GammaRAE II
Personal Radiation Monitor

User's Guide

www.raesystems.com

Read Before Operating

This manual must be carefully read by all individuals who have or will have the responsibility of using, maintaining, or servicing this product. The product will perform as designed only if it is used, maintained, and serviced in accordance with the manufacturer's instructions.

⚠ **Caution!**

To reduce the risk of electric shock, turn off power and remove batteries before removing the monitor cover. Never operate this monitor while the cover is removed. Remove monitor cover and sensor modules only in an area known to be non-hazardous.

⚠ **WARNING**

To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.

⚠ **WARNING**

Do not mix old batteries with used batteries or mix batteries from different manufacturers.

⚠ **WARNING**

Substitution of components may impair intrinsic safety.

⚠ **Warnings** ⚠

For safety reasons, this equipment must be operated and serviced by qualified personnel only. Read and understand the user manual completely before operating or servicing.

⚠ Computer Interface

Do not transfer data by means of the Bluetooth interface in hazardous atmospheres.

⚠ Static Hazard

Clean only with a damp cloth.

⚠ Long-Term Storage

Reliable performance of this radiation detector is based upon regular usage. For long-term storage, the battery should be disconnected. Preparation for use after long storage requires installation of the batteries and a warm-up period of at least 10 minutes for the sensors to equilibrate. The user should recognize that sensor life is based upon the purchase date.

⚠ **Avertissements** ⚠

Pour des raisons de sécurité, cet équipement doit être utilisé, entretenu et réparé uniquement par un personnel qualifié. Étudier le manuel d'instructions en entier avant d'utiliser, d'entretenir ou de réparer l'équipement.

⚠ Câble de Computer

Ne transférez pas les données au moyen de l'interface de bluetooth en atmosphères dangereuses.

⚠ Danger Risque D'origine Electrostatique

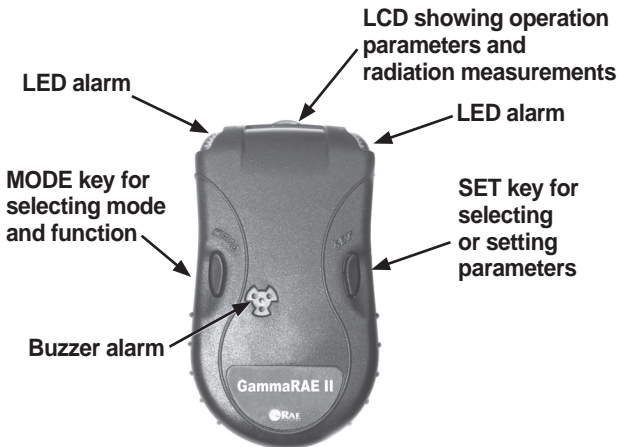Nettoyer uniquement avec un chiffon humide.

⚠ Stockage à Long Term

Le fonctionnement durable de ce détecteur de rayonnement est conditionné par une utilisation régulière de celui ci. Lors d'un stockage à long terme, la batterie doit être déconnectée. Le rédémarrage après une longue période d'arrêt, nécessite la réinstallation de la batterie, et une période de chauffage de 10 mn afin que les capteurs se mettent à l'équilibre. L'utilisateur doit être conscient que la durée de vie indiquée pour le capteur démarre à sa date d'achat.

2 **GammaRAE II**

Contents

GammaRAE II Features

LED alarm

LCD showing operation parameters and radiation measurements

LED alarm

MODE key for selecting mode and function

SET key for selecting or setting parameters

Buzzer alarm

GammaRAE II

Front View

Battery compartment

Battery compartment cover screw

Belt clip

Rear/Side View

GammaRAE II

General Information

The GammaRAE II is a rapid detector of γ-ray (gamma) sources. Because of its high sensitivity, it can alert first responders to the presence of a radiation threat well before they might be exposed to health-threatening levels. It is the only personal radiation detector with a loud audible alarm; big, bright flashing LEDs; and a vibration alarm. For stealth operations, law enforcement personnel can disable the alarms.

GammaRAE II's water-resistant design makes for reliable operation in wet environments. Its sensitive cesium iodide (CsI) scintillator provides fast (within about 2 seconds) response to radiological threats.

While not energy-compensated like a true dosimeter, the GammaRAE II does accumulate dosage. Stored dosage data can be cumulative or cleared and reset for each use period.

Inserting & Replacing Batteries

GammaRAE II uses two AA alkaline batteries as its power source (use only Duracell MN1500 or Energizer E91). To change batteries:

1. Use a coin or screwdriver to open the cover on the side of the unit. Turn the screw counterclockwise to loosen the screw, and then tilt the cover off.

2. Insert batteries into the compartment according to the legend on the rear of the GammaRAE II, making sure the batteries' polarity is correct.

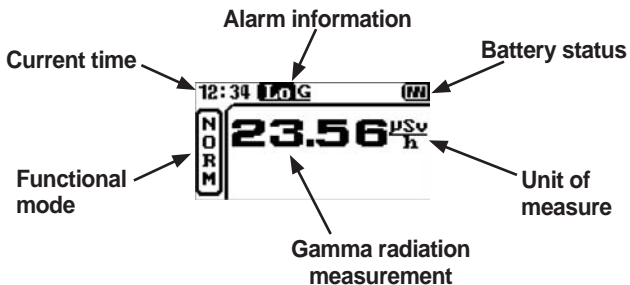3. Replace the cover and turn the screw clockwise to secure the cover.
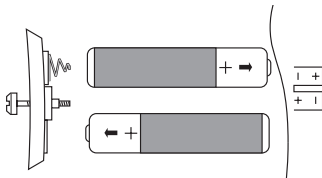
Note: When you touch the cover's internal contacts to the batteries, GammaRAE's alarm sounds briefly, indicating that the batteries are not dead. If the sound is distorted or irregular, the batteries should be replaced.

User Interface

GammaRAE's user interface consists of the display, LEDs, alarm transducer and two buttons, labeled MODE and SET. The LCD provides visual feedback that includes time, functional mode, battery condition, and gamma radiation measurement.

LCD display

Alarm information

Current time

Battery status

Functional mode

Unit of measure

Gamma radiation measurement

12:34 LoG ▥

23.56 μSv/h

NORM

MODE and SET switches

User Interface Icons

Icon	Indication
▭	Battery Voltage low Battery Low alarm triggered
▥	Battery fully charged
LoG	Gamma Low alarm triggered
ORG	Gamma Over Range (reading over 4000 μR/h)
OLG	Gamma Overload. Reading more than two times over range

Turning GammaRAE II On and Off

### Turning GammaRAE II On

Press and hold the MODE button for 3 seconds. As GammaRAE II starts up, the following occur:

1. A long beep sounds (if the buzzer is set to On), and unit information and the current firmware version are displayed. The LEDs and vibrator undergo a self-test.

```
GammaRAE II        Firmware:V1.00ND
  PRM-3000

                   Built: 15:59:04
RAE Systems Inc.   Sep 25 2004
```
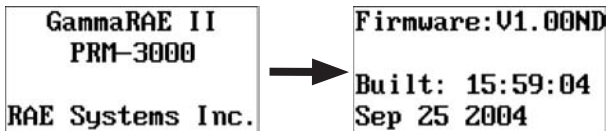
Important! If your GammaRAE II displays "Gamma sensor not found" or "No sensor installed!" contact your distributor or RAE Systems service at 408-952-8200. Do not attempt to use or repair the unit. There are no user-serviceable parts in the GammaRAE II.

2. Unit self-check. The time and battery status are displayed:

```
12:34                  ▥
I
N    Self Check..
I
T       ****
```
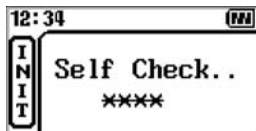
During the 60-second self-check, the detector checks that the Gamma sensor is installed. If found, the message "Gamma sensor installed!" is displayed.

```
12:34                  ▥
I
N    Gamma sensor
I
T    installed!
```
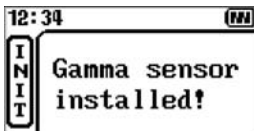
If no sensor is found, the message "No sensor installed!" is shown, and the unit powers off.

```
12:34            ▥      12:34            ▥
I                      I
N  Gamma sensor        N  No sensor
I                      I
T  not found!          T  installed!
```
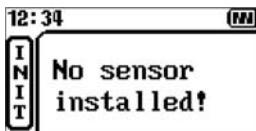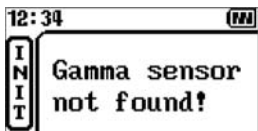
3. Background calibration. The GammaRAE II performs a 36-second calibration countdown, and is then in Normal Operating Mode.

```
12:34                    [W]
┌──────────────────────┐
│I│                    │
│N│   Calibrate...     │
│I│       36           │
│T│                    │
└──────────────────────┘
```
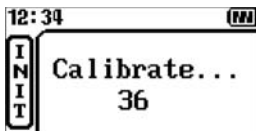
When calibration is complete and the unit is in Normal Operating Mode, the display looks like this:

```
12:34                    [W]
┌──────────────────────┐
│N│                    │
│O│        15   cps    │
│R│                    │
│M│                    │
└──────────────────────┘
```
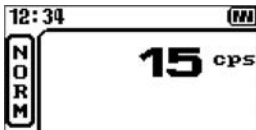
Turning GammaRAE II Off

Press the MODE button and hold for 5 seconds. The detector counts down 5 seconds and then turns itself off.

Flipping The Screen

The GammaRAE II is easy to read, whether in the hand or clipped to a belt. To flip the screen, press the SET button and hold it down for 3 seconds. When the image inverts, release the button.
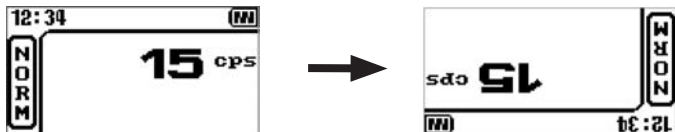

To flip the display again, hold SET for 3 seconds.

Operation

The GammaRAE II has two modes of operation: Operating Mode and Programming Mode.

Normal Operating Mode

In Normal Operating Mode, the GammaRAE II detects Gamma radiation and accumulates radiation dosage data. In Normal Operating Mode, pressing the MODE button sequentially steps the unit through the following functions:

NORM Normal Operating Mode
CAL Background calibration
PEAK Maximum radiation level detected since last cleared
MIN Minimum radiation level detected since last cleared
DOSE Accumulated radiation dosage since last cleared
STAT Detector status
TEST Self test

Each function remains active for 60 seconds before automatically returning to the Normal Operating Mode. Pressing the MODE button changes the selection from one function to the next one in the sequence.

NORM

> This function is displayed during Normal Operating Mode of the GammaRAE II.

> Displays a measurement of the ambient radiation. Can operate in "search mode" (expressed in counts per second, cps) or "detection mode" (μR/h or μSv/h, depending on how the detector is set up – see Programming Mode). Switch back and forth between search and detection modes by pressing the SET button.

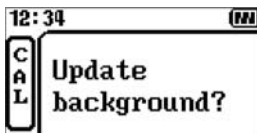| 12:34 ▥	12:34 ▥
N O R M **15** cps	N O R M **15** $\frac{\mu R}{h}$
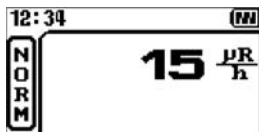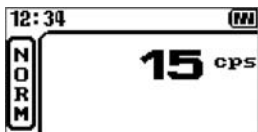
> Press the MODE button to step to the next function.

CAL

> Background calibration.
> Press the SET button to have the detector recalibrate to the background radiation.
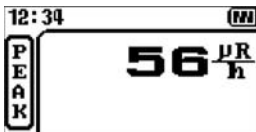
12:34   ▥
C A L   Update background?

> Press the MODE button to step to the next function.

PEAK

> The maximum radiation level detected since last cleared.
>
> Press the SET button to clear the PEAK value. The PEAK value is also cleared when the detector is turned off.

```
┌──────────────────────────┐
│ 12:34                 ▥  │
│ P │                   μR │
│ E │            56      ─ │
│ A │                    h │
│ K │                      │
└──────────────────────────┘
```

> Press the MODE button to step to the next function.

MIN

> The minimum radiation level detected since last cleared.
>
> Press the SET button to clear the MIN value. The MIN value is also cleared when the detector is turned off.

```
┌──────────────────────────┐
│ 12:34                 ▥  │
│ M │                   μR │
│ I │            15      ─ │
│ N │                    h │
│   │                      │
└──────────────────────────┘
```

> Press the MODE button to step to the next function.

DOSE

The accumulated radiation dosage since last cleared.
Press the SET button to clear the DOSE value.

```
12:34              [M]
┌─┐
│D│      56 μR
│O│
│S│
│E│
└─┘
```
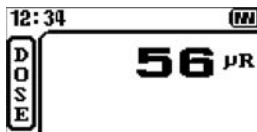
Press the MODE button to step to the next function.
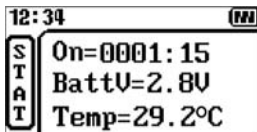
STAT

Detector status.

On   Run time from when the detector was turned
         on (shown in hours and minutes, 0000:00)
BattV Battery voltage
Temp Internal temperature (can be displayed in °C
         or °F – see Programming Mode)

```
12:34              [M]
┌─┐
│S│ On=0001:15
│T│ BattV=2.8V
│A│ Temp=29.2°C
│T│
└─┘
```

Press the MODE button to step to the next function.

TEST

Self test. This consists of tests to make sure all alert functions are working properly.

Press the SET button to accept and to initiate testing.

```
12:34                  (N)
T
E    Self test?
S
T
```
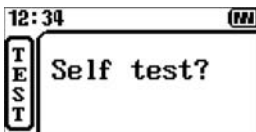
The Buzzer is tested. Press the SET button to start the next test.

```
12:34                  (N)
T
E    Buzzer on...
S
T
```
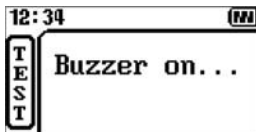
The Vibrator is tested. Press the SET button to start the next test.

```
12:34                  (N)
T
E    Vibrator on..
S
T
```
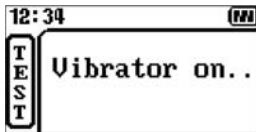
The LEDs are tested. Press the SET button to start the next test.

```
12:34              (M)
┌─┐
│T│
│E│  LEDs on...
│S│
│T│
```
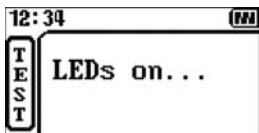
The back light is tested. Press the SET button to start the next test.

```
12:34              (M)
┌─┐
│T│
│E│  BKLite on...
│S│
│T│
```
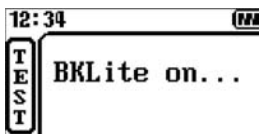
The buzzer in Alarm is tested.

```
12:34              (M)
┌─┐
│T│
│E│  Alarm on...
│S│
│T│
```
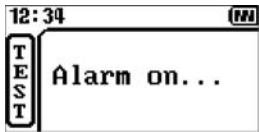
Press the SET button to finish the TEST functions. This returns GammaRAE II to Normal Operating Mode.

Programming Mode

Programming Mode is used to change alarm settings and detector settings (units of measure, time, etc.).

Note: Changes to some parameters cause the detector to automatically restart or recalibrate.

From Operating Mode, simultaneously press the MODE button and SET button, and hold them down for 3 seconds. GammaRAE II enters the Programming Mode and displays the Main Menu:

```
         Main Menu
    P  Alarm    Set
    R  Monitor Set
    O
    G  Quit
```
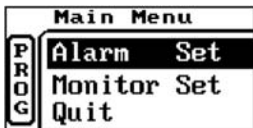
Press the MODE button to step through the menu of parameters.

Press the SET button to select a parameter.

Alarm Set

Select Alarm Set to set the low detection limit for the alarm. The Gamma CF (Gamma Correction Factor) is used to set the Low Alarm = $CF * \sigma bk$ (standard deviation of background).

Note: The default value is 005.0.

Press the MODE button to step through the digits from left to right. Use the SET button to increment each digit (from 0 through 9).

```
        Alarm Set
  P    Gamma CF
  R      005.0
  O
  G    Save    Quit
```
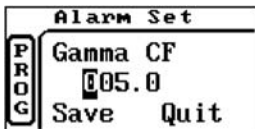
Select Save to save changes or Quit to discard changes.

To exit Alarm Set, step through the options using the MODE button until you see Quit. Press the SET button to exit Alarm Set, and then step through until you see Quit. Press SET to exit Program mode and return to Normal Operating Mode.

Monitor Set

Select Monitor Set to change any of the following parameters:

> Back Lite
> Buzz & Lite
> Vibrate Mode
> Temp Unit
> Gamma Unit
> Change Date
> Change Time
> Quit

Press the MODE button to step through these options.

Select an option using the SET button. Once you have selected a menu option, step through the options using the MODE button, and select using the SET button.

Back Lite

Set the behavior of the display backlight. Choices are Automatic (a photosensor turns on the light in dark locations), Manual (light stays on for 15 seconds when you tap SET in Normal Operating Mode), or Off.
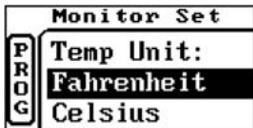
Buzz & Lite

Set the behavior of the audible and visible alarms. Choices are Both on (LEDs and audible alarm), Light only (LEDs only), or Both off.

Vibrate Mode

Set the vibration alarm. Choices are On or Off.

Temp Unit

> Set the unit of measure. Choices are Fahrenheit and
> Celsius. Press MODE to select Fahrenheit or Celsius.

> ```
> ┌─────────────────────┐
> │     Monitor Set     │
> │ P║ Temp Unit:       │
> │ R║ Fahrenheit       │
> │ O║                  │
> │ G║ Celsius          │
> └─────────────────────┘
> ```

> Then press SET to save your choice and exit.

Gamma Unit

> Set the unit of measure (of radiation). Choices are
> μR/h or μSv/h.

Change Date

> Set the date (mm/dd/yyyy). Press MODE to step
> through month, date, and year, and press SET to
> increment through the digits (holding the SET button
> continuously speeds through the numbers).

> ```
> ┌─────────────────────┐
> │     Monitor Set     │
> │ P║ Date:            │
> │ R║ 05/21/2004       │
> │ O║                  │
> │ G║ Save     Quit    │
> └─────────────────────┘
> ```
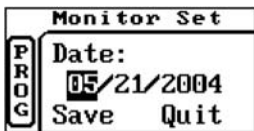
> Press MODE to select Save, or press MODE again and
> press SET to save your date changes. Otherwise, press
> MODE again to select Quit and press SET to exit.

Change Time

Set the time (hh/mm/ss). Press MODE to step through hours, minutes, and seconds, and press SET to increment through the digits (holding the SET button continuously speeds through the numbers).

```
        Monitor Set
    P  Time:
    R     12:30:45
    O
    G  Save    Quit
```

Note: The clock operates in 24-hour mode only.

Press MODE to select Save or press MODE again and press SET to save your time changes. Otherwise, press MODE again and select Quit. Press SET to exit.

Quit

To exit Monitor Set, step through the options of Monitor Set until you see Quit. Press the SET button to exit Monitor Set. Then step through Program selections using the MODE button until you see Quit. Press SET to exit Program Mode and return to Normal Operating Mode.

GammaRAE II Default Settings and Parameter Ranges

Main Menu	Sub Menu	Default Settings	Data Range
Alarm Set	Gamma CF*	5.0	1.0-9.9
	Neutron Low	---	---
Monitor Set	Back Lite	Manual	Automatic
			Manual
			Off
	Buzz & Lite	Both On	Both On
			Light Only
			Both Off
	Vibrate	On	On
			Off
	Temp Unit	Celsius	Fahrenheit
			Celsius
	Gamma Unit	μR/h	μR/h
			μSv/h
	Change Date		MM/DD/YYYY
	Change Time		HH/MM/SS

* Correction Factor

GammaRAE II Specifications*

Size	4.92" x 2.68" x 1.38" (125 x 68 x 35 mm)
Weight	9 oz. (240g)
Detector	CsI (TI)/Photodiode
Battery	2 AA alkaline batteries easily accessible with a coin
Operating Period	Up to 800 hours
Display	Graphic LCD display with 1.2" x 0.75" (30.5 mm x 19 mm) viewable area can be flipped for view by wearer or by others; cps or dosage rate in μR/hr or μSv
Key Pad	2 operation/program buttons
Direct Readout	Dosage rate, peak, min, dosage, battery status, time, temp
Alarms	Loud 85 dB @ 12" (30 cm) for noisy environments
	Built-in vibration alarm
	Highly visible LED lights on both sides of LCD graphic display

*Ongoing projects to enhance our products mean that these specifications are subject to change.

Specifications (continued)

Backlight	Automatic or manual on/off
Daily Calibration	Background level reference automatic on start-up, plus user-initiated as needed when in relative alarm mode
User Calibration	None required. Periodic functional test recommended using a lantern mantel, a smoke detector (1μCi ^{241}Am), or 1μCi ^{137}Cs reference
Alarm Setting	Programmable alarm sensitivity with background compensation to minimize false alarms
Alarm Modes	Audible and internal vibration alarms; separately enabled or disabled; automatic reset
Ergonomics	Nonslip rubber housing with grippable ridges securely fits hand or glove
Energy Range	0.06-3.0 MeV
Sensitivity	More than 1 cps per μR/hr (>100 cps per μSv/hr)
Dose Equivalent Rate (DER) range for ^{137}Cs	1–4000 μR/h (0.01–40 μSv/h)

Accuracy of DER for ^{137}Cs	±30%
Dosage Range	1 μR - 999 μR
Factory Calibration	Not required
Temperature	-20°C to 50°C (-4°F to 122°F)
Humidity	0% - 93% RH (non-condensing)
Shock Resistance	Passes drop test from 1.5m (59")
IP Rating	IP65
Attachments	Rugged metal belt clip and wrist strap; optional nylon pouch with spare battery compartment
Certification	Intrinsically safe; CSA Class I, Division 1, Groups A, B, C, D, T4 US/Canada

Limited Warranty

RAE Systems Inc. warrants GammaRAE II to be free from defects in materials and workmanship for a period of 1 year. This warranty is expressly limited to the original owner who purchases the equipment directly from RAE Systems or from an authorized RAE Systems reseller. To validate this warranty the original Warranty & Registration Card supplied with the

product must be completed and returned to RAE Systems, or the product registered online via the RAE Systems, Inc. online registration system, within 30 days of purchase.

To maintain this limited warranty, the product must be operated, calibrated and maintained in accordance with the Operation and Maintenance Manual supplied with the product. Abuse, mechanical damage, alteration, and/or repair procedures not made in accordance with the Operation and Maintenance Manual voids the RAE Systems Standard Limited Warranty.

The obligation of RAE Systems under this limited warranty is limited to the repair or replacement of components deemed by the RAE Systems Instrument Service Department to have been defective under the scope of this Standard Limited Warranty. To receive consideration for warranty repair or replacement procedures, products must be returned to RAE Systems at its manufacturing location in Sunnyvale, California, USA, with transportation and shipping charges prepaid. It is necessary to obtain a return authorization number from RAE Systems prior to shipment.

This limited warranty is expressly in lieu of any and all representations, express or implied, including but not limited to, the warranty of fitness for a particular purpose. RAE Systems will not be liable for loss or damage of any kind connected to the use of its products or failure of its products to function or operate properly.

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