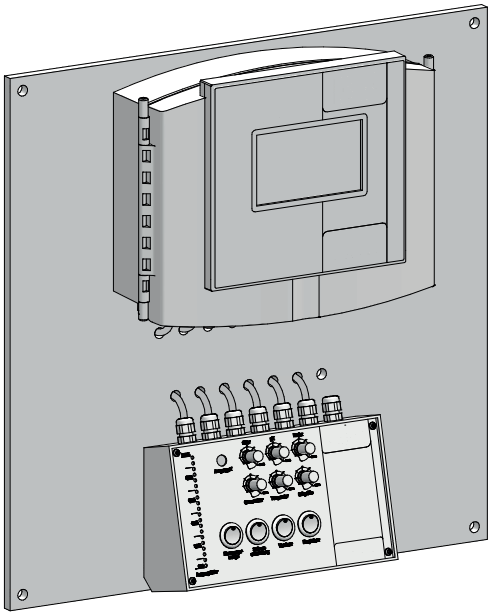
Hardware simulator

Operating instructions



Read the operating manual!

The user is responsible for installation and operation related mistakes!

Original operating instructions

Table of Contents

1 Notes for the Reader

This operating manual contains information and behaviour rules for the safe and designated operation of the **hardware simulator**.

Observe the following principles:

- Read the entire operating manual prior to starting-up the device.
- Ensure that everyone who works with or on the hardware simulator has read the operating manual and follows it.
- Keep the operating manual throughout the service life of the hardware simulator.
- Pass on the operating manual to any subsequent owner of the hardware simulator.

1.1 General non-discrimination

In this operating manual, only the male gender is used where grammar allows gender allocation. The purpose of this is to make the text easy to read. Men and women are always referred to equally. We would like to ask female readers for understanding of this text simplification.

1.2 Explanation of the signal words

Different signal words in combination with warning signs are used in this operating manual. Signal words illustrate the gravity of possible injuries if the risk is ignored:

Signal word	Meaning
DANGER!	Refers to imminent danger. Ignoring this sign may lead to death or the most serious injuries.
WARNING	Refers to a potentially hazardous situation. Failure to follow this instruction may lead to death or severe injuries.
CAUTION!	Refers to a potentially hazardous situation. Failure to follow this instruction may lead to minor injury or damage to property.
PLEASE NOTE	Refers to a danger which, if ignored, may lead to risk to the machine and its function.

Tab. 1: Explanation of the signal words

1.3 Explanation of the warning signs

Warning signs represent the type and source of a danger:

Warning sign	Type of danger
	General danger zone
	Danger of electric shock
	Danger of caustic or other burns
	Danger of electromagnetic radiation
	Danger of automatic start up
	Danger of damage to machine or functional influences

Tab. 2: Explanation of the warning signs

1.4 Identification of warnings

Warnings are intended to help you recognise risks and avoid negative consequences.

This is how warnings are identified:

Warning sign	**SIGNAL WORD**

Description of danger.

Consequences if ignored.

⇨ The arrow signals a safety precaution to be taken to eliminate the danger.

1.5 Identification of action instructions

This is how pre-conditions for action are identified:

✓ Pre-condition for action which must be met before taking action.

🛠 A resource such as a tool or auxiliary materials required to perform the operating instructions.

This is how instructions for action are identified:

➔ Separate step with no follow-up action.

1. First step in a series of steps.

2. Second step in a series of steps.

▶ Result of the above action.

✓ **Action completed, aim achieved.**

2 Safety

2.1 General warnings

The following warnings are intended to help you eliminate the dangers that can arise while handling the hardware simulator. Risk prevention measures always apply regardless of any specific action.

Safety instructions warning against risks arising from specific activities or situations can be found in the respective sub-chapters.

DANGER!

Mortal danger from electric shock!

Wrongly connected or located cables or damaged ones can injure you.

- ⇨ Connect the device only to a SCHUKO socket outlet protected by a ground fault circuit interrupter (GFCI).
- ⇨ Replace damaged cables without delay.
- ⇨ Do not use extension cables.
- ⇨ Do not bury cables.
- ⇨ Secure cables to avoid being damaged by other equipment.

CAUTION!

Increased risk of accidents due to insufficient qualification of personnel!

The **hardware simulator** and the accessories may only be installed, operated and maintained by personnel with sufficient qualifications. Insufficient qualification will increase the risk of accidents.

- ⇨ Ensure that all action is taken only by personnel with sufficient and corresponding qualifications.
- ⇨ Prevent access to the system for unauthorised persons.

PLEASE NOTE

Do not dispose of the device in the domestic waste!

Do not dispose of electric devices via the domestic waste.

- ⇨ The device and its packaging must be disposed of in accordance with locally-valid laws and regulations.
- ⇨ Dispose of different materials separately and ensure that they are recycled.

2.2 Hazards due to non-compliance with the safety instructions

Failure to follow the safety instructions may endanger not only persons, but also the environment and the device.

The specific consequences can be:

- Failure of important functions
- Failure of required maintenance and repair methods
- Danger to persons by electric shock

2.3 Working in a safety-conscious manner

Besides the safety instructions specified in this operating manual, further safety rules apply and must be followed:

- accident prevention regulations
- Safety and operating provisions
- Environmental protection provisions
- applicable standards and legislation.

2.4 Personnel qualification

Any personnel who work on the hardware simulator must have appropriate special knowledge and skills.

Anybody who works on the hardware simulator must meet the conditions below:

- Attendance at all the training courses offered by the owner,
- Personal suitability for the respective activity,
- sufficient qualification for the respective activity,
- training in how to handle the hardware simulator,
- knowledge of safety equipment and the way this equipment functions,
- knowledge of this operating manual, particularly of safety instructions and sections relevant for the activity and
- Knowledge of fundamental regulations regarding health and safety and accident prevention.

All persons must generally have the following minimum qualification:

- Training as specialists to carry out work on the hardware simulator unsupervised,
- Sufficient training that they can work on the hardware simulator under the supervision and guidance of a trained specialist

These operating instructions differentiate between these user groups:

2.4.1 Specialist staff

Thanks to their professional training, knowledge, experience and knowledge of the relevant specifications, specialist staff are able to perform the job allocated to them and recognise and/or eliminate any possible dangers by themselves.

2.4.2 Trained persons

Trained persons have received training from the operator about the tasks they are to perform and about the dangers stemming from improper behaviour.

In the table below, you can check what personnel qualifications are required for the respective tasks. Only people with appropriate qualifications are allowed to perform these tasks!

Qualification	Activities
Specialist staff	■ Assembly ■ Hydraulic installations ■ Electrical installation ■ Maintenance ■ Repairs ■ Commissioning ■ Taking out of operation ■ Disposal ■ Fault rectification
Trained persons	■ Storage ■ Transportation ■ Control ■ Fault rectification

Tab. 3: Personnel qualification

3 Intended use

3.1 Notes on product warranty

Any non-designated use of the product can compromise its function or intended protection. This leads to invalidation of any warranty claims!

Please note that liability is on the side of the user in the following cases:

- if people operate the product who are not adequately qualified to carry out their respective activities.
- no original spare parts or accessories of Lutz-Jesco GmbH are used.
- Unauthorised changes are made to the device.

3.2 Intended purpose

This operating manual describes a hardware simulator that enables the control of the chlorine and pH value output of the TOPAX® MC multi-channel controller. On the one hand, the hardware simulator generates the analogue sensor signals of the swimming pool technology such as chlorine, pH value, redox value and temperature, and on the other hand it displays the output value of the respective controlled variable calculated by the TOPAX® MC. Furthermore, digital signals such as insufficient sample water, pre- and main alarm as well as setpoint changeover can be switched on. One of the main applications is the commissioning of the TOPAX® MC configuration prior to inclusion in the water treatment plant.

3.3 Foreseeable misuse

The following section provides information regarding the hardware simulator applications which are classified as non-intended use. This section is intended to allow you to detect possible misuse in advance and to avoid it.

Foreseeable misuse is assigned to the individual stages of the product lifetime:

3.3.1 Incorrect assembly

- Unstable or unsuitable bracket and
- Hardware simulator bolted wrongly or loosely

3.3.2 Incorrect electrical installation

- Connecting the mains voltage without a protective earth
- Unsecured mains or one that does not conform to standards
- Not possible to immediately or easily disconnect the power supply
- Wrong connecting cables for mains voltage
- Protective earth removed
- Analogue and digital sensors connected to the incorrect terminals or incorrectly configured
- Shield of analog signal lines not connected or incorrectly connected

3.3.3 Incorrect start-up

- Commissioning without the establishment of all protective measures, fastenings etc.
- Personnel was not informed before the start-up
- System was recommissioned after maintenance without all the protective equipment and fixtures, etc. being reconnected.

3.3.4 Incorrect operation

- Protective equipment not functioning correctly or dismantled
- Unauthorised modification of the controller or hardware simulator
- Ignoring of alarm or error messages
- Ignoring operational disturbances
- The elimination of operational disturbances, alarm or error messages by insufficiently-qualified personnel
- Bridging the external fuse
- Operation made more difficult due to inadequate lighting or machines that are difficult to access
- Operation not possible due to dirty or illegible displays

3.3.5 Incorrect maintenance

- Carrying out maintenance during ongoing operation
- Carrying out work that is not described in the operating manual
- No adequate or regular inspection of correct functioning
- No replacement of damaged parts or cables with inadequate insulation
- No securing against reactivation during maintenance work
- Use of the wrong spare parts
- Installing spare parts without following the instructions in the operating manual
- Pulling off sections of the plant
- Mixing up the sensor lines
- Not reconnecting all the lines

3.3.6 Incorrect decommissioning

- Device not disconnected from the power supply
- Using the wrong dismantling tools

3.3.7 Incorrect disposal

- Improper disposal

4 Product description

4.1 Scope of delivery

Please compare the delivery note with the scope of delivery. The following items are part of the scope of delivery:

- Hardware simulator and multi-channel controller TOPAX® MC on mounting plate
- Operating instructions
- Mounting set

4.2 Design and function

4.2.1 Functional diagram of a two-channel controller

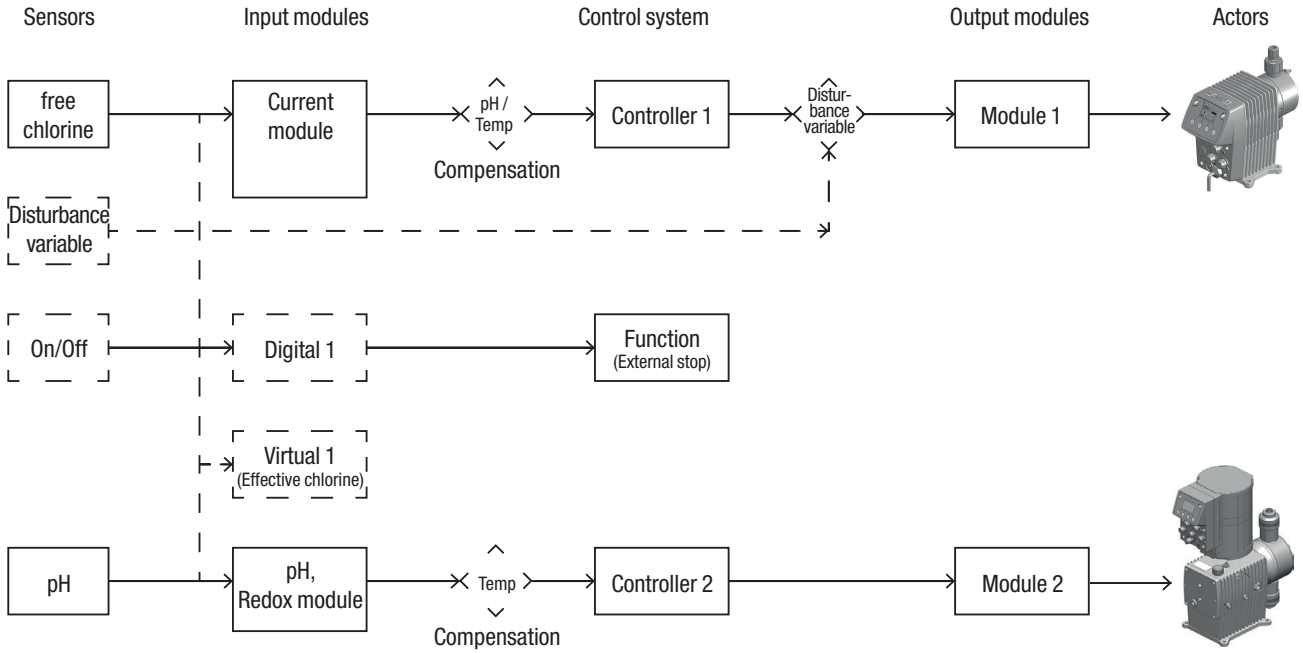


Fig. 1: Functional diagram of a two-channel controller

Gap	Field	Description
Sensors	**1.** Free chlorine **2.** Disturbance variable **3.** pH value	**1.** Measuring the free chlorine **2.** The disturbance variable is a variable flow volume which can be taken into account. **3.** Measuring the pH value
Input modules	**1.** Current module **2.** Digital 1 **3.** Virtual 1 **4.** pH Redox module	**1.** Module for 4 – 20 mA signals and sensors with 24 V voltage supply **2.** Digital input for the external control of a function (here: external stop) **3.** Parameter calculated (here effective chlorine) **4.** Module for pH and Redox single-rod measuring cells
Control system	**1.** Controller 1 **2.** Controller 2	**1.** Controlling the free chlorine inc. pH/temperature compensation and disturbance variable **2.** Controlling the pH value inc. temperature compensation
Output modules	**1.** Module 1 **2.** Module 2	**1.** Module on slot 1 to connect an actor (here: MAGDOS LD) **2.** Module on slot 2 to connect an actor (here: MEMDOS LP)

Tab. 4: Explanation of functional diagram of a two-channel controller

4.2.2 Description of components

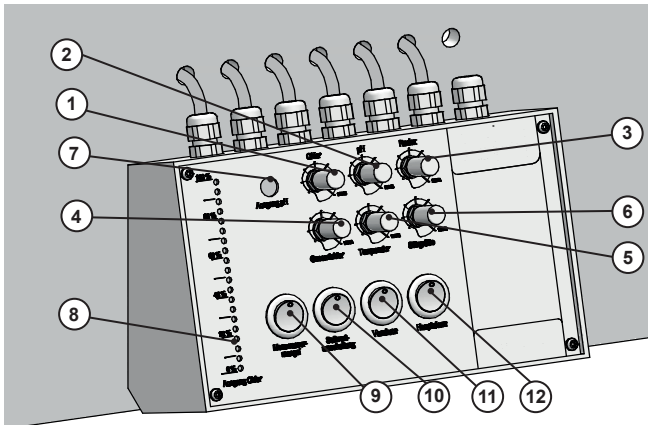


Fig. 2: TOPAX® MC and hardware simulator on mounting plate

The components are wired and preconfigured ready for operation. The multi-channel controller TOPAX® MC is equipped with input and output modules that allow the simulation of a chlorine content control and a pH value control. The simulation values for the following measured values can be varied with setting knobs:

Item	Function
1	Chlorine value
2	pH value
3	Redox value
4	Total chlorine value
5	Temperature
6	Disturbance variable

Tab. 5: Pos. numbers hardware simulator

The displays (see “Fig. 2: TOPAX® MC and hardware simulator on mounting plate” on page 9, items 7 and 8) are used for independent visualization of the controller output value for pulse-pause operation of a pH value control (item 7) and the continuous value of the chlorine value setting (item 8).

Item	Function
7	pH output
8	Chlorine output %

Tab. 6: Pos. numbers hardware simulator

The toggles (item 9 – 12) are used to simulate special events. They enable the activation of the following events:

Item	Function
9	Measuring water shortage
10	Setpoint changeover
11	Pre-alarm
12	Main alarm

Tab. 7: Pos. numbers hardware simulator

The red LED indicates that the device is switched-on.

4.2.3 Functions of the device

The stationary device simulates the water values by means of adjustable knobs and switches. Due to the parameter control in TOPAX® MC, the output values for the control of actuators such as dosing pumps are optically displayed on the simulator.

4.2.3.1 Event of insufficient sample water

To simulate the event of insufficient sample water, the corresponding toggle must be actuated. Insufficient sample water means that measurement is not possible. All controller outputs will be switched off.

Toggle	Function
Switch upwards	Sufficient sample water
Switch downwards	Insufficient sample water

Tab. 8: Toggle insufficient sample water

4.2.3.2 Event of setpoint switching

You can determine various setpoints which should actuate the device. You have four different sets of setpoints; the controller can switch between them automatically. The reference sets can be used to vary the control at different times of the day or in different operating conditions.

The following section describes the possibilities of controlling using setpoints and their configuration.

Toggle	Function
Switch upwards	No setpoint switching
Switch downwards	Setpoint changeover

Tab. 9: Toggle setpoint changeover

4.2.3.3 Event of pre-alarm

Only a pre-alarm message will be displayed. This message has no impact on the connected actuators, nothing is controlled.

Toggle	Function
Switch upwards	No pre-alarm
Switch downwards	Pre-alarm activated

Tab. 10: Toggle pre-alarm

4.2.3.4 Event of main alarm

In case of main alarm meassage, the corresponding controller output will be switched off.

Toggle	Function
Switch upwards	No main alarm
Switch downwards	Main alarm activated

Tab. 11: Toggle main alarm

5 Technical data

5.1 Hardware simulator

Information		Value
Input voltage	V AC	110/230
Power consumption	W	max. 22

Tab. 12: Technical data hardware simulator

Information		Value
Ambient temperature	°C	-5 to +45
Air humidity	%	max 95
Chlorine value		0 – 150 ppm or mg/l
pH value	mV	- 410 to + 410
Redox value	mV	0 – 1000
Total chlorine value	mA	4 – 20
Output distrubance variables	mA	0 – 20
Pulse-pause operation	Ω	80 – 120

Tab. 12: Technical data hardware simulator

5.2 TOPAX® MC

TOPAX® MC		
Housing dimensions (W x H x D)	mm	302 x 240 x 107
Voltage supply		100 – 240 V AC, 50/60 Hz
Power consumption	W	max. 20
Analogue outputs for remote transmission		4 x 0/4 – 20 mA, working resistance max. 500 Ω
Disturbance variable input	mA	0/4 – 20
Interfaces		Ethernet TCP/IP or RS485 Modbus RTU (optional)
Protection class		IP65
Ambient temperature	°C	-5 to +45 (no exposure to direct sunlight)
Control characteristic		P, PI, PID or PD behaviour, control direction selectable with disturbance variable feed forward, 2-side control selectable

Tab. 13: Technical data TOPAX® MC multi-channel controller

5.3 Multi-channel controller TOPAX® MC measuring inputs

All measuring inputs consist of an input for temperature measurement via Pt100 and a second input for the measurement of a further water parameter. On some measuring inputs, this input will measure a number of different parameters.

Measuring inputs (depending on version)			
Number of measuring inputs			up to 4
Free chlorine	Amperometric 3-electrode measuring cell with potentiostat (DMZ3.1)	mg/l	0 – 15 (dependant on the measuring cell transconductance)
	CS120 excess chlorine measuring cell	mg/l	0 – 10 (dependant on the measuring cell transconductance)
	Diaphragm-covered measuring cell	mg/l	0 – 10 (dependant on the measuring cell)
Chlorine dioxide	Amperometric 3-electrode measuring cell with potentiostat (DMZ3.1)	mg/l	0 – 15 (dependant on the measuring cell transconductance)
	CS120 excess chlorine measuring cell	mg/l	0 – 10 (dependant on the measuring cell transconductance)
	Diaphragm-covered measuring cell	mg/l	0 – 2 (dependant on the measuring cell)
Total chlorine	Diaphragm-covered measuring cell	mg/l	0 – 10 (dependant on the measuring cell)
pH value	pH single-rod measuring cell	pH	0 – 14 (dependant on the single-rod measuring chain)
Redox value	Redox single-rod measuring cell	mV	0 – 1000 (dependant on the single-rod measuring chain)
Temperature	Pt100	°C	-10 to +90

Tab. 14: Measuring inputs TOPAX® MC multi-channel controller

5.4 Multi-channel controller TOPAX® MC output modules

Output modules (depending on version)		
Servomotor relay		2 x 230 V AC, 5 A (ohmic load)
	kΩ	Potentiometer feedback: 1 – 10
Servomotor 20 mA		Constant 0/4 – 20 mA output
		Servomotor with 20 mA feedback
Relays		2 x 230 V AC, 5 A (ohmic load)
Optocoupler		2 x 80 V DC, 5 mA

Tab. 15: Output modules TOPAX® MC multi-channel controller

6 Dimensions

6.1 Dimensions of the baseplate with hardware simulator

The following figure shows the dimensions of the baseplate with a hardware simulator as well as the fastening holes for wall mounting. All dimensions in mm.

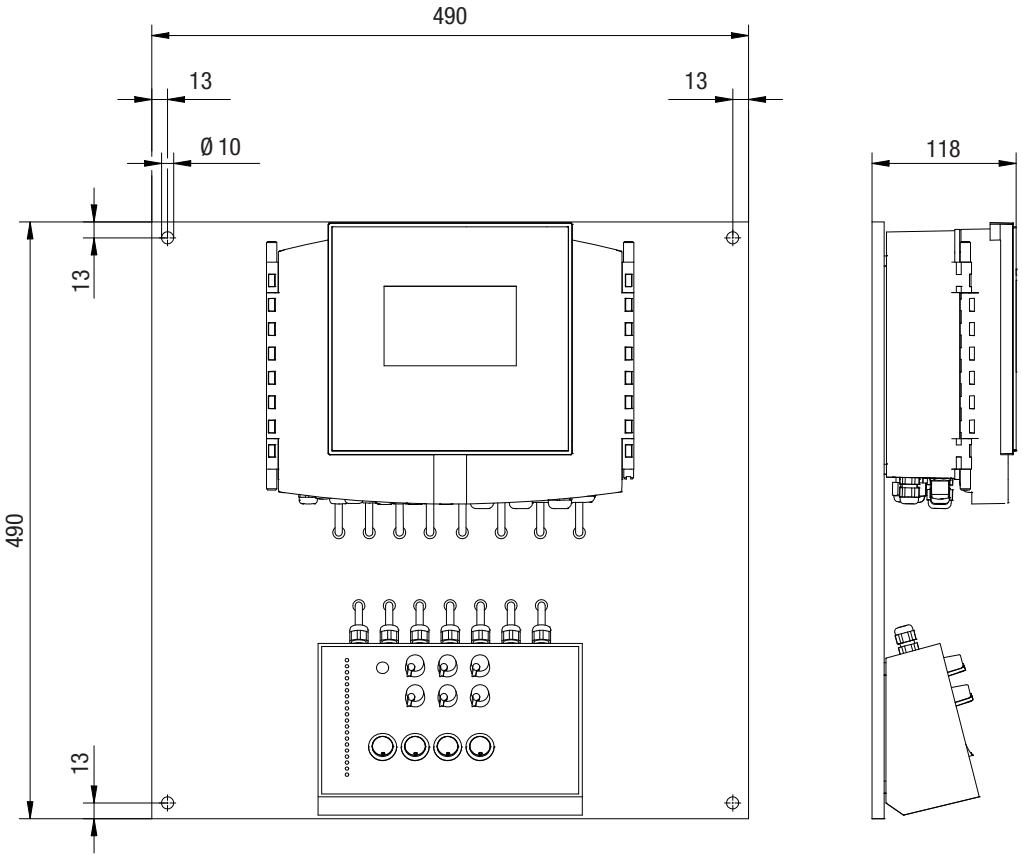


Fig. 3: Dimensions of the baseplate with hardware simulator

6.2 Dimensions TOPAX® MC multi-channel controller

All dimensions in mm.

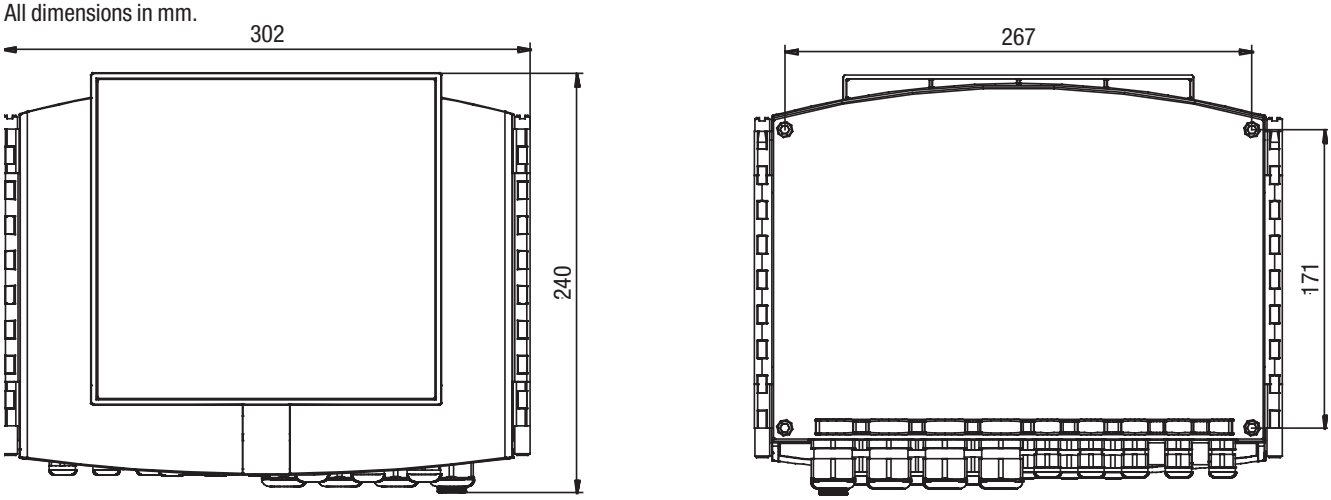


Fig. 4: Dimensions TOPAX® MC multi-channel controller

7 Installation

DANGER!

Mortal danger from electric shock!

Improperly installed or damaged components in the electronics installation can cause injury.

⇨ Ensure that all work on the electrical installation is performed by a qualified electrician.

⇨ Ensure that all work on the electrical installation is performed in a de-energised state.

⇨ Ensure that the power supply is secured with a fault current protective circuit.

⇨ Replace damaged cables or components without delay.

7.1 Principles

Make sure that the installation location complies with the following requirements:

- The displays and operator controls should be easily accessible and visible.
- The mounting plate is arranged so that there is sufficient space under the multi-channel controller for laying the cables.
- The cables are to be installed without kinking or damage.
- Various lines (e.g. voltage supply, data cable and sensitive lines for analogue signals) must be installed separately. If you want to connect further lines, different lines should only cross at 90° so as to prevent falsifications.
- Electrical, magnetic and electromagnetic fields affect signal transmission and can destroy electronic components.
- Compliance with the permissible ambient temperatures (see section "5 Technical data" on page 10).

7.2 Installation on the wall

Figure "Fig. 3: Dimensions of the baseplate with hardware simulator" on page 12 shows the dimensions of the baseplate and the fastening holes for wall mounting.

Resources required:

🛠 Assembly kit

🛠 Drill

🛠 Slotted screwdriver

Perform the following working steps:

1. Drill the four holes for mounting the plate onto the wall. The exact dimensions are stated in section "6 Dimensions" on page 12.
2. Use the screws for wall mounting. Ensure that the plate is correctly secured to the wall.
3. Tighten the fixing screws by hand.

✓ **Wall mounting finished.**

7.3 Electrical installation

The voltage supply to your device can now be performed via a normal Schuko plug or a control cabinet. Observe the following regulations for devices without premounted Schuko plug.

Required actions:

✓ The device was installed in accordance with section "7.2 Installation on the wall" on page 13.

✓ A power supply according to chapter "5 Technical data" on page 10 is available.

✓ The voltage supply is deactivated before the start and secured against reactivation.

Resources required:

🛠 Schuko plug

🛠 Wire end sleeves

1. If the supply cable has not yet been fitted with wire end sleeves, attach wire end sleeves to the cable ends.
2. If necessary, open the housing of the TOPAX® MC multi-channel controller.
3. Lead the supply cable through a cable screw connection to the underside of the multi-channel controller.
4. Turn the cable screw connection union nut until the line is fixed in the screw connection so that the screw connection performs strain relief. Ensure that the feed cable is installed loosely.
5. Connect the power supply cable with the open cable end to the corresponding terminals 44 – 52 of the TOPAX® MC multi-channel controller. Observe the division into protective earth (PE), neutral conductor (N) and the phase (L) on the circuit board.

✓ **Electrical installation completed.**

Only 3 of 9 clamps are required for connection of the voltage supply. The free terminals are used to supply the hardware simulator and possibly other devices with power. The contact load rating amounts to max. 4A.

7.4 Connecting Ethernet

You can use the Ethernet connection for the following actions:

- Reading/writing via Modbus TCP/IP protocol (PLC or Computer)
- Access via web browser
- Access via TFTP server

Tab. 16 shows the pin assignment of the Ethernet socket and the terminal assignment in the TOPAX® MC.

The device is fitted with a network input in the form or a 4-pole and D-coded M12x1 socket. Lutz-Jesco GmbH offers different lengths of special twisted-pair network cables to make the typical Ethernet RJ-45 plug connection. If you use third-party cables, choose a Category 5 cable with an impedance of 100 Ω or above.

Pin	Assignments	Wire colours	Terminal
1	TX-	yellow	37
2	TX+	orange	38
3	RX-	white	39
4	RX+	blue	40
-	Screen	-	-

Tab. 16: Pin assignment Ethernet interface

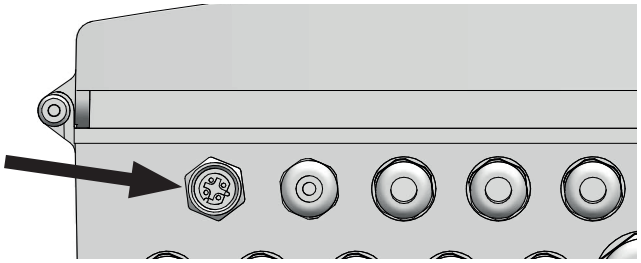


Fig. 5: Ethernet connection

Installing a wired network

During installation, comply with the following points:

- The Ethernet is cabled in a star topology. The maximum cable length is 100 m.
- Only use screened cables and connectors.
- Only use CAT5 cables or better.

7.5 RS485 interface

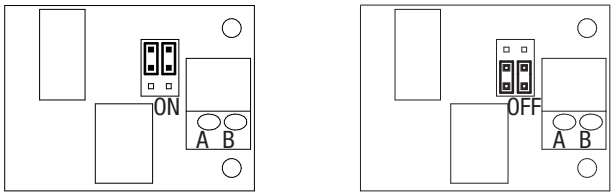


Fig. 6: Jumper position on RS485

> When using multiple devices on a data line you, must activate a 120 Ω resistance on the last device.
>
> You can activate the resistance by setting the jumper to "ON" as shown in Fig. 6 „Jumper position on RS485" on page 14.

Your device can have an optional RS485 interface. Using a second data cable you can connect up to 14 devices with a PC or a PLC. Modbus RTU protocol serves as a protocol for data transfer. You can use the addresses 1 – 14. The addresses 0 and 15 are reserved for internal purposes and are not supported.

RS485 Modbus settings:

- Baud rate: 9600
- Word length: 8 Bit
- Stop bit: 1 Bit
- Parity: None
- You can read out a maximum of 40 addresses at once.

The list of Modbus commands can be found in section 13 „Modbus addresses TOPAX® MC" on page 37.

Perform the following work steps:

1. Open the device housing.
2. Connect a two-wire cable to terminals A and B of the RS485 module.
3. Connect the device with your network.

✓ **Device connected with network.**

7.6 Terminal connection hardware simulator

On delivery, the connecting cables between the TOPAX® MC multi-channel controller and the hardware simulator are already pre-installed and ready for commissioning. For possible replacement, the connection is described below. For connecting the connecting cables to the TOPAX® MC multi-channel controller, it is essential to follow the relevant operating instructions.

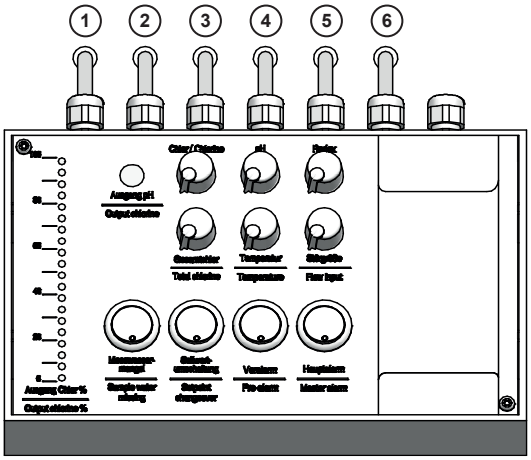


Fig. 7: Front view of the hardware simulator with numbered connection cables

The pin assignment of the connecting cables from the hardware simulator to the TOPAX® MC multi-channel controller is shown in the following table. The numbering of the connecting cables is shown in "Fig. 7: Front view of the hardware simulator with numbered connection cables" on page 14.

Cable	Cable colour	Pin	Assignments	Measurement
1	bn	Pin 14.1	Temperature	0 – 90 °C
	bl	Pin 14.2		
2	wh	Pin 14.3	pH value +	0 – 14 pH
	bn	Pin 14.4	pH value -	
	ngth	Pin 14.5	Redox value +	0 – 1000 mV
	gn	Pin 14.6	Redox value -	
3	wh	Pin 4.1	Continuous output chlorine value control	0 – 20 mA
	bn	Pin 4.2		
	ngth	Pin 4.3	Pulse output pH value pulse-pause control	Pulse
	gn	Pin 4.4		
4	1	Pin 15.1	Total chlorine +	0 – 11.4 mg/l
	gn/ye	Pin 15.2	Ground	-
	2	Pin 15.3	Free chlorine +	mg/l
	3	Pin 16.1	Disturbance variable +	0 – 10 l/h
	4	Pin 16.2	Disturbance variable -	
5	1	Pin 4.5	Measuring water shortage	Contact
	2	Pin 4.6	Setpoint changeover	Contact
	3	Pin 4.7	Pre-alarm	Contact
	4	Pin 4.8	Main alarm	Contact
	gn/ye	Pin 4.9	Ground	-
6	bl	Pin 6.1	Power supply neutral conductor	-
	gn/ye	Pin 6.2	Power supply protective earth	-
	bn	Pin 6.3	Power supply phase concuctor	-

Tab. 17: Assignment of the connection cables from the hardware simulator to the TOPAX® MC multi-channel controller

7.7 Terminal assignment TOPAX® MC multi-channel controller

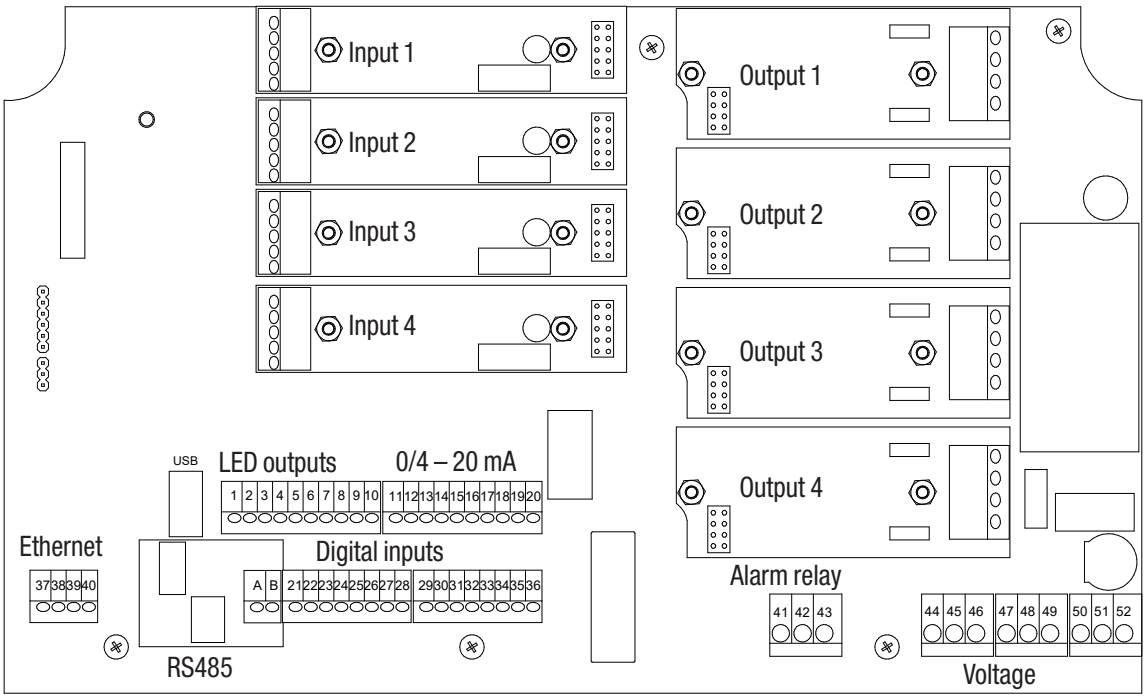


Fig. 8: Overview terminal assignment TOPAX® MC multi-channel controller

Terminal	Function		Description
1	LED output 1 (red)	+	5 V with 220 Ω series resistance for LEDs of the water sampling stations
2	LED-output 1 (green)	+	
3	LED output 2 (red)	+	
4	LED-output 2 (green)	+	
5	LED output 3 (red)	+	
6	LED-output 3 (green)	+	
7	LED output 4 (red)	+	
8	LED-output 4 (green)	+	
9 – 10	LED output GND	-	Ground for the LEDs
11	Disturbance variable input	+	0/4 – 20 mA
12		-	
13	Analogue output 1	+	0/4 – 20 mA, working resistance max. 500 Ω
14		-	
15	Analogue output 2	+	
16		-	
17	Analogue output 3	+	
18		-	
19	Analogue output 4	+	
20		-	
21 – 36	Digital inputs 1 – 8	+ (odd numbers) - (even numbers)	Function configurable
37 – 40	Ethernet connection		

Tab. 18: Terminal assignment TOPAX® MC multi-channel controller

Terminal	Function		Description
41 – 43	Alarm relay		Clamps 41 + 42 normal on Clamps 42 + 43 normal off
44 – 46	Connection supply voltage		Protective earth (PE)
47 – 49			Neutral line (N)
50 – 52			Phase (L)

Tab. 18: Terminal assignment TOPAX® MC multi-channel controller

Input	Module
1	Current module
2	Current module
3	pH/Redox module
4	pH/Redox module

Tab. 19: Assignment input modules TOPAX® MC multi-channel controller

Output	Module
1	n.c.
2	Servomotor 20 mA
3	Optocoupler
4	n.c.

Tab. 20: Assignment output modules TOPAX® MC multi-channel controller

8 Start-up

The device is pre-configured. The default values can be found in chapter “12 Default values hardware simulator” on page 35. However, you can also make your own configuration. We recommend to save the existing pre-configuration so that a functional configuration is always available (see chapter “8.2.4 Save the configuration” on page 24).

Outputs				Controller functions	Behaviour
Relays	Optocoupler	Servomotor relay	Servomotor 20 mA		
x				On/Off	■ The output switches if a value is exceeded. ■ Hysteresis can be set from 0,1 – 50 %
x	x			Pulse frequency 2-sides pulse frequency	■ Relay: 10 – 100 pulses per minute ■ Optocoupler: 10 – 350 pulses per minute ■ The pulse frequency is dependant on the control deviation and the set control parameters. ■ With a control output power of Y = 25 % and a maximum pulse frequency of 100 pulses/min., the controller would output 25 pulses/min.
x				Pulse length 2-sides pulse length	■ 0 – 3600 seconds cycle duration ■ Relay output (e. g. for solenoid valve) ■ Depending on the control deviation and the defined control parameters, the relay pulls in or drops out for the set cycle duration. If the cycle lasts 30 seconds and the controller output power is 40% the relay applies for example for 12 seconds, followed by 18 seconds of non-application.
		x		Servomotor with a feedback potentiometer	■ A feedback potentiometer can be connected (1 – 10 kΩ) for servomotors with position feedback. ■ Compensate the feedback potentiometer. During compensation, the servomotor is first started and then stopped automatically.
		x		Servomotor without a feedback potentiometer	■ For servomotors without feedback. ■ Measure and set the runtime of the servomotor.
			x	Continuous output	■ Continuous control output from 0/4 – 20 mA for the actuation of constant actors.
			x	Servomotor with 20 mA feedback	■ Servomotors which are controlled via 0/4 – 20 mA and have a 0/4 – 20 mA position feedback.

Tab. 21: Functions of the individual controllers

8.1 First steps

PLEASE NOTE

Distorting the measurement results

The measurement results of high-impedance sensor inputs may be distorted in the first 24 hours due to the heat development inside the housing of the TOPAX ® MC controller.

⇨ Activate the TOPAX® MC controller 24 hours before commissioning.

⇨ Factor in the distortion caused by the heat development and only perform the calibration for the measurement results 24 hours after activating the TOPAX® MC controller.

You need to make a number of basic settings before operating the device. This section leads you through initial commissioning.

Precondition for action:

✓ The device has been prepared in accordance with section “7 Installation” on page 13.

Configuration assistant

With initial commissioning, a configuration wizard will lead you through the basic settings: Your preferred language, the measured values, controller assignments and switch outputs. With the exception of the language, the values configured here can only be set in the configuration assistant. The finer settings are made in the sub-menus.

Working in the configuration assistant, determine the tasks of the installed modules, the controller and the output modules.

The finer settings such as the behaviour of these modules are made later, e. g in the “Outputs” menu item.

Perform the following work steps:

1. Set the preferred language and press on the arrow.
2. **Measured values:** Determine the desired measured value for the installed input modules. Press the right-hand arrow.
3. **Controller:** You can assign inputs for up to four controllers in this tab. Select a sensor, a virtual input or a timer. Set the centre row of the control function (“Tab. 21: Functions of the individual controllers” on page 18) and press the right-hand arrow. Controllers 1 – 4 must be assigned to the output modules 1 – 4 in a fixed fashion.
4. **Digital outputs:** You can assign a function to output modules in this tab. Only the output modules which are still free are displayed. Press the right-hand arrow.
5. Confirm the security query with “Yes” to save the configuration.

✓ **The configuration assistant has been ended.**

> Start the configuration assistant manually in System > Settings > Configuration > “Configuration assistant”.

8.1.1 Inputs

You can connect up to four sensors (depending on model) for various water parameters and the temperature to the device. You can also use up to eight digital inputs (depending on the version).

8.1.1.1 Sensor inputs

The sensors in the device must be configured individually to enable precise and error-free measurement of the water parameters. You can perform various settings.

Perform the following work steps:

1. In the main menu, navigate from System > Inputs to the “Sensors” tab.
2. In the “Sensors” tab, configure every connected sensor and state the following information.
3. **Input:** Select the input module of the sensor which you wish to configure.
4. **Signal:** Enter the type of the sensor signal. Depending on the input module, the signal type has been specified or you can select a signal type.
5. **Measurement:** Here, you can check which water parameters are measured. This setting can only be changed in the configuration assistant.
6. **Unit:** Select the appropriate unit.
7. **Measuring range:** Enter the maximum measuring range of the sensor.
8. **Min-alarm:** Activate or deactivate the minimum alarm and state a value under which the alarm will be triggered.
9. **Max-alarm:** Activate or deactivate the maximum alarm and state a value over which the alarm will be triggered.
10. **Delay:** Set a time delay for the “minimum and maximum alarm”.

✓ **Configuration of the sensors completed.**

8.1.1.2 Temperature inputs

You can connect up to four temperature sensors (depending on the version) to the device. This enables you to measure the temperatures at various positions.

Perform the following work steps:

1. In the main menu under System > Inputs, navigate to the “Temperature” tab.
2. In the “Temperature” tab, configure every connected temperature sensor and state the following information.
3. **Measurement:** Chose between “On” and “Off”.
4. **Min-alarm:** Activate or deactivate the minimum alarm and state a temperature under which the alarm will be triggered.
5. **Max-alarm:** Activate or deactivate the maximum alarm and state a temperature over which the alarm will be triggered.

✓ **Configuration of the temperature sensors completed.**

8.1.1.3 Compensation of cross sensitivities

The water parameters which you measure with the device can be falsified by interferences (e. g. with temperature or pH value). The device can compensate these interferences automatically.

Perform the following work steps:

1. Working in the main menu under System > Inputs, navigate to the “Compensation” tab.
2. Working in the “Compensation” tab, configure every sensor connected for which the measured value is to be compensated and state the following information
3. **Temperature:** If it is possible to compensate for the influence of the temperature, you can select a fixed reference value or one of the four temperature inputs.
4. **pH value:** If it is possible to compensate for the pH value error, you can select a fixed reference value or a sensor input.

✓ **Configuration of the compensation completed.**

8.1.1.4 Disturbance variable

You can connect the measurement of a disturbance variable (e.g. a flow volume) to an analogue 4 – 20 mA input. The disturbance variable can then be taken into account with a factor (0,1 – 10) during the calculation of the control variable Y.

Example: If the factor = 2 and the disturbance variable amounts to 42%, the controller can be set to a maximum of the control variable Y = 84 %. If the factor = 0.5 and the disturbance variable amounts to 42%, the controller can be set to a maximum of the control variable Y = 21 %.

Perform the following work steps:

1. Working in the main menu under System > Controller, navigate to the “Disturbance variable” tab and state the following information.
2. **Disturbance variable:** Set the disturbance variable to an input signal of 4 – 20 mA or 0 – 20 mA. You can also deactivate the disturbance variable.
3. **Unit:** As a rule, the disturbance variable is the measurement of a flow. Select the desired unit.

✓ **Configuration of the disturbance variable input completed.**

8.1.2 Inputs

8.1.2.1 Virtual inputs

You can calculate a new value from multiple measurements or reference values using a virtual input. You can assign the new virtual value to a controller in the configuration assistant. In this way, you can calculate the difference between the bound chlorine and the effective chlorine and use it as the basis for controlling your actors.

Difference

You can calculate the difference between two measured values or the difference between a measured value and a fixed reference value.

Perform the following work steps:

1. Working in the main menu under System > Inputs, navigate to the "Virtual" tab and state the following information.
2. **Calculation:** Select "difference".
3. Select a sensor.
4. Select a second sensor or a reference value. The second sensor must output the same measured value as the first. You will need to enter the reference value manually.
5. **Min-alarm:** Activate or deactivate the minimum alarm and state a difference value under which the alarm will be triggered.
6. **Max-alarm:** Activate or deactivate the maximum alarm and state a difference value over which the alarm will be triggered.
7. **Delay:** Set a time delay for the minimum and maximum alarm.

✓ **Configuration of the difference completed.**

Combined chlorine

Bound chlorine is calculated from the difference between the total chlorine and the free chlorine:

Bound chlorine = total chlorine - free chlorine

At least one total chlorine measurement is required to calculate bound chlorine. The chlorine value can be entered manually as a single reference value or a corresponding sensor input is selected.

Perform the following work steps:

1. Working in the main menu under System > Inputs, navigate to the "Virtual" tab.
2. Working in the "Virtual" tab, configure the desired calculation of the bound chlorine and state the following information.
3. **Calculation:** Select "bound chlorine" to calculate the bound chlorine.
4. **Total chlorine:** Select the sensor which measures the total chlorine.
5. **Free chlorine:** Select the sensor which measures the free chlorine. If no sensor is present, you can enter a reference value measured once which can be used for the calculation.
6. **Min-alarm:** Activate or deactivate the minimum alarm and state a value under which the alarm will be triggered.
7. **Max-alarm:** Activate or deactivate the maximum alarm and state a value over which the alarm will be triggered.
8. **Delay:** Set a time delay for the minimum and maximum alarm.

✓ **Configuration of the bound chlorine completed.**

Effective chlorine

The disinfectant effect of the free chlorine is highly dependant on the pH value of the process water. The pH value influences the reactivity of the Chlorine ions. This relationship is underscored by the dissociation curve of the chlorine ("Fig. 9: Dissociation curve of the effective chlorine" on page 20).

The actual disinfectant effect of the chlorine is generated by the hypochlorous acid (HClO). The figure shows that the proportion of the HClO is largest between pH 2 and pH 7.5. The disinfectant effect is very low outside this pH value.

For photometric measurements the pH value of the sample is buffered to approx. pH 6.5. As a result the measurement has a higher effective chlorine content than is actually in the process water. For high pH-values significant differences will therefore occur between the expected and actual disinfection if assessed by photometric analysis. The calculation of the effective chlorine can be used to display the proportion of the hypochlorous acid (HClO), i.e. the proportion which contributes to the disinfectant effect.

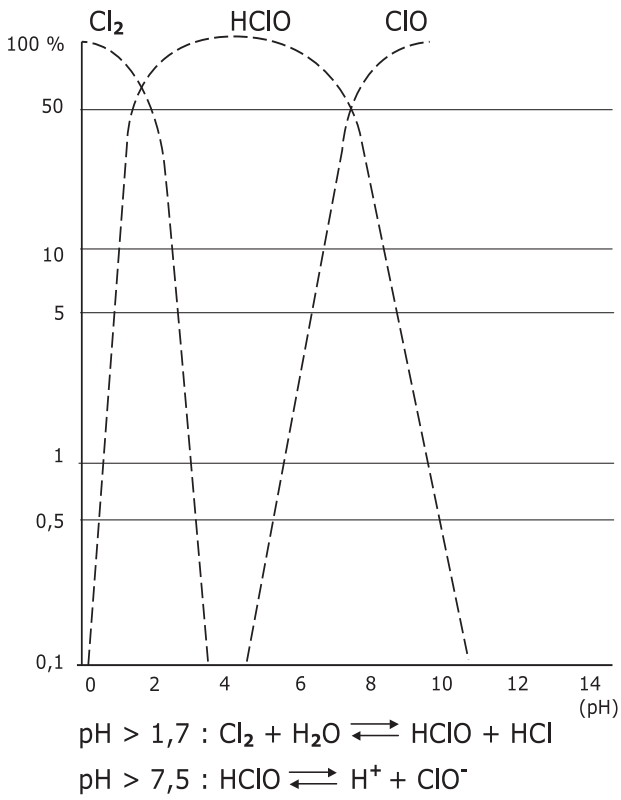


Fig. 9: Dissociation curve of the effective chlorine

Perform the following work steps:

1. Working in the main menu under System > Inputs, navigate to the "Virtual" tab.
2. Working in the "Virtual" tab, configure the desired calculation of the effective chlorine and state the following information.
3. **Calculation:** Select "effective chlorine" to calculate the effective chlorine.
4. **Free chlorine:** Select the sensor which measures the free chlorine.

5. **pH value:** Select the sensor which measures the pH value. If no sensor is present, you can enter a reference value measured once which can be used for the calculation.
6. **Temperature:** A temperature value is required to calculate the effective chlorine. Select the temperature input which can be used for the calculation. If no temperature sensor is present, you can set a reference value measured once which can be used for the calculation.
7. **Min-alarm:** Activate or deactivate the minimum alarm and state a value under which the alarm will be triggered.
8. **Max-alarm:** Activate or deactivate the maximum alarm and state a value over which the alarm will be triggered.
9. **Delay:** Set a time delay for the “minimum and maximum alarm”.

✓ **Configuration of the calculation of the effective chlorine completed.**

8.1.2.2 Digital inputs

You can use up to 8 digital inputs to evaluate switching statuses and to detect them as alarm message which are to be documented in the logbook.

Perform the following work steps:

1. In the main menu under System > Inputs, navigate to the “Digital” tab.
2. In the “Digital” tab, configure the inputs and state the following information.
3. **Action:** Choose between “OK = open” (N.O., working contact) or “OK = contact” (N.C., break contact).
4. **Function:** Select a function from “Tab. 21: Functions of the individual controllers” on page 18 depending on the desired reaction of the device to the input.

✓ **Configuration of the digital inputs completed.**

Function	Reaction
Off	The switching of the contact has no influence on the measurement or control.
Setpoint changeover	You can use the contact to switch between reference sets.
Measuring water shortage	All controller outputs will be switched off.
External stop	All controller outputs will be switched off.
Pre-alarm 1 – 4	Only display as an alarm message. Nothing is switched off.
Main alarm 1 – 4	The appendant controller output is switched off. The other outputs remain unaffected.
Others	You can assign an individual name to this digital input. The name is displayed in the alarm messages during switching the contacts.

Tab. 22: Functions digital inputs

8.1.3 Outputs

Depending on the equipment, you can connect a range of actors to the device and actuate them. Make sure that you actuate the actor with the correct signal type and select an appropriate output module with the configuration. An alarm relay, four analogue outputs and the possibility of connecting external LEDs (e.g. for water sampling stations) are available.

8.1.3.1 Controller outputs

You can configure and use up to four controllers.

Precondition for action:

✓ You have used the configuration assistant to assign an input and a control function to a controller (see section “Configuration assistant” on page 18).

Perform the following work steps:

1. Working in the main menu under System > Outputs, navigate to the “Controller” tab.
2. Working in the “Controller” tab, configure the controller output and state the following information.
3. **Y-alarm:** Activate the Y alarm. The Y alarm is a safety cut-out. If the controller output power amounts to more than 95 % (e.g. through a malfunction) over the set time, the Y alarm will be triggered and the corresponding controller output will be set to 0 %. You can set a time between 0 and 200 minutes.
4. **Basic load:** Depending on the controller function, you can set a base load which is always active independently of the control variable. With a base load of 10 %, the actor is always actuated with a minimum of 10 %.
5. **Limit:** Depending on the controller function, you can set a limit of between 5 – 100 %. State the value at which the actor should be actuated as maximum.
6. Further settings are dependant on the function of the controller. Further information is available in “Tab. 21: Functions of the individual controllers” on page 18.

✓ **Configuration of the controller outputs completed.**

8.1.3.2 Actuation via a timer

The output can be used for direct actuation via a timer. This is required e.g. to run the flocculant pump or the peristaltic pumps over a certain time.

Precondition for action:

✓ You have assigned the "Timer switch" input to a controller using the configuration wizard as described in the chapter “8.1 First steps” on page 18.

Perform the following work steps:

1. Working in the System menu, navigate to > Outputs and configure the output (see section “8.1.3 Outputs” on page 21).
2. Navigate to the menu > setpoints. Here, you can set the desired set control output directly from 0 to 100 %.

3. **Reference set:** Here, you can set various control outputs and via the timers in the "Switching" tab, you can determine when the control output should be changed. The checkmark must be set against "Switch setpoints automatically". Further information pertaining to switching is found in section "9.6 Setpoints and reference sets" on page 29.

✓ **Actuation configured via a timer.**

8.1.3.3 Controller parameters

You can configure the behaviour of the individual controller channels. Explanations of the various functions can be found in Tab. 21 „Functions of the individual controllers" on page 18.

Perform the following work steps:

1. Working in the main menu under System > Controller, navigate to the "parameter" tab.
2. Working in the "Parameter" tab, configure every control channel and state the following information.
3. **Control direction:** Configure the direction of control. If a switch is to be made between a 1- and a 2-side control, this must be set in the configuration assistant.
4. **Function:** Set the desired controller function. Possible: P-, PI-, PD- and PID-controller.
5. **Xp, Tn and Tv:** You can configure these parameters depending on the control function that has been set.
6. **Disturbance variable and factor disturbance variable:** If you have activated a disturbance variable (see chapter "8.1.1.4 Disturbance variable" on page 19), you can configure the influence of this disturbance variable on the selected controller channel. You can switch the influence on or off and set a factor between 0.1 and 10.

✓ **Configuration of the controller parameters completed.**

8.1.3.4 Digital output signals

You can use digital output signals via the outputs of the alarm relay, an optocoupler circuit board or a relay circuit board. The following sections describe the configurations that you can perform.

Alarm relay as an alarm output.

You can use the alarm relay (terminals 41 – 43) on the main board as an output for alarm messages.

Perform the following work steps:

1. In the main menu under System > Outputs, navigate to the "Digital" tab.
2. Working under "Digital output", select the "alarm relay" output.
3. Configure the alarm relay by entering the following data.
4. **Action:** Choose between "normal opened" (N.O., make contact) or "normal closed" (N.C., break contact).
5. **Latching:** "On "= the alarm relay is active until all alarms have been manually confirmed. "Off" = the relay is automatically deactivated if the active alarms are no longer pending.
6. **Output triggers upon:** Select which alarms should trigger the alarm relay. The relay switches as soon as one of the selected alarms is active.
7. **Alarm delay:** Determine the earliest point (in seconds) at which the relay should switch after activation of the alarm.

✓ **Configuration of the alarm relay completed.**

Further alarm outputs

In addition to the alarm relay, you can use the unused outputs of the optocoupler circuit board or relay circuit boards for further alarm messages.

Precondition for action:

✓ You have used the configuration assistant to assign the "alarm output" function to a free output (see section"Configuration assistant" on page 18).

Perform the following work steps:

1. In the main menu under System > Outputs, navigate to the "Digital" tab.
2. Working under "Digital output" select the desired output.
   - The free outputs will be displayed which you have configured as an "alarm output" in the configuration assistant. Example: "Relay 1.2". The first digit stands for the number of the output circuit board (1.X) and the second digit stands for the number of the output on the circuit board (X.2).
3. Working under the "Function" display, check whether the function with "alarm output" is displayed.
4. Configure the alarm output by entering the following data.
5. **Action:** Choose between "normal opened" (N.O., make contact) or "normal closed" (N.C., break contact).
6. **Latching:** "On "= the alarm output is active until all alarms have been manually confirmed. "Off" = the output will be deactivated automatically if the alarms are no longer active.
7. **Output triggers upon:** Select from the list of all possible alarms those which should trigger the output. The output switches as soon as one of the selected alarms is active.
8. **Alarm delay:** Determine the earliest point (in seconds) at which the output should switch after activation of the alarm.

✓ **Configuration of the alarm output completed.**

Limit value control

You can use unused outputs from optocoupler circuit boards or relay circuit boards as a limit value control (including "DIN contact"). An output for limit value control switches if all measured values are located within the defined limits.

Perform the following work steps:

✓ You have used the configuration assistant to assign the "limit value control" function to a free output (see section"Configuration assistant" on page 18).

Perform the following work steps:

1. In the main menu under System > Outputs, navigate to the "Digital" tab.

2. Working under “Digital output” select the desired output.
   ▶ The free outputs will be displayed which you have configured as “limit value control” in the configuration assistant.
   Example: “Relay 1.2”. The first digit stands for the number of the output circuit board (X.1) and the second digit stands for the number of the output on the circuit board (X.2).
3. Working in the “Function” display, check whether the function with a “limit value control” is displayed.
4. Configure the limit value control by entering the following data.
5. **Action:** Choose between “normal opened” (N.O., make contact) or “normal closed” (N.C., break contact).
6. **Delay:** The contact switches only if all water parameters are continually over the set lag time within the limits set. The lag time can be set between 0 and 10.
7. **Parameter:** Set the measured values in which the water parameters must be located so that the output switches. Press the minimum or maximum value that you wish to change.

✓ **Configuration of the limit value control completed.**

8.1.3.5 Analogue output signals

The basic configuration of the device includes up to four analogue 4 – 20 mA outputs. You can use the outputs to transmit the measured values to a control room or a PLC (programmable logic controller).

Some actuators such as dosing pumps can be controlled directly via this output.

Perform the following work steps:

1. In the main menu under System > Outputs, navigate to the “Analogue” tab.
2. Working under “Analogue”, select the desired output.
3. Configure the analogue output by entering the following data.
4. **20 mA type:** You can choose between the following signal types: 4 – 20 mA, 0 – 20 mA, 20 – 4 mA or 20 – 0 mA.
5. **Testsignal:** You can test the configuration of the analogue outputs. Check the actuation on the external device.
6. **Output:** Determine what should be outputted on the selected output. You can choose between the measurement and temperature values or outputs (controller outputs).
7. **Minimum:** Determine a minimum value. The minimum value indicates for which measured value the signal is the weakest.
8. **Maximum:** Determine a maximum value. The maximum value indicates for which measured value the signal is the weakest.

> The values for “minimum” and “maximum” serve the scaling of the analogue output signal. Example: Sensor 1 has a measuring range of 0 – 10 mg/l. 4 – 20 mA was selected as the 20 mA type. If the complete sensor measuring range is to be covered by the analogue signal, 0 mg/l should be selected for “Minimum” and 10 mg/l for “Maximum”. At 0 mg/l, a 4 mA signal will be issued; at 10 mg/l a 20 mA signal will be issued.

✓ **Configuration of the analogue outputs completed.**

8.1.3.6 Actuation of the LEDs for the water sampling stations

Some water sampling stations have multiple LEDs which display whether a water parameter is in the desired range. You can configure the actuation of the LEDs.

Perform the following work steps:

1. Working in the main menu under System > Outputs, navigate to the “External LEDs” tab.
2. Working under “LED”, select the desired LED.
3. Configure the LED by entering the following data.
4. **Function:** Select the reaction criteria for the LED. Selection of “Sample water shortage” standardly results in a green LED. If the digital contact “Sample water shortage” is active, it will illuminate red. Further options are the measured values of the sensor inputs 1 – 4.
5. **Minimum and maximum:** If you have decided to use a measured value, you must establish a minimum and a maximum value. The LED will illuminate red if the minimum value is undercut or the maximum value exceeded.
   It illuminates green between the values.
6. **Testsignal:** You can test the configuration of the LEDs.

✓ **Configuration of the external LED outputs completed.**

8.2 Second overview

In the main view, the device shows the measured values of the installed input modules. This display is pre-determined and cannot be changed. However, you can activate a “second overview” and adapt your needs individually (see “Fig. 10: Individual second overview” on page 23).

8.2.1 Activating the second overview

Perform the following work steps:

1. In the main menu under System > Settings, navigate to the “Display” tab.
2. **Second overview:** Activate the second overview with “On”.
3. **Number windows:** Select how many individual and freely-configurable windows should be displayed.

✓ **Second overview activated.**

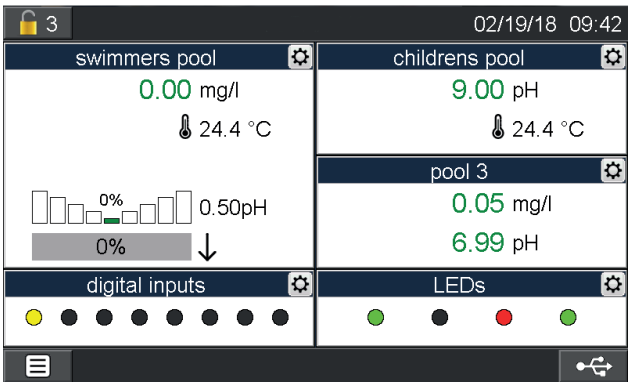


Fig. 10: Individual second overview

8.2.2 Configuring the second overview

Perform the following work steps:

1. Press the “Main menu” button (bottom left on the display) until the second overview with the individually-settable windows appears.
2. A gear wheel icon is displayed in the top right-hand corner of every window. Press on the icon to configure the selected window and state the following information.
3. **Name:** Give each window an individual name.
4. **Display 1 – 5:** Up to five displays can be configured depending on the size of the window. You can choose between the measured values, the virtual values, the outputs, the setpoints, the disturbance variables, the digital inputs and the external LED outputs.

✓ **Configuration of the second overview completed.**

8.2.3 Colours of the alarm messages

You can edit the colours of the different messages.

Perform the following work steps:

1. In the main menu under System > Settings, navigate to the “Alarm colour” tab.
2. Look in the “Alarm colour” tab for the message for which you wish to edit the alarm colour.
3. Press on the row of the alarm and then on “Edit”.

▶ You can chose between four colour fields.

✓ **Alarm colour edited.**

8.2.4 Save the configuration

You can save your individual configuration and load it later to rectify problems quickly.

> **Recommendation:** Leave the factory-set configuration file unchanged and save your personal configuration in a new file. Given problems with the configuration, this enables you to return to a functioning configuration quickly.

Perform the following work steps:

1. In the main menu under System > Settings, navigate to the “Configuration” tab.
2. Press “save” and enter an existing file name to overwrite the file or a new name to generate a new configuration file.
3. Press on the green checkmark to confirm the entry.

✓ **Configuration saved.**

8.2.5 Configuring the password protection

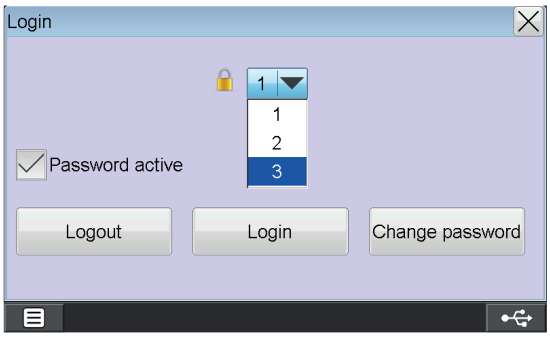


Fig. 11: Configuring the password protection

Perform the following work steps:

1. Press the lock icon in the left-hand upper corner to configure the password protection.
2. **Password active:** Select whether password protection should be activated or deactivated. Password protection can only be deactivated if you are logged in to level 3.

▶ Password protection must be activated to unlock the following steps.

3. Select one of the three password levels into which you wish to log on.
4. **Login:** Login with the password for the password level previously selected.
5. **Change password:** You can edit the password of the level in which you are logged in.

✓ **Password protection configured.**

8.3 Network settings

You may need to perform settings in order to be able to use the device in a network. Further information about using the device in a network can be found in section “9.7 Access via network” on page 30.

Perform the following work steps:

1. In the main menu under System > Service, navigate to the “Network” tab.
2. In the “Network” tab, configure the output and state the following information.
3. **IP address:** Give the device a unique IP address through which it can be reached in the network. If this IP address is already being used by another device, errors can result.
4. **Subnetmask** Enter the subnetmask.
5. **TFTP server:** “On” = Access via TFTP protocol activated on the device memory. “OFF” = Access via TFTP protocol de-activated on the device memory.
6. **Modbus RTU address:** Enter a number between 1 and 14 in the device if your device is fitted with a RS485 network connection.

✓ **Network settings performed.**

9 Operation

When in operation, the device will display the main view with the current values and the status row with status messages.

9.1 Confirming a message

You can view device alarm, error and service messages in the status row. The status row flashes in the colour set for the message type. Inactive messages are displayed white.

You must confirm a message on the device to end the display of inactive messages in the status row. Active messages will still be displayed, even if they have been cleared.

Perform the following work steps:

1. When a message is displayed, press on the status row or go to the "Messages" menu.
2. Select one or more messages and press either "Confirm" or "Confirm all".

▶ The confirmed message is marked with a green tick.

✓ **Message confirmed.**

History

You can follow the course of the messages in a history.

➔ In the main menu, press "messages" and the tab "History".

9.2 Logbook

The messages and service entries are saved in the device on a USB flash drive. You can display the files on the device or connect the USB flash drive to an external device.

The USB flash drive in the device contains the following logbook files:

Log	Format	Description
REPORTS	CSV	Messages
TREND	DAT	Trend data
SERVICE	CSV	Service entries
CHANGES	CSV	Changes to the configuration
SETUP	SET	Configuration
ADJUSTMENT	CSV	Calibration

Tab. 23: Logbook

You can open and analyse CSV files with a suitable programme (e. g. MS Excel). You can also view all CSV files on the device.

9.2.1 View and open files

You can display the logbook files on the device.

Perform the following work steps:

1. Press the USB icon in the status row (below right).

▶ The files saved on the USB flash drive will be displayed in a file browser.

2. Open one of the file folders.
3. Select the desired file and press "Open file".

✓ **File opened.**

9.2.2 Opening files externally

You can open the logbook files on an external device once you have removed the USB flash drive.

DANGER!

Mortal danger from electric shock!

When the device housing is open, you can touch live parts. There is the danger that you could suffer an electric shock.

⇨ Ensure that the machine has been disconnected from the voltage supply and is not live when conducting work with an open housing.

⇨ Secure the voltage supply against reactivation.

Precondition for action:

✓ The voltage supply is deactivated before the start and secured against reactivation.

Perform the following work steps:

1. Open the housing.
2. Remove the USB flash drive.
3. Connect the USB flash drive with an external device and open it.

▶ You can now access the logbook files.

✓ **Files opened externally.**

9.3 Configure trend display

You can view the trend progression of up to four measured values in the last 24 hours.

Perform the following work steps:

1. In the main menu, press “Trend”.
   ▶ The device will show the trend.
2. You can configure the display in accordance with your wishes. Press the “Display” tab and activate up to four values which are to be displayed in the trend.
3. You can set the scaling of the individual trend display for every value individually. Press on the “Scaling” tab, select a sensor and define "minimum” and “maximum”.

✓ **Trend display configured.**

9.4 Manual mode

You can manually control a controller output in the menu item “Manual mode” and set an output capacity between 0 and 100 %.

If a controller is in manual mode, this is indicated by a blue Y display in the main view and by a hand icon.

Working in the menu item “Manual mode”, you can also switch the automatic switching of the setpoints on or off (see section “9.6 Setpoints and reference sets” on page 29).

9.5 Calibration

You must first calibrate the sensors so that you can detect the correct measured values. All calibration processes in the device are monitored for plausibility (zero point and slope) and the measured values documented. Measured values resulting from an uncalibrated sensor are marked in the main overview. In this case, the measured values are displayed in red. If the measurement input is displayed individually in the main view, the information “Calibration not OK” will be displayed.

The current calibration and slope can be found in the “Calibration” menu in the “Overview” tab.

9.5.1 pH single-rod measuring cell

The calibration of the pH single-rod measuring cell must be carried out as a 2-point calibration.

The response time for a new single-rod measuring chain is a few seconds and is set when the physical reading becomes stable. Older single-rod measuring cells can have a longer reaction time.

9.5.1.1 2-point adjustment of the pH value

Perform the following work steps:

1. Working in the main menu under “Calibration”, navigate to the “Sensors” tab.
2. Working under “sensor”, select the sensor that measures the pH value and which you wish to calibrate.
3. Press the “2 points” button.
   ▶ 2-point calibration begins.
4. Turn the pH control knob to the extreme left.
5. Enter the pH value 0. This pH value serves as a reference value for the device. The ideal voltage value and the current voltage value is displayed in mV. If these values deviate too greatly from one another, the best value is displayed red. Too great a level of deviation is an indication that the pH single-rod measuring cell needs to be replaced.
6. Confirm the entry with the green checkmark.
7. Turn the pH control knob to the extreme right.
8. Enter the pH value 14.
9. Confirm the entry with the green checkmark.
10. A window with the actual slope of the sensor will open.

✓ **2-point adjustment of the pH value completed.**

9.5.1.2 1-point adjustment of the pH value

Pre-conditions for actions:

✓ A buffer solution is on hand for calibration.

✓ The slope of the pH single-rod measuring cell was measured in a laboratory beforehand.

Perform the following work steps:

1. Working in the main menu under “Calibration”, navigate to the “Sensors” tab.
2. Working under “sensor”, select the sensor that measures the pH value and which you wish to calibrate.
3. Press the “1 points” button.
   ▶ 1-point calibration begins.
4. Shut off the sample water of the sensor block.
5. Unscrew the pH single-rod measuring cell from the sensor block.
6. Rinse the pH single-rod measuring cell with water and dab it dry. Rubbing can cause electrical discharge on the glass membrane, which results in a delayed display.
7. Hold the pH single-rod measuring cell in the buffer solution and move back and forth for a short time.
8. Enter the pH value of the buffer solution. This pH value serves as a reference value for the device. The ideal voltage value and the current voltage value is displayed in mV.
   If these values deviate too greatly from one another, the best value is displayed red. Too great a level of deviation is an indication that the pH single-rod measuring cell needs to be replaced.
9. Wait until the value has stabilised.
10. Confirm the entry with the green checkmark.
11. You will be requested to set the slope. Enter the slope.
12. Confirm the entry with the green checkmark.

✓ **1-point adjustment of the pH value completed.**

9.5.1.3 Offset compensation

External influences can cause the pH value measured with the photometer to deviate from the electrometric measurement of the pH value by a constant value. The offset compensation enables you to compensate for this constant difference (zero-point deviation).

Perform the following work steps:

1. Working in the main menu under “Calibration”, navigate to the “Sensors” tab.
2. Working under “sensor”, select the sensor that measures the pH value and which you wish to calibrate.
3. Press the “Offset” button.
4. You can enter a pH offset from pH -0.30 to max pH +0.30.
5. Confirm the entry with the green checkmark.

✓ **Offset compensation completed.**

9.5.2 Redox value

The Redox value is measured using the Redox single-rod measuring cell. The Redox single-rod measuring cell measures the voltage present in the water due to oxidizing and reducing ions. You must calibrate the Redox single-rod measuring cell during commissioning.

9.5.2.1 1-point adjustment of the Redox value

Pre-conditions for actions:

✓ A buffer solution is on hand for calibration.

Perform the following work steps:

1. Working in the main menu under “Calibration”, navigate to the “Sensors” tab.
2. Working under “sensor”, select the sensor that measures the Redox value and which you wish to calibrate.
3. Press the “1 points” button.
   ▶ 1-point calibration begins.
4. Shut off the sample water of the sensor block.
5. Unscrew the Redox single-rod measuring cell from the sensor block.
6. Rinse the Redox single-rod measuring cell with water and dab it dry. Rubbing can cause electrical discharge on the glass membrane, which results in a delayed display.
7. Hold the Redox single-rod measuring cell in the buffer solution and move back and forth for a short time.
8. Enter the voltage value in mV which is recorded on the buffer solution. The voltage value entered and the current measured voltage value are displayed in mV. If these values deviate too greatly from one another, the best value is displayed red. Too great a level of deviation is an indication that the Redox single-rod measuring cell needs to be replaced.
9. Wait until the value has stabilised.
10. Confirm the entry with the green checkmark.

✓ **1-point adjustment of the Redox value completed.**

> With older sensors, the reaction time can increase or the measured value can differ considerably from the buffer solution value. This indicates that the Redox single-rod measuring cell must be checked and replaced if necessary.

9.5.3 3-Electrode potentiostat and excess chlorine measuring cell CS120

You should calibrate a 3-electrode potentiostat or the potentiostatic measuring cells (chlorine sensors) as single-point calibration as a matter of course. You will require a photometrically measured value in accordance with the DPD method as a reference value.

> With operation in a hot water system, electrochemical processes on the measuring electrode can result in a displacement of the zero point. In this case, 2-point calibration is necessary in which you calibrate the zero point using chlorine-free hot water. The second point is determined using the DPD method with chlorinated water as usual.

9.5.3.1 1-point adjustment of a 3-electrode potentiostat

To calibrate chlorine sensors, you will require a photometer with which to measure the reference value using the DPD method.

Pre-conditions for actions:

✓ A measurement device for determining the DPD value is already present.

✓ The sensor is operated with sample water.

Perform the following work steps:

1. Working in the main menu under “Calibration”, navigate to the “Sensors” tab.
2. Working under “Sensor”, select the sensor that you wish to calibrate.
3. Press the “1 points” button.
   ▶ 1-point calibration begins.
4. Take sample water in immediate proximity to the measuring cell and confirm with “OK”.
5. Determine the concentration in the sample water using the DPD method.
6. Enter the measured concentration. This serves the device as a reference value with which to permit correct measurement.
7. Confirm the entry with the green checkmark.

✓ **1-point adjustment of a 3-electrode potentiostat completed.**

9.5.3.2 2-point adjustment of a 3-electrode potentiostat

Pre-conditions for actions:

✓ A measurement device for determining the DPD value is already present.

✓ The sensor is operated with sample water.

Perform the following work steps:

1. Working in the main menu under "Calibration", navigate to the "Sensors" tab.
2. Working under "Sensor", select the sensor that you wish to calibrate.
3. Press the "2 points" button.
   ▶ 2-point calibration begins.
4. You will be asked to set the first reference value; this is the zero point. If the zero point was mal-set by accident, set it by pinching off the measuring electrode and entering a value of zero. Should real 2-point calibration be performed, e.g. due to hot water, you must first perform calibration with chlorine-free and then with chlorinated water. Enter a value for the zero point.
5. Confirm the entry with the green checkmark.
6. Take sample water in immediate proximity to the measuring cell and confirm with "OK". This means that the current signal at the time of the sample water extraction is saved to rule out signal fluctuation as a measurement error during the DPD ascertainment.
7. Determine the concentration in the sample water using the DPD method.
8. First enter the determined DPD value.
9. Confirm the entry with the green checkmark.

✓ **2-point adjustment of a 3-electrode potentiostat completed.**

9.5.4 Temperature

You can connect a temperature sensor to every input module. You can adjust the temperature sensor by setting a reference value.

When setting the reference value, the device will automatically correct the measurement of the temperature sensor by the difference.

9.5.4.1 Adjustment of a temperature sensor

Pre-conditions for actions:

✓ A thermometer is available.

✓ You have activated the measurement of the temperature (see section "8.1.1.2 Temperature inputs" on page 19).

Perform the following work steps:

1. Working in the Main menu under "Calibration", navigate to the "Temperature" tab.
2. Working under "input", select the input module for which you wish to set a reference value.
3. Press the "Reference value" button.
4. Enter the reference temperature measured beforehand.
5. Confirm with the green checkmark.

✓ **Adjustment of a temperature sensor completed.**

9.5.5 Servomotor 20 mA

You can connect servomotors with a 20 mA actuation and a 20 mA feedback to the device. The servomotors must be calibrated with the actuation before commissioning. You can calibrate the 20 mA output signal with ±1 mA.

9.5.5.1 Calibration of an servomotor 20 mA

Pre-conditions for actions:

✓ The servomotor is switched on and has been connected properly.

✓ The output has been configured correctly (see "Tab. 21: Functions of the individual controllers" on page 18).

Perform the following work steps:

1. Working in the Main menu under "Calibration", navigate to the "Outputs" tab.
2. Working under "Output", select the output which is to be adjusted.
3. Press the "Compensation" button.
   ▶ A further window with a progress bar opens; this indicates the position feedback.
4. Compensation is started using the "Start" button.
5. The motor starts and runs to top speed, then stops. This can take a number of minutes.
6. Completion of the compensation is signalled with "Compensation OK".

✓ **Calibration of an servomotor 20 mA completed.**

9.5.5.2 Calibrating the 20 mA output

If, whilst performing the previous compensation, you have determined that the output signal does not completely conform with the motor position, you can adjust the output signal. You can adjust both the lower signal range (0/4 mA) and the upper signal range (20 mA) to the motor position.

Perform the following work steps:

1. Working in the Main menu under "Calibration", navigate to the "Outputs" tab.
2. Working under "Outputs, select the output that you wish to adjust.
3. Press the "1 point" button to calibrate just the upper area or the "2 points" button for the upper and lower areas.
4. A further window will open in which you can set a tolerance. You can change this by maximum -50 to +50 depending on whether you wish to calibrate the upper or lower area. The maximum change corresponds c. to a current of 1 mA.
5. Check the output signal using a multimeter or a servomotor and make sure that the motor is now under exact control.
6. Save the current offset by pressing the "Save" button.

✓ **Calibrating the 20 mA output completed.**

9.6 Setpoints and reference sets

You can determine various setpoints which should actuate the device. You have four different sets of setpoints; the controller can switch between them automatically. The reference sets can be used to vary the control at different times of the day or in different operating conditions.

The following section describes the possibilities of controlling using setpoints and their configuration.

9.6.1 Setting the setpoints

You can configure and save the setpoints via the menu item “Setpoints”.

Perform the following work steps:

1. Working in the main menu under “Setpoints” navigate to the “Active” tab.
2. **Active:** You can view the reference set currently active in the “Active” tab.
   - The individual setpoints are displayed. If you change one of the values, it will immediately be activated as a new setpoint.
3. **Save:** You can save the active setpoints as a reference set. Select a reference set for this and press “Save".
4. **Setpoints 1 – 4:** The possible setpoints for the controller follow in sequence. The following information is displayed from left to right:

   - S1 – S4/V1 – V4 indicates the sensor input or virtual input.

   - O1 – O4 indicates the output. The “timer” indicates that the output is actuated directly.

   - The measured value of this input follows, e. g. free chlorine, pH or the text “No control function” if this controller is inactive.

   An upwards or downwards arrow indicates the control direction. Raise or lower.

   - This is followed by the setpoint. Pressing on the setpoint enables you to change it immediately. If it is a 2-side control, two setpoints must be entered, both for the control direction “Raise” or “Lower”. Changing these setpoints does not have an impact on the savable reference sets. To do so, you must perform step 3.
5. **Capacity:** You can activate or deactivate the flow. This enables you to reduce the flow by between 0 % and 100 %. The value of the flow is multiplied with the output Y. If the output is e.g. 80 % but the flow is only 50 %, this produces an output capacity of: Control variable Y Y = 80 % · 50 % = 40 %.

✓ **Setpoints set.**

9.6.2 Loading reference sets

You can load a reference set.

Perform the following work steps:

1. Working in the main menu under “Setpoints”, navigate to the “Reference set” tab.
2. Select the desired reference set.
3. Press "Load”.
   - The desired reference set is active immediately.

✓ **Reference set loaded.**

9.6.3 Switching between setpoints

The reference sets set in the previous section can be switched manually or automatically. You have two possibilities to activate automatic switching.

1. Working in the “Setpoints” menu item, navigate to the “Switching” tab. Set a checkmark against “Switch setpoints automatically”.
2. Working in the “Manual mode” menu, set a checkmark against “Switch setpoints automatically”.

You can use a digital input (see chapter 9.6.3.1 „Switching via digital inputs“ on page 29) and multiple internal timers for automatic switching (see chapter “9.6.3.5 Switching via timer” on page 30). The switching has priority over a digital input. Switching via a timer only occurs if no switching is active via a digital input.

9.6.3.1 Switching via digital inputs

Before you can use a digital input for switching to a particular reference set, you must configure the digital input in accordance with section “8.1.2.2 Digital inputs” on page 21.

Switching can be performed in three different forms: externally-controlled switching; switching via an internal timer and the “ECO control” function, which includes the limit value control.

9.6.3.2 Configure external switchover

In the case of external actuation, switching to the desired reference set is performed as long as the digital input has been activated. If the digital input is deactivated, the device switches back to the previous reference set. To configure, working in the “Setpoints” menu item, select the “Switching” tab.

Perform the following work steps:

1. Configure the switching and state the following information.
2. **Automatically switching the reference sets:** Set a checkmark here.
3. **Switch-over:** Select “Digital input”.
4. **Function:** Select the point “External switching”.
5. **Reference set:** Select the reference set to which is to be switched.
6. **Digital input:** The digital input in use is indicated here.

✓ **Configuration of the external switching completed.**

9.6.3.3 Switching via a timer

During switching via a timer, the desired reference set is active until the set period has been completed. The previous reference set is re-activated after the time has elapsed.

You can also start the timer manually, thereby e.g. triggering shock chlorination.

To configure, working in the “Setpoints” menu item, select the “Switching” tab.

Perform the following work steps:

1. Configure the switching and state the following information.
2. **Automatically switching the reference sets:** Set a checkmark here.
3. **Switch-over:** Select “Digital input”.
4. **Function:** Go to “Timer“.
5. **Reference set:** Select the reference set to which is to be switched.
6. **Digital input:** The digital input in use is indicated here.
7. **Time:** Configure the timer to the desired duration.
8. **“Off” or “Active”:** It will be displayed here whether the timer is currently active. If this is the case, the display will show how long it is still active.
9. **“Start” and “Stop” button:** The timer can be started or stopped manually, e. g. for a shock chlorination.

✓ **Configuration "Switchover via timer” completed.**

9.6.3.4 Switching via ECO control

A limit value control is defined for the "Economy mode”. The limit value control is generally used to reduce the circulation capacity.

If the measured values are located within the setpoints, the output is closed. If the digital input is also switched for switching to another reference set, “Economy mode” is active and the switch will be made to the desired reference set.

Precondition for action:

✓ The limit value control is configured as described in section”Limit value control” on page 22.

To configure, working in the “Setpoints” menu item, select the “Switching” tab.

Perform the following work steps:

1. Configure the switching and state the following information.
2. **Automatically switching the reference sets:** Set a checkmark here.
3. **Switch-over:** Select “Switching input”.
4. **Function:** Select “ECO control”.
5. **Reference set:** Select the reference set to which is to be switched.
6. **Digital input:** The digital input in use is indicated here.

✓ **Configuration "Switchover via ECO control” completed.**

9.6.3.5 Switching via timer

Up to ten timers can be configured parallel to the switching via a digital switching input (see section “9.6.3.1 Switching via digital inputs” on page 29). Times are defined for the point at which the timers should switch to a certain reference set.

To configure, working in the “Setpoints” menu item, select the “Switching” tab.

Perform the following work steps:

1. Configure the switching and state the following information.
2. **Automatically switching the reference sets:** Set a checkmark here.
3. **Switch-over:** Configure up to ten timer switches and state the following information.
4. **Off/Active:** Switch on the timer.
5. **Time:** Configure a time at which the switch-over is to be made. State the hour and minutes.
6. **Monday – Sunday:** Set a checkmark against every weekday on which the timer should be active.
7. **Reference set:** Select the reference set to which is to be switched.

✓ **Configuration "Switchover via timer” completed.**

9.7 Access via network

Accessing the device via a network requires that it is connected to an existing Ethernet or RS485 network.

Further information about connection to an existing network is specified in sections 7.4 „Connecting Ethernet“ on page 13, 7.5 „RS485 interface“ on page 14 and “8.3 Network settings” on page 24.

> If connection problems are experienced during access via network, check the configuration of your security software.

Modbus

You can access certain data on the device via the Modubus protocol using both Ethernet and the RS485. You need the Modbus protocol e.g. For the connection with a control panel or a PLC. Modbus TCP/IP is supported for Ethernet and Modbus RTU is supported for the RS485 interface.

The Modbus addresses of your device are stated in section “13 Modbus addresses TOPAX® MC” on page 37.

Web browser (only Ethernet)

You can access the device data using all network devices which are fitted with a web browser. You will require the IP address, subnetmask and possibly the MAC address of the device.

The network settings of your device are listed under Main menu > System > Service > Network.

Open the web browser of your end device and enter the IP address of the device in the address row. The page of the device will open and provide a range of information.

TFTP protocol (only Ethernet)

You can access the device memory via a TFTP client software as long as TFTP is activated in the network settings. You need the device IP address for access.

The network settings of your device are listed under Main menu > System > Service > Network.

10 Maintenance

Products by Lutz-Jesco are manufactured to the highest quality standards and have a long service life. However, some parts are subject to operational wear. This means that regular visual inspections are necessary to ensure a long operating life. Regular maintenance will protect the device from operation interruptions.

DANGER!

Mortal danger from electric shock!

Live parts can inflict fatal injuries.

⇨ Before carrying out any maintenance work, always disconnect the device from the power supply.

⇨ Secure the system to prevent it from being switched on by accident.

WARNING

Increased risk of accidents due to insufficient qualification of personnel!

The system and its accessories may only be installed, operated and maintained by personnel with sufficient qualifications. Insufficient qualification will increase the risk of accidents.

⇨ Ensure that all action is taken only by personnel with sufficient and corresponding qualifications.

10.1 Maintenance intervals

This table gives you an overview of maintenance work and the intervals at which you must carry it out. The next few sections contain instructions for carrying out this work.

Interval	Maintenance
Monthly	Visual check Touchscreen function test Calibrating the measured values
Annually	Checking the button cell

Tab. 24: Maintenance intervals

10.2 Keeping logfiles

If you make an entry in the logfiles, the product will issue a reminder when a sensor needs to be replaced.

Perform the following work steps:

1. Working in the main menu, navigate to System > Service > Service entry and working under “Service entry” / “Sensor”, select the desired sensor.
2. Enter the serial number in the tab and the manufacturing company of the sensor.
3. Activate the reminder function and enter a date for the next sensor change.

✓ **Logfiles maintained.**

10.3 Updating software

The most up-to-date firmware version can be downloaded from www.Lutz-Jesco.com. Copy this *.BIN file onto the device USB flash drive. The file must be saved in the root directory of the USB flashdrive and may not be stored in a sub-folder.

You can update the device software to a newer version.

Perform the following work steps:

1. Working in the main menu, navigate to System > Service > Device.
2. Press “Software update”.
3. Select the *.BIN file with the newer version and press “Load“.

▸ The software is installed. The device will restart automatically during this procedure.

✓ **Update performed**

10.4 Battery

The device is fitted with a button cell. Check the button cell within the scope of the annual maintenance. The lifetime of the button cell is determined by the device usage and can vary considerably.

You will need to replace the battery more often with devices which are switched off often or over a long period (e.g. over winter).

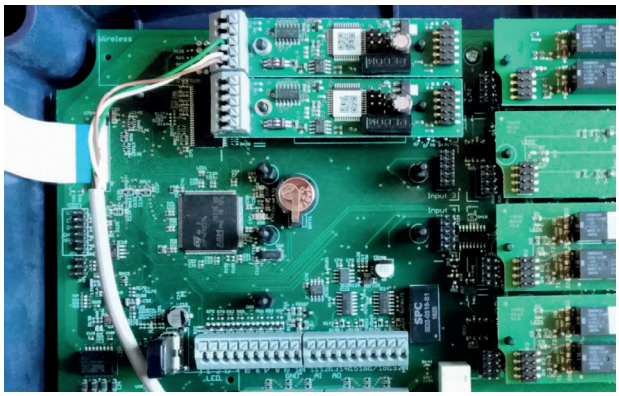


Fig. 12: CR1220 button cell

10.5 Checking the charge

You can check the battery charge easily using the device. Replace the battery if the charge amounts to less than 2.9 V.

➔ Working in the main menu, navigate to System > Information > System values and read the current charge state of the battery.

10.5.1 Replace the battery

You must remove the two input circuit boards to be able to replace the battery (“Fig. 12: CR1220 button cell” on page 31).

Precondition for action:

✓ The voltage supply has been disconnected and protected against re-connection.

✓ The housing is open.

Resources required:

🛠 Socket wrench 5.5 mm (M3)

🛠 New battery: CR1220, Ø12,5 mm, 3 V, 35 mAh

Perform the following work steps:

1. Pull all cable connections from the input circuit boards which you need to dismantle.
2. Using the socket wrench, unscrew the retaining nuts from the white protective plate and remove the plate.
3. Using the socket wrench, unscrew the two nuts from the input circuit boards which you need to remove.
4. Working carefully, slide the input circuit boards from their brackets.
   ▶ The battery is now easily accessible.
5. Lever the battery out of its holder without damaging the contact bow.
6. Slide a new battery in the holder.

✓ **The battery has been changed.**

10.6 Replacing the fuse

Your device is fitted with an electrical fuse to protect against short circuits or over-voltage. You can change the fuse if it is defective.

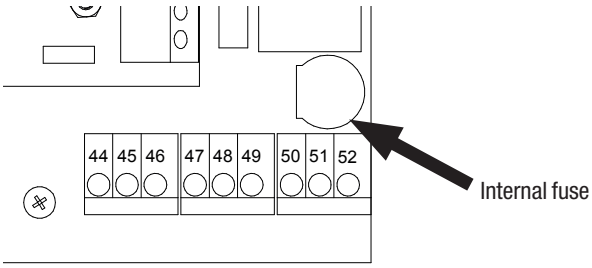


Fig. 13: Position of the fuse

Precondition for action:

✓ The voltage supply has been disconnected and protected against re-connection.

✓ The housing is open.

Resources required:

🛠 Slotted screwdriver

🛠 New fuse: 5 x 20 mm, 3.15 A, 250 V (delay)

Perform the following work steps:

1. The fuse holder in the form of a bayonet catch is located at the bottom right-hand side, above the clamps for PE, N and L with the marking “Fuse”. Use the slotted screwdriver to press the catch downwards and then turn it leftwards.
2. Remove the fuse.
3. Replace the fuse and fix the new fuse in place by turning the catch clockwise.

✓ **Fuse has been replaced.**

10.7 Resetting the settings

> The instructions differentiate between the internal factory settings and the device configuration.
>
> The factory settings contain the basic configuration of the device hardware and cannot be changed.
>
> The configuration file (*.SET) contains the individual device configuration. You can change, save and load the individual settings.

10.7.1 Reset to the factory settings

You can now reset the device to its factory settings. This deletes the configuration. You must then either load a configuration file or perform the configuration manually.

Perform the following work steps:

1. Working in the main menu, navigate to System > Service > Device.
2. Press “factory settings”.
3. Confirm with “Yes”.
   ▶ The configuration will be deleted. You must proceed with the following section.

✓ **All factory default settings will be reset.**

Reset the configuration

The device configuration will be saved in *.SET files. A factory-set configuration file with standard settings is already present. You can change these or save your personal configuration in new files.

Recommendation: Leave the factory-set configuration file unchanged and save your personal configuration in a new file. Given problems with the configuration, this enables you to return to a functioning configuration quickly.

Perform the following work steps:

1. Working in the main menu, navigate to System > Settings > Configuration.
2. Select an existing configuration file.
3. Click “Load” to confirm.
   ▶ The device configuration returns to the saved state.

✓ **Load the old configuration.**

10.8 Finishing maintenance

Perform the following work steps:

1. Make a note of the date and scope of the maintenance performed.
2. In the “Service” menu, navigate to the “Service entry” tab. Enter your company name and notes about the maintenance. Activate the reminder function and enter a date for the next service. Confirm with the “Save” button .

▶ Your service entry has been saved in the logfiles.

3. To restart the system, proceed in accordance with the instructions in section “8 Start-up” on page 18.

✓ **Maintenance completed.**

11 Troubleshooting TOPAX® MC

See below for information about how to rectify faults on the device or the system. If you cannot eliminate the fault, please consult with the manufacturer on further measures or return the device for repair.

Fault	Possible cause	Remedy
The device loses all settings after it has been disconnected from the network and then reconnected.	The battery is empty.	Check that the battery is really empty. To do so, navigate to the menu System > Information > System values. You can view the battery voltage under “Battery”. If the voltage is under 2.9 V, change the battery. Replace the battery (see chapter “10.5.1 Replace the battery” on page 32).
The device is off.	The power supply has been interrupted.	Restore the power supply.
	The device fuse is defective.	Replace the fuse (see chapter “10.6 Replacing the fuse” on page 32).
The sensor error is displayed as an alarm.	The sensor has not been installed correctly.	Make sure that the sensor has been connected correctly.
	The signal cable to the sensor has a break.	Replace the signal cable.

Tab. 25: Troubleshooting TOPAX® MC

12 Default values hardware simulator

12.1 Default values sensor inputs

Input	Module	Signal	Measurement	Unit	Measuring range	Min alarm	Max alarm	Delay
1	Current module	0 – 20 mA	Total chlorine	mg/l	11.4	deactivated	deactivated	deactivated
2	Potentiostat	µA	Free chlorine	mg/l	-	deactivated	deactivated	deactivated
3	pH/Redox module	mV	pH value	pH	-	deactivated	deactivated	deactivated
4	pH/Redox module	mV	Redox	mV	-	deactivated	deactivated	deactivated

Tab. 26: Default values sensor inputs

12.2 Default values compensation of cross sensitivities

Input	Module	Measurement	Temperature	pH value
1	Current module	Total chlorine	Off	Off
2	Potentiostat	Free chlorine	Off	Off
3	pH/Redox module	pH value	Off	-

Tab. 27: Default values compensation of cross sensitivities

12.3 Default values disturbance variable

Disturbance variable	Sampling system	Unit	Measuring range
4 – 20 mA	Flow rate	l/h	10

Tab. 28: Default values disturbance variable

12.4 Default values virtual inputs

Virtual input	Calculation	Sensor 1	Sensor 2 / reference value	Sensor 3 / reference value	Min alarm	Max alarm	Delay
1	Effective chlorine	Free chlorine: Input 2	pH value: Input 3	Temperature: Reference 25 °C	deactivated	deactivated	deactivated
2	Combined chlorine	Total chlorine: Input 1	Free chlorine: Input 2	-	deactivated	deactivated	deactivated
3 & 4	deactivated	-	-	-	-	-	-

Tab. 29: Default values virtual inputs

12.5 Default values digital inputs

Input	Behaviour	Function
1	OK = contact	Measuring water shortage
2	OK = opened	Setpoint changeover
3	OK = opened	Low level alert 1
4	OK = opened	Main alarm 1
5 – 8	-	deactivated

Tab. 30: Default values digital inputs

12.6 Default values controller outputs

Output	Function	Input	Y alarm	Basic load	Scaling	further adjustments
Servo motor 20 mA 2	Continuous output (20 mA)	Free chlorine: Input 2	deactivated	deactivated	deactivated	20 mA type: 0 – 20 mA
Optocoupler 3.1	Pulse frequency	pH value: Input 3	deactivated	deactivated	deactivated	Pulse frequency: 250 Imp/min

Tab. 31: Default values controller outputs

12.7 Default values controller parameters

Controller	Input	Control direction	Function	Xp	I	D	Disturbance variable & factor
2	Free chlorine: Input 2	Raise	P	2.00 mg/l	-	-	On: 1.0
3	pH value: Input 3	Raise	P	2.00 pH	-	-	Off

Tab. 32: Default values controller parameters

12.8 Default values analogue outputs

Controller	20 mA type	Output	Minimum	Maximum
Analogue 1	4 – 20 mA	Sensor 1	0.00 mg/l	10.00 mg/l
Analogue 2	4 – 20 mA	Sensor 2	0.00 mg/l	10.00 mg/l
Analogue 3	4 – 20 mA	Temperature 1	0 °C	90 °C
Analogue 4	4 – 20 mA	Output 3.1	-	-

Tab. 33: Default values analogue outputs

13 Modbus addresses TOPAX® MC

Address	Read	Write	Description	Meaning
Data that are not channel-related.				
4	x		Device type + version	0x0500 + (number of channels -1) A single-channel controller accordingly has the identification: 0x0500.
6 – 8	x		Software Version:	Transfer: ASCII sign e.g. 102 is the software version V1.02
10 – 11	x		Operating hours	
13	x		Hardware version	
2000 – 2002	x		Serial number	The information consists of a ASCII sign in HIGH-BYTE and one in LOW-BYTE. Serial number: 123456 will thus be transferred as Address 2000: 0x3132 Address 2001: 0x3334 Address 2002: 0x3536 transferred
2003	x		Status of digital inputs	Displays the terminal logic (not the configured software function). The individual bits are assigned directly to the input clamps. Example: 0x01 means that the first digital inputs (clamps 21 + 22) are actuated.
2004	x		Status of digital outputs	The individual bits of the output modules. Example: 0x03 means that the upper relay or the upper optocoupler of the second output module (from the top) is active.
2008 – 2017	x	x	Name of the device	Max. of 20 characters Caution! The evaluation must stop at the first zero (string end). The individual letters are located in the HIGH-BYTE and LOW-BYTE of every address. “GW” thus produces: Address 2008 = 0x4757 Address 2009 = 0x00 The question marks are undefined. In this case, all other addresses send undefined values.
Input-related data. 20 addresses will be held available for each of the 1 to 4 inputs. The address space for the inputs begins at 2020, 2040, 2060 and 2080.				

Tab. 34: Modbus addresses

Address	Read	Write	Description	Meaning
2020	x		Medium	■ 1 = pH ■ 2 = Redox ■ 3 = Free chlorine ■ 4 = Total chlorine ■ 5 = Chlorine dioxide ■ 6 = Bromine ■ 7 = Chlorite ■ 8 = Hydrogen peroxide ■ 9 = Ozone ■ 10 = Bromite ■ 11 = Fluoride ■ 12 = Salt content ■ 13 = Conductivity ■ 14 = Current ■ 15 = Temperature ■ 16 = Neutral (0 – 100%) ■ 254 = Free entry ■ 255 = No type
2021 – 2022	x		Measurement	Number of positions after the decimal point, see unit (4 bytes signed int.).
2023	x		Unit	**Number** / **Unit** / **decimal places** 0 / mA / 2 1 / µA / 1 2 / ppm / 2 3 / mg/l / 2 4 / µS/cm / 2 5 / mS/cm / 2 6 / % / 2 7 / mV / 1 8 / pH / 2 9 / min / 0 10 / s / 0 11 / mV/pH / 1 12 / Pulses/min. / 0 13 / Travelling unit / 1 14 / Celsius / 1
2024	x		The assigned input of the controller	■ 0 = Sensor 1 ■ 1 = Sensor 2 ■ 2 = Sensor 3 ■ 3 = Sensor 4 ■ 4 = Virtual input 1 ■ 5 = Virtual input 2 ■ 6 = Virtual input 3 ■ 7 = Virtual input 4 ■ 8 = Timer switch
2025	x		Control output Y (active control)	500 = 50,0 % (2 Byte signed int)
	x	x	Control output Y (only manual mode)	

Tab. 34: Modbus addresses

Address	Read	Write	Description	Meaning		
2026	x		Control output 2 Y2 (active control)	500 = 50,0 % (2 Byte signed int) Second side if 2-side control is active.		
	x	x	Control output 2 Y2 (only manual mode)			
2027 – 2028	x	x	Setpoint 1	Number of positions after the decimal point, see unit (4 bytes signed int.).		
2029 – 2030	x	x	Setpoint 2	If 2-side control is active (4 byte signed int).		
2031	x	x	Xp	Number of positions after the decimal point, see unit (2 bytes unsigned int.).		
2032	x	x	D	Derivative time in s (2 byte unsigned int).		
2033	x	x	I	Reset time in s (2 byte unsigned int).		
2034	x	x	Minimum and maximum alarm	Write: 0 = clear alarm	Read: Bit 0 = minimum alarm is active Bit 1 = maximum alarm is active	
2035	x	x	Y alarm	Write: 0 = clear alarm	Read: Bit 0 = Y alarm is inactive Bit 1 = Y alarm is active	
2036	x	x	Manual mode	Bit 0: Manual mode on Bit 1: Lower (with 2-side control)		
Input-related data of the virtual inputs. 20 addresses will be held available for each of the 1 to 4 inputs. The address space for the virtual inputs begins at 2100, 2120, 2140 and 2160.						
2100	x		Calculation	0 = off, no calculation 1 = difference value measurement 2 = bound chlorine 3 = effective chlorine		
2101 – 2102	x		Measurement	Number of positions after the decimal point, see unit (4 bytes signed int.).		
2103	x		Unit	**Number**	**Unit**	**decimal places**
				0	mA	2
				1	µA	1
				2	ppm	2
				3	mg/l	2
				4	µS/cm	2
				5	mS/cm	2
				6	%	2
				7	mV	1
				8	pH	2
				9	min	0
				10	s	0
				11	mV/pH	1
				12	Pulses/min.	0
				13	Travelling unit	1
				14	Celsius	1

Tab. 34: Modbus addresses

Address	Read	Write	Description	Meaning	
2104	x		The assigned input of the controller	■ 0 = Sensor 1 ■ 1 = Sensor 2 ■ 2 = Sensor 3 ■ 3 = Sensor 4 ■ 4 = Virtual input 1 ■ 5 = Virtual input 2 ■ 6 = Virtual input 3 ■ 7 = Virtual input 4 ■ 8 = Timer switch	
2105	x		Control output Y (active control)	500 = 50,0 % (2 Byte signed int)	
	x	x	Control output Y (only manual mode)		
2106	x		Control output 2 Y2 (active control)	500 = 50,0 % (2 Byte signed int) Second side if 2-side control is active.	
	x	x	Control output 2 Y2 (only manual mode)		
2107 – 2108	x	x	Setpoint 1	Number of positions after the decimal point, see unit (4 bytes signed int.)	
2109 – 2110	x	x	Setpoint 2	If 2-side control is active (4 byte signed int)	
2111	x	x	Xp	Number of positions after the decimal point, see unit (2 bytes unsigned int.)	
2112	x	x	D	Derivative time in s (2 byte unsigned int)	
2113	x	x	I	Reset time in s (2 byte unsigned int)	
2114	x	x	Minimum and maximum alarm	Write: 0 = clear alarm	Read: Bit 0 = minimum alarm is active Bit 1 = maximum alarm is active
2115	x	x	Y alarm	Write: 0 = clear alarm	Read: Bit 0 = Y alarm is inactive Bit 1 = Y alarm is active
2116	x	x	Manual mode	Bit 0: Manual mode on Bit 1: Lower (with 2-side control)	
Further non channel-related data.					
2220 – 2223	x		Analogue outputs 1 – 4	421 = 4.21 mA (2 byte signed int)	

Tab. 34: Modbus addresses

Address	Read	Write	Description	Meaning	
2225	x		Alarm status 1 If the bit is set, the associated alarm or message is active.	**Message or alarm**	**Bit**
				Sensor error 1	0
				Sensor error 2	1
				Sensor error 3	2
				Sensor error 4	3
				Sensor 1 maximum alarm	4
				Sensor 2 maximum alarm	5
				Sensor 3 maximum alarm	6
				Sensor 4 maximum alarm	7
				Virtual 1 maximum alarm	8
				Virtual 2 maximum alarm	9
				Virtual 3 maximum alarm	10
				Virtual 4 maximum alarm	11
				Sensor 1 minimum alarm	12
				Sensor 2 minimum alarm	13
				Sensor 3 minimum alarm	14
				Sensor 4 minimum alarm	15
2226	x		Alarm status 2 If the bit is set, the associated alarm or message is active.	**Message or alarm**	**Bit**
				Virtual 1 minimum alarm	0
				Virtual 2 minimum alarm	1
				Virtual 3 minimum alarm	2
				Virtual 4 minimum alarm	3
				Controller 1 Y alarm	4
				Controller 2 Y alarm	5
				Controller 3 Y alarm	6
				Controller 4 Y alarm	7
				Temperature 1 maximum alarm	8
				Temperature 2 maximum alarm	9
				Temperature 3 maximum alarm	10
				Temperature 4 maximum alarm	11
				Temperature 1 minimum alarm	12
				Temperature 2 minimum alarm	13
				Temperature 3 minimum alarm	14
				Temperature 4 minimum alarm	15

Tab. 34: Modbus addresses

Address	Read	Write	Description	Meaning	
2227	x		Alarm status 3 If the bit is set, the associated alarm or message is active.	**Message or alarm**	**Bit**
				Setpoint changeover	0
				Measuring water shortage	1
				External stop	2
				Low level alert 1	3
				Low level alert 2	4
				Low level alert 3	5
				Low level alert 4	6
				Main alarm 1	7
				Main alarm 2	8
				Main alarm 3	9
				Main alarm 4	10
				Digital input 1	11
				Digital input 2	12
				Digital input 3	13
				Digital input 4	14
				Digital input 5	15
2228	x		Alarm status 4 If the bit is set, the associated alarm or message is active.	**Message or alarm**	**Bit**
				Digital input 6	0
				Digital input 7	1
				Digital input 8	2
				Sensor 1 calibration not OK	3
				Sensor 2 calibration not OK	4
				Sensor 3 calibration not OK	5
				Sensor 4 calibration not OK	6
				Temperature 1 calibration not OK	7
				Temperature 2 calibration not OK	8
				Temperature 3 calibration not OK	9
				Temperature 4 calibration not OK	10
				Output 1 calibration not OK	11
				Output 2 calibration not OK	12
				Output 3 calibration not OK	13
				Output 4 calibration not OK	14
				Next service due	15
2229	x		Alarm status 5 If the bit is set, the associated alarm or message is active.	**Message or alarm**	**Bit**
				Sensor change sensor 1 due	0
				Sensor change sensor 2 due	1
				Sensor change sensor 3 due	2
				Sensor change sensor 4 due	3
2235	x		Temperature input 1	235 = 23.5 °C With an inactive temperature, the return is -10000 (2 byte signed int)	
2236	x		Temperature input 2		
2237	x		Temperature input 3		
2238	x		Temperature input 4		

Tab. 34: Modbus addresses

14 Declaration of conformity TOPAX® MC

(DE) EU-Konformitätserklärung
Hiermit erklären wir, dass das nachfolgend bezeichnete Gerät aufgrund seiner Konzipierung und Bauart sowie in der von uns in Verkehr gebrachten Ausführung den einschlägigen grundlegenden Sicherheits- und Gesundheitsanforderungen der aufgeführten EU-Richtlinien entspricht. Bei einer nicht mit uns abgestimmten Änderung am Gerät verliert diese Erklärung ihre Gültigkeit.

(EN) EU Declaration of Conformity
We hereby certify that the device described in the following complies with the relevant fundamental safety and sanitary requirements and the listed EU regulations due to the concept and design of the version sold by us.
If the device is modified without our consent, this declaration loses its validity.

(FR) Déclaration de conformité UE
Nous déclarons sous notre propre responsabilité que le produit ci-dessous mentionné répond aux exigences essentielles de sécurité et de santé des directives UE énumérées aussi bien sur le plan de sa conception et de son type de construction que du modèle que nous avons mis en circulation.
Cette déclaration perdra sa validité en cas d'une modification effectuée sur le produit sans notre accord explicite.

(ES) Declaración de conformidad UE
Por la presente declaramos que, dados la concepción y los aspectos constructivos del modelo puesto por nosotros en circulación, el aparato mencionado a continuación cumple con los requisitos sanitarios y de seguridad vigentes de las directivas de la U.E. citadas a continuación.
Esta declaración será invalidad por cambios en el aparato realizados sin nuestro consentimiento.

(PT) Declaração de conformidade UE
Declaramos pelo presente documento que o equipamento a seguir descrito, devido à sua concepção e ao tipo de construção daí resultante, bem como a versão por nós lançada no mercado, cumpre as exigências básicas aplicáveis de segurança e de saúde das directivas CE indicadas.
A presente declaração perde a sua validade em caso de alteração ao equipamento não autorizada por nós.

Bezeichnung des Gerätes:	Mehrkanalregler
Description of the unit:	Multi-Channel Controller
Désignation du matériel:	Régulateur multi-canaux
Descripción de la mercancía:	Controlador multi canal
Designação do aparelho:	Controlador multi-canal
Typ: **Type:**	TOPAX MC
EU-Richtlinien: **EU directives:**	2014/30/EU 2014/35/EU 2011/65/EU Die Schutzziele der Niederspannungsrichtlinie 2014/35/EU wurden gemäß Anhang I, Nr. 1.5.1 der Maschinenrichtlinie 2006/42/EG eingehalten. The protective aims of the Low Voltage Directive 2014/35/EU were adhered to in accordance with Annex I, No. 1.5.1 of the Machinery Directive 2006/42/EC.
Harmonisierte Normen: **Harmonized standards:**	DIN EN ISO 12100:2011-03 DIN EN 61000-4-2:2009-12 DIN EN 61000-4-3:2006 + A1:2008 + A2:2010 DIN EN 61000-4-4:2012 DIN EN 61000-4-5:2014 DIN EN 61000-4-6:2014-08 DIN EN 61000-4-11:2005-02 DIN EN 61000-6-2:2016-05 DIN EN 61000-6-3:2011-09 DIN EN 55016-2-3:2010 + A1:2010
Dokumentationsbevollmächtigter: **Authorized person for documentation:**	Lutz-Jesco GmbH

Heinz Lutz
Geschäftsführer / Chief Executive Officer
Lutz-Jesco GmbH
Wedemark, 01.03.2019

Lutz-Jesco GmbH
Am Bostelberge 19
30900 Wedemark
Germany

15 Declaration of conformity hardware simulator

(DE) EU-Konformitätserklärung
Hiermit erklären wir, dass das nachfolgend bezeichnete Gerät aufgrund seiner Konzipierung und Bauart sowie in der von uns in Verkehr gebrachten Ausführung den einschlägigen grundlegenden Sicherheits- und Gesundheitsanforderungen der aufgeführten EU-Richtlinien entspricht. Bei einer nicht mit uns abgestimmten Änderung am Gerät verliert diese Erklärung ihre Gültigkeit.

(EN) EU Declaration of Conformity
We hereby certify that the device described in the following complies with the relevant fundamental safety and sanitary requirements and the listed EU regulations due to the concept and design of the version sold by us.
If the device is modified without our consent, this declaration loses its validity.

(FR) Déclaration de conformité UE
Nous déclarons sous notre propre responsabilité que le produit ci-dessous mentionné répond aux exigences essentielles de sécurité et de santé des directives UE énumérées aussi bien sur le plan de sa conception et de son type de construction que du modèle que nous avons mis en circulation.
Cette déclaration perdra sa validité en cas d'une modification effectuée sur le produit sans notre accord explicite.

(ES) Declaración de conformidad UE
Por la presente declaramos que, dados la concepción y los aspectos constructivos del modelo puesto por nosotros en circulación, el aparato mencionado a continuación cumple con los requisitos sanitarios y de seguridad vigentes de las directivas de la U.E. citadas a continuación.
Esta declaración será invalidad por cambios en el aparato realizados sin nuestro consentimiento.

(PT) Declaração de conformidade UE
Declaramos pelo presente documento que o equipamento a seguir descrito, devido à sua concepção e ao tipo de construção daí resultante, bem como a versão por nós lançada no mercado, cumpre as exigências básicas aplicáveis de segurança e de saúde das directivas CE indicadas.
A presente declaração perde a sua validade em caso de alteração ao equipamento não autorizada por nós.

Bezeichnung des Gerätes:	Hardwaresimulator
Description of the unit:	Hardware simulator
Désignation du matériel:	Simulateur matérial
Descripción de la mercancía:	Simuladeur de hardware
Designação do aparelho:	Simuladeur de hardware
Typ: **Type:**	Hardwaresimulator
EU-Richtlinien: **EU directives:**	2014/30/EU 2014/35/EU 2011/65/EU
	Die Schutzziele der Niederspannungsrichtlinie 2014/35/EU wurden gemäß Anhang I, Nr. 1.5.1 der Maschinenrichtlinie 2006/42/EG eingehalten.
	The protective aims of the Low Voltage Directive 2014/35/EU were adhered to in accordance with Annex I, No. 1.5.1 of the Machinery Directive 2006/42/EC.
Harmonisierte Normen: **Harmonized standards:**	DIN EN ISO 12100:2011-03 DIN EN 61000-4-2:2009-12 DIN EN 61000-4-3:2006 + A1:2008 + A2:2010 DIN EN 61000-4-4:2012 DIN EN 61000-4-5:2014 DIN EN 61000-4-6:2014-08 DIN EN 61000-4-11:2005-02 DIN EN 61000-6-2:2016-05 DIN EN 61000-6-3:2011-09 DIN EN 55016-2-3:2010 + A1:2010
Dokumentationsbevollmächtigter: **Authorized person for documentation:**	Lutz-Jesco GmbH

Heinz Lutz
Geschäftsführer / Chief Executive Officer
Lutz-Jesco GmbH
Wedemark, 01.08.2019

Lutz-Jesco GmbH
Am Bostelberge 19
30900 Wedemark
Germany

16 Notes to conformity

The electrical equipment **hardware simulator** and **TOPAX® MC** do not fall under the purview of the Machinery directive.

The **hardware simulator** installed on the mounting plate is fitted with a CE mark and holds a declaration of conformity.

The **TOPAX® MC** multi-channel controller installed on the mounting plate is fitted with a CE mark and holds a declaration of conformity.

The electrical equipment **hardware simulator** and **TOPAX® MC** are designed and manufactured in accordance with the state of the art in safety technology

- so that the electromagnetic interference they cause does not reach a level at which proper operation of radio and telecommunications equipment or other equipment is not possible.
- they are sufficiently insensitive to the electromagnetic disturbances to be expected during normal operation to be able to operate as intended without unacceptable impairment.
- they do not endanger the safety of people and livestock or the preservation of property or goods when properly installed and maintained and used for their intended purpose.
- withstand non-mechanical influences under the intended ambient conditions to such an extent that people, domestic animals and livestock as well as material assets are not endangered.

The manufacturer and distributor of the **hardware simulator** is:

Lutz-Jesco GmbH / Am Bostelberge 19 / 30900 Wedemark / Germany

17 Declaration of no objection

Please copy the declaration, stick it to the outside of the packaging and return it with the device.

Declaration of no objection

Please fill out a separate form for each appliance!

We forward the following device for repairs:

Device and device type: ..... Part-no.: .....

Order No.: ..... Date of delivery: .....

Reason for repair: .....

.....

.....

Dosing medium

Description: ..... Irritating: ☐ Yes ☐ No

Properties: ..... Corrosive: ☐ Yes ☐ No

We hereby certify, that the product has been cleaned thoroughly inside and outside before returning, that it is free from hazardous material (i.e. chemical, biological, toxic, flammable, and radioactive material) and that the lubricant has been drained.

If the manufacturer finds it necessary to carry out further cleaning work, we accept the charge will be made to us.

We assure that the aforementioned information is correct and complete and that the unit is dispatched according to the legal requirements.

Company / address: ..... Phone: .....

..... Fax: .....

..... Email: .....

Customer No.: ..... Contact person: .....

Date, Signature: .....

18 Glossary

Limit value control/DIN contact

The limit value control is an output which switches when determined limit values are exceeded or undercut. This function is used to control an ECO or Night mode in a swimming pool with reduced circulation. If there are no swimmers in the swimming pool, energy and dosing media can be saved. The limit value control monitors the maintenance of the parameters.

In Germany, the limit values of the national standard DIN 19643 apply. As such, "DIN contact" is a widespread name for this function.

Hysteresis

Hysteresis is the delayed response time of a two position controller, when it reaches the "setpoint Y" and the control switches quickly between raising and lowering. As quick switching or control can have undesired effects, you can define hysteresis and achieve a more equal control.

Actual value X

The actual value 'X' is the continually **measured value of a sensor**.

Reset time Tn

The reset time 'Tn' is the **integral proportion (I proportion)** with PI and PID controllers. 'Tn' is the time **required by the controller to alter the control variable 'Y'**, which is generated by the proportional range 'Xp' immediately after the step change of the control deviation 'X-W'.

You can set a reset time 'Tn' of up to 200 minutes.

P controller

A P controller is **defined by the proportional range 'Xp'**. The use of a pure P controller means that a control deviation 'X-W' always remains. The setpoint 'W' will thus never be reached.

PI controller

The PI controller is **defined by the proportional range 'Xp' and the reset time 'Tn'**. The use of the PI controller means that the actual value 'X' can reach the setpoint 'W'.

The PI controller is suitable for the majority of applications.

PD-controller

The PD controller is **defined by the proportional range 'Xp' and the derivative time 'Tv'**. The use of a PD controller means that a control deviation 'X-W' always remains. The setpoint 'W' will thus never be reached.

PID controller

The PID controller is **defined by the proportional range 'Xp', the reset time 'Tn' and the derivative time 'Tv'**. The integral gain means that the actual value 'X' can reach the setpoint 'W'.

Proportional range Xp

The proportional range 'Xp' (p proportion) of a P, PI or PID controller indicates **the amount by which the actual value 'X' must deviate from the setpoint 'W' so that the variable Y = 100 %**. If the control deviation 'X-W' is lower, the control variable is also lower.

The control variable 'Y' of a P controller is only affected by the control deviation 'X-W'. The Xp value is stated in the unit of the variable to be controlled. If for example, during the control of the pH value, an Xp = 2 pH is selected and the actual value is X = 9 pH and setpoint W = 7 pH, the control deviation is X-W = 9 pH – 7 pH = 2 pH.

In this case, the deviation X-W is as large as the Xp value. In this case, the variable Y would be 100 %. With a decreasing deviation X-W, the control variable decreases in a linear fashion to 0 % with an actual value X = setpoint W.

Control deviation X-W

The control deviation X-W is **the difference between the actual value 'X' and the setpoint 'W'**. The control variable 'Y' results from the control deviation.

Setpoint W

The setpoint 'W' of a control is the **desired value**.

Control variable Y

The control variable 'Y' is the value **with which the controller** actuates **the actor** in accordance with its set parameters and the control deviation 'X-W'. The value lies between 0 % and 100 %.

Derivative time Tv

With PD or PID controllers, the differential proportion (D proportion) is defined with the derivative time 'Tv'. **The D proportion ensures that the control path already contains a correction factor at the point at which the actual value "X" begins to differ from setpoint "W".** The control variable 'Y' depends on the speed with which the control deviation 'X-W' takes place. The duration of the correction is determined by the derivative time 'Tv'. If the actual value 'X' does not change, i.e. the speed of change is "0", the correction factor effected by the D proportion with the derivative time 'Tv' drops as far as "0" (even if the actual value 'X' does not match the setpoint 'W', but consistently deviates from it). The fact that the control system causes the actual value 'X' to match the setpoint 'W' is due mainly to the I proportion of the controller. The D proportion often improves the controller behaviour because it acts against the trend to deviate.

The derivative time Tv can be set from 0 seconds to a maximum of 1200 seconds.

Y alarm

You can activate an alarm **which deactivates the controller if the control variable 'Y' amounts to over 95 % over a defined period.**

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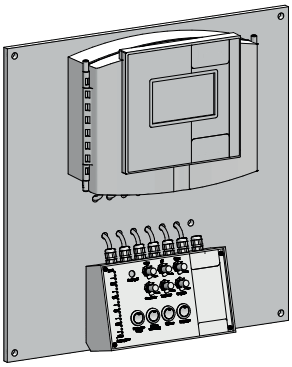

Lutz-Jesco GmbH

Am Bostelberge 19
D-30900 Wedemark

Phone: +49 5130 5802-0
info@lutz-jesco.com
www.lutz-jesco.com

Operating instructions
Hardware simulator