

Radon Scout Radon Scout PLUS

Radon monitor for long-term monitoring and ventilation control

The *Radon Scout* offers the highest sensitivity of its class exceeding the sensitivity of its competitors many times. This results in the lowest detection limit and statistical error. The thousands of times proven and US-EPA certified instrument will show the time distribution of Radon even at levels below 100 Bq/m³. Thus, meteorological influences as well as ventilation effects can be detected easily.

Due to its outstanding sensitivity, the instrument is perfectly suited for direct controlling of ventilation equipment by a potential-free switch contact. As an accessory, we offer a wireless switch which can be directly connected to the instrument. Thus, very low effort is required to control fans such as kitchen hoods, wall or window ventilators anywhere in your home. It is even possible to upgrade older instruments. The switch threshold for the *Radon Scout* is fixed to the EU target value of 300Bq/m³ whilst the *Radon Scout PLUS* allows user specific settings.

Two standard D-size cells enable an autonomous operation over a few months. The Radon detector *Radon Scout PLUS* offers an additional connection for an external power supply. In fact, this allows an operation over infinite time periods.

The size of the data memory was designed to get a high-resolution time distribution. Any number of measurement series may be created. The acquired data can be loaded by a PC even if a measurement is in progress. The Radon detector can be directly connected to a modem for remote data transmission.

The included Radon Vision software handles the remote connection as simple as a direct cable link.



Because of the high sensitivity, variations of the activity concentration will be detected accurately even in case of low Radon levels. The Radon detector works in diffusion mode so that a possible influence of Thoron can be excluded. The measurement chamber, equipped with a semiconductor detector and high voltage collection, is immune to ambient humidity.

Sensors for temperature and humidity (barometric pressure in addition in case of *Radon Scout PLUS*) are very useful add-ons. The integrated tilt detector will give a signal if the Radon detector was moved from its original position during the measurement.

The instrument has been certified by the US-EPA/NRSB and other international authorities.

Technical Data

Measurement Range	0 ... 10MBq/m ³
Sensitivity	1.8cpm @ 1000Bq/m ³ (independent on the humidity) 200Bq/m ³ with 20% statistical error (1σ) at 1 hour interval 1000Bq/m ³ with an statistical error (1σ) < 10 % at 1 hour interval 100Bq/m ³ with 17% statistical error (1σ) at 3 h interval
Response Time	120 Minutes to 95% of the final value
Internal sensors	Relative humidity (0...100%) Temperature (-20...40°C) Tilt PLUS: barometric pressure (800...1100mbar)
Integration interval	1 hour and 3 hours or customised 1...255 minutes, adjustable
Potential-free switch contact for ventilation control or alert indication	Threshold level fixed to 300Bq/m ³ PLUS: Adjustable alert threshold Maximum load 24V/0,5A
Data storage	Non-volatile memory (circular structure) storage of 672 data records PLUS: storage of 16383 data records
Power supply	2 x D-size cell (Ni-Cd, NiMH or Alkaline)

	PLUS: Additional external DC input
Battery operation	> 90 days
Interface	USB and RS232
Control	Single switch, measurement/stand-by (lock-function) PLUS: Display with backlight
Dimensions	175mm x 135mm x 55 mm
Weight	800 g (incl. Battery)
Radon Vision Software (included)	Set-up, data download (also via modem – analogue line, ISDN, GSM, TCP-IP) Interactive graphical display (zoom, pan, fit data-cursor, marker for tilt and start of a new measurement, error bars, smoothing) Selective ASCII export (EXCEL format) Selective graphical protocol print (space for individual header, user comments) Calculation of average concentration and exposure Automatic created file names and path structure o Switch over between US and SI-units (Bq/m ³ /pCi/L)

User Manual
RADON SCOUT
 Version 03/2017



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The instrument

General

The new Radon Scout is a versatile, easy to use and state-of-the-art instrument focused on the detection of Radon (Rn-222) in the ambient air. Beside the activity concentration of Radon, air temperature and relative humidity and barometric pressure in case of the RADON-SCOUT PLUS will be determined and saved to a non-volatile circular memory (first in - first out). Up to 670 (RADON-SCOUT PLUS up to 16383) chronological data sets will be available for data transfer to PC. An internal real time clock ensures a correct time regime, a tamper lock indicates dislocation during the measurement.

In case of the RADON-SCOUT PLUS a display informs about the actual readings.

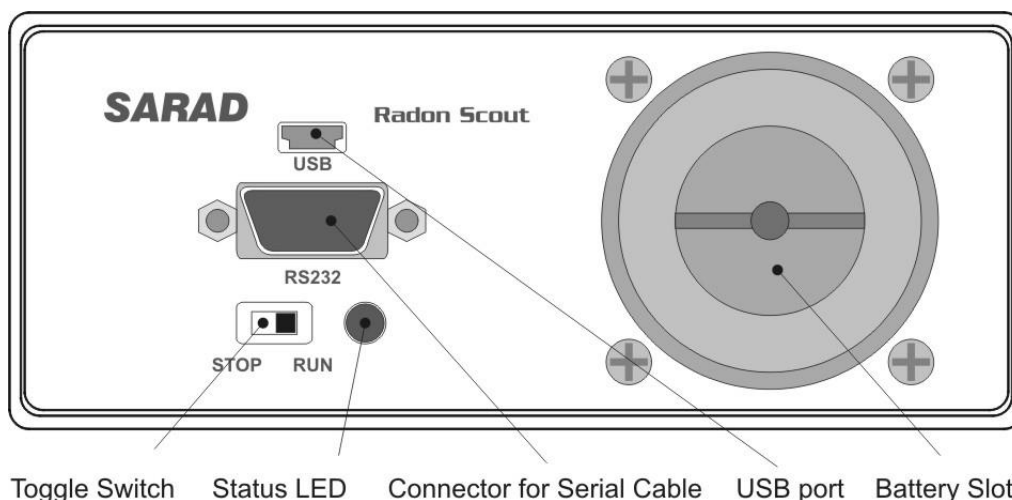
Neither mechanical parts like membrane pumps nor an external power supply are required. Therefore, use and exposition at home or at workplace is possible without any disturbance. A total duration of measurement of up to four month with continuous data recording is possible.

Due to its small dimensions and little weight, the Radon-Scout can be shipped by mail to the place of interest/measurement without any additional man-power required for installation or start-up of an analysis – even untrained staff is able to start a measurement.

Entire part of delivery will be a comfortable software for data read out and dose assessment, easy data back up and publishing of results in protocol prints.

- Read out of measurement data and adjustment of device parameter
- Interactive graphic display with zoom and pan
- Automatic backup of measurement data
- Protocol print of customised time periods with individual header
- Selective export and conversion of customised time periods to text files for additional tasks (like import to EXCEL)

Front panel elements



Power supply

Power supply of Radon-Scout is realised by two D size (Mono) batteries (also rechargeable). To open the battery slot, screw out the cover anticlockwise using a screw driver or a coin. Please pay special attention to the correct polarity of the batteries when inserted. The positive pole needs to be contacted to the front panel.

Change both batteries at the same time as differing charging levels may lead to failures. Use always batteries of the same type.

Close the battery slot by screwing clockwise for 45°. Ensure a tight sealing of the cover.

The RADON-SCOUT PLUS offers an external DC input to supply the instrument by an AC/DC mains power adapter.

ATTENTION: Connect the AC/DC adapter only if batteries had been inserted before. Never use the instrument without batteries even if it is supplied by an external voltage, otherwise malfunction can not be excluded.

If the AC/DC adapter is connected, the batteries will not be discharged. They will work as a buffer in case of mains power interruption. If rechargeable batteries are inserted, the batteries have to be recharged from time to time because of the self discharge process dependent on the used chemistry. They will **NOT** be charged by the connected AC/DC adapter! Using Alkaline batteries in combination with the external DC, the instrument can be operated over several years.

The connector for the AC/DC adapter (4.5V/500mA) is placed at the rear panel of the RADON-SCOUT PLUS.

After the batteries had been changed and replaced by new ones, the LED will light for about one second in orange.

Changing the batteries will force you to adjust the re-set internal real-time clock. A concerning message appears on the display of the RADON-SCOUT PLUS. Stored data remain in the memory and can be read out after changing of discharged batteries.

The selection of the right battery depends on the purpose and total duration of the measurement. For principals, NiCd- and NiMH-accumulators with a cell voltage of 1.2 V as well as alkaline-manganese or zinc-carbon batteries with 1.5 V can be used.

Important hint: Never use Lithium batteries - those cells provide a cell voltage of 3.0V or 3.6 V.

For long term measurements or frequent measurements with small periods of usage, the use of alkaline-manganese cells is recommended as those batteries provide a high energy density (up to 17000 mAh) and a low self-discharging.

Time-to-time measurements for short term are best supplied by rechargeable batteries, as they may be charged prior to usage. NiMH cells provide a energy density of up to 8000 mAh compared to NiCd-cells with a maximum of 5000 mAh. In addition, maintenance to avoid memory effects is not required for NiMH type but self-discharging is higher.

Because the capacity of any cell type is dependent on temperature, storage condition and age (especially rechargeable batteries), the following data is only an approximation:

Alkaline-manganese 17000mAh:	up to 4 month (RADON-SCOUT PLUS up to 3 month)
NiMH 8000mAh:	up to 2 month
NiCd 5000mAh:	up to 1 month

The uptake of power during stand-by is about 15 – 20 % of a measurement. Anyway: In case of storage of the instrument without usage, batteries should be removed.

If the battery cell voltage drops below 1.1 Volts, a warning "Replace battery!" appears in the display after stopping the measurement. During the measurement a red (instead of green) blinking LED indicates this status. The remaining capacity is 15 ... 25% depending on the chemistry of the used cells. If longer measurements are planned, the batteries should be replaced before to avoid data lost.

If the cell voltage drops further below 0.95 Volts, the measurement is stopped automatically and the device enters into the stand-by modus. Discharged batteries are indicated by the red LED, flashing each four seconds.

Start of a measurement

Setting the toggle switch to the right starts the measurement of the Radon activity concentration in the ambient air. Older data will remain in the memory and can transferred later together with the new one.

RADON-SCOUT only

In case that the switch is already set to the position "RUN" during replacement of discharged batteries, the measurement will be started immediately. Please set the real time clock and restart the measurement once again. The LED will flash in green for about half a second, then LED will flash one or three times each four seconds dependent on selected integration interval (one flash = three hours, flashing three times = 1 hour).

RADON-SCOUT-PLUS only

If the toggle switch is already in „RUN“ position after replacing the battery, the display will show a request to set the real time clock of the instrument by the PC software.

To start the acquisition, the switch has to be set firstly to "STOP" and then to "RUN" position. The green LED lights for a short time and blinks each 4 Seconds during acquisition.

After starting, the remaining time to finish the first integration interval (until the first value can be calculated) is displayed.

As soon as the results of the first integration interval are available, the display switches over automatically between two display pages (each Minute). The first page contains the actual value for Radon with statistical 1-Sigma error as well as the sensor readings (T, rH, p), battery voltage and time stamp. The second page shows the Radon average since the last start of an acquisition, the time of the start, the time period from start (used for averaging) and the number acquired records.

All results are stated in the physical units as selected by software (SI or US style).

Interruption of a measurement

A recent measurement series may be interrupted by switching the toggle switch to the position "STOP", assumed that it is not locked by the software. The Radon-Scout will enter the "STOP" modus immediately without finishing the recent integration interval.

The RADON-SCOUT PLUS will show "Radon-Scout PLUS"

To perform a measurement

Preparation

Prior to each new measurement campaign, the status and type of the batteries should be checked to avoid a loss of data with respect to a interruption of the analysis. In case that the cells had been changed after you adjusted the real-time clock the last time – adjust the timer again to ensure a reliable time regime!

Selection of the right location for exposure

The Radon-Scout was designed for stationary monitoring. Strong vibration, movement or mechanical shocks can disturb the analysis. This interference will be detected and

compensated by the instrument, therefore the sampling process is not affected. Disturbance during longer periods of time needs to be avoided by selecting an appropriate place of exposure. Measurements during transport must not be carried out.

In case that the device had been moved during measurement, the corresponding integration interval will be marked to detect e.g. an unauthorised transportation or a movement with admission.

Selection of the right integration interval

Radon-Scout will store 672 (RADON-SCOUT-PLUS = 16383) measurement records. In case that this maximum of data will be exceeded, the oldest data in the history will be erased and overwritten by the last cycle result (circular memory). Set the interval long enough to avoid data lost in case of measurements over long time periods.

If the assumed or predicted Radon concentration is smaller than 200 Bq/m^3 , the integration interval should be set to three hours. Otherwise the statistical error of each single value below 200 Bq/m^3 will exceed 20%. The integration interval can be changed by software only. The RADON-SCOUT-PLUS allows integration intervals from 1 to 255 Minutes. From the physical point of view intervals less than 60 Minutes make no sense because of the response time.

Lock toggle switch

To avoid a sudden or unintended interruption of a measurement campaign by unauthorised staff, the toggle switch can be locked by software. Two variants of the lock function have been implemented:

1 - The function is activated if the instrument is in stand-by mode (stopped)

It will be possible to start a measurement and stop it one time. After setting the button into STOP position, the sampling will be finished and the result of the whole test period appears in the display (1. line Start time/date; 2. line Stop time/date; 3. line result without statistical error). The result remains in the display until a new sample is started.

After the first access to the instrument via the serial port (any command), a new start is possible and the unit operates in the same manner as long as the lock function remains activated.

2 - The function is activated while the sampling is already in progress

In that case the display is also disabled but it will be impossible to stop the measurement by the toggle switch. The lock can be released only by the unlock function using in the PC software.

In both cases the display during the measurement period "Radon-Scout" instead of the results. The green LED is flashing periodically.

For the standard unit without display only the second version of the lock function is implemented.

Interfaces (RS232 and USB)

The serial interface according RS232 standard is required to read out measurement data and to adjust the measurement parameter of the Radon-Scout. Please note that the power consumption of the instrument is about five times higher if connected to the PC by the data transfer cable. In case that the device is permanently connected to a PC, the battery life-time is reduced due to that. The RS232 port is also used for connecting a modem or ZigBee wireless adapter.

Alternatively, the USB port can be used for communication. In that case, a software driver (available on SARAD website) must be loaded and installed before. The communication path appears as an additional COM port in RadonVision.

Both interfaces cannot be used simultaneously because the RS232 port will be disconnected automatically after plugging the USB cable into the port.

Alert switch

Both, Radon Scout and Radon Scout PLUS are equipped with a switch output which can be used for ventilation control or alert indication. The potential-free contacts of the switch will be connected at the end of the sampling interval if the measured Radon concentration exceeds the threshold. The output will be deactivated one minute before the subsequent interval ends. Therefore, the sampling interval must be set at least to two minutes. The alert threshold is fixed at 300Bq/m³ for the Radon Scout while it is user adjustable in the Radon Scout PLUS. The connector is located on the rear panel of the instrument. In case of pending alert, the red light at the front panel will blink instead of the green one.

As an accessory, we offer a wireless power switch which can be used for direct ventilation control. The switch includes a transmitter unit to be connected to the alert switch output of the instrument, and a plug adaptor (receiver) which can be placed between the wall outlet and the power cable of the ventilation unit. Optionally, a flush-mounting power switch is also available. The plug adaptor offers an additional timer function to define the duration of the ventilation period independently on the sampling interval of the instrument (for example 15 minutes on while the sampling interval is 60 minutes). The wireless switch is coded - that means, several transmission lines can be established within one building. The assignment between transmitter and receiver is easily done by a push button.

The sampling interval should be set to 60 or 120 minutes if the threshold level is lower than 300Bq/m³.

Technical Data

Alert Switch		
Max. switchable voltage	24V	
Max. switchable current	0,4A	
Max. pulse current	1,5A	
connector	2-pins	Manufacturer: Binder, series 710
Wireless switch		
Transmitter	2 inputs	Additional input can be used for manual switch
Frequency	433MHz	With coding for secure transmission
Range	approx. 30m	
Power supply	Battery CR2032	Good for 20000 switch actions
Plug adapter	220V/50Hz	6 code memories for group switching (e.g. for more than one Radon monitor)
Max. switchable power	3500W	
Timer settings	7s, 5min, 30min, 1h, 2h, 4h, 8h	If the timer function is not used the power switch follows the alert switch

Technical data

Measurement	Measurement chamber with HV collection and Si detector Gross alpha detection
Sampling	Diffusion
Sensitivity	1.8 cpm/kBq/m ³ (4 cph/pCi/L)
Measurement range	0 ... 2 MBq/m ³
Error	±5% within the whole range or smaller
Ambient conditions	-10 ... 40 °C, 0 ... 100 %rH not condensing
Temperature sensor	-20 ... + 80 °C
Humidity sensor	0 ... 100 %rH
Pressure Sensor	800 ... 1200 mbar
Alert switch	24V/0,4A (potential free Opto-MOS relais)
Tamper sensor	2G to detect movements or shocks
Memory	672 records (RADON-SCOUT-PLUS 16383)
Power supply	2 x battery type D (Mono) 1.5V/1.2V RADON-SCOUT-PLUS also by mains power (AC/DC adapter)
Autonomous operation	ca. 3 month for alkaline battery (17000mAh) at 20°C
Data transfer	Serial interface cable (RS232) or USB adapter
Operation	Start/Stop by toggle switch (may be locked via software) RADON-SCOUT-PLUS: display 3 x 16 characters
Dimension	ca. 175 x 135 x 55 mm
Weight	ca. 800 g incl. batteries