

**MKS-05 “TERRA-P+”
DOSIMETER-RADIOMETER**

Operating manual

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This operating manual (OM) provides comprehensive information on the MKS-05 “TERRA-P+” dosimeter-radiometer, including its operating principles and usage procedures. It contains all necessary details to fully utilize the device's technical capabilities and ensure correct operation.

The MKS-05 “TERRA-P+” dosimeter-radiometer is calibrated on standard sources of ionizing radiation after production.

GENERAL INFORMATION

Ionizing radiation is a natural phenomenon permanently existing in the environment. Radiation background of the Earth and the space adversely affects us on the regular basis. We are constantly influenced by natural radioactive materials stored in soil and construction materials of the buildings we live and work in. It also happens that more and more frequently we are exposed to the radioactive influence of specific life activities, for example, certain medical procedures, smoking etc. To say nothing of the impact of radioactive sources of artificial origin produced by Chernobyl Fallout that caused contamination of the vast territories. Therefore not only natural ionizing radiation but also Chernobyl Atomic Power-Station Disaster component that gets into human organism with agricultural products, grown on the polluted territories, berries and mushrooms, makes a great impact on people.

Ionizing radiation is primarily X-ray, gamma, beta, alpha and neutron radiation.

X-ray and gamma radiation is transmitted as energy waves, similar to the transmission of sunlight and sun warmth. X-ray and gamma radiation have similar nature. They differ only in their origin and wavelength.

Normally, humans are influenced by X-rays emanated by electronic apparatuses used in hospitals.

Gamma rays are radiated by unstable radioactive isotopes.

X-ray and gamma radiation is characterized by deep permeability into human organism, which is dependent on the energy of the rays. Gamma radiation permeability is so high that it can be hindered only by the thick lead or concrete plates.

Alpha radiation is a flow of nucleuses of helium. It has small permeability and can be hindered, for example, simply by a piece of paper. Therefore it is not hazardous until radioactive materials emanating alpha particles get into human organism either through open wound, or with food and air.

Beta radiation is a flow of electrons. Beta radiation obtains higher permeability and penetrates organism tissues at the depth of 1-2 cm.

Neutron radiation is a flow of neutrons originating from the process of nuclear fission in the reactors, or as a result of spontaneous division in the nuclear materials. Since neutrons are electroneutral particles they deeply penetrate any substance, including living tissues.

However, because people are more often exposed to gamma and beta radiation in everyday life, the majority of radiation monitoring devices measure exactly these kinds of radiation. As a matter of fact, the MKS-05 “TERRA-P+” dosimeter-radiometer, designed on the base of the modern professional dosimeter-radiometer MKS-05 “TERRA” exported into different countries and remaining an equipment choice for the Ukrainian force structures, serves to prevent gamma and beta radiation hazard.

The OM contains the following abbreviations and symbols:

- | | |
|-----------|---|
| DE | - ambient dose equivalent; |
| DER | - ambient dose equivalent rate; |
| MODE | - on/off button and switch between the corresponding modes of measurement and indication (gamma radiation DER, gamma radiation DE, surface beta particle flux density, DE accumulation time and real time); |
| THRESHOLD | - button of threshold levels programming and correction of clock and turning on the scale backlight. |

Note. Ambient dose equivalent (expressed in “Sieverts” (“Sv”)) characterizes the influence of ionizing gamma radiation on the biological object (human), as opposed to exposure dose (expressed in “Roentgens (“R”)”) that characterizes the capacity of gamma radiation to ionize the air. Generally, to make it simple, use the coefficient circa 100 to covert ambient dose equivalent units into exposure dose units: $1.0 \mu\text{Sv} \approx 100.0 \mu\text{R}$.

Dose rate conversion, correspondingly: $1.0 \mu\text{Sv/h} \approx 100.0 \mu\text{R /h}$.

Natural radiation background normally equals circa $0.1 \mu\text{Sv/h}$ ($\approx 10 \mu\text{R /h}$).

1 DESCRIPTION AND OPERATION

1.1 Purpose of use

The MKS-05 “TERRA-P+” dosimeter-radiometer (hereinafter called the dosimeter) is designed to measure ambient dose equivalent (DE) and ambient dose equivalent rate (DER) of gamma and X-ray radiation (hereinafter – photon ionizing radiation), as well as surface flux density of beta particles.

The dosimeter is used to monitor the radiation purity of residential premises, buildings and structures, household items, clothing, soil surface on household plots, vehicles, as well as visual aids for educational establishments.

1.2 Technical specifications

1.2.1 Key specifications are presented in Table 1.1.

Table 1.1 – Key specifications

Name	Unit of measurement	Standardized values according to technical specifications
1	2	3
Measurement range of photon ionizing radiation DER	$\mu\text{Sv/h}$	from 0.1 to 5×10^3
Main relative permissible error limit of photon ionizing radiation DER measurement with confidence probability of 0.95: - in the range from 0.1 $\mu\text{Sv/h}$ to 1.0 $\mu\text{Sv/h}$ - in the range from 1.0 $\mu\text{Sv/h}$ (inclusive) to $5 \times 10^3 \mu\text{Sv/h}$	%	$15 + 2/M$, where M is a dimensionless quantity numerically equal to the value of the measured DER in $\mu\text{Sv/h}$ 15

Table 1.1 (continued)

1	2	3
Measurement range of photon ionizing radiation DE	mSv	from 0,1 to 1×10^7
Main relative permissible error limit of photon ionizing radiation DE measurement with confidence probability of 0.95	%	± 25
Energy range of detected photon ionizing radiation	MeV	0.05 – 3.00
Energy dependence of the dosimeter readings at photon ionizing radiation DER and DE measurement in the energy range of 0.05 MeV to 1.25 MeV relative to the energy of 0.662 MeV (^{137}Cs)	%	± 35
Measurement range of surface beta-particles flux density	$\text{cm}^{-2} \cdot \text{min}^{-1}$	from 1×10^1 to 1×10^5

Table 1.1 (continued)

1	2	3
Main relative permissible error limit of beta-particles flux density measurement from a source of ionizing radiation $^{90}\text{Sr}+^{90}\text{Y}$ with a confidence probability of 0.95 by the MKS-05 "TERRA-P+" dosimeter: - in the range from $1 \times 10^1 \text{ cm}^{-2} \cdot \text{min}^{-1}$ to $5 \times 10^1 \text{ cm}^{-2} \cdot \text{min}^{-1}$ - in the range from $5 \times 10^1 \text{ cm}^{-2} \cdot \text{min}^{-1}$ (inclusive) to $1 \times 10^5 \text{ cm}^{-2} \cdot \text{min}^{-1}$	%	$25+200/M$, where M is a dimensionless quantity numerically equal to the value of the measured surface beta particles flux density in $\text{cm}^{-2} \cdot \text{min}^{-1}$ 25
Energy range of detected beta particles	MeV	0.50 – 3.00

Table 1.1 (continued)

1	2	3
Measurement range of DE accumulation time	h	9999
Resolution of DE accumulation time display in the range of 0 to 100 hrs of 100 hrs to 9999 hrs	-	1 min 1 h
Battery life (AAA×2 of 1280 mA·h capacity) under + 20 °C temperature, natural background radiation and switched off backlight of the liquid crystal display (LCD), not more than	h	2000
General operating supply voltage of the dosimeter from two AAA size batteries	V	3.0
Additional permissible error limit during measurement caused by a change in ambient temperature from minus 20 °C to +50 °C for all measured physical quantities	%	5 per each 10 °C deviation from 20 °C

Table 1.1 (continued)

1	2	3
Mean time to failure, not less than	h	6000
Average service life of the dosimeter, not less than	year	6
Average shelf life of the dosimeter, not less than	year	6
Dimensions, not more than	mm	55×26×120
Weight, not more than	kg	0.200

1.2.2 The dosimeter displays the statistical error value of measurement result of photon ionizing radiation DER and surface beta-particles flux density.

1.2.3 The dosimeter measures photon ionizing radiation DER and surface beta-particles flux density until the specified statistical error is gained.

1.2.3.1 The specified statistical error can be programmed by the user or automatically determined by the dosimeter depending on the radiation intensity.

1.2.4 For fast evaluation of photon ionizing radiation DER and surface beta-particles flux density the dosimeter has a ten-segment indicator of instantaneous value.

1.2.5 Threshold alarm system with three independent threshold levels is implemented in the dosimeter:

- photon ionizing radiation DER;
- photon ionizing radiation DE;
- surface beta-particles flux density.

1.2.5.1 Threshold level values of photon ionizing radiation DER in the range of 0 to 9999 $\mu\text{Sv/h}$ with discreteness of 0.01 $\mu\text{Sv/h}$ are programmed in the dosimeter.

1.2.5.2 Threshold level values of photon ionizing radiation DE in the range of 0 to 9999 mSv with discreteness of 0.001 mSv are programmed in the dosimeter.

1.2.5.3 Threshold level values of surface beta-particles flux density in the range of 0 to $9999 \times 10^3 \text{ cm}^{-2} \cdot \text{min}^{-1}$ with discreteness of $0.01 \times 10^3 \text{ cm}^{-2} \cdot \text{min}^{-1}$ are programmed in the dosimeter.

1.2.5.4 The programmed values of the threshold levels are saved in the nonvolatile memory of the dosimeter, and are not changed when the dosimeter is turned on/off or the batteries are replaced.

1.2.6 The dosimeter provides four alarm types about the programmed threshold levels exceeding: audio, vibration, vibration and audio, and visual.

1.2.6.1 The dosimeter sends a two-tone audio signal and/or an intermittent vibration signal when the programmed threshold levels are exceeded.

1.2.6.2 If the programmed threshold levels are exceeded the dosimeter provides visual alarm in the form of a measurement result blinking on the liquid crystal display, and periodic and subsequent (from left to right) highlighting of segments of a sound symbol (4) according to Figure 3.

1.2.7 The dosimeter sends a short one-tone audio signal and/or a short vibration signal if gamma quantum or beta-particle gets to the detector.

1.2.8 The dosimeter stores up to 1200 measurement results of photon ionizing radiation DER or surface beta-particles flux density in its nonvolatile memory. For more convenient identification every measurement result is stored along with a three-digit number of measurement object, as well as with time and date of measurement.

Time and date of measurement is received from the dosimeter clock, while the object number is entered by the user during saving.

1.2.9 The dosimeter has the mode of clock when the current time in hours and minutes, as well as the current date, month and year are displayed on the LCD.

1.2.10 The dosimeter has the mode of alarm clock.

1.2.11 The dosimeter provides indication of low battery status.

1.2.12 The dosimeter performs measurements under the following conditions:

- temperature from $-20\text{ }^{\circ}\text{C}$ to $+50\text{ }^{\circ}\text{C}$;
- relative humidity up to $(95\pm3)\%$ at $+35\text{ }^{\circ}\text{C}$ temperature;
- atmospheric pressure from 84 kPa to 106.7 kPa .

1.3 Delivery kit

1.3.1 The delivery kit of the dosimeter consists of the items and the maintenance documentation presented in Table 1.2.

Table 1.2 - Delivery kit of the dosimeter

Type	Item	Q-ty	Note
BICT.412129.008-08	MKS-05 “TERRA-P+” dosimeter-radiometer		
BICT.412129.006-10 HE	Operating manual	1 copy	
BICT.412915.065-04	Package	1 pc.	
ENERGIZER	Battery of AAA 1.5 V type	2 pcs.	Can be replaced with other types of AAA size 1.5 V batteries. Completed at the consumer's request
	Leather case	1 pc.	The model is not specified

1.4 Design and principle of operation

1.4.1 Design of the dosimeter

The dosimeter is designed as a flat square plastic body with rounded corners.

The dosimeter casing (Figure 1.1) consists of a lower cover (1) and an upper cover (2). In the central part of the upper cover (2), there is a liquid crystal display (3), with two control buttons located to its left and right – THRESHOLD (4) and MODE (5). A speaker (6) is positioned at the top of the upper cover (2).

The battery compartment (1) (Figure 1.1) and the window (3) for surface beta-particles flux density measurement are located in the lower cover (7). The battery compartment (1) and the window (3) are closed with the covers (2) and (4) respectively, both of which are fastened due to the elastic capacities of the material. The filter cover (4) contains the metrological mark (5) showing the mechanical center of the detector.



Figure 1.1 – External view of the dosimeter (top view)

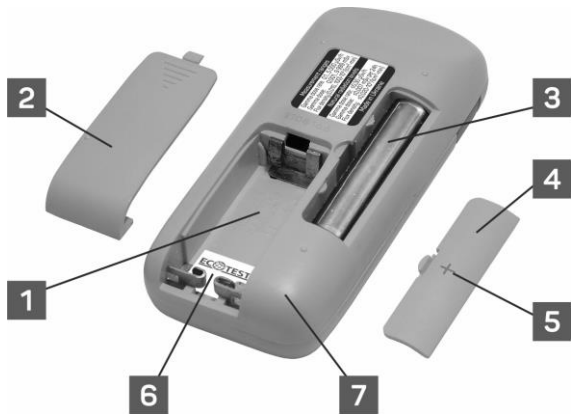


Figure 1.2 – External view of the dosimeter (bottom view)

The control and indication keys of the dosimeter contain the corresponding inscriptions. The information table is drawn on the lower cover (7) of the device. The polarity signs are indicated at the bottom of the battery compartment (1) for proper insertion of batteries.

1.4.2 Basic operation of the dosimeter

The dosimeter is designed as a monoblock, which contains:

- a detector of gamma and beta radiation;
- a printed-circuit board with the circuit of the anode voltage formation, the circuit of digital processing, control and indication;
- batteries.

The gamma and beta radiation detector built on the basis of Geiger-Muller counter, transforms radiation into the sequence of voltage pulses; the number of pulses per unit of time is proportional to the detected radiation intensity.

The circuit of the anode voltage formation and the circuit of digital processing, control and indication ensure:

- generation and regulation of the detector anode voltage;
- scaling and linearization of the detector counting response;
- measurement of photon ionizing radiation DER and surface beta-particles flux density by means of measurement of an average pulse frequency from the detector outlet;
- measurement of photon ionizing radiation DE by means of measurement of a general number of pulses from the detector outlet;
- measurement of DE accumulation time and real time;
- operating modes control;
- measurement results indication.

The power for operation is supplied by two AAA batteries.

1.5 Labeling and sealing

1.5.1 The upper cover of the dosimeter is inscribed with the name, the symbol of the device, the trademark of the producer enterprise, the ingress protection rating of the dosimeter.

The bottom cover bears the serial number and date of manufacture of the dosimeter, the conformity mark, and additional metrological marking.

1.5.2 Sealing is performed by the producer enterprise.

The dosimeter is sealed with a special film seal located in the battery compartment. It covers the screw heads, whereas the screws fasten the lower cover.

Removal of seals and repeated sealing is performed by the company in charge of repair and verification of the dosimeter.

1.6 Packing

The dosimeter kit (the device, the operating manual and the case) is delivered in the cardboard box.

2 PROPER USE

2.1 Operating limitations

Operating limitations are presented in Table 2.1.

Table 2.1 – Operating limitations

Operating limitations	Limitation parameters
1 Ambient air temperature	below - 20 °C above +55 °C
2 Relative humidity	up to 95 % at + 35 °C temperature, non-condensing
3 Photon ionizing radiation influence	DER up to 1.0 Sv/h during 5 min

Note. When operating in dusty environment or during atmospheric precipitations the dosimeter should be placed into a special case.

2.2 Preparation of the dosimeter for operation

2.2.1 Scope and order of external examination

2.2.1.1 Before using the dosimeter, unpack it and check if the delivery kit is complete. Examine for mechanical damages.

2.2.2 Rules and order of examination for operational readiness.

2.2.2.1 Study the operating manual before putting the dosimeter into operation.

2.2.2.2 Open the battery compartment and make sure the two batteries are inserted, connections are reliable, and there is no leakage of salts after durable storage of the dosimeter. In case there is a salt leakage, remove the batteries. Clean them, if possible, or replace, if not. Insert the batteries and close the battery compartment.

2.2.3 Guidelines on switching on and testing the dosimeter

2.2.3.1 Press shortly the MODE button to switch the dosimeter on. The dosimeter sends a short vibration-audio signal. The dosimeter enters the mode of photon ionizing radiation DER measurement, which is shown by “ γ ” symbol and “ $\mu\text{Sv/h}$ ” dimension of the measured quantity.

Note. If the low battery indication appears on the LCD (see 2.3.3.6), replace the batteries.

2.2.3.2 Press shortly the MODE button and make sure the dosimeter has entered the mode of indication of photon ionizing radiation DE accumulated value. “ γ ” symbol and “mSv” dimension of the measured quantity show that the dosimeter is operating in this mode.

2.2.3.3 Press shortly the MODE button and make sure the dosimeter enters the mode of surface beta-particles flux density measurement. “ β ” symbol and “ $\frac{10^3}{(cm^2 \cdot min)}$ ” dimension of the measured quantity show that the dosimeter is operating in this mode.

2.2.3.4 Press and hold (circa 6 seconds) the MODE button until the dosimeter turns off.

2.2.4 List of possible troubles and troubleshooting

2.2.4.1 The list of possible troubles and troubleshooting is presented in Table 2.2.

2.2.4.2 At failure to eliminate the troubles presented in Table 2.2, or at detection of more complicated faults, the dosimeter should be sent for repair to the manufacturer.

Table 2.2 – Possible troubles and troubleshooting

Trouble	Probable cause	Troubleshooting
The dosimeter does not switch on after the MODE button is pressed	1 The batteries are discharged 2 No contact between the batteries and the battery compartment clamps 3 One of the batteries is out of order	1 Replace the batteries 2 Restore the contact between the batteries and the clamps 3 Replace the defected battery
Low battery indication is displayed on the LCD after the batteries have been replaced	1 Poor contact between the batteries and the battery compartment clamps 2 One of the batteries is out of order	1 Clean out the contacts on the clamps and the batteries 2 Replace the defected battery
“Er01” message on the LCD of the dosimeter	Gamma and beta radiation detector is out of order	Send the dosimeter for repair to the manufacturer

2.3 Use of the dosimeter

2.3.1 Safety measures during use of the dosimeter

2.3.1.1 All works with the dosimeter shall be carried out in accordance with the requirements set out in the following documents:

“Radiation Safety Standards of Ukraine” (NRBU-97). State hygienic standards DGN 6.6.1-6.5.001-98.

“Main Sanitary Rules for Ensuring Radiation Safety of Ukraine” (OSPU-2005) DSP 6.177-2005-09-02.

2.3.1.2 Direct use of the dosimeter is not dangerous for the service personnel and is environmentally friendly.

2.3.1.3 The dosimeter contains no external parts exposed to voltages hazardous for life.

2.3.1.4 The dosimeter meets the requirements of DSTU 7237:2011 in terms of protection of people from electric shock according to safety class III in accordance with DSTU EN 60335-1:2017.

A special protective jacket is used to prevent accidental contact with conductive parts.

Ingress protection rating is IP20 under DSTU EN 60529:2018 standard.

2.3.1.5 According to the requirements of fire safety, the dosimeter meets the requirements of the current fire safety regulations and current statutory documents.

2.3.1.6 In case of contamination, the dosimeter should be deactivated. Wipe its surface by a gauze tampon moistened by standard decontaminating agent.

2.3.1.7 Disposal of the dosimeter should be performed in compliance with the general rules, i.e. metal is recycled or melted, and plastic parts are dumped.

2.3.2 Operating modes of the dosimeter

2.3.2.1 Operating modes of the dosimeter

The dosimeter operates within the following modes:

- photon ionizing radiation DER measurement;
- indication of accumulated value of photon ionizing radiation DE;
- surface beta-particles flux density measurement;
- clock;
- alarm clock;
- viewing measurement results stored in the nonvolatile memory.

2.3.2.2 Operating submodes of the dosimeter

Every operating mode of the dosimeter has its submodes.

The mode of photon ionizing radiation DER measurement consists of the following submodes:

- viewing specified statistical error;
- saving measurement results in the nonvolatile memory;
- measurement restart;

- programming new values of audio alarm threshold level and specified statistical error, and switching on/off audio signaling of detected gamma-quanta.

The mode of accumulated value indication of photon ionizing radiation DE consists of the following submodes:

- programming a new value of audio alarm threshold level;
- resetting the values of DE and DE accumulation time.

The mode of surface beta-particles flux density measurement has the following submodes:

- viewing specified statistical error;
- saving measurement results in the nonvolatile memory;
- measurement restart;

programming new values of audio alarm threshold level and specified statistical error, and switching on/off audio signaling of detected gamma quanta and beta particles.

The mode of clock has the submode of time and date correction.

The mode of alarm clock has the submode of programming the time of alarm activation.

The mode of measurement results viewing stored in the nonvolatile memory has the submode of measurement results clearing.

2.3.3 Operation procedure of the dosimeter

2.3.3.1 Dosimeter buttons

The THRESHOLD (4) and the MODE (5) buttons are used to operate the dosimeter (Figure 1).

The MODE button is used to switch on/off the dosimeter and change its operating modes.

The THRESHOLD button is used to change the operating submodes of the dosimeter within one operating mode, as well as to correct the numeric values of the threshold levels and other parameters of the dosimeter operation.

2.3.3.2 Switching the dosimeter on/off

Press shortly the MODE button to switch the dosimeter on. A short vibration-audio signal and symbols displayed on the LCD show that the dosimeter is on.

Press the MODE button once again and hold it pressed for circa six seconds to switch the dosimeter off.

2.3.3.3 General algorithm of the dosimeter operation control

The general algorithm of the dosimeter operation control is carried out in the following way.

After the dosimeter is switched on, it enters the mode of photon ionizing radiation DER measurement, which is shown by “ γ ” symbol and “ $\mu\text{Sv/h}$ ” dimension of the measured quantity. Each short press of the MODE button switches the dosimeter from one mode to another in the following order:

- the mode of photon ionizing radiation DER measurement (it is set as the first one when the dosimeter is switched on);
- the mode of accumulated value indication of photon ionizing radiation DE;
- the mode surface beta-particles flux density measurement;
- the mode of clock;

- the mode of alarm clock;
- the mode of measurement results viewing stored in the nonvolatile memory (if such results exist).

A short or a long press of the THRESHOLD button in any operating mode of the dosimeter changes the submodes of this operating mode. A detailed description of each operating mode of the dosimeter with its submodes is given below.

2.3.3.4 Alarm type change

The dosimeter provides the option to choose between three alarm types: audio, vibration and vibration-audio. Irrespective of the operating mode of the dosimeter a short press of the two buttons at a time (MODE and THRESHOLD) changes the alarm type and activates it for a short time. The alarm type is displayed on the LCD with “AUD” and/or “VIBR” symbols (6) (Figure 3).

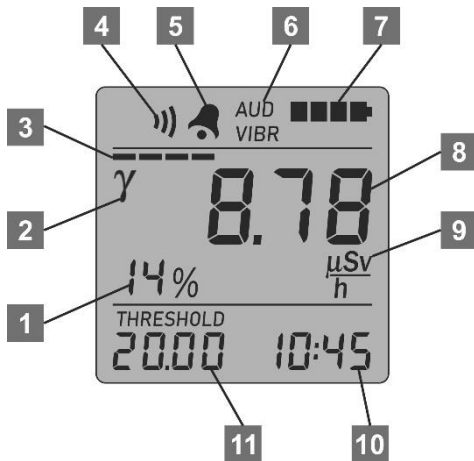


Figure 3 – LCD of the dosimeter
(the mode of photon ionizing radiation DER measurement)

2.3.3.5 LCD backlight control

Each press of any button of the dosimeter activates the LCD backlight for 6 seconds. Press the THRESHOLD button twice (time between presses should not exceed 0.5 s) to turn on a continuous LCD backlight. Press the THRESHOLD button twice once again to turn off a continuous LCD backlight.

2.3.3.6 Batteries status control

Irrespective of the chosen operating mode, the dosimeter carries out a non-stop control of batteries status. The control results are displayed on the LCD with a battery status symbol (7) (Figure 3), which consists of four segments. The number of blinking segments shows the level of batteries discharge. Blinking of three or four segments is accompanied by short audio and/or vibration signals. This means that the batteries should be replaced.

2.3.3.7 The mode of photon ionizing radiation DER measurement

The mode of photon ionizing radiation DER measurement is entered automatically after the dosimeter is switched on. With a short press on the MODE button you can proceed to this mode from any other operating mode.

To measure photon ionizing radiation DER, direct the dosimeter with its metrological mark “+” (5) (Figure 2) towards an examined object. The filter cover (4) should cover the window with the detector located behind it (hereinafter called the window of the detector).

In this mode the dosimeter LCD displays the following information (Figure 3):

- statistical error (1) of the measurement result (8);
- “ γ ” symbol (2) – an indication of the measured radiation type;
- instantaneous value indicator of radiation intensity (3);
- sound symbol (4) (if audio signaling of detected gamma quanta is switched on);

- alarm clock symbol (5) (if the alarm clock is on);
- alarm type symbol (6);
- battery status symbol (7);
- measurement result (8);
- dimension of measurement result (9);
- current time (10);
- threshold level of alarm actuation (11).

As soon as the measurement is started, the measurement results of photon ionizing radiation DER (8) and the statistical error values (1) that correspond to these results begin to be formed on the LCD.

If the DER measurement results exceed the alarm threshold level (11), the dosimeter sends a two-tone audio signal and/or an intermittent vibration signal, which depends on the chosen alarm type. Measurement results start blinking on the LCD of the dosimeter. Periodic and gradual (from left to right) highlighting of the sound symbol segments (4) serves as an indication of the threshold level exceeding as well (Figure 3).

The ten-segment indicator of instantaneous value (3) is used for fast evaluation of photon ionizing radiation intensity. The integration time during measurement of the instantaneous intensity value and the time of information update on the instantaneous value indicator are equal to 500 ms.

The instantaneous intensity value is displayed in pseudo-logarithmic scale. The first segment of the indicator becomes highlighted when the intensity corresponds to 2 cps pulse rate from the Geiger-Muller counter. The greater photon ionizing DER becomes the more scale segments start to be highlighted from left to right. The scale becomes fully highlighted when the intensity equals to 2900 cps pulse count rate from the Geiger-Muller counter. DER is about 1000 $\mu\text{Sv/h}$ in this case.

The sound symbol (4) means that audio signaling of detected gamma quanta is on. If signaling is on, the sound symbol is displayed on the LCD and each detected gamma quantum is followed by a short audio and/or vibration signal, which depends on the chosen alarm type.

Audio signaling of detected gamma quanta is switched on and off in the submode of alarm threshold level programming.

Photon ionizing radiation DER is measured in the following way. As soon as the measurement is started, the LCD of the dosimeter begins to display the measurement results and the statistical error values that correspond to these results. In the process of measurement the statistical error of each next measurement result becomes smaller, and in some time it reaches the specified statistical error. If this error is reached, a part of statistical information starts to be rejected while the measurement process continues. Therefore, all the following measurement results have the statistical error, which is equal to or less than the specified one.

The dosimeter can automatically determine the specified statistical error depending on the radiation intensity (Appendix A). The user can also do that in the submode of alarm threshold level programming. A blinking “%” symbol means that the user determined the statistical error.

If the specified statistical error is determined automatically by the dosimeter, its value is blinking on the LCD until it remains greater than the value of main relative permissible error limit of photon ionizing radiation DER measurement (Table 1.1). If the specified statistical error is determined by the user, its value is blinking on the LCD until it remains greater than the value of the specified statistical error.

While the statistical error value keeps exceeding 99 %, the LCD displays the “■■■%” symbols.

Press the THRESHOLD button in the mode of photon ionizing radiation DER measurement to view the value of the specified statistical error. The value of the specified statistical error is displayed on the LCD (Figure 4) while the THRESHOLD button is being pressed and held down (but not longer than 3 s). A zero value display means that the dosimeter determined the specified statistical error automatically depending on the radiation intensity.

If the THRESHOLD button is being held down for more than three seconds, the LCD displays the “Arch” symbols (Figure 5). Thus it becomes possible to proceed to the submode of measurement result saving in the nonvolatile memory.

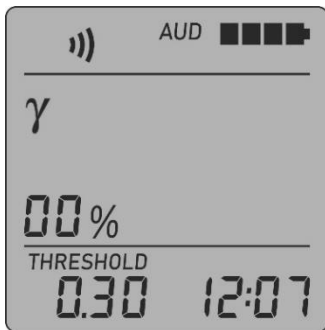


Figure 4 – LCD of the dosimeter
(viewing the value of specified statistical error)



Figure 5 – LCD of the dosimeter (start of the submode of measurement result saving in the nonvolatile memory)

If you keep holding the THRESHOLD button, the “Arch” symbols disappear from the LCD, and the measurement is restarted during the next two seconds (Figure 6).

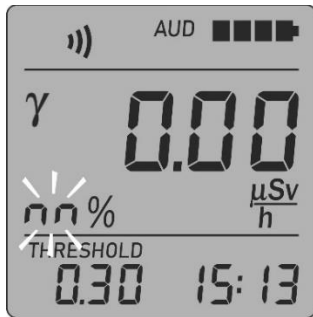


Figure 6 – LCD of the dosimeter (measurement restart)

If you keep holding the THRESHOLD button, then during the next two seconds the dosimeter will proceed to the submode of programming new values of the alarm threshold level and specified statistical error, and switching on/off audio signaling of detected gamma quanta (Figure 7). A stripe (1) “moving” across the instantaneous value indicator and blinking of the low-order digit (2) of a new threshold level serve as an indication of this submode. Then release the THRESHOLD button.

When a digit is blinking, it means that its value can be programmed. Use the THRESHOLD button to set the required value of the blinking digit. Successive short presses and releases of the THRESHOLD button change this value per unit. A long press of the THRESHOLD button starts automatic change of this value, which is stopped after the button is released.

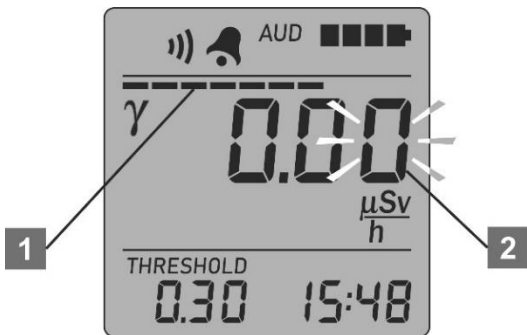


Figure 7 – LCD of the dosimeter
(the submode of alarm threshold level programming)

A short press of the MODE button fixes the value of the digit (it stops blinking) and allows presetting the value of the next digit, which starts blinking at that. Other digits are programmed likewise.

As soon as all digits of the new threshold level are programmed, the LCD of the dosimeter displays the specified statistical error (Figure 8). Its low-order digit is blinking, which means that its value can be programmed. Program the new value of the specified statistical error in a similar way to programming the new value of alarm threshold level. By presetting a zero value, you switch on automatic determination of the specified statistical error by the dosimeter depending on the radiation intensity.

As soon as all digits of the new value of the specified statistical error are programmed, the sound symbol starts blinking on the LCD of the dosimeter. Thus it becomes possible to switch on/off audio and/or vibration signaling of every detected gamma quantum. Successive short presses of the THRESHOLD button switches the alarm on/off. Each press of the THRESHOLD button changes the sound symbol status, and, correspondingly, switches the alarm on or off. The highlighted unblinking sound symbol shows that signaling is on, and the dark one shows that it is off.

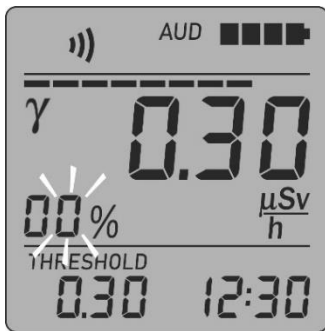


Figure 8 – LCD of the dosimeter
(the submode of alarm threshold level programming)

A short press of the MODE button after audio signaling of every detected gamma quantum has been switched on or off, fixes all programmed values in the nonvolatile memory of the dosimeter. It also finishes the submode of new values programming of the alarm threshold level and specified statistical error, as well as switching on/off audio signaling of detected gamma quanta.

If the programmed values are fixed, a new value of the threshold level blinks three times on the LCD, and the dosimeter returns to the mode of photon ionizing radiation DER measurement.

Important! If the submode of new values programming of alarm threshold level and specified statistical error, as well as switching on/off audio signaling of detected gamma quanta is paused for more than 30 s (the user presses no buttons of the dosimeter), the dosimeter automatically returns to the mode of photon ionizing radiation DER measurement. All changes made in the submode of new values programming will be cancelled.

Note. A zero value of the threshold level makes the alarm inactive.

To save the measurement result of photon ionizing radiation DER in the nonvolatile memory, press and hold the THRESHOLD button in the measurement mode until the “Arch” symbols are displayed on the LCD (Figure 5).

Then release the THRESHOLD button. Switching to the submode of measurement result saving should be confirmed by a short press of the MODE button. Press shortly the THRESHOLD button to cancel the action. If the buttons are not pressed for 30 s, the dosimeter automatically returns to the mode of photon ionizing radiation DER measurement.

If the “FULL” symbols are displayed on the LCD of the dosimeter instead of the “Arch” symbols (Figure 9), there is no free space in the nonvolatile memory of the dosimeter, and, correspondingly, the next measurement results cannot be saved.

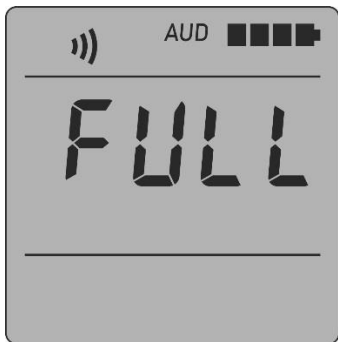


Figure 9 – LCD of the dosimeter
(start of the submode of measurement result saving – no free space in
the nonvolatile memory)

To clear the space in the nonvolatile memory, delete its saved measurement results. Measurement results can be cleared in the viewing mode (2.3.3.12 of the OM).

The “Arch” symbols (1) on the LCD of the dosimeter are an indication of the submode of measurement result saving (Figure 10). In this submode the LCD displays the measurement result (1) and the measurement object number (3) that will be saved in the nonvolatile memory. The nonvolatile memory status is displayed on the instantaneous value indicator (4). If the nonvolatile memory contains no data, only the first segment is highlighted on the indicator. If the memory is full, all segments are highlighted.

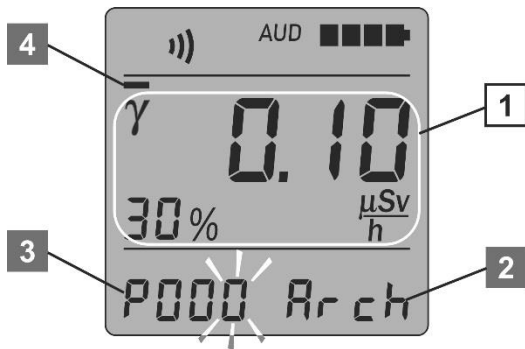


Figure 10 – LCD of the dosimeter
(the submode of measurement result saving of photon ionizing
radiation DER)

The low-order digit of the object number is blinking and shows that its value can be programmed. Use the THRESHOLD button to set the required value of the blinking digit. Successive short presses and releases of the THRESHOLD button change this value per unit. A long press of the THRESHOLD button starts automatic change of this value, which is stopped after the button is released.

A short press of the MODE button fixes the value of the digit (it stops blinking) and allows presetting the value of the next digit, which starts blinking at that. Other digits are programmed likewise.

As soon as the third (last) digit is programmed, the DER measurement result, the measurement object number, and the date and time of measurement are saved in the nonvolatile memory. If the information is saved, the measurement value under saving blinks three times on the LCD of the dosimeter, and it returns to the mode of photon ionizing radiation DER measurement.

Important! If the submode of measurement result saving is paused for more than 30 s (the user presses no buttons of the dosimeter), the dosimeter automatically returns to the mode of photon ionizing radiation DER measurement without saving the measurement result.

2.3.3.8 The mode of indication of photon ionizing radiation DE accumulated value

This mode can be entered from any other operating mode of the dosimeter with the help of a short press of the MODE button.

This mode follows the mode of photon ionizing radiation DER measurement.

The LCD of the dosimeter displays the following information in the mode of indication of photon ionizing radiation DE accumulated value (Figure 11):

- “ γ ” symbol (1) – an indication of the measured radiation type;
- DE current value (5);
- dimension (6);
- threshold level of alarm actuation (7);

- DE accumulation time (8);
- alarm clock symbol (2) (if the alarm clock is on);
- alarm type symbol (3);
- battery status symbol (4).

The accumulated value of photon ionizing radiation DE, DE accumulation time and DE threshold level are displayed in this mode. The process of photon ionizing radiation DE accumulation starts right after the dosimeter is switched on, and is performed in all operating modes, except for surface beta-particles flux density measurement. When the dosimeter is turned off, photon ionizing radiation DE value and DE accumulation time are saved in the nonvolatile memory of the dosimeter. DE value and DE accumulation time can be set to zero in the corresponding mode, which is described below.

DE accumulation time can be displayed on the LCD in two formats. As long as DE accumulation time does not exceed 100 hours, it is displayed in the “HH:MM” format, where HH stands for hours, and MM stands for the value of minutes of DE accumulation time. The values of hours and minutes are separated with the unblinking “:” symbol.

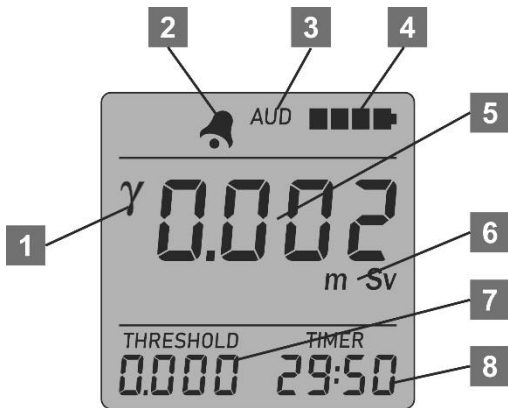


Figure 11 – LCD of the dosimeter
(the mode of indication of photon ionizing radiation DE
accumulated value)

As soon as DE accumulation time exceeds 100 hours, it is displayed in the “HHHH” format, where HHHH stands for the value of hours of DE accumulation time. The “:” symbol is absent.

The dosimeter sends a two-tone audio signal and/or an intermittent vibration signal when the measured DE value of alarm threshold level is exceeded, depending on the chosen alarm type. The DE value starts blinking on the LCD of the dosimeter. A periodic and subsequent (from left to right) highlighting of segments of the sound symbol also show that the threshold level has been exceeded.

To proceed to the submode of a new value programming of alarm threshold level, press and hold the THRESHOLD button until a stripe (1) is displayed on the LCD (Figure 12) that is “moving” across the instantaneous value indicator. The new threshold level with a blinking low-order digit (2) should also appear on the LCD.

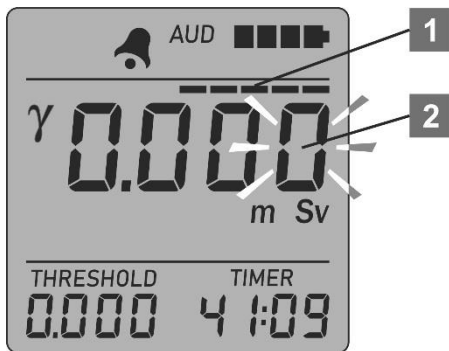


Figure 12 – LCD of the dosimeter
(the submode of a new value programming of alarm threshold level)

When a digit is blinking, it means that its value can be programmed. Use the THRESHOLD button to set the required value of the blinking digit. Successive short presses and releases of the THRESHOLD button change this value per unit. A long press of the THRESHOLD button starts automatic change of this value, which is stopped after the button is released.

A short press of the MODE button fixes the value of the digit (it stops blinking) and allows presetting the value of the next digit, which starts blinking at that. All other digits are programmed likewise.

A short press of the MODE button after the last digit has been programmed, fixes a new value of the alarm threshold level in the nonvolatile memory of the dosimeter. If it has been fixed, a new value of the threshold level blinks three times on the LCD, and the dosimeter returns to the mode of indication of photon ionizing radiation DE accumulated value and DE accumulation time.

Important! If the submode of a new value programming of alarm threshold level is paused for more than 30 s (the user presses no buttons of the dosimeter), the dosimeter automatically returns to the mode of indication of photon ionizing radiation DE accumulated value. All changes made in the submode of a new value programming will be cancelled.

Note. A zero value of the threshold level makes the alarm inactive.

In order to proceed to the submode of DE and DE accumulation time values resetting, simultaneously press and hold the THRESHOLD and the MODE buttons until “CLr” and “dOSE” symbols appear on the LCD of the dosimeter (Figure 13).



Figure 13 – LCD of the dosimeter
(the sumbode of DE and DE accumulation time values resetting)

To cancel resetting, shortly press the THRESHOLD button once again or do not press the buttons during 30 s (the dosimeter will automatically enter the mode of displaying photon ionizing radiation DE accumulated value and DE accumulation time).

To confirm resetting of DE and DE accumulation time values, shortly press the MODE button. The “CLr” symbols that blink three times on the LCD of the dosimeter, and return of the dosimeter to the mode of accumulated value indication of photon ionizing radiation DE mean that the values have been set to zero.

Important! If the submode of DE value and DE accumulation time resetting is paused for more than 30 s (the user presses no buttons of the dosimeter), the dosimeter automatically returns to the mode of displaying photon ionizing radiation DE accumulated value without resetting.

2.3.3.9 The mode surface beta-particles flux density measurement

This mode can be entered from any other operating mode of the dosimeter with the help of a short press of the MODE button. This mode follows the mode of measured value indication of photon ionizing radiation DE and DE accumulation time.

At first measure gamma background DER (to enable its further automatic subtraction), and then measure surface beta-particles flux density. To do this, place the dosimeter in the mode of DER measurement (filter cover covers the window of the detector) over the surface that should be examined for beta-particles flux density, and wait for the measurement result of gamma background DER with the required statistical error. Press shortly the MODE button twice. This will store the measured value of gamma background DER and switch the dosimeter from photon ionizing radiation DER measurement mode to surface beta-particles flux density measurement mode.

To measure surface beta-particles flux density, remove the filter cover from the window, located opposite the detector, direct the dosimeter with the window in parallel to the examined surface and place it as close as possible.

In the mode of surface beta-particles flux density measurement the dosimeter LCD displays the following information (Figure 14):

- statistical error (1) of the measurement result (8);
- “ β ” symbol (2) – an indication of the measured radiation type;
- indicator of instantaneous value (3);
- sound symbol (4) (if audio signaling of detected gamma quanta and beta particles is switched on);
- alarm clock symbol (5) (if the alarm clock is on);
- alarm type symbol (6);
- battery status symbol (7);
- measurement result (8);
- dimension of measurement result (9);
- current time (10);
- threshold level of alarm actuation (11).

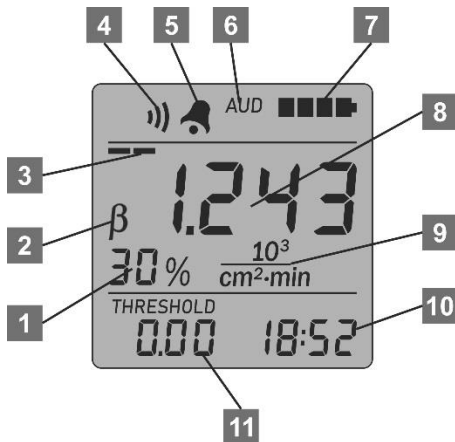


Figure 14 – LCD of the dosimeter
(the mode of surface beta-particles flux density measurement)

As soon as the measurement is started the surface beta-particles flux density measurement results (8) and the statistical error values (1) that correspond to these results begin to be formed on the LCD.

If the flux density measurement results exceed the alarm threshold level (11), the dosimeter sends a two-tone audio signal and/or an intermittent vibration signal, which depends on the chosen alarm type. Measurement results start blinking on the LCD of the dosimeter. Periodic and gradual (from left to right) highlighting of the sound symbol segments (4) serves as an indication of the threshold level exceeding as well.

The ten-segment indicator of instantaneous value (3) is used for fast evaluation of intensity of photon ionizing radiation and beta-particles flux. The integration time during measurement of the instantaneous intensity value and the time of information update on the instantaneous value indicator are equal to 500 ms.

The instantaneous intensity value is displayed in pseudo-logarithmic scale. The first segment of the indicator becomes highlighted when the intensity corresponds to 2 cps pulse rate from the Geiger-Muller counter.

The greater the intensity becomes the more scale segments start to be highlighted from left to right. The scale becomes fully highlighted when the intensity equals to 740 cps pulse rate from the Geiger-Muller counter. Beta-particles flux density is about $45 \cdot 10^3$ part./($\text{cm}^2 \cdot \text{min}$) in this case if gamma background is not increased.

The sound symbol (4) means that audio signaling of detected gamma quanta and beta-particles is on. If signaling is on, this symbol is displayed on the LCD, and each detected gamma quantum or beta particle is followed by a short audio and/or vibration signal, which depends on the chosen alarm type.

Audio signaling of detected gamma quanta and beta particles is switched on and off in the submode of alarm threshold level programming.

Surface beta-particles flux density is measured in a similar way to photon ionizing radiation DER measurement. As soon as the measurement is started the LCD of the dosimeter begins to display the measurement results and the statistical error values that correspond to these results. In the process of measurement the statistical error of each next measurement result becomes smaller, and in some time it reaches the specified statistical error.

If this error is reached, a part of statistical information starts to be rejected while the measurement process continues. Therefore, all the following measurement results will have the statistical error, which is equal to or less than the specified one.

The dosimeter can automatically determine the specified statistical error depending on the radiation intensity (Appendix A). The user can also do that in the submode of alarm threshold level programming. A blinking “%” symbol means that the user determined the statistical error. If the specified statistical error is determined automatically by the dosimeter, its value is blinking on the LCD until it remains greater than the value of main relative permissible error limit of surface beta-particles flux density measurement (Table 1.1). If the specified statistical error is determined by the user, its value is blinking on the LCD until it remains greater than the value of the specified statistical error.

While the statistical error value keeps exceeding 99 %, the LCD displays the “■■■%” symbols.

Press the THRESHOLD button in the mode of surface beta-particles flux density measurement to view the value of the specified statistical error.

The value of the specified statistical error is displayed on the LCD (Figure 15) while the THRESHOLD button is being pressed and held down (but not longer than 3 s). A zero value display means that the dosimeter determined the specified statistical error automatically depending on the radiation intensity.

If the THRESHOLD button is being held down for more than three seconds, the LCD displays the “Arch” symbols (Figure 16). Thus, it becomes possible to proceed to the submode of measurement result saving in the nonvolatile memory.

If you keep holding the THRESHOLD button, the “Arch” symbols will disappear from the LCD, and the measurement will be restarted during the next two seconds (Figure 17).

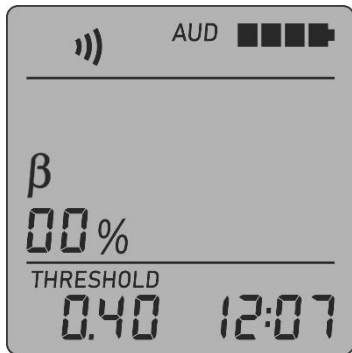


Figure 15 – LCD of the dosimeter
(viewing the value of specified statistical error)



Figure 16 – LCD of the dosimeter (start of the submode of measurement result saving in the nonvolatile memory)



Figure 17 – LCD of the dosimeter (measurement restart)

If you keep holding the THRESHOLD button, then during the next two seconds the dosimeter will proceed to the submode of new values programming of alarm threshold level and specified statistical error, and switching on/off audio signaling of detected gamma quanta and beta particles (Figure 18). A stripe (1) “moving” across the instantaneous value indicator and blinking of the low-order digit (2) of a new threshold level serve as an indication of this submode.

Operation with the dosimeter in this submode fully complies with the operation in a similar submode of the photon ionizing radiation DER measurement mode.

To save the measurement result of surface beta-particles flux density in the nonvolatile memory, press and hold the THRESHOLD button in the measurement mode until the “Arch” symbols are displayed on the LCD (Figure 16). Then release the THRESHOLD button.

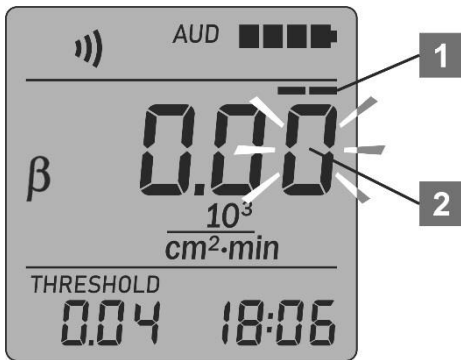


Figure 18 – LCD of the dosimeter
(the submode of alarm threshold level programming)

Proceeding to the submode of measurement result saving should be confirmed by a short press of the MODE button. Press shortly the THRESHOLD button to cancel the action. If the buttons are not pressed for 30 s, the dosimeter automatically returns to the mode of surface beta-particles flux density measurement.

If the “FULL” symbols are displayed on the LCD of the dosimeter (Figure 19) instead of the “Arch” symbols, there is no free space in the nonvolatile memory of the dosimeter, and, correspondingly, the next measurement results cannot be saved. To clear the space in the nonvolatile memory, delete its saved measurement results. Measurement results can be cleared in the viewing mode (2.3.3.12 of the OM).

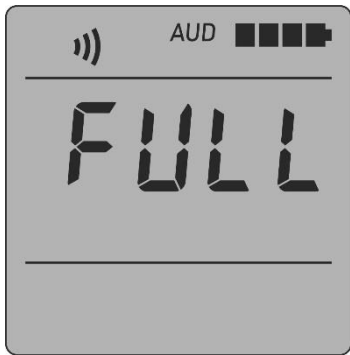


Figure 19 – LCD of the dosimeter
(start of the submode of measurement result saving – no free space in
the nonvolatile memory)

The “Arch” symbols (2) on the LCD of the dosimeter are an indication of the submode of measurement result saving (Figure 20). In this submode the LCD displays the measurement result (1) and the measurement object number (3) that will be saved in the nonvolatile memory. The nonvolatile memory status is displayed on the instantaneous value indicator (4). If the nonvolatile memory contains no data, only the first segment is highlighted on the indicator. If the memory is full, all segments are highlighted.

Operation with the dosimeter in this submode fully complies with the operation in a similar submode of the photon ionizing radiation DER measurement mode.

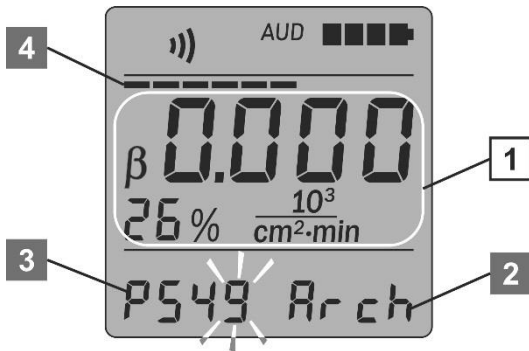


Figure 20 – LCD of the dosimeter
(the submode of measurement result saving of surface beta-particles
flux density)

2.3.3.10 The clock mode

This mode can be entered from any other operating mode of the dosimeter with the help of a short press of the MODE button. This mode follows the mode of surface beta-particles flux density measurement.

In the mode of clock, the dosimeter LCD displays the following information (Figure 21):

- alarm clock symbol (1) (if the alarm clock is on);
- alarm type symbol (2);
- battery status symbol (3);
- time (4);
- day (5);
- month (6);
- year (7).

To proceed to the submode of time and date correction, press and hold the THRESHOLD button until a stripe (1) “moving” across the instantaneous value indicator appears on the LCD, and the digits of minutes (2) start blinking (Figure 22).

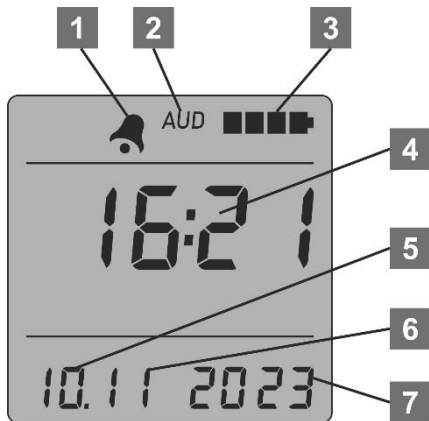


Figure 21 – LCD of the dosimeter
(the clock mode)

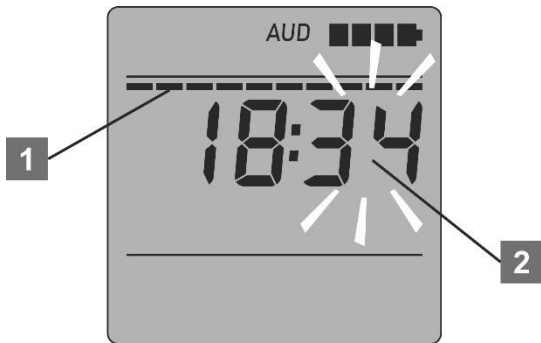


Figure 22 – LCD of the dosimeter
(the submode of time and date correction – time programming)

When digits are blinking, it means that their values can be programmed. Use the THRESHOLD button to set the required value of the digit. Successive short presses and releases of the THRESHOLD button change this value per unit. A long press of the THRESHOLD button starts automatic change of this value, which is stopped after the THRESHOLD button is released.

A short press of the MODE button fixes the values of the minute digits (they stop blinking) and allows presetting the values of the hour digits, which start blinking at that. The hour digits are programmed with the help of the THRESHOLD button in a similar way to the minute digits programming.

A short press of the MODE button fixes a new time value in the dosimeter memory. The new time value blinks three times on the LCD of the dosimeter to show that it has been fixed. A year is then displayed on the LCD (Figure 23).

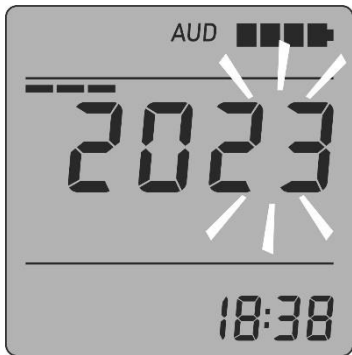


Figure 23 – LCD of the dosimeter
(the submode of time and date correction – year programming)

When the low-order digits of the year are blinking, it means that their values can be programmed. They are programmed with the help of the THRESHOLD button in a similar way to the minute digits programming. The year value can be set within the limits from 2010 to 2099.

A short press of the MODE button fixes a new value of year in the dosimeter memory. The new value of year blinks three times on the LCD of the dosimeter to show that it has been fixed. The date (1) and month (2) are then displayed on the LCD (Figure 24). When the month digits are blinking, it means that their values can be programmed. They are programmed with the help of the THRESHOLD button in a similar way to the minute digits programming.

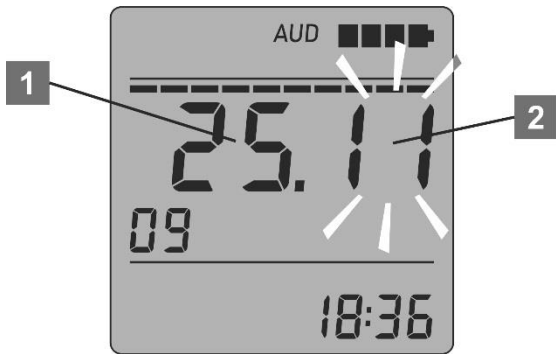


Figure 24 – LCD of the dosimeter
(the submode of time and date correction – date programming)

A short press of the MODE button fixes the values of the month digits (they stop blinking) and allows presetting the values of the date digits, which start blinking at that. The date digits are programmed with the help of the THRESHOLD button in a similar way to the hour digits programming.

A short press of the MODE button fixes a new value of date and month in the dosimeter memory. The new value blinks three times on the LCD, and the dosimeter returns to the mode of clock.

Important! If the submode of date and time correction is paused for more than 30 s (the user presses no buttons of the dosimeter), the dosimeter automatically returns to the mode clock. All changes made and not fixed in the dosimeter memory will be cancelled.

2.3.3.11 The mode of alarm clock

This mode can be entered from any other operating mode of the dosimeter with the help of a short press of the MODE button. This mode follows the mode of clock.

In the mode of alarm clock, the dosimeter LCD displays the following information (Figure 25):

- alarm clock symbol (1) (if the alarm clock is on);
- alarm type symbol (2);
- battery status symbol (3);
- time of the alarm clock activation (4);
- current time (5).

To proceed to the submode of alarm clock activation time programming, press and hold the THRESHOLD button until a stripe (1) “moving” across the instantaneous value indicator appears on the LCD, and the minute digits of alarm clock activation (3) start blinking (Figure 26).

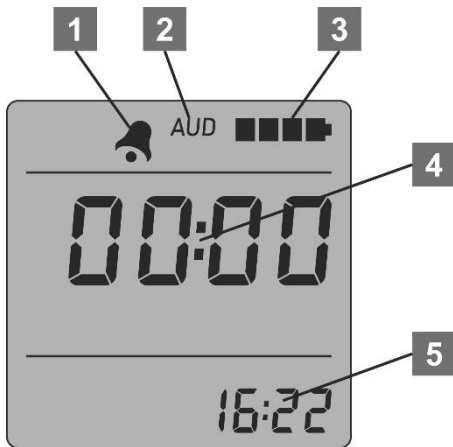


Figure 25 – LCD of the dosimeter
(the alarm clock mode)

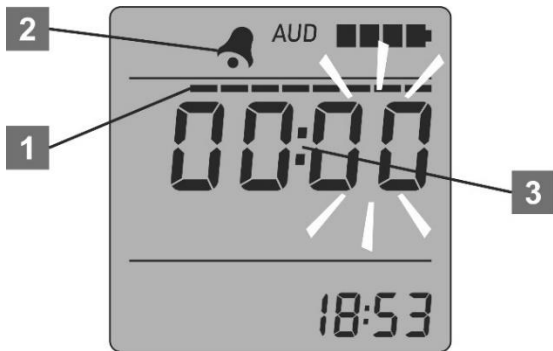


Figure 26 – LCD of the dosimeter
(the submode of alarm clock activation time programming)

Minutes and hours of the alarm clock activation are programmed in a similar way to time correction in the clock mode.

As soon as the alarm clock activation time is programmed, the alarm clock symbol (2) starts blinking on the LCD of the dosimeter. This it becomes possible to turn on/off the alarm clock ringing at a time set in advance. Successive short presses of the THRESHOLD button turn the alarm clock on/off. Each press of the THRESHOLD button changes the alarm clock symbol status. The highlighted unblinking alarm clock symbol shows that the alarm clock is on, and the dark one shows that it is off.

Important! If the submode of alarm clock activation time programming is paused for more than 30 s (the user presses no buttons of the dosimeter), the dosimeter automatically returns to the alarm clock mode. All changes made in the submode of alarm clock activation time programming will be cancelled.

If the alarm clock is on, and the current time coincides with the alarm clock activation time, the alarm clock is activated and the dosimeter starts generating the alarm clock signal – typical audio and/or vibration signals, in all operating modes and submodes of the dosimeter, except for the submode of time and date correction. The alarm clock symbol will be blinking at that. The alarm clock goes off even if the dosimeter is off.

The alarm clock signal can be switched off with a short press of the MODE or the THRESHOLD button in any operating mode or submode of the dosimeter, but for the submodes of new threshold level values input and the mode of measurement results viewing. If the alarm clock signal is not disabled using the buttons, it turns off automatically in 1 minute after activation.

If the dosimeter was off before the alarm clock goes off, the dosimeter enters the clock mode. The dosimeter automatically turns off as soon as the alarm clock signal stops ringing (in 1 min). If the user turns off the alarm clock signal before it stops ringing, the dosimeter remains on.

2.3.3.12 The mode of measurement results viewing stored in the nonvolatile memory

2.3.3.12.1 If the nonvolatile memory of the dosimeter contains measurement results, this mode can be entered from any other operating mode of the dosimeter with the help of a short press of the MODE button.

In the mode of measurement results viewing stored in the nonvolatile memory the dosimeter LCD displays the following information (Figure 27):

- “rEAd” (1) and “Arch” (2) symbols (an indication of this mode);
- alarm clock symbol (3) (if the alarm clock is on);
- alarm type symbol (4);
- battery status symbol (5);
- number of measurement results stored in the nonvolatile memory (6).

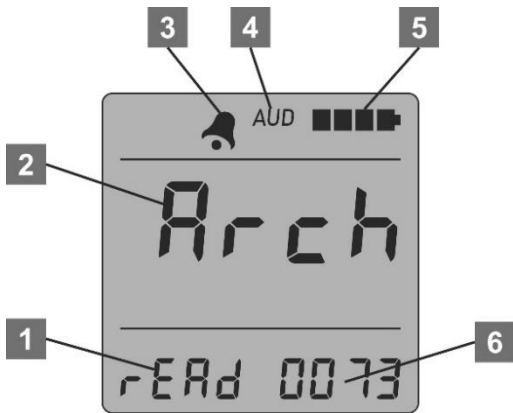


Figure 27 – LCD of the dosimeter
(the mode of measurement results viewing stored in the
nonvolatile memory)

Press shortly the THRESHOLD button to view the measurement results stored in the nonvolatile memory. The LCD of the dosimeter displays the following information (Figure 28):

- indicator of measurement results location in the nonvolatile memory (1);
- alarm clock symbol (2) (if the alarm clock is on);
- alarm type symbol (3);
- battery status symbol (4);
- measurement result (5);
- measurement object number (6);
- measurement time (7).

During viewing, if the user presses no buttons of the dosimeter, zones (6) and (7) of the LCD alternatively display the measurement object number and the measurement time, or the date and year of measurement.

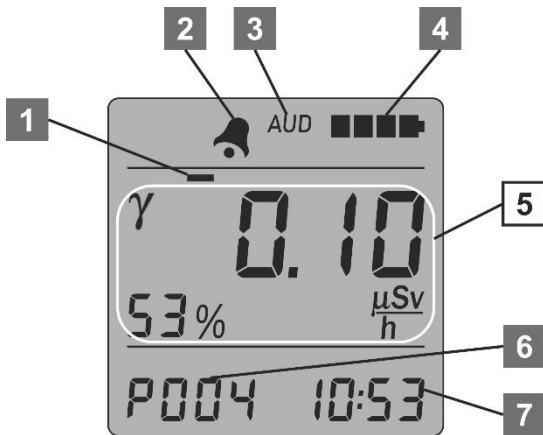


Figure 28 – LCD of the dosimeter
(measurement results viewing)

The indicator of location (1) shows a place of the measurement result (5) in the nonvolatile memory. The leftmost position of the location indicator corresponds to the start of the nonvolatile memory, i.e. the oldest measurement result (the measurement result that was first saved). The rightmost position corresponds the end of the nonvolatile memory, i.e. the newest measurement result (the measurement result that was last saved). If the nonvolatile memory contains only one measurement result, all ten segments are highlighted on the location indicator.

Shortly press the MODE and the THRESHOLD buttons to manage measurement results viewing. A short press on the MODE button makes it possible to view the next measurement result that has been saved after the measurement result, which is displayed on the LCD now.

A short press on the THRESHOLD button makes it possible to view the previous measurement result that has been saved before the measurement result, which is displayed on the LCD now. The LCD of the dosimeter displays the measurement object number and the time of measurement performance along with each measurement result.

To exit the mode of measurement results viewing stored in the nonvolatile memory, press and hold the THRESHOLD button (circa 6 seconds) until the dosimeter enters the mode of photon ionizing radiation DER measurement.

To clear the measurement results stored in the nonvolatile memory, simultaneously press and hold the MODE and the THRESHOLD buttons until the “CLr” and the “Arch” symbols appear on the LCD of the dosimeter (Figure 29).



Figure 29 – LCD of the dosimeter
(the submode of measurement results clearing stored
in the nonvolatile memory)

To cancel clearing, shortly press the THRESHOLD button or do not press the buttons during 30 s (the dosimeter will automatically enter the mode of measurement results viewing stored in the nonvolatile memory).

To confirm clearing of the measurement results stored in the nonvolatile memory, shortly press the MODE button. The “CLr” symbols that blink three times on the LCD of the dosimeter, and return of the dosimeter to the mode of photon ionizing radiation DER measurement mean that the values have been cleared.

Important! If the submode of measurement results clearing stored in the nonvolatile memory is paused for more than 30 s (the user presses no buttons of the dosimeter), the dosimeter automatically returns to the mode of measurement results viewing without measurement results clearing.

3 TECHNICAL MAINTENANCE

3.1 General instructions

Technical maintenance includes the following operations:

- external examination;
- operability check of the dosimeter;
- power supply switch off.

3.1.1 Safety measures

Safety measures during technical maintenance fully comply with safety measures stated in item 2.3.1 of the present OM.

3.1.2 External examination

External examination of the dosimeter should be performed in the following order:

- a) check the technical condition of surface, inspect for integrity of seals, absence of scratches, traces of corrosion, surface damages of the dosimeter;
- b) check the condition of clamps in the battery compartment.

3.1.3 Operability check of the dosimeter

Operability check of the dosimeter is performed according to item 2.2.3 of the present OM.

3.1.4 Power supply disconnection and status control

Power supply disconnection and status control shall be carried out before long-term storage of the dosimeter. The following operations must be performed in this case:

- switch the dosimeter off;
- open the lid of the battery compartment;
- remove the batteries;
- examine the battery compartment, check the contact clamps accuracy, clean the battery compartment from contamination and contact clamps from oxides;
- make sure there is no humidity, no salt spots on the surface of the batteries, and no damages of the insulated coating.

4 CERTIFICATE OF ACCEPTANCE

The MKS-05 “TERRA-P+” dosimeter-radiometer of
BICT.412129.006-10 type with _____ serial
number is calibrated and accepted for use.

Date of issue _____

Stamp here

QCD representative: _____
(signature)

5 PACKING CERTIFICATE

The MKS-05 “TERRA-P+” dosimeter-radiometer of
BICT.412129.006-10 type with _____ serial
number is packed by the Private Enterprise “SPPE “Sparing-Vist Center”.

Date of packing _____

Stamp here

Packed by: _____
(signature)

Packed product accepted by: _____
(signature)

6 WARRANTY

6.1 The warranty period of the dosimeter use shall terminate and be of no further effect in 24 months after the date of putting it into operation or after the warranty period of storage terminates.

6.2 The warranty period of storage of the dosimeter is 6 months after its manufacture date.

6.3 Free of charge repair or replacement during the warranty period of use is performed by the producer enterprise provided that:

6.3.1 The customer observed the guidelines on its use, transportation and storage;

6.3.2 The customer encloses the failed dosimeter.

6.4 If the defect (according to the claim) is eliminated, the warranty period is prolonged for the time when the dosimeter was not used because of the detected defects.

6.5 The batteries failure is not a reason for claim, after their warranty period is finished.

6.6 The warranty shall be void if:

6.6.1 Mechanical or thermal damages are detected;

6.6.2 Traces of any liquid are detected;

6.6.3 Foreign objects are found inside the dosimeter;

6.6.4 The integrity of the warranty seals is violated, or the case has been opened, repaired, or internally modified without authorization;

6.6.5 The factory serial number of the dosimeter has been removed or altered;

6.6.6 Accessories not approved by the manufacturer have been used.

7 REPAIR

7.1 In case of failure or troubles during the warranty period of the dosimeter, the user should contact the producer enterprise by e-mail (see below) to receive the address of the nearest service center:

PE “SPPE “Sparing-Vist Center”
Tel.: (+380 32) 242-15-15; Fax: (+380 32) 242-20-15;
E-mail: sales@ecotest.ua.

Warranty and post warranty repair is performed only by the manufacturing company.

8 STORAGE

8.1 The dosimeters should be stored in a packing box in heated and ventilated storehouses with air-conditioning at the ambient temperature from $+5\text{ }^{\circ}\text{C}$ to $+40\text{ }^{\circ}\text{C}$ and relative humidity up to 80 % at $+25\text{ }^{\circ}\text{C}$ temperature, non-condensing. The storehouse should be free of acids, gas, vapors of organic solvents, and alkali that may cause corrosion.

8.2 The location of the dosimeters in storehouses should ensure their free movement and access to them.

8.3 The dosimeters should be stored on the shelves.

8.4 The distance between the walls, the floor and the devices should not be less than 100 mm.

8.5 The distance between the heating gadgets of the storehouse and the devices should not be less than 0.5 m.

8.6 The average shelf life is not less than 6 years.

9 TRANSPORTATION

9.1 Packed dosimeters may be transported by any kinds of closed transport vehicles under the conditions with temperature limitation in the range of $-25\text{ }^{\circ}\text{C}$ to $+55\text{ }^{\circ}\text{C}$, and according to rules and standards effective for each means of transport.

9.2 The dosimeters in transport container should be placed and fixed in the vehicle to ensure their stable position and to avoid shocks (with each other and the sidewalls of the transport).

9.3 The dosimeters in transport container endure:

- temperature from $-25\text{ }^{\circ}\text{C}$ to $+55\text{ }^{\circ}\text{C}$;
- relative humidity $(95\pm3)\%$ at $+35\text{ }^{\circ}\text{C}$ temperature;
- shocks with acceleration of 98 m/s^2 , a shock pulse duration of 16 ms (number of shocks - 1000 ± 10 in each direction).

9.4 Canting is forbidden.

10 DISPOSAL

Disposal of the dosimeter is performed in compliance with the general rules, i.e. metals are recycled or melted, and plastic parts are dumped.

Disposal of the dosimeter is not dangerous for service personnel, and is environmentally friendly.

APPENDIX A

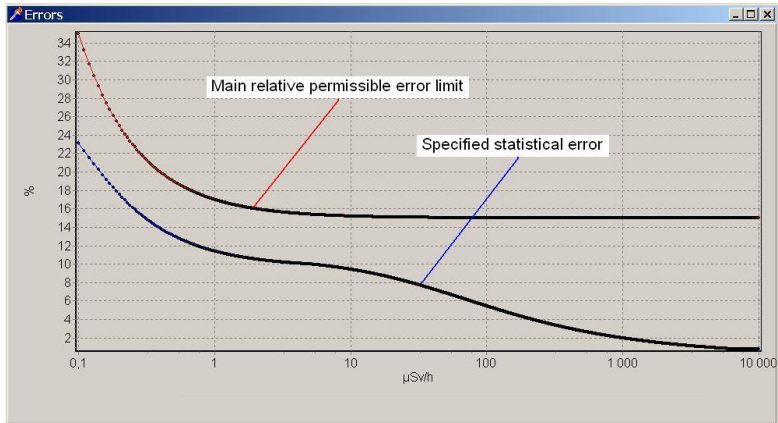


Figure A.1 – Graph of the dependence of the specified statistical error on the photon ionizing radiation DER

APPENDIX A

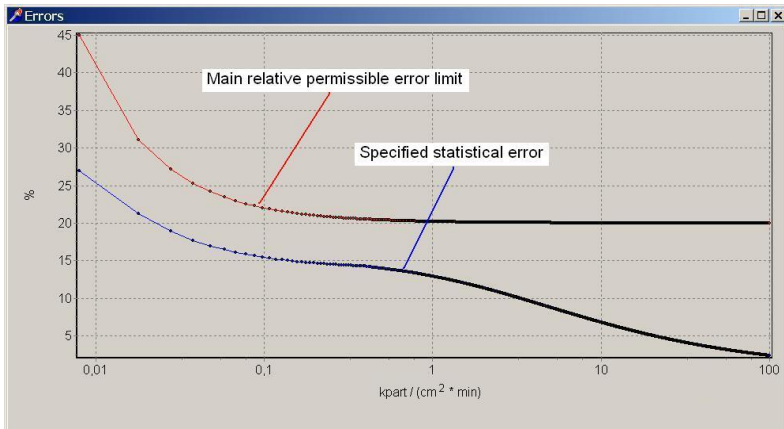


Figure A.2 – Graph of the dependence of the specified statistical error on surface beta-particles flux density