

MODBUS RTU “over serial line” protocol for SARAD instruments

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The MODBUS protocol offers a communication option in addition to the SARAD standard protocol. The protocol type can – depending on the type of instrument – be selected either by jumper, switch or menu. The MODBUS protocol implements only a part of the interface functionality and has been implemented primarily for the cyclic reading of current measuring results. The adjustment of the configuration parameters as well as the download of time distributions stored in the instrument is not possible.

Protocol

Standards

- MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1b3
- MODBUS over serial line specification and implementation guide V1.02
- www.modbus.org

With respect to the standard following communication parameter are defined:

Baud rate: 9600bps or 19200bps (configurable)

Data format: 1 start bit, 8 data bits, 1 parity bit, 1 stop bit (total 11 bit)

Parity: even

Address range: 1...255 (configurable)

Bus timing

	9600 bps	19200 bps
Min. period between two frames (t3.5)	4.025ms	2.01ms
Max. period between two bytes within a frame (t1.5)	1.75ms	0.862ms
Response time	< 1s	< 1s

Error management

Incomplete frames or frames with invalid check sums will be ignored and result in a client time out.

Invalid or not supported function codes, register addresses and data length settings are responded by the related exception codes:

- Invalid function: Code 0x01
- Invalid address: Code 0x02
- Invalid number of registers: Code 0x03

Hardware

- Instruments with native RS-485 interface (full bus functionality)
- Instruments with RS-232 interface with RS-232/RS-485 converter (full bus functionality)
- Instruments with RS-232 interface or internal USB/UART converter (point to point connection without bus functionality – for example host which handles transmission over virtual COM port)
- Instrument specific implementation of the bus functions

Smart Radon Sensor

Function code 0x03 (read holding register)

Valid register addresses are:

Register Address	Register content	Number of registers	Format
0x0000	Radon concentration [Bq/m ³]	2	Float
0x0002	Statistical error of Radon concentration [%]	2	Float
0x0004	Average Radon concentration since last start [Bq/m ³]	2	Float
0x0006	Battery voltage [V]	2	Float
0x0008	Temperature [°C]	2	Float
0x000A	Relative humidity [%]	2	Float
0x000C	Standard: not available Option P: barometric pressure [mbar] Option CO2: CO2 concentration [ppm]	2	Float

IEEE 745 float values (4 Byte) are transmitted as two sequential 16 bit registers. The number of registers to be read must be two. That means, only one value can be transmitted per frame. Other values and not stated register addresses will cause an exception response.

Bus Settings:

- Address by INIT Software
- Transfer protocol by toggle switch at the instrument (selection of Baudrate [9600/19200] by INIT software)

Sample frame

Request to send the relative humidity from instrument address 1:

Address	Function	Register H-Byte	Register L-Byte	Number H-Byte	Number H-Byte	CRC L-Byte	CRC H-Byte
0x01	0x03	0x00	0x0A	0x00	0x02	0x08	0x24

Response (rel. humidity = 39.9002 %):

Address	Function	Number of data bytes	Data byte 1	Data byte 2	Data byte 3	Data byte 4	CRC L-Byte	CRC H-Byte
0x01	0x03	0x04	0x99	0xCE	0x42	1F	F7	38

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Valid register addresses are:

Register Address	Register content	Number of registers	Format
0x0000	Radon concentration [Bq/m ³]	2	Float
0x0002	Statistical error of Radon concentration [%]	2	Float
0x0004	Average Radon concentration since last start [Bq/m ³]	2	Float
0x0006	Battery voltage [V]	2	Float
0x0008	Temperature [°C]	2	Float
0x000A	Relative humidity [%]	2	Float
0x000C	barometric pressure [mbar]	2	Float
0x000E	Thoron concentration [Bq/m ³]	2	Float
0x0010	Statistical error of Thoron concentration [%]	2	Float
0x0012	Average Thoron concentration since last start [Bq/m ³]	2	Float

IEEE 745 float values (4 Byte) are transmitted as two sequential 16 bit registers. The number of registers to be read must be two. That means, only one value can be transmitted per frame. Other values and not stated register addresses will cause an exception response.

Bus Settings:

- Address by INIT software
- Transfer protocol by push button menu at instrument