MODEL 23 AND 23-1
ELECTRONIC PERSONAL DOSIMETER

August 2017

RADIATION PRODUCTS DESIGN INC.

EXPECT SERVICE

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STATEMENT OF WARRANTY

Ludlum Measurements, Inc. warrants the products covered in this manual to be free of defects due to workmanship, material, and design for a period of twelve months from the date of delivery. The calibration of a product is warranted to be within its specified accuracy limits at the time of shipment. In the event of instrument failure, notify Ludlum Measurements to determine if repair, recalibration, or replacement is required.

This warranty excludes the replacement of photomultiplier tubes, G-M and proportional tubes, and scintillation crystals which are broken due to excessive physical abuse or used for purposes other than intended.

There are no warranties, express or implied, including without limitation any implied warranty of merchantability or fitness, which extend beyond the description of the face there of. If the product does not perform as warranted herein, purchaser's sole remedy shall be repair or replacement, at the option of Ludlum Measurements. In no event will Ludlum Measurements be liable for damages, lost revenue, lost wages, or any other incidental or consequential damages, arising from the purchase, use, or inability to use product.

RETURN OF GOODS TO MANUFACTURER

If equipment needs to be returned to Ludlum Measurements, Inc. for repair or calibration, please send to the address below. All shipments should include documentation containing return shipping address, customer name, telephone number, description of service requested, and all other necessary information. Your cooperation will expedite the return of your equipment.

LUDLUM MEASUREMENTS, INC.
ATTN: REPAIR DEPARTMENT
501 OAK STREET
SWEETWATER, TX 79556

800-622-0828 325-235-5494
FAX 325-235-4672

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Section

1

Introduction

The Model 23 EPDi is an electronic personal dosimeter, which measures personal dose equivalent from external radiation sources. It is ideal for the measurement and general monitoring of gamma and X-ray radiation in medical and laboratory environments, as well as any controlled or restricted area where personal radiation monitoring is required or desired.

The Model 23-1 is identical to the Model 23, except that it measures in Sv/h instead of R/hr.

The compact and lightweight body of the instrument (55.9 g {2 oz}) makes it ideal for personal use. It can be compared to the size of an ink pen.

This instrument is sensitive to a wide range of energies from 35 keV to 3 MeV. Dose, dose equivalent rate, and alarm values are easily seen on the four-digit LCD screen. Each preset alarm threshold is displayed on the screen. When the dose or dose rate reaches the preset alarm thresholds, the alarm activates.

Users who have multiple EPDi units, there is an optional reader/software kit that can be used to quickly take data directly from the EPDi Dosimeter via infrared communication to the user's PC. The optional software also allows the user to set or change alarm set points quickly.

Since the Model 23 has energy characteristics corresponding to 1 cm dose equivalent, by placing it close to the body it is able to measure 1 cm dose equivalent.

Notice!

The Model 23 Dosimeter may not measure pulsed radiation accurately. Point the "body side" (noted on the dosimeter) or display side towards the body or area to be measured. A dot next to the gamma symbol on the instrument indicates the center point of the unit.

Section

2

Getting Started

Unpacking and Repacking

Remove the calibration certificate and place it in a secure location. Remove the instrument and ensure that all of the items listed on the packing list are in the carton. Check individual item serial numbers and ensure calibration certificates match between instruments.

To return an instrument for repair or calibration, provide sufficient packing material to prevent damage during shipment and appropriate labeling.

Every returned instrument must be accompanied by an **Instrument Return Form**, which can be downloaded from the Ludlum website at www.ludlums.com. Find the form by clicking the "Support" tab and selecting "Repair and Calibration" from the drop-down menu. Then choose the appropriate Repair and Calibration division where you will find a link to the form.

Battery Installation

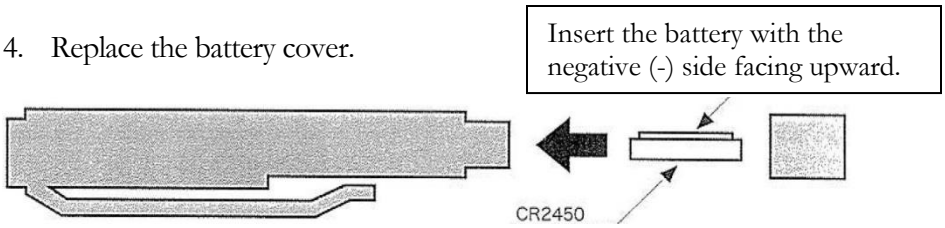
Replace the battery with the following procedure:

1. Press and hold the power switch (color: red) for approximately two seconds until the Model 23 turns off.

2. Remove the battery door.

3. Extract the used battery using miniature pliers or something similar and insert the new battery with the negative (-) side facing upward.

4. Replace the battery cover.



Caution:

Always turn off the Model 23 EPDi before replacing the battery. Be sure to observe proper polarity when replacing the battery. This product operates on the CR2450 battery (3.0 V) only (Part # 21-8639). Only use the battery specified.

Note:

When a low-battery indicator appears, take readings within one minute before replacing the battery. To save battery life, the power saving mode should be used.

Warning:

Do not throw the dosimeter or batteries into a fire. This could result in personal injury.

Preparing the Instrument for Use

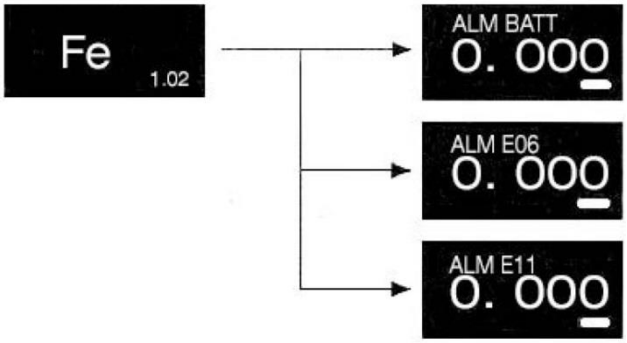
To start the Model 23 EPDi, press and hold the power switch (color: red) for approximately two seconds.

When the measurement screen appears, the red LED lamp lights for one second and one short beep sounds, indicating that the Model 23 is in the measurement mode.

Display at the time of normal operation

Green LED lamp flashes.

Display at the time of abnormal operation



ALM Batt: RED LED lamp flashes.
Replace the used battery with new one.

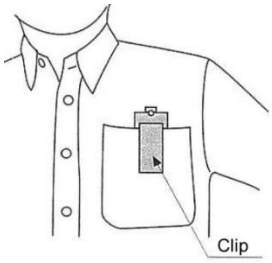
ALM E06: Red LED lamp flashes. Contact our representative or agency.

ALM E11: Red LED lamp flahes.
Restart the Model 23 by following the procedure:

- Press and hold the power switch for approximately two seconds until the Model 23 turns off.
- Pres and hold the power swith for approximately two seconds until the Model 23 turns on.

Operating the Instrument

Point the "body side" (display side) of the Model 23 towards your body and insert the Model 23 into your pocket, securing it with the clip as shown below.



To turn off the Model 23, press and hold the power switch for approximately two seconds.

Section

3

Specifications

Detector: silicon semiconductor

Measurement Range: 0.001 mSv/h to 999.9 mSv/h (0.0001 R/hr to 99.9 R/hr)

Radiation Detected: gamma and X-Ray (35 keV to 3 MeV)

Display: 4-digit liquid crystal display, with dose rate, low battery, overlow

Accuracy: within 10% from 0.01 to 999.9 mSv (1.0 mrem to 99.99 rem) (^{137}Cs)

Linearity: within 10% (to 100 mSv/h)

Alarm Output: low, medium, high user-settable volume, and OFF. When reaching or exceeding the present values – the alarm activates, red LED lamp flashes, and vibrator activates.

Alarm Volume: approximately 60 dB

Sensitivity: approximately 2 cpm per μSv/h (20cpm/mR/hr)

Data Logging: 600 records (optional IR reader required for data transmission to PC). When the Model 23 is turned off, the accumulative dose data is automatically deleted.

Default Settings:

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.

Temperature Range: -10 to 40 ˚C (14 to 104 ˚F)

Operating Humidity: ≤90% (non-condensing)

Shock Resistant: operates properly after a vertical drop test from 20 cm

Power: one each coin-type lithium battery (CR2450)

Battery Life: typically one month at 8 hours per day in non-alarm status

Size: 12 x 30 x 112.8 mm (0.5 x 1.2 x 4.4 in.) (H x W x D) without clip

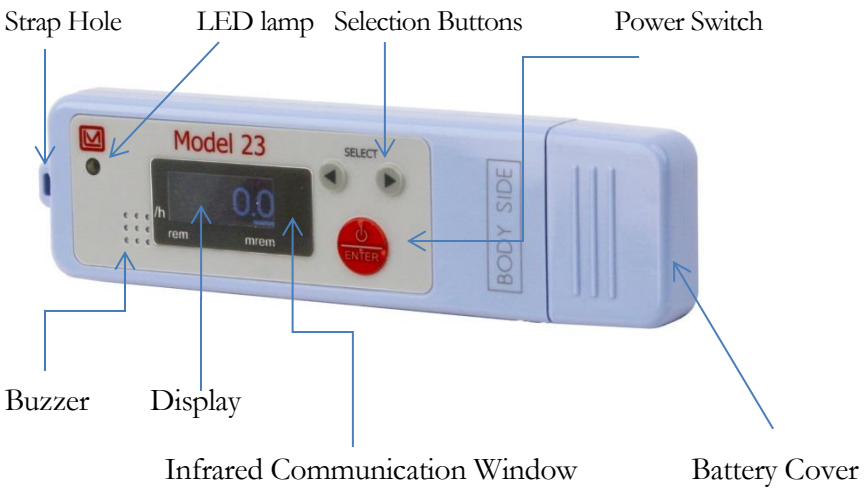
Weight: 55.9 g (2 oz)

Section

4

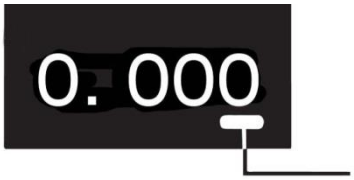
Description of Controls and Functions

Parts and Features



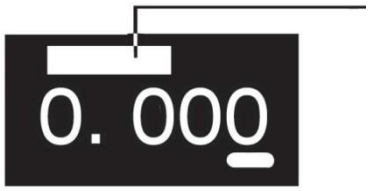
Display

Display at the end of normal operation



Indicates that the Model 23 is operating in the measurement mode.

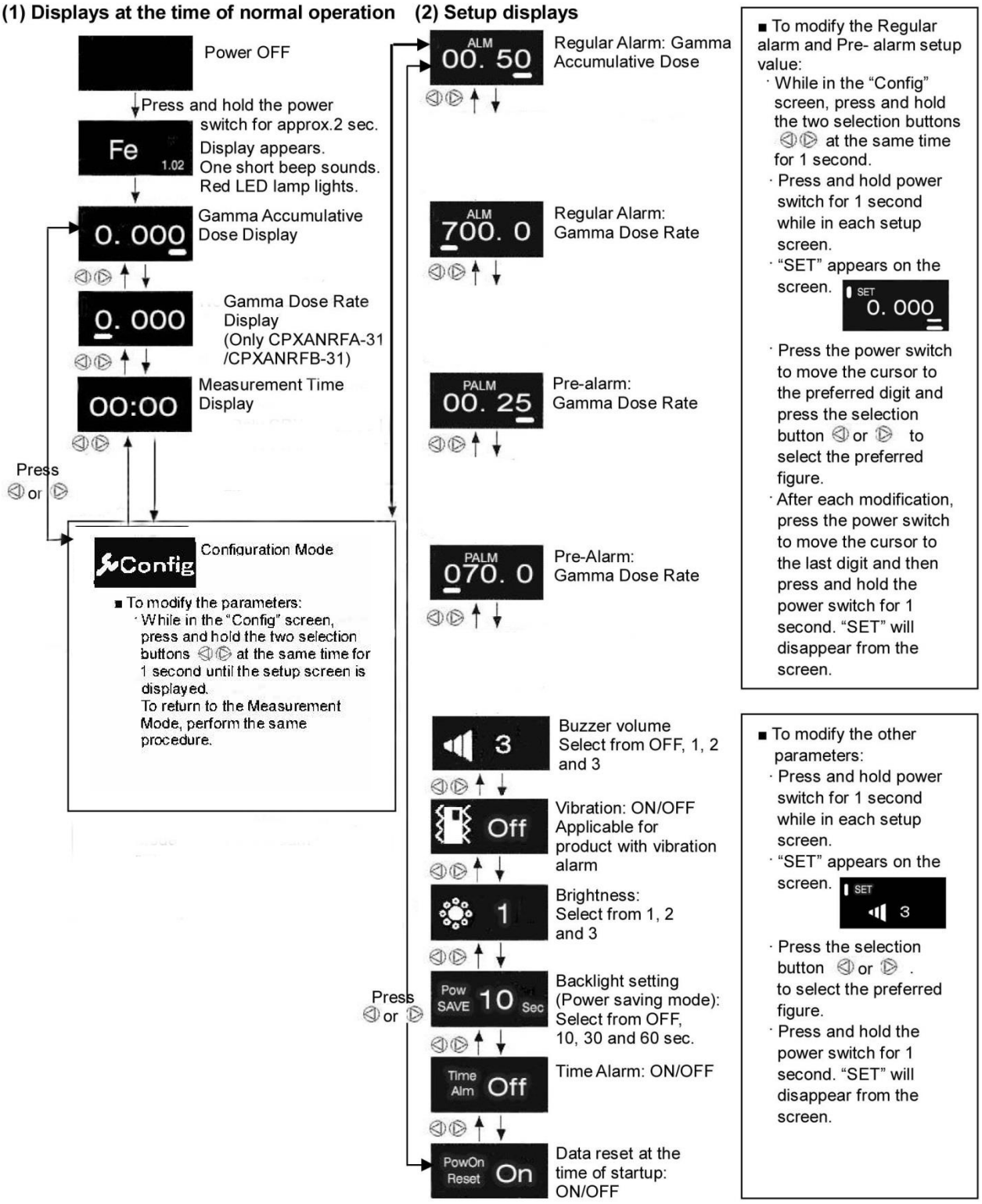
Display at the time of abnormal operation



Alarm indications:

- ALM DOSE (dose)
- ALM RATE (dose rate)
- ALM TIME (measurement time)
- ALM BATT (battery replacement)
- ALM E06 (faulty counting circuit)
- ALM 11 (setup error)
- ALM E12 (data recrording error)

See chart on following page for more examples.


(1) Displays at the time of normal operation
(2) Setup displays
Power OFF
Press and hold the power switch for approx.2 sec.
Fe 1.02
Display appears. One short beep sounds. Red LED lamp lights.
0. 000
Gamma Accumulative Dose Display
0. 000
Gamma Dose Rate Display (Only CPXANRFA-31 /CPXANRFB-31)
00:00
Measurement Time Display
Press or
Config
Configuration Mode
■ To modify the parameters:
· While in the "Config" screen, press and hold the two selection buttons at the same time for 1 second until the setup screen is displayed.
To return to the Measurement Mode, perform the same procedure.
ALM 00. 50
Regular Alarm: Gamma Accumulative Dose
ALM 700. 0
Regular Alarm: Gamma Dose Rate
PALM 00. 25
Pre-alarm: Gamma Dose Rate
PALM 070. 0
Pre-Alarm: Gamma Dose Rate
3
Buzzer volume Select from OFF, 1, 2 and 3
Off
Vibration: ON/OFF Applicable for product with vibration alarm
1
Brightness: Select from 1, 2 and 3
Pow SAVE 10 Sec
Backlight setting (Power saving mode): Select from OFF, 10, 30 and 60 sec.
Time Alm Off
Time Alarm: ON/OFF
PowOn Reset On
Data reset at the time of startup: ON/OFF
Press or
■ To modify the Regular alarm and Pre- alarm setup value:
· While in the "Config" screen, press and hold the two selection buttons at the same time for 1 second.
· Press and hold power switch for 1 second while in each setup screen.
· "SET" appears on the screen.
SET 0. 000
· Press the power switch to move the cursor to the preferred digit and press the selection button or to select the preferred figure.
· After each modification, press the power switch to move the cursor to the last digit and then press and hold the power switch for 1 second. "SET" will disappear from the screen.
■ To modify the other parameters:
· Press and hold power switch for 1 second while in each setup screen.
· "SET" appears on the screen.
SET 3
· Press the selection button or . to select the preferred figure.
· Press and hold the power switch for 1 second. "SET" will disappear from the screen.

Alarm

ALM DOSE ALM RATE	When the dose or the dose rate of gamma rays reaches preset values, the pre-alarm activates	Five 0.1-second beeps sound every second.	
ALM DOSE ALM RATE	When the dose or dose rate of gamma rays reaches preset values, the regular alarm activates.	1 1-minute beep, then a 1-second beep and a 1-second pause. This repeats for the time previously set.	Red flashes every two seconds
ALM BATT	Activates when battery voltage is low.	Alarm for "ALM BATT" is prioritized over "ALM DOSE" or "ALM RATE." A 2-minute beep, then a 2-second beep (3 times)	
ALM TIME	Activates when the operating time exceeds the set time.	A 1-minute beep, then a 1-second beep and a 1-second pause. This repeats for the time previously set.	Red flashes every two seconds
ALM E06	Activates when the counting circuit shorts out due to disconnection or condensation.	A 1-minute beep, then a 1-second beep and a 1-second pause. This repeats for the time previously set.	Red flashes every two seconds
Over (Overflow)	Activates when the accumulative dose has reached 10 Sv (1000 R) or when the dose rate is equal to or greater than 10 Sv/h (1000 R/hr), the alarm activates.	A 1-minute beep, then a 1-second beep and a 1-second pause. This repeats for the time previously set.	Red flashes every two seconds
ALM E11	Activates when the measurement circuit is abnormal.	A 2-minute beep, then a 2-second beep (repeats 3 times)	

Section

5

Safety Considerations

Environmental Conditions for Normal Use

No maximum altitude

Temperature range of -10 to 40 ˚C (14 to 104 ˚C)

Maximum relative humidity of less than 90% (non-condensing)

Pollution Degree 2 (as defined by IEC 664)

JIS Waterproof Grade 1: water resistant under normal living conditions

Notice!

The Model 23 Dosimeter may not measure pulsed radiation accurately. Also, do not use it as a survey meter.

Warning:

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 or fire. Do not throw the dosimeter or batteries into a fire. Do not disassemble the dosimeter.

Preacautions

Do not drop or subject to impact. Shock resistant after a vertical drop test from 20 cm.

Keep the dosimeter in a plastic bag for protection against organic solvents, water droplets, moisture, dust, and contamination.

Dosimeter should always be handled with clean, dry hands.

Do not place the dosimeter with metallic items in pocket.

Do not use the dosimeter in an environment with high-frequency noise and magnetic flux density equal to or greater than 200 gauss.

Pay careful attention when using it near the following devices:

- Cell phones
- PHS handsets
- High-power transceivers (or similar devices)
- Microwave ovens
- Radars
- Welding machinges
- Any other spark-discharging or high-intensity, radio-wave emitting devices.

Caution!

Keep at least 5 cm away from PHS handsets and cell phones. Failure to do this may result in false operation.

Caution!

Do not force open the clip, as it may be damaged.

Cleaning Instructions

The Model 23 Dosimeter may be cleaned externally with a dry cloth if contaminated with dirt.

Caution!

The operator or responsible body is cautioned that the protection provided by the equipment may be impaired if the equipment is used in a manner not specified by Ludlum Measurements, Inc.

Section

6

Recycling

Ludlum Measurements, Inc. supports the recycling of the electronics products it produces for the purpose of protecting the environment and to comply with all regional, national, and international agencies that promote economically and environmentally sustainable recycling systems. To this end, Ludlum Measurements, Inc. strives to supply the consumer of its goods with information regarding reuse and recycling of the many different types of materials used in its products. With many different agencies - public and private - involved in this pursuit, it becomes evident that a myriad of methods can be used in the process of recycling. Therefore, Ludlum Measurements, Inc. does not suggest one particular method over another, but simply desires to inform its consumers of the range of recyclable materials present in its products, so that the user will have flexibility in following all local and federal laws.

The following types of recyclable materials are present in Ludlum Measurements, Inc. electronics products, and should be recycled separately. The list is not all-inclusive, nor does it suggest that all materials are present in each piece of equipment:

- Batteries
- Glass
- Aluminum and Stainless Steel
- Circuit Boards
- Plastics
- Liquid Crystal Display (LCD)