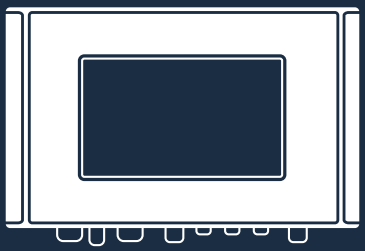
TriOS
Optical Sensors



TriBox3

OPERATING INSTRUCTIONS

Table of Contents

1 General Information

1.1 Introduction

Welcome to TriOS.

Thank you for choosing our TriBox3 controller.

The TriBox3 is a measurement and control unit for all TriOS sensors. The controller has four sensor interfaces, which support RS-232 and RS-485. In addition to the Modbus RTU, various other protocols are available. A built-in valve allows the use of compressed air cleaning of the sensors. The TriBox3 also offers a USB connection and the option of connecting to a network using a wireless or Ethernet interface. There are also six completely configurable outputs (4...20 mA) available to integrate the TriBox3 into other data acquisition systems. An integrated relay can be used to trigger alarms or to control external devices. Features such as low power consumption, a robust aluminium housing and a range of interfaces make these suitable for all applications that have to do with environmental monitoring, drinking water, wastewater treatment plants and many other areas.

In this manual, you will find all the information you need to commission and use the TriBox3. You can find the technical specifications and the dimensions in Chapter 7.

Please note that the user is responsible for complying with local and national regulations on the installation of electronic devices. Any damage caused by incorrect use or unprofessional installation will not be covered by the warranty. All sensors and accessories supplied by TriOS Mess- und Datentechnik GmbH must be installed and operated in accordance with the specifications provided by TriOS Mess- und Datentechnik GmbH. All parts were designed and tested in accordance with international standards on electronic instruments. The device meets the requirements of the international standards on electromagnetic compatibility. Please use only original TriOS accessories and cables to ensure smooth and professional operation of the devices.

Please read this manual carefully before using the device and keep this manual on hand for future use. Before commissioning the controller, please make sure that you have read and understood the following safety precautions. Always make sure that the controller is correctly operated. The safety precautions described on the following pages should ensure the smooth and correct operation of the device and any additional associated devices and should prevent injuries to yourself or other persons and damage to other equipment.

NOTICE	**If the translation is at all different from the original German text, the German version is binding.**

Software Updates

This manual refers to software version 1.5.4. From time to time TriOS Mess- und Datentechnik GmbH publishes software updates for the TriBox3. These updates include bug fixes, new features and options.

Copyright Notice

1.2 Health and Safety Information

This manual contains important information about health and safety rules. This information is labelled according to the international specifications of ANSI Z535.6 (“Product safety information in product manuals, instructions and other collateral materials”) and must be strictly followed. The distinction is made between the following categories:

⚠ **DANGER**	**Danger warning / will lead to serious injury or death**
⚠ **WARNING**	**Warning / may lead to serious injury or death**
⚠ **CAUTION**	**Caution / may cause moderate injury**
NOTICE	**Can result in damage to property**

Tip / Useful Information

Warning symbols

General warning sign, Follow all safety instructions associated with this symbol to avoid injury. When attached to the unit, refer to the operating or safety information in the manual.

Warning, possibility of electric shock

This symbol indicates that the marked part must be connected to a protective earth conductor. If the instrument does not have a mains plug on a cable, connect the protective earth to the protective earth terminal.

Electrical appliances marked with this symbol must not be disposed of in the normal public waste system. Return old appliances to the manufacturer. The manufacturer will dispose of the appliances at no cost to the user.

Electromagnetic Waves

Devices that radiate strong electromagnetic waves can influence the measurement data or result in a malfunction of the sensor. Avoid using the following devices in the same room as the TriOS sensors: mobile phones, cordless phones, transmitters/ receivers and other electrical devices that produce electromagnetic waves.

1.3 Warnings

- Make sure never to put damaged products into operation. After receiving the package, examine the device for any damage due to transport.
- Read the operating instructions carefully before beginning any installation or maintenance work.
- Make sure that the mains power cable is not damaged. Make sure that no heavy objects are placed on the mains power cable and that the cable is not kinked. Make sure that the mains power cable is not run near hot surfaces.
- If the cable is damaged, it must be replaced with an original part by the customer service of TriOS Mess- und Datentechnik GmbH.
- Stop operation of the sensor in the event of excessive heat development (i.e. if it is hot to the touch). Switch off the controller immediately and unplug the mains power cable from the power supply. Please contact your dealer or the TriOS customer service.
- Never try to disassemble or modify a part of the controller if such a procedure is not explicitly described in this manual. Inspections, modifications and repairs may only be carried out by the dealer or by qualified experts authorized by TriOS.
- Devices from TriOS Mess- und Datentechnik GmbH meet the highest safety standards. Repairs to the device must be carried out by TriOS Mess- und Datentechnik GmbH or by a workshop authorized by TriOS. Faulty, improper repairs can result in accidents and injuries.

⚠ DANGER	**TriOS does not guarantee the plausibility of the measured values. The user is always responsible for the monitoring and interpretation of the measured values.**

1.4 User and Operating Requirements

The TriBox3 has been developed for use in industry and science. The target group for the operation of the controller is technically skilled staff in plants, sewage treatment plants, water plants and institutes. We assume that the personnel are sufficiently qualified for operation and installation based on their professional training and experience. The personnel must be able to correctly understand and implement the safety labels and information on the packaging and in the package inserts.

1.5 Intended Use

The TriBox3 is intended to control supported sensors and collect, process and store measurement data. Its use is described in this manual. Please note the technical data of the controller. Any other use is not considered to be in compliance with the intended use.

According to current scientific knowledge, the device is safe to use when it is handled according to the instructions in this user manual.

1.6 Disposal Information

At the end of the device's life or use, the device and its accessories can be returned to the manufacturer for environmentally friendly disposal (see address below). Please contact us for more details before you send the device back.

Address of manufacturer:

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

1.7 Certificates and Approvals

This product meets all the requirements of the harmonized European standards. It therefore meets the legal requirements of the EU guidelines. TriOS Mess- und Datentechnik GmbH confirms the successful testing of the product by affixing the CE marking (see annex).

2 Introduction

The TriBox3 is a stationary measurement and control unit for all sensors made by TriOS Mess- und Datentechnik GmbH and for select sensors made by other manufacturers.

The system supplies power to the sensors and stores all measurement values, which can be displayed in various types of representations (numerical or graphical output). In addition, the TriBox3 assumes control of the entire measurement process as well as monitoring the measurement values.

A potential-free relay output (changeover contact) can be used for external control tasks. The relay switches when a freely definable limit of a measurement parameter is exceeded or falls short, and an alarm or external devices, such as pumps, etc., can be controlled.

A compressed air system can be installed to clean the optical sensors. For this purpose, a compressed air valve is installed in the TriBox3 that can switch in adjustable intervals and thus trigger compressed air cleaning in combination with a compressed air source.

In combination with the nano-coated glass panes in most optical sensors made by TriOS Mess- und Datentechnik GmbH, this makes for a very effective antifouling strategy.

Protection against water jets (IP65) allows operation in moist environments and extends the area of use when properly installed.

The measurement values are shown on a large TFT color display (resolution of 800x480 pixels) and saved internally on an SD card. The measurement values that are saved can be exported with a USB stick and then processed in a spreadsheet.

For wireless data transfer (measurement data, calibration files and service settings), the TriBox3 can be equipped with a WiFi module.

Six integrated analog outputs (4...20mA) allow the TriBox3 to be integrated into an SPS or other control system.

The device is operated via a capacitive touch screen which lets the user navigate the menu structure. The user can adjust all settings right on the device.

2.1 Product Identification

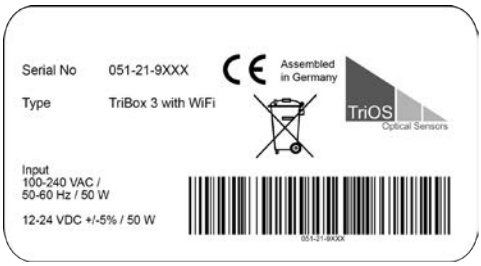
The TriBox3 is available in three versions: with 4-digit serial number with and without WiFi and with 8-digit serial number, especially for the EGC Water Analyzer.

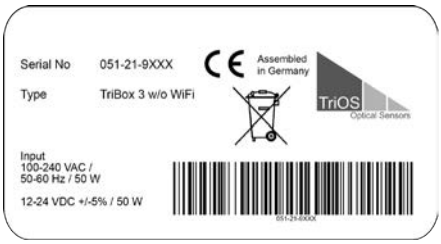
There is a rating plate on the product with the following information that you can use to uniquely identify the product:

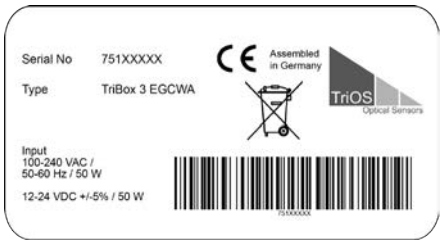
Serial number

Product type

Power supply







In addition to the product bar code, the rating plate includes the TriOS Mess- und Datentechnik GmbH logo and the CE quality label.

Please note that the specifications given here are for illustration purposes only and may deviate depending on the version of the product.

2.2 Scope of Delivery

The delivery contains the following components:

- TriBox3 with installed mains power cable and Schuko plug for operation in dry rooms
- Operating Instructions
- Accessories (if applicable)

Keep the original packaging of the device in case it needs to be returned for maintenance or repairs.

2.3 Product Structure

The following figure shows the main interfaces of the TriBox3.

2.4 Control Elements

2.4.1 Display

The TriBox3 has a capacitive touch-display with a resolution of 800x480 pixels. The display is not controlled by pressure, rather by touch or light tapping. It can be operated with bare fingers or with a special touch pen.

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

The main screen as well as the fixed control elements to the right and above can be configured individually. The measurement values/spectra and the device configuration of the TriBox3 can be represented by the user using different displays. With the touch screen, the various displays can be selected by “swiping” or touching.

2.4.2 Status LED

- ● ● ● ● ● flashing in service mode
- ○ ○ ● ○ ○ active power supply for the sensor (see chapter 3.4.4)
- ○ ○ ○ ● ○ measurement active
- ○ ○ ○ ○ ● cleaning active

3 Commissioning

This chapter deals with the commissioning of the controller up to the first function test. Please pay particular attention to this section and follow the safety precautions to protect the product from damage and yourself from injury.

Before the sensor is put into operation, it is important to ensure that all connections are connected correctly.

3.1 Power Supply

Plug the provided power supply cable into a Schuko socket that has been professionally installed. To protect against overloading, the device has internal glass tube fuses.

⚠ DANGER **If you need to replace a defective fuse, first unplug the power supply and use only fuses of the same type. Make sure you have completely eliminated the error before putting the device back into operation.**

⚠ DANGER **Danger to life due to electric shock. A residual current circuit breaker with a maximum ignition current of 30 mA must be used. A surge protector should be used for outdoor installations.**

The Tribox3 uses the following fuses:

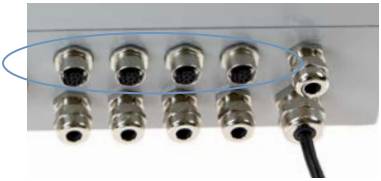
Fuse F1	1A, 250 V, time-lag, 5x20mm; item no. 00P100009
Fuse F2 and F3	4A, 125 V, fast-blow, SMD without holder; item no. 00P100008
Fuse F4 to F14	1A, 125 V, fast-blow, SMD without holder; item no. 00P100007

The TriBox3 requires a secure power supply within the voltage range of 100 VAC to 240 VAC with a mains frequency of 50 Hz to 60 Hz. The power supply must be secured according to the local safety standards.

The TriBox3 is shipped with a mains power cable that can be replaced by an alternative customer-specific cable if necessary (see chapter 4.2.1). The Tribox3 can also be powered by 12 – 24 VDC (see chapter 4.2.2).

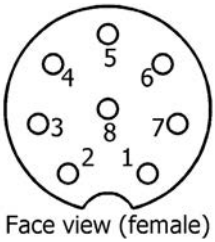
⚠ DANGER **The device has a housing grounding (protective conductor), which must be connected to the ground potential when operating with low voltage. Protective conductor grounding is recommended when operating with 12 – 24 VDC.**

3.2 Sensor interfaces



The TriBox3 is equipped with four female M12 sensor interfaces. The interfaces support RS-232 and RS-485 and can be set for the serial TriOS protocol, Modbus RTU and other special protocols.

M-12 industrial plug



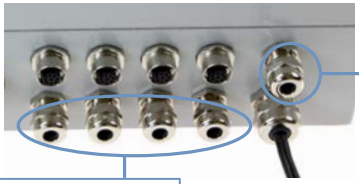
Face view (female)

1. RS-232 TX / RS-485 A
2. RS-232 RX / RS-485 B
3. not connected
4. not connected
5. not connected
6. +12 VDC
7. GROUND
8. +24 VDC

The designations of the data lines can be seen from the TriBox3. For example, RS-232 RX is the receiving line and RS-232 TX is the transmission line of the TriBox3.

3.3 Outputs

The TriBox3 has six analog outputs. The four cable glands at the bottom left of the image are not normally assigned, whereas the lower right cable bushing is intended for the mains power cable and therefore also has a larger cross section. When delivered, the mains power cable is already installed at this location. The upper right cable bushing is intended for the relay.



3.4 Menu

After installation, the TriBox3 can be switched on by switching on the power supply.

3.4.1 Main Menu

The main menu can be seen in the navigation bar on the right side of the display. This is always visible regardless of the submenu currently displayed, so that the user can switch between menu items at any time.

Sensors and COM ports Display and settings

Display configuration

System settings

Export and import of data

Device information and support contact

Switch off display or restart TriBox3

3.4.2 Sensor

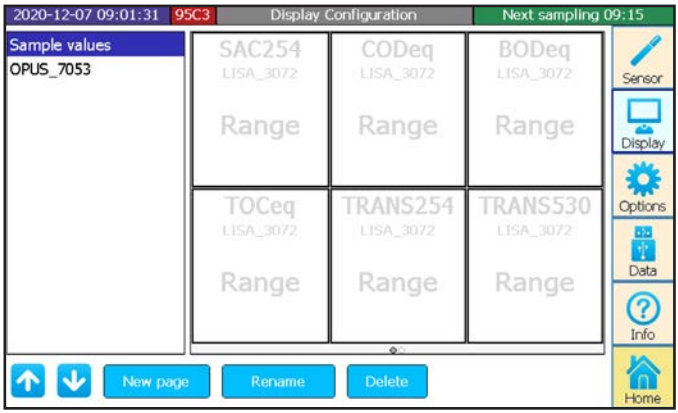
The “Sensor” button opens a submenu that displays the four COM ports, with sensors if applicable. If there are no sensors connected or if they are not recognized by the TriBox3, the “Sensor” submenu displays the following:

If a sensor is connected and is not shown on a COM port, a device search of all COM ports is initiated by pressing on the “Scan for Sensors” button in the lower area of the “Sensor” submenu.

If a connected sensor is not displayed after scanning the COM ports, check the compatibility of the sensor and COM port settings (see chapter 4.3 and 6.3.3).

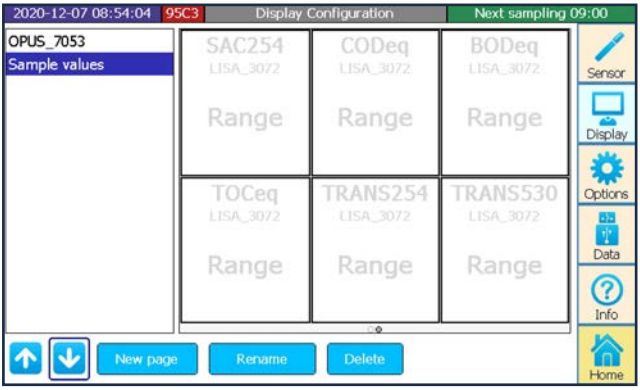
3.4.3 Display

The “Display” button opens a submenu that shows displays which are already configured and allows reconfiguration. It also allows the creation and configuration of new displays.



For example, select “Sample values” and then press the arrow up to move this display in the entire order.

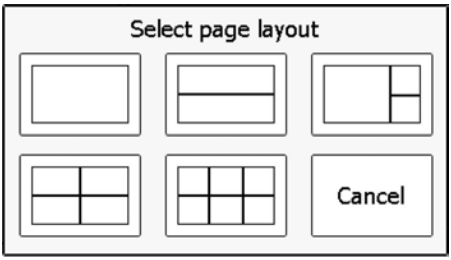
Change the position of a selected display in the entire order.



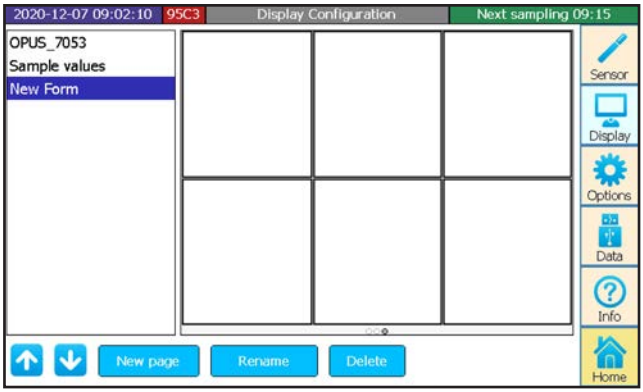
“Sample values” is already available when commissioning the device.

Create new display.

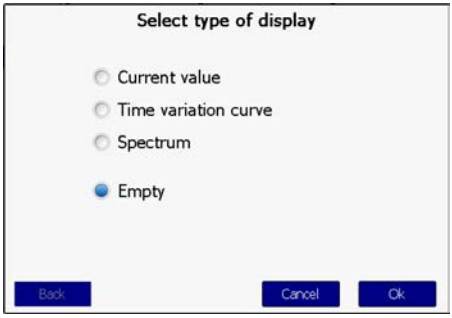
1. Select a page layout from the options displayed.



2. Click on any field of the selected page layout.



3. Select what is to be displayed: the current value, the values over a certain period of time as a hydrograph or a spectrum.

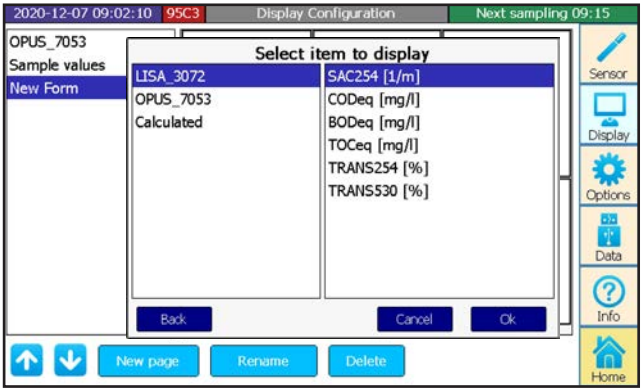


current value current measurement value as a number (scaled value)

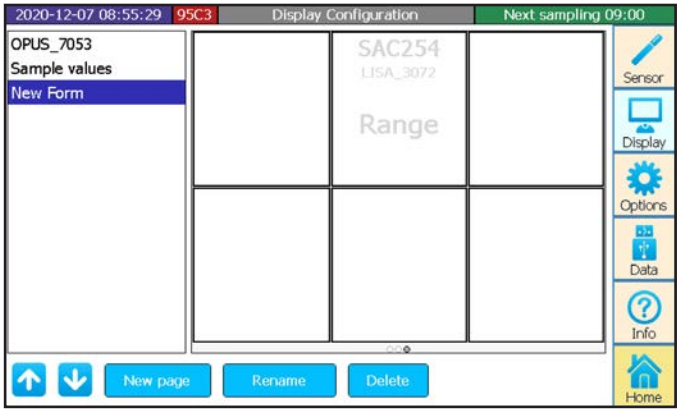
time variation curve representation of the measurement value over time

spectrum for spectral probes, representation of the measurement value over the wavelength

4. Select the sensor and the parameter and confirm by clicking “OK”.



5. The selected parameter of the selected sensor will be displayed in the selected window.

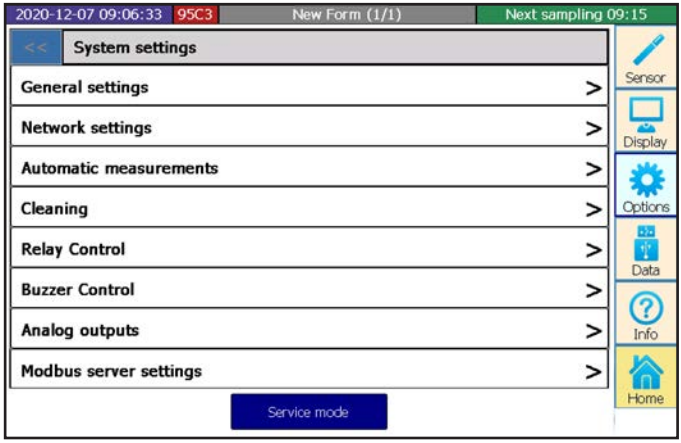


Rename — Rename the selected display.

Delete — Delete the selected display.

3.4.4 Options

The “Options” button opens a submenu that allows you to set general settings, define measurement and cleaning intervals, control the relay and buzzer and configure the analog outputs.

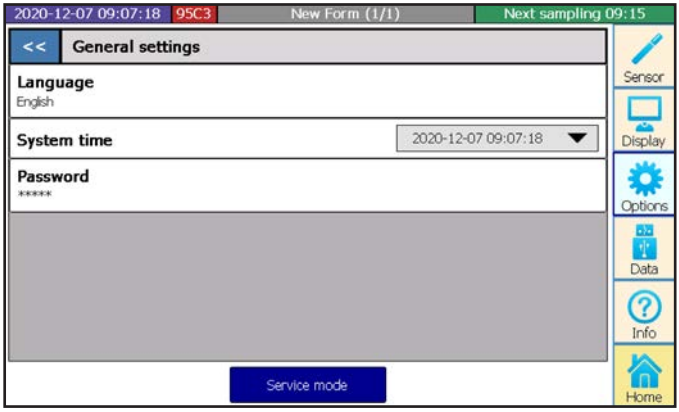


Service Mode

By pressing the “Service mode” button, the TriBox3 can be put into a paused state. As long as the service mode is active, all measured values and analog outputs are held at the last measured value to avoid malfunction alarms when cleaning, etc. Automatic communication with the sensor no longer takes place (cleaning, relays, valves, etc.). Please refer to chapter 6.2.1.

General settings

In the subitem “General settings”, language and system time can be set. The system must be restarted after selecting the language.



In the subitem “General settings”, language, system time and password can be set.

Network settings

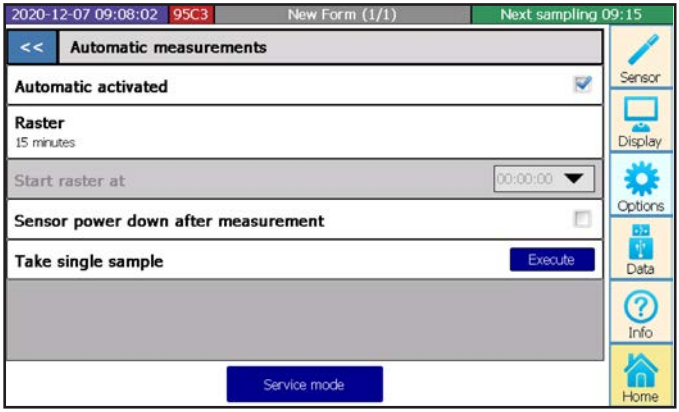
Subitem “Network settings” is dealt with in chapter 5.5.

Automatic measurements

The subitem “Automatic measurements” allows configuration of the automatic measurements.

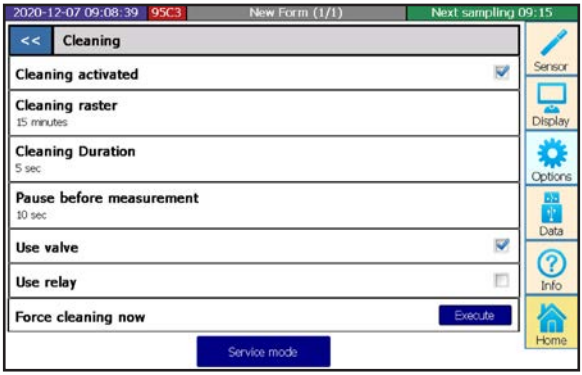
To make use of an automatic measurement interval, this must first be activated by checking the box and setting a measurement interval. For automatic measurement, the sensor must also be activated for automatic measurement (see chapter 4.3).

The power on the COM port can also be switched off after each measurement to save energy and individual measurements can be triggered. If this function is activated, the middle LED in the sensor power supply lights up.



Cleaning

The subitem “Cleaning” allows the user to define the cleaning intervals.



Relay control

The subitem “Relay control” is dealt with in chapter 5.3.

Buzzer control

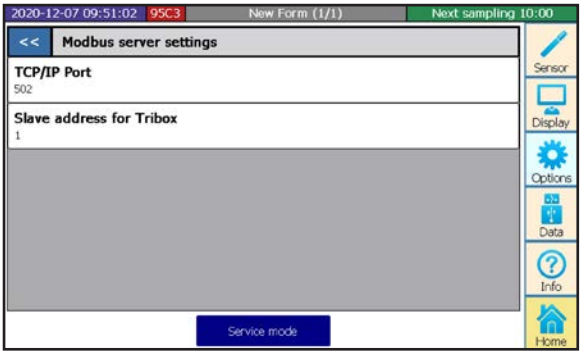
The subitem “Buzzer control” is dealt with in chapter 5.3.

Analog outputs

The subitem “Analog outputs” is dealt with in chapter 5.2.

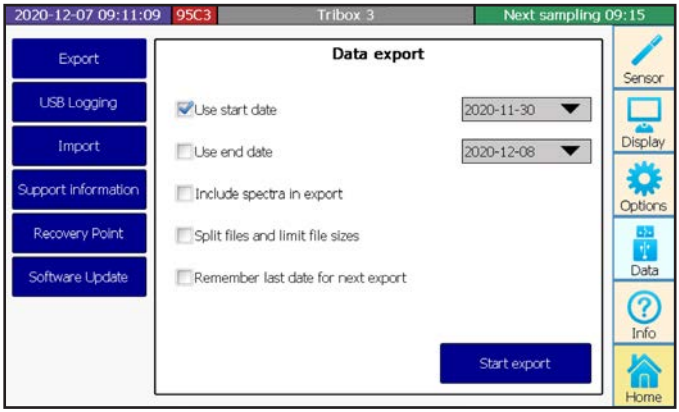
Modbus server settings

The TCP/IP port and the slave address of the Tribox can be changed under “Modbus server settings”. Detailed information on the use of the Modbus server mode can be found in chapter 5.4.



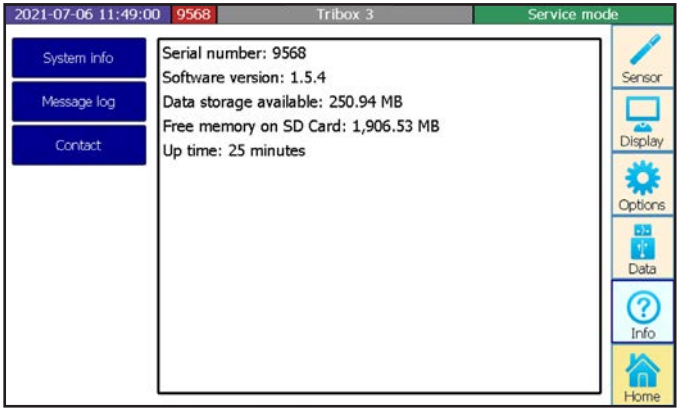
3.4.5 Data

For more information on the menu item “Data”, please see chapter 5.1.



3.4.6 Info

The “Info” button opens a window with system information, messages and the contact data of the nearest contact in case of problems or general inquiries. Before contacting the contact person, please read chapter 6 to ensure you have the right information for efficient troubleshooting.



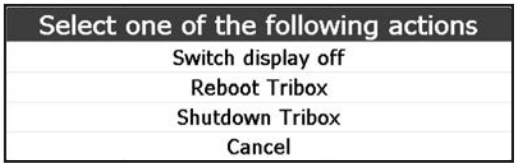
The “System Info” menu appears automatically when the menu item “Info” is opened. Here you can find information such as the serial number, storage space, etc.

Under “Message log”, you will find program messages that are only relevant when contacting support.

Under “Contact”, you will find the contact information of the manufacturer.

3.4.7 Power and Home

The “Power” button opens a window to restart the TriBox3 or switch off the display (e.g. to save energy in an autonomous measuring station). When the display is off, you can turn it back on by touching the screen again.



The “Home” button is only visible as long as the configuration menus are open. By pressing this button, the configuration menus are closed and only the displays are still visible.

To make sure that all previously entered settings are saved and updated, the controller should be restarted after every reconfiguration. After the restart, a recovery point should be stored.

4 Use

The TriBox3 is enclosed in a solid aluminium housing and is designed for outdoor use. The design of the TriBox3 meets the requirements of the IP65 protection class. This means that the internal components are protected against dust and water jets. For optimum operation, the device should be housed in a room or should be covered by a roof to protect against rain.

NOTICE	**Avoid direct sunlight and only operate the system within a temperature range of 0°C and 40°C.**

For maintenance and inspection tasks, choose an operation location that is easily accessible.

⚠ CAUTION	**The TriBox3 is delivered with a mains power cable that is only intended for use in dry environments. For outdoor operation, this must be replaced by a suitable power cable.**

⚠ DANGER	**Risk of death due to electric shock. Due to the unrestricted voltage in the device, installation may only be carried out by trained electronics specialists who are authorized to do so based on their training. The relevant safety and VDE regulations must be observed. The device may only be opened when the power supply is disconnected.**

⚠ DANGER	**Risk of death due to electric shock. A fault-current circuit breaker with a maximum ignition current of 30 mA must be used. When installed outdoors, search protection should be used.**

⚠ DANGER	**If the device is permanently connected, a power disconnection device must be integrated into the power line. This disconnection device must conform to the relevant standards and regulations. It must be installed near to the device where it can be reached by the user and must be labelled as a disconnection device for the controller. If a power cable permanently connected to the device is used, the plug of the power cable can serve as the local circuit breaker.**

⚠ DANGER	**Only use earthed sockets to connect this appliance to the power supply. If necessary, check the earthing of the socket.**

NOTICE	**If you are not sure whether the sockets are earthed, have this checked by a qualified electrician. In addition to supplying power, the mains plug is also used to quickly disconnect the unit from the mains if necessary. This is recommended for longer periods of non-use and can prevent possible hazards in the event of a fault. Therefore, make sure that the sockets to which the unit is connected can be easily reached by any user at any time.**

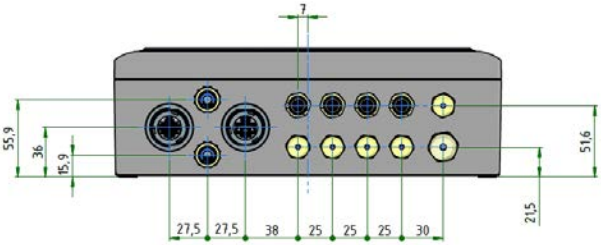
4.1 Mounting

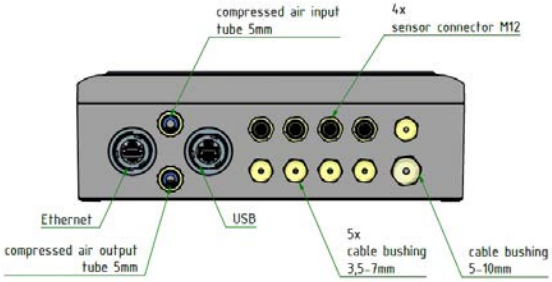
⚠ DANGER **Before making any changes to the power line or the plug, it is essential to make sure that the power is disconnected and cannot be reconnected or switched on.**

The TriBox3 will be securely screwed to a solid wall or similar feature.

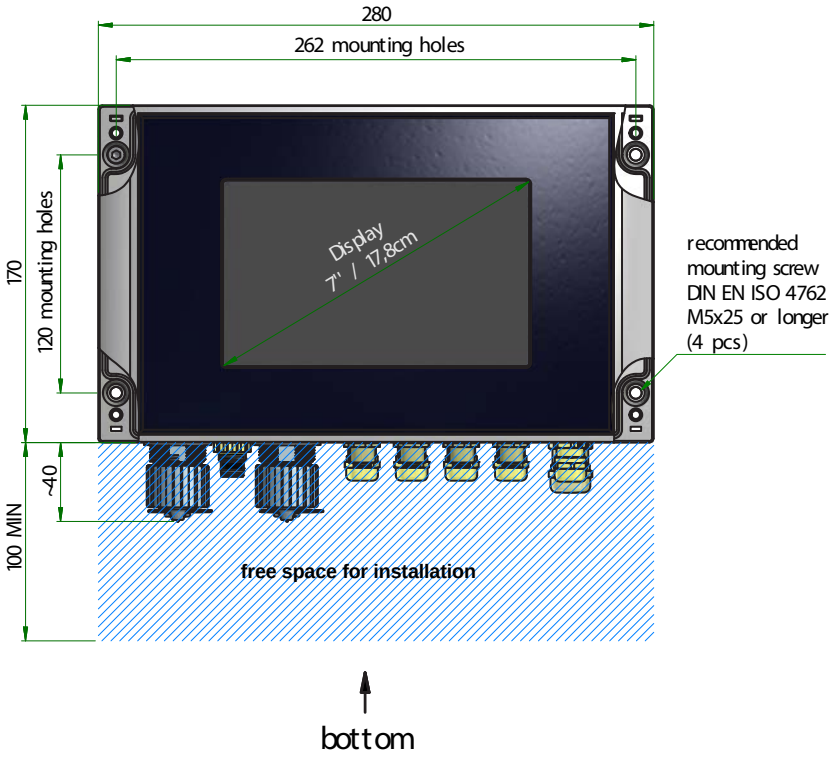
Make sure that the mounting surface selected is level and able to securely hold the device.

1. To mount the device, carefully remove the aluminium panels on both sides of the TriBox3 (see figure).
2. The device will be attached downward with the connection sockets. To ensure the IP protection level, all unused connections must be sealed with the plugs used by the manufacturer.
3. There are two 5.3 mm holes on each side of the TriBox3 for mounting. Make sure the TriBox3 is securely attached after installation.

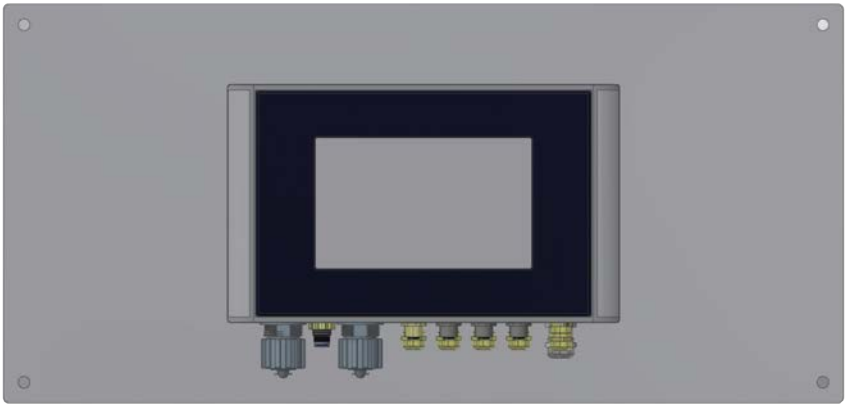




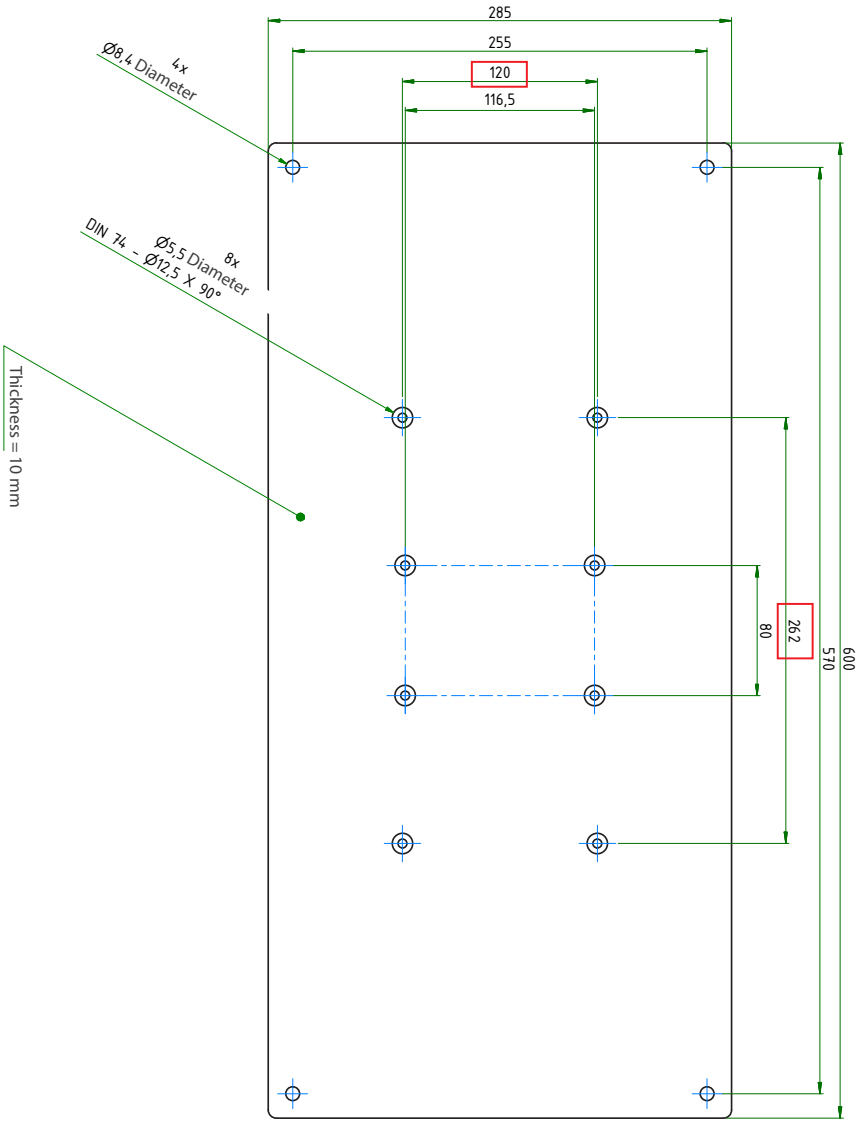
For better orientation, the following illustration describes the external dimensions in mm and the dimensions of the mounting holes.



TriOS offers suitable panels for mounting the TriBox3 (Art.Nr. 11A100000).



The dimensions of the panel and the mounting dimensions of the TriBox3.



4.2 Electrical Installation

The connections for the DC power supply can be found inside the TriBox3 and are only accessible when the unit is open. The next sections describe the connection of the individual components.

4.2.1 Operation with AC Voltage

Plug the provided power supply cable into a Schuko socket that has been professionally installed. To protect against overloading, the device has internal glass tube fuses (see chapter 6.3.1).

⚠ WARNING **If you need to replace a defective fuse, first unplug the power supply and use only fuses of the same type. Make sure you have completely eliminated the error before putting the device back into operation.**

Alternatively, a permanent power supply installation can be used. In this case, the pre-installed power cable with the Schuko plug can be removed. To do this, please proceed as follows:

NOTICE **Please note that the TriBox is operated at an operating temperature between 5°C and 40°C when operated with the integrated mains power cable. For an installation without the pre-installed mains cable, an operating temperature between -10°C and 50°C is recommended.**

1. Carefully remove the aluminium panels on both sides of the device.

2. Remove the four screws on the edge of the TriBox3 with a Phillips screwdriver.

⚠ DANGER **Before making any changes to the supply line or the plug, disconnect the mains voltage. It is essential to check that there is no voltage and to secure it against being switched on again.**

3. After removing the four screws, carefully open the cover of the housing upwards. The housing cover must be able to be opened without resistance and without the use of force, otherwise there is a risk of damaging the wires in the device.

⚠ DANGER **Risk of death due to electric shock! Due to the unrestricted voltage in the device, installation may only be carried out by trained electronics specialists who are authorized to do so based on their training. The relevant safety and VDE regulations must be observed. The device may only be opened when the power supply is disconnected.**

4. The figure below shows the position of the AC connection plug on the circuit board. Disconnect this plug from the power supply.

5. Remove the screws of the cable bushing and pull the power line out of the device.

NOTICE

Always use wire end ferrules with flexible conductors. Keep the flexible conductors short. Make the protective conductor longer than the other conductors. The large cable gland at the bottom right is designed for sheath diameters of 5-10 mm.

⚠ WARNING

Use only one power cable whose insulation is sufficient for the line voltage and which has a ground wire (PE). The cross section of the cable must be at least 0.75 mm².

⚠ WARNING

Before the power line is inserted into the TriBox3 or touches it, it is essential to make sure that the power to the TriBox3 is disconnected and cannot be reconnected or switched on.

6. Insert the new power line through the cable bushing into the device.
7. Connect the power line to the CON1 plug. The following table describes the contact assignment.

CON1 connector	
AC power supply	
Pin	**Assignment**
1	Protective conductor (PE)
2	Neutral conductor (N)
3	Phase (L)

8. Reconnect the plug to the circuit board and tighten the nut of the cable bushing.
9. Check the grounding.
10. Close the housing of the TriBox3 and screw the cover back on. Attach the aluminium panels. The device can now be put back into operation.

4.2.2 Operation with DC Voltage

The TriBox3 can also be integrated into battery-powered measuring stations. For these applications, the TriBox3 can be operated with 12–24 V (± 5%) DC voltage. Instead of the connection cable with Schuko plug, the 12–24 V DC can be directly connected to the TriBox3. When operating on 12–24 V DC power, the Schuko plug can be removed, but this is not absolutely necessary. Be sure that the DC power source can provide the necessary maximum power and has an output with low impedance. To operate the TriBox3 with DC power, follow these steps:

To open the box and to attach a suitable cable to the TriBox3, please proceed as follows:

1. Carefully remove the aluminium panels on both sides of the device.

2. Remove the four screws on the edge of the TriBox3 with a Phillips screwdriver.

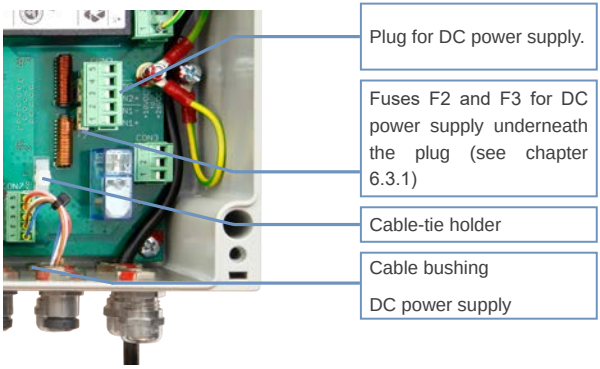
⚠ DANGER **Before making any changes to the power line or the plug, it is essential to make sure that the power is disconnected and cannot be reconnected or switched on.**

3. After removing the four screws, carefully open the cover of the housing upwards. The housing cover must be able to be opened without resistance and without the use of force, otherwise there is a risk of damaging the wires in the device.
4. Connect the DC power cable to the plug labelled CON2 in the illustration. The following table describes the contact assignment.

CON2 connector	
DC power supply	
Pin	**Assignment**
1	DC voltage 1, VIN1 (plus)
2	DC voltage 1, VIN1 (minus, GND)
3	DC voltage 2, VIN2 (plus)
4	DC voltage 2, VIN2 (minus, GND)
5	Protective conductor (PE)

5. Put the plug back in the socket and tighten the nut of the cable bushing until the power line rests snugly in the cable bushing.
6. Attach the cable to the white cable-tie holder with a cable tie.
7. Close the housing of the TriBox3 and screw the cover closed. After the aluminium panels are attached, the device can now be put into operation.

NOTICE	**Always use wire end ferrules with flexible conductors. Keep the flexible conductors short. Make the protective conductor longer than the other conductors. The small cable glands are designed for sheath diameters of 3.5-7 mm.**



4.2.3 Prioritized Supply Voltage

The TriBox3 can be operated with AC or DC voltage. The TriBox3 automatically chooses the power supply with the highest priority from the available input voltages. Prioritization is preset:

Priority	Assignment	Connectors/Pins
1	AC voltage	CON1, pin 1-3
2	DC voltage VIN1	CON2, pin 1-2
3	DC voltage VIN2	CON2, pin 3-4

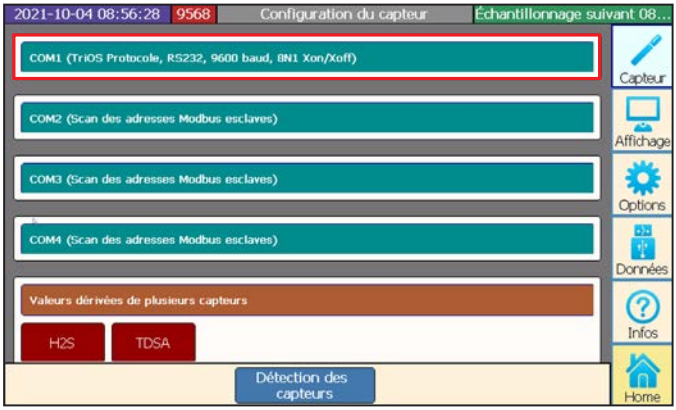
When more than one input voltage is being used at the same time, the power supply can also be switched or chosen when the device is on, allowing operation without interruption. If two DC input voltages are being used, these should have about the same potential (within 12 – 24 VDC (± 5%)).

4.3 Connection of the Sensors

As standard, the TriBox3 offers four serial sensor interfaces, COM1 to COM4. Customized extensions are available to connect additional sensors. Only original cables from TriOS Mess- und Datentechnik GmbH may be used to connect the sensors. Connect the cable of your TriOS sensor to a COM port on the TriBox3. Insert the M12 connector plug into the desired COM port and secure the connection by fastening the fitting (see the figure below).

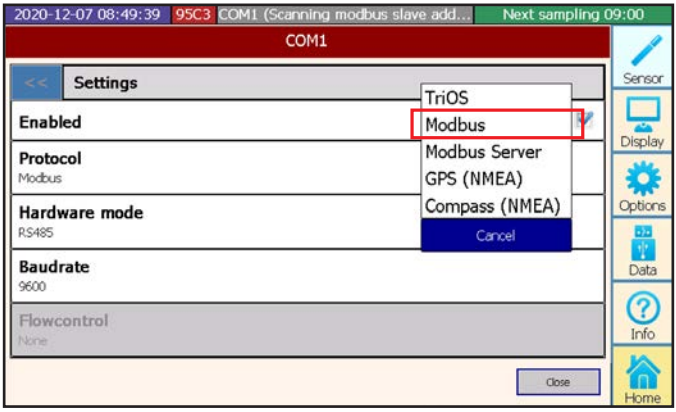
NOTICE **Connecting a sensor should always be done in maintenance mode.**

The respective settings of the individual COM ports are visible in the green fields of the COM ports.



For analogue sensors, a TAMMO module (for TriBox3 with 8-digit serial number AdamE) can additionally be installed, which converts analogue signals into the RS-485 Modbus RTU protocol (see the respective quick start guide).

The settings menu opens by clicking on the COM port button.



Standard settings of the COM ports for all Modbus-capable sensors:

Protocol: Modbus

Hardware mode: RS-485

Baud rate: 9600

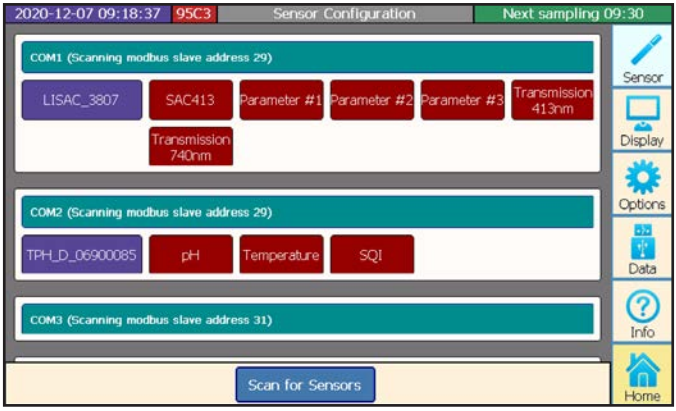
Flow control: None (setting locked when using Modbus protocol)

Parity: None

Data bits: 8

Stop bits: 1

If the sensor is correctly recognized after being connected, it appears in the overview of the COM ports, as shown in this example diagram:



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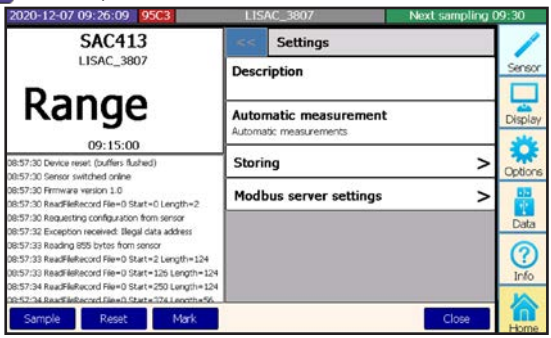
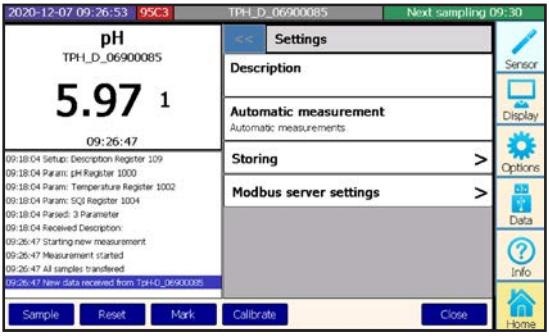
When the sensor button is pressed, a screen opens like the one in the following example:



TPH_D_06900085



In this screen, the current measured value can be seen at the top left and the log protocol of the sensor below that. On the right side, a description of the measurement site can be entered and automatic measurement can be activated or deactivated. Some sensors are equipped with the option “fastest possible”, whereby the sensor triggers a measurement as often as possible.

The automatic measurements must be activated for the sensor to take measurements.

The menu item “Storing” is dealt with in chapter 5.1, and the “Modbus Server Settings” can be found in chapter 5.4. Further information can be found in the corresponding sensor manual if necessary. Please contact TriOS Support if any other questions come up.

Sample — Clicking the “Sample” button immediately triggers a measurement by the corresponding sensor.

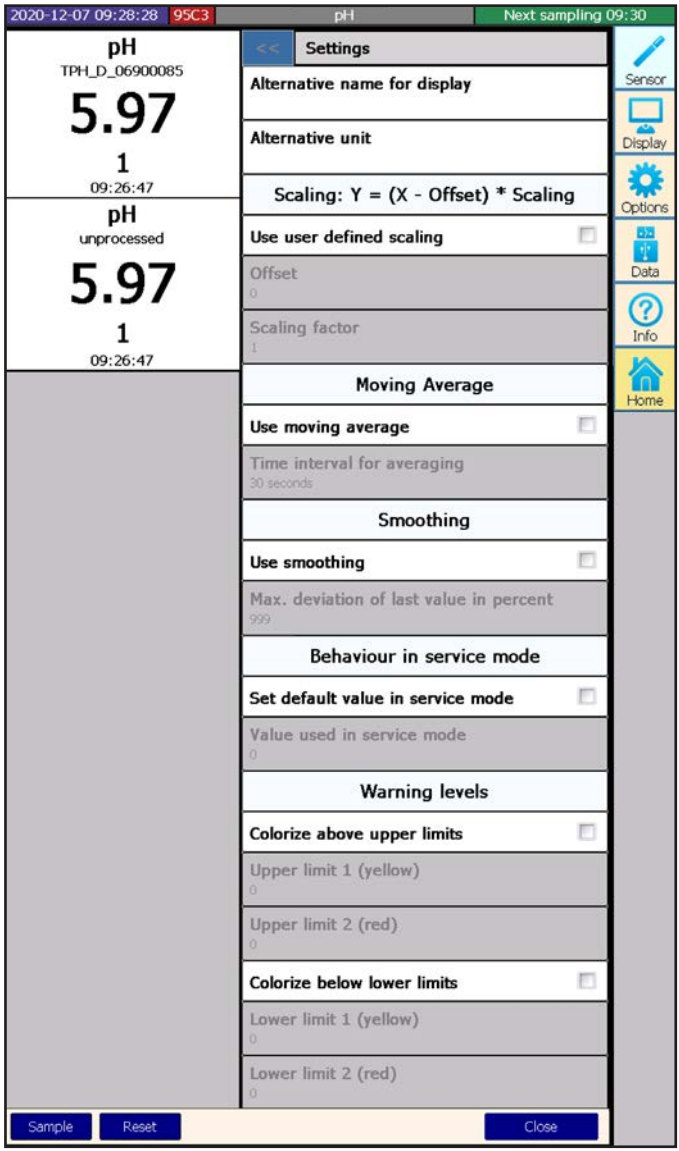
Reset — “Reset” resets the sensor.

Mark — The next measured value in the data log can be marked by clicking the “Mark” button.

Calibrate — Clicking “Calibrate” starts the calibration wizard. More information can be found in chapter 4.4.

pH

The following screen (sample illustration) opens when the “Parameter” button has been clicked.



On this screen, the current scaled measured value can be seen at the top left and the unscaled measured value below that.

Alternative name for display

A different display name for the parameter can be entered here.

Scaling

Here a scaling can be activated and an offset and scaling factor can be entered. Please refer to the manual of the respective sensor.

Moving Average

Subitem “Moving Average” is dealt with in chapter 4.3.1.

Smoothing

Subitem “Smoothing” is dealt with in chapter 4.3.2.

Behaviour in service mode

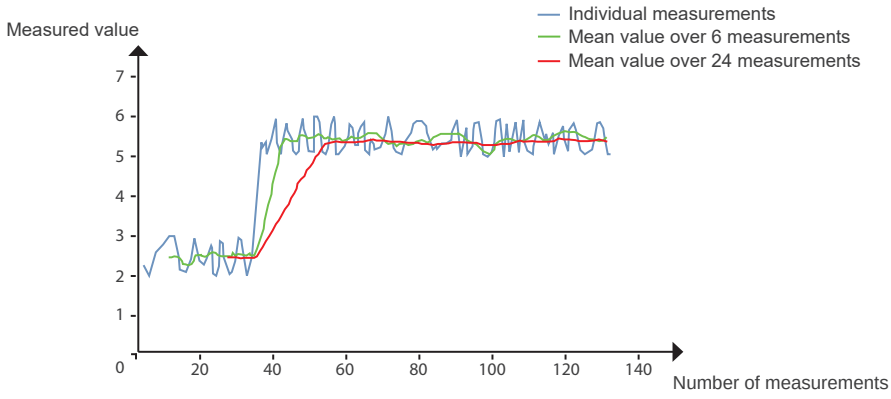
Here a standard value can be defined, which is always output in service mode (see chapters 3.4.4 and 6.2.1).

Warning levels

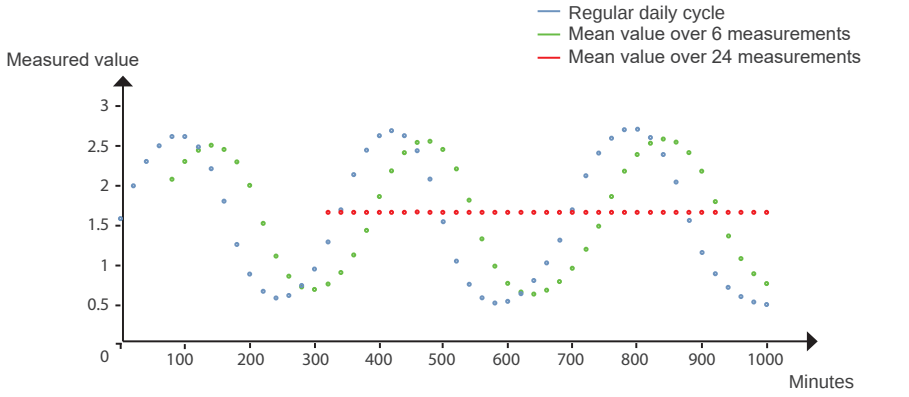
Subitem “Warning levels” is dealt with in chapter 4.3.3.

4.3.1 Moving Average

It is possible to output a moving average of the past measurements. You can select a period from 30 seconds up to one hour. However, it should be noted that sudden changes in the measurement results are only reproduced with a time delay when the moving averaging function is activated. This function is only conditionally recommended for cycles that occur regularly.



Daily cycle:



(measurement every 15 minutes)

4.3.2 Smoothing

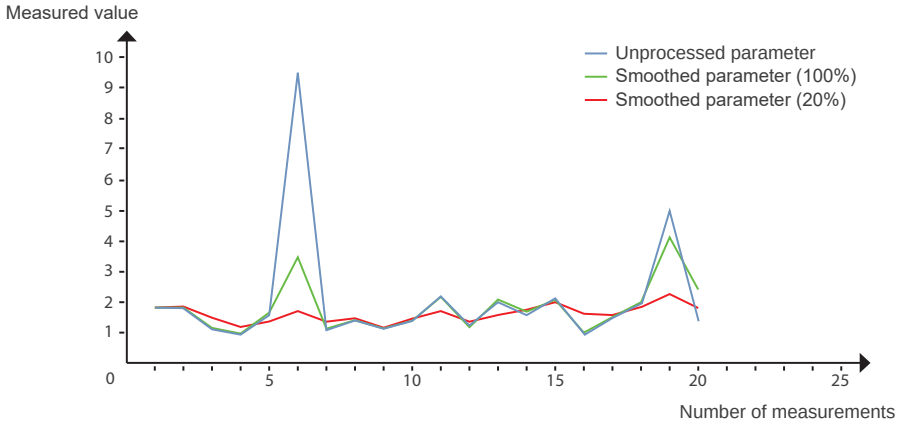
The smoothing of a parameter may be necessary if the measurement signal is very unsteady and the output concentrations vary greatly. This can happen if the measuring medium is inhomogeneous or in motion. The goal is to eliminate spikes in the course and to let the measured values increase only slowly. The setting of the smoothing (in %) defines the maximum deviation of the current measured value from the previous measured value.

The function can be activated for each measured value on the Tribox, whereby a maximum signal change of 1 to 999 percent of the previous measured value can be configured.

Caution:

- If the current (averaged, scaled) measured value is NaN*/range, then no smoothing is performed and the result is also NaN.
- If the current measured value is 0, then the 0 is replaced by the previous (averaged, scaled and smoothed) measured value.
- If the parameter settings are changed, a recalculation is then carried out on the basis of the first measured value after the change.

* NaN = Not a Number.



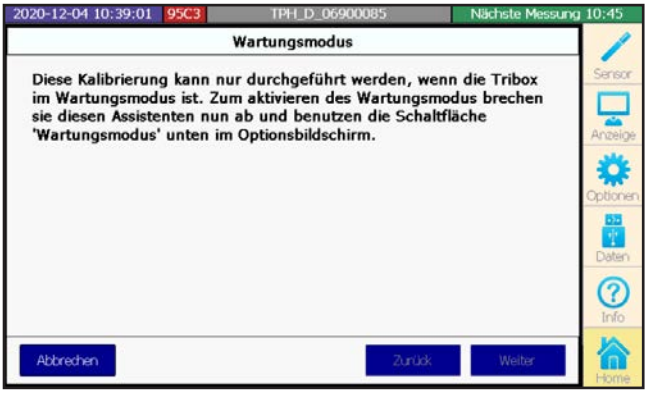
If the measured values are predominantly 0, a percentage smoothing is not recommended.

4.3.3 Warning Levels

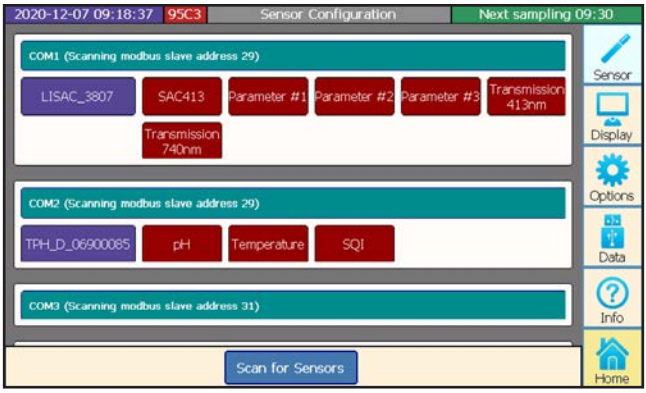
When you scroll further down, you will find the setting options for warning levels. In “Warning levels”, the display field of the relevant parameter is lit with a colored background corresponding to the chosen threshold values in all displays when the threshold value is exceeded.

4.4 Calibration Wizard

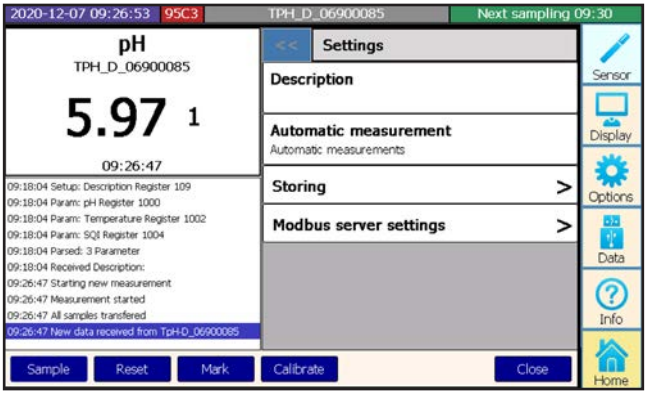
For the calibration of various sensors, the TriBox3 has a wizard that enables a completely guided calibration. To perform a calibration with the wizard, please proceed as follows:



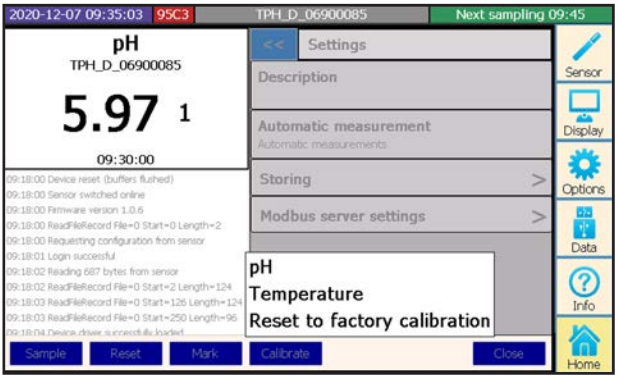
1. Switch to service mode (“Options” menu → “Maintenance mode” button at the bottom of the screen). As soon as the service mode is activated, the five LEDs flash.



2. In the sensor menu, select the sensor to be calibrated by touching the blue sensor button.



3. Select “Calibrate” in the menu of the selected sensor.
4. Calibration depends on the type of sensor. After selecting the value to be calibrated, the calibration wizard starts. The respective reference standards should already be available or prepared for calibration (e.g. TpH-D reference solutions etc.).



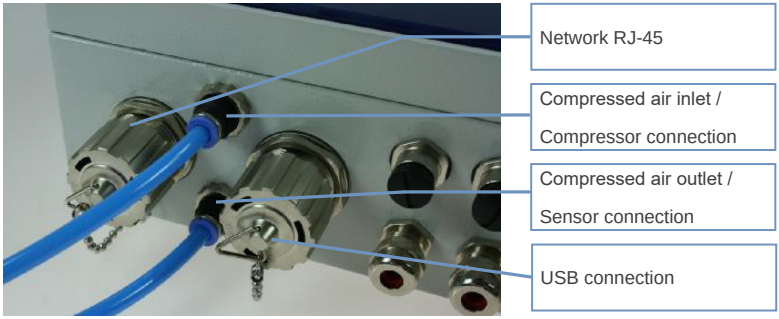
5. The instructions of the wizard must be strictly followed, otherwise the accuracy of the measurements cannot be guaranteed after completion of the wizard.

A room temperature of around 20 °C is required for precise calibration.

6. After calibration, the service mode can be exited.

4.5 Installation of Compressed Air Flushing

All sensors are available with components for compressed air cleaning. Operation with a controllable air valve is supported by the TriBox3, preventing cleaning during measurement and thus preventing error results. The sensors have a nozzle which directs the compressed air onto the glass plate and removes any biofilm or deposits. The required compressor must be provided by the customer and installed in the vicinity of the TriBox3.



1. Connect the compressor to the compressed air inlet of the TriBox3. To do this, insert the end of the hose into the compressed air inlet of the device and check that it is firmly seated by pulling. To remove the hose, press the small blue safety ring on the compressed air inlet in the direction of the device while pulling on the hose.
2. The compressed air outlet is connected to the compressed air nozzle of the sensor, also as described above. The air pressure of the compressor is maintained during the entire operation. By switching the compressed air valve, the compressed air is directed to the cleaning nozzle of the sensor.

NOTICE **TriOS recommends setting the air pressure at 3 to 6 bars. The air hose from the compressor to the sensor should not be longer than 25 meters.**

Suitable compressed air hoses of different lengths (10 m, 15 m and 25 m) are available from TriOS Mess- und Datentechnik GmbH and at industrial retail shops. The hose is type PU 6/4 (material: polyurethane, 6 mm outer diameter and 4 mm inner diameter).

NOTICE **The internal valve may only be used in unpressurized media. In the event of water ingress through the valve, no warranty claims can be made against TriOS.**

NOTICE	When the valve switches, the air must come out of the outlet and stop completely when the switching procedure has finished. If air is not released or if the valve does not close correctly at the end of the switching procedure, both hoses must be swapped.

NOTICE	The compressed air valve must never be exposed to pressure greater than 0.7 Mpa (7 bars). Otherwise, the valve can be damaged.

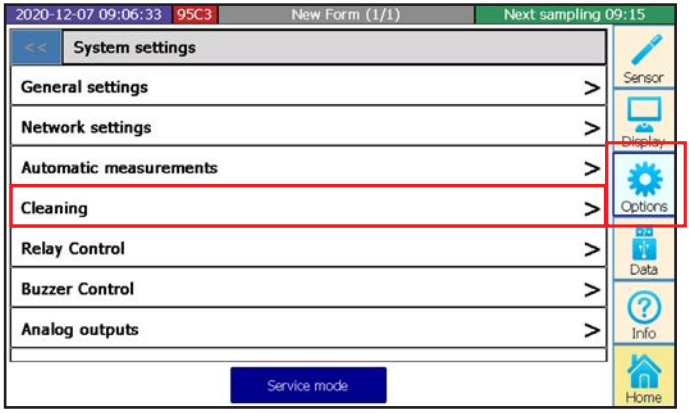
To ensure that settings made are not lost when reconfiguring, it is essential to save a restore point beforehand.

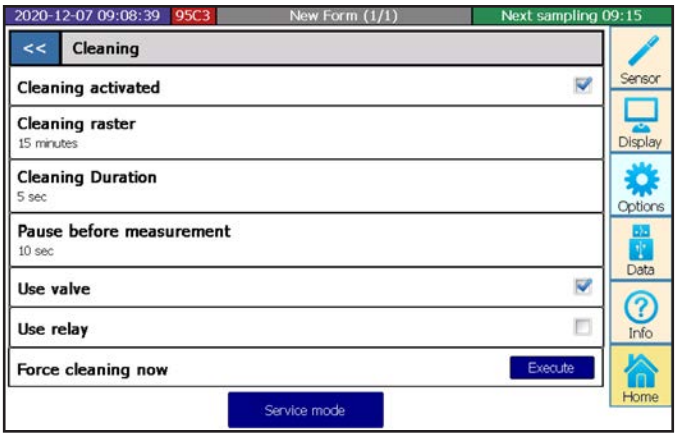
The subitem “Cleaning” (menu item “Options”) allows the user to set the cleaning intervals.

To make use of an automatic cleaning interval, this must first be activated by checking the box and setting a cleaning interval. The cleaning time and the pause before the measurement can also be defined here.

Please note that the measurement and cleaning intervals should be matched to each other to avoid suspension of measurements. If this is necessary, use the recommended settings described in the table below.

Cleaning can also be triggered and defined whether the valve and the relay are activated during cleaning.





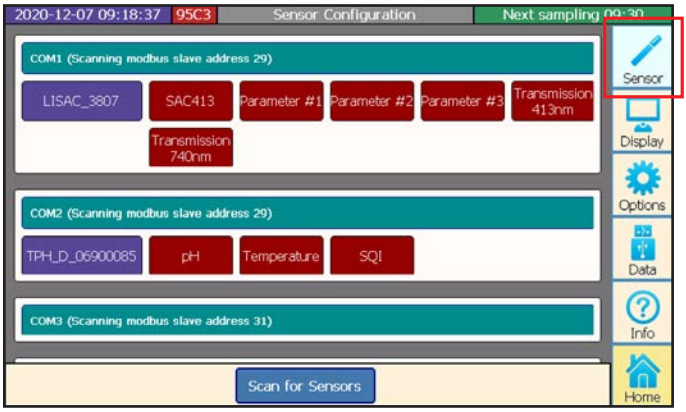
Recommendations for timer and cleaning intervals*				
	Measurement interval***	Cleaning interval	Cleaning time	Pause before measurement
minimum**	30 s	30 s	5 s	5 s
typical**	2 min	15 min	10 s	5 s
maximum	1 day	6 hours	20 s	5 min

* with 10-meter TriOS compressed air hose 4/6 mm

** depending on the type of sensor

*** see chapter 3.4.4 “Options”.

4.6 Data Storage



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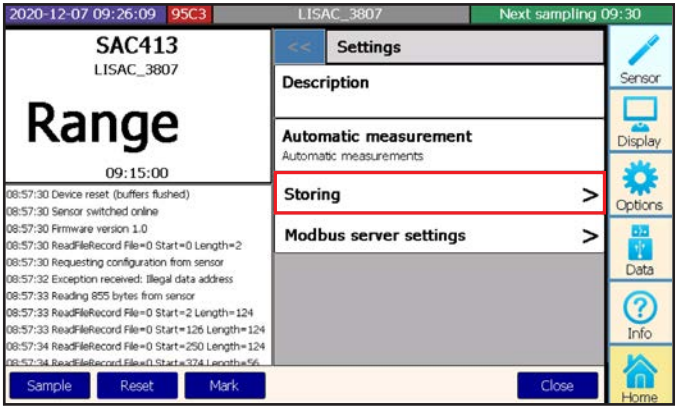
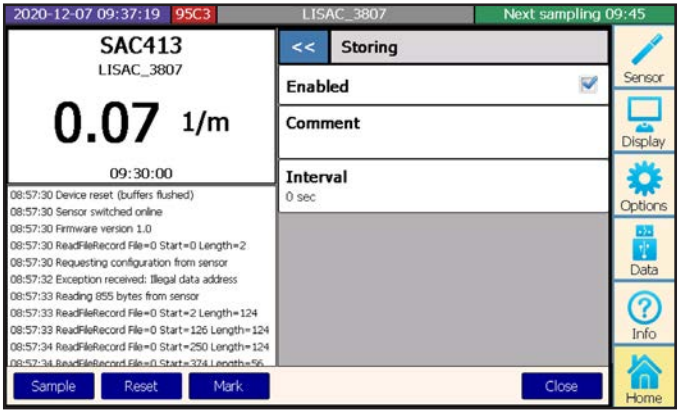
When the sensor button is pressed, a screen opens like the one in the following example:



The subitem “Storing” offers the following options:



Enabled This allows you to control whether the measured values for the individual sensor should be stored.

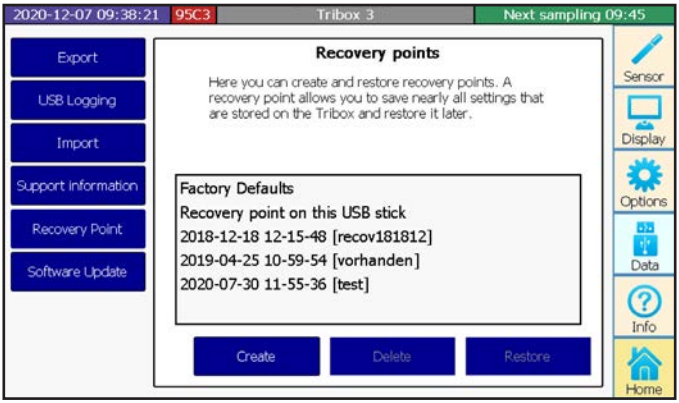
Comment This allows a comment to be individually configured for the sensor which is written to the measured values.

Interval An individual storage interval can be entered for the sensor, by which the number of stored measured values can be reduced without influencing the measurement interval and any associated alarm functions. This function is deactivated when the interval is set to 0 seconds.

4.7 Recovery

Recovery Point

Subitem “Recovery Point” also stores settings as recovery points. For your safety, a recovery point should always be saved when settings such as scaling factors, analog outputs or measurement intervals are changed, to allow you to use the previous settings at a later point in time.



In this illustration, a recovery point has already been saved in addition to the factory settings.

When the device is reset to the factory settings, all user-specific settings are lost!

To ensure that settings made are not lost when reconfiguring, it is essential to save a restore point beforehand.

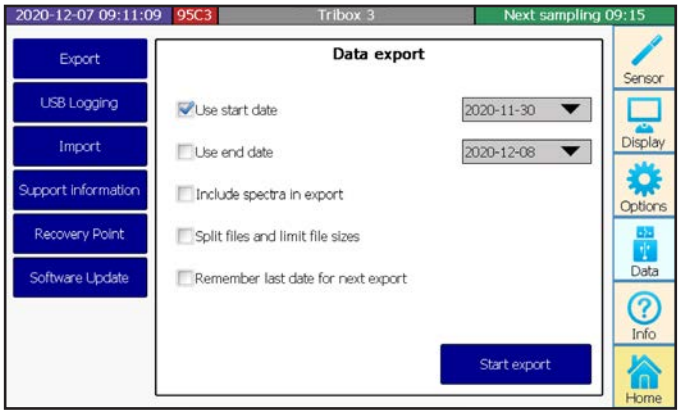
The recovery point can be saved locally and on a USB storage device. If a USB stick is in the TriBox3 when the “Create” button is pressed, the following window will open and the “Create” button will turn black.

Answering “Yes” confirms you want to save to the USB stick, and answering “No” lets you enter a comment for a recovery point directly on the TriBox3.

5 Advanced Use

5.1 Data Export

The “Data” button opens a submenu where all settings for data exchange using a USB stick (e.g. data, software, calibration files, etc.) can be configured and executed.



The subitem “Export” allows data and spectra to be copied from the TriBox3 to USB sticks, and this data can then be evaluated using standard programs.

Certain export characteristics can be defined in the five checkboxes:

“Use start date”

All data beginning with the start datum is copied to the USB stick.

“Use end date”

All data up to the end date is copied to the USB stick.

“Include spectra in export”

If using spectral probes, this allows the spectra to also be copied to the USB stick.

This selection is justified because the data volume of a spectrum is significantly greater than the calculated number values. Export may take a while for spectra of longer time periods. If spectra are being used for evaluation, it is always recommended to activate the following subitem “Log to USB”.

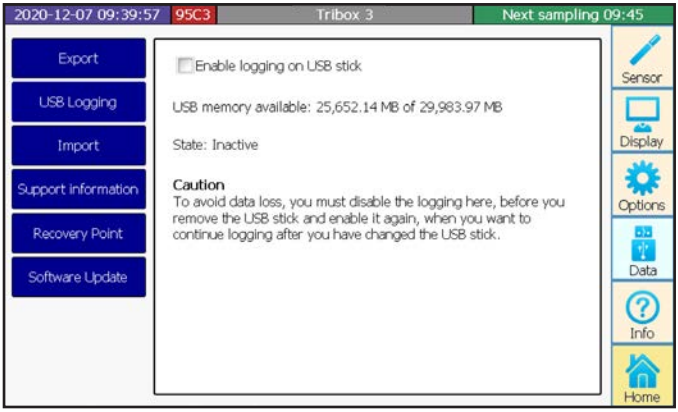
“Split files and limit file sizes”

The exported data will be written into several smaller files instead of one large file. For later evaluation, these individual files are then easier to handle.

“Remember last date for next export”

The datum from the last exported measured value is saved internally and can then be used as the start datum of the next export.

In the subitem “USB Logging”, you can activate the process whereby the data are stored on the internal SD card as well as on a USB stick.



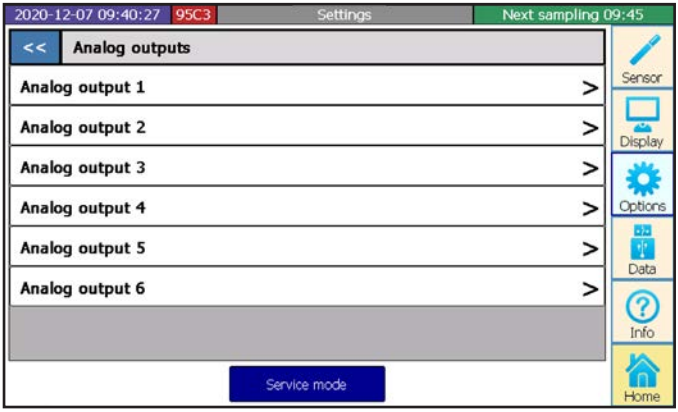
The “USB Logging” function is only active when a data storage device is inserted in the device. Always deactivate this window when removing the USB stick to avoid losing any data. Suitable USB sticks that do not affect the IP protection class are available as accessories from TriOS.

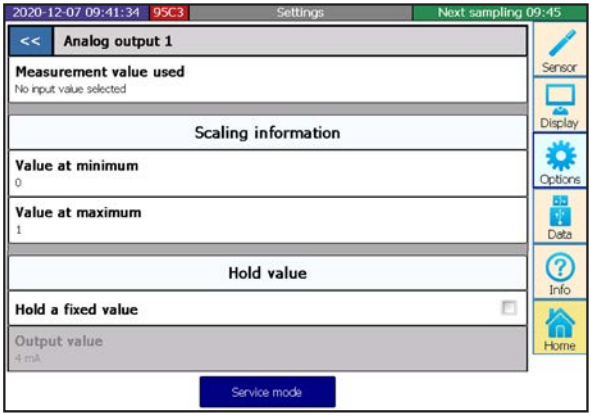
You can find information on the subitem “Import” in chapter 13 FAQ.

More information on the subitems "Support Information", “Recovery Point” and “Software Update” are dealt with in chapter 6.3.

5.2 Analog Output

The analog outputs can be configured in the “Analog outputs” submenu (“Options” menu). To configure, select one of the six buttons.





In the lower area, you can have a fixed value held for the respective interface for test purposes.

The TriBox3 has six analog outputs which provide 4...20 mA to the work area. The measured values can be transmitted in freely selectable scaling via the analogue interface to other systems, for example process control systems.

NOTICE **Please note that only passive components are connected to the analog outputs so that no external voltage can enter. This could damage the TriBox3.**

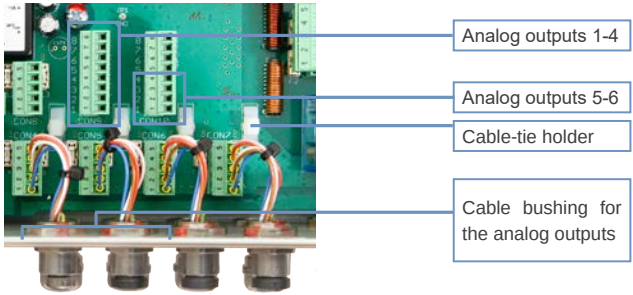
1. Carefully remove the aluminium panels on both sides of the device.

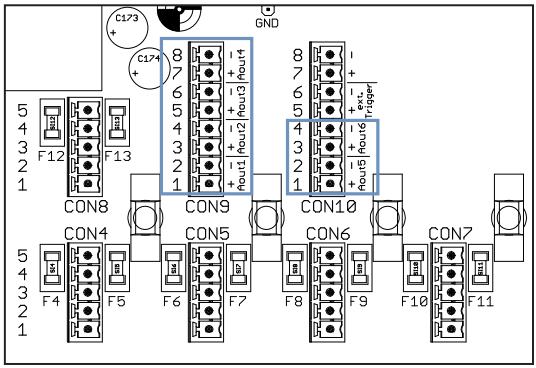
2. Remove the four screws on the edge of the TriBox3 with a Phillips screwdriver.

⚠ DANGER **Danger to life due to electric shock! Due to the free mains voltage in the unit, installation work may only be carried out by qualified personnel who are authorised to do so on the basis of their training. The relevant safety and VDE regulations must be observed. Before opening the unit, disconnect it from the power supply and secure it against being switched on again.**

3. After removing the four screws, carefully open the cover of the housing upwards. The housing cover must be able to be opened without resistance and without the use of force, otherwise there is a risk of damaging the wires in the device.

NOTICE **Always use wire end ferrules for flexible lines. The cable bushing is designed for a sheath diameter of 3.5 mm to 7 mm.**





4. Connect the control cable to the plug marked in the above illustration.
   The following tables describe the contact assignment.

CON9 connector	
Analog outputs 1 - 4	
Pin	**Assignment**
1	Analog output 1 (plus)
2	Analog output 1 (minus, GND)
3	Analog output 2 (plus)
4	Analog output 2 (minus, GND)
5	Analog output 3 (plus)
6	Analog output 3 (minus, GND)
7	Analog output 4 (plus)
8	Analog output 4 (minus, GND)

CON10 connector	
Analog outputs 5-6	
Pin	**Assignment**
1	Analog output 5 (plus)
2	Analog output 5 (minus, GND)
3	Analog output 6 (plus)
4	Analog output 6 (minus, GND)

5. Put the plug back in the socket and tighten the cable bushing snugly but not too tightly.
6. Attach the cable to the white cable-tie holder with a cable tie.
7. Close the housing of the TriBox3 and screw the cover closed. After the aluminium panels are attached, the device can now be put into operation.

5.3 Relay and Buzzer

The connections to connect the relay and an external trigger signal can be found inside the TriBox3 and are only accessible when the unit is open. The next sections describe the connection of the individual components.

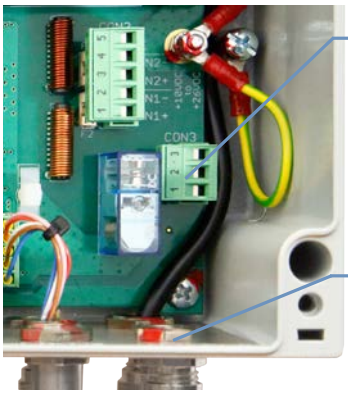
⚠ DANGER **Risk of death due to electric shock! Due to the unrestricted voltage in the device, installation may only be carried out by specialists who are authorized to do so based on their training. The relevant safety and VDE regulations must be observed. Before opening the device, it is essential to make sure that the power is disconnected and cannot be reconnected or switched on.**

The TriBox3 includes a potential-free relay changeover contact. The relay can switch small loads but, as far as possible, should only be used as a signal generator for a power relay / safeguard. With the relay, you can implement a programmable alarm output. In this case, the relay switches when, for example, a selected measured value is exceeded or not reached.

NOTICE **Always use wire end ferrules with flexible conductors. Keep the flexible conductors short. The small cable bushings are designed for sheath diameters of 3.5-7 mm.**

To connect the relay, first carry out steps 1 - 3 in chapter 4.2.1 to open the TriBox3 and insert a suitable cable into the TriBox3. Please observe the following instructions:

1. Remove the plug marked CON3 in the illustration and connect to the control line. The pin assignment is described in the following table.

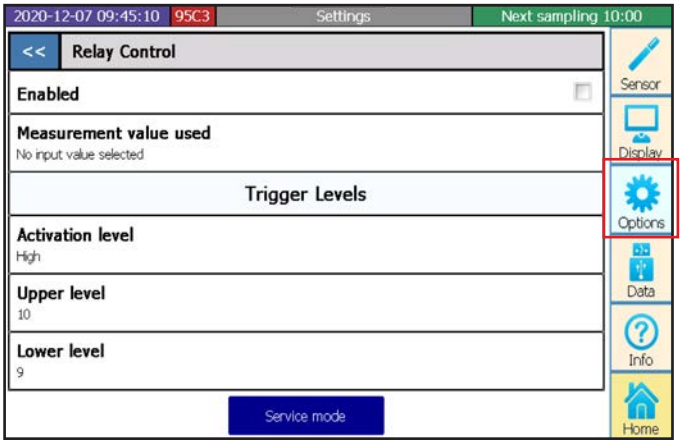


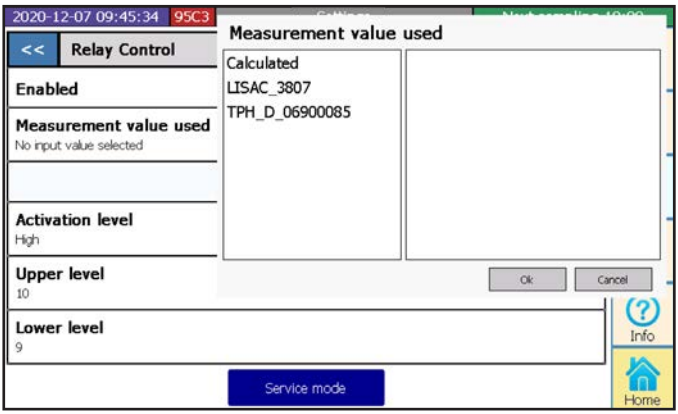
CON3 connector	
Relay changeover contact	
Pin	**Assignment**
1	Normally closed contact (NC)
2	Changeover contact (CO)
3	Normally open contact (NO)

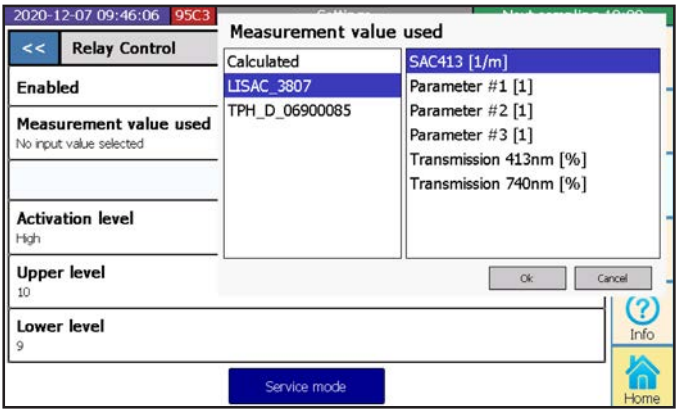
1. Put the plug back in the socket and tighten the cable bushing snugly but not too tightly.
2. Attach the cable to the white cable-tie holder with a cable tie.
3. Close the housing of the TriBox3 and screw the cover closed. After the aluminium panels are attached, the device can now be put into operation.

Clicking the checkmark in the subitem “Relay control” activates a routine that is configured in the subsequent points.

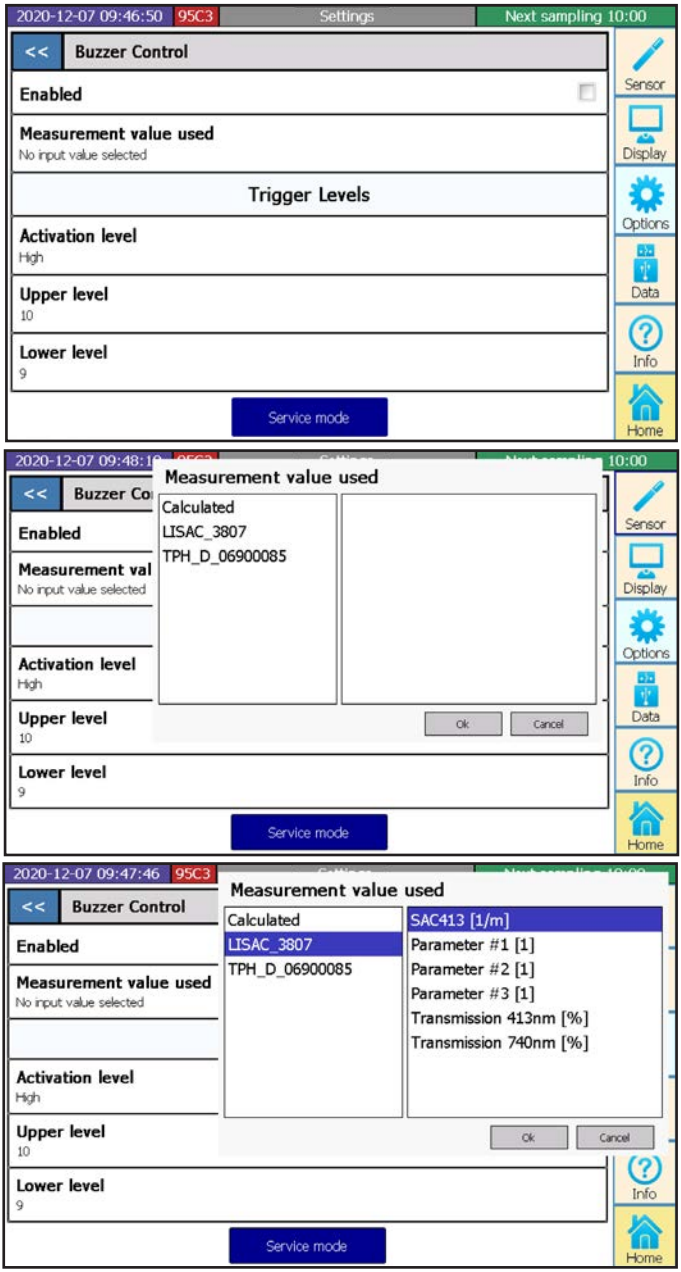
This defines the parameter that influences the relay trigger and its activation and deactivation limit.




2020-12-07 09:45:34
95C3
Measurement value used
<<
Relay Control
Calculated
LISAC_3807
TPH_D_06900085
Enabled
Measurement value used
No input value selected
Activation level
High
Upper level
10
Ok
Cancel
Lower level
9
Info
Service mode
Home

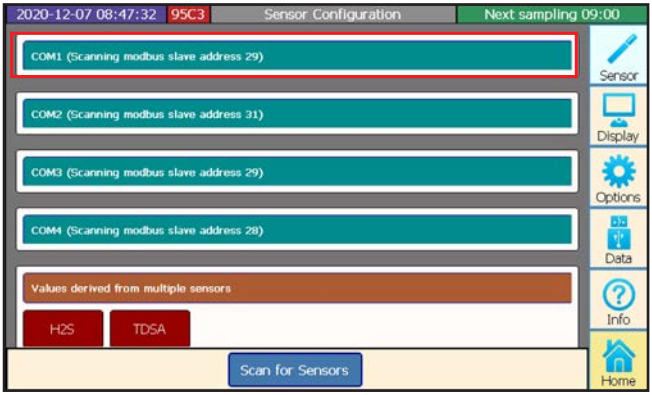

2020-12-07 09:46:06
95C3
Measurement value used
<<
Relay Control
Calculated
LISAC_3807
TPH_D_06900085
SAC413 [1/m]
Parameter #1 [1]
Parameter #2 [1]
Parameter #3 [1]
Transmission 413nm [%]
Transmission 740nm [%]
Enabled
Measurement value used
No input value selected
Activation level
High
Upper level
10
Ok
Cancel
Lower level
9
Info
Service mode
Home

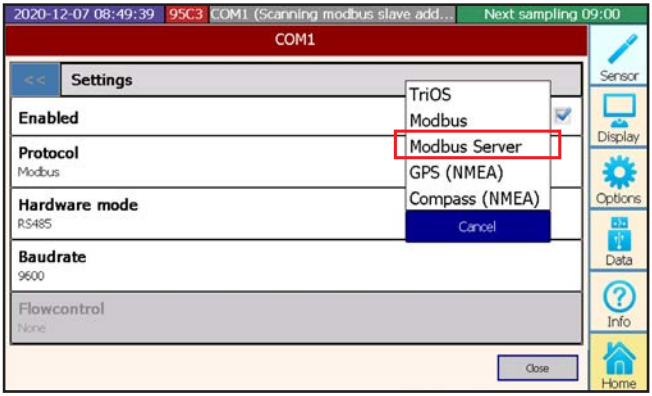
Clicking the checkmark in the subitem “Buzzer control” activates a routine that is configured in the subsequent points. This defines the parameter that influences the buzzer trigger and its activation and deactivation limit.

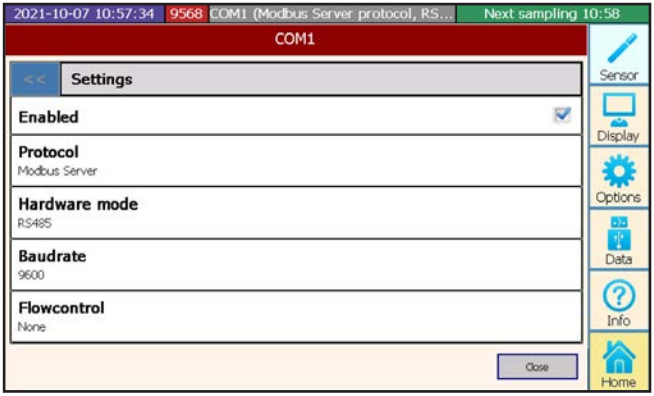


5.4 Modbus RTU

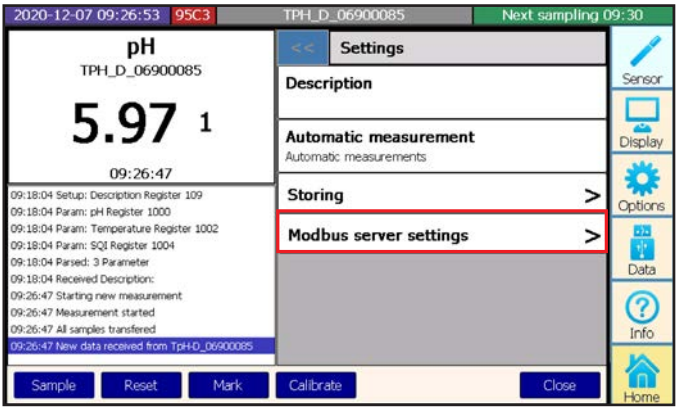
It is also possible to operate each COM port of the Tribox3 in such a way that it works in Modbus server mode. In this mode, Modbus RTU requests can be sent to the Tribox3, e.g. to read out current measured values. To activate this mode, select the “Modbus Server” setting in the protocol setting.



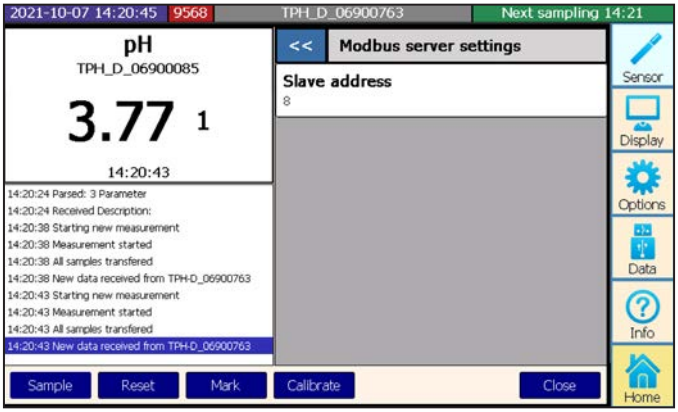




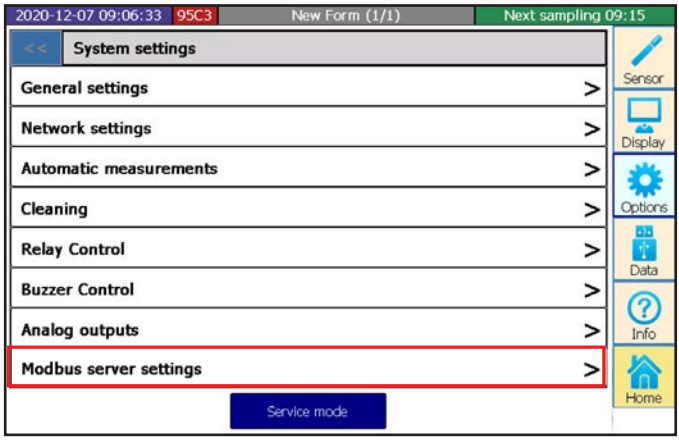
In contrast to a simple Modbus device, the Tribox3 responds at several slave addresses, because the connected sensors are distributed over different addresses. In these settings, you can view and change the sensor addresses being used.

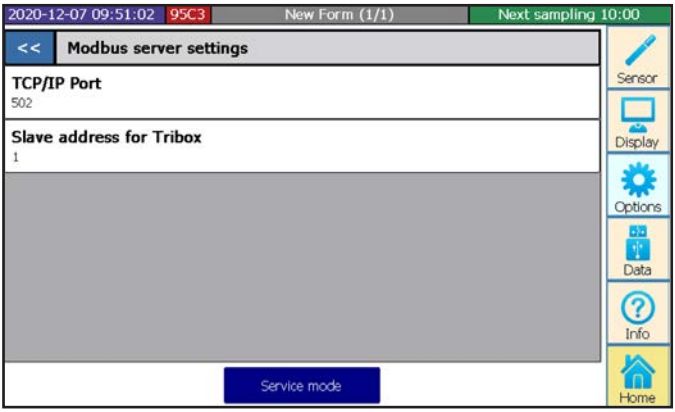


The slave address can be entered in the “Modbus server settings“.



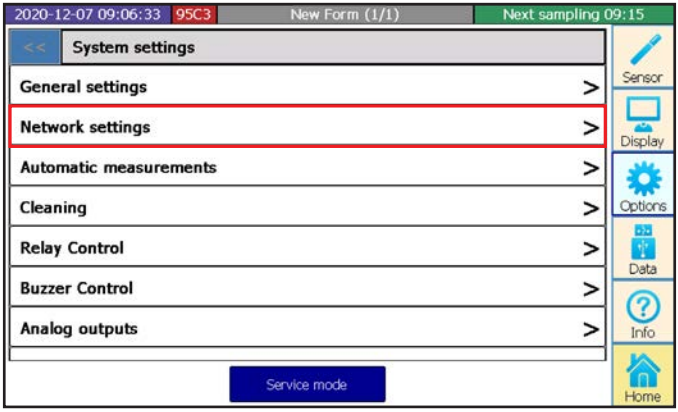
The Tribox3 also responds to Modbus TCP commands that it receives via the network at the chosen port. Port 502 is set as the default. However, you can change this port in the Tribox3 options.

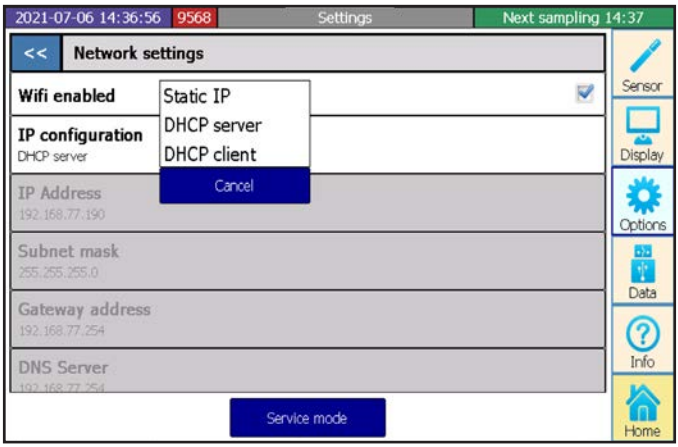




5.5 Network

In the subitem “Network settings”, you can view the IP address and check whether the WiFi is turned on.





The RJ45 network connection and a internal WiFi module allow the TriBox3 to connect directly to a PC or a network.

There are different settings for the TCP/IP connection:

Static IP The data are defined by the user (static).

DHCP server A DHCP server in the Tribox assigns the settings for the Tribox as well as for the PCs that are connected (DHCP server).

DHCP client The Tribox receives the setting of a DHCP server in an existing network (DHCP client).

- Notes on configuration:
- All devices that are involved in the data transmission with an IP protocol need a unique IP address. This IP address is made up of a combination of four numbers between 0 and 255 which are separated from each other by a dot. The DHCP configuration protocol automatically assigns the IP addresses in the network. In a class C network, all devices use an IP address in which the first three numbers match. The last number must be different for each device to uniquely identify the device within the network.
- The address ranges reserved for private purposes are:

IP range	Net mask	USE
192.168.0.0-192.168.255.255	255.255.255.0	Class C private networks (256 networks with approx. 250 participants)
172.16.0.0-172.31.255.255	255.255.0.0	Class B private networks (16 networks)
10.0.0.0-10.255.255.255	255.0.0.0	1 class A private network

- The TriBox3 IP address must be different from the IP address of the computer. If the TriBox3 is integrated into a network, it must be unique in the entire network.
- If you have any problems integrating the TriBox3, please contact your system administrator.

To call up the current TCP/IP settings on your computer, open a command window, enter “ipconfig/all” and confirm by pressing the “Enter” button.

To make changes to your TCP/IP settings, go to the properties of your network connection. Make sure that the entry for “Internet protocol Version 4 (TCP/IPv4)” (starting with Windows 7) is present and activated.

Contact your system administrator before you connect the TriBox3 to a network.

5.6 External Trigger

The TriBox3 offers the option of using an external trigger input to start a measurement. The trigger input can be operated with a DC voltage of 12–24 VDC (± 5%). When the trigger is set off, a measurement is started for all sensors that have automatic measurement activated.

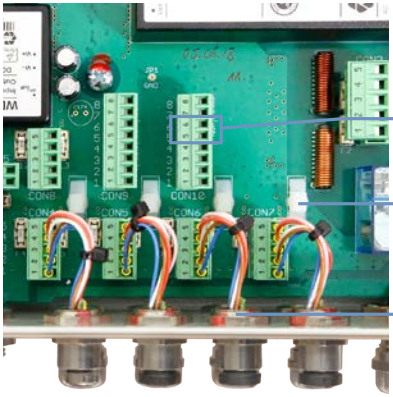
When using the external trigger, we recommend deactivating automatic (time-controlled) measurement in the “Options” menu of the TriBox3.

To connect the trigger input, follow steps 1 to 3 from chapter 4.2.1 and then carry out the following steps:

⚠ DANGER **Danger to life due to electric shock! Due to the free mains voltage in the unit, installation work may only be carried out by qualified personnel who are authorised to do so on the basis of their training. The relevant safety and VDE regulations must be observed. Before opening the unit, disconnect it from the power supply and secure it against being switched on again.**

NOTICE **Always use wire end ferrules with flexible conductors. Keep the flexible conductors short. The small cable bushings are designed for sheath diameters of 3.5-7 mm.**

1. Remove the plug marked CON10 in the following illustration and connect it to the control cable. The pin assignment is described in the following table.



CON10 connector	
External trigger input	
Pin	**Assignment**
5	Trigger input (plus)
6	Trigger input (minus, GND)

2. Put the plug back in the socket and tighten the cable bushing snugly but not too tightly.
3. Attach the cable to the white cable-tie holder with a cable tie.
4. Close the housing of the TriBox3 and screw the cover closed. After fixing the aluminium covers, put the device into operation.

Automatic measurement should be switched off when using an external trigger (see chapter 3.4.4).

6 Malfunction and Maintenance

6.1 Cleaning and Upkeep

6.1.1 Cleaning the Enclosure

- Regularly check the Tribox3 for mechanical damage.
- Regularly check all connections for leaks and corrosion.
- Regularly check all cables for mechanical damage.
- Clean the TriBox3 with a soft damp cloth from time to time. Use a mild cleaning solution if necessary.

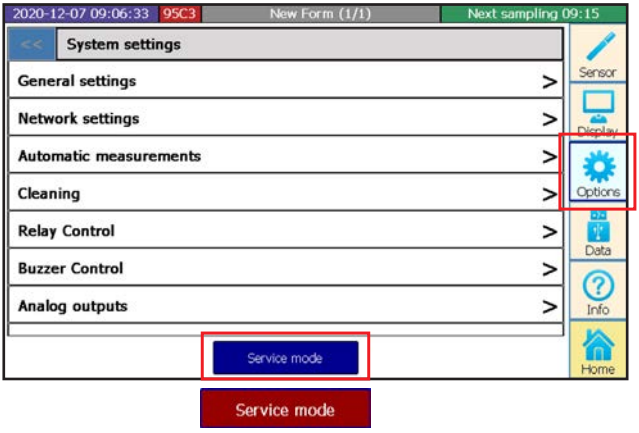
6.1.2 Manual Sensor Cleaning

To prevent unwanted measurements from being taken automatically when manually cleaning the sensors and thus possibly generating false alarms, the TriBox3 should be set to service mode beforehand.

6.2 Maintenance and Inspection

6.2.1 Service Mode

Choose the menu item “Options” from the navigation bar.



When the service mode is activated, the relay, valve and buzzer are deactivated. In addition, the automatic measuring system is suspended.

In each sensor parameter NO3-N, the behaviour for each parameter in service mode can be set.

Service mode also deactivates cleaning and prevents measurement commands from being sent to the sensor. The power voltages of the sensors are no longer changed by the global trigger, and measurement values, which are output by the analog outputs and are requested via the Modbus, receive the default value.

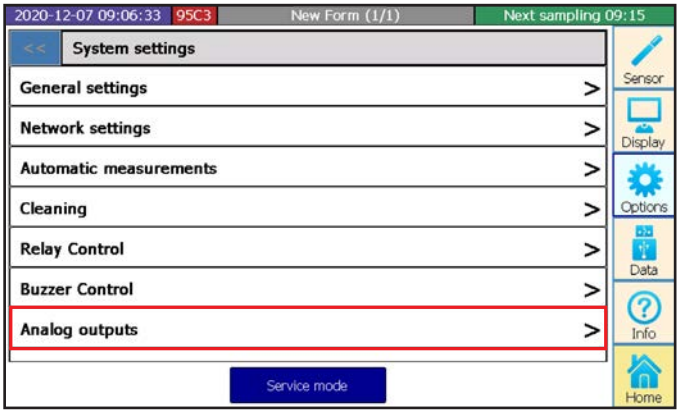
To make sure that the service mode does not remain active unintentionally, it is automatically deactivated after 2 hours, and before that, the TriBox3 will begin switching the buzzer on and off once a second to notify the user.

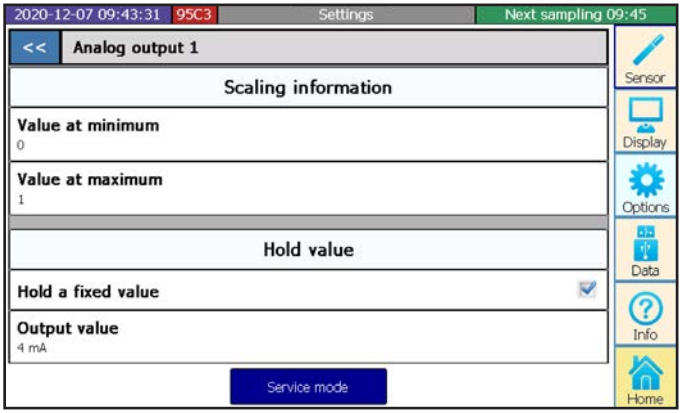
To prevent, for example, unwanted measurements when manually cleaning the sensors and thus potentially generating false alarms, the TriBox3 box should be set to service mode beforehand.

6.2.2 Checking the Analog Outputs

⚠ DANGER	**Danger to life due to electric shock! Due to the free mains voltage in the unit, tests may only be carried out by qualified personnel who are authorised to do so on the basis of their training. The relevant safety and VDE regulations must be observed.**

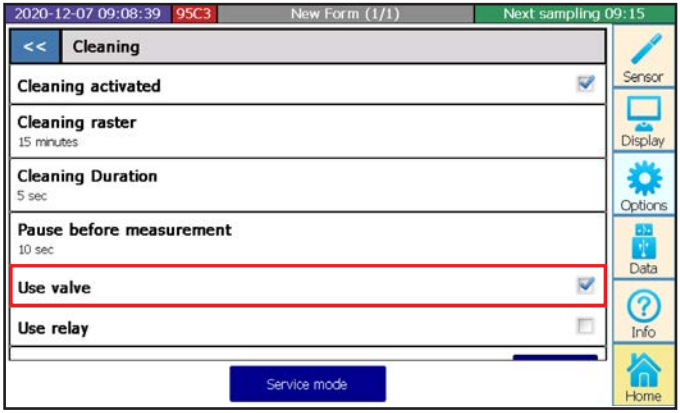
To check the functioning of the analog outputs, a constant, fixed output current can be set in the menu. This value can be measured directly at the corresponding analog output (see chapter 5.2). Holding the analog values is automatically deactivated when the user returns to the main view.





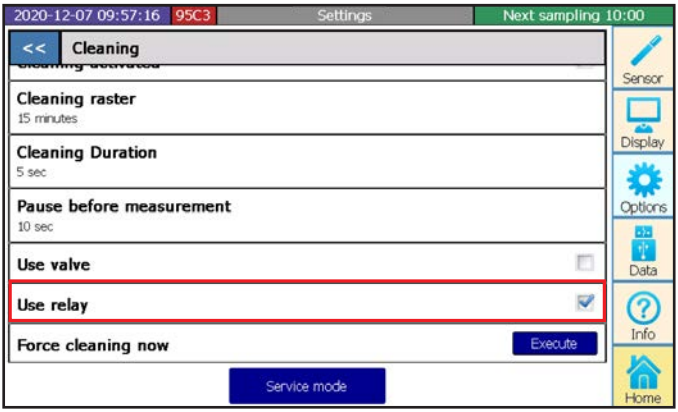
6.2.3 Checking the Valve

To check the functioning of the valve, the valve can be directly controlled via the menu. The compressed air from the input should then be at the output (below or closer to the wall). A clicking sound from the valve should be heard clearly every time it switches (see chapter 4.5).



NOTICE **The internal valve may only be used in unpressurized media. In the event of water ingress through the valve, no warranty claims can be made against TriOS.**

6.2.4 Checking the Relay

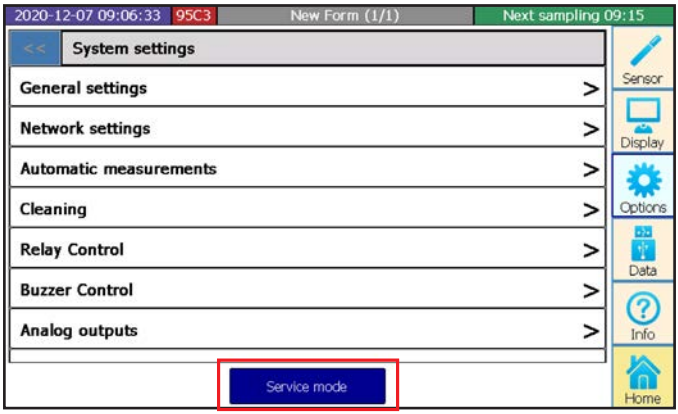


⚠ DANGER **Danger of electric shock and fire. Only qualified personnel should carry out the inspection check described in this chapter of the operating instructions.**

To check the functioning of the relay, it can be directly controlled via the menu. A clicking sound from the relay should be heard clearly every time it switches. The transit can be measured at the corresponding inputs and outputs (see chapter 5.3).

6.2.5 Working on the Compressed Air System

As when cleaning the sensors, the TriBox3 should be set to service mode before working on the compressed air system.



To make use of an automatic cleaning interval, this must first be activated by checking the box and setting a cleaning interval. The cleaning time and the pause before the measurement can also be defined here.

Cleaning can also be triggered and defined whether the valve and the relay are activated during cleaning.

6.2.6 Replacing a sensor

If it is necessary to replace a sensor, the following must be observed:

1. Switch on maintenance mode; This will keep all measured values at the output.
2. Remove the current sensor from the COM port.
3. Connect a new sensor to the COM port.
4. Start sensor scan.
5. Configure display settings (see chapter 3.4.3).
6. If necessary, change the Modbus slave ID (important if the sensor is linked to a PLC).
7. If necessary, reconfigure the analogue output (if measured values are transmitted to a central system via this output).
8. If necessary, set a new measuring interval.
9. Exit maintenance mode.

When using the TriBox3 with 8-digit serial numbers, the Modbus addresses are fixed. Point 6 is omitted in this case.

6.3 Troubleshooting

If the TriBox3 cannot be operated as described in the manual or if it displays other abnormalities, please first make sure that it is not damaged.

If the possibility of damage can be excluded, it is possible that the operating system is not working properly. In this case, reboot the system. This is particularly true when a new sensor is not immediately detected.

The “Info” button opens a window with the contact data of the nearest contact in case of problems or general inquiries. Before contacting the contact person, please read chapter 6 in full to ensure you have the right information for efficient troubleshooting.

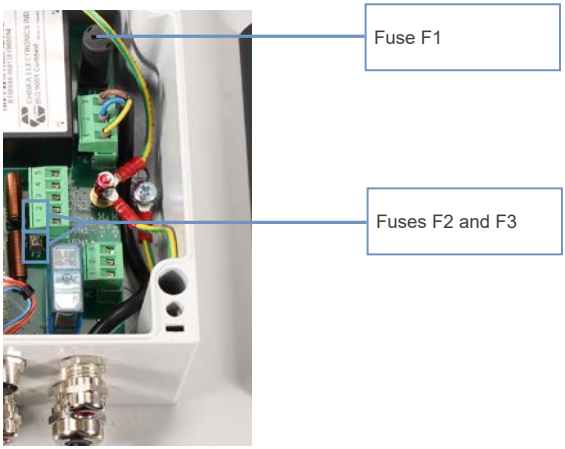
6.3.1 Changing the Fuse

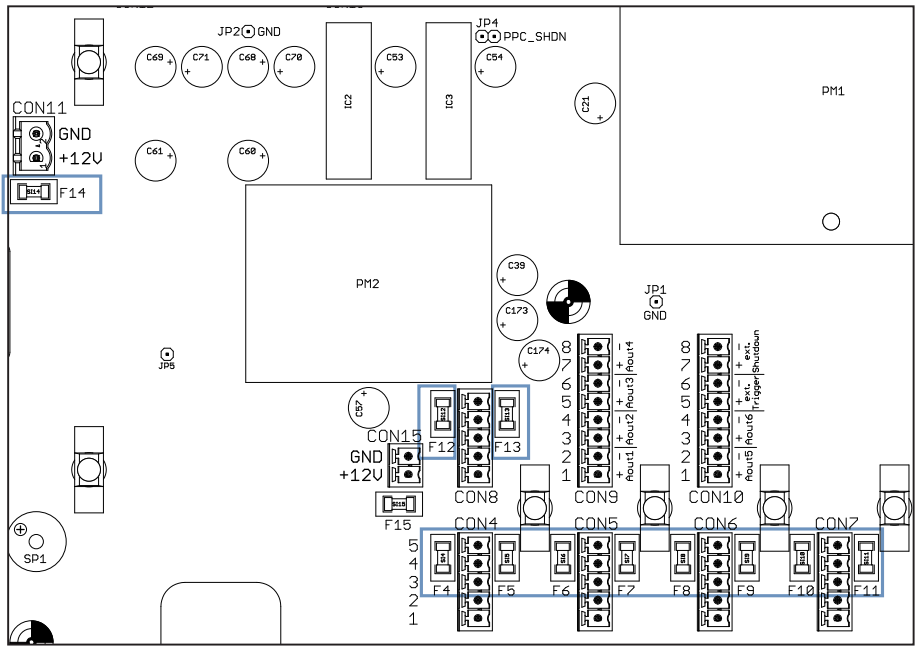
⚠ DANGER **Danger to life due to electric shock! Due to the free mains voltage in the unit, installation work may only be carried out by qualified personnel who are authorised to do so on the basis of their training. The relevant safety and VDE regulations must be observed. Before opening the unit, disconnect it from the power supply and secure it against being switched on again.**

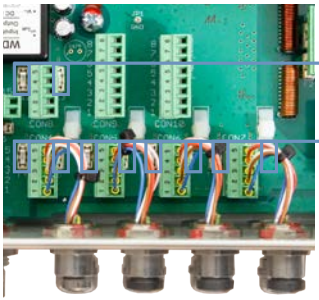
⚠ WARNING **If you need to replace a defective fuse, first unplug the power supply and use only fuses of the same type. Make sure you have completely eliminated the error before putting the device back into operation.**

The Tribox3 uses the following fuses:

Fuse F1	1A, 250V, time-lag, 5x20mm; item no. 00P100009
Fuse F2 and F3	4A, 125V, fast-blow, SMD without holder; item no. 00P100008
Fuse F4 to F14	1A, 125V, fast-blow, SMD without holder; item no. 00P100007







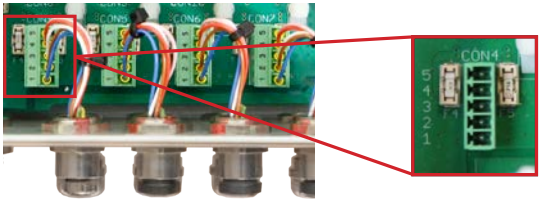
Fuses F12 and F13

Fuses F4 to F11

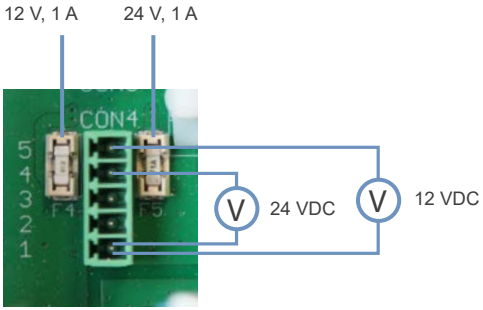
Fuse F14

6.3.2 Measuring the Output Voltage

To measure the output voltage, first open the cover of the TriBox. Here you can see that each COM port has a connector.



To measure the output voltage, a voltmeter can be used to measure a voltage of 24 VDC between 1 and 4 and a voltage of 12 VDC between 1 and 5.



If zero volts are displayed between pins 1 and 4, the fuse to the right of the connector must be replaced.

If zero volts are displayed between pin 1 and 5, the fuse to the left of the connector must be replaced.

6.3.3 Sensor is not displayed

As soon as a sensor is connected to the TriBox3, it is displayed under the corresponding COM port.

If the sensor does not appear in the display even after pressing the “Scan for Sensors” button, this can have various reasons.

Settings for data communication do not match

If the standard settings as shown in chapter 4.3 do not cause the device to be displayed, a G2 interface connection with the sensor should be established and the sensor settings should be set to the following:

Protocol: Modbus

Hardware mode: RS-485

Baud rate: 9600

Flow control: None (setting locked when using Modbus protocol)

Parity: None

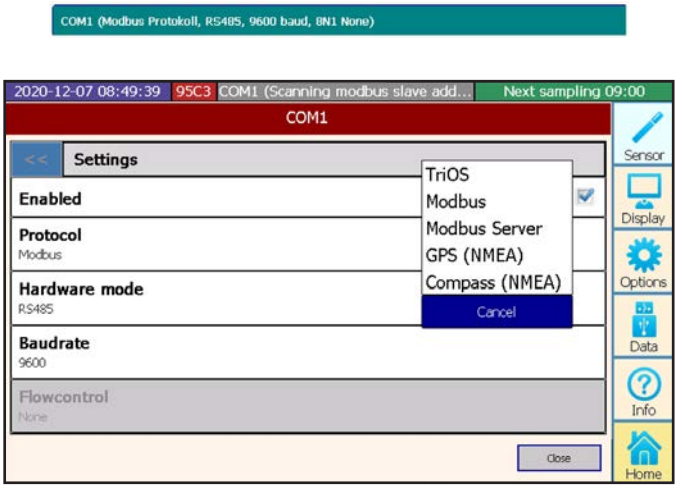
Data bits: 8

Stop bits: 1

If sensors are not Modbus-capable (see FAQ), the protocol must be reset to the TriOS data protocol if necessary.

Next, connect the sensor to the TriBox3 again and carry out the “Scan for Sensors” function once more.

The respective settings of the individual COM ports are visible in the green fields of the COM ports. The settings menu opens by clicking on the COM port button.



COM port defective

A possible cause for a sensor not being recognised could be a defective COM port. To check whether the COM port is possibly defective, please connect another sensor to the same COM port and check whether it is recognised. Please change the sensor as described in chapter 6.2.6 only in maintenance mode.

If the sensor is recognised and appears in the overview, the COM port is OK.

If this sensor is also not recognised, the fuses of the COM port should be checked. The exact procedure for this can be found in chapter 6.3.1.

Check power supply

With some sensors you can easily check whether the sensor receives a power supply from the TriBox.

The sensors TpH, TpH-D and TTurb have a status LED which is active as soon as the sensor is supplied with voltage.

In the case of enviroFlu, you can hear a soft ticking sound when the sensor is supplied with voltage.

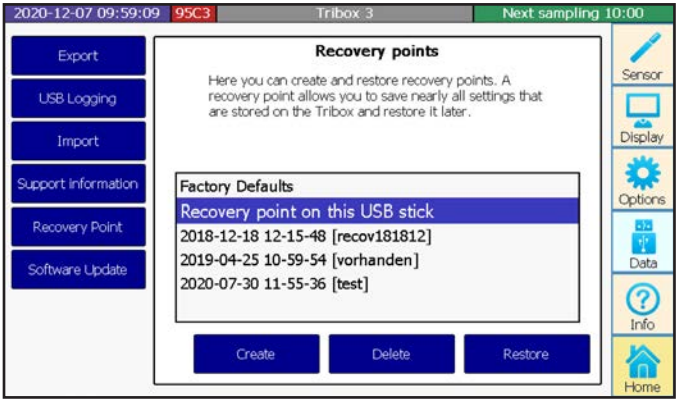
If you notice that the respective sensor does not show any of the described reactions, you can assume that no voltage supply has taken place. Here, too, you can carry out a check of the COM port as described in Chapter 6.3.1.

If the device is still not displayed after checking the points listed above, there is probably a serious problem. In this case, please contact TriOS customer support.

6.3.4 Calling up the Recovery point

Recovery Point

The subitem “Recovery Point” also stores settings. For your safety, a recovery point should always be stored when making changes to settings such as scaling factors, analog outputs or measurement intervals.



In this illustration, a recovery point has already been saved in addition to the factory settings.

When the device is reset to the factory settings, all user-specific settings are lost!

To make sure that all previously entered settings are saved and updated, the controller should be restarted after every reconfiguration. After the restart, a recovery point should be stored.

The second item in the list (illustration) is a restore point that has been saved on a USB stick and is only displayed as long as the USB stick is inserted in the TriBox3. When “Restore” is pressed, the following window opens.

With “OK” you confirm the installation of the restore point and with “Cancel” the process is cancelled.

6.3.5 Modbus Server Problems

Previous software versions may cause problems. The Modbus server can therefore only be used from version 1.4.20 without errors.

6.3.6 Support Info

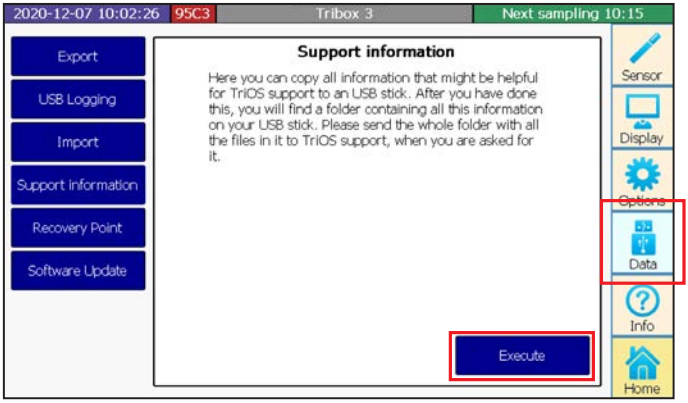
To ensure an error-free and reliable measurement, the device should be periodically checked and maintained.

For many malfunctions which ultimately require our technical support, it is helpful to document the status of the TriBox3 immediately after the occurrence of the possible malfunction. To do this, export the support information to a USB stick and send this to our customer support along with your first inquiry.

If the following sections do not correct the malfunction, please contact TriOS techincal support at the following email address: **support@trios.de**. The support information you exported must also be sent to ensure that your problem is solved quickly.

Support information

The subitem “Support information” allows flow trace protocols and settings to be copied to a USB stick. These files should always be sent to TriOS along with support requests.



6.3.7 Software Update

Software Update

In the subitem “Software Update”, new versions of the software can be installed in the TriBox3.

The new version of the software must first be copied to a USB stick. To do this, the files must be stored in a subdirectory on the top level. If the software update comes as a zip file, first extract the contents and copy the unzipped contents of the file to the USB stick. Then insert the USB stick in the TriBox3, and all software updates that are found will be displayed. The desired update can be selected and the TriBox3 will automatically install the update when the “Install” button is pressed. It will then restart.

6.4 Return

Please observe the following procedure for your returns.

If a sensor needs to be returned, please contact technical support. To ensure a smooth return and to avoid incorrect deliveries, each return package must first be reported to the customer service. You will then receive an RMA form with a number, which you need to fill out completely, check and send back to us. Please write the number assigned to you prominently on the package. This is the only way your return package can be correctly allocated and accepted.

A cleaning fee will be charged for very dirty devices.

Caution! Return shipments without an RMA number can not be accepted and processed!

In order to ship the goods undamaged, use the original packaging. If this is not on hand, make sure that safe transport is guaranteed and the sensor is safely packed using enough packing material.

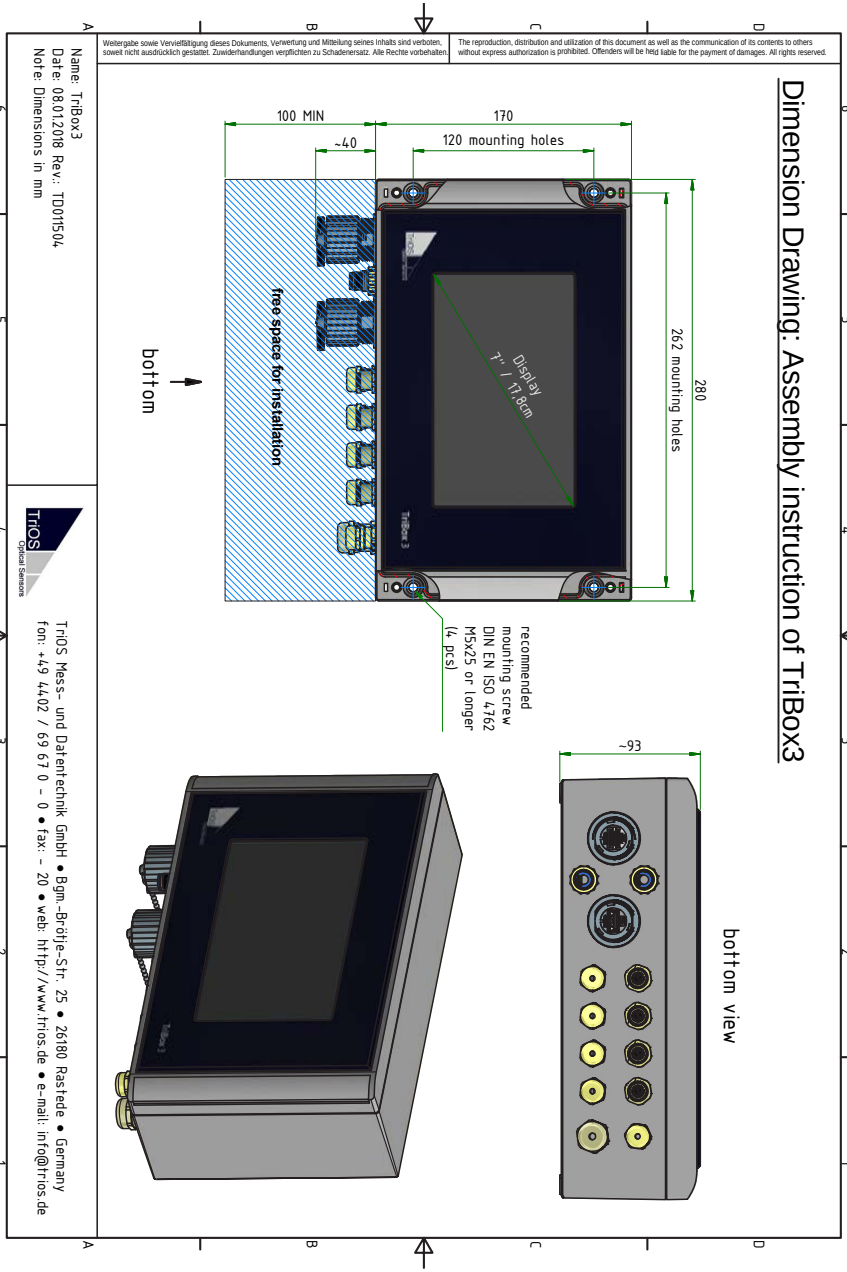
7 Technical Data

7.1 Technical Specifications

POWER SUPPLY		
Voltage supply	100...240 VAC, 50...60 Hz, 12...24 VDC (± 5%)	
Power consumption	Type: 6 W, max: 50 W	
Protection class	1	
Overvoltage category	II	
SENSOR INTERFACES		
Connection	4 M12 industrial connectors for TriOS sensors	
Standard	RS-232, RS-485	
Protocol	Modbus-RTU, TriOS	
MODBUS RTU		
Server RTU	yes (on each sensor connector)	
Client RTU	yes (on each sensor connector)	
Parameters	Adjustable (default: 9600-8-N-1)	
MODBUS TCP		
Server TCP	yes	
TCP port	Adjustable (default: 502)	
NETWORK/USB		
Standard	Ethernet, WiFi based on IEEE 802.11b/g/n	
Connection	1 RJ-45 integrated WiFi antenna (for TriBox3 with WiFi)	
Protocol	TCP/IP, Modbus TCP, VNC	
Web interface	no	
USB	USB 2.0 (Host), USB-A socket	
ANALOG INTERFACES		
Analog Output	6 analogue outputs, configurable: 4...20 mA	
Load	max. 500 Ω	
Connection terminals	1.5 mm²	16 AWG
Error indicator	0 mA	
SWITCH INPUT/OUTPUT		
Measurement trigger	Trigger for global measurement (galvanically isolated), Control voltage: 12...24 VDC (± 5%) Connection terminal: 1.5 mm² (AWG 16)	Control voltage: 12...24 VDC (± 5%) Connection terminal: AWG 16
Control voltage	no	

RELAY OUTPUTS		
Electrical specification	1 x relay changeover contact (SPDT) / 250 VAC, 2 A / 30 VDC, 2 A	
Connection terminals	max. 2.5 mm²	max. 14 AWG
COMPRESSED AIR CLEANING		
Valve	integrated, max. air pressure: 5 bar	
DISPLAY		
Display	7” capacitive touch-display (800x480 pixels)	
LED	5 status LEDs	
DATA STORAGE		
Storage medium	internal 2 GB microSD card, direct logging to USB stick possible.	
Data Export	via USB 2.0 Host	
ENVIRONMENT		
Operating temperature	-10...+50 (with pre-installed mains power cable +5...+40 °C)	~ +14 ˚F to +122 ˚F (with pre-installed mains power cable +41...+104 ˚F)
Storage temperature	-20...+70 °C	~ -4 ˚F to +158 ˚F
Relative air humidity	0...95 % (not condensing)	
Protection type	IP65	NEMA 4X
Pollution level	2	
MECHANICAL SYSTEM		
Dimensions (width x height x depth)	280 x 170 x 94 mm	~ 11” x 6.7” x 3.7”
Weight	3.7 kg	~ 8.2 lbs
Materials	Housing: aluminium die-cast alloy, front panel: acrylic glass (PMMA)	

7.2 External Dimensions



8 Accessories

8.1 AirShot2

The convenient AirShot2 compressed air cleaning system uses pulses of compressed air rather than a continuous airflow. This significantly reduces the required volume of air and allows the system to be very compact.

Additionally, compressed air pulses clean more effectively than a continuous stream of air, which makes the AirShot2 a valuable addition.

The AirShot2 can be used instead of a conventional compressor and can be controlled directly via the TriBox.

8.2 Modbus Distributor Box

5-input M12 connector

This distributor box allows a controller input to be expanded to allow five inputs, allowing significantly more sensors to be controlled via one controller then before.

8.3 Compass

3-axis compass

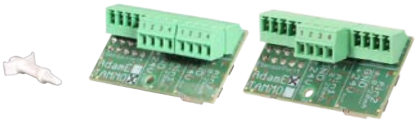
The 3-axis compass determines the compass direction, the angle of inclination and the angle of rotation.

It can be mounted together with sensors to bring the measured values in connection with the position.

8.4 TAMMO / AdamE

TAMMO is an expansion module for the TriBox3 that converts analogue signals to the RS-485 Modbus RTU protocol. The analogue-to-Modbus module offers a total of two current inputs, where both the parameter and the unit can be set for two parameters.

Variant AdamE is only valid in connection with the use of TriBox3 EGCWA with 8-digit serial number starting with 751xxxxx.



9 Warranty

The warranty period of our devices within the EU and the United States is 2 years from the date of the invoice. Outside of the EU, the warranty period is one year. All normal consumables, such as light sources, are not included in the warranty.

The warranty is subject to the following conditions:

- The device and all accessories must be installed as described in the corresponding manual and must be operated according to the specifications.
- Damage due to contact with corrosive and damaging substances, liquids or gases and damage during transport are not covered by the warranty.
- Damage due to improper handling and use of the device is not covered by the warranty.
- Damage resulting from modification or unprofessional attachment of accessories by the customer is not covered by the warranty.

10 Customer Service

If you are having a problem with the sensor, please contact the TriOS technical support.

Technical support contact:

support@trios.de

Telephone: +49 (0) 4402 69670 - 0

Fax: +49 (0) 4402 69670 – 20

To help us provide faster service, please send us the device ID number by email (the last four digits of the serial number consisting of letters and numbers, e.g. 28B2)

11 Contact

We are constantly working to improve our devices. Visit our website for news.
If you have found an error or bug in one of our devices or programs, please let us know:

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

TriOS Mess- und Datentechnik GmbH
Bürgermeister-Brötje-Str. 25
D-26180 Rastede
Germany

Telephone	**+49 (0) 4402 69670 - 0**
Fax:	**+49 (0) 4402 69670 - 20**

12 Keyword Index

13 FAQ - Frequently Asked Questions

You can find more FAQs on our website: **www.trios.de**.

1. Which TriOS sensors are not Modbus capable?

   The enviroFlu, microFlu and RAMSES sensors

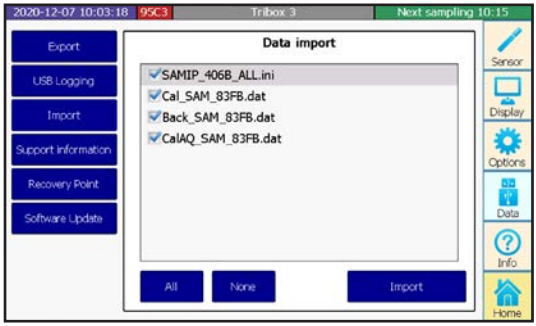
2. What do I have to take into account when using the RAMSES sensors in conjunction with the TriBox3?

   Before connecting the RAMSES to the TriBox3, the following files must be imported onto the TriBox3:

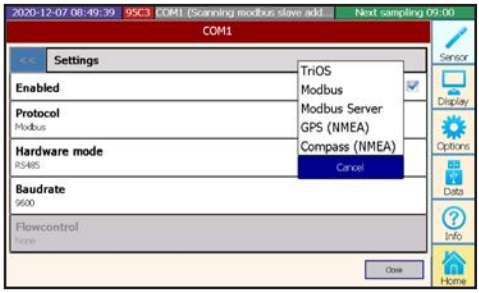
   - Cal_SAM_8XXX.dat
   - CalAQ_SAM_8XXX.dat
   - SAM_8XXX.ini
   - Back_SAM_8XXX.dat

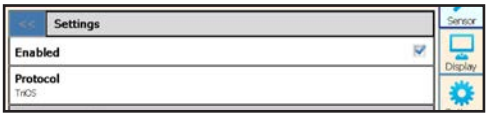
   These can be found on the calibration CD.

   To do this, copy the four files onto a USB stick and insert it into the TriBox. Select the “Data” menu in the navigation bar and then click on subitem “Import” (the blue button to the left). You will see the four files that you can then select and download onto the TriBox by clicking on the “Import” button (bottom right).



   Now go to the “Sensor” menu in the navigation bar and click on the COM port that you would like to use.

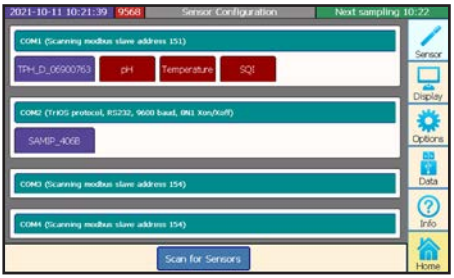


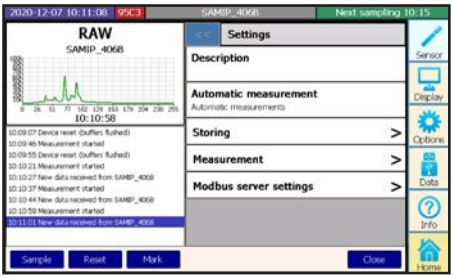


Click on “Protocol” and select the TriOS data protocol.

Now go back to the “Sensor” menu by clicking on the “Close” button (bottom right).

Connect your sensor to the TriBox3 and click on the “Scan for Sensors” button (bottom centre). All connected sensors are now displayed.

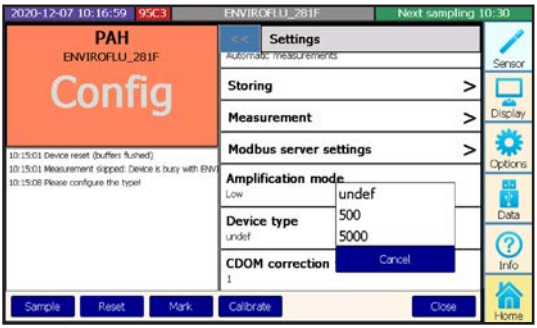




To change the sensor settings, click on the button corresponding to the sensor.

3. How do I connect an enviroFlu sensor?

Connect the sensor cable to the TriBox3. Now click on the corresponding COM port in the Sensor menu item and select the TriOS data protocol as described in the previous question. Tap on the sensor field to set the corresponding measuring channel of your sensor under “Device type”.



4. How can I switch the enviroFlu to the sensitive / high-resolution channel?

Touch the sensor button and then select the sensitivity “high” or “low” under “Gain Mode”.

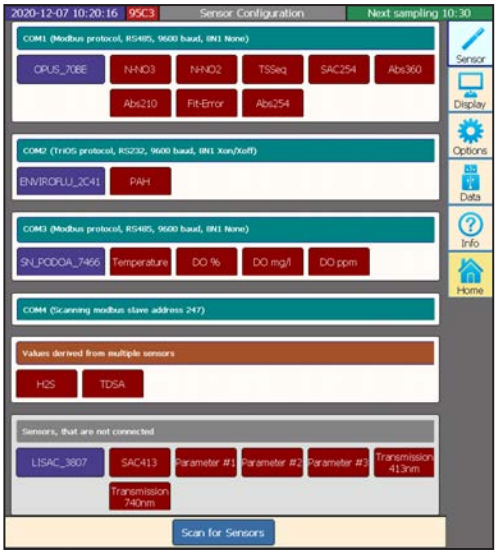
The adaptation can also be carried out via Modbus by an entry in register 102.

5. How to get Modbus addresses and registers from the TriBox3?

The TriBox3 can output Modbus TCP/IP via its Ethernet connection port or Modbus RTU via its COM ports. The following steps explain how to get the **ModbusStatus.txt** file from the TriBox3.

Step 1

To obtain the complete Modbus mapping, all required sensors must be connected to the TriBox3 and displayed with the corresponding parameters in the “Sensor” menu.



These are the currently connected sensors which are ready for measurement.

If the slave ID of the sensor is to be changed, this can be done under the Sensor button: ENVIROFLU_2C41.

The sensor menu opens. Now select “Modbus server settings” (on the right). Here the slave ID can be adjusted if necessary.

These parameters are calculated internally. They also appear in the **ModbusStatus.txt**.

Non-connected sensors should be removed:

1. Press sensor button LISAC_3807.

(Sensor menu opens)

2. Press the Remove Device button and confirm.

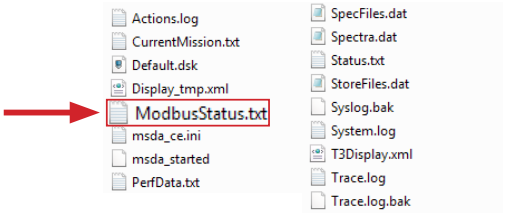
If all unconnected sensors have been removed or the slave IDs have been adjusted, the TriBox3 must be restarted (otherwise the ModbusStatus.txt will be longer than necessary).

Step 2

Connect a USB stick to the TriBox3 and open the “Data” menu. On the left side is the blue Support Information button: Support information

Pressing this button opens a submenu. If you press “Execute”, a folder with the current date of the TriBox3 will be copied to your USB stick. The folder contains the following files:

Open this file



Done!

Annex

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 Designation	**TriBox3**
Typ / Type / Type	*Art.Nr.10C000000 TriBox3 mit WiFi Art.Nr.10C100000 TriBox3 ohne WiFi Art.Nr.10C100001 TriBox3 EGCWA
Mit den folgenden Bestimmungen With applicable regulations Avec les directives suivantes	2014/30/EU EMV-Richtlinie 2014/35/EU Niederspannungsrichtlinie 2011/65/EU RoHS-Richtlinie *2014/53/EU RED-Richtlinie
Angewendete harmonisierte Normen Harmonized standards applied Normes harmonisées utilisées	EN 61326-1:2013 *EN 300 328 V2.2.2 *EN 301 489-1 V2.1.1 *EN 301 489-17 V3.1.1 EN 61010-1:2010 +A1:2019 +A1:2019/AC:2019 EN IEC 63000:2018
Datum / Date / Date	Unterschrift / Signature / Signatur
15.10.2021	

Modbus Server

1. Introduction

The TriBox3 Modbus server can be addressed either via Modbus/TCP using an IP connection or via Modbus/RTU using a serial RS-485 or RS-232 connection. In both cases, the same addresses and register assignments are used.

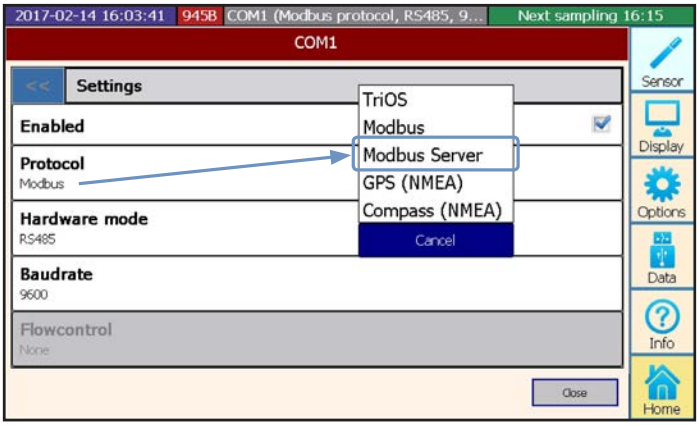
This document describes the specifications of the Modbus implementation on the TriBox3. It is not a complete Modbus documentation and it is assumed that the user is basically familiar with Modbus protocols.

2. Modbus/TCP

Modbus TCP can be used by any device that can establish a TCP connection to the TriBox3. By default, the TriBox receives incoming Modbus connections on the standard port 502, but the port number can be changed in the TriBox settings.

3. Modbus/RTU

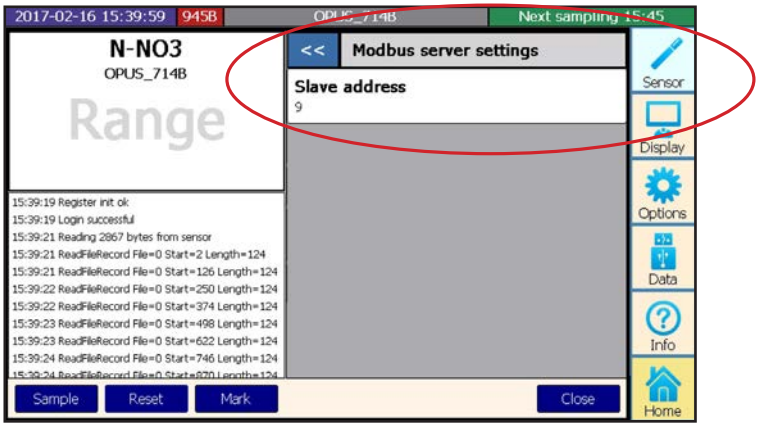
Alternatively, each of the four sensor connections can also be used to operate connected Modbus clients. In this case the protocol of the port must be changed to “Modbus server” (reboot the TriBox after the protocol settings have been changed to “Modbus server”).



In contrast to other Modbus slaves, the TriBox can respond to several slave addresses, since each connected sensor and the TriBox itself are handled like individual Modbus slaves with their own slave addresses.

4. Slave Addresses

To handle any number of sensors with its own register tables, the TriBox assigns each sensor its own slave address the first time it is detected. By default, the TriBox itself uses slave address 1. The slave address of the sensors can be set in the sensor menu.



If no address has been assigned here, the TriBox3 must be restarted.

To get an overview of all slave addresses to which a slave address has been assigned, the file ‘ ModbusStatus.txt can be viewed, which is part of the “Support Information”.

5. Data types

Name	Count	Format or Range
Boolean	1	False = 0,;True ≠ 0
Int16	1	16 bit integer. Range: -32,768 ... 32,767
Int32	2	32 bit integer.Range: −2,147,483,648 ... 2,147,483,647
Float	2	IEEE 754 32 bit floating point value
Char[n]	$\geq \left[\frac{n}{2}\right]$	ASCII String, padded with Null characters at the end
DateTime	6	Year, Month, Day, Hour, Minute, Second

Attention: All data types longer than 16 bits, such as floats, are processed in big endian format.

6. Register tables

The registers in this document are numbered from 0 to 65535, which is the same numbering used in the Modbus frames. If a software with a numbering starting from 1 is used, a 1 must be added to each register number that can be found in this document in order to obtain the correct register number for that software.

Input and Holding use the same table, so there is no difference between the results of the “Read Holding Register” and the “Read Input Register” commands.

Attention: Due to internal adjustments to adapt the register usage to our sensors, some inconsistencies have arisen, especially with regard to register arrangements of longer data types. It is possible that further adjustments will follow.

6.1 Coils

There are numerous coils among the different devices which are used to trigger specific actions such as measurements.

Register	Supported devices	Description
1	Sensors, TriBox	Trigger a measurement. For sensors a measurement is triggered on this sensor, for the TriBox a measurement for the entire measuring system is triggered.
2	Sensors	Resets the software status of the sensor.
3	TriBox	Trigger a cleaning.

6.2 Registers of Modbus devices

Register range	Datatype	Read/Write	Description
20 … 39	Char[40]	R	Name of the sensor, e.g. Opus_7123
80	Int16	R	Number of measured values
81	DateTime	R	Time of last measurement
1000ff		R	Measurement results (see below)
2000ff		R	Spectrum (if the sensor has one)
2000	DateTime	R	Spectrum sample time
2006	Int16	R	Integration time
2007	Int16	R	Number of channels
2008	Int16	R	Path length
2009	Float	R	CAL factor
2100ff	Floats	R	Spectral data

Measurement results

Depending on the sensor type, there are two different register mappings that are used here. If it is a TriOS sensor that uses registers 1000ff for its measurement results, the registers are mapped to the same registers that are used in the sensor. Further information regarding the register numbers can be found in the respective sensor manuals.

At the moment the TriBox sets the Hi and Lo of the floats to the low endian format. This differs from the behaviour of the sensors. This may be changed in future software versions.

Spectral data

These are pairs of wavelengths and Y-values: A wavelength value is always accompanied by the corresponding Y-value.

6.3 Registers of the TriBox

Register range	Datatype	Read/Write	Description
20 … 39	Char[40]	R	Name of Tribox: Tribox_9401
100 … 101	int32	R	Serial number
102 … 107	DateTime	RW	System time
108ff	Char[64]	RW	User-defined name of the TriBox

6.4 Register of other multiparameter probes

Where possible, all devices have the same register mapping. The following table lists the registers used by all sensors with up to 32 measurement parameters.

Register range	Datatype	Read/Write	Description
20 … 39	Char[40]	R	Name of the device
80	Int16	R	Number of parameters
81	DateTime	R	Time of last measurement
1000ff		R	Data of up to 32 measurement parameters
1000 … 1063	32 Floats	R	Up to 32 measurement results
1064 … 1383	32 * Char[20]	R	Names of the parameters in the order of the measurement results
1384 … 1639	32 * Char[16]	R	Names of the units of the parameters in the order of the measurement results