

BLIT[®]

**Operation Instruction Manual of
FS9000 Individual Dosage Alarm Device**
(Basic type)

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I. Notice:

FS9000 radiation individual alarm device 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. Be sure to use four AAA batteries to ensure that the four batteries have the same amount of power before they can be used.

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. Safe operational regulations:

Please carefully read this operation instruction manual; otherwise, it may lead to operational failure of the instrument.

1. Please use four batteries, or rechargeable batteries.
2. The modification or maintenance without approval may damage the instrument.

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3. Once you doubt about instrument malfunction in the normal operation, please shut down the instrument and swiftly evacuate from hazardous area; contact with the manufacturer as soon as possible.

III. Functional overview:

FS9000 radiation individual alarm device 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. Japanese and English dual-language interface.

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4. Real-time measurement and display of dosage rate and accumulative dosage.

5. Permanent data storage upon power cutoff.

6. Graphic LED and maximum screen. Resolution 128X64

7. Low power consumption and battery under-voltage indication function.

8. The instrument can preset the alarm valve value of dosage rate and accumulative dosage.

9. Sound Light Two kinds of alarm modes are available .

Technical index:

1. Detection ray: X, γ and hard β ray

2. Detector: Energy compensation GM pipe (Geiger counting pipe)

3. Normal background radiation value is below 0.20.

4. Measurement scope

a. Dosage equivalent rate: 0.08-1000 μ Sv/h (maximum: 10 mSv/h)

b. Accumulative dosage equivalence: 0.00 μ Sv500.0 mSv

5. Energy scope: 50 keV—1.5 MeV $\leq \pm 30\%$ (as for 137 Cs I)

6. Relative innate error: $\leq \pm 15\%$ (137 CS 1 mSv/h)

7. Flexibility: 80 CPM/ μ Sv/h (as for Co60)

8. Alarm valve 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.

9. Unit of dosage rate: μ Sv/h, μ Gy/h, m R/h.

10. Measurement display: The dosage rate is displayed per second; the protection alarm response is less than 5 seconds.

11. Utilization environment:

Temperature: -10 $^{\circ}$ C — +45 $^{\circ}$ C

Relative humidity: $\leq 95\%$ (+45 $^{\circ}$ C)

12. Power supply: use 4 batteries 7 batteries, or rechargeable batteries.

13. Dimension and weight: 130g; 120 X 70 X 25mm

IV. 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.

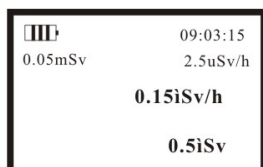
[\blacktriangledown] key: Downward key/minus one to digital item.

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

V. Basic operational methods

1. Startup

Prepare IV 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)

If the panel shows ERR within 5 seconds after start-up, it is normal. It will operate normally after 10 seconds.

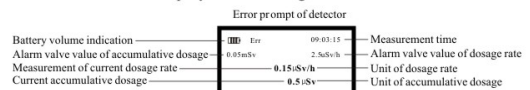
2. Shutdown

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 μ Sv/h, μ Gy/h and m R/h; accumulative value of dosage rate within a certain period of time: accumulative dosage in the unit of μ Sv or m Sv. Once any measurement value exceeds the setup alarm valve value, the

The instrument can display the following information:



(Figure 3)

instrument sends out alarm according to the setup alarm mode.

4. Specification of LCD display data

In case of inadequate power supply voltage, the battery under-voltage indication sign displays and blinks.

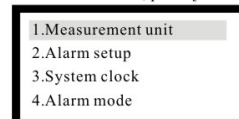
Under normal condition, Err sign does not appear; permanent appearance of Err sign means damage of Geiger counting pipe detector.

VI. Parameter setup:

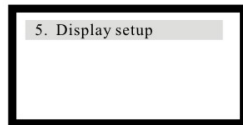
The following instrument parameters can be revised by the user: measurement unit, alarm setup, system clock, alarm mode and display setup. It can revise relevant parameters through the keyboard.

1. Entry into parameter setup status

Under the measurement status, press [Menu/OK] key to enter



(Figure 4)



(Figure 5)

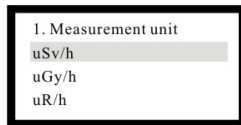
into the menu selection screen as shown below:

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/h and 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)

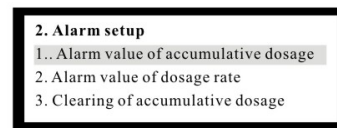
Notice: In the parameter setup status of this instrument, press [Menu/OK] key to express the user's willing to select the current item and enter into the sub-menu; once this item has no sub-menu, store revision value of the current item and return to the previous level of menu; press [Return/back] key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

measurement time

According to dosage rate and precision, select measurement time. The general measurement time is within 30 seconds. When measuring background radiation of small dosage rate, please select 60s. When measuring large dosage rate, select 1

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)

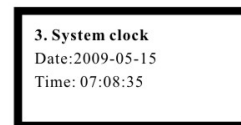
A. Alarm value of accumulative dosage: Select this item in (Figure 7) screen and press [Menu/OK] key-the instrument enters into the sub-menu of accumulative dosage alarm value; the sub-menu includes nine value values for selection: 0.05, 0.50, 1.00, 2.00, 5.00, 10.00, 20.00, 50.00 and 100.00 m Sv; select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

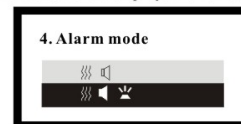


(Figure 8)

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:



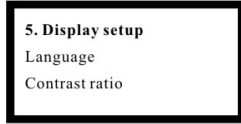
(Figure 9)

☹ 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.

Note: The basic type is not configured vibration alarm, only 9000 professional-type with this feature.

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)

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

B. 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. International standard (China is in strict adherence to this standard) 1990

1. Radioactive work personnel: 20 mSv/year (10 μ Sv/hour)

2. General personnel: 1 mSv/year (0.52 μ Sv/hour)

Remark: The above stipulations are in strict adherence to relevant suggestions of ICRP and basic standard of China's radioactive sanitation protection (GB-4792-84).

II. Unit conversion knowledge:

1 μ Sv/h=100 μ R/h

1 n Ckgh⁻¹/h = 4 μ R/h

1 μ R/h = 1 r (the unit of original nuclear industry in the mine exploration process)

Radioactive activity:

1 Ci = 3.7 X 10¹⁰ Bq = 37 GBq

1 m Ci = 3.7 X 10⁷ Bq = 37 MBq

1 i Ci = 3.7 X 10⁴ Bq = 37 KBq

1 Bq = 2.703 X 10⁻¹¹ Ci = 27.03 pci

Irradiation dosage:

1 R = 10³ mR = 10⁵ iR

1 R = 2.58 X 10⁻⁴ C kg⁻¹

Absorption dosage:

1 Gy = 10³ mGy = 10⁶ μ Gy

1 Gy = 100 rad

100 μ rad = 1 Gy

Dosage equivalence:

1 sV = 10³ m Sv = 10⁶ Sv

1 Sv = 100 rem

100 μ rem = 1 Sv

Others:

1 Sv is equivalent to 1 Gy. 1 Clay = 0.97 Ci ≈ 1 Ci

Radon unit: 1 Bq/L = 0.27 em = 0.27 X 10⁻¹⁰ Ci/L

III. Calculation of decay value of radioactive isotope

A = A₀e^{-λt} λ = 1 n2/T_{1/2}

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

A₀ 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:

Radioactive source	1/2 And 1/10 of difference substance (cm)					
	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

IV. Relationship between radioactive source and distance:

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

X = A. r/ R²

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
FS9000 main equipment	1	Stage	
Operation instruction manual	1	Entity	
Maintenance assurance card and quality eligibility certificate	1	Piece	
Clip	1	Piece	