



Using the GammaRAE II Responder  
Personal Radiation Detector and  
Dosimeter in One

Firmware Version 3.00 D

August 2006

# Topics

- GammaRAE II Responder Features
- Getting Started
  - Replacing the batteries
  - Turn the unit on/off
- Operation Screens
- Programming Modes
  - Basic Programming Mode
  - Full Programming Mode



# GammaRAE II Responder Features

- Detector: CsI(Tl)/Photodiode  
Photodiode + Lead shield
- Dose Equivalent: 1  $\mu$ R/h to 10 R/h  
Rate (DER) range (0.01  $\mu$ Sv/h to 0.1 Sv/h)  
for Cs137
- Accuracy of DER:  $\pm 20\%$   
for 137Cs
- Dosage Range: 1  $\mu$ R to 999.9 R
- Energy Range: 0.06 to 3.0 MeV
- Certifications: Intrinsically Safe - Class I, Division I,  
Groups A, B, C, D T4  
IP67 Rated - Immersible



# GammaRAE II Responder Features

- Functions as BOTH a sensitive, fast detector and an accurate dosimeter
- LCD display flips for 2-way viewing
- Continuous digital display of dosage rate in divisions of R/h or Sv/h (user programmable)
- Programmable audible, visible and vibration alarms
- Highly-visible LED lights on both sides of graphic display
- Loud alarm for noisy environments
- 2 operation/program buttons with an intuitive user interface

# GammaRAE II Responder Reliability

- Passes drop test from 59" (1.5m)
- Non-slip rubber housing with grippable ridges securely fits into hand or glove
- Immersible, IP67-rated case
- Certified intrinsically safe
- Temperature range of -4°F to 122°F (-20°C to 50°C)
- 500 hours on alkaline batteries
- Rugged metal belt clip, wrist strap



# Physical Description

## **MODE**

*button for selecting mode and function*

Battery Compartment

*Buzzer alarm*



**SET** *button for setting or selecting parameters*

# Physical Description

*LED alarm*



*LCD flips two ways with **SET** button to easily show operation parameters and radiation measurements*

*Battery compartment cover screw*

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# Replacing the Batteries

- Using either a flat-head screwdriver or a coin, turn screw counter-clockwise to loosen
- Tilt cover off to access AA batteries.



- Screw is captured in the battery cover
  - Note: Use only alkaline batteries. Carbon batteries may leak, causing damage.

# Replacing the Batteries

- Insert new batteries according to diagram on back of the GammaRAE II Responder
- Replace cover and turn screw clockwise to tighten cover



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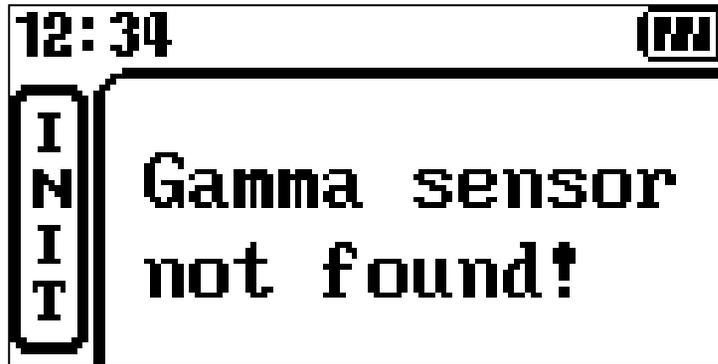


# Turning GammaRAE II Responder On

- Press and hold the **MODE** button for 3 seconds
- Buzzer sounds (if buzzer alert is set to ON)
- LCD displays unit information
  - Firmware version is shown
  - LEDs and vibrator self-test (if set to ON)
- Instrument performs self-check
  - Time and battery status are displayed
- Current mode settings are displayed
- 36-second background reference reading performed (if set to Search Mode)

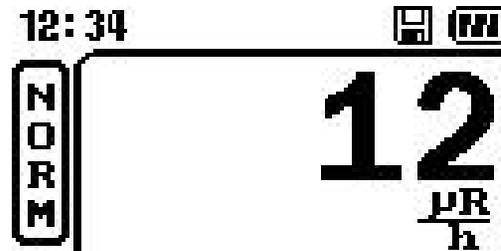


# Start-Up Warnings



**Important!** If your GammaRAE II Responder displays “Gamma sensor not found” or “No sensor installed!” contact your distributor or RAE Systems service at **1-888-723-4800 or 408-952-8486**. Do not attempt to use or repair the unit. There are no user-serviceable parts in the GammaRAE II Responder.

# Start-Up



Once the unit has started up, Normal Operating screen (NORM) is shown.

As the dose rate increases, the units will autorange, displaying different units of R/h, Sv/h or cps.

Note: NORM does not mean “Naturally Occurring Radioactive Material”; It indicates that the unit is on the Normal Operating screen.

# Turning GammaRAE II Responder Off

- Press and hold the **MODE** button for 5 seconds
- The detector counts down 5 seconds on the screen, flashes the orange LEDs (if set to ON), and beeps (if set to ON), and then shuts off
- Do not release the **MODE** button until the unit has counted down to zero or the unit will return to the Normal Operating screen.



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# GammaRAE II Responder Operations

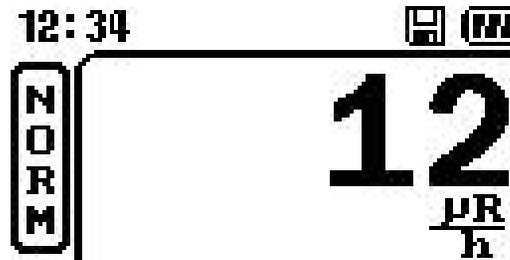
- The GammaRAE II Responder has three modes of operation: Normal Operating Mode and Basic Programming Mode and Full Programming Mode
- In Normal Operating Mode, the GammaRAE II Responder detects gamma radiation and accumulates radiation dosage data.
- In Basic and Full Programming Modes, operating parameters are specified.



# Operation Screens

- **NORM** Normal Operation screen
  - **BGND** Background reference reading (*Search Mode only*)
  - **PEAK** Maximum radiation level detected since last cleared
  - **MIN** Minimum radiation level detected since last cleared
  - **DOSE** Accumulated radiation dosage since last cleared
  - **TIME** Current time & date, time since start up
  - **STAT** Battery voltage and internal temperature
  - **COMM** Initiate Bluetooth® connection with computer
  - **TEST** Test alerts and detector functions (*only available if Diagnostic Flag is set at start up*)
- 
- Each screen remains active for 60 seconds before automatically returning to Normal Operating Mode.
  - Press the **MODE** button to go to the next screen in the sequence.

# Normal Operating Screen (NORM)



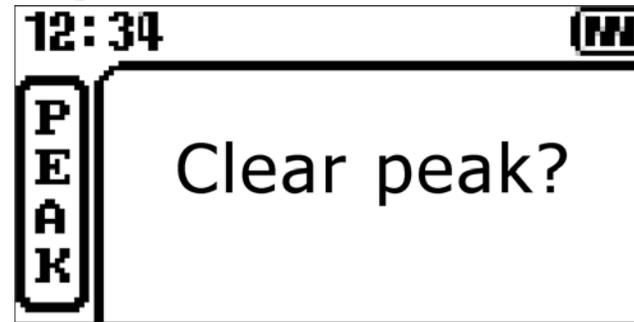
- Displays a measurement of the ambient radiation
- Can display dose rate in divisions of R/h or Sv/h (choose in Programming Mode), or radiation field measurement in cps (counts-per-second)
- Switch back and forth between dose rate units and cps units by pressing the **SET** button
- Flip the screen 180° by pressing and holding the **SET** button for 3 seconds
- Press the **MODE** button to step to the next function.

# Background Reference Reading (BGND)



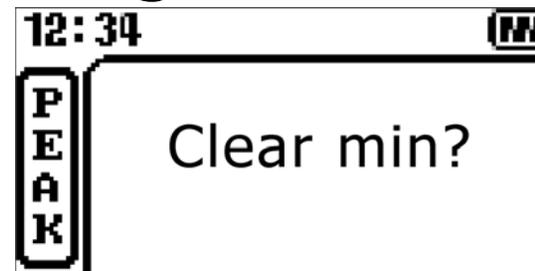
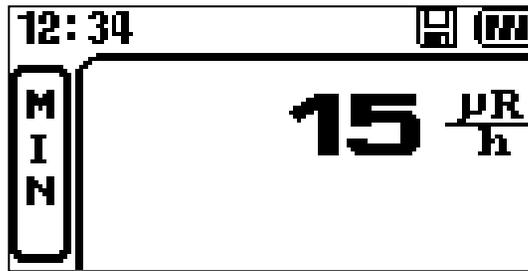
- Background reference reading (Search Mode only)
- Press the **SET** button to obtain a new background reference reading. This reading is used in determining the alarm threshold in Search Mode.
- Press the **MODE** button to step to the next function.

# Peak Reading (PEAK)



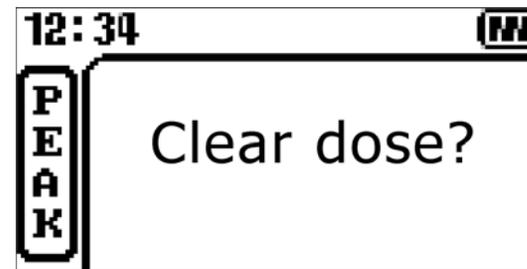
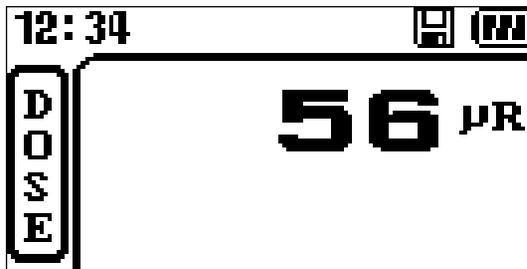
- The maximum radiation level (autoranging) detected since last cleared
- Press the **SET** button to clear the PEAK value: “Clear Peak?” will be displayed:
  - Press **SET** again to clear the PEAK
  - Press **MODE** to keep the current PEAK reading
- The PEAK value is also cleared when the detector is turned off
- Press **MODE** to step to the next function

# Minimum Reading (MIN)



- The minimum radiation level (autoranging) detected since last cleared
- Press the **SET** button to clear the MIN value: “Clear Min?” will be displayed:
  - Press **SET** again to clear the MIN
  - Press **MODE** to keep the current MIN reading
- The MIN value is also cleared when the detector is turned off
- Press **MODE** to step to the next function

# Accumulated Dose (DOSE)



- The accumulated radiation dose (autoranging) since last cleared
- Press the **SET** button to clear the DOSE value: “Clear Dose” will be displayed
  - Press **SET** again to clear the dose
  - Press **MODE** to keep the current dose reading
- The dose reading is *not* cleared when the detector is turned off.
- Press the **MODE** button to step to the next function

# Why Measure Dose?

- It makes a difference whether a dose of radiation is received all at one time or over a long period of time.
- “For example, a dose of 5,000 mSv is usually lethal if it is received in a short period and if the patient is left without special medical care. If a person receives the same dose slowly over several months, it may or may not cause any signs of illness.”
- “The same kind of effect could be illustrated by drinking a quart of whiskey. If you drink the whole bottle at once, you will get drunk, and you may even die. If you consume it during one year, drinking one teaspoonful every day or two, it will have no effect at all.”
- Bjorn Wahlstrom, Understanding Radiation

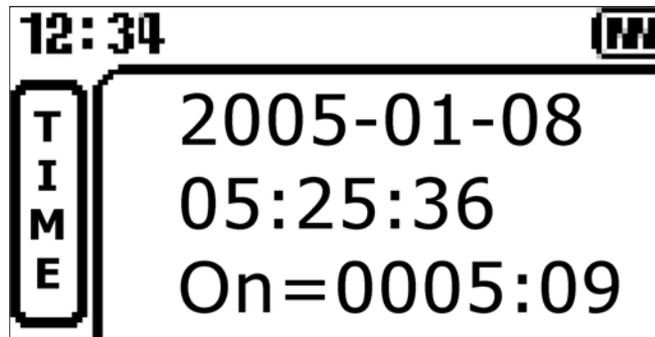
# ICRP Standards: Important Dose Limits

Exposed Workers	Average: 2000 mrem (20 mSv) per year Maximum: 5000 mrem (50 mSv) per year During pregnancy: 200 mrem (2 mSv) per year
The public	Average: 400 mrem (4 mSv) per year Single event: 500 mrem (5 mSv)

# Typical Radiation Doses

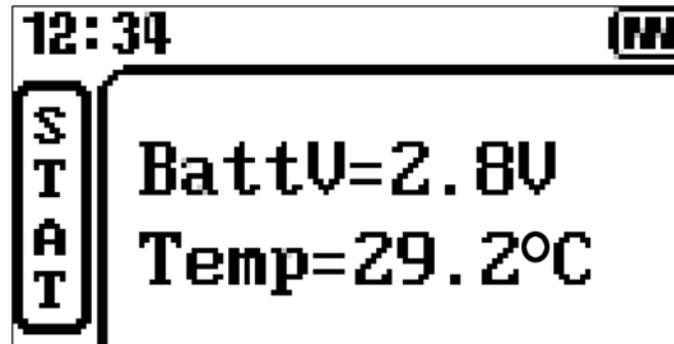
Exposed workers	Average: 100 to 300 mrem (1 to 3 mSv) per year Variation range: 0 to 2000 mrem (0 to 20 mSv)
Chest x-ray examination	About 10 mrem (0.1 mSv) per examination Variation range: 5 mrem to 500 mrem (0.05 to 5 mSv)
Major x-ray examination	Up to 2,000 mrem (20 mSv) per examination
Radon gas in houses	Average: 200 to 300 mrem (2 to 3 mSv) per year Variation range: 20 to 50,000 mrem (0.2 to 500 mSv)
Background radiation	Mostly 100 to 300 mrem (1 to 3 mSv per year) In extreme cases up to 2,000 mrem (20 mSv)
Construction materials in buildings	20 to 100 mrem (0.2 to 1 mSv) per year
Public in the vicinity of nuclear power plants	Maximum permissible: 10 mrem (0.1 mSv) per year Actual: 0.1 to 10 mrem (0.001 to 0.01 mSv) per year

# Time (TIME)



- Time, date, and time since start up
- **On**: Run time from when the detector was turned on (shown in hours and minutes, hhhh:mm)
- Press the **MODE** button to step to the next function

# Detector Status (STAT)



- Detector battery and temperature status
- **BattV**: Battery voltage
- **Temp**: Internal temperature (can be displayed in ° C or ° F – set in Programming Mode)
- Press the **MODE** button to step to the next function

# Communicate with Computer (COMM)

12:34 [Battery] [Signal]  
COMM  
Communicate  
with PC?

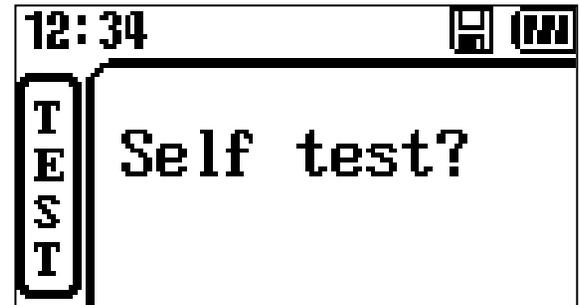
12:34 [Bluetooth] [Battery]  
COMM  
Communicate  
ready...  
BT:149-001011

- Press **SET** to open a Bluetooth® connection with a computer, and download configurations and datalogs using ProRAE Studio Radiation software
- Press the **MODE** button to step to the next function

# Self Test (TEST)

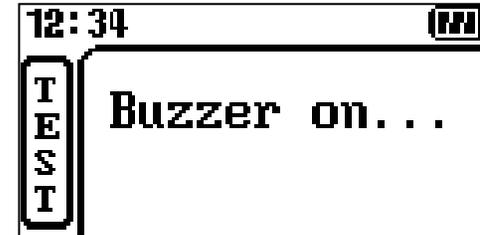
The Self Test consists of tests to make sure all alert functions are working properly. This screen is only available if the Diagnostic Flag has been set at start up. To set the flag, press and hold both the **MODE** and the **SET** buttons when turning the GammaRAE II Responder on.

Press the **SET** button to accept and to initiate testing.

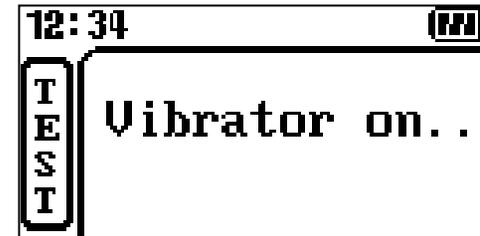


# Self Test (TEST)

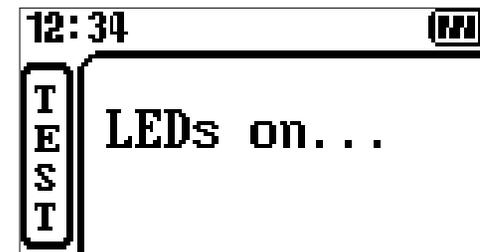
1. The buzzer is tested. Press the **SET** button to start the next test.



2. The vibrator is tested. Press the **SET** button to start the next test.



3. The LED is tested. Press the **SET** button to start the next test.

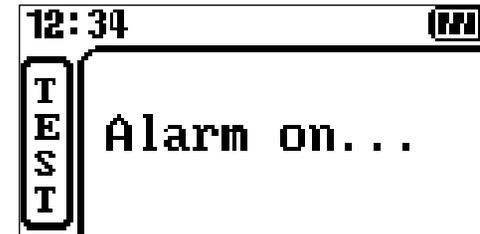


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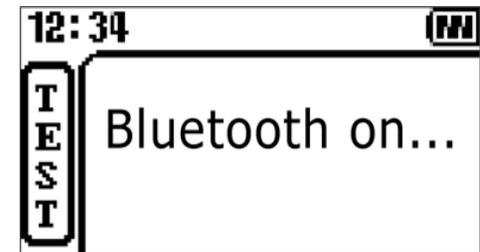
4. The backlight is tested.  
Press the **SET** button to start the next test.



5. The BlueTooth® radio is tested. Press the SET button to start the next test.



6. The alarm buzzer is tested.  
Press the **SET** button to finish the TEST functions.



# Self Test (TEST)

Each test will time out after 60 seconds and move to the next test if SET is not pressed. The GammaRAE II Responder returns to Normal Operating Mode at the end of testing.



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# Programming Modes

- **Basic Programming Mode**
  - No password required
  - Change alarm type and alerts, datalog type, backlight and basic settings
  - Cannot change alarm thresholds
- **Full Programming Mode**
  - Password protected
  - Access to ALL settings



# Programming Modes

- Press and hold the MODE and SET buttons for 3 seconds
- Datalog is paused
- Password entry screen is displayed

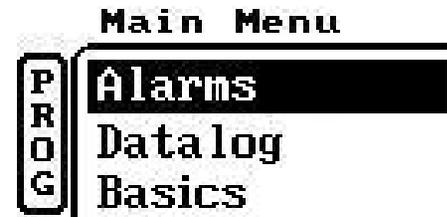
```
Program Menu
P
W
D
Password
0000 Skip
OK Quit
```

# Programming Modes

- To enter **Basic Programming Mode**
  - Press MODE until Skip is highlighted, then press SET
- To enter **Full Programming Mode**
  - Use SET to increment the password digits, and MODE to move between digits to enter the password
  - Use MODE to highlight Ok and press SET

# Basic Programming Mode

- Use MODE to step through the menu items, and SET to select one
- Highlighting and Selecting Quit exits Basic Programming Mode, restarts the datalog, and returns the unit to



Menu Item	Parameter	Description
Alarms	Alarm Type	Search or Safety Mode
	Alarm Alerts	Buzzer, Vibrate, LEDs
Datalog	Datalog Type	Continuous or Event-Driven
Basics	Backlight	Manual, Off or Automatic
	Temp Unit	Fahrenheit or Celcius
	Gamma Unit	uR/h or uSv/h

# Full Programming Mode

- Use MODE to step through the menu items, and SET to select one
- Highlighting and Selecting  
Quit exits Full Programming Mode, restarts the datalog, and returns the unit to the NORM screen



# Alarms Menu

- Change alarm settings

Item	Description
Alarm Type	Search or Safety Mode
Alarm Alerts	Buzzer, Vibrate, LEDs
Search Alarm	1.0 to 9.9
Safety High	1 uR/h to 10 R/h (0.01 uSv/h to 0.1 Sv/h) Choose units of uR/h, mR/h, R/h, uSv/h, mSv/h, Sv/h, cps, kcps, or Mcps
Safety Low	1 uR/h to 10 R/h (0.01 uSv/h to 0.1 Sv/h) Choose units of uR/h, mR/h, R/h, uSv/h, mSv/h, Sv/h, cps, kcps, or Mcps
Dose Alarm	1 uR to 999.9 R (0.01 uSv to 9.9 Sv) Choose units of uR, mR, R, uSv, mSv, or Sv

## Alarm Type

- **Search Mode** sets a single alarm threshold based on variations in the background radiation levels
  - Alarm Threshold = (Search Alarm) \* (standard deviation of background radiation level)
  - Background radiation level obtained at start up, or by selecting Update Background
- **Safety Mode** sets low and high absolute alarm thresholds based on dose rate

# Datalog Menu

- Change datalog settings and clear datalog

Item	Description
Clear Data	Press SET to confirm clear
Datalog Type	Continuous or Event-Driven
Log Interval	1 sec to 3600 sec

- Datalog Type
  - **Continuous** – always datalogging
  - **Event-Driven** – starts logging on alarm

# Basics Menu

- Change basic unit settings

Item	Description
Backlight	Manual, Off, or Automatic
Temp Unit	Fahrenheit or Celcius
Gamma Unit	uR/h (divisions of R) or uSv/h (divisions of Sv)
Change Date	Select Save to change date, or Quit to cancel
Change Time	Select Save to change time, or Quit to cancel

- Backlight

- **Manual** – turns on when a button is pushed
- **Off** – always off
- **Automatic** – turns on automatically in low lighting

# Defaults Menu

- Restores factory default settings
- Press SET to confirm restoration

# Questions?

## ***RAE Systems***

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PROTECTION THROUGH DETECTION