Inductive conductivity transmitter
- Type INDUTEC - Compact and separate version

Hengesbach Prozessmesstechnik

CIP / SIP - safe -

EHEDG EUROPEAN HYGIENIC ENGINEERING & DESIGN GROUP MEMBER SINCE 2010

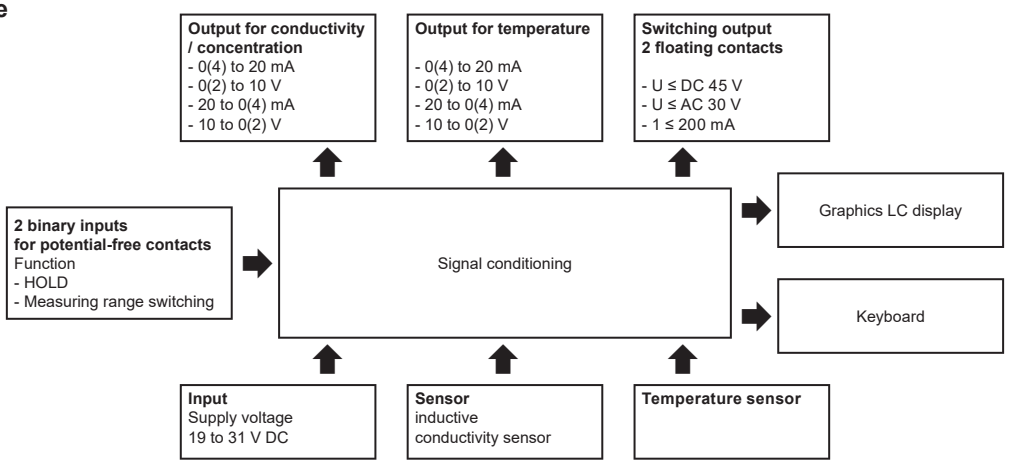
FEATURES

- HYGIENIC DESIGN SOLUTION
- ACTIVATION OF UP TO FOUR MEASURING RANGES AND TEMPERATURE COEFFICIENTS
- CONCENTRATION MEASUREMENT OF
  · caustic soda NaOH · Nitric acid HNO3 · a freely definable curve
- FAST-RESPONSE TEMPERATURE SENSOR
- PRODUCT DIFFERENTIATION = EXACT PHASE SEPARATION OF DIFFERENT MEDIA DURING CIP
- MINIMIZATION OF PRODUCT LOSS AND COSTS = ENERGY EFFICIENT
- CHEMICAL DOSING: SHARPENING OF THE CLEANING AGENTS = PROCESS CONTROL
- OPERATION VIA KEYBOARD, LC DISPLAY OR SOFTWARE

DESCRIPTION

The device is used for the measurement/control of conductivity or concentration in liquid media. 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, and a particularly robust conductivity probe 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 (desalting). The device is operated from the membrane keypad and plain-text graphics display. The display can be read in a vertical or horizontal mounting position. The separate sensor design is particularly suitable for systems with strong vibrations and/or strong heat emissions at the measuring location.
Typical areas of application: Food/beverage and pharmaceutical industries, product separation in the beverage industry, breweries and dairies, CIP systems, water and wastewater engineering, dosing of chemicals.

Block structure



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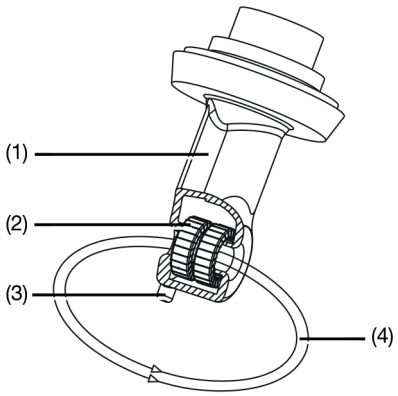
FUNCTIONAL DESCRIPTION

The inductive measurement method permits largely maintenance-free acquisition of the specific conductivity, even in the toughest media conditions.
Conductivity is measured by using an inductive probe. A sinusoidal AC 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.

DEVICE DESCRIPTION

Sensor

The sensor consists of a hermetically sealed body inside which the two measurement coils are arranged. A bore in the sensor enables the medium to flow through. The measurement principle entails an inevitable electrical isolation between the sample medium and the signal output. The sensor is largely unaffected by temperature and pressure variations.



Exposed temperature sensor
The exposed sensor reacts very quickly to changes in temperature. This is particularly important in CIP processes (phase separation).

Parts in contact with the medium
Depending on the sensor version, the following materials are wetted: PEEK, EPDM, stainless steel AISI 304, AISI 303 and AISI 316L; see Dimensions.

Temperature compensation
Since conductivity depends to a large extent on the temperature of the medium, it is usually necessary to compensate for the temperature effect. The device allows both linear and non-linear temperature compensation. If required, temperature compensation can be switched off, for example if the temperature conditions on the measurement site are stable or when temperature compensation is carried out by software in external evaluation devices (PLC or similar).

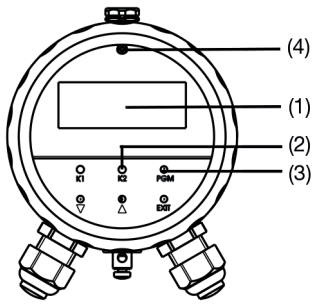
(1) Sensor body (PEEK) (2) Measuring coils (3) Temperature sensor (4) Liquid loop

Process connections
To cover a wide variety of applications, the device can be supplied with different process connections, see Dimensions.

Installation at the measurement point
The operating position is generally unrestricted. However, it is essential to ensure that there is a continuous exchange of the sample medium in the flow channel and that both air bubbles and dry-running are avoided.

Transmitter
The transmitter has been designed for use on site. A rugged housing protects the electronics and the electrical connections from corrosive environmental conditions (Protection class IP 67 according to DIN EN 60529). A vent screw with a PTFE membrane prevents condensation.

Displays and controls



Operation

The device can be operated by the membrane keypad and the graphics LC display. The device can be secured against unauthorized alteration by a password.

(1) Graphics LC display
(2) LEDs for the switching status indication of the outputs K1 and K2
(3) Keys
(4) Captive screw

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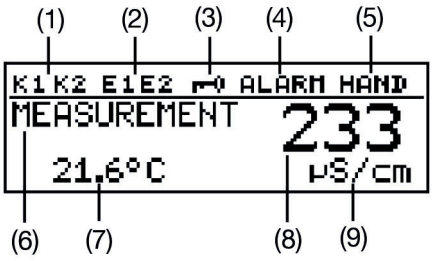
Functions of the output

Analog outputs

- One analog signal output for conductivity/concentration and temperature respectively
- The analog output signals are freely scalable (range start and end values)
- The response of the analog outputs to over/underrange or alarm can be programmed
- Simulation of the signal output:
  The analog signal outputs can be freely set in the manual („Hand“) mode
  Application: „Dry-run“ start-up of the plant, trouble-shooting, servicing

Graphics display



(1) Switching output 1 or 2 is active
(2) Binary input 1 or 2 is operated
(3) Keypad is inhibited
(4) Alarm has been activated
(5) Device is in manual mode
(6) Device status
(7) Temperature of medium
(8) Conductivity measurement
(9) Unit of conductivity measurement

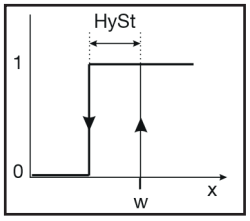
Switching outputs

The device features two floating switching outputs (solid-state relays) as standard. These can be used freely for monitoring the conductivity/concentration or the temperature. The following functions can be assigned:

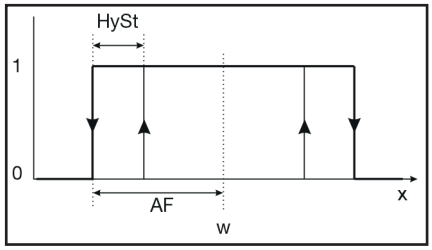
- Limit monitoring (MAX or MIN limit comparator) with programmable hysteresis
- Pulse function (the output switches briefly on reaching the switching point, then opens again).
- Pull-in and drop-out delay
- Inverted switching outputs
- Response to overrange/underrange or with activated measuring circuit monitoring (pull-in/drop-out)
- „Calibration timer run down“ signal

Contact functions

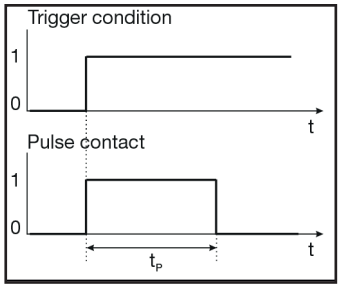
Limit function AF7



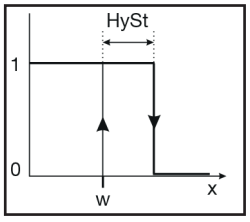
Alarm window AF1



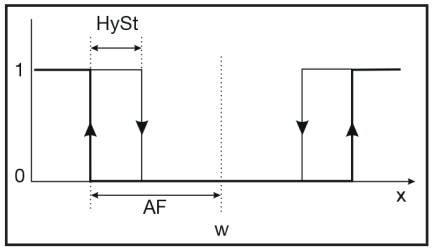
Pulse contact, Trigger conditions longer than pulse duration



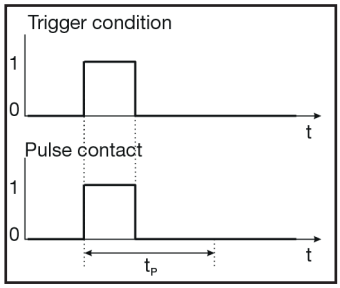
Limit function AF8



Alarm window AF2



Pulse contact, Trigger conditions shorter than pulse duration



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Binary inputs

The two binary inputs serve to implement the following functions:

- Key inhibit
- HOLD mode
- 4-fold range changeover
- 4-fold temperature coefficient changeover
- Initiation of desalting function and biocide dosing

Special functions

- The **learning function** for the temperature coefficient enables exact measurement of media with a non-linear characteristic. During a temperature change, the device “learns” the temperature coefficient of the present medium and stores the profile. The stored values then enable the correct indication of the temperature-compensated conductivity.
- **Individual characteristic** for concentration indication. An individual characteristic with 20 interpolation points can be entered through the setup program. This function can be used to generate special characteristics for specific media (e.g. special detergents). This results in correct measurements that contributes quality assurance and cost savings.
- **Desalting control** Various processes that find their application in wet cooling towers are stored as sequence control (biocide dosing and subsequent inhibiting of desalting). Detailed information can be found in the operating manual.
- The **calibration timer** draws your attention to a calibration schedule. This function is activated by entering a number of days, after which recalibration has to be carried out (plant or operator requirement).

Function of the binary inputs

Setting parameters		**Binary input 1**	**Binary input 2**
Range/temperature coefficient (TC) 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 desalting function		close (0 to 1 edge)	open
Stop desalting function		open	close (0 to 1 edge)

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TECHNICAL DATA

Conductivity transmitter

General information – A/D converter	
Resolution	15 bits
Sampling time	500 ms = 2 measurements / s
Power supply – for SELF and PELV curcuit operation only	
Standard	19 ... 31 V DC (24 V DC nominal)
Residual ripple	<5%
Reverse polarity protection	yes
Power draw	≤ 3 W
Contact rating of the Photo-MOS®-relay	
Voltage	≤ 45 V DC ≤ 30 V AC
Current	≤ 200 mA
Electrical connection	
	Cable glands/pluggable screw terminals, 2,5 mm²
	M12 plug/socket (instead of cable glands)
Display	
	Backlit graphic LCD; adjustable contrast
	Dimensions: 62 mm × 23 mm
Operating conditions	
Permissible ambient temperature	5 to +50°C; max. rel. humidity. 93 %, no condensation
Permissible storage temperature	-20 to +75°C; max. rel. humidity. 93 %, no condensation
Protection class	IP 67 according to DIN EN 60529
Electromagnetic compatibility according to DIN EN 61326	
Interference emission	Class B
Interference immunity	to industrial requirements
Housing	
Material	Stainless steel AISI 303
Weight	approx. 2 - 2,4 kg depending on the type
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 + sensor accuracy.	
Measuring accuracy (in % of the measuring range)	
Transmitter measuring ranges 0…5000 µS/cm ... 0…2000 mS/cm	≤ 0,5% FS
Concentration measurement – implemented in the device software	
NaOH (caustic soda)	0 ... 15 Gew.% oder 25 ... 50 Gew.% (0 ... 90°C)
HNO3 (nitric acid)	0 ... 25 Gew.% oder 36 ... 82 Gew.% (0 ... 80°C)
Customer-specific concentration curve	freely programmable via the setup program
Calibration timer	
	0 ... 999 days (0 = OFF)
Output	
Output signal conductivity and concentration (freely scalable)	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 at voltage output	≤ 500 Ω ≥ 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 set value
High	22.0 mA / 0.7 V or a set value

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TECHNICAL DATA

Temperature transmitters

Temperature acquisition	Observe the permissible temperature of the measured medium!
Typical use from approx. 100 µS/cm	Manually -20.0 ... 25.0 ... 150°C or °F or automatically
Measuring range	
	-20 ... 150°C or °F
Characteristic	
	linear
Accuracy	
	≤ 0,3% of the measuring range

Temperature compensation

Reference temperature	
	15 ... 30°C, adjustable
Temperature coefficient	
	0,0 ... 5,5%/K, adjustable
Compensation range	
	-20 ... 150°C
Function	
	linear or natural water (EN 27888) or non-linear

Inductive conductivity sensor

Measuring accuracy (in % of measuring range) Typical use from approx. 100 µS/cm	
0... 500 µS/cm / 0 ... 1000 µS/cm	≤ 1% FS
0 ... 2000 µS/cm / 0 ... 5000 µS/cm	≤ 0,5% FS
0 ...1000 mS/cm / 0 ... 2000 mS/cm	≤ 1% not temperature compensated
Material	
Material in contact with media	PEEK, stainless steel AISI 304
Permissible sample medium temperatures	
	-10 ... +120°C, briefly +140°C (Sterilization)
Pressure	
	max. 10 bar

Note: The temperature, pressure and sample medium affect the service life of the sensor!

MOUNTING LOCATION

- Ensure easy accessibility for subsequent calibration. The mounting must be secure and low-vibration.
- Avoid exposure to direct sunlight.
- Ensure good flow of and circulation around the sensor (2).
- When installing in a pipe, a minimum distance of 20 mm must be maintained between the sensor and the pipe wall.
- If these minimum distances cannot be maintained, a limited compensation can be achieved with the „installation factor“ parameter.
- For immersion operation in basins, an installation location representative of the typical conductivity or concentration must be provided.

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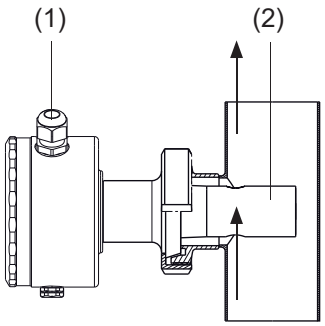
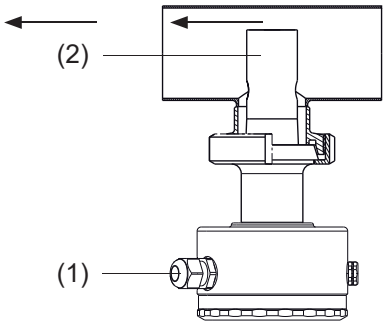
INSTALLATION INSTRUCTIONS

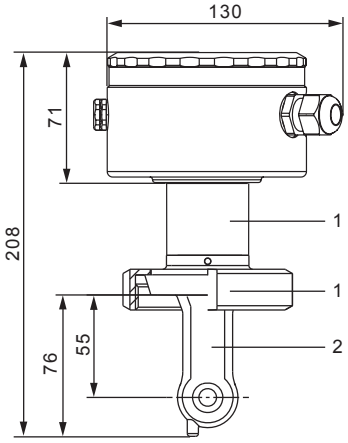
- The sensor must be completely immersed in the liquid.
- If possible, install the INDUTEC in vertical pipe sections to avoid air bubbles. The flow should be from bottom to top.
- If the INDUTEC is installed horizontally, it must be installed from below.
- Changes in the direction of flow (after pipe bends) can lead to turbulence in the medium. Install the sensor at least 1 m away from a pipe bend.
- The display can be adjusted according to the mounting direction using a captive fastening screw.



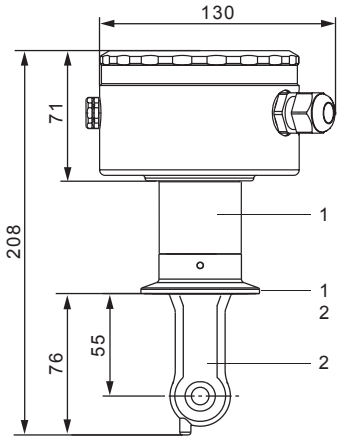


DIMENSIONAL DRAWINGS

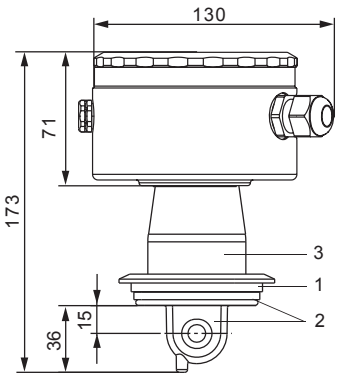
COMPACT VERSION



Version with process connection
Tapered connection piece with grooved union nut to DIN 11851, DN 50 or DN 65 or DN 80



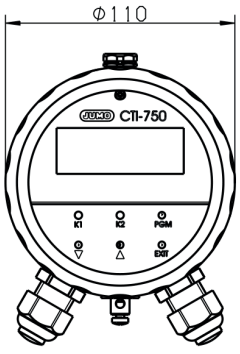
Version with process connection
Clamp to DIN 32676, DN 50 or DN 65

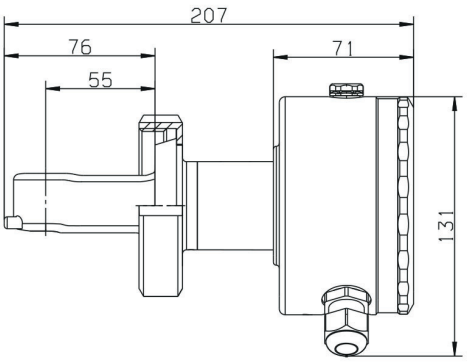


Version with process connection
Varivent type N for pipes DN 40 - DN 125

1 = Stainless steel AISI 304 2 = PEEK 3 = PPS GF 40

Control panel
Transmitter compact version with cable glands





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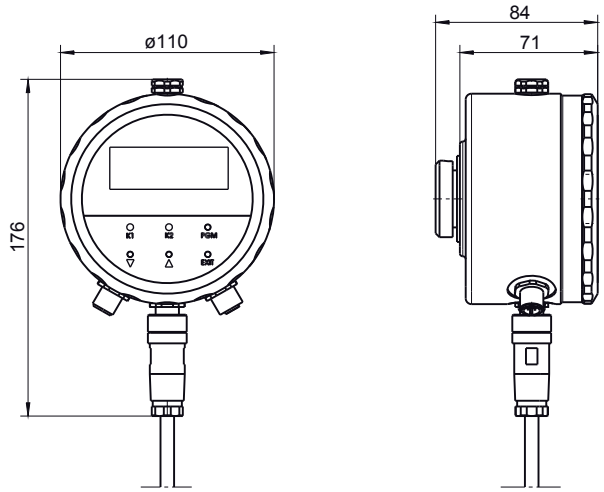
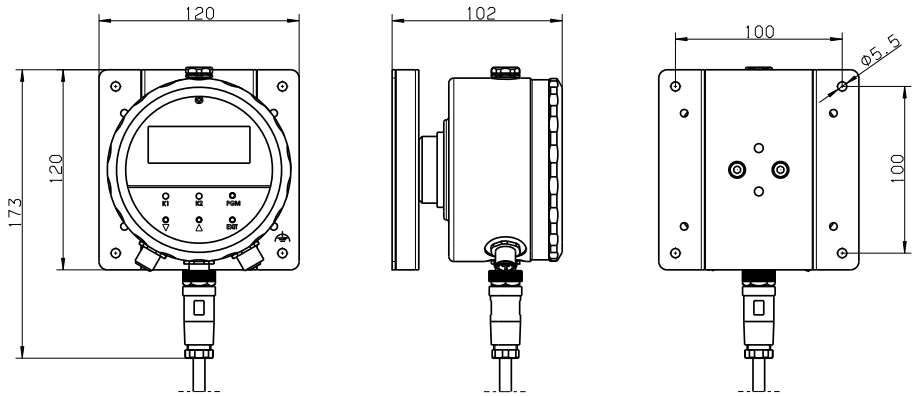
SEPARATE VERSION

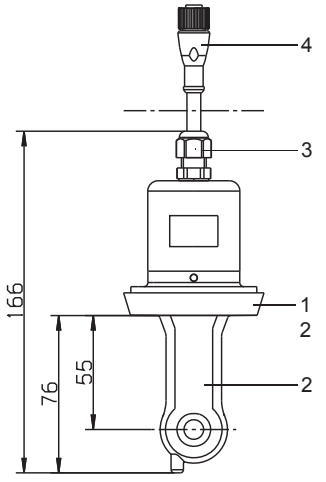
Control panel
Transmitter with separate sensor in stainless steel housing



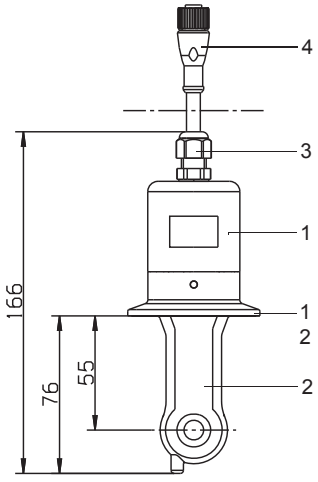
WALL MOUNTING



PROCESS CONNECTIONS



Separate version with process connection
Tapered connection piece with grooved union nut to DIN 11851,
DN 50 or DN 65 or DN 80 (union nut not included in scope of delivery)



Separate version with process connection
Clamp to DIN 32676, DN 50 or DN 65
(retaining clamp not included in scope of delivery)

1 = Stainless steel AISI 304 2 = PEEK 3 = PA 4 = TPU

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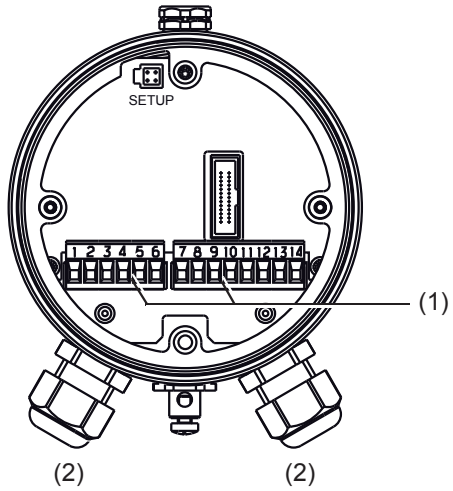
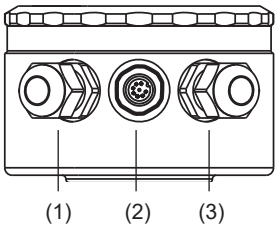
Electrical connection (cable gland)



Clamps		Description
1	L+	Power supply
2	L-	
3	+	Analog output of the actual value: conductivity / concentration (galvanically isolated)
4	-	
5	+	Analog output of the actual value: temperature (galvanically isolated)
6	-	
7		Photo MOS relay K1 (potential-free, no)
8		
9		Photo MOS relay K2 (potential-free, no)
10		
11		Binary input E1
12		
13		Binary input E2
14		

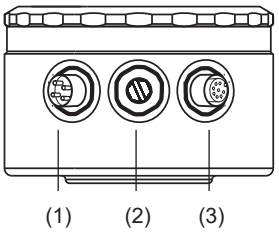
TRANSMITTER WITH SEPARATE SENSOR



(1) Power supply and measurement value output (conductivity/concentration and temperature) cable gland (PA)
(2) Separate sensor M12 connector
(3) Binary input and switching outputs cable gland (PA)

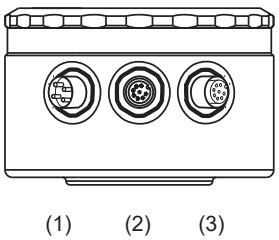
TRANSMITTER WITH ELECTRICAL CONNECTION M12 CONNECTOR

Compact version



(1) Plug I
Power supply and measurement value output conductivity/concentration
M12 plug-in connector, 5-pin
(2) Dummy plug
(3) Plug II
Measurement value output temperature and binary input and switching outputs
M12 panel-mounting socket, 8-pin

Separate version



(1) Plug I
Power supply and measurement value output conductivity/concentration
M12 plug-in connector, 5-pin
(2) Plug III
Inductive conductivity sensor
M12 built-in connector, 8-pin
(3) Plug II
Measurement value output temperature and binary input and switching outputs
M12 panel-mounting socket, 8-pin

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Calibration adapter AKA1FIDT

The AKA1FIDT calibration adapter can be used to quickly check the conductivity measurement of the INDUTEC:

1. Enter the password 300 in the INDUTEC operating menu in the administration to unlock the parameters.

2. Set the temperature compensation to 0.0% / K for the conductivity input in the parameter menu (default value 2.2% / K).

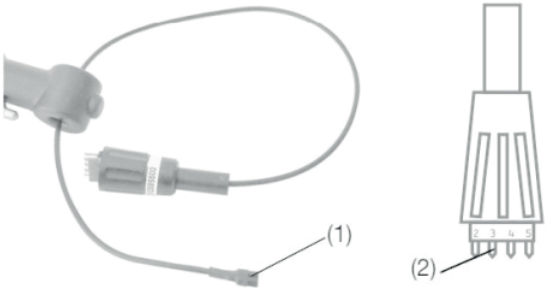
3. Place the conductor loop through the coil head of the INDUTEC **without** connecting it. The measured value should be 0 mS/cm.

4. Then - adjust the measuring range of the INDUTEC if necessary - connect the conductor loop to the connections of the calibration adapter and, if necessary, place it through the coil head several times to simulate the desired conductivities (see table below).
   The measured values displayed are compared with the theoretical values.

Connection conductor loop with	results in resistance (Ohm)	Number of windings	Cell constant (1 / cm)	Theoretical conductivity (ms / cm)
2	10,000	1	5,0	0.5
2	10,000	2	5,0	2.0
3	1,000	1	5,0	5.0
3	1,000	2	5,0	20.0
4	100	1	5,0	50.0
4	100	2	5,0	200.0
5	10	1	5,0	500.0

5. Important: Set the temperature compensation and measuring range back to the previous value.

CALCULATION OF THE CONDUCTIVITY



If the conductor loop (1) is connected to the terminals at the end of the calibration adapter (2), the following resistance values result:

2: 10 kOhm
3: 1 kOhm
4: 0.1 kOhm
5: 0.01 kOhm

Depending on the resistance of the calibration adapter, the conductivity is calculated as follows:

$$Lf\ (\text{conductivity}) = (N^2 \times K) / R$$

where

N – is the number of turns of the conductor loop (i.e. how often it was passed through the sensor bore of the INDUTEC)
K – is the cell constant (approx. 5.0 - the exact value is stored in the operating menu)
R – is the resistance (see above)

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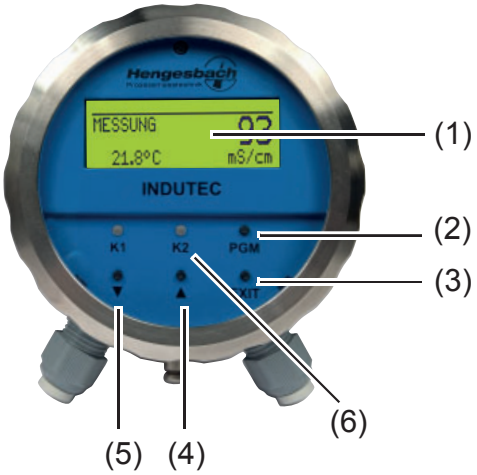
Inductive conductivity transmitter
- Type INDUTEC - Compact and separate version

Hengesbach Prozessmesstechnik

OPERATING ELEMENTS



(1) Graphic LC Display, backlit

(2) PGM key: Confirm entries, select menu

(3) EXIT key: Cancel entries without saving/ cancel calibration/one menu level back

(4) ▲ key: Increase numerical value/advance selection

(5) ▼ key: Decrease numerical value/advance selection

(6) LEDs „K1“/“K2“ indicate the status of the switching outputs.
In normal operation, the LED lights up when the corresponding switching output is active.
When the wiper function is activated, the LED only indicates the status.
LED “K1” flashes during calibration.
In the event of an error, LED “K1” and LED “K2” flash.

ORDER INFORMATION for the INDUTEC

Device type Version	
K	Compact
G	Separate version

Process connection	
C5	Clamp DN 50
M5	MK DN 50 DIN 11851 Tapered spigot with grooved union nut
M6	MK DN 65 DIN 11851 Tapered spigot with grooved union nut
V8	Varivent type N

Electrical connection	
M2	2x Round plug M12
K2	2x Cable gland for cable diameters 5-10mm

Length of connection cable (for separate version)
10m

INDUTEC_ [ ] _ [ ][ ] PE_ [10m]

ORDER EXAMPLE INDUTEC separate version with 10m cable length, process connection tapered spigot with grooved union nut according to DIN 11851 DN 50 with 2x cable gland: **INDUTEC_G_M5K2PE_10m**

ACCESSORIES / ASSEMBLY PARTS (please order separately)	**Item number**
Display interface	A-IDT_Display

Please observe the permissible nominal pressure of the selected process connection.
The stated specifications and certifications are only guaranteed if original Hengesbach parts are used.
The system operator is responsible for ensuring material compatibility with the process conditions and peripherals.
The devices are not suitable for use in potentially explosive atmospheres or safety-relevant system components (SIL).
Our devices are subject to continuous further development and are therefore subject to change.

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