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RADIOMETER RADON - 4



Operation instructions

1. The field of use

The α, β, γ -radiometer RADON-4 (later in the text "radiometer") is a device for the evaluation of the $\alpha\beta\gamma$ -radiation level in the surrounding atmosphere or for the location of the radiation sources in the environment. The device is also suitable for primary detection of the radon concentration in the air.

The radiometer has the audio alarm what switches automatically on as soon as the radiation dose rate will pass the preliminary fixed alarm value.

The reading on the LCD on the front panel of the radiometer shows the average level of the radiation either in $\mu\text{Sv/h}$ or in CPM (counts per minute). The reading on the LCD will be renewed in every second.

If measuring the radon concentration the radiometer shows the average concentration of radon in $10 \times \text{Bq/m}^3$.

The radiation level may be also evaluated by the change in the sound signal frequency as the frequency of the sound signal is proportional to the registered radiation level. Every registered by the radiometer particle generates the sound pulse. At normal background (in the range $0,08 - 0,12 \mu\text{Sv/h}$) the sound signal frequency is about 10-15 CPM.

2. Security

It is refused:

- to open the radiometer enclosure (**breaks the warranty and the danger of electric shock!**)
- to touch the central electrode inside the GM detector chamber with the metal piece in hands if the GM detector window is broken but the radiometer is still switched on (**the danger of electric shock!**)

3. Construction

The radiation detector is the end window type Geiger Mueller counter. The radiation detector has the removable $\alpha\beta$ - filter**(1)**. If the filter is closed, e.g. it is covering the detector the radiometer will measure γ -radiation and β -radiation.

ATTENTION! The β -radiation will be partly absorbed by the construction elements of the radiometer.

As for α -radiation the detector will register this radiation only with opened filter and from the front. Even then the detector registers the α -radiation only from the distance not more than 2 cm due to the α -radiation absorption in the air.

There is no direction sensitivity for the γ -radiation and the radiometer registers it from any direction as its penetration ability is very great.



On the front panel of the radiometer is a membrane switch MODE **(4)** what enables to switch the device on and off and choose the working regime. The short pressing to this switch MODE will turn the radiometer on. Longer than 1 s pressing to this switch MODE will turn the radiometer off.

After switching the radiometer on the next short pressings to the switch MODE will help you to choose the suitable and necessary working regime. The chosen regime will be applied after passing of 2 s from the switch pressing.

The choices of regimes are the following:

(-1-) γ -radiation measurement, the filter is closed.

The measuring unit is $\mu\text{Sv/h}$. This regime will be switched automatically on after the radiometer turning on. On the LCD there are three digits with moving comma.

(-2-) Registration of all radiation types, filter is opened.

The measuring unit is CPM (pulse/minute). In this working mode the arrow (8) on LCD will show to the unit CPM.

(bon)/(b--) The buzzer switching on and off.

This mode is to switch the buzzer on (choose "bon") or off (choose "b--").

The mode may be used in both abovementioned regimes, e.g. (-1-) or (-2-) regimes.

(Pon)/(P--) The precision measuring mode switching on and off of.

This precision measuring is switched on after choosing "Pon" and switched off after choosing "P--". The mode may be used in both abovementioned regimes, e.g. (-1-) or (-2-) regimes.

(rdn) The radon measuring regime will be switched on.

The battery is located in the battery section **(2)** on back panel of the radiometer. Appearance of B-figure **(3)** on the LCD is the indication of low voltage, the battery is discharging.

4. Working with the radiometer

Knowing that the α -radiation is absorbed by some centimeters thick layer of air and the β -radiation by some meters thick layer of air it is clear that these radiations will influence the total radiation value only from very near the radiating source.

Therefore the usual approach is to measure at first the total γ -radiation level with closed $\alpha\beta$ -filter and from the distance of some meters from the object (to exclude possible β -radiation). In this working mode the filter will cover the radiation detector. The LCD shows the γ -radiation level on LCD in $\mu\text{Sv/h}$.

The normal background radiation is mostly caused by the cosmic radiation. The experienced operator will recognise the normal background radiation already by the frequency of sound signal of buzzer. The level of this background radiation is quite irregular in time and space.

This is the reason why at measuring low radiation level near background (approximately 0.08-0.12 $\mu\text{Sv/h}$) the short normal measurement mode will give the values which fluctuate in great range.

Due to the abovementioned reasons at measuring the low radiation levels near background it is reasonable to choose the precise measuring mode **Pon**. To get the reliable measurement result keep the radiometer at the measurement point and follow the reading on LCD. As soon as this reading will be constant or the change in time is insignificant take this reading.

After leaving the precise measuring mode (choosing **P--**) the radiometer will delete all earlier measured results.

ATTENTION! The Geiger Mueller type detectors may get locked at very high radiation levels. It means that the detector will not register the radiation any more. Therefore it is recommended to switch the radiometer on in the place of preferably low radiation and thereafter with the working radiometer approach the place of interest.

If the measurement purpose is to find and locate the possible radiation source it is reasonable to use the radiometer with opened filter, e.g. in the regime (**-2-**). In this mode the radiometer will register all types of radiation in the units CPM.

As soon as the $\alpha\beta$ -filter has been pushed aside the GM detector membrane comes into sight from the bottom of the detector compartment.

ATTENTION! The membrane of the GM detector is extremely frail! It is refused to touch the membrane with any kind of material! Avoid the grass, dust etc. from the detector membrane!

At determining the exact location of the radiation sources there is very much help of following the change in sound signal frequency. Therefore it is recommended to switch the buzzer on (choose "bon"). The experienced operator will recognise the normal background radiation already by the frequency of sound signal of buzzer.

The radiometer has the warning alarm signal what is heard as fragmentary sound signal. The application of the alarm signal does not depend on the chosen working mode, e.g. whether the alarm is switched on or not, it will start automatically if the radiation level is higher than fixed by the operator value.

The radiometer has the warning alarm signal what is heard as fragmentary sound signal. The alarm will turn automatically on if the radiation level is higher than 10 $\mu\text{SV/h}$ (about 100 times higher than the normal background level). As soon as the radiation level falls below 10 $\mu\text{SV/h}$ the alarm will turn off.

NB! In case of need or wish it is possible to change the preliminary fixed alarm level. It can be regulated only by ENGLO.

ATTENTION! At all measuring regimes while on the LCD appears the image of HHH it is the mark of LCD overflow (radiation level is higher than 100 $\mu\text{Sv/h}$ or 1000 CPM)

The radiation level 100 $\mu\text{Sv/h}$ has known as the “turning back boarder line”. It will be dangerous to go on or stay there more than 10 s!

Summary

1. switch the device on in the place where you need to perform the measuring.
2. choose the right mode ($\mu\text{Sv/hr}$ or CPM). The arrow on the display will show you the mode. This mode will stay as long as you yourself will change the choice.
3. choose the **bon** if you want to hear the signals. It is highly recommended in the unknown surroundings.
4. choose the **Pon** if you want to get the mean precise value of the radiation measurements. It is recommended if you want to compare the results or calculate the possibility of different radiation types.

5. Measuring the radon concentration in the air

The recommended method of measuring the radon concentration in the air is as follows:

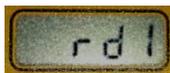
1) Step: background measuring

Open the GM detector by pushing the filter aside. The filter will fix firmly at the utmost end. Put the radiometer into thin plastic transparent bag.

Take the radiometer to the polluted surface and switch it on by choosing the measuring regime (**rdn**). Be careful with the opened GM detector!



The number 999 will appear on the counter what immediately starts to decrease whereas after every 5 s the reading **rd1** will appear on the screen of counter:



This reading means the chosen measuring regime. The measuring will take about 50 min.

As soon as the reading on the counter reaches zero the sound signal will be switched on in every 1 s and on the counter will stay the reading **rd1**.

The measuring of the background radiation has been finished. During measuring don't move the device!

2) Step: radon measuring

Take the radiometer out from the plastic bag and place the radiometer with removed filter on the same place where the background measuring was measured.

Make a light press to the membrane switch on the front panel of the device.

The number 999 again appears on the counter what immediately starts to decrease whereas after every 5 s the reading **rd2** will appear on the screen of counter:



This reading means the chosen measuring regime. The measuring will take about 50 min.

As soon as the reading on the counter reaches zero the sound signal will be switched on in every 1 s and on the counter will stay the reading **rd2**.

Now the radon measuring has finished.

To see the radon concentration make a short press to the membrane switch on the front panel.



The counter will show the radon concentration in **10 Bq/m³**.

Take the reading and switch the radiometer off by longer pressing on the membrane switch on the front panel of the device.

The durability of one radon measuring test is about 1 hr and 40 min.

3) Repeat test

If you want to repeat the radon measuring at the same place you will have to perform the test exactly according to this abovementioned process.

6. Maintenance

ATTENTION! The radiometer case is not waterproof. Therefore it should be kept from moisture and water.

If the device is not used for a longer time (2-3 months) it is recommended to take the battery off from the battery section to avoid its leakage and possible damage to the device.

The battery in the radiometer must be changed if into the left lower corner of LCD appears the mark "B".

Recommended type of the batteries for the radiometer are only the 9 V ALKALINE PP3 batteries because of their higher capacity and possibility to work at temperatures below 0 °C.

If the battery has emptied down to the limit where the radiometer is incapable to continue the measuring the mark "Err" appears on the LCD. The measuring ability restores immediately after changing the battery.

ATTENTION! Please, be careful at battery changing and follow exactly the polarity!

7. Technical characteristics

Radiation detector	type	Geiger Mueller
	effective diameter	9.1 mm
Output signal	dose rate of γ –radiation total $\alpha\beta\gamma$ – radiation radon measuring	$\mu\text{Sv/h}$ Cpm 10 Bq/m ³
Measuring units in automatically selected ranges	0.00 – 9.99 $\mu\text{Sv/h}$: 0.01 $\mu\text{Sv/h}$ 10.0 – 99.9 $\mu\text{Sv/h}$: 0.1 $\mu\text{Sv/h}$	
Range for radon	20-9990 Bq/m ³	
Precision for radon	± 30 Bq(m ³)	
Operating voltage	9 V (ALKALINE battery)	
Operating temperature range	- 15 °C to + 35 °C	
Display	8.7 mm LCD	
Weight	122 g	
Dimensions	96 x 60 x 26 mm	

8. Warranty

Englo gives the one year warranty to the radiation measuring device RADON-4 starting from the date of original purchase.

If within one year from the date of original purchase the radiation measuring device fails to function because of the defects in materials or workmanship, Englo will, at its option, either repair or replace the components of the device.

This warranty does not cover damage resulting from accident, misuse or abuse, water, tampering, servicing performed or attempted by unauthorized persons, or units that have been modified in any fashion. If the device or its components do not perform as warranted herein, the original purchaser's sole remedy will be the repair or replacement of the components as provided above.

In no events will Englo be liable for damages, lost revenue or any other incidental or consequential damages, rising from the purchase and use or inability to use the device.

All warranties for the radiation measuring device RADON-4 are limited to the warranty period of one year.

Englo guarantees the later maintenance of the radiation measuring device RADON-4 at price agreed with the purchaser.

Date of original purchase.....

Serial no.