MKS-07M “POSHUK”

SEARCH DOSIMETER-RADIOMETER

Operating Manual
BICT.412129.044-01 HE

CONTENTS

This Operating Manual (hereinafter referred to as the OM) is intended to familiarize the user with the operating principles of the MKS-07M "POSHUK" Search Dosimeter-Radiometer, the procedure for working with it, and contains all the information necessary proper operation and full use of its technical capabilities.

The following abbreviations and terms are used in this OM:

DE	– ambient dose equivalent $\dot{H}^*(10)$ of gamma and X-ray radiation
DER	– ambient dose equivalent rate $\dot{H}^*(10)$
GCD	– graphic color display
BDBG-07M-01	– wide-range gamma radiation detecting unit BDBG-07M-01
BDBG-07M-02	– search-type gamma radiation detecting unit BDBG-07M-02
BDIB-07M	– beta radiation detecting unit BDIB-07M
BDPA-07M	– alpha radiation detecting unit BDPA-07M
BDPN-07M	– neutron radiation detecting unit BDPN-07M
cps	– counts per second

1 DESCRIPTION AND OPERATION

1.1 Purpose of Use

The MKS-07M “POSHUK” Search Dosimeter-Radiometer (hereinafter referred to as the device) is designed to detect radioactive sources by their gamma, beta, alpha, and neutron radiation, as well as to:

- measure the DER of gamma and X-ray radiation (hereinafter referred to as photon ionizing radiation);
- measure the DE of photon ionizing radiation;
- display the pulse count rate from photon ionizing radiation detectors;
- measure the surface flux density of beta radiation particles;
- measure the surface activity of beta-emitting radionuclides;
- display the pulse count rate from the beta radiation detector;
- measure the surface flux density of alpha radiation particles;
- measure the surface activity of alpha-emitting radionuclides;
- display the pulse count rate from the alpha radiation detector;
- measure the DER of neutron radiation;
- display the pulse count rate from the neutron radiation detector.

The device may be supplied as a complete set with all detecting units or only with selected units at the customer’s request.

The device must be operated by qualified personnel and can be used within the radiation monitoring system of Ukraine, including in:

- the State Emergency Service;
- civil defense services;
- nuclear energy dosimetric control services;
- radiological laboratories;
- companies dealing with radioactive waste;
- other institutions working with radioactive materials.

1.2 Technical Specifications

1.2.1 The main technical data and specifications are provided in Tables 1.1 through 1.6.

Table 1.1 - Main technical data and characteristics of the device's control unit

Name	Unit of measure	Specified standard values
Display range of photon ionizing radiation and neutron radiation DERs	μSv/h	$0.01 – 1\times10^{7}$
Measurement range of photon ionizing radiation DER	μSv/h	$1.0 – 1\times10^{7}$
Display range of photon ionizing radiation DE	μSv	$0.01 – 1\times10^{8}$
Measurement range of photon ionizing radiation DE	μSv	$0.1 – 1\times10^{8}$
Main relative permissible error limit when measuring DER exceeding 1 μSv/h when calibrated by ^{137}Cs with a confidence probability of 0.95	%	15
Main relative permissible error limit when measuring DE when calibrated by ^{137}Cs with a confidence probability of 0.95	%	15
Energy range of detected photon ionizing radiation	MeV	0.05 – 10.00
Energy dependence when measuring DER, DE and absorbed dose of photon ionizing radiation in the energy range from 0.05 MeV to 1.25 MeV, relative to energy 0.662 MeV, maximum	%	± 25
Anisotropy in the solid angle ± 60 ° relative to the main measurement direction, which is marked with the symbol "+", maximum: – for ^{137}Cs and ^{60}Co radionuclides; – for ^{241}Am radionuclide	%	 25 60
Unstable readings of the control unit when measuring DER during continuous 8 hour operation, maximum	%	5

Table 1.1 (continued)

Name	Unit of measure	Specified standard values
Time of operating mode setting of the control unit, maximum	min	2
Additional relative permissible error during DER measurement caused by the deviation of the ambient temperature from 20 °C in the temperature range from -25 °C to +55 °C	%	5 for every 10 °C deviation from 20 °C
Operating supply voltage of the device from the Li-Ion battery	V	3.7
Continuous operation time of the device under normal climatic conditions: - With gamma background not exceeding 0.5 μSv/h, powered by a fully charged Li-Ion battery (3500 mAh), with remote detecting units disconnected, GPS receiver off, and display brightness set to minimum, the operation time is no less than: - With gamma background not exceeding 0.5 μSv/h, powered by a fully charged Li-Ion battery (3500 mAh), with any remote detecting unit connected in measurement mode of any radiation type, GPS receiver off, and display brightness set to minimum, the operation time is no less than: - With gamma background not exceeding 0.5 μSv/h, powered by a fully charged Li-Ion battery (3500 mAh), with any remote detecting unit connected in measurement mode of any radiation type, GPS receiver on, and display brightness set to minimum, the operation time is no less than: - With gamma background not exceeding 0.5 μSv/h, powered by an external Power Bank (10,000 mAh), with any remote detecting unit connected in measurement mode of any radiation type, GPS receiver on, and display brightness set to minimum, the operation time is no less than:	hour	160 96 24 200

Table 1.1 (continued)

Name	Unit of measure	Specified standard values
Additional relative permissible error during DER measurement caused by deviation of supply voltage from the nominal value in the voltage range from 3.4 V to 4.2 V, maximum	%	5
Display range of pulse count rate	cps	$0.01 – 2×10^6$
Display range of surface flux density of beta and alpha particles	part./(cm^2·min)	$0.01 – 5×10^5$
Display range of surface activity of beta- and alpha-emitting radionuclides	Bq/cm^2	$0.001 – 1×10^5$
Dimensions of the control unit, maximum	mm	155 × 85 × 35
Weight of the control unit, maximum	kg	0.5

Table 1.2 - Main technical data and characteristics of the BDBG-07M-01 unit

Name	Unit of measure	Specified standard values
Measurement range of photon ionizing radiation DER	μSv/h	0.05 – 1×10^7
Main relative permissible error limit when measuring DER when calibrated by ^{137}Cs with a confidence probability of 0.95	%	15
Energy range of detected photon ionizing radiation	MeV	0.05 – 10.00
Energy dependence when measuring photon ionizing radiation DER in the energy range from 0.05 MeV to 1.25 MeV, relative to the energy of 0.662 MeV, maximum	%	± 25
Anisotropy in the solid angle ± 60 ° relative to the main measurement direction, which is marked with the symbol "+", maximum: – for ^{137}Cs and ^{60}Co radionuclides; – for ^{241}Am radionuclide	%	 25 60
Unstable readings of the BDBG-07M-01 unit when measuring DER during continuous 8 hour operation, maximum	%	5
Time of operating mode setting of the BDBG-07M-01 unit, maximum	min	1
Additional relative permissible error during DER measurement caused by the deviation of the ambient temperature from 20 °C in the temperature range from -25 °C to +55 °C	%	5 for every 10 °C deviation from 20 °C
Additional relative permissible error during DER measurement caused by deviation of supply voltage from the nominal value in the voltage range from 3.4 V to 4.2 V, maximum	%	5
Dimensions of the BDBG-07M-01 unit, maximum	mm	Ø46 × 140 × 55
Weight of the BDBG-07M-01 unit, maximum	kg	0.3

Table 1.3 - Main technical data and characteristics of the BDBG-07M-02 unit

Name	Unit of measure	Specified standard values
Measurement range of photon ionizing radiation DER by ^{137}Cs	μSv/h	0.05 – 3×10^2
Main relative permissible error limit when measuring DER when calibrated by ^{137}Cs with a confidence probability of 0.95	%	15
Sensitivity for ^{137}Cs, not less	(cps)/(μSv/h)	1000
Energy range of detected photon ionizing radiation	MeV	0.05 – 10.00
Energy dependence when measuring photon ionizing radiation DER in the energy range from 0.05 MeV to 1.25 MeV, relative to the energy of 0.662 MeV, maximum	%	± 25
Anisotropy in the solid angle ± 120° relative to the main measurement direction, which is marked with the symbol "+", maximum: – for ^{137}Cs and ^{60}Co radionuclides; – for ^{241}Am radionuclide	%	 25 60
Unstable readings of the BDBG-07M-02 unit when measuring DER during continuous 8 hour operation, maximum	%	10
Time of operating mode setting of the BDBG-07M-02 unit, maximum	min	1
Additional relative permissible error during DER measurement caused by the deviation of the ambient temperature from 20 °C in the temperature range from -25 °C to +55 °C	%	5 for every 10 °C deviation from 20 °C
Additional relative permissible error during DER measurement caused by deviation of supply voltage from the nominal value in the voltage range from 3.4 V to 4.2 V, maximum	%	5
Dimensions of the BDBG-07M-02 unit, maximum	mm	Ø 66 × 195 × 65
Weight of the BDBG-07M-02 unit, maximum	kg	0.6

Table 1.4 - Main technical data and characteristics of the BDIB-07M unit

Name	Unit of measure	Specified standard values
Measuring range of surface beta particles flux density	part./(cm^2·min)	$0.5 – 5×10^5$
Measuring range of surface activity of beta-emitting radionuclides	Bq/cm^2	$0.022 – 2.2×10^4$ for sources of CO type ($^{90}Sr+^{90}Y$)
Energy range of detected beta particles	MeV	0.155 – 3.500
Main relative permissible error limit when measuring the surface beta particles flux density when calibrated by $^{90}Sr/^{90}Y$ with a confidence probability of 0.95	%	20
Main relative permissible error limit when measuring the surface activity of beta-emitting radionuclides when calibrated by $^{90}Sr/^{90}Y$ with a confidence probability of 0.95 from CO type sources	%	20
Detecting surface area of the detector, not less than	cm^2	100
Beta particle detection efficiency, not less than: - for ^{14}C isotope; - for ^{60}Co isotope; - for $^{90}Sr/^{90}Y$ isotope		 0.15 0.25 0.32
Time of operating mode setting of the device when measuring the surface beta-particles flux density and the surface activity of beta-emitting radionuclides, maximum	min	1

Table 1.4 (continued)

Name	Unit of measure	Specified standard values
Unstable readings of the BDIB-07M unit when measuring the surface beta-particles flux density and the surface activity of beta-emitting radionuclides during continuous 8 hour operation, maximum	%	5
Additional relative permissible error when measuring the surface beta-particles flux density and the surface activity of beta-emitting radionuclides caused by the deviation of the ambient temperature from 20 °C in the temperature range from -25 °C to +55 °C	%	5 for every 10 ºC deviation from 20 ºC
Additional relative permissible error when measuring the surface beta-particles flux density and the surface activity of beta-emitting radionuclides caused by deviation of supply voltage from the nominal value in the voltage range from 3.4 V to 4.2 V, maximum	%	5
Dimensions of the BDIB-07M unit, maximum	mm	106 × 172 × 35
Weight of the BDIB-07M unit, maximum	kg	0.7

Table 1.5- Main technical data and characteristics of the BDPA-07M unit

Name	Unit of measure	Specified standard values
Measuring range of surface alpha particles flux density	part./(cm^2·min)	$0.05 – 4×10^5$
Measuring range of surface activity of alpha-emitting radionuclides	Bq/cm^2	$0.01 – 1.36×10^4$ for sources of П9 type (^{239}Pu)
Energy range of detected alpha particles	MeV	from 4.0 to 8.0
Main relative permissible error limit when measuring the surface alpha particles flux density when calibrated by ^{239}Pu with a confidence probability of 0.95	%	20
Main relative permissible error limit when measuring the surface activity of alpha-emitting radionuclides when calibrated by ^{239}Pu with a confidence probability of 0.95 from П9 type sources	%	20
Detecting surface area of the detector, not less than	cm^2	100
Time of operating mode setting of the device when measuring the surface alpha particles flux density and the surface activity of alpha-emitting radionuclides, maximum	min	1
Unstable readings of the BDPA-07M unit when measuring the surface alpha particles flux density and the surface activity of alpha-emitting radionuclides during continuous 8 hour operation, maximum	%	5
Additional relative permissible error when measuring the surface alpha particles flux density and the surface activity of alpha-emitting radionuclides caused by the deviation of the ambient temperature from 20 °C in the temperature range from -25 °C to +55 °C	%	5 for every 10 °C deviation from 20 °C

Table 1.5 (continued)

Name	Unit of measure	Specified standard values
Additional relative permissible error when measuring the surface alpha particles flux density and the surface activity of alpha-emitting radionuclides caused by deviation of supply voltage from the nominal value in the voltage range from 3.4 V to 4.2 V, maximum	%	5
Dimensions of the BDPA-07M unit, maximum	mm	106 × 172 × 34
Weight of the BDPA-07M unit, maximum	kg	0.6

Table 1.6- Main technical data and characteristics of the BDPN-07M unit

Name	Unit of measure	Standardized values according to specification
Measuring range of neutron radiation DER	μSv/h	$0.1 – 1 \times 10^4$
Detected energy range	MeV	0.025 – 14.000
Main relative permissible error limit when measuring neutron radiation DER with a confidence probability of 0.95 (Pu/Be)	%	30
Time of operating mode setting of the device when measuring DER of neutron radiation, maximum	min	1
Unstable readings of the BDPN-07M unit when measuring neutron radiation DER during continuous 8 hour operation, maximum	%	5
Additional relative permissible error when measuring neutron radiation DER caused by the deviation of the ambient temperature from 20 °C in the temperature range from -25 °C to +55 °C	%	5 for every 10 °C deviation from 20 °C
Additional relative permissible error when measuring neutron radiation DER caused by deviation of supply voltage from the nominal value in the voltage range from 3.4 V to 4.2 V, maximum	%	5
Dimensions of the BDPN-07M unit, maximum	mm	290 × 150 × 210
Weight of the BDPN-07M unit, maximum	kg	2.2

1.2.2 The device provides the option to automatically subtract the gamma component of radiation when measuring beta radiation parameters.

1.2.3 The device allows storing up to 94,208 measurement results in non-volatile memory. For easier identification, each entry includes the measurement time, geographical coordinates, and a conditional three-digit object number entered at the time of recording.

1.2.4 The device automatically logs event history such as threshold exceedances and powering on/off events.

1.2.5 The device emits an audible signal when detecting each gamma quantum, alpha or beta particle, or neutron.

1.2.6 The device allows viewing previously saved measurement results on its own graphic color display (GCD) and transferring this data to a personal computer via a USB Type-C connector.

1.2.7 The device includes an analog indicator for the intensity of the measured radiation.

1.2.8 The device allows setting alarm threshold levels for each radiation parameter across the entire operating measurement range. Photon ionizing radiation DER threshold programming resolution: 0.01 μSv/h or 0.01 μGy/h. Neutron radiation DER threshold programming resolution: 0.01 μSv/h. Surface flux density threshold resolution for beta and alpha particles: 0.01 part./(cm²·min) Surface activity threshold resolution for beta and alpha radiation: 0.01 Bq/cm². Pulse count rate threshold resolution: 0.01 cps.

1.2.9 The device provides visual and audible alarms when the threshold levels are exceeded.

1.2.10 The device is powered by a lithium-ion 18650 battery. Nominal voltage: 3.7 V, capacity: 3500 mAh.

1.2.11 The device displays battery charge status.

1.2.12 The battery is charged via a USB-C connector using a 220 V, 50 Hz AC network through a 5V DC power adapter.

1.2.13 The device continuously monitors the status of its detectors and displays an appropriate message in case of a malfunction.

1.2.14 Mean time between failures (MTBF) is no less than 6,000 hours.

1.2.15 Mean time before first major repair is no less than 10,000 hours; average service life before the first major repair is at least 6 years.

1.2.16 The device remains operational under the following conditions:

- Temperature: −25 °C to +55 °C
- Relative humidity: up to 95 % at +30 °C
- Atmospheric pressure: 66 to 106.7 kPa.

1.2.17 The device is resistant to sinusoidal vibrations in accordance with performance group N1 per GOST 12997-84 recommendations.

1.2.18 The device is resistant to mechanical shocks with the following parameters:

- Shock pulse duration: 5–6 ms
- Pulse frequency: 40 to 180 per minute
- Number of shocks: (1000 ±10)
- Maximum acceleration: 50 m/s².

1.2.19 The device withstands exposure to constant and alternating magnetic fields with an intensity of 40 A/m.

1.2.20 In its transport case, the device withstands:

- Ambient temperature: −50 °C to +55 °C
- Relative humidity: up to 95 % at 35 °C
- Shaking with acceleration of 30 m/s² with a frequency of 10–120 shocks/minute (15,000 shocks total)

1.2.21 The device is resistant to photon ionizing radiation with a DER of 10 Sv/h applied for 5 min to the control unit, 10 Sv/h for 5 min to the BDBG-07M-01 unit, and 30 mSv/h for 5 min to the BDBG-07M-02 unit.

1.2.22 The ingress protection rating of the control unit enclosure is IP56, and that of the remote detecting units is IP65, according to DSTU EN 60529:2018.

1.3 Delivery Kit

1.3.1 The delivery kit includes the following items and operational documentation, as listed in Table 1.7.

Table 1.7 – Delivery kit of the device

Reference	Name	Qty	Notes
BICT.468166.043-01	Control Unit	1	
BICT.418266.076-01	BDBG-07M-01 Gamma Radiation Detecting Unit	1	
BICT.418266.078-01	BDBG-07M-02 Gamma Radiation Detecting Unit	1	
BICT.467979.019-01	BDIB-07M Beta Radiation Detecting Unit	1	
BICT.418251.036-01	BDPA-07M Alpha Radiation Detecting Unit	1	
BICT.418269.012-01	BDPN-07M Neutron Radiation Detecting Unit	1	Includes handle
BICT.304592.006	Telescopic Rod 1.5 m	1	
BICT.685662.015	Connecting Cable	1	
BICT.412129.044-01 HE	Operating Manual	1	
BICT.412915.072-01	Packaging	1	
	DC Power Adapter (5V)	1	Model not specified
	USB Type-C Cable	1	Model not specified
BICT.00042	“POSHUK READER” Software		Supplied on a USB flash drive
Note. The delivery kit may be changed upon the customer’s request			

1.3.2 The spare parts kit is given in Table 1.8.

Table 1.8

Designation	Name	Q-ty	Note
Spare parts kit BICT.412913.010-02 for BDPA-07M detecting unit includes:			
BICT.741121.040	Gasket	5	Mylar film, 2 μm
BICT.752651.002	Grid	2	
Spare parts kit BICT.412913.010-03 for BDIB-07M detecting unit includes:			
BICT.741121.057	Gasket	5	Aluminum foil, 15 μm
BICT.752651.002	Grid	2	

1.4 Labeling and Sealing

1.4.1 The control unit panel bears the trademark, model name, designation, enclosure protection rating – IP56 according to DSTU EN 60529:2018, and the conformity mark in accordance with the Technical Regulations approved by the Resolution of the Cabinet of Ministers of Ukraine No.1184 as of 30.12.2015.

The detecting unit enclosures are labeled with the trademark, model name, designation, and protection rating – IP65 according to DSTU EN 60529:2018.

1.4.2 The device is sealed by the manufacturer with compound N1 applied to fastener recesses.

1.4.3 Removing and reapplying seals is performed by the manufacturer after repair or calibration.

1.5 Packaging

The device kit, along with the operational documentation, is delivered in a plastic case.

The case containing the device components is placed inside a cardboard box and a polyethylene cover, which is sealed after packaging.

2 OPERATION AS INTENDED

2.1 Operating Limitations

Operating limitations are listed in Table 2.1.

Table 2.1 – Operating Limitations

Limiting Value	Limiting Value Parameters
1 Ambient air temperature	Below −20 °C or above +55 °C
2 Relative humidity	Above 95 % at +30 °C
3 Exposure to photon ionizing radiation	DER greater than 10 Sv/h for 5 (control unit and BDBG-07M-01); DER greater than 10 mSv/h for 5 minutes (BDBG-07M-02)

2.2 Safety Instructions

2.2.1 The device complies with DSTU 7237:2011 for electrical safety for protection class III in accordance with DSTU EN 61010-1:2014.

Protective enclosures prevent accidental contact with live parts. Enclosure protection rating: IP56 for the control unit and IP65 for the detecting units, per DSTU EN 60529:2018.

2.2.2 The device complies with fire safety standards: GOST 12.1.004-91 and GOST 12.2.007.0-75.

2.2.3 When working with sources of ionizing radiation, the following radiation safety regulations must be observed:

“Radiation Safety Norms of Ukraine” (NRBU-97);

“Basic Sanitary Rules for Radiation Safety of Ukraine” (DSP 6.177-2005-09).

If contaminated, the device should be decontaminated by wiping the outer surfaces with a gauze pad moistened with a standard decontamination solution.

2.2.4 Upon commissioning, check the device completeness and inspect for mechanical damage.

2.2.5 If commissioning a device that was in storage, perform de-preservation and verify operability.

Preservation records must be entered into Appendix A.

2.3 Possible Malfunctions and Troubleshooting

2.3.1 Possible malfunctions and troubleshooting are listed in Table 2.2.

Table 2.2 – Possible Malfunctions and Troubleshooting

Malfunction, manifestation and additional signs	Probable cause	Troubleshooting	Note
1 No image on GCD when the device is powered on	1 Battery is discharged 2 Poor contact in battery compartment	1 Recharge the battery 2 Remove battery and clean contacts (replace if needed)	
2 The control unit does not detect a connected remote unit	1 Damaged connecting cable 2 Failure of the remote detecting unit	1 Inspect and repair the cable 2 Send the device for repair to the manufacturer	

2.3.2 Malfunction records must be entered in Appendix B.

2.4 Device Design and Operating Principle

2.4.1 General Information

2.4.1.1 The device consists of a control unit, which includes a built-in gamma radiation detector for operator dose measurement and photon DER measurements, and remote detecting units: BDBG-07M-01 and BDBG-07M-02 for gamma radiation, BDIB-07M for beta radiation, BDPA-07M for alpha radiation, BDPN-07M for neutron radiation.

2.4.1.2 The control unit performs the following functions:

- managing operating modes;
- measuring DE and DER of photon ionizing radiation;
- displaying measurements on the GCD;
- determining geographical coordinates;
- providing visual and audio alarms;
- storing results in non-volatile memory;
- transferring measurement data via USB to a PC;
- supplying power to remote detecting units;
- battery charging.

2.4.1.3 A miniature scintillation detector (YSO(Ce)) is used in the control unit for DE and DER photon ionizing radiation measurements.

2.4.1.4 Detecting units BDBG-07M-01, BDBG-07M-02, BDIB-07M, BDPA-07M, and BDPN-07M measure gamma, beta, alpha and neutron radiation parameters and transmit measurement data via the RS-485 interface to the control unit.

2.4.1.5 BDBG-07M-01 wide-range gamma detecting unit has two measurement channels: a high-sensitivity channel with a sensitivity of 20 (cps)/(μSv/h) for ^{137}Cs; a low-sensitivity channel with 0.2 (cps)/(μSv/h) for ^{137}Cs. Both are based on YSO(Ce) scintillation detectors.

2.4.1.6 BDBG-07M-02 high-sensitivity gamma detecting unit uses a single measurement channel based on a CsI(Tl) scintillator with a sensitivity of 1000 (cps)/(μSv/h) for ^{137}Cs.

2.4.1.7 BDIB-07M beta radiation detecting unit uses a plastic scintillator with an active area of 100 cm².

2.4.1.8 BDPA-07M alpha radiation detecting unit is based a scintillation detector (ZnS:Ag) with an active area of 100 cm².

2.4.1.9 BDPN-07M neutron detecting unit uses two LiI(Eu) scintillation detectors.

2.4.1.10 The device is operated using the buttons “<”, “>”, ENTER, and “</SAVE”.

2.4.2 Design Description

2.4.2.1 Structurally, the device consists of:

- control unit;
- BDBG-07M-01 remote wide-range gamma detecting unit;
- BDBG-07M-02 remote high-sensitivity gamma detecting unit;
- BDIB-07M remote beta radiation detecting unit;
- BDPA-07M remote alpha radiation detecting unit;
- BDPN-07M remote neutron radiation detecting unit with bracket and handle;
- connecting cable;
- telescopic rod.

2.4.2.2 The control unit (Figure 1(a)) is housed in a rectangular enclosure with rounded edges. The front panel accommodates a graphic color display (GCD) (1), four control buttons (2), and indicator LEDs (3). The bottom cover of the control unit has a mount for attaching the unit to the rod (4) and a metrological mark "+" (5) indicating the detector's mechanical center. On the rear cover there is a battery compartment (6) with a 18650 Li-Ion battery, a DU socket (HR10A) (7) for connecting detecting units (with protective cap). The front cover includes CHARGE and SYNCH (USB-Type-C) connector (8) for battery charging and PC communication.

Note. Other connector types and dust caps may be used, provided they maintain the device's IP rating.

Figure 1(b) shows the battery installation/replacement procedure.

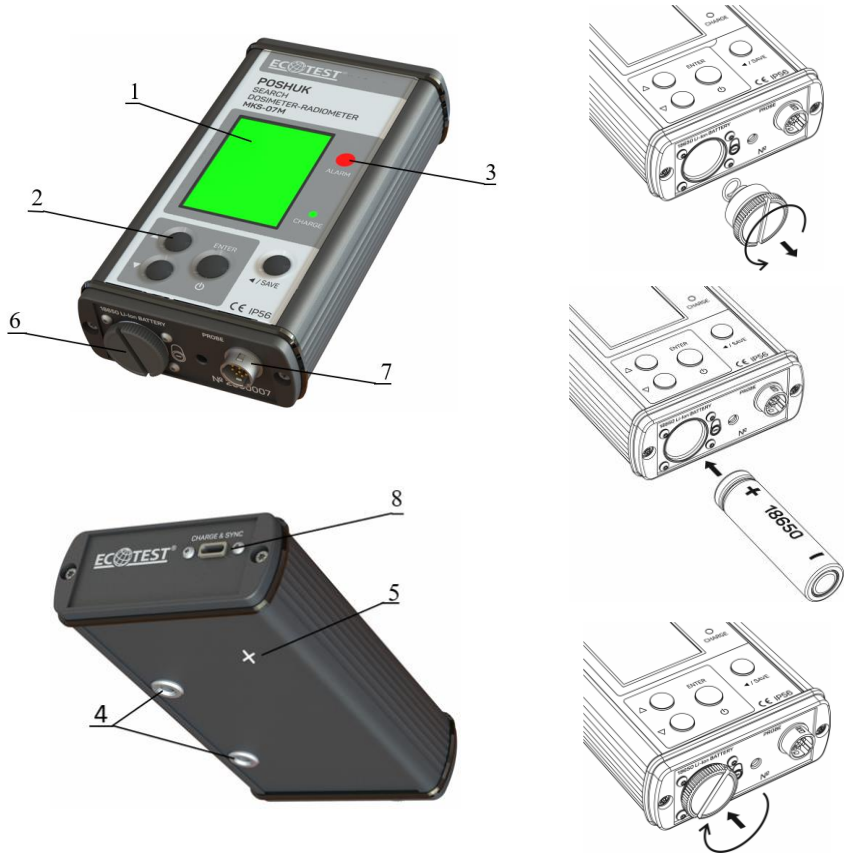


Figure 1 – Control unit

2.4.2.3 The remote wide-range gamma radiation detecting unit BDBG-07M-01 (hereinafter – BDBG-07M-01 unit) is designed as a cylinder (Figure 2) that houses two scintillation detectors of different sizes based on YSO(Ce). Light pulses from the scintillators are registered by silicon photomultipliers.

The bottom of the unit is marked with two metrological “+” symbols indicating the mechanical centers of the detectors.

At the top of the BDBG-07M-01 unit, there is a mount (2) for attaching it to the telescopic rod.

On the back, there is an HR-10A connector (plug) (3) for communication with the control unit via cable.

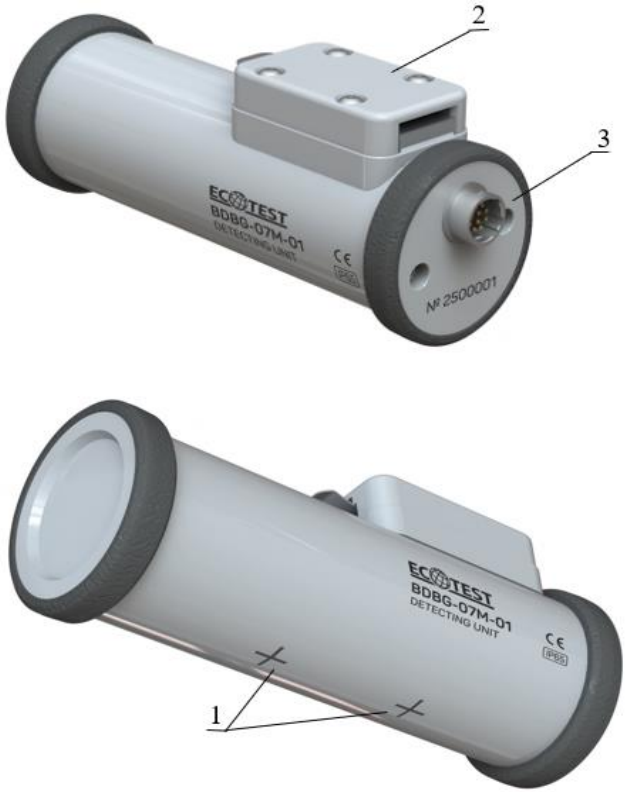


Figure 2 – BDBG-07M-01 unit

2.4.2.4 The remote high-sensitivity gamma radiation detecting unit BDBG-07M-02 (hereinafter – BDBG-07M-02 unit) consists of two cylinders of different diameters (Figure 3).

The detector is located in the front part of the BDBG-07M-02 unit, and its mechanical center is marked with a continuous line around the circumference of the housing (1).

The detector is based on a CsI(Tl) scintillator. Light pulses from the scintillator are recorded by a matrix silicon photomultiplier.

A metrological mark is applied to the front of the housing – the "+" symbol (2), which indicates the mechanical center of the detector.

A mounting mechanism (3) is placed at the top of the unit for attaching it to the telescopic rod.

The HR-10A connector (plug) (4) on the rear connects the unit to the control unit via cable.

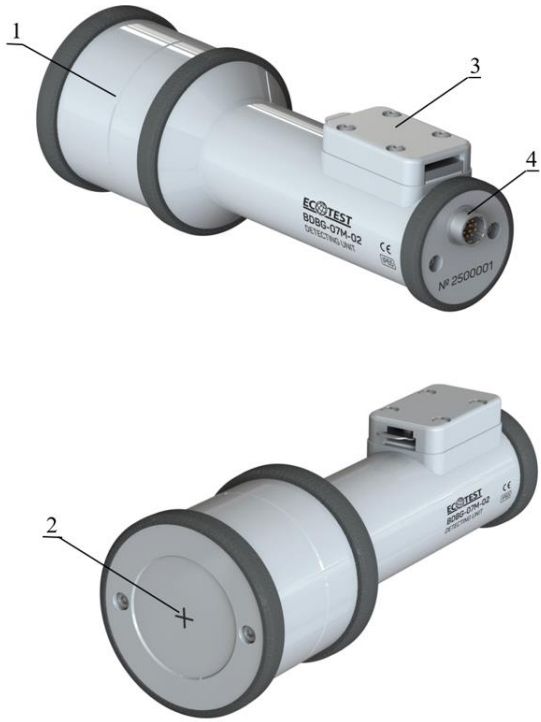


Figure 3 – BDBG-07M-02 unit

2.4.2.5 The remote beta radiation detecting unit BDIB-07M (hereinafter – BDIB-07M unit) is structurally designed as a rectangular parallelepiped (Figure 4).

At the top of the BDIB-07M unit, there is a mount (1) for attaching it to the telescopic rod.

On the back of the BDIB-07M unit, there is an HR-10A connector (plug) (2) for communication with the control unit via cable. In the bottom part of the BDIB-07M unit, there is a detector window (3), behind which the beta-particle detector is located.

The beta particle detector is built based on a plastic scintillator (80 mm×130 mm). Silicon photomultipliers are used to record light pulses from the scintillator.

To protect the detector from dust and moisture, aluminum foil is placed in the detector window between two protective grids.

In non-operational mode, the detector window is covered by a removable filter panel (4), which is secured to the BDIB-07M unit with two side clips (5). The panel is removed during operation with the BDIB-07M unit.

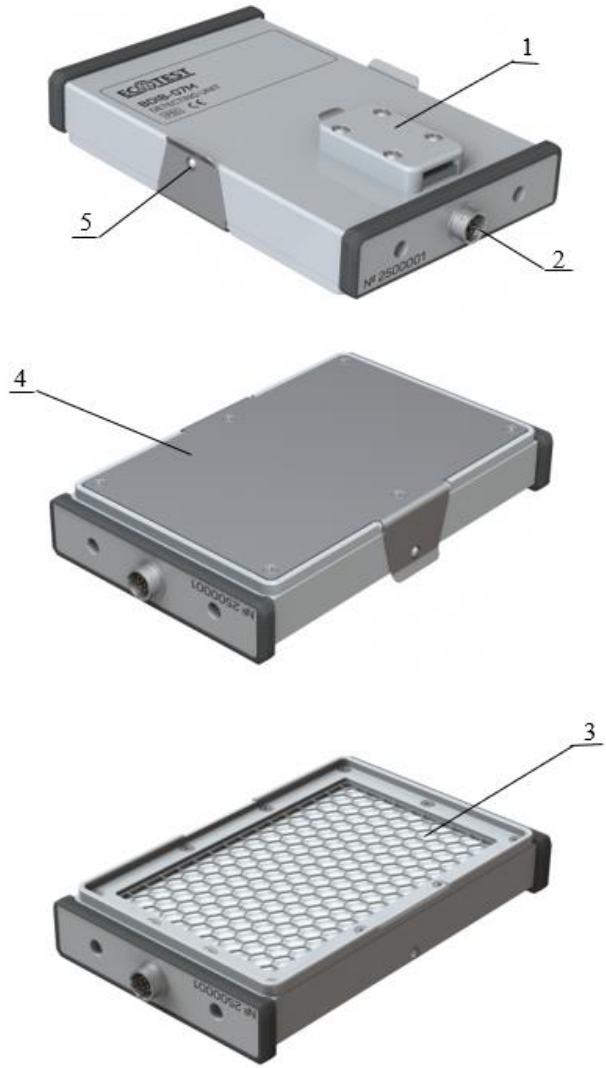


Figure 4 – BDIB-07M unit

2.4.2.6 The BDPA-07M remote alpha radiation detecting unit (hereinafter – BDPA-07M unit) is designed as a rectangular parallelepiped (Figure 5).

The top of the BDPA-07M unit features a mounting mechanism (1) for attaching it to the telescopic rod.

The rear of the BDPA-07M unit is equipped with a HR-10A connector (plug) (2), used for connecting to the control unit via a cable. In the bottom part of the BDPA-07M unit, there is a detector window (3), behind which the alpha-particle detector is located.

The alpha particle detector is based on an 80 mm × 130 mm PMMA (polymethyl methacrylate) light guide, coated with a layer of ZnS(Ag) scintillator. Silicon photomultipliers are used to register light pulses from the scintillator.

To protect the detector from dust and moisture, a Mylar film is placed in the detector window between two protective grids.

In non-operational mode, the window is covered by a removable panel (4), which is secured to the BDPA-07M unit with two side clips (5). The panel is removed during operation with the BDPA-07M unit.

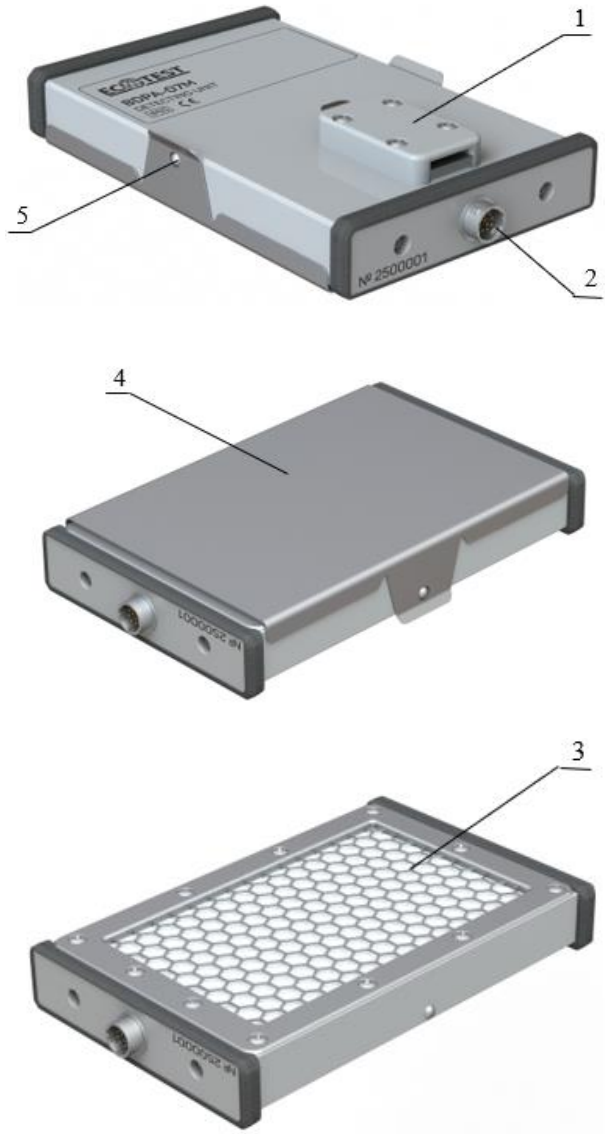


Figure 5 – BDPA-07M unit

2.4.2.7 The remote neutron radiation detecting unit BDPN-07M (hereinafter – BDPN-07M unit) is designed as a sphere (see Figure 6).

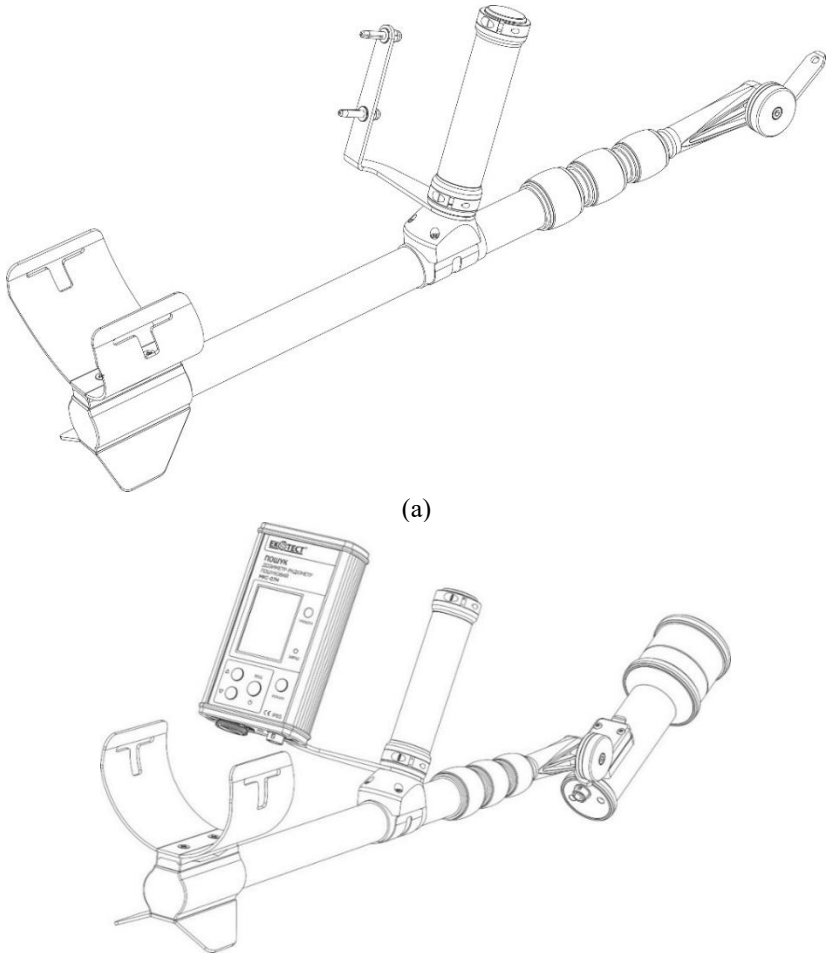
At the top of the BDPN-07M unit, there is a mounting bracket (1) for attaching it to the control unit, as well as a handle (2) for convenient transportation.

On the rear of the BDPN-07M unit, there is an HR-10A connector (plug) (3) used for connecting to the control unit via a cable.

The BDPN-07M unit consists of two detectors based on LiI(Eu) scintillators, with silicon photomultipliers.

Figure 6 – BDPN-07M unit

2.4.2.8 The remote detecting units BDBG-07M-01, BDBG-07M-02, BDIB-07M, and BDPA-07M are mounted at the end of the telescopic rod (see Figure 7), which extends to a length of 1.5 meters when fully extended.



(a)

(b)

Figure 7 – (a) Telescopic rod with handle;
(b) Telescopic rod with installed control unit and BDBG-07M-02 detecting unit.

2.5 Basic Operation of the Device

2.5.1 To switch on the device, press and hold the ENTER button for at least 4 seconds. This will activate the control unit. From the moment the device is powered on, it begins measuring the ambient dose equivalent (DE) of photon ionizing radiation. The operation of the device can be monitored on the graphic color display (GCD).

The DE measurement is continuously performed by the built-in detector of the control unit and is independent of the operating mode or the remote detecting unit connected to the control unit.

2.5.2 If no remote detecting unit is connected to the control unit, the unit will independently measure the dose equivalent rate (DER) of photon ionizing radiation or the pulse count rate for photon ionizing radiation.

2.5.3 If a remote detecting unit is connected, the control unit supplies power to it and, depending on the type of detecting unit and the selected units of measurement, switches to one of the following measurement modes:

- measurement mode of photon ionizing radiation DER;
- measurement mode of neutron ionizing radiation DER;
- measurement mode of surface flux density of alpha particles;
- measurement mode of surface flux density of beta particles;
- measurement mode of surface activity of alpha-emitting radionuclides;
- measurement mode of surface activity of beta-emitting radionuclides;
- measurement mode of pulse count rate of photon ionizing radiation;
- measurement mode of pulse count rate of neutron radiation;
- measurement mode of pulse count rate of alpha radiation;
- measurement mode of pulse count rate of beta radiation.

In these modes, the control unit sends requests to the remote detecting unit, which performs the measurements and transmits the results back to the control unit via the RS-485 interface. The results are displayed on the GCD and can be saved in the device's non-volatile memory.

2.5.4 The contents of the control unit's non-volatile memory can be transferred to a PC via the USB-Type-C connector. The data transfer is controlled by the PC.

3 PREPARATION OF THE DEVICE FOR USE

3.1 Preparation for Operation

3.1.1 Preparation of the Device for Operation

3.1.2 Before starting operation, familiarize yourself with the operating manual and the location and functions of the device's control elements.

3.1.3 Make sure that the battery is installed in the battery compartment of the control unit (see Figure 1(b)).

3.1.4 If the battery is discharged (indicated by the blinking battery symbol on the GCD), connect a USB-C cable to the control unit and the power adapter, then plug the adapter into the mains. The charging process is shown on the GCD.

3.1.5 Connect the required remote detecting unit to the device using the connecting cable via the DU connector located on the end face of the control unit.

3.1.6 **The control unit supports the following operational modes:**

- switching the device on/off;
- displaying the ambient dose equivalent (DE) of photon ionizing radiation;
- displaying the dose equivalent rate (DER) of photon ionizing radiation;
- displaying the DER of neutron ionizing radiation;
- displaying the surface flux density (or surface activity) of alpha particles;
- displaying the surface flux density (or surface activity) of beta particles;
- displaying the pulse count rate (for photon ionizing radiation, neutron ionizing radiation, alpha or beta particles);
- viewing and programming alarm threshold levels;
- saving measurement results and survey object identifiers to non-volatile memory;
- device configuration;
- data exchange with a PC.

Note. When a remote detecting unit is connected, the device automatically identifies the type of unit and switches to the corresponding measurement mode of the physical quantity: photon ionizing radiation DER, neutron radiation DER, surface flux density (or surface activity) of alpha or beta particles, or pulse count rate for photon ionizing radiation, neutron ionizing radiation, alpha or beta particles.

Figure 8 – Front panel of the control unit

To operate the device, the following buttons are used (see Figure 8): the two navigation buttons "∧", "∨", the ENTER button, and the "</SAVE" button.

The navigation buttons "∧" and "∨" are used to switch between operating modes, change settings, and navigate through the menu. The ENTER button is used to save settings, confirm entered data, perform recalibration, and switch the device on.

The "</SAVE" button is used to enter the mode for saving measurement results and survey object identifiers to non-volatile memory, and to return to the previous menu.

The device has an audio signaling mode for detected photon quanta, alpha and beta particles, and neutrons. This mode can be enabled or disabled in the following measurement modes: photon ionizing radiation DER, neutron ionizing radiation DER, surface flux density (or surface activity) of alpha particles, surface flux density (or surface activity) of beta particles, pulse count rate for photon ionizing radiation, neutron radiation, alpha radiation or beta radiation

To enable/disable this mode, press and hold the ENTER button for at least 3 seconds. To adjust the sound intensity level, briefly press the ENTER button.

Each brief press of the "∨" button switches the device between modes in the following sequence:

- DER display mode (surface flux density, surface activity, or pulse count rate);
- DE display mode;
- Device settings mode, which includes the following options:
    - Display;
    - Sound;
    - Light;
    - Language;
    - Location;
    - Measurement;
    - Time and Date;
    - Advanced;
    - About Device;
    - Back;
    - Power off.

Pressing the "∧" button switches the device between modes in reverse order.

During operation, the device generates the following sound and light signals:

"Quantum" – a sequence of short beeps indicating the intensity of registered photon ionizing radiation quanta, alpha or beta particles, and neutrons. The signal frequency is proportional to the pulse count rate for photon ionizing radiation, alpha or beta particles, and neutrons. The "**Quantum**" signal can be turned on or off only in DER display mode and in surface flux density (or surface activity) measurement mode for alpha or beta particles.

"Threshold Level Exceeded" – periodic light and/or sound signals generated when the measured DER of photon ionizing radiation or neutron radiation, or the surface flux density (or surface activity) of alpha or beta particles, or the pulse count rate (for photon ionizing radiation, neutron ionizing radiation, alpha or beta particles) exceeds the threshold level.

"**Safety Threshold Exceeded**" – periodic light and/or sound signals generated when the measured DER of photon ionizing radiation exceeds the safety threshold.

"**Accumulated Dose Threshold Exceeded**" – periodic light and/or sound signals generated when the measured value of photon ionizing radiation DE exceeds the threshold level.

"**Battery Discharge**" – periodic light and/or sound signals indicating significant battery discharge. These signals can be fully turned off.

“**Power On/Off**” – multi-tone light and sound signals indicating that the device has been powered on or off. These signals can be completely disabled.

“**Key Sounds**” – sound signals generated when interacting with the device's control elements. These signals can be completely disabled.

3.2 Device Operation

3.2.1 **Turning the Device On/Off**

3.2.1.1 To turn on the device, press and hold the ENTER button for at least 3 seconds. The device switches on, which is indicated by the backlighting of the GCD; afterward, the device information and the manufacturer’s brand appear on the screen (Figure 9).

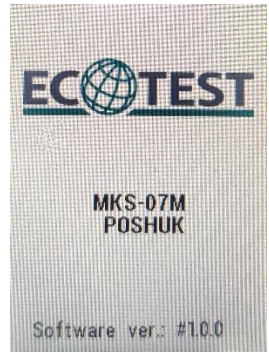


Figure 9 – Device Startup

If the battery is fully discharged, a battery icon  will appear on the display during startup, indicating that charging is required.

Note. Light and/or sound power-on signals can be enabled or disabled through the corresponding items in the settings menu.

3.2.1.2 After the internal self-test is completed, the device begins measuring the photon ionizing radiation DE and switches to one of the following measurement modes depending on the connected detecting unit: photon radiation DER, neutron radiation DER, or surface flux density (or surface activity) of alpha or beta particles.

If no detecting unit is connected, the built-in scintillation detector measures the photon ionizing radiation DER.

To turn the device off, open the settings menu and select “**Turn off the device**”. The manufacturer’s information will appear briefly, after which the device powers down.

Regardless of the current operating mode, the top area of the GCD may display icons indicating:

 - Current battery charge status

 - Current time

 - Navigation receiver status

 - threshold exceedance

 - Safety threshold exceedance

 - Pulse count rate alarm status

 - Sound alarm status

 - Light alarm status

3.2.2 **Measurement of Photon Ionizing Radiation DER**

3.2.2.1 To measure the photon ionizing radiation DER (hereinafter referred to as DER), connect one of the BDBG-07M-01 or BDBG-07M-02 detecting units to the control unit via the connecting cable, or operate the device without an external detecting unit.

3.2.2.2 Turn on the device. Open Settings → *Measurement* → *Units* and select Sieverts (Sv) or Grays (Gy) for gamma radiation. Switch to the DER display mode for photon ionizing radiation. Orient the BDBG-07M-01 or BDBG-07M-02 unit toward the target with the metrological "+" symbol facing the object. In this mode, the GCD displays (see Figure 10):

- the "DER" panel indicating DER measurement;
- the measurement results;
- the measurement units;
- the statistical error;
- the analog intensity scale (when an external unit is connected);
- the DE value and accumulation time (when no external unit is connected);
- the threshold value.

Figure 10 – window of photon ionizing radiation DER measurement:
(a, c) – with connected external detecting unit
(b, d) – without connected external detecting unit

To quickly assess the intensity of photon ionizing radiation, the device uses an 18-segment analog scale. The scale updates every 200 ms.

The display range on the analog scale is dynamic and adjusts based on the pulse intensity.

If sound mode is enabled, gamma quanta are accompanied by short beeps. To adjust the sound intensity, briefly press the ENTER button.

If the measured value exceeds the threshold, a two-tone audible alarm and/or light alarm is activated.

3.2.3 **Measurement of Surface Flux Density or Surface Activity of Beta Radiation**

3.2.3.1 To measure the surface flux density of beta radiation (hereinafter referred to as surface flux density) or surface activity, connect the BDIB-07M detecting unit to the control unit via the connecting cable.

3.2.3.2 Switch on the device. Open Settings → *Measurement* → *Units* and select $\frac{10^3}{cm^2 * min}$ for measuring surface flux density or $\frac{Bq}{cm^2}$ for measuring surface activity.

Important! To correctly account for gamma background in the results of surface flux density or surface activity measurement of beta radiation, it must first be measured and **stored**. The device will then automatically subtract it from subsequent beta measurements. Instructions for background measurement are provided in section 3.2.3.3 of this manual.

In surface flux density or surface activity measurement mode, the GCD displays (see Figure 11):

- the “SFD” panel for surface flux density;
- the “ACT” panel for surface activity;
- the measurement results;
- the measurement units;
- the statistical error;
- the analog intensity scale;
- the threshold value;
- the gamma background status (BG icon).

(a) (b)

Figure 11 – Measurement window of:
(a) Surface flux density of beta particles
(b) Surface activity of beta particles

Measurement results are updated every 500 ms.

For quick assessment of beta radiation intensity, the device uses an 18-segment analog scale. The scale updates every 200 ms.

The display range on the analog scale is dynamic and adjusts based on the pulse intensity.

If sound mode is enabled, beta particles generate short beeps. To adjust the sound level, briefly press ENTER.

If the measured value exceeds the threshold, a two-tone audible alarm and/or visual alarm is activated.

3.2.3.3 **Measurement of Gamma Background and Saving It for Future Automatic Subtraction in Surface Flux Density Measurement Mode for Beta Radiation**

To measure and store gamma background, perform the following steps during surface flux density or surface activity measurement:

- Position the detecting unit with the filter panel closed so that the detector window is parallel to and at a minimal distance from the surface being surveyed;
- Open Settings → *Measurement* → *Accuracy* and set the desired statistical error between 3% and 25%;
- Wait until the device reaches the selected accuracy level;
- Press and hold the "</SAVE" button for 3 seconds to open the lower menu. Select the "BG" icon, and press ENTER.

When the gamma background value is successfully stored, the "BG" icon changes color from white to green.

After saving the gamma background, remove the filter panel from the beta detector and proceed with surface flux density or surface activity measurements.

Note. When switching to a different measurement object, the gamma background must be measured and stored again for each new object.

3.2.4 **Measurement of Surface Flux Density or Surface Activity of Alpha Radiation**

3.2.4.1 To measure the surface flux density of alpha radiation (hereinafter referred to as surface flux density) or surface activity, connect the BDPA-07M detecting unit to the control unit via the connecting cable.

3.2.4.2 Switch on the device. Open Settings → *Measurement* → *Units* and select $\frac{\mathbf{10^3}}{\boldsymbol{cm^2 * min}}$ for measuring surface flux density or $\frac{\boldsymbol{Bq}}{\boldsymbol{cm^2}}$ for measuring surface activity. Remove the protective panel from the detector window. Position the BDPA-07M detecting unit so that its window is parallel to and at a minimal distance from the surface to be surveyed.

In surface flux density measurement mode, the GCD displays (see Figure 12):

- the "SFD" panel indicating surface flux density mode;
- the "ACT" panel indicating surface activity mode;
- the measurement results;

- the measurement units;
- the statistical error value;
- the analog pulse scale;
- the threshold value.

Measurement results are updated every 500 ms.

For quick evaluation of alpha radiation intensity, an 18-segment analog scale is used. The scale updates every 200 ms.

The display range on the analog scale is dynamic and adjusts based on the pulse intensity.

If the audio signaling mode is enabled, alpha particles are accompanied by short beeps. To recalibrate the sound intensity, briefly press the ENTER button.

If the measured value exceeds the threshold, a two-tone audible and/or visual alarm is triggered.

Figure 12 – Surface Flux Density Measurement Results with Gamma Background Subtraction

(a)

(b)

Figure 13 – Measurement Window of:
(a) Surface flux density of alpha particles
(b) Surface activity of alpha-emitting radionuclides

3.2.5 **Measurement of Neutron Radiation DER**

3.2.5.1 To measure the neutron radiation DER, connect the BDPN-07M detecting unit to the control unit using the connecting cable.

3.2.5.2 Switch on the device. Open Settings → *Measurement* → *Units*, and for neutron radiation, select Sieverts (Sv). Position the BDPN-07M detecting unit so that the mechanical center of the detector is directed toward the object being measured.

In the measurement mode of neutron radiation DER, the following will be displayed on the GCD (see Figure 14):

- the “DER” panel indicating neutron radiation DER;
- the measurement results;
- the units of measurement;
- the statistical error of measurements;
- the analog pulse intensity scale;
- the threshold value.

Figure 14 – Measurement window for neutron radiation DER

Measurement results are updated every 500 ms.

For quick evaluation of neutron radiation intensity, an 18-segment analog scale is used. The scale updates every 200 ms.

The display range on the analog scale is dynamic and adjusts based on the pulse intensity.

If the audio signaling mode is enabled, each registered neutron is accompanied by a short beep. To recalibrate the sound intensity, briefly press the ENTER button.

If the measured value exceeds the threshold, a two-tone audible and/or visual alarm is triggered.

3.2.6 **Measurement of Pulse Count Rate for Alpha, Beta, Gamma, and Neutron Radiation**

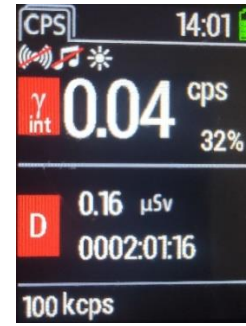
3.2.6.1 To measure the pulse count rate for alpha, beta, gamma, or neutron radiation, connect the corresponding remote detecting unit to the control unit using the connecting cable. Alternatively, you may leave the device without a remote unit — in that case, the pulse count rate will be displayed from the built-in detector.

3.2.6.2 Switch on the device. Open Settings → *Measurement* → *Units*, and for the selected radiation type, choose the unit "cps". Operate the detecting unit according to sections 3.2.2–3.2.5, depending on the connected detector.

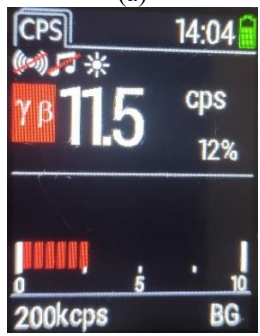
In the pulse count rate measurement mode, the following will be displayed on the GCD (see Figure 15):

- the "CPS" panel indicating pulse count rate mode;
- the measurement results;
- the measurement units;
- the statistical error of measurements;
- the analog pulse scale;
- the threshold value.

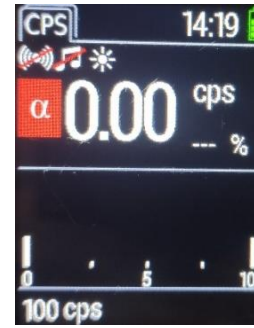
(a)



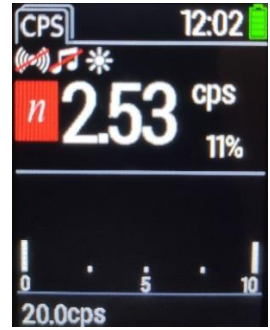
(b)



(c)



(d)



(e)

Figure 15 – Pulse Count Rate Measurement Window: (a) Gamma radiation with remote detecting unit, (b) Gamma radiation with built-in detecting unit, (c) Beta radiation, (d) Alpha radiation, (e) Neutron radiation

3.2.7 **Displaying DE**

The accumulated dose and the dose accumulation time since the device was powered on are displayed on the screen (see Figure 16).

In the DE display mode, the GCD shows (see Figure 16):

- the “AD” panel indicating dose equivalent display;
- the measurement results;
- the measurement units;
- the accumulation time.

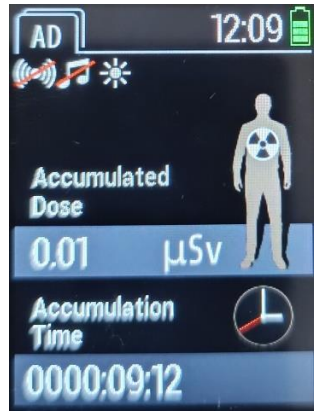


Figure 16 – DE display mode

3.2.8 **Device Settings Mode**

The Settings mode contains the following menu items (see Figure 17):

- **Display –** backlight settings;
- **Sound –** audio notifications and alarm settings;
- **Light –** visual notifications and alarm settings;
- **Language –** selection of the user interface language;
- **Location –** navigation receiver settings;
- **Connection –** communication interface settings;
- **Measurement –** alarm threshold settings and track logging settings;
- **Date and Time –** time and date configuration;
- **USB –** USB communication settings;
- **About Device –** information about the device and manufacturer;
- **Power Off –** turn the device off;
- **Back –** exit the settings screen.

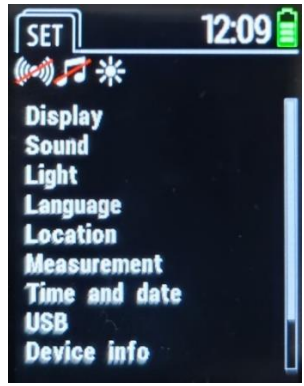


Figure 17 – Device Settings Mode

To navigate to a desired settings item, use the "∧" and "∨" buttons until the cursor highlights the corresponding line, then press ENTER to open it.

To change settings in the **Display**, **Sound, Light, Language, Location**, and **Advanced** sections, use the "∧" and "∨" buttons to select the desired parameter, and press the ENTER button to confirm. Then use the "∧" and "∨" buttons again to set the desired value or unit. After that, press ENTER or "</SAVE" to return to the parameter selection in that menu.

To change settings in the **Measurement** and **Date and Time** sections, use the "∧" and "∨" buttons to move the cursor to the desired parameter and press ENTER to confirm. Then use the "∧" and "∨" buttons to set the desired value or unit and press ENTER to move to the next digit. If the desired value is already set and no further field changes are needed, press the "</SAVE" button to deactivate the parameter. After all fields are set, press ENTER to exit to the parameter list.

Each settings menu contains icons Save (except for the **About Device** section) and Back, corresponding to the saving of settings and returning to the previous menu without saving changes, respectively. To select the desired icon, use the "∧" and "∨" buttons to move the cursor up or down until the icon is selected, then press ENTER to confirm.

Pressing the "</SAVE" button either deactivates the selected setting or returns to the previous settings window.

3.2.8.1 **Display**

The **Display** menu contains the following settings (see Figure 18):

Figure 18 – Display Parameters Settings

- **Brightness** – allows you to adjust the display backlight intensity from 0 % to 100 % in 10 % increments.
- **Backlight**– allows you to set the backlight duration to 1 minute, 2 minutes, 5 minutes, or continuous backlighting.

3.2.8.2 **Sound**

The **Sound** menu contains the following settings (see Figure 19):

Figure 19 – Sound Signal Settings

• **System Sounds –** enables or disables sounds when turning the device on/off and when the battery is low.

• **Key Sounds –** enables or disables audio feedback for button presses.

• **Alarm Sound –** enables or disables the audible alarm when radiation threshold levels are exceeded.

3.2.8.3 **Light**

The **Light** menu contains the following settings (see Figure 20):

Figure 20 – Light Signal Settings

• **System Light –** enables or disables light signals when the device is powered on/off and for battery discharge warnings.

• **Alarm Light –** enables or disables the visual alarm when radiation threshold levels are exceeded.

3.2.8.4 **Language**

The **Language** menu allows you to change the language used for displaying data on the device's screen (see Figure 21).

Figure 21 – Language Settings

3.2.8.5 **Location**

The **Location** menu contains the following settings (see Figure 22):

Figure 22 – Navigation Receiver Parameters Settings

• **Receiver –** enables or disables power to the device's navigation receiver.

• **Location Information –** allows you to view the current data from the navigation receiver, including: time and date, coordinates, number of satellites currently detected by the device (SIV), number of satellites currently in use (SIU), and information whether the coordinate data is valid

• **Satellite Information** – displays the unique identifiers of detected satellites and the signal-to-noise ratio for each satellite (see Figure 23).

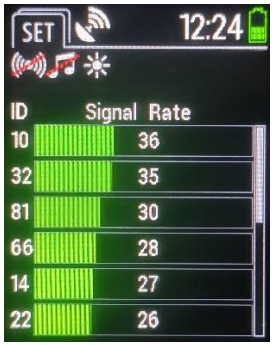


Figure 23 – Satellite Information Window

3.2.8.6 **Measurement**

The **Measurement** menu contains the following settings (see Figure 24):

Figure 24 – Measurement Parameter Settings

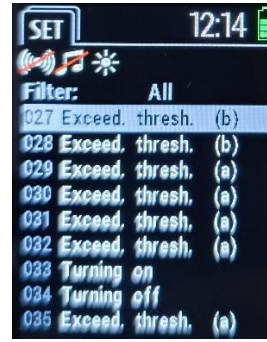


Figure 25 – Display of Saved Events

• **Thresholds –** allows you to set alarm thresholds for exceeding radiation levels and to set a safety threshold for the gamma channel, which is monitored regardless of the connected detecting unit.

• **Units –** allows you to select measurement units for different types of radiation.

• **Measurement Accuracy –** allows you to set statistical uncertainty limits.

• **Archive –** allows you to view stored measurements. Saved records can be filtered by type: “All”, “Thresholds”, or “Measurements”. To change the current filter, press and hold the “</SAVE” button until the filter label turns green, then use the “∧” and “∨” buttons to select the desired filter. To deactivate filter selection, press and hold the “</SAVE” button until the filter label turns gray.

• **Log Time –** when valid coordinates are available, allows automatic logging of events into non-volatile memory at the following time intervals: 15 s, 30 s, 60 s, 120 s, 300 s.

• **Log Distance** – when valid coordinates are available, allows automatic logging of events into non-volatile memory at the following distance intervals: 50 m, 100 m, 250 m, 500 m.

3.2.8.7 **Time and Date**

The **Time and Date** menu contains the following settings (see Figure 26):

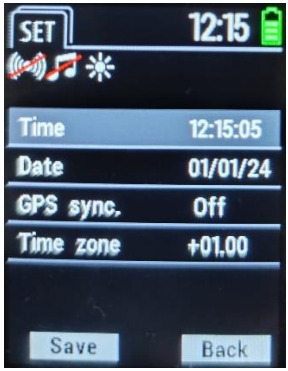


Figure 26 – Time and Date Parameter Settings

• **Time –** sets the current time;

• **Date –** sets the current date;

• **GPS Sync –** enables synchronization of time and date with the navigation receiver;

• **Time Zone –** sets the time zone used for synchronization with the navigation receiver. The time zone can be set from −12:00 to +12:00 in 15-minute increments.

3.2.8.8 **USB**

The USB menu contains the following setting (see Figure 27):

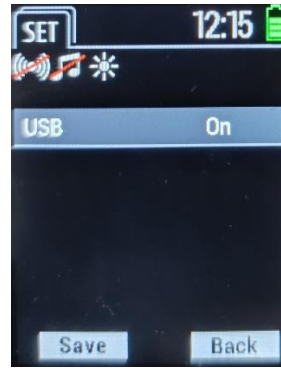


Figure 27 – Communication Interface Settings

- **USB** – enables communication with a PC via the USB interface.

3.2.8.9 About Device

The **About Device** menu provides information about the device model, firmware version, board version, serial number, and manufacturer details (see Figure 28).

Figure 28 – About Device

3.2.9 **Saving Measurement Results and Object Identifiers to Non-Volatile Memory**

Measurement results and object identifiers can be saved to non-volatile memory directly from the measurement mode.

3.2.9.1 To save a measurement result and the corresponding object number, press the “</SAVE” button on the measurement display screen. A menu will appear, allowing you to assign an object number and save the current measurement.

Figure 29 – Saving Measurement Results

Additionally, you can enable automatic saving of measurement results at fixed time intervals or distance intervals. Measurements saved in this mode are assigned the last stored object number. In this mode, the “object” is understood as a track recorded by the device.

3.2.10 **Monitoring the Status of Detectors**

The device continuously monitors the status of the built-in detector and the detectors of all connected remote units.

If the built-in detector fails, a corresponding message appears on the GCD (see Figure 30). The window shows the indicator of operation with the built-in detector – symbol γ int, and the error message “FAILED”.

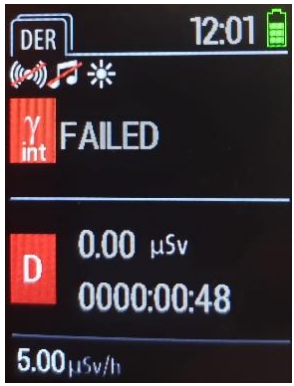


Figure 30 – Built-in Detector’s Error Message

If the detector of a remote detecting unit fails, a corresponding message appears on the GCD (see Figure 31). The window shows the radiation type of the remote unit (α, β, γ, or n) and the error message “FAILED”.

Figure 31 – Remote Detecting Unit’s Detector Error Message

If an unknown detecting unit is connected, a corresponding message appears on the GCD (see Figure 32). The window shows the indicator for the unknown unit – symbol ?, and the error message “FAILED”.

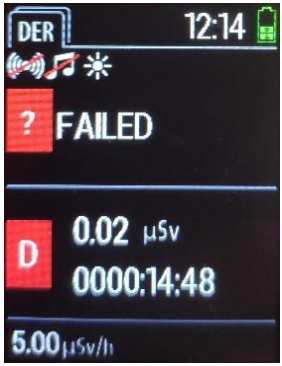


Figure 32 – Unknown Detecting Unit’s Connection Error Message

3.2.11 Information Exchange with a Personal Computer (PC)

3.2.11.1 Installing the Software

To read and view events from the device and to configure its parameters, you must use the **“POSHUK READER”** software (hereinafter referred to as **POSHUK READER SW**), supplied by the manufacturer.

Before establishing data exchange between the device and a PC, install the **POSHUK READER SW**.

The software is installed on a PC running Windows. To install **POSHUK READER SW**, run the file Setup_PoshukReader.exe from the Poshuk Reader folder on the installation media, and follow the on-screen instructions until installation completes.

Administrator rights are required to install the software.

3.2.11.2 Establishing Data Exchange with the PC

Connect the device to the PC using the USB cable. If the device is powered on, it will automatically turn off and switch to read/charging mode. To enter data exchange mode, launch the **POSHUK READER SW** (via the desktop shortcut or the Start menu). The login window will appear, containing the following fields (see Figure 33):

- **Language –** selects the interface language of the software;
- **COM Port –** selects the COM port to which the device is connected.

Note. The COM port number is detected automatically. However, if the device was connected after **POSHUK READER SW** was launched, you must trigger COM-port detection manually by clicking the rectangle to the right of the dropdown list. After successful detection, the field will display: "**ST Microelectronics Virtual COM Port**", indicating that the system has automatically detected the COM port.

You can also find the COM port number via Device Manager. To do this, search for Device Manager in the **Windows** search field, then go to the Ports (COM & LPT) section and find **"ST Microelectronics Virtual COM Port".** The COM port number (COM__) listed next to this device is used to select the correct COM port in the **POSHUK READER SW** login window.

After selecting the parameters, click **Apply**. If all data is entered correctly, the Settings tab of **POSHUK READER SW** will open.

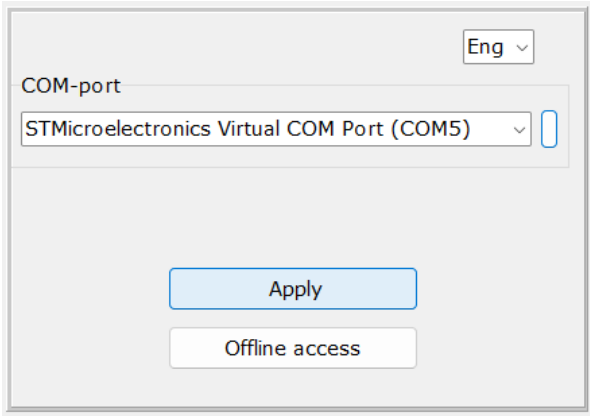


Figure 33 – **POSHUK READER SW** Login Window

3.2.11.3 Reading Events

To read events from the device, open the **Events** tab (see Figure 34).

In the upper-left corner of the **Events** tab, the factory serial number of the connected device is displayed in the format: "Serial No. XXXXXXXX", where XXXXXXXX is the unique serial number of the currently connected device.

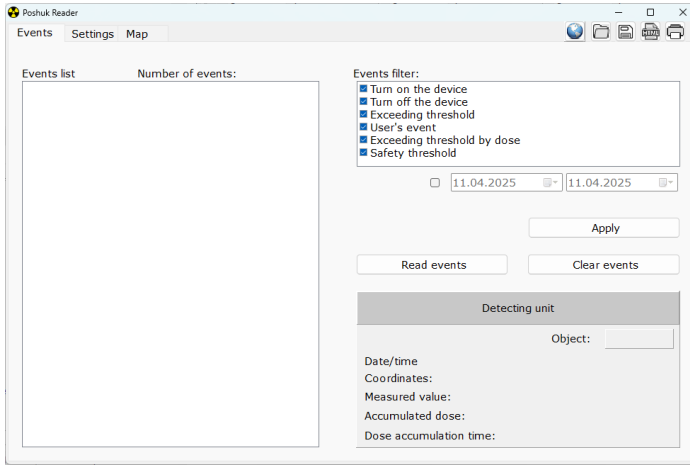


Figure 34 – "**Events**" Tab

This tab also contains the following fields:

• **Event List –** this field the list of events downloaded from the device after reading (see Figure 35);

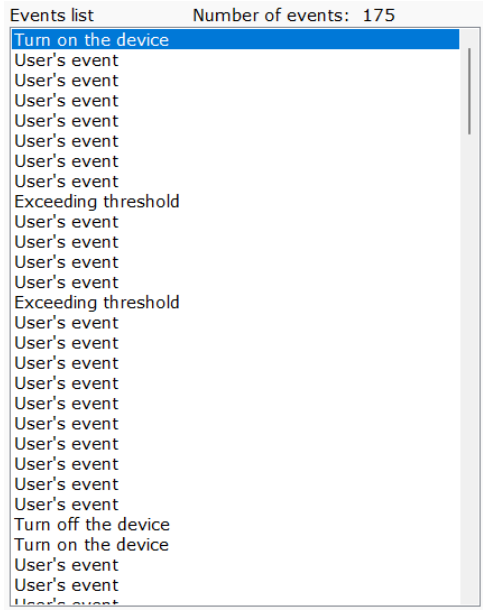


Figure 35 – **Event List** Field

• **Event Filter –** this field allows selection of event types and date ranges for events to be displayed in the list (see Figure 36).

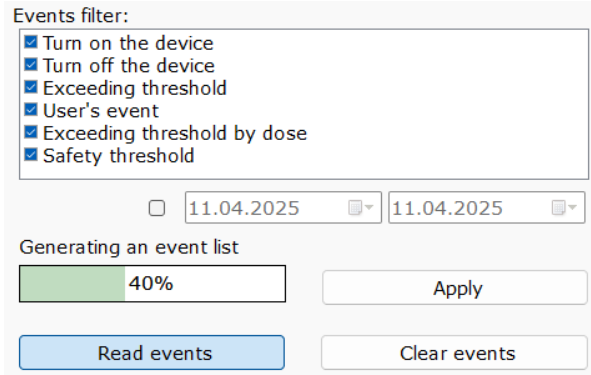


Figure 36 – **Event Filter** Field

To read all events stored in the device memory, click **"Read Events"** (see Figure 36).

IMPORTANT! If not all event types are selected in the **Event Filter**, only the selected types will appear in the **Event List**.

3.2.11.4 Working with Read Events

After successfully reading events from the device, they are displayed in the **Event List** field of the **Events** tab. The total number of events in the list is shown above the list (see Figure 37).

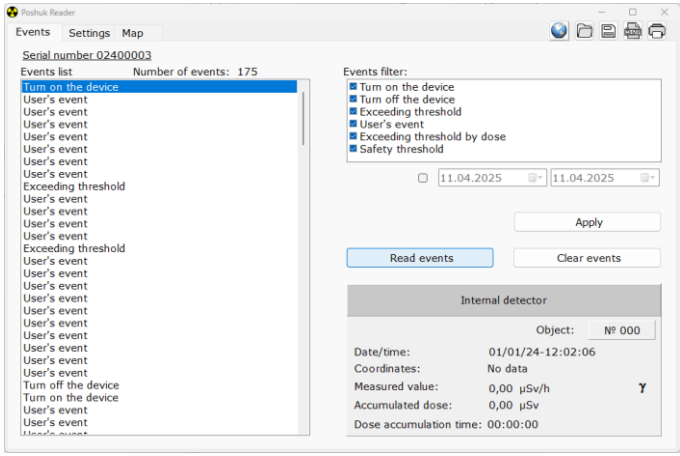


Figure 37 – Read Events Display

Select the required event in the **Event List** field. Detailed information for this event is shown on the right side of the window, under the **Event Filter** field (see Figure 38).

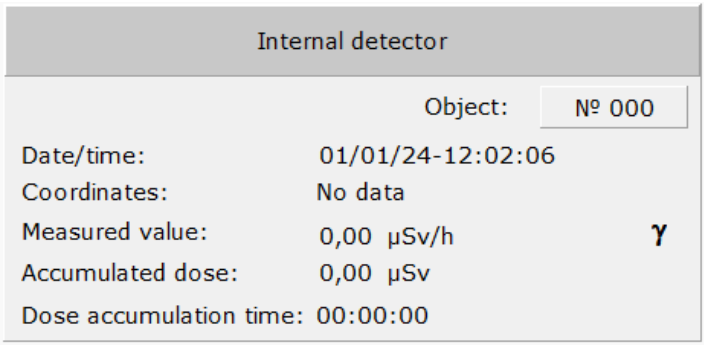


Figure 38 – Event Extended Information Field

This field contains the following information:

1) Detector:
- Built-in detector
- BDPA-07M unit
- BDIB-07M unit
- BDBG-07M-01 unit
- BDPN-07M unit
- BDBG-07M-02 unit.

2) Assigned survey object number (up to 999 objects)
3) Date and time when the event was stored in memory
4) Coordinates of the event used for displaying the event on the map
5) Measured radiation rate quantity with its corresponding units (µSv/h, mSv/h, Sv/h, µGy/h, mGy/h, Gy/h, 1/(cm²·min), 10^3/(cm²·min), Bq/cm², kBq/cm², cps, Kcps), and the type of radiation (alpha, beta, gamma, neutrons)
6) Accumulated dose (µSv/h, mSv/h, Sv/h, µGy/h, mGy/h, Gy/h)
7) Dose accumulation time.

If necessary, you can filter the events: in the **Event Filter** field, tick the checkboxes next to the event types you want to display in the **Event List**.

You can also specify a time interval to display events created within this period. To do this, tick the “from” and “to” checkboxes and set the required time range (see Figure 39).

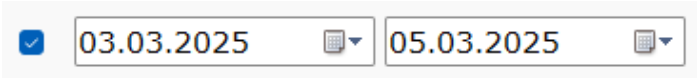


Figure 39 – Setting Time Interval

After selecting event types and/or a time interval, click **Apply** to display events according to the selected parameters.

The **Clear Events** button is used to delete all events from the device memory.

IMPORTANT! If events have not been saved to the PC hard drive (or a removable drive), they cannot be restored after being deleted from the device memory.

In the upper-right corner of the **Events** tab, the following event buttons are available:

– Save all events to the PC's hard drive in .dat format. The filename is generated automatically and consists of the prefix DT (Data File) and the date/time of creation. The event file contains all events read from the device, including those currently hidden by filters (see Figure 40).

Figure 40 – Saved Event File

- Load saved events from the PC's hard drive;
- Save all events to an .html file on the PC hard;
- Print a report (see Figure 41);

Serial number 02400003

11.04.2025 13:47:22

№	Events	Detecting unit	Object	Date/time	Coordinates	Measured value	Radiation identification	Dose	Dose time
1	Turn on the device	Internal	000	01/01/24 12:02:06	No data	0,00 μSv/h	gamma	0,00 μSv	00:00:00
2	User's event	Internal	000	01/01/24 12:02:07	No data	0,00 μSv/h	gamma	0,00 μSv	00:00:00
3	User's event	Internal	000	01/01/24 12:02:22	No data	0,00 μSv/h	gamma	0,00 μSv	00:00:15
4	User's event	Internal	000	01/01/24 12:02:36	No data	0,00 μSv/h	gamma	0,00 μSv	00:00:30
5	User's event	Internal	000	01/01/24 12:02:51	No data	0,00 μSv/h	gamma	0,00 μSv	00:00:44
6	User's event	Internal	000	01/01/24 12:03:06	No data	0,01 μSv/h	gamma	0,00 μSv	00:00:59
7	User's event	Internal	000	01/01/24 12:03:20	No data	0,01 μSv/h	gamma	0,00 μSv	00:01:14
8	User's event	Internal	000	01/01/24 12:03:35	No data	0,01 μSv/h	gamma	0,00 μSv	00:01:28
9	Exceeding threshold	BDIB-07M	000	01/01/24 12:03:45	No data	3,01 KBk/cm²	beta	0,00 μSv	00:01:38
10	User's event	BDIB-07M	000	01/01/24 12:03:50	No data	4,95 KBk/cm²	beta	0,00 μSv	00:01:43
11	User's event	Internal	000	01/01/24 12:04:04	No data	0,01 μSv/h	gamma	0,00 μSv	00:01:58
12	User's event	Internal	000	01/01/24 12:04:19	No data	0,01 μSv/h	gamma	0,00 μSv	00:02:12
13	User's event	Internal	000	01/01/24 12:04:34	No data	0,01 μSv/h	gamma	0,00 μSv	00:02:27
14	Exceeding threshold	BDIB-07M	000	01/01/24 12:04:47	No data	13,87 Bk/cm²	beta	0,00 μSv	00:02:41
15	User's event	BDIB-07M	000	01/01/24 12:04:48	No data	13,87 Bk/cm²	beta	0,00 μSv	00:02:41

Figure 41 – Generated Report in .pdf Format

 - Show event on the map according to the coordinates where it was recorded (if coordinates are available) (see Figure 42).

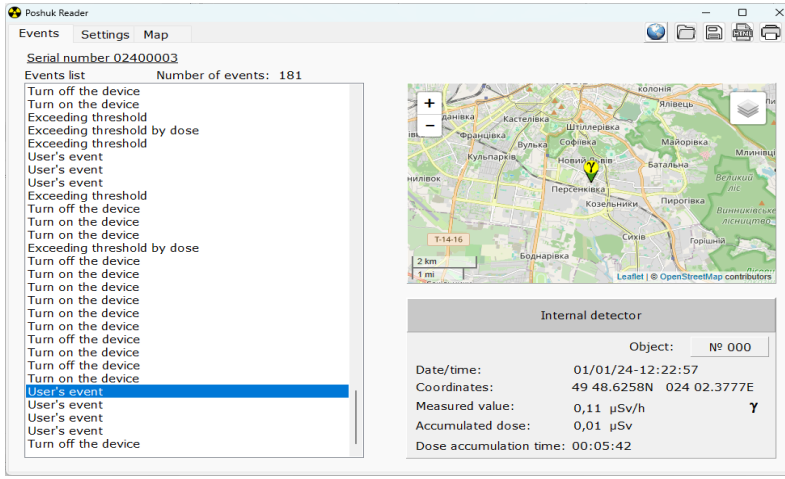


Figure 42 – Showing Event on the Map

3.2.11.5 Settings

The **Settings** tab allows you to configure device parameters (see Figure 43).

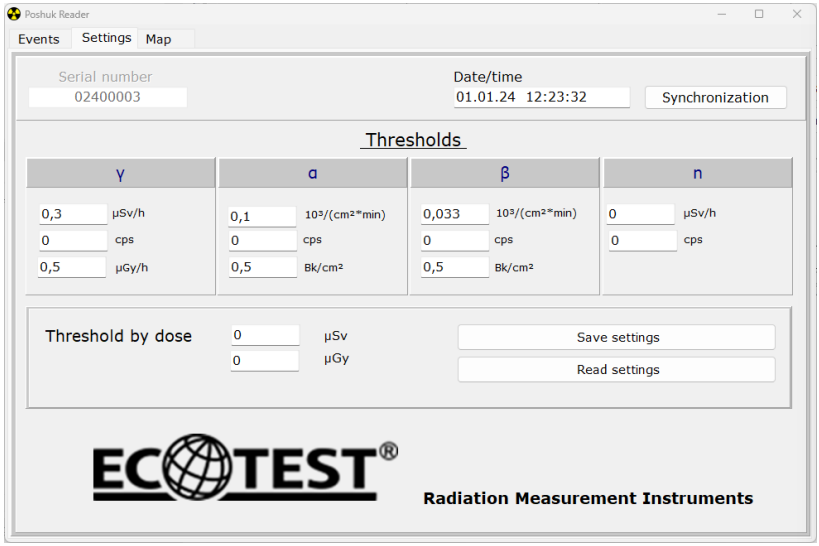


Figure 43 – Settings Tab

The **Settings** tab contains the following fields:

• **Ser. Number –** this field displays the unique factory number of the connected device;

• **Date/Time** – this field allows you to enter the current date and time or press the **Sync** button to read the system time from the PC;

• **Gamma Radiation Thresholds** – this field allows you to set the alarm thresholds for gamma radiation (µSv/h, cps, µGy/h);

• **Alpha Radiation Thresholds** – this field allows you to set the alarm thresholds for alpha radiation (10^3/(cm²·min), cps, Bq/cm²);

• **Beta Radiation Thresholds** – this field allows you to set the alarm thresholds for beta radiation (10^3/(cm²·min), cps, Bq/cm²);

• **Neutron Radiation Thresholds** – this field allows you to set the alarm thresholds for neutron radiation (µSv/h, cps);

• **Dose Thresholds** – these fields allow you to set the alarm thresholds for accumulated dose (µSv, µGy).

After entering the required values, click **Save Settings** to write the updated parameters to the device memory.

3.2.11.6 Map

The **Map** tab allows you to view all the points loaded during the last reading session, according to the coordinates where they were recorded (see Figure 44).

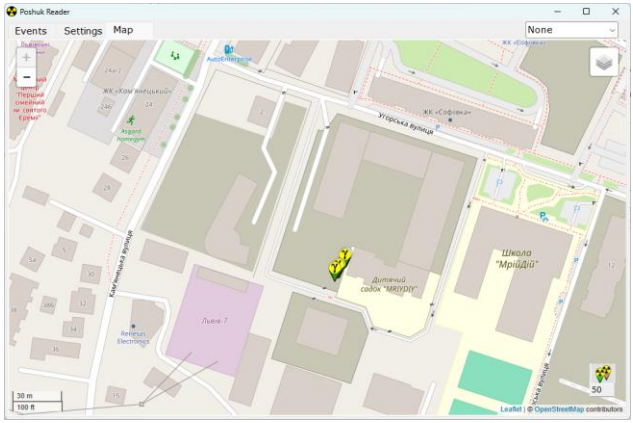


Figure 44 – Map Tab

IMPORTANT! Markers are displayed on the map starting from the currently selected event in the **Event List**. To display all events on the map, select the first event in the **Event List**.

The following marker types are displayed on the map depending on the event:

- Device powered on;
- Device powered off;
- Gamma radiation threshold exceeded;
- Beta radiation threshold exceeded;
- Alpha radiation threshold exceeded;
- Neutron radiation threshold exceeded;
- Gamma safety threshold exceeded with remote detecting unit connected;
- DE exceeded;

- User event for gamma radiation;

- User event for beta radiation;

- User event for alpha radiation;

- User event for neutron radiation.

When you click a marker, a window appears with detailed information about the event (see Figure 45), including: survey object number, measurement date and time, measured value at that point, accumulated dose, and dose accumulation time.

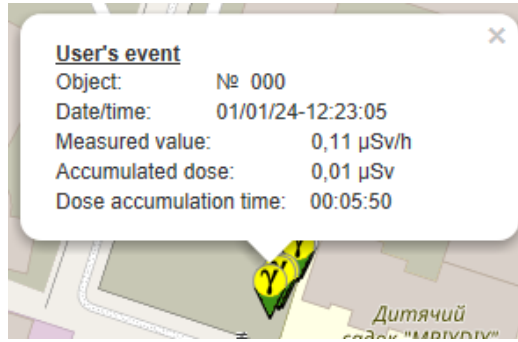


Figure 45 – Extended Event Information Field

In the upper-right corner, there is a dropdown list with saved object numbers (see Figure 46). Selecting an object groups all measurement points belonging to that object on the map, allowing you to see the coverage area of the survey (see Figure 47).

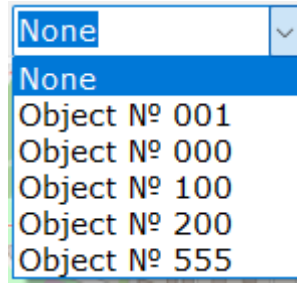


Figure 46 – Dropdown List Box

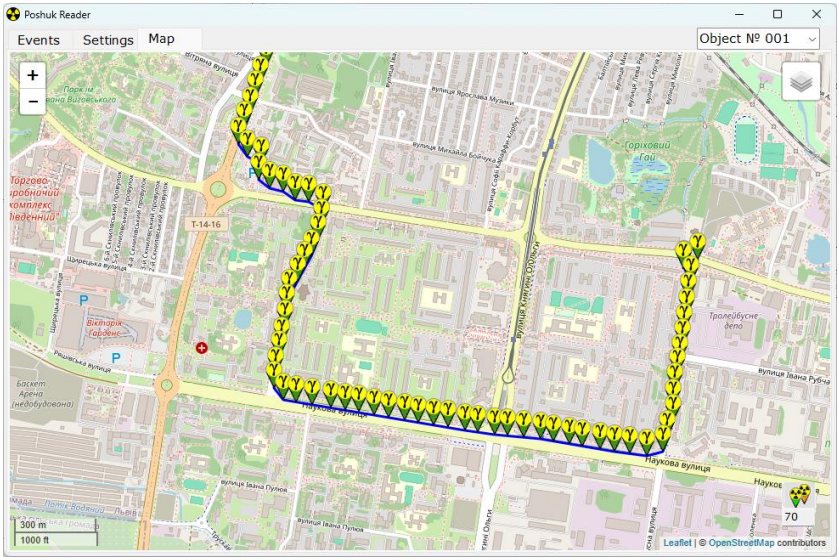


Figure 47 – Map Tab

For working with the map **offline** (without an Internet connection), you can switch to a user-defined map. In the map layer selection menu in the upper-right corner, select **“User map”**.

 - Map Layer Selection Menu.

There is also an option in the lower-right corner to **limit the number of markers** displayed on the map for performance optimization.

- Marker Display Limit Menu (default setting: 50 markers).

3.2.11.7 Offline Mode

The device supports offline mode for working with saved data on the PC without the device connected. In this mode, all main functions for viewing events, viewing the device settings as of the last reading, generating reports, and viewing data on the map are available.

To start offline mode, click “**Offline Mode**” button in the **POSHUK READER SW** login window (see Figure 48).

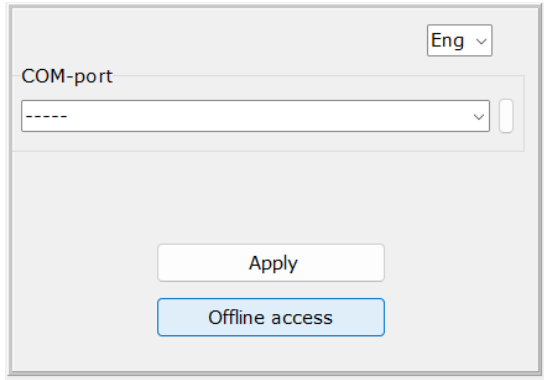


Figure 48 – **POSHUK READER** Login Window

Operation of **POSHUK READER SW** in offline mode is identical to operation in device read/program mode, **except** that reading events from the device, and programming device thresholds are **not available**.

4 TECHNICAL MAINTENANCE

4.1 General Instructions

The list of technical maintenance (TM) operations for the device, their sequence, and specific features at different operational stages are provided in Table 4.1.

Table 4.1 – List of Technical Maintenance Operations

Operations	Type of Technical Maintenance			Section of OM
	During operation		During long-term storage	
	daily	periodic		
External inspection	+	+	+	4.3.1
Delivery kit check	-	+	+	4.3.2
Functionality check	+	+	+	4.3.3
Power source (battery) status check	+	+	+	4.3.4
Device verification	-	+	+	4.4

Note 1. A “plus” sign (+) in the table indicates that the corresponding operation is performed during this type of maintenance; a “minus” sign (–) indicates that the operation is not performed.
Note 2. Devices are subject to verification during operation and after repair.

4.2 Safety Measures

Safety measures during TM fully correspond to the safety measures outlined in section 2.2 of this OM.

4.3 Technical Maintenance Procedure

4.3.1 External Inspection

Perform an external inspection of the device in the following order:

a) Check the condition of the device surfaces, the integrity of seals, and the absence of scratches, corrosion, or coating damage;

b) Check the condition of the USB connector contacts.

c) Check the protective gaskets of the BDPA-07M and BDIB-07M units for integrity.

If any damage is detected, replace the protective gasket assemblies in accordance with the recommendations shown in Figure 49:

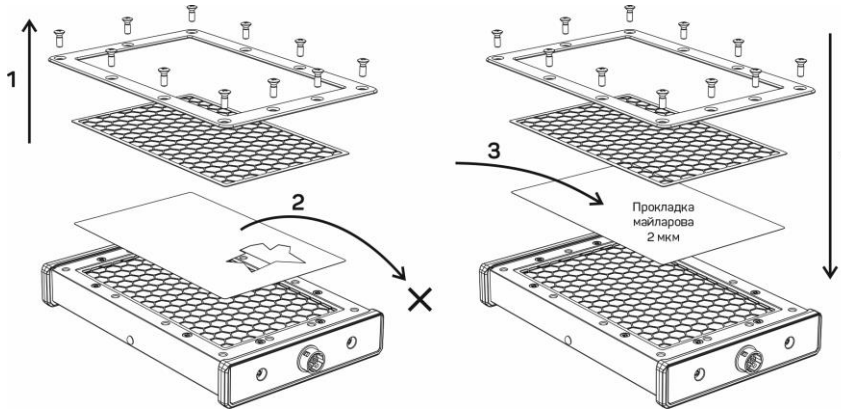


Figure 49.1 - Replacing the protective gasket with a grid for BDPA-07M from the spare parts kit BICT.412913.010

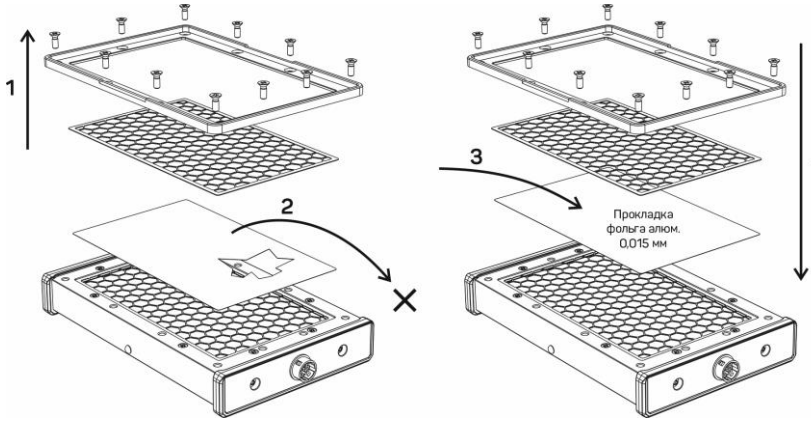


Figure 49.2 - Replacing the protective gasket with a grid for BDIB-07M from the spare parts kit BICT.412913.010-01

4.3.2 Delivery Kit Completeness Check

Verify the device delivery kit in accordance with Table 1.7.

4.3.3 Functionality Check

4.3.3.1 The functionality check and its procedure are performed according to section 2.5 of this OM.

4.3.4 Power Source Disconnection

The power source must be disconnected before placing the device into long-term storage. Proceed as follows:

- Turn off the device;
- Remove the battery compartment cover;
- Remove the battery from the compartment;
- Inspect the compartment, check contact integrity, clean the compartment from contamination and remove any oxidation from the contacts;
- Make sure there is no moisture, salt stains on the surface of the batteries, or damage to the insulation.

4.4 Verification

4.4.1 The device is subject to verification during operation (periodic verification at least once per year) and after repair. Verification is performed in accordance with procedures defined by regulatory acts of the central executive authority responsible for national policy in the field of metrology and metrological activity, or in accordance with applicable national standards.

4.4.2 Presentation of Verification Results

4.4.2.1 Satisfactory results of periodic verification and verification after repair are confirmed by issuing a verification certificate for the legally regulated measuring instrument and recorded in the tables of Appendix B.

4.4.2.2 If the device is found unfit for use as a result of verification, a certificate of non-conformity is issued.

5 CERTIFICATE OF ACCEPTANCE

The MKS-07M “POSHUK” Search Dosimeter-Radiometer, model BICT.412129.044, consisting of:

MKS-07 "POSHUK" Control Unit, factory number _____

BDBG-07M-01 Unit, factory number _____

BDBG-07M-02 Unit, factory number _____

BDIB-07M Unit, factory number _____

BDPA-07M Unit, factory number _____

BDPN-07M Unit, factory number _____

complies with the technical specifications and is deemed fit for use.

Date issued _____

QCD Representative:

Seal here

_____

(signature)

6 PACKING CERTIFICATE

The MKS-07M “POSHUK” Search Dosimeter-Radiometer, model BICT.412129.044, consisting of:

MKS-07 "POSHUK" Control Unit, serial number _____

BDBG-07M-01 Unit, factory number _____

BDBG-07M-02 Unit, factory number _____

BDIB-07M Unit, factory number _____

BDPA-07M Unit, factory number _____

BDPN-07M Unit, factory number _____

has been packaged at the Private Enterprise “SPPE “Sparing-Vist Center”.

Packaging date_____

Seal here

Packaged by_____
(signature)

Packed product accepted by _____
(signature)

7 WARRANTY

7.1 The manufacturer guarantees that the device complies with the specified requirements, provided that the user observes the operating, transportation, and storage conditions specified in the Operating Manual BICT.412129.044.

7.2 The warranty period of operation is 24 months from the date the device is put into operation or from the end of the warranty storage period.

7.3 The warranty storage period is 6 months from the date of manufacture, in accordance with the recommendations of DSTU 7216:2011 standard.

7.4 The warranty period of operation is extended by the time during which the device was undergoing warranty repair.

7.5 After the warranty period, repair is carried out under separate agreements.

7.6 Warranty and post-warranty repair is carried out only by the manufacturer.

7.7 In case of mechanical damage or broken seals, repair is performed at the user's expense.

7.8 Failure of the battery elements after their own warranty period has expired is not grounds for a claim.

8 DEVICE REPAIR

8.1 The device is repaired by the manufacturer at the following address:

Private Enterprise
“SPPE “Sparing-Vist Center”
79026, Ukraine, Lviv, Volodymyra Velykoho St., 33
Tel.: (032) 242-15-15, Fax: (032) 242-20-15.

8.2 All claims received are recorded in Table 8.1.

Table 8.1

Date of Failure	Short Description of the Claim	Actions Taken According to the Claim	Notes

8.3 Warranty and post-warranty repair is carried out only by the manufacturer. Information about device repair is recorded in the table of Appendix D.

9 TRANSPORTATION AND STORAGE

9.1 Transportation

9.1.1 The transportation conditions for the devices comply with GOST 15150-69 recommendations.

9.1.1.1 In terms of the effect of climatic factors, the transportation conditions correspond to group 4 (Ж2) as per GOST 15150-69 recommendations. The devices withstand transportation by rail, air, sea, or road over any distance in the manufacturer's packaging under the following conditions:

- By rail – in clean, closed carriages;
- By air – in pressurized compartments;
- By sea – in dry holds;
- By road – in closed vehicles.

9.1.2 The arrangement and securing of the devices in the transport packaging must ensure a stable position that prevents shifting and impacts between devices and against the walls of the transport vehicle.

9.1.3 No more than five devices may be transported in the manufacturer's packaging. Stacking of devices shall be vertical.

9.2 Storage

9.2.1 Devices in the manufacturer's packaging must be stored indoors at an ambient temperature between +5°C and +40°C and relative humidity up to 80 % at +25°C.

9.2.2 Devices without the manufacturer's packaging must be stored indoors at an ambient temperature between +10°C and +35°C and relative humidity up to 80% at +25°C.

9.2.3 The content of dust, acid vapours, alkalis, aggressive gases, and other harmful impurities that cause corrosion in the rooms where the devices are stored must not exceed the levels of corrosion-active elements specified for Atmosphere Type 1 in accordance with GOST 15150-69 recommendations.

9.2.4 The arrangement of devices in warehouses and storage facilities must ensure free movement and access to the devices.

9.2.5 The distance between the devices and the walls and floor of the warehouse or storage facility must be at least 1 m. The distance between heating devices and the devices must be at least 0.5 m.

9.2.6 Storage information is recorded in Appendix E.

Information about movement and assignment of the device during operation, work log, and inspection results is recorded in Appendices F, G, and H, respectively.

10 DISPOSAL INFORMATION

Disposal of the device shall be carried out in accordance with the Ukrainian laws “On Environmental Protection” and “On Waste Management”, following the approved methods and rules: Metals – for recycling (melting), Plastic parts – for disposal (landfill).

Disposal of the device does not pose a hazard to service personnel or the environment.

Note. If the device is contaminated with liquid or bulk substances containing radionuclides and cannot be fully decontaminated, it is subject to disposal as solid radioactive waste at UkrDO “Radon” enterprises in accordance with NRBU-97 regulations.

APPENDIX A

INFORMATION ON PRESERVATION AND DE-PRESERVATION OF THE DEVICE DURING OPERATION

Preservation Date	Preservation Method	De-preservation Date	Name or Designation of the Enterprise that Performed Preservation or De-preservation	Date, Position, and Signature of the Responsible Person

APPENDIX B

RECORD OF MALFUNCTIONS DURING OPERATION

Date and Time of Failure. Operating Mode	Malfunction Description (External Manifestation)	Cause of Malfunction, Operating Hours of the Failed Element	Corrective Actions Taken and Note on Claim Submission	Position, Name, and Signature of the Responsible Person	Notes

APPENDIX C

PERIODIC VERIFICATION OF MAIN TECHNICAL SPECIFICATIONS

Table C.1

Verified Characteristic		Measurement Date			
		20		20	
Name	Value According to Technical Specifications	Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)
1 Relative main error of the device when measuring DER of photon ionizing radiation greater than 1 μSv/h, calibrated using ^{137}Cs with a confidence probability of 0.95, in %	15				

Measurement Date					
20		20		20	
Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)

Table C.1 (continued)

Verified Characteristic		Measurement Date			
		20		20	
Name	Value According to Technical Specifications	Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)
2 Relative main error of the device when measuring DE of photon ionizing radiation with the control unit, calibrated using ^{137}Cs with a confidence probability of 0.95, in %	15				

Measurement Date					
20		20		20	
Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)

Table C.1 (continued)

Verified Characteristic		Measurement Date			
		20		20	
Name	Value According to Technical Specifications	Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)
3 Relative main error of the device when measuring DER of photon ionizing radiation with the BDBG-07M-01 unit, calibrated using ^{137}Cs with a confidence probability of 0.95, in %	15				

Measurement Date					
20		20		20	
Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)

Table C.1 (continued)

Verified Characteristic		Measurement Date			
		20		20	
Name	Value According to Technical Specifications	Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)
4 Relative main error of the device when measuring DER of photon ionizing radiation with the BDBG-07M-02 unit, calibrated using ^{137}Cs with a confidence probability of 0.95, in %	15				

Measurement Date					
20		20		20	
Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)

Table C.1 (continued)

Verified Characteristic		Measurement Date			
		20		20	
Name	Value According to Technical Specifications	Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)
5 Relative main error of the device when measuring the surface flux density of beta particles with the BDIB-07M unit, calibrated using $^{90}Sr/^{90}Y$ with a confidence probability of 0.95, in %	20				

Measurement Date					
20		20		20	
Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)

Table C.1 (continued)

Verified Characteristic		Measurement Date			
		20		20	
Name	Value According to Technical Specifications	Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)
6 Relative main error of the device when measuring the surface activity of beta-emitting radionuclides with the BDIB-07M unit, calibrated using $^{90}Sr/^{90}Y$ with a confidence probability of 0.95 from C0-type sources, in %	20				

Measurement Date					
20		20		20	
Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)

Table C.1 (continued)

Verified Characteristic		Measurement Date			
		20		20	
Name	Value According to Technical Specifications	Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)
7 Relative main error of the device when measuring the surface flux density of alpha particles with the BDPA-07M unit, calibrated using ^{239}Pu with a confidence probability of 0.95, in %	20				

Measurement Date					
20		20		20	
Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)

Table C.1 (continued)

Verified Characteristic		Measurement Date			
		20		20	
Name	Value According to Technical Specifications	Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)
8 Relative main error of the device when measuring the surface activity of alpha-emitting radionuclides with the BDPA-07M unit, calibrated using ^{239}Pu with a confidence probability of 0.95 from P9-type sources, in %	20				

Measurement Date					
20		20		20	
Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)

Table C.1 (continued)

Verified Characteristic		Measurement Date			
		20		20	
Name	Value According to Technical Specifications	Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)
9 Relative main error of the device when measuring the DER of neutron radiation with the BDPN-07M unit, with a confidence probability of 0.95, in %	30				

Measurement Date					
20		20		20	
Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)	Actual Value	Measured by (position, signature)

APPENDIX D

RECORD OF DEVICE REPAIRS

Name and Designation of the Device Component	Grounds for Sending for Repair	Date		Name of the Repair Organization	Number of Working Hours Before Repair	Type of Repair	Description of the Repair Work	Position, Name, and Signature of the Responsible Person	
		of Receipt for Repair	of Return from Repair					who performed the repair	who accepted after repair

APPENDIX E

STORAGE RECORD

Date		Storage Conditions	Position, Name, and Signature of the Responsible Person
of Storage	of Removal from Storage		

APPENDIX F

RECORD OF DEVICE MOVEMENT AND ASSIGNMENT DURING OPERATION

Device Movement During Operation

Table F.1

Received		Position, Name, and Signature of the Responsible Person for receiving	Sent		Position, Name, and Signature of the Responsible Person for sending
From	Number and Date		To	Order Number and Date	

Record of device assignment during operation

Table F.2

Position	Name of the Responsible Person for Operation	Order Number and Date		Signature of the Responsible Person
		on Appointment	on Cancellation	

APPENDIX G

WORK LOG

Table G.1

Date	Purpose of Powering On for Operation	Power-On Time	Power-Off Time	Duration of Operation

Calendar Work Log

Table G.2

Months	Annual Summary Record								
	20			20			20		
	Number of hours	Total	Signed	Number of hours	Total	Signed	Number of hours	Total	Signed

APPENDIX H

RECORD OF INSPECTION AND VERIFICATION RESULTS BY INSPECTORS AND VERIFIERS

Date	Type of Inspection or Verification	Inspection or Verification Result	Position, Name, and Signature of the Verifier	Note