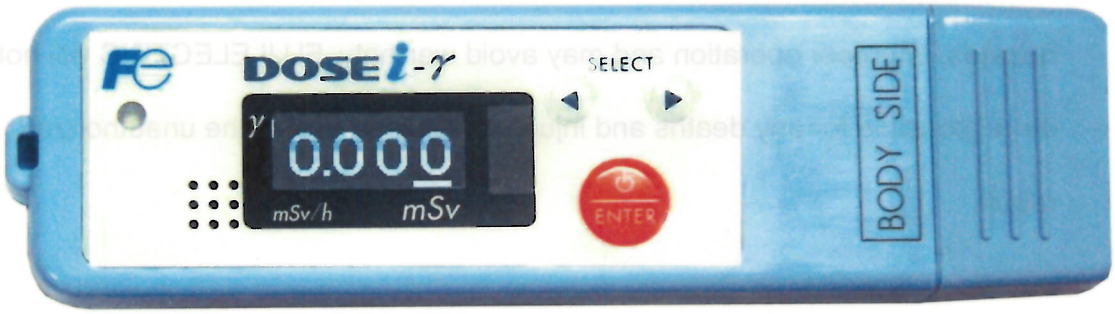
Instruction Manual

Electronic Personal Dosimeter

DOSE*i* - γ

Model: CPXANRFA-30



Fuji Electric Co., Ltd.

Preface

Congratulations. Thank you for purchasing FUJI ELECTRIC's **"DOSEι-γ."** This manual describes the operation, features and parts of the **"DOSEι-γ."** Please read the manual carefully to ensure the correct operation before use.

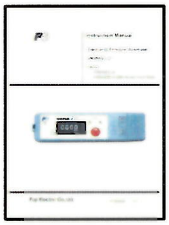
In case of a product failure, please contact our sales representative or agency with detailed information including the instrument status, problem specification, model and product serial number. Please enclose any pictures or diagrams in order to facilitate our understanding of the problem.

The unauthorized user, repairing or modifying may result in electrical shock hazards, improper operation and may avoid warranty. FUJI ELECTRIC will not be responsible for any deaths and injuries sustained due to the unauthorized repair.

Package Contents

The **"DOSEi - γ"** package contains the items listed in the table below.

Please ensure you have all items before use.

Item	Quantity	Remarks
DOSEi - γ 	1	
Battery 	1	CR2450
Instruction Manual 	1	Document No. : WTA 526488
Test Report	1	

Optional Accessories

The following optional accessories are available. Please contact our sales representative or agency.

Item	Remarks
Configuration Software (CD-ROM)	For Windows OS, 32bit type
Infrared Communication Device (USB Interface)	With USB driver software

For Your Safety

Read the following safety precautions in order to use the product safely and prevent personal injury and product damage. Read this instruction manual completely for further information before using the product. Please note that the contents of this manual may change due to the product modification, without notice.

	Safety Precautions
 Caution	- The **"DOSE$_i$-γ"** is a precision instrument and should be treated with care. - Do not drop or subject it to impact. - Keep the Dosimeter in a plastic bag for protection against organic solvents, water droplets, moisture, dust and contamination. - The Dosimeter should be handled with clean and dry hands. - If it is contaminated with dirt, clean the product by wiping it with a dry cloth. - Do not place the Dosimeter with metallic items in the pocket. - Do not use the Dosimeter in an environment with high-frequency noise and magnetic flux density equal to or greater than 200 gauss.

	Safety Precautions
 Caution	- Pay careful attention when using it near the following devices: 1. Cell phones/Mobile phones/Smart phones. (i.e. iPhone, Blackberry, etc.) 2. PHS handsets. 3. High power transceivers (or similar devices). 4. Microwave ovens. 5. Radars. 6. Welding machines. 7. Any other spark discharging or high-intensity, and radio-wave emitting devices. - Do not place the Cell phones, Mobile phones and Smart phones near the Dosimeter at least 5 cm, the Dosimeter may not operate properly. - When the "ALM BATT" appears, take readings within one-minute before replacing the battery. - Use only the CR2450-type battery. Be sure to observe the proper polarity when replacing the battery. - To save the battery life, we recommend that the Power Saving Mode be used. - When storing the Dosimeter for longer period, remove the battery from the Dosimeter. - When the Alarm activates, the battery consumption will be higher, so turn OFF the Dosimeter recommended.

	Safety Precautions
 Caution	- To prevent short outs, protect exposed terminals with insulating tape prior to disposal. Failure to do so may cause excessive heat generation, rupturing or combustion leading to personal injury and fire. - Do not throw the Dosimeter or the batteries into a fire. - Do not disassemble the Dosimeter, which may causes death or injury. - Do not force open the clip as it may be damaged. - Stop using the Dosimeter immediately if there is a malfunction or abnormality.

CONTENTS

1. General

The "DOSEι - γ" is an Electronic Personal Dosimeter, measures Gamma-Ray Personal Dose Equivalent Hp(10) (hereinafter referred to as "Dose") from the External Radiation Sources.

Each pre-set alarm threshold is displayed on the Configuration Mode screen and when the Dose or Dose Rate reaches the preset alarm thresholds, the Alarm activates.

By using the PC with the optional Software, the various parameters can be set and the data can be transmitted via the infrared communication.

2. Parts and Features

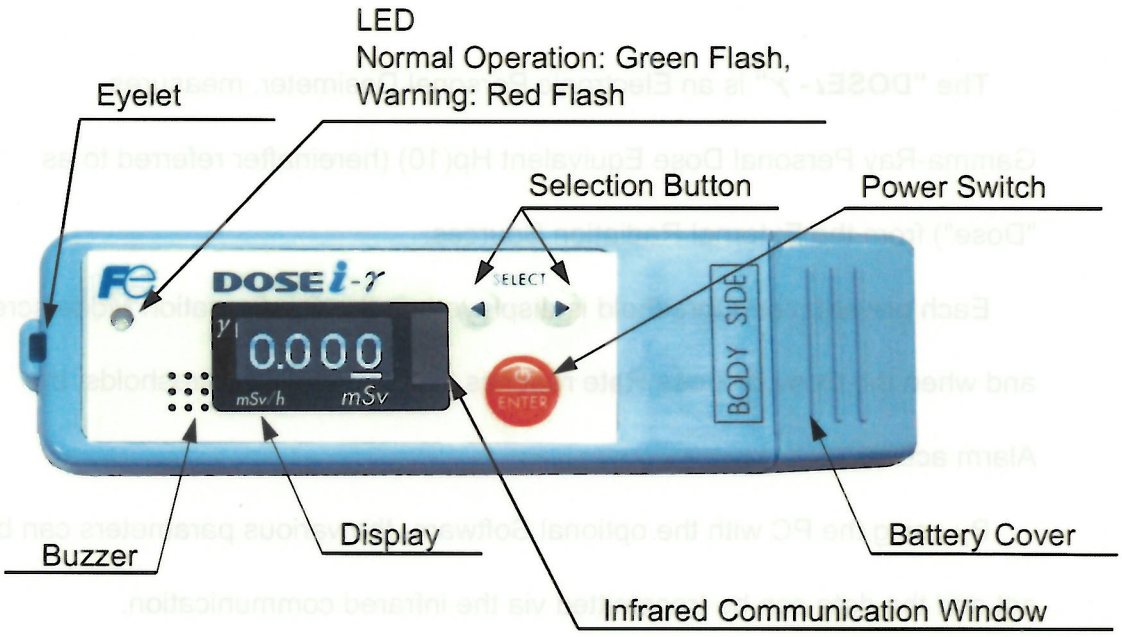


Figure 2-1 Front Side

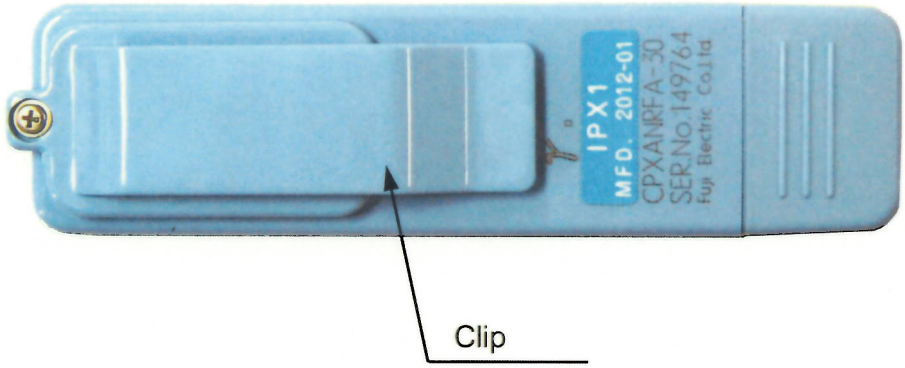


Figure 2-2 Back Side

3. Display

3.1 Display During the Normal Operation

- Display (Accumulated Dose)

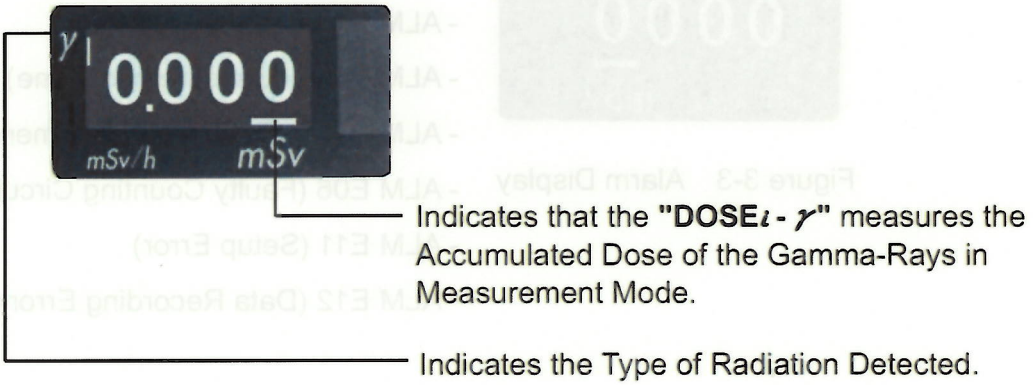


Figure 3-1 Display of Accumulated Dose

- Display (Dose Rate)

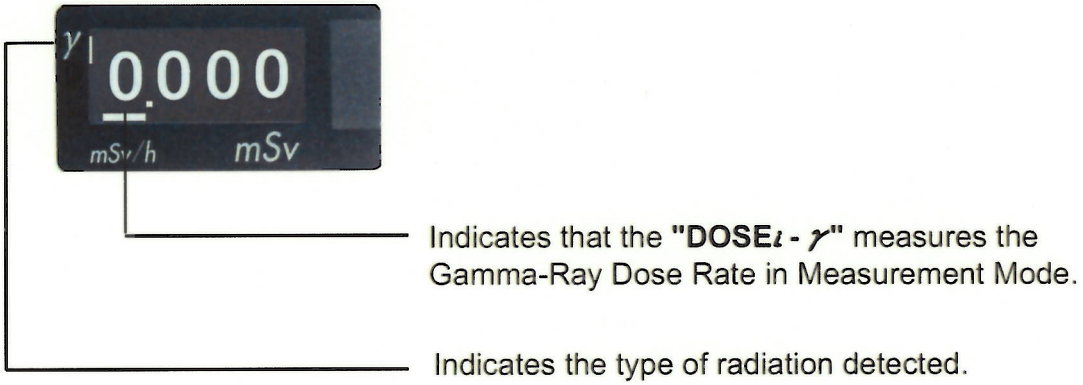


Figure 3-2 Display of Dose Rate

3.2 Display During the Abnormal Operation

Figure 3-3 Alarm Display

Alarm Indicators:

- ALM DOSE (Accumulated Dose)
- ALM RATE (Dose Rate)
- ALM TIME (Measurement Time)
- ALM BATT (Battery Replacement)
- ALM E06 (Faulty Counting Circuit)
- ALM E11 (Setup Error)
- ALM E12 (Data Recording Error)

4. Operation Procedures

(1) To start up the **"DOSEι – γ,"** press and hold the Power Switch Button (Color: Orange) for approximately 2-seconds.

If Data Reset Setting is effective, accumulated dose and operating time shall be reset at the time of startup automatically.

(2) When the Measurement Screen appears, the Red LED lights for 1-second and one Short Beep sounds, indicating that the **"DOSEι - γ"** is in Measurement Mode.

Display during Normal Situation

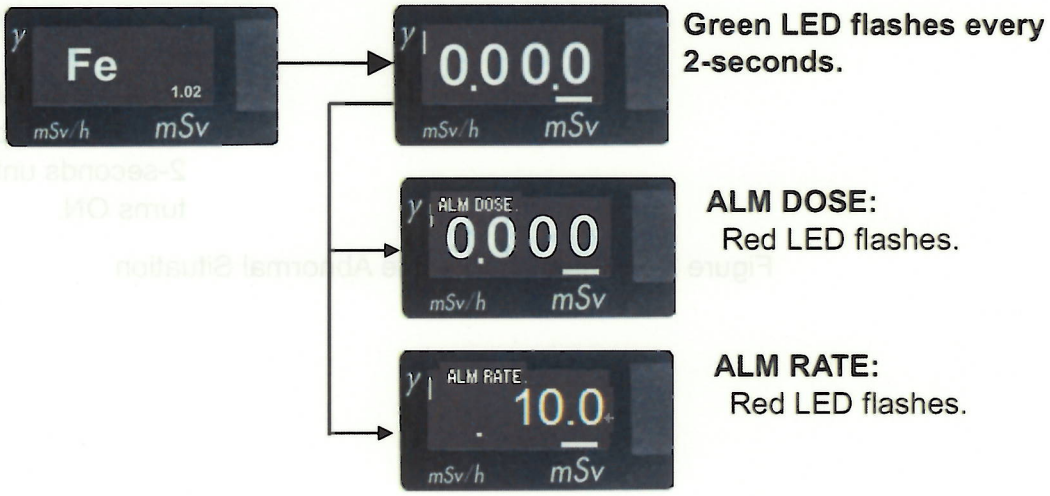
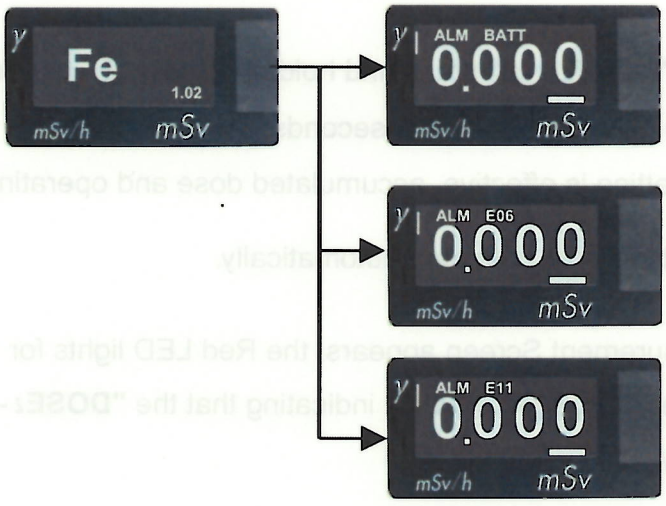


Figure 4-1 Display during Normal Situation

Display during the Abnormal Operation



ALM BATT:
Red LED flashes.
Replace the used battery with new one.

ALM E06:
Red LED flashes.
Contact Fuji Electric representative or agency.

ALM E11:
Red LED flashes.
Restart the **"DOSE*i* - *γ*"** by the following procedures:

- Press and hold Power Switch Button for approximately 2-seconds until **"DOSE*i* - *γ*"** turns OFF.
- Press and hold the Power Switch Button for approximately 2-seconds until the **"DOSE*i* - *γ*"** turns ON.

Figure 4-2 Display during the Abnormal Situation

(3) Point the "BODY SIDE" (display side) of the **"DOSEι - γ"** towards your body and insert the **"DOSEι - γ"** into your pocket, securing it with the Clip as shown in Figure 4-3.

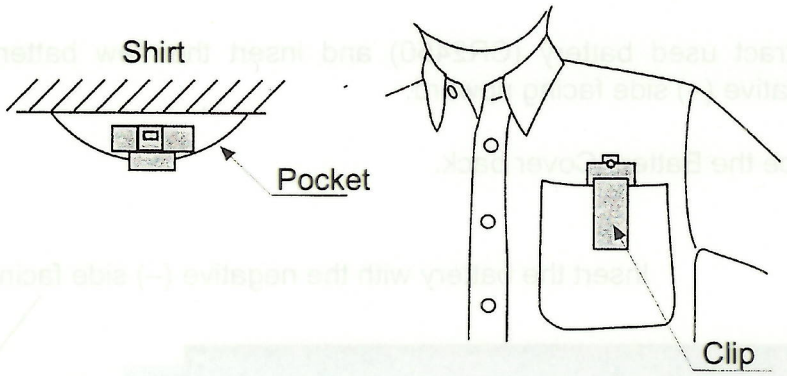


Figure 4-3 Inserting the **"DOSEι - γ"** into the Pocket

(4) To turn OFF the **"DOSEι – γ,"** press and hold the Power Switch Button for approximately 2-seconds.

5. Battery Replacement

Replace the battery (CR2450) with the new one by the following procedures:

(1) Press and hold the Power Switch Button (Color: Orange) for approximately 2-seconds until the **"DOSE*i* - *γ*"** turns OFF.

(2) Remove the Battery Cover.

(3) Extract used battery (CR2450) and insert the new battery with the negative (–) side facing upward.

(4) Place the Battery Cover back.

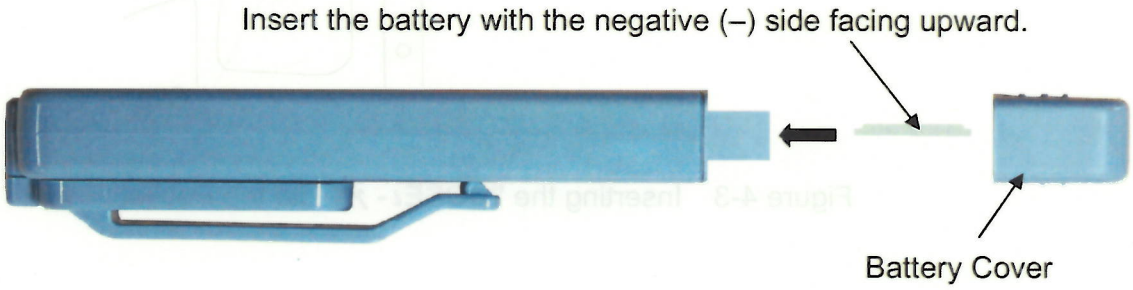


Figure 5-1 Inserting the Battery into the **"DOSE*i* - *γ*"**

Caution	- Always turn OFF the **"DOSE*i* - *γ*"** before replacing the battery. - Be sure to observe proper polarity when replacing the battery. - This Dosimeter operates on the CR2450 battery (3.0 V) only. - Only use the battery specified above.

6. Operation

The operational flow of the "DOSEi - γ" is as follows:

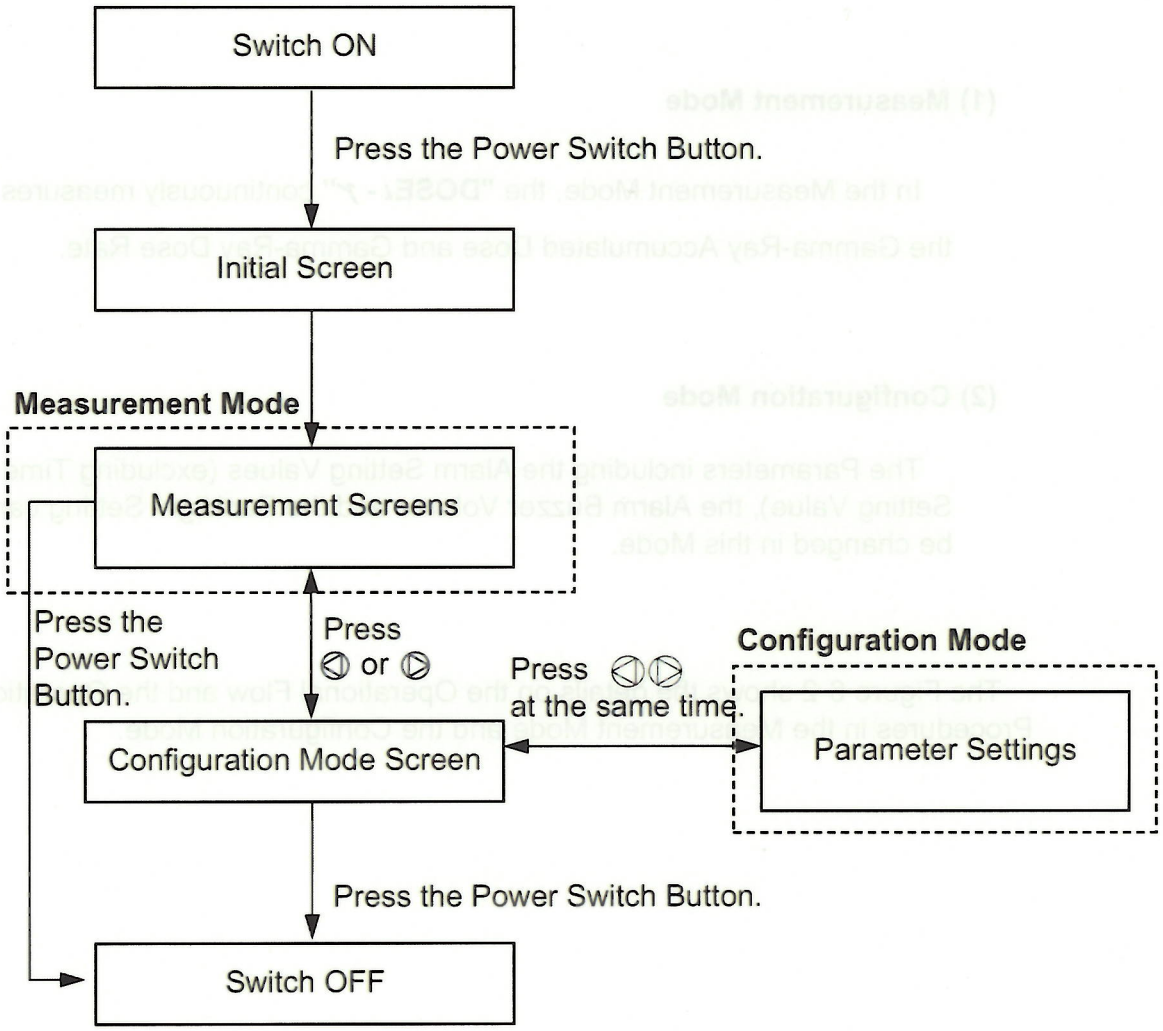


Figure 6-1 Operational Flow

The " **DOSE*i* - *γ*"** operates in the following two Modes:

- Measurement Mode

- Configuration Mode

(1) Measurement Mode

In the Measurement Mode, the **"DOSE*i* - *γ*"** continuously measures the Gamma-Ray Accumulated Dose and Gamma-Ray Dose Rate.

(2) Configuration Mode

The Parameters including the Alarm Setting Values (excluding Time Setting Value), the Alarm Buzzer Volume and the Backlight Setting can be changed in this Mode.

The Figure 6-2 shows the details on the Operational Flow and the Operation Procedures in the Measurement Mode and the Configuration Mode.

(1) Measurement Mode

(2) Configuration Mode

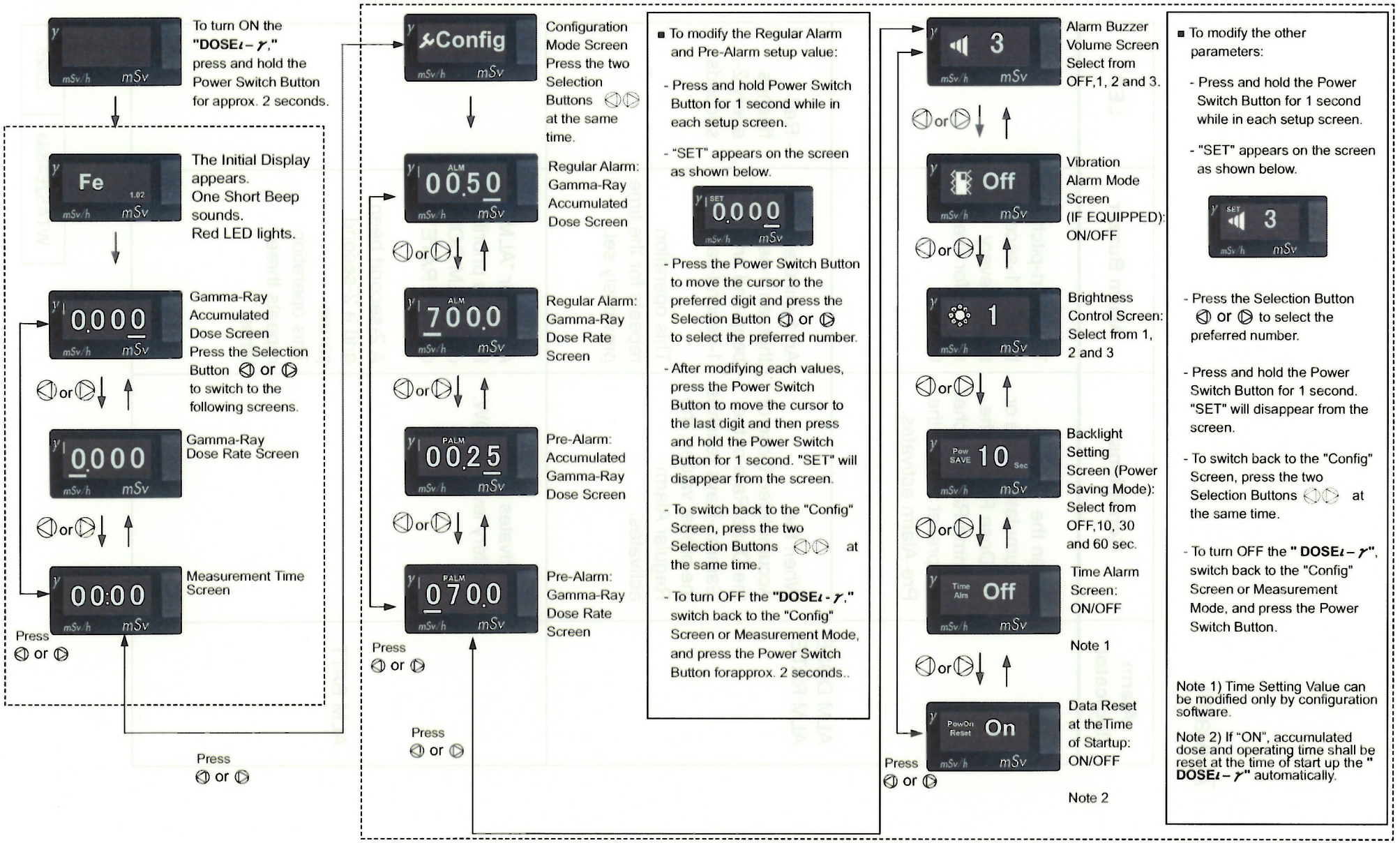


Figure 6-2 Detailed Operational Flow and Operation Procedures

7. Alarm

Alarm Indicator	Conditions	Alarm Buzzer	LED
ALM DOSE ALM RATE	When the Accumulated Dose or the Dose Rate of the Gamma-Rays reaches the preset values, the Pre-Alarm activates.	The short-pitched beep (0.1-second) sounds every second for five times.	
	When the Accumulated Dose or the Dose Rate of the Gamma-Rays reaches the preset values, the Regular Alarm activates.	An 1-minute beep, then an 1-second beep and an 1-second pause. This operation repeats for the time previously set.	- Red flashes every 2-seconds
ALM BATT	- Activates when battery level is LOW.	Alarm for "ALM BATT" is prioritized over "ALM DOSE" or “ALM RATE”. A 2-second beep and a 2-second pause This operation repeats three times.	

Alarm Indicator	Conditions	Alarm Buzzer	LED
ALM TIME	- Activates when the operating time exceeds the set time.	An 1-minute beep, then an 1-second beep and an 1-second pause. This operation repeats for the time previously set.	- Red flashes every 2-seconds
ALM E06	- Activates when the counting circuit shorts out due to disconnection or condensation.	An 1-minute beep, then an 1-second beep and an 1-second pause. This operation repeats for the time previously set.	- Red flashes every 2-seconds
over (Overflow)	- Activates when the Accumulated Dose has reached 10 Sv or when the Dose Rate is equal to or greater than 10 Sv/h.	An 1-minute beep, then an 1-second beep and an 1-second pause. This operation repeats for the time previously set.	- Red flashes every 2-seconds
ALM E11	- Activates when the measurement circuit is abnormal.	A 2-second beep and a 2-second pause (This operation repeats three times).	

8. Specifications

Items	Specifications
Detector	Silicon Semiconductor Detector
Measurement Range	0.001 mSv to 999.9 mSv 0.001 mSv/h to 999.9 mSv/h
Radiation Detected	Gamma (X) Rays:
Relative Intrinsic Error	Within ± 10% (0.01 to 999.9 mSv, Reference: ^{137}Cs)
Linearity of Dose Equivalent Rate	± 10% (to 100 mSv/h) Measurement Energy Range: 35keV to 3MeV
Display	- 4-digit LCD Screen (0.001 to 9999). - Switchable between the Accumulative Dose and Dose Rate Screens. - Refer to Section 7 about alarm indication.
Alarm Settings	- Accumulated Dose Alarm Threshold can be set in increments of 0.01 mSv. - Dose Rate Alarm Threshold can be set in increments of 0.1 mSv/h. Note: Alarm Setting Values can be modified by Configuration Mode or Configuration Software (including Infrared Communication Device).

Items	Specifications	
Alarm	When reaching or exceeding the preset values: - Alarm Sound activates (Alarm Buzzer Volume: Select from Off, 1, 2 and 3) - Red LED flashes.	
Alarm Volume	Maximum 60 dB	
Data Logging	Number of Data Records: 600 Note: The designated Software and the optional Infrared Communication Cable are required for the data transmission.	
Data Reset	If Data Reset Setting is effective, accumulated dose and operating time shall be reset at the time of startup automatically.	
Default Setting	Dose Alarm Threshold	Regular Alarm: 0.5 mSv Pre-Alarm: 0.3 mSv
	Dose Rate Alarm Threshold	Regular Alarm: 4 mSv/h Pre-Alarm: 2 mSv/h
Overflow	The message "over" appears.	
Operating Temperature	- 10°C to + 40 °C	
Operating Humidity	Up to 90% (Non-condensing)	
Typical Battery Life	Approximately one month (8 hours of daily continuous operation in the Power Saving Mode)	
Shock Resistance	The **"DOSE*i* - *γ"*** operates properly after a vertical drop test from 20 cm.	

Items	Specifications
Power Supply	A Coin-Type Lithium Battery: CR2450
Size	30 (W) × 110 (H) × 12 (D) mm (Excluding projecting parts)
Weight	Approx. 57 g (Including battery and the Clip)
Other	- IEC60529 Waterproof Grade 1: Water Resistance under the normal living conditions - Data can be transmitted to the PC via the infrared communication. Note: The optional Software and the optional Infrared Communication Device are required for the data transmission.

9. Calibration Procedure

This section describes the calibration procedure for **"DOSE*i* - *γ*"**.

Expose the **"DOSE*i* - *γ*"** to gamma-ray sources such as ^{137}Cs and ^{60}Co.

A dose rate should be measured by placing the source at the distance from reference point of the **"DOSE*i* - *γ*"** and it should be traceable to the National Standard.

(1) Determination of a reference dose rate value (R_0)

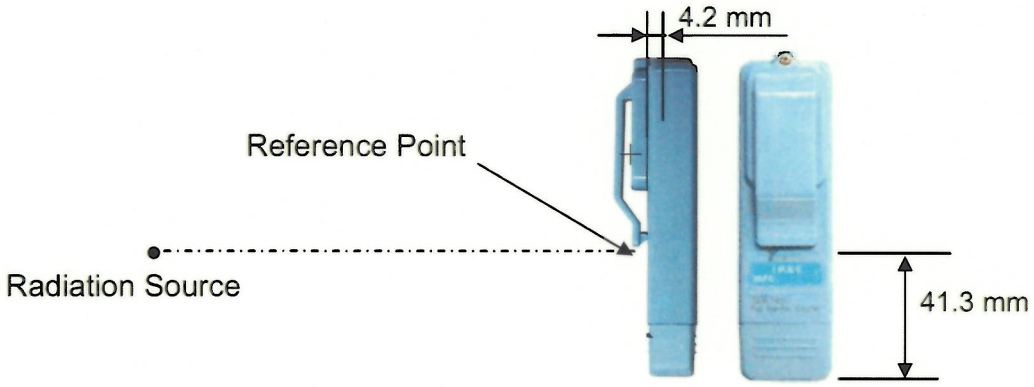
- Determine a reference dose rate value (R_0) by the following method:

  a. Calculate R_0 from the distance between the reference source and reference point of the **"DOSE*i* - *γ*"**.

  b. Or the dose rate value at the reference point (R_0) may be simply well-known by field calibration/characterization.

(2) Dose rate value (R_1) measurement

- Place the source such as ^{137}Cs and ^{60}Co at the distance from reference point of the **"DOSE*i* - *γ*"**.
- Take the dose rate reading (R_1).



Example of Geometrical Conditions

(3) Calculation of the calibration factor

- Compare the reference dose rate (R_0) and the dose rate reading (R_1). If there is an unacceptable difference between R_0 and R_1, change the calibration factor.

In general, the calibration factor (C_1) is calculated by the following formula:

$$C_1 = C_0 \times R_0/R_1$$

C_0: Original Calibration Factor

(4) Setup of the calibration factor

- To change the calibration factor, perform the following procedures:

a. After the irradiation, start the Configuration Software.
b. Click on "Manual Calibration" on the Menu Screen.
c. Enter the calculated calibration factor (C_1) to "Gamma calib. Const." of Setting area on "Manual Calibration" screen.
d. Press the "Write" button.
e. Confirm "Gamma calib. Const." of View area is set to the new value.