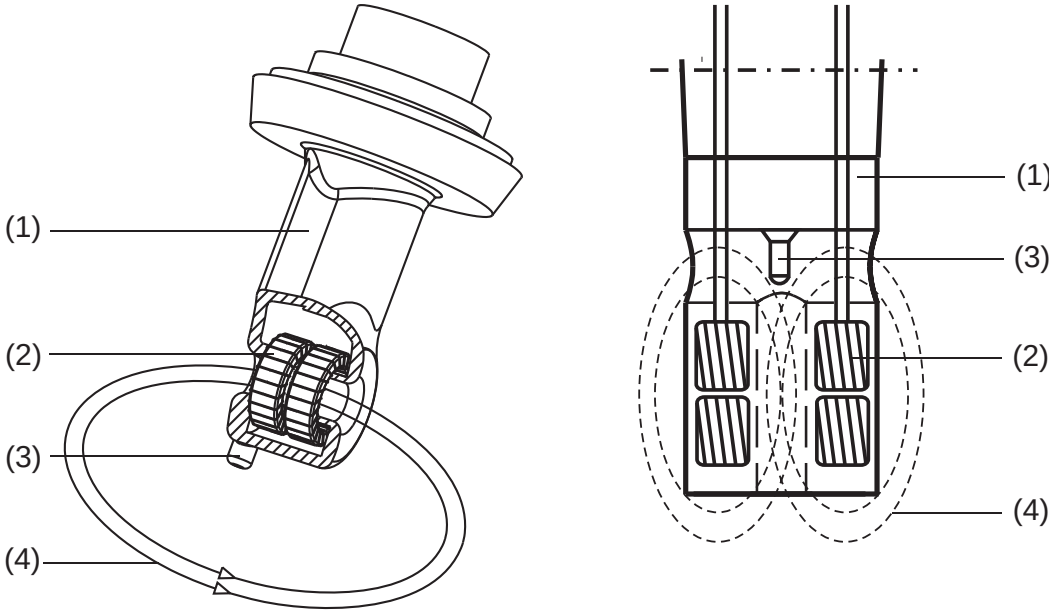
3.2 Function

Of the transmitter

The device has been designed for use on site. A rugged housing protects the electronics and the electrical connections from corrosive environmental conditions (enclosure IP67). As standard, the device has one analog signal output each for conductivity/concentration and temperature respectively. Further processing of the standard signals can take place in a suitable display/ control device, or, for example, directly in a PLC.
The output signals are electrically isolated from one another and from the medium.

Of the measuring cell

The conductivity is measured using an inductive probe. A sinusoidal a.c. voltage feeds the transmitting coil. Depending on the conductivity of the liquid to be measured, a current is induced in the receiver coil. This current is proportional to the conductivity of the medium. The cell constant of the inductive probe depends on its geometry. The cell constant can also be affected by components in the immediate vicinity.



(1) Plastic body
(2) Coils
(3) Temperature sensor
(4) Liquid loop

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4 Device identification

4.1 Important Notes

Intended Use

	The manufacturer cannot assume any liability for damage due to any other kind of use or the incorrect use of the devices. If in doubt, please contact the manufacturer with regard to the suitability of the device for your specific application before its installation.
	The device is **not** intended for operation in an explosive atmosphere.

Please read these operating instructions carefully before commissioning the devices. If you have questions, please contact the technical department oh Hengesbach.

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4.2 Assembly, commissioning and operation of the device

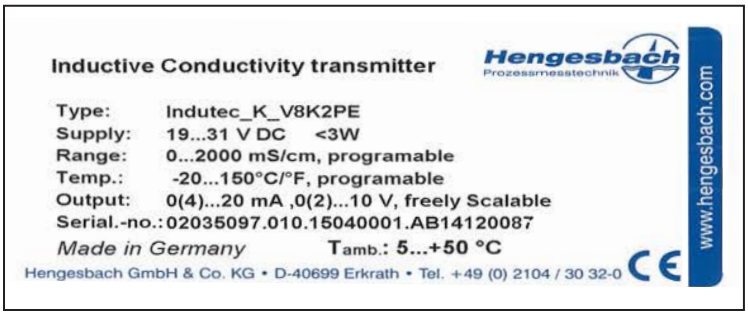
The transmitter has been manufactured according to state-of-the-art technical knowledge and complies with all relevant guidelines for it to be safely operated.

The assembly, connection, commissioning, operation and service of the device should always be carried out by qualified personnel. Personnel who are carrying out the above tasks must have been authorised by the plant operator.

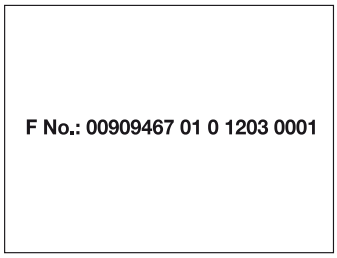
This document is to be kept in a location accessible to all the persons who need it. A further copy is available from Hengesbach or can be downloaded from www.hengesbach.com.

4.2 Nameplate

On the Transmitter



On the connecting cable (only with separate sensor)



CAUTION!
For devices with a separate sensor, the transmitter and detached sensor are matched to one another at the factory!

When connecting the components, please note that the serial number of the external sensor (marked on the label attached to the connecting cable) must match the serial number marked on the nameplate of the transmitter!

5 Device description

5.1 Technical Data

5.1.1 Conductivity Transmitter

A/D converter	
Resolution	15 bits
Sampling time	500 ms = 2 measurements/s
Power supply	For SELF and PELV circuit operation only.
Standard	19 - 31 V DC (24 V DC nominal)
Residual ripple	<5 %
Reverse polarity protection	Yes
Extra code 844	24 V DC ±10 %, 50 - 60 Hz
Power consumption with display	≤ 3W
Without display	≤ 2,6 W
Contact rating of the photo MOS relay	
Voltage	≤ 50 V AC/DC
Current	≤ 200 mA
Electrical connection	
82	Cable glands/pluggable screw terminals, 2,5 mm^2
83	M12 plug/socket (instead of cable glands)
84	Two M16 cable glands and a pluggable screw terminal blanking plug, 2,5 mm^2
Display	
Basic type extension 10	Without display
Basic type extension 15	Backlit graphic LCD; adjustable contrast; dimensions: 62 mm × 23 mm
Basic type extension 16	Backlit graphic LCD; adjustable contrast; dimensions: 62 mm × 23 mm
Permissible ambient temperature	5 to +50 °C; max. rel. humidity. 93 %, no condensation
Permissible storage temperature	-10 to +75 °C; max. rel. humidity. 93 %, no condensation
Protection rating[1]	IP67
Electromagnetic compatibility[2]	
Interference emission	Class B
Interference immunity	To industrial requirements
Housing	
Basic type extensions 10, 15, 20, 25, 60, 65	PA
Basic type extensions 16, 26, 66	Stainless steel 1.4305 (AISI 303)
Weight[3]	Approx. 0,3 - 2,4 kg

1: DIN EN 60529

2: DIN EN 61326

3: Dependent on version of process connection

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5.1.2 Measuring ranges

There is a choice of four different measuring ranges. Any one of these ranges can be activated by an external switch or by a PLC.

NOTE!
The overall accuracy is composed of transmitter accuracy plus sensor accuracy.

Transmitter measuring ranges	Accuracy (as % of measuring range span)
0 - 500 µS/cm	≤ 0,5 %
0 - 1000 µS/cm	
0 - 2000 µS/cm	
0 - 5000 µS/cm	
0 - 10 mS/cm	
0 - 20 mS/cm	
0 - 50 mS/cm	
0 - 100 mS/cm	
0 - 200 mS/cm	
0 - 500 mS/cm	
0 - 1000 mS/cm	
0 - 2000 mS/cm[1]	
Concentration measurement	Implemented in the device software
NaOH (caustic soda)	0 - 15 % by weight or 25 - 50 % by weight (0 - 90 °C)
HNO_3 (nitric acid)	0 - 25 % by weight or 36 - 82 % by weight (0 - 80 °C)
Customer-specific concentration curve	Freely programmable via the setup program (see „Special functions“)
Calibration timer	0 - 999 days (0 = OFF)
Output signal conductivity and concentration[2]	0 - 10 V or 10 - 0 V
	2 - 10 V or 10 - 2 V
	0 - 20 mA or 20 - 0 mA
	4 - 20 mA or 20 - 4 mA
Burden	
At current output	≤ 500 Ω
At voltage output	≥ 2 kΩ
Ambient temperature effect	≤ 0,1 %/K
Analog output at „Alarm“	
Low	0 mA/0 V/3.4 mA/1.4 V or a fixed value
High	22.0 mA/0.7 V or a fixed value

1: Not temperature compensated.
2: The output signal is freely scalable.

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5.1.3 Temperature Transmitters

Temperature acquisition[1]	Manually, -20.0 to 25.0 to 150 °C or °F, or automatically
Measuring range	-20 - 150 °C or °F
Characteristic	Linear
Accuracy	≤ 0.5 % of the measuring range
Ambient temperature effect	≤ 0.1 %/K
Output signal	0-10 V or 10 - 0 V 2-10 V or 10 - 2 V 0 - 20 mA or 20 - 0 mA 4 - 20 mA or 20 - 4 mA The output signal is freely scalable in the -20 to +200°C range
Burden	
At current output	≤ 500 Ω
At voltage output	≥ 2 kΩ
Analog output at „Alarm“	
Low	0 mA/0 V/3.4 mA/1.4 V or a fixed value
High	22.0 mA/10.7 V or a fixed value

1: Take the permissible sample medium temperature into consideration!

5.1.4 Temperature Compensation

Reference temperature	15 to 30 °C, adjustable
Temperature coefficient	5.5 %/°C, adjustable
Compensation range	-20 to +150 °C
Function	Linear or natural water (EN 27888) or nonlinear (learning function, see Special functions)

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5.1.5 Inductive conductivity sensor

Measuring range	Accuracy (as % of measuring range span)
0 - 500 µS/cm	≤ 1%
0 - 1000 µS/cm	≤ 1%
0 - 2000 µS/cm	≤ 0,5 %
0 - 5000 µS/cm	≤ 0,5 %
0 - 10 mS/cm	≤ 0,5 %
0 - 20 mS/cm	≤ 0,5 %
0 - 50 mS/cm	≤ 0,5 %
0 - 100 mS/cm	≤ 0,5 %
0 - 200 mS/cm	≤ 0,5 %
0 - 500 mS/cm	≤ 0,5 %
0 - 1000 mS/cm	≤ 1%
0 - 2000 mS/cm[1]	≤ 1%
Material	
for extra code 767	PEEK
for extra code 768	PVDF
Permissible sample medium temperatures	-10 - +120 °C, briefly +140 °C (sterilization)
Pressure	max. 10 bar

1: Not temperature compensated

The temperature, pressure and sample medium affect the service life of measuring cell!

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6 Installation

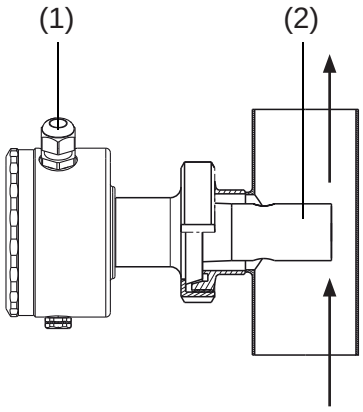
6.1 General

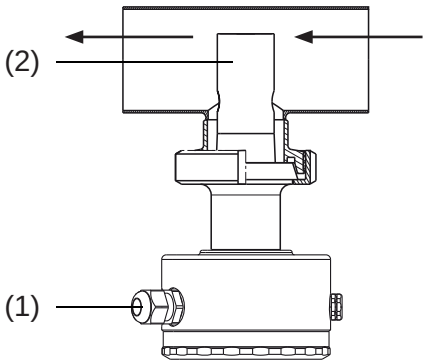
6.1.1 Installation location

- Make sure that the site is readily accessible, for calibration at a later time.
- The fixing must be secure and free from vibration.
- Avoid direct sunlight!
- Take care that there is adequate flow through and around the sensor (2)! If the device is to be mounted in a pipeline, there must be at least 20 mm clearance between the sensor and the wall of the pipe.
- If it is not possible to achieve this minimum clearance, then a limited compensation can be made through the „Mounting factor“ parameter.
- For submerged operation in basins, a location must be chosen that is representative of the typical conductivity or concentration.

6.1.2 Mounting position

- The Indutec should be installed in vertically running pipe sections (see fig.) in order to prevent trapped air from distorting readings. The flow should travel from bottom up.
- The display can be adjusted by means of a captive screw according to the mounting direction.
- If the transmitter is installed in horizontal pipes, the installation should be at the lower pipe side.
- Changing of flow direction (after pipe bends) may create turbulences.
  Please ensure installation of the sensor with a distance of min. 1 m to the pipe bend.





CAUTION!
With head transmitters, the PG cable glands (1) must point in the flow direction!

With separate conductivity sensors, the flow direction is indicated by a dot on the upper part of the sensor. This dot must point in the flow direction!

With „overhead installation“ the black breather (2) points upwards. In this case, no liquid (such as condensate) must be allowed to block the breather (2)!

6.1.3 Screwing the separate sensor in and out

CAUTION!
The cable must not be twisted!
Avoid forcefully tugging the cable, especially suddenly.

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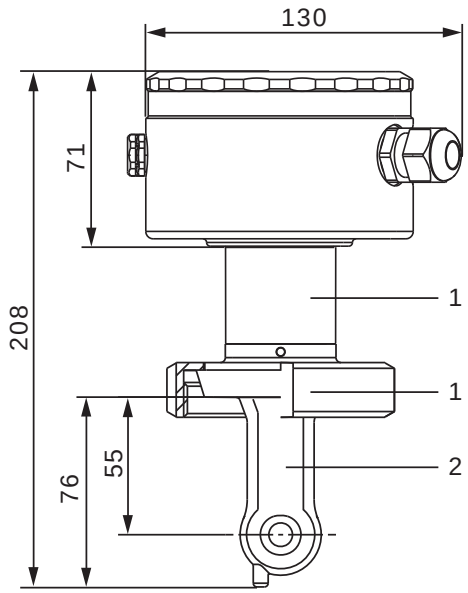
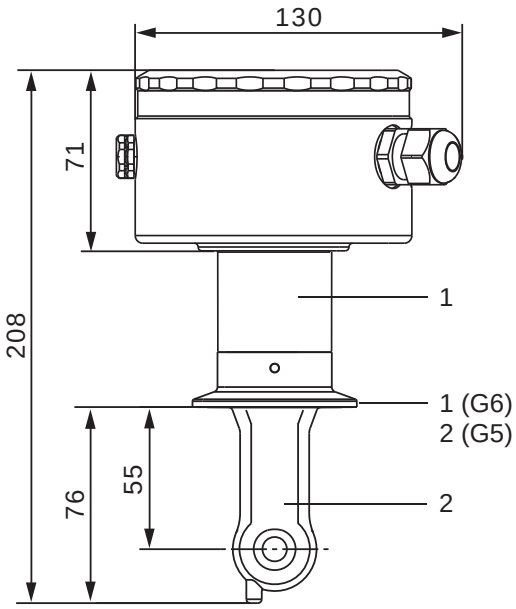
6.2 Head transmitter dimensions

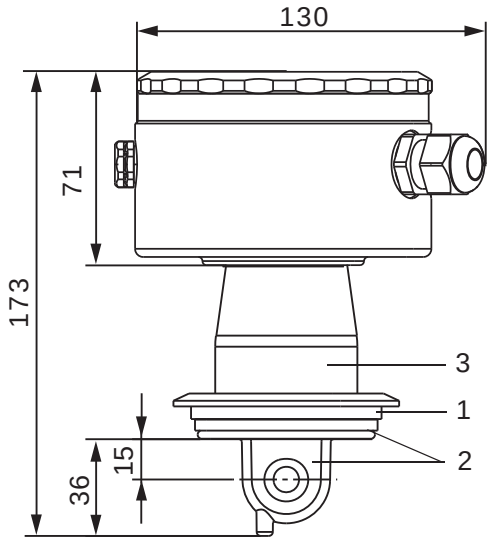
6.2.1 Process connections



Version with process connection
M5 = MK DN50
M6 = MK DN65
M8 = MK DN80



Version with process connection
C5 = Clamp 2“
C6 = Clamp 2½“
(retaining clip not included in delivery)



Version with process connection
V8 = Varivent® DN40/50

1 = Stainless steel 1.4301 2 = PEEK 3 = PPS GF40

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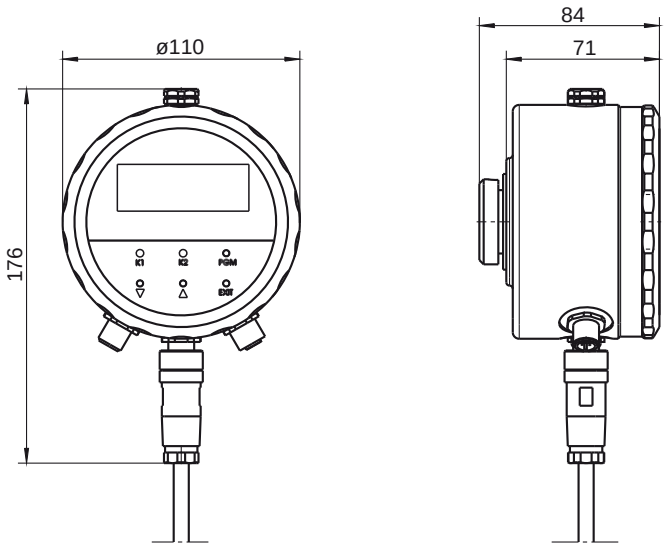
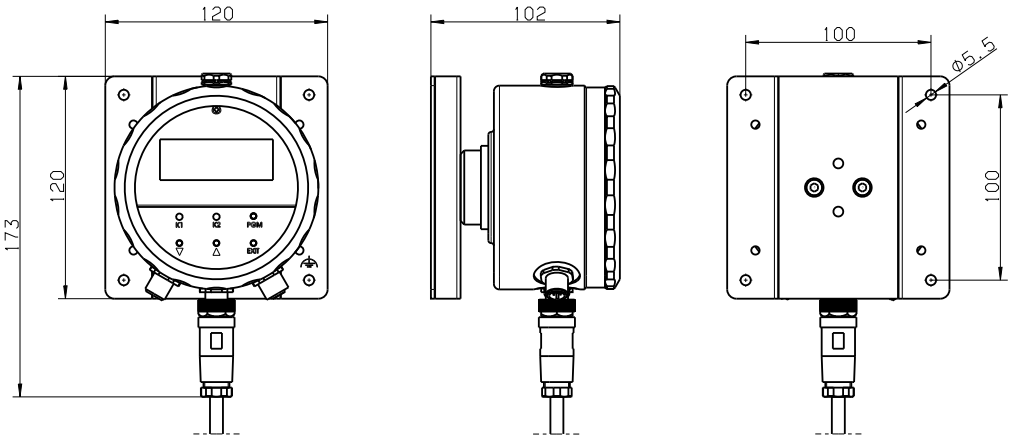
6.3 Device with separate sensor

6.3.1 Operating device

Transmitter with a separate sensor, in stainless steel housing



6.3.2 Drilling template for wall mounting



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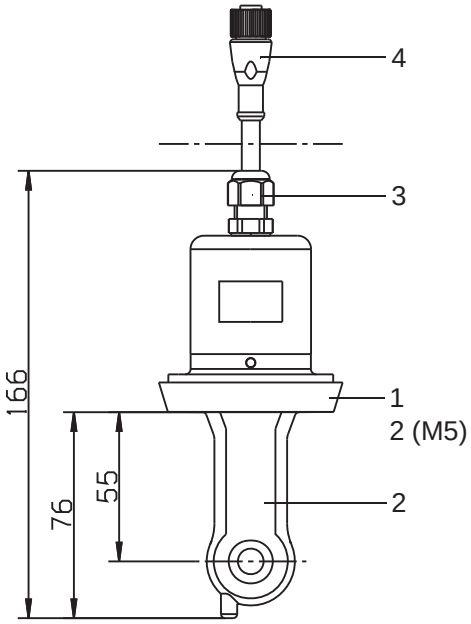
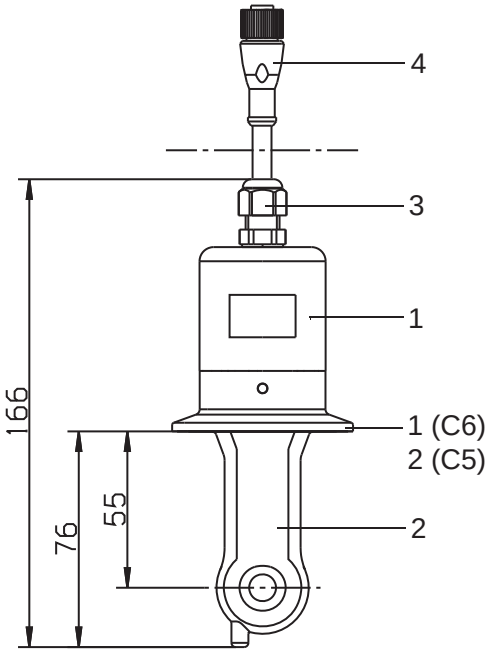
6.3.3 Process connections



Split version with process connection
M5 = MK DN50
M6 = MK DN60
M8 = MK DN80
(union nut not included)



Split version with process connection
C5 = Clamp 2“
C6 = Clamp 2½“
M8 = MK DN80
(retaining clip not included)

1 = Stainless steel 1.4301 2 = PEEK 3 = PA 4 = TPU

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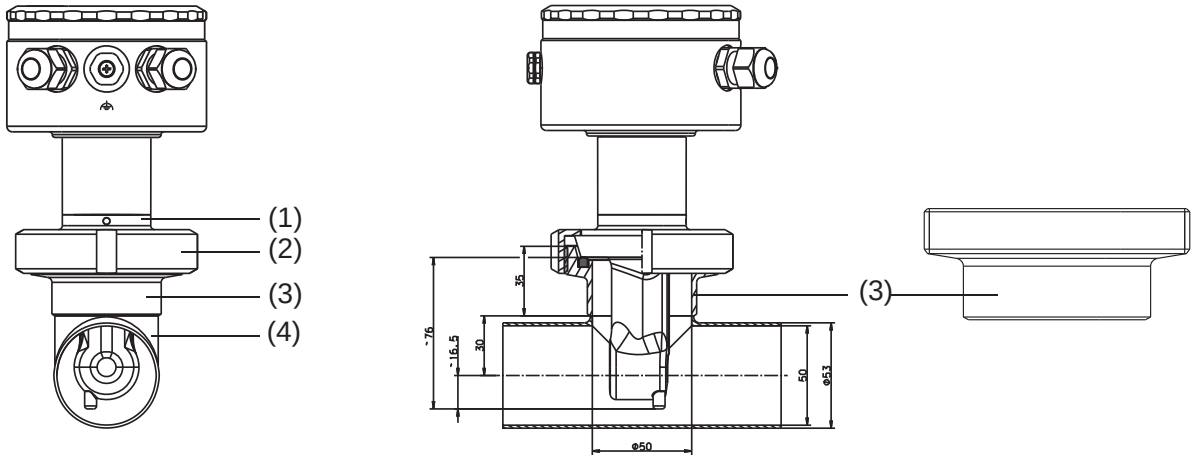
6.4 Mounting examples

Threaded pipe adapter

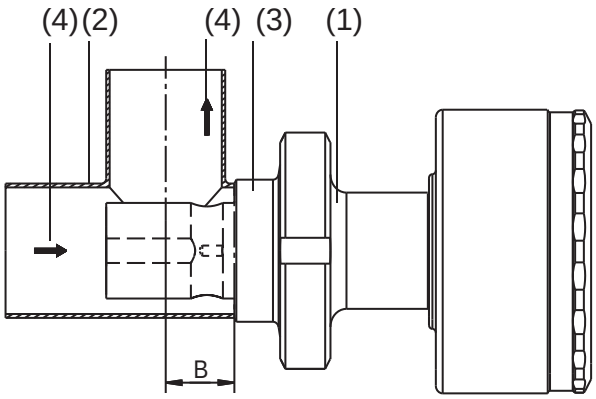


(1) Process connection M5, screwed pipe fitting DN 50, DIN 11851 (MK DN 50, milk cone), PEEK

(2) Ring nut DN 50, 1.4301

(3) Weld-on threaded pipe adaptor DN 50, DIN 11851, 1.4301

(4) Tee DIN 11852, short, DN50, 1.4301
(to be provided by the plant operator; **not** supplied by Hengesbach)



(1) Process connection M5, screwed pipe fitting DN 50, DIN 11851 (MK DN 50, milk cone), 1.4301

(2) Tee DIN 11852, SSS DN50, 1.4301, Dim. B shortened to 30 mm
(to be provided by the plant operator; **not** supplied by Hengesbach)

(3) Weld-on threaded pipe adaptor DN 50, DIN 11851, 1.4301
(matching part for process connection M5)

(4) Flow direction

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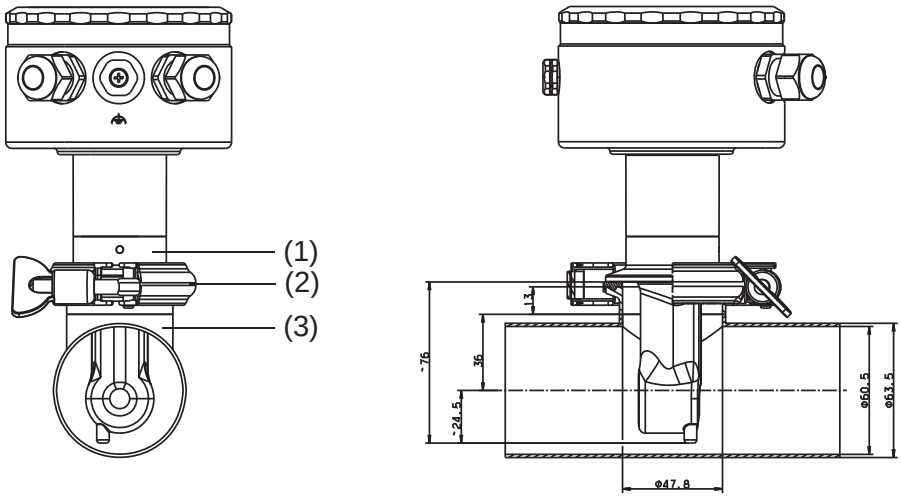
Clamp

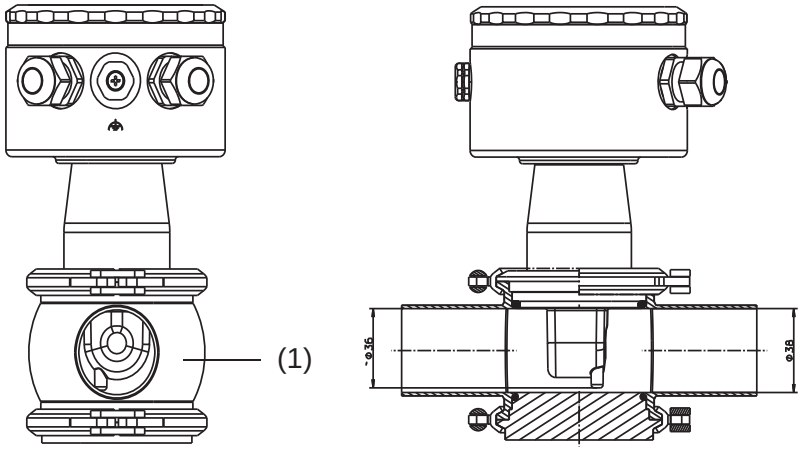


(1) Process connection C6, PEEK

(2) Clamping ring, 1.4301

(3) Tee, short, 2.5" - 2" similar to DIN 11852 and clamp adapter, 1.430
(to be provided by the plant operator, **not** supplied by Hengesbach)

VARIVENT®



(1) Tee, VARIVENT®, DN 50, 1.4404
(to be provided by the plant operator, **not** supplied by Hengesbach)

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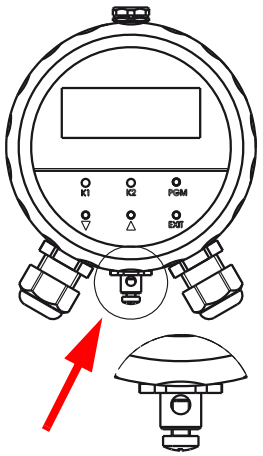
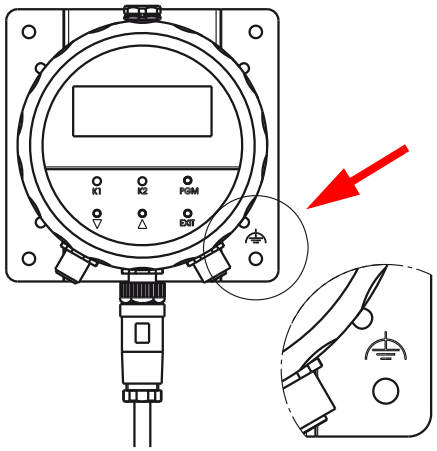
7 Installation

ATTENTION!
The electrical connection must only be carried out by properly qualified personnel!

- The choice of cable, the installation and the electrical connection must conform to the requirements of VDE 0100 “Regulations on the Installation of Power Circuits with Nominal Voltages below 1000 V” or the appropriate local regulations.
- The electrical connection must only be carried out by qualified personnel.
- If contact with live parts is possible while working on the device, it must be completely disconnected from the electrical supply.
- The electromagnetic compatibility conforms to EN 61 326.
- Run input, output and supply cables separately and not parallel to one another.
- The device is not suitable for use in areas with an explosion hazard (Ex areas).
- Apart from faulty installation, incorrect settings on the device may also affect the proper functioning of the subsequent process or lead to damage.
- The Indutec must be grounded with the connection for functional earth at the device or with the wall fastening (see figure)





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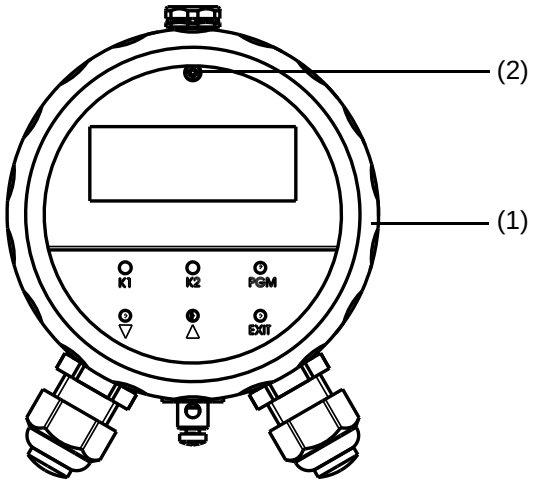
7.1 General

Opening the operating unit

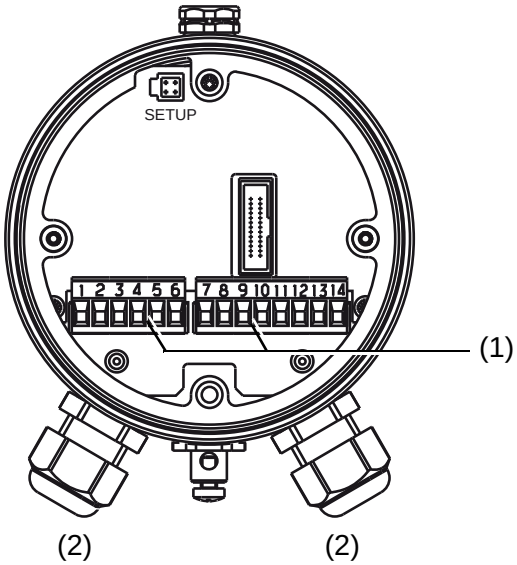
ATTENTION!
It is only necessary to open the housing for devices with cable glands.
Devices with M12 plug/socket connectors should not be opened!



✶ Unscrew the cover (1)

✶ Remove captive fastening screw (2) and carefully take out operating unit.

Connecting up the cables



ATTENTION!
To connect the single conductors pull off the pluggable screw terminals (1) in the operating unit.
Pass the connecting cables through the cable glands (2).

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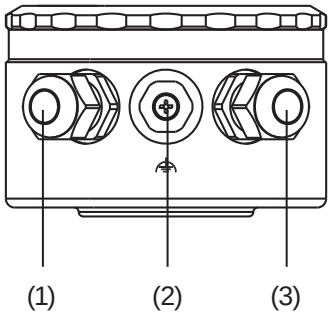
Wiring

	**DANGER!** For devices with a separate sensor, the transmitter and detached sensor are matched to one another at the factory! When connecting the components, please note that the serial number of the external sensor (marked on the label attached to the connecting cable) must match the serial number marked on the nameplate of the transmitter!

7.2 Electrical connection

7.2.1 Transmitter with electrical connection 82 (cable glands)

Head transmitter



(1) Power supply and actual value output
(conductivity/concentration and temperature) M12 cable gland (PA)

(2) Functional earth

(3) Binary input
M12 cable gland (PA)

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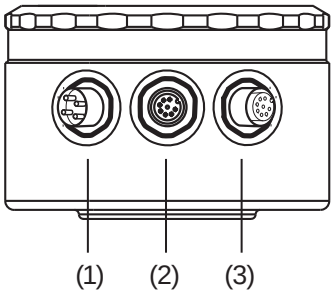
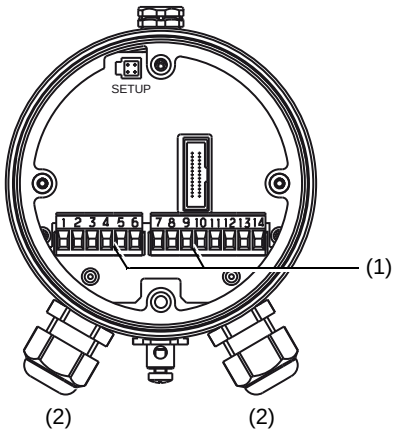
Transmitter with separate sensor



(1) Power supply and actual value output
(conductivity/concentration and temperature) M12 cable gland (PA)

(2) Separate sensor
M12 flush-type connector

(3) Binary input and switching outputs
M12 cable gland (PA)



Supply	Terminal assignment		Symbol
Supply (with reverse-polarity protection)	1	L +	L+ L - 1 2
	2	L -	

Outputs			
Analog signal output: Conductivity/concentration (electrically isolated)	3	+	3 4 + -
	4	-	
Analog signal output: Temperature (electrically isolated)	5	+	5 6 + -
	6	-	

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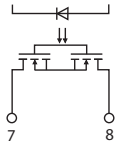
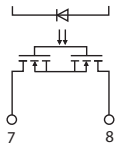
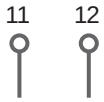
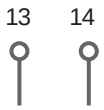
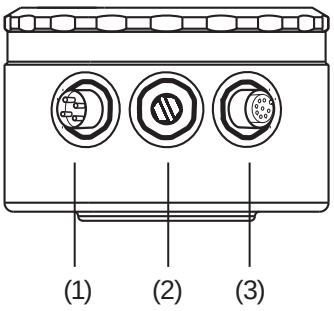
Photo-MOS-Relay K1 (floating, no)	7 8		
Photo-MOS-Relay K2 (floating, no)	9 10		

Binary inputs			
Binary input E1	11 12		
Binary input E2	13 14		

7.2.2 Transmitter with electrical connection 83 (M12 plug-and-socket connection)

Head transmitter



(1) **Connector I**
Power supply and actual value output for conductivity/concentration M12 flush-type connector, 5-pin

(2) Blanking plug

(3) **Connector II**
Actual value output for temperature, and binary input and switching outputs M12 flush-type connector, 8-pin

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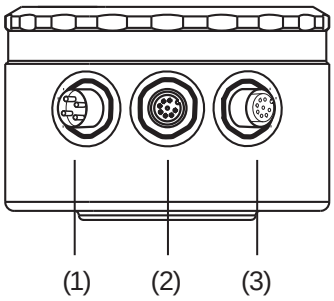
Transmitter with separate sensor



(1) **Connector I**
Power supply and actual value output for conductivity/concentration M12 flush-type connector, 5-pin

(2) **Connector III**
Inductive conductivity sensor

(3) **Connector II**
Actual value output for temperature, and binary input and switching outputs M12 flush-type connector, 8-pin

ATTENTION!
In devices with a separate sensor and M12 plug / socket connectors, the screw terminals in the device are painted over. Removing this paint voids the warranty!

Supply	Connector	Assignment	Symbol
Supply (with reverse-polarity protection)	I	L + L -	L+ L - 1 2

Outputs			
Analog signal output: Conductivity/concentration (electrically isolated)	I		3 4 + -
Analog signal output: Temperature (electrically isolated)	II		5 6 + -
Switching output K1 (floating, no)	II		7 8
Photo-MOS-Relay K2 (floating, no)	II		7 8

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Binary inputs			
Binary input E1	**I** **II**		
Binary input E2	**I** **II**		

DANGER!
The ground connector at the case must be connected with the functional earth (EN 60445).
A steel piping must be connected with functional earth (EN 60445)!

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8 Setup program

8.1 Function

Configurable parameters

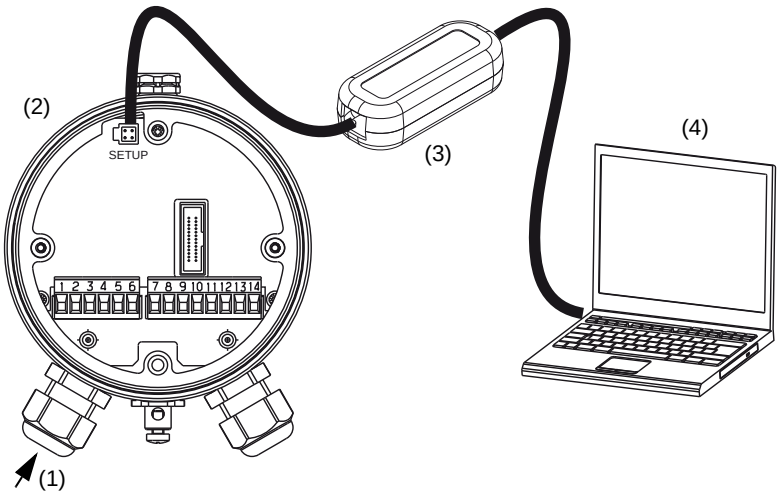
The setup program, which is available as an option, can be used for easy adaptation of the transmitter to specific requirements.

- Setting the measurement range and the range limits.
- Setting the response of the output to an out-of-range signal.
- Setting the functions of the switched outputs K1 and K2.
- Setting the functions of the binary inputs E1 and E2.
- Setting up special functions (e.g. the dilution function).
- Setting up a customer-specific characteristic, etc.

NOTE!
Data transmission from or to the transmitter can only take place when it is connected to the electrical supply, see Chapter 7 “Installation”, page 23ff.

Connection

CAUTION!
The setup interface is not electrically isolated. When connecting the PC interface cable, it is therefore absolutely essential to ensure that either the supply of the transmitter or of the PC is not electrically earthed (for instance, use a battery-powered notebook).



(1) Power supply
(2) Indutec
(3) PC interface cable
(4) PC or notebook

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9 Commissioning

CAUTION!
The transmitter has been tested in the factory for fault-free functioning, and is delivered ready for operation.

9.1 Head-mounted transmitter or transmitter with separate sensor

- Mounting the device, see “Installation”, page 17.
- Connecting the device, see “Installation”, page 23.

DANGER!
For devices with a separate sensor, the transmitter and detached sensor are matched to one another at the factory!
When connecting the components, please note that the serial number of the external sensor (marked on the label attached to the connecting cable) must match the serial number marked on the nameplate of the transmitter!

9.2 Replacement sensor

- Connect up the sensor as described in the operating instructions for the replacement sensor.
- Calibrate the sensor as described in the operating instructions for the replacement sensor.

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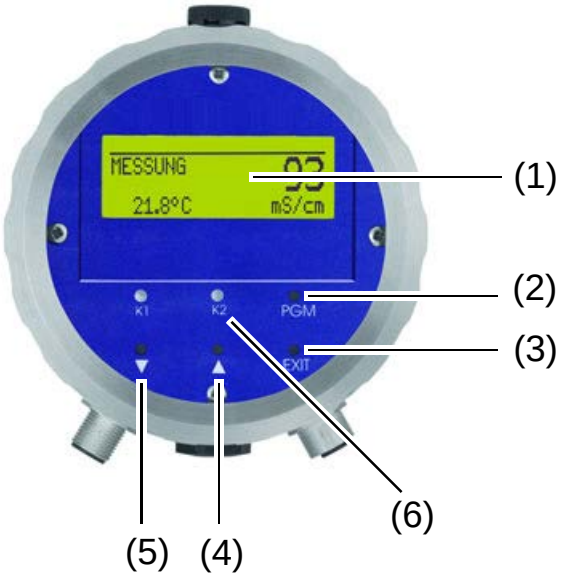
10 Operation

10.1 Controls



(1) Graphic LC display, back-lit

(2) PGM key, confirm entries/select menu

(3) EXIT key, cancel entry without saving/cancel calibration go back one menu level.

(4) ▲ key, increase value/step on in selection

(5) ▼ key, reduce value/step on in selection

(6) LEDs K1 and K2 show the states of the switched outputs.
In normal operation, the LED lights up if the corresponding output is active.
If the pulse function is active, the LED only indicates the status.
The K1 LED blinks during calibration.
In fault condition, the LED K1 and LED K2 blink.

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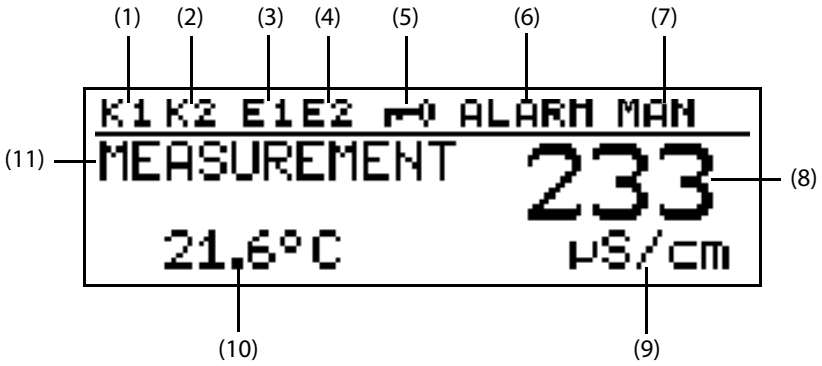
LC display



(1) Output K1 is active

(2) Output K2 is active

(3) Binary input 1 is activated

(4) Binary input 2 is activated

(5) Keypad is inhibited

(6) Device status (indications)
- Alarm (e.g. over range)
- Calib blinking (calibration timer has run down)
- Calib (customer calibration is active)

(7) Output mode
- Hand (manual operation)
- Hold (hold operation)

(8) Conductivity/concentration measurement

(9) Unit for conductivity/concentration measurement

(10) Temperature of the medium

(11) Device status e.g.
- Measurement (normal)
- Dilution (dilution function)
- Dosing (dilution function)
- Inhibited (dilution function)
- Calibration status

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10.2 Principle of operation

10.2.1 Operation in levels

Measurement mode, see Chapter 10.4 "Principle of operation", page 37

OPERATOR LEVEL, see chapter 10.5 "Operator level", page 37.

INPUT CONDUCTIVITY	MEASUREMENT RANGE 1...4
	TEMPERATURE COMPENSATION
	TEMP. COEFFICIENT 1...4
	REFERENCE TEMPERATURE
	REL. CELL CONSTANT
	MOUNTING FACTOR
	CONCENTR. MEASUREMENT
	CONCENTR. RANGE
	OFFSET
	FILTER TIME
	CALIBR. INTERVAL
OUTPUT CONDUCTIVITY	SIGNAL TYPE
	SCALING START 1...4
	SCALING END 1...4
	IN CASE OF ALARM
	DURING CALIBRATION
	SAFETY VALUE
	MANUAL OPERATION
	MANUAL VALUE
INPUT TEMPERATURE	UNIT
	MEAS. VALUE ACQUISITION
	MANUAL SPECIFICATION
	OFFSET
	FILTER TIME
OUTPUT TEMPERATURE	SIGNAL TYPE
	SCALING START
	SCALING END
	IN CASE OF ALARM
	DURING CALIBRATION
	SAFETY VALUE
	MANUAL OPERATION
	MANUAL VALUE
OUTPUT BINARY 1	FUNCTION
	LIMIT VALUE
	HYSTERESIS
	DISTANCE
	MANUAL OPERATION
	DURING HOLD
	IN CASE OF ALARM / CALIBR.
	SWITCH-ON DELAY
	SWITCH-OFF DELAY
	PULSE DURATION
OUTPUT BINARY 2	FUNCTION
	LIMIT VALUE
	HYSTERESIS
	DISTANCE
	MANUAL OPERATION
	DURING HOLD
	IN CASE OF ALARM / CALIBR.
	SWITCH-ON DELAY
	SWITCH-OFF DELAY
	PULSE DURATION
INPUT BINARY 1	FUNCTION
INPUT BINARY 2	FUNCTION
DILUTION	REDUCTION
	DOSING TIME
	LOCK TIME

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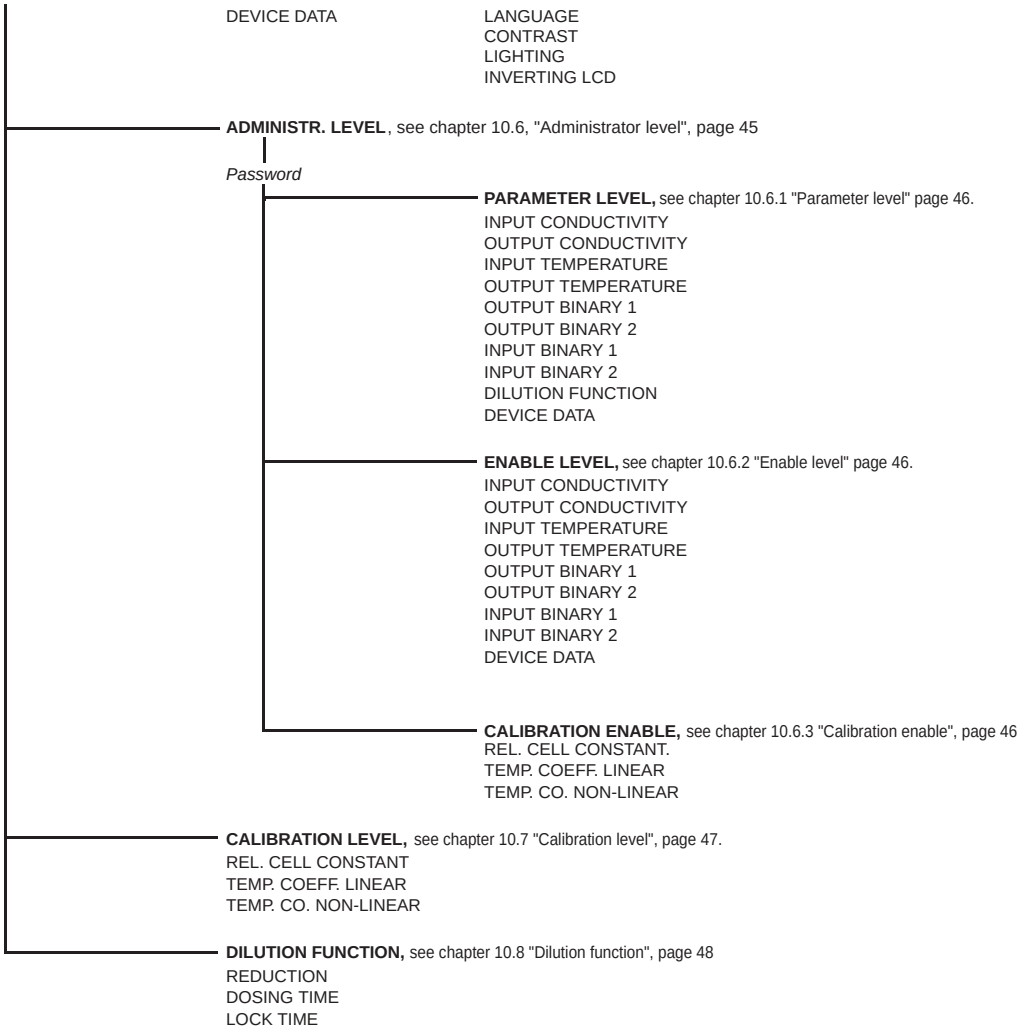

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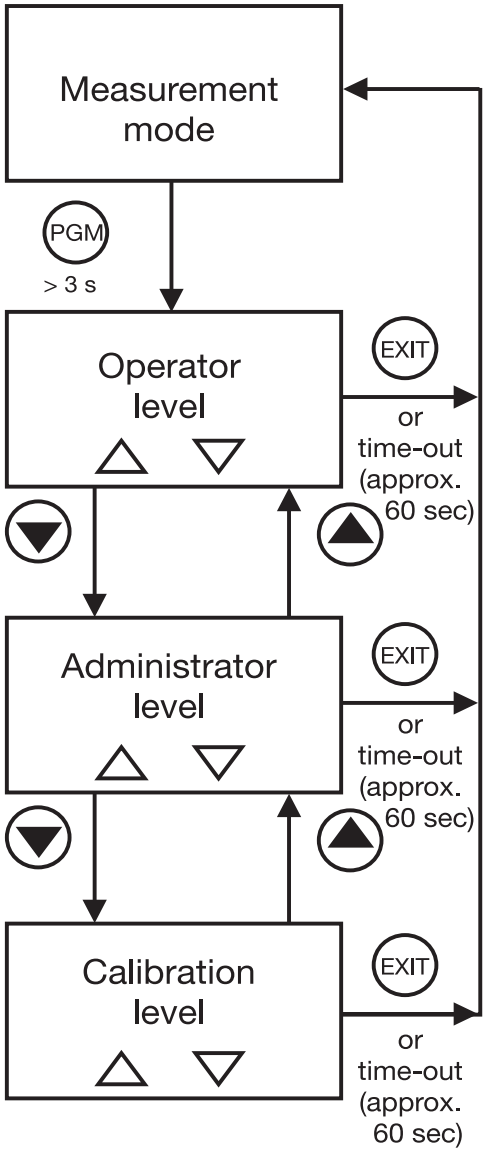
10.3 Principle of operation

Operation in levels



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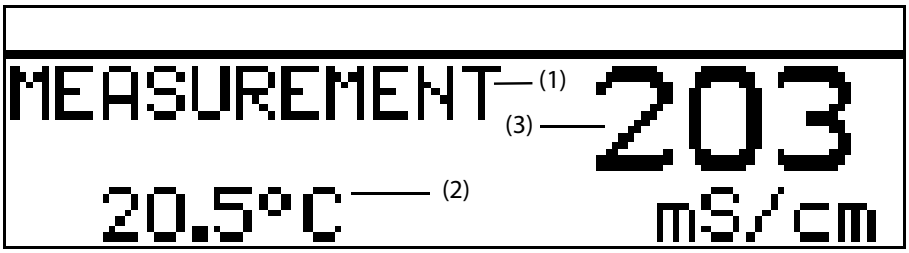
10.4 Measurement mode

Representation

In measurement mode, the conductivity is shown (compensated for the reference temperature) or the concentration and temperature of the medium being measured.



(1) MEASUREMENT -> Measurement mode

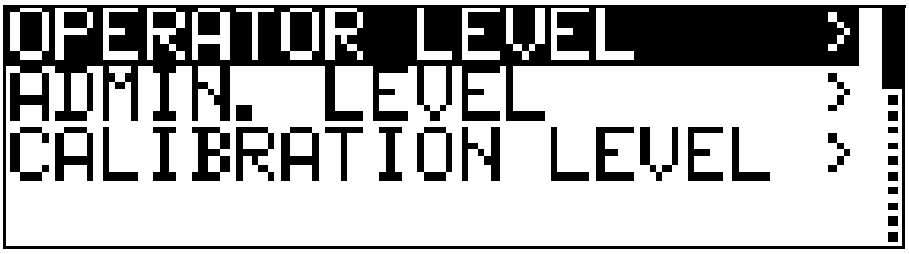
(2) 20.5 °C -> Temperature of the sample medium

(3) 203 mS/cm -> Conductivity of the medium (compensated for the reference/comparison temperature – usually 25 °C)

10.5 Operator level

All the parameters that have been enabled by the administrator (administrator level) can be edited in this level. All other parameters (marked by a key) can only be read.

* Press the PGM key for at least 3 seconds
* Select OPERATOR LEVEL



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10.5.1 CONDUCTIVITY IN (conductivity input)

RANGE 1 — 4[1]

0 – 500 µS/cm
0 – 1000 µS/cm
0 – 2000 µS/cm
0 – 5000 µS/cm
0 – 10 mS/cm
0 – 20 mS/cm
0 – 50 mS/cm
0 – 100 mS/cm
0 – 200 mS/cm
0 – 500 mS/cm
0 – 1000 mS/cm
0 – 2000 mS/cm UNC[2]

[1] Measurement ranges 2, 3 and 4 are only used if BINARY INPUT is configured to RANGE/TEMPCO.
[2] This measurement range is not temperature-compensated.

TEMP. COMPENSATION

LINEAR
NON-LINEAR (see “Non-linear temperature coefficient (ALPHA)”, page 57)
NATURAL WATER (permissible temperature range 0 to 36 °C as per EN 27888)

TEMP. COEFFICIENT 1 – 4[1]

0 – **2.20** – 5.5 %

[1] Ranges 2, 3 and 4 are only used if BINARY INPUT is configured to RANGE/TEMPCO.

REFERENCE TEMP.

15.0 to **25.0** to 30 °C

CELL CONSTANT

2.00 to 6.80 to 10.0 1/cm
A check or alteration is only necessary, if a replacement sensor has been connected to the transmitter with separate sensor. The cell constant is printed on the replacement sensor (K = x,xx).

REL. CELL CONSTANT

80.0 – **100.0** –120 %

MOUNTING FACTOR

80.0 – **100.0** –120 %
If it is not possible to achieve the minimum clearance of 20 mm between the sensor and the outer wall, then a limited compensation can be made through this parameter.

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CONC. MEAS. TYPE

NO FUNCTION
NaOH
HNO_3
CUSTOMIZED (values can only be entered by using the optional setup program)

CONC. MEAS. RANGE

For HNO_3:
0 – 25 % BY WEIGHT
36 – 82 % BY WEIGHT
For NaOH:
0 – 15 % BY WEIGHT
25 – 50 % BY WEIGHT

OFFSET

-100 to **0** to +100 mS/cm (±10 % of range)

FILTER TIME

00:00:00 – **00:00:01** – 00:00:25 H:M:S

CALIB. INTERVAL

0– 999 DAYS (0 = switched off)

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10.5.2 CONDUCTIVITY OUT (conductivity output)

SIGNAL TYPE

0 – 20 mA
4 – 20 mA
20 – 0 mA
20 – 4 mA
0 – 10 V
2 – 10 V
10 – 0 V
10 – 2 V

SCALING START 1 – 4[1]

0 µS/cm = 4 mA
Can be set in the range being used, depending on the signal type.
[1] Ranges 2, 3 and 4 are only used if BINARY INPUT is configured to RANGE/TEMPCO.

SCALING END 1 — 4[1]

1000 µS/cm = 20 mA
Can be set in the range being used, depending on the signal type.
[1] Ranges 2, 3 and 4 are only used if BINARY INPUT is configured to RANGE/TEMPCO.

DURING ALARM

LOW (0 mA/0 V/3.4 mA/1.4 V)
HIGH (22 mA/10.7 V)
SAFE VALUE (depending on the signal type)

DURING CALIBRATION

MOVING
FROZEN
SAFE VALUE

SAFE VALUE

0.0 – **4.0** – 22.0 mA (depending on the signal type)
0 – 10.7 V

MANUAL MODE

OFF
ON

MAN. VALUE

0.0 – **4.0** – 22.0 mA (depending on the signal type)
0 – 10.7 V

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10.5.3 TEMPERATURE IN

DIMENS. UNIT

°C
°F

MEAS. MODE

SENSOR
MANUAL

MANUAL VALUE

-20.0 to **25.0** to 150 °C

OFFSET

-15.0 to **0.0** to 15.0 °C

FILTER TIME

00:00:00 – **00:00:01** – 00:00:25 H:M:S

10.5.4 TEMPERATURE OUT

SIGNAL TYPE

0 – 20 mA
4 – 20 mA
20 – 0 mA
20 – 4 mA
0 – 10 V
2 – 10 V
10 – 0 V
10 – 2 V

SCALING START

-20.0 °C = 4 mA (depending on the signal type)

SCALING END

+200.0 °C = 20 mA (depending on the signal type)

DURING ALARM

LOW (0 mA/0 V/3.4 mA/1.4 V)
HIGH (22 mA/10.7 V)
SAFE VALUE (depending on the signal type)

DURING CALIBRATION

MOVING
FROZEN
SAFE VALUE

SAFE VALUE

0.0 – **4.0** – 22.0 mA (depending on the signal type)
0 – 10.7 V

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MANUAL MODE

OFF
ON

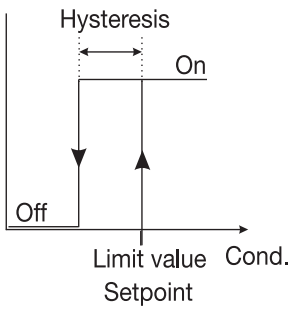
MAN. VALUE

0.0 — **4.0** — 22.0 mA (depending on the signal type)
0 — 10.7 V

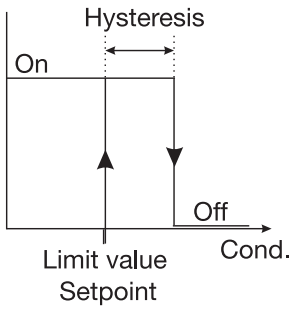
10.5.5 BINARY OUTPUT 1 and BINARY OUTPUT 2

FUNCTION

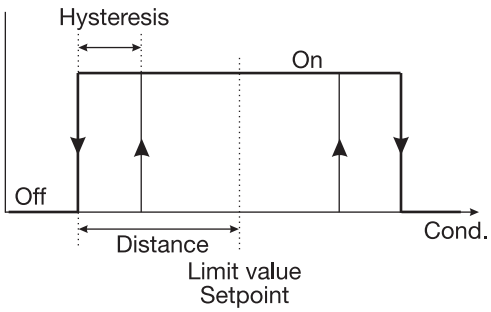
NO FUNCTION
MIN. CONDUCT.
MAX. CONDUCT.
LK1 CONDUCT.
LK2 CONDUCT.
MIN. TEMP.
MAX. TEMP.
LK1 TEMP.
LK2 TEMP.
CALIB. TIMER
ALARM



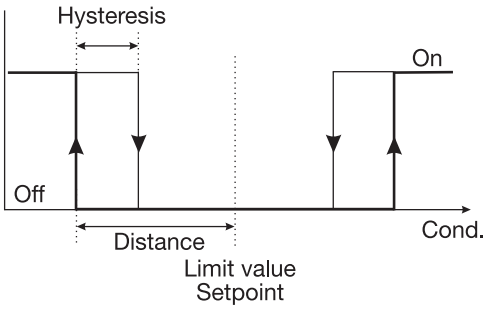
MAX limit comparator



MIN limit comparator



LK1 alarm window



LK2 alarm window

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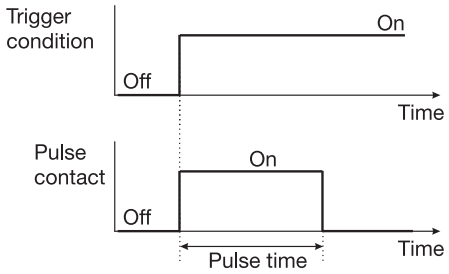
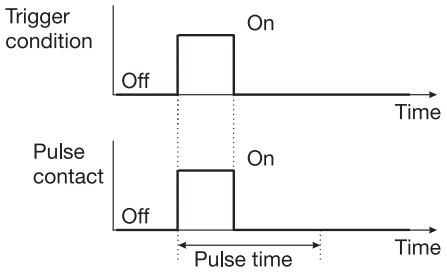


Pulse contact
Trigger condition longer than pulse duration



Pulse contact
Trigger condition shorter than pulse duration

LIMIT

-20.0 — 999.0 (depending on the function, see above)

HYSTERESIS

0.0 — 1.0 — 999.0 (depending on the function, see above)

SPACING

0.0 — 999.0 (depending on the function, see above)

MANUAL MODE

OFF
ON

FOR HOLD

INACTIVE
ACTIVE
FROZEN

FOR ALARM / CALIB.

INACTIVE
ACTIVE
FROZEN

ON-DELAY

00:00:00 — 01:00:00 H:M:S

OFF-DELAY

00:00:00 — 01:00:00 H:M:S

PULSE DURATION

00:00:00 — 01:00:00 H:M:S (see above: “Function, Pulse contact”)

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10.5.6 BINARY INPUT 1 and BINARY INPUT 2

FUNCTION

NO FUNCTION
HOLD/LOCK KEY
RANGE/TEMPCO.
DILUTION

Setting parameters		Binary input 1	Binary input 2
Range/temperature coefficient changeover	Range1/TC1	open	open
	Range2/TC2	closed	open
	Range3/TC3	open	closed
	Range4/TC4	closed	closed
Key inhibit		closed	X
Hold function		X	closed
Start dilution function		close (0 –1 edge)	open
Stop dilution function		open	close (0 –1 edge)

10.5.7 DILUTION

(description: see “Dilution function”, page 48)

REDUCE

0 – **10** – 50 %

DOSING TIME

0:00:00 – **00:01:00** – 18:00:00 H:M:S

LOCK TIME

0:00:00 – **00:01:00** – 18:00:00 H:M:S

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10.5.8 DEVICE DATA

LANGUAGE

GERMAN
ENGLISH
FRENCH
SPANISH
POLISH
SWEDISH
ITALIAN
PORTUGUESE
DUTCH
RUSSIAN

NOTE!
Entering the password 7485 in the administrator level will reset the operating language to English.

CONTRAST

0 — **6** — 11

LIGHTING

OFF
ON
IF OPERATED (approx. 50 s after the last key operation the lighting will be switched off)

LCD INVERSE

OFF
ON

10.6 Administrator level

- All parameters can be edited (altered) in this level.
- In this level, you can also define which parameters can be edited (altered) by a “normal” user, and/or which calibration actions are permitted. Editable parameters can be edited in the operator level. Non-editable parameters are marked in the operator level by a key symbol

You can access the administrator level as follows:

* Press the PGM key for at least 3 seconds.
* Use the ▼ or ▲ key to select ADMINISTRATOR LEVEL.
* Use ▼ or ▲ to enter password 300.
* Press the PGM key.

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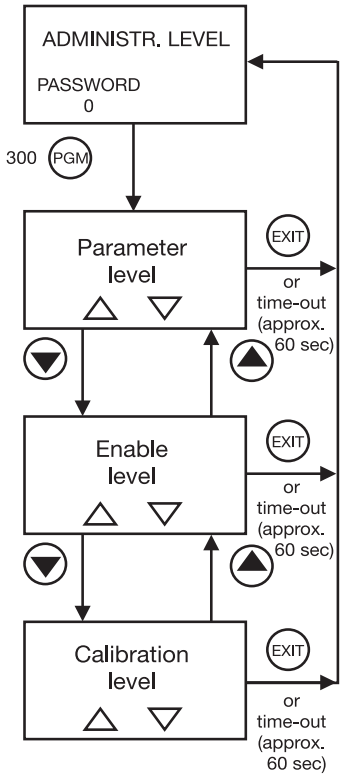
Levels within the administrator level



10.6.1 Parameter level

The administrator can edit all parameters for the operator level in this level. The structure “Parameter level” within the administrator level is identical to the operator level, see “Operator level”, page 37 and the following

10.6.2 Enable level

In this level, the administrator can define which parameters can be altered or edited by the operator in the operator level. The available options are READ ONLY and EDIT.
The structure “Parameter level” within the administrator level is identical to the operator level, see “Operator level”, page 37 and the following.

10.6.3 Calibration enable (CALIB. ENABLE)

In this level, the administrator can define whether the operator can calibrate or alter

- The relative cell constant
- The linear temperature coefficient
- The nonlinear temperature coefficient.

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10.7 Calibration level

All the calibrations that have been enabled by the administrator (administrator level) can be carried out in this level.

* Press the PGM key for at least 3 seconds
* Use the ▼ or ▲ key to select CALIBRATION LEVEL

10.7.1 REL. CELL CONSTANT (relative cell constant)

If this function has been enabled by the administrator, then the operator can calibrate the relative cell constant of the device here; see “Calibrating the relative cell constant”, page 52.

10.7.2 TEMPCO LINEAR (linear temperature coefficient)

If this function has been enabled by the administrator, then the operator can calibrate the Indutec for liquids with a linear temperature coefficient; see “Linear temperature coefficient (ALPHA)”, page 54.

10.7.3 TEMPCOMP NON-LIN. (non-linear temperature coefficient)

If this function has been enabled by the administrator, then the operator can calibrate the Indutec for liquids with a non-linear temperature coefficient; see “Non-linear temperature coefficient (ALPHA)”, page 57.

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10.8 Dilution function

Brief description

For cooling water, the conductivity is used to deduce the total salt content. If a conductivity limit is reached (at the maximum permissible salt content/concentration), then the cooling water must be diluted. A dilution valve is opened, the concentrated water flows out, and is replaced by fresh water. When the conductivity of the cooling water has fallen below the limit, the dilution valve is closed again.

Addition of biocide

A biocide is added to the cooling water, to prevent biological growth in the cooling system. There is no ideal setting for the amount used and the timing of the biocide dosing. In most cases, the dosing time is used as the controlled variable. The dosing quantity is therefore defined by the pumping rate and duration (system-specific). The success of the biocide treatment must be checked at regular intervals.

Dilution before biocide addition

If a biocide that increases conductivity is added to the cooling water, this could increase the conductivity to beyond the limit. This would cause the dilution valve to be opened, and a portion of the added biocide would be discharged into the waste water (possibly contravening regulations!).

To prevent this, the conductivity in the cooling system is reduced by dilution to, for example, 10 % below the limit, before the biocide is added. The dilution valve is then temporarily blocked.

Dilution inhibit

After adding the biocide, the dilution should be inhibited for a while, until the biocide that is present in the cooling system is mostly decomposed (observe the statutory regulations!).

Implementation with the Indutec

- The dilution function is only available in the „Conductivity measurement“ mode – not for concentration measurement.
- When the dilution function is activated, all the parameters that are irrelevant for this function are switched off.
- The dilution function can be started through binary input 1 and stopped through binary input 2, see “BINARY INPUT 1 and BINARY INPUT 2”, page 44.
- The dilution function can also be stopped by using the (EXIT) key.
- The present status of the dilution function will be shown in the display.
- The dilution valve is controlled by output K1.
- The addition of biocide valve is controlled by output K2.
- After dilution, K1 goes to the configured hold state (dilution inhibit).
- The dilution factor can be adjusted through binary input 1 over a range.
- 1 – 50 % below the limit value. The preset value is 10 % below the limit.

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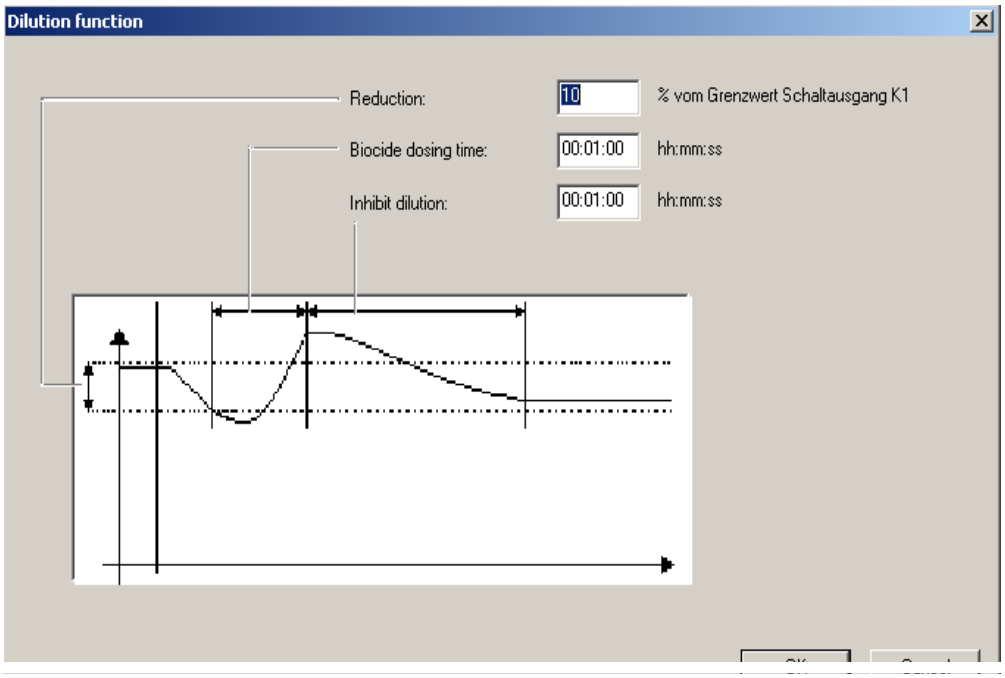
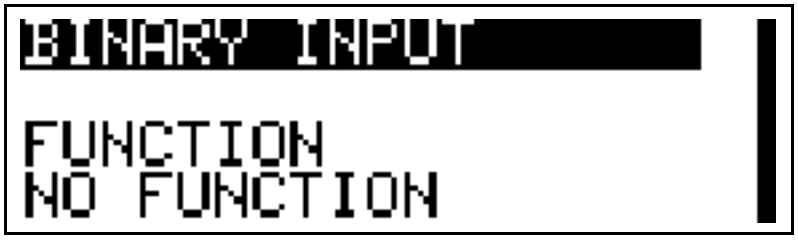


10.8.1 Stop dilution

All the parameters are system-dependent, and must be adjusted to suit system requirements.

* Press the PGM key for at least 3 seconds
* Use the ▼ or ▲ key to select OPERATOR LEVEL; use the PGM key to confirm the selection

* Use the ▼ or ▲ key to select BINARY INPUT; use the PGM key to confirm the selection



* Use the ▼ or ▲ key to select DILUTION; use the PGM key to confirm the selection

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* Change to the operator level using the PGM key.
* Use the ▼ key to select DILUTION.

* Confirm the selection with the PGM key.

* Use the ▼ or ▲ key to set the dilution factor in the range from 1 – 10 – 50 % below the limit value
* Confirm the selection with the PGM key
* Use the ▼ or ▲ key to select DOSING TIME; use the PGM key to confirm the selection.

* Set the dosing time with the ▼ and ▲ keys in the range from 0:00:00 – **00:01:00** – 18:00:00 H:M:S
* Confirm the setting with the PGM key
* Use the ▼ or ▲ key to select LOCK TIME; use the PGM key to confirm the selection.

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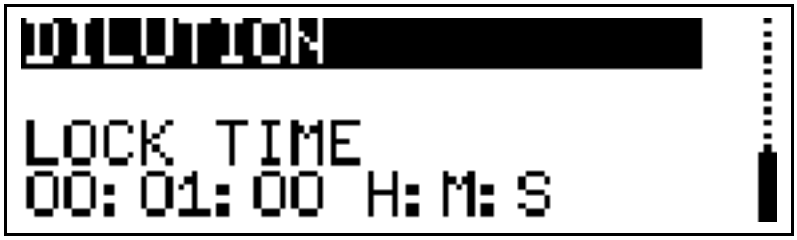

* Set the lock time with the ▼ or ▲ key in the range from 0:00:00 – **00:01:00** – 18:00:00 H:M:S.
* Confirm the setting with the PGM key

NOTE!
If there is an interruption in the supply voltage during dilution, the function will be cancelled.
The dilution function will have to be restarted if it is to be continued.

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11 Calibration

11.1 General

The device offers various calibration options to increase the precision.

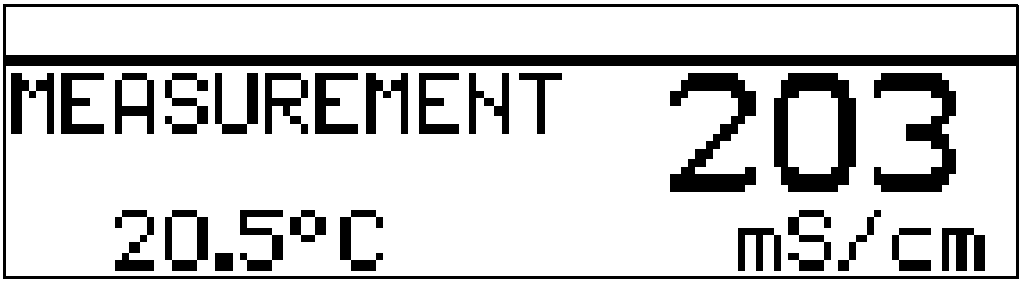
NOTE!
The conductivity sensor should be cleaned and calibrated at regular intervals, depending on the medium being measured.
The K1 LED blinks during calibration.

11.2 Calibrating the relative cell constant

In order to meet enhanced demands for precision, the cell constant must first be calibrated.

Requirements

- The supply voltage for the Indutec must be present, see Chapter 7 “Installation”, page 23ff.
- The sensor must be connected to the transmitter (applies to the split version).
- The transmitter is in the measurement mode.



* Immerse the conductivity sensor in a reference solution with a known conductivity.

CAUTION!
The temperature of the sample solution must remain constant during calibration!

* Press the EXIT key for at least 3 seconds.
* Use the ▼ or ▲ key to select CALIBRATION LEVEL; use the PGM key to confirm the selection.

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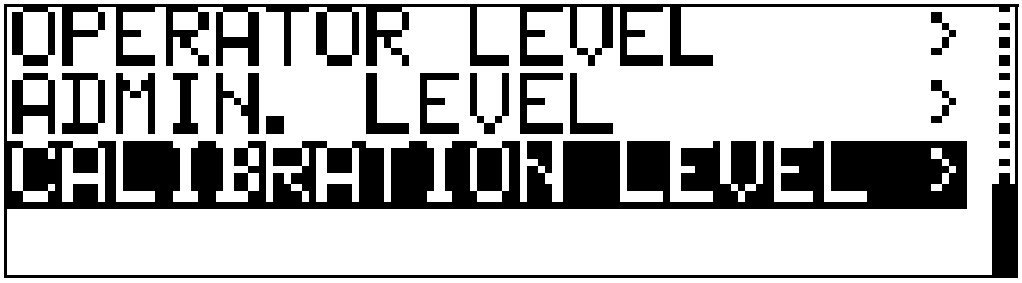
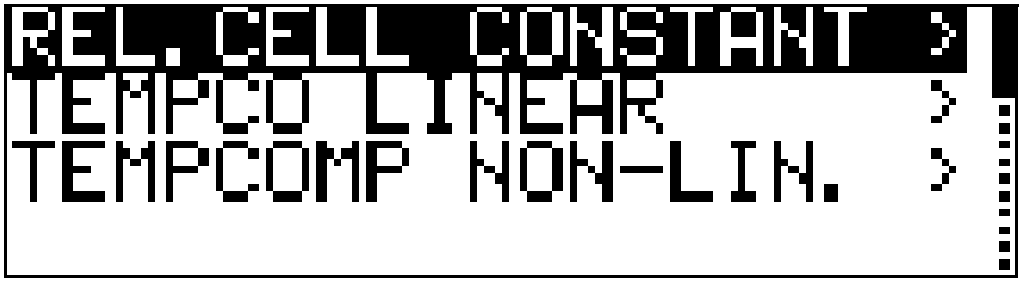
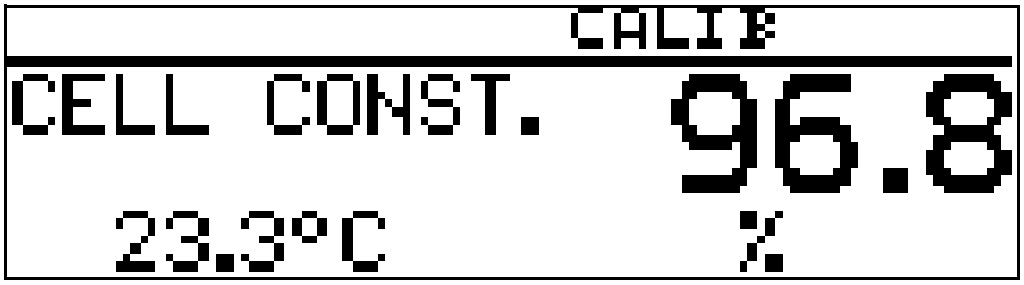


* Use the ▼ or ▲ key to select REL. CELL CONSTANT; use the PGM key to confirm the selection.



* When the measurement is stable, press the PGM key.
* Use the ▼ or ▲ key to correct the indicated uncompensated conductivity to match the known value for the reference solution.
* Press PGM .
  The relative cell constant calculated by the device will be displayed.



* To accept the relative cell constant that has been determines -> press the PGM key for at least 3 seconds or to reject the value -> press the EXIT key.
  The transmitter is in the calibration menu.
* Press the EXIT key;
  the transmitter is now in the measurement mode and shows the compensated conductivity of the reference solution.

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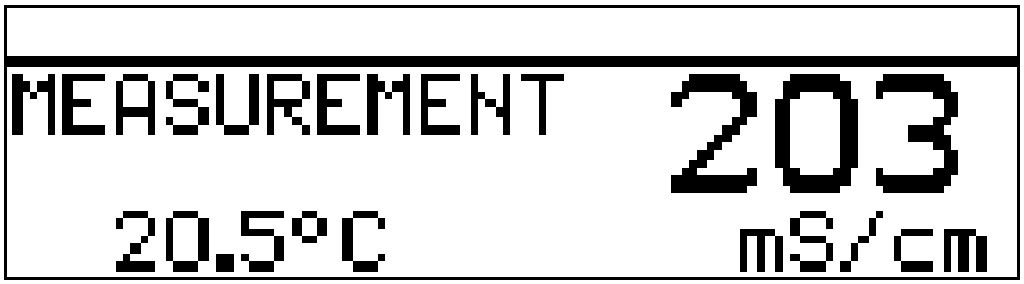
11.3 Calibrating the temp. coefficient of the sample solution

11.3.1 Linear temperature coefficient (ALPHA)

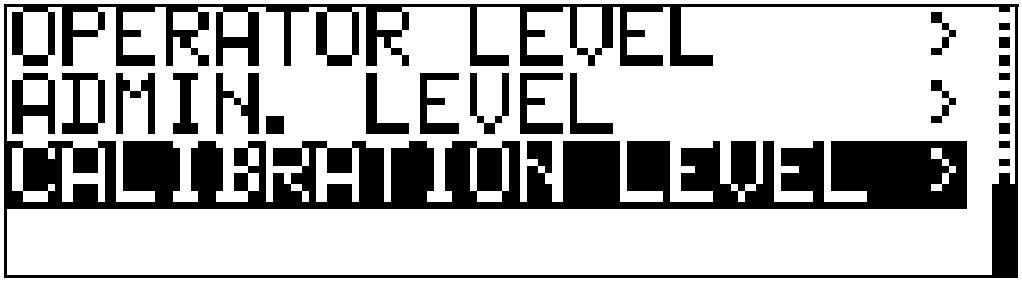
The conductivity of any sample solution will change according to its individual temperature coefficient.
We therefore recommend carrying out a calibration of the temperature coefficient.

Requirements

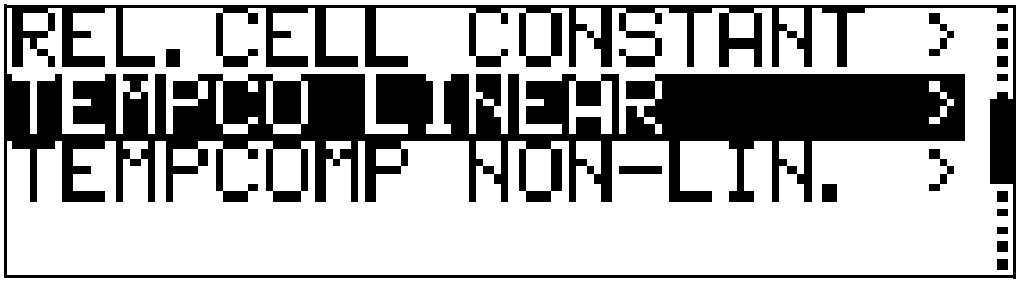
- The supply voltage for the Indutec must be present, see Chapter 7 “Installation”, page 23ff.
- The sensor must be connected to the transmitter (applies to the split version).
- The transmitter is in the measurement mode.



* Immerse the conductivity sensor in a sample of the solution to be measured.
* Press the PGM key for at least 3 seconds.
* Use the ▼ or ▲ key to select CALIBRATION LEVEL; use the PGM key to confirm the selection.



* Use the ▼ or ▲ key to select TEMPCO LINEAR; use the PGM key to confirm the selection.



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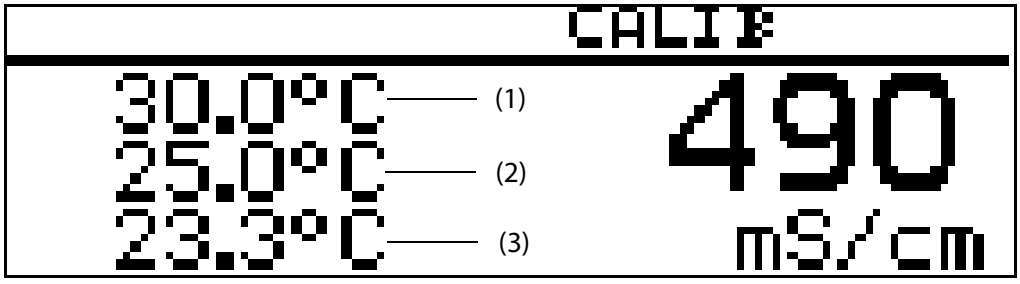
✶ Use the ▼ or ▲ key to enter the working temperature; confirm with the PGM key.

NOTE!
The working temperature must be at least 5 °C above or below the reference temperature (25.0 °C).



The LC display now shows:

(1) The selected working temperature (blinking),

(2) the reference temperature (blinking) and

(3) the present sensor temperature (steady)

✶ Warm up the sample medium until both the reference and the working temperatures have been reached (the corresponding values no longer blink).

CAUTION!
During calibration, the rate of change of temperature for the sample solution must not exceed

10 K/min for a device with exposed temperature sensor, or
1 K/min for a device with an internal temperature sensor.

As soon as one of the target temperatures has been reached, its display becomes static (no longer blinking).

NOTE!
Calibration can also be carried out through a cooling procedure (falling temperature). In this case, it starts above the working temperature and finishes below the reference temperature.

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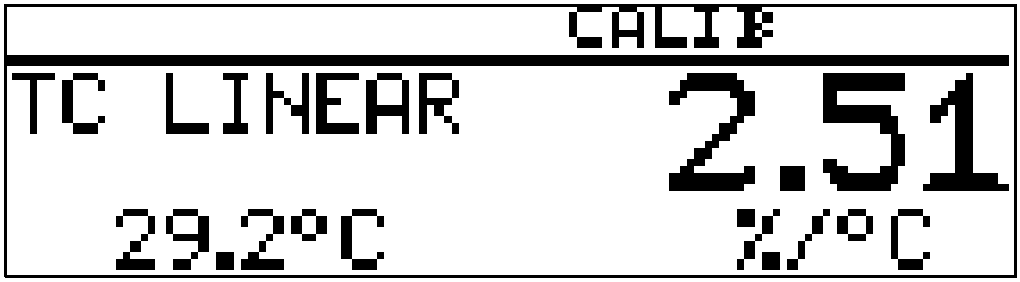

The LC display now shows the derived temperature coefficient in %/°C.
To accept the temperature coefficient that has been determined -> press the PGM key for at least 3 seconds or to reject the value -> press the EXIT key.

The transmitter is in the calibration menu.

* Press the EXIT key.
  The transmitter is now in the measurement mode and shows the compensated conductivity of the reference solution.

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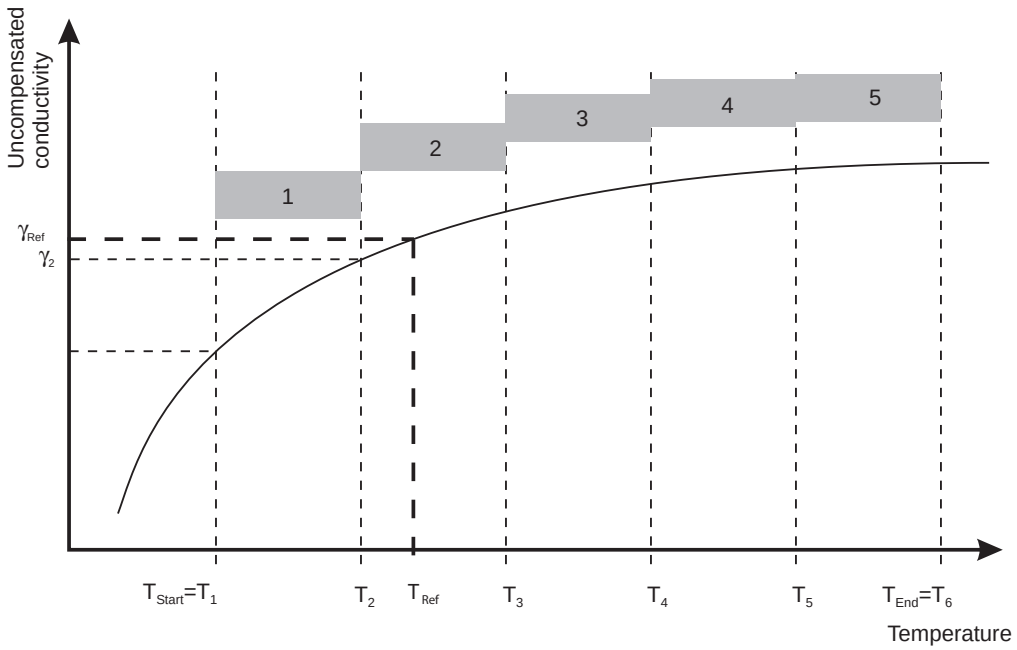
11.3.2 Non-linear temperature coefficient (ALPHA)

General

Since the temperature coefficient of some media is not constant over a sizeable temperature range, the Indutec provides the option of subdividing a temperature range (T_{Start} to T_{End}) into 5 sections. A different TC value can be used for compensation in each of these range sections. This „TC curve“ can be

- edited with the setup program and transmitted to the device or
- the calibration can be performed automatically on the device.

Determining the TC curve



Calculation of a temperature coefficient

$$\alpha_1 = \frac{\left(\frac{\gamma_1}{\gamma_{Ref}} - 1\right) \times 100}{T_1 - T_{Ref}}$$

α temperature coefficient (TC)
γ uncompensated conductivity

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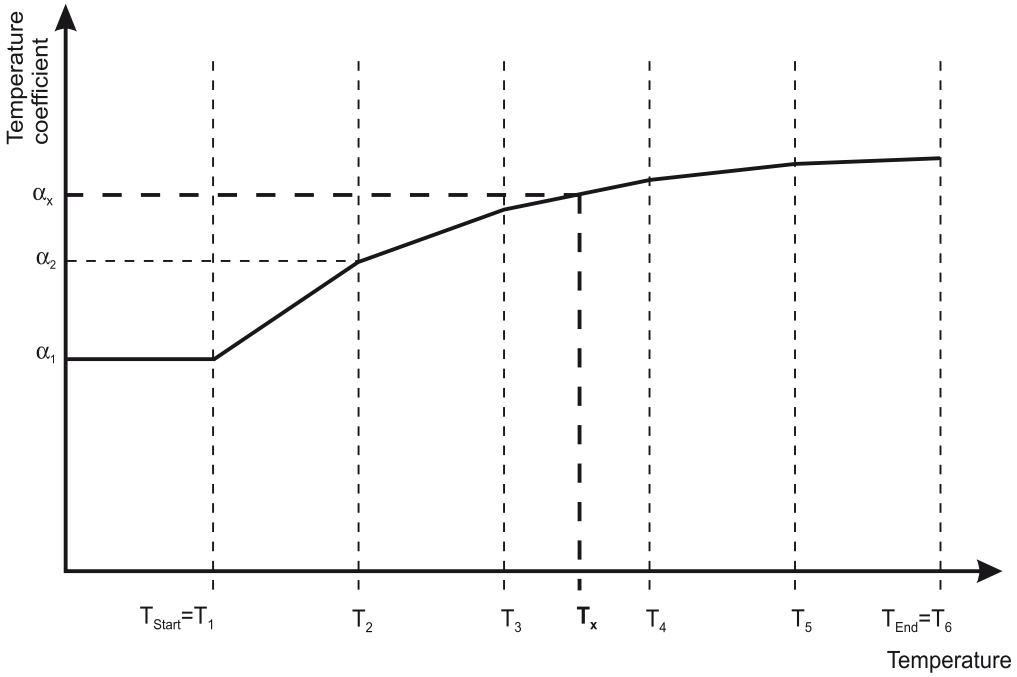

Temperature compensation with the TC curve

The present temperature of the medium is applied to the TC curve to determine the corresponding temperature coefficient, see “TC curve” above.
Intermediate values, e.g. (α_x at T_x) between two known values (α_3 at T_3) and (α_4 at T_4) are derived through a linear interpolation.
The derived TC is used to calculate the compensated conductivity, in the same way as with the linear compensation.

NOTE!
If the measured temperature is lower than the start temperature, the first TC is used for compensation.
If the measured temperature is higher than the end temperature, the last TC is used for compensation.

$$\gamma_{(Comp)} = \frac{\gamma_{(Meas)}}{\left(1 + \frac{\alpha_x}{100} * (T_x - T_{Ref})\right)}$$

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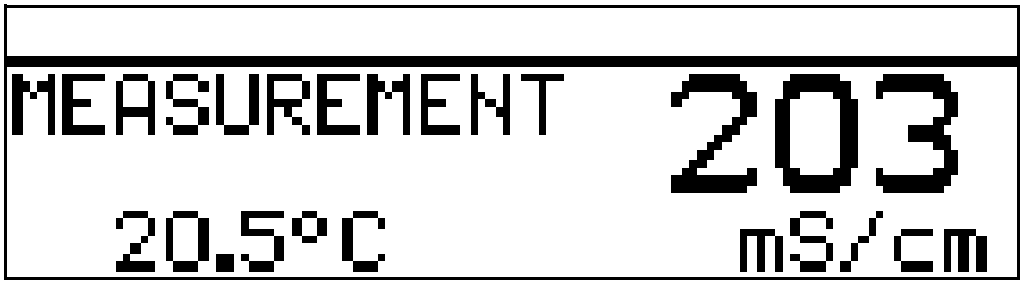
Sequence for automatic calibration

The TC curve is automatically recorded over a temperature range that has been defined by the user. The temperature range between the start and end temperatures is subdivided into 5 sections of equal size.
The temperature range must be larger than 20 °C, and cover the reference temperature.
Example: Reference temperature 25 °C, start temperature 18 °C and end temperature 50 °C.

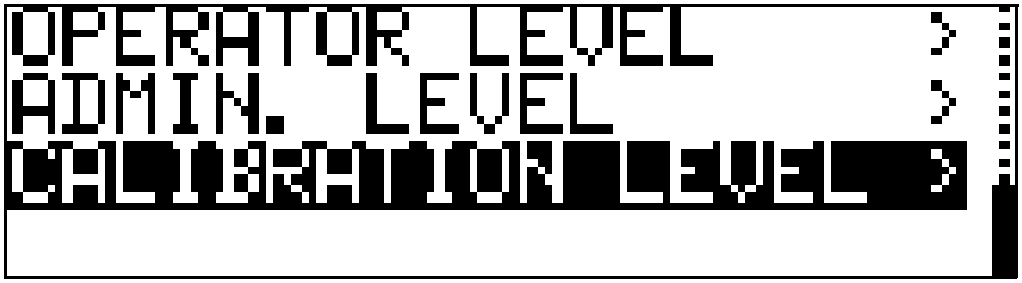
NOTE!
The rate of change of the temperature must not exceed
• 10 K/min for an exposed temperature sensor, and
• 1 K/min for an internal temperature sensor.

Requirements

- The supply voltage for the Indutec must be present, see Chapter 7 “Installation”, page 23ff.
- The sensor must be connected to the transmitter (for the split version).
- The transmitter is in the measurement mode.



* Immerse the conductivity sensor in a sample of the solution to be measured.
* Press the PGM key for at least 3 seconds.
* Use the ▼ or ▲ key to select CALIBRATION LEVEL; use the PGM key to confirm the selection.



* Use the ▼ or ▲ key to select TEMPCOMP NON-LIN; use the PGM key to confirm the selection.

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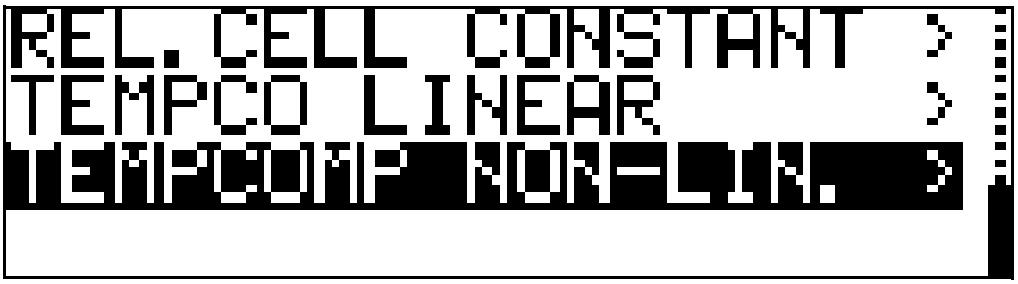
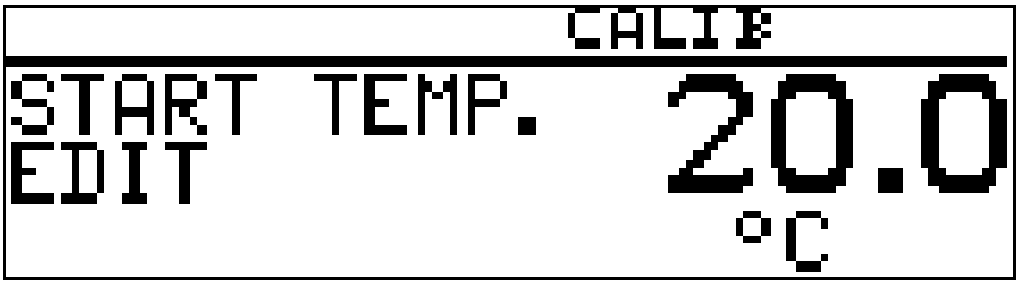
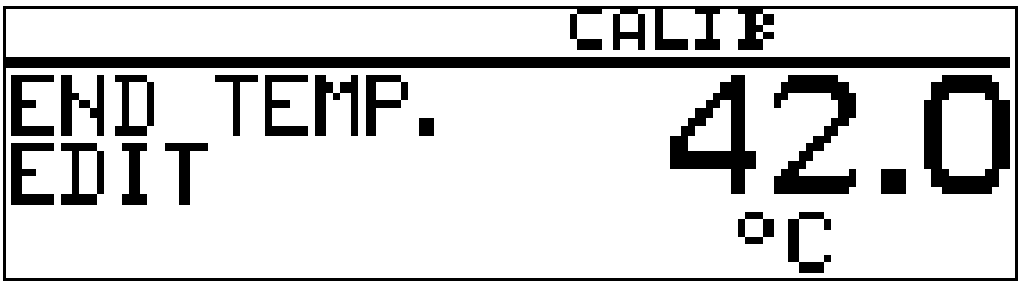


* Use the ▼ or ▲ key to enter the start temperature; confirm with the PGM key.



NOTE!
The start temperature must be lower than the reference temperature (25.0 °C).

* Use the ▼ or ▲ key to enter the end temperature; confirm with the PGM key.



NOTE!
The end temperature must be at least 20°C above the start temperature.

The transmitter will define the fixed temperature points itself. The LC display now shows

- at top (1): the next target temperature (blinking)
- below (2): the present sensor temperature (steady)

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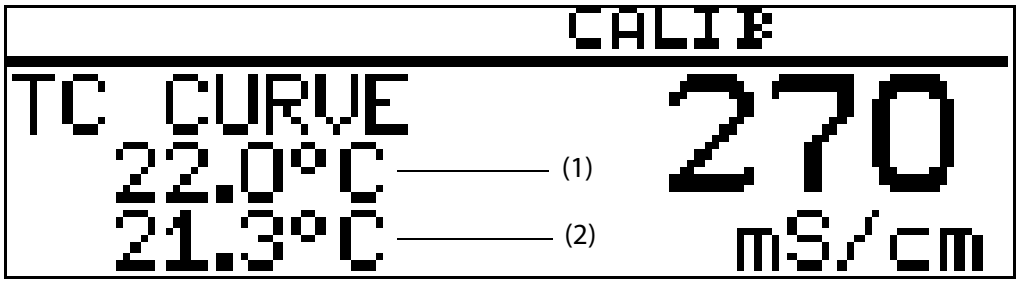
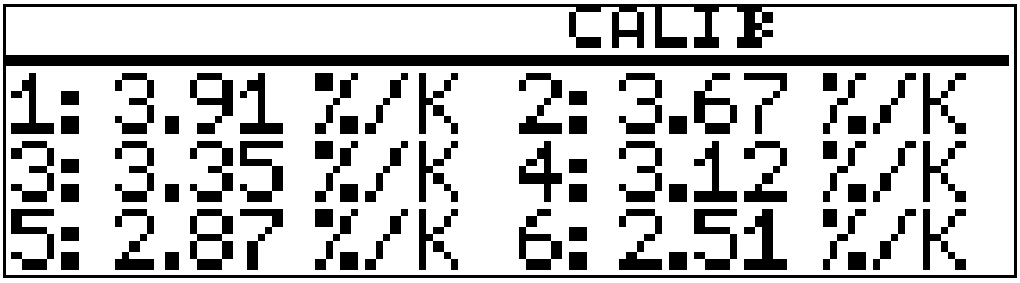


* Warm up the sample medium until is it above/below the temperature that is blinking. The next target measured temperature is displayed as blinking.

CAUTION!
During calibration, the rate of change of temperature for the sample solution must not exceed
10 K/min for a device with exposed temperature sensor, or
1 K/min for a device with an internal temperature sensor.
As soon as one of the target temperatures has been reached, its display becomes static (no longer blinking).

* Warm up the sample medium until is it above the temperature that is blinking.
* Repeat the procedure as often as required, until the device has determined all 6 temperature coefficients.



The LC display now shows the derived temperature coefficients in %/K

* To accept the temperature coefficients that have been determined -> press the PGM key for at least 3 seconds or to reject the values -> press the EXIT key.
  The transmitter is in the calibration menu
* Press the EXIT key.
  The transmitter is now in the measurement mode, and shows the compensated conductivity of the reference solution.

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12 Maintenance

12.1 Cleaning the conductivity sensor

CAUTION!
Do not use solvents.
Hard-to-remove crusts and deposits can be softened and removed with dilute hydrochloric acid.
Observe the safety regulations!

Deposits

Deposits on the sensor section can be removed with a soft brush (e.g. a bottle brush).

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12.2 Repair, return and guarantee

12.2.1 Repair

If the transmitter shows any sign of malfunction, please always contact the manufacturer first. The manufacturer will help you over the telephone with all further actions that are necessary and may be able to suggest a solution for the problem. Often, the devices are merely incorrectly set and seem to be malfunctioning because of such incorrect settings.

However, if a device has a definite fault, please return it to the manufacturer. The transmitter does not contain any parts, which can be repaired by the user. The manufacturer‘s QA department will ensure that your device is repaired as quickly as possible or, if the device is still under warranty, will provide you with a free replacement device.

Please do not attempt to repair the transmitter on your own accord. You may loose your warranty entitlement and possibly make the fault worse.

12.2.2 Return

If you return a device to us, please observe the following notes:

- Secure the measuring cell against all forms of contact
- Pack the device in transport-proof outer packaging
- Pack the electronic components in ESD-compliant outer packaging
- Include a precise description of the transmitter fault with the returned device
- Tell us what you would like us to do with the returned item if applicable
- Use the product accompaniment form included in the scope of delivery when returning the device.

The returns address is:

Hengesbach Prozessmesstechnik GmbH & Co. KG
Schimmelbuschstraße 17
40699 Erkrath
GERMANY

service@hengesbach.com
www.hengesbach.com
Phone: +49(0)2104 3020-0
Fax: +49(0)2104 3020-22

12.2.3 Guarantee

The manufacturer warrants all manufactured products for a period of 1 year from delivery. Devices, which develop a fault or fail entirely during this period, will be repaired or replaced by the manufacturer. Please contact the manufacturer before you make your complaint in order to discuss further actions, as this will ensure the quick and smooth processing of your request.

Faults, which are due to incorrect handling, incorrect installation or other improper handling of the product, will not be regarded as warranty cases. In such instances, the manufacturer will prepare a report for each individual case.

Please also observe the return notes in the event of warranty processing. The manufacturer may not be able to tell who should be responsible for a device, which has become damaged during its return transport to the manufacturer because it was incorrectly packed. Therefore, in the worst case scenario, you may have to bear the damage yourself. For this reason we ask you to always make sure that you choose a safe means of transport packaging and pay special attention to the membrane of the measuring cell, as this is the one item, which gets damaged most often.

12.3 Disposal

A certain packaging effort is required to protect the device against damage during transport. Please recycle the packaging materials correctly or reuse them for packing other items.

The devices consist of a number of different materials, all of which need to be specifically disposed of. Therefore, please dispose of the devices via a suitable recycling specialist or return them to the manufacturer for the purpose of disposal.

NOTE!
The device is not subject to the WEEE directive 2002/96/EC and its associated laws and regulations. Therefore, obsolete devices are not designed for disposal in communal recycling centres.

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13 Eliminating faults and malfunctions

Possible Errors

Problem	Possible cause	Measures
No measurement display or signal output	Supply voltage missing	Check supply voltage, also check terminals
Measurement display 000 or signal output 0 % (e.g. 4 mA)	Sensor not immersed in medium, reservoir level too low	Top up the reservoir
	Flow-through fitting is blocked	Clean flow-through fitting
	Sensor is faulty	See „Checking the device“, page 65
Measurement display 8888 blinking + device status ALARM blinking. The temperature display is OK or LED 1 + LED 2 blink	Out of range => above or below measurement/display range	Choose suitable measurement range, or check the concentration table
Measurement display 8888 blinking + device status ALARM blinking. The temperature display shows 8888 blinking or LED 1 + LED 2 blink	The temperature sensor is faulty.	The transmitter or the conductivity sensor has to be replaced or set measurement acquisition "Temperature input“ briefly to manual, see “TEMPERATURE IN”, page 41.
Wrong or unstable measurement display	Sensor not immersed deeply enough	Top up the reservoir
	Inadequate mixing	Ensure good mixing, for sensor: make sure there is an all-round clearance of approx. 5 mm, to allow all-round flow
	Air bubbles	Check mounting site, see “Mounting”, page 17.

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13.1 Checking the device

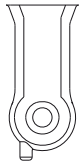
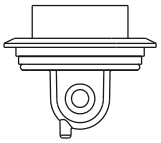
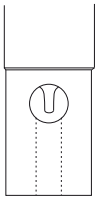
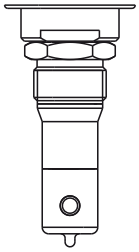
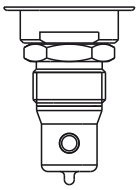
General

The device is calibrated at the factory, and is maintenance-free. If, nevertheless, measurement deviations appear with no apparent cause, the transmitter can be tested as follows.

13.1.1 Resistance loop test

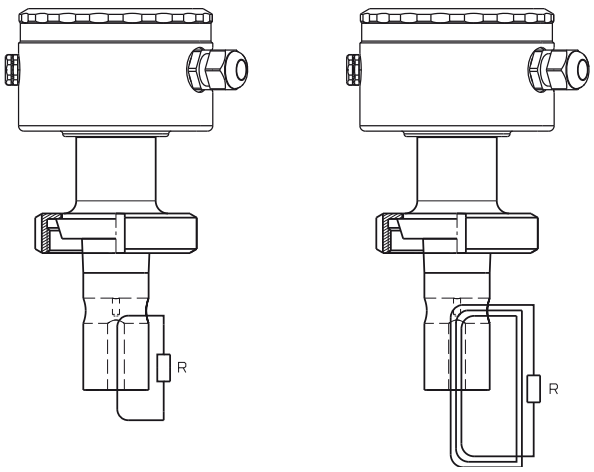
Cell constant

	**CAUTION!** The cell constant of the device is type-dependent!

				
PEEK K = 5,0 1/cm	PEEK K = 5,15 1/cm	PVDF K = 5,45 1/cm	PEEK K = 6,0 1/cm	PEEK K = 6,1 1/cm

Position of resistor loop

	**CAUTION!** During calibration, do not touch the sensitive part of the cell or put it down on any surface, otherwise the measurement will be falsified.



- ✶ Run wire through measuring cell (see diagram)
- ✶ Connect resistor R to wire

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Calculating resistance

Formula for calculating the resistance of the resistor loop:

$$R = \frac{N^2 \cdot K}{Lf}$$

R resistance of resistor loop
N number of loop windings
K cell constant
Lf required display in S/cm

Note: 1 mS/cm = 1·10-3 S/cm
1 µS/cm = 1·10-6 S/cm

For display values up to 20 mS, the resistor loop must have one winding.
For display values up to 50 mS, the resistor loop must have three windings.

Example 1

The device with a T-shaped PVDF m easuring cell should display 20 mS:

$$R = \frac{1^2 \cdot 5.45\ 1/cm}{20 \cdot 10^{-3}\ S/cm} = 272.5\ \Omega$$

To get a display of 20 mS/cm, the resist or loop (with 1 winding) must have a resistance of 272.5 ohm.

Example 2

The device with a T-shaped PVDF measuring cell should display 500 mS:

$$R = \frac{3^2 \cdot 5.45\ 1/cm}{500 \cdot 10^{-3}\ S/cm} = 98.1\ \Omega$$

To get a display of 500 mS/cm, the resist or loop (with 3 windings) must have a resistance of 98.1 ohm.

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Precalculated values

Display value 0 is obtained if the following conditions are met:

- The sensor is dry **and**
- the sensor does not have any conductive coatings **and**
- a resistor loop is not installed.

Display at measuring range end	Number of windings	Cell constant [1/cm]	Required resistance [Ω]
500 µS/cm	1	5,0	10.000
1000 µS/cm			5.000
2000 µS/cm			2.500
5000 µS/cm			1.000
10 mS/cm			500
20 mS/cm			250
50 mS/cm	3		900
100 mS/cm			450
200 mS/cm			225
500 mS/cm			90
1000 mS/cm			45
2000 mS/cm			22,5

Running the test

✶ Define the test resistance

✶ Electrically connect the device, see Chapter 7 "Installation", page 23.

✶ Install resistor loop as shown in the diagram.

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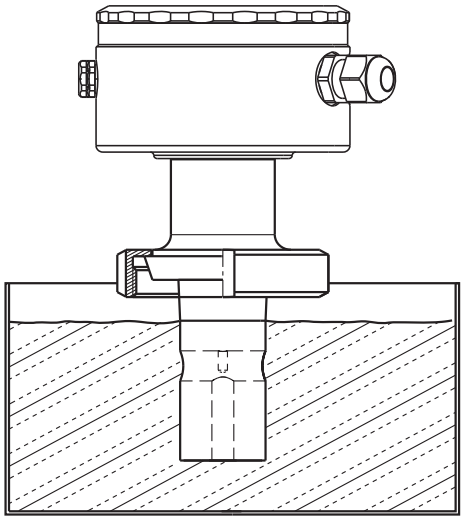
13.1.2 Reference liquid test

Immerse in test solution



Test sequence

- Prepare the conductivity test solution in a container of adequate size.
- Connect up the Indutec, see Chapter 7 “Installation”, page 23.
- Select the range appropriate to the conductivity test solution, see Chapter 10.5.1 “CONDUCTIVITY IN (conductivity input)”, page 38 -> RANGE 1 – 4
- Set TC to 0 %/°C, see Chapter 10.5.1 “CONDUCTIVITY IN (conductivity input)”, page 38 -> TEMPCO.
- Immerse the cell in the container and do not move it any more during the measurement.

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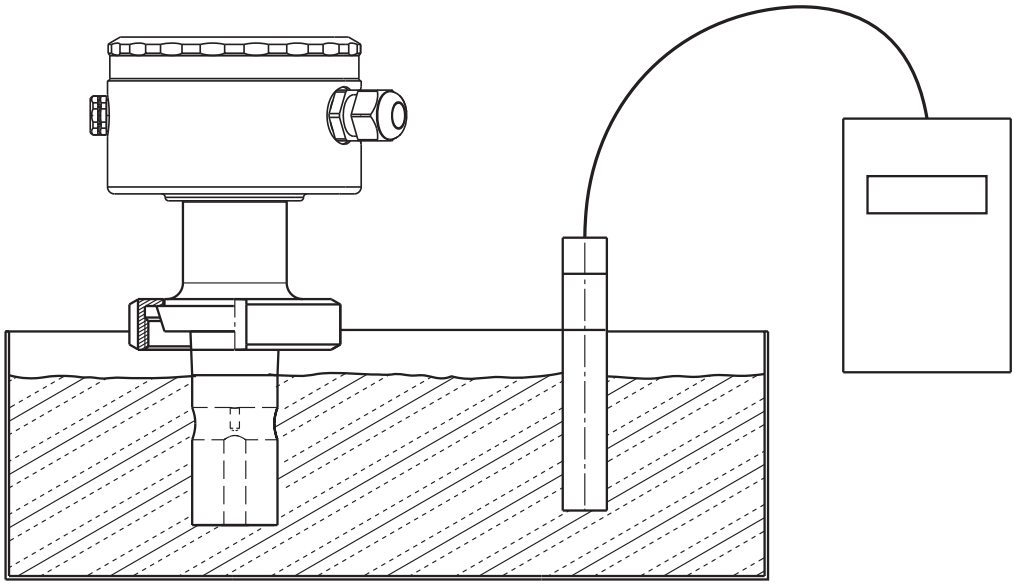
13.1.3 Reference measuring device test

Immerse in test solution



Test sequence

- Prepare the conductivity test solution in a container of adequate size.
- Connect up the device, see Chapter 7 “Installation”, page 23.
- Select the range appropriate to the conductivity test solution, see Chapter 10.5.1 “CONDUCTIVITY IN (conductivity input)”, page 38 -> RANGE 1 – 4
- Set TC to 0%/°C, see Chapter 10.5.1 “CONDUCTIVITY IN (conductivity input)”, page 38 -> TEMPCO.
- Set the TC for the reference device to 0 %/°C as well (see operating instructions for the reference device). If this is not possible, then the sample liquid must be tempered to the reference temperature for the reference device.
- Immerse the cell under test and the cell for the reference device in the container, and do not move them any more during the measurement.
- The output and display of the device under test or the attached display unit must match the indication of the attached reference device, taking into account acceptable device deviations.

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14 Appendix

14.1 Before configuration

If a number of device parameters have to be modified in the device, then it is advisable to note them in the table below, and then modify these parameters in the sequence given.

NOTE!
The following list shows the maximum number of parameters that can be altered. Depending on the configuration, some of the parameters will not be alterable (editable) for your device.

Parameter	Selection / Value range **Factory Setting**	New setting
Conductivity input		
Range 1 – 4	0 – 500 µS/cm **0 – 1000 µS/cm** 0 – 2000 µS/cm 0 – 5000 µS/cm 0 – 10 mS/cm 0 – 20 mS/cm 0 – 50 mS/cm 0 – 100 mS/cm 0 – 200 mS/cm 0 – 500 mS/cm 0 – 1000 mS/cm 0 – 2000 mS/cm (uncompensated)	
Temperature compensation	**linear** non-linear natural water	
Temperature coeff. 1 – 4	0 to **2.20** to 5.5 %/K	
Reference temperature	15.0 to **25.0** to 30 °C	
Cell constant	2.00 – **6.80** – 10.00 1/cm	
Relative cell constant	80.0 – **100.0** – 120.0 %	
Mounting factor	80.0 – **100.0** – 120.0 %	
Concentration measurement	**no function** NaOH HNO_3 customer-specific	
Offset	-200 to **0** to +200 mS/cm	
Filter time	**00:00:01** – 00:00:25 H:M:S	
Calibration interval	**0** – 999 days	

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Parameter	Selection / Value range **Factory Setting**	New setting
Conductivity output		
Signal type	0 – 20 mA **4 – 20** mA 20 – 0 mA 20 – 4 mA 0 – 10 V 2 – 10 V 10 – 0 V 10 – 2 V	
Scaling start	**0** – 90 % = 4 mA (e.g.) of range span	
Scaling end	**100** – 10 % = 20 mA (e.g.) of range span	
During alarm	**low** high safe value	
During calibration	**moving** frozen safe value	
Safe value	0.0 – **4.0** – 22.0 mA	
Manual mode	**off** on	
Manual value	0.0 – **4.0** – 22.0 mA	
Temperature input		
Unit	**°C** °F	
Measurement acquisition	**sensor** manual	
Manual value	-20.0 to **25** to 150 °C	
Offset	-15.0 to **0.0** to +15 °C	
Filter time	00:00:00 – **00:00:01** – 00:00:25 H:M:S	
Temperature output		
Signal type	0 – 20 mA **4 – 20 mA** 20 – 0 mA 20 – 4 mA 0 – 10 V 2 – 10 V 10 – 0 V 10 – 2 V	
Scaling start	-20 to **0.0** to 183 °C = 4 mA (0 – 90 % of range span)	
Scaling end	-3 to **150** to 200 °C = 20 mA (100 – 10 % of range span)	

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Parameter	Selection / Value range **Factory Setting**	New setting
During alarm	**low** high safe value	
During calibration	**moving** frozen safe value	
Safe value	0.0 – **4.0** – 22.0 mA	
Manual mode	**off** on	
Manual value	0.0 – **4.0** – 22.0 mA	
Binary output 1 or binary output 2		
Function	**no function** conductivity MIN contact conductivity MAX contact conductivity LK1 conductivity LK2 temperature MIN contact temperature MAX contact temperature LK1 temperature LK2 calibration timer alarm	
Limit value	**-20.0** – 9999.0	
Hysteresis	0.0 – **1.0** – 999.0	
Spacing	**0.0** – 999.0	
Manual mode	**off** on	
For "Hold"	**inactive** active frozen	
For alarm/calibration	**inactive** active frozen	
Switch-on delay	**00:00:00** – 01:00:00 H:M:S	
Switch-off delay	**00:00:00** – 01:00:00 H:M:S	
Pulse duration	**00:00:00** – 01:00:00 H:M:S	
Binary input		
Function	**no function** key lock / hold meas. range / temperature coefficient dilution function	
Dilution function		
Reduction	0 – **10** – 50 %	
Dosing time	00:00:00 – **00:01:00** – 18:00:00 H:M:S	

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Parameter	Selection / Value range **Factory Setting**	New setting
Lock time	00:00:00 — 00:01:00 — 18:00:00 H:M:S	
Device data		
Language	**German** English French Spanish Polish Swedish Italian Portuguese Dutch Russian	
Contrast	0 – **6** – 11	
Lighting	off on **during operation**	
LCD inverse	**off** on	

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