RS485 Modbus Manual

thevios 3

thevios®

Revision

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1 General

This document describes the RS485 Modbus interface for the devices:

- 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	Temperature	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:

Address	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 Readability in hexadecimal
1235	R / u16	Firmware version (revision/build)	
2102	RW / u16	Maintenance countdown	
2103	RW / u16	Calibration countdown	
2104	RW / u16	Maintenance interval	
2105	RW / u16	Calibration interval	

Address	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 9 600, 19 200, 38 400, 57 600, 76 800, 115 200
- 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: 38 400
- 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: 115 200
- 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.

Address	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

Address	Access	Description	Default	Note
17000	RW	Device address (Slave ID) 1..247	1	
17001	RW / u32	Baud rate 9 600 | 19 200 | 38 400 | 57 600 | 76 800 | 115 200	38 400	
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

Address	Access	Description	Default	Note
3030	RW / int16	Sensitivity	Medium	The sensitivity should be adjusted via the app. A restart is required after making changes.
3031	RW / int16	Delay time	600 s	
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	Unit	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	Unit	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	Unit	Default	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

Address	Access	Description	Resolution / Unit
103	R / int16	Relative Humidity	1 %

Address: 2100 = 1 (Unit SI)

Address	Access	Description	Unit	Resolution / Unit
104	R / int16	Absolute Humidity	SI	0.1 g/m³
105	R / int16	Enthalpy	SI	0.1 kJ/kg
106	R / int16	Dewpoint	SI	0.1 °C

Register 2100 = 1 (Unit Imperial)

Address	Access	Description	Unit	Resolution / Unit
104	R / int16	Absolute Feuchte	Imperial	0.1 gr/ft³
105	R / int16	Enthalpy	Imperial	0.1 BTU/lb
106	R / int16	Dewpoint	Imperial	0.1 °F

2.5.2 Offset / Correction value: Humidty

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

= EEPROM (Configuration register)

2.6 Measurement variable: Movement and luminosity

2.6.1 Sensor value: Movement and luminosity

Address	Access	Description	Resolution / Unit
100	R / int16	Movement	1
110	R / int16	Luminosity	1 lux

Address	Access	Description	Default	Resolution / Unit
4012	RW	Lower range limit	0	1 lux
4013	RW	Upper range limit	20 000	1 lux

2.6.2 Field calibration and adjustment of luminosity

Address	Access	Description	Default	Resolution / Unit
4023	RW	Factor		0.001

For cases where the reference instrument reading and the measured value of the thevios 3 differ, field calibration and adjustment can be performed. To do so, divide the reference instrument reading by the thevios 3 reading and multiply the result by 1000. Enter the calculated value in register 4023 (Factor).
Example: Reference instrument reading = 1200 lux; thevios 3 reading = 600 lux → 2 × 1000 = factor 2000.

2.7 LED display

The LED display on the thevios 3 can be switched on and off directly using the table values.
This makes it possible to change the colour of the LED display 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 display lights up red when detection occurs, regardless of the configured colour.**

Address	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 registers	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

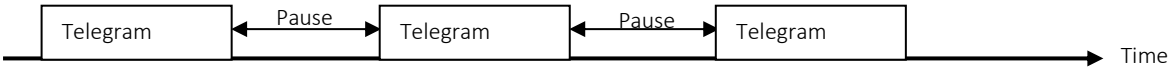
Data are sent to the bus in accordance with strictly defined defaults:

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 depends on the set baud rate and amounts to 3,5 × Word transmission time (11 Bit). With 9 600 Baud at least 4 ms and with 19 200 at least 2 ms 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 (Cyclicyal 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 is 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 polynominal for CRC16
        }
        return(crc_temp);
}
```