

Description of serial communication for radon probe RPP-T

Hardware

Pinout:

Pin	Name	Direction Probe Side	Note
1	VCC	IN	5VDC (3-5mA)
2	TX	OUT	3,3V; 0V voltage levels
3	RX	IN	3,3V; 0V voltage levels
4	GND	-	Ground

Parameters:

19,2 kb/s; 8bit; No parity; 1 stop bit

The probes is „slave“ and host is „master“ in serial communication

Software

- **Syntax of *basic data frame***

1.byte	2.byte	3.byte	4. – X.byte	last. byte
@	nB	Command	parameters/data	CRC8

1.byte - @ - start symbol

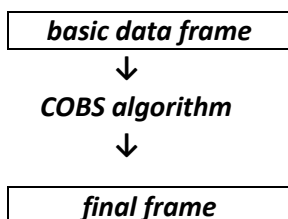
2.byte – nB - number of following bytes without CRC8 byte

3.byte – **Command** - symbol of command e.g. C, D, S, T etc.

4. –X.byte – **parameters** of command for request or **data** for response

last.byte - **CRC8** – error check byte - exact count of it is in /C_examples

- **Syntax of final frame**



For creating of final frame you have to apply on basic data frame **COBS** algorithm described on https://en.wikipedia.org/wiki/Consistent_Overhead_Byte_Stuffing - example of it is in /C_examples

- **Commands**

Actual data get – D

request : @ 1 D CRC8

response: @ 45 D data CRC8

data (size)	name	description
2 byte (MSB, LSB)	concentrationTime	Actual running time in interval 240s (4 min.) in seconds. New value of Rn concentration is available every 4 min!
4 byte (MSB...LSB)	concentration	Actual value of Rn concentration in Bq/m3. Values is moving average per last 1 hour.
1 byte	temperature	Actual temperature in °C Coding signed char - range from -128 to +127 °C dec hex °C 0 0x00 0 1 0x01 +1 . 127 0x7F +127 128 0x80 -128 129 0x81 -127 . 254 0xFE -2 255 0xFF -1
1 byte	humidity	Actual humidity in %
4 byte (MSB...LSB)	sum1	Actual number of Alpha particles with energy power below level d1 (for service use)
4 byte (MSB...LSB)	sum2	Actual number of Alpha particles with energy power between level d1 and level d2 (for service use)
4 byte (MSB...LSB)	sum3	Actual number of Alpha particles with energy power between level d2 and level d3 (for service use)
4 byte (MSB...LSB)	sum4	Actual number of Alpha particles with energy power above d3 (for service use)
1 byte	impulsesHV	Actual number of voltage impulses for create high voltage – status of high voltage generator (for service use)
4 byte (MSB...LSB)	concentrationDay	Actual value of long-term Rn concentration in Bq/m3. Values is moving average per last 1 day.
2 byte (MSB, LSB)	recordTime	Actual running time in setting interval of record saving in seconds. Records are saved into radon probe memory.
2 byte (MSB, LSB)	recordCount	Actual number of saved records
2 byte (MSB, LSB)	spectrumTime	Actual running time in setting interval of energy spectrum saving in seconds. Energy spectrum are saved into radon probe memory.
2 byte (MSB, LSB)	spectrumCount	Actual number of record just measured energy spectrum
4 byte (MSB...LSB)	impulsesTotal	Actual total number of Alpha particles (for service use)
1 byte	switch	00h – for service use
2 byte (MSB, LSB)	voltage	Actual values of power supply in mV

Code and version get – C

request : @ 1 C CRC8

response: @ 21 C code version CRC8

size	name	description
10 byte	code	String of equipment code
10 byte	version	String of firmware version

Serial number get – V

request : @ 1 V CRC8

response: @ 11 V serial CRC8

size	name	description
10 byte	serial	String of serial number

User parameters – U, u

User parameters **get** – U

request : @ 1 U CRC8

response: @ 7 U parameters CRC8

User parameters **set** – u

request : @ 7 u parameters CRC8

response: @ 1 u CRC8

parameters (size)	name	description
2 byte (MSB, LSB)	limit	Limit of radon concentration for generate alarm at some kind of systems
1 byte	recordInterval	Regular time interval for saving record of data (concentration) in minutes (default is 60 (1 hour))
2 byte (MSB, LSB)	spectrumInterval	Regular time interval for saving energy spectra in minutes (default is 720 (12 hours))
1 byte	algorithm	Type of concentration calculation. 0 – calculation from RnA; 1..255 – calculation from RnA + RnC

Real time – T, t

Real time **get** – T

request : @ 1 T CRC8

response: @ 12 T table CRC8

Real time **set** – t

request : @ 5 t time CRC8

response: @ 1 t CRC8

table (size)	name	description
4 byte (MSB...LSB)	time	Actual number of seconds since year 2000
1 byte	day	Actual day
1 byte	month	Actual month
2 byte (MSB, LSB)	year	Actual year
1 byte	hour	Actual hour
1 byte	minute	Actual minute
1 byte	second	Actual second

Data records get - Z

request : @ 3 Z index CRC8

response: @ 29 Z record CRC8

index (size)	name	description
2 byte (MSB,LSB)	index	Index of requested data record. Number of records in internal memory can be up to 4096. One record has 10 values. The record with highest number is actual record. Number of actual record is available in command D – recordCount. After erasing of all records the first records has number 1. After fulfilment of memory the new one record is written to position 4096 and rest of memory is shift -1 and record number one is overwritten by record number 2.

record (size)	name	description
4 byte (MSB...LSB)	time	Date and time of record. Time when the data record was saved into internal memory Actual number of seconds since start of year 2000. (UINT)
4 byte (MSB...LSB)	concentration	Rn concentration in Bq/m3. Average value per RecordInterval (default per 1h). (UINT)
1 byte	temperature	Temperature in °C (INT) in chamber. Average value per RecordInterval (default per 1h). Coding signed char - range from -128 to +127 °C dec hex °C 0 0x00 0 1 0x01 +1 . 127 0x7F +127 128 0x80 -128 129 0x81 -127 . 254 0xFE -2 255 0xFF -1
1 byte	humidity	Humidity in % (UINT) in chamber. Average value per RecordInterval (default per 1h).
4 byte (MSB...LSB)	Sum1	Number of Alpha particles with energy power below level d1 (for service use) (UINT). Sum of impulses per RecordInterval (default per 1h)
4 byte (MSB...LSB)	Sum2	Number of Alpha particles with energy power between level d1 and level d2 (for service use) (UINT). Sum of impulses per RecordInterval (default per 1h) $sum2 = (RaA(^{218}Po-218))$
4 byte (MSB...LSB)	Sum3	Number of Alpha particles with energy power between level d2 and level d3

		(for service use). Sum of impulses per RecordInterval (default per 1h) (UINT). $\text{sum3} = (\text{RaC}({}^{214}\text{Po}))$
4 byte (MSB...LSB)	Sum4	Number of Alpha particles with energy power above d3 (for service use) (UINT). Sum of impulses per RecordInterval (default per 1h).
1 byte	impulsesHV	Number of voltage impulses for create high voltage – status of high voltage generator (for service use)
1 byte	algorithm	Type of setting concentration calculation. 0 – calculation from RnA; 1..255 – calculation from RnA + RnC

Spectrum records get – S

request : @ 3 S index CRC8

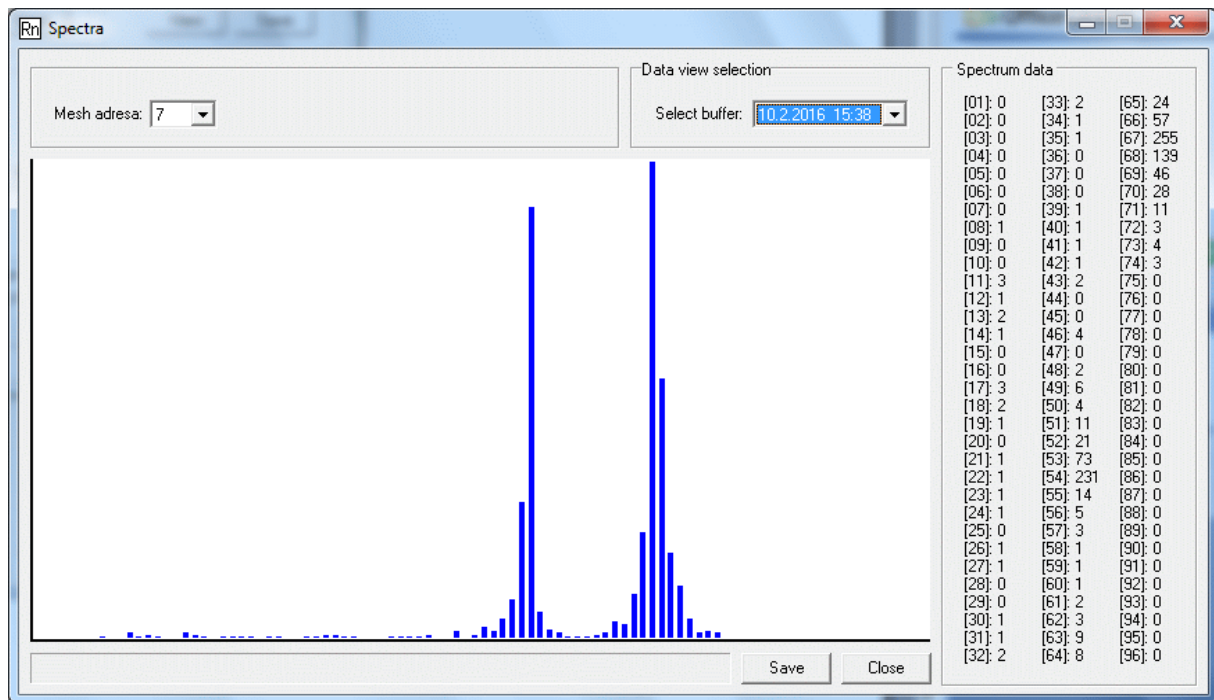
response: @ 103 S spectrum CRC8

index (size)	name	description
2 byte (MSB,LSB)	index	Index of requested spectrum record. Number of spectrum records in internal memory can be up to 512. One record has 3 values. The record with highest number is actual record. Number of actual record is available in command D – spectrumCount. After erasing of all records the first records has number 1. After fulfilment of memory the new one record is written to position 512 and rest of memory is shift -1 and record number 1 is overwritten by record number 2.

spectrum (size)	name	description
4 byte (MSB...LSB)	time	Date and time of record. Time when the spectrum record was begun to measure. Actual number of seconds since start of year 2000. (UINT)
2 byte (MSB,LSB)	measureTime	Real time of spectrum measurement (UINT) in seconds. If the number of impulses in some energy levels crosses 255 the record of the spectrum is stopped earlier before reaching the end of the measurement interval (SpectrumInterval).
96 byte	spectrumData	96 values (UINT) (bytes) of number of alpha impulses. Every value shows number of Alpha impulses in 96 diferent energy channels. (for radon expert use only) Detail description of energy spectrum and graphical example of spectrum data is on figure below.

The energy spectrum shows the number of impulses generated due to radon decay. Every detected impulse has definite energy which is measured and evaluated into 96 discrete energy levels (channels). One discrete level presents energy interval 0,1 MeV and the whole energy graph is approximately ranging 0 - 10 MeV. If the number of impulses in some energy levels crosses 255 the record of the spectrum is stopped earlier before reaching the end of the measurement.

The expected energy peak for Po-218 is in 60-61 channel as 6,00MeV. The expected energy peak for Po-214 is in 77-78 channel as 7,69MeV.



Erase actual measurement – NI

request : @ 2 NI CRC8

response: @ 1 N CRC8

- Command erases calculating buffers with actual data and reruns new measurement

Erase records – NZ

request : @ 2 NZ CRC8

response: @ 1 N CRC8

- Command erases all old data records in internal memory

Erase spectra – NS

request : @ 2 NS CRC8

response: @ 1 N CRC8

- Command erases all old spectrum records in internal memory

Erase all – NV

request : @ 2 NV CRC8

response: @ 1 N CRC8

- Command makes commands NI,NZ,NS in one time.

Expert parameters – W, w (only for Servis or Expert, change of this influences functionality of radon probe measurement !)

Expert parameters **get – W**

request : @ 1 W CRC8

response: @ 12 W parameters CRC8

Expert parameters **set – w**

request : @ 12 w parameters CRC8

response: @ 1 w CRC8

parameters (size)	name	description
1 byte	discrimination1	The whole energy spectrum is divided into three adjustable discriminatory layers divides the whole area into four parts. Value of layer 1. It is determined individually during probe calibration.
1 byte	discrimination2	The whole energy spectrum is divided into three adjustable discriminatory layers divides the whole area into four parts. Value of layer 2. It is determined individually during probe calibration.
1 byte	discrimination3	The whole energy spectrum is divided into three adjustable discriminatory layers divides the whole area into four parts. Value of layer 3. It is determined individually during probe calibration.
2 byte (MSB, LSB)	calibrationA	The constant value for the calculation of the concentration of radon from RnA. It is determined individually during probe calibration.
2 byte (MSB, LSB)	calibrationAC	The constant value for the calculation of the concentration of radon from RnA + RnC. It is determined individually during probe calibration.
2 byte (MSB, LSB)	signalization	Limit of radon concentration for generate alarm at some kind of systems
1 byte	gain	Value of movement of the energy spectrum to left or right. It is determined individually during probe calibration.
1 byte	offset	Offset value for correct setup of analog path. It is determined individually during probe calibration.

Error

response: @ 1 E CRC8

- In case of bad range of requested values