





TTurb OPERATING INSTRUCTIONS

Table of Contents

1 General Information	2
1.1 Introduction	2
1.2 Health and Safety Information	3
1.3 Warnings	4
1.4 Users and Operating Requirements	4
1.5 Intended Use	4
1.6 Disposal Information	5
1.7 Certificates and Approvals	5
2 Introduction	6
2.1 Product Identification	6
2.2 Scope of Delivery	7
2.3 Measurement Principle and Design	7
2.4 Browser	8
3 Commissioning	14
3.1 Electrical Installation	14
3.1.1 Fixed Cable with M12 Industrial Plug	14
3.2 Interfaces	15
3.2.1 Serial Interface	15
4 Use	16
4.1 Normal Operation	16
4.2 Bypass Installation	16
4.3 Operation with Type Approval according to IMO regulations	17
4.3.1 Specification according to MEPC.340(77)	17
4.3.2 Mounting	17
4.3.3 Electrical Installation	17

5 Calibration	18
5.1 Manufacturer Calibration	18
5.2 Customer Calibration	18
5.2.1 Calibration with TTurbCAL	19
5.2.2 Calibration with Formazine Standard	
Solution	24
6 Malfunction and Maintenance	25
6.1 Cleaning and Upkeep	25
6.2 Maintenance and Inspection	25
6.3 Return	25
7 Technical Data	26
7.1 Technical Specifications	26
7.2 External Dimensions	27
8 Accessories	28
8.1 TriBox3	28
8.2 TriBox mini	28
8.3 TTurbCAL	28
9 Warranty	29
10 Customer Service	30
11 Contact	31
12 Keyword Index	32
Annex	34

General Information // TTurb

1 General Information

1.1 Introduction

Welcome to TriOS.

We are glad that you have chosen to purchase our TTurb nephelometric turbidity sensor.

The TTurb is based on the physical measurement method of 90° infrared scattering and measures the turbidity in a range of up to 100, 400 or 1000 NTU, depending on the sensor subtype. Measured values can also be indicated in FNU, mg/l or TSSeq. This intelligent sensor stores calibrations internally. This enables a "plug-and-play" system without recalibration when the location or measuring transducer is changed.

In this manual, you will find all the information you will need to commission the TTurb sensor. Technical specifications as well as detection limits and the dimensions can be found in chapter 7.

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

Please read this manual carefully before using the device and keep this manual on hand for future use. Before commissioning the sensor, please make sure that you have read and understood the following safety precautions. Always make sure that the sensor is operated correctly. The safety precautions described on the following pages should ensure the smooth and correct operation of the device and any additional associated devices and should prevent injuries to yourself or other persons and damage to other equipment. TTurb meets the requirements of EN ISO 7027-1:2016-11.

Software Updates

This manual refers to software version 1.0.7. From time to time TriOS Mess- und Datentechnik GmbH publishes software updates for the TTurb. These updates include bug fixes, new features and options.

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

Copyright Notice

All content in this manual, i.e. texts, photographs and graphics, are protected by copyright. Unless expressly stated otherwise, TriOS Mess- und Datentechnik GmbH is the owner of the copyright. Persons who violate the copyright shall be liable pursuant to § 106 et seq of the copyright law, they will be warned at their own expense and must pay compensation.

1.2 Health and Safety Information

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



Electromagnetic Waves

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

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 biologically dangerous. 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 regulations on water pollution, drainage and waste disposal must be observed.

General Information

1.3 Warnings

- This sensor 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 sea water.
- The material resistance should be checked after every use.
- Do not cut, damage or change the cord. Make sure that no heavy objects are placed on the cord and that the cord is not folded. Make sure that the cord is not run near hot surfaces.
- If the sensor cable is damaged, it must be replaced with an original part by the customer service of TriOS Mess- und Datentechnik GmbH.
- Stop operation of the sensor in the event of excessive heat development (i.e. if it is hot to the touch). Switch off the sensor immediately and remove the cable from the power supply. Please contact your dealer or the TriOS customer service.
- 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.

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.

NOTICE

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 TTurb sensor has been developed for use in industry and science. The target group for the operation of the TTurb sensor is technically skilled staff in plants, sewage treatment plants, water plants and institutes. The use of this device often requires the handling of hazardous substances. We assume that the operating personnel are familiar with dealing with hazardous substances based on their professional training and experience. 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 TTurb sensor is exclusively to measure turbidity in aqueous solutions, as described in this manual. In this respect, the TTurb sensor is an immersion sensor used under water or in conjunction with flow cells. Please note the technical data of the accessory parts. Any other use is not considered to be in compliance with the intended use.

TTurb // General Information

The compact and robust sensor is particularly suitable for the following areas of application:

- · Industrial and municipal sewage treatment plants
- · Wastewater management
- · Monitoring of surface waters
- Aquaculture and fish farming
- · Drinking water monitoring

Use in other media can damage the sensor. For the use of the TTurb sensor in other media than those specified in this manual, please contact the customer service of TriOS Mess- und Datentechnik GmbH (support@trios. de).

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 must be proven with a certificate. Please contact us for more details before you send the device back.

Address of manufacturer:

TriOS Mess- und Date	ntechnik Gmbl	Н		
Bürgermeister-Brötje-Str. 25				
26180 Rastede				
Germany				
Telephone:	+49 (0) 4402	69670 – 0		
Fax:	+49 (0) 4402	69670 - 20		

1.7 Certificates and Approvals

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

TTurb has a type approval according to IMO regulation MEPC.340(77), for the monitoring of turbidity, as specified in the regulations. Please note the restrictions of use of the TTurb (see chapter 4.3 and Annex).

Introduction // TTurb

2 Introduction

TTurb is a turbidity sensor for nephelometric measurements in the infrared range.

The sensor is available in different measuring ranges. A reference measurement of the light source ensures a long-term stability of the measurement and a reduction in service expenditure as a result of rare calibration.

An innovative multi-coloured LED shows the current status of the sensor. Green during a measurement, blue during calibration.

Thanks to the integrated suppression of background illumination, the sensor does not need to be protected from direct sunlight.

As an immersion sensor, the TTurb can be used directly in the measuring medium, but is also available in the FlowCell-optimized version for bypass applications. In addition, it is possible to obtain the TTurb directly in a set with the dry-standard TTurbCAL. This standard is calibrated to each individual instrument and thus allows a calibration on site, without any reagents.

2.1 Product Identification

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

The ID label contains the following information that you can use to uniquely identify the product:

	$\left(\right)$	
Serial number	Serial No 070FFFFF	CE Assembled in Germany
Product type	Type TTurb-1000 2m FC	Optical Sensors
Power Supply	Sensor Power 12 – 24 VDC 10 % / 1.5 W	
Interface	Sensor Interface RS-485	

In addition to the product bar code, the ID label 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.

TTurb // Introduction

2.2 Scope of Delivery

The delivery contains the following components:

- 1. Sensor
- 2. Operating Instructions
- 3. Accessories (if applicable)

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 sensor measures with the nephelometric principle of 90° infrared scattering. The turbidity of a liquid can be determined precisely by means of the scattering intensity measured by the detector, which is arranged at 90° to the light source.

The measured value can be displayed in FNU (Formazine Nephelometric Units), NTU, mg/L or TSS_{eq}[mg/L]. Formazine is used internationally as the standard for calibrating turbidity sensors and thus makes them comparable with each other.



Principle of 90° scattered light measurement



Introduction // TTurb

2.4 Browser

TTurb is equipped with a web interface, which can be used to configure and calibrate the sensor. For example, offsets and scaling factors can be assigned, interfaces can be configured and further settings can be entered. To access the web interface, you will need the G2 InterfaceBox and an Ethernet-capable device with a web browser, e.g. a notebook or smartphone (when using G2 InterfaceBox wireless version).

Open one of the following URLs (depending on the network structure) in your web browser:

http://TTurb_070xxxxx/ (070xxxxx is the serial number)

http://192.168.77.1/

The web interface is divided into three areas (see figure):

Title, menu and contents.

			litle	
			Overview	0
	TriOS	▲ Sensor		
	Optical Senso	туре	TTurb	
	Overview	> Subtype	1000	
חנ	Measurement	Serial Number	TTurb_070000A0	
Mer	Peripherals	Firmware Version	1.0.5	
-	System	Tranceiver	RS485	
	login			
ogin	password			
	Login!	0		
	ь			
		L		

In the title, the name of the current page is displayed. To the right of that is the Info button **1**. It shows the contact data of the corresponding TriOS dealer as well as that of the TriOS Mess- und Datentechnik GmbH. In the menu on the left, the individual pages are listed. The name of the current page is highlighted in blue. In the menu, you will find the login form for certified TriOS service technicians to authenticate themselves. In most cases, problems can be solved on site using this option.

Please note that the service login can only be passed on to trained personnel. If you are interested in a an internal training, please contact TriOS Mess- und Datentechnik GmbH personally.



Completed settings must be saved with the "Save" button. Otherwise, all settings are lost.

TTurb // Introduction

Overview

Basic information about the sensor is summarized in "Overview". This includes the device type, serial number and firmware version of the sensor.

		Overview	0
TriOS	∧ Sensor		
Optical Sensors	Туре	TTurb	
Overview >	Subtype	1000	
Measurement 🔊	Serial Number	TTurb_070000A0	
Peripherals	Firmware Version	1.0.5	
System 🔊	Tranceiver	RS485	
login			
password			
Login!			

Measurements

"Measurement" includes the results of the last measurements performed and allows the interval to be set for automatic measurements. The new measurement can be triggered at any time. To do this, press "Measure Now!". A new measurement will be triggered with the saved settings.

		Measurement	0
TriOS	∧ Parameter		
Overview 🔊	Measure now!	• Settings	Columns
Measurement >	Parameter	Processed Value	
Peripherals	Turbidity (FNU)	N/A	
System 🔊	Turbidity (mg/l)		
-	Turbidity (NTU)		
login	▼ more		
password	∧ Settings		
Login!			
	Automatic	Off	
	Interval [s]	10s	•
	🖉 Edit		

Scaling factors can be entered for all parameters under **O** Settings , see Chapter 5. Customer Calibration for details.

Parameter	Offset	Scaling
Turbidity (FNU)	0	1
Turbidity (mg/l)	0	1
Turbidity (NTU)	0	1
TSSeq (mg/l)	0	1

In "Moving average" an average correction for N (number) measured values can be defined.

Demoving average is call		uala
Parameter	N	
Turbidity (FNU)	1	
Turbidity (mg/l)	1	
Turbidity (NTU)	1	
TSSeq (mg/l)	1	
▼ more		

TTurb // Introduction

In "Settings", you can enter settings for automatic measurement by clicking "Edit".

- · Automatic measurements can be activated.
- · An interval for the automatic measurements can be specified.

▲ Settings			
Automatic	Off		
Interval [s]		10s	\odot
S Edit			

Please note that the factory setting for automatic measurement is set to "off".



To record data sets, please activate the automatic measurement only under a permanent power supply!

Introduction // TTurb

Peripherals

"Peripherals" is used to configure the interface, select a protocol, and change the Modbus address by clicking "Edit".

		Peripherals	
TriOS Optical Sensor	▲ Digital I/O Modul		
Overview	Transceiver RS485		
Measurement	Digital I/O Settings		
Peripherals	>		
System	Protocol	Modbus RTU	0
	Baudrate	9600	0
password	Flow Control	None	0
Login!	Parity	None	0
	Stop Bits	One	
	Address 40		
	Address 40		
	Ethernet Medul Settings		
	Disable after 1min	Off	
	S Edit		
	LED Settings		
	Enable Status LED On		

The factory settings are: Protocol: Modbus RTU Baud rate: 9600 Flow control: None Parity: None Stop bits: 1

Keyword Index

TTurb // Introduction

System

"System" is used to download the current configuration settings of the sensor (Recovery Point) and a System Log. For detailed descriptions see below.

			System	3
TriOS	▲ Common Settin	ngs		
Overview 🔊	Description			
Measurement 🔊	🔗 Edit			
Peripherals >				
System >	 Recovery Point 	t		
	Backup	0	Download!	
login	Recover	Datei auswählen Kei	ne ausgewählt	Upload!
password				
Logan U	 System Log 			
	0		Download!	

Common Settings

After pressing "Edit", a comment such as a name or the location of the sensor can be entered as a description.

Recovery Point

Press the "Download" button to load the current calibration from the sensor and save it on a PC or other medium. This calibration file (config.ini) must be stored and kept safe. Use the "Upload" function to restore a previously downloaded calibration file or to upload a calibration file generated by the customer support of TriOS Mess- und Datentechnik GmbH to the TTurb.

Please note that this function requires authentication. See also chapter 5. Calibration.

System Log

This area is freely accessible and displays events such as performed measurements, changed settings and error messages. In case of service the system information can be downloaded here. This information may be important in the event of troubleshooting by the customer service and must be included with the request.

Login

To use the Service function, you need a login and a password. You will receive this when you participate in a TriOS training session. For further information, please contact the customer service of TriOS Mess- und Datentechnik GmbH.

Commissioning // TTurb

3 Commissioning

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

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

3.1 Electrical Installation



3.1.1 Fixed Cable with M12 Industrial Plug



get damaged.

- 1. RS-485 A (commands)
 2. RS-485 B (data)
 3. ETH_RX 4. ETH_RX+
 5. ETH_TX 6. ETH_TX+
 - 7. Ground (Power + Ser. Interface)

Ensure correct polarity of the supply voltage, because otherwise the sensor might

8. Power (12-24 VDC)



The sensor 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.

NOTICE

ce

D01-070en202211 Manual TTurb

General Information

3.2 Interface

3.2.1 Serial Interface

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

With RS-485, voltages from -5 V to +5 V to ground are possible. RS-485 uses a differential signal with the sign-negative potential of the A line is put on the B line. The A-B difference is decisive, where the transmission is most resistant to interactive interference signals.

The protocol used is Modbus RTU. A detailed description of the Modbus RTU protocol for TTurb can be found in the annex.

Use // TTurb

4 Use

TTurb can be operated with all TriOS controllers. Instructions for correct installation can be found in the relevant controller manual. The sensor is automatically detected during the sensor scan after switching on the TriOS controller.

If the sensor is operated with the DIN rail module HS 100 or directly with a process control system or SCADA system, the customer is responsible for correct commissioning and programming. A detailed description of the Modbus registers and the calibration procedure can be found in the annex.

When using the TTurb, make sure the flow direction is towards the optical windows. A different flow direction may lead to improper readings

4.1 Normal Operation

The sensor can be used directly in open water such as rivers, lakes, basins or the like. Thanks to the integrated suppression of background illumination, the measurement is not disturbed by sunlight.

It is imperative to ensure that there is a sufficient distance between the sensor and other probes, the edge of the pool, shore or similar. Scattering on surfaces could falsify the measurement result.

4.2 Bypass Installation

The sensor can be used in the optional FlowCell. If a FlowCell not purchased from TriOS is used, calibration is mandatory.

The TriOS TTurb FlowCell has several advantages over conventional products.

The sensor is always fixed in the same position by a positioning groove with end stop. This guarantees stable measurement values after the device was removed for cleaning or service purposes.

The FlowCell can be dismantled and / or opened in a few seconds due to its simple assembly and innovative closure technology. It can be extended to the right with additional cells for other parameters such as pH.

A drain screw is located on the bottom of the flow cell to remove deposited dirt with very little effort.



NOTICE Negative pressure may harm the sensor.

D01-070en202211 Manual TTurb

TTurb // Use

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

- 1. Remove the pressure ring from the FlowCell. It can easily be opened 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.
- 3. When the TTurb is positioned along the groove, guide the pressure ring along the cable above the sensor to fix it to the FlowCell.
- 4. When the TTurb has been positioned correctly, tighten the pressure ring by hand.

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



(1) Pressure ring

(2) TTurb

(3) O-ring



4.3 Operation with Type Approval according to IMO regulations

TTurb has a type approval in accordance with IMO Regulation MEPC.340(77) for monitoring the turbidity in FNU or NTU in discharge water of exhaust gas cleaning systems.

4.3.1 Specification according to MEPC.340(77)

With ship approval, an operating temperature between 5 °C and 55 °C is assumed.

4.3.2 Mounting

TTurb can be installed with a FlowCell (FlowCell eCHEM) as a bypass (see section 4.2).

4.3.3 Electrical Installation

Type approved applications shall be set up with TTurb with a fixed cable of maximum 5 m length. The shielded cable has an M12 industrial plug as connection. The sensor should be connected to an external control unit for power supply (12 VDC or 24 VDC) and recording measuring data. The shielding of the M12 industrial plug must also be grounded (see chapter 3.1.1 Fixed Cable with M12 Industrial Plug).

Calibration // TTurb

5 Calibration

5.1 Manufacturer Calibration

The TTurb sensor provides the measured value in FNU units (Formazine Nephelometric Units), NTU, mg/L or TSS_{m} [mg/L].

5.1.1 Standard Manufacturer Calibration

For the standard manufacturer calibration, the sensor is calibrated in a big container with Formazine standard.

5.1.2 Calibration for FlowCell use

For use in a TriOS FlowCell, the calibration is directly performed in a TriOS FlowCell. The sensor is factory calibrated with Formazine or a polymer traceable to Formazine.

5.2 Customer Calibration

The sensor can be recalibrated during operation with a one-point calibration for scaling, this is called a post-processing calibration. The factory calibration will stay untouched. If the post-processed values are needed, via Modbus registers 1500 and following must be polled. The raw values are stored in registers 1000 and following.

The measured value should always be checked against a standard solution or reference measurement before performing a calibration. Incorrect calibration always leads to incorrect measured values.

The sensor has the possibility to output the measured value in FNU scaled as solid TSS_{eq} in mg/l. To determine the scaling factor, a linear regression between at least one laboratory value and one measured value must be calculated.

Calibration is possible with the controllers (see Chapter 8). This intelligent sensor stores calibrations internally. Thus, the current calibration is always available.

TTurb should be checked and calibrated regularly. Table 1 lists TriOS recommendations for maintenance and calibration intervals.

Table 1: Maintenance and calibration interval of TTurb sensors

Sonoor	Maintenance	Test	Manufacturer maintenance and calibration		
Sensor			With TTurbCAL	Without TTurbCAL	
TTurb	Weekly	Monthly calibration / validation	Every 4 years	Every 2 years	

5.2.1 Calibration with TTurbCAL

TTurbCAL can be used for calibration and verification (see chapter 8).



Measuring principle

The TTurbCAL Solid Standard is used to calibrate the assigned TTurb-1000 sensor. The light emitted by the sensor is scattered by the material of 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 ID label. The serial number (TTurb SN) of the corresponding TTurb-1000 is also noted. The figure below shows an example of such a ID label.



Warnings

- The product is developed for use in industry and science. It should only be used to calibrate the associated Turb-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.

Calibration // TTurb

TTurbCAL

TTurbCAL can only be used together with the TriOS TTurb-1000 sensor it was delivered with. Both products have been calibrated to each other in the manufacturer's laboratory.



Calibration with TTurbCAL only allows to adjust the scaling factor. More is 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.

Application with EGC Water Analyzer and TriBox3

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. Set the controller to service mode and set the scaling for TTurb to 1.
- 2. Place the supplied holder on the FlowCell adapter of the TpH-D.



Measurement setup before checking the sensor

TpH-D FlowCell adapter

nty S

TTurbCAL holder

- 3. If not already done, stop the water flow in the system and empty the FlowCell.
- 4. Unscrew the pressure ring of the sensor and remove the TTurb-1000 sensor from the FlowCell.
- 5. Leave the O-ring and the pressure ring on the TTurb-1000.
- 6. Clean the sensor thoroughly (see chapter 6 of this manual).

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.

When the sensor head is clean and dry, you can start calibrating the TTurb-1000.

7. Place the TTurb in the holder with the sensor head facing upwards.





Calibration // TTurb

- 8. Open the TTurbCAL and remove any dust and dirt with a lint-free cloth. You shall not use cleaning agents.
- 9. 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. TTurbCAL will find the correct position on its own, if you slightly press it down on the sensor head. To find the correct position, put the TTurbCAL three times on the sensor head. The highest value indicates the perfect fit.



- 10. Follow the instructions of the calibration wizard on your TriBox3 to adjust the scaling of the sensor. You will find the concentration value printed on the TTurbCAL ID label.
- 11. When calibration is complete, remove the standard, reinsert the TTurb-1000 including O-ring into the FlowCell and tighten the pressure ring.
- 12. Close the TTurbCAL with the lid again and remove the holder from the TpH-D pressure ring.
- 13. As soon as the TpH-D is also inserted again, first open the water outlet of the FlowCell and then the water inlet of the EGC Water Analyzer.
- 14. Now you can continue with your measurement.

TTurb // Calibration

Application without EGC Water Analyzer

The TTurb-1000 turbidity sensor can also be calibrated outside the FlowCell application. In this case follow the instructions above with the following exceptions:

To measure the solid standard without a TTurbCAL holder, hold the sensor in one hand and place the TTurbCAL on the sensor.

Calibrate the sensor according to the instructions provided in the TriBox3 wizard.

If you do not have a TriBox3, you can check your TTurb-1000 as follows:

- 1. Set the measuring interval of the TTurb-1000 to 10 seconds (via Web Interface or Modbus) and let the sensor warm up for at least 10 minutes before calibration.
- 2. Follow the cleaning instructions for TTurb and TTurbCAL provided in the previous section.
- When the TTurb has warmed up and both the sensor and the TTurbCAL are free from contamination, you can start checking the TTurb-1000.
- 4. Hold the sensor in your hand with the head upright and place the TTurbCAL on the TTurb. Note the previous section Nr. 9.
- Take 16 measurements and calculate the average value. Note the measured concentration (e.g. in the protocol found in the Quick guide of the TTurbCAL).
- 6. Read the concentration of the TTurbCAL from the ID label and calculate the scaling using below formula:

scaling = Concentration of the TTurbCAL Mean value of the 16 measurements

The scaling should be between 0.5-2.

If the scaling is out of this range, repeat the measurement to exclude an application error. If the scaling is outside the specified range repeatedly, you should send the TTurb-1000 together with the TTurbCAL for checking and calibration.

After successful calculation, enter the value for the scaling into the controller or into the process control system (PLC). Follow the instructions in the respective manual of the controller. You can then continue with your measurements.

Calibration

5.2.2 Calibration with Formazine standard solution

The TTurb-1000 turbidity sensor can be calibrated outside the FlowCell application and without TTurbCAL. In this case follow the instructions above with the following exceptions:

To measure the concentration of a Formazine standard solution, immerse the sensor into the Formazine standard solution of a known concentration and place the setup on a flat surface. For this purpose, you could either use a big black bucket or container with enough space between the sensor head and the wall of the bucket or container. This is important, because light might scatter from the wall to the sensor and will cause wrong readings. Leave the assembly untouched during calibration and avoid disturbing factors, such as contact or environmental influences.

ACAUTION Formazine is carcinogenic, can cause allergic reactions and is harmful to water organisms. Use Formazine standard solutions with great care.

If applicable, run the calibration wizard for scaling on your TriBox3 and follow the instructions.

If you do not have a TriBox3, you can check your TTurb-1000 as follows:

- 1. Set the measuring interval of the TTurb-1000 to 10 seconds (via Web Interface or Modbus) and let the sensor warm up for at least 10 minutes before calibration.
- 2. Follow the cleaning instructions for TTurb as described in chapter 6 of this manual.
- When the TTurb has warmed up and both the sensor and the Formazine solution are free from contamination, you can start calibrating the TTurb-1000.
- 4. Place the TTurb into the Formazine standard solution. Place the assembly on a flat surface.
- 5. Take 16 measurements and calculate the average value. Write down the measured concentration
- 6. Read the concentration of the Formazine standard solution and calculate the scaling using this formula:

scaling = Concentration of the Formazine standard solution Mean value of the 16 measurements

The scaling should be between 0.5-2.

If the scaling is out of this range, repeat the measurement to exclude an application error. If the scaling is outside the specified range repeatedly, you should send the TTurb-1000 for checking and calibration.

If the scaling is within the above range, continue:

 After successful calculation, enter the value for the slope into the controller or into the process control system (PLC). To do this, follow the instructions in the respective manual of the controller. You can then continue with your measurements.

6 Malfunction and Maintenance

6.1 Cleaning and Upkeep

The sensor should be cleaned manually at application-dependent intervals. For this purpose, the sensor must be removed from the application or FlowCell.

NOTICE

In combination with TriOS controllers, always switch to service mode before starting service, so that the faulty measurements caused by cleaning do not trigger any faults.

Clean the windows with a soft cloth and wipe them with Isopropanol. If heavy staining (such as carbonates or iron oxides) is visible, you may use normal kitchen detergent to dissolve the staining.

NOTICE With every service the optical measuring windows and cable need to be checked.

6.2 Maintenance and Inspection

The sensor does not require any special maintenance apart from cleaning and checking the cable and optical measuring windows.

6.2.1 Check functionality

A standard solution (e.g. Formazine) can be used or a reference measurement can be carried out to check the measured values. The standard solution should be within the expected measuring range of the measuring medium.

For a quick functional check, hold the sensor perpendicular to a white piece of paper, it should give a full scale reading (such as 1000 FNU). Go on measuring while gradually distancing the sensor from the paper. If the measured values become lower, this indicates that the sensor is functional.

6.3 Return

Please read the following procedure for your returns.

Prior to returning the sensor to TriOS, please contact our technical support to assure a smooth return process and avoid incorrect shipments. You will then receive a numbered RMA form, which you need to complete, sign and return to us. Please attach a printed copy of this form to the return package or write the RMA number in large letters on the return package. This is the only way 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 ship the goods undamaged, use the original packaging. If this is not on hand, make sure that safe transport is guaranteed and the sensor is safely packed using enough packing material.

NOTICE We reserve the right to charge a cleaning fee for sensors that have not been cleaned and disinfected properly prior to shipping them to us.

Technical Data // TTurb

7 Technical Data

7.1 Technical Specifications

Measurement technology		LED light source		
Measurement principle				
measurement principle				
Parameters		Turbidity as FNU; mg/L; NTU; TSSeq		
Measuring ra	ange	0–100, 0–400, 0–1000 FNU		
Measuremen	it accuracy	±(5 % + 0.5); max. ±2 FNU		
		0.5 FNU for TTurb 100		
Detection lin	nit	2 FNU for TTurb 400		
Mossuromor	at wavelength	2 FNU for 1 lurb 1000		
Reaction tim	o T100	6 s		
Magauramar				
MedSuremen	it interval	235		
Housing mat	terial	PET / POM / NBR		
Dimensions	(L x Ø)	170 x 36 mm	~ 6.7″ x 1.4″	
Weight		0.3 kg	~ 0.7 lbs	
Interface		Ethernet (TCP/IP)		
interface		RS-485 (Modbus RTU)		
Power consu	umption	typically < 0.9 W		
Power Supply		12–24 VDC (±10 %)		
Connection	.,	8-pin M12 plug		
Connection				
Required su	pervision	≤ 0.5 h/month typically		
Calibration/ maintenance	interval	24 months, when using TTurbCAL, factory calibration interval is 4–5 years		
System com	patibility	Modbus RTU		
M		1 year (EU&US: 2 years) on electronics;		
Warranty		wearing parts are excluded from the warranty		
Max. pres-	with fixed cable	3 bar	~ 43.5 psig	
sure	in flow cell	1 bar, 2–4 L/min	~ 14.5 psig, 0.5 to 1 gpm	
Protection type		IP68	NEMA 6P	
Sample temp	perature	0 °C to +40 °C	~ +32 °F to +104 °F	
Ambient tem	perature	0 °C to +40 °C	~ +32 °F to +104 °F	
Storage temperature		0 °C to +80 °C	~ +32 °F to +176 °F	
Inflow veloci	ty	max. 0.1 m/s	maximum ~ 0.33 fps	
Inflow velocity		max. 0.1 m/s	maximum ~ 0.33 fps	

The sensor meets requirements of DIN EN ISO 7027-1:2016-11.



7.2 External Dimensions

TTurb // Technical Data

Accessories // TTurb

8 Accessories

8.1 TriBox 3

Digital 4-channel display and control unit with integrated solenoid valve for pneumatic control

TriBox3 is a measurement and control system for all TriOS sensors. The device provides 4 sensor channels with selectable RS-232 or RS-485 function. In addition to the Modbus RTU, various other protocols are available. A built-in valve allows the use of compressed-air cleaning for the sensors The TriBox3 also offers TCP/IP and WLAN networks, USB connection and 6 analog outputs (4–20 mA). An integrated relay can be used to trigger alarms or to control external devices. Features such as low power consumption, a robust aluminium housing and a range of interfaces make it suitable for all applications that have to do with environmental monitoring, drinking water, wastewater treatment plants and many other areas.



Firmware version 1.4.11 or higher.

8.2 TriBox Mini

Digital 2-channel controller

Mini controller with two digital and serial sensor channels and two 4–20mA outputs. All measured values and diagnostics data which are stored can be selected using an integrated web browser.

Firmware version 1.2.0 or higher.



8.3 TTurbCAL

The TTurbCAL is a solid standard, which provides an FNU or NTU value for reagent-free calibration of TriOS TTurb sensors. The standard is very easy to use and makes device calibration on site much easier.



9 Warranty

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

The warranty is subject to the following conditions:

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

NOTICE Opening the sensor voids the warranty!

D01-070en202211 Manual TTurb

Customer Service // TTurb

10 Customer Service

If you are having a problem with the sensor, please contact the TriOS customer service.

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 sensor ID number by e-mail.

TTurb // Contact

11 Contact

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

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

General

D01-070en202211 Manual TTurb

Keyword Index // TTurb

12 Keyword Index

Δ			

Accessories	22
В	
Biological safety	3
Bypass installation	16

С

D

Е

F Flow cell

G

Dimensions

Electrical Installation

Electromagnetic Waves

Disposal

Calibration	18
CE certification	28
Certificates & approvals	5
Cleaning	19
Contact	25
Copyright	2
Customer Service	24

H Health and Safety Information I Intended Use 4 ID label 6

Μ

L

J

κ

M12 industrial plug	14
Maintenance	19
Measurement Properties	18

Ν

20

5

14

3

16

Normal Operation	16
rionna operation	

Operating	requirements	4
-----------	--------------	---

TTurb // Keyword Index

v

4

Genera Informatid

Product Identification	6
Q	
R	
Reagents	3
Return	19
RMA number	19

W	
Warnings	4
Warranty	23
Waste	3
x	
Y	
Z	

s

Ρ

Safety instructions	3
Scope of Delivery	7
Specifications	20
Structure of the sensor	7

т

Technical Specifications	20

U Lleer requiremente

User	requirements		

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 TTurb

Typ / Type / Type

100, 400, 1000

Mit den folgenden Bestimmungen With applicable regulations Avec les directives suivantes 2014/30/EU EMV-Richtlinie 2011/65/EU RoHS-Richtlinie + (EU) 2015/863 + (EU) 2017/2102

Angewendete harmonisierte Normen Harmonized standards applied Normes harmonisées utilisées EN 61326-1:2013 EN 61010-1:2010 +A1:2019 +A1:2019/AC:2019 EN IEC 63000:2018

Unterschrift / Signature / Signatur

Datum / Date / Date

28.10.2021

R. Heuermann

D05-070yy202110

Seite 1 von 1



TYPE APPROVAL CERTIFICATE

Certificate No: TAA00002X2 Revision No: 1

This is to certify:

That the Miscellaneous Transmitter

with type designation(s) TTurb

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 B Enclosure B (IP68)

Issued at **Hamburg** on **2022-07-06** This Certificate is valid until **2025-12-16**. 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 tot (including negligence), shall be limited to direct losses and under any circumstance be limited to 300,000 USD.



Revision: 2021-03

www.dnv.com

Annex // TTurb



Job Id: Revision No:

262.1-030658-2 Certificate No: TAA00002X2 1

Product description

Turbidity Sensors TTurb 100, TTur	rb 400 and 110rb 1000
Measurement technology:	LED light source Photodiode detector
Measurement principle	Nephelometry
Parameters	Turbidity as FNU; mg/L; NTU; TSSeq
Measuring range	0100, 0400, 01000 FNU
Measurement accuracy	± (5 % + 0.5); max. ±2 FNU
Detection limit	0.5 FNU for TTurb 100
	2 FNU for TTurb 400 and TTurb 1000
Measurement wavelength	860 nm, FWHM 30 nm
Reaction time T100	6 s
Measurement interval	≥ 3 s
Interface	Ethernet (TCP/IP) RS-485 (Modbus RTU)
Power Supply	1224 VDC (± 10 %)
Connection	8-pin M12 plug

Application/Limitation

The Type Approval covers hardware listed under Product description. When the hardware is used in applications to be classed by DNV, documentation for the actual application is to be submitted for approval by the manufacturer of the application system in each case. Reference is made to DNV rules for classification of ships Pt.4 Ch.9 Control and monitoring systems.

The "TTurb" is found to be in compliance with the requirements of Resolution MEPC.259(68) - "2015 Guidelines for exhaust gas cleaning systems", Chapter 10.2 "Washwater monitoring" as well as Resolution MEPC.340(77) - "2021 Guidelines for exhaust gas cleaning systems", Chapter 10.2 "Discharge water monitoring" The Trios turbidity sensor TTurb meets the following requirements:

Permission deviation of the Turbidity monitoring equipment

(MEPC.340(77), 10.2.2) Principle of detection for Turbidity MEPC.259(68), 10.2.5 and MEPC.340(77), 10.2.6)

Product certificate

If specified in the Rules, ref. Pt.4 Ch.9 Sec.1, the control and monitoring system in which the above listed hardware is used shall be delivered with a product certificate. For each such delivery the certification test is to be performed at the manufacturer of the application system before the system is shipped to the yard. The test shall be done according to an approved test program.

Tests carried out

Applicable Tests according to DNV CG-0339, August 2021

Marking of product

Maker, type designation, serial number.

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

www.dnv.com

Page 2 of 3



Job ld: Certificate No: Revision No:

262.1-030658-2 TAA00002X2 1

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

Annex // TTurb

Modbus RTU

Serial Interface

Upon delivery, the RS-485 serial interface is configured with the following settings (9600, 8N1):

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

Data types

Name	Register	Format
Bool	1	False: 0x0000, true: 0xFF00
Uint8	1	8-bit positive integer. Value range: 0x0000 - 0x00FF
Uint16	1	16 bit positive integer. Value range: 0x0000 - 0xFFFF
Uint32	2	32 bit positive integer. Value range: 0x00000000 - 0xFFFFFFF
Float	2	IEEE 754 32-bit floating-point number
Char[n]	$\left[\frac{n}{2}\right]$	Null-terminated ASCII string of n characters
Uint16[n]	n	Field of n Uint16 values
Float[n]	2n	Field of n float values

Functions

The sensor supports the following Modbus functions:

Name	Code	Description / Use
Read multiple registers	0x03	Read the firmware version, configuration, calibration and measurement data.
Write multiple registers	0x10	Write the configuration and calibration.
Write single register	0x06	Write the configuration and calibration.
Report slave ID	0x11	Read the serial number and firmware version.

Default Slave Address

The factory default setting of the slave address is 40 (0x28).

Access Permissions

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

Letter	Description
R	Read only
R/W	Read and Write

Read / Write multiple registers (0x03 / 0x10)

The following values are in the registers:

Designation	R/W	Address	Data type	Description
Modbus slave ID	RW	0	Uint16	Modbus server address of the sensor.
Measurement timeout	R	1	Uint16	The time in [10 ⁻¹ s] that the currently running measurement process will still require
Device serial number	R	10	Char[10]	Serial number of the TTurb sensor.
Firmware version	R	15	Char[10]	Version number of the installed firmware.
Subtype	R	20	Char[10]	Maximum measurement range (100; 400; 1000)
Self-trigger activated	RW	100	Bool	Indicates whether the sensor is in automatic mode.
Self-trigger interval	RW	101	Uint32	The measurement interval in [s] for the auto- matic mode. Adjustable range: 1s – 86400s.
Moving average	R	103	Uint16	The number of samples to calculate a mean concentration. Value range: 1 – 300.
Value range: 1 – 300.	RW	104	Uint32	Date and time as seconds since 1 January 1970.
Device description	RW	106	Char[64]	An unrestricted description of the sensor e.g.: "south supply line".
Allow negative values	RW	139	Bool	Enables or disables the clipping of negative measurement values to zero.
				When setting the parameter index, an offset or scaling factor can be set for the selected parameter.
Parameter Index for offset / scaling	RW	400	Uint16	The parameter list is shown in this document and starts at address 1000 (e.g. 0x0000 for turbidity (FNU), 0x0001 for turbidity (mg/L), 0x0002 for Turbidity (NTU), 0x0003 for TSS _{eq} (mg/L)).
Activate offset / scaling	RW	401	Bool	Enables or disables postprocessing. For the selected parameter, starting at Modbus address 400.
Offset	RW	402	Float	Parameter offset. Formula: scaled = (raw – offset) * scaling
Scaling	RW	404	Float	Scaling factor. Formula: scaled = (raw – offset) * scaling
Moving Average	RW	406	Uint32	The number of samples to calculate a mean concentration. Adjustable range: 1 – 25.

Annex // TTurb

Turbidity (FNU) concentration / scaled concentration	R	1000 / 1500	Float	Turbidity concentration in FNU / scaled concentration
Turbidity (mg/L) concentration / scaled concentration	R	1002 / 1502	Float	Turbidity concentration in mg/L / scaled concentration
Turbidity NTU concentration / scaled concentration	R	1004 / 1504	Float	Turbidity concentration in NTU / scaled concentration
TSS _{eq} mg/L concentration / scaled concentration	R	1014 / 1514	Float	$\mbox{TSS}_{\mbox{\tiny eq}}$ concentration in mg/L / scaled concentration
Temperature LED	R	1412	Float	Temperature on LED PCB-Board
FSM Control	R/W	5000	Uint16	Finite-state machine control register.
FSM Parameter	R/W	5001	Uint16	The parameter to be processed in the finite-state machine.
FSM Status	R	5002	Uint16	The current status of the finite-state ma- chine.
Permanent errors	R	5003	Uint16	Error messages are described in table ErrorBits below.
Temporary errors	R	5004	Uint16	Warnings are described in table ErrorBits below.
Permanent warnings	R	5005	Uint16	Error messages are described in table ErrorBits below.
Temporary warnings	R	5006	Uint16	Warnings are described in table ErrorBits below.
Calibration Control	R/W	6000	Uint16	Reset all parameters to: 0x0001: Factory calibration 0x0002: Last calibration
Factory calibration – Parameter	R	6001	Uint16	Reserved (set to 0x0000)
Factory calibration – Offset	R	6002	Float	Offset factor of the factory calibration
Factory calibration – Scaling	R	6004	Float	Scaling factor of the factory calibration.
Factory calibration – Square	R	6006	Float	Square factor of the factory calibration.
Factory calibration – Timestamp	R	6008	Uint32	Timestamp of the factory calibration.

TTurb // Annex

Active calibration – Parameter	R	6010	Uint16	Reserved (set to 0x0000)
Active calibration – Offset	R/W	6011	Float	Offset factor of the active calibration.
Active calibration – Scaling	R/W	6013	Float	Scaling factor of the active calibration.
Active calibration – Square	R/W	6015	Float	Square factor of the active calibration.
Active calibration – Timestamp	R/W	6017	Uint32	Timestamp of the active calibration.
Last calibration – Parameter	R	6019	Uint16	Reserved (set to 0x0000)
Last calibration - Offset	R	6020	Float	Offset factor of the factory calibration.
Last calibration – Scaling	R	6022	Float	Scaling factor of the factory calibration.
Last calibration – Square	R	6024	Float	Square factor of the factory calibration.
Last calibration – Timestamp	R	6026	Uint32	Timestamp of the factory calibration.

Write single register (0x06)

By writing a value that is not 0x0000 to the following coils / registers, the associated action will be performed by the TTurb.

Designation	Address	Description
Trigger measurement	1	A single measurement is taken.

Report slave ID (0x11)

Provides the sensor designation followed by the serial number followed by the firmware version each as a null-terminated ASCII character string.

Example:



Annex // TTurb

ErrorBits

	Bit No.	Device Driver Description	Description
Permanent Error			Reference Overflow Error during Reference Light measurement
	0	REF_OVERFLOW	I.e, this bit is set (and never cleared) if during a regular measurement RawRefLight is greater than 32500.
	1	REF_UNDERFLOW	Not implemented
	4	FSM_STATE	FSM State General Error (Set when the State machine – which should not be possible – enters an unknown invalid state)
	5	FSM_TRANSITION	FSM Transition Error (invalid transition step)
Temporary Error	6	FSM_AUTHENTICATION	FSM Authentication Error (no authentication for secured actions (e.g. writing a manufacturer calibration))
	8	FSM1_PARAMETER_METHOD	FSM1 Parameter Method Error (unsupported calibration method)
	9	FSM1_CALCULATE	FSM1 Calculate Error (calibration parameter could not be calculated) (Not enough measu- rement points were taken for a calibration, e.g only 2 points for a square calibration.)
Permanent Warning	0	CAL_OVERFLOW	With current calibration coefficients, the measuring range of the sensor can no longer be fully covered. This bit is only set or cleared during a calibration process using the internal state machine
Temporary Warning	0	SIG_OVERFLOW	Signal Overflow Warning during Signal Light measurement. I.e, this bit is set if during a regular measure-
			ment, if RawSigLight is greater than 32500, and cleared if its smaller or equal.

TTurb // Annex