

TW pH / EC

OPERATING INSTRUCTIONS

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1 General information

Welcome to TriOS.

We are delighted that you have chosen a device from our TW Master series, the analyzer for determining the pH value and conductivity in drinking water.

The TW pH / EC measures the pH value and electrical conductivity in one device. The sensor stores calibrations internally. This enables a “plug-and-play” system without recalibration if the location or transmitter is changed.

In this manual you will find all the information about TW pH / EC that you need for commissioning. Technical specifications, detection limits and dimensions can be found in chapter 7.

Please note that the user is responsible for complying with regional and national regulations for the installation of electronic devices. Any damage caused by incorrect use or unprofessional installation is not covered by the warranty.

All sensors and accessories supplied by TriOS Mess- und Datentechnik GmbH must be installed and operated in accordance with TriOS Mess- und Datentechnik GmbH specifications. All parts have been designed and tested according to international standards for electronic instruments. The device complies with international standards for electromagnetic compatibility. Please use only original TriOS accessories and cables to ensure smooth and professional use of the devices.

Read this manual carefully before using the device and keep it for future reference. Before using the sensor, make sure that you have read and understood the safety precautions described below. Always ensure that the sensor is operated correctly. The safety precautions described on the following pages are intended to ensure problem-free and correct operation of the device and the associated accessories and to prevent you, other persons or devices from being harmed.

NOTICE

If translations differ from the original German text, the German version is binding.

Software updates

This manual refers to software version 3.0.0. and higher. Updates include bug fixes and new functions and options. Devices with older software versions may not have all the functions described here.

Copyright notice

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1.1 Health and safety instructions

This manual contains important information on health and safety regulations. This information is marked in accordance with the international specifications of ANSI Z535.6 (“Product safety information in product manuals, instructions and other collateral materials”) and must be followed. The following categories are distinguished:

▲ DANGER

Danger / Will cause serious injury or death

⚠ WARNING

Warnings / May cause serious injury or death

⚠ CAUTION

Caution / May cause moderate injury

NOTICE

May lead to material damage

**Tip / Useful information**

Electromagnetic waves

Devices that emit strong electromagnetic waves can influence the measurement data or cause the sensor to malfunction. Avoid operating the following devices in the same room as the TriOS sensor: cell phones, cordless phones, transceivers or other electrical devices that generate electromagnetic waves.

Reagents

Follow the manufacturer's safety and operating instructions when using reagents. Observe the applicable Hazardous Substances Ordinance for reagents (GefStoffV)!

Biological safety

Liquid waste may be biologically hazardous. You should therefore always wear gloves when handling such materials. Observe the currently valid Biological Substances Ordinance (BioStoffV)!

Waste

When handling liquid waste, the regulations for water pollution, drainage and waste disposal must be observed.

1.2 Warnings

This sensor has been developed for use in industry and science. It should only be used to measure aqueous solutions such as drinking water, process waste water, river water or seawater.

⚠ DANGER

This product is not suitable for use in potentially explosive atmospheres.

Further notes:

- The material resistance should be tested for each application.
- Do not cut, damage or modify the cables. Ensure that there are no heavy objects on the cables and that the cables do not kink. Ensure that the cables do not run close to hot surfaces.
- If a cable is damaged, it must be replaced with an original part by TriOS Mess- und Datentechnik GmbH customer support.

- Stop operation of the sensor if excessive heat is generated (i.e. more than lukewarm). Switch the sensor off immediately. Please contact your dealer or TriOS technical support.
- Never attempt to disassemble or modify any part of the sensor unless specifically described in this manual. Inspections, modifications and repairs may only be carried out by the device dealer or by TriOS authorized and qualified specialists.
- TriOS Mess- und Datentechnik GmbH devices comply with the highest safety standards. Repairs to the devices (which include the replacement of the connecting cable) must be carried out by TriOS Mess- und Datentechnik GmbH or an authorized TriOS workshop. Incorrect, improper repairs can lead to accidents and injuries.

NOTICE

TriOS does not guarantee the plausibility of the measured values. The user is always responsible for monitoring and interpreting the measured values.

1.3 User and operating requirements

The TW pH / EC was developed for use in industry and science. The target group for operating the TW pH / EC is technically experienced specialist personnel in drinking water treatment plants, sewage treatment plants, waterworks and institutes.

The application often requires the handling of hazardous substances. We assume that the operating personnel are familiar with the handling of hazardous substances due to their professional training and experience. In particular, the operating personnel must be able to correctly understand and implement the safety markings and safety instructions on the packaging and in the package inserts of the test kits.

1.4 Intended use

The TW pH / EC sensor is used to precisely analyze the pH value and electrical conductivity in aqueous solutions as described in this manual. TW pH / EC is a flow sensor that can be used together with other devices of the TW Master series. Please observe the technical data of the accessories. Any other use is considered improper.

The compact and robust sensor is particularly suitable for the following applications:

- Drinking water monitoring in water supply systems
- Quality control in sewage treatment plants
- Water quality research projects

Use in other media may damage the sensor. If the TW pH / EC sensor is to be used in media other than those specified in these instructions, please contact TriOS Mess- und Datentechnik GmbH Technical Support (support@trios.de).

According to current scientific knowledge, the device is safe to use if it is handled in accordance with the instructions in this operating manual.

NOTICE

Damage caused by improper use is excluded from the warranty.

1.5 Disposal instructions

At the end of its service life or useful life, the device and its accessories can be returned to the manufacturer (see address below) for disposal in an environmentally friendly manner. Proof of prior professional decont-

amination must be provided in the form of a certificate. Please contact us before returning the device for further details.

[Address of the manufacturer:](#)

TriOS Mess- und Datentechnik GmbH
Bürgermeister-Brötje-Str. 25
26180 Rastede
Rastede, Germany
Phone: +49 (0) 4402 69670 - 0
Fax: +49 (0) 4402 69670 - 20

1.6 Certificates and approvals

The product meets all requirements of the harmonized European standards. It therefore fulfills the legal requirements of the EU directives. TriOS Mess- und Datentechnik GmbH confirms the successful testing of the product by affixing the CE mark (see appendix).

2 Introduction

The TW pH / EC is a sensor from the TW Master series. TW pH / EC has been specially developed for the precise analysis of pH value and electrical conductivity in drinking water and meets the highest standards of accuracy and reliability.

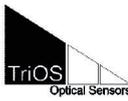
The modular design of the TW Master series makes it easy to expand the measuring system with sensors that exactly meet the requirements of your application. All devices in the TW Master series can be installed in a series (up to 3 devices) and analyze the desired parameters in just one bypass installation.

2.1 Product identification

All TriOS Mess- und Datentechnik GmbH products are provided with a product label that clearly shows the product designation.

There is also a type plate on the device with the following information, which you can use to clearly identify the product:

TW pH / EC

Serial number	Serial No 6680DDDD 
Product type	Type TW pH / EC
Power supply	Sensor Power 12-24 VDC +/-10% / max. 2 W
Interface	Sensor Interface Ethernet, RS-485, USB
	TW Master Series
	  

The nameplate also contains the product barcode, the TriOS Optical Sensors logo and the CE quality mark.

Please note that the specifications given here are for illustrative purposes only and may vary depending on the product version.

2.2 Scope of delivery

The delivery includes the following components:

- Sensors (pH / EC electrodes)
- Controller and display module
- Flow cell
- Operating instructions
- Delivery accessories
 - Allen key, 6 mm
 - PVC hose, 30 cm
 - TW pH / EC starter kit
 - 2 x blanking plugs
 - Protective cap with KCl buffer solution

TW pH / EC starter kit

- pH-4 buffer solution
- pH-7 buffer solution
- Conductivity calibration solution 1413 $\mu\text{S}/\text{cm}$
- Tool for removing the electrode heads (“EW-17-Tool”)
- Calibration cup

2.3 Measuring principle and structure

Sensor interface TW pH / EC

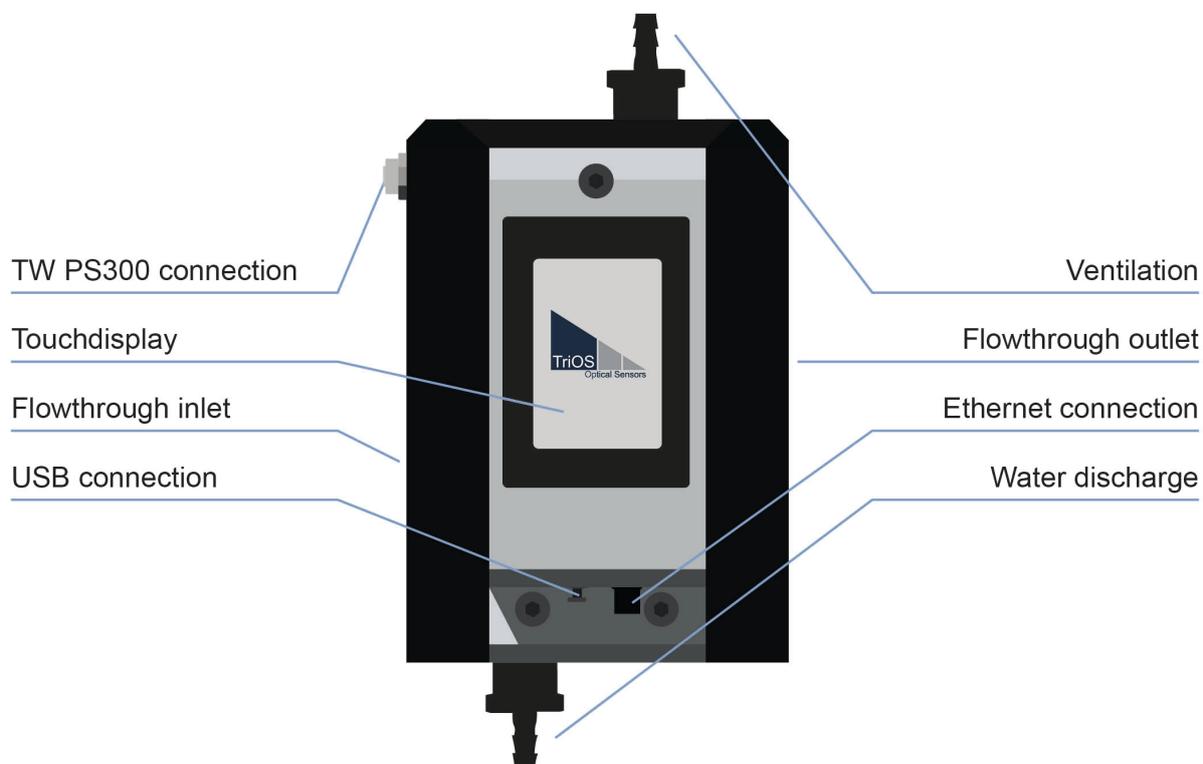
The sensor unit of the TW pH / EC has a sensor head for measuring the pH value and one for the electrical conductivity in one device. Both sensors are housed in a flow cell.



Sensor unit and flow cell

2.4 Sensor operation

The capacitive touch display can be operated by touching or lightly tapping it with bare fingers or a special stylus.



NOTICE

The use of sharp or pointed objects when operating the touch display can cause damage to the display.

Start screen

The start screen shows the current measured values of the respective parameters. In the example below, data for tap water is displayed.



The screenshot shows the start screen with the following elements:

- Menu:** A triple menu bar icon at the top left.
- Date and time:** 13.11.2024 12:48:18 at the top right.
- Current values:**
 - pH: 7.69
 - Conductivity: 435.6 $\mu\text{S}/\text{cm}$
 - Temperature: 21.4 $^{\circ}\text{C}$
- Firmware version of the sensor:** 6680000B (SW: 3.0.0) at the bottom.

Main menu

By clicking on the menu symbol (the triple menu bar) at the top left of the display, the main menu of the TW pH / EC appears.



2.4.1 Menu buttons / Functions



This button takes you to the sensor **calibration screen**. A detailed description of calibration can be found in chapter 5 of this manual.



This button leads to the settings of the **analog output screen** of the sensor. The measured value can be output via one of the six 4...20 mA outputs in the TW PS300 power supply unit. The configuration of the analog output is described in chapters 3 and 4 of this manual.



This button takes you to the sensor **cleaning screen**. A detailed description can be found in chapter 4 of this manual.



This button takes you to the screen for **setting the storage interval**. A detailed description can be found in chapter 4 of this manual.



This button takes you to the sensor **data export** screen. Data exports are necessary if you have problems with the measurements. A detailed description can be found in Chapter 6 of this manual.



This button takes you to the screen for **updating the sensor's firmware**. A firmware update is provided to improve measurements or to correct errors.



This button takes you to the sensor's **network settings** screen. If the sensor is to be integrated into a system, settings can be adjusted here. A detailed description can be found in chapter 6.



This button takes you to the sensor's **alarm and relay settings** screen. Threshold values for the alarm or the activation of relays can be set in the submenu. A detailed description can be found in Chapter 4 of this manual.



This button takes you to the sensor's **password settings** screen. You can set a password to restrict access to the sensor. A detailed description can be found in chapter 6 of this manual.



This button takes you to the sensor's **display settings** screen. A detailed description can be found in chapter 4 of this manual.



This button takes you to the sensor's **main settings screen**. Language and time can be set. English, French and German are currently available. A detailed description can be found in chapter 4 of this manual.



This button takes you to the sensor's **energy settings** screen. This button is used to access **maintenance mode**. A detailed description can be found in chapter 4.



This button takes you to the sensor's **measurement interval screen**. A detailed description can be found in Chapter 4 of this manual.



This button allows you to edit texts and numbers if required.



This button allows you to approve changes.



You can use this button to reject changes.



You can use this interactive button to switch functions on or off.



3 Commissioning

This chapter deals with commissioning the sensor. Pay particular attention to this section and follow the safety precautions to protect the sensor from damage and yourself from injury.

Before putting the sensor into operation, make sure that it is securely fastened and that all connections are made correctly.

3.1 Hydraulic connection

The sensor (when sold as a single unit) is supplied with connection plates that have plug-in connections for hoses with an outer diameter of 10 mm.

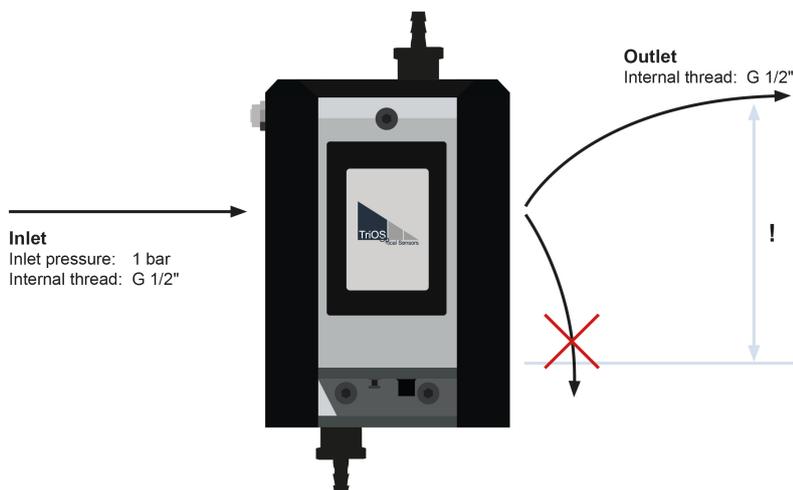
Hose to be used with these connectors must be suitable for this use (externally calibrated and tight enough)! TriOS offers these two solutions:

65A000022	TW Master connection hose black 5 m
02A110000	PUR hose 10-8 black 10 m
02A110001	PUR hose 10-8 black 25 m

NOTICE

Not every conventional hose with an outer diameter of 10 mm can be used!

Hydraulic connection diagram



Make sure that the drain hose is not installed hanging downwards, as this can create suction in the outflowing water, which causes negative pressure in the sensor. This favors the outgassing of the sample and significantly influences the measurement!

If the measured values indicate that there is still a negative pressure in the cell and the sample is outgassing too much, a baffle plate can be inserted into the outlet connection plate to reduce the line cross-section and thus reduce the pressure drop.

Alternatively, a tap or throttle can be fitted in the outlet to increase the pressure in the measuring cell. In this case, however, it is essential to ensure that the pressure in the cell does not exceed 1 bar, e.g. by installing a pressure reducer.

3.2 Electrical installation

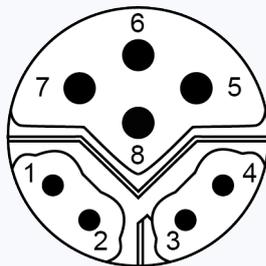
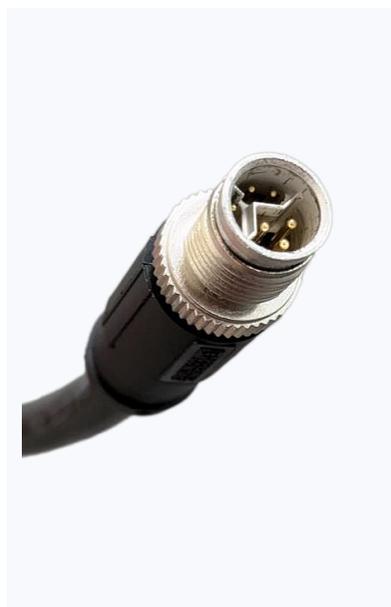
The power supply is ensured by the M12 hybrid cable included in the scope of delivery.

NOTICE

Before connecting the TW pH / EC to the TW PS300, make sure that the power supply is switched off.

Please use the contacts provided in the TW PS300 for the Modbus connection or analog outputs. Further information on the connection can be found in the TW PS300 operating instructions.

3.2.1 M12 hybrid industrial connector



pin	color	Function
1	White/ Orange	RS-485 A
2	Orange	RS-485 B
3	White/ Green	Do not connect
4	Green	Do not connect
5	Blue	Do not connect
6	White	Do not connect
7	Brown	+24 VDC
8	black	GND / Ground

The sensor is ready for commissioning as soon as the installation of the accessories has been completed (supply lines, down conductors), it is connected to the TW PS300 and the necessary configuration has been completed.

NOTICE

Ensure that the polarity of the supply voltage is correct, otherwise the sensor may be damaged.

3.3 Inserting the sensor heads

The sensor heads for measuring the conductivity and pH value are transported separately from the sensor unit for safety reasons. Before the sensor can be put into operation, they must be refitted in the sensor.

To do this, the two dummy plugs must be unscrewed by hand and the sensor heads screwed in. To make it easier to fit the sensor heads, a tool (see “EW17 tool”) is included in the scope of delivery for this purpose.

NOTICE

The pH sensor head is stored in a buffered potassium chloride solution. The sensor should not be stored dry.

NOTICE

The conductivity sensor head must be aligned in the direction of flow.



3.4 Interfaces

3.4.1 Serial interface

The serial interface of the sensor is RS-485 (9600bps/8-N-1).

The protocol used is Modbus RTU. A detailed description of the Modbus RTU protocol for TW pH / EC can be found in the appendix.

Please use the contacts provided in the TW PS300 for the Modbus connection. Further information on the connection can be found in the TW PS300 operating instructions.

3.4.2 Analog output

The TW pH / EC can be used to control the analog 4...20 mA outputs of the TW PS300. To set this up, please connect your system to a TW PS300 with integrated analog outputs.

Configuration is carried out via the corresponding display. The desired output number (1 to 6) can be selected and the measured value can be scaled. For detailed settings, please read chapter 4.2 Setup and configuration.

3.4.3 Ethernet interface



If a connection to a company network is required, the network settings can be configured accordingly. To use the network, connect an Ethernet cable to the RJ-45 port. There are now two options:

1. Use the automatic IP search so that your company network provides the IP address.
2. Use a static IP for the sensor and configure it accordingly.

5s 16:32:28

✕ Auto IP address
10.0.3.44

IP address
[]

Subnet Mask
255.0.0.0

Gateway
10.9.9.9

5s 16:32:28

✕ Auto IP address
10.0.3.44

IP address
[]

Subnet Mask
255.0.0.0

Gateway
10.9.9.9

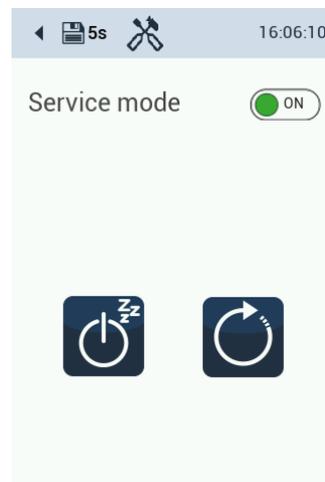
4 Application

4.1 Setup and configuration TW pH EC

Maintenance mode



Maintenance mode should always be activated if configuration changes are required. To activate it, click on the power switch and switch on maintenance mode. The tool symbol at the top of the display indicates that maintenance mode is activated.



Language, date and time



The date and time must be set in order to adapt to the local time zones.

To change the language, drag the country flags to the left or right. To set the date and time, click and drag the window and swipe up or down.



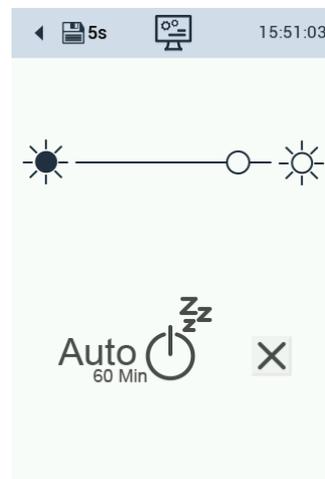
Setting the display



The brightness of the display can be adjusted to the local conditions.

To do this, swipe the cursor back and forth between the two settings (dark - light).

The display can also be switched off after 60 minutes to save power (auto sleep). It switches on again automatically as soon as you touch the screen.

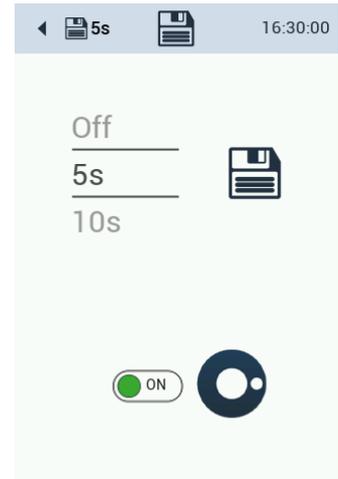


Saving



Saving the measurement data can be switched off by tapping "Off".

Measurement can be switched off by pressing the "ON / OFF" button. Corresponding warning symbols appear on the main screen. The last value is saved.

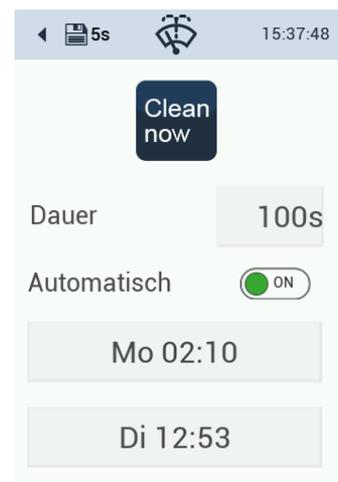
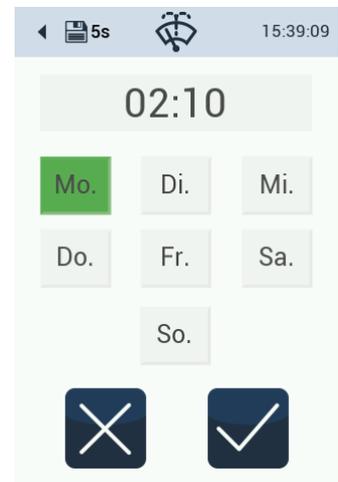


Cleaning interval



Two cleaning times can be configured, which are repeated on an adjustable number of days per week.

When activated by the interactive switch, the field turns green and shows "ON".



Display and configuration of the measured values

The display shows the serial number and the current software version at the bottom of the display.



If post-processing is activated, the symbol for this appears at the top right of the measurement field.



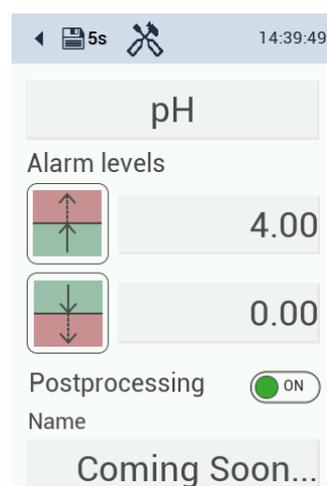
Post-processing

It may be necessary to adapt the measurement results to the local conditions. To check whether this is necessary, analyze a water sample in the laboratory. The difference between the laboratory result and the measurement result of the TW pH / EC can be calculated.

The scaling can be edited in the submenu of the main display. Activate or deactivate the box for post-processing. This does not change the factory or customer calibration.

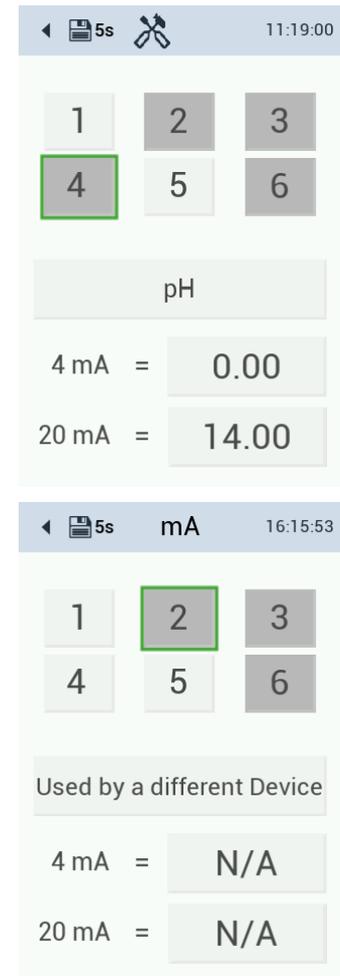
The post-processed measurement result is shown on the display. If you want to read out this value via Modbus, query register 1500.

The post-processed value is used for the analog output. The name and unit of the post-processing cannot be edited at the moment. (Software version 3.0.0)



Configuration of the analog outputs

There are 6 analog outputs available. Each output can be configured separately. Switch between the analog outputs and set the values for 4 mA and 20 mA. Check the box to activate the analog output.



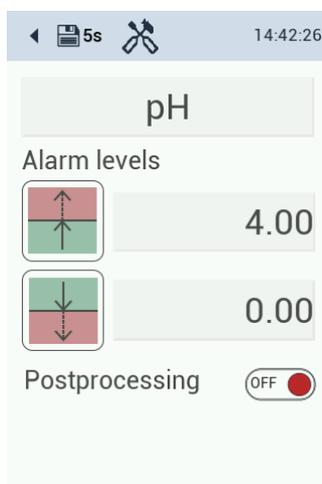
The analog output being configured is outlined in green. Outputs that are occupied are highlighted in gray. Outputs assigned by another device must first be enabled before they can be assigned again.

4.2 Alarm and relay

The TW pH / EC offers an alarm and relay output via the TW PS300. For setup, please connect your system to the relay and buzzer output interface of the TW PS300 (chapter 2.3 of the TW PS300 manual).

The buzzer and relay output is configured via the TW pH / EC display. The alarm values can be set by clicking on the measured value fields.

Configuration of the alarm values for pH



Alarm setting

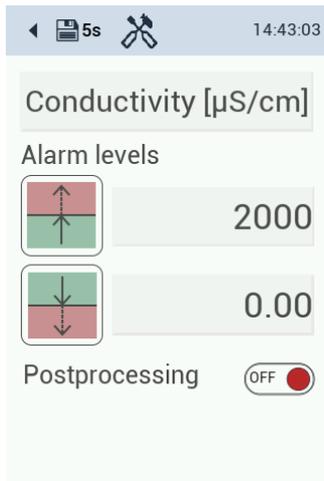


Alarm via relay

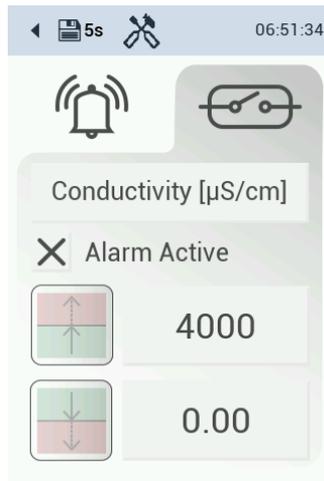


Alarm to TW PS300

Configuration of the alarm values for conductivity



Alarm setting

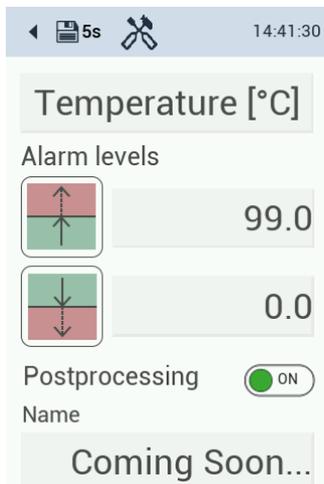


Alarm via relay



Alarm on TW PS300

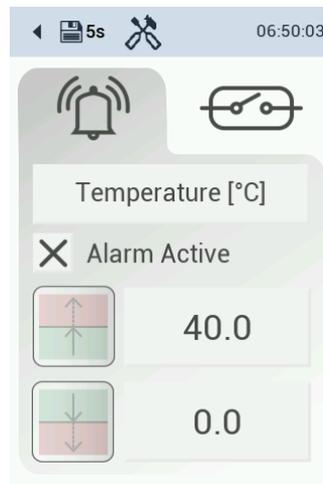
Configuration of alarm values for temperature



Alarm setting



Alarm via relay



Alarm on TW PS300

4.3 Bypass installation

TW pH / EC can only be used as a bypass installation. The 10 mm hose is supplied with the system.

When the power cable is connected, the sensor is powered up. This can take up to one minute. The screen will remain black in the meantime.

4.4 Connecting plate with RGB LED

An RGB LED is connected to 3 GPIO connections (General Purpose Input/Output), which is used to signal the status of the loop. Here (R, G, B) = (PB10, PB11, PA12).

LED	LED Description
Green permanent	Normal operation, loop closed and confirmed
Red flashing	Loop is open
Flashing blue	Loop closed and waiting for confirmation
Flashing green	Loop released and waiting for voltage stabilization

In the bootloader, the LED flashes red and blue alternately and at the end of a firmware update it flashes red or green for a short period, depending on whether the update process was successful or not.



4.5 Notes on installation

When using several TW master devices in a bypass installation, care must be taken to ensure that all devices have the same software package version.

The latest software package can be installed on the devices using a USB stick.

5 Calibration

5.1 Manufacturer calibration

TW pH / EC is supplied calibrated.

5.2 Customer calibration

It is recommended that calibration is carried out at regular intervals. Two solutions (2-point) are required to calibrate the pH sensor head and one conductivity solution (1-point) is required for the conductivity sensor head. TriOS offers suitably filled buffer solutions pH 4 and pH 7 as well as a conductivity solution with a concentration of 1413 $\mu\text{S}/\text{cm}$.

5.2.1 pH calibration



Calibration is used to calibrate the zero value (pH 7) and the slope (pH 4 or pH 10, depending on the application). For calibration, select pH buffer solutions with an accuracy of ± 0.01 pH and observe the temperature. Fresh or newly prepared solutions must be used for each calibration.

Procedure

- Set the system to maintenance mode.
- Close the inlet (important: when using the cleaning panel, be sure to close the main inlet)
- Close the drain
- Position the collection vessel under the drain and open the drain valve
- Open the vent at the top
- Drain the water from the measuring cell
- If another measuring cell is connected to the TW pH / EC, drain this cell as well.
- Remove the hose from the inlet adapter
- Dismantle the TW pH / EC sensor module

Dismantling the sensor module



Loosen the Allen screws (quarter turn)



Remove the sensor module

- Rinse the sensor with distilled water
- Fill the calibration cup up to the specified line with pH 7 buffer solution
- Attach the calibration cup to the measuring device of the TW pH / EC and press the cup firmly onto the sensor unit. (See illustration)

Handling the calibration beaker



Fill the calibration beaker

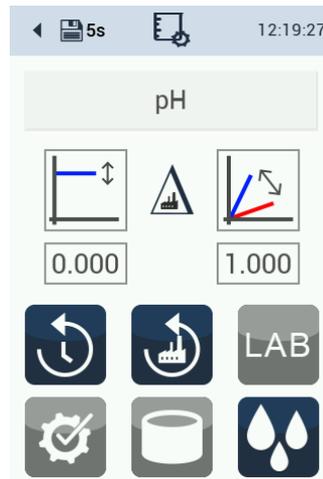


Immerse the sensor unit & press firmly

- Check whether there are any air bubbles on the electrode and remove them by gently shaking / tapping if necessary
- The sensor must then be inserted into the FlowCell with the calibration cup in order to be supplied with power
- To start the calibration, open the main menu and press the button at the top left



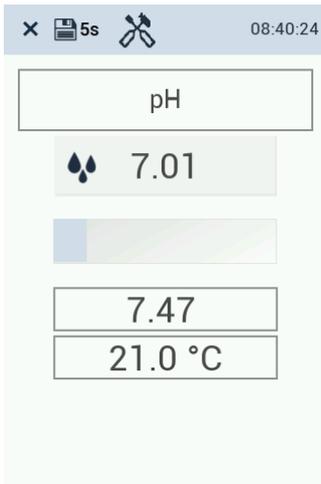
Main menu



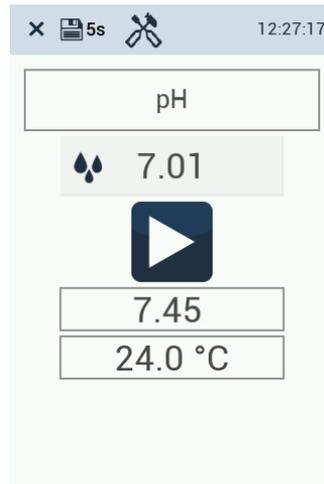
pH calibration screen

Calibration process

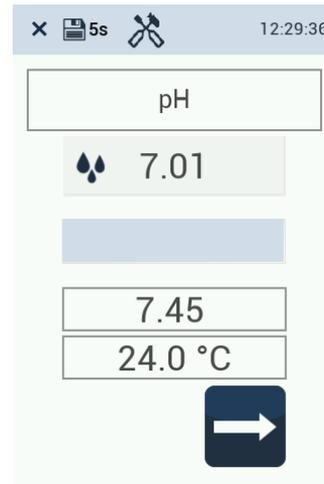
- Start the calibration. Depending on the temperature displayed on the calibration screen, the corresponding target value must be entered next to the 3 drops
- Once the blue bar on the screen has run through, a "Play" symbol appears in the middle. Please press "Play". A blue progress bar appears again
- If the sensor has enough measurements for calibration, the arrow at the bottom right of the screen turns blue and can be confirmed



pH 7 stabilization



pH 7 Start

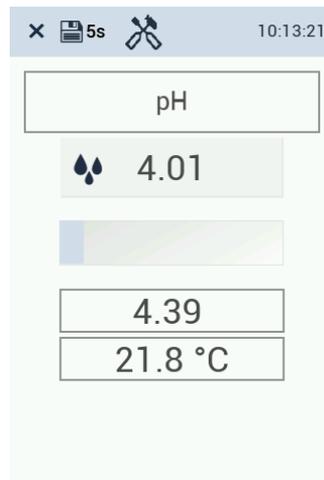


Confirm calibration

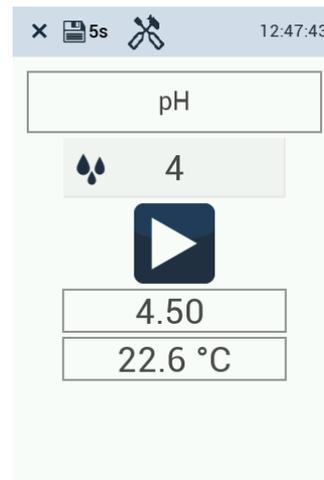
- A video prompt to change the calibration solution appears on the screen. To do this, unscrew the sensor from the FlowCell, discard the pH solution and clean the calibration cup
- Now fill the second buffer solution for the scaling calibration into the beaker up to the line
- Rinse the sensor again with distilled water
- Attach the calibration beaker to the measuring device of the TW pH / EC again. Check whether there are any air bubbles on the electrode and remove them by gently shaking or tapping if necessary
- Then insert the sensor with the mounted calibration cup back into the FlowCell so that the calibration can be continued
- Depending on the temperature, the corresponding target value of the scaling calibration solution must be entered next to the 3 drops
- Once the blue bar on the screen has run through, a “Play” symbol appears in the middle. Please press “Play”



Solution exchange

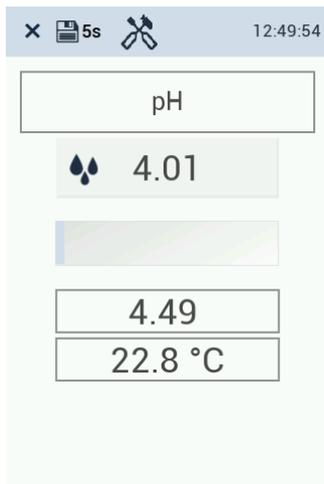


pH 4 stabilization



pH 4 start

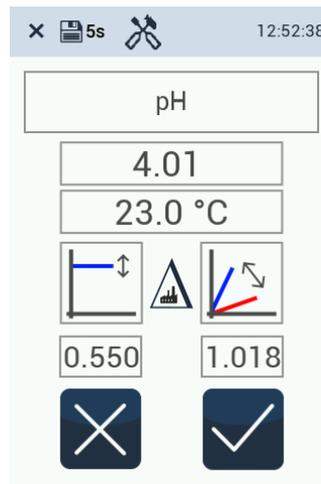
- A blue progress bar appears again
- If the sensor has enough measurements for calibration, the arrow at the bottom right of the screen turns blue and can be confirmed



Measure pH 4

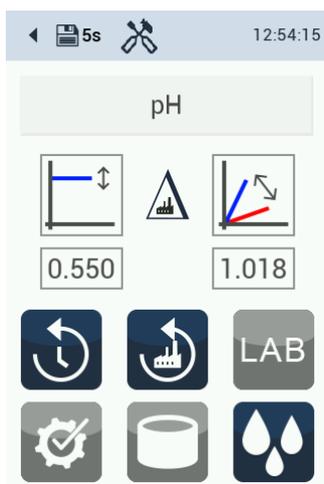


Confirm pH 4

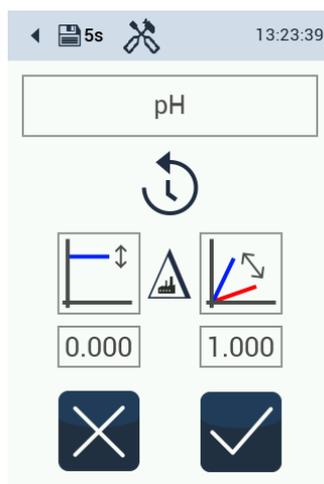


Save calibration

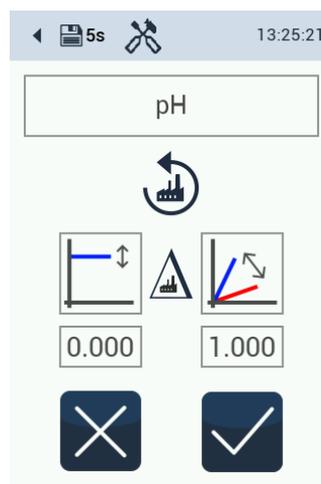
- If the calibration was successful, it can be saved. If there were any complications during calibration, the calibration can be canceled or reset at this point.
- The calibration device can now be removed.



Calibration accepted



Reset calibration



Back to factory calibration

5.2.2 Conductivity calibration



Calibration is used to calibrate the slope with a suitable standard solution. A concentration of 1413 $\mu\text{S}/\text{cm}$ is recommended for drinking water applications.

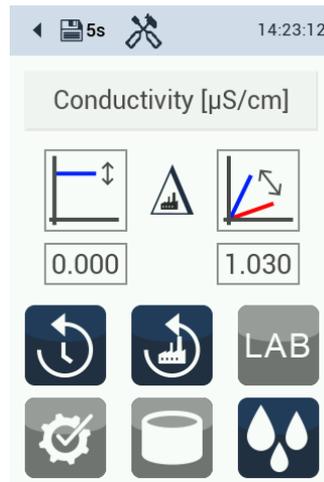
Procedure

- Set the system to maintenance mode.
- Close the inlet (important: when using the cleaning panel, always close the main inlet)
- Close the drain
- Position the collection vessel under the drain and open the drain valve
- Open the vent at the top
- Drain the water from the measuring cell
- If another measuring cell is connected to the TW pH / EC, drain this cell as well.

- Remove the hose from the inlet adapter
- Dismantle the TW pH / EC sensor module
- Rinse the sensor with distilled water
- Fill the calibration cup up to the specified line with the standard solution 1413 $\mu\text{S}/\text{cm}$ conductivity
- Attach the calibration beaker to the measuring device of the TW pH / EC and press the beaker firmly onto the sensor unit. (See illustration in section 5.2.1)
- Check whether there are any air bubbles on the electrode and remove them by gently shaking / tapping if necessary
- The sensor must then be installed in the FlowCell in order to be supplied with power
- To start the calibration, open the main menu and press the button at the top left



Main menu



Calibration screen EC

Calibration process

- Start the calibration. Depending on the temperature displayed on the calibration screen, the corresponding target value must be entered next to the 3 drops.
- Once the blue bar on the screen has run through, a “Play” symbol appears in the middle. Please press “Play”. A blue progress bar appears again.



Calibration EC Stabilization



Calibration EC Start

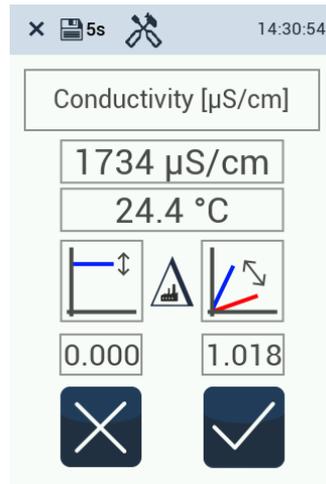


Measure calibration

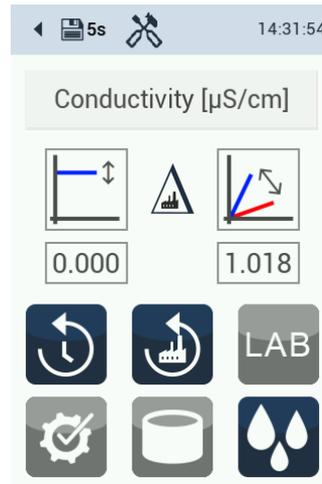
- If the sensor has enough measurements for calibration, the arrow at the bottom right of the screen turns blue and can be confirmed.



Confirm calibration

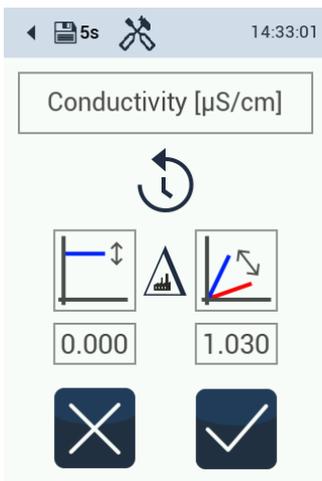


Save calibration

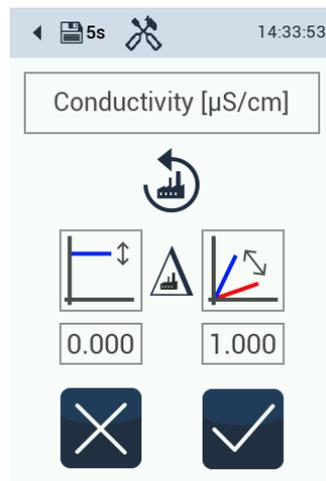


Calibration accepted

- If the calibration was successful, it can be confirmed. If there were complications during calibration, the calibration can be canceled or reset at this point.



Reset calibration



Reset to factory calibration

6 Malfunction and maintenance

6.1 Maintenance and inspection

The sensor requires only minimal maintenance. In applications that cause heavy soiling on the sensor, it should be cleaned more frequently.

Notes on maintenance

- The sensor should always be kept clean. If there is a biofilm on the sensor, this can lead to measurement errors.
- A dirty sensor should be cleaned with buffer solution.
- Please avoid mechanical impact on the glass membrane / graphite electrode.
- A very soft brush or a soft sponge can be used carefully for stubborn soiling.
- In the case of firmly adhering deposits, the sensor can be immersed in a diluted potassium chloride solution or a base. In the case of organic deposits, pepsin can also be used.

NOTICE

Always rinse the sensor and the sensor system carefully with distilled water after cleaning.

NOTICE

If the pH sensor is taken out of service, it should be stored cleaned. The protective cap must be filled with a 3 molar potassium chloride solution. In this case, the pH sensor port must be sealed with a blanking plug.

Replacing the pH electrode

It is recommended to replace the pH electrode if a calibration can no longer be accepted because the limit values for offset and / or scaling have been exceeded.

- Lower limit pH scaling: 0.95
- Upper limit pH scaling: 1.43
- Lower limit offset scaling: -1
- Upper limit offset scaling: 1

6.2 Functionality test

To check the measured values, a standard solution can be used or a reference measurement of the measured values can be carried out. The standard solution should be within the expected measuring range of the measuring medium.

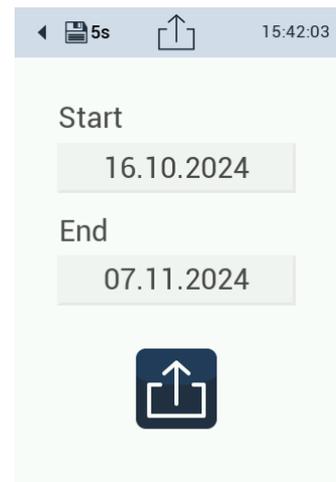
Table 1: Maintenance and calibration intervals

Sensor	Maintenance	Inspection
TW pH / EC	Weekly	Monthly

6.3 Downloading measurement data



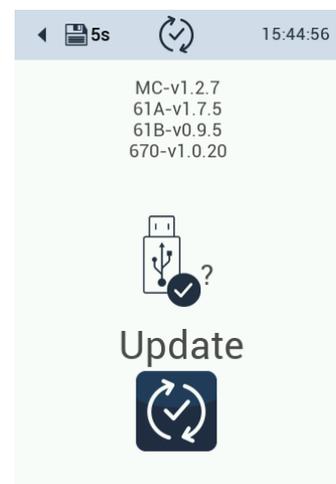
To download measurement data, connect a USB device. Click on the “Export data” button and set a start and end time. Click on “Export data” and the download will start.



6.4 Firmware update



A firmware update may be required. To upload a new firmware version, the firmware must be on a USB stick. Insert the USB stick into the sensor and open the submenu. Start the upload by clicking on the “Confirm” button.



6.5 Return shipment

Please note the procedure for your return.

If you wish to return the sensor or the device, please contact technical support first. To ensure a smooth return process and to avoid incorrect shipments, every return shipment must first be reported to technical support. You will then receive a numbered RMA form, which you must complete in full, check and return to us.

Please stick this form with the number clearly visible on the outside of the return package or write it in large letters on the packaging. This is the only way your return can be correctly assigned and accepted.



Please note! Returns without an RMA number cannot be accepted and processed!

Please note that the sensor or the device must be cleaned and disinfected before shipping.

Use the original packaging to ensure that the goods are sent undamaged. If this is not available, ensure that safe transportation is guaranteed and that the sensors are secured with sufficient packing material.

7 Technical data

7.1 Technical specifications

Application	Determination of pH value and conductivity in drinking water
Measurement technology - pH	pH electrode
Measurement technology - EC	Conductivity
Measuring principle - pH	Potentiometry
Measuring principle - EC	Conductivity with two graphite electrodes
Parameters	pH value, conductivity, temperature
Applied standard	DIN EN ISO 27888:1993

	pH	EC	Temperature
Measuring range	0...14 pH	0.00...5000 $\mu\text{S/cm}$	0...65°C
Measuring accuracy	± 0.06 pH	± 40 $\mu\text{S/cm}$ at 1000 $\mu\text{S/cm}$, ± 200 $\mu\text{S/cm}$ at 5000 $\mu\text{S/cm}$	$\pm 0,5^\circ\text{C}$
Resolution	0.01 pH	<100 = 0.01 $\mu\text{S/cm}$; <1000 = 0.1 $\mu\text{S/cm}$; >1000 = 1 $\mu\text{S/cm}$	0,1°C
Repeatability precision	pH1: 0.001; pH7: 0.0006; pH13: 0.001	± 2 $\mu\text{S/cm}$ at 1000 $\mu\text{S/cm}$; ± 7 $\mu\text{S/cm}$ at 4000 $\mu\text{S/cm}$	-
Detection limit	not applicable	3 $\mu\text{S/cm}$	-

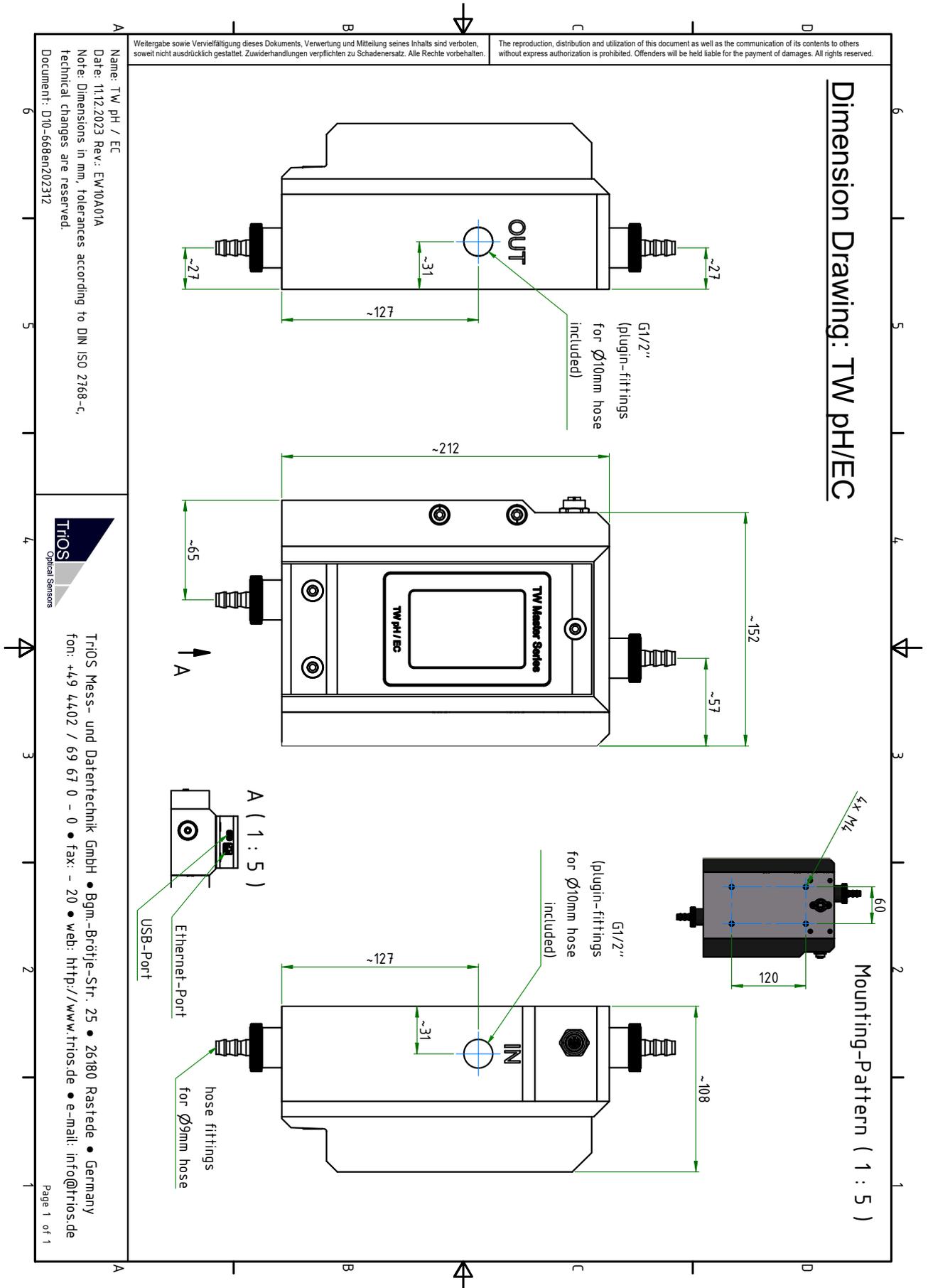
Response time T90 / T100	T90 increasing 15 s ; T90 decreasing 20 s
Warm-up time	< 5 min
Stability / drift	Short-term drift 24h: < 0.03 pH
	Long-term drift 1 week: < 0.05 pH
Temperature compensation	Pt1000
Turbidity compensation	No
Data logger	Internal 8 GB memory
Response time	10 s
Shortest measurement interval	5 s

Cross sensitivities	None known
Display	3.5 inch capacitive color touch display, 320x480 pixels
Interface - digital	RS-485 (Modbus RTU), Ethernet (Modbus TCP)
Interface - analog	-
Power supply	12-24 VDC ($\pm 10\%$)
Power consumption	typically 2 W; stand-by: 1.5 W
Protection class	CLASS III
Overvoltage category	I
Connection	M12 hybrid industrial connector, 8-pin

	Flow cell	Sensor	pH sensor head	EC sensor head
Housing material	POM / aluminum	POM / NBR / stainless steel	PET / pH glass / NBR	PET / NBR / epoxy / graphite
Dimensions (W/H/D)	160 / 280 / 108 mm			
weight	approx. 3.8 kg			

Operating conditions	
Operating temperature	Sample (insitu) 2...40 C°
min. Internal pressure	0.2 bar
max. internal pressure	1 bar
Inflow velocity	min. 10 L/h
Transport conditions	0...80°C
Storage conditions	0...80°C
Protection class	IP30
Maintenance effort	
	≤ 0.5 h / month typical
Calibration/maintenance interval	pH: 4 weeks typical, EC: 6 months typical Regular cleaning, depending on the water quality
System compatibility	TW Master, Modbus RTU, Modbus TCP
Warranty period	1 year (EU & USA: 2 years)

7.2 Outer dimensions



8 Accessories

8.1 Accessories

Delivery accessories

See chapter 2.2 Scope of delivery.

Art. 65A000013 TW pH / EC calibration set

- 6 bags each of pH 7 and pH 4 calibration liquid
- 2 bags of conductivity calibration liquid 1413 μS

Art. 65A0011 TW EC replacement electrode

Art. 65A0003 TW pH replacement electrode

9 Warranty

The warranty period for our devices within the EU and the USA is 2 years from the date of invoice. Outside the EU it is 1 year. Excluded from the warranty are all normal consumables (depending on the product, e.g. light sources or windows).

The guarantee is subject to the following conditions:

- The appliance and all accessories must be installed as described in the relevant manual and operated in accordance with the specifications.
- Damage caused by contact with aggressive and material-damaging substances, liquids or gases, as well as transport damage, are not covered by the guarantee.
- Damage caused by improper handling and use of the appliance is not covered by the warranty.
- Damage caused by modification or unprofessional attachment of accessories by the customer is not covered by the warranty.

NOTICE

Opening the device will void the warranty!

10 Technical support

If you have a problem with a TriOS sensor / a TriOS device, please contact TriOS technical support.

We recommend sending in sensors every 2 years for maintenance and calibration. To do this, please request an RMA number from technical support.

Contact technical support:

E-mail: support@trios.de
Phone: +49 (0) 4402 69670 - 0
Fax: +49 (0) 4402 69670 - 20

To enable us to help you quickly, please send us the sensor ID number (serial number with 8 digits, consisting of letters and numbers, e.g. 6700003F) by e-mail.

11 Contact us

We are constantly working on improving our devices. Please visit our website for the latest news.

If you have found a fault in one of our devices or programs or would like additional functions, please contact us:

Technical Support:	support@trios.de
General questions/sales:	sales@trios.de
Website:	www.trios.de

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Telephone

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Fax

+49 (0) 4402 69670 - 20

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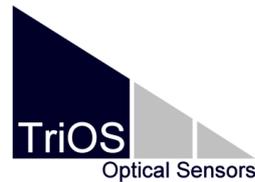
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13 Appendix

13.1 CE Declaration of Conformity



Hersteller/Manufacturer/Fabricant: TriOS Mess- und Datentechnik GmbH
 Bürgermeister-Brötje-Str. 25
 D- 26180 Rastede

Konformitätserklärung Declaration of Conformity Déclaration de Conformité

Die TriOS GmbH bescheinigt die Konformität für das Produkt
 The TriOS GmbH herewith declares conformity of the product
 TriOS GmbH déclare la conformité du produit

Bezeichnung Product name Désignation	TW pH / EC
Typ / Type / Type	-
Mit den folgenden Bestimmungen With applicable regulations Avec les directives suivantes	2014/30/EU EMV-Richtlinie 2011/65/EU RoHS-Richtlinie + (EU) 2015/863 + (EU) 2017/2102
Angewendete harmonisierte Normen Harmonized standards applied Normes harmonisées utilisées	EN IEC 61326-1:2021 EN 61010-1:2010 +A1:2019 +A1:2019/AC:2019 EN IEC 63000:2018
Datum / Date / Date	Unterschrift / Signature / Signature
23.05.2024	 R. Heuermann

D05-668de202405

Seite 1 von 1

13.2 Modbus RTU - TW Master

Modbus server in TW Master Series

TW Master Software Package V3.0.0

Serial interface

On delivery, the TW sensors are configured to RS-485 with the following settings:

- Baud rate: 9600 bps
- Data bits: 8
- Stop bits: 1
- Parity: none

Ethernet interface (Modbus TCP)

The port number is 502. The corresponding IP address can be found in the network settings.

Data types

Data type name	Register	Format
Bool	1	false= 0x0000, true ≠ 0x0000
Uint8	1	8-bit positive integer. Values: 0x0000 - 0x00FF
Uint16	1	16-bit positive integer. Values: 0x0000 - 0xFFFF
Uint32	2	32-bit positive integer. Values: 0x00000000 - 0xFFFFFFFF
Uint64	4	64-bit positive integer. Values: 0x00000000 - 0xFFFFFFFFFFFFFFFF (2 ⁶⁴ - 1)
Float	2	IEEE 754 32-bit floating point number
Char[n]	$\lceil \frac{n}{2} \rceil$	Zero terminated ASCII character string
Uint16[n]	n	Field of n 16-bit integers (cf. Uint16)
Float[n]	2n	Field of n floating point numbers (cf. Float)

Functions

These Modbus function codes are supported:

Name	Code	Description / Use
Read multiple registers	0x03	Read serial no., configuration, calibration and measurement data
Write multiple registers	0x10	Write configuration and calibration
Write single register	0x06	Write configuration and calibration
Report slave ID	0x11	Read device type, serial number and firmware version.

Default slave address

The factory default setting for the slave address is

Sensor	Sensor address
TW Turb 40	2 (0x02)
TW pH / EC	5 (0x05)
TW Turb W40	7 (0x07)

Reading / writing multiple registers (0x03 / 0x10)

The R/W column describes the access restrictions for the registers. An 'R' means that it can be read (0x03), a 'W' means that it can be written (0x10).

Name	R/W	Address	Data type	Data type Description
Modbus slave address	R/W	0	UInt8	Identifier used for the Modbus protocol. Valid IDs: 1...247
Measurement	W	1	UInt16	0x0000 Sends a trigger 0x0001 Read parameters only
Device serial Number	R	10	Char[10]	The serial number of the sensor
Firmware version	R	15	Char[10]	The version of the installed firmware
Trigger enabled	R/W	100	Bool	false= 0x0000, true ≠ 0x0000
Storage interval	R/W	101	UInt16	Storage interval in seconds; 0x0000 = OFF
Service mode	R/W	102	Bool	false= 0x0000, true ≠ 0x0000
System Time	R/W	120	UInt64	64-bit Unix time (in seconds since 01/01/1970)
Description	R/W	124	Char[64]	Description for the sensor
IP address	R	156	UInt32	Current IP address of the sensor
Postprocessing	R/W	200ff	Bool	see below (Scaling and offset table)
Free memory	R	840	UInt32	Free memory of the data logger in KB
Cleaning state (if applicable)	R	843	UInt16	0x0000 unkown 0x0001 not active 0x0002 error 0x0003 stopped due to error 0x0004 valve closed 0x0005 pumps activated 0x0006 exposure time 0x0007 flushing 0x0008 finished 0x0009 door open

Name	R/W	Address	Data type	Data type Description
				0x000A door closed 0x000B busy (lead time) 0x0020 debubble valve closed 0x0021 debubble valve open
Flags PS300	R	844	UInt16	see table “TW PS300 flags” below
Parameter / scaled parameter	R	1000ff / 1500ff	Float	TW Turb 1000/1500: Turbidity in FNU/NTU
				TW pH / EC 1000/1500: pH 1004/1504: Temperature in °C 1014/1514: Conductivity in µS/cm

Scaling and offset (post-processing)

Name	R/W	Address	Data type	Description
Postprocessing of parameter #1	R/W	200	Bool	OFF = 0x0000, ON ≠ 0x0000
Offset	R/W	201	Float	Offset (to be subtracted from measurement value)
Scaling factor	R/W	203	Float	Scaling of the measurement value
Averaging	R/W	205	Bool	OFF = 0x0000, ON ≠ 0x0000
Averaging in s	R/W	206	UInt16	Number of seconds for averaging
Postprocessing of parameter #2	R/W	240	Bool	OFF = 0x0000, ON ≠ 0x0000
Offset	R/W	241	Float	Offset (to be subtracted from measurement value)
Scaling factor	R/W	243	Float	Scaling of the measurement value
Averaging	R/W	245	Bool	OFF = 0x0000, ON ≠ 0x0000
Averaging in s	R/W	246	UInt16	Number of seconds for averaging
Postprocessing of parameter #3	R/W	280	Bool	OFF = 0x0000, ON ≠ 0x0000
		...		
Postprocessing of parameter #4	R/W	320	Bool	OFF = 0x0000, ON ≠ 0x0000
		...		
Postprocessing of parameter #5	R/W	360	Bool	OFF = 0x0000, ON ≠ 0x0000
		...		

Global measurement table

This makes it possible to offer all available measured values of all sensors in a coherent register area for each individual sensor.

A register area from register 1200 to register 1399 is reserved for this purpose, in which 100 measured values can be stored as 32-bit floating point numbers.

Designation	R/W	Ad- dress	Data type	Data type Description
Turbidity value	R	1200	Float	[FNU/NTU]
Temperature	R	1202	Float	[°C]
pH	R	1204	Float	[pH]
Conductivity	R	1206	Float	[µS/cm]

TW PS300 flags

Bit	Flag
0	Is set when the TW PS300 has reported for the first time.
1	Set when the control panel is present
2	Set if the cleaning system is present
3	Set when the TW PS300 is in service mode
4	Set when the TW PS300 alarm is activated
5	Set when the relay of the TW PS300 is switched
6	Set when the valve of the TW PS300 is closed
7	Set when the door is present and open
8	Set when the cleaning pump is pumping
9	Set when the fill level in the cleaning container is too low

Example

Response: 0x0041 -> 0000 0000 0100 0001

Bit#	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1

Setting the flags for this example: 0 and 6

Report slave ID (0x11)

The sensor name, the serial number and the firmware version are each displayed as a zero-terminated ASCII character string.

Example (n for hexadecimal numbers, x for decimal numbers):

TRIOS	0x00	Sensor type	0x00	Serial number	0x00	Software version	0x00
TRIOS	0x00	TWTurb-40	0x00	670nnnnn	0x00	x.x.x	0x00
TRIOS	0x00	TWTurb-W40	0x00	670nnnnn	0x00	x.x.x	0x00
TRIOS	0x00	TWpHEC	0x00	668nnnnn	0x00	x.x.x	0x00

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