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Chapter 1

1 Intoduction

This section contains the general information about dosimeter Radiacode 103,103G,103L, 103S. Later in the document, the dosimeter Radiacode 103,103G,103L,103S is also referred to as "device" and "dosimeter".

General view of the device is shown below:

Radiacode 103,103G,103L,103S

1.1 Device purpose

Portable dosimeter Radiacode 103,103G,103L,103S is designed to assess an ambient background radiation and a level of radiation from various substances and objects (any suspicious objects and surfaces: building materials, antiques, vehicles, soil samples, etc.). It assesses the radiation situation by the power of ionizing radiation, reacting to X-rays, gamma radiation and a flow of beta particles. It also able to visualize the energy spectrum of the absorbed photon radiation.

1.2 Device features

- Instant reaction to changes in the radiation environment thanks to embedded detector based on CsI (Tl) scintillator and solid-state silicon photomultiplier in conjunction with an adaptive software processing of incoming data.
- Providing continuous assessment of the radiation environment, the results can be viewed on display at any time the device is turned on.
- Measurement results can be viewed in form of dose rate, count rate, accumulated dose and energy spectrum of absorbed photon radiation.
- Measurement results can also be transferred to a computer or a smartphone and can be saved in external cloud storage.
- Binding of measurement results to coordinates of a research area, displaying the results on Google maps (when connected to smartphone).
- Long-lasting standalone operation from built-in Li-Pol battery – up to 500 hours.
- Large volume of built-in non-volatile memory – up to 1000 hours of a standalone registration;
- Parameters for assessing the detected ionizing radiation can be viewed in various units: Sv (Sievert), R (Roentgen), CPS (counts per second), CPM (counts per minute).
- Measured dose rate value is displayed along with its error level.
- Dose rate, count rate and accumulated dose are displayed with an additional graphic scale.
- Alarm sound and vibration signaling – both on dosimeter and a smartphone.
- Additional alarm light signaling on dosimeter.
- Display backlight with automatic turn-on in darkness.
- Automatic rotation of display image according to device orientation.
- Increased splash and dust protection of dosimeter case – class IP64.

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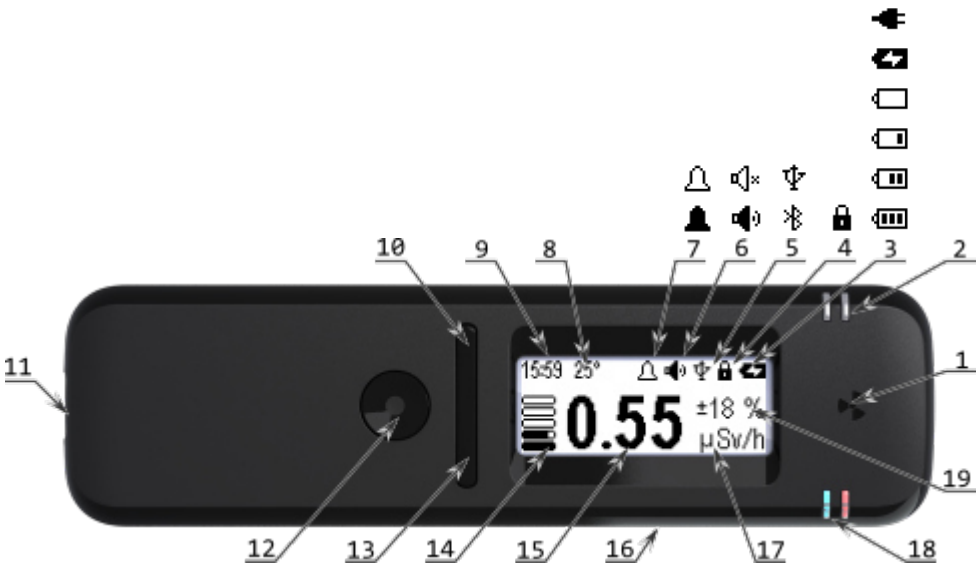
1.3 Device design



1. Location of radiation sensor, digital thermometer and device orientation sensor.
2. Ambient light sensor (for backlight auto turning-on feature).
3. Built-in battery status: charge level (4 variants), charging, powered from an external source (end of charging).
4. Swing buttons' control sign: locked, unlocked.
5. External connection sign: USB, Bluetooth.
6. Sound status: on, off.
7. Alarm sign: presence and level.
8. Radiation sensor temperature indicator.
9. Current time indicator.
10. Swing button:
    - "*up*" for the left-hand orientation,
    - "*down*" for the right-hand orientation.
11. USB type C connector: for device charging and data exchange.
12. Round button, used for turning on the device and navigating through the menu a, entering the main menu and submenus, selection of menu and submenu item and confirmation of the item choice.
13. Swing button:
    - "*down*" for the left-hand orientation,
    - "*up*" for the right-hand orientation.
14. Dose rate graphical representation.
15. Dose rate numerical representation.
16. Sound speaker location.
17. Dose rate units.
18. Two light signaling indicators:
    - charge (*blue*);
    - registration of gamma quanta (*green* when low level, *red* when alarm threshold is exceeded).
19. Random error of dose rate assessment (at a confidence level of 0.95).

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1.4 Technical specifications

Device characteristics

Energy range of registered photon radiation (X-ray and gamma)	0.05…3 MeV
Dose rate assessment: ▪ range ▪ error ▪ time (display update period) ▪ time for a level of random error ±15% with natural radiation background 0.08 μSv/h	 0.1…1000 uSv/h ±15% 0.5 s 34 s
Accumulated dose assessment: ▪ range	 0…10 Sv
Non-volatile memory: ▪ registration volume of Standalone mode	 last 1000 h
Continuous operation time (for fully charged battery)	up to 500 h
Built-in battery: ▪ type and capacity ▪ charging voltage, typical ▪ charging current, max ▪ full charge time, typical	 Li-Pol 3.7 V, 1000 mAh 5 V 500 mA 2 h
Operating temperature range	-10…+35°C
Relative humidity, max	85 %
Wire connection: ▪ type ▪ cable ▪ current consumption, max	 USB 2.0 and higher type C 500 mA
Wireless connection	BLE (Bluetooth 4.0 and higher)
Display	Monochrome graphic LCD, 128x48 pixels, 34x13 mm, FSTN, Transflective, Positive
Dimensions, W*H*D	123x34x18 mm
Weight	65 g
Dust and moisture protection, code	IP64

Requirements for PC

The device works with PCs with the following system requirements:

- operating system..... Windows XP/7/8/10
- free hard disk space, min..... 1 GB
- operating memory (RAM) size, min..... 2 GB
- video card resolution, min..... 1024x768
- USB port..... 1 pc.

Requirements for mobile device

The device works with pads and smartphones with BLE interface (Bluetooth 4.0 and higher) and operating system Android 6.0 and higher.

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1.5 Developer contacts

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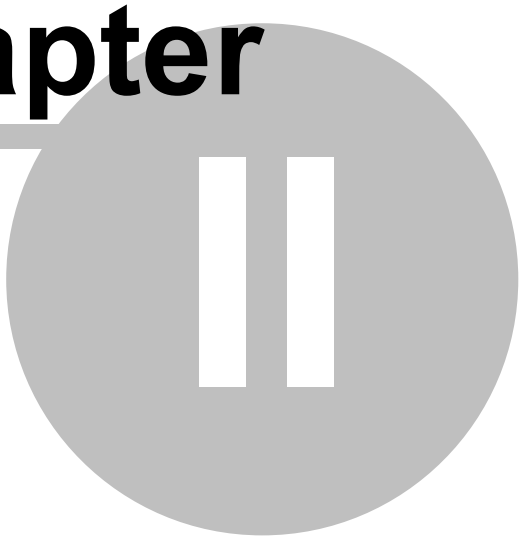
Chapter



2 Safety precautions and warnings

Read this manual carefully before using the device.

- ***Keep the device out of the reach of children and pets!***
- ***Do not disassemble the device!*** Repair of the device is allowed only in certified service centers.
- ***Do not use defective chargers! Use only dedicated chargers or USB port of computer to charge the device!*** A device damaged as a result of improper charging is not eligible for warranty repair.
- Protect your device from extreme temperatures (below -20 ° C or above +45 ° C). Temperatures that are too high or too low will reduce the capacity of the battery and shorten its life.
- Avoid getting the device wet. Moisture can cause serious damage to the device. Moisture penetration into the device will void the manufacturer's warranty.
- If you brought the package with the device from frost to a warm room, leave it to warm up for two hours without opening. Otherwise, moisture may condense inside the device and cause the device to malfunction.
- Do not use or store the device in dirty areas.
- Avoid exposing the device to strong electromagnetic fields.The action of the electromagnetic field can damage the device.
- Mobile phones, electronic and household appliances can interfere with the operation of the device.
- External shocks and rough handling can seriously damage the electronics of the device.
- Do not grip the device strongly in your hand, press the buttons lightly.
- Handle the device with care, the display is made of glass and can be broken if handled roughly.
- Do not disconnect the device from the computer while the firmware is being updated. An attempt to disrupt the download process may lead to a malfunction of the device, which can only be fixed by a certified service center.

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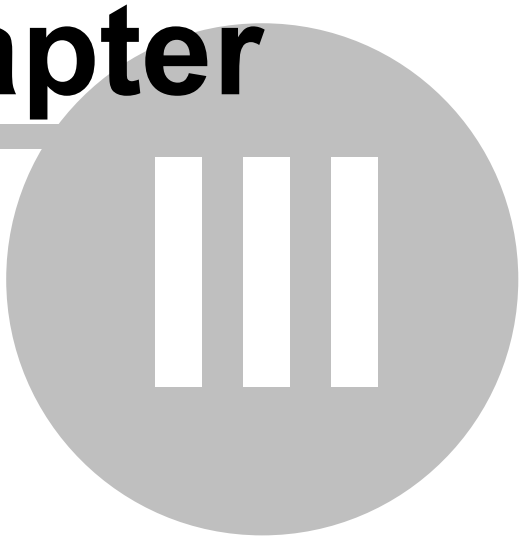
Chapter



3 Standalone usage

Radiacode 103,103G,103L,103S is designed for long-term standalone use, it allows you to store the accumulated
data in the internal memory up to a thousand of the last hours of observations.
The device continuously evaluates the radiation situation all the time it is turned on. The results can be presented at any time in the form of an assessment of the dose rate, count rate, accumulated dose and energy spectrum of absorbed radiation. The assessment and accumulation processes are independent of the selected display mode.

3.1 Before use

Note: If you brought the package with the device from frost to a warm room, leave it to warm up for two hours without opening. Otherwise, moisture may condense inside the device and cause the device to malfunction. Moisture penetration into the device will void the manufacturer's warranty.

First steps:
- take the device out of the package;
- make sure it is intact;
- read the instructions;
- check the completeness according to the product passport;
- check the availability and correctness of filling in the passport/warranty card;
- fully charge the battery.

After the battery is fully charged, turn on the device and set the current time. After it, you may additionally:
- select menu language;
- set display parameters;
- set up signals;
- update firmware of the device.

3.2 Battery charging

To charge the battery:
- plug the USB cable to the connector located at the end of the device ([14] in the general view);
- plug the USB cable to the connector of a computer or a special charger;
- leave the device connected to the charging source until it is fully charged.

The indicator of the activity of the charging process is the glowing of the blue indicator ([18] in the general view). If the device is turned on, then the screen displays the icon ([3] in the general view). At the end of the charging procedure, the blue indicator will turn off and the icon will change to the sign of power supply from an external source.
Pay attention to the charge indicator icon while using the device. If the charge indicator is empty 🏷, then connect the device to the charger.

Attention! Use only dedicated chargers or a computer USB port to charge the device. Connecting the device to the wrong charging source may damage it. A device damaged as a result of improper charging is not eligible for warranty repair.

3.3 Firmware update

The device is constantly being improved and the firmware (built-in software) is regularly updated by the developer company. The current version of the device firmware is available through the Device info menu item.
To update the firmware take the following steps:
- download the latest version of **Radiacode** software at https://space.radiacode.com;

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- install **Radiacode** on your computer and run it;
- connect the device directly to your computer's USB port using the USB cable type-C (supplied with the device);
- turn on the device;
- if there is a fresh version of the firmware, you will be prompted to update it;
- wait for the update process to finish.

Attention! Do not disconnect the device from the computer while the firmware is being updated. An attempt to disrupt the download process may lead to a malfunction of the device, which can only be rectified by a service center.

3.4 Contols and indication

Radiacode 103,103G,103L,103S is equipped with a combined user interface:
- display;
- buttons;
- sound emitter;
- LEDs;
- vibration signaling.

Sound, light and vibration signaling complement the information presented on the display and provide feedback when pressing the buttons (see the table below):

Event / state	Display status bar	Sound	Vibration	Light
Turning on		tone-rhythm		
Turning off		tone-rhythm		
USB connection established				
Bluetooth connection established		tone-rhythm		
Bluetooth connection lost		tone-rhythm		
Low battery		tone-rhythm		
Charging				blue, continuous
Finding the device		tone-rhythm	rhythm	
Button pressed		beep	whizz	
Wrong button pressed		beep-beep	whizz-whizz	
Quantum fixation		click		green / red, flashing
Alarm 1		tone-rhythm	rhythm	display backlight
Alarm 2		tone-rhythm	rhythm	display backlight
Going off the scale		tone-rhythm	rhythm	display backlight

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3.4.1 Display

The device is equipped with a display with the following characteristics:

- Monochrome graphic LCD;
- 128x48 dots;
- 34x13 mm;
- FSTN, transflective, positive;
- built-in backlight.

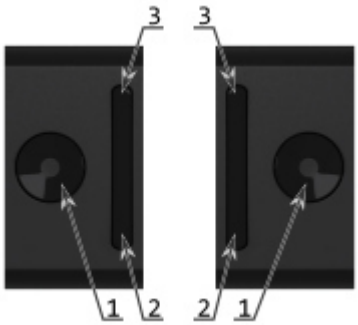
The display is used to show:
- device status;
- control menu;
- dose rate or count rate in the Monitor mode;
- accumulated dose;
- energy spectrum of absorbed radiation;
- count rate in the Search mode.

How to configure the backlight and image orientation parameters through the menu, see Screen section of Device settings.

Note: The display is made on a glass base and may break if the device is handled carelessly.

3.4.2 Buttons

Dosimeter Radiacode103,103G,103L,103S has an intuitive menu system and is controlled by three buttons (see image below):



The device is in the left hand in the right hand

1. round button for turning on and confirming;
2. swing button "down";
3. swing button "up".

There are two types of pressing the buttons: *short* and *long* (at least two seconds).
A *long* press on the *round* button [1] is used to:
- turn on the device,
- call up the menu.

A *short* press on the *round* button is used to:
- unlocking and locking the *swing* buttons;
- return from the main menu to the display mode;
- confirming the selection of the highlighted menu item;
- switch between options.

A *short* press on the *swing* "*up*" and "*down*" buttons [2, 3] is used to:
- moving between menu items;

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- setting numerical values.

A *long* press on the *swing* "*up*" and "*down*" buttons serves different purposes in different cases. In the menu, a *long* press on the *swing* "*up*" and "*down*" buttons leads to a quick selection of items. In the display modes, a *long* press on the "*up*" button turns on and off the sound signaling.

The *swing* buttons are automatically locked after 5, 10, 15 or 30 seconds of inactivity, the time to auto-lock depends on the settings.
The *swing* buttons can be unlocked by briefly pressing the *round* button [1]. This will turn on the backlighting of the screen, if it is enabled (in the device settings). In sufficient light, the backlight will not turn on in Auto mode.
A detailed description of how to use the buttons in different modes can be found in the sections ~~Menu~~, ~~Display modes~~ and ~~Device settings~~.
Sound and vibration accompanying button presses can be separately disabled and enabled through the menu, see ~~Signals~~.

3.4.3 Signals

Radiacode 103,103G,103L,103S has built-in sources of sound and vibration for confirmation of pressing the button and indication of events and alarms. Also light indication is provided for control at a distance.

Sound can be accompanied by:
- turning the device on and off;
- pressing the button;
- establishing communication via Bluetooth;
- registration of a quantum of radiation;
- exceeding alarm thresholds;
- low battery warning;
- response to the request "Search for device".

Vibration can indicate:
- pressing the button;
- exceeding alarm thresholds;
- response to the request "Search for device".

Light indication is used in case of:
- battery charging - blue color, continuous light;
- registration of a quantum of radiation in normal environment - green, flash;
- registration of a quantum of radiation in case of alarm - red, flash;
- exceeding the alarm threshold - turn on the screen backlight.

You can enable or disable alarms for individual groups:
- all sounds;
- sound of pressing buttons;
- sound of registration of a quantum of radiation;
- all types of vibration;
- light indication.

A detailed description of how to customize the signal parameters of the device, see Signals item of menu.

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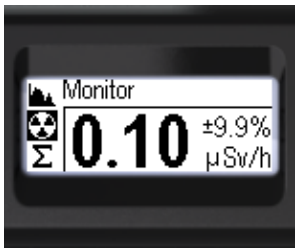
3.5 Turning on and off

For the initial state, we take the "Device is off". To turn on the device:

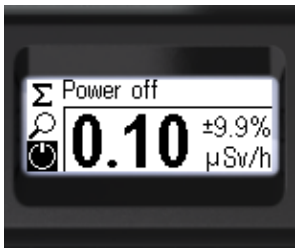
- press the *round* button and hold it for two seconds (*long* press);
- wait while the device comes into working state - the display will turn on and the sound will play, if enabled.

The default working state after turning on is Monitor.

To turn off the device (while in one of the Display modes):



- enter the main menu by *long* pressing the *round* button;
- set focus on **[Power off]** item by *short* pressing the "*up*" and "*down*" *swing* buttons;
- confirm your choice by *short* pressing the *round* button.

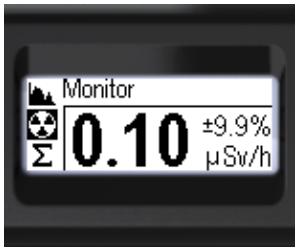


With the appropriate settings, the "off" sound will be played at this point. The device screen will be turned off.

3.6 Menu

After turning-on, Radiacode 103,103G,103L,103S starts to work in Monitor mode.

While in one of the Display modes (**Monitor** in this example), enter the menu by *long* pressing the *round* button.
After entering the menu, the menu item icons is located on the left side, and the text name of the selected item is located at the top of the display.



Six menu items are available at the top level (see the table below):

	Settings	Settings submenu.
	Spectrum	Display mode: energy spectrum of absorbed photon radiation (X-ray and gamma).
	Monitor	Display mode: dose rate or count rate (see also Display units).
	Dose	Display mode: accumulated dose (X-ray and gamma).
	Search	Display mode: graphical representation of the count rate (search graph).
	Power off	Turning off the device.

There are three simultaneously visible items after entering the menu. Navigating through the menu and selection of the desired item is made by *short* pressing the *swing* buttons “*up*” and “*down*”. Hidden items become visible as you move through the menu. When the button is held down, the items are quickly scrolled up or down. The selected item will be marked with a negative icon, to confirm your choice *short* press on the *round* button.

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The menu is organized cyclically at all levels. For example, pressing the *swing* button "*down*" on the top level of menu moves the focus from item to item in the following order: --> --> --> --> --> --> --> etc...

General structure of the menu is shown below.

[Settings] – transition to device settings submenu .

- **[Display units]** – choice between presentation of dose rate and count rate for Monitor mode (see also Display units).
- **[Measurement units]** – transition to submenu.
  - **– [Dose]** – selection of the units: **[Sv** (Sievert)**]** / **[R** (Roentgen)**]**
  - **– [Count rate]** – selection of the units: **[CPS** (counts per second)**]** / **[CPM** (counts per minute)**]**
  - **– [< Back]** – return to a higher level, presented in all submenus;
  - **– [<< Menu quit]** – return to display mode, presented in all submenus;

* *further, the last two points* **[< Back]** *and* **[<< Menu quit]** *are designated as* **[< <<]**

- **[Dose rate]** – transition to submenu.
  - **– [Alarm 1]** – setting alarm threshold 1 for the dose rate;
  - **– [Alarm 2]** – setting alarm threshold 2 for the dose rate;
  - **– [< <<];**
- **[Dose]** – transition to submenu.
  - **– [Alarm 1]** – setting alarm threshold 1 for the accumulated dose;
  - **– [Alarm 2]** – setting alarm threshold 2 for the accumulated dose;
  - **– [< <<];**
- **[Screen]** – transition to submenu.
  - **– [Backlight]** – transition to submenu;
  - **– – [Turning on]** - backlight turninig-on mode: **[Auto]** / **[Never]** / **[By button]**;
  - **– – [Duration]** - backlight turninig-off timeout: **[5 s]**, **[10 s]**, **[15 s]**, **[30 s]**
  - **– – [Brightness]** - backlight brightness level: from **[0]** to **[9]**
  - **– – [< <<];**
  - **– [Rotate]** – image orientation mode: **[Auto]** / **[Right]** / **[Left]**;
  - **– [< <<];**
- **[Signals]** – transition to submenu.
  - **– [Sound]** – selection **[On]** / **[Off]**, for all sounds
  - **– [Vibro]** – selection **[On]** / **[Off]**, for all vibration signals
  - **– [Light]** – selection **[On]** / **[Off]**, light flash for a radiation quantum registration, separately
  - **– [Clicks]** – selection **[On]** / **[Off]**, sound for a radiation quantum registration, separately
  - **– [Buttons]** – transition to submenu
  - **– – [Sound**] – selection **[On]** / **[Off]**, sound for pressing the buttons, separately
  - **– – [Vibro]** – selection **[On]** / **[Off]**, vibration for pressing the buttons, separately
  - **– – [< <<];**
  - **– [Alarms]** – transition to submenu.
  - **– – [Dose rate]** – transition to submenu.
  - **– – – [Alarm 1]** – transition to submenu.
  - **– – – – [Sound]** – selection **[On]** / **[Off]**
  - **– – – – [Vibro]** – selection **[On]** / **[Off]**
  - **– – – – [< <<];**
  - **– – – [Alarm 2]** – transition to submenu.
  - **– – – – [Sound]** – selection **[On]** / **[Off]**
  - **– – – – [Vibro]** – selection **[On]** / **[Off]**
  - **– – – – [< <<];**
  - **– – – [Out of scale]** – transition to submenu.
  - **– – – – [Sound]** – selection **[On]** / **[Off]**
  - **– – – – [Vibro]** – selection **[On]** / **[Off]**
  - **– – – – [< <<];**
  - **– – [Dose]** – transition to submenu.
  - **– – – [Alarm 1]** – transition to submenu.
  - **– – – – [Sound]** – selection **[On]** / **[Off]**
  - **– – – – [Vibro]** – selection **[On]** / **[Off]**

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– – – – **[< <<];**
– – – **[Alarm 2]** – transition to submenu.
– – – – **[Sound]** – selection **[On]** / **[Off]**
– – – – **[Vibro]** – selection **[On]** / **[Off]**
– – – – **[< <<];**
– – – **[Out of scale]** – transition to submenu.
– – – – **[Sound]** – selection **[On]** / **[Off]**
– – – – **[Vibro]** – selection **[On]** / **[Off]**
– – – – **[< <<];**
– – – **[< <<];**
– – **[< <<];**
– **[< <<];**

- **[Bluetooth]** – selection **[On]** / **[Off]**
- **[Language]** – selection **[Russian** (Русский)**]** / **[English]**
- **[Time]** – transition to the time setting dialog
- **[Device info]** – transition to the device information submenu
- **[Factory settings]** – transition to the reset dialog
  – selection **[No]** / **[Yes]**
- **[< <<];**

[Spectrum] – display of photon energy spectrum;
[Monitor] – display of dose rate or count rate;
[Dose] – display of accumulated dose;
[Search] – display of count rate search graph;
[Power off] – turning off the device.

3.7 Display modes

One of four display modes is available at any time of the assessment of radiation situation. The default mode after turning on is Monitor.

The display mode is selected via the menu. In the menu, the items are marked with icons and text names (see the table below):

	Spectrum	Display mode: energy spectrum of absorbed photon radiation (X-ray and gamma)
	Monitor	Display mode: dose rate or count rate (see also Display units)
	Dose	Display mode: accumulated dose (X-ray and gamma).
	Search	Display mode: graphical representation of the count rate (search graph).

Selected item of the menu is marked with a negative icon.

You can view the device status in any of the display modes in the screen status bar. The status bar is located at the top of the display.

On the right side of the status bar, you can see standard information (that does not depend on the selected mode) (see the table below):

	At least 60% of the charge.
	At least 30% of the charge.
	At least 10% of the charge.
	Less than 10% charge, need to charge the battery.
	The battery is charging.
	Powered from an external source, charging is finished.
	Swing buttons are locked.

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	USB connection established.
	Bluetooth connection established.
	All sounds are turned off.
	Separately permitted sounds are turned on.
	Alarm level 1.
	Alarm level 2.

The following icons represent standard device information:
- Alarm sign: exceeding thresholds for dose rate or accumulated dose - presence and level.
- Sound status: on, off.
- External connection sign: presence and type - USB, Bluetooth.
- Swing buttons control sign: locked, unlocked.
- Built-in battery status: charge level (4 variants), charging, powered from the external source (end of charging).

Example of the standard status information is shown below:

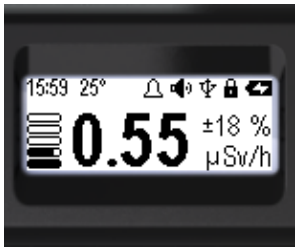
- exceeding threshold 1 for the dose rate or accumulated dose;
- sounds are enabled;
- USB connection established;
- swing buttons are locked;
- battery is charging.

Note: In all Display modes, a long press on the swing button "up" global turns on and off the sound signaling.

3.7.1 Monitor

Monitor mode is designed to represent the dose rate or count rate. When the device is turned on, it starts to work in this display mode.

In the **Monitor** display mode (see also Display units), the screen represents:
- status bar - at the top;
- vertical graphic scale of the dose rate or count rate - at the left;
- numerical value of the dose rate or count rate with its error level - at the center and on the right.



All incoming data is accumulated and analyzed. When a change in the radiation environment is detected, dosimeter starts a new interval of data accumulation. In the absence of changes in the radiation environment, data averaging continues in order to increase the reliability of the assessment.

If any of the alarm thresholds for the dose rate or accumulated dose level is exceeded, the corresponding alarm will be triggered. To stop the dose rate alarm, place the device in location with a normal background radiation level. Then, you need to confirm that you have received the alarm with a *short* press on the *round* button.

There is a standard information of Display modes on the right side of status bar.

The following information is shown on the left side of status bar:

15:59	Current time
25°	Radiation sensor temperature

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Using buttons

The following quick control options are available in this mode by using the buttons:

- *short* press on the *swing* button "*up*" switches between the display types of photon radiation intensity - dose rate or count rate;
- *long* press on the *swing* button "*up*" global turns on and off the sound signaling.

Setting alarm thresholds

Using the menu, you can set two alarm thresholds for the dose rate level. If the level of the alarm threshold is exceeded, a pulsating sign will be displayed in the status bar:

- - for Alarm 1;
- - for Alarm 2.

On the rate of reaction to changes in the radiation environment

The lower the count rate, the longer it takes to obtain a reliable assessment of the dose rate. The smaller the change in the radiation environment, the longer it will take to reliably detect that change. The higher the sensor's sensitivity, the higher the counting rate. All other things being equal, the higher the counting rate, the faster reliable assessment will be obtained.

The table below shows a comparison of radiation sensors for the required time to obtain reliable assessment:

	Scintillation detector embedded in RadioCode-103	Geiger, Beta-1-1	Geiger, SBM-20
CPM, pulses per minute with a background of 0.08 µSv/h	300	18	9
Time for background assessment 0.08 µSv/h with a tolerance of 15%, seconds.	34	570	1140
Time for reliable differentiation 0.08 and 0.10 µSv/h, seconds.	100	1667	3333
Time for reliable differentiation 0.08 and 0.12 µSv/h, seconds.	10	163	327
Time for reliable differentiation 0.08 and 0.20 µSv/h, seconds.	1	18	37

3.7.2 Dose

Dose mode is designed to represent the accumulated dose for X-ray and gamma radiation.

In the **Dose** display mode, the screen represents:

- status bar - at the top;
- vertical graphic scale of the accumulated dose - at the left;
- numerical value of the accumulated dose with its units - at the center and on the right.

There is a standard information of Display modes on the right side of status bar.

The following information is shown on the left side of status bar:

5d 21:39	Time of the dose accumulation: days, hours, minutes.

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Using buttons

The following quick control options are available in this mode by using the buttons:

- *long* press on the *swing* button "*down*" resets the accumulated dose value;
- *long* press on the *swing* button "*up*" global turns on and off the sound signaling.

Setting alarm thresholds

Using the menu, you can set two alarm thresholds for the accumulated dose level. If the level of the alarm threshold is exceeded, a pulsating sign will be displayed in the status bar:

- - for Alarm 1;
- - for Alarm 2.

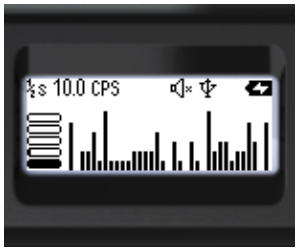
If any of the alarm thresholds for the accumulated dose level is exceeded, the corresponding alarm will be triggered. To stop the accumulated dose alarm you need to confirm that you have perceived the alarm by *short* pressing the *round* button.

3.7.3 Search

Search mode is designed to represent the count rate in the form of a search graph. It can be used to quickly search for a source or an area with an increased radiation level.

In the **Search** display mode, the screen represents:

- status bar - at the top;
- vertical graphic scale of the cont rate - at the left;
- search graph - at the center.



There is a standard information of Display modes on the right side of status bar.

The following information is shown on the left side of status bar:

½s	Count rate averaging time: 0.5 s
1s	Count rate averaging time: 1 s
2s	Count rate averaging time: 2 s
4s	Count rate averaging time: 4 s
10.0 CPS	Current value of the count rate in CPS
240 CPM	Current value of the count rate in CPM

The CPS or CPM display units can be selected via the menu.

Using buttons

The following quick control options are available in this mode by using the buttons:

- *short* press on the *swing* button "*up*" increases the averaging time;
- *short* press on the *swing* button "*down*" reduces the averaging time;
- *long* press on the *swing* button "*up*" global turns on and off the sound signaling;
- *long* press on the *swing* button "*down*" clears the search graph and starts a new search session.

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3.7.4 Spectrum

Spectrum mode is designed to represent the energy spectrum of photon radiation (X-ray and gamma).

In the Spectrum display mode, the screen represents:
- status bar - at the top;
- vertical graphic scale of the count rate - at the left;
- histogram of the energy spectrum - at the center.

There is a standard information of Display modes on the right side of status bar.

The following information is shown on the left side of status bar:

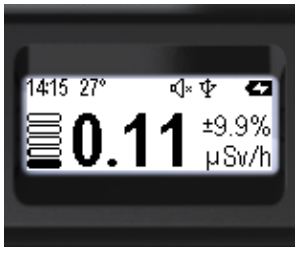
lin	Linear scale of the amplitude of the energy spectrum of photon radiation.
log	Logarithmic scale of the amplitude of the energy spectrum of photon radiation.
00:15:09	Time from the beginning of spectrum accumulation: hours, minutes, seconds.

Using buttons

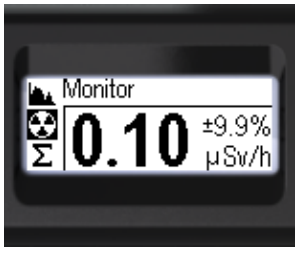
The following quick control options are available in this mode by using the buttons:
- *short* press on the *swing* button "*up*" switches the scale of the spectrum amplitude between linear and logarithmic;
- *short* press on the *swing* button "*down*" cyclically changes the scale of the energy spectrum: 1 MeV -> 2 MeV -> 3 MeV -> 1 MeV ...;
- *long* press on the *swing* button "*up*" global turns on and off the sound signaling;
- *long* press on the *swing* button "*down*" clears the spectrum histogram and starts a new accumulation session.

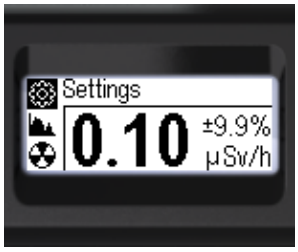
3.8 Device settings

The device settings are available from the corresponding submenu of the device - ⚙ "Settings". (while in one of the Display modes):

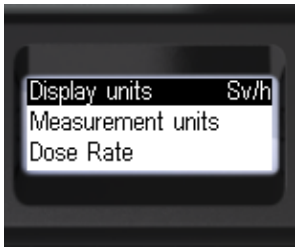


- enter the main menu by *long* pressing the *round* button;





- set focus on **[Settings]** item by *short* pressing the "*up*" and "*down*" *swing* buttons;
- confirm your choice by *short* pressing the *round* button.



After entering the ⚙ "Settings", you can move the focus to the desired item by *short* pressing the "*up*" and "*down*" *swing* buttons.

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The structure of the "Settings" submenu with its brief description is shown below:

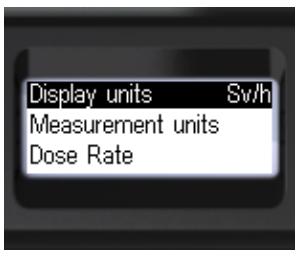
Display units	Selection of the assessment type of radiation intensity for Monitor mode: dose rate or count rate. This type affects the display units which also depend on Measurement units: Sv/h or R/h for dose rate selection, CPS (counts/s) or CPM (counts/min) for count rate selection.
Measurement units	Selection of measurement units: for dose (dose rate): Sv (Sv/h) or R (R/h); for count rate: CPS or CPM.
Dose rate	Setting thresholds 1 and 2 for dose rate alarms.
Dose	Setting thresholds 1 and 2 for dose alarms; accumulated dose resetting.
Screen	Selection of display backlight and rotation modes.
Signals	Global: turning on/off the sound and vibration signaling; gamma quanta registration: turning on/off the sound (clicks) and light signaling; alarms and buttons: separate turning on/off the sound and vibration signaling.
Bluetooth	Bluetooth turning on/off.
Language	Language selection: English, Russian.
Time	Setting current time.
Device info	View the information about the device: serial number, firmware version and bootloader version.
Factory settings	Calling up the menu for reset device settings.

To return to the top level or quit the menu (while in the "Settings"):

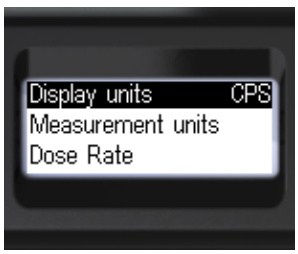
- set focus on the **[<Back]** or **[<< Menu quit]** item according to your choice;
- confirm your choice by *short* pressing the *round* button.

3.8.1 Display units

Use **[Display units]** item of Settings to select the presentation type of measurement results for Monitor mode - dose rate or count rate:



- while in the Settings, set focus on the **[Display units]** by *short* pressing the *swing* buttons;
- select the presentation type by *short* pressing the *round* button.



Display units depend on Measurement units: **Sv/h** or **R/h** for dose rate selection, **CPS** or **CPM** for count rate selection.

If required, go to next items of Settings by short pressing the "up" and "down" swing buttons.

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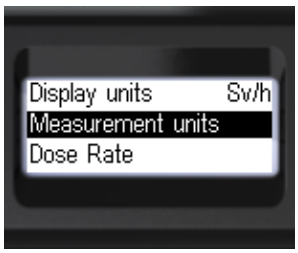
To return to the top level or quit the menu, set focus on the **[<Back]** or **[<< Menu quit]** item respectively and confirm your choice by *short pressing* the *round* button.

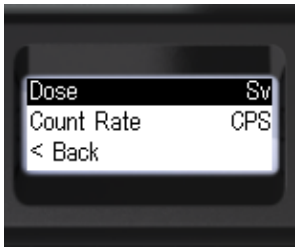
3.8.2 Measurement units

Use **[Measurement units]** item of Settings submenu to change the units of Monitor, Dose and Search display modes:

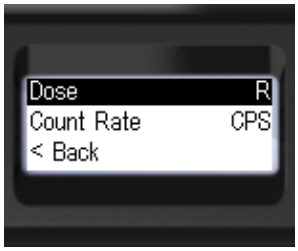
- while in the Settings, set focus on the **[Measurement units]** by *short* pressing the "*up*" and "*down*" *swing* buttons;
- enter the submenu by *short* pressing the *round* button.



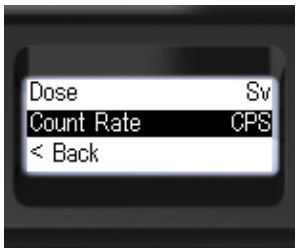
If you need to change the units of Monitor / dose rate and Dose display modes take the following steps (while in the **[Measurement units]**):



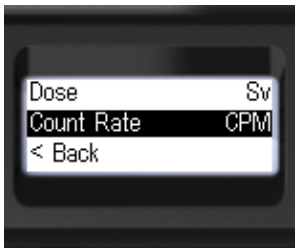
- set focus on the **[Dose]** item by *short* pressing the *swing* buttons;
- select the dose (and dose rate) units by *short* pressing the *round* button: **Sv** {Sievert} (**Sv/h** for Monitor mode) or **R** {Roentgen} (**R/h** for Monitor mode).



If you need to change the units of Monitor / count rate and Search display modes take the following steps (while in the **[Measurement units]**):



- set focus on the **[Count rate]** item by *short* pressing the *swing* buttons;
- select the count rate units by *short* pressing the *round* button: **CPS** {counts per second} or **CPM** {counts per minute}.



To return to the Settings or quit the menu select **[<Back]** or **[<< Menu quit]** item respectively and confirm your choice by *short* pressing the *round* button.

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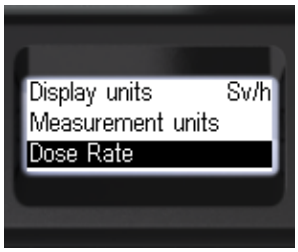
3.8.3 Dose rate

Use **[Dose rate]** item of Settings to set up the alarm thresholds 1 and 2 for the dose rate estimation:

- while in the Settings,set focus on the **[Dose rate]** item by *short* pressing the "*up*" and "*down*" *swing* buttons;
- enter the submenu by *short* pressing the *round* button



If you need to change the alarm threshold 1, take the following steps (while in the **[Dose rate]** submenu):

- set focus on **[Alarm 1]** item by *short* pressing the *swing* buttons;
- enter the submenu by *short* pressing the *round* button, then setup dialog will appear;
- select the desired digit of the threshold value by *short* pressing the *round* button;
- change the value of the selected digit by *short* pressing the *swing* buttons;
- repeat the previous two steps to set all digits of the value.

- To return to the higher level with or without changes select **[Enter]** or **[Esc]** item respectively;
- confirm your choice by *long* pressing the *round* button.

If you need to change the alarm threshold 2, take the following steps (while in the **[Dose rate]** submenu):

- set focus on **[Alarm 2]** item by *short* pressing the *swing* buttons;
- enter the submenu by *short* pressing the *round* button, then setup dialog will appear;
- select the desired digit of the threshold value by *short* pressing the *round* button;
- change the value of the selected digit by *short* pressing the *swing* buttons;
- repeat the previous two steps to set all digits of the value.

- To return to the higher level with or without changes select **[Enter]** or **[Esc]** item respectively;
- confirm your choice by *long* pressing the *round* button.

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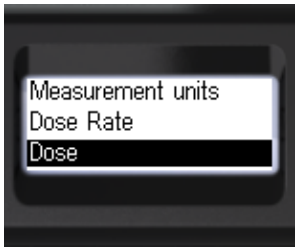
To return to the Settings or quit the menu set focus on the **[<Back]** or **[<< Menu quit]** item respectively and confirm your choice by *short* pressing the *round* button.

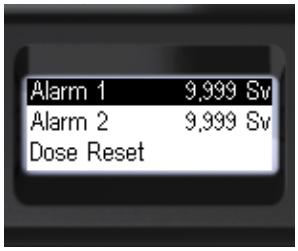
3.8.4 Dose

Use **[Dose]** item of Settings to set up the alarm thresholds 1 and 2 for the accumulated dose of radiation:

- while in the Settings, set focus on the **[Dose]** item by *short* pressing the "*up*" and "*down*" *swing* buttons;
- enter the submenu by *short* pressing the *round* button.



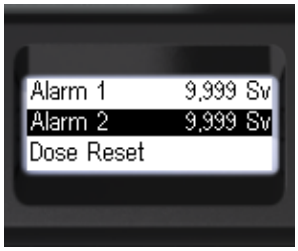
If you need to change the alarm threshold 1, take the following steps (while in the **[Dose]**):



- set focus on **[Alarm 1]** item by *short* pressing the *swing* buttons;
- enter the submenu by *short* pressing the *round* button, then setup dialog will appear;
- select the desired digit of the threshold value by *short* pressing the *round* button;
- change the value of the selected digit by *short* pressing the *swing* buttons;
- repeat the previous two steps to set all digits of the value.

- To return to the higher level with or without changes select **[Enter]** or **[Esc]** item respectively;
- confirm your choice by *long* pressing the *round* button.

If you need to change the alarm threshold 2, take the following steps (while in the **[Dose rate]** submenu):



- set focus on **[Alarm 2]** item by *short* pressing the *swing* buttons;
- enter the submenu by *short* pressing the *round* button, then setup dialog will appear;
- select the desired digit of the threshold value by *short* pressing the *round* button;
- change the value of the selected digit by *short* pressing the *swing* buttons;
- repeat the previous two steps to set all digits of the value.

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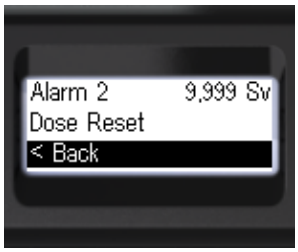
- To return to the higher level with or without changes select **[Enter]** or **[Esc]** item respectively;
- confirm your choice by *long* pressing the *round* button.



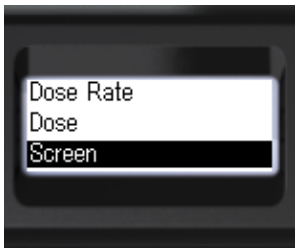
To return to the Settings or quit the menu set focus on the **[<Back]** or **[<< Menu quit]** item respectively and confirm your choice by *short pressing* the *round* button.

3.8.5 Screen

You can customize the screen parameters to suit your needs.

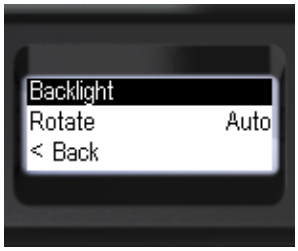
Use **[Screen]** item of Settings to customize the display parameters:

- while in the Settings, set focus on the **[Screen]** item by *short* pressing the "*up*" and "*down*" *swing* buttons;
- enter the submenu by *short* pressing the *round* button.

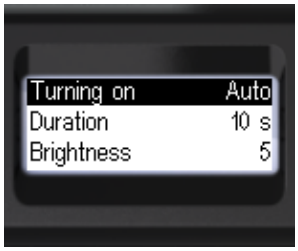


If you need to change the backlight parameters of display, take the following steps (while in the **[Screen]**):

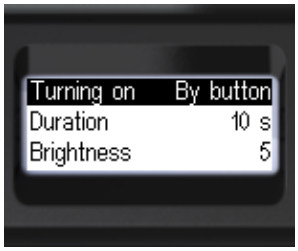
- set focus on the **[Backlight]** item by *short* pressing the "*up*" and "*down*" *swing* buttons;
- enter the submenu by *short* pressing the *round* button.



- To change the backlight turning-on mode (while in the **[Backlight]**):



- set focus on the **[Turning on]** item by *short* pressing the *swing* buttons;
- select the backlight turning-on mode by *short* pressing the *round* button, there are 3 variants: **[Auto]** (default)**, [Never], [By button]**.



- To change the backlight duration (while in the **[Backlight]**):

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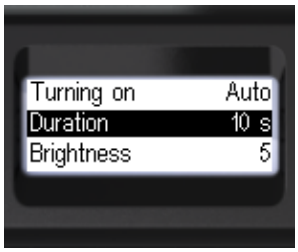
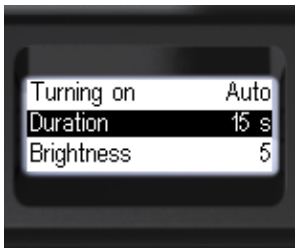
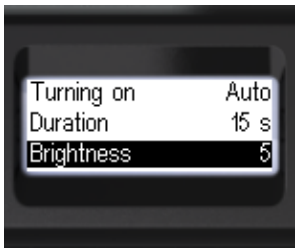


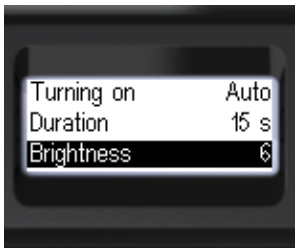
- set focus on the **[Duration]** item by *short* pressing the *swing* buttons;
- select the backlight duration by *short* pressing the *round* button, there are 4 variants: **[5 s]**, **[10 s]** (default), **[15 s]**, **[30 s]**.



- To change the backlight brightness level (while in the **[Backlight]**):

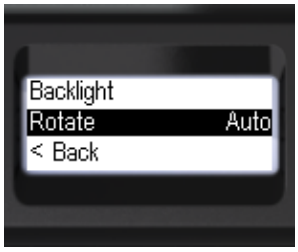


- set focus on the **[Brightness]** item by *short* pressing the *swing* buttons;
- select the backlight duration by *short* pressing the *round* button, there are 10 variants: from **[0]** to **[9]**, default level is **[5]**.

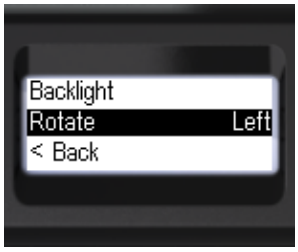


To return to the higher level or quit the menu set focus on the **[<Back]** or **[<< Menu quit]** item respectively and confirm your choice by *short* pressing the *round* button.

If you need to change the mode of display orientation, take the following steps (while in the **[Screen]**).



- set focus on the **[Rotate]** item by *short* pressing the *swing* buttons;
- select the display orientation mode by *short* pressing the *round* button, there are 3 variants: **[Auto]** (default), **[Left]**, **[Right]**.



To return to the Settings or quit the menu, set focus on the **[<Back]** or **[<< Menu quit]** item respectively and confirm your choice by *short* pressing the *round* button.

3.8.6 Signals

You can define the operating mode of sound, light and vibration signaling via the menu. Separate sound and vibration permissions are available for buttons and alarms.

Use **[Signals]** item of Settings to define the operating mode of signalization:

- while in the Settings, set focus on the **[Signals]** item by *short* pressing the "*up*" and "*down*" *swing* buttons;
- enter the submenu by *short* pressing the *round* button.

If you need to change the global sound permission, take the following steps (while in the **[Signals]**):

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- select **[Sound]** item by *short* pressing the *swing* buttons;
- select **[On]** or **[Off]** variant, according to the desired action, by *short* pressing the *round* button.

If you need to change the global vibration permission, take the following steps (while in the **[Signals]**):

- select **[Vibro]** item by *short* pressing the *swing* buttons;
- select **[On]** or **[Off]** variant, according to the desired action, by *short* pressing the *round* button.

If you need to change the light signaling permission for gamma quanta registration, take the following steps (while in the **[Signals]**):

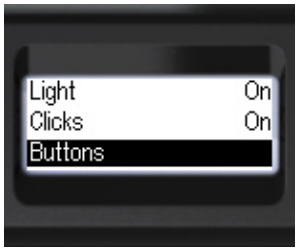
- select **[Light]** item by *short* pressing the *swing* buttons;
- select **[On]** or **[Off]** variant, according to the desired action, by *short* pressing the *round* button.

If you need to change the click signaling permission for gamma quanta registration, take the following steps (while in the **[Signals]**):

- select **[Clicks]** item by *short* pressing the *swing* buttons;
- select **[On]** or **[Off]** variant, according to the desired action, by *short* pressing the *round* button.

If you need to change the separate permissions for buttons pressing, take the following steps (while in the **[Signals]**):

- set focus on the **[Buttons]** item by *short* pressing the "up" and "down" *swing* buttons;
- enter the submenu by *short* pressing the *round* button.



- To change the sound permission (while in the **[Buttons]**):

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- select **[Sound]** item by *short* pressing the *swing* buttons;
- select **[On]** or **[Off]** variant, according to the desired action, by *short* pressing the *round* button.

- To change the vibration permission (while in the **[Buttons]**):

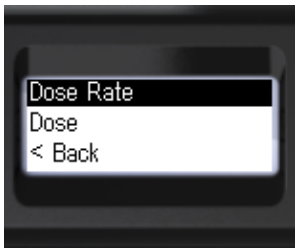
- select **[Vibro]** item by *short* pressing the *swing* buttons;
- select **[On]** or **[Off]** variant, according to the desired action, by *short* pressing the *round* button.

To return to the higher level or quit the menu, set focus on the **[<Back]** or **[<< Menu quit]** item respectively and confirm your choice by *short pressing* the *round* button.

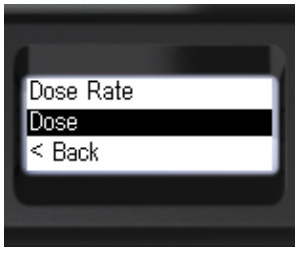
If you need to change the separate permissions for alarms signaling, take the following steps (while in the **[Signals]**):

- set focus on the **[Alarms]** item by *short* pressing the "up" and "down" *swing* buttons;
- enter the submenu by *short* pressing the *round* button.

- To change the sound and vibration permissions of the dose rate alarms (while in the **[Alarms]**):
  - set focus on the **[Dose rate]** item by *short* pressing the "up" and "down" *swing* buttons;
  - enter the submenu by *short* pressing the *round* button.



- To change the sound and vibration permissions of the accumulated dose alarms (while in the **[Alarms]**):
  - set focus on the **[Dose]** item by *short* pressing the "up" and "down" *swing* buttons;
  - enter the submenu by *short* pressing the *round* button.



Next steps are identical for **[Dose rate]** and **[Dose]** settings:

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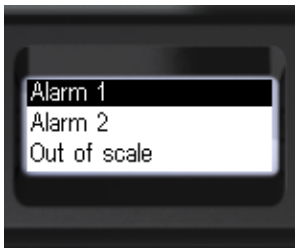
- select the **[Alarm1]**, **[Alarm2]** or **[Out of scale]** item by *short* pressing the "up" and "down" *swing* buttons;
- enter the submenu by *short* pressing the *round* button.



Next steps are identical for **[Alarm1]**, **[Alarm2]** and **[Out of scale]** settings:

- to change the sound permission (while in the **[Alarm1]**, **[Alarm2]** or **[Out of scale]**):

- select **[Sound]** item by *short* pressing the *swing* buttons;
- select **[On]** or **[Off]** variant, according to the desired action, by *short* pressing the *round* button.

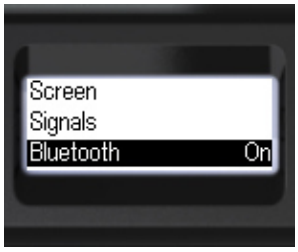
- to change the vibration permission (while in the **[Alarm1]**, **[Alarm2]** or **[Out of scale]**):

- select **[Vibro]** item by *short* pressing the *swing* buttons;
- select **[On]** or **[Off]** variant, according to the desired action, by *short* pressing the *round* button.

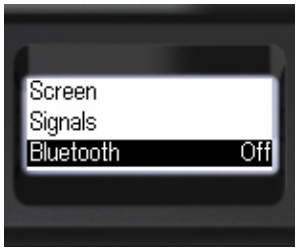
To return to the higher level or quit the menu, set focus on the **[<Back]** or **[<< Menu quit]** item respectively and confirm your choice by *short pressing* the *round* button.

3.8.7 Bluetooth

Use **[Bluetooth]** item of Settings to turn on and off the Bluetooth interface on dosimeter:



- while in the Settings, set focus on the **[Bluetooth]** item by *short* pressing the "*up*" and "*down*" *swing* buttons;
- select **[On]** or **[Off]** variant, according to the desired action, by *short* pressing the *round* button.



If required, go to next items of Settings by short pressing the "up" and "down" swing buttons.

To return to the top level or quit the menu, set focus on the **[<Back]** or **[<< Menu quit]** item respectively and confirm your choice by *short pressing* the *round* button.

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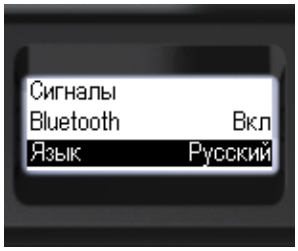
3.8.8 Language

The device supports English and Russian languages for menus and messages.

Use **[Language]** item of Settings to select the language of menu items and messages - English or Russian:

- while in the Settings, set focus on the **[Language]** item by *short* pressing the "*up*" and "*down*" *swing* buttons;
- select the language, English or Russian (Русский), by *short* pressing the *round* button.



If required, go to next items of Settings by short pressing the "up" and "down" swing buttons.

To return to the top level or quit the menu, set focus on the **[<Back]** or **[<< Menu quit]** item respectively and confirm your choice by *short* pressing the *round* button.

3.8.9 Time

When connecting Radiacode 103,103G,103L,103S to a smartphone or computer, the time on the device will be set automatically.

When you use the dosimeter in a standalone mode, you may need to set up the current time manually. For this purpose use **[Time]** item of Settings:

- while in the Settings, set focus on the **[Time]** item by *short* pressing the "up" and "down" *swing* buttons;
- enter the submenu by *short* pressing the *round* button, then setup dialog will appear.

- select the desired component of the time (hours, minutes, seconds) by *short* pressing the *round* button;
- change the value of the selected component by *short* pressing the *swing* buttons;
- repeat the previous two steps to set all the time components.

To quit the dialog with saving a new time value:

- select **[Enter]** item by *short* pressing the *round* button;
- confirm your choice by *long* pressing the *round* button.

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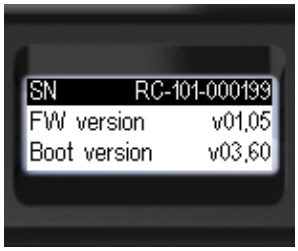
To quit the dialog without saving changes:
- select **[Esc]** item by short pressing the round button;
- confirm your choice by long pressing the round button.

3.8.10 Device info

Use **[Device info]** item of Settings to view the information about the serial number, firmware version and bootloader version of the device:

- while in the Settings, set focus on the **[Device info]** item by *short* pressing the "*up*" and "*down*" *swing* buttons;
- enter the submenu by *short* pressing the *round* button.



To return to the Settings or quit the menu, set focus on the **[<Back]** or **[<< Menu quit]** item respectively and confirm your choice by *short* pressing the *round* button.

3.8.11 Factory settings

Use **[Factory settings]** item of Settings to reset the device options to their default values:

- while in the Settings, set focus on the **[Factory settings]** item by *short* pressing the "*up*" and "*down*" *swing* buttons;
- enter the submenu by *short* pressing the *round* button, then reset dialog will appear.

To reset the options and quit the dialog:
- select **[Yes]** item by *short* pressing the *round* button;
- confirm your choice by *long* pressing the *round* button.

To quit the dialog without resetting the options:
- select **[No]** item by *short* pressing the *round* button;
- confirm your choice by *long* pressing the *round* button.

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Chapter

4 Mobile device communication

To work in pair with a mobile device (smartphone, pad, etc.) with OS Android v.6.0 and higher, install the application **Radiacode** on it.

The application is available at https://space.radiacode.com and in GooglePlay. You can also use the QR code:

A detailed interface description is built into the application and available after installing it.

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Chapter

5 PC communication

To work in pair with a computer with OS Windows XP/7/8/10, install the application **Radiacode** on it.
The application is available at https://space.radiacode.com.
A detailed interface description is built into the application and available after installing it.

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Federal Communications Commission (FCC) Statement. This device complies with part 15 of the FCC Rules. Operation is subject to the following twoconditions:

(1) This device may not cause harmful interference, and

(2) this device must accept any interference received,

including interference that may cause undesired operation. Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide Reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one ormore of the following measures:

•Reorient or relocate the receiving antenna.

•Increase the separation between the equipment and receiver.

•Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

•Consult the dealer or an experienced radio/TV technician for help.

Warning: Changes or modifications made to this device not expressly approved by **Radiacode LTD** may void the FCC authorization to operate this device.Note: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

RF exposure statement:

This device complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. The device is installed and operated without restriction.