

# RAM GAM-1

## Gamma Survey Meter

### Operating Manual

Document #PRIR46A9.DOC

Version 5.3 – July 2018



**Rotem Industries Ltd** →

**Radiation Detection Division**  
**Rotem Industrial Park**

Mishor Yamin D.N. Arava, 8680600 Israel  
Tel. +972 8 656 4780/1 | Fax. +972 8 657 3252  
Mail: [laurence@rotemi.co.il](mailto:laurence@rotemi.co.il)

**RCTEM**  
Rotem Industries Ltd רותם תעשיות בע"מ  
<http://rotem-radiation.co.il>

← **רותם תעשיות בע"מ**

**היחידה לניטור קרינה**  
**פארק תעשיות רותם**

מישור ימין ד.ג. ערבה 8680600  
טל. 08 656 4780/1 | פקס. 08 657 3252  
דוא"ל: [laurence@rotemi.co.il](mailto:laurence@rotemi.co.il)

## Version / Revision Log: RAM GAM-1/ RAM GAM-2 - Operating Manual

Ver./Rev.#	Date	Revised Pages	Comments
4.1	May 1998		Document # BM9601.WP / N16 (MGP) Document # BM9413.WP / N16 (ROTEM)
4.2	May 1998		Operating Manual, Document # PRIR46A9.DOC
4.3	October 2009		Metal, cancel gam-2
5.0	October 2010		modified CPU board LIGHT push button cancel Light pus button add Measurements units indicated by RED led on the touch panel
5.1	January 2011		Light description Select measurements units description
5.2	August 2017		Added external power options
5.3	July 2018	5,6, 8	Changed Measuring Range from 0.05 mR/h to 4 R/h as per AMP-50

*ROTEM Industries Ltd. reserves the right to change specifications without advance notice*

# Table of Contents

<b>1. RAM GAM-1</b> .....	4
1.1. General Description.....	4
1.2. Ordering Information .....	4
<b>2. Specifications</b> .....	5
<b>3. Operating Instructions</b> .....	7
3.1. Preparation for Use.....	7
3.2. Starting-up .....	7
3.3. General Functions.....	7
3.4. Units of Measurement Selection .....	8
3.5. Threshold Selection.....	8
3.6. Alarms .....	9
3.7. Push-buttons Function.....	10
3.8. Battery Replacement .....	10
3.9. Using Chargeable batteries.....	11
<b>4. Calibration</b> .....	11
4.1. Calibration Procedure.....	11
4.2. CPU Unit Pulser Check.....	13
<b>5. Measuring units selection</b> .....	13

# 1. RAM GAM-1

## 1.1. General Description

The RAM GAM-1, a gamma survey meter, is a state-of-the-art microprocessor-based instrument. It is designed for highly stable and accurate measurements of dose rate and integrated dose rate gamma radiation. The RAM GAM-1 covers a measuring range of 0.05 mR/h (0.5  $\mu$ Sv/h) up to 4000 mR/h (40,000  $\mu$ Sv/h). **Two versions of the RAM GAM-1 meter are available, one for mR/h units and the other for  $\mu$ Sv/h units.**

RAM GAM-1 is a one-hand-operation instrument, portable, lightweight and compact. Only three push-buttons are needed for operation: "ON/OFF", "LIGHT" for display backlight enable, and "SPEAKER" push-button for audible indicator volume control. Three ways of indications enable the RAM GAM-1 user to monitor and survey rapidly and accurately: a large four 7-segment LCD, an audible click whose rate varies directly with count rate, and a LED indicator that flashes with each incident radiation pulse.

The sophisticated software offers special features and optimal performance. A wide dynamic range from background up to 4000mR/h or 40000 $\mu$ S/h, is obtained by the automatic dead time correction, according to the preset calibration. A special averaging function softens the readout and maintains fast response time, while keeping the standard deviation at a minimum.

An automatic self-diagnostic procedure continuously checks both meter and detector and reports any case of detector failure. The meter also alarms in case the reading exceeds the threshold value, reading overflow or low battery. The threshold can be selected from a list of 11 preset values. When the meter is turned off, the last threshold value and the calibration factor are retained in memory and will be recalled next time the instrument is turned on.

The RAM GAM-1 is equipped with a recessed internal energy compensated GM tube.

The meter includes two cards:

1. Detector, amplifier and HV card.
2. CPU card including rate meter and display.

The RAM GAM-1 meter can be placed in a base holder.

## 1.2. Ordering Information

Item description	Model No.
RAM GAM-1 (meter and base holder) <mR/h> (Rotem)	BAK-1750
RAM GAM-1 (meter and base holder) < $\mu$ Sv/h > (Rotem)	BAK-1752
RAM GAM-1 (meter and base holder) mR/h > (MGP)	BAK-1753
RAM GAM-1 (meter and base holder) < $\mu$ Sv/h > (MGP)	BAK-1754
RAM GAM-1 Desktop holder	BAK-1810
RAM GAM-1 Leather Case and hanging belt	BAK-1760
RAM GAM-1 Belt Clip	BEN-1320

## 2. Specifications

<b>Display</b>	LCD readout showing: <ul style="list-style-type: none"><li>- Four digits for accurate and easy readout</li><li>- Detector failure</li><li>- Low battery</li><li>- Overflow</li><li>- Threshold</li></ul>
<b>LED</b>	Count Rate indication
<b>Audio</b>	Internally mounted piezo-electric element
<b>Measuring unit</b>	mR/h and mR or $\mu\text{Sv/h}$ and $\mu\text{Sv}$
<b>Controls</b>	<ul style="list-style-type: none"><li>- ON/OFF push-button</li><li>- LIGHT push-button</li><li>- SPEAKER push-button</li></ul>
<b>Power source</b>	One 9-Volt cell battery (option external power supply) <ul style="list-style-type: none"><li>- 50 hours minimum continuous operation, Using an alkaline battery (speaker off)</li><li>- Automatic battery check under full load</li></ul>
<b>Detector</b>	Energy compensated GM tube (ZP1201 or equivalent)
<b>Sensitivity (<math>^{137}\text{Cs}</math>)</b>	17 cps/mR/h
<b>Accuracy</b>	$\pm 15\%$ of reading within the measuring range
<b>Energy range</b>	50 KeV to 1.3 MeV
<b>Energy dependence</b>	$\pm 20\%$ related to $^{137}\text{Cs}$
<b>Angular dependence</b>	Less than $\pm 20\%$ for $45^\circ$ of preferred direction
<b>Measuring range</b>	0.05 mR/h to 4 R/h (0.5 $\mu\text{Sv/h}$ to 40 mSv/h)
<b>Display range</b>	
<b>Dose rate</b>	0.01 mR/h to 4,000 mR/h (0.1 $\mu\text{Sv/h}$ to 40,000 $\mu\text{Sv/h}$ )
<b>Accumulated dose</b>	0.01 mR to 999 KmR (0.1 $\mu\text{Sv}$ to 999 K $\mu\text{Sv}$ )

<b>Temperature range</b>	Operation: -10°C to +50°C (15°F to 122°F) Storage: -20°C to +60°C (-5°F to 140°F)
<b>Humidity range</b>	40% to 95% RH (non condensing)
<b>Casing</b>	metal anodize aluminum
<b>Dimensions</b>	13 cm x 7.2 cm x 3.4 cm (5.12" x 2.83" x 1.34")
<b>Weight</b>	400 g (0.88 lbs) (include battery)

### 3. Operating Instructions

#### 3.1. Preparation for Use

Remove the instrument from the shipping container and check for physical damage. In case of damage, report it immediately to the carrier.

***Do not attempt to install or operate damaged equipment since safety and performance may be affected***

#### 3.2. Starting-up

Press the ON/OFF push-button. When the meter is turned on, it carries out a short self test procedure indicated by emitting a beep for a short period. Now the meter is ready for use.

#### 3.3. General Functions

**a. Readout:** The measuring units are mR/h ( $\mu\text{Sv/h}$ ) for dose rate and mR ( $\mu\text{Sv}$ ) for dose. Values through 9999 are expressed in 1 to 4 digits. For higher values, up to 999,000 a factor of 1000 will be indicated by displaying E.

Dose rate [mR/h]	Dose [mR]	Dose rate [ $\mu\text{Sv/h}$ ]	Dose rate [ $\mu\text{Sv}$ ]
0.01 - 9.99	0.01 - 9.99	0.1 - 9.9	0.1 - 9.9
10.0 - 99.9	10.0 - 99.9	10.0 - 99.9	10.0 - 99.9
100 - 999	100 - 9999	100 - 9999	100 - 9999
1000 - 3999	10.0E - 99.9E	10.0 E – 39.9 E	10.0E - 99.9E
	100E - 999E		100E - 999E

To display the accumulated dose measurement, press the LIGHT & SPEAKER push-button simultaneously. A blinking display during 10 seconds indicates that the reading is the accumulated dose measurement. After the 10 seconds, the meter returns to display the dose rate. To reset the accumulated dose press the LIGHT push-button while the accumulated dose measurement displayed.

**b. LED:** A LED indicator, located above the LCD, flashes with each incident radiation pulse.

**c. Display backlight:** Press the LIGHT push-button to turn display backlight off to on, or on to off.

Display backlight will turn automatically off after 10 seconds.

**d. Audible indication:** When the meter is turned on, the audible indication is activated at its high volume, so that the rate and trend of measurement are noticed. This volume control is specially activated at low rates of measurement. To turn it off press the SPEAKER push-button.

### 3.4. Units of Measurement Selection

The RAM GAM-1 is supplied with a touch panel showing both units of measurement ( $\mu\text{Sv/h}$  and  $\text{mR/h}$ ). The red LED is lit next to the relevant unit on measurement upon power up. The instrument is supplied to the customer with the units of measurement factory set. To change the Units of measurement, please follow this routine:

Click SPEAKER with a long press until the display shows either u-10 ( $\text{mR/h}$ ) or u-20 ( $\mu\text{Sv/h}$ )  
A short click on SPEAKER will toggle the selection, and the relevant LED will be activated.

A long press on SPEAKER will store the section, and revert the instrument back to the Dose Rate collection mode.

### 3.5. Threshold Selection

The threshold value can be selected from a range of 11 programmed values. The selected value is also kept in memory after the meter is turned off.

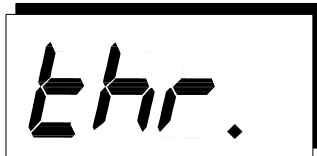
The following threshold values may be selected:

0.5, 2, 5, 10, 25, 50, 100, 250, 500, 750, 1000, 2000, 3000, 3999 [ $\text{mR/h}$ ]

5, 20, 50, 100, 250, 500, 1000, 2500, 5000, 7500, 10.0E, 20.0E, 30.0E, 39.9E [ $\mu\text{Sv/h}$ ]

To choose the required threshold value, proceed with the following steps:

- 3.5.1. Enter threshold mode by pressing the LIGHT pushbutton for two seconds. The reading will be zero, and later on the **thr.** LCDs will be displayed to indicate that the threshold setting mode is activated.

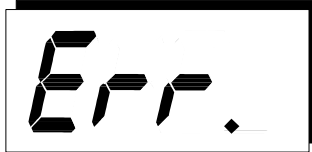


- 3.5.2. Pressing the SPEAKER push-button displays the existing threshold value.
- 3.5.3. Each additional press on the SPEAKER push-button displays the next threshold value, according to the order described in section 3.4.
- 3.5.4. To exit set threshold mode and to save the new threshold value, press the LIGHT push-button for two seconds. Saving will be verified by an audible beep and blinking of the threshold value.
- 3.5.5. To exit the set threshold mode without saving the new value (cancel threshold change), press LIGHT push-button for a very short period (less than two seconds). Saving will be verified by blinking of the “old” threshold value and **no beep will be sounded**.



### 3.6. Alarms

*a. Detector alarm:* If the detector is defective or disconnected the **Err.** LCDs will blink on the display and an interrupted audible alarm will be activated. To mute the audible alarm press the SPEAKER push-button.



*b. Battery alarm:* If battery voltage decreases below 6.2 Volts, the **bAt.** LCDs blink on the display and an interrupted audible alarm is activated.



To display the measured readings and mute the audible alarm, press the SPEAKER push-button. After the SPEAKER push-button is pressed, the **bAt.** LCDs will reappear every five minutes for two seconds, and every 30 minutes accompanied by an audible beep to remind users of the low battery condition.

*c. Overflow alarm:* If the displayed count rate is over 3999mR/h (39999 $\mu$ Sv/h), the **OFLO** LCDs blink on the display and an interrupted audible alarm is activated. To mute the audible alarm press the SPEAKER push-button.



*d. Threshold alarm:* If the reading exceeds threshold value, the **ALr.** LCDs and the reading are displayed alternately, accompanied by an audible beep.



Pressing the SPEAKER push-button mutes the audible alarm, but the **ALr.** LCDs and the reading are continuing to be displayed alternately, until the reading decreases to 75% of the threshold value. If the reading exceeds threshold value and then quickly decreases to below 75% of threshold value, the **ALr.** LCDs and the beep are automatically canceled, even though the SPEAKER push-button has not been pressed.

### 3.7. Push-buttons Function

Function	Pressing mode	Push-button
Meter on/off		ON / OFF
Display backlight on-off		LIGHT
Speaker volume modification		SPEAKER
In / out threshold mode	Long press	LIGHT
Displays/advances threshold		SPEAKER (within threshold mode)
Out of threshold mode, saving new threshold	Long press	LIGHT (within threshold mode)
Out of threshold mode, resuming old threshold	Short press	LIGHT (within threshold mode)
Display accumulated dose	Simultaneously	LIGHT + SPEAKER
Resets accumulated dose		LIGHT (within accumulated dose)
Displays/decreases calibration factor Decreases calibration factor	Short press Long press	LIGHT (within calibration mode)
Displays/increases calibration factor Increases calibration factor	Short press Long press	SPEAKER (within calibration mode)
Setting Units of Measurement	Long Press	SPEAKER
Selecting Units of Measurement	Short Press	SPEAKER
Saving Units of Measurement	Long Press	SPEAKER

### 3.8. Battery Replacement

The battery compartment is located at the instrument back. To replace the battery, unscrew two screws at the battery compartment cover. Use one 9-Volt alkaline battery; be sure to connect it with the right polarity.



### 3.9. Using Chargeable batteries

The RAM GAM-1 has the capability to connect to an external power transformer which provides 9VDC 0.5A. Power. This input can also be used to charge chargeable batteries. In order to make your instrument compatible to using chargeable batteries, you need to solder a jumper into E1 holes.



#### WARNING

We strongly recommend that you mark the instrument with a sticker that reads:

RECHARGEABLE  
BATTERY  
ONLY

Charging a non-chargeable battery will cause the battery to heat up and possibly explode

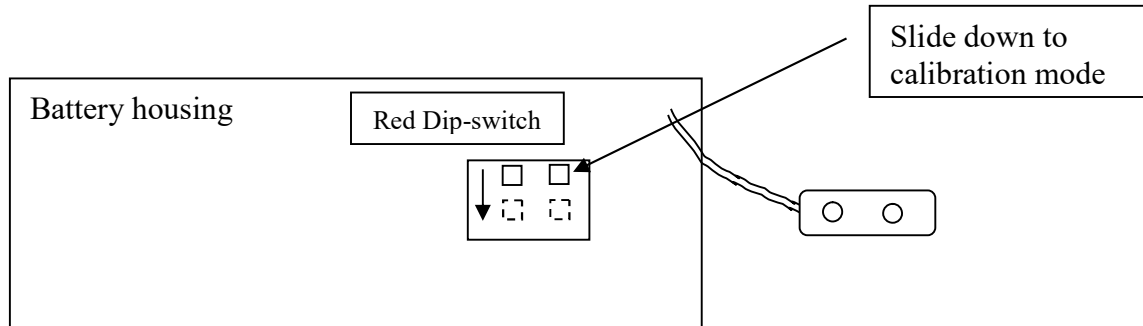
## 4. Calibration

To improve linearity, the RAM GAM-1 includes two calibration factors: The first factor is for the low range and the second factor is for the high range. The low calibration factor has to be set first at 50 mR/h (30 mR/h to 70 mR/h) and then the high calibration factor at 350 mR/h (300 mR/h to 400 mR/h).

### 4.1. Calibration Procedure

The calibration should be performed only by an authorized technician.

4.1.1. Open the RAM GAM-1 battery compartment cover and Slide down the internal dip switch 1 (the right-hand dip-switch) to the ON (calibration) position.



4.1.2. The **Cal.** LCDs are displayed.

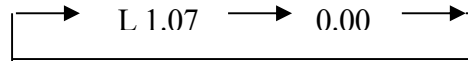
4.1.3. Press the **SPEAKER** or **LIGHT** push-button once. The display will be flashing between the reading and the **factor values** (factor is indicated by either the L letter for low factor

or H letter for high factor).

Example:



**4.1.4.** Press the SPEAKER and LIGHT push-buttons simultaneously. The display will be flashing between the reading and the low factor.



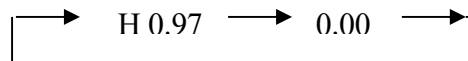
**4.1.5.** Expose the meter to a known radiation field in the range of 50 mR/h  $\pm$ 20 and calculate the new factor. The new factor should be:

$$\text{New low factor} = \frac{\text{Previous low factor} * \text{radiation field}}{\text{Instrument reading}}$$

**4.1.6.** Set the new factor value.

Press the SPEAKER push-button to increase the factor value (meter reading) and the LIGHT push-button to decrease the factor value (meter reading). The display will return to the alternate mode only when either the SPEAKER or LIGHT push-button is not pressed for more than 3 seconds.

**4.1.7.** Press the SPEAKER and LIGHT push-buttons simultaneously again. The display will be flashing between the reading and the high factor.



**4.1.8.** Expose the meter to a known radiation field in the range of 350 mR/h  $\pm$ 50 and calculate the new factor. The new factor should be:

$$\text{New high factor} = \frac{\text{Previous high factor} * \text{radiation field}}{\text{Instrument reading}}$$

**4.1.9.** Set the new factor value.

Press the SPEAKER push-button to increase the factor value (meter reading) and the LIGHT push-button to decrease the factor value (meter reading). The display will return to the alternate mode only when either the SPEAKER or LIGHT push-button is not pressed for more than 3 seconds.

**4.1.10.** When the required reading (factor) is obtained, turn the internal switch back to the measuring position and the meter will enter the measuring mode.

**4.1.11.** The calibration factors values (high and low) are between 0.60 to 1.40 and they are stored in the EEPROM.

## 4.2. CPU Unit Pulser Check

The CPU unit counts the input pulses, calculates dead time, averages the results, and displays the reading.

To check the CPU unit ("calibration") perform the following procedure:

- a. Loosen the 4 screws located on the meter back.
- b. Separate carefully between the front and back parts of the meter.
- c. Disconnect the Lumberg connector (4 pin) from the CPU card.
- d. Adjust the output pulser to obtain pulses of 5 Volts amplitude and 10µsec width.
- e. Connect the output pulser to the base unit connector (Lumberg 4 pin), via the test cable.
- f. Turn the meter on first, and then turn the pulser on. Ensure that the meter reads (within  $\pm 10\%$ ) according to the following table:

<b>Input Frequency</b> <Hz>	<b>Display</b> <mR/h>
100	5.88
500	29.4
2000	152
4000	440
5000	658
5500	794
6000	941
6500	OFLO

## 5. Measuring units selection

Measuring units types on the meter touch panel and indicated by a RED led.

Measuring units that can be selected: mR/h or uSv/h.

Procedure:

Press SPK push button for 10 second.

On the display will be displayed U-xx:

U10 – mR/h

U20 – uSv/h

Each press on the SPK push button will move from one to other measuring unit.

To save the new measuring unit Press on the SPK for 10 second again.

## RAM GAM-1

**Notes:**