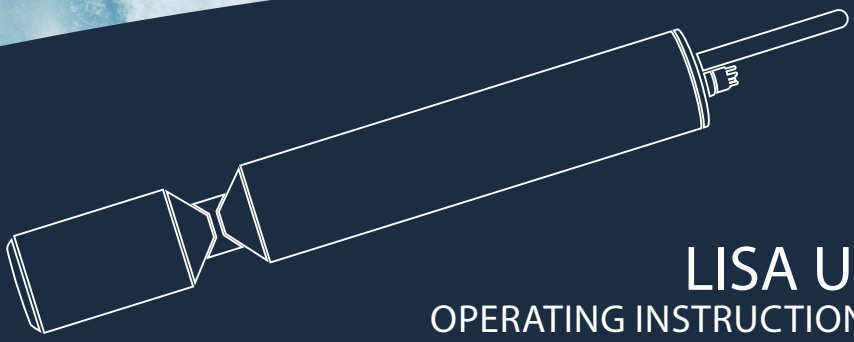
TriOS
Optical Sensors



LISA UV

OPERATING INSTRUCTIONS

Table of Contents

1 General Information

1.1 Introduction

Welcome to TriOS.

We are glad that you have chosen to purchase our LISA UV immersion sensor.

LISA UV uses two different LEDs for long-term stable measurements of SAC or colours at different wavelengths. The first channel is the nominal wavelength. The second channel is used for turbidity or background correction. Equipped with our innovative G2 interface with web browser configuration, internal data logger, flexible protocols and data outputs, LISA UV has versatile features.

In this manual, you will find all the information you will need to commission the LISA UV. Technical specifications, detection limits and 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 reliable and correct operation of the devices.

Before using the device, read the manual carefully, and keep this manual on hand for future reference. 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 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 software version 1.7.11. Updates include bug fixes, new features and options. Devices with older software versions may not have all functions described here.

Copyright Notice

1.2 Health and Safety Information

This manual contains important information about health and safety rules. This information is labelled according to the international specifications of ANSI Z5356 ("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

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.

⚠ CAUTION	**Never look directly at the light source. 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. Observe the currently valid biological agents regulation (BioStoffV)!

Waste

When handling liquid waste, observe the regulations on water pollution, drainage and waste disposal.

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.

NOTICE **Stainless steel sensors are not intended for use in sea water or in high chloride concentrations (corrosion). Only sensors made of titanium can be used in these cases.**

- Sensors made from stainless steel must be cleaned immediately after coming into contact with salt water or other corrosive substances (e.gacids, alkalis, chlorine-based connections).
- The material resistance should be checked after every use.
- The sensor has seals made from NBR (nitrile butadiene rubber). Sealing rings made from other materials may be used upon individual request. Before operation, please ensure that the measured medium does not damage the seals.
- Do not cut, damage or change the cord. Make sure there are no heavy objects on the cable and that the cable is not folded. Make sure that the cable is not anywhere 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.
- Do not place unsuitable items in the optical path as long as the measurement process is running, as this can cause damage to the sensor or incorrect measurement results.
- 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 unplug the power cord 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. Defective, improper repairs can lead to accidents and injuries.

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

1.4 User and Operating Requirements

The LISA UV photometer has been developed for use in industry and science. The target group for the operation of the LISA UV SAC probe is technically skilled staff in plants, sewage treatment plants, water plants and institutes. Operating this device often requires the handling of hazardous substances. We assume that the operating personnel are familiar with dealing with dangerous substances based on their professional training and experience. 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

LISA UV must be used exclusively for the implementation of SAC or transmission measurements as described in this manual. For this purpose, the photometer is an immersion sensor, which is used underwater or with a flow cell. Please note the technical data of the accessory parts. Other uses do not comply with the intended use.

The sensor may only be used to measure the SAC and transmission of aqueous fluids, such as process wastewater, municipal wastewater, and the surface/groundwater. The use of other media can damage the sensor. For the use of the LISA UV in other media then those specified this manual, please contact the Customer Service of TriOS Mess- und Datentechnik GmbH (support@trios.de).

NOTICE	**Avoid touching the glass parts of the optical window, since these can become scratched or dirty. If this happens, the functionality of the device can no longer be guaranteed.**

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 addressbelow). 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 EU guidelines. TriOS Mess- und Datentechnik GmbH confirms the successful testing of the product by affixing the CE marking. (See Annex.)

2 Introduction

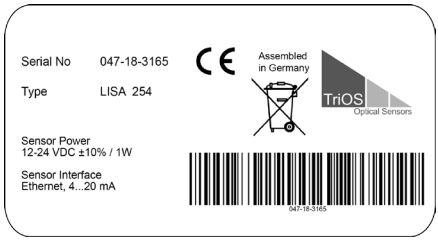
LISA UV is a photometer with a nominal wavelength of 254 nm that cannot be changed. There are also “digital” and “analog” versions of the LISA UV. This makes the sensor particularly suitable for industrial monitoring systems and short research applications in the open field.

2.1 Product Identification

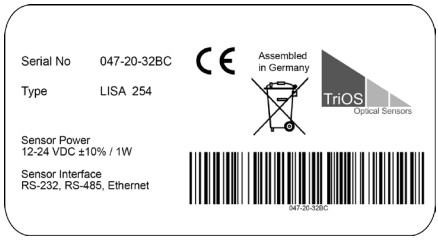
All TriOS Mess- und Datentechnik GmbH products have a label, which clearly shows the product designation.

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

Serial number
Product type
Power supply
Interface



Serial number
Product type
Power supply
Interface



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

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

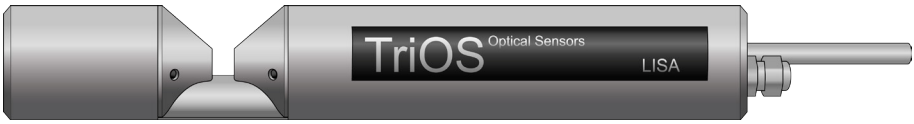
2.2 Scope of Delivery

The shipment contains the following components:

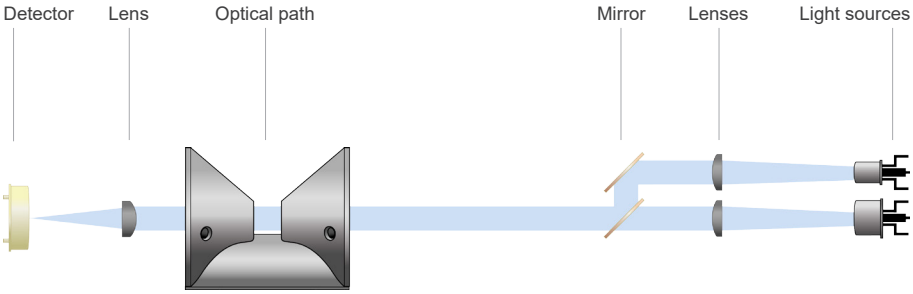
1. Sensor
2. Operating Instructions
3. Calibration Certificate
4. Compressed air fitting
5. For analogue version: M12 mounting socket

Keep the original packaging for possible return for maintenance or repair purposes.

2.3 Measurement Principle and Design



For optimal use of the sensor, it is essential to understand the measuring principle and measurement setup which the sensor is based on. The following is an overview of the measurement principle, the optical arrangement and the subsequent calculation.



LISA UV essentially consists of four parts: a defined light source, a lens system, the optical path through the medium and a detector with ambient light suppression. The arrangement of these parts is represented schematically in the above illustration.

The light source consists of two LEDs of different wavelengths. The wavelength of the first LED (LED 1) is 254 nm. The wavelength of the second LED (LED 2) is 530 nm. This wavelength is used for turbidity correction. Both LEDs are connected one after the other in a special profile. The light emitted by the LEDs passes through the medium on the way to the detector and is partially weakened by the medium. The detector picks up the remaining light and thus determines its intensity I .

The weakening of the light when passing through the measurement medium is compared to the weakening caused by ultra-pure water. The measurement in ultra-pure water provides the so-called basic intensity I_0. Using equation 1 and equation 2, the LISA UV determines the transmission T and the absorbance A of both of the above-mentioned wavelengths.

$$T = \frac{I}{I_0}$$

Equation 1: Calculation of transmission

$$A = -log_{10} T$$

Equation 2: Calculation of absorbance

where:

T	transmission in %
I	current light intensity
I_0	basic light intensity in ultra-pure water
A	absorption in AUs (AU = absorbance unit)

The light intensity of LEDs often varies with the temperature. Therefore, a temperature correction factor is determined for each wavelength of the LISA UV and is used to calculate the measurement value.

2.3.1 Spectral Absorption Coefficient SAC

LISA UV outputs the SAC of the wavelength of LED 1 at 254 nm. This is referred to as SAC_{254} in the following. Accordingly, the absorption at the wavelength of LED 1 will be denoted with A_{254}.

Scattering of light on particles in a solution is seen as turbidity by the observer. The LISA UV uses the absorbance of 530 nm (A_{530}) for the turbidity correction of the absorption measurement of the wavelength emitted by LED 1 (A_{254}). The SAC_{254} is calculated using the equation 3 In this equation, d is the optical path length in millimetres [mm]. Path lengths 0.3, 1, 2, 5, 10, 50 mm are available for LISA UV.

$$SAC_{254} = \frac{(A_{254} - A_{530}) \cdot 1000}{d}$$

Equation 3: Calculation of the spectral absorption coefficient at nominal wavelength 254

where:

d	length of the optical path in millimetres [mm]
SAC	spectral absorption coefficient in [1/m]

$$SAC_{254} = Abs_{254} - Abs_{530}$$

Equation 4: Calculation of the spectral absorption coefficient with measured absorbance values

where:

$Abs254$	absorption in [1/m]
$Abs530$	absorption in [1/m]

2.3.2 Parameters

LISA UV uses two different LEDs for long-term stable measurements of SAC values. The following parameters (see table) can be measured or derived with LISA UV.

Parameters	Unit
SAC_{254}*	1/m
COD_{eq}	mg / L
BOD_{eq}	mg / L
TOC_{eq}	mg/L
$Turb_{530}$	FAU
Abs_{254}	1/m
Abs_{530}	1/m
$Trans_{254}$	%
$Trans_{530}$	%
SQI	1

* According to DIN 38404-3

In addition, there are three freely selectable parameters (Custom#1, Custom#2, Custom#3), which can be derived, scaled and named from the aforementioned parameters.

2.3.3 Calculation UVT_{254n} normalized to 10 mm

The parameter $Trans_{254}$ (=UVT_{254}) refers to the current path length. If the specification UVT_{254} is to be calculated in relation to 10 mm (standard cuvettes), the following formula must be used:

$$UVT_{254n}\ mm\ [\%] = 100 \cdot 10^{\frac{-Abs_{254}\ [AU] \cdot 10}{Path\ length}}$$

with:

Abs_{254}	measured absorbance value at 254 nm in AU
Path length	used Path length of the sensor

2.4 Browser

LISA UV is equipped with a web interface, which can be used to configure and calibrate the sensor. To access the web interface, you will need the G2 InterfaceBox and an Ethernet-capable device with a web browser, such asa notebook / laptop.

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

http://lisa/ bzw.

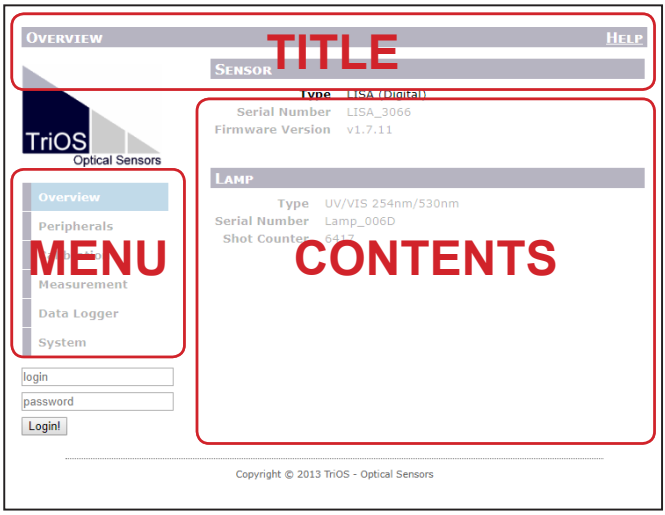
http://lisa_3XXX/ (3XXX ist die Seriennummer) bzw.

http://192.168.77.1/

When connected to an Internet-capable device, automatic measurements will be stopped. As soon as the sensor is disconnected from your device, the measurements will continue at the set interval if the timer is activated for automatic measurements.

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

Title, menu and contents.



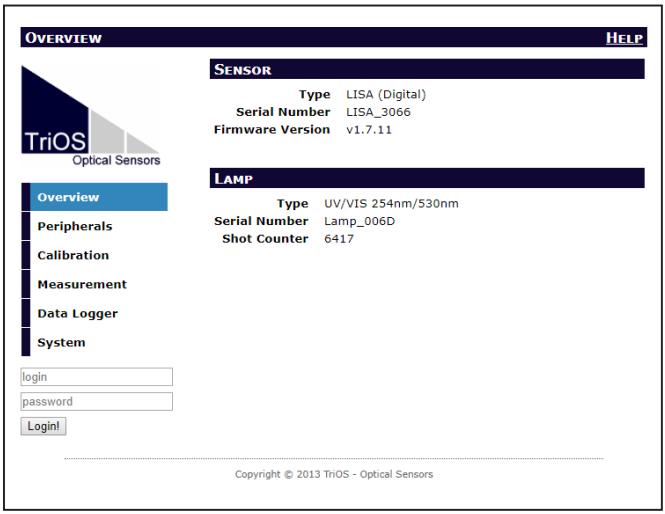
In the menu on the left, the subpoints are listed. There is a “Help” link on the right side that will take you to the TriOS Mess- und Datentechnik GmbH website. An active Internet connection is required to access the website.

The menu is used to navigate the web interface. Each line is a link to another page with different setting options. The link that refers to the page currently displayed is always highlighted in the menu. Special, selected contents and functions are reserved exclusively for the technical support of TriOS Mess- und Datentechnik GmbH. Authentication is needed for this content.

The Contents area displays the relevant information and setting options. Contents that require authentication are deactivated (“grayed out”).

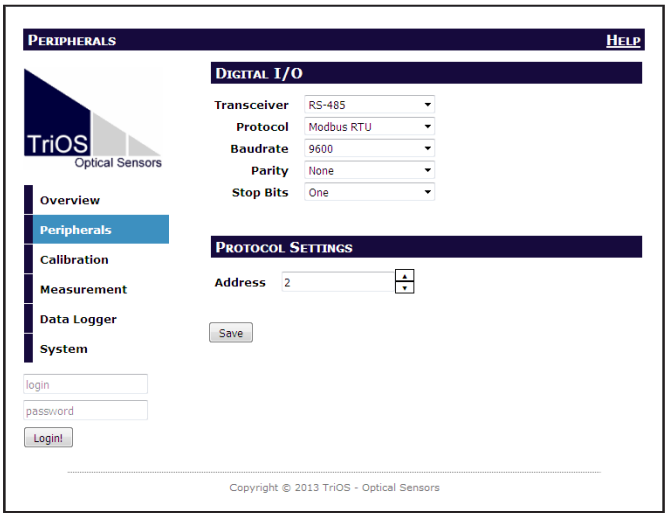
Overview

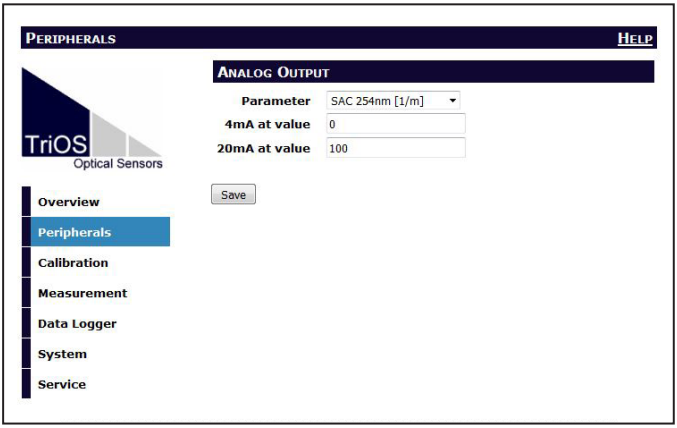
As shown in the following illustration, basic information about the sensor is summarized on the “Overview” page. This includes the device type and serial number of the sensor as well as the version number of the firmware which has been installed. The type of lamp module with the serial number is listed as well as the number of measurements, which have been carried out by this lamp module.



Peripherals

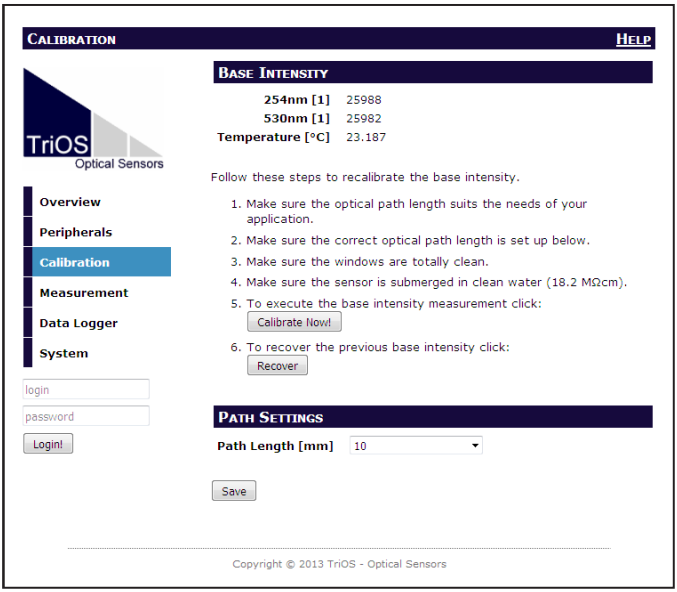
In the environment settings (“Peripherals”), various options are available depending on the version of the sensor.





Calibration

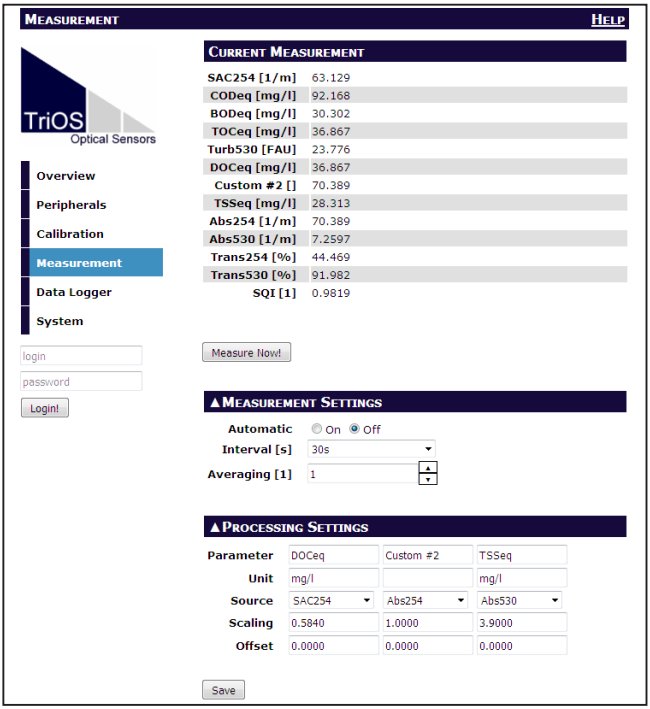
On the “Calibration” page, the zero value for the sensor can be calibrated and the optical path length can be entered.



Measurement

The “Measurement” page shows the results of the last measurement executed as well as the interval settings for the automatic measurements in the number of individual measurements which should have been averaged for the final measurement. On this page, it is also possible to scale the measured value for the SAC_{254} [1/m] to the desired parameters with the help of entries for “Offset” and “Scaling”.

The new measurement can be triggered at any time. To do this, click on the “Measure Now!” button. A new measurement will then be carried out with the saved settings. The parameters that are recorded include:



The sample view shows the values of the following parameters:

- SAC 254 nm [1/m] - absorption coefficient at 254 nm in 1/m
- CODeq [mg/L] - COD equivalent
- BODeq [mg/L] - BOD equivalent
- TOCeq [mg/L] - TOC equivalent
- Turb 530 [FAU] - turbidity
- Custom #1 - freely selectable parameter
- Custom #2 - freely selectable parameter
- Custom #3 - freely selectable parameter
- Absorbance 254 [1/m] - absorbance at 254 nm
- Absorbance 530 [1/m] - absorbance at 530 nm
- Trans 254 [%] - transmission value at 254 nm in %
- Trans 530 [%] - transmission value at 530 nm in %
- SQI [1] - Sensor Quality Index

The time interval for automatic measurements is entered in the field for “Interval[s]”. This interval should be understood as a minimum value. If the previous measurement has not yet been completed after the interval has elapsed (e.g. because the LISA UV simply needs more time to calculate the average), this previous measurement will be waited out, and the next one will be started as soon as possible.

The factory-set measurement interval recommended by TriOS Mess- und Datentechnik GmbH is 60 seconds.

If several individual measurements should be averaged for a measurement, this can be set up in the “Averaging [1]” field. Enter the number of individual measurements here.

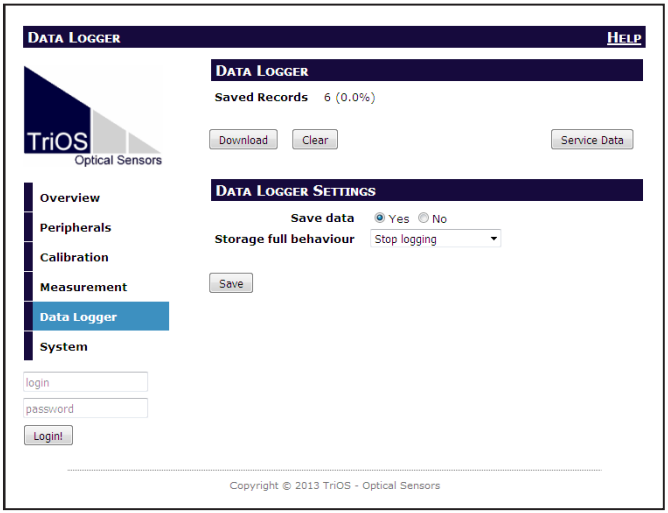
The SAC_{254} parameter [1/m] can be calculated automatically with a scaling factor and an offset for specific parameters. The scaling factor always depends on the application and must be determined by the user, with the exception of the parameters predefined by the manufacturer. The values are entered in the corresponding “Scaling” and “Offset” fields. More information on the scalable parameters can be found in chapter 5 -Customer Calibration.

Important: Changed values must be saved by clicking on the “Save” button so that they are accepted for the following measurements.

Data storage

LISA UV is equipped with a simple data logger function that allows it to save approximately28,000 measurements The data logger function is controlled on the “Data Logger” page, which is shown in the following figure.

Data storage is started by activating “Save data”. In normal operation, every measurement is stored until the memory is full. The factory-set measurement interval is set to 60 seconds, which means that the data logger will record measurements for approximately 530 hours (22 days). If “Delete oldest data” is selected under “Storage full behavior”, only the most recent recorded data is saved, and old data is overwritten.

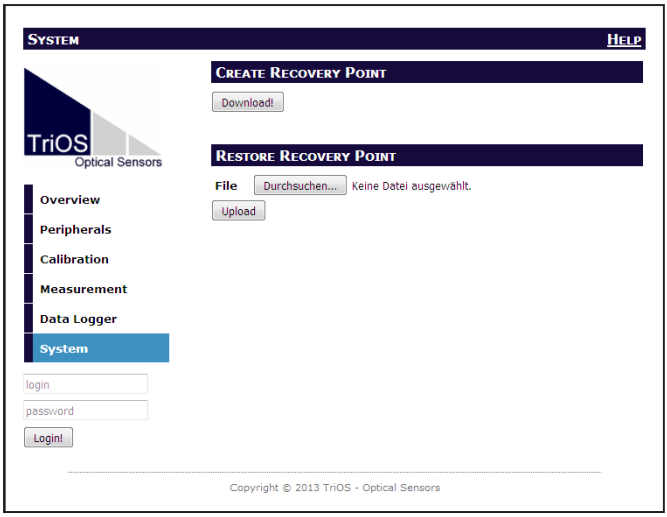


The previously stored data can be retrieved by clicking on the “Download” button. The sensor presents this data as a CSV (comma-separated values) file, which can be read by conventional spreadsheet programs.

To delete the data, click on the “Clear” button. If the subsequent confirmation prompt is confirmed, all previously stored measurements will be irrevocably deleted from the storage.

System

The “System” page is used to manage the sensor. On this page you can upload the calibration file and download the current calibration as a restore point.



Service

To use the Service function, you need a login and a password. You will receive this when you participate in a TriOS training session.

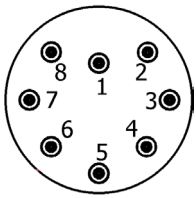
3 Commissioning

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 of the connections are connected correctly.

3.1 Electrical installation

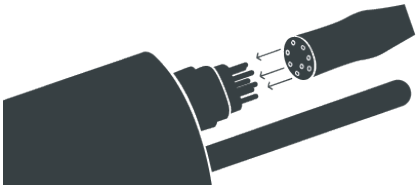
3.1.1 SubConn 8-pin Connector



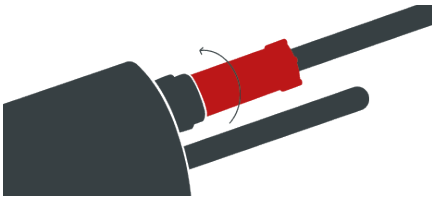
Face view (male)

DIGITAL VERSION	ANALOG VERSION
1. Ground (Power + Ser. Interface)	1. Ground (Power + Ser. Interface)
2. RS-232 RX / RS-485 A (commands)	2. analog out (4...20 mA)
3. RS-232 TX / RS-485 B (data)	3. not connected
4. Power (12...24 VDC)	4. Power (12...24 VDC)
5. ETH_RX-	5. ETH_RX-
6. ETH_TX-	6. ETH_TX-
7. ETH_RX+	7. ETH_RX+
8. ETH_TX+	8. ETH_TX+

Connect the male end of the connecting cable into the connector by making the pins align with the slots of the cable.

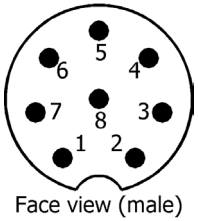


The next step is to hand-tighten the locking sleeve to secure the end of the connector into the bulkhead connection.



NOTICE **Do not twist or bend the connector when plugging or unplugging it. Insert the connector straight in and use the locking sleeve to attach the male contact pin.**

3.1.2. Fixed Cable with M12 Industrial Plug



Face view (male)

DIGITAL VERSION	ANALOG VERSION
1. RS-232 RX / RS-485 A (commands)	1. analog out (4...20 mA)
2. RS-232 TX / RS-485 B (data)	2. not connected
3. ETH_RX-	3. ETH_RX-
4. ETH_RX+	4. ETH_RX+
5. ETH_TX-	5. ETH_TX-
6. ETH_TX+	6. ETH_TX+
7. Ground (Power + Ser. Interface)	7. Ground (Power + Ser. Interface)
8. Power (12...24 VDC)	8. Power (12...24 VDC)

NOTICE **Ensure correct polarity of the operating voltage or otherwise the sensor may be damaged.**

3.2 Interfaces

3.2.1 Serial Interface

The **“digital” version** of LISA UV is equipped with a configurable digital, serial interface and provides two lines for digital, serial communication with a control unit. The RS-232 (also EIA 232) and RS-485 (also EIA 485) standards are supported, and the web interface allows switching between the two.

The digital interfaces RS-232 and RS-485 are voltage interfaces (in contrast to a current interface, as is the case withthe analog output of the “analog” version). For the RS-232, voltages of –15 V to +15 V with respect to the ground are possible. For the RS-485, voltages of –5 V to +5 V with respect to the ground are possible.

Upon delivery, the LISA UV is configured to RS-485 with the following settings:

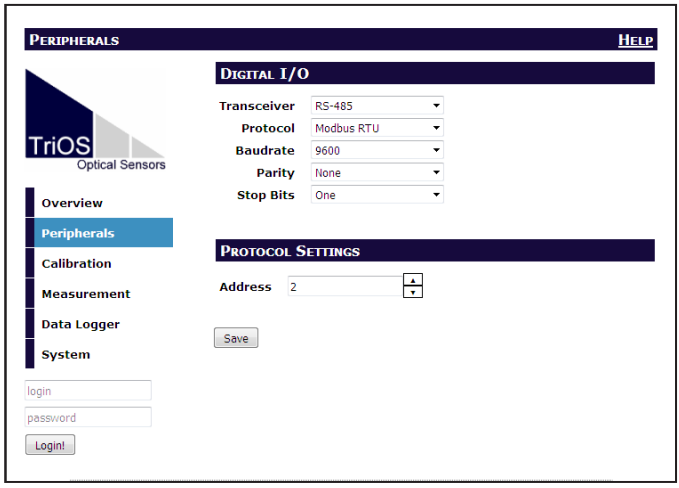
- Baud rate: 9600 bps
- Data bits: 8
- Stop bits: 1
- Parity: none

A detailed description of the Modbus protocol commands can be found in the Annex.

For the RS-232, data transmission takes place on one line per direction, with the RX cable being used for the communication from the control device to the sensor and the TX cable being used from the sensor to the control device.

RS-485 uses a differential signal where 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.

For the “digital” version, the “Peripherals” page of the web interface allows configuration of the digital interface. The following setting options are available, as shown in the following figure:



- Transceiver: The electrical connection standard can be selected here. The available choices are:
  - RS-232 (also EIA 232) and
  - RS-485 (also EIA 485)
- Protocol: Specifies the data protocol to be used. Supported:
  - Modbus RTU
- Baud rate: Specifies the transmission speed.

In the event of difficulties in the communication, try to reduce the baud rate.

- Flow control: Activates flow control at software level (XON/XOFF).

This is only supported with the internal TriOS data protocol and must be deactivated when using the Modbus RTU.

- Parity: Activates the parity check for data transmission. Possible options are:
  - None (deactivated)
  - Even
  - Odd
- Stop bits: Defines the number of stop bits.

In various Modbus devices, it may be necessary to set this to “Two” if a parity check does not need to take place.

In the “Protocol settings” section, you can input settings for the active protocol.

- In the Modbus RTU protocol, the following property is additionally available:
  - Address: This is the slave address for Modbus communication. It identifies the sensor in the bus system and must be unique.

3.2.2 Analogue Interface

For the **"analog" version** of LISA UV, a current controller is used for the analog output. This offers the advantage that the signal is not distorted by the internal resistance of the cable even over long distances, as would be the case with a voltage regulator.

The analog output is only available in the “analog” version of the sensor. An analog current signal is available from this output. This signal represents the measured value of the set parameter of the last measurement. The signal is always in the range from 4 mA to 20 mA. 4...20 mA output is linear to the measuring range. To convert the values of the mA analog output into SAC [1/m] for example, the following formula must be used:

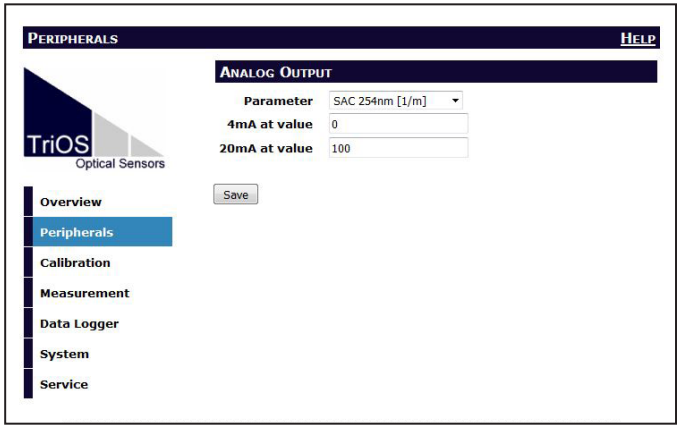
If 4 mA = 0:

$$SAC = \frac{analog\ value[mA] - 4[mA]}{16[mA]} \cdot upper\ limit\ of\ the\ measuring\ range^{*}$$

*For the SAC, the path length must be considered when determining the upper limit of the measurement range (see table p. 20).

If 4 mA ≠ 0:

$$SAC = \frac{analog\ value[mA] - 4[mA]}{16[mA]} \cdot (upper\ limit - lower\ limit)$$



The **“analog” version** offers three options on the “Peripherals” page of the web interface: the parameter to be output as well as the lower and upper limits for the linear spread of the measurement value from 4 mA to 20 mA.

- Parameter: in this field, the measured parameter, which should be output by the analog output, is set.
- 4 mA at value: specifies the lower limit for the linear spread of the measurement value.
- 20 mA at value: Indicates the upper limit for the linear spread of the measurement value.

Important: Changed values must be saved by clicking on the "Save" button in order for them to be accepted.

NOTICE **Observe the measurement ranges of the parameters as a function of the path length of the sensor!**

Output parameter SAC_{254}

In the table, the measurement range SAC_{254} [1/m] depends on the path length, which absolutely must be taken into consideration when configuring the analog output.

Path length (mm)	Measurement range SAC_{254} [1/m]
50	0...30
10	0...150
5	0...300
2	0...750
1	0...1500

The factory-set default setting for the analog output, for a 50-mm path for example, is configured as follows:

- SAC_{254} = 0 [1/m] corresponds to 4 mA analog
- SAC_{254} = 30 [1/m] corresponds to 20 mA analog

Output parameter transmission

The factory-set default setting for the analog output for transmission is configured as follows:

100 % transmission = 20 mA

0 % transmission = 4 mA

3.2.3 Network

For the TriOS G2 sensors, the IEEE 802.3 10BASE-T-compliant Ethernet interface is used as a universal interface. This makes it possible to connect a single sensor or even to build a complex sensor network.

Network with a single G2 sensor

The easiest way to connect to the LISA UV is with the G2 InterfaceBox. It serves as both the connection and the power supply for the sensor and can be used with all TriOS G2 sensors.

The following figure shows a connection to a single sensor:

The TriOS G2 InterfaceBox translates the 8-pin M12 sensor plug to the conventional power supply connections (2.1 mm barrel connector) and to the network access (RJ45 socket).

G2 InterfaceBox

There are three connectors on the housing of the G2 InterfaceBox:

1. Power supply 12 or 24 VDC; 2.1 mm barrel connector
2. Sensor connector 8-pin M12
3. Ethernet connection RJ45 socket

The G2 InterfaceBox WiFi differs slightly from the illustration shown here. Further information regarding the G2 InterfaceBox WiFi can be found in the corresponding Quick Start Guide.

Proceed as follows to connect the sensor to an Ethernet-capable device via the G2 InterfaceBox:

Step 1) Make sure that the Ethernet adapter of your device is configured to automatically obtain the network settings (IP address and DNS server).

Step 2) Plug the M12 plug on the cable end of the sensor into the M12 socket (2) of the G2 InterfaceBox and tighten the screw plug.

Step 3) Connect the 12 or 24 VDC power supply to the G2 InterfaceBox to supply the sensor with power.

Step 4) Wait at least 3 seconds before you connect your Ethernet LAN cable with your Ethernet-capable device and the G2 InterfaceBox.

The web interface can be viewed with any browser via the following URL:

http://lisa/

http://lisa_3XXX/ (3XXX is the serial number)

http://192.168.77.1/

If the web interface cannot be accessed, make sure that the LAN cable was connected after the sensor was connected to the power supply and try all three URL options.

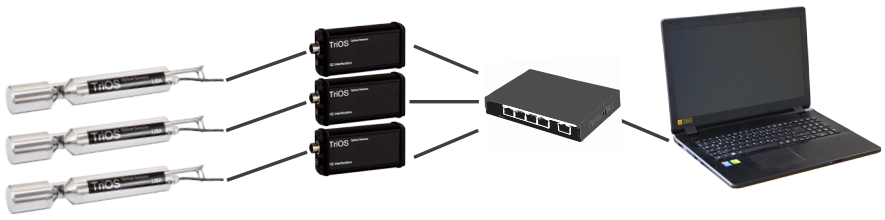
Automatic measurement by the LISA UV is stopped when an Ethernet-capable device is connected. As soon as the LAN connection between the sensor and the Internet capable device is disconnected, the measurements will be continued at the set interval if the timer is activated.

Network with multiple G2 sensors

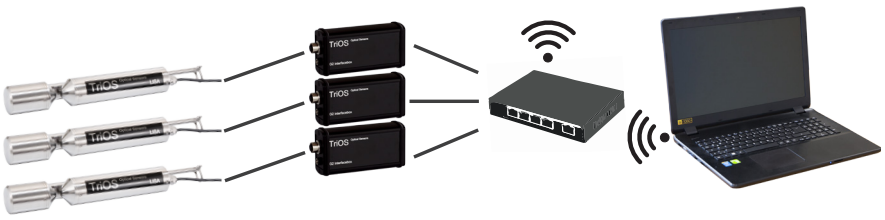
By using an Ethernet switch / hub or a conventional router, it is possible to connect multiple sensors into a complex network and use them simultaneously. In the sensor network, each sensor must have its own G2 InterfaceBox for power supply.

Like any G2 sensor, the LISA UV delivers a simple DHCP server as well as a simple DNS server, which is configured exclusively for direct connection, as described in the previous section. For a complex sensor network, the servers must be supplied by the user. The LISA UV recognizes these automatically and then turns off the internal servers. Ask your network administrator for advice on how this can best be implemented in your case.

The following illustrations show examples of different ways to set up a sensor network.



G2 sensors	G2 InterfaceBox	a) Ethernet switch / hub b) Router with DHCP server	a) Ethernet-capable device with DHCP server b) Ethernet-capable device



G2 sensors	G2 InterfaceBox	a) Access point b) Wireless router with DHCP server	a) Wireless-capable device with DHCP server b) Wireless-capable device

LISA UV can only be used by one Ethernet-capable device at one time.

If several sensors are used in a network, the web interface can be reached via the host name http://lisa_3XXX/ (3XXX is the serial number) or via the IP. Ask your network administrator for advice.

NOTICE	**Damage caused by improper use is not excluded from the guarantee!**

4 Use

The LISA UV can be operated with all TriOS controllers. Instructions for correct installation can be found in the controller manual.

NOTICE **Never transport the sensor by holding the cable.**

4.1 Normal Operation

4.1.1 Diving Operation

For immersion operation, the LISA UV can be completely or partially immersed in the water / measuring medium. To make a correct measurement, the measuring window must be completely immersed and free of air bubbles. Use the mounting rod with a shackle and a stainless steel chain or a steel wire to hang the device in the medium. Do not use the sensor cable to carry the device, and do not pull on the cable The LISA UV can also be attached with suitable hydraulic clamps, as shown in the following illustration. Make sure to use suitable brackets with an inner diameter of 48 mm (not for the deepsea version). To protect the housing pipe against excess pressure at certain points, install the brackets close to the device covers. Fitting brackets can be obtained from TriOS.

When immersing the sensor, make sure there are no air bubbles in front of the sensor discs. If there are air bubbles in front of the window, carefully shake the sensor until the bubbles have been removed.

4.1.2 Cleaning System

LISA UV is equipped with innovative antifouling technology to prevent pollution and dirt from attaching to the optical window: nano-coated window in combination with compressed-air cleaning.

Nano-coating

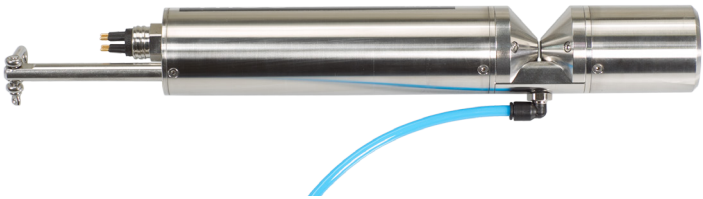
All of the optical windows from TriOS are treated with a nano-coating.

Window with nano-coating | Window without nano-coating

Wetting of the surface of the coated glass is significantly lower. This effect creates a nano-coated surface on the glass, to which dirt cannot adhere. In combination with the compressed-air cleaning, the windows are kept clean for long periods of time, reducing the amount of cleaning necessary.

Compressed air cleaning

The LISA UV can be modified with the optional compressed-air cleaning head. The head has an air outlet directly on the window plate of the device and a hose fitting for the compressed-air connection. TriOS controllers have valves which allow fixed cleaning intervals to be set and controlled by software. For this, compressed air of between 3 and 6 bars must be provided.



NOTICE	**The optimum pressure for compressed-air cleaning is 3 to 6 bars. The total length of the hose should not exceed 25 meters* (polyurethane, 6 mm outer diameter, 4 mm inner diameter).**

To connect the hose, push the hose into the matching connection port. To remove the hose, press the blue locking ring in the direction of the connection and pull the hose out. Secure the hose to the device and the cable with cable ties if necessary to avoid uncontrolled hits and movement of the compressed-air hose.

NOTICE	**The pressure should not exceed 7 bars! This may damage the valve!**

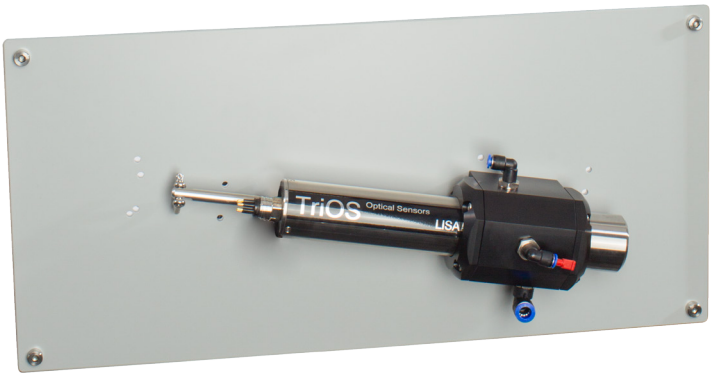
***Suitable hoses are available from TriOS.**

4.1.3 Float

The float is the ideal solution for fluctuating water levels.

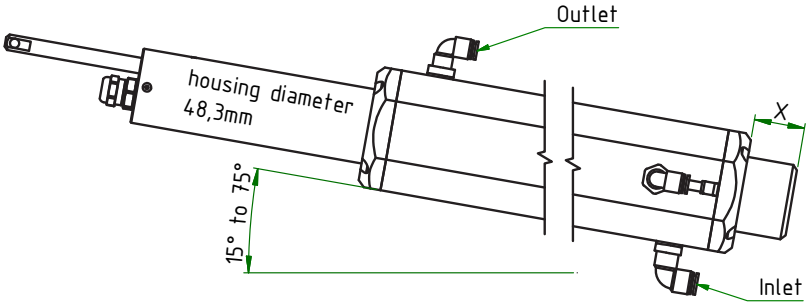
4.2 Bypass

With the optional flow cell, the LISA UV can be installed as a bypass. Along with the flow cell, a panel is available on which the LISA UV and the flow cell can easily be mounted.



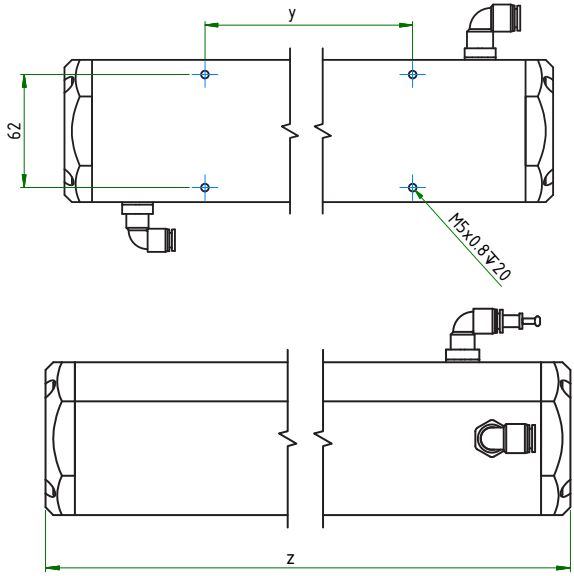
NOTICE **The maximum pressure in the flow cell must not exceed 1 bar. Make sure that the sensor is installed in the correct position to guarantee the free flow of water.**

The flow cell of the LISA UV has three hose connections. The inflow has an 8-mm hose connection and is located on the right side of the flow cell. There is a 6-mm outlet hose connection on the left side of the cell. Finally, there is a third hose connection on the top of the cell which can be used for cleaning with fluids. If this inlet is not being used, it should be sealed with a plug.



Because the LISA UV is available in different path lengths, the dimensions of the associated flow cells vary accordingly, as described in the following table:

Path length (mm)	x [mm]	y [mm]	z [mm]
1	33.5	62	108
2	33.5	62	108
5	33.5	62	108
10	33.5	62	108
50	32.5	96	150

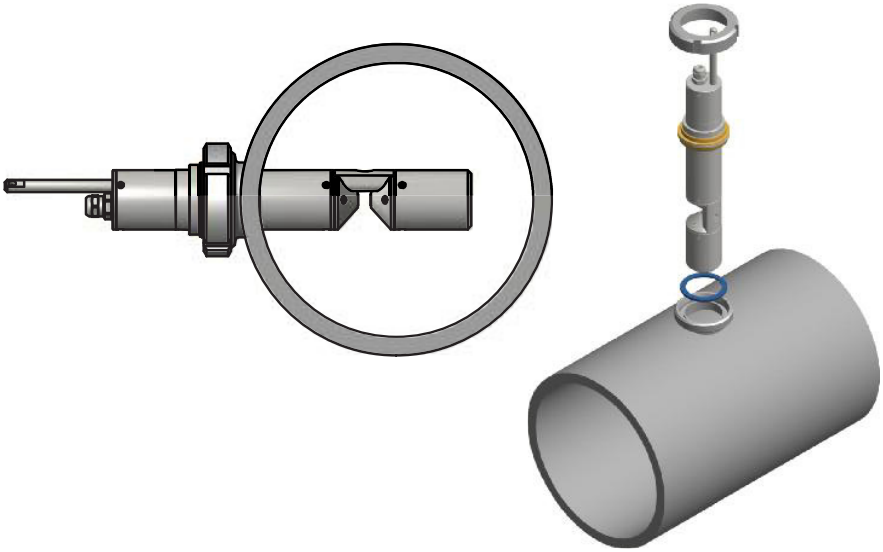


The hoses are installed by putting light pressure on the hose connectors. To remove the hoses, press on the locking ring on the hose connector and carefully pull the hose away.

NOTICE **The flow cell cannot be combined with the compressed-air cleaning.**

4.3 Tube Installation

The LISA UV can be mounted directly in the pipe (either with the special flanged version of the sensor or installation by the customer on-site). In the case of a grounded tube, no additional grounding of the sensor housing is required (as long as there is no insulation between the tube and the sensor). One of the flange solutions available from TriOS is shown in the figure below.



4.4 Use with Cuvette

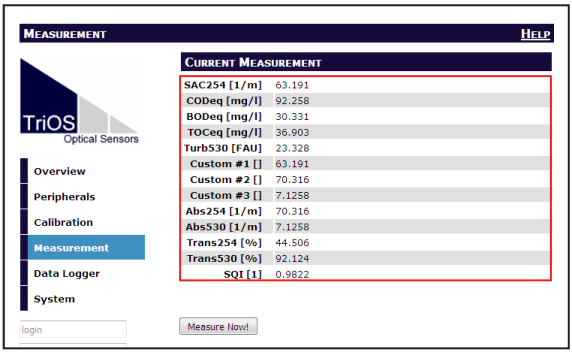
For laboratory measurements and very small quantities of water, the LISA UV with a path length of 10 mm or more can be outfitted with a cuvette holder (ItemNo. 10A200000) for standard 5-mm cuvettes.

To take measurements with cuvettes, a new zero value must be set. Before taking a new zero value, the current calibration should be downloaded and stored so that later it can be uploaded again when using the sensor in the submerged state (Restore Point, see chapter 6.3.1).

5 Calibration

5.1 Manufacturer Calibration

All TriOS sensors are delivered calibrated. The calibration factors of the LISA UV are stored in the sensor,meaning that all values that are output (digital or analog) are calibrated values.



The conversion of the spectral absorption coefficient to the scaled measurement parameter is carried out using the following equations.

The offset and scaling factor are stored in a sensor for the measurement parameter.

The manufacturer calibration of the sensor is carried out as follows:

- The offset is determined by measuring in ultra-pure water (free of humic and fulvic acid, 18.2 MΩcm water)

$$A = Raw - Offset$$

- The scaling factor for each measurement range is determined by using the respective calibration standard.

$$B = A \cdot lin$$

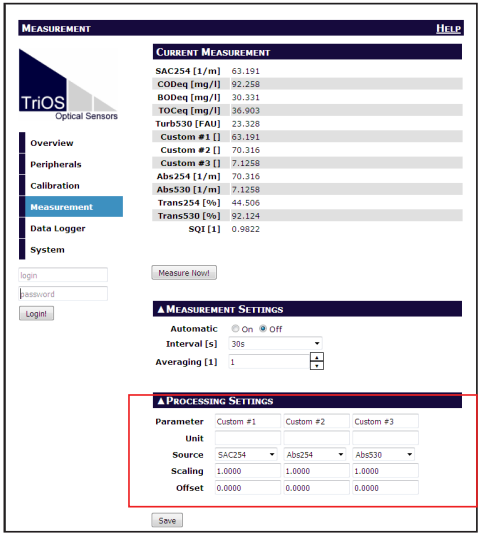
where:

A	offset corrected value
Raw	raw data
Offset	offset value
B	concentration of the substance in physical units
lin	scaling factor

The manufacturer calibration should not be changed!

5.2 Customer calibration

The sensor can be adapted to laboratory analyses and local conditions with other calibration factors. This is set using the scaling function of the controller or directly in the browser of the sensor. To do this, open the “Measurement” submenu in the browser. The customer calibration or local calibration supplements the manufacturer calibration. The manufacturer calibration values are not changed by the customer calibration.



The customer calibration can be used as a fine adjustment of the sensor for special media and supplements the manufacturer calibration.

Before recording measurement values, check the zero value of the sensor with their reference solutions. If necessary, determine a new zero value (see chapters 6.2.1 and 6.3.1).

The local calibration is adjusted using a linear equation. Two constants will be needed for this, the scaling factor and the offset, which can be used according to the following equation:

$$A = SAC - offset$$

$$B = A \cdot scaling$$

With *A* being the SAC output, which is output by the LISA UV.

A	offset corrected value
Offset	offset value
B	customer calibrated parameters

For local calibration, at least two data points, i.e. a laboratory value and a sensor value, are required. The easiest way to do this is to use a non-contaminated sample and a contaminated sample.

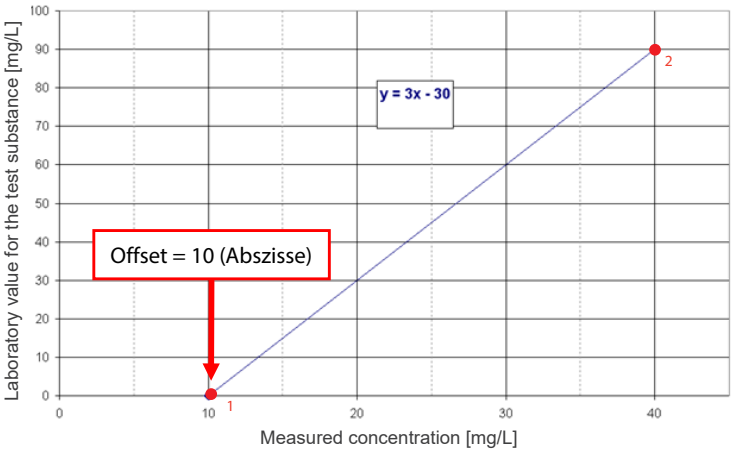
1. The non-contaminated sample is used to determine the offset. To do this, immerse the photometer in the uncontaminated liquid. In this specific case, the signal gives the value of the offset directly for local calibration.

   $$offset = measuredvalue1$$

   If a non-contaminated sample is not available, the equation in point 5 below offers another option.

2. Now immerse the sensor in the contaminated medium and note down measuredvalue2, which is output by the photometer, and do a laboratory analysis of the sample.

3. Make a diagram like the one shown below and connect the two data points with a straight line. The slope of the straight line is the scaling factor.



4. The scaling factor can be calculated using the following equation:

$$scaling\ factor = \frac{lab}{measuredvalue2 - offset}$$

Where lab is the laboratory value, and measuredvalue is the value output by the sensor.

For the previous example in the figure, this means:

$$scaling\ factor = \frac{90\ \text{mg/L}}{(40 - 10)\ \text{mg/L}} = 3$$

5. If a non-contaminated sample is not available, at least two samples with very different levels of contamination are needed. In this case, first calculate the scaling factor as follows:

$$scaling\ factor = \frac{(lab2 - lab1)}{(measuredvalue2 - measuredvalue1)}$$

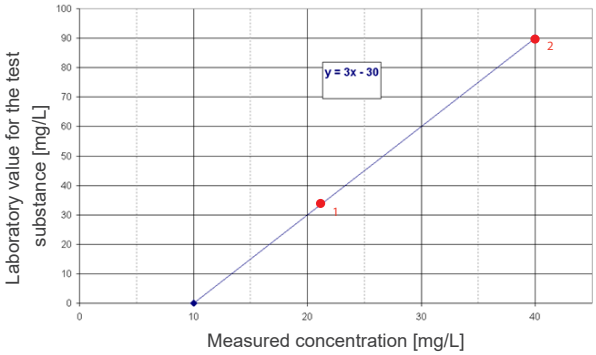
Calculation of the offset without zero-point measurement (1.):

$$offset = measuredvalue2 - \frac{lab2}{Scaling\ factor}$$

measuredvalue2 should be significantly larger than measuredvalue1. The offset can also be found using the abscissa of the straight line (intersection with X axis). For the above example, this means:

$$scaling\ factor = \frac{90 - 30}{40 - 20} = 3$$

$$offset = 40 - \frac{90}{3} = 40 - 30 = 10$$



All TriOS controllers have the ability to set scaling factors and offset values for the measurement parameters. Please refer to the appropriate manual. Make sure not to carry out double scaling with the sensor: once in the G2 sensor menu directly and once more with the TriOS controller!

Customer calibration can be used as a fine adjustment of the sensor for special media and is not intended to replace the manufacturer calibration.

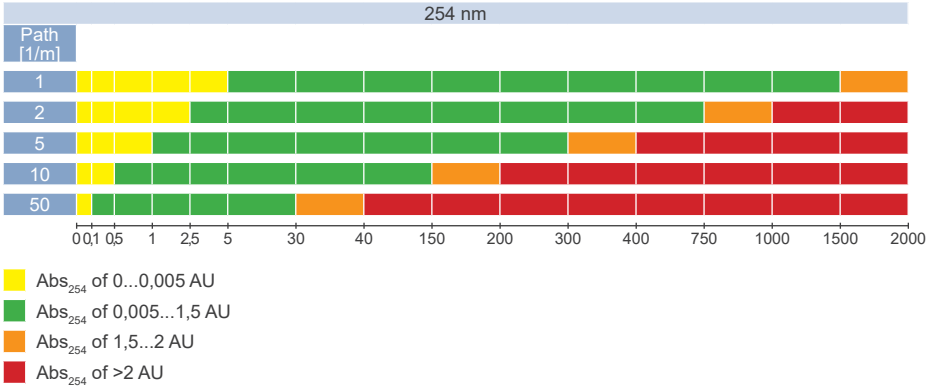
NOTICE **Measurement ranges and detection limits of the scaled parameters are dependent on the scaling factor!**

5.3 Measurement properties

Ideally, the optical path is chosen so that the absorption at 254 (Abs254) does not exceed 1.5 AU and the absorption at 530 (Abs530) does not exceed 0.5 AU. If the absorption at 254 nm is more than 2 AU or at absorption 530 nm more than 0.8 AU, the measured values can deviate considerably or can no longer be calculated (output NaN).

The path length must be chosen according to the absorption level of the medium.

Absorption limits at 254 nm and 530 nm in AU and 1/m



If the difference ($A_{254} - A_{530}$) results in a negative value when calculating the SAC, the result is invalid and output as NaN. If this is the case, the zero value should be checked.

6 Malfunction and Maintenance

To ensure an error-free and reliable measurement, the device should be periodically checked and maintained. The sensor must first be cleaned.

6.1 Cleaning and Upkeep

Vegetation deposits and dirt depend on the medium and the duration of exposure in the medium. Therefore, the degree of pollution depends on how the sensor is used. For this reason, it is not possible to give a general answer regarding how often the sensor should be cleaned.

Normally, the system is kept clean by the nano-coated window and, additionally, the air cleaning system. If the contamination is too bad, follow the instructions below.

6.1.1 Cleaning the Enclosure

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

To loosen dirt, we recommend soaking the sensor for several hours in a rinsing solution. 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.

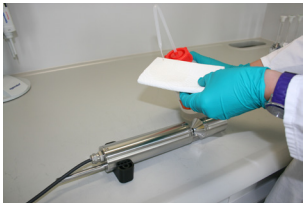
If the sensor is very dirty, additional cleaning with a sponge may be necessary. You should exercise extreme caution to avoid scratching the glass of the optical path.

In the case of calcification, a 10% citric acid solution or acetic acid can be used for cleaning.

Brownish dirt or spots can be contamination from iron manganese oxides. For this type of contamination, a 5% oxalic acid solution or a 10% ascorbic acid solution can be used to clean the sensor. Please note that the sensor should only briefly come in contact with the acid, and then it should be thoroughly rinsed.

NOTICE

Under no circumstances should the sensor 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 should have a titanium housing.


6.1.2 Cleaning the Measuring Window

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

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

NOTICE

Do not use any aggressive cleaning solutions, putty, sandpaper or cleaning solutions that contain abrasive substances to remove dirt.

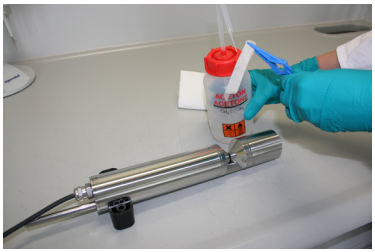
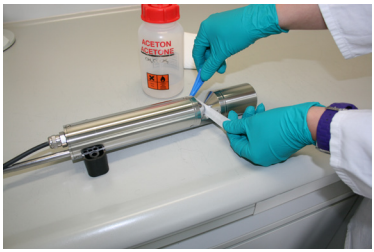
Damaged windows can be replaced by TriOS Mess- und Datentechnik GmbH Customer Service. Please contact our TriOS Customer Service at support@trios.de or your dealer.

NOTICE

After replacing the measuring windows, carry out a new zero-value measurement.

NOTICE

When replacing the measuring windows, make sure that the O-ring is inserted.

6.1.3 Preparing the Sensor for the Function Test and Zero Value Determination

Clean the probe as described in chapter 6.1.1. At the end of the cleaning process, rinse the probe carefully with deionized water. Dry the sensor with a paper towel. Wipe the sensor off with a little acetone on a kitchen towel to remove any greasy residues.

⚠ CAUTION **For your own safety, you must wear the appropriate gloves and protective goggles!**

Clean the sensor window with special optical paper or a soft, lint-free cloth and a few drops of acetone according to the previous instructions on cleaning the measuring window.

Important: Polish the window next with a soft dry cloth or special optical paper to remove the thin film that may have appeared while cleaning the window.

NOTICE **Damage caused by improper cleaning is not covered by the warranty!**

Have a suitable measurement container filled with ultra-pure water ready nearby. Before this step, the measurement container should already have been cleaned carefully with a detergent solution and rinsed with ultra-pure water.

Immerse the sensor in the container, which has been sufficiently filled with ultra-pure water so that the measuring windows are completely covered by water. Wait 10 – 15 minutes. During this time, hidden dirt can come loose from the sensor.

Remove the probe from the water and rinse it with ultra-pure water. Fill the container once more with fresh ultra-pure water and immerse the sensor again. Lift the probe and move it around in the water to remove any air bubbles that may have formed. Carry out the function test or the calibration of the sensor.

The sensors should be positioned diagonally in the measurement container, if at all possible, to prevent very small, almost invisible air bubbles collecting at the top of the measuring window. When using an upright measuring cylinder which requires the sensor to be positioned vertically, make sure to watch out for air bubbles in the optical path.

Make sure it is sufficiently stable!

6.2 Maintenance and Inspection

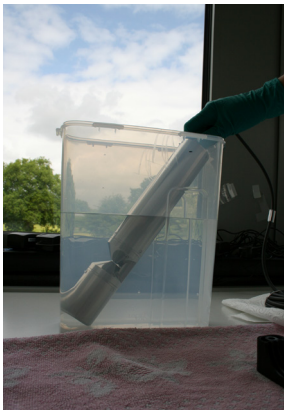
NOTICE	**Avoid touching the glass parts of the optical window, since these can become scratched or dirty. If this happens, the functionality of the device can no longer be guaranteed.**

6.2.1 Checking the Zero Value

Prepare the sensor for the zero-value check as described in the previous chapter.

We recommend using the TriOS VALtub to check and determine the zero value, because this seals the optical path optimally and allows for a fast zero-value measurement. Make sure that the O rings of the VALtub are positioned exactly over the seals of the sensor.

Alternatively, another container suitable for immersion can be used. When taking a measurement, the optical path must always be completely immersed in the water.



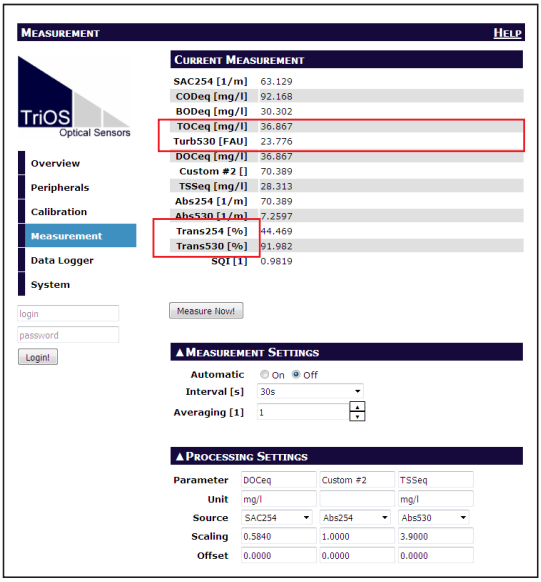
The zero value of the LISA UV is checked via the web interface. To access the web interface, you will need the G2 InterfaceBox and an Ethernet-capable device with a web browser, such as a notebook / laptop.

Before the zero value check, the sensor is prepared as described in chapter 6.1.3. Rinse the properly cleaned sensor carefully with deionized water and immerse it in a container of ultra-pure water. The optical path must be completely in the water. Watch for air bubbles!

Carry out the zero-value determination at an ambient temperature of 20°C, if at all possible. The temperature of the ultra-pure water should also be 20°C.

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.
- Be sure to use highly pure water (ultra pure, resistance of 18.2 MΩcm) or distilled water.
- If impurities appear in the water during the test, it must be replaced.
- Make sure there are no air bubbles in front of the measuring windows. Even very small air bubbles in front of the measuring windows can cause a transmission of 97% or less.



We recommend carrying out at least five individual measurements in “Measurement” prior to the check, to bring the sensor up to operating temperature.

Limit values for the determination of zero values

To obtain reliable values, a defined value range should not be exceeded when checking the zero value.

SAC

If the measured value for the SAC_{254} in ultra-pure water is more than specified in the following table, clean the measuring window again and repeat the process of checking the zero value. If the value again exceeds the limit, first check the sensor settings and the ammeter. If the sensor settings are correct and errors in the output system can be ruled out, the sensor should be recalibrated.

Path length (mm)	Permitted minimum measuring value range for SAC_{254} [1/m]	Permitted maximum analog output [mA]
50	0…1	4.53[1]
10	0…5	4.53[1]
5	0…10	4.53[1]
2	0…25	4.53[1]
1	0…50	4.53[1]

For analog LISA with 10 mm path:

SAC 0 [1/m] ≙ 4mA

SAC 150 [1/m] ≙ 20mA

[1]Calculation: value Analog [mA] $= \frac{x - min}{max - min} - 16\ mA + 4\ mA$ with min < x < max

x = max. Value from minimum measuring range in [1/m]

min = lower limit;

max = upper limit

Transmission

Check the zero value with approximately 5 measured values.

- Start the measurements on the controller with an interval of 60 seconds or carry out about 5 individual measurements via the web interface. Document the following measured values: transmission 254 nm and transmission 530 nm.
- If less than 90% transmission is displayed, clean the measuring window again and then carry out the zero-value check once more.
- If the display for transmission is repeatedly below 90%, recalibrate the sensor or carry out a new zero-value measurement of the sensor in ultra-pure water (see chapter 6.3.1).

Zero Value at the Analog Output

Normally the zero value of the measured value SAC_{254} corresponds to an analog output of 4 mA.

Zero values for transmission show a transmission value at 100%. In general, this value corresponds to an analog output of 20 mA.

In the event of a deviation of more than 10% of the transmission, which corresponds to less than 18.4 mA (display of 90% transmission) analog, first check the sensor settings and the ammeter. If the sensor settings are correct and errors in the output system can be ruled out, the sensor should be recalibrated or a new zero-value measurement of the sensor should be carried out (see chapter 6.3.1 "Determining New Zero Point").

6.2.2 Checking the Maximum Value

The maximum value can only be checked if the two transmission values are available.

Hold a piece of cardboard in the optical path so that no light can fall on the detector. The following measured value shows 0% transmission. As a rule, this value corresponds to an analog output of 4 mA. If this value is greater than 4.5 mA (corresponding to 3% transmission), first check the sensor settings and the ammeter. If the sensor settings are correct and errors in the output system can be ruled out, please contact TriOS Mess- und Datentechnik GmbH Customer Service.

6.3 Troubleshooting

6.3.1 Determining the New Zero Point

Before you determine a new zero point, we recommend you save the current calibration so that this is recoverable at a later point in time.

By clicking on the “Download” button, the current calibration of the sensor can be downloaded and saved, for example, on a PC. The LISA UV presents all relevant data in the form of a calibration file, as can be seen in the figure below. This file must be stored and kept safe.

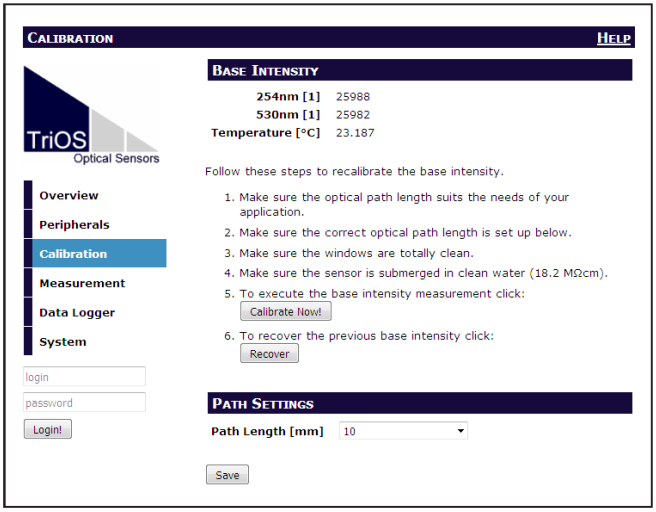
Before the actual calibration, we recommend carrying out 3-5 individual measurements in “Measurement” to bring the sensor up to operating temperature.

Carry out the zero-value determination at an ambient temperature of 20°C, if at all possible. The temperature of the ultra-pure water should also be 20°C.

During calibration, the base intensity I_0 for both LEDs is determined anew.

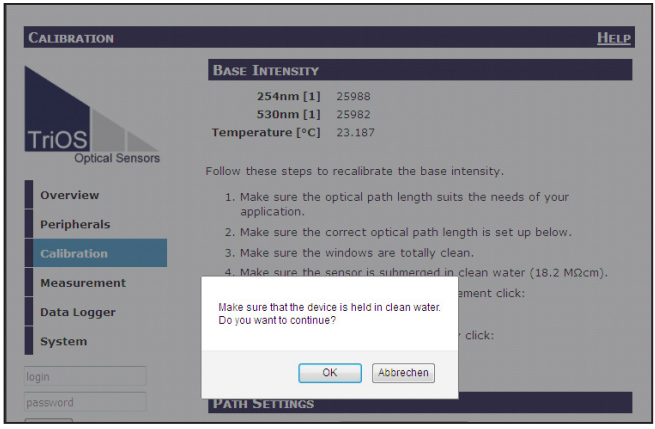
NOTICE **The values under “Base Intensity” must not be less than 13000 for either wavelength.**

The base intensity for the zero value is delivered factory-set at 26000 for both LEDs. The values under "Base Intensity" must not be less than 13000 for either wavelength. This corresponds to a light intensity of approximately 50% of the output intensity. If the “Calibrated Raw” values are below that, you should first make sure the measuring window is clean and the ultra-pure water is pure. If the zero-value measurement is repeatedly below 14000, the sensor should be sent to TriOS Mess- und Datentechnik GmbH for maintenance.



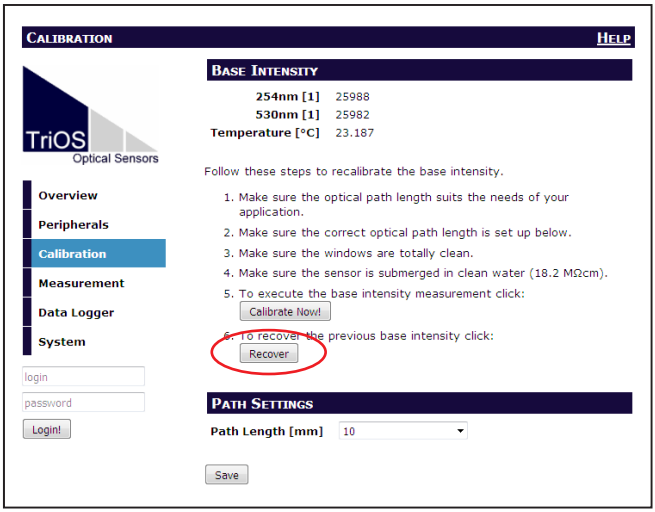
If a new customer calibration is carried out under “Calibration”, the path must be set correctly beforehand, otherwise the parameter will not be calculated correctly.

The zero value determination is carried out by clicking on the “Calibrate Now!” but and confirming the security query. For this procedure, the cleaned sensor must be immersed in ultra-pure water.



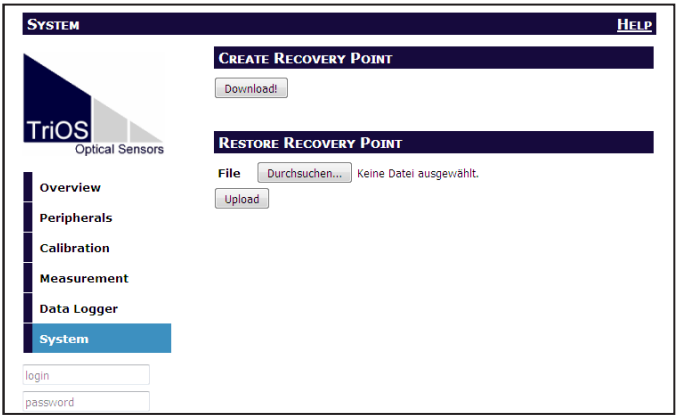
6.3.2 Restore Point

The previous zero-value measurement can be restored by clicking on “Recover” (page "Calibration").

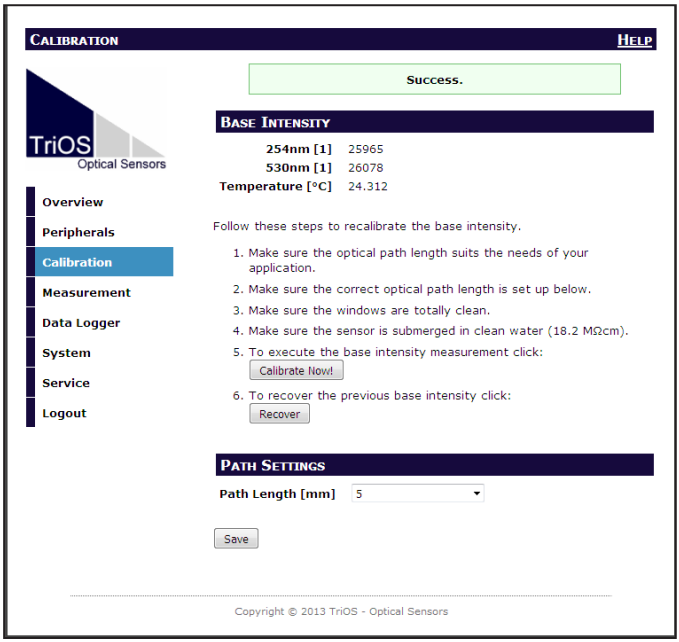


NOTICE **An incorrect zero-value measurement can result in completely false measurement results!**

The “Upload” function on the “System” page allows a previously downloaded calibration to be restored or a calibration file created by the service of TriOS Mess- und Datentechnik GmbH to be installed on the sensor.



Enter the storage path for the appropriate calibration file in the “File” field or select it with the help of the file dialogue by clicking on the “Browse...” button. Next, click on the “Upload” button to begin the transfer. When the process has been successfully completed, this will be indicated by a green “Success” box. If the process is not successful, a red box will be displayed with an error message.

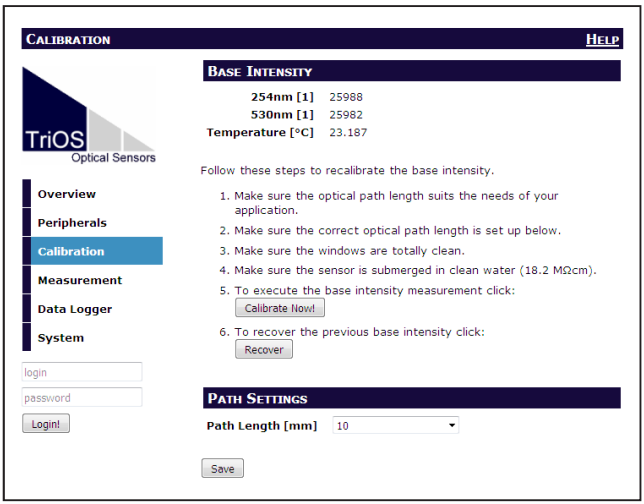


The following error messages and warnings are possible:

- **File not OK.** The calibration file could not be read correctly. Make sure that you have selected the correct file and repeat the process. If the error persists, please contact TriOS Customer Service at support@trios.de.
- **Device type or serial number does not match.** The calibration file is not suitable for the currently connected sensor. Make sure that the correct calibration file has been selected.

6.3.3 Measurements with Cuvette

As already mentioned in chapter 4.4,measurements with a cuvette are also possible. In this case, it is absolutely necessary to determine a zero point. In each case, save the current zero point so that you can use the adapted calibration again later during immersion operation.



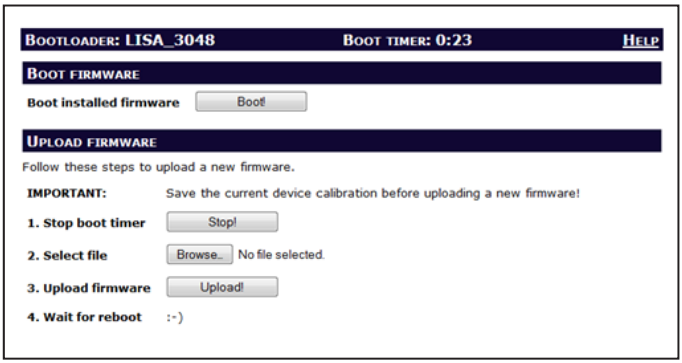
The path length is entered in the combination field "Pathlength [mm]". Possible path lengths are 0.3, 1, 2, 5, 10, 50, 100, 150 and 250 mm.

When taking measurements with a cuvette, the length of the cuvette must be set as the path length.

Important: After the path length has been selected, this setting must be saved by clicking the “Save” button so that it is applied for the following measurements.

6.3.4 Firmware updates

LISA UV offers the option of updating the firmware,i.e. the operating system of the sensor with all of its functions and setting options, via the bootloader. A view of the bootloader is shown in the following figure.



Proceed as follows to access the bootloader. First, make sure that the Ethernet adapter of your Ethernet-capable device is set as follows:

- IP: 169.254.77.2
- Subnetmask: 255.255.0.0
- no standard gateway
- no DNS server

Next, carry out the following steps:

1. Connecting the sensor to the G2 InterfaceBox. Do not yet switch on the power supply.
2. Connect the LAN cable to your Ethernet-capable device and the G2 InterfaceBox.
3. Now switch on the power supply of G2 InterfaceBox.
4. Open the URL in the web browser of your device: http://lisa_3XXX/ (3XXX is the serial number) or http://169.254.77.1/ The bootloader is displayed as shown in the figure above.
5. Stop the “Boot timer”.
6. To install a firmware update, enter the path to the firmware file (this is usually named „LISA_YYYY.MM.DD.hex") in the "File" field, or select it by clicking on "Browse...". Next, click on the “Upload!” button to start the process.
7. Wait until the message "success. Please wait…." appears.
8. Reset the Ethernet adapter to automatically obtain an IP address.
9. Request the sensor again using http://lisa_3XXX/ or http://192.168.77.1/.
10. The usual overview page will appear again.

Attention: There is only a limited time of 30 s to get into the bootloader. If this amount of time is exceeded or if the bootloader view does not appear, remove the sensor power supply again and repeat the above procedure starting at step 4.

NOTICE	Do not switch off the sensor during the update process!

NOTICE	The loss of operating voltage during the update process can lead to a total loss of the sensor.

If the update is successful, this will be indicated by a green “Success.”box.

If an error occurs during the update process, this will be indicated by a red box with a corresponding error message.

The following is a list of possible error messages:

- **"File not found"** No firmware was found in the internal buffer. Try the update again. If the error persists, please contact the technical support of TriOS Mess- und Datentechnik GmbH via support@trios.de.
- **"File not OK"** An error occurred while transferring the firmware file. Make sure the correct file is selected and try the update again. If the problem persists, please contact the technical support of TriOS Mess- und Datentechnik GmbH via support@trios.de.
- **"Internal writing error"** An error occurred while writing the internal buffer. Try the update again. If the error persists, please contact the technical support of TriOS Mess- und Datentechnik GmbH via support@trios.de.
- **"Firmware type does not match"** Make sure that the correct file is selected. Is the firmware file a LISA UV sensor firmware? Does the hardware version of your sensor match the firmware file (analog or digital)?

To leave the bootloader without making changes, first reset the Ethernet adapter to “Obtain IP address automatically” and then click on the “Boot!” button. After a few seconds, the usual overview page will be displayed, and you can use the sensor.

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

Measurement technology	Light source	2 LED (254 nm, 530 nm)	
	Detector	Photodiode	
Measurement principle		Attenuation, transmission	
Optical path		0,3 mm, 1 mm, 2 mm, 5 mm, 10 mm, 50 mm	
Parameters		SAC_{254}, CODeq, BODeq, TOCeq, UVT, Turb 530	
Measurement range		see parameter list p.46	
Repeatability		0.2%	
Turbidity compensation		at 530 nm	
Data logger		~ 2 MB	
Reaction time T100		4 s	
Measurement interval		≥ 2s	
Housing material		Stainless steel (1.4571/1.4404) or titanium (3.7035)	
Dimensions (L x Ø)		300 mm x 48 mm (with 10 mm path)	~ 11.8” x 1.9” (with 10 mm path)
Weight	stainless steel	~ 2.3 kg (with 10 mm path)	~ 5.1 lbs (with 10 mm path)
	titanium	~ 2.1 kg (with 10 mm path)	~ 4.6 lbs (with 10 mm path)
Interface	digital	Ethernet (TCP/IP)	
		RS-232 or RS-485 (Modbus RTU)	
	analog	Ethernet (TCP/IP)	
		4...20 mA, max. load: 500 Ohm	
Power consumption		≤ 1 W	
Power supply		12...24 VDC (± 10 %)	
Required supervision		≤ 0.5 h/month (typical)	
Calibration/maintenance interval		24 months	
System compatibility		Modbus RTU	
		or: Analog Out (4...20 mA)	
Warranty		1 year (EU & USA: 2 years)	

INSTALLATION

pressure	with Subconn	30 bars	~ 435 psig
	with fixed cable	3 bar	~ 43.5 psig
	in flow cell	1 bar, 2...4 L/min	~ 14.5 psig at 0.5 to 1.0 gpm
Protection type		IP68	NEMA 6P

Sample temperature	+2...+40 °C	~ +36 °F to +104 °F
Ambient temperature	+2...+40 °C	~ +36 °F to +104 °F
Storage temperature	-20...+80 °C	~ -4 °F to +176 °F
Inflow velocity	0,1...10 m/s	~ 0.33 fps to 33 fps

7.2 Measuring Ranges and Detection Limits*

The following table provides an overview of the measurement ranges of various parameters as a function of the path length:

Parameters	Unit	Factor	Measurement range				
			1 mm	2 mm	5 mm	10 mm	50 mm
SAC_{254}	1/m		5...1500	2.5...750	1...300	0.5...150	0,1...30
COD_{eq}**	mg/L	1.46	8...2200	4...1100	1.5...440	0.8...220	0.15...45
BOD_{eq}**	mg/L	0.48	2.5...700	1.25...350	0.5...140	0.25...70	0.05...15
TOC_{eq}**	mg/L	0.584	3...880	1.5...440	0.6...175	0.3...90	0.06...20
$Turb_{530}$	FAU***	3.2054 / 0.096	20...4000	10...1400	4...420	2...200	0.4...40
TSS_{eq}****	mg/L	3.9	20...2000	10...1000	4...400	2...200	0.4...40
abs_{254}	1/m		5...1500	2.5...750	1...300	0.5...150	0,1...30
abs_{530}	1/m		5...500	2.5...250	1...100	0.5...50	0,1...10
$Trans_{254}$	%		3...98.8	3...98.8	3...98.8	3...98.8	3...98.8
$Trans_{530}$	%		3...98.8	3...98.8	3...98.8	3...98.8	3...98.8

*under laboratory conditions

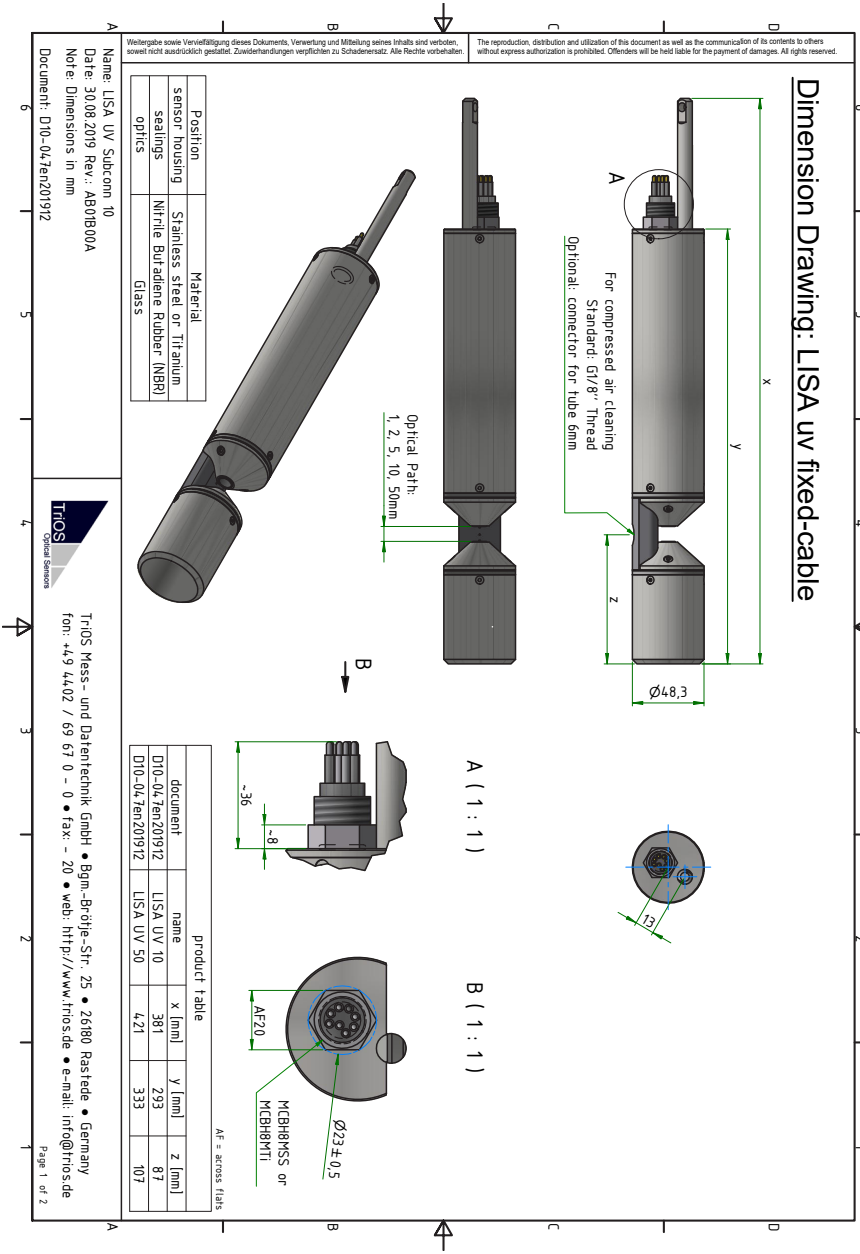
** based on KHP (Note: 100 mg COD standard solution is equivalent to 85 mg/L KHP)

***Formazine attenuation unit

****related to SiO_2

NOTICE **Transmission at 530 nm must not fall below 33%, otherwise the content of turbid substances in the medium is too high and the path must be shortened.**

7.3 External Dimensions



8 Accessories

8.1 Measuring Accessories

8.1.1 VALtub

The VALtub is used to test and recalculate the zero values. Because of the adapted shape, only small amounts of water are required to take a measurement.

8.1.2 Cuvette Holder

Cuvette holder standard 5-mm cuvettes. Especially suitable for laboratory measurements and very small sample quantities.

8.2 Controller

8.2.1 TriBox3

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 has 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. Besides the TriBox3 offers various interfaces, includingan IEEE 802.3 Ethernet interface, a IEEE 802.11 b/g/n interface, a USB port and 6 analog outputs (4...20 mA). An integrated relay can trigger alarms or control external devices. Features such as low power consumption, a robust aluminium housing and a range of interfaces make it suitable for all applications associated with environmental monitoring, drinking water, wastewater treatment plants and many other areas.

8.2.2 TriBox mini

Digital 2-channel controller

Mini controller with two digital sensor inputs and two 4...20mA outputs. All of the measured values and diagnostics data that are saved can be selected using an integrated web browser.

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 is valid for 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 the sensor voids the warranty!**

10 Customer Service

If you are having a problem with the sensor, please contact TriOS Customer Service.

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

Technical support contact:

support@trios.

Telephone: +49 (0) 4402 69670 - 0

Fax: +49 (0) 4402 69670 – 20

To enable quick assistance, please send us the sensor ID number by e-mail (4 last digits of the serial number, consisting of letters and numbers, e.g.28B2).

11 Contact

We are constantly working to improve our devices. Visit our website for news 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

D-26180 Rastede

Germany

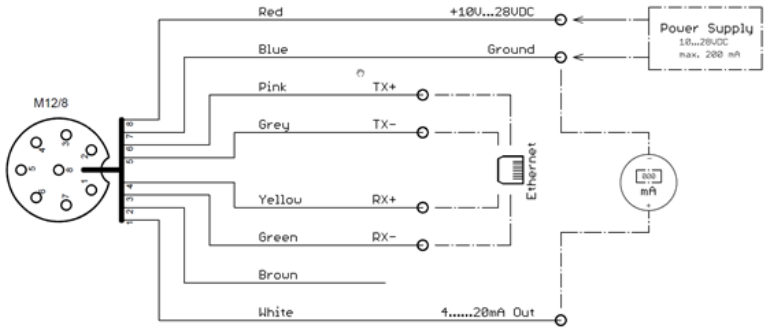
Telephone	+49 (0) 4402 69670 - 0
Fax	+49 (0) 4402 69670 - 20

12 Keyword Index

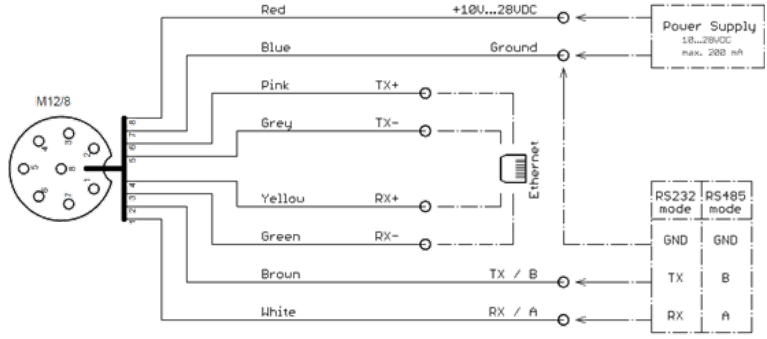
13 FAQ - Frequently Asked Questions

Further FAQs can be found on our website:**www.trios.de.**.

1. What is the cable configuration of the M12 connector for the analog version of the LISA UV:



2. What is the cable configuration of the M12 connector for the digital version of the LISA UV:



3. When do I need the G2 InterfaceBox?

The LISA UV is an innovative measurement instrument that can be operated without additional hardware.

The settings of the LISA sensor can be changed via the web interface. To access the web interface, you will need the G2 InterfaceBox and an Ethernet-capable device with a web browser, such as a notebook / laptop.

4. What wavelengths are used to take measurements?

The LISA sensor can measure at the wavelengths 254 nm and 530 nm. The measurement at 530 nm is only intended as turbidity correction for the SAC_{254}. For the measurement of UV transmission, only 254 nm is measured. The wavelengths are fixed and cannot be changed.

5. Why do the optical windows have to be cleaned carefully?

   The windows of an optical measurement device must always guarantee maximum transmission. Scratched or cracked windows can significantly affect the measurement and can result in bad measurements.

6. The sensor only outputs NAN values or “???”.

   Probably the measured value cannot be calculated, see chapter 5.3.

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	**LISA**
Typ / Type / Type	**UV**
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
Datum / Date / Date 26.10.2021	Unterschrift / Signature / Signatur R. Heuermann

D05-047yy202110

Seite 1 von 1

Modbus RTU

Software Version

This Modbus protocol refers to software version 1.7.8 and higher.

Serial Interface

On delivery, the LISA UV is configured on RS-485 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. Range: 0x0000 – 0x00FF
Uint16	1	16-bit positive integer. Range: 0x0000 – 0xFFFF
Uint32	2	32-bit positive integer. Range: 0x00000000 – 0xFFFFFFFF
Float	2	IEEE 754 32 bit floating point value
Char[n]	$\left\lceil \frac{n}{2} \right\rceil$	Null-terminated ASCII character string

Functions

The LISA UV supports the following Modbus functions:

Name	Code	Description / Use
Read multiple registers	0x03	Read the serial number, configuration, calibration and measurement data
Write multiple registers	0x10	Write the configuration and calibration
Write single coil	0x05	Trigger the calibration and measurement
Write single register	0x06	Trigger the calibration and measurement
Report slave ID	0x11	Read the serial number

Standard Modbus Server Address

Upon delivery, the LISA UV is set to address 2 (0x02).

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	The Modbus slave ID of this device.
New data available	RW	1	Bool	True, if new measurement data is available. Must be cleared by the user after reading the results.
LISA serial number	R	10	Char[10]	Serial number of the LISA UV sensor
Lamp serial number	R	20	Char[44]	Serial number followed by the type designation followed by the shot counter (see below) of the LISA UV lamp module
Self-trigger	RW	100	Bool	Enables or disables the self-trigger mode.
Averaging	RW	101	Uint16	Number of individual measurements which are averaged for a measurement
Interval	RW	102	Uint32	The measurement interval in [s] for the automatic mode
Path length	RW	122	Float	Optical path length in [mm]. Possible values: 0.3, 1, 2, 5, 10, 50
Custom name #1	RW	132	Char[16]	The name of the 1st custom calibrated parameter.
Custom unit #1	RW	140	Char[8]	The unit of the 1st custom calibrated parameter.
Custom input #1	RW	144	Uint32	The input of the 1st custom calibrated parameter. Values: 0x00: SAC_{254} 0x01: Abs_{254} 0x02: Abs_{530}
Custom offset #1	RW	146	Float	The offset of the 1st custom calibrated parameter.
Custom scaling #1	RW	148	Float	The scaling of the 1st custom calibrated parameter.
Custom name #2	RW	150	Char[16]	The name of the 2nd custom calibrated parameter.
Custom unit #2	RW	158	Char[8]	The unit of the 2nd custom calibrated parameter.
Custom input #2	RW	162	Uint32	The input of the 2nd custom calibrated parameter. Values: 0x00: SAC254 0x01: Abs254 0x02: Abs530
Custom offset #2	RW	164	Float	The offset of the 2nd custom calibrated parameter.
Custom scaling #2	RW	166	Float	The scaling of the 2nd custom calibrated parameter.
Custom name #3	RW	168	Char[16]	The name of the 3rd custom calibrated parameter.
Custom unit #3	RW	176	Char[8]	The unit of the 3rd custom calibrated parameter.
Custom input #3	RW	180	Uint32	The input of the 3rd custom calibrated parameter. Values: 0x00: SAC_{254} 0x01: Abs_{254} 0x02: Abs_{530}

Custom offset #3	RW	182	Float	The offset of the 3rd custom calibrated parameter.
Custom scaling #3	RW	184	Float	The scaling of the 3rd custom calibrated parameter.
Shot Counter	R	200	Uint32	Count of samples the lamp module shot in its life time so far.
SAC_{254}	R	1000	Float	Spectral absorption coefficient at 254 nm in [m^{-1}]
COD_{eq}	R	1002	Float	Equivalent to the chemical oxygen demand in [mg/L]
BOD_{eq}	R	1004	Float	Equivalent to the biological oxygen demand in [mg/L]
TOC_{eq}	R	1006	Float	Total organic carbon in [mg/L]
$Trans_{254}$	R	1008	Float	Transmission of the UV LED in [%]
$Trans_{530}$	R	1010	Float	Transmission of the correction LED in [%]
Turbidity	R	1032	Float	Turbidity in [FAU]
Abs_{254}	R	1034	Float	Absorbance at 254 nm in [m^{-1}]
Abs_{530}	R	1036	Float	Absorbance at 530 nm in [m^{-1}]
SQI	R	1038	Float	Spectral quality index [1]
$AbsAU_{254}$	R	1040	Float	Absorbance at 254 nm in [AU]
$AbsAU_{530}$	R	1042	Float	Absorbance at 530 nm in [AU]
Custom #1	R	1044	Float	The 1st custom calibrated parameter.
Custom #2	R	1046	Float	The 2nd custom calibrated parameter.
Custom #3	R	1048	Float	The 3rd custom calibrated parameter.

Write single coil / register (0x05 / 0x06)

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

Designation	Address	Description
Trigger Measurement	1	A single measurement is triggered. Duration: ~2s.

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:

L	I	S	A	0x00	3	0	4	4	0x00	1	.	7	0x00