JUMO CTI-750

Inductive Conductivity Transmitter
Type 202756

B 20.2756.0

Operating Instructions

JUMO

11.07/00452846

WARNING:

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

Please assist us to improve these operating instructions, where necessary.

Your comments will be appreciated.

Phone (06 61) 60 03-7 14
Fax (06 61) 60 03-6 05

All the nececssary 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 righs under the instrument warranty!

Please contact the nearest subsidiary or the head office in such a case.

In case of technical questions
Service hotline:
Phone: (06 61) 60 03-3 00 oder (06 61) 60 03-6 53
Fax: (06 61) 60 03-88 13 00 oder (06 61) 60 03-88 16 53
e-mail: Service@jumo.net

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:

Q Switch off the supply voltage.

Q 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 / ....

Contents

Contents

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.

2 General

2.1 Preface

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

Please assist us to improve these operating instructions, where necessary.

Your comments will be appreciated.

Phone +49 661 6003-0
Fax +49 661 6003-607
e-mail mail@jumo.net

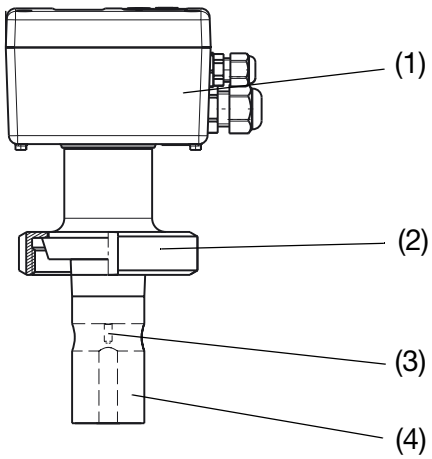
All necessary settings are described in this manual. However, if any difficulties should still arise during start-up, please do not carry out any unauthorized manipulations. You could endanger your rights under the instrument warranty!

Please contact the nearest subsidiary or the head office in such a case.

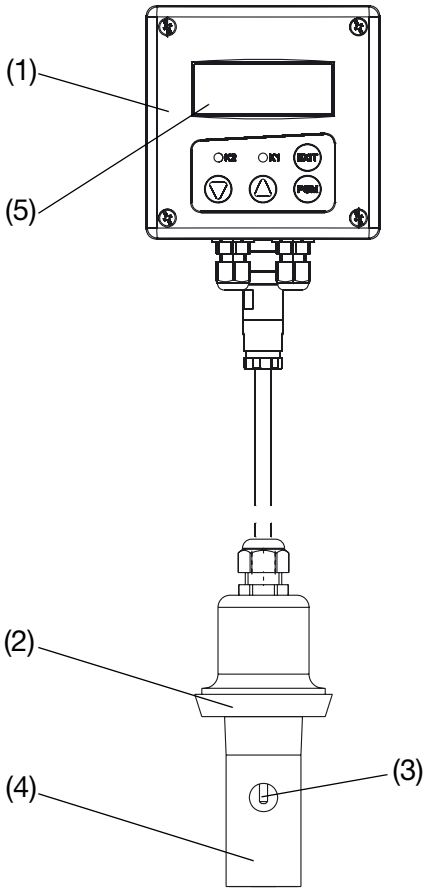
2.2 Design of the JUMO CTI-750

Examples

Version:
Transmitter
combined with
conductivity sensor,
Type 202756/xx...



Version:
Transmitter with
separate sensor,
Type 202756/xx...



(1) Transmitter

(2) Process connection

(3) Temperature probe

(4) Inductive conductivity sensor

(5) With or without graphics LC display

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 instrument 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 instrument 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 instrument configuration data for plant documentation can be saved and printed out. To prevent any tampering, the instrument can also be supplied without keypad or display. In this case, the setup program is needed for programming.

The JUMO CTI-750 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)

3.2 Function

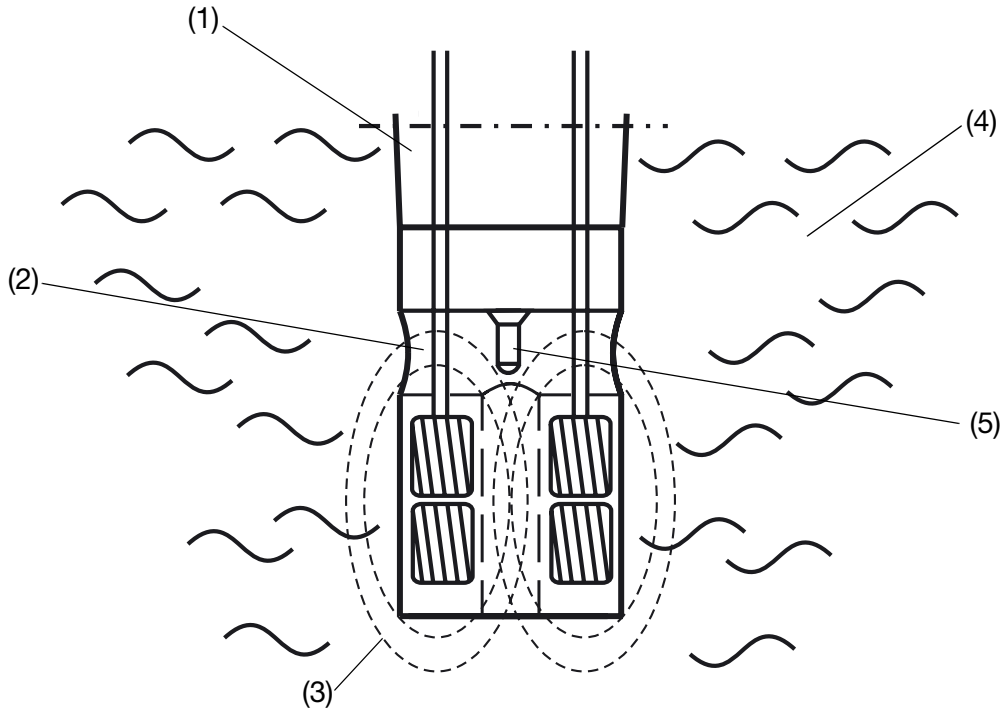
of the transmitter

The JUMO CTI-750 transmitter 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

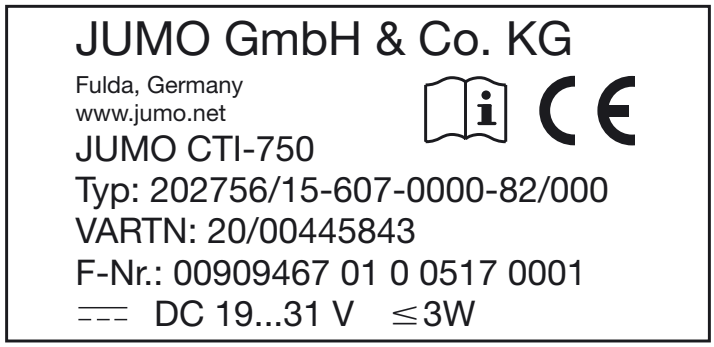
The conductivity is measured using an inductive probe. A sinusoidal a.c. voltage feeds the transmitting coil. Depending on the conductivity of the liquid to be measured, a current is induced in the receiver coil. This current is proportional to the conductivity of the medium. The cell constant of the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



(1) Plastic body
(2) T-shaped flow channel
(3) Liquid loop
(4) Sample medium
(5) Pt100 temperature sensor

4.1 Nameplate

on the transmitter



on the connecting cable (only with separate sensor)

For devices with a separate sensor (type code extensions (2) /60 or /65), 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!

The date of manufacture is coded in the “F-Nr.” (serial number):

0517 means manufactured in year 2005 / calendar week 17

4.2 Type designation

4.3 JUMO CTI-750 as “Head-mounted transmitter”

				(1)	**Basic type**
			202756		JUMO CTI-750 Inductive transmitter/switching device for conductivity/concentration and temperature
				(2)	**Basic type extensions**
			10		head-mounted transmitter im in plastic housing, without display/keypad [1]
			15		head-mounted transmitter im in plastic housing, with display/keypad
			16		head-mounted transmitter in stainless steel housing, with display/keypad
				(3)	**Process connection**
o	o	o	107		stud thread G1 1/4A
o	o	o	108		stud thread G1 1/2A
o	o	o	110		stud thread G 2A
o	o	o	606		screwed pipe connection DN40, DIN 11 851 (MK DN40, milk cone)
o	o	o	607		screwed pipe connection DN50, DIN 11 851 (MK DN50, milk cone)
o	o	o	608		screwed pipe connection DN65, DIN 11 851 (MK DN65, milk cone)
o	o	o	609		screwed pipe connection DN80, DIN 11 851 (MK DN80, milk cone)
o	o	o	617		clamp 2 1/2" [2]
o	o	o	686		VARIVENT® DN40/50 [3]
o	o	o	690		SMS 2"
				(4)	**Immersion length**
o	o	o	000		see “Dimensions / Process connections (head-mounted transmitter)”
				(5)	**Electrical connection**
o	o	o	82		cable glands
o	o	o	83		M12 plug/socket connectors (instead of cable glands) [4]
o	o	o	84		two M16 cable glands and one blanking plug
				(6)	**Extra codes [5]**
x	x	x	000		no extra code
o	o	o	580		1 set M12 plug/socket connectors
o	o	o	767		cell material PEEK
o	o	o	768		cell material PVDF
o	o	o	844		supply voltage 24 V AC

x = standard
o = option

4 Instrument identification

	(1)	(2)	(3)	(4)	(5)	(6)	(6)
Order code	☐ /	☐ -	☐ -	☐ -	☐ /	☐ ,	...
Order example	202756 /	10 -	607 -	000 -	82 /	767 ,	

1 The PC setup program is required for programming the instrument, see accessories.

2 Assembly material (holding clamps) not part of supplied kit.

3 Only in conjunction with extra code 767 (measuring cell material PEEK).

4 If required, order extra code 580.

5 List extra codes in sequence, separated by commas.

4.4 JUMO CTI-750 as “Transmitter with separate sensor”

						(1)	**Basic type**
					202756		JUMO CTI-750 Inductive transmitter/switching device for conductivity/concentration and temperature
						(2)	**Basic type extensions**
					20		transmitter in plastic housing, without display/keypad (without sensor) [1]
					25		transmitter in plastic housing, with display/keypad (without sensor) [2]
					26		transmitter in stainless steel housing, with display/keypad (without sensor) [2]
					60		transmitter in plastic housing, without display/keypad including sensor (cable length: 10 m) [1]
					65		transmitter in plastic housing, with display/keypad including sensor (cable length: 10 m)
					66		transmitter in stainless steel housing, with display/keypad including sensor (cable length: 10 m)
					80		replacement sensor with 10 meter cable, for transmitter in plastic housing, without transmitter [2, 3]
					85		replacement sensor with 10 meter cable, for transmitter in stainless steel housing, without transmitter [2, 3]
						(3)	**Process connection**
x	x				000		not available
		o	o	o	107		stud thread G1 1/4A
		o	o	o	108		stud thread G1 1/2A
		o	o	o	110		stud thread G2A
		o	o	o	606		DN40 screwed pipe fitting, DIN 11 851 (MK DN40, milk cone)
		o	o	o	607		DN50 screwed pipe fitting, DIN 11 851 (MK DN50, milk cone)
		o	o	o	608		DN65 screwed pipe fitting, DIN 11 851 (MK DN65, milk cone)
		o	o	o	609		DN80 screwed pipe fitting, DIN 11 851 (MK DN80, milk cone)
		o	o	o	617		clamp 2 1/2" [3]
		o	o	o	686		VARIVENT® DN40/50 [4]
		o	o	o	690		SMS 2"
						(4)	**Immersion length (**see “Dimensions separate sensor”) [5]
x	x				0000		not present
o	o				0500		500 mm
o	o				1000		1000 mm
o	o				1500		1500 mm
o	o				2000		2000 mm
o	o				xxxx		special length (in grid of 250 mm; e.g. 0250; 0750; 1250; 1750)
						(5)	**Electrical connection**
				x	21		fixed cable with M12 socket connector on separate sensor
o	o	o	o		82		cable glands on the operating unit
o	o	o	o		83		M12 plug/socket connectors on operating unit [3]
o	o	o	o		84		Two screwed cable glands M16 and one dummy plug

Continued, see next page

4 Instrument identification

						(6)	**Extra codes** [7]
x	x	x	x	x	000		no extra code
o	o	o	o		580		1 set M12 plug/socket connectors
o	o	x	x	x	767		cell material PEEK
		o	o	o	768		cell material PVDF
o	o	o	o		844		supply voltage 24 V AC

x = standard
o = option

	(1)		**(2)**		**(3)**		**(4)**		**(5)**		**(6)**		**(6)**
Order code		/		-		-		-		/		,	...
Order example	202756	/	65	-	607	-	0000	-	82	/	767		

[1] The PC setup program is required for programming the instrument, see accessories.
[2] An equalization set is indispensable for start-up. If not available, please order (see accessories).
[3] Fixing items (union/ring nuts, mounting brackets, holding clamps) are not included in delivery.
If required, please include in order, see accessories.
[4] Only in conjunction with extra code 767 (measuring cell material PEEK).
[5] Only in conjunction with extra code 768 (measuring cell material PVDF).
[6] If required, order M12 connector/ sockets, extra code 580.
[7] List extra codes in sequence, separated by commas.

5.1 General

Installation site

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!

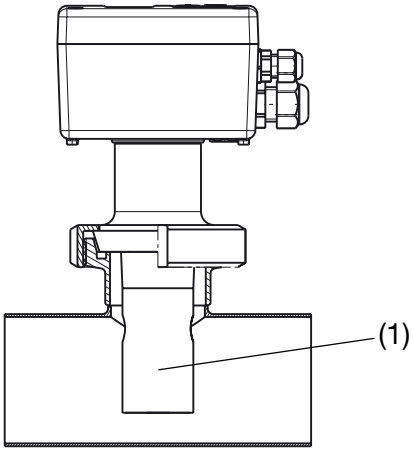
Take care that there is adequate flow through and around the sensor (1)!

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.

Operating position

The JUMO CTI-750 can be mounted in any position.

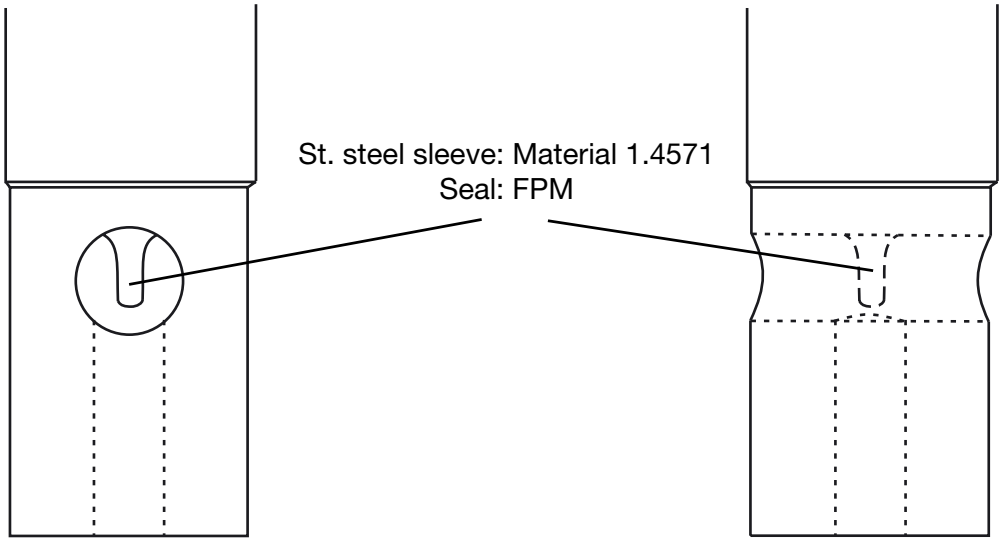


Screwing in and unscrewing the detached sensor

The cable must not be twisted!

Avoid putting tension on the cable. In particular, avoid tugging it.

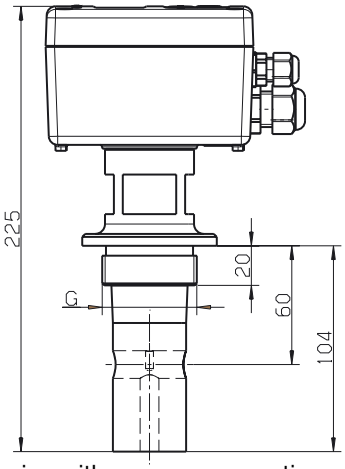
Sensor details



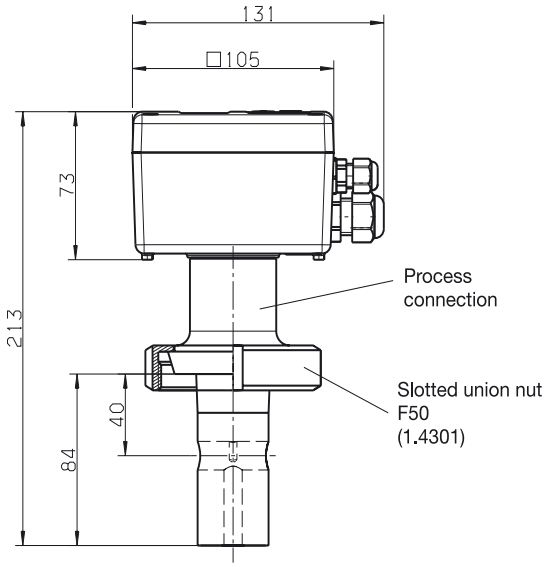
5 Mounting

5.2 Dimensions / Process connections for head transmitter

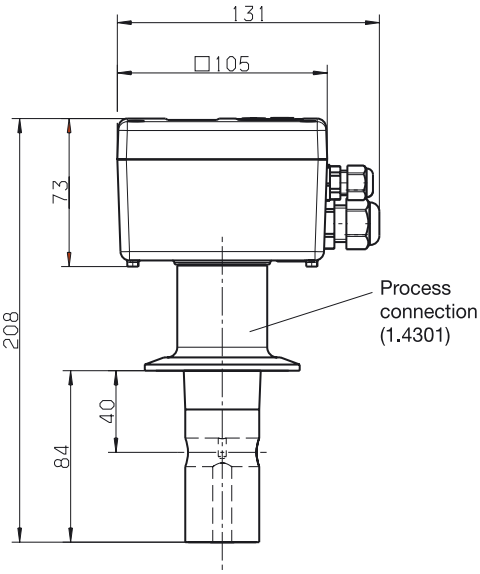
Installation variations



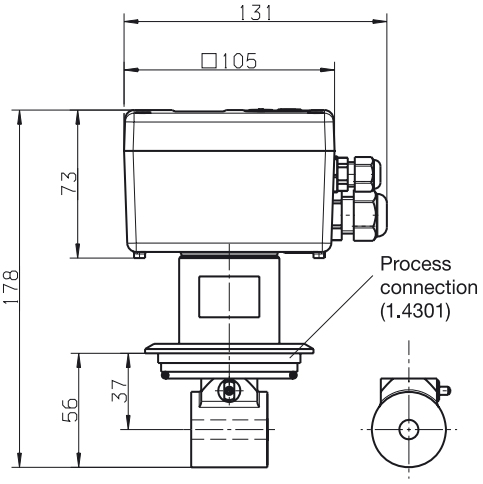
Version with process connection
107 = stud thread G1 1/4A
108 = stud thread G1 1/2A
110 = stud thread G2A



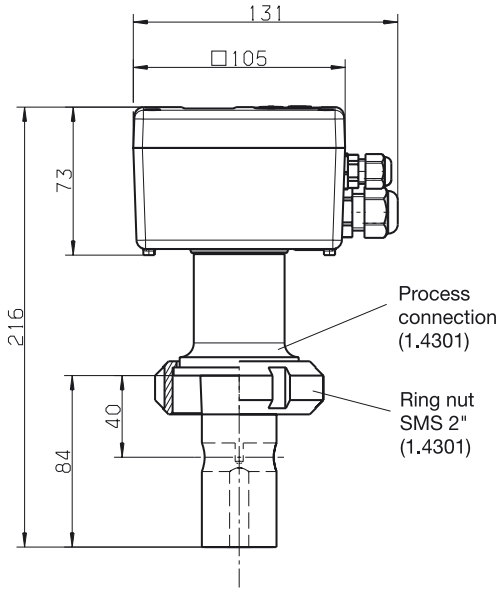
Version with
process connection -607
MK DN50



Version with
process connection -617
clamp $2^1/_2$"
(retaining clip not
included in delivery)



Version with
process connection® -686
VARIVENT® DN50
(retaining clip not
included in delivery)

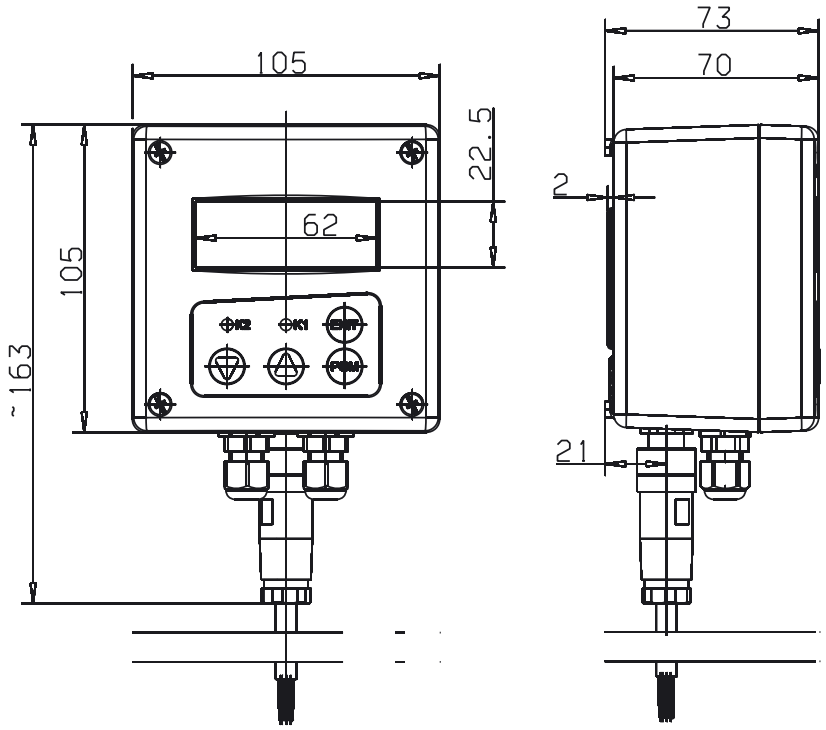


Version with
process connection -690
SMS 2"

5 Mounting

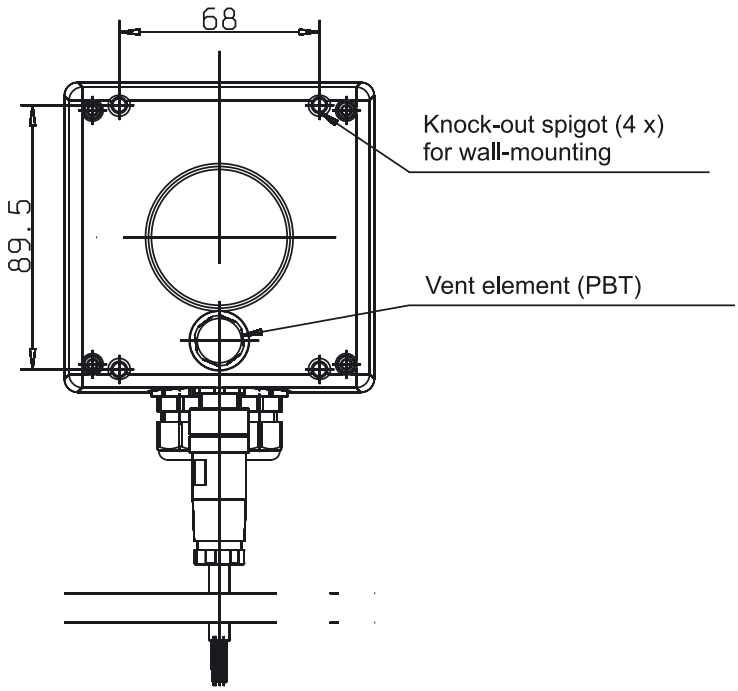
5.3 JUMO CTI-750 with separate sensor (split version)

Transmitter head

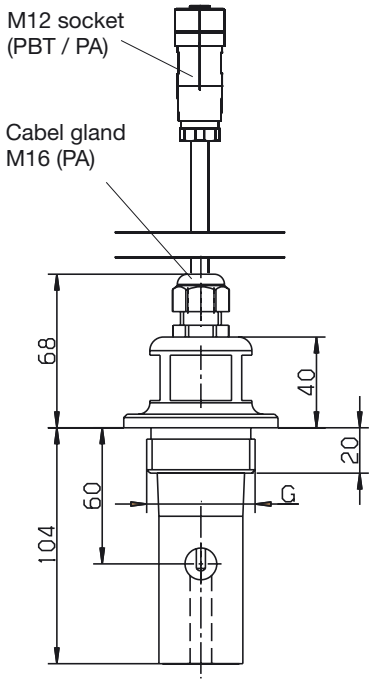


CTI-750 Housing
(Transmitter)

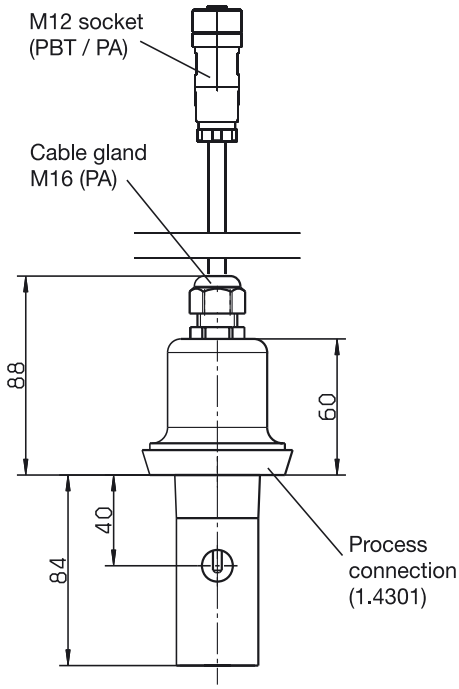
Drilling jig for wall-mounting



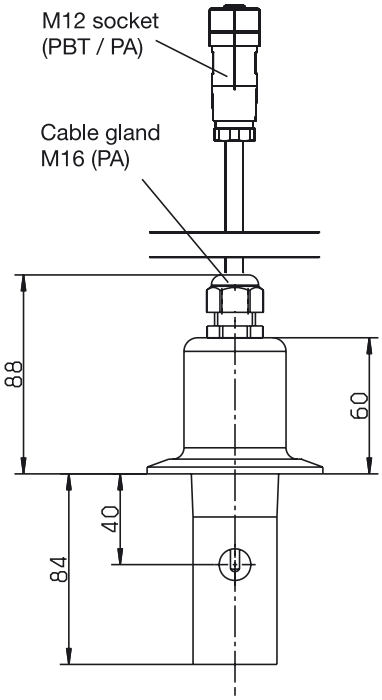
Sensor component



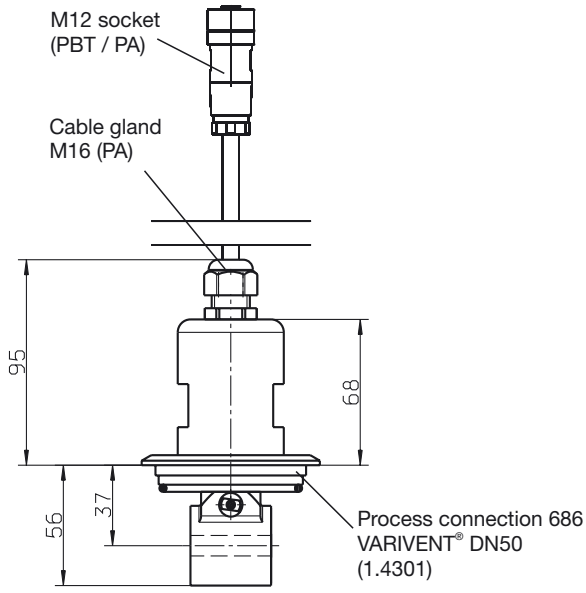
Version with process connection
107 = stud thread G1 1/4A
108 = stud thread G1 1/2A
110 = stud thread G2A



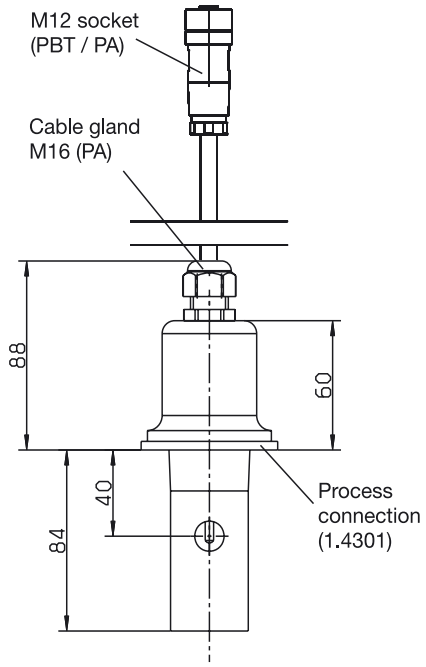
Split version with
process connection -607
MK DN50
(union nut not
included in delivery)



Split version with
process connection -617
clamp $2^1/_2$"
(retaining clip not
included in delivery)

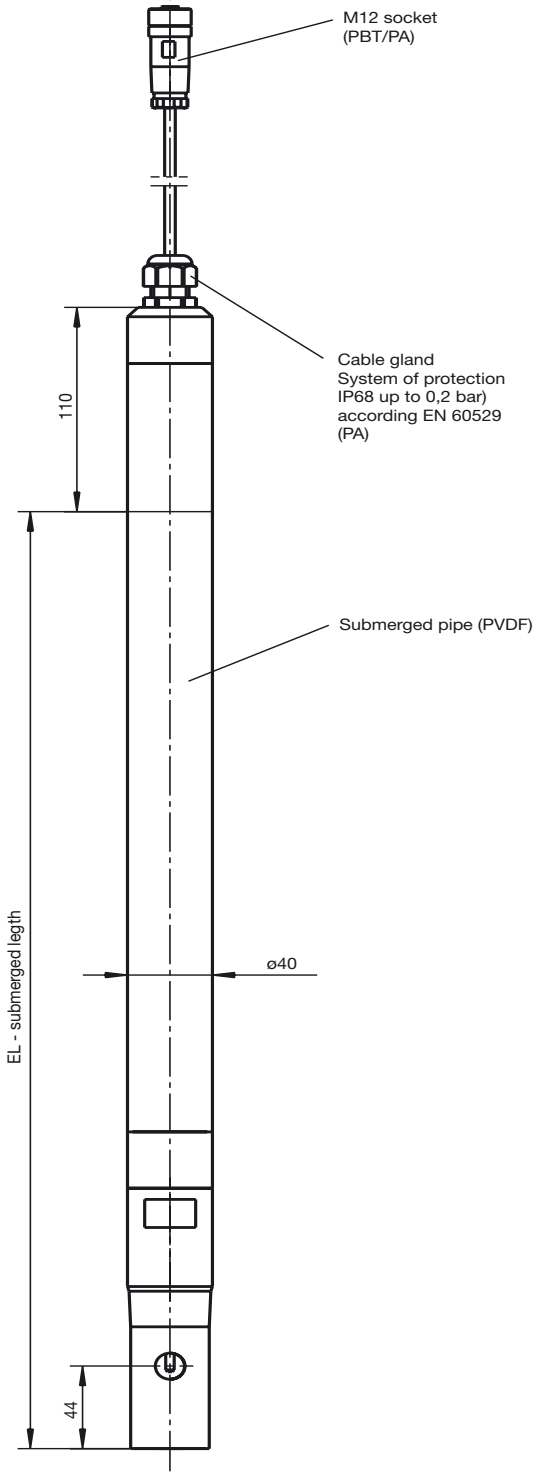


Split version with
process connection -686
VARIVENT® DN50
(retaining clip not
included in delivery)

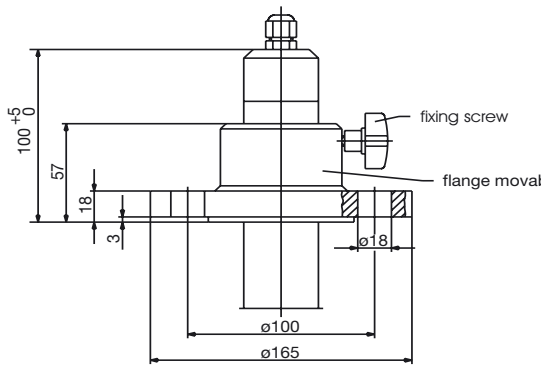


Split version with
process connection -690
SMS 2"
(union nut not
included in delivery)

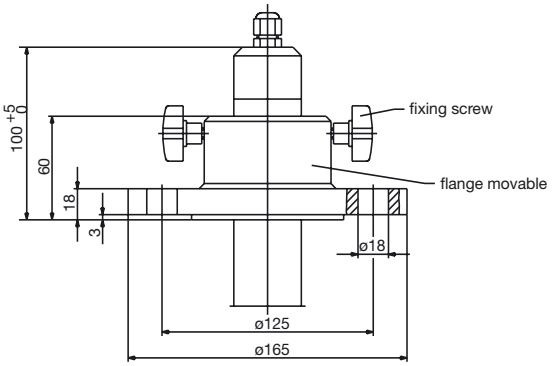
5.3.1 Separate sensor as submersible version



Shouldered version with process connection 706
Submersible version
(pipe clamps not part of delivery)



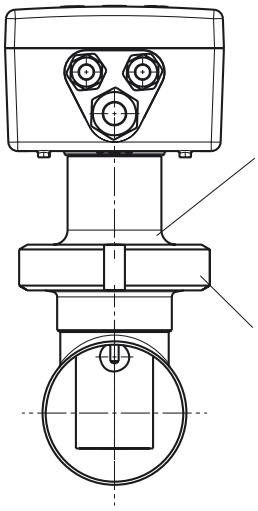
Optional accessories:
Flange DN 32, sales no. 20/00083375



Optional accessories:
Flange DN 50, sales no. 20/00083376

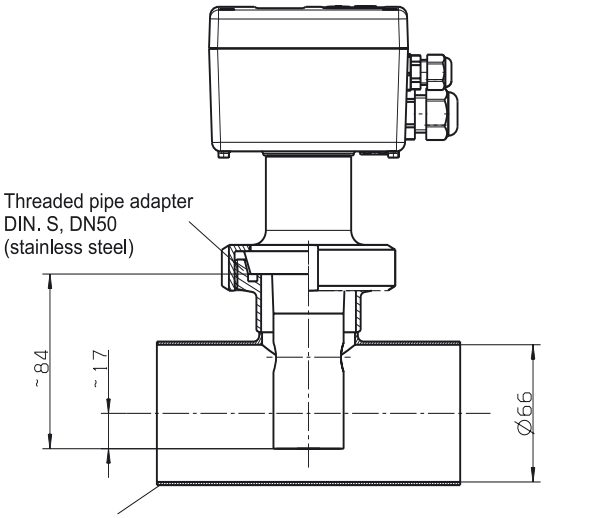
5 Mounting

5.4 Mounting examples



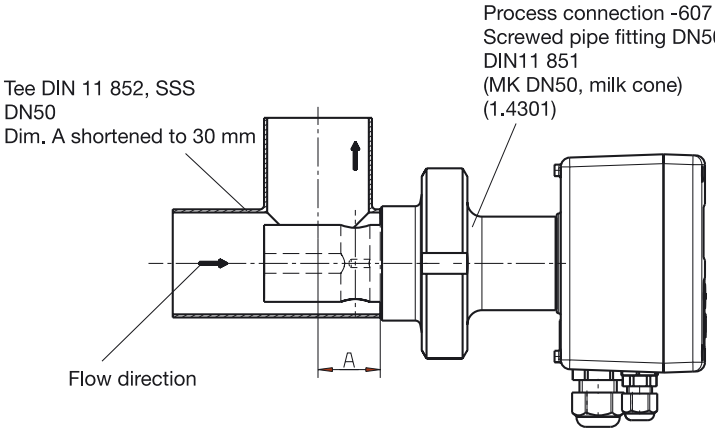
Process connection -607
Screwed pipe fitting DN50,
DIN 11 851
(MK DN50, milk cone)
(1.4301)

Ring nut DN50
(1.4301)



Threaded pipe adapter
DIN. S, DN50
(stainless steel)

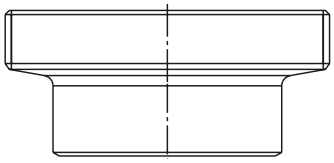
Reducing tee DIN, short, SSS DN65/50
(e.g. 1.4301)
(to be provided by the plant operator; not supplied by JUMO)



Tee DIN 11 852, SSS
DN50
Dim. A shortened to 30 mm

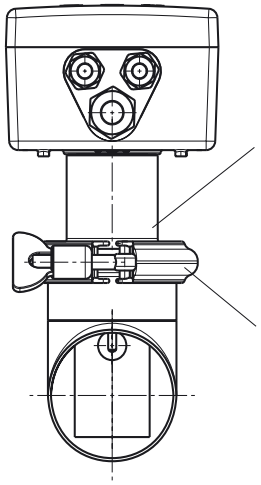
Process connection -607
Screwed pipe fitting DN50
DIN11 851
(MK DN50, milk cone)
(1.4301)

Flow direction



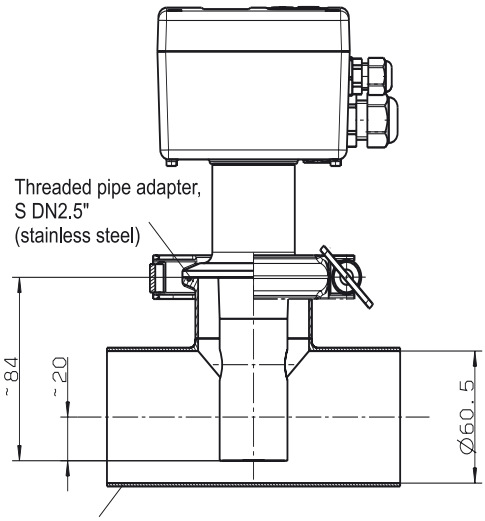
Weld-on threaded pipe adaptor
DN50, DIN 11 851
(matching part for process connection -607)

Sales No. 20/00085020



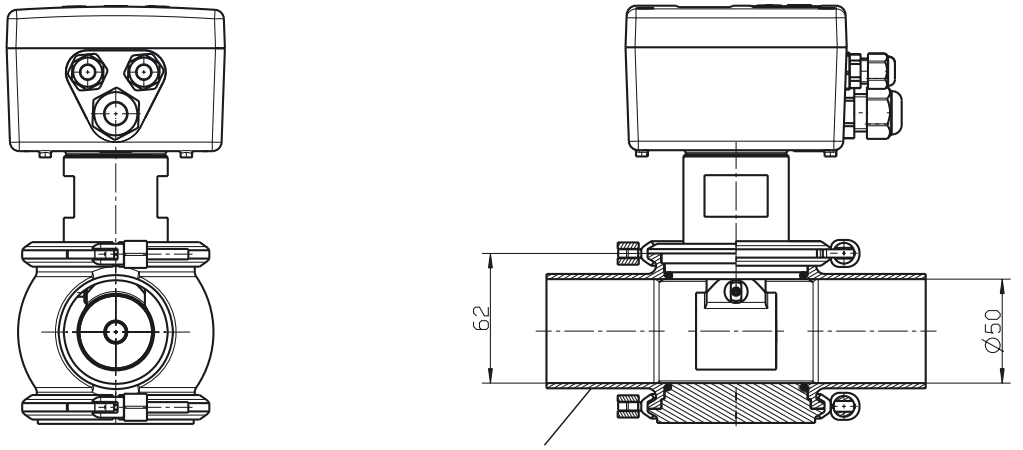
Process connection -617
Clamp 21/2"
(1.4301)

Clamping ring
(e.g. 1.4301)



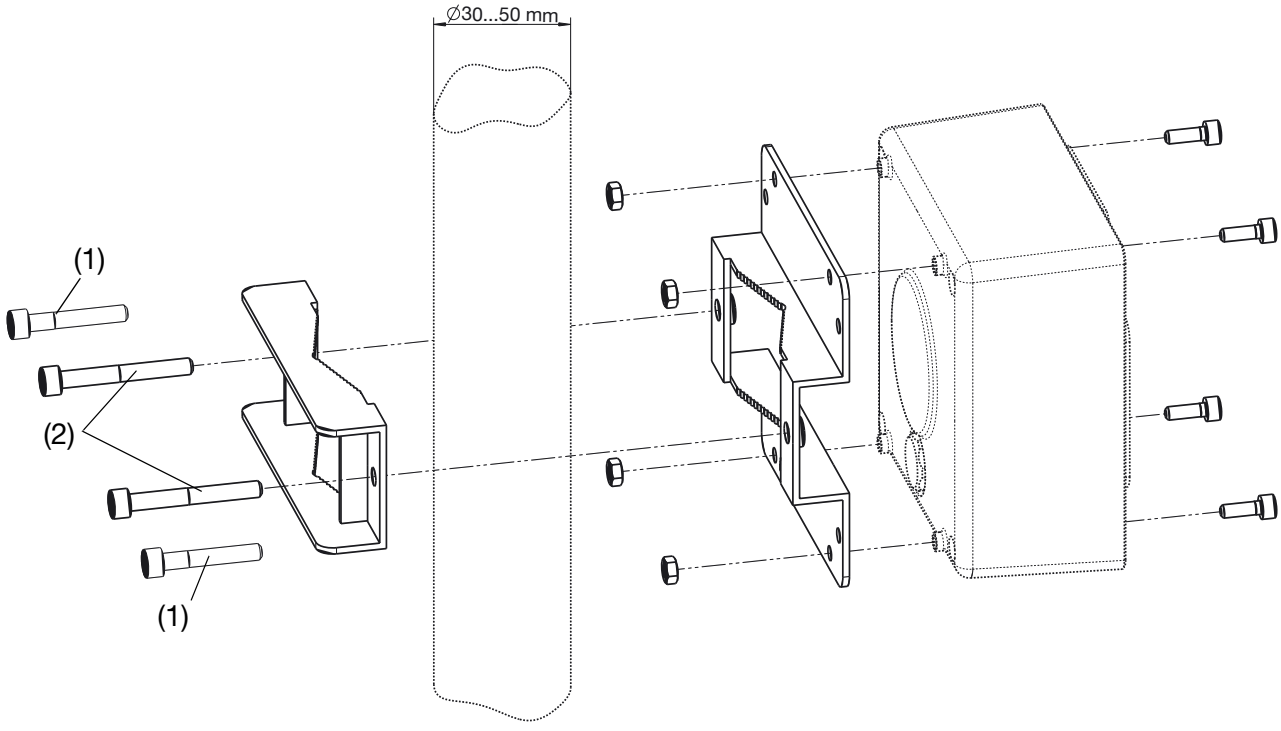
Threaded pipe adapter,
S DN2.5"
(stainless steel)

Tee, short, SSS DN2.5"
(e.g. 1.4301)
(to be provided by the plant operator; not supplied by JUMO)



Tee, VARIVENT, DN50
(e.g. 1.4301)
(to be provided by the plant operator; not supplied by JUMO)

5.4.1 Pipe-mounting kit



The screws (1) M5 x 30 are used with pipe diameters from 30 to 40 mm.
The screws (2) M5 x 40 are used with pipe diameters from 40 to 50 mm.
The pipe-mounting kit is also suitable for horizontal pipes.

6 Instrument description

6.1 Technical data for transmitter

6.1.1 General

A/D converter	resolution: 15-bit sampling time: 500 msec = 2 measurements/sec
Supply	for operation on SELV or PELV circuits standard: 19 — 31 V DC (24 V DC nominal), with reverse-polarity protection ripple: < 5% power consumption with display: ≤ 3 W power consumption without display: ≤ 2.6 W with extra code 844: 24 V AC ±10%
Rating of the solid-state relays	U < 50 V AC/DC I ≤ 200 mA
Electrical connection	plug-in screw terminals 2.5 mm^2 or M12 plug/socket connectors
Display (option)	graphics LCD with background lighting; adjustable contrast dimensions: 62 x 23 mm
Permissible ambient temperature (transmitter)	-5 to +50°C max. 93% relative humidity, no condensation
Permissible storage temperature (transmitter)	-10 to +65°C max. 93% relative humidity, no condensation
Enclosure protection (transmitter)	IP67
Housing	polycarbonate
Weight	depending on version and process connection approx. 0.3 — 2 kg

6.1.2 Conductivity/concentration transmitter

Concentration measurement (implemented in the device software)

- NaOH (caustic soda)
  0 — 15 % by weight or 25 — 50 % by weight
- HNO_3 (nitric acid); check chemical resistance of the sensor !
  0 — 25 % by weight or 36 — 82 % by weight
- customer-specific concentration curve
  freely programmable through the setup program (see “special functions”)

Calibration timer

adjustable: 0 — 999 days (0 = off)

Output signal Conductivity/ concentration

0 — 10 V / 10 — 0 V
2 — 10 V / 10 — 2 V
0 — 20 mA / 20 — 0 mA
4 — 20 mA / 20 — 4 mA

The output signal is freely scalable.

Burden

≤ 500Ω for current output
≥ 2kΩ for voltage output

Ambient temperature error

≤ 0.1%/°C

Analog output for “Alarm”

Low (0 mA / 0 V / 3.4 mA / 1.4 V) or
High (22.0 mA / 10.7 V) or
a value with a fixed setting (safe value)

Measuring ranges

Four ranges can be selected.
One of these ranges can be activated via an external switch or a PLC.

Measurement ranges Transmitter	**Tolerance** (in % of 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]	

[1] not compensated for temperature

Note:
The overall tolerance is made up of the tolerance of the transmitter + the tolerance of the sensor.

6.1.3 Temperature transmitter

Temperature acquisition	manually -20.0 to 25.0 to 150°C/°F or automatically
Temperature measurement range	-20 to 150°C/°F
Characteristic	linear
Accuracy	≤ 0.5% of range
Ambient temperature error	≤ 0.1%/°C
Output signal for temperature	0 — 10 V / 10 — 0 V 2 — 10 V / 10 — 2 V 0 — 20 mA / 20 — 0 mA 4 — 20 mA / 20 — 4 mA The output signal is freely scalable.
Burden	≤ 500Ω for current output ≥ 2 kΩ for voltage output
Analog output for "Alarm"	Low (0 mA / 0 V / 3.4 mA / 1.4 V) or High (22.0 mA / 10.7 V) or a value with a fixed setting (safe value)

6.1.4 Temperature compensation

Reference temperature	15 to 30°C, adjustable
Temperature coefficient	0.0 to 5.5 %/°C, adjustable
Compensation range	-20 to 150°C
Function	- Linear compensation (constant temperature coefficient). This type of compensation can be used with normal water with an acceptable level of accuracy. The temperature coefficient used is then about 2,2 %/K. - Natural water (DIN EN27888 or ISO 7888 as the case may be). In this case, a so-called non-linear temperature compensation is used.

According to the above standard, the corresponding type of compensation can be applied in the case of natural ground water, mountain spring water and surface warter.
The conductivity of the water is compensated in the range from 0°C to 36°C.

- non-linear (learning function, see special functions)
  Here, the actual graph of the temperature coefficient during a heating-up or cooling-down process is determined by the transmitter.

6.1.5 Sensor

Material

PEEK (polyether ether ketone) or
PVDF (polyvinylidene fluoride)
Note:
Temperature, pressure and sample medium affect the operating life of the cell

Temperature of the sample medium

-10 to +120°C
briefly 140°C (sterilization)

Pressure

10 bar max.

Measurement range Sensor	**Tolerance** (in % of range span)
0 — 500 µS/cm	≤ 1%
0 — 1000 µS/cm	
0 — 2000 µS/cm	≤ 0.5%
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	≤ 1%
0 — 2000 mS/cm [1]	

[1] not compensated for temperature

7 Installation

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

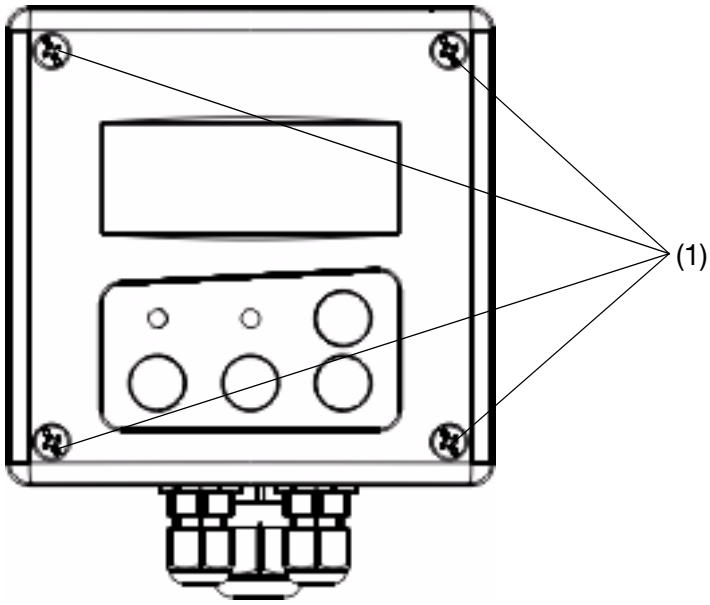
- ❏ The choice of cable, the installation and the electrical connection must conform to the requirements of VDE 0100 “Regulations on the Installation of Power Circuits with Nominal Voltages below 1000 V” or the appropriate local regulations.
- ❏ The electrical connection must only be carried out by qualified 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 instrument may also affect the proper functioning of the subsequent process or lead to damage.

7.1 General

Opening the operating unit

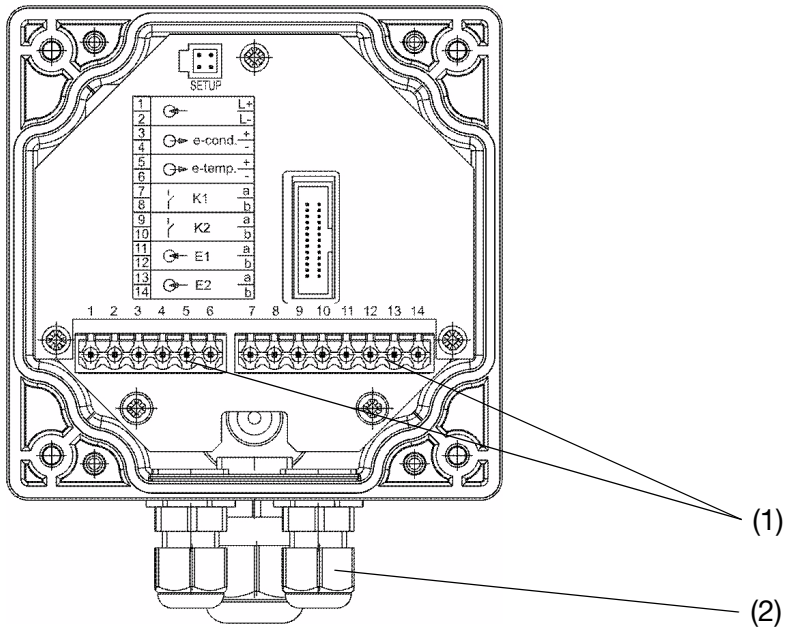
It is only necessary to open the housing for devices with cable glands.

Devices with M12 plug/socket connectors should not be opened!



✱ Remove four screws (1) and take off the cover

Connecting up the cables



To connect the single conductors, pull off the pluggable screw terminals (1) in the operating unit.

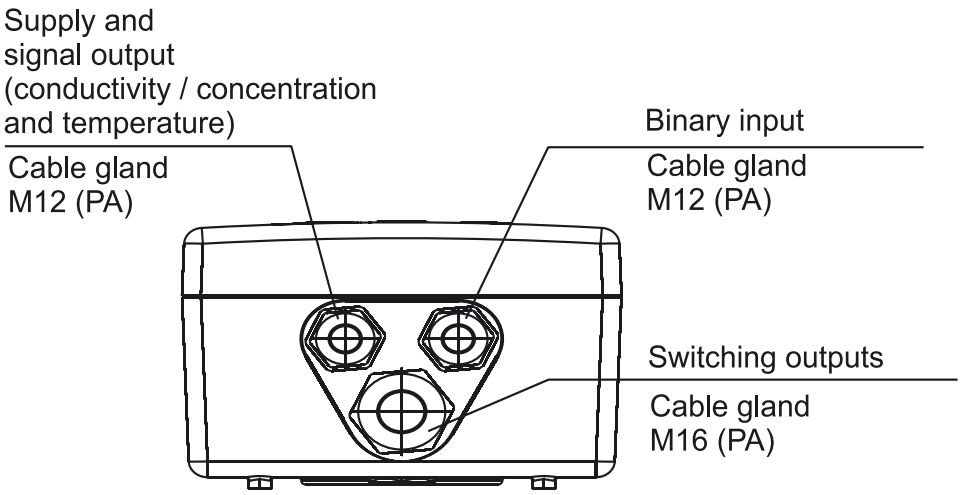
Pass the connecting cables through the cable glands (2).

7 Installation

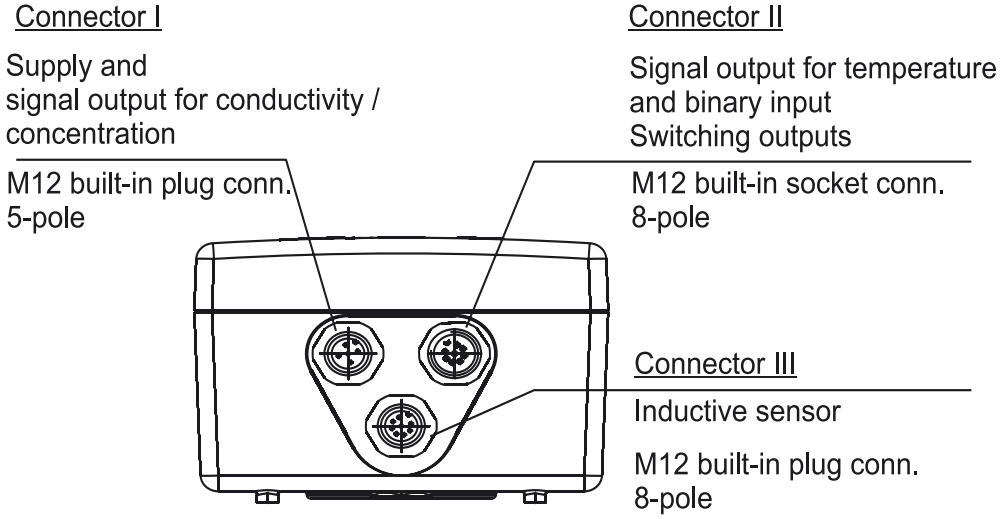
Wiring

For devices with a separate sensor (type code extensions (2) /60 or /65), 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!

Wiring recommendation - head transmitter

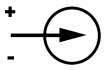
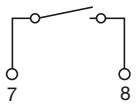
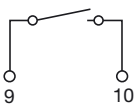
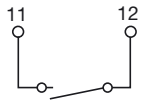
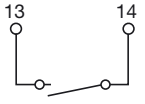


Transmitter with separate sensor



Caution:
On devices with a separate sensor and M12 plug/socket connectors, the screw terminals are sealed inside the device.
Removal of this sealing will invalidate the warranty!

Connections for the transmitter

Connection		Screw terminals	Conn./pin
Supply			
standard: supply voltage 19 — 31 V DC (with reverse-polarity protection) with extra code 844: 24 V AC		1 L+ 2 L-	I / 1 I / 2
Outputs			
Analog signal output: Conductivity/concentration 0 — 20 mA resp. 20 — 0 mA or 4 — 20 mA resp. 20 — 4 mA or 0 — 10 V resp. 10 — 0 V or 2 — 10 V resp. 10 — 2 V (electrically isolated)		3 + 4 -	I / 3 I / 4
Analog signal output: Temperature 0 — 20 mA resp. 20 — 0 mA or 4 — 20 mA resp. 20 — 4 mA or 0 — 10 V resp. 10 — 0 V or 2 — 10 V resp. 10 — 2 V (electrically isolated)		5+ 6-	II / 1 II / 2
Switching output K1 (floating) Status indication LED K1		7 8	II / 3 II / 4
Switching output K2 Status indication LED K2		9 10	II / 5 II / 6
Binary inputs			
Binary input E1		11 12	II / 7 I / 5
Binary input E2		13 14	II / 8 I / 5

8 Setup program

8.1 Function

Configurable parameters

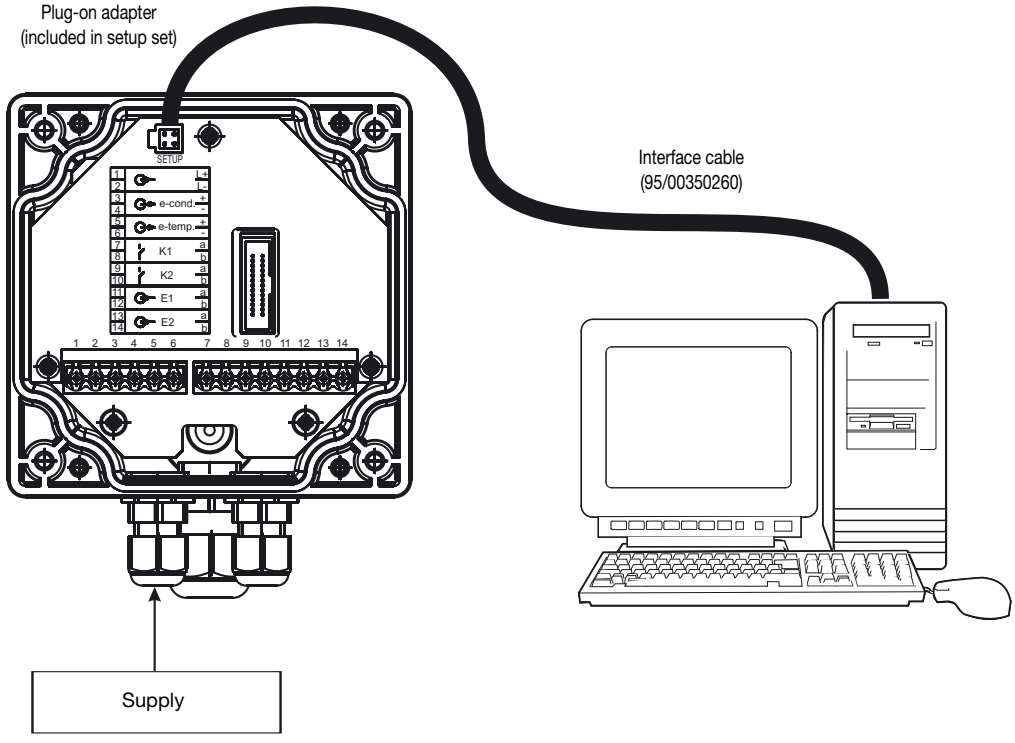
The setup program, which is available as an option, can be used for easy adaptation of the transmitter to specific requirements.

- 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.

Data transmission from or to the transmitter can only take place when it is connected to the electrical supply, see Chapter 7 “Installation”, page 28ff.

Connection

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).



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 instrument, see “Mounting”, page 15.
- Connecting the instrument, see “Installation”, page 28.

For devices with a separate sensor (type code extensions (2) /60 or /65), 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!

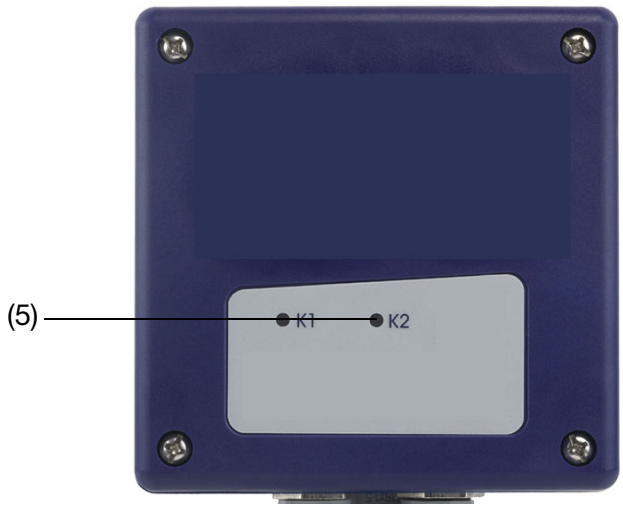
9.2 Replacement sensor

- 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.

10 Operation

10.1 Controls

JUMO CTI-750 without LC display



JUMO CTI-750 with LC display

(1) Graphics 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

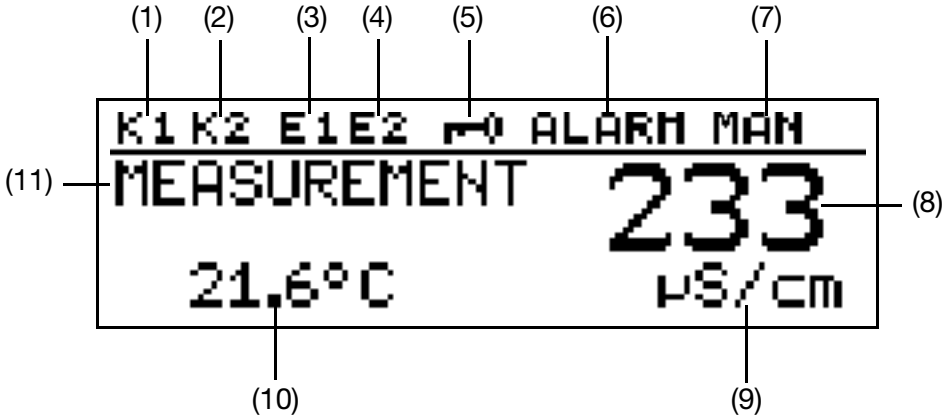
(4) ▲ key
increase value / step on in selection.
▼ key
reduce value / step on in selection.

(5) 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.

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 overrange)
- 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

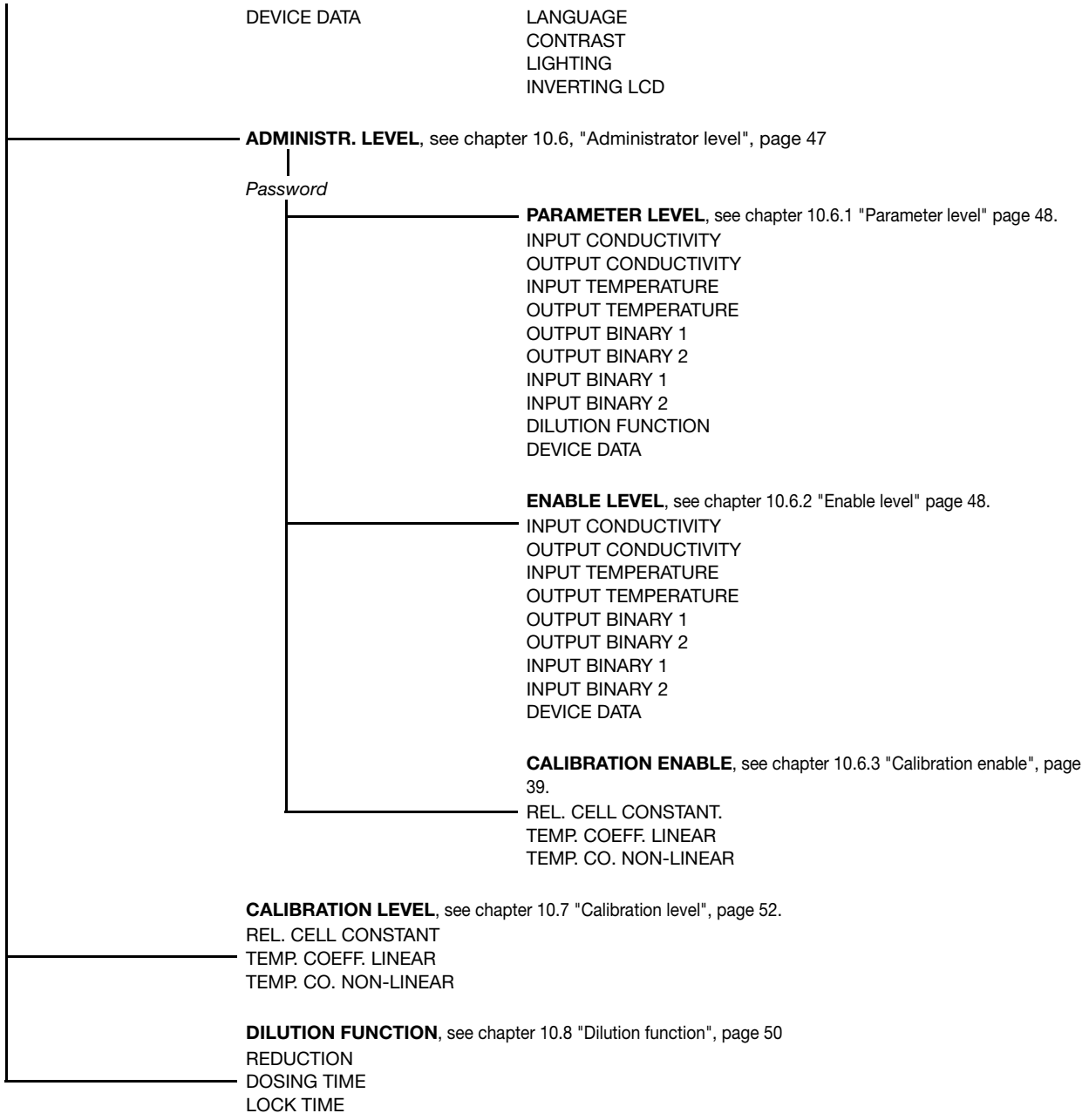
10 Operation

10.2 Principle of operation

10.2.1 Operation in levels

Measurement mode, see Chapter 10.4 "Principle of operation" page 39

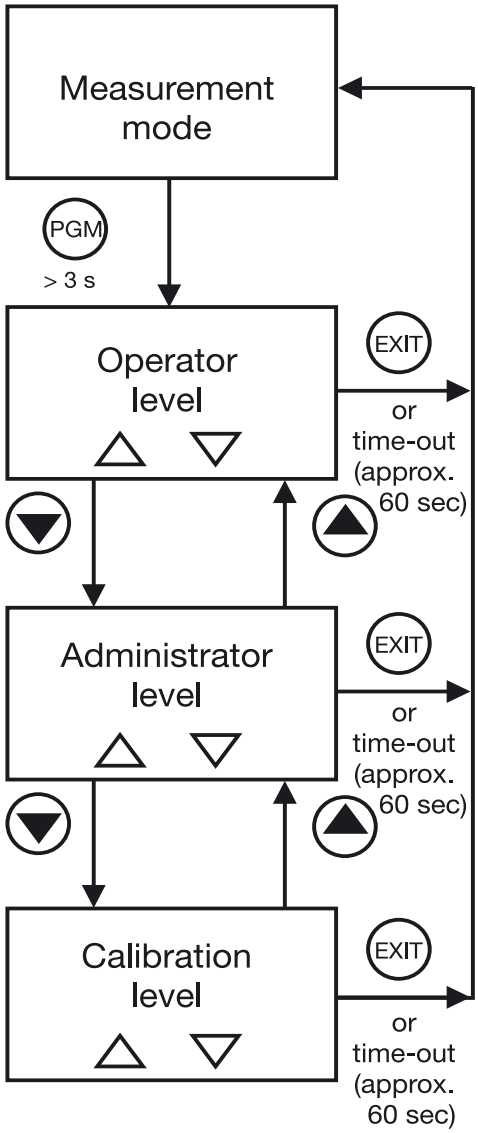
- **OPERATOR LEVEL**, see chapter 10.5 "Operator level", page 39.
  - INPUT CONDUCTIVITY
    - MEASUREMENT RANGE 1...4
    - TEMPERATURE COMPENSATION
    - TEMP. COEFFICIENT 1...4
    - REFERENCE TEMPERATURE
    - REL. CELL CONSTANT
    - MOUNTING FACTOR
    - CONCENTR. MEASUREMENT
    - CONCENTR. RANGE
    - 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


DEVICE DATA
LANGUAGE
CONTRAST
LIGHTING
INVERTING LCD
ADMINISTR. LEVEL, see chapter 10.6, "Administrator level", page 47
Password
PARAMETER LEVEL, see chapter 10.6.1 "Parameter level" page 48.
INPUT CONDUCTIVITY
OUTPUT CONDUCTIVITY
INPUT TEMPERATURE
OUTPUT TEMPERATURE
OUTPUT BINARY 1
OUTPUT BINARY 2
INPUT BINARY 1
INPUT BINARY 2
DILUTION FUNCTION
DEVICE DATA
ENABLE LEVEL, see chapter 10.6.2 "Enable level" page 48.
INPUT CONDUCTIVITY
OUTPUT CONDUCTIVITY
INPUT TEMPERATURE
OUTPUT TEMPERATURE
OUTPUT BINARY 1
OUTPUT BINARY 2
INPUT BINARY 1
INPUT BINARY 2
DEVICE DATA
CALIBRATION ENABLE, see chapter 10.6.3 "Calibration enable", page 39.
REL. CELL CONSTANT.
TEMP. COEFF. LINEAR
TEMP. CO. NON-LINEAR
CALIBRATION LEVEL, see chapter 10.7 "Calibration level", page 52.
REL. CELL CONSTANT
TEMP. COEFF. LINEAR
TEMP. CO. NON-LINEAR
DILUTION FUNCTION, see chapter 10.8 "Dilution function", page 50
REDUCTION
DOSING TIME
LOCK TIME

10 Operation

10.3 Principle of operation

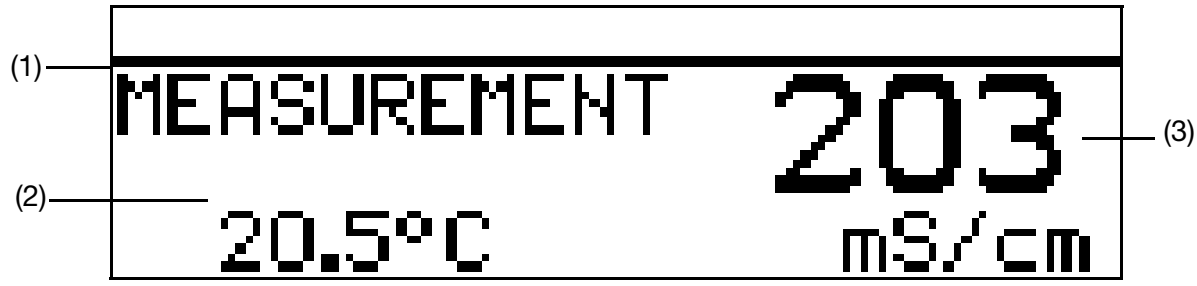
Operation in levels



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

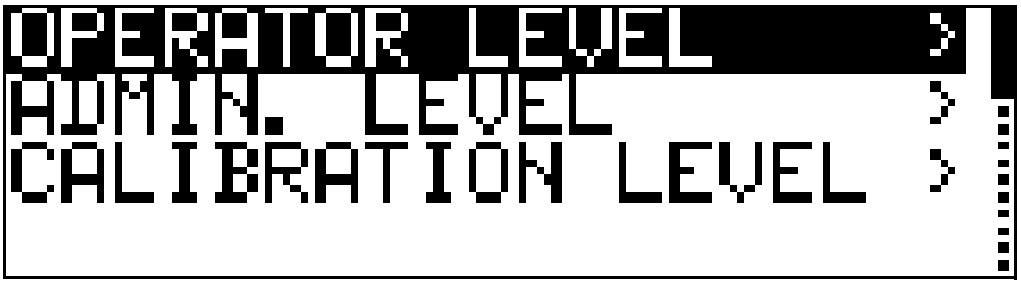
(2) 20.5°C -> Temperature of the sample medium

(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.



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 58)
NATURAL WATER (permissible temperature range 0 to 36°C as per EN 27 888)

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 (basic type extension 80) 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.

CONC. MEAS. TYPE

NO FUNCTION

NaOH

HNO3

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)

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

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

MANUAL MODE

OFF
ON

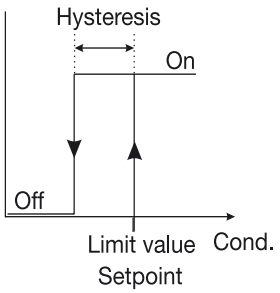
MAN. VALUE

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

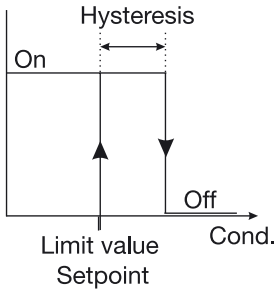
10.5.5 BINARY OUTPUT 1 and BINARY OUTPUT 2

FUNCTION

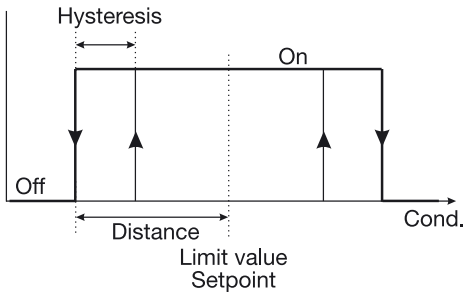
NO FUNCTION
MIN. CONDUCT.
MAX. CONDUCT.
LK1 CONDUCT.
LK2 CONDUCT.
MIN. TEMP.
MAX. TEMP.
LK1 TEMP.
LK2 TEMP.
CALIB. TIMER
ALARM



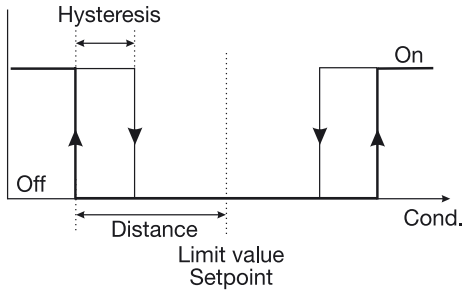
MAX limit comparator



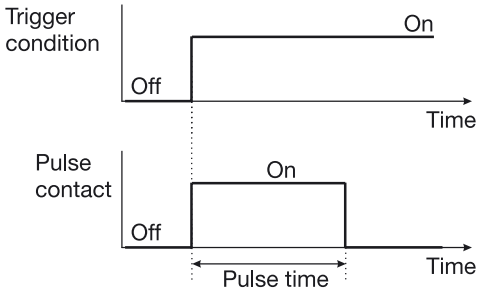
MIN limit comparator



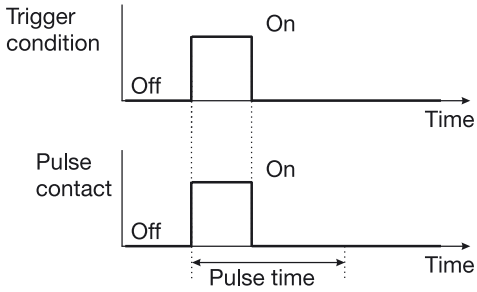
LK1 alarm window



LK2 alarm window



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”)

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 50)

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

10.5.8 INSTRUMENT DATA

LANGUAGE

GERMAN
ENGLISH
FRENCH
SPANISH
POLISH
SWEDISH
ITALIAN
PORTUGUESE
DUTCH
RUSSIAN

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 sec after the last key operation: the lighting will be switched off)

LCD INVERSE

OFF
ON

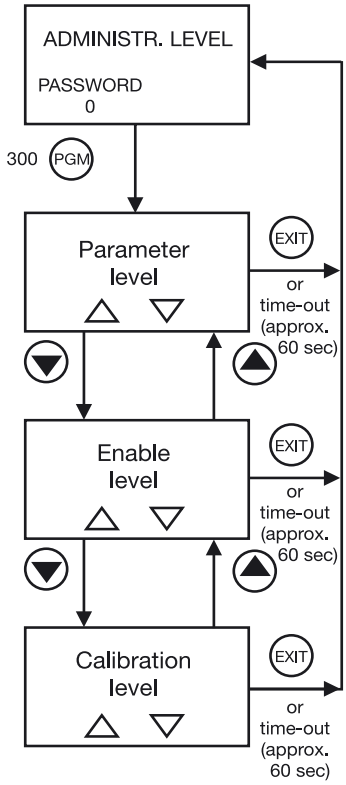
10.6 Administrator level

- 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 the password 300.
* Press the PGM key.

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 39 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 39 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 non-linear temperature coefficient.

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 JUMO CTI-750 here;
see “Calibrating the relative cell constant”, page 54.

10.7.2 **TEMPCO LINEAR** (linear temperature coefficient)

If this function has been enabled by the administrator, then the operator can calibrate the JUMO CTI-750 for liquids with a linear temperature coefficient;
see “Linear temperature coefficient (ALPHA)”, page 55.

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 JUMO CTI-750 for liquids with a non-linear temperature coefficient;
see “Non-linear temperature coefficient (ALPHA)”, page 58.

10 Operation

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.

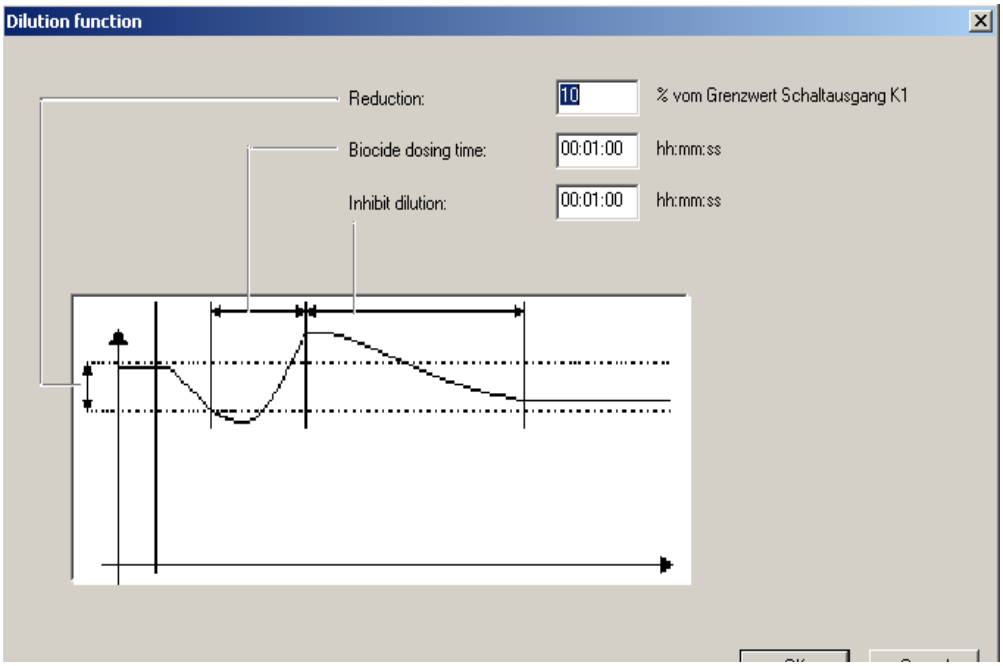
Dilution inhibit

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 JUMO CTI-750

- 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 46.
  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.



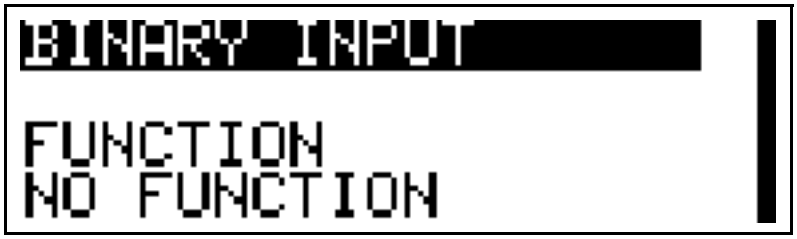
10.8.1 Stop dilution

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.

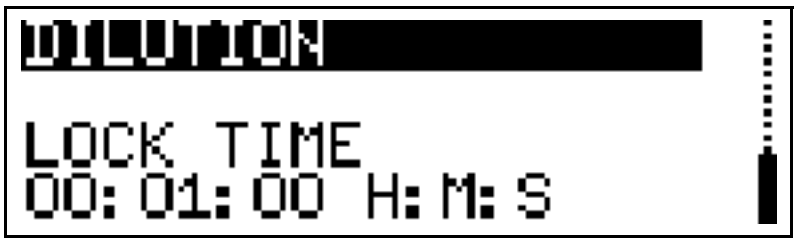
* Change to the operator level, using the (EXIT) key.
* Use the (▼) key to select DILUTION.

* 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.



* 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.

☞ If there is an interruption in the supply voltage during dilution, the function will be canceled.

The dilution function will have to be restarted if it is to be continued.

11 Calibration

11.1 General

The device offers various calibration options to increase the precision.

The conductivity sensor should be cleaned and calibrated at regular intervals, depending on the medium being measured.

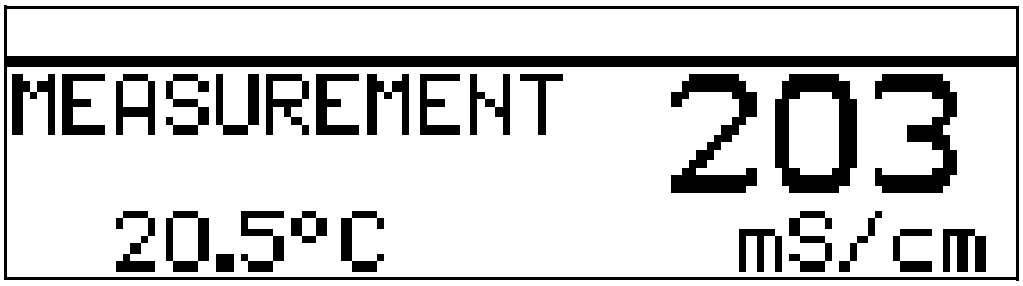
The K1 LED blinks during calibration.

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 JUMO CTI-750 must be present.
  see Chapter 7 “Installation”, page 28ff.
- The sensor must be connected to the transmitter (applies to the split version).
- The transmitter is in the measurement mode.

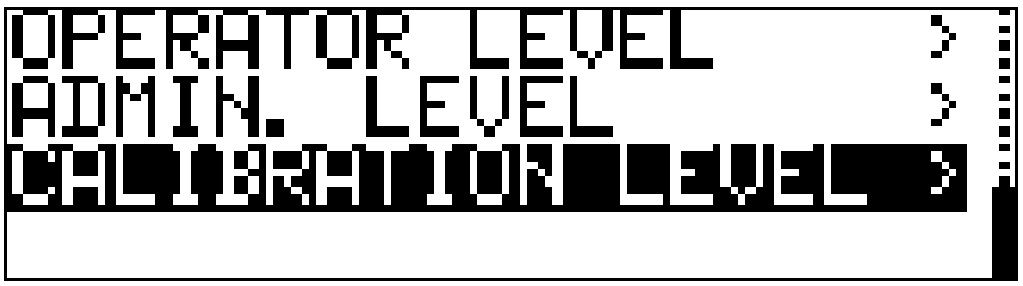


✱ Immerse the conductivity sensor in a reference solution with a known conductivity.

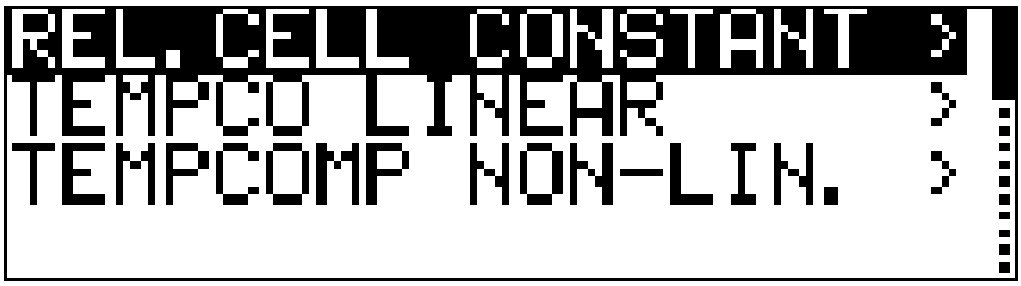
The temperature of the sample solution must remain constant during calibration!

✱ 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.



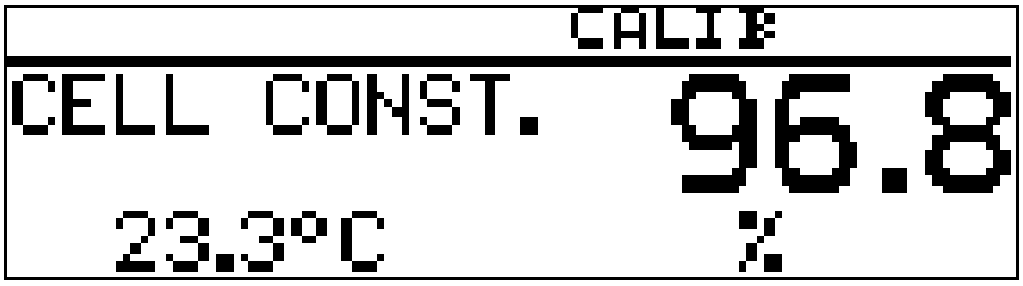
✱ Use the ▼ or ▲ key to select REL. CELL CONSTANT; use the PGM key to confirm the selection.



✱ 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 JUMO CTI-750 will be displayed.



✱ To accept the relative cell constant 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.

11.3 Calibrating the temp. coefficient of the sample solution

11.3.1 Linear temperature coefficient (ALPHA)

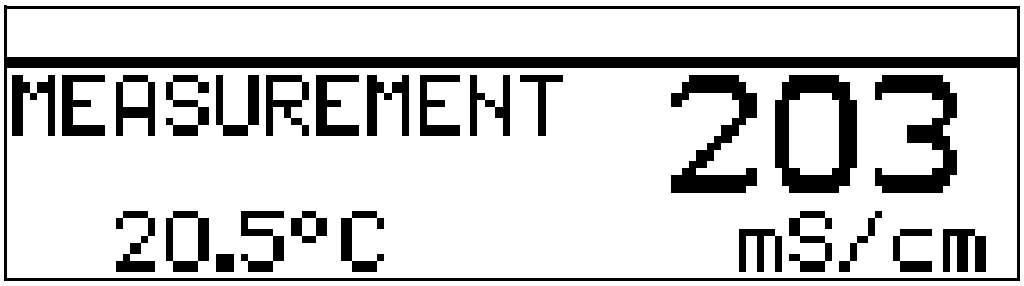
The conductivity of any sample solution will change according to its individual temperature coefficient.
We therefore recommend carrying out a calibration of the temperature coefficient.

Requirements

- The supply voltage for the JUMO CTI-750 must be present.

see Chapter 7 “Installation”, page 28ff.

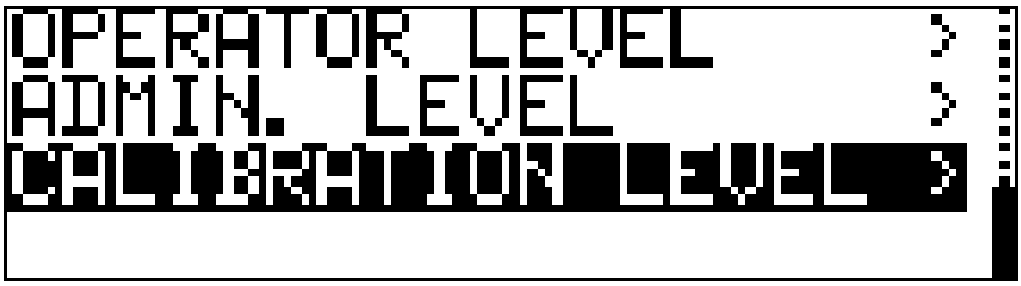
- The sensor must be connected to the transmitter (applies to the split version).
- The transmitter is in the measurement mode.



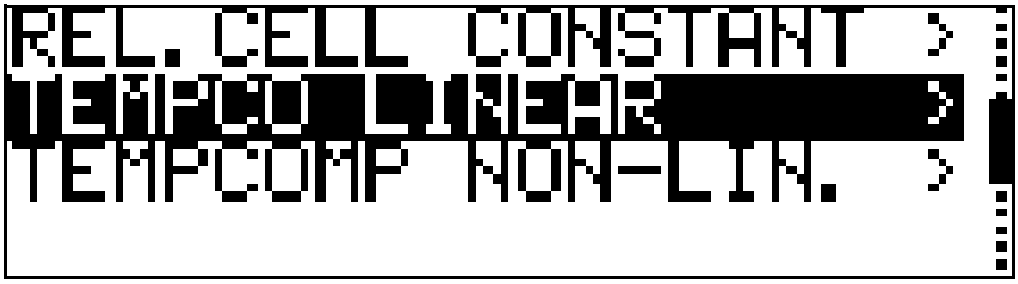
✱ Immerse the conductivity sensor in a sample of the solution to be measured.

✱ 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.

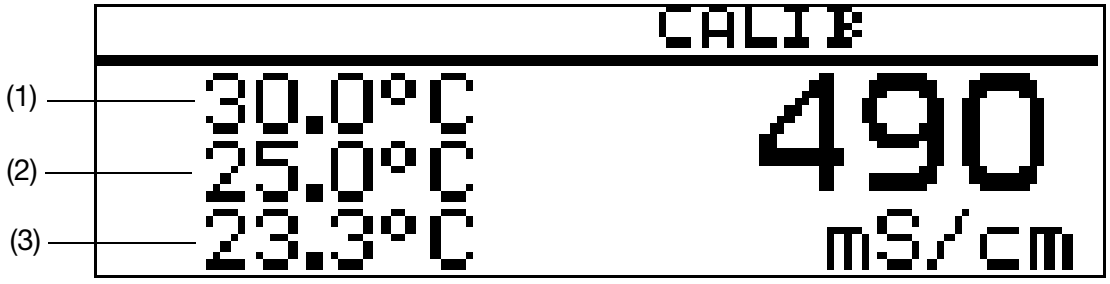


✱ Use the ▼ or ▲ key to select TEMPCO LINEAR; use the PGM key to confirm the selection.



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

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



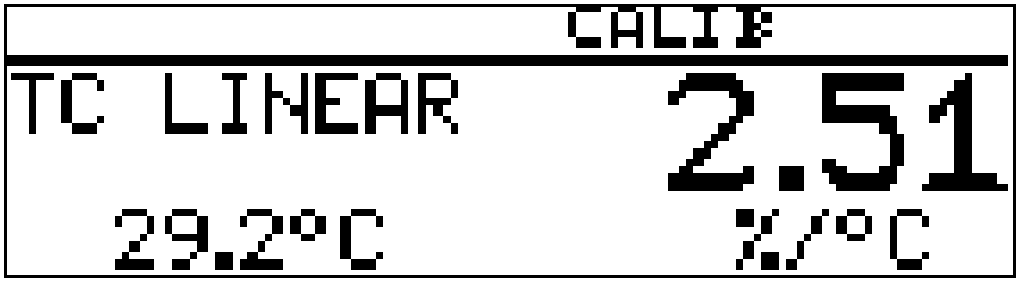
The LC display now shows
- at top (1): the selected working temperature (blinking)
- in the middle (2): the reference temperature (blinking)
- below (3): the present sensor temperature (steady)

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

During calibration, the rate of change of temperature for the sample solution must not exceed
10°C/min for a JUMO CTI-750 with exposed temperature sensor, or
1°C/min for a JUMO CTI-750 with an internal temperature sensor.

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

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.



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.

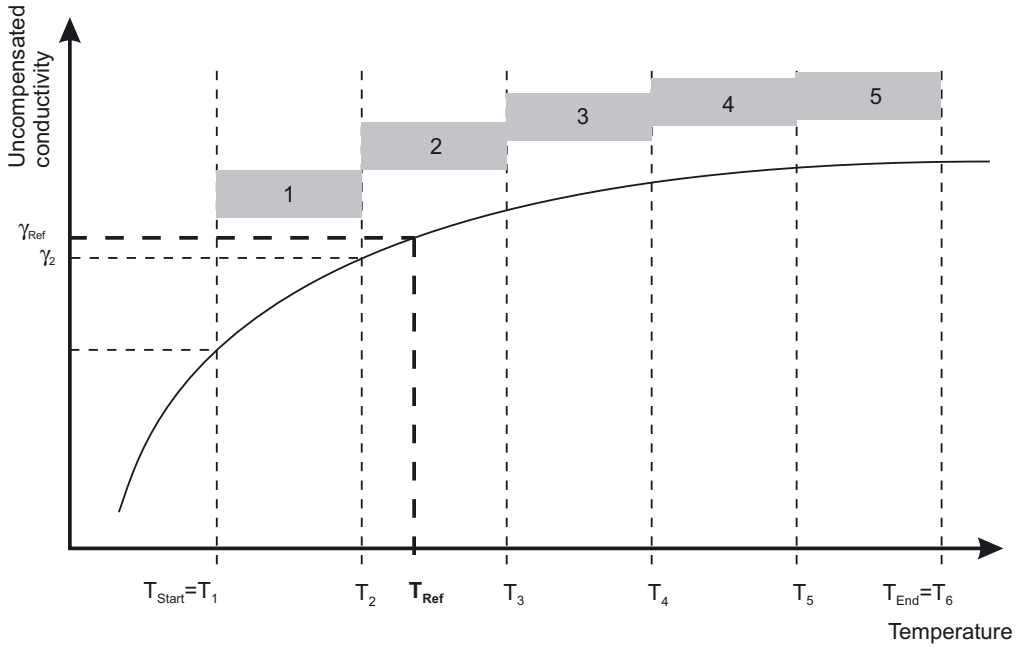
11.3.2 Non-linear temperature coefficient (ALPHA)

General

Since the temperature coefficient of some media is not constant over a sizeable temperature range, the JUMO CTI-750 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 calibration can be performed automatically on the device.

Determining the TC curve



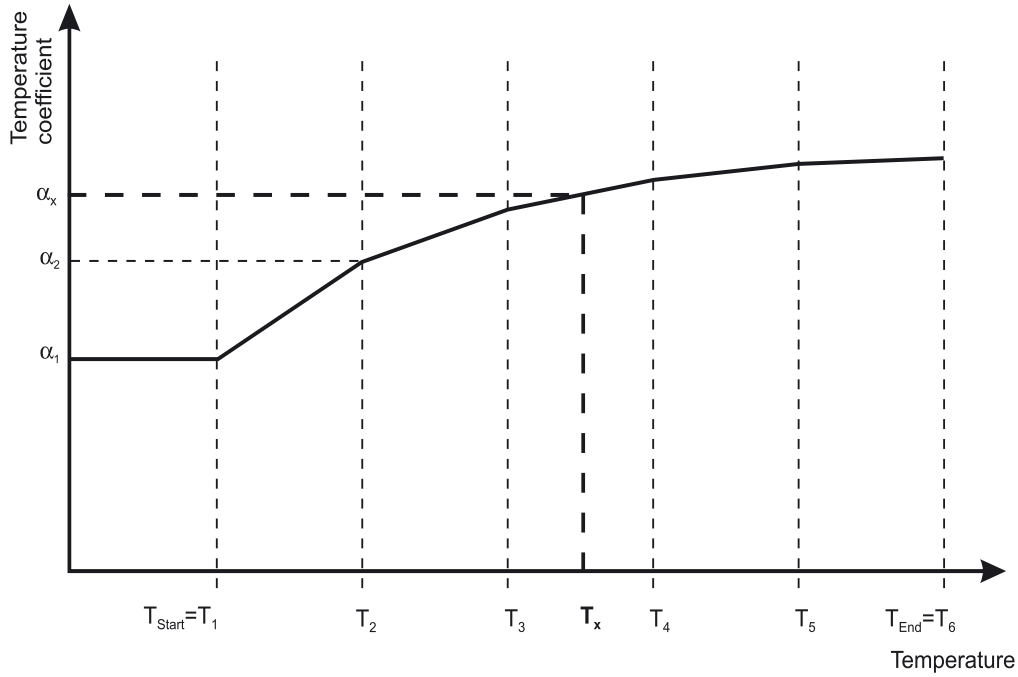
Calculation of a temperature coefficient

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

α = temperature coefficient (TC)

γ = uncompensated conductivity

TC curve



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”, page 59.

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.

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.

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

Sequence for automatic calibration on the JUMO CTI-750

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.

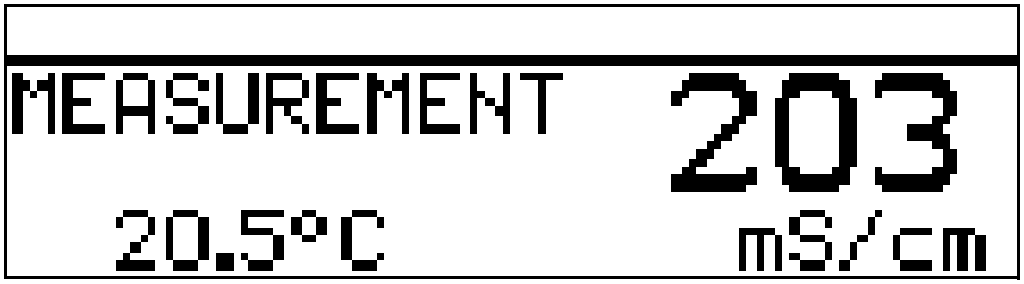
The temperature range must be larger than 20°C, and cover the reference temperature.
Example: Reference temperature 25°C, start temperature 18°C and end temperature 50°C.

11 Calibration

The rate of change of the temperature must not exceed
- 10°C / min for an exposed temperature sensor, and
- 1°C / min for an internal temperature sensor.

Requirements

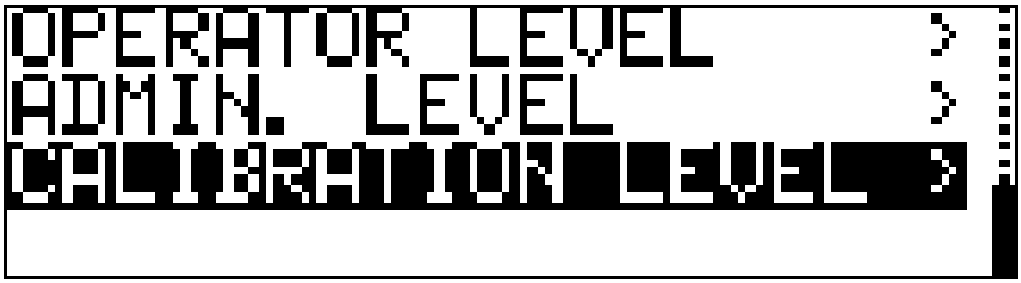
- The supply voltage for the JUMO CTI-750 must be present.
  see Chapter 7 “Installation”, page 28ff.
- The sensor must be connected to the transmitter (for the split version).
- The transmitter is in the measurement mode.



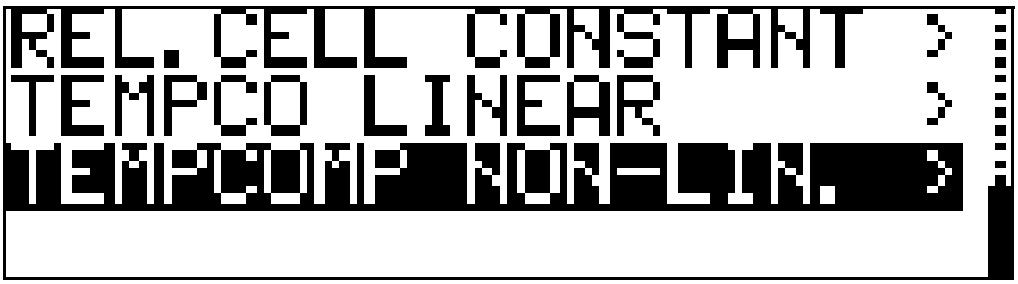
✱ Immerse the conductivity sensor in a sample of the solution to be measured.

✱ Press the PGM key for at least 3 seconds.

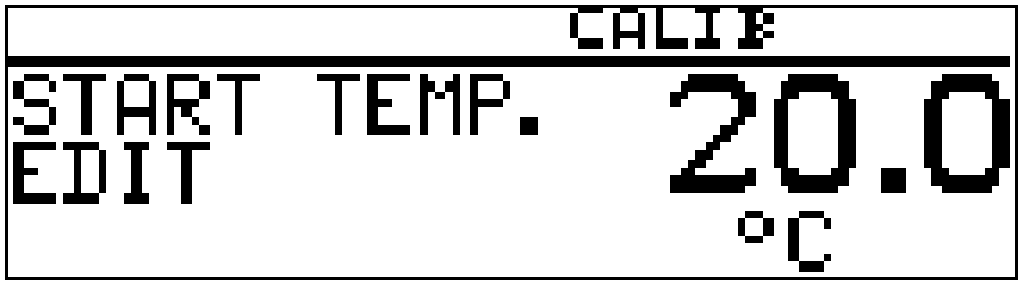
✱ Use the ▼ or ▲ key to select CALIBRATION LEVEL; use the PGM key to confirm the selection.



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

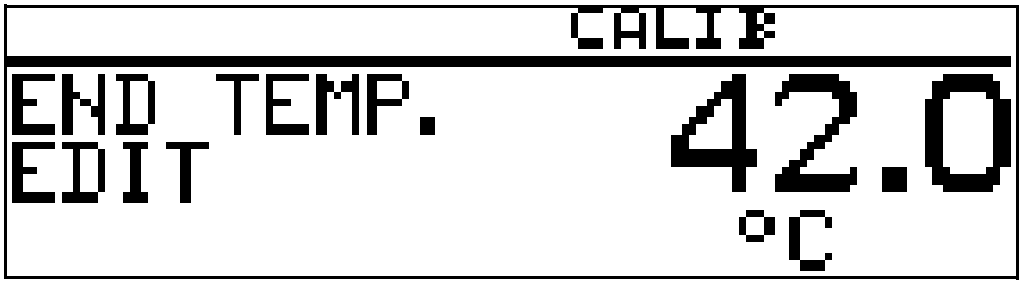


✱ Use the ▼ or ▲ key to enter the start temperature; confirm with the PGM key.



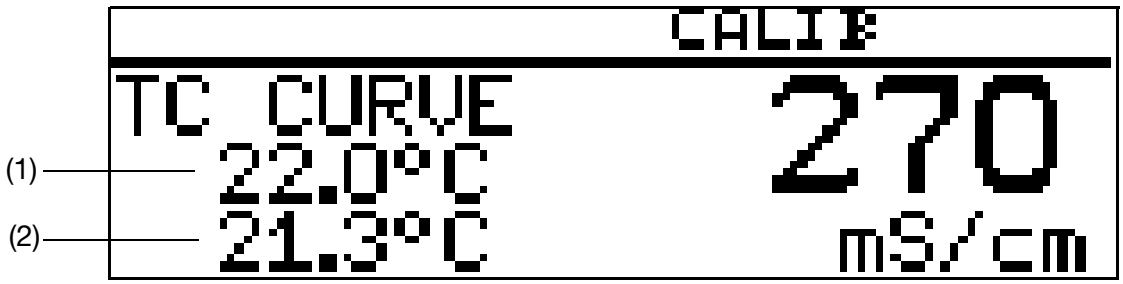
☞ The start temperature must be lower than the reference temperature (25.0°C).

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



☞ 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)



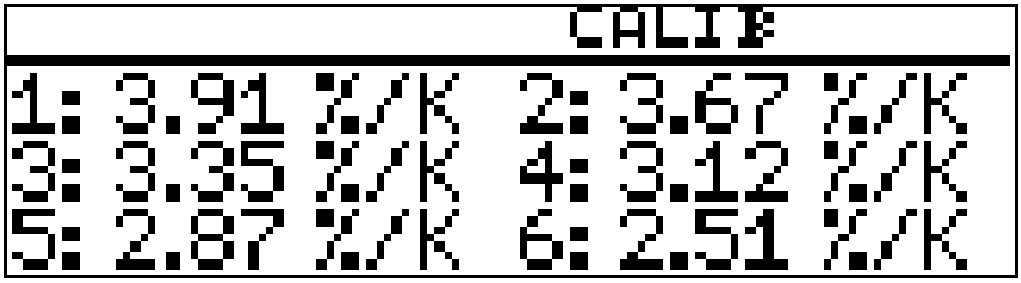
✱ Warm up the sample medium until is it above/below the temperature that is blinking.

The next target measured temperature is displayed as blinking.

During calibration, the rate of change of temperature for the sample solution must not exceed
10°C/min for a JUMO CTI-750 with exposed temperature sensor, or
1°C/min for a JUMO CTI-750 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 JUMO CTI-750 has determined all 6 temperature coefficients.



The LC display now shows the derived temperature coefficients in %/°C.

* 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.

12.1 Cleaning the conductivity sensor

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).

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 instrument”, page 64
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 43.
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 “General”, page 15.

13.1 Checking the instrument

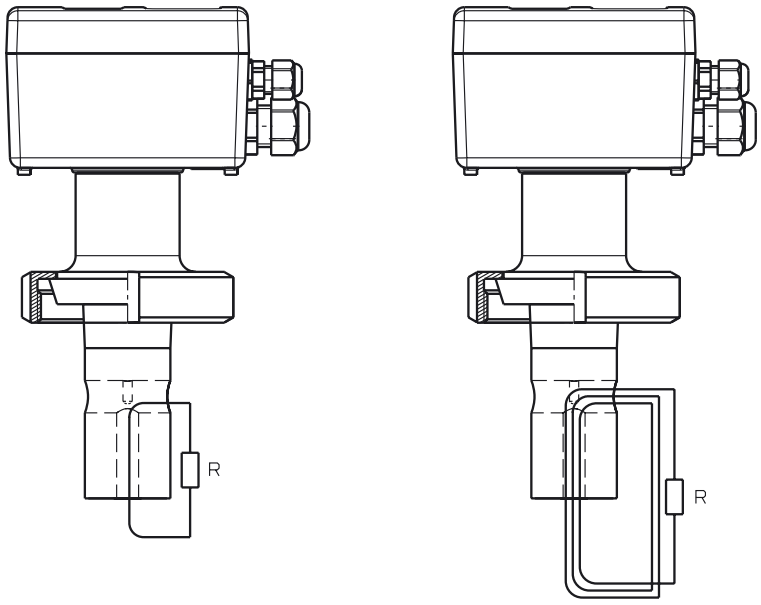
General

The instrument 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

Position of the resistance loop

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



✱ Loop a wire through the cell (see diagram)

✱ Connect a resistor R to the wire

Calculating the resistance

Formula for calculating the resistance of the resistance loop:

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

R = Resistance of the resistance loop
N = No. of turns in the loop
K = Cell constant
Cond = Required display in S/cm

Note: 1 mS/cm = $1 \cdot 10^{-3}$ S/cm
1 µS/cm = $1 \cdot 10^{-6}$ S/cm

For display values up to 20 mS, the loop must have 1 turn.
For display values above 50 mS, the loop must have 3 turns.

The cell constant of the JUMO CTI-750 depends on the style.

The T-shaped measuring cell has a cell constant of 6.80 1/cm.
The VARIVENT® cell has a cell constant of 6.50 1/cm.

Example 1

The JUMO CTI-750 with a T-shaped PEEK measuring cell is to show 20 mS:

$$R = \frac{1^2 \cdot 6.80\ 1/cm}{20 \cdot 10^{-3}\ S/cm} = 340\ \Omega$$

To obtain a display of 20 mS/cm, the resistance loop (with 1 turn) must have a resistance of 340 Ohm.

Example 2

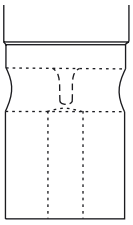
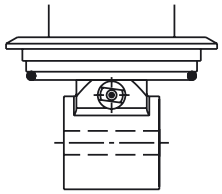
The JUMO CTI-750 with a T-shaped PEEK measuring cell is to show 500 mS:

$$R = \frac{3^2 \cdot 6.80\ 1/cm}{500 \cdot 10^{-3}\ S/cm} = 122.4\ \Omega$$

The obtain a display of 500 mS/cm, the resistance loop (with 3 turns) must have a resistance of 122.4 Ohm.

Precalculated values

The display value 0 is obtained if the sensor is dry and without a conductive deposit, and has no resistance loop fitted.

Style / cell constant		
		
Material: PEEK K = 6.80 1/cm	Material: PVDF K = 5.45 1/cm	Material: PEEK K = 6.50 1/cm

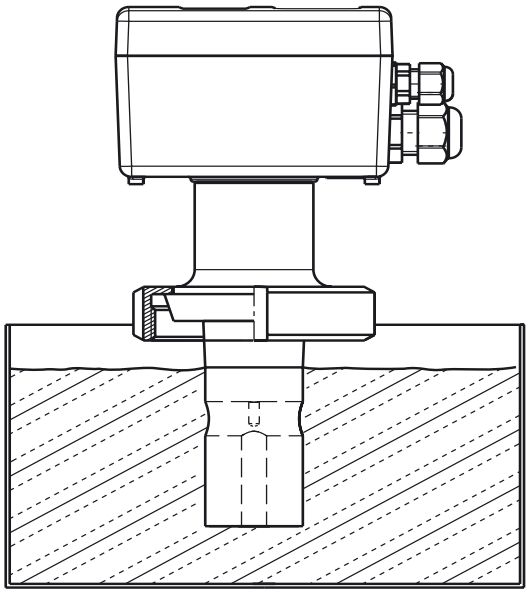
Display for range end	Number of turns	Cell constant [1/cm]	Required resistance [Ω]
500 µS/cm	1	6.80	13600.00
	1	6.50	13000.00
1000 µS/cm	1	6.80	6800.00
	1	6.50	6500.00
2000 µS/cm	1	6.80	3400.00
	1	6.50	3250.00
5000 µS/cm	1	6.80	1360.00
	1	6.50	1300.00
10 mS/cm	1	6.80	680.00
	1	6.50	650.00
20 mS/cm	1	6.80	340.00
	1	6.50	325.00
50 mS/cm	3	6.80	1224.00
	3	6.50	1170.00
100 mS/cm	3	6.80	612.00
	3	6.50	585.00
200 mS/cm	3	6.80	306.00
	3	6.50	292.50
500 mS/cm	3	6.80	122.40
	3	6.50	117.00
1000 mS/cm	3	6.80	61.20
	3	6.50	58.50
2000 mS/cm	3	6.80	30.60
	3	6.50	29.25

Test sequence

- ✱ Calculate the test resistance.
- ✱ Connect up the JUMO CTI-750, see Chapter 7 “Installation”, page 28.
- ✱ Select the corresponding measurement range, see Chapter 10.5.1 “CONDUCTIVITY IN (conductivity input)”, page 40 -> RANGE 1 — 4
- ✱ Set TC to 0%/°C, see Chapter 10.5.1 “CONDUCTIVITY IN (conductivity input)”, page 40 -> TEMPCO.
- ✱ Fit the resistance loop as shown in the diagram.

13.1.2 Reference liquid test

Immerse in test solution

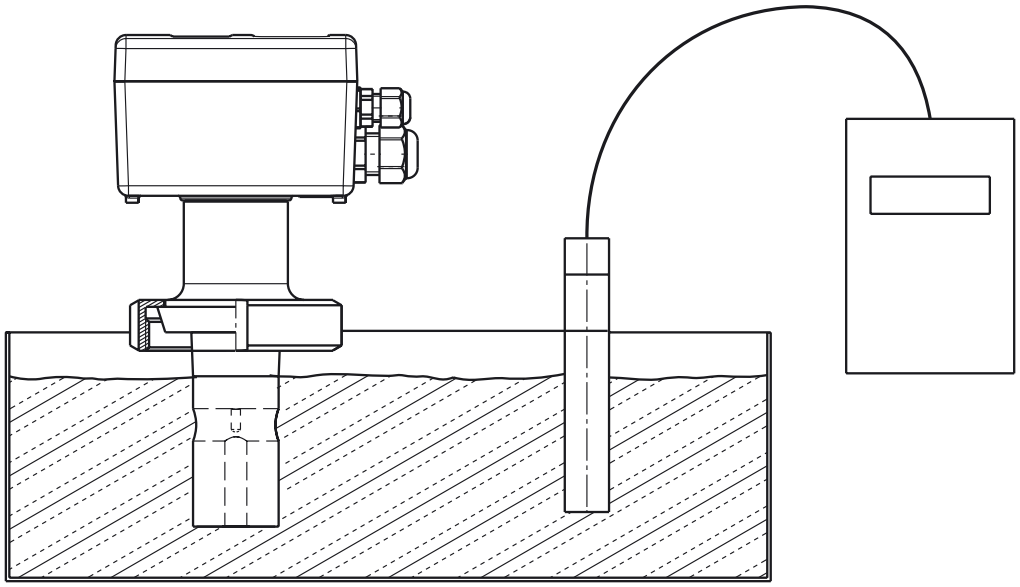


Test sequence

- ✱ Prepare the conductivity test solution in a container of adequate size.
- ✱ Connect up the device, see Chapter 7 “Installation”, page 28.
- ✱ Select the range appropriate to the conductivity test solution, see Chapter 10.5.1 “CONDUCTIVITY IN (conductivity input)”, page 40 -> RANGE 1 — 4
- ✱ Set TC to 0%/°C, see Chapter 10.5.1 “CONDUCTIVITY IN (conductivity input)”, page 40 -> TEMPCO.
- ✱ Immerse the cell in the container, and do not move it any more during the measurement.

13.1.3 Reference measuring instrument test

Immerse in test solution



Test sequence

- Prepare the conductivity test solution in a container of adequate size.
- Connect up the JUMO CTI-750, see Chapter 7 “Installation”, page 28.
- Select the range appropriate to the conductivity test solution, see Chapter 10.5.1 “CONDUCTIVITY IN (conductivity input)”, page 40 -> RANGE 1 — 4
- Set TC to 0%/°C, see Chapter 10.5.1 “CONDUCTIVITY IN (conductivity input)”, page 40 -> TEMPCO.
- Set the TC for the reference instrument to 0%/°C as well (see operating instructions for the reference instrument). If this is not possible, then the sample liquid must be tempered to the reference temperature for the reference instrument.
- Immerse the cell under test and the cell for the reference instrument 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 instrument, taking into account acceptable device deviations.

14 Appendix

14.1 Before configuration

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

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 instrument.

Parameter	Selection / value range **Factory setting**	New setting	see page
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)		40
Temperature compensation	**linear** non-linear natural water		40
Temperature coeff. 1 — 4	0 to **2.20** to 5.5%/°C		40
Reference temperature	15.0 to **25.0** to 30°C		40
Cell constant	2.00 — **6.80** — 10.00 1/cm		40
Relative cell constant	80.0 — **100.0** — 120.0%		40
Mounting factor	80.0 — **100.0** — 120.0%		41
Concentration measurement	**no function** NaOH HNO_3 customer-specific		41
Offset	-200 to **0** to +200 mS/cm		41
Filter time	**00:00:01** — 00:00:25 H:M:S		41
Calibration interval	**0** — 999 days		41
Conductivity output			

Parameter	Selection / value range **Factory setting**	New setting	see page
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		42
Scaling start	**0** — 90% = 4 mA (e.g.) of range span		42
Scaling end	**100** — 10% = 20 mA (e.g.) of range span		42
During alarm	**low** high safe value		42
During calibration	**moving** frozen safe value		42
Safe value	0.0 — **4.0** — 22.0 mA		42
Manual mode	**off** on		42
Manual value	0.0 — **4.0** — 22.0 mA		42
Temperature input			
Unit	**°C** °F		43
Measurement acquisition	**sensor** manual		43
Manual value	-20.0 to **25** to 150°C		43
Offset	-15.0 to **0.0** to +15°C		43
Filter time	00:00:00 — **00:00:01** — 00:00:25 H:M:S		43
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		43
Scaling start	-20 to **0.0** to 183°C = 4 mA (0 — 90% of range span)		43

14 Appendix

Parameter	Selection / value range **Factory setting**	New setting	see page
Scaling end	-3 to **150** to 200°C = 20 mA (100 — 10% of range span)		43
During alarm	**low** high safe value		42
During calibration	**moving** frozen safe value		42
Safe value	0.0 — **4.0** — 22.0 mA		44
Manual mode	**off** on		42
Manual value	0.0 — **4.0** — 22.0 mA		42
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		44
Limit value	**-20.0** — 9999.0		45
Hysteresis	0.0 — **1.0** — 999.0		45
Spacing	**0.0** — 999.0		45
Manual mode	**off** on		45
For “Hold”	**inactive** active frozen		45
For alarm/calibration	**inactive** active frozen		45
Switch-on delay	**00:00:00** — 01:00:00 H:M:S		46
Switch-off delay	**00:00:00** — 01:00:00 H:M:S		46
Pulse duration	**00:00:00** — 01:00:00 H:M:S		46
Binary input			
Function	**no function** key lock / hold meas. range / temperature coefficient dilution function		46
Dilution function			
Reduction	0 — **10** — 50%		46

Parameter	Selection / value range **Factory setting**	New setting	see page
Dosing time	00:00:00 — **00:01:00** — 18:00:00 H:M:S		46
Lock time	00:00:00 — **00:01:00** — 18:00:00 H:M:S		46
Device data			
Language	**German** English French Spanish Polish Swedish Italian Portuguese Dutch Russian		47
Contrast	0 — **6** — 11		47
Lighting	off on **during operation**		47
LCD inverse	**off** on		47

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