RadiaCode

RADIACODE

10X SERIES

Portable Radiation Detector

USER MANUAL

RADIACODE LTD

Contents

Chapter 1

1 Introduction

This section contains the general information about dosimeter Radiacode-10X series. Later in the document, the dosimeter Radiacode-10X series is also referred to as "device" and "dosimeter".

Attention! This user manual is valid for devices with firmware version from 4.11

The developer is constantly improving the firmware of the device, therefore it is recommended to always use the latest version of the user manual. The latest information can be found at the links in the section: Developer contacts.

1.1 Appointment of the device

Radiacode-10X series

Portable dosimeter portable radiation detector Radiacode-10X series is designed to assess the radiation situation in real time. In addition, the instrument automatically keeps a log of measurement results and events. This makes it possible to analyze them, including with the help of standard software on a smartphone or personal computer. The dosimeter is suitable for work on the ground, with samples of construction materials, with specially selected and prepared food or soil samples.

The instrument has high sensitivity to gamma and X-ray radiation.
It is suitable for assessing dose rate, accumulated dose, absorbed radiation energy spectrum and radiation hazard warning.

Portable radiation detector Radiacode-10X series is a universal tool for radiation safety assessment. With it, it is always available for:
site reconnaissance;

- inspection of objects and materials;
- continuous monitoring of the radiation situation;
- automatic data storage in the instrument's memory;
- accumulated dose monitoring;
- quick search for radiation sources;
- two-channel alarm signaling of radiation danger and changes in the radiation situation;
- time-based database;
- possibility of autonomous operation, or in pair with a smartphone;
- wireless data transmission;
- wide possibilities of data processing in Windows, Android and IOS applications.

Instrument features

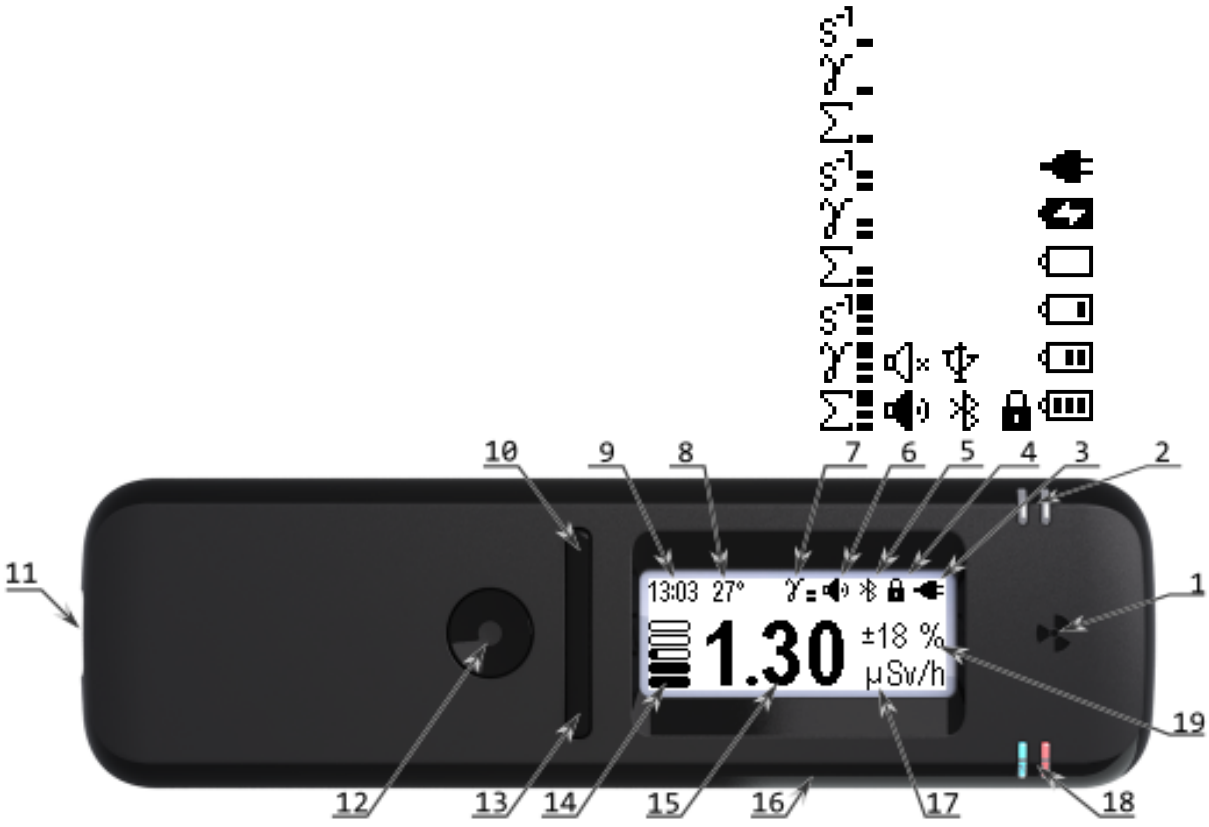
- Fast response to changes in the radiation environment, thanks to the CsI(Tl) scintillator detector working together with a silicon photomultiplier tube and adaptive processing of incoming data.
- Continuous assessment of the radiation situation as long as the instrument is switched on. Results at any moment can be presented in the form of dose rate, count rate, accumulated dose, absorbed radiation energy spectrum. Assessment and accumulation of data do not depend on the change of the display mode.
- Splash-proof, dust-proof - IP64 class.

- Long autonomous operation from the built-in battery.
- Independent alarm thresholds for count rate exceedance, dose rate exceedance and accumulated dose exceedance. Possibility to set 2 thresholds for each value.
- Built-in non-volatile memory for data accumulation, the volume of about 1000 hours of autonomous observations. Possibility to transfer data to a computer via USB and to a smartphone via Bluetooth. Storage of results in an external database.
- Binding of results to geographic coordinates and display on Google and OSM maps when used in conjunction with a smartphone.
- Availability of a program for personal computer and applications for Android and IOS.
- Continuous development of the project. Possibility of software upgrades.
- Economical graphic display with automatic backlighting in the dark. Rotation of the image on the screen when the device is rotated.
- Sound, light and vibration alarms on the device, and the ability to duplicate them on a smartphone.

Radiacode-10X series is a highly sophisticated and sensitive instrument. Please read the instructions to obtain reliable results.

1.2 Device design

Design elements, controls and indications controls and indications portable radiation detector Radiacode-10X series



1. Location of the radiation sensor, digital thermometer, and instrument orientation sensor.
2. Ambient light sensor to turn on the screen backlight in the dark.
3. Status of the built-in battery: charge level, charging, end of charging (powered from external source).
4. Control button lock indication.
5. External connection: USB, Bluetooth.
6. Audio indication status.

7. Presence, source and level of alarm.
8. Temperature of the radiation sensor.
9. Current time.
10. Swing button "up", when the display image is reversed, "down".
11. USB type C connector for charging the device and data exchange.
12. Power and confirmation button, round.
13. Swing button "down", when the display image is turned upside down.
14. Graphical representation of dose rate.
15. Numerical representation of dose rate.
16. Source of audible indication.
17. Units of numerical representation of dose rate.
18. Light indication:

- charge (blue color);
- gamma-quantum registration (green in normal, red when the alarm threshold is exceeded).

19. Random error of dose rate estimation.

1.3 Technical specifications

General technical characteristics

Energy range of registered photon radiation (X-ray and gamma)	0.02…3 MeV
Dose rate assessment: ▪ range (by Cs-137) ▪ error ▪ time (display update period)	 0.1…1000 uSv/h ±15% 0.5 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 300 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…+45°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

The device works with personal computers with minimum system requirements:
- Windows XP/7/8/10 operating system;
- RAM (RAM) not less than 2 GB;
- video card with resolution not worse than 1024x768;
- free space on the hard disk not less than 1 GB;
- USB port 1 pc.

Technical requirements to the mobile device

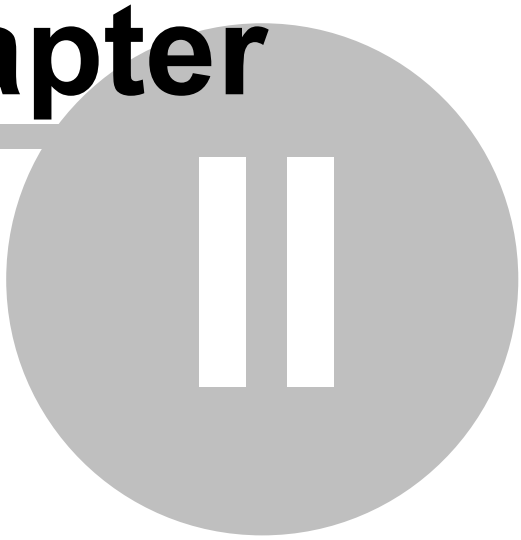
The device works with tablets or smartphones with minimum system requirements:
Android operating system version 6.0 and higher.

The device works with iPhone and iPad devices with minimum system requirements:
iOS operating system 17.0 or higher, or macOS 14.0 or newer and MAC with Apple chips.

1.4 Developer contacts

Radiacode Ltd.
3 Thalia Street, Office 222, Limassol 3011, Cyprus
Тел. +357 96 207695
E-mail: support@radiacode.com
Web:https://radiacode.com

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.

FCC warning.

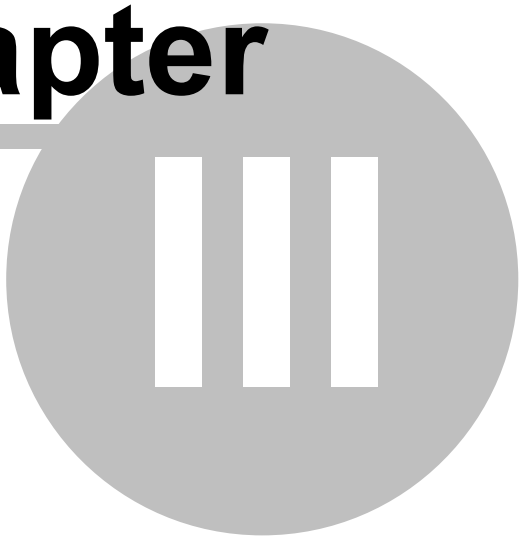
Federal Communications Commission (FCC) Statement. This device complies with part 15 of the FCC Rules. Operation is subject to the following twoconditions:
(1) This device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause 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.

Chapter



3 Stand-alone use of the device

Portable dosimeter portable radiation detector Radiacode-10X series is designed to assess the radiation situation in real time. In addition, the instrument automatically keeps a log of measurement results and events. This makes it possible to analyze them, including with the help of standard software on a smartphone or personal computer. The dosimeter is suitable for work on the ground, with samples of construction materials, with specially selected and prepared food or soil samples.

Radiacode-10X series is designed for long-term autonomous use. Results at any moment can be presented in the form of dose rate estimation, count rate, accumulated dose, absorbed radiation energy spectrum. Assessment and accumulation of data do not depend on the change of display mode.
The instrument allows storing the accumulated data in the internal memory up to thousand last hours of observations.

In addition to autonomous operation portable radiation detector can be connected to a personal computer via USB cable or to an Android or iOS smartphone via Bluetooth. Connection to an Android smartphone is also possible via USB OTG. When connected to a computer or smartphone, the accumulated data are transferred to an external device, and the newly received data are transferred there immediately without being stored in the built-in memory.

To connect the device to a computer it is necessary to install software Radiacode.
The program is available for download at https://space.radiacode.com.
With the help of the program Radiacode you can transfer data to a computer, view it and manage it portable radiation detectorом.
For a detailed description of the program interface, see in chapter "Working with the use of a computer".

To work with a smartphone install the app on it Radiacode,
available at https://space.radiacode.com and GooglePlay,
or use the QR code:

3.1 Before use

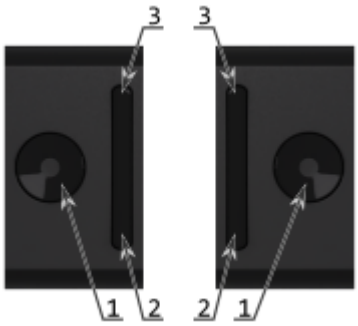
Note: If you brought the package with the device from frost to a warm room, leave it to warm up for two hours without opening. Otherwise, moisture may condense inside the device and cause the device to malfunction. Moisture penetration into the device will void the manufacturer's warranty.

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 Buttons

Portable radiation detector Radiacode-10X series has an intuitive menu system and is controlled by three buttons.
Sound and vibration indication are also helpful in operating the instrument.



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 instrument;
- unlock the swing buttons;
- to lock the swing buttons;
- confirm viewing of the presented list of maximum alarm levels;
- in some setup screens.

A short press of the round button is used to:
- call up the menu;
- return from the main menu to the display mode;
- confirm selection of the highlighted menu item;
- toggle the selection options.
- to turn off the alarms.

The swing buttons are automatically locked after 5, 10, 15, 30 seconds of inactivity. At the same time, the backlight of the screen is switched off, if it was on. In addition, there are 2 additional time intervals for the display backlighting - 2 and 5 minutes, the swing buttons are locked after 30 seconds of inactivity. The time until the backlight auto-locks and turns off depends on the settings.

You can unlock these buttons by long pressing the round button [1]. This will also turn on the screen backlight, if it is enabled in the instrument settings.
If there is sufficient light in the "Auto" mode, the backlight will not be switched on. The buttons can be switched back to the locked state by briefly pressing the round button [1].

A short press on the up/down swing buttons [2, 3] is used to:
- move between menu items;
- setting numerical values.
- additional options in different modes.

Long press on the up/down swing buttons[2, 3] is used for different purposes in different cases.
In menus, a long press on the up/down swing buttons[2, 3] leads to a quick selection of items.
In scene display modes, a long press on the "up" swing button turns the sound indication on and off.

Which of the swing buttons will be "up" and which will be "down" depends on the screen orientation settings.
When moving through the menu at any level, the selected item will be presented in negative - light on dark.

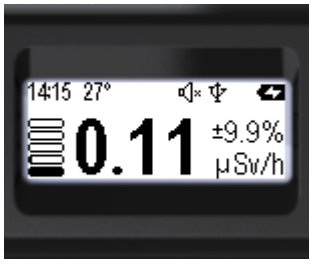
Detailed description of using the buttons in different modes can be found in the sections "Display Modes" и "Menu Usage".

Pressing any button is accompanied by a short sound and vibration, depending on the settings.

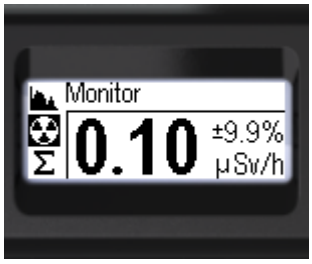
*The sound and vibration accompanying button presses can be turned off.

3.3 Turning on and off

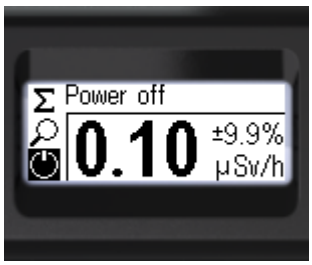
To include Radiacode-10X series click on round button and hold it down for three seconds.
The device can be switched off via the menu.



- To turn on the instrument, press and hold the round button until the instrument turns on (at least 3 seconds).
  - When the instrument is turned on, it will be in Monitor mode.
  - With the appropriate settings, the power on. sound will be played at this moment.
  - With the appropriate settings, the vibration indication. will be played at this moment.
  - At appropriate settings, the display backlight will be turned on at this point.



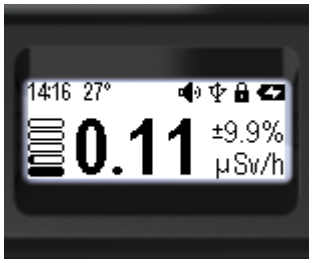
- To turn off, briefly press the round button of the instrument until the menu icons appear.
  - Icon display 🔒 indicates that the swing buttons are locked.
  - To unlock, press and hold the round button (at least 3 seconds).



- Short presses on the up or down swing buttons move the cursor to the shutdown icon ⏻.
- A short press on the round button will turn the appliance off.
  - With the appropriate settings, a shutdown sound will be played at this point.
  - The instrument screen will be turned off.

3.4 Display

The instrument is equipped with a graphical monochrome display.



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

**Handle with care, the display may be broken or scratched if handled carelessly.*

The screen is equipped with a backlight for operation in the dark.
The device automatically detects the light level when the setting is set to "Auto". In this case, the backlight is turned on only when the button is pressed. In bright light, for example in the sun, the backlight will not turn on.
The backlight brightness has ten gradations.

You can set the orientation of the image on the screen for left or right handed operation, or select the automatic rotation mode.

Power on conditions, backlight time, backlight brightness and image orientation are set via the menu, section Settings.

The display is used to show:
- instrument status;
- graphical dose rate level;
- control menu;
- settings menu;
- spectrum mode, for estimation of absorbed radiation energies;
- monitor mode, for estimation of dose rate;
- Dose mode, for estimation of accumulated dose;
- search mode, for visual estimation of count rate.

The status panel is placed in the upper part of the display. The content of the status panel depends on the selection of the display mode.
The type and meaning of the icons used are described in more detail in the section Icons.

3.5 Icons

In all display modes except settings, the display shows a logarithmic indicator:

Each horizontal bar shows a graphical representation of a value (dose rate, dose, count rate) on a logarithmic scale.
The ranges of the bars differ by a factor of 10. For example, for dose rate (µSv/h) the ranges will look as follows:

Various icons are used to label fields on the instrument status panel.

 At least 60% charge.

 At least 30% charge.

 At least 10% charge.

 Less than 10% charge, the battery needs to be recharged.

 The battery is being charged.

 Charge completed, external power supply.

 The "swing" buttons are locked.

 USB communication has been established.

 Bluetooth communication has been established.

 All sounds are off.

 Sounds included.

 Level 1 alarm on Count Rate.

 Level 2 alarm on Count Rate.

 Count Rate over-range alarm.

 Level 1 Dose Rate alarm.

 Level 2 Dose Rate alarm.

 Dose Rate over-range alarm.

 Level 1 alarm on Dose.

 Level 2 alarm on Dose.

 Dose off-scale alarm.

 Linear scale of the amplitude of the energy spectrum of photon radiation.

 Logarithmic scale of the amplitude of the energy spectrum of photon radiation.

In the menu (entry via a short press on the round button), the sections are indicated by icons and text.

 *Settings* Instrument settings menu.

	*Spectrum*	Display of the energy spectrum of radiation.
	*Monitor*	Display the current dose rate or count rate.
	*Dose*	Display of accumulated dose of photon radiation (gamma and X-ray).
	*Search*	Search mode - display the count rate as a graph.
	*Power off*	Turning off the device.
	*About device*	Information about the dosimeter serial number and software version.

3.6 Indication: sound, vibration, light

In portable radiation detectore Radiacode-10X series sound and vibration sources are built in to acknowledge button presses and to indicate events and alarms. A light indication is provided for remote monitoring

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

Vibration can be accompanied by:
- switching the device on and off;
- pressing the button;
- exceeding alarm thresholds;
- response to the "Search for the device" request.

Light indication:
- battery charging - blue color, continuous glow;
- registration of radiation quantum in normal conditions - green color, flash;
- registration of radiation quantum in case of alarm - red color, flash;
- exceeding the alarm threshold - switching on the screen backlight.

It is possible to turn signals on or off the alarms by separate groups:
- all sounds;
- button pressing sound;
- sound of radiation quantum registration;
- all types of vibration;
- light indication.

3.7 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.
In order to ensure correct battery charging conditions and increase battery life, the dosimeter is designed to block the battery charging process when the instrument temperature is above +40°C or below 0°C.

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.
If the battery is completely discharged, the instrument may not respond to attempts to turn on. To start the dosimeter, the battery must be recharged. Then disconnect the cable and reconnect it. The device will be ready for operation.

3.8 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;
- 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.

Update the firmware using your smartphone and the Android app:
- install the latest version of the Android application in the application store: Radiacode or download from the link: https://space.radiacode.com;

If the device bootloader is version 4.0 or higher - it is possible to update the firmware via Bluetooth: launch the application;
- call the menu by pressing the button with three horizontal dashes on the top left;
- select "Devices";
- select Bluetooth communication interface and confirm by pressing the [OK] button;
- after connecting the device, confirm the firmware update of the device;
- wait for the download and update process to complete. The red LED will be on during the update process.

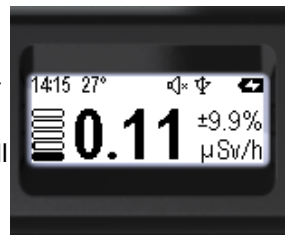
If the device bootloader is lower than version 4.0 you will need a USB OTG adapter for your smartphone:
- connect the instrument with the cable and adapter to your smartphone;
- Allow the RadiaCode app to be used with the connected device;
- launch the app;
- access the menu by pressing the button with three horizontal dashes on the top left;
- select "Devices";
- select the USB communication interface and confirm by pressing the [OK] button;
- confirm the firmware update of the instrument;
- wait for the update process to complete.

Attention! Do not turn off the instrument and do not disconnect the USB cable until the process is complete!
Violation of the firmware update process may lead to instrument failure.
Please contact the service department to restore operation.

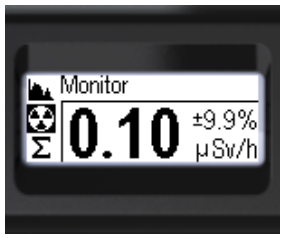
3.9 Menu usage

Let's take the state "The device is off" as the initial state.

- Press and hold the round button until the instrument turns on (at least 3 seconds);
  - When turned on, the instrument will be in the Monitor and display the dose rate;
  - With the appropriate settings, the sound power on will be played at this time.
  - At appropriate settings at this moment the backlight of the display will be turned on.



- Use a short press the round button to move to the menu;
  - The name of the current menu item will be displayed at the top. (In this case it is "Monitor");
  - The icons of the main menu items will be placed vertically;
  - The active item will be highlighted with a negative icon.



There are seven menu items available on the main menu level.

	Settings	Device settings - go to the submenu;
	Spectrum	Photon radiation energy spectrum (gamma and X-ray) - display mode;
	Monitor	Dose rate, count rate - display mode;
	Dose	Accumulated dose - display mode;
	Search	Count rate search graph - display mode
	Power off	Turning off the appliance is an action;
	About device	Serial number and software version information.

Use a short press on the up/down swing buttons to select the desired item. The selected item will be highlighted with a negative icon. To confirm the selection, use a short press on the round button.
Only three selections are available on the instrument screen at a time, the others will become available when the up/down swing buttons are pressed again.

Of the seven items, four [*Spectrum*, *Monitor*, *Dose*, *Search*] give access to the selection of the radiation situation display mode.

Item [*Power off*] – is an action point, if it is confirmed with the round button, the instrument will be switched off.

Item [*Settings*] is used to go to the submenu of the instrument settings.

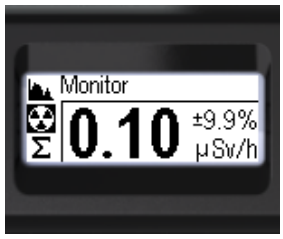
Item [*About device*] is used to obtain information about the instrument number and firmware and bootloader versions.

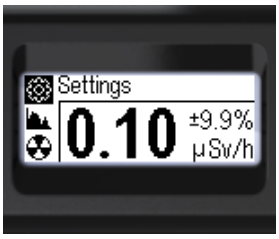
At all levels, the menu is arranged in a cyclical fashion. For example, on the main level, pressing the down swing button moves the focus from item to item in the following order: --> --> --> --> --> --> --> ...

3.10 Device settings

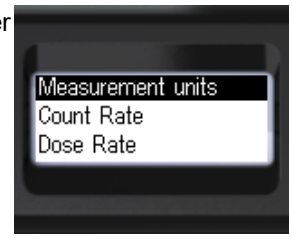
The instrument settings can be accessed from the corresponding instrument submenu – "Settings".

- Press and hold the round button until you reach the menu;
- The name of the current menu item will appear at the top. (In this case it is "Monitor");
  - The icons of the main menu items will be placed vertically;
  - The active item will be highlighted with a negative icon.





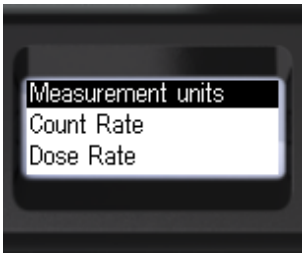
- Short presses on the upper swing button (or the lower one, the menu is circular) focus on the item "Settings";
- Press the round button briefly to confirm access to the "Settings" submenu.



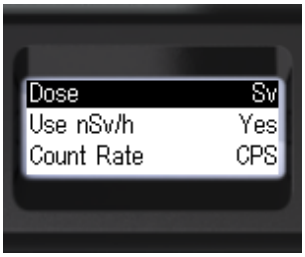
Next, short presses on the up/down buttons of the swings can be used to move the focus to the desired item and make the required settings.
This and deeper menu levels can be exited via **[< Back]** and **[<< Menu quit]**.

Selecting units of measurement
Count rate - alarm levels
Dose rate - alarm levels
Dose - alarm levels
Display settings
Signals - sound, vibration, light
Bluetooth settings
Language selection
Time settings
Device info
Reset to factory settings

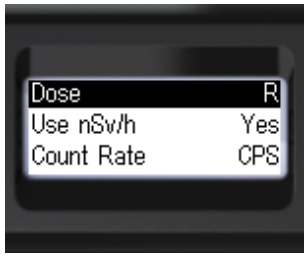
3.10.1 Selecting units of measurement

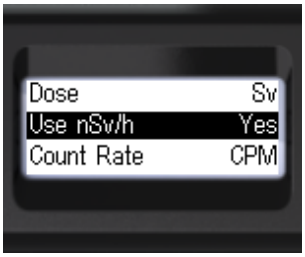


- Briefly press the up/down rocker buttons to move the focus to **[Measurement units]**;
- Short press the round button to move to **[Measurement units]**.

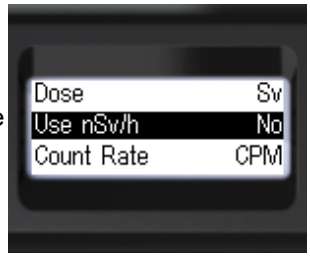


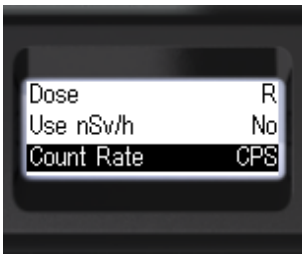
- Short presses on the round button to select dose rate measurement units:
- Sv - Sievert or R - Roentgen;
- Short presses on the up/down swing buttons move the focus to the item **[Use nSv/h]**.



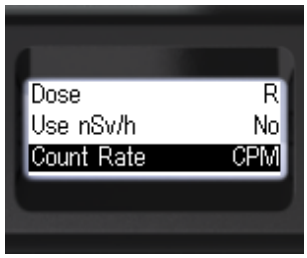


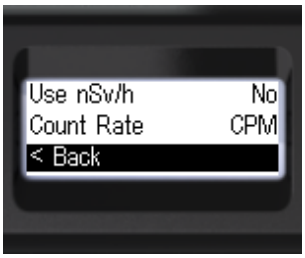
- Short presses on the round button to select the use of nSv/h when selecting dose rate units in Sv: **[Yes]** or **[No]**;
- Shortly press the up/down swing buttons to move the focus to **[Count Rate]**.





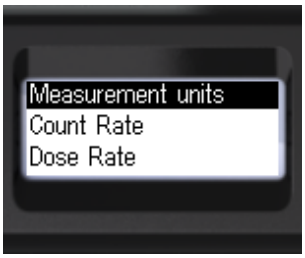
- Short presses on the round button to select the units of count rate estimation:
- CPS - Count Per Second;
- CPM - Count Per Minute.



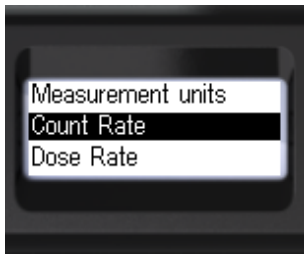


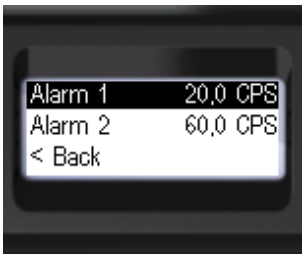
- To return to the previous level or exit the menu, briefly press the up/down swing buttons to move the focus to **[< Back]** or **[<< Menu quit]**;
- Briefly press the round button to confirm your selection;

3.10.2 Count rate - alarm levels



- Briefly press the up/down rocker buttons to move the focus to **[Count rate]**;
- Short press the round button to move to **[Count rate].]**;





- Short press the round button to move to **[Alarm 1]**;
- Short press the round button to select the desired digit of the threshold value;
- Short presses on the up/down swing buttons to change the value of the selected digit;
- Set all digits;

- Short presses on the round button to select **[Enter]** or **[Esc]**;
- Long press the round button to confirm your selection;

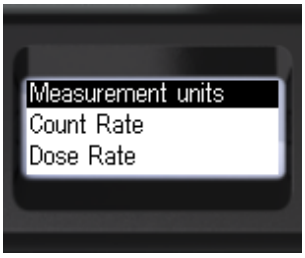
This and deeper menu levels can be exited via **[< Back]** and **[<< Menu quit]**. or go to **[Alarm 2]**.

- Short press the round button to move to **[Alarm 2]**;
- Short press the round button to select the desired digit of the threshold value;
- Short presses on the up/down swing buttons to change the value of the selected digit;
- Set all digits;

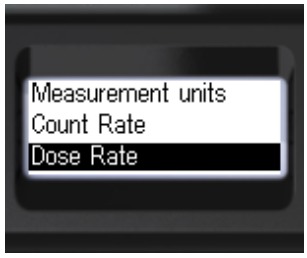
- Short presses on the round button to select **[Enter]** or **[Esc]**;
- Long press the round button to confirm your selection;

- To return to the previous level or exit the menu, briefly press the up/down swing buttons to move the focus to **[< Back]** or **[<< Menu quit]**;
- Briefly press the round button to confirm your selection;

3.10.3 Dose rate - alarm levels



- Briefly press the up/down rocker buttons to move the focus to **[Dose rate]**;
- Short press the round button to move to **[Dose rate]**.



- Short press the round button to move to **[Alarm 1]**;
- Short press the round button to select the desired digit of the threshold value;
- Short presses on the up/down swing buttons to change the value of the selected digit;
- Set all digits;

- Short presses on the round button to select **[Enter]** or **[Esc]**;
- Long press the round button to confirm your selection;

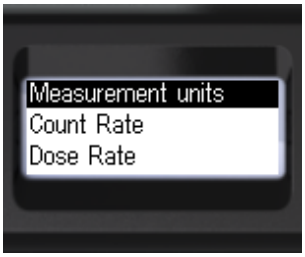
This and deeper menu levels can be exited via **[< Back]** and **[<< Menu quit]**. or go to **[Alarm 2]**.

- Short press the round button to move to **[Alarm 2]**;
- Short press the round button to select the desired digit of the threshold value;
- Short presses on the up/down swing buttons to change the value of the selected digit;
- Set all digits;

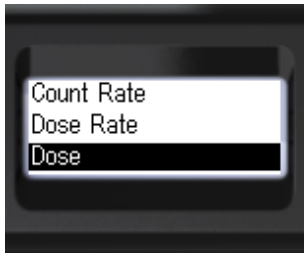
- Short presses on the round button to select **[Enter]** or **[Esc]**;
- Long press the round button to confirm your selection;

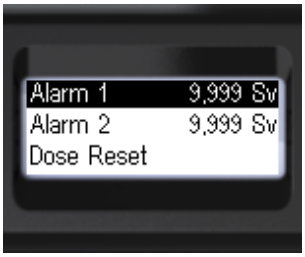
- To return to the previous level or exit the menu, briefly press the up/down swing buttons to move the focus to **[< Back]** or **[<< Menu quit]**;
- Briefly press the round button to confirm your selection;

3.10.4 Dose - alarm levels



- Briefly press the up/down rocker buttons to move the focus to **[Dose]**;
- Short press the round button to move to **[Dose]**.

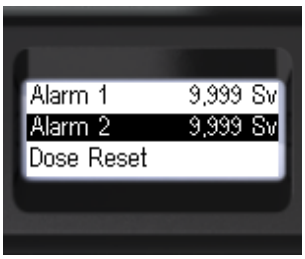




- Short press the round button to move to **[Alarm 1]**;
- Short press the round button to select the desired digit of the threshold value;
- Short presses on the up/down swing buttons to change the value of the selected digit;
- Set all digits.

- Short presses on the round button to select **[Enter]** or **[Esc]**;
- Long press the round button to confirm your selection.

This and deeper menu levels can be exited via **[< Back]** and **[<< Menu quit]**. or go to **[Alarm 2]**.



- Short press the round button to move to **[Alarm 2]**;
- Short press the round button to select the desired digit of the threshold value;
- Short presses on the up/down swing buttons to change the value of the selected digit;
- Set all digits.

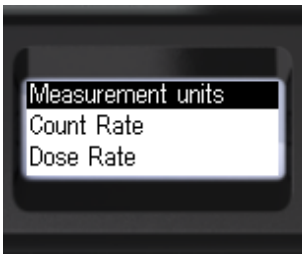
- Short presses on the round button to select **[Enter]** or **[Esc]**;
- Long press the round button to confirm your selection.

- To return to the previous level or exit the menu, briefly press the up/down swing buttons to move the focus to **[< Back]** or **[<< Menu quit]**;
- Briefly press the round button to confirm your selection.

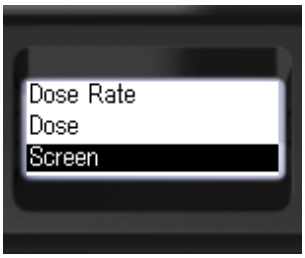
3.10.5 Display settings

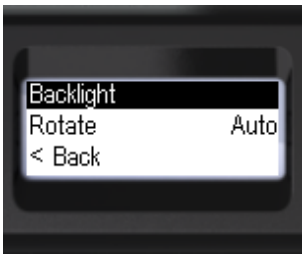
You can customize the screen properties to suit your needs.

You can select one of ten screen backlight brightness levels (0 to 9). The default setting is 5. Lower levels use up battery power more slowly. The screen backlight will turn off automatically after a period of time when no buttons are pressed. You can select a shutdown delay of 5, 10, 15, 30 seconds and 2, 5 minutes. The screen backlight can be disabled completely, allowed to be unconditionally turned on by pressing the buttons or by pressing the button in case of insufficient light level.
By default the device is set in the mode of automatic screen rotation when working with it with right or left hand. You can disable the automatic screen rotation option and select its orientation in the right or left position.

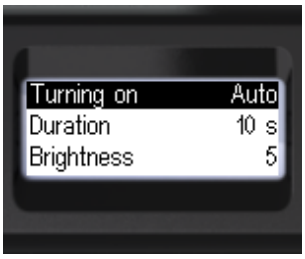


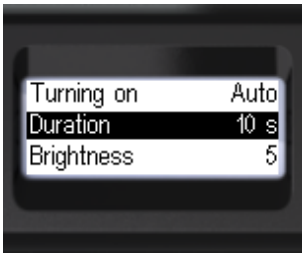
- Briefly press the up/down rocker buttons to move the focus to **[Screen]**;
- Short press the round button to move to **[Screen]**.



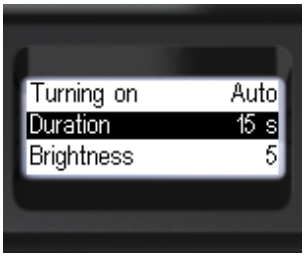


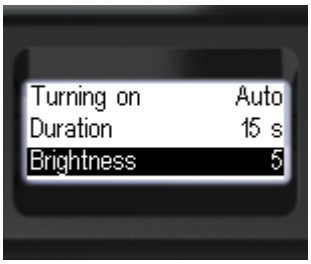
- Short press the round button to move to **[Backlight]**;
- Briefly press the up/down swing buttons to move the focus to **[Turning on]**;
- Short presses on the round button to select the backlight on mode: **[Auto]**, **[Never]**, or **[By Button]**;





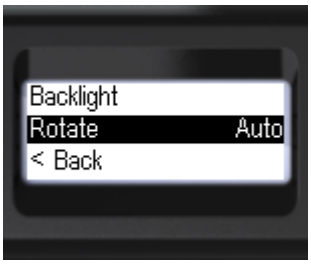
- Briefly press the up/down swing buttons to move the focus to **[Duration]**;
- Short press the round button to select the delay until the screen backlight turns off automatically: **5**, **10**, **15**, **30** sec. and **2**, **5** min;



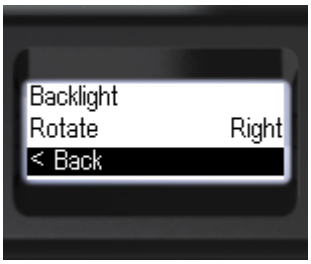


- Short press the up/down swing buttons to move the focus to **[Brightness]**;
- Short press the round button to select the backlight brightness level from **0** to **9**;

- To return to the previous level, briefly press the up/down swing buttons to move the focus to **[< Back]**;
- Briefly press the round button to confirm your selection;



- Briefly press the up/down swing buttons to move the focus to **[Rotate]**;
- Short press the round button to select the screen orientation:
  [Auto], **[Right]** or **[Left]**;



- To return to the previous level, briefly press the up/down swing buttons to move the focus to **[< Back]**;
- Briefly press the round button to confirm your selection;

- To return to the previous level or exit the menu, briefly press the up/down swing buttons to move the focus to **[< Back]** or **[<< Menu quit]**;
- Briefly press the round button to confirm your selection.

3.10.6 Signals - sound, vibration, light

Portable radiation detector Radiacode-10X series is equipped with a combined interface for user interaction:

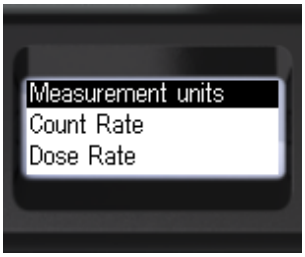
- display;
- buttons;
- sound emitter;
- LEDs;
- vibration signaling device.

Sound, light, vibration complement the information presented on the display and provide feedback when pressing the buttons.

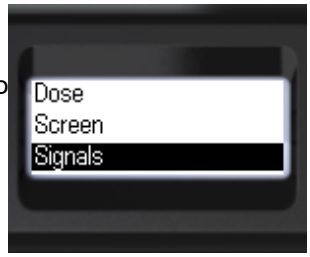
Event/state	Display	Sound	Vibration	Led/Backlight
Switching on	–	+	+	–
Switching off	–	+	–	–

Establishing a connection		+	–	–
Loss of connection	–	+	–	–
Low battery charge		+	+	–
Battery charge process		–	–	blue - continuous
Device search	–	+	+	–
Pressing the button	–	+	+	–
Quantum registration	–	+	–	green, red - flashes
Alarm 1		+	+	screen backlight
Alarm 1		+	+	screen backlight
Out of scale		+	+	screen backlight

In the menu you can select the operation mode of sound, light and vibration alarms.
Separate permissions to play alarm sounds, buttons, clicks are available.



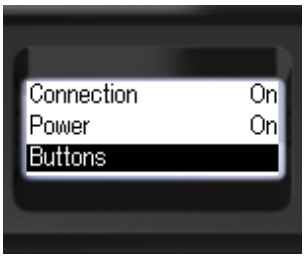
- Briefly press the up/down rocker buttons to move the focus to **[Signals]**;
- Short press the round button to move the focus to **[Signals].**



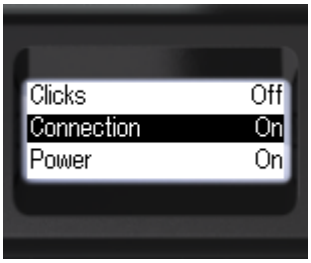
- Briefly press the up/down swing buttons to move the focus to the item **[Sound]**;
- Short presses on the round button to select the sound signaling mode:
  [On] - all allowed sounds;
  [Off] - only the sounds of searching for the instrument and going out of the measuring scale remain, if it is allowed by the settings.

- Vibration and light modes can be set in the same way:
- Move the focus to **[Vibro]** or **[Light]** by short presses on the up/down swing buttons;
- Short presses on the round button to select the **[On]** or **[Off]** mode.

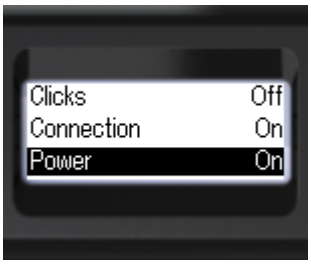
- The presence of gamma and X-ray photon registration clicks can be controlled separately.
- By short presses on the up/down swing buttons move the focus to the item **[Clicks]**;
- Short presses on the round button to select the **[On]** or **[Off]** mode.



- Briefly press the up/down swing buttons to move the focus to the **[Buttons]**;
- Short press the up/down swing buttons to move the focus to **[Buttons]** or **[Vibro]**;
- Short press the round button to select the desired response type.

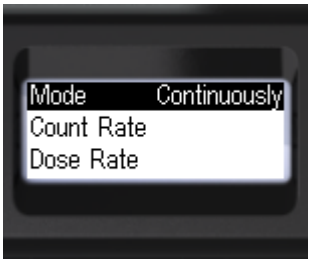


- Separately, you can control the presence of the device connection and disconnection signal.
- Briefly press the up/down swing buttons to move the focus to **[Connection]**;
- Short press the round button to select **[On]** or **[Off].**

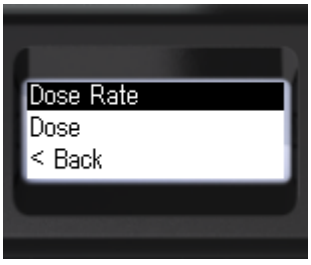


- The presence of the on/off signal can be controlled separately.
- Short press the up/down swing buttons to move the focus to **[Power]**;
- Short press the round button to select **[On]** or **[Off].**

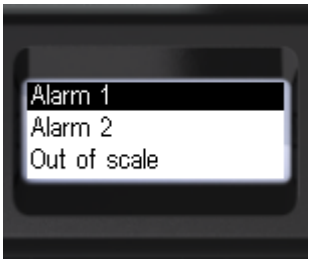
- To set the alarms, move the focus to **[Alarms]**;
- Press the round button briefly to confirm your selection.



- Short presses on the round button to select the alarm indication mode **[One-shot]** or **[Continuous]**.



- To select an alarm channel, move the focus to the desired item, e.g. **[Dose rate]**;
- Press the round button briefly to confirm your selection.

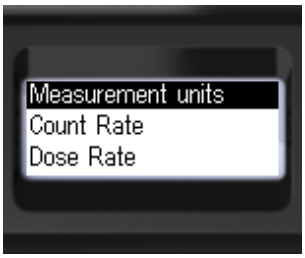


- Briefly press the up/down swing buttons to move the focus to the desired alarm level **[Alarm 1]** or **[Alarm 2]**;
- Press the round button briefly to confirm your selection.

- Short press the up/down swing buttons to move the focus to **[Sound]** or **[Vibration]**;
- Short press the round button to select **[On]** or **[Off]**;

- To return to the previous level or exit the menu, briefly press the up/down swing buttons to move the focus to **[< Back]** or **[<< Menu quit]**;
- Briefly press the round button to confirm your selection.

3.10.7 Bluetooth settings

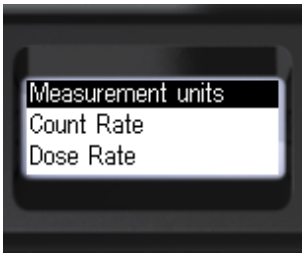


- Short press the up/down swing buttons to move the focus to **[Bluetooth]**;
- Short press the *round button* to select the Bluetooth wireless communication mode: **[On]** or **[Off]**;

- To return to the previous level or exit the menu, briefly press the up/down swing buttons to move the focus to **[< Back]** or **[<< Menu quit]**;
- Briefly press the round button to confirm your selection.

3.10.8 Language selection

The device can support multiple languages for menus and messages.

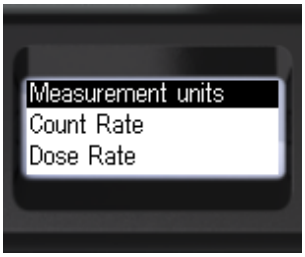


- Briefly press the up/down swing buttons to move the focus to the item **[Language]**;
- Short press the round button to select the instrument interface language: **[English]** or other supported languages.

- To return to the previous level or exit the menu, briefly press the up/down swing buttons to move the focus to **[< Back]** or **[<< Menu quit]**;
- Briefly press the round button to confirm your selection.

3.10.9 Time settings

When connecting Radiacode-10X series The time on the device will be set automatically when you connect it to your smartphone or computer.
Time setting is also available from the local menu of the device:



- Briefly press the up/down rocker buttons to move the focus to **[Time]**;
- Short press the *round button* to confirm your selection.

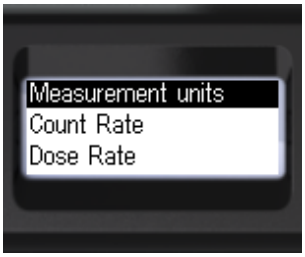
- Short presses on the round button to select the desired time entry field;
- Short press the up/down swing button to change the value of the selected field;
- To quickly change values - hold the up or down swing button.

- Short press the round button to select **[Enter]** or **[Esc]**;
- Long press the round button to confirm your selection;
  - This will return to the previous menu level.

- To return to the previous level or exit the menu, briefly press the up/down swing buttons to move the focus to **[< Back]** or **[<< Menu quit]**;
- Briefly press the round button to confirm your selection.

3.10.10 Reset to factory settings

The menu provides an item for resetting the instrument to its original factory settings.



- Briefly press the up/down swing buttons to move the focus to the item
- **[Factory settings]**;
- Press the round button briefly to confirm your selection;

- Short presses on the round button to select the **[Yes]** or **[No]** field;

- Long press the round button to confirm your selection;
  - Confirming **[Yes]** will reset the instrument to its original settings and return to the previous menu level.

- To return to the previous level or exit the menu, briefly press the up/down swing buttons to move the focus to **[< Back]** or **[<< Menu quit]**;
- Briefly press the round button to confirm your selection.

3.11 Display Modes

The Radiacode-10X series dosimeter has a single mode of operation - continuous data collection, accumulation and analysis.
At any moment one of several ways of displaying the radiation situation assessment is available:

Spectrum – energy spectrum of photon radiation;

Monitor – estimation of dose rate and count rate;

.. Dose – dose assessment;

Search – operational search.

During operation, the instrument also detects the exceeding of all Alarms levels. Informs the user of radiation hazards or changes in the environment.

3.11.1 Spectrum

The mode is intended for representation of the general view of the photon (gamma and X-ray) radiation energy spectrum.

In the **Spectrum** display mode the screen shows:
state panel - from top;
energy spectrum of photon (gamma and X-ray) radiation.

The upper part of the screen, from left to right, contains basic information about the instrument status:

- scale of the amplitude scale of the photon radiation energy spectrum - linear or logarithmic;
- time since the beginning of spectrum accumulation: hours, minutes, seconds;
- sign of exceeding thresholds by dose rate, dose rate, count rate;
- audio indication status;
- Bluetooth or USB connection;
- swing buttons lock sign;
- battery status.

At the bottom of the screen from left to right:

- graphical representation of dose rate estimation.
- histogram of the photon radiation energy spectrum;

Labels are placed under the energy scale of the histogram:
- dots - every 100keV;
- dashes every 500keV;
- arrows - every 1000keV.

Using the buttons

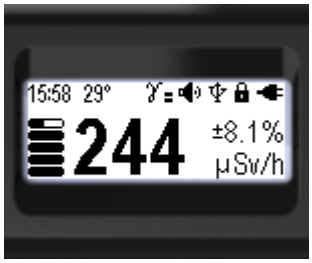
Quick control of the spectrum view is available via the buttons:
- a short press on the upper swing button switches the spectrum amplitude scale between linear and logarithmic;

- a short press on the lower button of the swing cycles the scale of the energy scale 1MeV -> 2MeV -> 3MeV -> 1MeV.... ;
- long press on the lower button of the swing clears the screen and starts a new session of spectrum accumulation;
- long pressing the upper button of the swing turns on and off the sound indication.

3.11.2 Monitor

This mode is intended to represent dose rate or count rate. When the instrument is turned on, it starts working in this particular display mode. All incoming data are accumulated and analyzed. If a change in the radiation situation is detected, the instrument starts a new interval of data accumulation. If there are no signs of changes in the radiation situation, the averaging continues in order to increase the reliability of the estimation. Statistical error in the Monitor mode is maintained at the level not more than 15% for the confidence interval 2δ at sufficient radiation intensity.

In the **Monitor** display mode, the screen shows:
- status panel - from the top;
- parameters of dose rate or count rate estimation - at the bottom.



The upper part of the screen, from left to right, contains basic information about the status of the instrument:

- current time: hours, minutes;
- detector temperature;
- sign of exceeding the thresholds for dose rate, dose rate, count rate;
- audio indication status;
- presence of Bluetooth or USB connection;
- swing button lock sign;
- battery status.

At the bottom of the screen from left to right:
- graphical representation of the dose rate or count rate estimate;
- value of the dose rate or count rate estimate;
- value of random error in %;
- dose rate measurement units - Sv/h, R/h, or count rate - CPS, CPM.

With the help of the menu the choice between the measurement units is available:
- Sv/h or R/h - when displaying dose rate;
- CPS or CPM - when displaying the count rate.

The type of radiation intensity estimation: Dose rate or count rate can be selected in the menu, or can be switched operatively with the instrument buttons.

Using the buttons

Quick control in this mode is available via the buttons:

- a short press on the top button of the swing to switch between the types of photon radiation intensity display:
  - dose rate or count rate;
  - long pressing on the upper button of the swing turns on and off the sound indication;
  - short pressing on the lower button of the swing switches on the sound indication of registered quanta (clicks).

Setting alarm thresholds

Two alarm thresholds for the dose rate level can be set using the menu.
When the dose rate alarm threshold level is exceeded, a pulsating sign will be displayed in the status bar:

- "Alarm 1" –  ;
- "Alarm 2" –  .
- "Alarm 3 (off the scale)" –  .

Two alarm thresholds for the count rate alarm level can be set using the menu.
When the count rate alarm threshold level is exceeded, a pulsating sign will be displayed in the status bar:

- "Alarm 1" –  ;
- "Alarm 2" –  .
- "Alarm 3 (off the scale)" –  .

3.11.3 Dose

The mode is intended for presentation of accumulated dose.

In the Dose display mode the screen shows:
- status panel - from the top;
- parameters of accumulated dose estimation.

The upper part of the screen, from left to right, contains basic information about the status of the instrument:

- time since the beginning of dose accumulation: days, hours, minutes;
- detector temperature;
- sign of exceeding the thresholds for dose rate, dose rate, count rate;
- audio indication status;
- presence of Bluetooth or USB connection;
- swing button lock sign;

- battery status.

At the bottom of the screen from left to right:
- graphical representation of the cumulative dose estimate.
- cumulative dose assessment value;
- dose measurement units - Sv, R;

Using the menu you can choose between the measurement units:
- Sv or P - when displaying dose rate.

Using the buttons

Quick operation in this mode is available via the buttons:
- long pressing the lower button resets the value of the accumulated dose;
- long pressing on the upper button of the swing turns on and off the sound indication.

Setting alarm thresholds

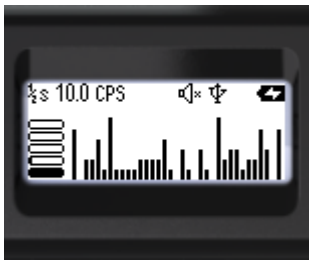
Two alarm thresholds for the accumulated dose level can be set using the menu.

When the alarm threshold level is exceeded, a pulsating sign will be displayed in the status bar:
- "Alarm 1" – Σ▬;
- "Alarm 2" – Σ▬;
- "Alarm 3 (off the scale)" – Σ▬.

3.11.4 Search

The mode is designed to represent the count rate in the form of a search graph. It is applicable for operative search of the source or zone with increased radiation level.

In the Search display mode the screen shows:
- status bar - on top;
- search graph of count rate - at the bottom.



The upper part of the screen, from left to right, contains basic information about the status of the instrument:

- averaging time, price of one bar on the chart in seconds - 1/2, 1, 2, 4 seconds;
- current count rate value;
- count rate units - CPS or CPM;
- sign of exceeding thresholds on dose rate, dose rate, count rate level;
- audio indication status;

- Bluetooth or USB connection;
- swing buttons lock sign;
- battery status.

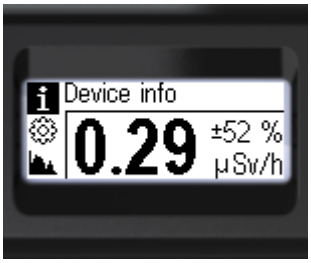
At the bottom of the screen from left to right:
- graphical representation of the current count rate.
- search graph of the count rate;

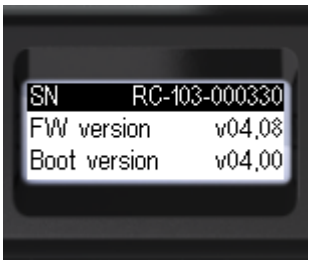
Using the buttons

Quick control in this mode is available via buttons:
- a short press on the upper swing button increases the averaging time;
- a short press on the lower swing button decreases the averaging time;
- long press on the lower swing button clears the screen and starts a new search session;
- long pressing the upper swing button turns the sound indication on and off.

3.11.5 Device info

The mode is intended for presenting brief information about the device:
- Instrument model and serial number;
- Firmware version;
- Bootloader version;
- FCC ID. **Not specified for all devices*





3.12 Alarms

The sources of alarms in the Radiacode-10X series device are:
current value of count rate value;
current value of dose rate value;
value of accumulated dose;

There are three alarm thresholds for each of these sources in the Radiacode-10X series instrument:
If the current count rate, dose rate, or dose value crosses any of the thresholds from bottom to top, an **Alarm event** occurs:
- first threshold - Alarm 1;
- second threshold - Alarm 2;
- upper limit of the scale - over scale;

The values of alarm thresholds of the first and second level, separately for each of the sources, are set in the device settings. They can be changed at your discretion.
The value of the third threshold is the upper limit of the scale of each of the measured values. These thresholds cannot be changed through the menu.
The instrument constantly checks the current values of count rate, dose rate, accumulated dose and compares them with the threshold values.

Exceeding any of the thresholds puts the instrument into the **Alarm state**.

Each **Alarm Source** defines one of 4 states:
- Normal - value below the first threshold (no alarm);
- Alarm 1 - value higher than the first threshold but not higher than the second;
- Alarm 2 - value higher than the second threshold, but not higher than the third;
- Over scale - value above the third threshold, going beyond the scale.

Exceeding the upper threshold by count rate leads to unreliability of dose rate estimation. In this case the upper threshold for dose rate is also considered to be exceeded.

If any of the alarm thresholds for dose rate, count rate or accumulated dose is exceeded, the corresponding alarm will be activated. To stop the alarm for any level, you need to confirm by briefly pressing the round button that you have accepted the alarm. The instrument will continue to display exceeding the set level with a flashing icon of the appropriate type. To terminate an alarm based on the accumulated dose level, you must reset it to zero, or change the corresponding alarm threshold.

Each **Alarm Event** has corresponding Alarms associated with it:
- audible alarm;
- vibration signal;

Audio and vibration Alarms can be enabled/disabled in the Radiacode-10X series settings for each level of any of the **alarm sources** independently.

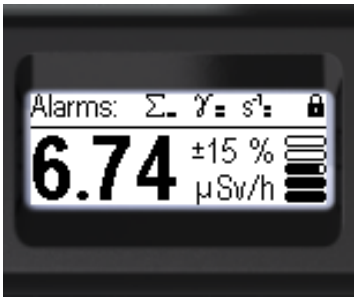
On an **Alarm Event**, Radiacode-10X series will play the Alarms allowed in the settings.
You can stop playing the alarm by briefly pressing the *round button*.
The next **Alarm Event** will be signaled again.

The **Alarm Status** is indicated by:
- red LED flashes;
- alarm icons on the status panel of the device display;
- unacknowledged alarms status line.

 Alarm 1 on Count Rate.
 Alarm 2 on Count Rate.
 Alarm 3 on Count Rate over scale.
 Alarm 1 on Dose Rate.
 Alarm 2 on Dose Rate.
 Alarm 3 on Dose Rate over scale.
 Alarm 1 on Dose.
 Alarm 2 on Dose.
 Alarm 3 on Dose over scale

Light signals can be turned on/off in the settings Radiacode-10X series

If the device has been locked, if the alarm indication settings (sound and/or vibro) are enabled, a line of maximum recorded levels of unconfirmed alarms will be shown on the device display after the thresholds have been exceeded:



The following rules are adopted for indication of states and events of alarms on the display:

- If the swing buttons are locked, the status panel displays the message "Alarms:" and icons of maximum alarm levels reached from the moment the buttons are locked to the current moment of time - one icon for each source.
- By long pressing the round button, the user can confirm viewing of the presented list of maximum alarm levels, after which the swing buttons will be unlocked and the normal instrument status panel will be displayed.
- If Alarm Events occurred while displaying the menu, upon exiting the menu, the display will show the list of maximum alarm levels mentioned above. The swing buttons will then be locked.
- If the swing buttons are unlocked and the display shows one of the measurement display modes, the status bar will show the current alarm level icons for each of the sources, alternating between them.

3.13 Possible problems

Typical faults	Possible causes	Methods of elimination
The device does not turn on autonomously	Battery discharged	Charge the battery
The device operates only when external power is connected	Battery defective	Contact customer support
The device vibrates, displays the icon:	Battery discharged	Charge the battery
After disconnecting the dosimeter from the charger, the charge level is less than 100%	Battery not fully charged	Make sure that the battery is fully charged until the blue LED goes out
15 minutes after the battery is fully charged, the charge level is less than 85%	Battery capacity has been significantly reduced	The device is in bootloader mode
Battery is not charging (Blue LED does not light up)	Temperature above +40°C or below 0°C.	Ensure the right temperature
The device does not turn on, vibrates continuously, blue LED is on	The device is in the loader	Contact customer support
The instrument is running, the monitor mode displays zero values (0.00) of the count rate	The device is defective	Contact customer support
The dosimeter displays “Instrument not calibrated”	There is no calibration data in the dosimeter memory	Contact customer support

when turned on		
The device turns off without low battery message	The device is affected by static electricity	Protect the device from static discharges
One dominant channel in the random part of the spectrum is observed on the spectrum	The device is affected by static electricity	Turn the device off and then on again. Protect the device from static discharge
The calibration coefficients a0 and a2 are zero	Calibration error	Perform a factory reset
The device displays: “Hardware error [1XX]”	EEPROM error	Turn the unit off and then on again. If the error recurs regularly, contact customer service
The device displays: “Hardware error [2XX]”	Bluetooth error	Turn the unit off and then on again. If the error recurs regularly, contact customer service
The device displays: “Hardware error [3XX]”	Accelerometer error	Turn the unit off and then on again. If the error recurs regularly, contact customer service
The device displays: “Hardware error [4XX]”	Optical sensor error	Turn the unit off and then on again. If the error recurs regularly, contact customer service
The device displays: “Hardware error [5XX]”	Thermometer error	Turn the unit off and then on again. If the error recurs regularly, contact customer service
The device displays: “Hardware error [6XX]”	Option status error	Turn the unit off and then on again. If the error recurs regularly, contact customer service

In case of malfunctions, please contact the support team by following the links in the section: developer information.
In case of other problems - report them to the support service.

Chapter

4 Working with a smartphone

To pair with your smartphone, install the app on your smartphone Radiacode, available at link: https://space.radiacode.com and GooglePlay, or use the QR-code:

The IOS app is available by clicking here: https://apps.apple.com/ru/app/radiacode/id6449358533?l=en-GB.
A detailed description of the application interface is included with the application and is available after installation.

Note: When external power is connected, the device can be communicated with via Bluetooth or USB whether it is switched on or off. This allows you to remotely switch the device on or off.

Chapter V

5 Work with a PC

To connect the device to a computer, the software must be installed Radiacode.
The program is available for downloading at: https://space.radiacode.com.
With the help of the program Radiacode you can transfer the data to a computer, view it,
and manage portable radiation detector. A detailed description of the program interface is included with the program and is available after installation.

Note: When external power is connected, the unit can be communicated with via USB regardless of whether it is switched on or off. This allows you to remotely switch the device on or off.