

ATO

Handheld Portable Radiation Detector User Manual



I. Notice:

Handheld portable radiation detector is a precise instrument. Please pay attention to protection.

The following suggestions are good for the instrument maintenance and longer use life.

1. Please keep dry in the storage and utilization; excessive humidity can damage the instrument.
2. It is forbidden to fall, knock or vibrate violently; otherwise, it can damage the detector.
3. In case of long-term idling, please take out the battery.
4. In case of operational failure, please send to the designated authorized service point for maintenance.
5. Please adopt standard No. 5 battery or charging battery.
6. The modification or maintenance without approval may damage the instrument.
7. Once you doubt about instrument malfunction in the normal operation, please shut down the instrument and swiftly evacuate from hazardous area.

Note: Please carefully read this operation instruction manual; otherwise, it may lead to operational failure of the instrument. The company has the ultimate interpretation right to the manual. The company has to reserve the right to upgrade the product performance or revise this operation instruction manual without in-advanced notification.

II. Functional overview:

Handheld portable radiation detector is collocated with highly flexible Geiger counting pipe as detector; it is mainly responsible for monitoring the radiation of X, γ and hard β ray in various radioactive work areas; it is featured as swift response and broad measurement scope; it is able to display the dosage equivalent rate and accumulative dosage in the work area; during the battery replacement, the calendar, time and accumulative data can be stored permanently; it is widely applied in the individual safety protection monitor and radioactive indication for work personnel in the following fields: nuclear power plant, accelerator, iron & steel industry, chemical industry, isotope application, industrial X and γ non-destructive flaw detection, radioactive medical treatment, Cobalt source treatment, γ radiation, radioactive laboratory and surrounding environment monitor of nuclear facilities.

Features:

1. Monitor of X, γ and hard β ray.
2. The instrument enjoys a high flexibility and can measure the environmental background.
3. Chinese and English operational interface.
4. Real-time measurement and display of dosage rate and accumulative dosage.
5. Permanent data storage upon power cutoff.
6. Graphic LCD and maximum screen.
7. Low power consumption and battery under-voltage indication function.
8. The instrument can preset the alarm value of dosage rate and accumulative dosage.
9. Three selective alarm modes: sound, light and vibration.

Technical index:

1. Detection ray: X, γ and hard β ray
2. Detector: Energy compensation GM pipe (Geiger counting pipe)
3. Measurement scope:
 - a. Dosage equivalent rate: 0.08—99999 μ Sv/h (maximum: 100 mSv/h)
 - b. Accumulative dosage equivalence: 0.00 μ Sv—999.0 mSv
4. Energy scope: 50 keV—1.5 MeV $\leq \pm 30\%$ (as for ^{137}Cs I)
5. Relative innate error: $\leq \pm 10\%$ (^{137}Cs 1 mSv/h)
6. Flexibility: 80 CPM/ μ Sv/h (as for ^{60}Co)
7. Alarm value value:
 - a. Dosage rate: Selection among 0.5, 1.0, 1.5, 2.0, 2.5, 5.0, 10.0, 50.0, 100.0 μ Sv/h at disposal.
 - b. Accumulative dosage: Selection among 0.05, 0.5, 1.0, 1.5, 2.0, 5.0, 10.0, 20.0, 50.0, 100.0 m Sv at disposal.
8. Unit of dosage rate: μ Sv/h, μ Gy/h, m R/h.
9. Measurement display: The dosage rate is displayed per second; the protection alarm response is less than 5 seconds.
10. Utilization environment:

Temperature: - 10 °C — + 45 °C

Relative humidity: $\leq 95\%$ (+ 45 °C)
11. Power source: Two No.7 (AAA) batteries or charging batteries.
12. Dimension and weight: 0.3 kg; 100 X 70 X 25 mm

III. Key functional specification:

[Menu/OK] key: Enter into the parameter setup menu/confirm operation.

[Return/back] key: Return from next level of menu to previous level of menu.

[Switch/power] key: Switch on/off the instrument/start up the back light of LCD.

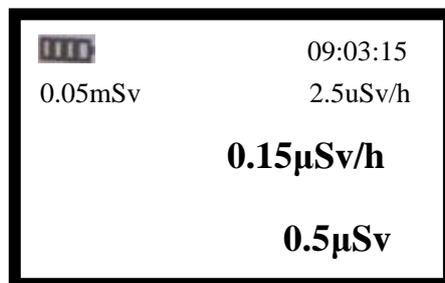
[▼] key: Downward key/minus one to digital item.

[▲] key: Upward key/plus one to digital item.

IV. Basic operational methods

1. Startup

Prepare two No. 7 batteries; upon battery installation, the instrument sends out a “beep” and LCD shines; once the instrument has installed the batteries, press [Switch/power] key for 3 seconds—the instrument starts up and LCD displays the following figure:



(Figure 2)

2. Shutdown

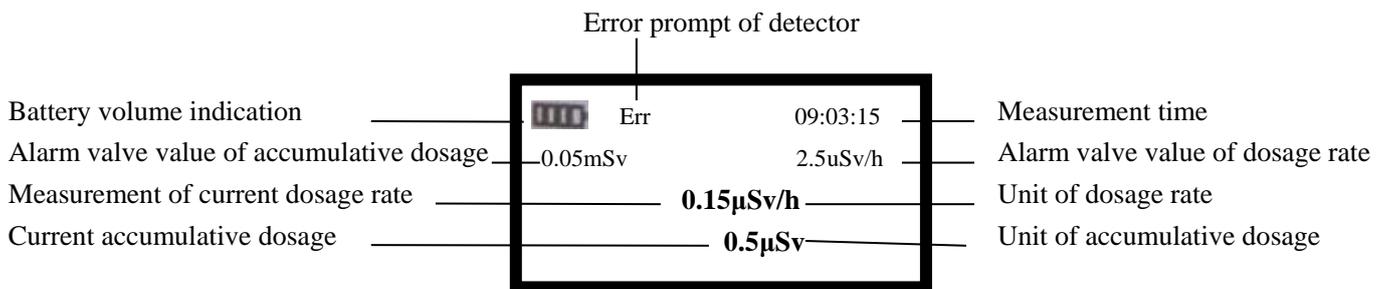
Press [Switch/power] key for 3 seconds; the instrument sends out a “beep” and the instrument is shut down.

3. Measurement

The instrument enters into the measurement status upon startup; during the measurement, it can place in the hand, pocket and backpack. The instrument has two measurement values: dosage rate in the unit of $\mu\text{Sv/h}$, $\mu\text{Gy/h}$ and mR/h ; accumulative value of dosage rate within a certain period of time: accumulative dosage in the unit of μSv or mSv . Once any measurement value exceeds the setup alarm valve value, the instrument sends out alarm according to the setup alarm mode.

4. Specification of LCD display data

The instrument can display the following information:



(Figure 3)

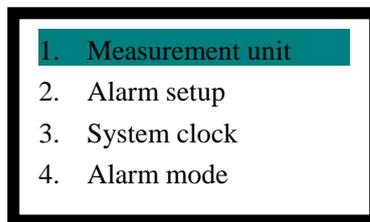
In case of inadequate power supply voltage, the battery under-voltage indication sign displays and blinks. Under normal condition, Err sign does not appear; permanent appearance of Err sign means damage of Geiger counting pipe detector.

V. Parameter setup:

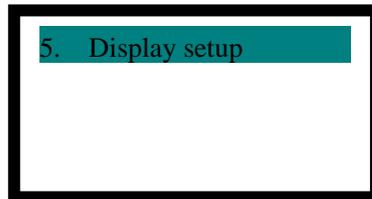
The following instrument parameters can be revised by the user: measurement unit, alarm setup, system clock, alarm mode and display setup. It can revise relevant parameters through the keyboard.

1. Entry into parameter setup status

Under the measurement status, press [Menu/OK] key to enter into the menu selection screen as shown below:



(Figure 4)



(Figure 5)

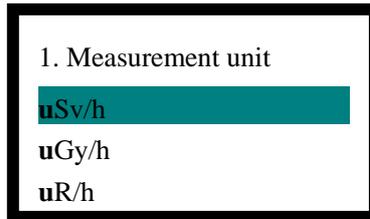
Press [▼] or [▲] key to move the icon and select setup items.

Select the setup items and then press [Menu/OK] key for subitem parameter setup; press [Return/back] key to exit the parameter setup.

2. Setup of measurement unit

Press [Menu/OK] key to enter into the menu; select the first menu item "1. Measurement unit" and then press [Menu/OK] key to enter for selection; display three items: uSv/h、 uGy/hand m R/h;

press [▼] or [▲] key to select the corresponding unit; press [Menu/OK] key for the second time and instrument stores the current item and returns to the previous level of menu; press [Return/back] key and instrument does not store the current item and returns to the previous level of menu.

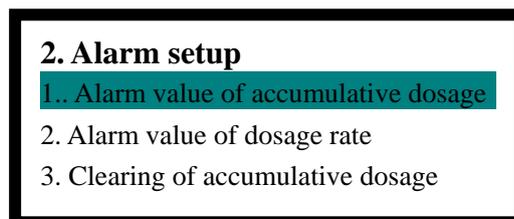


(Figure 6)

Notice: In the parameter setup status of this instrument, press [Menu/OK] key to express the user's willing to select the current item and enter into the sub-menu; once this item has no sub-menu, store revision value of the current item and return to the previous level of menu; press [Return/back] key to express the user's abandonment of current revision value and return to the previous level of menu.

3. Alarm setup

Press [▼] or [▲] key in the menu selection screen (Figure 4 and Figure 5) to select the second menu item "2. Alarm setup"; press [Menu/OK] key to enter into the item. It displays the following screen:



(Figure 7)

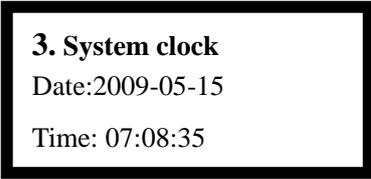
A. Alarm value of accumulative dosage: Select this item in (Figure 7) screen and press [Menu/OK] key—the instrument enters into the sub-menu of accumulative dosage alarm value; the sub-menu includes nine valve values for selection: 0.05, 0.50, 1.00, 2.00, 5.00, 10.00, 20.00, 50.00 and 100.00 m Sv; select a proper valve value, press [Menu/OK] key and store setup and return; press [Return/back] key to abandon storage and return.

B. Alarm value of dosage rate: Press [▼] or [▲] key in (Figure 7) screen to select “2. Alarm value of dosage rate” and then press [Menu/OK] key—the instrument enters into the sub-menu of dosage rate alarm value; the sub-menu includes nine dosage rate valve values for selection: 0.50, 1.00, 1.50, 2.00, 2.50, 5.00, 10.00, 50.00 and 100.00 μ Sv/h; the general radioactive work area has to adopt 2.5 μ Sv/h.

C. Clearing of accumulative dosage: Select this item in (Figure 7) and press [Menu/OK] key to enter into deletion interface; press [▼] or [▲] key to select “YES” or “NO” to decide deletion of accumulative dosage.

4. System clock

Press [▼] or [▲] key in menu selection screen (Figure 4 and 5) and select the third menu: “3. System clock”; press [Menu/OK] key to enter for selection. It displays the following screen:



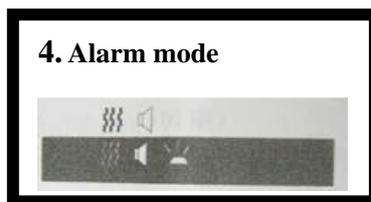
3. System clock
Date: 2009-05-15
Time: 07:08:35

(Figure 8)

Press [Menu/OK] key in Figure 8; “09” in “2009” blinks and displays; press [▼] or [▲] key to revise “09”; upon revision, press [Menu/OK] key to set up the instrument storage period and blinks the month; set up the figure of “second” according to the same method; press [Menu/OK] key to set up the instrument storage period and then return to the previous level of menu.

5. Alarm mode

Press [▼] or [▲] key in the menu selection screen (Figure 4 and 5) and select 4th menu: “4. Alarm mode”; press [Menu/OK] key to enter for selection. It displays the following screen:



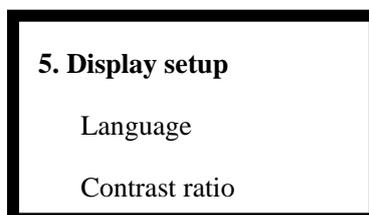
(Figure 9)

 in Figure 9 means vibration alarm;  means sound alarm;  means light alarm.

Press [▼] or [▲] key to select a proper audible and visual vibration alarm mode.

6. Display setup

Press [▼] or [▲] key in the menu selection screen (Figure 4 and 5) and select 2nd menu: “5. Display setup”; press [Menu/OK] key to enter for selection. It displays the following screen:



(Figure 10)

Language: Select this item in (Figure 10) screen and then press [Menu/OK] key to select Chinese or English.

Contrast ratio: Select “contrast ratio” subitem in (Figure 10) screen and then press [Menu/OK] key to enter for subitem setup; press [▼] or [▲] key to revise the contrast ratio and thus modify LCD effect.

Conversion knowledge of radioactive units

I. Unit conversion knowledge:

$$1\mu\text{Sv/h}=100\mu\text{R/h}$$

$$1\text{ n Ckgh}^{-1}/\text{h} = 4\mu\text{R/h}$$

$$1\mu\text{R/h} = 1\text{ r (the unit of original nuclear industry in the mine exploration process)}$$

Radioactive activity:

$$1\text{ Ci} = 3.7 \times 10^{10}\text{ Bq} = 37\text{ GBq}$$

$$1\text{ m Ci} = 3.7 \times 10^7\text{ Bq} = 37\text{ MBq}$$

$$1\mu\text{Ci} = 3.7 \times 10^4\text{ Bq} = 37\text{ KBq}$$

$$1\text{ Bq} = 2.703 \times 10^{-11}\text{ Ci} = 27.03\text{ pci}$$

Irradiation dosage:

$$1\text{ R} = 10^3\text{ mR} = 10^6\mu\text{R}$$

$$1\text{ R} = 2.58 \times 10^{-1}\text{ C kg}^{-1}$$

Absorption dosage:

$$1\text{ Gy} = 10^3\text{ mGy} = 10^6\mu\text{Gy}$$

$$1\text{ Gy} = 100\text{ rad}$$

100 μ rad = 1 μ Gy

Dosage equivalence:

1 sV = 10^3 m Sv = 10^6 μ Sv

1 Sv = 100 rem

100 μ rem = 1 μ Sv

Others:

1 Sv is equivalent to 1 Gy. 1 Clay = 0.97 Ci \approx 1 Ci

Radon unit: 1 Bq/L = 0.27 em = 0.27×10^{-10} Ci/L

II. Calculation of decay value of radioactive isotope

$$A = A_0 e^{-\lambda t} \quad \lambda = \ln 2 / T_{1/2}$$

$T_{1/2}$ means semi-decay period;

A_0 means strength of known source;

A means strength upon time period t .

Please search for the radioactive decay calculation form and calculate the radioactive screen:

1/2 and 1/10 of difference substance (cm)						
Radioactive source	Lead		Iron		Concrete	
	1/2	1/10	1/2	1/10	1/2	1/10
Cs—137	0.65	2.2	1.6	5.4	4.9	16.3
Ir—192	0.55	1.9	1.3	4.3	4.3	14.0
Co—60	1.10	4.0	2.0	6.7	6.3	20.3

III. Relationship between radioactive source and distance:

The strength of radioactive source is in inverse proportion to the square of distance.

$$X = A \cdot r / R^2$$

A: Radioactive activity of spot source;

R: Distance with source;

r: Constant figure of illumination rate.

Remark:

Ra—226 (t = 1608 years) r = 0.825 Lun. m²/hour. Curie

s – 137 (t = 29.9 years) r = 0.33 Lun. m²/hour. Curie

Co – 60 (t = 5.23 years) r = 1.32 Lun. m²/hour. Curie

List of fittings

Goods name	Quantity	Unit	Remark
FS2011 main equipment	1	Stage	
Operation instruction manual	1	Entity	
Maintenance assurance card and quality eligibility certificate	1	Piece	
			* *

Remark: * * fittings are collocated according to the user's requirements.