

RAM GENE-1 ERK MK-I & MK-II

Contamination & Radiation Meter

Operating Manual

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1.0	November 2004		Doc. #PRIR90N2.DOC
2.0	May 2007	3, 4	Addition of MK-II meter type: metal case and backlight
		3	1.3 Ordering Information
2.1	January 2009	Cover page, 3, 10	Photo & logo, Models number, Calibration instruction
2.2	October 2009	3,4,9,11	Cpm threshold, units select, new photo, dose function
2.3	August 2017		Updated External Power information + Threshold change
2.4	September 2017	TOC	Added Measuring Units Selection

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WARNING:

For air delivery, the detector should be placed in a sealed container to ensure gradual changes in pressure, which otherwise may cause irreparable damage to the GM tube.

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1. RAM GENE-1

1.1. Meter Type

MK-I – RAM GENE-1 with plastic (ABS) case.

MK-II – RAM GENE-1 with metal (aluminum) case and display backlight.

1.2. General Description

The RAM GENE-1 radiation and contamination meter is designed to detect very low levels of alpha, beta and gamma surface radiation contamination in CPS or CPM unit and it switched to measure radiation field in $\mu\text{Sv/h}$ or mR/h units .

RAM GENE-1 meter is a state-of-the-art microprocessor based instrument, equipped with a recessed internal GM pancake detector of 1.75" effective diameter, with a thin mica window covered by a protective stainless steel wire mesh screen.

The meter is a one-hand-operation instrument, portable, lightweight and compact. Only three pushbuttons are needed for operation: ON/OFF, RESET for accurate measurement of low level contamination (MK1) or LIGHT (MK2), and SPEAKER push-button for audible indicator volume control. Switching between the measuring units is automatically performed according to the energy cap location.

Three ways of indications enable the RAM GENE-1 user to monitor and survey surface contamination 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, up to 42000 cps (999E cpm) for contamination, and up to 720 mR/h (7200 $\mu\text{Sv/h}$) for radiation, is obtained by 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 any case of a reading exceeding threshold value, reading overflow or low battery. Threshold can be selected from a range of 11 preset threshold values for each unit. When the meter is turned off, the last threshold value and the calibration factor are kept in memory.

The RAM GENE-1 meter can be ordered with a PELICAN suitcase or a leather case, for protection against mechanical damages.

1.3. Ordering Information

Item Description	Model No.
RAM GENE-1 MK-I	BAK-1865
RAM GENE-1 MK-II	BAK-1880
Pelican case (1150)	BAK-1380
Leather case	MAC-4380

2. Specifications

Display	LCD readout showing: <ul style="list-style-type: none">- Four digits for accurate and easy readout- Detector failure- Low battery- Overflow- Threshold
LED	Count Rate indication
Audio	Internally mounted piezo-electric element
Measuring units	contamination: CPS or CPM Radiation: $\mu\text{Sv/h}$ or mR/h
Controls	<ul style="list-style-type: none">- ON/OFF push-button- RESET or LIGHT push-button- SPEAKER push-button
Power source	<ul style="list-style-type: none">- One 9-volt cell battery, with external power available- 50 hours minimum continuous operation using an alkaline battery (speaker off)- Automatic battery check under full load
Detector	Pancake GM tube (LND 73110 or equivalent) Effective diameter 1.75"
Window thickness	Mica, 1.5 to 2 mg/cm^2 protected by a stainless steel wire mesh
Background reading	$\sim 0\text{-}1$ cps, $0.2 \mu\text{Sv/h}$ (0.02 mR/h)
Sensitivity (^{137}Cs)	$5.8 \text{ cps}/\mu\text{Sv/h}$ ($58 \text{ cps}/\text{mR/h}$)
Display range	0 to 42,000 cps (0-999E cpm) $0.01 \mu\text{Sv/h}$ to $7200 \mu\text{Sv/h}$ (0.001 mR/h to 720 mR/h)
Accuracy	$\pm 10\%$ of reading
Temperature range	
Operation:	-10°C to $+50^\circ\text{C}$ (15°F to 122°F)
Storage:	-20°C to $+60^\circ\text{C}$ (-5°F to 140°F)
Humidity range	40% to 95% RH (non condensing)

Casing High impact plastic for MK-I
Aluminum for MK-II

Dimensions

Width: 6.7 cm (2.6")
Length: 11.0 cm (4.3")
Height: 7.4 cm (2.9")

Weight 540 g (1.2 lbs) include battery

Surface sensitivity (in contact) for cps units:

Isotope	Energy E or Emax keV	Sensitivity kcps/ μ Ci	Surface Sensitivity		Minimum Detectable level*	
			$\frac{\text{cps}}{10^{-4}\mu\text{Ci/cm}^2}$	$\frac{\text{cps}}{\text{Bq/cm}^2}$	pCi/cm ²	Bq/cm ²
¹⁴ C (β)	156	0.67	1	0.25	250	9
³⁵ S (β)	167	1.64	2.5	0.65	100	3.7
¹⁴⁷ Pm (β)	224	3.1	4.8	1.25	55	2
⁹⁹ Tc (β)	290	4.22	6.5	1.75	40	1.5
⁹⁰ Sr+ ⁹⁰ Y (β)	580+2280	20.56	30	8.5	8	0.3
³⁶ Cl (β)	714	8.7	13	3.5	20	0.7
²¹⁰ Pb (β)	1160	9.97	15	4	17	0.6
³² P (β)	1710	13.25	20	5.5	13	0.5
⁵¹ Cr (γ)	325	0.0424	0.06	0.017	4000	150
^{99m} Tc (γ)	140	1.12	1.7	0.45	150	5.5
¹²⁵ I (γ)	35	0.097	0.15	0.04	1700	63
¹³¹ I (β)	610	7.56	11	3	22	0.8
²³⁰ Th (α)	4600	2.7	4	1	60	2.5
²⁴¹ Am (α)	5400	2.7	4	1	60	2.5
⁶⁰ Co (γ)	1200	7.5	8	2	32	1.2

* Minimum detectable level calculations are based on background reading of 1 cps, and the confidence level is 99%.

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 displaying all the segments on the display, and emitting a beep for a short period. Now the meter is ready for use.

The energy cap is on the detector housing so the measuring unit is $\mu\text{Sv/h}$ (mR/h).

3.3. General Functions

a) Switching measuring mode:

Contamination readings:

To acquire contamination readings, **remove** the energy cap from the pancake detector and adhere it to the top of the meter case (Fig. 2).

The reading will be displayed in cps or cpm units.

Dose rate radiation

To acquire dose rate radiation readings, **place** the energy cap over the pancake detector (Fig. 1).

The reading will be displayed in $\mu\text{Sv/h}$ or mR/h units.

Accumulated dose reading:

If case of the radiation readings, long press on SPEAKER push-button will display accumulated dose reading in a period of 10 second, the reading display will blink in this time. Accumulated dose will be calculated only in case of radiation readings, meter turn off and on accumulated dose start from zero.

b) Readout:

Values through 9999 are expressed in 1 to 4 digits. For higher values, a factor of 1000 will be indicated by displaying E.

For example: 10,400 = 10.4E, 127,000 = 127E



Fig. 1
Dose rate reading
Filter cup covering the detector



Fig. 2
Contamination reading
Filter cup removed from detector and attached to the instrument

c) **LED:**

A LED indicator located above the LCD flashes with each incident radiation pulse.

d) **Reading reset: Available only with MK-I type**

To reset the reading press RESET push-button. The reset function provides a rapid means of discharging the display and enables accurate measurement of low level contamination.

e) **Display backlight: Available only with MK-II type**

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.

f) **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. To turn the speaker off, press the SPEAKER push-button.

3.4. Threshold Selection

Threshold value can be selected from a range of 11 threshold values for each measuring unit. The selected value is also kept in memory after the meter is turned off.

The following threshold values may be selected:

3, 4, 5, 10, 20, 50, 100, 200, 300, 500, 42K [cps]

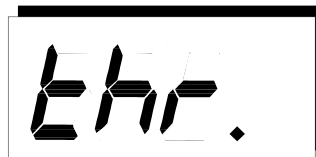
200, 250, 300, 350, 400, 1000, 5000, 10.0E, 20.0E, 999E [cpm]

1, 10, 50, 100, 200, 300, 400, 500, 600, 700, 720 [mR/h]

1, 2, 3, 4, 5, 10, 20, 50, 100, 200, 7200 [μ Sv/h]

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

- 3.4.1. Enter threshold mode by pressing the RESET (LIGHT) push-button 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.



- 3.4.2. Pressing the SPEAKER push-button displays the existing threshold value.
- 3.4.3. Each additional press on the SPEAKER push-button displays the next threshold value, according to the order described in section 3.4.
- 3.4.4. To switch between the two measuring units (dose rate and contamination readings) remove or replace the energy cap from/to the detector housing.
- 3.4.5. To exit set threshold mode and save the new threshold value, press the RESET push-button for 2 seconds. Saving will be verified by an audible beep and blinking of the threshold value.
- 3.4.6. To exit the set threshold mode without saving new values (cancel threshold change), press RESET push-button for a very short period (less than 2 seconds). The threshold value will blink on the display and **no beep will be sounded**.

3.5. Alarms

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



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

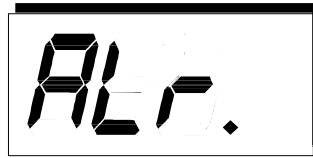


To display the measured readings and mute the audible alarm, press the SPEAKER push-button. After the SPEAKER push-button is pressed, the **bAt.** LCDs will reappear every 5 minutes for 2 seconds, and every 30 minutes accompanied by an audible beep to remind of low battery condition.

c. Overflow alarm: If the displayed count rate is over the measuring range (42000 cps, 999000 cpm, 720 mR.h, 7200 μ Sv/h), the **OFLO** LCDs blinks 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 0.75 from threshold value. In case the reading exceeds threshold value and then decreases below 0.75 of threshold value, the **ALr.** LCDs and the beep sound are automatically canceled, even though the SPEAKER push-button has not been pressed.

3.6. Battery Replacement

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



Figure 3 RAM GENE-1 Battery Compartment

3.7. Using Chargeable batteries

The RAM GENE-1 has the capability to connect to an external power transformer which provides 9V DC 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

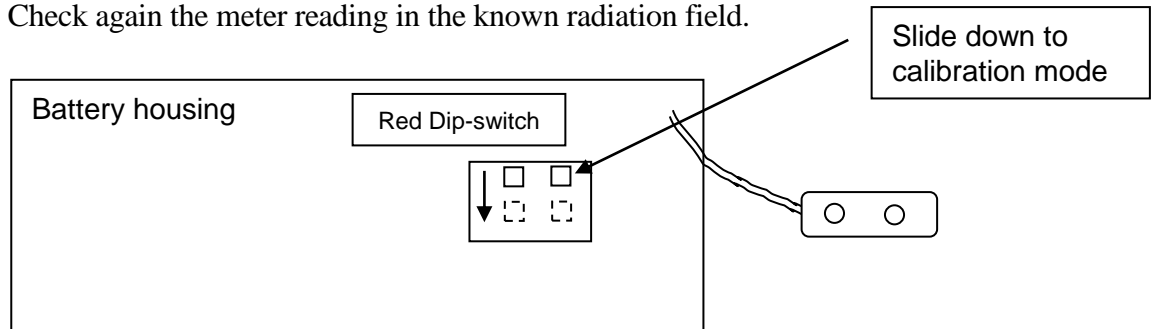
4.1. Calibration with a Contamination Source

Calibration should be performed by an authorized technician.

To calibrate the RAM GENE-1 meter, use U9 dip-switch on the CPU board.

- 4.1.1. Expose the detector to a Beta source to calibrate the meter to contamination measurement (cps or cpm) (^{99}Tc source whose activity is 50 to 250 Kdpm).
- 4.1.2. Expose the detector to a Gamma source to calibrate the meter to radiation measurement (uSv/h or mR/h) (^{137}Cs source whose activity is 180mCi).
- 4.1.3. Check the RAM GENE-1 reading and compare it with the expected reading.
For example:
100 Kdpm ^{99}Tc should give 10,000 cpm with stainless steel wire mesh screen.
If the difference is lower than 10%, the detector is calibrated.
If the difference is higher than 10%, perform the following steps:
 - a. Open the battery cover.
 - b. Move the internal dip-switch located on the electronic board down to the calibration position.. The **Cal.** LCDs will be displayed.
 - c. Press the SPEAKER push-button once, the reading and factor values will flash alternately on the display (the factor is indicated by the letter F, e.g. F 1.23).

- d. Expose the meter to a known radiation field and change the calibration factor value.
- e. Press the SPEAKER push-button to increase the factor value (meter reading) and the RESET push-button to decrease the factor value (meter reading). The display will return to the alternate mode only when either SPEAKER or RESET push-button is not pressed for more than 3 seconds.
- f. When the required reading (factor) is obtained, turn the internal dip-switch back to the measuring position and the meter will enter the measuring mode. The calibration factor value can be 0.60 to 1.40 stored in the EEPROM.
- g. Check again the meter reading in the known radiation field.



5. Measuring Units Selection

Measuring units can be selected, but the touch panel must be replacing or corrected.

Measuring units can be: CPS, CPM, CPS-mR/h, CPS-uSv/h, CPM-mR/h, CPM-uSv/h.

Procedure:

Press on the LIGHT& SPK for 10 second.

On the display will be displayed U-xx:

U10 – CPS

U20 – CPM

U11 - CPS-mR/h

U12 - CPS-uSv/h

U21 - CPM-mR/h

U22 - CPM-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 LIGHT& SPK for 10 second again.