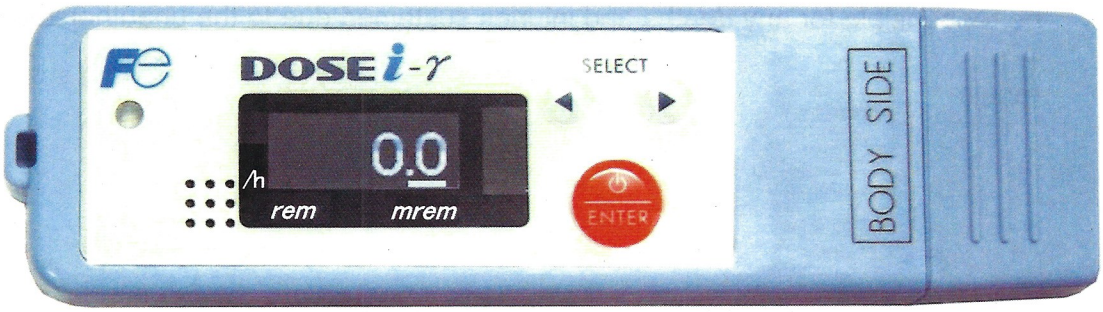
Instruction Manual

Electronic Personal Dosimeter

DOSE*i* - γ

Model: CPXANRFC-30



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Preface

Thank you for purchasing FUJI ELECTRIC's **"DOSEℓ-γ"** This manual describes the operation, features and parts of the **"DOSEℓ-γ"**

Please read this manual carefully to ensure the correct operation before use.

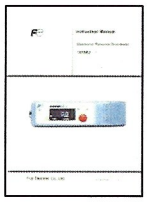
In case of a product failure, please contact Fuji Electric sales representative or agency with detailed information including the instrument status, problem specification, model and product serial number. Please enclose any pictures or diagrams in order to facilitate our understanding of the problem.

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 **"DOSE*i* - *γ*"** package contains the items listed in the table below.

Please ensure you have all items before use.

Item	Quantity	Remarks
DOSE*i* - *γ* 	1	
Battery 	1	CR2450
Instruction Manual 	1	Document No. : WTA527499
Test Report	1	

Optional Accessories

Following optional accessories are available. Please contact Fuji Electric 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 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 product modification, without notice.

	Safety Precautions
 Attention	- The **"DOSEι-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
 Attention	- 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 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 CR2450-type battery. Be sure to observe the proper polarity when replacing the battery. - To save 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
 Attention	- 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 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. - Some batteries may cause flicker of backlight on display. This is not a malfunction.

CONTENTS

1. General

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

Each preset 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

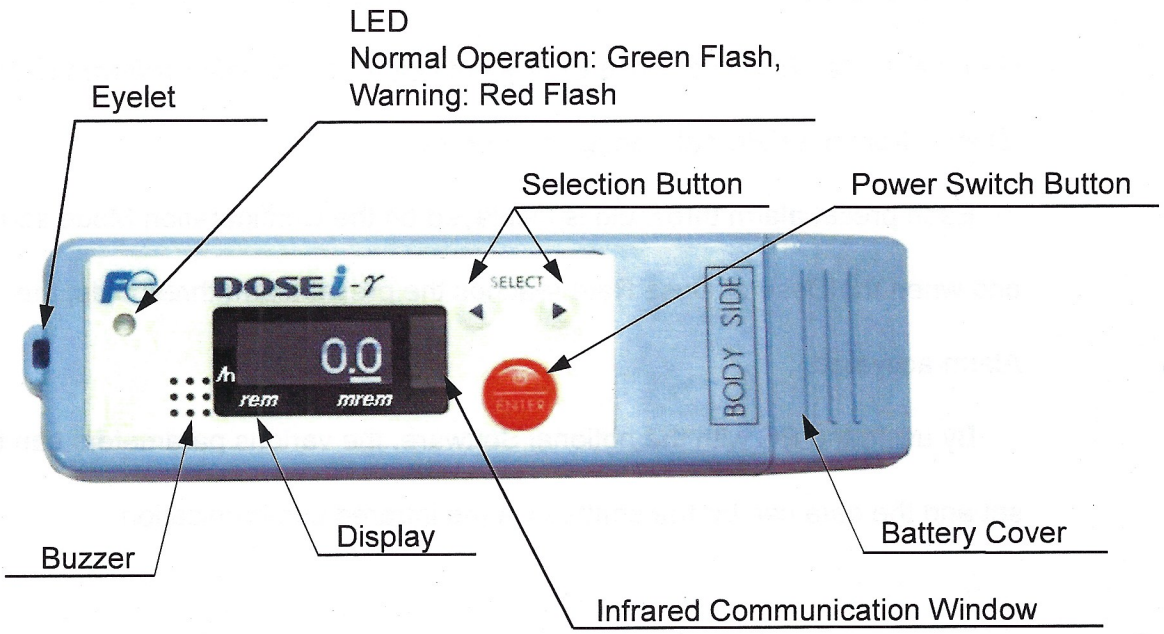


Figure 2-1 Front Side

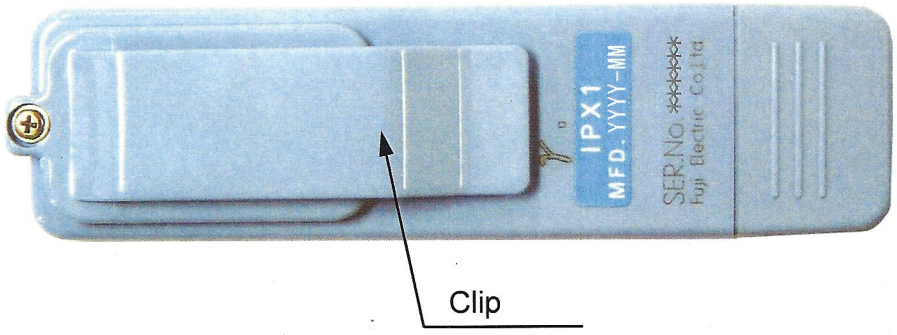


Figure 2-2 Back Side

Note) Display on this manual shows Organic EL display. On liquid crystal display, black and white are inverted, and you cannot change brightness.

3. Display

3.1 Display During Normal Situation

- Display (Accumulated Dose)

Indicates that the **"DOSEi -γ"** measures Accumulated Dose of Gamma-Rays in Measurement Mode.
When the indicated value exceeds upper limit of the mrem unit, the bottom bar is moved to the left and the value of rem unit is displayed.

Figure 3-1 Display of Accumulated Dose

- Display (Dose Rate)

When the indicated value exceeds upper limit of mrem unit, the bottom bar is moved to the left and the value of rem unit is displayed.

Indicates that the **"DOSEi - γ"** measures Gamma-Ray Dose Rate in Measurement Mode.

Figure 3-2 Display of Dose Rate

3.2 Display During Abnormal Situation

Alarm Indicators:

- ALM DOSE (Accumulated Dose Alarm)
- ALM RATE (Dose Rate Alarm)
- ALM TIME (Operating Time Alarm)
- ALM BATT (Low Battery Alarm)
- ALM E06 (Counting Circuit failed)
- ALM E11 (Setup Error)

Figure 3-3 Alarm Display

4. Operation Procedures

(1) To start up the **"DOSE*i* – *γ*,"** press and hold 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 Measurement Screen appears, the Red LED lights for 1- second and one Short Beep sounds, indicating that the **"DOSE*i* - *γ"** is in Measurement Mode.

Display during Normal Situation

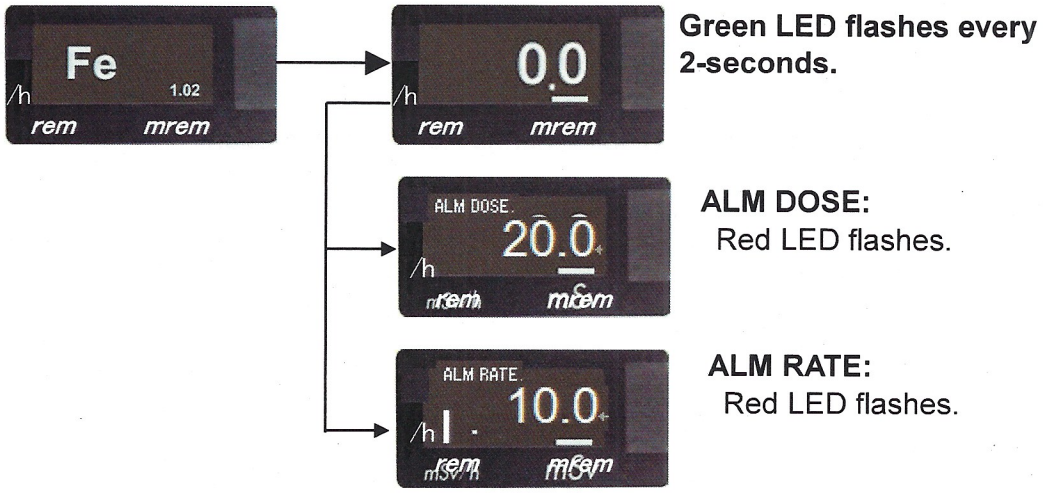
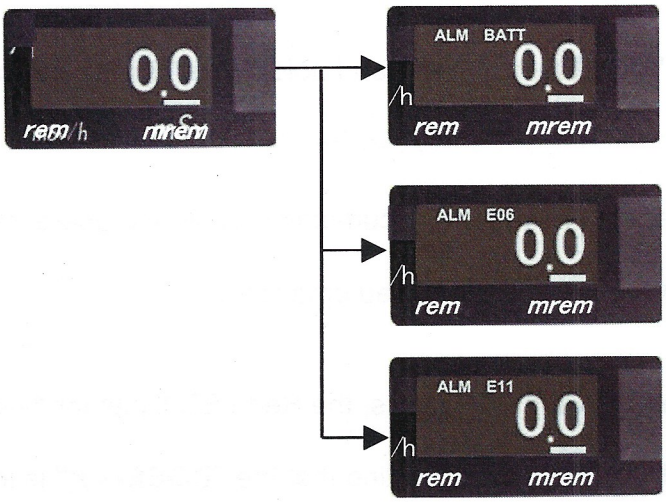


Figure 4-1 Display during Normal Situation

Display during Abnormal Situation



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 **"DOSE$_i$ - γ"** turns ON.

Figure 4-2 Display during Abnormal Situation

(3) Put the **"DOSEℓ - γ"** with its clip in shirt pocket.

Please make sure the surface marked "BODY SIDE" facing to your body as shown in Figure 4-3.

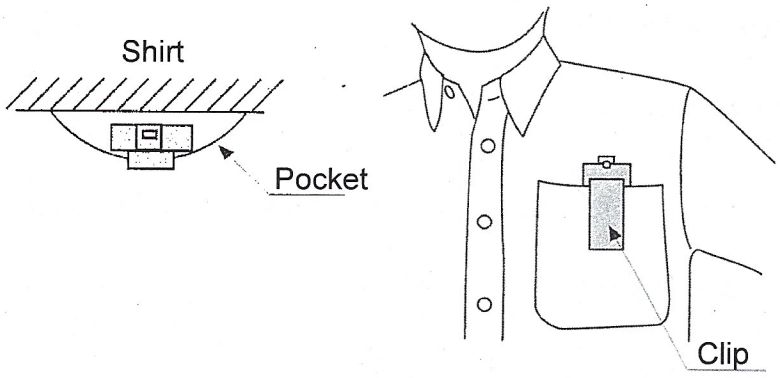


Figure 4-3 Fix the **"DOSEℓ - γ"** into the Pocket

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

5. Battery Replacement

The procedure of replacement battery is as follows.

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

(2) Remove the Battery Cover.

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

(4) Place the Battery Cover back.

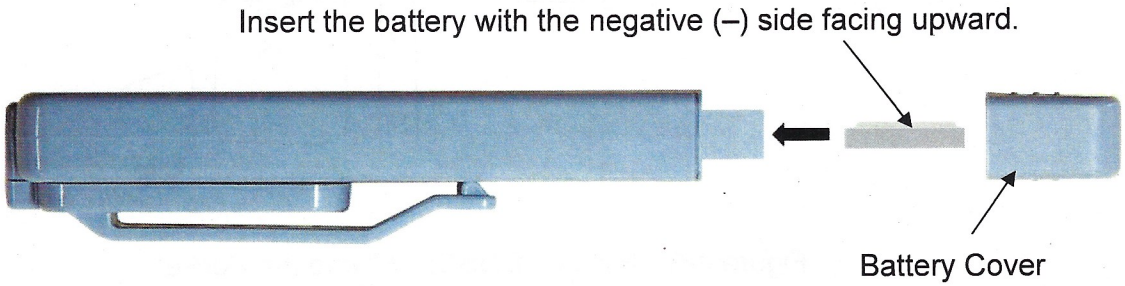


Figure 5-1 Inserting Battery into **"DOSEι - γ"**

Attention	- Always turn OFF the **"DOSEι - γ"** before replacing the battery. - Be sure to check proper polarity when replacing battery. - **"DOSEι - γ"** operates on the CR2450 battery (3.0 V) only. - Do not use other types of batteries. - When error message "E12" appears after tuning on the power, Case1: Battery was removed and inserted before the power was turned on. This is not a malfunction. Turn off the power and then turn it on again. Case 2: Battery was NOT removed and inserted before the power was turned on. There may be data recording failure. Stop using the dosimeter.

6. Operation

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

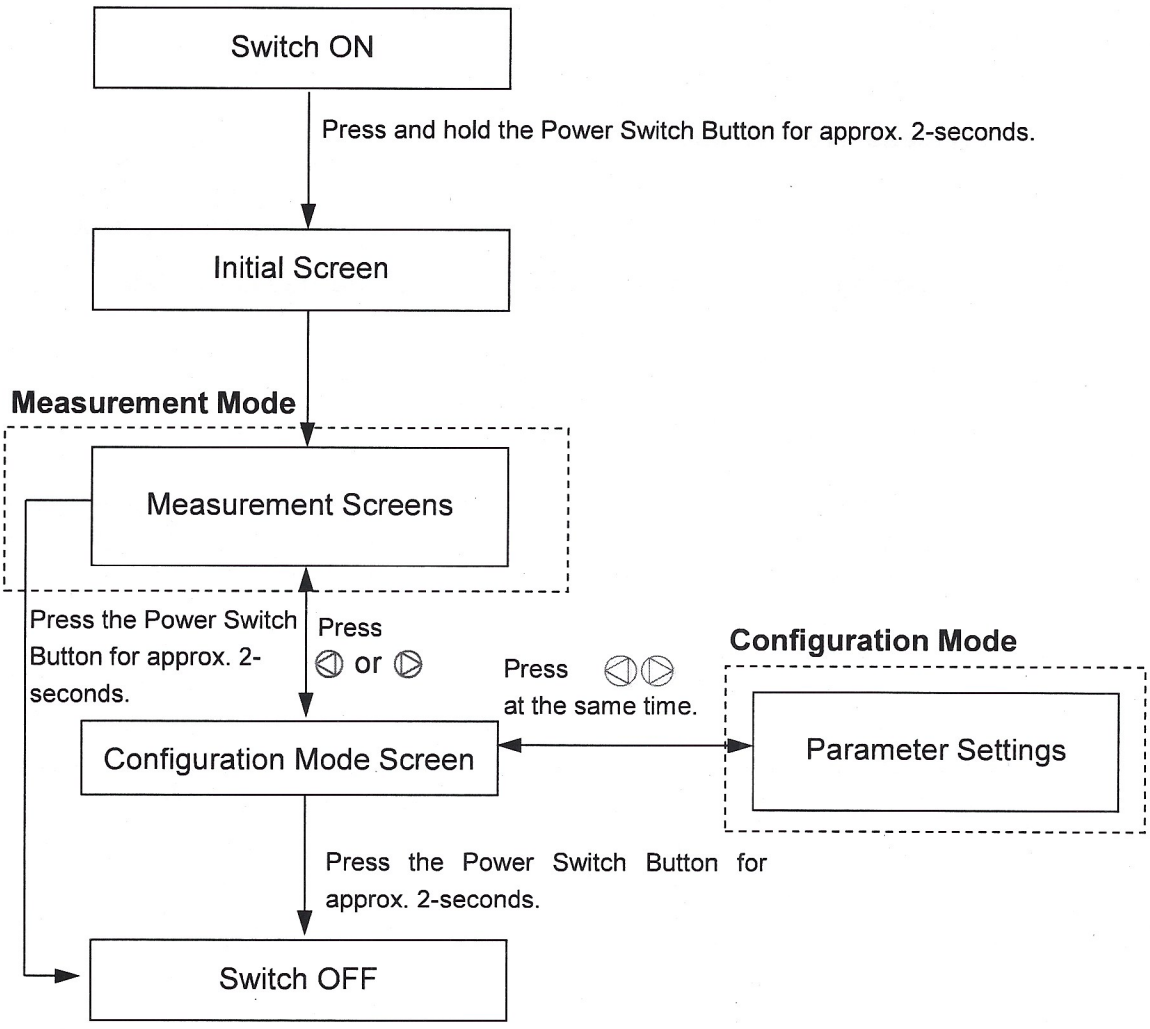


Figure 6-1 Operational Flow

The " **DOSEι - γ**" operates in following two Modes:

- **Measurement Mode**
- **Configuration Mode**

(1) Measurement Mode

In the Measurement Mode, the **"DOSEι - γ"** continuously measures 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

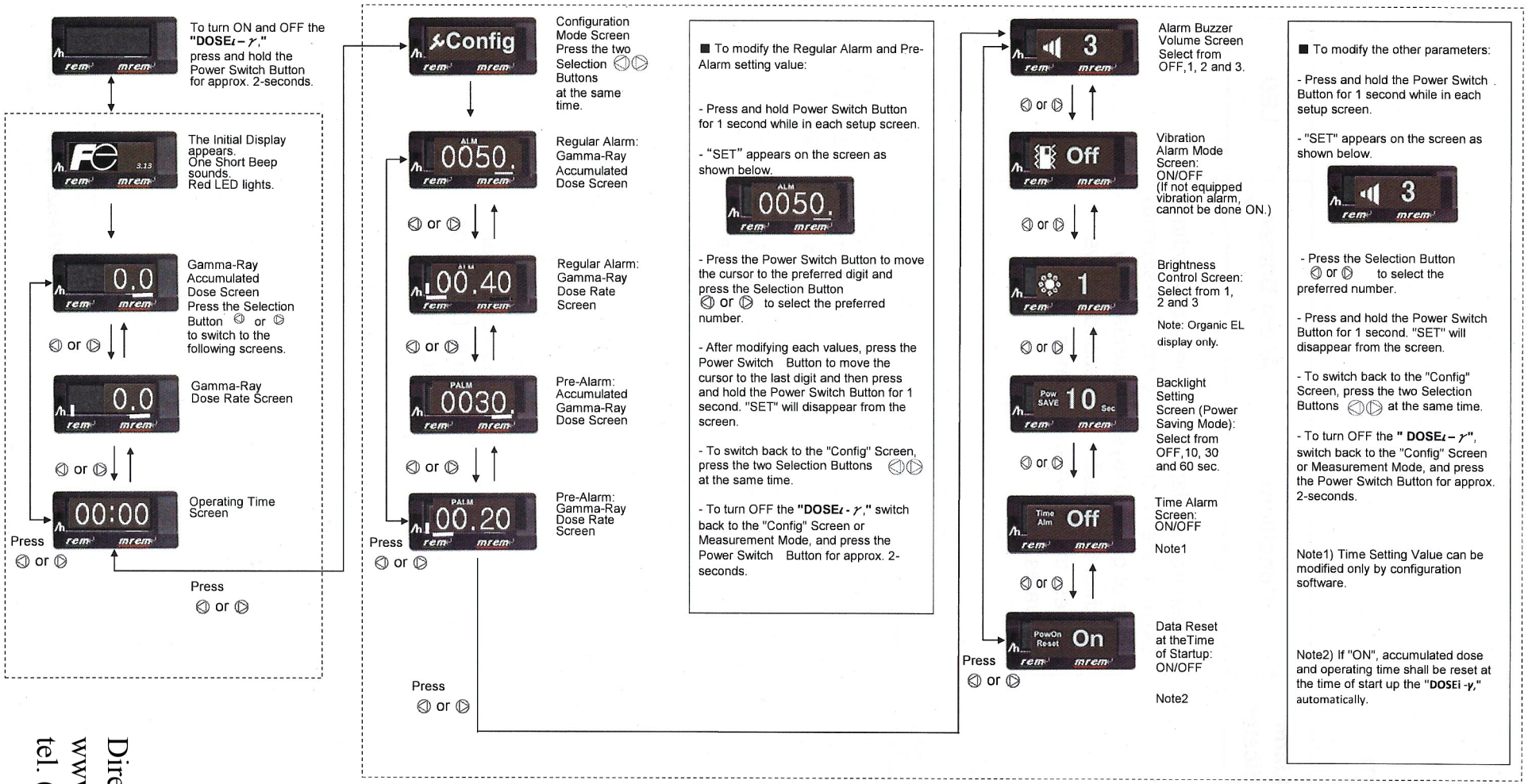


Figure 6-2 Detailed Operational Flow and Operation Procedures

7. Alarm

Alarm Indicator	Conditions	Alarm Buzzer	LED
ALM DOSE ALM RATE	When Accumulated Dose or the Dose Rate of gamma-rays reaches the preset values, the Pre-Alarm activates.	The short-pitched beep (0.1-second) sounds every second for five times.	
	When Accumulated Dose or the Dose Rate of 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, condensation or etc.	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 100 rem or when the Dose Rate is equal to or greater than 100 rem/h.	(No Alarm Buzzer)	- 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).	

Alarm Indicator	Conditions	Alarm Buzzer	LED
ALM E12	- Activates when the data recording is abnormal.	A 2-second beep and a 2-second pause This operation repeats three times.	- Red flashes every 2-seconds

8. Specifications

Items	Specifications
Detector	Silicon Semiconductor Detector
Measurement Range	0.1 mrem to 99.99 rem 0.1 mrem/h to 99.99 rem/h
Radiation Detected	Gamma (X) Rays
Accuracy	Within ± 10% (1.0mrem to 99.99 rem, Reference: ^{137}Cs)
Linearity of Dose Equivalent Rate	± 10% (to 10 rem/h) Measurement Energy Range: 35keV to 3MeV
Display	- 4-digit of measured values (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 1 mrem. - Dose Rate Alarm Threshold can be set in increments of 10 mrem/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 device 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: 50 mrem Pre-Alarm: 30 mrem
	Dose Rate Alarm Threshold	Regular Alarm: 400 mrem/h Pre-Alarm: 200 mrem/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	Approx. 1.2 (W) × 4.3 (H) × 0.47 (D) inch (Excluding projecting parts)
Mass	approx. 2.0 oz. (Including batteries and the Clip)
Others	- 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 **"DOSEℓ - γ"**.

Expose the **"DOSEℓ - 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 **"DOSEℓ - γ"** and it should be traceable to the National Standard.

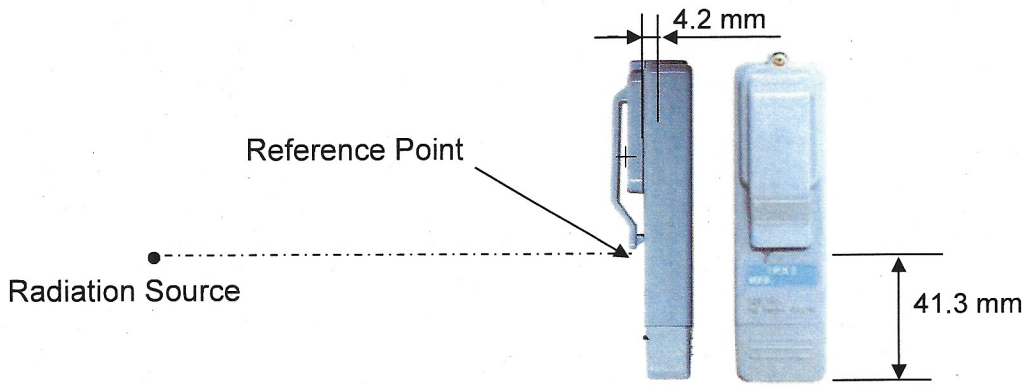
(1) Determination of a reference dose rate value (R_0)

- 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 **"DOSEℓ - 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 **"DOSEℓ - 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.