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Dosimeter DEFENDER

Purpose

Dosimeter Defender is designed for measuring the cumulative radiation dose and assessing the product radioactivity level and detecting objects, food or construction materials contaminated with radioactive elements.

Dosimeter Defender can easily assess the level of radioactivity according to the power level of ion radiation (gamma radiation and beta particles stream) with taking into account x-ray radiation.

Base kit

Dosimeter Defender has the following items included in the base kit:

Dosimeter Defender	1 pcs
Passport	1 pcs
Rechargeable batteries (AAA size)	2 pcs
USB power cable-mini USB	1 pcs
Adapter block	1 pcs
Rigid paperboard box	1 pcs

A Geiger-Muller counter is used as ion radiation sensor in our dosimeter Defender.

The manufacturer reserves the right to add new features to the device. Please follow new code modifications on the official website: **www.soeks.ru**. The device's code can be modified only in the manufacturer's service centers.

Specification

Range of indicated background radiation level, mcSv/h	Up to 1000
Registered gamma radiation energy	from 0.1
Measurement range of cumulative dose, Sv	Up to 1000
Levels, mcSv/h	from 0.3 to 100
Time of measurement, seconds	up to 20
Display format of indication	Constantly, number and graphical
Power elements	AAA size batteries rechargeable or non-rechargeable
Power voltage range, V	1.9 - 3.5
Time of continuous work of the device, hours at least**	10
Overall dimensions height x width x thickness, max, mm	105x43x18
Weight (without power elements), max, grams	57
Battery charging current, max, mA	300
Current consumption from charger or USB not more than	500
Output charger voltage	from 4.5 to 5.5
Display	Color TFT, 128x160
Operating temperature range, °C	from -20 to +60

Comment:
* Increasing the number of measurements shall improve the reliability of readings.
** The time of continuous work of the device is up to 10 hours, with default settings and two batteries of capacity 1350mAh.
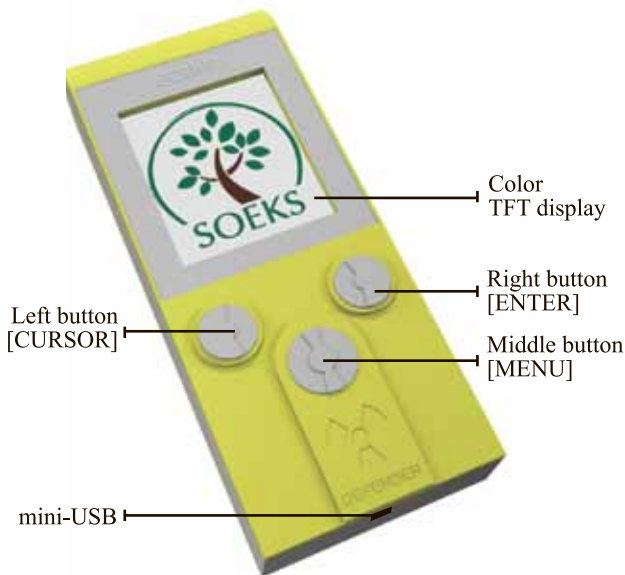*** Default settings: alarm level - 1,2, color theme - green, sound – on.

Precautions

Before using the product, please read carefully the safety measures below and strictly observe them when using the product. Violation of these rules may cause malfunction or cause total failure of the product. The manufacturer's guarantee shall be void if the safety measures stated below are violated.

• Protect the product from shock and other mechanical impacts that can damage it.
• Do not use the product in conditions of high humidity, under or in contact with water: the product is not waterproof.
• Do not leave the product in places with intensive sun light or high temperatures for a long time, this can cause electrolyte leakage from power elements, failure of the product, and injuries.
• Do not leave the product for a long time near devices that generate strong magnetic fields, such as magnets or electric motors, and where strong electrical magnetic signals are generated, such as transmitter towers.
• Do not perform measurements close to cell phones and microwaves, this may affect the instrument's readings.
• Do not disassemble and do not try to repair the device on your own.
• Do not connect the device to a PC or socket while it has regular batteries installed.
• Strictly observe polarity when you install power elements, otherwise the device may overheat and fail.

Appearance of the device

Color TFT display

Right button [ENTER]

Left button [CURSOR]

Middle button [MENU]

mini-USB

Controls

Left button [CURSOR]- scroll down the list. After you reach the lowest (last) position on the list you return to the topmost (first) position. Keyboard lock/unlock

Right button [ENTER]- confirm selection.

Middle button [MENU] – turn the device on/of, shift to "Measure" mode from the top menu, shift to "Radiation Dose" mode from "Measure" mode, and return to the top menu.

Power

At the back side of the device there is the cover of the battery section. AAA type accumulators or batteries can be used to power the device. The bottom of the battery section shows the manufacturer's trademark - SOEKS - and board model.

The front side of the device has a mini-USB port that can be used to recharge batteries from a computer via a USB-mini-USB cable or from the power mains. If connected to a PC or electric mains, the device can work without power elements.

How to install power elements

• Strictly observe polarity when you install power elements, otherwise the device may fail.
• When the device is turned off, you can leave the power elements installed – the batteries and accumulators are not spent if the device is in standby mode.
• If you expect not to use the device for a long time, it is recommended to remove the power elements after the device is turned off.

Attention!
Never connect the device to a charger or a PC if it has not rechargeable batteries installed or has no batteries inside. This can overheat the power elements, cause their failure and electrolyte leakage, damage the case and break the device

Screen indicators

1. Keyboard lock indicator

- keyboard is active

- keyboard is locked. Indicator is flashing.

2. Sound indicator

- sound is on

- sound is off because of the low battery

- sound is off

3. Radiation dose level indicator

- the determined level of cumulative radiation dose is not exceeded

- the determined level of cumulative radiation dose is exceeded. A warning signal is heard

4. Diagram

Shows radioactivity during the previous minute. The diagram keeps moving from right to left, and the bar height shows the level of background radiation: the higher the background, the taller the bar. The bar may be blue, yellow and red.

5. USB indicator

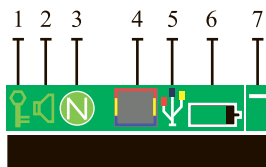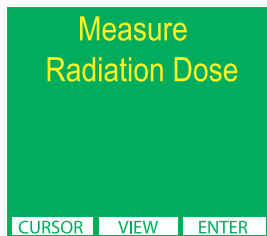- USB cable connected

- batteries are charging

- charging completed

1 2 3   4 5 6   7

Main Menu

Measure
Radiation Dose

CURSOR   VIEW   ENTER

6. Battery charge status indicator:

 - normal power level

 - running down

 - low power level

 - replace or recharge the batteries

Attention! When the accumulator charge is critically low and the device switches off itself because of lack of power the loss or wrong data can occur. Installed setting can be deleted. That's why if the red indicator switches on it's necessary to charge the device or exchange the batteries. It's recommended to switch of the device beforehand using button "Off".

7. Active status indicator

The continuously moving element in the upper right corner of the screen indicates the device's active status.

When buttons are pressed, icons in this area show which button has been pressed.

 - the [CURSOR] button was pressed

 - the [ENTER] button was pressed

 - the [MENU] button was pressed

8. Help line

Contains the names of the functions of control buttons.

CURSOR - move down the list

ENTER - confirm the selection
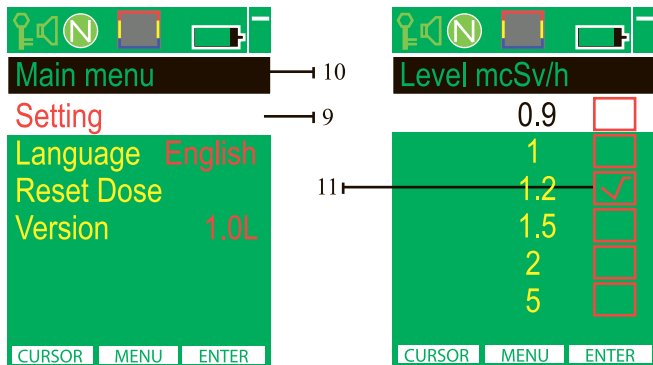
MENU - return to the main menu

VIEW - shift to another mode

UNLOCK - unlock the keyboard
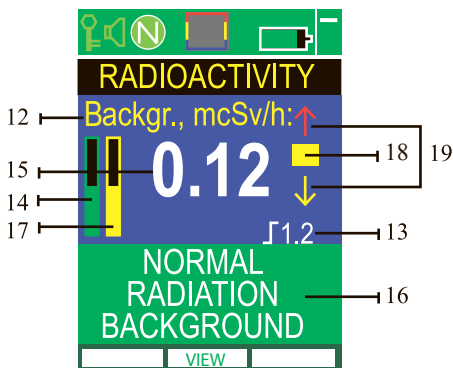
Menu indication and navigation

9. The current (selected) line is highlighted with color.
10. Inside a selected menu item, the upper line on the list indicates the parent menu item.
11. As the device is being set up, the current parameter value is flagged with a tick mark.

Indicators in the «Measure» mode
A screen with the following elements appears in the measure mode:

12. Units: mcSv/h

13. Level in preset units

14. Indicator of measured results: filled up within 10 sec. If the background radiation is high the result may be available much sooner.

15. Radiation level. Shown as large digits in the screen center. The first measurement also shows the word «MEASURE»

16. The message about radiation bagkground:

- if the measured background radiation is less than 0,4 mcSv/h, a «NORMAL RADIATION BACKGROUND» indication appears on a green background.

- if measured background radiation is 0,4-1,2 mcSv/h, caption «HIGH RADIATION BACKGROUND» appears on a yellow background.

- if the measured background radiation is greater than 1,2 mcSv/h, caption «DANGEROUS RADIATION BACKGROUND» appears on a red background.

17. The indicator of measurement accuracy – with increasing of accuracy fills in with yellow colour. With each measurement (it takes 10 sec.) the column of the indicator of measurement accuracy grows till complete fulfillment. The complete fulfillment takes about 2 minutes (12 measure-ments). If during the measurement some sharp changes of the radiation are defined (more than three times increasing or ten times decreasing), than the indicator of measurement accuracy zeroes. Thanks to this fact, the defining of sharp changes of radiation background with reflection of exact data takes no more than 10-20 seconds.
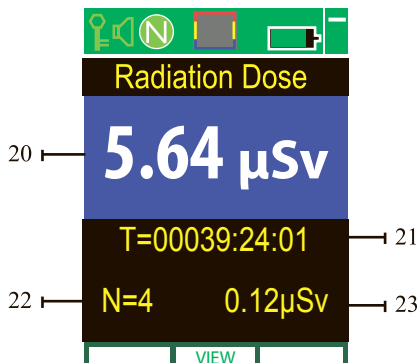
18. The indicator of defining radiation fractions: If the fractions follow often, than the indicator blinks with yellow and red, if the fractions are rare – the indicator is yellow.

19. The indicators of radiation background changes:

- One red up arrow appears when increasing of radiation background is more than 30% of average.

- One red down arrow appears when decreasing of radiation background is more than 30% of average.

- Two red up arrows appear when the increasing of the radiation background is considerable.

- Two green or yellow down arrows appear when decreasing of radiation background is considerable.

Indicators in the «Radiation Dose» mode

A screen with the following elements appears in the measure mode:

20. The rate of accumulated radiation dose.
21. Dose accumulation time (hh. mm.ss.)
22. Quantity of switching on of the device during this period.
23. Current radiation background

The device's menu consists of 3 items:
● Main Menu – device settings
● Measure – measurement of radiation background level
● Radiation Dose – measurement of accumulated dose level

Main menu

Settings

In this section you can preset the parameters for the device and the interface.

Items of the Settings menu:

● **Level mcSv/h.**

You can select the threshold value from 16 preset values on the list.

mcSv/h
no
0,3
0,4
0,5
0,6
0,7
0,8
0,9
1
1,2
1,5
2
5
10
30
60
100

If the measured background radiation exceeds the preset level, alarm sound appears.

Alarm sound switching off:

Settings > Level mcSv/h > no

● **Dose Level**

You can select the threshold value from 16 preset values on the list.

no
0,01 mSv
0,05 mSv
0,1 mSv
0,5 mSv
1 mSv
5 mSv
10 mSv
50 mSv
0,1 Sv
0,5 Sv
1 Sv
5 Sv
10 Sv
50 Sv
100 Sv

If the measured accumulated radiation dose exceeds the preset level, alarm sound appears.

Alarm sound switching off:

Settings > DoseLevel > no

● **Vision**

In this section you can adjust screen settings: brightness, display time, and color pattern.

● Brightness

Select low, medium or high brightness level of the screen.

To save power and help the batteries last longer it is recommended to use the low or medium brightness level of the screen.

● Theme

Select from 4 possible combinations of background and font color: green, gray, blue and white.

● OffTime, min.

Set the time of display backlight in standby mode. You can select from 1 to 15 minutes in the options list.

no – backlight is always on while the device is in use.

● **Sound**

In this section you can adjust the sound parameters.

      ● Sound on (yes/no)

      ● Keypad tone (yes/no)

To save power and make the batteries last, it is recommended to turn the sound off.

      ● Sensor Sound (yes/no)

      ● Dose Sound (yes/no)

      ● Sound tone

Select one of the 4 available sound tones.

      ● Volume (low/medium/high)

Default is the average volume.

●**Power**

In this section you can adjust parameters of the power elements used in the device.

      ● OffTime,min.

Set the time in minutes after which the device shall automatically shut down. When it turns off automatically the data of accumulated radiation dose saves in the memory of the device.

no – the device will work until turned off with the [MENU] button.

● **Language**

In this section you can select the interface language. This device has only 2 options: Russian and English.

> **Attention!** After the [MENU] button is pressed the screen will display the root menu in the selected language. If you made an error and selected the unfamiliar language, press the following sequence of buttons to return to the language selection menu: **right-left-right.** Then select the language you need and confirm your choice with right button.

Dose Reset

In this section you can reset the accumulated dose counter.

● Cancel - zeroing not completed (blue indicator «Canceled»).

      Press any key to return to main menu.

● Reset - zeroing completed (red indicator «Reseted»).

      Press any key to return to main menu.

Power control of the device

1. To turn the device on, press and hold the [MENU] button until the display turns on (the screen backlight is on) then release the [MENU] button.
- When the device is on, an animated screen with the company's logo appears. To skip this screen press the [ENTER] button.
- After the splash screen the display will indicate the model (code modification version) of the device for 3 seconds.

2. To turn the device off press and hold the [MENU] button until the display shows an animated screen with falling autumn leaves. Then release the [MENU] button. Pressing and holding the [MENU] button will turn the device off in any mode. The data of accumulated radiation dose saves in the memory of the device.
Switching off by the other ways, for example, because of total discharging of power elements or after its extraction, it's not recommended, because it can cause the loss of the accumulated dose data.

3. While connected to a USB, the device will be on.

When the device is off, you can leave the power elements installed – batteries and accumulators are not spent if the device is in standby mode. If you expect not to use the device for a long time, it is recommended to remove power elements after the device is turned off.

Buttons block

For buttons block press and hold left button till the indicator of buttons block will not turn red and start blinking. To unlock buttons press and hold left button till the indicator of buttons block will not turn green. (p.30, p.1)

If the buttons are blocked and the screen is turned off, so when you press any key it temporally switches on and then switches off.

Beginning to use the device

1. Install the power source (page 29)
2. Turn the device on (page 38)
Before you begin measurements, we recommend that you tune up the device (page 35)
4. When switched on, the device automatically enters the "Measure" mode and starts measuring radioactivity. Approximately in 10 seconds you can see the first measuring results; afterwards the next measurement cycle begins. The measurements are made permanently until the device is switched off, regardless of the current mode. The most accurate results are shown when the indicator of accuracy is full (page 33, article 17).

If the readings are higher than the natural radiation background typical for the locale, this means that the examined object is contaminated by radiation.

Results obtained using the device can not be used for official conclusions regarding the radiological situation.

Measuring radiation background of objects

To measure radiation background of foodstuffs, building materials and other things do this sequence:
1. Measure the level of radiation background several meters away from the target.
2. Move the device directly to the target and measure radiation background as close as possible to the target.
3. Compare the resulting data with the radiation background level measured in step 1.

The difference of readings in step 1 and step 2 will represent the radiation background of the target.

To evaluate radioactive contamination of liquids, the unit must be placed above open surface of the liquid. To protect the unit from contact with the liquid, it is recommended that the unit should be wrapped in a polyethylene bag, but ensuring that the wrapping is one layer of plastic only.

Cumulative dose measurement

Accumulation process of radioactive dose starts right after the device is switched on and goes on permanently until the device is switched off, regardless of the current mode. When you switch on the device again, the accumulation process continues.

You can reset the figures with the function "dose figures reset" in the top menu (page 37).

If necessary, please use the function of keyboard lock (page 38).

● If the screen goes blank, press any button to reactivate it.

Marking and sealing

The name of the device is written on the case. The serial number and date of manufacturing are written in the battery section under the accumulator. The manufacturer does not seal the device.

Package

The package ensures safety of the device during transportation and storage, provided normal climatic conditions.

Transportation and storage

The packed device can by shipped by any type of transport over any distance.

During shipment, the device must be protected against humidity.

Shipping conditions of the packed device must meet the following requirements:
- environment temperatures from -40° to +60°C.
- relative humidity max 90% at +25°C.

Until operation, the device must be stored in the factory package, in a warehouse with air temperatures from -5° to +40° C and maximum relative air humidity 80% (at temperature +25°C). The device may not be stored without the package. If the device remained at below-zero temperatures for a long time, it must be left indoors for 2 hours before use.

Maintenance

Maintenance includes:
- removal of dust from the outer surface of the device;
- timely changing or charging the power elements;
- if the device is not used for a long time (more than 2 weeks), power elements must be uninstalled;
- clean the display with soft cloth only.
Prevent foreign objects from getting inside the device through the accumulator section or perforation on the back side of the device.

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