JUMO AQUIS 500 Ci
Transmitter/Controller for Inductive Conductivity,
Concentration and Temperature
Type 202566

B 202566.0
Operating Instructions
WARNING:
A sudden malfunction of the device, or one of the sensors connected to it, could potentially result in dangerous, imprecise dosing! Suitable preventive measures must be in place to prevent this from happening.

Note:
Please read these Operating Instructions before placing the device in operation. Keep the manual in a place which is accessible to all users at all times.

Resetting the brightness of the LC display:
If the brightness/contrast setting has been adjusted so that the display text is no longer legible, the basic setting can be restored as follows:
Switch off the supply voltage.
Switch on the supply voltage and immediately press and hold the ▼ and ▲ keys simultaneously.

Reset the language to "English":
If the language has been adjusted so that the display text is no longer comprehensible, use the Administrator password, 7485, to reset the language to "English":
Press the ▼ key for longer than 3 seconds.
Press the ▼ key once.
Briefly press the ▼ key.
Enter 7485.
Briefly press the ▼ key.
The required language can then be set in ADMINISTR. LEVEL / PASSWORD / PARAMETER LEVEL / DISPLAY / LANGUAGE.
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1 Typographical conventions

1.1 Warning symbols

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 Reference symbols

Note
This symbol is used to draw your special attention to a remark.

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 consecutive superscript numbers.

Instruction
This symbol indicates that an action to be performed is described.
The individual steps are marked by this asterisk.
Example:
* Loosen Phillips-head screws.
2 Description

**General information**

The JUMO AQUIS 500 CI is used for the inductive measurement / control of electrolytic conductivity or of the concentration of liquids. With this device, it is also possible to display the measured conductivity in accordance with a specifically customized table.

Inductive JUMO measuring cells can be connected to the device.

Temperature measurement is performed with a Pt100/1000, as a second input variable. Specific, automatic temperature compensation is possible here, depending on the measurement variable.

The device is operated by keys, and has a large, easily legible graphic display. Parameters are displayed in plain text, making configuration easier for the user and helping with the proper programming of the device.

Input signals can be shown as numbers or as a bar graph on the graphic display. Parameters are displayed in plain text for easily comprehensible and secure operation.

With two optional relay switching contacts, it is possible to implement both simple switching or alarm functions and demanding control tasks with P, PI, PD and PID action. If required, the device can also be provided with two freely configurable and scalable analog outputs (0 - 10 V or 0(4) - 20 mA).

**Advantages**

With the inductive measurement method, acquisition of the specific conductivity is largely maintenance-free, even in difficult medium conditions. Unlike the conductive measurement method, problems such as electrode breakdown and polarization simply do not occur.

Because temperature measurement is integrated, temperature compensation takes place quickly and precisely, which is particularly important when measuring conductivity.

**Typical areas of application**

Particularly recommended is use in media in which heavy deposits from contaminants, oil and grease, or gypsum and lime precipitation are to be expected.

According to which sensor is connected, the device can be used in

- fresh water and waste water
- air conditioning systems and cooling tower monitoring
- swill tanks (e.g. electroplating plant monitoring)
- feed and final control in in-house wastewater treatment plants
- concentration monitoring
- vehicle washers
- CIP cleaning (Clean In Place / Process)
- concentration monitoring and chemicals dosing
- food, drinks and pharmaceutical industries (monitoring phase separation)
(1) JUMO tecLine Ci, inductive conductivity and temperature sensor
(2) Cable (JUMO tecLine Ci component)
(3) JUMO AQUIS 500 Ci, transmitter/controller for conductivity, concentration and temperature

Key features

- Display: mS/cm, µS/cm, g/l, etc.
  Special visualizations can also be configured with the setup program.
- Large, backlit LC graphic display.
- A choice of display visualizations: large numbers, bar graph or trend display.
- Integrated calibration routines.
- Calibration logbook.
- IP67 enclosure protection for surface mounting
  IP65 enclosure protection for switch cabinet mounting
- Selectable languages: German, English, French; additional languages can be loaded later through the setup program.
- Through the setup program: user-friendly programming, system documentation, subsequent loading of additional languages.
2 Description

Block diagram

Analog inputs
- Input 1: Inductive conductivity cell
- Input 2: Temperature
  manual input or automatic
  Pt100 / Pt1000 / 4 kW

Binary input
- For floating contact
  Functions:
  - keyboard inhibit
  - alarm stop
  - HOLD

Power supply
- 110 - 240 V AC
- 12 - 24 V DC
- 20 - 30 V AC/DC

Analog outputs (option)
- Outputs 1 + 2:
  0(4) - 20 mA or 0 - 10 V
  Can be configured as analog
  actual value output and/or
  continuous
  controller output (PID action)

Switching outputs (option)
- Outputs 3 + 4:
  - relay, changeover (SPDT)
  - pulse width output
    (PID action)
  - pulse frequency output
    (PID action)
  - modulating controller
    (PID action)
  - washing timer
  - calibration timer run down

Setup interface
- Standard
- Option

User-friendly configuration
Subsequent language loading
System documentation
3 Identifying the device version

3.1 Nameplate on the transmitter

JUMO AQUIS 500 Ci
Typ: 202566/10-888-000-000-000-23/000
F-Nr.: 0168122901016010001
〜 AC 110..240V -15/+10% 48..63Hz ≤ 14VA

The date of manufacture is encoded in "F No." (serial number):
1601 means manufactured in 2016, week 01.

3.2 Order details

(1) Basic type
202566 JUMO AQUIS 500 Ci transmitter/controller for conductivity, concentration and temperature

(2) Basic type extension
10 for panel mounting
20 in surface-mounted housing

(3) Output 1 (for main value or continuous controller)
000 no output
888 analog output 0(4) - 20 mA and 0 - 10 V

(4) Output 2 (for temperature or continuous controller)
000 no output
888 analog output 0(4) - 20 mA and 0 - 10 V

(5) Output 3
000 no output
310 relay with changeover contact

(6) Output 4
000 no output
310 relay with changeover contact

(7) Power supply
23 110 - 240 V AC, +10% / -15%, 48 - 63 Hz
25 20 - 30 V AC/DC, 48 - 63 Hz
30 12 - 24 V DC, ± 15%¹

(8) Extra codes
000 none

Order code (1) (2) (3) (4) (5) (6) (7) (8) / - ----/, . . .
Order example 202566 / 20 - 888 - 888 - 310 - 310 - 23 / 000

¹
3 Identifying the device version

3.3 Accessories (optional)

<table>
<thead>
<tr>
<th>Type</th>
<th>Part no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protective roof for JUMO AQUIS 500</td>
<td>00398161</td>
</tr>
<tr>
<td>Pipe installation set for JUMO AQUIS 500</td>
<td>00483664</td>
</tr>
<tr>
<td>DIN rail installation set for JUMO AQUIS 500</td>
<td>00477842</td>
</tr>
<tr>
<td>Support pillar with base clamp, arm and chain</td>
<td>00398163</td>
</tr>
<tr>
<td>Holder for suspension fitting</td>
<td>00453191</td>
</tr>
<tr>
<td>Back panel set 202560/65</td>
<td>00506351</td>
</tr>
<tr>
<td>PC setup software</td>
<td>00483602</td>
</tr>
<tr>
<td>PC interface cable including USB/TTL converter and two adapters (USB connecting cable)</td>
<td>00456352</td>
</tr>
<tr>
<td>Calibration adapter for inductive conductivity measurement, type 202711/21</td>
<td>00544942</td>
</tr>
</tbody>
</table>

1 With the pipe installation set, the JUMO AQUIS 500 can be attached to a pipe (e.g. a support pillar or a railing).

2 With the DIN rail installation set, the JUMO AQUIS 500 can be attached to a 35 mm x 7.5 mm DIN rail as per EN 60715 A.1.

The following are required for the initial commissioning of the sensor and transmitter/controller or when replacing components:

- the JUMO AQUIS 500 Ci transmitter/controller, data sheet 20.2566
- an inductive conductivity and temperature sensor JUMO tecLine Ci
- a calibration adapter for inductive conductivity measurement, type 202711/21, data sheet 20.2711
4 Mounting

4.1 General

Mounting location

Find a location that ensures easy accessibility for the later calibration. The fastening must be secure and must ensure low vibration for the device. Avoid direct sunlight!

Permissible ambient temperature at the installation location: -10 to 55°C with max. 95% rel. humidity, no condensation.

Installation position

The device can be mounted in any position.

Insertion and removal of separate screw-in sensor

The cable between the transmitter and the conductivity sensor must not be damaged (twisted, shortened, etc.). Avoid pulling on the cable, especially jerkily.

4.2 Surface mounting the transmitter

Befestigungslaschen (1) sind im Lieferumfang enthalten.
4 Mounting

Attachment

* Screw four fixing brackets (1) onto the enclosure. The fixing brackets can be turned in increments of 90°.
* Attach the housing to a surface by the fixing brackets (with screws, dowels, etc.).

4.3 Pipe installation set / weather protection roof

The pipe installation set for JUMO AQUIS 500 (part no.: 00483664) can be used to fasten the device (and optionally the protective roof for JUMO AQUIS 500, part no.: 00398161) onto pipes or railings with a diameter from 30 to 50 mm.

Screws (1) M5 x 30 for pipe diameters from 30 to 40 mm.
Screws (2) M5 x 40 for pipe diameters from 40 to 50 mm.
The pipe installation set is also suitable for horizontal pipes.

4.4 DIN rail installation set

The DIN rail installation set for JUMO AQUIS 500 (part no.: 00477842) can be used to attach the device to a 35 mm x 7.5 mm DIN rail, as per EN 60715 A.1.
4.5 Mounting in a panel

Panel cut-out

Drilling template See section 12.3 "Template for panel cutout", page 82.
The panel must be sufficiently thick to achieve the specified IP65 enclosure protection!

Installation

* Prepare the panel cut-out and holes based on the drill template.
* Place the control panel (1) with gasket (3) in the panel cut-out and fasten it with the two upper screws (2) spacing rollers (3) and nuts (4).

To ensure electrical safety, the cable cover must be mounted, see next page!
Fit the bracket (4) for strain relief with the two lower screws (5).

Make the electrical connection, See section 5 "Electrical connection", page 16.

Break off the required flap(s) (3) from the cable cover (2) so that the cable can be laid in the cable path.

Attach the cable cover (2) onto the control panel (1).

Depth behind panel

44
Attaching the M12 round plug

✱ Insert the connecting cable (4) into the recess of the bracket (5) for strain relief.
✱ "Click" the gland from below into the recess of the bracket (5), like shown in the photo right above.
✱ Tighten the pressure nut (3) (left-hand thread).
✱ Tighten the acorn nut (2), to incorporate strain relief to the circular plug M12 (1) and the connecting cable (4).

4.6 Fitting the conductivity sensor

Only inductive conductivity sensors of the JUMO tecLINE Ci type, see data sheet 202941, can be connected to the JUMO AQUIS 500 Ci.

The installation of these conductivity cells is described in operating instructions B 202941.4.
5 Electrical connection

5.1 Installation notes

The electrical connection must only be performed by 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. Only flexible cables and wires shall be used!

If contact with live parts is possible while working on the device, it must be completely disconnected from the electrical supply.

Load circuits must be fused for the maximum relay current in each case, in order to prevent welding of the relay contacts in the event of a short circuit.

The electromagnetic compatibility conforms to EN 61326.

Run input, output and supply cables separately and not parallel to one another.

Use shielded sensor cables with twisted conductors. Do not run these cables close to current-carrying components or cables. Ground shielding at one end.

Sensor leads should be implemented as uninterrupted cables (not routed via terminal blocks etc.).

Do not connect any additional loads to the supply terminals of the device.

The device is not suitable for use in areas with an explosion hazard (Ex areas).

Apart from faulty installation, incorrect settings on the device may also affect the proper functioning of the subsequent process or lead to damage. Safety devices independent of the device should therefore always be provided and should only be capable of adjustment by specialist personnel.

### Conductor cross-sections and ferrules

<table>
<thead>
<tr>
<th></th>
<th>Minimum cross-section</th>
<th>Maximum cross-section</th>
<th>Minimum ferrule length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without ferrule</td>
<td>0.34mm²</td>
<td>2.5mm²</td>
<td>10mm (stripped)</td>
</tr>
<tr>
<td>Ferrule without collar</td>
<td>0.25mm²</td>
<td>2.5mm²</td>
<td>10mm</td>
</tr>
<tr>
<td>Ferrule with collar, up to 1.5mm²</td>
<td>0.25mm²</td>
<td>1.5mm²</td>
<td>10mm</td>
</tr>
<tr>
<td>Ferrule with collar, from 1.5mm²</td>
<td>1.5mm²</td>
<td>2.5mm²</td>
<td>12mm</td>
</tr>
<tr>
<td>Twin ferrule with collar</td>
<td>0.25mm²</td>
<td>1.5mm²</td>
<td>12mm</td>
</tr>
</tbody>
</table>

The enclosure protection specified for the device (IP67) is only achievable if not more than one cable runs into the device through each cable gland.
5 Electrical connection

5.2 Electrical isolation

- Setup interface
- Relay contacts
- Binary input
- Analog output 1
- 3700 V AC
- 30 V AC
- 50 V DC
- Main input
- Inductive conductivity cell
- Type JUMO tecLINE Ci

- Analog output 2
- Secondary input
- Temperature sensor
- Pt100 or Pt1000
- 3700 V AC

\* Not for SELV/PELV of 3U (12 - 24 V DC) supply voltage!
5 Electrical connection

5.3 Opening and closing the device

Opening the device

✱ Prior to opening, loosen all cable fittings (2) so that the cables are moveable.

✱ Push connection cable a little into the case so that enough cable reserve is available for opening.

✱ Loosen the 4 front-panel screws (1) of the case lid and pull them out as much as possible.

✱ Pull the lid to the front and then fold to the front. The user needs to be able to easily open the lid. Do not use force while opening!

Closing the device

✱ When closing the device, pull the connecting cables to the outside while the cable fittings are in a released state and make sure that the lines in the inside of the device run properly. Pay attention to the corresponding sheathing measurement to ensure strain relief and protection type (IP67) of the cable fitting.

✱ The user must be able to close the lid with the 4 screws without a high degree of pressure.

✱ Tighten cable fittings.
5.4 Connecting the cables

The electrical connection for the surface-mountable housing is easily accessible when the device is folded out.

The device contains a guide plate that ensures an optimum cable path. **After laying the cables, the cable cover (1) must be attached until it clicks, like shown above. This is important to ensure the electrical safety!**

To connect the individual core wires, remove pluggable screw terminals from the control panel.

Run the connecting cables through the cable glands.

---

The clip (3) (see next page) must **only** be attached by a 3.5 x 6.5 pan head screw! If the screw is any longer, dangerous voltage could be directed to the cable shielding!
5 Electrical connection

Interior view

- Lead the connecting cables in through the cable fittings.
- In case of rerouting the sensor cable: use the cable clip (3) to clamp the signal cable to the shielding.
- Break off the required flap(s) from the cable cover so that the cable can be laid in the cable path. Attach the cable cover.
- Connect the cores as assigned below, and see section 5.6 “Pin assignment”, page 21.
- Push the plug-in terminals for row 1 (1) and row 2 (2) into the sockets in the device.

5.5 Terminal assignment

![Terminal assignment diagram]
## 5 Electrical connection

### 5.6 Pin assignment

<table>
<thead>
<tr>
<th>Connection</th>
<th>Terminal</th>
<th>Row</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inputs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply (23): 110 - 240 V AC, + 10% / -15%, 48 - 63 Hz</td>
<td>1 N (L-)</td>
<td>1</td>
</tr>
<tr>
<td>Power supply (25): 20 - 30 V AC/DC, 48 - 63 Hz</td>
<td>2 L1 (L+)</td>
<td></td>
</tr>
<tr>
<td>Power supply (30): 12 - 24 V DC, ± 15%</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>NC</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Only JUMO tecLINE Lf Ci inductive conductivity cells can be operated at the M12 connector, see data sheet 20.2941.</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Resistance thermometer in 2-wire circuit</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Resistance thermometer in 3-wire circuit</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Binary input</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Outputs</strong></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog output 1</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>0 - 20 mA and 20 - 0 mA or 4 - 20 mA and 20 - 4 mA or 0 - 10 V and 10 - 0 V (electrically isolated)</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Analog output 2</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>0 - 20 mA and 20 - 0 mA or 4 - 20 mA and 20 - 4 mA or 0 - 10 V and 10 - 0 V (electrically isolated)</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

---

means: Do not modify the factory wiring!
## 5 Electrical connection

<table>
<thead>
<tr>
<th>Connection</th>
<th>Terminal</th>
<th>Row</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switching output K1 (floating)</td>
<td></td>
<td>4 pole</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 NO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 NC</td>
</tr>
<tr>
<td>NC</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Switching output K2 (floating)</td>
<td></td>
<td>8 pole</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 NO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9 NC</td>
</tr>
</tbody>
</table>
6 Operation

device operation via the optional set-up program. See section 9 “Setup program”, page 58.

Operation via the device keypad is described below.

6.1 Controls

(1) Display backlit (during operation)
(2) CAL key Start calibration
(3) EXIT key Cancel entry / Exit level
(4) PGM key Change level
Forward selection
Confirm selection
(5) ▼ key Reduce numerical value
Forward selection
(6) ▲ key Increase numerical value
Forward selection
## 6 Operation

### 6.2 Display

#### 6.2.1 Measuring mode (normal display)

Example

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
<td>(7)</td>
</tr>
<tr>
<td>Relay K1 is active</td>
<td>Relay K2 is active</td>
<td>Binary input 1 is triggered</td>
<td>Keypad is locked</td>
<td>device status (notes)</td>
<td>Measurement value</td>
<td>Measurement unit</td>
</tr>
</tbody>
</table>

- Alarm (e.g. overrange)
- Calib flashes (calibration timer expired)
- Calib (customer calibration active)

<table>
<thead>
<tr>
<th>(8)</th>
<th>(9)</th>
<th>(10)</th>
<th>(11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature of medium</td>
<td>device status e.g.</td>
<td>- Measuring (normal)</td>
<td>AL R12 = Alarm, controllers 1 and 2</td>
</tr>
<tr>
<td>(7)</td>
<td>(8)</td>
<td>(9)</td>
<td>(10)</td>
</tr>
<tr>
<td>Measurement value</td>
<td>Measurement unit</td>
<td>Temperature of medium</td>
<td>device status e.g.</td>
</tr>
</tbody>
</table>

(1) (2) (3) (5) (4) (6) (7) (8) (9) (10) (11)

To return to measuring mode (MEASURING):
press the key or wait for a "timeout".
6 Operation

6.3 Principle of operation

6.3.1 Operation in levels

- Measurement mode
  - Normal display

- Main menu
  - Operator level
  - Administrator level
  - Calibration level
  - Calibration logbook
  - Device info

- Operator level
  - Conductivity input
  - Temperature input
  - Binary input
  - Controller channel 1
  - Controller channel 2
  - Controller spec. funkt.
  - Switch output 1
  - Switch output 2
  - Analog output 1
  - Analog output 2
  - Display
  - Wash Timer

- Administrator level
  - Password
  - Parameter level
  - Enable level
  - Basic settings
  - Calibration level
  - Calibration enable
  - Delete logbook

- Calibration level
  - Lin. temp. compensation
  - Temp. coef. curve
  - Rel. cell constant

- Calibration logbook
  - Calibration data

- Device info
  - Cell constant
  - Operating mode
  - Unit
  - Decimal point
  - Compensation type
  - Temperature coeff.
6 Operation

6.4 Parameter overview

Measuring mode (normal display); See section 6.5 “Measuring mode”, page 28

- CTRL. Setpoints
  - MIN/MAX values
    - See section 6.6.1 “MIN/MAX values”, page 28
  - Output level display
    - See section 6.6.2 “Output level display”, page 29
  - Manual mode overview
    - See section 6.7 “MANUAL mode / simulation mode”, page 30

OPERATOR LEVEL, See section 6.9 “Operator level”, page 35
- CONDUCT. INPUT
- TEMPERATURE INPUT
- BINARY INPUT
- CTRL. CHAN. 1
- CTRL. CHAN. 2
- CTRL. SPEC. FUNCT.
- SWITCH OUTPUT 1
- SWITCH OUTPUT 2
- ANALOG OUTPUT 1
- ANALOG OUTPUT 2
- DISPLAY
- WASH TIMER

ADMINISTR. LEVEL, See section 6.10 “Administrator level”, page 35

Password

PARAMETER LEVEL, See section 6.10.2 “Parameter level”, page 37
- CONDUCT. INPUT
- TEMPERATURE INPUT
- BINARY INPUT
- CTRL. CHAN. 1
- CTRL. CHAN. 2
- CTRL. SPEC. FUNCT.
- SWITCH OUTPUT 1
- SWITCH OUTPUT 2
- ANALOG OUTPUT 1
- ANALOG OUTPUT 2
- DISPLAY
- WASH TIMER

ENABLE LEVEL, See section 6.10.3 “Enable level”, page 37
- CONDUCT. INPUT
- TEMPERATURE INPUT
- BINARY INPUT
- CTRL. CHAN. 1
- CTRL. CHAN. 2
- CTRL. SPEC. FUNCT.
- SWITCH OUTPUT 1
- SWITCH OUTPUT 2
- ANALOG OUTPUT 1
- ANALOG OUTPUT 2
- DISPLAY
- WASH TIMER
6 Operation

Measuring mode

ADMINISTRATOR LEVEL

BASIC SETTINGS, See section 6.10.4 "Basic settings", page 39
OPERATING MODE
UNIT
DECIMAL POINT
COMPENSATION TYPE
TEMPERATURE COEFF.
TEMPERATURE SENSOR
NEW DEVICE INITIALIZE?

CALIB. LEVEL, See section 6.10.6 "Calibration level", page 40
LINEAR TEMP. CO.
TEMP. COEF. CURVE
REL. CELL CONSTANT

CALIB. ENABLE
LINEAR TEMP. CO.
TEMP. COEF. CURVE
REL. CELL CONSTANT

DELETE LOGBOOK

CALIB. LEVEL
LINEAR TEMP. CO.
TEMP. COEF. CURVE
REL. CELL CONSTANT

CALIB. LOGBOOK

DEVICE INFO
CELL CONSTANT
OPERATING MODE
UNIT
DECIMAL POINT
COMPENSATION TYPE
TEMPERATURE COEFF.
TEMPERATURE SENSOR
6 Operation

6.5 Measuring mode

6.5.1 Normal display

Visualization

The following are displayed in measuring mode:
- the analog input signal
- the unit: (configurable as pH, mS/cm, µS/cm, ppm, %, mV, etc.)
- the temperature of the medium

![Display Example]

(1) MEASURING -> measuring mode
(2) 24.3 -> the temperature of the medium
(3) 404 µS/cm -> the measurement value calculated from the standard signal at the input

The "trend display" or "bar graph" display types can also be selected in measuring mode, See "MEAS. DISPLAY TYPE" page 73.

6.6 Input/output information

6.6.1 MIN/MAX values

![MinMax Example]

Activating the display of min/max values

The device is in measuring mode (normal display)

* Press the key for less than 2 seconds.

The minimum and maximum values of the main variable (conductivity, concentration, etc.), and the temperature are displayed.

The extreme values of the main measurement variable and the temperature are not mutually assigned (e. g. not 282 µS/cm at 0.0°C).
6 Operation

6.6.2 Output level display

The device is in measuring mode (normal display)

✱ Press the key twice for less than 2 seconds.
The output level of both controller contacts will be displayed (if available).

Measurements with “out of range” are ignored.
Press the key again briefly to go to "Output level display" mode.

The min./max. value memory can be reset:
Operator level / Display / Min./max. reset.
If the basic setting is changed or there is a loss of power, the min and max values are deleted.

The output level of an output can only be displayed if the output concerned has been configured:
e.g. Administrator level / Parameter level / Controller channel 1 or 2.

To return to the normal display:
Press the key or wait for a “timeout”.
Press the key again to go to “Manual mode overview” mode.

The device is in measuring mode (normal display)

✱ Press the key twice for less than 2 seconds.
The output level of both controller contacts will be displayed (if available).
6 Operation

6.7 MANUAL mode / simulation mode

These functions can be used to manually set the switching outputs and analog outputs of the device to a defined state. This facilitates dry startup, troubleshooting and customer service, for example.

Simulation mode directly accesses switching outputs K1/2 or analog outputs 1/2. When simulation mode has been selected, MANUAL mode is not possible!

In MANUAL mode the settings for "higher order controllers" are taken into consideration.

6.7.1 MANUAL mode via "higher order control functions"

The JUMO AQUIS 500 is configured for higher order control functions when the following setting is made:

User level / controller channel 1 or 2 / control type Limit value or pulse width or pulse frequency or modulating or continuous controller.

When the configuration is set to continuous controller, analog outputs 1 and/or 2 are activated in manual mode. In other configurations switching outputs K1 or K2 are switched.

Selecting manual mode

In the factory setting of the device the MANUAL mode parameter is locked and can only be activated by the Administrator!

This parameter must first be enabled for other users, See section 6.10.3 "Enable level", page 37.

* Set Administrator level / Password / Parameter level / Special controller functions / Manual mode locked, Pulsed or Switched.
**6 Operation**

Locked = No manual mode, control via JUMO AQUIS 500.

Pulsed = the outputs are active as long as the ▼ or ▲ key is pressed.

Switched = the outputs are active if the ▼ or ▲ key is pressed. If the corresponding key is pressed again, the output becomes inactive again.

**Activating manual mode**

The device is in display mode

* Press the EXIT and ▲ keys for less than 2 seconds.
  The word MANUAL appears in the status line of the display.

If the EXIT and ▲ keys are pressed for longer than 3 seconds, the device goes into HOLD mode.
Then the outputs of the device respond according to the default settings.
To exit HOLD mode, press the EXIT and ▲ keys for longer than 3 seconds.

Control is no longer through the JUMO AQUIS 500. The output level of the controller channels is 0%.

Controller channel 1 is activated by the ▲ key. In this case the output level of controller channel 1 is 100%.

Controller channel 2 is activated by the ▼ key. In this case the output level of controller channel 2 is 100%.

**Deactivation**

* Press the EXIT key.

Control is once again through the outputs of the device.
The word MANUAL disappears from the status line of the display.

**Overview of MANUAL/Simulation mode**

You can display which outputs and/or controllers are in MANUAL mode.
The device is in "normal display" mode

Press the PGM key several times for less than 2 seconds (the number of times varies depending on the equipment and configuration of the device).

<table>
<thead>
<tr>
<th>MAN.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SWITCH, OUT</td>
</tr>
<tr>
<td>ANALOG OUT</td>
</tr>
<tr>
<td>CONTROLLER 1+2 MAN.</td>
</tr>
</tbody>
</table>

**Output level of controller channels**

The device is in "normal display" mode

Press the PGM key several times for less than 2 seconds (the number of times varies depending on the equipment and configuration of the device).
The display changes when the ⬆️ key or the ⬇️ key is pressed.

To return to measuring mode:
press the EXIT key or wait for a "timeout".

6.7.2 Simulating the switching outputs

Simplewitching
functions

The switching outputs are configured when the following setting is made:
Operator level / Controller channels 1 and/or 2 / Controller type Off
and
Switching output 1 and/or 2 / Function ⬇️ or ⬆️ or ⬇️ or ⬆️.

Activating the
simulation

In the factory setting of the device, the MANUAL mode parameter is set to "No simulation" and can only be activated by the Administrator!
This parameter must first be enabled for other users, See section 6.10.3 "Enable level", page 37.

* Set Administrator level / Password / Parameter level / Switching output 1
and/or 2 / Manual mode no simulation, Inactive or Active.

No simulation = No manual mode, control is via the JUMO AQUIS 500.
Inactive = Relay K1 or K2 is de-energized.
Active = Relay K1 or K2 is energized.

Deactivating
manual mode

No simulation = No manual mode, control via JUMO AQUIS 500.
6.7.3 Simulation of analog outputs via MANUAL mode

**Enabling and activation**

* Select activation of simulation of the actual value output:
  Administrator level / Password / Parameter level / Analog output 1 and/or 2 / Simulation / Off or On.

With "On", the output takes on the value of the "Simulation value" parameter.
When the JUMO AQUIS is in display mode, the word MANUAL appears in the status line of the display.

**Deactivation**

* Administrator level / Password / Parameter level / Analog output 1 and/or 2 / Simulation / Off.

The corresponding output of the JUMO AQUIS 500 works again.
When the JUMO AQUIS is in display mode, the word MANUAL disappears from the status line of the display.

6.7.4 MANUAL/Simulation overview

You can display which outputs and/or controllers are in MANUAL mode.
The device is in "normal display" mode

Press the [PGM] key several times for less than 2 seconds (the number of times varies depending on the equipment and configuration of the device).

```
MAN.
SWITCH. OUT ----
ANALOG OUT 1+2 MAN.
CONTROLLER ----
```

To return to measuring mode:
press the [EXIT] key or wait for a "timeout".
6 Operation

6.8 HOLD mode

In the HOLD state, the outputs take on the states programmed in the relevant parameter (controller channel, switching output or analog output). This function can be used to "freeze" the switching outputs and the analog outputs of the device. This means the current status of the output will be retained even when the measurement value changes. Control is not via the device.

If MANUAL mode is activated while HOLD mode is activated, MANUAL mode takes precedence and MANUAL then appears in the status line of the display! MANUAL mode can be terminated by pressing the EXIT key. If HOLD mode is still activated (by the binary input or via the keypad), the device then returns to HOLD mode!

HOLD mode can be activated by pressing the key or by the binary input.

** Activation by pressing a key

Press and hold the EXIT and A keys longer than 3 seconds.
Then the outputs of the device respond according to the default settings.
The word HOLD appears in the status line of the display.

If the EXIT and A keys are pressed for less than 3 seconds, the device goes into Manual mode.
Then the outputs of the device respond according to the default settings.

** Pressing a key to deactivate HOLD mode

Press the EXIT and A keys for longer than 3 seconds.

If the EXIT and A keys are pressed for less than 3 seconds, the device goes into Manual mode.
Then the outputs of the device respond according to the default settings.

Control is through the outputs of the device again. The word MANUAL disappears from the status line of the display.
6.9 Operator level
All the parameters that the Administrator (See section 6.10 "Administrator level", page 35) has enabled can be edited at this level. All the other parameters (marked with a key 🗝️) are read only.

✱ Press the 🗝️ key for longer than 2 seconds.
✱ Select "OPERATOR LEVEL".

6.10 Administrator level
- All the parameters can be edited at this level.
- At this level, it is also possible to define which parameters can be edited by a "normal" operator and which calibrations can be performed.

To get to the Administrator level, proceed as follows:

✱ Press the 🗝️ key for longer than 2 seconds.
✱ Use the 🕒 or 🕑 keys to select "ADMINISTR. LEVEL".
✱ Use the 🕒 or 🕑 keys to enter the password 300.
✱ Confirm the 🗝️ key.
6 Operation

6.10.1 The levels of Administrator level

![Diagram of levels of Administrator level]

- ADMIN. LEVEL
  - PASSWORD
    - 0
- PARAMETER LEVEL
  - or timeout (adjustable)
- ENABLE LEVEL
  - or timeout
- BASIC SETTINGS
  - or timeout
- CALIBRATION LEVEL
  - or timeout
- CALIB. ENABLE
  - or timeout
- DELETE LOGBOOK
  - or timeout
6.10.2 Parameter level

The settings that can be made here are the same as those at operator level. See section 6.9 "Operator level", page 35. As the operator has administrator rights here, the parameters that are locked at operator level can now also be modified.

6.10.3 Enable level

All parameters can be enabled (editing possible) or locked (editing not possible) for editing here. All the possible parameters are listed below; depending on the configuration, some of these parameters will not be displayed on the device.

**CONDUCT. INPUT** (conductivity input)
- Relative cell constant
- Mounting factor
- Zero point
- Compensation type
- Temperature coefficient
- Reference temperature
- Filter time constant
- Calibration interval

**TEMPERATURE INPUT**
- Sensor type
- Unit
- Manual temperature
- Filter time constant
- Offset

**BINARY INPUT**
- No function
- Key lock
- Hold mode
- Inverse Hold mode
- Alarm stop

**CTRL. CHAN. 1 and CTRL. CHAN. 2**
- Controller type
- Setpoint
- Min/max contact
- Proportional band
- Reset time
- Derivative time
- Pulse period
- Min. ON time
- Output level limit
- Max. pulse frequency
- Hysteresis
- Pull-in delay
- Drop-out delay
6 Operation

Controller alarm
In Hold mode
On error
Max. actual value
Min. actual value

CTRL. SPEC. FUNCT. (special controller function)
I switch-off
separate controllers
Manual mode

SWITCH OUTPUT 1 and SWITCH OUTPUT 2
Function
Switching point
USP pre-alarm
Spacing
Hysteresis
Switch-on delay
Switch-off delay
Pulse time
During calibration
Response on error
Response in Hold mode
Response in Manual mode
Break/make contact

ANALOG OUTPUT 1 and ANALOG OUTPUT 2
Signal type
Scaling start
Scaling end
During scaling
On error
In Manual mode
Safe value
Simulation
Simulation value
Signal selector

<table>
<thead>
<tr>
<th>Output</th>
<th>Analog process value output</th>
<th>Continuous controller main value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Main variable</td>
<td>Temperature</td>
</tr>
<tr>
<td>1</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>-</td>
<td>X</td>
</tr>
</tbody>
</table>

DISPLAY
Language
Lighting
LCD inverse
Meas. display type
Lower display
Upper display
Bar graph calibration start
6.10.4 Basic settings

The device has a basic settings wizard, to make it easier for the user to configure the extensive conductivity and standard signal input setting options and to avoid configuration conflicts. Here all the important settings are systematically queried. At the end, once a request for confirmation has been acknowledged, the device is initialized with the new settings. Dependent parameters are checked and adjusted.

6.10.5 Basic settings wizard

The basic settings of the device are specified at this level. Parameters are modified using keys ▼ and ▲. Use the [OK] key to select the next parameter.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating mode</td>
<td><strong>Conductivity</strong></td>
</tr>
<tr>
<td>Unit</td>
<td>µS/cm or mS/cm</td>
</tr>
<tr>
<td>Decimal point</td>
<td>XXXX / XXX.x / XX.xx / X.xxx</td>
</tr>
<tr>
<td>Compensation type</td>
<td>NaOH / HNO3 / H2SO4 / HCL</td>
</tr>
<tr>
<td>Temperature coeff.</td>
<td>0.0 ... 5.5% / K</td>
</tr>
<tr>
<td>Temperature sensor</td>
<td>Pt100/Pt1000 or customized or no sensor</td>
</tr>
<tr>
<td>Confirmation request</td>
<td>New device initialize ?</td>
</tr>
</tbody>
</table>
6 Operation

6.10.6 Calibration level

Three calibration options are provided:
- Linear temperature coefficient
- Non-linear temperature coefficient (temp. coef. curve)
- Relative cell constant
The calibration level is reached via: ADMINISTR. LEVEL / PASSWORD / CALIB. LEVEL.

6.10.7 Calibration enable

Here you can set whether or not the start of the calibration procedure is enabled at the operator level or by the "CAL" key.
Calibration enable is reached via: ADMINISTR. LEVEL / PASSWORD / CALIB. ENABLE.
The following can be locked or enabled:
- Linear temperature coefficient
- Non-linear temperature coefficient (temp. coef. curve)
- Relative cell constant

6.10.8 Delete logbook

The last five calibration processes are archived in the calibration logbook.
If required, the logbook can be deleted once a request for confirmation has been acknowledged.

6.11 Device info

Here is a list of the current configuration of all the important parameters (from the Basic Settings menu).

Example

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CELL CONSTANT</td>
<td>5.15</td>
</tr>
<tr>
<td>OPERATING MODE</td>
<td>CONDUCTIVITY</td>
</tr>
<tr>
<td>UNIT</td>
<td>mS/cm</td>
</tr>
<tr>
<td>DECIMAL POINTS</td>
<td>XXXX</td>
</tr>
<tr>
<td>COMPENSATION TYPE</td>
<td>LINEAR</td>
</tr>
<tr>
<td>TEMPERATUR COEFF.</td>
<td>2.20%/K</td>
</tr>
</tbody>
</table>
## 6.12 Controller functions

**Simple switching functions**

In the JUMO AQUIS 500, simple switching functions (AF) such as alarm contacts, limit value monitoring or calibration timer signaling are configured at parameter level via the parameters of “Switching outputs 1 and 2”.

The parameters of controller channels 1 and 2 must then be set to “Off”!

**Higher order control functions**

Higher order control functions are configured at parameter level via the parameters of “Controller channels 1 and 2”.

The parameters of the controller channels must then be set to “Controller 1 and Controller 2”!

### Operator level parameters

<table>
<thead>
<tr>
<th>Switching output 1 / 2</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>No switching function and no control function required</td>
</tr>
<tr>
<td>Controller 1 device control should be of a “higher order”</td>
<td></td>
</tr>
<tr>
<td>Controller 2 device control should be of a “higher order”</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Controller alarm 1 / 2</th>
<th>“Simple” switching functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main var. AF1</td>
<td>AF1 main variable</td>
</tr>
<tr>
<td>Main var. AF2</td>
<td>AF2 main variable</td>
</tr>
<tr>
<td>Main var. AF7</td>
<td>AF7 main variable</td>
</tr>
<tr>
<td>Main var. AF8</td>
<td>AF8 main variable</td>
</tr>
<tr>
<td>Temp. AF1</td>
<td>AF1 temperature</td>
</tr>
<tr>
<td>Temp. AF2</td>
<td>AF2 temperature</td>
</tr>
<tr>
<td>Temp. AF7</td>
<td>AF7 temperature</td>
</tr>
<tr>
<td>Temp. AF8</td>
<td>AF8 temperature</td>
</tr>
</tbody>
</table>

| Sensor error           | Calib. timer |
|                       | Autorange |
|                       | USP |
|                       | USP pre-alarm |
|                       | PH. EUR |
|                       | PH. EUR pre-al. |

<table>
<thead>
<tr>
<th>Controller channel 1 / 2</th>
<th>“Higher order” control functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limit</td>
<td></td>
</tr>
<tr>
<td>Pulse width</td>
<td></td>
</tr>
<tr>
<td>Pulse frequency</td>
<td></td>
</tr>
<tr>
<td>Continuous</td>
<td></td>
</tr>
<tr>
<td>Modulating</td>
<td></td>
</tr>
<tr>
<td>Off</td>
<td>Must be selected if &quot;simple&quot; switching functions are required.</td>
</tr>
</tbody>
</table>
7 Startup

7.1 Getting started

The B 202566.0.1 calibration instructions must be used to coordinate the JUMO AQUIS 500 Ci transmitter and the inductive conductivity sensor!

The calibration instructions are included with the type 202711/21 calibration adapter option. Needed for the adaptation are:

- the JUMO AQUIS 500 Ci transmitter/controller, data sheet 202566
- an inductive conductivity and temperature sensor, data sheet 202941, 202942 or 202943
- a type 202711/21 calibration adapter for inductive conductivity measurement, data sheet 202711

Below is a suggestion for configuring the device reliably in little time.
By checking the setting options of this list before starting the configuration, you can avoid timeouts during the configuration.

- Mount the JUMO AQUIS 500 Ci transmitter/controller, See section 4 "Mounting", page 11
- Mount the JUMO tecLine Ci inductive conductivity and temperature sensor, see installation instructions B 20.2941.4.
- Install both devices, See section 5 "Electrical connection", page 16 ff.
- Call up Administrator level (ADMINISTR. LEVEL).
- Enter password 300.
- Call up PARAMETER LEVEL / DISPLAY / OP. TIMEOUT.
- Set OP. TIMEOUT to 0 minutes (no timeout).
- Exit the Parameter level.
- Call up Administrator level (ADMINISTR. LEVEL).
- Enter password 300.
- Select BASIC SETTINGS and work through all the menu items.
- Answer "YES" to the "New device initialize" query.
- Configure the required parameters.
- Calibrate the device to the sensor and the sample medium, See section 8 "Calibrating inductive conductivity cells", page 48.
7.2 Setting example

7.2.1 Measurement in the food industry with an hygienic inductive conductivity and temperature sensor (PEEK)

**Task**
- Measurement range: 0 - 1.00 mS/cm
- Display: two decimal places
- Cell constant K: 5.15 l/cm (see printing on cell)
- Output signal: 4 - 20 mA
- Temperature compensation: linear
- Temperature measurement: automatic (sensor is incorporated in the cell)
- Control function: limit controller, max. function
- Limit: 600 µS/cm corresponding to 0.6 mS/cm

**Calling up**

**Administrator level**

**Operator level**

**Calibration level**

**Calibration logbook**

**Device info**
7 Startup

Calling up the basic settings

![Diagram of basic settings process]

- Admin. Level
  - Password
  - Level
- Parameter Level
  - Adjustment
- Enable Level
  - Adjustment
- Basic Settings
  - Calibration Level
  - Calibration Enable
- Delete Logbook

Continue on next page.
Making the basic settings for the main input

Operating mode

Confirmation request
New device initialize ?

Yes

Initialize all dependent parameters

No

No alterations to the parameters

Concentration

Unit

µS/cm or mS/cm

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

NaOH / HNO3 / H2SO4 / HCL

Custom table

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

Curve
Nat. water

Linear

Temperature coef.

0.0 ... 5.5%/K

Temperature sensor

Pt100/Pt1000 or customized or no sensor

Conductivity

Unit

µS/cm or mS/cm

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

Curve
Nat. water

Linear

Temperature coef.

0.0 ... 2.3 ... 5.5%/K

Temperature sensor

Pt100/Pt1000 or customized or no sensor

% or customized

Concentration

Unit

µS/cm or mS/cm

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

NaOH / HNO3 / H2SO4 / HCL

Custom table

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

Curve
Nat. water

Linear

Temperature coef.

0.0 ... 5.5%/K

Temperature sensor

Pt100/Pt1000 or customized or no sensor

% or customized

Concentration

Unit

µS/cm or mS/cm

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

NaOH / HNO3 / H2SO4 / HCL

Custom table

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

Curve
Nat. water

Linear

Temperature coef.

0.0 ... 5.5%/K

Temperature sensor

Pt100/Pt1000 or customized or no sensor

% or customized

Concentration

Unit

µS/cm or mS/cm

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

NaOH / HNO3 / H2SO4 / HCL

Custom table

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

Curve
Nat. water

Linear

Temperature coef.

0.0 ... 5.5%/K

Temperature sensor

Pt100/Pt1000 or customized or no sensor

% or customized

Concentration

Unit

µS/cm or mS/cm

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

NaOH / HNO3 / H2SO4 / HCL

Custom table

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

Curve
Nat. water

Linear

Temperature coef.

0.0 ... 5.5%/K

Temperature sensor

Pt100/Pt1000 or customized or no sensor

% or customized

Concentration

Unit

µS/cm or mS/cm

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

NaOH / HNO3 / H2SO4 / HCL

Custom table

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

Curve
Nat. water

Linear

Temperature coef.

0.0 ... 5.5%/K

Temperature sensor

Pt100/Pt1000 or customized or no sensor

% or customized

Concentration

Unit

µS/cm or mS/cm

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

NaOH / HNO3 / H2SO4 / HCL

Custom table

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

Curve
Nat. water

Linear

Temperature coef.

0.0 ... 5.5%/K

Temperature sensor

Pt100/Pt1000 or customized or no sensor

% or customized

Concentration

Unit

µS/cm or mS/cm

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

NaOH / HNO3 / H2SO4 / HCL

Custom table

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

Curve
Nat. water

Linear

Temperature coef.

0.0 ... 5.5%/K

Temperature sensor

Pt100/Pt1000 or customized or no sensor

% or customized

Concentration

Unit

µS/cm or mS/cm

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

NaOH / HNO3 / H2SO4 / HCL

Custom table

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

Curve
Nat. water

Linear

Temperature coef.

0.0 ... 5.5%/K

Temperature sensor

Pt100/Pt1000 or customized or no sensor

% or customized

Concentration

Unit

µS/cm or mS/cm

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

NaOH / HNO3 / H2SO4 / HCL

Custom table

Decimal point

XXXX / XXX.x / XX.xx / X.xxx

Compensation type

Curve
Nat. water

Linear

Temperature coef.

0.0 ... 5.5%/K

Temperature sensor

Pt100/Pt1000 or customized or no sensor
7 Startup

Calling up Parameter level

ADMIN. LEVEL
PASSWORD

PARAMETER LEVEL

ENABLE LEVEL

BASIC SETTINGS

CALIBRATION LEVEL

CALIB. ENABLE

DELETE LOGBOOK

PGM

continue on next page

PGM

or timeout (adjustable)

or timeout

or timeout

or timeout

or timeout

or timeout

✔

continue on next page

✔

✔
### Concluding device settings

<table>
<thead>
<tr>
<th><strong>Input for temperature</strong></th>
<th><strong>Controller channel 1</strong></th>
<th><strong>Controller channel 2</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor type:</td>
<td>Pt100/Pt1000</td>
<td></td>
</tr>
<tr>
<td>Unit:</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Filter time constant:</td>
<td>00:00:02</td>
<td></td>
</tr>
<tr>
<td>Offset:</td>
<td>0.0°C</td>
<td></td>
</tr>
<tr>
<td>Controller type:</td>
<td>limit</td>
<td></td>
</tr>
<tr>
<td>Setpoint:</td>
<td>0.60 mS/cm</td>
<td></td>
</tr>
<tr>
<td>Min./max. contact:</td>
<td>as required</td>
<td></td>
</tr>
<tr>
<td>Hysteresis:</td>
<td>as required</td>
<td></td>
</tr>
<tr>
<td>Pull-in delay:</td>
<td>as required</td>
<td></td>
</tr>
<tr>
<td>Drop-out delay:</td>
<td>as required</td>
<td></td>
</tr>
<tr>
<td>Controller alarm:</td>
<td>as required</td>
<td></td>
</tr>
<tr>
<td>In Hold mode:</td>
<td>as required</td>
<td></td>
</tr>
<tr>
<td>On error:</td>
<td>as required</td>
<td></td>
</tr>
<tr>
<td>Max. setpoint:</td>
<td>as required</td>
<td></td>
</tr>
<tr>
<td>Min. setpoint:</td>
<td>as required</td>
<td></td>
</tr>
<tr>
<td>Controller type:</td>
<td>OFF</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Switching output 1</strong></th>
<th><strong>Switching output 2</strong></th>
<th><strong>Analog output 1</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Function:</td>
<td>controller 1</td>
<td>Signal selector:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>main variable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Signal type:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 - 20 mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scaling start:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.00 mS/cm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scaling end:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.00 mS/cm</td>
</tr>
</tbody>
</table>
8 Calibrating inductive conductivity cells

8.1 Notes

During calibration, relays and analog output signals adopt their configured states!

The sensors connected to the device should be cleaned and the device itself calibrated, at regular intervals (subject to the medium).

8.2 General

The device provides three calibration options for adapting the JUMO AQUIS 500 Ci to the sensor and the medium:

- Calibration of the relative cell constants; this is a one-point calibration, See section 8.3 "Calibrating the relative cell constant", page 49.

- Calibration of a linear temperature coefficient; this is a two-point calibration, See section 8.4 "Calibrating the temperature coefficient of the measurement solution", page 51.

- Calibration of a non-linear temperature coefficient. The temperature coefficient is calibrated at six points here, See section 8.4 "Calibrating the temperature coefficient of the measurement solution", page 51.

Calibration can be started as follows:

- By pressing the CAL key, if this has been enabled in ADMINISTR. LEVEL / PASSWORD / CALIB. ENABLE.

- via ADMINISTR. LEVEL / PASSWORD / CALIB. LEVEL.

- via CALIB. LEVEL, if this has been enabled in ADMINISTR. LEVEL / PASSWORD / CALIB. ENABLE.

During calibration, the active component of the inductive conductivity sensor must not be allowed to touch the floor or the wall of the vessel (comply with the minimum distance as per the inductive sensor operating instructions).
8 Calibrating inductive conductivity cells

8.3 Calibrating the relative cell constant

When there is an increased demand for accuracy, the cell constant first has to be calibrated.

**Requirement**

- The JUMO AQUIS 500 Ci must be supplied with voltage. See section 5 "Electrical connection", page 16 ff.
- A conductivity sensor must be connected.
- The configuration of the basic settings must be as follows:
  - SIGNAL TYPE relevant to the connected transmitter
  - OPERATING MODE "CONDUCTIVITY"
  - UNIT mS/cm or µS/cm
  - DECIMAL POINT as required
  - SCALING START ¹
  - SCALING END ¹
- Calibration must be enabled, See section 6.10 "Administrator level", page 35.
- The transmitter is in "measuring mode".

![Calibration Step](calibration-step)

MEASURING 1937 µS/cm

The measurement solution must maintain a constant temperature during calibration!

✱ Press the CAL key or
  select the calibration level (CALIB. LEVEL) or
  at Administrator level (password required), select the calibration level.

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

![Linear Temp. Co. Setup](linear-temp-co-setup)

LINEAR TEMP. CO. >
TEMP. COEF. CURVE >
REL. CELL CONSTANT >

✱ Select REL. CELL CONSTANT;
✱ Press the POS key.
8 Calibrating inductive conductivity cells

- When the measurement value is steady, press the key; the displayed conductivity measurement flashes.

- Use the or keys to set the value to the actual conductivity.

- Press the key; the relative cell constant determined by the device is displayed (as a %).

- Use the key to accept the temperature coefficient or the key to reject it.

The current measurement value and the temperature are displayed.
8 Calibrating inductive conductivity cells

8.4 Calibrating the temperature coefficient of the measurement solution

8.4.1 Linear temperature coefficient

The conductivity of each measurement solution changes in accordance with its specific temperature coefficient. We therefore recommend that you run a temperature coefficient calibration.

**Requirement**
- The JUMO AQUIS 500 Ci must be supplied with voltage. See section 5 "Electrical connection", page 16 ff.
- A conductivity sensor must be connected.
- A temperature sensor must be connected.
- The configuration of the basic settings must be as follows:
  - SIGNAL TYPE relevant to the connected transmitter
  - OPERATING MODE "CONDUCTIVITY"
  - UNIT mS/cm or µS/cm
  - DECIMAL POINT as required
  - SCALING START
  - SCALING END
- Calibration must be enabled, See section 6.10 "Administrator level", page 35.
- The transmitter is in "measuring mode".

✱ Immerse the conductivity sensor in a sample of the measurement solution.
✱ Press the key or select the calibration level (CALIB. LEVEL) or at Administrator level (password required), select the calibration level.
✱ Select "LINEAR TEMP. CO.".

```
MEASURING 404
24.3°C µS/cm
```
8 Calibrating inductive conductivity cells

The displayed current sensor temperature flashes (1).
✱ Enter the required working temperature and confirm your entry.

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

The LC display now shows the chosen working temperature (flashing) (2).
✱ Press the key.

The conductivity (399 µS/cm) at the current temperature (24.3°C) now appears on the right of the LC display.
The temperatures T1 (25°C) and T2 (70.0°C) that have yet to be triggered, are shown on the left.
✱ Press the key.
✱ Heat the medium until the working temperature is reached.

During calibration, the rate of temperature change in the measurement solution must not exceed 10 °C/min.

Calibration is also possible in the cooling process (with a falling temperature). It starts above the working temperature and ends below the reference temperature.
8 Calibrating inductive conductivity cells

As soon as the temperature of the medium exceeds T1 (25°C), this is hidden on the display. The uncompensated conductivity at the current temperature is displayed on the right.

<table>
<thead>
<tr>
<th>CALIB</th>
<th>800</th>
</tr>
</thead>
<tbody>
<tr>
<td>T2</td>
<td>73.0°C</td>
</tr>
<tr>
<td></td>
<td>74.3°C</td>
</tr>
</tbody>
</table>

If the temperature of the medium exceeded T2 (73.0°C), the device determines the temperature coefficient.

The LC display now shows the determined temperature coefficient as %/°C.

<table>
<thead>
<tr>
<th>CALIB</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEMP. COEF. 1.99 %</td>
</tr>
</tbody>
</table>

* Use the key to accept the temperature coefficient or the key to reject it.

<table>
<thead>
<tr>
<th>MEASURING</th>
</tr>
</thead>
<tbody>
<tr>
<td>405</td>
</tr>
<tr>
<td>74.2°C</td>
</tr>
</tbody>
</table>

The transmitter is in "measuring mode" and displays the compensated conductivity of the solution.
8 Calibrating inductive conductivity cells

8.4.2 Non-linear temperature coefficient (TEMP. COEF. CURVE)

The non-linear temperature coefficient can only be calibrated with a rising temperature!
The start temperature must be below the configured reference temperature (usually 25°C)!
The "Temp. coef. curve" menu item is only displayed when a temperature sensor is connected: "TEMPERATURE INPUT/ Pt100/Pt1000".

The conductivity of each measurement solution changes in accordance with its specific temperature coefficient.
We therefore recommend that you run a temperature coefficient calibration.

Requirement
- The JUMO AQUIS 500 Ci must be supplied with voltage.
  See section 5 "Electrical connection", page 16 ff.
- A conductivity sensor must be connected.
- A temperature sensor must be connected.
- The configuration of the basic settings must be as follows:
  SIGNAL TYPE relevant to the connected transmitter
  OPERATING MODE "CONDUCTIVITY"
  UNIT mS/cm or µS/cm
  DECIMAL POINT as required
  SCALING START
  SCALING END
- Calibration must be enabled,
  See section 6.10 "Administrator level", page 35.
- The transmitter is in "measuring mode".

✱ Immerse the conductivity sensor in a sample of the measurement solution.
✱ Press the key or
  select the calibration level (CALIB. LEVEL) or
  at Administrator level (password required), select the calibration level.

* MEASURING 404
  24.3°C  µS/cm

* LINEAR TEMP. CO.
  TEMP. COEF. CURVE
  REL. CELL CONSTANT

54
8 Calibrating inductive conductivity cells

✱ Select "TEMP. COEF. CURVE " and press the key.

Enter the required start temperature (1) for the temp. coef. curve.

Enter the required end temperature (2) for the temp. coef. curve.

✱ Enter the required end temperature (2) for the temp. coef. curve.

✱ Heat the medium continuously
(3) the current uncompensated conductivity
(4) the current temperature of the medium
(5) the first target temperature

During calibration, the rate of temperature change in the measurement solution must not exceed 10 °C/min.

During the calibration process, the device displays values for the following five temperature interpolation points.

The LC display now shows the determined temperature coefficients as %/°C.

✱ Use the key to accept the temperature coefficients or the key to reject the calibration result.
8 Calibrating inductive conductivity cells

The transmitter is in "measuring mode" and displays the compensated conductivity of the solution.
8 Calibrating inductive conductivity cells

8.5 Calibration logbook

The results of the last successful calibration are documented in the calibration logbook.

- Relative cell constant (CELL CONST) = 102.9%.
- Temperature coefficient of the sample medium = 2.0%/°C.
- The temperature coefficient was determined at temperatures T1 and T2.

It is not possible to assign a time.
9 Setup program

9.1 Function

Both the setup program and the PC interface cable with USB/TTL converter (70/00456352) are available as options, and provide a convenient way to adapt the JUMO AQUIS Ci to meet requirements:

- Setting the measuring range.
- Setting the response of the outputs to an overrange signal.
- Setting the functions of switching outputs K1 and K2.
- Setting the functions of binary input E1.
- Setting special functions (e.g. operating mode, controller).
- Setting a customized characteristic.
- etc.

Data can only be transferred from or to the transmitter if it is supplied with voltage, See section 5 "Electrical connection", page 16ff.

Connection

(1) JUMO AQUIS 500 Ci
(2) PC interface cable with USB/TTL converter, part no.: 00456352
(3) PC or Notebook
## 10 Eliminating errors and faults

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>No measurement display or current output</td>
<td>There is no power supply</td>
<td>Check the power supply</td>
</tr>
<tr>
<td>Measurement display 0000 or current output 4 mA</td>
<td>Sensor not immersed in medium; level in container too low</td>
<td>Top up the container</td>
</tr>
<tr>
<td></td>
<td>Flow-through fitting is blocked</td>
<td>Clean the flow-through fitting</td>
</tr>
<tr>
<td></td>
<td>Sensor is faulty</td>
<td>Replace the sensor</td>
</tr>
<tr>
<td>Incorrect or fluctuating measurement display</td>
<td>Sensor positioning incorrect</td>
<td>Choose another installation location</td>
</tr>
<tr>
<td></td>
<td>Too little sensor to wall distance</td>
<td>Choose another installation location, Compensation via the &quot;mounting factor&quot; -&gt; PARAMETER LEVEL / CONDUCT. INPUT. / MOUNTING FACTOR</td>
</tr>
<tr>
<td></td>
<td>No mixing</td>
<td>Ensure proper mixing. Make sure sensor is washed all-round</td>
</tr>
<tr>
<td></td>
<td>Air bubbles</td>
<td>Optimize the mounting</td>
</tr>
<tr>
<td>Measurement display 8888, temperature display &quot;ok&quot;, flashing</td>
<td>Overrange</td>
<td>Choose a suitable measuring range</td>
</tr>
<tr>
<td>Measurement display 8888, temperature display 8888 flashing</td>
<td>Temperature is overrange or underrange</td>
<td>Temperature of medium must be within the permitted range. Replace the sensor. Send the device away for repair.</td>
</tr>
<tr>
<td></td>
<td>Temperature probe short-circuit or interruption</td>
<td>Replace sensor and/or cable. Send the device away for repair.</td>
</tr>
<tr>
<td></td>
<td>Broken lead</td>
<td>Replace sensor and/or cable</td>
</tr>
<tr>
<td></td>
<td>No sensor connected</td>
<td>Connect a sensor. Configure the sensor on the device.</td>
</tr>
<tr>
<td></td>
<td>Short-circuit - cable - sensor - terminals</td>
<td>Check cable and connections. Replace sensor.</td>
</tr>
</tbody>
</table>
10 Eliminating errors and faults

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TEMPERATURE INPUT: OVER RANGE</strong></td>
<td>Temperature is too high</td>
<td>Keep to the permitted range</td>
</tr>
<tr>
<td><strong>TEMPERATURE INPUT: UNDER RANGE</strong></td>
<td>Temperature is too low</td>
<td>Keep to the permitted range</td>
</tr>
<tr>
<td><strong>MAIN UAR, INPUT: UNDER RANGE</strong></td>
<td>Input signal is too low</td>
<td>Check the sensor</td>
</tr>
<tr>
<td><strong>MAIN UAR, INPUT: OUT OF RANGE</strong></td>
<td>Concentration is outside the permitted range</td>
<td>Check the concentration</td>
</tr>
<tr>
<td><strong>MAIN UAR, INPUT: OVER RANGE</strong></td>
<td>Input signal is too high</td>
<td>Check the sensor</td>
</tr>
<tr>
<td><strong>COMPENSATION RANGE LEFT</strong></td>
<td>Temperature is lower or higher than the compensation range (e.g. greater than 36°C for natural water)</td>
<td>Check the temperature</td>
</tr>
<tr>
<td><strong>PARAMETER LOCKED</strong></td>
<td>Parameter is not enabled</td>
<td>Enable the parameter at Enable level</td>
</tr>
<tr>
<td><strong>WRONG PASSWORD</strong></td>
<td>Incorrect password</td>
<td>The correct password can be read out with the setup program</td>
</tr>
<tr>
<td><strong>KEYS LOCKED</strong></td>
<td>Key lock has been activated through the binary input</td>
<td>Override binary input activation</td>
</tr>
</tbody>
</table>
## 11 Technical data

### 11.1 Main input conductivity

| Measuring range | 0000 - 9999 µS/cm  
|                 | 0.000 - 9.999 mS/cm  
|                 | 0.00 - 99.99 mS/cm  
|                 | 0.0 - 999.9 mS/cm  
|                 | 0 - 2000 mS/cm  |

#### Accuracy

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>Accuracy</th>
</tr>
</thead>
</table>
| 0.000 - 1.000 mS/cm | 1.5% of span  
| 1.01 - 500 mS/cm | 1% of span  
| 501 - 2000 mS/cm | 1.5% of span  |

#### Operating mode

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>Operating mode</th>
</tr>
</thead>
</table>
| NaOH caustic solution | Concentration measurement  
| Range 1: | 0 - 12 % by weight (0 - 90°C)  
| Range 2: | 20 - 50 % by weight (0 - 90°C)  
| HNO3 nitric acid | Range 1: | 0 - 25 % by weight (0 - 80°C)  
| Range 2: | 36 - 82 % by weight (0 - 80°C)  
| H2SO4 sulphuric acid | Range 1: | 0 - 28 % by weight (0 - 90°C)  
| Range 2: | 36 - 85 % by weight (0 - 90°C)  
| Range 3: | 92 - 99 % by weight (0 - 90°C)  
| HCL hydrochloric acid | Range 1: | 0 - 18 % by weight (0 - 65°C)  
| Range 2: | 22 - 44 % by weight (0 - 65°C)  |

#### Customized table

The temperature compensated conductivity is converted to a new display value with a table. The table can contain as many as 20 value pairs.

The display unit can also be adapted.

Process sequence:
Uncompensated conductivity > Temperature compensation > Linearization with table > Display value.

---

[1] Effect of temperature on the JUMO AQUIS 500 Ci with inductivity conductivity probe JUMO tecLINE Ci. Variation from 22°C relative to the final output signal value 0(4) - 20 mA and 0 -10 V.

### 11.2 Secondary input temperature

<table>
<thead>
<tr>
<th>Pt100 (automatic detection)</th>
<th>Measuring range</th>
<th>-50 to 250°C</th>
</tr>
</thead>
</table>
| Accuracy                    | ± 0,5_K (up to 100 °C); ± 0,8_K (as of 100 °C)  
| Ambient temperature error   | 0,05 %/10°C  |

<table>
<thead>
<tr>
<th>Pt1000 (automatic detection)</th>
<th>Measuring range</th>
<th>-50 ... 250°C</th>
</tr>
</thead>
</table>
| Accuracy                      | ± 0,5_K (up to 100 °C); ± 1,0_K (as of 100 °C)  
| Ambient temperature error     | 0,05 %/10K  |
## 11 Technical data

### NTC / PTC

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>max. 4 kΩ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input of a table with up to 20 value pairs via the setup program</td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td>≤ 0.3°C (subject to the interpolation points)</td>
</tr>
<tr>
<td>Ambient temperature error</td>
<td>0.05 %/10°C</td>
</tr>
</tbody>
</table>

### 11.3 Temperature compensation

#### Linear

<table>
<thead>
<tr>
<th>TC (α) setting range</th>
<th>0 - 5.5 %/°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature range</td>
<td>0(-10) to 100°C</td>
</tr>
</tbody>
</table>

#### Natural water (ISO 7888)

<table>
<thead>
<tr>
<th>TC (α) setting range</th>
<th>not applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature range</td>
<td>0 to 36°C</td>
</tr>
</tbody>
</table>

#### Reference temperature

<table>
<thead>
<tr>
<th>Adjustable: 15 - 30°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preset to 25°C (default)</td>
</tr>
</tbody>
</table>

### 11.4 Measuring circuit monitoring

#### Conductivity input

<table>
<thead>
<tr>
<th>Overrange/underrange</th>
<th>yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-circuit</td>
<td>Subject to measuring range</td>
</tr>
<tr>
<td>Broken lead</td>
<td>Subject to measuring range</td>
</tr>
</tbody>
</table>

#### Temperature input

<table>
<thead>
<tr>
<th>Overrange/underrange</th>
<th>yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-circuit</td>
<td>yes</td>
</tr>
</tbody>
</table>

### 11.5 Cell constant

<table>
<thead>
<tr>
<th>Adjustment range 1</th>
<th>4 to 6 [1/cm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjustment range 2</td>
<td>6 to 8 [1/cm]</td>
</tr>
<tr>
<td>Setting range of the relative cell constant</td>
<td>80 - 120%</td>
</tr>
<tr>
<td>Mounting factor</td>
<td>80 - 120%</td>
</tr>
</tbody>
</table>

### 11.6 Binary input

<table>
<thead>
<tr>
<th>Activation</th>
<th>by floating contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>key lock, HOLD, alarm suppression</td>
</tr>
</tbody>
</table>
### 11 Technical data

#### 11.7 Controller

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Controller type</strong></td>
<td>alarm functions, limit controller, pulse width controller, pulse frequency controller, modulating controller, continuous controller</td>
</tr>
<tr>
<td><strong>Controller structure</strong></td>
<td>P / PI / PD / PID</td>
</tr>
<tr>
<td><strong>A/D converter</strong></td>
<td>dynamic resolution up to 14 bits</td>
</tr>
<tr>
<td><strong>Sampling time</strong></td>
<td>500 ms</td>
</tr>
</tbody>
</table>

**Switching outputs (max. two (SPDT) changeovers)**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated load</strong></td>
<td>3 A / 250 VAC (resistive load)</td>
</tr>
<tr>
<td><strong>Contact life</strong></td>
<td>&gt;2 x 10⁵ operations at rated load</td>
</tr>
</tbody>
</table>

#### 11.8 Setup interface

Interface for configuring the device with the available setup program option (for device configuration only).

#### 11.9 Electrical data

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power supply</strong></td>
<td>110 - 240 V AC; -15/+10%; 48 - 63 Hz</td>
</tr>
<tr>
<td></td>
<td>20 - 30 V AC/DC; 48 - 63 Hz</td>
</tr>
<tr>
<td></td>
<td>12 - 24 V DC +/-15% (permissible only for connection to SELV/PELV circuits)</td>
</tr>
<tr>
<td><strong>Power consumption</strong></td>
<td>approx. 14 VA</td>
</tr>
<tr>
<td><strong>Electrical safety</strong></td>
<td>to EN 61 010, Part 1, overvoltage category III¹, pollution degree 2</td>
</tr>
<tr>
<td><strong>Data backup</strong></td>
<td>EEPROM</td>
</tr>
<tr>
<td><strong>Electrical connection</strong></td>
<td></td>
</tr>
<tr>
<td>Power supply, relay outputs,</td>
<td></td>
</tr>
<tr>
<td>sensor inputs</td>
<td></td>
</tr>
<tr>
<td>Analog outputs</td>
<td></td>
</tr>
<tr>
<td>Inductive conductivity sensor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pluggable screw terminals for max. conductor cross-section</td>
</tr>
<tr>
<td></td>
<td>2.5 mm²</td>
</tr>
<tr>
<td></td>
<td>Pluggable screw terminals, max. conductor cross-section</td>
</tr>
<tr>
<td></td>
<td>1.5 mm²</td>
</tr>
<tr>
<td></td>
<td>M12 connection</td>
</tr>
</tbody>
</table>

¹ Not valid for power supply 30, 12 - 24 V DC.

#### 11.10 Display

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Graphic LC display</strong></td>
<td>120 x 32 pixels</td>
</tr>
<tr>
<td><strong>Backlighting</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Programmable:</td>
</tr>
<tr>
<td></td>
<td>- off</td>
</tr>
<tr>
<td></td>
<td>- on for 60 seconds during operation</td>
</tr>
</tbody>
</table>

#### 11.11 Housing

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material</strong></td>
<td>ABS</td>
</tr>
<tr>
<td><strong>Cable entry</strong></td>
<td>Cable glands, max. 3 x M16 and 2 x M12</td>
</tr>
<tr>
<td><strong>Feature</strong></td>
<td>Ventilation element to prevent condensation</td>
</tr>
</tbody>
</table>
11 Technical data

<table>
<thead>
<tr>
<th>Property</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature range</td>
<td>-10 to 50°C</td>
</tr>
<tr>
<td>(the specified accuracy is adhered to in this range)</td>
<td></td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-15 to 65°C</td>
</tr>
<tr>
<td>(device operational)</td>
<td></td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>-30 to 70°C</td>
</tr>
<tr>
<td>Climatic rating</td>
<td>rel. humidity ≤ 90% annual mean, no compensation (based on EN 60721 3-3 3K3)</td>
</tr>
<tr>
<td>Enclosure protection to EN 60529</td>
<td>surface-mounted wall housing: IP67</td>
</tr>
<tr>
<td></td>
<td>control cabinet mounting: at front IP65, at rear IP20</td>
</tr>
<tr>
<td>Vibration resistant to EN 60068-2-6</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>surface-mounted wall housing: approx. 900 g</td>
</tr>
<tr>
<td></td>
<td>control cabinet mounting: approx. 480 g</td>
</tr>
<tr>
<td>Dimensions</td>
<td>See section 4.2 &quot;Surface mounting the transmitter&quot;, page 11</td>
</tr>
</tbody>
</table>

11.12 Analog outputs (max. 2)

<table>
<thead>
<tr>
<th>Output type</th>
<th>Signal range</th>
<th>Accuracy</th>
<th>Temperature error</th>
<th>Permissible load resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current signal</td>
<td>0/4 - 20 mA</td>
<td>≤ 0.25%</td>
<td>0.08%/10 °C</td>
<td>≤ 500 Ω</td>
</tr>
<tr>
<td>Voltage signal</td>
<td>0 - 10 V</td>
<td>≤ 0.25%</td>
<td>0.08%/10 °C</td>
<td>≥ 500 Ω</td>
</tr>
</tbody>
</table>

Analog outputs respond in accordance with NAMUR recommendation NE43.
Analog outputs are electrically isolated, 30 V AC / 50 V DC.

11.13 Approvals/marks of conformity

<table>
<thead>
<tr>
<th>Mark of conformity</th>
<th>Testing laboratory</th>
<th>Certificates/certification numbers</th>
<th>Test basis</th>
<th>valid for</th>
</tr>
</thead>
<tbody>
<tr>
<td>c UL us</td>
<td>Underwriters Laboratories</td>
<td>E 201387</td>
<td>UL 61010-1</td>
<td>all types</td>
</tr>
</tbody>
</table>
12.1 Operator level parameters

When there are numerous device parameters to configure, it is advisable to make a note in the table below of all the parameters to be changed and to work through these parameters in the given order.

The following list shows the maximum number of parameters that can be modified.

Some of these parameters will not be visible (and therefore not editable) for your particular device, depending on the configuration.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Selection / value range</th>
<th>New setting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conductivity input</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature coefficient</td>
<td>0 - 2.2 - 5.5%/°C</td>
<td></td>
</tr>
<tr>
<td>Relative cell constant</td>
<td>80 - 100 - 120%</td>
<td></td>
</tr>
<tr>
<td>Mounting factor</td>
<td>80 - 100 - 120%</td>
<td></td>
</tr>
<tr>
<td>Zero point</td>
<td>Conductivity: -20 to 0 to +20% of range</td>
<td></td>
</tr>
<tr>
<td>Decimal point</td>
<td>XXXX</td>
<td>XXX.x</td>
</tr>
<tr>
<td></td>
<td>XX.xx</td>
<td>X.xxx</td>
</tr>
<tr>
<td><strong>Compensation type</strong></td>
<td>Conductivity measurement operating mode</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Linear</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Temp. coef. curve</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Natural water</td>
<td></td>
</tr>
<tr>
<td>Concentration measurement operating mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- NaOH  0 - 12 % by weight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- NaOH  20 - 50 % by weight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- HNO3  0 - 25 % by weight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- HNO3  36 - 82 % by weight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- H2SO4  0 - 28 % by weight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- H2SO4  36 - 85 % by weight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- H2SO4  92 - 99 % by weight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- HCl  0 - 18 % by weight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- HCl  22 - 44 % by weight</td>
<td></td>
</tr>
<tr>
<td>Reference temperature</td>
<td>15.0 - 25.0 - 30.0°C</td>
<td></td>
</tr>
<tr>
<td>Filter time constant</td>
<td>0 to 25 s</td>
<td></td>
</tr>
<tr>
<td>Calibration interval</td>
<td>0 - 999 days (0 = off)</td>
<td></td>
</tr>
<tr>
<td><strong>Temperature input</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensor type</td>
<td>Pt100/Pt1000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Customized</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manual temperature entry</td>
<td></td>
</tr>
<tr>
<td>Unit</td>
<td>°C</td>
<td>°F</td>
</tr>
<tr>
<td>Filter time constant</td>
<td>0 - 2 - 25 s</td>
<td></td>
</tr>
<tr>
<td>Manual temperature entry</td>
<td>-50.0 to 25.0 to 250.0°C</td>
<td></td>
</tr>
<tr>
<td>Offset</td>
<td>-20.0 to 0.0 .to +20.0°C</td>
<td></td>
</tr>
<tr>
<td><strong>Binary input</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Parameter Selection / value range

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Selection / value range</th>
<th>New setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>No function</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Key lock</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hold mode</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hold mode inverse</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alarm stop (for controller only)</td>
<td></td>
</tr>
<tr>
<td>Controller channel 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controller type</td>
<td>No function</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Limit controller</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pulse frequency output</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pulse width output</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Continuous controller</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Modulating controller</td>
<td></td>
</tr>
<tr>
<td>Setpoint</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>According to device variant</td>
<td></td>
</tr>
<tr>
<td>Second setpoint (modulating controller at controller 1 only)</td>
<td>According to device variant</td>
<td></td>
</tr>
<tr>
<td>Min. / max. contact</td>
<td>Min. contact</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Max. contact</td>
<td></td>
</tr>
<tr>
<td>Proportional band</td>
<td>0 - 9999 (configurable decimal places)</td>
<td></td>
</tr>
<tr>
<td>Reset time</td>
<td>0 - 9999</td>
<td></td>
</tr>
<tr>
<td>Derivative time</td>
<td>0 - 9999</td>
<td></td>
</tr>
<tr>
<td>Pulse period</td>
<td>2.5 - 20 - 999.5</td>
<td></td>
</tr>
<tr>
<td>Actuator stroke time</td>
<td>15 - 60 - 3000 s</td>
<td></td>
</tr>
<tr>
<td>(modulating controller at controller 1 only)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hysteresis (of limit controller)</td>
<td>0 - 200 - 9999 (configurable decimal places)</td>
<td></td>
</tr>
<tr>
<td>Minimum ON time</td>
<td>0.5 - 999.5</td>
<td></td>
</tr>
<tr>
<td>Maximum pulse frequency</td>
<td>0 - 60 1/min.</td>
<td></td>
</tr>
<tr>
<td>Output level limit</td>
<td>0 - 100%</td>
<td></td>
</tr>
<tr>
<td>Pull-in delay</td>
<td>0.00 - 999.5 s</td>
<td></td>
</tr>
<tr>
<td>Drop-out delay</td>
<td>0.00 - 999.5 s</td>
<td></td>
</tr>
<tr>
<td>Limit controller</td>
<td>Off</td>
<td></td>
</tr>
<tr>
<td>monitoring</td>
<td>On</td>
<td></td>
</tr>
<tr>
<td>Alarm tolerance</td>
<td>0 - end of range</td>
<td></td>
</tr>
<tr>
<td>Alarm delay</td>
<td>0 - 9999 s</td>
<td></td>
</tr>
<tr>
<td>Response during Hold</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frozen</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hold value</td>
<td></td>
</tr>
<tr>
<td>Hold value</td>
<td>0 - 100%</td>
<td></td>
</tr>
<tr>
<td>Response on error</td>
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</tr>
<tr>
<td></td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frozen</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hold value</td>
<td></td>
</tr>
<tr>
<td>Min. setpoint limit</td>
<td>0 - 9999 (configurable decimal places)</td>
<td></td>
</tr>
<tr>
<td>Max. setpoint limit</td>
<td>0 - 9999 (configurable decimal places)</td>
<td></td>
</tr>
<tr>
<td>Parameter</td>
<td>Selection / value range</td>
<td>New setting</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>Controller channel 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controller type</td>
<td>No function</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Limit controller</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pulse frequency output</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pulse width output</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Continuous controller</td>
<td></td>
</tr>
<tr>
<td>Setpoint</td>
<td>According to device variant</td>
<td></td>
</tr>
<tr>
<td>Second setpoint</td>
<td>According to device variant</td>
<td></td>
</tr>
<tr>
<td>(modulating controller at controller 1 only)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Min. / max. contact</td>
<td>Min. contact Max. contact</td>
<td></td>
</tr>
<tr>
<td>Proportional band</td>
<td>0 - 9999 (configurable decimal places)</td>
<td></td>
</tr>
<tr>
<td>Reset time</td>
<td>0 - 9999</td>
<td></td>
</tr>
<tr>
<td>Derivative time</td>
<td>0 - 9999</td>
<td></td>
</tr>
<tr>
<td>Pulse period</td>
<td>2.5 - 20 - 999.5</td>
<td></td>
</tr>
<tr>
<td>Actuator stroke time</td>
<td>15 - 60 - 3000 s</td>
<td></td>
</tr>
<tr>
<td>Hysteresis</td>
<td>0 - 200 - 9999 (configurable decimal places)</td>
<td></td>
</tr>
<tr>
<td>(of limit controller)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum ON time</td>
<td>0.5 - 999.5</td>
<td></td>
</tr>
<tr>
<td>Maximum pulse frequency</td>
<td>0 - 60 1/min.</td>
<td></td>
</tr>
<tr>
<td>Output level limit</td>
<td>0 - 100%</td>
<td></td>
</tr>
<tr>
<td>Pull-in delay</td>
<td>0.00 - 999.5 s</td>
<td></td>
</tr>
<tr>
<td>Drop-out delay</td>
<td>0.00 - 999.5 s</td>
<td></td>
</tr>
<tr>
<td>Limit controller monitoring</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>Alarm tolerance</td>
<td>0 - end of range</td>
<td></td>
</tr>
<tr>
<td>Alarm delay</td>
<td>0 - 9999 s</td>
<td></td>
</tr>
<tr>
<td>Response during Hold</td>
<td>0%</td>
<td>100 Frozen Hold value</td>
</tr>
<tr>
<td>Hold value</td>
<td>0 - 100%</td>
<td></td>
</tr>
<tr>
<td>Response on error</td>
<td>0%</td>
<td>100% Frozen Hold value</td>
</tr>
<tr>
<td>Min. setpoint limit</td>
<td>0 - 9999 (configurable decimal places)</td>
<td></td>
</tr>
<tr>
<td>Max. setpoint limit</td>
<td>0 - 9999 (configurable decimal places)</td>
<td></td>
</tr>
<tr>
<td><strong>Controller special functions</strong></td>
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<td></td>
</tr>
<tr>
<td>Manual mode</td>
<td>Manual mode not allowed Pulsed Switched</td>
<td></td>
</tr>
<tr>
<td>Separate controllers</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>I-component switch-off</td>
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<td>No</td>
</tr>
</tbody>
</table>
### 12 Appendix

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Selection / value range</th>
<th>New setting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Switching output 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Function</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Controller output 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Controller output 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Controller alarm 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Controller alarm 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AF1 main variable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AF2 main variable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AF7 main variable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AF8 main variable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AF1 temperature</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AF2 temperature</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AF7 temperature</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AF8 temperature</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Range or sensor error</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Calibration timer expired</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wash timer</td>
<td></td>
</tr>
<tr>
<td>Switching point</td>
<td>0 - 9999</td>
<td></td>
</tr>
<tr>
<td>Interval to switching point</td>
<td>0 - 50% of range or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 - 150°C</td>
<td></td>
</tr>
<tr>
<td>Window width at AF1 / AF2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hysteresis</td>
<td>0 - 100% of range or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-50 to +250</td>
<td></td>
</tr>
<tr>
<td>Switch-on delay</td>
<td>00:00:00 - 01:00:00 H:M:S</td>
<td></td>
</tr>
<tr>
<td>Switch-off delay</td>
<td>00:00:00 - 01:00:00 H:M:S</td>
<td></td>
</tr>
<tr>
<td>Pulse time(^1)</td>
<td>00:00:00 - 01:00:00 H:M:S</td>
<td></td>
</tr>
<tr>
<td>During calibration</td>
<td>Inactive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Active</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Status maintained</td>
<td></td>
</tr>
<tr>
<td>On error</td>
<td>Inactive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Active</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Status maintained</td>
<td></td>
</tr>
<tr>
<td>In Hold mode</td>
<td>Inactive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Active</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Status maintained</td>
<td></td>
</tr>
<tr>
<td>Manual mode</td>
<td>No simulation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inactive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Active</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) Drop-out delay is automatically deactivated when pulse times are greater than 0 seconds.
### Switching output 2

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Selection / value range</th>
<th>New setting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No function</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controller output 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controller output 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controller alarm 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controller alarm 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AF1 main variable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AF2 main variable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AF7 main variable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AF8 main variable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AF1 temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AF2 temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AF7 temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AF8 temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range or sensor error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calibration timer expired</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wash timer</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Switching point</strong></td>
<td>0 - 9999</td>
<td></td>
</tr>
<tr>
<td><strong>Interval to switching point</strong></td>
<td>0 - 50% of range or</td>
<td></td>
</tr>
<tr>
<td><strong>Window width at AF1 / AF2</strong></td>
<td>0 - 150°C</td>
<td></td>
</tr>
<tr>
<td><strong>Hysteresis</strong></td>
<td>0 - 100% of range or</td>
<td></td>
</tr>
<tr>
<td><strong>Switch-on delay</strong></td>
<td>00:00:00 - 01:00:00 H:M:S</td>
<td></td>
</tr>
<tr>
<td><strong>Switch-off delay</strong></td>
<td>00:00:00 - 01:00:00 H:M:S</td>
<td></td>
</tr>
<tr>
<td><strong>Pulse time</strong></td>
<td>00:00:00 - 01:00:00 H:M:S</td>
<td></td>
</tr>
<tr>
<td><strong>During calibration</strong></td>
<td>Inactive</td>
<td></td>
</tr>
<tr>
<td><strong>On error</strong></td>
<td>Inactive</td>
<td></td>
</tr>
<tr>
<td><strong>In Hold mode</strong></td>
<td>Inactive</td>
<td></td>
</tr>
<tr>
<td><strong>Manual mode</strong></td>
<td>No simulation</td>
<td></td>
</tr>
</tbody>
</table>

1. Drop-out delay is automatically deactivated when pulse times are greater than 0 seconds.
## 12 Appendix

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Selection / value range</th>
<th>New setting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Analog output 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal selector</td>
<td>Actual value of main variable / Temperature</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Continuous controller output 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Continuous controller output 2</td>
<td></td>
</tr>
<tr>
<td>Signal type</td>
<td>0 - 10 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 - 20 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 - 20 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 - 0 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 - 0 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 - 4 mA</td>
<td></td>
</tr>
<tr>
<td>Scaling start of main variable</td>
<td>Dependent on measurement variable and measuring range</td>
<td></td>
</tr>
<tr>
<td>Scaling end of main variable</td>
<td>Dependent on measurement variable and measuring range</td>
<td></td>
</tr>
<tr>
<td>Response during calibration</td>
<td>Moving</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frozen</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Safe value</td>
<td></td>
</tr>
<tr>
<td>Response on error</td>
<td>Low (0 V / 0 mA / 3.4 mA)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High (10.7 V / 22 mA)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frozen</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Safe value</td>
<td></td>
</tr>
<tr>
<td>Response in Hold mode</td>
<td>Low (0 V / 0 mA / 3.4 mA)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High (10.7 V / 22 mA)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frozen</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moving</td>
<td></td>
</tr>
<tr>
<td>Safe value</td>
<td>0 - 10.7 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 - 22 mA</td>
<td></td>
</tr>
<tr>
<td>Simulation</td>
<td>Off</td>
<td></td>
</tr>
<tr>
<td></td>
<td>On</td>
<td></td>
</tr>
<tr>
<td>Simulation value</td>
<td>0 - 10.7 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 - 22 mA</td>
<td></td>
</tr>
<tr>
<td><strong>Analog output 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal selector</td>
<td>Actual value of main variable / Temperature</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Continuous controller output 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Continuous controller output 2</td>
<td></td>
</tr>
<tr>
<td>Signal type</td>
<td>0 - 10 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 - 20 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 - 20 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 - 0 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 - 0 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 - 4 mA</td>
<td></td>
</tr>
<tr>
<td>Scaling start of main variable</td>
<td>Dependent on measurement variable and measuring range</td>
<td></td>
</tr>
<tr>
<td>Scaling end of main variable</td>
<td>Dependent on measurement variable and measuring range</td>
<td></td>
</tr>
<tr>
<td>Response during calibration</td>
<td>Moving</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frozen</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Safe value</td>
<td></td>
</tr>
</tbody>
</table>
### Parameter Selection / value range

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Selection / value range</th>
<th>New setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response on error</td>
<td>Low (0 V / 0 mA / 3.4 mA) High (10.7 V / 22 mA) Frozen Safe value</td>
<td></td>
</tr>
<tr>
<td>Response in Hold mode</td>
<td>Low (0 V / 0 mA / 3.4 mA) High (10.7 V / 22 mA) Frozen Safe value Moving</td>
<td></td>
</tr>
<tr>
<td>Safe value</td>
<td>0 - 10.7 V / 0 - 22 mA</td>
<td></td>
</tr>
<tr>
<td>Simulation</td>
<td>Off</td>
<td></td>
</tr>
<tr>
<td>Simulation value</td>
<td>0 - 10.7 V / 0 - 22 mA</td>
<td></td>
</tr>
</tbody>
</table>

### Display

<table>
<thead>
<tr>
<th>Language</th>
<th>German</th>
<th>English</th>
<th>French</th>
<th>Customized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lighting</td>
<td>When operated</td>
<td>Off</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LCD inverse</td>
<td>Off</td>
<td>On</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurement display type</td>
<td>Normal</td>
<td>Trend</td>
<td>Bar graph</td>
<td></td>
</tr>
<tr>
<td>Lower display</td>
<td>Temperature</td>
<td>Output level 1</td>
<td>Output level 2</td>
<td>Setpoint 1</td>
</tr>
<tr>
<td>Upper display</td>
<td>Compensated</td>
<td>Uncompensated</td>
<td>Temperature</td>
<td>Output level 1</td>
</tr>
<tr>
<td>Max. / min. reset</td>
<td>No</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operator timeout</td>
<td>0...1 - 10 min</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contrast</td>
<td>0...5...20</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Wash timer

<table>
<thead>
<tr>
<th>Cycle duration</th>
<th>0 - 240 hours (0 = off)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wash duration</td>
<td>1 - 60 - 1800 seconds</td>
</tr>
</tbody>
</table>
TEMP. COMPENSATION

LINEAR

TEMP. COEF CURVE (non-linear)
NAT. WATER (permissible temperature range 0 - 36°C as per EN 27 888)

FUNCTION

NO FUNCTION
- Alarm window AF1 MAIN VAR.
- Alarm window AF2 MAIN VAR.
- Limit function AF7 MAIN VAR.
- Limit function AF8 MAIN VAR.
- Alarm window AF1 TEMP.
- Alarm window AF2 TEMP.
- Limit function AF7 TEMP.
- Limit function AF8 TEMP.

SENSOR ERROR

CALIB. TIMER

![Diagram of HySt and AF for Alarm window AF1 and AF2, Limit function AF7 and AF8]
**Pulse contact**
Triggering condition longer than pulse duration

<table>
<thead>
<tr>
<th>Pulse contact</th>
<th>Triggering condition shorter than pulse duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>1</td>
</tr>
<tr>
<td>On</td>
<td>0</td>
</tr>
<tr>
<td>Spacing</td>
<td>$t_p$</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>$x$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Off</td>
</tr>
<tr>
<td>1</td>
<td>On</td>
</tr>
<tr>
<td>$t_p$</td>
<td>Pulse duration</td>
</tr>
<tr>
<td>$w$</td>
<td>Setpoint / Limit</td>
</tr>
<tr>
<td>$x$</td>
<td>Actual value / Measurement value</td>
</tr>
</tbody>
</table>

**MEAS. DISPLAY TYPE**

**NORMAL**

**TREND**

**BAR GRAPH**

**NORMAL**

The measurement value, measurement variable and temperature of the medium are shown in normal display.

(1) Operating mode
(2) Lower display (temperature input)
(3) Upper display (analog input measurement value)
TREND

The operator can quickly see the direction in which the measurement is changing.

BAR GRAPH

- The analog input measurement value (main input variable) is displayed as a variable bar.
- The temperature is no longer displayed.
- Setpoints are marked with arrows above the bar graph for devices with configured control contact(s).

Scaling the bar

Activate “BAR GRAPH” as the measurement display type.

Use [▼] to select “BARGR. SCALE START”.

Confirm the selection with [OK].

Use [▼] or [▲] to enter the lower limit of the range to be displayed.

Confirm the selection with [OK].

Use [▼] to select “BARGR. SCALE END”.

Use [▼] or [▲] to enter the upper limit of the range to be displayed.
Confirm the selection with \( \text{CONF} \).

To return to measuring mode:
press the \( \text{EXIT} \) key repeatedly or wait for a "timeout".

**LOWER DISPLAY**

![Display Image]

1. Operating mode
2. Lower display
3. Upper display

The following values can be assigned to the "lower" display (2):
This parameter is only available for the "NORMAL" and "TREND" measurement display types.

**TEMPERATURE**
OUTPUT LEVEL 1
OUTPUT LEVEL 2
SETPOINT 1
SETPOINT 2
NONE
COMPENSATED
UNCOMPENSATED

**UPPER DISPLAY**

The following values can be assigned to the "upper" display (3):

COMPENSATED
UNCOMPENSATED
TEMPERATURE
OUTPUT LEVEL 1
OUTPUT LEVEL 2
SETPOINT 1
SETPOINT 2
NONE

---

**12 Appendix**

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12.2 Glossary

Pulse width controller (output active with $x > w$ and P control structure)

If actual value $x$ exceeds setpoint $W$, the P controller will control in proportion to the control deviation. When the proportional band is exceeded, the controller operates with an output level of 100% (100% clock ratio).

Setpoint $W$

<table>
<thead>
<tr>
<th>Process value $X$</th>
<th>Output level $y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0$</td>
<td>$0%$</td>
</tr>
<tr>
<td>$X - W$</td>
<td>$10% - 90%$</td>
</tr>
<tr>
<td>$X_p$</td>
<td>$90%$</td>
</tr>
<tr>
<td>$1$</td>
<td>$100%$</td>
</tr>
</tbody>
</table>

Switching period

Pulse frequency controller (output active with $x > w$ and P control structure)

If actual value $x$ exceeds setpoint $W$, the P controller will control in proportion to the control deviation. When the proportional band is exceeded, the controller operates with an output level of 100% (maximum switching frequency).

Setpoint $W$

<table>
<thead>
<tr>
<th>Process value $X$</th>
<th>Output level $y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0$</td>
<td>$0%$</td>
</tr>
<tr>
<td>$X - W$</td>
<td>$10% - 90%$</td>
</tr>
<tr>
<td>$X_p$</td>
<td>$90%$</td>
</tr>
<tr>
<td>$1$</td>
<td>$100%$</td>
</tr>
</tbody>
</table>

Maximum pulse frequency

50% of pulse frequency

No pulses

Calibration timer

The calibration timer indicates (on request) a required routine calibration. The calibration timer is activated by entering the number of days that must expire before there is a scheduled re-calibration (specified by the system or the operator).
The device can calculate the concentration of different mediums from the current measurement values of uncompensated conductivity and temperature.

Choice of concentration calculations:

**NaOH (caustic soda)**
- Range 1: 0 - 12 % by weight (0 - 90°C)
- Range 2: 20 - 50 % by weight (10 - 90°C)

**HNO₃ (nitric acid)**
- Range 1: 0 - 25 % by weight (0 - 50°C)
- Range 2: 36 - 82 % by weight (0 - 50°C)

**H₂SO₄ (sulphuric acid)**
- Range 1: 0 - 28 % by weight (0 - 100°C)
- Range 2: 36 - 85 % by weight (0 - 100°C)
- Range 3: 92 - 99 % by weight (0 - 100°C)

**HCl (hydrochloric acid)**
- Range 1: 0 - 12 % by weight (10 - 50°C)
- Range 2: 22 - 44 % by weight (0 - 50°C)

**Customized characteristic**
In this mode, the device can model a monotonically increasing input variable to any output value.
The optional setup program is used to enter the requisite value table.

### Customized table
In this mode, the input value can be displayed in accordance with a table (max. 20 value pairs). With this function, non-linear input variables can be displayed and linearized. Values can only be entered in the table using the optional setup program.

### Max./min. value memory
This memory records the minimum and maximum input quantities that occur. This information can be used, for example, to assess whether the design of the connected sensor is suitable for the values that actually occur.

The max./min. value memory can be reset: Operator level / Display / Max./min. value memory / Yes,

See "Operator level parameters" page 65ff.

### Conductivity temperature compensation
The conductivity of a measurement solution is temperature-dependent (the conductivity of a solution rises as the temperature increases). The dependency of conductivity and temperature describes the **temperature coefficient** of the measurement solution. As conductivity is not always measured for the reference temperature, automatic temperature compensation is integrated in this device. The transmitter uses the temperature coefficient to calculate the conductivity that would exist for a reference temperature from the current conductivity and the current temperature. This is then displayed. This process is called temperature compensation. Modern transmitters offer different ways to perform this temperature compensation.

- **Linear compensation** (constant temperature coefficient).
  This type of compensation can be applied to many kinds of normal water, with acceptable accuracy. The temperature coefficient used is then approx. 2.2%/°C

- **See below for non-linear compensation.**

- **Natural water (EN27888 or ISO 7888).**
  In this case, so-called non-linear temperature compensation is used. According to the standard cited above, the relevant type of compensation can be applied to natural groundwater, spring water and surface water. The definition range for the water temperature looks like this $0°C \leq T < 36°C$. 

---

![Table Image](https://via.placeholder.com/150)
Determining the temp. coef. curve

Calculating a temperature coefficient

\[ \alpha = \frac{\gamma - \gamma_{\text{Reference}}}{T_1 - T_{\text{Reference}}} \times 100 \]

\( \alpha = \) temperature coefficient (TC)

\( \gamma = \) uncompensated measurement value

Temp. coef. curve
The relevant temperature coefficient is determined from the temp. coef. curve by means of the current temperature of the medium.

Intermediate values, such as \( \alpha_x \) at \( T_x \) between the two ascertained values \( \alpha_3 \) at \( T_3 \) and \( \alpha_4 \) at \( T_4 \) are linearly approximated.

As with linear temperature compensation, the compensated measurement value is calculated with the ascertained TC.

If the measured temperature is lower than the temperature at the beginning, the first TC is used for compensation.

If the measured temperature is higher than the temperature at the end, the last TC is used for compensation.

\[
\gamma_{(\text{comp})} = \frac{\gamma_{(\text{mess})}}{1 + \frac{\alpha_x}{100} \times (T_x - T_{\text{Ref}})}
\]

The temp. coef. curve is automatically applied in a temperature range specified by the user. The temperature range from beginning to end is divided into 5 segments of equal size.

The temperature range must be greater than 20 Kelvin and must overlap the reference temperature.

**Example:** Reference temperature 25°C, temperature at beginning 18°C and temperature at end 50°C.

The following functions can be activated in this menu:

- **Manual mode** (activate controller outputs manually), See section 6.7 "MANUAL mode / simulation mode", page 30
- Separate controllers (see below)
- I-component switch-off (see below)

This function is normally deactivated (factory setting or "No" selection).

In the deactivated state, the software stops the two controller outputs being able to work "against each other". So, for example, it is not possible to dose acid and lye at the same time.

If the controllers are separate ("yes" selection), each controller can be freely configured.

This function is normally deactivated (factory setting or "No" selection).

In the deactivated state, the controller works in accordance with general controller theory.

When I-component switch-off is activated ("yes" selection), the part of the output level that can be traced back to the I-component is set to zero when the setpoint is reached.

This can be beneficial with mutual neutralization (acid and lye dosing both possible) in one medication tank.
Wash timer

Automated sensor cleaning can be implemented with the wash timer. This function is assigned to a switching output (1 or 2) for this purpose.

The cycle duration (cleaning interval) can be set in the range from 1 to 240 hours. The wash duration (cleaning duration) is adjustable from 1 to 1800 seconds. For the duration of the wash, the controller is in the HOLD state, which lasts a further 10 seconds after the wash duration is over. A sensor calibration within the cycle duration restarts the wash timer.

The wash timer is deactivated with cycle duration "0".
12.3 Template for panel cutout

Note:
1. Fix template to panel.
2. Drill holes (4.5 mm and 10 mm dia.)
3. Cut out the section within the marked lines.
4. Deburr.

In order to ensure the enclosure protection as per data sheet, the panel must be of adequate thickness and stability.
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---

Note:
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