TriOS xylem

EGC Water Analyzer

OPERATING INSTRUCTIONS

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1 General Information

1.1 Introduction

Welcome to TriOS.

We are glad that you have chosen to purchase our Exhaust Gas Cleaning Water Analyzer.

The EGC Water Analyzer is a measurement cabinet to determine the various parameters in wash water from exhaust gas cleaning systems on ships. It can be equipped with three types of sensors: the enviroFlu for PAH, the TTurb for turbidity and the TpH-D for the pH value. The flow rate, the temperature and the turbidity-corrected PAH value can also be determined.

In this manual, you will find all the information you will need to commission the EGC Water Analyzer. Technical specifications, detection limits and dimensions can be found in chapter 7.

Please note that the user is responsible for complying with local and state regulations for the installation of electronic equipment. 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. For trouble-free, professional use of the devices, please use only original accessories and cables from TriOS Mess- und Datentechnik GmbH.

Before using the device, read the manual carefully, and keep this manual on hand for future reference. Make sure that you have read and understood the safety precautions described below before using the sensors. Always make sure that the sensors are operated correctly. The safety precautions described on the following pages should ensure the reliable and correct operation of this 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 EGC Water Analyzer with hexadecimal serial numbers 081XXXXX and TriBox3 EGCWA with 8-digit hexadecimal serial numbers starting with 751XXXXX equipped with software version 1.5.4 and higher. From time to time, TriOS Mess- und Datentechnik GmbH publishes software updates for the TriBox3. These updates include bug fixes, new features and options.

If you have an older version of the TriBox3 EGCWA, you can perform a software update (only possible for the TriBox3 EGCWA with 8-digit hexadecimal serial number 751XXXXX); to do that, follow the instructions in Chapter 6.3.7 of the TriBox3 manual.

Please contact customer support of TriOS Mess- und Datentechnik GmbH if you would like to send your TriBox3 in.

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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 following are distinct 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 sensors. 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.

⚠ **CAUTION**	**Never look directly into the light source of the enviroFlu. The radiation emitted (UV light) can cause serious damage to the eyes.**

Reagents

Follow the safety and operating instructions of the manufacturer when using reagents. Observe the valid Hazardous Materials Ordinance for reagents (German GefStoffV)!

Biological safety

Liquid waste may be a biohazard. Therefore, you should always wear gloves when working with such materials. Please observe the currently valid biological agents regulation! (German BioStoffV)

Waste

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

1.3 Warnings

- This product has been developed for use in industry and science. It should only be used for the measurement of aqueous solutions, e.g. process waste water, river water or seawater.
- The voltage supply of the EGC Water Analyzer should have 100–240 VAC / 50–60 Hz.
- In no circumstances should alcohol, benzene, thinner or other flammable substances be used to clean the equipment.
- Do not cut, damage or change the cord. Make sure that no heavy objects are placed on the cable and that the cable is not kinked.
- Make sure that the cable routing and cables do not run near hot surfaces.
- If a sensor cable is damaged, it must be replaced with an original part by the technical support of TriOS Mess- und Datentechnik GmbH.
- Introducing materials and parts whose usage is not intended for the measurement can damage the optics or at least cause incorrect measurements.
- Stop operation of the sensors in the event of excessive heat development (i.e. if it is hot to the touch), smoke or emission of gases. Switch off the sensors immediately and remove the cable from the power supply. Please contact your dealer or TriOS technical support.
- Never try to disassemble or modify a part of the sensor 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 Mess- und Datentechnik GmbH.
- Devices from TriOS Mess- und Datentechnik GmbH meet the highest safety standards. Repairs to the device (which involve the replacement of the connecting cable) 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.

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 EGC Water Analyzer has been developed for use in industry, industrial cleaning systems and science. The target group for the operation of the EGC Water Analyzer is technically skilled staff on ships. We assume that the operating personnel are familiar with dealing with dangerous substances based on their professional training and experience.

The use of the determination measurement in the test often requires the use of hazardous substances. The operating personnel must be able to correctly understand and implement the safety labels and information on the packaging and in the package inserts of the test kits.

1.5 Intended Use

The purpose of the EGC Water Analyzer is to measure the parameters PAH, turbidity and pH of the wash water from exhaust gas washers, as described in this manual. For this purpose, all the sensors are immersion sensors that are used underwater or with flow cells (FlowCells). The device should only be used to measure aqueous fluids. Please note the technical data of the accessory parts. Other uses do not comply with the intended use. For the use of the EGC Water Analyzer in other substances than those specified this manual, please contact the technical support of TriOS Mess- und Datentechnik GmbH (support@trios.de).

Caution!

- Due to the risk of contaminating or scratching the optics with electrodes, you should avoid any physical contact with the glass and plastic components of the measurement heads. Precise measurements and functionality can then no longer be guaranteed.
- Please only touch the sensors on the housing.
- Never lift or adjust the sensors using the cable.
- Always avoid installing the sensors and cables near hot surfaces.

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 for a fee (see address below). The preceding professional decontamination of the device must be proven with a certificate. 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 of the requirements of the harmonised European standards. It therefore meets the legal requirements of the EC guidelines. TriOS Mess- und Datentechnik GmbH confirms the successful testing of the product by affixing the CE marking (see Annex).

The EGC Water Analyzer is certified by: DNV (for requirements see chapter 4.2.1), ClassNK, KR, ABS and CCS (see appendix).

2 Introduction

The EGC Water Analyzer is a measurement cabinet to quantify polycyclic aromatic hydrocarbons (PAHs), measure turbidity and determine the pH value of waste water. Inside the measurement cabinet is a TriBox3 that all the sensors are connected to.

The Ethernet interface and the six integrated analog outputs (4–20 mA) are connected directly to a connection box at the plant, which allows the TriBox3 to be integrated into an existing system.

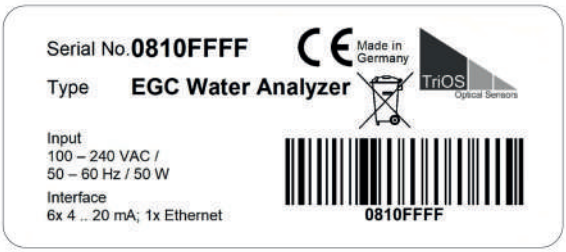
If you work with TTurb-1000 in EGC Water Analyzer, make sure you use the MEPC version of the sensor (81S200220 without TTurbCAL or 81S200222 with TTurbCAL)

2.1 Product Identification

All TriOS Mess- und Datentechnik GmbH products have a label, which clearly shows the product designation.

There is also a rating plate inside the measurement cabinet with the following information that you can use to uniquely identify the product:

Serial number
Product type
Power supply
Interface



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 be different depending on the version of the product.

2.2 Scope of Delivery

The shipment contains the following components:

- 1 EGC Water Analyzer
- 1 control cabinet key
- 1 test certificate according to DIN VDE 0701-0702
- 1 EGC Water Analyzer manual
- 1 TriBox3 incl. manual
- 1 enviroFlu (optional) incl. manual
- 1 TTurb incl. manual
- 1 TpH-D incl. manual
- 1 O-ring set (item number 22P000010) for commissioning and two maintenance sessions

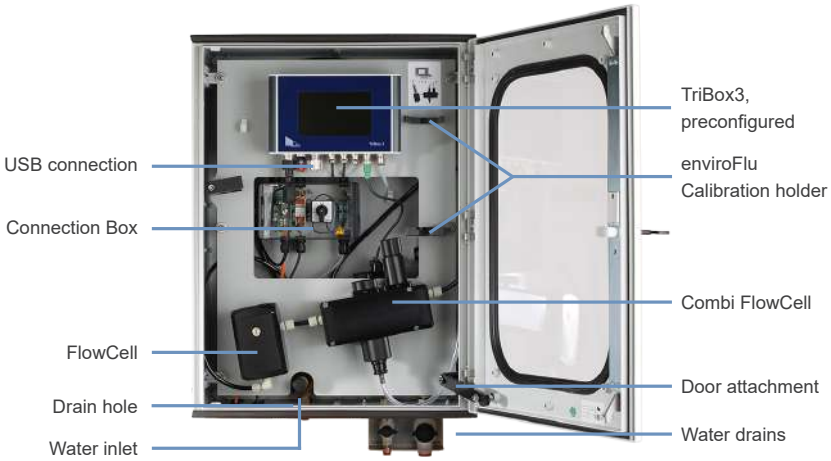
The cables for the power supply, the Ethernet and the analog outputs to connect to the connection box are NOT included in the delivery.

The delivery includes a total of three O-ring sets that are attached inside the measurement cabinet.

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

2.3 Measurement Principle and Design

The EGC Water Analyzer is a system consisting of sensors to determine the parameters PAH, turbidity and pH of exhaust gas cleaning systems on ships. The measurement principles of the individual sensors can be found in the respective manuals.



3 Commissioning

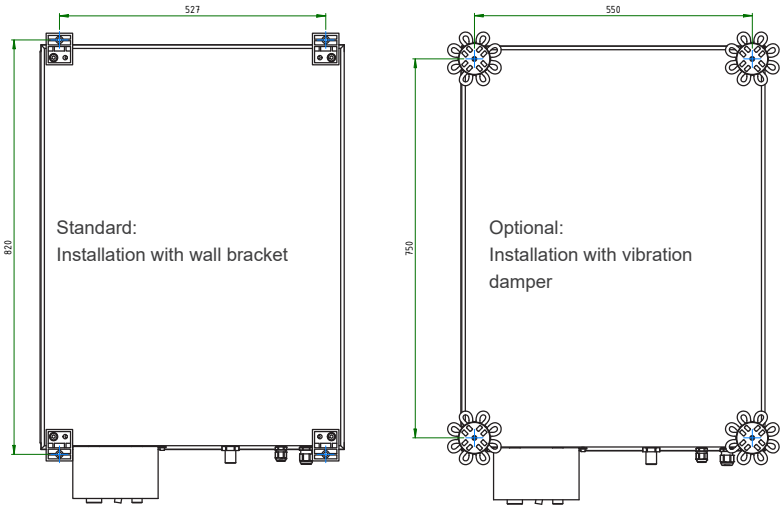
This chapter deals with the commissioning and mounting of the EGC Water Analyzer up to the first function test. Please pay particular attention to this section and follow the safety precautions to protect the measurement cabinet from damage and yourself from injury. Before the EGC Water Analyzer is put into operation, it is important to ensure that it is securely attached and all connections are connected correctly. The measurement cabinet is ready for commissioning as soon as the installation of accessories is complete, it is connected to your control device and the configuration is complete.

Never cut through a cable to make an open end for the connection to SCADA or a process control system, for example. Please contact TriOS Mess- und Datentechnik GmbH customer service for more information.

3.1 Mounting

The EGC Water Analyzer, as a measurement cabinet, is intended for installation on a wall. Make sure that the wall is sufficiently stable, and the installation height is convenient for the use of the panel.

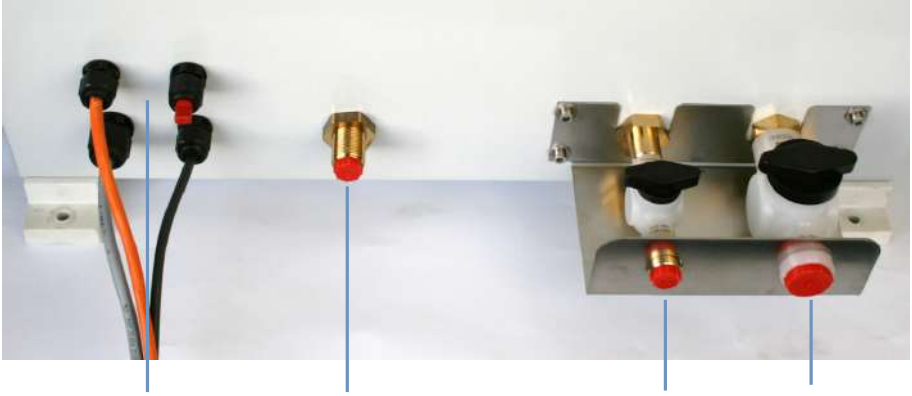
For better orientation, the schematic sketches below use millimetres (mm) to describe the measurements and hole distances to install the measurement cabinet on a wall.



(Dimensions in mm)

3.1.1 Hydraulic connection

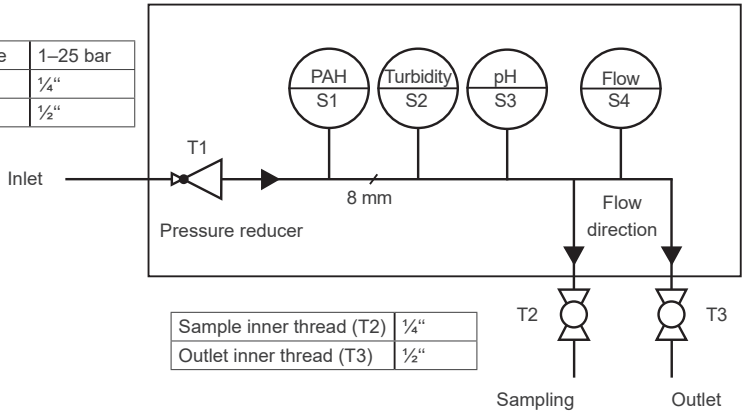
Underside of the cabinet:



The T2 sample output is only intended to take samples for chemical analyses. Use the T3 fluid outlet for normal use.

Max. internal pressure	3 bar
Flow volume	2–5 L/min

Inlet pressure	1–25 bar
Inner thread	¼“
Outer thread	½“



Sample inner thread (T2)	¼“
Outlet inner thread (T3)	½“

⚠ CAUTION **If you want to use 3 bar internal pressure, make sure you have the enviroFlu installed in a FlowCell with two O-rings.**

Internally in the system, the pressure is reduced by 1 bar by the pressure reducer so that there is a pressure difference of 1 bar from the inlet to the outlet. The internal pressure is max. 3 bar. New FlowCells have the second groove for 3 bar internal pressure implemented. If needed, please order at TriOS.

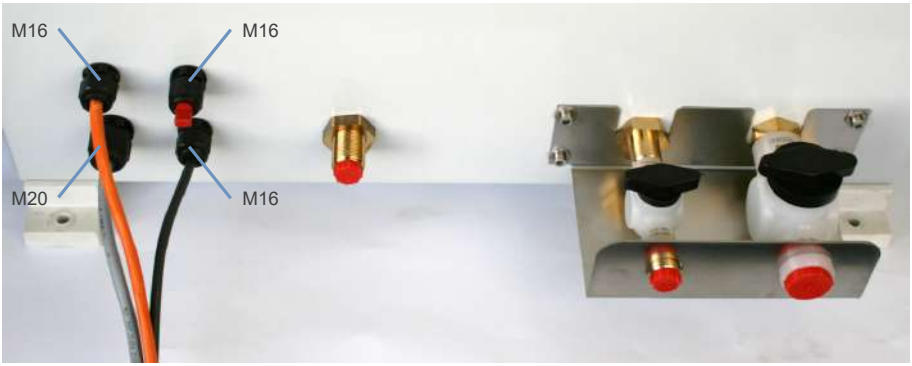
NOTICE **Avoid negative pressure on the outlet. This may damage the sensors.**

3.2 Electrical Installation

Four (4) screw cable connections are provided for the electrical connection.

- Three M16: 4.5–9 mm outer diameter
- One M20: 7–13 mm outer diameter

Underside of the cabinet:

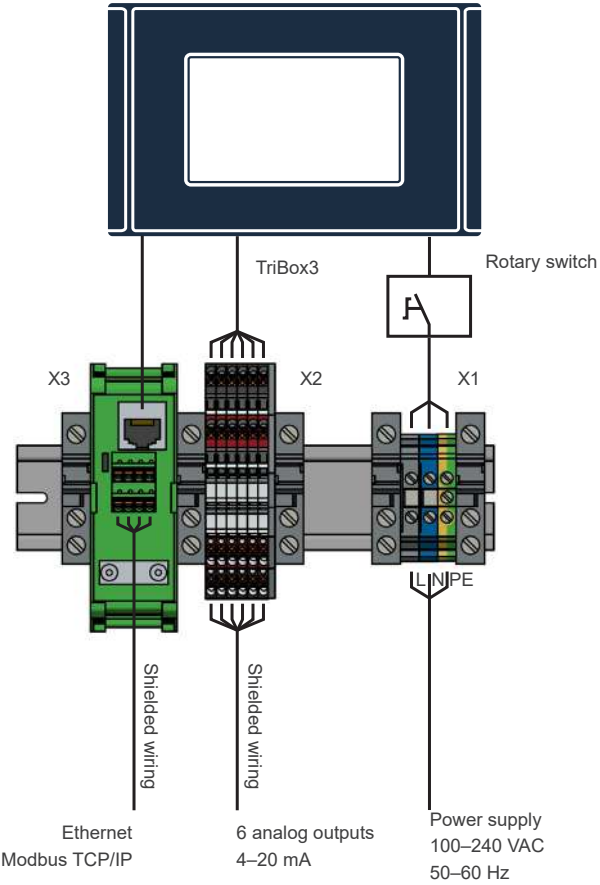


Cables are not included in the delivery.

⚠ CAUTION **Only a trained electrician may carry out the electrical installation.**

⚠ DANGER **Before carrying out electrical installations, it is essential to de-energize the device and secure it against being switched on again.**

3.2.1 Wiring Diagram



X3

Contact	Standard: 10BASE-T
1	TX+
2	TX–
3	RX+
4	Not connected
5	Not connected
6	RX–
7	Not connected
8	Not connected

X2

Analog output no.	Red Contact	Black Contact	Parameters
1	4–20 mA	COM	PAH
2	4–20 mA	COM	Turbidity
3	4–20 mA	COM	pH
4	4–20 mA	COM	Temperature
5	4–20 mA	COM	PAH-tc
6	4–20 mA	COM	FlowVolume

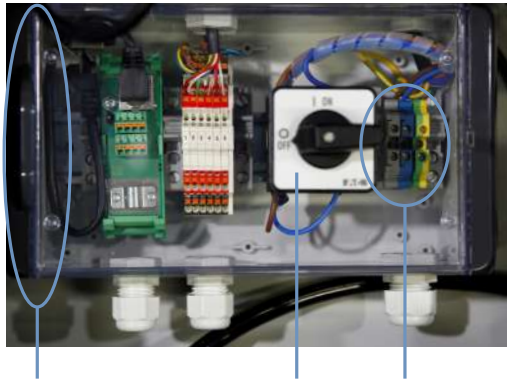
X1

Green/ yellow	Protective earth (PE)
Blue	Neutral conductor (N)
Gray	Phase (L)

3.2.2 Power supply

The connections for the 230 VAC power supply (Table X1) are inside the transparent connection box. Use the large cable guide on the right side of the connection box for the connection cable. The electricity can be switched on and off with the power switch on the front part of the connection box.

The cross-section of the connection cable should be at least 3 x 1.5 mm². We recommend installing an easy-to-reach switch near the device. This should be labelled as the switch for the EGC Water Analyzer.



The power supply connection can be found in Table X1 in chapter 3.2.1.

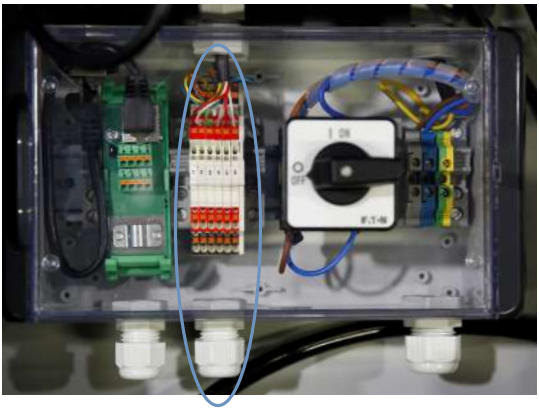
Please note that the terminal blocks are only designed for rigid cables or flexible cables with end sleeves. A secure connection cannot be guaranteed for other types of cables.

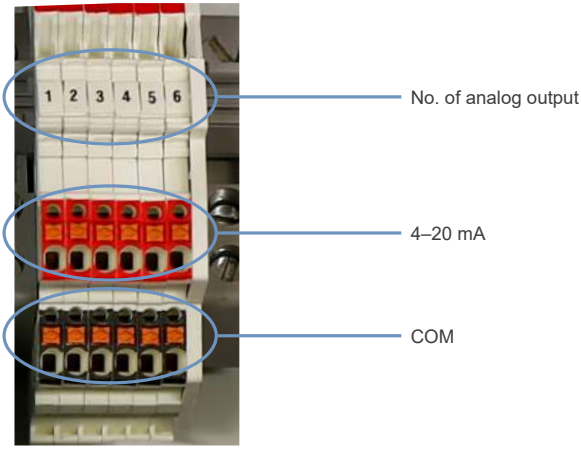
3.2.3 Analog Output

The six analog outputs of the TriBox3 are connected to the terminal bar from six white terminal blocks in the connection box. Each terminal block is considered an output. The numbering of the terminal blocks and that of the analog outputs are the same. For the TriBox3 of the EGC Water Analyzer, the scaling of the measured values is already preconfigured (Table X4), but it can be adjusted if necessary. Please refer to the TriBox3 manual, Chapter 5.2 Analog Outputs.

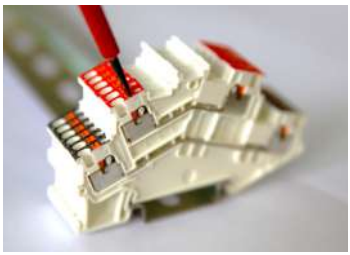
X4

Analog output no.	Parameters	Scaling of measured values	
		4 mA	20 mA
1	PAH	0 µg/L	500/5000
2	Turbidity	0 FNU	1000 FNU
3	pH	pH 0	pH 14
4	Temperature	0 °C	45 °C
5	PAH-tc	0 µg/L	3*PAK
6	FlowVolume	0 L/min	15 L/min



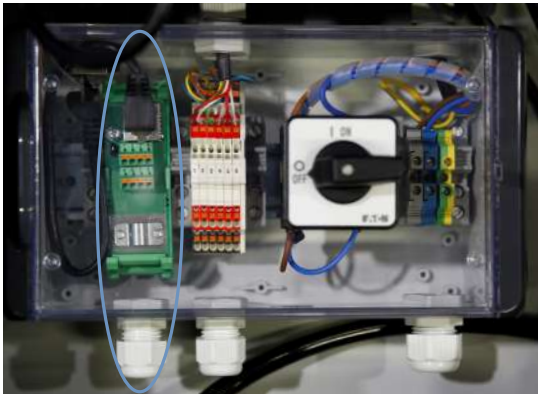


The cables are attached with push-in connection terminals. The orange lever buttons open and close spring contacts.

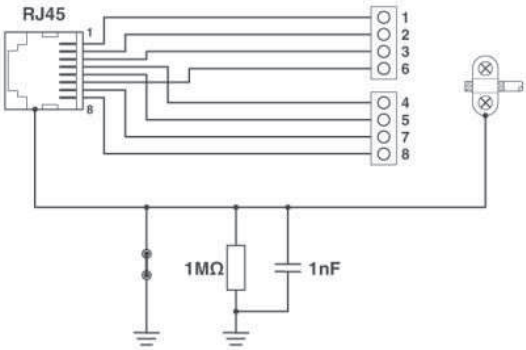


3.2.4 Network

The Ethernet interface of the TriBox3 is already connected to the connection box. This allows you to connect the power cable directly to the green terminal bar.



Connection diagram of the patch panel:



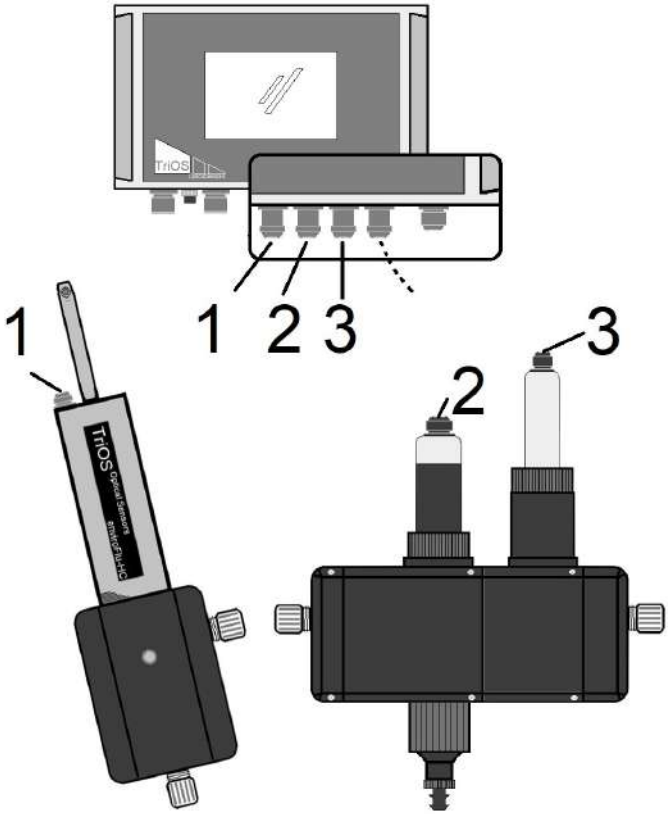
3.3 Sensor Installation

Make certain that every sensor is assigned to a COM port on the TriBox3.

The assignment is

- COM1: enviroFlu
- COM2: TTurb
- COM3: TpH-D
- COM4: Flow rate sensor (this is already connected by the manufacturer)

and is explained in detail in the following chapters.

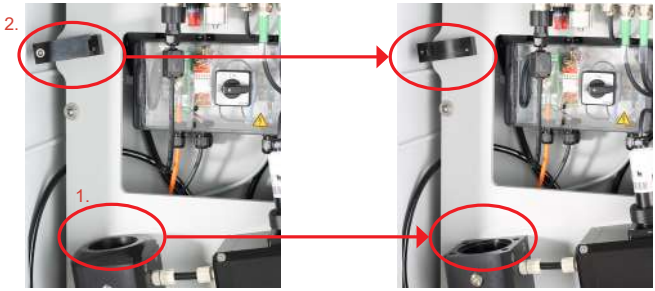


3.3.1 enviroFlu

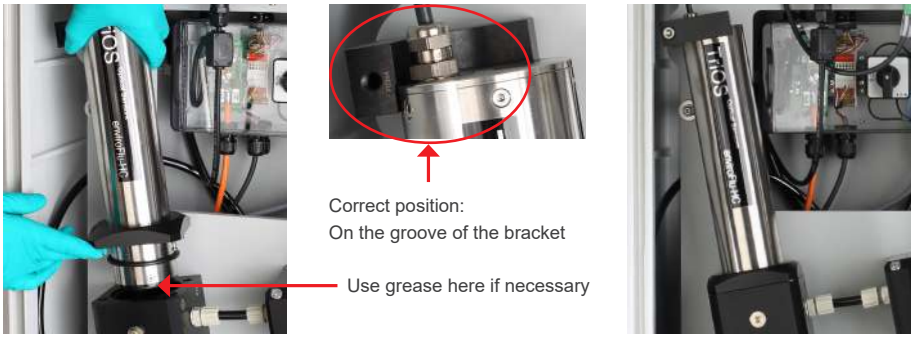
Follow the steps of the instructions on the following pages to install the enviroFlu in the FlowCell.

1. Remove the FlowCell pressure ring with the O-ring by loosening the four screws using a 6 mm Allen key with a 180° counterclockwise movement.

2. Remove the clamp bracket with a 6 mm Allen key. To attach the cables of the sensors, you can use the plastic brackets on the front and back panels.



3. First slide the pressure ring onto the enviroFlu and then the O-ring. As an aid, some grease from the scope of delivery can be lubricated to the front edge of the enviroFlu to facilitate installation. Next, insert the enviroFlu into the FlowCell, as shown in the figure below. The device is then inserted into the FlowCell up to the groove of the bracket. Make sure that the sealing ring is in the correct position and is undamaged. The correct O-rings (sealing rings) can be obtained from TriOS.



4. When the enviroFlu is positioned correctly, reattach the clamp bracket and tighten the screws.
5. The sensor is connected to COM1 of the TriBox3.

3.3.2 TTurb

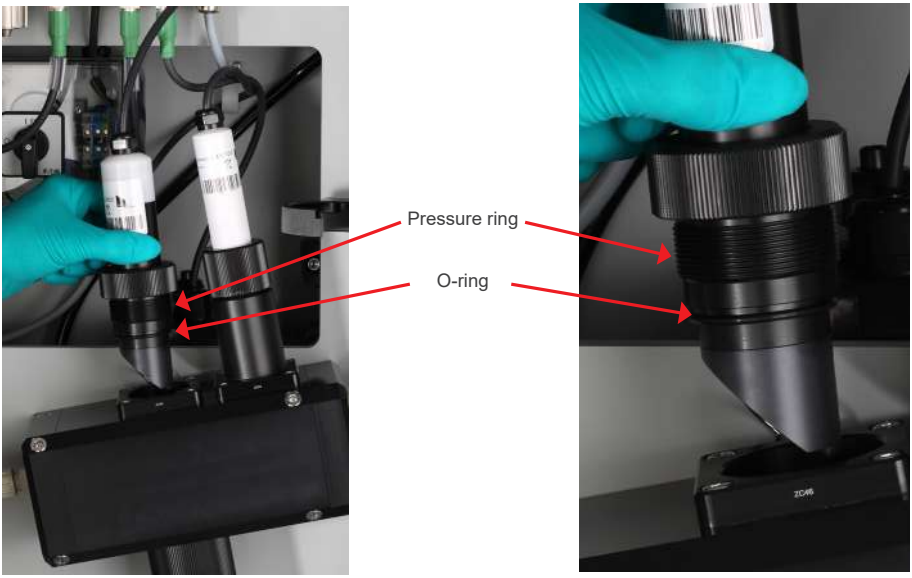
Follow the steps below to install the TTurb turbidity sensor into the FlowCell.

1. Remove the pressure ring from the FlowCell. It can easily be loosened by hand.
2. First push the O-ring (which is attached to the FlowCell in the bag) onto the TTurb. Next insert the TTurb into the FlowCell.

NOTICE	**The TTurb may only be mounted into the FlowCell as shown in the pictures. The FlowCell has a positioning groove for correct alignment.**

3. Position the TTurb along the groove, then move the pressure ring over the cable, from the plug to the sensor, and attach it to the FlowCell.
4. When the TTurb has been positioned correctly, tighten the pressure ring by hand (without using a tool).
5. The sensor is connected to COM2 of the TriBox3.

If you work with TTurb-1000 in EGC Water Analyzer, make sure you use the MEPC version of the sensor (81S200220 without TTurbCAL or 81S200222 with TTurbCAL)



3.3.3 TpH-D

Follow the steps below to install the TpH-D pH sensor in the FlowCell. The TpH-D should only be installed when water will very soon be directed into the FlowCell. If this is not the case, you should leave the sensor in the delivery container to keep it moist. For the function test, it is sufficient to connect the sensor only to COM3 at first. After the function test, the sensor can be installed in the FlowCell according to these instructions.

NOTICE **The TpH-D must not dry out.**

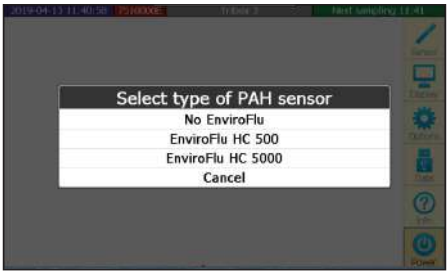
1. Remove the pressure ring from the FlowCell. It can easily be loosened by hand.
2. First push the O-ring (which is attached to the FlowCell in the bag) onto the TpH-D. Next insert the TpH-D into the FlowCell.
3. As soon as the TpH-D is attached to the FlowCell, move the pressure ring over the cable, from the plug to the sensor, and attach it to the FlowCell.

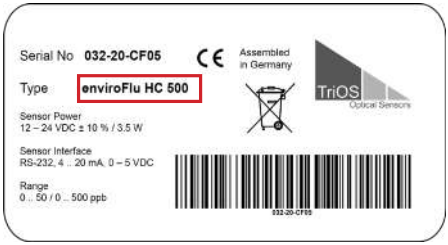
4. When the TpH-D has been positioned correctly, tighten the pressure ring by hand (without using a tool).
5. The sensor is connected to COM3 of the TriBox3.

3.4 Function Test

Carry out the first function test to test if all the sensors are connected correctly and the system is functioning. This test is only to check if the system recognizes the sensors and the network is connected correctly. To do that, the measurement cabinet must not yet be connected to the water circuit.

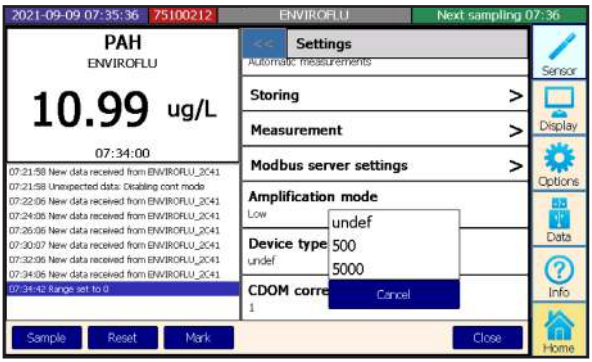
Switch the system on with the power switch on the connection box ("On" position). As soon as the TriBox3 has started up, you can select the type of enviroFlu being used (measurement range 500/5000). The sensor type can be found on the rating plate of the sensor.





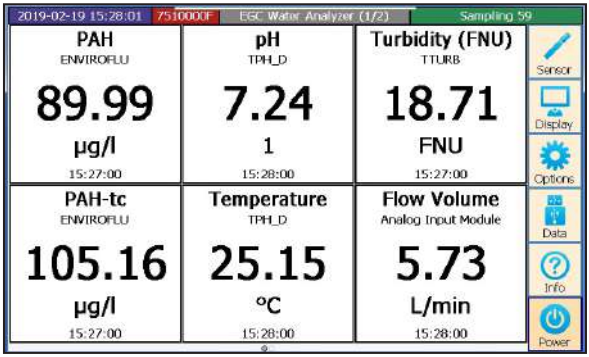
The system should have recognized all the sensors after about two minutes. Make sure that the sensor cable is firmly attached to the TriBox3; tighten the screw connector if necessary. If necessary, make sure that each sensor is connected to the correct COM port, as described above.

If the sensor type has been set incorrectly, this can be adjusted under “Sensor” → ENVIROFLU → “Device Type”.



When all the sensors have been connected correctly, you will see the following preconfigured display with measurement data from the individual sensors (The figure is only an example; measured values may differ).

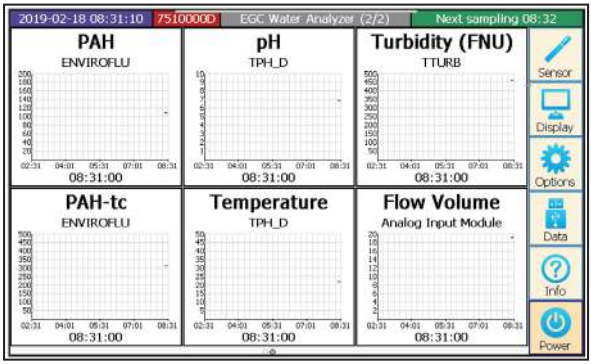
Date / time | TriBox3 serial number | Display of current menu section | Time until next measurement



Due to the measurement method, it is not possible to measure a correct flow rate in a dry system. This can lead to implausible measured values.

If you have not installed an enviroFlu and have selected "No EnviroFlu" on the start page, only four display fields are shown (pH, Temperature, Turbidity [FNU], Flow Volume).

If you swipe left on the display, you can display measurements series instead. This covers a period of six hours.



The enviroFlu outputs the measured values for PAHs in µg/l PAHphe equivalent according to IMO regulations: **PAH-p**. The TriBox3 then uses the measured values from the TTurb to calculate a turbidity corrected PAH-p value: **PAH-p-tc**. The enviroFlu can also output the measured values as sum of all PAHs: **PAH**, which is also calculated with turbidity correction: **PAH-tc**.

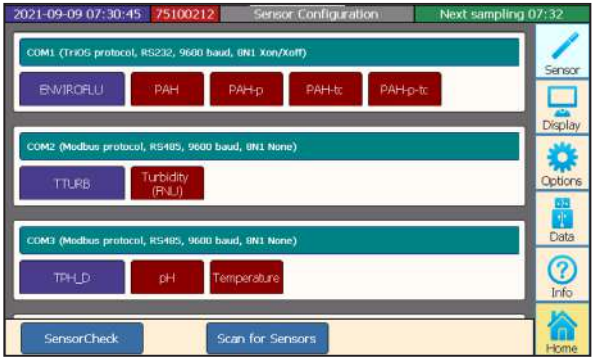
10 µg/L of PAHphe equivalent (PAH-p) generates a fluorescence signal of 62 µg/L of PAH.

The TpH-D outputs the pH value and the temperature.

TTurb outputs the turbidity in FNU.

The flow sensor outputs the flow within the EGC Water Analyzer.

Using "Sensor", you can go to the overview page with the sensors that are connected. Here you can set which values are displayed on the main display. To do that, please refer to the TriBox3 manual.



The measured values presented on the display can be selected as follows: "Display" → "New Form" → select the view field to be changed → "Current value" → "Continue" → "ENVIROFLU" →; the parameter that should be displayed can then be selected. You can find a detailed description of how to change the measured value display in the TriBox3 manual.

Checking the MODBUS TCP interface

You have the option of connecting the EGC Water Analyzer to a DHCP server via a DHCP client or directly to a laptop or computer using a static IP. To do that, please refer to the TriBox3 manual.

When you connect the TriBox3 to a network, an IP address is assigned to the TriBox3. You can find this in the "Options" menu → „Network“ → „IP Address“.

To check the MODBUS TCP communication with the TriBox3, we recommend polling the serial number of the TriBox3. To do that, use the command "Read Holding Register 0x03" for Slave Address 1 Register 20 for length 20 (01 03 00 14 00 14).

The answer is a Char[40] ASCII String. The registers have TriBox_NNNNNNN, with NNNN as the serial number of the TriBox3.

The entire mapping is defined to make previous programming easier.

Name	Address	R/W	Register	Length	Data type	Description
PAH	2	R	1000	2	Float	The PAH value in µg/L
PAH-p	2	R	1002	2	Float	The PAH-p value in µg/L
PAH-tc	2	R	1004	2	Float	The PAH-tc value, turbidity corrected in µg/L
PAH-p-tc	2	R	1006	2	Float	The PAH-p-tc value, turbidity corrected in µg/L
Turbidity	3	R	1500	2	Float	The turbidity in FNU
pH	4	R	1000	2	Float	The pH value
Temperature	4	R	1002	2	Float	The sensor temperature in °C
Flow volume	5	R	1000	2	Float	The flow volume in L/min

4 Use

4.1 Normal Operation

The medium is brought into the system under a pressure of 1 to 25 bars above the inlet. An integrated pressure regulator reduces the system pressure to max. 3 bar. The flow sensor continuously measures the flow of the EGC Water Analyzer.

The enviroFlu measures the PAH concentration; the turbidity is provided by the TTurb and the pH value is provided by the TpH-D sensor.

The TriBox3 automatically controls the measurements in a fixed time frame. The standard setting for the measurements is one minute. The system stores the data and outputs it as 4–20 mA analog values and via the MODBUS TCP.

To change the measurement interval, go to "Options" → „Automatic measurements“ → „Grid“.

For more information, please refer to the operating instructions of the sensors used and the TriBox3.

NOTICE	**The inlet pressure should be at least 1 bar. Avoid negative pressure on the outlet. This may damage the sensors.**

NOTICE	**The measurement system must be put into operation properly to be able to provide a dependable measurement.**

Due to the measurement method, it is not possible to measure a correct flow rate in a dry system. This can lead to implausible measured values.

4.2 Operation with Type Approval according to IMO regulations

The EGC Water Analyzer, fully equipped with Tph-D, TTurb and enviroFlu, has a type approval according to IMO regulations MEPC.340(77) and MEPC.259(68) for monitoring the PAH concentration, turbidity and pH value in the discharge water of the exhaust gas cleaning systems. The certification is only valid as long as the points described in this chapter are complied with. For the approval, the following specifications are required when using the EGC Water Analyzer:

4.2.1 Specifications according to MEPC.340(77)

With the marine certification, an operating temperature of between 5 °C and 55 °C is required. The accuracy of the parameter measurements can only be guaranteed at temperatures from 5 °C to 40 °C. The enviroFlu has approval according to MEPC.340(77) and MEPC.259(68). The TTurb is based on the physical measurement method of 90° infrared scattering according to DIN EN ISO 7027-1:2016-11 and has a type approval according to MEPC.340(77). The TpH-D sensor conforms to DIN EN 60746-2:2003-09, to BS 2586:1979 and has a type approval according to MEPC.340(77). Read the type approval specifications in the respective manual.

If you work with TTurb-1000 in EGC Water Analyzer, make sure you use the MEPC version of the sensor (81S200220 without TTurbCAL or 81S200222 with TTurbCAL)

Since plastic piping is used for the inlet and outlet, remotely operated valves must be provided to close the water flow to and from the analyzer. Valves shall be controlled from outside space. This requirement is waived if the EGC Analyzer will be installed in scrubber systems where the main pipes of the wash water are also made of plastic.

4.2.2 Sensors

The sensors in the EGC Water Analyzer must be complete, meaning one enviroFlu, one TTurb and one TpH-D must be properly installed, connected and configured.

4.2.3 Software

The software version of the TriBox3 must be version 1.5.4 or higher. To guarantee all the functions of the EGC Water Analyzer, the eight-digit hexadecimal serial number of the TriBox3 must start with 7510XXXX.

4.2.4 Electrical Installation

The electrical installation must be carried out as described in Chapter 3.2. Please note that the cables for the network and for the analog output must be shielded when connected. The shield of the network cable should be laid out flat on the patch panel. The shield for the analog output signal should be laid to the side of the user. Six analog outputs are provided for

1) PAH
2) Turbidity
3) pH
4) Temperature
5) PAH-tc
6) Flow Volume

The order may be different on the display.

4.2.5 Mounting

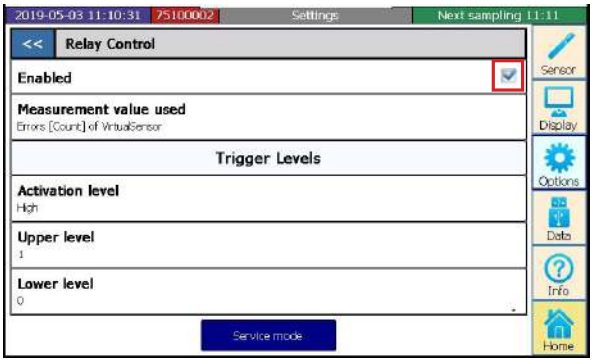
The EGC Water Analyzer is intended for installation on a wall. The SD-EGCWA 63-74 wire cable shock absorbers are mandatory for this purpose.

4.3 Additional Functions

4.3.1 Relay and Buzzer

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, for example, when a selected measured value is exceeded or not reached. You can find the settings for the relay and buzzer in the "Options" submenu.

Clicking the checkmark in the subitem "Relay control" activates a routine that is configured in the subsequent items. The limit values for triggering are already preconfigured. The buzzer and the relay are activated at the plant.



With the default settings, the buzzer and relay are triggered when:

- A sensor does not respond.
- Measured values are outside the limits.

The buzzer and the relay are reset as soon as the sensor responds again or the measured value returns to its limits.

4.4 Data Export

"Data" 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 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 checkboxes:

"Use start date"

All data from the defined start date are copied to the USB stick.

"Use end date"

All data until the defined end date are copied to the USB stick.

"Include spectra in export"

If using spectral probes, this allows the spectra also to be copied to the USB stick (not possible for enviroFlu, TTurb and TpH-D).

"Split files and limit file size"

The exported data are written to several smaller files instead of one large file. The individual files are easier to manipulate for later evaluation.

"Remember last date for next export"

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

"Start export" exports text files for all four sensors individually. They contain the date, time, measured values and, if necessary, comments.

The respective file name contains the following information:

TriBox_Sensor_YYYY-MM-DD_HH-MM-SS_to_ YYYY-MM-DD_HH-MM-SS.txt

An "Events" file can also be exported that contains information on sensor messages.

For assistance from the manufacturer, it is necessary to send supporting information to customer service.

"Data" menu → “Support information“ → „Execute“.

4.5 Useful Information

The time of the EGC Water Analyzer is not synchronised with the time of the ship.

The GPS data from the ship cannot be processed by the TriBox.

5 Validation and Calibration

For validation or calibration, the sensors must first be removed and cleaned. Please refer to Chapter 6.1 Cleaning and Upkeep.

We recommend carrying out maintenance and validation / calibration of the sensors at the following time intervals.

NOTICE **The manufacturer does not recommend the customer calibrate the enviroFlu or the TTurb. This requires regular cleaning and checks by the user.**

Sensor	Maintenance	Test	Manufacturer maintenance and calibration	
			With DryCAL / TTurbCAL	Without DryCAL / TTurbCAL
enviroFlu	weekly	Monthly calibration / validation	Every 4 years	Every 2 years
TTurb	weekly	Monthly calibration / validation	Every 4 years	Every 2 years
TpH-D	weekly	Monthly calibration	Replacement every 2 years	Replacement every 2 years

5.1 General Preparation

Required materials:

- Disposable gloves
- Soft paper towels
- Acetone / isopropanol to clean the enviroFlu measuring window (or spirits)
- Solid material standard DryCAL bzw. TTurbCAL (can be ordered from TriOS Mess- und Datentechnik GmbH)
- Spirits / isopropanol to clean the TTurb measuring window
- if necessary, measuring solution
- Distilled / deionized water to rinse the TpH-D sensor; if necessary, fresh water can also be used
- Container with pH 7 buffer solution
- Container with pH 4 buffer solution
- Calibration bracket for TpH-D (included in the pH-buffer set)
- New O-ring set

⚠ WARNING **For calibration solutions, e.g. Formazin, wear protective eye wear and suitable gloves; after use, dispose of the measuring solutions properly according to local regulations.**

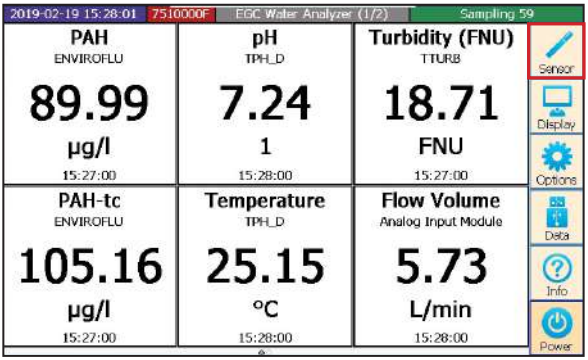
TriOS recommends checking the O-rings of the FlowCell weekly during maintenance. Corresponding spare part sets can be ordered from TriOS Mess- und Datentechnik.

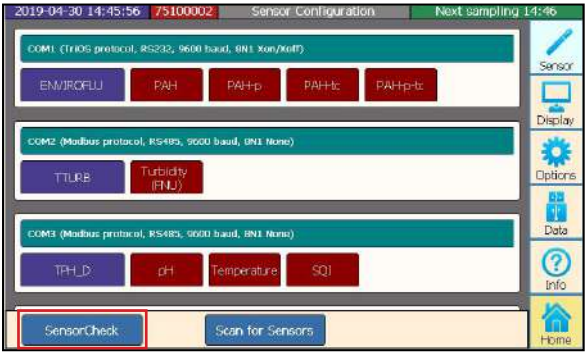
5.2 Guided Calibration / Validation

It is possible to calibrate the enviroFlu and TTurb sensors with the TriOS DryCAL and TTurbCAL solid standards or, alternatively, to carry out validation with your own solutions. However, a service period of 4 years can only be guaranteed if DryCAL and TTurbCAL are used. If own solutions are used, the period is reduced to two years, as can be seen from the table on the left.

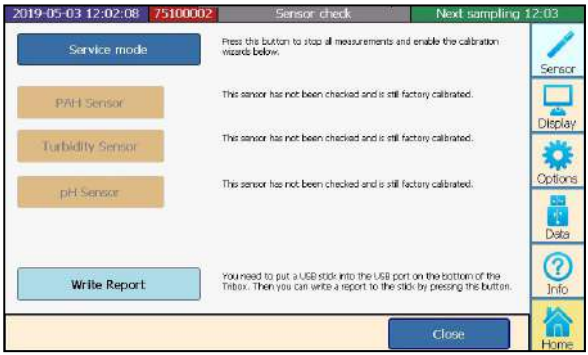
Before the sensors are validated or calibrated, the TriBox3 must be set to service mode so that the measured values are held at the outputs and there are no malfunctions or incorrect values transferred.

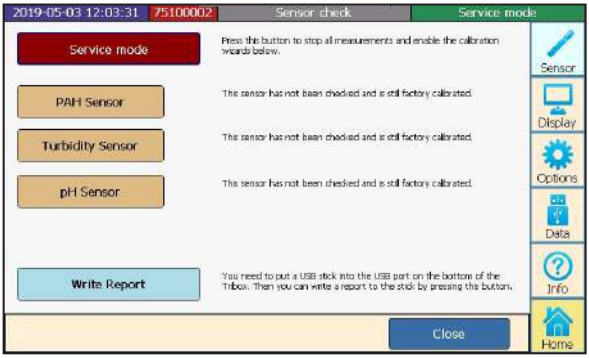
To start service mode, select "Sensor" at the top right of the main menu and then select "Sensor check" (bottom left).





Service mode is started with the "Service mode" button (top left). The background colour of the button changes from blue to red, and the buttons for the sensors become activated. As soon as the service mode is activated, the five LEDs on the front of the TriBox3 flash.





1. Cut off the water flow (close ball valve taps on the underside of the cabinet)
2. Stop water feed from the user
3. Let water drain from the FlowCells.

For validation or calibration, the sensors must first be cleaned. Please refer to Chapter 6.1 Cleaning and Up-keep.

The TpH-D should not dry out; it should therefore be stored with the calibration bracket in a pH-7 buffer solution while the other sensors and the FlowCells are being cleaned. Please refer to Chapter 5.5.1 on this topic.

Service mode is automatically ended after two hours. This ensures that the measurements are continued if the manual stop has been forgotten. If the work has not been finished in that time, you can reactivate “Service mode”.

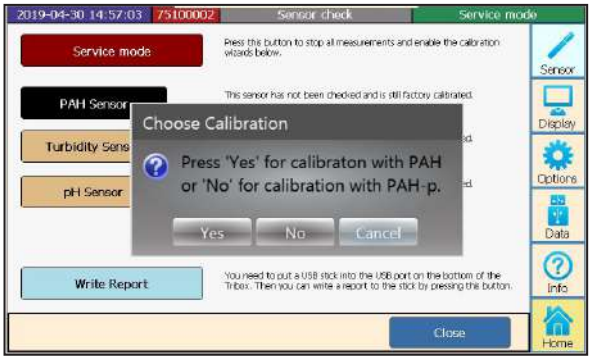
5.3 Validation / Calibration of the enviroFlu

Please read the enviroFlu manual. The manufacturer calibrates the enviroFlu with PAHphe equivalents as described in the enviroFlu manual.

At the beginning, you can choose to use the method recommended by the manufacturer:

Press "Yes" to calibrate with PAH as TriOS standard output

Press “No“ to calibrate according to IMO regulation MEPC.340(77) using PAH-p



An installed wizard guides you through the calibration / validation process step-by-step. At the top edge of the display, you can always see which step is currently being carried out.

Read this section and continue by pressing "Continue".

5.3.1 Preparation of the enviroFlu

See also Chapter 3.3.1 and the enviroFlu manual

1. Remove the clamp bracket of the enviroFlu.
2. Release the pressure ring of the FlowCell.
3. Remove the enviroFlu from the FlowCell.
4. Remove the sealing ring of the enviroFlu.
5. Rinse the sensor with clean water (not seawater) and clean the measuring window with a soft paper towel and acetone or spirits. Polish it with a clean, dry cloth. Please also read Chapter 6 of the enviroFlu manual.
6. Start guided calibration / validation.

5.3.2 Calibration of the enviroFlu (with DryCAL)

Measuring principle and design

DryCAL-0 and DryCAL-1 consist of a fluorescent glass cylinder embedded in a holder and protected by a glass pane. The measurement is performed using the UV fluorescence method. The particles integrated in the glass are excited by the UV light of the highly efficient xenon flash lamp of the enviroFlu at 254 nm. These particles emit a defined fluorescence signal at 360 nm, which is detected by the sensor. The special shape of the DryCAL ensures precise application and prevents the penetration of ambient or extraneous light.

Parameter

The DryCAL set was developed for checking the measurement of polycyclic aromatic hydrocarbons (PAH) with the enviroFlu HC. The enviroFlu detects PAH in a measuring range of 0–50 µg/L PAH, 0–500 µg/L PAH or 0–5000 µg/L PAH (enviroFlu HC 500, enviroFlu HC 5000). To be in compliance with MEPC.340(77) PAH_{phe} equivalent, please choose the parameter PAH-p.

Each individual DryCAL generates a signal corresponding to a specific concentration, that is noted on the type plate. The serial number of the corresponding enviroFlu is also noted. The picture shows an example of such nameplate.

- DryCAL-0 for measuring the zero value (offset)
- DryCAL-1 for measuring the slope (scaling)

Warnings

- The DryCAL set has been developed for use in industry and science. It can only be used with the assigned enviroFlu.
- It is used to check the function and is used in case of a necessary calibration.
- Only use the DryCAL set in air. Use in other media may damage the product.
- Protect the DryCAL set from environmental influences. Never expose it to sun, rain or dust.
- Store the DryCAL set in a dry place and preferably keep it in the transport box provided.
- Never try to disassemble or modify the DryCAL set. Inspections, modifications and repairs may only be carried out by the device dealer or by specialists authorized and qualified by TriOS.
- If fissures, scratches or cracks are visible on the glass during the visual inspection, the DryCAL set should be sent to TriOS Mess- und Datentechnik GmbH together with the assigned enviroFlu for inspection.
- The DryCAL set should always be sent in for maintenance together with the enviroFlu.

Application DryCAL

The DryCAL set can only be used together with the respective assigned enviroFlu HC 500 or enviroFlu HC 5000. Both products have been precisely matched to each other in the manufacturer‘s laboratory, so that the control of the measured value is only guaranteed in combination with the corresponding enviroFlu. The serial number of the corresponding sensor is printed on the type plate. DryCAL-0 determines the offset (zero value), DryCAL-1 determines the slope (scaling).

NOTICE	**Calibration with DryCAL-0 (offset determination / zero value) should first be performed in both channels (High and Low) of the respective enviroFlu. For the subsequent calibration of the slope (DryCAL-1) the enviroFlu must be set to the 500 channel. From firmware version 1.5.4 this is done automatically in the wizard.**

Application

1. Check DryCAL-0 and DryCAL-1 for scratches and dust. If both DryCAL are clean, you can first place them with the glass side down on a clean, lint-free cloth.
2. To calibrate the sensors the TriBox3 must be set to maintenance mode.
3. Remove the enviroFlu from the FlowCell by loosening the screws of the FlowCell and the upper bracket with a 180° counterclockwise movement.
4. Clean the front area of the enviroFlu thoroughly (see enviroFlu manual, Chapter 6).
5. The measuring window should be free of dirt and fingerprints. If possible, use optical, lint-free paper for cleaning. For heavier soiling you can also use acetone. You can use the empty bottle supplied in the DryCAL set for acetone. When cleaning, make sure that the optical window is not scratched and no longer has any coating.
6. When cleaning is complete, the sensor can be placed in the calibration holder provided on the right (see figure) and calibration of the sensor can begin.
7. Follow the instructions of the calibration wizard of the TriBox3.

5.3.3 Validation of the enviroFlu

Offset

A measured value close to zero should be selected to validate the offset. The first PAH target value is measured in the air and is then 0. Hold the sensor upright. A black, non-reflecting cloth should be laid under the sensor. The distance to the cloth should not be less than 10 cm. Use "Edit" to enter 0 and click "OK" to confirm. Then click "Continue" to go on.

After the test of the measured value stability, “Sample” is activated. Using “Sample”, have the first validation point calculated as the offset (average of 16 measurements). The measurement data sampling step can be repeated by clicking on “Sample”.

“Continue” is activated as soon the measurement recording process has finished. Selecting “Continue” confirms the result.

You will receive a confirmation that the offset value has been calculated. Then click “Continue” to go on.

Scaling

Ideally, scaling is carried out with a solid materials standard (SolidCAL) from TriOS Mess- und Datentechnik GmbH.

Similar to the process of the first measurement point, enter the value of the SolidCAL ("Edit", enter value, "OK") and click "Continue" to go on.

After the test of the measured value stability, “Sample” is activated. The second validation point is recorded with “Sample” as the average of 16 measurements. This step can be repeated by clicking on “Sample” again. Click “Continue” to confirm the result.

The calculated values for offset and scaling are now displayed. Click “Continue” to go on.

When validating the enviroFlu, the upper limit of the offset is 60; the scaling must be between 0.5 – 2. Otherwise, we recommend you return the sensors to TriOS Mess- und Datentechnik GmbH for service and recalibration. To do that, please contact customer service.

You will be informed as to whether all the calculated values are OK. By clicking "Continue", you confirm that the sensor is still functioning properly with the factory default settings and you keep the default settings.

Clicking “Calibrate” would overwrite the factory default settings and is NOT recommended at this time, because an accurate calibration can only be carried out for this sensor under laboratory conditions. If “Calibrate” is inadvertently selected, you can undo this by clicking on “X” in the main menu and repeating the validation of the sensor.

At the end, you will receive a report that confirms that the sensor has been tested. Click "Finish" to finish the validation of the enviroFlu.

After successful validation, push the presser ring of the FlowCell and sealing ring over the sensor head again.

Carefully reinsert the sensor back into the FlowCell and secure the pressure ring again. Do not use force! Attach clamp holder.

5.4 Calibration / validation of the TTurb

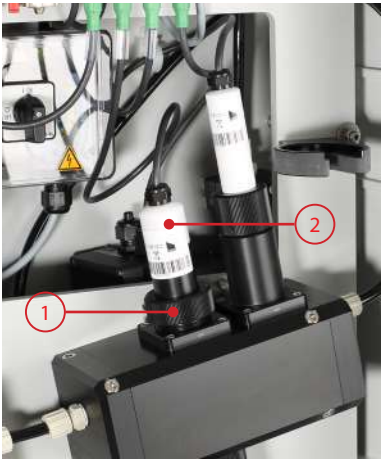
For this, read the TTurb manual.

For the TTurb, a calibration with TTurbCAL or alternatively a one-point validation for the slope can be performed.

Start the calibration / validation of the TTurb with “Turbidity Sensor”.

5.4.1 Preparation of the TTurb

1. Release the pressure ring of the FlowCell (1).
2. Remove the TTurb (2) from the FlowCell.
3. Remove the sealing ring (3) of the TTurb (2).
4. As described in the TTurb manual, rinse the sensor with clean water (not seawater) and clean the measuring window with a soft paper towel and acetone or spirits.



(1) Pressure ring

(2) TTurb

(3) O-ring

An installed wizard guides you through the validation process step-by-step. At the top edge of the display, you can always see which step is currently being carried out. After you have read the instructions on the first page, click "Continue" to move on.

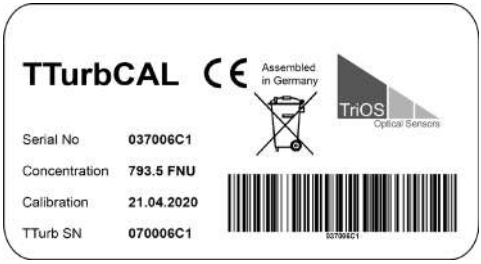
5.4.2 Calibration of the TTurb (with TTurbCAL)

Measuring principle

The TTurbCAL Solid Standard is used to check the assigned TTurb-1000 sensor. The light emitted by the sensor is scattered by the material in the standard and detected by the sensor at an angle of 90°. The penetration of ambient light or external light is prevented by putting the standard onto the sensor head.

Parameter

TTurbCAL was developed for the calibration of TriOS TTurb-1000. The sensor measures turbidity in a measuring range from 0–1000 FNU.
Each TTurbCAL generates a specific turbidity signal corresponding to a turbidity concentration in FNU. The exact concentration of the TTurbCAL is noted on the nameplate. The serial number (TTurb s/n) of the corresponding TTurb-1000 is also noted. The figure below shows an example of such a nameplate.



Warnings

- The product is developed for use in industry and science. It should only be used to calibrate the associated TTurb-1000.
- Use TTurbCAL in air only. Use in other media may damage the product.
- Protect TTurbCAL from environmental influences like precipitation.
- Store TTurbCAL in a dry place. After use, the cover of TTurbCAL should be screwed back on to avoid ingress of dust or liquids.
- Never try to disassemble or modify any part of the TTurbCAL. Inspections, modifications and repairs may only be carried out by the device dealer or by specialists authorized and qualified by TriOS.

Application

TTurbCAL can only be used together with the TriOS TTurb-1000 sensor it was delivered with. Both products have been adjusted to each other in the manufacturer's laboratory. Instructions for the correct installation of the TTurb-1000 can be found in the manual of the sensor.

Calibration with TTurbCAL only allows to adjust the scaling factor. More is also not necessary, because aging affects the scaling. A calibration of the offset is only possible with a turbidity standard liquid (e.g. formazine) and a multi-point calibration.

The application described here is for the operation of a TTurb-1000 in a TriOS EGC Water Analyzer, which has a special TTurbCAL holder for mounting on a FlowCell for associated TpH-D. The TTurbCAL can also be used without a TpH-D FlowCell or such a holder.
To check the function of the TTurb-1000, the following instructions should be followed:

1. Place the supplied holder on the TpH-D pressure ring of the FlowCell.

Measurement setup before checking the sensor

2. If not already done, stop the water flow in the system and empty the FlowCell.
3. Unscrew the pressure ring of the sensor and remove the TTurb-1000 sensor from the FlowCell.
4. Leave the O-ring and the pressure ring on the TTurb-1000.
5. Clean the sensor thoroughly (see also the sensor manual).
6. The optical windows of the sensor should be free of dirt and fingerprints. Use a lint-free cloth and take care not to scratch the windows. Dirt on the optical windows affects the accuracy of the measurement. If the sensor is very dirty, isopropanol can be used to clean the sensor head.
7. When the sensor head is clean and dry, you can start calibrating the TTurb-1000.
8. Place the TTurb in the holder with the sensor head up.
9. Open the TTurbCAL and remove any dust and dirt with a lint-free cloth. You should not use cleaning agents.
10. If the TTurbCAL is clean and shows no optical defects, place the TTurbCAL on the sensor. The shape of the standard is designed to fit the TTurb perfectly. It should not be possible to twist the standard by turning it slightly.

11. Follow the instructions of the calibration wizard on your TriBox3 to adjust the scaling of the sensor. You will find the suitable value printed on the TTurbCAL.
12. When calibration is complete, remove the standard, reinsert the TTurb-1000 including O-ring into the FlowCell and screw the sensor tight.
13. Close the TTurbCAL with the lid again and remove the holder from the TpH-D pressure ring.
14. Once the TTurb is reinstalled in the FlowCell (and the TpH-D is also reinstalled), first open the FlowCell water drain and then the EGC Water Analyzer water inlet.
15. Now you can continue with your measurement.

5.4.3 Validation of the TTurb

Scaling

To validate the slope, a solution concentration should be chosen that is in the upper range of your current measurement values.

If your measurements have a maximum value of 100 FNU, the scaling should be carried out with a measuring solution of 50–100 FNU.

The TTurb cannot be calibrated with a solution in a glass beaker (manual), because reflections on the walls of the container emit a strong signal, which invalidates the calibration. Therefore, validation of the TTurb in the cleaned FlowCell is preferred. This guarantees that the sensor head is immersed in the measuring solution up to the collar and it cannot be moved.

Enter the value of your measuring solution ("Edit", enter value, "Ok") and click "Continue" to go on.

After the test of the measured value stability, “Sample” is activated. The validation point is recorded with “Sample” as the average of 16 measurements. This step can be repeated by clicking on “Sample” again. Click “Continue” to confirm the result.

The value calculated for the scaling is now displayed and is then confirmed by clicking “Continue”.

You will be informed as to whether the calculated scaling is OK. By clicking “Continue”, you confirm that the sensor is still functioning properly with the factory default settings and you keep the default settings.

When validating the TTurb, the scaling must be between 0.5 and 2. Otherwise, we recommend you return the sensors to TriOS Mess- und Datentechnik GmbH for service and recalibration. To do that, please contact technical support.

Clicking “Calibrate” would overwrite the factory default settings and is NOT recommended at this time, because an accurate calibration can only be carried out for this sensor under laboratory conditions. If “Calibrate” is inadvertently selected, you can undo this by clicking on “X” in the Sensor Check menu and repeating the sensor validation.

Click "Finish" to finish the validation of the TTurb.

Rinse the sensor with water, dry it, attach a suitable O-ring and carefully reinsert it into the FlowCell. Tighten the pressure ring by hand. Bear in mind the direction of the sensor. Do not use force. Also read the TTurb manual.

5.5 Calibration of the TpH-D

Read the TpH-D manual.

Select "pH Sensor" to start the calibration.

An installed wizard guides you through the calibration process step-by-step. At the top edge of the display, you can always see which step is currently being carried out. After you have read the instructions on the first page, click "Continue" to move on.

5.5.1 Preparation of the TpH-D

1. Release the pressure ring of the FlowCell (1).
2. Remove the TpH-D (2) from the FlowCell.
3. Hang the calibration bracket (3) on the FlowCell.
4. Rinse the sensor head with distilled water.
5. Hang container (4) with pH 7 buffer solution in bracket.

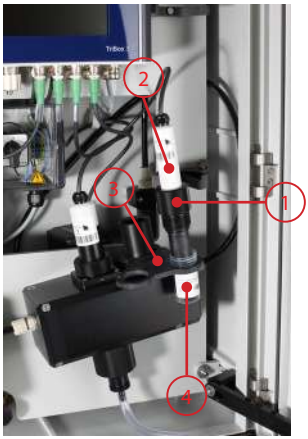
(1) Pressure ring

(2) TpH-D

(3) Calibration bracket

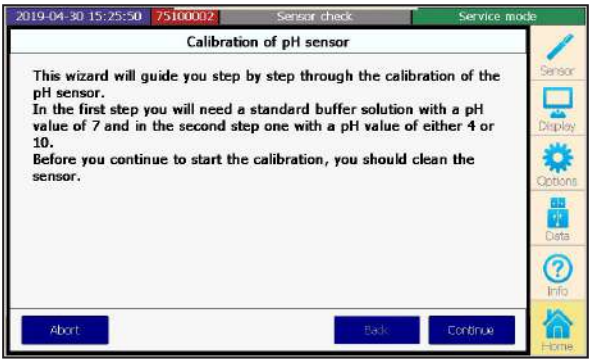
(4) Container with buffer solution

Calibration bracket



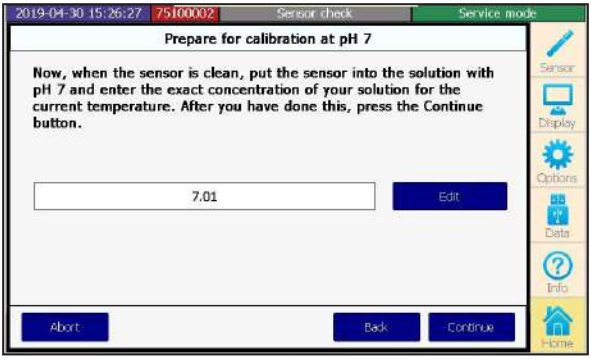
5.5.2 pH 7 Calibration

On the next page, you will see the instruction again that the sensor must be cleaned before you continue. To clean the sensor, rinse it with water and then place it in the pH 7 buffer solution.

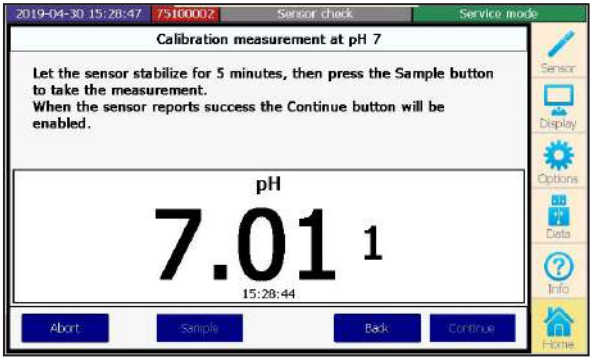


Use "Edit" to enter the pH value that matches the temperature of the buffer solution and click "OK" to confirm. Then click "Continue" to go on.

The pH value of the buffer solution is dependent on the temperature. The table on the buffer solution package shows the pH values at different temperatures.

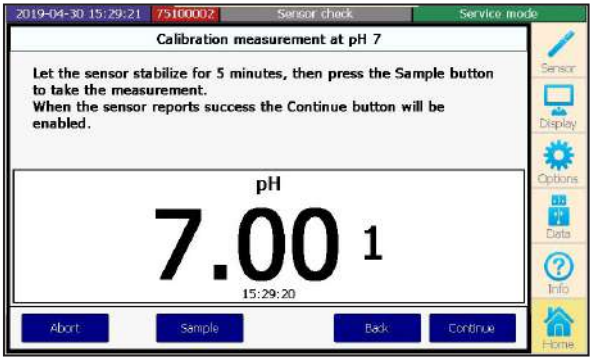


After the test of the measured value stability, "Sample" is activated. The pH value is recorded with "Sample" as the average of 16 measurements. This step can be repeated by clicking on "Sample" again.

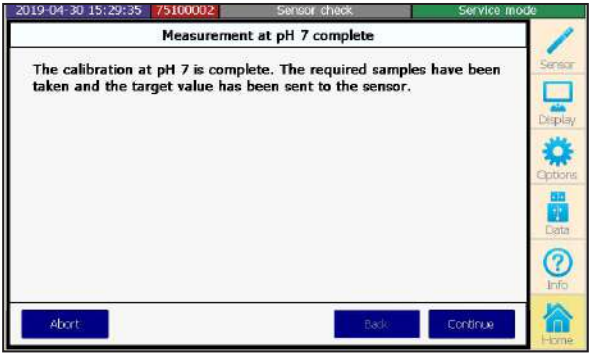


The "Continue" button is activated as soon as the measurement is finished.

Click "Continue" to confirm the result.



Click "Finish" to confirm finalization of the calibration.



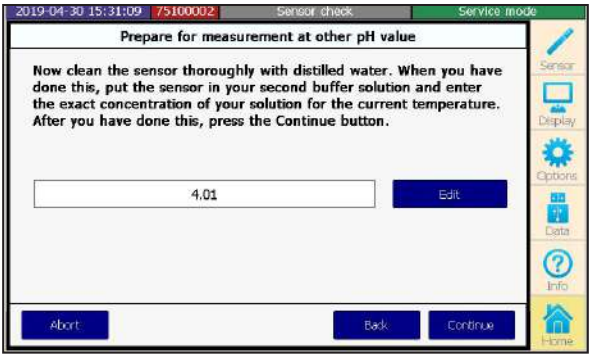
5.5.3 pH 4 Calibration

Rinse the sensor with distilled / deionized water and continue with the calibration.

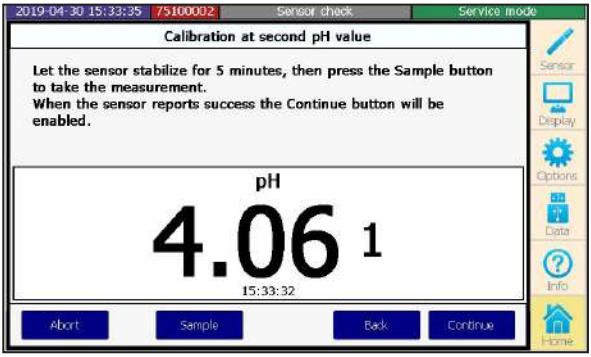
Place the sensor in the container with the pH 4 buffer solution and let it stabilize for five minutes. Use "Edit" to enter the pH value that matches the temperature of the buffer solution and click "OK" to confirm. Then click "Continue" to go on.

The pH of the buffer solution is dependent on the temperature. The table on the buffer solution package shows the pH values at different temperatures.

After the test of the measured value stability, "Sample" is activated. The pH value is recorded with "Sample" as the average of 16 measurements. This step can be repeated by clicking on "Sample" again.

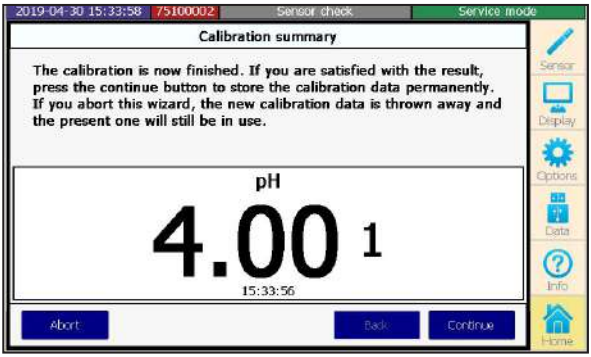


The "Continue" button is activated as soon as the measurement is finished.

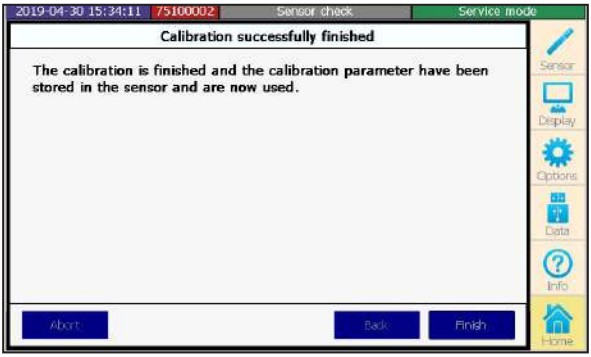


Click "Continue" to confirm the result.

You will be informed that the calibration is finished. If the value does not deviate from the target value of pH 4, you can click "Continue" to go on. If it deviates widely, you can now click "Abort". This deletes the values of the current calibration, and the values of the last calibration are retained.



Click "Finish" to confirm finalization of the calibration.



Remove the pH sensor from the buffer solution and rinse it with distilled / deionized water. When the calibration is finished, you should reinstall the TpH-D. Remove the mounting bracket from the sensor plug. Carefully reinsert the sensor back into the FlowCell and tighten the pressure ring by hand.

NOTICE	**Make sure that the TpH-D is stored in buffer solution or clean water until the calibration process is finished to prevent the membrane from drying out.**

5.6 Stop Service Mode

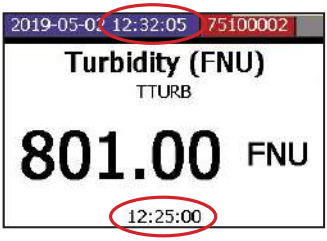
After finishing the validation and, if necessary, the calibration, you have the option of writing a report. You can save this report on a USB stick. Select "Write Report". You can find a description of the report in Chapter 5.7.

1. Close the drain of the TTurb FlowCell.
2. Activate water inflow.
3. Check both FlowCells for leaks.
4. Deactivate "Service mode" (The colour of the button changes from red to blue; the buttons for the sensors become inactive; the TriBox3 LEDs no longer light up).

General Information
Introduction
Commis-sioning
Use
Calibration
Malfunction & Maintenance
Technical Data
Accessories
Warranty
Customer Service
Contact
Keyword Index
FAQ

In the menu, click on "Display" to check if all the sensors are functioning properly again. Wait five minutes to check if all the sensors are recognized. Take a look at the measured values. If everything is functioning properly, you can finally finish the maintenance process.

Make sure that the time of the last measurement in the field of the respective sensor matches the system time. Only then has the sensor been recognized and is properly taking measurements.



If the sensors are not functioning properly, click on “Sensor” in the “Sensor Configuration” area to search for the sensors again.

Dispose of the used measuring solutions in accordance with local regulations.

5.7 Report

The report indicates the time the last sensor check was carried out. Is copied as a PDF onto the USB stick (cf. 1 Paragraph of Chapter 5.6). Print out the report on your computer and save it with your documentation.

The system fills in the columns of the table with the following information:

Test Performed: "Factory" or "Date/time"

Meaning:

- "Factory": The sensor was last checked by the manufacturer.
- "Date/time": Date and time of the last check.

Calibration Performed: "Factory" or "Date/time"

Meaning:

- "Factory": The sensor was last calibrated by the manufacturer.
- "Date/time": Date and time of the last calibration.

Status: "Factory", "passed" or "failed"

Meaning:

- "Factory": The sensor check was last carried out by the manufacturer.
- "passed": The sensor check was successful.
- "failed": The sensor check was not successful. (Offset too large or slope (Scaling) too large or too small

When delivered, "Factory" is entered in all the cells:

	Test performed	Calibration performed	Status
PAH ENVIROFLU_24CF	Factory	Factory	Factory
pH TpH-D_069000F8	Factory	Factory	Factory
Turbidity TTurb_07000018	Factory	Factory	Factory
"Factory" means that test results and calibration data from TriOS are still valid.			

When the enviroFlu and the TTurb (factory calibration not overwritten) and the TpH-D have successfully been calibrated, you will receive the following report:

	Test performed	Calibration performed	Status
PAH ENVIROFLU_24CF	2019/04/25 11:24	Factory	passed
pH TpH-D_069000F8	2019/04/25 11:55	2019/04/25 11:55	passed
Turbidity TTurb_07000018	2019/04/25 11:51	Factory	passed
"Factory" means that test results and calibration data from TriOS are still valid.			

When the sensor check (validation / calibration) is successful and the factory calibration of all three sensors has been overwritten, you will receive the following report:

	Test performed	Calibration performed	Status
PAH ENVIROFLU_24CF	2019/04/18 16:25	2019/04/18 16:25	passed
pH TpH-D_069000F8	2019/04/18 16:46	2019/04/18 16:46	passed
Turbidity TTurb_07000018	2019/04/18 16:41	2019/04/18 11:27	passed
"Factory" means that test results and calibration data from TriOS are still valid.			

6 Malfunction and Maintenance

The following chapters describe measures that can help you in case of questions or problems. If you do not find a solution to your problem here, contact TriOS technical support.

For a quick and uncomplicated process, it is important that you submit the following data:

Recovery Point

Support Information

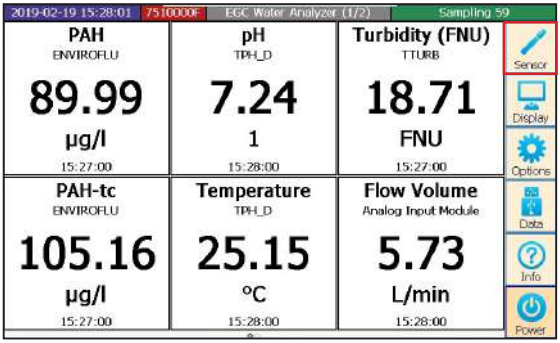
Data of the sensors

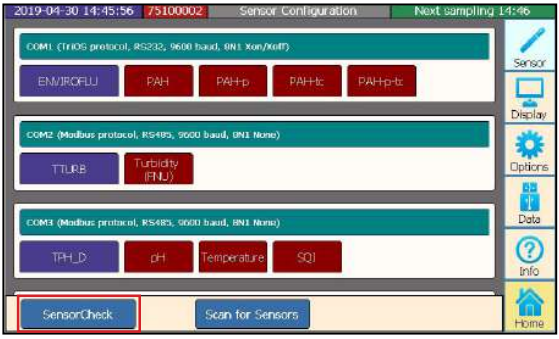
Serial number of the device

6.1 Cleaning and Upkeep

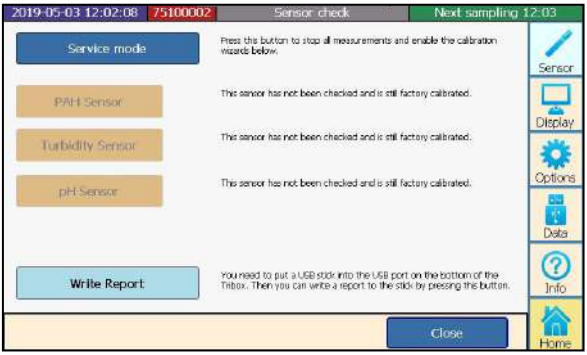
Before the sensors are calibrated / validated, the TriBox3 must be set to service mode so that the measured values are held at the outputs and there are no malfunctions or incorrect values transferred.

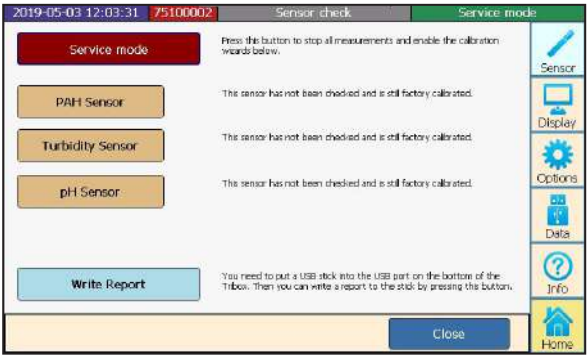
To start service mode, select "Sensor" at the top right of the main menu and then select "Sensor check" (bottom left).





Service mode is started with the "Service mode" button (top left). The background colour of the button changes from blue to red, and the buttons for the sensors become activated. As soon as the service mode is activated, five LEDs on the front of the TriBox3 flash.





1. Cut off the water flow (close ball valve taps on the underside of the cabinet)
2. Stop water feed from the user
3. Let water drain from the FlowCells.

⚠ CAUTION **Always wear gloves when using solvents to clean**

General Information:

- Do not touch the part of the sensor which has been submerged in the ultra-pure water with your hands during the sensor check unless you are wearing gloves.
- Make sure to use ultra pure water (resistance of 18.2 MΩcm).
- If impurities in the water show up during the check, the process must be started over!

6.1.1 Cleaning the FlowCells

The FlowCells must be serviced regularly. The cleaning interval depends on the degree of contamination of the medium. The FlowCells Can be rinsed and cleaned with clean water.

The TTurb FlowCell has an additional valve for draining.

Turn cleaning valve anticlockwise to open it.

The valve can be turned anticlockwise. Only open it wide enough for fluid to come out. If the valve is turned further, it can be removed. For proper use, the valve must be closed.

Please note that the FlowCell can only have brief contact with the cleaning fluid. The FlowCell must be thoroughly rinsed after that.

Do not clean the FlowCells with hydrochloric acid under any circumstances. Even at very low concentrations, this can damage plastic.

TriOS Mess- und Datentechnik GmbH also warns against using strong acids for your own safety.

6.1.2 Cleaning the Sensors

Read the respective sensor manual on cleaning the sensors.

Sensor	Cleaning
enviroFlu	Rinse sensor head with clean water and clean measuring window with acetone, spirits or isopropanol.
TTurb	Rinse sensor head with clean water and clean measuring window with spirits or isopropanol.
TpH-D	Rinse measurement electrodes with clean water (distilled or deionized water; fresh water, if necessary)

⚠ CAUTION **Please use protective goggles and gloves when cleaning the sensors, especially when using acids, etc.**

Cleaning the sensor housing

The following steps should only be used to clean the enviroFlu and the TTurb.

Clean the sensor housing with a clean cloth.

During cleaning, do not let exposed connectors come in contact with water.

To prevent contact with water, make sure that the locking cap of the connector is properly locked. Please learn about the risks and the safe handling of the cleaning solution used.

If the sensor is very dirty, additional cleaning with a sponge may be necessary. You should exercise extreme caution to avoid scratching the glass.

Under no circumstances should the sensor housing be cleaned with hydrochloric acid. Even very low concentrations of hydrochloric acid can damage components made of stainless steel. In addition, TriOS Mess- und Datentechnik GmbH cautions against using strong acids, even if the sensor has a titanium housing.

Please learn about the risks and the safe handling of the cleaning solutions used.

For the TpH-D, only the housing should be cleaned, not the electrodes, because they can be damaged.

Cleaning the sensor measuring window

You can clean the measuring window of enviroFlu and TTurb with a lint-free cloth, a clean paper towel or a special optical paper from TriOS Mess- und Datentechnik GmbH with a few drops of acetone (only enviroFlu) or isopropanol. Make sure that you do not touch the window surface with your fingers!

When cleaning the window, a thin film will appear, which can be removed with a soft cloth or clean water. Do not use any aggressive cleaning solutions, putty, sandpaper or cleaning solutions that contain abrasive substances to remove dirt.

TriOS Mess- und Datentechnik GmbH offers a cleaning set with a bottle for acetone and special optical cleaning paper to simplify cleaning the optical window of the enviroFlu.

NOTICE	**The glass electrodes of the TpH-D and windows of TTurb must not be cleaned with acetone.**

If you have further questions on this topic, we would be pleased to help you. Please contact our technical support at support@trios.de.

6.1.3 Cleaning the Flow Sensor

The sensor must be removed for cleaning. For that reason, there must not be any pressure in the system and the water flow must be cut off.

To remove the flow sensor, we may recommend removing the turbidity and pH sensors beforehand. That makes it easier to remove the flow sensor from its bracket.

Remove the union nut by turning it clockwise and carefully pull the sensor out of the FlowCell. The entire sensor can then be taken out.

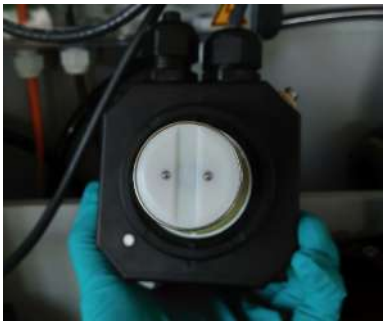
The sensor can now be cleaned with a cloth that has been slightly moistened with water. For very dirt cases, we recommend normal washing-up liquid.

NOTICE **Do not use abrasive cleaners.**

Cleaning the electrodes

Dirty electrodes can cause measurement errors. Therefore, we recommend checking the electrodes for contamination. The following figures show clean electrodes and the clean sensor. You should regularly clean the elements of the sensor that are in continuous contact with the fluid. The electrodes should be rinsed after cleaning.

NOTICE	**Do not use abrasive cleaners.**



After the flow sensor has been cleaned, it should be securely screwed back into the EGC Water Analyzer. To do that, insert the sensor back into the intended bracket and tighten the union nut by turning it.

6.2 Maintenance and Inspection

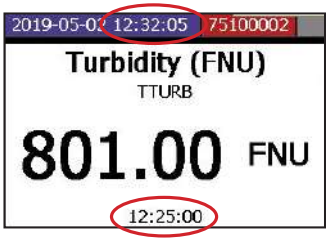
If there is a leak, please replace the O-rings. You can get suitable replacements from TriOS. For more information on the respective sensors and servicing them, please refer to the respective manuals. You will find more information on this topic in Chapter 6 of each manual.

6.2.1 Checking the Sensors

After every service, test and, if necessary, replacement of a sensor, at least one scan should be carried out to see if the system recognizes the sensors (cf. Chapter 5.6; "Sensor" □ "Scan for Sensors").

It may occur that a sensor is not recognized after service mode.

The time of the last measurement is shown in the field of the respective sensor. If it matches the system time, the sensor has been recognized and is carrying out measurements properly.



If the sensors are not functioning properly, click on “Sensor” in the “Sensor Configuration” area to search for the sensors again.

Carry out the following measures first:

- Check cable and connection
- Disconnect sensor plugs, wait two minutes and reconnect the plugs
- Shut off TriBox3
- Restart TriBox3
- Read TriBox3 manual
- Read sensor manual

You may have to reset the system to the factory default settings. However, this should only be done as the last measure. To do that, carry out the steps described in Chapter 6.3.4 of this manual.

When replacing the enviroFlu, you should also make sure that you have selected the correct sensor type. The system will ask you if you have installed "no enviro-Flu", an "enviroFlu HC 500", an "enviroFlu HC 5000" or if you want to "Cancel". If you are not sure which sensor you have, you can check the product rating label of the sensor under "Type". If a sensor is not recognized or if you have installed a new sensor, carry out a manual sensor check.

6.2.2 Replacing the O-rings

It is recommended to check the O-rings at the sensor inlet of the FlowCell during maintenance and to replace the sealing rings of the FlowCell after each monthly calibration / validation of the sensors.

6.2.3 Battery

We recommend replacing the battery (button cell) inside the TriBox3 every five years. A type CR2032 battery is required. The battery is very visible on the cover of the TriBox3.

6.3 Troubleshootinqg

6.3.1 Sensor is not detected

There can be several reasons why a sensor is not recognized.

Sensor not correctly connected	Check the connector and whether it is seated correctly. If necessary, remove the connector and try to insert it again correctly. In the EGCWA, each sensor also has its assigned COM port that must be used, see chapter 3.3.
COM port settings incorrect	The settings of the respective COM port can be checked at the TriBox3 by tapping the respective COM port and checking the settings in the submenu.
Sensor has a new serial number that the TriBox3 does not recognize	Check which firmware version is on your TriBox3. The firmware should be at least version 1.5.4, if it is older please upgrade the firmware.
The TriBox3 was switched off in the meantime without being shut down	Please restart the TriBox3.
The sensor does not get voltage	To check whether the sensor on the COM port is supplied with voltage at all, please connect another sensor to the COM port. If this sensor also has no voltage, it can be assumed that there is an error on the COM port. For checking and changing the fuse, see the TriBox3 manual.
COM port defective	Check the fuse of the COM port. Detailed instructions for this can be found in the TriBox3 manual.

6.3.2 "Range" display

"Range" with grey field: Sensor has not been connected or recognized yet.

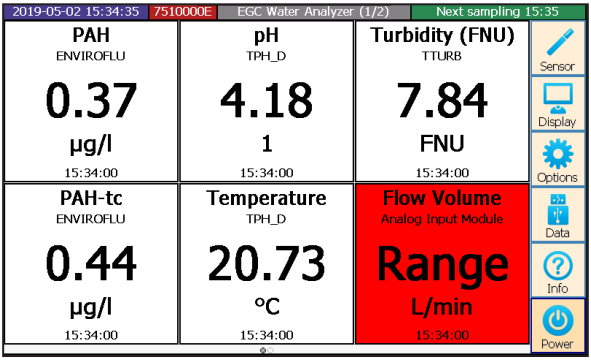
"Range" with red field: There is air in the system or flow ≥ 15 L/min.

Yellow field for flow indicator: Flow is 0.1–1 L/min or 6–10 L/min.

Red field for flow indicator: When flow is <0.1 or 10–15 L/min.

Measures:

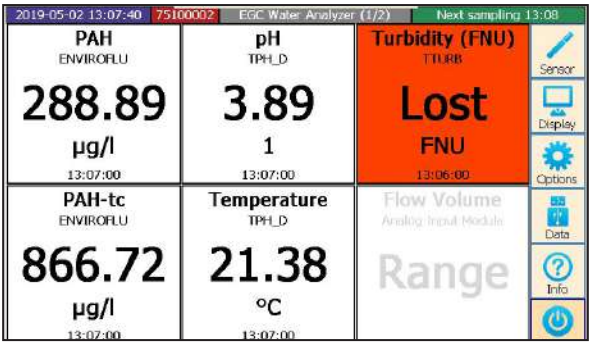
- Sensor check, as described in Chapter 6.2.1
- Check cable connection
- Check flow inlet
- Check flow outlet
- Check flow sensor



6.3.3 "Lost" display

Display “Lost” means, the sensor does not send any data. This error can occur if a previously detected sensor is no longer sending a signal or the sensor has been removed from the TriBox3 in operating mode.

NOTICE **If sensors need to be replaced, always set the TriBox3 to maintenance mode.**



Measures:

- Sensor check, as described in Chapter 6.2.1
- Check cable and connection
- Disconnect sensor plugs, wait two minutes and reconnect the plugs
- Shut off TriBox3
- Restart TriBox3
- Read sensor manual
- Read TriBox3 manual

6.3.4 Calibration of the Flow Sensor

The flow sensor was calibrated with seawater ex works (35 PSU). If the liquid to be measured has characteristics very different from seawater, this will also be obvious in the flow volume, and a zero flow calibration is required.

We only recommend removing the flow sensor if you notice a problem with the flow or if the flow is restricted by contamination.

Calibration of zero flow

NOTICE	**One hour before calibrating the zero point, the measuring element should already be immersed in the liquid or the pipe should be filled with liquid.**

- Fill pipe with liquid.
- Stop the flow.
- Open the housing of the flow sensor.

- Calibrate zero flow using the figures below.

Explanation of symbols:

LED red
LED green

LED states:

- LED off
- LED flashing
- LED lit

Device on read level

Press and hold the button.

After 2 seconds, device on settings level:

The bar graph switches between:

1 2 3 4 5 6 7 8 9 10

Calibration of zero flow
Calibration of the measurement range end value

Release the button when the bar graph shows Calibration of zero flow.

For automatic calibration

Briefly press the button.

Calibration in progress

End of calibration: Red LED off?

NO

Red LED quickly flashes two times:
The zero point could not be calibrated.

Briefly press the button.

Return to read level using the zero point of the previous calibration.

Check whether you followed the calibration instructions (see Chapter 5.5.1).

Start the zero flow point calibration again.

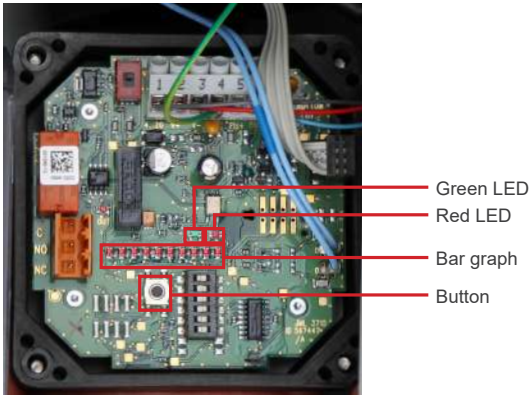
YES

Zero point saved.

Return to read level.

Due to the measurement method, it is not possible to measure a correct flow rate in a dry system. This can lead to implausible measured values.

The button is on the circuit board of the flow sensor.



Short guide for the calibration process:

1. Press and hold the button until all the LEDs are flashing
2. Release the button when all the LEDs are off
3. Then press the button briefly one more time to start calibration
4. Wait approx. 15 s for calibration (LED chase lighting)
5. Calibration finished

To cancel the calibration process, do not enter anything for 15 seconds. The green LED should then start flashing again.

6.3.5 Recovery Point

To make sure that all settings that have been made are saved and updated, a recovery point should be created prior to every reconfiguration.

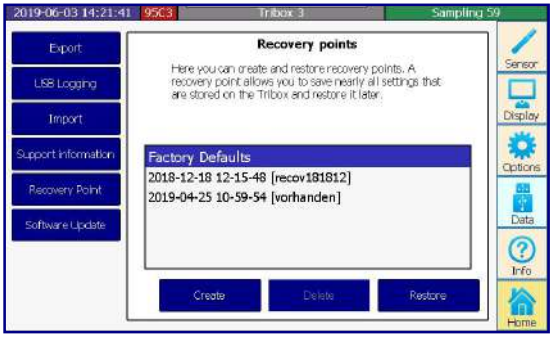
To do this, perform the following steps: In the main menu choose „Data“ → „Recovery Point“ and click on „Create“. If there is an USB Stick connected, you can save the recovery point onto the USB device by choosing „Yes“. By choosing „No“ the next step will be to insert a comment fort he recovery point directly on the TriBox3.

After every reconfiguration, the TriBox should be rebooted and a recovery point should be saved afterwards. To do so, follow the previously described steps.

Before and after every change to the settings, a recovery point should be generated.

6.3.6 Reset TriBox3 of the EGC Water Analyzer to Factory Defaults

You have the option to reset the system to factory default. To do so choose „Data“ → „Recovery Point“ → „Factory Defaults“ in the menu. You will then be asked if you want to discard the settings that have been made so far. Choose „Yes“, if you want to reset the system to factory default.



If you restore to factory default, ALL user specific setting will be lost.

After restoring the system to factory default the selection screen fort he enviroFlu will appear (see chapter 3.4 Function Test). Choose the connected enviroFlu.

By resetting to factory default all previously made sensor checks and calibrations will be lost.

6.3.7 EGC Water Analyzer defective

Leaky FlowCell: New sealing rings can be inserted. Only original replacement parts from TriOS should be used. Please read the respective manual.

Currently, there is no way to carry out proper on-site repairs on the TriBox3 controller or on one of the sensors. For more information, contact customer service.

When returning a measurement device, please follow the instructions in Chapter 6.4, including providing the RMA number.

6.4 Returns

Please observe the following instructions when returning items.

If returning a sensor, please contact customer service first. To ensure hassle-free returns and avoid incorrect deliveries, each return package must first be reported to the customer service. You will then receive a numbered RMA form, which you need to fill out completely, check and send back to us. Please attach the form with the number so it is clearly visible on the outside of the return package or write it in large numbers on the packaging so that your return package can be correctly allocated and accepted.

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

Please make sure that the sensor is cleaned and disinfected before shipping. In order to prevent damage to the goods during shipping, use the original packaging. If this is not available, make sure that safe transport is guaranteed and that the sensor is safely packed with enough packing material.

7 Technical Data

7.1 Technical Specifications

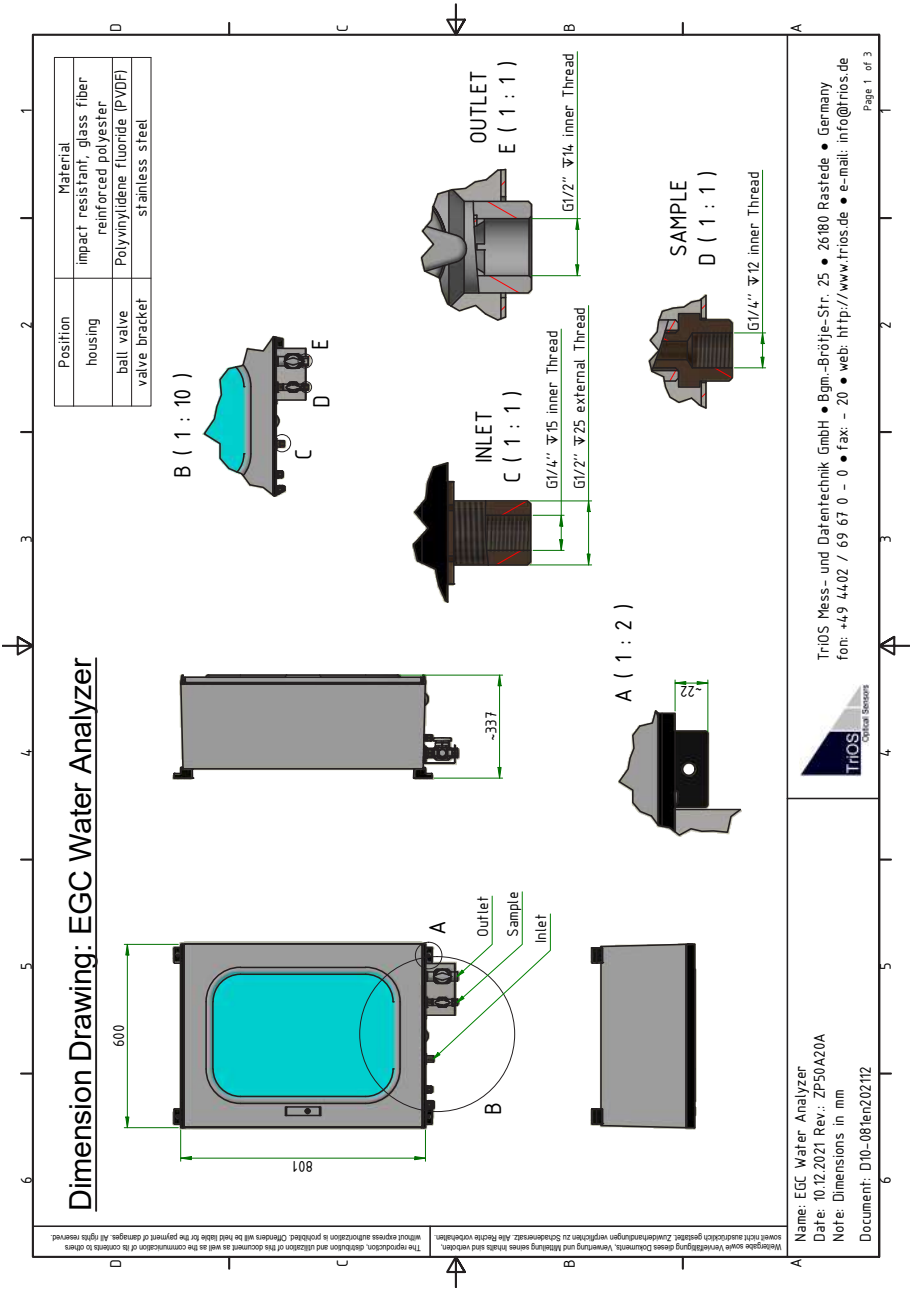
POWER SUPPLY		
Voltage supply	100–240 VAC, 50–60 Hz	
Power consumption	Max. 50 W	
INTERFACES		
digital	Ethernet	
analogue	6 outputs: 4–20 mA	
Load	max. 500 Ω	
Protocol	Modbus TCP/IP	
Parameters	PAH pH (BS EN 60746-2:2003) Turbidity (DIN EN ISO 7027:2016) Temperature (of TpH-D) Flow (internal) PAH turbidity corrected	
MECHANICAL SYSTEM		
Size (width x height x depth)	600 x 800 x 337 mm	~ 23.6“ x 31.5“ x 13.3“
Weight	43 kg (without sensors) 45.5 kg (with sensors)	~ 95 lbs (without sensors) ~ 100 lbs (with sensors)
ENVIRONMENT		
Sample temperature	+2 °C to +40 °C	~ +36 °F to +104 °F
Ambient temperature	0 °C to +45 °C	~ +32 °F to +113 °F
Storage temperature	–20 °C to +80 °C	~ –4 °F to +176 °F
Relative air humidity	0–95% (non-condensing)	
pH value	> pH4	
Protection type	IP56	NEMA 4
INLET		
Max. pres-sure – Inlet pres-sure	1 to 25 bar maximum	~ 14.5 psig to 363 psig maximum
Max. pres-sure – Internal	max. 3 bar	~ 43.5 psig
Flow volume	2–5 L/min	
Internal volume	Approx. 1 L	

The sensor specifications can be found in the respective manual of the sensor.

7.1.2 Internal Data Storage

The TriBox3 has an internal data storage that can save the recorded measurement data in a measurement period of at least 18 months. The data are protected from change and manipulation.

7.2 External Dimensions



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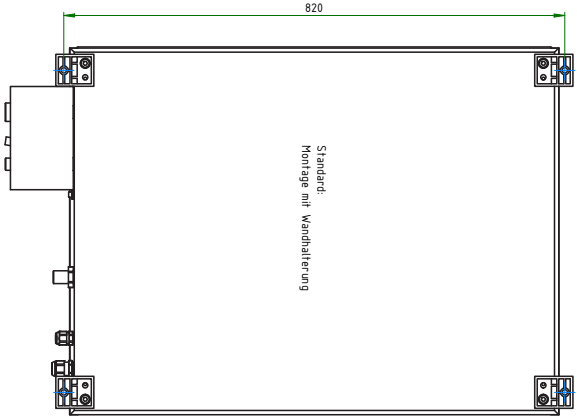

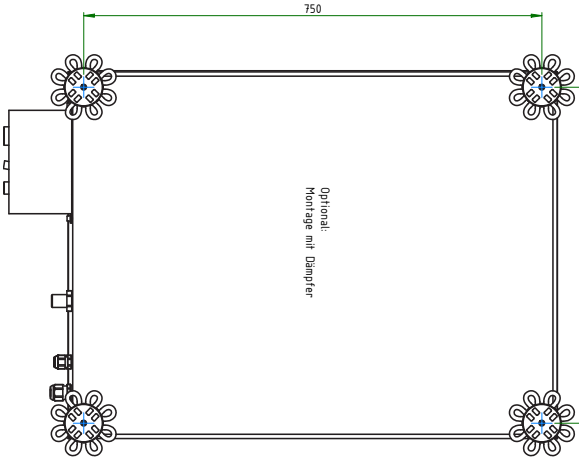

8 Accessories

8.1 Calibration set

TriOS offers the required certified pH4 and pH7 buffer solutions, including the calibration bracket, that are needed to calibrate the TriOS TpH-D sensors (see spare parts list in the appendix). The liquids do not need to be replaced, because the containers are used during the calibration process.

8.2 O-rings

To service the EGC Water Analyzer, TriOS offers further O-ring sets in addition to the O-ring set that is included (see spare parts list in the appendix). Contact technical support or TriOS sales if you need a new set.

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. 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.

NOTICE	**Opening a sensor voids the warranty!**

10 Customer Service

If you are having a problem with the EGC Water Analyzer, please contact TriOS technical support.

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

Technical support contact:

support@trios.de

Telephone: +49 (0) 4402 69670 - 0

Fax: +49 (0) 4402 69670 - 20

For quick help, please send us the device or sensor ID number, consisting of letters and numbers, by e-mail.

11 Contact

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

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

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

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

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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	**EGC Water Analyzer**
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
Angewendete harmonisierte Normen Harmonized standards applied Normes harmonisées utilisées	EN 61326-1:2013 EN 61010-1:2010 +A1:2019 +A1:2019/AC:2019 EN IEC 63000:2018
Datum / Date / Date 04.11.2021	Unterschrift / Signature / Signatur R. Heuermann

DNV

TYPE APPROVAL CERTIFICATE

Certificate No:
TAA00002AS
Revision No:
2

This is to certify:

That the Monitoring System

with type designation(s)
EGC Water Analyzer

Issued to
TriOS Mess- und Datentechnik GmbH
Rastede, **Germany**

is found to comply with
DNV rules for classification – Ships, offshore units, and high speed and light craft

Application :

Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV.

Temperature	**A**
Humidity	**B**
Vibration	**A**
EMC	**A**
Enclosure	**B**

Issued at **Hamburg** on **2022-10-06**
This Certificate is valid until **2024-04-15**.
DNV local station: **Hamburg – CMC North/East**

Approval Engineer: **Jens Dietrich**

for **DNV**

Joannis Papanuskas
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid.
The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

LEGAL DISCLAIMER: Unless otherwise stated in the applicable contract with the holder of this document, or following from mandatory law, the liability of DNV AS, its parent companies and their subsidiaries as well as their officers, directors and employees ("DNV") arising from or in connection with the services rendered for the purpose of the issuance of this document or reliance thereon, whether in contract or in tort (including negligence), shall be limited to direct losses and under any circumstance be limited to 300,000 USD.

DNV

Job Id: **262.1-029913-3**
Certificate No: **TAA00002AS**
Revision No: **2**

Product description

The EGC Water Analyzer cabinet consists of the following main sub-components:
-Enclosure Rittal KS1469.500 with Plexiglas window, IP56
-Monitoring unit TriBox3 providing with HMI display for measurements data and configuration
-enviroFlu Polycyclic Aromatic Hydrocarbon (PAH) sensor
-TTurb Turbidity sensor
-TpH-D ph sensor
-Flow sensor, magnetic-inductive, Bürkert type 8041
-Flow cells for sensor mounting
-Power supply connection- and switch-box
-Terminals for Ethernet connectivity (Modbus TCP/IP)
-Terminals for analogue outputs (6 x 4...20mA)
-Wash water inlet connector with pressure reducer
-Wash water outlet with ball valve; Wash water sample taking with ball valve
Power supply: 230VAC, 50Hz (Range: 100-240VAC, 50-60Hz).
TriBox3 Software: V1.5.x.

Range of Application:
The "TriOS EGC Water Analyzer" is intended for installation on-board vessels operating an exhaust gas cleaning system (EGCS).
The TriOS EGC Water Analyzer is found to be in compliance with the requirements of Resolution MEPC.340(77) – "2021 Guidelines for exhaust gas cleaning systems", Chapter 10.2 "Discharge water monitoring".

"TriOS EGC Water Analyzer" meets the following requirements:

- Definition of Phenanthrene equivalent, $PAH_{PHE\ Eq}$	(MEPC.340(77), 2.3.1, Table 3)
- Principle of detection for $PAH_{PHE\ Eq}$	(MEPC.340(77), 10.1.3.3)
- Measurement range for $PAH_{PHE\ Eq}$	(MEPC.340(77), 10.1.3.3)
- Turbidity influences on $PAH_{PHE\ Eq}$	(MEPC.340(77), 10.2.4)
- Permission deviation of the discharge water monitoring equipment	(MEPC.340(77), 10.2.2)
- Principle of detection for pH	(MEPC.340(77), 10.2.4)
- Resolution for pH	(MEPC.340(77), 10.2.3)
- Temperature compensation for pH	(MEPC.340(77), 10.2.3)
- Principle of detection for Turbidity	(MEPC.340(77), 10.2.6)
- Sampling frequency	(MEPC.340(77), 10.4.1)

Technical Data

TriOS EGC Water Analyzer			
Component	Type(s)	Sensor type	Range
$PAH_{PHE\ Eq}$	enviroFlu-HC 500 enviroFlu-HC 5000	Fluorescence	0 – 80 µg/L 0 –800 µg/L
Turbidity	TTurb	90° infrared scattering	0 – 1000 FNU
pH	TpH-D	pH potential combination electrode with NTC thermistor	0 – 14
Temperature			2 – 40°C
Controller	TriBox3	Data processing, logging and reporting device	-

The PAH values from enviroFlu are corrected on the controller TriBox3 with the measured values of TTurb. The original PAH values and the turbidity corrected PAH values are displayed and stored on the TriBox3.

Approval conditions

Job Id:	**262.1-029913-3**
Certificate No:	**TAA00002AS**
Revision No:	**2**

The following documentation of the actual application is to be submitted for approval in each case:
- Reference to this Type Approval Certificate
- System block diagram
- Power supply arrangement (may be part of the System block diagram)

The Type Approval covers hardware and software listed under Product description.

As long as the units are covered by the Type Approval, a product certificate according to Pt.4 Ch.9 Sec.1 [1.4] will not be required. Correct on-board configuration and integration into the exhaust gas cleaning system (EGCS) will still be subject to verification against the requirements of MEPC.340(77) (e.g. point of sampling, minimum sample flow) for each delivery and is to be tested during commissioning after installation.

"TriOS EGC Water Analyzer" shall be installed, operated and calibrated in accordance with the requirements and intervals as specified in the operating instructions.

The particulars of the system stipulated in MEPC.340(77), 8.2 as well as SW version are to be recorded in the Onboard Monitoring Manual (OMM).

Software control
All changes in software are to be recorded as long as the system is in use on board. Re-test of compliance according to MEPC.340(77) maybe required. Documentation of major changes is to be forwarded to DNV for evaluation and approval before implemented on board. Certification of modified functionality may be required for the particular vessel.

Tests carried out

-Applicable tests according to DNV CG-0339, August 2021
- Requirements in Resolution MEPC.340(77) adopted on 26 November 2021
"2021 Guidelines for exhaust gas cleaning systems", Chapter 10.2 "Discharge Water"

Marking of product
Manufacturer name, type, serial number, power supply.

Periodical assessment

The scope of the periodical assessment is to verify that the conditions stipulated for the type are complied with, and that no alterations are made to the product design or choice of systems, software versions, components and/or materials.

The main elements of the assessment are:
- Ensure that type approved documentation is available
- Inspection of factory samples, selected at random from the production line (where practicable)
- Review of production and inspection routines, including test records from product sample tests and control routines
- Ensuring that systems, software versions, components and/or materials used comply with type approved documents and/or referenced system, software, component and material specifications
- Review of possible changes in design of systems, software versions, components, materials and/or performance, and make sure that such changes do not affect the type approval given
- Ensuring traceability between manufacturer's product type marking and the type approval certificate

Periodical assessment is to be performed after 2 years and after 3.5 years. A renewal assessment will be performed at renewal of the certificate.

END OF CERTIFICATE

Form 130

NIPPON KAIJI KYOKAI

STATEMENT for Water Monitoring System

No.: KB20MP0933

Unit manufacturer: **TriOS Mess- und Datentechnik GmbH**

Model: **TriOS EGC Water Analyzer**

THIS IS TO STATE that the above product has been found to be in compliance with applicable requirements specified in Chapter 10 of Resolution MEPC.259(68) "2015 Guidelines for exhaust gas cleaning systems" upon reviewing the submitted documents.

Product descriptions:

The "TriOS EGC Water Analyzer" is a continuous water monitoring system. As a standard configuration the system monitors PAH, turbidity, pH and temperature.

Main component	Manufacturer / Model	Specification
PAH sensor	TriOS Mess- und Datentechnik GmbH/ enviroFlu-HC 500, enviroFlu-HC 5000	- Measurement range: 0-500, 0-5000 µg/L phenanthrene equivalent - Measurement technology: Fluorescence
Turbidity sensor	TriOS Mess- und Datentechnik GmbH/ TTurb	- Measurement range: 0-1000 FNU - Measurement technology: Nephelometric 90° scatter
pH/temperature sensor	TriOS Mess- und Datentechnik GmbH/ TpH-D	- Measurement range: 0-14 pH unit, 0-45°C - Measurement technology: Glass electrode with temperature compensation

Examined Documents:

- Report on the inspection of the enviroFlu-HC sensor for use according to MEPC.184(59) Guidelines for Exhaust Gas Cleaning Systems (Dated 26 August 2013)
- OPERATING INSTRUCTIONS (Document No.: D01-081en201908) and relevant documents

Remarks:

- In order to completely fulfill the requirements for washwater monitoring, additional equipment (e.g. data recording device, etc.) is to be installed.
- The "TriOS EGC Water Analyzer" is to be installed, calibrated and operated in accordance with the manufacturer's instruction.
- In case where the "TriOS EGC Water Analyzer" is fitted to SOx scrubber system installed on ships which are classed or to be classed with the Society, confirmation of compliance with the requirements applied at the time of certification is required in each system. In each project, this statement and declaration of validity of this statement are to be submitted. If any modification is made to the product and the relevant documents, detail of the modification is to be submitted.

Issued at Tokyo on 27 March 2020

T. Shimada
General Manager of Machinery Department
NIPPON KAIJI KYOKAI

This Report is issued subject to the condition that it is understood and agreed that neither the Society nor any of its Committees is under any circumstances whatever to be held responsible for any inaccuracy in any report or certificate issued by this Society or its Surveyors or in any entry in the Record or other publication of the Society or for any error of judgment, default or negligence of its Officers, Surveyors or Agents.

97. 11. 10000 (K)

TYPE APPROVAL CERTIFICATE

Certificate No. : HMB41280-AC001 **Initial Approval :** 22nd May, 2020

Product : Water Monitoring System

Manufacturer : TriOS Mess-und Datentechnik GmbH
Buergermeister-Broetje-Strasse 25, 26180 Rastede, Germany

Product Description : Type : EGC Water Analyzer
Intended for the measurement of wash water on exhaust gas cleaning system
" See Appendix 1"

Approval Condition : " See Appendix 1"

THIS IS TO CERTIFY that the above-mentioned product has been approved in accordance with the relevant requirement of this Society's Rules and / or of the recognized standards as follows and entered in the "List of Approved Manufacturers and Type Approved Equipment".

Pt. 6, Ch. 2, Art. 301 of the Rules for Classification, Steel Ships and MEPC.259(68)

This Certificate is valid until 21st May, 2025

Issued at Busan, Korea on 26th May, 2020

This certificate is signed electronically in accordance with IMO FAL.5/Circ.39/Rev.2. Validation and authentication of the certificate can be confirmed from "http://e-cert.krs.co.kr" by using the tracking No (ME20018760612) and certificate No.(HMB41280 -AC001).

KOREAN REGISTER

General Manager of
Marine & Ocean Equipment Team

Note : 1. This certificate will be valid subject to complying with the approval conditions described on the certificate and/or on the Rules of this Society.
2. This certificate will be invalid from the expiry date aforementioned unless the extension or renewal has been granted to the applicant or the manufacturer.
3. Any significant modifications or changes in design or construction to the above product without approval from this Society will render this certificate invalid.
4. Should the specified rules, regulations or standards be amended during the validity of this certificate, the product is to be re-approved by this Society in accordance with the requirements as amended.

Form AC-2A (2019.01) 1/3

CERTIFICATE NUMBER	20-2042573-PDA
EFFECTIVE DATE	23 October 2020
EXPIRATION DATE	22 October 2025
ABS TECHNICAL OFFICE	Singapore Engineering Services

CERTIFICATE OF

Product Design Assessment

This is to certify that a representative of this Bureau did, at the request of

TRIOS MESS- UND DATENTECHNIK GMBH

located at

BUERGERMEISTER-BROETJE-STR. 25, D-26180 RASTEDE, GERMANY

assess design plans and data for the below listed product. This assessment is a representation by the Bureau as to the degree of compliance the design exhibits with applicable sections of the Rules. This assessment does not waive unit certification or classification procedures required by ABS Rules for products to be installed in ABS classed vessels or facilities. This certificate, by itself, does not reflect that the product is Type Approved. The scope and limitations of this assessment are detailed on the pages attached to this certificate.

Product **Monitoring System, Emissions**

Model **11A10001X**

This Product Design Assessment (PDA) Certificate remains valid until 22 October 2025 or until the Rules and/or Standards used in the assessment are revised or until there is a design modification warranting design reassessment (whichever occurs first).

Acceptance of product is limited to the "Intended Service" details prescribed in the certificate and as per applicable Rules and Standards.

This Certificate is valid for installation of the listed product on ABS units which exist or are under contract for construction on or previous to the effective date of the ABS Rules and standards applied at the time of PDA issuance. Use of the Product for non-ABS units is subject to agreement between the manufacturer and intended client.

American Bureau of Shipping

Manoraaju, Engineer/ Consultant

NOTE: This certificate evidences compliance with one or more of the Rules, Guides, standards or other criteria of ABS or a statutory, industrial or manufacturer's standards. It is issued solely for the use of ABS, its committees, its clients or other authorized entities. Any significant changes to the aforementioned product without approval from ABS will result in this certificate becoming null and void. This certificate is governed by ABS Rules 1-1-A3/5.9 Terms and Conditions of the Request for Product Type Approval and Agreement (2010)

Certificate of Product Design Assessment Rev.3 Page 1 of 1

ABS

Certificate Number	20-4542064
Effective Date	03-DEC-2020
Expiration Date	02-DEC-2025
ABS Port Office	Hamburg, Germany
Website	www.trios.de

CERTIFICATE OF

Manufacturing Assessment

This is to certify that the Undersigned evaluated the manufacturing quality procedures of

TriOS Mess- und Datentechnik GmbH

located at

Bürgermeister-Brötje-Straße 25, 26180 Rastede

The quality monitoring systems during production were verified to reflect the specific surveys, required by the ABS Rules, Guides, the associated Specifications and Standards for the manufacture of

Emissions Monitoring System

This manufacturer presented a sample or specimen of the product, representative of the "type" approved for the purpose of verifying that the "type" has been manufactured in conformance with the Manufacturer's Product Design Assessment(s).

This Certificate is manufacturer and location specific and is subject to annual audits. Consult the ABS Type Approval website to confirm the continued validity of this certificate and the status of products.

The ABS Office issuing the certificate is to be kept updated with changes to the production methods, quality control systems, products and models and any changes made.

Heine Juergen, Surveyor

Annual Endorsement

First	Second	Third	Fourth
Surveyor			
5008401, WO and Date			

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Certificate of Manufacturing Assessment Rev.5 Page 1 of 1

中国船级社
CHINA CLASSIFICATION SOCIETY

证书编号/Certificate No.
HB22PTB00011

型式认可证书
CERTIFICATE OF TYPE APPROVAL

兹证明本证书所述制造厂具备按照下列标准的要求生产本证书所列产品的能力和条件。
This is to certify that the manufacturer stated in the certificate meets the requirements of the standards listed below and is available with the ability and conditions to produce the products described in the certificate.

制造厂/Manufacturer

TriOS Mess- und Datenetechnik GmbH

地址/Address

Buergermeister-Broetje-Strasse 25, DE-26180 Rastede, Germany

产品名称/Product

废气洗涤水监测系统
Exhaust Gas Washwater Monitoring System

附加标志/Notations

无/Nil.

认可标准/Approval Standard

1. 国际海事组织环保会决议 MEPC.340(77)《2021年废气滤清系统指南》
IMO Resolution MEPC.340(77) 2021 Guidelines for Exhaust Gas Cleaning Systems
2. 中国船级社《钢质海船入级规范》（2022）及其变更通告 第7篇第1、2章
Chapter 1 and 2, Part Seven of China Classification Society "Rules for Classification of Sea-Going Steel Ships" (2021)and its Amendments
3. 中国船级社《船舶废气清洗系统设计与安装指南 2015》
CCS Guidelines for Design and Installation of Exhaust Gas Cleaning Systems 2015
4. 中国船级社《船舶废气清洗系统试验与检验指南 2016》
CCS Guidelines for Testing and Survey of Exhaust Gas Cleaning Systems 2016

用于/Intended for

船舶与海上设施/Ships and Offshore Installations

证书有效期至/This Certificate is valid until **2026年10月02日/ Oct. 02,2026**

发证机构 中国船级社汉堡分社 签发日期 2022年10月03日
Issued by CCS Hamburg Branch Date Oct. 03,2022

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UTN:P022-73006617

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证书编号/Certificate No. **HB22PTB00011**

产品明细/Product Description

废气洗涤水监测系统/Exhaust Gas Washwater Monitoring System(M0001)

名称/Name	属性（值）/Value	单位/Unit
型号/Type	EGC Water Analyzer	
PH值/PH Criteria	0-14	
PAH（多环芳烃）浓度/PAH Concentration	0-500 / 0-5000	μg/L
混浊度/Turbidity	1000	FNU
洗涤水温度/Temperature of Washwater	2-40	℃
额定流量/Rated Flow	2-5	L/min
额定工作压力/Rated Working Pressure	max 3 bar (Internal), 2 to 25 bar maximum (Inlet pressure)	
测量成分/方法/Measuring Components / Method	PAH / Fluorescence, Turbidity / 90° infrared scattering, pH / pH ptential combination electrode with NTC thermistor	
测量误差/Error of Measuring	PAH: ±5%FS Turbidity: ±(5%+0.5), max. ±2 FNU pH-value: ±0.06 pH	
软件版本号/Software Version	1.4.22 or higher	
电源/Power Source	100 - 240 VAC (50/60Hz)	
防护等级/Degree of Protection	IP54	
系统组成/System Component	see others	

批准的图纸/Approved Drawings

图纸批准号/ Drawings Approval No.: NP20PPP01696

产品认可试验报告/ Approval Test Report

试验报告编号/ Test Report No.: 18-11008A Rev.1
试验报告日期/ Test Report Date: 2018-12-07
试验单位/ Laboratory: PAConsult GmbH
试验单位地址/ Test Address: Birkenau 3, 22087 Hamburg, Germany

试验报告编号/ Test Report No.: 18-11008B Rev.1
试验报告日期/ Test Report Date: 2018-12-14
试验单位/ Laboratory: PAConsult GmbH
试验单位地址/ Test Address: Birkenau 3, 22087 Hamburg, Germany

试验报告编号/ Test Report No.: 18-11161B Rev.1
试验报告日期/ Test Report Date: 2019-05-24
试验单位/ Laboratory: PAConsult GmbH
试验单位地址/ Test Address: Birkenau 3, 22087 Hamburg, Germany

试验报告编号/ Test Report No.: 18249-1R1-R00
试验报告日期/ Test Report Date: 2018-11-16
试验单位/ Laboratory: TUEV NORD CERT GmbH
试验单位地址/ Test Address: Harburger Schlossstr. 6-12, 21079 Hamburg, Germany

试验报告编号/ Test Report No.: 21144-3-R00
试验报告日期/ Test Report Date: 2021-05-16
试验单位/ Laboratory: TUEV NORD CERT GmbH
试验单位地址/ Test Address: Harburger Schlossstr. 6-12, 21079 Hamburg, Germany

试验报告编号/ Test Report No.: DA1-032de201812
试验报告日期/ Test Report Date: 2018-11-22
试验单位/ Laboratory: TriOS Mess- und Datentechnik GmbH
试验单位地址/ Test Address: Buergemeister-Broetje-Strasse 25, 26180 Rastede, Germany

试验报告编号/ Test Report No.: DA1-081de201812

证书编号/Certificate No. **HB22PTB00011**

试验报告日期/ Test Report Date： 2018-12-06
试验单位/ Laboratory: TriOS Mess- und Datentechnik GmbH
试验单位地址/ Test Address: Buergemeister-Broetje-Strasse 25, 26180 Rastede, Germany

认可后的产品检验方式/ Method of Product Inspection after Approval

按规范只认可不进行产品检验的产品/The product approved only in term of the rules:
认可后的产品检验由制造厂按本社批准的产品检验计划进行检验，经检验合格后由制造厂签发合格证明，并连同该产品的本社认可证书复印件一并交付用户，制造厂对产品符合公约、法规、本社规范和本社认可的标准规定负责。
After approval, product inspection should be carried out by the Manufacturer in accordance with the product inspection scheme approved by the Society. Upon satisfactory inspection, and the Quality Certificate issued by the Manufacturer should be provided to the purchaser together with the copy of the approval certificate issued by the Society. The manufacturer should take responsibility for the product being in compliance with the convention, statutory regulation, the Society rules and the standard accepted by the Society.

认可保持条件/ Maintenance Requirements of Approval

1.型式认可后，如果产品及其重要零部件的设计、所用材料或制造方法有所改变，且影响到产品的主要特性、特征；或产品的性能指标有所更改，且超过认可的范围，则有关图纸和文件应经检验机构审批。并在检验机构认为必要时，经本社检验人员见证有关试验和进行检查，其结果应能证实仍符合认可条件。
After type approval, if there are changes to the design, materials used or manufacturing method of the product and important components and such changes affect major characteristics and properties of the product, or property indexes of the product are changed and exceed the scope of approval, related drawings and documents are to be examined and approved by the concerned survey office. Where deemed necessary by the survey office, the surveyor to the Society will go to witness relevant tests and conduct inspection and the results should be able to demonstrate compliance with the approval conditions.
2.工厂的质量管理体系应保持有效运行，并且与认可时一致。如果质量管理体系发生改变，应经原体系认证机构审核并报本社批准。
The quality management system of the factory shall be ensure effective operation, and shall be the same as the situation of approval. If there are any changes to the quality management system, auditing of the original certification organization for quality management system and the society's approval shall be obtained.
3.认可证书有效期内，如果出现可能导致本社取消认可的情况，工厂应及时采取有效的纠正措施。
Within the validity of the approval certificate, if cases occur that may cause the Society to withdraw the approval, the manufacturer should take corrective actions in a prompt and effective manner.
4.在认可证书有效期内，本社检验人员可在未经事先通知的情况下对工厂的产品制造过程进行审核，以验证产品的生产是否符合业经本社批准的图纸和文件。工厂应予以配合。
Within the validity of the approval certificate, the surveyor to the Society may pay unannounced audit to the manufacturing process of the product in order to confirm whether it is in compliance with the drawings and documents approved by the Society. The factory should provide an active cooperation and necessary for the surveyor.
5.如果属于获得型式认可B 模式证书，且无需颁发船用产品证书/等效证明文件的情况，证书获得者应接受本社每年一次的定期审核，定期审核日为认可证书期满之日对应的每一周年日，检查工作应在周年日的前后三个月内进行。
If belong to the situation of the product has type approval mode B certificate, and marine product certificate/equivalent document is not necessary, those who have obtained the certificate should be subject to periodical audit every year. The date of periodical audit shall be each anniversary date which corresponds to the date of expiry of the relevant certificate and the periodical audit shall be done within a time span of three months before and after the annual surveillance date.

备注/Remarks

本社已审核了产品厂无石棉声明，但本社的审核不免除产品厂按照合同关系向订货方保证产品无石棉的责任。
The declaration of asbestos-free submitted by manufacturer has been reviewed by the Society. However, liability of the manufacturer to guarantee the products are asbestos-free to purchaser under contract will not be exempted.

System should be installed, operated and calibrated in accordance with the manufacturer's instruction.

System Components:
The EGC Water Analyzer cabinet consists of the following main sub-components:
-Enclosure Rittal KS1469.500 with Plexiglas window, IP56
-Monitoring unit TriBox3 providing with HMI display for measurements data and configuration

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-enviroFlu Polycyclic Aromatic Hydrocarbon (PAH) sensor
-TTurb Turbidity sensor
-TpH-D ph sensor
-Flow sensor, magnetic-inductive, Bürkert type 8041
-Flow cells for sensor mounting
-Power supply connection- and switch-box
-Terminals for Ethernet connectivity (Modbus TCP/IP)
-Terminals for analogue outputs (6 x 4...20mA)
-Wash water inlet connector with pressure reducer
-Wash water outlet with ball valve; Wash water sample taking with ball valve

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CCS Hamburg Branch

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Sample report

Report

EGC Water Analyzer

	Test performed	Calibration performed	Status
PAH ENVIROFLU_24D0	Factory	Factory	Factory
pH TpH-D_06900729	Factory	Factory	Factory
Turbidity TTurb_070000A0	Factory	Factory	Factory
'Factory' means, that test results and calibration data from TriOS are still valid.			

Calibration results are traceable to the internal quality standards of TriOS GmbH.

EGCWA Tribox: 75100002
System software: Version 1.5.4

Please add this certificate to your documents.

2020-11-12

Date Signature of inspector

Contact

TriOS Mess- und Datentechnik GmbH, Bgm.-Brötje-Straße 25, 26180 Rastede, Germany
Tel +49(0)4402-69670-0 Fax +49(0)4402-69670-20 info@trios.de www.trios.de

FB-TriOS Report EGCWA 2019-04-15 Schutzvermerk nach DIN ISO 16016 / Copyright reserved

Analog Output

The analog outputs generate a current from 4–20 mA, whereas 4 mA is 0% of the output value and 20 mA is 100%.

The EGC Water Analyzer has six analog outputs. You will find the table with the allocation of the parameter to the individual output below.

$$PAH_{phe}[\mu g / L] = \frac{analog\ value\ [mA] - 4\ [mA]}{16\ [mA]} \cdot upper\ limit\ of\ the\ measured\ value$$

Analog Out No.	Parameter	Lower Limit (4mA)	Upper Limit (20mA)
1	PAH	0 [µg/L]	500–5,000 [µg/L]
2	Turbidity	0 [FNU]	1000 [FNU]
3	pH	[pH] 0	[pH] 14
4	Temperature	0 [°C]	45 [°C]
5	PAH – tc	0 [µg/L]	1,500–15,000 [µg/L]
6	Flow Volume	0 [L/min]	15 [L/min]

Modbus TCP/IP

Data types

Name	Count	Format or range
Float	2	IEEE 754 32 bit floating point value.

Functions

These Modbus function codes are supported by the TriBox3 Modbus Server:

Name	Code	Description / Use
Read multiple registers	0x03	Read the serial number, firmware version and measurement data.

Default slave address

The following table shows the default slave addresses for each probe.

Read parameter registers (0x03)

The following table describes the generic virtual Modbus register mapping:

Name	Address	R/W	Register	Length	Data type	Description
PAH	2	R	1000	2	Float	The PAH value in [µg/L]
PAH-p	2	R	1002	2	Float	The PAH-p value in [µg/L]
PAH-tc	2	R	1004	2	Float	The PAH-tc value, turbidity corrected in [µg/L]
PAH-p-tc	2	R	1006	2	Float	The PAH-p-tc value, turbidity corrected in [µg/L]
Turbidity	3	R	1500	2	Float	The turbidity in [FNU]
pH	4	R	1000	2	Float	The pH value
Temperature	4	R	1002	2	Float	The sensor Temperature in [°C]
Flow Volume	5	R	1000	2	Float	The Flow Volume in [L/min]

If desired, a list with all measured values can also be output with one command.

For this the Read command for address 1000 with the length 640 or the addresses 1000 - 1016 must be read out to the SlaveID 1.

The address 1000 is the number of errors. From 1002 the measured values follow.

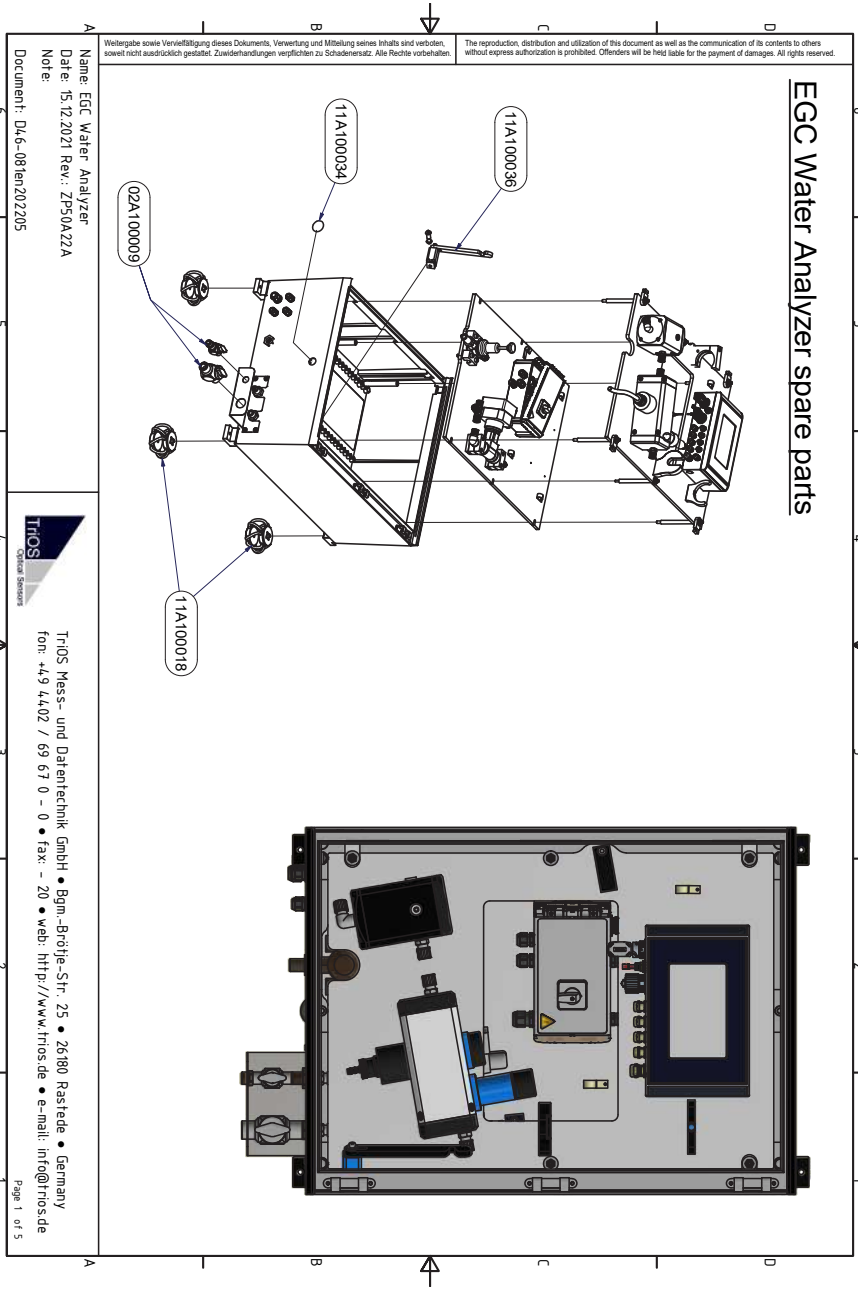
Read status registers (0x03)

To detect the operational availability of the sensors, the status register can be read out. This indicates whether the sensor is available, nor responding, or offline.

Name	Address	R/W	Register	Length	Data type	Description
enviroFlu	2	R	40	1	16 Bit Interger	Sensor Status
TTurb	3	R	40	1	16 Bit Interger	Sensor Status
TpH-D	4	R	40	1	16 Bit Interger	Sensor Status
ADAM	5	R	40	1	16 Bit Interger	Sensor Status

In the following table the values of the register are assigned to the corresponding status.

Status Value	Status
0	Sensor available
7999	Sensor offline
9999	Sensor Lost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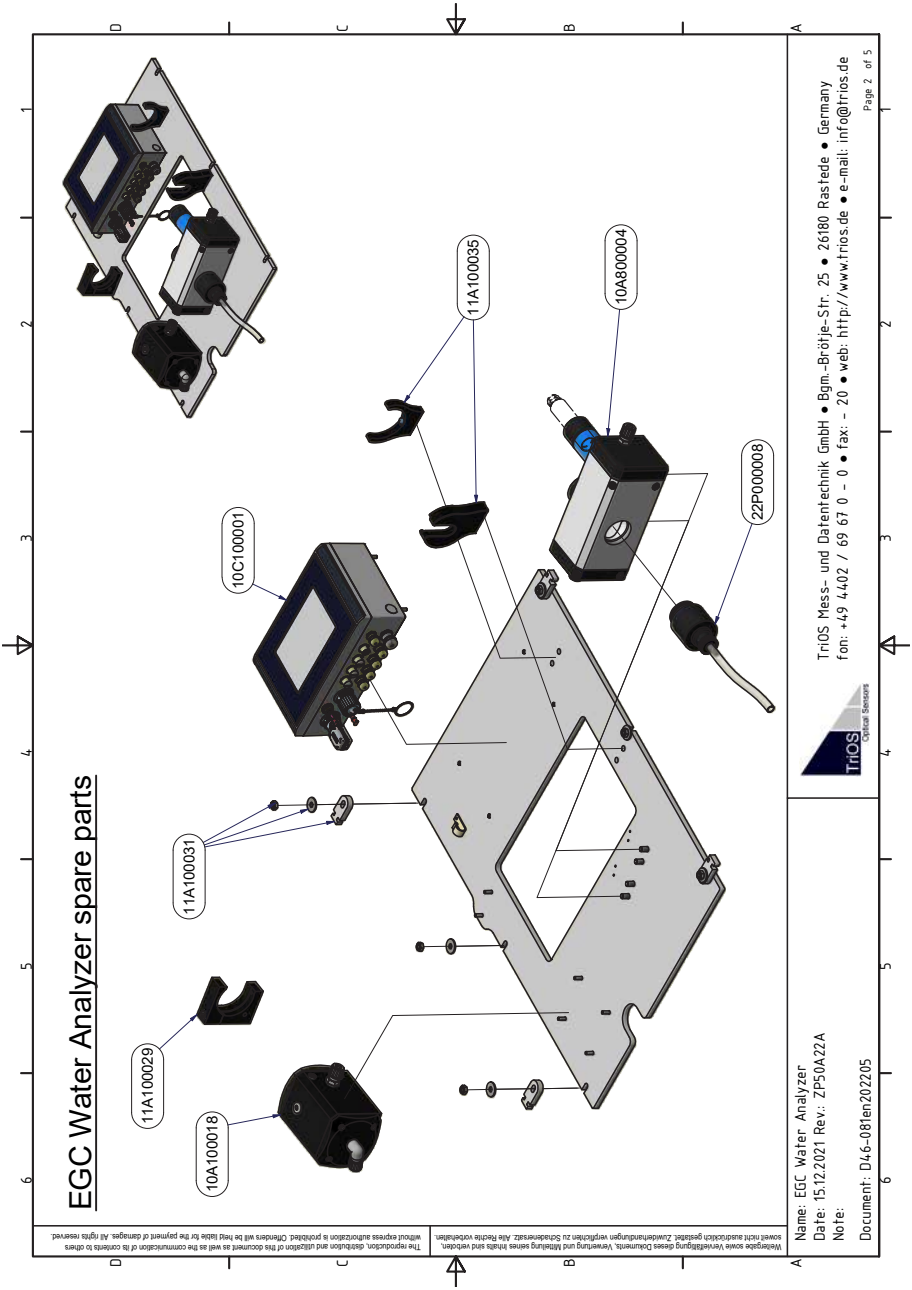
EGC Water Analyzer spare parts
11A100036
11A100034
02A100009
11A100018
Name: EGC Water Analyzer
Date: 15.12.2021 Rev.: ZP50A22A
Note:
Document: D4.6-081en202205
TriOS
Optical Sensors
TriOS Mess- und Datentechnik GmbH • Bgm.-Bröjte-Str. 25 • 26180 Rastede • Germany
fon: +49 4402 / 69 67 0 - 0 • fax: - 20 • web: http://www.trios.de • e-mail: info@trios.de
Page 1 of 5



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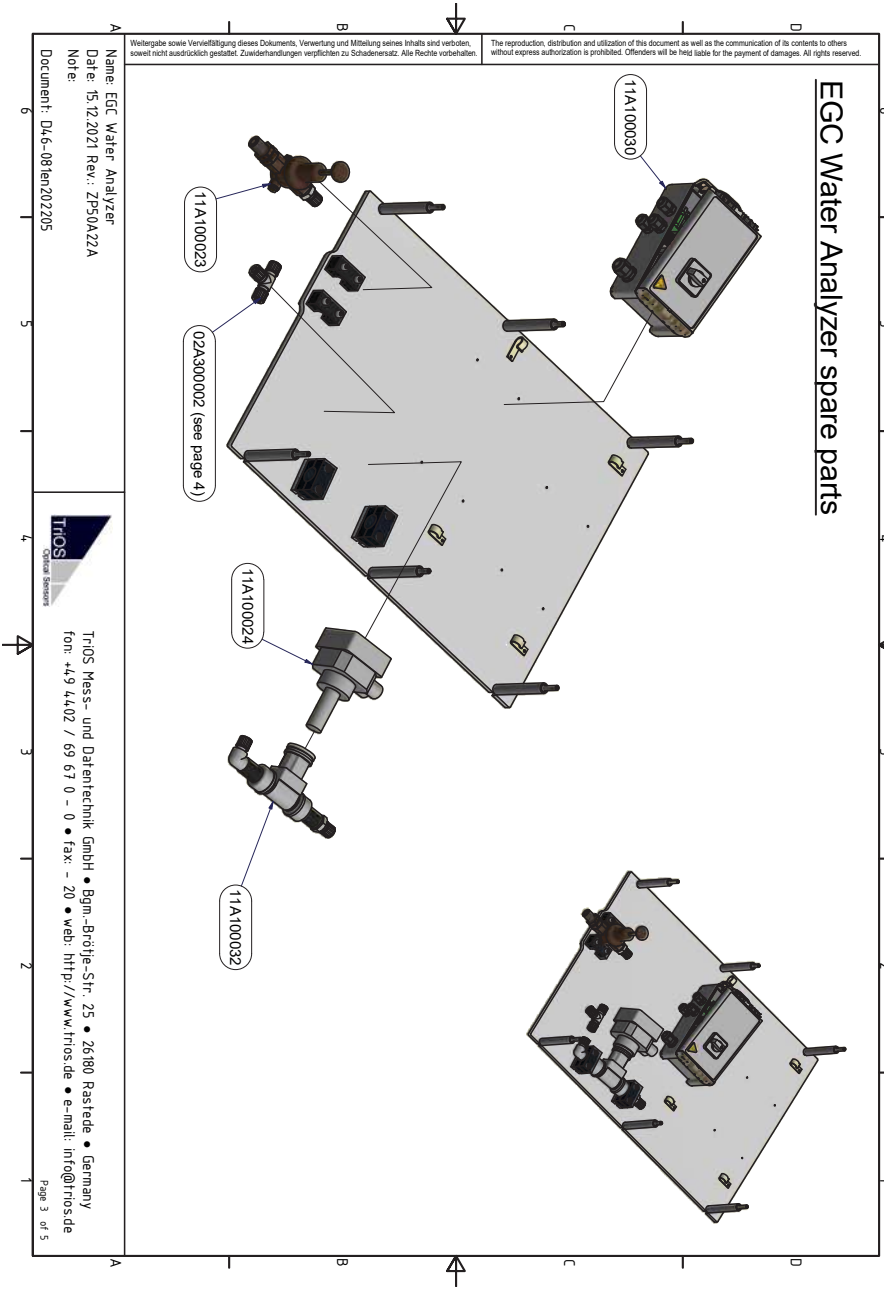
EGC Water Analyzer spare parts
11A100030
11A100023
02A300002 (see page 4)
11A100024
11A100032
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Name: EGC Water Analyzer
Date: 15.12.2021 Rev.: ZP50A22A
Note:
Document: D4.6-081en202205
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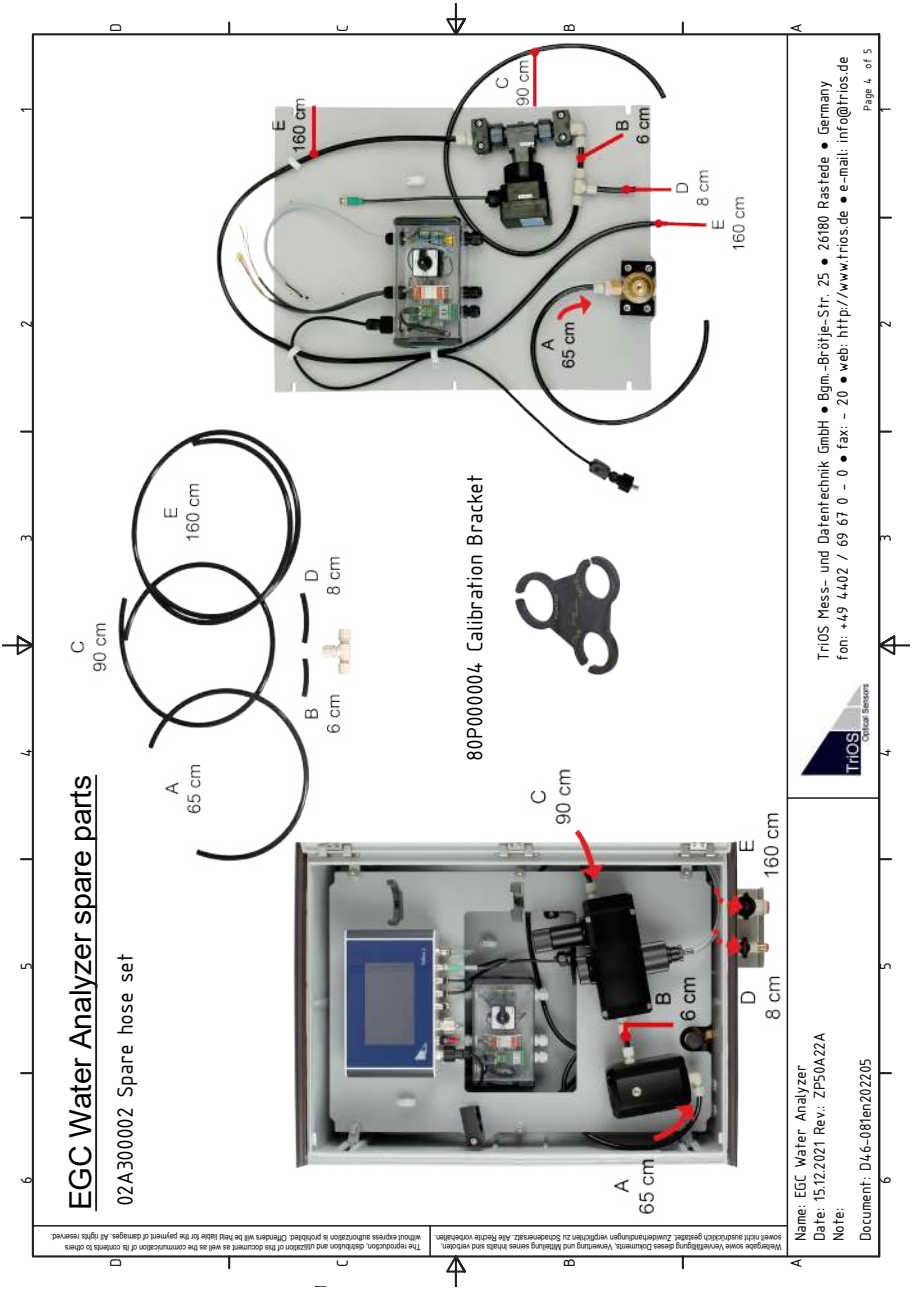
EGC Water Analyzer spare parts
02A300002 Spare hose set
A 65 cm
B 6 cm
C 90 cm
D 8 cm
E 160 cm
80P000004 Calibration Bracket
Name: EGC Water Analyzer
Date: 15.12.2021 Rev.: ZP50A22A
Note:
Document: D46-081en202205
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EGC Water Analyzer spare parts

Part-No.	Sensor / Controller
30S002030	enviroFlu-HC-Ti-500-0,5m
30S002039	enviroFlu-HC-Ti-500-0,5m incl. DryCAL
30S102030	enviroFlu-HC-Ti-5000-0,5m
30S102039	enviroFlu-HC-Ti-5000-0,5m incl. DryCAL
81S200020	TTurb-1000 0,5m
81S200022	TTurb-1000 0,5m incl. TTurbCAL
80S200020	eCHEM TpH-D 0,5m
10C100001	TriBox3 EGCWA

Part-No.	Spare-part	Included parts
80M000000	Salt Bridge replacement and calibration (TpH-D)	
80P000001	Electrolyte solution for TpH-D	
80P000002	pH buffer set	
10A800004	FCkit EGCWA (TTurb & TpH-D)	
22P000008	FC NEPH TTurb outlet	TTurb-Outlet; O-Rings; hose
10A100018	FC68 EGCWA (enviroFlu)	
22P000010	Spare part set for EGCWA FC´s	O-Rings 28x2,5 / 36x2,5 / 68x2,5 / 68x5; screws M5x20 + washer; allen key 6mm
11A100029	enviroFlu bracket	Bracket; screw M8x35; screw M5x25 + washer
50A033000	Cable PUR M12-M12/0.3m	Cable Flowmeter - TriBox
11A100030	Connection box	Connection Box; connection cables; self-tapping screws
11A100024	Flowmeter	
11A100032	Flowmeter fittingset	Flowmeter-fitting; fitting G1/2"-10x8mm; elbow fitting G1/2"-10x8mm
11A100023	Pressure regulator	Pressure regulator; bulkhead connection; fitting G1/2"-10x8mm
02A100009	Ballvalves	Ballvalve G1/4" PN10; ballvalve G1/2" PN10
11A100018	Vibration damper	Vibration dampers; screws M8x25; damper adaptors
11A100031	Fastening elements panels	6x Mounting brackets; 6x nut M8 + washer;
02A300002	Spare hose set	Hoses 6cm / 8cm / 65cm / 90cm / 160cm; T-piece
11A100020	Cabinet key	
11A100035	Bracket for enviroFlu calibration	2x bracket; 4x screw M8x25 + washer
80P000004	TTurb & TpH-D calibration bracket	
11A100036	Door latch	Door latch; mounting post; latch bolt; screws M8x20, M6x12, M8x30 + washers, slot nut
11A100034	Drain plug	5x drain plug

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Date: 15.12.2021 Rev.: ZP50A22A
Note:

Document: D46-081en202205

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