DOC 420 6500-E-1.6-BDA

Manual
Modbus Tool.exe for GO Modbus Sensors

Creation date: 18.10.2023 Described software version: 1.07 to 1.15

File name: DOC 420 6500-E-1.5-BDA Modbusconfig.pdf

1 Introduction

This manual describes the operation of the Modbus configuration program Modbus Tool.exe of GO Systemelektronik in version 1.07 to 1.15 with the article number 420 6500 for the following sensors:

Modbus sensor	Article number
BlueTrace Oil in Water	461 6200
BlueTrace Crude Oil	461 6300
BlueTrace Turbidity	461 6780
BlueEC Conductivity	461 2092

The program automatically[1] recognises the connected Modbus sensors.

Modbus Tool.exe is included with the above-mentioned Modbus sensors of GO Systemelektronik.[2]

Modbus Tool.exe allows you, amongst others, to read out sensor information, assign a Modbus address, determine the internal gain of the input signal, calibrate the sensor and display measurement values

The program runs under Windows 7 and newer. An Installation is not necessary; the program starts when Modbus Tool.exe is called up.

The products of GO Systemelektronik are constantly being developed, therefore deviations between this manual and the delivered product can result. Please understand that no legal claims can be derived from the contents of this manual.

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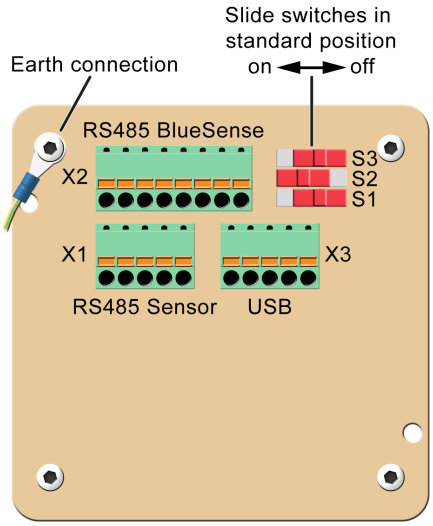
[1] Exception: BlueEC, see *3.1 The Start Window (Modbus Connection)*

[2] If not, contact GO Systemelektronik.

2 Preparation

To enable your PC to communicate with a Modbus sensor, you need a **converter from RS485 to USB** and **driver software**. Here, as an example, the Modbus USB* converter of GO Systemelektronik (article number 486 S810) with the driver software at:
https://ftdichip.com/drivers/d2xx-drivers there „D2XX Drivers“
The driver software creates a virtual COM port in the Windows system – in this example "USB Serial Port (COM*n*)".
A Modbus sensor is connected via the clamp socket strip in slot X1. If a Modbus sensor is to be connected to a BlueConnect module of GO Systemelektronik, the clamp socket strip from the BlueConnect module can be used at slot X1.
Exception: If a Modbus sensor is to be connected to the BlueSense Transducer of GO Systemelektronik, the clamp socket strip on the BlueSense Transducer can be used at slot X2.

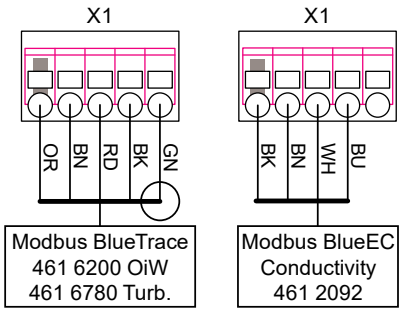
Converter module circuit board



In case of communication problems:
Check the earth connection of the converter.
Install the latest driver.

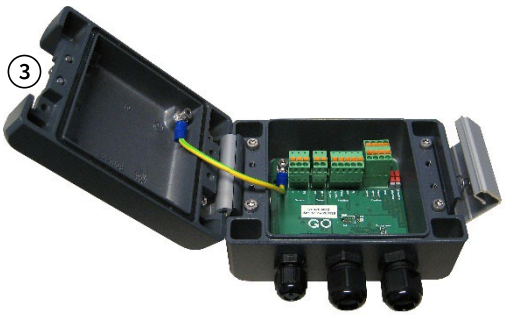
Earth the converter.
This is the only way to ensure trouble-free operation.

The earth connection is on the left side of the housing.



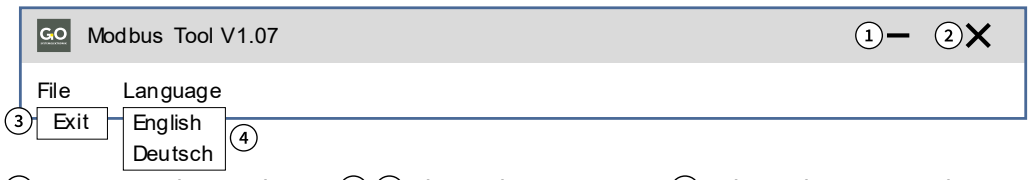
2.1 Opening the Converter Housing

① Turn the housing bracket to the right.
② Loosen the screws (Torx T20).



③ Open housing cover to the left.

3 Program Properties with Connected Modbus Sensors



Title bar
Menu bar

① minimises the window – ② ③ closes the program – ④ selects the program language

* USB 2.0 and newer

3.1 The Start Window (Modbus Connection)

all > Modbus

In the start window you can

- establish the connection with your PC via a selected COM Port,
- automatically recognise connected Modbus sensors,
- change the Modbus Slave ID of detected Modbus sensors
- and set the baud rate (BlueEC only)

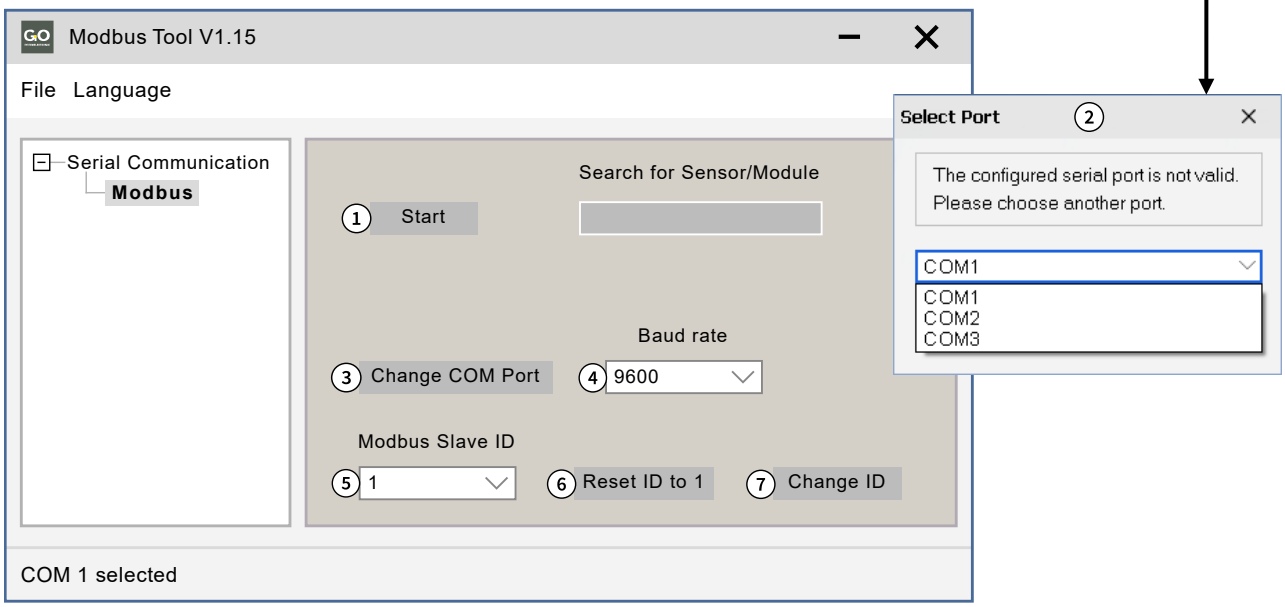
After starting the program, the Modbus connection window opens.
Click on button <Start> ①.

The Select Port window ② opens.
Select the correct* COM Port for communication with the converter.
Via ③ <Change COM Port> you can afterwards change the COM Port.

The program searches for the Modbus Slave ID of a connected Modbus sensor.

⇨ The starting point of the search is the value entered at ⑤.

⇨ Only sensors with the baud rate entered under ④ are searched for.
If a connected BlueEC sensor has a baud rate other than that entered in ④ it will not be recognised; in this case, try the other two selectable baud rates.



④ **Set baud rate for sensor search:** 9600, 19200 or 57600.
This selection only has a function if a BlueEC sensor is connected (see *3.3* there *BlueEC Conductivity > Parameter*), all other sensors have the standard baud rate of 9600.

⑤ **Modbus Slave ID:** The value entered here (default value is 1 - quick selection 1 to 16 or input 1 to 230) is the start value from which the program searches for the next Modbus Slave ID of a connected sensor after clicking the <Start> button ①. If the program does not find a sensor with this Modbus Slave ID, the message "No Modbus sensor was found !!!" appears.

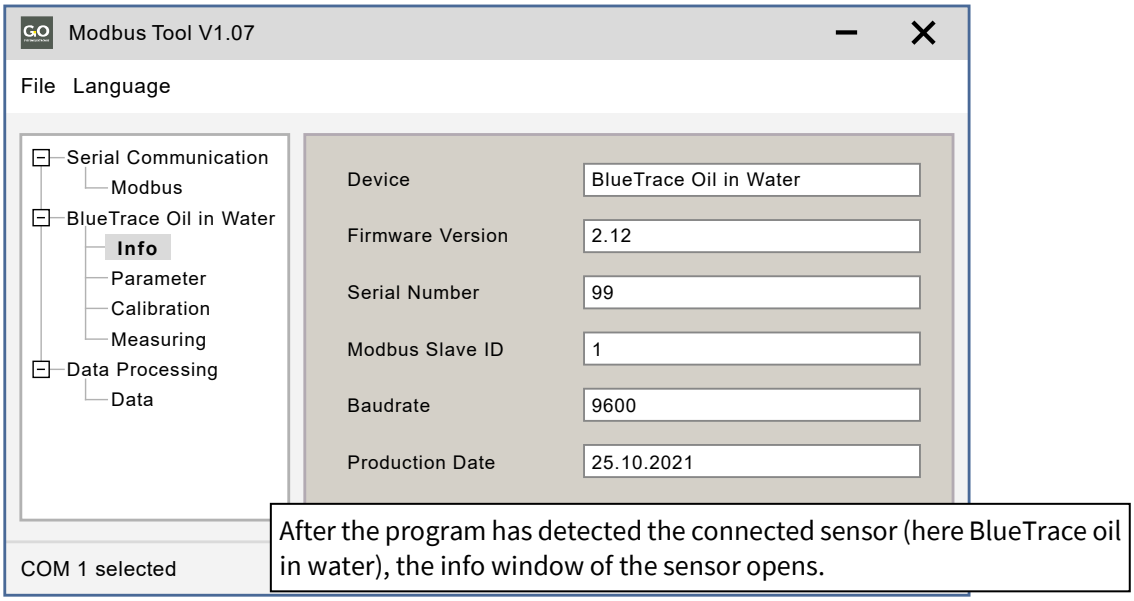
⑥ **Reset to 1:** The Modbus Slave ID of a detected Modbus sensor is set to 1 and the value in ⑤ is set to 1.

⑦ **Change ID:** The Modbus Slave ID of a detected Modbus sensor is set to the entered value (1 to 230) and the value in ⑤ is set to the same value.

* see *2 Preparation* – The COM Ports of your PC are displayed in the Windows Device Manager.

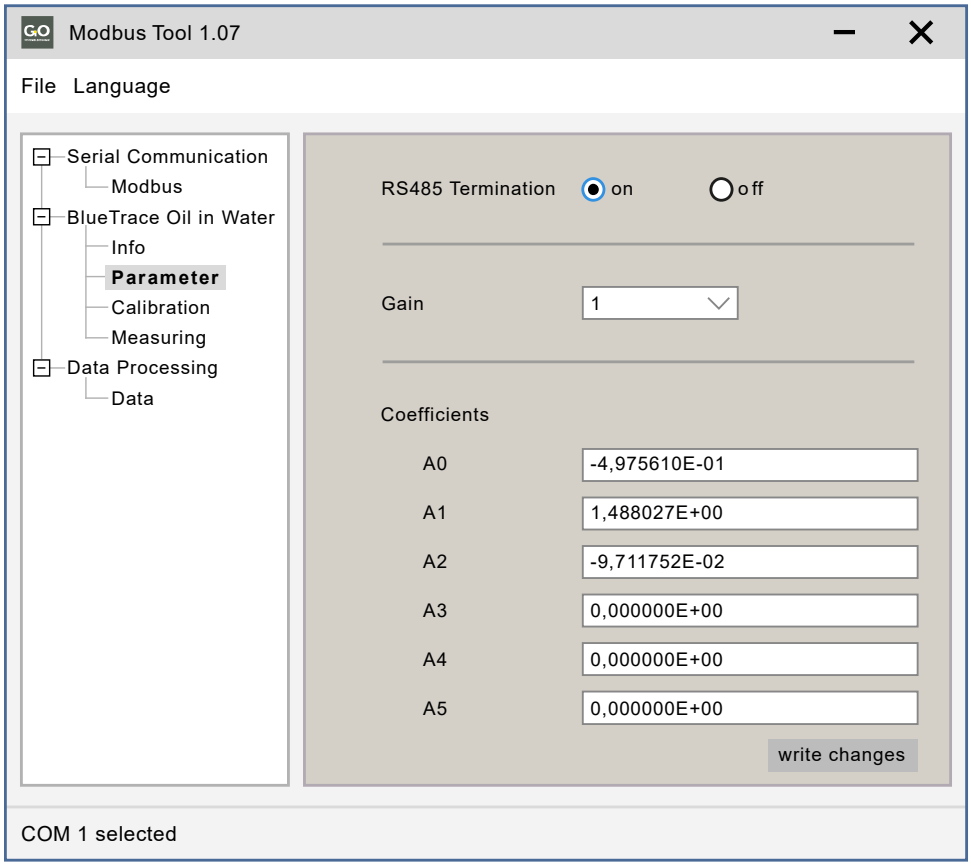
3.2 The Info Window

all > Info



3.3 The Parameter Window

BlueTrace Oil in Water > Parameter



RS485 Termination Switches the termination of the Modbus (RS485) on and off.

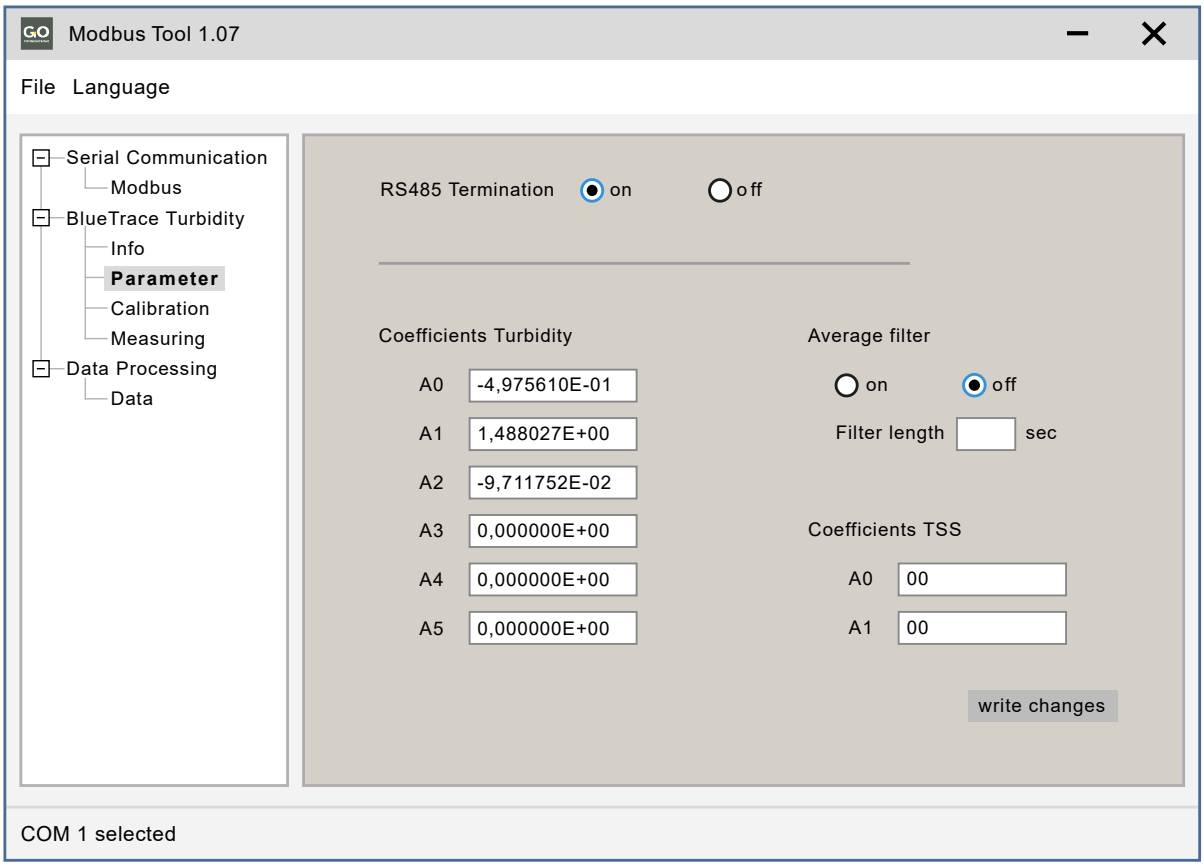
Gain Selection of the internal gain of the input signal from 1 to 128

Coefficients Calibration coefficients, the displayed values are from the calibration function. see *3.4 The BlueTrace Calibration Window*

write changes — Writes the current settings to the sensor memory.
Settings that have not yet been saved are marked in red.

Note: Decimal separator is the comma; if a dot is entered, an error message appears.

BlueTrace Turbidity > Parameter



RS485 Termination Switches the termination of the Modbus (RS485) on and off.

Coefficients Turbidity Calibration coefficients, the displayed values are taken from the calibration function. see *3.4 The BlueTrace Calibration Window*

Average filter
Filter length Calculates the measurement value as moving average from the measurement values determined in Filter length (1 measurement value per second)

Coefficients TSS Calculation coefficients TSS

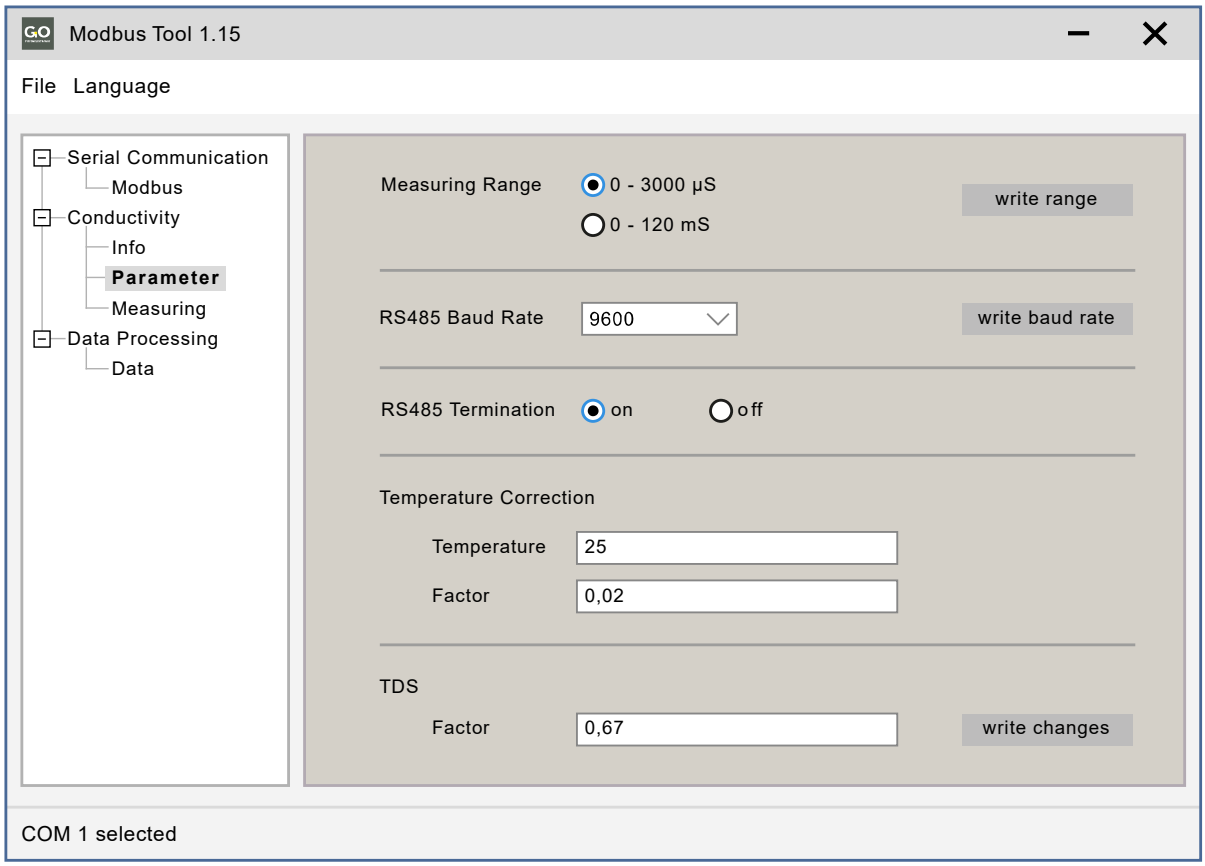
write changes

Writes the current settings to the sensor memory.
Settings that have not yet been saved are marked in red.

Note: Decimal separator is the comma; if a dot is entered, an error message appears.

BlueTrace Crude Oil > Parameter Like *BlueTrace Turbidity > Parameter*, but without *Coefficients TSS*.

BlueEC Conductivity > Parameter



Measuring range Selection between two measurement ranges

write range — Writes the selected measuring range into the sensor memory.
A selection that has not yet been saved is marked in red.

RS485 Baud Rate Sets the baud rate of the RS485 interface of the sensor to 9600, 19200 or 57600. This setting also sets the baud rate setting in the Start Window (see *3.1* there ④).

write baud rate — Writes the selected baud rate into the sensor memory.
A selection that has not yet been saved is marked in red.

RS485 Termination Switches the termination of the Modbus (RS485) on and off.

Temperature Correction **Temperature:** Temperature value of the temperature compensation, here 25 (default value)
Temperature Correction Factor: Factor of the temperature compensation, here 0,02 (default value)

TDS (Total Dissolved Solids) **TDS factor** for calculating the TDS value, here 0,67 (default value)

write changes — Writes the current settings to the sensor memory.
Settings that have not yet been saved are marked in red.

Note: Decimal separator is the comma; if a dot is entered, an error message appears.

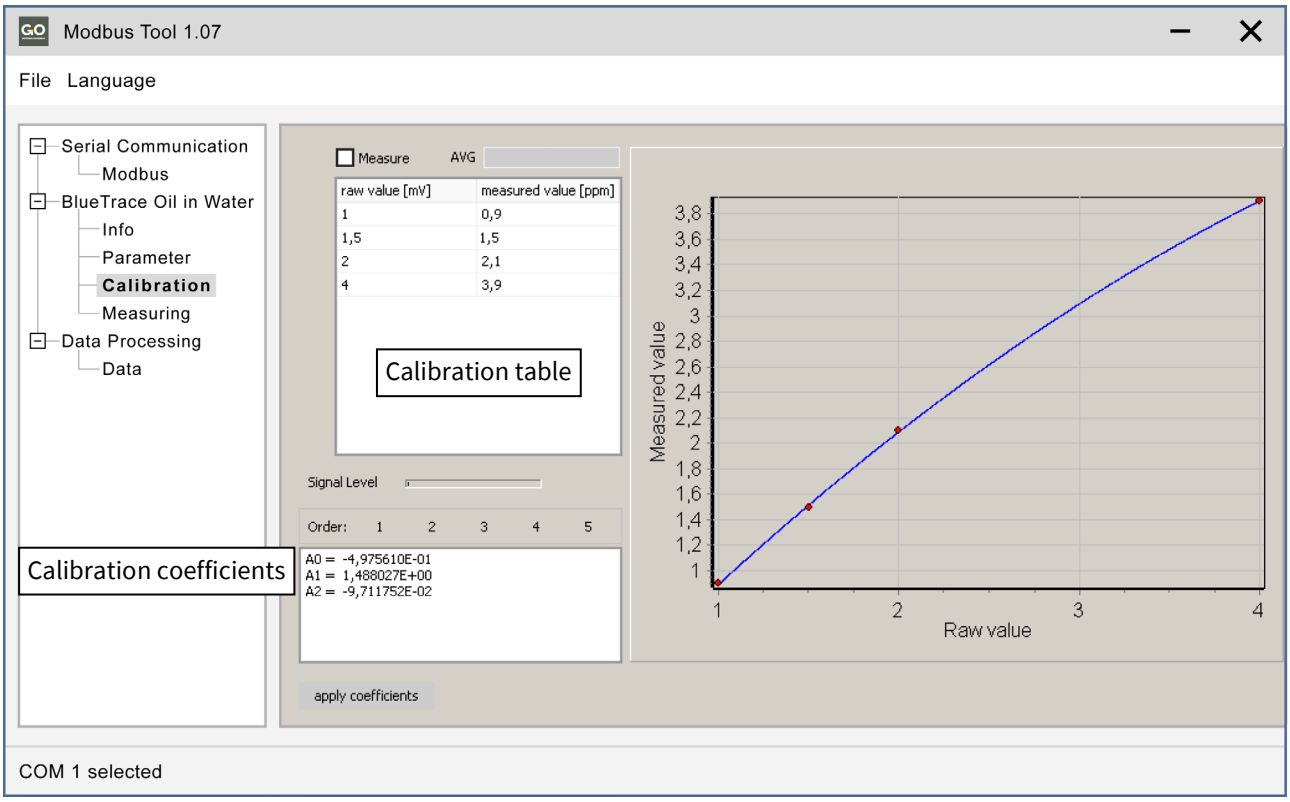
To calculate TDS [mg/L] from the electrical conductivity EC [µS/cm] use the formula:
TDS = ke × EC **ke** = TDS factor **EC** = electrical conductivity of the water, compensated to 25 °C
If the ions in the water increase, set the value of **ke** (value range 0,5 to 0,8) correspondingly higher, default value is 0,67.

3.4 The BlueTrace Calibration Window

BlueTrace Oil in Water / BlueTrace Turbidity > Calibration

A calibration compares the **value pairs** of the measured **sensor raw values*** and allocated **reference values** from calibration liquids. These value pairs are taken as points in a coordinate system. The curve of a 1. to 5. Order polynomial is placed through these points as accurately as possible; this is how the calibration polynomial is created.

Example with a 2. Order polynomial:



Note: BlueEC Conductivity does not have a calibration window.

* A raw sensor value is the uncalibrated sensor reading.

3.4.1 The Calibration Table

There are two ways to enter the raw values

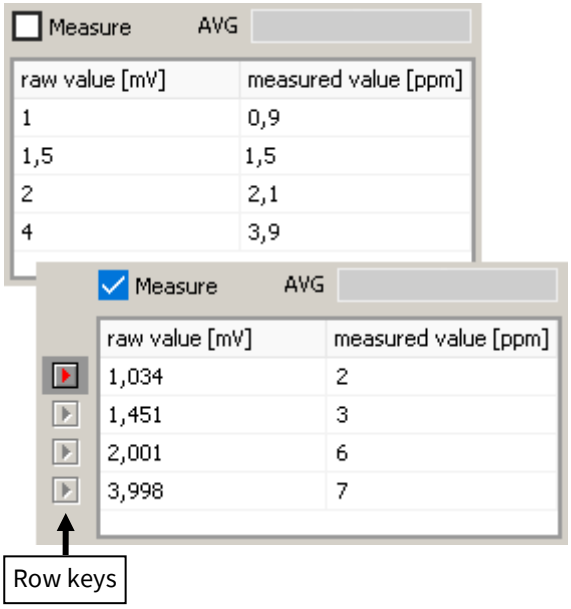
- **manual input** – gives the possibility to calculate hypothetical calibrations
- **measurement value transfer** – current measured raw values for the actual calibration

Reference values are always entered manually. You can enter up to 10 value pairs.

„**measured value [ppm]**“ is the reference value of a calibration liquid.

Note: Decimal separator is the comma; dots are not accepted.

Manual input: not activated: ☐ **Measure**



After the first opening of the calibration window, the calibration table has only one row. Click with the cursor in the "raw value" cell and enter the first raw value, click with the cursor in the "measured value" cell and enter the first reference value, or vice versa.

Measurement value transfer: *activated: ☑ **Measure**

After the first opening of the calibration window, the calibration table has only one row. Click with the cursor on the first row key ▶: As long as the row key is active ▶, the current measured raw value appears in the "raw value" cell. Click with the cursor in the "measured value" cell and enter the first reference value.

To **create a new line**, click with the cursor in the last line with an entry and press the ENTER key.

To **delete a line**, delete all line entries and click in another line.

AVG
only at Oil in Water

Progress bar for the calculation of the measurement value. A measurement value of the BlueTrace is the result of a moving average of 45 individual measurements. A single measurement takes place every second

Signal Level

Display of the signal strength of the bright value (LED on).
If the AD converter is overloaded, the display field is highlighted in red.

Order:

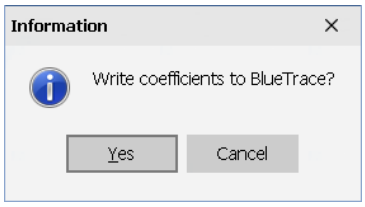
Order means the order/degree of the calibration polynomial.
Click on one of the Order buttons 1 to 5 to get the best fit.

1 2 3 4 5

The graph of the calibration polynomial is displayed.

apply coefficients

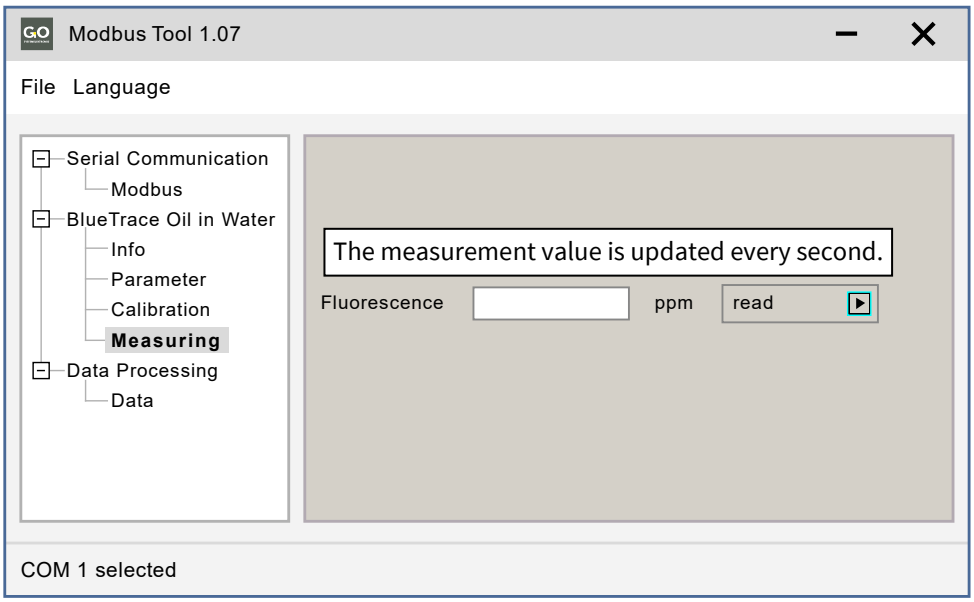
Button, copies the calculated coefficient values into the sensor.

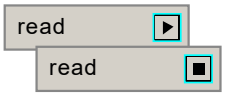


* When activated, the warning message **Attention! Raw value passes 45 seconds average filter** appears. see under AVG on this page

3.5 The Measurement Value Window

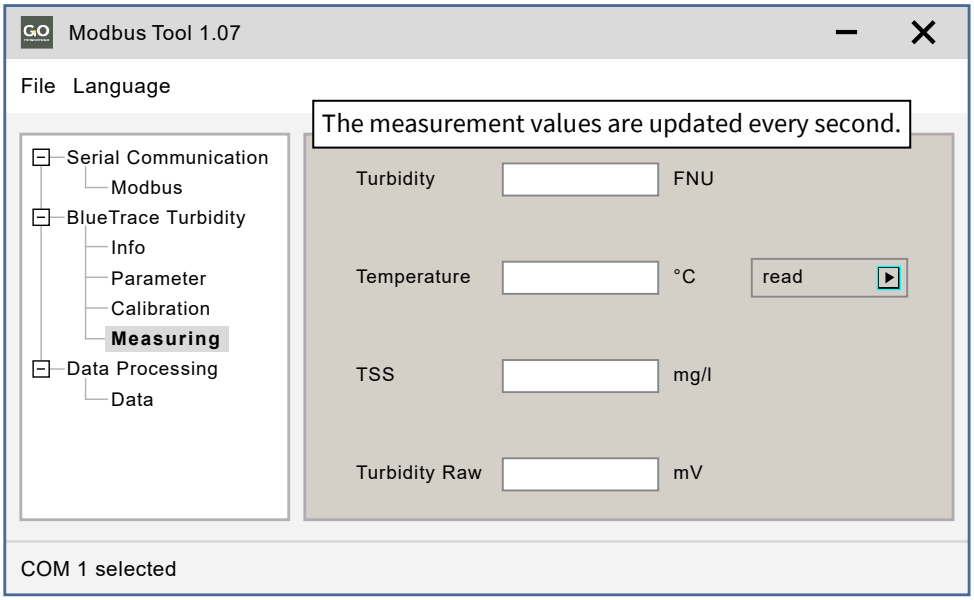
BlueTrace Oil in Water > Measuring

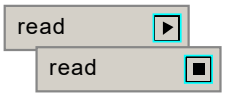




Starts and stops the measurement display.

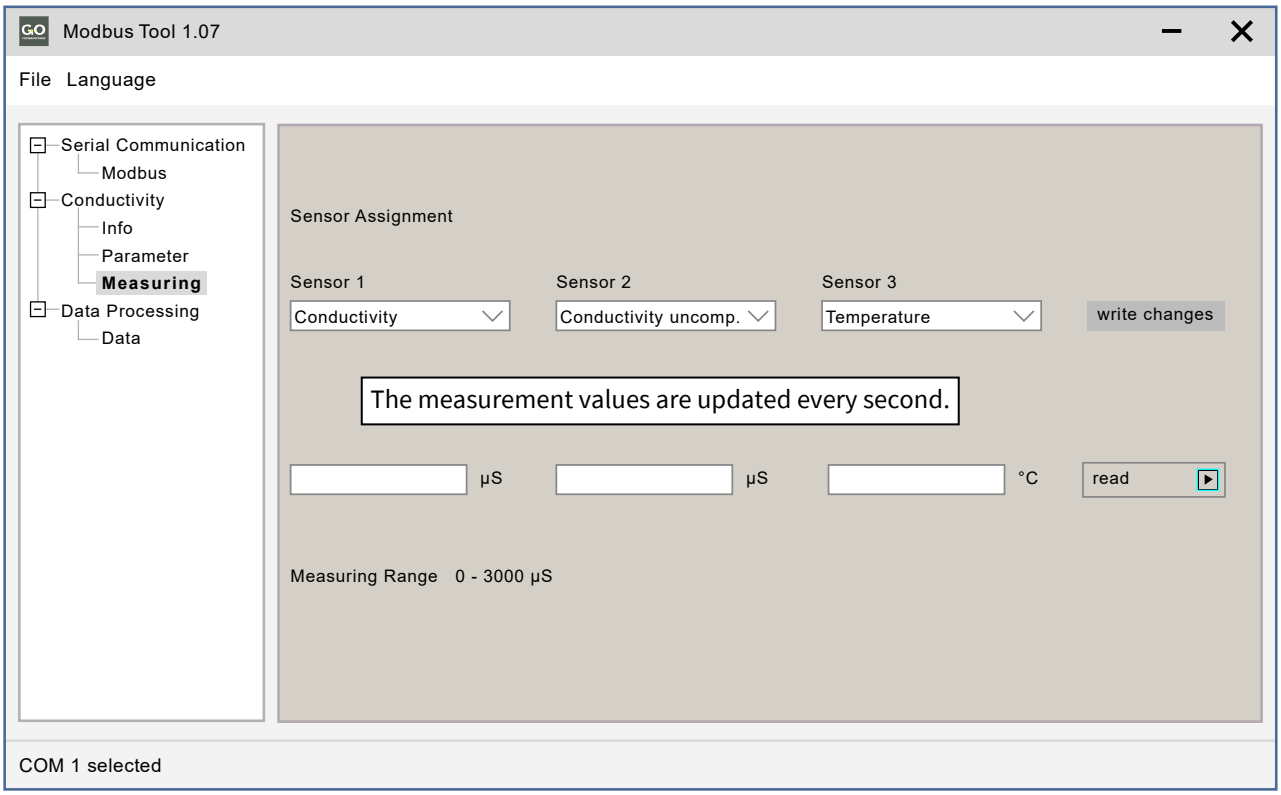
BlueTrace Turbidity > Measuring



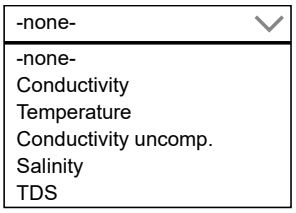


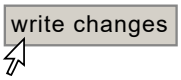
Starts and stops the measurement display.

BlueEC Conductivity > Measuring



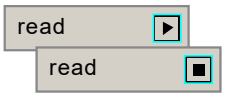
You can select five measurement values from each of the three drop-down menus. If the display is activated, the current measurement values of the selection are shown every second. A BlueBox/BlueMon system receives all three selected measured values, a BlueSense Transducer only the first two.





Writes the selection to the sensor memory.

Note: This selection is only possible with a sensor firmware version ≥ 2.03.
Otherwise, standard measurement values are used:
Conductivity – Temperature – Conductivity uncomp.

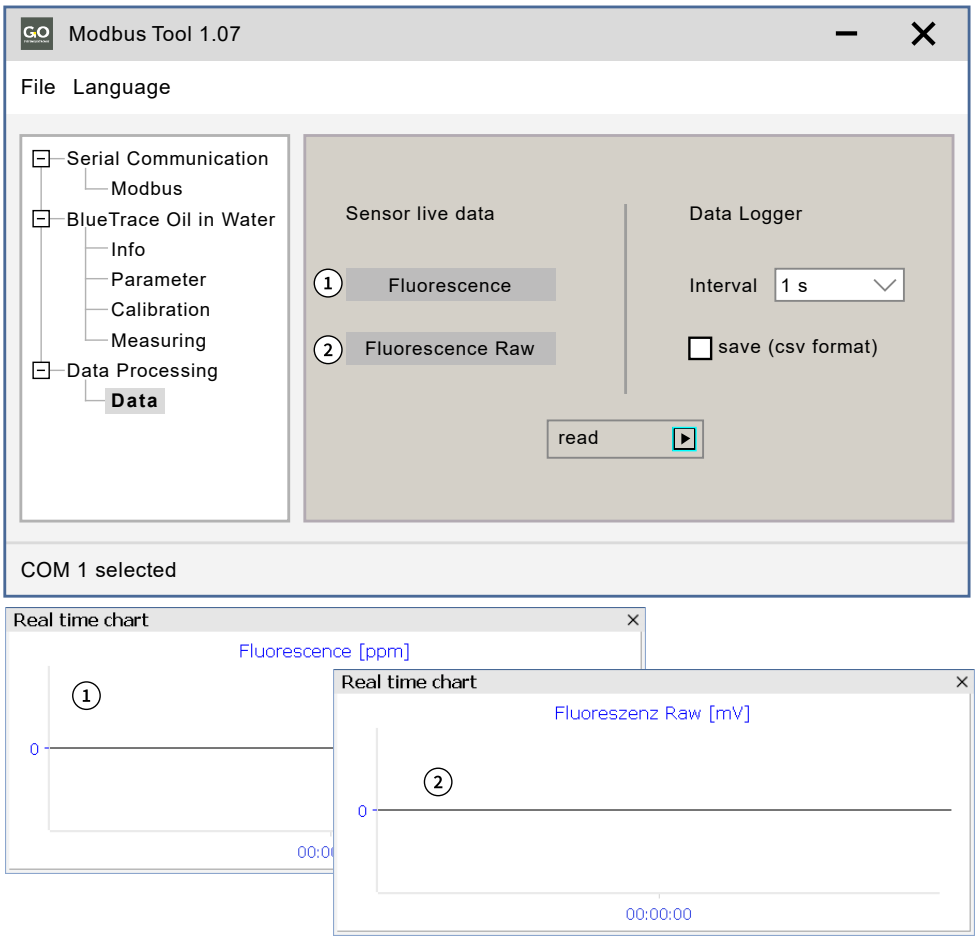


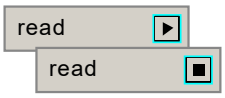
Starts and stops the measurement display.

Note: Salinity according to the generally valid UNESCO formula for seawater

3.6 The Measurement Value Recording Window

all > Data





Starts and stops the running measurement display.

Interval 1 s — Drop-down field for input/selection of the recording interval

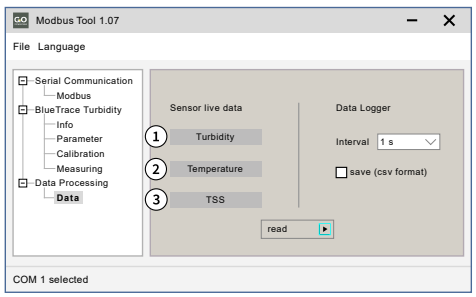
☐ save (csv format) — Opens a window for entering the storage path of a csv file. After the file has been created, the recording of the measurement values into the csv file starts.

The button changes to:
☑ save (csv format)

At the bottom right of the program window this appears:

Data Logger running **Stop**

Click on <Stop> stops the data recording.



Differences

BlueTrace Crude Oil	BlueTrace Turbidity	BlueEC Conductivity
① Crude Oil	① Turbidity	① Conductivity
② empty	② Temperature	② Temperature
③ empty	③ TSS	③ Conductivity uncomp.

4 General Modbus Specification for GO Modbus Sensors

General The data to be transferred is always in a fixed frame and is defined as follows:

Address	Function code	Data	CRC
1 byte	1 byte	0 … 252 byte(s)	2 bytes

Description

Address:	Sensor address (valid from 1 – 230) Address 0 is the broadcast address and will not be answered.
Function code:	Here you define whether parameters are to be read or written.
Data:	e.g. from the master: Which parameters are requested? e.g. from the slave: content of the requested parameters
CRC:	CRC16

Data types

Standardized data types: **byte** (8-bit) and **short integer** (16-bit)
According to the Modbus specification, a register always transmits the high-byte first, followed by the low-byte.

Extended data types: **32-bit integer** and **32-bit float** are transmitted as 2 consecutive 16-bit registers. The format of the float number corresponds to the IEEE standard 754.

Function codes

Function code	Name	Description
03	Read Hold Register	Read device parameters (Integer / Float)
04	Read Input Register	Read actual values (Integer / Float)
06	Write Single Register	Write device parameters word by word
16 *	Write Multiple Register	Write several device parameters word by word

* only approved for sensor coefficients

Transmission parameter ● RTU Modus ● 9600 Baud ● 8 data bits ● no parity bit ● 1 stop bit

Register
Modbus provides to store the data in different registers. Each register stores 2 byte. A difference is made in the following registers:

Register number Register address	Type	Modbus designation	Description
–	read / write	Discrete Output Coils	Discrete outputs
–	read only	Discrete Input Contacts	Discrete inputs
0x0100 – 0x0FFF	write only (except IO)	Input Registers	Input register, Measurement values of the sensors
0x0000 – 0x00FF	read / write	Output Holding Registers	Hold register for parameters, Device configuration, etc.

Slave table Each slave has a parameter table and an actual value table. From these tables it can be seen which parameters can be found under which addresses.
Coils should not be used, I/Os are managed via the parameter table.

5 BlueTrace Oil in Water 461 6200 – Modbus Address Overview

29.6.2021

Address	Parameter name	Range	Meaning	Data type	Authorization
0x00	Device ID	102	102 – BlueTrace Oil in Water	Short	R
0x01	Firmware Version	100 – 9999	100 = 1.00, 2410 = 24.1	Short	R
0x02	Serial No.	0 – 65535	Serial number	Short	R
0x03	Modbus Slave ID	1 – 230	Modbus address	Short	R/W
0x04	Baud rate	0 – 2	0 = 9600 8N1	Short	R
0x05	Production date	ddmmyyyy	Date	Short x 2	R

Address	Parameter name	Range	Meaning	Data type	Authorization
0x14	A0	0 – 0xffffffff	Cal Coefficient A0	32 bit Float	R/W
0x16	A1	0 – 0xffffffff	Cal Coefficient A1	32 bit Float	R/W
0x18	A2	0 – 0xffffffff	Cal Coefficient A2	32 bit Float	R/W
0x1A	A3	0 – 0xffffffff	Cal Coefficient A3	32 bit Float	R/W
0x1C	A4	0 – 0xffffffff	Cal Coefficient A4	32 bit Float	R/W
0x1E	A5	0 – 0xffffffff	Cal Coefficient A5	32 bit Float	R/W

Address	Parameter name	Range	Meaning	Data type	Authorization
0xD1	Gain	0 – 7	1 – 128	Short	R/W
0xD3	Modbus termination	0 – 1	Termination resistor	Short	R/W

Address	Parameter name	Range	Data type	Authorization
0x101	Value Sensor 1 [ppm]	0 – 0xffffffff	32 bit Float	R
0x104	Value Sensor 1 RAW	0 – 0xffffffff	32 bit Float	R

Note on 32 bit Float data (MSB = 0xByte4, LSB = 0xByte1),
The Receiving sequence of the values (Hex) is: 0x [Byte2] [Byte1] [Byte4] [Byte3]

6 BlueTrace Crude Oil 461 6300 – Modbus Address Overview

17.5.2023

Address	Parameter name	Range	Meaning	Data type	Authorization
0x00	Device ID	114	114 – BlueTrace Crude Oil	Short	R
0x01	Firmware Version	100 – 9999	100 = 1.00, 2410 = 24.1	Short	R
0x02	Serial No.	0 – 65535	Serial number	Short	R
0x03	Modbus Slave ID	1 – 230	Modbus address	Short	R/W
0x04	Baud rate	0 – 2	0 = 9600 8N1	Short	R
0x05	Production date	ddmmyyyy	Date	Short x 2	R

Address	Parameter name	Range	Meaning	Data type	Authorization
0x14	A0	0 – 0xffffffff	Cal Coefficient A0	32 Bit Float	R/W
0x16	A1	0 – 0xffffffff	Cal Coefficient A1	32 Bit Float	R/W
0x18	A2	0 – 0xffffffff	Cal Coefficient A2	32 Bit Float	R/W
0x1A	A3	0 – 0xffffffff	Cal Coefficient A3	32 Bit Float	R/W
0x1C	A4	0 – 0xffffffff	Cal Coefficient A4	32 Bit Float	R/W
0x1E	A5	0 – 0xffffffff	Cal Coefficient A5	32 Bit Float	R/W

Address	Parameter name	Range	Meaning	Data type	Authorization
0x24	A0	0 – 1	Average Filter on/off	32 Bit Float	R/W
0x26	A1	0 – 60	Filter length [sec]	32 Bit Float	R/W

Address	Parameter name	Range	Meaning	Data type	Authorization
0xD3	Modbus termination	0 – 1	Termination resistor	Short	R/W

Address	Parameter name	Range	Data type	Authorization
0x101	Value Sensor 1 [ppm]	0 – 0xffffffff	32 Bit Float	R

Note on 32 bit Float data (MSB = 0xByte4, LSB = 0xByte1),
The Receiving sequence of the values (Hex) is: 0x [Byte2] [Byte1] [Byte4] [Byte3]

7 BlueTrace Turbidity 461 6780 – Modbus Address Overview

29.6.2021

Address	Parameter name	Range	Meaning	Data type	Authorization
0x00	Device ID	109	109 – BlueTrace Turbidity	Short	R
0x01	Firmware Version	100 – 9999	100 = 1.00, 2410 = 24.1	Short	R
0x02	Serial No.	0 – 65535	Serial number	Short	R
0x03	Modbus Slave ID	1 – 230	Modbus address	Short	R/W
0x04	Baud rate	0 – 2	0 = 9600 8N1	Short	R
0x05	Production date	ddmmyyyy	Date	Short x 2	R

Address	Parameter name	Range	Meaning	Data type	Authorization
0x14	A0	0 – 0xffffffff	Cal Coefficient A0	32 bit Float	R/W
0x16	A1	0 – 0xffffffff	Cal Coefficient A1	32 bit Float	R/W
0x18	A2	0 – 0xffffffff	Cal Coefficient A2	32 bit Float	R/W
0x1A	A3	0 – 0xffffffff	Cal Coefficient A3	32 bit Float	R/W
0x1C	A4	0 – 0xffffffff	Cal Coefficient A4	32 bit Float	R/W
0x1E	A5	0 – 0xffffffff	Cal Coefficient A5	32 bit Float	R/W
0x2A	A0	0 – 0xffffffff	Cal Coefficient A0 TSS	32 bit Float	R/W
0x2E	A1	0 – 0xffffffff	Cal Coefficient A1 TSS	32 bit Float	R/W

Address	Parameter name	Range	Meaning	Data type	Authorization
0xD3	Modbus termination	0 – 1	Termination resistor	Short	R/W

Address	Parameter name	Range	Data type	Authorization
0x101	Turbidity [FNU]	0 – 0xffffffff	32 bit Float	R
0x104	Temperature [°C]	0 – 0xffffffff	32 bit Float	R
0x107	TSS [mg/l]	0 – 0xffffffff	32 bit Float	R

Note on 32 bit Float data (MSB = 0xByte4, LSB = 0xByte1),
The Receiving sequence of the values (Hex) is: 0x [Byte2] [Byte1] [Byte4] [Byte3]

8 BlueEC Conductivity 461 2092 – Modbus Address Overview

17.10.2023

Address	Parameter name	Range	Meaning	Data type	Authorization
0x00	Device ID	101	101 – BlueEC Conductivity	Short	R
0x01	Firmware Version	100 – 9999	100 = 1.00, 2410 = 24.1	Short	R
0x02	Serial No.	0 – 65535	Serial number	Short	R
0x03	Modbus Slave ID	1 – 230	Modbus address	Short	R/W
0x04	Baud rate	0 – 2	0 = 9600 8N1 | 1 = 19200 8N1 2 = 57600 8N1	Short	R
0x05	Production date	ddmmyyyy	Date	Short x 2	R

Address	Parameter name	Range	Meaning	Data type	Authorization
0x14	A0	0 – 0xffffffff	Cal Coefficient A0	32 bit Float	R/W
0x16	A1	0 – 0xffffffff	Cal Coefficient A1	32 bit Float	R/W
0x18	A2	0 – 0xffffffff	Cal Coefficient A2	32 bit Float	R/W
0x1A	A3	0 – 0xffffffff	Cal Coefficient A3	32 bit Float	R/W
0x1C	A4	0 – 0xffffffff	Comp. - Temperature	32 bit Float	R/W
0x1E	A5	0 – 0xffffffff	Comp - Correction factor	32 bit Float	R/W

Address	Parameter name	Range	Meaning	Data type	Authorization
0xD0	Meas. range	0 – 1	0: 0 – 3000 µS 1: 0 – 120 mS	Short	R/W
0xD1	Modbus termination	0 – 1	Termination resistor	Short	R/W
0xD3	TDS factor × 100	0 – 100	Values 0 – 100	Short	R/W

Address	Parameter name	*Standard*	Range	Data type	Authorization
0x101	Value Sensor 1 – selectable	*Cond. comp.*	0 – 0xffffffff	32 bit Float	R
0x104	Value Sensor 2 – selectable	*Temperature*	0 – 0xffffffff	32 bit Float	R
0x107	Value Sensor 3 – selectable	*Cond. uncomp*	0 – 0xffffffff	32 bit Float	R
0x10A	Value Sensor 4 Salinity		0 – 0xffffffff	32 bit Float	R
0x10D	Value Sensor 5 TDS		0 – 0xffffffff	32 bit Float	R

Note on 32 bit Float data (MSB = 0xByte4, LSB = 0xByte1),
The Receiving sequence of the values (Hex) is: 0x [Byte2] [Byte1] [Byte4] [Byte3]