

RAM SURF

Surface Contamination Meter

Operating Manual

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		All pages	Letter size pages (instead of A4)
		1	Updated ROTEM address
		2	Addition of this log
		8	Orthogonal replaced with hexagonal
		10-11	“Segment” replaced with LCDs
		13	Sec. 4.1, Err. value deviation corrected
3.3	September 2010	All figures	Updated
			Update ordering information
			Cancel collimators usage
			Modify threshold selection value
			Modify push button function
			Modify calibration
			Add measure unit selection

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.

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

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1. The RAM SURF Meter

1.1. General Description

The RAM SURF radiation contamination meter is a state-of-the-art microprocessor-based instrument, designed to detect very low levels of alpha, beta and gamma surface radiation contamination. **Two versions of the RAM SURF meter are available, one for CPS units and the other for CPM units.**

The RAM SURF meter is built of two parts:

- a. Detector, amplifier and HV assembly.
- b. Base unit including rate-meter and display.

The RAM SURF detached detector is a GM pancake tube of 1.75" effective diameter, with a thin mica window covered by a protective stainless steel wire or copper beryllium screen. The RAM SURF detachable detector offers extra flexibility for getting at underneath surfaces and hard-to-reach places.

The meter is a one-hand-operation instrument, portable, lightweight and compact. Only three push-buttons are needed for operation: ON/OFF, RESET for accurate measurement of low level contamination, and SPEAKER push-button for audible indicator volume control. Three ways of indications enable the RAM SURF 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 of up to 42,000 counts per second or 999,000 counts per minute is obtained by the automatic dead time correction, according to the preset calibration. A special averaging function "smoothes" the readout and maintains fast response time, while keeping the standard deviation at a minimum.

An automatic self-diagnostic procedure continuously checks both counter and detector, and reports any case of detector failure. The meter also alarms in any case of reading exceeding threshold value, reading overflow or low battery. Threshold can be selected from a range of 10 preset threshold values. When the meter is turned off, the last threshold value is kept in memory.

The RAM SURF meter can be placed in a holder. The detector surface is covered with a cap for protection against mechanical damage.

Ordering Information

Item description

Model No.

RAM SURF (including meter, detector, cable, holder and cover cap)	
CPS	BAK-2080
CPM	BAK-2090
RAM SURF meter cps	BAK-2085
RAM SURF meter cpm	BAK-2086
RAM SURF detector (GM-10) with telephone connector	BAK-1171
RAM SURF holder	BAK-2190
Detector cover cap	MEC-1551
Detector tester	BAK-2180
Telephone cable	WIR-1020

2. Specifications

Display	four digits LCD readout showing: <ul style="list-style-type: none">- for accurate and easy readout- detector failure- low battery- overflow- threshold
LED	Count Rate indication
Audio	Internally mounted piezo - electric element
Measuring unit	Counts per second Counts per minute
Controls	<ul style="list-style-type: none">- ON/OFF push-button- RESET push-button for accurate measurement of low level contamination- SPEAKER push-button to control audible indicator volume
Power source	One 9-Volt cell battery <ul style="list-style-type: none">- 50 hours minimum continuous operation, Using an alkaline battery (speaker off)- Automatic battery check under full load
Detector	Pancake GM tube (LND 73118 or equivalent) Effective diameter 1.75"
Window thickness	Mica, 1.5 to 2 mg/cm ² protected by a stainless steel wire mesh or hexagonal copper beryllium screen
Background reading	0 to 1 cps 0 to 50 cpm
Sensitivity (Cs-137)	Approx. 5.8 cps/μSv/h (58 cps/mR/h) Approx. 350 cpm/μSv/h (3500 cpm/mR/h)
Count rate range	0 to 42,000 cps 0 to 999,000 cpm
Accuracy	±15% of reading

Temperature range	Operation: -10°C to +50°C (15°F to 122°F) Storage: -20°C to + 60°C (-5°F to 140°F)	
Humidity range	40% to 95% RH (non condensing)	
Casing	High impact plastic	
Dimensions	Counter	Detector
	Width 6.7 cm (2.6")	7.1 cm (2.8")
	Length 11.0 cm (4.3")	27.0 cm (10.6")
	Height 4.6 cm (1.8")	8.9 cm (3.5")
Weight	780 g (1.7 lb)	

Surface sensitivity (in contact) in cps units when using a wire mesh screen

Isotope	Energy E or Emax keV	Sensitivity Kcps/μCi	Surface Sensitivity		Minimum Detectable Level*	
			cps 10 ⁻⁴ μCi/cm ²	cps 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

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

Surface sensitivity (in contact) in cpm units when using a wire mesh screen

Isotope	Energy E or Emax keV	Sensitivity Kcpm/ μ Ci	Surface Sensitivity		Minimum Detectable Level*	
			$\frac{\text{cpm}}{\text{pCi/cm}^2}$	$\frac{\text{cpm}}{\text{Bq/cm}^2}$	pCi/cm ²	Bq/cm ²
¹⁴ C (β)	156	40	0.6	15	125	5
³⁵ S (β)	167	95	1.5	40	50	1.9
¹⁴⁷ Pm (β)	224	180	2.8	75	28	1
⁹⁹ Tc (β)	290	250	3.9	100	20	0.75
⁹⁰ Sr+ ⁹⁰ Y(β)	580+2280	1230	18	500	4	0.15
³⁶ Cl (β)	714	520	7.8	200	10	0.35
²¹⁰ Pb (β)	1160	590	9	240	9	0.3
³² P (β)	1710	790	12	330	7	0.25
⁵¹ Cr (γ)	325	2.5	0.036	1.0	2000	75
^{99m} Tc (γ)	140	65	1.02	25	75	2.8
¹²⁵ I (γ)	35	5.8	0.09	2.4	850	32
¹³¹ I (β)	610	450	6.6	180	11	0.4
²³⁰ Th (α)	4600	160	2.4	60	30	1.3
²⁴¹ Am (α)	5400	160	2.4	60	30	1.3

Surface sensitivity (in contact) in cpm units when using a hexagonal cooper beryllium screen

Isotope	Energy E or Emax keV	Sensitivity Kcpm/ μ Ci	Surface Sensitivity		Minimum Detectable Level*	
			$\frac{\text{cpm}}{\text{pCi/cm}^2}$	$\frac{\text{cpm}}{\text{Bq/cm}^2}$	pCi/cm ²	Bq/cm ²
¹⁴ C (β)	156	93	1.3	34.8	50	2
¹⁴⁷ Pm (β)	224	432	6.7	180	10.8	0.38
⁹⁹ Tc (β)	290	516	7.6	206.4	9.1	0.34
⁹⁰ Sr+ ⁹⁰ Y(β)	580+2280	1446	21.7	588	1.57	0.06
³⁶ Cl (β)	714	686	9.8	264	7.9	0.27
²¹⁰ Pb (β)	1160	796	12	324	6.42	0.21

* Minimum Detectable Level calculations are based on background reading of 50 cpm, 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. After the self test the meter is ready for use.

3.3. General Functions

a. Readout: The measuring units are counts per second or counts per minute. Values through 9999 cps or cpm are expressed in 1 to 4 digits. For higher values, up to 42,000 cps or 999,000 cpm, a factor of 1000 will be indicated by displaying E. (E3 in the earlier cps versions).

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

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

c. Reading reset: 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.

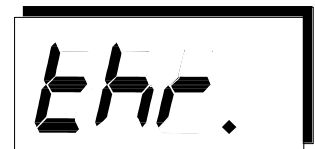
d. Audible indication: When the meter is turned on, the audible indication is activated at its high volume, so that the rate and trend of measurement are noticed. To turn the speaker off, press the **SPEAKER** push-button.

3.4. Threshold Selection

The threshold value can be selected from a range of nine programmed values. 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 [cps]
200, 250, 300, 350, 400, 1000, 5000, 10.0E, 20.0E, 999E [cpm]



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

- 3.4.1. Enter threshold mode by pressing the RESET push-button for three 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 3.5.
- 3.4.4. To exit set threshold mode and to save the new threshold value, press the RESET push-button for 3 seconds. Saving will be verified by an audible beep and blinking of the threshold value.
- 3.4.5. To exit the set threshold mode without saving new values (cancel threshold change), press RESET push-button for a very short period (less than 3 seconds). Threshold value blinks 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.



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 42.0E (42,000 cps) or 999E (999,000 cpm), the **OFLO** LCDs blinks on the display.



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



If the reading exceeds threshold value and then decreases below 75% of threshold value, the **ALr.** LCDs and the beep sound are automatically cancelled, even though the SPEAKER push-button has not been pressed.

3.6. Push-buttons Function

Push-button	Pressing Mode	Function
ON / OFF		Meter on / off
RESET		Momentary reading reset
SPEAKER		Speaker volume modification
RESET	Long press	In / out threshold mode
SPEAKER	Short press	Displays / advances threshold
RESET	Long press	Out of threshold mode saving new threshold
RESET	Short press	Out of threshold mode resuming old threshold
RESET& SPEAKER		Measuring units selection (refer to section 5)

4. Power Supplies

4.1. 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; ensure to connect it with the right polarity.



Figure 5-1. RAM SURF Battery Compartment

4.2. External Power Supply

The RAM SURF equipped with an external dc input. It can be operated either with a 9V battery or an external 9V DC power supply. The battery can be used in conjunction with the external power supply. In case of external power failure the battery supplies the current. The DC voltage should be 10 to 12 volts, to avoid drain current from the battery. The internal battery is connected as a back-up battery.

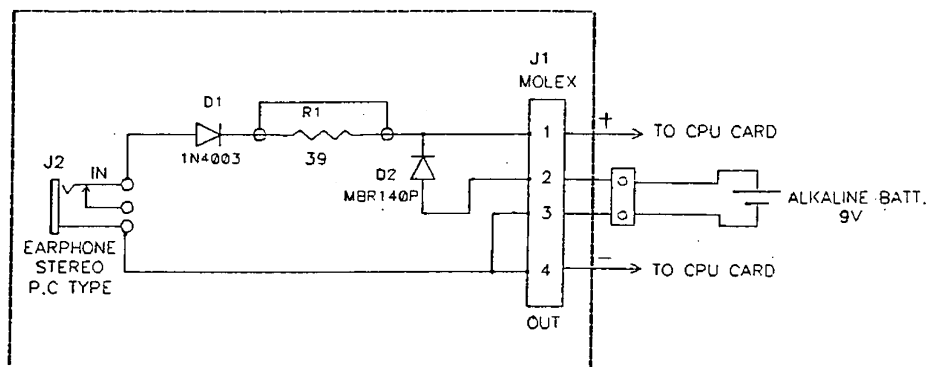


Figure 5-2. Internal Battery and External Power Supply Connection

5. Calibration

5.1. Calibration with a Contamination Source

Calibration should be performed by an authorized technician.

5.1.1. To calibrate the RAM SURF meter, use U9 dip-switch on the CPU board.

5.1.2. 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).

5.1.3. Check the RAM GENE-1 reading and compare it with the expected reading.

For example:

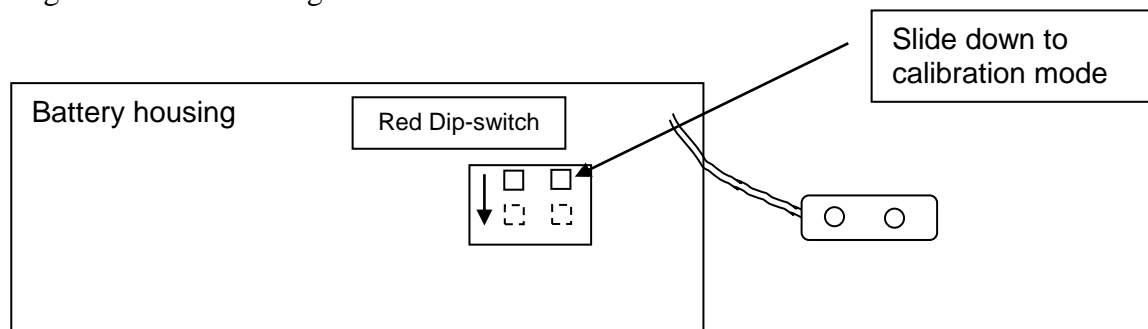
100 Kdpm ^{99}Tc should give 10,000 cpm with stainless steel wire mesh screen.

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, to store the factor value at the meter memory 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.

Check again the meter reading in the known radiation field.



6. Measuring units selection

Measuring units can be selected, but the touch panel must be replacing or corrected in case of modify measuring units.

Measuring units can be: CPS, CPM.

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 (not in use in this meter)

U12 - CPS-uSv/h (not in use in this meter)

U21 - CPM-mR/h (not in use in this meter)

U22 - CPM-uSv/h (not in use in this meter)

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.