

RS485 Modbus Manual

thevios 3

thevios®

Revision

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1 General

This document describes the RS485 Modbus interface for the device:

- thevios 3 RS485 Modbus

Depending on the device type and configuration level, not all measured values and configuration parameters listed in this document are available. Please refer to the overview below to see which measured values are available.

	Movement	Luminosity	Relative Humidity	Absolute Humidity	Enthalpy & Dewpoint	Radiation - Temperature
thevios 3 OCC Lum	•	•				
thevios 3 OCC Lum rH	•	•	•	•	•	
thevios 3 OCC Lum rH IR	•	•	•	•	•	•

1.1 General Registers

General device information can be read out via the following registers.

Adress	Access	Description	Note
1200..1223	R / W	Device description	Maximum 24 characters, not written upon delivery, one register per character in format (Register 1200..1223)
1230	R / W	Production date month / day	
1231		Production date year	
1232	R	Operating hours counter	
1234	R / u16	Firmware version (major/minor version)	Example: V 1.1 = 0x0101
1235	R / u16	Firmware version (revision/build)	Readability in hexadecimal
2102	RW / u16	Maintenance countdown	
2103	RW / u16	Ccalibration countdown	
2104	RW / u16	Maintenance interval	
2105	RW / u16	calibration interval	

Adress	Access	Description	Standard	Note
118	R / u16	Information in the event of an internal sensor error Sensor error is displayed in bit code.	1	

1.2 Hardware Installation

The device can be connected using a twisted pair cable (line resistance 120 ohms). For detailed information on commissioning and installation, please refer to the product data sheet for the device and the data sheet wiring_rs485_network.pdf.

1.3 RS485 Transceiver

The maximum number of bus participants without using a repeater is specified by the RS485 transceiver. The transceiver used in the device allows a maximum of 32 devices per bus segment.

1.4 Protokoll

The device is a slave bus participant that may only send to the bus at the request of the master. The protocol complies with the specifications in:

- [MODBUS Application Protocol Specification V1.1](#) (Link)
- [MODBUS over Serial Line Specification & Implementation guide V1.0](#) (Link)

1.5 Configuration options

The Thermokon uConfig software can be used to adapt the device to the respective bus topology.

- Bus address of the device (1 – 247)
- Baud rate 9600, 19200, 38400, 57600, 76800, 115200
- Parity even, odd or no parity
- The number of stop bits is automatically determined by the device depending on the parity.
 - 1 stop bit at parity „even“ or „odd“
 - 1 or 2 stop bits at parity „none“, configurable

1.6 Default Communication-Settings

Use the following data for communication **via RS485 Modbus bus** upon delivery:

- Bus address of the device: 1
- Baud rate: 38400
- Parity: even
- Stop bit: 1 stop bit

Use the following data for communication via a standard micro USB cable in the Thermokon uConfig software:

- Bus address of the device: 1
- Baud rate: 115200
- Parity: none (no parity)
- Stop bit: 1 stop bit

The device can only be configured via the RS485 Modbus interface or micro USB cable.

Simultaneous configuration via RS485 Modbus and micro USB cable is not possible.

2 Modbus Register Description

All registers listed below are holding registers that can be accessed via Modbus function codes 3, 6 and 16 (0x03, 0x06 and 0x10). The 'Address' column shows the data address of the respective register. The 'Access' column indicates whether the respective register is read-only (R) or read-write (RW). In addition, the 'Access' column also specifies the data type of the respective register (u16 – unsigned 16 bit, s16 – signed 16 bit).

2.1 Basic Information

2.1.1 EEPROM configuration register

Addresses marked with a # are configuration registers (EEPROM data) which must not be written to in frequently recurring cycles.

2.1.2 Unit system

The desired unit system can be selected via register 2100. Please note that changing the unit system does not adjust the upper/lower limits of the measured values.

Adress	Access	Description	default	Note
# 2100	RW / u16	Selection of the unit system 1: SI 2: Imperial	1	

= EEPROM (Configuration register)

2.2 Modbus Address Configuration

Adress	Access	Beschreibung	Standard	Bemerkung
17000	RW	Device address (Slave ID) 1..247	1	
17001	RW / u32	Baud rate 9600 19200 38400 57600 76800 115200	38400	
17003	RW	Parity gerade (even) ungerade (odd) keine (none)	Even	
17004	RW	Stop bits 1 Stop bit at parity „even“ or „odd“ 1 or 2 Stop bits at Parity „none“, configurable	1	

Changed data has a direct impact on the device and may lead to a connection failure. To perform the configuration without a connection failure when changing the address, use Thermokon uConfig and a USB cable.

2.3 Measurement variable: Movement

Adress	Access	Description	Default	Note
3011	RW / int16	Offset		
3030	RW / int16	Sensitivity		
3031	RW / int16	Delay time		
3032	RW / int16	PIR LED Mode 0 = LED permanently switched off 1 = LED on/off (activated by movement) 2 = Walk test		

2.4 Measurement variable: Temperature

2.4.1 Sensor value Temperature

Address 2100 = 1 (Unit SI)

Address	Access	Description		Resolution / Unit	
101	R / int16	Temperature	SI	0.1	°C
102	R / int16	Temperature IR	SI	0.1	°C
111	R / int16	Temperature MIX	SI	0.1	°C

Address 2100 = 2 (Unit Imperial)

Address	Access	Description		Resolution / Unit	
101	R / int16	Temperature	Imperial	0.1	°F
102	R / int16	Temperature IR	Imperial	0.1	°F
111	R / int16	Temperature MIX	Imperial	0.1	°F

2.4.2 Offset-/ Correction values Temperature

Address 2100 = 1 (Unit SI)

Address	Access	Description	Unit	Default	Resolution / Unit	
# 3111	RW / int16	Temperature Offset	SI	0	0.1	°C
# 3211	RW / int16	Temperature IR Offset	SI	0	0.1	°C

= EEPROM (Configuration register)

Address 2100 = 2 (Unit Imperial)

Address	Access	Description	Einheit	Standard	Resolution / Unit	
# 3111	RW / int16	Temperature Offset	Imperial	0	0.1	°F
# 3211	RW / int16	Temperature IR Offset	Imperial	0	0.1	°F

= EEPROM (Configuration register)

2.5 Measurement variable: Humidity

2.5.1 Sensor value Humidity

Adress	Access	Description	Resolution / Unit	
103	R / int16	Relative Humidity	0.1	%

Address: 2100 = 1 (Unit SI)

Adress	Access	Description	Resolution / Unit	
104	R / int16	Absolute Humidity	SI	0.1 g/m ³
105	R / int16	Enthalpy	SI	0.1 kJ/kg
106	R / int16	Dewpoint	SI	0.1 °C

Register 2100 = 1 (Unit Imperial)

Adress	Access	Description	Resolution / Unit	
104	R / int16	Absolute Feuchte	Imperial	0.1 gr/ft ³
105	R / int16	Enthalpy	Imperial	0.1 BTU/lb
106	R / int16	Dewpoint	Imperial	0.1 °F

2.5.2 Offset-/ Correction value Humidity

Adress	Access	Description	Default	Resolution / Unit	
# 3311	RW / int16	Offset relative Humidity	0	1	%

= EEPROM (Configuration register)

2.6 Measurement variable: Movement Luminosity

2.6.1 Sensor value Movement / Luminosity

Adress	Access	Description	Resolution / Unit	
100	R / int16	Bewegung	1 / 0	
110	R / int16	Luminosity	Lux	

Adress	Access	Description	Default	Resolution / Unit
3723	RW	Factor		

2.7 LED Anzeige

The LED on the thevios 3 can be switched on/off directly using the table values.

This makes it possible to change the colour of the LED during operation. After restarting the device, the registers must be rewritten, as the values are not saved. During PIR LED mode 'On/Off' and 'Run test', the LED lights up red when detection occurs, regardless of the configured colour.

Adress	Access	Description	Default	Note
119	RW / u16	LED lighting (colour) 0 = off 1 = red 2 = green 3 = yellow 4 = blue 5 = magenta 6 = cyan 7 = white	0 (off)	Lights up continuously until the device is restarted or reconfigured.

3 Modbus Protocol

<http://www.modbus.org/>

3.1 Supported Control Commands

The following MODBUS control commands are supported by the device:

Description	Function Code	
Read Holding Register	03 (hex)	3 (dec)
Write Single Register	06 (hex)	6 (dec)
Write Multiple Register	10 (hex)	16 (dec)

3.2 Data Transmission

3.2.1 Master/Slave Protocol

One Master and one or several Slaves are connected to the serial bus. The communication between Master and Slave is solely controlled by the Master. Slaves are only allowed to send if they were called by the Master before. Slaves are only sending to a Master, never to another Slave.

3.2.2 Data Frame

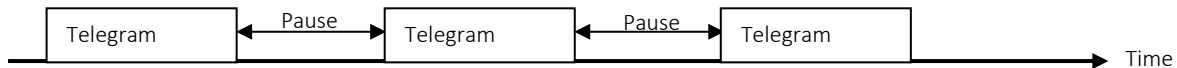
Data are sent to the bus in accordance with strictly defined defaults:

Address	Control Command	Data	Checksum
---------	-----------------	------	----------

In general a MODBUS telegram starts with the address of a slave, followed by a control command (e.g. read out of register) and the data. By means of the checksum at the end of the telegram the bus participants can recognize transmission errors.

3.2.3 Transmission Mode RTU

In the transmission mode RTU telegrams are separated by transmission pauses.



The period of the transmission pauses for separation of telegrams is depending on the set baud rate and amounts to $3,5 * \text{Word-Transmission Time (11 Bit)}$. With 9600 Baud at least 4 ms and with 19200 at least 2ms must pass by between two telegrams.

3.2.3.1 Telegram Structure

Address 1 Byte	Control Command 1 Byte	Data 0 - 100 Byte	Checksum	
			Low	High

3.2.3.2 Calculation of CRC-Checksum

The CRC checksum (Cyclic Redundancy Check) is calculated by the sender by means of all bytes transmitted and is attached to the message. Then, the receiver calculates the CRC checksum again and compares the same with checksum received. If the values are not matching, a transmission error must be assumed and the data received are rejected. The low-order byte of the 16 bit checksum is sent in the telegram next to the last position and the high-order byte at the last position.

Calculation of Checksum (programming example in C):

```

crc = 0xFFFF; // CRC-Check, Init
for(i = 0; i < telegram_length-2; i++)
    crc = crc_calc(crc, telegram_data[i]);

crc_low = crc & 0x00FF; // Low-Byte
crc_high = (crc & 0xFF00) >> 8; // High-Byte

// Calculate CRC
unsigned int crc_calc(unsigned int crc_temp, unsigned int data)
{
    unsigned int Index_CC=0;
    unsigned int LSB=0;
    crc_temp = ( ( crc_temp ^ data ) | 0xFF00 ) & ( crc_temp | 0x00FF );
    for(Index_CC = 0; Index_CC<8; Index_CC++)
    {
        LSB = (crc_temp & 0x0001);
        crc_temp >>= 1;
        if(LSB)
            crc_temp = crc_temp ^ 0xA001; // calculation polynomial for CRC16
    }
    return(crc_temp);
}

```