



AlphaTracer Industry

Modbus 485

Real-time radon measurements in humid rooms

The AlphaTracer is a professional, highly innovative real-time radon sensor for fixed installation in smart buildings for connection to ventilation controls or other devices suitable for analog or digital input signals. It measures Rn-222 activity concentration in indoor air, which is provided as a proportional digital output signal.

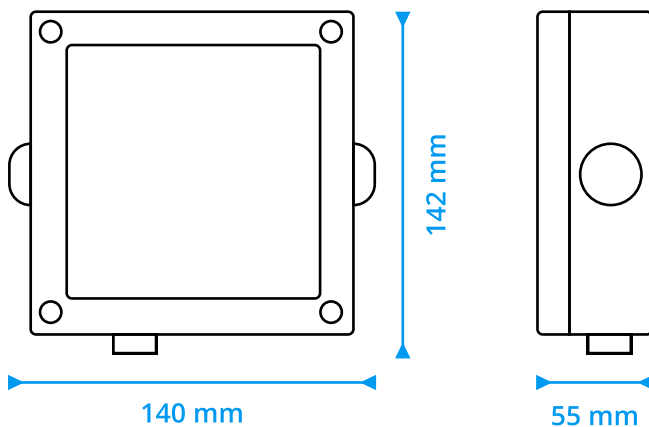


Sensor Specifications

Technology	Lucas Cell
Initial measurement value	10 min
Data interval	10 min
Sensitivity	17 cph at 100 Bq/m ³
Operation conditions	0 – 60 °C , RH < 99 %
Measurement range	0 – 1,000,000 Bq/m ³ (0.2 – 27,000 pCi/l)
Precision	< ± 10 % at 370 Bq/m ³ (10 pCi/l)
Accuracy	< ± 10 %
Data communication	Modbus RS485
Diffusion time	~ 10 min

General Device Specifications

Dimensions, Weight and Placement



Weight: 303 g

The sensor can be mounted in any conceivable position, as it is not sensitive to humidity or vibration.

Calibration

Recalibration is recommended every 3 years. If the sensor is exposed to very high concentrations (on average more than 1,000 Bq/m³), calibration is recommended every 2 years. A factory calibration is offered by the company LivAir GmbH. The sensor itself does not require any maintenance.

Safety and warning notices



Please read the data sheet carefully before commissioning the AlphaTracer. Damage caused by non-observance of the instructions in the data sheet is excluded from any liability.

- The radon sensor may only be installed by qualified personnel and must be installed in accordance with the data sheet.
- To avoid damage to the sensor, check that it has been connected correctly before applying the supply voltage.
- When unpacking, it must be checked whether the correct device version has been delivered.
- The AlphaTracer may only be used in the manner described in this operating manual. If the product is used in any other way, this may result in danger to the operator as well as destruction of the sensor.
- No technical modifications may be made to the sensor.
- The sensor housing should only be cleaned with a damp cloth. Do not use scouring agents or cleaning agents containing solvents.
- Furthermore, the sensor must not be used if the ambient conditions are not within the limits specified in the data sheet.
- The sensor must not be used in an explosive atmosphere.
- Failure to observe the safety instructions may result in damage to the sensor and injury to the user.

Power and Connectivity Options

Power 7 – 24 V DC, 16 mA

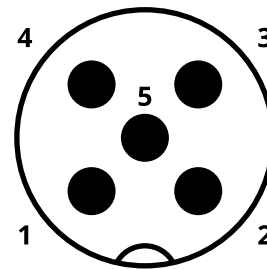
Communication M12 plug

There is a M12 connector to connect the sensor. As soon as the sensor is supplied with voltage, the measurement starts.



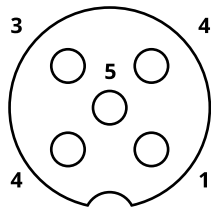
Pin assignment

Number	Connection
1	Shield
2	Vcc
3	GND
4	B-
5	A+



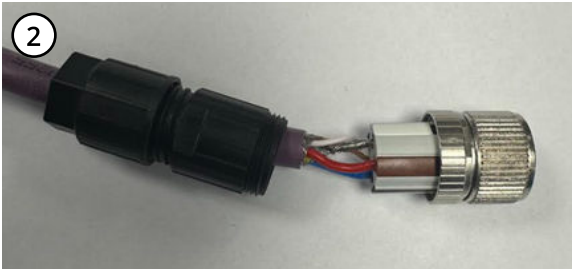
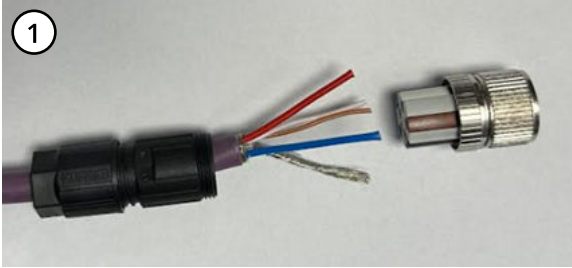
Pin assignment M12 male connector, 5-pos.,
A-coded, male side

Example for a M12 plug

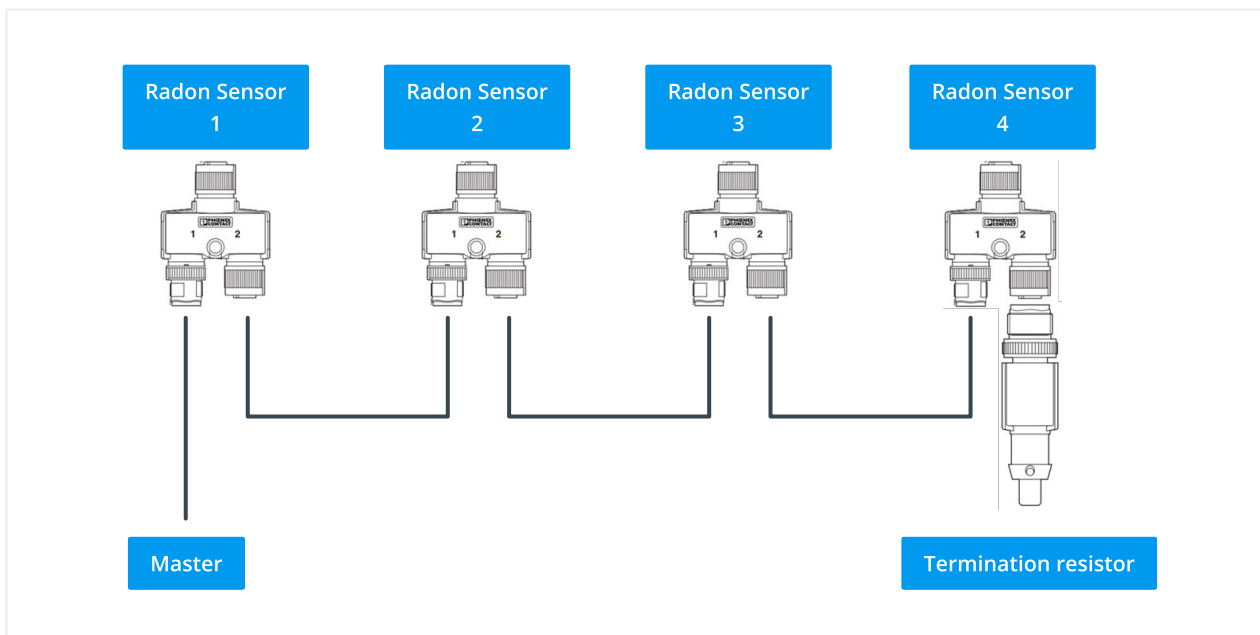


Connector - SACC-M12FS-5PL M
Manufacturer Part No: 1424652
Manufacturer: Phoenix Contact

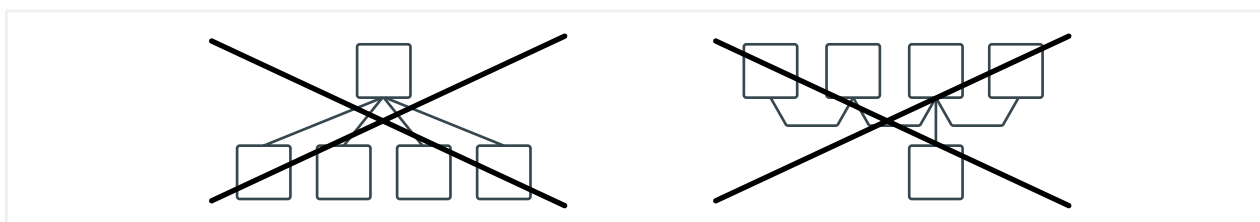
M12 mounting with self-assembled cables



Chaining

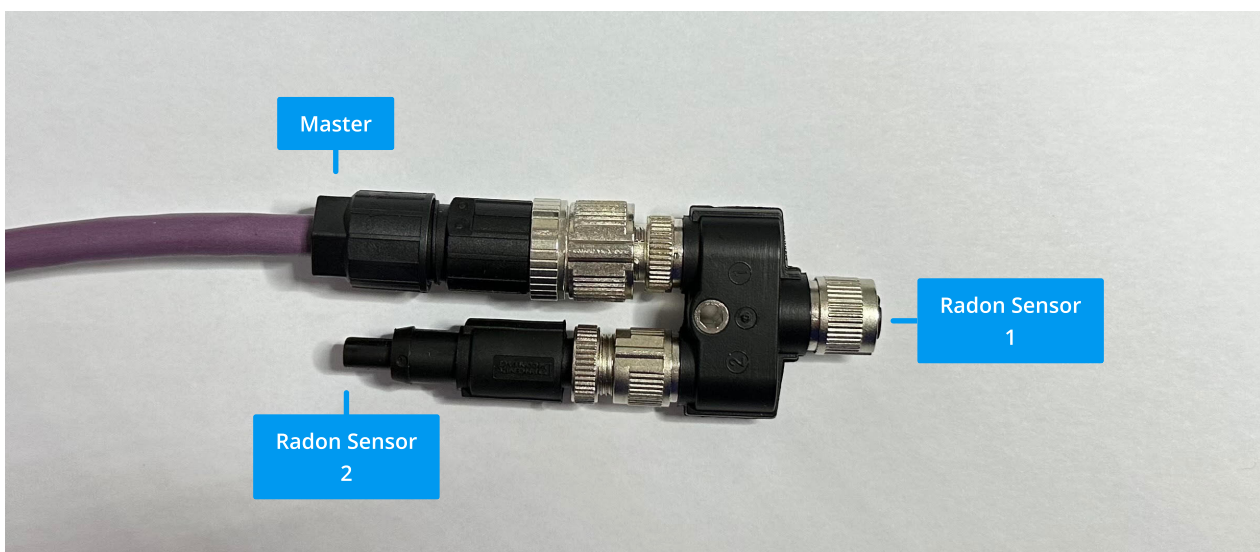


Correct example of four radon sensors in a row



Incorrect wiring Modbus RS485

Each sensor connected to the bus is assigned a unique address. This must be set beforehand with a programming tool. All sensors require the same transmission speed.



Bus system cable, Y distributor and termination resistor (The components used can be found on the next page.)

Components

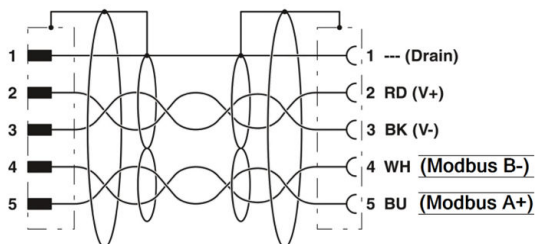
Cable



Bus system cable - SAC-5P-M12MS/ 2,0-920/M12FS (2 Meters)

Manufacturer Part No: 1507557

Manufacturer: Phoenix Contact



Y Distributor



Y distributor - SAC-5PY-F/M-F VP SH

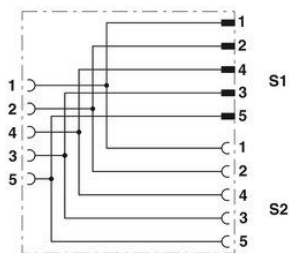
Manufacturer Part No: 1419933

Manufacturer: Phoenix Contact



All pins of the Y distributor must be plated through 1to1

Circuit diagram



Contact assignment of the M12 Y distributor

Termination resistor



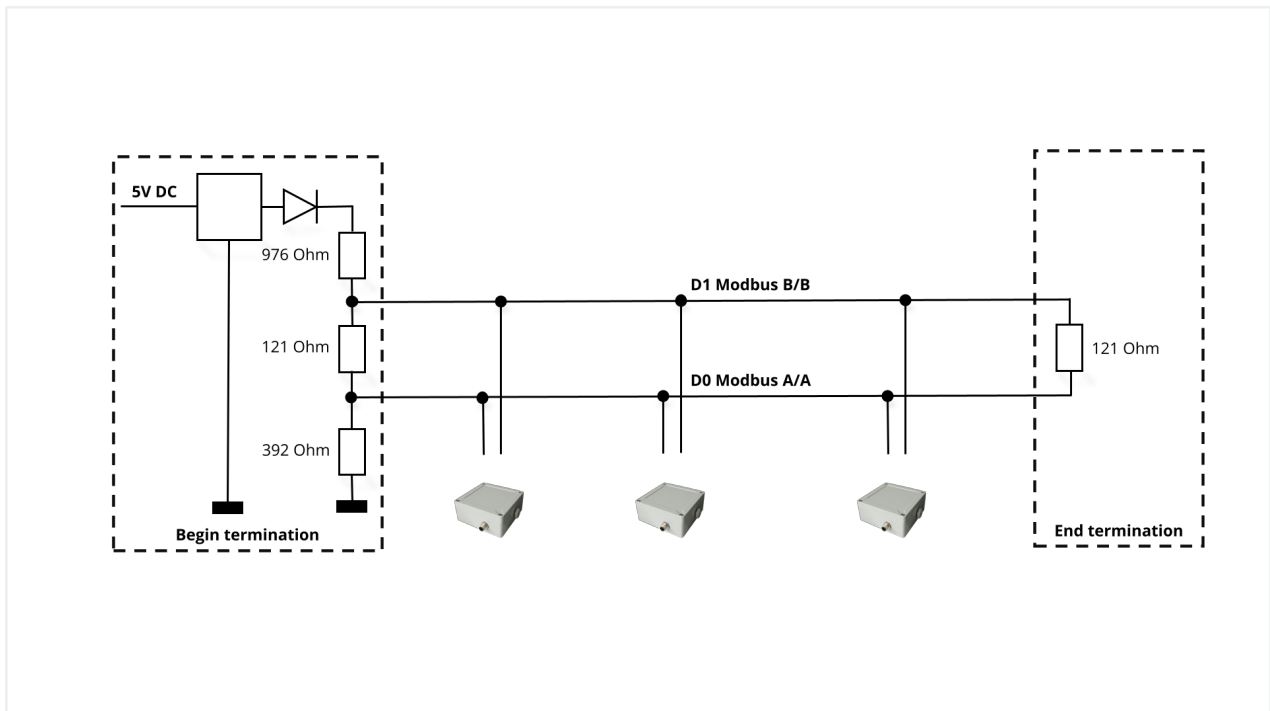
Termination resistor - SAC-5P-M12MS CAN TR

Manufacturer Part No: 1507816

Manufacturer: Phoenix Contact

Bus termination

Line polarization and line termination are a must for the Modbus RTU and ASCII devices. A resistor is added in parallel to the "A" and "B" line of the receiver in accordance with the characteristic impedance of the data line specified by the cable manufacturer (120 Ω is a common value). This value describes the characteristic resistance of the transmission line and is not dependent on the line length. Terminating resistors of less than 90 Ω should not be used. The terminating resistors may only be placed at the outer ends of the data line (see resistors RT1 and RT2 in the termination diagram), and in a system without repeaters no more than two terminations should be placed



Modbus System

The transmission line must be terminated with a resistor 120 Ohm / 0.25 W at the respective last receiver of the Modbus transmission line. This resistor must be inserted directly between the two signal lines before the input of the last receiver circuit. Only shielded cables with twisted wires should be used for Modbus.



Please supply the AlphaTracer only one time with voltage!

Modbus

Driver Typ: Modbus RTU

Polling frequ. max [sec]:	180
Data bits	8
Stop bits	1
Parity	none
RTS	disable
Timeout [ms]:	500

Standard values to read out

Poll the sensor as seldom as possible!
 Measured values only change every 10 min.
 Too frequent polling (<1 min) can influence the measurement!

Name	DeviceID	Function	Type	Read only	Address	WordSize	Content Type	Modbus Address	
Register 0	1	03/06	Holding Register		0	Word(16bit)	unsigned	Modbus Address	1*
Register 4	1	03/06	Holding Register		4	Word(16bit)	unsigned	Baudrate	5*
Register 20	1	03	Holding Register	x	20	Dword(32bit)	unsigned	Radon value live	16*
Register 22	1	03	Holding Register	x	22	Dword(32bit)	unsigned	Radon value 24h	17*
Register 24	1	03	Holding Register	x	24	Dword(32bit)	unsigned	Radon value long	18*
Register 26	1	03	Holding Register	x	26	Word(16bit)	unsigned	Radon entries since start	19*

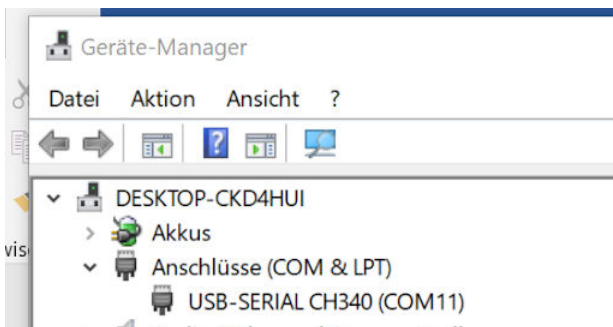
1*	2-248 1*standard
5*	0=2400 1=4800 *2=9600 3=19200 4=38400
16*	Radon value live 0-2,000,000 Bq/m ³
17*	Radon value 24h 0-2,000,000 Bq/m ³
18*	Radon value long 0-2,000,000 Bq/m ³
19*	Radon entries [10 min] since start

As default the sensor is using slave address 1. The radon value can be found in register 20.

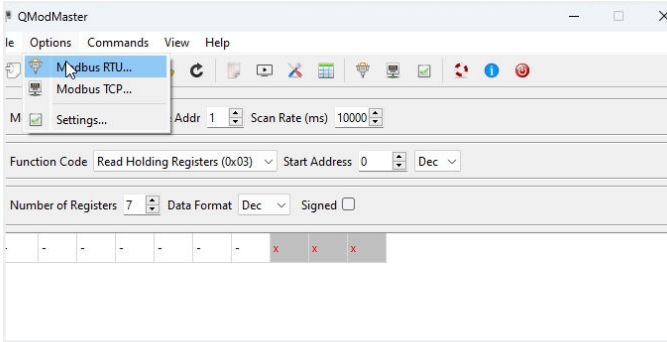
Example 1 - QModMaster

You can use the open source program QModMaster, which you can download here: <https://sourceforge.net/projects/qmodmaster/>

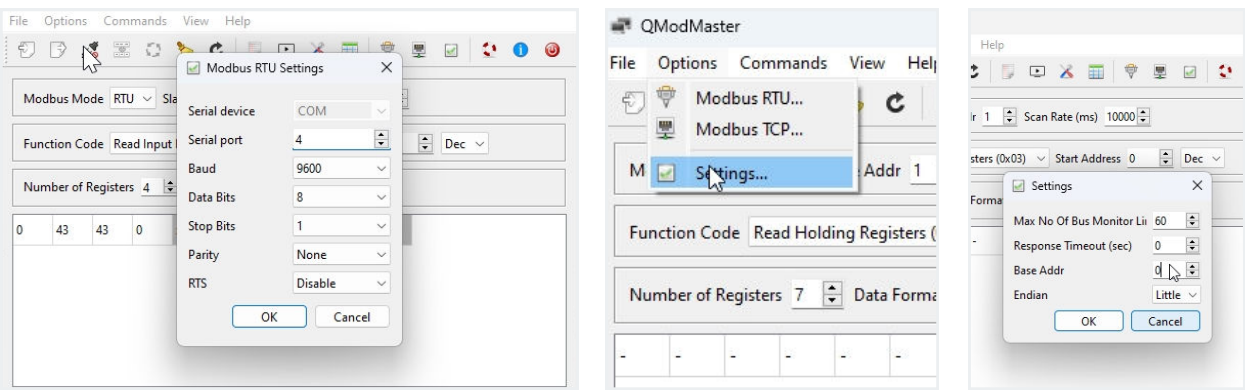
Just check which Com Port your USB to RS485 adapter is using. In our case it's COM11.



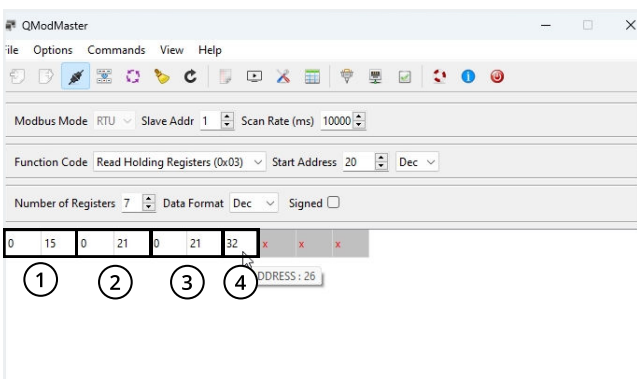
Select **Modbus RTU...** in the **Options** menu.



Set **Serial device** to **Com**, **Serial port** to **4** and **Baud** to **9600** and go to **Settings** and switch the **Base Addr** to **0**.



Set the **Modbus Mode** to **RTU** and **Slave Addr** to **1**. Important, put the **Scan Rate** to **10000 ms** (which means every 10 seconds). Normally we recommend to set the scan rate to 10 minutes, because the sensors radon value is updated every 10 minutes. A faster scan rate just disturbs the sensors radon measurement process.



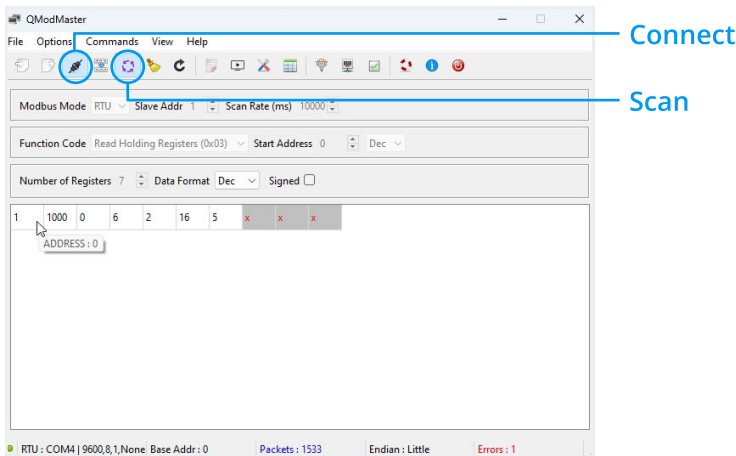
In this example, we read 7 registers at **Start Address 20**.

1. Radon value live **32bit**
2. Radon value 24h **32bit**
3. Radon value since start **32bit**
4. Radon entries since start **16bit**



The radon value is in two registers because it is a 32bit value. Only a radon value up to 65535 would be displayed there. At 65536 there is 0 and in the next register then a 1. These are the high and low bytes of a 32bit register.

Define **Function Code Read Holding Registers (0x03)** and **Start Address 0**, **Number of Registers 7** and the **Data Format Dec**. **Connect** and activate **Scan** (so that the tool automatically updates the information every 10 seconds). Now you can see the sensor address in register 0.

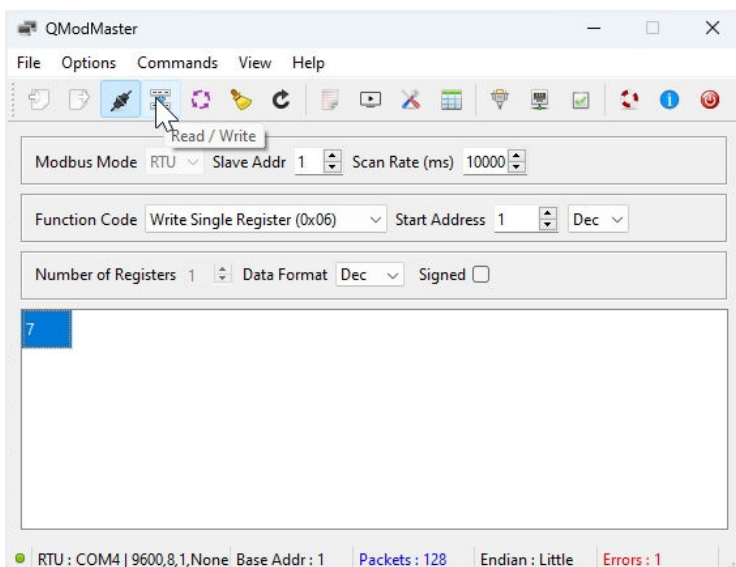


How to change the slave id address?

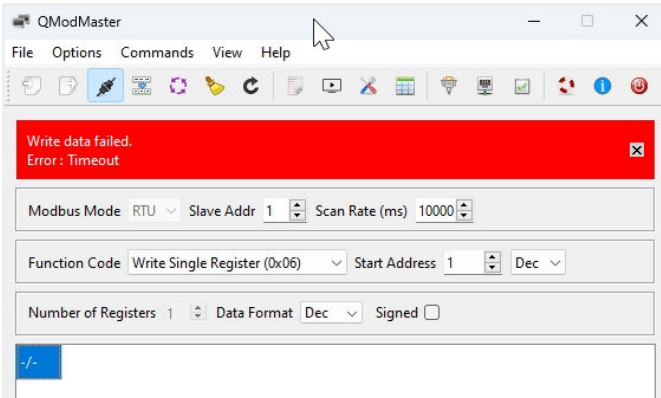
If you want to use more than one sensor on the cable, then you need to give each sensor its own address. By default each sensor is on the Modbus slave id 1.

You can change the slave id as follows:

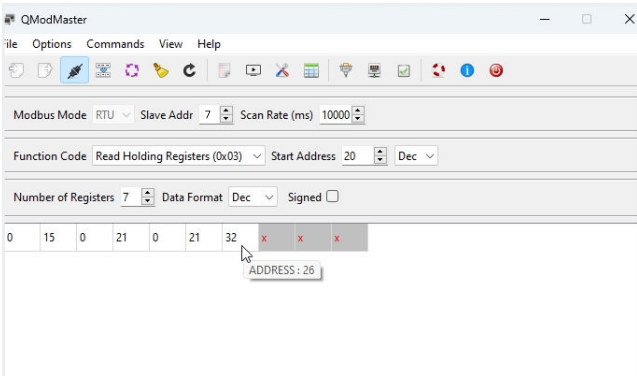
1. Select **Function Code Write Single Register (0x06)**
2. Now you can write for example the slave address to 7
3. Press the button **Read/Write**



If you now try to read out the input register again, you will get an error message because the tool cannot reach the sensor on **Slave Addr 1**, that means that the change of the slave address has worked.



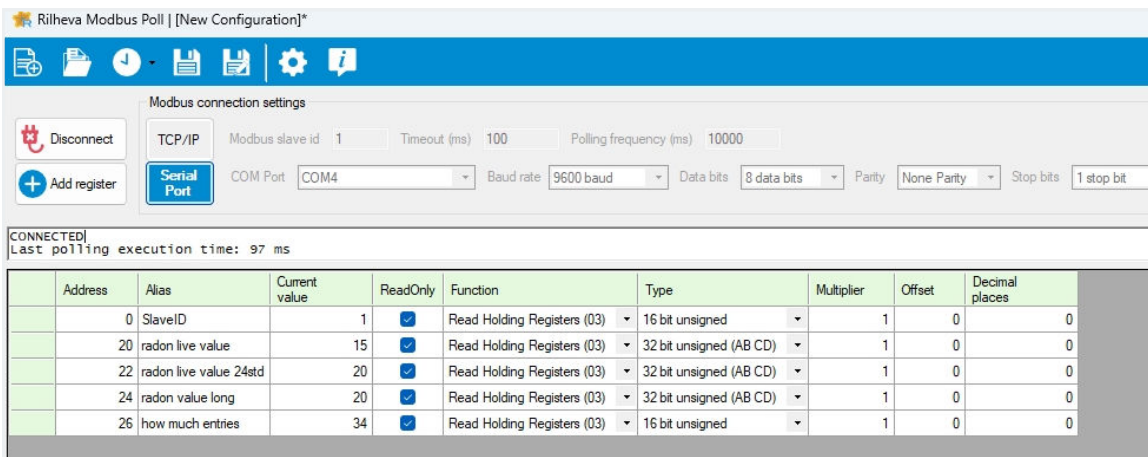
Let's change the **Slave Addr** to **7** and the **Start Address** to **20** and test again.



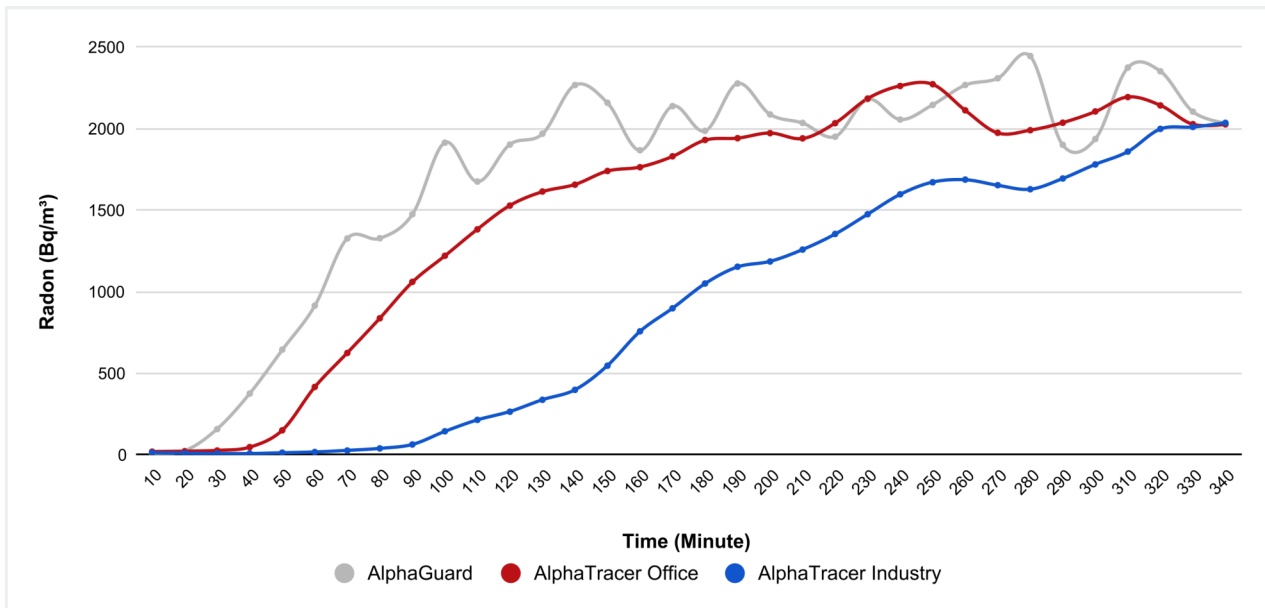
As a result the connection works and we get the radon live value on address 20.

Example 2 - Rilheva Tool

There is a free version called Rilheva Modbus Poll that you can download here:
<https://www.rilheva.com/rilheva-modbus-poll-desktop-edition>



Comparative measurement



In this example, we have induced (under laboratory conditions) a very rapid increase in the Radon-222 activity concentration from 30 to over 2,500 Bq/m³:

Both AlphaTracer variants show, only delayed in time, the same total exposure as the reference instrument AlphaGuard (approx. 15,000 Euro acquisition cost).

Thus, the **AlphaTracer Office** reaches the measurement curve of the reference instrument with a time delay of approx. 30 min, the **AlphaTracer Industry** with a delay of approx. 100 min due to its IP54 class.

A very fast increase or decrease of the radon concentration leads to a delayed reproduction of the concentration change for radon measuring instruments with a denser housing and consequently slower air entry, but the correct measurement of the total exposure is not falsified or impaired by this.



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