

# User Manual

# RADON VISION 4

Version 10/2009

## Operation Software for

- Radon-Scout (versions 1, 2, PLUS and PMT)
- RTM1688, RTM1688-2
- DOSEman, DOSEman PRO
- Analog Radon Sensor, Analog Progeny Sensor, Indoor Air Sensor

## CONTENT

System Requirements .....	2
Installation .....	2
Radon Vision Functions .....	2
1. Software Protection .....	2
2. Communication with the Instrument .....	2
3. Main Window Software Buttons .....	4
4. Instrument Setup .....	6
4.1. Set-up Dialog for Radon Scout, Radon Scout PLUS and RTM1688-2 .....	6
4.2. Set-up Dialog for DOSEman, DOSEman PRO, RTM1688 and Analog Sensors .....	8
4.3. Dose Calculation used for DOSEman and DOSEman PRO .....	10
4.4. Additional Set-up and Test Functions of the Analog Sensors .....	11
5. Data Display .....	13
5.1. Time Distribution .....	13
5.2. Defining a Region of Interest (ROI) .....	13
5.3. Output of Integral Results .....	14
5.4. Selection of Radon Display Mode .....	14
5.5. Smoothing function .....	14
5.6. Spectrum View .....	15
6. Communication via Modem .....	15
6.1. Accessing the Instruments using a Modem Connection .....	15
6.2. Configuration of the Instrument Modem .....	16
6.3. Detailed Description of the Modem Control Procedures .....	17
6.4. Modem Parameter Management .....	20
6.5. Selecting the Modems .....	20
6.6. Cables .....	20
7. ZigBee wireless communication networks .....	21

## System Requirements

- Windows 2000, Windows XP, Windows Vista
- 64 MByte RAM
- Graphic with at least 800x600 pixels/256 colours
- Mouse/Touch Pad
- Serial port (COM) or USB port (with USB/RS232 adapter)

## Installation

Insert the CD in your drive and start "setup.exe". The install shield will lead through the installation process.

## Radon Vision Functions

- Upload of set-up parameters
- Download of acquired measurement data
- Interactive graphical view of the acquired data (zoom, data cursor etc.)
- Data management (automatic file name and path generation, comment text)
- Support for both, SI and US unit system
- Selective ASCII export
- Graphic protocol print with space for user specific letterhead

### 1. Software Protection

The program may be installed and used on a unlimited number of computers at the same time. However, a special instrument access code is required for each instrument used together with this software. Without the access code it is impossible to save data on hard disc, to export a text file and to print a protocol from the downloaded time distribution. All other functions like set-up etc. are still enabled.

After the first data download from a non registered instrument, a dialog window to enter the access code appears on the screen. Enter the ten alphanumeric characters and click the OK button. If the code is valid, the instrument becomes registered within the file "instrument.act". In this case the software will never ask again for the access code. The file "instrument.act" will be created within the program directory of Radon Vision. Copy the file into the Radon Vision program directory of any other computer to use the access codes there.

If the access code has been not accepted, you will get a message to try it once again. You may leave the dialog by the CANCEL button, but in this case the data output is disabled.

### 2. Communication with the Instrument

To communicate with the instrument via serial interface, the serial cable has to be connected to both, PC and instrument. First select the used COM port from the list in the upper-left corner of the software. The list contains each COM port between COM1 and COM9 which is available at the computer. Ports occupied by the execution of other software are not included.

It is possible to use USB to RS232 adapters. The manufacturer of such adapters will deliver a suitable driver together with the hardware – please install these drivers following the installation guide. In case that an USB – RS232 adapter is in use, the driver implements a "virtual COM port". The port index may exceed the supported numbers COM1 to COM9. In

this case the port index can be re-assigned to a value below COM9 by the Windows hardware manager.

The instruments DOSEman and DOSEman PRO using an infrared interface (IrDA) for communication. This program supports the latest USB version as well as the older RS232 version of the adapter.

If the USB version of the adapter is connected for the first time, a device driver has to be installed. The driver files are available on the Radon Vision program CD. Follow the instructions of the Windows hardware assistant. Make sure that the virtual COM port assigned to the adapter is linked to COM1 to COM9, similar to the USB – RS232 adapter cable.

Several units may be connected to different COM ports of a computer at the same time. Then, the instruments can be selected by their related COM number.



If the assignment of the receptacle (to which one the cable is connected) and COM port index is unknown, the SCAN function may be used. The software checks each available port to get a communication with one or more connected instruments. After finishing the process, a list containing all connected instrument with the related port connection appears on the screen. If a modem or a SARAD ZigBee wireless adapter is connected to any serial port it will be also listed because it can be used to access instruments connected to a remote modems or ZigBee interfaces. Read chapters 6 and 7 to get detailed information about the modem and ZigBee communication.



### 3. Main Window Software Buttons



Reads all data from the instrument. An message box will show the number of transferred data records while the transfer is in progress. If the instrument access code was not yet entered for the recently connected instrument, the access code dialog will ask to enter it (see chapter Software Protection) .



All transferred data will be saved as a binary data file. The file is named automatically. The file name will be created from a short cut of the instrument type, the serial number followed by the date and time of the first and last stored measurement record. The file extension is \*.rv3.

To ensure absolute data integrity, file directories will be generated automatically as well. The main data directory is called DATA and will be created in the same directory where the program file "RadonVision.exe" is stored.

All measurement series acquired within one year will be stored in a sub-directory: "Year-XXXX", whereby XXXX is the last year for which one data is stored in the saved file. Within each of this annual directories, one sub directory for each instrument will be created: "Dev.No. YYYY" whereby YYYY is the serial number of the device. If saving a new measurement series a comment may be added to the file. This comment remains unchanged for the future and will be the default text for the comment of the exported text files or protocol prints later on.

The saving of the data requires a registered instrument (see chapter Software Protection).

To keep the full data integrity, the storage on hard disc is only possible if the data has been read from the instrument.



Opens a binary data file. The standard file extension is "rv3", but also older file formats such as "rsb" (Radon Scout software) or "rvb" (Radon Vision 1.0 and 2.0). Any other data format will cause an error message.

**Info** Moving cursor to this button will display the comment assigned to the actual loaded binary data file .

**pCi/Bq** Physical units for displayed, printed or exported data will be switched over between to US style and SI style.



Toggles the error bars for the recently shown Radon time distribution. The selected view determines also the style of the Radon curve within the printed protocol.



Only visible for instruments with integrated alpha spectroscopy. Opens a window containing the acquired alpha spectrum. In case of the RTM1688-2 only the data of the selected time period is shown, for all other instruments it contains the summary spectrum of the whole measurement period (see also section Spectrum View).



Exports the measurement data to an EXCEL compatible (items separated by tabulator stops) text file. The file contains only the actually displayed measurement data. Use display zoom to select data for text export. A comment (max. 255 characters) can be added. There are no restrictions regarding file name and directories.

The export function is only enabled if the data were saved on the hard disc before.



Starts the print of a graphic measurement protocol containing the data within the selected time period (see also section Data Display). The standard Windows printer dialog appears to select the printer and the page orientation. A comment (max. 255 characters) may be added. The protocol reserves space for an own letterhead or official writing paper.

All selected data for the protocol print have to be a member of one unique measurement series. If there are interruptions of the measurement within the selected time period, the print function is disabled.

The print function is only enabled if the data were saved on hard disc before.



Opens a dialog to change the instrument set-up. The instrument has to be connected to the selected COM port, otherwise an error message will appear. The actual set-up values of the connected instrument are shown directly after calling the set-up function.

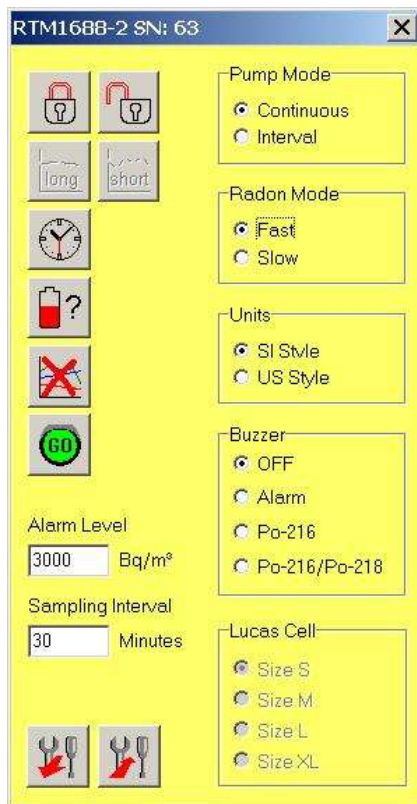
If one of the instruments DOSEman, DOSEman PRO, RTM1688 or an Analog Sensor is connected, a probably running sample has to be cancelled before. In this case a dialog to stop the measurement appears on the screen.

### Checking the Calibration Parameters

The calibration constants of an instrument can be displayed by clicking to the instrument name left below the separation line for the integral values .

## 4. Instrument Setup

### 4.1. Set-up Dialog for Radon Scout, Radon Scout PLUS and RTM1688-2



Unlocks the toggle switch. A measurement series can be stopped and restarted by the switch.



Locks the toggle switch. Just one measurement can be started by toggling the switch. Afterwards the switch is without any function.



Active for Radon Scout (PLUS) only. Sets the integration interval for the calculation of the Radon concentration to one hour. It is allowed to change to an 1 hour integration interval during a performed measurement with 3 hours integration interval. If the duration of the current 3-hour interval already exceeds 1 hour, the current 3-hours interval will be finished before continuing the measurement with 1 hour integration time.



Active for Radon Scout (PLUS) only. Sets the integration time to three hours. It is allowed to change to a 3-hours integration interval during a performed measurement using 1 hour integration interval. The current 1-hour interval will be expanded to a three hour interval.



Adjusts the real time clock and harmonises the time regime to the PC clock. Might be carried out during a running measurement but this is not recommended to ensure integrity of the data.



Erases all the data within the memory of the instrument. In case that a measurement is running, it will be stopped and restarted using the adjusted integration interval time.



Returns the actual cell voltage of the batteries. Dependent on the used battery chemistry, the remaining live time of the batteries can be estimated.

**Pump Mode** (active for RTM1688-2 only)

Continuous:

The pump is running continuously over the whole measurement period

Interval:

The pump is running only for the first five Minutes of a new sampling interval. If the adjusted interval is less than five Minutes the pump will run continuously.

**Radon Mode** (active for RTM1688-2 only)

Effects only the Radon concentration displayed on the instrument. If the data is presented later on by the PC, the results of both calculation modes will appear.

Fast:

Only the detected Po-218 decays will be used for the calculation of the Radon activity concentration. The final value is presented after about 12 to 15 Minutes and the sensitivity is about the half compared with the "Slow Mode". This increases the statistical error.

Slow:

Po-218 as well as Po-214 decays are used for the calculation of the Radon activity concentration. Because of the longer half life times of the nuclides within the decay chain, the response time is expanded to about 150 Minutes. The sensitivity is double as high compared with the "Fast Mode". This decreases statistical error.

**Buzzer** (active for RTM 1688-2 only)

OFF:

The internal buzzer is always off.

Alarm:

If the measured Radon concentration exceeds the adjusted alert level, an audible alert will become active (a short beep at each Second). The alert has to be confirmed by pressing the push button. The alert check is performed at the end of each sample interval.

Po-216:

Each Po-216 decay will indicated by a short beep.

Po-216/Po-218:

A short beep indicates Po-216 as well as Po-218 decays.

**Units** (only for Radon-Scout PLUS and RTM1688-2)

Defines the physical units of the measured results displayed at the instrument (Barometric Pressure, Temperature, Radon Concentration):

SI:

Bq/m<sup>3</sup>, °C, mbar

US:

pCi/L, °F, inHg

**Lucas Cell** (only for Radon-Scout PMT)

Scintillation chambers (Lucas cell) of various size may be used by the Radon-Scout PMT. Because there is a direct relationship between chamber size and sensitivity, four different calibration factors are stored in the instrument. These factors are assigned to the pre-defined chamber sizes S, M, L and XL. Use the setup function to advise the Radon-Scout PMT which one of the calibration factors shall be used for the calculation of the Radon concentration. Make sure that the size is always set correctly with respect to the currently installed chamber. The size labels are placed on the outer surface of the chambers.

**Sampling Interval** (only for Radon-Scout PLUS and RTM1688-2)

Defines the time period between the single points of a measurement series (time distribution). The Radon/Thoron concentration calculated for a data point within the time distribution is derived from the decays counted during this period.

**Alarm Level** (only for RTM1688-2)

Defines the limit of the Radon concentration for alert generation (see also buzzer mode).



All set-up parameters will be received from the instrument



All set-up parameters will be transmitted to the instrument.

## 4.2. Set-up Dialog for DOSEman, DOSEman PRO, RTM1688 and Analog Sensors

To change any set-up parameter, the instrument has to be in the stand by mode (sample stopped).



Adjusts the real time clock and harmonises the time regime to the PC clock.



Clears all data within the instrument and starts a new sample. For some instrument types the time distribution remains in the instrument memory while the first integration interval is not yet finished (read instrument manual).



Stops a running sample.



Switches off the instrument. It is not possible to use this function if the measurement was started before. The instrument has to be turned on manually by pressing the push button. This function is not implemented for Analog Sensors.



Only enabled for Analog Sensors. Opens one more dialog window to access the additional set-up and test functions of the Analog Sensors.

### **User ID** (Not enabled for Analog Sensors)

A number which can be used for personal assignment of the acquired data. The valid range is 0 ... 65535.

### **Country Code, Region Code, Entry Code**

Numbers which can be used to assign the place of measurement to the acquired data. The valid range of each item is 0 ... 255.

### **Sampling Interval**

Counting interval for Radon or Progeny calculation. Defines the time period between the single data points within the acquired time distribution. The range is 1 to 255 Minutes.

### **Alarm Level** (only active for DOSEman and DOSEman PRO)



Sets the dose limit. If the derived equivalent dose exceeds this value, an alert is generated by the instrument. The limit can be adjusted between 0 and 20000 $\mu$ Sv. The dose calculation procedure is explained in the section "Dose calculation DOSEman and DOSEman PRO".

**Buzzer**ON

Gives a short beep if pressing the push button.

OFF

No sound if pressing the push button.

**Button** (not for Analog Sensors)Locked

Starting and stopping of the data acquisition is only possible by the software. A unintended interruption of a measurement will be avoided. This mode should be set for each long term measurement because the instrument will switch off automatically in case of discharged battery. Pushing the button two times in this state would restart the measurement and the acquired data may be lost.

The push button is still toggling the display page.

Unlocked

The data acquisition can be started by the button and the instrument can be switched off by the push button.

**Pump Mode** (RTM1688 only)Continuous:

The pump is running continuously over the whole measurement period

Interval:

The pump is running only for the first five Minutes of a new sampling interval. If the adjusted interval is less than five Minutes the pump will run continuously.

**Radon Calculation**

Effects only the Radon concentration displayed on the instrument. If the data is presented later on by the PC, the results of both calculation modes will appear.

Fast:

Only the detected Po-218 decays will be used for the calculation of the Radon activity concentration. The final value is presented after about 12 to 15 Minutes and the sensitivity is about the half compared with the "Slow Mode" which increases the statistical error.

Slow:

Po-218 as well as Po-214 decays are used for the calculation of the Radon activity concentration. Because of the longer half life times of the nuclides within the decay chain, the response time is expanded to about 150 Minutes. The sensitivity is double as high compared with the "Fast Mode" which leads to a decreased statistical error.



All set-up parameters will be received from the instrument



All set-up parameters will be transmitted to the instrument.

#### 4.3. Dose Calculation used for DOSEman and DOSEman PRO

**F+g** Both instruments, DOSEman and DOSEman pro are able to calculate the equivalent dose from the Radon/Progeny exposure using the so-called dose conversion coefficients. Click to the F+g button within the set-up dialog to open a dialog to adjust these coefficients.



Because any dose calculation is based on the Radon exposure respectively the Radon daughter products, the Equilibrium Factor F has to be estimated if the Radon exposure (concentration) was measured in case of the DOSEman. The Equilibrium Factor defines the assumed ratio between Radon daughter products and Radon gas. If the real conditions are not known from earlier investigations it should be set to 0.5 what is a reasonable value for the most places.

A list box offers the actual valid dose conversion coefficients for workers and publics. It is possible to enter other values following special regulations of local authorities.

The equivalent dose P is derived from the exposure E by these expressions:

$$\text{DOSEman:} \quad E = P(Rn) * F * g(EEC) \quad [g(EEC)] = \text{Sv}/(\text{Bqh}/\text{m}^3)$$

$$\text{DOSEman PRO} \quad E = P(\text{PAEC}) * g(\text{pot}) \quad [g(\text{pot})] = \text{Sv}/(\text{Jh}/\text{m}^3)$$

In case of the DOSEman the product of F and g(EEC) is handled as only one coefficient. The recent setting of this coefficient is read from instrument when opening the dialog. Because a unique assignment of F and g(EEC) is not possible, the program assumes that the setting was based on the workers dose conversion coefficient. Then, the Equilibrium Factor is given for this setting (check your original setting by entering the original used dose conversion coefficient).

Set always the dose conversion coefficient firstly and the Equilibrium Factor after that.

Because the internal used data format is shortened, some small rounding errors may appear when reading back the settings from the instrument.

#### 4.4. Additional Set-up and Test Functions of the Analog Sensors

##### Analog Output 1 / Analog Output 2

###### Range

defines the concentration range for which one the analogous output signal of 0 ... 1000mV will be generated. For example: If the value was set to 25000, a concentration of 25000 Bq/m<sup>3</sup> will cause an output voltage of 1000mV.

###### Alarm

If the concentration exceeds the defined level, the digital output becomes active (if it is programmed as an alert output).

##### Digital Output

###### Alarm:

The digital output is configured as an alert output.

###### Pulse:

The digital output is configured as a counter output, that means a pulse is generated immediately if an alpha decay was detected.

###### ROI1 ... ROI5:

If the check box of a ROI is marked, a digital output pulse is generated if the emission energy of the incoming alpha decay is covered by the related ROI limits (ROI's are normally related to the several Radon daughter products). If the check box is not marked no pulse is generated.

###### rH/T:

Mark the check box to apply the temperature and humidity readings to the analogous outputs. In this mode the user can select the digital output for Radon logging and the analogous port to log the additional ambient conditions.



All set-up parameters will be received from the instrument



All set-up parameters will be transmitted to the instrument.

**DAC Test**

This option offers the possibility to check the proper operation of the analogous outputs. The entered voltage values (in mV, range 0 ... 1000) are applied to the outputs when pressing the Set DAC button. The probably running measurement has to be stopped before.

**Switch Test**

Allows to toggle the digital output for test purposes. Stop a running measurement before using this function.

**Display of the Recent Results**

To check the proper operation of the Analog Sensor the data acquisition can be started and stopped by software buttons. The actual sensor readings can be read from the unit if a measurement is in progress.



Clears old data and starts a new measurement



Stops a running measurement



Click to load the recent sensor readings from the unit. Valid values appear within the edit fields above if the first integration interval was finished. Beside the calculated concentrations and temperature/humidity values, the generated output voltages (with respect to the currently used range settings) are stated too.

**Timer/Interval**

if the Timer check box is marked, the program will force the download of the actual sensor readings automatically. The time period between the downloads has to be defined by the value in the Interval edit field.

## 5. Data Display

### 5.1. Time Distribution

After successful data transfer from the instrument or if a present data file has been loaded, the results are displayed in the graphical view area. Moving the cursor line within the diagram shows the corresponding data set underneath the x-axis together with its time stamp.

If it is not possible to show the whole data within the window, the view can be scrolled by the scroll bar below the graphic area. The zoom in and zoom out function is realised by the buttons right beside the scroll bar.

In case that the tamper lock recorded a movement during the measurement, the corresponding interval is marked in light grey. A red-brown line indicates the start of a new measurement series.



### 5.2. Defining a Region of Interest (ROI)

To define a region of Interest (ROI) click with the left mouse button to the left and a second time to the right border of the desired range within the diagram (use scroll function if necessary). The range appears dark grey shaded. A double click into the diagram removes the ROI selection. In case of a text file export or protocol print only the marked range will be considered.

To fit the marked range to the actual view size use the fit button between the two zoom buttons. To show again the whole time distribution clear the ROI selection prior and use the fit-button after that.

### 5.3. Output of Integral Results

The statistical values of the measurement are stated below the separation line. If no ROI is selected the values are valid for the whole data set. Then, the text colour is grey. In case of a marked ROI, the values are related to the selected range – the text colour turns to black. If the selected range contains parts of more than one measurement series, the colour moves to red and the protocol print is disabled. The ASCII export remains unaffected.

### 5.4. Selection of Radon Display Mode

Depending on the instrument type several views can be generated. Select the desired view by the list box right down of the main window. The following table shows the instrument specific view selections:

Radon Scout	no selection (list box invisible)
Radon Scout PLUS	no selection (list box invisible)
RTM1688-2	Radon (fast), Radon (slow), Thoron
DOSEman	Radon (fast), Radon (slow)
DOSEman PRO	EEC (Rn-222), PAEC (Rn-222), PAEC (Rn-220/Thoron)
RTM1688	Radon (fast), Radon (slow), Thoron
Analog Radon Sensor	Radon (fast), Radon (slow), Thoron
Analog Progeny Sensor	EEC (Rn-222), PAEC (Rn-222)

The selected view defines the Radon curve within the printed protocol. An exported text file always contains all the values independent on the selection.

### 5.5. Smoothing function

Measurements in the surrounding of the detection limit causes strong statistical fluctuations of the single values of the acquired time distribution. Those fluctuations can be reduced by the implemented smoothing function.

The smoothing procedure calculates a sliding average for each single data point for a number of periods left and right of the considered point. The number of periods is selected by the list box right down in the application window. If a smoothing period of “+/- 2 Periods” has been selected, a total number of 5 values are included in the averaging - the both prior data points, the considered point itself and the both following data points. The smoothing function is applied separately for each acquired time distribution, meaning that the first and last data points are interpreted as boundary values.

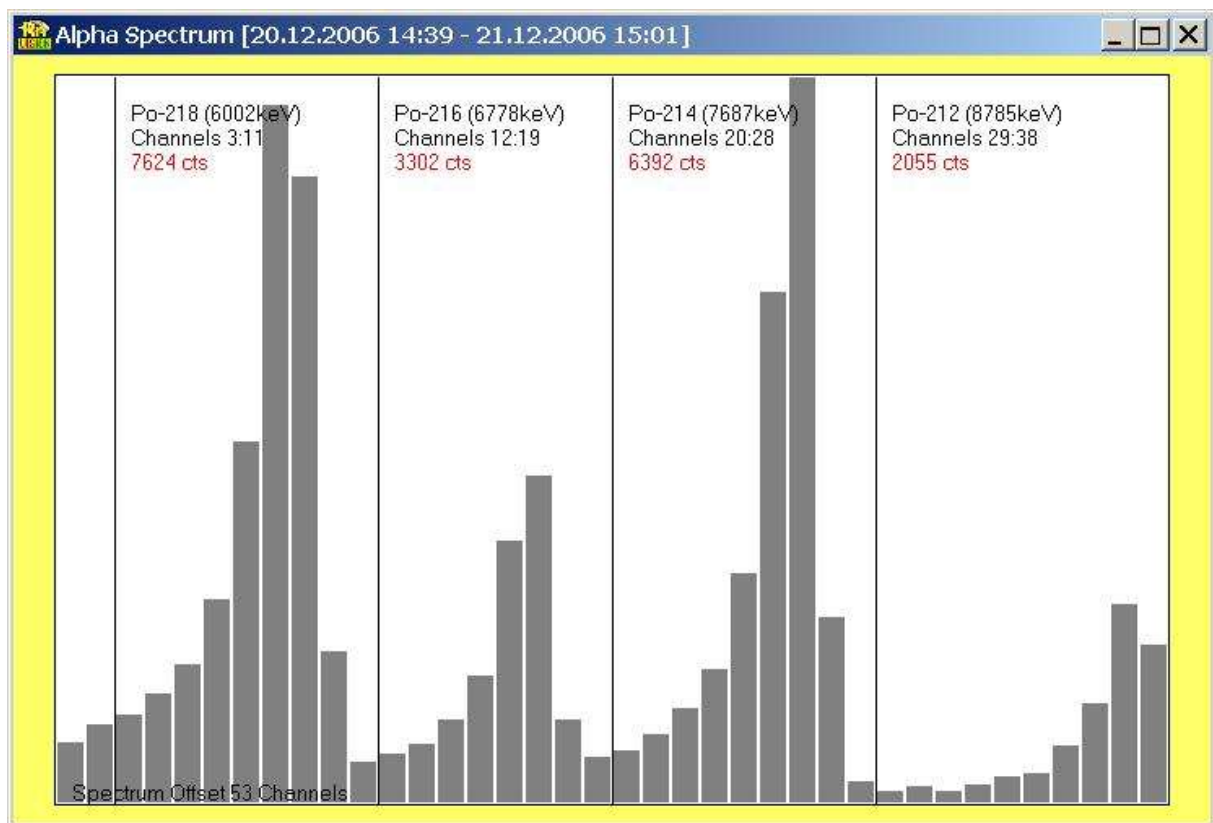
It should be noted that also real existing short time variations of the concentration undergo the smoothing procedure. Therefore, the user should find an optimum between a smooth curve and the required dynamic response. A helpful tool is the original time distribution (error bars should be enabled) shown in the background. This feature makes it easy to decide whether the smoothing is suitable or not.

The result for the data point selected by the mouse cursor will show the smoothed value and the output of the related statistical error is replaced by the hint “smoothed”. All displayed integral values remain related to the original time distribution.

The printed protocol will contain, in opposition to the screen view, only the smoothed curve. Below the X-axis label appears “sXP” – X means the number of periods used for smoothing.



## 5.6. Spectrum View



If the data has been acquired by an instruments with integrated alpha spectroscopy, the spectrum can be displayed within a separate window. The pre-defined energy ranges used for Radon calculations are indicated by vertical lines. The channel boundaries as well as the number of counts within the ranges are shown.

The RTM1688-2 stores one spectrum for each data point within the time distribution. This feature allows to show a spectrum which contains only the counts recorded during the selected Region of Interest within the main window. The spectrum view is not modal. That means any redefinition of the ROI causes a redraw of the spectrum.


All other instrument deliver only a summary spectrum of the whole sampling period.



## 6. Communication via Modem

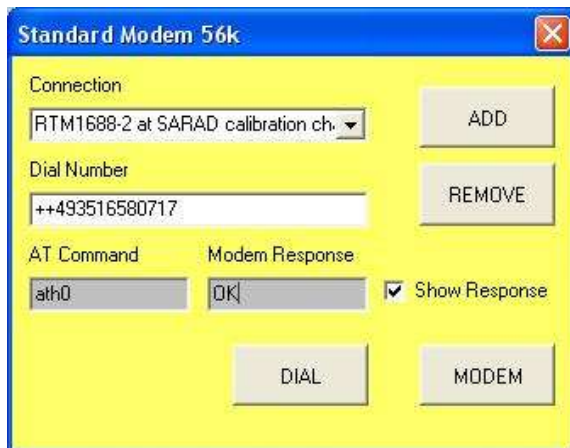
Radon Vision offers the possibility to communicate via modem with the instrument types Radon-Scout, Radon-Scout PLUS and RTM1688-2. The steps necessary to establish a modem connection are explained in the following chapters.

### 6.1. Accessing the Instruments using a Modem Connection

Connect an external modem to any serial port (COM) of your computer. If the computer provides an internal modem, it can be accessed by an internal COM port as well.

Run the Radon Vision software and start the "Port-Scan"  function to check to which port number the modem is connected. Select this port from the COM selection list box. If no other SARAD instrument is connected, Radon Vision will select this port automatically after finishing the port scan process.

Click either on the "Read Data"  or on the "Set-up"  button to open the dial in dialog window.



Choose any phone number from the connection list box or create a new item within the list using the "ADD" button. To delete an item select it from the list and click to the "REMOVE" button. After the selection of a dial number call the remote modem by the "DIAL" button. This process will take a few Seconds.

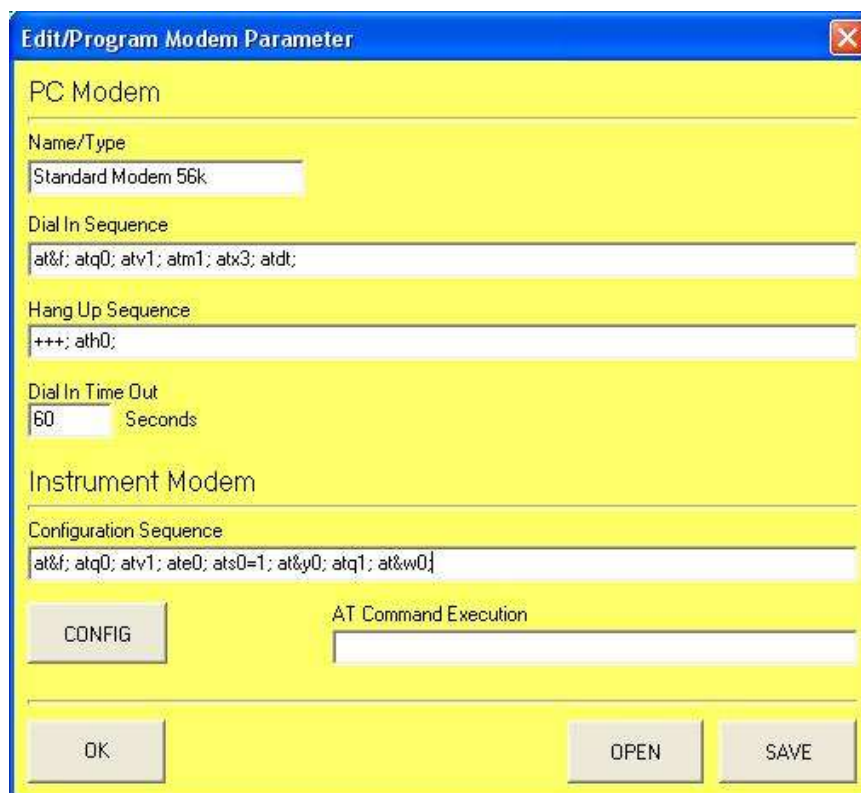
If the call was successful, the data transfer begins or the set-up dialogs will be opened in the same manner as known from the direct connection of the instrument to a COM port. After finishing the data download or if the set-up dialogs have been closed, the dial in dialog appears once again to shut down the modem

connection. If you are faced to any problem with respect to the dial in process, please read the chapter "Modem Control" within the appendix.

## 6.2. Configuration of the Instrument Modem

The modems at the instruments side have to be configured before usage to allow them to pick up an incoming call automatically. The configuration procedure is provided by Radon Vision as well. Please note that the modem only accepts an incoming call if the SARAD modem cable is already connected (independent on the configuration)

Connect the instrument modem to the PC firstly and open the dial in dialog in the same way as described in the previous chapter. Click now to the "MODEM" button. A dialog window containing several modem parameters will appear on the screen.



Start the configuration sequence by the "CONFIG" button and wait until the sequence is written to the modem step by step. The progress of this process is shown in the text box next to the button. Please note: During the execution of the last two commands, the modem will



not respond with OK but with NO RESPONSE. This behaviour is part of the configuration and is not an error.

Disconnect the modem now from the COM port and switch it off. The configuration is stored non-volatile and will be reloaded if the modem will be switched on again.

Close the modem parameter dialog by the "OK" button and cancel the dial in dialog.

Important note: Do not connect the modem once again to any computer before connect it to the instrument. Other PC software could try to access the modem and to change the configuration unintended.

The pre-set configuration sequence will work with any standard 56k analogues modem. If problems arise if you want to use other transfer standards (like ISDN, GSM, GPRS), please read the chapter "Modem control" carefully.

### *6.3. Detailed Description of the Modem Control Procedures*

After switching on the modem, it enters to the command mode and can be controlled by so-called AT-commands. These commands are text strings always starting with the two characters "AT" (means attention) and followed by one or more characters which are interpreted as instructions by the modem.

To establish a modem communication, a number of AT-commands (dial in sequence) have to be transferred to the modem. The dial in command has to be stated at the end of these sequence. Radon Vision will append the dial number selected from the connection list before to this command.

If the call was successful (instrument modem picks up the line automatically if configured correctly), both modems define a transfer protocol with respect to the quality of the line. After that, both modems switch over to the online mode, meaning that PC and instrument are now connected transparently. The modems will not longer listen to any AT-command.

A special control sequence (hang up sequence) has to be written to the modem to cancel the communication. This sequence starts the escape string ("+++") to switch the modem from online mode back to the command mode. Please note, that the character (+) used for the escape string can be programmed also by an AT-command and therefore it could differ from the standard. To detect the escape string within the (still) transparent data flow it is necessary to have no communication at least 1 Second before and after transmitting the escape string. You need not to take care for that because Radon Vision will manage this automatically.

Another command is required to close the line (hang up).

The AT command set of each modem contains basic commands which are unified and a number of special commands depending on the capabilities of the used model. Normally, only the basic commands are required to realise a modem communication.

Radon Vision defines standard sequences containing the basic commands only. If it is necessary to edit those sequences, the modem parameter dialog has to be used. The single commands of the sequences will be processed from the left to the right. Each AT-command (also the last one) has to be terminated by a semicolon. The sequence can contain spaces but must not exceed a total number of 255 characters. There is no difference between capitals and non-capitals. The correct processing of the sequence during the dial in and the hang up procedure can be observed if the checkbox "Show Response" is marked within the dial in dialog.

The modem confirms any AT-command with a response if it was not disabled (also by an AT-command) before. If the command can be interpreted, the modem will respond with "OK", otherwise with "ERROR". Radon Vision generates the string "NO RESPONSE" if the modem did not respond. After the dial-in the modem will give back one of the following strings:

„CONNECT 9600“	if the connection was established successfully
„BUSY“	if the remote modem is already accessed by another connection
„NO CARRIER“	if no exchange line is available
„NO DIAL TONE“	if no dial tone can be detected on the line (private branch exchange)

Radon Vision waits for the message „CONNECT 9600“ and begins with the data transfer between PC and instrument after that. If other responses has been received or if no connection could established until the time out timer has reached the limit (stated within modem parameter dialog), the software cancels the dial in process. Note: The modem uses an internal time out too (programmable by an AT-command), therefore the shorter period of both settings is applied.

“NO RESPONSE” appears if Radon Vision cancels the process, otherwise “NO CARRIER”.

The command sequences below are pre-set after the installation of Radon Vision and are accepted by any 56k analogues modem.

### Dial In Sequence

***at&f; atq0; atv1; atm1; atx3; atdt;***

AT&F	Loads the original factory settings
ATQ0	Enables the modem to respond to AT-commands
ATV1	Sets the modem to give responses as text strings (OK, ERROR etc.)
ATM1	the speaker of the modem will be switched off if the connection has been established
ATX3	the modem will not wait for an carrier signal before dial-in (important in case of a private brunch exchange)
ATDT	Dial command, radon vision appends the phone number to this command. The modem uses the frequency mode for dial-in, if the pulse mode shall be used, the command ATDT has to be replaced by the command ATDP. Note: To get a short dial break (for example to pick up the exchange line), a comma has to be inserted directly into the phone number.

### Hang Up Sequence

***+++; ath0;***

+++	switches the modem back to the command mode
ATH0	disconnects the modem from the line (hang up)

### Configuration Sequence (for the instrument modem)

***at&f; atq0; atv1; ate0; at&c0; at&d0; ats0=1; at&y0; atq1; at&w0;***

AT&F	Loads the original factory settings
ATQ0	Enables the modem to respond to AT-commands
ATV1	Sets the modem to give responses as text strings (OK, ERROR etc.)
ATE0	Disables the local echo
AT&C0	DCD signal always set
AT&D0	signal level on DTR line will be ignored
ATS0=1	The remote modem picks up the line automatically after the first call
AT&Y0	Modem configuration profile 0 will be loaded after power on

ATQ1	Disables the modem to respond to AT commands
AT&W0	Saves all settings within the configuration profile 0

Note: The baud rate of the connection between the modem and the instrument is set to the one which is used for the transfer of the last AT-command (the modem is able to detect the baud rate automatically when a command is received). Radon Vision uses the same baud rate during the configuration process which is used later by the instrument. The baud rate setting remains also stored in the modem and will be present after switching it on.

Make sure that no other AT command (probably using a different baud rate) was sent to the modem by any other PC software before connecting it to the instrument.

### Additional requirements for GSM Modems

Similar to a mobile phone, a PIN code is required before the GSM modem can log in to the GSM network.

For the SIM card of the modem at the instrument site, the PIN query function has to be deactivated. Otherwise, the modem will be not able to log in to the GSM network after a power interruption. Please note that not all SIM cards will provide this possibility. Please ask your service provider regarding this item before purchasing a card.

If the SIM card was placed for the first time into the modem, the PIN has to be entered by using a special AT command. Another AT command is available to deactivate the PIN query (unlock PIN). If the modem is used at the PC site, the PIN command can be inserted into the „Dial In Sequence“ if you don't want to unlock the card. You should do it only if you use always the same arrangement (PC, modem, SIM card) to prevent the transmission of a wrong PIN during the dial in process. Repeated transmission of a mismatching PIN results in a locked card.

The required AT-commands are not a standard. Refer to the manual of the used modem. The following example is only valid for the FALCOM Tango 55/56 modem (internal equal to Siemens C55):

AT+CPIN = 1234

Transmits the PIN (Example: 1234) to the modem, the modem logs into the GSM network directly after if the PIN is correct.

AT+CLCK = "SC",0,"1234"

Deactivates the PIN query

A GSM modem distinguishes between the transmission standards "Voice", "Fax" and "Data". The information about the standard is carried by the bearer signal if the call was originated by a GSM modem. However, if the call was originated by an analogous modem this signal is missing. The receiving GSM modem (instrument side) assumes as a standard that each incoming call without transmission standard information is a "Voice" call. Therefore, calls of analogous modems are not accepted (independent on the ATSO settings). A special command (e.g. AT+CSNS=4 in case of the Tango 55/56) advises the GSM modem to interpret incoming calls as "Data" even if no information about the used standard is transmitted.

Dial In Sequence example for the PC modem (Tango 55, PIN = 1234):

*at&f; atq0; atv1; atm1; atx3; at+cpin=1234; atd;*

Please note that the log in process is just started after transmission of the pin. Make sure that the dial in time out (modem parameter dialog) will not appears too soon. If the configuration sequence below once has been applied to the PC modem before, the SIM card has been unlocked permanently and the AT+CPIN command can be removed from the dial in sequence.

Configuration sequence example for the instrument modem (Tango 55, PIN = 1234):

```
at&f; atq0; atv1; ate0; at&c0; at&d0; at+csns=4; at+cpin=1234; at+clck="SC",0,"1234";  
ats0=1; atq1; at&w0;
```

#### 6.4. Modem Parameter Management

The recent settings of the modem parameters are stored in the file „modem“ which is placed in the program directory of Radon Vision. If the file has been deleted, Radon Vision sets all modem parameters back to pre-set values and creates a new “modem” file. If several modem settings are required (for example if different models are used at the instrument side), the edited parameters can be saved and reloaded using the “SAVE” and the “OPEN” button within the modem parameter dialog. The “OK” button closes the modem parameter dialog and actualises the “modem” file if it is necessary.

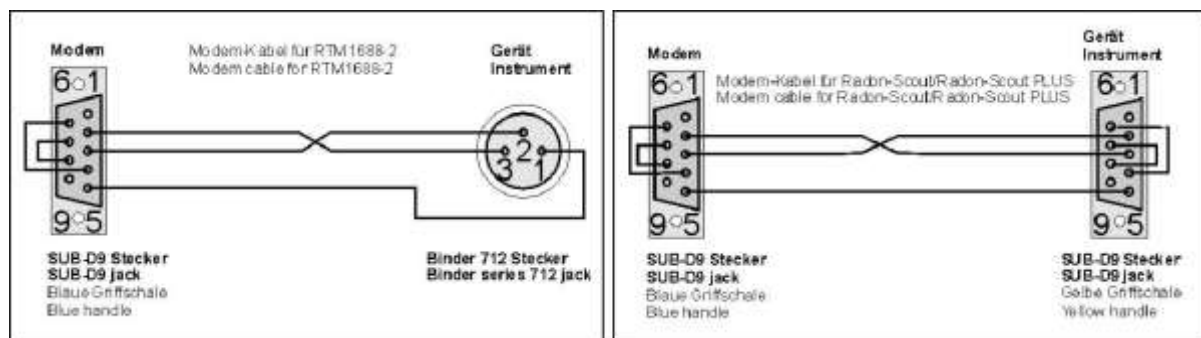
#### 6.5. Selecting the Modems

Generally, all modems controlled by AT-commands can be used independent on the transfer standard (analogues, ISDN, GSM, GPRS). It can be still required to fit the command sequences according the transfer standard and the capabilities of the modem. Refer to the complete list of available AT-commands provided by the manufacturer of the used model.

It is recommended to use the same models at both sides, instrument and PC, because they will share the same set of transfer protocols. In case of not matching combinations a protocol with reduced transfer rate could be applied for the communication.

#### 6.6. Cables

The modem connection cable at the PC side is normally included in the delivery of the modem. For the cable between the remote modem and the instrument, some additional connections are required to allow the communication. The standard transfer cable delivered with the instrument can not be used for this purpose. Please make sure that the cable meets the requirements as sketched below.



## 7. ZigBee wireless communication networks

In addition to the direct connection of the instruments by a cable and the usage of modems, the ZigBee technology offers another comfortable way to create a local wireless instrumentation network. ZigBee is used where

- a number of instruments within a building or a facility, or
- instruments placed in restricted areas (private homes, security areas etc.)

shall be linked to a central PC. The range of the network depends on the local conditions (walls, shields etc.). The free air distance reaches a few hundred Meter.

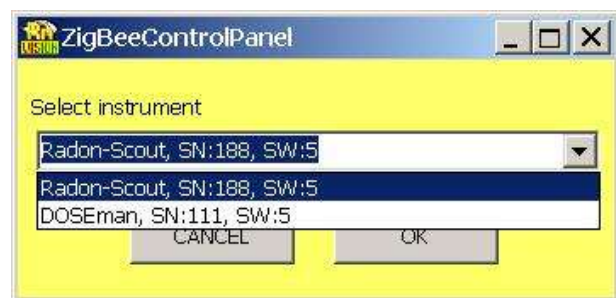
The SARAD ZigBee adapter (Coordinator) is connected by a USB cable to the PC. When using the adapter for the first time, it may be necessary to install a driver software. This is done in the same way as described in chapter 2 for the IR reader and the USB/Serial adapter.



The adapter will be automatically detected during the port check sequence and can be accessed via the assigned COM port index.

Instruments equipped with a ZigBee interface located within the network range are automatically detected. If a instrument is just switched on or is moved from outside into the network area it takes a few Seconds for the detection process.

The access to an instrument is similar to the other kinds of connection. At first the COM port assigned to the adapter must be selected. A click onto the "read data" or "set-up" buttons opens a dialog window containing a listbox of all acknowledged instruments (instrument type, serial number etc.). After selection of the desired unit, the data will be transferred or the set-up dialog appears on the screen.



All SARAD instruments served by Radon Vision can be integrated in a ZigBee network using an adapter for the serial port.

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