



UDKG-01A
“Gamma Sapiens”
INTELLECTUAL
GAMMA RADIATION
DETECTOR

Operating manual

Dear users,

You had chosen well if purchased a device of “ECOTEST” trademark manufactured by “Sparing-Vist Center”. Your device is easy to use and can be applied for household purposes without special training of the user. Should any questions arise, please contact our managers by telephone **(+38 032) 242-15-15**, fax **(+38 032) 242-20-15** or e-mail **sales@ecotest.ua**.

We would greatly appreciate to receive your comments and suggestions on its operation. The device is under 18-months (free of charge) warranty maintenance.

Best regards, International Sales Department

Dear users,

We would like to draw your attention to the delivery kit of the UDKG-01A “Gamma Sapiens” intellectual gamma radiation detector that includes two AAA batteries. However, the power for operation can also be supplied by two AAA nickel-metal-hydride (NiMH) rechargeable batteries of no less than 800 mAh capacity instead of batteries that come with the device. You can buy these rechargeable batteries and their charger at any retail outlet. Famous manufactures, such as Varta, are highly recommended.

Choose an automatic battery charger, preferably with a function to control charging of each rechargeable battery.

Charge rechargeable batteries only when they are fully discharged. Recharging partially discharged rechargeable batteries on a repeated basis minimizes considerably their lifespan.

Do not use one rechargeable battery along with a non-rechargeable one to power the gamma radiation detector. This will lead to the rechargeable battery failure.

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This operating manual (hereinafter called the OM) is intended to inform the user about the principles of operation of the UDKG-01A “Gamma Sapiens” intellectual gamma radiation detector and its operation procedure. The OM contains all information necessary for proper use of the detector and full realization of its technical capabilities.

The UDKG-01A “Gamma Sapiens” intellectual gamma radiation detector is easy to use without the need of special training of the user.

The UDKG-01A “Gamma Sapiens” intellectual gamma radiation detector is intended to work with smartphones or tablets which under the Android operating system.

The OM contains the following abbreviations and symbols:

DE - ambient dose equivalent of gamma radiation;

DER - ambient dose equivalent rate of gamma radiation;

QCD - Quality Control Department;

TS - technical specifications.

1 DESCRIPTION AND OPERATION

1.1 Purpose of use

The UDKG-01A “Gamma Sapiens” intellectual gamma radiation detector (hereinafter called the detector) is designed to measure ambient dose equivalent (DE) and ambient dose equivalent rate (DER) of gamma radiation and transfer measured data to a smartphone or a tablet via the Bluetooth radio interface.

The detector is used to:

- monitor personal radiation safety;
- monitor apartments, buildings, and constructions, household items, clothes, soil surface of grounds, and vehicles exposed to radiation.

The detector is not applicable for use in nuclear power facilities.

1.2 Technical specifications

1.2.1 Measurement range of gamma radiation DER – from 0.1 to 5000 $\mu\text{Sv/h}$.

1.2.2 Main relative permissible error limit in gamma radiation DER measurement at energy of 0.662 MeV $\delta\dot{H}^*(10)$, %, with confidence probability of 0.95 (calibrated with ^{137}Cs) is estimated by the formula:

$$\delta\dot{H}^*(10) = 25 + 2/\dot{H}^*(10) \quad (1.1)$$

where $\dot{H}^*(10)$ is a numeric value of measured gamma radiation DER in $\mu\text{Sv/h}$.

1.2.3 Measurement range of gamma radiation DE is from 0.001 to 9999 mSv.

1.2.4 Main relative permissible error limit in gamma radiation DE measurement with confidence probability of 0.95 is 25 %.

1.2.5 Energy range of registered gamma radiation is from 0.05 to 3.00 MeV.

1.2.6 Energy dependence of the measurement results during gamma radiation DER and DE measurements in the energy range from 0.05 to 1.25 MeV is not more than $\pm 25\%$.

1.2.7 Complementary permissible error limit in gamma radiation DER and DE measurements caused by ambient air temperature variations from -18 to $+50\text{ }^{\circ}\text{C}$ is not more than 5% per each $10\text{ }^{\circ}\text{C}$ deviation from $+20\text{ }^{\circ}\text{C}$.

1.2.8 Power for the detector is supplied by two AAA batteries with operating supply voltage of 3.0 V. Supply voltage is possible to be changed during discharge of batteries in the range from 3.2 to 2.4 V.

1.2.9 Complementary permissible error limit in gamma radiation DER and DE measurements caused by supply voltage variations of the detector within 2.4- 3.2 V is not more than 5% .

1.2.10 Average current consumption of the detector is not more than 20 mA.

1.2.11 Time of continuous operation of the detector on a new rechargeable battery consisting of two AAA cells of up to 1280 mAh capacity under natural radiation background conditions is not less than 60 hours.

1.2.12 Setup time of operating mode and measurement time of the detector is not more than 3 minutes.

1.2.13 Unstable readings of the detector during gamma radiation DER measurement for an 8-hour continuous operation is not more than 5 %.

1.2.14 The Bluetooth radio interface (thereafter – radio channel) serves as the interface for data communications between the detector and the smartphone or tablet personal computer.

1.2.15 The detector is able to perform data communications via the interface within a distance of not less than 5 m.

1.2.16 Mean time between failure is not less than 6000 hours.

1.2.17 Average service life of the detector is not less than 6 years.

1.2.18 Mean time to repair of the detector is not more than 12 hours.

1.2.19 Average shelf life of the detector is not less than 1 year

1.2.20 Dimensions of the detector is not more than 19×40×95 mm.

1.2.21 Weight of the detector without batteries is not more than 0.05 kg.

1.2.22 The detector meets the requirements of technical specifications (TS) under the following operating conditions:

- temperature from -18 to $+50^{\circ}\text{C}$;
- relative humidity up to 95 % at $+35^{\circ}\text{C}$, non-condensing;
- atmospheric pressure from 84 to 106.7 kPa (from 645 to 800 mm Hg).

1.2.23 The detector is tolerant to sinusoidal vibration effects of the group N1 according to ГOCT 12997-84 over a frequency range of 10 – 55 Hz, shift amplitude corresponds to 0.15 mm.

1.2.24 The detector withstands exposure to shocks according to ГOCT 12997-84 with the following parameters:

- shock pulse duration – 9.5 ms;
- number of shocks – 1000 ± 10 ;
- maximum shock acceleration – 100 m/s^2 .

1.2.25 The detector in its shipping container can endure:

- ambient air temperature from -25 to $+55$ °C;
- relative air humidity up to (95 ± 3) % at $+35$ °C temperature;
- shocks with 98 m/s² acceleration, shock pulse duration – 16 ms, number of shocks – 1000 ± 10 in each direction.

1.2.26 The detector is immune to constant or alternating with (50 ± 1) Hz magnetic fields of 400 A/m intensity.

1.2.27 The detector tolerates exposure to gamma radiation with DER of 1 Sv/h within 5 minutes.

1.2.28 Ingress protection rating of the detector's housing meets IP30 specifications according to GOST 14254-96.

1.2.29 The design of the detector supports decontamination.

1.3 Delivery kit

1.3.1 The detector delivery kit consists of units and maintenance documentation presented in Table 1.1.

Table 1.1 – Delivery kit of the UDKG–01A detector

Type	Item	Quantity	Note
BICT.412129.024-06	UDKG–01A “Gamma Sapiens” intellectual gamma radiation detector	1 pc.	
BICT.412129.022-02 HE	Operating manual	1 copy	

Table 1.1(continued)

Type	Item	Quantity	Note
	ENERGIZER AAA 1.5 V battery	2 pcs.	Batteries of other manufac- turers are permitted
	Case of model 491, Galvemo Ltd	1 pc.	
BICT.412915.019-06	Package	1 set	

1.4 Design and principle of operation

1.4.1 General information

The detector is presented as a monoblock construction with a built-in sensor of gamma radiation (the Geiger-Muller counter), a printed-circuit board with electronic components, and batteries.


The operation principle of the detector is based on transformation of radiation by the Geiger-Muller counter into the sequence of voltage pulses; the number of pulses is proportional to the registered radiation intensity.

The power for operation is supplied by two AAA batteries.

1.4.2 Design description

The detector is designed as a flat square plastic housing with rounded corners.

The housing (Figure 1) consists of the front (1) and the back (2) covers.

On the right side of the front cover there is a disk-shaped control and indication board (3) with a decorative circle frame (4) around. The window (5) for two-color LED indicator and the  control button (6) are also located in that area.

The battery compartment (7) for two AAA batteries is in the middle of the back cover. The polarity signs are indicated at the bottom of the battery compartment (7) for proper insertion of batteries. The battery compartment is closed with a lid (8).

A clip with an opening (9) fixed to the back cover is used to attach the detector to a strap.

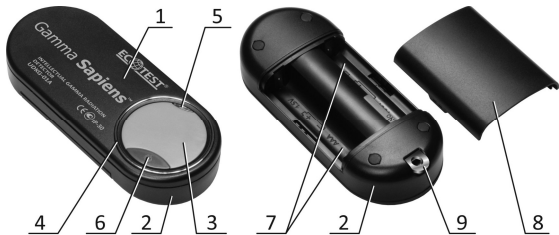


Figure 1 – UDKG-01A “Gamma Sapiens” intellectual gamma radiation detector

1.5 Labeling and sealing

The detector is inscribed with the:

- full name of the detector;
- trademark of the manufacturer;
- approval mark in compliance with ДСТУ 3400:2006;
- CE marking;
- ingress protection rating meets IP30 according to ГОСТ 14254-96.

The TS number and “Made in Ukraine” marking are placed on the individual packaging of the detector.

1.5.1 The housing of the detector (under a battery compartment lid) should contain:

- type, voltage and polarity of batteries;
- date and year of manufacture;
- serial number according to the numbering system of the manufacturer.

1.5.2 Labeling quality meets the ГOCT 26828-86 requirements and is maintained during service life under all conditions and modes, except for labeling done on the individual package.

1.5.3 All detectors accepted by the Quality Control Department (QCD) and prepared for packing are sealed.

1.6 Packing of the detector

1.6.1 Packing is performed in accordance with the requirements specified in BICT.412915.019-06 design documents.

1.6.2 When packed for transport, detectors are placed into unitized shipping containers, i.e. packing boxes as required by ГOCT 5959-80.

1.6.3 The size of packing boxes depends on the number of detectors to be transported. Weight of a single transport article (gross weight) should not exceed 10 kg, while its largest dimensions should be less than 1 m. Inside surfaces of the walls, bottom and cover of the box should be furnished with corrugated cardboard according to the ГOCT 7376-89 standard.

1.6.4 The detectors are allowed to be packed in shipping containers in two or more layers with insertion of corrugated cardboard sheets between layers.

1.6.5 To avoid free movement of the detectors inside a shipping container, corrugated cardboard pads may be used.

1.6.6 Other types of unitized containers and cushioning materials, which do not degrade the quality of package and meet the requirements specified in 9.2, are allowed.

2 PURPOSE OF USE

2.1 Operating limitations

Operating limitations are given in Table 2.1.

Table 2.1

Operating limitations	Limitation parameters
1 Ambient air temperature	from -18 to $+50$ °C
2 Relative humidity	up to 95 % at $+35$ °C temperature, non-condensing
3 Gamma radiation resistance	DER up to 1 Sv/h during 5 min

2.2 Preparation for operation and use

2.2.1 Safety measures before putting the detector in use, scope and order of external examination.

2.2.1.1 The detector contains no external parts exposed to voltages hazardous for life.

Direct use of the detector is not dangerous for the user, and is environmentally friendly.

The detector meets the requirements of ДСТУ 7237:2011 with regard to people protection against electric shock hazard of class safety II according to ГОСТ 12.2.007.0-75.

A special protective jacket is used to prevent accidental contact with conductive parts. The ingress protection rating is IP30 according to ГОСТ 14254-96.

The detector complies with the requirements of fire safety standards ГОСТ 12.1.004-91, ГОСТ 12.2.007.0-75 and НАПБ А.01.001-2004.

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

2.2.2 Read carefully this OM and examine the location and purpose of use of the control and indication means before using the detector.

2.2.3 Prepare the detector for operation in the following way:

- unpack the detector;
- open the battery compartment as shown in Figure 2. Insert two AAA batteries (from the delivery kit), observing the polarity.

Note. As soon as the batteries are inserted, the detector turns on.



Figure 2 – Removing the back cover

2.3 Use of the detector

2.3.1 Safety measures

Safety measures during the use of the detector should be compliant with 2.2.1 of the present OM.

2.3.2 List of possible troubles and troubleshooting

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

Table 2.2


Trouble	Probable cause	Solution
1 The detector does not switch on when the  button is pressed	1 The battery is discharged	1 Replace the batteries
	2 No contact between the batteries and the battery compartment clamps	2 Restore the contact between the batteries and the battery compartment clamps
	3 One of the batteries is out of order	3 Replace the batteries

Table 2.2 (continued)

Trouble	Probable cause	Solution
2 Low battery indication is displayed when the detector is switched on after the batteries have been replaced	1 Poor contact between the batteries and the battery compartment clamps	1 Clean out the contacts on the clamps and the batteries
	2 One of the batteries is out of order	2 Replace the batteries

2.3.2.2 If troubles listed in Table 2.2 fail to be eliminated, or more complicated problems occur, the detector should be sent for repair to appropriate repair services or to the manufacturer (see Repair section).


2.3.3 Operation procedure

2.3.3.1 Display means

The smartphone or the tablet personal computer (hereafter the smartphone) along with the installed special-purpose software is required to display, store and process measurement results, as well as control detector's operating modes. The special-purpose software can be downloaded and installed on the smartphone from Google Play.

An operation procedure for the special-purpose software intended for the smartphone is described in associated instructions on its use.

2.3.3.2 Switch-on

Press the  button to switch on the detector.

As soon as the detector switches on, the LED indicator starts blinking.

The LED indicator flashes different colors to show various battery statuses: green (good charge) – battery remaining capacity is more than 25 %; red (discharge) – battery remaining capacity is less than 25 %.

The frequency at which the LED indicator is blinking shows the occurrence of a data connection between the detector and the smartphone: high frequency – data connection is not available, where the detector is trying to establish a data connection; low frequency – active data connection, where the detector operates under the control of the special-purpose software that has been started on the smartphone.

2.3.3.3 Establishing a data connection to the smartphone

When switched on, the detector starts immediately establishing a connection to the smartphone with which data communications have been performed successfully.

At this point, the special-purpose software should be running on the smartphone.


In case of a failed connection with this smartphone (e.g. the smartphone is outside the range of the detector's Bluetooth radio interface), the detector is searching for the smartphone with a Bluetooth name starting with the "CHECKPOINT" symbols.


If that smartphone is found, an attempt is made to establish a connection to it.

In case of a successful connection, the LED indicator starts blinking at low frequency. If an attempt to establish the connection fails, the detector is searching for the smartphone with a Bluetooth name starting with the “CHECKPOINT” symbols.

The search and attempts to initiate a connection take 1.5 minutes. Then, if the connection is not made, the detector will automatically switch off.

2.3.3.4 **Switch-off**

If a data connection between the detector and the smartphone is not established, use the  button to switch the detector off. This is achieved by pressing and holding this button for more than four seconds. The switched off detector will be indicated by the non-blinking LED indicator.

If the data connection between the detector and the smartphone is established, the  button is inactive, and the detector can be switched off with the use of the special-purpose software that runs on the smartphone.

2.3.3.5 **Battery replacement**

If the LED indicator is blinking red, the batteries of the detector should be replaced.

Switch off the detector, and then remove the lid of the battery compartment (as shown in Figure 2) and insert newly charged batteries.

Note. If the detector is operated in a dusty environment or during atmospheric precipitations, it should be placed into a plastic bag or a special case attached to a waist belt.

3 MAINTENANCE

3.1 Technical maintenance of the detector

3.1.1 General instructions

The list of operations during technical maintenance (hereinafter called the TM) of the detector, the order and peculiarities of operational phases are given in Table 3.1.

Table 3.1 – List of operations during technical maintenance

Operations	TM type			OM item No.
	during		during	
	everyday use	periodic use (once a year)	long-term storage	
External examination	+	+	+	3.1.3.1
Delivery kit completeness	-	+	+	3.1.3.2
Operability check	+	+	+	3.1.3.3
Batteries switching off and their status control	-	+	+	3.1.3.4
Calibration of the detector	-	-	-	3.2
Note: “+” means the operation is applicable to this type of TM; “-” means the operation is not applicable.				

3.1.2 Safety measures

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

3.1.3 Maintenance procedure of the detector

3.1.3.1 External examination

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

- a) check the technical condition of component parts surface, integrity of seals, absence of scratches, traces of corrosion, and surface damage of the detector;
- b) check the condition of battery clamps in the battery compartment.

3.1.3.2 Delivery kit completeness check

Check if the delivery kit of the detector is complete according to Table 1.1.

3.1.3.3 Operability check of the detector

Operability check of the detector is performed according to 2.3.3 of this OM.

3.1.3.4 Batteries switching off and their status control

Power supply is switched off each time the detector is not in use for a long time. Do this as follows:

- switch off the detector;
- remove the lid of the battery compartment;
- remove the batteries;
- examine the battery compartment, check the contact clamps, clean the battery compartment from dirtying and contact clamps from oxides;
- make sure there is no humidity, no salt spots on the battery surface, and the insulated coating is not damaged.

3.2 Calibration of the detector

The detectors after manufacture should be calibrated with ^{137}Cs against standard sources of ionizing radiation and are not subject to verification.

Calibration results are recorded in Table 3.2.

Table 3.2 – Calibration results

Tested specification		Actual value
Name	Standardized value	
Main relative error in gamma radiation DER measurement with confidence probability of 0.95 (calibrated with ^{137}Cs)	$(25+2/\dot{H}^*(10))\%$, where $\dot{H}^*(10)$ is a measured value of gamma radiation DER measurement in $\mu\text{Sv/h}$	
Main relative error in gamma radiation DE measurement with confidence probability of 0.95	25 %	

4 CERTIFICATE OF ACCEPTANCE

The UDKG-01A “Gamma Sapiens” intellectual gamma radiation detector of BICT.412129.024-06 type with _____ serial number meets the technical requirements specified in TY Y 33.2-22362867-029:2012, and is calibrated and accepted for use.

Date of manufacture _____

Stamp here

QCD Representative: _____
(signature)

5 PACKING CERTIFICATE

The UDKG-01A “Gamma Sapiens” intellectual gamma radiation detector of BICT.412129.024-06 type with _____ serial number is packed by the private enterprise “SPPE “Sparing-Vist Center” in accordance with the requirements specified in TY Y 33.2-22362867-029:2012.

Date of packing _____

Stamp here

Packed by _____
(signature)

6 WARRANTY

6.1 The manufacturer guarantees the conformity of the detector to the TY Y 33.2-22362867-029:2012 technical specifications on condition that the customer observes the guidelines on its use, shipping and storage presented in the operating manual.

6.2 The warranty period of the detector shall terminate and be of no further effect in 18 months after the date of commissioning, or after the end of the storage period.

6.3 The warranty period of storage of the detector is 6 months after its manufacture date.

6.4 Free of charge repair or replacement during the warranty period of use is performed by the manufacturer provided that:

6.4.1 The customer observed the guidelines on its use, shipping and storage.

6.4.2 The customer encloses a warranty certificate filled out accurately and clearly.

6.4.3 The customer encloses the failed detector.

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

6.6 The batteries failure is not a reason for claim, after their warranty period is expired.

6.7 Warranty is void in case of:

6.7.1 Any mechanical or thermal damage;

6.7.2 Any liquid remains;

6.7.3 Foreign objects found inside the detector;

6.7.4 The warranty stamps are violated, the housing opened, repairs or any internal changes made;

6.7.5 The serial number of the detector deleted or changed.

7 REPAIR

7.1 In case of failure or troubles during the warranty period of the detector, the user should deliver the detector to the retail outlet or the producer enterprise at the address:

PE “SPPE “Sparing-Vist Center”

33 Volodymyr Velyky Str.,

Lviv 79026, Ukraine

Tel.: (+380 32) 242 15 15;

Fax: (+380 32) 242 20 15

E-mail: sales@ ecotest.ua

7.2 Warranty and post warranty repair is performed by the producer enterprise or any other enterprise authorized by the manufacturer if the warranty certificate is available.

8 STORAGE

8.1 The detectors should be stored in the packing box in compliance with conditions 1 of ГOCT 15150-69 in heated and ventilated storehouses with air-conditioning at the ambient air temperature from +5 to +40 °C and relative humidity up to 80 % at +25 °C temperature, non-condensing. The storehouse should be free of acids, alkali and gases that may cause corrosion, and vapors of organic solvents.

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

8.3 The detectors should be stored on the shelves.

8.4 The distance between the walls, the floor of the storehouse and detectors should be at least 100 mm.

8.5 The distance between the heating gadgets of the storehouse and the detectors should be at least 0.5 m.

9 SHIPPING

9.1 Packed detectors may be transportable by any kind of closed transport vehicles under the conditions 4 of (with temperature limitations in the range from -25 to $+55$ °C) ГOCT 15150-69 and the rules and standards valid for each means of transport.

9.2 The detectors in shipping containers should be placed and fastened in the vehicle so that their stable position is ensured and shocks (with each other and the sidewalls of the transport) are avoided.

9.3 The detectors in shipping container endure:

- temperature from -25 to $+55$ °C;
- relative humidity $(95\pm 3)\%$ at $+35$ °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).

10 DISPOSAL

Disposal of the detector is performed in compliance with the group 4 of ДСанПіН 2.2.7.029-99, i.e. metal is recycled or melted, and plastic parts are dumped.

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

WARRANTY CERTIFICATE

for UDKG-01A “Gamma Sapiens” intellectual gamma
radiation detector

TY Y 33.2-22362867-029:2012

Serial number _____

Manufacture date _____

Primary calibration performed _____

Hereby I confirm the acceptance of the packed
detector applicable for use and the acceptance of the
warranty terms

Sales date _____

Salesperson _____

signature

Stamp here

Note. If any controversy arises, the parties should
act in accordance with the Article 14 of the Law of
Ukraine on the Protection of Consumer Rights.